Brunswick County Courthouse Addition & Renovations

Addendum 1

December 16, 2019

To: All Plan Holders

From: John R. Sawyer, AIA

SAWYER SHERWOOD & ASSOCIATE ARCHITECTURE

General Items

1. Geotechnical Engineering Report is enclosed.
2. Geotechnical Engineering Report Addendum is enclosed.

Specification Items

1. Invitation to Bid: The Pre-Bid meeting time has changed to 10am. The meeting location has also changed to the Brunswick County Courthouse, Jury Assembly room # 2084 located on the second floor.

2. Section 01 2000 – Price and Payment Procedures: Under 1.05 MODIFICATION PROCEDURES part G, Substantiation of cost: change "On request, provide" to "Provide"

3. Add specification section 01 2100 Allowances. A contingency allowance of $250,000.00 is being added to the project. This allowance shall be included in the base bid.

4. Section 01 4533 – Special Inspections: The statement of special inspections has been revised and is to be replaced with the enclosed special inspections document.

5. Section 09 6813, Tile Carpet: Tile pattern in room 12200 will require three different color tiles. Tile layout drawing will be provided by architect following award of construction contract. Bidders shall include installation cost required to work with three colors in this space

6. Delete specification 260548, Seismic Controls for Electrical Systems.

7. Delete electrical specification sections referencing seismic requirements:

   - 260533-1.2.B.3.
   - 260533-1.4.B.
   - 260533-1.4.C.
   - 262416-1.4.C.
   - 262416-2.2.G.
   - 262416-3.1.J.
   - 283111-1.5.E.
   - 283111-3.1.B.3.
   - 283111-3.4.C.3.

- 286000-1.4.D.
- 285000-2.1.B.

8. Section 12 6760 Pews and Courtroom Furniture, Part 2.02 MATERIALS, item B engineered core with veneer in the species specified may be used.

Drawing Items

9. Sheet G 1.1, Appendix B, change the occupancy category for the addition to category II.

10. Sheet G2.0, First Floor Life Safety Plan, Exit Stair 1020, egress route lengths do not extend through the one hour rated stair. Travel distance from courtroom 1200 is revised to 84'. Travel distance from Attorney Lounge is revised to 82'. Travel distance from courtroom 1030 is revised to 78'.

11. Sheet G 2.1, Second Floor Life Safety Plan, Revise the Total Stair Capacity to read 247"/ 0.2" = 1235.

12. Sheet G2.2, Third Floor Life Safety Plan,
    a. Revise room name in room # 3208 to read Reception.
    b. Revise dead end distance in corridor 3224 to extend from office 3220 to reception 3208, the revised distance is 38'.
    c. Corridor 3108 is a dead end condition with a dead end length of 37'.
    d. Revise total stair capacity to read 164"/0.2 = 820.

13. Sheet A1.2, Third Floor Plan, Change room name in room # 3208 to Reception.

14. Sheet A2.0, North Building Elevation,
    a. horizontal spacing of the verticals in the ramp railing shall be 34".
    b. Landing at the top of the ramp to grade dimension is 2'-0".

15. Sheet A6.0 Finish & Door Schedule. Door 1070A, 1070B and 1070C shall be 45 minute rated doors and frames.

16. Sheet A7.8 Finish Floor Plan Second Floor, Jury Assembly Room 2200. Seating quantity is reduced to 199 seats. Chairs to be provided by the GC are specified in section 12 6100. Chairs shall be secured to the floor in the arrangement shown.

Clarifications None

Approved Substitutions None

End of Addendum 1

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contingency allowance.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Directive authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by Change Directive signed by the contractor, architect and owner.

C. Architect will issue change directives.

D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Contingency Allowance: Include the stipulated sum/price of $250,000.00 for use upon Owner's instructions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Statement of Special Inspections

Project: Brunswick County Courthouse Addition & Renovations
Location: Bolivia, NC
Owner's Representative: Mr. William L. Pinnix, PE
Owner's Address: 75 Courthouse Drive, Building I, Bolivia, NC 28422

Architect of Record: John Sawyer, AIA
Structural Engineer of Record: Jeffrey R. Troutman, PE

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the 2018 North Carolina State Building Code. It includes a Schedule of Special Inspection Services applicable to this project as well as the name of the Special Inspector and the identity of other approved agencies intended to be retained for conducting these inspections.

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Structural Engineer and Architect of Record. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Structural Engineer and Architect of Record. The Special Inspections program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Owner, Structural Engineer and Architect of Record.

Interim Report Frequency: Monthly

A Final Report of Special Inspections documenting completion of all required Special Inspections and correction of any discrepancies should be submitted prior to issuance of a Certificate of Use and Occupancy.

Job Site safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by (Structural Engineer of Record):

Jeffrey R Troutman, PE
(Type or print name)

11.14.2019

Signature Date

NORTH CAROLINA PROFESSIONAL SEAL 22567 ENGINEER JEFFREY R. TROUTMAN

11.14.2019

Owner's Authorization Accepted by Brunswick County Inspections:

Signature Date Signature Date

Schedule of Special Inspection Services

The following sheets comprise the required schedule of special inspections for this project. The construction divisions which require special inspections for this project are as follows.

- ☒ Structural Steel
- ☐ Cold-Formed Steel Framing
- ☒ Cast-in-Place Concrete
- ☒ Masonry
- ☐ Wood Construction
- ☒ Soils
- ☒ Special Foundations (Piles)
- ☐ Wall Panels/Veneer
- ☒ Sprayed Fire-Resistant Material
- ☒ Exterior Insulation & Finish System
- ☐ Smoke Control
- ☐ Fire Rated Penetrations & Joints
- ☒ Wind-Resisting Requirements
- ☒ Seismic Requirements

Inspection Agents	Qualifications	Address
1. Special Inspector	SI	
2. Structural Engineer of Record Criser Troutman Tanner Consulting Engineers	SER	3809 Peachtree Avenue, Suite 102 Wilmington, NC 28403
3. Testing Laboratory	ITL	
4. Other		

Note: The inspection and testing agent shall be engaged by the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Architect, prior to commencing work.

Seismic Design Category: C

Ultimate Design Wind Speed: 147 MPH

Wind Exposure Category: C

Schedule of Special Inspection Services
Structural Steel

Item	Qualifications	Scope
1. Fabricator Certification/Quality Control Procedures	SI SI SI SI	• Collect and review fabricator & erector documents (verify reports and certificates as listed in AISC 360, Chapter N, paragraph 3.2 for compliance with construction documents) • Collect Certificate of Compliance from fabricator at completion of fabrication. • Verify material for structural steel. Review structural steel mill test reports. • Review fabricator's certified test reports.
2. Welding	SI SI SI SI SI	• Continuous inspection of welding of complete and partial penetration grove welds (radiographic or ultrasonic testing) • Periodic inspection of single and multipass fillet welds. • Continuous inspection of stud welding. • Collect certificate of compliance for weld filler material. • Identify use of approved filler material and in accordance with AWS D1.1.
3. Metal Deck	SI SER / SI	• Collect material data sheets for decking and connectors or fasteners, confirm identification markings conform to AISC 360 for structural steel and that other steel conforms to ASTM standards specified in the approved construction documents. • Periodic inspection of connections of decking
4. Open-Web Steel Joists	SI SI	• Periodic inspection to verify end connections per SJI 2207.1. • Periodic inspection to verify standard bridging (horizontal and diagonal) per SJI 2207.1 and bridging that differs from the SJI specifications listed in SJI 2207.1.
4. Structural Details	SER / SI	• Periodic inspection of steel framing and joint details at each connection.
5. Bolting	SI SI SER / SI SI	• Collect material data sheets for bolts, nuts, and washers & confirm identification markings conform to ASTM standards specified in the approved construction documents. • Collect certificate of compliance from bolt supplier • Periodic inspection of bolted connections. • Continuous inspection and collection of embedment submittals. Verify diameter, grade, type, length, embedment and anchors.
6. Material Certification	SI	• Collect Certified mill test reports.

Schedule of Special Inspection Services
Cast-in-Place Concrete

Item	Qualifications	Scope
1. Mix Design/Material Certifications	SER / SI	• Collect mix designs and verify appropriate mix use during specific installation
2. Reinforcement Installation	SER / SI SI	• Periodic inspection of reinforcing steel and welded wire fabric • Collection of certified mill test reports
3. Concrete Placement/Monitoring Fresh Concrete, Sampling & prep of test samples	SI SI SI / ITL SI	• Continuous inspection of cast-in-place concrete placement. • Periodic inspection of formwork for shape, location and dimensions of the concrete member being formed. • Continuous monitoring of sampling of fresh concrete, slump test, air content test, temperature of concrete and creation of strength test specimens • Continuous inspection of bolts, anchors and other embedments to be installed in concrete prior to and during placement
5. Post-Installed Anchors in Hardened Concrete	SI SI	• Continuous inspection of adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. • Periodic inspection of mechanical anchors and adhesive anchors not sustaining sustained tension loads.
5. Curing & Protection	SI	• Periodic inspections of curing techniques and specified curing temperatures.

Schedule of Special Inspection Services
Masonry (Level B Quality Assurance)

Item	Qualifications	Scope
1. Material Certification	SI SI SI	• Collect mix design for mortar • Collect mix design for grout • Collect Certificates of Compliance for masonry constituents • Periodic inspection to verify compliance with approved submittals.
2. Mixing of Mortar & Grout	SI	• Periodic inspection of site prepared mortar.
3. Installation of Masonry	SI SER / SI	• Inspection of construction of mortar joints, prior to beginning masonry construction and during construction • Periodic inspection to verify size and location of structural masonry elements.
4. Reinforcement Installation	SER / SI SER / SI	• Verify location of reinforcement and connections to structure prior to construction • Prior to grouting verify size, grade, and placement of reinforcement and connection of masonry to structural frame
5. Grouting Operations	SI SI SI SI SI SI SI	• Continuous inspection to verify slump flow as delivered to the project. • Periodic inspection to verify proportions of site-mixed mortar & grout. • Periodic inspection to verify grade, type and size of reinforcement, anchor rods and anchorages. • Periodic inspection to verify construction of mortar joints. • Periodic inspection to verify grout space prior to grouting. • Periodic inspection to verify placement of reinforcement, connectors and anchorages. • Continuous observation of the placement of all grout, conforming cleanliness of grout space placement of the reinforcing connectors.
6. Weather Protection	SI	• Periodic inspection to verify preparation, construction and protection techniques for construction of masonry during cold weather (temperatures below 40ºF) or hot weather (temperatures above 90ºF)
7. Verification and Evaluation of Masonry Strength	SI / ITL	• Periodic inspection of the preparation of grout specimens, mortar specimens and observation of preparation of prisms and verification of f'm prior to construction by unit strength or prism test method.

Schedule of Special Inspection Services
Soils

Item	Qualifications	Scope
1.Site Preparation	SI SI	• Periodic inspection to determine that site and has been prepared in accordance with the approved soils report, prior to placement of compacted fill. • Periodic inspection to verify materials below shallow foundations (slab-on-grade) are adequate to achieve the design bearing capacity.
2. Fill Placement	SI SI	• Continuous inspection to determine use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill. • Periodic inspection to perform classification and testing of compacted fill materials.
3. Density Evaluation	SI / ITL	• Determine that in-place dry density of the compacted fill complies with approved soils report

Schedule of Special Inspection Services

Special Foundations (Cast-In-Place Deep Foundations)

Item	Qualifications	Scope
1.Pile Foundations	SI / SER SI SI SI SI	• Continuous inspection to observe drilling operations and maintain complete and accurate records. • Continuous inspection to verifiy placement locations and plumbness; Confirm element diameter; Confirm element length; Record concrete or grout volumes. • Periodic inspection to verify when pile foundations are being installed. • Continuous inspection to record top and tip elevation of each pile relative to a permanent reference. • Perform tests and inspection in accordance with the Schedule of Special Inspection Services for Cast-in-Place Concrete

Schedule of Special Inspection Services
Sprayed On Fire-Resistant Materials

Item	Qualification	Scope
1. Fireproofing of Steel	SI / ITL SI / ITL SI / ITL SI / ITL SI / ITL	• Periodic inspection to verify preparation of substrate condition prior to installation in accordance with approved fire resistance design and approved manufacturer's written instructions. • Periodic inspection to verify that substrate has minimum ambient temperature before and after application as specified by the fire resistance design and approved manufacturer's written instructions • Periodic inspection to verify average thickness of sprayed on fire-resistant material applied to structural members per fire resistance design and approved manufacturer's written instructions • Periodic inspection to verify density of sprayed on material per fire resistance design and approved manufacturer's written instructions • Periodic inspection to verify/test bond strength to ensure a value greater than 150 ponds per square foot to the extent specified in NCSBC Section 1705.14.6.

Schedule of Special Inspection Services
Exterior Insulation and Finish Systems (EIFS)

Item	Qualifications	Scope
2. Application	SI	• Periodic inspection to verify water-resistive barrier over sheathing substrate.

Schedule of Special Inspection Services
Wind-Resisting Components

Item	Qualifications	Scope
1. Roof Cladding	SI	• Periodic inspection of submittal reviews and field verification of roof covering, roof deck and roof anchorage to roof and floor diaphragms in accordance with the approved submittals.
2. Wall Cladding/Coverings, Parapet & Connections	SI	• Periodic inspection of submittal reviews and field verification of wall/parapet anchorage and wall coverings to roof and floor diaphragms and framing in accordance with the approved submittals.

Schedule of Special Inspection Services
Seismic Requirements

Item	**Qualifications**	**Scope**
1. Electrical components	SI	• Periodic inspection during the anchorage of electrical equipment used for emergency power systems.
2. Seismic masonry testing	SI SI SI	• Verification of f'm prior to construction • Verification of f'm every 5000 square feet during construction • Verification of proportions of materials in mortar and grout as delivered to the site

ECS Southeast, LLP

Geotechnical Engineering Report

Brunswick County Court House Addition

310 Court House Dr. NE
Bolivia, North Carolina

ECS Project Number # 22:26623

May 7, 2018

ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm F-1078
NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3252

May 7, 2018

Mr. Bill Pinnix, PE
Brunswick County
Post Office Box 249
75 Court House Drive NE
Building 1
Bolivia, North Carolina 28422

ECS Project No. 22:26623

Reference: Geotechnical Engineering Report
Brunswick County Courthouse Addition
Bolivia, Brunswick County, North Carolina

Dear Mr. Pinnix:

ECS Southeast, LLP (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our Proposal No. 22:22354, dated April 2, 2018. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration conducted, and our design and construction recommendations.

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

Respectfully submitted,

ECS Southeast, LLP

Mike Ellis, E.I.
Project Manager
MEllis@ecslimited.com

Winslow Goins, PE
Principal Engineer
WGoins@ecslimited.com

TABLE OF CONTENTS

APPENDICES

Appendix A – Drawings & Reports

- Site Location Diagram
- Exploration Location Diagram

Appendix B – Field Operations

- Reference Notes for Sounding Logs
- CPT Sounding Logs - S-1 through S-5

Appendix C – Supplemental Report Documents

- ASFE Document

EXECUTIVE SUMMARY

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

- The geotechnical exploration performed for the planned development included five (5) electronic cone penetration test (CPT) soundings to refusal/termination depths ranging from around 50 to 65 feet.

- The soundings generally encountered coastal plain soils consisting of Lean and Fat CLAY (CL, CH), Silty CLAY (CL-ML), and Sandy SILT (ML) underlain by Silty and Clean SAND (SM, SP).

- Due to the presence of liquefiable soils, it is recommended that the soil be supported on a deep foundation system with piles installed to a minimum embedment depth of 40 feet beneath existing grades. Recommendations for 8-inch tip timber piles and 12-inch square piles are presented in Section 4.1.1 of this report.

- Groundwater was encountered at approximately 6 to 8.3 feet below existing grades at the site.

- Due to liquefiable soils onsite, the site has been assigned a seismic site class “F”. However, If the risks for liquefaction is addressed in design and the building has a fundamental period of less than or equal to 0.5 seconds, seismic site class “D” parameters can be used for the building.

1.0 INTRODUCTION

1.1 GENERAL

ECS' understanding of this project is based on information provided by Mr. Bill Pinnix, P.E. of Brunswick County. The site is located near the existing courthouse at 310 Court House Drive in Bolivia, Brunswick County, North Carolina. The proposed construction consists of expanding the existing court house and constructing a parking with an associated stormwater detention pond. This report contains the results of our subsurface explorations, site characterization, engineering analyses, and recommendations for the design of the proposed courthouse addition.

1.2 SCOPE OF SERVICES

To obtain the necessary geotechnical information required for design of the proposed courthouse addition, a total of five (5) CPT soundings were performed. The CPT soundings S-1 through S-4 were advanced to termination/refusal depths ranging from approximately 50 to 65 feet beneath the ground surface. Shear wave velocity tests were performed in sounding S-5 for seismic site classification and liquefaction potential. This report discusses our exploratory and testing procedures, presents our findings and evaluations and includes the following:

- A brief review and description of our field test procedures and the results of testing conducted;
- A review of surface topographical features and site conditions;
- A review of area and site geologic conditions;
- A review of subsurface soil stratigraphy with pertinent available physical properties;
- Deep foundation recommendations;
- Site development recommendations;
- Suitability of soils for use as fill material;
- Discussion of groundwater impact;
- Compaction recommendations;
- Special conditions encountered;
- Seismic site classification and liquefaction potential;
- Site vicinity map;
- Exploration location plan; and
- CPT sounding logs.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 22-22354, dated April 2, 2018, as authorized by Brunswick County on April 18, 2018, and include the Terms and Conditions of Service outlined with our proposal.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The site is located near the existing courthouse at 310 Court House Drive in Bolivia, Brunswick County, North Carolina. Figure 2.1.1 below shows an aerial image of the site.

Figure 2.1.1 Site Location

2.2 CURRENT SITE CONDITIONS

The proposed construction site consists of an existing asphalt parking lot with a grass covered area separating the parking lot from the courthouse.

2.3 PROPOSED CONSTRUCTION

The project consists of constructing an addition to the existing courthouse. Structural loading information was not available at the time of this report. Based on similar projects, we assumed maximum column and wall loads of 150 kips and 5 kips per foot, respectively.

3.0 FIELD EXPLORATION

3.1 FIELD EXPLORATION PROGRAM

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

3.1.1 Cone Penetrometer Soundings

The subsurface conditions were explored by drilling five (5) electronic cone penetration test (CPT) soundings within the proposed building expansion area to termination/refusal depths ranging from around 50 to 65 feet.

Sounding locations were located in the field by an ECS representative using a hand held GPS unit and referencing existing site features. The approximate as-drilled sounding location is shown on the Exploration Location Diagram in Appendix A.

The CPT soundings were conducted in general accordance with ASTM D 5778. The cone used in the soundings has a tip area of 10 cm^2 and a sleeve area of 150 cm^2. The CPT soundings recorded tip resistance and sleeve friction measurements to assist in determining pertinent index and engineering properties of the site soils. The ratio of the sleeve friction to tip resistance is then used to aid in assessing the soil types through which the tip is advanced. The results of the CPT soundings are presented in Appendix B.

Within sounding S-5, seismic tests were performed at approximately three foot intervals to refusal to measure the shear wave velocity (v_s) of the subsurface materials to aid in assessing the dynamic response properties of the site subsurface materials. The seismic shear waves are generated by making impact with a 20-pound sledgehammer onto a steel beam. The impacts are initiated on the right and left sides of the CPT rig and the corresponding wave traces recorded on an oscilloscope are analyzed to determine the shear wave velocity of the tested material. The waves are measured with three geophones that are installed in the cone. The results of the CPT soundings are presented in Appendix B.

3.2 REGIONAL/SITE GEOLOGY

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

Based on the U.S. Geological Survey[1,2] the proposed construct site lies within the Waccamaw Formation (Tpyw). Soils in the Waccamaw Formation typically contain alluvial sands and clays with shells. An overview of the general site geology is illustrated in Figure 3.2.1 below.

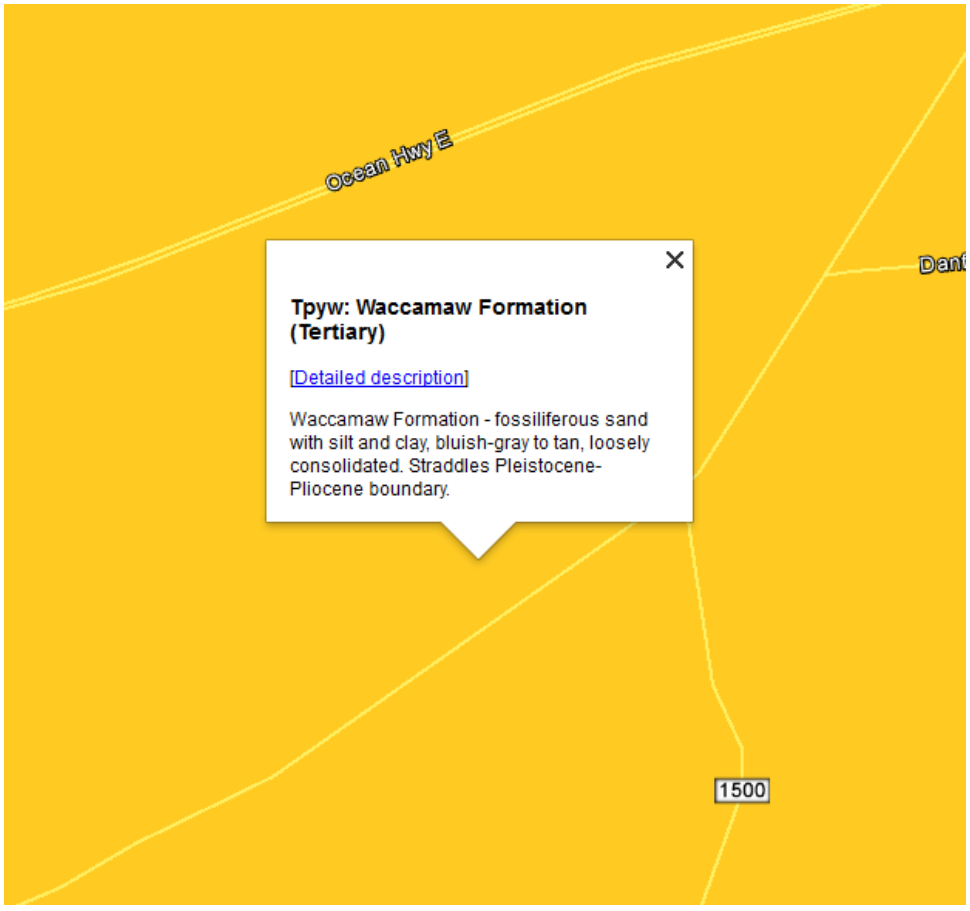


Figure 3.2.1

Geologic map for Figure 3.2.1 obtained from The North Carolina Dept. of Environment, Health, and Natural Resources, Division of Land Resources, NC Geological Survey, in cooperation with the NC Center for Geographic Information and Analysis, 1998, Geology - North Carolina (1:250,000), coverage data file geol250 and Google Earth.

[1] The North Carolina Dept. of Environment, Health, and Natural Resources, Division of Land Resources, NC Geological Survey, in cooperation with the NC Center for Geographic Information and Analysis, 1998, Geology - North Carolina (1:250,000), coverage data file geol250. The data represents the digital equivalent of the official State Geology map (1:500,000 scale), but was digitized from (1:250,000 scale) base maps.

[2] Rhodes, Thomas S., and Conrad, Stephen G., 1985, Geologic Map of North Carolina: Department of Natural Resources and Community Development, Division of Land Resources, and the NC Geological Survey, 1:500,000-scale, compiled by Brown, Philip M., et al, and Parker, John M. III, and in association with the State Geologic Map Advisory Committee.

3.3 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil encountered during our subsurface exploration. For subsurface information at a specific location, refer to the CPT Sounding Logs in Appendix B.

Table 3.3.1 Subsurface Stratigraphy

Approximate Depth Range (ft)	Stratum	Description	Ranges of N*-Values[(1)] blows per foot (bpf)
0-0.5	N/A	Surface Cover: Soundings S-1 and S-4 and asphalt depths of approximately 2 inches underlain by approximately 3 inches of ABC stone. Approximately 6 inches of topsoil was encountered in the remaining soundings. Deeper topsoil or organic laden soils are most likely present in wet, poorly drained areas and potentially unexplored areas of the site.	N/A
0.5-28.0	I	Very Soft to Stiff, Sandy SILT (ML), Silty CLAY (CL-ML) and Lean to Fat CLAY (CL, CH) with interbedded layers of Very Loose to Medium Dense, Clayey, Silty and Clean SAND (SC, SM, SP), Moist to Saturated	2 to 35
28.0-65.0	II	Loose to Very Dense, Clayey, Silty and Clean SAND (SM, SP) with intermittent layers of Firm to Very Stiff Sandy SILT (ML), Silty CLAY (CL-ML) and Lean CLAY (CL), Moist to Saturated	7 to 62

Notes: (1) Equivalent Corrected Standard Penetration Test Resistances

3.4 GROUNDWATER OBSERVATIONS

Porewater pressure measurements were made at the sounding locations during exploration as noted on the CPT sounding logs in Appendix B. The apparent groundwater depths in the soundings were observed at the time of drilling to range from approximately 6 to 8.3 feet below the ground surface.

The highest groundwater observations are normally encountered in the late winter and early spring. 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 not immediately apparent at the time of this exploration. If long term water levels are crucial to the development of this site, it would be prudent to verify water levels with the use of perforated pipes or piezometers.

4.0 DESIGN RECOMMENDATIONS

4.1 BUILDING DESIGN

The following sections provide recommendations for foundation, floor slab, and seismic design.

4.1.1 Foundations

Deep Foundations: Due to the presence of potentially liquefiable sands at shallower depths, we anticipate piles will need to be installed to a minimum embedment depth of 40 feet below existing site grades. Allowable downward, uplift and lateral pile capacities for 8-inch tip timber piles and 12 inch square concrete piles are presented in the following table. The provided allowable loads account for the potential down-drag forces in the upper soft and loose zones.

Table 4.1.1 – 8 Inch Tip Timber Piles

Embedment Depth (Feet)	Axial Capacity (Tons)	Uplift (Tons)	Lateral (Tons) Free Head	Lateral (Tons) Fixed Head
40	30	8.5	1	2.5

Table 4.1.1 – 12 Inch Square Pre-Stressed Concreted Piles

Embedment Depth (Feet)	Axial Capacity (Tons)	Uplift (Tons)	Lateral (Tons) Free Head	Lateral (Tons) Fixed Head
40	44	13.5	2.5	6
45	52	16	2.5	6
50	60	18.5	2.5	6

We recommend that the pile driving hammer used to install timber piles have a minimum rated energy blow of 12,000 foot-pounds and a minimum rated energy blow of 20,000 foot pounds for pre-stressed concrete piles. Driving criteria and bearing elevations should be established prior to driving piles.

It is suggested that several over length piles be driven prior to the start of production pile driving, to establish the driving criteria, pile lengths to be ordered and to determine if auger “pilot” holes are justified. Production piles should not be ordered until the required pile lengths can be determined. A minimum of two test piles are recommended for the structure. In accordance with the North Carolina Building Code, piles with downward capacities of greater than 80 kips require load testing. We recommend Pile Dynamic Analysis (PDA) testing be performed during test pile installation.

The over length piles could be driven in production pile locations. Pile installation operations and PDA testing should be monitored by a senior soil technician working under the supervision of a Licensed Engineer. ECS has the PDA equipment and would be pleased to provide PDA testing once the method of installation and the contractor has been selected. Construction of pile caps or grade beams can begin only after all piles have been installed.

We recommend that pre-condition and post-condition surveys be performed on the adjacent buildings (within at least 500 foot radius) prior to pile installation. Vibration monitoring during pile driving may also be desirable. ECS can prepare a proposal and estimated fee to provide these services, if requested.

4.1.2 Floor Slabs

Subgrade Modulus: Provided the Subgrade Preparations and Earthwork Operations Sections of this report are followed, the slab may be designed assuming a modulus of subgrade reaction (k) of 125 pci (lbs/cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Slab Isolation: Ground-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab. Maximum differential settlement of soils supporting interior slabs is anticipated to be less than 0.5 inches in 50 feet.

4.1.3 Seismic Design Considerations

Seismic Site Classification: The International Building Code (IBC) 2009 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 first method (shear wave velocity) was used in classifying this site.

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:

Table 4.1.3.1: Seismic Site Classification

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

The North Carolina Building Code (2009 International Building Code with North Carolina Amendments) requires that a seismic Site Class be assigned for new structures. The seismic Site Class for the site was determined by calculating a weighted average of the shear velocities of the overburden to the depth of rock/refusal. The CPT test data indicates that the existing natural, overburden soils at the site have shear velocities ranging from approximately 351 ft/sec to 1,550 ft/sec. The method for determining the weighted average value is presented in Section 1613.5.5 of the IBC 2009. The weighted average value for the site is 950 ft/sec. Due to liquefiable soils onsite, the site has been assigned a seismic site class "F".

The IBC 2009 allows the design spectral response accelerations for a site to be determined without regard to liquefaction provided buildings have a fundamental period of less than or equal to 0.5 seconds and the risks of liquefaction are considered in design. The building should meet this criterion; however, this must be confirmed by the Structural Engineer.

If a Site Class F must be used, a site specific seismic hazard analysis (which is beyond our scope of work) is needed to determine the seismic design parameters. As such, additional seismic hazard analysis of the site could be needed to satisfy code requirements.

Liquefaction: The potential for liquefaction at the site is considered low based upon the CPT results and the liquefaction index procedure developed by Iwasaki (1982). Based on our CPT results and our evaluation using a site peak ground acceleration of 0.14, an earthquake event with a magnitude of 7.3 and procedures developed by Robertson (2009) and Boulanger & Idriss (2014), the liquefaction induced settlement at the subject site is estimated to be less than 3 inches.

Ground Motion Parameters: If the risks for liquefaction is addressed in design and the building has a fundamental period of less than or equal to 0.5 seconds, seismic site class "D" parameters can be used for the building. ECS has determined the design spectral response acceleration parameters following the IBC 2009 methodology The Mapped Reponses were estimated from the free Java Ground Motion Parameter Calculator available from the USGS website. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far right end of the following table.

Table 4.1.3.2: Ground Motion Parameters (IBC 2009 Method)

Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
Reference	Figures 1613.5.1 (1) & (2)		Tables 1613.5.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.340	F_a	1.528	$S_{MS}=F_aS_s$	0.520	$S_{DS}=2/3\ S_{MS}$	0.346
1.0	S_1	0.108	F_v	2.368	$S_{M1}=F_vS_1$	0.346	$S_{D1}=2/3\ S_{M1}$	0.171

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

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

It should be noted that the natural geology of the site has been modified in the past; therefore potential fill and unsuitable material may be present on the site. The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, existing fill, and any other soft or unsuitable materials from the 10-foot expanded building area and 5-foot expanded pavement areas. ECS should be called on to verify that topsoil and unsuitable surficial materials have been completely removed prior to the placement of structural fill or construction of the building.

5.1.2 Proofrolling

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any 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 previously approved 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 any localized yielding materials. In the event that unstable or "pumping" subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of any subsequent structural fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting or moisture conditioning, should be discussed with the geotechnical engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help in determined the cause of the observed unstable materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

5.2 EARTHWORK OPERATIONS

5.2.1 Structural Fill Materials

Product Submittals: Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and 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 SM, SC, SW, SP, GW, GP, GM, and GC, or a combination of these group symbols, per ASTM D 2487. Natural fine-grained soils classified as clays or silts (CL, ML) should generally not be considered for use as engineered fill, but may be evaluated by the geotechnical engineer to determine their suitability at the contractor's request. The materials should be free of organic matter, debris, and should contain no particle sizes greater than 4 inches in the largest dimension. Open graded materials, such as gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric. Suitable structural fill material should have the index properties shown in Table 5.2.1.1.

Table 5.2.1.1 Structural Fill Index Properties

Location with Respect to Final Grade	LL	PI	Max % Fines Passing # 200 Sieve
Building Area	35 max	9 max	20
Pavement Area	35 max	9 max	20

Unsatisfactory Materials: Materials that should not be used as engineered fill include topsoil, organic materials (OH, OL), and high plasticity clays and silts (CH, MH). Such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved on or off-site disposal areas.

On-Site Borrow Suitability: Near surface SANDS (SM, SP) with a fines content less than 20 percent should be suitable for re-use as structural fill. Moisture conditioning should be anticipated for the soils to achieve the optimum moisture content for fill placement.

5.2.2 Compaction

Structural Fill Compaction: Structural fill within the expanded building, pavement, and embankment limits should be placed in maximum 8-inch loose lifts, moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content, and be compacted with suitable equipment to a dry density of at least 98% of the standard Proctor maximum dry density (ASTM D698). Beyond these areas, compaction of at least 95% should be achieved. ECS should be called on to document that proper fill compaction has been achieved.

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for the proposed construction area, at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified representative of the construction testing laboratory to determine that the minimum compaction requirements are being achieved. Field density testing of fills will be performed at the frequencies shown in Table 5.2.2.1, but not less than 1 test per lift.

Table 5.2.2.1 Frequency of Compaction Tests in Fill Areas

Location	Frequency of Tests
Building Area	1 test per 2,500 sq. ft.
Utility Trenches	1 test per 200 sq. ft.
Pavement Areas	1 test per 10,000 sq. ft.

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

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

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

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils.

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. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

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

5.3 GENERAL CONSTRUCTION CONSIDERATIONS

Moisture Conditioning: 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 mechanical manipulation, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

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. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used in pavement areas.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to minimize infiltration of surface water.

Excavation Safety: Cuts or excavations associated with utility excavations may require forming or bracing, slope flattening, or other physical measures to control sloughing and/or prevent slope failures. Contractors should be familiar with applicable OSHA codes to ensure that adequate protection of the excavations and trench walls is provided.

Excavation Considerations: Based on the results of the soundings, we expect that the natural Coastal Plain soils encountered on this site can be excavated with conventional earth moving equipment such as loaders, bulldozers, rubber tired backhoes, etc.

The site soils are OSHA Type C soils for the purpose of temporary excavation support. Excavations should be constructed in compliance with current OSHA standards for excavation and trenching safety. Excavations should be observed by a "competent person," as defined by OSHA, who should evaluate the specific soil type and other conditions, which may control the excavation side slopes or the need for shoring or bracing. Regardless, site safety shall be the sole responsibility of the contractor and their subcontractors. Exposed earth slopes shall be protected during periods of inclement weather.

Erosion Control: The surface soils may be erodible. Therefore, the contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. All erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

6.0 CLOSING

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

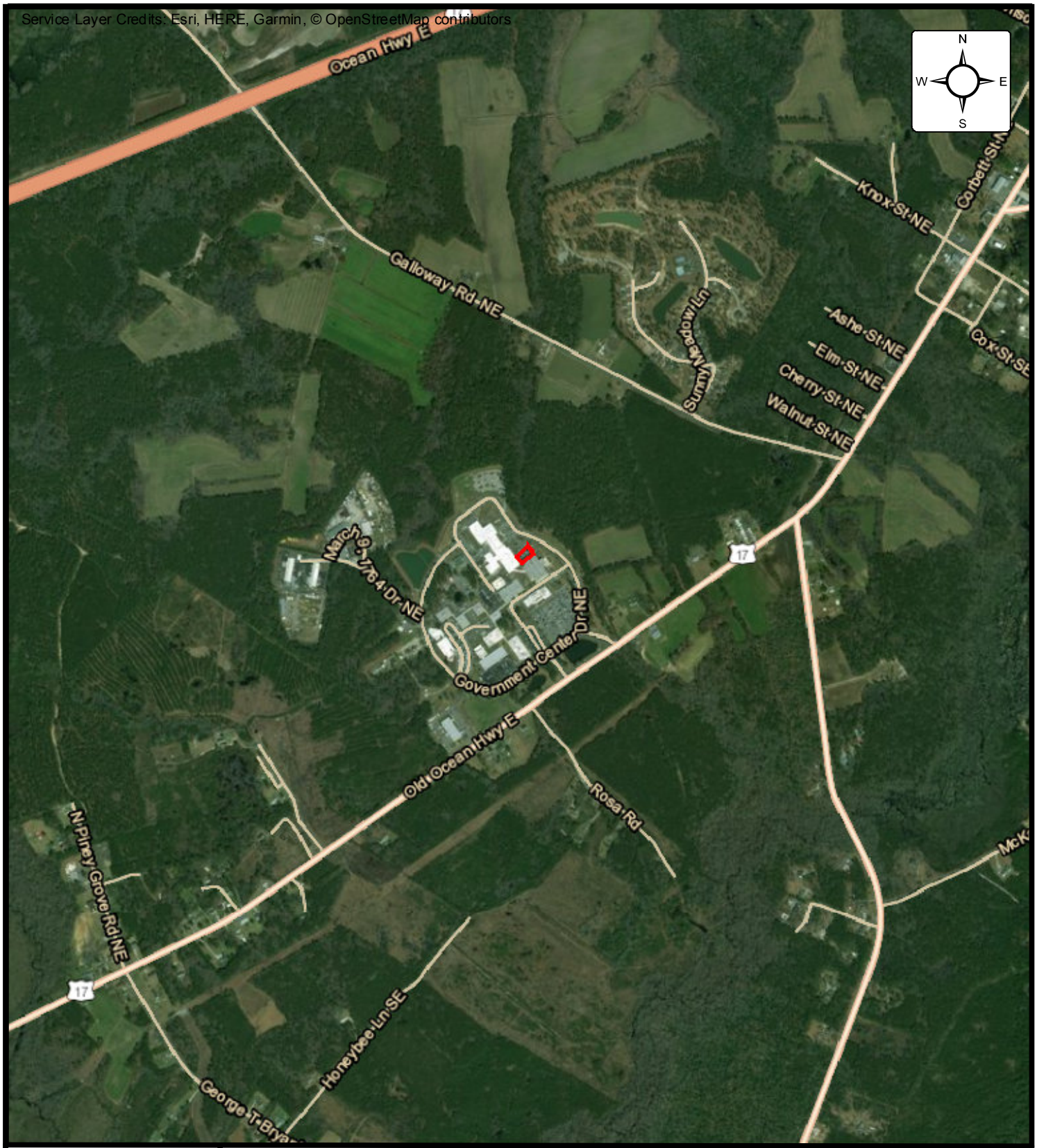
The description of the proposed project is based on information provided to ECS by Brunswick County. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately so that we can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

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

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

APPENDIX A – Drawings & Reports

Site Location Diagram
Exploration Location Diagram



SITE LOCATION DIAGRAM

BRUNSWICK COUNTY COURTHOUSE ADDITION

BOLIVIA, NORTH CAROLINA

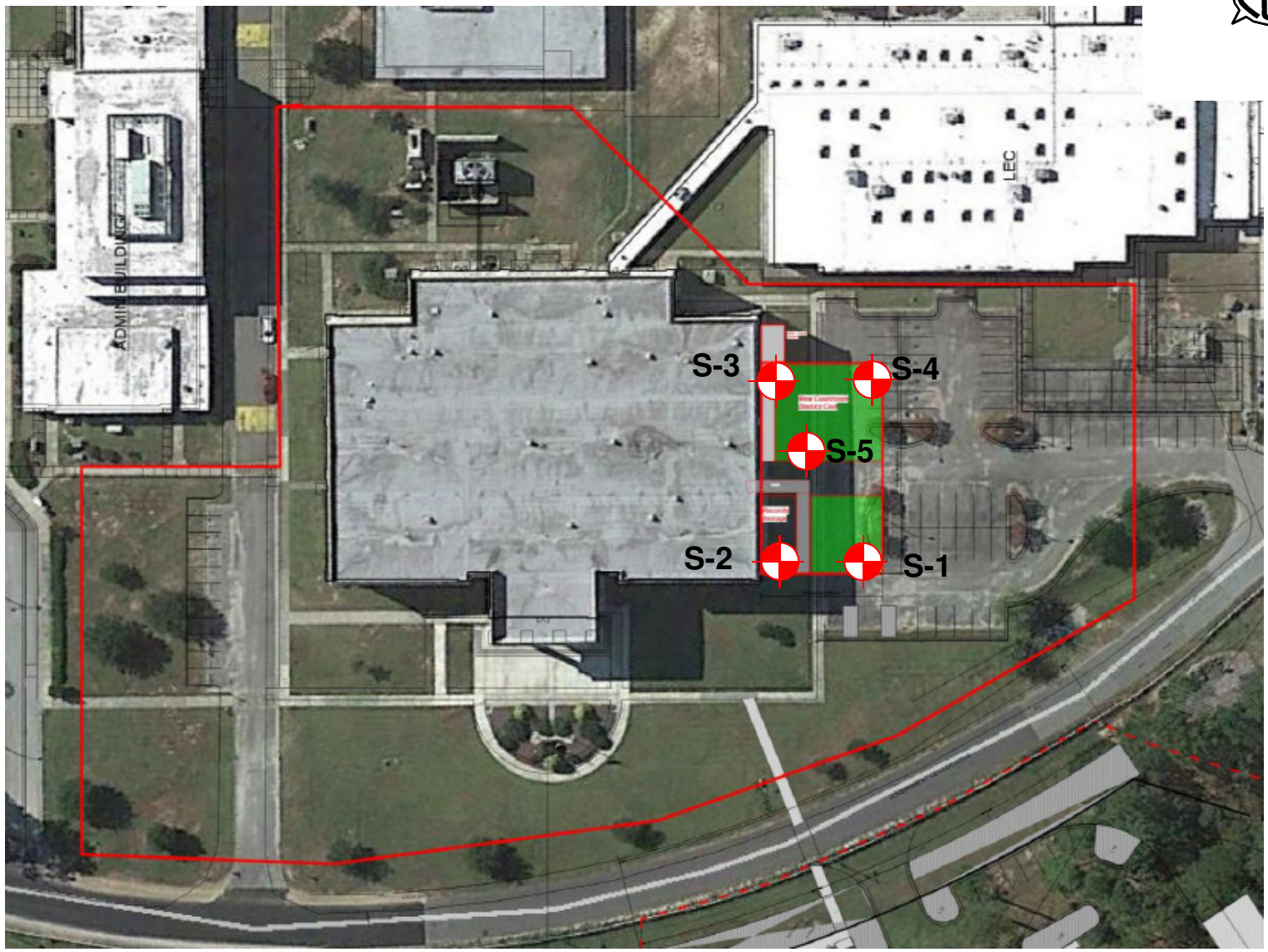
ENGINEER	WEG
SCALE	NTS
PROJECT NO.	22:26623
SHEET	1 OF 2
DATE	5/3/2018

EXPLORATION LOCATION DIAGRAM

Brunswick County Courthouse Addition

Bolivia, North Carolina

REFERENCE	Sawyer Sherwood & Associate
ENGINEER	WEG
DRAFTING	MME
SCALE	NTS
PROJECT NO.	22-26623
SHEET	2 of 2
DATE	5/3/2018



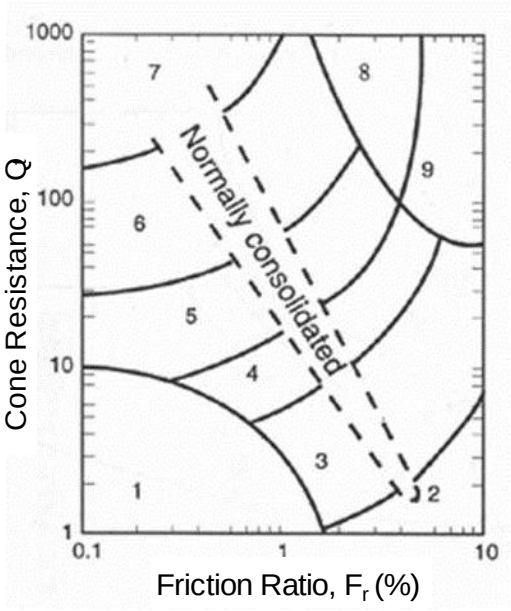
DENOTES APPROXIMATE LOCATION OF CPT SOUNDING

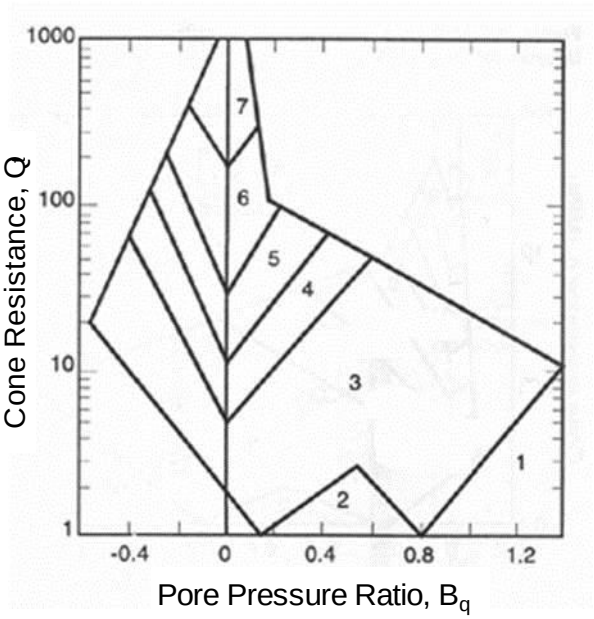
APPENDIX B – Field Operations

Reference Notes for Sounding Logs
CPT Sounding Logs - S-1 through S-5

REFERENCE NOTES FOR CONE PENETRATION TEST (CPT) SOUNDINGS

In the CPT sounding procedure (ASTM-D-5778), an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance (q_c), pore water pressure (u_2), and sleeve friction (f_s). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, preconsolidation pressure, and undrained shear strength. The graphs below represent one of the accepted methods of CPT soil behavior classification (Robertson, 1990).





1. Sensitive, Fine Grained
2. Organic Soils-Peats
3. Clays; Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sands to Silty Sands
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

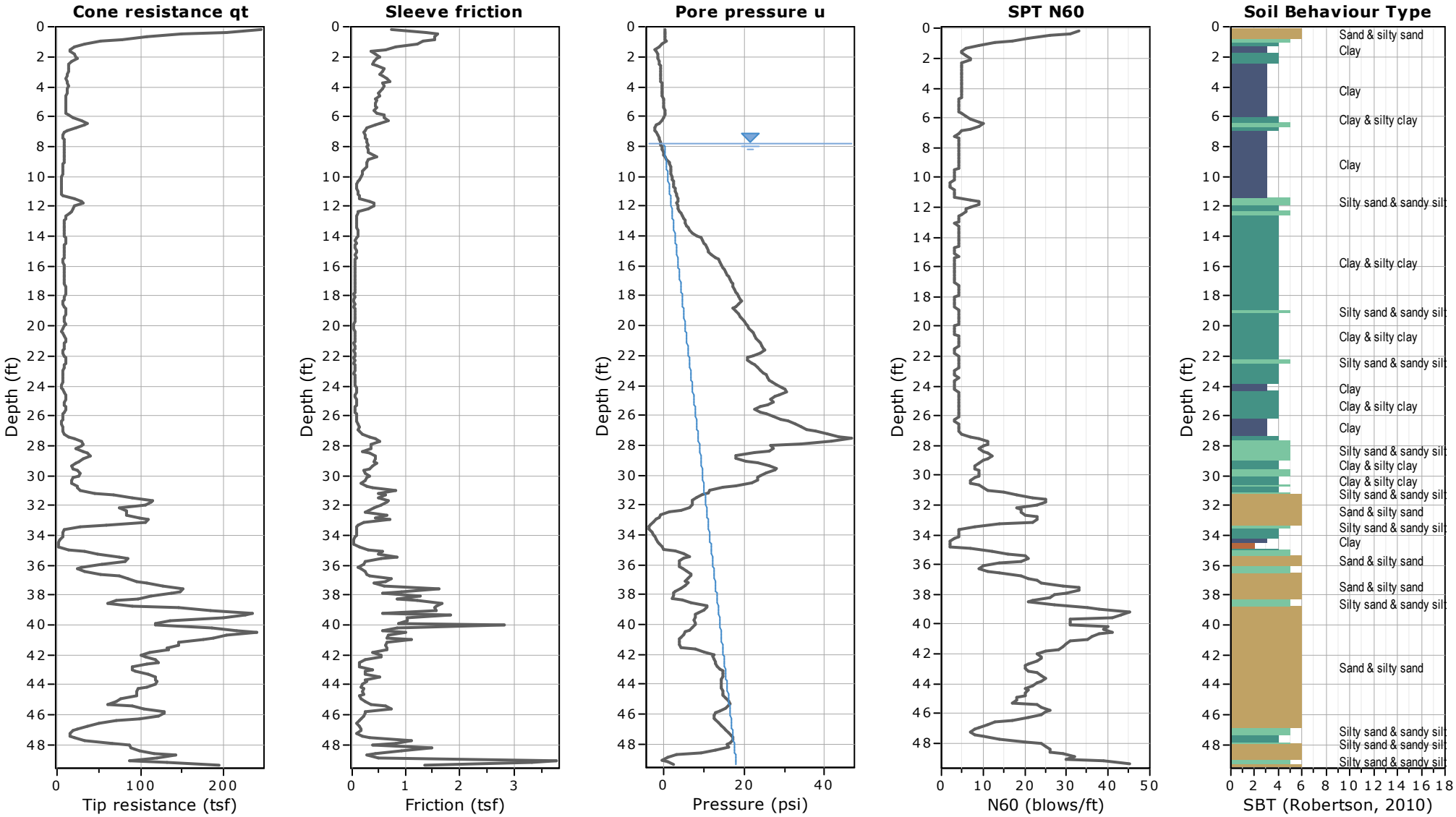
The following table presents a correlation of corrected cone tip resistance (q_c) to soil consistency or relative density:

SAND		**SILT/CLAY**	
Corrected Cone Tip Resistance (q_c) (tsf)	**Relative Density**	**Corrected Cone Tip Resistance (q_c) (tsf)**	**Relative Density**
<20	Very Loose	<5	Very Soft
20-40	Loose	5-10	Soft
40-120	Medium Dense	10-15	Firm
		15-30	Stiff
120-200	Dense	30-45	Very Stiff
>200	Very Dense	45-60	Hard
		>60	Very Hard

ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22:26623

Project: **Brunswick County Courthouse Addition**
Location: **Bolivia, Brunswick County, North Carolina**

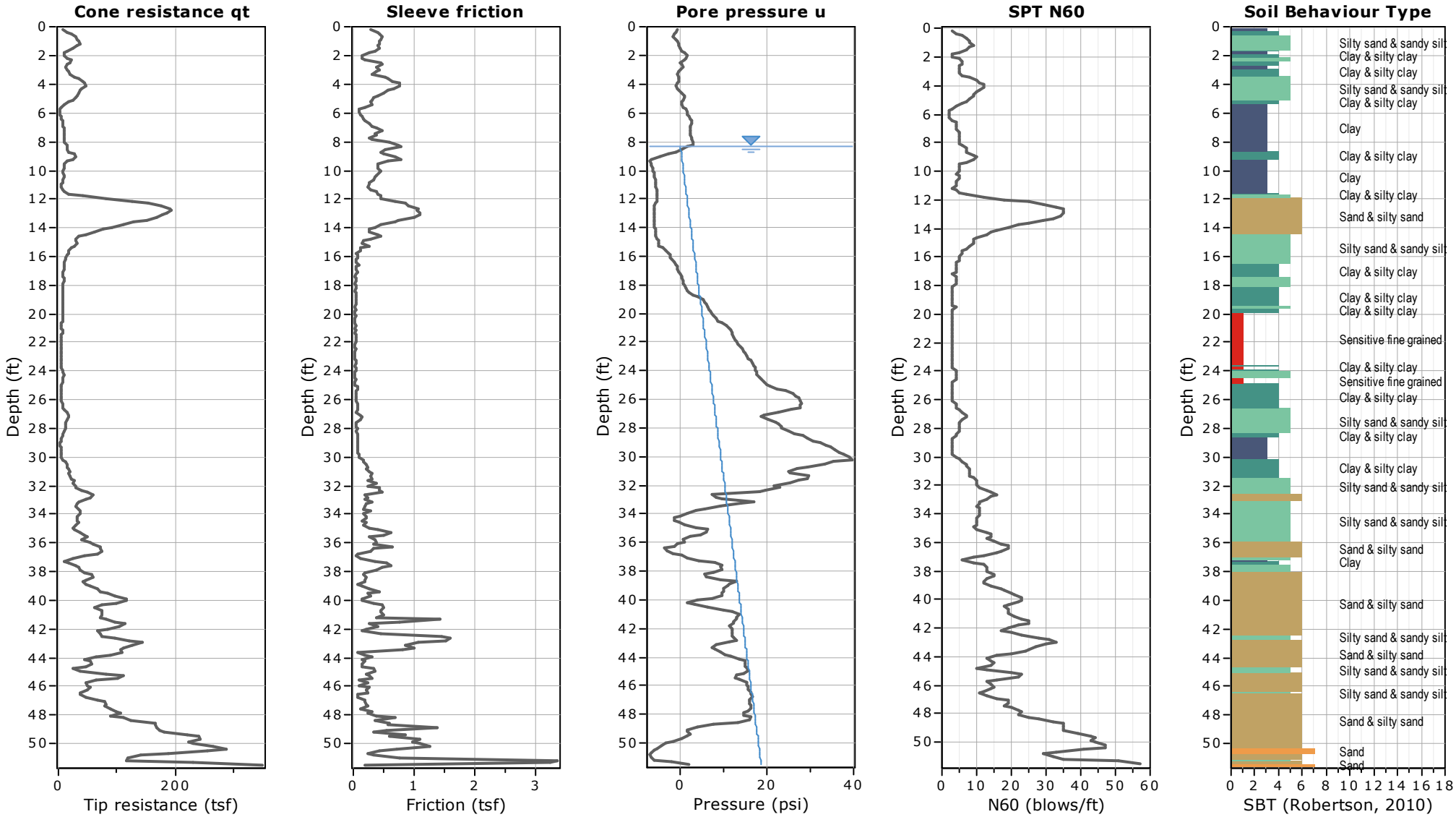
CPT: S-1
Total depth: 49.38 ft



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22:26623

Project: **Brunswick County Courthouse Addition**
Location: **Bolivia, Brunswick County, North Carolina**

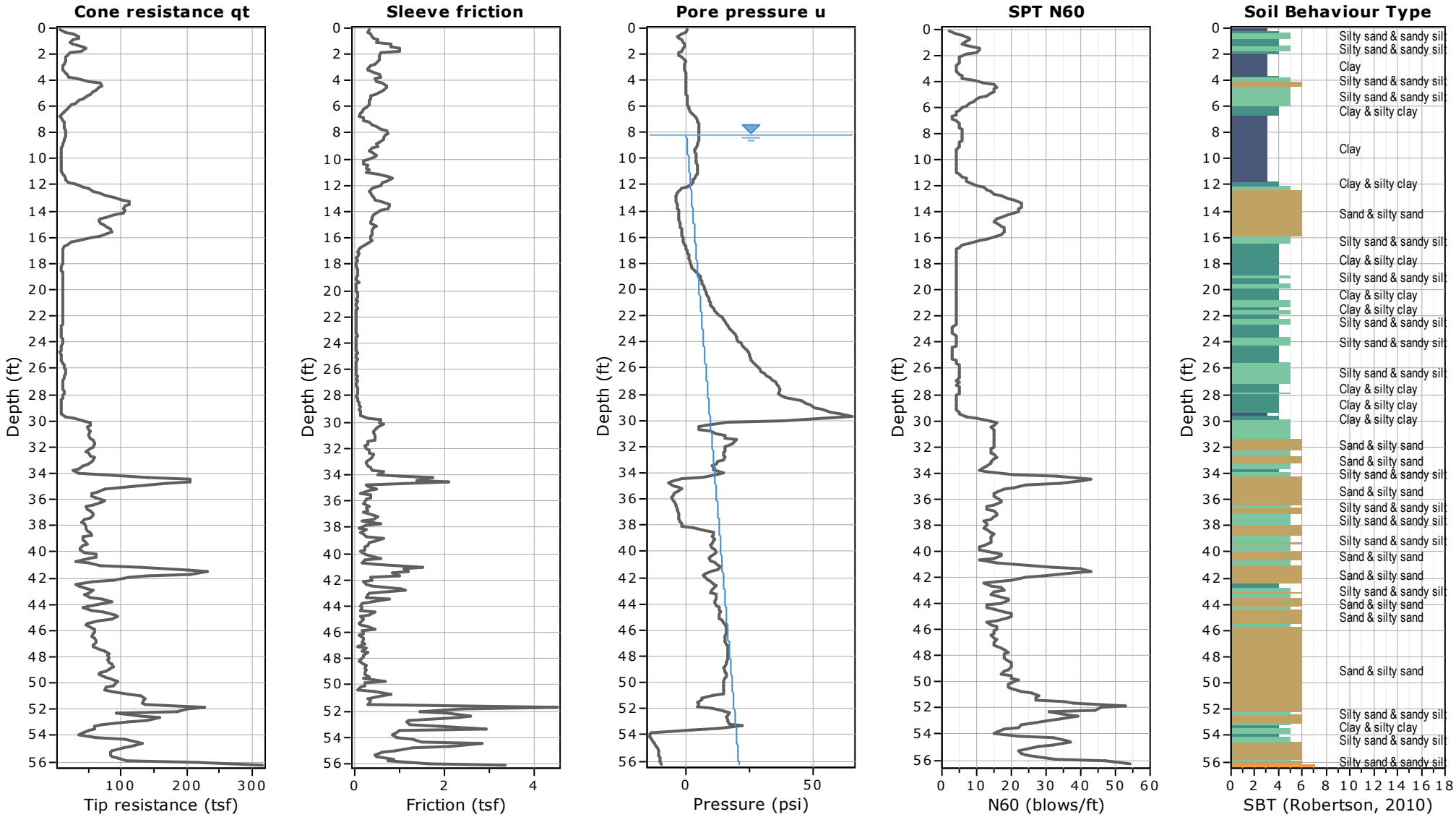
CPT: S-2
Total depth: 51.51 ft



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22:26623

Project: **Brunswick County Courthouse Addition**
Location: **Bolivia, Brunswick County, North Carolina**

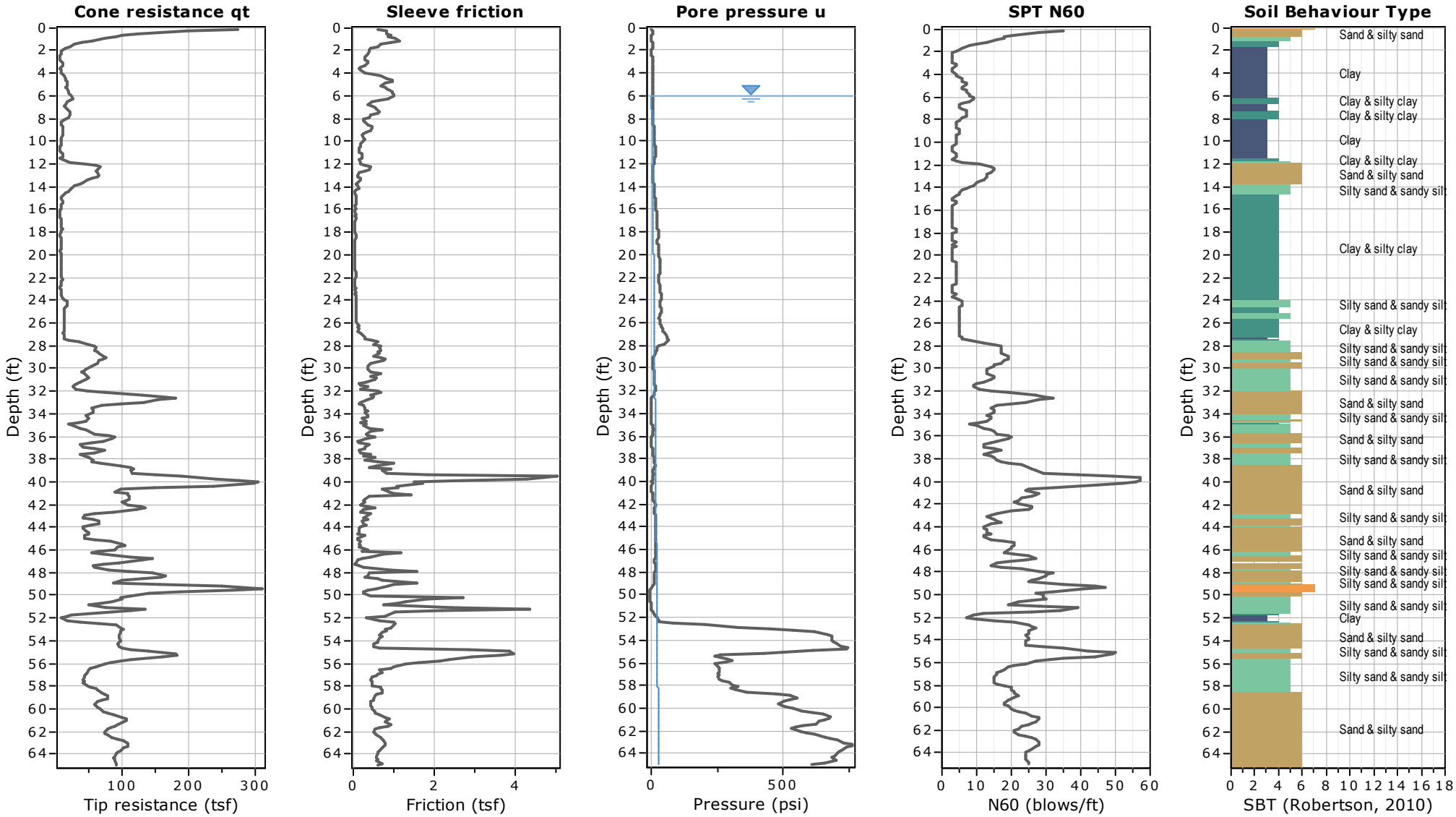
CPT: S-3
Total depth: 56.27 ft



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22:26623

Project: **Brunswick County Courthouse Addition**
Location: **Bolivia, Brunswick County, North Carolina**

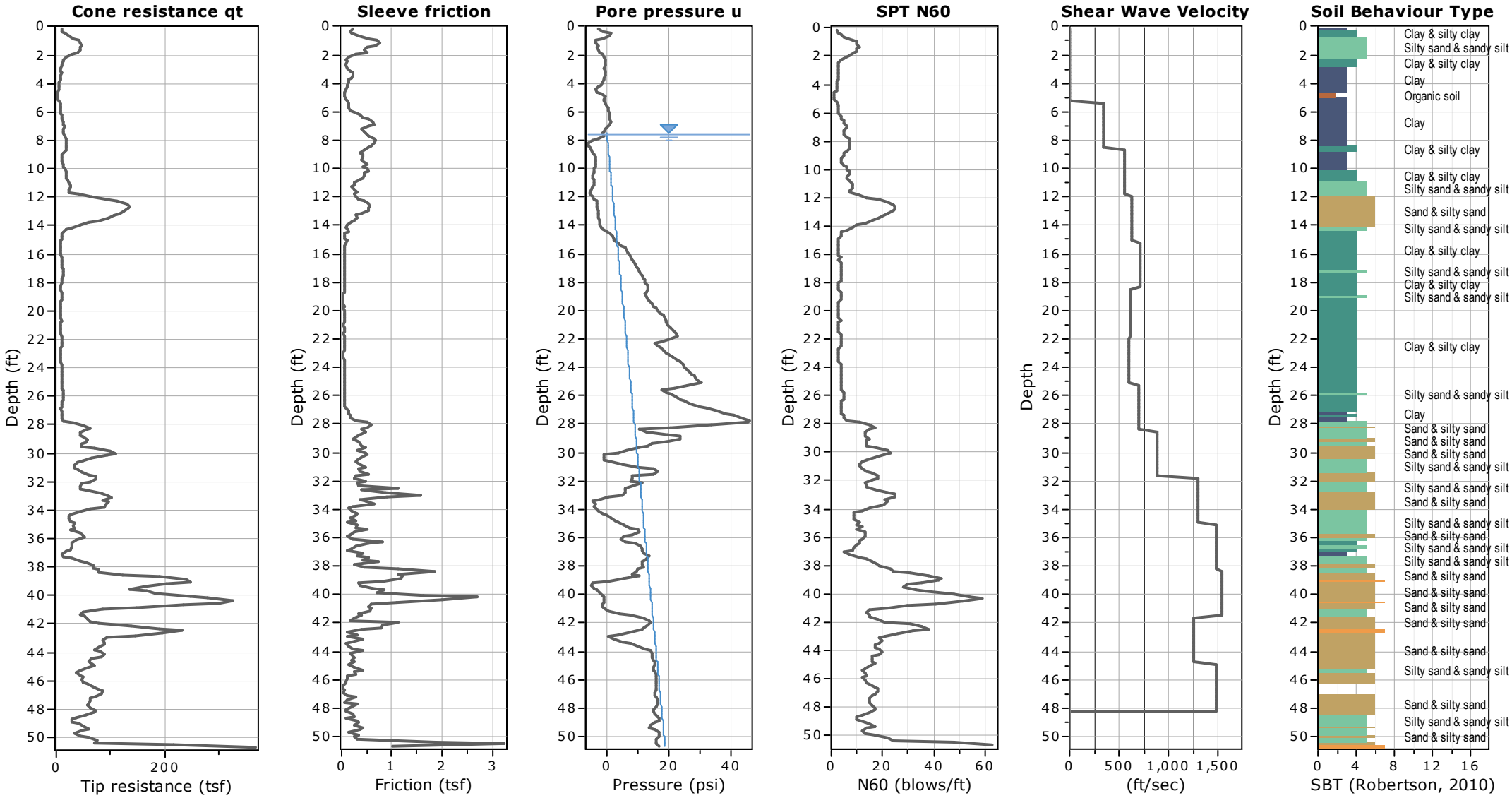
CPT: S-4
Total depth: 64.96 ft



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22:26623

Project: **Brunswick County Courthouse Addition**
Location: **Bolivia, Brunswick County, North Carolina**

CPT: S-5
Total depth: 50.69 ft



APPENDIX C – Supplemental Report Documents

ASFE Document

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone:' 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

Copyright 2004 by ASFE, Inc. Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with ASFE's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of ASFE, and only for purposes of scholarly research or book review. Only members of ASFE may use this document as a complement to or as an element of a geotechnical engineering report. Any other firm, individual, or other entity that so uses this document without being anASFE member could be committing negligent or intentional (fraudulent) misrepresentation.

IIGER06045.0M

April 4, 2019

Mr. Bill Pinnix, PE
Brunswick County
Post Office Box 249
75 Court House Drive NE
Building 1
Bolivia, North Carolina 28422

Re: Report of Geotechnical Engineering Analysis
Brunswick County Courthouse Addition
Bolivia, Brunswick County, North Carolina

ECS Project No.: 22:26623

Dear Mr. Pinnix:

ECS has analyzed 12-inch, 14-inch and 16-inch Auger Cast In Place Piles (ACIP) for the proposed construction.

Auger Cast in Place Piles

The following table shows the allowable pile capacity for 12-inch, 14-inch and 16-inch diameter auger cast-in-place (ACIP) piles installed to various embedment depths. The embedment depths shown are in reference to the elevation of the soundings. The allowable pile capacities (based on a factor of safety of 2.0 for axial capacity and 3.0 for uplift capacity) are presented in the following tables:

12-Inch Diameter Auger Cast In Place Piles

Embedment Depth (Feet)	Axial Capacity (Tons)	Uplift Capacity (Tons)	Lateral Capacity Free Head– (Tons) Free Head	Lateral Capacity Fixed Head– (Tons)
40	16	9.5	2	5
45	22	10.5	2	5
50	30	11.5	2	5

14-Inch Diameter Auger Cast In Place Piles

Embedment Depth (Feet)	Axial Capacity (Tons)	Uplift Capacity (Tons)	Lateral Capacity Free Head– (Tons) Free Head	Lateral Capacity Fixed Head– (Tons)
40	23.5	11.5	3	7
45	31	12.5	3	7
50	41	13	3	7

16-Inch Diameter Auger Cast In Place Piles

Embedment Depth (Feet)	Axial Capacity (Tons)	Uplift Capacity (Tons)	Lateral Capacity Free Head– (Tons) Free Head	Lateral Capacity Fixed Head– (Tons)
40	33	13.5	3.5	8.5
45	43	15.5	3.5	8.5
50	52	17	3.5	8.5

The provided compression and tension capacities are based on a factor of safety of 2.0 and 3.0, respectively. The lateral loads were designed assuming 0.5 inches of deflections and was applied to the pile flush to the existing grade. If shallower limestone is encountered, the allowable axial and uplift capacities listed above should be reduced. ECS should be contacted to provide reduced capacities based on the encountered conditions.

The loading assumes a free head pile condition with axial and shear forces applied to the pile head.

The auger withdrawal should be performed in accordance with the 2018 North Carolina Building Code (International Building Code 2015 with State Amendments) Section 1810.4.8 to maintain the appropriate grout head for the project. A thorough monitoring of the auger cast pile installation procedures, the grout head, and the grout factor should be implemented. The grout factor is the actual grout volume of the pile divided by the theoretical pile volume. It is recommended that a grout factor of 2.0 to 3.0 be budgeted for the project.

We recommend that at least two auger cast test piles be installed per building to confirm the pile length and to confirm the contractor's installation procedures and techniques.

Depending on the final design load of the pile system selected, a pile load test should be performed for piles with axial load capacities greater than 40 tons in order to verify the pile capacity. Axial compression load tests should be performed in accordance with ASTM D1143. Tension pile load tests should be performed for each structure in accordance with ASTM 3689. The criteria for the pile load test acceptance is the Davisson Offset Limit. The structural engineer of record should determine the number of pile load tests to be performed.

During installation, it is recommended that an approximate 48 inch distance be maintained between adjacent piles. A minimum period of 12 hours is required for installing adjacent piles at less than this minimum distance.

The minimum grout strength for the auger cast in place piles should conform to the NC Building Code Section 1810.3.2.6.

Closure: We appreciate the opportunity to be of service to you during the design phase of this project and look forward to our continued involvement during the construction phase. If you have any questions concerning the information and recommendations presented in this report, please contact us at (910) 686-9114 for further assistance.

Respectfully submitted,

ECS SOUTHEAST, LLP

Mike Ellis, PE
Project Manager

Winslow E. Goins, PE
Principal Engineer