Edgecombe County Animal Shelter

Geotechnical Engineering Report

April 23, 2024 | Terracon Project No. 72235121

Prepared for:

Stocks Engineering, P.A.
PO Box 1108
Nashville, NC 27856

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April 23, 2024

Stocks Engineering, P.A.
PO Box 1108
Nashville, NC 27856

Attn: Mr. Kevin Varnell
P: (252) 459-8196
E: kvarnell@stocksengineering.com

Re: Geotechnical Engineering Report
Edgecombe County Animal Shelter
3005 Anaconda Road
Tarboro, North Carolina
Terracon Project No. 72235121

Dear Mr. Varnell:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. P72235121 dated November 17, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

NORTH CAROLINA PROFESSIONAL SEAL 042183 ENGINEER ANDREW J. GLINIAK 4/23/2024

Liam H. Locklear
Assistant Project Manager

Andrew J. Gliniak, P.E.
Project Engineer
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Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	Plans for the project include constructing a new animal shelter with associated paved parking and drives.
Geotechnical Characterization	The exploration encountered very loose to medium dense sand and medium stiff to stiff clay. Groundwater is anticipated at depths ranging from 10 feet to 20 feet beneath existing site grades.
Earthwork	Our recommendations include vibratory rolling the subgrade, raising existing site grades on the order of 1 foot and remediation of soils that are not improved during earthwork. Isolated subgrade repairs and foundation overexcavation should be anticipated. Earthwork operations should be performed during the warmer, drier periods of the year (May through October) to avoid problems associated with a wet subgrade. The use of low ground pressure/tracked equipment should be anticipated for site preparation. Further details are provided in **Earthwork**.
Shallow Foundations	With subgrade prepared as noted in **Earthwork**. Allowable bearing pressure = 2,000 psf Expected settlements: < 1-inch total, < 1/2-inch differential
Pavements	With subgrade prepared as noted in **Earthwork**. Concrete: ▪ 5 inches Portland Cement Concrete (PCC) in Light Duty and Medium Duty areas ▪ 7 inches PCC over 4 inches ABC in Heavy Duty areas Asphalt: ▪ 3 inches Asphaltic Concrete (AC) over 6 inches ABC in Light Duty areas ▪ 4 inches AC over 8 inches ABC in Medium Duty areas
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed animal shelter to be located at 3005 Anaconda Road in Tarboro, North Carolina. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification
- Site preparation and earthwork
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of electronic Cone Penetration Test (CPT) soundings and macrocore sampling, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and as separate graphs in the **Exploration and Laboratory Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Project information was obtained via email correspondence on November 8, 2023. The email contained a summary of the project, requested submittals for the geotechnical report, the site location and floor plan. We also completed a wetlands/waters delineation report for the site, Terracon project number 70237634, dated March 8, 2024.

Item	Description
	The site investigation was delayed until any conflict with the planned building area and potential wetlands were determined.
Project Description	Plans for the project include constructing a new animal shelter with associated paved parking and drives. It will be a single-story building with a footprint of approximately 13,150 square feet.
Building Construction	We assume the structure will be single-story metal framed bearing on shallow foundations with slab-on-grade construction.
Finished Floor Elevation	Not provided, assumed to be at or near existing site grades
Maximum Loads	In the absence of structural loading information provided by the design team, we have assumed the following structural loads to estimate settlement at the site: ▪ Columns: up to 50 kips ▪ Walls: less than 3 kips per linear foot (klf) ▪ Slabs: less than 100 pounds per square foot (psf)
Grading/Slopes	Less than 2 feet of cut and fill is assumed to develop final grades excluding remedial grading and cut of the existing earthen berm on the east side of the site.
Below-Grade Structures	None.
Free-Standing Retaining Walls	None.
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Anticipated traffic is as follows: ▪ Autos/light trucks: 500 vehicles per day ▪ Light delivery and trash collection vehicles: 20 vehicles per week ▪ Tractor-trailer trucks: <1 vehicle per week The pavement design period is 20 years.
Stormwater Management	No stormwater management features are indicated on the provided plans.
Building Code	2018 North Carolina State Building Code

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading information, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The site is located at 3005 Anaconda Road in Tarboro, North Carolina. GPS Coordinates: N 35.9106, W 77.5912 (approximate) See **Site Location**
Existing Improvements	The Edgecombe County Jail and Sheriff's Office are currently located on the northeast corner of the property. Edgecombe County Water and Sewer Department is located on the southwest corner of the property. The proposed development area is currently wooded. Based on historical aerial imagery of the site, a portion of the land was cleared during or before the year 2006. An earthen berm, approximately 4 feet high visually, was observed during our site visit and is located along the eastern portion of the site.
Current Ground Cover	Moderately to heavily wooded, grass areas.
Existing Topography	Based on the publicly available topographic information obtained from Google Earth Pro™, the site gently slopes downwards from an elevation of approximately 106 feet MSL on the north side to approximately 100 feet MSL on the south side.

We also collected photographs at the time of our field exploration program. Representative photos are provided in our **Photography Log**.

Geotechnical Characterization

Soil Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report. Surficial materials are not included in the GeoModel.

As part of our analyses, we identified the following model layers within the subsurface profile, excluding surface materials. For a more detailed view of the model layer depths at each boring location, refer to the **GeoModel**. Surficial materials are not included in the GeoModel and CPT model layers do not delineate these materials.

Model Layer	Layer Name	General Description
1	Near Surface Sand	Sand with varying amounts of silt and clay, very loose to medium dense
2	Sand and Clay	Sand with varying amounts of silt and clay, clay with varying amounts of sand and silt; loose to medium dense, medium stiff to stiff

Groundwater Conditions

Based on the cave in depths, no groundwater being encountered to cave in depths, and moisture condition of the soil samples, groundwater is anticipated at depths of 10 feet to 20 feet below the existing ground surface. Groundwater readings would likely require additional time to stabilize due to the low permeability of the soils encountered.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the soundings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Geology

The project site is located in the Coastal Plain Physiographic Province. The Coastal Plain soils consist mainly of marine sediments that were deposited during successive periods of fluctuating sea level and moving shoreline. The soils include sands, silts, and clays with irregular deposits of shells, which are typical of those lain down in a shallow sloping sea bottom. Recent alluvial sands, silts, and clays are typically present near rivers and creeks.

According to USGS Mineral Resources On-Line Spatial Data based on the 1998 digital equivalent of the 1985 Geologic Map of North Carolina, the site is mapped within the Yorktown Formation and Duplin Formation, Undivided (Tertiary).

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7-10 and the North Carolina Building Code (NCSBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of D** be considered for the project. Subsurface exploration at this site was extended to a maximum depth of 20 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current exploration depth.

Liquefaction

Liquefaction occurs when a rapid buildup in water pressure, caused by ground motion, pushes sand particles apart, resulting in a loss of strength and later densification as the water pressure dissipates. This loss of strength can cause bearing capacity failure while the densification can cause excessive settlement.

The amount of settlement is dependent on the magnitude and distance from a seismic event, and geologic age of the soil deposit. Based on the relatively mild ground motions associated with the design earthquake, the potential for liquefaction is negligible at this site.

Geotechnical Overview

Based upon the geotechnical conditions encountered in our exploration, the site can be improved for the proposed construction, provided that the recommendations given herein are implemented in the design and construction phases of this project. Our recommendations include vibratory rolling the subgrade, raising existing site grades on the order of 1 foot and remediation of soils that are not improved during earthwork. Isolated subgrade repairs and foundation overexcavation should be anticipated. Test location B-05 had relatively looser soil to a depth of at least 3 feet that will likely require remediation.

Subsurface conditions at the site included relatively loose moisture sensitive sand. Earthwork operations should be performed during the warmer, drier periods of the year (May through October) to avoid problems associated with a wet subgrade. Positive site drainage is essential to aid in maintaining stable subgrade conditions. Laboratory testing of near-surface soils samples revealed natural moisture content that is expected to be higher than the soil Plastic Limit, which suggests instability of the subgrade soils should be anticipated. For this reason, low ground pressure/tracked equipment should be anticipated for site preparation.

Following the recommended **Earthwork**, the building can be supported on shallow foundations bearing on approved existing soils or structural fill compacted as recommended and sized for a maximum net allowable soil bearing pressure of 2,000 psf. The **Shallow Foundations** section addresses support of the building bearing on densified existing fill soils or structural fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

A rigid or flexible pavement system is suitable for this site. The **Pavements** section addresses the design of pavement systems supported on the densified existing soils or structural fill.

The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and structural fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements. Grading for the structure should incorporate the limits of the proposed structure plus 5 feet beyond proposed perimeter building walls and any exterior columns.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and root mats should be removed. Based on the results of our exploration, topsoil thickness measurements of at least 6 inches should be anticipated. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. Deeper topsoil or organic-laden soils may be present in wet, poorly drained areas of the site. Stumps should be removed, and the hole somewhat enlarged for backfill with compacted fill.

Although no evidence of underground facilities (such as septic tanks, cesspools, basements, and utilities) was observed during the exploration and site reconnaissance, such features could be encountered during construction. If unexpected existing fill soils or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

After stripping and removing topsoil and once any areas of cut have been excavated to proposed subgrade elevation, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. The purpose of the vibratory rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils. The roller should make at least six passes across the site, with the second set of three passes perpendicular to the first set of three passes with intermittent vibration activated. If water is brought to the surface by the vibratory rolling, the operation should be discontinued until the water subsides. Vibratory rolling should be completed during dry weather. Static rolling and additional repairs should be anticipated for areas too wet for vibratory rolling.

After the vibratory rolling, pore pressures should be allowed to dissipate for a minimum of 16 hours. After the waiting period, proofrolling should be performed on the exposed subgrade soils in areas to receive fill or at the subgrade elevation with a loaded, tandem-axle dump truck (15 to 20 ton total vehicle weight) or similar rubber-tired construction equipment. Proofrolling is recommended as a means of detecting areas of soft or unstable subgrade soils. The proofrolling should be performed during a period of dry weather to avoid degrading an otherwise suitable subgrade. The proofrolling operations should be observed by a representative of the geotechnical engineer. Subgrade soils that exhibit excessive rutting or deflection during proofrolling should be repaired as directed by the field representative. Typical repairs include overexcavation followed by replacement with either properly compacted fill or by a subgrade stabilization fabric in conjunction with a sand fill or crushed stone.

If subgrade soils are unsuitable, they will require removal and replacement; however, if they are unstable due to excessive moisture, the most economical solution for remediation may be to scarify, dry and recompact the material. This remediation is most effective during the typically hotter months of the year (May to October). If construction is performed during the cooler period of the year, the timeline for scarifying, drying, and recompacting typically increases considerably and may lead to alternative remediation solutions. These solutions can include overexcavation of some or all of the unstable material to be backfilled with either approved structural fill or geotextile and ABC Stone. Potential undercutting can be reduced if the site preparation work is performed during a period of dry weather and if construction traffic is kept to a minimum on prepared subgrades. We recommend that the contractor submit a unit rate cost for undercutting as part of the bidding process.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or continued construction.

Fill Material Types

Fill (engineered fill) required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 5 feet of structures and pavements. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural fill should meet the following material property requirements:

Soil Type[1]	USCS Classification	Acceptable Location for Placement
Imported Soil	SC, SM, SP	All locations and elevations
On-Site Soils	SC, SM	All locations and elevations

1. Structural fill should consist of approved materials free of organic matter and debris. Frozen materials should not be used, and fill should not be placed on frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Fine-grained soils such as clays and silts should not be reused as structural fill due to their moisture sensitivity when compared to the sandier soils available. Reuse of SC material could lead to delays in construction depending on moisture conditions at the site at that time.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2,3]	95% of maximum 98% of maximum within 1 foot of pavement subgrade	92% of max.
Water Content Range [1, 3]	Within 2 percent of optimum moisture content	As required to achieve min. compaction requirements

1. Fill should be tested for moisture content and compaction during placement. If in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the tests should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. It is not necessary to achieve 95% compaction on the existing ground prior to placing fill or beginning construction. However, the subgrade should be evaluated by the Geotechnical Engineer prior to placing fill or beginning construction.
3. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
4. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility being supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the material requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 5 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 5 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Earthwork operations should be performed during the warmer, drier periods of the year (May through October) to avoid problems associated with a wet subgrade.

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could affect overexcavation efforts, especially for overexcavation and replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps may be necessary to achieve the recommended depth of overexcavation depending on groundwater conditions at the time of construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. The bottom of footings should be checked with hand augers and Dynamic Cone Penetrometer (DCP) testing. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	2,000 psf
Required Bearing Stratum [3]	Approved existing soils or structural fill
Minimum Foundation Dimensions	Per NC Building Code: Columns: 24 inches Continuous: 16 inches Thickened: 12 inches
Sliding Resistance [4]	0.3 ultimate coefficient of friction
Minimum Embedment below Finished Grade [5]	12 inches
Estimated Total Settlement from Structural Loads [2]	Less than approximately 1 inch
Estimated Differential Settlement [2, 6]	Up to 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure. The maximum net allowable bearing pressure may be increased by 1/3 for transient wind loads and seismic loads.

Item	Description

2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations. For fine-grained materials, lateral resistance using cohesion should not exceed ½ the dead load.
5. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
6. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., e < b/6, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the North Carolina Building Code basic load combinations.

Item	Description
Soil Moist Unit Weight	120 pcf
Soil Effective Unit Weight[1]	48 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface

1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. This is an essential part of the construction process. The Geotechnical Engineer should use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing should be performed to a depth of 3 to 5 feet below the bottom of foundation excavation and through any existing fill soils. Excessively soft, loose, or wet bearing soils should be over excavated to a depth recommended by the geotechnical engineer. The excavated soils should be replaced with structural fill or washed, crushed stone (NCDOT No. 57) wrapped in a geotextile fabric (Mirafi 140 N or equivalent). The need for the geotextile fabric with the crushed stone should be determined by the Geotechnical Engineer during construction based on sloughing/caving soils and excavation observations. However, footings could bear directly on the soils after over excavation if approved by the Geotechnical Engineer.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively disturbed or saturated, the affected soil should be removed prior to placing concrete.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Suitable existing soils or new structural fill compacted in accordance with **Earthwork** section of this report.
Estimated Modulus of Subgrade Reaction[2]	100 pounds per square inch per inch (psi/in) for point loads
Aggregate base course/capillary break[3]	Minimum 4 inches of free-draining granular material (less than 5% passing the U.S. No. 200 sieve) such as NCDOT No. 57 stone.

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

Item	Description
	3. Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base stone and concrete and corrective action will be required to repair the damaged areas.

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Pavements

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

A California Bearing Ratio (CBR) of 3 was selected for design based upon our experience with similar near surface subgrade soils and our understanding of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A minimum pavement section thickness was also included in the design for future maintenance.

Pavement Section Thicknesses

The following table provides our opinion of minimum thickness for AC sections:

Asphaltic Concrete Design

Layer	Thickness (inches)		
	NCDOT Grading [1]	Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)
AC Surface	S-9.5B	3 [2]	1.5
AC Intermediate	I-19.0C	--	2.5
Aggregate Base	ABC	6	8

1. All materials should meet the current North Carolina Department of Transportation Standard Specifications
2. Placed in two equal lifts.
3. See **Project Description** for more specifics regarding traffic assumptions.

The following table provides our estimated minimum thickness of PCC pavements.

Portland Cement Concrete Design

Layer	Specification [1]	Thickness (inches)		
		Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)	Heavy Duty [2]
PCC	4,000 psi	5		7
Aggregate Base	ABC [3]	4		4

1. All materials should meet the current North Carolina Department of Transportation (NCDOT) Standard Specifications.
2. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g. dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles.
3. Crushed Aggregate Base Course is recommended for construction purposes. Concrete could be placed directly on an approved subgrade. However, stormwater can quickly degrade exposed subgrades without the crushed aggregate base course leading to additional subgrade repair.
4. See **Project Description** for more specifics regarding traffic assumptions.

For subgrade instability that could develop due to the weather, we recommend that contingencies be placed in the budget for stabilization of the subgrade in planned pavement areas using a geosynthetic fabric or geogrid and additional ABC stone. The geosynthetic or geogrid could be left off corridors/easements for deeper utility lines for ease of construction.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. If the actual traffic varies from the assumptions outlined in **Project Description** we should be contacted to update our recommendations as necessary.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted backfill against the exterior side of curb and gutter.

- Place curb, gutter and/or sidewalk directly on compacted subgrade soils rather than on unbound granular base course materials

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

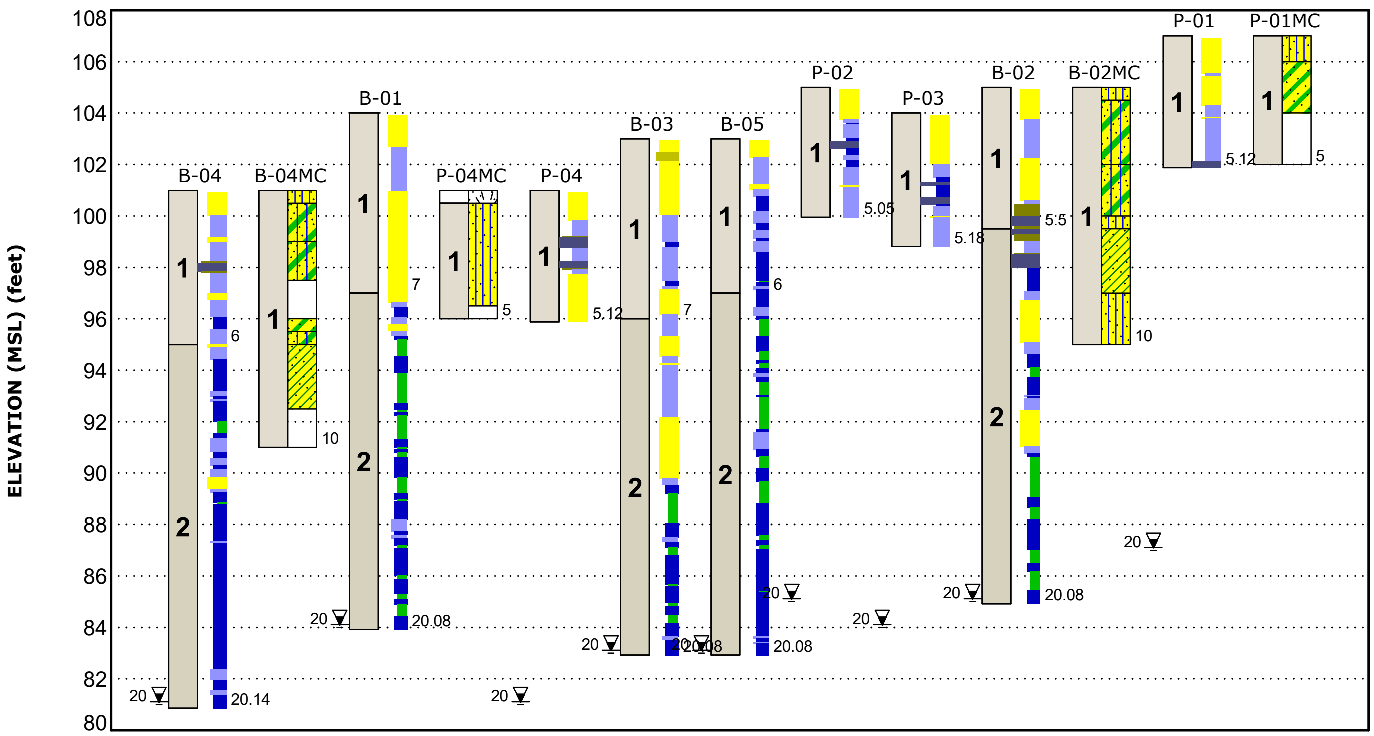
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

Contents:

Terracon
314 Beacon Dr
Winterville, NC

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Near Surface Sand	Sand with varying amounts of silt and clay, very loose to medium dense
2	Sand and Clay	Sand with varying amounts of silt and clay, clay with varying amounts of sand and silt; loose to medium dense, medium stiff to stiff

Legend

- Silty Sand
- Silty Clayey Sand
- Sandy Lean Clay
- Clayey Sand
- Topsoil

Soil Behavior Type (SBT)

- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 3 Clay - silty clay to clay
- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 6 Sands - clean sand to silty sand
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 9 Very stiff fine grained

CPT Assumed Water Depth

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

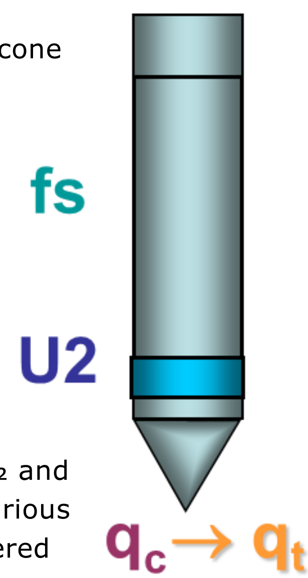
Field Exploration

Number of Soundings	Approximate Sounding Depth (feet) [1]	Location
5 (B-01 through B-05)	20	Building area
4 (P-01 through P-04)	5	Parking/driveway area

1. Referenced from existing ground surface.

Exploration Layout and Elevations: Terracon personnel provided the exploration layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. A forestry mulcher was used to clear access paths to the test locations. Approximate ground surface elevations were estimated using Google Earth . If elevations and a more precise exploration layout are desired, we recommend our locations be surveyed.

Cone Penetration Testing (CPT): The subsurface exploration was performed by a track mounted power drilling rig utilizing direct push, cone penetration testing (CPT) to advance into the subsurface.



The CPT hydraulically pushes an instrumented cone through the soil while nearly continuous readings are recorded to a portable computer. The cone is equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 10 cm2. Digital data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle are recorded about every 2 centimeters while advancing through the ground at a rate between 1½ and 2½ centimeters per second. These measurements are correlated to various soil properties used for geotechnical design. No soil samples are gathered through this subsurface investigation technique.

CPT testing is conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils." Upon completion, the data collected was downloaded and processed by the project engineer.

Additionally, select macrocore samples were obtained adjacent to select CPT sounding locations to obtain laboratory samples and visually classify near-surface soils. Samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Grain-Size Analysis
- Atterberg Limits

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Photography Log

Site photographs taken during site visit on February 28, 2024.

Site facing southwest

Site facing northwest and existing berm

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

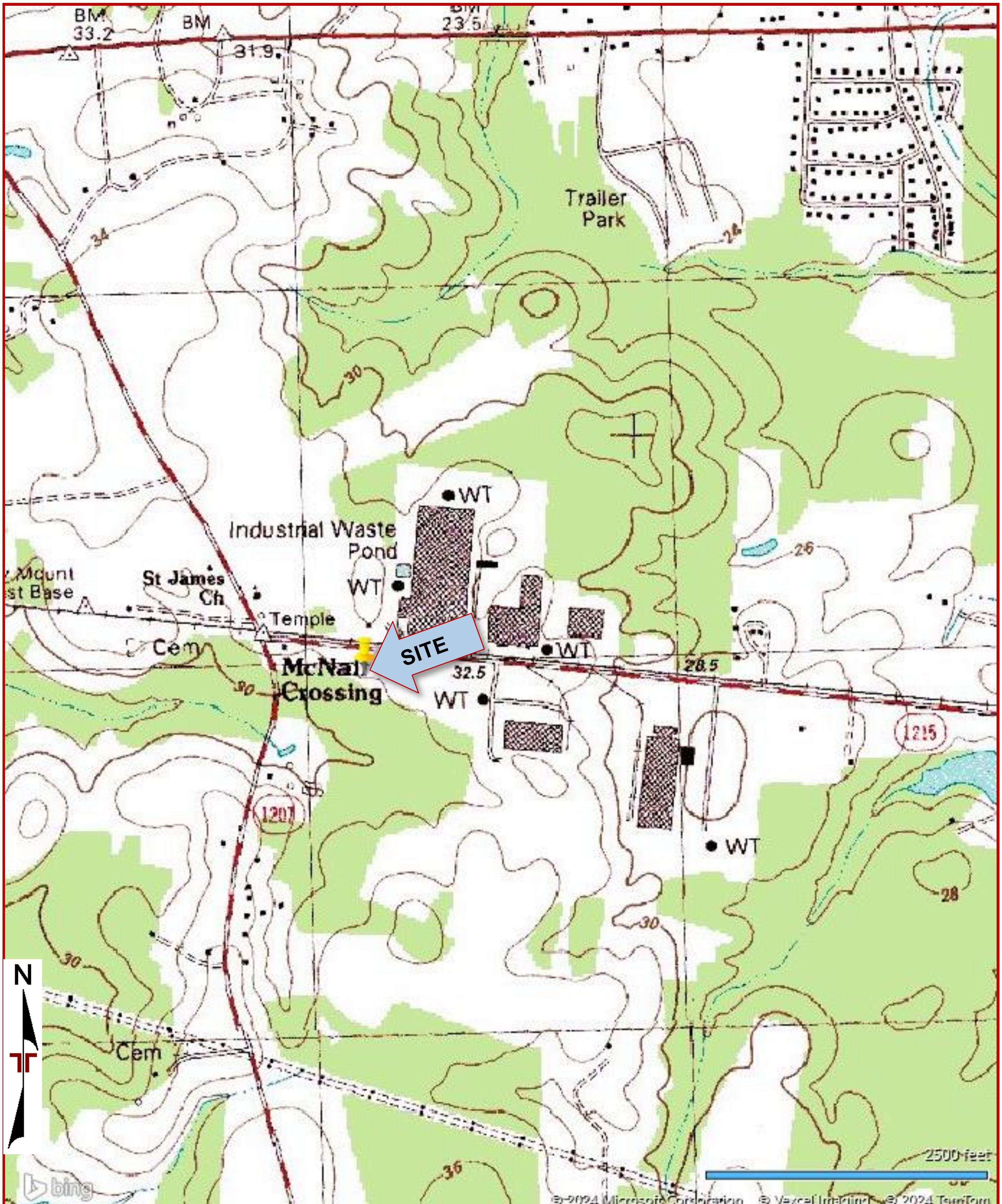


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES
MAP PROVIDED BY USGS, TARBORO, NC (1/1/1981))

Exploration Plan

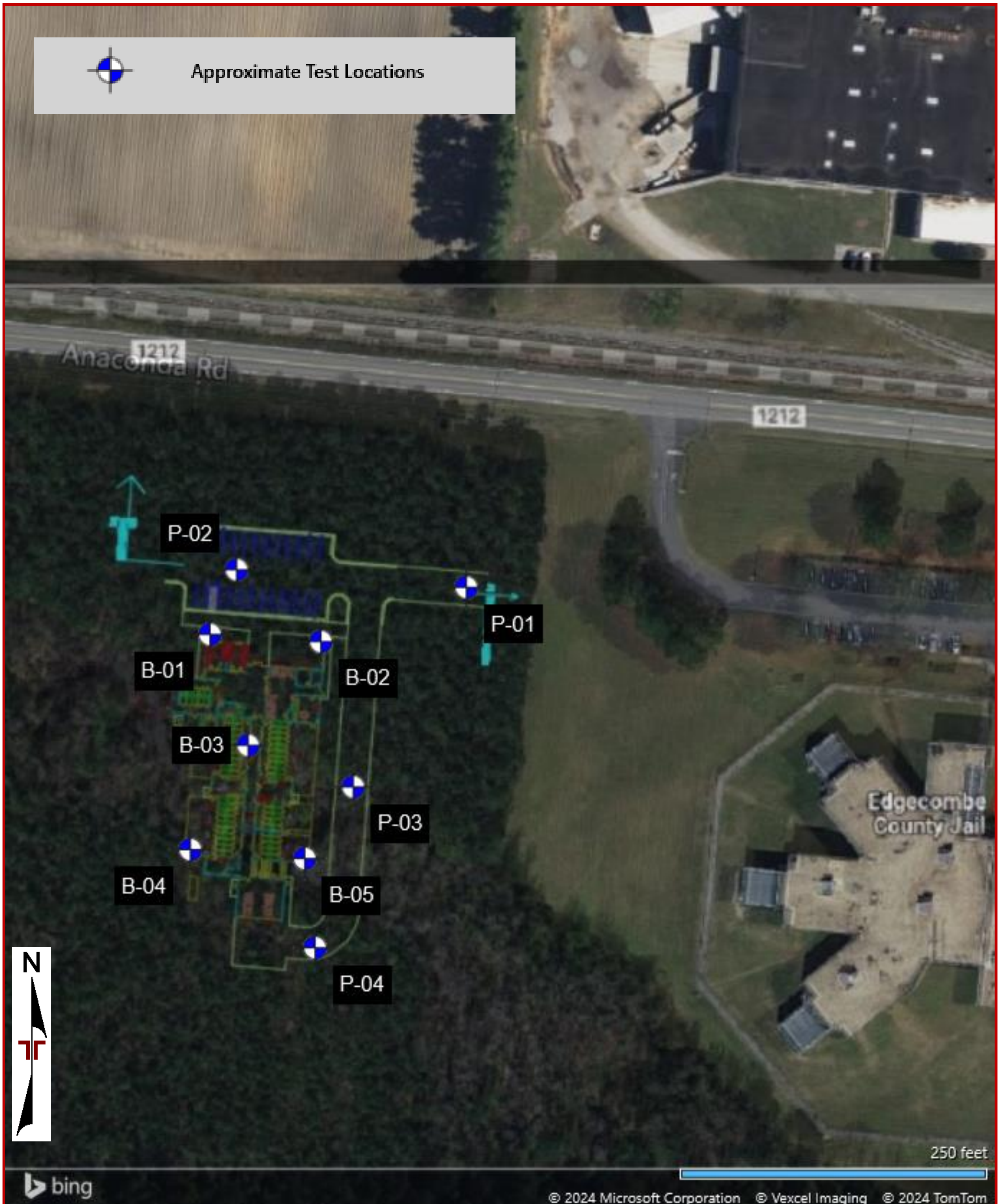


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS
SITE PLAN PROVIDED BY CLIENT

Exploration and Laboratory Results

Contents:

Exploration Logs (B-01 through B-05, P-01 through P-04, B-02MC, B-04MC, P-01MC, and P-04MC)
Grain Size Distribution
Atterberg Limits

Note: All attachments are one page unless noted above.

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

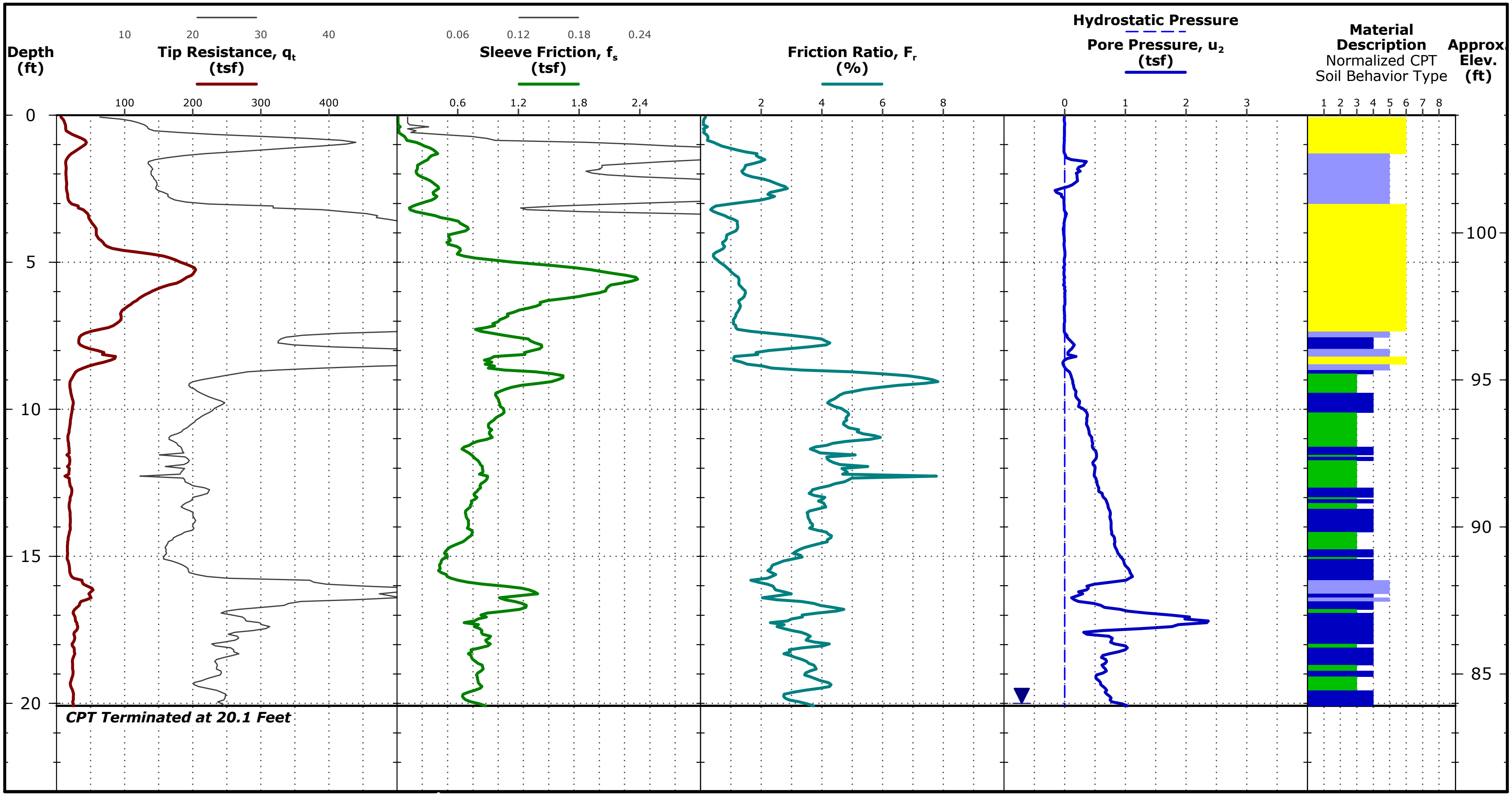
CPT Sounding ID B-01

Latitude: 35.9111° Longitude: -77.5912°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 104 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

Cave in = 15.4 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

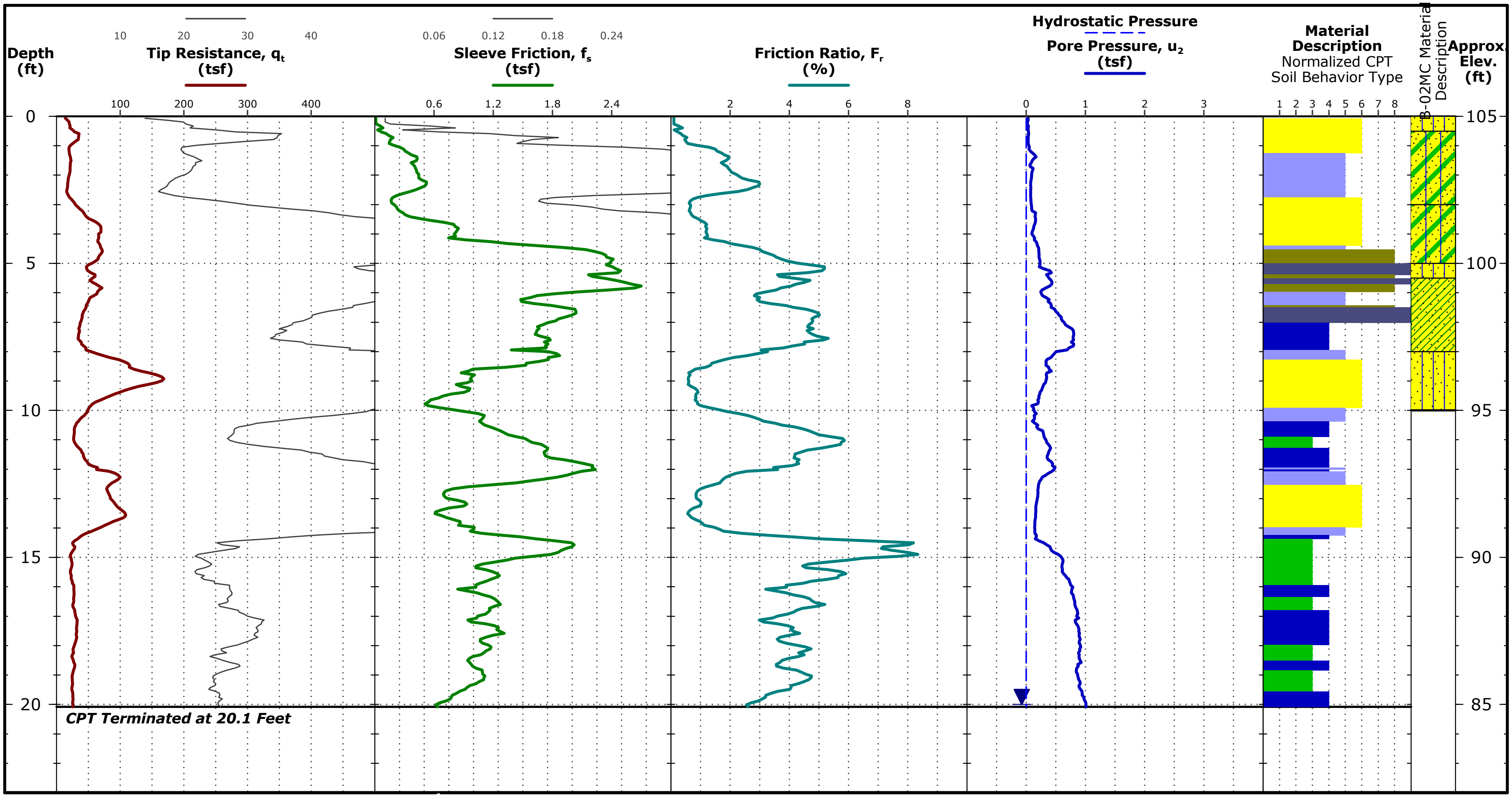
CPT Sounding ID B-02

Latitude: 35.9111° Longitude: -77.5909°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 105 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

See B-02MC for the adjacent test's full details.

Cave in = 19 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

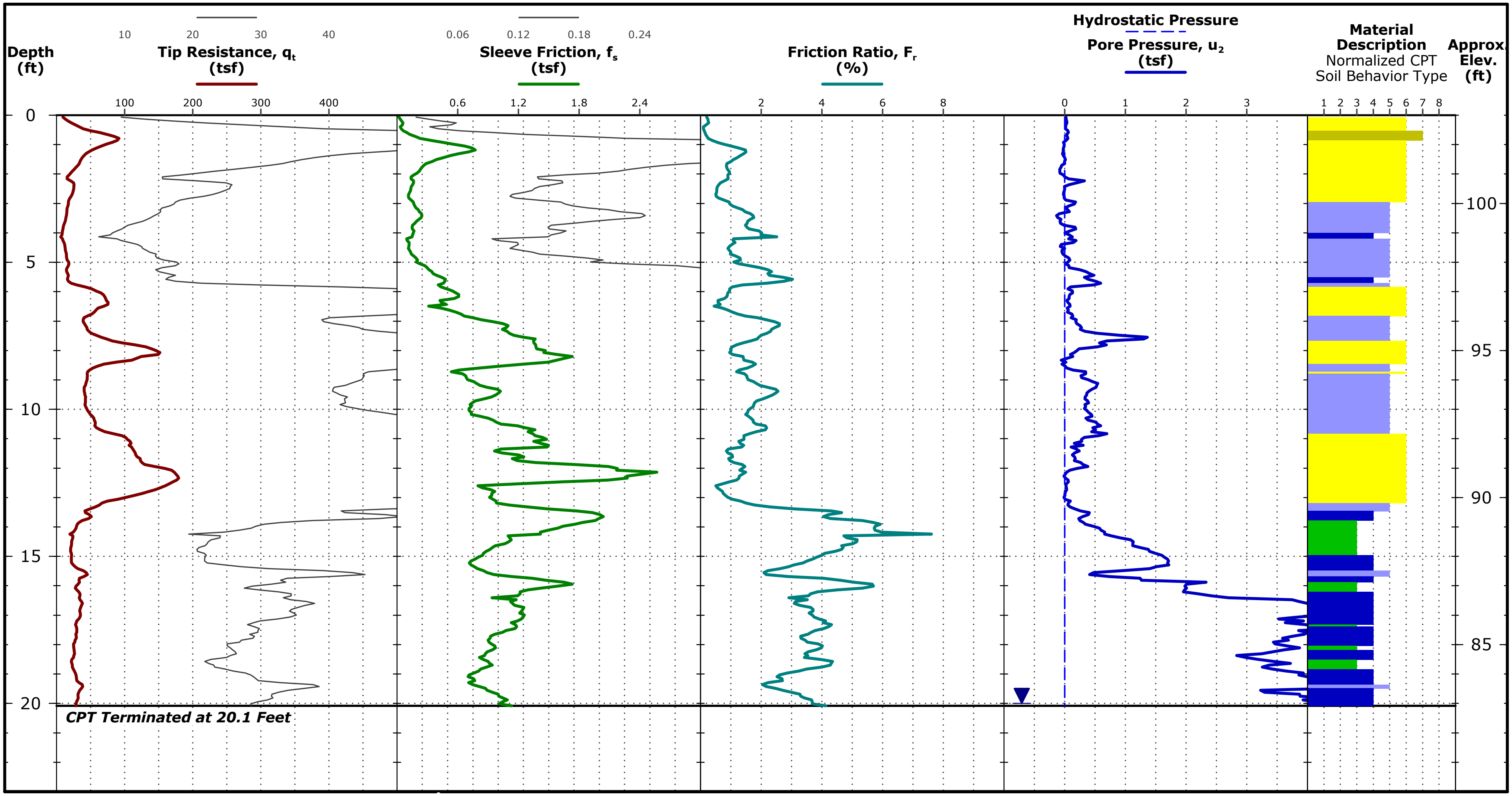
CPT Sounding ID B-03

Latitude: 35.9109° Longitude: -77.5911°

314 Beacon Dr
Winterville, NC

Elevation: 103 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

Cave in = 19.5 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

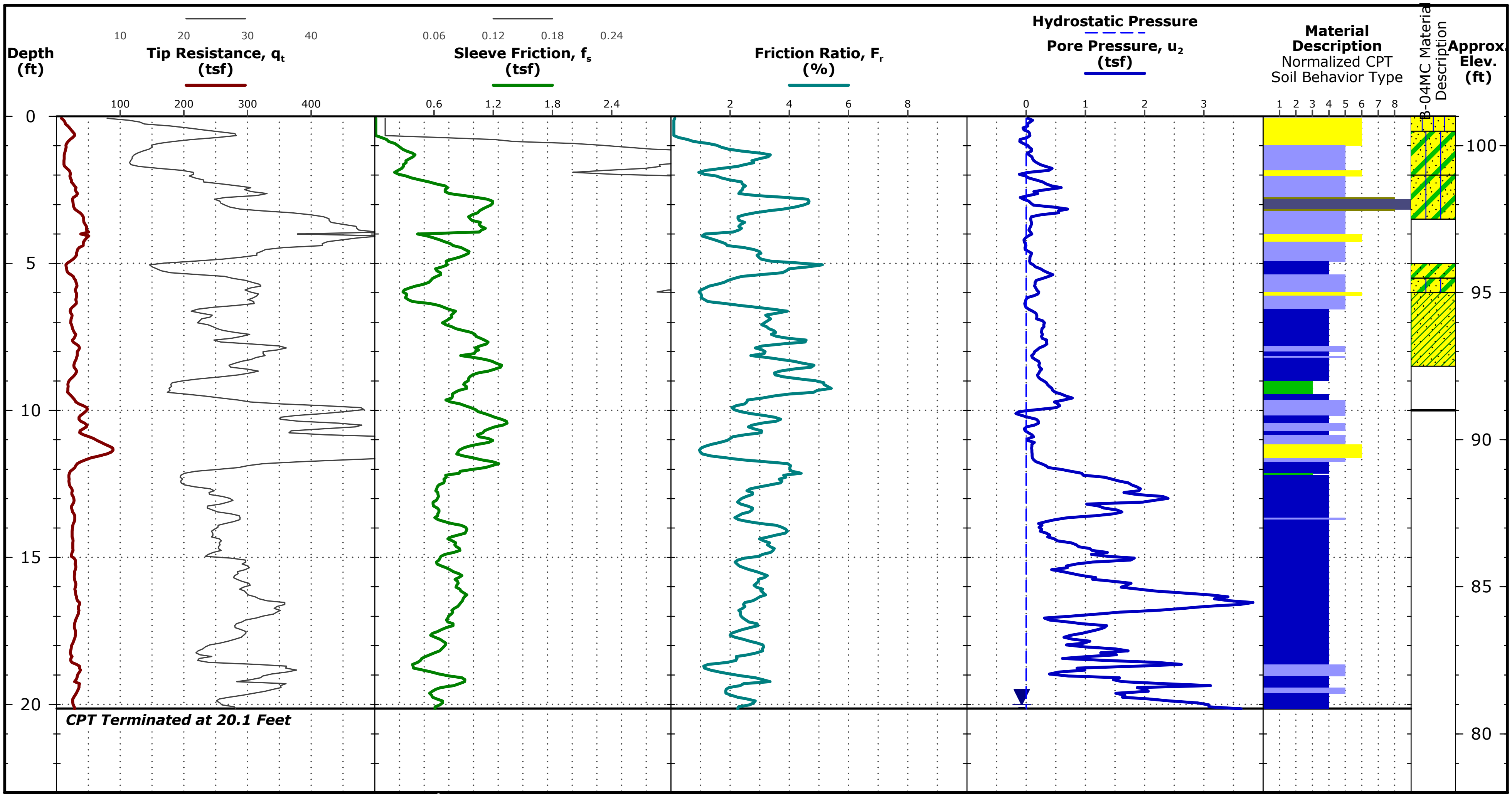
CPT Sounding ID B-04

Latitude: 35.9107° Longitude: -77.5913°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 101 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

See B-04MC for the adjacent test's full details.

Cave in = 6 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

▼ 20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

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8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

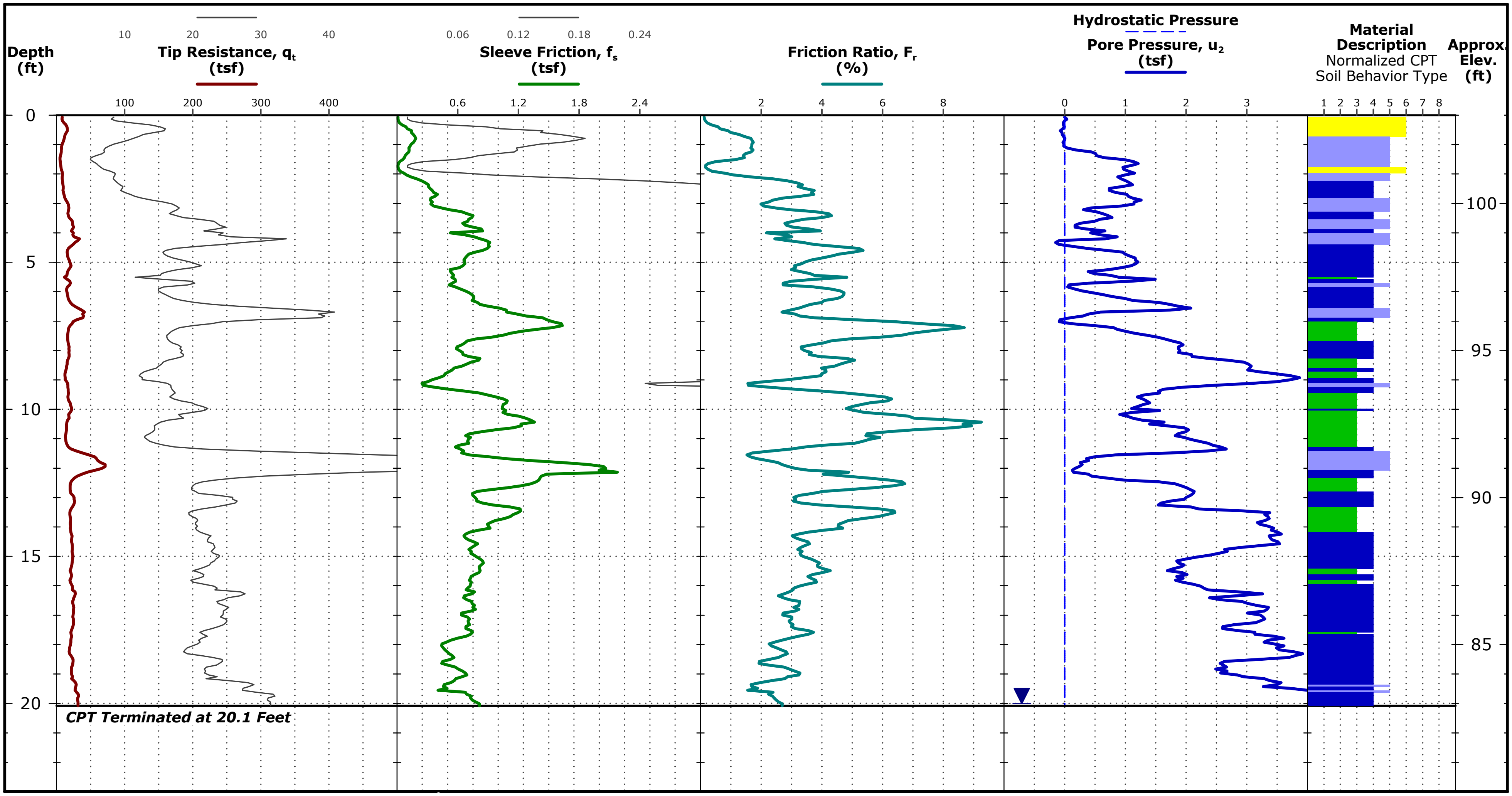
CPT Sounding ID B-05

Latitude: 35.9106° Longitude: -77.5910°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 103 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

Cave in = 12 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

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9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

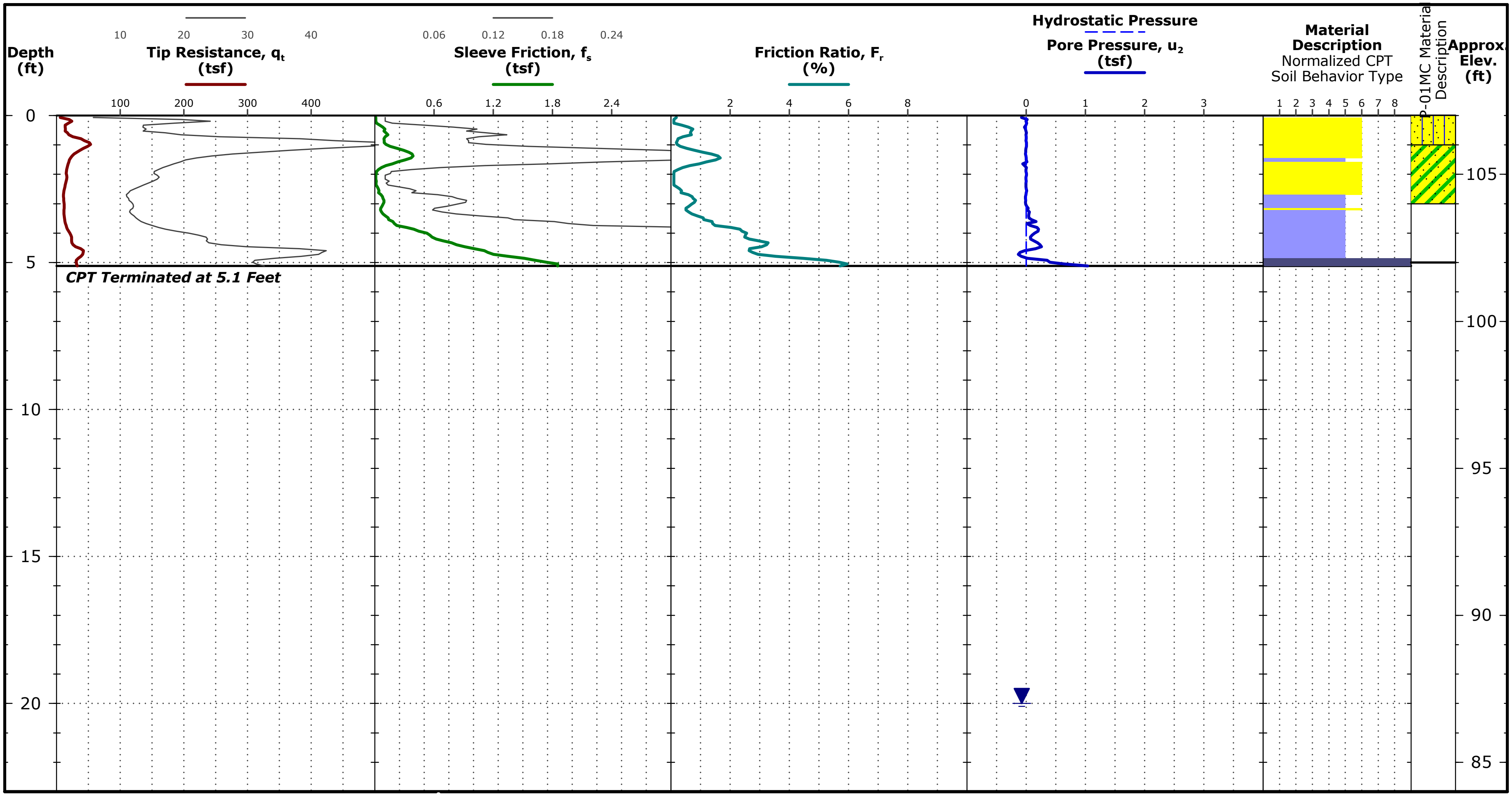
CPT Sounding ID P-01

Terracon
314 Beacon Dr
Winterville, NC

Latitude: 35.9112° Longitude: -77.5905°

Elevation: 107 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

See P-01MC for the adjacent test's full details.

Cave in = 4 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

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8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

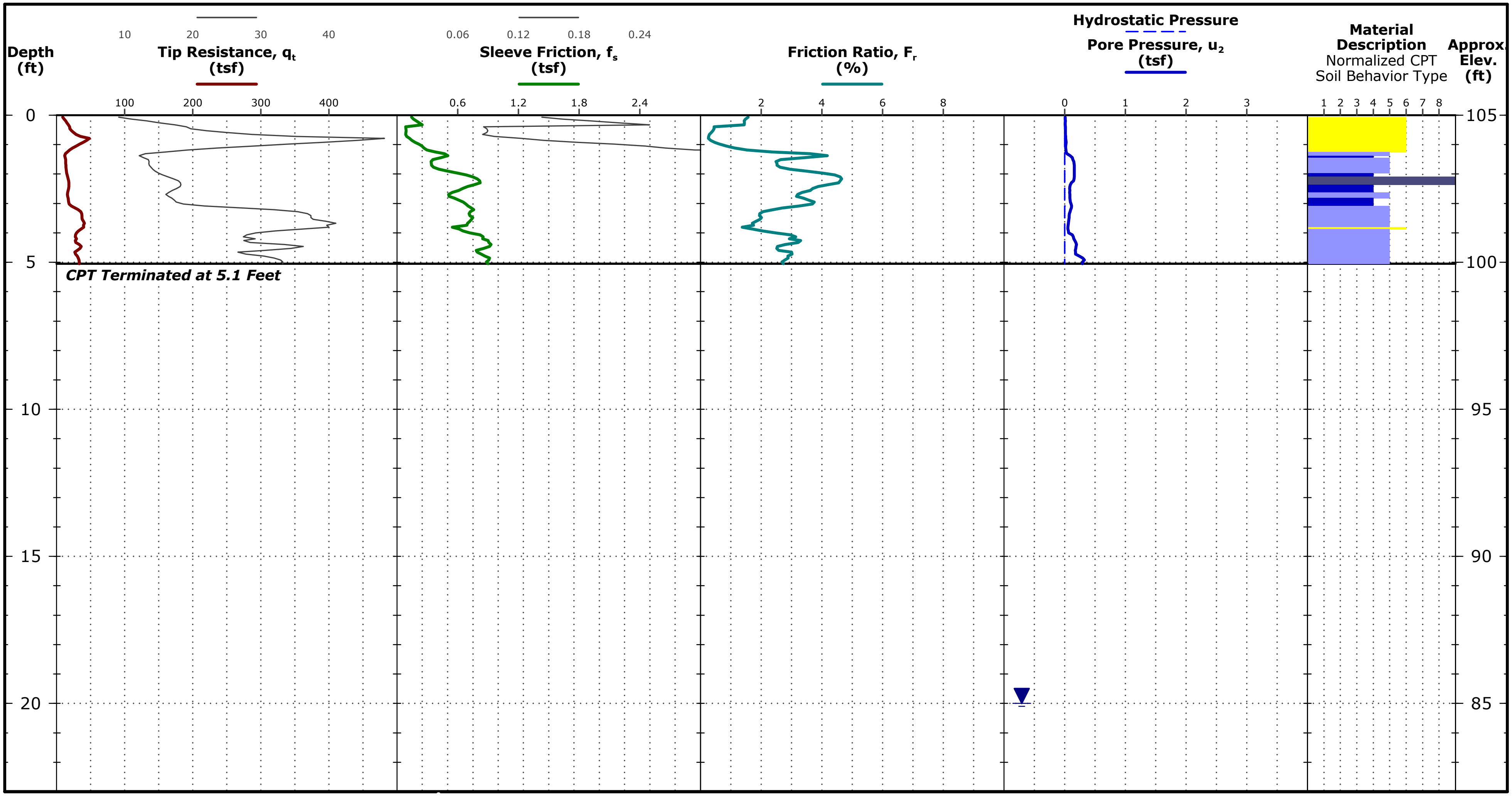
CPT Sounding ID P-02

Latitude: 35.9113° Longitude: -77.5911°

314 Beacon Dr
Winterville, NC

Elevation: 105 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

Cave in = 4.7 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

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(Robertson 1990)

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Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

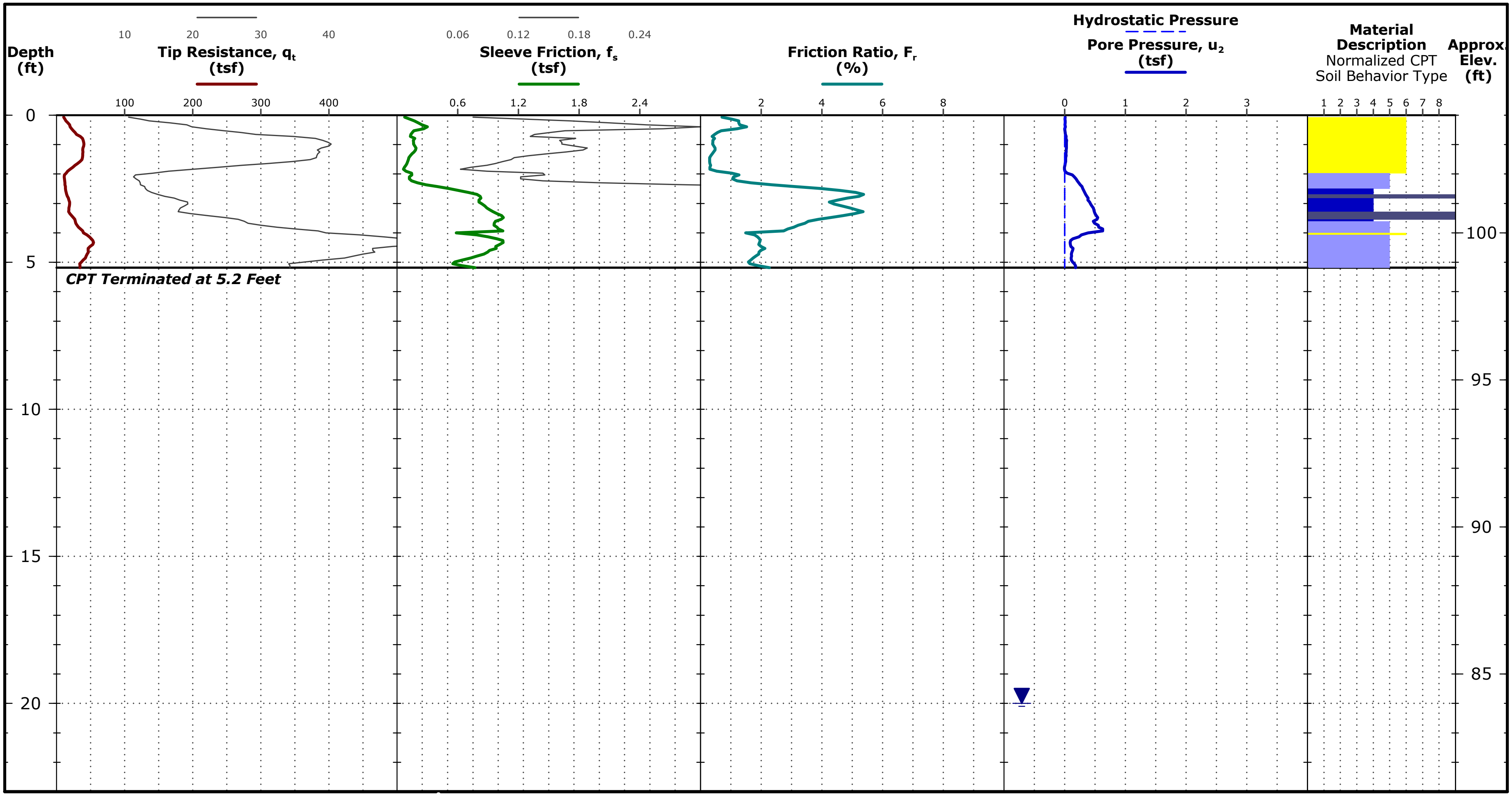
CPT Sounding ID P-03

Latitude: 35.9108° Longitude: -77.5908°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 104 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

Cave in = 4.8 feet

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

Auger anchors used as reaction force

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

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8 Very stiff sand to clayey sand
9 Very stiff fine grained

Edgecombe County Animal Shelter
3005 Anaconda Road | Tarboro, NC
Terracon Project No. 72235121

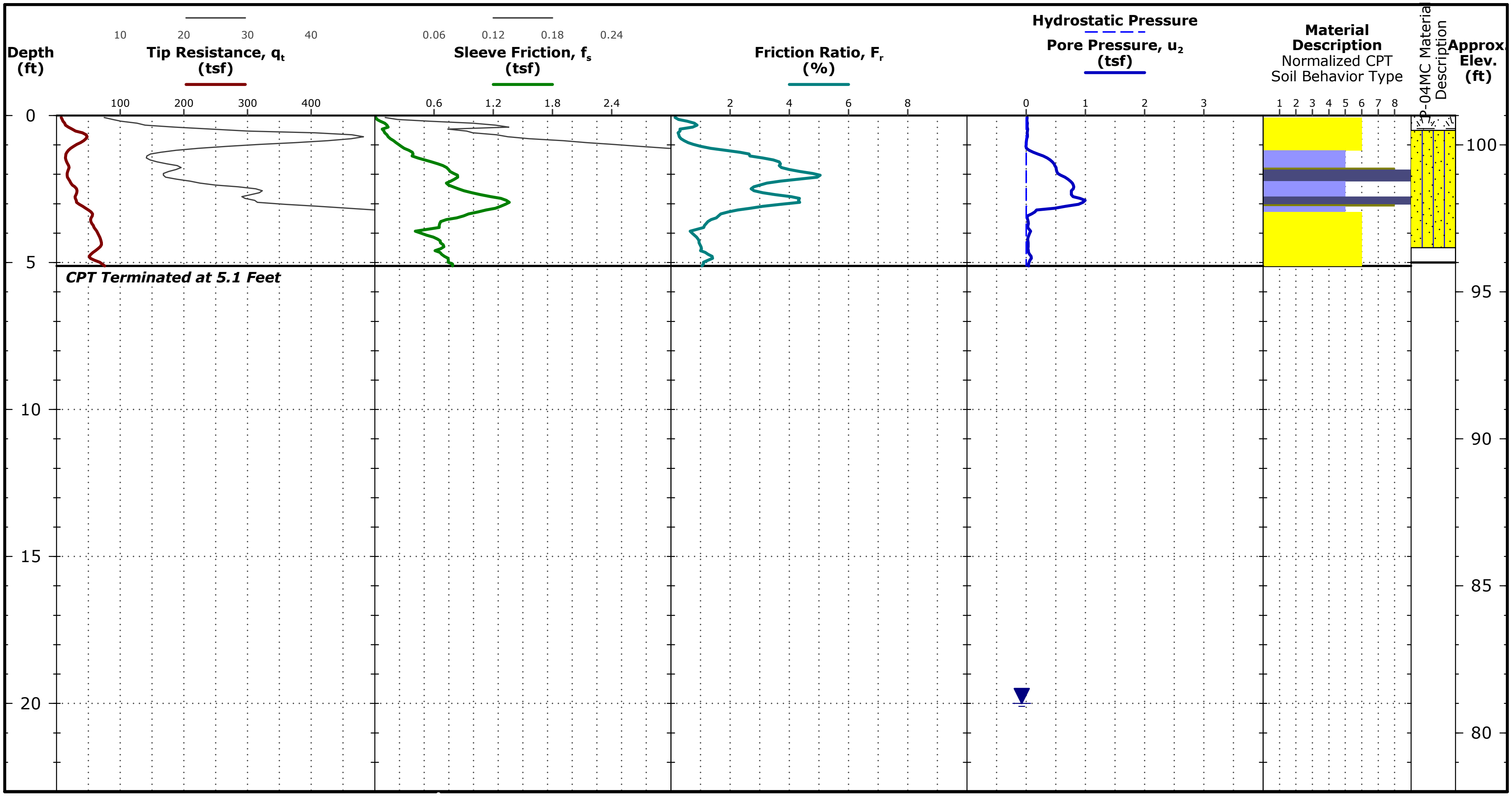
CPT Sounding ID P-04

Latitude: 35.9104° Longitude: -77.5909°

Terracon
314 Beacon Dr
Winterville, NC

Elevation: 101 (ft) +/-
Elevation Reference: Elevations obtained from Google Earth.

CPT Started: 3/18/2024
CPT Completed: 3/18/2024



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data, if any.

See Supporting Information for explanation of symbols and abbreviations.

Notes

Test Location: See Exploration Plan

See P-04MC for the adjacent test's full details.

CPT Equipment

CPT Rig: Geoprobe

Operator: RDU

CPT sensor calibration reports available upon request

Probe No. 5143 with net area ratio of 0.84

U_2 pore pressure transducer location

Manufactured by Geotech A.B.- Calibrated 2/1/2019

Tip and sleeve areas of 10 cm^2 and 150 cm^2

Ring friction reducer with O.D. of 1.875 in

Water Level Observation

20 ft estimated water depth

(used in normalizations and correlations)

Normalized Soil Behavior Type
(Robertson 1990)

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7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. B-02MC

Location: See Exploration Plan

Latitude: 35.9111° Longitude: -77.5909°

Elevation: 105 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.5	**SILTY SAND (SM)**, trace organics, gray	104.5						
	3.0	**SILTY CLAYEY SAND (SC-SM)**, brown and tan	102				15.1		
	5.0	**SILTY CLAYEY SAND (SC-SM)**, brown and tan	100	5					
	5.5	**SILTY SAND (SM)**, brown and tan	99.5						
	8.0	**SANDY LEAN CLAY (CL)**, red and gray	97						
	10.0	**SILTY SAND (SM)**, tan	95	10					

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevations obtained from Google Earth.

Water Level Observations
See CPT log

Notes

Advancement Method
Sampler with vibratory hammer

Abandonment Method
NA

Drill Rig
Geoprobe

Hammer Type
NA

Driller
RDU

Logged by
LHL

Boring Started
03-21-2024

Boring Completed
03-21-2024

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. B-04MC

Location: See Exploration Plan

Latitude: 35.9107° Longitude: -77.5913°

Elevation: 101 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.5	**SILTY SAND (SM)**, trace organics, dark gray	100.5			
1	2.0	**SILTY CLAYEY SAND (SC-SM)**, gray and orange	99			
1	3.5	**SILTY CLAYEY SAND (SC-SM)**, gray and orange	97.5			
1	5.0	**No recovery**	96			
1	5.5	**CLAYEY SAND (SC)**, brown	95.5			
1	6.0	**SILTY CLAYEY SAND (SC-SM)**, gray	95			
1	8.5	**SANDY LEAN CLAY (CL)**, gray	92.5	17.6	32-18-14	50
1	10.0	**No recovery**	91			

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevations obtained from Google Earth.

Water Level Observations
See CPT log

Drill Rig
Geoprobe

Hammer Type
NA

Driller
RDU

Notes

Advancement Method
Sampler with vibratory hammer

Abandonment Method
NA

Logged by
LHL

Boring Started
03-21-2024

Boring Completed
03-21-2024

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. P-01MC

Location: See Exploration Plan

Latitude: 35.9112° Longitude: -77.5905°

Elevation: 107 (Ft.) +/-

Model Layer	Depth (Ft.)	Description	Elevation	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.0–1.0	**SILTY SAND (SM)**, trace organics, gray	106						
1	1.0–3.0	**CLAYEY SAND (SC)**, brown and red	104				18.2	33-15-18	46
1	3.0–5.0	**No recovery**	102	5					

Boring Terminated at 5 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevations obtained from Google Earth.

Water Level Observations
See CPT log

Notes

Advancement Method
Sampler with vibratory hammer

Abandonment Method
NA

Drill Rig
Geoprobe

Hammer Type
NA

Driller
RDU

Logged by
LHL

Boring Started
03-21-2024

Boring Completed
03-21-2024

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. P-04MC

Location: See Exploration Plan

Latitude: 35.9104° Longitude: -77.5909°

Elevation: 101 (Ft.) +/-

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Elevation (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.5	**TOPSOIL**, 6 inches	100.5						
1		4.5	**SILTY SAND (SM)**, gray and tan	96.5				18.4		
1		5.0	**No recovery**	96	5					
			Boring Terminated at 5 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations obtained from Google Earth.

Water Level Observations
See CPT log

Drill Rig
Geoprobe

Hammer Type
NA

Driller
RDU

Notes

Advancement Method
Sampler with vibratory hammer

Abandonment Method
NA

Logged by
LHL

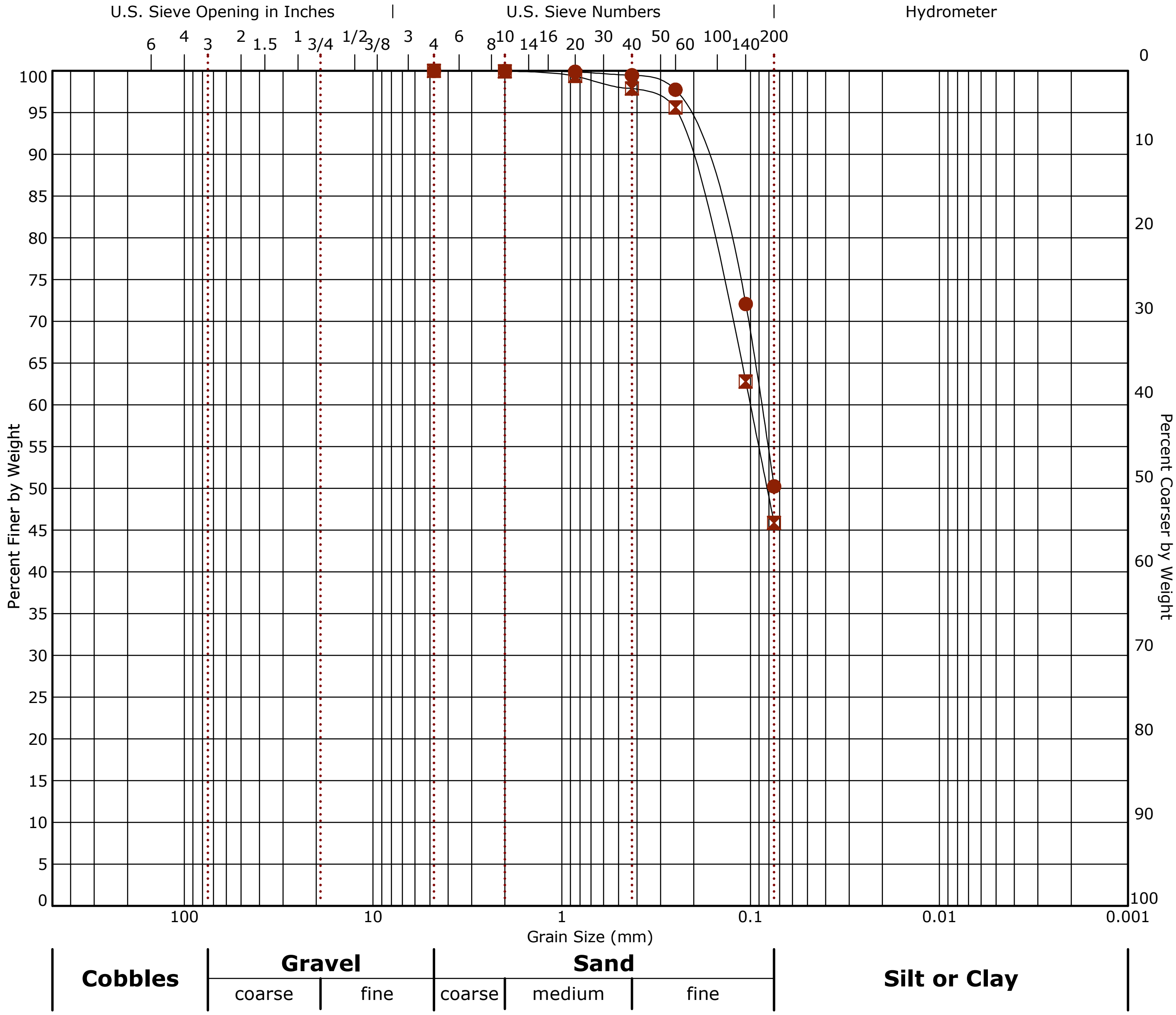
Boring Started
03-21-2024

Boring Completed
03-21-2024

Terracon
314 Beacon Dr
Winterville, NC

Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



	Boring ID	Depth	% Cobbles	% Gravel	% Sand	% Fines	% Silt	% Clay	USCS
●	**B-04MC**	7 - 8	0.0	0.0	49.8	50.2			CL
⊠	**P-01MC**	1 - 2	0.0	0.0	54.1	45.9			SC

	Description
●	SANDY LEAN CLAY
⊠	CLAYEY SAND

	Remarks
●	
⊠	

● Sieve	● % Finer	⊠ Sieve	⊠ % Finer	Sieve	% Finer
#4	100.0	#4	100.0		
#10	99.99	#10	99.95		
#20	99.88	#20	99.39		
#40	99.46	#40	97.9		
#60	97.74	#60	95.62		
#140	72.07	#140	62.79		
#200	50.23	#200	45.86		

Grain Size

	●	⊠	
D_{60}	0.088	0.1	
D_{10}			

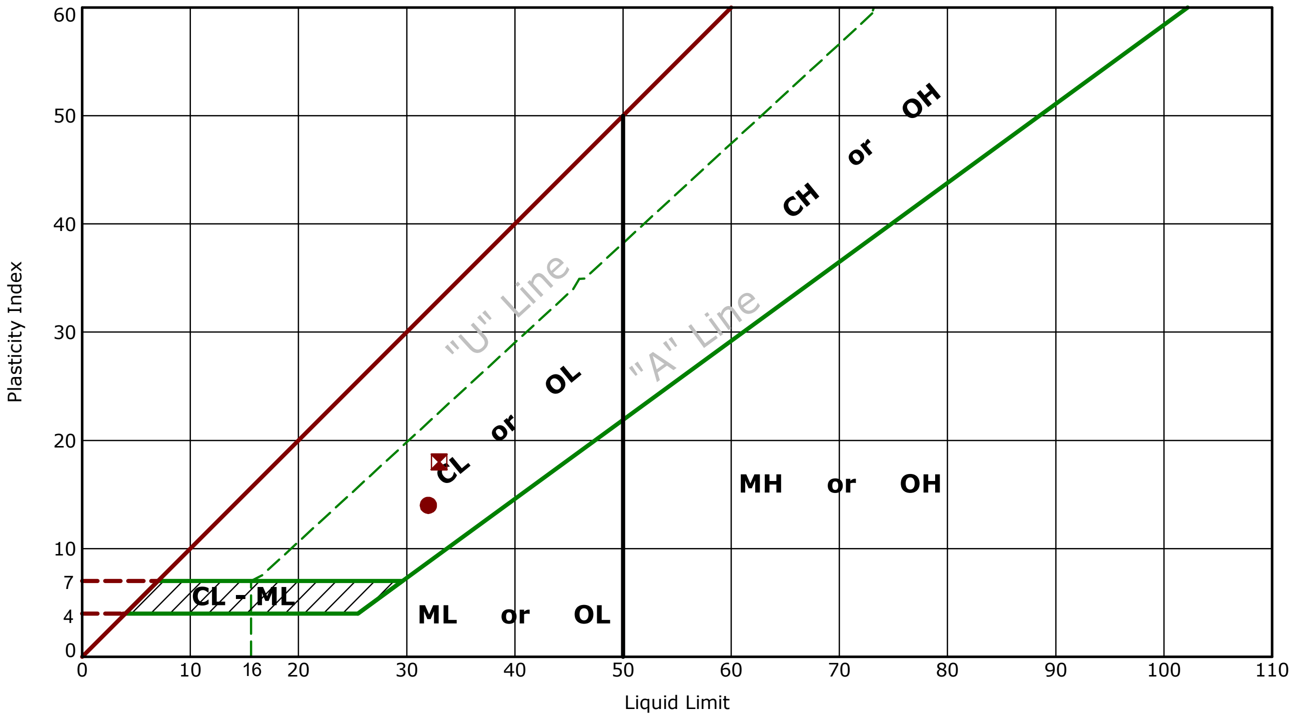
Coefficients

	●	⊠	
C_C			
C_U			

314 Beacon Dr
Winterville, NC

Atterberg Limit Results

ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-04MC	7 - 8	32	18	14	50.2	CL	SANDY LEAN CLAY
☒	P-01MC	1 - 2	33	15	18	45.9	SC	CLAYEY SAND

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
314 Beacon Dr
Winterville, NC

General Notes

Sampling	Water Level	Field Tests
Grab Sample; GeoProbe Macro Core or Large Bore	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

CPT GENERAL NOTES

Terracon

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater and net area ratio effects
$q_t = q_c + u_2(1 - a)$

Where a is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85

Pore Pressure, u
Pore pressure measured during penetration
u_1 - sensor on the face of the cone
u_2 - sensor on the shoulder (more common)

Sleeve Friction, f_s
Frictional force acting on the sleeve divided by its surface area

Normalized Friction Ratio, F_r
The ratio as a percentage of f_s to q_t, accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, V_s
Measured in a Seismic CPT and provides direct measure of soil stiffness

DESCRIPTION OF GEOTECHNICAL CORRELATIONS

Normalized Tip Resistance, Q_{tn}
$Q_{tn} = ((q_t - \sigma_{v0})/P_a)(P_a/\sigma'_{v0})^n$
$n = 0.381(I_c) + 0.05(\sigma'_{v0}/P_a) - 0.15$

Over Consolidation Ratio, OCR
OCR (1) $= 0.25(Q_{tn})^{1.25}$
OCR (2) $= 0.33(Q_{tn})$

Undrained Shear Strength, S_u
$S_u = Q_{tn} \times \sigma'_{v0}/N_{kt}$
N_{kt} is a soil-specific factor (shown on S_u plot)

Sensitivity, S_t
$S_t = (q_t - \sigma_{v0}/N_{kt}) \times (1/f_s)$

Effective Friction Angle, ϕ'
ϕ' (1) $= \tan^{-1}(0.373[\log(q_c/\sigma'_{v0}) + 0.29])$
ϕ' (2) $= 17.6 + 11[\log(Q_{tn})]$

Unit Weight, γ
$\gamma = (0.27[\log(F_r)]+0.36[\log(q_t/atm)]+1.236) \times \gamma_{water}$
σ_{v0} is taken as the incremental sum of the unit weights

Small Strain Shear Modulus, G_0
G_0 (1) $= \rho V_s^2$
G_0 (2) $= 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$

Soil Behavior Type Index, I_c
$I_c = [(3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2]^{0.5}$

SPT N_{60}
$N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817Ic)}$

Elastic Modulus, E_s (assumes $q/q_{ultimate}$ ~ 0.3, i.e. FS = 3)
E_s (1) $= 2.6\psi G_0$ where $\psi = 0.56 - 0.33\log Q_{tn,clean\ sand}$
E_s (2) $= G_0$
E_s (3) $= 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$
E_s (4) $= 2.5q_t$

Constrained Modulus, M
$M = \alpha_M(q_t - \sigma_{v0})$
For $I_c > 2.2$ (fine-grained soils)
$\alpha_M = Q_{tn}$ with maximum of 14
For $I_c < 2.2$ (coarse-grained soils)
$\alpha_M = 0.0188 \times 10^{(0.55Ic + 1.68)}$

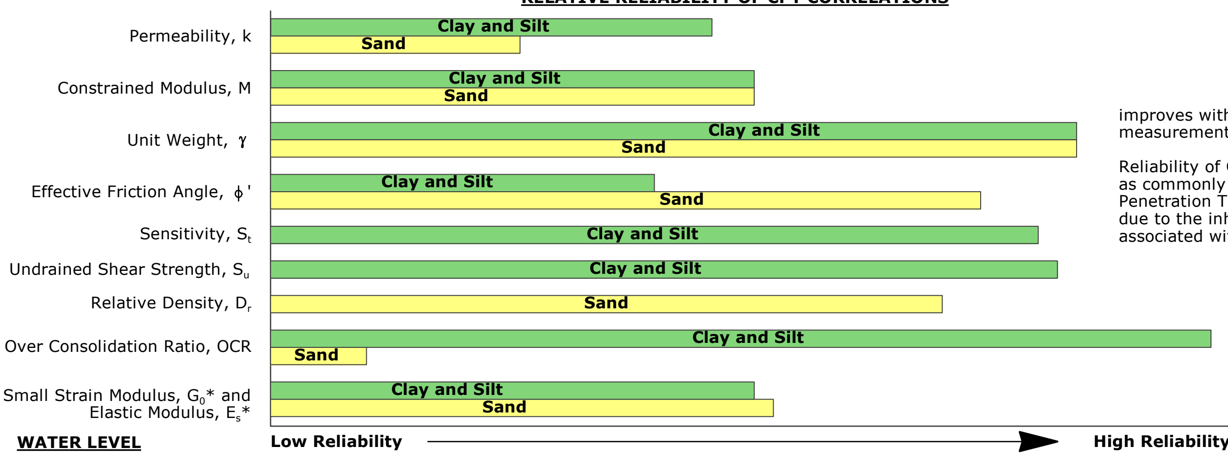
Hydraulic Conductivity, k
For $1.0 < I_c < 3.27$ $k = 10^{(0.952 - 3.04Ic)}$
For $3.27 < I_c < 4.0$ $k = 10^{(-4.52 - 1.37Ic)}$

Relative Density, D_r
$D_r = (Q_{tn} / 350)^{0.5} \times 100$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include q_t, f_s, and u. Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. To this end, more than one correlation to a given parameter may be provided. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



improves with seismic V_s measurements

Reliability of CPT-predicted N_{60} values as commonly measured by the Standard Penetration Test (SPT) is not provided due to the inherent inaccuracy associated with the SPT test procedure.

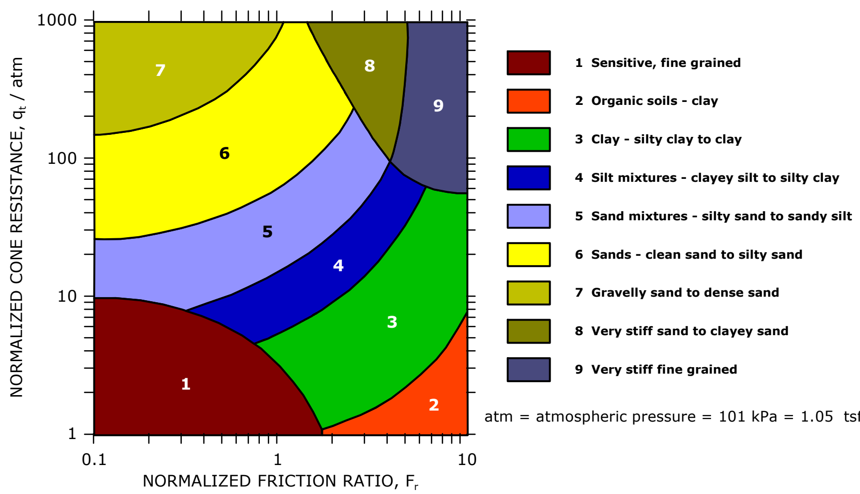
WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"
Measured - Depth to water directly measured in the field
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions
While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (f_s), and porewater pressure (u_2). The normalized friction ratio (F_r) is used to classify the soil behavior type.

Typically, silts and clays have high F_r values and generate large excess penetration porewater pressures; sands have lower F_r's and do not generate excess penetration porewater pressures. The adjacent graph (Robertson *et al.*) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



REFERENCES

Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.
Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institue of Technology, Atlanta, GA.
Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.
Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand,"*Journal of the Soil Mechanics and Foundations Division*,96(SM3), 1011-1043.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	**Group Name** [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.