REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION

Marion County Industrial Park – Lot 4

Marion County, South Carolina
S&ME Project No. 1633-12-332

Prepared By:

S&ME

1330 Highway 501 Business
Conway, South Carolina 29526

December 13, 2012

December 13, 2012

Alliance Consulting Engineers, Inc.
Post Office Box 8147
Columbia, South Carolina 29202-8147

Reference: **Report of Preliminary Geotechnical Exploration**
Marion County Industrial Park – Lot 4
Marion County, South Carolina
S&ME Project No. 1633-12-332

S&ME, Inc. has completed the preliminary geotechnical exploration for the referenced project after receiving authorization to proceed on November 29, 2012. Our exploration was conducted in general accordance with our Proposal No. 1633-0343-12, dated November 13, 2012.

The purpose of this exploration was to evaluate general subsurface conditions at the site as they relate to general commercial/industrial development, to satisfy portions of the South Carolina Department of Commerce's Site Certification Program. This report characterizes the general surface and subsurface conditions of the site, offers preliminary recommendations regarding site preparation, suitability of on-site soils for use in construction and potential foundation types. The recommendations contained herein are not valid for design without the confirmation of an additional design level subsurface investigation after the locations of proposed structures, pavements and general site features are determined.

PROJECT INFORMATION

We are familiar with this site, having performed a due diligence phase assessment of a 230-acre tract of land, which included a portion of the subject property, in 2005. We have also performed geotechnical explorations within the southeast and west portions of the site for industrial development projects under consideration in the past. Our current exploration associated with this report was conducted within the approximately 33 acres of land associated with Lot 4.

The subject property is located north of U.S. Highway 76, and southwest of U.S. Highway 501, in Marion County, South Carolina as shown in Figure 1 of Appendix A. The site generally consists of wooded land.

EXPLORATION PROCEDURES

Field Exploration

On December 5, 2012, representatives of S&ME, Inc. visited the site. Using the information provided, we performed the following tasks:

- We performed a site walkover, observing features of topography, existing structures, ground cover, and surface soils at the project site.
- We provided clearing of vegetation along two paths to obtain access of the CPT rig to the test locations. The clearing was performed by our drilling subcontractor using a ASV RC 100 Posi-track with a Fecon mulch head.
- We established six cone penetration test (CPT) sounding locations spread widely throughout the site. The approximate sounding locations are shown on the test location sketch included as Figure 2 in Appendix A.
- Each of the CPT soundings was advanced to a depth of about 15 feet.
- Direct-push samples were obtained from each of the sounding locations between depths of approximately 0 to 4 feet with a Geoprobe Model 5400 rig mounted on the CPT track rig. The samples were transported to the laboratory for further observation.

A description of the field tests performed during the exploration as well as the CPT sounding logs are attached in Appendix B.

Laboratory Testing

After the recovered soil samples were brought to our laboratory, a geotechnical professional examined each sample to estimate its distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geologic origin in general accordance with ASTM D 2488, *“Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)”*.

The resulting classifications are presented on the sounding logs, included in Appendix B. Similar soils were grouped into representative strata on the logs. The strata contact lines represent approximate boundaries between soil types. The actual transitions between soil types in the field are likely more gradual in both the vertical and horizontal directions than those which are indicated on the logs.

SURFACE CONDITIONS

Currently the site is heavily wooded with dense underbush. Ground surface elevations were not surveyed at the CPT sounding locations for the purposes of this report. From visual observation, the site appears to be relatively level to gently sloping. Organic topsoil was encountered at all of the test locations, ranging from about 3 to 15 inches in thickness. Thicker zones of topsoil and rootmat may be encountered in parts of the site that were not explored.

SUBSURFACE CONDITIONS

Local Geology

The site is located in the Coastal Plain Physiographic Region of South Carolina. A review of local geologic mapping indicates that the site area likely lies within an outcrop area of the Bear Bluff Formation (Tb), typically inter-layered terrestrial clays, silts, sands, and shell beds laid down during the Upper Pliocene Epoch approximately 1.8 to 2.4 million years ago.

These materials weathered in place and have formed a mantle of clays and sands anticipated to be approximately 20 to 30 feet thick which overlie less weathered, much older, calcareous soils below. The surface has been reworked by erosional processes over geologic time, and the limestone residuum has been masked by deposits of loose to dense sands or stiff to very stiff clays and silts. The upper contact of the lower sands may be irregular due to localized scouring and redeposition of the overlying clays. While not penetrated by our CPT soundings, soils below approximately 20 to 30 feet are mapped as Cretaceous-age sediments of the Pee Dee Formation (Kpd). Soils below the Pee Dee Formation, are mapped as Cretaceous-age sediments of the Donoho Creek Formation (Kdc).

USDA Soil Survey Information

USDA Soils Conservation Service soils mapping for Marion County indicates the sands and loamy sands described in Table 1, as the general soil series composition at the site. Soil map units are also described in terms of some relevant engineering properties or in terms of relative suitability for use in land development. High water elevations are generally given for the winter and spring months (November through April).

Table 1 – USDA Soil Survey Soil Series

Soil Group	Depth to Seasonal GWT (feet)	Permeability	Remarks
Coxville fine sandy loam	0 – 2½	Moderate to Moderately slow	Nearly level slopes
Dunbar loamy sand	1 – 2½	Moderately rapid to Moderately slow	Nearly level slopes
Duplin fine sandy loam	2½ – 3½	Moderately rapid to Moderately slow	0 to 2 percent slopes
Goldsboro loamy fine sand	1½ – 2½	Moderately rapid to Moderate	0 to 2 percent slopes

Interpreted Subsurface Profiles

The generalized subsurface conditions at the site are described below. For more detailed descriptions and stratifications at a test location, the respective sounding logs should be reviewed in Appendix B. Two interpreted subsurface cross-sectional profile of the site soils are attached in Appendix A as Figures 3 and 4. The profile orientations in plan view are shown on Figure 2. These profiles are given to provide a general representation of the subsurface conditions encountered at widely-spaced locations across the site.

The strata indicated in the profiles are characterized in the following section. Note that the profiles are not to scale. The subsurface profiles were prepared for illustrative purposes only. Subsurface stratifications may be more gradual than indicated, and conditions may vary between test locations.

Soils encountered by each of the soundings presented on the profile were grouped into three general strata, based on estimated physical properties derived from the CPT data, and the recovered near-surface samples. The strata encountered are labeled I through III on the soil profiles to allow their properties to be systematically described.

Stratum I: Upper Soft Clays and Loose Clayey Sands

Underlying the surficial topsoil layer, an upper stratum of clays and clayey sands was encountered to depths ranging from about 4 to 9¼ feet. These soils consisted of clayey sands, and sandy lean clays, were moist to wet, and were predominately brown, tan, orange, red, and gray in color.

The soils of Stratum I exhibited sleeve stresses ranging from less than 0.1 to about 2.8 tsf. The tip stresses in these soils ranged from less than 10 to about 90 tsf. The soil typically exhibited tip stresses ranging from 10 to 30 tsf, which is consistent with very loose to loose clayey sands, and soft to stiff clays.

In sounding C-3, a very loose sand seam was encountered from below the topsoil to a depth of about 1½ feet. These soils were moist and were predominately tan and gray in color. The soil typically exhibited sleeve stresses ranging from less than 0.1 to about 0.2 tsf, and tip stresses ranging from less than 10 to 12 tsf, which is consistent with very loose sands.

Stratum II: Intermediate Stiff Clays and Medium Dense Clayey Sands

In all of the soundings except C-4 and C-6, beginning at depths of 5 to 5½ feet, a stratum of clayey soils was encountered to depths ranging from about 7 to 7¾ feet. These soils exhibited sleeve stresses ranging from 0.5 to 4.7 tsf. The tip stresses in these soils ranged from 12 to 179 tsf, but typically were around 20 to 90 tsf, which is consistent with medium dense sands, and stiff to hard clays and silts.

Stratum III: Intermediate Dense Sands (Bear Bluff Formation)

Beneath Stratum I in soundings C-4 and C-6, and Stratum II in the other soundings, beginning at depths of 4 to 9¼ feet, a stratum of sandy soils was encountered to the sounding termination depth of about 15 feet. These soils exhibited sleeve stresses ranging from less than 0.1 to 2.3 tsf. The tip stresses in these soils ranged from 14 to about 387 tsf, but typically were around 100 to 150 tsf, which is consistent with medium dense to dense sands.

Subsurface Water

Water levels within the CPT soundings were measured at the time of our exploration to range from about 3 to 6 feet below the existing ground surface. Subsurface water levels may fluctuate seasonally at the site, being influenced by rainfall variation and other factors. Site construction activities can also influence water elevations.

PRELIMINARY SEISMIC CONSIDERATIONS

Seismic induced ground shaking at the foundation is the effect taken into account by seismic-resistant design provisions of the 2006 International Building Code (IBC). Other effects, including soil liquefaction, are not addressed in building codes but must also be considered.

Liquefaction of saturated, loose, cohesionless soils occurs when they are subject to earthquake loading that causes the pore pressures to increase, and effective overburden stresses to decrease, to the point where large soil deformation or even transformation from a solid to a liquid state results.

We performed a preliminary liquefaction analysis based on the design earthquake prescribed by the 2006 edition of the International Building Code (IBC 2006), the "simplified procedure" as presented in Youd et al. (2001), and recent research concerning the liquefaction resistance of aged sands (Hayati & Andrus, 2008; Andrus et al. 2009; Hayati & Andrus, 2009). Our analysis was based upon a peak ground surface acceleration of 0.22g.

The sands encountered at this site do not appear likely to undergo widespread liquefaction in the event of the design earthquake. Our qualitative assessment was based on the relatively high overall density, the amount of fines of these soils, and their apparent geologic age. These soils are not historically recorded to have experienced liquefaction in previous earthquakes. Our preliminary assessment indicates that the potential for liquefaction does not appear to constitute a seismic hazard.

Based on our previous work performed at the site and our knowledge of the general geologic profile of this area, it appears a Seismic Site Class of D will be available at the site. However, we recommend further seismic testing and evaluations be performed once specific structure locations are determined.

CONCLUSIONS AND RECOMMENDATIONS

The preliminary conclusions and recommendations included in this section are based on the project information outlined previously and the data obtained during our exploration. The recommendations provided below are preliminary in nature and should be considered as such. When the final site layout is determined, S&ME, Inc. should be retained to complete a design-grade geotechnical exploration.

Site Preparation and Earthwork

Stripping depths will likely be about 3 to 15 inches over the majority of the site. In drainage features, or within heavily wooded areas of the site, stripping depths may be greater.

Fine-grained, sandy lean clays (CL) were encountered by our soundings in the upper soil profile at the site. These soils may pump, rut and become unstable under construction equipment when they are wet, and may be difficult to dry out once they become wet. These unfavorable conditions will be exacerbated during periods of wet weather. To help reduce the impact of water on site grading, we recommend ditching be installed around the site perimeter prior to starting grading. Drainage by ditching may also need to be performed to remove potential near-surface lenses of perched groundwater. This will reduce the potential for damage to the subgrade during earthwork operations and should help stabilize the subgrade. Perched water can likely be controlled during mass grading by excavating open ditches and/or constructing underdrains that discharge toward lower elevations.

On-Site Fill Suitability

Based upon our interpretation of CPT sounding data, correlations between Robertson Soil Behavior Types and Unified Soil Classification System Soil Types, and the previous explorations performed at the site, highly variable soil types appear to be present within the subsurface profile. Soil types encountered within the subsurface profile include poorly graded sands (SP), poorly graded sands with silt or clay (SP-SM, SP-SC), silty sands (SM), clayey sands (SC), sandy lean clays and silts (CL, ML), and high plasticity silts and clays (MH, CH). Excluding high plasticity silts and clays (MH, CH), the remaining soil types are typically suitable for reuse as structural fill, based on our past experience. Moisture conditioning may be required after excavation before these soils are suitable for placement and compaction.

Some of the soils that classify as sandy lean clays or silts (CL, ML) or clayey sands (SC) may be less preferred for reuse as fill than other soils of lower fines content. While these clayey soils do contain some sandy material, they often contain a large enough percentage of fines to induce cohesive behavior, especially under wet conditions, and are difficult to dry. Although these soils are not ideal for use as fill material, our experience suggests that contractors have been able to use this type of material when given enough time and suitable weather conditions to properly dry and compact the soils. Drying can typically be facilitated by disking and scarifying soils repeatedly during favorable weather conditions.

Preliminary Fill Placement and Compaction Recommendations

Where fill soil is required, structural fill within building pads and parking areas must be compacted throughout to the degree of compaction determined necessary during the final design-grade geotechnical exploration. Compacted soils should be stable and must not exhibit pumping or rutting under equipment traffic. Loose lifts of fill should be no more than 8 inches in thickness prior to compaction. Structural fill should extend at least 10 feet from the edge of building and parking areas before either sloping or being allowed to exhibit a lower level of compaction.

Potential Foundation Types

The soil profiles encountered appear generally suitable for development for light to medium industrial use, considering static loading. However, it should be noted that very soft to soft clayey soils were encountered to a depth of about 9 feet within sounding C-6, in the southwest portion of the site. These conditions may impact site development, depending upon site layout, structural loads, the extent of these soft soils, and other factors.

The use of shallow foundations for support of column loads up to about 100 kips would likely be feasible for typical light to medium industrial structural column configurations, provided footings are properly constructed and settlements of up to about one inch can be tolerated. Area loads imposed by new fill placement, floor slab loads, stacked materials, large vessels or tanks can likely be supported by mat or strip footings, provided that up to several inches of settlement can be withstood by the structure, or possibly in conjunction with ground improvement techniques such as surcharging or other methods identified during the geotechnical report.

Once building locations are established, test soundings and/or borings should be conducted within each building footprint prior to design of foundations to address these issues.

Groundwater and Surface Runoff Control

Depending on proposed site grades, seasonal fluctuations and other factors, groundwater may be encountered within 3 to 5 feet of the existing ground surface elevations, as indicated on the sounding logs. Due to the highly variable nature of the subsurface water levels in the site vicinity, groundwater may also be encountered in areas of the site not tested in this preliminary subsurface investigation.

If perched water or groundwater is encountered during grading, ditching will be necessary to provide a stable bearing surface for foundations or pavements. In areas were machine pits may be constructed, ditching or excavation of sumps and pumping may be necessary to control potential perched water conditions. Capacity of sediment or detention ponds may also be limited in areas where shallow groundwater is encountered. In areas of proposed construction where shallow groundwater is encountered, it may be desirable to raise site grades to help reduce the impact of groundwater on construction.

During normal rainfall periods, ditching or other provisions for drainage should be provided prior to stripping and grading in low areas. If subsurface water or infiltrating surface water is not properly controlled during construction, the subgrade soils that will support foundations, as well as pavements or floor slabs, may be damaged. Furthermore, construction equipment mobility may be impaired. The design and installation of permanent underdrainage systems may be required to reduce the potential impact of shallow subsurface water, and should be further evaluated during the design phase of development.

Grade Slab Support and Construction

It is likely that grade slabs may be supported upon properly prepared existing soils or borrow soils.

- Soils similar to those penetrated by the soundings will generally provide adequate support to soil-supported slabs, assuming proper preparation, moisture control, and compaction of the subgrade for static load conditions.

- A capillary break of at least 4 inches of granular soils or washed, crushed stone placed below floor slabs will be required. Granular soils proposed for use should have less than 5 percent fines (silt and clay).

- We recommend that a vapor barrier be installed to limit moisture infiltration into finished space, or other areas where moisture infiltration will potentially cause problems.

Pavement Subgrade Preparation

Further exploration of near-surface soils is required to evaluate their pavement pavement characteristics. Typically, fine-grained soil types similar to the surface soils of Stratum I (clays and clayey sands) are less preferred for direct support of pavements due to their relatively low strength characteristics. Some of these materials require stabilization measures such as lime or cement stabilization, partial undercut of the clayey soils and replacement with sand material exhibiting a higher support value, or installation of geogrid.

Drainage of subgrade material plays an important role in the performance of pavement sections. Site preparation should allow for drainage that results in groundwater elevations being maintained at least 2 feet below the bottom of the pavement section. Laboratory California Bearing Ratio (CBR) testing should be performed upon representative soil samples of each soil type during the design geotechnical exploration. This is to establish the relationship between relative compaction and CBR for the existing soils, and to develop recommendations for pavement section design and construction.

RECOMMENDATIONS FOR ADDITIONAL WORK

It was not within the scope of this preliminary report to explore areas of proposed structures or pavements. A design-grade geotechnical report should be performed, which should include an exploration program designed by the geotechnical engineer, including Standard Penetration Test (SPT) borings or Cone Penetration Test (CPT) soundings with seismic design considerations within the areas of any proposed structures and pavements.

The exploration program should also include laboratory testing to evaluate engineering properties of subsurface soils and facilitate development recommendations for design and construction.

LIMITATIONS OF REPORT

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

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations of the soils at the site to those encountered at our test locations will not become evident until construction. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the development are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by the submitting engineers.

Assessment of site environmental conditions; sampling of soils, ground water or other materials for environmental contaminants; identification of jurisdictional wetlands, rare or endangered species, geological hazards, potential air quality and noise impacts, seismic considerations, or seismic site class determination were beyond the scope of this geotechnical exploration.

CLOSURE

S&ME appreciates this opportunity to work with you, as your geotechnical engineering consultant. If you should have any questions concerning this preliminary geotechnical report, please do not hesitate to contact us.

Sincerely,
S&ME, Inc.

Christopher M. Douton, P.E.
Project Engineer

Thomas C. Still, P.E.
Senior Engineer

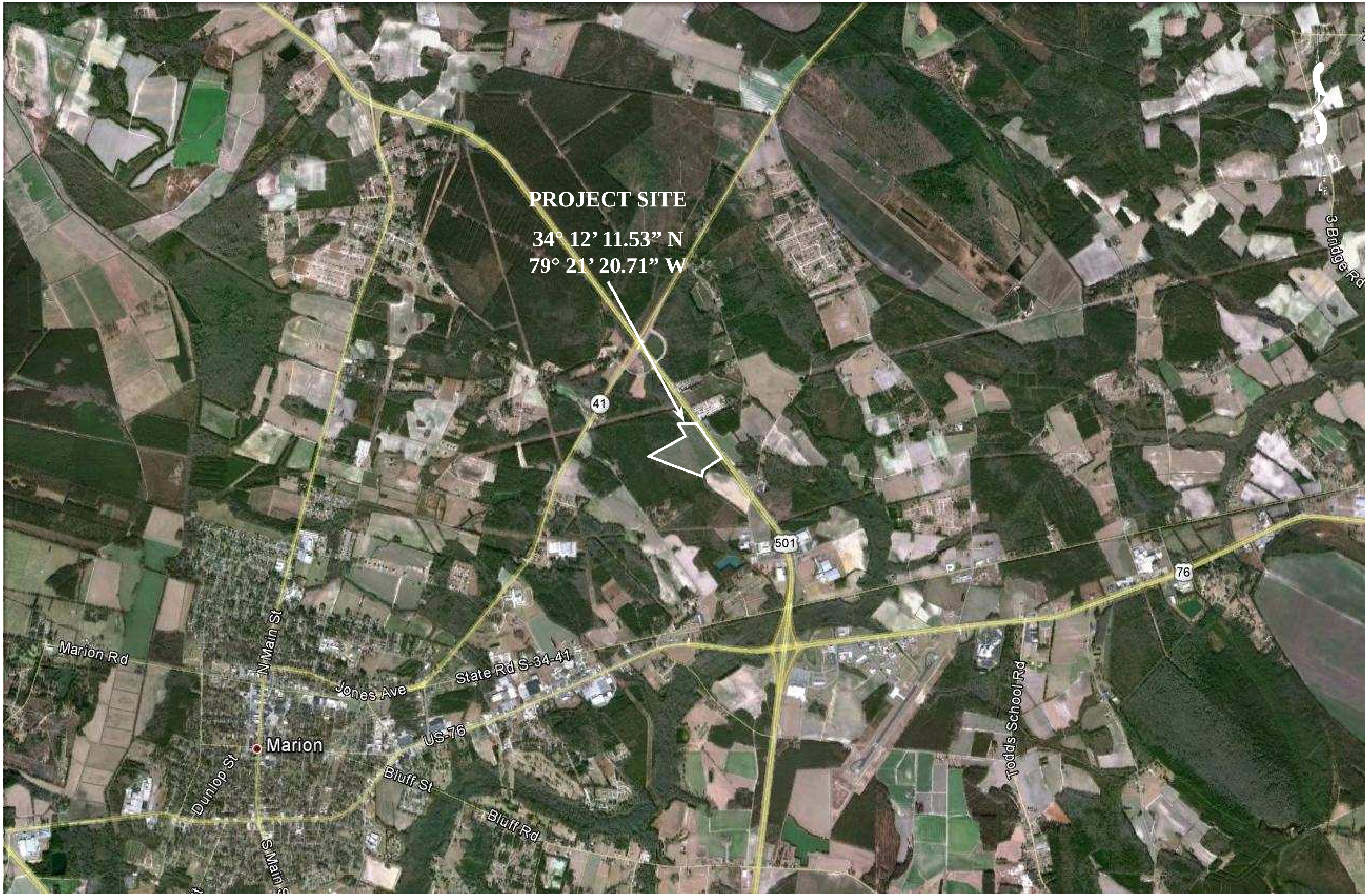
Attachments: Appendix A
Appendix B

APPENDIX A

SITE VICINITY PLAN

TEST LOCATION PLAN

INTERPRETED SUBSURFACE PROFILES



SCALE:	Not To Scale
SOURCE:	Google Earth
SOURCE DATE:	December, 2011
DATE:	December, 2012

S&ME

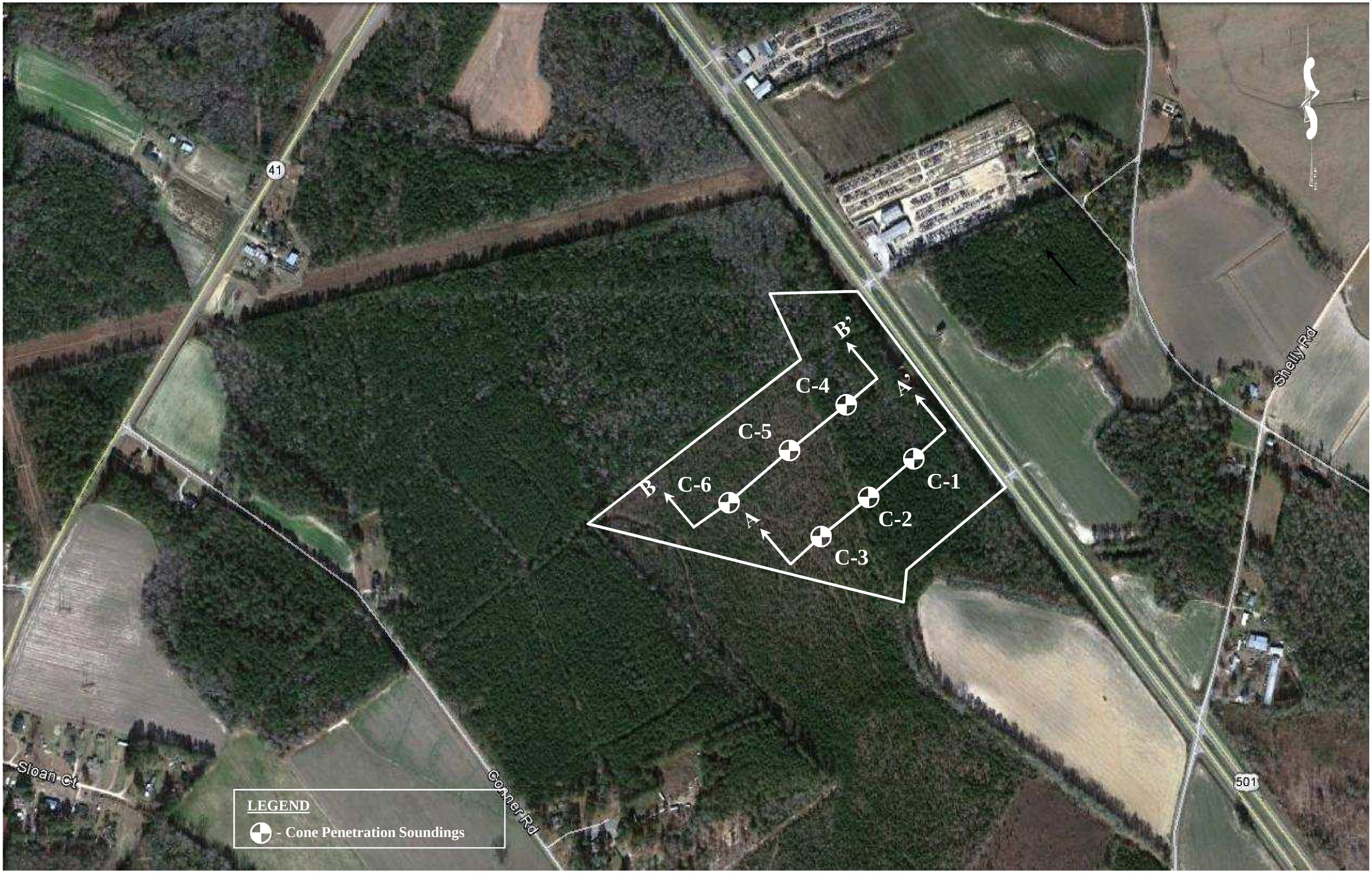
SITE VICINITY PLAN

Marion County Industrial Park – Lot 4

Marion, South Carolina

JOB NO. **1633-12-332**

FIGURE NO **1**



SCALE:	Not To Scale
SOURCE:	Google Earth
SOURCE DATE:	December, 2011
DATE:	December, 2012

S&ME

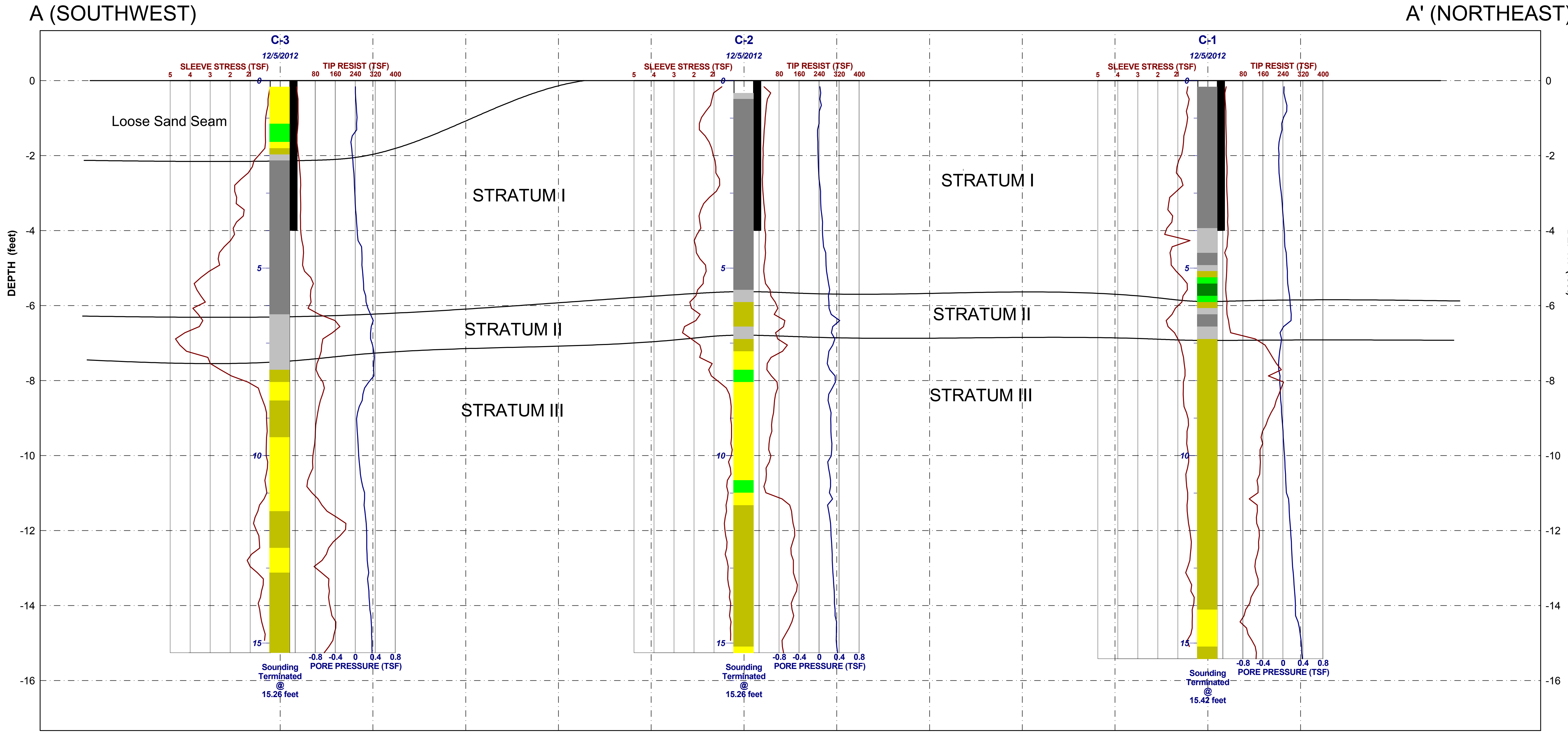
TEST LOCATION SKETCH

Marion County Industrial Park – Lot 4

Marion, South Carolina

JOB NO. **1633-12-332**

FIGURE NO **2**



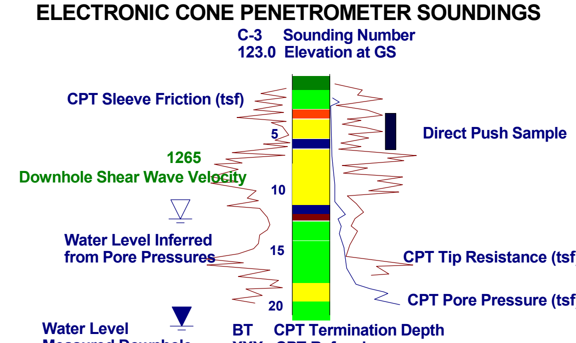
FACING NORTHWEST

STRATUM I: UPPER SOFT CLAYS & LOOSE CLAYEY SANDS
STRATUM II: INTERMEDIATE STIFF CLAYS & MEDIUM DENSE CLAYEY SANDS
STRATUM III: INTERMEDIATE DENSE SANDS (BEAR BLUFF FORMATION)

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS



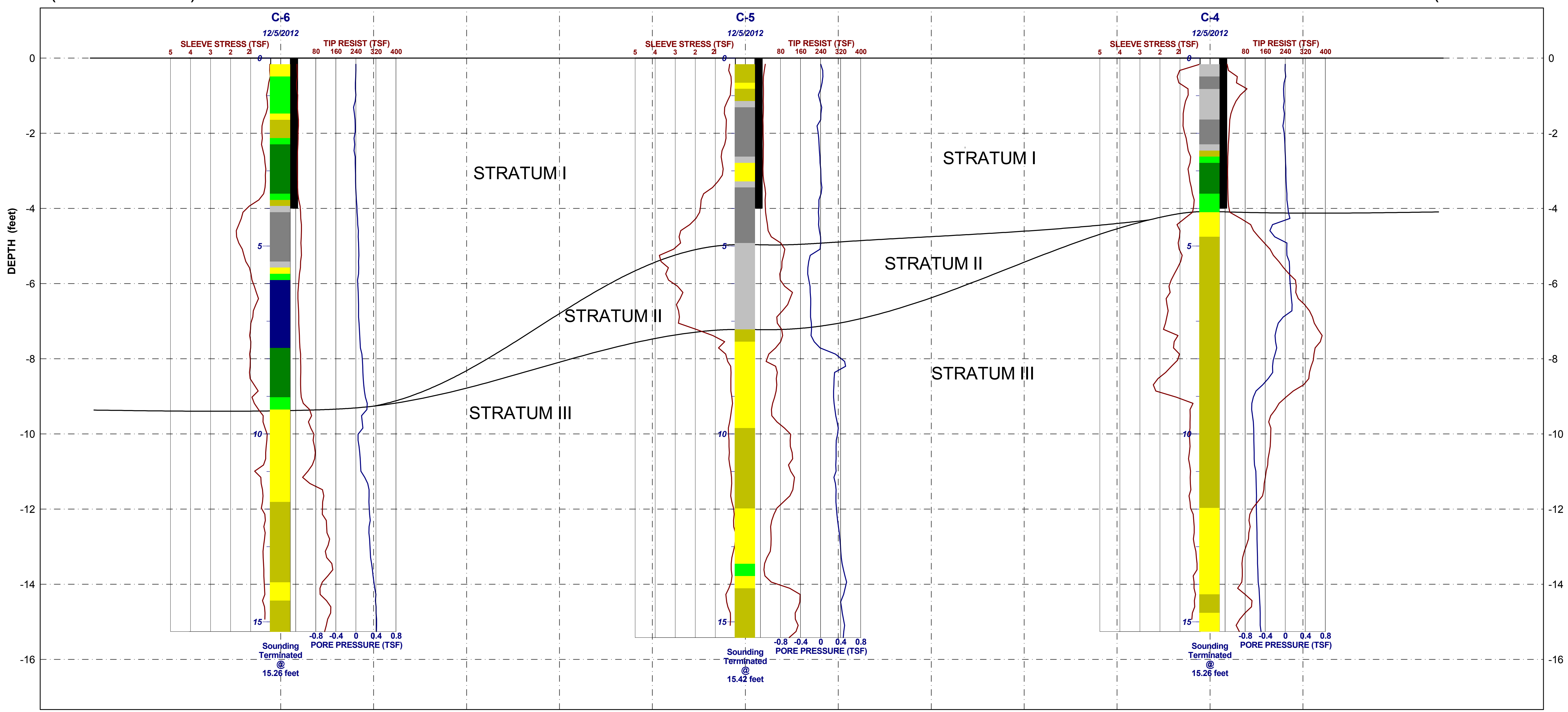
The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgment. The actual subsurface conditions will vary between boring locations.

SUBSURFACE PROFILE - A-A'

PROJECT: Marion County Industrial Park - Lot 4
LOCATION: Marion, South Carolina
FIGURE: 3

JOB NO: 1633-12-332
DATE: 12/10/12

S&ME



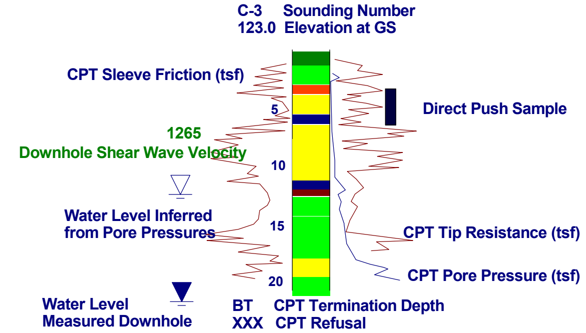
FACING NORTHWEST

STRATUM I: UPPER SOFT CLAYS & LOOSE CLAYEY SANDS
STRATUM II: INTERMEDIATE STIFF CLAYS & MEDIUM DENSE CLAYEY SANDS
STRATUM III: INTERMEDIATE DENSE SANDS (BEAR BLUFF FORMATION)

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgment. The actual subsurface conditions will vary between boring locations.

SUBSURFACE PROFILE - B-B'	JOB NO: 1633-12-332
PROJECT: Marion County Industrial Park - Lot 4	
LOCATION: Marion, South Carolina	DATE: 12/10/12
FIGURE: 4	

S&ME

APPENDIX B

SUMMARY OF EXPLORATION PROCEDURES

CPT SOIL CLASSIFICATION LEGEND

CPT SOUNDING LOGS

SUMMARY OF EXPLORATION PROCEDURES

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-98, "*Standard Guide to Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

RECONNAISSANCE OF THE PROJECT AREA

Where practical, we reviewed available topographic maps, county soil surveys, reports of nearby investigations and aerial photographs when preparing the boring and sampling plan. Then we walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the Palmetto Utility Protection Service (PUPS) before we drill or excavate at any site. PUPS is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of South Carolina. PUPS forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

SOUNDINGS AND SAMPLING

Electronic Cone Penetrometer (CPT) Soundings

CPT soundings consist of a conical pointed penetrometer which is hydraulically pushed into the soil at a slow, measured rate. Procedures for measurement of the tip resistance and side friction resistance to push generally follow those described by ASTM D-5778, "*Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils*."

A penetrometer with a conical tip having a 60 degree apex angle and a cone base area of 10 cm^2 was advanced into the soil at a constant rate of 20 mm/s. The force on the conical point required to penetrate the soil was measured electronically every 50 mm penetration to obtain the *cone resistance* q_c. A friction sleeve is present on the penetrometer immediately behind the cone tip. The force exerted on the sleeve was measured electronically at a minimum of every 50 mm penetration and divided by the surface area of the sleeve to obtain the *friction sleeve resistance value* f_s A pore pressure element mounted immediately behind the cone tip was used to measure the pore pressure induced during advancement of the cone into the soil.

CPT Soil Stratification

Using ASTM D-5778 soil samples are not obtained. Soil classification was made on the basis of comparison of the tip resistance, sleeve resistance and pore pressure values to values measured at other locations in known soil types, using experience with similar soils and exercising engineering judgment.

Plots of normalized tip resistance versus friction ratio and normalized tip resistance versus penetration pore pressure were used to determine soil classification (Soil Behavior Type, SBT) as a function of depth using empirical charts developed by P.K. Robertson (1990). The friction ratio soil classification is determined from the chart in the appendix using the normalized corrected tip stress and the normalized corrected tip stress and the normalized friction ratio.

At some depths, the CPT data fell outside of the range of the classification chart. When this occurred, no data was plotted and a break was shown in the classification profile. This occasionally occurred at the top of a penetration as the effective vertical stress is very small and commonly produced normalized tip resistances greater than 1000.

To provide a simplified soil stratigraphy for general interpretation and for comparison to standard boring logs, a statistical layering and classification system was applied the field classification values. Layer thicknesses were determined based on the variability of the soil classification profile, based upon changes in the standard deviation of the SBT classification number with depth. The average SBT number was determined for each successive 6-inch layer, beginning at the surface. Whenever an additional 6-inch increment deviated from the previous increment, a new layer was started, otherwise, this material was added to the layer above and the next 6-inch section evaluated. The soil behavior type for the layer was determined by the mean value for the complete layer.

Direct Push Sampling

Near-surface soil samples were obtained using a Geoprobe Model 5400 rig, which is a hydraulically powered soil probe unit, mounted on the CPT track rig. The probes are driven into the ground using a hydraulic hammer, which delivers a minimum of 1,800 blows per minute at a force greater than 15,000 pounds (66.6 KN) per blow. The hydraulic hammer allows the probes to be driven into the soil at a force greater than the weight of the rig thus allowing greater penetration depths than with a conventional hydraulic ram direct push tool of similar size.

The geoprobe rig obtains soil samples at either specific depths or continuously. Continuous soil sampling is accomplished using a small-diameter dual tube (macro-core) sampler, with a 1.125 inch I.D., and a 2.25 inch O.D. The soil cores were obtained using tube a segment of 4-foot in length.

Subsurface Water Level Determination

CPT penetration pore pressures include the *in-situ equilibrium pore pressure*, controlled by the local ground water regime, and the *excess pore pressure*, generated by insertion of the probe. In clays and silts, penetration is essentially undrained and recorded pore pressures significantly exceed in-situ equilibrium pore pressures. In sands and gravels, penetration is essentially drained and recorded pore pressures are essentially equal to the in-situ equilibrium pore pressure. The piezometric surface, defined as the point of zero equilibrium pore pressure, was obtained by plotting in-situ equilibrium pore pressure vs. depth using only pore pressure data from sand or gravel soils. Where possible, derived piezometric surface was verified by tape measurement through the sounding opening after removal of the CPT rod and before collapse of the soils.

Examination of Recovered Soil Samples

Soil and field records were reviewed in the laboratory by the geotechnical professional. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, "*Standard Practice for Description and Identification of Soils (Visual-Manual Method)*".

CPT Soil Classification Legend

Zone		Q_t/N	Description
1		2	Sensitive, Fine Grained
2		1	Organic Soils-Peats
3		1.5	Clays-Clay to Silty Clay
4		2	Silt Mixtures-Clayey Silt to Silty Clay
5		3	Sand Mixtures-Silty Sand to Sandy Silt
6		4.5	Sands-Clean Sand to Silty Sand
7		6	Gravelly Sand to Sand
8		1	Very Stiff Clay to Clayey Sand*
9		2	Very Stiff, Fine Grained*

(*) Heavily Overconsolidated or Cemented

Robertson's Soil Behavior Type (SBT), 1990			
Group #	**Description**	**Ic**	
		Min	**Max**
1	Sensitive, fine grained	N/A	
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N/A	
9	Very stiff, fine grained (High OCR or cemented)	N/A	

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

Relative Density and Consistency Table			
SANDS		SILTS and CLAYS	
Cone Tip Stress, qt (tsf)	Relative Density	Cone Tip Stress, qt (tsf)	Consistency
Less than 20	Very Loose	Less than 5	Very Soft
20 - 40	Loose	5 - 15	Soft to Firm
40 - 120	Medium Dense	15 - 30	Stiff
120 - 200	Dense	30 - 60	Very Stiff
Greater than 200	Very Dense	Greater than 60	Hard

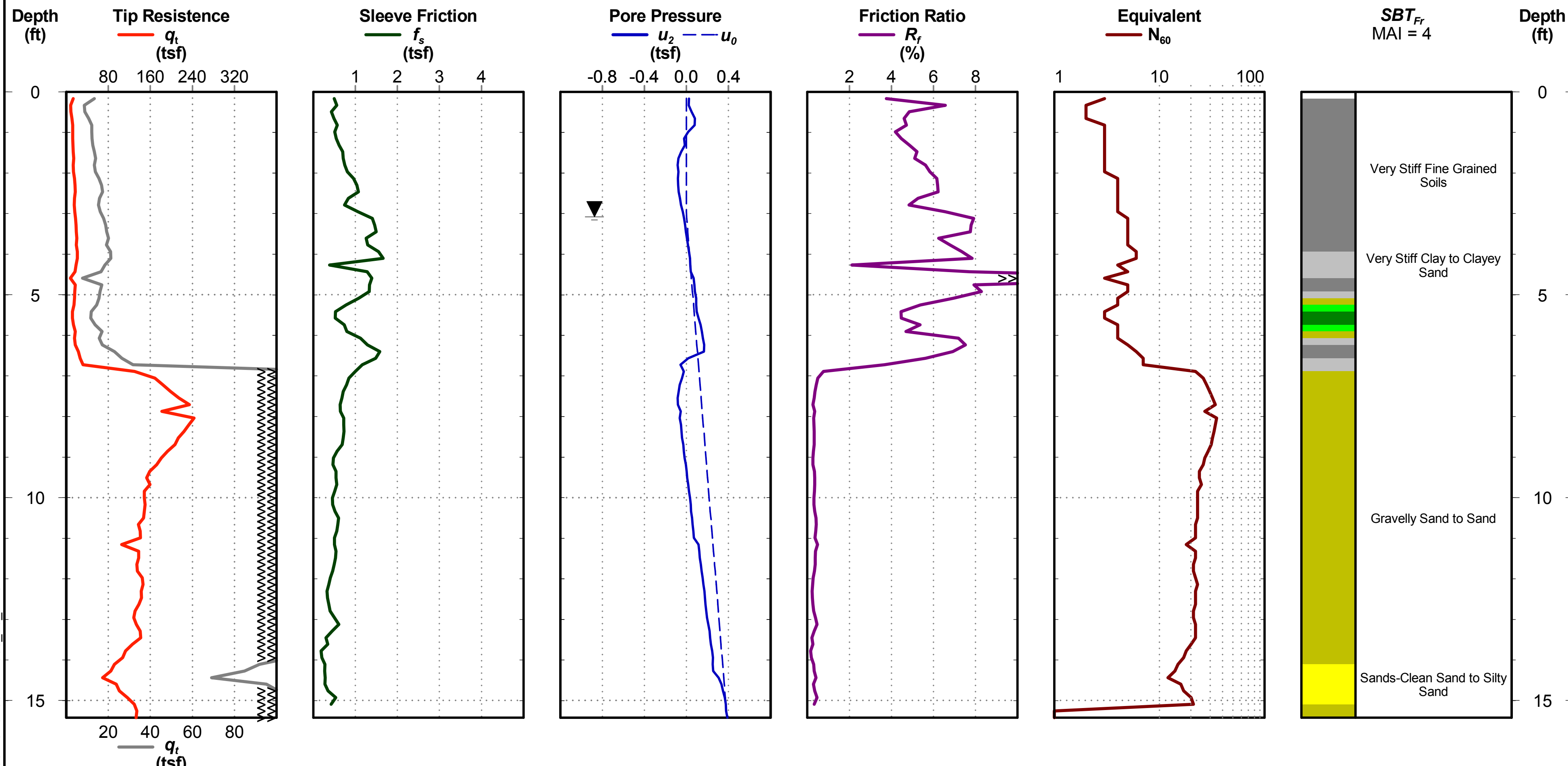
Cone Penetration Test

C-1

Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Date: Dec. 5, 2012
Estimated Water Depth: 3.08 ft
Rig/Operator: CPT Track Rig/C. Robison

Total Depth: 15.4 ft
Termination Criteria: Target Depth
Cone Size: 1.44



C-1

CPT REPORT - DYNAMIC 1633-12-332.GPJ S&ME 2008_06_24.GDT 12/11/12

Electronic Filename: Marion Industrial Park S-1.cpt

S&ME

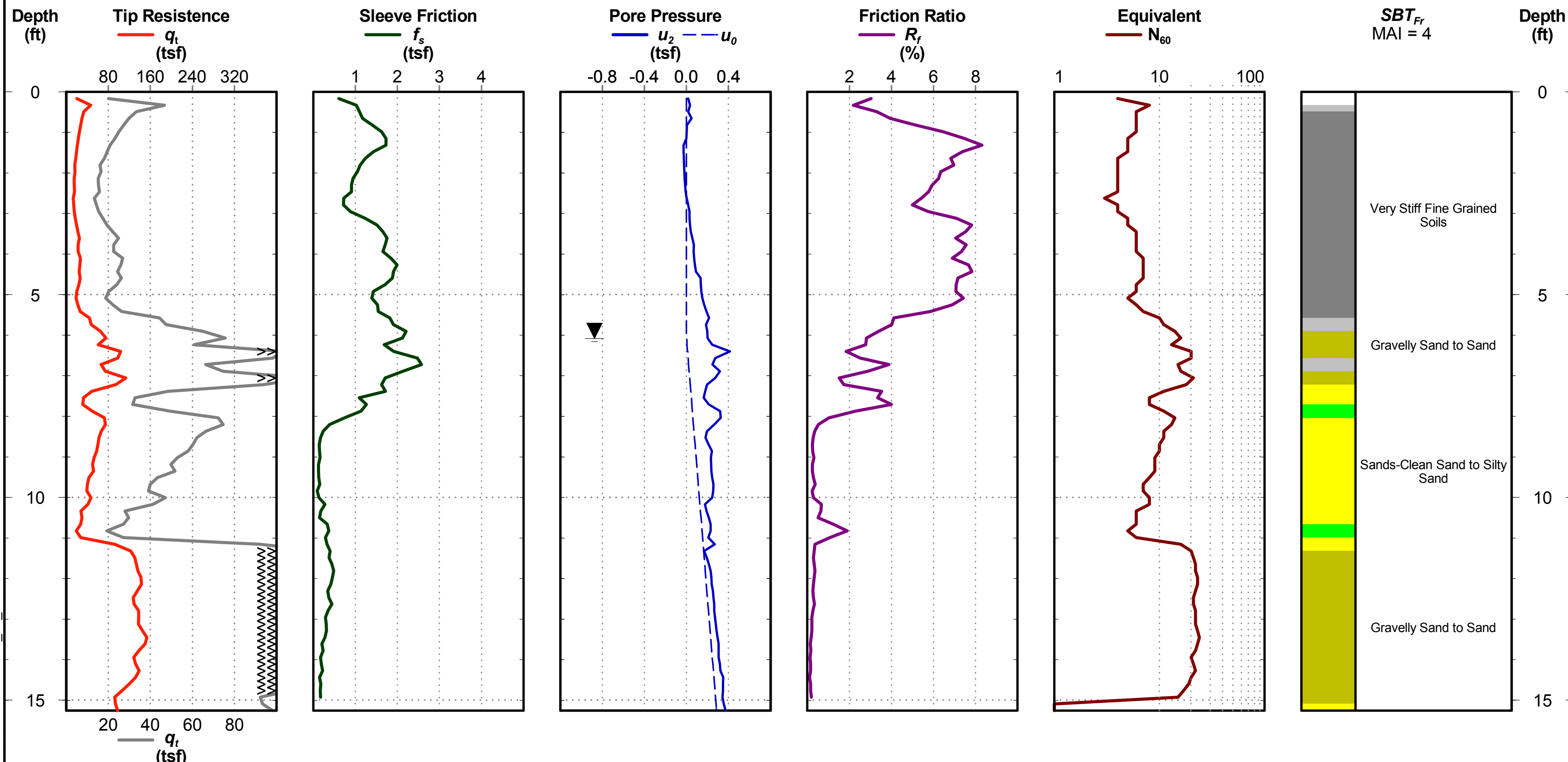
Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Cone Penetration Test

C-2

Date: Dec. 5, 2012
Estimated Water Depth: 6.08 ft
Rig/Operator: CPT Track Rig/C. Robison

Total Depth: 15.3 ft
Termination Criteria: Target Depth
Cone Size: 1.44



C-2

Electronic Filename: Marion Industrial Park S-2.cpt

S&ME

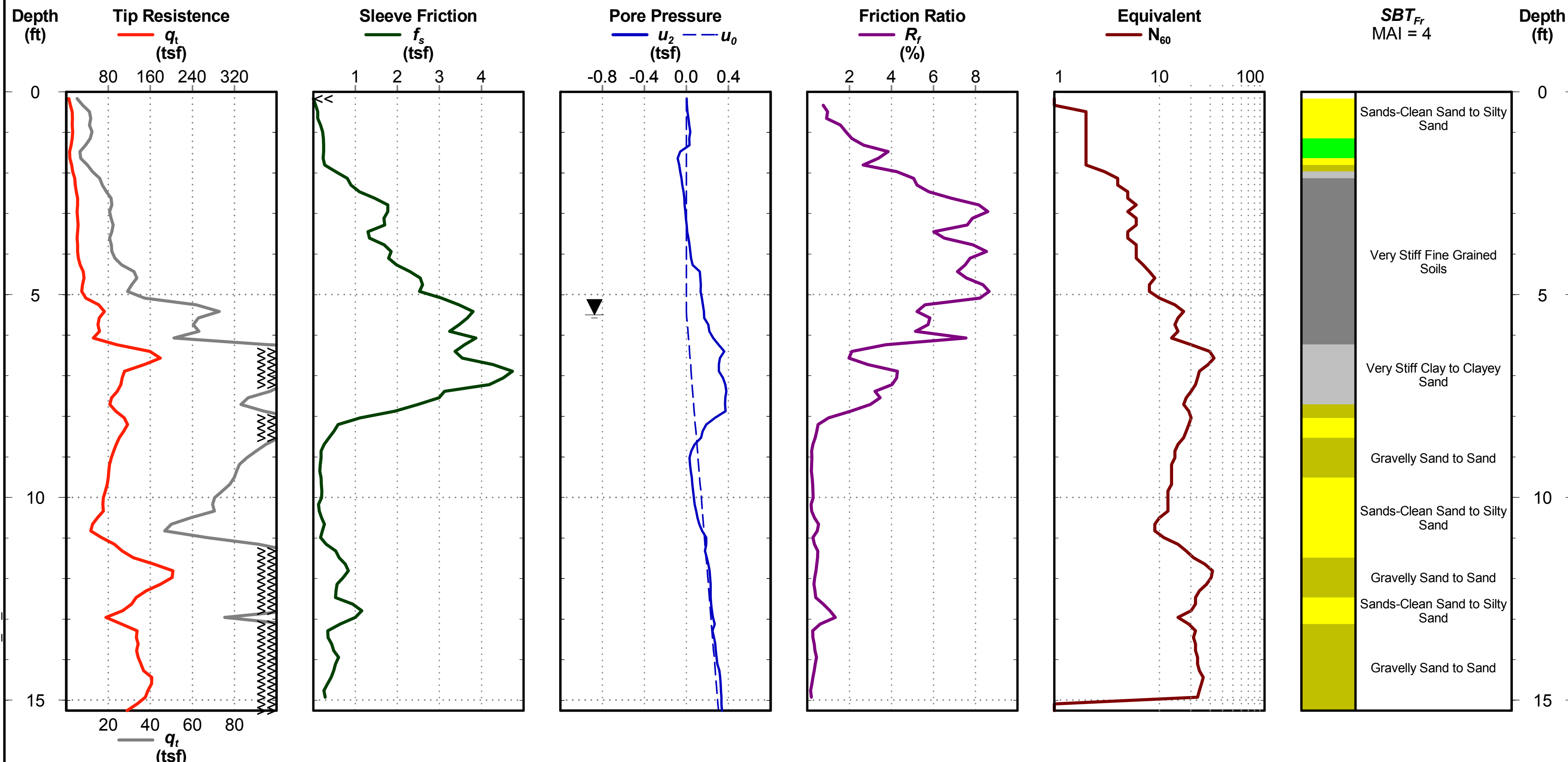
Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Cone Penetration Test

C-3

Date: Dec. 5, 2012
Estimated Water Depth: 5.5 ft
Rig/Operator: CPT Track Rig/C. Robison

Total Depth: 15.3 ft
Termination Criteria: Target Depth
Cone Size: 1.44



CPT REPORT - DYNAMIC 1633-12-332.GPJ S&ME 2008_06_24.GDT 12/11/12

C-3

Electronic Filename: Marion Industrial Park S-3.cpt

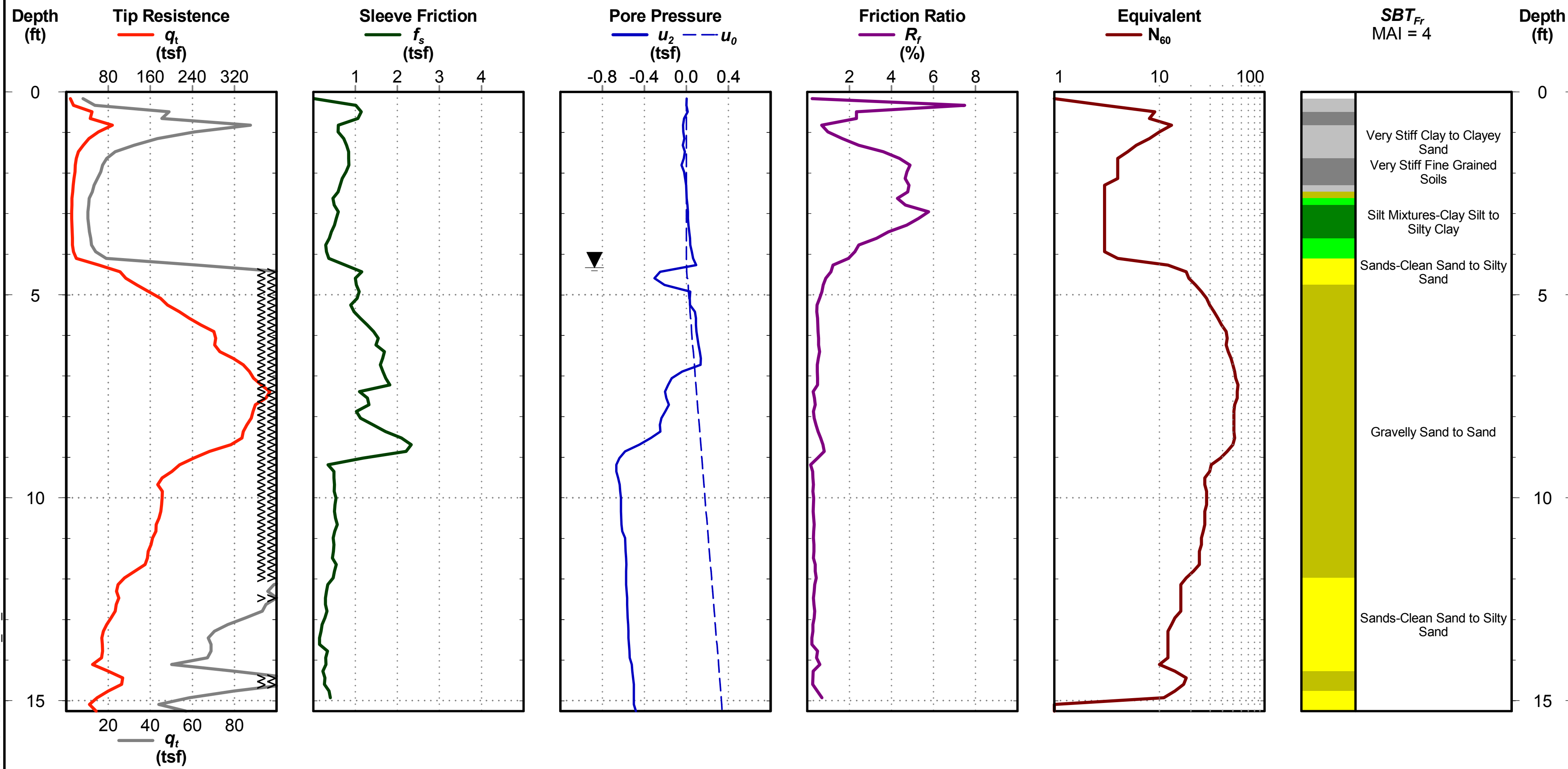
Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Cone Penetration Test

C-4

Date: Dec. 5, 2012
Estimated Water Depth: 4.33 ft
Rig/Operator: CPT Track Rig/C. Robison

Total Depth: 15.3 ft
Termination Criteria: Target Depth
Cone Size: 1.44



C-4

Electronic Filename: Marion Industrial Park S-4.cpt

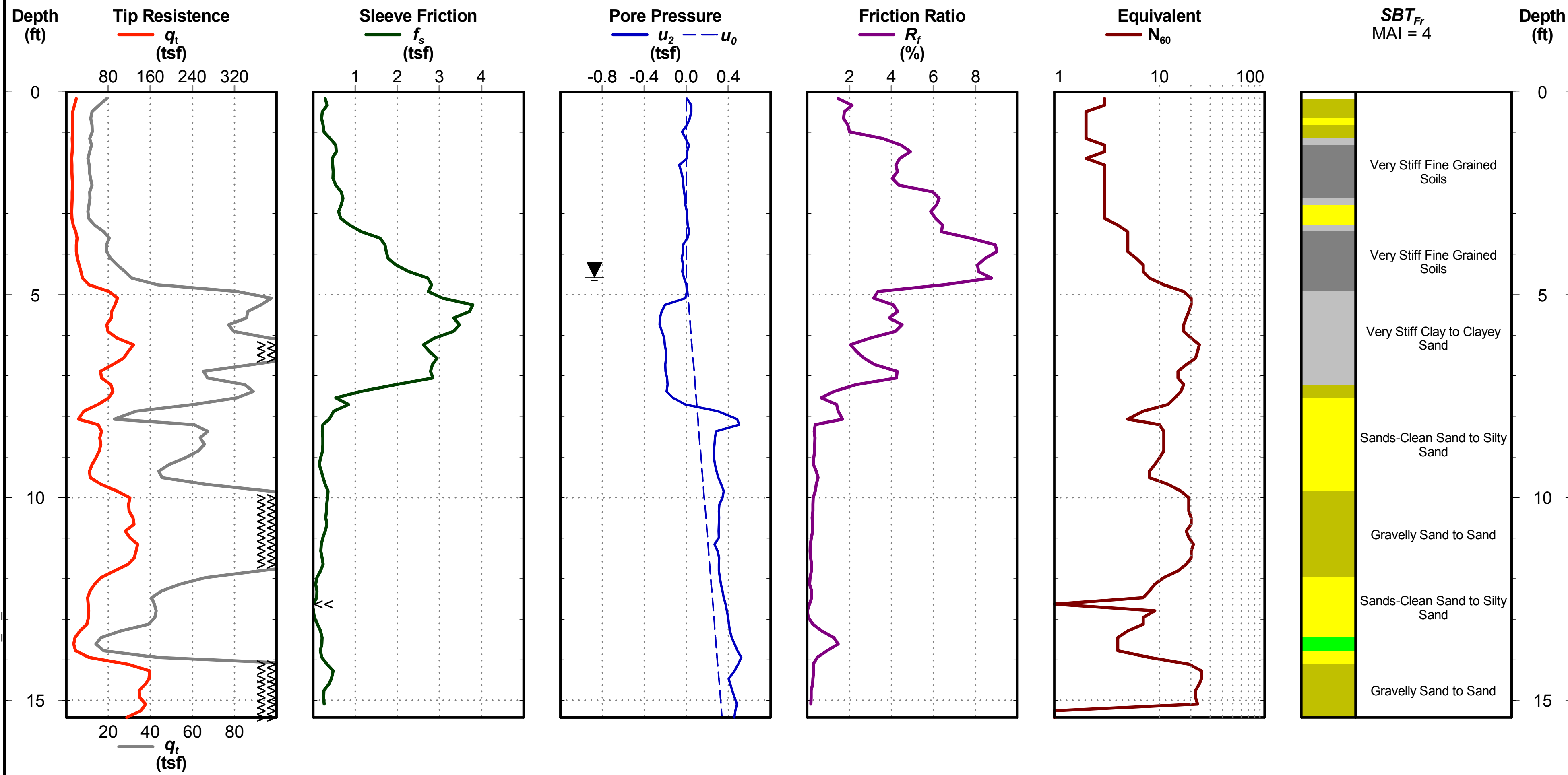
S&ME

Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Cone Penetration Test

C-5

Date:	Dec. 5, 2012	**Total Depth:**	15.4 ft
Estimated Water Depth:	4.58 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	CPT Track Rig/C. Robison	**Cone Size:**	1.44



C-5

Electronic Filename: Marion Industrial Park S-5.cpt

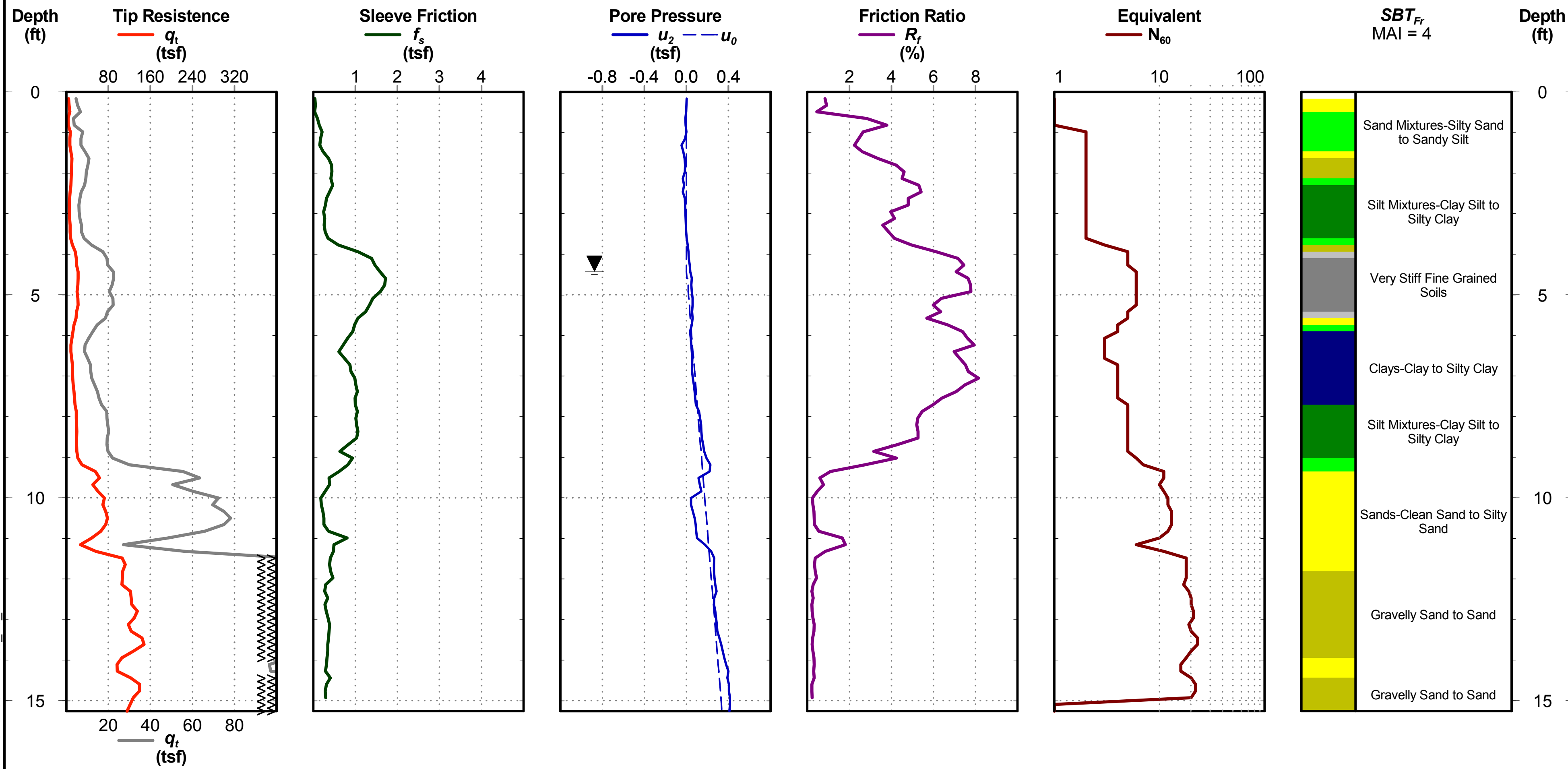
Marion County Industrial Park - Lot 4
Marion, South Carolina
S&ME Project No: 1633-12-332

Cone Penetration Test

C-6

Date: Dec. 5, 2012
Estimated Water Depth: 4.42 ft
Rig/Operator: CPT Track Rig/C. Robison

Total Depth: 15.3 ft
Termination Criteria: Target Depth
Cone Size: 1.44



CPT REPORT - DYNAMIC 1633-12-332.GPJ S&ME 2008_06_24.GDT 12/11/12

C-6

Electronic Filename: Marion Industrial Park S-6.cpt