REPORT OF

GEOTECHNICAL INVESTIGATION

OFFICE AND WAREHOUSE
BELLE CHASE, LOUISIANA

REPORT DATE

MAY 23, 2006

PREPARED FOR

INSULATION TECHNOLOGIES, INC.
HARVEY, LOUISIANA

PREPARED BY

AQUATERRA ENGINEERING, LLC
P. O. BOX 82160 ▪ BATON ROUGE, LA 70884-2160
3499 I-10 FRONTAGE ROAD ▪ PORT ALLEN, LOUISIANA
TEL: 225.344.6052 ▪ FAX: 225.344.6346

DANIEL J. AUCUTT
REG. No. 25492

Daniel J Aucutt

DANIEL J. AUCUTT, P.E.

aquaterra
engineering LLC

Post Office Box 82160 ● Baton Rouge, Louisiana 70884-2160
3499 I-10 Frontage Road ● Port Allen, Louisiana 70767
Office: 225.344.6052 ● Fax: 225.344.6346 ● Web: www.aquaterraeng.com

May 23, 2006

Mr. Steve Vignes
Insulation Technologies, Inc.
P.O. Box 98
Harvey, Louisiana 70059

RE: Geotechnical Investigation
Proposed Office and Warehouse
Bell Chasse, Louisiana
AQT No. 9106138

Dear Mr. Vignes:

Submitted herein are the results of our geotechnical investigation for the proposed office and warehouse facility along Herman Drive in Belle Chasse, Louisiana. This work was requested by Mr. Vignes.

In general, the soil borings encountered 5 to 6 inches of topsoil over two to four feet of firm to very stiff silty clays and clays. Below this "crust", very soft clays with organics were identified to a depth of 10 feet. CPT-1 and CPT-2 confirmed the presence of very soft clays from approximately 4 feet to 10 feet. Below 10 feet, the probes noted the presence of very soft sensitive fine grained soils to approximately 40 feet. From 40 to 61 feet, soft sensitive fine grained soils were identified. A layer of very loose silty sand was encountered at 61 feet to approximately 68 feet. At 68 feet a dense sand layer was encountered to the probe termination depth of 69 feet.

The first step in preparing this site will be modification of the upper soil layers. The upper 12 inches of exposed subgrade should be lime modified with 4%by weight hydrated lime. The upper 9 to 12 inches of modified subgrade should then be stabilized with 10%by weight Type 1 Portland cement, and graded to drain toward the lower perimeter areas. Shallow foundations for the building can be placed on the modified subgrade. Alternatively, driven steel pipe piles placed to approximately 68 feet may be used to support the structure. A rigid (concrete) pavement should be placed at this site in the parking and truck loading areas.

We request that we be retained to review final plans and specifications in order to confirm consistency with our recommendations. Further, the construction quality aspects of site preparation and foundation construction should be documented by this office. Please contact this office if you have any questions.

Sincerely,

Aquaterra Engineering, LLC

Lynne R Smith

Lynne R. Smith, E.I.

Daniel J Aucutt

Daniel J. Aucutt, P.E.

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

Insulation Technologies, Inc. is designing a new high bay office and warehouse facility along Herman Drive in Belle Chasse, Louisiana. The site is located near Latitude 29°51'56.6" North and Longitude 90°01'10.2" West. A site vicinity map indicating the general location of the proposed new warehouse and office is illustrated on Figure 1. More detailed information regarding proposed construction is provided in Paragraph 2.2.

1.1 Purpose

Aquaterra Engineering, LLC was retained by Insulation Technologies, Inc. to conduct a geotechnical investigation for the new office and warehouse facility. This investigation was intended to provide an understanding of the subsurface conditions and to develop options available for foundations at this facility.

1.2 Scope

The geotechnical investigation conducted for this project included the following:

- Site Reconnaissance: A visual review and documentation of site conditions pertinent to the geotechnical study at the time of our field exploration.
- Soil Borings: Four soil borings were placed for this project and advanced to depths of 6 to 10 feet. The locations of the soil borings are illustrated on Figure 2.
- Cone Penetrometer Tests: Two Cone Penetrometer Test (CPT) probes were made to an approximate depth of 69 feet adjacent to the soil boring locations (B-1/CPT-1 and B-2/CPT-2). The results of the CPT testing, expressed as cone and sleeve resistance and pore pressure, are provided in Appendix B. Using standard procedures established in literature, based upon theoretical analyses and empirical interpretations, the CPT data have been evaluated to estimate soil behavior properties, the apparent undrained shear strength (for cohesive soils), and the equivalent Standard Penetration Test (N-Value) resistance are included with the CPT probe data in Appendix B.
- Laboratory Testing: The determination of index and engineering properties of selected soil samples by performing geotechnical laboratory testing, including: moisture content, Atterberg limits and unconfined compressive strength on selected soil samples.
- Engineering Evaluations & Reporting: The performance of engineering analyses for pertinent design recommendations and the development of this report.

1.3 Procedures

This investigation followed procedures established by our firm as routine for a geotechnical investigation of this nature with sampling and analyses in general accordance with appropriate guidelines established by ASTM. Appendix A describes the field and laboratory procedures utilized to accomplish this geotechnical investigation.

1.4 Limitations

The analyses and recommendations presented in this report are based upon the assumption that the soil borings made for this investigation represent the soil and groundwater conditions throughout the site. Variations in soil or groundwater conditions may occur between or away from the boring locations. If conditions different from those described in Section 3 are encountered or are expected, this office should be promptly notified so that the effects of the varying conditions can be determined, and any necessary changes to these analyses and recommendations can be made.

This investigation program and these recommendations are intended for specific application to the project generally described in Section 2 at the site described in Paragraph 3.1. The data or the analyses and recommendations presented in this report are not necessarily applicable for any other project or location. If the nature of the project should change from the descriptions provided in Section 2, these recommendations should be reevaluated.

The only warranty made in connection with the services provided is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty is expressed or implied.

2.0 PROJECT INFORMATION

The following paragraphs present the project information that was available at the time this report was prepared. Should this information be incorrect, or change significantly, please contact this office so that our analysis and recommendations can be reevaluated.

2.1 Information Sources

Information related to this project was provided by Insulation Technologies, Inc. representative, Mr. Steve Vignes. A site plan was also provided.

2.2 Anticipated Construction

We understand that the new warehouse and office will be a pre-engineered metal clad structure that is approximately 8,800 sq. ft. in plan. There will be a parking area for employees and a truck loading area.

We expect that one to two feet of fill may be used to bring the site to grade. No additional excavations, other than those for foundation and miscellaneous small utility construction, are anticipated.

2.3 Anticipated Loads

Final structural loads were not available at the time the proposal was issued. Based upon our experience with similar projects, we expect that column loads will not exceed 40 kips. Depending upon the design, uplift and lateral loading should be on the order of 15 kips and 5 kips, respectively, while maximum wall loads should not exceed 2 klf. Should actual loading conditions vary by more than 10 percent from those presented in here, this office should be notified so that the effects of the variations can be analyzed.

3.0 SITE CONDITIONS

In a geotechnical investigation of this nature, local topography and surface conditions, geologic setting and site-specific soil and groundwater conditions are important. The following paragraphs summarize our findings relative to these topics.

3.1 Physical Setting

The proposed office and warehouse site was located along Herman Drive in Belle Chasse, Louisiana. At the time of our exploration, the site vegetation consisted of a short grass cover. A power plant was located on the western side of the property. At the southern end of the property, a drainage ditch that was approximately 6 feet deep was noted, but did not exhibit standing water. The site was relatively flat and appeared to drain by sheetwash toward the ditch. Our track mounted drilling equipment was able to traverse the site without difficulty.

3.2 Geologic Setting

This site is within an area of Natural Levee Deposits of Holocene Age. These deposits are present along current and recent river channels in this area and are characterized by soft to firm clays and silty clays with localized silt and sand layering. Beneath the Natural Levee deposits, soft to very soft Holocene Age Alluvial deposits consisting of typically weak and compressible clays and silty clays are encountered. At depths on the order of 60 to 80 feet, older and more competent sands of Pleistocene Age have been identified.

3.3 Soil Conditions

Boring B-1 was placed near the northeastern corner of the proposed building and encountered approximately 5 inches of topsoil. Beneath the topsoil, the boring encountered a stiff to very stiff clay (Unified Soil Classification System symbol, CH) "crust" to approximately 4 feet. Very soft clay (CH) was identified to the boring termination depth of 10 feet. These clays were laminated and blocky, and contained organic material.

Boring B-2 was placed in the southwestern corner of the proposed building. Beneath approximately 6 inches of topsoil, firm to stiff silty clays (CL) were identified to a depth of 2 feet. Stiff to very stiff clay (CH) was encountered to a depth of 4 feet. Below 4 feet, very soft clay (CH) with organics was observed to the boring termination depth of 10 feet.

The parking lot borings encountered approximately 3 to 5 inches of topsoil. Beneath the topsoil, firm to soft clays (CH) were encountered in the upper 2 feet. Below 2 feet, very soft clays (CH) with organics were identified to a boring termination depth of 6 feet.

CPT-1 and CPT-2 confirmed the presence of very soft clays from approximately 4 feet to 10 feet. Below 10 feet, the probes noted the presence of very soft sensitive fine grained soils to approximately 40 feet. From 40 to 61 feet, soft sensitive fine grained soils were identified. A layer of very loose silty sand (SM) was encountered at 61 feet to approximately 68 feet. At 68 feet a dense sand (SP) layer was encountered. Probe refusal was encountered at a depth of 69 feet.

The soil boring logs located in Appendix A include the field and laboratory data collected and a description of soil conditions specific to each boring. The CPT logs located in Appendix B provide the results of the CPT data and include interpretations of soil types, undrained shear strength and standard penetration resistance based upon empirical correlations of the data.

3.4 Groundwater Conditions

The soil borings were dry augered to document groundwater conditions at the time of our investigation. The soil boring logs in Appendix A illustrate the groundwater observations in each boring. Groundwater was encountered at a depth of 6.5 to 7 feet in Borings B-1 and B-2. Borings P-1 and P-2 did not encounter groundwater while drilling to 6 feet.

Groundwater levels will vary with rainfall and other seasonal variations. The depth to groundwater should be verified prior to the initiation of activities that could be impacted by groundwater.

4.0 GEOTECHNICAL CONSIDERATIONS

The information provided by the designers for this project has been combined with our findings from the site investigation to develop guideline recommendations for foundation design. The following paragraphs summarize these considerations. Subsequent sections of this report address these issues in more detail.

The existing surficial silty clays (CL) and clays (CH) will likely become disturbed if exposed to construction activities during wet conditions. Once disturbed, this material can be difficult to mitigate (i.e., it may be most efficient to overexcavate and replace the disturbed material). Drainage should be improved and maintained during construction to remove storm water as rapidly as possible. Section 5 provides site preparation, fill selection, and fill compaction recommendations.

The natural clays (CH) ranged from firm to very stiff within the upper 2 to 4 feet. The very soft clays (CH) below 4 feet will limit the design bearing pressure. If shallow foundations are desired, then a mat foundation can be used if supported on lime modified and cement stabilized subgrade (described in Section 5). Section 6 provides our recommendation for shallow foundations.

The warehouse and office may be supported on driven steel pipe piles to a depth of about 68 feet. Section 7 provides our recommendation for steel pipe piles.

The use of rigid (Portland cement concrete) paving is recommended unless the site is graded to provide excellent drainage. Section 8 provides our recommendation for pavement design.

Appropriate quality control and quality assurance provisions are essential to the successful implementation of the recommendations provided in the subsequent paragraphs for site preparation and shallow foundation construction. Section 9 addresses the required quality control and quality assurance provisions that are within the scope of this phase of the project.

5.0 SITE PREPARATION

The following paragraphs provide guideline recommendations for site preparation, excavations and fill placement.

5.1 Site Drainage

The site was relatively flat and appeared to drain by sheetwash southwest toward a drainage ditch. The depth of the ditch was approximately 6 feet with no standing water observed. The cohesive soils will deteriorate in this relatively flat area if construction is attempted during wet seasons, unless excellent drainage is provided. Effective drainage should be installed at the start of construction, and maintained subsequent to construction to remove storm water from the site as rapidly as possible.

5.2 Clearing, Grubbing, and Proof-Rolling

Site preparation should include clearing to remove organic bearing materials and any rubble or debris that may be present within the area of planned construction. Soils containing objectionable materials should not be used for backfill.

After the mitigation operations are performed (as described below in Paragraph 5.3), the entire area to be filled and/or occupied by paving or foundations should be proof-rolled with a loaded tandem-axle dump truck or similar pneumatic-tired equipment with a minimum weight of 15 tons and a maximum weight of 25 tons to observe for the presence of weak, yielding, or pumping foundation soils. If rutting or pumping is encountered, the areas should be further mitigated.

5.3 Mitigation of Unstable Soils

The in-place soils must be stable prior to the placement of fill materials or structures over them. At the time of this investigation, the near-surface clays (CH) were described as firm to very stiff in some areas and soft in others. In order to provide more uniform support, the entire site should be modified with hydrated lime mixed at 4% by weight to a minimum depth of 12 inches. The contractor should be required to provide a stabilizer capable of mixing to the full depth of 12 inches. The purpose of the lime is to remove excess moisture from the soil and to reduce the Plasticity Index (PI) of the moderately plastic areas. The procedure should follow the guidelines presented for Type C Mixing in Section 304 of the Louisiana Standard Specifications for Roads and Bridges, 2000 Edition (Red Book).

After completion of the lime modification, the subgrade area should be cement modified using Type 1 Portland cement mixed at 10% by weight to a minimum depth of 9 inches. If the building is to be supported on shallow foundations, then the building area should be included within the mitigation. Cement modification procedures should follow Section 301 of the Red Book. The exposed subgrade surface should be graded to shed water toward the lower perimeter areas. No traffic should be allowed on the prepared subgrade for at least 72 hours after final compaction and grading.

5.4 Excavations

Foundation excavations placed into the upper 4 feet in the firm to very stiff clays (CH) should be capable of standing on near vertical slopes for short-term conditions. The soft and very soft clays (CH) may require sloping or benching to maintain stability. Groundwater seepage should be minor. The depth to groundwater should be evaluated before foundation excavations are placed.

All excavations should be made and kept in compliance with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1926). These regulations require that excavations greater than five feet in depth be sloped, benched, sheeted, or braced to protect employees working in or near the excavation against the risk of collapse.

5.5 Fill Materials

Fill used to bring the site to grade should be either a low plasticity clay (CL) or a clayey sand (SC). The sandy materials are easier to work during wet weather, but the lean clay is less susceptible to erosion, provides a better long-term barrier to surface water penetration and is generally more stable. Additionally, the lean clay materials would provide more uniform support system for slabs on grade.

Imported soils to be used as fill should be free of roots, construction debris, organic matter or any other type deleterious matter. The clayey soils should have a liquid limit of less than 45 and a plasticity index of between 8 and 25.

5.6 Fill Placement/Compaction

The fill should be placed in loose lifts graded to provide a uniform thickness not exceeding nine inches. The surface of each preceding, compacted lift should be lightly scarified to ensure adequate bonding between lifts.

The moisture content during compaction should be maintained within five percent of its optimum as determined by the standard Proctor compaction test (ASTM D 698). The minimum compaction requirements are a function of the future use of the area. These requirements are as follows:

- Structural Fill: (beneath footings, building pads, floor slabs, or parking/driveway areas) at least 95 percent of its maximum density as determined by the standard Proctor compaction test (ASTM D 698), and
- Grading Fill: (outside of the areas listed above) at least 90 percent of its maximum density as determined by the standard Proctor compaction test (ASTM D 698).

6.0 SHALLOW FOUNDATIONS

The following paragraphs provide recommendations for shallow foundations, protection of the bearing stratum, and proportioning the foundations associated with the new office and warehouse facility.

6.1 Bearing Stratum/Depth

A reinforced mat foundation could be supported on a prepared soil-cement subgrade as described in Section 5.

The following precautions are recommended to protect the bearing surface from degradation:

- Verify the depth to groundwater before placing the excavations,
- Provide positive drainage away from the foundations, both during and after construction,
- Avoid excavations during inclement weather and place concrete within the excavations within 24 hours after completion of the excavations,
- Place a "mudmat" of lean concrete to seal the bearing stratum in the event wet conditions are experienced or expected, and
- Minimize traffic in excavations to only that necessary to place the steel and concrete for the footings.

Construction monitoring of the bearing surface is recommended to verify that the provisions of this paragraph are being followed. This construction monitoring should be performed by a representative of this firm.

6.2 Foundation Capacities

Footings constructed in accordance with the provisions of Paragraph 6.1 should be sized based upon the following allowable bearing capacities:

Continuous Footings (B<<L):	1,400 lbs/sq ft
Square Footings (B = L):	1,600 lbs/sq ft
Rectangular Footings:	see Figure 3

These values include an adequate factor of safety against bearing capacity failure. They take into consideration the weight of concrete and soil below grade. In designs for very transient conditions the allowable bearing capacity values as provided can be increased by 33%.

Figure 3 illustrates the allowable bearing capacities as well as provides recommendations for uplift and lateral loading design of shallow foundations. Even in the event the designs allow smaller widths, minimum footing widths are recommended. Continuous footings should be at least 16 inches wide and square footings should be at least 24 inches wide.

6.3 Settlement/Movement

In general, the natural soils are compressible and may be subject to long-term consolidation movements. Total settlement caused by the weight of the new warehouse and office is anticipated to be on the order of 1 ½ inches. Differential settlement should be on the order of ¾-inch. Foundations supported on the carefully prepared soil-cement subgrade will experience less total and differential settlement (about 1 inch and ½-inch, respectively).

7.0 STEEL PIPE PILE FOUNDATIONS

As noted in Section 4, the new office and warehouse may be supported on a deep foundation system consisting of driven or jacked steel pipe piles.

7.1 Installation

Steel pipe piles can be driven with minimal driving resistance until the dense sand (SP) layer at approximately 68 feet is encountered. Piles may be driven with closed or open ends. After driving, open end piles should be cleaned out and filled with concrete.

7.2 Pile Spacing and Group Effects

Pile groups should be designed to allow a center to center spacing of at least 2.5 diameters. Closer spacing could create installation difficulties and/or reduced group capacities. The axial capacities of pile groups of up to four with this minimum spacing can be calculated as the sum of the axial capacities of individual piles. Spacing of less than 2.5 diameters or larger groups could cause reduction of the capacity of the pile groups. For pile groups larger than four piles, axial uplift capacities should be calculated using the block perimeter method. Since these analyses require that the pile group configuration be designed, these analyses have not been performed and could be performed if the group configurations are provided.

7.3 Axial Capacities

Axial capacities were computed for various diameter steel pipe piles. These analyses considered both frictional (skin) resistance along the sides and end bearing at the base. Figures 4 and 5 provided allowable compression and uplift capacities for steel pipe piles.

These allowable design loads may be increased by 33% for maximum wind gusts or other, highly transient loads. The capacities provided herein consider failure at the pile/soil interface and bearing failure only.

7.4 Settlements/Displacement

Loads in accordance with those outlined in Section 2 or less should not experience settlements in excess of one inch for piles installed into the sand (SP) below 68 feet.

8.0 PAVEMENT CONSIDERATIONS

Employee parking areas, plus a truck loading area will be constructed as part of this new development. The following paragraphs present our guideline recommendations for pavement subgrade preparation. Pavement design analyses were performed for estimated traffic types and volumes. The use of rigid (Portland cement concrete) paving is recommended unless the site is graded to provide excellent drainage. Design recommendations for flexible paving systems can be provided if desired. For the purpose of this report, the employee parking areas are considered to require light-duty pavement, while the truck loading area is categorized as a moderate-duty area.

8.1 Subgrade Conditions & Preparation Recommendations

The P-series soil borings were placed in the planned parking/driveway areas (see Figure 2). Soft to firm clays (CH) were encountered over very soft clays (CH). These clays are susceptible to disturbance in the presence of free moisture.

As indicated in Section 5, the upper 12 inches of exposed subgrade should be lime modified with 4% by weight hydrated lime. The top 9 to 12 inches of modified subgrade should then be stabilized with 10% by weight Type 1 Portland cement, and graded to drain toward the lower perimeter areas. All procedures should follow the guidelines provided in the Louisiana Department of Transportation Red Book.

8.2 Base Preparation

These site preparation conditions are anticipated to yield a CBR value of at least 3 for design of flexible paving systems and a modulus of subgrade reaction of at least 75 pci for design of rigid paving systems. The improvements to the subgrade will increase the design CBR value to about 50, and k to about 300 pci.

8.3 Pavement Design Assumptions

The following recommendations are provided for a pavement system over the subgrade that has been prepared as prescribed in the previous section.

Estimated Traffic Conditions

Traffic Type	Frequency
Automobiles	25 vehicles/day
2 & 3 Axle Trucks	3 vehicles/day
4 Axle Trucks	2 vehicles/day

Anticipated traffic volumes and loading conditions were not provided for this facility. However, experience with similar facilities indicate that the traffic utilizing these pavements will primarily consist of automobiles in the light duty traffic (parking) areas and a combination of automobiles, and delivery trucks in the moderate traffic areas. Traffic estimates used in the determination of required pavement thicknesses are summarized in the inset table. If these traffic assumptions are not correct, please advise this office so that the pavement designs can be analyzed and revised thickness designs can be developed.

8.4 Rigid Pavement Thickness

The following concrete thickness design is recommended for light (automobiles and pickup trucks) and moderate (delivery trucks) conditions:

Rigid Paving Thickness

Load Condition	Thickness (inches)
Light	5
Moderate	8

8.5 Rigid Pavement Construction Considerations

The concrete should have a minimum 28-day compressive strength of 4,000 psi in order to provide a recommended minimum flexural strength of 600 psi. Transverse contraction joints with a minimum spacing of 13 feet should be provided. For the Moderate loading condition, doweled transverse joints having 1.25-inch diameter dowels spaced 12 inches center-to-center should be used. These dowels should be placed near the center of the slab. At the proper time after concrete placement, joints should be saw cut, or grooved, to a depth of approximately 1/3 the slab thickness. Upon completion, all joints should be sealed with a high quality joint sealant in accordance with current industry standards and practice. Longitudinal joints should consist of keyed construction joints, or a tied and sawed joint. Number 4 tie bars should be spaced approximately 30 inches center-to-center along the length of this longitudinal joint. Proper doweling and reinforcement of odd-shaped slabs is also recommended to help reduce cracking in these elements.

8.6 Garbage Dumpster Pad

A garbage dumpster is expected to be placed at this site. The pad should be large enough to hold the largest expected container with approximately five feet of apron. Additionally, the pad should contain an approach apron on the loading side of the pad that is proportioned to accommodate half the length of the anticipated collection vehicle.

The pad for garbage dumpsters should be designed as a structural slab for the anticipated loading conditions. A typical design for small to medium containers would consist of an 8-inch thick concrete slab with top and bottom reinforcement consisting of No. 4 bars spaced at 12 inches on center in both directions having a cover of 2 inches. Tooled contraction joints should be provided at intervals that will provide a slab size that does not exceed 20 feet by 20 feet. Expansion joints should not be placed in these pads unless they are required where the container pad directly abuts a building or other fixed structure.

9.0 CONSTRUCTION QUALITY DOCUMENTATION

Several recommendations have been made in this report that assume that the conditions required for the design recommendations have been provided. Failure to provide adequate construction quality control testing can result in construction difficulties and unsatisfactory foundation performance. Construction Quality Control (the collection of field and laboratory data to document conformance with specifications) and Quality Assurance (the collection and evaluation of test results and frequencies to confirm that the objectives of construction are met) are required for the following aspects of construction:

- Final site grubbing and proof-rolling as well as mitigation procedures as outlined in Sections 5.2 and 5.3,
- Earthen fill selection as recommended in Section 5.5,
- Fill import, placement and compaction as recommended in Section 5.6,
- Protection of the foundation bearing surface as recommended in Section 6.1,
- Placement of reinforcing steel, and, if post-tensioned slabs are utilized, documentation of tensioning techniques,
- Testing of concrete to be used for foundations to document proper slump, compressive strength and curing conditions.

These quality control and quality assurance services should be administered by a representative of this firm who is familiar with the site conditions and recommendations as provided in this report.

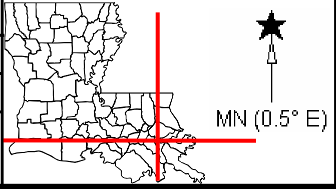
At a minimum, the quality assurance provisions of the work should be performed by this office under direct contract to the owner or the owner’s design professional. This quality assurance program should include a final review of the construction plans and specifications for all aspects of earthwork, foundation and pavement construction to assure that the recommendations of this report are reflected in these documents.

10.0 CONSULTATION

This report is provided to transmit our findings and recommendations regarding this project. Often, during the review of the report of geotechnical study, during final design, or during construction, questions may arise which require further review of site conditions, clarification of the recommendations provided in this report or development of more specific recommendations. We recommend a brief telephone call or conference to resolve any questions or needs for clarification of the recommendations presented in this report.

FIGURES

Engineer:	DJA
Drawn By:	WLW
Checked By:	DJA
Date:	04/24/06
Project:	9106138



mi
0 ½ 1 1½ 2 2½

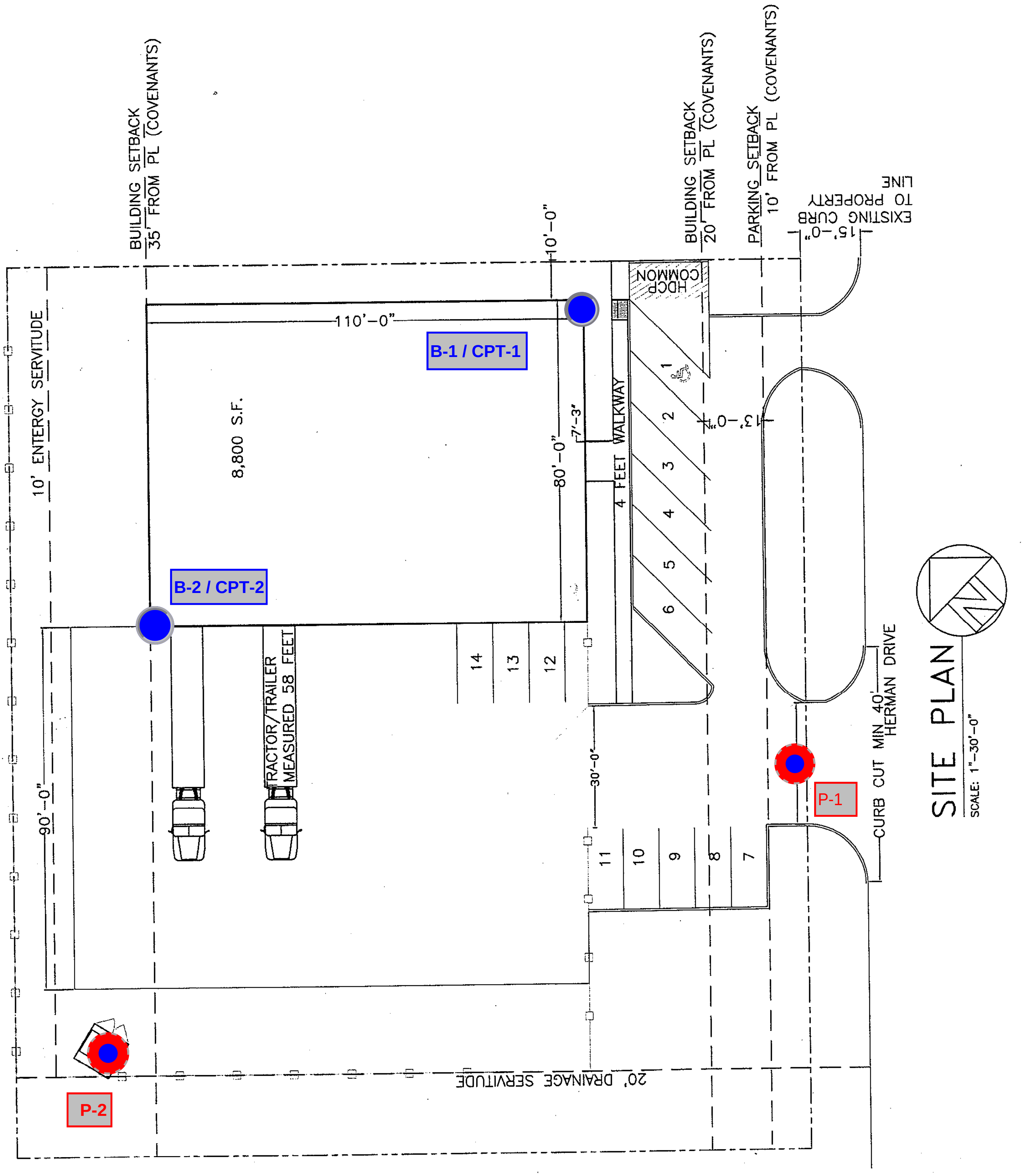
aquaterra engineering

Site Vicinity Map

Proposed Office and Warehouse
Belle Chasse, Louisiana

Insulation Technologies
Harvey, Louisiana

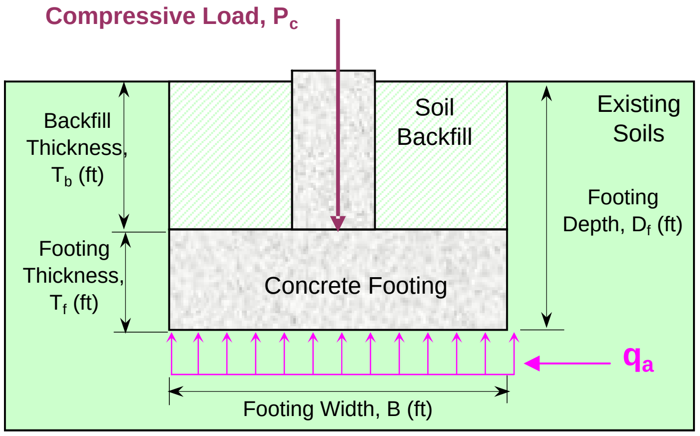
Figure
1



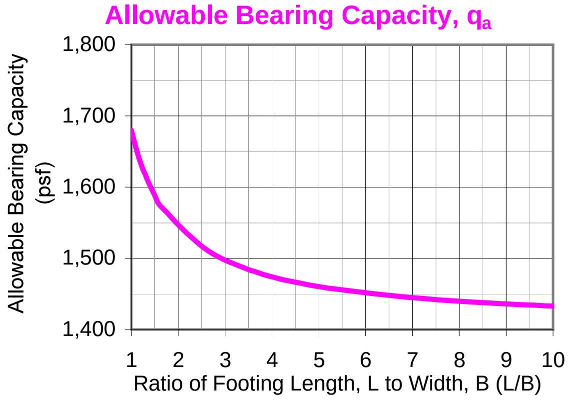
Legend:

●	Boring to 10'; CPT to 80'
●	Parking Lot Boring to 6'

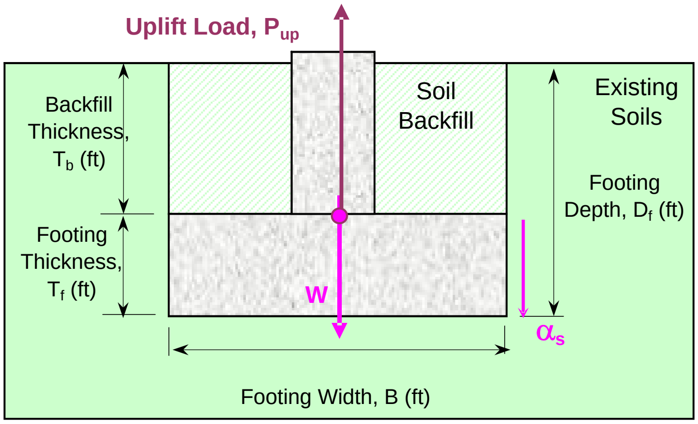
FIGURE 2



Compressive Loading Condition



Summary of Bearing Capacity	
Shape	Soil-Cement Support @ 18"
Square	1,600 psf
Continuous	1,400 psf



Uplift Loading Condition

Allowable Uplift Resistance, q_{up} (lbs)

$= W + \alpha_s$

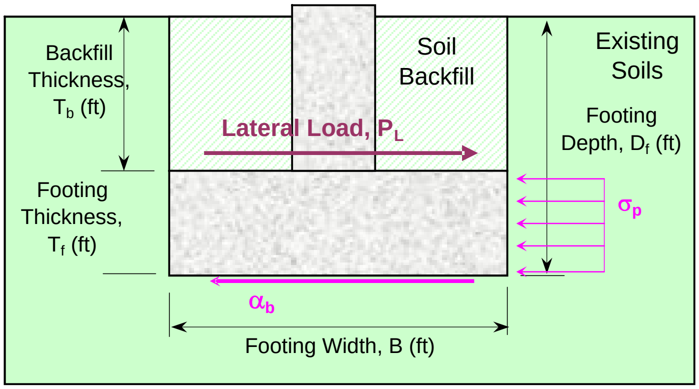
Weight Component, **W**

$= B^2 \times [(T_f \times 83) + (T_b \times 48)]$

Adhesion Component, α_s

$= 4B \times T_f \times 500$

NOTE: α_s requires backfill adjacent to footing to be placed in accordance with report Section 5.



Lateral Loading Condition

Allowable Lateral Force, q_p (lbs)

$= P_p + \alpha_b$

Passive Pressure Component, P_p

$= \sigma_p \times T_f \times L$

where:

$\sigma_p = 48(T_b+T_f/2)+500$

L = Footing Length

Adhesion Component, α_b

$= B^2 \times 500$

NOTE: $\alpha_b = 0$ if uplift loading is present, and σ_p requires backfill adjacent to footing to be placed in accordance with report Section 5.

Bearing Stratum

Shallow foundations may be supported on a soil-cement subgrade. Preparation of the bearing stratum should be performed in accordance with Section 5.

Bearing Depth

Footings should bear at a minimum depth of 18 inches below the final exterior grade. Protection of the bearing stratum should be performed in accordance with Section 6. The discussion in the text is necessary for proper understanding of this figure.

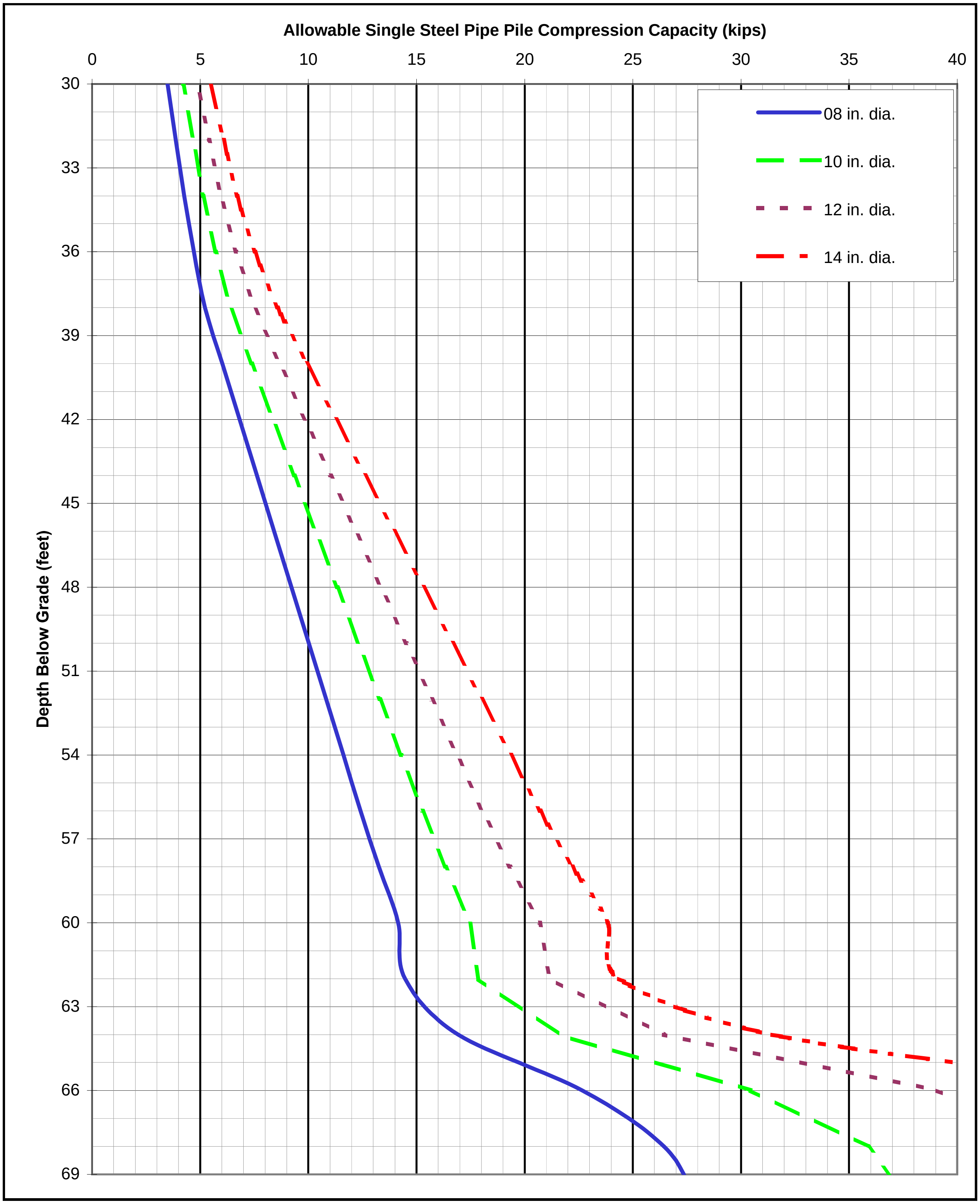
Shallow Foundation Capacities

Insulation Technologies Warehouse and Office
Belle Chasse, Louisiana

Engr: LRS
9106138

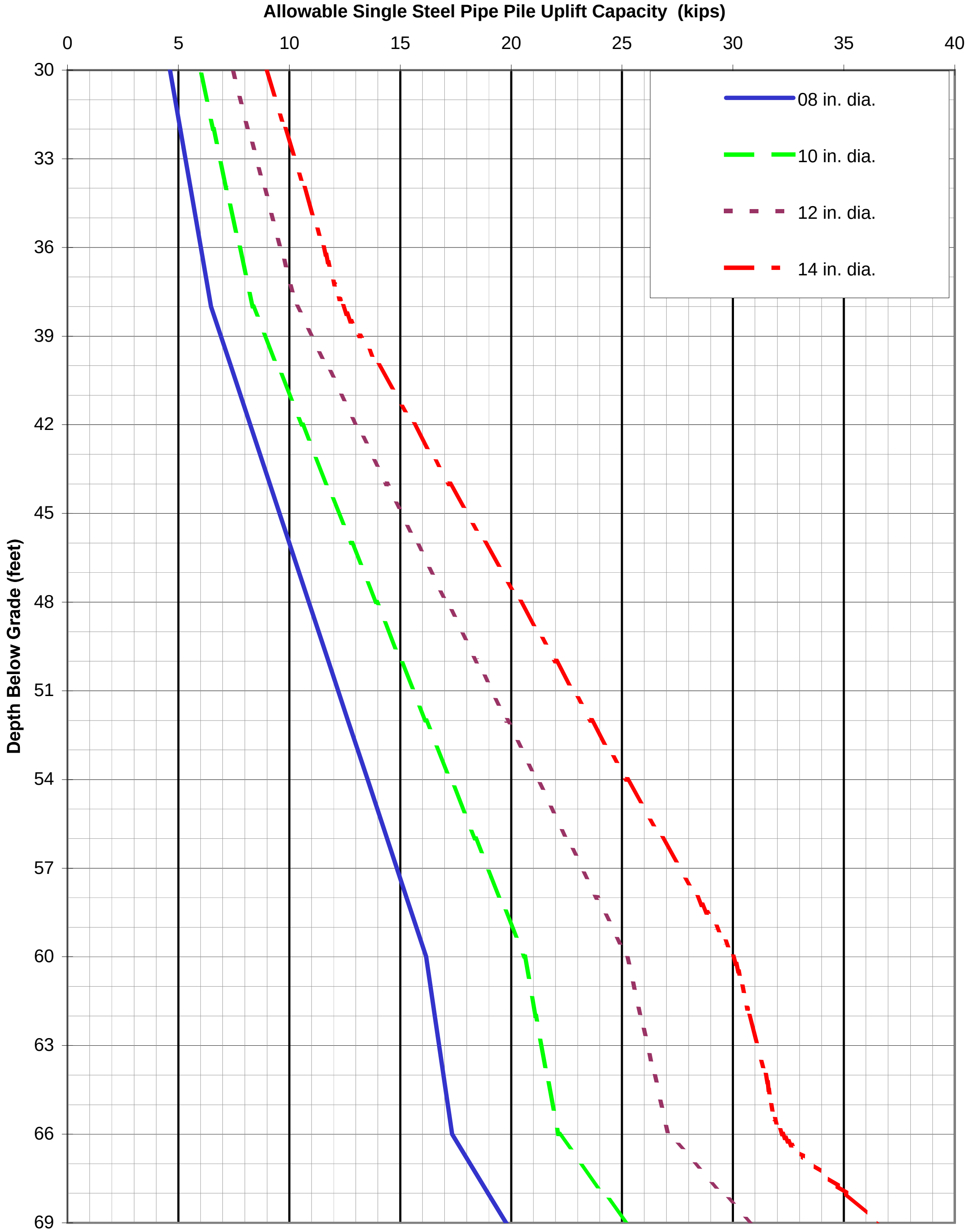
aquaterra engineering

Fig. No.
3



These are allowable capacities for single steel pipe piles in compression.
An adequate factor of safety has been provided for static loading conditions.
These values may be increased by 33% for transient loading conditions.
No consideration has been made for reductions due to group effects.

Compression Capacities **Steel Pipe Piles**		
Insulation Technology Office and Warehouse Belle Chasse, Louisiana		
Engr: LRS 9106138	aquaterra engineering Environmental and Geotechnical Consultants	Fig. No. **4**



These are allowable capacities for single steel pipe pile in uplift (tension).
An adequate factor of safety has been provided for sustained loading conditions.
These values may be increased by 33% for transient loading conditions. The values presented above include the buoyant weight of the concrete-filled pipe pile below grade.
No consideration has been made for reductions due to group effects.

Uplift Capacities
Steel Pipe Piles

Insulation Technology Office and Warehouse
Belle Chasse, Louisiana

Engr: LRS
9106138

aquaterra engineering
Environmental and Geotechnical Consultants

Fig. No.
5

APPENDIX A

DESCRIPTION OF FIELD AND LABORATORY PROCEDURES
SOIL BORING LOGS
SOIL BORING LEGEND

This geotechnical investigation was conducted utilizing standard procedures developed by Aquaterra Engineering, LLC for investigations of this nature. The following paragraphs describe the field and laboratory procedures utilized. The soil boring logs which provide data collected and a description of soil and groundwater conditions is also included. The appendix also provides a legend that describes the terms and symbols used in the boring logs.

FIELD INVESTIGATION

The field investigation was conducted on May 2, 2006. It included a site reconnaissance to document site characteristics pertinent to the geotechnical investigation and the conduct of a soil exploration program. The information collected during the field investigation was documented by an Aquaterra Engineering Technician.

Site Reconnaissance

The engineering technician walked the project site and documented observations that are of significance to the geotechnical investigation. Such observations include: topography, vegetation, trees, drainage, other structures, surface soil conditions, and trafficability.

These observations were reported to the project engineer in the form of field notes. The project engineer reviewed the results of the field reconnaissance with the engineering technician in a project meeting subsequent to the field investigation.

Soil Boring

Four soil borings were advanced to a depths ranging from 6 to 10 feet using a GeoProbe™ track-mounted drilling rig. The boring locations are shown on Figure 2. Borings B-1 and B-2 were augmented by utilizing a Cone Penetrometer Test (CPT) probe adjacent to the selected borings (B-1/CPT-1 and B-2/CPT-2). The CPT data are presented in Appendix B.

Soil Boring Advancement. The borings were advanced by rotating a four-inch diameter, short-flight earth auger with the drilling rig, removing the auger from each boring, and cleaning the cuttings from the auger before sampling or reinserting the auger into the borings. This technique allowed for the observation of soil cuttings and description of soil conditions encountered. This dry auger technique allowed for detection of free groundwater within the borings.

Soil Sampling. The soil sampling program included the collection of disturbed and undisturbed soil samples. Disturbed soil samples were collected in specified borings by the auger method in accordance with ASTM D 1452 (AASHTO T203). The spiral-type (solid-stem) Auger, consist of a flat thin metal strip, machine twisted to a spiral configuration of uniform pitch having at one end, a sharpened or hardened point, with a means of attaching a shaft or extension at the opposite end. Depths at which these auger samples were obtained are indicated by a bold vertical line in the "Samples" column of the attached boring logs. The soil content from the auger was visually classified, labeled and placed in a sealed container to prevent moisture loss during transportation to the laboratory.

Relatively undisturbed soil samples were obtained by pushing a three-inch diameter, Shelby tube sampler a distance of two feet into the soil in general accordance with ASTM D1587. Depths at which these undisturbed samples were obtained are indicated by a shaded portion in the "Samples" column of the attached boring logs.

After the Shelby tube was removed from the boring, the sample was carefully extruded in the field and visually classified. Relative strength estimates of the sample were obtained by penetrometer readings. These penetrometer readings in units of tons per square foot are indicated by the symbol "(P)" in the "Field Test Results" column of the boring logs. Disturbed portions of the sample were discarded and the undisturbed sample was placed in a protective container for transportation to the laboratory.

Groundwater Observations. During the soil boring advancement and sampling operation, observations for free groundwater were made. Information regarding water level observations is recorded in the "groundwater" column on each soil boring logs. Where free water was encountered, the depth of the observation is noted in that column as an open triangle. Information regarding water level observations has also been noted under "Groundwater Level Data" at the bottom of the soil boring logs.

Boring Abandonment. Upon completion of the field investigation phase of this study, the borings were sealed with available soil cuttings in accordance with State regulations.

LABORATORY TESTING

The soil samples were delivered to the Aquaterra laboratory for testing. The project engineer reviewed the soil boring logs developed in the field and assigned laboratory testing on select samples to provide the data necessary for the anticipated designs.

Laboratory testing was accomplished to determine the engineering properties of the soils encountered. These procedures are discussed below.

Index Properties

Moisture Content. Moisture content tests were performed to better understand the classification and shrink/swell potential of the soils encountered. These tests were performed in general accordance with ASTM D 2216. The results of these tests are tabulated within the Laboratory Data section of the attached boring logs.

Atterberg Limits. Liquid limit (LL) and plastic limit (PL) determinations were performed to assist in classification by the Unified Soil Classification System (USCS). These tests were performed in general accordance with ASTM D 4318. The plasticity index (PI = LL-PL) was calculated for each Atterberg limit determination. The results of these tests are tabulated within the Laboratory Data section of the attached boring logs.

Strength Tests

Unconfined Compression. The undrained shear strength of selected undisturbed soil samples was determined by means of unconfined compression tests (ASTM D 2166). In an unconfined compression test, a cylindrical sample of soil is subjected to a uniformly increasing axial strain until failure develops. For cohesive soils, the undrained shear strength, or cohesion, is taken to be equal to one-half of the maximum observed normal stress on the sample during the test.

Triaxial Compression. The undrained shear strength of selected undisturbed soil samples was determined by means of unconsolidated, undrained triaxial (TX-UU) compression tests (ASTM D 4767). The TX-UU testing determines the shear strength of cylindrical soil samples that are confined under fluid pressure. The confining pressures allow for the development of the friction component of shear strength, thereby yielding higher shear strengths in granular soils.

The results of the tests are provided as undrained shear strength values within the Laboratory Data section of the attached boring logs. Also shown are the natural water contents and unit dry weights determined as a part of each compression test.

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

SOIL BORING LOG

No. B-1

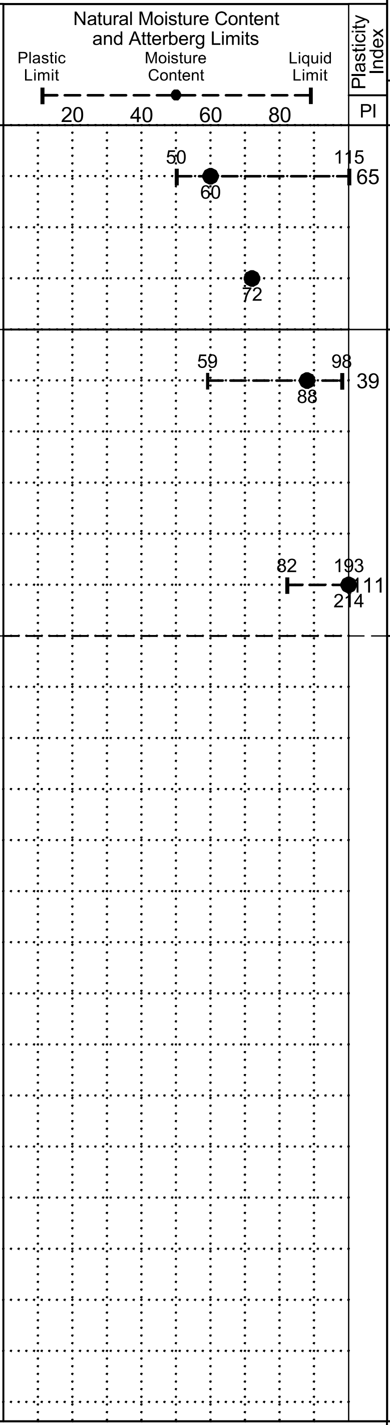
SHEET 1 OF 1

FILE: 9106138
DATE: May 2, 2006
DRILLER: D. Macera
TECH.: B. Alexander
ENGINEER: D. Aucutt

Location: See Figure 2.

LAT: 29° 51' 56.6" N
LONG: 90° 01' 10.2" W

FIELD DATA				LABORATORY DATA							
Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry		Plasticity Index PI	DESCRIPTION	Strata Break Depth	Soil Type
1								65	Stiff to very stiff brown **CLAY (CH)** - with silt laminations and organics		▨
3	■		2.00 (P)								▨
4	■									4.0	▨
5	■		0.00 (P)					39	Very soft black and gray **CLAY (CH)** - with organics - laminated, blocky		▨
7		▽									▨
9								111			▨
10									**Boring Terminated at 10 Feet.**	10.0	



STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

▽ First encountered at 7 ft.

Advancement Method

0' - 10' : Short-flight Auger

Abandonment Method

Hole backfilled with soil cutting upon completion.

Notes

5 inches of topsoil

aquaterra engineering

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

SOIL BORING LOG

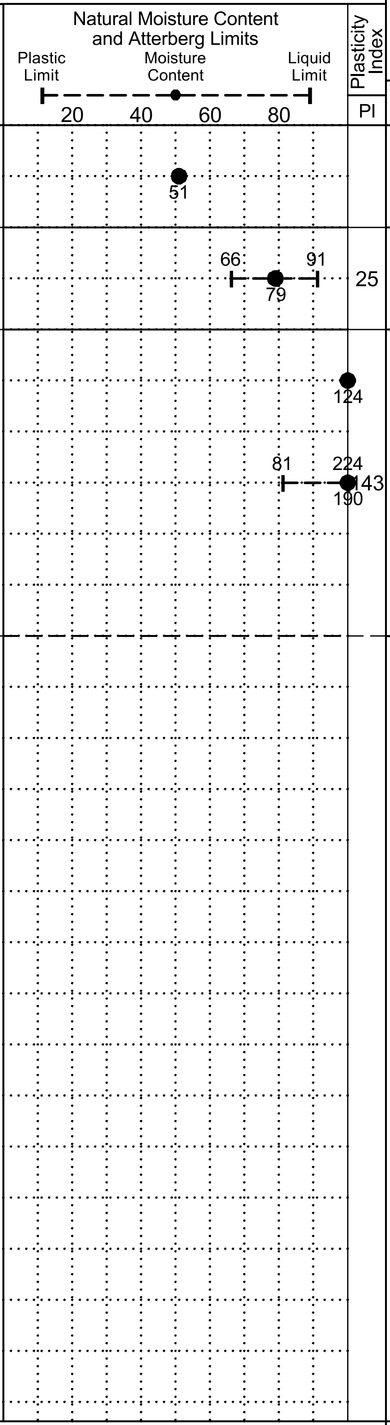
No. B-2

SHEET 1 OF 1

FILE: 9106138
DATE: May 2, 2006
DRILLER: D. Macera
TECH.: B. Alexander
ENGINEER: D. Aucutt

Location: See Figure 2.

LAT: 29° 51' 56.7" N
LONG: 90° 01' 11.0" W



FIELD DATA				LABORATORY DATA							
Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Natural Moisture Content and Atterberg Limits	Plasticity Index PI	DESCRIPTION	Strata Break Depth	Soil Type
0 - 2							51		Firm to stiff brown **SILTY CLAY (CL)** - with silt laminations	2.0	▨
2 - 4	■		2.25 (P)				66 / 79 / 91	25	Stiff to very stiff brown **CLAY (CH)** - with organics - laminated, blocky	4.0	▨
4 - 10	■	▽ (6.5)	0.00 (P)				124 81 / 190 / 224	143	Very soft brown and gray **CLAY (CH)** - with organics - laminated	10.0	▨
10									**Boring Terminated at 10 Feet.**		

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

▽ First encountered at 6.5 ft.

Advancement Method

0' - 10' : Short-flight Auger

Abandonment Method

Hole backfilled with soil cutting upon completion.

Notes

6 inches of topsoil

aquaterra engineering

PROJECT:	Geotechnical Investigation Proposed Office and Warehouse Belle Chasse, Louisiana	FILE:	9106138
		DATE:	May 2, 2006
		DRILLER:	D. Macera
CLIENT:	Insulation Technologies, Inc. Harvey, Louisiana	TECH.:	B. Alexander
		ENGINEER:	D. Aucutt

SOIL BORING LOG

No. P-1

SHEET 1 OF 1

Location: See Figure 2.

LAT: 29° 51' 55.5" N
LONG: 90° 01' 10.8" W

FIELD DATA				LABORATORY DATA								
Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry		Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 20 40 60 80)	Plasticity Index PI	DESCRIPTION	Strata Break Depth	Soil Type
0 – 2	■		1.00 (P)	0.67	96	66		54 / 46 / 90	36	Firm gray and brown **CLAY (CH)** - with organics	2.0	▨
2 – 4	■		0.00 (P)					52 / 76 / 120	68	Very soft dark gray and brown **CLAY (CH)** - with organics		▨
5	■		0.00 (P)	0.16	71	15		366			6.0	▨
										Boring Terminated at 6 Feet.		
10												
15												
20												
25										*STRATA BOUNDARIES MAY NOT BE EXACT*		

Groundwater Level Data	Advancement Method	Notes
☒ No free water encountered	0' - 6' : Short-flight Auger	5 inches of topsoil

Abandonment Method
Hole backfilled with soil cutting upon completion.

aquaterra engineering

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

SOIL BORING LOG

No. P-2

SHEET 1 OF 1

FILE: 9106138
DATE: May 2, 2006
DRILLER: D. Macera
TECH.: B. Alexander
ENGINEER: D. Aucutt

Location: See Figure 2.

LAT: 29° 51' 55.8" N
LONG: 90° 01' 12.6" W

FIELD DATA				LABORATORY DATA											
Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf)			Natural Moisture Content and Atterberg Limits			Plasticity Index	DESCRIPTION	Strata Break Depth	Soil Type
					Moist	Dry		Plastic Limit	Moisture Content	Liquid Limit	PI			
0–2	■		0.00 (P)	0.38	90	52			74			Soft brown and gray **CLAY (CH)** - with organics		▨
2–4	■		0.00 (P)					74	85	157	83		4.0	▨
4–6 (5)	■		0.00 (P)	0.12 (t)	71	19			279			Very soft dark gray and brown **CLAY (CH)** - slightly silty - with organics	6.0	▨
6												**Boring Terminated at 6 Feet.**		

Depth scale: 5, 10, 15, 20, 25

Moisture content scale: 20, 40, 60, 80

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

☒ No free water encountered

Advancement Method

0' - 6' : Short-flight Auger

Abandonment Method

Hole backfilled with soil cutting upon completion.

Notes

3 inches of topsoil
t: unconsolidated, undrained, triaxial compression test at overburden pressure

aquaterra
engineering

SOIL BORING LEGEND

FIELD DATA

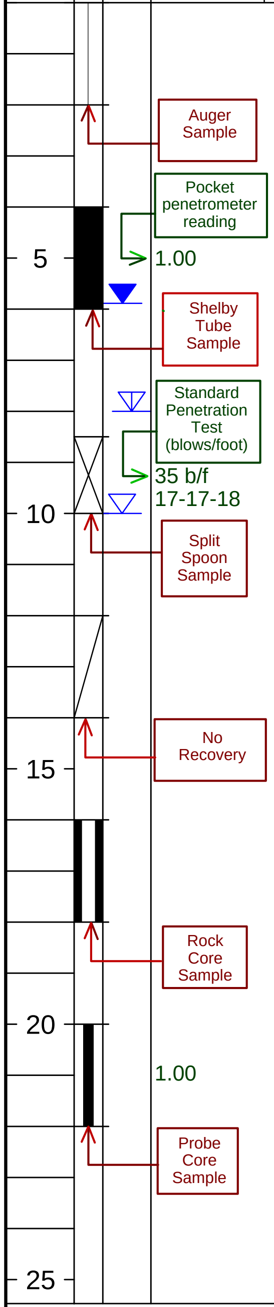
LABORATORY DATA

Location: Coordinate (North & East)

Latitude Longitude

Surface Elevation: Elev.

Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Other/ Percent Finer	Natural Moisture Content and Atterberg Limits: Plastic Limit ⊢ – – Moisture Content – ● – – Liquid Limit ⊣ (20 40 60 80)	Plasticity Index PI	DESCRIPTION	Soil Type



TERMS DESCRIBING CONSISTENCY

Noncohesive Soils

(includes gravels, sands and silts) Consistency determined by Standard Penetration Resistance

Cohesive Soils

(includes clays) Consistency determined by laboratory shear strength testing or by field visual-manual procedures.

Descriptive Term	Standard Penetration Resistance (blows per foot)	Descriptive Term	Undrained Shear Strength (kips per sq. ft.)
Very Loose	less than 4	Very Soft	less than 0.25
Loose	5 to 9	Soft	0.25 to 0.50
Medium Dense	10 to 29	Firm	0.50 to 1.00
Dense	30 to 50	Stiff	1.00 to 2.00
Very Dense	above 50	Very Stiff	2.00 to 4.00
		Hard	above 4.00

FIELD TESTING

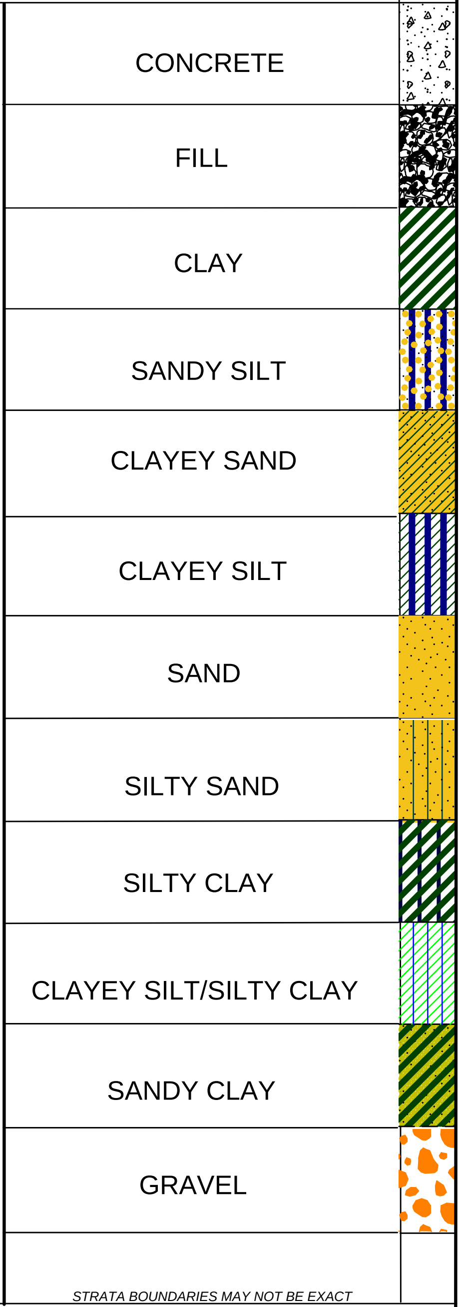
Standard Penetration Testing	Pocket Penetrometer
The penetration resistance is the number of blows required to drive the split-spoon sampler the final 12 inches of penetration.	Strength estimates of relatively undisturbed samples are obtained by penetrometer readings. The measured units are in tons per square foot (tsf).

NOTES REGARDING SOIL DESCRIPTION

Soil descriptions provide classifications according to ASTM D2487 - Classifications of Soils for Engineering Purposes. Where laboratory data are available for shear strength and for classification verification, the data are utilized. Where no laboratory data exist, the descriptions are based upon the field classifications as made during the exploration according to ASTM D2488 - Description and Identification of Soils (Visual - Manual Procedure).

Soil structure as described on the boring logs can be defined as follows:

Layer: A soil deposit with a thickness in excess of one inch
Seam: A soil layer with a thickness of less than one inch.
Homogeneous: Having the same color and appearance throughout and lacking fissures.
Fissured: Having definite planes of discontinuity within a soil mass.
Slickensided: A fissured condition with fracture planes that appear polished and glossy.
Jointed: A fissured condition with fracture planes that are numerous and limited in extent.
Laminated: Numerous thin seams of soil types which vary in texture or color.
Calcareous: Containing obvious quantities of calcium carbonate.
Indurated: Hardened by pressure or cementation.
Friable: Easily crumbled.
Organic: Containing remains of living organisms.



Groundwater Level Data

▽ Water initially encountered during dry augering

▽ Groundwater level after a specified observation period

▼ Stabilized water level after an extended period of observation

Actual depth to water may vary from the conditions observed in the borings. The presence of groundwater is masked in borings advanced by rotary wash methods.

Advancement Method

Description of methodology used to advance soil boring.

Abandonment Method

Description of methodology used to abandon or fill the completed borehole.

Notes

Notes describing other laboratory tests or surface conditions.

aquaterra engineering

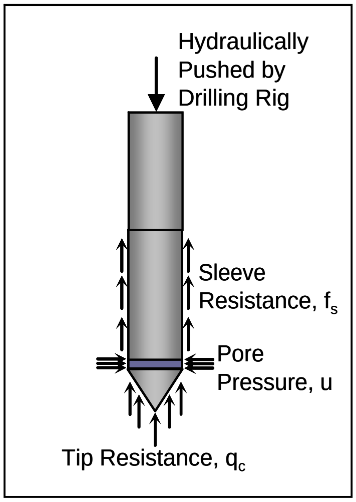
APPENDIX B

CONE PENETROMETER TEST (CPT) PROCEDURES
CPT CALIBRATION CERTIFICATE
CPT LOGS
CPT INTERPRETATIONS
CPT LEGEND

Cone Penetrometer Testing

The field investigation included the conduct of two Cone Penetration Tests (CPT) at locations designated by the project engineer. These locations are illustrated on Figure 2.

At the designated locations a CPT test was performed by pushing a 10 sq. cm. electric cone penetrometer (cylindrical probe with a cone-shaped tip equipped with electronic load sensors) with load cells to measure tip resistance and sleeve resistance. A pressure transducer is utilized to measure pore pressure at an approximate rate of 20 mm/sec using the hydraulic cylinders of the drilling rig. The illustration shows the forces acting on the CPT device.



The CPT device was equipped to measure soil resistance to tip and sleeve penetration, pore pressure and inclination at 50 mm intervals during penetration. These data were transferred to an on-site computer using acoustic data transmission and interpretation software. The data were also stored in the memory of the CPT tool. This process allowed for continuous monitoring of the data as the cone was advanced in order to understand the resistance and inclination of the tool in a real-time fashion.

Upon completion of the testing, the data collected were downloaded directly from the CPT device to the on-site computer. The collected data were then interpreted using software provided by the manufacturer. The software interprets the basic information related to cone and sleeve resistance, pore pressure, and inclination. It also allows interpretation of apparent soil behavior properties (for example clay, silt, sand, etc.) and soil parameters, such as undrained shear strength, standard penetration resistance, overconsolidation ratio, unit weight, etc. The conventional field data from the soil borings, and the available laboratory test results (presented in Appendix A), were used to correlate the CPT interpretations for this particular site.

The testing and calibration of the CPT device were conducted in general conformance with ASTM D 5778. Presented below are the initial and final CPT Baseline Readings for this project. The Calibration Certificate for the CPT probe(s) utilized on this project is presented in this Appendix.

CPT Baseline Readings:

		CPT Initial Zero Test Reading			**CPT Final Zero Test Reading**		
CPT #	**Probe #**	Point Resistance	Pore Pressure	Local Friction	Point Resistance	Pore Pressure	Local Friction
1	3302	391	403	430	2	0	-20
		11.6 MPa	457.8 kPa	90.6 kPa	0.0 %	0.0 %	-4.2 %
2	3302	390	402	427	-2	-3	-17
		11.5 MPa	456.6 kPa	90.0 kPa	-0.1 %	-3.4 %	-3.6 %

The resulting CPT data are included in this Appendix. A description of the symbols and methods used as a part of the CPT effort is also provided in this Appendix.

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

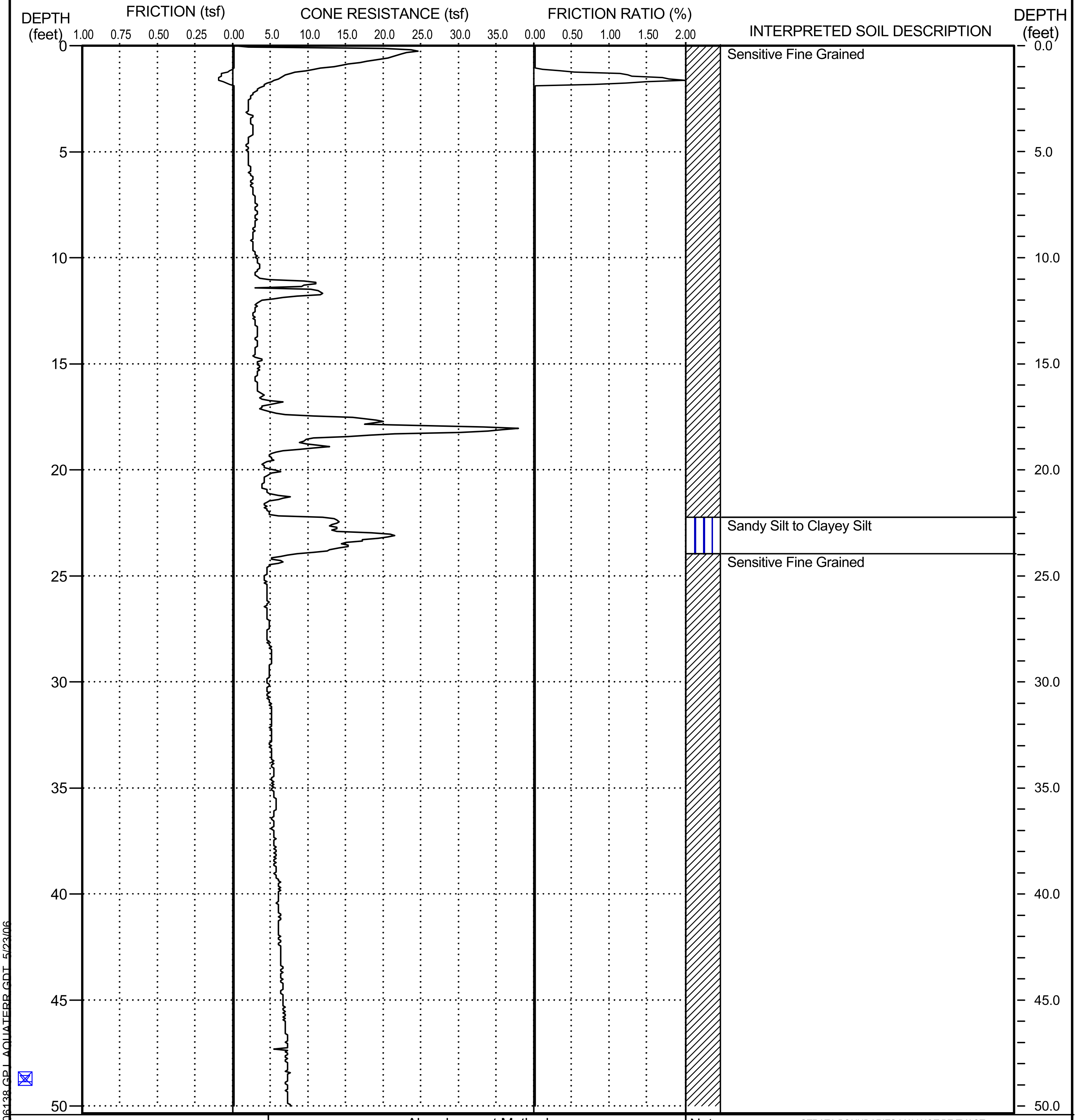
CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

CONE PENETROMETER TEST LOG

No. CPT-1

SHEET 1 OF 2

FILE: 9106138
DATE: May 2, 2006
DRILLER: D. Macera
TECH.: B. Alexander
ENGINEER: D. Aucutt



Abandonment Method	Notes	*STRATA BOUNDARIES MAY NOT BE EXACT*

aquaterra
engineering

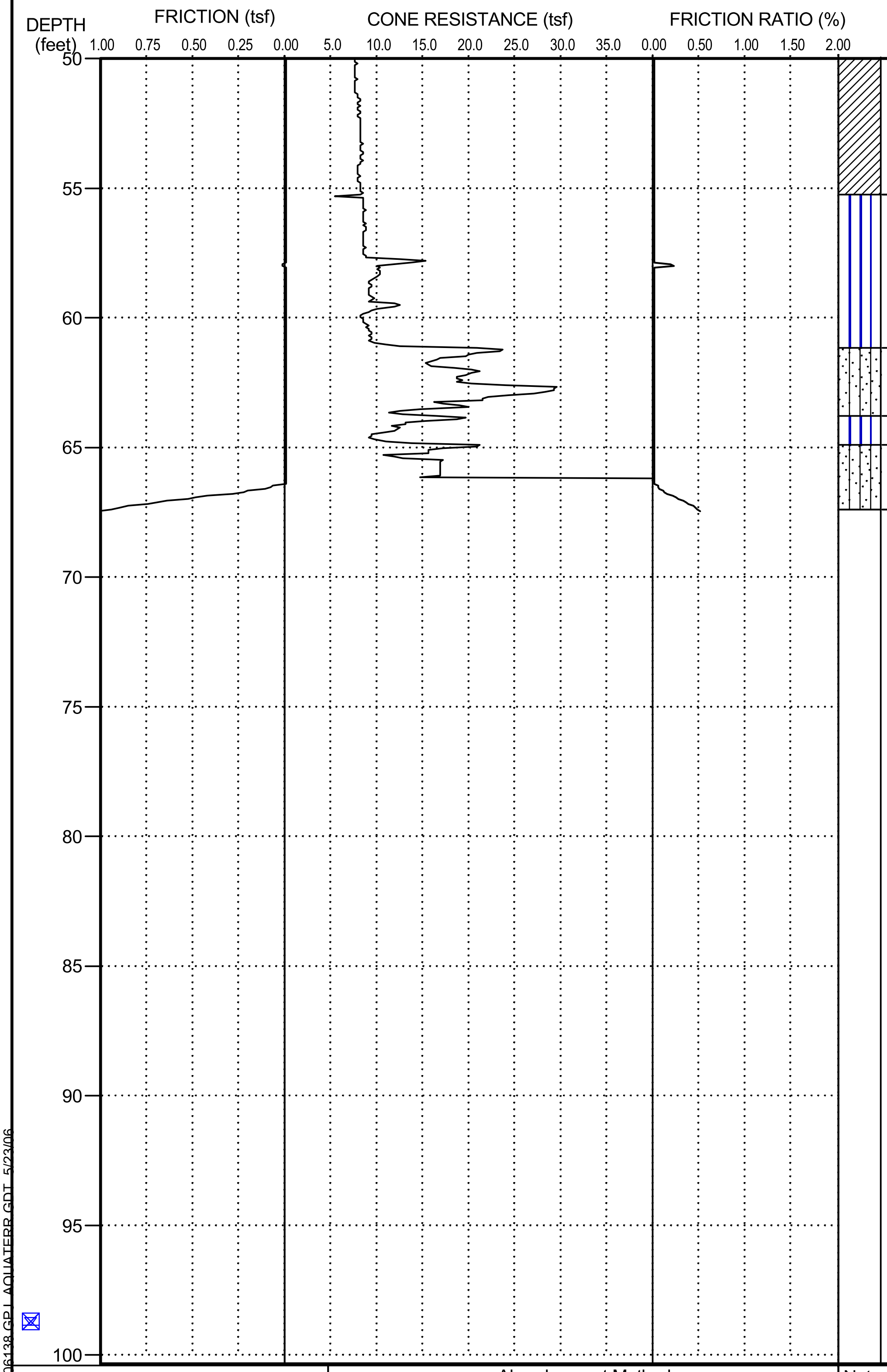
CPT LOG SBLOGS 9106138.GPJ AQUATERR.GDT 5/23/06

PROJECT:	Geotechnical Investigation Proposed Office and Warehouse Belle Chasse, Louisiana		FILE:	9106138
			DATE:	May 2, 2006
			DRILLER:	D. Macera
CLIENT:	Insulation Technologies, Inc. Harvey, Louisiana		TECH.:	B. Alexander
			ENGINEER:	D. Aucutt

CONE PENETROMETER TEST LOG

No. CPT-1

SHEET 2 OF 2

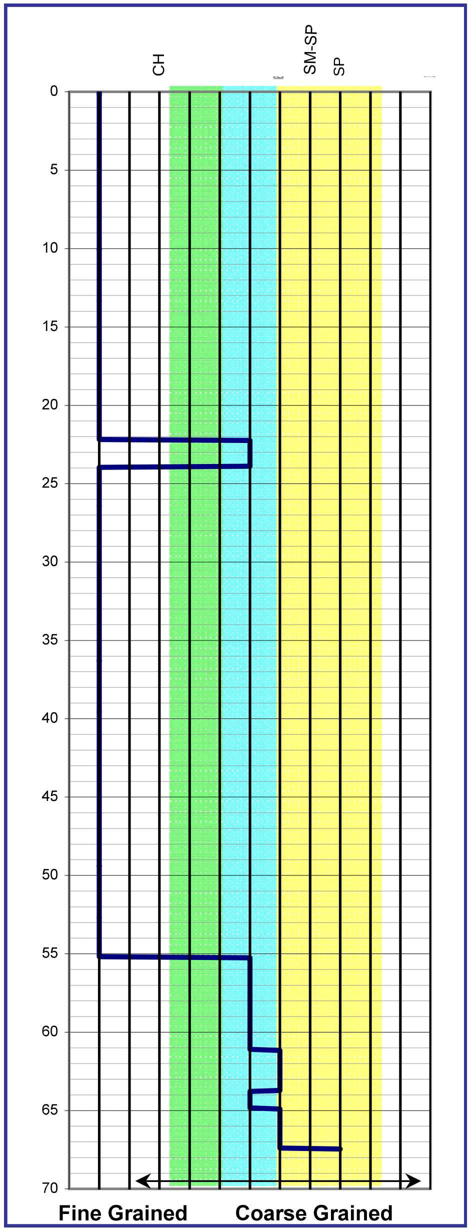


INTERPRETED SOIL DESCRIPTION — DEPTH (feet)

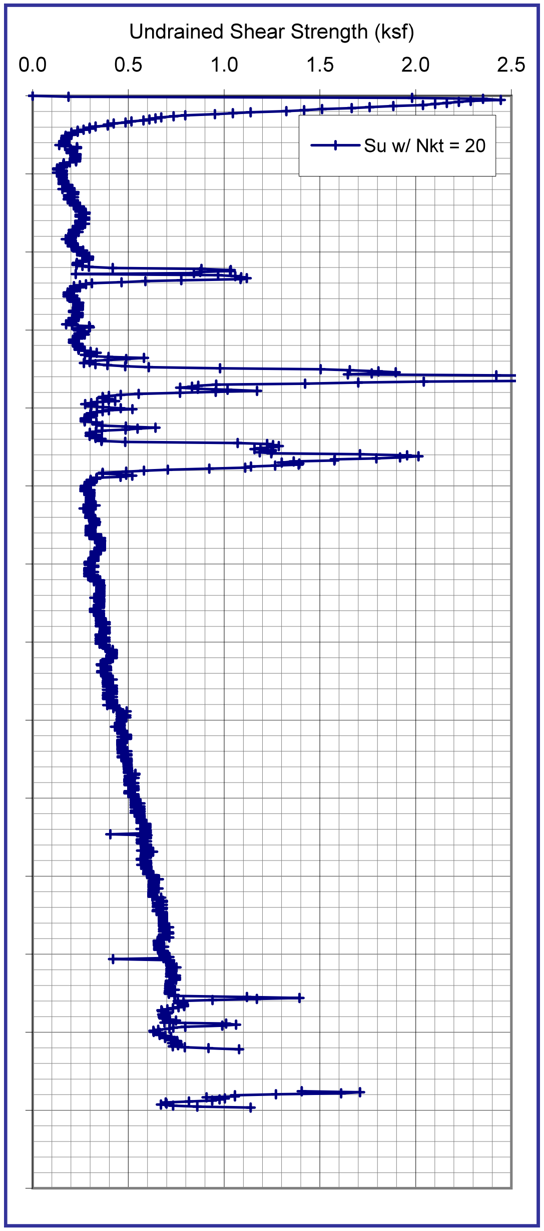
Depth (feet)	Interpreted Soil Description
50.0	Sensitive Fine Grained *(continued)*
55.0	Sandy Silt to Clayey Silt
60.0	Silty Sand to Sandy Silt
	Sandy Silt to Clayey Silt
65.0	Silty Sand to Sandy Silt
	CPT Probe Terminated at 67.4 Feet.
70.0	
75.0	
80.0	
85.0	
90.0	
95.0	
100.0	

	Abandonment Method	Notes *STRATA BOUNDARIES MAY NOT BE EXACT*
aquaterra engineering		

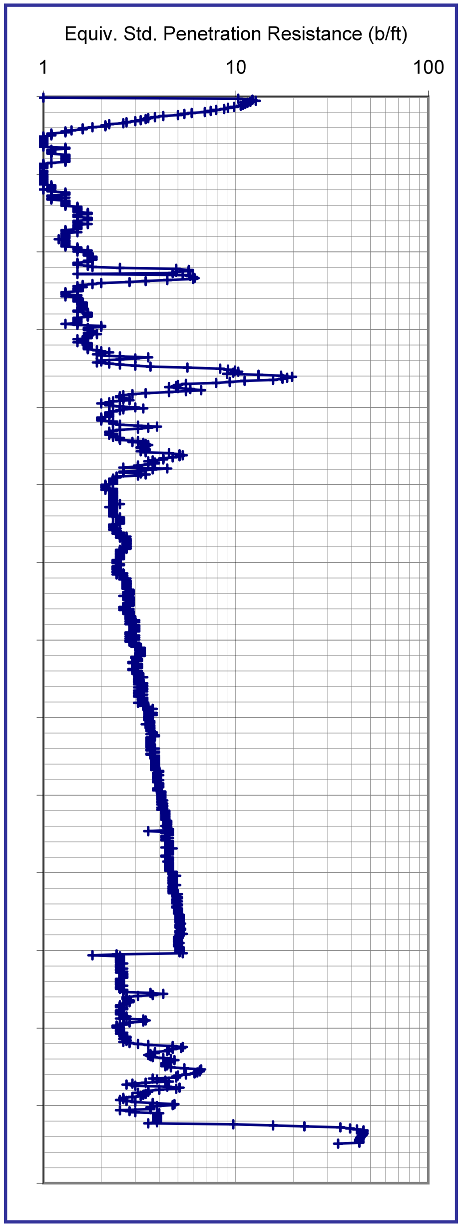
Interpreted Parameters from CPT - 1
Insulation Technologies Office and Warehouse
Belle Chasse, Louisiana



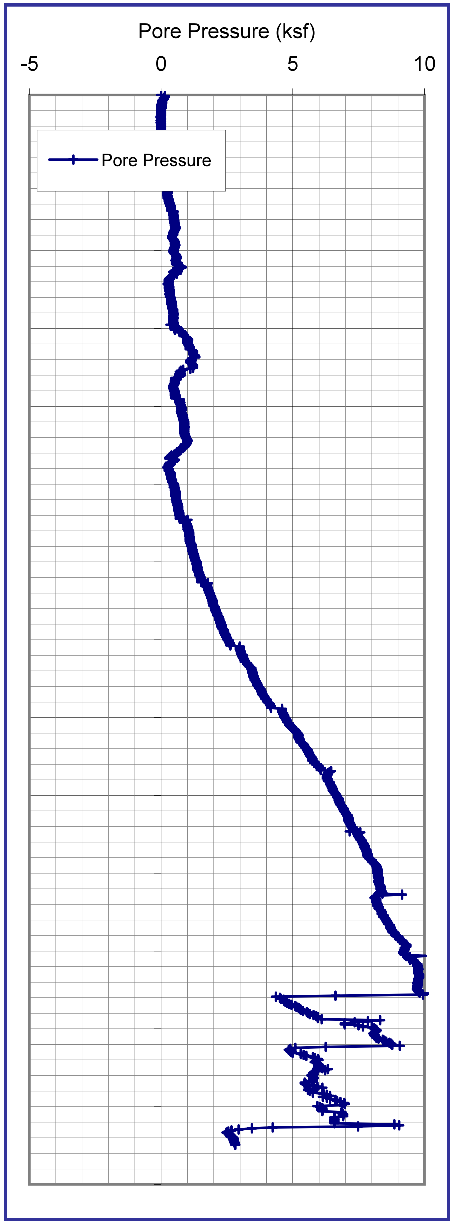
Soil Behavior



Undrained Shear Strength
(Using Cone Factor = 20)
(applicable to cohesive soils only)



Est. Std. Penetration Resistance



Pore Pressure

All data are interpreted from CPT data collected.
See explanation of symbols and methods.

AQT# 9106138

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

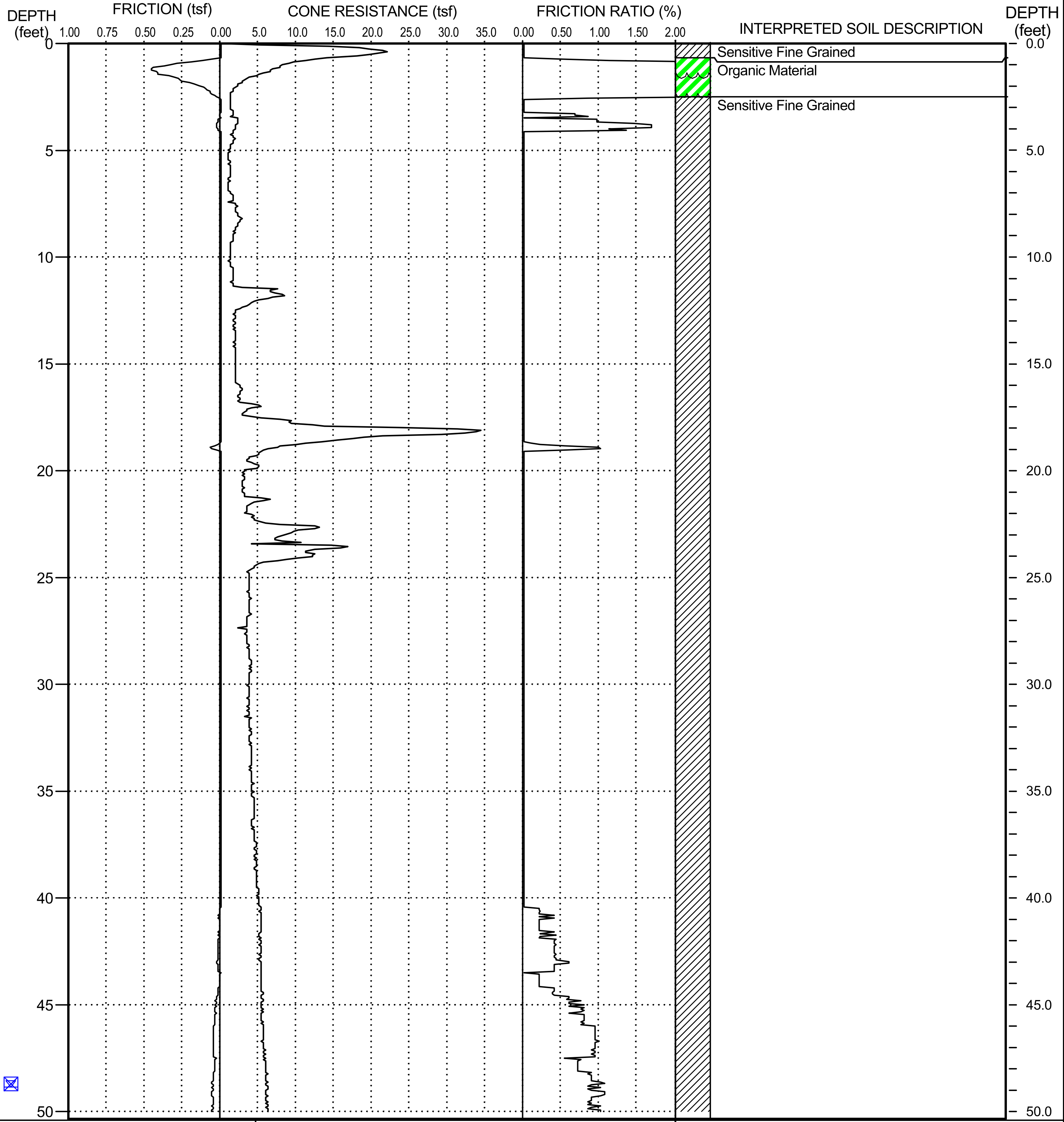
CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

CONE PENETROMETER TEST LOG

No. CPT-2

SHEET 1 OF 2

FILE:	9106138
DATE:	May 2, 2006
DRILLER:	D. Macera
TECH.:	B. Alexander
ENGINEER:	D. Aucutt



Abandonment Method	Notes	*STRATA BOUNDARIES MAY NOT BE EXACT*

aquaterra
engineering

PROJECT: Geotechnical Investigation
Proposed Office and Warehouse
Belle Chasse, Louisiana

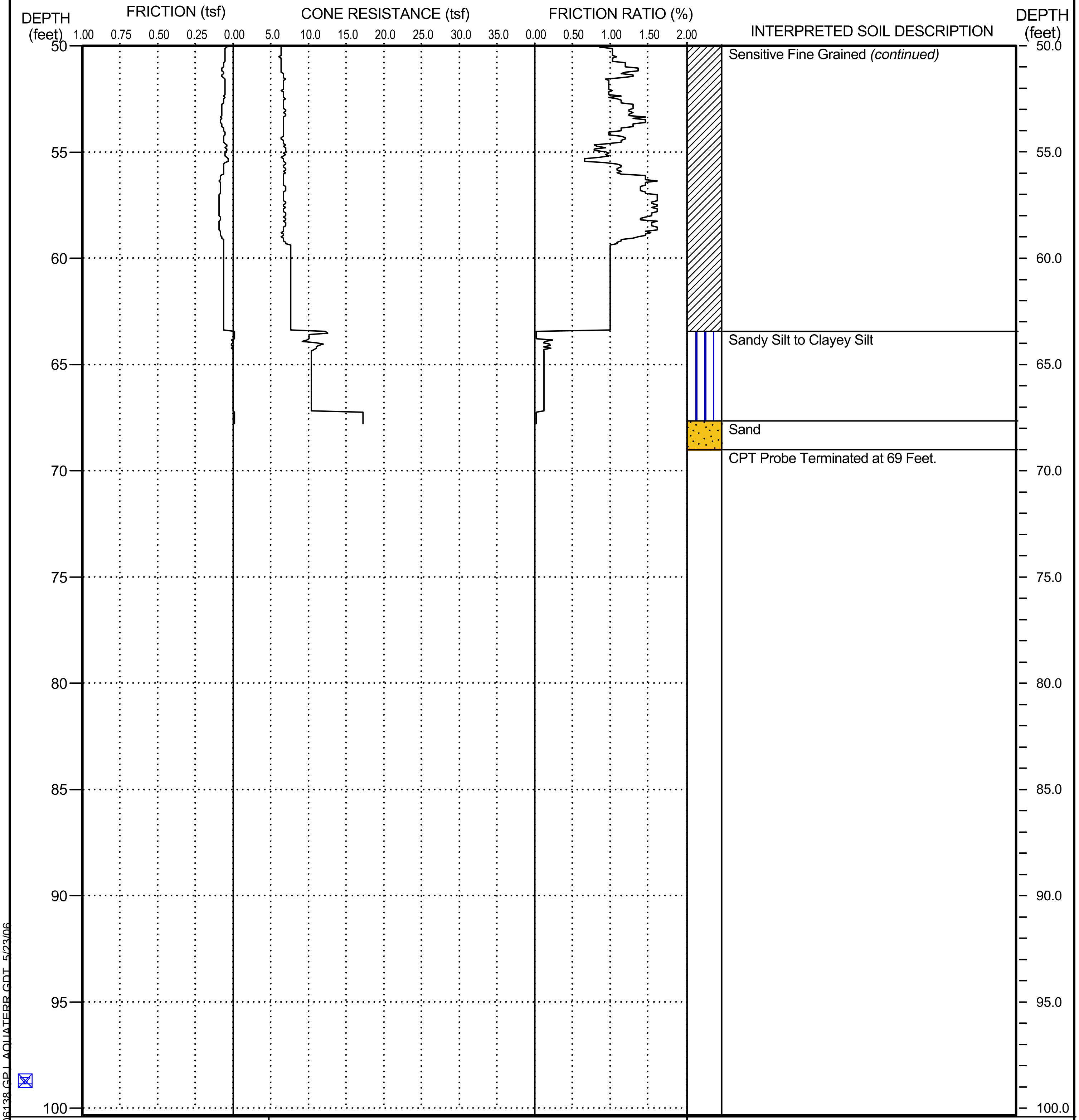
CLIENT: Insulation Technologies, Inc.
Harvey, Louisiana

CONE PENETROMETER TEST LOG

No. CPT-2

SHEET 2 OF 2

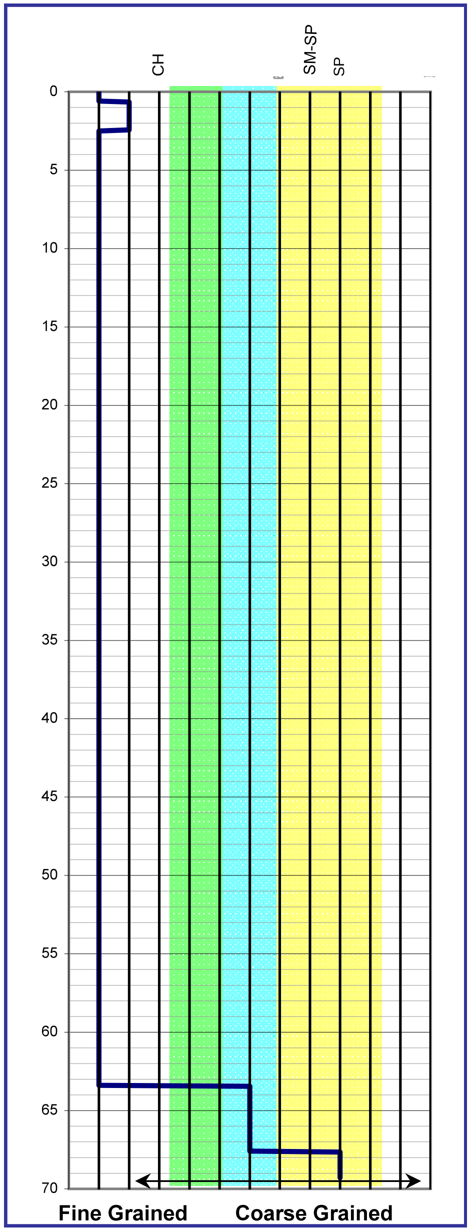
FILE: 9106138
DATE: May 2, 2006
DRILLER: D. Macera
TECH.: B. Alexander
ENGINEER: D. Aucutt



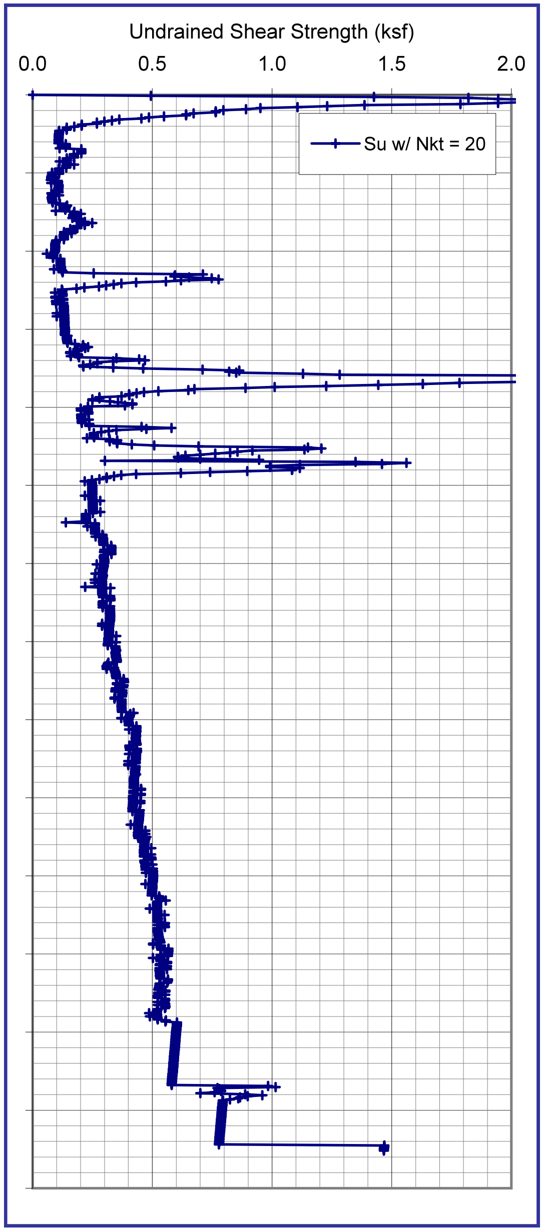
Abandonment Method	Notes
	STRATA BOUNDARIES MAY NOT BE EXACT

aquaterra
engineering

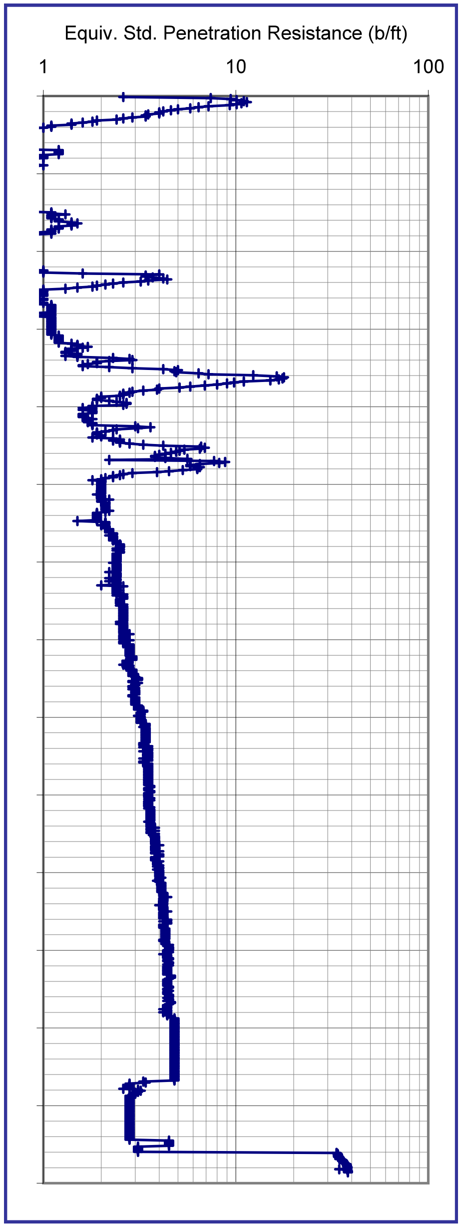
Interpreted Parameters from CPT - 2
Insulation Technologies Office and Warehouse
Belle Chasse, Louisiana



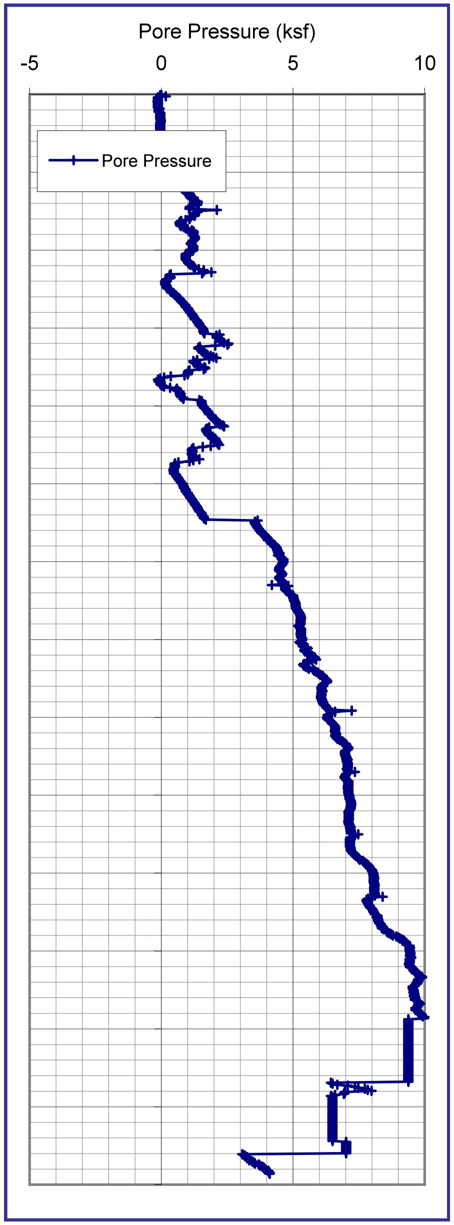
Soil Behavior



Undrained Shear Strength
(Using Cone Factor = 20)
(applicable to cohesive soils only)



Est. Std. Penetration Resistance

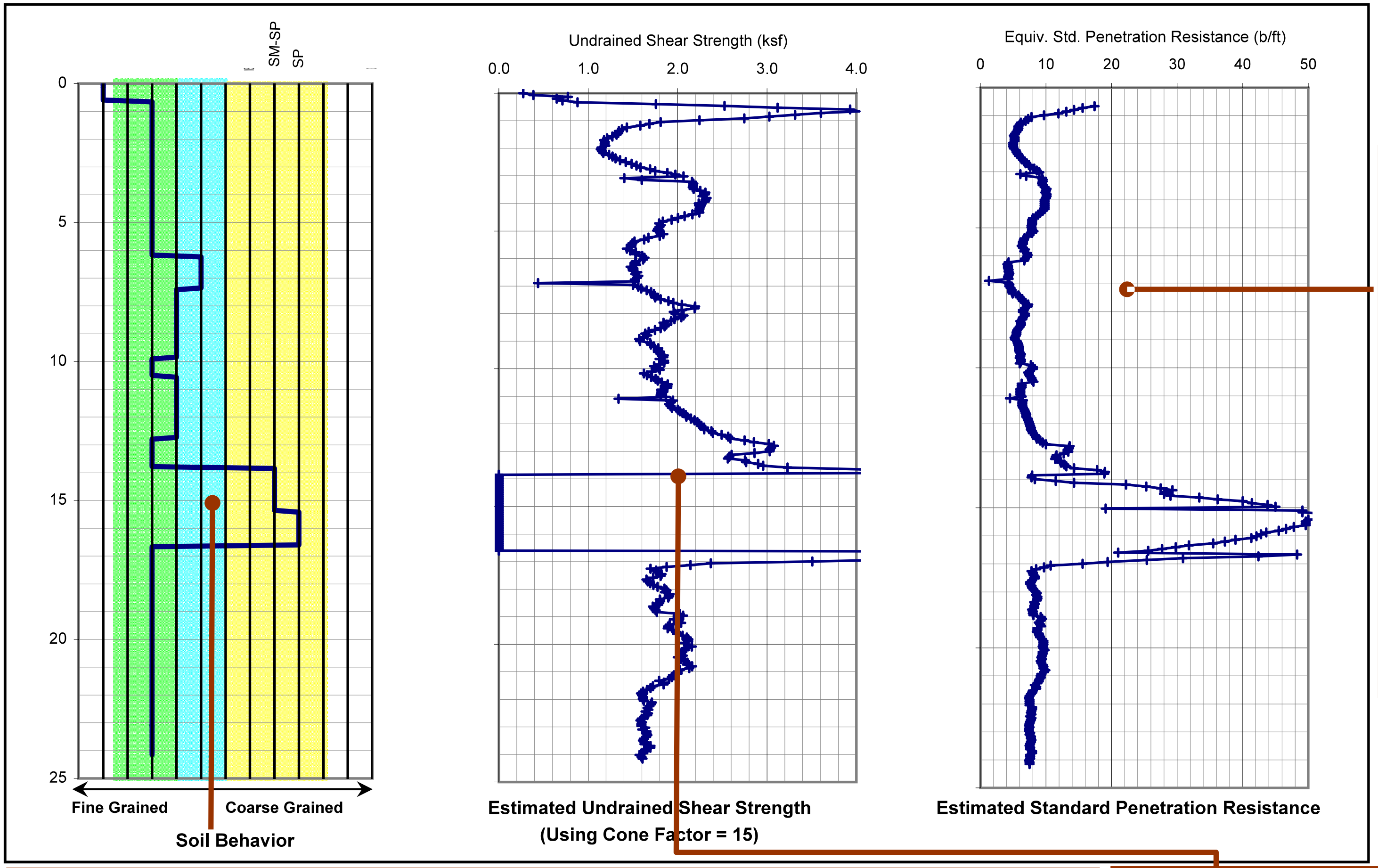


Pore Pressure

All data are interpreted from CPT data collected.
See explanation of symbols and methods.

AQT# 910138

Explanation of Symbols and Methods
Interpreted Parameters from CPT Soundings



Ref: Robertson, P.D.et al (1986), "Use of piezometer cone data". Proceedings of the ASCE Specialy Conference In Situ '86, 1263-80

Explanation of Soil Behavior Interpretation

Ref: Lunne,Robertson and Powell, "Cone Penetration Testing in Geotechnical Practice, Spon Press, 1997. pp 63 -8