APPENDIX C

Geotechnical Report

GEOTECHNICAL REPORT

ZERO WASTE ENERGY
ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

Submitted to:

Ms. Emily Hanson
Zero Waste Energy Development Company, LLC
1500 Berger Drive
San Jose, CA 95112
ehanson@greenwaste.com

Prepared by:
ENGEO Incorporated

March 19, 2010
Project No. 8900.000.000

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
8900.000.000

March 19, 2010

Ms. Emily Hanson
Zero Waste Energy Development Company, LLC
1500 Berger Drive
San Jose, CA 95112
ehanson@greenwaste.com

Subject: Zero Waste Energy Anaerobic Digestion Facility
San Jose, California

GEOTECHNICAL REPORT

Dear Ms. Hanson:

ENGEO Incorporated prepared this geotechnical report for Zero Waste Energy as outlined in our master agreement dated January 8, 2010 and Task Order 1 dated January 15, 2010. We characterized the subsurface conditions at the site to provide the enclosed geotechnical recommendations for design.

Our experience and that of our profession clearly indicates that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to review the project plans and specifications and provide geotechnical observation and testing services during construction. Please let us know when working drawings are nearing completion, and we will be glad to discuss these additional services with you.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Paul Cottingham, CEG
Project Geologist

Jonathan Boland, GE
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
MARK M. GILBERT
No. 2191
Exp. 3/31/2012
GEOTECHNICAL
STATE OF CALIFORNIA

Mark Gilbert, GE
Principal

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

ENGEO prepared this report as outlined in our master agreement dated January 8, 2010 and Task Order 1 dated January 15, 2010. Zero Waste Energy Development Company authorized ENGEO to conduct the proposed scope of services, which included the following:

- Service Plan Development
- Health and Safety Plan
- Geotechnical Work Plan
- Subsurface Field Exploration
- Soil Laboratory Testing
- Data Analysis and Conclusions
- Report Preparation.

For our use, we received the following:

1) Worley Parsons, Zero Waste Energy Systems Anaerobic Digestion Facility, Phase I-III, Technical Specification, Dated November 18, 2009.

2) SCS Engineers, Field Investigation and Site Development Feasibility Summary Report, Dated September 17, 2007.

3) SCS Engineers, Preliminary Feasibility Report: Land Use Study for the City of San Jose Nine Par Landfill Site, Dated March 14, 2007.

4) Worley Parsons, preliminary grading plans, received via email March 1, 2010.

5) Worley Parsons, existing site topography, received via email February 3, 2010.

6) BHS, Anaerobic Digestion Facility Phase 1, sheets 3 and 5, dated January 14, 2010.

7) BHS, drawing 006, sheets 3, 4, 7, and 9, undated.

This report was prepared for the exclusive use of our client and their consultants for design of this project. In the event that any changes are made in the character, design or layout of the development, we must be contacted to review the conclusions and recommendations contained in this report to determine whether modifications are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 PROJECT LOCATION

Figure 1 displays a Site Vicinity Map. The approximately 96-acre Nine Par Landfill is located at 2100 Los Esteros Road in San Jose, California. The site is bordered by Zanker Road Landfill and tidal marshes to the north, City of San Jose Water Pollution Control Plant (WPCP) sludge drying beds to the east, Los Esteros Road to the south, and Artesian Slough to the west.

Figure 2 shows the existing site topography, historic exploration locations, and current ENGEO exploratory locations.

1.3 PROJECT DESCRIPTION

Figure 3 shows the currently proposed improvement layout for Phase 1, historic exploration locations, and ENGEO's exploratory locations. We understand future Phases 2 and 3 will be located east of Phase 1 and will include similar improvements. This report applies to Phases 1, 2, and 3.

Based on our discussion with Zero Waste Energy Development Company and the project team, as well as review of the documents provided, we understand that each phase (1, 2, and 3) of the Anaerobic Digestion Facility will include the following:

- An approximately 10,125 square foot, single story, receiving building
- 16 compost tunnels totaling approximately 38,730 square feet
- 16 digester tunnels totaling approximately 27,800, square feet
- Miscellaneous facilities that include biofilters, storage tanks, and conveyors
- Compost maturation and finishing areas
- Underground utilities
- Asphalt Concrete Pavements

According to the Technical Specifications provided by Worley Parsons (Reference 1), the structural loads and post construction maximum differential settlements for the primary structures in each phase are as follows:

Table 1
Design Parameters

Structure	Approximate Dead Load (kips)	Max Post Construction Differential Settlements
Receiving Building	2,000	¾
Compost Tunnels	30,000	½
Digester Tunnels	24,800	½

In addition, based on out discussions with BHS, we understand that the digester tunnels have a 2 percent slope requirement that will be important to the function of the facility.

2.0 FINDINGS

2.1 SITE BACKGROUND

Historically, the property was operated as the Nine Par Landfill and began accepting waste beginning in 1938. As described in the SCS reports, the Nine Par Landfill was receiving municipal solid waste through 1970's and received other imported materials through 2005. Waste and import materials reportedly included:

- 1938 to 1970: Domestic and municipal waste, inert debris, and possibly septic pumpings.
- Early 1980's: Random, non-engineered imported fill soil placed as cover.
- Late 1970's until Late 1980's: Grit from aerator tanks and inert biosolids from the adjacent WPCP facility.
- 2003: Imported soil containing naturally occurring asbestos (NOA), currently located on the northwestern portion of the site. The NOA stockpile was reportedly placed, covered, and surveyed under U.S. EPA oversight.
- 2005: Imported soil spoils from the civic center and San Jose Airport improvement projects. This stockpile makes up a large portion of the northern half of the site.

2.2 FIELD EXPLORATION

As specified by Worley Parsons, our field exploration included drilling two borings, excavating two test pits and advancing eight Cone Penetration Test (CPT) soundings at various locations on the site. We performed our field exploration between February 1st and February 11th, 2010. We performed a site reconnaissance concurrently with our field exploration.

We also performed one infiltration test and two electrical resistivity tests at the request of Worley Parsons.

The location and elevations of our explorations are approximate and were determined using a hand held GPS device; they should be considered accurate only to the degree implied by the method used. Our current borings, test pits, CPTs and previous explorations by SCS are shown on Figures 2 and 3.

We provide a brief description of our field exploration in the following subsections.

2.2.1 Borings

ENGEO observed the drilling of two boring and logged the subsurface conditions at each location. We retained a Balloon Tire CME 750X drill rig and crew to advance the borings using 8-inch diameter hollow stem auger and mud rotary methods. Both borings were advanced to a depth of 81½ feet below existing grade. We completed our borings, which included conductor casing, in accordance with our Geotechnical Work Plan, dated January 27, 2010. Borings were backfilled in accordance with our approved Santa Clara Valley Water District permit, including in place grouting of the PVC conductor casing.

We obtained soil samples at various intervals using standard penetration tests and a California Modified Sampler (3-inch O.D. split spoon with 2.5-inch I.D. liners). The blow counts were obtained by dropping a 140-pound hammer through a 30-inch free fall. The sampler was driven 18 inches and the number of blows was recorded for each 6 inches of penetration. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows required to drive the last 1 foot of penetration; the blow counts have not been converted using any correction factors. When sampler driving was difficult, penetration was recorded only as inches penetrated for 50 hammer blows.

We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

2.2.2 Test Pits

We observed the excavation of two test pits. An ENGEO representative supervised the test pit excavation and logged the subsurface conditions at each location. We retained a 318 Caterpillar excavator to excavate the test pits using a 3-foot wide bucket. The maximum depth penetrated by the test pits was 23½ feet.

We obtained bulk soil samples from the test pits using hand sampling techniques. The test pit logs present descriptions and graphically depict the subsurface conditions encountered. We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time due to degradation and decomposition of the landfill waste.

2.2.3 Cone Penetration Tests

We retained a CPT rig to advance the cone penetrometer to maximum depths of 85 to 100 feet below existing grade. The CPT has a 20-ton compression-type cone with a 15-square-centimeter (cm^2) base area, an apex angle of 60 degrees, and a friction sleeve with a surface area of 225 cm^2. The cone, connected with a series of rods, is pushed into the ground at a constant rate. Cone readings are taken at approximately 5-cm intervals with a penetration rate of 2 cm per second in

accordance with ASTM D-3441. Measurements include the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and pore pressure (U) (Robertson and Campanella, 1988). CPT logs are presented in Appendix B.

CPT soundings were backfilled using retraction grouting techniques in accordance with our Geotechnical Work Plan.

2.2.4 Infiltration Testing

We performed double-ring infiltration testing in general conformance with ASTM D3385-903 at the location shown on Figures 2 and 3, using double ring infiltrometer equipment. The infiltration rate at the testing location was approximately 0.4 inches per hour. Surface soil consisted of dark gray-brown, medium plasticity clay.

2.2.5 Electrical Resistivity Testing

Electrical resistivity testing was performed for use in designing electrical grounding systems. We retained a subcontractor to perform electrical resistivity testing in two locations to evaluate the in-situ soil resistivity. At each location, a Wenner electrode array was used to obtain measurements oriented in roughly east-west and north-south orientations. Electrode spacings of 2, 5, 7, 10, 20, and 40 feet were used to obtain electrical resistivity measurements to a depth of about 25 feet below grade. The data is recorded as apparent resistivity versus electrode spacing, and presented in a tabular format. The report, attached in Appendix E, describes the method used, field procedures, and a tabulation of the results. The field survey was performed by NORCAL Geophysical Consultants using a 2-person crew headed by a licensed California Professional Geophysicist.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Geology

Geologic maps locate the site within the broad, north-south trending, alluvial filled Santa Clara Valley of the Coast Range geomorphic province. The Geologic Map prepared by Dibblee (2005), shows the site located at the southern margin of Quaternary Bay Mud and partially in Quaternary Alluvial Clay deposits. The alluvial thickness map by Bishop (1974), displayed in Figure 9, shows Bay Mud thickness of approximately 0 to 5 feet and suggests the total alluvial thickness could be as deep as 700 feet.

2.3.2 Seismicity

The Bay Area contains numerous active earthquake faults. Nearby active faults include the Hayward to the east and the San Andreas to the west. An active fault is defined by the State

Mining and Geology Board as one that has had surface displacement within Holocene time (about the last 11,000 years) (Hart, 1997).

Numerous small earthquakes occur every year in the San Francisco Bay Region, and larger earthquakes have been recorded and can be expected to occur in the future. Figure 8 shows the approximate locations of these faults and significant historic earthquakes recorded within the San Francisco Bay Region.

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site. Fault rupture through the site, therefore, is not anticipated. We used the software program EQFAULT Version 3.00b (Blake, 2000) to locate the nearest active faults and have summarized the output in the table below.

Table 2
Summarized Nearest Active Faults

Fault	Distance from Site (miles)	Moment Magnitude
Hayward	5.4	7.3
Calaveras	7.9	6.9
Monte Vista - Shannon	12.1	6.7
San Andreas	14.2	7.9
Greenville	22.1	6.9
Mount Diablo	22.1	6.7
Zayante-Vergeles	24.0	7.0
Great Valley 7	25.8	6.7

The California Geological Survey supports a web database that includes probabilistic peak horizontal ground accelerations (PHGA) for the state. The probabilistic data is based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA, 2002) model, and yielded a PHGA of 0.51g for the property. This data is used in determining site specific seismic response, seismic slope stability, liquefaction potential and other design recommendations.

2.4 SURFACE CONDITIONS

The majority of the site is covered with native grasses and shrubs. Based on site topography provided by Worley Parsons, the ground surface generally slopes up at the property boundary from an offsite elevation of approximately +5 feet to a relatively flat bench ranging from +11 to +20 feet in elevation. The 2003 NOA stock pile and the 2005 stock pile rise above the bench to elevations of about +33 feet.

Please refer to the Exploration Layout with Existing Topography, Figure 2, for more information on site features.

2.5 SUBSURFACE CONDITIONS

In general, the explorations encountered medium stiff to hard, moderately plastic clay fill ranging from approximately 6 to 19 feet in thickness, overlying refuse. Within the Phase 1 area of the site, the fill overlying the refuse is approximately 6 to 8 feet thick. We encountered refuse in our test pits that consists of 40 to 50 percent clay soil mixed with refuse primarily consisting of paper, wood, and glass. Other components of the refuse include plastic, wire, metal, tires, and asphalt. The refuse observed generally showed slight to moderate degradation, newspaper was discolored, but portions were still legible. A newspaper headline was recovered dated 1966. The refuse typically had an intermittent odor of decomposing organic material. The refuse appeared to be municipal solid waste (MSW) type material. In general, refuse thickness ranges from 10 to 20 feet thick across the site and is generally about 11 to 16 feet thick in the Phase 1 area.

Beneath the refuse, we typically encountered medium stiff to hard, normally consolidated clays and silts as well as areas of fine to medium-grained sand and silty sand. Sand layers observed were typically medium dense to loose and generally between 3 and 12 feet thick and in some cases occur directly beneath the refuse fill.

Figure 2 and the exploration logs provide specific subsurface conditions at each location. Additionally, interpretive cross sections are displayed on Figures 4, 5, and 6. We include our exploration logs in Appendix A. The logs contain the soil type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System. The logs graphically depict the subsurface conditions encountered at the time of the exploration. Appendix A also provides additional exploratory information in the general notes to the logs. Appendix B provides the CPT plots in a report by Gregg Drilling.

2.6 GROUNDWATER CONDITIONS

We observed static groundwater in several of our subsurface explorations. We summarize our observations below:

Table 3
Groundwater Observations

Exploration Location	Approximate Depth to Groundwater (ft.)	Approximate Groundwater Elevation (ft.)
B4A	13*	0
B5A	15*	0
B6A	15*	0
B7A	12*	0
B8A	16	-2
TP-1A	16	-3
TP-2A	17	0

*CPT groundwater levels were calculated from pore pressure readings

We observed groundwater level near elevation zero, which is generally within the refuse material. Groundwater observations made during our explorations and historic explorations are depicted on Figures 4 through 6. The 2007 SCS report described floating hydrocarbons at the groundwater surface within the refuse. We did not observe floating hydrocarbons in our explorations.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, tides, and other factors not evident at the time measurements were made.

2.7 LABORATORY TESTING

We performed laboratory tests on selected soil samples to determine their engineering properties. For this project, we performed moisture content, dry density, unconfined compression, plasticity index, expansion index, sieve, compaction, consolidation, collapse potential, resistance value, and soil corrosion potential testing.

The laboratory test results are included on the boring and test pit logs in Appendix A. Individual test results are presented in Appendix C.

2.8 SLOPE STABILITY ANALYSES

Based on the current grading plan (March 1, 2010), we analyzed a total of three representative slope cross-sections. These sections are shown in plan view on in Appendix D. In general, the proposed slopes are no steeper than 3:1, horizontal to vertical, and have total elevation differences ranging between approximately 7 and 25 feet. Our analysis considered loading from future buildings, tanks, and other related improvements.

2.8.1 Method of Analysis

We used the two-dimensional slope stability software program UTEXAS4 to analyze both static and seismic stability for the site. UTEXAS4 uses an automatic search routine to locate the minimum factor of safety and critical slip surfaces via Spencer's method. Our analytical model was derived from topographic information received via e-mail on March 1, 2010 from Worley Parsons, our boring, CPT, and test pit logs, and results of our laboratory testing.

In evaluating the stability of slopes under seismic conditions, we used a "pseudo-static" method of analysis. For the past 50 years, this has been the standard method of evaluating the stability of earth embankments against sliding during earthquakes. The pseudo-static method models the effects of transient or pulsating earthquake loading on a potential slide mass by using an equivalent sustained horizontal force determined as the product of a seismic coefficient and the weight of the potential slide mass. The slope is first analyzed to establish the minimum factor of safety under static conditions. Once this minimum failure surface is located, an additional horizontal force acting in the direction of potential failure is imposed on the sliding mass. This

additional force is equal to the soil mass multiplied by a seismic coefficient of horizontal acceleration. For the pseudo-static stability analyses, we used a seismic coefficient of 0.25g, or 50% of the peak horizontal ground acceleration obtained from the CGS website.

2.8.2 Factors of Safety

The minimum allowable factors of safety with respect to static slope stability commonly range from 1.5 to 3 and 1 to 1.5 for seismic cases. Based on local geotechnical practice, in our opinion, we recommend a minimum static factor of safety of 1.5 and a minimum pseudo-static, seismic, factor of safety of 1.1. We considered the various levels of conservatism involved in determining the engineering properties of the soil (density, shear strength, unit weight, etc…), the assumptions made in the method of analysis, and potential variations in field conditions.

2.8.3 Material Properties

In selecting strength parameters, we made a distinction between free-draining materials and non-free-draining materials. Free-draining materials are defined as coarse-grained materials with little or no plastic fines such that when sheared these materials do not generate excess porewater pressure. Free-draining materials were assumed to remain drained and hence their shear strength was characterized with effective stress drained parameters for all loading conditions. The effective cohesion intercept (c') was assumed to be zero for all drained materials. Fine-grained soils were modeled using undrained strength parameters based on laboratory strength data and empirical correlations of SPT blow counts, CPT soundings, plasticity index (PI), and soil type. Waste was modeled using a Mohr Coulomb strength criterion, including both cohesion and friction angle based on work by Bray et al, 2009.

We summarize our model soil inputs below:

Table 4
Model Soil Inputs

Material Type/Name	Shear Strength, Su (psf)	Friction Angle (degrees)	Comment
Engineered Fill (CL)	750	--	
Waste	250	25	Conservative values based on Bray et al, 2009
Shallow Sand (SM/SP)	--	28	
Native Clay (CL)	1,750	--	
Deep Sand (SM/SP)	--	33	

2.8.4 Results of Analyses

Our analyses showed the factors of safety exceeded the prescribed minimums for both static and seismic conditions. The results of our analyses are summarized in below.

Table 5
Summary of Slope Stability Analyses

Location	Factor of Safety	
	Static (Circular/Non-Circular)	Pseudo-Static (Circular/Non-Circular)
Section 1	2.53/2.23	1.28/1.46
Section 2	2.08/2.14	1.10/1.15
Section 3	3.92/4.31	1.59/1.82

2.9 LIQUEFACTION ANALYSES

Liquefaction is a phenomenon in which saturated, cohesionless soil is subject to a temporary, but essentially total loss of shear strength because of pore pressure buildup under the reversing cyclic shear stresses associated with earthquakes. The potential for liquefaction depends on the actual depth to groundwater at the site, the density of the underlying soil, and the potential level of ground shaking.

As discussed in Section 2.5, Subsurface Conditions, the borings and CPTs encountered sand layers and fine-grained material underlying the refuse, extending to the maximum depth of our explorations. Within the sand layers, relatively thin zones of loose, granular materials were encountered. In addition, the CPT's encountered groundwater at depths between 12 and 15 feet below grade.

We performed liquefaction analyses for the interpreted subsurface conditions based on guidelines provided in Robertson and Wride (1997), Robertson and Campanella (1988), Finn (1996), and Seed et al. (2003). SPT blow counts of saturated silt and sand layers were used to calculate the Cyclic Stress Ratio (CSR). The scaled Cyclic Resistance Ratio (CRR) is divided by the CSR to determine the factor of safety (F.S.) against liquefaction within the given soil profile layer. Our analyses considered a peak ground acceleration of 0.51g (CGS website) and a groundwater elevation of 0 feet (Datum MSL). In general, potentially liquefiable sandy and silty deposits (F.S.<1.2) up to a cumulative thickness of 3 to 7 feet are identified within the site. Our analyses show theoretical liquefaction-induced settlements in the range of approximately 1 to 2 inches may occur at the project site as a result of a large seismic event. We present details of other liquefaction related settlement and other hazards in Section 3. Tabular liquefaction calculations are included in Appendix D.

3.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the proposed project may be designed as planned, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications.

The primary geotechnical concern is the long-term settlement of the refuse. Long term settlement will influence choices of grading, foundation types, ongoing maintenance and other critical project features. We summarize our conclusions below.

3.1 REFUSE SETTLEMENT

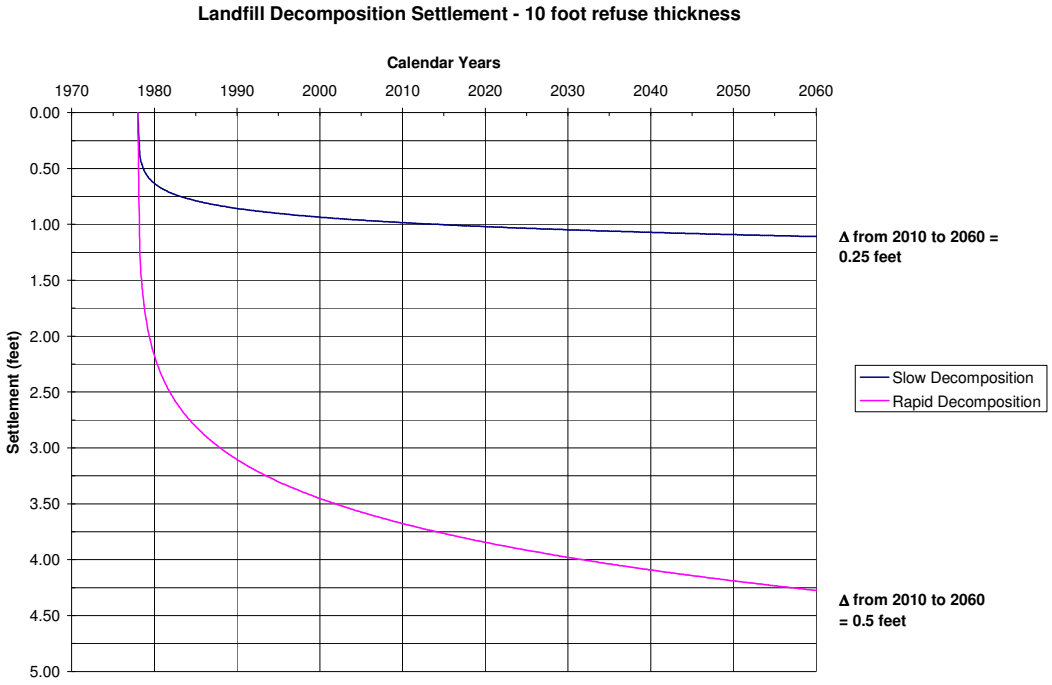
Characterization of the refuse material is difficult due to the highly variable nature of municipal solid waste and limited documentation of older landfill operations. The refuse is non-engineered and will produce surface settlement and distress to structures if not properly mitigated. There is no site-specific settlement data for the Nine Par Landfill and therefore we have used correlations with other published landfill data for our analysis. From this, we assigned material characteristics and engineering properties to the on-site refuse for estimating settlements.

Ground settlement due to the refuse is expected to occur by means of two distinct mechanisms; short term immediate settlement due to compression of the refuse and long term settlement due to decomposition. To force immediate settlement to occur prior to structural improvements we recommend a surcharge program. Details of our surcharge approach are presented in Section 4. We estimate that the immediate settlement in the surcharged areas may range between of ½ to 2½ feet, and will be completed within 3 months of loading.

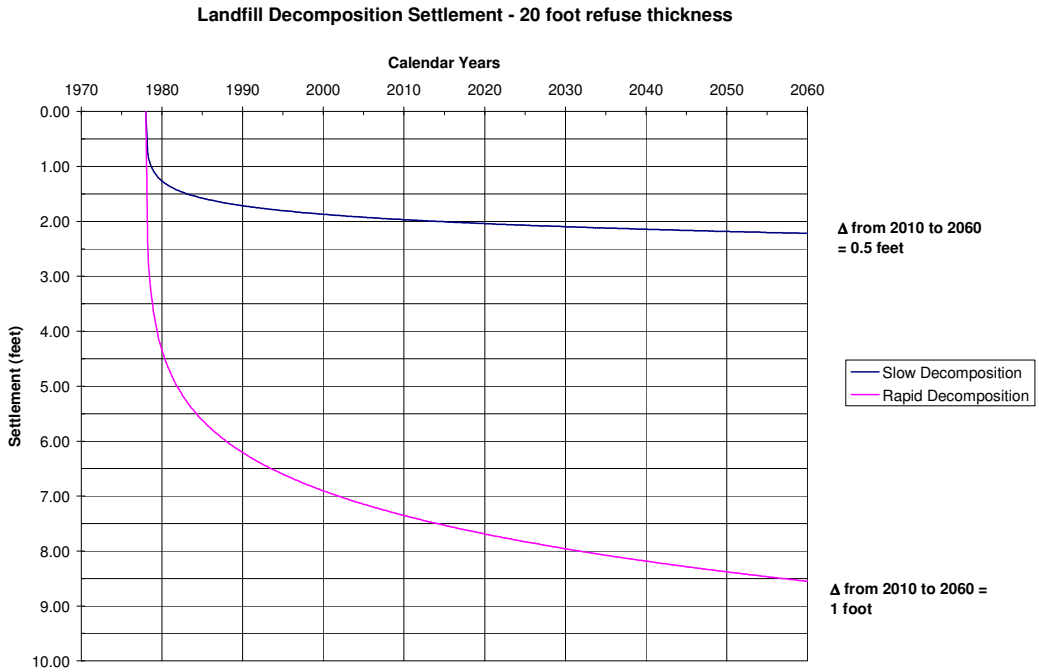
Long term settlement of the ground surface due to decomposition of the landfill material is expected to continue for years, and will vary depending on decomposition rates, refuse composition, and thickness of the waste. The proposed improvements must consider the settlement increment from 2010 though the design life of the project.

Favorable, aerobic, conditions above the groundwater table will accelerate decomposition and unfavorable, anaerobic, conditions will retard it. Much of the waste material onsite lies above the groundwater, so we anticipate somewhat favorable conditions to decay.

We understand the last of the refuse was placed on-site in approximately 1978. For our long-term settlement estimates, we assumed this date as the start of any decomposition settlement. We plotted settlement versus time for both favorable and unfavorable decomposition rates for two different waste thicknesses.



Long Term Settlement – 10 Feet of Refuse



Long Term Settlement – 20 Feet of Refuse

As can be seen in the above graphs, decomposition settlement rate shortly after waste placement is high and gradually reduces as the refuse ages. Given the approximately 32 years since the landfill was active, a large percentage of potential decomposition settlement has already occurred. The proposed improvements need to consider the settlement increment from 2010 though the design life of the project. We have tabulated the estimated long term settlement that may be expected from 2010 to 2060 in the table below.

Table 6
Long Term Settlement Estimates (50 years)

Waste Thickness (feet)	Slow Decomposition Rate (feet)	Fast Decomposition Rate (feet)
10	¼	½
20	½	1¼

We estimate differential settlement from long term refuse settlement could be up to one-half of the long-term settlement. We estimate differential settlement on the order of 6 inches in 50 feet could occur. Liquefaction settlement, discussed in Section 2.9, should be considered in addition to long term settlement. Structural design should include provisions for this differential movement (i.e. flexible utility connections, hinged slabs, etc.). We present specific foundation recommendations in Section 5.Gravity flow utilities should be designed based on the possibility of total and differential settlements outlined above.

3.2 FOUNDATION SUPPORT – STRUCTURAL IMPROVEMENTS

Significant long-term differential settlement of site structures, including, the receiving building, digester tunnels, compost tunnels, biofilter, storage tanks, and conveyor systems is likely to occur from decomposition of the underlying refuse. Settlement of this magnitude could cause distress to conventional shallow foundation systems. To mitigate this distress, we provide recommendations to support the facility on deep foundations that derive their support from the soil below the landfill. We recommend driven precast concrete piles as an economical pile type.

When supporting the structures on pile foundations, differential settlement at the building connection points are exacerbated. The design will need to incorporate hinged walkways and flexible pipe connections at all connections with pile-supported structures.

Additionally, we have considered ways to ‘float’ the facility on the existing landfill to avoid the cost and other challenges associated with deep foundation systems. As an alternative to pile supported structures, a grid foundation system may be used, provided that the cost of additional maintenance and re-leveling of facilities is acceptable to the owner. The grid foundation system is designed to span large unsupported areas to reduce the damaging affects from differential settlement and provide more uniform settlement of the structure.

For either foundation type, we recommend that the building areas be surcharged to allow for observation and documentation of the immediate settlement of the refuse.

3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, and ground lurching. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site.

3.3.1 Ground Rupture

As discussed in Section 2.3.2, since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the site.

3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures should be designed using sound engineering judgment and the 2007 California Building Code (CBC) requirements, as a minimum. Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The code-prescribed lateral forces are generally considered substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

3.3.3 Liquefaction-Induced Ground Deformation

In addition to the liquefaction analysis in Section 2.9, we also evaluated the capping effect of any overlying non-liquefiable soils. In order for liquefaction-induced ground failure to occur, the pore water pressure generated within the liquefied strata must exert a sufficient enough force to break through the overlying soil and vent to the surface resulting in sand boils or fissures.

In 1985, Ishihara presented preliminary empirical criteria to assess the potential for ground surface disruption at liquefiable sites based on the relationship between thickness of liquefiable sediments and thickness of overlying non-liquefiable soil. A more recent study by Youd and Garris (1995) expanded on the work of Ishihara to include data from over 308 exploratory borings, 15 different earthquakes, and several ranges of recorded peak ground acceleration.

In general, the project site has a thick enough cap of non-liquefiable material (soil plus refuse) to prevent venting to the ground surface. However, liquefiable sands directly beneath the refuse may vent into the refuse, potentially allowing some settlement. It is our opinion that such settlement will be relatively small compared to that from the refuse.

3.3.4 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form in weaker soils. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock. Such an occurrence is possible at the site as in other locations in the Bay Area region, but based on the site location, it is our opinion that the offset is expected to be very minor.

3.4 Site Specific Ground Motion Analysis

We performed a seismic hazard analyses for the project site based on the latest California Building Code (CBC, 2007) Chapter 16. The CBC references the American Society of Civil Engineers Standard 7-05 (ASCE 7-05) Chapter 21 as the basis for developing "Site Specific Ground Motion Procedures for Seismic Design". For this analysis we used the computer program EZ-FRISK and current California fault data to model the seismic setting of the region. This procedure accounts for the following:

- Earthquake magnitude
- Rupture length
- Location of rupture
- Maximum possible earthquake magnitude
- Recurrence interval of earthquake events

We conducted probabilistic and deterministic analyses to develop the spectra shown in Figures 10 and 11. The probabilistic and deterministic spectra were derived using the Next Generation Attenuation relationships (NGA) developed by Boore-Atkinson (2008), Campbell-Bozorgnia (2008), Abrahamson and Silva (2008) and Chiou and Youngs (2008). The probabilistic analysis considered a 2 percent probability of exceedance within a 50-year period.

To develop the site specific spectra, we first developed the 2 percent in 50 years probabilistic Maximum Credible Earthquake (MCE) spectrum, in accordance with ASCE 7-05 Section 21.2.1, shown in blue on Figure 10. We then calculated the deterministic response accelerations by selecting the largest median spectral response for characteristic earthquakes within a 100 km (62miles) radius and multiplying it by 1.5 (150 percent). The largest median spectral response accelerations were calculated from an earthquake on the Hayward-Rogers Creek Fault with a Moment Magnitude of 7.26 and at a distance of 8.2 km (5.1 miles) from the subject site. We compared the 150 percent median deterministic spectrum (shown in green on Figure 10) to the "Deterministic Lower Limit on the MCE Response Spectrum" (shown in brown on Figure 10) and selected the greater of the two as the deterministic MCE (shown in pink on Figure 10) in accordance with ASCE 7-05 Section 21.2.2. ASCE 7-05 recommends that the site-specific MCE response spectrum be taken as the lesser of the spectral response spectrum from the probabilistic analysis and the deterministic spectrum, subject to the deterministic spectrum lower limit. As a result, the probabilistic MCE spectrum governs at periods less than approximately 0.8 seconds and the deterministic MCE spectrum governs at periods greater than approximately 0.8 seconds. Figure 10 shows the site-specific MCE spectrum in black.

The 2007 CBC (CBC), by reference to ASCE 7-05, states that the "Design Spectrum" be computed by taking two-thirds of the governing site-specific MCE spectrum (shown in black on Figure 11). However, this design spectrum cannot be less than 80 percent of the design response spectrum developed in accordance with the CBC using the USGS mapped values (shown in pink on Figure 11). As shown on Figure 11, the governing design response spectrum is two-thirds of the site-specific MCE. We then calculated the spectral acceleration at short periods, S_{DS}, and the spectral acceleration at a period of 1 second, S_{D1}, for the design response spectrum in accordance with Section 21.4 of ASCE 7-05. Figure 11 shows the site specific recommended design spectrum in green. Figure 11 also depicts the USGS mapped design spectrum developed in accordance with the CBC in light blue for comparison. Below is the table with the numeric values of the spectra and ground motions for the short period and long period at the site.

Table 7
Recommended Design Spectral Acceleration Parameters

Coefficient	Value
Site Class	D
Design, 5% Damped, Spectral Response Acceleration from Site Specific Analysis at Short Periods, S_{DS}	0.921
Design, 5% Damped, Spectral Response Acceleration from Site Specific Analysis at a Period of 1 second, S_{D1}	0.773

We calculated a Site Class D, stiff soil profile, in accordance with the 2007 CBC Section 1613.5.5, based on average shear wave velocities and blow counts within the upper 100 feet of the site soil profile. Based on literature by Kavazanjian, 1996, we assigned a shear wave velocity of 500 feet per second to the landfill waste. The fill and native soil profile was assigned a shear

wave velocity of 500 fps and 700 fps, respectively, based on correlations to SPT blow counts using data from the borings and CPTs. From this we used an average shear wave velocity of 630 fps for the upper 100 feet of the site soil profile in our analysis.

We considered a Site Class E, soft soil profile, due to the variable nature of the landfill material. In general, the site-specific response spectrum for a Site Class E soil profile would yield higher spectral accelerations at longer periods and lower spectral accelerations at shorter periods due to the soft soil site response. Therefore, it is our opinion that the use of a Site Class D is appropriate, as the use of Site Class E would yield lower, less conservative, spectral accelerations at lower periods corresponding to the rigid, short period, structures proposed at the Zero Waste Energy facility.

3.5 EXPANSIVE SOIL

We observed potentially expansive clay near the surface of the site in our explorations. Our laboratory testing indicates that these soils exhibit moderate shrink/swell potential with variations in moisture content. Expansive soil can cause distress to lightly-loaded foundations, floor slabs, pavements, sidewalks, and other improvements that are sensitive to soil movements. We present expansive soil mitigation recommendations for exterior flatwork in Section 5.3.

We have also provided specific grading recommendations for compaction of clay soil at the site. The purpose of these recommendations is to reduce the swell potential of the clay by compacting the soil at a higher moisture content.

3.6 METHANE GAS HAZARDS

Methane gas can be produced in landfills as organic material decays. Our scope did not include assessment of landfill gas, however we recommend that the landfill gas be evaluated. Methane escaping from a landfill can pose significant health hazards. If methane collects beneath a building foundation it can seep into confined spaces and become an asphyxiation or explosion hazard.

3.7 NATURALLY OCCURRING ASBESTOS

Naturally Occurring Asbestos (NOA) is a term used to classify a group of silicate minerals that occur as asbestiform fibers. Asbestos minerals belong to either the serpentine mineral group or the amphibole mineral group. The most common type of asbestos found in California is chrysotile, a serpentine mineral. We understand the stockpile in the eastern portion of the site is known to contain NOA, which can pose a health risk during construction if it becomes airborn.

If during grading operations NOA bearing materials are disturbed, an Asbestos Dust Mitigation Plan (ADMP) application should be submitted to the Bay Area Air Quality Management District (BAAQMD).

3.8 SOIL CORROSION POTENTIAL

We submitted select soil samples to an analytical lab for determination of pH, resistivity, sulfate, and chloride. The sulfate lab test results indicate the sulfate exposure may be categorized as "Moderate" in accordance with Table 19-A-4 of the California Building Code. For "Moderate" sulfate exposure, the CBC indicates that Type II Portland Cement with a water to cement ratio of less than 0.50 may be used for concrete mix designs for the project.

The samples tested had low resistivities, indicating that they are moderately to highly corrosive to buried metal.

If desired to investigate this further, we recommend a corrosion consultant be retained to determine if specific corrosion recommendations are necessary for the project. We present the analytical lab test results in Appendix C.

3.9 EARTHWORK SHRINK/SWELL FACTORS

We considered potential shrinkage/swelling of the on-site soil when compacted to 90 percent relative compaction, based on the ASTM D1557 test standard. Based on our experience, field observation, boring logs and laboratory test data, we estimate the near surface clayey soil may have volume change ranging between -15 to +5 percent for the referenced relative compaction.

Volume change factors should be used for estimating quantities only. These factors do not take into account volume changes due to stripping of organics, overcompaction, wind losses during compaction, topographic relief not reflected on the site map, or grade/survey tolerances. The plans should include a contingency for variations in volume change so that excess material can be disposed or additional import fill available.

4.0 SURCHARGE PROGRAM

We recommend that all building areas be surcharged prior to building construction. Very little historic monitoring and documentation has occurred at this landfill making waste characterization and estimation of settlement challenging. To reduce potential differential settlement, we recommend implementing a surcharge program. Surcharging is a process where the proposed improvement areas are temporarily loaded with fill that compresses the underlying soil and refuse. Surcharging will be essential to reduce short-term settlement for improvements founded on shallow foundations, create a more uniform stress history across the site, and will yield valuable insight into the engineering and settlement behavior of the refuse. If deep foundations are selected, surcharging will also help to limit differential settlement due to new fills/loads outside the pile supported building limits.

For Phase 1 development, we recommend a surcharge fill height of approximately 8 feet above proposed site grades in building and improvement locations (this material can come from the existing stockpile on site). We anticipate primary settlement due to surcharging will be complete within approximately 2 to 3 months, then soil may be removed to reach site final design grades. During the surcharge period, site settlements between ½ and 2½ feet may occur, and will vary depending on waste thickness, in place density, and surcharge pressure variation based on existing topography. Depending on the critical path of the project grading schedule, the surcharge height may be increased to reduce the required surcharge time. The surcharge height may be increased to 12 feet and surcharge time could be complete in approximately 6 to 8 weeks.

We recommend settlement monitoring during surcharging to gather data about the nature and consistency of the refuse and fill material. This information will assist in a better understanding of future differential settlement and characterization for future project phases. Settlement monitoring should be done using multiple settlement plates installed prior to the surcharge grading. The plate elevations should be periodically surveyed as surcharge fill is placed. Figure 12 shows surcharge extent and a recommended settlement monument grid based on the most recent site improvement plan. Should structural improvements be relocated, or new improvements added (tanks, substations, etc.) that are outside these limits, the surcharge plan will require updating. ENGEO should review the final site improvement and grading plans prior to surcharging the site.

5.0 FOUNDATION RECOMMENDATIONS

The foundation type for this project is yet to be determined. The foundation decision will depend on many factors including the sensitivity of the facility to differential settlement, risk of on-going maintenance/repair costs, and the economics of each foundation system. We present both a "floating" grid foundation system and a deep foundation system. The floating foundation must accommodate anticipated differential settlement and will likely require additional maintenance and re-leveling throughout the lifespan of the facility.

5.1 GRID FOUNDATIONS

There are several factors we considered with this shallow foundation approach including uniformity of refuse thickness within each project phase, refuse age and composition, and final industrial improvement type. Benefits of shallow foundations can include:

- Cost savings relative to deep foundation systems.
- No Regional Water Board oversight/regulation due to driving piles into and through municipal solid waste.
- No need to mobilize a specialty foundation contractor or equipment.

Possible risks and drawbacks of shallow foundations include:

- Long term differential foundation settlements may be on the order of 6 inches over a 50 foot span, exceeding the original project specifications.
- Will require ongoing monitoring and maintenance.
- Risk of damaging settlement that may require repair or foundation re-leveling.
- Requires more control joints and hinged slabs to accommodate differential settlement.

Provided the owner accepts the risk of ongoing maintenance, possible differential settlement, and potential future re-leveling of structures, it is our opinion the improvements may be founded on a shallow grid foundation system. These systems consist of continuous footings and or isolated footings tied together with grade beams. Shallow grid foundations should be designed to mitigate distress due to differential settlement by providing a relatively stiff foundation capable of spanning localized irregularities in waste settlement and redistributing forces to other parts of the foundation system.

The base of footings and grade beams should be established a minimum of 2 feet below lowest adjacent grade and a minimum of 3 feet above the top of the refuse. This specification may require removal of the upper portion of the waste in some areas and replacement with engineered fill. We recommend continuous footings and grade beams be at least 1½ feet wide and isolated footings be a minimum of 3 feet wide. Footing concrete should be poured in neat excavations in competent soil without the use of side forms.

All footings and grade beams should be designed to span unsupported lengths as tabulated below.

Table 8
Grid Foundation Design Criteria

Location/Support Condition	Unsupported Length (feet)
Cantilever Perimeter (Edge Loss)	8
Cantilever Corner	10

Additionally, the structural foundation system should be designed to span, without any subgrade support, a 30 foot diameter area located anywhere within the building footprint. A modulus of subgrade reaction, k, of 20 pounds per cubic inch may be used for design of the foundation system.

For the shallow foundation option we recommend constructing a 3 foot thick engineered fill 'cap' within foundation areas. This will provide a more uniform subgrade for support of the grid foundation. Constructing the engineered fill layer may require overexcavation depending on the current grade relative to the proposed grade within structural improvement areas. We present detailed compaction recommendations in the Earthwork section of this report.

For full dead and live loads, footings that comply with the above support criteria may be designed for a maximum allowable bearing pressure of 3,000 psf. Allowable bearing pressures can be increased by one-third for temporary loads including wind or seismic.

5.1.1 Control Joints and Slab Hinges

To reduce damage from differential settlement, the project structural engineer should apply strategic placement of slab hinges and control joints between adjacent structural members and at transitions between different project elements and structure types.

5.1.2 Foundation Lateral Resistance

Lateral loads may be resisted by friction along the base and by passive pressure along the sides of foundations. The passive pressure is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend the following allowable values for design:

Passive Lateral Pressure: 300 pcf

Coefficient of Friction: 0.25

The above allowable values include a factor of safety of 1.5. Increase the above values by one-third for the short-term effects of wind or seismic loading. Passive lateral pressure should not be used for footings on or above slopes.

5.1.3 Flexible Utility Connections

Due to the large anticipated differential and total settlements, it will be necessary to incorporate flexible utility connections into the design of the project. Ball joints, sleeve type, or other flexible couplings should be located, at a minimum, between piping and buildings and in utility areas where large differential settlements may occur.

5.1.4 Settlement Monitoring

In order to track the settlement of the facility, we recommend developing a settlement monitoring plan. This plan should include regularly surveying fixed locations in or on the facility to gather settlement data over time. This will allow the owners to plan ahead for any required maintenance or possible re-leveling of the area should settlements reach tolerance thresholds. Additionally,

periodic floor level surveys of the facility interior will likely yield useful data. If desired, ENGEO can assist in developing a settlement monitoring plan and performing the settlement surveys. The project civil and structural engineers should coordinate to determine appropriate locations of embedded benchmarks within slab, wall, and foundation concrete for ongoing settlement monitoring.

Settlement data can also be used to refine engineering designs for Phases II and III.

5.1.5 Foundation Re-leveling

A contingency budget should be set aside for foundation re-leveling throughout the life of the project should substantial differential settlement occur. Compaction grouting, also called mud jacking, can be an effective way to re-level a foundation that has exceeded its differential settlement tolerances. Compaction grouting is a method of densifying soil and creating uplift using a mortar-like grout pumped at high pressures into the ground in stages to form stiff columns and displace the surrounding soil. If foundation re-leveling is necessary, we can assist in developing a re-leveling strategy.

5.2 PILE FOUNDATIONS

The proposed structures can be supported on driven precast concrete piles. These deep foundations will derive their vertical capacity primarily from skin friction within the stiff soil layers below the refuse. We developed pile capacities based on an assumed pile cap bottom at approximately 5 feet below the proposed site grade. Due to the settlement of the refuse, deep foundation piles will be subject to downdrag forces and a reduction in total allowable capacity. We have included an alternative of coating the upper portion of concrete piles with a bitumen material to reduce the adhesion between the settling fill and the pile, thereby reducing the amount of downdrag force imparted to the pile. Based on the current grading plan and improvement layout, we estimate the upper 15 to 20 feet of the piles should be bitumen coated if this alternative is selected. Determination of the use of bitumen coating will likely be based on economic impact to the project.

We provide vertical and lateral capacities for 12- or 14-inch square precast, pre-stressed concrete piles.

5.2.1 Vertical Capacities

Based on the mud rotary borings, CPT soundings and laboratory testing, we recommend the following design criteria for deep foundations.

Table 9
Allowable Vertical Downward Capacity and Pile Lengths
Driven, Precast Concrete Piles

Pile Type	Minimum Pile Length* (feet) for 100 ton Capacity	Minimum Pile Length* (feet) for 100 ton Capacity with Bitumen Coating**
12-inch square	109	100
14-inch square	98	91

*Based on an approximate pile top elevation of +5 feet (5 feet below proposed grade)
**Bitumen coating of the upper 15 to 20 feet based on current improvement plans.

Increase the above downward capacities by one-third for the short-term effects of wind or seismic loading. To reduce pile group effects, space piles and piers at least 3 diameters apart, center to center. For square piles, use the least dimension for determining the effective diameter.

Structural loads and the number and configuration of pile groups are not known at this time. On a preliminary basis, we estimate that post construction pile foundation settlements will be less than 1 inch. Differential settlement between adjacent columns will be dependent on the final design of these foundation elements, although we anticipate that differential settlement will be less than about ¾ to ½ inch between columns. Once column spacings, loads and pile group configurations are determined, we should be retained to review the design and update our settlement estimates.

Allowable resistance to vertical uplift can be determined by taking two-thirds of the allowable vertical downward capacities presented in the tables below. Increase the above uplift capacities by one-third for the short-term effects of wind or seismic loading provided piles are spaced at least 3 pile diameters or more on center. Capacity reduction for uplift on pile groups is not considered necessary.

5.2.2 Lateral Capacities

5.2.2.1 Single Pile Lateral Capacity

Lateral load resistance for pile-supported structures is developed through pile bending/soil interaction. The magnitude of the lateral load resistance is dependent upon several factors including pile stiffness, pile embedment length, conditions of fixity at the pile cap, the physical properties of surrounding soil, and the magnitude of lateral deflections.

We used the computer program LPILE to estimate lateral pile loads for ¼- and ½-inch pile top deflections. Lateral capacities and deflection characteristics were calculated using pile stiffness (EI) of 7.35×10^9 and 1.37×10^{10} pound-inch^2 for 12- and 14-inch-square concrete piles, respectively. We also assumed a minimum 28-day compressive strength of 6,000 pounds per square inch (psi) for pile concrete and a cross sectional area defined by Santa Fe-Pomeroy, Inc for prestressed, precast concrete piles. If pile stiffness varies by no more than 20 percent of that

reported above, then load deflection characteristics can be approximated by multiplying the deflection values by the ratio of the pile stiffness. For pile stiffness significantly different from the values listed above, we should be contacted to provide revised lateral pile characteristics.

Table 10
Allowable Lateral Capacities (Single 12-inch square pile)

Allowable Lateral Capacity (Kips)		
Pile Condition	**¼-inch Deflection**	**½-inch Deflection**
Free Head	3.2	4.5
Fixed Head	7.1	10.2

Table 11
Allowable Lateral Capacities (Single 14-inch square pile)

Allowable Lateral Capacity (Kips)		
Pile Condition	**¼-inch Deflection**	**½-inch Deflection**
Free Head	4.2	6.1
Fixed Head	9.1	13.2

The above lateral capacities represent the probable response of a single pile under short term loading conditions and do not include a factor of safety. Suitable factors of safety should be selected based on the type of loading.

We estimated maximum bending moments and points of fixity for driven piles for ¼- and ½-inch pile top deflection for both fixed and free head conditions. As referenced in the tables below, "point of fixity" is defined as a point of zero lateral deflection. We present the results in the table below:

Table 12
Load Deflection Characteristics
Precast Driven Piles

Pile Type	Deflection Characteristic	Pile Deflection Free Head		Pile Deflection Fixed Head	
		¼-inch	½-inch	¼-inch	½-inch
12-inch square	Maximum Bending Moment (in-kips)	174.4	286.0	432.8	696.9
	*Depth to Maximum Bending Moment (feet)	7.0	8.0	0	0
	*1st Point of Fixity (feet)	11.6	13.3	16.5	19.5
	*2nd Point of Fixity (feet)	23.7	25.0	27.5	30.0

Pile Type	Deflection Characteristic	Pile Deflection Free Head		Pile Deflection Fixed Head	
		¼-inch	½-inch	¼-inch	½-inch
14-inch square	Maximum Bending Moment (in-kips)	249.9	408.5	625.9	1011.2
	*Depth to Maximum Bending Moment (feet)	8.0	9.0	0	0
	*1st Point of Fixity (feet)	14.0	16.0	19.0	21.5
	*2nd Point of Fixity (feet)	26.5	28.5	31.0	31.5

*Below Top of Pile

5.2.2.2 Group Lateral Capacity Reduction

Research has shown that the lateral capacity of a group of piles is generally less than that of a single pile for pile spacings less than 6 to 8 pile diameters. For pile groups with a minimum spacing of 3 pile diameters, we recommend reducing the single pile allowable lateral capacities by the percentages in the following table.

Table 13
Group Reduction Percentages

Number of Piles in Group	Percentage to Reduce single Pile Capacity By
2	25
4	30
9	43
16	48
25	54

Please contact us if group reduction percentages are needed for additional pile group configurations.

5.2.3 Driven Pile Installation and Testing

5.2.3.1 Indicator Piles

We recommend that indicator piles be driven to:

- Develop production driving criteria.
- More accurately estimate production pile lengths that will vary based on driving resistance and depth to various soil layers.

- Determine appropriate predrill depth, if required.
- Evaluate the contractors pile driving system.

Both the indicator and production piles should be driven with the same pile driving system. The hammer should be capable of delivering a minimum rated driving energy of approximately 70,000 foot-pounds. We recommend that the contractor perform a wave equation analysis to confirm the compatibility and drivability of the pile driving system with the pile type and soil conditions onsite. The wave equation analysis will also help confirm that the pile driving stresses will not exceed the allowable pile stresses. We should review the wave equation results prior to mobilization of pile driving equipment to the site.

Indicator piles should be cast at least 5 feet longer than needed to confirm field pile capacities and final design lengths.

Indicator piles may be driven as production piles provided that minimum recommended tip elevations are achieved and no structural damage occurs to the pile from installation. However, optional indicator locations may be preferable to allow for evaluation of predrill depths and other factors.

Once foundation plans are finalized, including the number and layout, we should be retained to prepare an indicator pile program for the project.

5.2.3.2 Pile Load Tests

We recommend that the vertical allowable downward capacity be evaluated by performing a pile load test prior to production pile installation.

The load test should be performed in accordance with ASTM D1143 (Reapproved 1994) *Standard Test Method for Piles Under Static Axial Compressive Load*, *Standard Loading Procedure*. The Standard Loading Procedure requires loading up to 200 percent of the design load. Because testing a pile to failure can provide the best information for determining actual capacities, we recommend that additional loading be performed if the pile does not fail under 200 percent of the design load. In this case, we recommend that Section 5.1 of ASTM D1143 be performed, *Loading in Excess of Standard Test Load,* and the maximum load be increased to 300 percent of design load.

An optional uplift capacity load test may be performed in accordance with ASTM D3689-90 *Standard Test Method for Individual Piles Under Static Axial Tensile Load*.

Prior to test pile installation, we will review the indicators pile driving logs and the wave equation analysis to select the appropriate locations.

The contractor is responsible for the design, operation, and safety of the load test system. This includes supplying and installing all of the necessary components including the dial gauges and reference beams.

We should be retained to review the load test program prior to mobilization of pile test equipment to the site. We should also be retained to monitor and evaluate the entire pile load test, including test pile installation.

Load test piles should not be used as production piles. It may be feasible to use at least one of the indicator piles for the load test reaction piles.

5.2.3.3 Production Piles

Following our analysis of the indicator pile installation and load testing, we should be retained to consult with you and structural engineer to establish the minimum pile lengths necessary to achieve the desired pile capacities.

Production piles should be driven using the same hammer and system as the indicator and load test piles. We will use data obtained from the indicator pile program, load tests, wave equation analysis, and this geotechnical report to develop pile driving criteria for production piles.

We should be retained to observe and record the results of all production pile driving.

5.3 LIGHT POLE FOUNDATIONS

We understand isolated light poles may be included with the improvements on-site. Details of light pole loading have not yet been developed, however, we recommend light poles be supported on shallow spread footings to avoid drilled pier excavations that could penetrate into the refuse. The intent is to provide a shallow embedded footing wide enough to resist overturning that does not extend into or near the refuse.

Shallow light pole footings should be embedded between 2 to 3 feet below adjacent grade and designed for a maximum average allowable bearing pressure of 500 pounds per square foot (psf) for dead plus live loads. For overturning resistance, use a maximum heel bearing pressure of 1,000 psf due to temporary wind and seismic loading.

The maximum allowable bearing pressure is a net value; the weight of the footing may be neglected for design purposes. All footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 (horizontal:vertical) plane projected upward from the bottom edge of the trench to the footing.

We recommend that we review the preliminary foundation plans and structural loads to check that these recommendations are appropriate.

5.4 EXTERIOR FLATWORK

Exterior flatwork includes items such as concrete sidewalks, steps, and outdoor courtyards exposed to foot traffic only. To reduce potential for damage from expansive soil as well as settlement, we recommend the following.

Provide a minimum section of 5 inches of concrete over 6 inches of aggregate base. Compact the aggregate base to at least 90 percent relative compaction (ASTM D1557). Place wire mesh or rebar within the middle third of the slab to help control the width and offset of cracks. Construct control and construction joints in accordance with current Portland Cement Association Guidelines.

6.0 EARTHWORK RECOMMENDATIONS

The relative compaction and optimum moisture content of soil and aggregate base referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal *flexing* or *pumping,* as determined by an ENGEO representative.

As used in this report, the term "moisture condition" refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry.

We define "structural areas" in Section 3 of this report as any area sensitive to settlement of compacted soil. These areas include, but are not limited to building pads, sidewalks, pavement areas, and retaining walls.

6.1 COMPOST MATURATION AREA

We understand the compost maturation area will support piles or rows of waste and heavy equipment on a soil subgrade and it is desired to have an all-weather surface without gravel or aggregate base. In order to accomplish this, we present the following alternatives for the compost maturation area subgrade.

- Import 2½ feet of soil and compact to 95 percent relative density. Import material should be predominately granular and have a minimum R-value of 25.

- Place Tensar TriAx Geogrid, or equivalent, at the base of the subgrade section and import 18 inches of predominately granular select fill, with a minimum R-value of 25, compacted to 95 percent relative density.

- Lime treat the upper 18-inches of clay soil. For planning purposes we recommend a 4 percent high calcium lime by dry weight. Additional laboratory testing should be performed to finalized lime treatment design. Lime should be evenly mixed and compacted to 95 percent relative density.

Allow ENGEO to sample and test proposed select imported fill within the compost maturation area at least 72 hours prior to delivery to the site.

6.2 GENERAL SITE CLEARING

Strip the site to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or, if considered suitable by the landscape architect and owner, use them in landscape fill.

It may also be feasible to mulch organics in place, depending on the amount and type of vegetation present at the time of grading as well as the proposed mulching method. If desired, ENGEO can evaluate site vegetation at the time of grading to determine the feasibility of mulching organics in place.

6.3 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. Wet soil can make proper compaction difficult or impossible. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather;
2. Mixing with drier materials;
3. Mixing with a lime, lime-flyash, or cement product; or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated and approved by ENGEO prior to implementation.

6.4 ACCEPTABLE FILL

On-site soil material is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension.

Imported fill materials should meet the above requirements, have a plasticity index less than 20, and have at least 20 percent passing the No. 200 sieve. Allow ENGEO to sample and test proposed imported fill materials at least 72 hours prior to delivery to the site.

See Section 6.1 for select import requirements within the Compost Maturation Area.

6.5 FILL COMPACTION

6.5.1 Grading in Structural Areas (Building and Equipment Areas)

If the shallow foundation alternative is used, an engineered fill 'cap' should be constructed, extending a minimum of 3 feet below subgrade level. Depending on current and proposed site grades, this may require over excavation of non-engineered fill and recompaction as outlined below.

Perform subgrade compaction prior to fill placement, following cutting operations, and in areas left at grade as follows.

1. Scarify to a depth of at least 8 inches;

2. Moisture condition soil to at least 3 percentage points over the optimum moisture content; and

3. Compact the subgrade to at least 90 percent relative compaction. Compact the upper 6-inches of finish pavement subgrade to at least 92 percent relative compaction prior to aggregate base placement.

After the subgrade has been compacted, place and compact acceptable fill (defined in Section 6.4) as follows:

1. Spread fill in loose lifts that do not exceed 8 inches;

2. Moisture condition lifts to at least 3 percentage points over the optimum moisture content; and

3. Compact fill to at least 90 percent relative compaction; compact the upper 6 inches of fill in pavement areas to at least 92 percent relative compaction prior to aggregate base placement.

6.5.2 Underground Utility Backfill

The contractor is responsible for conducting all trenching and shoring in accordance with CALOSHA requirements. Project consultants involved in utility design should specify pipe bedding materials.

Place and compact trench backfill in structural areas as follows:

1. Trench backfill should have a maximum particle size of 6 inches;

2. Moisture condition trench backfill to 3 percent above the optimum moisture content. Moisture condition backfill outside the trench;

3. Place fill in loose lifts not exceeding 12 inches; and

4. Compact fill to a minimum 90 percent relative compaction

Jetting of backfill is not an acceptable means of compaction. We may allow thicker loose lift thicknesses based on acceptable density test results, where increased effort is applied to rocky fill, or for the first lift of fill over pipe bedding.

6.5.3 Landscape Fill

Process, place and compact fill in accordance with Sections 6.5, except compact to at least 85 percent relative compaction (ASTM D1557).

6.6 SLOPES

6.6.1 Gradients

Construct final slope gradients to 3:1 (horizontal:vertical) or flatter. The contractor is responsible to construct temporary construction slopes in accordance with CALOSHA requirements.

6.6.2 Fill Placed on Existing Slopes

We recommend keying and benching where fills are placed on original grade with a gradient of 6:1 or steeper.

Construct a minimum 20-foot wide key inward from the toe of the new fill slope. Extend the key at least 2 feet below original grade into firm competent soil, as determined by ENGEO. Slope the key bottom at least 2 percent downward toward the heel of the key. Deeper keys may be required by ENGEO based on actual soil/rock conditions observed during construction.

Cut benches into original grade after the key has been nearly filled and compacted in accordance with Section 6.5. Construct benches into original slope grade as filling proceeds every 2 feet vertically, to remove loose soil. Deeper bench depths may be required by ENGEO depending on actual conditions observed during construction. Bench widths will vary depending on the original slope grade and actual bench depth.

6.7 SURFACE DRAINAGE

The project civil engineer is responsible for designing surface drainage improvements. With regard to geotechnical engineering issues, we provide the following minimum recommendation for surface drainage.

1. Slope pavement areas a minimum of 1 percent towards drop inlets or other surface drainage devices.

2. Slope finished grade away from building exteriors at a minimum of 5 percent for a distance of at least 10 feet.

3. Discharge roof down spouts away from buildings to appropriate drainage devices.

7.0 BELOW GRADE RETAINING WALLS

7.1 LATERAL EARTH PRESSURES

Design below grade retaining walls to resist lateral earth pressures from adjoining natural materials and/or backfill and from any surcharge loads. Provided that adequate drainage is included as recommended below, design walls restrained from movement at the top to resist an equivalent fluid pressure of 65 pounds per cubic foot (pcf). In addition, design restrained walls to resist an additional uniform pressure equivalent to one-half of any surcharge loads applied at the surface.

Design unrestrained retaining walls with adequate drainage to resist an equivalent fluid pressure of 40 pcf plus one-third of any surcharge loads.

The above lateral earth pressures assume level backfill conditions and sufficient drainage behind the walls to prevent any build-up of hydrostatic pressures from surface water infiltration and/or a rise in the groundwater level. If adequate drainage is not provided, we recommend that an additional equivalent fluid pressure of 40 pcf be added to the values recommended above for both restrained and unrestrained walls. Damp-proofing of the walls should be included in areas where wall moisture would be problematic.

Construct a drainage system, as recommended in Section 7.3, to reduce hydrostatic forces behind the retaining wall.

7.2 SEISMIC LATERAL EARTH PRESSURE

Based on the subsurface conditions encountered during our geotechnical exploration and the probabilistic horizontal peak horizontal ground acceleration of 0.51g obtained from the CGS website, we developed seismic design parameters for retaining walls. For calculation of seismic

loading on retaining walls, apply a resultant load of 11.4 H^2 acting on the wall at 0.6 H from the wall base if the wall is unrestrained. If the wall is restrained from movement at the top, the resultant load would be 30.6 H^2 acting at 0.55 H from the wall base. In these equations, the load is in pounds per foot of wall length, and the dimension H is the height of retained earth, in feet.

7.3 RETAINING WALL DRAINAGE

Construct either graded rock drains or geosynthetic drainage composites behind the retaining walls to reduce hydrostatic lateral forces. For rock drain construction, we recommend two types of rock drain alternatives:

1. A minimum 12-inch-thick layer of Class 2 Permeable Filter Material (Caltrans Specification 68-1.025) placed directly behind the wall, or

2. A minimum 12-inch-thick layer of washed, crushed rock with 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. Envelope rock in a nonwoven geotextile filter fabric such as Mirafi 140NC, or equivalent.

For both types of rock drains:

1. Place the rock drain directly behind the walls of the structure.

2. Extend rock drains from the wall base to within 12 inches of the top of the wall.

3. Place a minimum of 4-inch-diameter perforated pipe at the base of the wall, inside the rock drain and fabric, with perforations placed down.

4. Place pipe at a gradient at least 1 percent to direct water away from the wall by gravity to a drainage facility.

ENGEO should review and approve geosynthetic composite drainage systems prior to use.

8.0 PAVEMENT DESIGN

8.1 FLEXIBLE PAVEMENTS

We obtained a representative bulk sample of the surface soil and performed R-value tests to provide data for pavement design. The results of the test are included in Appendix C and indicate R-values of 7 and less than 5, with some expansion pressure. Because of the relatively uniform clay encountered across the site, we judged an R-value of 5 to be applicable for design. Using estimated traffic indices, correlated to specific improvements on-site, we developed the following recommended pavement sections using Procedure 608 of the Caltrans Highway Design Manual (including the asphalt factor of safety), presented in below.

Table 14
Recommended Asphalt Concrete Pavement Sections

Estimated Traffic Index	Pavement Section	
	Asphalt Concrete (in.)	Class 2 Aggregate Base (in.)
5	2½	11
6	3	14
7	3½	17

The civil engineer should determine the appropriate traffic indices for parking areas, entry/exit drives and fire/maintenance roads based on anticipated vehicle loading and frequencies.

To reduce pavement distress due to long term landfill settlement, place Tensar TriAx geogrid or equivalent on the prepared subgrade prior to aggregate base placement.

8.2 RIGID PAVEMENTS

Use concrete pavement sections to resist heavy loads and turning forces in areas such as fire lanes or trash enclosures. Final design of rigid pavement sections and reinforcement should be performed based on estimated traffic loads and frequencies. We recommend the following minimum design sections for rigid pavements:

- Use a minimum section of 6 inches of Portland Cement concrete over 6 inches of Caltrans Class 2 Aggregate Base.
- Concrete pavement should have a minimum 28-day compressive strength of 3,500 psi.
- Provide minimum control joint spacing in accordance with Portland Cement Association guidelines.

8.3 PAVEMENT SUBGRADE AND AGGREGATE BASE COMPACTION

Compact finish subgrade in accordance with Section 6.5. Compact the Caltrans Class 2 Aggregate Base section to at least 95 percent relative compaction (ASTM D1557). Moisture condition aggregate base to or slightly above the optimum moisture content prior to compaction. Aggregate Base should meet the requirements for ¾ -inch maximum Class 2 AB per section 26-1.02a of the latest Caltrans Standard Specifications.

9.0 PLAN REVIEW AND CONSTRUCTION MONITORING

Our experience and that of our profession clearly indicates that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to:

1. Review the final grading and foundation plans and specifications prior to construction to determine whether our recommendations have been implemented, and to provide additional or modified recommendations, if necessary. This also allows us to check if any changes have occurred in the nature, design or location of the proposed improvements and provides the opportunity to prepare a written response with updated recommendations.

2. Perform construction monitoring to check the validity of the assumptions we made to prepare this report. All earthwork operations should be performed under the observation of our representative to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of the fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is essential.

If we are not retained to perform the services described above, then we are not responsible for any party's interpretation of our report (and subsequent addenda, letters, and verbal discussions).

10.0 SPECIAL INSPECTIONS

In accordance with Chapter 17 of the 2007 California Building Code, we recommend special inspections for soil fill placement (Section 1704A.7) and pile foundation construction (Section 1704A.8). The recommended minimum inspection frequencies are summarized below.

Table 15
Inspection of Soils*

Task	Continuous Inspection	Periodic Inspection
Inspection footing excavations – material and depth		X
Classification and testing of controlled fill		X
Inspection of fill material, density and lift thickness during engineered fill placement	X	
Site clearing and subgrade inspection		X

*Based on CBC Section 17, Table 1704A.7

Table 16
Inspection of Pile Foundations*

Task	Continuous Inspection	Periodic Inspection
Inspect pile materials, sizes and lengths per project specifications	X	
Observation of test piles and load tests, as required	X	
Installation observation- hammer type, plumbness, location, blow counts, tip elevations, pile damage	X	

*Based on CBC Section 17, Table 1704A.8

Additional special inspections may be required, including masonry construction, concrete placement, steel construction, and wood framing depending on the final improvements at the site.

11.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the Zero Waste Energy Anaerobic Digestion Facility project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of the actual subsurface conditions across the site. Considering possible underground variability of soil, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, notify ENGEO immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, then notify the proper regulatory officials immediately.

This document must not be subject to unauthorized reuse that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from

the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

FIGURES

Figure 1 - Vicinity Map
Figure 2 - Exploration Layout with Exiting Topography
Figure 3 - Exploration Layout with Proposed Improvements
Figure 4 - Section A-A'
Figure 5 - Section B-B'
Figure 6 - Section C-C'
Figure 7 - Boring B8A and Matched CPT Comparison
Figure 8 - Regional Faulting and Seismicity Map
Figure 9 - Alluvium Thickness Map
Figure 10 - Site Specific Maximum Credible Earthquake
Figure 11 - Design Response Spectrum
Figure 12 – Surcharge Area and Slope Stability Selection Locations

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N

0 MILES 1
0 KILOMETERS 2

BASE MAP SOURCE: MS STREETS AND TRIPS

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VICINITY MAP

ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY

SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO.
DATE: MARCH 2010		1
DRAWN BY: SRP	CHECKED BY: MG	

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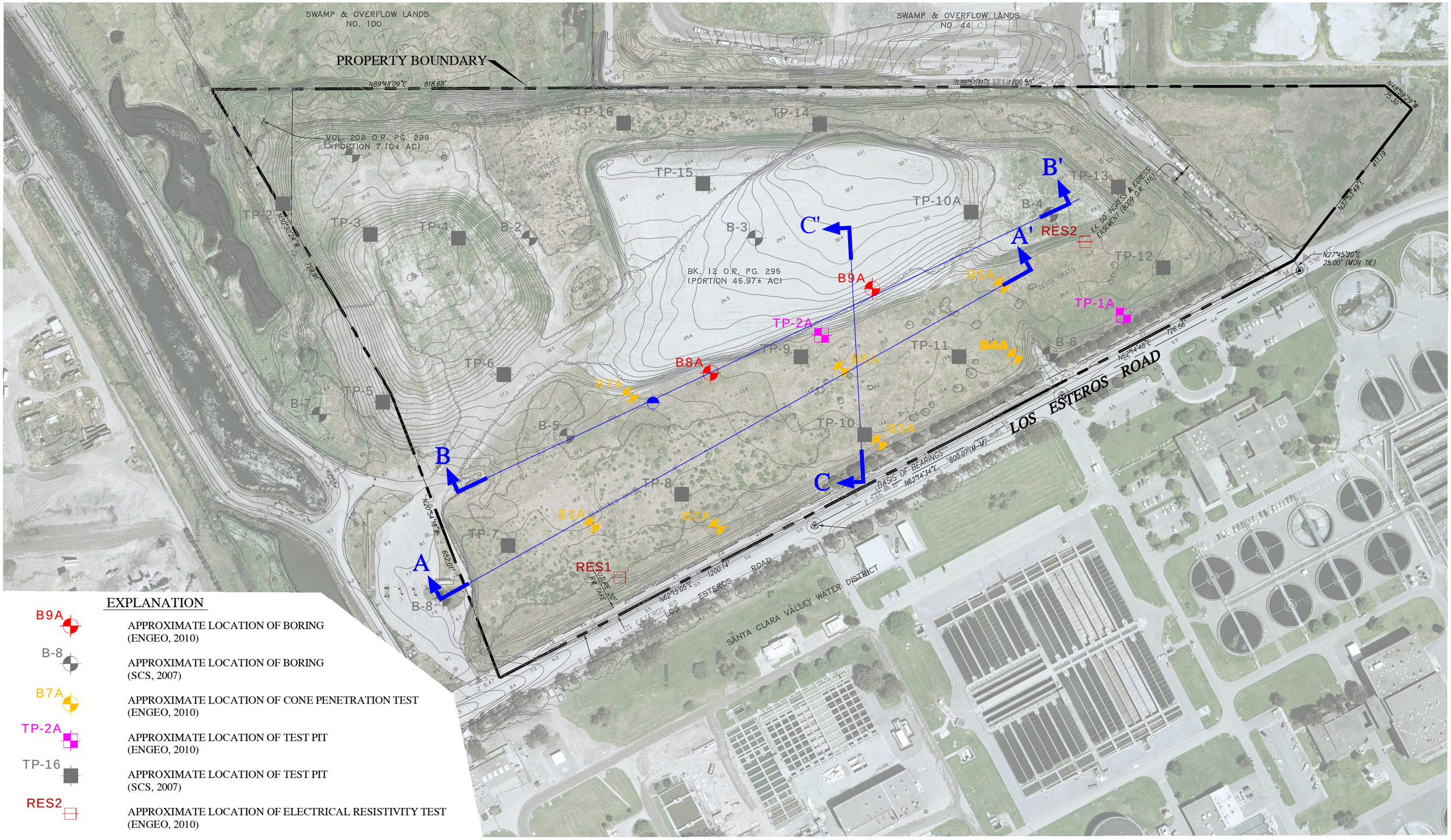

EXPLANATION

B9A	APPROXIMATE LOCATION OF BORING (ENGEO, 2010)
B-8	APPROXIMATE LOCATION OF BORING (SCS, 2007)
B7A	APPROXIMATE LOCATION OF CONE PENETRATION TEST (ENGEO, 2010)
TP-2A	APPROXIMATE LOCATION OF TEST PIT (ENGEO, 2010)
TP-16	APPROXIMATE LOCATION OF TEST PIT (SCS, 2007)
RES2	APPROXIMATE LOCATION OF ELECTRICAL RESISTIVITY TEST (ENGEO, 2010)
	APPROXIMATE LOCATION OF INFILTRATION TEST (ENGEO, 2010)
C C'	APPROXIMATE LOCATION OF CROSS SECTION

N

0 FEET 200
0 METERS 100

BASE MAP SOURCE: WORLEY PARSONS

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EXPLORATION LAYOUT WITH EXISTING TOPOGRAPHY

ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY

SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO.
DATE: MARCH 2010		2
DRAWN BY: PC	CHECKED BY: MG	

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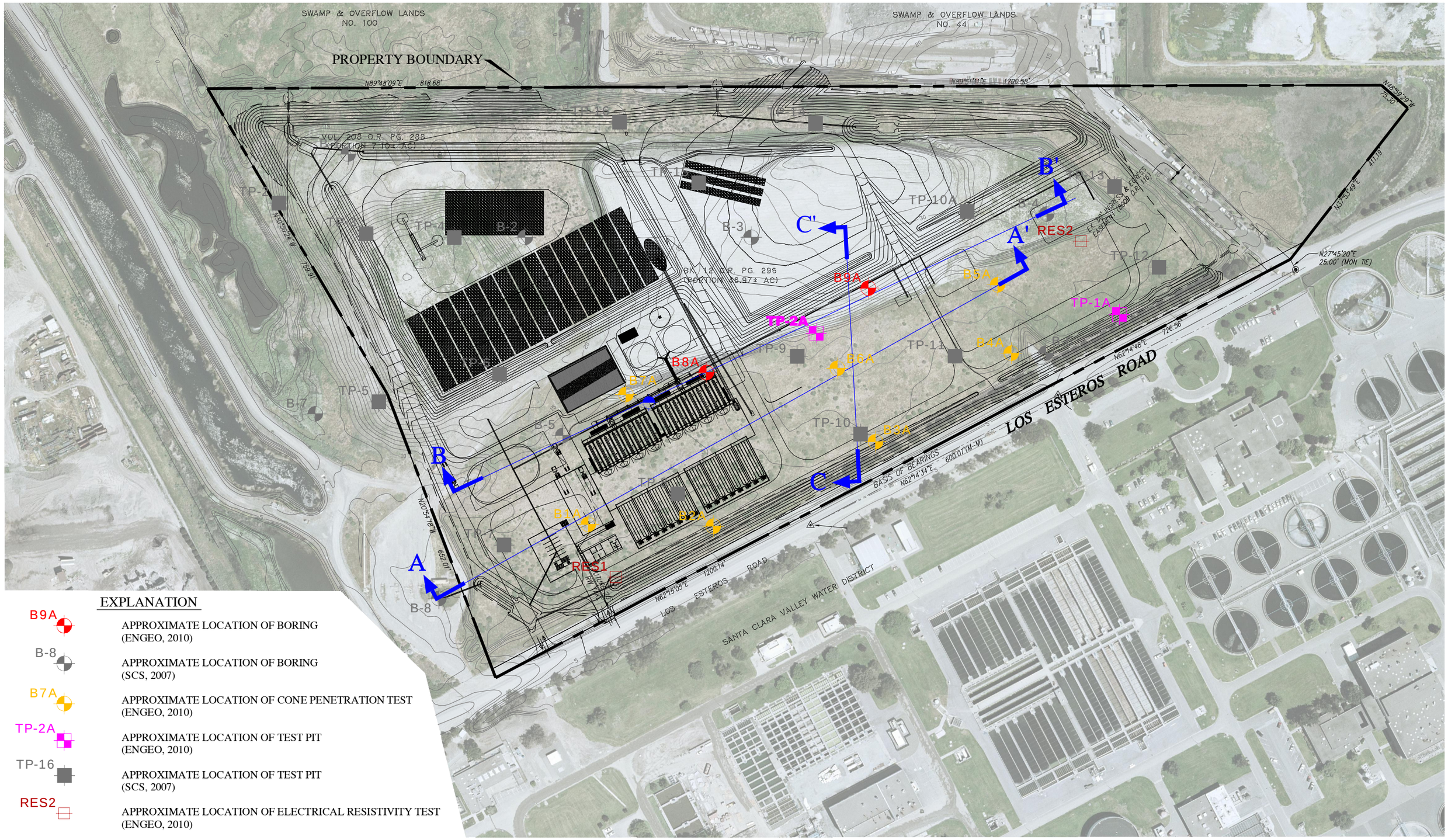

EXPLANATION

B9A	APPROXIMATE LOCATION OF BORING (ENGEO, 2010)
B-8	APPROXIMATE LOCATION OF BORING (SCS, 2007)
B7A	APPROXIMATE LOCATION OF CONE PENETRATION TEST (ENGEO, 2010)
TP-2A	APPROXIMATE LOCATION OF TEST PIT (ENGEO, 2010)
TP-16	APPROXIMATE LOCATION OF TEST PIT (SCS, 2007)
RES2	APPROXIMATE LOCATION OF ELECTRICAL RESISTIVITY TEST (ENGEO, 2010)
	APPROXIMATE LOCATION OF INFILTRATION TEST (ENGEO, 2010)
C C'	APPROXIMATE LOCATION OF CROSS SECTION

N

0 FEET 200
0 METERS 100

BASE MAP SOURCE: WORLEY PARSONS, MARCH 2, 2010

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EXPLORATION LAYOUT WITH PROPOSED IMPROVEMENTS

ZERO WASTE ENGERGY ANAEROBIC DIGESTION FACILITY

SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO.
DATE: MARCH 2010		3
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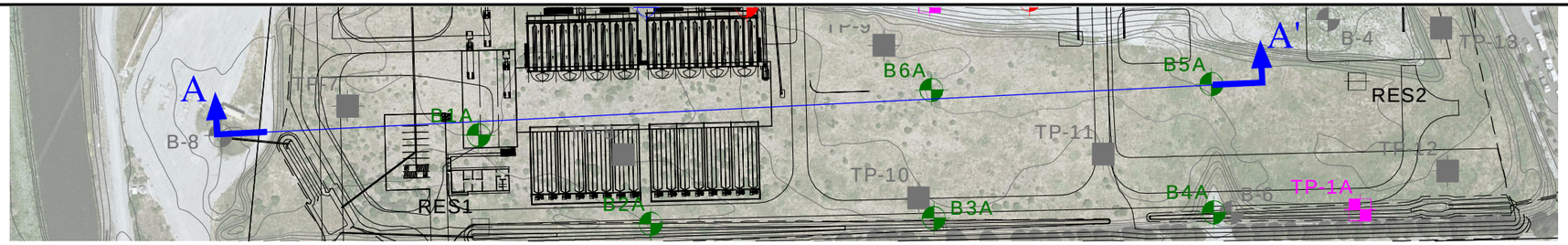
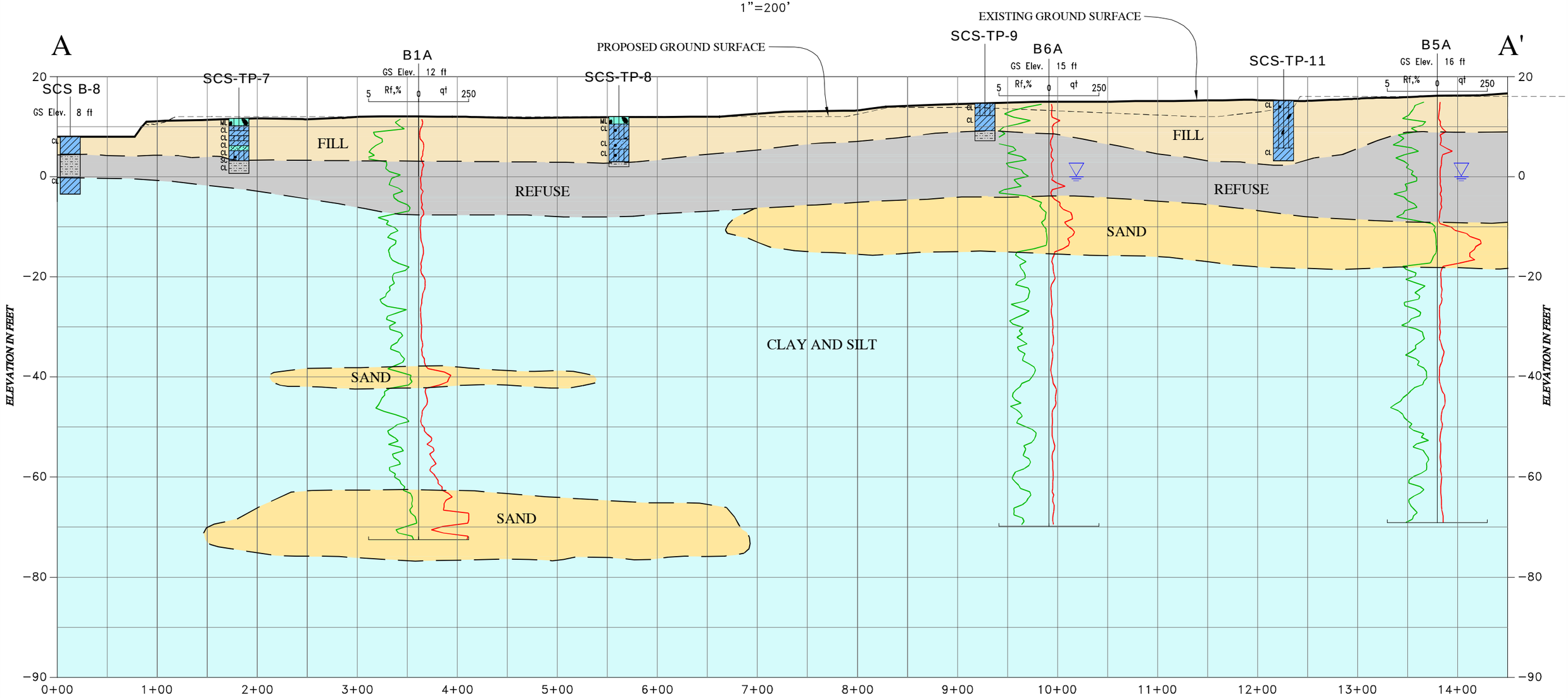


PLAN VIEW
1"=200'



SECTION A-A'
1"=100'(H), 1"=20'(V)

EXPLANATION

APPROXIMATE GROUNDWATER ELEVATION

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SECTION A-A'
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

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FIGURE NO. 4

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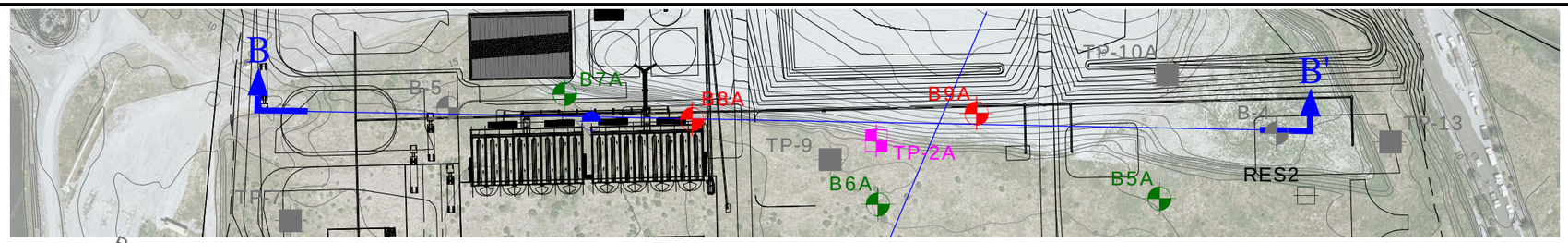
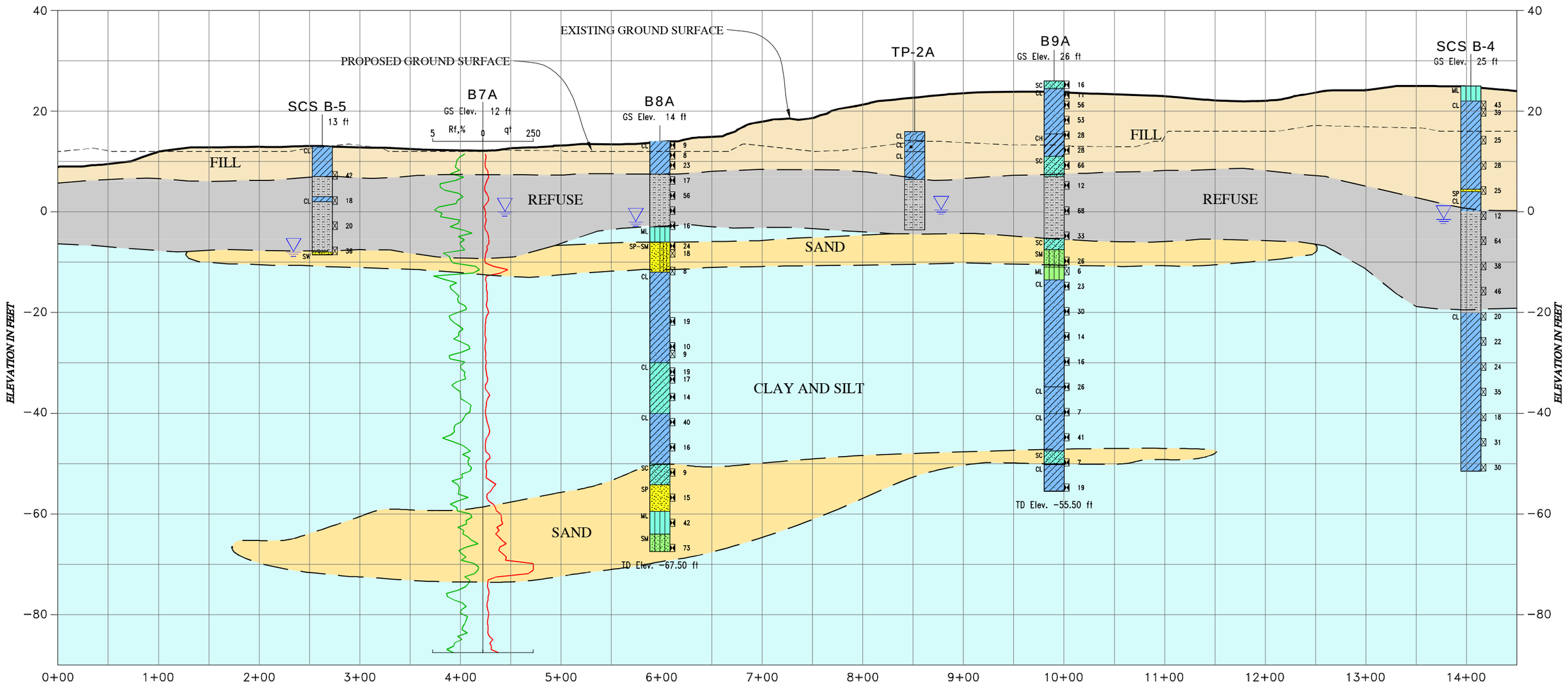


PLAN VIEW
1"=200'



SECTION B-B'
1"=100'(H), 1"=20'(V)

EXPLANATION

APPROXIMATE GROUNDWATER ELEVATION

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SECTION B-B'
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

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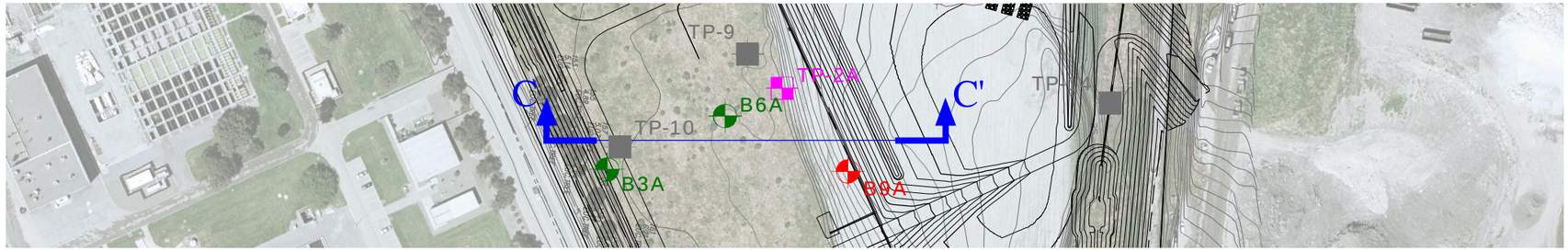
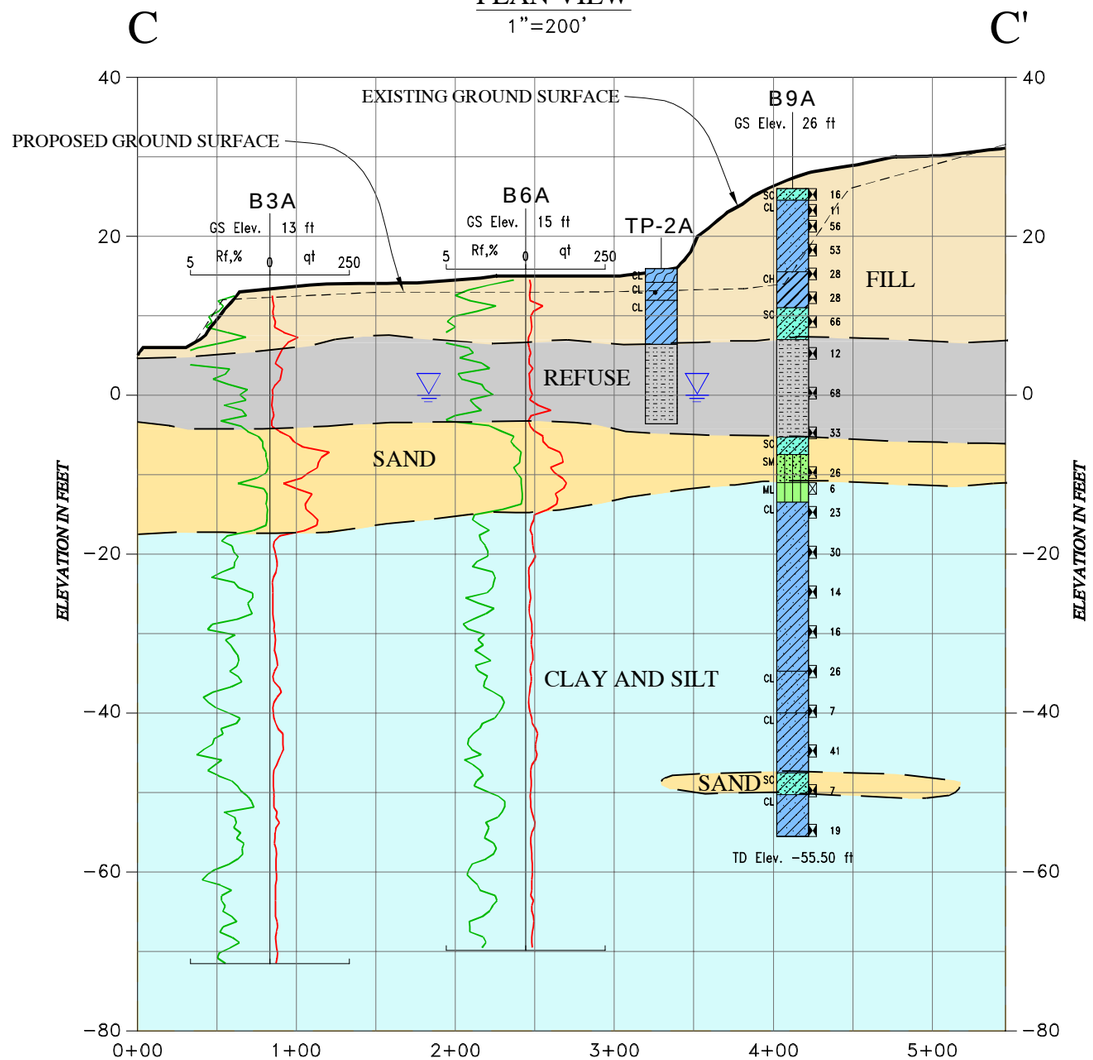


PLAN VIEW
1"=200'



SECTION C-C'
1"=100'(H), 1"=20'(V)

EXPLANATION

APPROXIMATE GROUNDWATER ELEVATION

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SECTION C-C'
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

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FIGURE NO
6

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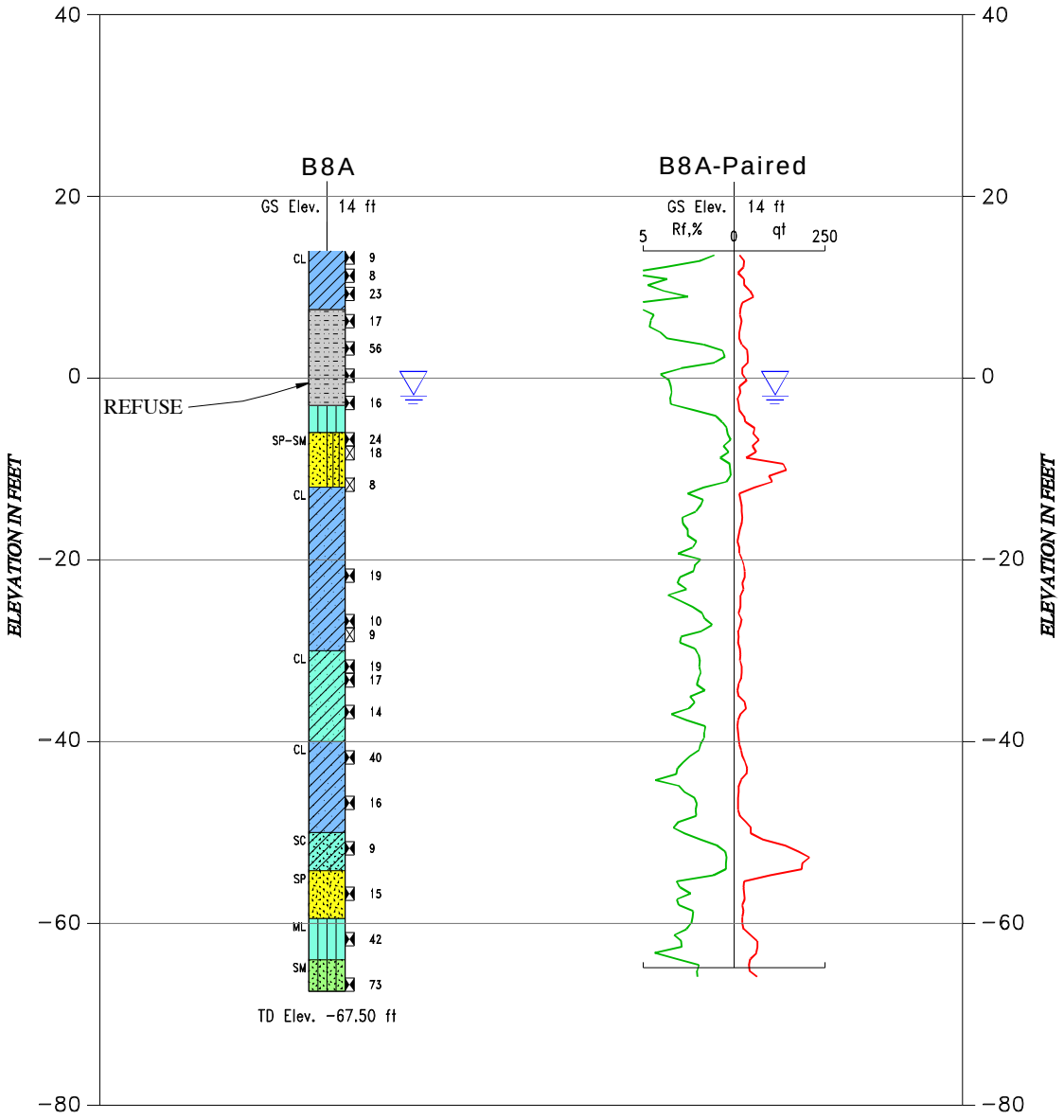

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BORING B8A AND MATCHED CPT COMPARISON
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

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FIGURE NO. 7

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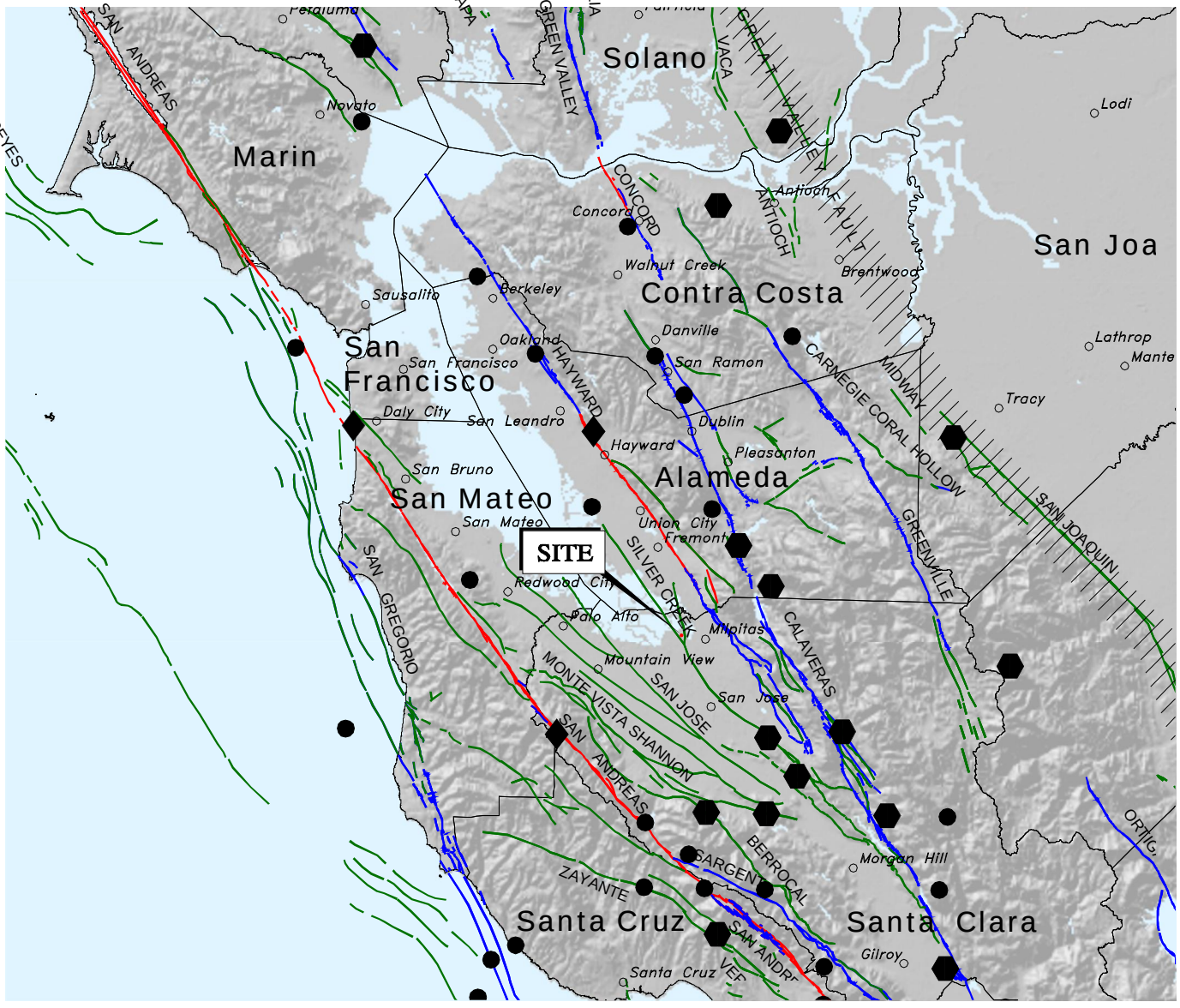

EXPLANATION

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6
- HISTORIC FAULT
- HOLOCENE FAULT
- QUATERNARY FAULT
- HISTORIC BLIND THRUST FAULT ZONE

N

0 MILES 15
0 KILOMETERS 30

BASE MAP SOURCE:
U.S.G.S. 1-ARC SECOND S.R.T.M. DATABASE
U.S.G.S. QUATERNARY FAULT DATABASE, MARCH, 2006
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-2000)

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REGIONAL FAULTING AND SEISMICITY
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

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FIGURE NO. 8

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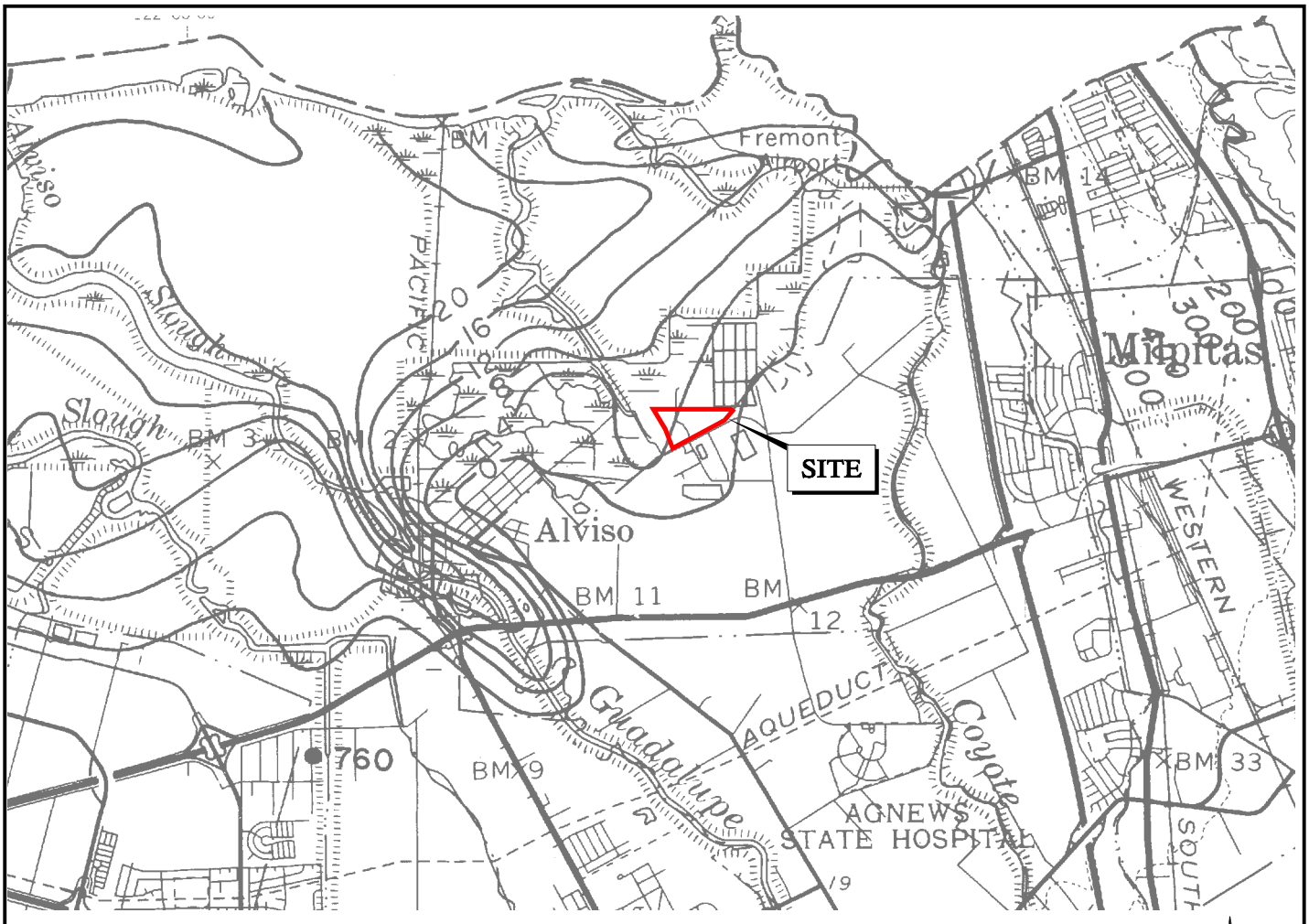

0 MILES 1
0 KILOMETERS 2

N

EXPLANATION

ISOPACH OF SOIL-LIKE ALLUVIAL MATERIAL (ESTIMATED SHEAR WAVE VELOCITY LESS THAN 2500 FEET PER SECOND): ISOPACH INTERVAL 100 FEET; SOLID WHERE CONTROL IS GOOD, DASHED WHERE CONTROL IS OF INTERMEDIATE QUALITY, DOTTED WHERE CONTROL IS POOR.

● 132 * DATA POINT: WELL; PENETRATED BEDROCK AT INDICATED DEPTH IN FEET BELOW GROUND SURFACE ("BEDROCK" FOR THE PURPOSES OF THIS REPORT IS CONSIDERED TO BE MATERIAL WITH AN ESTIMATED SHEAR WAVE VELOCITY IN EXCESS OF 2500 FEET PER SECOND).

○ 52 * DATA POINT: WELL; STILL IN SOIL-LIKE ALLUVIAL MATERIAL AT DEPTH IN FEET BELOW GROUND SURFACE INDICATED.

** ISOPACH INDICATING THICKNESS OF BAY MUD; ISOPACH INTERVAL 4 FEET.

* - DATA FROM CALIFORNIA DEPARTMENT OF WATER RESOURCES (WATER WELL LOGS), CALIFORNIA DEPARTMENT OF TRANSPORTATION (ENGINEERING BORINGS), SAN JOSE WATER WORKS (WATER WELL DATA), COOPER-CLARK & ASSOCIATES (ENGINEERING BORINGS), CITIES OF MORGAN HILL AND GILROY-PUBLIC WORKS DEPARTMENTS (WATER WELL DATA), DAMES & MOORE (ENGINEERING BORINGS)

** - DATA AFTER TUDOR ENGINEERING (1973).

BASE MAP SOURCE: BISHOP, 1974

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ALLUVIAL THICKNESS MAP

ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY

SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO. 9
DATE: MARCH 2010		
DRAWN BY: SRP	CHECKED BY: MG	

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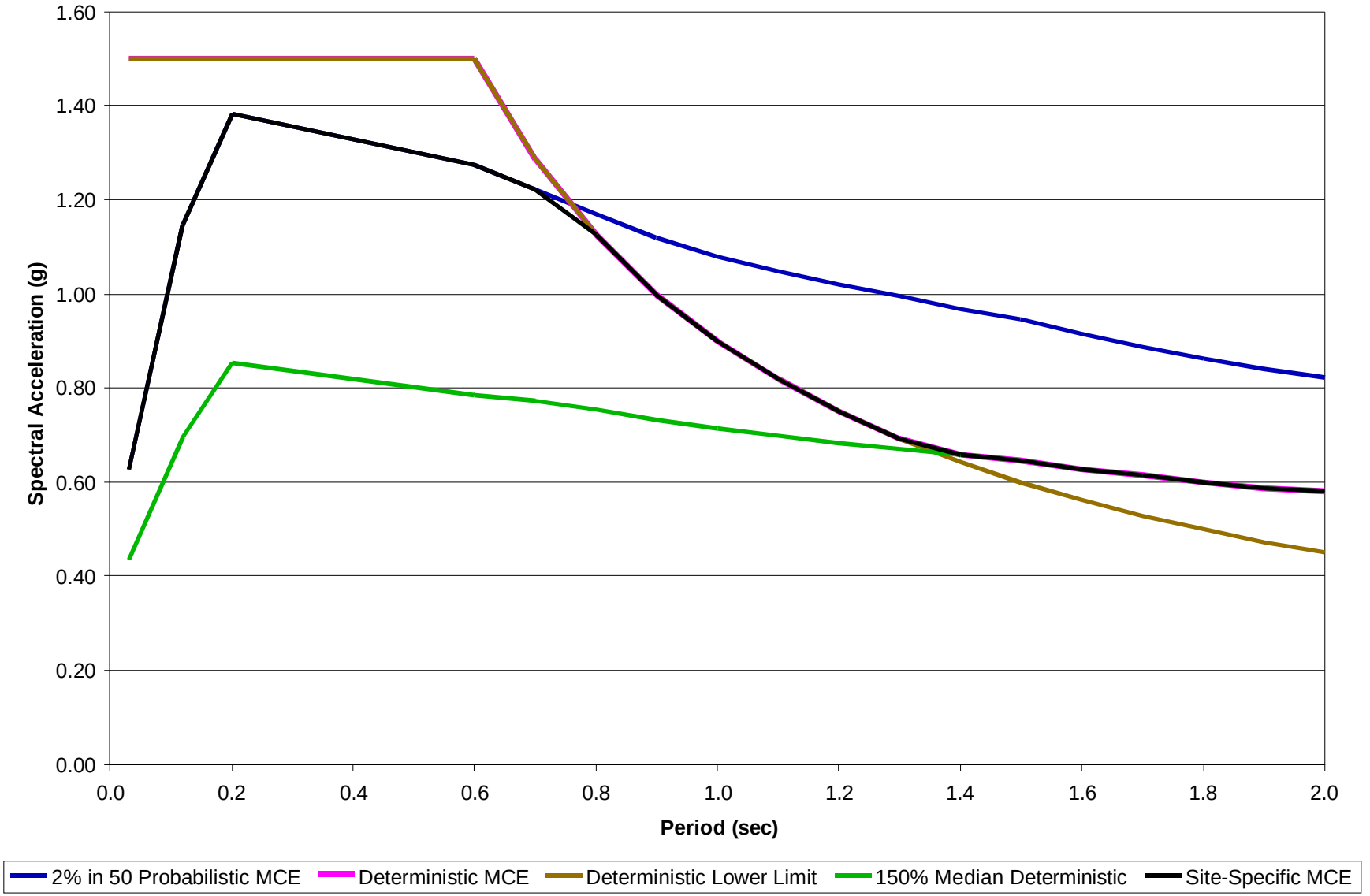

NO SCALE

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SITE SPECIFIC MAXIMUM CREDIBLE EARTHQUAKE
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

PROJECT NO.:	8900.000.000
DATE:	MARCH 2010
DRAWN BY: PC	CHECKED BY: MG

FIGURE NO. 10

ORIGINAL FIGURE PRINTED IN COLOR

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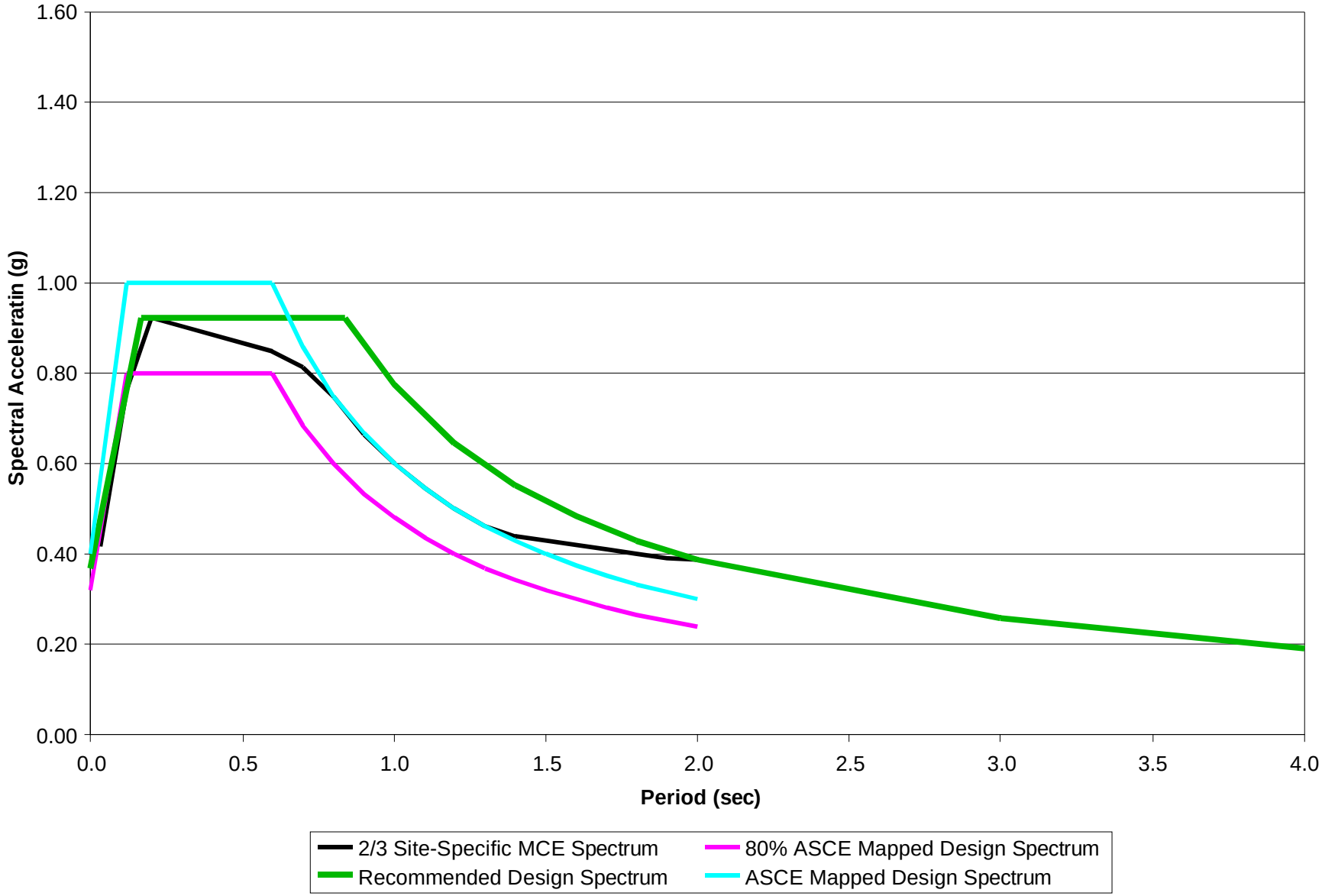

NO SCALE

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Expect Excellence

DESIGN RESPONSE SPECTRUM
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000	FIGURE NO. 11
DATE: MARCH 2010	
DRAWN BY: PC	CHECKED BY: MG

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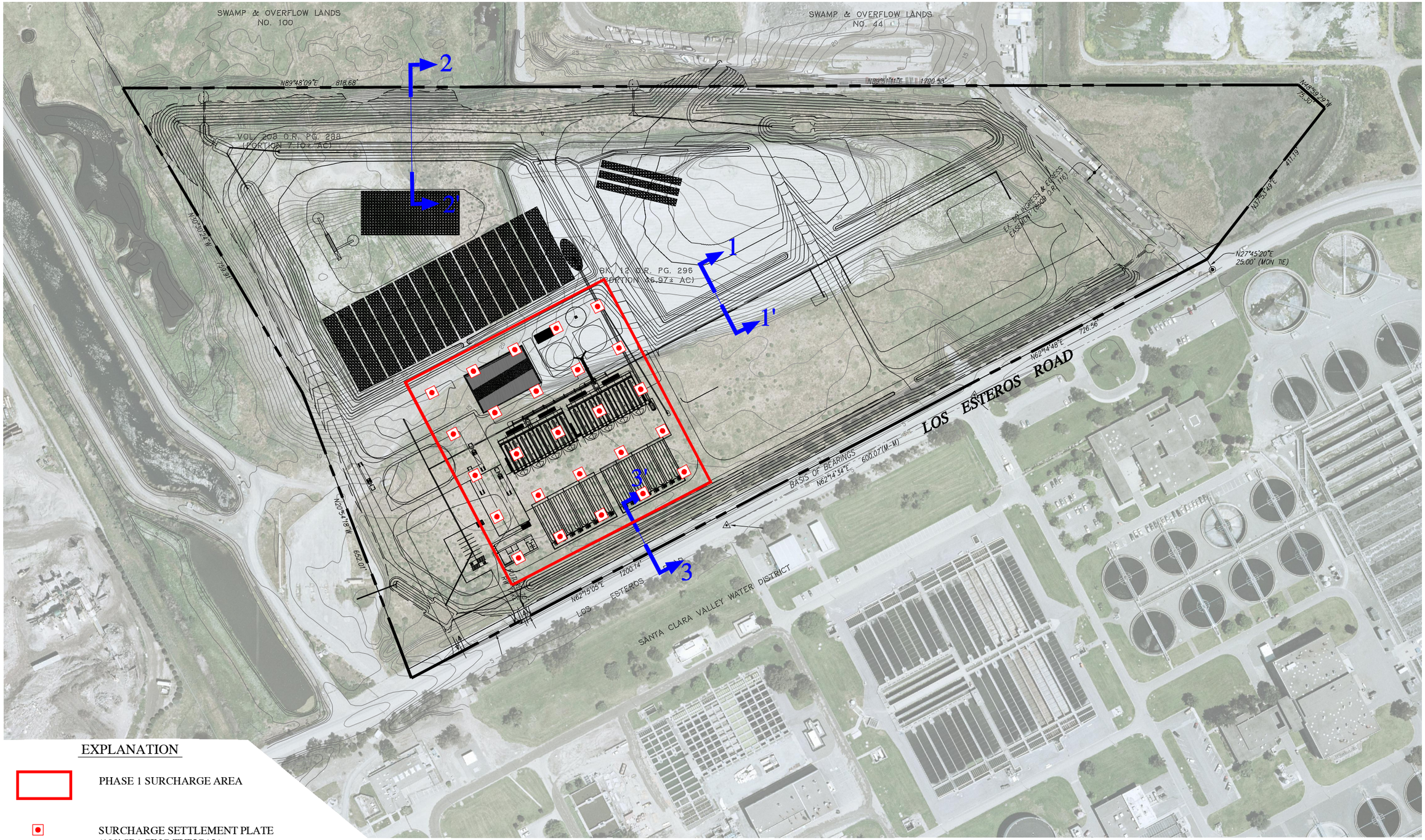

EXPLANATION

PHASE 1 SURCHARGE AREA

SURCHARGE SETTLEMENT PLATE
(100' SPACING TYPICAL)

3 3' APPROXIMATE LOCATION OF SLOPE STABILITY CROSS SECTION

N

0 FEET 200
0 METERS 100

BASE MAP SOURCE: WORLEY PARSONS

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SURCHARGE AREA AND SLOPE
STABLILITY SECTION LOCATIONS
ZERO WASTE ENGERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO.
DATE: MARCH 2010		12
DRAWN BY: PC	CHECKED BY: MG	

ORIGINAL FIGURE PRINTED IN COLOR

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APPENDIX A

Key to Boring Logs
Exploration Logs

APPENDIX A

KEY TO SOIL LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW - Well graded gravels or gravel-sand mixtures GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW - Well graded sands, or gravelly sand mixtures SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity CL - Inorganic clay with low to medium plasticity OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Elastic silt with high plasticity CH - Fat clay with high plasticity OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

For fine-grained soils with 15 to 29% retained on the #200 sieve, the words "with sand" or "with gravel" (whichever is predominant) are added to the group name.

For fine-grained soil with >30% retained on the #200 sieve, the words "sandy" or "gravelly" (whichever is predominant) are added to the group name.

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4 "		3"	12"
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*
VERY SOFT	0-1/4
SOFT	1/4-1/2
MEDIUM STIFF	1/2-1
STIFF	1-2
VERY STIFF	2-4
HARD	OVER 4

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Continuous Core
- Bag Samples
- Grab Samples
- NR No Recovery

MOISTURE CONDITION

DRY	Dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater

LINE TYPES

- Solid - Layer Break
- Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

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LOG OF BORING B8A

ENGEO INCORPORATED

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 14 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY WITH SAND (CL), dark brown, soft, moist, trace gravel, gravel on ground surface, [FILL]			9	38	17	21		19 15.2	116.1	
			Dark brown mottled with yellowish-brown, medium stiff; unconfined compessive strength: 1570 psf										1.5*
			Unconfined compessive strength: 680 psf			8							
	1												1.75*
5			Very stiff			23							3.0*
	2		SILTY CLAY (CL), dark grayish brown to olive, medium stiff, moist, with debris (plywood and plastic sheet), organic an hydrocarbon odors, [SOIL/REFUSE FILL]			17					43.7		
			Specific gravity: 2.24										
			Debris observed										
10	3					56							
			Debris observed										
	4		Wood fragments Wood fragments Paper and glass			17					70.1		
15					▽								
	5		Rubber sheet			16				59	19.5		
			SANDY SILT (ML), olive brown, medium dense, moist, trace organics										
	6												
20			POORLY GRADED SAND WITH SILT (SP-SM), brown, medium dense, wet, trace gravel, trace silt			24				6	26	96.6	
						18					17		
	7		Strong ammonia odor										
25													

LOG OF BORING B8A

ENGEO INCORPORATED

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 14 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			POORLY GRADED SAND WITH SILT (SP-SM), brown, medium dense, wet, trace gravel, trace silt			8	42	21	21		9.7		
	8		SILTY CLAY WITH SAND (CL), yellowish brown mottled with olive, stiff, moist										
	9												
30			Hole caving										
	10												
35						19							
	11		Same olive mottling										2.0*
	12												
40						10							
	13					9	37	17	20		26.7		
			SANDY CLAY (CL), dark yellowish brown mottled with olive, very stiff, moist										
45						19							
	14					17					19.7	110.5	2.5*
	15												
50													

LOG OF BORING B8A

ENGEO INCORPORATED

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
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Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SANDY CLAY (CL), dark yellowish brown mottled with olive, very stiff, moist			14					20.6		0.75*
			Medium dense, with more sand										
	16												
			SILTY CLAY WITH SAND (CL), dark yellowish brown mottled with olive, hard										
55													
	17					40	35	16	19		20.3	78.4	3.0*
	18												
60													
			medium stiff			16					26.3		0.5* 0.5*
	19												
			CLAYEY SAND (SC), yellowish brown, loose to medium dense, wet, fine-grained sand										
65													
	20					9				39	21.8		
			POORLY GRADED SAND WITH SILT (SP), brown to dark yellowish brown, loose, wet, fine- to medium-grained sand										
	21												
70			Medium dense			15				8	28.5		
	22												
			SANDY SILT (ML), dark olive mottled with reddish brown, hard, moist, fine-grained sand										
75													

LOG OF BORING B8A

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 14 ft.

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HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	23		SANDY SILT (ML), dark olive mottled with reddish brown, hard, moist, fine-grained sand			42					22.6		3.5* 3.5*
	24		SILTY SAND (SM), blue gray, dense, wet, medium-grained sand										
80						73				23	14.9		
			Boring terminated at approximately 81 1/2 feet. Groundwater encountered at approximately 16 feet.										

LOG OF BORING B9A

ENGEO INCORPORATED

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 26 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAYEY SAND (SC), dark brown, medium dense, moist, some gravel, gravel on ground surface, [FILL]			16				30	11.9		
			SILTY CLAY WITH SAND (CL), olive brown mottled with yellowish brown, medium stiff, moist, trace gravel, [FILL]			11					15.1	110.2	1.0*
5	1		Specific Gravity: 2.49 Greenish gray, plastic fragment, hard			56					16.1		4.5+*
	2		Mottled gray and yellowish-brown			53					14.3	101.9	4.5+*
10	3		Specific Gravity: 2.37 CLAY (CH), dark brown, stiff, moist, some sand, conduit fragment, [FILL]			28	58	19	39				2.0*
	4		Mottled dark yellowish-brown, trace gravel			28					15.6		2.0*
15	5		CLAYEY SAND WITH GRAVEL (SC), dark brown mottled with olive brown, very dense, moist, [FILL]			66				20	10.9		
20	6		SILTY CLAY WITH SAND (CL), very dark dark black mottled with gray, medium stiff, moist, with paper debris, [SOIL/REFUSE FILL]			12					47.5	96.7	
25	7												

LOG OF BORING B9A

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 26 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	8		SILTY CLAY WITH SAND (CL), very dark dark black mottled with gray, medium stiff, moist, with paper debris, [SOIL/REFUSE FILL]			58/10"							
	9												
30			Peat layer, roots, debris (paper, wire, and plastic)			33					71.7		
			CLAYEY SAND (SC/CL), olive, medium stiff, moist										1.25*
	10												
			SILTY SAND (SM), gray, medium dense, wet										
35													
	11					26				16	22.8		
			SANDY SILT (ML), yellowish brown mottled with gray, medium stiff, moist, ammonia odor			6							
	12												
40			SILTY CLAY WITH SAND (CL), yellowish brown mottled with olive, stiff, moist			23	26	13	13		23		1.25*
	13												
45													
	14		Dark yellowish-brown mottled with olive, stiff			30					21.4		1.75*
	15												
50													

LOG OF BORING B9A

ENGEO INCORPORATED

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 26 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			SILTY CLAY WITH SAND (CL), yellowish brown mottled with olive, stiff, moist			14					29.1		
			Dark yellowish-brown with slight olive mottling										1.0*
	16												
55													
	17		Dark yellowish-brown with faint olive mottling			16					25.1		1.0*
	18												
60													
			SANDY LEAN CLAY (CL), dark yellowish brown, medium stiff, wet			26					19.1		1.0* 0.75*
	19												
65													
	20		SILTY CLAY WITH SAND (CL), dark yellowish brown, medium dense, wet			7					24.9		
	21												
70													
			Very stiff			41					17.9		4.25* 2.5*
	22												
			CLAYEY SAND (SC), dark yellowish brown, loose, wet										
75													

LOG OF BORING B9A

Geotechnical Exploration
ZWE Digestion Facility
San Jose, California
8900.000.000

DATE DRILLED: 2/1/2010
HOLE DEPTH: Approx. 81½ ft.
HOLE DIAMETER: 4 and 8 in.
SURF ELEV (msl): Approx. 26 ft.

LOGGED / REVIEWED BY: M. Harrell / PC
DRILLING CONTRACTOR: Precision Sampling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
	23		CLAYEY SAND (SC), dark yellowish brown, loose, wet			7					23.5		
			SILTY CLAY (CL), dark yellowish brown, medium dense, wet										
	24												
80						16							0.25*
			Medium stiff										
			Boring terminated at approximately 81 1/2 feet. Groundwater level undetermined due to drilling method.										

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EXPANSION INDEX=53
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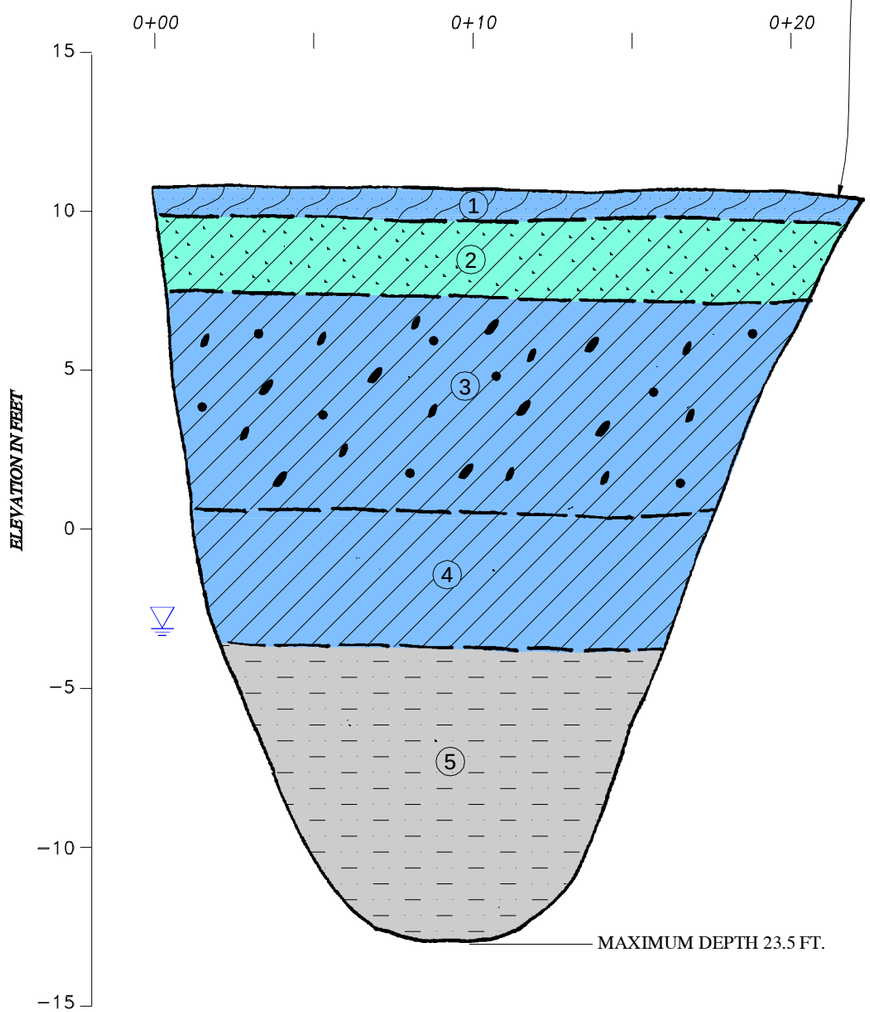
COMPACTION CURVE=124.2PCF AT 9.7% MOISTURE



REFUSE SPOILS

LOOKING INTO TEST PIT

EXPLANATION

1. Silty CLAY (CL), grey, soft, moist trace organics from surface vegetation
2. Clayey SAND (SC), light grey to brown, loose, moist
3. Silty Clay (CL), with gravel, brown, medium stiff, moist
4. Silty Clay (CL), with refuse, dark brown, medium stiff to stiff, moist to saturated, refuse includes glass, wood, and newspaper
5. Refuse FILL, approximately 40% soil, major constituents are paper, wood, and glass. Other constituents include: plastic, wire, metal, tires, and asphalt. A high fraction of intact glass bottles were observed.

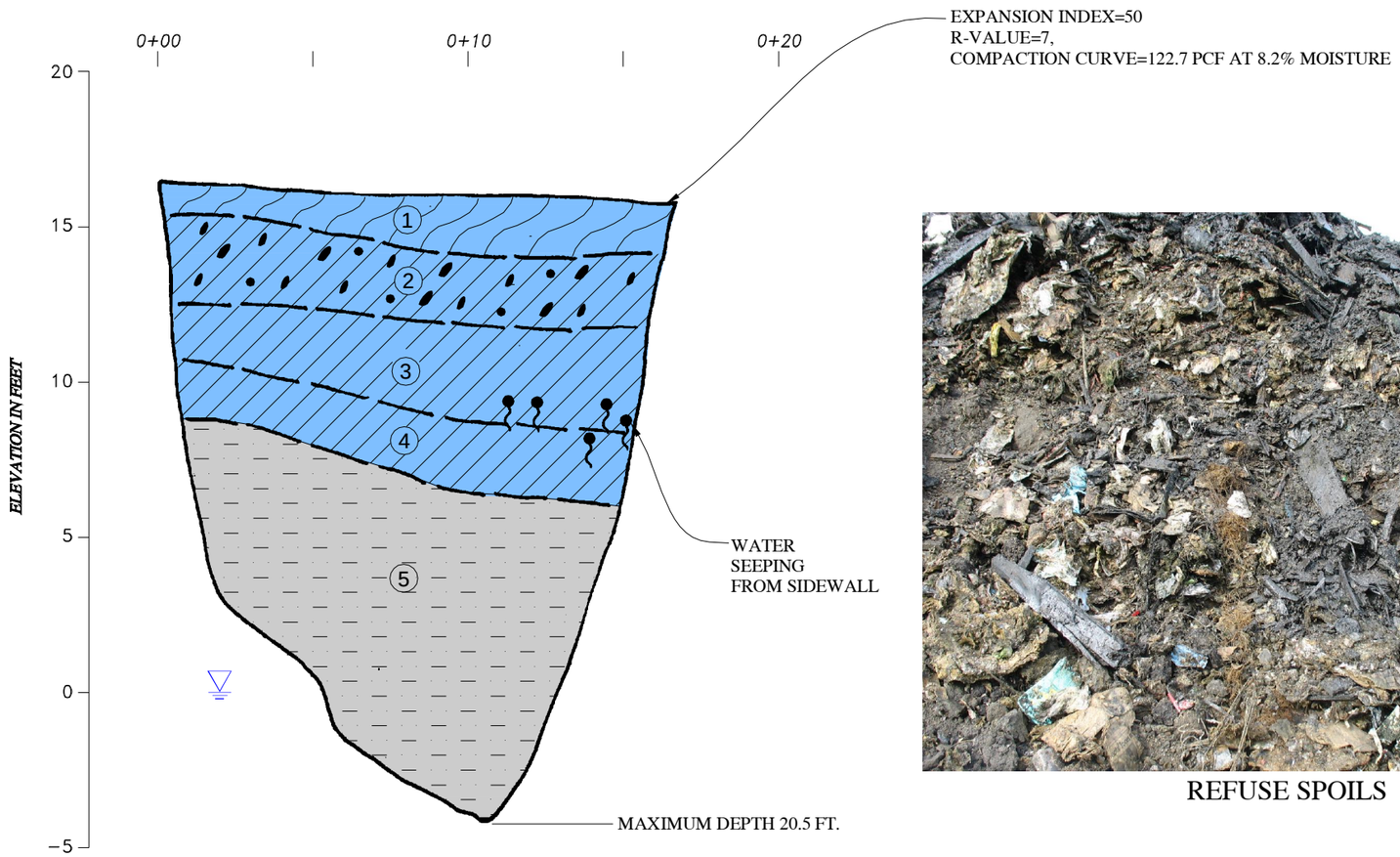
ENGEO Expect Excellence

TEST PIT LOG TP-1A
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO
DATE: MARCH 2010		
DRAWN BY: SRP	CHECKED BY: MG	

G:\Drafting\DRAFTING2_Dwg\8900\000\GEX\8900000000-GEX-Test Pit Log -TP1A-0310.dwg 3-19-10 01:39:33 PM spatters

ORIGINAL FIGURE PRINTED IN COLOR



REFUSE SPOILS

REFUSE SPOILS CLOSE UP

EXPLANATION

1. Silty CLAY (CL), grey, soft, moist trace organics from surface vegetation
2. Silty CLAY (CL), with gravel, olive brown, stiff, moist, minor pieces of concrete and paper
3. Clay (CL) dark black, medium stiff, moist, wet
4. Clay (CL) dark brown, mottled with black, medium stiff, wet, one brick observed
5. Refuse FILL, approximately 50% soil, major constituents are paper, wood, and glass. Other constituents include: plastic, metal, and bricks. A legible newspaper scrap was recovered dated 1966.

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TRENCH LOG TP-2A
ZERO WASTE ENERGY ANAEROBIC DIGESTION FACILITY
SAN JOSE, CALIFORNIA

PROJECT NO.: 8900.000.000		FIGURE NO
DATE: MARCH 2010		
DRAWN BY: PC	CHECKED BY: MG	

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APPENDIX B

CPT Logs

APPENDIX B

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

February 3, 2010

Engeo
Attn: Paul Cottingham
6399 San Ignacio Ave., Suite 150
San Jose, California 95119

Subject: CPT Site Investigation
Zero Waste Energy Anaerobic Facility
San Jose, California
GREGG Project Number: 10-021MA

Dear Mr. Cottingham:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

950 Howe Rd • Martinez, California 94553 • (925) 313-5800 • FAX (925) 313-0302
OTHER OFFICES: LOS ANGELES • HOUSTON
www.greggdrilling.com

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
CPT-01	2/01/10	85	-	-	-
CPT-02	2/01/10	85	-	-	-
CPT-03	2/01/10	85	-	-	-
CPT-04	2/02/10	100	-	-	92.4
CPT-05	2/02/10	85	-	-	32.6
CPT-06	2/02/10	85	-	-	22.5

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice" E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

Mayne, P.W., "NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization", available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp. 107-112.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

Robertson, P.K., T. Lunne and J.J.M. Powell, "Geo-Environmental Application of Penetration Testing", Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

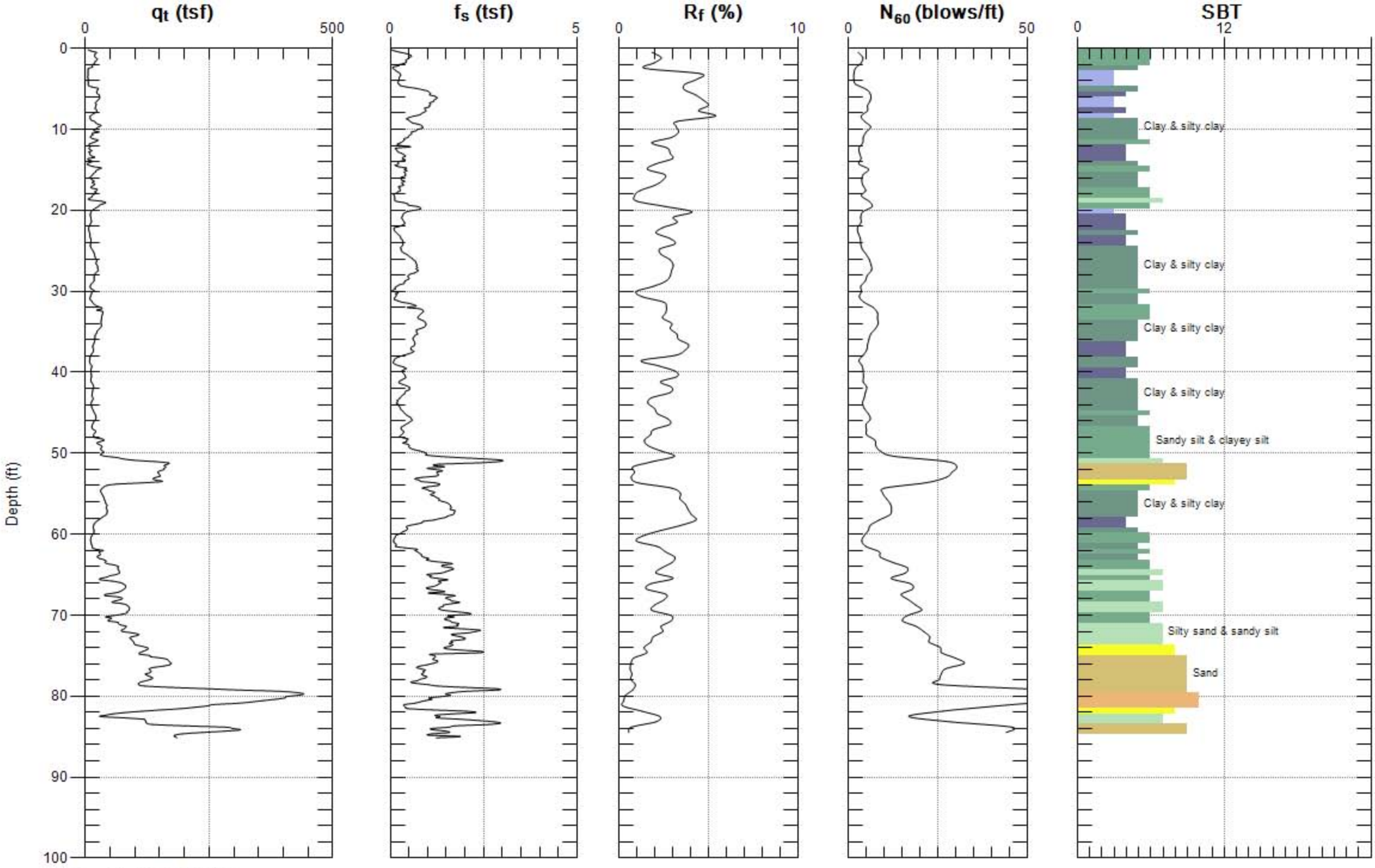
Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Copies of ASTM Standards are available through www.astm.org

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-01

Engineer: P.COTTINGHAM
Date: 2010-02-01 09:30



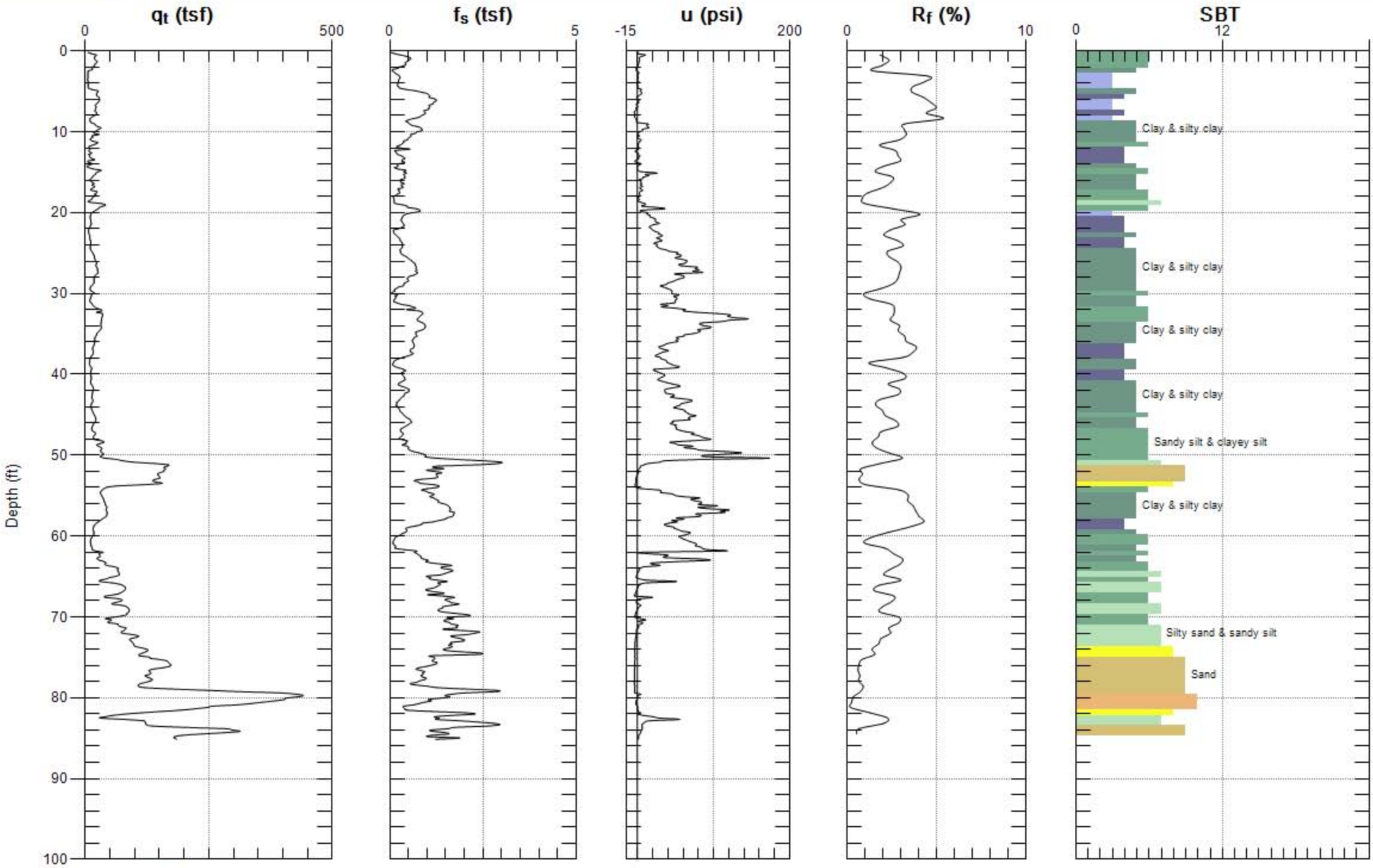
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-01

Engineer: P.COTTINGHAM
Date: 2010-02-01 09:30



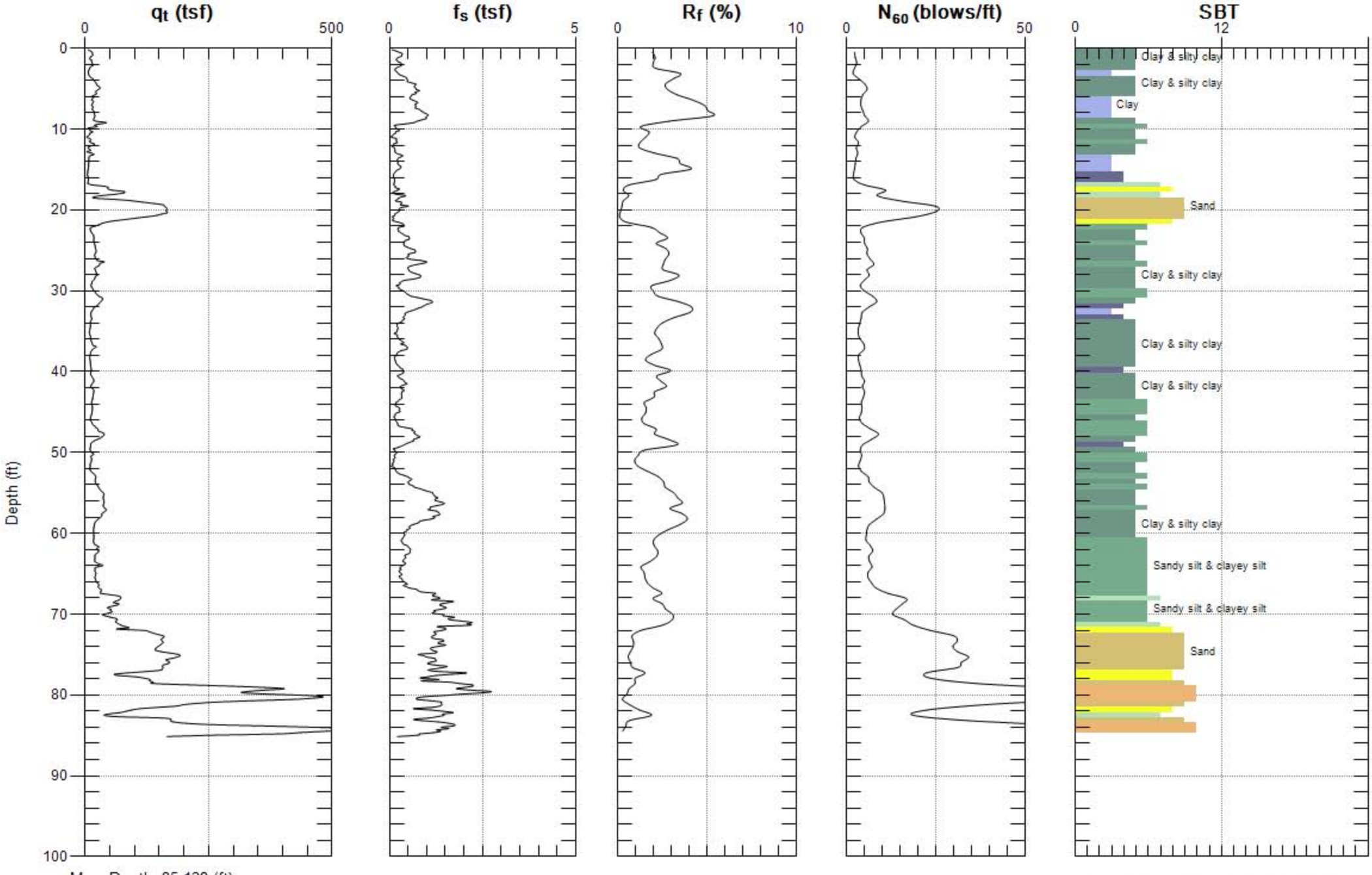
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-02

Engineer: P.COTTINGHAM
Date: 2010-02-01 11:39



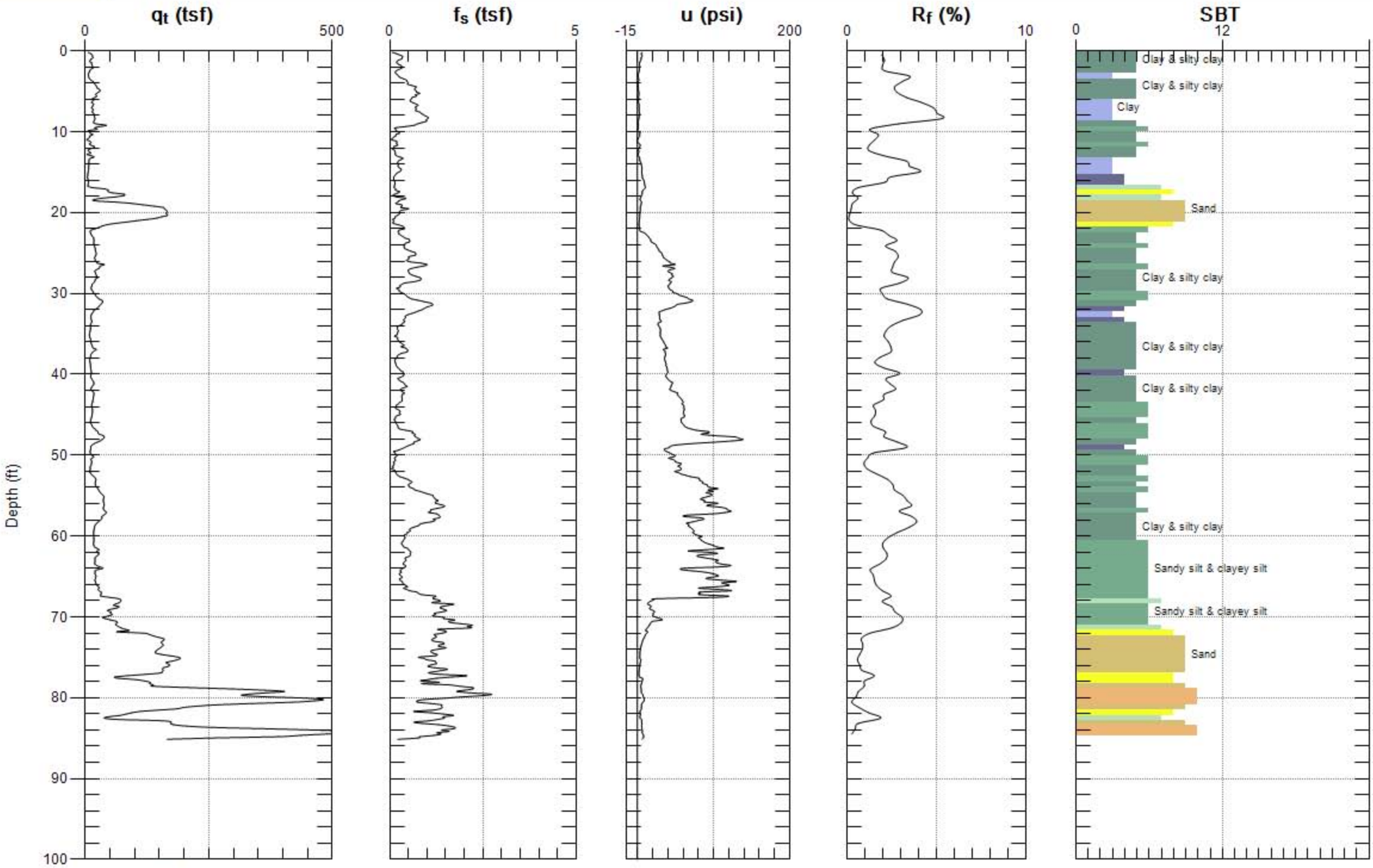
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-02

Engineer: P.COTTINGHAM
Date: 2010-02-01 11:39



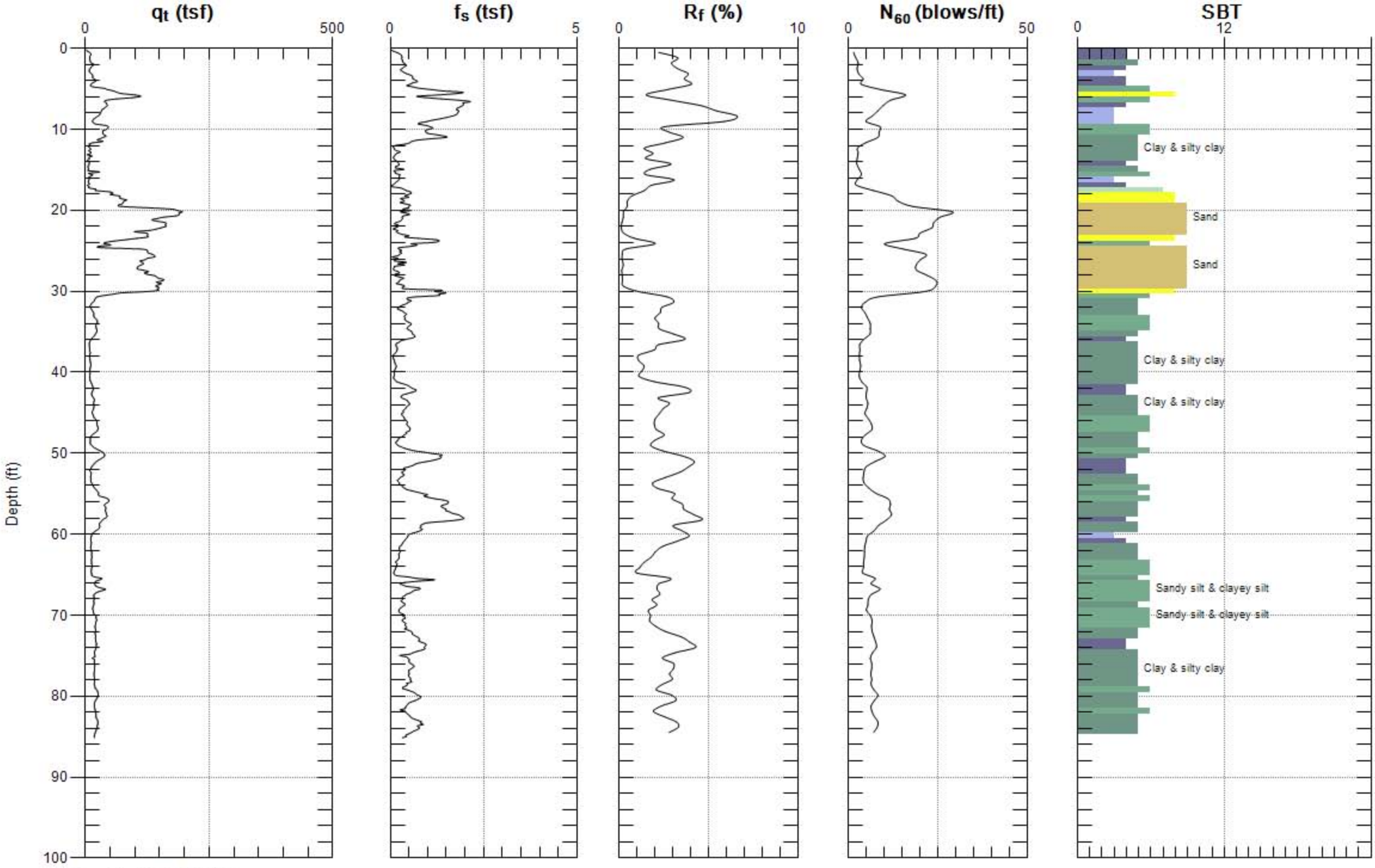
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-03

Engineer: P.COTTINGHAM
Date: 2010-02-01 01:27



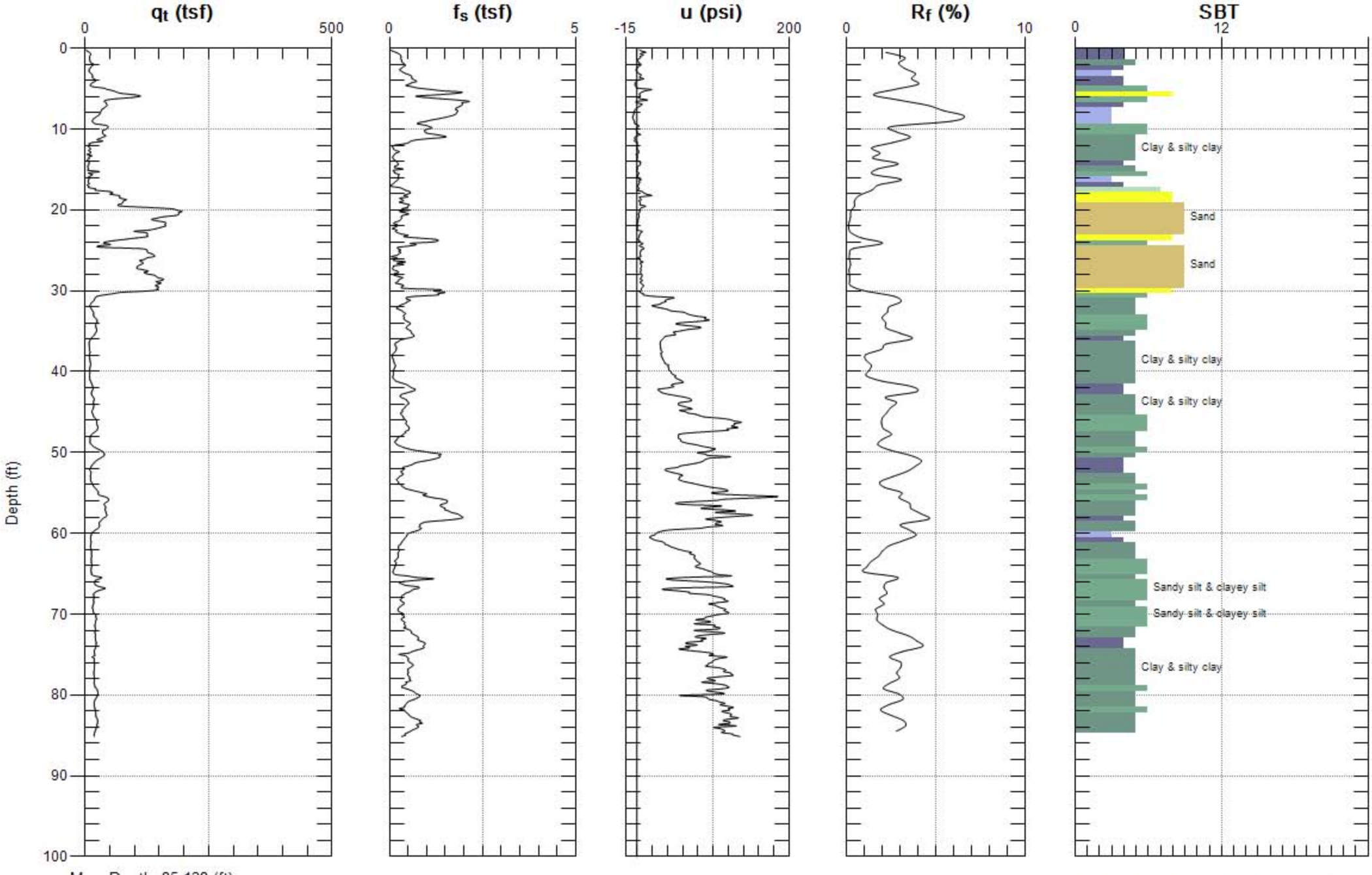
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-03

Engineer: P.COTTINGHAM
Date: 2010-02-01 01:27



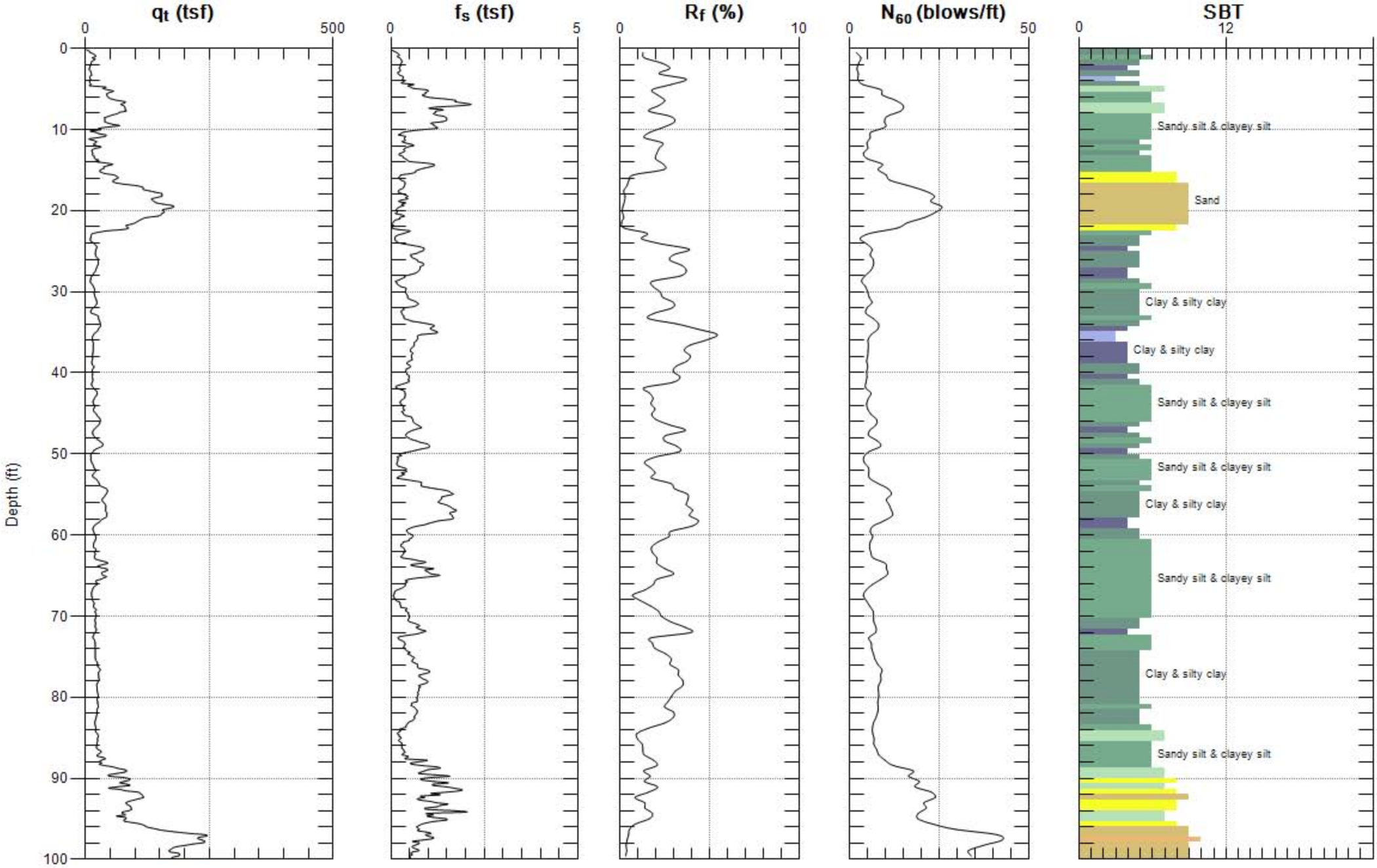
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-04

Engineer: P.COTTINGHAM
Date: 2010-02-02 08:11



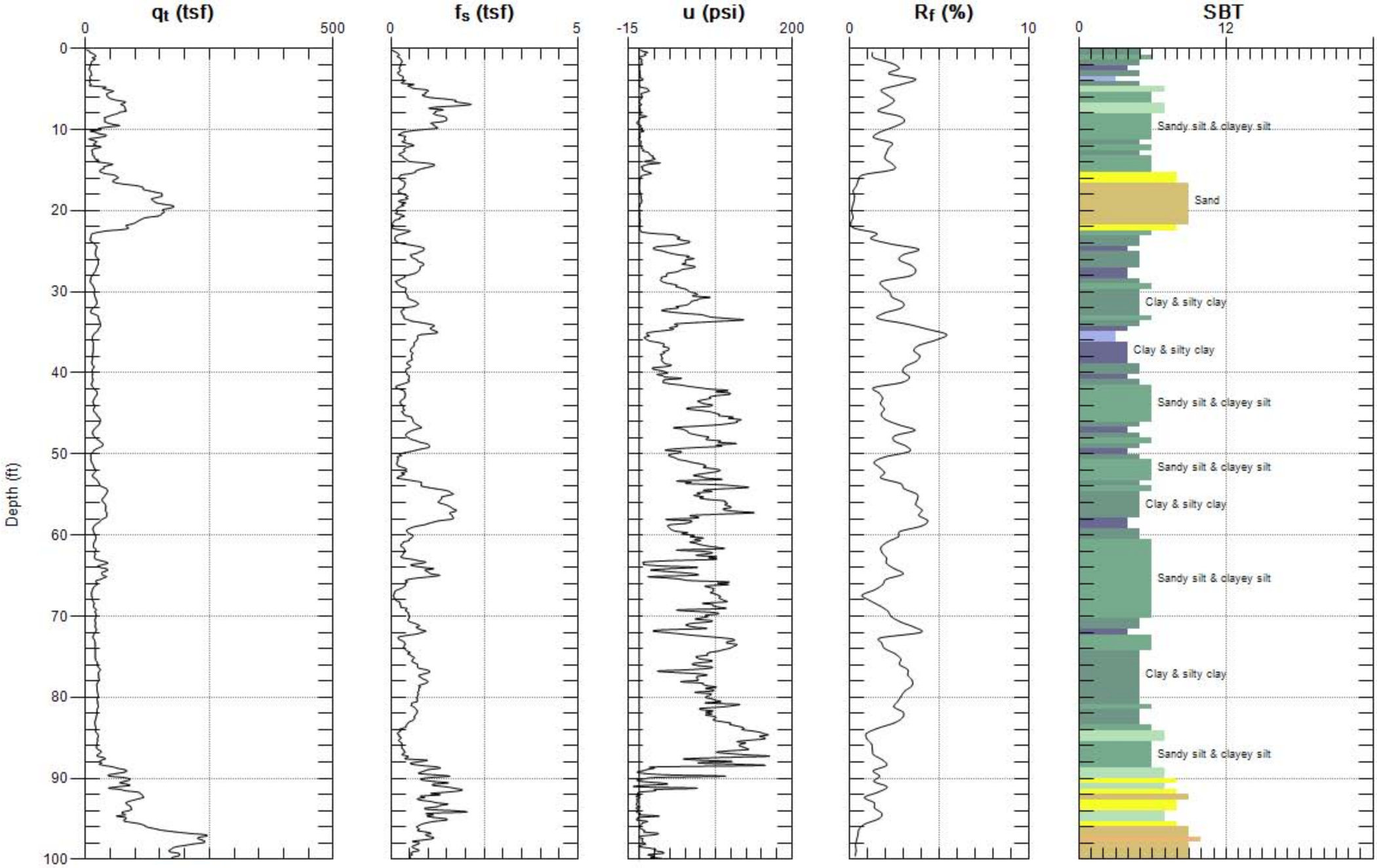
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-04

Engineer: P.COTTINGHAM
Date: 2010-02-02 08:11



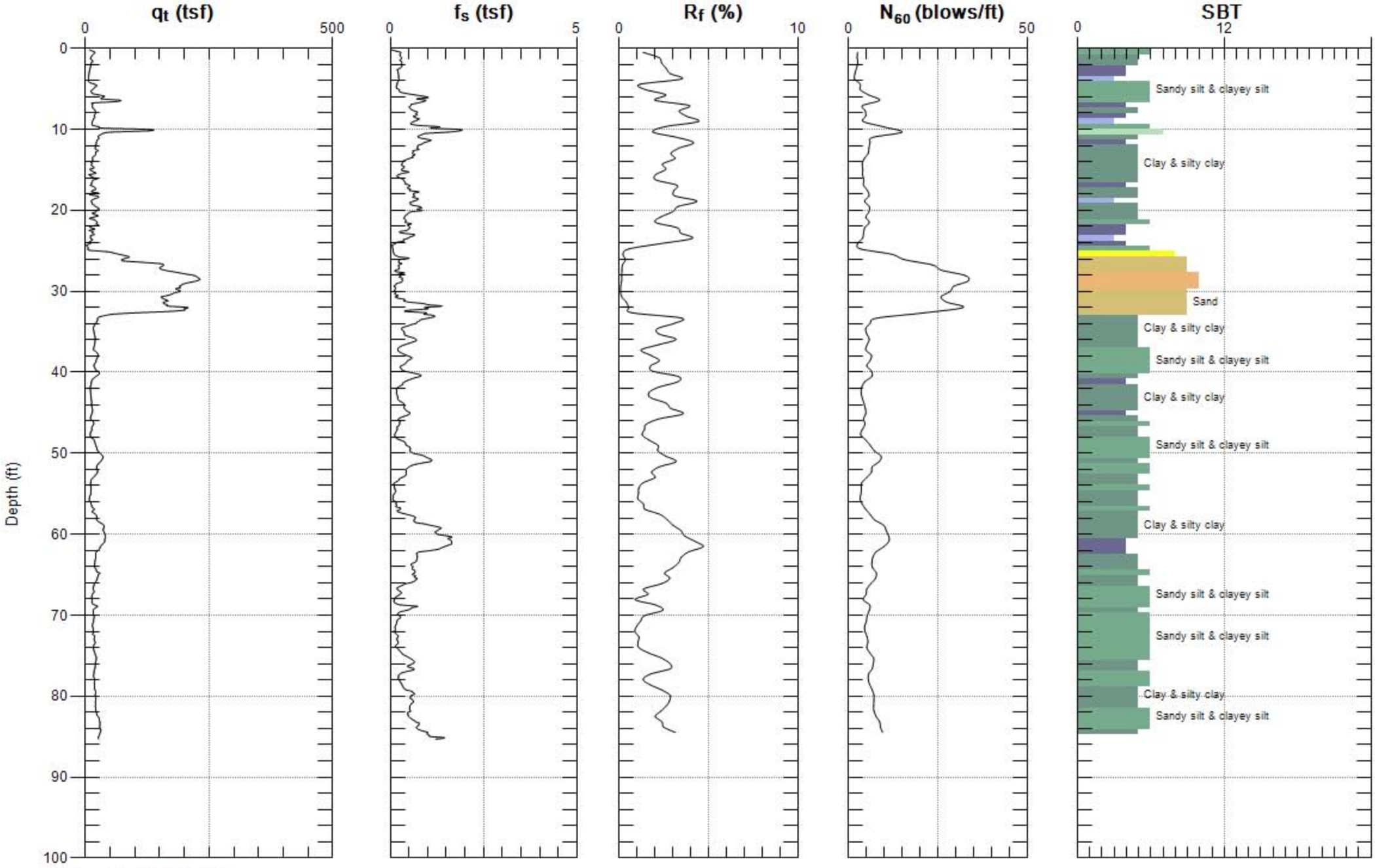
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-05

Engineer: P.COTTINGHAM
Date: 2010-02-02 10:30



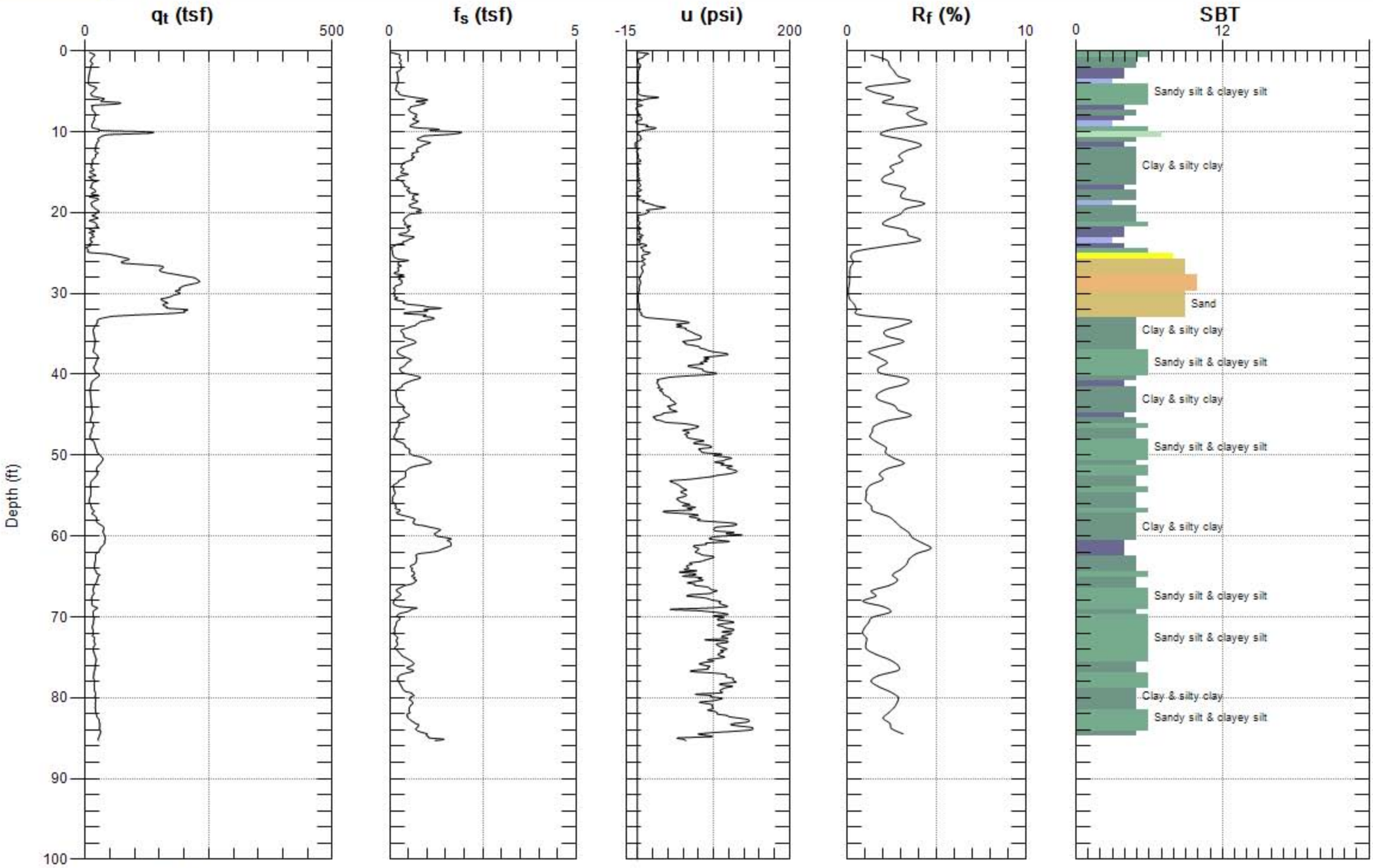
Max. Depth: 85.302 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-05

Engineer: P.COTTINGHAM
Date: 2010-02-02 10:30



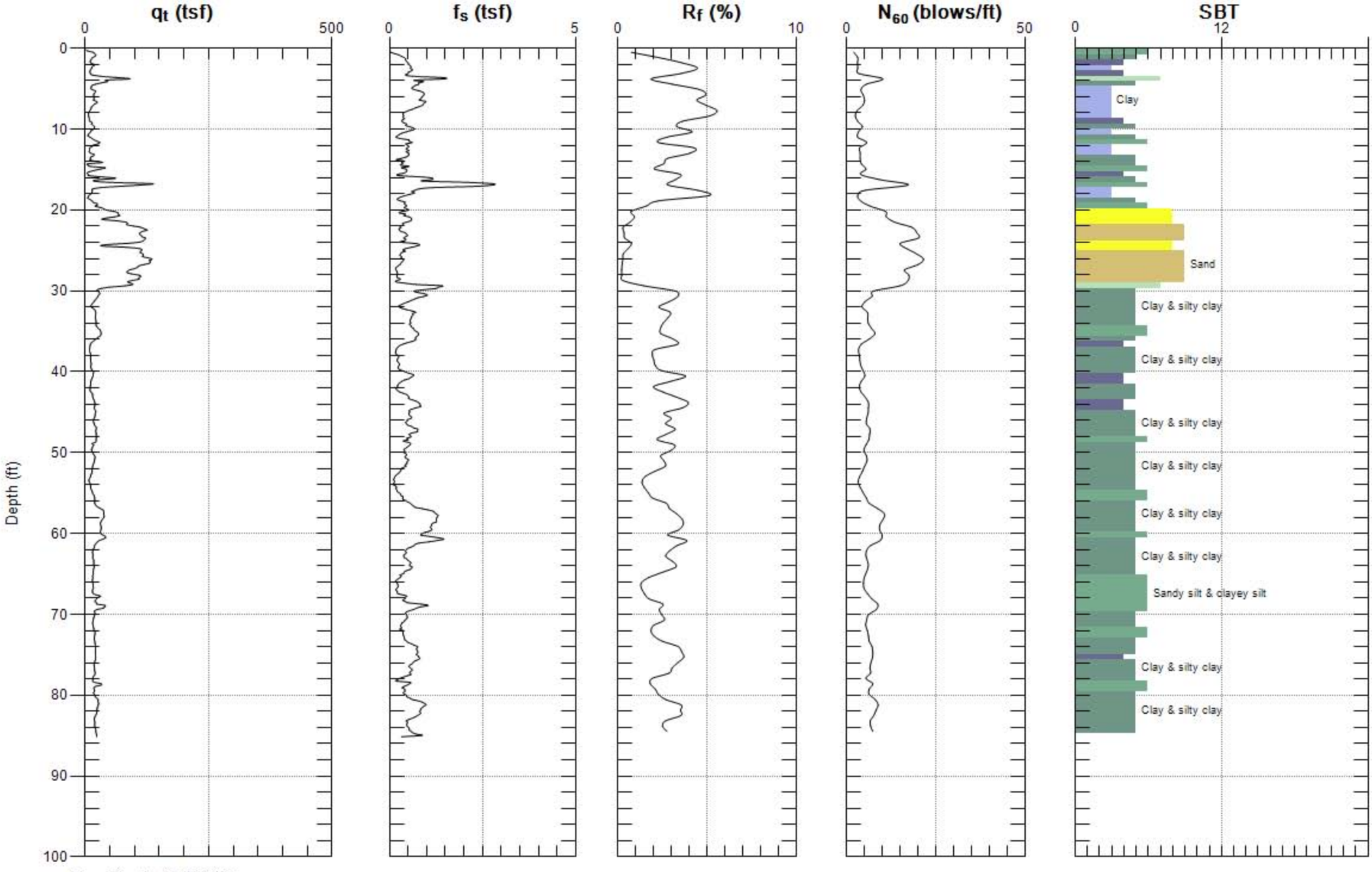
Max. Depth: 85.302 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-06

Engineer: P.COTTINGHAM
Date: 2010-02-02 01:10



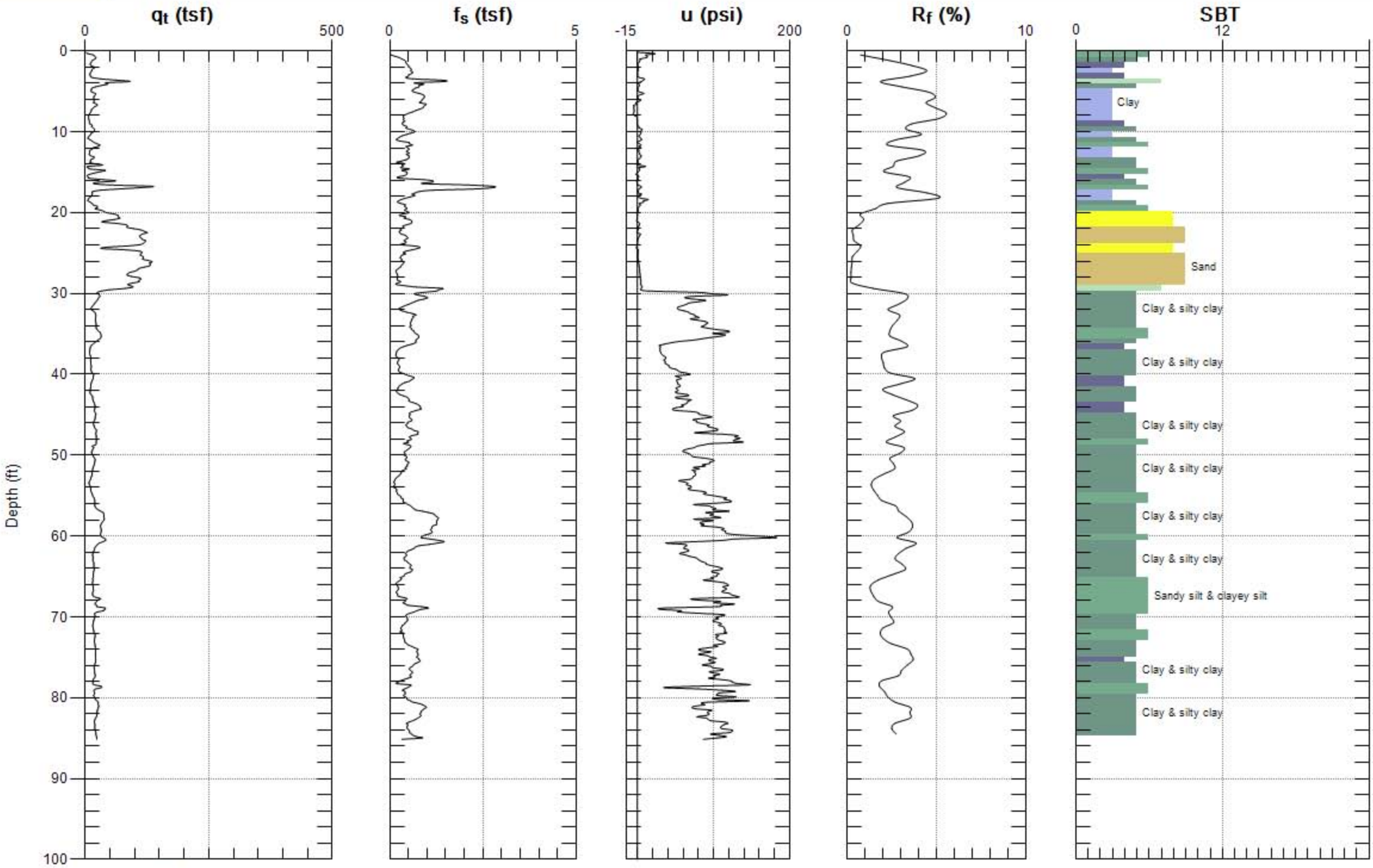
Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-06

Engineer: P.COTTINGHAM
Date: 2010-02-02 01:10



Max. Depth: 85.138 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

February 8, 2010

Engeo
Attn: Paul Cottingham
6399 San Ignacio Ave., Suite 150
San Jose, California 95119

Subject: CPT Site Investigation
Zero Waste Energy Anaerobic Facility
San Jose, California
GREGG Project Number: 10-021MA - part 2

Dear Mr. Cottingham:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
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Mary Walden
Operations Manager

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OTHER OFFICES: LOS ANGELES • HOUSTON
www.greggdrilling.com

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
CPT-07	2/05/10	100	-	-	72.5
CPT-B10A	2/05/10	80	-	-	-

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice" E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

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Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

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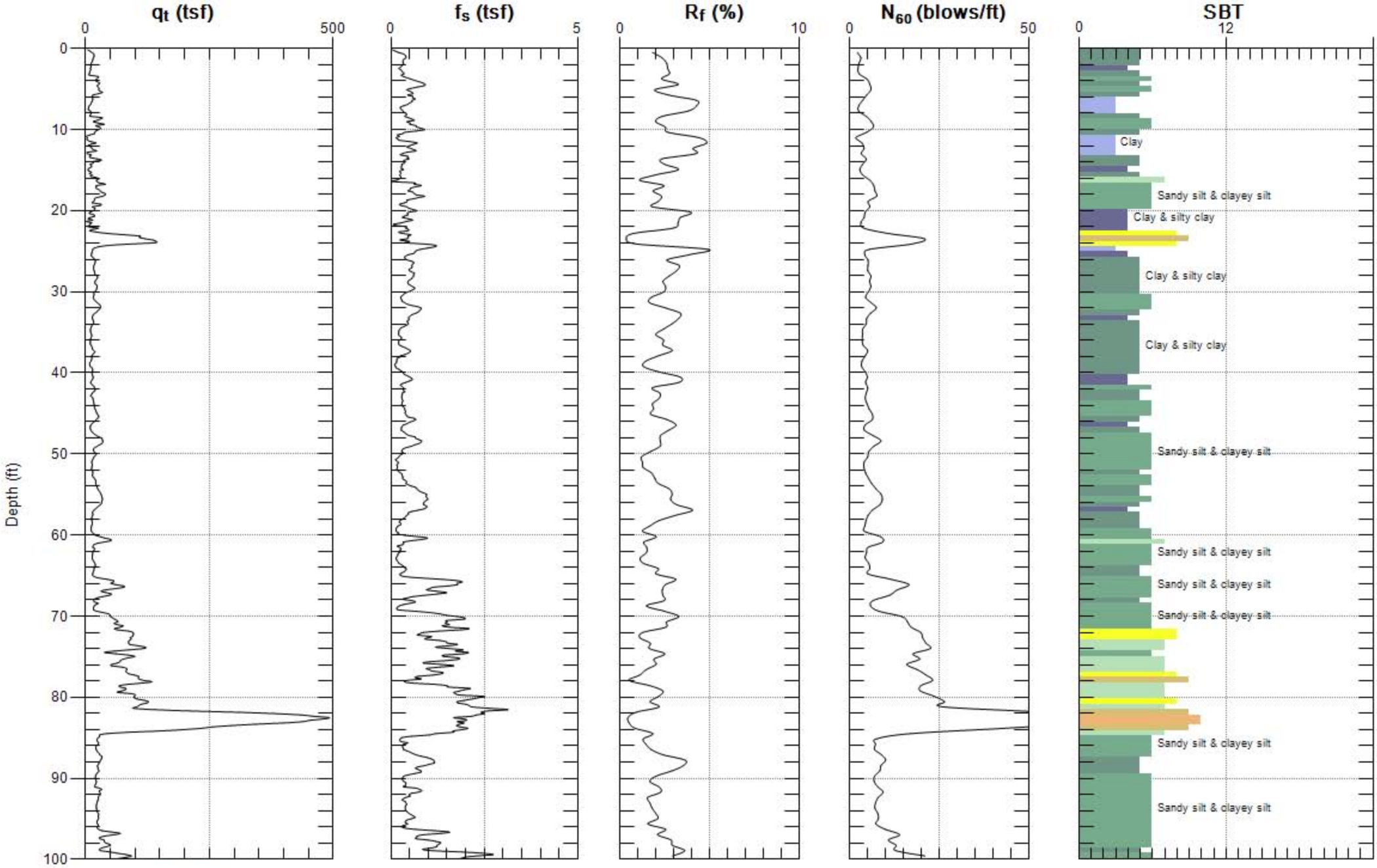
Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Copies of ASTM Standards are available through www.astm.org

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-07

Engineer: P.COTTINGHAM
Date: 2010-02-05 01:05



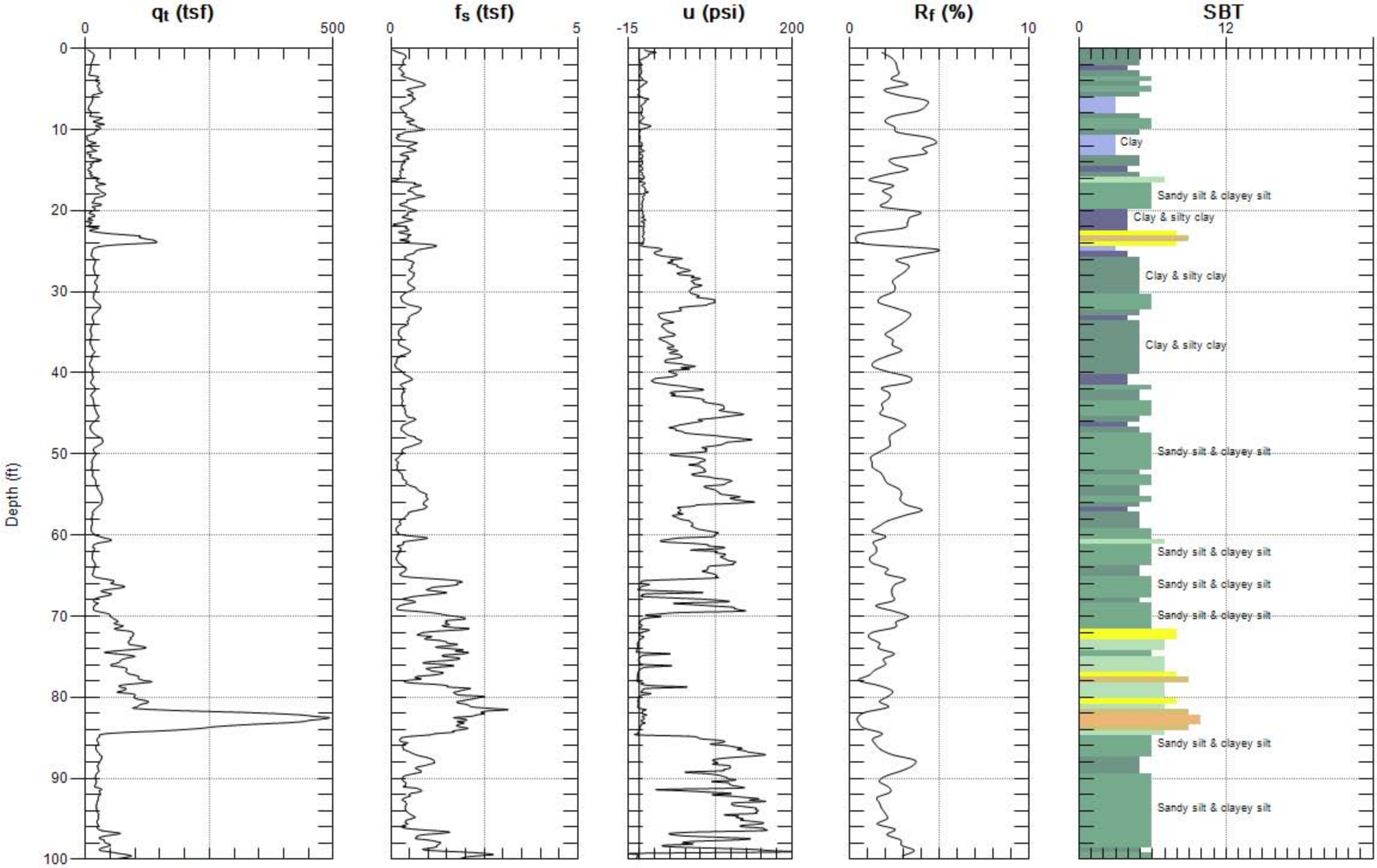
Max. Depth: 100.230 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-07

Engineer: P.COTTINGHAM
Date: 2010-02-05 01:05



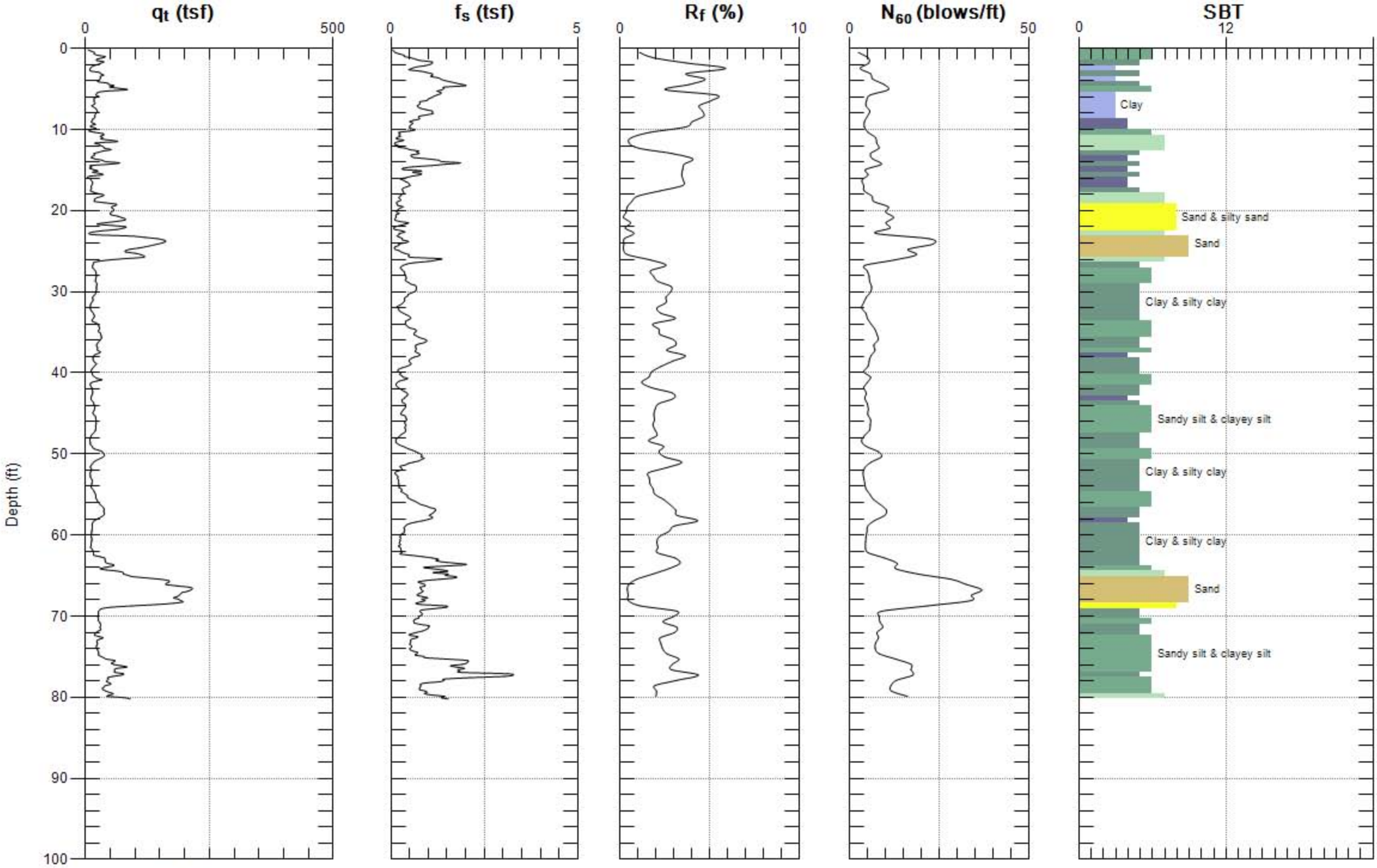
Max. Depth: 100.230 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-B10A

Engineer: P.COTTINGHAM
Date: 2010-02-05 11:09



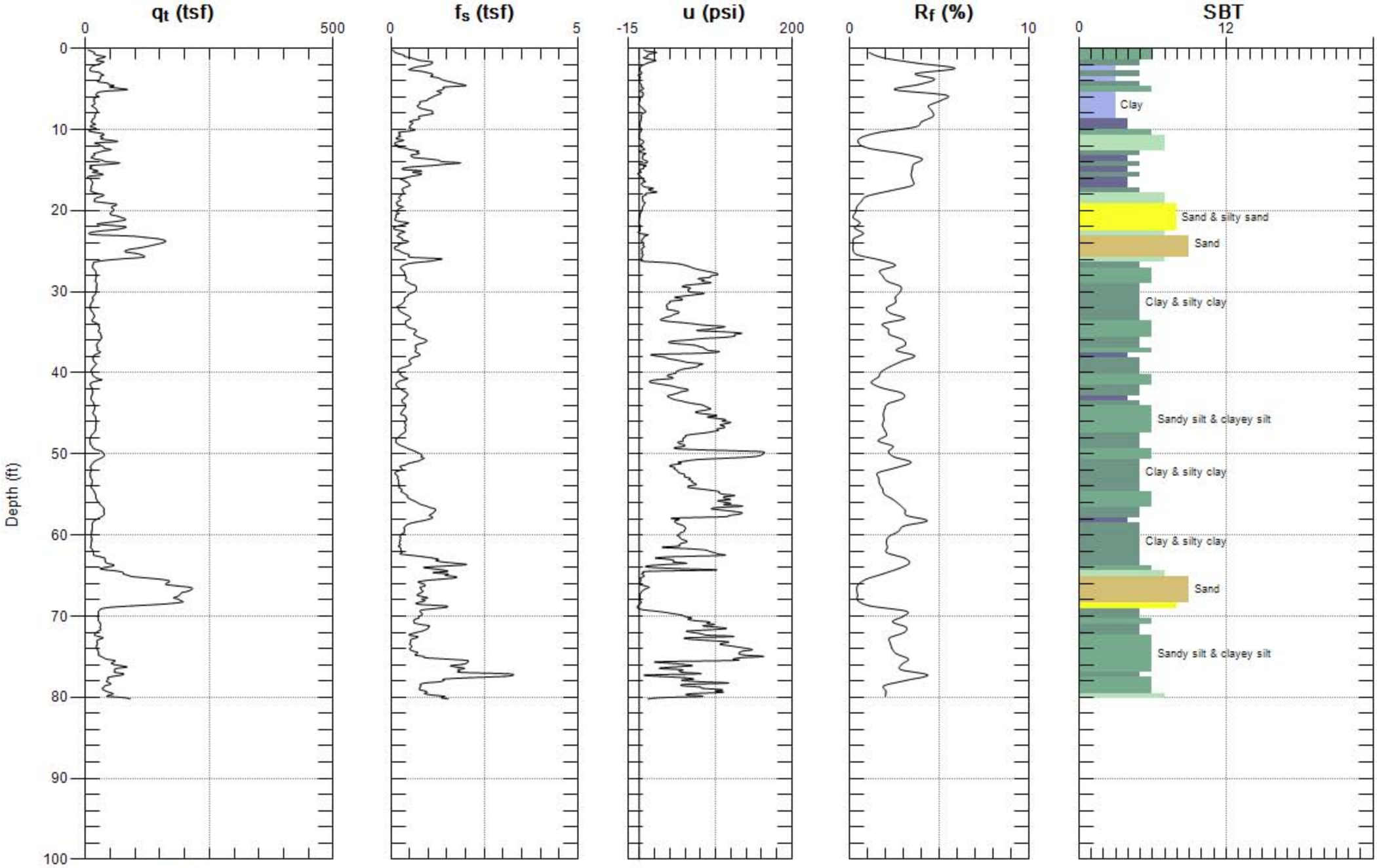
Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: ZERO WASTE ENERGY
Sounding: CPT-B10A

Engineer: P.COTTINGHAM
Date: 2010-02-05 11:09



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C

Laboratory Test Data

APPENDIX C

COMPACTION TEST REPORT

Curve No.: 1

Project No.: 8900.000.000 **Date:** 02/16/10

Project: Zero Waste Energy Digestion Facility

Location: Zero Waste Energy Digestion Facility

Elev./Depth: **Sample No.** TP-1A

Remarks:

MATERIAL DESCRIPTION

Description: Dark Gray Clay w/Trace of Organics

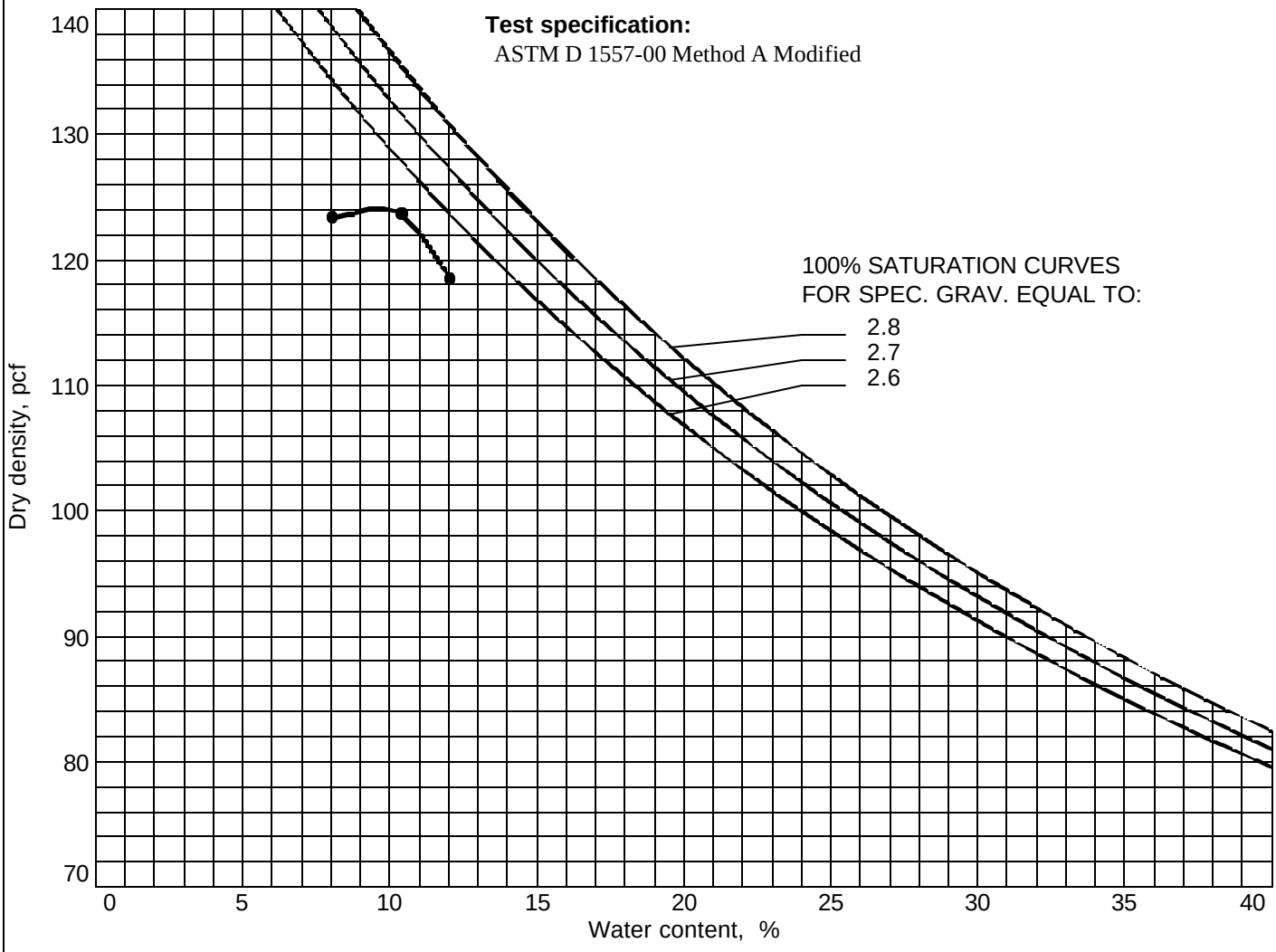
Classifications - **USCS:** CL **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 124.2 pcf
Optimum moisture = 9.7 %



Figure

COMPACTION TEST REPORT

Curve No.: 2

Project No.: 8900.000.000 **Date:** 02-17-10

Project: Zero Waste Energy Digestion Facility

Location: Zero Waste Energy Digestion Facility

Elev./Depth: **Sample No.** TP-2A

Remarks:

MATERIAL DESCRIPTION

Description: Very Dark Gray Clay w/Trace of Organics

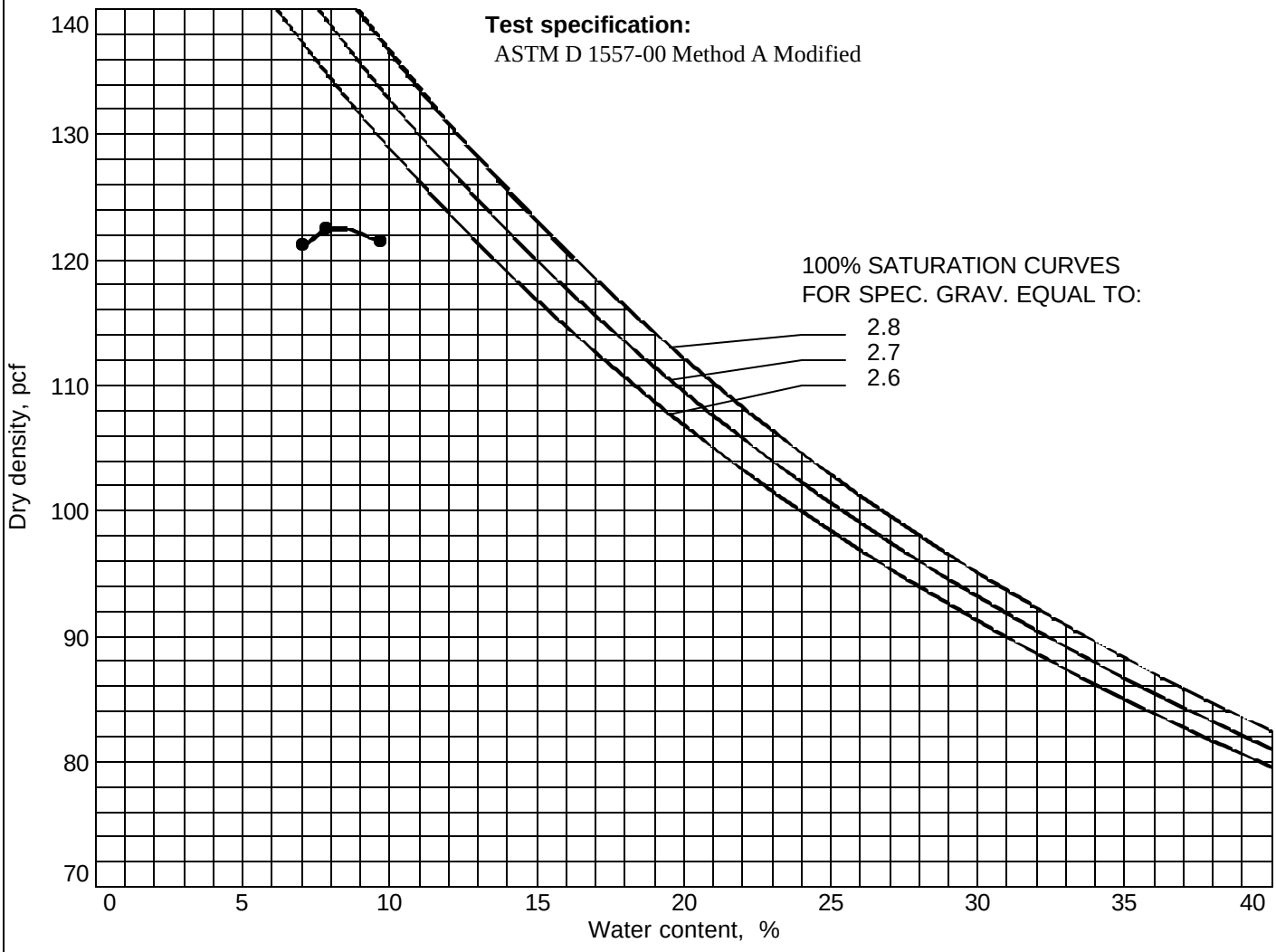
Classifications - **USCS:** CL **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 122.7 pcf
Optimum moisture = 8.2 %



Figure

COMPACTION TEST REPORT

Curve No.: 3

Project No.: 8900.000.000 **Date:** 02-17-10

Project: Zero Waste Energy Digestion Facility

Location: Zero Waste Energy Digestion Facility

Elev./Depth: **Sample No.** SS-1A

Remarks:

MATERIAL DESCRIPTION

Description: Dark Gray Clay w/Trace of Organics

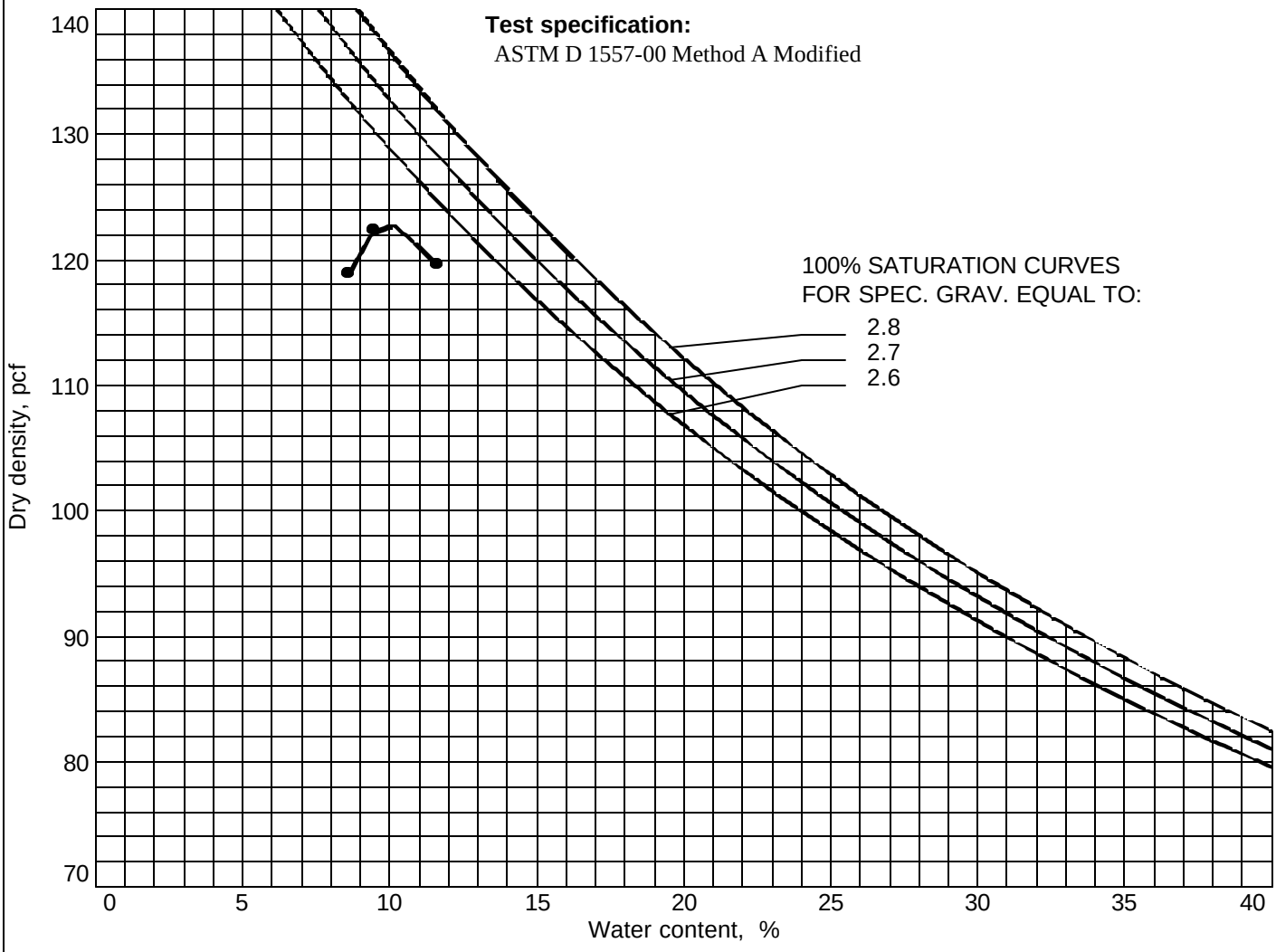
Classifications - **USCS:** CL **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

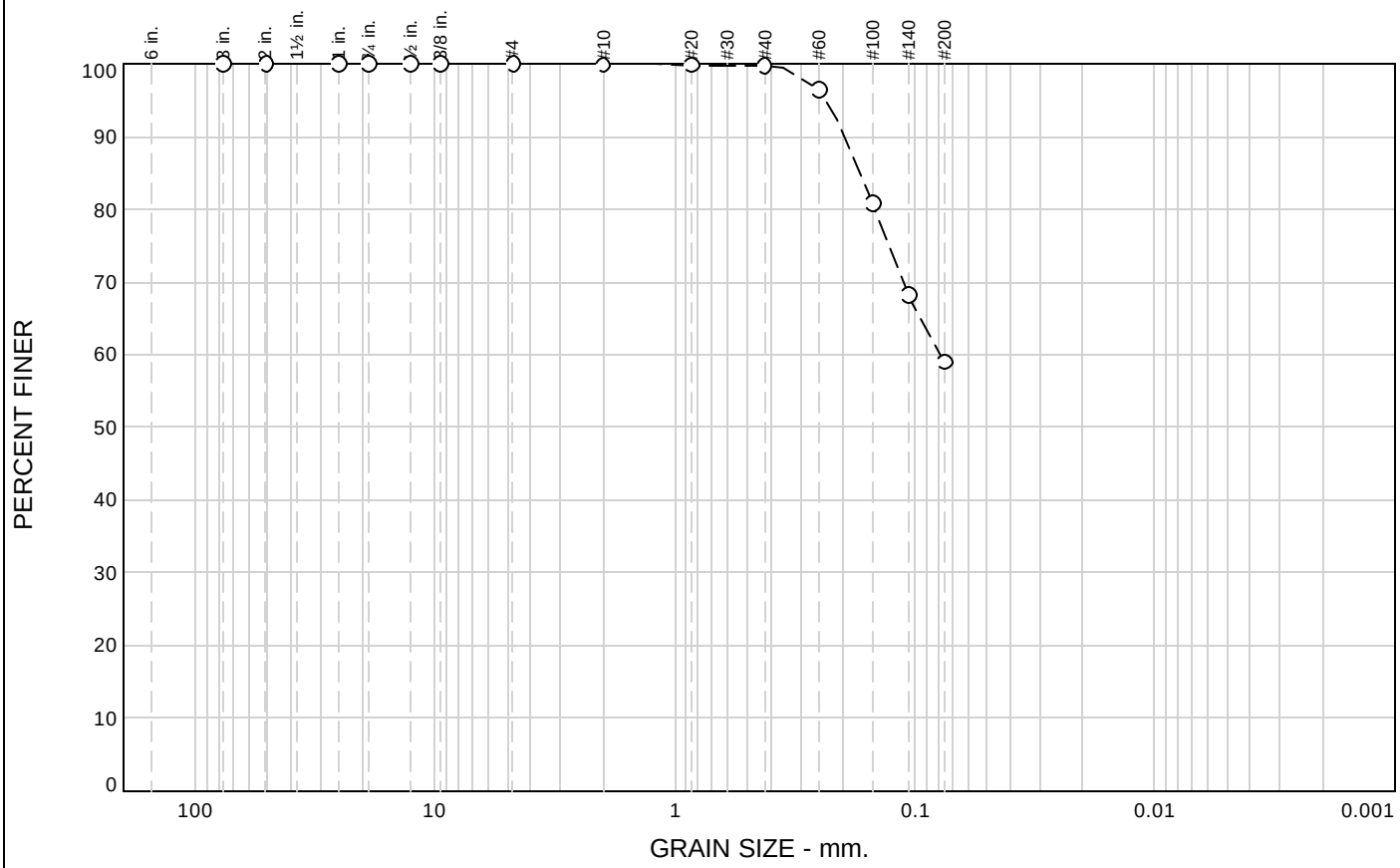
% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 122.9 pcf
Optimum moisture = 9.9 %



Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	40.8	59.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	96.5		
#100	80.9		
#140	68.2		
#200	59.0		

* (no specification provided)

Material Description

Olive gray sandy CLAY.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.1675 D_{60}= 0.0781 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Sample Number: B8A @ 17 **Date:** 02/17/10

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

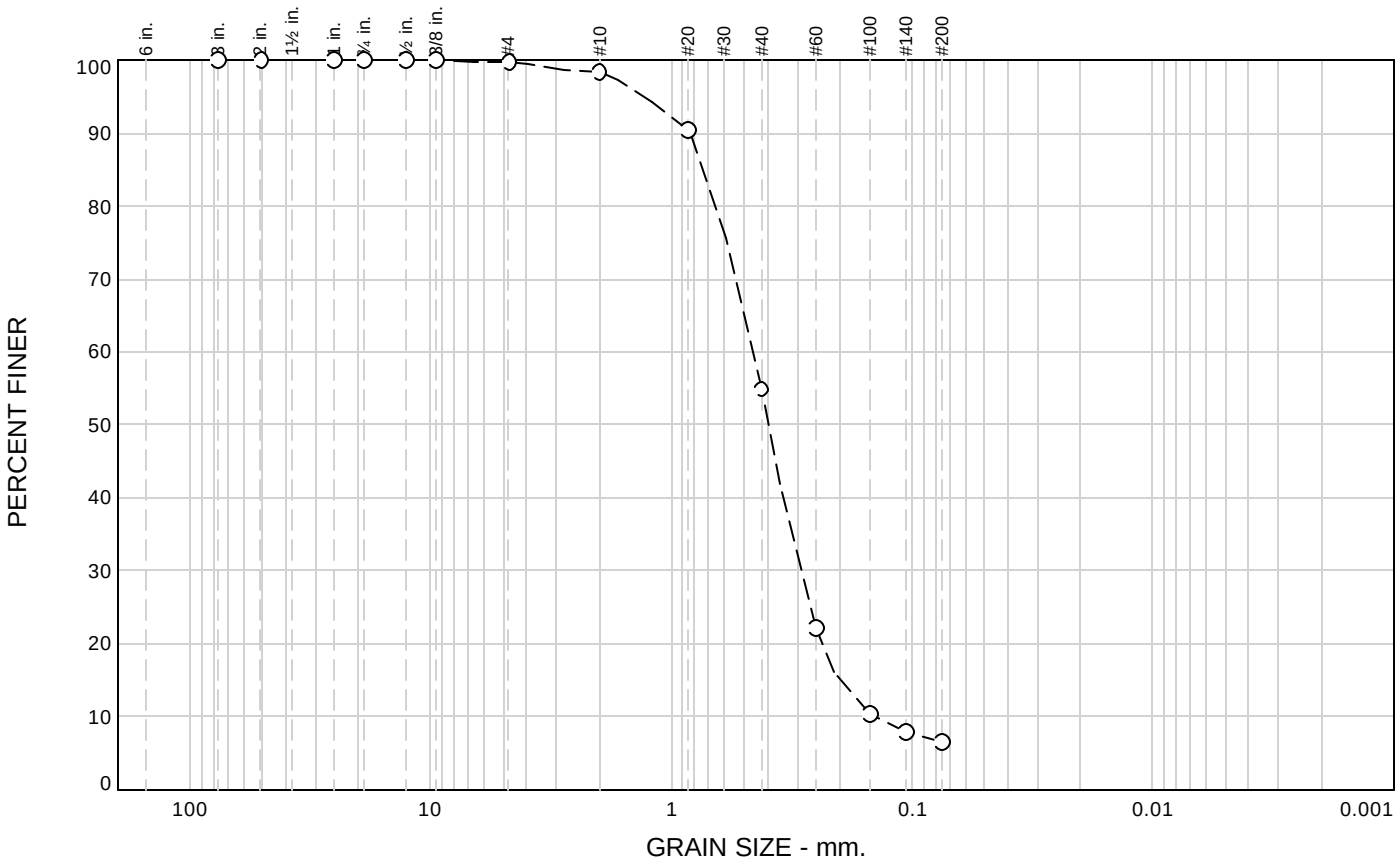
Client:

Project: Zero Waste Energy Digestion Facility

Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	1.3	43.5	48.5	6.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	99.7		
#10	98.4		
#20	90.5		
#40	54.9		
#60	22.1		
#100	10.4		
#140	7.9		
#200	6.4		

* (no specification provided)

Material Description

Dark grayish brown poorly-graded SAND with silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.7291 D_{60}= 0.4592 D_{50}= 0.3953
D_{30}= 0.2913 D_{15}= 0.2022 D_{10}= 0.1439
C_u= 3.19 C_c= 1.28

Classification

USCS= SP-SM AASHTO=

Remarks

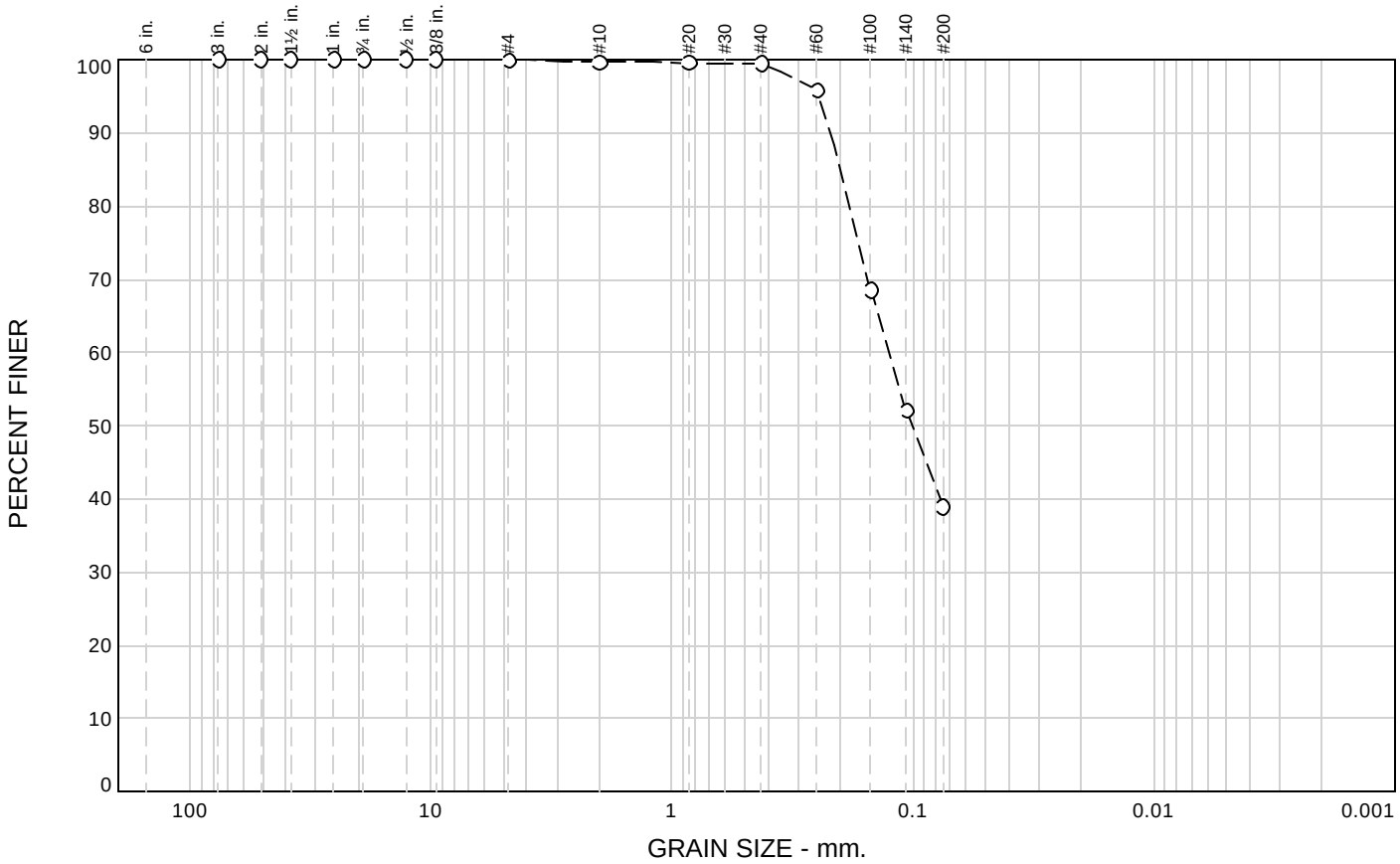
Sample Number: B8A @ 21 **Date:** 02/17/10

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	0.2	60.6	38.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	99.7		
#20	99.6		
#40	99.5		
#60	95.9		
#100	68.5		
#140	52.0		
#200	38.9		

* (no specification provided)

Material Description

Dark yellowish brown clayey SAND.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.1980 D_{60}= 0.1272 D_{50}= 0.1008
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

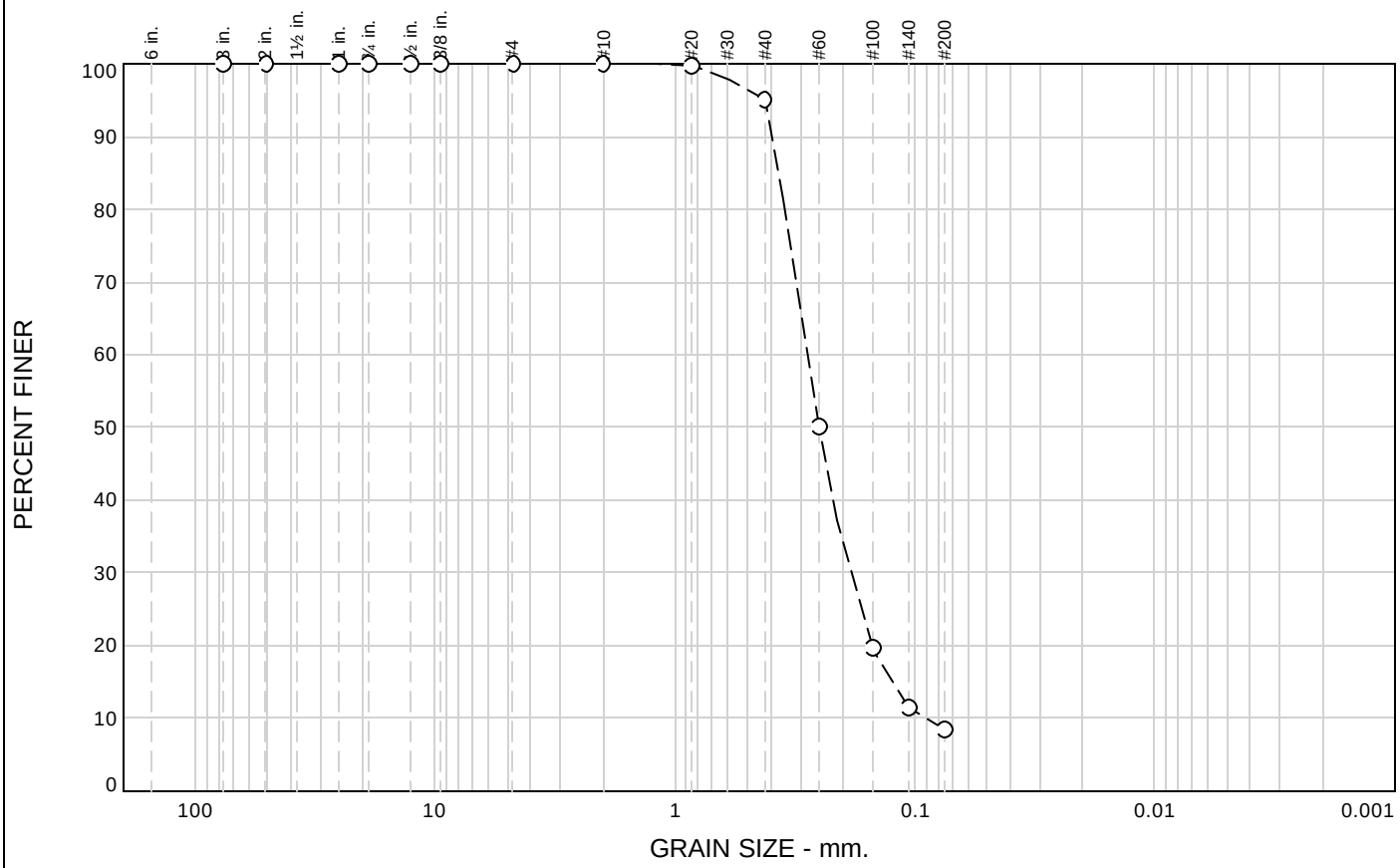
Sample Number: B8A @ 66 **Date:** 02/12/10

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	4.8	86.8	8.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	95.2		
#60	50.2		
#100	19.6		
#140	11.4		
#200	8.4		

* (no specification provided)

Material Description

Dark yellowish brown poorly-graded SAND with silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.3666 D_{60}= 0.2787 D_{50}= 0.2495
D_{30}= 0.1879 D_{15}= 0.1285 D_{10}= 0.0934
C_u= 2.99 C_c= 1.36

Classification

USCS= SP-SM AASHTO=

Remarks

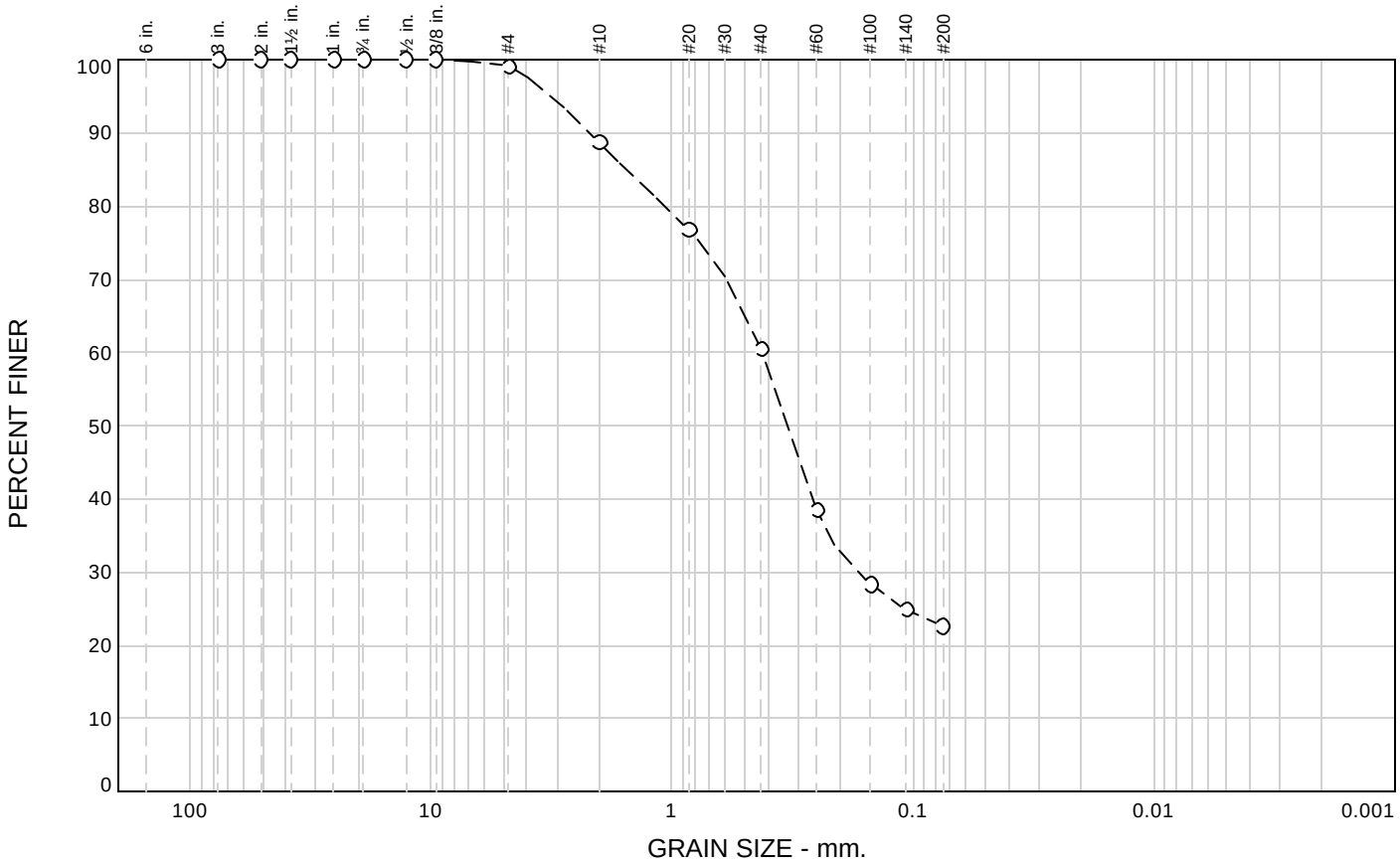
Sample Number: B8A @ 71 **Date:** 02/17/10

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	10.4	28.1	38.0	22.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	99.1		
#10	88.7		
#20	76.7		
#40	60.6		
#60	38.6		
#100	28.3		
#140	24.9		
#200	22.6		

* (no specification provided)

Material Description

Very dark greenish gray silty SAND.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.5319 D_{60}= 0.4186 D_{50}= 0.3310
D_{30}= 0.1709 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

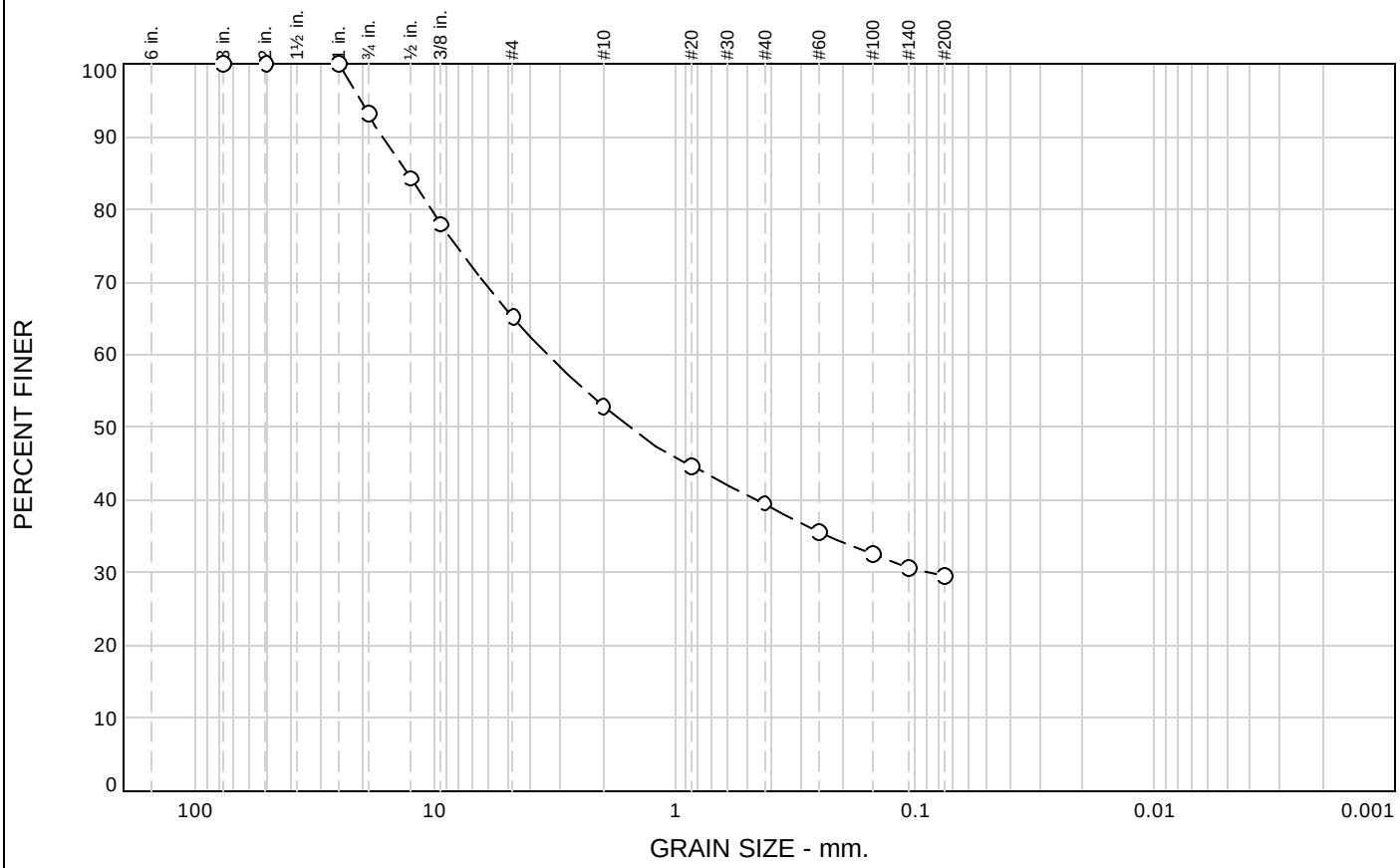
Sample Number: B8A @ 81 **Date:** 02/12/10

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	28.1	12.3	13.3	10.0	29.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	93.2		
1/2	84.3		
3/8	78.0		
#4	65.1		
#10	52.8		
#20	44.6		
#40	39.5		
#60	35.6		
#100	32.5		
#140	30.7		
#200	29.5		

* (no specification provided)

Material Description

Very dark grayish brown clayey SAND with gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 13.1133 D_{60}= 3.4226 D_{50}= 1.5540
D_{30}= 0.0882 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

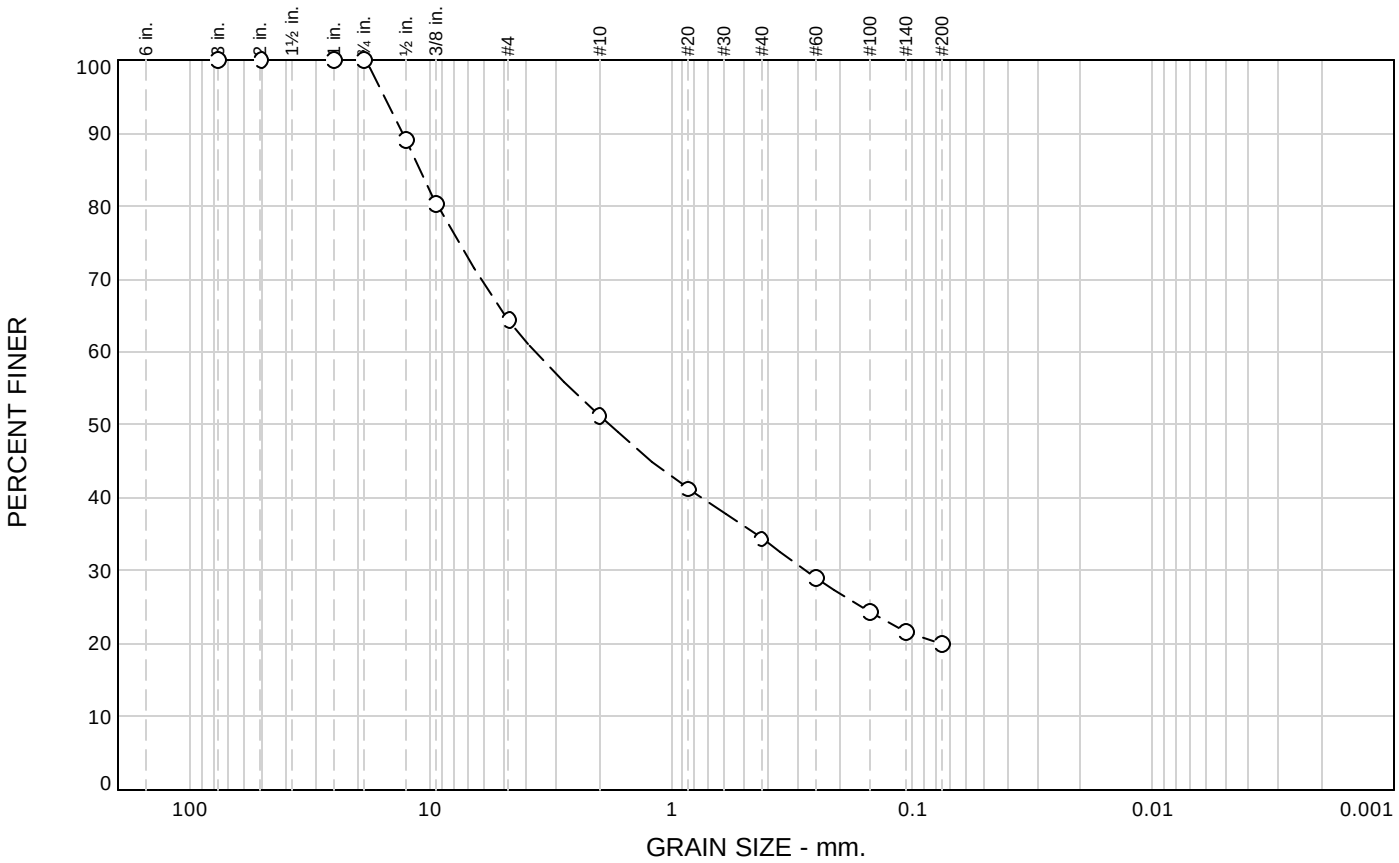
Sample Number: B9A @ 1 **Date:** 02/17/10

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	35.6	13.1	16.9	14.5	19.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	100.0		
1/2	89.0		
3/8	80.3		
#4	64.4		
#10	51.3		
#20	41.2		
#40	34.4		
#60	28.9		
#100	24.2		
#140	21.6		
#200	19.9		

* (no specification provided)

Material Description

Very dark greenish gray and very dark grayish brown clayey SAND with gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 11.1864 D_{60}= 3.6858 D_{50}= 1.8097
D_{30}= 0.2776 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

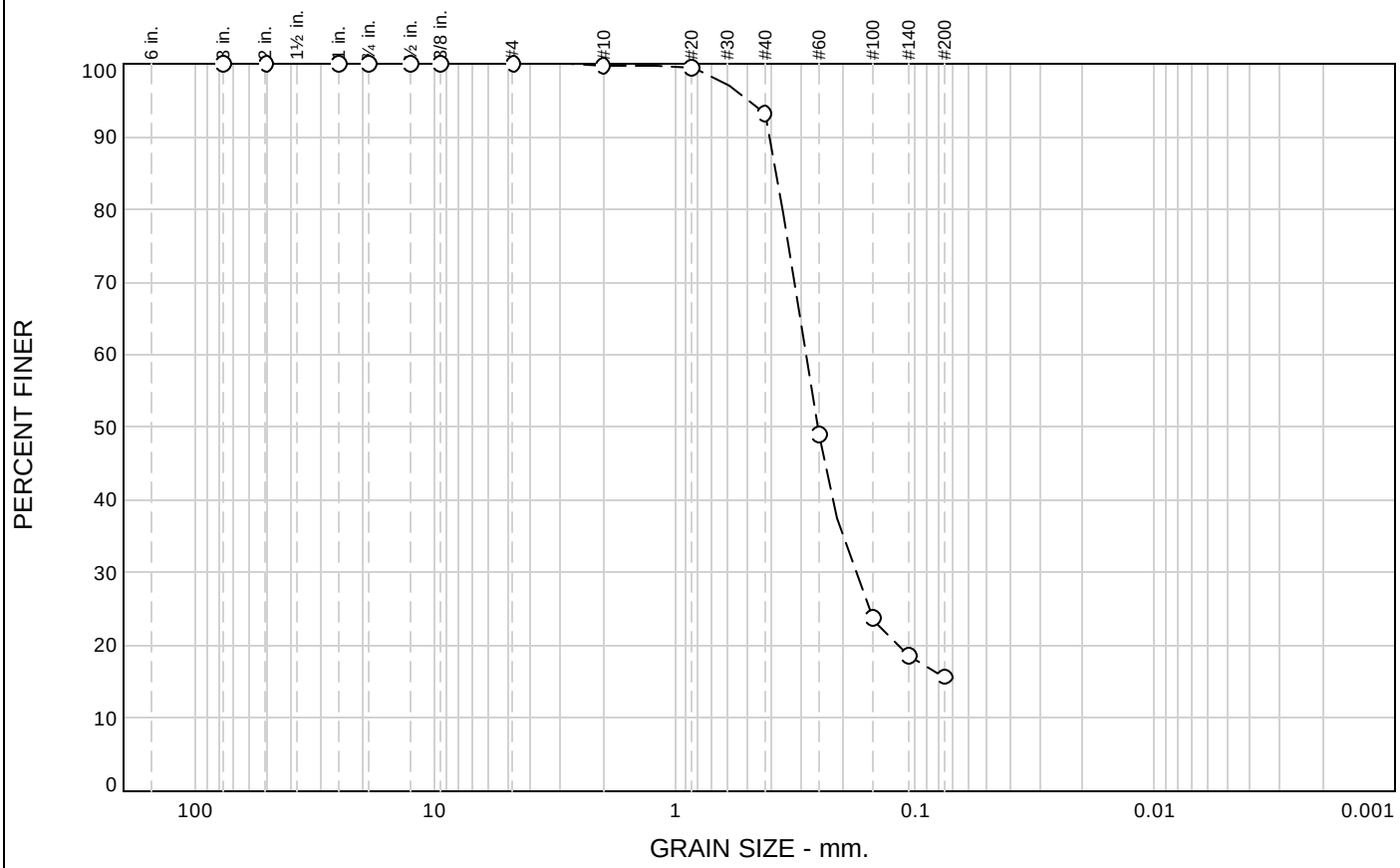
Sample Number: B9A @ 17 **Date:** 02/17/10

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:
Project: Zero Waste Energy Digestion Facility
Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	6.6	77.7	15.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	99.9		
#20	99.6		
#40	93.3		
#60	49.1		
#100	23.7		
#140	18.6		
#200	15.6		

* (no specification provided)

Material Description

Very dark grayish brown silty SAND.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.3761 D_{60}= 0.2838 D_{50}= 0.2528
D_{30}= 0.1817 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: B9A @ 36 **Date:** 02/17/10

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — MATERIALS TESTING

Client:

Project: Zero Waste Energy Digestion Facility

Project No: 8900.000.000 **Plate**

Tested By: GC **Checked By:** RC

Specific Gravity of Soil Solids by Water Pycnometer

(ASTM D854-05)

Job Name: Zero Waste Energy Digestion Facility Date: 2/18/2010

Job number: 8900.000.000 By: RC

Sample ID: B9A @ 4.5'

%Passing #4: 100

Soil description: See Boring Log

Method used: A ___ B _X__

DETERMINATION NUMBER	1	2	3	4
Temperature (^oC), T_{test}	20.0	20.0		
Tare name				
Tare weight (g)	0.00	0.00		
Weight of tare + dry soil (g)	52.20	69.40		
Weight of test sample (g)	52.20	69.40		
Density of water @ T_{test} (See Table 2)	1.00000	1.00000		
Flask number	A	B		
Average calibrated weight of flask (g), $M_?$	819.30	823.20		
Average calibrated volume of flask (ml)	0.0	0.0		
Weight of flask + water (g) @ $T_{test,}$ ($M_{?w,t}$)	819.30	823.20		
Weight of flask + water + soil (g) @ T_{test}	850.40	865.00		
Density of soil solids (g/cm^3)				
Temperature coefficient from Table 2 (K)	0.99979	0.99979		
Specific gravity of water @ T_{test}				
Specific gravity of soil @ $T_{test,}$ G_t	2.47	2.51		
Specific gravity of soil @ 20 ^oC	2.47	2.51		

Avegage Specific Gravity: **2.49**

ENGEO INCORPORATED

Specific Gravity of Soil Solids by Water Pycnometer

(ASTM D854-05)

Job Name: Zero Waste Energy Digestion Facility Date: 2/18/2010

Job number: 8900.000.000 By: RC

Sample ID: B9A @ 10.5'

%Passing #4: 100

Soil description: See Boring Log

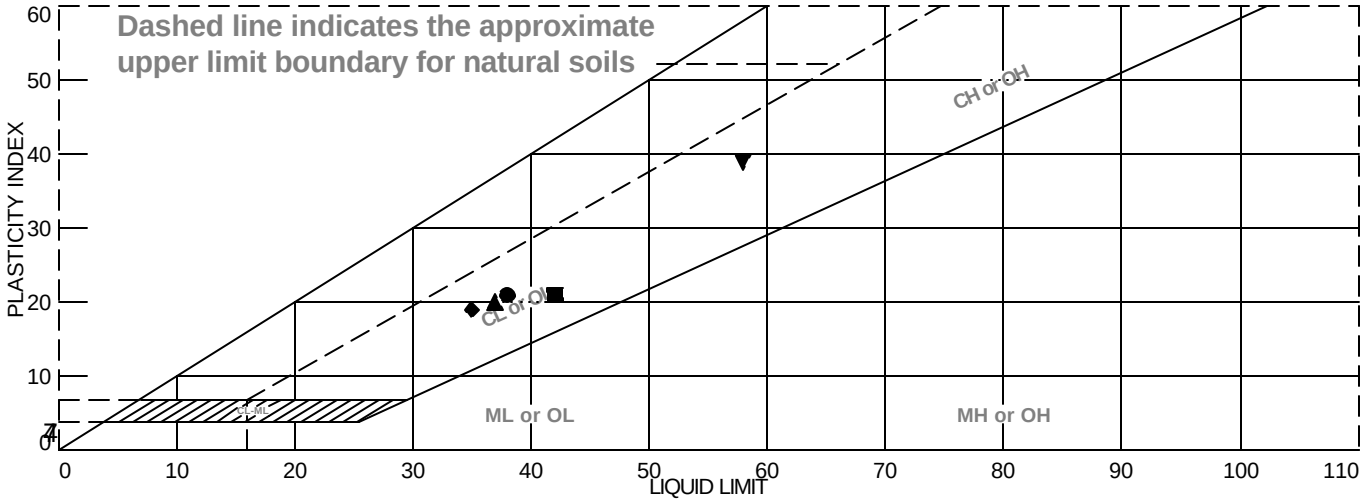
Method used: A ___ B _X__

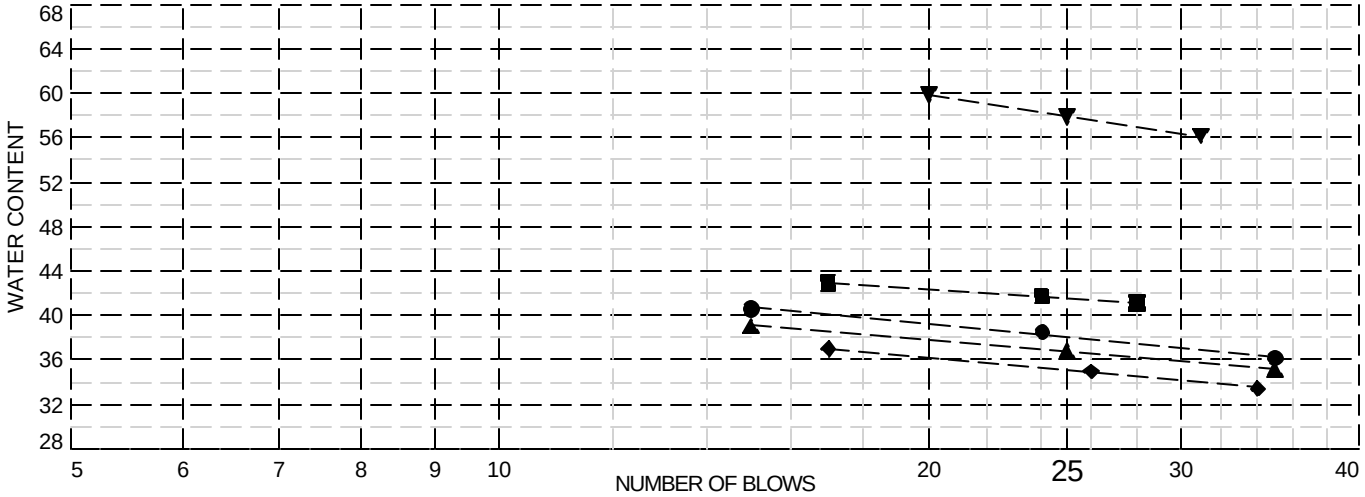
DETERMINATION NUMBER	1	2	3	4
Temperature (^oC), T_{test}	20.0	20.0		
Tare name				
Tare weight (g)	0.00	0.00		
Weight of tare + dry soil (g)	55.60	68.70		
Weight of test sample (g)	55.60	68.70		
Density of water @ T_{test} (See Table 2)	1.00000	1.00000		
Flask number	A	B		
Average calibrated weight of flask (g), $M_?$	823.20	823.20		
Average calibrated volume of flask (ml)	0.0	0.0		
Weight of flask + water (g) @ $T_{test,}$ ($M_{?w,t}$)	823.20	823.20		
Weight of flask + water + soil (g) @ T_{test}	855.50	862.80		
Density of soil solids (g/cm^3)				
Temperature coefficient from Table 2 (K)	0.99979	0.99979		
Specific gravity of water @ T_{test}				
Specific gravity of soil @ $T_{test,}$ G_t	2.39	2.36		
Specific gravity of soil @ 20 ^oC	2.39	2.36		

Avegage Specific Gravity: **2.37**

ENGEO INCORPORATED

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark grayish brown clayey SAND.	38	17	21			SC
■	Light olive brown sandy CLAY.	42	21	21			CL
▲	Light olive brown silty CLAY.	37	17	20			CL
◆	Light olive brown silty CLAY.	35	16	19			CL
▼	Very dark grayish brown CLAY.	58	19	39			CH

Project No. 8900.000.000 **Client:**

Project: Zero Waste Energy Digestion Facility

● **Sample Number:** B8A @ 1
■ **Sample Number:** B8A @ 25
▲ **Sample Number:** B8A @ 42
◆ **Sample Number:** B8A @ 56
▼ **Sample Number:** B9A @ 11

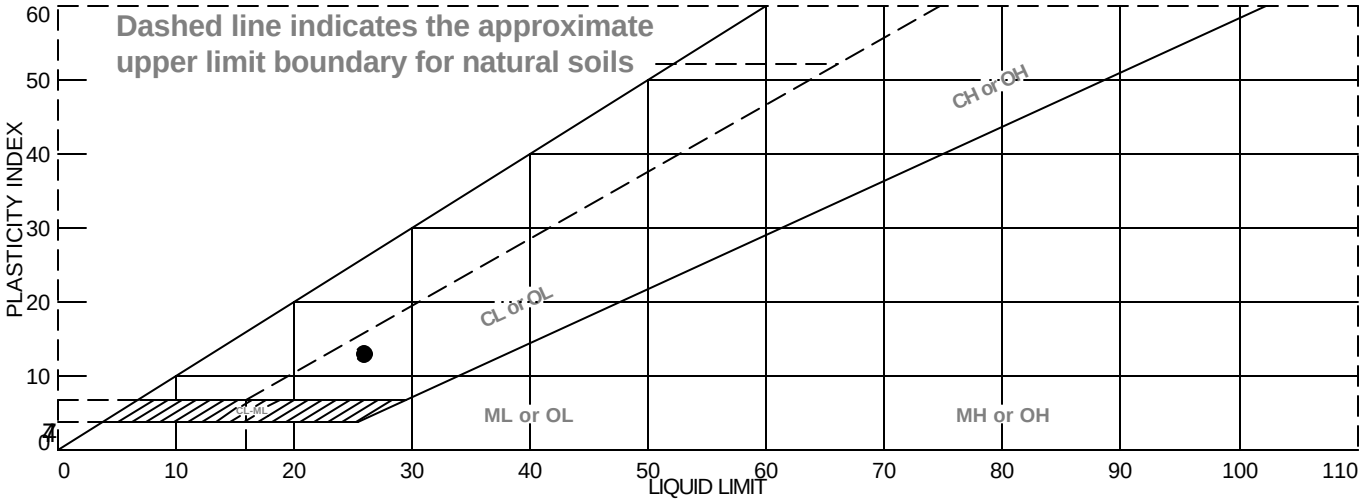
ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Remarks:

Plate

Tested By: ○ KEL □ GC △ KEL ◇ KEL ▽ KEL **Checked By:** GC

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light olive brown clayey SAND.	26	13	13			SC

Project No. 8900.000.000 **Client:**

Project: Zero Waste Energy Digestion Facility

● **Sample Number:** B9A @ 41

Remarks:

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

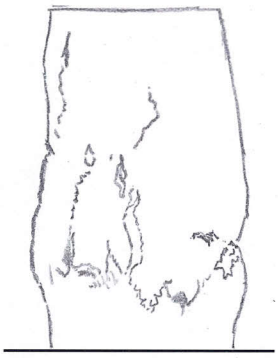
Plate

Tested By: KEL **Checked By:** GC

UNCONFINED COMPRESSION FAILURE DIAGRAM

Job number: **8900.000.000**

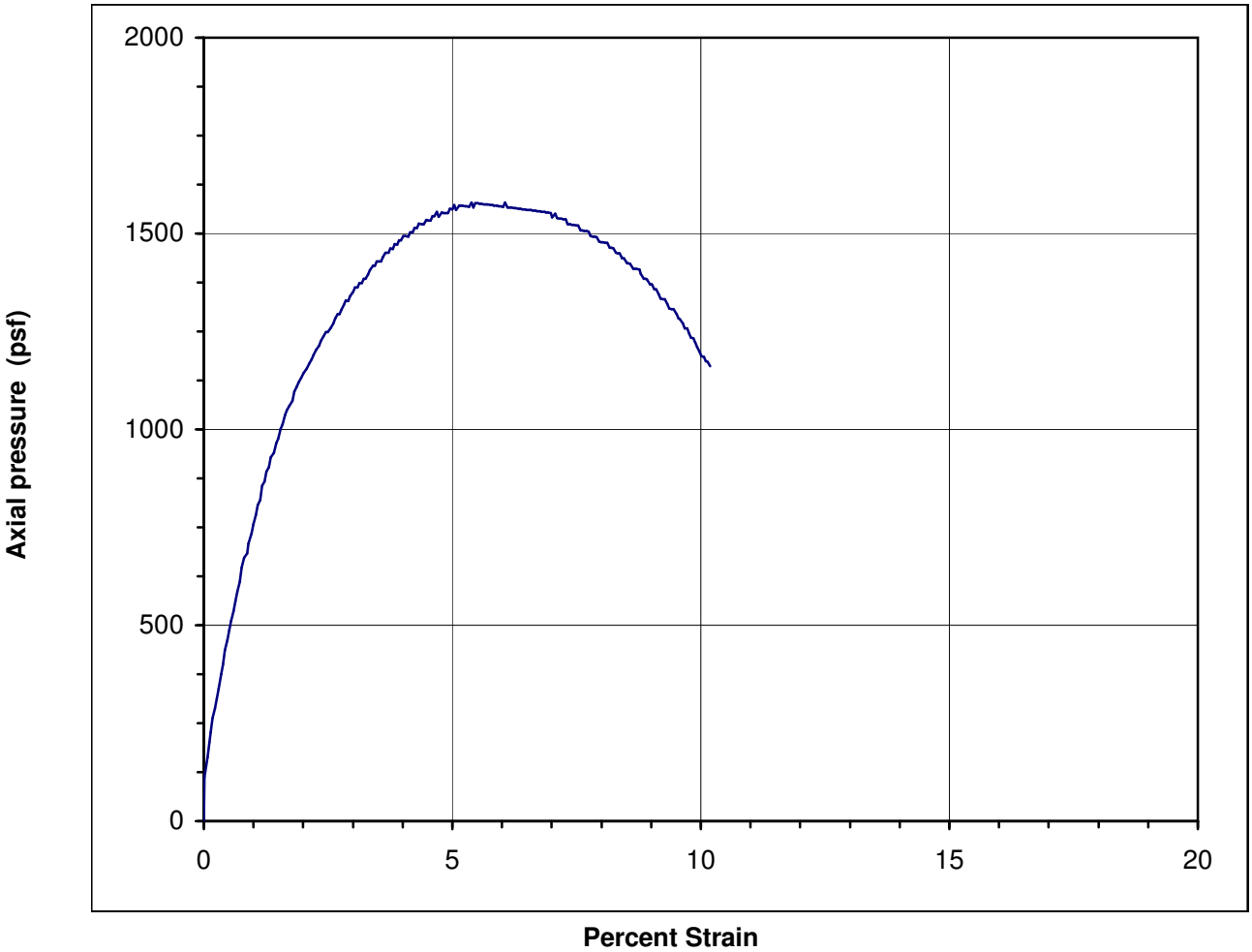
Sample #: **B8A@1**



Sample #: **B9A@2.5**

Sample #: _____

Unconfined Compression Test
ASTM Test Method D2166



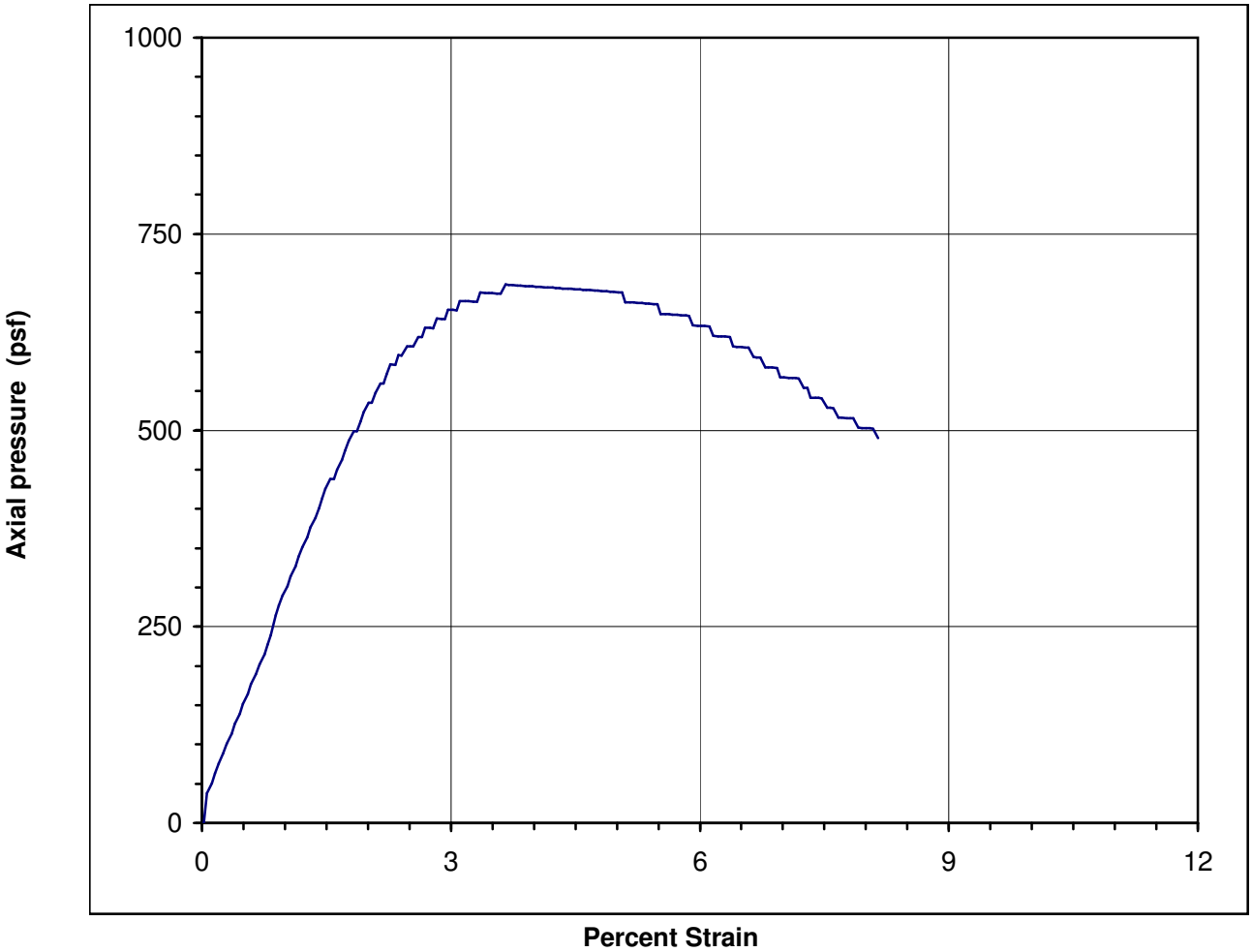
Unconfined Compressive Strength: 1570 psf 0.8 tsf

Sample Description: Dark grayish brown clayey SAND

Initial Diameter:	2.415	in.	Sample Number:	B8A@1	
Initial Height:	5.47	in.	Dry Unit Weight:	116.1	pcf
Strain Rate:	1.327	%/min	Moisture Content:	15.2	%
Total Strain:	10.19	%	Depth of Sample:	1.0	ft.

ENGEO INCORPORATED	ZERO WASTE ENERGY DIGESTION FACILITY San Jose, California	Job No.: 8900.000.000 Sample Number: Date: 2/9/2010	Figure No.

Unconfined Compression Test
ASTM Test Method D2166



Unconfined Compressive Strength: 680 psf 0.3 tsf

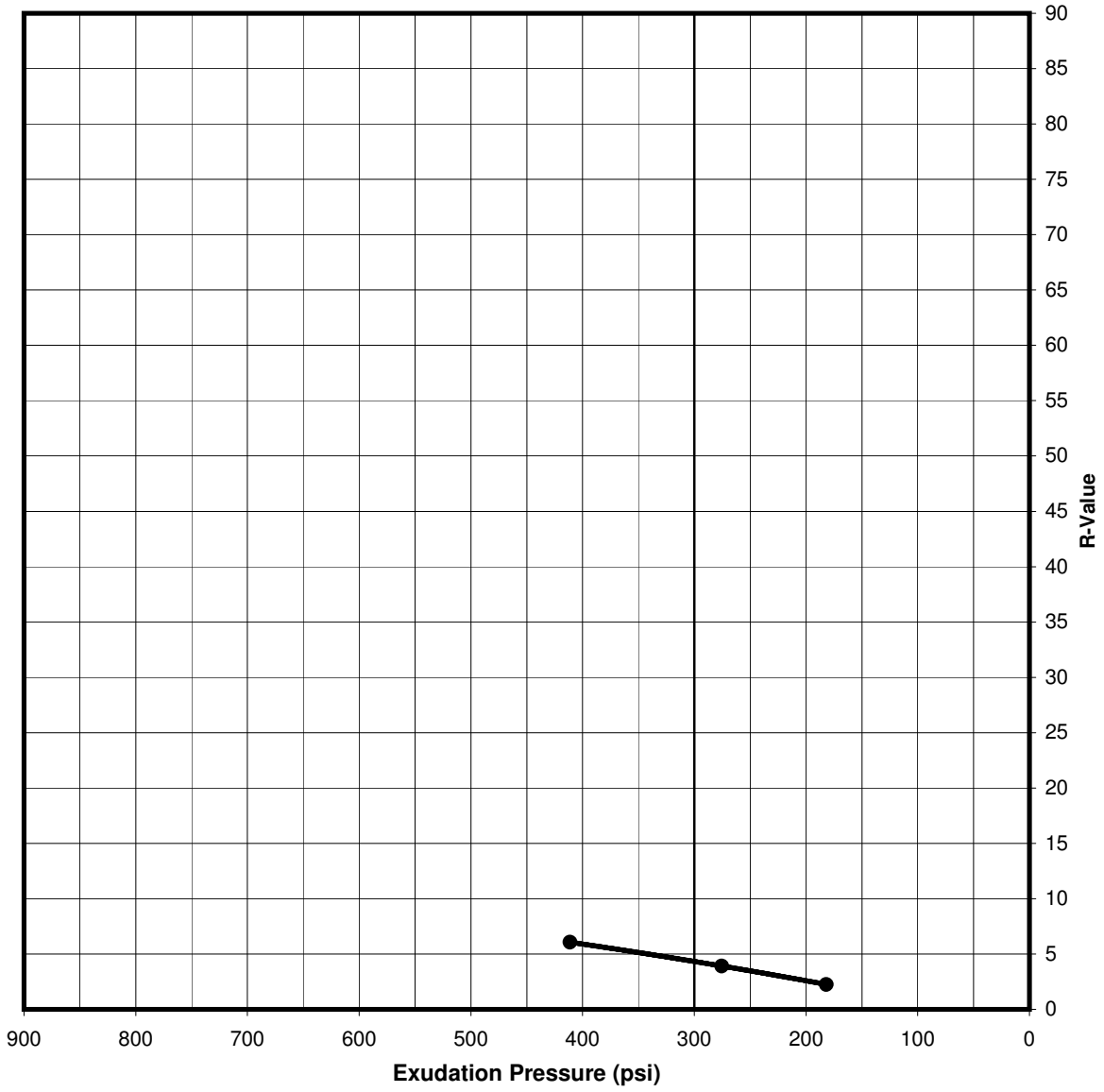
Sample Description: Very dark grayish brown clayey SAND with AC fragments

Initial Diameter:	2.400	in.	Sample Number:	B9A@2.5	
Initial Height:	4.90	in.	Dry Unit Weight:	110.2	pcf
Strain Rate:	1.425	%/min	Moisture Content:	15.1	%
Total Strain:	8.15	%	Depth of Sample:	2.5	ft.

ENGEO INCORPORATED	ZERO WASTE ENERGY DIGESTION FACILITY San Jose, California	Job No.: 8900.000.000 Sample Number: Date: 2/9/2010	Figure No.

ENGEO INCORPORATED

R VALUE TEST REPORT
CAL-301

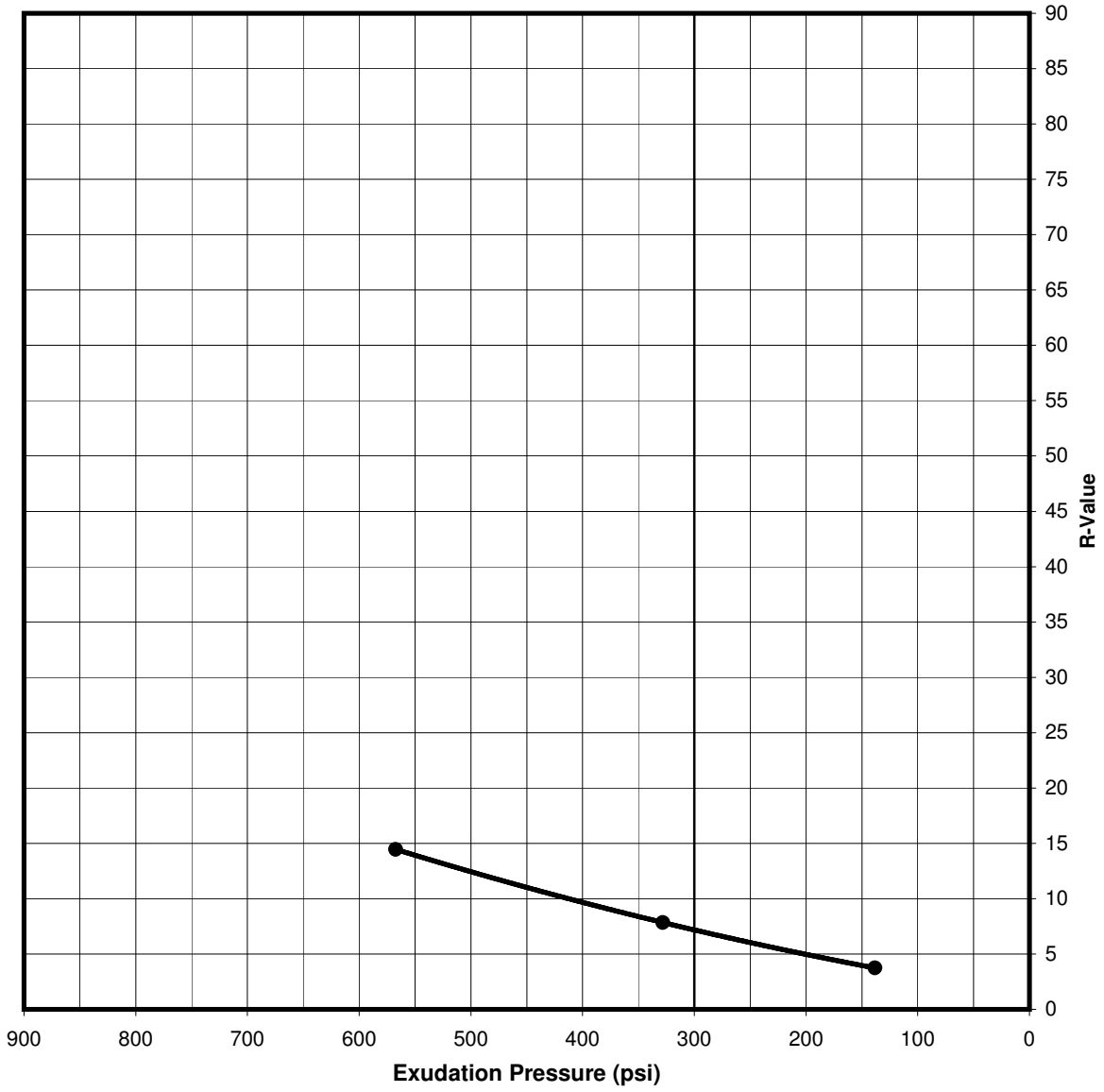


Date: 2/17/10
Project Name: Zero Waste Energy Digestion Facility
Project Number: 8900.000.000
Sample: RV-1: TP-1A
Description: Very dark grayish brown sandy CLAY

Specimen	A	B	C
Exudation Pressure, p.s.i.	411	275	182
Expansion dial (.0001")	12	7	5
Expansion Pressure, p.s.f.	52	30	22
Resistance Value, "R"	6	4	2
% Moisture at Test	20.5	22.5	24.5
Dry Density at Test, p.c.f.	105.4	99.3	97.1
"R" Value at 300 p.s.i., Exudation Pressure	<5		

ENGEO INCORPORATED

R VALUE TEST REPORT
CAL-301



Date: 2/17/10
Project Name: Zero Waste Energy Digestion Facility
Project Number: 8900.000.000
Sample: RV-2: TP-2A
Description: Dark grayish brown sandy CLAY

Specimen	A	B	C
Exudation Pressure, p.s.i.	567	328	138
Expansion dial (.0001")	2	0	0
Expansion Pressure, p.s.f.	9	0	0
Resistance Value, "R"	14	8	4
% Moisture at Test	19.3	21.5	23.2
Dry Density at Test, p.c.f.	110.9	107.4	104.2
"R" Value at 300 p.s.i., Exudation Pressure		7	

Specific Gravity of Soil Solids by Water Pycnometer

(ASTM D854-05)

Job Name: Zero Waste Energy Digestion Facility Date: 2/18/2010

Job number: 8900.000.000 By: RC

Sample ID: B8A @ 8'

%Passing #4: 100

Soil description: See Boring Log

Method used: A ___ B _X__

DETERMINATION NUMBER	1	2	3	4
Temperature (^oC), T_{test}	21.0	21.0		
Tare name				
Tare weight (g)	0.00	0.00		
Weight of tare + dry soil (g)	56.30	56.20		
Weight of test sample (g)	56.30	56.20		
Density of water @ T_{test} (See Table 2)	0.99799	0.99799		
Flask number	A	B		
Average calibrated weight of flask (g), $M_?$	823.60	823.20		
Average calibrated volume of flask (ml)	0.0	0.0		
Weight of flask + water (g) @ $T_{test,}$ ($M_{?w,t}$)	823.60	823.20		
Weight of flask + water + soil (g) @ T_{test}	853.50	855.50		
Density of soil solids (g/cm^3)				
Temperature coefficient from Table 2 (K)	0.99979	0.99979		
Specific gravity of water @ T_{test}				
Specific gravity of soil @ $T_{test,}$ G_t	2.13	2.35		
Specific gravity of soil @ 20 ^oC	2.13	2.35		

Avegage Specific Gravity: **2.24**

ENGEO INCORPORATED

EXPANSION INDEX TEST REPORT
ASTM D 4829

PROJECT NAME: Zero Waste Anaerobic Digestion Facility REPORT DATE: 2/18/2010

CLIENT: Zero Waste Energy Development Company

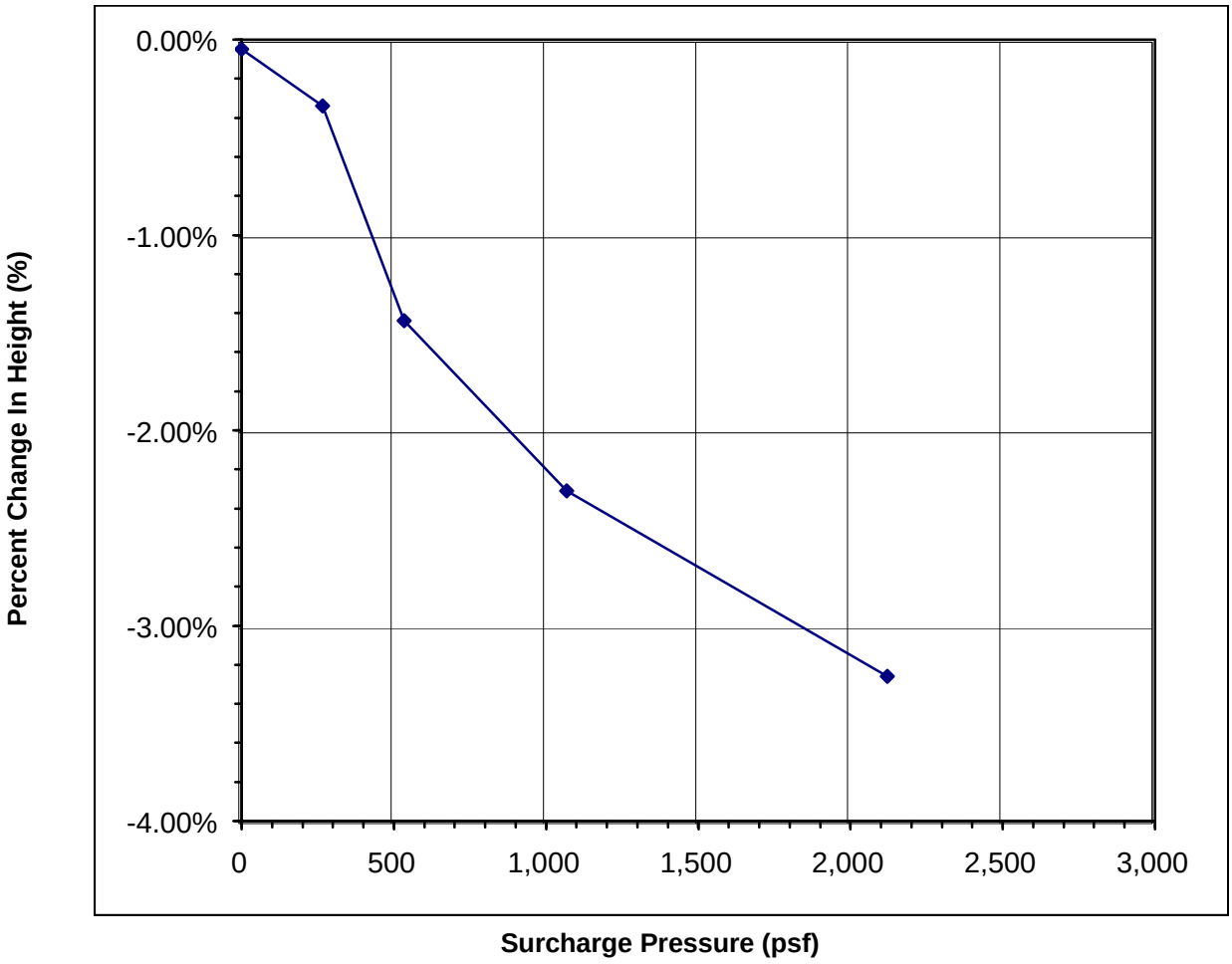
PROJECT NO.: 8900.000.000 TESTED BY: RAM

Sample ID	Soil Description	Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Expansion Index
1A	Dark Gray Clay w/ Traces of Organics	103.4	11.6	23.4	54.4
TP1	Dark Gray Clay w/ Traces of Organics	108.3	11.1	21.5	52.6
TP2	Very Dark Gray Clay w/ Traces of Organics	106.8	9.5	23.1	49.8

CLASSIFICATION OF EXPANSIVE SOIL

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

Collapse Potential
ASTM Test Method D5333-03



Sample Description: Mottled v. dark gry and olive brown sandy silty Clay with gravel

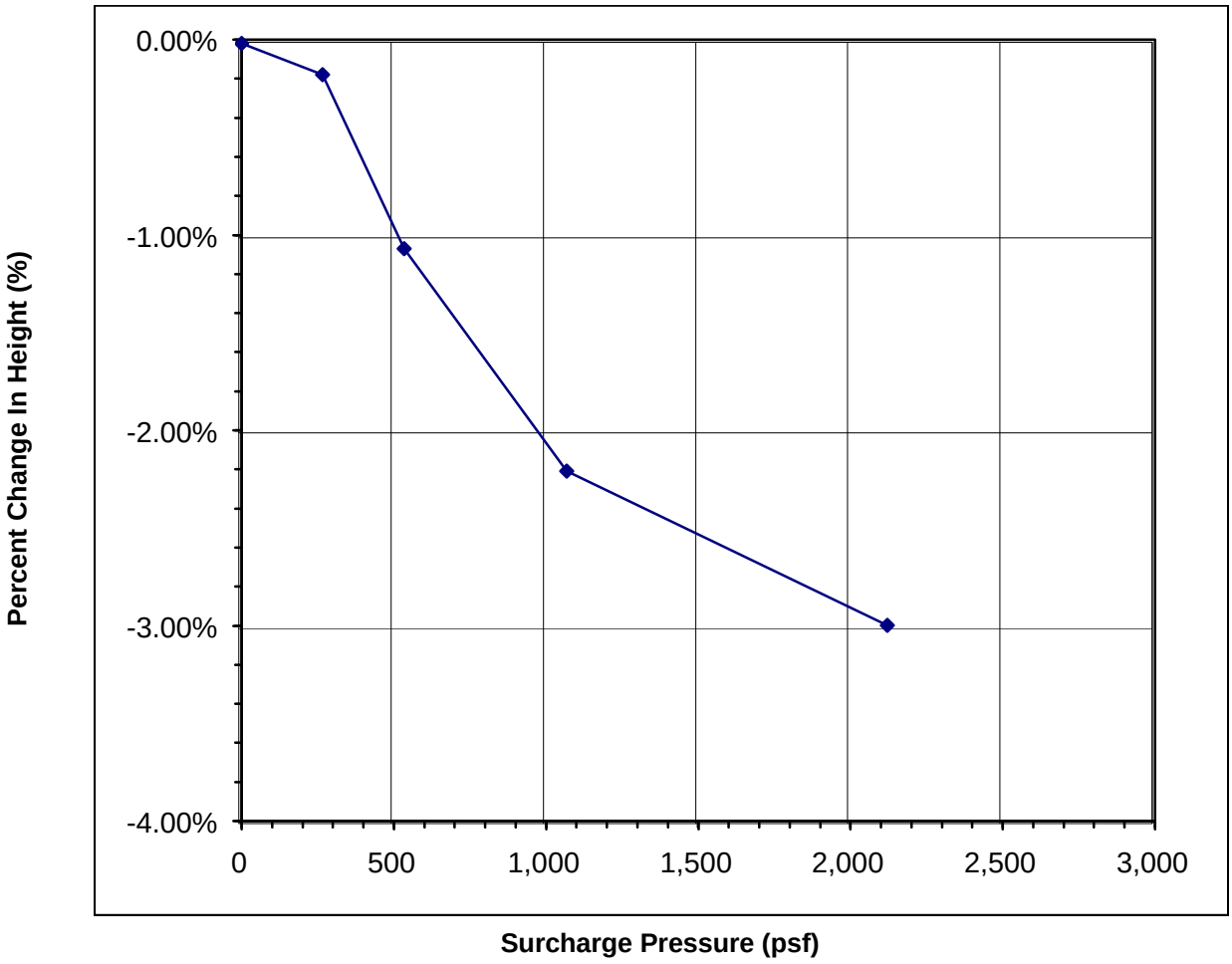
Sample Number: B8A@3'

Depth of Sample:

PRE-TEST DATA			POST-TEST DATA		
Moisture Content:	19.3	%	Moisture Content:	19.3	%
Dry Unit Weight	109.1	pcf	Dry Unit Weight	105.6	pcf

***EN* GEO** INCORPORATED	ZERO WASTE ENERGY DIGESTION FACILITY	Job No.:	8900.000.000
		Sample Number:	B8A@3'
		Date:	

Collapse Potential
ASTM Test Method D5333-03



Sample Description: Dark gryish brown sandy silty Clay with gravel

Sample Number: B8A@5'

Depth of Sample:

PRE-TEST DATA

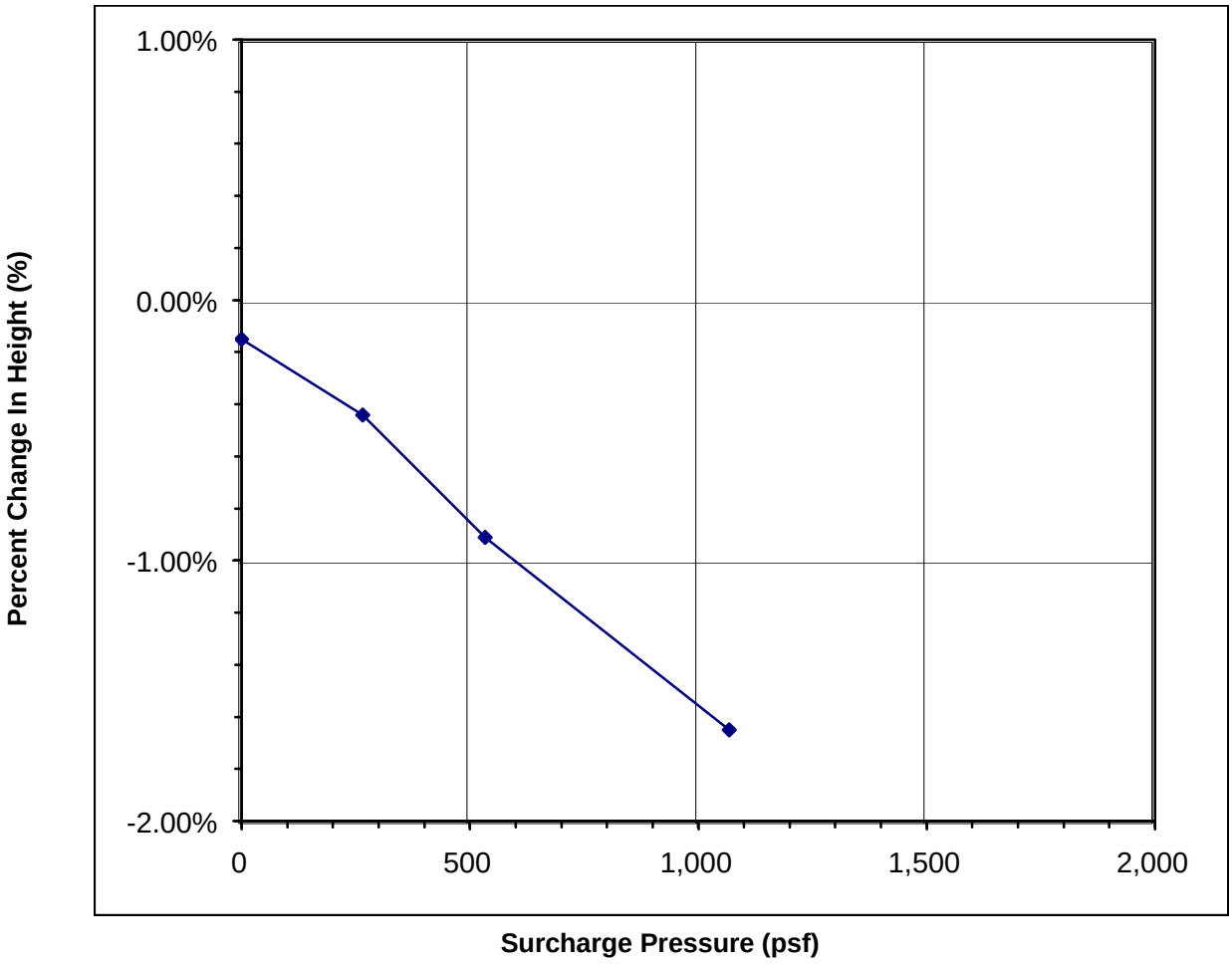
Moisture Content: 18.7 %
Dry Unit Weight 110.2 pcf

POST-TEST DATA

Moisture Content: 19.7 %
Dry Unit Weight 113.6 pcf

***EN* GEO** INCORPORATED	ZERO WASTE ENERGY DIGESTION FACILITY	Job No.:	8900.000.000
		Sample Number:	B8A@5'
		Date:	

Collapse Potential
ASTM Test Method D5333-03



Percent Heave: -0.15 %

Swell Pressure: 400 psf

Sample Description: Very dark Brown sandy silty Clay with gravel

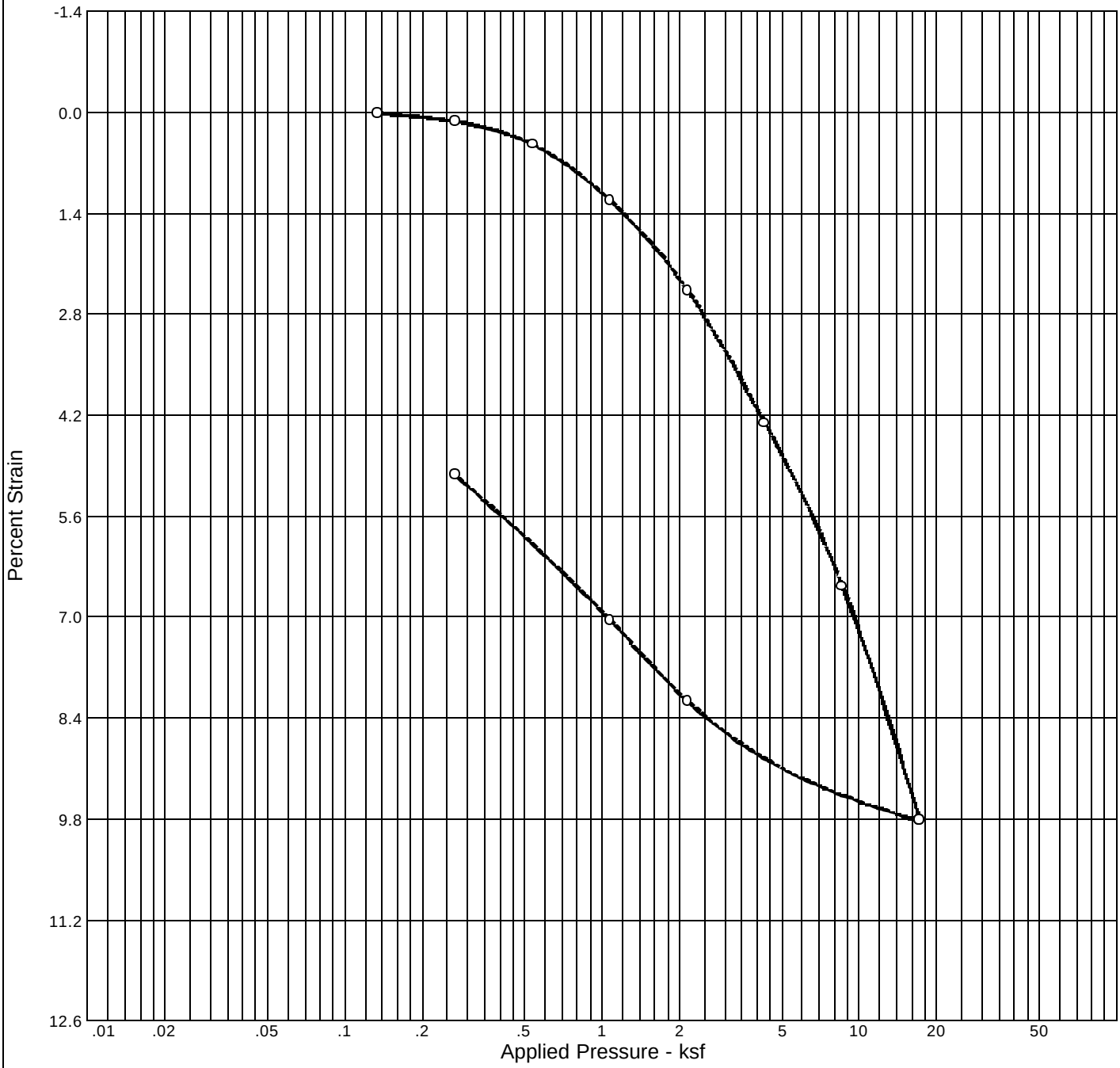
Sample Number: B9A@3'

Depth of Sample:

PRE-TEST DATA			POST-TEST DATA		
Moisture Content:	22.9	%	Moisture Content:	22.5	%
Dry Unit Weight	112.1	pcf	Dry Unit Weight	110.2	pcf

***EN* GEO** INCORPORATED	ZERO WASTE ENERGY DIGESTION FACILITY	Job No.:	8900.000.000
		Sample Number:	B9A@3'
		Date:	

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.9 %	23.0 %	105.1			2.75			0.634

MATERIAL DESCRIPTION

Olive brown silty CLAY

Project No. 8900.000.000 **Client:**

Project: Zero Waste Energy Digestion Facility

Source: **Sample No.:** B8A @ 35

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

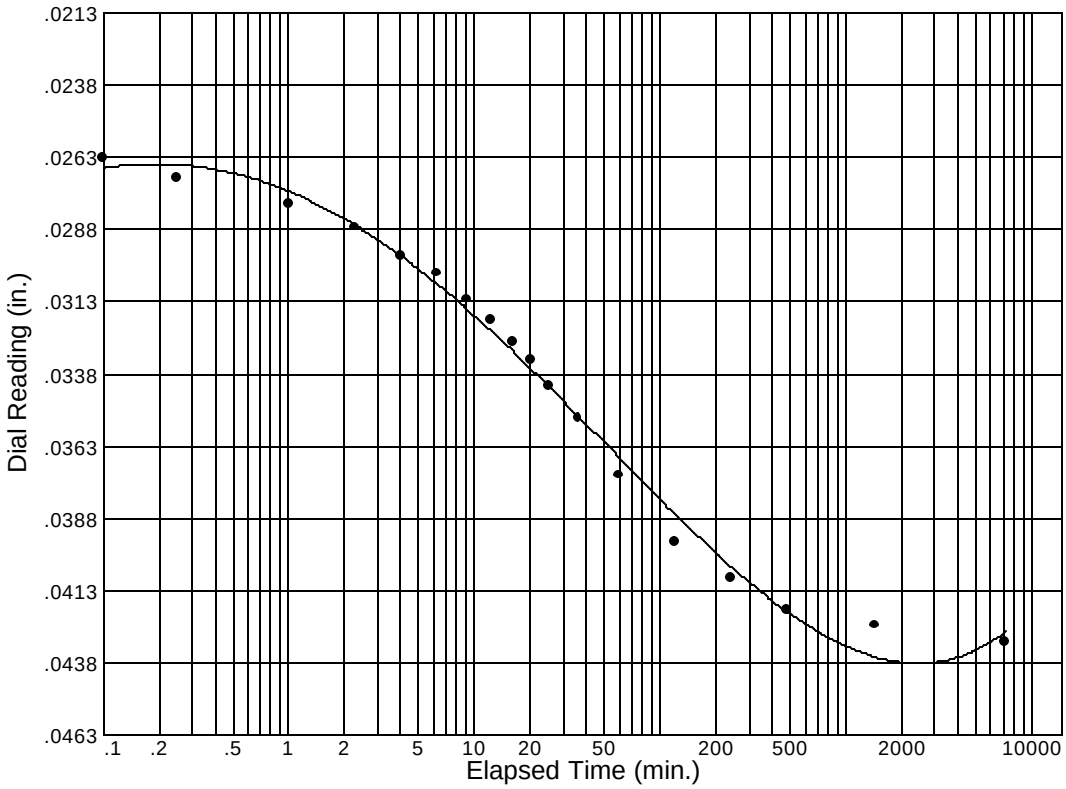
Remarks:

Plate

Dial Reading vs. Time

Project No.: 8900.000.000
Project: Zero Waste Energy Digestion Facility

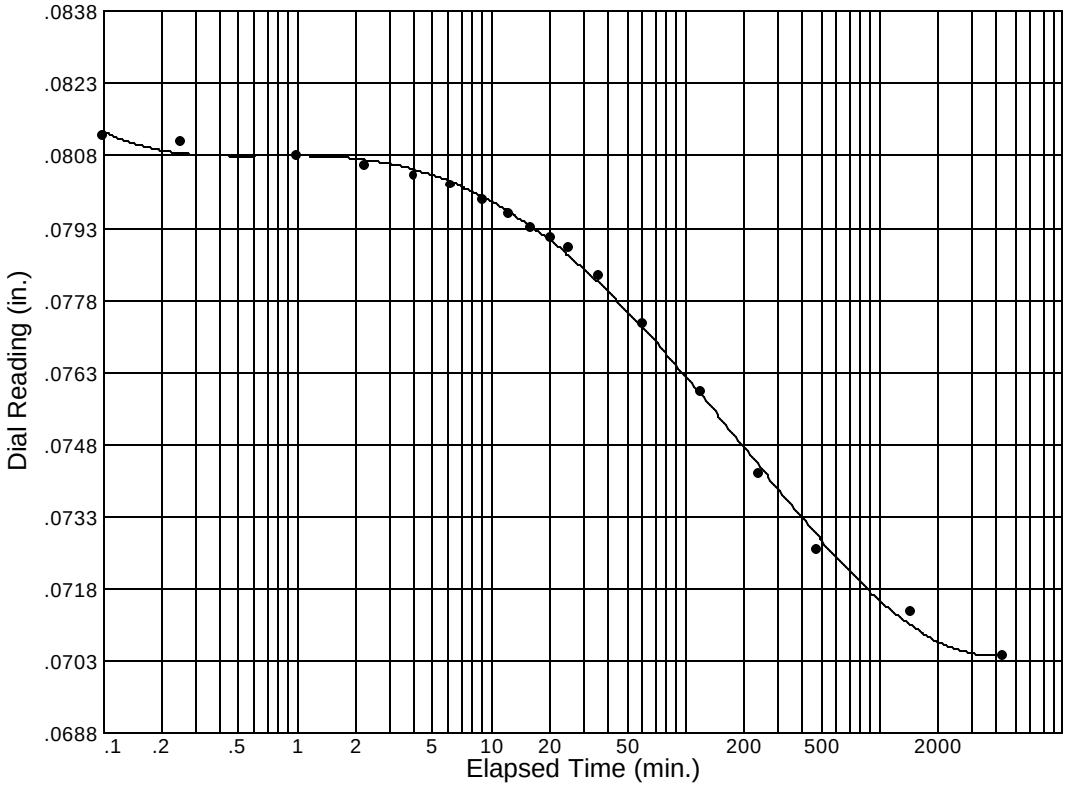
Source: Sample No.: B8A @ 35



Load No.= 6
Load= 4.29 ksf
D_0 = 0.02519
D_{50} = 0.03360
D_{100} = 0.04201
T_{50} = 19.91 min.

C_v @ T_{50}
0.0000 in.^{2}/sec.

C_α = 0.001



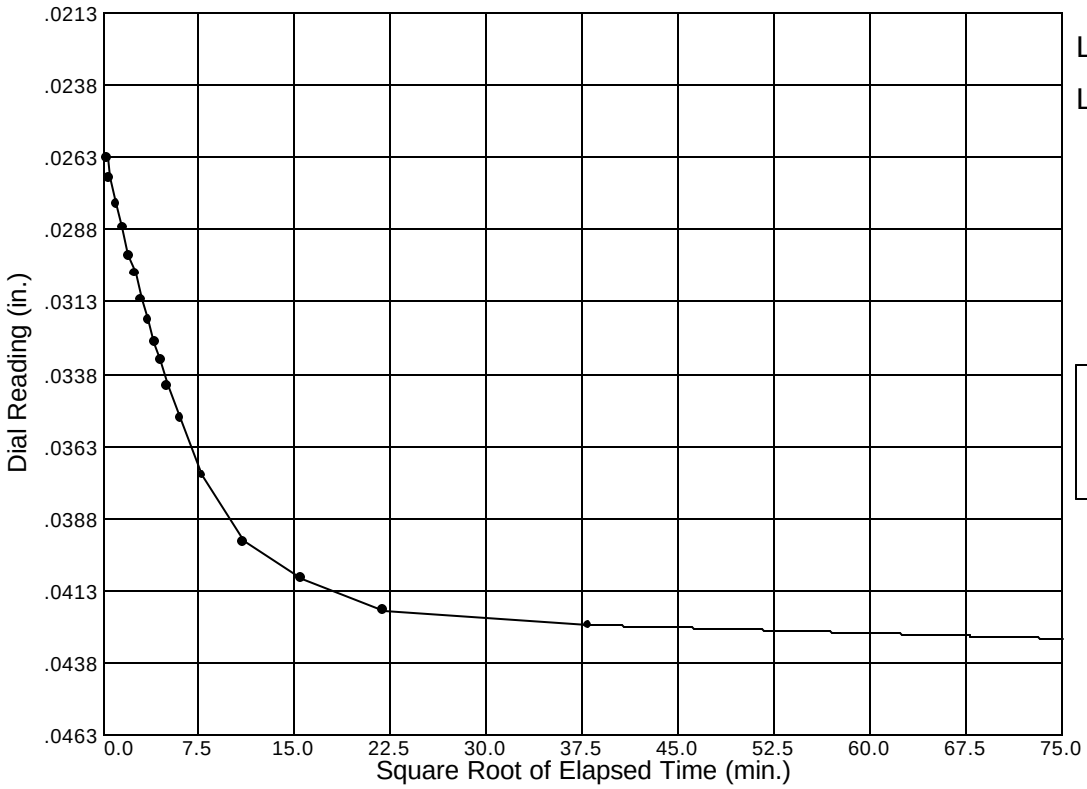
Load No.= 10
Load= 1.07 ksf
D_0 = 0.08177
D_{50} = 0.07679
D_{100} = 0.07180
T_{50} = 75.40 min.

C_v @ T_{50}
0.0000 in.^{2}/sec.

Dial Reading vs. Time

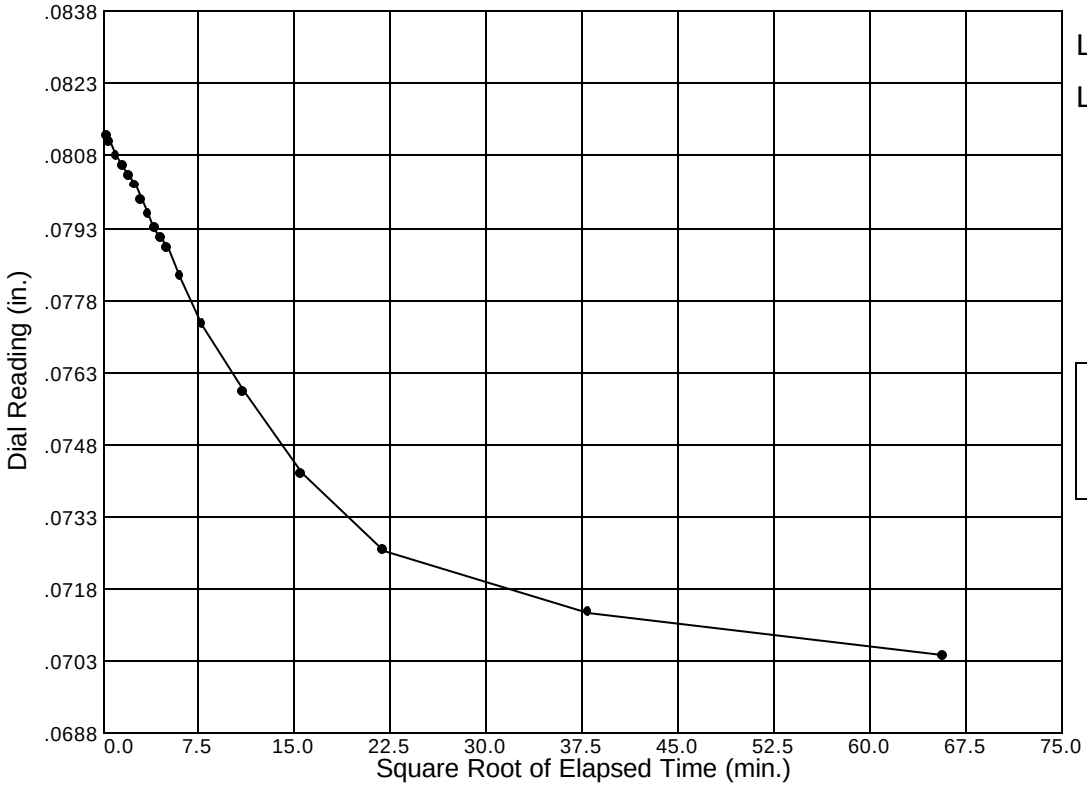
Project No.: 8900.000.000
Project: Zero Waste Energy Digestion Facility

Source: Sample No.: B8A @ 35



Load No.= 6
Load= 4.29 ksf
D_0 = 0.02648
D_{90} = 0.03835
D_{100} = 0.03967
T_{90} = 84.87 min.

C_v @ T_{90}
0.0000 in.^{2}/sec.



Load No.= 10
Load= 1.07 ksf
D_0 = 0.08137
D_{90} = 0.07374
D_{100} = 0.07289
T_{90} = 300.42 min.

C_v @ T_{90}
0.0000 in.^{2}/sec.

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

19 February, 2010

Job No.1002054
Cust. No.10169

Mr. Paul Cottingham
ENGEO Inc.
2010 Crow Canyon Place, Suite 250
San Ramon, CA 94583

Subject: Project No.: 8900.000.000
Project Name: Zero Waste Energy Digestion Facility
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Cottingham:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on February 09, 2010. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, Sample No.004 is classified as "severely corrosive", Samples No.001 and No.002 are classified as "corrosive" and Sample No.003 is classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations range from none detected to 480 mg/kg. Because the chloride ion concentrations are greater than 300 mg/kg, they are determined to be sufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentrations range from none detected to 740 mg/kg and determined to be sufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The pH of the soils range from 7.6 to 8.9 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials range from 460 to 480-mV, which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call JDH Corrosion Consultants, Inc. at (925) 927-6630.

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMullen for
J. Darby Howard, Jr., P.E.
President

JDH/jdl

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax: 925 462 2775
www.cercoanalytical.com

Client: ENGEO Incorporated
Client's Project No.: 8900.000.000
Client's Project Name: Zero Waste Energy Digestion Facility
Date Sampled: 8-Feb-10
Date Received: 9-Feb-10
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 19-Feb-2010

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1002054-001	B8A @ 4.5'	480	7.6	-	550	-	180	740
1002054-002	B8A @ 11'	460	7.7	-	640	-	210	220
1002054-003	B9A @ 0.5'	480	8.0	-	2,800	-	N.D.	N.D.
1002054-004	B9A @ 37'	460	8.9	-	440	-	480	18

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	17-Feb-2010	17-Feb-2010	-	19-Feb-2010	-	17-Feb-2010	17-Feb-2010

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

ENGEO INCORPORATED
2010 Crow Canyon Place, Suite 250
San Ramon, California
Phone: (925) 866-9000
Fax (925) 866-0199

1002054

10169

CHAIN OF CUSTODY RECORD

PROJECT NUMBER: 8900.000.000

PROJECT NAME: Zero Waste/Energy Digestion Facility

SAMPLED BY: (SIGNATURE) ANDY FIRMIN

	SAMPLE NUMBER	DATE	TIME	MATRIX	CONTAINER NUMBER	CONTAINER SIZE	PRESERVATIVE	TPH- GASOLINE (EPA 8015/5030)	TPH- DIESEL (EPA 8015/3550/3510)	PURGEABLE AROMATICS BTEX (EPA 602, 8020)	PURGEABLE HALOCARBONS (EPA 601,8010)	VOLATILE ORGANICS (EPA 624, 8240)	BASE / NEUTRALS, ACIDS (EPA 625,8270)	TOTAL OIL & GREASE (SWWW 5520 (F))	O-C PESTICIDES / PCBs (EPA 608, 8080)	O-P PESTICIDES (EPA 614, 8140)	TITLE 26 METALS (17)	PRIORITY METALS (13)	Sulfates	MTBE	ASTM CORROSIVITY			REMARKS/ REQUIRED DETECTION LIMITS
01	B8Ae4.5	2/8/10	3:45	soil		qt	none														X			
2	B8Ae11	2/8/10	↓	soil		qt	none														X			
3	B9Ae0.5	2/8/10		soil		qt	none														X			
4	B9Ae37	2/8/10		soil		qt	none														X			

Rec'd by 02/23/10

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	RELINQUISHED BY:	DATE / TIME	RECEIVED BY:
[signature]	2/9/10 8:45	[signature]			
RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	RELINQUISHED BY: Paul	DATE / TIME	RECEIVED BY:
RELINQUISHED BY:	DATE / TIME	RECEIVED FOR LABORATORY BY:	REMARKS: Email results to pcottingham@engeo.com (916)580-6509		

APPENDIX D

Liquefaction Sample Calculation Tables
Slope Stability Sample Input/Output

LIQUEFACTION POTENTIAL EVALUATION USING CORRECTED BLOWCOUNTS

Project Name: Zero Waste Energy

Project Number: 8900000000 Phase 001

Liquefaction Analyses 2004 Youd Method

EQ Magnitude: 7.26 **MWF:** 1.087

PGA: 0.51

Boring	Sample Depth (FT)	Water Table (FT)	Measured Blow Count (N)	CE	CB	CR	CS	Corrected Blow Count (N)	Est. % FINES (%)	Est. PI	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	C_N	$(N_1)_{60}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments	Liquefiable Layer
B8A	5.0	16	23	1.3	1.05	0.75	0.63	15	60	25	120	600.0	600.0	1.60	24	0.332	0.290	0.315	0.95	Above W.T.	
B8A	7.0	16	17	1.3	1.05	0.75	0.63	11	50	15	60	420.0	420.0	1.60	18	0.332	0.175	0.190	0.57	Above W.T.	
B8A	16.0	16	17	1.3	1.05	0.85	0.63	12	50	15	60	960.0	960.0	1.44	18	0.325	0.175	0.190	0.59	Liquefaction	Refuse…not liquefiable
B8A	18.0	16	16	1.3	1.05	0.85	0.63	12	59	0	115	2070.0	1945.2	1.01	12	0.346	0.110	0.120	0.35	Liquefaction	Silt…marginal liquefaction
B8A	20.0	16	24	1.3	1.05	0.95	0.63	20	6.4	0	115	2300.0	2050.4	0.99	19	0.357	0.143	0.155	0.43	Liquefaction	
B8A	23.0	16	18	1.3	1.05	0.95	1.2	28	6.4	0	115	2645.0	2208.2	0.95	27	0.381	0.261	0.284	0.74	Liquefaction	
B8A	25.0	16	8	1.3	1.05	0.95	1.2	12	6.4	0	115	2875.0	2313.4	0.93	12	0.395	0.077	0.083	0.21	Liquefaction	
B8A	35.0	16	19	1.3	1.05	1	0.63	16	75	15	115	4025.0	2839.4	0.84	14	0.329	0.130	0.141	0.43	Check PI	Clay, no liquefaction
B8A	43.0	16	9	1.3	1.05	1	0.63	8	75	15	115	4945.0	3260.2	0.78	6	0.292	0.070	0.076	0.26	Check PI	Clay, no liquefaction

Settlement calculations for B8A

Liq Layers (FT)	USGS	Layer Thickness (FT)	Vol. Strain (%)	Settlement (inches)
17-20	ML*	3	1.5%	0.54
20-23	SP	3	2.3%	0.81
23-26	SP	3	3.0%	1.08
				0.00
				0.00
				0.00
		9		**2.43**

*Note - reduced volumetric strain for marginally liquefiable layers

LIQUEFACTION POTENTIAL EVALUATION USING CORRECTED BLOWCOUNTS

Project Name: Zero Waste Energy

Project Number: 8900000000 Phase 001

Liquefaction Analyses 2004 Youd Method

EQ Magnitude: 7.26 **MWF:** 1.087
PGA: 0.51

Boring	Sample Depth (FT)	Water Table (FT)	Measured Blow Count (N)	CE	CB	CR	CS	Corrected Blow Count (N)	Est. % FINES (%)	Est. PI	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	C_N	$(N_1)_{60}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments	Liquefiable Layer
B9A	3.0	28	11	1.3	1.05	0.75	0.63	7	60	15	110	330.0	330.0	1.60	11	0.332	0.095	0.103	0.31	Above W.T.	
B9A	13.0	28	28	1.3	1.05	0.85	0.63	20	60	15	110	1430.0	1430.0	1.18	24	0.325	0.290	0.315	0.97	Above W.T.	
B9A	21.0	28	17	1.3	1.05	0.95	0.63	14	50	10	110	2310.0	2310.0	0.93	13	0.318	0.120	0.130	0.41	Above W.T.	
B9A	30.0	28	33	1.3	1.05	1	0.63	28	50	10	60	1800.0	1675.2	1.09	31	0.328	0.600	0.652	1.99	(N1)60>30	Refuse…no liquefaction
B9A	35.0	28	26	1.3	1.05	1	0.63	22	15.6	0	110	3850.0	3413.2	0.77	17	0.262	0.131	0.142	0.54	Liquefaction	
B9A	38.0	28	6	1.3	1.05	1	1.2	10	50	10	115	4370.0	3746.0	0.73	7	0.271	0.075	0.082	0.30	Liquefaction	Silt, marginally liquefiable
B9A	41.0	28	23	1.3	1.05	1	0.63	20	60	15	115	4715.0	3903.8	0.72	14	0.232	0.130	0.141	0.61	Check PI	Clay, no liquefaction
B9A	45.0	28	30	1.3	1.05	1	0.63	26	60	15	115	5175.0	4114.2	0.70	18	0.242	0.175	0.190	0.79	Check PI	Clay, no liquefaction
B9A	55.0	28	16	1.3	1.05	1	0.63	14	60	15	115	6325.0	4640.2	0.66	9	0.249	0.085	0.092	0.37	Check PI	Clay, no liquefaction

Settlement calculations for B9A

Liq Layers (FT)	USGS	Layer Thickness (FT)	Vol. Strain (%)	Settlement (inches)
34-37	SP	3	2.5%	0.90
37-39	ML*	2	2.0%	0.48
				0.00
				0.00
				0.00
				1.38

*Note - reduced volumetric strain for marginally liquefiable layers

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	7.26
PGA (g):	0.51
MSF:	1.08

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments		Ev	(inches) S
CPT-01	0.164	12	5.218	0.026	115	19	19	10.0	552.1	0.50	1.2	2.0	0.00	0.0	10.0	0.332	0.080	0.087	0.26	Above W.T.		0.00	0.0000
CPT-01	0.328	12	12.204	0.132	115	38	38	23.4	645.8	1.08	1.4	1.7	0.00	0.0	23.4	0.332	0.081	0.088	0.26	Above W.T.		0.00	0.0000
CPT-01	0.492	12	22.527	0.281	115	57	57	43.1	795.0	1.25	1.4	2.0	0.00	0.0	43.1	0.332	0.087	0.094	0.28	Above W.T.		0.00	0.0000
CPT-01	0.656	12	19.504	0.447	115	75	75	37.4	515.9	2.30	1.8	7.1	0.06	2.3	39.6	0.332	0.086	0.093	0.28	Above W.T.		0.00	0.0000
CPT-01	0.82	12	19.105	0.546	115	94	94	36.6	404.0	2.86	1.9	10.1	0.14	5.7	42.3	0.332	0.087	0.094	0.28	Above W.T.		0.00	0.0000
CPT-01	0.984	12	18.877	0.568	115	113	113	36.2	332.5	3.02	1.9	11.5	0.17	7.6	43.8	0.332	0.088	0.095	0.29	Above W.T.		0.00	0.0000
CPT-01	1.148	12	21.301	0.492	115	132	132	40.8	321.6	2.32	1.9	9.3	0.12	5.3	46.1	0.332	0.089	0.096	0.29	Above W.T.		0.00	0.0000
CPT-01	1.312	12	24.323	0.463	115	151	151	46.6	321.3	1.91	1.8	7.8	0.07	3.7	50.3	0.332	0.092	0.099	0.30	Above W.T.		0.00	0.0000
CPT-01	1.476	12	22.384	0.414	115	170	170	42.9	262.6	1.86	1.8	8.6	0.10	4.6	47.4	0.332	0.090	0.097	0.29	Above W.T.		0.00	0.0000
CPT-01	1.64	12	19.561	0.437	115	189	189	37.5	206.3	2.24	2.0	11.6	0.18	8.1	45.5	0.332	0.089	0.096	0.29	Above W.T.		0.00	0.0000
CPT-01	1.804	12	19.048	0.388	115	207	207	36.5	182.6	2.05	2.0	11.7	0.18	7.9	44.4	0.332	0.088	0.095	0.29	Above W.T.		0.00	0.0000
CPT-01	1.969	12	14.942	0.269	115	226	226	28.6	130.9	1.81	2.0	13.1	0.22	7.9	36.5	0.332	0.085	0.091	0.28	Above W.T.		0.00	0.0000
CPT-01	2.133	12	13.858	0.225	115	245	245	26.5	111.9	1.64	2.0	13.5	0.23	7.8	34.3	0.332	0.084	0.090	0.27	Above W.T.		0.00	0.0000
CPT-01	2.297	12	14.657	0.078	115	264	264	28.1	109.9	0.54	1.7	6.4	0.04	1.1	29.2	0.332	0.082	0.089	0.27	Above W.T.		0.00	0.0000
CPT-01	2.461	12	5.988	0.066	115	283	283	11.5	41.3	1.13	2.2	20.7	0.42	8.3	19.7	0.332	0.081	0.087	0.26	Above W.T.		0.00	0.0000
CPT-01	2.625	12	5.646	0.121	115	302	302	10.8	36.4	2.20	2.5	29.2	0.65	19.8	30.6	0.332	0.083	0.089	0.27	Above W.T.		0.00	0.0000
CPT-01	2.789	12	5.247	0.161	115	321	321	10.0	31.7	3.17	2.6	36.1	0.80	40.2	50.2	0.332	0.092	0.099	0.30	Above W.T.		0.00	0.0000
CPT-01	2.953	12	5.304	0.223	115	340	340	10.2	30.2	4.34	2.7	41.6	0.80	40.6	50.8	0.332	0.092	0.100	0.30	Above W.T.		0.00	0.0000
CPT-01	3.117	12	5.161	0.265	115	358	358	9.9	27.8	5.32	2.8	46.5	0.80	39.5	49.4	0.332	0.091	0.099	0.30	Above W.T.		0.00	0.0000
CPT-01	3.281	12	5.817	0.28	115	377	377	11.1	29.8	4.97	2.8	44.1	0.80	44.6	55.7	0.332	0.096	0.104	0.31	Above W.T.		0.00	0.0000
CPT-01	3.445	12	4.705	0.259	115	396	396	9.0	22.7	5.75	2.9	51.7	0.80	36.0	45.1	0.332	0.089	0.096	0.29	Above W.T.		0.00	0.0000
CPT-01	3.609	12	4.762	0.239	115	415	415	9.1	21.9	5.25	2.9	50.8	0.80	36.5	45.6	0.332	0.089	0.096	0.29	Above W.T.		0.00	0.0000
CPT-01	3.773	12	5.76	0.236	115	434	434	11.0	25.5	4.26	2.8	44.3	0.80	44.1	55.2	0.332	0.096	0.103	0.31	Above W.T.		0.00	0.0000
CPT-01	3.937	12	5.96	0.216	115	453	453	11.4	25.3	3.77	2.7	42.5	0.80	45.7	57.1	0.332	0.097	0.105	0.32	Above W.T.		0.00	0.0000
CPT-01	4.101	12	5.617	0.22	115	472	472	10.8	22.8	4.09	2.8	45.7	0.80	43.0	53.8	0.332	0.094	0.102	0.31	Above W.T.		0.00	0.0000
CPT-01	4.265	12	5.988	0.197	115	490	490	11.5	23.4	3.43	2.7	42.5	0.80	45.9	57.3	0.332	0.098	0.105	0.32	Above W.T.		0.00	0.0000
CPT-01	4.429	12	5.874	0.246	115	509	509	11.2	22.1	4.38	2.8	47.5	0.80	45.0	56.2	0.332	0.097	0.104	0.31	Above W.T.		0.00	0.0000
CPT-01	4.593	12	6.644	0.271	115	528	528	12.6	24.1	4.25	2.8	45.3	0.80	50.6	63.2	0.332	0.104	0.112	0.34	Above W.T.		0.00	0.0000
CPT-01	4.757	12	13.174	0.436	115	547	547	24.6	47.1	3.38	2.5	31.0	0.69	56.0	80.6	0.332	0.129	0.139	0.42	Above W.T.		0.00	0.0000
CPT-01	4.921	12	25.521	0.685	115	566	566	46.9	89.2	2.71	2.2	20.6	0.42	33.4	80.3	0.332	0.128	0.138	0.42	Above W.T.		0.00	0.0000
CPT-01	5.085	12	24.951	0.845	115	585	585	45.1	84.3	3.43	2.3	23.9	0.51	46.2	91.3	0.332	0.151	0.163	0.49	Above W.T.		0.00	0.0000
CPT-01	5.249	12	23.839	0.999	115	604	604	42.5	78.0	4.24	2.4	27.7	0.60	65.0	107.4	0.332	0.195	0.211	0.64	Above W.T.		0.00	0.0000
CPT-01	5.413	12	22.641	1.039	115	622	622	39.7	71.7	4.65	2.5	30.0	0.67	79.4	119.1	0.332	0.237	0.256	0.77	Above W.T.		0.00	0.0000
CPT-01	5.577	12	23.725	1.081	115	641	641	41.0	73.0	4.62	2.5	29.6	0.66	78.9	119.9	0.332	0.240	0.260	0.78	Above W.T.		0.00	0.0000
CPT-01	5.741	12	27.802	1.057	115	660	660	47.3	83.2	3.85	2.4	25.6	0.55	57.7	105.1	0.332	0.188	0.203	0.61	Above W.T.		0.00	0.0000
CPT-01	5.906	12	28.714	1.199	115	679	679	48.2	83.5	4.23	2.4	26.8	0.58	67.1	115.3	0.332	0.222	0.240	0.72	Above W.T.		0.00	0.0000
CPT-01	6.07	12	29.085	1.255	115	698	698	48.2	82.3	4.37	2.4	27.4	0.60	71.8	119.9	0.332	0.240	0.260	0.78	Above W.T.		0.00	0.0000
CPT-01	6.234	12	27.659	1.22	115	717	717	45.2	76.1	4.47	2.5	28.7	0.63	77.5	122.7	0.332	0.252	0.272	0.82	Above W.T.		0.00	0.0000
CPT-01	6.398	12	24.951	1.169	115	736	736	40.2	66.8	4.76	2.5	31.2	0.70	93.5	133.8	0.332	0.303	0.327	0.99	Above W.T.		0.00	0.0000
CPT-01	6.562	12	22.812	1.155	115	755	755	36.3	59.4	5.15	2.6	33.9	0.77	123.5	159.8	0.332	0.459	0.496	1.50	Above W.T.		0.00	0.0000
CPT-01	6.726	12	20.246	1.055	115	773	773	31.9	51.3	5.31	2.6	36.5	0.80	127.4	159.3	0.332	0.456	0.492	1.48	Above W.T.		0.00	0.0000
CPT-01	6.89	12	22.127	1.08	115	792	792	34.4	54.8	4.97	2.6	34.5	0.79	127.7	162.1	0.332	0.476	0.514	1.55	Above W.T.		0.00	0.0000
CPT-01	7.054	12	21.415	1.049	115	811	811	32.9	51.8	4.99	2.6	35.4	0.80	131.6	164.5	0.332	0.494	0.533	1.61	Above W.T.		0.00	0.0000
CPT-01	7.218	12	20.987	1.049	115	830	830	31.9	49.5	5.10	2.6	36.4	0.80	127.5	159.4	0.332	0.456	0.493	1.49	Above W.T.		0.00	0.0000
CPT-01	7.382	12	19.105	0.923	115	849	849	28.7	44.0	4.94	2.6	37.6	0.80	114.8	143.4	0.332	0.355	0.383	1.16	Above W.T.		0.00	0.0000
CPT-01	7.546	12	22.356	0.943	115	868	868	33.2	50.5	4.30	2.6	33.5	0.76	105.2	138.4	0.332	0.327	0.353	1.06	Above W.T.		0.00	0.0000
CPT-01	7.71	12	23.211	0.958	115	887	887	34.1	51.3	4.21	2.5	32.9	0.75	99.8	133.9	0.332	0.303	0.328	0.99	Above W.T.		0.00	0.0000
CPT-01	7.874	12	21.814	0.911	115	906	906	31.7	47.2	4.26	2.6	34.3	0.78	114.4	146.1	0.332	0.370	0.400	1.21	Above W.T.		0.00	0.0000
CPT-01	8.038	12	17.109	0.832	115	924	924	24.6	36.0	5.00	2.7	41.0	0.80	98.5	123.1	0.332	0.254	0.274	0.83	Above W.T.		0.00	0.0000
CPT-01	8.202	12	13.117	0.792	115	943	943	18.7	26.8	6.26	2.9	50.1	0.80	74.7	93.4	0.332	0.156	0.168	0.51	Above W.T.		0.00	0.0000
CPT-01	8.366	12	9.923	0.625	115	962	962	14.0	19.6	6.62	3.0	57.4	0.80	56.0	70.0	0.332	0.112	0.121	0.36	Above W.T.		0.00	0.0000
CPT-01	8.53	12	9.553	0.507	115	981	981	13.3	18.5	5.59	3.0	55.5	0.80	53.4	66.7	0.332	0.108	0.116	0.35	Above W.T.		0.00	0.0000
CPT-01	8.694	12	10.037	0.435	115	1000	1000	13.9	19.1	4.56	2.9	51.1	0.80	55.6	69.4	0.332	0.111	0.120	0.36	Above W.T.		0.00	0.0000
CPT-01	8.858	12	11.862	0.499	115	1019	1019	16.3	22.3	4.40	2.8	47.4	0.80	65.0	81.3	0.332	0.130	0.140	0.42	Above W.T.		0.00	0.0000
CPT-01	9.022	12	18.963	0.536	115	1038	1038	25.8	35.5	2.91	2.6	33.1	0.75	77.4	103.2	0.332	0.182	0.197	0.59	Above W.T.		0.00	0.0000
CPT-01	9.186	12	21.101	0.593	115	1056	1056	28.4	38.9	2.88	2.5	31.6	0.71	69.8	98.3	0.332	0.168	0.182	0.55	Above W.T.		0.00	0.0000
CPT-01	9.35	12	24.865	0.74	115	1075	1075	33.2	45.2	3.04	2.5	30.2	0.67	68.1	101.2	0.332	0.176	0.191	0.57	Above W.T.		0.00	0.0000
CPT-01	9.514	12	31.737	0.842	115	1094	1094	42.0	57.0	2.70	2.4	25.6	0.55	51.4	93.4	0.332	0.156	0.168	0.51	Above W.T.		0.00	0.0000
CPT-01	9.678	12	27.032	0.861	115	1113	1113	35.5	47.6	3.25	2.5	30.4	0.68	74.4	109.9	0.332	0.203	0.220	0.66	Above W.T.		0.00	0.0000
CPT-01	9.843	12	22.812	0.866	115	1132	1132	29.7	39.3	3.89	2.6	35.7	0.80	118.7	148.3	0.332	0.384	0.414	1.25	Above W.T.		0.00	0.0000
CPT-01	10.007	12	19.989	0.73	115	1151	1151	25.8	33.7	3.76	2.6	37.6	0.80	103.1	128.9	0.325	0.279	0.302	0.93	Above W.T.		0.00	0.0000
CPT-01	10.171	12	17.366	0.691	115	1170	1170	22.2	28.7	4.12	2.7	41.7	0.80	88.9	111.1	0.325	0.207	0.224	0.69	Above W.T.		0.00	0.0000
CPT-01	10.335	12	27.603	0.567	115	1189	1189	35.0	45.4	2.10	2.4	25.6	0.55	42.8	77.8	0.325	0.124	0.134	0.41	Above W.T.		0.00	0.0000
CPT-01	10.499	12	13.63	0.577	115	1207	1207	17.2	21.6	4.43	2.8	48.1	0.80	68.7	85.8	0.325	0.139	0.150	0.46	Above W.T.		0.00	0.0000
CPT-01	10.663	12	15.37	0.539	115	1226	1226	19.2	24.1	3.65	2.7	42.9	0.80	76.8	96.0	0.325	0.162	0.175	0.54	Above W.T.		0.00	0.0000
CPT-01	10.827	12	11.007	0.489	115	1245	1245	13.6	16.7	4.71	2.9	54.5	0.80	54.6	68.2	0.325	0.110	0.118	0.36	Above W.T.		0.00	0.0000
CPT-01	10.991	12	10.408	0.474	115	1264	1264	12.8	15.5	4.85	3.0	56.6	0.80	51.2	64.0	0.325	0.104	0.113	0.35	Above W.T.		0.00	0.0000
CPT-01	11.155	12	14.971	0.371	115	1283	1283	18.3	22.3	2.59	2.7	39.2	0.80	73.2	91.4	0.325	0.151	0.163	0.50	Above W.T.		0.00	0.0000
CPT-01	11.319	12	25.378	0.377	115	1302	1302	30.8	38.0	1.52	2.4	24.6	0.52	33.7	64.5	0.325	0.105	0.113	0.35	Above W.T.		0.00	0.0000
CPT-01	11.483	12	21.928	0.333	115	1321	1321	26.4	32.2	1.57	2.4	27.2	0.59	38.4	64.8	0.325	0.105	0.114	0.35	Above W.T.		0.00	0.0000
CPT-01	11.647	12	14.999	0.278	115	1339	1339	17.9	21.4	1.94	2.6	36.2	0.80	71.7	89.7	0.325	0.147	0.159	0.49	Above W.T.		0.00	0.0000
CPT-01	11.811	12	7.614	0.191	115	1358	1358	9.0	10.2	2.75	3.0	56.4	0.80	36.2	45.2	0.325	0.089	0.096	0.29	Above W.T.		0.00	0.0000
CPT-01	11.975	12	8.469	0.242	115	1377	1377	10.0	11.3	3.11	3.0	56.0	0.80	39.9	49.9	0.325	0.092	0.099	0.30	Above W.T.		0.00	0.0000
CPT-01	12.139	12	10.066	0.544	115	1396	1387	11.8	13.5	5.81	3.1	63.2	0.80	47.3	59.1	0.327	0.099	0.107	0.33	NonLiqfble.		0.00	0.0000
CPT-01	12.303	12	7.728	0.16	115	1415	1396	9.1	10.1	2.28	2.9	53.8	0.80	36.2	45.3	0.329	0.089	0.096	0.29	NonLiqfble.		0.00	0.0000
CPT-01	12.467	12	8.555	0.158	115	1434	1405	10.0	11.2	2.02	2.9	49.7	0.80	40.0	49.9	0.332	0.092	0.099	0.30	NonLiqfble.		0.00	0.0000
CPT-01	12.631	12	13.317	0.187	115	1453	1413	15.5	17.8	1.49	2.6	36.3	0.80	62.0	77.5	0.334	0.123	0.133	0.40	NonLiqfble.		0.00	0.0000
CPT-01	12.795	12	6.901	0.208	115	1471	1422	8.0	8.7	3.37	3.1	63.8	0.80	32.0	40.0	0.336	0.086	0.093	0.28	NonLiqfble.		0.00	0.0000
CPT-01	12.959	12	9.809	0.307	115	1490	1430	11.3	12.7	3.39	2.9	54.8	0.80	45.4	56.7	0.338	0.097	0.105	0.31	NonLiqfble.		0.00	0.0000
CPT-01	13.123	12	9.182	0.362	115	1509	1439	10.6	11.7	4.30	3.0	60.8	0.80	42.4	53.0	0.341	0.094	0.101	0.30	NonLiqfble.		0.00	0.0000
CPT-01	13.287	12	12.832	0.411	115	1528	1448	14.8	16.7	3.41	2.9	49.0	0.80	59.0	73.8	0.343	0.117	0.127	0.37	NonLiqfble.		0.00	0.0000
CPT-01	13.451	12	18.82	0.341	115	1547	1456	21.6	24.8	1.89	2.6	33.4	0.76	67.6	89.2	0.345	0.146	0.158	0.46	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	13.615	12	5.561	0.33	115	1566	1465	6.4	6.5	6.91	3.4	86.2	0.80	25.4	31.8	0.347	0.083	0.090	0.26	NonLiqfble.		0.00	0.0000
CPT-01	13.78	12	6.872	0.402	115	1585	1474	7.8	8.2	6.61	3.3	78.5	0.80	31.3	39.2	0.349	0.086	0.092	0.26	NonLiqfble.		0.00	0.0000
CPT-01	13.944	12	14.6	0.254	115	1604	1482	16.6	18.6	1.84	2.7	38.1	0.80	66.4	83.0	0.351	0.133	0.144	0.41	NonLiqfble.		0.00	0.0000
CPT-01	14.108	12	8.583	0.208	115	1622	1491	9.7	10.4	2.68	3.0	55.5	0.80	38.9	48.6	0.354	0.091	0.098	0.28	NonLiqfble.		0.00	0.0000
CPT-01	14.272	12	3.336	0.221	115	1641	1500	3.8	3.4	8.79	3.7	100.0	0.80	15.1	18.8	0.356	0.081	0.087	0.24	NonLiqfble.		0.00	0.0000
CPT-01	14.436	12	7.585	0.126	115	1660	1508	8.5	9.0	1.87	2.9	53.6	0.80	34.2	42.7	0.358	0.087	0.094	0.26	NonLiqfble.		0.00	0.0000
CPT-01	14.6	12	16.653	0.22	115	1679	1517	18.7	20.8	1.39	2.5	32.8	0.74	54.0	72.7	0.360	0.116	0.125	0.35	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	14.764	12	32.193	0.435	115	1698	1525	36.1	41.1	1.39	2.3	22.6	0.47	32.0	68.1	0.362	0.109	0.118	0.33	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	14.928	12	26.319	0.376	115	1717	1534	29.4	33.2	1.48	2.4	26.2	0.56	38.1	67.5	0.364	0.109	0.117	0.32	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	15.092	12	21.301	0.449	115	1736	1543	23.7	26.5	2.20	2.6	34.1	0.78	83.2	107.0	0.366	0.194	0.209	0.57	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	15.256	12	20.645	0.37	115	1754	1551	22.9	25.5	1.87	2.5	32.8	0.74	66.2	89.2	0.367	0.146	0.158	0.43	Liquefaction	!!	0.00	0.0000 Refuse…no liquefa
CPT-01	15.42	12	16.368	0.404	115	1773	1560	18.1	19.8	2.61	2.7	41.5	0.80	72.5	90.7	0.369	0.149	0.161	0.44	NonLiqfble.		0.00	0.0000
CPT-01	15.584	12	14.799	0.408	115	1792	1569	16.3	17.7	2.93	2.8	45.4	0.80	65.4	81.7	0.371	0.131	0.141	0.38	NonLiqfble.		0.00	0.0000
CPT-01	15.748	12	12.661	0.402	115	1811	1577	13.9	14.9	3.42	2.9	51.4	0.80	55.8	69.7	0.373	0.112	0.120	0.32	NonLiqfble.		0.00	0.0000
CPT-01	15.912	12	9.239	0.297	115	1830	1586	10.2	10.5	3.57	3.0	60.1	0.80	40.6	50.8	0.375	0.092	0.100	0.27	NonLiqfble.		0.00	0.0000
CPT-01	16.076	12	10.665	0.295	115	1849	1594	11.7	12.2	3.03	2.9	53.8	0.80	46.7	58.4	0.377	0.099	0.106	0.28	NonLiqfble.		0.00	0.0000
CPT-01	16.24	12	14.087	0.303	115	1868	1603	15.4	16.4	2.30	2.8	43.4	0.80	61.6	77.0	0.378	0.122	0.132	0.35	NonLiqfble.		0.00	0.0000
CPT-01	16.404	12	17.793	0.39	115	1886	1612	19.4	20.9	2.31	2.7	38.9	0.80	77.6	97.0	0.380	0.165	0.178	0.47	NonLiqfble.		0.00	0.0000
CPT-01	16.568	12	13.602	0.315	115	1905	1620	14.8	15.6	2.49	2.8	45.5	0.80	59.1	73.9	0.382	0.118	0.127	0.33	NonLiqfble.		0.00	0.0000

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	**7.26**
PGA (g):	**0.51**
MSF:	**1.08**

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments		Ev (inches)	S	
CPT-01	16.732	12	19.191	0.331	115	1924	1629	20.8	22.4	1.82	2.6	34.6	0.79	78.9	99.7	0.384	0.172	0.186	0.48	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	16.896	12	17.109	0.357	115	1943	1638	18.5	19.7	2.21	2.7	39.4	0.80	74.0	92.5	0.385	0.154	0.166	0.43	NonLiqfble.		0.00	0.0000	
CPT-01	17.06	12	12.461	0.222	115	1962	1646	13.4	13.9	1.93	2.8	44.3	0.80	53.8	67.2	0.387	0.108	0.117	0.30	NonLiqfble.		0.00	0.0000	
CPT-01	17.224	12	11.52	0.255	115	1981	1655	12.4	12.7	2.42	2.9	49.4	0.80	49.6	62.0	0.389	0.102	0.110	0.28	NonLiqfble.		0.00	0.0000	
CPT-01	17.388	12	23.553	0.25	115	2000	1663	25.3	27.1	1.11	2.4	26.3	0.57	33.4	58.6	0.391	0.099	0.107	0.27	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	17.552	12	22.555	0.275	115	2018	1672	24.1	25.8	1.28	2.4	28.5	0.63	40.5	64.6	0.392	0.105	0.113	0.29	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	17.717	12	18.877	0.203	115	2037	1681	20.1	21.2	1.14	2.5	30.4	0.68	42.5	62.6	0.394	0.103	0.111	0.28	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	17.881	12	22.441	0.158	115	2056	1689	23.9	25.3	0.74	2.3	23.8	0.50	24.2	48.1	0.395	0.090	0.098	0.25	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	18.045	12	16.282	0.095	115	2075	1698	17.3	17.9	0.62	2.4	28.0	0.61	27.4	44.7	0.397	0.088	0.095	0.24	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	18.209	12	13.744	0.114	115	2094	1707	14.6	14.9	0.90	2.6	34.4	0.78	53.0	67.5	0.399	0.109	0.117	0.29	Liquefaction	!!	0.00	0.0000	Refuse…no liquefa
CPT-01	18.373	12	12.575	0.116	115	2113	1715	13.3	13.4	1.01	2.6	37.5	0.80	53.1	66.4	0.400	0.107	0.116	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	18.537	12	7.186	0.124	115	2132	1724	7.6	7.1	2.03	3.0	60.6	0.80	30.3	37.9	0.402	0.085	0.092	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	18.701	12	8.212	0.115	115	2151	1732	8.6	8.2	1.61	2.9	53.6	0.80	34.5	43.2	0.403	0.087	0.094	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	18.865	12	31.794	0.151	115	2169	1741	33.3	35.3	0.49	2.1	16.7	0.31	15.1	48.4	0.405	0.091	0.098	0.24	Liquefaction	!!	4.50	0.0885	
CPT-01	19.029	12	41.033	0.349	115	2188	1750	42.9	45.6	0.87	2.2	17.4	0.33	21.2	64.2	0.406	0.105	0.113	0.28	Liquefaction	!!	3.55	0.0699	
CPT-01	19.193	12	35.644	0.471	115	2207	1758	37.2	39.3	1.36	2.3	23.0	0.48	34.6	71.8	0.408	0.114	0.124	0.30	Liquefaction	!!	3.13	0.0616	
CPT-01	19.357	12	27.888	0.484	115	2226	1767	29.0	30.3	1.81	2.5	29.7	0.66	56.1	85.1	0.409	0.137	0.148	0.36	Liquefaction	!!	2.67	0.0525	
CPT-01	19.521	12	26.063	0.722	115	2245	1776	27.1	28.1	2.89	2.6	36.8	0.80	108.2	135.3	0.411	0.310	0.335	0.82	NonLiqfble.		0.00	0.0000	
CPT-01	19.685	12	21.415	0.815	115	2264	1784	22.2	22.7	4.02	2.8	45.5	0.80	88.7	110.9	0.412	0.207	0.223	0.54	NonLiqfble.		0.00	0.0000	
CPT-01	19.849	12	17.08	0.804	115	2283	1793	17.6	17.8	5.04	2.9	54.3	0.80	70.6	88.2	0.414	0.144	0.155	0.38	NonLiqfble.		0.00	0.0000	
CPT-01	20.013	12	13.573	0.6	115	2301	1801	14.0	13.8	4.83	3.0	59.1	0.80	56.0	70.0	0.407	0.112	0.121	0.30	NonLiqfble.		0.00	0.0000	
CPT-01	20.177	12	11.606	0.445	115	2320	1810	11.9	11.5	4.26	3.0	61.0	0.80	47.7	59.7	0.408	0.100	0.108	0.26	NonLiqfble.		0.00	0.0000	
CPT-01	20.341	12	10.323	0.376	115	2339	1819	10.6	10.1	4.11	3.1	63.6	0.80	42.4	53.0	0.409	0.094	0.101	0.25	NonLiqfble.		0.00	0.0000	
CPT-01	20.505	12	9.752	0.343	115	2358	1827	10.0	9.4	4.00	3.1	64.9	0.80	39.9	49.9	0.411	0.092	0.099	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	20.669	12	9.724	0.339	115	2377	1836	9.9	9.3	3.97	3.1	65.0	0.80	39.7	49.6	0.412	0.091	0.099	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	20.833	12	10.608	0.309	115	2396	1845	10.8	10.2	3.28	3.0	59.3	0.80	43.2	54.0	0.413	0.095	0.102	0.25	NonLiqfble.		0.00	0.0000	
CPT-01	20.997	12	10.979	0.313	115	2415	1853	11.2	10.5	3.20	3.0	58.1	0.80	44.6	55.8	0.415	0.096	0.104	0.25	NonLiqfble.		0.00	0.0000	
CPT-01	21.161	12	11.463	0.332	115	2434	1862	11.6	11.0	3.24	3.0	57.3	0.80	46.5	58.1	0.416	0.098	0.106	0.26	NonLiqfble.		0.00	0.0000	
CPT-01	21.325	12	12.204	0.36	115	2452	1870	12.3	11.7	3.28	3.0	56.0	0.80	49.4	61.7	0.417	0.102	0.110	0.26	NonLiqfble.		0.00	0.0000	
CPT-01	21.49	12	11.577	0.383	115	2471	1879	11.7	11.0	3.70	3.0	59.6	0.80	46.7	58.4	0.419	0.099	0.106	0.25	NonLiqfble.		0.00	0.0000	
CPT-01	21.654	12	10.18	0.387	115	2490	1888	10.3	9.5	4.33	3.1	66.1	0.80	41.0	51.3	0.420	0.093	0.100	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	21.818	12	8.583	0.327	115	2509	1896	8.6	7.7	4.46	3.2	72.1	0.80	34.5	43.1	0.421	0.087	0.094	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	21.982	12	7.243	0.244	115	2528	1905	7.3	6.3	4.08	3.2	76.1	0.80	29.0	36.3	0.422	0.084	0.091	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	22.146	12	6.559	0.111	115	2547	1914	6.6	5.5	2.10	3.1	68.0	0.80	26.2	32.8	0.424	0.083	0.090	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	22.31	12	6.359	0.101	115	2566	1922	6.3	5.3	1.99	3.1	68.4	0.80	25.4	31.7	0.425	0.083	0.090	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	22.474	12	6.73	0.108	115	2585	1931	6.7	5.6	1.99	3.1	66.5	0.80	26.8	33.5	0.426	0.083	0.090	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	22.638	12	7.414	0.138	115	2603	1940	7.4	6.3	2.26	3.1	65.5	0.80	29.5	36.8	0.427	0.085	0.091	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	22.802	12	8.697	0.171	115	2622	1948	8.6	7.6	2.32	3.0	61.0	0.80	34.5	43.1	0.428	0.087	0.094	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	22.966	12	9.011	0.211	115	2641	1957	8.9	7.9	2.74	3.1	62.8	0.80	35.7	44.6	0.430	0.088	0.095	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	23.13	12	8.925	0.253	115	2660	1965	8.8	7.7	3.33	3.1	66.6	0.80	35.2	44.0	0.431	0.088	0.095	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	23.294	12	9.011	0.276	115	2679	1974	8.9	7.8	3.60	3.1	67.8	0.80	35.5	44.4	0.432	0.088	0.095	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	23.458	12	10.151	0.282	115	2698	1983	10.0	8.9	3.20	3.1	62.3	0.80	39.9	49.9	0.433	0.092	0.099	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	23.622	12	11.093	0.318	115	2717	1991	10.9	9.8	3.27	3.0	60.3	0.80	43.5	54.4	0.434	0.095	0.103	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	23.786	12	11.064	0.339	115	2735	2000	10.8	9.7	3.50	3.0	61.6	0.80	43.3	54.1	0.435	0.095	0.102	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	23.95	12	10.437	0.342	115	2754	2009	10.2	9.0	3.78	3.1	64.8	0.80	40.8	50.9	0.436	0.092	0.100	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	24.114	12	10.237	0.333	115	2773	2017	10.0	8.8	3.76	3.1	65.5	0.80	39.9	49.9	0.437	0.092	0.099	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	24.278	12	10.123	0.343	115	2792	2026	9.8	8.6	3.93	3.1	66.7	0.80	39.4	49.2	0.439	0.091	0.098	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	24.442	12	9.866	0.309	115	2811	2034	9.6	8.3	3.65	3.1	66.3	0.80	38.3	47.9	0.440	0.090	0.097	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	24.606	12	10.551	0.278	115	2830	2043	10.2	8.9	3.04	3.0	61.3	0.80	40.9	51.1	0.441	0.092	0.100	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	24.77	12	12.347	0.287	115	2849	2052	11.9	10.6	2.63	2.9	54.7	0.80	47.7	59.6	0.442	0.100	0.108	0.24	NonLiqfble.		0.00	0.0000	
CPT-01	24.934	12	14.087	0.292	115	2867	2060	13.6	12.3	2.31	2.9	49.5	0.80	54.3	67.9	0.443	0.109	0.118	0.27	NonLiqfble.		0.00	0.0000	
CPT-01	25.098	12	15.683	0.317	115	2886	2069	15.1	13.8	2.23	2.8	46.5	0.80	60.3	75.4	0.444	0.120	0.130	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	25.262	12	16.852	0.362	115	2905	2078	16.2	14.8	2.35	2.8	45.8	0.80	64.7	80.9	0.445	0.129	0.140	0.31	NonLiqfble.		0.00	0.0000	
CPT-01	25.427	12	17.85	0.44	115	2924	2086	17.1	15.7	2.69	2.8	46.5	0.80	68.4	85.5	0.446	0.138	0.149	0.33	NonLiqfble.		0.00	0.0000	
CPT-01	25.591	12	18.107	0.485	115	2943	2095	17.3	15.9	2.92	2.8	47.5	0.80	69.2	86.5	0.447	0.140	0.152	0.34	NonLiqfble.		0.00	0.0000	
CPT-01	25.755	12	18.905	0.525	115	2962	2104	18.0	16.6	3.01	2.8	47.2	0.80	72.1	90.2	0.448	0.148	0.160	0.36	NonLiqfble.		0.00	0.0000	
CPT-01	25.919	12	20.046	0.585	115	2981	2112	19.1	17.6	3.15	2.8	46.7	0.80	76.3	95.4	0.449	0.161	0.174	0.39	NonLiqfble.		0.00	0.0000	
CPT-01	26.083	12	21.899	0.611	115	3000	2121	20.8	19.2	3.00	2.8	44.1	0.80	83.2	104.0	0.450	0.185	0.199	0.44	NonLiqfble.		0.00	0.0000	
CPT-01	26.247	12	22.356	0.669	115	3018	2129	21.2	19.6	3.21	2.8	44.8	0.80	84.8	106.0	0.451	0.191	0.206	0.46	NonLiqfble.		0.00	0.0000	
CPT-01	26.411	12	21.244	0.683	115	3037	2138	20.1	18.4	3.46	2.8	47.2	0.80	80.4	100.5	0.452	0.174	0.188	0.42	NonLiqfble.		0.00	0.0000	
CPT-01	26.575	12	20.759	0.697	115	3056	2147	19.6	17.9	3.62	2.8	48.5	0.80	78.4	98.0	0.453	0.168	0.181	0.40	NonLiqfble.		0.00	0.0000	
CPT-01	26.739	12	22.727	0.722	115	3075	2155	21.4	19.7	3.41	2.8	45.7	0.80	85.7	107.1	0.454	0.194	0.210	0.46	NonLiqfble.		0.00	0.0000	
CPT-01	26.903	12	23.981	0.701	115	3094	2164	22.6	20.7	3.12	2.8	43.3	0.80	90.2	112.8	0.455	0.213	0.230	0.51	NonLiqfble.		0.00	0.0000	
CPT-01	27.067	12	23.696	0.733	115	3113	2173	22.2	20.4	3.31	2.8	44.5	0.80	89.0	111.2	0.456	0.208	0.225	0.49	NonLiqfble.		0.00	0.0000	
CPT-01	27.231	12	23.81	0.691	115	3132	2181	22.3	20.4	3.11	2.8	43.5	0.80	89.2	111.5	0.457	0.209	0.226	0.49	NonLiqfble.		0.00	0.0000	
CPT-01	27.395	12	25.207	0.752	115	3150	2190	23.6	21.6	3.18	2.7	42.8	0.80	94.3	117.8	0.458	0.232	0.251	0.55	NonLiqfble.		0.00	0.0000	
CPT-01	27.559	12	23.468	0.721	115	3169	2198	21.9	19.9	3.29	2.8	44.9	0.80	87.6	109.5	0.459	0.202	0.218	0.48	NonLiqfble.		0.00	0.0000	
CPT-01	27.723	12	20.445	0.653	115	3188	2207	19.0	17.1	3.46	2.8	48.7	0.80	76.2	95.2	0.460	0.160	0.173	0.38	NonLiqfble.		0.00	0.0000	
CPT-01	27.887	12	17.822	0.531	115	3207	2216	16.6	14.6	3.27	2.9	51.1	0.80	66.3	82.8	0.461	0.133	0.143	0.31	NonLiqfble.		0.00	0.0000	
CPT-01	28.051	12	17.024	0.48	115	3226	2224	15.8	13.9	3.11	2.9	51.4	0.80	63.2	79.0	0.462	0.126	0.136	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	28.215	12	17.024	0.48	115	3245	2233	15.8	13.8	3.12	2.9	51.5	0.80	63.1	78.8	0.462	0.126	0.136	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	28.379	12	16.995	0.507	115	3264	2242	15.7	13.7	3.30	2.9	52.6	0.80	62.8	78.5	0.463	0.125	0.135	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	28.543	12	16.938	0.48	115	3282	2250	15.6	13.6	3.14	2.9	52.0	0.80	62.5	78.1	0.464	0.124	0.134	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	28.707	12	17.052	0.393	115	3301	2259	15.7	13.6	2.55	2.8	48.7	0.80	62.8	78.5	0.465	0.125	0.135	0.29	NonLiqfble.		0.00	0.0000	
CPT-01	28.871	12	15.085	0.381	115	3320	2267	13.9	11.8	2.84	2.9	53.4	0.80	55.4	69.3	0.466	0.111	0.120	0.26	NonLiqfble.		0.00	0.0000	
CPT-01	29.035	12	12.148	0.368	115	3339	2276	11.1	9.2	3.51	3.1	63.0	0.80	44.6	55.7	0.467	0.096	0.104	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	29.199	12	10.351	0.245	115	3358	2285	9.5	7.6	2.83	3.1	64.2	0.80	37.9	47.4	0.468	0.090	0.097	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	29.364	12	9.125	0.185	115	3377	2293	8.3	6.5	2.49	3.1	66.3	0.80	33.3	41.7	0.469	0.087	0.094	0.20	NonLiqfble.		0.00	0.0000	
CPT-01	29.528	12	9.581	0.125	115	3396	2302	8.7	6.8	1.59	3.0	58.0	0.80	34.9	43.7	0.469	0.088	0.095	0.20	NonLiqfble.		0.00	0.0000	
CPT-01	29.692	12	11.263	0.145	115	3415	2311	10.3	8.3	1.52	2.9	52.7	0.80	41.0	51.3	0.470	0.093	0.100	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	29.856	12	16.852	0.06	115	3433	2319	15.3	13.0	0.40	2.5	30.4	0.68	32.1	47.4	0.471	0.090	0.097	0.21	Liquefaction	!!	4.50	0.0885	
CPT-01	30.02	12	13.773	0.083	115	3452	2328	12.5	10.3	0.69	2.7	39.1	0.80	50.0	62.5	0.452	0.103	0.111	0.25	Check PI		0.00	0.0000	
CPT-01	30.184	12	12.005	0.212	115	3471	2336	10.9	8.8	2.06	3.0	55.6	0.80	43.5	54.3	0.453	0.095	0.103	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	30.348	12	11.805	0.148	115	3490	2345	10.7	8.6	1.47	2.9	51.5	0.80	42.7	53.3	0.454	0.094	0.102	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	30.512	12	10.066	0.168	115	3509	2354	9.1	7.1	2.02	3.0	60.7	0.80	36.3	45.4	0.455	0.089	0.096	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	30.676	12	9.581	0.134	115	3528	2362	8.6	6.6	1.71	3.0	60.0	0.80	34.5	43.1	0.455	0.087	0.094	0.21	NonLiqfble.		0.00	0.0000	
CPT-01	30.84	12	8.612	0.115	115	3547	2371	7.7	5.8	1.68	3.1	63.4	0.80	31.0	38.7	0.456	0.085	0.092	0.20	NonLiqfble.		0.00	0.0000	
CPT-01	31.004	12	8.868	0.115	115	3565	2380	8.0	6.0	1.62	3.1	62.0	0.80	31.8	39.8	0.457	0.086	0.093	0.20	NonLiqfble.		0.00	0.0000	
CPT-01	31.168	12	11.976	0.201	115	3584	2388	10.7	8.5	1.97	3.0	55.6	0.80	42.9	53.6	0.458	0.094	0.102	0.22	NonLiqfble.		0.00	0.0000	
CPT-01	31.332	12	13.317	0.311	115	3603	2397	11.9	9.6	2.70	3.0	57.5	0.80	47.6	59.5	0.458	0.100	0.108	0.23	NonLiqfble.		0.00	0.0000	
CPT-01	31.496	12	16.196	0.523	115	3622	2405	14.4	12.0	3.64	3.0	57.3	0.80	57.8	72.2	0.459	0.115	0.124	0.27	NonLiqfble.		0.00	0.0000	
CPT-01	31.66	12	18.535	0.624	115	3641	2414	16.5	13.8	3.73	2.9	54.4	0.80	66.0	82.5	0.460	0.132	0.143	0.31	NonLiqfble.		0.00	0.0000	
CPT-01	31.824	12	22.555	0.693	115	3660	2423	20.0	17.1	3.34	2.8	48.1	0.80	80.2	100.2	0.461	0.174	0.188	0.41	NonLiqfble.		0.00	0.0000	
CPT-01	31.988	12	30.825	0.456	115	3679	2431	27.4	23.8	1.57	2.5	31.9	0.72	69.9	97.2	0.461	0.166	0.179	0.39	Liquefaction	!!	2.44	0.0480	
CPT-01	32.152	12	32.564	0.789	115	3697	2440	28.8	25.2	2.57	2.6	37.0	0.80	115.4	144.2	0.462	0.359	0.388	0.84	NonLiqfble.		0.00	0.0000	
CPT-01	32.316	12	21.928	0.868	115	3716	2449	19.4	16.4	4.33	2.9	53.3	0.80	77.6	96.9	0.463	0.165	0.178	0.38	NonLiqfble.		0.00	0.0000	
CPT-01	32.48	12	33.362	0.888	115	3735	2457	29.4	25.6	2.82	2.7	38.0	0.80	117.8	147.2	0.464	0.377	0.407	0.88	NonLiqfble.		0.00	0.0000	
CPT-01	32.644	12	33.448	0.853	115	3754	2466	29.5	25.6	2.70	2.6	37.4	0.80	117.9	147.4	0.464	0.378	0.408	0.88	NonLiqfble.		0.00	0.0000	
CPT-01	32.808	12	33.362	0.813	115	3773	2475	29.3	25.4	2.58	2.6	36.9	0.80	117.4	146.7	0.465	0.374	0.404	0.87	NonLiqfble.		0.00	0.0000	
CPT-01	32.972	12	31.823	0.777	115	3792	2483	27.9	24.1	2.60	2.7	37.9	0.80	111.8	139.7	0.466	0.334	0.360	0.77	NonLiqfble.		0.00	0.0000	
CPT-01	33.136	12	31.024	0.751	115	3811	2492	27.2	23.4	2.58	2.7	38.4	0.80	108.8	136.0	0.466	0.314	0.339	0.73	NonLiqfble.		0.00	0.0000	

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	7.26
PGA (g):	0.51
MSF:	1.08

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments	Ev	(inches) S
CPT-01	33.301	12	31.024	0.734	115	3830	2500	27.1	23.3	2.52	2.7	38.1	0.80	108.6	135.7	0.467	0.313	0.338	0.72	NonLiqfble.	0.00	0.0000
CPT-01	33.465	12	31.081	0.801	115	3848	2509	27.1	23.2	2.75	2.7	39.4	0.80	108.6	135.7	0.468	0.313	0.338	0.72	NonLiqfble.	0.00	0.0000
CPT-01	33.629	12	30.625	0.886	115	3867	2518	26.7	22.8	3.09	2.7	41.4	0.80	106.8	133.5	0.468	0.301	0.326	0.69	NonLiqfble.	0.00	0.0000
CPT-01	33.793	12	30.568	0.933	115	3886	2526	26.6	22.7	3.26	2.7	42.3	0.80	106.4	133.0	0.469	0.299	0.323	0.69	NonLiqfble.	0.00	0.0000
CPT-01	33.957	12	30.511	0.956	115	3905	2535	26.5	22.5	3.35	2.7	42.8	0.80	106.1	132.6	0.470	0.297	0.320	0.68	NonLiqfble.	0.00	0.0000
CPT-01	34.121	12	30.996	0.959	115	3924	2544	26.9	22.8	3.30	2.7	42.4	0.80	107.6	134.5	0.470	0.306	0.331	0.70	NonLiqfble.	0.00	0.0000
CPT-01	34.285	12	31.167	0.942	115	3943	2552	27.0	22.9	3.23	2.7	42.0	0.80	108.0	135.0	0.471	0.309	0.333	0.71	NonLiqfble.	0.00	0.0000
CPT-01	34.449	12	30.169	0.898	115	3962	2561	26.1	22.0	3.19	2.7	42.5	0.80	104.3	130.4	0.472	0.286	0.309	0.66	NonLiqfble.	0.00	0.0000
CPT-01	34.613	12	27.431	0.796	115	3980	2569	23.7	19.8	3.13	2.8	44.2	0.80	94.7	118.4	0.472	0.234	0.253	0.54	NonLiqfble.	0.00	0.0000
CPT-01	34.777	12	24.951	0.701	115	3999	2578	21.5	17.8	3.05	2.8	45.9	0.80	86.0	107.5	0.473	0.196	0.211	0.45	NonLiqfble.	0.00	0.0000
CPT-01	34.941	12	22.641	0.702	115	4018	2587	19.5	15.9	3.40	2.9	49.9	0.80	77.9	97.4	0.474	0.166	0.179	0.38	NonLiqfble.	0.00	0.0000
CPT-01	35.105	12	22.156	0.711	115	4037	2595	19.0	15.5	3.53	2.9	51.0	0.80	76.1	95.1	0.474	0.160	0.173	0.36	NonLiqfble.	0.00	0.0000
CPT-01	35.269	12	20.816	0.735	115	4056	2604	17.8	14.4	3.91	2.9	54.3	0.80	71.4	89.2	0.475	0.146	0.158	0.33	NonLiqfble.	0.00	0.0000
CPT-01	35.433	12	19.077	0.665	115	4075	2613	16.3	13.0	3.90	3.0	56.5	0.80	65.3	81.7	0.476	0.131	0.141	0.30	NonLiqfble.	0.00	0.0000
CPT-01	35.597	12	18.449	0.638	115	4094	2621	15.8	12.5	3.89	3.0	57.4	0.80	63.1	78.8	0.476	0.126	0.136	0.28	NonLiqfble.	0.00	0.0000
CPT-01	35.761	12	18.706	0.611	115	4113	2630	16.0	12.7	3.67	3.0	56.2	0.80	63.8	79.8	0.477	0.127	0.137	0.29	NonLiqfble.	0.00	0.0000
CPT-01	35.925	12	18.506	0.608	115	4131	2638	15.8	12.5	3.70	3.0	56.7	0.80	63.1	78.8	0.478	0.126	0.136	0.28	NonLiqfble.	0.00	0.0000
CPT-01	36.089	12	18.392	0.629	115	4150	2647	15.6	12.3	3.86	3.0	57.6	0.80	62.6	78.2	0.478	0.124	0.134	0.28	NonLiqfble.	0.00	0.0000
CPT-01	36.253	12	17.651	0.653	115	4169	2656	15.0	11.7	4.20	3.0	60.3	0.80	59.9	74.9	0.479	0.119	0.129	0.27	NonLiqfble.	0.00	0.0000
CPT-01	36.417	12	16.881	0.661	115	4188	2664	14.3	11.1	4.47	3.1	62.8	0.80	57.2	71.5	0.479	0.114	0.123	0.26	NonLiqfble.	0.00	0.0000
CPT-01	36.581	12	15.997	0.657	115	4207	2673	13.5	10.4	4.73	3.1	65.5	0.80	54.2	67.7	0.480	0.109	0.118	0.24	NonLiqfble.	0.00	0.0000
CPT-01	36.745	12	14.657	0.633	115	4226	2682	12.4	9.4	5.05	3.2	69.4	0.80	49.5	61.9	0.481	0.102	0.110	0.23	NonLiqfble.	0.00	0.0000
CPT-01	36.909	12	14.429	0.564	115	4245	2690	12.2	9.1	4.58	3.1	68.1	0.80	48.7	60.9	0.481	0.101	0.109	0.23	NonLiqfble.	0.00	0.0000
CPT-01	37.073	12	15.854	0.555	115	4263	2699	13.4	10.2	4.04	3.1	63.1	0.80	53.4	66.8	0.482	0.108	0.116	0.24	NonLiqfble.	0.00	0.0000
CPT-01	37.238	12	16.082	0.564	115	4282	2708	13.5	10.3	4.05	3.1	62.8	0.80	54.1	67.6	0.482	0.109	0.117	0.24	NonLiqfble.	0.00	0.0000
CPT-01	37.402	12	15.427	0.636	115	4301	2716	13.0	9.8	4.79	3.1	67.3	0.80	51.8	64.8	0.483	0.105	0.114	0.24	NonLiqfble.	0.00	0.0000
CPT-01	37.566	12	14.657	0.582	115	4320	2725	12.3	9.2	4.66	3.1	68.4	0.80	49.1	61.4	0.484	0.102	0.110	0.23	NonLiqfble.	0.00	0.0000
CPT-01	37.73	12	12.404	0.481	115	4339	2733	10.4	7.5	4.70	3.2	74.0	0.80	41.5	51.9	0.484	0.093	0.100	0.21	NonLiqfble.	0.00	0.0000
CPT-01	37.894	12	10.665	0.356	115	4358	2742	8.9	6.2	4.20	3.3	77.1	0.80	35.6	44.6	0.485	0.088	0.095	0.20	NonLiqfble.	0.00	0.0000
CPT-01	38.058	12	9.324	0.245	115	4377	2751	7.8	5.2	3.43	3.3	78.3	0.80	31.1	38.9	0.485	0.085	0.092	0.19	NonLiqfble.	0.00	0.0000
CPT-01	38.222	12	8.868	0.16	115	4396	2759	7.4	4.8	2.40	3.2	74.0	0.80	29.5	36.9	0.486	0.085	0.091	0.19	NonLiqfble.	0.00	0.0000
CPT-01	38.386	12	8.555	0.115	115	4414	2768	7.1	4.6	1.81	3.2	71.0	0.80	28.5	35.6	0.486	0.084	0.091	0.19	NonLiqfble.	0.00	0.0000
CPT-01	38.55	12	7.842	0.102	115	4433	2777	6.5	4.0	1.81	3.2	74.7	0.80	26.0	32.6	0.487	0.083	0.090	0.18	NonLiqfble.	0.00	0.0000
CPT-01	38.714	12	7.87	0.075	115	4452	2785	6.5	4.1	1.33	3.2	70.1	0.80	26.1	32.6	0.488	0.083	0.090	0.18	NonLiqfble.	0.00	0.0000
CPT-01	38.878	12	8.669	0.093	115	4471	2794	7.2	4.6	1.45	3.1	67.5	0.80	28.7	35.9	0.488	0.084	0.091	0.19	NonLiqfble.	0.00	0.0000
CPT-01	39.042	12	10.265	0.142	115	4490	2802	8.5	5.7	1.77	3.1	64.4	0.80	33.9	42.4	0.489	0.087	0.094	0.19	NonLiqfble.	0.00	0.0000
CPT-01	39.206	12	12.49	0.247	115	4509	2811	10.3	7.3	2.41	3.1	62.7	0.80	41.2	51.5	0.489	0.093	0.100	0.20	NonLiqfble.	0.00	0.0000
CPT-01	39.37	12	12.29	0.364	115	4528	2820	10.1	7.1	3.63	3.2	70.4	0.80	40.5	50.6	0.490	0.092	0.099	0.20	NonLiqfble.	0.00	0.0000
CPT-01	39.534	12	11.606	0.429	115	4546	2828	9.5	6.6	4.60	3.3	77.1	0.80	38.2	47.7	0.490	0.090	0.097	0.20	NonLiqfble.	0.00	0.0000
CPT-01	39.698	12	11.093	0.359	115	4565	2837	9.1	6.2	4.08	3.2	76.4	0.80	36.5	45.6	0.491	0.089	0.096	0.20	NonLiqfble.	0.00	0.0000
CPT-01	39.862	12	10.494	0.304	115	4584	2846	8.6	5.8	3.71	3.2	76.7	0.80	34.4	43.0	0.491	0.087	0.094	0.19	NonLiqfble.	0.00	0.0000
CPT-01	40.026	12	10.465	0.33	115	4603	2854	8.6	5.7	4.04	3.3	78.6	0.80	34.3	42.9	0.454	0.087	0.094	0.21	NonLiqfble.	0.00	0.0000
CPT-01	40.19	12	11.492	0.364	115	4622	2863	9.4	6.4	3.97	3.2	74.9	0.80	37.6	47.0	0.455	0.090	0.097	0.21	NonLiqfble.	0.00	0.0000
CPT-01	40.354	12	11.777	0.398	115	4641	2871	9.6	6.6	4.21	3.2	75.3	0.80	38.5	48.1	0.455	0.090	0.098	0.21	NonLiqfble.	0.00	0.0000
CPT-01	40.518	12	12.005	0.406	115	4660	2880	9.8	6.7	4.20	3.2	74.7	0.80	39.2	48.9	0.456	0.091	0.098	0.22	NonLiqfble.	0.00	0.0000
CPT-01	40.682	12	11.492	0.412	115	4678	2889	9.4	6.3	4.50	3.3	77.8	0.80	37.4	46.8	0.456	0.090	0.097	0.21	NonLiqfble.	0.00	0.0000
CPT-01	40.846	12	10.836	0.347	115	4697	2897	8.8	5.9	4.09	3.3	78.1	0.80	35.2	44.0	0.457	0.088	0.095	0.21	NonLiqfble.	0.00	0.0000
CPT-01	41.011	12	10.693	0.282	115	4716	2906	8.7	5.7	3.38	3.2	75.1	0.80	34.7	43.4	0.457	0.088	0.095	0.21	NonLiqfble.	0.00	0.0000
CPT-01	41.175	12	11.434	0.231	115	4735	2915	9.3	6.2	2.55	3.1	67.8	0.80	37.1	46.3	0.458	0.089	0.096	0.21	NonLiqfble.	0.00	0.0000
CPT-01	41.339	12	12.889	0.25	115	4754	2923	10.4	7.2	2.38	3.1	62.8	0.80	41.7	52.2	0.458	0.093	0.101	0.22	NonLiqfble.	0.00	0.0000
CPT-01	41.503	12	14.4	0.341	115	4773	2932	11.6	8.2	2.84	3.1	62.3	0.80	46.5	58.2	0.459	0.098	0.106	0.23	NonLiqfble.	0.00	0.0000
CPT-01	41.667	12	15.541	0.435	115	4792	2940	12.5	8.9	3.31	3.1	62.7	0.80	50.2	62.7	0.459	0.103	0.111	0.24	NonLiqfble.	0.00	0.0000
CPT-01	41.831	12	16.368	0.511	115	4811	2949	13.2	9.5	3.66	3.1	63.0	0.80	52.8	65.9	0.460	0.107	0.115	0.25	NonLiqfble.	0.00	0.0000
CPT-01	41.995	12	15.569	0.516	115	4829	2958	12.5	8.9	3.92	3.1	65.9	0.80	50.1	62.6	0.460	0.103	0.111	0.24	NonLiqfble.	0.00	0.0000
CPT-01	42.159	12	14.628	0.508	115	4848	2966	11.8	8.2	4.16	3.1	69.0	0.80	47.0	58.8	0.461	0.099	0.107	0.23	NonLiqfble.	0.00	0.0000
CPT-01	42.323	12	14.229	0.419	115	4867	2975	11.4	7.9	3.55	3.1	67.1	0.80	45.7	57.1	0.461	0.097	0.105	0.23	NonLiqfble.	0.00	0.0000
CPT-01	42.487	12	13.402	0.402	115	4886	2984	10.7	7.3	3.67	3.2	69.7	0.80	42.9	53.7	0.461	0.094	0.102	0.22	NonLiqfble.	0.00	0.0000
CPT-01	42.651	12	13.146	0.381	115	4905	2992	10.5	7.1	3.56	3.2	69.9	0.80	42.1	52.6	0.462	0.094	0.101	0.22	NonLiqfble.	0.00	0.0000
CPT-01	42.815	12	12.974	0.328	115	4924	3001	10.4	7.0	3.12	3.1	68.0	0.80	41.5	51.8	0.462	0.093	0.100	0.22	NonLiqfble.	0.00	0.0000
CPT-01	42.979	12	12.49	0.299	115	4943	3009	10.0	6.7	2.98	3.1	68.6	0.80	39.8	49.8	0.463	0.091	0.099	0.21	NonLiqfble.	0.00	0.0000
CPT-01	43.143	12	14.771	0.257	115	4961	3018	11.8	8.1	2.09	3.0	57.6	0.80	47.1	58.8	0.463	0.099	0.107	0.23	NonLiqfble.	0.00	0.0000
CPT-01	43.307	12	14.685	0.242	115	4980	3027	11.7	8.1	1.98	3.0	57.1	0.80	46.7	58.4	0.464	0.099	0.106	0.23	NonLiqfble.	0.00	0.0000
CPT-01	43.471	12	13.488	0.185	115	4999	3035	10.7	7.2	1.68	3.0	57.4	0.80	42.8	53.6	0.464	0.094	0.102	0.22	NonLiqfble.	0.00	0.0000
CPT-01	43.635	12	11.862	0.202	115	5018	3044	9.4	6.1	2.16	3.1	65.5	0.80	37.6	47.0	0.465	0.090	0.097	0.21	NonLiqfble.	0.00	0.0000
CPT-01	43.799	12	10.779	0.163	115	5037	3053	8.5	5.4	1.97	3.1	67.6	0.80	34.1	42.7	0.465	0.087	0.094	0.20	NonLiqfble.	0.00	0.0000
CPT-01	43.963	12	11.064	0.218	115	5056	3061	8.7	5.6	2.55	3.2	70.9	0.80	35.0	43.7	0.465	0.088	0.095	0.20	NonLiqfble.	0.00	0.0000
CPT-01	44.127	12	11.548	0.231	115	5075	3070	9.1	5.9	2.56	3.2	69.5	0.80	36.5	45.6	0.466	0.089	0.096	0.21	NonLiqfble.	0.00	0.0000
CPT-01	44.291	12	11.948	0.256	115	5093	3079	9.4	6.1	2.72	3.2	69.4	0.80	37.7	47.1	0.466	0.090	0.097	0.21	NonLiqfble.	0.00	0.0000
CPT-01	44.455	12	13.288	0.275	115	5112	3087	10.5	6.9	2.56	3.1	64.9	0.80	41.9	52.3	0.467	0.093	0.101	0.22	NonLiqfble.	0.00	0.0000
CPT-01	44.619	12	14.457	0.289	115	5131	3096	11.4	7.7	2.43	3.0	61.4	0.80	45.5	56.8	0.467	0.097	0.105	0.22	NonLiqfble.	0.00	0.0000
CPT-01	44.783	12	15.199	0.333	115	5150	3104	11.9	8.1	2.64	3.0	61.3	0.80	47.7	59.7	0.467	0.100	0.108	0.23	NonLiqfble.	0.00	0.0000
CPT-01	44.948	12	16.596	0.359	115	5169	3113	13.0	9.0	2.56	3.0	58.3	0.80	52.1	65.1	0.468	0.106	0.114	0.24	NonLiqfble.	0.00	0.0000
CPT-01	45.112	12	18.05	0.399	115	5188	3122	14.1	9.9	2.58	3.0	56.1	0.80	56.5	70.7	0.468	0.113	0.122	0.26	NonLiqfble.	0.00	0.0000
CPT-01	45.276	12	19.504	0.436	115	5207	3130	15.3	10.8	2.58	2.9	54.1	0.80	61.0	76.3	0.469	0.121	0.131	0.28	NonLiqfble.	0.00	0.0000
CPT-01	45.44	12	20.445	0.495	115	5226	3139	16.0	11.4	2.78	2.9	54.0	0.80	63.9	79.8	0.469	0.127	0.138	0.29	NonLiqfble.	0.00	0.0000
CPT-01	45.604	12	20.673	0.554	115	5244	3148	16.1	11.5	3.07	3.0	55.4	0.80	64.5	80.6	0.469	0.129	0.139	0.30	NonLiqfble.	0.00	0.0000
CPT-01	45.768	12	20.246	0.568	115	5263	3156	15.8	11.2	3.22	3.0	56.9	0.80	63.1	78.8	0.470	0.126	0.136	0.29	NonLiqfble.	0.00	0.0000
CPT-01	45.932	12	18.563	0.588	115	5282	3165	14.4	10.1	3.69	3.0	61.7	0.80	57.7	72.2	0.470	0.115	0.124	0.26	NonLiqfble.	0.00	0.0000
CPT-01	46.096	12	16.767	0.528	115	5301	3173	13.0	8.9	3.74	3.1	65.0	0.80	52.1	65.1	0.471	0.106	0.114	0.24	NonLiqfble.	0.00	0.0000
CPT-01	46.26	12	15.085	0.485	115	5320	3182	11.7	7.8	3.90	3.2	69.2	0.80	46.8	58.5	0.471	0.099	0.107	0.23	NonLiqfble.	0.00	0.0000
CPT-01	46.424	12	13.944	0.422	115	5339	3191	10.8	7.1	3.74	3.2	71.1	0.80	43.2	54.0	0.471	0.095	0.102	0.22	NonLiqfble.	0.00	0.0000
CPT-01	46.588	12	13.088	0.365	115	5358	3199	10.1	6.5	3.51	3.2	72.2	0.80	40.5	50.6	0.472	0.092	0.099	0.21	NonLiqfble.	0.00	0.0000
CPT-01	46.752	12	12.204	0.304	115	5376	3208	9.4	5.9	3.20	3.2	73.1	0.80	37.7	47.1	0.472	0.090	0.097	0.21	NonLiqfble.	0.00	0.0000
CPT-01	46.916	12	12.632	0.285	115	5395	3217	9.7	6.2	2.87	3.2	70.0	0.80	39.0	48.7	0.473	0.091	0.098	0.21	NonLiqfble.	0.00	0.0000
CPT-01	47.08	12	16.054	0.304	115	5414	3225	12.4	8.3	2.28	3.0	58.5	0.80	49.5	61.8	0.473	0.102	0.110	0.23	NonLiqfble.	0.00	0.0000
CPT-01	47.244	12	20.103	0.349	115	5433	3234	15.5	10.7	2.01	2.9	50.5	0.80	61.9	77.3	0.473	0.123	0.133	0.28	NonLiqfble.	0.00	0.0000
CPT-01	47.408	12	19.134	0.363	115	5452	3242	14.7	10.1	2.21	2.9	53.2	0.80	58.8	73.5	0.474	0.117	0.126	0.27	NonLiqfble.	0.00	0.0000
CPT-01	47.572	12	16.966	0.33	115	5471	3251	13.0	8.8	2.32	3.0	57.4	0.80	52.1	65.1	0.474	0.106	0.114	0.24	NonLiqfble.	0.00	0.0000
CPT-01	47.736	12	14.856	0.296	115	5490	3260	11.4	7.4	2.44	3.1	62.4	0.80	45.5	56.9	0.475	0.097	0.105	0.22	NonLiqfble.	0.00	0.0000
CPT-01	47.9	12	16.026	0.258	115	5509	3268	12.3	8.1	1.94	3.0	56.6	0.80	49.1	61.3	0.475	0.101	0.110	0.23	NonLiqfble.	0.00	0.0000
CPT-01	48.064	12	17.394	0.32	115	5527	3277	13.3	8.9	2.19	3.0	56.0	0.80	53.2	66.5	0.475	0.107	0.116	0.24	NonLiqfble.	0.00	0.0000
CPT-01	48.228	12	32.935	0.48	115	5546	3286	25.1	18.4	1.59	2.6	36.6	0.80	100.6	125.7	0.476	0.265	0.286	0.60	NonLiqfble.	0.00	0.0000
CPT-01	48.392	12	37.298	0.432	115	5565	3294	28.4	20.9	1.25	2.5	31.6	0.71	69.8	98.2	0.476	0.168	0.182	0.38	Liquefaction !!	2.44	0.0480
CPT-01	48.556	12	29.428	0.441	115	5584	3303	22.4	16.1	1.66	2.7	39.5	0.80	89.6	112.0	0.476	0.211	0.228	0.48	NonLiqfble.	0.00	0.0000
CPT-01	48.72	12	22.213	0.334	115	5603	3311	16.9	11.7	1.72	2.8	46.5	0.80	67.6	84.4	0.477	0.136	0.147	0.31	NonLiqfble.	0.00	0.0000
CPT-01	48.885	12	26.148	0.472	115	5622	3320	19.9	14.1	2.02	2.8	44.8	0.80	79.4	99.3	0.477	0.171	0.185	0.39	NonLiqfble.	0.00	0.0000
CPT-01	49.049	12	31.081	0.509	115	5641	3329	23.6	17.0	1.80	2.7	39.5	0.80	94.3	117.9	0.477	0.232	0.251	0.53	NonLiqfble.	0.00	0.0000
CPT-01	49.213	12	32.592	0.492	115	5659	3337	24.7	17.8	1.65	2.6	37.6	0.80	98.7	123.4	0.478	0.255	0.275	0.58	NonLiqfble.	0.00	0.0000
CPT-01	49.377	12	30.311	0.54	115	5678	3346	22.9	16.4	1.97	2.7	41.3	0.80	91.7	114.6	0.478	0.220	0.238	0.50	NonLiqfble.	0.00	0.0000
CPT-01	49.541	12	29.542	0.635	115	5697	3355	22.3	15.9	2.38	2.8	44.5	0.80	89.3	111.6	0.479	0.209	0.226	0.47	NonLiqfble.	0.00	0.0000
CPT-01	49.705	12	32.222	0.785	115	5716	3363	24.3	17.5	2.67	2.8	44.3	0.80	97.2	121.6	0.479	0.247	0.267	0.56	NonLiqfble.	0.00	0.0000

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	7.26
PGA (g):	0.51
MSF:	1.08

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments		Ev	(inches) S
CPT-01	49.869	12	35.758	0.903	115	5735	3372	26.9	19.5	2.75	2.7	42.6	0.80	107.8	134.7	0.479	0.307	0.332	0.69	NonLiqfble.		0.00	0.0000
CPT-01	50.033	12	31.623	0.978	124	6204	3831	22.4	14.9	3.43	2.9	51.4	0.80	89.4	111.8	0.403	0.210	0.227	0.56	NonLiqfble.		0.00	0.0000
CPT-01	50.197	12	29.342	0.956	124	6224	3841	20.7	13.7	3.64	2.9	54.3	0.80	82.9	103.6	0.403	0.183	0.198	0.49	NonLiqfble.		0.00	0.0000
CPT-01	50.361	12	38.068	1.251	124	6245	3851	26.8	18.1	3.58	2.8	48.0	0.80	107.4	134.2	0.403	0.305	0.329	0.82	NonLiqfble.		0.00	0.0000
CPT-01	50.525	12	62.59	1.813	124	6265	3861	44.1	30.8	3.05	2.6	36.0	0.80	176.3	220.4	0.403	1.075	1.161	2.88	NonLiqfble.		0.00	0.0000
CPT-01	50.689	12	75.051	2.492	124	6285	3871	52.8	37.1	3.47	2.6	34.9	0.80	207.8	260.6	0.404	1.725	1.863	4.62	FS>1.3		0.00	0.0000
CPT-01	50.853	12	96.808	2.993	124	6306	3881	68.0	48.2	3.20	2.5	29.9	0.67	135.5	203.4	0.404	0.863	0.932	2.31	FS>1.3		0.00	0.0000
CPT-01	51.017	12	139.3	2.913	124	6326	3891	97.7	69.9	2.14	2.2	20.6	0.42	69.6	167.3	0.404	0.515	0.557	1.38	FS>1.3		0.00	0.0000
CPT-01	51.181	12	168.15	2.359	124	6346	3902	117.8	84.5	1.43	2.1	14.8	0.26	41.9	159.7	0.404	0.459	0.495	1.23	Low F.S.	!!	0.21	0.0042
CPT-01	51.345	12	165.84	1.314	124	6367	3912	116.0	83.1	0.81	1.9	10.8	0.15	21.3	137.3	0.405	0.321	0.346	0.86	Liquefaction	!!	1.01	0.0198
CPT-01	51.509	12	159.23	1.167	124	6387	3922	111.2	79.5	0.75	1.9	10.7	0.15	20.0	131.3	0.405	0.290	0.314	0.77	Liquefaction	!!	1.39	0.0273
CPT-01	51.673	12	162.76	1.451	124	6407	3932	113.6	81.1	0.91	2.0	11.8	0.18	25.1	138.7	0.405	0.328	0.354	0.87	Liquefaction	!!	1.01	0.0198
CPT-01	51.837	12	159.28	0.994	124	6428	3942	111.0	79.2	0.64	1.9	9.8	0.13	16.4	127.4	0.405	0.272	0.294	0.73	Liquefaction	!!	1.47	0.0289
CPT-01	52.001	12	159.14	1.199	124	6448	3952	110.8	78.9	0.77	1.9	11.0	0.16	20.9	131.7	0.406	0.292	0.316	0.78	Liquefaction	!!	1.39	0.0273
CPT-01	52.165	12	151.19	1.399	124	6468	3962	105.1	74.7	0.95	2.0	12.8	0.21	27.7	132.8	0.406	0.298	0.322	0.79	Liquefaction	!!	1.39	0.0273
CPT-01	52.329	12	146.51	1.25	124	6489	3972	101.7	72.1	0.87	2.0	12.6	0.20	25.8	127.5	0.406	0.273	0.295	0.73	Liquefaction	!!	1.47	0.0289
CPT-01	52.493	12	147.96	1.267	124	6509	3982	102.6	72.6	0.88	2.0	12.5	0.20	25.9	128.4	0.406	0.277	0.299	0.74	Liquefaction	!!	1.47	0.0289
CPT-01	52.657	12	150.16	1.295	124	6529	3992	104.0	73.6	0.88	2.0	12.5	0.20	25.9	129.9	0.407	0.284	0.306	0.75	Liquefaction	!!	1.47	0.0289
CPT-01	52.822	12	151.1	1.212	124	6550	4003	104.5	73.8	0.82	2.0	12.0	0.19	23.8	128.3	0.407	0.277	0.299	0.73	Liquefaction	!!	1.47	0.0290
CPT-01	52.986	12	142.32	0.834	124	6570	4013	98.3	69.3	0.60	1.9	10.7	0.15	17.5	115.8	0.407	0.224	0.242	0.60	Liquefaction	!!	2.08	0.0410
CPT-01	53.15	12	136.67	0.658	115	6112	3544	100.4	75.4	0.49	1.8	8.9	0.10	11.7	112.1	0.429	0.211	0.228	0.53	Liquefaction	!!	2.16	0.0425
CPT-01	53.314	12	142.77	0.783	115	6131	3553	104.8	78.6	0.56	1.8	9.2	0.11	13.2	118.0	0.429	0.233	0.251	0.59	Liquefaction	!!	2.08	0.0410
CPT-01	53.478	12	155.38	0.827	115	6150	3562	113.9	85.5	0.54	1.8	8.3	0.09	11.2	125.1	0.429	0.262	0.283	0.66	Liquefaction	!!	1.79	0.0352
CPT-01	53.642	12	117.37	1.191	115	6169	3570	85.9	64.0	1.04	2.1	15.0	0.27	31.4	117.4	0.430	0.230	0.249	0.58	Liquefaction	!!	2.08	0.0410
CPT-01	53.806	12	64.273	1.32	115	6188	3579	47.0	34.2	2.16	2.5	29.9	0.67	93.5	140.5	0.430	0.338	0.365	0.85	Liquefaction	!!	0.95	0.0188
CPT-01	53.97	12	43.656	1.281	115	6207	3588	31.9	22.6	3.16	2.7	41.9	0.80	127.6	159.5	0.430	0.457	0.494	1.15	NonLiqfble.		0.00	0.0000
CPT-01	54.134	12	38.096	1.018	115	6225	3596	27.8	19.4	2.91	2.8	43.5	0.80	111.2	139.0	0.430	0.330	0.356	0.83	NonLiqfble.		0.00	0.0000
CPT-01	54.298	12	33.847	0.858	115	6244	3605	24.7	17.0	2.79	2.8	45.4	0.80	98.7	123.3	0.431	0.254	0.275	0.64	NonLiqfble.		0.00	0.0000
CPT-01	54.462	12	31.338	0.989	115	6263	3614	22.8	15.6	3.51	2.9	50.8	0.80	91.2	114.0	0.431	0.218	0.235	0.55	NonLiqfble.		0.00	0.0000
CPT-01	54.626	12	30.425	1.047	115	6282	3622	22.1	15.1	3.84	2.9	53.1	0.80	88.5	110.6	0.431	0.206	0.222	0.52	NonLiqfble.		0.00	0.0000
CPT-01	54.79	12	30.539	1.186	115	6301	3631	22.2	15.1	4.33	2.9	55.1	0.80	88.7	110.9	0.431	0.207	0.223	0.52	NonLiqfble.		0.00	0.0000
CPT-01	54.954	12	32.307	1.156	115	6320	3639	23.4	16.0	3.97	2.9	52.3	0.80	93.7	117.2	0.432	0.230	0.248	0.57	NonLiqfble.		0.00	0.0000
CPT-01	55.118	12	33.192	1.075	115	6339	3648	24.0	16.5	3.58	2.9	50.0	0.80	96.2	120.2	0.432	0.242	0.261	0.60	NonLiqfble.		0.00	0.0000
CPT-01	55.282	12	34.931	1.178	115	6357	3657	25.3	17.4	3.71	2.9	49.5	0.80	101.1	126.4	0.432	0.268	0.289	0.67	NonLiqfble.		0.00	0.0000
CPT-01	55.446	12	36.157	1.23	115	6376	3665	26.1	18.0	3.73	2.8	48.9	0.80	104.5	130.7	0.433	0.287	0.310	0.72	NonLiqfble.		0.00	0.0000
CPT-01	55.61	12	37.069	1.308	115	6395	3674	26.8	18.4	3.86	2.9	49.0	0.80	107.0	133.8	0.433	0.303	0.327	0.76	NonLiqfble.		0.00	0.0000
CPT-01	55.774	12	37.668	1.3	115	6414	3683	27.2	18.7	3.77	2.8	48.3	0.80	108.6	135.8	0.433	0.313	0.338	0.78	NonLiqfble.		0.00	0.0000
CPT-01	55.938	12	38.752	1.387	115	6433	3691	27.9	19.2	3.90	2.8	48.3	0.80	111.6	139.5	0.433	0.333	0.359	0.83	NonLiqfble.		0.00	0.0000
CPT-01	56.102	12	39.693	1.521	115	6452	3700	28.6	19.7	4.17	2.8	48.9	0.80	114.2	142.8	0.434	0.351	0.379	0.87	NonLiqfble.		0.00	0.0000
CPT-01	56.266	12	40.434	1.573	115	6471	3708	29.1	20.1	4.23	2.8	48.8	0.80	116.2	145.3	0.434	0.365	0.394	0.91	NonLiqfble.		0.00	0.0000
CPT-01	56.43	12	42.915	1.612	115	6489	3717	30.8	21.3	4.06	2.8	46.9	0.80	123.2	154.0	0.434	0.420	0.453	1.04	NonLiqfble.		0.00	0.0000
CPT-01	56.594	12	41.632	1.625	115	6508	3726	29.8	20.6	4.23	2.8	48.3	0.80	119.4	149.2	0.434	0.389	0.420	0.97	NonLiqfble.		0.00	0.0000
CPT-01	56.759	12	40.406	1.631	115	6527	3734	28.9	19.9	4.39	2.9	49.6	0.80	115.7	144.7	0.435	0.361	0.390	0.90	NonLiqfble.		0.00	0.0000
CPT-01	56.923	12	41.832	1.604	115	6546	3743	29.9	20.6	4.16	2.8	48.0	0.80	119.7	149.6	0.435	0.391	0.423	0.97	NonLiqfble.		0.00	0.0000
CPT-01	57.087	12	42.943	1.735	115	6565	3752	30.7	21.1	4.37	2.8	48.3	0.80	122.7	153.4	0.435	0.416	0.449	1.03	NonLiqfble.		0.00	0.0000
CPT-01	57.251	12	42.972	1.718	115	6584	3760	30.7	21.1	4.33	2.8	48.2	0.80	122.6	153.3	0.435	0.415	0.448	1.03	NonLiqfble.		0.00	0.0000
CPT-01	57.415	12	42.601	1.714	115	6603	3769	30.4	20.8	4.36	2.8	48.5	0.80	121.4	151.8	0.436	0.405	0.438	1.01	NonLiqfble.		0.00	0.0000
CPT-01	57.579	12	40.577	1.669	115	6622	3777	28.9	19.7	4.48	2.9	50.1	0.80	115.5	144.4	0.436	0.360	0.389	0.89	NonLiqfble.		0.00	0.0000
CPT-01	57.743	12	37.668	1.535	115	6640	3786	26.8	18.1	4.47	2.9	51.8	0.80	107.1	133.9	0.436	0.303	0.328	0.75	NonLiqfble.		0.00	0.0000
CPT-01	57.907	12	33.163	1.496	115	6659	3795	23.6	15.7	5.01	3.0	56.9	0.80	94.2	117.8	0.436	0.232	0.250	0.57	NonLiqfble.		0.00	0.0000
CPT-01	58.071	12	30.169	1.319	115	6678	3803	21.4	14.1	4.92	3.0	58.9	0.80	85.6	107.0	0.437	0.194	0.210	0.48	NonLiqfble.		0.00	0.0000
CPT-01	58.235	12	25.749	1.176	115	6697	3812	18.2	11.7	5.25	3.1	64.5	0.80	73.0	91.2	0.437	0.151	0.163	0.37	NonLiqfble.		0.00	0.0000
CPT-01	58.399	12	22.213	0.889	115	6716	3821	15.7	9.9	4.72	3.1	66.7	0.80	62.9	78.6	0.437	0.125	0.135	0.31	NonLiqfble.		0.00	0.0000
CPT-01	58.563	12	19.333	0.855	115	6735	3829	13.7	8.3	5.36	3.2	73.7	0.80	54.7	68.3	0.437	0.110	0.118	0.27	NonLiqfble.		0.00	0.0000
CPT-01	58.727	12	17.195	0.721	115	6754	3838	12.1	7.2	5.22	3.3	77.2	0.80	48.6	60.7	0.438	0.101	0.109	0.25	NonLiqfble.		0.00	0.0000
CPT-01	58.891	12	16.368	0.534	115	6772	3846	11.5	6.7	4.11	3.2	74.2	0.80	46.2	57.7	0.438	0.098	0.106	0.24	NonLiqfble.		0.00	0.0000
CPT-01	59.055	12	15.284	0.433	115	6791	3855	10.8	6.2	3.64	3.2	74.4	0.80	43.1	53.9	0.438	0.095	0.102	0.23	NonLiqfble.		0.00	0.0000
CPT-01	59.219	12	15.199	0.45	115	6810	3864	10.7	6.1	3.82	3.2	75.6	0.80	42.8	53.5	0.438	0.094	0.102	0.23	NonLiqfble.		0.00	0.0000
CPT-01	59.383	12	16.225	0.462	115	6829	3872	11.4	6.6	3.61	3.2	72.3	0.80	45.6	57.0	0.438	0.097	0.105	0.24	NonLiqfble.		0.00	0.0000
CPT-01	59.547	12	16.51	0.416	115	6848	3881	11.6	6.7	3.18	3.2	69.4	0.80	46.4	58.0	0.439	0.098	0.106	0.24	NonLiqfble.		0.00	0.0000
CPT-01	59.711	12	16.738	0.327	115	6867	3890	11.7	6.8	2.46	3.1	64.6	0.80	47.0	58.7	0.439	0.099	0.107	0.24	NonLiqfble.		0.00	0.0000
CPT-01	59.875	12	15.826	0.294	115	6886	3898	11.1	6.3	2.37	3.1	66.1	0.80	44.4	55.5	0.439	0.096	0.104	0.24	NonLiqfble.		0.00	0.0000
CPT-01	60.039	12	13.602	0.194	115	6904	3907	9.5	5.2	1.91	3.1	68.2	0.80	38.1	47.6	0.387	0.090	0.097	0.25	NonLiqfble.		0.00	0.0000
CPT-01	60.203	12	11.948	0.142	115	6923	3915	8.4	4.3	1.67	3.2	71.4	0.80	33.4	41.8	0.387	0.087	0.094	0.24	NonLiqfble.		0.00	0.0000
CPT-01	60.367	12	10.608	0.133	115	6942	3924	7.4	3.6	1.86	3.3	78.5	0.80	29.6	37.0	0.387	0.085	0.092	0.24	NonLiqfble.		0.00	0.0000
CPT-01	60.531	12	10.237	0.107	115	6961	3933	7.1	3.4	1.58	3.3	77.7	0.80	28.6	35.7	0.387	0.084	0.091	0.23	NonLiqfble.		0.00	0.0000
CPT-01	60.696	12	9.524	0.091	115	6980	3941	6.6	3.1	1.51	3.3	80.7	0.80	26.6	33.2	0.387	0.083	0.090	0.23	NonLiqfble.		0.00	0.0000
CPT-01	60.86	12	9.695	0.093	115	6999	3950	6.7	3.1	1.50	3.3	79.8	0.80	27.0	33.7	0.388	0.084	0.090	0.23	NonLiqfble.		0.00	0.0000
CPT-01	61.024	12	10.608	0.099	115	7018	3959	7.4	3.6	1.39	3.2	74.5	0.80	29.5	36.9	0.388	0.085	0.091	0.24	NonLiqfble.		0.00	0.0000
CPT-01	61.188	12	11.007	0.149	115	7037	3967	7.6	3.8	1.99	3.3	78.4	0.80	30.6	38.2	0.388	0.085	0.092	0.24	NonLiqfble.		0.00	0.0000
CPT-01	61.352	12	11.548	0.162	115	7055	3976	8.0	4.0	2.02	3.2	76.6	0.80	32.1	40.1	0.388	0.086	0.093	0.24	NonLiqfble.		0.00	0.0000
CPT-01	61.516	12	12.918	0.153	115	7074	3985	9.0	4.7	1.63	3.1	68.6	0.80	35.8	44.8	0.388	0.088	0.095	0.25	NonLiqfble.		0.00	0.0000
CPT-01	61.68	12	13.202	0.406	115	7093	3993	9.1	4.8	4.21	3.3	84.5	0.80	36.6	45.7	0.389	0.089	0.096	0.25	NonLiqfble.		0.00	0.0000
CPT-01	61.844	12	19.647	0.724	115	7112	4002	13.6	8.0	4.50	3.2	71.1	0.80	54.4	67.9	0.389	0.109	0.118	0.30	NonLiqfble.		0.00	0.0000
CPT-01	62.008	12	36.271	0.666	115	7131	4010	25.1	16.3	2.04	2.7	41.9	0.80	100.2	125.3	0.389	0.263	0.284	0.73	NonLiqfble.		0.00	0.0000
CPT-01	62.172	12	27.916	0.733	115	7150	4019	19.3	12.1	3.01	2.9	53.9	0.80	77.1	96.3	0.389	0.163	0.176	0.45	NonLiqfble.		0.00	0.0000
CPT-01	62.336	12	28.173	0.777	115	7169	4028	19.4	12.2	3.16	2.9	54.5	0.80	77.7	97.1	0.389	0.165	0.178	0.46	NonLiqfble.		0.00	0.0000
CPT-01	62.5	12	30.368	0.832	115	7188	4036	20.9	13.3	3.11	2.9	52.4	0.80	83.7	104.6	0.390	0.186	0.201	0.52	NonLiqfble.		0.00	0.0000
CPT-01	62.664	12	24.865	0.837	115	7206	4045	17.1	10.5	3.94	3.0	61.8	0.80	68.4	85.5	0.390	0.138	0.149	0.38	NonLiqfble.		0.00	0.0000
CPT-01	62.828	12	23.04	0.893	115	7225	4054	15.8	9.6	4.60	3.1	67.0	0.80	63.3	79.2	0.390	0.126	0.136	0.35	NonLiqfble.		0.00	0.0000
CPT-01	62.992	12	27.574	1.028	115	7244	4062	18.9	11.8	4.29	3.0	60.6	0.80	75.7	94.6	0.390	0.159	0.172	0.44	NonLiqfble.		0.00	0.0000
CPT-01	63.156	12	37.44	0.967	115	7263	4071	25.7	16.6	2.86	2.8	46.3	0.80	102.7	128.4	0.390	0.277	0.299	0.77	NonLiqfble.		0.00	0.0000
CPT-01	63.32	12	41.746	1.122	115	7282	4079	28.6	18.7	2.94	2.8	44.4	0.80	114.4	143.0	0.391	0.352	0.380	0.97	NonLiqfble.		0.00	0.0000
CPT-01	63.484	12	39.179	1.443	115	7301	4088	26.8	17.4	4.06	2.9	51.0	0.80	107.2	134.1	0.391	0.304	0.328	0.84	NonLiqfble.		0.00	0.0000
CPT-01	63.648	12	44.569	1.667	115	7320	4097	30.5	20.0	4.08	2.8	48.3	0.80	121.9	152.3	0.391	0.409	0.441	1.13	NonLiqfble.		0.00	0.0000
CPT-01	63.812	12	59.625	1.409	115	7338	4105	40.7	27.2	2.52	2.6	35.4	0.80	162.9	203.6	0.391	0.865	0.934	2.39	NonLiqfble.		0.00	0.0000
CPT-01	63.976	12	66.468	1.399	115	7357	4114	45.3	30.5	2.23	2.5	32.0	0.72	117.8	163.1	0.391	0.483	0.522	1.33	FS>1.3		0.00	0.0000
CPT-01	64.14	12	65.584	1.636	115	7376	4123	44.7	30.0	2.64	2.6	34.5	0.79	165.5	210.2	0.391	0.944	1.020	2.60	FS>1.3		0.00	0.0000
CPT-01	64.304	12	65.698	1.692	115	7395	4131	44.7	30.0	2.73	2.6	34.9	0.80	177.8	222.5	0.392	1.104	1.193	3.04	FS>1.3		0.00	0.0000
CPT-01	64.469	12	67.523	1.591	115	7414	4140	45.9	30.8	2.49	2.6	33.3	0.76	142.1	188.0	0.392	0.698	0.754	1.92	FS>1.3		0.00	0.0000
CPT-01	64.633	12	69.035	1.48	115	7433	4148	46.9	31.5	2.27	2.5	31.8	0.71	117.4	164.3	0.392	0.493	0.532	1.36	FS>1.3		0.00	0.0000
CPT-01	64.797	12	68.493	1.359	115	7452	4157	46.5	31.1	2.10	2.5	31.0	0.69	105.4	151.9	0.392	0.406	0.438	1.12	Low F.S.	!!	0.31	0.0060
CPT-01	64.961	12	62.961	0.988	115	7471	4166	42.7	28.4	1.67	2.5	29.8	0.66	83.2	125.9	0.392	0.266	0.287	0.73	Liquefaction	!!	1.47	0.0289
CPT-01	65.125	12	49.16	1.097	115	7489	4174	33.3	21.7	2.42	2.7	38.8	0.80	133.2	166.5	0.393	0.509	0.550	1.40	NonLiqfble.		0.00	0.0000
CPT-01	65.289	12	44.055	1.064	115	7508	4183	29.8	19.3	2.64	2.7	42.2	0.80	119.2	149.0	0.393	0.388	0.419	1.07	NonLiqfble.		0.00	0.0000
CPT-01	65.453	12	31.024	1.267	115	7527	4192	21.0	13.0	4.65	3.0	59.8	0.80	83.9	104.8	0.393	0.187	0.202	0.51	NonLiqfble.		0.00	0.0000
CPT-01	65.617	12	29.627	1.54	115	7546	4200	20.0	12.3	5.96	3.1	65.9	0.80	80.0	100.0	0.393	0.173	0.187	0.48	NonLiqfble.		0.00	0.0000
CPT-01	65.781	12	53.665	1.298	115	7565	4209	36.2	23.7	2.60	2.7	38.3	0.80	144.8	181.0	0.393	0.631	0.682	1.73	NonLiqfble.		0.00	0.0000
CPT-01	65.945	12	69.206	1.363	115	7584	4218	46.6	31.0	2.08	2.5	31.0	0.69	105.5	152.1	0.393	0.408	0.440	1.12	Low F.S.	!!	0.31	0.0060
CPT-01	66.109	12	76.477	1.307	115	7603	4226	51.5	34.4	1.80	2.4	27.7	0.61	79.5	131.0	0.394	0.289	0.312	0.79	Liquefaction	!!	1.39	0.0273
CPT-01	66.273	12	80.269	1.255	115	7621	4235	54.0	36.1	1.64	2.4	26.1	0.56	69.3	123.3	0.394	0.254	0.274	0.70	Liquefaction	!!	1.90	0.0374

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	7.26
PGA (g):	0.51
MSF:	1.08

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments		Ev (inches)	S (inches)
CPT-01	66.437	12	81.667	1.157	115	7640	4243	54.9	36.7	1.49	2.4	24.8	0.53	61.6	116.4	0.394	0.227	0.245	0.62	Liquefaction	!!	2.02	0.0397
CPT-01	66.601	12	81.011	0.974	115	7659	4252	54.4	36.3	1.26	2.3	23.4	0.49	52.3	106.7	0.394	0.193	0.208	0.53	Liquefaction	!!	2.25	0.0442
CPT-01	66.765	12	78.616	1.03	115	7678	4261	52.7	35.1	1.38	2.4	24.7	0.53	58.3	111.0	0.394	0.207	0.224	0.57	Liquefaction	!!	2.16	0.0425
CPT-01	66.929	12	74.424	1.258	115	7697	4269	49.8	33.0	1.78	2.4	28.2	0.62	81.2	131.1	0.394	0.289	0.313	0.79	Liquefaction	!!	1.39	0.0273
CPT-01	67.093	12	69.862	1.458	115	7716	4278	46.7	30.8	2.21	2.5	31.8	0.71	117.0	163.8	0.395	0.489	0.528	1.34	FS>1.3		0.00	0.0000
CPT-01	67.257	12	58.427	1.022	115	7735	4287	39.0	25.4	1.87	2.5	32.9	0.74	113.2	152.3	0.395	0.408	0.441	1.12	Low F.S.	!!	0.31	0.0060
CPT-01	67.421	12	41.176	1.45	115	7753	4295	27.5	17.4	3.89	2.9	50.3	0.80	110.0	137.4	0.395	0.321	0.347	0.88	NonLiqfble.		0.00	0.0000
CPT-01	67.585	12	40.605	1.741	115	7772	4304	27.1	17.1	4.74	2.9	54.1	0.80	108.3	135.4	0.395	0.311	0.336	0.85	NonLiqfble.		0.00	0.0000
CPT-01	67.749	12	66.639	1.546	115	7791	4312	44.4	29.1	2.46	2.6	34.1	0.78	154.1	198.5	0.395	0.808	0.872	2.21	FS>1.3		0.00	0.0000
CPT-01	67.913	12	74.852	1.49	115	7810	4321	49.8	32.8	2.10	2.5	30.2	0.67	102.5	152.3	0.395	0.409	0.441	1.12	Low F.S.	!!	0.31	0.0060
CPT-01	68.077	12	70.517	1.603	115	7829	4330	46.9	30.8	2.41	2.5	32.9	0.74	136.7	183.6	0.396	0.655	0.708	1.79	FS>1.3		0.00	0.0000
CPT-01	68.241	12	60.052	1.649	115	7848	4338	39.9	25.9	2.94	2.7	38.4	0.80	159.6	199.5	0.396	0.818	0.883	2.23	NonLiqfble.		0.00	0.0000
CPT-01	68.406	12	54.121	1.859	115	7867	4347	35.9	23.1	3.70	2.8	43.9	0.80	143.7	179.6	0.396	0.619	0.668	1.69	NonLiqfble.		0.00	0.0000
CPT-01	68.57	12	74.595	1.656	115	7886	4356	49.5	32.4	2.34	2.5	31.7	0.71	123.2	172.7	0.396	0.559	0.603	1.52	FS>1.3		0.00	0.0000
CPT-01	68.734	12	83.492	1.435	115	7904	4364	55.3	36.4	1.80	2.4	26.9	0.59	78.2	133.5	0.396	0.301	0.325	0.82	Liquefaction	!!	1.06	0.0209
CPT-01	68.898	12	86.856	1.416	115	7923	4373	57.5	37.9	1.71	2.4	25.8	0.56	71.7	129.2	0.396	0.281	0.303	0.76	Liquefaction	!!	1.47	0.0289
CPT-01	69.062	12	89.137	1.317	115	7942	4381	58.9	38.9	1.55	2.4	24.4	0.52	63.5	122.4	0.397	0.250	0.270	0.68	Liquefaction	!!	1.90	0.0374
CPT-01	69.226	12	88.966	1.305	115	7961	4390	58.7	38.7	1.54	2.3	24.4	0.52	63.2	121.9	0.397	0.248	0.268	0.68	Liquefaction	!!	1.90	0.0374
CPT-01	69.39	12	88.425	1.426	115	7980	4399	58.3	38.4	1.69	2.4	25.5	0.55	70.6	128.9	0.397	0.279	0.301	0.76	Liquefaction	!!	1.47	0.0289
CPT-01	69.554	12	84.603	1.75	115	7999	4407	55.8	36.6	2.17	2.5	29.0	0.64	99.5	155.2	0.397	0.428	0.462	1.16	Low F.S.	!!	0.30	0.0059
CPT-01	69.718	12	84.233	2.066	115	8018	4416	55.5	36.3	2.58	2.5	31.2	0.70	129.1	184.5	0.397	0.664	0.717	1.81	FS>1.3		0.00	0.0000
CPT-01	69.882	12	74.082	2.133	115	8036	4425	48.7	31.7	3.04	2.6	35.6	0.80	194.9	243.6	0.397	1.425	1.539	3.87	NonLiqfble.		0.00	0.0000
CPT-01	70.046	12	56.174	1.539	115	8055	4433	36.9	23.5	2.95	2.7	40.2	0.80	147.7	184.6	0.398	0.665	0.718	1.81	NonLiqfble.		0.00	0.0000
CPT-01	70.21	12	40.862	1.71	115	8074	4442	26.8	16.6	4.64	2.9	54.3	0.80	107.3	134.1	0.398	0.304	0.329	0.83	NonLiqfble.		0.00	0.0000
CPT-01	70.374	12	52.753	1.489	115	8093	4450	34.6	21.9	3.06	2.7	42.0	0.80	138.4	173.0	0.398	0.561	0.606	1.52	NonLiqfble.		0.00	0.0000
CPT-01	70.538	12	47.677	1.469	115	8112	4459	31.2	19.6	3.37	2.8	45.6	0.80	125.0	156.2	0.398	0.434	0.469	1.18	NonLiqfble.		0.00	0.0000
CPT-01	70.702	12	46.821	1.613	115	8131	4468	30.6	19.1	3.77	2.8	47.8	0.80	122.6	153.2	0.398	0.415	0.448	1.12	NonLiqfble.		0.00	0.0000
CPT-01	70.866	12	65.556	1.65	115	8150	4476	42.9	27.5	2.68	2.6	36.2	0.80	171.5	214.4	0.398	0.996	1.076	2.70	NonLiqfble.		0.00	0.0000
CPT-01	71.03	12	66.326	1.834	115	8168	4485	43.3	27.7	2.95	2.6	37.3	0.80	173.3	216.7	0.398	1.026	1.108	2.78	NonLiqfble.		0.00	0.0000
CPT-01	71.194	12	70.916	1.788	115	8187	4494	46.3	29.7	2.68	2.6	34.8	0.80	180.5	226.8	0.399	1.165	1.258	3.16	FS>1.3		0.00	0.0000
CPT-01	71.358	12	82.294	1.795	115	8206	4502	53.7	34.7	2.30	2.5	30.4	0.68	113.5	167.2	0.399	0.515	0.556	1.39	FS>1.3		0.00	0.0000
CPT-01	71.522	12	80.84	1.433	115	8225	4511	52.7	34.0	1.87	2.4	28.3	0.62	86.9	139.5	0.399	0.333	0.359	0.90	Liquefaction	!!	0.67	0.0132
CPT-01	71.686	12	78.017	1.969	115	8244	4519	50.8	32.7	2.66	2.6	33.2	0.75	155.8	206.5	0.399	0.899	0.971	2.43	FS>1.3		0.00	0.0000
CPT-01	71.85	12	73.141	2.409	115	8263	4528	47.6	30.5	3.49	2.7	38.1	0.80	190.2	237.8	0.399	1.330	1.437	3.60	NonLiqfble.		0.00	0.0000
CPT-01	72.014	12	75.394	2.277	124	8930	5185	45.8	27.3	3.21	2.7	38.7	0.80	183.3	229.1	0.377	1.198	1.294	3.43	NonLiqfble.		0.00	0.0000
CPT-01	72.178	12	94.755	2.085	124	8950	5195	57.5	34.7	2.31	2.5	30.5	0.68	122.7	180.2	0.377	0.624	0.674	1.79	FS>1.3		0.00	0.0000
CPT-01	72.343	12	107.53	1.655	124	8971	5205	65.2	39.6	1.61	2.4	24.6	0.52	71.3	136.5	0.377	0.316	0.342	0.91	Liquefaction	!!	0.67	0.0132
CPT-01	72.507	12	104.85	1.716	124	8991	5215	63.5	38.5	1.71	2.4	25.6	0.55	77.6	141.2	0.377	0.342	0.369	0.98	Liquefaction	!!	0.65	0.0127
CPT-01	72.671	12	92.93	1.886	124	9011	5225	56.2	33.8	2.13	2.5	29.9	0.67	112.0	168.3	0.377	0.523	0.565	1.50	FS>1.3		0.00	0.0000
CPT-01	72.835	12	89.965	2.005	124	9032	5235	54.4	32.6	2.35	2.5	31.6	0.71	134.1	188.5	0.377	0.703	0.759	2.01	FS>1.3		0.00	0.0000
CPT-01	72.999	12	93.129	1.96	124	9052	5246	56.3	33.8	2.21	2.5	30.4	0.68	118.5	174.8	0.378	0.577	0.623	1.65	FS>1.3		0.00	0.0000
CPT-01	73.163	12	95.496	1.64	124	9072	5256	57.6	34.6	1.80	2.4	27.7	0.61	88.4	146.0	0.378	0.370	0.399	1.06	Low F.S.	!!	0.44	0.0087
CPT-01	73.327	12	98.319	1.673	124	9093	5266	59.3	35.6	1.78	2.4	27.1	0.59	85.8	145.0	0.378	0.364	0.393	1.04	Low F.S.	!!	0.44	0.0087
CPT-01	73.491	12	98.776	1.58	124	9113	5276	59.5	35.7	1.68	2.4	26.4	0.57	79.6	139.1	0.378	0.330	0.357	0.94	Liquefaction	!!	0.67	0.0132
CPT-01	73.655	12	101.54	1.68	124	9133	5286	61.1	36.7	1.73	2.4	26.4	0.57	81.5	142.6	0.378	0.350	0.378	1.00	Liquefaction	!!	0.65	0.0127
CPT-01	73.819	12	113.26	1.611	124	9154	5296	68.1	41.0	1.48	2.3	23.3	0.49	64.9	133.0	0.378	0.299	0.323	0.85	Liquefaction	!!	1.06	0.0209
CPT-01	73.983	12	124.18	1.448	124	9174	5306	74.6	45.1	1.21	2.2	20.2	0.41	50.9	125.5	0.378	0.264	0.285	0.75	Liquefaction	!!	1.47	0.0289
CPT-01	74.147	12	127.35	1.507	124	9194	5316	76.4	46.2	1.23	2.2	20.0	0.40	51.2	127.6	0.378	0.273	0.295	0.78	Liquefaction	!!	1.47	0.0289
CPT-01	74.311	12	122.5	1.901	124	9215	5326	73.4	44.2	1.61	2.3	23.1	0.48	68.9	142.3	0.379	0.348	0.376	0.99	Liquefaction	!!	0.65	0.0127
CPT-01	74.475	12	116.28	2.449	124	9235	5336	69.6	41.8	2.19	2.4	27.2	0.59	101.5	171.2	0.379	0.546	0.590	1.56	FS>1.3		0.00	0.0000
CPT-01	74.639	12	109.64	2.348	124	9255	5347	65.6	39.3	2.24	2.4	28.3	0.62	108.3	173.9	0.379	0.569	0.615	1.62	FS>1.3		0.00	0.0000
CPT-01	74.803	12	110.15	1.123	124	9276	5357	65.9	39.4	1.06	2.3	20.8	0.42	47.9	113.8	0.379	0.217	0.234	0.62	Liquefaction	!!	2.16	0.0425
CPT-01	74.967	12	130.06	1.182	124	9296	5367	77.7	46.7	0.94	2.2	17.7	0.34	39.9	117.5	0.379	0.231	0.249	0.66	Liquefaction	!!	2.02	0.0397
CPT-01	75.131	12	132.22	1.209	124	9316	5377	78.9	47.4	0.95	2.2	17.6	0.34	39.8	118.7	0.379	0.236	0.255	0.67	Liquefaction	!!	2.02	0.0397
CPT-01	75.295	12	154.38	1.175	124	9337	5387	92.0	55.6	0.78	2.1	14.5	0.25	31.1	123.1	0.379	0.254	0.274	0.72	Liquefaction	!!	1.56	0.0306
CPT-01	75.459	12	165.67	1.14	124	9357	5397	98.7	59.6	0.71	2.0	13.1	0.22	27.1	125.7	0.379	0.265	0.286	0.75	Liquefaction	!!	1.47	0.0289
CPT-01	75.623	12	168.21	1.266	124	9377	5407	100.1	60.5	0.77	2.0	13.5	0.23	29.4	129.5	0.379	0.282	0.304	0.80	Liquefaction	!!	1.13	0.0222
CPT-01	75.787	12	170.92	1.256	124	9398	5417	101.6	61.3	0.76	2.0	13.2	0.22	28.5	130.1	0.380	0.285	0.307	0.81	Liquefaction	!!	1.06	0.0209
CPT-01	75.951	12	173.91	1.146	124	9418	5427	103.3	62.3	0.68	2.0	12.4	0.20	25.2	128.5	0.380	0.277	0.300	0.79	Liquefaction	!!	1.47	0.0289
CPT-01	76.115	12	170.35	0.99	124	9438	5437	101.1	60.9	0.60	2.0	11.8	0.18	22.6	123.7	0.380	0.256	0.276	0.73	Liquefaction	!!	1.56	0.0306
CPT-01	76.28	12	158.09	0.798	124	9459	5448	93.7	56.3	0.52	2.0	11.8	0.18	20.9	114.7	0.380	0.220	0.238	0.63	Liquefaction	!!	2.16	0.0428
CPT-01	76.444	12	138.27	0.702	124	9479	5458	81.9	48.9	0.53	2.0	13.3	0.22	23.4	105.3	0.380	0.189	0.204	0.54	Liquefaction	!!	2.25	0.0442
CPT-01	76.608	12	129.03	0.81	124	9499	5468	76.3	45.4	0.65	2.1	15.4	0.28	29.4	105.8	0.380	0.190	0.205	0.54	Liquefaction	!!	2.25	0.0442
CPT-01	76.772	12	130.63	0.944	124	9520	5478	77.2	45.9	0.75	2.1	16.2	0.30	33.0	110.3	0.380	0.205	0.221	0.58	Liquefaction	!!	2.16	0.0425
CPT-01	76.936	12	132.91	0.882	124	9540	5488	78.5	46.7	0.69	2.1	15.5	0.28	30.4	108.9	0.380	0.200	0.216	0.57	Liquefaction	!!	2.25	0.0442
CPT-01	77.1	12	130.31	0.899	124	9560	5498	76.9	45.6	0.72	2.1	16.0	0.29	31.9	108.8	0.380	0.200	0.216	0.57	Liquefaction	!!	2.25	0.0442
CPT-01	77.264	12	121.36	0.838	124	9581	5508	71.5	42.3	0.72	2.1	16.9	0.32	33.3	104.8	0.381	0.187	0.202	0.53	Liquefaction	!!	2.34	0.0460
CPT-01	77.428	12	125.44	0.882	124	9601	5518	73.9	43.7	0.73	2.1	16.6	0.31	33.2	107.1	0.381	0.194	0.210	0.55	Liquefaction	!!	2.25	0.0442
CPT-01	77.592	12	130.97	0.982	124	9621	5528	77.1	45.6	0.78	2.1	16.6	0.31	34.4	111.5	0.381	0.209	0.226	0.59	Liquefaction	!!	2.16	0.0425
CPT-01	77.756	12	136.27	0.936	124	9642	5539	80.1	47.4	0.71	2.1	15.5	0.28	31.2	111.4	0.381	0.208	0.225	0.59	Liquefaction	!!	2.16	0.0425
CPT-01	77.92	12	132	0.792	124	9662	5549	77.5	45.8	0.62	2.1	15.0	0.27	28.4	105.9	0.381	0.190	0.206	0.54	Liquefaction	!!	2.25	0.0442
CPT-01	78.084	12	122.73	0.727	124	9682	5559	72.0	42.4	0.62	2.1	15.9	0.29	29.4	101.4	0.381	0.177	0.191	0.50	Liquefaction	!!	2.34	0.0460
CPT-01	78.248	12	112.06	0.55	124	9703	5569	65.7	38.5	0.51	2.1	15.9	0.29	26.8	92.5	0.381	0.154	0.166	0.44	Liquefaction	!!	2.55	0.0501
CPT-01	78.412	12	107.64	0.687	124	9723	5579	63.1	36.8	0.67	2.2	18.1	0.35	33.8	96.8	0.381	0.164	0.178	0.47	Liquefaction	!!	2.44	0.0480
CPT-01	78.576	12	107.87	1.02	124	9743	5589	63.1	36.8	0.99	2.3	21.0	0.43	47.2	110.3	0.381	0.205	0.221	0.58	Liquefaction	!!	2.16	0.0425
CPT-01	78.74	12	119.05	1.271	124	9764	5599	69.6	40.8	1.11	2.3	20.7	0.42	50.3	119.9	0.382	0.240	0.260	0.68	Liquefaction	!!	2.02	0.0397
CPT-01	78.904	12	172.29	1.968	124	9784	5609	100.7	59.7	1.18	2.1	16.7	0.31	45.8	146.5	0.382	0.372	0.402	1.05	Low F.S.	!!	0.44	0.0087
CPT-01	79.068	12	243.46	2.823	124	9804	5619	142.1	84.9	1.18	2.0	13.3	0.22	40.3	182.4	0.382	0.644	0.696	1.82	FS>1.3		0.00	0.0000
CPT-01	79.232	12	306.16	2.891	124	9825	5629	178.5	107.0	0.96	1.9	9.8	0.13	26.4	205.0	0.382	0.881	0.951	2.49	FS>1.3		0.00	0.0000
CPT-01	79.396	12	391.68	2.043	124	9845	5640	228.2	137.1	0.53	1.6	4.9	0.00	0.0	228.2	0.382	1.185	1.280	3.35	FS>1.3		0.00	0.0000
CPT-01	79.56	12	428.32	1.661	124	9865	5650	249.3	149.8	0.39	1.5	3.3	0.00	0.0	249.3	0.382	1.521	1.643	4.30	FS>1.3		0.00	0.0000
CPT-01	79.724	12	441.64	1.479	124	9886	5660	256.9	154.2	0.34	1.5	2.6	0.00	0.0	256.9	0.382	1.656	1.788	4.68	FS>1.3		0.00	0.0000
CPT-01	79.888	12	428.61	1.612	124	9906	5670	249.1	149.4	0.38	1.5	3.2	0.00	0.0	249.1	0.382	1.517	1.638	4.28	FS>1.3		0.00	0.0000
CPT-01	80.052	12	406.11	1.365	124	9926	5680	235.8	141.2	0.34	1.5	3.1	0.00	0.0	235.8	0.382	1.299	1.403	3.67	FS>1.3		0.00	0.0000
CPT-01	80.217	12	403.26	1.039	124	9947	5690	233.9	139.9	0.26	1.5	2.4	0.00	0.0	233.9	0.382	1.270	1.372	3.59	FS>1.3		0.00	0.0000
CPT-01	80.381	12	384.3	1.117	124	9967	5700	222.7	133.0	0.29	1.5	3.0	0.00	0.0	222.7	0.383	1.107	1.196	3.13	FS>1.3		0.00	0.0000
CPT-01	80.545	12	359.54	0.938	124	9988	5710	208.2	124.1	0.26	1.5	3.1	0.00	0.0	208.2	0.383	0.919	0.993	2.59	FS>1.3		0.00	0.0000

Project Name:	Zero Waste Energy
Project Number:	8900000000 Phase 001
Date:	1-Feb-10
CPT Number:	CPT-01
Depth to Groundwater:	12 ft

EQ Magnitude (M_w):	**7.26**
PGA (g):	**0.51**
MSF:	**1.08**

Total Liquefaction Settlement

2.79 inches

Cone	Depth (FT)	Water Table (FT)	Tip Resist. (TSF)	Sleeve Frict. (TSF)	γ (PCF)	Total Stress (PSF)	Effective Stress (PSF)	Norm. Tip q_{c1N}	Corr. Tip Q	Friction Ratio F	Ic	F.C. (%)	K_{CPT}	Δq_{c1N}	$(q_{c1N})_{cs}$	Induced Stress Ratio	Liquef. Stress M7.5	Liquef. Stress M7.26	Factor of Safety	Comments		Ev	(inches) S
CPT-01	80.709	12	335.76	0.788	124	10008	5720	194.2	115.6	0.24	1.5	3.2	0.00	0.0	194.2	0.383	0.762	0.822	2.15	FS>1.3		0.00	0.0000
CPT-01	80.873	12	308.5	0.649	124	10028	5731	178.3	105.9	0.21	1.5	3.5	0.00	0.0	178.3	0.383	0.607	0.656	1.71	FS>1.3		0.00	0.0000
CPT-01	81.037	12	259.2	0.381	124	10049	5741	149.7	88.5	0.15	1.6	3.9	0.00	0.0	149.7	0.383	0.392	0.423	1.11	Low F.S.	!!	0.31	0.0061
CPT-01	81.201	12	246.71	0.367	124	10069	5751	142.3	84.0	0.15	1.6	4.3	0.00	0.0	142.3	0.383	0.348	0.376	0.98	Liquefaction	!!	0.65	0.0127
CPT-01	81.365	12	221.82	0.412	124	10089	5761	127.9	75.2	0.19	1.7	5.6	0.02	2.0	129.8	0.383	0.283	0.306	0.80	Liquefaction	!!	1.47	0.0289
CPT-01	81.529	12	194.13	0.477	124	10110	5771	111.8	65.5	0.25	1.8	7.4	0.06	7.8	119.6	0.383	0.239	0.258	0.67	Liquefaction	!!	2.02	0.0397
CPT-01	81.693	12	154.55	1.123	124	10130	5781	88.9	51.7	0.75	2.1	14.9	0.27	32.1	121.0	0.383	0.245	0.264	0.69	Liquefaction	!!	1.90	0.0374
CPT-01	81.857	12	115.14	2.038	124	10150	5791	66.2	38.0	1.85	2.4	26.6	0.58	90.5	156.7	0.383	0.438	0.473	1.23	Low F.S.	!!	0.21	0.0042
CPT-01	82.021	12	79.842	2.281	124	10171	5801	45.9	25.8	3.05	2.7	39.0	0.80	183.5	229.3	0.384	1.202	1.298	3.38	NonLiqfble.		0.00	0.0000
CPT-01	82.185	12	55.661	1.652	124	10191	5811	31.9	17.4	3.27	2.8	47.4	0.80	127.8	159.7	0.384	0.459	0.496	1.29	NonLiqfble.		0.00	0.0000
CPT-01	82.349	12	40.007	1.204	124	10211	5821	22.9	12.0	3.45	3.0	56.3	0.80	91.8	114.7	0.384	0.220	0.238	0.62	NonLiqfble.		0.00	0.0000
CPT-01	82.513	12	29.684	1.332	124	10232	5832	17.0	8.4	5.42	3.2	73.7	0.80	68.0	85.0	0.384	0.137	0.148	0.39	NonLiqfble.		0.00	0.0000
CPT-01	82.677	12	78.502	1.244	124	10252	5842	44.9	25.1	1.70	2.5	31.9	0.72	114.6	159.6	0.384	0.458	0.495	1.29	Low F.S.	!!	0.21	0.0042
CPT-01	82.841	12	117.05	1.853	124	10272	5852	67.0	38.2	1.66	2.4	25.3	0.54	79.6	146.6	0.384	0.373	0.403	1.05	Low F.S.	!!	0.44	0.0087
CPT-01	83.005	12	120.85	2.374	124	10293	5862	69.1	39.5	2.05	2.4	27.3	0.59	101.1	170.2	0.384	0.538	0.582	1.51	FS>1.3		0.00	0.0000
CPT-01	83.169	12	122.22	2.8	124	10313	5872	69.8	39.9	2.39	2.5	28.9	0.64	123.4	193.2	0.384	0.750	0.810	2.11	FS>1.3		0.00	0.0000
CPT-01	83.333	12	124.04	2.953	124	10333	5882	70.8	40.4	2.48	2.5	29.2	0.65	129.1	199.9	0.384	0.822	0.888	2.31	FS>1.3		0.00	0.0000
CPT-01	83.497	12	136.7	2.627	124	10354	5892	77.9	44.6	2.00	2.4	25.3	0.54	92.0	169.9	0.384	0.536	0.579	1.51	FS>1.3		0.00	0.0000
CPT-01	83.661	12	202.14	1.745	124	10374	5902	115.1	66.7	0.89	2.0	13.4	0.23	33.5	148.6	0.385	0.385	0.416	1.08	Low F.S.	!!	0.43	0.0084
CPT-01	83.825	12	282.81	1.572	124	10394	5912	160.9	93.9	0.57	1.8	7.8	0.08	13.1	174.0	0.385	0.570	0.616	1.60	FS>1.3		0.00	0.0000
CPT-01	83.99	12	297.7	1.099	124	10415	5923	169.3	98.7	0.38	1.7	5.7	0.02	3.1	172.4	0.385	0.556	0.601	1.56	FS>1.3		0.00	0.0000
CPT-01	84.154	12	313.61	1.152	124	10435	5933	178.1	103.9	0.37	1.7	5.3	0.01	1.5	179.6	0.385	0.619	0.668	1.74	FS>1.3		0.00	0.0000
CPT-01	84.318	12	281.96	1.484	124	10455	5943	160.0	93.1	0.54	1.8	7.6	0.07	12.0	172.1	0.385	0.554	0.598	1.55	FS>1.3		0.00	0.0000
CPT-01	84.482	12	235.08	1.581	124	10476	5953	133.3	77.2	0.69	1.9	10.5	0.15	22.8	156.1	0.385	0.434	0.469	1.22	Low F.S.	!!	0.21	0.0042
CPT-01	84.646	12	196.21	1.125	124	10496	5963	111.2	64.0	0.59	1.9	11.3	0.17	22.4	133.6	0.385	0.302	0.326	0.85	Liquefaction	!!	1.06	0.0209
CPT-01	84.81	12	180.96	1.037	124	10516	5973	102.4	58.8	0.59	2.0	12.1	0.19	24.0	126.4	0.385	0.268	0.289	0.75	Liquefaction	!!	1.47	0.0289
CPT-01	84.974	12	180.16	1.876	124	10537	5983	101.9	58.4	1.07	2.1	16.2	0.30	43.5	145.4	0.385	0.366	0.395	1.03	Low F.S.	!!	0.44	0.0087
CPT-01	85.138	12	185.52	1.234	124	10557	5993	104.9	60.1	0.68	2.0	12.8	0.21	27.4	132.3	0.385	0.295	0.319	0.83	Liquefaction	!!	1.06	0.0209

```
GRAphics output
HEAding follows -
Element VII:  Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

PROfile line data follow -
1 1 Ground surface
-200    14
0       14
40      28
50      28.25
117     30.79
250     30.79

2 2 landfill waste
-200    9
250     9

3 3 shallow sand
-200    -5
250     -5

4 4 Deep clay (CL)
-200    -15
0       -15
40      -10
250     -10

5 5 Deep Sand (SM/SP)
-200    -50
250     -50

6 4 Deep clay (CL)
-200    -55
250     -55


MATerial property data follow -
1 Engineered Fill (CL/ML)
120
Conventional shear strengths
750     0.0
Piezometric Line
1
2 Landfill Waste
75
Conventional shear strengths
250     25
Piezometric Line
1
3 Shallow Sand (Sand 1, SM/SP)
120
Conventional shear strengths
0       28.0
Piezometric Line
1
4 Deep Clay (CL)
115
Conventional shear strengths
1750    0.0
Piezometric Line
1
```

```
5 Deep Sand (Sand 2, SM/SP)
120
Conventional shear strengths
0       33.0
Piezometric Line
1

PIEZometric line for water pressure calc
1     62.4
-200    0
250     0


DIStributed loading for structures
-150    14      0       0
-150    14      875     0
-10     14      875     0
-10     14      0       0
50      28.25   0       0.0
50      28.25   800     0
117     30.79   800     0
117     30.79   0       0

ANAlysis/computation data follow -
     Circle Search 1
          5 65 1 -70
Point
33      5
RES
A S
-50  120


COMpute
ANAlysis/computation data follow -
Noncircular Search
0       2.48
25      -10
50      5
80.38   28

1.0     0.1
PAS
100

COMpute
```

Section 1 - Static Slope Stability Output
UTEXAS4

Element VII: Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 30
****
* OUTPUT FOR TYPE 1 AUTOMATIC SEARCH WITH CIRCLES *
****

------ Output for Circles Tangent to a Given Horizontal Line ------
------ Tangent line elevation, Y: 4.35

Center Coordinates X	Y	Radius	1-Stage Factor of Safety	Side Force Inclination (degrees)	Iterations
-6.00	37.00	32.65	Center rejected as follows:		
24.00	37.00	32.65	3.134	11.067	5
54.00	37.00	32.65	5.053	4.832	17
-6.00	67.00	62.65	13.674	5.495	24
54.00	67.00	62.65	4.033	6.575	7
-6.00	97.00	92.65	6.950	6.631	10
24.00	97.00	92.65	2.840	7.476	5
54.00	97.00	92.65	4.021	6.254	7
- - - - - - New 9-Point Grid (only new points calculated) - - - - - -					
19.00	62.00	57.65	2.688	9.563	5
24.00	62.00	57.65	2.545	10.225	4
29.00	62.00	57.65	2.601	9.879	4
19.00	67.00	62.65	2.713	9.033	5
29.00	67.00	62.65	2.610	9.636	4
19.00	72.00	67.65	2.743	8.602	5
24.00	72.00	67.65	2.569	9.376	5
29.00	72.00	67.65	2.627	9.398	4
- - - - - - New 9-Point Grid (only new points calculated) - - - - - -					
21.00	64.00	59.65	2.601	9.764	4
24.00	64.00	59.65	2.541	10.093	4
27.00	64.00	59.65	2.560	9.896	4
21.00	67.00	62.65	2.623	9.380	4
27.00	67.00	62.65	2.566	9.735	4
21.00	70.00	65.65	2.646	9.050	4
24.00	70.00	65.65	2.549	9.639	5
27.00	70.00	65.65	2.575	9.580	5
- - - - - - New 9-Point Grid (only new points calculated) - - - - - -					
23.00	66.00	61.65	2.542	9.980	5
24.00	66.00	61.65	2.540	9.963	5
25.00	66.00	61.65	2.544	9.907	5
23.00	67.00	62.65	2.551	9.827	5
25.00	67.00	62.65	2.544	9.845	5
23.00	68.00	63.65	2.560	9.683	5
24.00	68.00	63.65	2.540	9.837	5
25.00	68.00	63.65	2.544	9.784	5

----- Critical Circle After the Current Mode of Search -----
X: 24.00 Y: 67.00 Radius: 62.650
Factor of safety: 2.539 Side force inclination: 9.900

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Element VII: Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 33
```
*********************************************
* 1-STAGE FINAL CRITICAL CIRCLE INFORMATION *
*********************************************
X Coordinate of Center . . . . . . . . . . . . .  24.00
Y Coordinate of Center . . . . . . . . . . . . .  67.00
Radius . . . . . . . . . . . . . . . . . . . . .  62.65
Factor of Safety . . . . . . . . . . . . . . . . 2.539
Side Force Inclination (degrees) . . . . . . . . 9.90
Number of Circles Tried  . . . . . . . . . . . .  85
Number of Circles F Calculated for . . . . . . .  84
Time Required for Search (seconds) . . . . . . .  0.3
```

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Element VII: Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 43
```
************************************************************
* Coordinate, Weight, Strength and Pore Water Pressure     *
* Information for Individual Slices for Conventional       *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the    *
* case of an automatic search.)                            *
************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	-9.41	14.00					
1	-8.00	13.16	283	1	750.0	0.00	0.0
	-6.59	12.32					
2	-5.14	11.56	850	1	750.0	0.00	0.0
	-3.68	10.80					

3	-2.19	10.11	1390	1	750.0	0.00	0.0
	-0.70	9.43					
4	-0.35	9.28	399	1	750.0	0.00	0.0
	0.00	9.13					
5	0.16	9.06	188	1	750.0	0.00	0.0
	0.31	9.00					
6	1.85	8.42	2212	2	250.0	25.00	0.0
	3.38	7.84					
7	4.94	7.34	2912	2	250.0	25.00	0.0
	6.51	6.84					
8	8.09	6.43	3594	2	250.0	25.00	0.0
	9.68	6.01					
9	11.29	5.68	4250	2	250.0	25.00	0.0
	12.89	5.34					
10	14.51	5.09	4871	2	250.0	25.00	0.0
	16.13	4.85					
11	17.76	4.68	5450	2	250.0	25.00	0.0
	19.40	4.52					
12	21.03	4.44	5980	2	250.0	25.00	0.0
	22.67	4.36					
13	23.34	4.36	2559	2	250.0	25.00	0.0
	24.00	4.35					
14	25.64	4.39	6631	2	250.0	25.00	0.0
	27.28	4.44					
15	28.91	4.56	7020	2	250.0	25.00	0.0
	30.55	4.69					
16	32.17	4.91	7344	2	250.0	25.00	0.0
	33.80	5.12					
17	35.41	5.42	7598	2	250.0	25.00	0.0
	37.03	5.72					
18	38.51	6.07	7249	2	250.0	25.00	0.0
	40.00	6.43					
19	41.57	6.89	7691	2	250.0	25.00	0.0
	43.15	7.35					
20	44.70	7.89	7360	2	250.0	25.00	0.0
	46.24	8.43					
21	46.96	8.72	3348	2	250.0	25.00	0.0
	47.69	9.00					

```
  22     48.84      9.50         5200    1       750.0     0.00
0.0
         50.00     10.00
  23     51.47     10.72         6220    1       750.0     0.00
0.0
         52.95     11.44
  24     54.38     12.23         5569    1       750.0     0.00
0.0
         55.82     13.03
  25     57.21     13.90         4880    1       750.0     0.00
0.0
         58.60     14.77
  26     59.94     15.71         4164    1       750.0     0.00
0.0
         61.28     16.65
  27     62.57     17.66         3431    1       750.0     0.00
0.0
         63.87     18.67
  28     65.10     19.75         2695    1       750.0     0.00
0.0
         66.34     20.82
  29     67.52     21.96         1967    1       750.0     0.00
0.0
         68.70     23.10
  30     69.82     24.30         1261    1       750.0     0.00
0.0
         70.94     25.50
  31     71.99     26.76          588    1       750.0     0.00
0.0
         73.04     28.02
  32     73.49     28.59           59    1       750.0     0.00
0.0
         73.93     29.16

No water in crack.

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Element VII:  Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 44
*********************************************************
* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations.               *
* (Information is for the critical shear surface in the  *
* case of an automatic search.)                          *
*********************************************************

                                                FORCES DUE TO DISTRIBUTED
LOADS
```

Slices No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
1	-8.00	0	13.58	0	0	-8.00	14.00
2	-5.14	0	12.78	0	0	-5.14	14.00
3	-2.19	0	12.06	0	0	-2.19	14.00
4	-0.35	0	11.64	0	0	-0.35	14.00
5	0.16	0	11.56	0	0	0.16	14.06
6	1.85	0	11.64	0	0	1.85	14.65
7	4.94	0	11.81	0	0	4.94	15.73
8	8.09	0	12.03	0	0	8.09	16.83
9	11.29	0	12.32	0	0	11.29	17.95
10	14.51	0	12.68	0	0	14.51	19.08
11	17.76	0	13.10	0	0	17.76	20.22
12	21.03	0	13.60	0	0	21.03	21.36
13	23.34	0	13.98	0	0	23.34	22.17
14	25.64	0	14.40	0	0	25.64	22.97
15	28.91	0	15.05	0	0	28.91	24.12
16	32.17	0	15.75	0	0	32.17	25.26
17	35.41	0	16.50	0	0	35.41	26.39
18	38.51	0	17.28	0	0	38.51	27.48
19	41.57	0	17.83	0	0	41.57	28.04
20	44.70	0	18.20	0	0	44.70	28.12
21	46.96	0	18.50	0	0	46.96	28.17
22	48.84	0	18.86	0	0	48.84	28.22
23	51.47	0	19.51	2360	0	51.47	28.31
24	54.38	0	20.33	2296	0	54.38	28.42
25	57.21	0	21.21	2226	0	57.21	28.52
26	59.94	0	22.17	2150	0	59.94	28.63

```
  27     62.57          0      23.19        2069          0     62.57
28.73
  28     65.10          0      24.29        1981          0     65.10
28.82
  29     67.52          0      25.44        1888          0     67.52
28.91
  30     69.82          0      26.65        1790          0     69.82
29.00
  31     71.99          0      27.92        1687          0     71.99
29.08
  32     73.49          0      28.86         709          0     73.49
29.14

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Element VII:  Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 47
**************************************************************
*  Information for the Iterative Solution for the Factor of  *
*  Safety and Side Force Inclination by Spencer's Procedure  *
**************************************************************
Allowable force imbalance for convergence:  1
Allowable moment imbalance for convergence: 45

        Trial     Trial
       Factor   Side Force     Force       Moment                 Delta
Iter-    of    Inclination   Imbalance   Imbalance    Delta-F     Theta
ation  Safety   (degrees)      (lbs.)    (ft.-lbs.)
(degrees)

   1   3.00000    17.1887   2.675e+003   1.630e+005
First-order corrections to F and Theta ............   -0.5107    -
6.7124
Reduced values - Deltas were too large ............   -0.2180    -
2.8648

   2   2.78205    14.3239   1.365e+003   9.608e+004
First-order corrections to F and Theta ............   -0.2564    -
4.2364
Reduced values - Deltas were too large ............   -0.1734    -
2.8648

   3   2.60864    11.4592   3.115e+002   3.347e+004
First-order corrections to F and Theta ............   -0.0704    -
1.5431
Second-order corrections to F and Theta ...........   -0.0692    -
1.5587

   4   2.53941     9.9005  -4.809e-001   1.611e+001
```

```
First-order corrections to F and Theta ...........    0.0000    -
0.0006
Second-order corrections to F and Theta ..........    0.0000    -
0.0006

   5   2.53942     9.8998   7.054e-011  -1.102e-009
First-order corrections to F and Theta ...........   -0.0000
0.0000

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Element VII:  Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 55
**********************************************************************
* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.)       *
**********************************************************************

Summation of Horizontal Forces: 1.64135e-011

Summation of Vertical Forces: 1.21929e-011

Summation of Moments: 6.63931e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.42482e-012

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Element VII:  Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 58
**********************************************************************
**
* Final Results for Stresses Along the Shear Surface
*
* (Results are for the critical shear surface in the case of a search.)
*
**********************************************************************
**

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY
Factor of Safety: 2.539     Side Force Inclination:   9.90

       -------- VALUES AT CENTER OF BASE OF SLICE --------
```

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	-8.00	13.16	365.5	365.5	295.3
2	-5.14	11.56	549.8	549.8	295.3
3	-2.19	10.11	711.2	711.2	295.3
4	-0.35	9.28	801.8	801.8	295.3
5	0.16	9.06	831.7	831.7	295.3
6	1.85	8.42	931.6	931.6	269.5
7	4.94	7.34	1149.0	1149.0	309.4
8	8.09	6.43	1345.7	1345.7	345.6
9	11.29	5.68	1522.8	1522.8	378.1
10	14.51	5.09	1680.8	1680.8	407.1
11	17.76	4.68	1820.5	1820.5	432.7
12	21.03	4.44	1942.4	1942.4	455.1
13	23.34	4.36	2018.9	2018.9	469.2
14	25.64	4.39	2084.2	2084.2	481.2
15	28.91	4.56	2164.8	2164.8	496.0
16	32.17	4.91	2228.8	2228.8	507.7
17	35.41	5.42	2276.6	2276.6	516.5
18	38.51	6.07	2307.8	2307.8	522.2
19	41.57	6.89	2266.8	2266.8	514.7
20	44.70	7.89	2158.5	2158.5	494.8
21	46.96	8.72	2074.3	2074.3	479.4
22	48.84	9.50	2018.3	2018.3	295.3
23	51.47	10.72	2601.4	2601.4	295.3
24	54.38	12.23	2402.2	2402.2	295.3
25	57.21	13.90	2188.2	2188.2	295.3
26	59.94	15.71	1960.2	1960.2	295.3
27	62.57	17.66	1719.2	1719.2	295.3
28	65.10	19.75	1466.3	1466.3	295.3
29	67.52	21.96	1202.6	1202.6	295.3
30	69.82	24.30	929.6	929.6	295.3
31	71.99	26.76	648.5	648.5	295.3
32	73.49	28.59	443.2	443.2	295.3

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Element VII: Cross Section 1
Static analysis
DATA FOR STABILITY CALCULATIONS

TABLE NO. 59
****
**
* Final Results for Side Forces and Stresses Between Slices
*
* (Results are for the critical shear surface in the case of a search.)
*
****
**

---------- VALUES AT RIGHT SIDE OF SLICE ----------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	-6.59	1467	13.41	0.647	1622.3	102.7
2	-3.68	3189	12.78	0.619	1683.1	279.5
3	-0.70	5073	12.21	0.609	1809.7	375.6
4	0.00	5526	12.09	0.608	1841.8	393.4
5	0.31	5729	12.04	0.594	1729.7	479.3
6	3.38	7666	11.59	0.511	1094.9	961.6
7	6.51	9811	11.15	0.456	755.8	1292.8
8	9.68	12062	10.77	0.418	532.2	1556.3
9	12.89	14324	10.48	0.390	365.1	1777.9
10	16.13	16512	10.30	0.368	229.7	1968.3
11	19.40	18549	10.22	0.350	113.7	2132.6
12	22.67	20369	10.25	0.335	10.1	2273.7
13	24.00	21029	10.29	0.329	-29.2	2324.7
14	27.28	22449	10.47	0.316	-121.8	2436.1
15	30.55	23530	10.76	0.303	-209.3	2527.4
16	33.80	24237	11.15	0.291	-293.4	2599.3
17	37.03	24547	11.63	0.278	-375.0	2652.0
18	40.00	24464	12.17	0.266	-449.4	2683.7
19	43.15	23991	12.83	0.264	-470.9	2751.0
20	46.24	23171	13.56	0.260	-510.7	2825.2
21	47.69	22676	13.92	0.256	-539.1	2867.0
22	50.00	21321	14.61	0.253	-556.3	2858.1
23	52.95	18496	15.85	0.261	-470.3	2623.7
24	55.82	15564	17.17	0.268	-389.2	2375.3

25	58.60	12621	18.57	0.275	-313.0	2114.0
26	61.28	9764	20.06	0.283	-241.2	1840.7
27	63.87	7092	21.62	0.292	-173.3	1556.2
28	66.34	4706	23.25	0.302	-108.4	1260.9
29	68.70	2703	24.96	0.317	-44.3	953.9
30	70.94	1178	26.73	0.346	24.8	630.8
31	73.04	220	28.44	0.384	59.1	333.2
32	73.93	-0	29.16	1.000	0.0	0.0

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APPENDIX E

Electrical Resistivity Results

APPENDIX E

NORCAL GEOPHYSICAL CONSULTANTS, INC.

February 24, 2009

Mr. Paul Cottingham
ENGEO, Inc.
2213 Plaza Drive
Rocklin, California 95765

Subject: Soil Electrical Resistivity Measurements
Zero Waste Energy Anaerobic Digestion Facility, San Jose, California
NORCAL Job # 10-241.40

Dear Mr. Cottingham:

This report presents the findings of an electrical resistivity (ER) survey performed by NORCAL Geophysical Consultants, Inc. at the Zero Waste Energy Anaerobic Digestion Facility, 2100 Los Esteros Road, San Jose, California. The field survey was conducted on February 11, 2009 by NORCAL Professional Geophysicists Donald J. Kirker and David T. Hagin. Logistical support was provided by Scott Johns of ENGEO.

1.0 SITE DESCRIPTION AND PURPOSE

The ER survey was performed on a vacant parcel of land occupied by an inactive landfill. The parcel is currently covered with grass and low vegetation, as shown on Plate 1. The location of the landfill is evidenced by surface topography and gentle slopes around the perimeter of the property. Site information, provided by ENGEO, indicates that the landfill is relatively thin and overlies bay mud. Currently, there are plans to construct a power plant on top of the landfill.

The purpose of the ER survey was to measure soil resistivity values at two locations determined by ENGEO. It is our understanding that the resistivity results will be used by others to determine corrosion potential and design a grounding system in the vicinity of the new construction.

2.0 METHODOLOGY

Electrical resistivity is the resistance of a volume of material to the flow of electrical current. The electrical resistivity method is often used to measure the variation in electrical resistivity with depth beneath a fixed point or along a profile; in this case beneath a fixed point. This information can be valuable in evaluating corrosion potential and grounding characteristics, as well as other groundwater and geologic parameters. A more detailed description of the ER methodology is provided in Appendix A.

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3.0 FIELD INVESTIGATION

Vertical electrical soundings were obtained using the Wenner electrode array in accordance with ASTM standards. This array utilizes four evenly spaced electrodes placed in the ground in a collinear arrangement. One pair of electrodes is used to transmit electrical current into the earth. The second pair of electrodes is used to measure the resulting potential drop (voltage). Successive measurements using increased electrode spacing's provide information at greater depths.

ER soundings were performed at two locations, as specified by ENGEO, and are designated as Soundings 1 and 2 on Plate 1. The "x" shown on Plate 1 represents the center point of each pair of soundings. The yellow hatched lines extending away from the center point represent the orientation and maximum dimensions of the electrode arrays.

The scope of work, as specified by ENGEO, was to obtain ER data at each location along two perpendicular arrays using electrode separations of 2, 5, 7, 10, 20 and 40 feet. This resulted in total line lengths of 6, 15, 21, 30, 60, and 120 feet, respectively. One array was oriented approximately north-south, and the other approximately east-west.

We measured the resistivity data using an Advanced Geosciences, Inc. (AGI) *SuperSting R1* resistivity meter. The instrument records voltage and current and calculates an apparent resistivity in user-specified units. These data were manually tabulated with a backup copy written to the internal memory of the unit. The electrodes consisted of 18-inch long stainless steel rods. These were connected to the resistivity meter by 16 gauge insulated stranded copper wire.

4.0 RESULTS

The resistivity results are summarized in Tables A and B, below. These tables list the various electrode spacings for the north-south and east-west arrays at each respective measurement location, and the recorded voltage and current for the respective electrode pairs. Additionally, computed apparent resistivities (in ohm-ft) are also shown.

The ER data in both tables shows that the apparent resistivity values generally decrease with depth. Typically, high apparent resistivity values are associated with an increase in coarse grained materials such as sand and gravel, and/or a decrease in moisture content. High resistivity values can also be associated with imported landfill material and debris. Conversely, lower values are typically associated with an increase in fine grained materials (silt, clay, etc.) and/or moisture content, such as with saturated bay mud. As expected, the ER data in Tables A and B show that the landfill materials have higher resistivity values than the underlying bay mud. These tables also show a wider range of apparent resistivity values at Sounding 1 than at Sounding 2. This suggests that the landfill material maybe thicker beneath Sounding 2.

Table A: ER Data, Sounding 1

SOUNDING	ELECTRODE SPACING (ft)	CURRENT (milliamps)	VOLTAGE (millivolts)	APPARENT RESISTIVITY (ohm-ft)
(S-N)	2	339.9	2,563	94.76
	5	420.6	1,197	89.39
	7	409.3	728.5	78.29
	10	596.2	558.9	58.90
	20	740.8	209.2	35.50
	40	566.8	44.40	19.69
(W-E)	2	662.9	5,733	108.7
	5	789.7	2,582	102.7
	7	796.1	1,567	86.56
	10	730.4	812.5	69.90
	20	265.6	173.6	33.36
	40	617.7	42.12	17.14

Table B: ER Data, Sounding 2

SOUNDING	ELECTRODE SPACING (ft)	CURRENT (milliamps)	VOLTAGE (millivolts)	APPARENT RESISTIVITY (ohm-ft)
(S-N)	2	869.6	4,627	66.87
	5	783.4	1,542	61.83
	7	832.4	1,218	64.36
	10	860.2	842.3	61.52
	20	410.0	354.0	51.52
	40	506.2	71.31	35.40
(W-E)	2	832.7	4,061	61.29
	5	797.1	1,681	66.25
	7	730.4	1,078	64.89
	10	884.4	824.0	58.54
	20	832.3	321.2	48.50
	40	781.1	109.7	35.29

5.0 STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical techniques to explore the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar techniques. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with our geophysical services.

Respectfully,

NORCAL Geophysical Consultants, Inc.

Donald J. Kirker

Donald J. Kirker
Geophysicist PGp 997

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Enclosures:	Plate 1	Site Map
	Appendix A	Electrical Resistivity Surveys

Appendix A

GEOPHYSICAL METHODOLOGY

Appendix A

ELECTRICAL RESISTIVITY SURVEYS

Rational

Electrical resistivity is the physical property of a material that resists the flow of electrical current. The electrical resistivity of earth materials is directly affected by moisture content and permeability. Typically, electrical resistivity decreases as permeability and moisture content increases. The resistivity of earth materials is also greatly affected by the concentration of dissolved salts or free ions in the saturating fluid. Generally, fine-grained materials such as clays have a lower electrical resistivity than coarse grained materials such as sands and gravels. The presence of fluids that have a high concentration of dissolved salts or free ions can significantly decrease the electrical resistivity of both fine and coarse-grained materials.

Electrical properties of rock can vary greatly depending upon degree of weathering and fracturing, as well as composition. Rock formations that are deeply buried and not exposed to chemical weathering are generally impermeable, contain little water, and have a relatively high electrical resistivity. Conversely, highly weathered and fractured rock that contains moisture typically has lower resistivity.

Based on the above relationships, geophysical methods that measure the electrical resistivity of the subsurface can be used to evaluate corrosion potential and grounding characteristics, and to determine the depth and thickness of groundwater aquifers, the depth to groundwater, the depth and thickness of clay layers, the thickness of landfills, and in some cases, the depth to bedrock.

Methodology

Determining the variation in electrical resistivity with depth beneath a fixed point is referred to as a vertical electric sounding (VES). This involves transmitting electrical current *(I)* into the ground between two electrodes, and measuring the resulting potential drop (*V*) between two other electrodes. There are a number of different electrode configurations that can be used. The most common are the Wenner and Schlumberger arrays. With both techniques, the four electrodes are arranged in a collinear array. Current is transmitted between the outer two electrodes and the potential drop is measured across the inner two electrodes. Readings are taken with many different electrode separations, ranging from less than a foot to hundreds of feet. The larger the separation, the deeper the current is forced to flow in order to complete a circuit. The readings for each electrode separation are used to compute a value referred to as apparent resistivity *(ρa)*. The term "apparent" is used because the value represents the resistivity of a volume of earth rather than a discrete layer. This value is computed according to the following equation:

$$\rho a = 2\pi k\ (V/I)$$

where k is a geometric factor for the electrode array that is used.

The *ρa* values can be plotted versus electrode separation on log-log paper to form a field curve. This curve can then be inverted using either computer or curve-matching techniques to determine the depth, thickness, and true resistivity of horizontal layers beneath the center of the electrode array.

Instrumentation

Apparent resistivity data is typically acquired using a SuperSting R1 Resistivity meter, manufactured by Advanced Geosciences Incorporated (AGI). The Sting is a self-contained unit that transmits current at outputs ranging from 1 to 500 milliamps (mA). The unit also measures the potential drop and converts the data to values of apparent resistivity for a number of electrode arrays. The data are stored in internal memory and can be downloaded to a computer for processing.

Limitations

A common feature of all electrical methods is that the models derived from the electric profiling are not unique. That is, depending on the subsurface geo-electric structure, there may be many models that will produce essentially the same apparent resistivities. This is known as the *principal of equivalence*. To overcome this limitation, computer software programs include routines for evaluating the equivalence of a given model relative to the observed resistivity values, resulting in a model that provides the closest fit to the observed data.