Geotechnical Report

Vega SES Solar Facility
SWC Wixom Road and Drew Road
El Centro, California

Prepared for:

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Geotechnical Report
Vega SES Solar Facility
SWC Wixom Road and Drew Road
El Centro, California
LCI Report No. LE18083

Dear Mr. Abatti:

This geotechnical report is provided for design and construction of the proposed development of a 250-MW PV solar power generation facility at the approximately 530-acre site located southwest of the intersection of Wixom Road and Drew Road approximately 7 miles southwest of El Centro, California. The Vega SES Solar Facility includes an electrical substation and an operations and maintenance building. Our geotechnical exploration was conducted in response to your request for our services. The enclosed report describes our soil engineering site evaluation and presents our professional opinions regarding geotechnical conditions at the site to be considered in the design and construction of the project.

This executive summary presents ***selected*** elements of our findings and professional opinions. This summary ***may not*** present all details needed for the proper application of our findings and professional opinions. Our findings, professional opinions, and application options are ***best related through reading the full report***, and are best evaluated with the active participation of the engineer of record who developed them. The findings of this study are summarized below:

- Depending on the site selected for the O&M building, foundation designs for *thin slabs-on-grade* should mitigate expansive soil conditions by one of the following methods:
  1. Remove and replace upper 2.0 feet of clay soils with non-expansive sands.
  2. Design foundations to resist expansive forces in accordance with the 2016 California Building Code (CBC) Chapter 18, Section 1808 or the Post-Tensioning Institute, 3rd Edition. This requires grade-beam stiffened of floor slabs (25 feet maximum on center) or post-tensioned floor slabs. Design soil bearing pressure = 1,500 psf. Differential movement of 1.0 to 1.5 inches can be expected for slab on grade foundations placed on clay soils.
  3. A combination of the methods described above.

- Inverter mat foundations may be designed for a soil bearing pressure of 2,000 psf. The mats should be placed on a 12-inch compacted layer (95% of ASTM D1557 maximum density) of Caltrans Class 2 aggregate base material. Short drilled concrete piers are also acceptable for inverter steel frame supports (see Section 4.3 and Tables 6 and 7).

- The risk of liquefaction induced settlement is low (estimated settlement of less than 1.0 inch at 13.5 to 50 feet below ground surface. There is a very low risk of ground rupture should liquefaction occur. There are no known faults on or adjacent to the project site.

- The clay soils are aggressive to concrete and steel. Concrete mixes shall have a maximum water cement ratio of 0.45 and a minimum compressive strength of 4,500 psi (minimum of 6.0 sacks Type V cement per cubic yard except along Wixom Road (6.5 sacks recommended). Steel posts will require galvanizing or other corrosion protection to mitigate the corrosive soils.

- All reinforcing bars, anchor bolts and hold down bolts shall have a minimum concrete cover of 3.0 inches (4.0 inches at Wixom Road) unless epoxy coated (ASTM D3963/A934).

- All-weather accessways should consist of a minimum of 6 inches of Caltrans Class 2 aggregate base material placed over 12 inches of compacted (90%) native soil. The native clays become "slick" when wetted and will rut under prolonged wetting.

- Pavement structural sections should be designed for clay subgrade soils (R-Value = 5) or silt/sand soils (R-Value = 25).

We did not encounter soil conditions that would preclude development of the proposed project provided the professional opinions contained in this report are considered in the design and construction of this project. Please provide our office with a set of the foundation plans and civil plans for review to insure that the geotechnical site constraints have been included in the design documents. We appreciate the opportunity to provide our findings and professional opinions regarding geotechnical conditions at the site. If you have any questions or comments regarding our findings, please call our office at (760) 370-3000.

Respectfully Submitted,
Landmark Consultants, Inc.

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Section 1
INTRODUCTION

1.1 Project Description

This report presents the findings of our geotechnical exploration and soil testing for the proposed development of a 250-MW PV solar power generation facility at the approximately 530-acre site located southwest of the intersection of Wixom Road and Drew Road approximately 7 miles southwest of El Centro, California (See Vicinity Map, Plate A-1). The solar power generation facility will consist of installing PV solar panels mounted on steel racks supported by short piers, shallow driven posts or shallow spread footings. The proposed solar energy facility will have an operations maintenance/storage (O&M) building and an electrical substation with step-up transformers and dead-end A-frames for overhead power line connections. The photovoltaic modules are planned to be ground mounted on single-axis tracker frames or fixed-tilt frames.

The electrical substation, O&M building, and battery storage area are planned to be located at the southwest corner of the project site (east of Liebert Road) and north of the Westside Main Canal (see Appendix A, Plate A-2. Footing loads at exterior bearing walls are estimated at 1 to 5 kips per lineal foot. Column loads are estimated to range from 5 to 30 kips. The O&M building will consist of slab-on-grade foundation with steel frame and/or wood-frame construction. Site development will include minimal site grading for the PV panel areas, building pad preparation for the O&M building and electrical substation, underground utility installation, site paving and all weather road surfacing.

1.2 Purpose and Scope of Work

The purpose of this geotechnical study was to investigate the upper 50 feet of subsurface soil at selected locations within the site for evaluation of physical/engineering properties, liquefaction potential during seismic events, field testing for steel post capacities and soil electrical/thermal resistivity parameters.

Professional opinions were developed from field and laboratory test data and are provided in this report regarding geotechnical conditions at this site and the effect on design and construction.

The scope of our services consisted of the following:

- Field exploration and in-situ testing of the site soils at selected locations and depths.
- Laboratory testing for physical and/or chemical properties of selected samples.
- Review of the available literature and publications pertaining to local geology, faulting, and seismicity.
- Installation and testing of galvanized steel posts (lateral and uplift)
- Engineering analysis and evaluation of the data collected.
- Preparation of this report presenting our findings and professional opinions regarding the geotechnical aspects of project design and construction.

This report addresses the following geotechnical parameters:

- Subsurface soil and groundwater conditions
- Site geology, regional faulting and seismicity, near source factors, and site seismic accelerations
- Liquefaction potential and its mitigation
- Expansive soil and methods of mitigation
- Aggressive soil conditions to metals and concrete

Professional opinions with regard to the above parameters are provided for the following:

- Site grading and earthwork
- Building pad and foundation subgrade preparation
- Allowable soil bearing pressures and expected settlements
- Capacities for drilled piers and/or driven steel posts
- Soil parameters for L-Pile program determined by steel post load tests
- Underlayment for tanks (5,000 and 10,000 gallons)
- Concrete slabs-on-grade
- Concrete walkway sections
- Excavation conditions and buried utility installations
- Mitigation of the potential effects of salt concentrations in native soil to concrete mixes and steel reinforcement
- Seismic design parameters
- SWPPP site criteria
- Structural section for unpaved roadways and construction laydown areas
- Pavement structural sections

Our scope of work for this report did not include an evaluation of the site for the presence of environmentally hazardous materials or conditions, groundwater mounding, or landscape suitability of the soil.

1.3 Authorization

Authorization to proceed with our work was provided by signed agreement with Mr. Mike Abatti on April 18, 2018. We conducted our work according to our written proposal dated June 2, 2017.

Section 2
METHODS OF INVESTIGATION

2.1 Field Exploration

Subsurface exploration was performed on June 11, 2018 using Middle Earth Geo-Testing, Inc. of Orange, California to advance sixteen (16) electric cone penetrometer (CPT) soundings to approximate depths of 20 to 50 feet below existing ground surface. The soundings were made at the locations shown on the Site and Exploration Plan Appendix A, (Plate A-2). The approximate sounding locations were established in the field and plotted on the site map by sighting to discernible site features.

Shallow (3-foot deep) hand auger borings (3-inch diameter auger) were made adjacent to the CPT soundings in order to obtain near surface soil samples for laboratory analysis.

CPT soundings provide a continuous profile of the soil stratigraphy with readings every 2.5cm (1 inch) in depth. Direct sampling for visual and physical confirmation of soil properties has been used by our firm to establish direct correlations with CPT exploration in this geographical region.

The CPT exploration was conducted by hydraulically advancing an instrumented Hogentogler 10cm^2 conical probe into the ground at a rate of 2cm per second using a 23-ton truck as a reaction mass. An electronic data acquisition system recorded a nearly continuous log of the resistance of the soil against the cone tip (Qc) and soil friction against the cone sleeve (Fs) as the probe was advanced. Empirical relationships (Robertson and Campanella, 1989) were then applied to the data to give a continuous profile of the soil stratigraphy. Interpretation of CPT data provides correlations for SPT blow count, phi (ϕ) angle (soil friction angle), undrained shear strength (S_u) of clays and over-consolidation ratio (OCR). These correlations may then be used to evaluate vertical and lateral soil bearing capacities and consolidation characteristics of the subsurface soil.

Interpretive logs of the CPT soundings are presented on Plates B-1 through B-16 in Appendix B. A key to the interpretation of CPT soundings is presented on Plate B-17. The stratification lines shown on the subsurface logs represent the approximate boundaries between the various strata. However, the transition from one stratum to another may be gradual over some range of depth.

2.2 Laboratory Testing

Laboratory tests were conducted on selected bulk (auger cuttings) soil samples obtained from the shallow soil borings to aid in classification and evaluation of selected engineering properties of the site soils. The tests were conducted in general conformance to the procedures of the American Society for Testing and Materials (ASTM) or other standardized methods as referenced below. The laboratory testing program consisted of the following tests:

- Plasticity Index (ASTM D4318) – used for soil classification and expansive soil design criteria
- Particle Size Analyses (ASTM D422) – used for soil classification and liquefaction evaluation
- Moisture Contents (ASTM D2216) – used for insitu soil parameters
- Chemical Analyses (soluble sulfates & chlorides, pH, and resistivity) (Caltrans Methods) – used for concrete mix proportions and corrosion protection requirements.

The laboratory test results are presented on Plates C-1 through C-8 in Appendix C.

Engineering parameters of soil strength, compressibility and relative density utilized for developing design criteria provided within this report were either extrapolated from correlations with the subsurface CPT data or from data obtained from the field and laboratory testing program.

2.3 Electrical Resistivity Testing

Wenner 4-pin field resistivity testing was conducted by RF Yeager Engineering of Lakeside, California on June 20, 2018 at five (5) locations within the project site in accordance with ASTM G57 standards. The tests were conducted at pin spacings of 2.5, 5, 10, 15, and 20 feet. Additionally, a near surface soil sample (upper 5 feet) was obtained for laboratory soil corrosivity testing at the select locations. The results of the electrical resistivity and soil corrosivity testing are presented in Appendix F.

Section 3
DISCUSSION

3.1 Site Conditions

The Vega SES Solar Facility is comprised of eight (8) agricultural fields south of Wixom Road and west of Drew Road. The western portion of the project area is located adjacent to the Westside Main Canal. The Westside Main Canal (WSMC) is a major irrigation and raw water supply for the west side of the Imperial Valley. The WSMC runs north along the west side of the Imperial Valley from the International Border between the United States and Mexico to Westmorland, California. The WSMC earthen canal banks are approximately 5 feet higher in elevation than the adjacent agricultural land.

A majority of the agricultural fields were recently harvested of the wheat crop and the fields were being prepared for the next crop. The northern field was in sugar beet crop and the southernmost field was in alfalfa crop. The westernmost field was being watered after recently being planted. Several rural paved roads cross the project site as well as dirt field roads and Imperial Irrigation District concrete lined canals and open cut agricultural drains. Adjacent properties are flat-lying and are approximately at the same elevation of the Vega SES facility, consisting of agricultural fields.

The Vega SES Solar Facility lies at an elevation of approximately 20 to 30 feet below mean sea level (MSL) (El. 980 to 970 local datum) in the southwestern region of the Imperial Valley in the California low desert. The surrounding properties lie on terrain which is flat (planar), part of a large agricultural valley, which was previously an ancient lake bed covered with fresh water (about 300 years ago) to an elevation of 43± feet above MSL. Annual rainfall in this arid region is less than 3 inches per year with four months of average summertime temperatures above 100 ºF. Winter temperatures are mild, seldom reaching freezing.

3.2 Geologic Setting

The project site is located in the Imperial Valley portion of the Salton Trough physiographic province. The Salton Trough is a topographic and geologic structural depression resulting from large scale regional faulting. The trough is bounded on the northeast by the San Andreas Fault and Chocolate Mountains and the southwest by the Peninsular Range and faults of the San Jacinto Fault Zone. The Salton Trough represents the northward extension of the Gulf of California, containing both marine and non-marine sediments deposited since the Miocene Epoch (Morton, 1977). Tectonic activity that formed the trough continues at a high rate as evidenced by deformed young sedimentary deposits and high levels of seismicity. Figure 1 shows the location of the site in relation to regional faults and physiographic features.

The Imperial Valley is directly underlain by lacustrine deposits, which consist of interbedded lenticular and tabular silt, sand, and clay. The Late Pleistocene to Holocene (present) lake deposits are probably less than 100 feet thick and derived from periodic flooding of the Colorado River which intermittently formed a fresh water lake (Lake Cahuilla). Older deposits consist of Miocene to Pleistocene non-marine and marine sediments deposited during intrusions of the Gulf of California. Basement rock consisting of Mesozoic granite and Paleozoic metamorphic rocks are estimated to exist at depths between 15,000 - 20,000 feet.

3.3 Subsurface Soil

The U. S. Soil Conservation Service compiled a map of surface soil conditions based on a thirteen-year study from 1962-1975 (Zimmerman, 1981). The Soil Survey maps were published in 1981 and indicate that surficial deposits at the site and surrounding area consist predominantly of silty clay and silty clay loams of the Imperial, Glenbar, Meloland, Holtville, Vint, and Indio soil groups (see Appendix B). These loams are formed in sediment and alluvium of mixed origin (Colorado River overflows and fresh-water lake-bed sediments).

Subsurface soils encountered during the field exploration conducted on June 11, 2018 consist of predominantly interbedded stiff to very stiff clays (CL-CH) and medium dense to dense silty sand (SM) soils to a depth of 50 feet below ground surface.

The subsurface soils at the electrical substation and O&M building area located in the westernmost field are predominately dense sandy silts (ML) and stiff to very stiff leans clays (CL) with interbedded layers of silty sand (SM) soils at a depth of 21 to 28 feet below ground surface in the western portion and predominantly silty sand (SM) with interbedded clay (CL) soils at depths of 24 to 32 feet and 43 to 50 feet below ground surface, the maximum depth of exploration. The subsurface logs (Plates B-1 through B-16) depict the stratigraphic relationships of the various soil types.

The native surface clays encountered in the near surface soil exhibit low to high swell potential (Expansion Index, EI = 20 to 110) when correlated to Plasticity Index tests (ASTM D4318) performed on the native clays. The clay is expansive when wetted and can shrink with moisture loss (drying). Large shrinkage cracks and blocky fracturing of the clays occur with long periods of drying or fallowing. The dried clays become very hard. Development of building foundations, concrete flatwork, and asphaltic concrete pavements should include provisions for mitigating potential swelling forces and reduction in soil strength, which can occur from saturation of the soil.

Causes for soil saturation include standing storm water, broken utility lines, or capillary rise in moisture upon sealing the ground surface to evaporation. Moisture losses can occur with lack of landscape watering, close proximity of structures to downslopes and root system moisture extraction from deep rooted shrubs and trees placed near the foundations. Typical measures used for light industrial projects to remediate expansive soil include:

- Replacement of expansive clays with non-expansive sands or silts.
- Moisture conditioning subgrade soils to a minimum of 5% above optimum moisture (ASTM D1557) within the drying zone of surface soils.
- Design of foundations that are resistant to shrink/swell forces of silt/clay soil.
- A combination of the methods described above

3.4 Groundwater

Groundwater was not noted in the CPT soundings, but is typically encountered at about 6 to 8 feet below ground surface within the Vega SES Solar Facility project area. There is uncertainty in the accuracy of short-term water level measurements, particularly in fine-grained soil. Groundwater levels may fluctuate with precipitation, irrigation of adjacent properties, site landscape watering, drainage, and site grading. The referenced groundwater level should not be interpreted to represent an accurate or permanent condition.

3.5 Faulting

The project site is located in the seismically active Imperial Valley of southern California with numerous mapped faults of the San Andreas Fault System traversing the region. The San Andreas Fault System is comprised of the San Andreas, San Jacinto, and Elsinore Fault Zones in southern California. The Imperial fault represents a transition from the more continuous San Andreas fault to a more nearly echelon pattern characteristic of the faults under the Gulf of California (USGS, 1990). We have performed a computer-aided search of known faults or seismic zones that lie within a 62 mile (100 kilometer) radius of the project site (Table 1).

A fault map illustrating known active faults relative to the site is presented on Figure 1, *Regional Fault Map*. Figure 2 shows the project site in relation to local faults. The criterion for fault classification adopted by the California Geological Survey defines Earthquake Fault Zones along active or potentially active faults. An active fault is one that has ruptured during Holocene time (roughly within the last 11,000 years). A fault that has ruptured during the last 1.8 million years (Quaternary time), but has not been proven by direct evidence to have not moved within Holocene time is considered to be potentially active. A fault that has not moved during Quaternary time is considered to be inactive.

Review of the current Alquist-Priolo Earthquake Fault Zone maps (CGS, 2000a) indicates that the nearest mapped Earthquake Fault Zone is an unnamed fault located approximately 2.9 miles west of the project site. Geologic mapping by the USGS (Rymer and others, 2011) of the Imperial Valley after the April 4, 2010 magnitude 7.2M_w El Mayor-Cucapah Earthquake indicates movement along several known and unknown faults west of the project site. Surface rupture on these faults is possible from future seismic events in the area.

The nearest mapped Earthquake Fault Zone is the Superstition Hills fault located approximately 8.3 miles north of the project site and the Laguna Salada fault located approximately 10 miles west of the project site.

3.6 General Ground Motion Analysis

The project site will likely be subjected to moderate to strong ground motion from earthquakes in the region. Ground motions are dependent primarily on the earthquake magnitude and distance to the seismogenic (rupture) zone. Acceleration magnitudes also are dependent upon attenuation by rock and soil deposits, direction of rupture and type of fault; therefore, ground motions may vary considerably in the same general area.

<u>CBC General Ground Motion Parameters:</u> The 2016 CBC general ground motion parameters are based on the Risk-Targeted Maximum Considered Earthquake (MCE_R). The U.S. Geological Survey "U.S. Seismic Design Maps Web Application" (USGS, 2018) was used to obtain the site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. **The site soils have been classified as Site Class D (stiff soil profile).**

Design spectral response acceleration parameters are defined as the earthquake ground motions that are two-thirds (2/3) of the corresponding MCE_R ground motions. Design earthquake ground motion parameters are provided in Table 2. **A Risk Category II was determined using Table 1604A.5 for the O&M building and the Seismic Design Category is D since S_1 is less than 0.75g.**

The Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration (PGA_M) value was determined from the "U.S. Seismic Design Maps Web Application" (USGS, 2018) for liquefaction and seismic settlement analysis in accordance with 2016 CBC Section 1803A.5.12 and CGS Note 48 ($PGA_M = F_{PGA}*PGA$). **A PGA_M value of 0.50g has been determined for the project site.**

3.7 Seismic and Other Hazards

- **Groundshaking.** The primary seismic hazard at the project site is the potential for strong groundshaking during earthquakes along the Superstition Hills, Imperial and Laguna Salada faults.
- **Surface Rupture.** The California Geological Survey (2016) has established Earthquake Fault Zones in accordance with the 1972 Alquist-Priolo Earthquake Fault Zone Act. The Earthquake Fault Zones consists of boundary zones surrounding well defined, active faults or fault segments. The project site does not lie within an A-P Earthquake Fault Zone; therefore, surface fault rupture is considered to be low at the project site.
- **Liquefaction.** Liquefaction is a design consideration because of underlying saturated sandy substrata. The potential for liquefaction is discussed in more detail in Section 3.8.

<u>Other Potential Geologic Hazards.</u>

- **Landsliding.** The hazard of landsliding is unlikely due to the regional planar topography. No ancient landslides are shown on geologic maps of the region and no indications of landslides were observed during our site investigation.
- **Volcanic hazards.** The site is not located in proximity to any known volcanically active area and the risk of volcanic hazards is considered very low.
- **Tsunamis and seiches.** The site is not located near any large bodies of water, so the threat of tsunami, seiches, or other seismically-induced flooding is unlikely. The project site lies adjacent to the Westside Main Canal (WSMC), a major irrigation supply canal for the Imperial Valley. The embankments of the WSMC are elevated approximately 5 feet above the elevation of the project site. There is a potential for sheet flooding of the project site from breaching of the canal embankments from lateral spreading during a strong seismic event. No breaching of WSMC canal embankments has occurred during strong earthquakes.
- **Flooding.** The project site is located in FEMA Flood Zone X, an area determined to be outside the 0.2% annual chance floodplain (FIRM Panel 06025C2050C).
- **Expansive soil.** In general, much of the near surface soils in the Imperial Valley consist of silty clays and clays which are moderate to highly expansive. The expansive soil conditions are discussed in more detail in Section 3.3.

3.8 Liquefaction

Liquefaction occurs when granular soil below the water table is subjected to vibratory motions, such as produced by earthquakes. With strong ground shaking, an increase in pore water pressure develops as the soil tends to reduce in volume. If the increase in pore water pressure is sufficient to reduce the vertical effective stress (suspending the soil particles in water), the soil strength decreases and the soil behaves as a liquid (similar to quicksand). Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations.

Four conditions are generally required for liquefaction to occur:

(1) the soil must be saturated (relatively shallow groundwater);
(2) the soil must be loosely packed (low to medium relative density);
(3) the soil must be relatively cohesionless (not clayey); and
(4) groundshaking of sufficient intensity must occur to function as a trigger mechanism.

All of these conditions exist to some degree at this site.

<u>Methods of Analysis:</u> Liquefaction potential at the O & M building and electrical substation site (CPT-6 and CPT-7 locations) was evaluated using the 1997 NCEER Liquefaction Workshop methods. The 1997 NCEER methods utilize direct SPT blow counts or CPT cone readings from site exploration and earthquake magnitude/PGA estimates from the seismic hazard analysis. The resistance to liquefaction is plotted on a chart of cyclic shear stress ratio (CSR) versus a corrected blow count $N_{1(60)}$ or Qc_{1N}. A PGA_M value of 0.50g was used in the analysis with a 6-foot groundwater depth and a threshold factor of safety (FS) of 1.3.

The computer program CLiq (Version 2.2.0.32, Geologismiki, 2017) was utilized for liquefaction assessment at the project site. The estimated settlements have been adjusted for transition zones between layers and the post liquefaction volumetric strain has been weighed with depth (Robertson, 2014 and Cetin et al., 2009). Computer printouts of the liquefaction analyses are provided in Appendix D.

The fine content of liquefiable sands and silts increases the liquefaction resistance in that more ground motion cycles are required to fully develop increased pore pressures. The CPT tip pressures (Qc) were adjusted to an equivalent clean sand pressure (Q_{ClNcs}) in accordance with Robertson and Wride (1997).

The soil encountered at the points of exploration included saturated silts and silty sands that could liquefy during a Maximum Considered Earthquake. Liquefaction can occur within a several isolated silt and sand layers between depths of 13.5 to 50 feet. The likely triggering mechanism for liquefaction appears to be strong groundshaking associated with the rupture of the Laguna Salada fault or other nearby faults. The analysis is summarized in the table below.

Table 3. Summary of Liquefaction Analysis (O&M Building/Substation)

Boring Location	Depth To First Liquefiable Zone (ft)	Potential Induced Settlement (in)
CPT-6	9.5	¼
CPT-7	7.0	1¾

Liquefaction Induced Settlements: ***Based on empirical relationships, total induced settlements are estimated to be up to about 1¾-inch should liquefaction occur.*** The magnitude of potential liquefaction induced differential settlement is estimated at be two-thirds of the total potential settlement in accordance with California Special Publication 117; therefore, there is a potential for 1¼ inch of liquefaction induced differential settlement at the substation and O & M building site.

The differential settlement based on seismic settlements is estimated at 1 inch over a distance of 100 feet. Foundations should be designed for a maximum deflection of L/720.

Liquefaction Induced Ground Failure: Based on research from Ishihara (1985) and Youd and Garris (1995) small ground fissure or sand boil formation is possible because of the relatively thin layer of the overlying unliquefiable soil. Sand boils are conical piles of sand derived from the upward flow of groundwater caused by excess porewater pressures created during strong ground shaking. Sand boils are not inherently damaging by themselves, but are an indication that liquefaction occurred at depth (Jones, 2003).

Liquefaction induced lateral spreading is not expected to occur at this site due to the planar topography. According to Youd (2005), if the liquefiable layer lies at a depth greater that about twice the height of a free face, lateral spread is not likely to develop. Slopes or free faces occur only at the open IID drains and large seismic events have typically resulted in small surficial slope failures within the drain maintenance roads.

Liquefaction related failures and ground fissures were noted along the Westside Main Canal in the area of the project site after the April 4, 2010 magnitude 7.2M_w El Mayor-Cucapah Earthquake. McCrink and others (2011) reported several liquefaction related failures to the embankment of the Westside Main Canal along the southern margin of the project site. Ground fissures and sand boils were noted along the embankments of the Westside Main Canal.

Mitigation: Because of the potential for differential settlement upon liquefaction, the designer should consider the structures be either founded on:

1) Foundations that use grade-beam footings to tie floor slabs and isolated columns to continuous footings (conventional or post-tensioned).

2) Structural flat-plate mats, either conventionally reinforced or tied with post-tensioned tendons.

3) Deep foundations (drilled piers, geopiers, stone columns or piles) founded at a depth of 25 feet.

These alternatives reduce the potential effects of liquefaction-induced settlements by making the structures more able to withstand differential settlement.

Section 4
DESIGN CRITERIA

4.1 Site Preparation (Mass Grading, Inverters, and Tanks)

Clearing and Grubbing: All debris or vegetation including grass, agricultural crops, and weeds on the site at the time of construction should be removed from the construction area. Root balls of trees should be completely excavated. Crops should either be removed by harvesting or burning. Excess crop residue may be disced into the ground or removed by a shallow blade cut (about 0.05 ft. depth). Organic strippings should not be used in structural areas or as engineered fill. All trash, construction debris, concrete slabs, old pavement, landfill, and buried obstructions such as old foundations and utility lines exposed during rough grading should be traced to the limits of the foreign material by the grading contractor and removed under our supervision. Any excavations resulting from site clearing should be sloped to a bowl shape to the lowest depth of disturbance and backfilled under the observation of the geotechnical engineer's representative.

The site may be underlain by subsurface agricultural tile drain lines at a depth of approximately 5.5 to 6.0 feet below ground surface. Tile lines should be cut and plugged at each Imperial Irrigation District (IID) drain outlet and within 10 feet of any septic system leach fields. The IID requires an encroachment permit for the tile drain outlet cut-offs. The pipelines are likely full of water and may temporarily flood excavations if not plugged promptly. Base (collector) tile lines (8 inch diameter and larger), if under buildings or substations, should be located and crushed in-place with the backfill compacted to a minimum of 90% of ASTM D1557 maximum density.

Mass Grading for PV Posts Area: Prior to placing any fills, the surface 12 inches of native clay/silt soils shall be uniformly moisture conditioned to a minimum of 2% over optimum, and recompacted to at least 90% of ASTM D1557 maximum density. Onsite native clays/silts placed as engineer fill should be uniformly moisture conditioned by discing and wetting or drying to optimum plus 2 to 8% and compacted to a minimum of 90% relative compaction. Clods shall be reduced by discing to a maximum dimension of 1.0 inch prior to being placed as fill.

Building Support Pad Preparation The soil within the O&M building pad and substation switchgear areas should be removed to 30 inches below the building pad elevation or existing natural surface grade (whichever is lower) extending five feet beyond all exterior wall/column lines (including concreted areas adjacent to the building). Exposed subgrade (silts/sandy silts) should be scarified to a depth of 8 inches, uniformly moisture conditioned to 2 to 6% above optimum moisture content and recompacted to 87 to 92% of the maximum density determined in accordance with ASTM D1557 methods.

Prior to over-excavation of the surface soil, deep moisture penetration may be achieved by bordering the site and applying multiple floodings or by sprinkler application to allow water to permeate to a minimum depth of 3.0 feet (16% minimum moisture content) below existing natural surface. Extended drying periods may be required when utilizing this method of pre-saturation.

The native soil is suitable for use as general fill provided it is free from concentrations of organic matter or other deleterious material. However, special foundation designs are required when native clays are used. The fill soil should be uniformly moisture conditioned by discing and watering to the limits specified above, placed in maximum 8-inch lifts (loose), and compacted to the limits specified above. Clay soil should not be overcompacted because highly compacted soil will result in increased swelling. Imported fill soil (for foundations designed for expansive soil conditions) should have a Plasticity Index less than 10 and sulfates (SO_4) less than 500 ppm.

If foundation designs are to be utilized which do not include provisions for expansive soil conditions, an engineered building support pad consisting of 2.0 feet of non-expansive granular soil. The non-expansive, granular soil shall meet the USCS classifications of SM, SP-SM, or SW-SM with a maximum rock size of 3 inches and 5 to 35% passing the No. 200 sieve. The geotechnical engineer should approve imported fill soil sources before hauling material to the site. Imported granular fill should be placed in lifts no greater than 8 inches in loose thickness and compacted to a minimum of 90% of ASTM D1557 maximum dry density at optimum moisture ±2%.

In areas other than the building pad which are to receive sidewalks or area concrete slabs, the ground surface should be presaturated to a minimum depth of 24 inches and then scarified to 8 inches, moisture conditioned to a minimum of 2% over optimum, and recompacted to 85-90% of ASTM D1557 maximum density just prior to concrete placement.

Subgrade Preparation for Mat Foundations at Inverters: The native clay/silt soil within the mat foundation excavations should be removed to 12 inches below the bottom of the mat foundations to 2 feet beyond the edges of the foundation. Exposed subgrade should be scarified to a depth of 12 inches, uniformly moisture conditioned to a minimum of 2% above optimum moisture content, and recompacted to a minimum of 90% of the maximum density determined in accordance with ASTM D1557 methods.

A 12 inch layer of Caltrans Class 2 aggregate base, compacted in maximum 6 inch lifts to at least 95% of ASTM D1557 maximum density at 2% below to 4% above optimum moisture, shall be placed over the compacted subgrade prior to placing mat foundations. Design soil pressure = 2,000 psf.

10,000 Gallon Water Tank Foundation Subgrade Preparation: The native clay/silt soil within the water tank pad excavations should be removed to 12 inches below the bottom of the mat foundation to 2 feet beyond the edges of the foundation. Exposed subgrade should be scarified to a depth of 12 inches, uniformly moisture conditioned to a minimum of 2% above optimum moisture content, and recompacted to a minimum of 90% of the maximum density determined in accordance with ASTM D1557 methods. The water tank mat foundation should be underlain with a minimum of 12 inches of Class 2 aggregate base, compacted in maximum 6 inch lifts to at least 95% of ASTM D1557 maximum density at 2% below to 4% above optimum moisture. Design soil pressure = 2,000 psf.

Observation and Density Testing: All site preparation and fill placement should be continuously observed and tested by a representative of a qualified geotechnical engineering firm. Full-time observation services during the excavation and scarification process is necessary to detect undesirable materials or conditions and soft areas that may be encountered in the construction area.

The geotechnical firm that provides observation and testing during construction shall assume the responsibility of "*geotechnical engineer of record*" and, as such, shall perform additional tests and investigation as necessary to satisfy themselves as to the site conditions and the geotechnical parameters for site development.

4.2 Utility Trench Backfill

Utility Trench Backfill: Trench backfill for utilities should conform to San Diego Regional Standard Drawing S-4 (Appendix F), using either Type A, B or C backfill.

Type A backfill for HDPE pipe (above groundwater) consists of a 4 to 6 inch bed of ¾-inch crushed rock below the pipe and pipezone backfill (to 12" above top of pipe) consisting of crusher fines (sand). Sewer pipes (SDR-35), water mains, and stormdrain pipes of other than HDPE pipe may use crusher fines for bedding. The crusher fines shall be compacted to a minimum of 95% of ASTM D1557 maximum density. Pipe deflection should be checked to not exceed 2% of pipe diameter. Native clay/silt soils may be used to backfill the remainder of the trench. Soils used for trench backfill shall be compacted to a minimum of 90% of ASTM D1557 maximum density.

Type B backfill for HDPE pipe (shallow cover) requires 6 inches of ¾-inch crushed rock as bedding and to springline of the pipe. Thereafter, sand/cement slurry (3 sack cement factor) should be used to 12 inches above the top of the pipe. Native clay and silt soils may be used in the remainder of the trench backfill as specified above.

Type C backfill for HDPE pipe (below or partially below groundwater) shall consist of a geotextile filter fabric encapsulating ¾-inch crushed rock. The crushed rock thickness shall be 6 inches below and to the sides of the pipe and shall extend to 12 inches above the top of the pipe. The filter fabric shall cover the trench bottom, sidewalls and over the top of the crushed rock. Native clay and silt soils may be used in the remainder of the trench backfill as specified above.

Type C backfill must be used in wet soils and below groundwater for all buried utility pipelines. When excavations are planned below groundwater, dewatering (by well points) is required to at least 24 inches below the trench bottom prior to excavation. Type A backfill may be used in the case of a dewatered trench condition in clay soils only.

On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill above pipezone, but may be difficult to uniformly maintain at specified moistures and compact to the specified densities. Native backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material.

Imported granular material is acceptable for backfill of utility trenches. Granular trench backfill used in native clay building pad areas should be plugged with a solid (no clods or voids) 2-foot width of native clay soils at each end of the building foundation to prevent landscape water migration into the trench below the building.

Backfill soil of utility trenches within paved areas should be uniformly moisture conditioned to a minimum of 4% above optimum moisture, placed in layers not more than 6 inches in thickness and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density, except that the top 12 inches shall be compacted to 95% (if granular trench backfill).

4.3 Foundations and Settlements (Mats, Grade-beam Reinforced Slabs, Drilled Piers, Steel Posts)

Shallow spread footings in clay/silt soils are suitable to support the O&M Building provided they are structurally tied with grade-beams to continuous perimeter wall footings to resist differential movement associated with expansive soils. The foundations may be designed using an allowable soil bearing pressure of 1,500 psf for compacted native clay or silt soil and 2,500 psf when foundations are supported on imported sands (extending a minimum of 1.5 feet below footings). The allowable soil pressure may be increased by 20% for each foot of embedment depth of the footings in excess of 18 inches and by one-third for short term loads induced by winds or seismic events. The maximum allowable soil pressure at increased embedment depths shall not exceed 3,000 psf (clays).

As an alternative to shallow spread foundations, flat plate structural mats or grade-beam reinforced foundations may be used to mitigate expansive soil heave related movement.

Flat Plate Structural Mats: Structural concrete mat foundations may be designed using an allowable soil bearing pressure of 2,000 psf when the foundation is supported on 12 inches of compacted Class 2 aggregate base. The allowable soil pressure may be increased by one-third for short term loads induced by winds or seismic events. Design criteria for mat foundations are provided below. The structural mat shall have a double mat of steel and a minimum thickness of 12 inches, except that inverters and 10,000-gallon water tank slabs may be 8 inches thick. Structural mats may be designed for a modulus of subgrade reaction (Ks) of 150 pci when placed on 12 inches of compacted Class 2 aggregate base. An allowable friction coefficient of 0.35 may also be used at the base of the mat to resist lateral sliding.

Resistance to horizontal loads will be developed by passive earth pressure on the sides of footings and frictional resistance developed along the base of footings. Passive resistance to lateral earth pressure may be calculated using an equivalent fluid pressure of 250 pcf to resist lateral loadings. An allowable friction coefficient of 0.35 may also be used at the base of the footings to resist lateral sliding.

Grade-beam Reinforced Foundations: Specific soil data for building structures with grade-beam reinforced foundations placed on the native clays (without replacement of the surface clays with 2.0 feet of granular fill) are presented below in accordance with the design method given in CBC Chapter 18 Section 1808A.6.2 (*WRI/CRSI Design of Slab-on-Ground Foundations*):

Weighted Plasticity Index (PI) = 10
Slope Coefficient (C_s) = 1.0
Strength Coefficient (C_o) = 0.8
Climatic Rating (C_w) = 15
Effective PI = 8
Maximum Grade-beam Spacing = 25 feet

All exterior footings in clay soils should be embedded a minimum of 24 inches (18 inches for silt and sand sites) below the building support pad or lowest adjacent final grade, whichever is deeper. Minimum embedment depth of interior should be at least 12 inches into the building support pad to account for variable environmental conditions.

Interior and exterior embedment depths listed herein are minimum depths and greater depths/widths may be required by the structural engineer/designer and should be sufficient to limit differential movement to L/480 for center lift and L/720 for edge lift to comply with the current standards. Continuous wall footings should have a minimum width of 12 inches. Spread footings should have a minimum dimension of 24 inches and should be structurally tied to perimeter footings or grade beams. Concrete reinforcement and sizing for all footings should be provided by the structural engineer.

Resistance to horizontal loads will be developed by passive earth pressure on the sides of footings and frictional resistance developed along the bases of footings and concrete slabs. Passive resistance to lateral earth pressure may be calculated using an equivalent fluid pressure of 250 pcf (300 pcf for imported sands) to resist lateral loadings. The top one foot of embedment should not be considered in computing passive resistance unless the adjacent area is confined by a slab or pavement. An allowable friction coefficient of 0.25 (0.35 for imported sands) may also be used at the base of the footings to resist lateral loading.

Foundation movement under the estimated static (non-seismic) loadings and static site conditions are estimated to not exceed 1 inch with differential movement of about two-thirds of total movement for the loading assumptions stated above when the subgrade preparation guidelines given above are followed. Seismically induced liquefaction settlement of the surrounding land mass and structure may be on the order of ¾ inch (total) and ½ inch (differential).

<u>Non-Constrained Drilled Pier Foundations</u>: Individual short piers should be adequate to support the light, security camera poles and other electrical switchyard elements. Embedment depth for short piers to resist lateral loads where no constraint is provided at ground surface may be designed using the following formula per 2016 CBC Section 1807.3.2.1:

$$d = A/2\ [1 + (1+4.36h/A)^{1/2}]$$

where:

A = 2.34P/S1*b*.
b = Pier diameter in feet.
d = Embedment depth in feet (not over 12 feet for purpose of computing lateral pressure).
h = Distance in feet from ground surface to point of application of "P".
P = Applied lateral force in pounds.
S1 = Allowable lateral soil bearing pressure (basic value of 100 psf, (Table 1806.2 for Class 5 soil and Section 1806). Isolated piers such solar panel short piers that are not adversely affected by a 0.5 inch motion at the ground surface due to short-term lateral loads are permitted to be designed using lateral soil bearing pressures equal to two times the basic value.

The vertical load capacity of short pier foundations may be designed using an allowable downward soil bearing pressure of 1,500 psf.

***Installation*:** Excavation for piers should be inspected by the geotechnical consultant. A tremie pipe should be used to pour concrete from the bottom up and to ensure less than five feet of free fall. Groundwater is expected to be encountered at approximately 6 to 8 feet below ground surface. The structural steel and concrete should be placed immediately after drilling. Prior to placing any structural steel or concrete, loose soil or slough material should be removed from the bottom of the drilled pier excavation.

Driven Steel Posts: The use of driven steel posts requires special provisions for corrosion protection due to the corrosive nature of the subsurface soils. Steel posts for PV panel mounting frames have been preliminary sized as W6x7 (frame and axle supports) or W6x15 steel sections (gearbox columns). Due to soil stratigraphy encountered during the soil exploration, the site was divided into two (2) areas for computing the vertical and lateral capacities of W-pile shapes. The area on the northwest side with surface clay soils is congregated by CPT's-1, 2, 5, 6, 7 and 9, and the area with predominant sandy soils is located to the southeast side of the project encompassing CPT's-3, 4, 8, 10, 11, 12, 13, 14, 15 and 16. The specified tip elevation (5, 6 and 8 feet) and allowable vertical and lateral capacities for typical driven steel W-pile shapes are provided in Tables 4, 5, 6 and 7.

Vertical Capacity: End bearing and skin friction parameters have been used to determine the allowable shaft capacity. The allowable capacities include a factor of safety of 2.5. The allowable vertical compression capacities may be increased by 33 percent to accommodate temporary loads from wind or seismic forces. The allowable vertical shaft capacities are based on the supporting capacity of the soil.

Lateral Capacity: The allowable lateral capacity for the preliminary steel sections (W6x7 and W6x15) at 5, 6 and 8 feet embedment depths are given in Tables 4, 5, 6 and 7. The allowable lateral capacity is based on a deflection of one-half inch at the top of the steel post section. If greater deflection can be tolerated, lateral load capacity can be increased directly in proportion to a maximum of one inch deflection. Axial and lateral loads were applied at 4.0 feet above ground surface.

Table 4: Allowable Capacities of Driven Steel Posts (Frame Supports)
Northwest Area (CPT's – 1, 2, 5, 6, 7 and 9)

Pile Type:		Driven W6x7	
Pile Length (ft):	**9 feet**	**10 feet**	**12 feet**
Specified Tip Depth (ft):	**5 feet**	**6 feet**	**8 feet**
Height Above Ground (ft):	**4 feet**	**4 feet**	**4 feet**
Allowable Axial Capacity (kips) – FS=2.5:	3.30	4.12	4.64
Allowable Uplift Capacity (kips) – FS=2.5:	3.28	4.00	4.27
Lateral Load – Free Head Condition (kips):	1.00	1.22	1.36
Top Deflection (in) – Free Head Condition	1.00	1.00	1.00
Maximum Moment from Lateral Load, Free Head Condition (ft-kips):	4.54	5.95	6.82
Depth of Maximum Moment (from Top of Post), Free Head (ft):	5.0	5.4	5.5

Table 5: Allowable Capacities of Driven Steel Posts (Frame Supports)
Southeast Area (CPT's – 3, 4, 8, 10, 12, 13, 14, 15 and 16)

Pile Type:		Driven W6x7	
Pile Length (ft):	**9 feet**	**10 feet**	**12 feet**
Specified Tip Depth (ft):	**5 feet**	**6 feet**	**8 feet**
Height Above Ground (ft):	**4 feet**	**4 feet**	**4 feet**
Allowable Axial Capacity (kips) – FS=2.5:	1.64	2.85	5.57
Allowable Uplift Capacity (kips) – FS=2.5:	1.20	2.20	4.15
Lateral Load – Free Head Condition (kips):	0.60	0.85	1.20
Top Deflection (in) – Free Head Condition	1.00	1.00	1.00
Maximum Moment from Lateral Load, Free Head Condition (ft-kips):	2.93	4.57	6.66
Depth of Maximum Moment (from Top of Post), Free Head (ft):	5.5	5.8	6.1

Table 6: Allowable Capacities of Driven Steel Posts (Motor Supports)
Northwest Area (CPT's – 1, 2, 5, 6, 7 and 9)

Pile Type:	Driven W6x15
Pile Length (ft):	**12 feet**
Specified Tip Depth (ft):	**8 feet**
Height Above Ground (ft):	**4 feet**
Allowable Axial Capacity (kips) – FS=2.5:	5.21
Allowable Uplift Capacity (kips) – FS=2.5:	4.52
Lateral Load – Free Head Condition (kips):	2.43
Top Deflection (in) – Free Head Condition	1.00
Maximum Moment from Lateral Load, Free Head Condition (ft-kips):	12.58
Depth of Maximum Moment(from Top of Post), Free Head (ft):	6.0

Table 7: Allowable Capacities of Driven Steel Posts (Motor Supports)
Southeast Area (CPT's – 3, 4, 8, 10, 12, 13, 14, 15 and 16)

Pile Type:	Driven W6x15
Pile Length (ft):	**12 feet**
Specified Tip Depth (ft):	**8 feet**
Height Above Ground (ft):	**4 feet**
Allowable Axial Capacity (kips) – FS=2.5:	6.32
Allowable Uplift Capacity (kips) – FS=2.5:	4.38
Lateral Load – Free Head Condition (kips):	2.1
Top Deflection (in) – Free Head Condition	1.00
Maximum Moment from Lateral Load, Free Head Condition (ft-kips):	11.83
Depth of Maximum Moment(from Top of Post), Free Head (ft):	6.4

Design criteria for other steel shapes and sizes can be made available upon request. The top six inches of post embedment should not be considered in computing axial and lateral design.

Soil Parameters: Interpretive soil parameters of the subsoil for L-Pile program are presented in the table below.

Table 8: Soil Strength Parameters for L-Pile Program
Northwest Area (CPT's – 1, 2, 5, 6, 7 and 9)

Layer Type	Depth (ft)	Unit Weight (pcf)	Friction Angle (deg)	Cohesion (ksf)	Strain Factor, E50 or Dr (%)	Lateral Soil Modulus, k (pci) (*)
CL	0 to 6	125	---	1.00	1.00	225
SP-SM	6 to 20	115	35^o	---	50	90

(*) k value for static loading. For cycling loading, use 50% of listed value.

Table 9: Soil Strength Parameters for L-Pile Program
Southeast Area (CPT's – 3, 4, 8, 10, 12, 13, 14, 15 and 16)

Layer Type	Depth (ft)	Unit Weight (pcf)	Friction Angle (deg)	Cohesion (ksf)	Strain Factor, E50 or Dr (%)	Lateral Soil Modulus, k (pci) (*)
SM	0 to 4	115	35^o	---	50	90
CL	4 to 8	125	---	1.50	0.80	375
SP-SM	8 to 20	115	37^o	---	60	100

(*) k value for static loading. For cycling loading, use 50% of listed value.

Settlement: Total settlements of less than ¼ inch, and differential movement of about two-thirds of total movement for single piles designed according to the preceding design values. If pile spacing is at least 2.5 pile diameters center-to-center, no reduction in axial load capacity is considered necessary for a group effect.

Drilled Pier Foundations: The switch stands, bus supports and dead end frames may be supported on cast-in-place, drilled piers.

***Vertical Capacity*:** Vertical capacity for 18 and 24 inch diameter shafts are presented in Figure 4. Capacities for other shaft sizes can be determined in direct proportion to shaft diameters. Point bearing and skin friction parameters have been used to determine the allowable shaft capacity. The allowable capacities include a factor of safety of 2.5. The allowable vertical compression capacities may be increased by 33 percent to accommodate temporary loads that result from wind or seismic forces.

***Lateral Capacity*:** The allowable lateral capacity for 18 and 24 inch diameter shafts are given in the table shown below. The horizontal deflection at the top of the drilled pier for the lateral loads indicated is one-half inch (0.50 inch).

Table 10: Lateral Capacities of Drilled Piers

Shaft Diameter (in.)	**18**		**24**	
Head Condition	Free	Fixed	Free	Fixed
Allowable Head Deflection (in.)	0.5	0.5	0.5	0.5
Minimum Length (ft.)	**5**	**5**	**5**	**5**
Lateral Capacity (kips)	4.7	16.0	5.6	18.5
Maximum Moment (foot-kips)	4.88	-43.6	5.7	-49.8
@Depth from Pier Head (ft.)	2.0	0	2.0	0
Minimum Length (ft.)	**10**	**10**	**10**	**10**
Lateral Capacity (kips)	11.4	32.5	13.0	45.0
Maximum Moment (foot-kips)	25.2	-168.3	27.9	-255.8
@Depth from Pier Head (ft.)	4.0	0	4.0	0
Minimum Length (ft.)	**15**	**15**	**15**	**15**
Lateral Capacity (kips)	18.0	35.6	23.0	53.0
Maximum Moment (foot-kips)	59.9	-164.2	81.0	-339.2
@Depth from Pier Head (ft.)	6.2	0	6.8	0
Minimum Length (ft.)	**20**	**20**	**20**	**20**
Lateral Capacity (kips)	18.7	39.7	29.0	62.0
Maximum Moment (foot-kips)	65.0	-180.0	127.5	-360.8
@Depth from Pier Head (ft.)	6.7	0	8.6	0

Settlement: Total static (non-seismic) settlements of less than ¼ inch are anticipated for single piles designed according to the preceding design values. If pile spacing is a least 2.5 pile diameters center-to-center, no reduction in axial load capacity is considered necessary for a group effect.

Uplift Capacity: Pier capacity in tension should be taken as 50% of the compression capacity.

Soil Parameters for Drilled Piers: Interpretive soil parameters of the subsurface soil for use with L-Pile software are provided in the table below:

TABLE 11: Drilled Pier Soil Parameters

Layer Type	Depth (ft)	Unit Weight (pcf)	Friction Angle (deg)	Cohesion (ksf)	Strain Factor, E50 or Dr (%)	Lateral Soil Modulus, k (pci) (*)
CL	0 to 8	125	---	1.00	1.00	225
ML	8 to 12	120	24°	0.30	0.85	300
CL-CH	12 to 21	125	---	1.50	0.75	400
SM	21 to 28	115	37°	---	60.0	100
CL-CH	28 to 50	125	---	1.75	0.65	500

Installation**:** The drilled piers shall be placed in conformance to ACI 336 guidelines. Excavation for piers should be inspected by the geotechnical consultant. A tremie pipe should be used to pour concrete from the bottom up and to ensure less than five feet of free fall. All drilled piers shall be cased below groundwater depth to prevent caving or lateral deformation. Groundwater is expected to be encountered at 8 feet below ground surface. The structural steel and concrete should be placed immediately after drilling. Prior to placing any structural steel or concrete, loose soil or slough material should be removed from the bottom of the drilled pier excavation.

4.4 Slabs-On-Grade

Structural Concrete: Concrete slabs placed over native clay soil should be designed in accordance with Chapter 18 of the 2016 CBC and shall be a minimum of 5 inches thick due to expansive soil conditions (minimum 6-inch thick where the slab is subjected to wheel loads). Concrete floor slabs shall be monolithically placed with the footings (no cold joints) unless placed on 2.0 feet of granular fill soil.

American Concrete Institute (ACI) guidelines (ACI 302.1R-04 Chapter 3, Section 3.2.3) provide recommendations regarding the use of moisture barriers beneath concrete slabs. The concrete floor slabs should be underlain by a 10-mil polyethylene vapor retarder that works as a capillary break to reduce moisture migration into the slab section. All laps and seams should be overlapped 6-inches or as recommended by the manufacturer. The vapor retarder should be protected from puncture.

The joints and penetrations should be sealed with the manufacturer's recommended adhesive, pressure-sensitive tape, or both. The vapor retarder should extend a minimum of 12 inches into the footing excavations. The vapor retarder should be covered by 4 inches of clean sand (Sand Equivalent SE>30) unless placed on 2.0 feet of granular fill, in which case, the vapor retarder may lie directly on the granular fill with 2 inches of clean sand cover.

For areas with moisture sensitive flooring materials, ACI recommends that concrete slabs be placed without a sand cover directly over the vapor retarder, provided that the concrete mix uses a low-water cement ratio and concrete curing methods are employed to compensate for release of bleed water through the top of the slab. The vapor retarder should have a minimum thickness of 15-mil (Stego-Wrap or equivalent).

Structural concrete slab reinforcement should consist of chaired rebar slab reinforcement (minimum of No. 3 bars at 16-inch centers, both horizontal directions) placed at slab mid-height to resist potential swell forces and cracking. Slab thickness and steel reinforcement are minimums only and should be verified by the structural engineer/designer knowing the actual project loadings. All steel components of the foundation system should be protected from corrosion by maintaining a 3-inch (4-inch near Wixom Road) minimum concrete cover of densely consolidated concrete at footings (by use of a vibrator).

The construction joint between the foundation and any mowstrips/sidewalks placed adjacent to foundations should be sealed with a polyurethane based non-hardening sealant to prevent moisture migration between the joint. Epoxy coated embedded steel components (ASTM D3963/A934) or permanent waterproofing membranes placed at the exterior footing sidewall may also be used to mitigate the corrosion potential of concrete placed in contact with native soil.

Control joints should be provided in all concrete slabs-on-grade at a maximum spacing (in feet) of 2 to 3 times the slab thickness (in inches) as recommended by American Concrete Institute (ACI) guidelines. All joints should form approximately square patterns to reduce randomly oriented contraction cracks. Contraction joints in the slabs should be tooled at the time of the pour or sawcut (¼ of slab depth) within 6 to 8 hours of concrete placement. Construction (cold) joints in foundations and area flatwork should either be thickened butt-joints with dowels or a thickened keyed-joint designed to resist vertical deflection at the joint. All joints in flatwork should be sealed to prevent moisture, vermin, or foreign material intrusion. Precautions should be taken to prevent curling of slabs in this arid desert region (refer to ACI guidelines).

Non-structural Concrete: All non-structural independent flatwork (sidewalks and uncovered area slabs) shall be a minimum of 4 inches thick and should be placed on a minimum of 4 inches of aggregate base compacted to 90%, dowelled to the perimeter foundations where adjacent to the building to prevent separation and sloped 2% (sidewalks) or 1 to 2% (housekeeping slabs) away from the building.

A minimum of 24 inches of moisture conditioned (2% minimum above optimum) and 8 inches of compacted subgrade (87 to 92%) should underlie all independent flatwork. Flatwork which contains steel reinforcing (except wire mesh) should be underlain by a 15-mil (minimum) polyethylene separation sheet and at least 4-inches of Class 2 aggregate base. All flatwork should be jointed in square patterns and at irregularities in shape at a maximum spacing of 8 feet or the least width of the sidewalk.

4.5 Concrete Mixes and Corrosivity

Selected chemical analyses for corrosivity were conducted on bulk samples of the near surface soil from the project site (Plates C12 and C-13). The native soils were found to have low to to severe levels of sulfate ion concentration (550 to 8,550 ppm). Sulfate ions in high concentrations can attack the cementitious material in concrete, causing weakening of the cement matrix and eventual deterioration by raveling. The following table provides American Concrete Institute (ACI) recommended cement types, water-cement ratio and minimum compressive strengths for concrete in contact with soils:

Table 12. Concrete Mix Design Criteria due to Soluble Sulfate Exposure

Sulfate Exposure	Water-soluble Sulfate (SO_4) in soil, ppm	Cement Type	Maximum Water-Cement Ratio by weight	Minimum Strength f'c (psi)
Negligible	0-1,000	–	–	–
Moderate	1,000-2,000	II	0.50	4,000
Severe	2,000-20,000	V	0.45	4,500
Very Severe	Over 20,000	V (plus Pozzolon)	0.45	4,500

Note: from ACI 318-11 Table 4.2.1

A minimum of 6.0 sacks (6.5 sacks near Wixom Road) per cubic yard of concrete (4,500 psi) of Type V Portland Cement with a maximum water/cement ratio of 0.45 (by weight) should be used for concrete placed in contact with native soil on this project (sitework including sidewalks, housekeeping slabs, and foundations). Admixtures may be required to allow placement of this low water/cement ratio concrete.

The native soil has low to severe levels of chloride ion concentration (90 to 1,180 ppm). Chloride ions can cause corrosion of reinforcing steel, anchor bolts and other buried metallic conduits. Resistivity determinations on the soil indicate very severe potential for metal loss because of electrochemical corrosion processes. Mitigation of the corrosion of steel can be achieved by using steel pipes coated with epoxy corrosion inhibitors, asphaltic and epoxy coatings, cathodic protection or by encapsulating the portion of the pipe lying above groundwater with a minimum of 3 inches of densely consolidated concrete.

Foundation designs shall provide a minimum concrete cover of three (3) inches around steel reinforcing or embedded components (anchor bolts, etc.) exposed to native soil (4 inch cover near Wixom Road). If the 3-inch (4-inch near Wixom Road) concrete edge distance cannot be achieved, all embedded steel components (anchor bolts, etc.) shall be epoxy coated for corrosion protection (in accordance with ASTM D3963/A934) or a corrosion inhibitor and a permanent waterproofing membrane shall be placed along the exterior face of the exterior footings. Additionally, the concrete should be thoroughly vibrated at footings during placement to decrease the permeability of the concrete.

4.6 Excavations

All site excavations should conform to CalOSHA requirements for Type B soil. The contractor is solely responsible for the safety of workers entering trenches. Temporary excavations with depths of 4 feet or less may be no steeper than 1:1 (horizontal:vertical). Sandy soil slopes should be kept moist, but not saturated, to reduce the potential of raveling or sloughing. Excavations will require slope inclinations in conformance to CAL/OSHA regulations for Type B soil.

Surcharge loads of stockpiled soil or construction materials should be set back from the top of the slope a minimum distance equal to the height of the slope. All permanent slopes should not be steeper than 3:1 to reduce wind and rain erosion. Protected slopes with ground cover may be as steep as 2:1. However, maintenance with motorized equipment may not be possible at this inclination.

4.7 Seismic Design

This site is located in the seismically active southern California area and the site structures are subject to strong ground shaking due to potential fault movements along the Laguna Salada, Superstition Hills, and Imperial Faults. Engineered design and earthquake-resistant construction are the common solutions to increase safety and development of seismic areas. Designs should comply with the latest edition of the CBC for Site Class D using the seismic coefficients given in Section 3.6 and Table 2 of this report.

4.8 All-Weather Roadways and Construction Laydown Areas

All-weather accessways for Emergency Vehicles and construction laydown areas should consist of 6 inches of Caltrans Class 2 aggregate base (compacted to 90% minimum of ASTM D1557 maximum density) placed over 12 inches of compacted (90% minimum of ASTM D1157 at minimum of 2% above optimum moisture) native clay subgrade soil.

4.9 Soil Erosion Factors for SWPPP Plans

The site soils near Wixom Road are classified as heavy clays with greater than 50% clay fraction soil particles (10% sand, 40% silt, and 50% clay) and sandy silts (60% silt and 40% sand) in the remaining areas of the project site. Groundwater can be expected at a depth of 8 to 10 feet below ground surface.

4.10 Pavements

Pavements should be designed according to the 2012 Caltrans Highway Design Manual or other acceptable methods. Traffic indices were not provided by the project engineer or owner; therefore, we have provided structural sections for several traffic indices for comparative evaluation. The public agency or design engineer should decide the appropriate traffic index for the site. Maintenance of proper drainage is necessary to prolong the service life of the pavements.

Based on the current Caltrans method, an R-value of 5 for the clay subgrade soil and an R-value of 25 for silt subgrade and assumed traffic indices, the following table provides our estimates for asphaltic concrete (AC) and Portland Cement Concrete (PCC) pavement sections.

Table 13. Pavement Structural Sections (clays)

R-Value of Subgrade Soil - 5 (estimated) Design Method - Caltrans 2012

Traffic Index (assumed)	Flexible Pavements		Rigid (PCC) Pavements	
	Asphaltic Concrete Thickness (in.)	Aggregate Base Thickness (in.)	Concrete Thickness (in.)	Aggregate Base Thickness (in.)
4.0	3.0	6.5	5.0	6.0
5.0	3.0	10.0	5.5	6.0
6.0	4.0	11.5	6.0	8.0
6.5	4.0	14.0	7.0	8.0
8.0	5.0	17.5	8.0	11.0

Table 14. Pavement Structural Sections (silts/sands)

R-Value of Subgrade Soil - 25 (estimated) Design Method - Caltrans 2012

Traffic Index (assumed)	Flexible Pavements		Rigid (PCC) Pavements	
	Asphaltic Concrete Thickness (in.)	Aggregate Base Thickness (in.)	Concrete Thickness (in.)	Aggregate Base Thickness (in.)
4.0	3.0	6.0	5.0	4.0
5.0	3.0	7.0	5.5	4.0
6.0	3.0	10.0	6.0	6.0
6.5	4.0	10.0	7.0	6.0
8.0	4.0	5.0	8.0	9.0

Notes:

1) Asphaltic concrete shall be Caltrans, Type B, ¾ inch maximum (½ inch maximum for parking areas), medium grading with PG70-10 asphalt cement (PS64-16 for parking lot areas), compacted to a minimum of 95% of the Hveem density (CAL 366).
2) Aggregate base shall conform to Caltrans Class 2 (¾ in. maximum), compacted to a minimum of 95% of ASTM D1557 maximum dry density.
3) Place pavements on 12 inches of moisture conditioned (minimum 4% above optimum if clays) native clay soil compacted to a minimum of 90% of the maximum dry density (ASTM D1557).
4) Portland cement concrete for pavements should have Type V cement, a minimum compressive strength of 4,500 psi at 28 days, and a maximum water-cement ratio of 0.45.
5) Typical Street Classifications (Imperial County).

   Parking Areas: TI = 4.0
   Cul-de-Sacs: TI = 5.0
   Local Streets: TI = 6.0
   Minor Collectors: TI = 6.5
   Major Collectors: TI = 8.0

Section 5
LIMITATIONS AND ADDITIONAL SERVICES

5.1 Limitations

The findings and professional opinions within this report are based on current information regarding the proposed Vega SES photo-voltaic solar power generation facility situated on the approximately 530-acre site located southwest of the intersection of Wixom Road and Drew Road approximately 7 miles southwest of El Centro, California. The conclusions and professional opinions of this report are invalid if:

- Structural loads change from those stated or the structures are relocated.
- The Additional Services section of this report is not followed.
- This report is used for adjacent or other property.
- Changes of grade or groundwater occur between the issuance of this report and construction other than those anticipated in this report.
- Any other change that materially alters the project from that proposed at the time this report was prepared.

Findings and professional opinions in this report are based on selected points of field exploration, geologic literature, laboratory testing, and our understanding of the proposed project. Our analysis of data and professional opinions presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil conditions can exist between and beyond the exploration points or groundwater elevations may change. If detected, these conditions may require additional studies, consultation, and possible design revisions.

This report contains information that may be useful in the preparation of contract specifications. However, the report is not worded is such a manner that we recommend its use as a construction specification document without proper modification. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report was prepared according to the generally accepted *geotechnical engineering standards of practice* that existed in Imperial County at the time the report was prepared. No express or implied warranties are made in connection with our services.

This report should be considered invalid for periods after two years from the report date without a review of the validity of the findings and professional opinions by our firm, because of potential changes in the Geotechnical Engineering Standards of Practice.

The client has responsibility to see that all parties to the project including, designer, contractor, and subcontractor are made aware of this entire report. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

5.2 Additional Services

We recommend that a qualified geotechnical consultant be retained to provide the tests and observations services during construction. *The geotechnical engineering firm providing such tests and observations shall become the geotechnical engineer of record and assume responsibility for the project.*

The professional opinions presented in this report are based on the assumption that:

- Consultation during development of design and construction documents to check that the geotechnical professional opinions are appropriate for the proposed project and that the geotechnical professional opinions are properly interpreted and incorporated into the documents.
- Landmark Consultants will have the opportunity to review and comment on the plans and specifications for the project prior to the issuance of such for bidding.
- Observation, inspection, and testing by the geotechnical consultant of record during site clearing, grading, excavation, placement of fills, building pad and subgrade preparation, and backfilling of utility trenches.
- Observation of foundation excavations and reinforcing steel before concrete placement.
- Other consultation as necessary during design and construction.

We emphasize our review of the project plans and specifications to check for compatibility with our professional opinions and conclusions. Additional information concerning the scope and cost of these services can be obtained from our office.

TABLES

Table 1
Summary of Characteristics of Closest Known Active Faults

Fault Name	Approximate Distance (miles)	Approximate Distance (km)	Maximum Moment Magnitude (Mw)	Fault Length (km)	Slip Rate (mm/yr)
Unnamed 1*	2.9	4.7			
Unnamed 2*	3.4	5.4			
Yuha*	4.5	7.2			
Shell Beds	8.2	13.1			
Superstition Hills	8.3	13.3	6.6	23 ± 2	4 ± 2
Yuha Well *	8.8	14.0			
Laguna Salada	10.0	16.0	7	67 ± 7	3.5 ± 1.5
Superstition Mountain	10.7	17.2	6.6	24 ± 2	5 ± 3
Vista de Anza*	11.5	18.4			
Borrego (Mexico)*	12.1	19.4			
Imperial	13.1	20.9	7	62 ± 6	20 ± 5
Brawley *	14.5	23.2			
Painted Gorge Wash*	15.3	24.5			
Ocotillo*	16.3	26.1			
Rico *	17.6	28.2			
Pescadores (Mexico)*	19.7	31.5			
Elsinore - Coyote Mountain	20.1	32.1	6.8	39 ± 4	4 ± 2
Cerro Prieto *	20.9	33.4			
Cucapah (Mexico)*	22.0	35.2			
Elmore Ranch	22.7	36.4	6.6	29 ± 3	1 ± 0.5
San Jacinto - Borrego	26.4	42.2	6.6	29 ± 3	4 ± 2
San Andreas - Coachella	43.0	68.7	7.2	96 ± 10	25 ± 5

* Note: Faults not included in CGS database.

Table 2
2016 California Building Code (CBC) and ASCE 7-10 Seismic Parameters

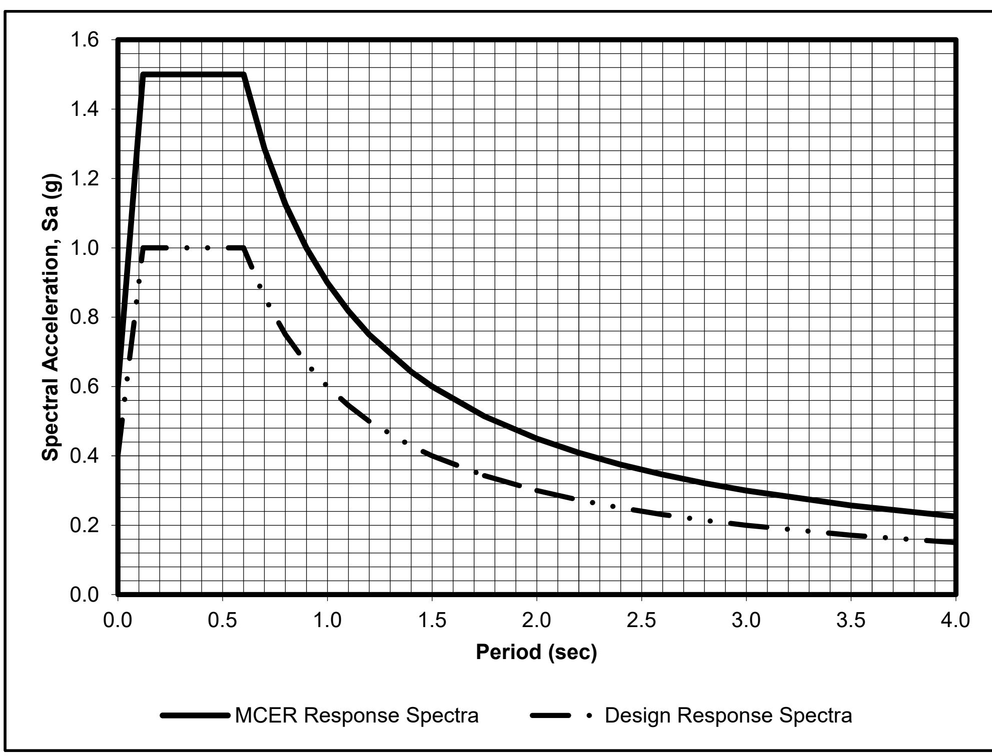
			CBC Reference
Soil Site Class:	**D**		Table 20.3-1
Latitude:	32.7295	N	
Longitude:	-115.6926	W	
Risk Category:	I		
Seismic Design Category:	D		

Maximum Considered Earthquake (MCE) Ground Motion

Mapped MCE_R Short Period Spectral Response	$\mathbf{S_s}$	1.500 g	Figure 1613.3.1(1)	
Mapped MCE_R 1 second Spectral Response	$\mathbf{S_1}$	0.600 g	Figure 1613.3.1(2)	
Short Period (0.2 s) Site Coefficient	$\mathbf{F_a}$	1.00	Table 1613.3.3(1)	
Long Period (1.0 s) Site Coefficient	$\mathbf{F_v}$	1.50	Table 1613.3.3(2)	
MCE_R Spectral Response Acceleration Parameter (0.2 s)	$\mathbf{S_{MS}}$	1.500 g	$= F_a * S_s$	Equation 16-37
MCE_R Spectral Response Acceleration Parameter (1.0 s)	$\mathbf{S_{M1}}$	0.900 g	$= F_v * S_1$	Equation 16-38

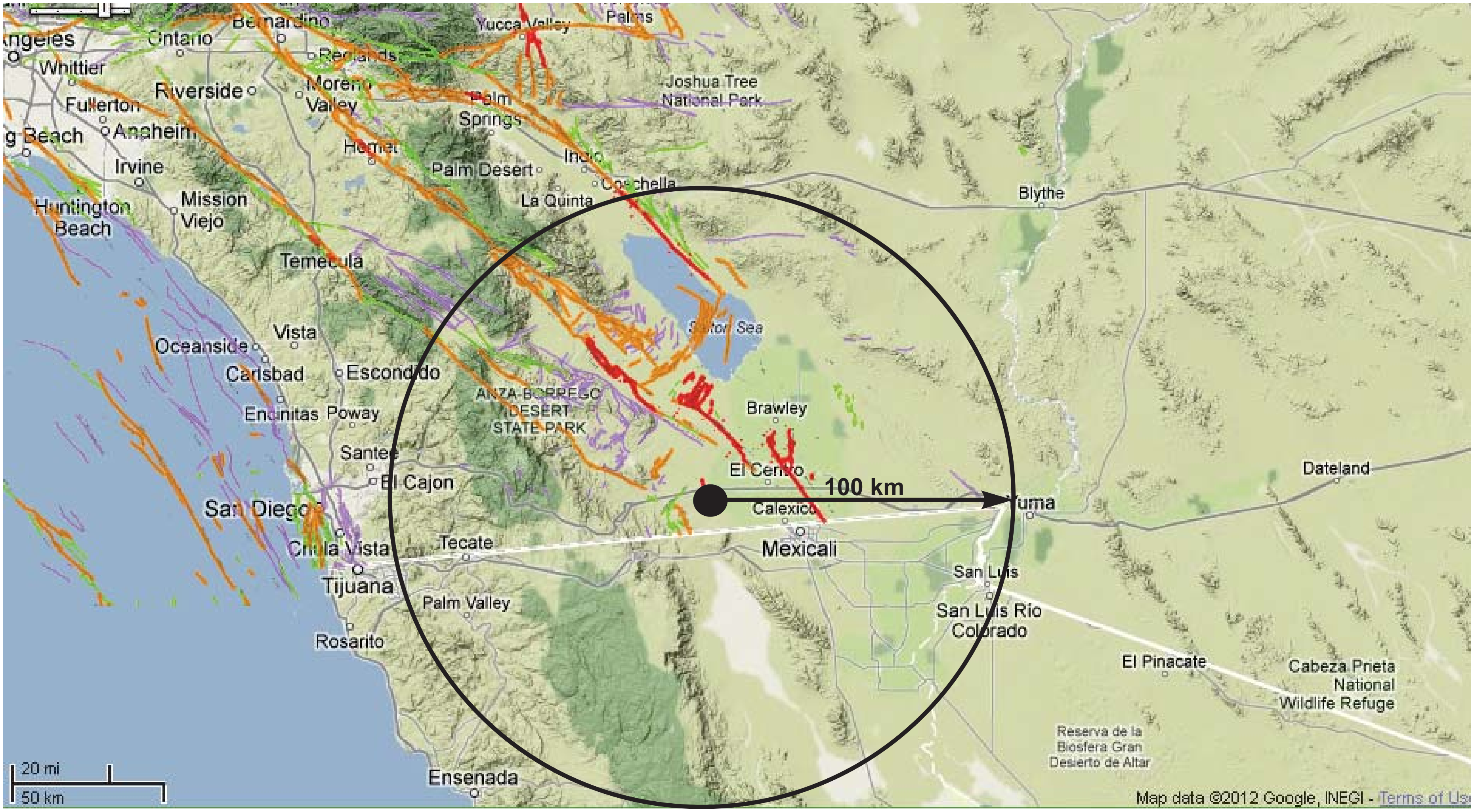
Design Earthquake Ground Motion

Design Spectral Response Acceleration Parameter (0.2 s)	$\mathbf{S_{DS}}$	1.000 g	$= 2/3*S_{MS}$	Equation 16-39
Design Spectral Response Acceleration Parameter (1.0 s)	$\mathbf{S_{D1}}$	0.600 g	$= 2/3*S_{M1}$	Equation 16-40
Risk Coefficient at Short Periods (less than 0.2 s)	$\mathbf{C_{RS}}$	1.124		ASCE Figure 22-17
Risk Coefficient at Long Periods (greater than 1.0 s)	$\mathbf{C_{R1}}$	1.097		ASCE Figure 22-18
	$\mathbf{T_L}$	8.00 sec		ASCE Figure 22-12
	$\mathbf{T_O}$	0.12 sec	$=0.2*S_{D1}/S_{DS}$	
	$\mathbf{T_S}$	0.60 sec	$=S_{D1}/S_{DS}$	
Peak Ground Acceleration	$\mathbf{PGA_M}$	0.50 g		ASCE Equation 11.8-1



Period T (sec)	Sa (g)	MCE_R Sa (g)
0.00	0.40	0.60
0.12	1.00	1.50
0.60	1.00	1.50
0.70	0.86	1.29
0.80	0.75	1.13
0.90	0.67	1.00
1.00	0.60	0.90
1.10	0.55	0.82
1.20	0.50	0.75
1.20	0.50	0.75
1.40	0.43	0.64
1.50	0.40	0.60
1.75	0.34	0.51
2.00	0.30	0.45
2.20	0.27	0.41
2.40	0.25	0.38
2.60	0.23	0.35
2.80	0.21	0.32
3.00	0.20	0.30
3.50	0.17	0.26
4.00	0.15	0.23

FIGURES



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#

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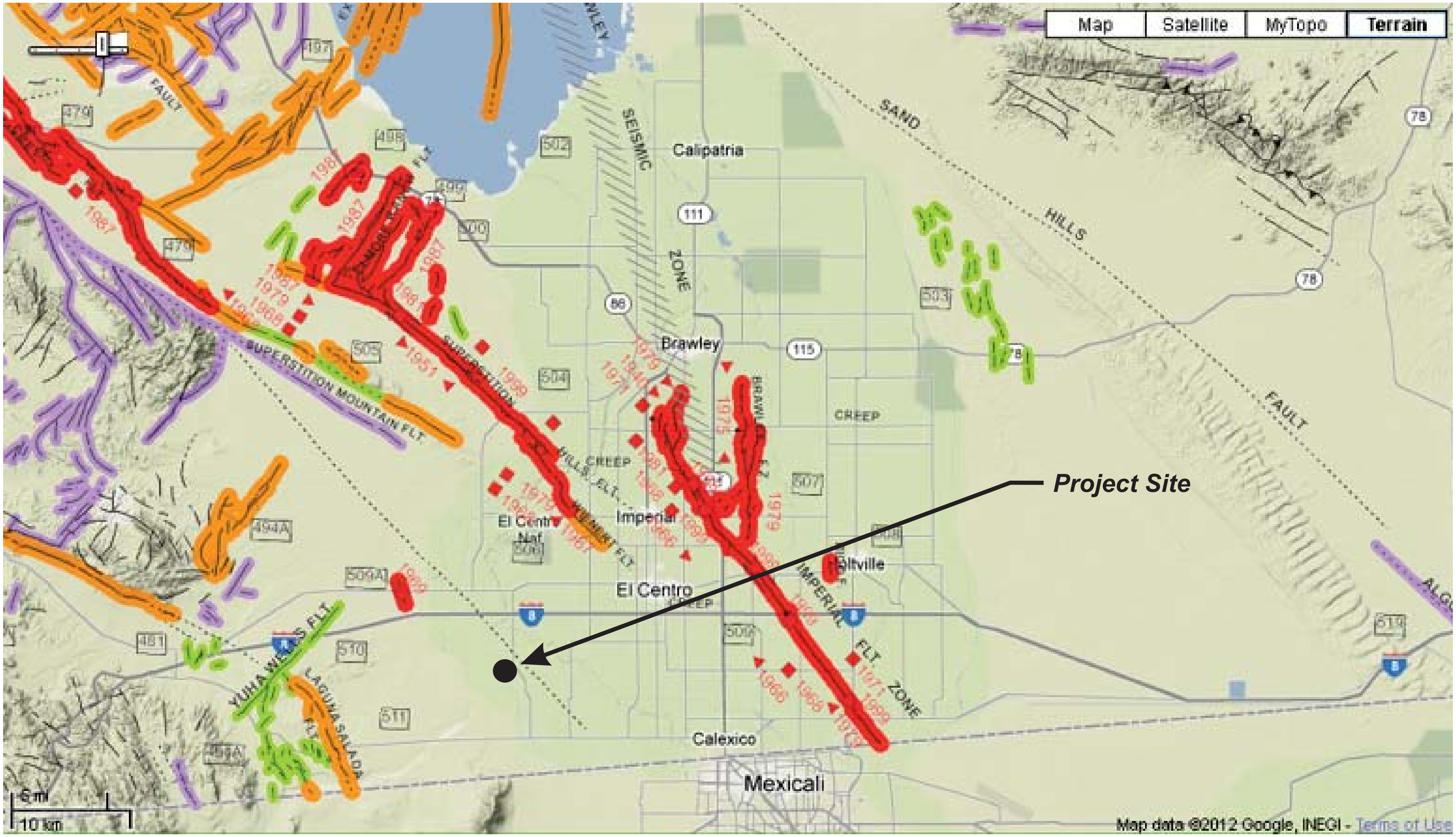
Regional Fault Map

Figure 1



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#

LANDMARK Geo-Engineers and Geologists Project No.: LE18083	Map of Local Faults	Figure 2

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain. Concealed faults in the Great Valley are based on maps of selected subsurface horizons, so locations shown are approximate and may indicate structural trend only. All offshore faults based on seismic reflection profile records are shown as solid lines where well defined, dashed where inferred, queried where uncertain.

FAULT CLASSIFICATION COLOR CODE
(Indicating Recency of Movement)

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.

A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened. On offshore faults, barbs simply indicate a reverse fault regardless of steepness of dip.

OTHER SYMBOLS

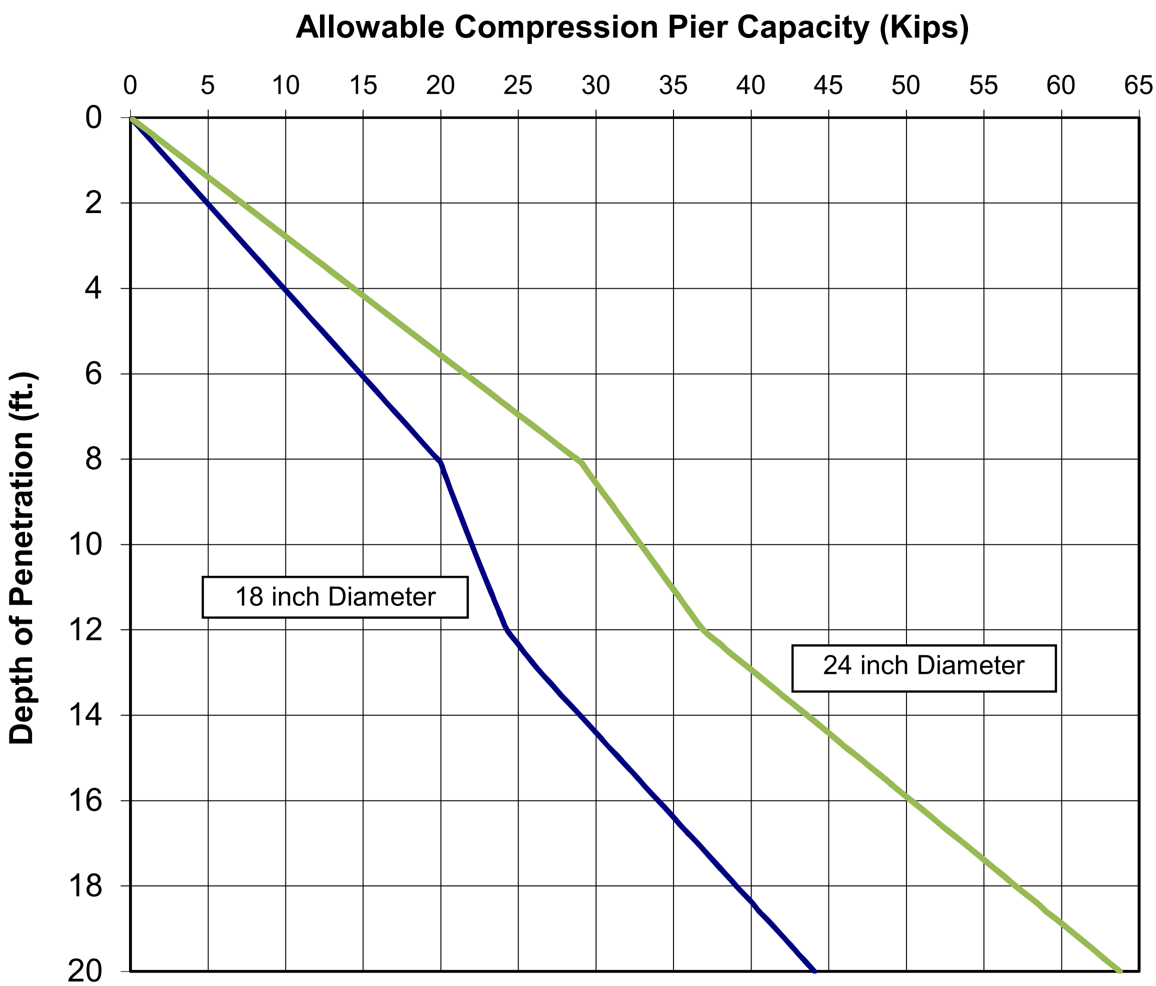
Numbers refer to annotations listed in the appendices of the accompanying report. Annotations include fault name, age of fault displacement, and pertinent references including Earthquake Fault Zone maps where a fault has been zoned by the Alquist-Priolo Earthquake Fault Zoning Act. This Act requires the State Geologist to delineate zones to encompass faults with Holocene displacement.

Structural discontinuity (offshore) separating differing Neogene structural domains. May indicate discontinuities between basement rocks.

Brawley Seismic Zone, a linear zone of seismicity locally up to 10 km wide associated with the releasing step between the Imperial and San Andreas faults.

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION ON LAND	DESCRIPTION OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	11,700			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	700,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		1,600,000*			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.



Notes:

1. Compression load capacity are based on skin friction and end-bearing capacity. The structural capacity of the piers should be checked.

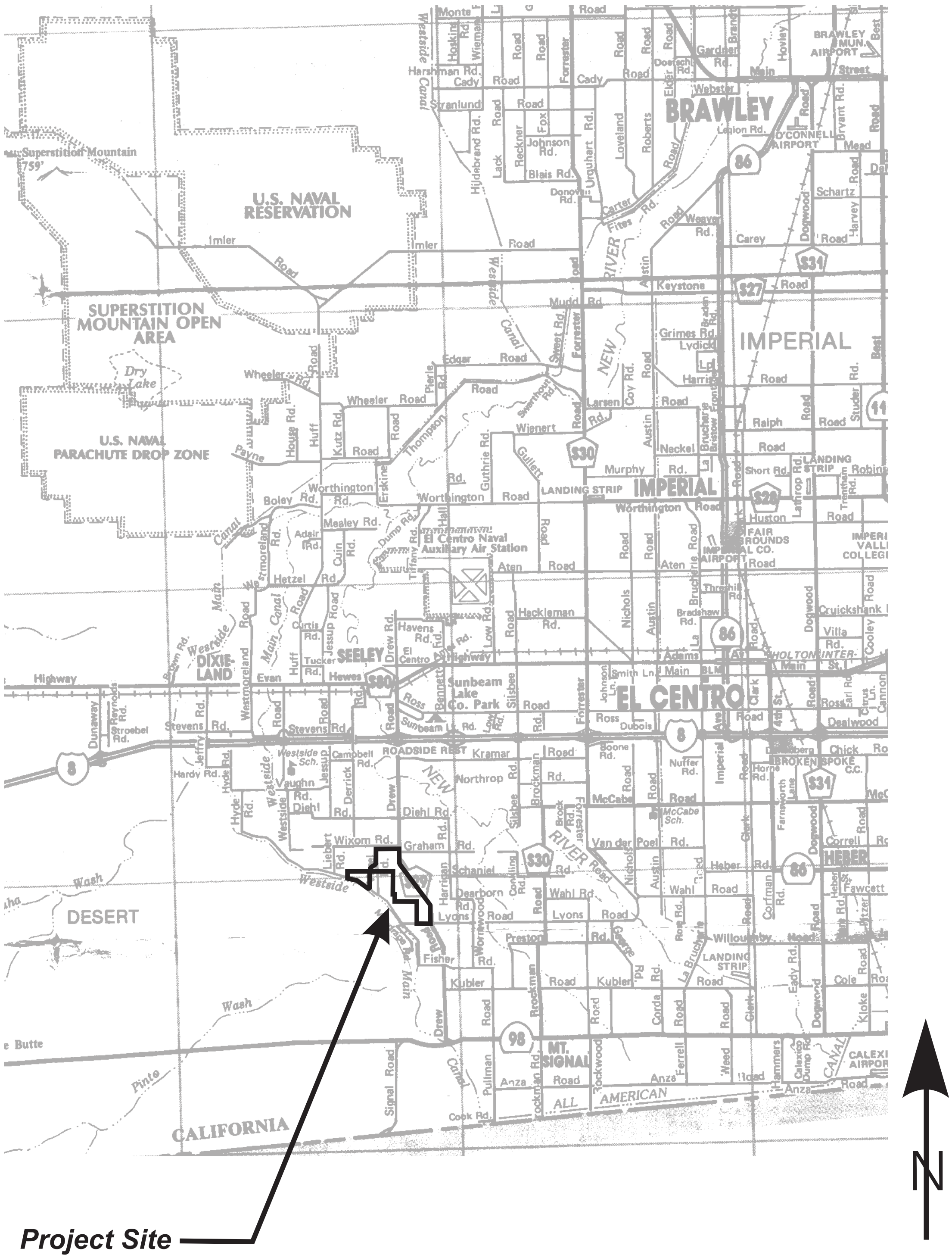
2. The indicated capacities are for sustained (dead plus live) vertical compression load, and include a factor of safety of at least 3.0

3. For temporary wind or seismic load, the above values may be increased by one-third.

4. Capacities of other pier sizes are in direct proportion to the pier diameter.

LANDMARK Geo-Engineers and Geologists **Project No.: LE18083**	**Drilled Pier Compression Capacity Chart** **Vega SES Solar Facility** **El Centro, California**	**Figure** **3**

APPENDIX A



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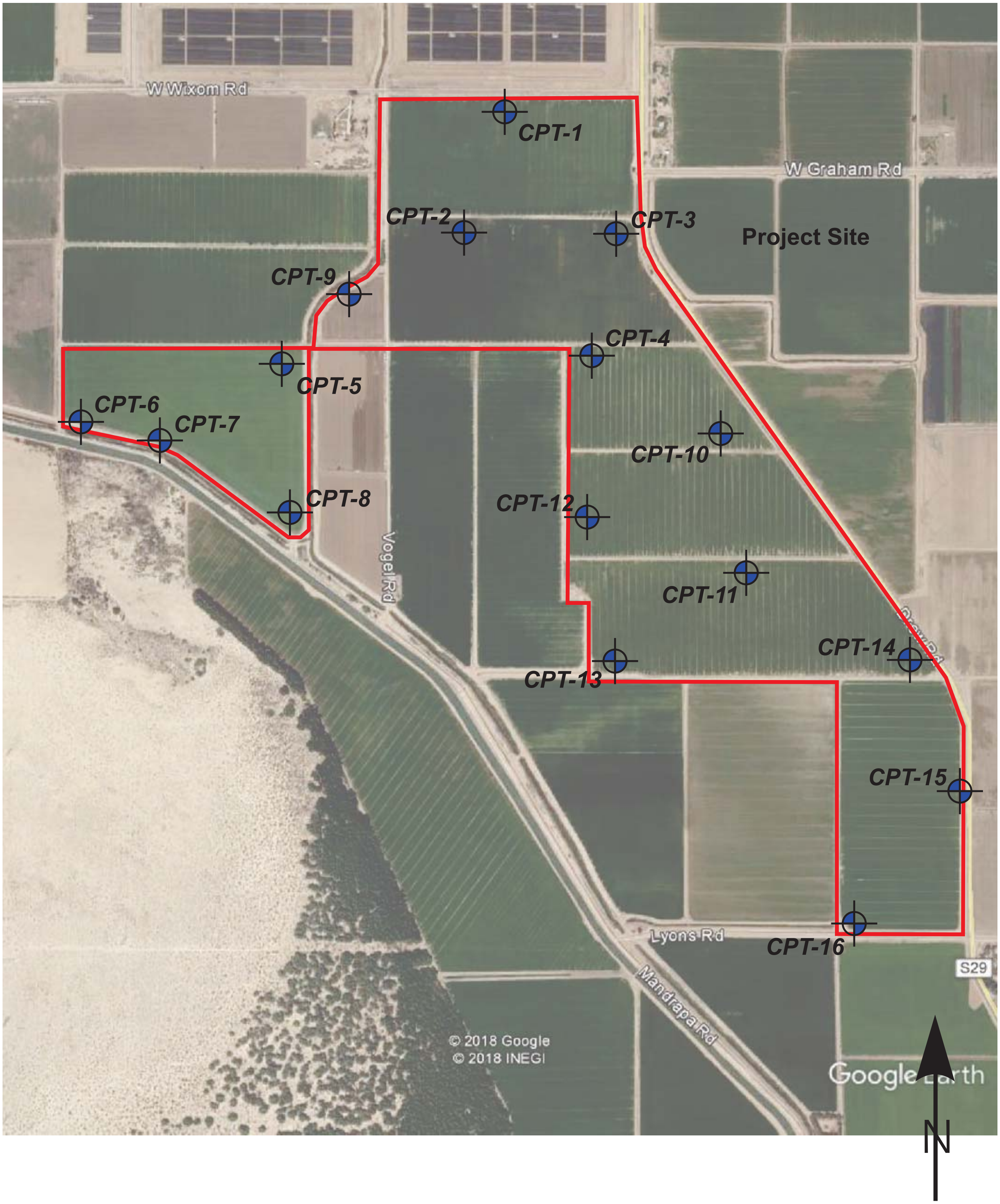
Vicinity Map

Plate
A-1



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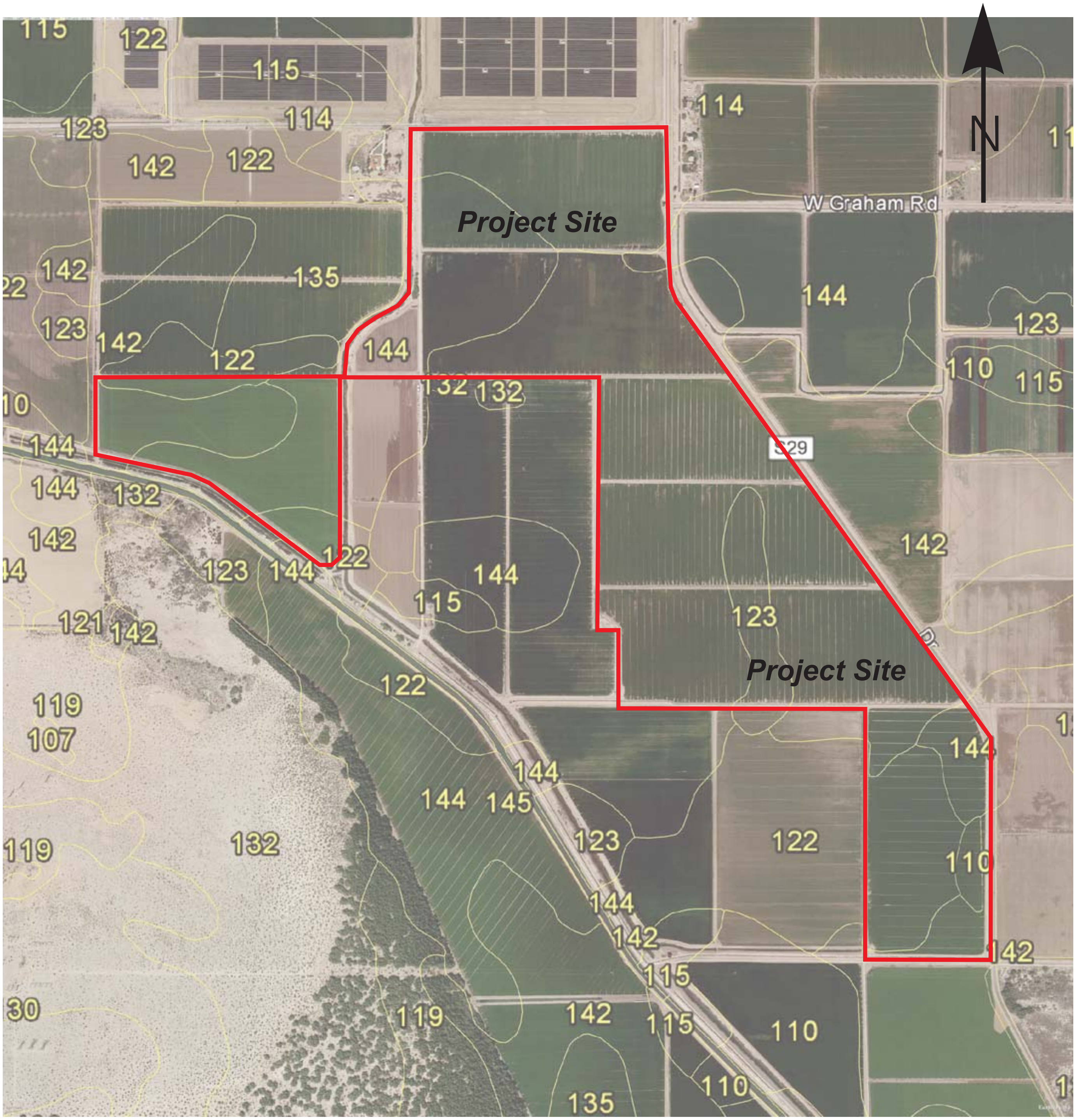
Site and Exploration Map

Plate
A-2



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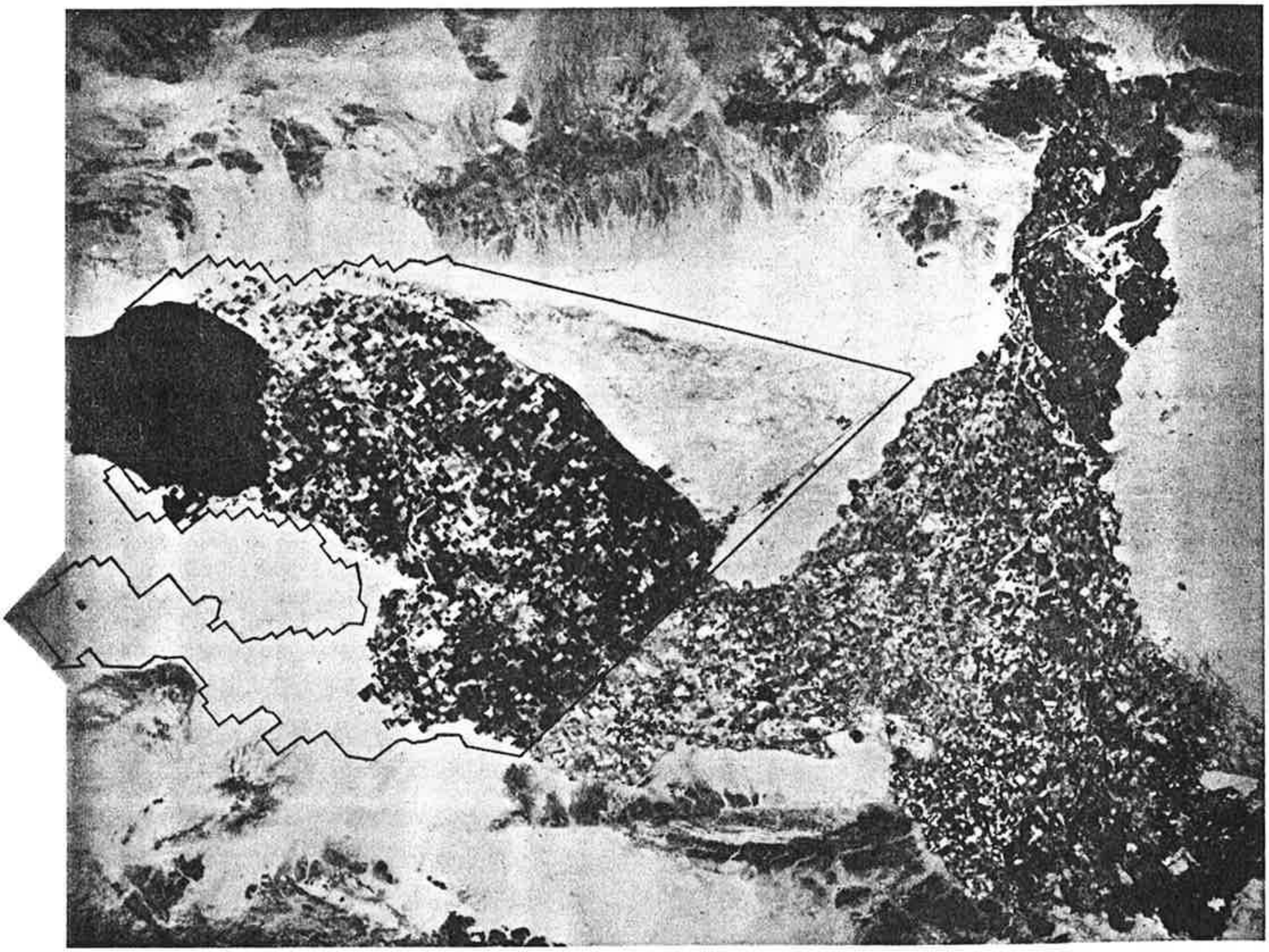
Soil Survey Map

Plate
A-3

Soil Survey of

IMPERIAL COUNTY CALIFORNIA IMPERIAL VALLEY AREA



United States Department of Agriculture Soil Conservation Service
in cooperation with
University of California Agricultural Experiment Station
and
Imperial Irrigation District

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
100---------------- Antho	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho--------------	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition------	0-6	Fine sand-------	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*. Badland											
103---------------- Carsitas	0-10	Gravelly sand---	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104* Fluvaquents											
105---------------- Glenbar	0-13	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106---------------- Glenbar	0-13	Clay loam-------	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*--------------- Glenbar	0-13	Loam-----------	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108---------------- Holtville	0-14	Loam-----------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109---------------- Holtville	0-17	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110---------------- Holtville	0-17	Silty clay------	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
111*:											
Holtville----------	0-10	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	10-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
Imperial----------	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
112---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
113---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	100	85-95	50-70	25-45
114---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
115*:											
Imperial----------	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
116*:											
Imperial----------	0-13	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	13-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
117, 118----------- Indio	0-12	Loam------------	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
119*:											
Indio-------------	0-12	Loam------------	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
Vint--------------	0-10	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	25-35	---	NP
	10-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
120*--------------- Laveen	0-12	Loam------------	ML, CL-ML	A-4	0	100	95-100	75-85	55-65	20-30	NP-10
	12-60	Loam, very fine sandy loam.	ML, CL-ML	A-4	0	95-100	85-95	70-80	55-65	15-25	NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

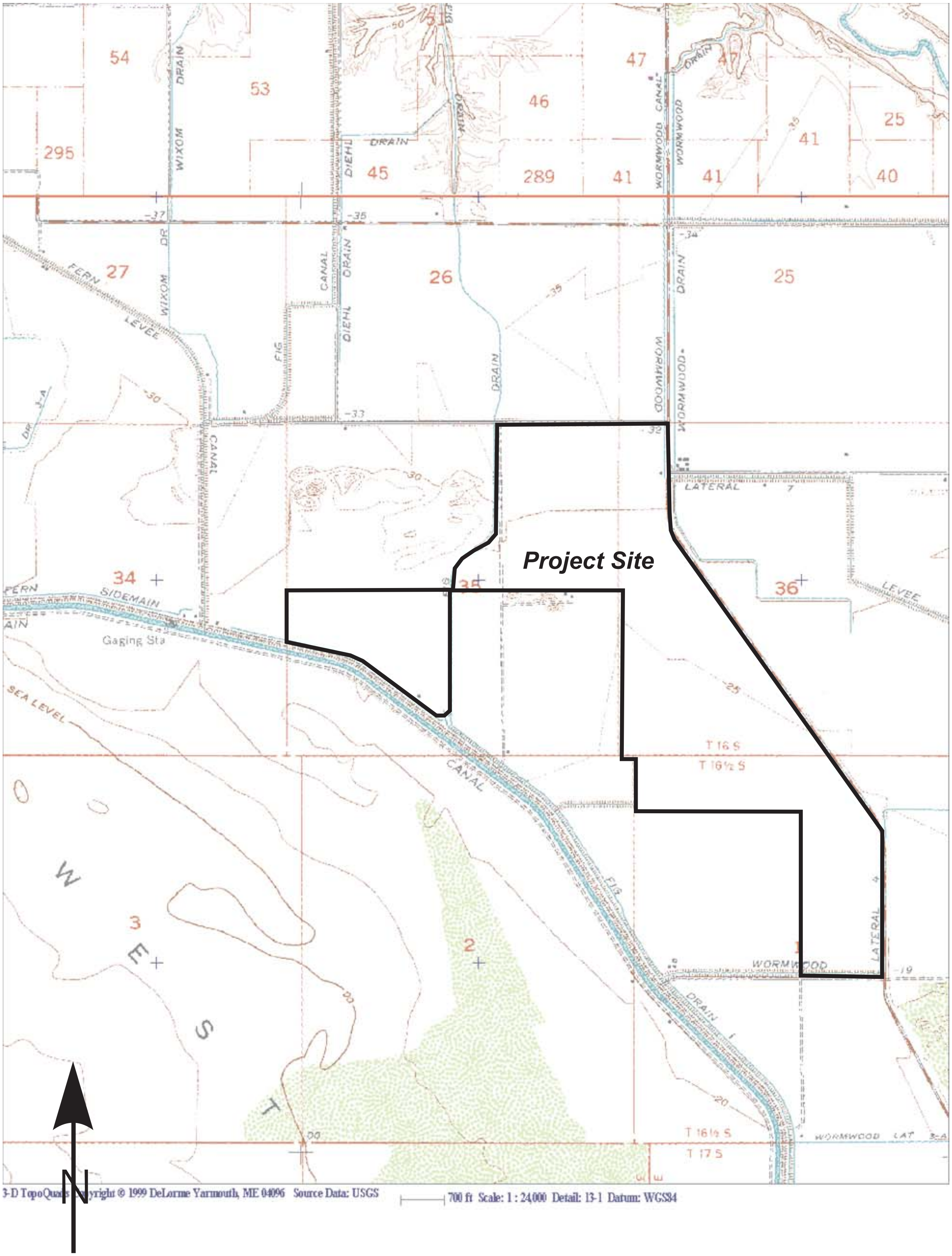
Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
121----------------- Meloland	0-12	Fine sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122----------------- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*:											
Meloland----------	0-12	Loam-------------	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville---------	0-12	Loam-------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125----------- Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126----------------- Niland	0-23	Fine sand-------	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127----------------- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*:											
Niland------------	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial----------	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131----------- Rositas	0-27	Sand------------	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
132, 133, 134, 135- Rositas	0-9	Fine sand	SM	A-3, A-2	0	100	80-100	50-80	10-25	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
136 Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
137 Rositas	0-12	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-30	NP-5
	12-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
138*:											
Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
139 Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
140*:											
Torriorthents											
Rock outcrop											
141*:											
Torriorthents											
Orthids											
142 Vint	0-10	Loamy very fine sand.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
143 Vint	0-12	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-85	45-55	15-25	NP-5
	12-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
144*:											
Vint	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-40	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
	40-60	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Indio	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-40	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	40-72	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35

* See description of the map unit for composition and behavior characteristics of the map unit.

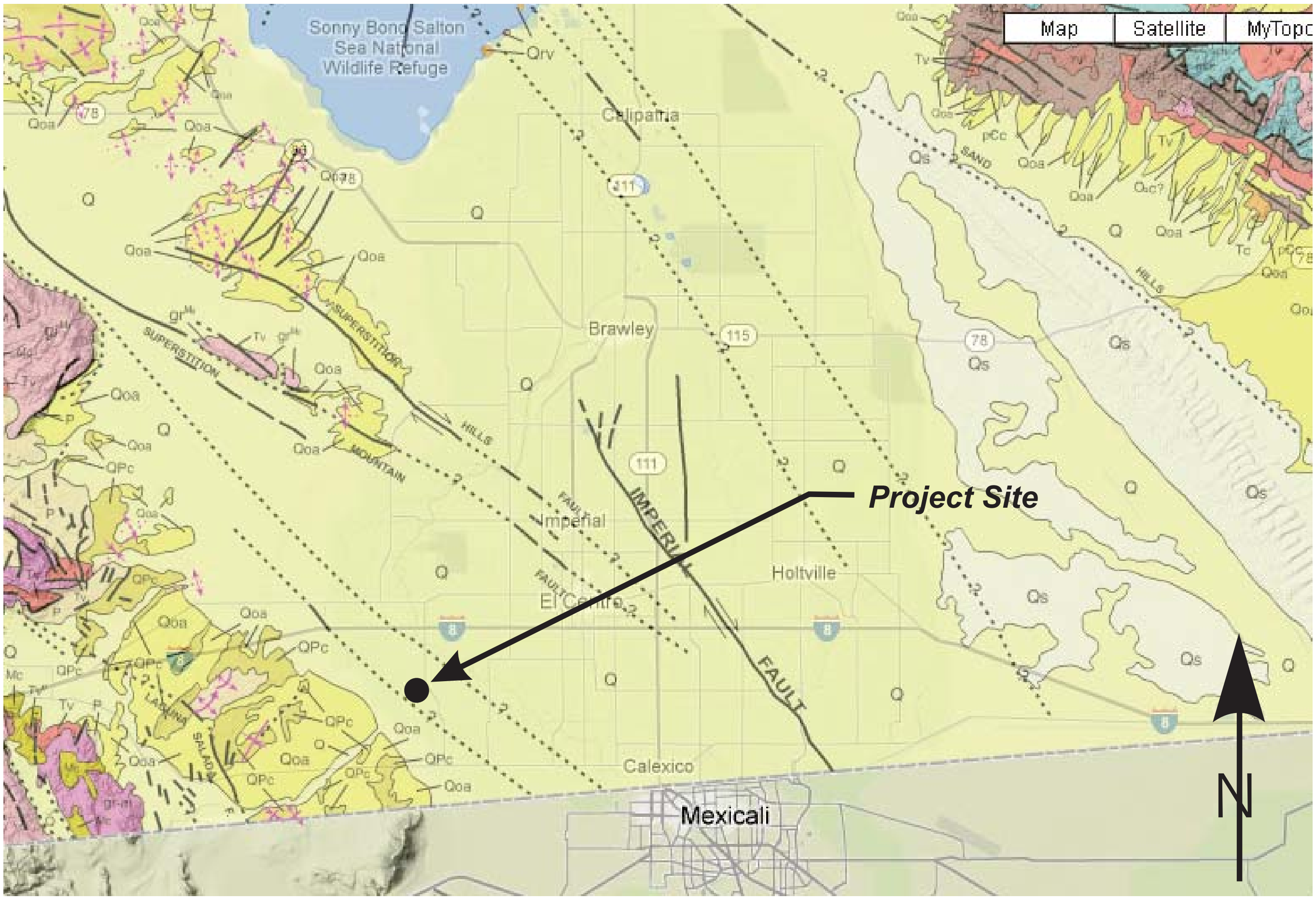


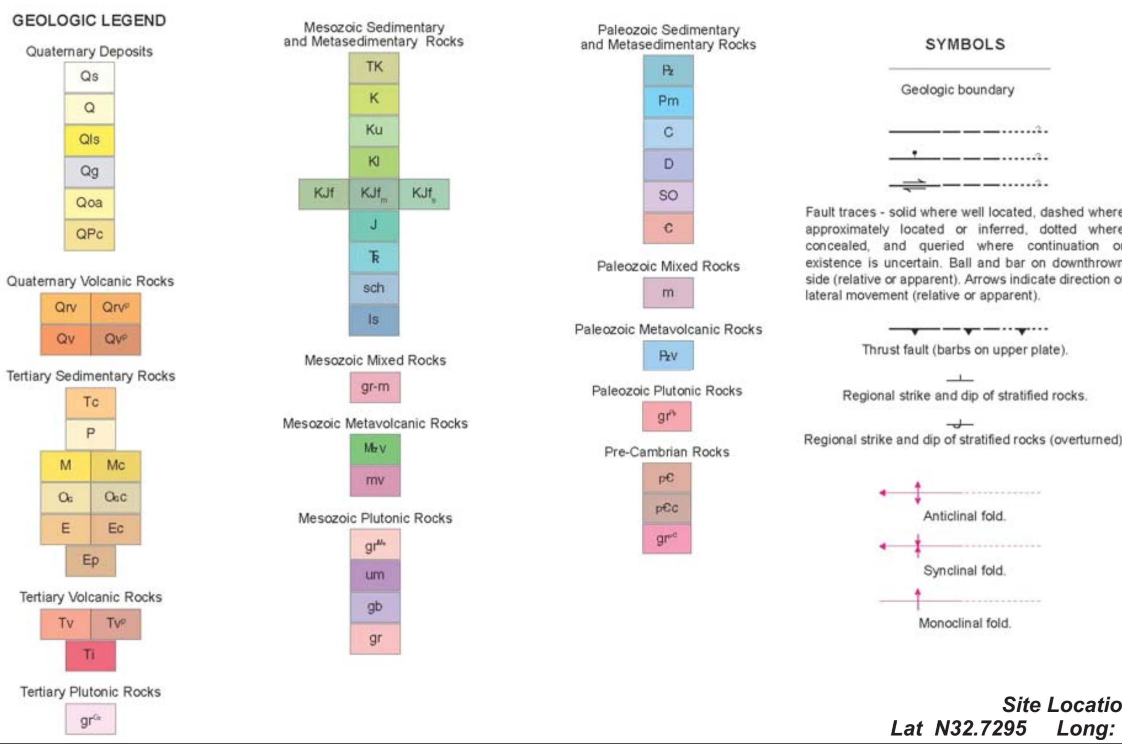
LANDMARK
Geo-Engineers and Geologists

Project No.: LE18083

Topographic Map

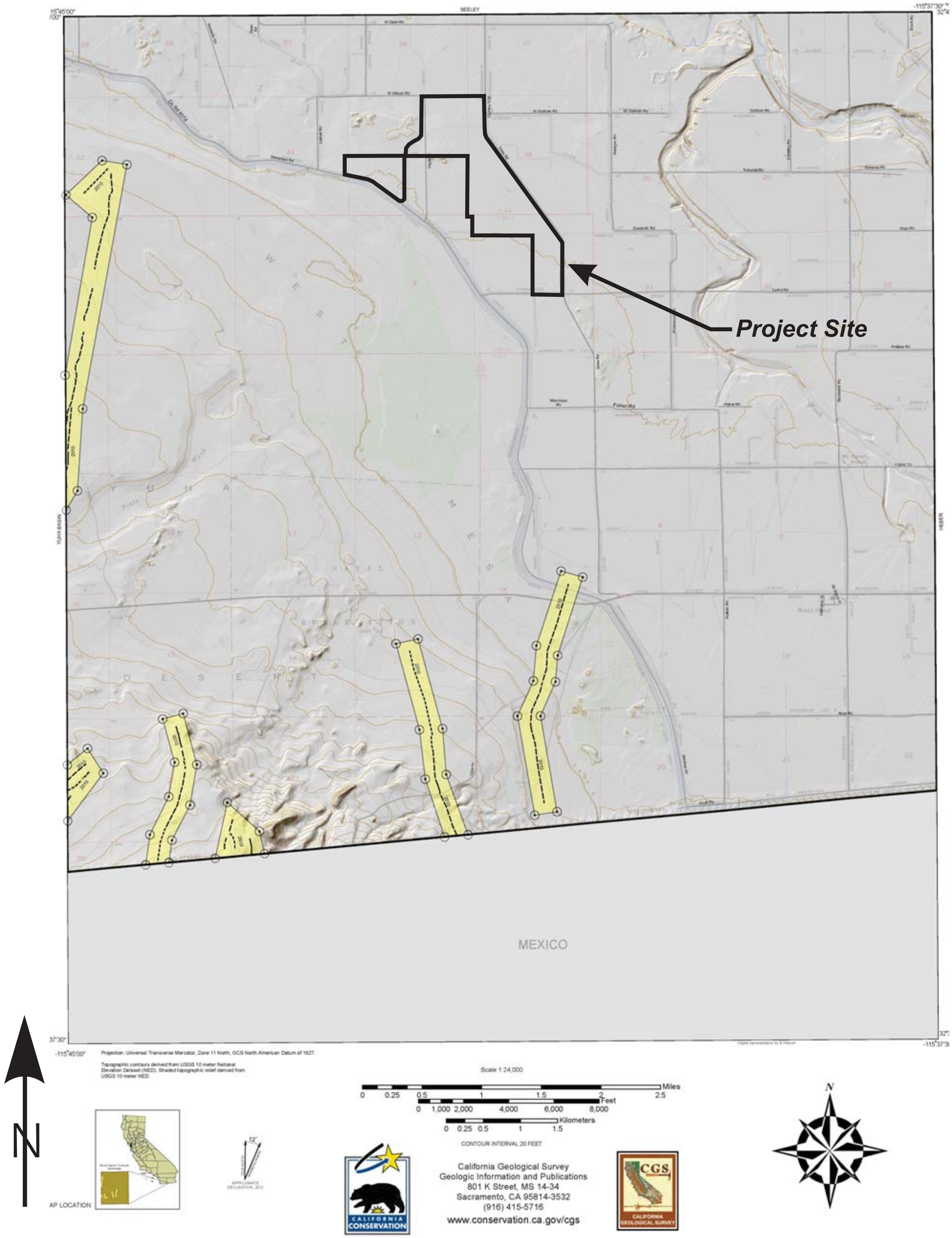
Plate
A-4





Site Location
Lat N32.7295 Long: W-115.6926

LANDMARK Geo-Engineers and Geologists **Project No.: LE18083**	**Regional Geologic Map**	**Plate A-5**

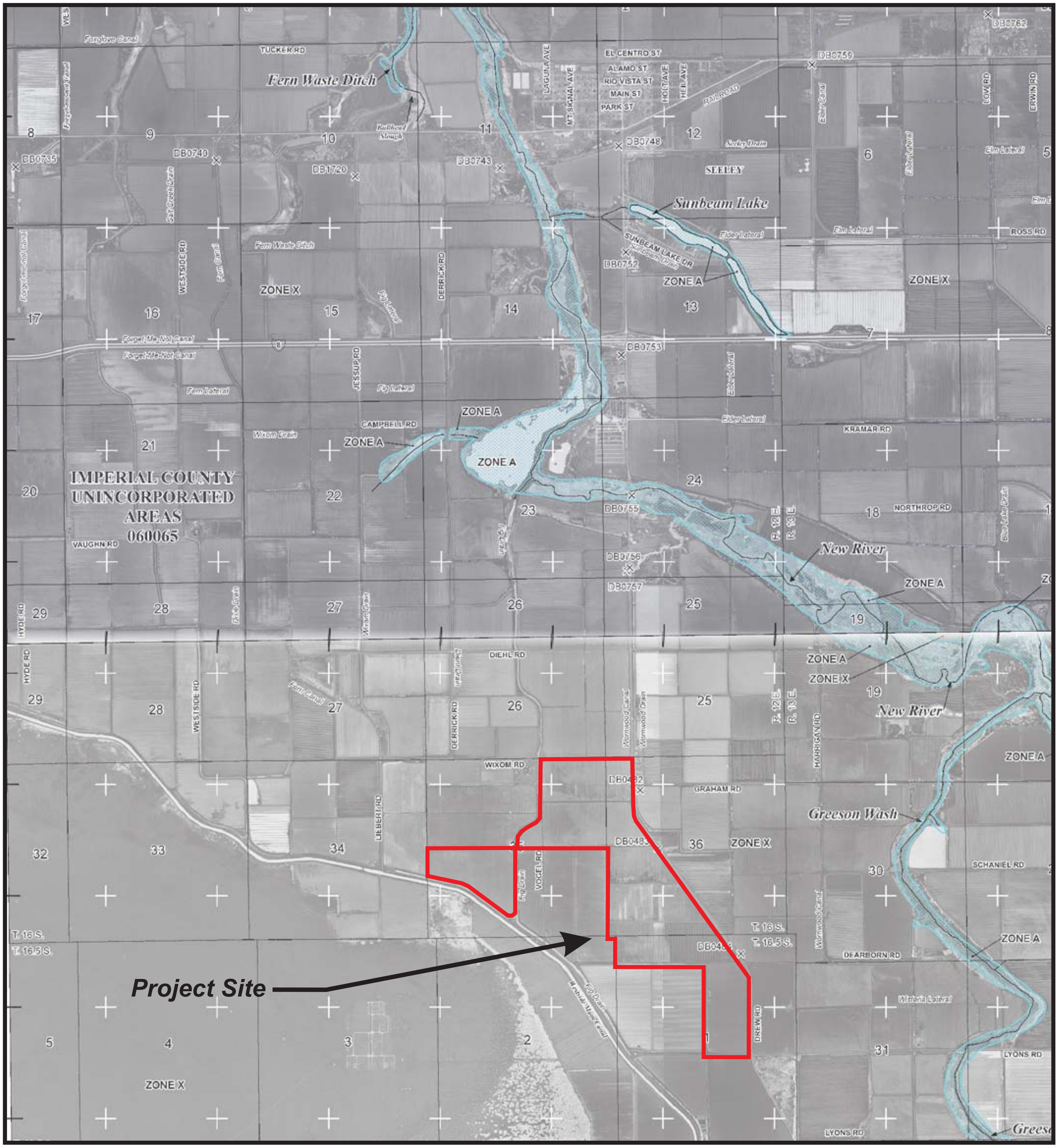


LANDMARK
Geo-Engineers and Geologists

Project No.: LE18083

A-P Earthquake Fault Zone Map

Plate
A-6



Reference: Federal Emergency Management Agency (FEMA)
Imperial County-Panel Numbers 06025C1770C and 06025C2050C

LANDMARK Geo-Engineers and Geologists **Project No.: LE18083**	**Flood Insurance Rate Map (FIRM)**	**Plate** **A-7**

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 11N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPSZONE 0406), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

APPENDIX B

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-1

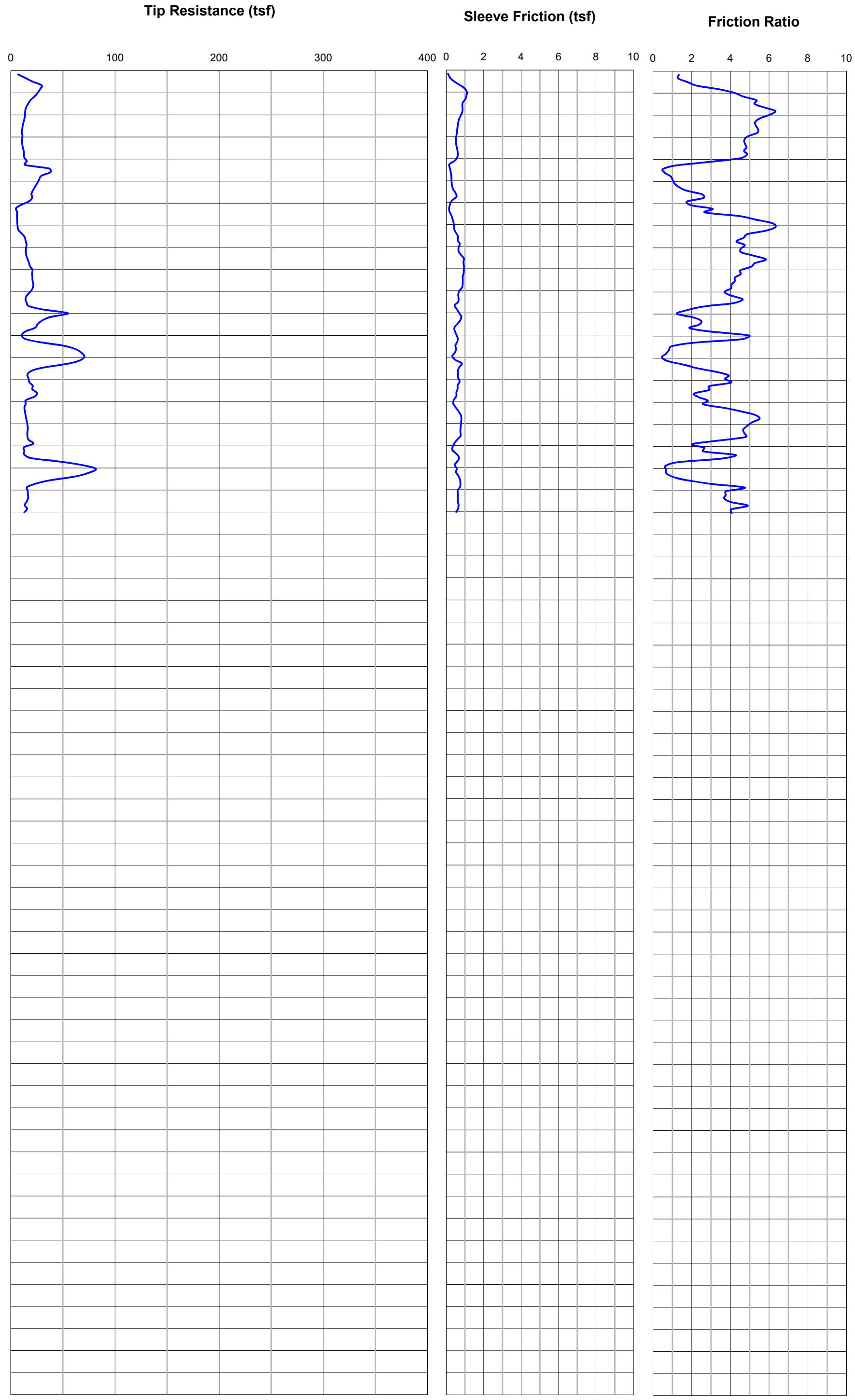
DEPTH

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Clayey Silt to Silty Clay	ML/CL	very stiff
Clay	CL/CH	stiff
Clay	" "	stiff
Clay	" "	stiff
Sandy Silt to Clayey Silt	ML	medium dense
Sandy Silt to Clayey Silt	" "	medium dense
Clay	CL/CH	firm
Clay	" "	stiff
Clay	" "	stiff
Silty Clay to Clay	CL	very stiff
Clayey Silt to Silty Clay	ML/CL	very stiff
Clayey Silt to Silty Clay	" "	very stiff
Silty Sand to Sandy Silt	SM/ML	medium dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clay	CL/CH	stiff
Silty Clay to Clay	CL	stiff
Sandy Silt to Clayey Silt	ML	medium dense
Sandy Silt to Clayey Silt	" "	medium dense
Silty Clay to Clay	CL	stiff

5 10 15 20 25 30 35 40 45 50 55



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-1

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-1
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	14.03	1.47	Sandy Silt to Clayey Silt	ML	dense	115	4	26.5	65	76	39		
0.30	1.0	27.94	3.31	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		60			1.64	>10
0.45	1.5	19.71	5.08	Clay	CL/CH	very stiff	125	16		85			1.16	>10
0.60	2.0	14.14	6.04	Clay	CL/CH	stiff	125	11		100			0.83	>10
0.75	2.5	12.38	5.38	Clay	CL/CH	stiff	125	10		100			0.72	>10
0.93	3.0	10.93	5.24	Clay	CL/CH	stiff	125	9		100			0.63	>10
1.08	3.5	11.02	4.77	Clay	CL/CH	stiff	125	9		100			0.64	>10
1.23	4.0	12.68	4.70	Clay	CL/CH	stiff	125	10		100			0.73	>10
1.38	4.5	21.94	1.58	Sandy Silt to Clayey Silt	ML	medium dense	115	6	41.5	50	47	35		
1.53	5.0	31.62	0.84	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	57.2	30	56	36		
1.68	5.5	22.50	1.68	Sandy Silt to Clayey Silt	ML	medium dense	115	6	38.8	50	45	34		
1.83	6.0	16.22	2.10	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		65			0.93	>10
1.98	6.5	5.68	3.40	Clay	CL/CH	firm	125	5		100			0.31	5.00
2.13	7.0	6.27	5.95	Clay	CL/CH	firm	125	5		100			0.35	5.42
2.28	7.5	10.48	5.14	Clay	CL/CH	stiff	125	8		100			0.59	>10
2.45	8.0	14.62	4.53	Clay	CL/CH	stiff	125	12		90			0.84	>10
2.60	8.5	15.13	5.21	Clay	CL/CH	stiff	125	12		95			0.86	>10
2.75	9.0	18.86	4.95	Clay	CL/CH	very stiff	125	15		85			1.08	>10
2.90	9.5	20.70	4.33	Silty Clay to Clay	CL	very stiff	125	12		80			1.19	>10
3.05	10.0	20.52	3.92	Silty Clay to Clay	CL	very stiff	125	12		75			1.18	>10
3.20	10.5	14.94	4.30	Clay	CL/CH	stiff	125	12		90			0.85	>10
3.35	11.0	34.76	1.86	Sandy Silt to Clayey Silt	ML	medium dense	115	10	47.7	45	51	35		
3.50	11.5	31.39	2.32	Sandy Silt to Clayey Silt	ML	medium dense	115	9	42.5	55	47	35		
3.65	12.0	16.05	3.35	Silty Clay to Clay	CL	stiff	125	9		85			0.91	>10
3.80	12.5	31.06	2.54	Sandy Silt to Clayey Silt	ML	medium dense	115	9	40.9	55	46	34		
3.95	13.0	67.31	0.65	Sand to Silty Sand	SP/SM	medium dense	115	12	87.7	15	69	38		
4.13	13.5	50.22	1.51	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	64.7	35	60	36		
4.28	14.0	17.27	3.63	Silty Clay to Clay	CL	stiff	125	10		85			0.98	>10
4.43	14.5	19.81	3.28	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		80			1.13	>10
4.58	15.0	20.82	2.44	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		70			1.19	>10
4.73	15.5	13.63	3.64	Silty Clay to Clay	CL	stiff	125	8		100			0.76	>10
4.88	16.0	15.09	5.20	Clay	CL/CH	stiff	125	12		100			0.85	>10
5.03	16.5	16.07	4.73	Clay	CL/CH	stiff	125	13		100			0.91	>10
5.18	17.0	17.23	2.70	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		85			0.97	>10
5.33	17.5	15.04	3.46	Silty Clay to Clay	CL	stiff	125	9		100			0.84	>10
5.48	18.0	66.60	0.86	Sand to Silty Sand	SP/SM	medium dense	115	12	77.1	25	65	37		
5.65	18.5	59.78	1.16	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	68.6	30	61	37		
5.80	19.0	18.86	3.85	Silty Clay to Clay	CL	very stiff	125	11		95			1.07	>10
5.95	19.5	16.10	3.82	Silty Clay to Clay	CL	stiff	125	9		100			0.90	>10
6.10	20.0	13.99	4.34	Clay	CL/CH	stiff	125	11		100			0.78	6.43

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-2

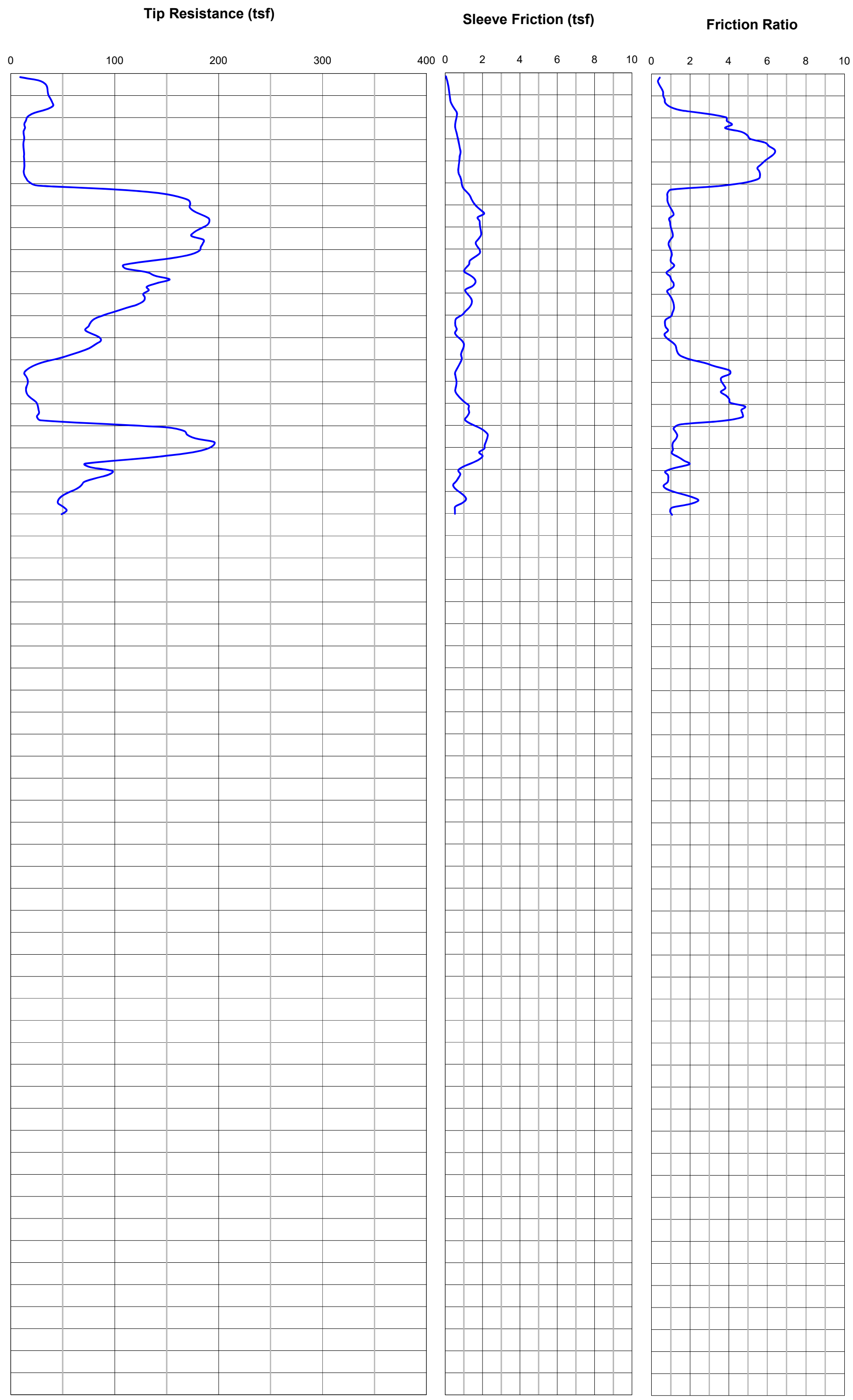
DEPTH

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Silty Sand to Sandy Silt	SM/ML	dense
Sandy Silt to Clayey Silt	ML	dense
Clay	CL/CH	stiff
Clay	" "	stiff
Clay	" "	stiff
Sand to Silty Sand	SP/SM	very dense
Sand	SP	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	very dense
Sand	SP	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Silty Sand to Sandy Silt	SM/ML	dense
Silty Clay to Clay	CL	very stiff
Silty Clay to Clay	" "	very stiff
Clayey Silt to Silty Clay	ML/CL	hard
Sand	SP	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	medium dense
Silty Sand to Sandy Silt	SM/ML	medium dense

5 10 15 20 25 30 35 40 45 50 55



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-2

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-2
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	23.55	0.39	Silty Sand to Sandy Silt	SM/ML	very dense	115	5	44.5	30	92	41		
0.30	1.0	35.66	0.57	Silty Sand to Sandy Silt	SM/ML	dense	115	8	67.4	25	88	40		
0.45	1.5	39.57	0.78	Silty Sand to Sandy Silt	SM/ML	dense	115	9	74.8	25	83	40		
0.60	2.0	23.78	2.73	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		60			1.39	>10
0.75	2.5	13.80	3.97	Clay	CL/CH	stiff	125	11		90			0.80	>10
0.93	3.0	12.61	4.92	Clay	CL/CH	stiff	125	10		100			0.73	>10
1.08	3.5	12.28	6.12	Clay	CL/CH	stiff	125	10		100			0.71	>10
1.23	4.0	12.83	6.13	Clay	CL/CH	stiff	125	10		100			0.74	>10
1.38	4.5	12.85	5.59	Clay	CL/CH	stiff	125	10		100			0.74	>10
1.53	5.0	15.10	5.36	Clay	CL/CH	stiff	125	12		95			0.87	>10
1.68	5.5	105.03	1.55	Sand to Silty Sand	SP/SM	very dense	115	19	181.0	20	90	41		
1.83	6.0	171.83	0.89	Sand	SP	very dense	110	26	283.9	10	103	42		
1.98	6.5	182.88	1.05	Sand	SP	very dense	110	28	297.1	10	105	43		
2.13	7.0	187.20	0.99	Sand	SP	very dense	110	29	299.2	10	105	43		
2.28	7.5	178.49	1.05	Sand	SP	very dense	110	27	280.8	10	103	42		
2.45	8.0	183.11	0.94	Sand	SP	very dense	110	28	283.7	10	103	42		
2.60	8.5	154.11	1.02	Sand	SP	very dense	110	24	235.2	10	98	42		
2.75	9.0	116.72	0.98	Sand to Silty Sand	SP/SM	dense	115	21	175.5	15	89	40		
2.90	9.5	144.24	1.04	Sand	SP	very dense	110	22	213.7	10	95	41		
3.05	10.0	130.41	0.94	Sand	SP	very dense	110	20	190.6	10	92	41		
3.20	10.5	126.00	1.10	Sand to Silty Sand	SP/SM	very dense	115	23	181.6	15	90	41		
3.35	11.0	99.11	1.09	Sand to Silty Sand	SP/SM	dense	115	18	140.8	15	83	40		
3.50	11.5	77.15	0.72	Sand to Silty Sand	SP/SM	dense	115	14	108.1	15	75	38		
3.65	12.0	78.11	0.77	Sand to Silty Sand	SP/SM	dense	115	14	108.0	15	75	38		
3.80	12.5	81.21	1.18	Sand to Silty Sand	SP/SM	dense	115	15	110.8	20	76	39		
3.95	13.0	55.81	1.62	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	75.2	35	64	37		
4.13	13.5	22.20	3.38	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		75			1.27	>10
4.28	14.0	14.81	3.77	Silty Clay to Clay	CL	stiff	125	8		90			0.84	>10
4.43	14.5	15.24	3.72	Silty Clay to Clay	CL	stiff	125	9		90			0.86	>10
4.58	15.0	20.28	3.99	Silty Clay to Clay	CL	very stiff	125	12		85			1.16	>10
4.73	15.5	26.59	4.74	Clay	CL/CH	very stiff	125	21		80			1.53	>10
4.88	16.0	73.72	2.76	Sandy Silt to Clayey Silt	ML	medium dense	115	21	91.7	40	70	38		
5.03	16.5	171.44	1.28	Sand to Silty Sand	SP/SM	very dense	115	31	211.0	15	95	41		
5.18	17.0	192.75	1.10	Sand	SP	very dense	110	30	234.8	10	98	42		
5.33	17.5	141.57	1.37	Sand to Silty Sand	SP/SM	dense	115	26	170.8	20	88	40		
5.48	18.0	82.03	1.31	Sand to Silty Sand	SP/SM	dense	115	15	98.0	25	72	38		
5.65	18.5	82.62	0.85	Sand to Silty Sand	SP/SM	dense	115	15	97.7	20	72	38		
5.80	19.0	62.14	0.95	Sand to Silty Sand	SP/SM	medium dense	115	11	72.8	25	63	37		
5.95	19.5	46.88	2.16	Sandy Silt to Clayey Silt	ML	medium dense	115	13	54.4	50	55	36		
6.10	20.0	51.13	1.03	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	58.8	35	57	36		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

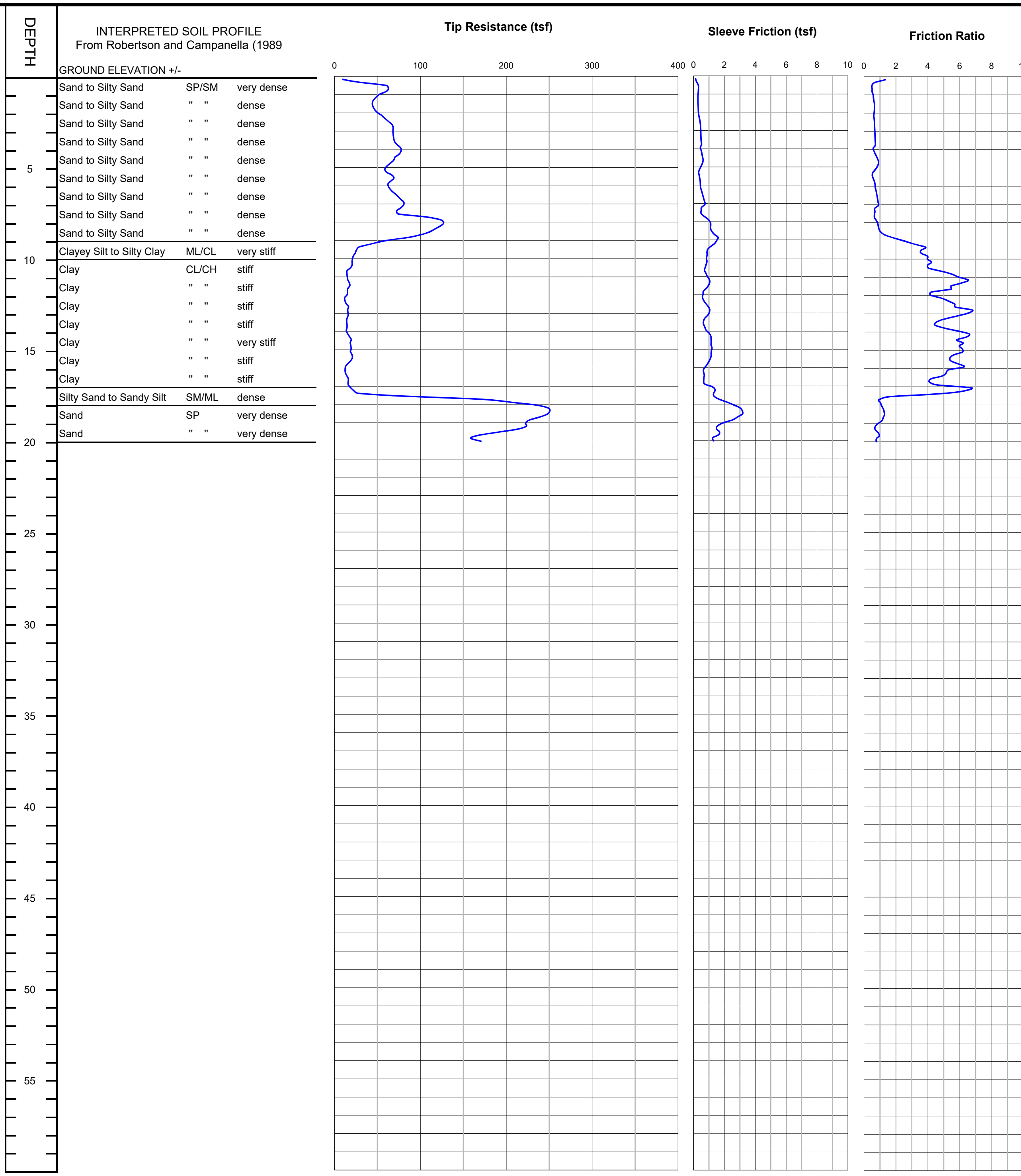
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-3

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand to Silty Sand	SP/SM	very dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clay	CL/CH	stiff
Clay	" "	stiff
Clay	" "	stiff
Clay	" "	stiff
Clay	" "	very stiff
Clay	" "	stiff
Clay	" "	stiff
Silty Sand to Sandy Silt	SM/ML	dense
Sand	SP	very dense
Sand	" "	very dense



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-3

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-3
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	33.23	0.82	Silty Sand to Sandy Silt	SM/ML	very dense	115	7	62.8	30	102	42		
0.30	1.0	58.51	0.53	Sand to Silty Sand	SP/SM	very dense	115	11	110.6	15	102	42		
0.45	1.5	45.83	0.62	Sand to Silty Sand	SP/SM	dense	115	8	86.6	20	87	40		
0.60	2.0	46.93	0.65	Sand to Silty Sand	SP/SM	dense	115	9	88.7	20	83	40		
0.75	2.5	58.59	0.63	Sand to Silty Sand	SP/SM	dense	115	11	110.8	15	86	40		
0.93	3.0	67.63	0.67	Sand to Silty Sand	SP/SM	dense	115	12	127.9	15	87	40		
1.08	3.5	68.63	0.69	Sand to Silty Sand	SP/SM	dense	115	12	129.7	15	85	40		
1.23	4.0	73.76	0.66	Sand to Silty Sand	SP/SM	dense	115	13	139.4	15	85	40		
1.38	4.5	74.33	0.72	Sand to Silty Sand	SP/SM	dense	115	14	140.5	15	84	40		
1.53	5.0	65.04	0.87	Sand to Silty Sand	SP/SM	dense	115	12	121.0	20	78	39		
1.68	5.5	63.78	0.59	Sand to Silty Sand	SP/SM	dense	115	12	112.8	15	76	39		
1.83	6.0	63.69	0.68	Sand to Silty Sand	SP/SM	dense	115	12	107.7	15	75	38		
1.98	6.5	69.52	0.79	Sand to Silty Sand	SP/SM	dense	115	13	115.3	15	77	39		
2.13	7.0	79.20	0.88	Sand to Silty Sand	SP/SM	dense	115	14	128.9	15	80	39		
2.28	7.5	74.50	0.67	Sand to Silty Sand	SP/SM	dense	115	14	119.1	15	78	39		
2.45	8.0	119.28	0.76	Sand	SP	very dense	110	18	187.5	10	91	41		
2.60	8.5	117.06	0.97	Sand to Silty Sand	SP/SM	very dense	115	21	181.0	15	90	41		
2.75	9.0	79.97	1.96	Silty Sand to Sandy Silt	SM/ML	dense	115	18	121.7	30	78	39		
2.90	9.5	32.74	3.53	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		60			1.90	>10
3.05	10.0	22.37	3.85	Silty Clay to Clay	CL	very stiff	125	13		75			1.29	>10
3.20	10.5	19.88	4.09	Silty Clay to Clay	CL	very stiff	125	11		80			1.14	>10
3.35	11.0	14.66	5.43	Clay	CL/CH	stiff	125	12		100			0.83	>10
3.50	11.5	16.85	6.02	Clay	CL/CH	stiff	125	13		100			0.96	>10
3.65	12.0	15.11	4.60	Clay	CL/CH	stiff	125	12		95			0.86	>10
3.80	12.5	12.54	5.27	Clay	CL/CH	stiff	125	10		100			0.71	>10
3.95	13.0	15.76	6.35	Clay	CL/CH	stiff	125	13		100			0.90	>10
4.13	13.5	14.84	5.14	Clay	CL/CH	stiff	125	12		100			0.84	>10
4.28	14.0	14.29	5.11	Clay	CL/CH	stiff	125	11		100			0.81	>10
4.43	14.5	17.37	6.28	Clay	CL/CH	stiff	125	14		100			0.99	>10
4.58	15.0	18.91	6.11	Clay	CL/CH	very stiff	125	15		100			1.08	>10
4.73	15.5	19.88	5.73	Clay	CL/CH	very stiff	125	16		100			1.13	>10
4.88	16.0	15.05	5.73	Clay	CL/CH	stiff	125	12		100			0.85	>10
5.03	16.5	14.19	4.76	Clay	CL/CH	stiff	125	11		100			0.80	8.85
5.18	17.0	16.77	5.12	Clay	CL/CH	stiff	125	13		100			0.95	>10
5.33	17.5	45.20	4.19	Clayey Silt to Silty Clay	ML/CL	hard	120	18		65			2.62	>10
5.48	18.0	205.19	1.02	Sand	SP	very dense	110	32	241.1	10	98	42		
5.65	18.5	249.18	1.25	Sand	SP	very dense	110	38	290.3	10	104	43		
5.80	19.0	228.90	1.06	Sand	SP	very dense	110	35	264.4	10	101	42		
5.95	19.5	208.76	0.76	Sand	SP	very dense	110	32	239.2	10	98	42		
6.10	20.0	165.69	0.83	Sand	SP	very dense	110	25	188.3	10	91	41		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

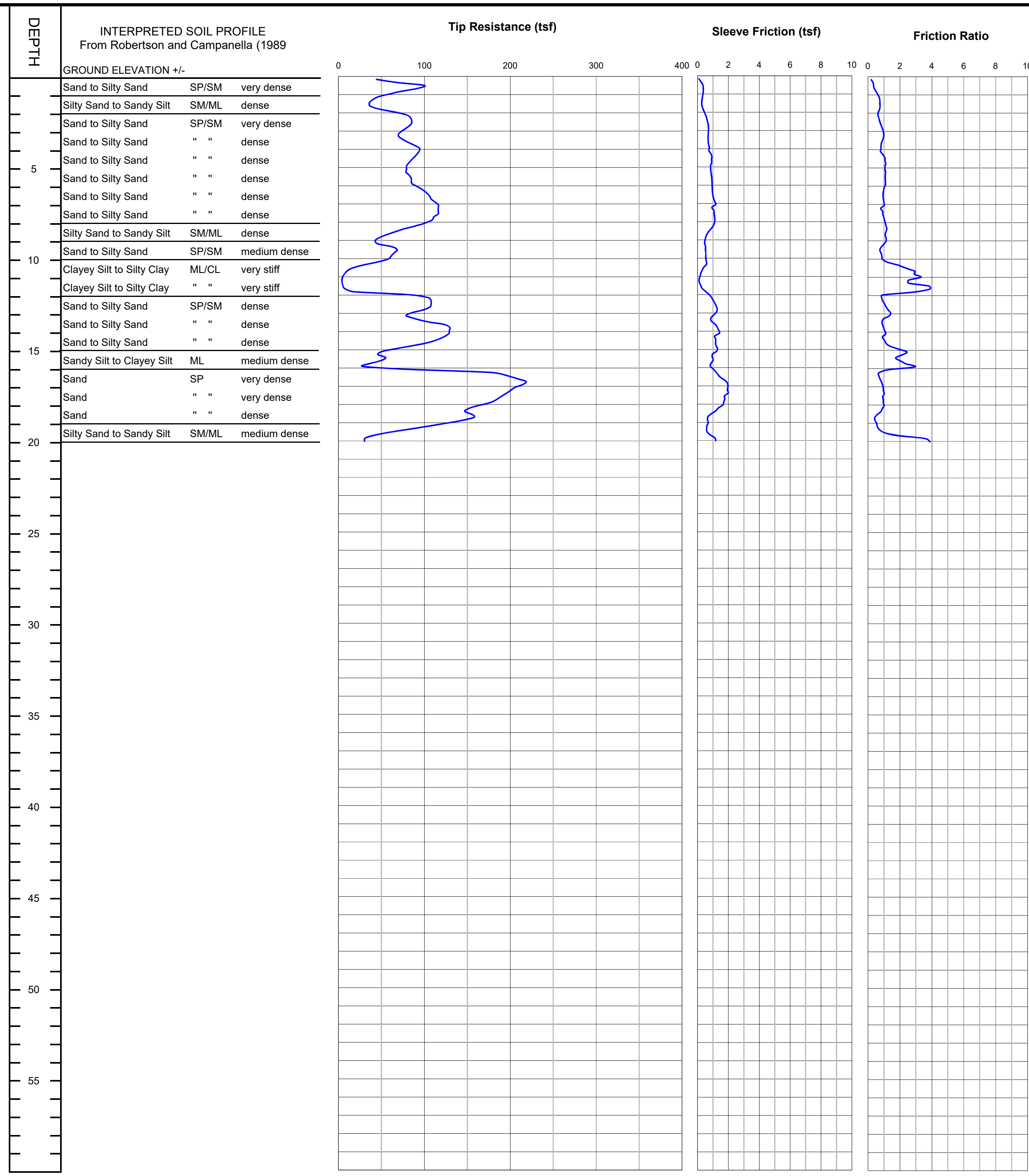
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-4

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand to Silty Sand	SP/SM	very dense
Silty Sand to Sandy Silt	SM/ML	dense
Sand to Silty Sand	SP/SM	very dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Silty Sand to Sandy Silt	SM/ML	dense
Sand to Silty Sand	SP/SM	medium dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clayey Silt to Silty Clay	" "	very stiff
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sandy Silt to Clayey Silt	ML	medium dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	dense
Silty Sand to Sandy Silt	SM/ML	medium dense



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-4

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-4
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	70.33	0.29	Sand to Silty Sand	SP/SM	very dense	115	13	132.9	10	124	45		
0.30	1.0	74.13	0.51	Sand to Silty Sand	SP/SM	very dense	115	13	140.1	10	109	43		
0.45	1.5	39.71	0.73	Silty Sand to Sandy Silt	SM/ML	dense	115	9	75.1	25	83	40		
0.60	2.0	50.90	0.70	Sand to Silty Sand	SP/SM	dense	115	9	96.2	20	86	40		
0.75	2.5	83.33	0.69	Sand to Silty Sand	SP/SM	very dense	115	15	157.5	15	96	42		
0.93	3.0	79.96	0.87	Sand to Silty Sand	SP/SM	very dense	115	15	151.2	15	92	41		
1.08	3.5	71.68	0.96	Sand to Silty Sand	SP/SM	dense	115	13	135.5	20	87	40		
1.23	4.0	87.69	0.82	Sand to Silty Sand	SP/SM	very dense	115	16	165.8	15	90	41		
1.38	4.5	91.16	0.92	Sand to Silty Sand	SP/SM	dense	115	17	172.3	15	90	41		
1.53	5.0	81.88	1.08	Sand to Silty Sand	SP/SM	dense	115	15	152.3	20	85	40		
1.68	5.5	81.13	1.08	Sand to Silty Sand	SP/SM	dense	115	15	143.6	20	83	40		
1.83	6.0	87.94	1.07	Sand to Silty Sand	SP/SM	dense	115	16	148.7	20	84	40		
1.98	6.5	102.36	0.95	Sand to Silty Sand	SP/SM	dense	115	19	169.7	15	88	40		
2.13	7.0	112.12	0.99	Sand to Silty Sand	SP/SM	very dense	115	20	182.5	15	90	41		
2.28	7.5	116.02	0.88	Sand to Silty Sand	SP/SM	very dense	115	21	185.4	10	91	41		
2.45	8.0	107.03	1.04	Sand to Silty Sand	SP/SM	dense	115	19	168.1	15	88	40		
2.60	8.5	77.19	1.14	Sand to Silty Sand	SP/SM	dense	115	14	119.2	20	78	39		
2.75	9.0	48.35	1.11	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	73.4	30	63	37		
2.90	9.5	59.00	0.85	Sand to Silty Sand	SP/SM	medium dense	115	11	88.2	20	69	38		
3.05	10.0	61.61	0.86	Sand to Silty Sand	SP/SM	medium dense	115	11	90.7	20	70	38		
3.20	10.5	31.17	1.83	Sandy Silt to Clayey Silt	ML	medium dense	115	9	45.2	45	49	35		
3.35	11.0	7.44	3.05	Silty Clay to Clay	CL	firm	125	4		100			0.41	6.65
3.50	11.5	4.50	2.97	Clay	CL/CH	soft	125	4		100			0.24	2.34
3.65	12.0	35.68	2.54	Sandy Silt to Clayey Silt	ML	medium dense	115	10	49.4	50	52	35		
3.80	12.5	106.77	0.94	Sand to Silty Sand	SP/SM	dense	115	19	145.8	15	84	40		
3.95	13.0	97.54	1.27	Sand to Silty Sand	SP/SM	dense	115	18	131.5	20	81	39		
4.13	13.5	90.09	1.05	Sand to Silty Sand	SP/SM	dense	115	16	120.0	20	78	39		
4.28	14.0	127.45	0.98	Sand to Silty Sand	SP/SM	dense	115	23	167.7	15	88	40		
4.43	14.5	122.49	1.01	Sand to Silty Sand	SP/SM	dense	115	22	159.3	15	86	40		
4.58	15.0	86.77	1.45	Sand to Silty Sand	SP/SM	dense	115	16	111.5	25	76	39		
4.73	15.5	50.46	2.10	Sandy Silt to Clayey Silt	ML	medium dense	115	14	64.1	40	59	36		
4.88	16.0	49.73	2.14	Sandy Silt to Clayey Silt	ML	medium dense	115	14	62.5	45	59	36		
5.03	16.5	193.25	0.70	Sand	SP	very dense	110	30	240.3	5	98	42		
5.18	17.0	212.86	0.90	Sand	SP	very dense	110	33	262.2	10	101	42		
5.33	17.5	195.12	0.97	Sand	SP	very dense	110	30	238.1	10	98	42		
5.48	18.0	175.26	0.97	Sand	SP	very dense	110	27	211.9	10	95	41		
5.65	18.5	151.44	0.75	Sand	SP	very dense	110	23	181.4	10	90	41		
5.80	19.0	142.64	0.47	Sand	SP	dense	110	22	169.3	5	88	40		
5.95	19.5	81.90	0.77	Sand to Silty Sand	SP/SM	dense	115	15	96.3	20	71	38		
6.10	20.0	34.24	3.15	Clayey Silt to Silty Clay	ML/CL	very stiff	120	14		65			1.97	>10

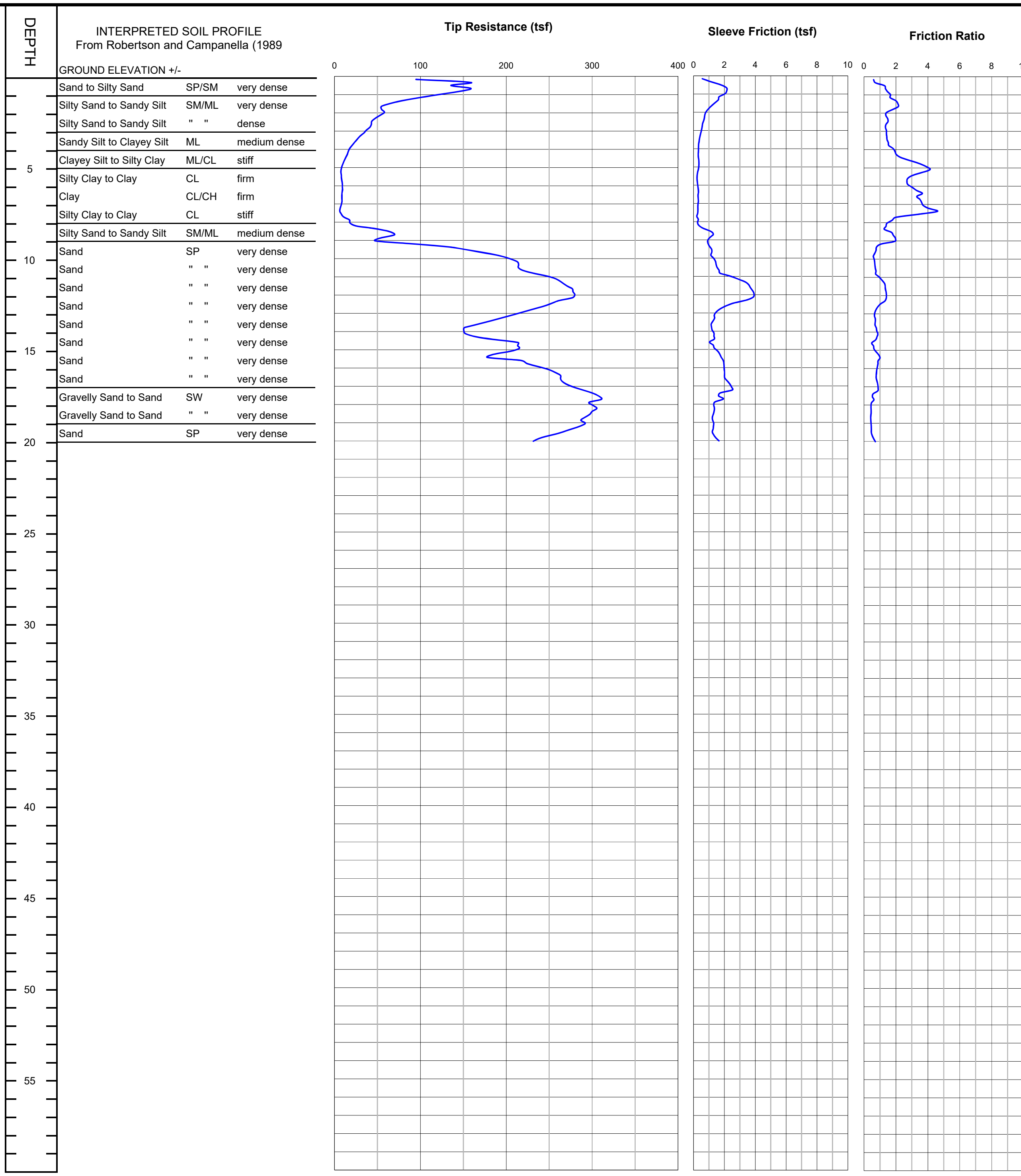
CLIENT:	ZGlobal	**CONE PENETROMETER:**	Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
PROJECT:	Vega SES Solar - Calexico, CA		
LOCATION:	See Site and Boring Location Plan	**DATE:**	6/11/2018

CONE SOUNDING DATA CPT-5

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand to Silty Sand	SP/SM	very dense
Silty Sand to Sandy Silt	SM/ML	very dense
Silty Sand to Sandy Silt	" "	dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	stiff
Silty Clay to Clay	CL	firm
Clay	CL/CH	firm
Silty Clay to Clay	CL	stiff
Silty Sand to Sandy Silt	SM/ML	medium dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Gravelly Sand to Sand	SW	very dense
Gravelly Sand to Sand	" "	very dense
Sand	SP	very dense



END OF SOUNDING AT 20 ft.

Project No.		PLATE
LE18083	LANDMARK Geo-Engineers and Geologists	B-5

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-5
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	129.67	0.87	Sand	SP	very dense	110	20	245.1	10	143	48		
0.30	1.0	142.45	1.49	Sand to Silty Sand	SP/SM	very dense	115	26	269.3	15	129	46		
0.45	1.5	82.57	1.92	Silty Sand to Sandy Silt	SM/ML	very dense	115	18	156.1	30	105	43		
0.60	2.0	55.89	1.77	Silty Sand to Sandy Silt	SM/ML	dense	115	12	105.7	35	89	40		
0.75	2.5	48.00	1.45	Silty Sand to Sandy Silt	SM/ML	dense	115	11	90.7	30	80	39		
0.93	3.0	40.36	1.37	Silty Sand to Sandy Silt	SM/ML	dense	115	9	76.3	35	72	38		
1.08	3.5	30.04	1.42	Sandy Silt to Clayey Silt	ML	medium dense	115	9	56.8	40	61	37		
1.23	4.0	20.69	1.63	Sandy Silt to Clayey Silt	ML	medium dense	115	6	39.1	55	48	35		
1.38	4.5	14.80	2.09	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		70			0.86	>10
1.53	5.0	10.18	3.41	Silty Clay to Clay	CL	stiff	125	6		95			0.58	>10
1.68	5.5	7.83	3.39	Clay	CL/CH	firm	125	6		100			0.44	>10
1.83	6.0	9.00	2.82	Silty Clay to Clay	CL	stiff	125	5		95			0.51	>10
1.98	6.5	8.88	3.42	Clay	CL/CH	stiff	125	7		100			0.50	>10
2.13	7.0	8.31	3.61	Clay	CL/CH	firm	125	7		100			0.47	9.19
2.28	7.5	6.91	4.00	Clay	CL/CH	firm	125	6		100			0.38	6.21
2.45	8.0	15.34	1.73	Sandy Silt to Clayey Silt	ML	loose	115	4	23.6	65	30	32		
2.60	8.5	46.43	1.45	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	70.4	35	62	37		
2.75	9.0	57.11	1.91	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	85.2	35	68	37		
2.90	9.5	126.14	0.85	Sand	SP	very dense	110	19	185.5	10	91	41		
3.05	10.0	190.45	0.63	Sand	SP	very dense	110	29	276.3	5	102	42		
3.20	10.5	213.80	0.69	Sand	SP	very dense	110	33	306.2	5	106	43		
3.35	11.0	235.14	0.81	Sand	SP	very dense	110	36	332.5	5	108	43		
3.50	11.5	265.06	1.24	Sand	SP	very dense	110	41	370.2	10	111	44		
3.65	12.0	278.08	1.38	Sand	SP	very dense	110	43	383.7	10	112	44		
3.80	12.5	263.39	1.24	Sand	SP	very dense	110	41	359.1	10	110	43		
3.95	13.0	229.34	0.75	Sand	SP	very dense	110	35	309.1	5	106	43		
4.13	13.5	191.57	0.69	Sand	SP	very dense	110	29	255.3	5	100	42		
4.28	14.0	155.86	0.75	Sand	SP	very dense	110	24	205.4	10	94	41		
4.43	14.5	167.23	0.80	Sand	SP	very dense	110	26	218.0	10	96	41		
4.58	15.0	213.99	0.57	Sand	SP	very dense	110	33	276.1	5	102	42		
4.73	15.5	188.74	0.90	Sand	SP	very dense	110	29	241.0	10	98	42		
4.88	16.0	231.62	0.85	Sand	SP	very dense	110	36	292.7	5	104	43		
5.03	16.5	261.06	0.77	Sand	SP	very dense	110	40	326.7	5	107	43		
5.18	17.0	271.66	0.86	Sand	SP	very dense	110	42	336.6	5	108	43		
5.33	17.5	299.93	0.66	Sand	SP	very dense	110	46	368.1	5	111	44		
5.48	18.0	302.66	0.51	Gravelly Sand to Sand	SW	very dense	115	40	367.8	0	111	44		
5.65	18.5	300.93	0.44	Gravelly Sand to Sand	SW	very dense	115	40	362.0	0	110	43		
5.80	19.0	290.17	0.43	Gravelly Sand to Sand	SW	very dense	115	39	345.6	0	109	43		
5.95	19.5	275.29	0.46	Gravelly Sand to Sand	SW	very dense	115	37	324.7	0	107	43		
6.10	20.0	240.82	0.61	Sand	SP	very dense	110	37	281.5	5	103	42		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight

LOCATION: See Site and Boring Location Plan

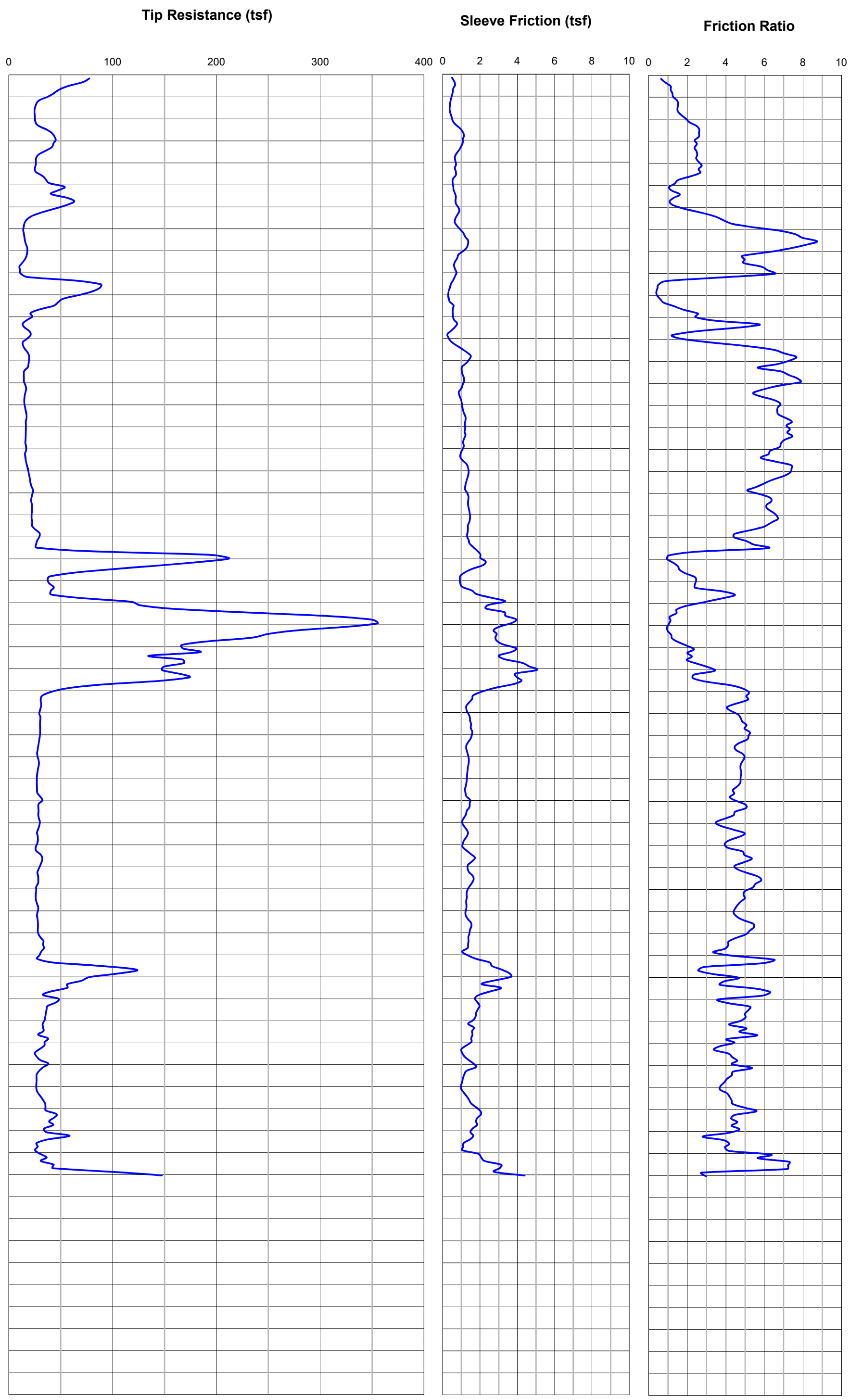
DATE: 6/11/2018

CONE SOUNDING DATA CPT-6

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

DEPTH			
	Silty Sand to Sandy Silt	SM/ML	very dense
	Sandy Silt to Clayey Silt	ML	medium dense
	Sandy Silt to Clayey Silt	" "	dense
	Sandy Silt to Clayey Silt	" "	medium dense
5	Sandy Silt to Clayey Silt	" "	medium dense
	Silty Sand to Sandy Silt	SM/ML	medium dense
	Silty Clay to Clay	CL	very stiff
	Clay	CL/CH	stiff
	Clay	" "	stiff
10	Sand to Silty Sand	SP/SM	dense
	Silty Sand to Sandy Silt	SM/ML	medium dense
	Clayey Silt to Silty Clay	ML/CL	stiff
	Clay	CL/CH	stiff
	Clay	" "	stiff
15	Clay	" "	stiff
	Clay	" "	stiff
	Clay	" "	stiff
	Clay	" "	stiff
	Clay	" "	very stiff
20	Clay	" "	very stiff
	Clay	" "	very stiff
	Sandy Silt to Clayey Silt	ML	dense
	Silty Sand to Sandy Silt	SM/ML	dense
	Sandy Silt to Clayey Silt	ML	medium dense
25	Sand	SP	very dense
	Sand	" "	very dense
	Silty Sand to Sandy Silt	SM/ML	dense
	Sandy Silt to Clayey Silt	ML	dense
	Silty Clay to Clay	CL	very stiff
30	Clay	CL/CH	very stiff
	Silty Clay to Clay	CL	very stiff
	Clay	CL/CH	very stiff
	Silty Clay to Clay	CL	very stiff
	Silty Clay to Clay	" "	very stiff
35	Silty Clay to Clay	" "	very stiff
	Silty Clay to Clay	" "	very stiff
	Clay	CL/CH	very stiff
	Silty Clay to Clay	CL	very stiff
	Clay	CL/CH	very stiff
40	Clayey Silt to Silty Clay	ML/CL	very stiff
	Clayey Silt to Silty Clay	" "	hard
	Silty Clay to Clay	CL	hard
	Silty Clay to Clay	" "	hard
	Silty Clay to Clay	" "	very stiff
45	Silty Clay to Clay	" "	very stiff
	Silty Clay to Clay	" "	very stiff
	Silty Clay to Clay	" "	very stiff
	Silty Clay to Clay	" "	hard
	Silty Clay to Clay	" "	very stiff
50	Overconsolidated Soil	??	medium dense
55			



END OF SOUNDING AT 50 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-6

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-6

Est. GWT (ft): 6

Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	69.01	0.88	Sand to Silty Sand	SP/SM	very dense	115	13	130.4	20	123	45		
0.30	1.0	43.61	1.21	Silty Sand to Sandy Silt	SM/ML	very dense	115	10	82.4	30	94	41		
0.45	1.5	27.12	1.50	Sandy Silt to Clayey Silt	ML	dense	115	8	51.3	45	72	38		
0.60	2.0	24.91	1.71	Sandy Silt to Clayey Silt	ML	medium dense	115	7	47.1	50	65	37		
0.75	2.5	29.61	2.40	Sandy Silt to Clayey Silt	ML	medium dense	115	8	56.0	55	66	37		
0.93	3.0	43.30	2.53	Sandy Silt to Clayey Silt	ML	dense	115	12	81.9	45	74	38		
1.08	3.5	40.05	2.45	Sandy Silt to Clayey Silt	ML	medium dense	115	11	75.7	45	69	38		
1.23	4.0	27.14	2.52	Sandy Silt to Clayey Silt	ML	medium dense	115	8	51.3	55	56	36		
1.38	4.5	25.76	2.67	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		60			1.50	>10
1.53	5.0	35.79	1.67	Sandy Silt to Clayey Silt	ML	medium dense	115	10	66.4	40	60	36		
1.68	5.5	49.25	1.29	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	87.0	30	68	38		
1.83	6.0	54.82	1.41	Silty Sand to Sandy Silt	SM/ML	dense	115	12	92.5	30	70	38		
1.98	6.5	24.54	3.30	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		65			1.42	>10
2.13	7.0	14.48	5.43	Clay	CL/CH	stiff	125	12		100			0.83	>10
2.28	7.5	15.02	8.10	Clay	CL/CH	stiff	125	12		100			0.86	>10
2.45	8.0	17.36	7.19	Clay	CL/CH	stiff	125	14		100			1.00	>10
2.60	8.5	15.38	4.92	Clay	CL/CH	stiff	125	12		95			0.88	>10
2.75	9.0	10.76	6.18	Clay	CL/CH	stiff	125	9		100			0.61	>10
2.90	9.5	56.64	1.71	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	83.2	30	67	37		
3.05	10.0	78.68	0.42	Sand to Silty Sand	SP/SM	dense	115	14	113.9	10	76	39		
3.20	10.5	47.72	0.90	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	68.1	25	61	37		
3.35	11.0	24.32	2.27	Sandy Silt to Clayey Silt	ML	medium dense	115	7	34.2	55	41	34		
3.50	11.5	15.21	4.54	Clay	CL/CH	stiff	125	12		90			0.87	>10
3.65	12.0	19.58	1.75	Sandy Silt to Clayey Silt	ML	loose	115	6	26.8	60	34	33		
3.80	12.5	14.30	4.91	Clay	CL/CH	stiff	125	11		100			0.81	>10
3.95	13.0	19.10	7.32	Clay	CL/CH	very stiff	125	15		100			1.09	>10
4.13	13.5	17.38	6.39	Clay	CL/CH	stiff	125	14		100			0.99	>10
4.28	14.0	14.55	7.61	Clay	CL/CH	stiff	125	12		100			0.82	>10
4.43	14.5	16.19	6.03	Clay	CL/CH	stiff	125	13		100			0.92	>10
4.58	15.0	15.01	6.40	Clay	CL/CH	stiff	125	12		100			0.85	>10
4.73	15.5	16.24	6.70	Clay	CL/CH	stiff	125	13		100			0.92	>10
4.88	16.0	16.63	7.25	Clay	CL/CH	stiff	125	13		100			0.94	>10
5.03	16.5	16.27	7.23	Clay	CL/CH	stiff	125	13		100			0.92	>10
5.18	17.0	16.40	6.65	Clay	CL/CH	stiff	125	13		100			0.93	>10
5.33	17.5	15.99	6.19	Clay	CL/CH	stiff	125	13		100			0.90	>10
5.48	18.0	18.16	7.38	Clay	CL/CH	very stiff	125	15		100			1.03	>10
5.65	18.5	20.23	6.49	Clay	CL/CH	very stiff	125	16		100			1.15	>10
5.80	19.0	22.63	5.49	Clay	CL/CH	very stiff	125	18		100			1.29	>10
5.95	19.5	21.86	6.25	Clay	CL/CH	very stiff	125	17		100			1.24	>10
6.10	20.0	22.21	6.40	Clay	CL/CH	very stiff	125	18		100			1.26	>10
6.25	20.5	22.31	6.33	Clay	CL/CH	very stiff	125	18		100			1.27	>10
6.40	21.0	28.20	4.73	Silty Clay to Clay	CL	very stiff	125	16		90			1.61	>10
6.55	21.5	26.78	5.56	Clay	CL/CH	very stiff	125	21		95			1.53	>10
6.70	22.0	160.98	1.46	Sand to Silty Sand	SP/SM	dense	115	29	173.2	20	89	40		
6.85	22.5	141.35	1.46	Sand to Silty Sand	SP/SM	dense	115	26	150.9	25	85	40		
7.00	23.0	46.04	2.25	Sandy Silt to Clayey Silt	ML	medium dense	115	13	48.8	55	51	35		
7.18	23.5	41.00	2.89	Sandy Silt to Clayey Silt	ML	medium dense	115	12	43.1	65	48	35		
7.33	24.0	76.11	3.67	Clayey Silt to Silty Clay	ML/CL	hard	120	30		55			4.43	>10
7.48	24.5	172.72	1.60	Sand to Silty Sand	SP/SM	dense	115	31	178.7	25	90	41		
7.63	25.0	338.29	1.08	Sand	SP	very dense	110	52	347.5	10	109	43		
7.78	25.5	282.04	1.03	Sand	SP	very dense	110	43	287.8	10	104	43		
7.93	26.0	196.94	1.57	Sand to Silty Sand	SP/SM	very dense	115	36	199.6	20	93	41		
8.08	26.5	163.45	2.14	Silty Sand to Sandy Silt	SM/ML	dense	115	36	164.5	30	87	40		
8.23	27.0	155.33	3.01	Silty Sand to Sandy Silt	SM/ML	dense	115	35	155.2	40	85	40		
8.38	27.5	159.98	2.54	Silty Sand to Sandy Silt	SM/ML	dense	115	36	158.8	35	86	40		
8.53	28.0	61.30	4.80	Silty Clay to Clay	CL	hard	125	35		70			3.55	>10
8.68	28.5	31.35	4.92	Clay	CL/CH	very stiff	125	25		95			1.79	>10
8.85	29.0	30.13	4.30	Silty Clay to Clay	CL	very stiff	125	17		95			1.71	>10
9.00	29.5	30.20	4.89	Clay	CL/CH	very stiff	125	24		100			1.72	>10
9.15	30.0	30.13	5.13	Clay	CL/CH	very stiff	125	24		100			1.71	>10
9.30	30.5	28.86	4.75	Silty Clay to Clay	CL	very stiff	125	16		100			1.64	>10
9.45	31.0	27.55	4.80	Clay	CL/CH	very stiff	125	22		100			1.56	>10
9.60	31.5	28.66	4.80	Clay	CL/CH	very stiff	125	23		100			1.62	>10
9.75	32.0	27.32	4.78	Clay	CL/CH	very stiff	125	22		100			1.54	>10
9.90	32.5	27.06	4.57	Silty Clay to Clay	CL	very stiff	125	15		100			1.53	>10
10.05	33.0	30.00	4.39	Silty Clay to Clay	CL	very stiff	125	17		100			1.70	>10
10.20	33.5	28.62	4.84	Clay	CL/CH	very stiff	125	23		100			1.62	>10
10.38	34.0	29.05	3.92	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		95			1.64	>10
10.53	34.5	28.24	4.38	Silty Clay to Clay	CL	very stiff	125	16		100			1.59	>10
10.68	35.0	27.75	4.25	Silty Clay to Clay	CL	very stiff	125	16		100			1.56	>10
10.83	35.5	27.54	4.64	Silty Clay to Clay	CL	very stiff	125	16		100			1.55	>10
10.98	36.0	31.44	4.91	Clay	CL/CH	very stiff	125	25		100			1.78	>10
11.13	36.5	28.24	5.31	Clay	CL/CH	very stiff	125	23		100			1.59	9.59
11.28	37.0	26.99	5.31	Clay	CL/CH	very stiff	125	22		100			1.51	8.41
11.43	37.5	26.08	4.88	Clay	CL/CH	very stiff	125	21		100			1.46	7.70
11.58	38.0	27.84	4.48	Silty Clay to Clay	CL	very stiff	125	16		100			1.56	>10
11.73	38.5	27.60	4.95	Clay	CL/CH	very stiff	125	22		100			1.55	8.27

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-6
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
11.88	39.0	28.14	5.24	Clay	CL/CH	very stiff	125	23		100			1.58	8.41
12.05	39.5	32.22	4.25	Silty Clay to Clay	CL	very stiff	125	18		100			1.82	>10
12.20	40.0	31.50	3.94	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.77	>10
12.35	40.5	53.88	5.09	Silty Clay to Clay	CL	hard	125	31		90			3.09	>10
12.50	41.0	102.67	3.53	Sandy Silt to Clayey Silt	ML	medium dense	115	29	85.1	60	68	37		
12.65	41.5	60.97	4.38	Clayey Silt to Silty Clay	ML/CL	hard	120	24		80			3.50	>10
12.80	42.0	40.44	5.26	Clay	CL/CH	hard	125	32		100			2.30	>10
12.95	42.5	39.83	4.83	Silty Clay to Clay	CL	hard	125	23		100			2.26	>10
13.10	43.0	35.04	4.91	Clay	CL/CH	very stiff	125	28		100			1.98	>10
13.25	43.5	32.97	4.65	Silty Clay to Clay	CL	very stiff	125	19		100			1.85	>10
13.40	44.0	33.53	4.70	Silty Clay to Clay	CL	very stiff	125	19		100			1.89	>10
13.58	44.5	29.62	3.73	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		100			1.66	>10
13.73	45.0	31.65	4.41	Silty Clay to Clay	CL	very stiff	125	18		100			1.77	>10
13.88	45.5	29.72	4.68	Silty Clay to Clay	CL	very stiff	125	17		100			1.66	9.79
14.03	46.0	26.59	3.90	Silty Clay to Clay	CL	very stiff	125	15		100			1.47	7.70
14.18	46.5	28.23	3.98	Silty Clay to Clay	CL	very stiff	125	16		100			1.57	8.41
14.33	47.0	34.66	4.80	Silty Clay to Clay	CL	very stiff	125	20		100			1.95	>10
14.48	47.5	42.75	4.45	Silty Clay to Clay	CL	hard	125	24		100			2.42	>10
14.63	48.0	37.57	4.38	Silty Clay to Clay	CL	hard	125	21		100			2.12	>10
14.78	48.5	41.01	3.62	Clayey Silt to Silty Clay	ML/CL	hard	120	16		95			2.32	>10
14.93	49.0	27.68	4.82	Clay	CL/CH	very stiff	125	22		100			1.53	5.65
15.10	49.5	36.85	6.72	Clay	CL/CH	hard	125	29		100			2.07	9.19
15.25	50.0	96.87	4.30	Overconsolidated Soil	??	medium dense	120	97	73.2	70	63	37		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

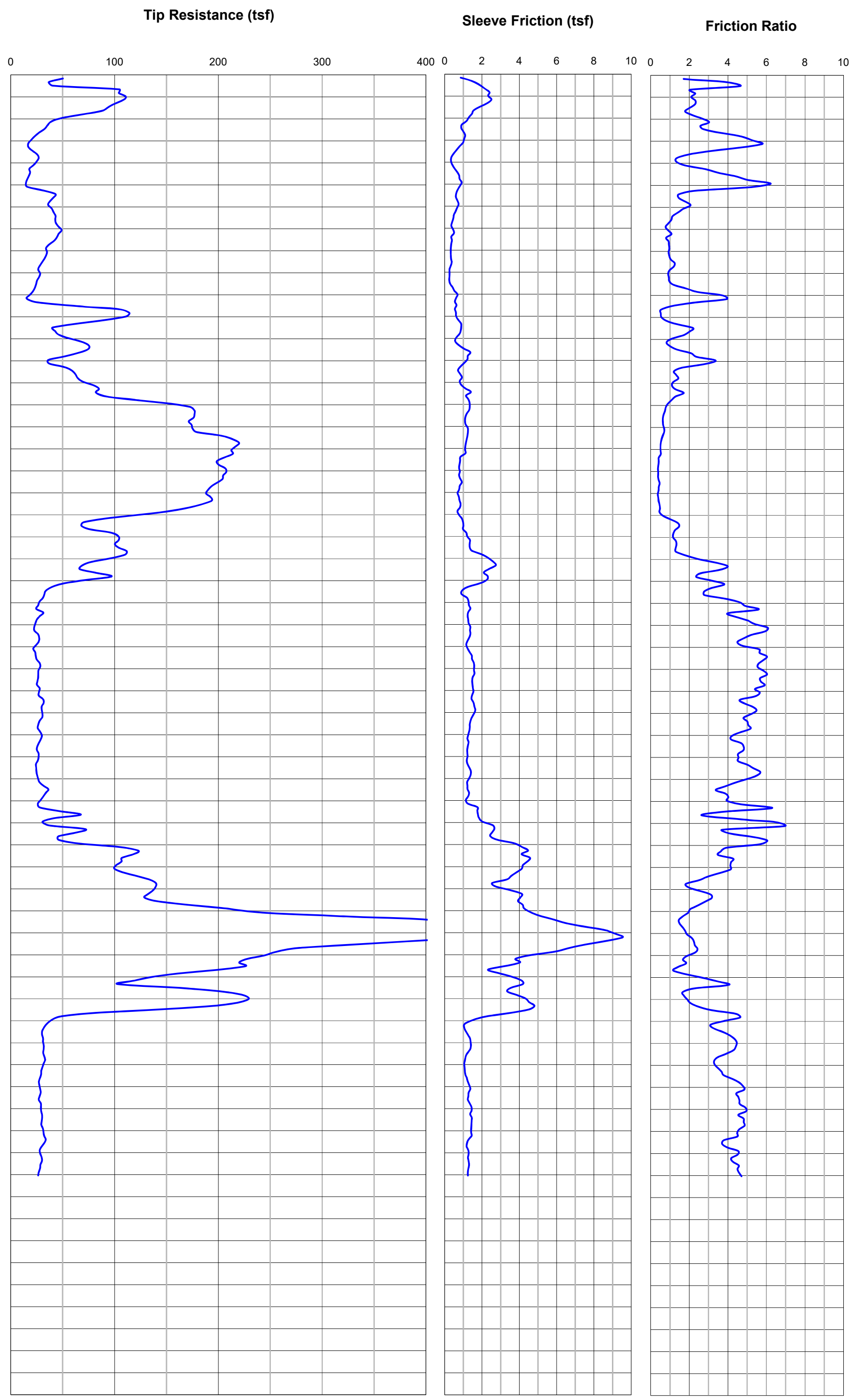
CONE SOUNDING DATA CPT-7

DEPTH

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sandy Silt to Clayey Silt	ML	very dense
Silty Sand to Sandy Silt	SM/ML	very dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clayey Silt to Silty Clay	" "	very stiff
Silty Clay to Clay	CL	very stiff
Sandy Silt to Clayey Silt	ML	medium dense
Silty Sand to Sandy Silt	SM/ML	medium dense
Silty Sand to Sandy Silt	" "	medium dense
Silty Sand to Sandy Silt	" "	medium dense
Sandy Silt to Clayey Silt	ML	medium dense
Silty Sand to Sandy Silt	SM/ML	dense
Silty Sand to Sandy Silt	" "	medium dense
Silty Sand to Sandy Silt	" "	medium dense
Silty Sand to Sandy Silt	" "	medium dense
Sand to Silty Sand	SP/SM	dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	hard
Clay	CL/CH	very stiff
Clay	" "	very stiff
Clay	" "	very stiff
Clay	" "	very stiff
Clay	" "	very stiff
Clay	" "	very stiff
Silty Clay to Clay	CL	very stiff
Clay	CL/CH	very stiff
Clayey Silt to Silty Clay	ML/CL	very stiff
Silty Clay to Clay	CL	hard
Clay	CL/CH	hard
Clayey Silt to Silty Clay	ML/CL	hard
Silty Sand to Sandy Silt	SM/ML	dense
Silty Sand to Sandy Silt	" "	dense
Sand	SP	very dense
Sand to Silty Sand	SP/SM	very dense
Sand to Silty Sand	" "	dense
Silty Sand to Sandy Silt	SM/ML	dense
Sandy Silt to Clayey Silt	ML	dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clayey Silt to Silty Clay	" "	very stiff
Silty Clay to Clay	CL	very stiff
Silty Clay to Clay	" "	very stiff
Silty Clay to Clay	" "	very stiff
Silty Clay to Clay	" "	very stiff
Silty Clay to Clay	" "	very stiff



END OF SOUNDING AT 50 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-7

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-7
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	42.49	3.48	Clayey Silt to Silty Clay	ML/CL	hard	120	17		55			2.50	>10
0.30	1.0	106.50	2.15	Silty Sand to Sandy Silt	SM/ML	very dense	115	24	201.3	25	120	45		
0.45	1.5	100.61	2.21	Silty Sand to Sandy Silt	SM/ML	very dense	115	22	190.2	30	110	43		
0.60	2.0	67.85	2.20	Silty Sand to Sandy Silt	SM/ML	very dense	115	15	128.3	35	94	41		
0.75	2.5	35.49	2.79	Sandy Silt to Clayey Silt	ML	dense	115	10	67.1	50	71	38		
0.93	3.0	23.37	4.57	Clay	CL/CH	very stiff	125	19		75			1.37	>10
1.08	3.5	18.22	4.51	Clay	CL/CH	very stiff	125	15		85			1.06	>10
1.23	4.0	25.70	1.52	Sandy Silt to Clayey Silt	ML	medium dense	115	7	48.6	45	54	36		
1.38	4.5	19.52	2.72	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		70			1.13	>10
1.53	5.0	15.92	5.23	Clay	CL/CH	stiff	125	13		95			0.92	>10
1.68	5.5	32.59	2.58	Sandy Silt to Clayey Silt	ML	medium dense	115	9	56.7	50	56	36		
1.83	6.0	37.72	1.85	Sandy Silt to Clayey Silt	ML	medium dense	115	11	62.8	40	59	36		
1.98	6.5	42.37	1.21	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	69.3	30	62	37		
2.13	7.0	46.09	0.87	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	74.0	25	64	37		
2.28	7.5	44.11	0.93	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	69.6	25	62	37		
2.45	8.0	35.28	0.95	Silty Sand to Sandy Silt	SM/ML	medium dense	115	8	54.7	30	55	36		
2.60	8.5	32.18	1.08	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	49.1	35	51	35		
2.75	9.0	27.46	1.02	Silty Sand to Sandy Silt	SM/ML	medium dense	115	6	41.2	40	46	34		
2.90	9.5	25.69	1.02	Silty Sand to Sandy Silt	SM/ML	medium dense	115	6	38.0	40	44	34		
3.05	10.0	20.92	2.66	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		65			1.20	>10
3.20	10.5	33.66	2.39	Sandy Silt to Clayey Silt	ML	medium dense	115	10	48.2	50	51	35		
3.35	11.0	110.36	0.53	Sand	SP	dense	110	17	156.0	5	86	40		
3.50	11.5	63.83	1.46	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	89.1	25	69	38		
3.65	12.0	48.41	1.59	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	66.7	35	61	36		
3.80	12.5	72.85	1.06	Sand to Silty Sand	SP/SM	dense	115	13	99.0	20	72	38		
3.95	13.0	51.25	2.61	Sandy Silt to Clayey Silt	ML	medium dense	115	15	68.8	45	61	37		
4.13	13.5	49.40	1.87	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	65.5	40	60	36		
4.28	14.0	65.37	1.30	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	85.6	25	68	38		
4.43	14.5	82.21	1.37	Silty Sand to Sandy Silt	SM/ML	dense	115	18	106.4	25	74	38		
4.58	15.0	119.03	1.08	Sand to Silty Sand	SP/SM	dense	115	22	152.3	15	85	40		
4.73	15.5	175.54	0.73	Sand	SP	very dense	110	27	222.2	5	96	41		
4.88	16.0	174.22	0.65	Sand	SP	very dense	110	27	218.4	5	96	41		
5.03	16.5	198.75	0.61	Sand	SP	very dense	110	31	246.7	5	99	42		
5.18	17.0	216.32	0.51	Sand	SP	very dense	110	33	265.9	5	101	42		
5.33	17.5	206.21	0.45	Sand	SP	very dense	110	32	251.1	5	100	42		
5.48	18.0	204.79	0.39	Sand	SP	very dense	110	32	247.1	0	99	42		
5.65	18.5	202.50	0.41	Sand	SP	very dense	110	31	242.1	0	99	42		
5.80	19.0	190.54	0.40	Sand	SP	very dense	110	29	225.8	5	97	42		
5.95	19.5	190.19	0.42	Sand	SP	very dense	110	29	223.4	5	96	41		
6.10	20.0	146.93	0.52	Sand	SP	dense	110	23	171.1	10	88	40		
6.25	20.5	75.91	1.30	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	87.6	30	69	38		
6.40	21.0	93.48	1.20	Sand to Silty Sand	SP/SM	dense	115	17	106.9	25	74	38		
6.55	21.5	102.65	1.31	Sand to Silty Sand	SP/SM	dense	115	19	116.3	25	77	39		
6.70	22.0	105.68	1.86	Silty Sand to Sandy Silt	SM/ML	dense	115	23	118.7	30	78	39		
6.85	22.5	70.79	3.65	Clayey Silt to Silty Clay	ML/CL	hard	120	28		55			4.12	>10
7.00	23.0	83.63	2.69	Sandy Silt to Clayey Silt	ML	dense	115	24	92.3	45	70	38		
7.18	23.5	40.79	3.26	Clayey Silt to Silty Clay	ML/CL	hard	120	16		65			2.35	>10
7.33	24.0	30.25	3.76	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		80			1.73	>10
7.48	24.5	27.46	4.83	Clay	CL/CH	very stiff	125	22		90			1.57	>10
7.63	25.0	25.59	4.93	Clay	CL/CH	very stiff	125	20		95			1.46	>10
7.78	25.5	23.89	5.75	Clay	CL/CH	very stiff	125	19		100			1.36	>10
7.93	26.0	26.28	4.68	Clay	CL/CH	very stiff	125	21		95			1.49	>10
8.08	26.5	23.58	5.79	Clay	CL/CH	very stiff	125	19		100			1.33	>10
8.23	27.0	27.67	5.67	Clay	CL/CH	very stiff	125	22		100			1.57	>10
8.38	27.5	26.20	5.81	Clay	CL/CH	very stiff	125	21		100			1.49	>10
8.53	28.0	26.76	5.66	Clay	CL/CH	very stiff	125	21		100			1.52	>10
8.68	28.5	29.91	4.98	Clay	CL/CH	very stiff	125	24		95			1.70	>10
8.85	29.0	30.07	5.33	Clay	CL/CH	very stiff	125	24		100			1.71	>10
9.00	29.5	28.25	4.96	Clay	CL/CH	very stiff	125	23		100			1.60	>10
9.15	30.0	28.06	4.68	Clay	CL/CH	very stiff	125	22		100			1.59	>10
9.30	30.5	27.38	4.56	Silty Clay to Clay	CL	very stiff	125	16		100			1.55	>10
9.45	31.0	26.24	4.63	Silty Clay to Clay	CL	very stiff	125	15		100			1.48	>10
9.60	31.5	24.97	4.96	Clay	CL/CH	very stiff	125	20		100			1.41	>10
9.75	32.0	25.44	5.38	Clay	CL/CH	very stiff	125	20		100			1.43	>10
9.90	32.5	31.80	3.86	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		90			1.81	>10
10.05	33.0	31.18	3.95	Silty Clay to Clay	CL	very stiff	125	18		90			1.77	>10
10.20	33.5	33.25	4.95	Clay	CL/CH	very stiff	125	27		95			1.89	>10
10.38	34.0	46.54	4.56	Silty Clay to Clay	CL	hard	125	27		85			2.67	>10
10.53	34.5	57.07	4.91	Silty Clay to Clay	CL	hard	125	33		80			3.29	>10
10.68	35.0	52.58	5.68	Clay	CL/CH	hard	125	42		85			3.03	>10
10.83	35.5	115.50	3.68	Sandy Silt to Clayey Silt	ML	dense	115	33	104.2	50	74	38		
10.98	36.0	105.11	4.19	Overconsolidated Soil	??	dense	120	105	94.3	60	71	38		
11.13	36.5	115.71	3.29	Sandy Silt to Clayey Silt	ML	dense	115	33	103.2	50	73	38		
11.28	37.0	138.81	2.12	Silty Sand to Sandy Silt	SM/ML	dense	115	31	123.1	35	79	39		
11.43	37.5	134.04	3.02	Sandy Silt to Clayey Silt	ML	dense	115	38	118.2	45	77	39		
11.58	38.0	204.45	2.15	Silty Sand to Sandy Silt	SM/ML	dense	115	45	179.3	30	90	41		
11.73	38.5	376.00	1.54	Sand	SP	very dense	110	58	328.1	15	108	43		

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-7
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
11.88	39.0	471.16	1.77	Sand to Silty Sand	SP/SM	very dense	115	86	409.1	15	114	44		
12.05	39.5	389.20	2.22	Sand to Silty Sand	SP/SM	very dense	115	71	336.2	25	108	43		
12.20	40.0	258.68	2.20	Silty Sand to Sandy Silt	SM/ML	very dense	115	57	222.3	30	96	41		
12.35	40.5	224.60	1.64	Sand to Silty Sand	SP/SM	very dense	115	41	192.0	25	92	41		
12.50	41.0	165.74	1.88	Sand to Silty Sand	SP/SM	dense	115	30	141.0	30	83	40		
12.65	41.5	128.21	3.23	Sandy Silt to Clayey Silt	ML	dense	115	37	108.5	50	75	38		
12.80	42.0	218.57	1.76	Sand to Silty Sand	SP/SM	very dense	115	40	184.1	25	91	41		
12.95	42.5	186.24	2.56	Silty Sand to Sandy Silt	SM/ML	dense	115	41	156.1	35	86	40		
13.10	43.0	54.81	4.28	Clayey Silt to Silty Clay	ML/CL	hard	120	22		80			3.14	>10
13.25	43.5	32.29	3.36	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		95			1.82	>10
13.40	44.0	30.77	4.31	Silty Clay to Clay	CL	very stiff	125	18		100			1.73	>10
13.58	44.5	31.57	4.22	Silty Clay to Clay	CL	very stiff	125	18		100			1.77	>10
13.73	45.0	32.31	3.36	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		95			1.82	>10
13.88	45.5	29.72	3.64	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		100			1.66	>10
14.03	46.0	27.56	4.53	Silty Clay to Clay	CL	very stiff	125	16		100			1.54	9.00
14.18	46.5	28.36	4.61	Silty Clay to Clay	CL	very stiff	125	16		100			1.58	9.39
14.33	47.0	28.55	4.77	Clay	CL/CH	very stiff	125	23		100			1.59	6.88
14.48	47.5	30.01	4.73	Silty Clay to Clay	CL	very stiff	125	17		100			1.68	>10
14.63	48.0	30.66	4.65	Silty Clay to Clay	CL	very stiff	125	18		100			1.71	>10
14.78	48.5	32.71	4.00	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.83	>10
14.93	49.0	28.68	4.33	Silty Clay to Clay	CL	very stiff	125	16		100			1.60	8.70
15.10	49.5	29.47	4.33	Silty Clay to Clay	CL	very stiff	125	17		100			1.64	9.00
15.25	50.0	27.24	4.60	Silty Clay to Clay	CL	very stiff	125	16		100			1.51	7.56

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

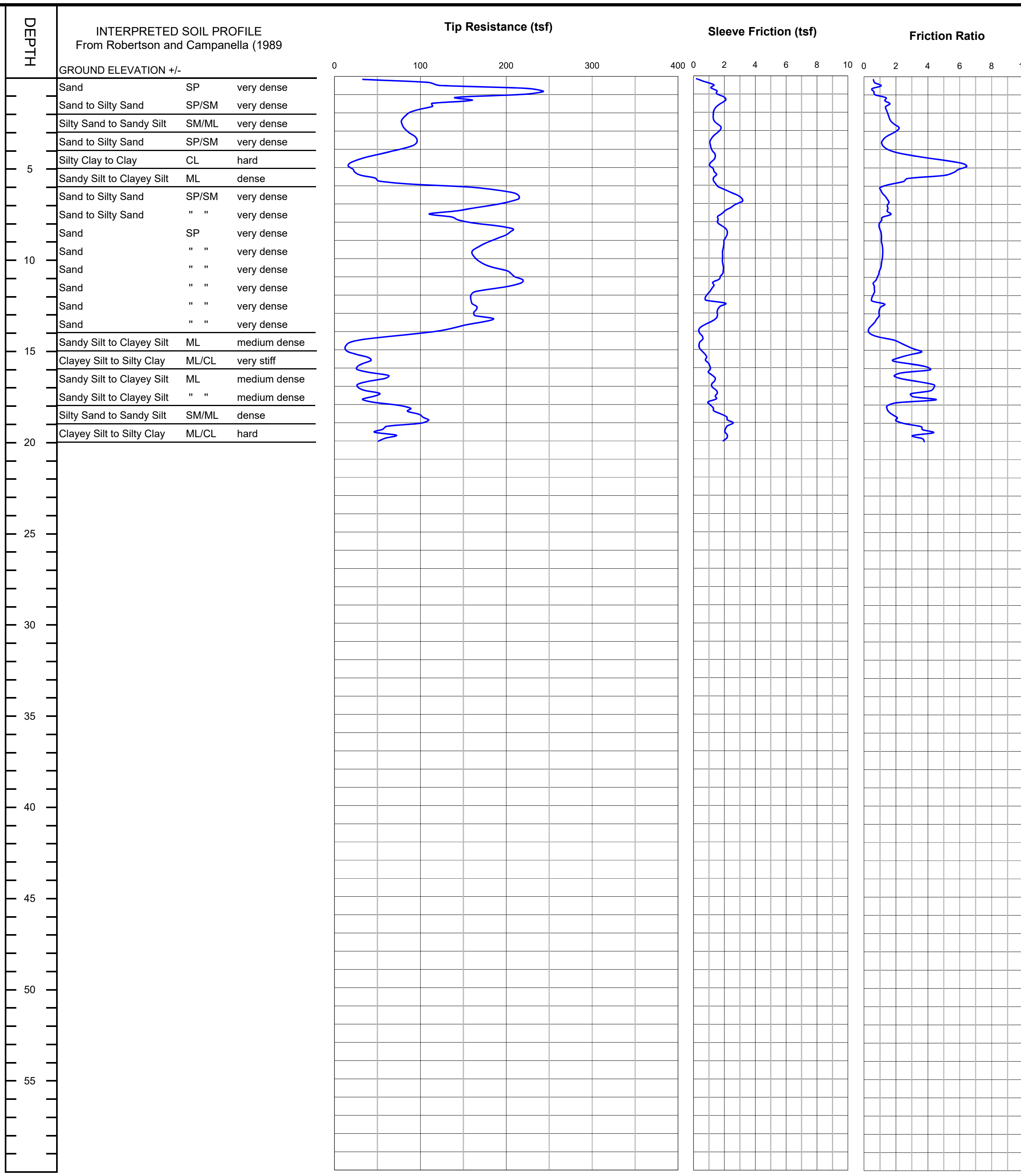
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-8

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand	SP	very dense
Sand to Silty Sand	SP/SM	very dense
Silty Sand to Sandy Silt	SM/ML	very dense
Sand to Silty Sand	SP/SM	very dense
Silty Clay to Clay	CL	hard
Sandy Silt to Clayey Silt	ML	dense
Sand to Silty Sand	SP/SM	very dense
Sand to Silty Sand	" "	very dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Sandy Silt to Clayey Silt	ML	medium dense
Sandy Silt to Clayey Silt	" "	medium dense
Silty Sand to Sandy Silt	SM/ML	dense
Clayey Silt to Silty Clay	ML/CL	hard



END OF SOUNDING AT 20 ft.

Project No. LE18083	LANDMARK Geo-Engineers and Geologists	PLATE B-8

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-8
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	88.32	0.78	Sand to Silty Sand	SP/SM	very dense	115	16	167.0	15	131	46		
0.30	1.0	228.95	0.60	Sand	SP	very dense	110	35	432.8	0	143	48		
0.45	1.5	138.44	1.43	Sand to Silty Sand	SP/SM	very dense	115	25	261.7	15	120	45		
0.60	2.0	100.34	1.41	Sand to Silty Sand	SP/SM	very dense	115	18	189.7	20	106	43		
0.75	2.5	80.23	1.62	Silty Sand to Sandy Silt	SM/ML	very dense	115	18	151.7	25	95	41		
0.93	3.0	80.88	2.07	Silty Sand to Sandy Silt	SM/ML	very dense	115	18	152.9	30	93	41		
1.08	3.5	92.34	1.45	Silty Sand to Sandy Silt	SM/ML	very dense	115	21	174.6	20	94	41		
1.23	4.0	89.86	1.22	Sand to Silty Sand	SP/SM	very dense	115	16	169.9	20	91	41		
1.38	4.5	51.98	2.75	Sandy Silt to Clayey Silt	ML	dense	115	15	98.3	45	73	38		
1.53	5.0	19.91	5.91	Clay	CL/CH	very stiff	125	16		90			1.16	>10
1.68	5.5	30.61	4.82	Clay	CL/CH	very stiff	125	24		70			1.78	>10
1.83	6.0	98.71	1.71	Silty Sand to Sandy Silt	SM/ML	dense	115	22	166.0	25	87	40		
1.98	6.5	204.31	1.19	Sand	SP	very dense	110	31	337.2	10	108	43		
2.13	7.0	200.39	1.49	Sand to Silty Sand	SP/SM	very dense	115	36	325.0	15	107	43		
2.28	7.5	137.95	1.55	Sand to Silty Sand	SP/SM	very dense	115	25	219.7	20	96	41		
2.45	8.0	147.06	1.07	Sand to Silty Sand	SP/SM	very dense	115	27	230.2	10	97	42		
2.60	8.5	200.83	1.00	Sand	SP	very dense	110	31	309.4	10	106	43		
2.75	9.0	191.03	1.09	Sand	SP	very dense	110	29	290.0	10	104	43		
2.90	9.5	167.79	1.16	Sand to Silty Sand	SP/SM	very dense	115	31	250.9	10	100	42		
3.05	10.0	162.16	1.16	Sand to Silty Sand	SP/SM	very dense	115	29	238.8	10	98	42		
3.20	10.5	177.14	1.07	Sand	SP	very dense	110	27	257.2	10	100	42		
3.35	11.0	205.55	0.90	Sand	SP	very dense	110	32	294.6	5	104	43		
3.50	11.5	214.36	0.66	Sand	SP	very dense	110	33	303.3	5	105	43		
3.65	12.0	169.11	0.62	Sand	SP	very dense	110	26	236.3	5	98	42		
3.80	12.5	159.29	0.76	Sand	SP	very dense	110	25	219.9	5	96	41		
3.95	13.0	164.30	0.98	Sand	SP	very dense	110	25	224.1	10	96	41		
4.13	13.5	174.41	0.81	Sand	SP	very dense	110	27	235.2	5	98	42		
4.28	14.0	139.65	0.37	Sand	SP	very dense	110	21	186.2	5	91	41		
4.43	14.5	63.84	1.05	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	84.1	25	67	37		
4.58	15.0	14.42	2.70	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		85			0.82	>10
4.73	15.5	26.87	2.86	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		65			1.55	>10
4.88	16.0	32.17	3.19	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		65			1.86	>10
5.03	16.5	54.06	2.20	Sandy Silt to Clayey Silt	ML	medium dense	115	15	67.8	40	61	37		
5.18	17.0	31.10	4.08	Silty Clay to Clay	CL	very stiff	125	18		75			1.79	>10
5.33	17.5	44.29	3.40	Clayey Silt to Silty Clay	ML/CL	hard	120	18		60			2.57	>10
5.48	18.0	51.06	2.67	Sandy Silt to Clayey Silt	ML	medium dense	115	15	61.9	50	58	36		
5.65	18.5	90.73	1.60	Silty Sand to Sandy Silt	SM/ML	dense	115	20	108.8	30	75	38		
5.80	19.0	104.20	2.22	Silty Sand to Sandy Silt	SM/ML	dense	115	23	123.8	30	79	39		
5.95	19.5	54.69	3.87	Clayey Silt to Silty Clay	ML/CL	hard	120	22		60			3.18	>10
6.10	20.0	60.71	3.49	Clayey Silt to Silty Clay	ML/CL	hard	120	24		55			3.53	>10

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

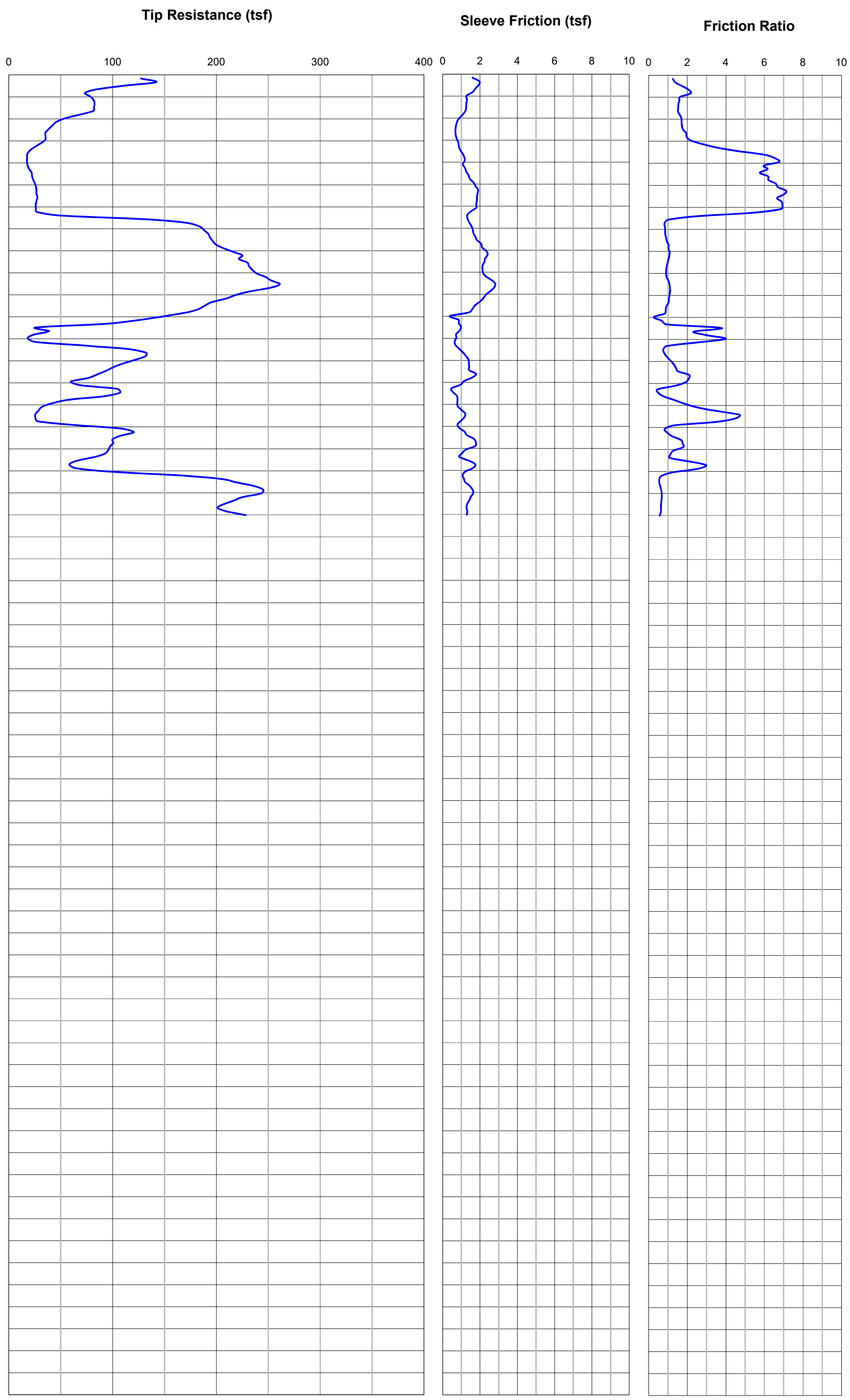
CONE SOUNDING DATA CPT-9

DEPTH

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Silty Sand to Sandy Silt	SM/ML	very dense
Silty Sand to Sandy Silt	" "	very dense
Sandy Silt to Clayey Silt	ML	dense
Clay	CL/CH	very stiff
Clay	" "	very stiff
Clay	" "	very stiff
Silty Sand to Sandy Silt	SM/ML	very dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sandy Silt to Clayey Silt	ML	medium dense
Sand to Silty Sand	SP/SM	dense
Silty Sand to Sandy Silt	SM/ML	dense
Sand to Silty Sand	SP/SM	dense
Sandy Silt to Clayey Silt	ML	medium dense
Sand to Silty Sand	SP/SM	dense
Silty Sand to Sandy Silt	SM/ML	dense
Sand	SP	very dense
Sand	" "	very dense



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-9

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA | **Project No:** LE18083 | **Date:** 6/11/2018

CONE SOUNDING: CPT-9
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	126.66	1.46	Sand to Silty Sand	SP/SM	very dense	115	23	239.4	20	141	48		
0.30	1.0	78.84	1.96	Silty Sand to Sandy Silt	SM/ML	very dense	115	18	149.0	30	111	44		
0.45	1.5	82.12	1.55	Silty Sand to Sandy Silt	SM/ML	very dense	115	18	155.2	25	105	43		
0.60	2.0	68.10	1.61	Silty Sand to Sandy Silt	SM/ML	very dense	115	15	128.7	30	94	41		
0.75	2.5	42.16	1.73	Silty Sand to Sandy Silt	SM/ML	dense	115	9	79.7	40	76	39		
0.93	3.0	35.20	2.02	Sandy Silt to Clayey Silt	ML	medium dense	115	10	66.5	45	68	38		
1.08	3.5	25.07	3.64	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		70			1.46	>10
1.23	4.0	17.55	6.44	Clay	CL/CH	very stiff	125	14		95			1.02	>10
1.38	4.5	19.75	5.97	Clay	CL/CH	very stiff	125	16		90			1.15	>10
1.53	5.0	23.57	6.33	Clay	CL/CH	very stiff	125	19		85			1.37	>10
1.68	5.5	26.75	6.87	Clay	CL/CH	very stiff	125	21		85			1.55	>10
1.83	6.0	26.16	6.90	Clay	CL/CH	very stiff	125	21		85			1.52	>10
1.98	6.5	69.87	3.05	Sandy Silt to Clayey Silt	ML	dense	115	20	113.6	40	76	39		
2.13	7.0	181.01	0.84	Sand	SP	very dense	110	28	289.3	5	104	43		
2.28	7.5	194.03	0.90	Sand	SP	very dense	110	30	305.2	5	105	43		
2.45	8.0	207.21	1.05	Sand	SP	very dense	110	32	321.0	10	107	43		
2.60	8.5	225.48	1.02	Sand	SP	very dense	110	35	344.1	5	109	43		
2.75	9.0	234.83	0.91	Sand	SP	very dense	110	36	353.3	5	110	43		
2.90	9.5	253.71	1.01	Sand	SP	very dense	110	39	376.3	5	112	44		
3.05	10.0	234.20	1.09	Sand	SP	very dense	110	36	342.7	10	109	43		
3.20	10.5	197.66	0.99	Sand	SP	very dense	110	30	285.4	10	103	42		
3.35	11.0	165.70	0.65	Sand	SP	very dense	110	25	236.2	5	98	42		
3.50	11.5	80.84	1.80	Silty Sand to Sandy Silt	SM/ML	dense	115	18	113.7	25	76	39		
3.65	12.0	26.90	3.11	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		65			1.55	>10
3.80	12.5	71.31	1.40	Silty Sand to Sandy Silt	SM/ML	dense	115	16	97.5	25	72	38		
3.95	13.0	128.33	0.96	Sand to Silty Sand	SP/SM	dense	115	23	173.3	10	89	40		
4.13	13.5	101.40	1.40	Sand to Silty Sand	SP/SM	dense	115	18	135.2	20	81	39		
4.28	14.0	73.75	2.03	Silty Sand to Sandy Silt	SM/ML	dense	115	16	97.1	35	72	38		
4.43	14.5	93.58	0.78	Sand to Silty Sand	SP/SM	dense	115	17	121.8	15	78	39		
4.58	15.0	64.44	1.34	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	82.9	30	67	37		
4.73	15.5	28.75	3.57	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		70			1.66	>10
4.88	16.0	55.74	2.54	Sandy Silt to Clayey Silt	ML	medium dense	115	16	70.0	45	62	37		
5.03	16.5	109.27	1.28	Sand to Silty Sand	SP/SM	dense	115	20	135.8	20	82	39		
5.18	17.0	97.88	1.61	Silty Sand to Sandy Silt	SM/ML	dense	115	22	120.4	25	78	39		
5.33	17.5	79.23	1.45	Silty Sand to Sandy Silt	SM/ML	dense	115	18	96.4	30	71	38		
5.48	18.0	74.24	2.25	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	89.4	40	69	38		
5.65	18.5	197.01	0.58	Sand	SP	very dense	110	30	235.1	5	98	42		
5.80	19.0	241.76	0.64	Sand	SP	very dense	110	37	285.9	5	104	42		
5.95	19.5	216.19	0.65	Sand	SP	very dense	110	33	253.5	5	100	42		
6.10	20.0	213.19	0.61	Sand	SP	very dense	110	33	247.8	5	99	42		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

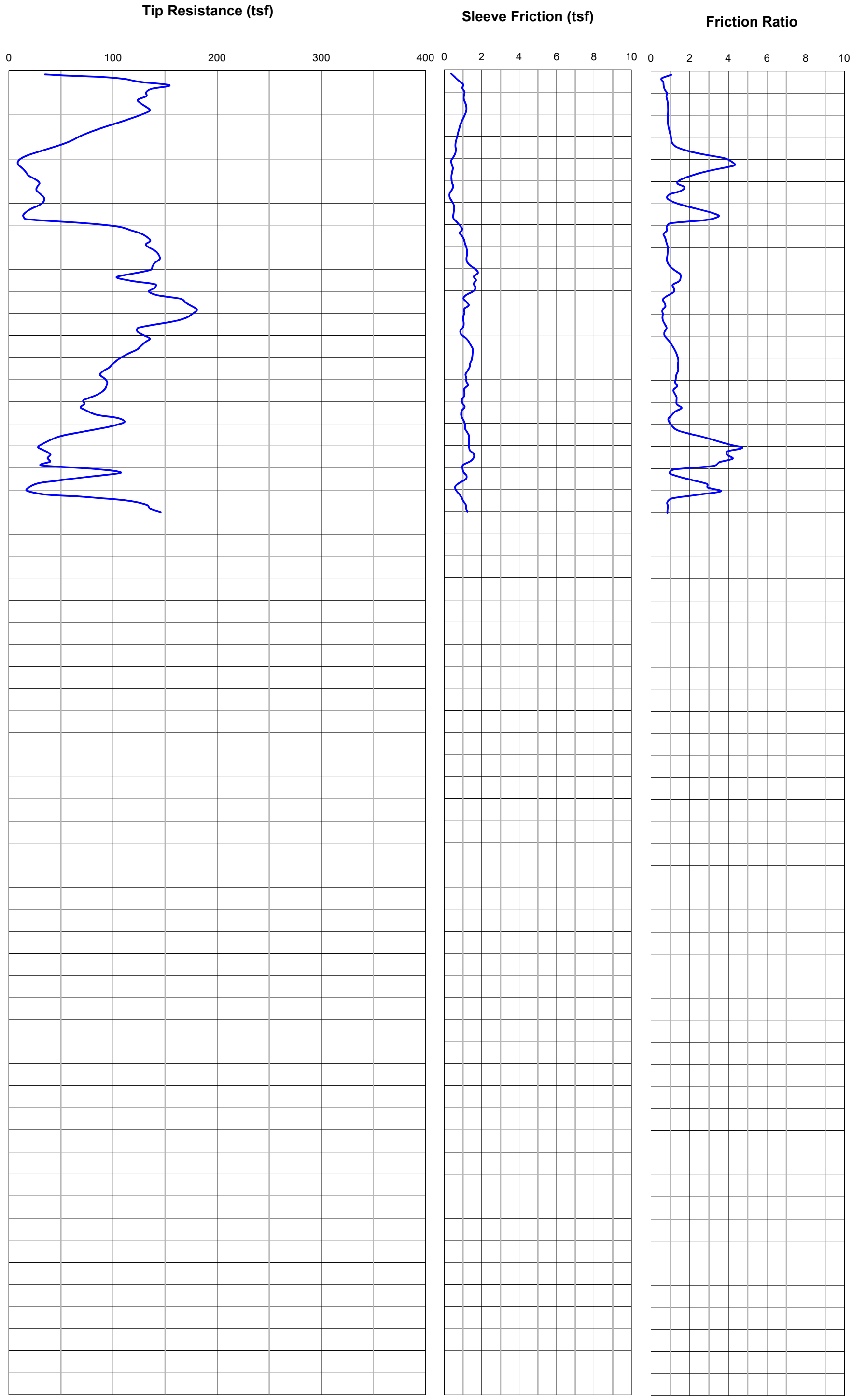
CONE SOUNDING DATA CPT-10

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand	SP	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	very dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	stiff
Silty Sand to Sandy Silt	SM/ML	medium dense
Sandy Silt to Clayey Silt	ML	medium dense
Sand	SP	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	very dense
Sand	SP	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sand to Silty Sand	" "	dense
Sandy Silt to Clayey Silt	ML	medium dense
Clayey Silt to Silty Clay	ML/CL	hard
Sandy Silt to Clayey Silt	ML	medium dense
Sand to Silty Sand	SP/SM	dense

DEPTH: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-10

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-10
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	87.67	0.74	Sand to Silty Sand	SP/SM	very dense	115	16	165.7	15	130	46		
0.30	1.0	140.80	0.72	Sand	SP	very dense	110	22	266.2	10	128	46		
0.45	1.5	127.50	0.84	Sand	SP	very dense	110	20	241.0	10	118	45		
0.60	2.0	131.91	0.88	Sand	SP	very dense	110	20	249.4	10	114	44		
0.75	2.5	108.28	0.88	Sand to Silty Sand	SP/SM	very dense	115	20	204.7	15	105	43		
0.93	3.0	77.69	0.98	Sand to Silty Sand	SP/SM	very dense	115	14	146.9	20	92	41		
1.08	3.5	53.46	1.17	Silty Sand to Sandy Silt	SM/ML	dense	115	12	101.1	25	78	39		
1.23	4.0	22.29	2.80	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		65			1.30	>10
1.38	4.5	10.41	3.98	Clay	CL/CH	stiff	125	8		100			0.60	>10
1.53	5.0	20.29	2.04	Sandy Silt to Clayey Silt	ML	medium dense	115	6	37.7	60	44	34		
1.68	5.5	28.31	1.40	Sandy Silt to Clayey Silt	ML	medium dense	115	8	50.1	45	52	35		
1.83	6.0	32.34	1.19	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	54.7	35	55	36		
1.98	6.5	17.52	2.99	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		75			1.01	>10
2.13	7.0	62.92	1.59	Silty Sand to Sandy Silt	SM/ML	dense	115	14	102.2	30	73	38		
2.28	7.5	125.44	0.73	Sand	SP	very dense	110	19	200.3	10	93	41		
2.45	8.0	134.32	0.83	Sand	SP	very dense	110	21	211.1	10	95	41		
2.60	8.5	143.52	0.84	Sand	SP	very dense	110	22	222.2	10	96	41		
2.75	9.0	138.09	1.04	Sand	SP	very dense	110	21	210.6	10	94	41		
2.90	9.5	113.25	1.49	Sand to Silty Sand	SP/SM	dense	115	21	170.1	20	88	40		
3.05	10.0	138.27	1.16	Sand to Silty Sand	SP/SM	very dense	115	25	204.5	15	94	41		
3.20	10.5	159.11	0.72	Sand	SP	very dense	110	24	232.0	5	97	42		
3.35	11.0	177.52	0.65	Sand	SP	very dense	110	27	255.4	5	100	42		
3.50	11.5	158.66	0.65	Sand	SP	very dense	110	24	225.4	5	96	42		
3.65	12.0	125.49	0.73	Sand	SP	dense	110	19	176.0	10	89	40		
3.80	12.5	131.00	0.99	Sand to Silty Sand	SP/SM	very dense	115	24	181.4	10	90	41		
3.95	13.0	115.90	1.31	Sand to Silty Sand	SP/SM	dense	115	21	158.4	15	86	40		
4.13	13.5	99.88	1.40	Sand to Silty Sand	SP/SM	dense	115	18	134.8	20	81	39		
4.28	14.0	89.86	1.32	Sand to Silty Sand	SP/SM	dense	115	16	119.7	20	78	39		
4.43	14.5	93.41	1.25	Sand to Silty Sand	SP/SM	dense	115	17	123.0	20	79	39		
4.58	15.0	80.03	1.29	Sand to Silty Sand	SP/SM	dense	115	15	104.1	25	74	38		
4.73	15.5	72.28	1.39	Silty Sand to Sandy Silt	SM/ML	dense	115	16	92.9	25	70	38		
4.88	16.0	100.44	1.00	Sand to Silty Sand	SP/SM	dense	115	18	127.7	15	80	39		
5.03	16.5	66.49	1.95	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	83.6	35	67	37		
5.18	17.0	33.61	4.00	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		70			1.94	>10
5.33	17.5	37.27	4.04	Clayey Silt to Silty Clay	ML/CL	hard	120	15		70			2.16	>10
5.48	18.0	51.03	2.65	Sandy Silt to Clayey Silt	ML	medium dense	115	15	62.0	50	58	36		
5.65	18.5	80.45	1.53	Silty Sand to Sandy Silt	SM/ML	dense	115	18	96.8	30	72	38		
5.80	19.0	21.59	3.15	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		80			1.23	>10
5.95	19.5	79.59	1.43	Silty Sand to Sandy Silt	SM/ML	dense	115	18	93.8	30	71	38		
6.10	20.0	138.07	0.85	Sand	SP	dense	110	21	161.2	15	87	40		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
LOCATION: See Site and Boring Location Plan
DATE: 6/11/2018

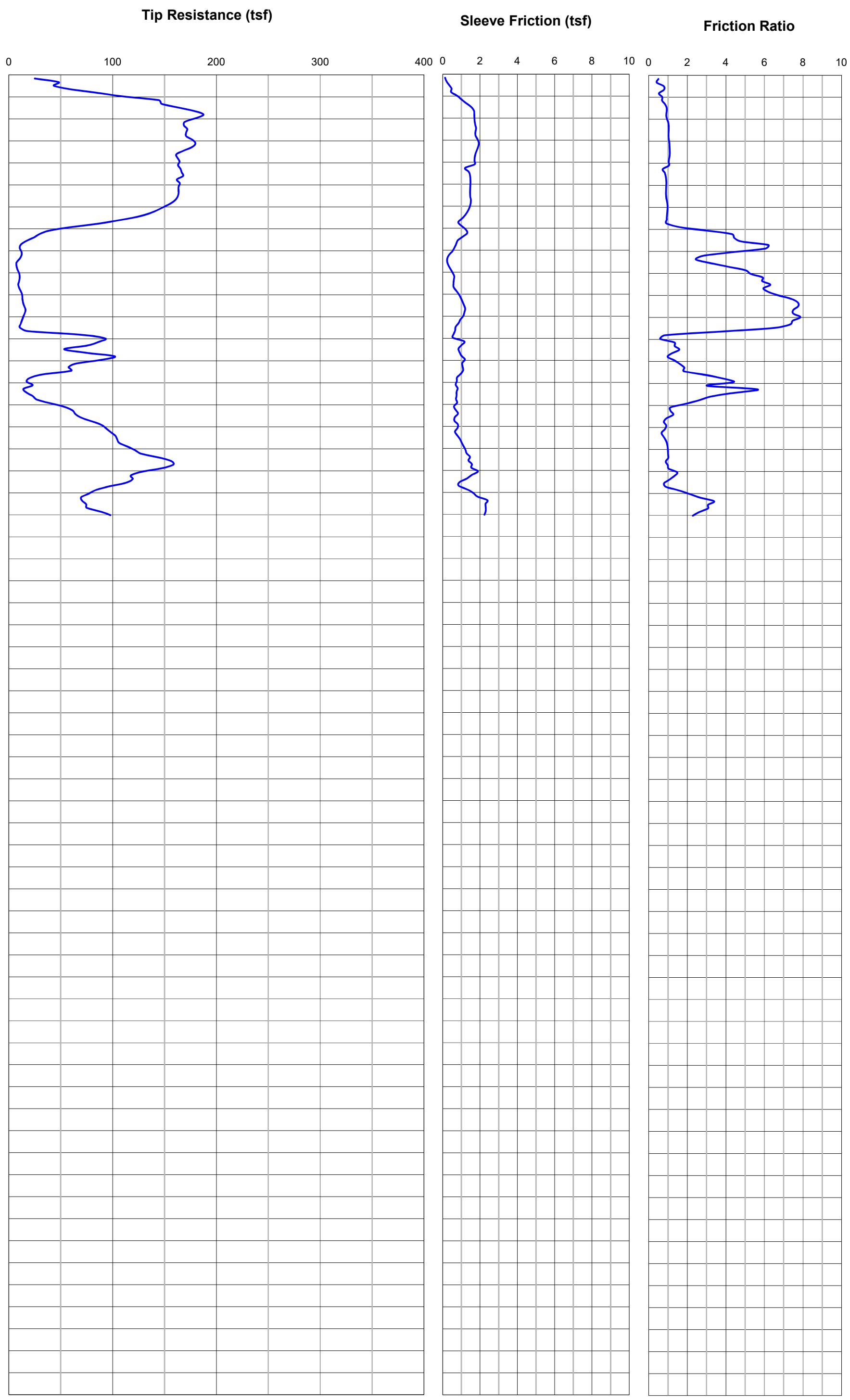
CONE SOUNDING DATA CPT-11

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

DEPTH			
	Sand to Silty Sand	SP/SM	very dense
	Sand	SP	very dense
	Sand	" "	very dense
	Sand	" "	very dense
5	Sand	" "	very dense
	Sand	" "	very dense
	Sand to Silty Sand	SP/SM	dense
	Clay	CL/CH	very stiff
	Clay	" "	stiff
10	Clay	" "	stiff
	Clay	" "	stiff
	Silty Clay to Clay	CL	hard
	Sand to Silty Sand	SP/SM	dense
	Sandy Silt to Clayey Silt	ML	medium dense
	Clayey Silt to Silty Clay	ML/CL	very stiff
15	Sand to Silty Sand	SP/SM	dense
	Sand to Silty Sand	" "	dense
	Sand	SP	dense
	Sand to Silty Sand	SP/SM	dense
	Sandy Silt to Clayey Silt	ML	dense
20			

DEPTH: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-11

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-11
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	38.77	0.56	Silty Sand to Sandy Silt	SM/ML	very dense	115	9	73.3	25	106	43		
0.30	1.0	85.63	0.67	Sand to Silty Sand	SP/SM	very dense	115	16	161.9	10	113	44		
0.45	1.5	151.28	0.82	Sand	SP	very dense	110	23	286.0	10	123	45		
0.60	2.0	182.08	0.92	Sand	SP	very dense	110	28	344.2	10	124	45		
0.75	2.5	170.07	1.03	Sand	SP	very dense	110	26	321.5	10	118	45		
0.93	3.0	172.91	1.03	Sand	SP	very dense	110	27	326.9	10	115	44		
1.08	3.5	174.88	1.08	Sand	SP	very dense	110	27	330.6	10	113	44		
1.23	4.0	162.80	1.06	Sand	SP	very dense	110	25	307.8	10	109	43		
1.38	4.5	164.97	0.87	Sand	SP	very dense	110	25	311.8	10	108	43		
1.53	5.0	164.83	0.90	Sand	SP	very dense	110	25	311.6	10	106	43		
1.68	5.5	163.15	0.90	Sand	SP	very dense	110	25	293.9	10	104	43		
1.83	6.0	152.95	0.97	Sand	SP	very dense	110	24	263.4	10	101	42		
1.98	6.5	126.21	0.94	Sand	SP	very dense	110	19	213.4	10	95	41		
2.13	7.0	65.88	1.81	Silty Sand to Sandy Silt	SM/ML	dense	115	15	109.3	30	75	39		
2.28	7.5	23.94	4.51	Silty Clay to Clay	CL	very stiff	125	14		75			1.39	>10
2.45	8.0	11.45	5.53	Clay	CL/CH	stiff	125	9		100			0.65	>10
2.60	8.5	9.95	2.81	Silty Clay to Clay	CL	stiff	125	6		90			0.56	>10
2.75	9.0	8.63	4.80	Clay	CL/CH	firm	125	7		100			0.48	8.27
2.90	9.5	9.87	6.03	Clay	CL/CH	stiff	125	8		100			0.56	>10
3.05	10.0	11.45	6.30	Clay	CL/CH	stiff	125	9		100			0.65	>10
3.20	10.5	13.80	7.64	Clay	CL/CH	stiff	125	11		100			0.79	>10
3.35	11.0	15.14	7.62	Clay	CL/CH	stiff	125	12		100			0.86	>10
3.50	11.5	11.59	7.10	Clay	CL/CH	stiff	125	9		100			0.65	>10
3.65	12.0	59.98	1.71	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	82.7	30	67	37		
3.80	12.5	71.78	1.42	Silty Sand to Sandy Silt	SM/ML	dense	115	16	97.7	25	72	38		
3.95	13.0	88.27	1.18	Sand to Silty Sand	SP/SM	dense	115	16	118.6	20	78	39		
4.13	13.5	60.73	1.76	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	80.6	35	66	37		
4.28	14.0	23.22	3.74	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		75			1.33	>10
4.43	14.5	17.99	4.35	Clay	CL/CH	very stiff	125	14		90			1.03	>10
4.58	15.0	30.08	2.59	Sandy Silt to Clayey Silt	ML	medium dense	115	9	38.4	60	44	34		
4.73	15.5	59.75	1.18	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	75.4	30	64	37		
4.88	16.0	83.21	0.86	Sand to Silty Sand	SP/SM	dense	115	15	103.9	20	74	38		
5.03	16.5	101.70	0.76	Sand to Silty Sand	SP/SM	dense	115	18	125.6	15	79	39		
5.18	17.0	114.08	0.97	Sand to Silty Sand	SP/SM	dense	115	21	139.5	15	82	40		
5.33	17.5	142.68	0.97	Sand	SP	dense	110	22	172.7	15	89	40		
5.48	18.0	144.57	1.17	Sand to Silty Sand	SP/SM	dense	115	26	173.3	15	89	40		
5.65	18.5	116.75	1.07	Sand to Silty Sand	SP/SM	dense	115	21	138.6	20	82	39		
5.80	19.0	86.30	1.52	Silty Sand to Sandy Silt	SM/ML	dense	115	19	101.5	30	73	38		
5.95	19.5	71.67	3.04	Sandy Silt to Clayey Silt	ML	medium dense	115	20	83.5	45	67	37		
6.10	20.0	87.05	2.66	Sandy Silt to Clayey Silt	ML	dense	115	25	100.4	40	73	38		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

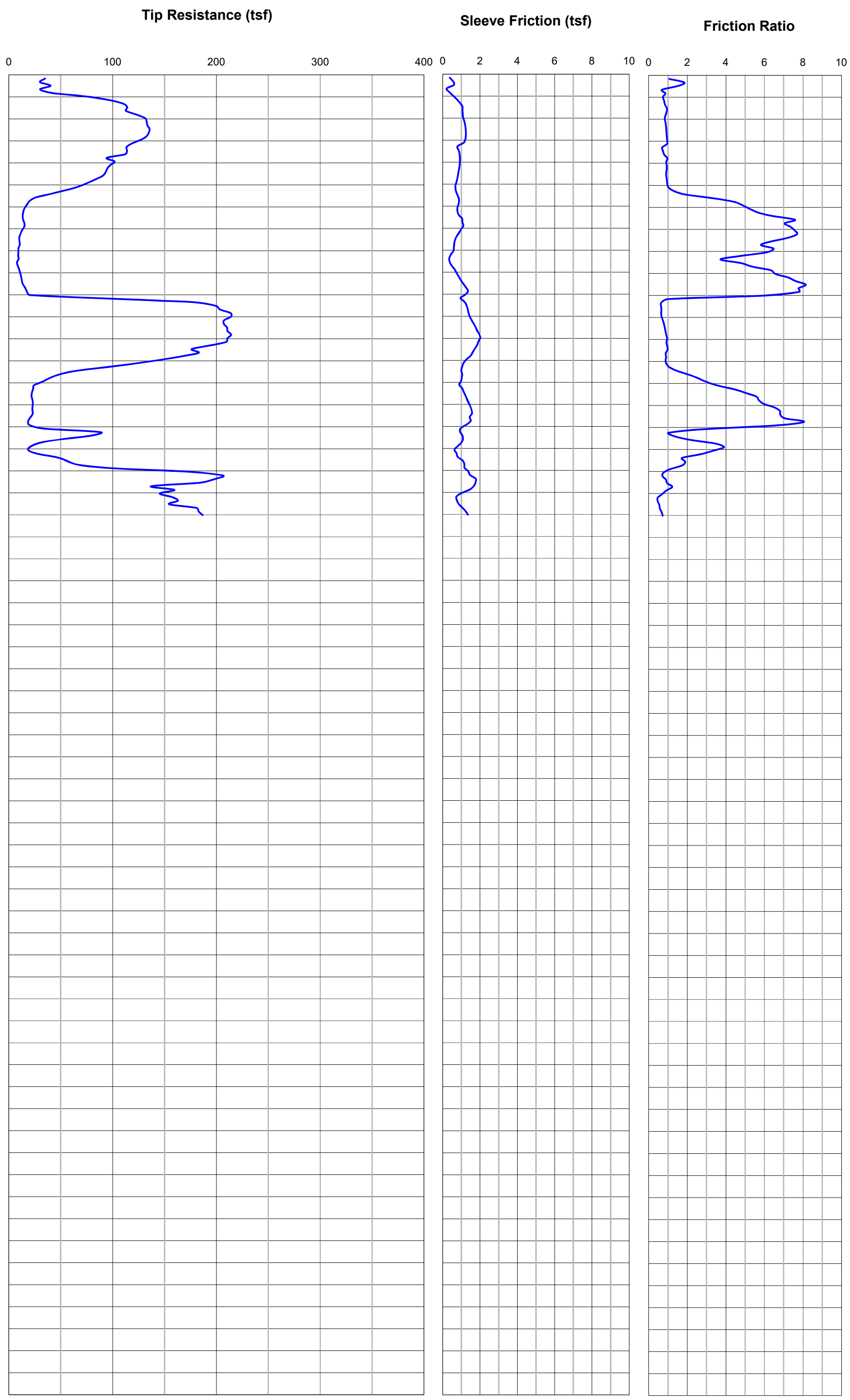
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-12

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

DEPTH			
	Silty Sand to Sandy Silt	SM/ML	very dense
	Sand	SP	very dense
	Sand	" "	very dense
	Sand to Silty Sand	SP/SM	very dense
	Sand to Silty Sand	" "	dense
5	Clayey Silt to Silty Clay	ML/CL	very stiff
	Clay	CL/CH	stiff
	Clay	" "	stiff
	Clay	" "	stiff
	Clay	" "	stiff
10	Sand	SP	very dense
	Sand	" "	very dense
	Sand	" "	very dense
	Silty Sand to Sandy Silt	SM/ML	medium dense
	Clay	CL/CH	very stiff
15	Clay	" "	very stiff
	Sandy Silt to Clayey Silt	ML	medium dense
	Silty Sand to Sandy Silt	SM/ML	dense
	Sand	SP	very dense
	Sand	" "	very dense
20			
25			
30			
35			
40			
45			
50			
55			



END OF SOUNDING AT 20 ft.

Project No.	LANDMARK Geo-Engineers and Geologists	PLATE
LE18083		B-12

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-12
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	35.07	1.46	Silty Sand to Sandy Silt	SM/ML	very dense	115	8	66.3	40	103	42		
0.30	1.0	48.88	0.76	Silty Sand to Sandy Silt	SM/ML	very dense	115	11	92.4	20	97	42		
0.45	1.5	107.21	0.85	Sand to Silty Sand	SP/SM	very dense	115	19	202.7	10	113	44		
0.60	2.0	122.44	0.88	Sand to Silty Sand	SP/SM	very dense	115	22	231.4	10	112	44		
0.75	2.5	133.98	0.89	Sand	SP	very dense	110	21	253.3	10	111	43		
0.93	3.0	131.49	0.94	Sand	SP	very dense	110	20	248.6	10	107	43		
1.08	3.5	115.31	0.79	Sand	SP	very dense	110	18	218.0	10	101	42		
1.23	4.0	102.76	0.89	Sand to Silty Sand	SP/SM	very dense	115	19	194.3	15	95	41		
1.38	4.5	95.22	0.92	Sand to Silty Sand	SP/SM	very dense	115	17	180.0	15	91	41		
1.53	5.0	82.95	0.93	Sand to Silty Sand	SP/SM	dense	115	15	155.4	15	85	40		
1.68	5.5	46.49	1.86	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	82.8	40	67	37		
1.83	6.0	17.41	4.83	Clay	CL/CH	very stiff	125	14		90			1.00	>10
1.98	6.5	13.63	6.56	Clay	CL/CH	stiff	125	11		100			0.78	>10
2.13	7.0	14.26	7.33	Clay	CL/CH	stiff	125	11		100			0.82	>10
2.28	7.5	10.53	7.10	Clay	CL/CH	stiff	125	8		100			0.60	>10
2.45	8.0	9.69	6.15	Clay	CL/CH	stiff	125	8		100			0.55	>10
2.60	8.5	8.71	4.43	Clay	CL/CH	firm	125	7		100			0.49	8.41
2.75	9.0	9.96	6.08	Clay	CL/CH	stiff	125	8		100			0.56	>10
2.90	9.5	12.61	7.66	Clay	CL/CH	stiff	125	10		100			0.72	>10
3.05	10.0	17.74	7.22	Clay	CL/CH	very stiff	125	14		100			1.02	>10
3.20	10.5	158.28	0.76	Sand	SP	very dense	110	24	225.2	5	96	42		
3.35	11.0	210.30	0.66	Sand	SP	very dense	110	32	295.4	5	104	43		
3.50	11.5	208.25	0.79	Sand	SP	very dense	110	32	289.0	5	104	43		
3.65	12.0	211.83	0.91	Sand	SP	very dense	110	33	290.4	5	104	43		
3.80	12.5	192.90	0.95	Sand	SP	very dense	110	30	261.4	10	101	42		
3.95	13.0	164.80	0.88	Sand	SP	very dense	110	25	220.8	10	96	41		
4.13	13.5	93.42	1.19	Sand to Silty Sand	SP/SM	dense	115	17	123.7	20	79	39		
4.28	14.0	40.28	2.58	Sandy Silt to Clayey Silt	ML	medium dense	115	12	52.7	50	54	35		
4.43	14.5	23.35	4.37	Silty Clay to Clay	CL	very stiff	125	13		80			1.34	>10
4.58	15.0	22.55	5.75	Clay	CL/CH	very stiff	125	18		90			1.29	>10
4.73	15.5	22.81	6.72	Clay	CL/CH	very stiff	125	18		100			1.31	>10
4.88	16.0	22.88	6.17	Clay	CL/CH	very stiff	125	18		95			1.31	>10
5.03	16.5	72.30	1.51	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	88.7	30	69	38		
5.18	17.0	22.87	3.57	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		80			1.31	>10
5.33	17.5	43.52	2.09	Sandy Silt to Clayey Silt	ML	medium dense	115	12	52.3	50	53	35		
5.48	18.0	113.38	1.24	Sand to Silty Sand	SP/SM	dense	115	21	134.8	20	81	39		
5.65	18.5	196.22	0.85	Sand	SP	very dense	110	30	231.1	10	97	42		
5.80	19.0	147.32	0.94	Sand	SP	dense	110	23	172.0	15	89	40		
5.95	19.5	158.22	0.49	Sand	SP	very dense	110	24	183.2	5	90	41		
6.10	20.0	183.47	0.65	Sand	SP	very dense	110	28	210.7	10	94	41		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

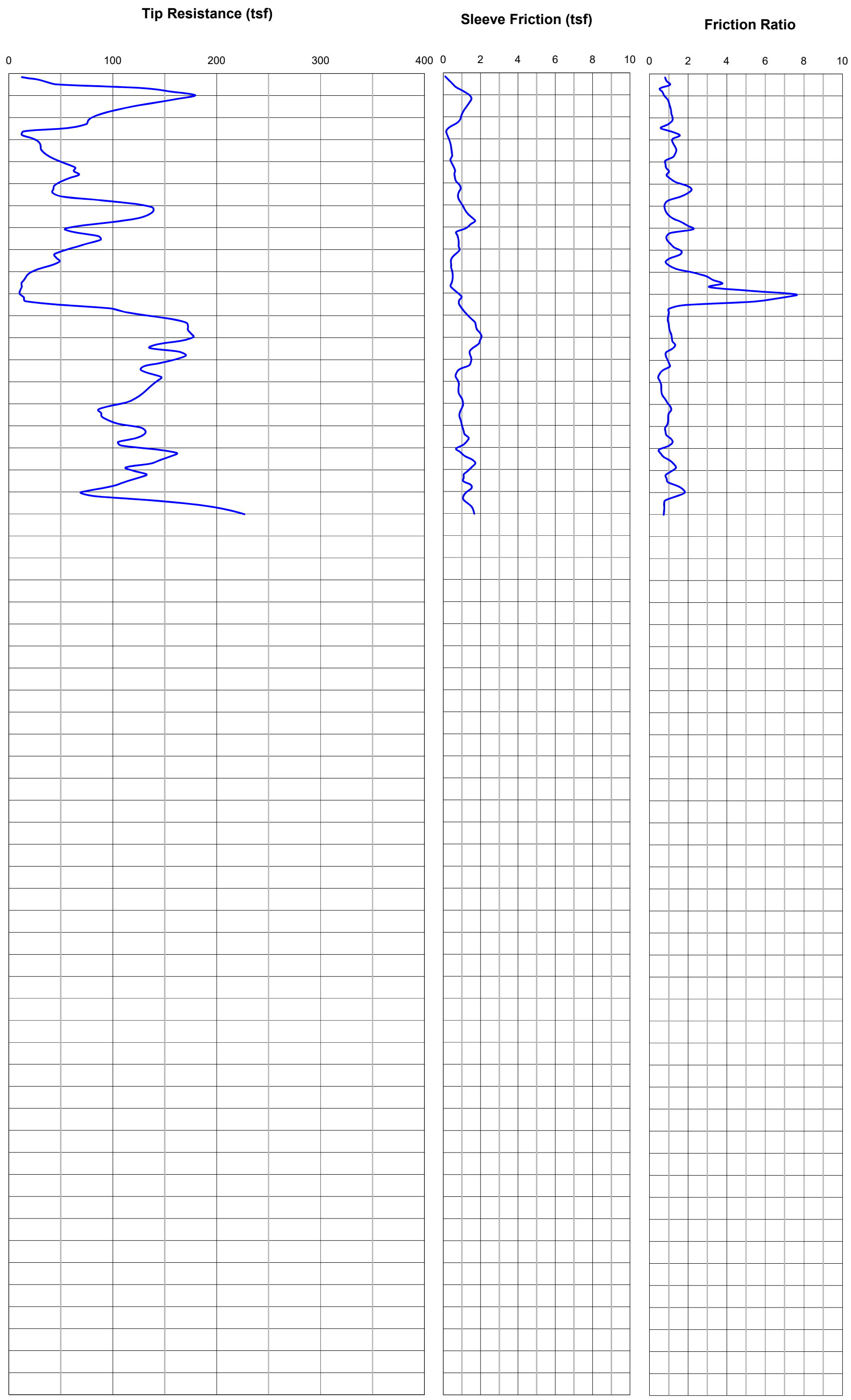
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-13

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

DEPTH			
	Sand to Silty Sand	SP/SM	very dense
	Sand to Silty Sand	" "	very dense
	Silty Sand to Sandy Silt	SM/ML	dense
	Silty Sand to Sandy Silt	" "	medium dense
	Silty Sand to Sandy Silt	" "	dense
5	Silty Sand to Sandy Silt	" "	dense
	Sand to Silty Sand	SP/SM	dense
	Sand to Silty Sand	" "	dense
	Silty Sand to Sandy Silt	SM/ML	medium dense
	Clay	CL/CH	stiff
10	Sandy Silt to Clayey Silt	ML	dense
	Sand	SP	very dense
	Sand	" "	very dense
	Sand	" "	very dense
	Sand	" "	dense
15	Sand to Silty Sand	SP/SM	dense
	Sand to Silty Sand	" "	dense
	Sand	SP	dense
	Sand to Silty Sand	SP/SM	dense
	Sand	SP	very dense
20			
25			
30			
35			
40			
45			
50			
55			



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-13

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-13
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	30.48	0.92	Silty Sand to Sandy Silt	SM/ML	very dense	115	7	57.6	35	99	42		
0.30	1.0	154.19	0.66	Sand	SP	very dense	110	24	291.5	5	131	46		
0.45	1.5	141.98	1.00	Sand	SP	very dense	110	22	268.4	10	121	45		
0.60	2.0	92.14	1.15	Sand to Silty Sand	SP/SM	very dense	115	17	174.2	20	104	42		
0.75	2.5	70.09	0.90	Sand to Silty Sand	SP/SM	very dense	115	13	132.5	20	92	41		
0.93	3.0	16.64	1.31	Sandy Silt to Clayey Silt	ML	medium dense	115	5	31.5	55	46	34		
1.08	3.5	30.16	1.30	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	57.0	40	61	37		
1.23	4.0	39.94	1.12	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	75.5	30	67	37		
1.38	4.5	60.43	0.90	Sand to Silty Sand	SP/SM	dense	115	11	114.2	20	78	39		
1.53	5.0	58.25	1.12	Silty Sand to Sandy Silt	SM/ML	dense	115	13	108.9	25	75	38		
1.68	5.5	44.61	1.93	Sandy Silt to Clayey Silt	ML	medium dense	115	13	79.3	40	66	37		
1.83	6.0	113.88	0.85	Sand to Silty Sand	SP/SM	very dense	115	21	193.3	10	92	41		
1.98	6.5	133.07	1.01	Sand to Silty Sand	SP/SM	very dense	115	24	221.4	10	96	41		
2.13	7.0	76.62	1.96	Silty Sand to Sandy Silt	SM/ML	dense	115	17	125.1	30	79	39		
2.28	7.5	79.66	0.96	Sand to Silty Sand	SP/SM	dense	115	14	127.7	20	80	39		
2.45	8.0	64.72	1.34	Silty Sand to Sandy Silt	SM/ML	dense	115	14	102.0	25	73	38		
2.60	8.5	46.14	1.16	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	71.5	30	63	37		
2.75	9.0	30.94	1.57	Sandy Silt to Clayey Silt	ML	medium dense	115	9	47.1	45	50	35		
2.90	9.5	14.79	3.34	Silty Clay to Clay	CL	stiff	125	8		85			0.85	>10
3.05	10.0	11.31	5.29	Clay	CL/CH	stiff	125	9		100			0.64	>10
3.20	10.5	26.18	4.63	Silty Clay to Clay	CL	very stiff	125	15		75			1.51	>10
3.35	11.0	113.79	0.99	Sand to Silty Sand	SP/SM	dense	115	21	161.9	15	87	40		
3.50	11.5	166.86	0.98	Sand	SP	very dense	110	26	234.2	10	98	42		
3.65	12.0	175.01	1.11	Sand	SP	very dense	110	27	242.7	10	99	42		
3.80	12.5	147.72	1.24	Sand to Silty Sand	SP/SM	very dense	115	27	202.3	15	93	41		
3.95	13.0	165.42	0.88	Sand	SP	very dense	110	25	223.8	10	96	41		
4.13	13.5	135.03	0.91	Sand	SP	dense	110	21	180.6	10	90	41		
4.28	14.0	141.67	0.50	Sand	SP	very dense	110	22	187.4	5	91	41		
4.43	14.5	134.86	0.61	Sand	SP	dense	110	21	176.4	10	89	40		
4.58	15.0	120.54	0.80	Sand	SP	dense	110	19	156.0	10	86	40		
4.73	15.5	90.96	1.06	Sand to Silty Sand	SP/SM	dense	115	17	116.4	20	77	39		
4.88	16.0	104.53	0.91	Sand to Silty Sand	SP/SM	dense	115	19	132.3	15	81	39		
5.03	16.5	127.58	0.94	Sand	SP	dense	110	20	159.8	15	86	40		
5.18	17.0	117.50	0.88	Sand to Silty Sand	SP/SM	dense	115	21	145.7	15	84	40		
5.33	17.5	154.12	0.79	Sand	SP	very dense	110	24	189.2	10	91	41		
5.48	18.0	122.96	1.25	Sand to Silty Sand	SP/SM	dense	115	22	149.4	20	84	40		
5.65	18.5	122.80	0.89	Sand to Silty Sand	SP/SM	dense	115	22	147.7	15	84	40		
5.80	19.0	85.89	1.66	Silty Sand to Sandy Silt	SM/ML	dense	115	19	102.3	30	73	38		
5.95	19.5	127.48	0.97	Sand to Silty Sand	SP/SM	dense	115	23	150.4	15	85	40		
6.10	20.0	212.35	0.75	Sand	SP	very dense	110	33	248.2	5	99	42		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-14

DEPTH

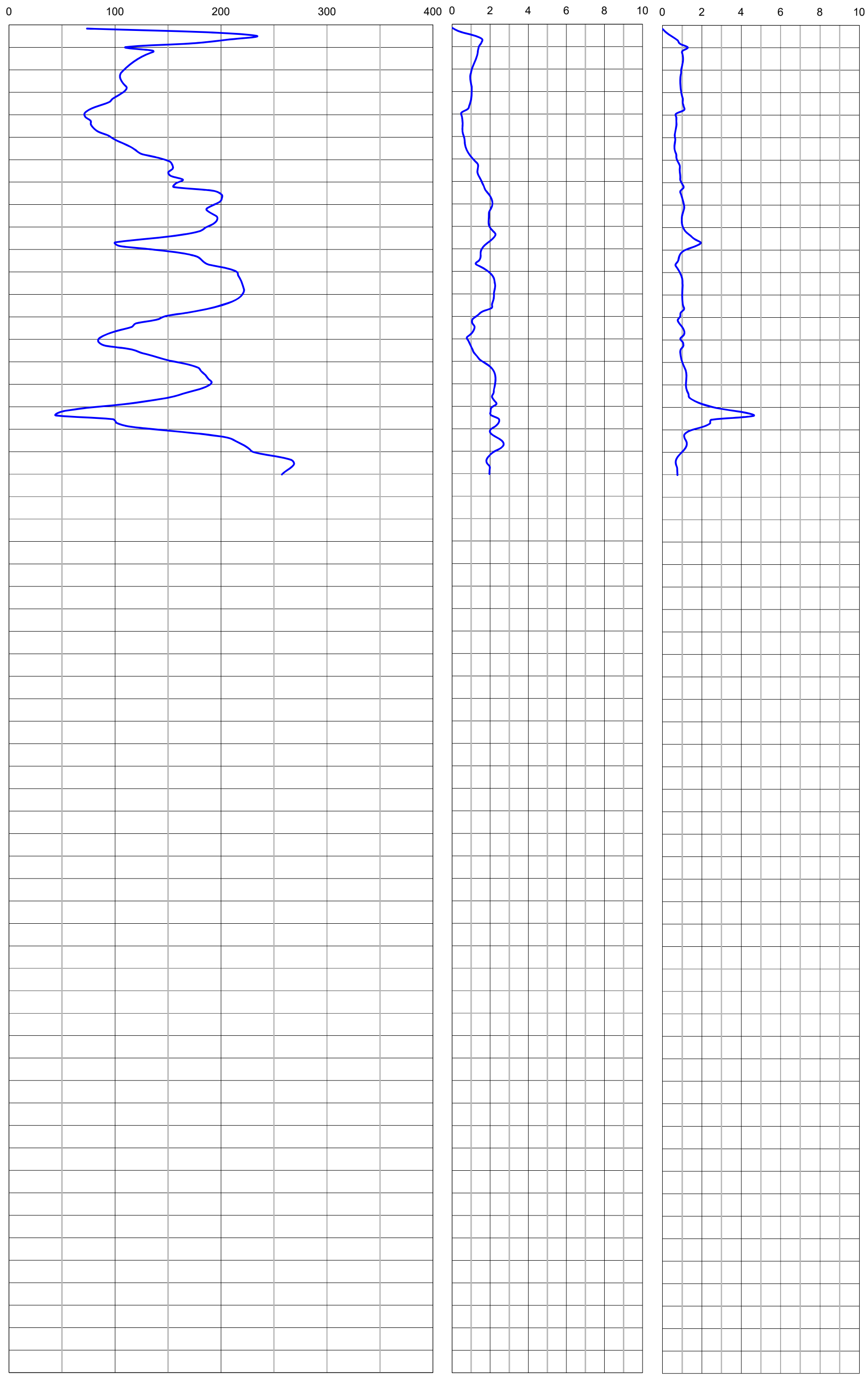
INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand	SP	very dense
Sand to Silty Sand	SP/SM	very dense
Sand to Silty Sand	" "	very dense
Sand to Silty Sand	" "	very dense
Sand to Silty Sand	" "	dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	very dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Sand	SP	very dense
Sand to Silty Sand	SP/SM	dense
Sandy Silt to Clayey Silt	ML	dense
Sand	SP	very dense
Sand	" "	very dense

5 10 15 20 25 30 35 40 45 50 55

Tip Resistance (tsf) Sleeve Friction (tsf) Friction Ratio



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-14

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-14
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	165.07	0.23	Sand	SP	very dense	110	25	312.0	0	150	49		
0.30	1.0	163.13	0.98	Sand	SP	very dense	110	25	308.4	10	133	47		
0.45	1.5	129.46	1.02	Sand to Silty Sand	SP/SM	very dense	115	24	244.7	10	119	45		
0.60	2.0	113.34	0.99	Sand to Silty Sand	SP/SM	very dense	115	21	214.3	15	110	43		
0.75	2.5	105.37	0.92	Sand to Silty Sand	SP/SM	very dense	115	19	199.2	15	104	43		
0.93	3.0	109.32	0.93	Sand to Silty Sand	SP/SM	very dense	115	20	206.6	15	102	42		
1.08	3.5	98.62	1.01	Sand to Silty Sand	SP/SM	very dense	115	18	186.4	15	96	41		
1.23	4.0	77.02	0.95	Sand to Silty Sand	SP/SM	dense	115	14	145.6	20	87	40		
1.38	4.5	75.42	0.71	Sand to Silty Sand	SP/SM	dense	115	14	142.6	15	84	40		
1.53	5.0	85.89	0.65	Sand to Silty Sand	SP/SM	dense	115	16	160.5	10	86	40		
1.68	5.5	109.77	0.63	Sand	SP	very dense	110	17	195.2	10	92	41		
1.83	6.0	138.57	0.73	Sand	SP	very dense	110	21	235.9	10	98	42		
1.98	6.5	152.94	0.88	Sand	SP	very dense	110	24	255.7	10	100	42		
2.13	7.0	158.07	0.94	Sand	SP	very dense	110	24	259.7	10	101	42		
2.28	7.5	182.82	0.98	Sand	SP	very dense	110	28	295.4	10	104	43		
2.45	8.0	197.17	1.06	Sand	SP	very dense	110	30	313.5	10	106	43		
2.60	8.5	190.74	1.03	Sand	SP	very dense	110	29	298.6	10	105	43		
2.75	9.0	191.41	1.01	Sand	SP	very dense	110	29	295.1	10	104	43		
2.90	9.5	158.04	1.41	Sand to Silty Sand	SP/SM	very dense	115	29	239.9	15	98	42		
3.05	10.0	113.90	1.57	Sand to Silty Sand	SP/SM	dense	115	21	170.2	20	88	40		
3.20	10.5	175.07	0.84	Sand	SP	very dense	110	27	257.8	5	100	42		
3.35	11.0	202.52	0.77	Sand	SP	very dense	110	31	294.2	5	104	43		
3.50	11.5	218.07	1.00	Sand	SP	very dense	110	34	312.7	5	106	43		
3.65	12.0	220.97	1.01	Sand	SP	very dense	110	34	312.8	5	106	43		
3.80	12.5	209.84	1.02	Sand	SP	very dense	110	32	293.4	10	104	43		
3.95	13.0	169.08	0.97	Sand	SP	very dense	110	26	233.6	10	98	42		
4.13	13.5	124.93	0.89	Sand to Silty Sand	SP/SM	dense	115	23	170.4	10	88	40		
4.28	14.0	93.18	1.03	Sand to Silty Sand	SP/SM	dense	115	17	125.5	15	79	39		
4.43	14.5	96.28	1.00	Sand to Silty Sand	SP/SM	dense	115	18	128.1	15	80	39		
4.58	15.0	137.44	0.94	Sand	SP	dense	110	21	180.7	10	90	41		
4.73	15.5	175.44	1.13	Sand	SP	very dense	110	27	228.2	10	97	42		
4.88	16.0	187.92	1.20	Sand	SP	very dense	110	29	241.9	10	99	42		
5.03	16.5	165.39	1.31	Sand to Silty Sand	SP/SM	very dense	115	30	210.6	15	94	41		
5.18	17.0	103.46	2.25	Silty Sand to Sandy Silt	SM/ML	dense	115	23	130.3	30	80	39		
5.33	17.5	63.67	3.74	Clayey Silt to Silty Clay	ML/CL	hard	120	25		50			3.71	>10
5.48	18.0	120.39	1.93	Silty Sand to Sandy Silt	SM/ML	dense	115	27	148.2	25	84	40		
5.65	18.5	200.51	1.15	Sand	SP	very dense	110	31	244.4	10	99	42		
5.80	19.0	226.22	1.10	Sand	SP	very dense	110	35	273.2	10	102	42		
5.95	19.5	261.55	0.71	Sand	SP	very dense	110	40	313.0	5	106	43		
6.10	20.0	261.87	0.75	Sand	SP	very dense	110	40	310.6	5	106	43		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

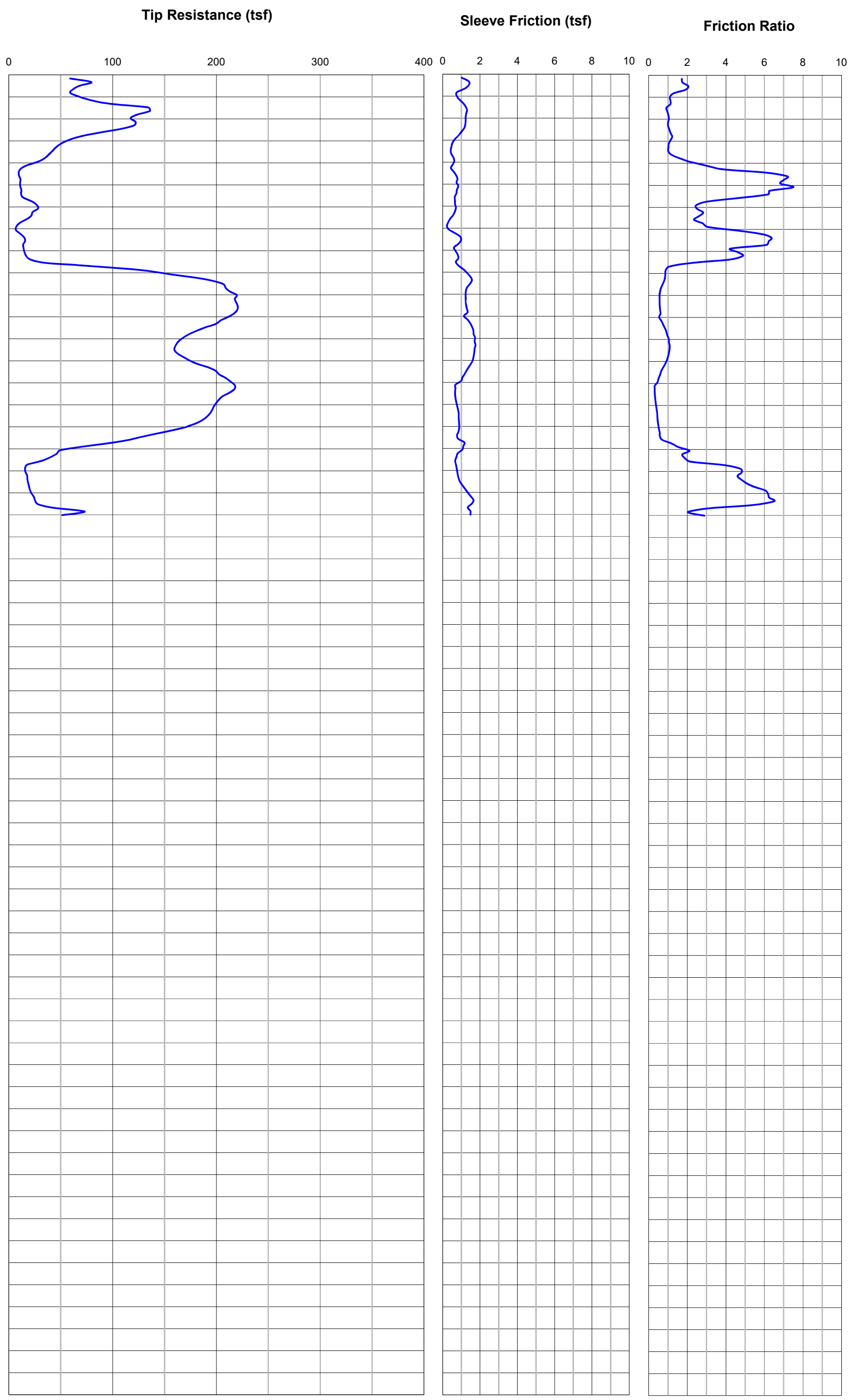
CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

CONE SOUNDING DATA CPT-15

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

DEPTH			
	Silty Sand to Sandy Silt	SM/ML	very dense
	Sand to Silty Sand	SP/SM	very dense
	Sand to Silty Sand	" "	very dense
	Silty Sand to Sandy Silt	SM/ML	medium dense
5	Clay	CL/CH	stiff
	Clay	" "	very stiff
	Clayey Silt to Silty Clay	ML/CL	stiff
	Clay	CL/CH	stiff
	Silty Sand to Sandy Silt	SM/ML	dense
10	Sand	SP	very dense
	Sand	" "	very dense
	Sand	" "	very dense
	Sand	" "	very dense
	Sand	" "	very dense
15	Sand	" "	very dense
	Sand	" "	very dense
	Sand to Silty Sand	SP/SM	dense
	Clayey Silt to Silty Clay	ML/CL	very stiff
	Clay	CL/CH	very stiff
20	Silty Clay to Clay	CL	hard



END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
Geo-Engineers and Geologists

PLATE
B-15

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-15
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	68.94	1.84	Silty Sand to Sandy Silt	SM/ML	very dense	115	15	130.3	30	123	45		
0.30	1.0	62.88	1.43	Silty Sand to Sandy Silt	SM/ML	very dense	115	14	118.9	25	104	43		
0.45	1.5	103.40	1.05	Sand to Silty Sand	SP/SM	very dense	115	19	195.5	15	112	44		
0.60	2.0	125.66	1.01	Sand to Silty Sand	SP/SM	very dense	115	23	237.5	15	112	44		
0.75	2.5	116.55	1.02	Sand to Silty Sand	SP/SM	very dense	115	21	220.3	15	106	43		
0.93	3.0	71.72	1.16	Silty Sand to Sandy Silt	SM/ML	dense	115	16	135.6	20	89	40		
1.08	3.5	46.15	1.02	Silty Sand to Sandy Silt	SM/ML	dense	115	10	87.2	25	74	38		
1.23	4.0	34.01	1.65	Sandy Silt to Clayey Silt	ML	medium dense	115	10	64.3	40	62	37		
1.38	4.5	13.00	4.31	Clay	CL/CH	stiff	125	10		95			0.75	>10
1.53	5.0	10.67	7.01	Clay	CL/CH	stiff	125	9		100			0.61	>10
1.68	5.5	12.21	6.15	Clay	CL/CH	stiff	125	10		100			0.70	>10
1.83	6.0	25.58	2.66	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		60			1.48	>10
1.98	6.5	20.60	2.59	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		65			1.19	>10
2.13	7.0	8.26	3.48	Clay	CL/CH	firm	125	7		100			0.46	9.19
2.28	7.5	13.78	6.16	Clay	CL/CH	stiff	125	11		100			0.79	>10
2.45	8.0	14.29	4.99	Clay	CL/CH	stiff	125	11		95			0.82	>10
2.60	8.5	22.75	3.77	Silty Clay to Clay	CL	very stiff	125	13		70			1.31	>10
2.75	9.0	118.25	0.93	Sand to Silty Sand	SP/SM	dense	115	22	175.4	10	89	40		
2.90	9.5	192.33	0.78	Sand	SP	very dense	110	30	281.2	5	103	42		
3.05	10.0	213.76	0.59	Sand	SP	very dense	110	33	308.4	5	106	43		
3.20	10.5	219.05	0.57	Sand	SP	very dense	110	34	312.0	0	106	43		
3.35	11.0	216.49	0.58	Sand	SP	very dense	110	33	304.5	0	105	43		
3.50	11.5	197.62	0.74	Sand	SP	very dense	110	30	274.6	5	102	42		
3.65	12.0	173.33	0.97	Sand	SP	very dense	110	27	237.9	10	98	42		
3.80	12.5	161.01	1.07	Sand	SP	very dense	110	25	218.5	10	96	41		
3.95	13.0	167.26	0.99	Sand	SP	very dense	110	26	224.3	10	96	41		
4.13	13.5	190.54	0.74	Sand	SP	very dense	110	29	252.7	5	100	42		
4.28	14.0	208.45	0.52	Sand	SP	very dense	110	32	273.5	0	102	42		
4.43	14.5	216.11	0.31	Sand	SP	very dense	110	33	280.5	0	103	42		
4.58	15.0	202.77	0.34	Sand	SP	very dense	110	31	260.4	0	101	42		
4.73	15.5	195.39	0.42	Sand	SP	very dense	110	30	248.4	0	99	42		
4.88	16.0	179.06	0.49	Sand	SP	very dense	110	28	225.3	5	96	42		
5.03	16.5	133.10	0.62	Sand	SP	dense	110	20	165.9	10	87	40		
5.18	17.0	73.02	1.61	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	90.1	30	69	38		
5.33	17.5	38.96	1.91	Sandy Silt to Clayey Silt	ML	medium dense	115	11	47.6	50	51	35		
5.48	18.0	16.47	4.50	Clay	CL/CH	stiff	125	13		100			0.93	>10
5.65	18.5	17.95	4.83	Clay	CL/CH	very stiff	125	14		100			1.02	>10
5.80	19.0	20.54	5.90	Clay	CL/CH	very stiff	125	16		100			1.17	>10
5.95	19.5	25.95	6.08	Clay	CL/CH	very stiff	125	21		95			1.49	>10
6.10	20.0	56.03	2.66	Sandy Silt to Clayey Silt	ML	medium dense	115	16	64.6	50	60	36		

CLIENT: ZGlobal
PROJECT: Vega SES Solar - Calexico, CA
LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight
DATE: 6/11/2018

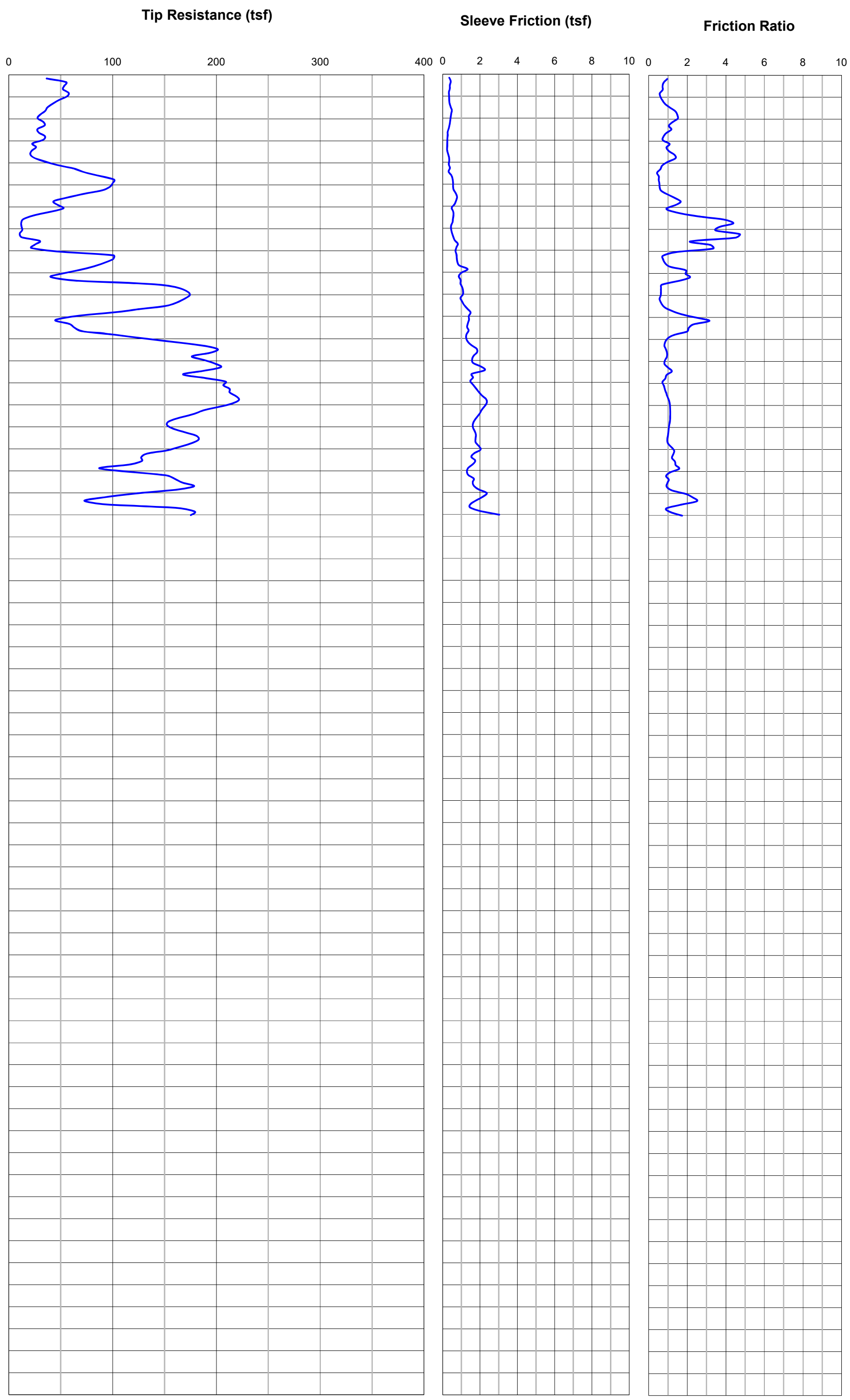
CONE SOUNDING DATA CPT-16

DEPTH

INTERPRETED SOIL PROFILE
From Robertson and Campanella (1989

GROUND ELEVATION +/-

Sand to Silty Sand	SP/SM	very dense
Silty Sand to Sandy Silt	SM/ML	dense
Silty Sand to Sandy Silt	" "	medium dense
Sandy Silt to Clayey Silt	ML	medium dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	dense
Clayey Silt to Silty Clay	ML/CL	very stiff
Clayey Silt to Silty Clay	" "	very stiff
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	very dense
Sand to Silty Sand	" "	very dense
Silty Sand to Sandy Silt	SM/ML	dense
Sand	SP	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand	" "	very dense
Sand to Silty Sand	SP/SM	dense
Sand to Silty Sand	" "	very dense
Sand to Silty Sand	" "	dense



5 10 15 20 25 30 35 40 45 50 55

END OF SOUNDING AT 20 ft.

Project No.
LE18083

LANDMARK
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PLATE
B-16

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

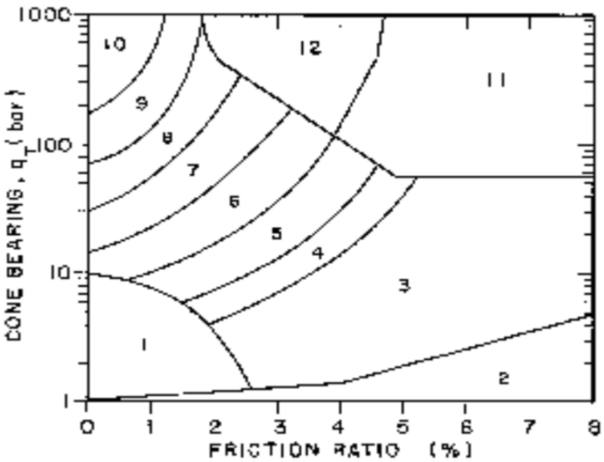
Project: Vega SES Solar - Calexico, CA **Project No:** LE18083 **Date:** 6/11/2018

CONE SOUNDING: CPT-16
Est. GWT (ft): 6
Phi Correlation: **0** 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	**Nk:** Phi (deg.)	**17** Su (tsf)	OCR
0.15	0.5	48.36	0.82	Silty Sand to Sandy Silt	SM/ML	very dense	115	11	91.4	25	113	44		
0.30	1.0	55.20	0.63	Sand to Silty Sand	SP/SM	very dense	115	10	104.3	20	101	42		
0.45	1.5	42.48	0.90	Silty Sand to Sandy Silt	SM/ML	dense	115	9	80.3	25	85	40		
0.60	2.0	30.99	1.46	Sandy Silt to Clayey Silt	ML	dense	115	9	58.6	40	71	38		
0.75	2.5	31.76	1.15	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	60.0	35	68	38		
0.93	3.0	32.29	0.80	Silty Sand to Sandy Silt	SM/ML	medium dense	115	7	61.0	30	65	37		
1.08	3.5	23.69	1.02	Sandy Silt to Clayey Silt	ML	medium dense	115	7	44.8	40	54	36		
1.23	4.0	26.67	1.23	Sandy Silt to Clayey Silt	ML	medium dense	115	8	50.4	40	55	36		
1.38	4.5	60.98	0.58	Sand to Silty Sand	SP/SM	dense	115	11	115.3	15	78	39		
1.53	5.0	96.30	0.53	Sand	SP	dense	110	15	179.3	10	90	41		
1.68	5.5	78.74	0.89	Sand to Silty Sand	SP/SM	dense	115	14	139.6	15	82	40		
1.83	6.0	47.53	1.31	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	80.5	30	66	37		
1.98	6.5	25.26	2.61	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		60			1.47	>10
2.13	7.0	12.34	3.84	Clay	CL/CH	stiff	125	10		95			0.70	>10
2.28	7.5	17.55	3.79	Silty Clay to Clay	CL	very stiff	125	10		80			1.01	>10
2.45	8.0	32.38	2.64	Sandy Silt to Clayey Silt	ML	medium dense	115	9	50.5	55	52	35		
2.60	8.5	98.05	0.77	Sand to Silty Sand	SP/SM	dense	115	18	150.5	10	85	40		
2.75	9.0	68.04	1.64	Silty Sand to Sandy Silt	SM/ML	dense	115	15	102.7	30	73	38		
2.90	9.5	81.16	1.44	Silty Sand to Sandy Silt	SM/ML	dense	115	18	120.7	25	78	39		
3.05	10.0	169.86	0.63	Sand	SP	very dense	110	26	248.9	5	99	42		
3.20	10.5	161.19	0.65	Sand	SP	very dense	110	25	233.1	5	97	42		
3.35	11.0	92.45	1.66	Silty Sand to Sandy Silt	SM/ML	dense	115	21	131.9	25	81	39		
3.50	11.5	55.31	2.51	Sandy Silt to Clayey Silt	ML	medium dense	115	16	77.8	40	65	37		
3.65	12.0	100.22	1.40	Sand to Silty Sand	SP/SM	dense	115	18	139.1	20	82	40		
3.80	12.5	182.11	0.85	Sand	SP	very dense	110	28	249.5	5	99	42		
3.95	13.0	186.13	0.91	Sand	SP	very dense	110	29	252.1	10	100	42		
4.13	13.5	196.88	1.01	Sand	SP	very dense	110	30	263.6	10	101	42		
4.28	14.0	188.54	0.83	Sand	SP	very dense	110	29	249.6	5	99	42		
4.43	14.5	210.71	0.84	Sand	SP	very dense	110	32	276.0	5	102	42		
4.58	15.0	218.84	1.03	Sand	SP	very dense	110	34	283.6	10	103	42		
4.73	15.5	189.09	1.11	Sand	SP	very dense	110	29	242.5	10	99	42		
4.88	16.0	157.31	1.07	Sand	SP	very dense	110	24	199.7	15	93	41		
5.03	16.5	177.55	0.99	Sand	SP	very dense	110	27	223.1	10	96	41		
5.18	17.0	165.18	1.16	Sand to Silty Sand	SP/SM	very dense	115	30	205.4	15	94	41		
5.33	17.5	129.36	1.28	Sand to Silty Sand	SP/SM	dense	115	24	159.2	20	86	40		
5.48	18.0	106.44	1.36	Sand to Silty Sand	SP/SM	dense	115	19	129.6	20	80	39		
5.65	18.5	159.79	0.97	Sand	SP	very dense	110	25	192.7	10	92	41		
5.80	19.0	153.33	1.36	Sand to Silty Sand	SP/SM	very dense	115	28	183.1	20	90	41		
5.95	19.5	86.09	2.14	Silty Sand to Sandy Silt	SM/ML	dense	115	19	101.8	35	73	38		
6.10	20.0	172.03	1.25	Sand to Silty Sand	SP/SM	very dense	115	31	201.5	15	93	41		

Simplified Soil Classification Chart

After Robertson & Campanella (1989)

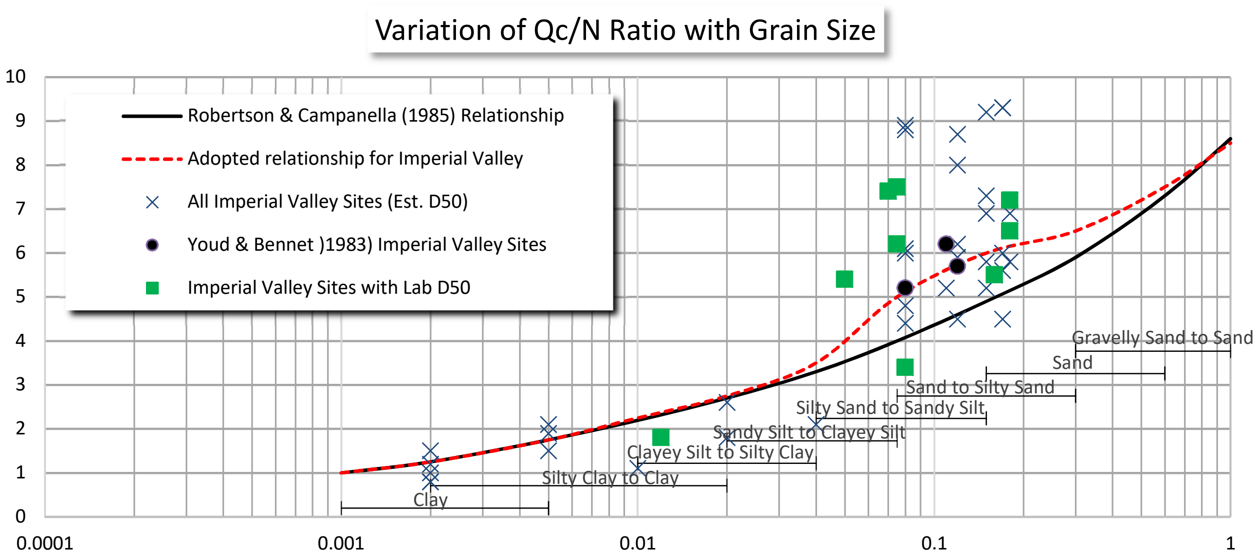


Geotechnical Parameters from CPT Data:

Equivalent SPT N(60) blow count = Qc/(Qc/N Ratio)
N1(60) = Cn*N(60) Normalized SPT blow count
Cn = 1/(p'o)^0.5 < 1.6 max. from Liao & Whitman (1986)
p'o = effective overburden pressure (tsf) using unit densities
given below and estimated groundwater table.
Dr = Relative density (%) from Jamiolkowski et. al. (1986) relationship
= -98 +68*log(Qc/p'o^0.5) where Qc, p'o in tonne/sqm
Note: 1 tonne/sqm = 0.1024 tsf, 1 bar =1.0443 tsf
Phi = Friction Angle estimated from either:

1. Roberton & Campanella (1983) chart:
   Phi = 5.3 + 24*(log(Qc/p'o))+3(log(Qc/p'o))^2
2. Peck, Hansen & Thornburn (1974) N-Phi Correlation
3. Schmertman (1978) chart [Phi = 28+0.14*Dr for fine uniform sands]

Su = undrained shear strength (tsf)
= (Qc-p'o)/Nk where Nk varies from 10 to 22, 17 for OC clays
OCR = Overconsolidation Ratio estimated from Schmertman (1978)
chart using Su/p'o ratio and estimated normal consolidated Su/p'o



Note: Assumed Properties and Adopted Qc/N Ratio based on correlations from Imperial Valley, California soils

Table of Soil Types and Assumed Properties

Zone	Soil Classification	UCS	Density (pcf)	R&C Qc/N	Adopted Qc/N	Est. PI	Fines (%)	D50 (mm)
1	Sensitive fine grained	ML	120	2	2	NP-15	65-100	0.02
2	Organic Material	OL/OH	120	1	1	--	--	--
3	Clay	CL/CH	125	1	1.25	25-40+	90-100	0.002
4	Silty Clay to Clay	CL	125	1.5	2	15-40	90-100	0.01
5	Clayey Silt to Silty Clay	ML/CL	120	2	2.75	25-May	90-100	0.02
6	Sandy Silt to Clayey Silt	ML	115	2.5	3.5	NP-10	65-100	0.04
7	Silty Sand to Sandy Silt	SM/ML	115	3	5	NP	35-75	0.075
8	Sand to Silty Sand	SP/SM	115	4	6	NP	May-35	0.15
9	Sand	SP	110	5	6.5	NP	0-5	0.3
10	Gravelly Sand to Sand	SW	115	6	7.5	NP	0-5	0.6
11	Overconsolidated Soil	--	120	1	1	NP	90-100	0.01
12	Sand to Clayey Sand	SP/SC	115	2	2	NP-5	--	---

Su (tsf)	Consistency
0-0.13	very soft
0.13-.25	soft
0.25-0.5	firm
0.5-1.0	stiff
1.0-2.0	very stiff
>2.0	hard
Dr (%)	**Relative Density**
0-15	very loose
15-35	loose
35-65	medium dense
65-85	dense
>85	very dense

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Geo-Engineers and Geologists

Project No: LE18083

Key to CPT Interpretation of Logs

Plate B-17

APPENDIX C

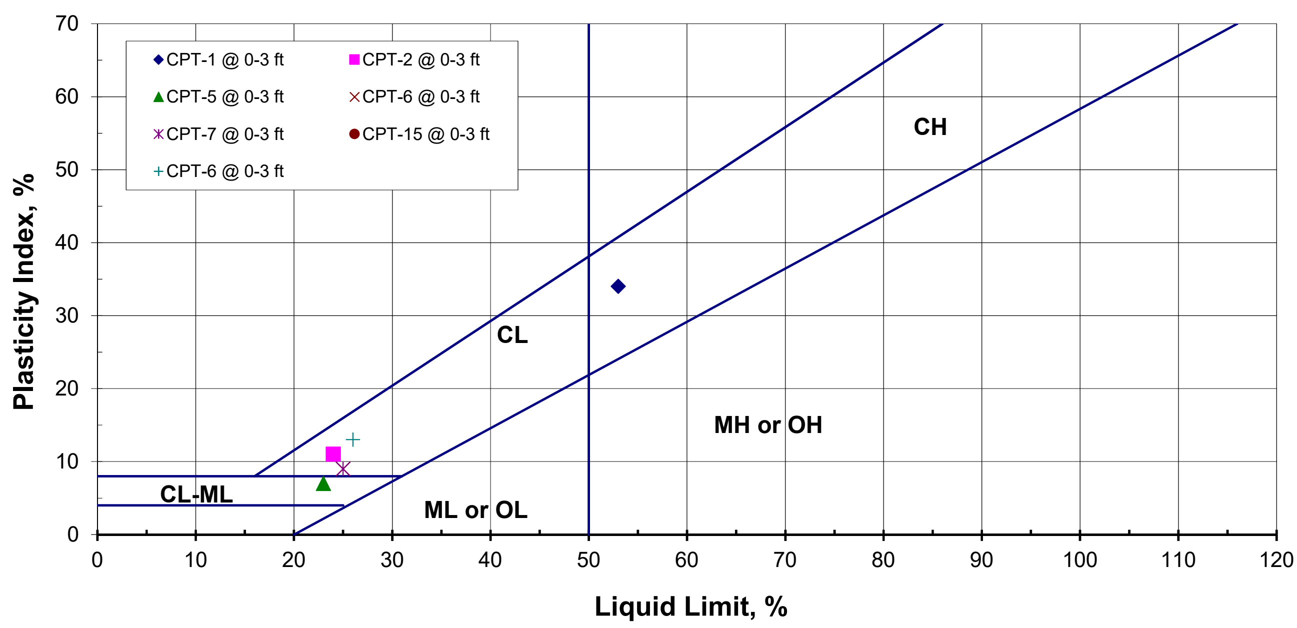
LANDMARK CONSULTANTS, INC.

CLIENT: Z Global
PROJECT: Vega SES Solar Site - El Centro, CA
JOB No.: LE18083
DATE: 06/26/18

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
CPT-1	0-3	53	19	34	CH
CPT-2	0-3	24	13	11	CL
CPT-5	0-3	23	16	7	CL-ML
CPT-6	0-3	25	16	9	CL
CPT-7	0-3	25	16	9	CL
CPT-15	0-3	NL	NP		ML
CPT-6	0-3	26	13	13	CL

PLASTICITY CHART



LANDMARK
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Project No.: LE18083

Atterberg Limits Test Results

Plate C-1

LANDMARK CONSULTANTS, INC.

El Centro, California

MOISTURE CONTENT TEST RESULTS

ASTM D - 2216/CALTRAN 226

Project No.:	LE18083	**Sampled By:**	P. LaBrucherie
Project Name:	Vega SES Solar Site	**Date Sampled:**	6/12/2018
Client Name:	Z Global	**Date Tested:**	6/13/2018
		Tested By:	AM

SAMPLE LOCATION	Soil Type	LAB NO.	WET WEIGHT	DRY WEIGHT	MOIST. (%)
CPT-1	CH		508.6	397.1	28.1
CPT-2	CL		503	408.5	23.1
CPT-3	SM		504	468.9	7.5
CPT-4	SM		508.2	489.9	3.7
CPT-5	SC		503	422.9	18.9
CPT-6	SC		509.1	419.1	21.5
CPT-7	SC		505.7	401.4	26.0
CPT-8	SM		508.6	461.9	10.1

LANDMARK
Geo-Engineers and Geologists

Project No.: LE18083

Selected Chemical Test Results

Plate C-2

LANDMARK CONSULTANTS, INC.
El Centro, California

MOISTURE CONTENT TEST RESULTS
ASTM D - 2216/CALTRAN 226

Project No.: LE18083
Project Name: Vega SES Solar Site
Client Name: Z Global

Sampled By: P. LaBrucherie
Date Sampled: 6/12/2018
Date Tested: 6/13/2018
Tested By: AM

SAMPLE LOCATION	Soil Type	LAB NO.	WET WEIGHT	DRY WEIGHT	MOIST. (%)
CPT-9	SM		507.8	454.7	11.7
CPT-10	SM		507.4	478.3	6.1
CPT-11	SM		501.0	487.0	2.9
CPT-12	SM		508.4	487.1	4.4
CPT-13	SM		505.9	486.7	3.9
CPT-14	SM		502.0	458.4	9.5
CPT-15	SC		502.9	442.6	13.6
CPT-16	SC		508.4	439.6	15.7

LANDMARK
Geo-Engineers and Geologists
Project No.: LE18083

Selected Chemical Test Results

Plate C-3

LANDMARK CONSULTANTS, INC.

CLIENT: Z Global
PROJECT: Vega SES Solar Site - El Centro, CA
JOB No.: LE18083
DATE: 06/26/18

CHEMICAL ANALYSIS

Boring:	CPT-1	CPT-4	CPT-6	CPT-9	CPT-13	CPT-16	**Caltrans**
Sample Depth, ft:	0-3	0-3	0-3	0-3	0-3	0-3	**Method**
pH:	7.6	8.0	7.6	7.9	8.3	7.9	**643**
Electrical Conductivity (mmhos):	4.9	0.2	0.6	0.4	0.2	0.3	**424**
Resistivity (ohm-cm):	--	--	--	--	--	--	**643**
Chloride (Cl), ppm:	2,380	30	130	80	20	60	**422**
Sulfate (SO4), ppm:	9,273	26	485	397	0	26	**417**

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Range of Values	Degree of Corrosivity
Concrete	Soluble Sulfates (ppm)	0 - 1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides (ppm)	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity (ohm-cm)	1 - 1,000	Very Severe
		1,000 - 2,000	Severe
		2,000 - 10,000	Moderate
		> 10,000	Low

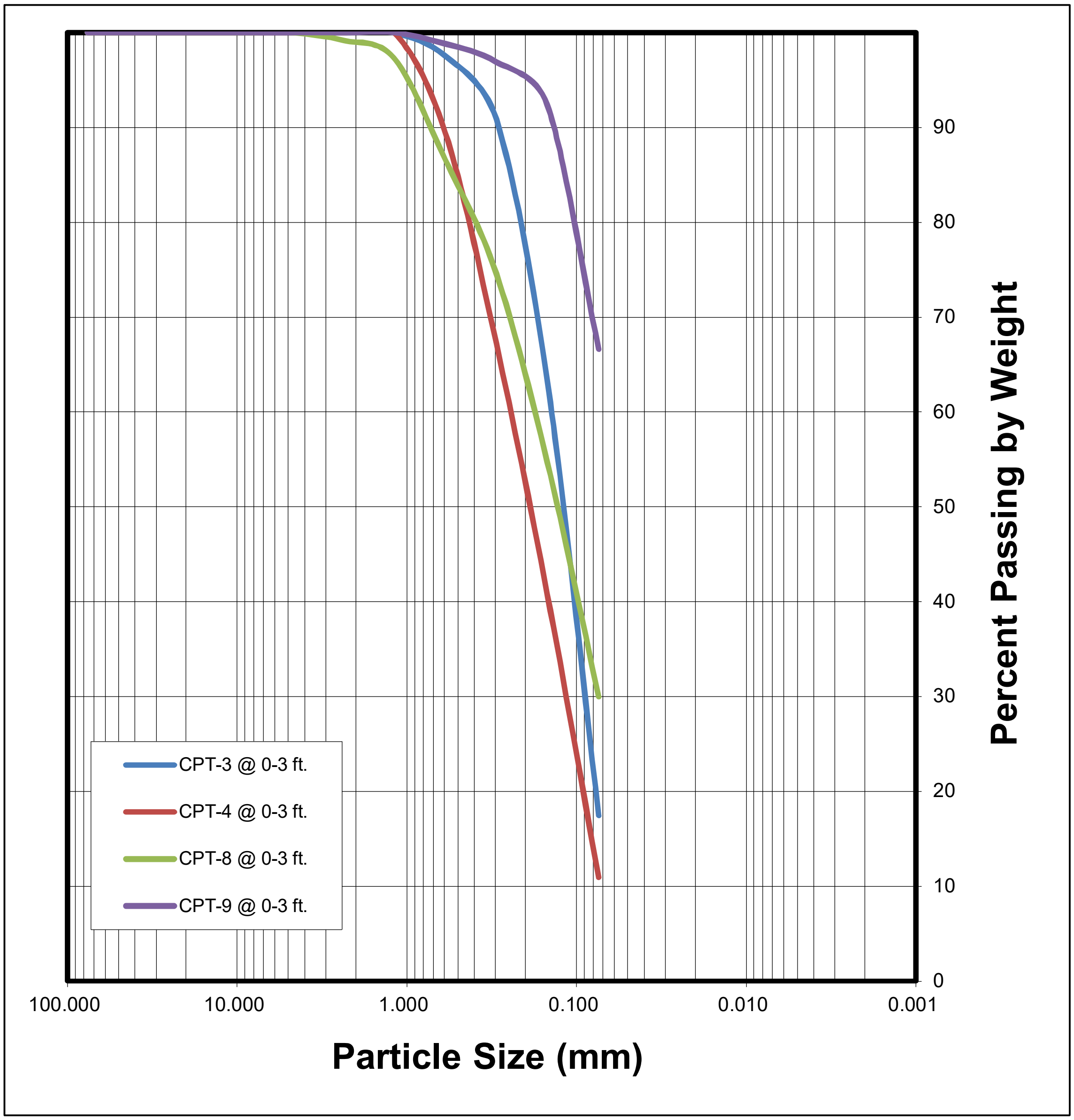
LANDMARK Geo-Engineers and Geologists

Project No.: LE18083

Selected Chemical Test Results

Plate C-4

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



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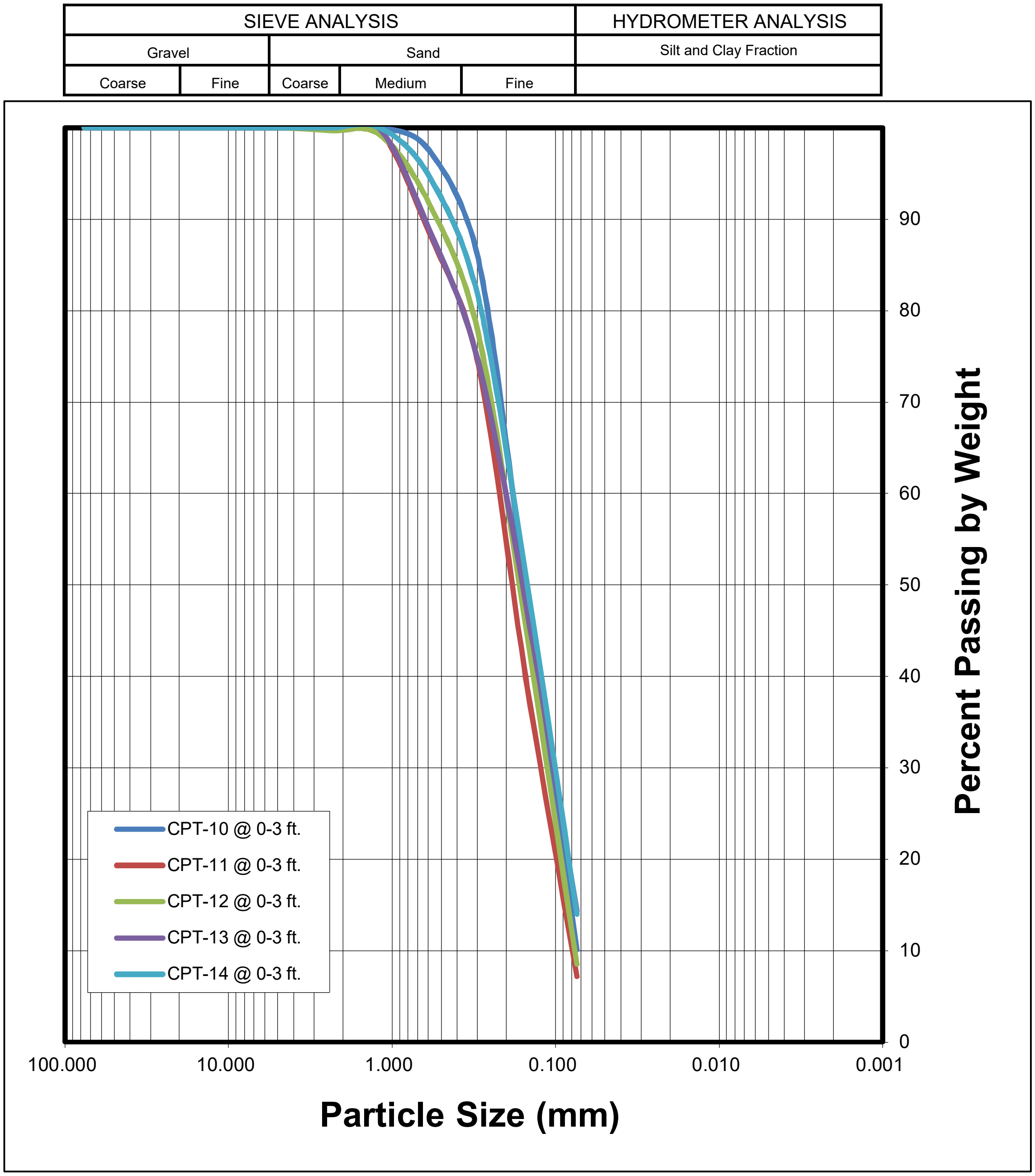
Project No.: LE18083

Grain Size Analysis

Plate C-5

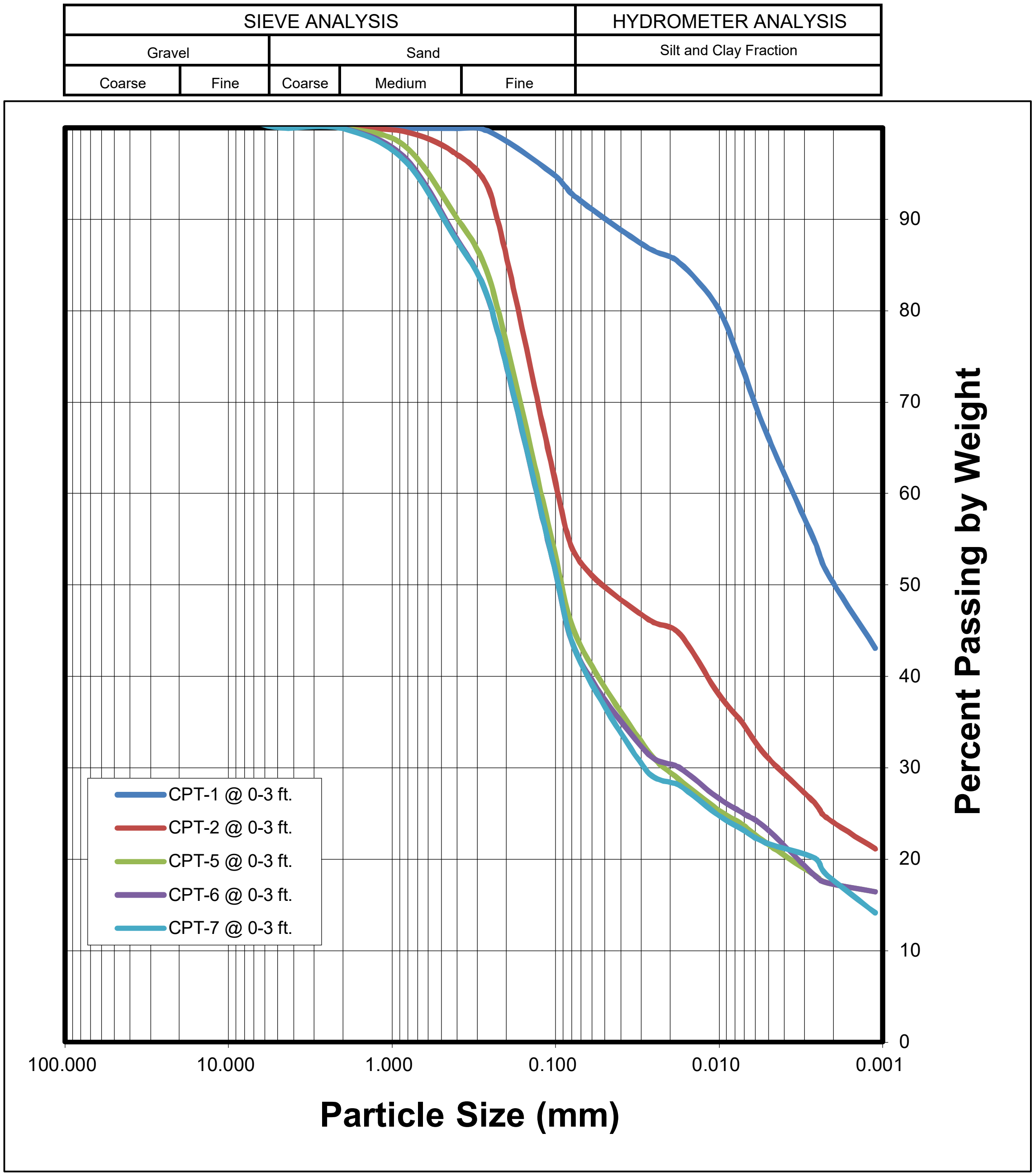


LANDMARK Geo-Engineers and Geologists

Project No.: LE18083

Grain Size Analysis

Plate C-6



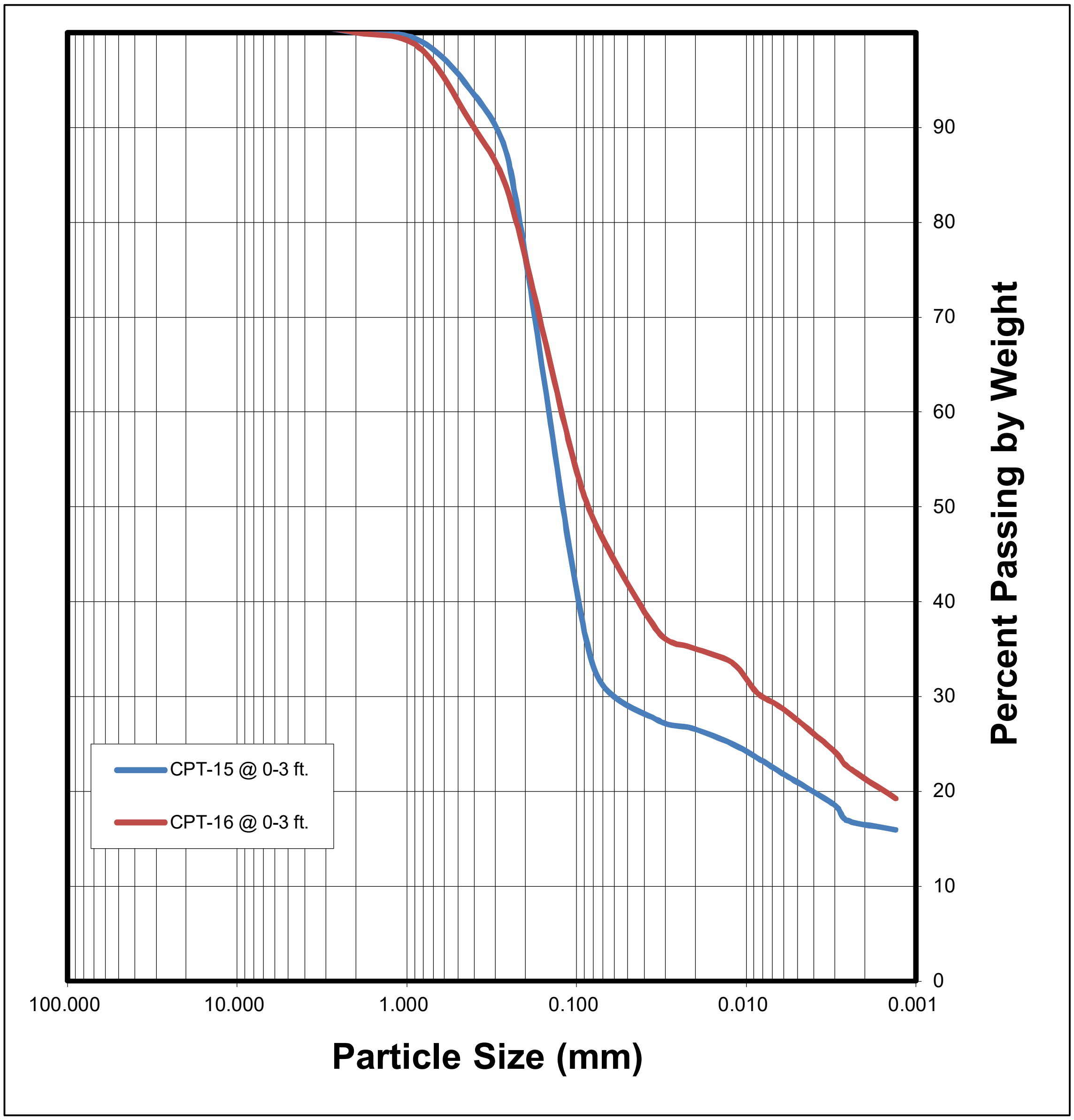
LANDMARK Geo-Engineers and Geologists

Project No.: LE18083

Grain Size Analysis

Plate C-7

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



LANDMARK Geo-Engineers and Geologists

Project No.: LE18083

Grain Size Analysis

Plate C-8

APPENDIX D

Landmark Consultants, Inc.
780 N. 4th Street
El Centro, CA 92243

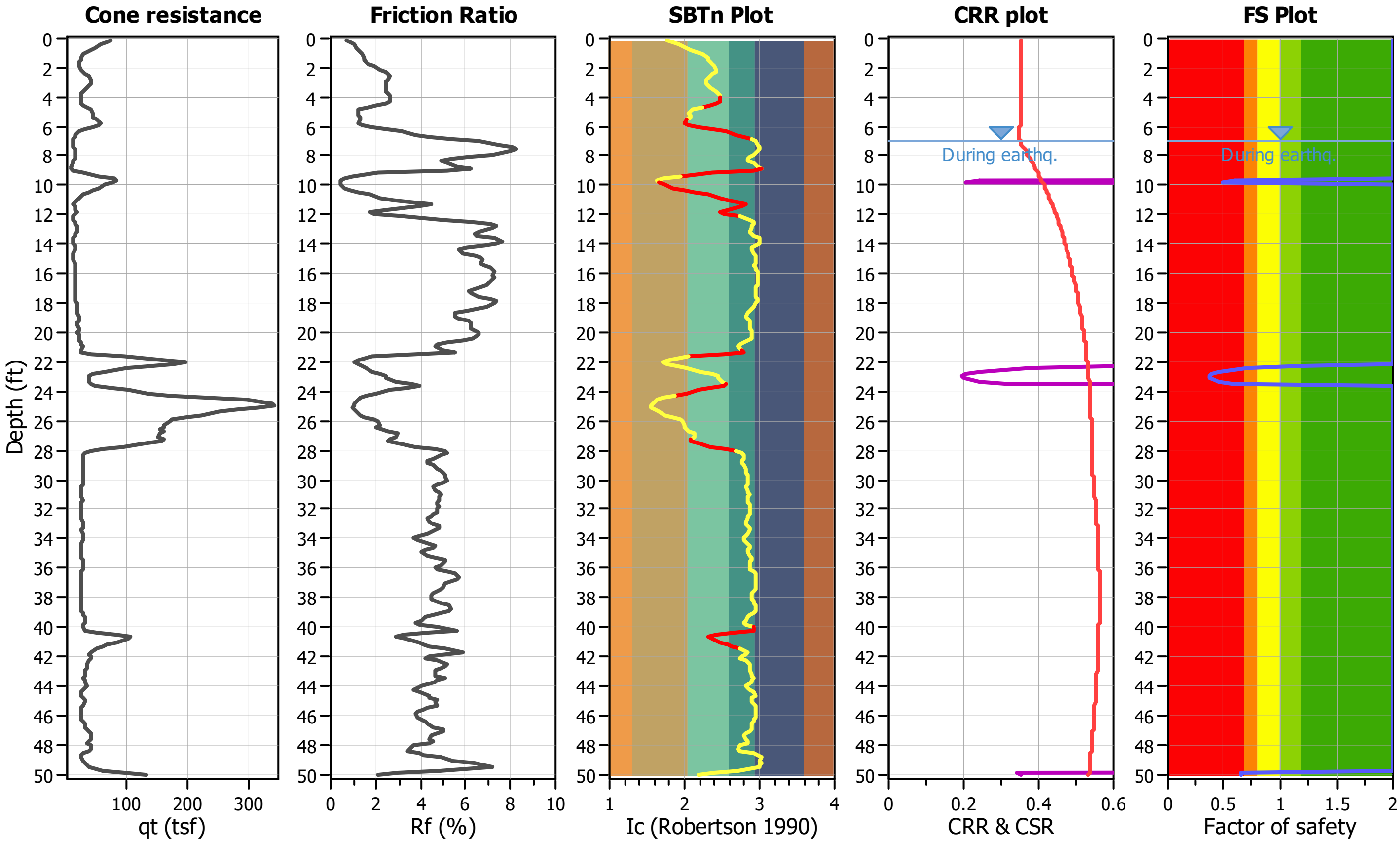
LIQUEFACTION ANALYSIS REPORT

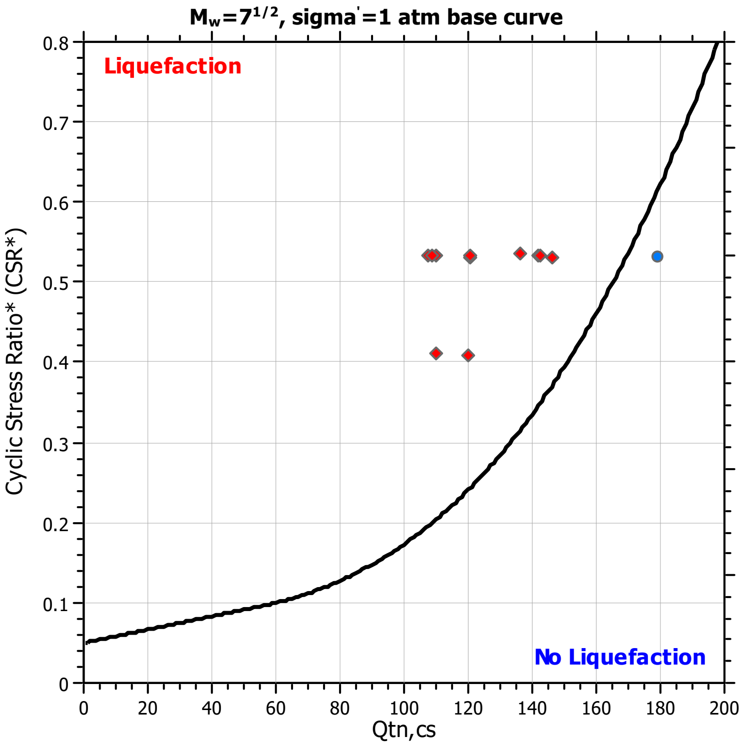
Project title : Vega SES Solar **Location :**

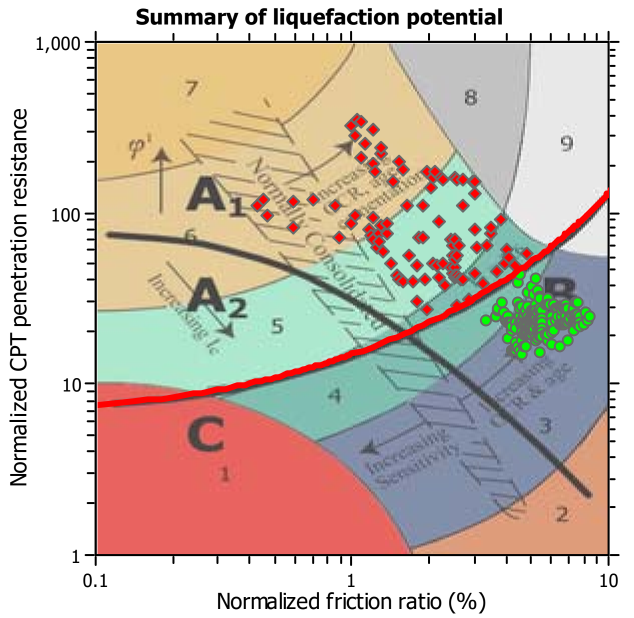
CPT file : CPT-06

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.50	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

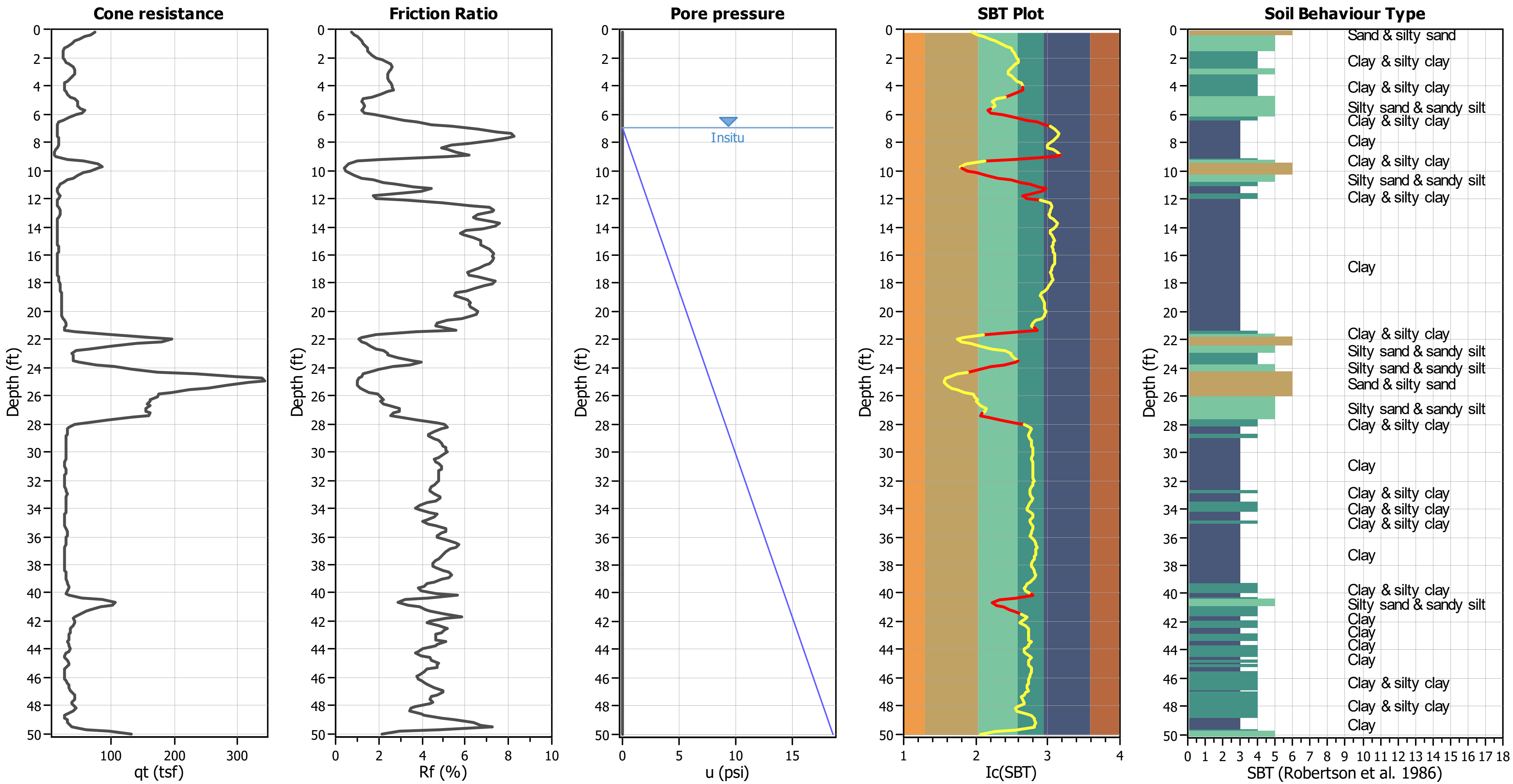






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



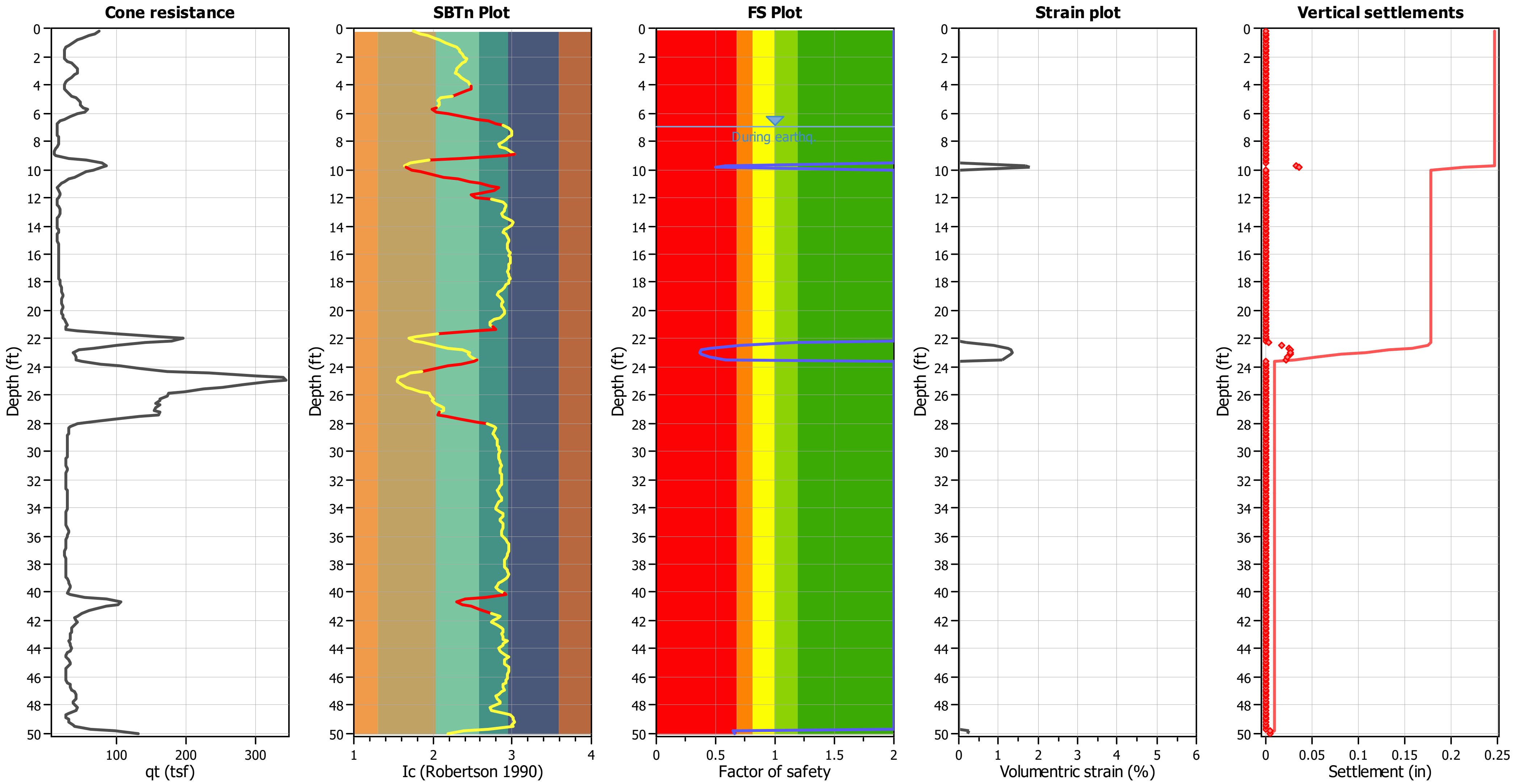
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	7.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.50	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
7.05	138.10	2.00	0.00	0.88	0.00	7.22	148.49	2.00	0.00	0.88	0.00
7.38	157.96	2.00	0.00	0.87	0.00	7.55	163.20	2.00	0.00	0.87	0.00
7.71	165.08	2.00	0.00	0.87	0.00	7.87	159.01	2.00	0.00	0.87	0.00
8.04	146.93	2.00	0.00	0.86	0.00	8.20	134.30	2.00	0.00	0.86	0.00
8.37	123.39	2.00	0.00	0.86	0.00	8.53	117.84	2.00	0.00	0.86	0.00
8.69	115.12	2.00	0.00	0.85	0.00	8.86	117.54	2.00	0.00	0.85	0.00
9.02	118.46	2.00	0.00	0.85	0.00	9.19	105.66	2.00	0.00	0.84	0.00
9.35	108.91	2.00	0.00	0.84	0.00	9.51	121.27	2.00	0.00	0.84	0.00
9.68	119.80	0.59	1.68	0.84	0.03	9.84	110.25	0.50	1.80	0.83	0.04
10.01	95.21	2.00	0.00	0.83	0.00	10.17	93.27	2.00	0.00	0.83	0.00
10.33	93.07	2.00	0.00	0.82	0.00	10.50	94.63	2.00	0.00	0.82	0.00
10.66	97.42	2.00	0.00	0.82	0.00	10.83	98.37	2.00	0.00	0.82	0.00
10.99	102.48	2.00	0.00	0.81	0.00	11.15	111.49	2.00	0.00	0.81	0.00
11.32	116.76	2.00	0.00	0.81	0.00	11.48	112.13	2.00	0.00	0.81	0.00
11.65	93.66	2.00	0.00	0.80	0.00	11.81	80.42	2.00	0.00	0.80	0.00
11.98	80.45	2.00	0.00	0.80	0.00	12.14	98.20	2.00	0.00	0.79	0.00
12.30	120.45	2.00	0.00	0.79	0.00	12.47	142.03	2.00	0.00	0.79	0.00
12.63	160.07	2.00	0.00	0.79	0.00	12.80	168.64	2.00	0.00	0.78	0.00
12.96	168.25	2.00	0.00	0.78	0.00	13.12	158.07	2.00	0.00	0.78	0.00
13.29	149.52	2.00	0.00	0.77	0.00	13.45	144.96	2.00	0.00	0.77	0.00
13.62	147.59	2.00	0.00	0.77	0.00	13.78	150.62	2.00	0.00	0.77	0.00
13.94	151.00	2.00	0.00	0.76	0.00	14.11	147.78	2.00	0.00	0.76	0.00
14.27	140.63	2.00	0.00	0.76	0.00	14.44	136.21	2.00	0.00	0.76	0.00
14.60	135.78	2.00	0.00	0.75	0.00	14.76	139.91	2.00	0.00	0.75	0.00
14.93	143.63	2.00	0.00	0.75	0.00	15.09	146.13	2.00	0.00	0.74	0.00
15.26	148.26	2.00	0.00	0.74	0.00	15.42	151.72	2.00	0.00	0.74	0.00
15.58	154.42	2.00	0.00	0.74	0.00	15.75	154.90	2.00	0.00	0.73	0.00
15.91	153.97	2.00	0.00	0.73	0.00	16.08	152.50	2.00	0.00	0.73	0.00
16.24	152.74	2.00	0.00	0.72	0.00	16.40	150.86	2.00	0.00	0.72	0.00
16.57	148.59	2.00	0.00	0.72	0.00	16.73	146.17	2.00	0.00	0.72	0.00
16.90	143.64	2.00	0.00	0.71	0.00	17.06	140.33	2.00	0.00	0.71	0.00
17.22	135.45	2.00	0.00	0.71	0.00	17.39	135.66	2.00	0.00	0.71	0.00
17.55	142.19	2.00	0.00	0.70	0.00	17.72	150.41	2.00	0.00	0.70	0.00
17.88	156.23	2.00	0.00	0.70	0.00	18.04	157.30	2.00	0.00	0.69	0.00
18.21	155.51	2.00	0.00	0.69	0.00	18.37	151.60	2.00	0.00	0.69	0.00
18.54	147.41	2.00	0.00	0.69	0.00	18.70	143.59	2.00	0.00	0.68	0.00
18.86	144.05	2.00	0.00	0.68	0.00	19.03	146.99	2.00	0.00	0.68	0.00
19.19	150.70	2.00	0.00	0.67	0.00	19.36	151.34	2.00	0.00	0.67	0.00
19.52	150.79	2.00	0.00	0.67	0.00	19.69	151.44	2.00	0.00	0.67	0.00
19.85	153.12	2.00	0.00	0.66	0.00	20.01	154.53	2.00	0.00	0.66	0.00
20.18	153.98	2.00	0.00	0.66	0.00	20.34	151.26	2.00	0.00	0.66	0.00
20.51	147.81	2.00	0.00	0.65	0.00	20.67	143.66	2.00	0.00	0.65	0.00
20.83	140.75	2.00	0.00	0.65	0.00	21.00	140.62	2.00	0.00	0.64	0.00
21.16	143.38	2.00	0.00	0.64	0.00	21.33	150.21	2.00	0.00	0.64	0.00
21.49	147.40	2.00	0.00	0.64	0.00	21.65	154.17	2.00	0.00	0.63	0.00
21.82	192.86	2.00	0.00	0.63	0.00	21.98	218.71	2.00	0.00	0.63	0.00
22.15	208.23	2.00	0.00	0.62	0.00	22.31	179.56	1.17	0.17	0.62	0.00
22.47	146.53	0.70	0.88	0.62	0.02	22.64	120.53	0.46	1.24	0.62	0.02

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
22.80	109.97	0.38	1.33	0.61	0.03	22.97	107.33	0.37	1.35	0.61	0.03
23.13	108.85	0.37	1.33	0.61	0.03	23.29	120.66	0.46	1.21	0.61	0.02
23.46	136.04	0.59	1.09	0.60	0.02	23.62	156.77	2.00	0.00	0.60	0.00
23.79	173.28	2.00	0.00	0.60	0.00	23.95	180.41	2.00	0.00	0.59	0.00
24.11	187.33	2.00	0.00	0.59	0.00	24.28	207.72	2.00	0.00	0.59	0.00
24.44	252.11	2.00	0.00	0.59	0.00	24.61	302.52	2.00	0.00	0.58	0.00
24.77	343.77	2.00	0.00	0.58	0.00	24.93	347.09	2.00	0.00	0.58	0.00
25.10	320.48	2.00	0.00	0.57	0.00	25.26	283.63	2.00	0.00	0.57	0.00
25.43	255.38	2.00	0.00	0.57	0.00	25.59	239.19	2.00	0.00	0.57	0.00
25.75	223.36	2.00	0.00	0.56	0.00	25.92	216.58	2.00	0.00	0.56	0.00
26.08	219.91	2.00	0.00	0.56	0.00	26.25	212.16	2.00	0.00	0.56	0.00
26.41	206.90	2.00	0.00	0.55	0.00	26.57	207.86	2.00	0.00	0.55	0.00
26.74	221.20	2.00	0.00	0.55	0.00	26.90	231.52	2.00	0.00	0.54	0.00
27.07	227.91	2.00	0.00	0.54	0.00	27.23	224.98	2.00	0.00	0.54	0.00
27.40	217.58	2.00	0.00	0.54	0.00	27.56	208.07	2.00	0.00	0.53	0.00
27.72	194.12	2.00	0.00	0.53	0.00	27.89	178.25	2.00	0.00	0.53	0.00
28.05	158.52	2.00	0.00	0.52	0.00	28.22	145.04	2.00	0.00	0.52	0.00
28.38	135.57	2.00	0.00	0.52	0.00	28.54	129.46	2.00	0.00	0.52	0.00
28.71	124.28	2.00	0.00	0.51	0.00	28.87	123.28	2.00	0.00	0.51	0.00
29.04	126.27	2.00	0.00	0.51	0.00	29.20	129.12	2.00	0.00	0.51	0.00
29.36	131.42	2.00	0.00	0.50	0.00	29.53	131.98	2.00	0.00	0.50	0.00
29.69	133.53	2.00	0.00	0.50	0.00	29.86	133.83	2.00	0.00	0.49	0.00
30.02	133.63	2.00	0.00	0.49	0.00	30.18	130.16	2.00	0.00	0.49	0.00
30.35	125.48	2.00	0.00	0.49	0.00	30.51	121.72	2.00	0.00	0.48	0.00
30.68	121.19	2.00	0.00	0.48	0.00	30.84	122.90	2.00	0.00	0.48	0.00
31.00	124.69	2.00	0.00	0.47	0.00	31.17	125.14	2.00	0.00	0.47	0.00
31.33	124.36	2.00	0.00	0.47	0.00	31.50	123.22	2.00	0.00	0.47	0.00
31.66	121.89	2.00	0.00	0.46	0.00	31.82	120.92	2.00	0.00	0.46	0.00
31.99	119.89	2.00	0.00	0.46	0.00	32.15	118.85	2.00	0.00	0.46	0.00
32.32	117.01	2.00	0.00	0.45	0.00	32.48	115.81	2.00	0.00	0.45	0.00
32.64	115.70	2.00	0.00	0.45	0.00	32.81	119.36	2.00	0.00	0.44	0.00
32.97	122.49	2.00	0.00	0.44	0.00	33.14	124.82	2.00	0.00	0.44	0.00
33.30	122.28	2.00	0.00	0.44	0.00	33.46	119.14	2.00	0.00	0.43	0.00
33.63	114.22	2.00	0.00	0.43	0.00	33.79	110.01	2.00	0.00	0.43	0.00
33.96	107.42	2.00	0.00	0.42	0.00	34.12	109.30	2.00	0.00	0.42	0.00
34.28	114.27	2.00	0.00	0.42	0.00	34.45	117.16	2.00	0.00	0.42	0.00
34.61	115.66	2.00	0.00	0.41	0.00	34.78	111.31	2.00	0.00	0.41	0.00
34.94	107.55	2.00	0.00	0.41	0.00	35.10	109.34	2.00	0.00	0.41	0.00
35.27	115.50	2.00	0.00	0.40	0.00	35.43	124.34	2.00	0.00	0.40	0.00
35.60	127.76	2.00	0.00	0.40	0.00	35.76	125.34	2.00	0.00	0.39	0.00
35.93	119.95	2.00	0.00	0.39	0.00	36.09	117.76	2.00	0.00	0.39	0.00
36.25	121.26	2.00	0.00	0.39	0.00	36.42	125.36	2.00	0.00	0.38	0.00
36.58	127.14	2.00	0.00	0.38	0.00	36.75	124.62	2.00	0.00	0.38	0.00
36.91	119.94	2.00	0.00	0.37	0.00	37.07	115.91	2.00	0.00	0.37	0.00
37.24	113.88	2.00	0.00	0.37	0.00	37.40	112.79	2.00	0.00	0.37	0.00
37.57	112.35	2.00	0.00	0.36	0.00	37.73	111.72	2.00	0.00	0.36	0.00
37.89	110.98	2.00	0.00	0.36	0.00	38.06	110.37	2.00	0.00	0.35	0.00
38.22	111.46	2.00	0.00	0.35	0.00	38.39	115.37	2.00	0.00	0.35	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
38.55	119.16	2.00	0.00	0.35	0.00	38.71	120.31	2.00	0.00	0.34	0.00
38.88	118.99	2.00	0.00	0.34	0.00	39.04	116.60	2.00	0.00	0.34	0.00
39.21	115.15	2.00	0.00	0.34	0.00	39.37	113.70	2.00	0.00	0.33	0.00
39.53	112.80	2.00	0.00	0.33	0.00	39.70	108.08	2.00	0.00	0.33	0.00
39.86	107.87	2.00	0.00	0.32	0.00	40.03	114.30	2.00	0.00	0.32	0.00
40.19	131.86	2.00	0.00	0.32	0.00	40.35	142.11	2.00	0.00	0.32	0.00
40.52	149.88	2.00	0.00	0.31	0.00	40.68	158.60	2.00	0.00	0.31	0.00
40.85	167.16	2.00	0.00	0.31	0.00	41.01	165.19	2.00	0.00	0.30	0.00
41.17	153.78	2.00	0.00	0.30	0.00	41.34	149.77	2.00	0.00	0.30	0.00
41.50	149.98	2.00	0.00	0.30	0.00	41.67	149.74	2.00	0.00	0.29	0.00
41.83	135.13	2.00	0.00	0.29	0.00	41.99	126.50	2.00	0.00	0.29	0.00
42.16	126.48	2.00	0.00	0.29	0.00	42.32	128.86	2.00	0.00	0.28	0.00
42.49	128.29	2.00	0.00	0.28	0.00	42.65	125.79	2.00	0.00	0.28	0.00
42.81	122.77	2.00	0.00	0.27	0.00	42.98	117.68	2.00	0.00	0.27	0.00
43.14	116.46	2.00	0.00	0.27	0.00	43.31	115.65	2.00	0.00	0.27	0.00
43.47	118.32	2.00	0.00	0.26	0.00	43.64	116.40	2.00	0.00	0.26	0.00
43.80	115.76	2.00	0.00	0.26	0.00	43.96	111.22	2.00	0.00	0.25	0.00
44.13	104.73	2.00	0.00	0.25	0.00	44.29	98.23	2.00	0.00	0.25	0.00
44.46	96.87	2.00	0.00	0.25	0.00	44.62	101.80	2.00	0.00	0.24	0.00
44.78	109.28	2.00	0.00	0.24	0.00	44.95	116.38	2.00	0.00	0.24	0.00
45.11	115.03	2.00	0.00	0.24	0.00	45.28	109.13	2.00	0.00	0.23	0.00
45.44	100.34	2.00	0.00	0.23	0.00	45.60	97.11	2.00	0.00	0.23	0.00
45.77	94.65	2.00	0.00	0.22	0.00	45.93	93.14	2.00	0.00	0.22	0.00
46.10	94.11	2.00	0.00	0.22	0.00	46.26	97.84	2.00	0.00	0.22	0.00
46.42	103.13	2.00	0.00	0.21	0.00	46.59	107.73	2.00	0.00	0.21	0.00
46.75	113.20	2.00	0.00	0.21	0.00	46.92	119.58	2.00	0.00	0.20	0.00
47.08	124.97	2.00	0.00	0.20	0.00	47.24	125.60	2.00	0.00	0.20	0.00
47.41	122.98	2.00	0.00	0.20	0.00	47.57	120.61	2.00	0.00	0.19	0.00
47.74	117.92	2.00	0.00	0.19	0.00	47.90	114.56	2.00	0.00	0.19	0.00
48.06	111.36	2.00	0.00	0.19	0.00	48.23	109.43	2.00	0.00	0.18	0.00
48.39	105.45	2.00	0.00	0.18	0.00	48.56	99.78	2.00	0.00	0.18	0.00
48.72	94.52	2.00	0.00	0.17	0.00	48.88	104.13	2.00	0.00	0.17	0.00
49.05	114.84	2.00	0.00	0.17	0.00	49.21	127.01	2.00	0.00	0.17	0.00
49.38	138.35	2.00	0.00	0.16	0.00	49.54	146.89	2.00	0.00	0.16	0.00
49.70	149.09	2.00	0.00	0.16	0.00	49.87	141.67	0.64	0.27	0.15	0.01
50.03	142.74	0.66	0.23	0.15	0.00						

Total estimated settlement: 0.25

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

Landmark Consultants, Inc.
780 N. 4th Street
El Centro, CA 92243

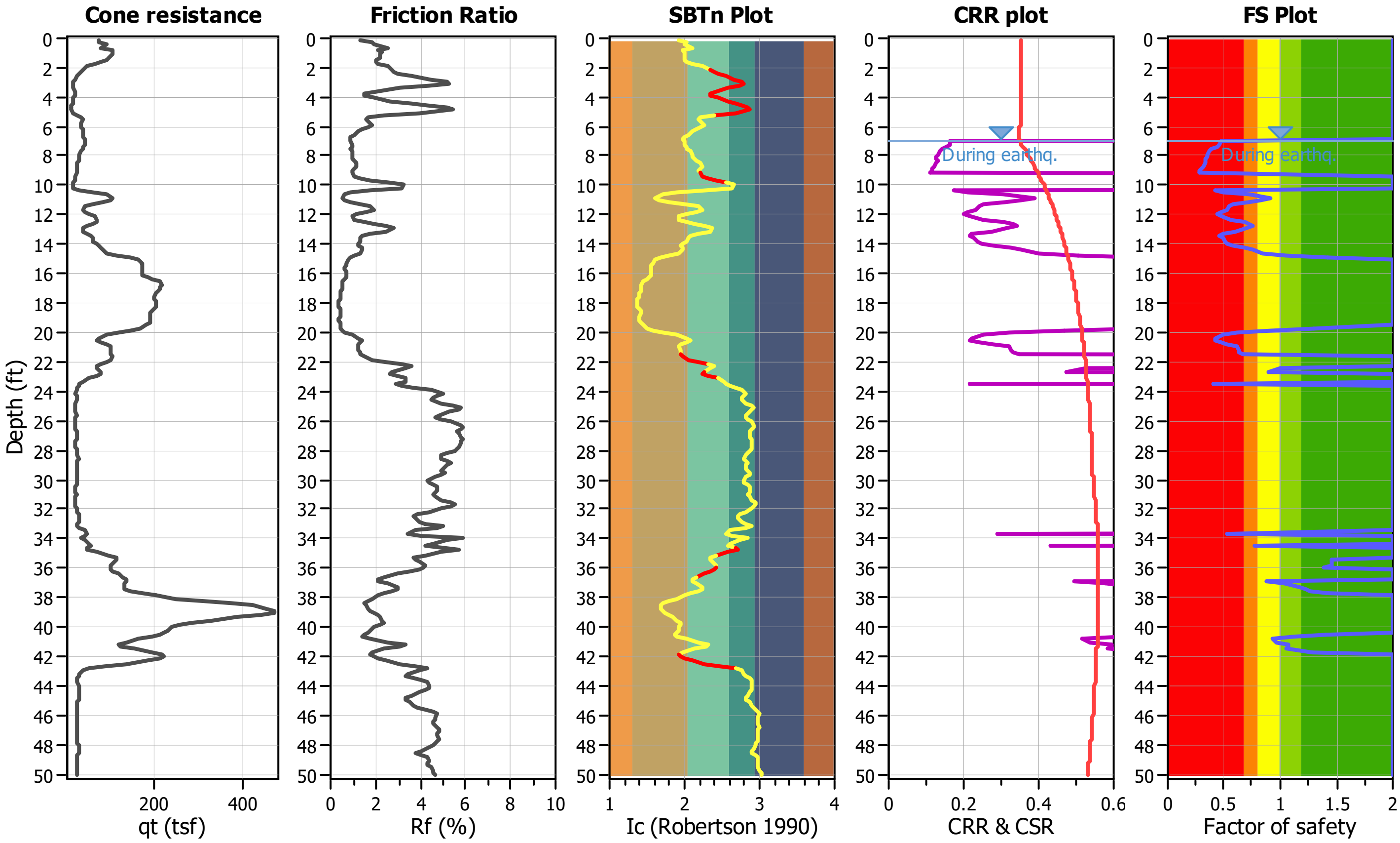
LIQUEFACTION ANALYSIS REPORT

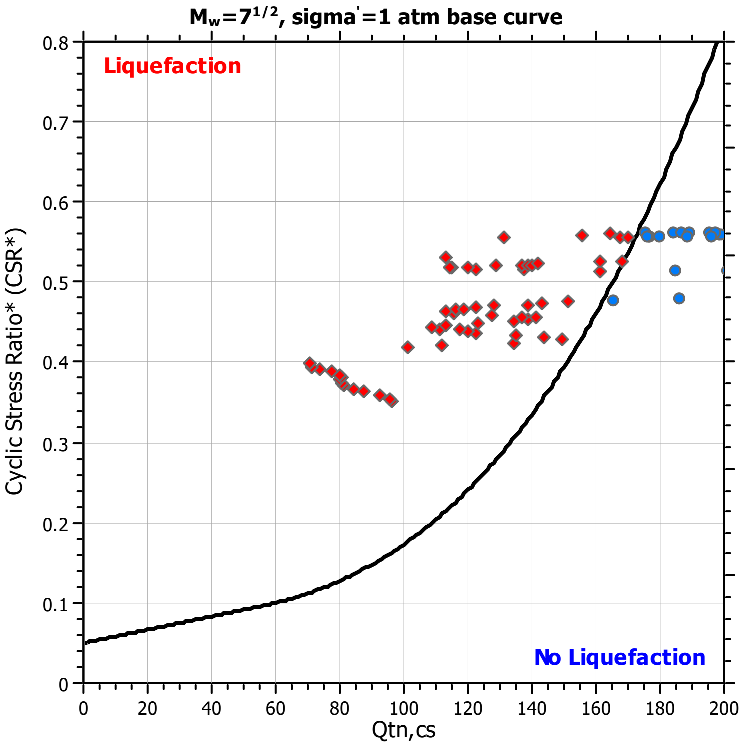
Project title : Vega SES Solar **Location :**

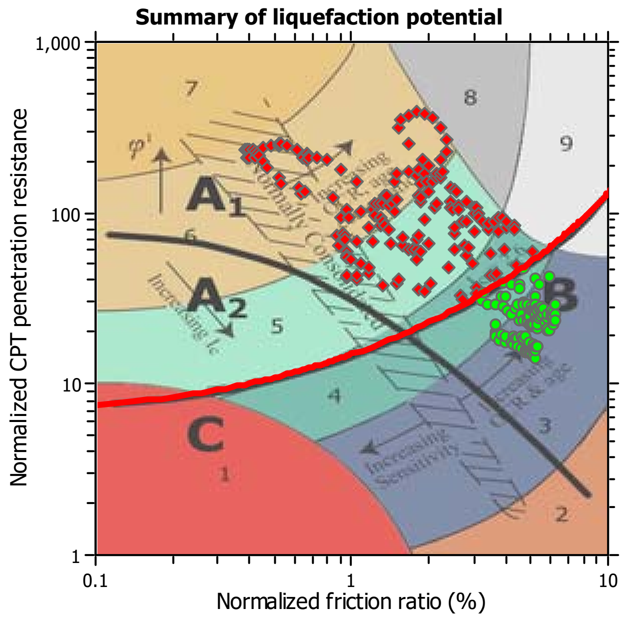
CPT file : CPT-07

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.50	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

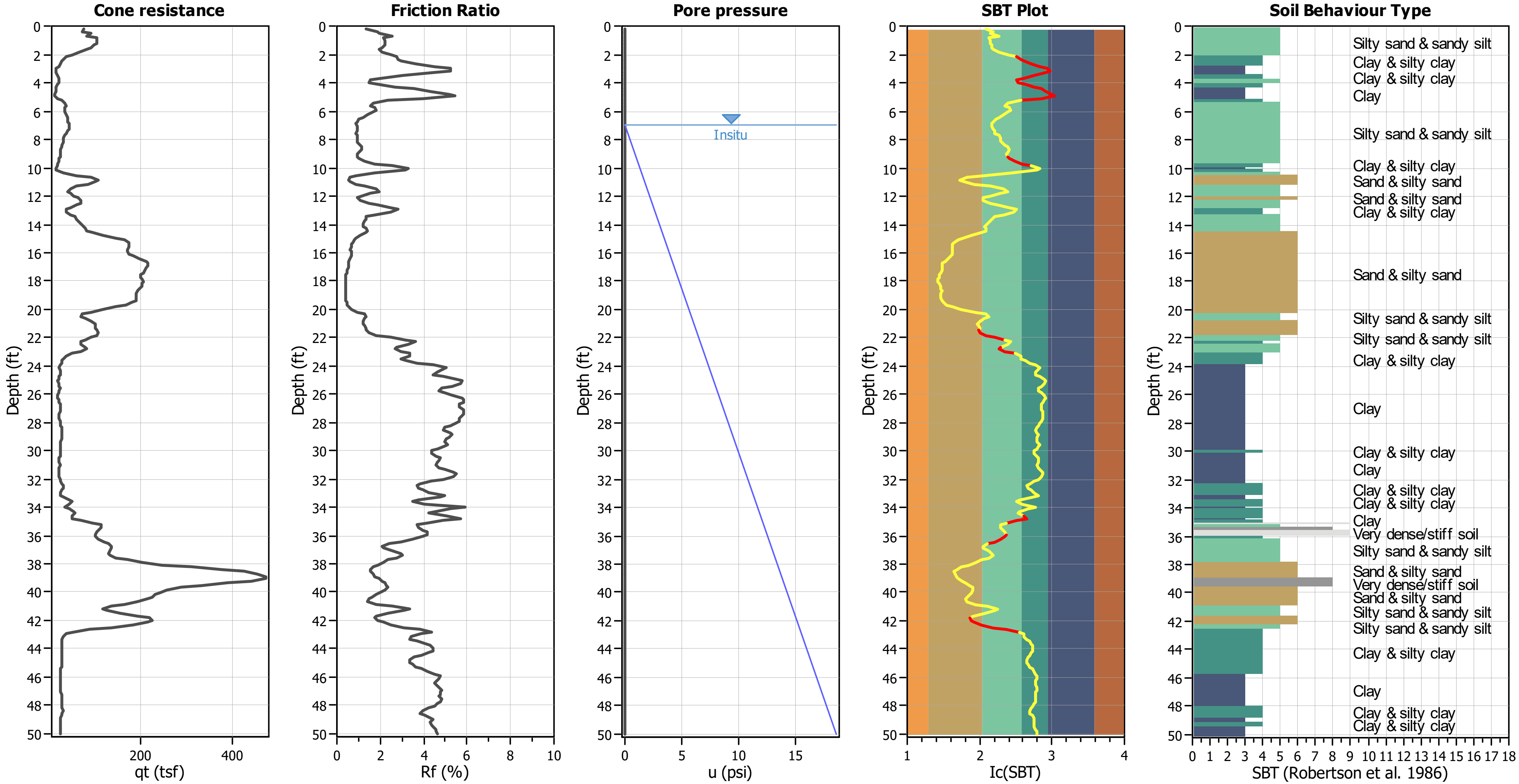






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



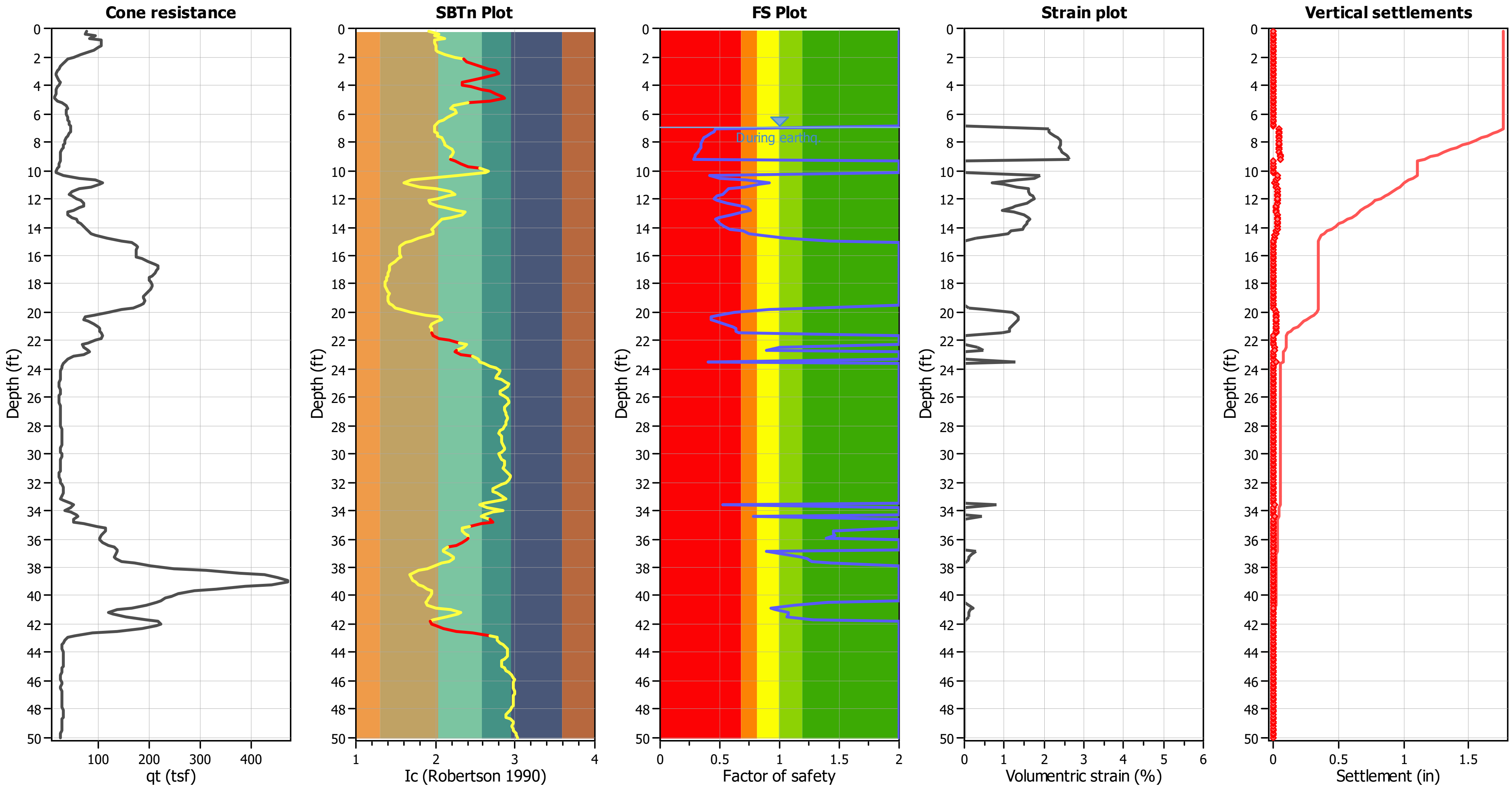
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	7.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.50	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
7.05	96.27	0.46	2.12	0.88	0.04	7.22	95.87	0.46	2.12	0.88	0.04
7.38	92.74	0.43	2.17	0.87	0.04	7.55	87.29	0.39	2.28	0.87	0.04
7.71	84.27	0.37	2.34	0.87	0.05	7.87	81.35	0.35	2.40	0.87	0.05
8.04	80.32	0.34	2.42	0.86	0.05	8.20	80.08	0.34	2.41	0.86	0.05
8.37	80.77	0.34	2.39	0.86	0.05	8.53	80.04	0.33	2.40	0.86	0.05
8.69	77.38	0.32	2.46	0.85	0.05	8.86	73.51	0.30	2.56	0.85	0.05
9.02	71.19	0.29	2.62	0.85	0.05	9.19	70.58	0.28	2.63	0.84	0.05
9.35	71.16	2.00	0.00	0.84	0.00	9.51	76.53	2.00	0.00	0.84	0.00
9.68	85.98	2.00	0.00	0.84	0.00	9.84	100.02	2.00	0.00	0.83	0.00
10.01	107.71	2.00	0.00	0.83	0.00	10.17	107.83	2.00	0.00	0.83	0.00
10.33	100.95	0.42	1.91	0.82	0.04	10.50	112.10	0.50	1.75	0.82	0.03
10.66	134.60	0.72	1.32	0.82	0.03	10.83	149.61	0.92	0.71	0.82	0.01
10.99	143.48	0.82	0.98	0.81	0.02	11.15	134.85	0.71	1.30	0.81	0.03
11.32	122.72	0.58	1.60	0.81	0.03	11.48	119.85	0.55	1.62	0.81	0.03
11.65	117.47	0.52	1.64	0.80	0.03	11.81	111.45	0.47	1.71	0.80	0.03
11.98	108.50	0.45	1.74	0.80	0.03	12.14	113.28	0.48	1.68	0.79	0.03
12.30	123.36	0.57	1.56	0.79	0.03	12.47	134.58	0.68	1.27	0.79	0.03
12.63	139.02	0.73	1.21	0.79	0.02	12.80	141.32	0.75	0.96	0.78	0.02
12.96	136.60	0.69	1.23	0.78	0.02	13.12	127.50	0.59	1.49	0.78	0.03
13.29	115.58	0.48	1.61	0.77	0.03	13.45	113.28	0.46	1.63	0.77	0.03
13.62	116.02	0.48	1.59	0.77	0.03	13.78	118.78	0.51	1.56	0.77	0.03
13.94	122.25	0.53	1.51	0.76	0.03	14.11	128.30	0.59	1.45	0.76	0.03
14.27	138.45	0.69	1.17	0.76	0.02	14.44	143.33	0.75	1.11	0.76	0.02
14.60	151.33	0.85	0.84	0.75	0.02	14.76	165.68	1.05	0.30	0.75	0.01
14.93	186.18	1.42	0.00	0.75	0.00	15.09	202.83	2.00	0.00	0.74	0.00
15.26	212.78	2.00	0.00	0.74	0.00	15.42	213.32	2.00	0.00	0.74	0.00
15.58	210.27	2.00	0.00	0.74	0.00	15.75	208.31	2.00	0.00	0.73	0.00
15.91	207.13	2.00	0.00	0.73	0.00	16.08	209.37	2.00	0.00	0.73	0.00
16.24	220.10	2.00	0.00	0.72	0.00	16.40	234.53	2.00	0.00	0.72	0.00
16.57	249.73	2.00	0.00	0.72	0.00	16.73	253.93	2.00	0.00	0.72	0.00
16.90	252.48	2.00	0.00	0.71	0.00	17.06	249.18	2.00	0.00	0.71	0.00
17.22	244.22	2.00	0.00	0.71	0.00	17.39	238.00	2.00	0.00	0.71	0.00
17.55	231.88	2.00	0.00	0.70	0.00	17.72	231.27	2.00	0.00	0.70	0.00
17.88	233.91	2.00	0.00	0.70	0.00	18.04	234.80	2.00	0.00	0.69	0.00
18.21	233.04	2.00	0.00	0.69	0.00	18.37	228.93	2.00	0.00	0.69	0.00
18.54	223.87	2.00	0.00	0.69	0.00	18.70	217.93	2.00	0.00	0.68	0.00
18.86	213.19	2.00	0.00	0.68	0.00	19.03	212.23	2.00	0.00	0.68	0.00
19.19	212.78	2.00	0.00	0.67	0.00	19.36	210.73	2.00	0.00	0.67	0.00
19.52	201.55	2.00	0.00	0.67	0.00	19.69	185.01	1.30	0.12	0.67	0.00
19.85	160.96	0.91	0.51	0.66	0.01	20.01	137.28	0.62	1.19	0.66	0.02
20.18	122.31	0.48	1.30	0.66	0.03	20.34	115.11	0.43	1.36	0.66	0.03
20.51	114.09	0.42	1.37	0.65	0.03	20.67	120.21	0.47	1.31	0.65	0.03
20.83	128.49	0.53	1.23	0.65	0.02	21.00	137.03	0.61	1.16	0.64	0.02
21.16	138.79	0.63	1.15	0.64	0.02	21.33	139.74	0.64	1.13	0.64	0.02
21.49	141.94	0.66	0.95	0.64	0.02	21.65	149.61	2.00	0.00	0.63	0.00
21.82	157.68	2.00	0.00	0.63	0.00	21.98	165.92	2.00	0.00	0.63	0.00
22.15	173.81	2.00	0.00	0.62	0.00	22.31	175.69	2.00	0.00	0.62	0.00
22.47	168.35	0.99	0.34	0.62	0.01	22.64	161.54	0.90	0.48	0.62	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
22.80	159.68	2.00	0.00	0.61	0.00	22.97	157.13	2.00	0.00	0.61	0.00
23.13	146.07	2.00	0.00	0.61	0.00	23.29	129.03	2.00	0.00	0.61	0.00
23.46	112.91	0.40	1.27	0.60	0.03	23.62	113.18	2.00	0.00	0.60	0.00
23.79	120.90	2.00	0.00	0.60	0.00	23.95	129.35	2.00	0.00	0.59	0.00
24.11	133.60	2.00	0.00	0.59	0.00	24.28	132.33	2.00	0.00	0.59	0.00
24.44	130.55	2.00	0.00	0.59	0.00	24.61	128.07	2.00	0.00	0.58	0.00
24.77	129.55	2.00	0.00	0.58	0.00	24.93	132.72	2.00	0.00	0.58	0.00
25.10	134.43	2.00	0.00	0.57	0.00	25.26	135.51	2.00	0.00	0.57	0.00
25.43	133.59	2.00	0.00	0.57	0.00	25.59	130.16	2.00	0.00	0.57	0.00
25.75	126.24	2.00	0.00	0.56	0.00	25.92	125.10	2.00	0.00	0.56	0.00
26.08	127.38	2.00	0.00	0.56	0.00	26.25	132.24	2.00	0.00	0.56	0.00
26.41	135.64	2.00	0.00	0.55	0.00	26.57	138.55	2.00	0.00	0.55	0.00
26.74	139.78	2.00	0.00	0.55	0.00	26.90	140.90	2.00	0.00	0.54	0.00
27.07	141.39	2.00	0.00	0.54	0.00	27.23	140.08	2.00	0.00	0.54	0.00
27.40	138.41	2.00	0.00	0.54	0.00	27.56	136.57	2.00	0.00	0.53	0.00
27.72	136.26	2.00	0.00	0.53	0.00	27.89	136.85	2.00	0.00	0.53	0.00
28.05	136.01	2.00	0.00	0.52	0.00	28.22	134.16	2.00	0.00	0.52	0.00
28.38	133.33	2.00	0.00	0.52	0.00	28.54	134.53	2.00	0.00	0.52	0.00
28.71	137.60	2.00	0.00	0.51	0.00	28.87	138.10	2.00	0.00	0.51	0.00
29.04	135.87	2.00	0.00	0.51	0.00	29.20	132.06	2.00	0.00	0.51	0.00
29.36	128.53	2.00	0.00	0.50	0.00	29.53	126.93	2.00	0.00	0.50	0.00
29.69	125.36	2.00	0.00	0.50	0.00	29.86	123.41	2.00	0.00	0.49	0.00
30.02	120.65	2.00	0.00	0.49	0.00	30.18	120.00	2.00	0.00	0.49	0.00
30.35	119.95	2.00	0.00	0.49	0.00	30.51	120.05	2.00	0.00	0.48	0.00
30.68	118.81	2.00	0.00	0.48	0.00	30.84	118.19	2.00	0.00	0.48	0.00
31.00	117.49	2.00	0.00	0.47	0.00	31.17	117.59	2.00	0.00	0.47	0.00
31.33	119.02	2.00	0.00	0.47	0.00	31.50	122.31	2.00	0.00	0.47	0.00
31.66	124.69	2.00	0.00	0.46	0.00	31.82	124.31	2.00	0.00	0.46	0.00
31.99	120.85	2.00	0.00	0.46	0.00	32.15	117.25	2.00	0.00	0.46	0.00
32.32	114.47	2.00	0.00	0.45	0.00	32.48	115.17	2.00	0.00	0.45	0.00
32.64	115.69	2.00	0.00	0.45	0.00	32.81	115.05	2.00	0.00	0.44	0.00
32.97	114.62	2.00	0.00	0.44	0.00	33.14	122.37	2.00	0.00	0.44	0.00
33.30	129.45	2.00	0.00	0.44	0.00	33.46	131.92	2.00	0.00	0.43	0.00
33.63	131.38	0.52	0.80	0.43	0.02	33.79	136.56	2.00	0.00	0.43	0.00
33.96	150.06	2.00	0.00	0.42	0.00	34.12	156.57	2.00	0.00	0.42	0.00
34.28	158.71	2.00	0.00	0.42	0.00	34.45	155.89	0.77	0.44	0.42	0.01
34.61	159.99	2.00	0.00	0.41	0.00	34.78	172.79	2.00	0.00	0.41	0.00
34.94	183.95	2.00	0.00	0.41	0.00	35.10	194.11	2.00	0.00	0.41	0.00
35.27	195.71	2.00	0.00	0.40	0.00	35.43	199.05	1.45	0.00	0.40	0.00
35.60	198.75	1.45	0.00	0.40	0.00	35.76	199.59	1.46	0.00	0.39	0.00
35.93	195.69	1.39	0.00	0.39	0.00	36.09	190.17	2.00	0.00	0.39	0.00
36.25	183.84	2.00	0.00	0.39	0.00	36.42	177.10	2.00	0.00	0.38	0.00
36.58	167.97	2.00	0.00	0.38	0.00	36.75	163.22	2.00	0.00	0.38	0.00
36.91	164.66	0.88	0.28	0.37	0.01	37.07	175.35	1.04	0.19	0.37	0.00
37.24	184.34	1.18	0.10	0.37	0.00	37.40	187.16	1.23	0.10	0.37	0.00
37.57	189.27	1.27	0.07	0.36	0.00	37.73	197.58	1.42	0.00	0.36	0.00
37.89	213.57	2.00	0.00	0.36	0.00	38.06	239.80	2.00	0.00	0.35	0.00
38.22	281.63	2.00	0.00	0.35	0.00	38.39	325.57	2.00	0.00	0.35	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

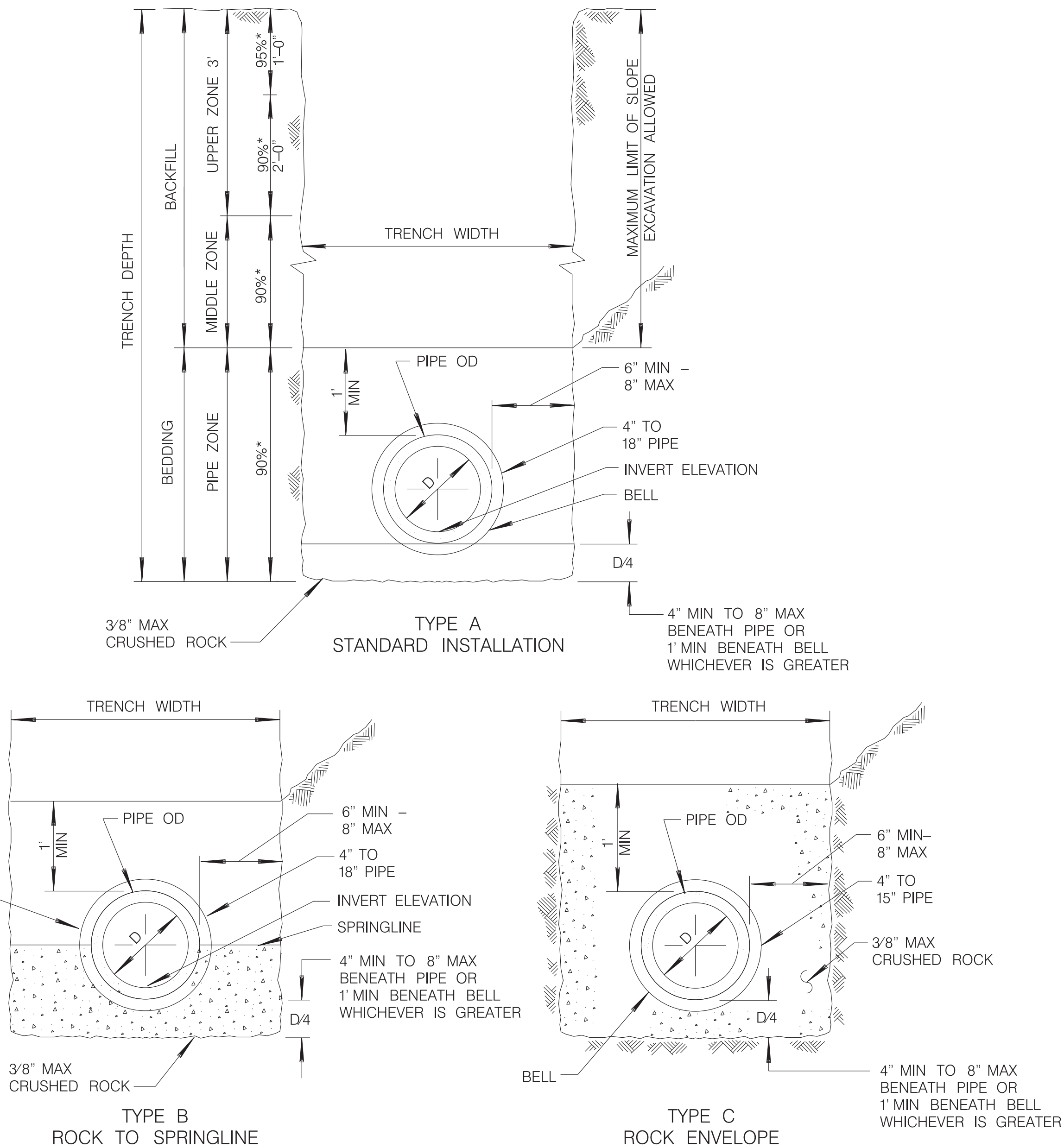
Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
38.55	361.33	2.00	0.00	0.35	0.00	38.71	386.80	2.00	0.00	0.34	0.00
38.88	406.11	2.00	0.00	0.34	0.00	39.04	411.92	2.00	0.00	0.34	0.00
39.21	393.36	2.00	0.00	0.34	0.00	39.37	357.54	2.00	0.00	0.33	0.00
39.53	314.67	2.00	0.00	0.33	0.00	39.70	280.11	2.00	0.00	0.33	0.00
39.86	252.88	2.00	0.00	0.32	0.00	40.03	232.13	2.00	0.00	0.32	0.00
40.19	217.44	2.00	0.00	0.32	0.00	40.35	208.00	2.00	0.00	0.32	0.00
40.52	196.10	1.40	0.00	0.31	0.00	40.68	180.28	1.12	0.12	0.31	0.00
40.85	167.19	0.93	0.23	0.31	0.00	41.01	170.08	0.97	0.16	0.30	0.00
41.17	177.16	1.07	0.11	0.30	0.00	41.34	176.68	1.07	0.11	0.30	0.00
41.50	175.94	1.06	0.11	0.30	0.00	41.67	189.00	1.28	0.05	0.29	0.00
41.83	203.32	2.00	0.00	0.29	0.00	41.99	211.05	2.00	0.00	0.29	0.00
42.16	210.54	2.00	0.00	0.29	0.00	42.32	199.93	2.00	0.00	0.28	0.00
42.49	182.54	2.00	0.00	0.28	0.00	42.65	161.96	2.00	0.00	0.28	0.00
42.81	139.01	2.00	0.00	0.27	0.00	42.98	114.93	2.00	0.00	0.27	0.00
43.14	101.23	2.00	0.00	0.27	0.00	43.31	96.75	2.00	0.00	0.27	0.00
43.47	99.09	2.00	0.00	0.26	0.00	43.64	103.12	2.00	0.00	0.26	0.00
43.80	106.25	2.00	0.00	0.26	0.00	43.96	108.12	2.00	0.00	0.25	0.00
44.13	108.11	2.00	0.00	0.25	0.00	44.29	106.05	2.00	0.00	0.25	0.00
44.46	102.35	2.00	0.00	0.25	0.00	44.62	98.55	2.00	0.00	0.24	0.00
44.78	95.89	2.00	0.00	0.24	0.00	44.95	95.01	2.00	0.00	0.24	0.00
45.11	94.87	2.00	0.00	0.24	0.00	45.28	95.61	2.00	0.00	0.23	0.00
45.44	97.11	2.00	0.00	0.23	0.00	45.60	99.03	2.00	0.00	0.23	0.00
45.77	101.68	2.00	0.00	0.22	0.00	45.93	103.92	2.00	0.00	0.22	0.00
46.10	104.28	2.00	0.00	0.22	0.00	46.26	103.50	2.00	0.00	0.22	0.00
46.42	101.74	2.00	0.00	0.21	0.00	46.59	102.29	2.00	0.00	0.21	0.00
46.75	104.14	2.00	0.00	0.21	0.00	46.92	106.39	2.00	0.00	0.20	0.00
47.08	106.51	2.00	0.00	0.20	0.00	47.24	106.60	2.00	0.00	0.20	0.00
47.41	106.38	2.00	0.00	0.20	0.00	47.57	107.08	2.00	0.00	0.19	0.00
47.74	106.57	2.00	0.00	0.19	0.00	47.90	106.08	2.00	0.00	0.19	0.00
48.06	106.03	2.00	0.00	0.19	0.00	48.23	104.29	2.00	0.00	0.18	0.00
48.39	101.59	2.00	0.00	0.18	0.00	48.56	98.24	2.00	0.00	0.18	0.00
48.72	97.91	2.00	0.00	0.17	0.00	48.88	98.90	2.00	0.00	0.17	0.00
49.05	99.62	2.00	0.00	0.17	0.00	49.21	99.62	2.00	0.00	0.17	0.00
49.38	99.78	2.00	0.00	0.16	0.00	49.54	100.03	2.00	0.00	0.16	0.00
49.70	99.46	2.00	0.00	0.16	0.00	49.87	98.60	2.00	0.00	0.15	0.00
50.03	98.13	2.00	0.00	0.15	0.00						

Total estimated settlement: 1.76

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

APPENDIX E



NOTES

1. FOR TRENCH RESURFACING IN IMPROVED STREETS, SEE STANDARD DRAWINGS SDG–107 AND SDG–108.
2. (*) INDICATES MINIMUM RELATIVE COMPACTION.
3. MINIMUM DEPTH OF COVER FROM THE TOP OF PIPE TO FINISH GRADE FOR PVC SDR 35 SEWER MAIN SHALL BE 5'. FOR SHALLOWER DEPTH, SPECIAL DESIGN IS REQUIRED. SEE SDS–101.
4. SEE TYPE A INSTALLATION FOR DETAILS NOT SHOWN FOR TYPES B AND C.
5. FOR PIPE SIZE ENCASEMENT LARGER THAN 15", MAXIMUM SIDE WALL CLEARANCE SHALL BE 12" OR AS SHOWN ON THE PLANS.
6. 6" METAL TAPE SHALL BE INSTALLED ABOVE PIPE 4" BELOW TRENCH CAP AND 12" BELOW FINISH GRADE IN UNIMPROVED STREETS.
7. 1' SAND CUSHION OR A 6" MINIMUM SAND CUSHION WITH 1" NEOPRENE PAD SHALL BE PLACED FOR CROSSINGS UTILITIES WHEN VERTICAL CLEARANCE IS 1' OR LESS. THE NEOPRENE PAD SHALL BE PLACED ON THE MOST FRAGILE UTILITY.

From: City of San Diego Standard Drawing SDS-110 (2016)

LANDMARK Geo-Engineers and Geologists **Project No.: LE18083**	**Pipe Bedding and Trench Backfill Recommendations**	**Plate D-1**

APPENDIX F

June 30, 2018

Steve Williams
Landmark Consultants
780 N. 4th Street
El Centro, California 92243

SUBJECT: VEGA SES SOLAR PROJECT - SOIL TESTING SUMMARY REPORT

RFYeager Engineering Project No.: 18111

Dear Steve,

On June 20, 2018, RFYeager Engineering conducted soil resistivity testing at five locations within the Vega SES Solar project site near El Centro, California. Additionally, five soil samples were taken from the project site and submitted for chemical analysis. The objective of this study is to determine the electrical resistivity and corrosivity of the soil at the test locations within the project site.

The location of the test sites was based upon the site map which was provided by Landmark (see Figure 1). The resistivity of the soil was determined by using the Wenner 4-pin method. Five readings were recorded for each test site based upon pin spacings of 20, 15, 10, 5, and 2.5 feet.

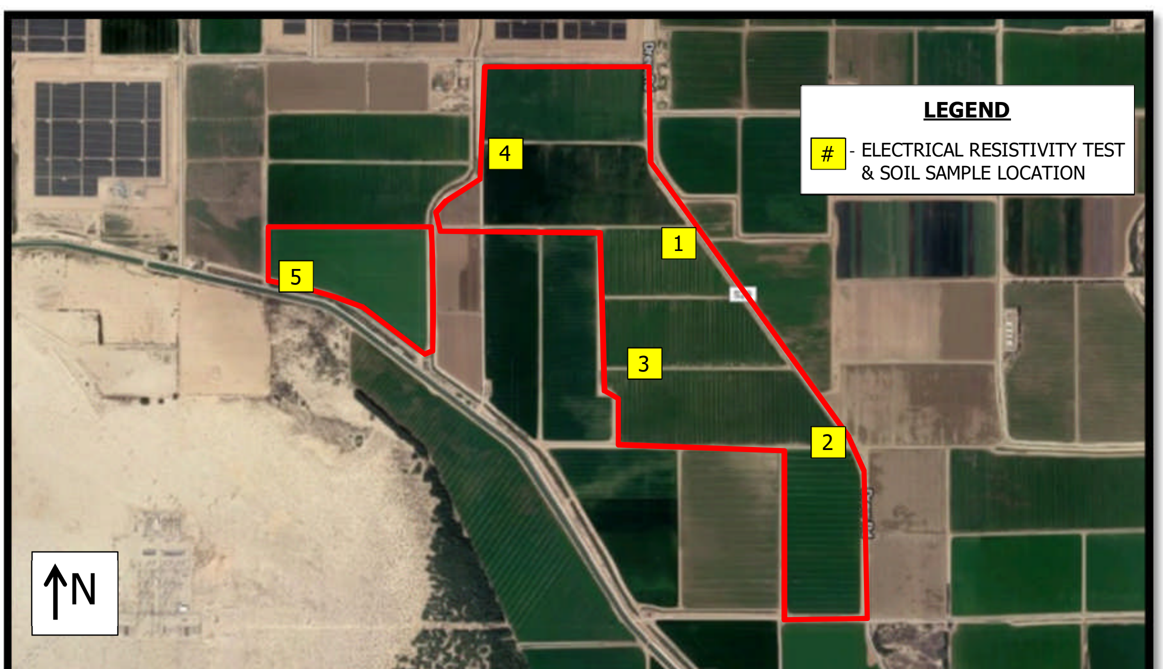


Figure 1 – Soil Test Locations

The soil corrosivity was evaluated based on the results of the field soil resistivity survey and the chemical analyses of five soil samples, one taken from each test site. The soil samples were obtained from holes hand augured by RFYeager Engineering the same day the resistivity testing was conducted. The soil sample depths were approximately 18 to 24 inches.

From the test data, the following conclusions are offered:

1. The results of the field soil resistivity testing are provided in Table 1 below. Resistivity readings varied between sites. Readings from Site 4 were the lowest overall, ranging from 517 ohm-cm to 1226 ohm-cm. Readings from Site 1 and 2 were relatively high at the shallower depths of 5 and 2.5 feet.

Table 1 - Vega SES Solar Project
Soil Resistivity Test Data
Prepared by: RFYeager Engineering
Test Date: 06.20.2018

	Soil Resistivity (Ohm-cm)				
	Ave. Soil Depth (feet)				
Site ID[1]	**20**	**15**	**10**	**5**	**2.5**
Site 1	1341	1637	2011	3361	5391
Site 2	1724	1896	2068	3313	4223
Site 3	1187	1293	1436	2154	2700
Site 4	1226	1178	1053	699	517
Site 5	1455	1925	2202	3102	2758

1 - See Figure 1 for test location relative to project site

2. The chemical analysis results are provided in Table 2 below. Site 4 had significantly higher concentrations of both chlorides and sulfates compared to the other test sites.

3. The saturated soil resistivity of the Site 4 sample was also considerably lower than the other soil samples (likely due to the higher soluble salt concentrations). The pH readings for all 5 soil samples were indicative of relatively neutral soil.

Table 2 - Imperial Solar Energy Center West Project Soil Chemical Analysis Data Prepared by: RFYeager Engineering				
Site ID.[1]	**Min. Soil Box Resistivity - CalTest 643 (ohm-cm)**	**Chloride Concentration - CalTest 422 (ppm)**	**Sulfate Concentration - CalTest 417 (ppm)**	**pH CalTest 643**
Site 1	990	85	240	7.8
Site 2	3700	32	120	8.4
Site 3	3300	140	140	8.5
Site 4	160	1600	1800	7.9
Site 5	3400	43	120	8.7

1 - See Figure 1 for soil sample location relative to project site

4. The data collected from Sites 1, 2, 3, and 5 indicate that the soil in the vicinity of these sites should be considered as fairly corrosive to buried metallic structures. This conclusion is based primarily on the moderately high in-situ resistivity readings, a majority of which are higher than 2,000 ohm-cm. In contrast, the soil data collected for Site 4 indicates that the soil in the vicinity of this test site should be considered as very aggressive to buried metallic utilities. This conclusion is primarily based upon the high soluble salt content and low in-situ and saturated soil box resistivities.

5. Although there is a wide variance in soil corrosivity, the data from each test site does indicate that the surrounding soil will support metallic corrosion to some extent. Accordingly, supplemental corrosion control measures are recommended for any metallic utilities buried in the vicinity of each test site in order to prevent premature failure.

DISCUSSION

Soil Resistivity Survey - Soil resistivity (inverse of conductivity) measures the ability of an electrolyte (soil) to support electrical current flow. The most common method of measuring soil resistivity is the Wenner 4-Pin Method which uses four pins (electrodes) that are driven into the earth and equally spaced apart in a straight line. The Wenner 4-pin Method provides an average resistivity of a hemisphere (essentially) of soil whose radius is approximately equal to the pin spacing. For example, the resistivity value obtained with the pins spaced at 5 feet apart is the average resistivity of a hemisphere of soil from the surface to a depth of 5 feet. By taking readings at different pin spacings (or depths), average soil resistivity conditions can be obtained within areas at, above, and below trench zones.

Corrosion versus Resistivity - Corrosion is an electrochemical process, whereby the reaction rate is largely dependent upon the conductivity of the surrounding electrolyte. Accordingly, the lower the resistivity, then the greater the current flow and the greater the corrosion rate assuming all other factors are equal.

One common relationship between corrosivity and soil resistivity used by corrosion engineers is as follows:

Corrosivity	Resistivity
Very Corrosive	0-1000 ohm-cm
Corrosive	1001-2000 ohm-cm
Fairly Corrosive	2001-5000 ohm-cm
Moderately Corrosive	5001-12000 ohm-cm
Slightly Corrosive	12001-30000 ohm-cm
Relatively Non-corrosive	Greater than 30001 ohm-cm

Thank you for this opportunity to provide our professional services. Please call if you have any questions.

With best regards,

REGISTERED PROFESSIONAL ENGINEER
RANDY J. GEVING
Exp.6/30/20
No.1060
CORROSION
STATE OF CALIFORNIA

Randy J. Geving, PE
Registered Professional Engineer – Corrosion No.1060

APPENDIX G

REFERENCES

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