GEOHAZARDS EVALUATION REPORT

FOR PROPOSED

RELOCATABLE CLASSROOM BUILDINGS AT

HUENEME HIGH SCHOOL,

500 WEST BARD ROAD,

OXNARD, CALIFORNIA

PROJECT NO.: 303277-004

AUGUST 16, 2021

PREPARED FOR

OXNARD UNION HIGH SCHOOL DISTRICT

BY

EARTH SYSTEMS PACIFIC

1731-A WALTER STREET

VENTURA, CALIFORNIA

Earth Systems
1731 Walter Street, Suite A | Ventura, CA 93003 | Ph: 805.642.6727 | www.earthsystems.com

August 16, 2021

Project No.: 303277-004
Report No.: 21-8-23

Attention: Poul Hanson
Oxnard Union High School District
309 South K Street
Oxnard, CA 93030

Project: Hueneme High School Relocatable Classroom Buildings
500 West Bard Road
Oxnard, California

As authorized, we have performed a geohazards study for three proposed relocatable classroom buildings to be located on the campus of Hueneme High School in the City of Oxnard, California. The accompanying Geohazards Evaluation Report presents the results of our analyses and our conclusions and recommendations pertaining to potential geohazards that could affect the proposed project. This report completes the scope of services described within our Proposal No. VEN-21-08-003 dated August 5, 2021.

We have appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

EARTH SYSTEMS PACIFIC

PROFESSIONAL GEOLOGIST
PATRICK V. BOALES
No. 1346
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Patrick V. Boales 8-16-21
Engineering Geologist

REGISTERED PROFESSIONAL ENGINEER
ANTHONY P. MAZZEI
GE 2823
EXP. 6-30-23
GEOTECHNICAL
STATE OF CALIFORNIA
8/16/21

Anthony P. Mazzei
Geotechnical Engineer

Copies: 2 - Poul Hanson at OUHSD (1 via US mail, 1 via email)
1 - Alan Camerano at DC Architects (via email)
1 - Project File

TABLE OF CONTENTS

INTRODUCTION

This report presents results of a study performed to evaluate geohazards that could potentially impact the proposed placement of three triple-wide relocatable classroom buildings on the campus of Hueneme High School at 500 West Bard Road in the City of Oxnard (see Vicinity Map in Appendix A). The relocatable buildings would be located at the southern end of the western parking lot on the campus. The structures, which are intended to be supported by wood foundations, will be located within an area is paved in asphalt and essentially flat with no nearby slopes. The coordinates of the site are 34.1598° north latitude and -119.1838° west longitude. There are no springs or seeps on the campus. Based on interpretation of the USGS 7.5-minute Oxnard Quadrangle, there is approximately 5 feet of fall over about 1,200 feet in the vicinity of the subject site, or a gradient of about 0.4 percent. There are no springs or seeps on the property.

The site is located adjacent to a geotechnical study performed by Earth Systems in 2012 for the carport-mounted solar array that currently exists in the parking lot. That study included exploration with two mud rotary borings and two cone penetration test (CPT) soundings, laboratory testing of samples obtained from the exploration, and analyses of geohazards. However, there have been multiple changes in the California Building Code and standard of practice evaluations of geohazards that have been implemented since the 2012 report was prepared. This current 2021 report has utilized the data from the original report to reanalyze the geohazards for the currently proposed relocatable structures.

PURPOSE AND SCOPE OF WORK

The purpose of the geotechnical study that led to this report was to analyze the geology and soil conditions of the site with respect to potential geohazards that could affect the proposed improvements. The scope of work included:

1. Reconnaissance and geologic mapping of the site.
2. Reviewing pertinent geologic literature.
3. Reviewing aerial photographs taken of the site and surrounding areas on October 25, 1945 by Fairchild Aerial Surveys, Inc.
4. Analyzing the data generated during the previous study for the adjacent carport-mounted solar array.
5. Preparing this report.

GEOLOGY

The site lies within the Ventura basin in the western portion of the Transverse Ranges geologic province. Numerous east-west trending folds and reverse faults indicative of ongoing north-south transpressional tectonics characterize the region. The school site is situated within the Oxnard Plain. Ongoing folding and uplift have tilted Pleistocene to Tertiary age sedimentary rocks in the region. Recent alluvium blankets the bedrock units in the vicinity of Hueneme High School.

The campus is not within any of the Fault Rupture Hazard Zones that have been delineated by the State of California. The Simi-Santa Rosa Fault is the nearest significant fault. It is a north dipping reverse fault that generally parallels the north side of the eastern end of the Oxnard Plain. At its closest position to the school site (approximately 10.0 kilometers to the northeast of the campus), it is mapped as buried by alluvium. Portions of this fault are considered "active" by the State.

The Oak Ridge (Onshore) fault is potentially more significant to the campus despite its surface trace being further away. It is a south dipping reverse fault that generally parallels the south side of the Santa Clara River Valley and portions are considered “active” by the State. The closest position of the surface trace to the school is approximately 11.5 kilometers to the north where it is mapped as buried by alluvium. However, because the fault dips southward, the upward projection from the base of the fault plane is approximately 1 kilometer north of the campus.

Bedrock was not encountered during the subsurface investigation, and it is anticipated that it is located at least several hundred feet below the existing ground surface. Natural earth materials underlying the subject site are alluvial deposits (Qal). Natural units encountered within the test borings below about 4 feet consisted of sands and silty sands to depths of about 22 feet, then silts and clays with minor interbeds of sand to depths of at least 50 feet.

Bedding attitudes were not measured within the alluvial deposits, but it is considered likely that bedding is oriented nearly parallel to the natural ground surface.

No faults or landslides were observed to be located on or trending into the subject property during the field study, during reviews of the referenced geologic literature, including the County of Ventura Seismic Safety Element and the City of Oxnard 2020 General Plan, or during review of the aerial photographs taken of the site and surrounding areas.

GEOLOGIC HAZARDS

Geologic hazards that may impact a site include seismic shaking, fault rupture, landsliding, rock fall, liquefaction, seismic-induced settlement of dry sands, and flooding.

A. Seismic Shaking

1. Southern California is a seismically active region where the potential for significant ground shaking is universal. Earthquakes of a size large enough to cause structural damage are relatively common in the region. Per the State of California guidelines for these types of reports, when evaluating the seismicity potential of a specific site, it is general practice to look at the historical seismic record of the area and also review the site location with respect to mapped potentially active and active faults. By using this procedure, estimates of maximum ground accelerations are determined for consideration in structural design for buildings. The geotechnical community uses the method even though most are well aware of its shortcomings. The most significant shortcomings relate to the presence of unknown seismogenic faults well below the surface, and the amount of uncertainty regarding the time intervals between earthquake events on many of the recognized faults. The 1983 Coalinga and 1994 Northridge Earthquakes are examples of relatively large events that occurred on previously unrecognized faults. Man has only been using instruments to monitor earthquakes since the 1930's, which is a relatively short time span considering that the intervals between large earthquakes on some of the regional faults are on the order of thousands of years. Considering the above, an evaluation of site acceleration potential will lead to a value that must be considered an approximation. The structural designers must be aware that there are inherent uncertainties in the determined value or range.

2. The Oxnard area has not experienced any local large earthquakes since records have been kept; however, regional earthquakes have led to significant ground shaking and structural damage. Notable regional earthquakes include the 1812 Santa Barbara Channel and 1857 Fort Tejon events. The epicenter of the 1812 earthquake is thought to have been in the western part of the Santa Barbara channel. Associated

with this earthquake, a tsunami with a disputed run up height of up to 15 feet impacted the Ventura coastal area. On January 9, 1857, the Fort Tejon earthquake with an estimated Richter magnitude of 8.25 impacted the region. According to C.D.M.G. (1975), the earthquake caused the roof of the Mission San Buenaventura to fall in.

3. One measure of ground shaking is intensity. The Modified Mercalli Intensity Scale of ground shaking ranges from I to XII with XII indicating the maximum possible intensity of ground movement. Structural damage begins to occur when the intensity exceeds a value of VI. Southern Ventura County has been mapped by the California Division of Mines and Geology to delineate areas of varying predicted seismic response. The Alluvium that underlies the subject area is mapped as having a probable maximum intensity of earthquake response of approximately IX on the Modified Mercalli Scale. Historically, the highest estimated intensity in the Oxnard area has been VII (CDMG, 1975, 1994).

4. The school site, like any other site in the region, is subject to relatively severe ground shaking in the event of a maximum earthquake on a nearby fault. A Regional Fault Map is presented in Appendix A is that shows the site's relationship to the identified faults in the region.

5. It is assumed that the 2019 CBC and ASCE 7-16 guidelines will apply for the seismic design parameters. The 2019 CBC includes several seismic design parameters that are influenced by the geographic site location with respect to active and potentially active faults, and with respect to subsurface soil or rock conditions. The “general procedure” (i.e. probabilistic) seismic design parameters presented below were retrieved from the U.S. Seismic Design Maps "risk-targeted" web services using the SEAOC/OSHPD website which presents the data in a report format. The data were retrieved for the ASCE 7-16 design code, site coordinates 34.1598° North Latitude and 119.1838° West Longitude, Soil Site Class D (for stiff soils), and Occupancy (Risk) Category III (which includes public school classroom buildings). (A listing of the calculated 2019 CBC and ASCE 7-16 Seismic Parameters is presented below and again in Appendix B.)

Summary of Seismic Parameters – 2019 CBC "General Procedure"

Site Class (ASCE 7-16)	D
Occupancy (Risk) Category	III
Seismic Design Category	See CBC Section 11.4.8
Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.603 g
Spectral Response Acceleration at 1 sec. – S_1	0.587 g
Site Coefficient – F_a	1.008
Site Coefficient – F_v	See CBC Section 11.4.8
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	1.603 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	See CBC Section 11.4.8
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	1.069 g
One Second Spectral Response – S_{D1}	See CBC Section 11.4.8
Site Modified Peak Ground Acceleration - PGA_M	0.764 g
Values appropriate for a 2% probability of exceedance in 50 years	

When the seismic factor S_1 is greater than 0.2 g and the Site Class is "D", and the structural engineer determines that the exceptions of ASCE 7-16 Section 11.4.8 do not apply, a site-specific (i.e. deterministic) ground motion hazard analysis is required. The site-specific study takes into account soil amplification effects. The United States Geological Survey (USGS, 2009) has undertaken a probabilistic earthquake analyses that covers the continental United States. A reasonable site-specific spectral response curve may be developed from USGS Unified Hazard Tool web page, which adjusts for site-specific ground factors. The interactive webpage appears to be a precise calculation based on site coordinates. For the purposes of this study, the Dynamic: Conterminous U.S. 2014 (Update) (Version 4.20) values have been chosen for use in the analysis.

NGA West 2014 attenuation relationships were used in the analyses. These attenuations included those of Abrahamson, Silva and Kamai, Boore and Stewart, Campbell and Bozorgnia, Chiou and Youngs, and Idriss.

Summary of Seismic Parameters – 2019 CBC "Site-Specific Procedure"

Site Class (ASCE 7-16)	D
Occupancy (Risk) Category	III
Seismic Design Category	D
Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.603 g
Spectral Response Acceleration at 1 sec. – S_1	0.587 g
Site Coefficient – F_a	1.00
Site Coefficient – F_v	2.50
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	1.730 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	1.598 g
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	1.153 g
One Second Spectral Response – S_{D1}	1.065 g
Site Modified Peak Ground Acceleration - PGA_M	0.746 g
Values appropriate for a 2% probability of exceedance in 50 years	

The Fault Parameters table in Appendix B lists the significant "active" and "potentially active" faults within an approximate 37-mile radius of the project site. The distance between the project site and the nearest portion of each fault is shown as well as the respective estimated maximum earthquake magnitudes. However, it should be noted that the distance to the Oak Ridge fault was modified to one kilometer for the site-specific analysis because the site is south of the fault, and the fault dips southward. This geometric relationship means that the fault plane projects below the site at depth.

6. California has had several large earthquakes in this century, and studies on the structural effects of the ground shaking have led to changes in the building codes. After the 1933 Long Beach Earthquake, the State of California Field Act was written with the intention of making public schools more earthquake resistant. The intent of the act, as is the intent of the most modern codes, is as follows: "School buildings

constructed pursuant to these regulations are expected to resist earthquake forces generated by major earthquakes in California without catastrophic collapse, but may experience some repairable architectural or structural damage". Following the 1971 San Fernando Earthquake, many changes were made to the public school building codes. After the 1994 Northridge Earthquake, a study of 127 public schools in the Los Angeles area by the State of California Division of the State Architect (1994a) revealed that the intent of the Field Act was being met even when buildings were subjected to horizontal accelerations approaching 0.9 g (much higher than expected) over a large area. None of the schools collapsed and most of the damage that would have caused injury to students, had school been in session, was from failures of non-structural items such as light fixtures, florescent bulbs, suspended ceilings, etc. Most of the schools that experienced these non-structural failures were built before the changes to the building code that applied to these non-structural items. The study also resulted in recommended changes to building codes regarding steel framed school buildings, (State of Calif. Div. of State Architect, 1994b).

B. Fault Rupture

Surficial displacement along a fault trace is known as fault rupture. Fault rupture typically occurs along previously existing fault traces. As mentioned in the "Structure" section above, no existing fault traces were observed to be crossing the site. As a result, it is the opinion of this firm that the potential for fault rupture on this site is low.

C. Landsliding and Rock Fall

As mentioned previously, the subject site is relatively flat. As a result, it appears that the hazards posed by landsliding and rock fall are considered nil.

D. Liquefaction, Cyclic Softening, and Lateral Spreading

Earthquake-induced cyclic loading can be the cause of several significant phenomena, including liquefaction in fine sands and silty sands. Liquefaction results in a loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. Cyclic softening in clays during earthquakes has resulted in buildings experiencing foundation failure and ground surface deformation similar to that resultant from liquefaction. If liquefaction or cyclic softening occurs beneath sloping ground, a phenomenon known as lateral spreading can occur. Liquefaction and cyclic softening is typically limited to the upper 50 feet of the subsurface soils. There are a number of conditions that need to be satisfied for liquefaction or cyclic softening to occur. Of primary importance is that groundwater, perched or otherwise, usually must be within the upper 50 feet of soils.

The subject site is located within one of the Liquefaction Hazard Zones delineated by the State of California (CGS, 2002b).

Earthquake-induced vibrations can be the cause of several significant phenomena, including liquefaction in fine sands and silty sands. Liquefaction results in a loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. Liquefaction is typically limited to the upper 50 feet of soils underlying a site.

Fine sands and silty sands that are poorly graded and lie below the groundwater table are the soils most susceptible to liquefaction. Soils that have I_c values greater than 2.6, soils with plasticity indices (PI) greater than 7, sufficiently dense soils, and/or soils located above the groundwater table are not generally susceptible to liquefaction.

An examination of the conditions existing at the site, in relation to the criteria listed above, indicates the following:

1. Groundwater was encountered at a depth of 4.5 feet in Boring B-2 and at a depth of 5 feet in both of the soundings. A mapping of historic high groundwater levels in the subject area by the State shows the site to have a high groundwater level between 5 and 10 feet below the surface (CGS, 2002a). (A copy of the map of historic high groundwater levels is presented in Appendix A.) Based on these data, a depth to high groundwater of 4.5 feet has been assumed within our analyses.
2. Plasticity index (PI) values determined from samples of fine grained soils taken from Boring B-1 were compared to I_c values interpreted from CPT-1. In addition, fine contents measured from hydrometer tests were compared with fine contents from the CPT sounding. The intent was to help assess correlation between the two methods of determining "non-plastic" behavior. Atterberg limit evaluations indicate that the fine grained soils between 23 and 25.3 feet have a PI of 12, thus classifying as a CL, and the corresponding I_c values are greater than 2.6. Fine contents from a sample taken at 23 feet were found to be 76.1 percent, whereas those interpreted from that zone from the CPT data were 90 to 100 percent. Soils between 25.8 and

28.6 feet have a PI of 12, thus classifying as a CL, and the corresponding I_c values are greater than 2.6. Fine contents from a sample taken at 26 feet were found to be 79.9 percent, whereas those interpreted from the CPT data were 100 percent. Soils between 39.7 and 43.2 feet have a PI of 8, thus classifying as an ML, and these also have I_c values greater than 2.6. Fine contents from a sample taken at 40 feet were found to be 87.9 percent, whereas those interpreted from the CPT data were 100 percent. Although correlations between boring and CPT data are not perfect, they do appear to be acceptably comparative, and no adjustments to I_c values are considered necessary for liquefaction analysis.

3. CPT readings indicate that there are additional soil layers beyond those discussed above with I_c values greater than 2.6, which is generally considered the boundary between soils prone and not prone to liquefaction. Such soils were encountered between depths of 30.2 and 31.4 feet, and 44.5 and 49.9 feet.
4. Soils with I_c values greater than 2.6 are expected to exhibit clay-like behavior during earthquake cyclic loading based on comparison of I_c values to plasticity indices.
5. Standard penetration tests conducted in the borings, and SPT blow counts interpreted from CPT data, indicate that soils within the tested depth are in a variably dense state.
6. Soil profiles between the two CPT soundings were relatively consistent, as depicted in Geologic Cross-Section A-A’ in Appendix A.

Based on the above, a cyclic mobility analysis was undertaken to analyze the liquefaction potentials of the various soil layers. The analysis was performed in general accordance with the methods proposed by NCEER (1997). In the analysis, the design earthquake was considered to be a 7.4 moment magnitude event, and a modified peak ground acceleration of 0.764 g was assumed, as per the discussion in the “Seismic Shaking” section of this report.

The analysis for soils in the vicinity of CPT-2 (the nearest of the two soundings to the proposed relocatable structures) indicated that layers with a cumulative thickness of 15.7 feet had factors of safety less than 1.3 (see Appendix D for calculations). Those zones with factors of safety less than 1.3 are considered potentially liquefiable (C.G.S., 2008, and SCEC, 1999).

The volumetric strain for the combination of potentially liquefiable zones and dry sands potentially susceptible to seismic induced settlement was estimated by spreadsheet based on a chart derived by Tokimatsu and Seed (1987) and reducing the $N_1$60 values by the calculated "FC Delta" value, then making adjustments for fines content as per Seed (1987) and SCEC (1999). Using this methodology, the volumetric strain was found to be approximately 2.2 inches, with all of the potential settlement related to liquefaction and none related to seismic-induced settlement of the upper 4.5 feet of the soil profile.

The first potentially liquefiable zone with significant thickness is at depths between 4.5 and 11 feet below the ground surface. However, only the uppermost 1.5 feet of this zone of potentially liquefiable soils exhibits blowcounts ("N") values that are between 9 and 10. (Soils with N-values less than 10 are those considered most likely to flow during a significant earthquake.) Given that there is 4.5 feet of non-liquefiable soil above this zone, it appears unlike that ground damage could occur, but it cannot be stated for certain that this thickness of soils would mobilize to the point where ground damage could occur. (Examples of ground damage are sand boils and ground cracks.)

The post-liquefaction residual undrained strength of the potentially liquefiable zone between the depths of 4.5 and 11 feet was estimated to be 800 psf using the lowest equivalent clean sand SPT blow count $(N_1)_{60\text{-}CS}$ within this liquefiable zone of 18.4 and the lower bound of the Seed & Harder (1990) plot. Based on this residual undrained shear strength and the fact that the structures will be supported by wood foundations bearing on asphaltic pavement, bearing failures related to liquefaction are considered unlikely.

As mentioned previously, the total liquefaction-related settlement could potentially range up to about 2.2 inches. According to SCEC (1999), up to about half of the total settlement could be realized as differential settlement. As a result, differential settlement could range up to about 1.1 inches over a horizontal distance of 30 feet at the ground surface.

For the purposes of this analysis, "lateral spreading" will be discussed as two different phenomena: "traditional" lateral spreading related to nearby ground slopes with a consistent pattern of ground displacements, and "ground slope" lateral spreading for nearly flat sites without a consistent pattern of deformation.

”Free face” lateral spreading does not appear to pose a potential hazard because there are no nearby sloped areas or canyons (Bartlett and Youd, 1995).

However, “ground slope” lateral spreading, sometimes referred to as “ground oscillation”, can occur when adjusted blow counts ($N_{1(60)}$) measured within potentially liquefiable zones are less than 15. Two such zones were identified. The cumulative thickness of these layers is about three feet or about one meter. The potential ground oscillation was analyzed in accordance with procedures developed by Youd, Hansen and Bartlett (2002). In the analyses, it was assumed that the surface slope was 0.4 percent, which is equivalent to about 5 feet of fall in 1,200 feet, as shown on the Oxnard Quadrangle near the subject site. Fine contents were assumed to be 55 percent based on conservative weighting of the interpreted fine contents listed within the CPT data, and on hydrometer testing performed on samples gathered during subsurface studies. The cumulative displacement was calculated to be about 0.8 feet if both zones liquefied simultaneously and continuously across the site. (Calculations are included within Appendix D of this report.)

Based on calculated liquidity indices, it appears that at least some of the clay and low-plastic silt layers at the site that are sensitive. Samples of these lenses taken from depths of 26 and 40 feet have liquidity indices of about 1.3 and 1.5, respectively, and sensitivities of about 10 and 20. These layers are 6 and 9 feet thick, respectively. Potential ground deformations may arise from cyclic softening for clay and low-plastic silt soils with a sensitivity greater than 8. Post-liquefaction settlement from consolidation of these soils disturbed by a design level earthquake could be on the order of about 4.5 inches. However, due to the depths of these potentially sensitive soil layers, post-liquefaction settlement from consolidation of these soils would likely be areal in extent.

Based on the above, it is the opinion of this firm that a potential for liquefaction, lateral spreading, and cyclic settlement of sensitive low-plastic silts and clays exists at this site.

E. <u>Seismic-Induced Settlement of Dry Sands</u>

Sands tend to settle and densify when subjected to earthquake shaking. The amount of settlement is a function of relative density, cyclic shear strain magnitude, and the number of strain cycles. A procedure to evaluate this type of settlement was developed by Seed and Silver (1972) and later modified by Pyke, et al (1975).). Tokimatsu and Seed (1987) presented a simplified procedure that has been reduced to a series of equations by Pradel (1998).

To analyze this phenomenon, the Tokimatsu and Seed procedure, as implemented by Pradel, was used in the analysis discussed above for liquefaction. Also as mentioned above, no seismic-induced settlement of dry sands is expected to be experienced. (Printouts of the analyses are within the printouts in Appendix D.)

F. Flooding

Earthquake-induced flooding types include tsunamis, seiches, and reservoir failure. The site is not near any lakes; thus, hazard posed by seiches is nil. The site is not located within the tsunami inundation zone delineated by CEMA, et al. (2009), or within the tsunami inundation zone delineated in the City of Oxnard 2020 General Plan (1990). Thus, the potential hazard posed by tsunamis is low.

According to the Ventura County General Plan Hazards Appendix (2013), this site, like most of the Oxnard Plain, is within a dam failure inundation zone for Lake Castaic, Pyramid Lake, Lake Piru, and Bouquet Canyon Dam. Proper maintenance of these dams is anticipated, and assuming the maintenance continues as planned, the hazard posed by reservoir failure appears to be low.

The majority of the campus, including the location of the proposed relocatable classrooms, is within an area designated by FEMA Flood Map Service Center website as Zone X, which is designated as an “area of minimal flood hazard". As a result, it appears that the hazard posed by storm-induced flooding is low.

CONCLUSIONS AND RECOMMENDATIONS

The site is suitable for the proposed development provided that the recommendations contained in this report can be successfully mitigated during design of the project.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The scope of services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report or on the soil boring logs regarding odors noted, unusual or suspicious items or conditions observed, are strictly for the information of the client.

Findings of this report are valid as of this date; however, changes in conditions of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside the control of this firm. Therefore, this report is subject to review and should not be relied upon after a period of one year.

In the event that any changes in the nature, design, or location of the improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

This report is issued with the understanding that it is the responsibility of the Owner, or of his representative to ensure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plan and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

As the Engineering Geologist for this project, Earth Systems has striven to provide services in accordance with generally accepted geotechnical engineering practices in this community at this time. No warranty or guarantee is expressed or implied. This report was prepared for the exclusive use of the Client for the purposes stated in this document for the referenced project only. No third party may use or rely on this report without express written authorization from Earth Systems for such use or reliance.

AERIAL PHOTOGRAPHS REVIEWED

Fairchild Aerial Surveys, October 25, 1945, Frame Nos. 9800-3-337 & 338, Scale 1:20,000.

SITE-SPECIFIC BIBLIOGRAPHY

Earth Systems Southern California, May 29, 2012, Engineering Geology and Geotechnical Engineering Report for Proposed Solar Array in Northwestern Parking Lot at Hueneme High School, 500 West Bard Road, Oxnard, California (Job No. VT-24513-01).

GENERAL BIBLIOGRAPHY

Abrahamson, N.A., and Silva, W.J., 1997, Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes: Seismological Research Letters.

Bartlett & Youd, 1995, Empirical Prediction of Liquefaction-Induced Lateral Spread, Journal of Geotechnical Engineering, April, 1995.

Boatwright, John, 1994, Modeling Ground Motions in the Near-Field of Rupturing Faults.

Boore, D.M., and Joyner, W.B., 1994, Prediction of Ground Motion in North America.

Boore, D.M., Stewart, J.P., Seyhand, E., and Atkinson, G., 2014, NGA-West 2 Equations for Predicting PGA, PGV, nd5% Damped PGA for Shallow Crustal Earthquakes.

California Building Standards Commission, 2019, California Building Code, California Code of Regulations Title 24.

CDMG, 1972, Fault Rupture Hazard Zones in California, Special Publication 42.

CDMG, 1973, Geology and Mineral Resources of Southern Ventura County, California.

CDMG, 1975, Seismic Hazards Study of Ventura County, California.

CDMG, 1994, The Northridge California Earthquake of 17 January, 1994, Special Publication 116.

CDMG., 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

California Emergency Management Agency (Cal EMA), February 15, 2009, Tsunami Inundation Map for Emergency Planning, State of California – County of Ventura, Oxnard Quadrangle.

California Geological Survey (CGS), 2002a, Seismic Hazard Zone Report for the Oxnard 7.5-Minute Quadrangle, Ventura County, California, Seismic Hazard Zone Report 052.

CGS, 2002b, Seismic Hazard Zones Map of the Oxnard Quadrangle.

CGS, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A.

Campbell, K.W., and Bozorgnia, Y., 2014, NGA-West2 Ground Motion Model for the Average Horizontal Components of PGA, PGV and 5% Damped Linear Acceleration Response Spectra.

Cetin, K.O., Seed, R.B., Der Kiureghian, A., Tokimatsu, K. Harder, L.F., Kayen, R.E., and Moss, R.E.S., 2004, Standard Penetration Test-Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential: ASCE Journal of Geotechnical and Geoenvironmental Engineering, v. 130, n. 12, p. 1314-1340.

Chiou, B.S-J, and Youngs, R.R., 2014, Update of the Chiou and Youngs NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra.

City of Oxnard, November 1990, City of Oxnard 2020 General Plan Safety Element.

Clahan, Kevin B., 2003, Geologic Map of the Oxnard 7.5’ Quadrangle, Ventura County, California: A Digital Database, Version 1.0, U.S.G.S., S.C.A.M.P., and C.G.S. Map.

County of Los Angeles Department of Public Works, July 2013, Manual for Preparation of Geotechnical Reports.

Crowell, John C., 1975, San Andreas Fault in Southern California, C.D.M.G. Special Report 118.

Donnellan, A. Hager, B.H., and King, R.W., 1993, Rapid North-South Shortening of the Ventura Basin, Southern California.

Federal Emergency Management Agency (FEMA), 2021, Flood Map Service Center Website.

Hauksson Egill, Jones, Lucille M., and Hutton, Kate, 1995, The 1994 Northridge Earthquake Sequence in California.

Heaton, T.H., and Hartzell, S.H., 1994, Earthquake Ground Motions in the Near Source Region.

Huftile, Gary J., and Yeats, Robert S., 1995, Convergence Rates Across a Displacement Transfer Zone in the Western Transverse Ranges, Ventura Basin, California.

Idriss, I.M., and Boulanger, R.W., 2004, Semi-empirical procedures for evaluation liquefaction potential during earthquakes: Proceedings of the 11th SDEE and 3rd ICEGE, University of California, Berkeley, January 2004, plenary session, p. 32-56.

Idriss, I.M., and Boulanger, R.W., 2008, Soil liquefaction during earthquakes, Earthquake Engineering Research Institute, MNO-12.

Idriss, I.M., 2014, An NGA-West2 Empirical Model for Estimating the Horizontal Spectral Values Generated by Shallow Crustal Earthquakes.

Ishihara, K., 1985, Stability of Natural Deposits during Earthquakes, Proceedings of the International Conference on Soil Mechanics and Foundation Engineering.

Jennings, C.W., and W.A. Bryant, 2010, Fault Activity Map of California, Scale 1:750,000, CGS Geologic Data Map No. 6.

Keller, E.A., and Pinter, N., 1996, Active Tectonics-Earthquakes, Uplift, and Landscape.

Lajoie, Kenneth R., Sarna-Wojcicki, A.M., and Yerkes, R.F., 1982, Quaternary Chronology and Rates of Crustal Deformation in the Ventura area, California.

NCEER, 1997, Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Technical Report NCEER-97-0022.

Petersen, Mark D., and Wesnousky, S.D., 1994, Fault Slip Rates and Earthquake Histories for Active Faults in Southern California.

Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 4, April.

Pyke, R., Seed, H. B., and Chan, C. K., 1975, Settlement of Sands Under Multidirectional Shaking, ASCE, Journal of Geotechnical Engineering, Vol. 101, No. 4, April, 1975.

Sadigh, K., Chang, C.Y., Egan, J.A., Madisi, F., and Youngs, R.R., 1997, Attenuation Relations for Shallow Crustal Earthquakes Based on California Strong Motion Data. Seismological Research Letters, Vol. 68, No. 1, pp 180-189.

SEAOC and OSHPD, 2021, Seismic Design Maps Website.

Seed, H. B., and Silver, M. L., 1972, Settlement of Dry Sands During Earthquakes, ASCE, Journal of Geotechnical Engineering, Vol. 98, No. 4, April, 1972.

Seed, R.B., Bray, J.D., Chang, S.W., and Dickensen, S.E., 1997, Site-Dependent Seismic Response Including Recent Strong Motion Data.

Seed, R.B., Cetin, K.O., Moss, R.E. S., Kammerer, A.M., Wu, J., Pestana, J.M., Riemer, M.F., Sancio, R.B., Bray, H.D., Kayen R.E., and Faris, A., 2003, Recent Advances in Soil Liquefaction Engineering,: A Unified and Consistent Framework: University of California, Earthquake Engineering Research Center Report 2003-06, 71p.

Shakal, A.F., Huang, M.J., Darragh, R.B., Cao, T., Sherburne, R.W., Malhotra, P., Cramer, C.H., Sydnor, R.H., Graizer V., Maldonado, G., Petersen, C., and Wampole, J., 1994, CSMIP Strong-Motion Records from the Northridge, California Earthquake of 17 January 1994.

Shaw, John H., and Suppe, John, 1994, Active Faulting and Growth Folding in the Eastern Santa Barbara Channel, California.

Sieh, Kerry E., 1978, Earthquake Intervals, San Andreas Fault, Palmdale, California, CDMG California Geology, June 1978.

Southern California Earthquake Center (SCEC), 1999, Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California.

State of California Division of the State Architect Office of Regulation Services, May 1994, Northridge Earthquake (January 17, 1994) Performance of Public School Buildings.

State of California Division of the State Architect Office of Regulation Services, May 1994, Implementation of Northridge Earthquake Interim Guidelines for Steel Moment Frames.

Tokimatsu, K., and Seed, H. B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering-August 1987.

United States Geological Survey (USGS) 1989, Map Showing Late Quaternary Faults and 1978-1984 Seismicity of the Los Angeles Region, California. Map MF-1964.

USGS, 2017, U.S. Unified Hazard Tool Website.

Ventura County Planning Department, 1974, Seismic and Safety Element Summary.

Weber, F. Harold, Jr. and others, 1973, Geology and Mineral Resources of Southern Ventura County, California, C.D.M.G., Preliminary Report 14.

Wills, C.J., and Silva, W.S., 1998, Shear Wave Velocity Characteristics of Geologic Units in California.

Yeats, R.S., 1982 Low-Shake Faults of the Ventura Basin, California, in Cooper, J.D. compiler, Volume and Guidebook, Neotectonics in Southern California.

Yeats, Robert S., 1983, Large-Scale Quaternary Detachments in the Ventura Basin, Southern California.

Yeats, Robert S., Huftile, Gary J., and Grigsby, F.B., 1988, Oak Ridge Fault, Ventura Fold Belt, and the Sisar Decollement, Ventura Basin, California.

Yerkes, Robert F., and Lee. W.H.K., 1987, Late Quaternary Deformation in the Western Transverse Ranges.

Yerkes, R.F., Sarna-Wojcicki, A.M., and Lajoie, K.R., 1987, Geology and Quaternary Deformation of the Ventura Area, in Recent Faulting in the Transverse Ranges, California. USGS Professional Paper 1339.

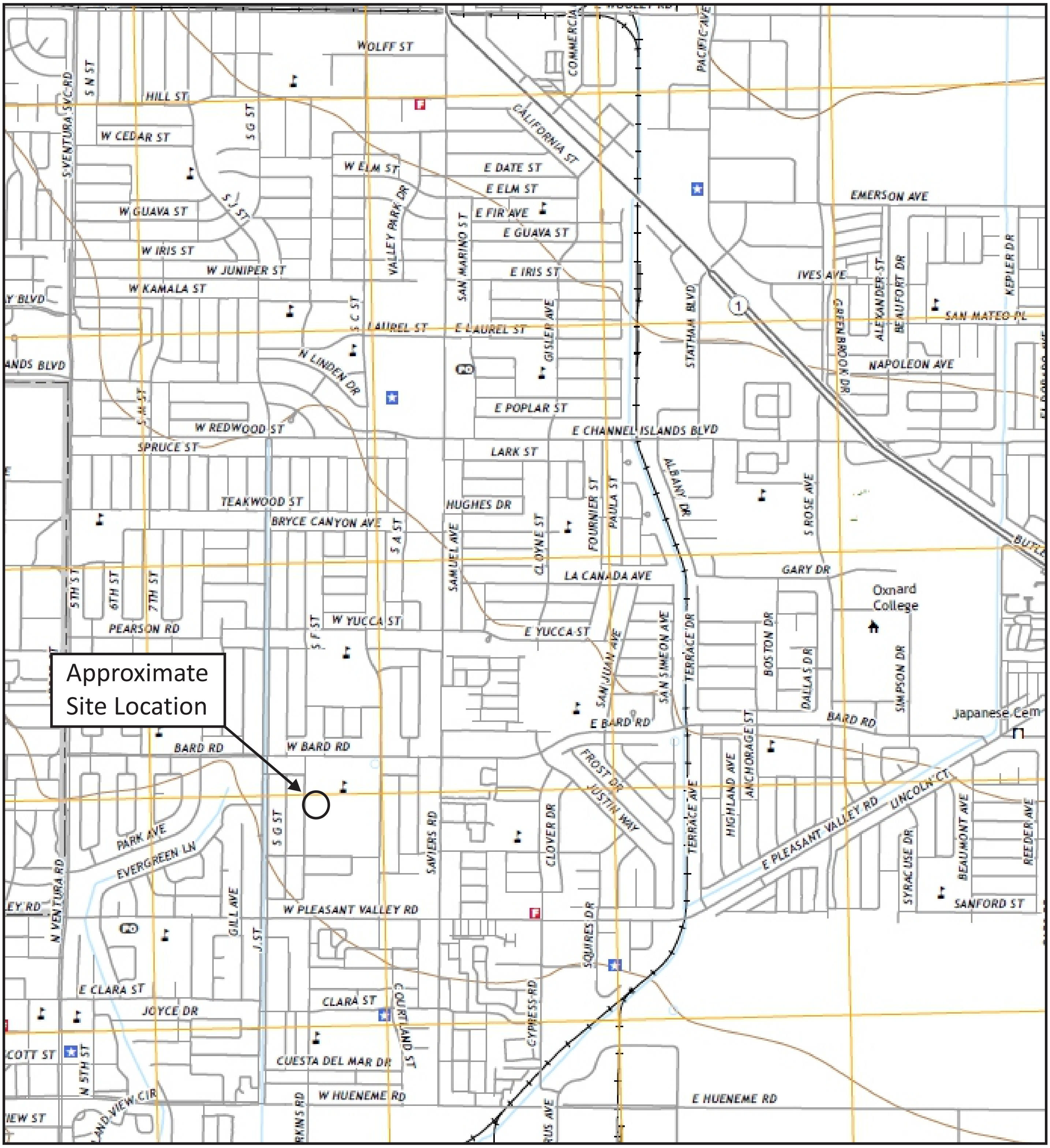
Youd, T.L. and Garris, C.T., 1995, Liquefaction-Induced Ground-Surface Disruption: ASCE Journal of Geotechnical Engineering, v 121, n. 11, p. 805-809.

Youd, T.L., and Idriss, I.M., and 19 others, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils: ASCE Geotechnical and Geoenvironmental Journal, v. 127, n. 10, p 817-833.

Youd, T.L., C.M. Hansen, and S.F. Bartlett, 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, in Journal of Geotechnical and Geoenvironmental Engineering, December 2002.

APPENDIX A

Vicinity Map
Regional Fault Map
Regional Geologic Map
Seismic Hazard Zones Map
Historically High Groundwater Map
Geologic Map
Geologic Cross-Section
Boring Logs (2012)
CPT Log and Interpretation (2012)



*Taken from USGS Topo Map, Oxnard Quadrangle, California, 2018.

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

N

VICINITY MAP

Hueneme High School Relocatables
Oxnard, California

Earth Systems

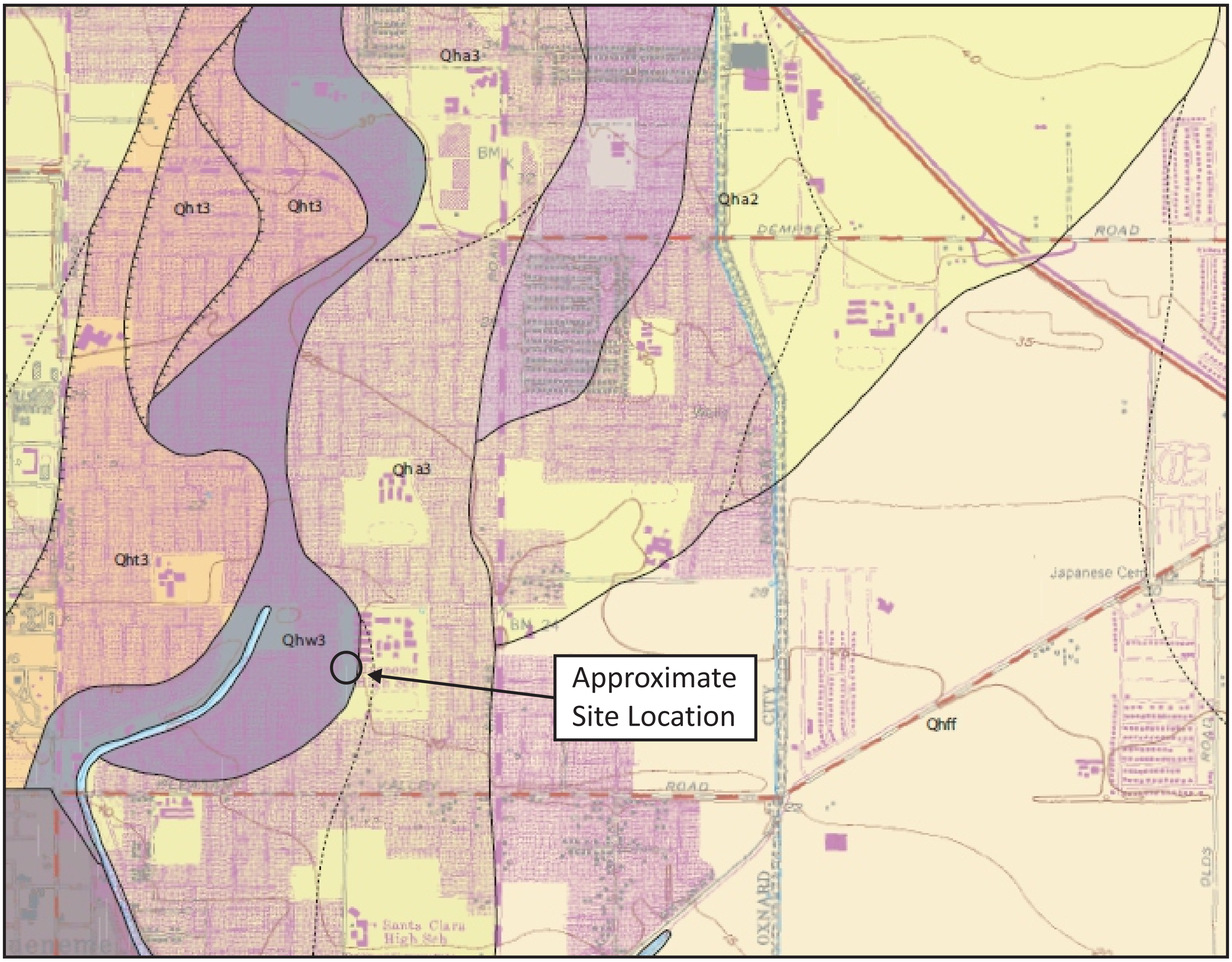
August 2021	303277-004

*Taken from Jennings and Bryant, Geologic Data Map No.6, 2010

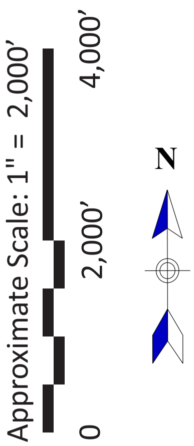
N

Approximate Scale:
1 Inch = 2 Mile

REGIONAL FAULT MAP	
Hueneme High School Relocatables Oxnard, California	
Earth Systems	
August 2021	303277-004



*Taken from USGS, SCAMP Geologic Map of the Ventura 7.5' Quadrangle, Ventura County, California, 2003.



MAP SYMBOLS

Contact between map units of different relative age; generally approximately located.

Contact between terraced alluvial units; hachures point towards topographically lower surface.

Contact between similar map units; generally approximately located.

Fault; dotted where concealed.

Axis of anticline; dotted where concealed.

Axis of syncline; dotted where concealed.

Qha3: Holocene alluvial deposits

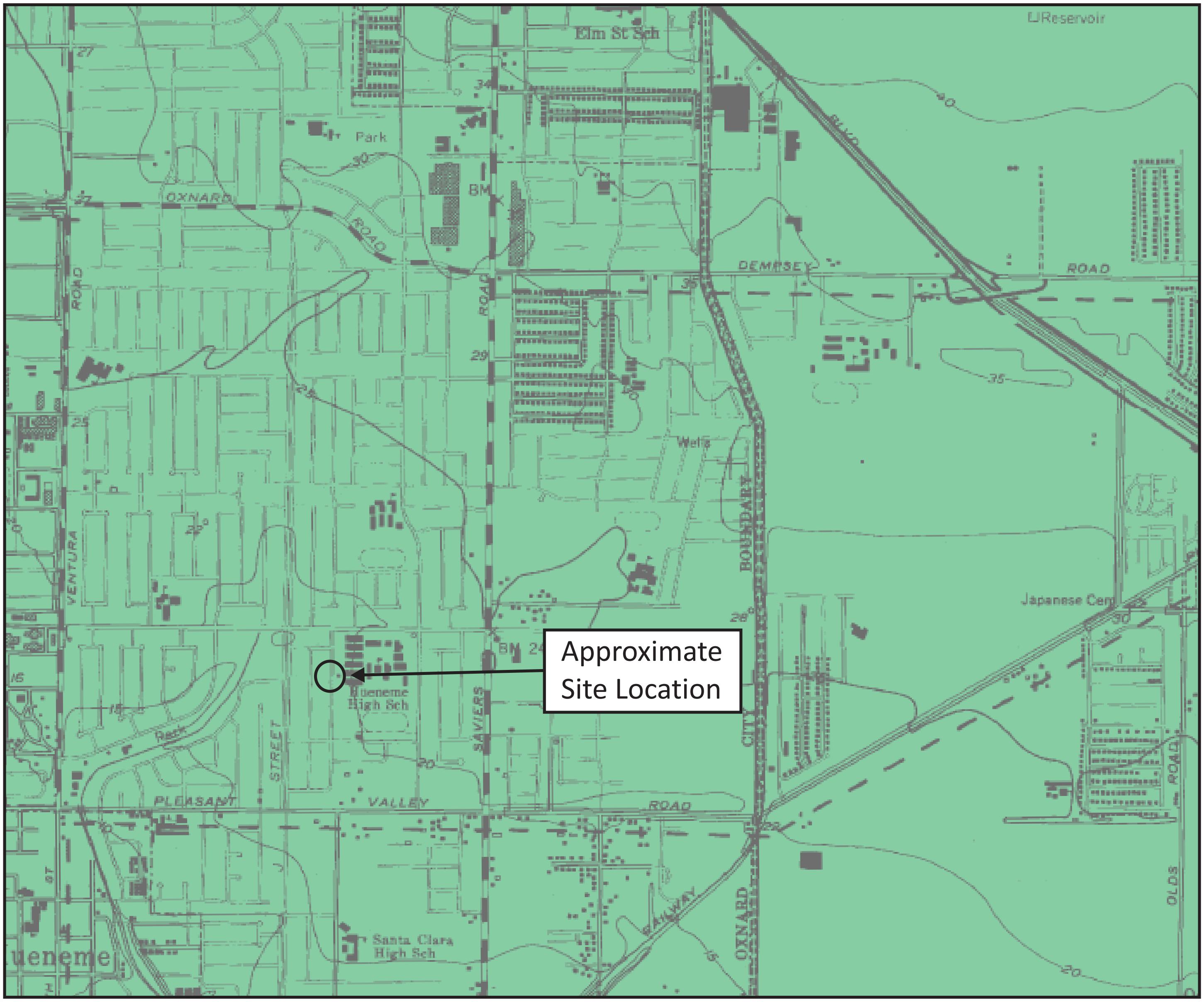
Qhw3: Holocene wash deposit

REGIONAL GEOLOGIC MAP

Hueneme High School Relocatables
Oxnard, California

Earth Systems

August 2021 | 303277-004



MAP EXPLANATION

Zones of Required Investigation:

Liquefaction

Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground-water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Within the Oxnard Quadrangle, no areas have been designated as "zones of required investigation for earthquake-induced landslides." However, the potential for landslides may exist locally, particularly along stream banks, margins of drainage channels, and similar settings where steep banks or slopes occur. Such occurrences are of limited lateral extent, or are too small and discontinuous to be depicted at 1:24,000 scale (the scale of Seismic Hazard Zone Maps). Within the liquefaction zones, some geologic settings may be susceptible to lateral-spreading (a condition wherein low-angle landsliding is associated with liquefaction). Also, landslide hazards can be created during excavation and grading unless appropriate techniques are used.

NOTE: Seismic Hazard Zones identified on this map may include developed land where delineated hazards have already been mitigated to city or county standards. Check with your local building/planning department for information regarding the location of such mitigated areas.

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

STATE OF CALIFORNIA

SEISMIC HAZARD ZONES

Delineated in compliance with Chapter 7.8, Division 2 of the California Public Resources Code (Seismic Hazards Mapping Act)

OXNARD QUADRANGLE

REVISED OFFICIAL MAP

Released: December 20, 2002

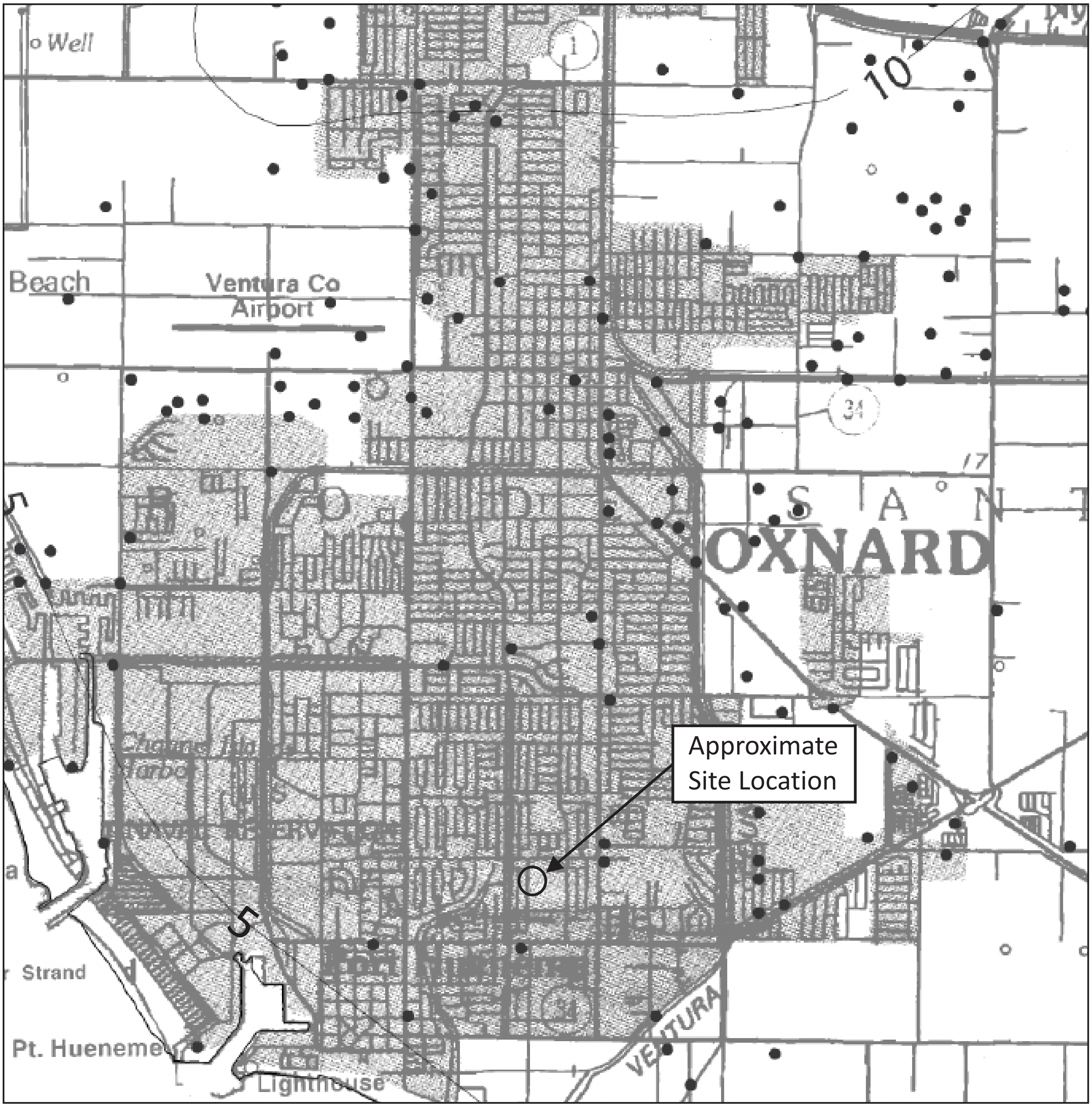
N

SEISMIC HAZARD ZONES MAP

Hueneme High School Relocatables
Oxnard, California

Earth Systems

August 2021	303277-004



*Taken from CGS, Seismic Hazard Zone Report For The Oxnard 7.5-Minute Quadrangle, Ventura County, California, 2003.

30 Depth to ground water in feet

• Borehole Site

Approximate Scale: 1" = 4,000'

0 4,000' 8,000'

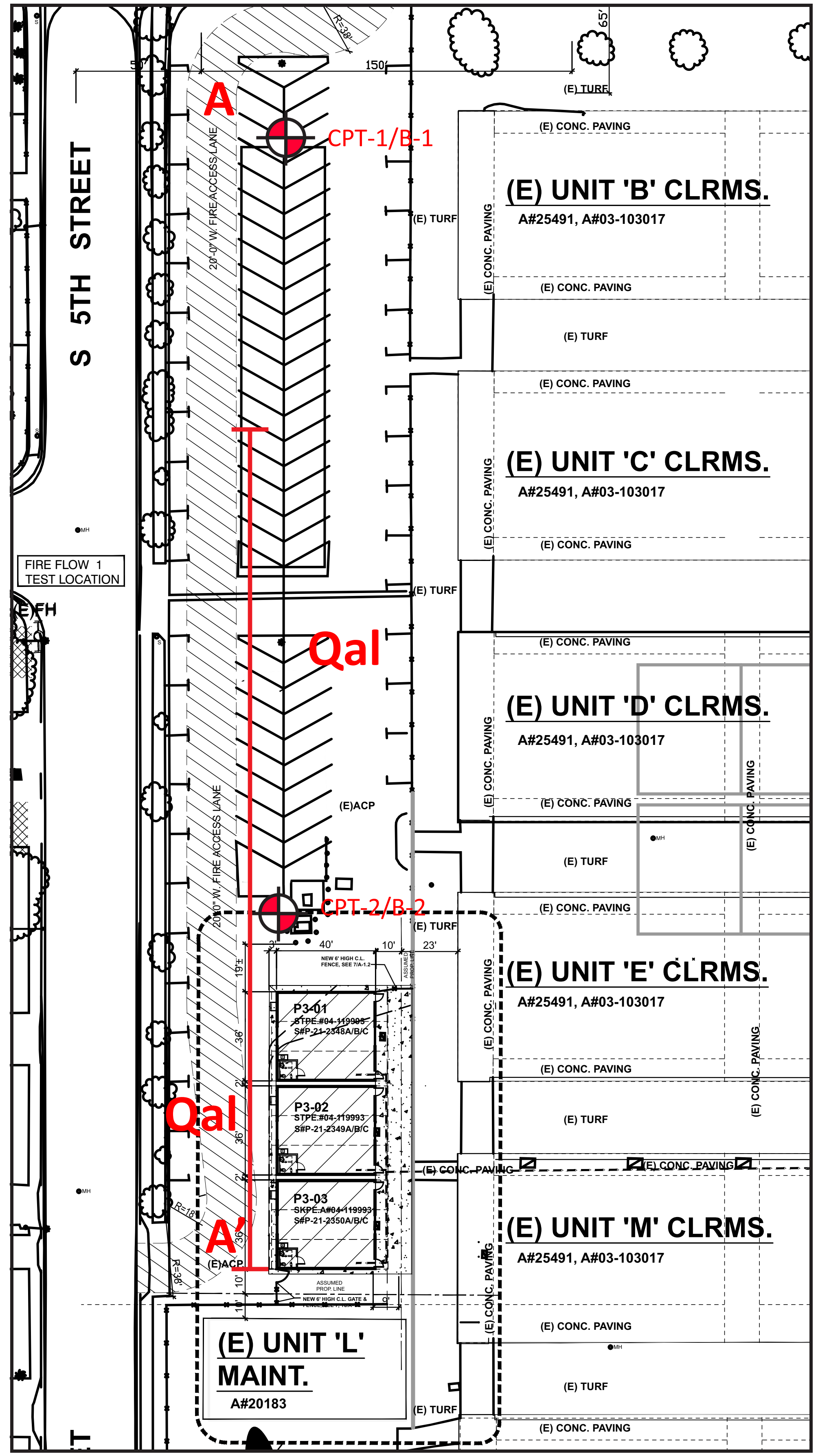
N

HISTORICAL HIGH GROUNDWATER MAP

Hueneme High School Relocatables
Oxnard, California

Earth Systems

August 2021	303277-004



Qal : Alluvium

CPT-2/B-2 : CPT and Boring Locations.

A — A' : Line of Cross-Section

Approximate Scale: 1" = 40'

0 40' 80'

*Taken from Overall Site Plan - DC Architects, Upland, California, 2021

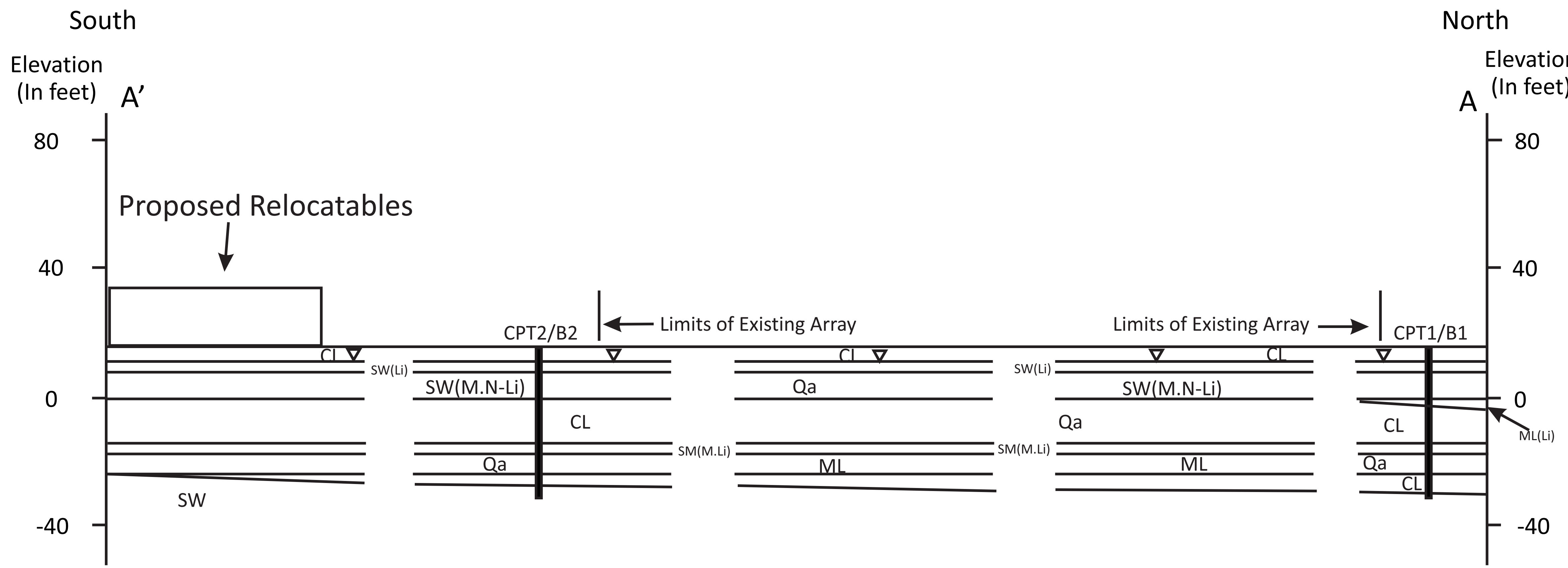
N

GEOLOGIC MAP

Hueneme High School Relocatables
Oxnard, California

Earth Systems

August 2021	303277-004



(Li) = Liquefiable Soil Horizon

(M.Li) = Most Lenses in Horizon Are Potentially Liquefiable

(M.N-Li) = Most Lenses in Soil Horizon Are Non- Liquefiable

▽ = Groundwater (Actual and Historic High)

Approximate Scale: 1" = 40'

0 40' 80'

N

GEOLOGIC CROSS-SECTION A-A'

Hueneme High School Relocatables
Oxnard, California

Earth Systems

August 2021	303277-004

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: 1
PROJECT NAME: Hueneme High School Solar Array
PROJECT NUMBER: VT-24513-01
BORING LOCATION: Per Plan

DRILLING DATE: May 10, 2012
DRILL RIG: Mobile B-61
DRILLING METHOD: 4" Mud Rotary
LOGGED BY: G. Olin

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0						GM			4" AC over gravelly silty sand; slightly moist; dense; yellow brown
			X	3/5/5		CL	87.0	34.1	**ALLUVIUM:** Silty sandy clay, moist, medium stiff, gray brown
5			X	3/4/7		CL	103.1	19.3	**ALLUVIUM:** Silty sandy clay, moist, medium stiff, gray brown
		X		4/4/6		SW			**ALLUVIUM:** Fine to medium sand; moist; dense; yellow brown
10		X		5/7/10		SW			**ALLUVIUM:** Fine to medium sand with trace clay; moist; dense; gray brown to dark gray
15		X		8/10/12		SW			**ALLUVIUM:** Fine to coarse sand; moist; dense; dark gray
		X		4/3/2		SW			**ALLUVIUM:** Fine to medium sand with some clay; moist; dense; dark gray
20									
		X		12/3/2		CL		29.7	**ALLUVIUM:** Sandy clay; moist; stiff; dark gray
25		X		2/2/3		CL		33.1	**ALLUVIUM:** Sandy clay; moist; stiff; mottled yellow brown and gray
30		X		4/3/3		SM			**ALLUVIUM:** Silty sand; moist; dense; mottled yellow brown and blue gray
35		X		14/15/20		SW			**ALLUVIUM:** Fine to medium sand; moist; dense; dark gray

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: 1 (Continued)
PROJECT NAME: Hueneme High School Solar Array
PROJECT NUMBER: VT-24513-01
BORING LOCATION: Per Plan

DRILLING DATE: May 10, 2012
DRILL RIG: Mobile B-61
DRILLING METHOD: 4" Mud Rotary
LOGGED BY: G. Olin

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
40		X		2/4/4		ML		37.2	**ALLUVIUM:** Sandy silt; moist; stiff; dark gray
45		X		2/2/3		ML			**ALLUVIUM:** Sandy silt; moist; stiff; dark gray
50		X		2/8/7		CL			**ALLUVIUM:** Silty sandy clay; moist; stiff to very stiff; dark gray
55									**TOTAL DEPTH: 51.5 Feet** **Groundwater Could Not Be Measured**
60									
65									
70									
75									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: 2
PROJECT NAME: Hueneme High School Solar Array
PROJECT NUMBER: VT-24513-01
BORING LOCATION: Per Plan

DRILLING DATE: May 10, 2012
DRILL RIG: Mobile B-61
DRILLING METHOD: 4" Mud Rotary
LOGGED BY: G. Olin

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0						GM			3" AC over gravelly silty sand; slightly moist; dense; yellow brown
	X		■	3/5/8		CL	91.7	31.4	**ALLUVIUM:** Sandy clay, moist, stiff, olive brown
5	X		■	4/5/7		SW	97.5	26.6	**ALLUVIUM:** Fine to medium sand; moist; dense; olive brown
		■		8/8/8		SW			**ALLUVIUM:** Fine to medium sand; moist; dense; dark gray
10		■		6/7/9		SC			**ALLUVIUM:** Clayey silty sand; moist; dense; dark gray
15		■		7/9/10		SW			**ALLUVIUM:** Fine to medium sand; moist; dense; dark gray
20		■		12/14/12		SW			**ALLUVIUM:** Medium to coarse silty sand with some coarse gravel; moist; dense; dark gray
25									**TOTAL DEPTH: 21.5 Feet** **Groundwater Was Encountered At 4.5 Feet**
30									
35									

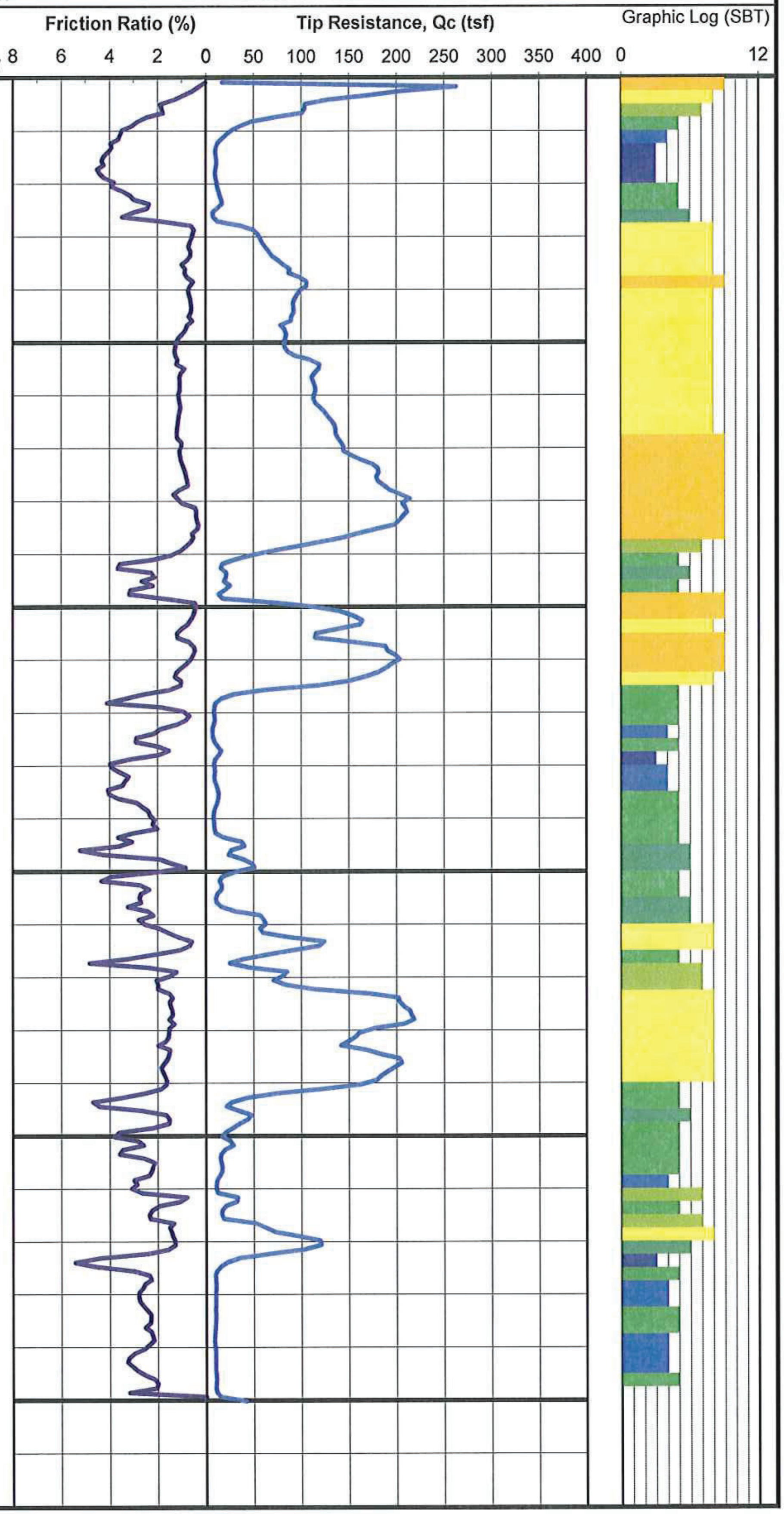
Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
Southern California

CPT No: CPT-1
Project Name: Hueneme High School Northwest Solar Array
Project No.: VT24513-01
Location: See Site Exploration Plan

CPT Vendor: **Kehoe Testing and Engineering**
Truck Mounted Electric
Cone with 30-ton reaction
Date: 5/3/2012

Interpreted Soil Stratigraphy Robertson & Campanella ('89)	Density/Consistency
Sand	dense
Sandy Silt to Clayey Silt	medium dense
Clay	stiff
Clay	stiff
Clayey Silt to Silty Clay	stiff
Silty Sand to Sandy Silt	medium dense
Sand to Silty Sand	medium dense
Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	dense
Sand to Silty Sand	dense
Sand to Silty Sand	dense
Sand	dense
Sand	dense
Sand	dense
Sand to Silty Sand	medium dense
Clayey Silt to Silty Clay	very stiff
Silty Sand to Sandy Silt	medium dense
Sand	medium dense
Sand	dense
Sand to Silty Sand	dense
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	firm
Clayey Silt to Silty Clay	stiff
Silty Clay to Clay	stiff
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	very stiff
Sandy Silt to Clayey Silt	loose
Clayey Silt to Silty Clay	stiff
Sandy Silt to Clayey Silt	medium dense
Sand to Silty Sand	medium dense
Sandy Silt to Clayey Silt	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	dense
Sand to Silty Sand	dense
Sand to Silty Sand	dense
Clayey Silt to Silty Clay	hard
Sandy Silt to Clayey Silt	very stiff
Clayey Silt to Silty Clay	very stiff
Clayey Silt to Silty Clay	stiff
Sandy Silt to Clayey Silt	very stiff
Sand to Silty Sand	medium dense
Clayey Silt to Silty Clay	hard
Silty Clay to Clay	firm
Clayey Silt to Silty Clay	firm
Silty Clay to Clay	firm
Silty Clay to Clay	firm



End of Sounding @ 50.2 feet

Earth Systems
Southern California

CONE PENETROMETER INTERPRETATION

(based on Robertson & Campanella, 1989)

Project: **Hueneme High School Northwest Solar Array** Project No: VT24513-01 Date: 05/03/12

CPT SOUNDING: CPT-1	Plot: 1	Density: 1	SPT N	Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest
Est. GWT (feet): **5.0**		Dr correlation: 0	Baldi	Qc/N: 0 Jefferies & Davies; Phi Correlation: 4 SPT N

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	2.6 Ic	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Est. % Fines	Rel. Dens. Dr (%)	Phi (deg.)	Nk: 17 Su (tsf)	OCR
0.15	0.5	212.90	0.59	Sand	SP	very dense	100	6.3	34	0.013	0.013	0.59	0.50	1.70	342.1	1.36	342.1	57	68	5	100	42		
0.30	1.0	112.03	1.67	Sand to Silty Sand	SP/SM	dense	100	5.3	21	0.038	0.038	1.67	0.57	1.70	180.0	1.89	211.6	36	42	25	100	38		
0.46	1.5	74.03	2.34	Silty Sand to Sandy Silt	SM/ML	medium dense	110	4.9	15	0.064	0.064	2.34	0.64	1.70	119.0	2.11	176.3	26	35	35	84	35		
0.61	2.0	28.57	3.36	Clayey Silt to Silty Clay	ML/CL	medium dense	120	4.1	7	0.093	0.093	3.37	0.76	1.70	45.9	2.51	130.5	12	26	70	45	31		
0.76	2.5	13.17	3.82	Silty Clay to Clay	CL	stiff	120	3.5	4	0.123	0.123	3.86	0.85	1.70	21.2	2.80		4		100			0.77	31.9
0.91	3.0	10.47	4.20	Clay	CL/CH	stiff	120	3.3	3	0.153	0.153	4.26	0.88	1.70	16.8	2.91		3		100			0.61	20.3
1.07	3.5	10.37	4.38	Clay	CL/CH	stiff	120	3.3	3	0.183	0.183	4.46	0.89	1.70	16.7	2.92		3		100			0.60	16.7
1.22	4.0	11.17	3.98	Clay	CL/CH	stiff	120	3.4	3	0.213	0.213	4.06	0.87	1.70	17.9	2.87		3		100			0.64	15.5
1.37	4.5	14.70	3.19	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.7	4	0.243	0.243	3.24	0.83	1.70	23.6	2.72		4		90			0.85	17.9
1.52	5.0	12.03	2.59	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.7	3	0.273	0.273	2.65	0.83	1.70	19.3	2.73		3		90			0.69	12.9
1.68	5.5	26.33	1.60	Sandy Silt to Clayey Silt	ML	medium dense	120	4.4	6	0.303	0.287	1.62	0.71	1.70	42.3	2.33	87.1	10	17	55	41	30		
1.83	6.0	56.93	0.59	Sand to Silty Sand	SP/SM	medium dense	120	5.5	10	0.333	0.301	0.59	0.55	1.70	91.5	1.81	101.7	18	20	20	73	33		
1.98	6.5	66.27	0.65	Sand to Silty Sand	SP/SM	medium dense	120	5.5	12	0.363	0.316	0.65	0.54	1.70	106.5	1.78	116.0	20	23	20	79	33		
2.13	7.0	81.90	0.86	Sand to Silty Sand	SP/SM	medium dense	120	5.5	15	0.393	0.330	0.87	0.54	1.70	131.6	1.78	143.6	25	29	20	88	35		
2.29	7.5	97.40	0.71	Sand to Silty Sand	SP/SM	medium dense	120	5.7	17	0.423	0.345	0.72	0.51	1.70	156.5	1.67	159.0	29	32	15	95	36		
2.44	8.0	100.07	0.68	Sand	SP	medium dense	120	5.8	17	0.453	0.359	0.69	0.50	1.70	160.8	1.65	161.0	29	32	15	97	36		
2.59	8.5	92.30	0.60	Sand to Silty Sand	SP/SM	medium dense	120	5.8	16	0.483	0.373	0.61	0.50	1.69	147.1	1.64	146.9	26	29	15	93	35		
2.74	9.0	90.57	0.61	Sand to Silty Sand	SP/SM	medium dense	120	5.7	16	0.513	0.388	0.62	0.51	1.66	142.4	1.66	143.8	25	29	15	91	35		
2.90	9.5	82.20	0.84	Sand to Silty Sand	SP/SM	medium dense	120	5.5	15	0.543	0.402	0.85	0.54	1.69	131.1	1.77	142.6	23	29	20	88	34		
3.05	10.0	83.13	1.20	Sand to Silty Sand	SP/SM	medium dense	120	5.3	16	0.573	0.417	1.21	0.57	1.70	133.6	1.87	155.4	24	31	25	89	34		
3.20	10.5	96.13	1.23	Sand to Silty Sand	SP/SM	medium dense	120	5.4	18	0.603	0.431	1.24	0.56	1.66	150.4	1.84	171.3	27	34	20	94	35		
3.35	11.0	117.63	1.03	Sand to Silty Sand	SP/SM	dense	120	5.6	21	0.633	0.445	1.03	0.53	1.58	175.9	1.74	187.1	32	37	15	100	36		
3.51	11.5	113.03	1.07	Sand to Silty Sand	SP/SM	dense	120	5.5	20	0.663	0.460	1.07	0.54	1.57	167.4	1.77	181.2	30	36	20	98	36		
3.66	12.0	114.30	1.10	Sand to Silty Sand	SP/SM	dense	120	5.5	21	0.693	0.474	1.11	0.54	1.54	166.9	1.78	181.8	30	36	20	98	36		
3.81	12.5	120.10	1.06	Sand to Silty Sand	SP/SM	dense	120	5.6	22	0.723	0.489	1.07	0.54	1.51	171.8	1.76	184.9	31	37	20	99	36		
3.96	13.0	131.67	1.13	Sand to Silty Sand	SP/SM	dense	120	5.6	24	0.753	0.503	1.14	0.54	1.49	185.3	1.75	199.1	33	40	20	100	37		
4.11	13.5	137.00	1.18	Sand to Silty Sand	SP/SM	dense	120	5.6	25	0.783	0.517	1.19	0.54	1.47	190.2	1.76	205.1	34	41	20	100	37		
4.27	14.0	143.77	1.02	Sand	SP	dense	120	5.7	25	0.813	0.532	1.03	0.52	1.43	194.5	1.71	202.8	35	41	15	100	37		
4.42	14.5	163.53	1.01	Sand	SP	dense	120	5.7	29	0.843	0.546	1.01	0.51	1.40	216.6	1.67	220.4	39	44	15	100	38		
4.57	15.0	180.47	0.84	Sand	SP	dense	120	5.9	31	0.873	0.561	0.84	0.50	1.37	234.4	1.59	234.4	41	47	10	100	39		
4.72	15.5	187.03	0.86	Sand	SP	dense	120	5.9	32	0.903	0.575	0.86	0.50	1.36	239.8	1.59	239.8	42	48	10	100	39		
4.88	16.0	209.05	0.98	Sand	SP	dense	120	5.9	36	0.933	0.589	0.98	0.50	1.34	264.8	1.60	264.8	46	53	10	100	40		
5.03	16.5	207.60	0.38	Sand	SP	dense	120	6.4	32	0.963	0.604	0.38	0.50	1.32	259.8	1.32	259.8	42	52	5	100	39		
5.18	17.0	179.23	0.40	Sand	SP	dense	120	6.3	29	0.993	0.618	0.40	0.50	1.31	221.6	1.39	221.6	36	44	5	100	38		
5.33	17.5	119.50	0.64	Sand	SP	medium dense	120	5.7	21	1.023	0.633	0.65	0.51	1.30	146.7	1.66	148.4	26	30	15	93	35		
5.49	18.0	49.40	1.54	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.7	10	1.053	0.647	1.58	0.66	1.39	64.8	2.18	105.2	13	21	40	59	31		
5.64	18.5	18.47	3.15	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.7	5	1.083	0.661	3.34	0.82	1.47	25.7	2.70		5		85			1.05	7.9
5.79	19.0	22.13	2.31	Sandy Silt to Clayey Silt	ML	loose	120	4.0	6	1.113	0.676	2.43	0.78	1.42	29.7	2.56	92.2	7	18	75	26	29		
5.94	19.5	17.20	2.65	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.7	5	1.143	0.690	2.84	0.82	1.42	23.1	2.69		5		85			0.97	7.0
6.10	20.0	111.77	0.44	Sand	SP	medium dense	120	5.8	19	1.173	0.705	0.44	0.50	1.23	129.5	1.61	129.5	23	26	10	88	34		
6.25	20.5	160.60	0.63	Sand	SP	dense	120	5.9	27	1.203	0.719	0.64	0.50	1.21	184.1	1.58	184.1	32	37	10	100	37		
6.40	21.0	123.30	1.11	Sand to Silty Sand	SP/SM	medium dense	120	5.4	23	1.233	0.733	1.12	0.56	1.23	143.0	1.83	161.2	27	32	20	92	35		
6.55	21.5	177.20	0.54	Sand	SP	dense	120	6.0	29	1.263	0.748	0.54	0.50	1.19	199.2	1.51	199.2	34	40	10	100	37		
6.71	22.0	199.60	0.63	Sand	SP	dense	120	6.0	33	1.293	0.762	0.64	0.50	1.18	222.3	1.52	222.3	38	44	10	100	38		
6.86	22.5	179.40	1.16	Sand	SP	dense	120	5.6	32	1.323	0.777	1.17	0.53	1.18	199.8	1.74	212.8	36	43	15	100	38		
7.01	23.0	109.90	1.18	Sand to Silty Sand	SP/SM	medium dense	120	5.3	21	1.353	0.791	1.19	0.58	1.18	122.9	1.89	145.4	23	29	25	85	34		
7.16	23.5	19.20	3.33	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.6	5	1.383	0.805	3.58	0.84	1.26	22.8	2.76		5		95			1.08	6.6
7.32	24.0	9.00	1.14	Clayey Silt to Silty Clay	ML/CL	firm	120	3.5	3	1.413	0.820	1.35	0.86	1.24	10.6	2.79		3		95			0.48	2.8
7.47	24.5	8.43	1.28	Clayey Silt to Silty Clay	ML/CL	firm	120	3.4	2	1.443	0.834	1.55	0.88	1.23	9.8	2.85		2		100			0.45	2.5
7.62	25.0	7.93	2.62	Silty Clay to Clay	CL	firm	120	3.0	3	1.473	0.849	3.22	0.93	1.23	9.2	3.04		3		100			0.42	2.3
7.77	25.5	14.27	1.82	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.6	4	1.503	0.863	2.04	0.83	1.19	16.0	2.73		4		90			0.79	4.4
7.92	26.0	9.40	3.67	Clay	CL/CH	stiff	120	3.0	3	1.533	0.877	4.39	0.94	1.19	10.6	3.07		3		100			0.50	2.7
8.08	26.5	9.83	3.38	Silty Clay to Clay	CL	stiff	120	3.0	3	1.563	0.892	4.02	0.93	1.17	10.9	3.04		3		100			0.53	2.8
8.23	27.0	13.17	3.90	Silty Clay to Clay	CL	stiff	120	3.2	4	1.593	0.906	4.44	0.91	1.15	14.3	2.97		4		100			0.72	3.8
8.38	27.5	10.47	2.62	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.2	3	1.623	0.921	3.10	0.91	1.13	11.2	2.96		3		100			0.56	2.9
8.53	28.0	8.50	2.20	Clayey Silt to Silty Clay	ML/CL	firm	120	3.1	3	1.653	0.935	2.73	0.92	1.12	9.0	3.01		3		100			0.45	2.2
8.69	28.5	12.37	2.89	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.3	4	1.683	0.949	3.35	0.90	1.10	12.9	2.93		4		100			0.67	3.4
8.84	29.0	34.93	3.96	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.8	9	1.713	0.964	4.17	0.81	1.08	35.6	2.66		9		80			2.00	10.3
8.99	29.5	36.87	2.53	Sandy Silt to Clayey Silt	ML	loose	120	4.1	9	1.743	0.978	2.66	0.76	1.06	37.0	2.51	105.1	9	21	70	36	30		
9.14	30.0	32.87	2.26	Sandy Silt to Clayey Silt	ML	loose	120	4.1	8	1.773	0.993	2.39	0.77	1.05	32.6	2.53	94.8	8	19	70	30	29		
9.30	30.5	15.87	3.13	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.4	5	1.803	1.007	3.53	0.88	1.04	15.7	2.88		5		100			0.87	4.2
9.45	31.0	11.37	2.70	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.2	4	1.833	1.021	3.22	0.91	1.03	11.1	2.98		4		100			0.61	2.8
9.60	31.5	34.73	2.60	Sandy Silt to Clayey Silt	ML	loose	120	4.0	9	1.863	1.036	2.74	0.78	1.02	33.4	2.56	102.6	9	21	70	31	29		
9.75	32.0	60.03	2.40	Sandy Silt to Clayey Silt	ML	medium dense	120	4.4	14	1.893	1.050	2.48	0.72	1.01	57.0	2.35	121.9	13	24	55	54	31		
9.91	32.5	90.13	1.09	Sand to Silty Sand	SP/SM	medium dense	120	5.1	18	1.923	1.065	1.11	0.61	1.00	84.9	1.99	109.7	17	22	30	70	32		
10.06	33.0	92.10	1.30	Sand to Silty Sand	SP/SM	medium dense	120	5.0	18	1.953	1.079	1.33	0.62	0.99	86.0	2.04	116.6	18	23	35	71	33		
10.21	33.5	36.60	3.50	Clayey Silt to Silty Clay	ML/CL	hard	120	3.8	10	1.983	1.093	3.70	0.80	0.97	33.7	2.64		10		80			2.09	9.5
10.36	34.0	78.60	1.59	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.8	16	2.013	1.108	1.63	0.66	0.97	72.1	2.16	112.9	16	23	40	63	32		
10.52	34.5	122.23	1.82	Silty Sand to Sandy Silt	SM/ML	medium dense	120	5.0	25	2.043	1.122	1.85	0.63	0.96	111.4	2.06	154.2	23	31	35	81	34		
10.67	35.0	204.50	1.44	Sand to Silty Sand	SP/SM	dense	120	5.4	38	2.073	1.137	1.45	0.56	0.96	185.7	1.83	209.9	35	42	20	100	37		
10.82	35.5	216.30	1.42	Sand to Silty Sand	SP/SM	dense	120	5.4	40	2.103	1.151	1.44	0.55	0.95	195.2	1.81	217.9	37	44	20	100	38		
10.97	36.0	182.70	1.45	Sand to Silty Sand	SP/SM	dense	120	5.3	34	2.133	1.165	1.47	0.57	0.95	163.4	1.87	190.0	32	38	25	97	36		
11.13	36.5	153.88	1.66	Sand to Silty Sand	SP/SM	medium dense	120	5.1	30	2.163	1.180	1.69	0.60	0.94	136.2	1.97	172.0	28	34	30	90	35		
11.28	37.0	197.27	1.60	Sand to Silty Sand	SP/SM	dense	120	5.3	37	2.193	1.194	1.62	0.57	0.93	173.9	1.88	204.4	34	41	25	100	37		
11.43	37.5	190.70	1.78	Sand to Silty Sand	SP/SM	dense	120	5.2	37	2.223	1.209	1.80	0.59	0.92	166.7	1.93	203.5	33	41	25	98	37		
11.58	38.0	154.17	1.71	Sand to Silty Sand	SP/SM	medium dense	120	5.1	30	2.253	1.223	1.73	0.60	0.92	133.5	1.98	170.8	27	34	30	89	35		

Earth Systems
Southern California

CONE PENETROMETER INTERPRETATION

(based on Robertson & Campanella, 1989)

Project: Hueneme High School Northwest Solar Array Project No: VT24513-01 Date: 05/03/12

CPT SOUNDING: CPT-1	Plot: 1	Density:	1	SPT N		Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest	
Est. GWT (feet): **5.0**		Dr correlation:	0	Baldi	Qc/N: 0	Jefferies & Davies	Phi Correlation: 4 SPT N

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	2.6 Ic	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Est. % Fines	Rel. Dens. Dr (%)	Phi (deg.)	Nk: Su (tsf)	17 OCR
11.73	38.5	48.90	3.57	Clayey Silt to Silty Clay	ML/CL	medium dense	120	3.9	12	2.283	1.237	3.75	0.79	0.88	40.9	2.58	131.7	11	26	75	40	30		
11.89	39.0	33.87	2.90	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.8	9	2.313	1.252	3.11	0.81	0.87	27.9	2.65		9		80			1.92	7.6
12.04	39.5	35.67	1.75	Sandy Silt to Clayey Silt	ML	loose	120	4.1	9	2.343	1.266	1.87	0.76	0.87	29.4	2.50	80.9	8	16	65	26	29		
12.19	40.0	20.83	3.41	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.4	6	2.373	1.281	3.85	0.88	0.85	16.6	2.88		6		100			1.15	4.3
12.34	40.5	21.23	3.21	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.4	6	2.403	1.295	3.62	0.87	0.84	16.8	2.86		6		100			1.17	4.4
12.50	41.0	15.73	2.30	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.3	5	2.433	1.309	2.71	0.89	0.83	12.3	2.90		5		100			0.85	3.0
12.65	41.5	14.10	2.53	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.2	4	2.463	1.324	3.06	0.91	0.82	10.9	2.97		4		100			0.75	2.6
12.80	42.0	11.10	2.87	Silty Clay to Clay	CL	stiff	120	2.9	4	2.493	1.338	3.69	0.96	0.80	8.4	3.11		4		100			0.57	1.9
12.95	42.5	28.60	1.27	Silty Sand to Sandy Silt	SM/ML	loose	120	4.1	7	2.523	1.353	1.39	0.77	0.83	22.4	2.52	64.4	6	13	70	15	29		
13.11	43.0	17.03	2.29	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.4	5	2.553	1.367	2.69	0.88	0.80	12.8	2.88		5		100			0.92	3.2
13.26	43.5	62.17	1.43	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.6	14	2.583	1.381	1.49	0.69	0.83	48.9	2.26	89.4	12	18	45	47	31		
13.41	44.0	112.03	1.32	Sand to Silty Sand	SP/SM	medium dense	120	5.0	22	2.613	1.396	1.35	0.62	0.84	89.2	2.03	120.0	19	24	30	72	33		
13.56	44.5	69.20	2.78	Sandy Silt to Clayey Silt	ML	medium dense	120	4.3	16	2.643	1.410	2.89	0.74	0.81	52.9	2.42	127.8	14	26	60	50	31		
13.72	45.0	15.97	4.35	Clay	CL/CH	stiff	120	2.9	5	2.673	1.425	5.22	0.95	0.75	11.4	3.10		5		100			0.86	2.8
13.87	45.5	9.67	2.38	Clayey Silt to Silty Clay	ML/CL	firm	120	2.8	3	2.703	1.439	3.30	0.97	0.74	6.8	3.16		3		100			0.48	1.5
14.02	46.0	9.77	2.73	Silty Clay to Clay	CL	firm	120	2.7	4	2.733	1.453	3.79	0.98	0.73	6.8	3.19		4		100			0.49	1.5
14.17	46.5	9.60	2.60	Silty Clay to Clay	CL	firm	120	2.7	3	2.763	1.468	3.65	0.98	0.72	6.6	3.20		3		100			0.48	1.4
14.33	47.0	9.45	2.36	Clayey Silt to Silty Clay	ML/CL	firm	120	2.8	3	2.793	1.482	3.35	0.98	0.72	6.4	3.18		3		100			0.47	1.3
14.48	47.5	8.57	2.22	Clayey Silt to Silty Clay	ML/CL	firm	120	2.7	3	2.823	1.497	3.31	1.00	0.71	5.7	3.22		3		100			0.42	1.2
14.63	48.0	8.97	2.63	Silty Clay to Clay	CL	firm	120	2.6	3	2.853	1.511	3.86	1.00	0.70	5.9	3.25		3		100			0.44	1.2
14.78	48.5	9.47	3.17	Silty Clay to Clay	CL	firm	120	2.6	4	2.883	1.525	4.56	1.00	0.69	6.2	3.27		4		100			0.47	1.3
14.94	49.0	9.90	2.50	Silty Clay to Clay	CL	firm	120	2.7	4	2.913	1.540	3.54	0.98	0.69	6.5	3.19		4		100			0.49	1.4
15.09	49.5	10.13	2.41	Clayey Silt to Silty Clay	ML/CL	stiff	120	2.8	4	2.943	1.554	3.40	0.98	0.69	6.6	3.18		4		100			0.50	1.4

Earth Systems
Southern California

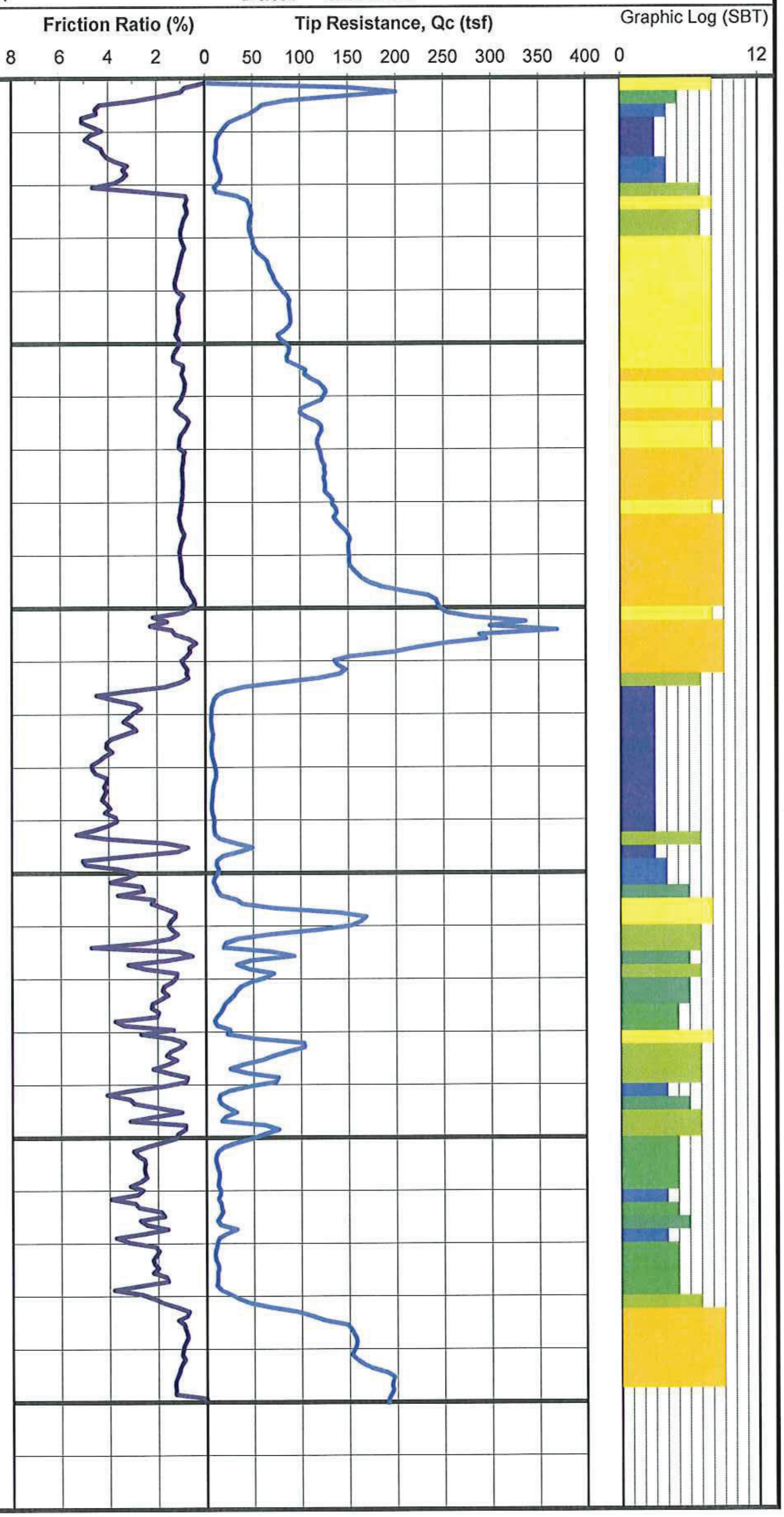
CPT No: CPT-2

Project Name: Hueneme High School Northwest Solar Array
Project No.: VT24513-01
Location: See Site Exploration Plan

CPT Vendor: **Kehoe Testing and Engineering**
Truck Mounted Electric
Cone with 30-ton reaction
Date: 5/3/2012

DEPTH (FEET)

Interpreted Soil Stratigraphy Robertson & Campanella ('89)	Density/Consistency
Silty Sand to Sandy Silt	dense
Clay	very stiff
Clay	stiff
Silty Clay to Clay	stiff
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand	dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand	dense
Sand	dense
Sand	dense
Sand	dense
Sand	dense
Sand to Silty Sand	very dense
Sand	dense
Sand to Silty Sand	medium dense
Clay	firm
Clay	firm
Clay	firm
Clay	firm
Clay	firm
Clayey Silt to Silty Clay	very stiff
Silty Clay to Clay	stiff
Clayey Silt to Silty Clay	very stiff
Sand to Silty Sand	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Sandy Silt to Clayey Silt	loose
Clayey Silt to Silty Clay	stiff
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Clayey Silt to Silty Clay	very stiff
Silty Sand to Sandy Silt	loose
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	stiff
Clayey Silt to Silty Clay	stiff
Sand to Silty Sand	medium dense
Sand	medium dense
Sand	medium dense



End of Sounding @ 50.2 feet

Earth Systems
Southern California

CONE PENETROMETER INTERPRETATION

(based on Robertson & Campanella, 1989)

Project: Hueneme High School Northwest Solar Array — Project No: VT24513-01 — Date: 05/03/12

CPT SOUNDING: CPT-2 — Plot: 1 — Density: 1 SPT N — Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest

Est. GWT (feet): **5.0** — Dr correlation: 0 Baldi — Qc/N: 0 Jefferies & Davies — Phi Correlation: 4 SPT N

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	2.6 Ic	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Est. % Fines	Rel. Dens. Dr (%)	Phi (deg.)	Nk: 17 Su (tsf)	OCR
0.15	0.5	163.60	1.23	Sand to Silty Sand	SP/SM	dense	100	5.7	29	0.013	0.013	1.23	0.51	1.70	262.9	1.68	269.2	49	54	15	100	40		
0.30	1.0	66.50	3.92	Clayey Silt to Silty Clay	ML/CL	medium dense	110	4.5	15	0.039	0.039	3.93	0.70	1.70	106.9	2.32	214.1	25	43	50	80	35		
0.46	1.5	35.97	4.90	Silty Clay to Clay	CL	medium dense	110	4.0	9	0.066	0.066	4.91	0.78	1.70	57.8	2.56	179.6	15	36	75	54	32		
0.61	2.0	17.87	4.56	Clay	CL/CH	very stiff	120	3.6	5	0.095	0.095	4.58	0.83	1.70	28.7	2.75		5		90			1.05	56.1
0.76	2.5	12.30	4.63	Clay	CL/CH	stiff	120	3.4	4	0.125	0.125	4.68	0.87	1.70	19.8	2.88		4		100			0.72	29.2
0.91	3.0	11.43	4.00	Clay	CL/CH	stiff	120	3.4	3	0.155	0.155	4.05	0.87	1.70	18.4	2.86		3		100			0.66	21.8
1.07	3.5	15.13	3.28	Silty Clay to Clay	CL	stiff	120	3.7	4	0.185	0.185	3.32	0.82	1.70	24.3	2.72		4		90			0.88	24.2
1.22	4.0	13.87	3.93	Silty Clay to Clay	CL	stiff	120	3.5	4	0.215	0.215	4.00	0.85	1.70	22.3	2.80		4		95			0.80	19.0
1.37	4.5	30.17	1.35	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.6	7	0.245	0.245	1.37	0.68	1.70	48.5	2.24	85.9	11	17	45	47	30		
1.52	5.0	48.10	0.77	Sand to Silty Sand	SP/SM	medium dense	120	5.2	9	0.275	0.275	0.77	0.59	1.70	77.3	1.93	94.3	16	19	25	66	32		
1.68	5.5	47.23	0.92	Silty Sand to Sandy Silt	SM/ML	medium dense	120	5.1	9	0.305	0.289	0.92	0.60	1.70	75.9	1.98	97.0	16	19	30	65	32		
1.83	6.0	49.90	0.96	Silty Sand to Sandy Silt	SM/ML	medium dense	120	5.1	10	0.335	0.304	0.97	0.60	1.70	80.2	1.98	101.9	17	20	30	68	32		
1.98	6.5	56.40	0.91	Sand to Silty Sand	SP/SM	medium dense	120	5.2	11	0.365	0.318	0.91	0.58	1.70	90.6	1.92	109.4	18	22	25	73	33		
2.13	7.0	67.03	1.05	Sand to Silty Sand	SP/SM	medium dense	120	5.3	13	0.395	0.333	1.06	0.58	1.70	107.7	1.90	128.3	22	26	25	80	34		
2.29	7.5	73.03	1.19	Sand to Silty Sand	SP/SM	medium dense	120	5.3	14	0.425	0.347	1.20	0.58	1.70	117.4	1.91	140.6	24	28	25	83	34		
2.44	8.0	82.70	1.08	Sand to Silty Sand	SP/SM	medium dense	120	5.4	15	0.455	0.361	1.08	0.56	1.70	132.9	1.84	151.1	26	30	20	89	35		
2.59	8.5	88.90	1.05	Sand to Silty Sand	SP/SM	medium dense	120	5.5	16	0.485	0.376	1.06	0.55	1.70	142.8	1.81	159.2	27	32	20	92	35		
2.74	9.0	90.17	1.08	Sand to Silty Sand	SP/SM	medium dense	120	5.4	17	0.515	0.390	1.09	0.55	1.70	144.9	1.81	161.8	27	32	20	92	35		
2.90	9.5	83.10	1.16	Sand to Silty Sand	SP/SM	medium dense	120	5.4	16	0.545	0.405	1.16	0.57	1.70	133.5	1.86	154.1	24	31	25	89	35		
3.05	10.0	84.60	1.07	Sand to Silty Sand	SP/SM	medium dense	120	5.4	16	0.575	0.419	1.08	0.56	1.68	134.2	1.84	152.2	24	30	20	89	34		
3.20	10.5	87.07	1.28	Sand to Silty Sand	SP/SM	medium dense	120	5.3	16	0.605	0.433	1.29	0.57	1.67	137.3	1.88	161.1	25	32	25	90	35		
3.35	11.0	102.33	0.92	Sand to Silty Sand	SP/SM	medium dense	120	5.6	18	0.635	0.448	0.93	0.53	1.58	153.1	1.75	164.0	27	33	20	94	35		
3.51	11.5	118.30	0.84	Sand	SP	dense	120	5.7	21	0.665	0.462	0.85	0.52	1.53	171.3	1.69	176.4	31	35	15	99	36		
3.66	12.0	124.83	0.92	Sand to Silty Sand	SP/SM	dense	120	5.7	22	0.695	0.477	0.93	0.52	1.51	178.6	1.70	185.4	32	37	15	100	37		
3.81	12.5	104.00	1.14	Sand to Silty Sand	SP/SM	medium dense	120	5.4	19	0.725	0.491	1.15	0.55	1.53	150.5	1.82	168.7	27	34	20	94	35		
3.96	13.0	116.07	0.73	Sand	SP	medium dense	120	5.7	20	0.755	0.505	0.73	0.51	1.46	159.8	1.67	162.4	28	32	15	96	36		
4.11	13.5	120.53	0.95	Sand to Silty Sand	SP/SM	medium dense	120	5.6	22	0.785	0.520	0.96	0.53	1.46	166.0	1.73	175.9	30	35	15	98	36		
4.27	14.0	119.70	0.99	Sand to Silty Sand	SP/SM	medium dense	120	5.6	21	0.815	0.534	1.00	0.54	1.44	163.1	1.75	175.0	29	35	20	97	36		
4.42	14.5	123.67	0.90	Sand	SP	medium dense	120	5.6	22	0.845	0.549	0.90	0.52	1.41	165.0	1.72	173.3	30	35	15	98	36		
4.57	15.0	125.57	0.93	Sand	SP	medium dense	120	5.6	22	0.875	0.563	0.94	0.53	1.40	165.6	1.73	175.0	30	35	15	98	36		
4.72	15.5	126.10	0.92	Sand	SP	medium dense	120	5.6	22	0.905	0.577	0.92	0.53	1.38	164.1	1.73	173.2	30	35	15	97	36		
4.88	16.0	133.98	0.96	Sand	SP	dense	120	5.6	24	0.935	0.592	0.97	0.53	1.36	172.0	1.73	181.5	31	36	15	99	36		
5.03	16.5	137.17	1.05	Sand to Silty Sand	SP/SM	dense	120	5.6	25	0.965	0.606	1.05	0.53	1.35	174.5	1.75	186.7	32	37	20	100	36		
5.18	17.0	146.77	0.93	Sand	SP	dense	120	5.7	26	0.995	0.621	0.93	0.52	1.32	182.9	1.70	189.2	33	38	15	100	37		
5.33	17.5	151.27	0.97	Sand	SP	dense	120	5.7	27	1.025	0.635	0.98	0.52	1.30	186.5	1.70	194.1	34	39	15	100	37		
5.49	18.0	151.10	1.03	Sand	SP	dense	120	5.6	27	1.055	0.649	1.04	0.53	1.29	184.7	1.73	194.8	33	39	15	100	37		
5.64	18.5	155.63	0.97	Sand	SP	dense	120	5.7	27	1.085	0.664	0.97	0.52	1.27	187.4	1.70	194.6	34	39	15	100	37		
5.79	19.0	174.17	0.89	Sand	SP	dense	120	5.8	30	1.115	0.678	0.89	0.50	1.25	205.8	1.65	205.9	37	41	15	100	38		
5.94	19.5	228.43	0.57	Sand	SP	dense	120	6.2	37	1.145	0.693	0.57	0.50	1.24	266.9	1.43	266.9	44	53	5	100	39		
6.10	20.0	248.57	0.68	Sand	SP	dense	120	6.1	41	1.175	0.707	0.68	0.50	1.22	287.4	1.46	287.4	48	57	5	100	40		
6.25	20.5	305.30	2.01	Sand to Silty Sand	SP/SM	very dense	120	5.5	55	1.205	0.721	2.01	0.54	1.23	355.2	1.78	388.0	65	78	20	100	43		
6.40	21.0	317.63	1.09	Sand	SP	very dense	120	5.9	53	1.235	0.736	1.10	0.50	1.20	360.0	1.56	360.0	62	72	10	100	43		
6.55	21.5	224.03	0.55	Sand	SP	dense	120	6.2	36	1.265	0.750	0.55	0.50	1.19	251.5	1.44	251.5	42	50	5	100	39		
6.71	22.0	142.30	0.88	Sand	SP	medium dense	120	5.6	25	1.295	0.765	0.88	0.53	1.19	159.5	1.72	167.9	29	34	15	96	36		
6.86	22.5	136.03	0.74	Sand	SP	medium dense	120	5.7	24	1.325	0.779	0.74	0.52	1.17	150.6	1.69	155.4	27	31	15	94	35		
7.01	23.0	47.30	1.98	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.5	11	1.355	0.793	2.04	0.70	1.22	54.7	2.31	108.6	12	22	50	52	31		
7.16	23.5	9.60	3.73	Clay	CL/CH	stiff	120	3.1	3	1.385	0.808	4.36	0.93	1.28	11.7	3.04		3		100			0.52	3.1
7.32	24.0	6.27	2.93	Clay	CL/CH	firm	120	2.8	2	1.415	0.822	3.79	0.97	1.28	7.6	3.15		2		100			0.32	1.8
7.47	24.5	6.37	3.10	Clay	CL/CH	firm	120	2.8	2	1.445	0.837	4.02	0.97	1.26	7.6	3.17		2		100			0.33	1.8
7.62	25.0	7.43	3.79	Clay	CL/CH	firm	120	2.8	3	1.475	0.851	4.72	0.97	1.23	8.7	3.16		3		100			0.39	2.1
7.77	25.5	6.60	4.04	Clay	CL/CH	firm	120	2.7	2	1.505	0.865	5.23	0.99	1.22	7.6	3.23		2		100			0.34	1.8
7.92	26.0	9.57	4.59	Clay	CL/CH	stiff	120	2.9	3	1.535	0.880	5.46	0.96	1.19	10.8	3.13		3		100			0.51	2.7
8.08	26.5	9.90	4.23	Clay	CL/CH	stiff	120	2.9	3	1.565	0.894	5.03	0.95	1.17	11.0	3.10		3		100			0.53	2.8
8.23	27.0	7.40	4.19	Clay	CL/CH	firm	120	2.7	3	1.595	0.909	5.34	0.99	1.16	8.1	3.22		3		100			0.38	1.9
8.38	27.5	6.80	4.07	Clay	CL/CH	firm	120	2.6	3	1.625	0.923	5.34	1.00	1.15	7.4	3.25		3		100			0.35	1.7
8.53	28.0	8.93	3.81	Clay	CL/CH	firm	120	2.9	3	1.655	0.937	4.67	0.96	1.12	9.5	3.13		3		100			0.47	2.3
8.69	28.5	11.33	4.69	Clay	CL/CH	stiff	120	2.9	4	1.685	0.952	5.51	0.95	1.11	11.8	3.10		4		100			0.61	3.0
8.84	29.0	38.63	1.18	Silty Sand to Sandy Silt	SM/ML	loose	120	4.5	9	1.715	0.966	1.23	0.70	1.07	38.9	2.29	74.8	9	15	50	38	30		
8.99	29.5	13.83	4.40	Clay	CL/CH	stiff	120	3.1	4	1.745	0.981	5.04	0.92	1.07	14.0	3.02		4		100			0.76	3.7
9.14	30.0	12.00	3.24	Silty Clay to Clay	CL	stiff	120	3.1	4	1.775	0.995	3.81	0.91	1.06	12.0	2.99		4		100			0.65	3.1
9.30	30.5	10.50	3.06	Silty Clay to Clay	CL	stiff	120	3.1	3	1.805	1.009	3.69	0.93	1.04	10.4	3.04		3		100			0.56	2.6
9.45	31.0	28.90	2.66	Sandy Silt to Clayey Silt	ML	very stiff	120	3.9	7	1.835	1.024	2.84	0.80	1.03	28.0	2.63		7		80			1.64	7.9
9.60	31.5	126.93	1.41	Sand to Silty Sand	SP/SM	medium dense	120	5.2	25	1.865	1.038	1.43	0.59	1.01	121.3	1.95	150.9	24	30	30	85	34		
9.75	32.0	144.37	1.46	Sand to Silty Sand	SP/SM	medium dense	120	5.2	28	1.895	1.053	1.48	0.59	1.00	136.9	1.93	166.1	27	33	25	90	35		
9.91	32.5	41.37	1.71	Silty Sand to Sandy Silt	SM/ML	loose	120	4.3	10	1.925	1.067	1.79	0.73	0.99	38.9	2.39	88.1	9	18	55	38	30		
10.06	33.0	60.03	2.14	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.4	14	1.955	1.081	2.21	0.71	0.98	55.9	2.33	113.9	13	23	50	53	31		
10.21	33.5	41.30	2.44	Sandy Silt to Clayey Silt	ML	loose	120	4.1	10	1.985	1.096	2.56	0.76	0.97	38.0	2.50	104.3	10	21	65	37	30		
10.36	34.0	60.37	1.27	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.7	13	2.015	1.110	1.31	0.67	0.97	55.3	2.19	90.1	12	18	40	52	31		
10.52	34.5	32.93	1.70	Sandy Silt to Clayey Silt	ML	loose	120	4.1	8	2.045	1.125	1.81	0.76	0.95	29.7	2.48	79.9	8	16	65	26	29		
10.67	35.0	20.97	2.11	Sandy Silt to Clayey Silt	ML	very stiff	120	3.7	6	2.075	1.139	2.34	0.83	0.94	18.6	2.71		6		90			1.17	5.0
10.82	35.5	11.87	2.57	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.1	4	2.105	1.153	3.13	0.92	0.92	10.4	2.99		4		100			0.63	2.5
10.97	36.0	19.73	2.48	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.5	6	2.135	1.168	2.78	0.85	0.92	17.1	2.79		6		95			1.09	4.5
11.13	36.5	86.03	1.20	Sand to Silty Sand	SP/SM	medium dense	120	5.0	17	2.165	1.182	1.23	0.63	0.93	75.8	2.06	105.2	16	21	35	65	32		
11.28	37.0	56.07	1.48	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.6	12	2.195	1.197	1.54	0.69	0.92	48.7	2.27	90.5	11	18	50	47	30		
11.43	37.5	48.50	1.49	Silty Sand to Sandy Silt	SM/ML	loose	120	4.4	11	2.225	1.211	1.56	0.71	0.91	41.7	2.33	85.1	10	17	55	40	30		
11.58	38.0	47.77	1.93	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.3	11	2.255	1.225	2.03	0.73	0.90	40.5	2.41	95.1	10	19	60	39	30		

Earth Systems
Southern California

CONE PENETROMETER INTERPRETATION

(based on Robertson & Campanella, 1989)

Project: Hueneme High School Northwest Solar Array Project No: VT24513-01 Date: 05/03/12

CPT SOUNDING: CPT-2 Plot: 1 Density: **1** SPT N Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest

Est. GWT (feet): **5.0** Dr correlation: **0** Baldi Qc/N: **0** Jefferies & Davies Phi Correlation: **4** SPT N

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	2.6 Ic	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Est. % Fines	Rel. Dens. Dr (%)	Phi (deg.)	Nk: 17 Su (tsf)	OCR
11.73	38.5	14.47	3.41	Silty Clay to Clay	CL	stiff	120	3.1	5	2.285	1.240	4.04	0.92	0.86	11.8	3.01		5		100			0.78	2.9
11.89	39.0	25.13	1.69	Sandy Silt to Clayey Silt	ML	very stiff	120	3.9	6	2.315	1.254	1.86	0.80	0.87	20.7	2.62		6		80			1.40	5.5
12.04	39.5	51.50	1.62	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.4	12	2.345	1.269	1.70	0.71	0.88	42.8	2.34	89.4	10	18	55	42	30		
12.19	40.0	47.67	1.43	Silty Sand to Sandy Silt	SM/ML	loose	120	4.4	11	2.375	1.283	1.50	0.71	0.87	39.3	2.34	81.7	10	16	55	38	30		
12.34	40.5	13.90	2.78	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.1	4	2.405	1.297	3.36	0.92	0.83	10.9	2.99		4		100			0.74	2.7
12.50	41.0	10.87	2.55	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.0	4	2.435	1.312	3.28	0.95	0.82	8.4	3.08		4		100			0.56	1.9
12.65	41.5	13.10	2.57	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.1	4	2.465	1.326	3.17	0.92	0.81	10.1	3.01		4		100			0.69	2.4
12.80	42.0	14.00	2.87	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.1	5	2.495	1.341	3.50	0.92	0.80	10.6	3.01		5		100			0.74	2.6
12.95	42.5	14.43	3.24	Silty Clay to Clay	CL	stiff	120	3.1	5	2.525	1.355	3.92	0.93	0.79	10.8	3.04		5		100			0.77	2.6
13.11	43.0	14.27	2.12	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.3	4	2.555	1.369	2.58	0.90	0.79	10.7	2.94		4		100			0.76	2.6
13.26	43.5	22.57	2.22	Sandy Silt to Clayey Silt	ML	very stiff	120	3.6	6	2.585	1.384	2.51	0.84	0.80	17.0	2.76		6		95			1.25	4.3
13.41	44.0	11.53	3.03	Silty Clay to Clay	CL	stiff	120	2.9	4	2.615	1.398	3.92	0.96	0.77	8.3	3.13		4		100			0.60	1.9
13.56	44.5	9.13	2.08	Clayey Silt to Silty Clay	ML/CL	firm	120	2.8	3	2.645	1.413	2.93	0.97	0.76	6.5	3.15		3		100			0.45	1.4
13.72	45.0	11.80	2.12	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.1	4	2.675	1.427	2.74	0.93	0.76	8.4	3.04		4		100			0.61	1.9
13.87	45.5	11.00	1.99	Clayey Silt to Silty Clay	ML/CL	stiff	120	3.0	4	2.705	1.441	2.64	0.94	0.75	7.8	3.06		4		100			0.56	1.7
14.02	46.0	24.57	2.89	Clayey Silt to Silty Clay	ML/CL	very stiff	120	3.5	7	2.735	1.456	3.25	0.86	0.76	17.6	2.82		7		100			1.36	4.5
14.17	46.5	69.10	1.25	Silty Sand to Sandy Silt	SM/ML	medium dense	120	4.7	15	2.765	1.470	1.30	0.67	0.80	52.4	2.20	87.4	12	17	45	50	31		
14.33	47.0	133.58	0.95	Sand	SP	medium dense	120	5.3	25	2.795	1.485	0.97	0.58	0.82	103.9	1.89	122.5	21	25	25	78	33		
14.48	47.5	156.07	0.83	Sand	SP	medium dense	120	5.5	28	2.825	1.499	0.84	0.55	0.83	121.8	1.80	134.6	23	27	20	85	34		
14.63	48.0	154.37	0.99	Sand	SP	medium dense	120	5.4	29	2.855	1.513	1.01	0.57	0.82	119.1	1.86	136.9	23	27	25	84	34		
14.78	48.5	164.87	1.01	Sand	SP	medium dense	120	5.4	31	2.885	1.528	1.03	0.56	0.81	126.8	1.84	144.1	25	29	20	87	35		
14.94	49.0	193.60	1.22	Sand	SP	medium dense	120	5.4	36	2.915	1.542	1.24	0.56	0.81	148.0	1.85	169.1	29	34	20	93	36		
15.09	49.5	194.47	1.29	Sand	SP	medium dense	120	5.3	36	2.945	1.557	1.31	0.57	0.80	147.5	1.87	171.0	29	34	25	93	36		

APPENDIX B

Site Class Determination Calculations
2019 CBC & ASCE 7-16 Seismic Parameters
USGS Design Maps Reports
Spectral Response Values Table
Fault Parameters

Earth Systems	
	Job Number: 303277-004
	Job Name: Hueneme HS Relocatables
	Calc Date: 8/9/2021
	CPT ID: CPT-2
	Total Depth of CPT= 100.00 ft
	Sublayer Thickness= 0.50 ft

Thickness of Cohesionless Soils =	31.50	ft
N_{ch}-bar Value =	16.5	*
Site Classification from N-bar =	Class D	
Thickness of Cohesive Soils =	18.50	ft
Su-bar Value =	1212	**
Site Classification from Su-bar =	Class D	

↓

Use the weaker Class if they are different.

*Equation 20.4-3 of ASCE 7-16

**Equation 20.4-4 of ASCE 7-16

Depth (ft)	SPT $N_{(60)}$	Sublayer Thick/$N_{(60)}$	Su (tsf)	Su (psf)	Sublayer Thick/Su	Ic
0.50	28.66	0.0174		N/A	N/A	1.68
1.00	14.90	0.0336		N/A	N/A	2.32
1.50	9.03	0.0554		N/A	N/A	2.56
2.00	4.95	0.1010	1.05	2091	0.0002	2.75
2.50	3.66	0.1366	0.72	1432	0.0003	2.88
3.00	3.37	0.1484	0.66	1327	0.0004	2.86
3.50	4.11	0.1217	0.88	1759	0.0003	2.72
4.00	3.93	0.1271	0.80	1606	0.0003	2.80
4.50	6.54	0.0764		N/A	N/A	2.24
5.00	9.22	0.0542		N/A	N/A	1.93
5.50	9.23	0.0542		N/A	N/A	1.98
6.00	9.73	0.0514		N/A	N/A	1.98
6.50	10.76	0.0465		N/A	N/A	1.92
7.00	12.71	0.0393		N/A	N/A	1.90
7.50	13.89	0.0360		N/A	N/A	1.91
8.00	15.33	0.0326		N/A	N/A	1.84
8.50	16.30	0.0307		N/A	N/A	1.81
9.00	16.55	0.0302		N/A	N/A	1.81
9.50	15.52	0.0322		N/A	N/A	1.86
10.00	15.66	0.0319		N/A	N/A	1.84
10.50	16.39	0.0305		N/A	N/A	1.88
11.00	18.36	0.0272		N/A	N/A	1.75
11.50	20.78	0.0241		N/A	N/A	1.69
12.00	22.03	0.0227		N/A	N/A	1.70
12.50	19.13	0.0261		N/A	N/A	1.82
13.00	20.25	0.0247		N/A	N/A	1.67
13.50	21.51	0.0232		N/A	N/A	1.73
14.00	21.50	0.0233		N/A	N/A	1.75
14.50	21.95	0.0228		N/A	N/A	1.72
15.00	22.36	0.0224		N/A	N/A	1.73
15.50	22.45	0.0223		N/A	N/A	1.73
16.00	23.84	0.0210		N/A	N/A	1.73
16.50	24.60	0.0203		N/A	N/A	1.75
17.00	25.84	0.0193		N/A	N/A	1.70
17.50	26.72	0.0187		N/A	N/A	1.70
18.00	26.88	0.0186		N/A	N/A	1.73
18.50	27.46	0.0182		N/A	N/A	1.70
19.00	30.16	0.0166		N/A	N/A	1.65
19.50	36.84	0.0136		N/A	N/A	1.43
20.00	40.50	0.0123		N/A	N/A	1.46
20.50	55.38	0.0090		N/A	N/A	1.78
21.00	53.39	0.0094		N/A	N/A	1.56
21.50	36.25	0.0138		N/A	N/A	1.44
22.00	25.29	0.0198		N/A	N/A	1.72
22.50	23.92	0.0209		N/A	N/A	1.69
23.00	10.57	0.0473		N/A	N/A	2.31
23.50	3.14	0.1590	0.52	1034	0.0005	3.04
24.00	2.22	0.2255	0.32	641	0.0008	3.15
24.50	2.28	0.2198	0.33	651	0.0008	3.17
25.00	2.64	0.1891	0.39	774	0.0006	3.16
25.50	2.47	0.2024	0.34	675	0.0007	3.23
26.00	3.32	0.1506	0.51	1022	0.0005	3.13
26.50	3.37	0.1484	0.53	1060	0.0005	3.10
27.00	2.74	0.1827	0.38	764	0.0007	3.22
27.50	2.58	0.1939	0.35	691	0.0007	3.25
28.00	3.10	0.1610	0.47	941	0.0005	3.13
28.50	3.86	0.1296	0.61	1221	0.0004	3.10
29.00	8.56	0.0584		N/A	N/A	2.29
29.50	4.47	0.1120	0.76	1512	0.0003	3.02
30.00	3.82	0.1309	0.65	1295	0.0004	2.99
30.50	3.43	0.1456	0.56	1117	0.0004	3.04

31.00	7.49	0.0668	1.64	3280	0.0002	2.63
31.50	24.53	0.0204		N/A	N/A	1.95
32.00	27.61	0.0181		N/A	N/A	1.93
32.50	9.57	0.0522		N/A	N/A	2.39
33.00	13.51	0.0370		N/A	N/A	2.33
33.50	10.04	0.0498		N/A	N/A	2.50
34.00	12.79	0.0391		N/A	N/A	2.19
34.50	7.96	0.0628		N/A	N/A	2.48
35.00	5.68	0.0880	1.17	2333	0.0002	2.71
35.50	3.78	0.1323	0.63	1260	0.0004	2.99
36.00	5.57	0.0898	1.09	2184	0.0002	2.79
36.50	17.33	0.0289		N/A	N/A	2.06
37.00	12.32	0.0406		N/A	N/A	2.27
37.50	10.92	0.0458		N/A	N/A	2.33
38.00	11.15	0.0449		N/A	N/A	2.41
38.50	4.67	0.1071	0.78	1556	0.0003	3.01
39.00	6.49	0.0771	1.40	2809	0.0002	2.62
39.50	11.67	0.0429		N/A	N/A	2.34
40.00	10.78	0.0464		N/A	N/A	2.34
40.50	4.43	0.1129	0.74	1483	0.0003	2.99
41.00	3.66	0.1365	0.56	1124	0.0004	3.08
41.50	4.21	0.1188	0.69	1385	0.0004	3.01
42.00	4.51	0.1108	0.74	1489	0.0003	3.01
42.50	4.72	0.1059	0.77	1539	0.0003	3.04
43.00	4.39	0.1140	0.76	1517	0.0003	2.94
43.50	6.29	0.0796	1.25	2492	0.0002	2.76
44.00	4.01	0.1247	0.60	1192	0.0004	3.13
44.50	3.21	0.1556	0.45	908	0.0006	3.15
45.00	3.86	0.1295	0.61	1220	0.0004	3.04
45.50	3.65	0.1371	0.56	1125	0.0004	3.06
46.00	7.05	0.0709	1.36	2719	0.0002	2.82
46.50	14.73	0.0339		N/A	N/A	2.20
47.00	25.21	0.0198		N/A	N/A	1.89
47.50	28.48	0.0176		N/A	N/A	1.80
48.00	28.77	0.0174		N/A	N/A	1.86
48.50	30.55	0.0164		N/A	N/A	1.84
49.00	35.98	0.0139		N/A	N/A	1.85
49.50	36.39	0.0137		N/A	N/A	1.87
100.00	25.00	0.0200		N/A	N/A	1.87

Table F-5 - General Procedure Seismic Design Values

2019 California Building Code (CBC) (ASCE 7-16) Seismic Design Parameters

(Values presented should only be used by a Structural Engineer to determine if the exception in 11.4.8 (ASCE 7-16) can be used)

			CBC Reference	ASCE 7-16 Reference
Seismic Design Category		**D**	Table 1613.5.6	Table 11.6-1
Site Class		**D**	Table 1613.5.2	Table 20.3-1
Latitude:		34.160		
Longitude:		-119.184		
Maximum Considered Earthquake (MCE) Ground Motion				
Short Period Spectral Reponse	S_S	**1.603 g**	Figure 1613.5	Figure 22-1
1 second Spectral Response	S_1	**0.587 g**	Figure 1613.5	Figure 22-2
Site Coefficient	F_a	1.00	Table 1613.5.3(1)	Table 11.4-1
Site Coefficient	F_v	1.71	Table 1613.5.3(2)	Table 11-4.2
	S_{MS}	1.603 g	$= F_a*S_S$	
	S_{M1}	1.006 g	$= F_v*S_1$	
Design Earthquake Ground Motion				
Short Period Spectral Reponse	S_{DS}	**1.069 g**	$= 2/3*S_{MS}$	
1 second Spectral Response	S_{D1}	**0.670 g**	$= 2/3*S_{M1}$	

Site Specific Evaluation May Be Required Due to Site Class = D or E and S1>=0.2. The Presented SDS and SD1 are NOT Valid Unless the Exception of ASCE7-16, Section 11.4.8 Applies

To	0.13 sec	$= 0.2*S_{D1}/S_{DS}$
Ts (11.4.8 ASCE 7-16 Exception Assumed)	0.63 sec	$= S_{D1}/S_{DS}$
Risk Category	III	Table 1604.5
Seismic Importance Factor	1.25	
F_{PGA}	1.10	
PGA_M	**0.76**	
Vertical Coefficient (C_V)	1.42	Table 11.9-1

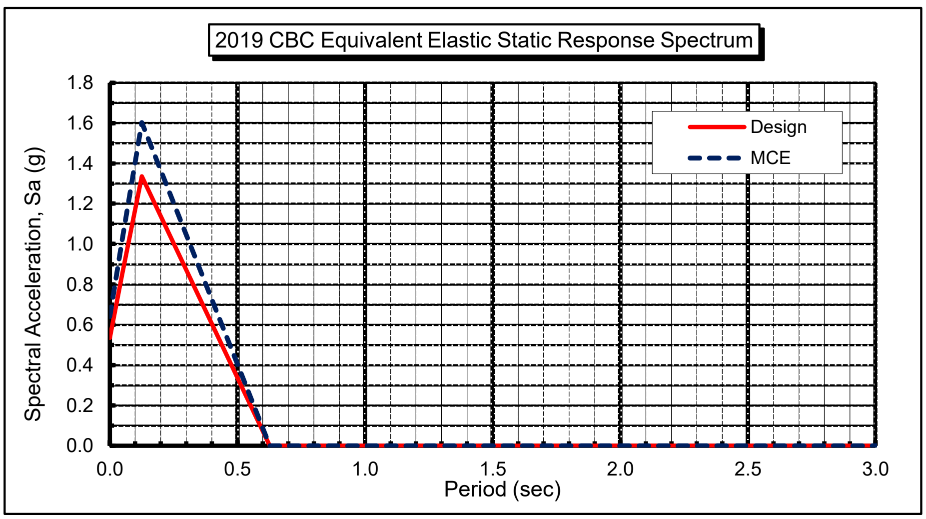
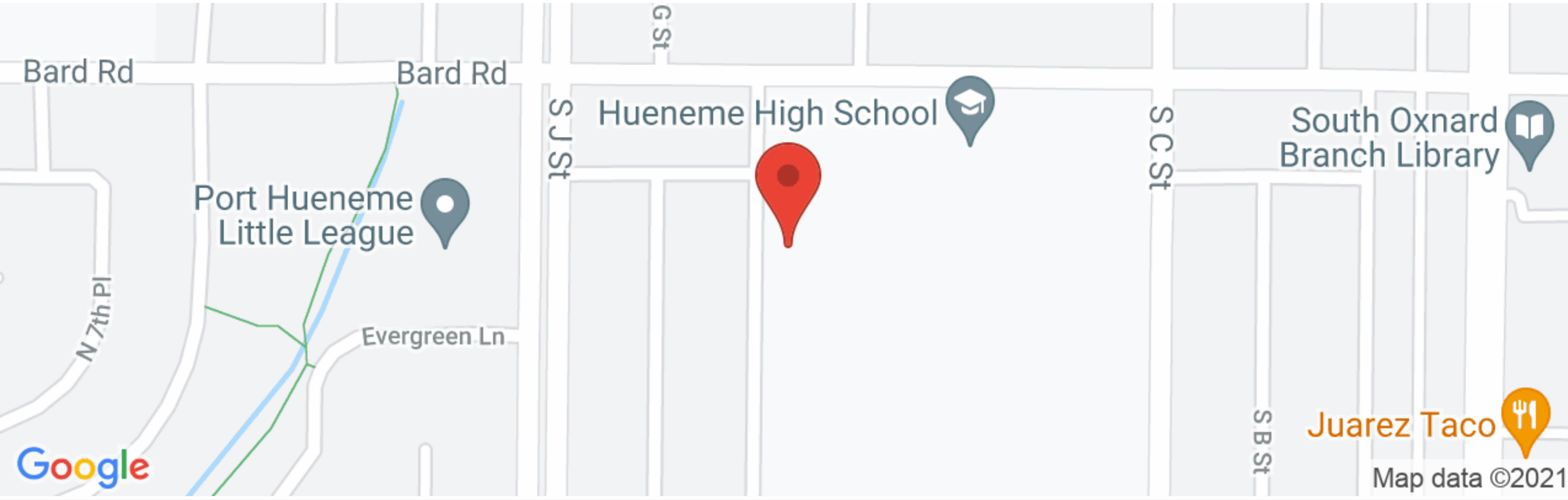


Table 11.5-1 Period T (sec)	Design Sa (g)
0.00	0.534
0.05	0.854
0.13	1.336
0.63	0.000
0.80	0.000
1.00	0.000
1.20	0.000
1.40	0.000
1.60	0.000
1.80	0.000
2.00	0.000
2.20	0.000
2.40	0.000
2.60	0.000
2.80	0.000
3.00	0.000

Hueneme HS Relocatable Classroom Buildings

Latitude, Longitude: 34.1598, -119.1838



Date	8/9/2021, 9:45:39 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.603	MCE_R ground motion. (for 0.2 second period)
S_1	0.587	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.603	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.069	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.694	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.764	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.603	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.796	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.13	Factored deterministic acceleration value. (0.2 second)
S1RT	0.587	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.661	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.643	Factored deterministic acceleration value. (1.0 second)
PGAd	0.844	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.893	Mapped value of the risk coefficient at short periods
C_{R1}	0.889	Mapped value of the risk coefficient at a period of 1 s

34.1598 -119.1838 Lat/Long

Site Specific Spectral Response Values
Probabilistic and Deterministic Response Spectra for MCE compared to Code Spectra
for 5% Viscous Damping Ratio

Natural Period T (seconds)	GeoMean Probab. 2% in 50 year MCE Spectrum (1) 2475-year (ASCE 21.2.1)	Max Rotated Probab. 2% in 50 year MCEr Spectrum (2) 2475-year (ASCE 21.2.1.1)	Max 84th Percentile Determ. MCE Spectrum (3) (ASCE 21.2.2)	Determ. Lower Limit MCE Spectrum (4) (3) * 1.00=Scaling (ASCE 21.2.2)	Determ. MCE Spectrum (5) Max (3),(4) (ASCE 21.2.2)	Site Specific MCE, Ground Response (SaM) (6) Min (2),(5) (ASCE 21.2.3)	Site Specific MCE Spectrum Comparator (6b) Max (6),1.5*(8) (ASCE 21.2.3)	2019 CBC MCE Spectrum (7)	Site Specific Design Spectrum (Sa) (8) (ASCE 21.3)	2019 CBC Design Spectrum (9) 2/3*(7)
0.00	0.746	0.733	0.804	0.804	0.804	0.733	0.733	0.641	0.489	0.428
0.05	0.992	0.974	0.874	0.874	0.874	0.874	0.874	0.904	0.583	0.603
0.10	1.237	1.215	1.214	1.214	1.214	1.214	1.214	1.167	0.810	0.778
0.15	1.455	1.429	1.512	1.512	1.512	1.429	1.429	1.429	0.953	0.953
0.20	1.672	1.642	1.726	1.726	1.726	1.642	1.642	1.603	1.095	1.069
0.30	1.905	1.913	1.951	1.951	1.951	1.913	1.913	1.603	1.275	1.069
0.40	1.877	1.883	1.983	1.983	1.983	1.883	1.883	1.603	1.255	1.069
0.50	1.848	1.936	1.922	1.922	1.922	1.922	1.922	1.603	1.282	1.069
0.75	1.548	1.619	1.600	1.600	1.600	1.600	1.600	1.603	1.067	1.069
1.00	1.247	1.442	1.391	1.391	1.391	1.391	1.391	0.000	0.928	0.000
1.50	0.956	1.105	1.034	1.034	1.034	1.034	1.034	0.000	0.689	0.000
2.00	0.666	0.799	0.807	0.807	0.807	0.799	0.799	0.000	0.533	0.000
3.00	0.415	0.516	0.535	0.535	0.535	0.516	0.516	0.000	0.344	0.000
4.00	0.281	0.362	0.379	0.379	0.379	0.362	0.362	0.000	0.242	0.000
5.00	0.206	0.275	0.270	0.270	0.270	0.270	0.270	0.000	0.180	0.000
8.00	0.138	0.185	0.154	0.154	0.154	0.154	0.154	0.000	0.102	0.000
10.00	0.131	0.175	0.076	0.076	0.076	0.076	0.117	0.000	0.078	0.000

C_{RS}:	0.893	
C_{R1}:	0.889	
Site Specific To:	0.185	$= 0.2*S_{D1}/S_{DS}$
Site Specific Ts:	0.923	$= S_{D1}/S_{DS}$

The value of Fa used in Column (3) is defined within ASCE 21.2.2 Supplement 1. This Fa value only applies within Column (3).

Site Coefficients	
F_{PGA}	1.10
F_a	1.00
F_v	2.50

Probabilistic spectrum from 2014 USGS Ground Motion Mapping Program adjusted for site conditions and scaled to represent maximum response in a horizontal plane, in accordance with ASCE 7-16 Section 21.2

Mapped MCE Acceleration Values		
PGA	0.694	g
S_S	1.603	g
S_1	0.587	g

Risk Coefficients have been applied to Column (2); If Method 1 was utilized the Risk Coefficients, CRS and CR1 are presented above, if Method 2 was utilized the Risk Coefficients were obtained from the USGS Risk Targeted Ground Motion Calculator (https://earthquake.usgs.gov/designmaps/rtgm).

Site Class	**D**
Risk Category	**III**

Reference: ASCE 7-16, Chapters 21.2, 21.3, 21.4, 21.5, 11.4, and 11.8

Calculation Utilized ASCE7-16, Section 21.2.1.1 - Method 1

Short-Period Seismic Design Category:	**1-Second Period Seismic Design Category:**
D	D

Site-Specific Design Acceleration Values		
PGA_M	**0.746**	**g**
S_{DS}	**1.153**	**g**
S_{D1}	**1.065**	**g**

Vertical Coefficient (C_V)
1.42

Site-Specific MCE_R, 5% damped, Spectral Response Acceleration Parameter		
S_{MS}	**1.730**	**g**
S_{M1}	**1.598**	**g**

1 g = 980.6 cm/sec^2 =32.2 ft/sec^2

PSV (ft/sec) = 32.2(S_a)T/(2p)

Key: Probab. = Probabilistic, Determ. = Deterministic, MCE = Maximum Considered Earthquake

Table F-2
Fault Parameters

Fault Section Name	**Distance** (miles)	(km)	Upper Seis. Depth (km)	Lower Seis. Depth (km)	Avg Dip Angle (deg.)	Avg Dip Direction (deg.)	Avg Rake (deg.)	Trace Length (km)	Fault Type	**Mean Mag**	Mean Return Interval (years)	Slip Rate (mm/yr)
Simi-Santa Rosa FM3.1, 3.2	6.2	10.0	1.0	12.1	60	346	30	39	B	**6.8**		1
Malibu Coast (Extension), alt 1, FM3.1	6.4	10.3	0.0	7.8	74	4	30	35	B'	**6.5**		
Malibu Coast (Extension), alt 2 FM3.2	6.4	10.3	0.0	16.6	74	4	30	35	B'	**6.9**		
Oak Ridge (Onshore) FM3.1, 3.2	7.1	11.5	1.0	19.4	65	159	90	50	B	**7.4**		4
Oak Ridge (Offshore) FM3.2	8.1	13.1	0.0	7.9	32	180	90	38	B	**6.9**		3
Ventura-Pitas Point FM3.1, 3.2	8.6	13.8	1.0	15.0	64	353	60	59	B	**6.9**		1
Channel Islands Thrust FM3.1, 3.2	10.3	16.6	5.0	12.3	20	354	90	59	B	**7.3**		1.5
Anacapa-Dume, alt 1, FM3.1	13.0	20.9	0.0	15.5	45	354	60	51	B	**7.2**		3
Anacapa-Dume, alt 2, FM3.2	13.0	20.9	1.2	11.4	41	352	60	65	B	**7.2**		3
Santa Cruz Island FM3.1, 3.2	13.0	20.9	0.0	13.3	90	188	30	69	B	**7.1**		1
Red Mountain FM3.1, 3.2	14.1	22.7	0.0	14.1	56	2	90	101	B	**7.4**		2
Channel Islands Western Deep Ramp FM3.1, 3.2	14.2	22.9	4.8	12.5	21	204	90	62	B'	**7.3**		
Malibu Coast, alt 1, FM3.1	16.3	26.3	0.0	7.8	75	3	30	38	B	**6.6**		0.3
Malibu Coast, alt 2 FM3.2	16.3	26.3	0.0	16.6	74	3	30	38	B	**6.9**		0.3
Pitas Point (Lower)-Montalvo, FM3.1	16.8	27.0	0.4	12.7	16	359	90	30	B	**7.3**		2.5
Sisar FM3.1, 3.2	17.4	27.9	0.0	17.4	29	168	na	20	B'	**7.0**		
North Channel FM3.2	17.6	28.3	1.1	4.5	26	10	90	51	B	**6.7**		1
San Cayetano FM3.1, 3.2	19.4	31.2	0.0	16.0	42	3	90	42	B	**7.2**		6
Mission Ridge-Arroyo Parida-Santa Ana FM3.1, 3	19.6	31.5	0.0	7.6	70	176	90	69	B	**6.8**		0.4
Santa Cruz Catalina Ridge alt 1, FM3.1	20.9	33.7	0.0	11.0	90	na	na	114	B'	**7.2**		
Santa Cruz Catalina Ridge Alt2 FM3.2	20.9	33.7	0.0	11.0	90	38	na	137	B'	**7.3**		
Pitas Point (Upper) FM3.2	24.9	40.1	1.4	10.0	42	15	90	35	B	**6.8**		1
Santa Monica Bay FM3.1, 3.2	25.0	40.2	2.3	18.0	20	44	na	17	B'	**7.0**		
Santa Ynez (East) FM3.1, 3.2	25.2	40.5	0.0	13.3	70	172	0	68	B	**7.2**		2
San Pedro Basin FM3.1, 3.2	26.8	43.1	0.8	12.3	88	51	na	69	B'	**7.0**		
Santa Susana, alt 1, FM3.1	27.5	44.2	0.0	16.3	55	9	90	27	B	**6.8**		5
Santa Susana, alt 2 FM3.2	27.7	44.6	0.0	10.6	53	10	90	43	B'	**6.8**		
Oak Ridge (Offshore), west extension FM3.2	28.9	46.4	0.0	3.1	67	195	na	28	B'	**6.1**		
Pine Mtn FM3.1, 3.2	29.0	46.6	0.0	16.3	45	5	na	62	B'	**7.3**		
Northridge Hills FM3.1, 3.2	29.0	46.6	0.0	14.9	31	19	90	25	B'	**7.0**		
Del Valle FM3.1, 3.2	30.8	49.6	0.0	18.8	73	195	90	9	B'	**6.3**		
Holser, alt 1, FM 3.1	31.2	50.2	0.0	18.6	58	187	90	20	B	**6.7**		0.4
Holser, alt 2 FM3.2	31.2	50.2	0.0	18.5	58	182	90	17	B'	**6.7**		
Northridge FM3.1, 3.2	32.3	51.9	7.4	16.8	35	201	90	33	B	**6.8**		1.5
Compton FM3.1, 3.2	33.8	54.3	5.2	15.6	20	34	90	65	B'	**7.5**		
Pitas Point (Lower, West), FM 3.1	34.2	55.0	1.5	8.8	13	3	90	35	B	**7.2**		2.5
San Pedro Escarpment FM3.1, 3.2	34.3	55.2	1.0	16.0	17	38	na	27	B'	**7.3**		
Santa Ynez (West) FM3.1, 3.2	34.8	56.0	0.0	9.2	70	182	0	80	B	**6.9**		2
Big Pine (Central) FM3.1, 3.2	36.5	58.7	0.0	6.6	76	167	na	23	B'	**6.3**		
Mission Hills FM3.1, 3.2	36.6	59.0	0.0	14.5	55	na	na	13	B'	**6.5**		

Reference: USGS OFR 2013-1165 (CGS SP 228)

Based on Site Coordinates of 34.1598 Latitude, -119.1838 Longitude

Mean Magnitude for Type A Faults based on 0.1 weight for unsegmented section, 0.9 weight for segmented model (weighted by probability of each scenario with section listed as given on Table 3 of Appendix G in OFR 2008-1437). Mean magntude is average of Ellworths-B and Hanks & Bakun moment area relationship.

APPENDIX C

Applicable Laboratory Data from 2012 Study

TABULATED LABORATORY TEST RESULTS

BORING AND DEPTH	B-2 @ 1-5'
USCS	CL
MAXIMUM DENSITY (pcf)	116.5
OPTIMUM MOISTURE (%)	13.5
COHESION (psf)	510* 120**
ANGLE OF INTERNAL FRICTION	25°* 29°**
EXPANSION INDEX	112
pH	7.1
SOLUBLE CHLORIDES (mg/Kg)	14
RESISTIVITY (OHMs-cm)	630
SOLUBLE SULFATES (mg/Kg)	2,600

BORING AND DEPTH	B-1 @ 23'	B-1 @ 26'	B-1 @ 40'
USCS	CL	CL	ML
IN-PLACE MOISTURE (%)	29.7	33.1	37.2
LIQUID LIMIT	32	33	35
PLASTIC LIMIT	20	21	27
PLASTICITY INDEX	12	12	8
GRAIN SIZE DISTRIBUTION (%)			
GRAVEL	0.0	0.0	0.0
SAND	23.9	20.1	12.1
SILT	49.6	54.4	61.4
CLAY (2ųm to 5ųm)	5.3	6.8	8.3
CLAY (≤2ųm)	21.2	18.7	18.2

* = Peak Strength Parameters

** = Ultimate Strength Parameters

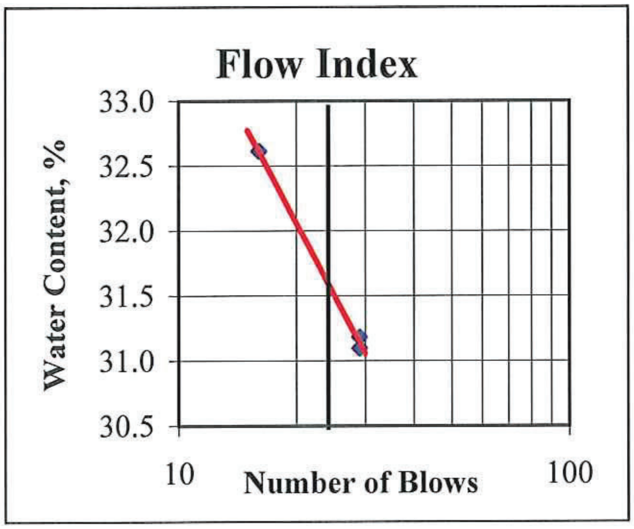
File No.: VT-24513-01 May 21, 2012

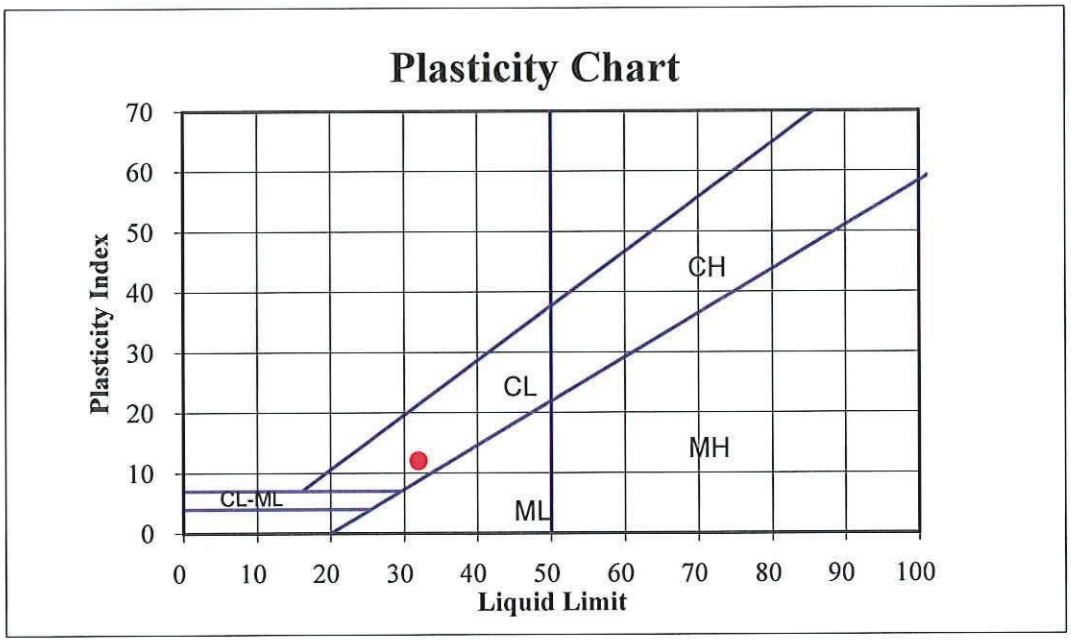
PLASTICITY INDEX

ASTM D-4318

Job Name: Hueneme High School Solar (Northwest)
Sample ID: B 1 @ 23'
Soil Description: CL/ML

DATA SUMMARY				TEST RESULTS	
Number of Blows:	16	29	29	LIQUID LIMIT	32
Water Content, %	32.6	31.2	31.1	PLASTIC LIMIT	20
Plastic Limit:	20.4	20.3		PLASTICITY INDEX	12





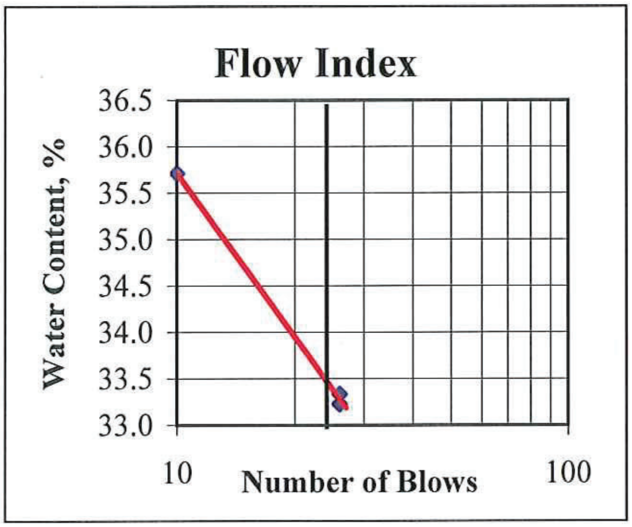
File No.: VT-24513-01 May 21, 2012

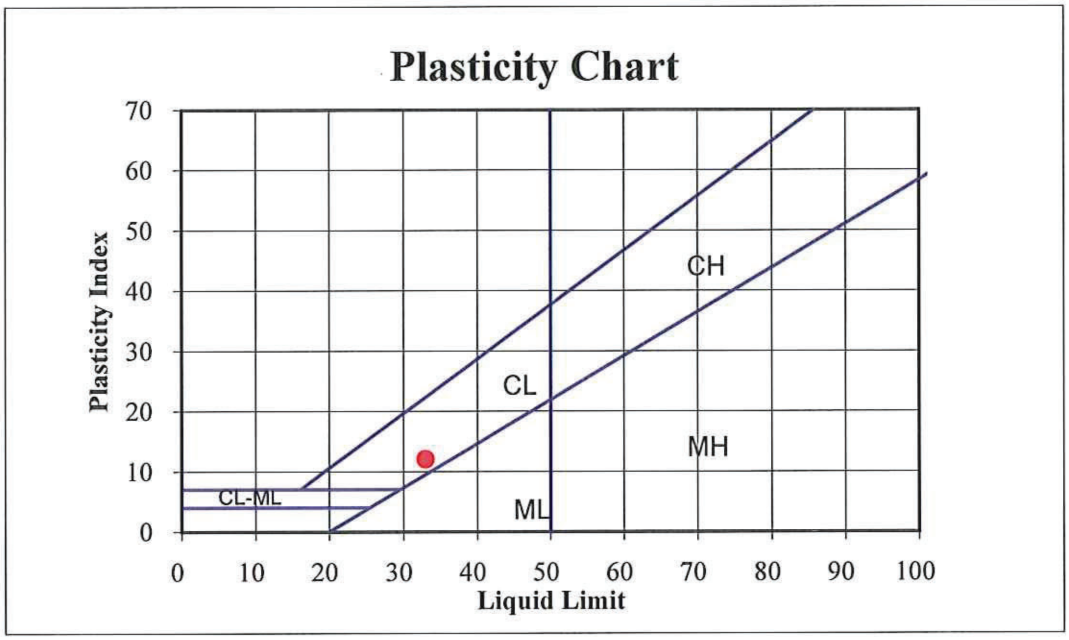
PLASTICITY INDEX

ASTM D-4318

Job Name: Hueneme High School Solar (Northwest)
Sample ID: B 1 @ 26'
Soil Description: CL/ML

DATA SUMMARY				TEST RESULTS	
Number of Blows:	10	26	26	**LIQUID LIMIT**	**33**
Water Content, %	35.7	33.3	33.2	**PLASTIC LIMIT**	**21**
Plastic Limit:	21.5	21.5		**PLASTICITY INDEX**	**12**



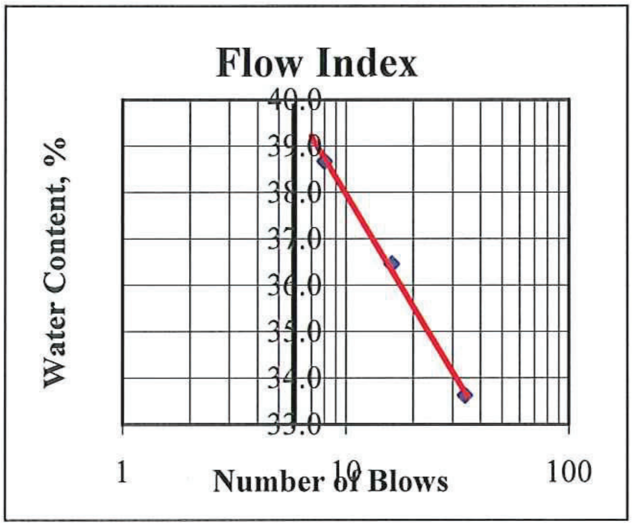


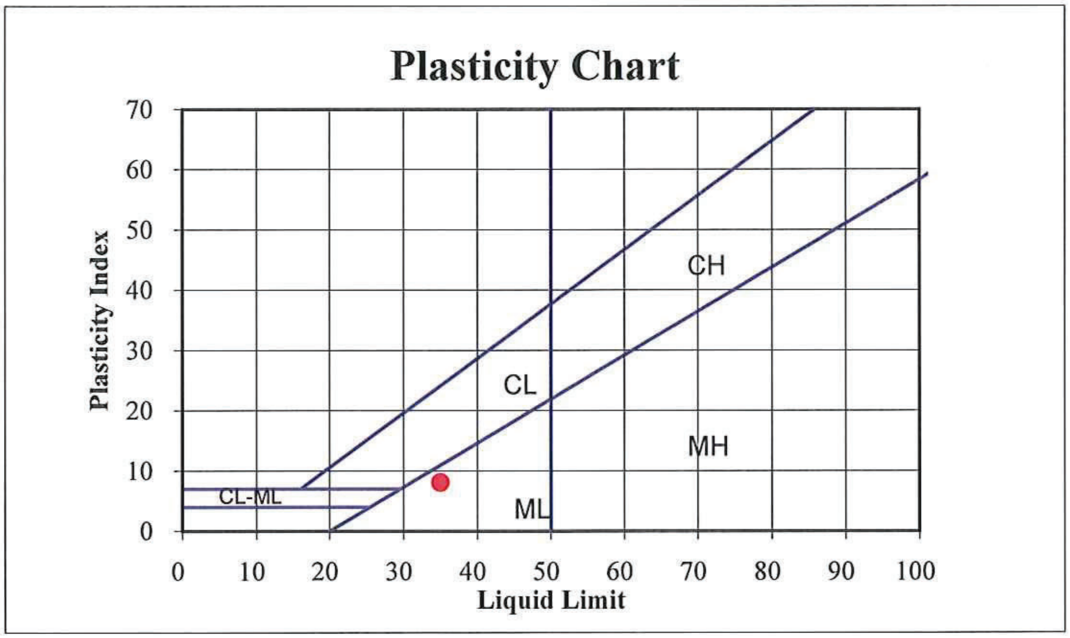
PLASTICITY INDEX

ASTM D-4318

Job Name: Hueneme High School Solar (Northwest)
Sample ID: B 1 @ 40'
Soil Description: ML

DATA SUMMARY				TEST RESULTS	
Number of Blows:	8	16	34	**LIQUID LIMIT**	**35**
Water Content, %	38.7	36.5	33.6	**PLASTIC LIMIT**	**27**
Plastic Limit:	27.6	27.2		**PLASTICITY INDEX**	**8**





APPENDIX D

Liquefaction Analysis Calculations
Liquefaction Analysis Calculation Curves
Lateral Spreading Analysis Calculations

CPT-LIQUEFY.XLS - A SPREADSHEET FOR EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL USING CPT DATA

Developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest

Project: Hueneme HS Relocatables
Job No: 303277-004
Date: 8/16/2021
Sounding: CPT-2

Liquefaction Analysis using 1998 NCEER (Robertson & Wride) method
Settlement Analysis using Tokimatsu & Seed (1987), clean sand Qc1n/N1(60) ratio =5

EARTHQUAKE INFORMATION:
Magnitude: 7.4 7.5
PGA, g: 0.76 0.74
MSF: 1.03
GWT, feet: 5.0
Calc GWT, feet: 4.5

Plot: 1
Method Used: 1 1998 NCEER (Robertson & Wride)
Averaging Increment: 3 0.15 m
Induced CSR (M=7.5) = 0.65*PGA*(po/p'o)*rd/MSF
Clean Sand Qc1n = C_Q*K_C*K_H*Qc
SF = $CRR_{7.5}$*Kσ/CSR

Ignore 1st/last increment into sand/silt soils: 1 yes
Ignore/remediate upper: 0.0 m
Unit Weight of unsaturated soils: 115 pcf
Unit Weight of saturated soils: 130 pcf
Limiting Ic for liquefiable soils: 2.60
Limiting Ic for K_H: 2.6

Use Moss @ P_L: 15%
Use Tokimatsu & Seed (0) or Ishihara &Yoshmine (1): 0
Required SF: 1.30
Min SF of Liquefiable Layers: 0.18
Avg SF of Liquefiable Layers: 0.44
Max $\Delta N_{1(60)}$ - post liquefied: 5.5
Max $\Delta N_{1(60)}$ - non liquefied: 5.0

Total Liquefied Thickness (feet): 15.7
Total Induced Subsidence (inches): 2.2

Depth (feet)	(m)	Tip Qc (tsf)	Friction Fs (tsf)	Friction Ratio Rf %	qc MPa	Total Unit Wt. (pcf)	Total Stress po (tsf)	Eff. Stress p'o (tsf)	rd	F %	n	Max 1.70 Cq	Q	Moss qc1 MPa	Moss Δqc MPa	Moss qc_{1mod} MPa	Moss eff K_C	Qc1n	Ic	Overide	Liquef. Suscept. (0 or 1)	Rel. Dens. Dr (%)	K_C	K_H	Clean Sand Qc1n	1.0 Kσ	CRR	Induced M=7.5 CSR	Liquefac. Safety Factor	Qc1n $N_{1(60)}$ Ratio	Equiv. $N_{1(60)}$	FC Adj. $\Delta N_{1(60)}$	Equiv. $N_{1(60)cs}$	Volumetric Strain (%)
0.49	0.15	117.77	1.07	0.91	11.28	115	0.028	0.028	1.000	0.91	0.51	1.70	189.18	19.17	0.42	19.59	1.02	189.23	1.68		1	100	1.02	1.00	193.6	1.00	Infin.	0.320	Non-Liq.	5.7	33.1	5.0	38.1	0.01
0.98	0.30	95.13	1.09	1.15	9.11	115	0.057	0.057	1.000	1.15	0.55	1.70	152.77	15.49	0.67	16.15	1.04	152.86	1.82		1	94	1.12	1.00	170.9	1.00	Infin.	0.320	Non-Liq.	5.4	28.1	5.0	33.1	0.02
1.48	0.45	51.77	2.46	4.75	4.96	115	0.085	0.085	0.999	4.76	0.74	1.70	83.04	8.43	4.36	12.79		83.18	2.45		0			1.00		1.00		0.320	Non-Liq.	4.2	19.8			0.00
1.97	0.60	26.27	1.82	6.92	2.52	130	0.117	0.117	0.997	6.95	0.84	1.70	42.02	4.28	4.62	8.89		42.21	2.77		0			1.00		1.00		0.319	Non-Liq.	3.6	11.8			0.00
2.46	0.75	13.03	0.96	7.34	1.25	130	0.149	0.149	0.996	7.42	0.91	1.70	20.70	2.12	4.62	6.74		20.94	3.00		0			1.00		1.00		0.319	Non-Liq.	3.1	6.7			0.00
2.95	0.90	11.57	0.56	4.80	1.11	130	0.181	0.181	0.995	4.87	0.88	1.70	18.29	1.88	4.41	6.29		18.59	2.92		0			1.00		1.00		0.318	Non-Liq.	3.3	5.7			0.00
3.44	1.05	13.43	0.47	3.52	1.29	130	0.213	0.213	0.994	3.58	0.84	1.70	21.24	2.19	3.10	5.29		21.58	2.78		0			1.00		1.00		0.318	Non-Liq.	3.6	6.1			0.00
3.94	1.20	16.23	0.51	3.14	1.55	130	0.245	0.245	0.993	3.19	0.81	1.70	25.69	2.64	2.71	5.35		26.08	2.69		0			1.00		1.00		0.318	Non-Liq.	3.7	7.0			0.00
4.43	1.35	18.67	0.45	2.43	1.79	130	0.277	0.277	0.992	2.47	0.78	1.70	29.55	3.05	1.97	5.02		30.11	2.57		0			1.00		1.00		0.317	Non-Liq.	4.0	7.6			0.00
4.92	1.50	46.43	0.35	0.76	4.45	130	0.309	0.309	0.990	0.77	0.59	1.70	74.11	7.56	0.31	7.87	1.04	74.61	1.94		1	65	1.23	1.00	92.0	1.00	0.152	0.484	0.32	5.2	14.4	4.0	18.4	1.61
5.41	1.65	48.27	0.38	0.78	4.62	130	0.341	0.336	0.989	0.79	0.59	1.70	77.02	7.86	0.34	8.19	1.04	77.56	1.94		1	66	1.23	1.00	95.1	1.00	0.160	0.506	0.32	5.2	14.9	4.1	19.0	1.56
5.91	1.80	47.47	0.43	0.91	4.55	130	0.373	0.352	0.988	0.91	0.60	1.70	75.70	7.73	0.49	8.22	1.06	76.27	1.98		1	66	1.28	1.00	97.3	1.00	0.166	0.525	0.32	5.1	14.9	4.6	19.5	1.53
6.40	1.95	51.20	0.47	0.91	4.90	130	0.405	0.369	0.987	0.91	0.59	1.70	81.68	8.33	0.50	8.84	1.06	82.27	1.96		1	69	1.25	1.00	102.5	1.00	0.180	0.543	0.33	5.2	15.9	4.6	20.5	1.46
6.89	2.10	60.67	0.53	0.87	5.81	130	0.437	0.385	0.986	0.87	0.58	1.70	96.86	9.53	0.45	9.98	1.05	97.48	1.88		1	76	1.17	1.00	114.4	1.00	0.219	0.559	0.39	5.3	18.4	4.5	22.9	1.30
7.38	2.25	68.87	0.67	0.98	6.59	130	0.469	0.402	0.985	0.98	0.57	1.70	110.01	10.25	0.59	10.85	1.06	110.66	1.87		1	81	1.16	1.00	128.9	1.00	0.279	0.573	0.49	5.3	20.8	5.0	25.8	1.13
7.87	2.40	73.57	0.82	1.12	7.04	130	0.501	0.419	0.984	1.13	0.58	1.70	117.53	10.48	0.78	11.26	1.07	118.21	1.89		1	84	1.18	1.00	139.5	1.00	0.333	0.586	0.57	5.3	22.3	5.5	27.8	1.02
8.37	2.55	82.70	0.89	1.07	7.92	130	0.533	0.435	0.983	1.08	0.57	1.66	128.83	11.51	0.73	12.24	1.06	129.52	1.85		1	88	1.14	1.00	148.2	1.00	0.383	0.599	0.64	5.4	24.1	5.5	29.6	0.83
8.86	2.70	88.90	0.91	1.03	8.51	130	0.565	0.452	0.982	1.03	0.56	1.61	134.53	12.17	0.67	12.84	1.05	135.22	1.82		1	89	1.12	1.00	151.8	1.00	0.406	0.610	0.67	5.4	24.9	5.5	30.4	0.74
9.35	2.85	90.17	0.96	1.06	8.63	130	0.597	0.469	0.981	1.06	0.56	1.58	134.05	12.10	0.71	12.81	1.06	134.75	1.83		1	89	1.13	1.00	152.4	1.00	0.409	0.620	0.66	5.4	24.9	5.5	30.4	0.74
9.84	3.00	83.10	0.97	1.16	7.96	130	0.629	0.485	0.979	1.17	0.58	1.57	122.77	10.95	0.85	11.81	1.08	123.49	1.89		1	86	1.18	1.00	145.5	1.00	0.366	0.629	0.58	5.3	23.3	5.5	28.8	1.00
10.33	3.15	84.60	0.93	1.10	8.10	130	0.661	0.502	0.978	1.11	0.58	1.54	122.12	11.04	0.78	11.82	1.07	122.85	1.87		1	85	1.17	1.00	143.2	1.00	0.353	0.638	0.55	5.3	23.1	5.5	28.6	1.00
10.83	3.30	87.07	1.01	1.16	8.34	130	0.693	0.519	0.977	1.17	0.58	1.51	123.64	11.13	0.86	11.99	1.08	124.38	1.89		1	86	1.18	1.00	146.3	1.00	0.371	0.646	0.57	5.3	23.4	5.5	28.9	1.00
11.32	3.45	102.33	1.03	1.01	9.80	130	0.725	0.535	0.976	1.01	0.55	1.46	140.20	12.95	0.66	13.60	1.05	140.94	1.80		1	91	1.11	1.00	156.3	1.00	0.435	0.654	0.67	5.5	25.8	5.5	31.3	0.64
11.81	3.60	118.30	0.97	0.82	11.33	130	0.757	0.552	0.975	0.82	0.52	1.40	156.31	14.93	0.42	15.35	1.03	157.05	1.71		1	96	1.04	1.00	163.9	1.00	Infin.	0.661	Non-Liq.	5.7	27.8	5.0	32.8	0.00
12.30	3.75	124.83	1.07	0.86	11.95	130	0.789	0.568	0.974	0.86	0.52	1.38	162.46	15.44	0.47	15.91	1.03	163.21	1.71		1	97	1.04	1.00	170.4	1.00	Infin.	0.667	Non-Liq.	5.7	28.9	5.0	33.9	0.00
12.80	3.90	104.00	1.17	1.12	9.96	130	0.821	0.585	0.973	1.13	0.56	1.40	136.60	12.56	0.82	13.38	1.06	137.37	1.84		1	90	1.14	1.00	156.7	1.00	0.438	0.673	0.65	5.4	25.5	5.5	31.0	0.68
13.29	4.05	116.07	1.02	0.87	11.11	130	0.853	0.602	0.972	0.88	0.53	1.35	147.49	14.06	0.49	14.55	1.03	148.25	1.75		1	93	1.07	1.00	158.5	1.00	0.450	0.679	0.66	5.6	26.6	5.1	31.7	0.60
13.78	4.20	120.53	0.99	0.82	11.54	130	0.885	0.618	0.971	0.83	0.53	1.33	150.35	14.47	0.43	14.90	1.03	151.13	1.72		1	94	1.05	1.00	159.1	1.00	0.455	0.684	0.66	5.6	26.9	5.0	31.8	0.58
14.27	4.35	119.70	1.17	0.97	11.46	130	0.917	0.635	0.970	0.98	0.54	1.32	148.46	14.05	0.62	14.67	1.04	149.25	1.78		1	93	1.09	1.00	162.5	1.00	Infin.	0.689	Non-Liq.	5.5	27.0	5.0	32.0	0.00
14.76	4.50	123.67	1.15	0.93	11.84	130	0.949	0.652	0.969	0.93	0.54	1.30	150.81	14.39	0.57	14.95	1.04	151.61	1.76		1	94	1.08	1.00	163.1	1.00	Infin.	0.694	Non-Liq.	5.6	27.3	5.0	32.3	0.00
15.26	4.65	125.57	1.14	0.91	12.02	130	0.981	0.668	0.968	0.91	0.53	1.28	150.90	14.47	0.54	15.01	1.04	151.71	1.75		1	94	1.07	1.00	162.5	1.00	Infin.	0.698	Non-Liq.	5.6	27.2	5.0	32.2	0.00
15.75	4.80	126.10	1.16	0.92	12.08	130	1.013	0.685	0.967	0.93	0.54	1.26	149.69	14.37	0.56	14.93	1.04	150.51	1.76		1	94	1.08	1.00	162.0	1.00	Infin.	0.702	Non-Liq.	5.6	27.1	5.0	32.1	0.00
16.24	4.95	132.77	1.21	0.91	12.71	130	1.045	0.702	0.966	0.91	0.53	1.24	155.29	14.97	0.54	15.52	1.04	156.11	1.74		1	95	1.07	1.00	166.3	1.00	Infin.	0.706	Non-Liq.	5.6	27.9	5.0	32.9	0.00
16.73	5.10	136.97	1.34	0.97	13.12	130	1.077	0.718	0.965	0.98	0.54	1.23	158.49	15.23	0.63	15.86	1.04	159.33	1.75		1	96	1.07	1.00	171.3	1.00	Infin.	0.710	Non-Liq.	5.6	28.6	5.0	33.6	0.00
17.22	5.25	142.63	1.42	0.99	13.66	130	1.109	0.735	0.964	1.00	0.53	1.22	162.98	15.68	0.66	16.34	1.04	163.82	1.75		1	97	1.07	1.00	175.7	1.00	Infin.	0.713	Non-Liq.	5.6	29.4	5.0	34.4	0.00
17.72	5.40	151.30	1.40	0.92	14.49	130	1.141	0.751	0.962	0.93	0.52	1.20	170.22	16.52	0.57	17.09	1.03	171.07	1.72		1	99	1.05	1.00	179.4	1.00	Infin.	0.716	Non-Liq.	5.6	30.3	5.0	35.3	0.00
18.21	5.55	150.90	1.47	0.98	14.45	130	1.172	0.768	0.961	0.98	0.53	1.18	168.15	16.30	0.63	16.94	1.04	169.01	1.74		1	99	1.06	1.00	179.6	1.00	Infin.	0.719	Non-Liq.	5.6	30.2	5.0	35.2	0.00
18.70	5.70	152.73	1.53	1.00	14.63	130	1.204	0.785	0.960	1.01	0.53	1.17	168.39	16.34	0.67	17.02	1.04	169.26	1.74		1	99	1.07	1.00	180.8	1.00	Infin.	0.722	Non-Liq.	5.6	30.3	5.0	35.3	0.00
19.19	5.85	165.63	1.53	0.92	15.86	130	1.236	0.801	0.959	0.93	0.52	1.15	179.92	17.61	0.57	18.18	1.03	180.79	1.70		1	100	1.04	1.00	187.5	1.00	Infin.	0.724	Non-Liq.	5.7	31.9	5.0	36.9	0.00
19.69	6.00	209.40	1.48	0.70	20.05	130	1.268	0.818	0.958	0.71	0.50	1.14	224.22	22.20	0.27	22.48	1.01	225.10	1.55		1	100	1.00	1.00	225.1	1.00	Infin.	0.727	Non-Liq.	6.0	37.7	5.0	42.7	0.00
20.18	6.15	244.70	1.34	0.55	23.43	130	1.300	0.835	0.956	0.55	0.50	1.13	259.52	25.90	0.06	25.96	1.00	260.41	1.43		1	100	1.00	1.00	260.4	1.00	Infin.	0.729	Non-Liq.	6.2	42.0	5.0	47.0	0.00
20.67	6.30	290.37	2.94	1.01	27.81	130	1.332	0.851	0.955	1.01	0.50	1.11	305.07	29.82	0.68	30.50	1.02	305.97	1.57		1	100	1.00	1.00	306.0	1.00	Infin.	0.731	Non-Liq.	5.9	51.7	5.0	56.7	0.00
21.16	6.45	318.90	4.88	1.53	30.54	130	1.364	0.868	0.954	1.53	0.52	1.11	333.00	32.20	1.38	33.58	1.04	333.91	1.70		1	100	1.03	1.00	345.5	1.00	Infin.	0.733	Non-Liq.	5.7	58.8	5.0	63.8	0.00
21.65	6.60	256.37	3.30	1.29	24.55	130	1.396	0.884	0.952	1.29	0.52	1.10	264.88	25.91	1.06	26.97	1.04	265.80	1.69		1	100	1.03	1.00	274.8	1.00	Infin.	0.735	Non-Liq.	5.7	46.8	5.0	51.8	0.00
22.15	6.75	161.97	1.35	0.83	15.51	130	1.428	0.901	0.951	0.84	0.52	1.09	165.39	16.52	0.44	16.96	1.03	166.32	1.69		1	98	1.03	1.00	171.9	1.00	Infin.	0.736	Non-Liq.	5.7	29.3	5.0	34.3	0.00
22.64	6.90	142.37	1.19	0.83	13.63	130	1.460	0.918	0.950	0.84	0.53	1.08	144.17	14.44	0.45	14.89	1.03	145.11	1.74		1	92	1.06	1.00	154.5	1.00	0.423	0.738	0.57	5.6	26.0	5.0	30.9	0.70
23.13	7.05	80.33	0.96	1.19	7.69	130	1.492	0.934	0.948	1.20	0.62	1.08	81.05	8.10	0.93	9.02		82.00	2.03		0			1.00		1.00		0.739	Non-Liq.	5.0	16.3			0.00

Depth (feet)	(m)	Tip Qc (tsf)	Friction Fs (tsf)	Friction Ratio Rf %	qc MPa	Total Unit Wt. (pcf)	Total Stress po (tsf)	Eff. Stress p'o (tsf)	rd	F %	n	Max 1.70 Cq	Q	Moss qc1 MPa	Moss Δqc MPa	Moss qc_{1mod} MPa	Moss eff K_C	Qc1n	Ic	Overide	Liquef. Suscept. (0 or 1)	Rel. Dens. Dr (%)	K_C	K_H	Clean Sand Qc1n	1.0 Kσ	CRR	Induced M=7.5 CSR	Liquefac. Safety Factor	Qc1n $N_{1(60)}$ Ratio	Equiv. $N_{1(60)}$	FC Adj. $\Delta N_{1(60)}$	Equiv. $N_{1(60)cs}$	*Volumetric Strain (%)*
23.62	7.20	14.07	0.65	4.64	1.35	130	1.524	0.951	0.946	4.98	0.92	1.10	13.67	1.42	5.58	7.00		14.66	3.02		0			1.00		1.00		0.740	**Non-Liq.**	3.1	4.7			**0.00**
24.11	7.35	6.80	0.36	5.27	0.65	130	1.556	0.968	0.945	6.14	1.00	1.09	6.03	0.70	6.06	6.75		7.03	3.36		0			1.00		1.00		0.741	**Non-Liq.**	2.4	2.9			**0.00**
24.61	7.50	6.03	0.19	3.20	0.58	130	1.588	0.984	0.943	3.83	1.00	1.07	5.13	0.61	3.64	4.26		6.13	3.30		0			1.00		1.00		0.742	**Non-Liq.**	2.5	2.4			**0.00**
25.10	7.65	7.57	0.23	2.97	0.72	130	1.620	1.001	0.941	3.43	0.97	1.05	6.55	0.76	3.33	4.09		7.55	3.18		0			1.00		1.00		0.743	**Non-Liq.**	2.8	2.7			**0.00**
25.59	7.80	6.40	0.26	4.01	0.61	130	1.652	1.018	0.940	4.77	1.00	1.04	5.29	0.63	4.73	5.36		6.29	3.34		0			1.00		1.00		0.744	**Non-Liq.**	2.5	2.6			**0.00**
26.08	7.95	8.40	0.32	3.75	0.80	130	1.684	1.034	0.938	4.28	0.97	1.02	7.12	0.82	4.38	5.20		8.12	3.21		0			1.00		1.00		0.744	**Non-Liq.**	2.7	3.0			**0.00**
26.57	8.10	10.97	0.43	3.92	1.05	130	1.716	1.051	0.936	4.34	0.94	1.01	9.43	1.05	4.61	5.67		10.43	3.11		0			1.00		1.00		0.745	**Non-Liq.**	2.9	3.6			**0.00**
27.07	8.25	8.40	0.42	4.96	0.80	130	1.748	1.067	0.934	5.68	0.99	0.99	6.87	0.80	6.01	6.81		7.87	3.29		0			1.00		1.00		0.745	**Non-Liq.**	2.6	3.1			**0.00**
27.56	8.40	7.00	0.32	4.57	0.67	130	1.780	1.084	0.932	5.41	1.00	0.98	5.46	0.66	5.49	6.15		6.46	3.36		0			1.00		1.00		0.745	**Non-Liq.**	2.4	2.7			**0.00**
28.05	8.55	7.47	0.29	3.93	0.72	130	1.812	1.101	0.930	4.61	1.00	0.96	5.78	0.69	4.62	5.32		6.78	3.30		0			1.00		0.99		0.745	**Non-Liq.**	2.5	2.7			**0.00**
28.54	8.70	9.10	0.33	3.66	0.87	130	1.844	1.117	0.928	4.18	0.96	0.95	7.16	0.84	4.26	5.10		8.16	3.20		0			1.00		0.99		0.745	**Non-Liq.**	2.7	3.0			**0.00**
29.04	8.85	18.60	0.46	2.49	1.78	130	1.876	1.134	0.925	2.65	0.85	0.94	15.57	1.72	2.68	4.40		16.58	2.81		0			1.00		0.99		0.745	**Non-Liq.**	3.5	4.7			**0.00**
29.53	9.00	34.33	0.50	1.46	3.29	130	1.908	1.151	0.923	1.51	0.74	0.94	29.48	3.99	1.29	5.28		38.57	2.44		0			1.26		0.99		0.745	**Non-Liq.**	4.2	9.1			**0.00**
30.02	9.15	12.37	0.50	4.06	1.18	130	1.940	1.167	0.920	4.48	0.94	0.91	9.65	1.12	4.79	5.91		10.66	3.11		0			1.00		0.98		0.744	**Non-Liq.**	2.9	3.7			**0.00**
30.51	9.30	10.17	0.45	4.38	0.97	130	1.972	1.184	0.918	4.95	0.97	0.90	7.61	0.91	5.22	6.13		8.62	3.22		0			1.00		0.98		0.744	**Non-Liq.**	2.7	3.2			**0.00**
31.00	9.45	18.60	0.38	2.06	1.78	130	2.004	1.201	0.915	2.20	0.84	0.90	14.79	1.66	2.10	3.76		15.81	2.78		0			1.00		0.98		0.743	**Non-Liq.**	3.6	4.4			**0.00**
31.50	9.60	83.67	0.86	1.03	8.01	130	2.036	1.217	0.913	1.04	0.62	0.92	71.47	7.58	0.71	8.29		72.80	2.04		0			1.00		0.97		0.742	**Non-Liq.**	5.0	14.5			**0.00**
31.99	9.75	161.53	1.78	1.10	15.47	130	2.068	1.234	0.910	1.11	0.56	0.92	139.07	14.65	0.81	15.46	1.06	140.14	1.83		1	91	1.13	1.00	158.7	0.95	0.451	0.741	**0.58**	5.4	25.9	5.5	31.4	**0.64**
32.48	9.90	73.40	1.63	2.21	7.03	130	2.100	1.250	0.907	2.25	0.70	0.89	60.70	6.64	2.31	8.94	1.35	61.75	2.31		1	57	1.97	1.00	121.6	0.95	0.247	0.740	**0.32**	4.5	13.8	5.5	19.3	**1.58**
32.97	10.05	35.93	0.85	2.36	3.44	130	2.132	1.267	0.904	2.45	0.78	0.87	28.48	3.19	2.50	5.69	1.79	29.53	2.58		1	26	3.20	1.00	94.4	0.97	0.158	0.739	**0.21**	4.0	7.5	5.5	13.0	**2.17**
33.46	10.20	57.43	0.75	1.30	5.50	130	2.164	1.284	0.901	1.33	0.68	0.88	46.54	5.05	1.08	6.13	1.21	47.61	2.25		1	46	1.79	1.00	85.3	0.96	0.138	0.738	**0.18**	4.6	10.4	5.5	15.9	**1.87**
33.96	10.35	59.50	0.84	1.41	5.70	130	2.196	1.300	0.898	1.44	0.68	0.87	47.79	5.22	1.23	6.45	1.23	48.86	2.26		1	47	1.83	1.00	89.3	0.96	0.146	0.737	**0.19**	4.6	10.7	5.5	16.2	**1.84**
34.45	10.50	38.90	0.77	1.98	3.73	130	2.228	1.317	0.894	2.04	0.76	0.85	30.11	3.39	1.98	5.37		31.16	2.51		0			1.00		0.96		0.735	**Non-Liq.**	4.1	7.6			**0.00**
34.94	10.65	24.83	0.54	2.18	2.38	130	2.260	1.334	0.891	2.30	0.81	0.83	18.39	2.12	2.26	4.38		19.44	2.71		0			1.00		0.96		0.733	**Non-Liq.**	3.7	5.3			**0.00**
35.43	10.80	14.87	0.38	2.58	1.42	130	2.292	1.350	0.888	2.84	0.89	0.80	10.28	1.24	2.79	4.02		11.31	2.97		0			1.00		0.95		0.732	**Non-Liq.**	3.2	3.6			**0.00**
35.93	10.95	15.23	0.33	2.19	1.46	130	2.324	1.367	0.884	2.40	0.88	0.80	10.47	1.25	2.26	3.52		11.51	2.93		0			1.00		0.95		0.730	**Non-Liq.**	3.3	3.5			**0.00**
36.42	11.10	58.77	0.55	0.94	5.63	130	2.356	1.384	0.880	0.96	0.66	0.84	45.49	5.70	0.58	6.28		53.70	2.17		0			1.15		0.95		0.728	**Non-Liq.**	4.7	11.3			**0.00**
36.91	11.25	86.87	0.96	1.10	8.32	130	2.388	1.400	0.877	1.12	0.63	0.84	67.78	8.54	0.80	9.34	1.09	79.41	2.07		1	67	1.41	1.15	111.7	0.92	0.210	0.726	**0.27**	4.9	16.1	5.5	21.6	**1.41**
37.40	11.40	40.93	0.90	2.19	3.92	130	2.420	1.417	0.873	2.27	0.76	0.80	29.89	4.00	2.26	6.26	1.56	35.69	2.54		1	34	2.99	1.15	106.7	0.95	0.193	0.724	**0.25**	4.0	8.9	5.5	14.4	**2.01**
37.89	11.55	64.67	0.62	0.96	6.19	130	2.452	1.433	0.869	0.99	0.65	0.82	49.07	6.20	0.62	6.82		57.84	2.15		0			1.15		0.94		0.721	**Non-Liq.**	4.8	12.1			**0.00**
38.39	11.70	28.20	0.68	2.39	2.70	130	2.484	1.450	0.865	2.52	0.81	0.77	19.57	2.34	2.53	4.86		20.63	2.72		0			1.00		0.94		0.719	**Non-Liq.**	3.7	5.6			**0.00**
38.88	11.85	17.23	0.59	3.39	1.65	130	2.516	1.467	0.861	3.71	0.90	0.75	11.11	1.40	3.86	5.25		12.15	3.01		0			1.00		0.94		0.716	**Non-Liq.**	3.1	3.9			**0.00**
39.37	12.00	22.80	0.43	1.89	2.18	130	2.548	1.483	0.857	2.02	0.82	0.76	15.27	1.83	1.85	3.67		16.33	2.75		0			1.00		0.94		0.714	**Non-Liq.**	3.6	4.5			**0.00**
39.86	12.15	66.57	0.53	0.79	6.37	130	2.580	1.500	0.852	0.81	0.63	0.80	49.28	7.55	0.39	7.94		70.93	2.11		0			1.41		0.93		0.711	**Non-Liq.**	4.9	14.5			**0.00**
40.35	12.30	33.50	0.60	1.79	3.21	130	2.612	1.517	0.848	1.88	0.77	0.76	22.88	3.81	1.72	5.53		33.72	2.59		0			1.41		0.93		0.708	**Non-Liq.**	3.9	8.6			**0.00**
40.85	12.45	10.87	0.44	4.00	1.04	130	2.644	1.533	0.843	4.66	0.97	0.70	6.15	0.83	4.65	5.48		7.16	3.28		0			1.00		0.93		0.705	**Non-Liq.**	2.6	2.8			**0.00**
41.34	12.60	12.07	0.31	2.54	1.16	130	2.676	1.550	0.839	2.92	0.93	0.70	6.98	0.91	2.71	3.61		8.01	3.12		0			1.00		0.93		0.702	**Non-Liq.**	2.9	2.8			**0.00**
41.83	12.75	12.77	0.33	2.58	1.22	130	2.708	1.566	0.834	2.95	0.92	0.70	7.38	0.96	2.76	3.72		8.41	3.10		0			1.00		0.93		0.699	**Non-Liq.**	2.9	2.9			**0.00**
42.32	12.90	14.00	0.39	2.81	1.34	130	2.740	1.583	0.830	3.17	0.92	0.69	8.11	1.06	3.05	4.11		9.15	3.09		0			1.00		0.92		0.696	**Non-Liq.**	3.0	3.1			**0.00**
42.81	13.05	16.00	0.42	2.61	1.53	130	2.772	1.600	0.825	2.91	0.89	0.69	9.41	1.22	2.79	4.01		10.45	3.01		0			1.00		0.92		0.693	**Non-Liq.**	3.1	3.4			**0.00**
43.31	13.20	13.43	0.36	2.64	1.29	130	2.804	1.616	0.820	3.00	0.92	0.68	7.57	1.00	2.83	3.82		8.60	3.10		0			1.00		0.92		0.690	**Non-Liq.**	2.9	2.9			**0.00**
43.80	13.35	22.07	0.41	1.87	2.11	130	2.836	1.633	0.816	2.01	0.83	0.70	13.47	1.67	1.80	3.47		14.55	2.79		0			1.00		0.92		0.686	**Non-Liq.**	3.5	4.1			**0.00**
44.29	13.50	10.23	0.39	3.76	0.98	130	2.868	1.650	0.811	4.49	0.98	0.65	5.24	0.74	4.29	5.03		6.25	3.33		0			1.00		0.92		0.683	**Non-Liq.**	2.5	2.5			**0.00**
44.78	13.65	9.93	0.23	2.35	0.95	130	2.900	1.666	0.806	2.82	0.95	0.65	5.07	0.69	2.43	3.12		6.09	3.23		0			1.00		0.91		0.679	**Non-Liq.**	2.7	2.3			**0.00**
45.28	13.80	11.70	0.22	1.89	1.12	130	2.932	1.683	0.801	2.21	0.92	0.65	6.19	0.82	1.83	2.65		7.23	3.10		0			1.00		0.91		0.676	**Non-Liq.**	2.9	2.5			**0.00**
45.77	13.95	12.20	0.29	2.35	1.17	130	2.964	1.700	0.796	2.73	0.93	0.64	6.40	0.86	2.42	3.28		7.43	3.14		0			1.00		0.91		0.672	**Non-Liq.**	2.9	2.6			**0.00**
46.26	14.10	34.60	0.54	1.56	3.31	130	2.996	1.716	0.791	1.64	0.77	0.69	21.45	2.63	1.39	4.02		22.65	2.58		0			1.00		0.91		0.669	**Non-Liq.**	4.0	5.7			**0.00**
46.75	14.25	91.30	0.77	0.85	8.74	130	3.028	1.733	0.786	0.86	0.61	0.74	62.59	7.02	0.45	7.47	1.06	63.80	2.03		1	58	1.35	1.00	85.9	0.86	0.139	0.665	**0.18**	5.0	12.7	4.5	17.2	**1.74**
47.24	14.40	140.90	1.10	0.78	13.49	130	3.060	1.749	0.781	0.79	0.56	0.75	99.26	10.95	0.36	11.31	1.03	100.51	1.85		1	77	1.14	1.00	115.0	0.82	0.221	0.661	**0.27**	5.4	18.7	4.3	23.0	**1.31**
47.74	14.55	156.07	1.34	0.86	14.95	130	3.092	1.766	0.776	0.87	0.56	0.75	109.61	12.23	0.47	12.70	1.04	110.87	1.84		1	81	1.14	1.00	126.1	0.82	0.267	0.658	**0.33**	5.4	20.6	4.7	25.2	**1.17**
48.23	14.70	154.37	1.41	0.91	14.78	130	3.124	1.783	0.771	0.93	0.56	0.75	107.45	12.10	0.54	12.64	1.04	108.71	1.86		1	80	1.16	1.00	125.8	0.81	0.265	0.654	**0.33**	5.3	20.3	4.8	25.2	**1.17**
48.72	14.85	164.87	1.60	0.97	15.79	130	3.156	1.799	0.766	0.98	0.56	0.74	114.31	12.97	0.61	13.58	1.05	115.57	1.86		1	83	1.15	1.00	133.3	0.81	0.300	0.650	**0.37**	5.4	21.6	5.1	26.7	**1.09**
49.21	15.00	193.60	2.02	1.04	18.54	130	3.188	1.816	0.761	1.05	0.55	0.74	134.41	15.37	0.70	16.07	1.05	135.69	1.83		1	89	1.13	1.00	153.0	0.81	0.413	0.647	**0.52**	5.4	25.0	5.5	30.5	**0.73**
49.70	15.15	194.47	2.44	1.25	18.62	130	3.220	1.833	0.756	1.27	0.57	0.73	133.09	15.59	0.97	16.56	1.06	134.36	1.89		1	89	1.18	1.00	158.1	0.81	0.447	0.643	**0.56**	5.3	25.3	5.5	30.8	**0.69**

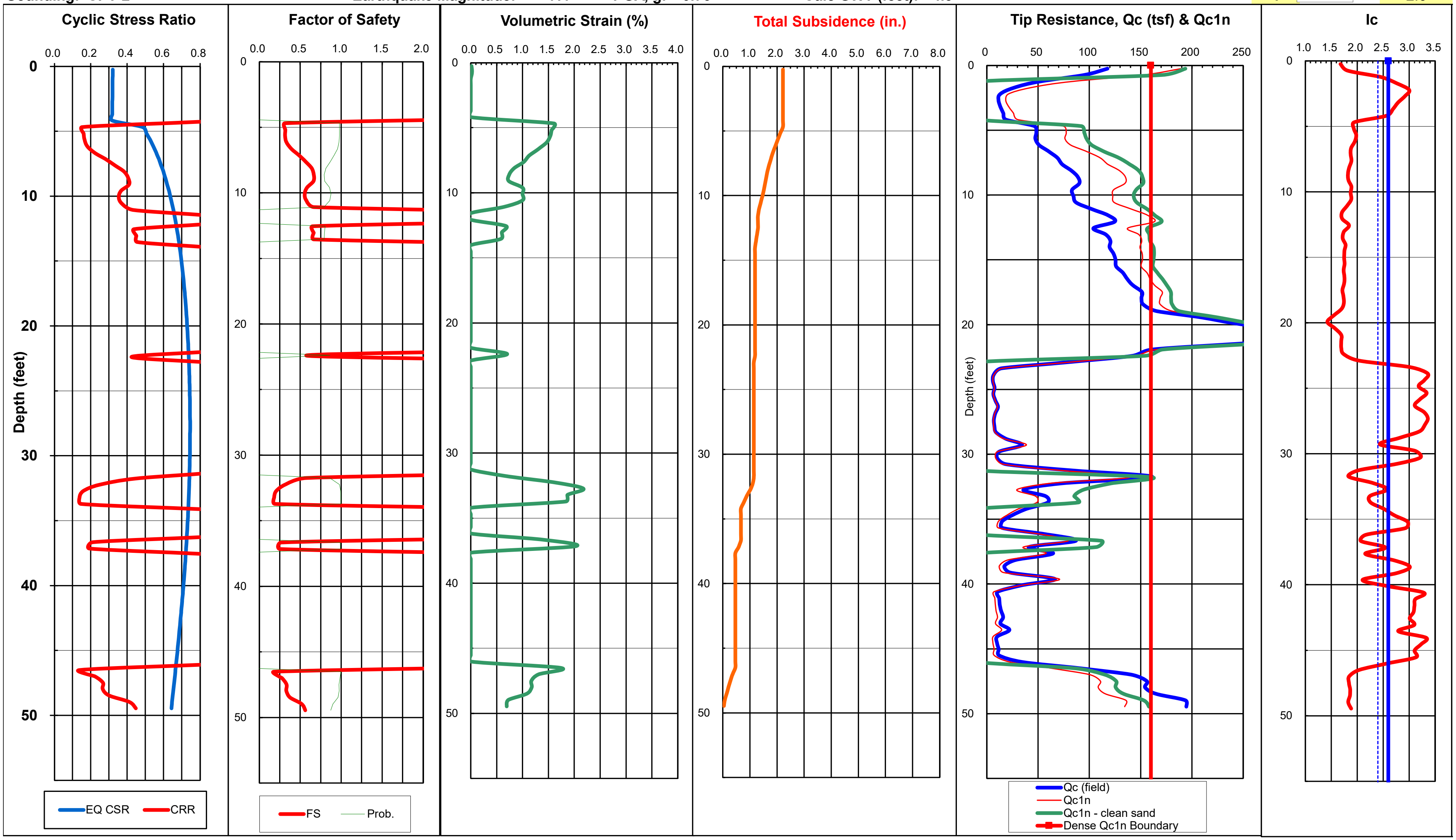
EARTH SYSTEMS - EVALUATION OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE

Hueneme HS Relocatables **Project No: 303277-004** Method Used: 1 1998 NCEER (Robertson & Wride)

Settlement Analysis using Tokimatsu & Seed (1987), clean sand Qc1n/N1(60) ratio =5

Plot: 1 Limiting Ic: 2.6

Sounding: CPT-2 **Earthquake Magnitude: 7.4** **PGA, g: 0.76** **Calc GWT (feet): 4.5**



Total Thickness of Liquefiable Layers: 15.7 feet **Estimated Total Ground Subsidence (Settlement): 2.2 inches**

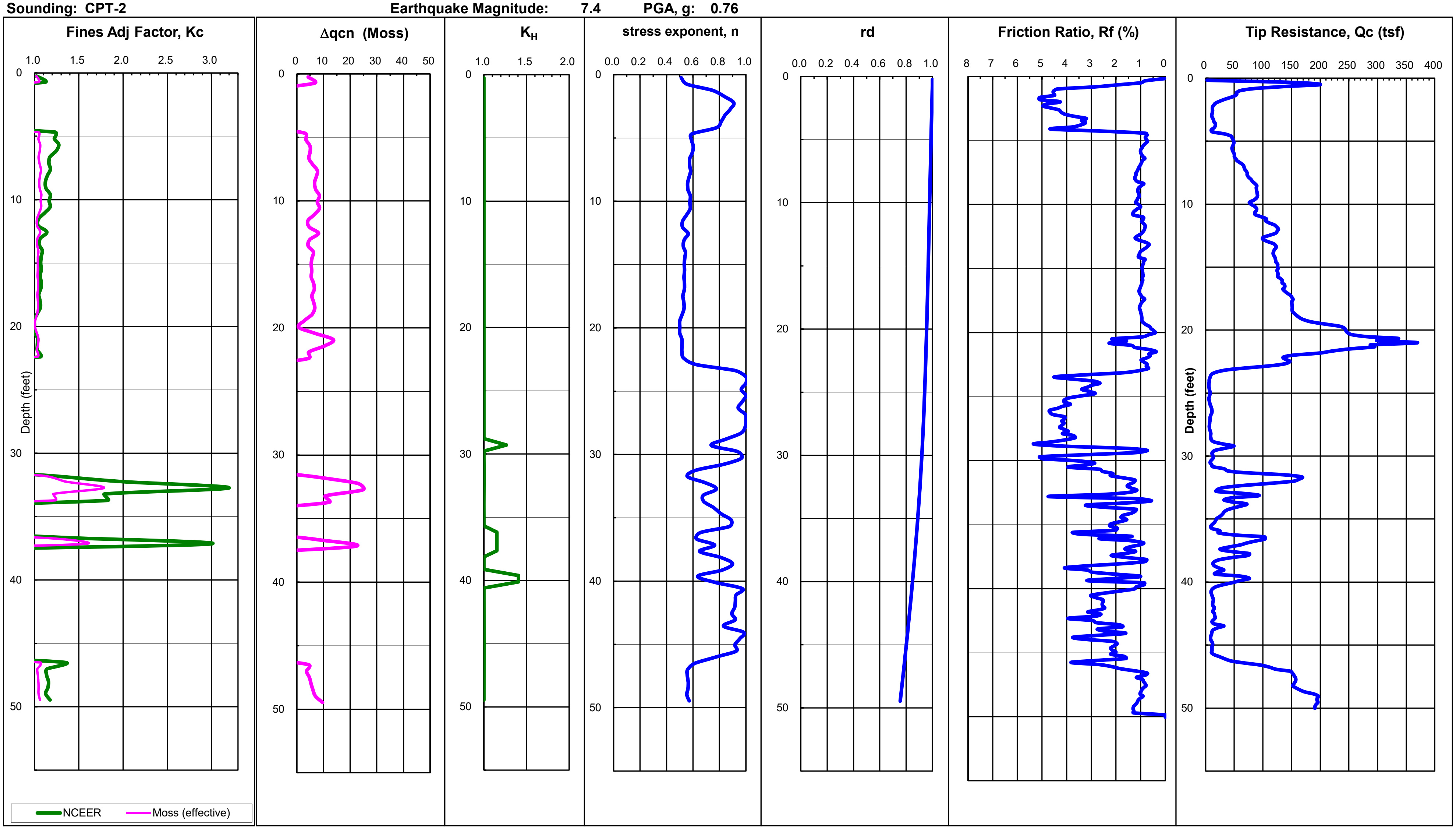
EARTH SYSTEMS - EVALUATION OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE

3 avg increment =0.15m Qc1n/N1(60): 5

Ignore 1st/last increment into sand/silt soils: 0

Method Used: 1998 NCEER (Robertson & Wride)

Sounding: CPT-2 **Earthquake Magnitude: 7.4** **PGA, g: 0.76**



Job Number:	303277-004
Job Name:	Hueneme HS Relocatables
CPT Number:	CPT-2
Date:	August 11, 2021
Calculated By:	PVB

Prediction of Liquefaction Induced Lateral Spreading with Ground Slope Conditions

Based on Data Published in the ASCE Journal of Geotechnicial and Geoenvironmental Engineering December 2002
(Youd, Hansen, and Bartlett, 2002)

Variables Used in Calculation Defined

Earthquake Magnitude (M)
Horizontal Distance to Nearest Seismic Energy Source, km (R)
Percent Slope (S)
Cumulative Thickness in Meters of Saturated Cohesionless Sediments with SPT $(N1)_{60}$ Values <= 15 (T_{15})
Average Fines Content in Percent (F_{15})
Mean Grain size in milimeters ($D50_{15}$)

$\text{Log } D_H = -16.213 + 1.532M - 1.406\text{Log}(R + 10^{(0.89M-5.64)}) - 0.012R + 0.338\text{LogS} + 0.540\text{Log}T_{15} + 3.413\text{Log}(100 - F_{15}) - 0.795\text{Log}(D50_{15} + 0.1\text{mm})$

Requirements and Limitations Used to Develop this Model

Soils must be Liquefiable
Saturated Cohesionless Sediments with SPT $(N1)_{60}$ less than 15
Earthquake Magnitude (M) must be between 6 and 8
Percent Slope (S) must be between 0.1% and 6%
Cumulative Thickness (T15) must be between 1 and 15 meters
Depth to top of Liquefied layer must be between 1 and 10 meters
Distance to Fault Rupture (R_{eq}) must be determined using Figure 10 if soft soils are present.
F_{15} and $D50_{15}$ must be within bounds shown in Fig. 5.
If R or R_{eq} < 0.5 km use 0.5; otherwise use R or R_{eq}.

Input Values	
M = 7.4	
R = 1	km
S = 0.4	%
T_{15} = 1	m
F_{15} = 55	%
$D50_{15}$ = 0.5	mm

Horizontal Ground Displacement in meters (D_H) = 0.25
Horizontal Ground Displacement in feet (D_H) = 0.8