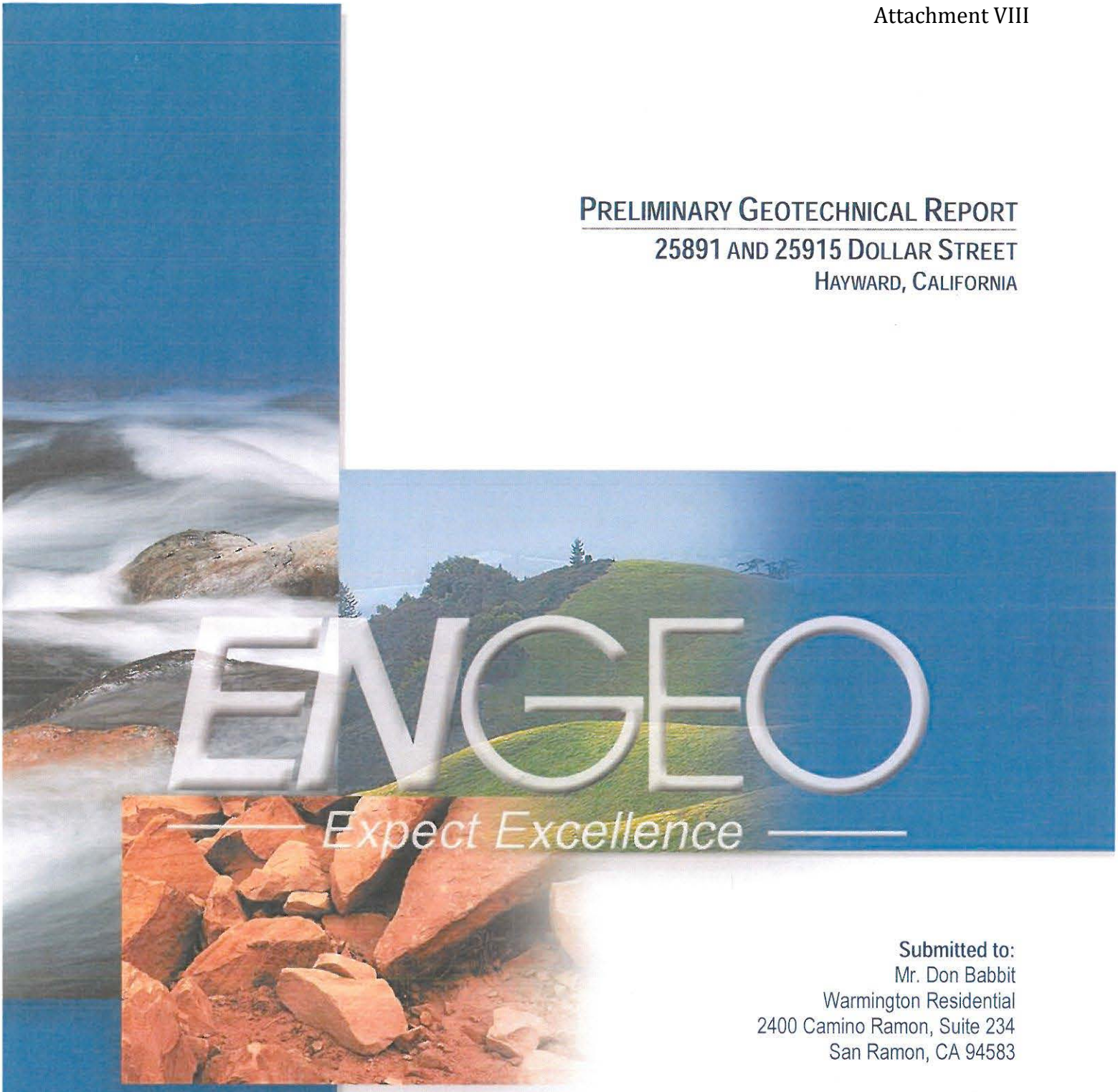
PRELIMINARY GEOTECHNICAL REPORT

25891 AND 25915 DOLLAR STREET

HAYWARD, CALIFORNIA



Submitted to:
Mr. Don Babbit
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Prepared by:
ENGEO Incorporated

September 10, 2015
Revised September 18, 2015

Project No.
12257.000.000

ENGEO
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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
12257.000.000

September 10, 2015
Revised September 18, 2015

Mr. Don Babbitt
Warmington Residential
2400 Camino Ramon, Suite 234
San Ramon, CA 94583

Subject: 25891 and 25915 Dollar Street
Hayward, California

PRELIMINARY GEOTECHNICAL REPORT

Dear Mr. Babbitt:

With your authorization, we completed a preliminary geotechnical report for your residential project at 25891 and 25915 Dollar Street in Hayward, California (Property). The report presents the field exploration data with our conclusions and preliminary recommendations for development at the site.

Our findings indicate that the Property is suitable for the proposed residential development provided the preliminary recommendations and guidelines in this report are incorporated in project planning. The scope of this report was limited as an initial study and did not involve the collection or laboratory testing of soil samples. Once the proposed site development plans are available, a design-level geotechnical exploration with the collection of soil samples for laboratory testing is necessary to refine the foundation design and grading recommendations.

We are pleased to have been of service to you on this project and are prepared to consult further with you and your design team as the project progresses.

Sincerely,

ENGEO Incorporated

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this preliminary geotechnical study is to provide preliminary conclusions and recommendations for the planned residential development of the site. The information presented in this report may be used for general land planning purposes.

The scope of our services included:

- Suitability of the site for the proposed development.
- Preliminary assessment of geological hazards at the site and in the general project area.
- Preliminary analysis of potential total and differential settlement due to liquefaction and consolidation, as appropriate.
- Preliminary discussion of treatment of geotechnical constraints such as loose/soft surface soils, existing fills, compressible soils, expansive soils, liquefiable soils, and lateral spreading, as necessary, based on field exploration results.
- Preliminary earthwork recommendations, including engineered fill placement, utility trench backfill, and recommendations for site drainage.
- Preliminary foundation recommendations.
- California Building Code seismic criteria.
- Preliminary pavement section recommendations.
- Recommendations for design-level study.

We prepared this report exclusively for Warmington Residential and their design team consultants. ENGEO should review any changes made in the character, design or layout of the development to modify the conclusions and recommendations contained in this report, as necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO.

1.2 SITE LOCATION AND DESCRIPTION

The Property is located at 25891 and 25915 Dollar Street in Hayward, California (Figures 1 and 2). The approximately 2.3-acre site is identified as Assessor's Parcel Numbers (APN) 444-0078-008-06 and 444-0078-007-07. The parcels are bound by Dollar Street to the east, a

Bay Area Rapid Transit (BART) right-of-way to the west, warehouse development to the north, and retail and commercial development to the south. An Alameda County Flood Control Channel runs along the west to northwest Property limit. Review of recent aerial photographs found that the Property is occupied by a vehicle repair and maintenance business with associated parking. The paved areas of the Property are also used to store and park vehicles and tractor trailers along with various automotive parts and miscellaneous debris.

1.3 PROPOSED DEVELOPMENT

Based on our conversations with you and review of conceptual site plans prepared by Carlson, Barbee and Gibson Inc., dated June 3, 2015, we understand that the planned development will consist of 42-unit three-story townhome project on eight building pads with asphalt-paved streets and parking. Landscaping is planned throughout the site as well as bioretention areas. Structural loads are not available at this time; however, we anticipate moderate building loads and assume no below-grade construction.

1.4 AERIAL PHOTOGRAPH REVIEW

We reviewed aerial photographs of the site flown between 1946 and 2012 available through Google Earth and historicaerials.com. Review of the photographs indicates that the Property was used as an orchard and agricultural lands until at least 1958. By 1960, the orchard in the middle of the Property was partially removed and a structure was constructed near the east corner. By 1966, the remainder of the orchard and agricultural land had been removed and graded with further site development by 1980 with a large structure evident on the north side of the site.

1.5 ENVIRONMENTAL STUDY

ENGEO has completed phase I and phase II environmental site assessments for the subject site concurrent with this preliminary geotechnical feasibility assessment. The environmental reports have been published separately.

2.0 GEOLOGY AND SEISMICITY

2.1 REGIONAL GEOLOGY AND SITE SOILS

The region is within the Coast Range Province of California, an area dominated by northwest-trending geologic features such as folds and faults. More specifically, the subject site is located on alluvial deposits near the eastern margin of the San Francisco Bay. The San Francisco Bay is located in a fault bound, elongated structural trough that has been filled with a sequence of Quaternary age sedimentary deposits derived from the surrounding Coast Ranges.

Based on mapping by Dibblee (2005), the deposits underlying the subject site are comprised of Holocene-aged alluvial deposits (Figure 3). Dibblee describes these deposits as alluvial gravel, sand and clay of valley areas and gravel and sand of major stream channels.

2.2 SITE SEISMICITY

The San Francisco Bay Area contains numerous active faults. Figure 4 shows the approximate location of active and potentially active faults and significant historic earthquakes mapped within the San Francisco Bay Region. An active fault is defined by the State as one that has had surface displacement within Holocene time (about the last 11,000 years). Review of the 2010 USGS Quaternary Fault and Fold Database (QFFD) found that the nearest active fault is the Hayward fault located approximately 0.25 mile northeast of the site. Other active faults located near the site include the Calaveras fault, approximately 8.3 miles to the east-northeast of the site, and the San Andreas fault, approximately 18.3 miles to the west-southwest.

Numerous small earthquakes occur every year in the San Francisco Bay Region, and larger earthquakes have been recorded and can be expected to occur in the future. The Working Group on California Earthquake Probabilities (WGCEP) (2008) evaluated the 30-year probability of a M6.7 or greater earthquake occurring on the known active fault systems in the Bay Area, including the Hayward fault. The UCERF generated an overall probability of 63 percent for the Bay Area as whole, and a probability of 31 percent for the Hayward fault, 7 percent for the Calaveras fault, and 21 percent for the Northern San Andreas fault.

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone (Figure 5) and no known surface expression of an active fault trends beneath the site.

3.0 FIELD EXPLORATION

The sections below summarize our field exploration activities as well as ground surface, subsurface, and groundwater conditions.

3.1 SURFACE CONDITIONS

The relatively flat site generally slopes from the southeast to the northwest. The automotive repair facility occupies roughly the center of the project site. The Property contains paved and unpaved areas, with the pavement near the structure along with a small landscaped area and near the north corner of the site. Trees are generally located near the southwest boundary of the site.

3.2 CONE PENETRATION TESTS

The field exploration for this preliminary study was conducted on August 21, 2015, and included advancing five cone penetration test (CPT) probes to depths of approximately 50 feet below the existing grade. Figure 2 shows the approximate location of the CPT probes established by taping or pacing from existing features. As a result, the mapped locations should be considered only as accurate as the methods used to determine them.

The cone, connected with a series of rods, is pushed into the ground at a constant rate. Cone readings are taken at approximately 5-cm intervals with a penetration rate of 2 cm per second in

accordance with revised (2002) ASTM standards (D-5778-95). Measurements include the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and dynamic pore pressure (U). The CPT logs and supporting empirical data are located in Appendix A. The CPT holes were backfilled with cement grout upon completion in accordance with the requirements of Alameda County Public Works Department.

3.3 SUBSURFACE CONDITIONS

Based on empirical correlations of the CPT data to estimated soil type and strength, the subsurface conditions at the exploration locations predominantly consist of stiff to hard clayey silts and silty clays with interbedded very dense strata to the maximum depth explored of approximately 50 feet below the ground surface. Small lenses of sand and silty sand were encountered in the upper 5 feet of the exploration. Consult the site plan and exploration logs for specific subsurface conditions at each location. We include the CPT sounding logs in Appendix A. The logs graphically depict the subsurface conditions encountered at the time of the exploration.

3.4 GROUNDWATER

Groundwater was measured during our field exploration between 15 and 31 feet below the ground surface using a water level indicator. Historical high groundwater levels were mapped by the California Geologic Survey (CGS) at a depth of approximately 30 to 40 feet below the ground surface.

Fluctuations in groundwater levels should be expected during seasonal changes or over a period of years because of precipitation changes, perched zones, changes in drainage patterns, and/or irrigation.

4.0 DISCUSSION AND CONCLUSIONS

From a geologic and geotechnical standpoint, the study area appears to be suitable for the proposed development. The preliminary recommendations in this report should be considered in the initial planning for the study area. A design-level exploration is recommended prior to preparation of the final land plan in order to develop recommendations for site grading and foundations.

Potential geologic hazards in the study area include seismic hazards, undocumented fills, potential liquefaction, and expansive soils. These potential hazards and other geotechnical issues relevant to the study area are discussed in the following sections of this report.

4.1 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface

faulting. The common secondary seismic hazards include ground shaking, liquefaction, densification, lateral spreading, and ground lurching. The following sections present a discussion of these hazards as they apply to the site.

Based on topographic and lithologic data, the risk of regional subsidence/uplift, landslides, tsunamis, or seiches is considered low to negligible at the site.

4.1.1 Ground Rupture

As described above, the site is not located within a State of California Earthquake Fault Hazard Zone (Hayward Quadrangle, 1982) and no known faults cross the site. Therefore, it is our opinion that ground rupture is unlikely at the Property.

4.1.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures should be designed using sound engineering judgment and the latest California Building Code (CBC) requirements, as a minimum.

Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The code-prescribed lateral forces are generally considered to be substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

4.1.3 Soil Liquefaction

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded fine sands below the groundwater table.

The Property is not located within a State of California Seismic Hazard Zone (CGS, 2003) for areas that may be susceptible to liquefaction (Figure 4). Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands.

We performed a liquefaction potential analysis of the CPT data using the procedure introduced by the 1996 National Center for Earthquake Engineering Research (NCEER) workshop and the 1998 NCEER/National Science Foundation (NSF) workshop. The workshops are summarized by Youd et al. (2001). The Cyclic Stress Ratio (CSR) was estimated for a Peak Ground Acceleration (PGA_M) value of 0.93g as outlined in the ASCE 7-10 and moment magnitude of 7.3. The results indicate that the medium dense sand layer is potentially liquefiable.

We calculated potential liquefaction-induced settlement estimates using the methods published. Since the clayey sand layer was characterized as medium dense and potentially liquefiable, we estimate the total liquefaction-induced settlements across the site to be less than 1 inch. Differential settlement during a liquefaction event is expected to be less than ½ inch (SCEC, 1999).

4.1.4 Ground Lurching and Lateral Spreading

Lurch cracking and lateral spreading can occur in weaker soils on slopes and adjacent to open channels that are subjected to strong ground shaking during earthquakes. Based on the site topography, it is our opinion that there is a low potential for liquefaction-induced lateral spreading.

4.1.5 Flooding

According to the Federal Emergency Management Agency (Map Number 06001C0289G Effective Date August 3, 2009), the project site is located within an area to be outside the 0.2% annual chance floodplain; however, the Civil Engineer should review pertinent information relating to possible flood levels for the Property based on final pad elevations and provide appropriate design measures for development of the project, if necessary.

4.2 EXPANSIVE SOILS

Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations.

Successful construction on expansive soils requires special attention during grading. It is imperative to keep exposed soils moist by occasional sprinkling. If the soils dry, it is extremely difficult to remoisturize the soils (because of their clayey nature) without excavation, moisture conditioning, and recompaction.

Conventional grading operations, incorporating fill placement specifications tailored to the expansive characteristics of the soil and use of a mat foundation are common, generally cost-effective measures to address the expansive potential of the foundation soils. The CPT data suggests clayey soils are present onsite, which may be potentially expansive based on their flood plain origin. Laboratory testing of clayey fill on nearby sites found that the soil was moderate to

highly expansive. The soil expansion potential of the Property soils should be evaluated at the time of design-level study and mitigated during remedial grading activities.

4.3 EXISTING FILLS

The Property currently contains existing structures. As such, buried foundation elements, underground utilities and undocumented surficial fill are anticipated throughout the site.

Existing fills could undergo vertical movement that is not easily characterized and could ultimately be inadequate to effectively support the proposed building loads. In general, undocumented fills should be excavated and, if deemed suitable for reuse, replaced as engineered soil fill. The soil encountered in the upper 5 feet of the CPT soundings can be indicative of undocumented fill within the site; however, the extent and quality of existing fills should be evaluated at the time of design-level study and mitigated as appropriate during remedial grading activities.

4.4 STATIC AND PERCHED GROUNDWATER

Groundwater was measured during the field exploration between 15 and 31 feet below the existing ground surface. Plate 1.2 of the Seismic Hazard Zone Report for the Hayward Quadrangle (2003) indicates historic groundwater highs between 30 and 40 feet below the ground surface. Thus, shallow groundwater is present at the site.

A groundwater level of 15 feet below the existing ground surface may be conservatively considered for preliminary design purposes. Fluctuations in groundwater levels should be expected during seasonal changes or over a period of years because of precipitation changes, perched zones, changes in drainage patterns, and irrigation.

4.5 CORROSIVITY CONSIDERATIONS

Corrosivity testing was not performed as part of this preliminary study. Laboratory testing and analysis to assess the corrosivity potential of near-surface soils should be performed in the design-level study. In general, soil samples are tested for redox potential, pH, resistivity, sulfide, soluble sulfate, and chloride ion concentrations to help determine corrosivity considerations for concrete and metal buried or in contact with soil.

4.6 CONCLUSIONS

Based on the findings of this preliminary study, it is our opinion that the Property is suitable for the proposed residential development. The potential geotechnical issues for the site are:

- Presence of potentially expansive soils.
- Presence of man-made undocumented fill materials and buried structures or utilities.

A design-level geotechnical study should be performed as part of the on-going planning process, and should include a subsurface exploration and laboratory testing to provide data for the preparation of specific recommendations regarding site grading, foundations, and drainage for the proposed development. The study should include a more detailed evaluation of the above-described geotechnical issues and provide recommendations to mitigate the potential geotechnical/geological hazards, as appropriate.

5.0 PRELIMINARY RECOMMENDATIONS

The following recommendations are for initial land planning, estimating and design purposes. Final recommendations regarding site grading and foundation construction will be provided after the additional site-specific exploration has been completed.

5.1 DEMOLITION AND STRIPPING

Site demolition includes the removal of structures, foundations, and buried structures, including abandoned utilities, wells, septic tanks and leach fields, if any exist. Near-surface soft compressible soils and surficial debris should be also removed from locations to be graded, from areas to receive fill or structures, or those areas to serve as borrow. The depth of removal of such materials should be determined by the Geotechnical Engineer in the field at the time of grading.

Any existing vegetation should be removed from areas to receive fill or improvements, or those areas to serve for borrow material. Tree roots should be removed to a depth of at least 3 feet below existing grade. Subject to approval by the Landscape Architect, strippings and organically contaminated soils can be used in landscape areas. Otherwise, such soils should be removed from the project site. Any topsoil that will be retained for future use in landscape areas should be stockpiled in areas where it will not interfere with grading operations.

All excavations from demolition and stripping below design grades should be cleaned to a firm undisturbed soil surface determined by the Geotechnical Engineer. The exposed surface should then be scarified, moisture conditioned, and backfilled with compacted engineered fill. No loose or uncontrolled backfilling of depressions resulting from demolition or stripping is permitted.

5.2 EXISTING FILL AND LOOSE SOIL

The CPT detected small lenses of sand and silty sand in the upper 5 feet of the exploration. These soils may represent a shallow fill layer or the former surface and near soils from the former orchard use. The extent and density of these soils should be evaluated during the design-level exploration. Based on the findings of the exploration and the planned site grading, all or some portion of the loose soil may required and should be subexcavation to underlying firm native soils as approved by the Geotechnical Engineer.

5.3 SELECTION OF MATERIALS

With the exception of construction debris (wood, brick, asphalt, concrete, metal, etc.), trees, high organic content soil (soil which contains more than 3 percent organic content by weight), and environmentally impacted soils (if any), we anticipate the site soils are suitable for use as engineered fill. Other materials and debris, including trees with their root balls, should be removed from the project site. If reuse of select materials such as asphalt and concrete onsite as engineered fill is desired, site-specific breakdown, blending and placement recommendations can be developed.

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

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

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

5.4 FILL PLACEMENT

For land planning and cost estimating purposes, the following compaction control requirements should be anticipated for general fill areas:

Test Procedures:	ASTM D-1557.
Required Moisture Content:	Not less than 3 percentage points above optimum moisture content.
Minimum Relative Compaction:	Not less than 90 percent.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material.

Successful construction on expansive soils requires special attention during grading. It is imperative to keep exposed soils moist by occasional sprinkling. If the soils dry, it is extremely difficult to remoisturize the soils (because of their clayey nature) without excavation, moisture conditioning, and recompaction. Additional compaction requirements may need to be developed during our detailed exploration to address potentially expansive soil.

5.5 2013 CALIFORNIA BUILDING CODE SEISMIC PARAMETERS

Considering nearby faults, we provide the 2013 CBC seismic parameters in Table 5.5-1 for your use in the preliminary foundation design. The seismic design parameters presented in the 2013 CBC are based upon the 2012 International Building Code and the ASCE standard "Minimum Design Loads for Buildings and Other Structures" (ASCE 7-10) published in 2010. To obtain 2013 CBC seismic parameters, we used the USGS Seismic Design Map online tool to develop ASCE 7-10 seismic design parameters.

TABLE 5.5-1
2013 CBC Seismic Design Parameters
Latitude: 37.651204 Longitude: -122.069414

Parameter	Value
Site Class	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	2.42
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	1.01
Site Coefficient, F_A	1.00
Site Coefficient, F_V	1.50
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	2.42
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	1.51
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.61
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	1.01
Mapped MCE Geometric Mean Peak Ground Acceleration (g)	0.93
Site Coefficient, F_{PGA}	1.00
MCE Geometric Mean Peak Ground Acceleration, PGA_M (g)	0.93
Long period transition-period, T_L	8 sec

5.6 PRELIMINARY FOUNDATION DESIGN

Although the preliminary structural concept and foundation loads have not yet been developed, based on our experience with similar projects, we anticipate the proposed structures may be supported on a stiff structural mat foundation or post-tensioned mats. Alternatively, conventional footing systems with slab-on-grade flooring may be appropriate for the proposed structures. Suitability of foundation types should be re-assessed during the design-level phase based on design structural loads and laboratory testing of site soils.

5.6.1 Conventionally Reinforced Structural Mat Foundation

In order to reduce the effects of potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. This can be

accomplished with construction of relatively rigid mat foundations, such as post-tensioned structural mats.

A minimum mat thickness of 12 inches designed to impose an average bearing pressure of at most 1,500 pounds per square foot (psf) for dead-plus-live loads may be used for preliminary planning purposes.

5.6.2 Conventional Footing System with Slab-on-Grade Flooring

The proposed structures may also be supported by a conventional footing system depending on design loads. A maximum allowable bearing pressure of 2,500 psf for dead-plus-live loads for footings should be anticipated for preliminary purposes, which may be increased by one-third when considering total loads including wind or seismic. The footings should be embedded at least 24 inches below lowest adjacent soil subgrade and should be at least 24 inches in width. Deeper footings may be recommended if the soils are more expansive than anticipated.

For preliminary purposes, we recommend concrete slabs be at least 6 inches thick. The slab reinforcing should be designed by the Structural Engineer, as needed. As a minimum, the slab reinforcement should consist of No. 4 bars spaced 16 inches on-center each way. Low-expansive fill with a thickness of approximately 18 inches could be considered to reduce the potential impacts of expansive soil on the floor slab.

5.7 PRELIMINARY PAVEMENT DESIGN

As applicable, the following preliminary pavement section for new streets has been determined for a Traffic Index of 4 through 7, an assumed R-value of 5, and in accordance with the design methods contained in the Caltrans Highway Design Manual. Preliminary recommendations are presented in the table below.

TABLE 5.7-1
Preliminary Pavement Sections

Traffic Index	HMA (inches)	AB (inches)
4.0	2½	8
5.0	3	10
6.0	3½	13
7.0	4	16

Notes: HMA – Hot Mix Asphalt
AB – Caltrans Class 2 aggregate base (R-value of 78 or greater)

The above preliminary pavement sections are provided for estimating only. We recommend the actual subgrade material be tested for R-value once established and the Traffic Index and minimum pavement section(s) should be confirmed by the Project Civil Engineer and City of Hayward.

5.8 SURFACE DRAINAGE

The building pads must be positively graded at all times to provide for rapid removal of surface water runoff from the foundation systems and to prevent ponding of water under floors or seepage toward the foundation systems at any time during or after construction. Ponding of stormwater must not be permitted on the building pads during prolonged periods of inclement weather. We suggest that finished grades have slopes of at least 5 percent within 10 feet from the exterior walls at right angles to them to allow surface water to drain positively away from the structures. For paved areas, the slope gradient can be reduced to 2 percent. All roof stormwater should be collected and directed to downspouts.

Stormwater from roof downspouts should not be allowed to discharge onto splashblocks or into landscape areas within 5 feet from the foundation; rather, they should discharge through the curb and into the street or onto an impermeable material that drains into the street. ENGEO should be consulted to develop recommendations if these criteria are not feasible.

5.9 REQUIREMENTS FOR LANDSCAPING IRRIGATION

For planning purposes, vegetation should not be planted immediately adjacent to the structures. If planting adjacent to a building is desired, we recommend using plants that require very little moisture with drip irrigation systems. Similarly, sprinkler systems should not be installed where they may cause ponding or saturation of foundation soils within 5 feet of the walls or under the structures as ponding or saturation of foundation soils may cause loss of soil strength, and movements of the foundation and slabs.

Irrigation of landscaped areas should be strictly limited to that necessary to sustain vegetation. Excessive irrigation could result in saturating and weakening of foundation soils.

5.10 STORMWATER INFILTRATION OPPORTUNITIES AND POST-CONSTRUCTION BMPS

Based on the anticipated fines content and density, the near-surface site soils are expected to have low permeability values to handle stormwater infiltration. Post-construction BMPs should not rely on infiltration; rather, we recommend BMPs receive subdrains that discharge treated stormwater into the planned bioretention areas.

If possible, we recommend the bioretention areas and other BMPs be planned a minimum of 5 feet away from structural site improvements. Where this is not practical, bioretention areas located within 5 feet of structural onsite or offsite improvements can either:

1. Be constructed with structural side walls capable of withstanding the loads from the adjacent improvements, or

2. Incorporate filter material compacted to between 85 and 90 percent relative compaction (ASTM D1557, latest edition). Bioretention design should incorporate a waterproofing system lining the bioretention excavation. The waterproofing system should cover the bioretention area excavation in such a manner as to reduce the potential for moisture transmission beneath the adjacent improvements.

In addition, site improvements located adjacent to bioretention areas that are underlain by base rock, sand, or other imported granular materials, should be designed with a deepened edge that extends to the bottom of the imported material underlying the improvement. Where adjacent site improvements include streets steeper than 3 percent or design elements that will experience lateral loads (such as from impact or traffic patterns), additional design considerations may be required.

Given the nature of bioretention systems and possible proximity to improvements, we recommend ENGEO consult further with you as needed, review design plans, and provide testing and observation services during the installation of linings, compaction of the filter material, and connection of designed drains (if implemented).

It should be noted that the contractor is responsible for conducting all excavation and shoring in a manner that does not cause damage to adjacent improvements during construction and future maintenance of the bioretention areas. As with any excavation adjacent to improvements, the contractor should minimize the exposure time such that the improvements are not detrimentally impacted.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This preliminary report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this preliminary report are solely professional opinions.

The professional staff of ENGEO strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

This preliminary report is based upon field and other conditions discovered at the time of preparation of ENGEO's report. This document must not be subject to unauthorized reuse that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time. Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must

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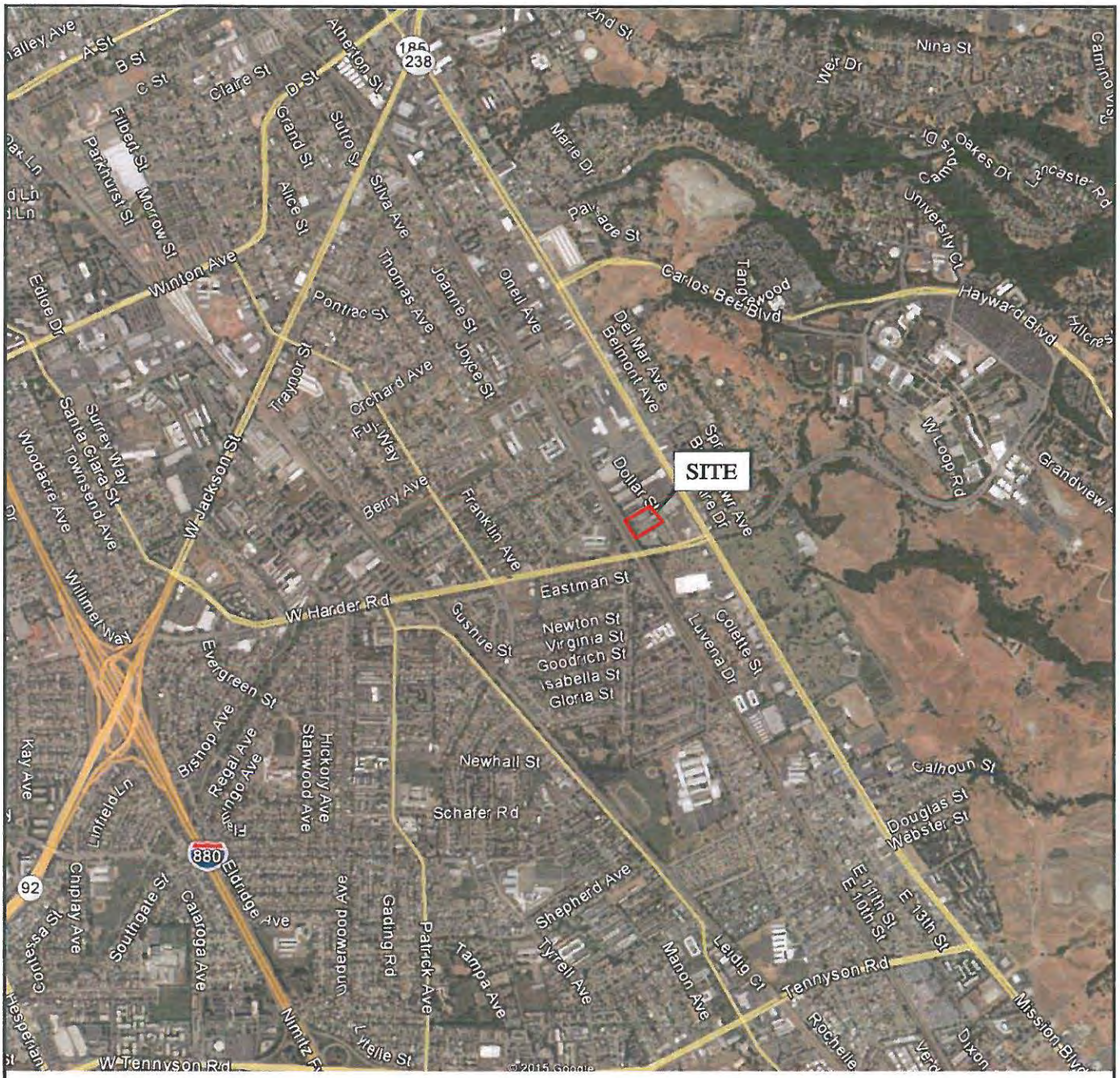
FIGURES

LIST OF FIGURES



N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GOOGLE EARTH PRO

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VICINITY MAP

DOLLAR STREET

HAYWARD, CALIFORNIA

PROJECT NO.: 12257.000.000		FIGURE NO. 1
SCALE: AS SHOWN		
DRAWN BY: SRP	CHECKED BY: BF	

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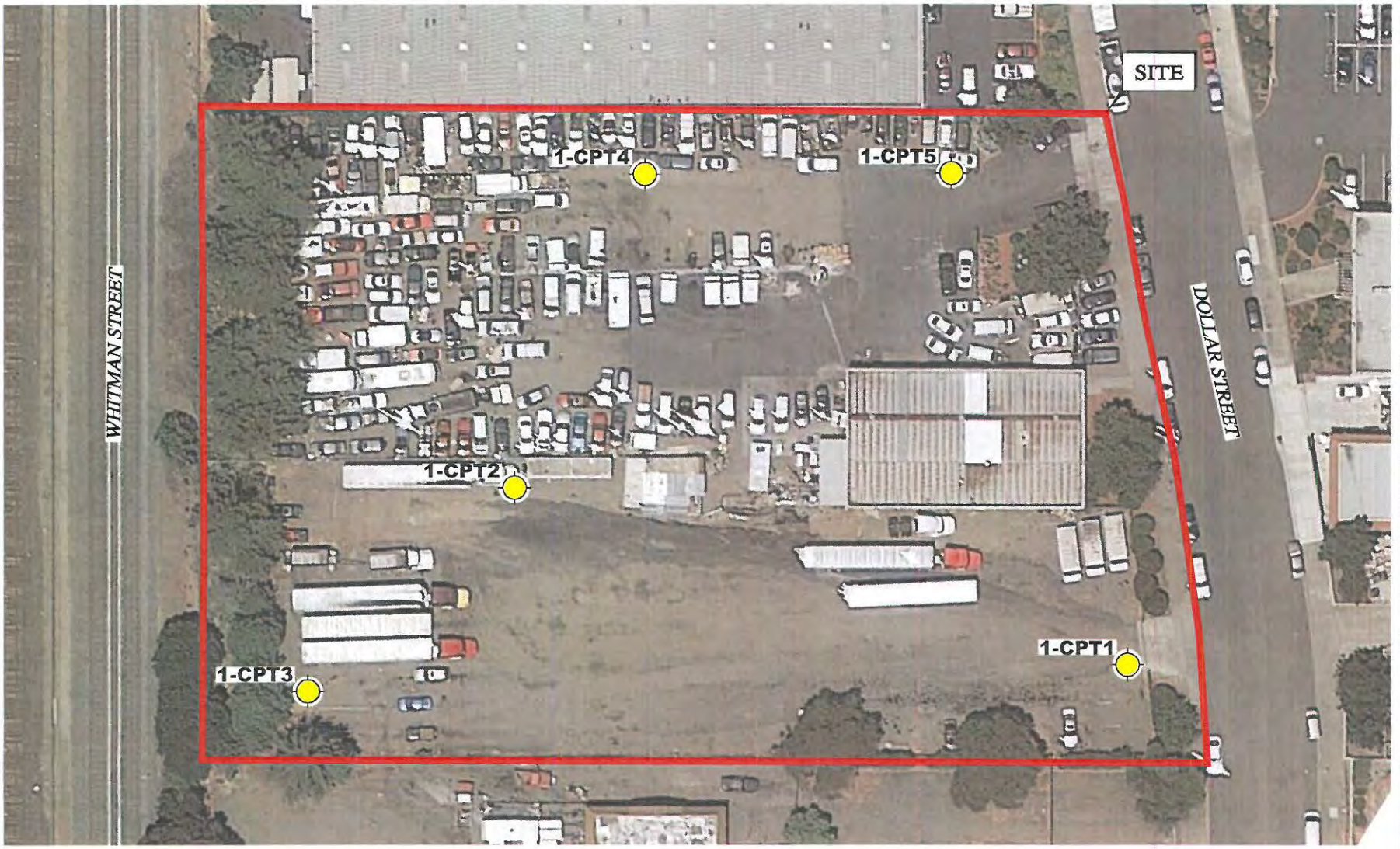

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

1-CPT5 CONE PENETRATION TEST

N

0 FEET 60

0 METERS 30

BASE MAP SOURCE: GOOGLE EARTH PRO

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SITE PLAN

DOLLAR STREET

HAYWARD, CALIFORNIA

PROJECT NO.: 12257.000.000		FIGURE NO. 2
SCALE: AS SHOWN		
DRAWN BY: SRP	CHECKED BY: BF	

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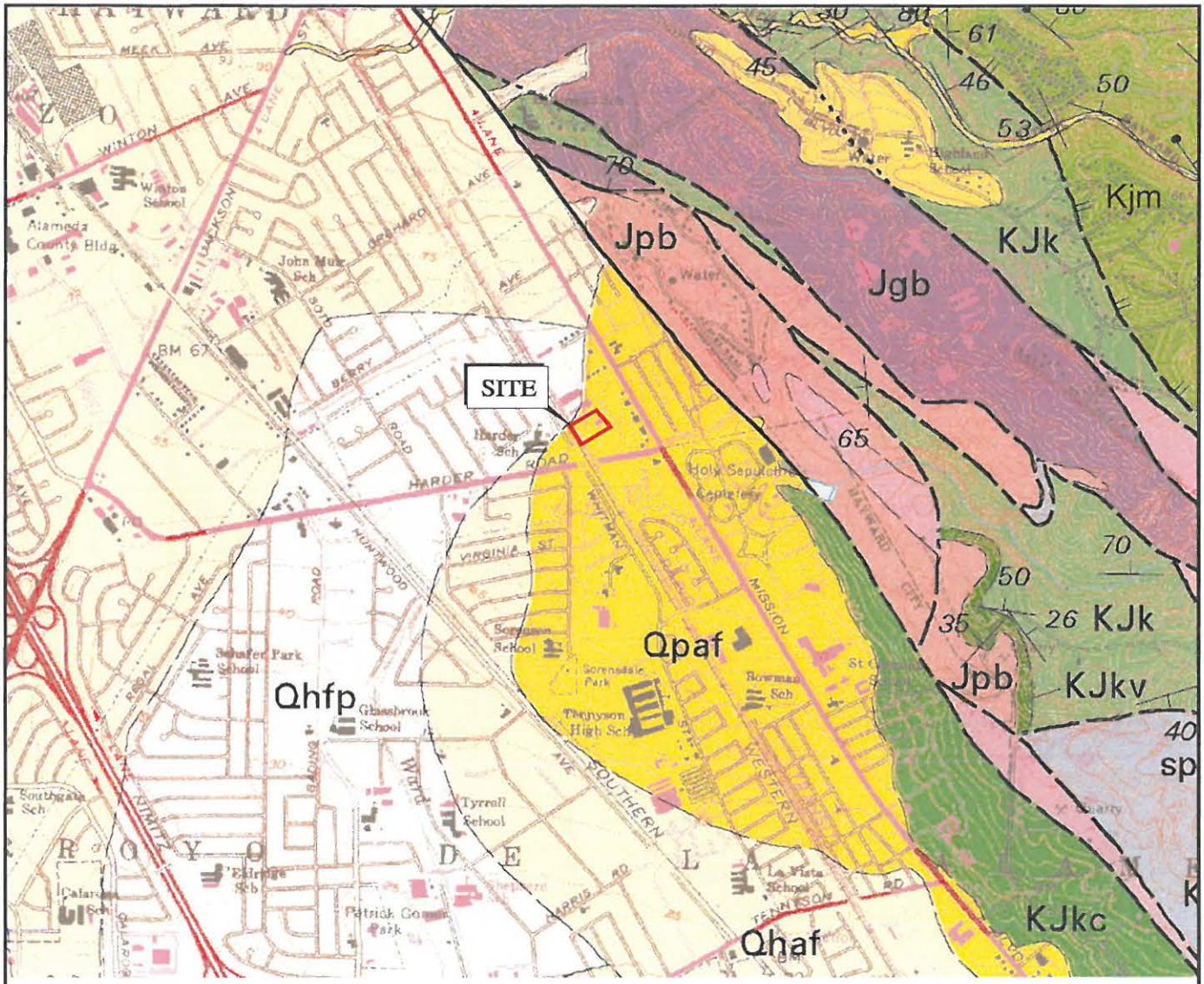

EXPLANATION

Qhaf	ALLUVIAL FAN & FLUVIAL DEPOSITS (HOLOCENE)
Qpaf	ALLUVIAL FAN & FLUVIAL DEPOSITS (PLESITOCENE)
Qhfp	FLOODPLAIN DEPOSITS
Kjm	JOAQUIN MILLER FORMATION
KJk	KNOXVILLE FORMATION
KJkc	CONGLOMERATE
KJkv	VOLCANOCLASTIC BRECCIA
Jpb	PILLOW BASALT
Jgb	GABBRO
sp	SERPENTINITE

GEOLOGIC CONTACT-DASHED WHERE GRADATIONAL OR APPROXIMATELY LOCATED

FAULT-DASHED WHERE INFERRED, DOTTED WHERE CONCEALED, QUERIED WHERE EXISTENCE IS DOUBTFUL. SAWTEETH ARE ON UPPER PLATE OF LOW ANGLE THRUST FAULT.

STRIKE AND DIP OF STRATA

INCLINED

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GRAYMER, 2000

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REGIONAL GEOLOGIC MAP
DOLLAR STREET
HAYWARD, CALIFORNIA

PROJECT NO.: 12257.000.000
SCALE: AS SHOWN
DRAWN BY: SRP
CHECKED BY: BF

FIGURE NO. 3

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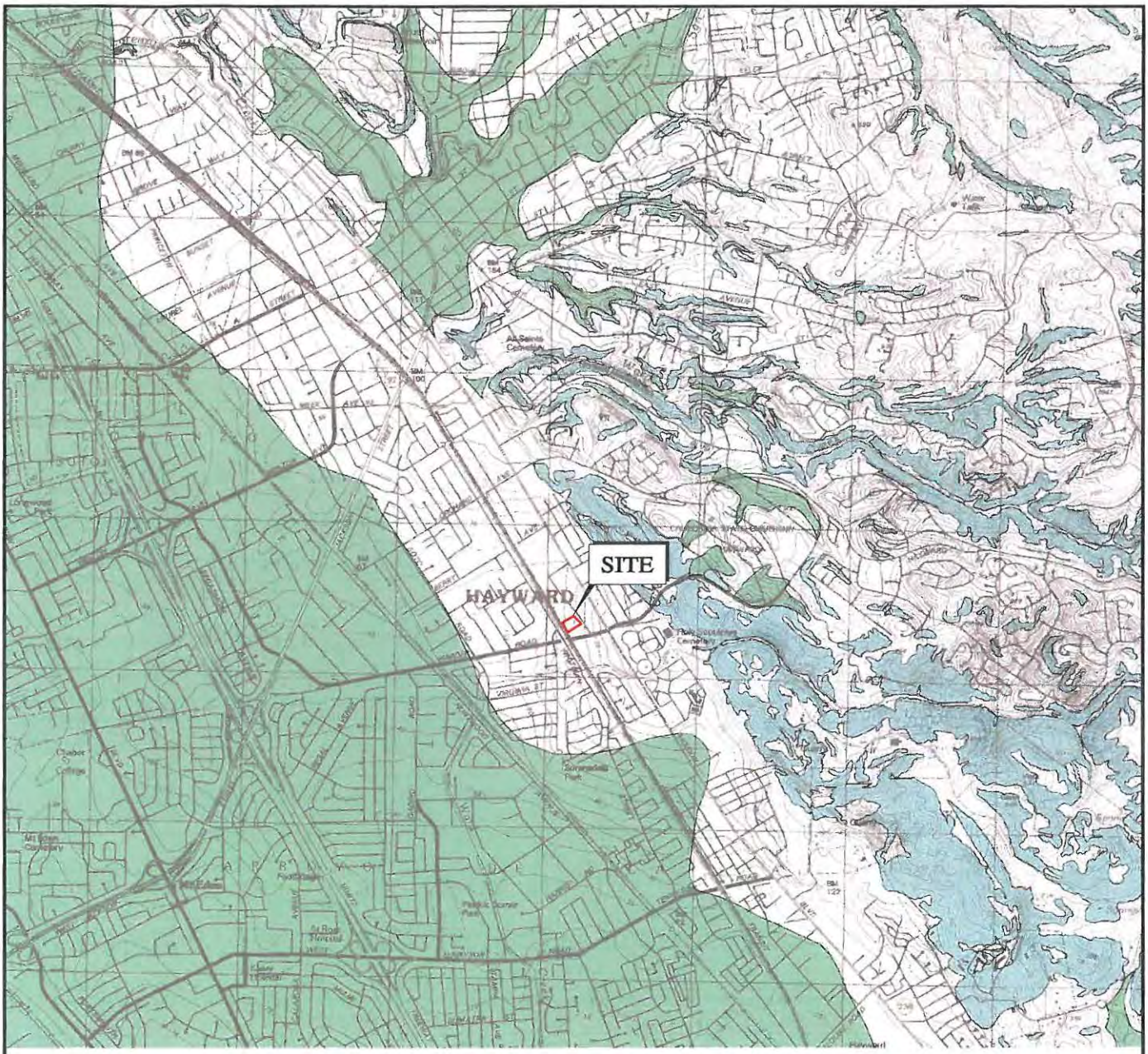
ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

LIQUEFACTION

AREAS WHERE HISTORIC OCCURRENCE OF LIQUEFACTION, OR LOCAL GEOLOGICAL, GEOTECHNICAL AND GROUNDWATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

EARTHQUAKE-INDUCED LANDSLIDES

AREAS WHERE PREVIOUS OCCURRENCE OF LANDSLIDE MOVEMENT, OR LOCAL TOPOGRAPHIC, GEOLOGICAL, GEOTECHNICAL AND SUBSURFACE WATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

N

0 FEET 4000

0 METERS 2000

BASE MAP SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY, 2006

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SEISMIC HAZARD ZONES MAP

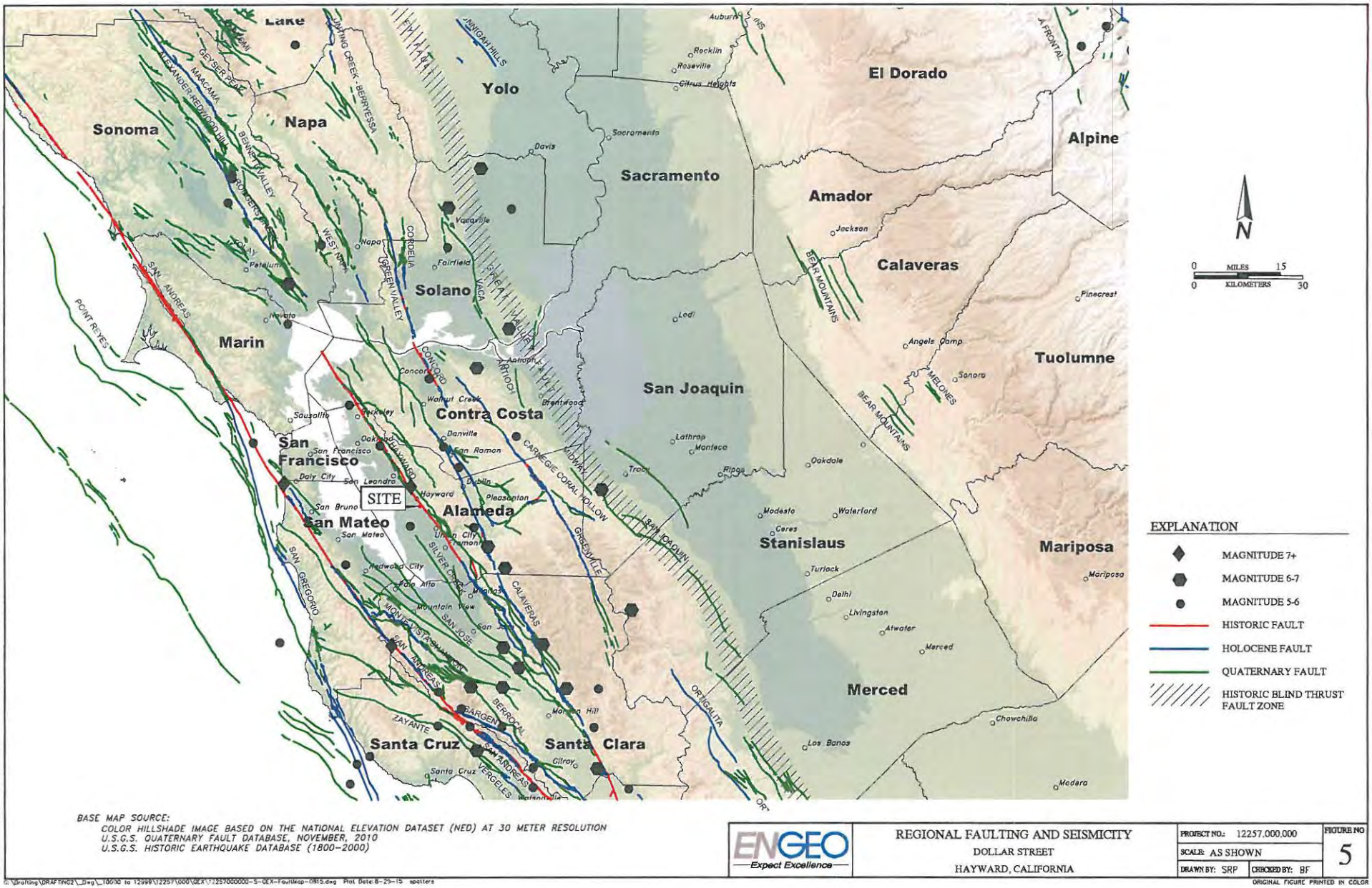
DOLLAR STREET

HAYWARD, CALIFORNIA

PROJECT NO.: 12257.000.000		FIGURE NO. 4
SCALE: AS SHOWN		
DRAWN BY: SRP	CHECKED BY: BF	

C:\Drafting\DRAFTING2_Dwg_10000 to 12999\12257\000\GEX\12257000000-4-GEX-SeismicHazardsMap-0815.dwg Plot Date: 8-25-15 spotters

ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE:
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U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800–2000)

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REGIONAL FAULTING AND SEISMICITY
DOLLAR STREET
HAYWARD, CALIFORNIA

PROJECT NO.: 12257.000.000	FIGURE NO
SCALE: AS SHOWN	5
DRAWN BY: SRP	CHECKED BY: BF

ORIGINAL FIGURE PRINTED IN COLOR

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APPENDIX A

Cone Penetration Test (CPT) Logs
(Middle Earth Geo-Testing Inc.)

APPENDIX A

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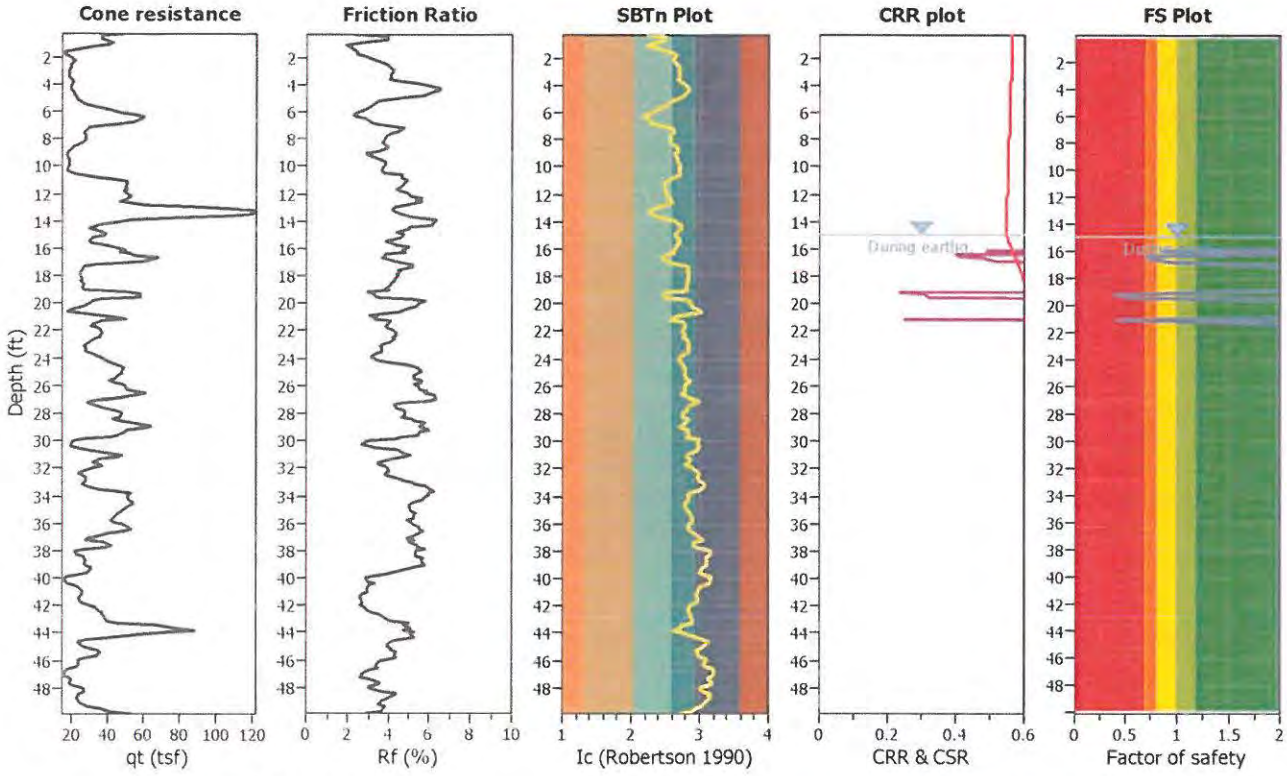
LIQUEFACTION ANALYSIS REPORT

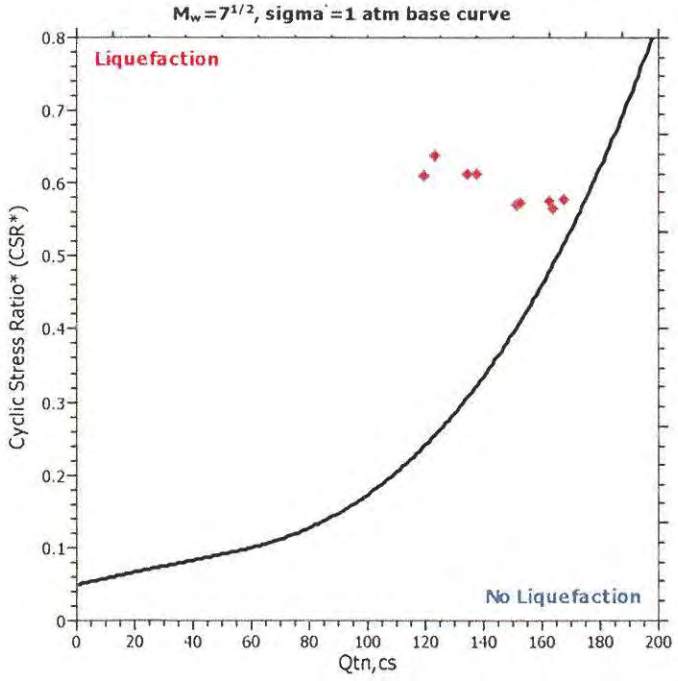
Project title : Dollar Street **Location : Hayward, CA**

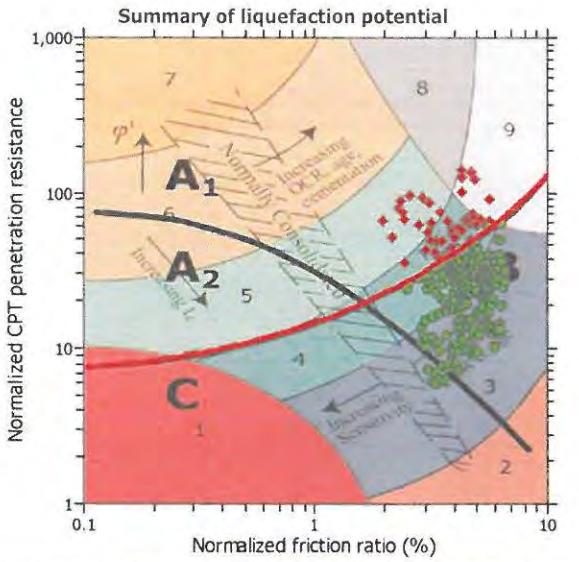
CPT file : 1-CPT01

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	25.50 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.93	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

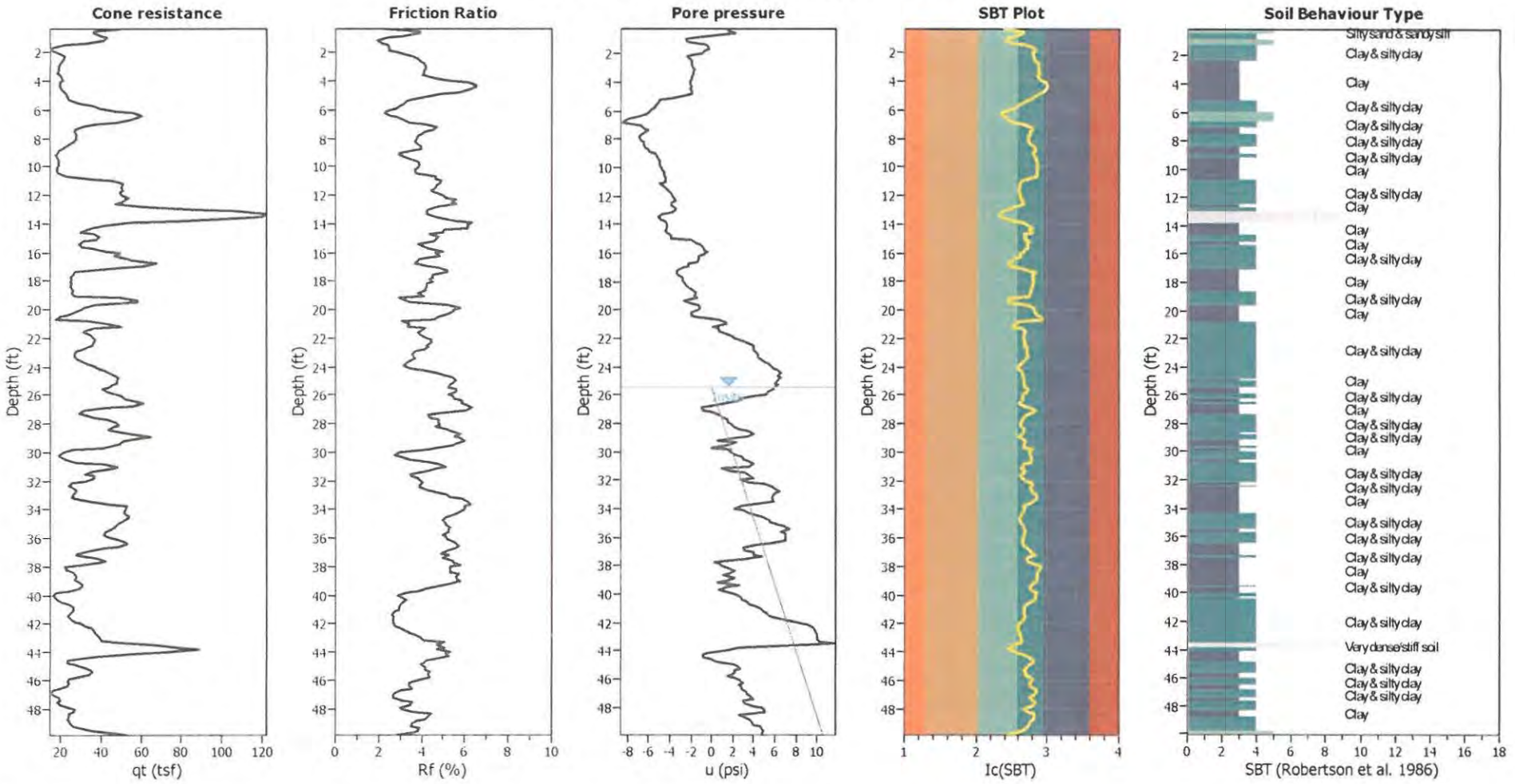






Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A': Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength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

CPT basic interpretation plots



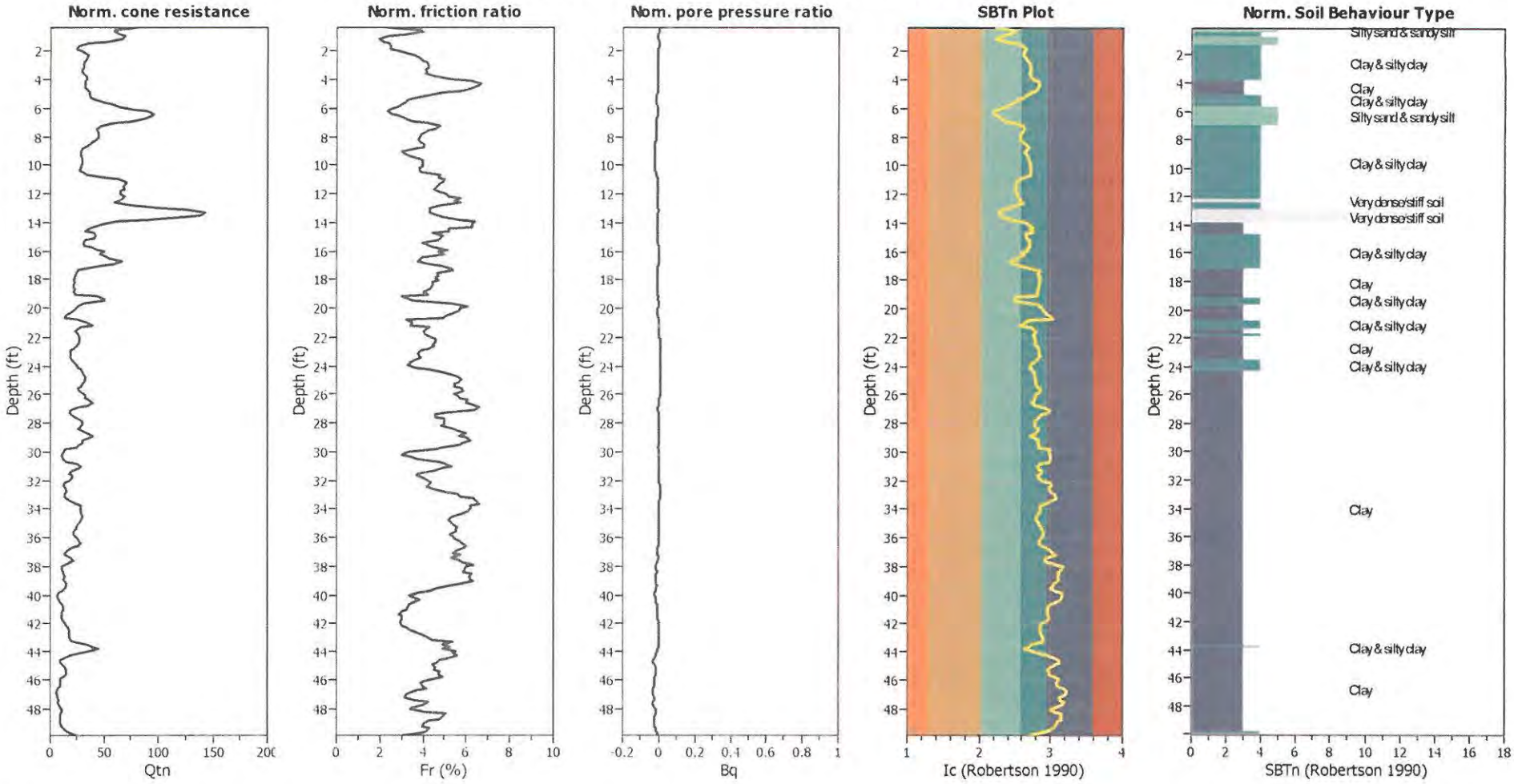
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



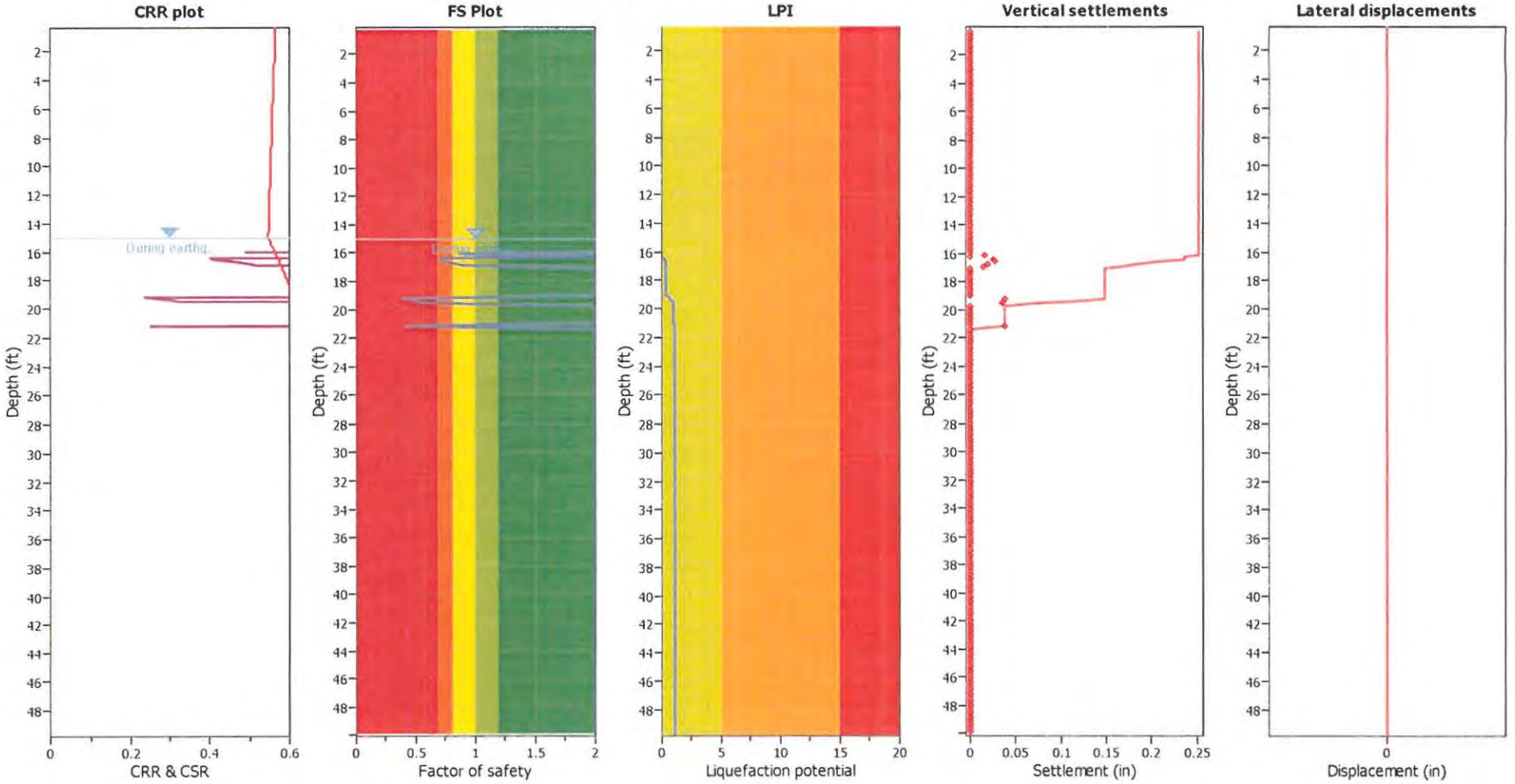
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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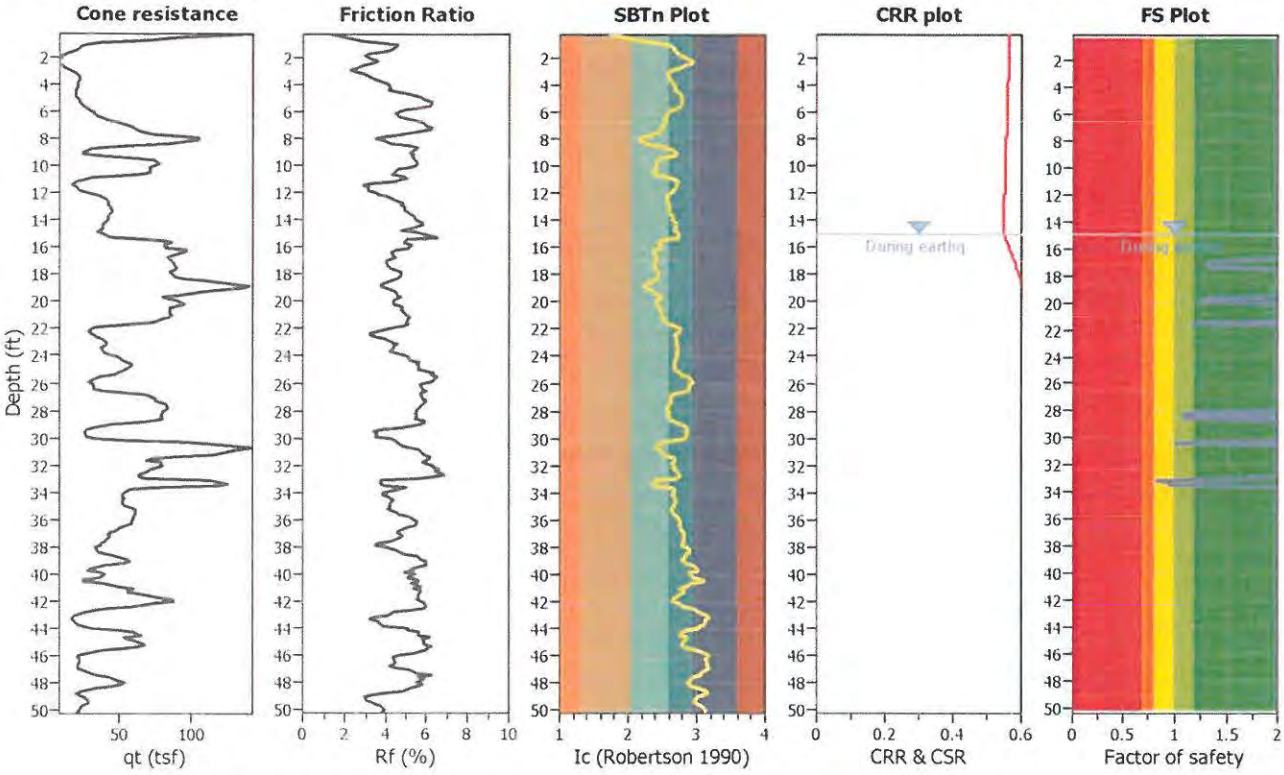
LIQUEFACTION ANALYSIS REPORT

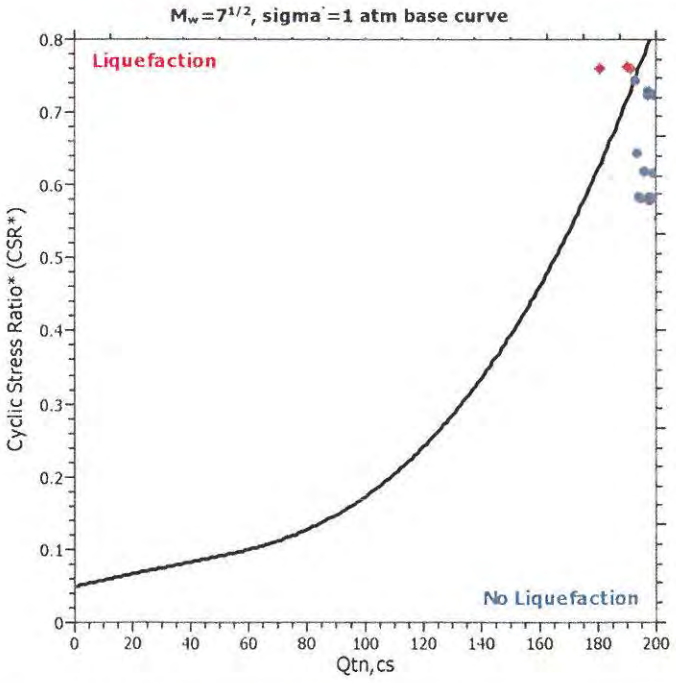
Project title : Dollar Street **Location : Hayward, CA**

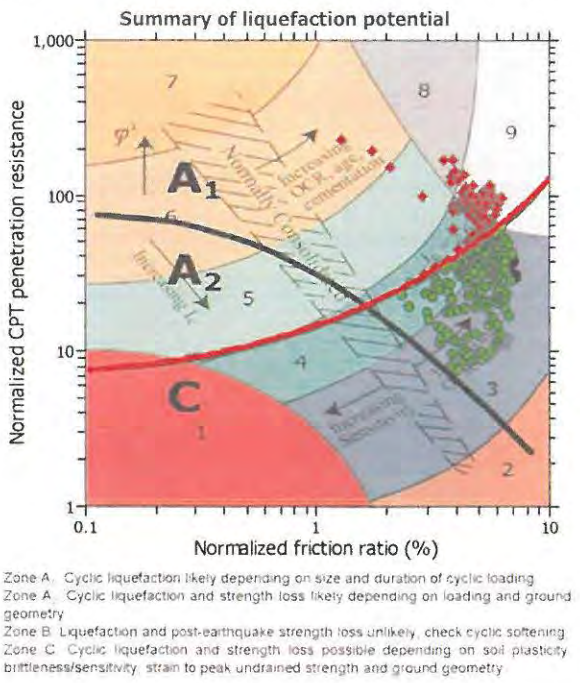
CPT file : 1-CPT02

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.93	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

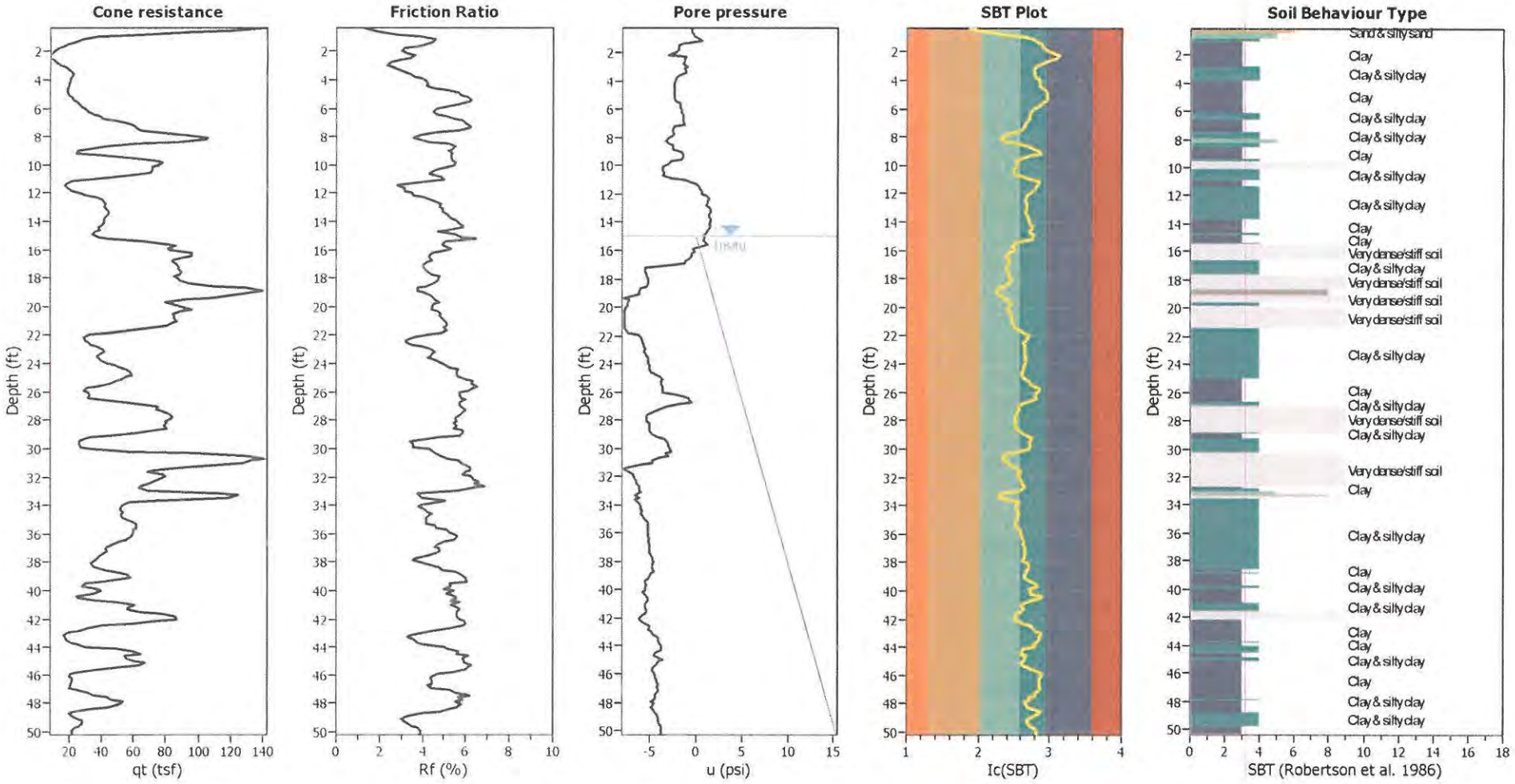






Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A': Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength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

CPT basic interpretation plots



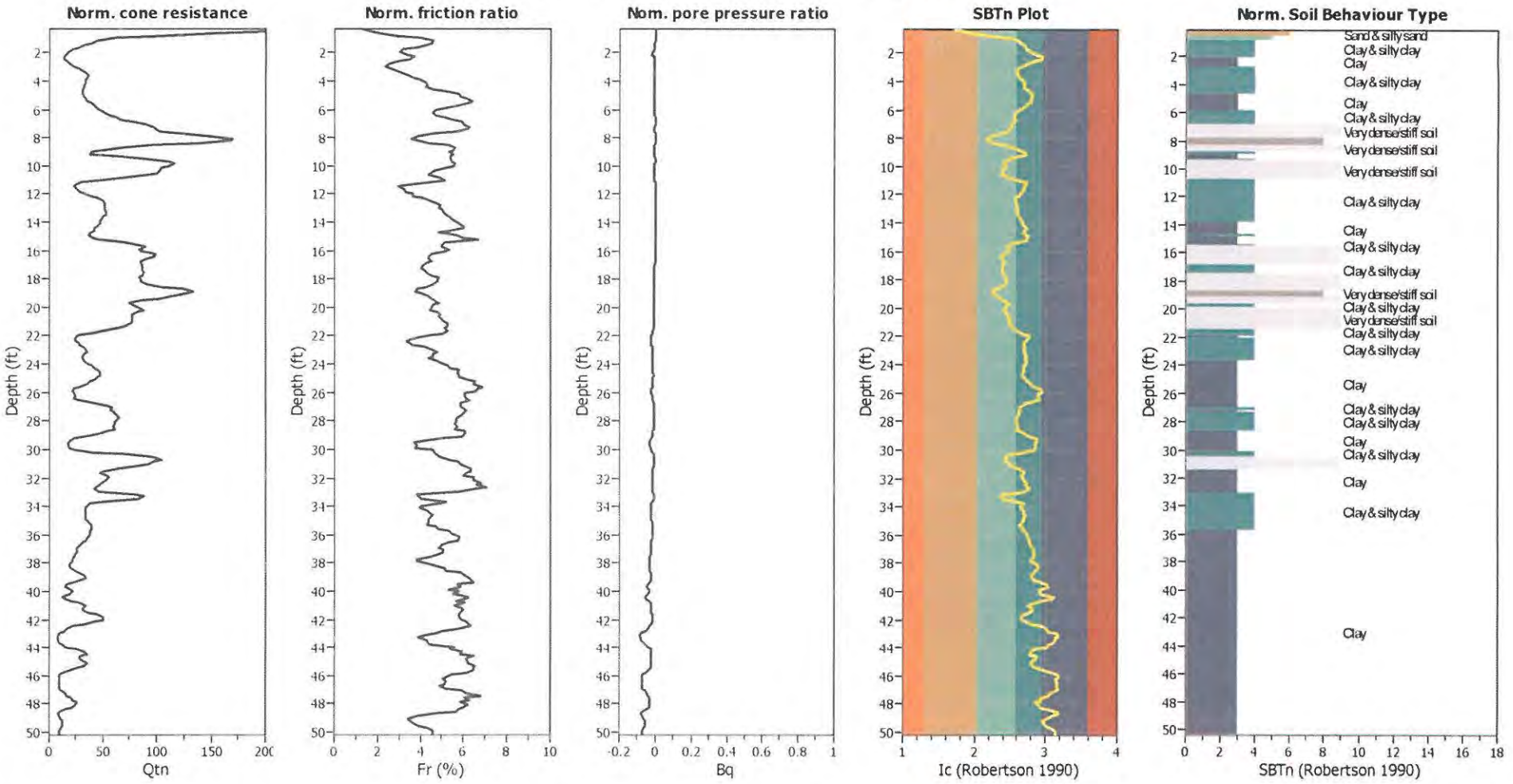
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



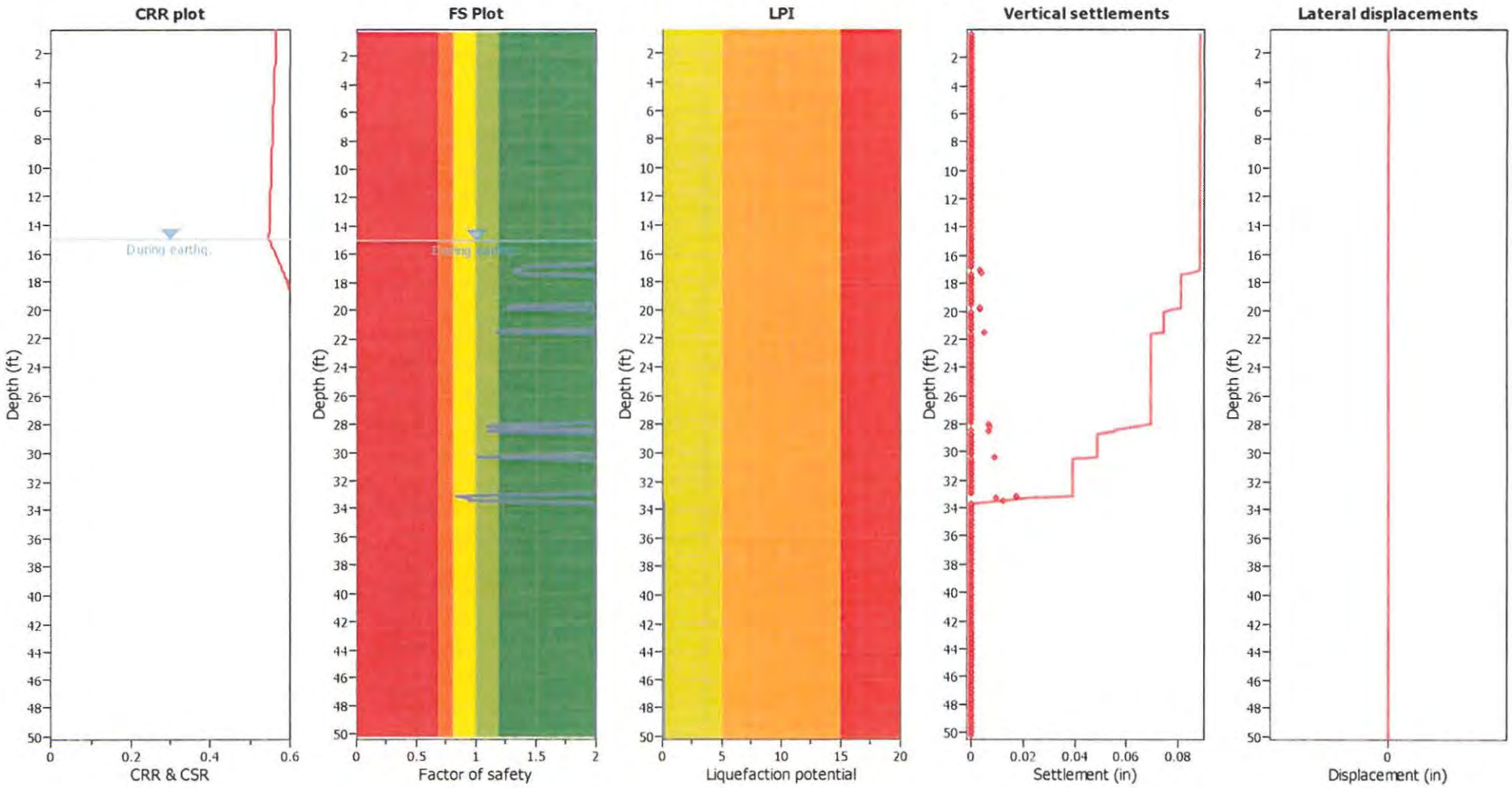
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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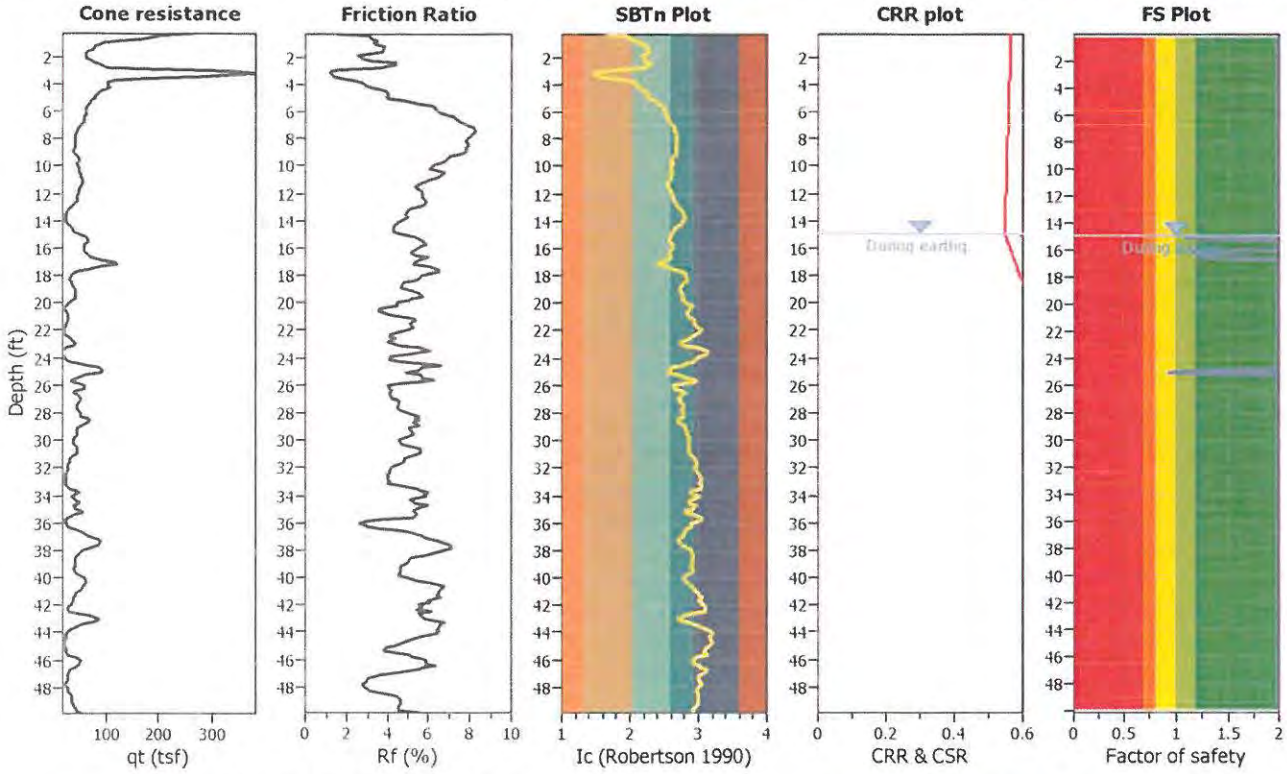
LIQUEFACTION ANALYSIS REPORT

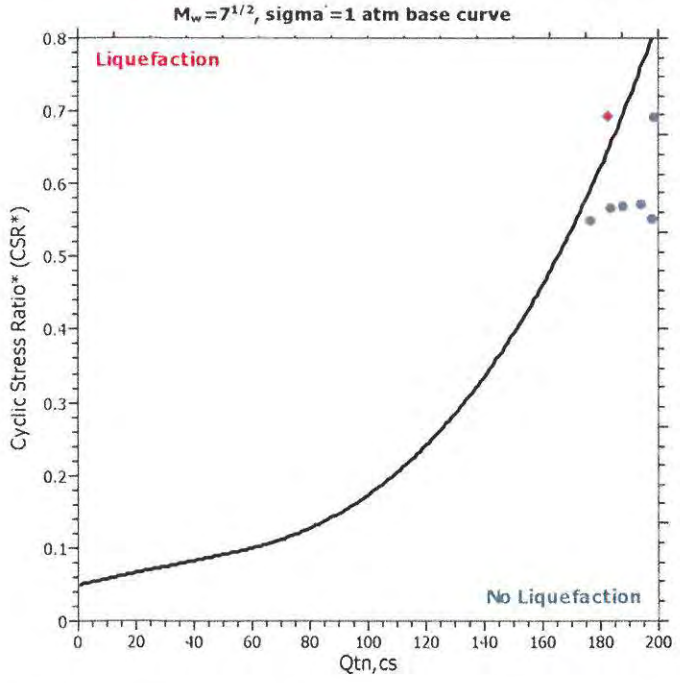
Project title : Dollar Street **Location : Hayward, CA**

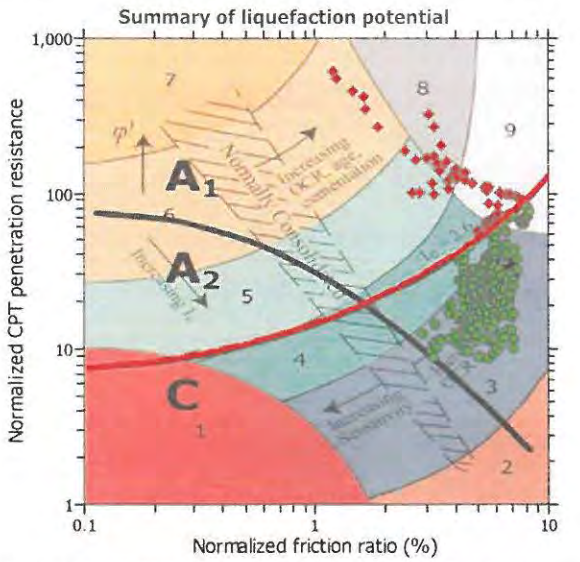
CPT file : 1-CPT03

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	25.50 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.93	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

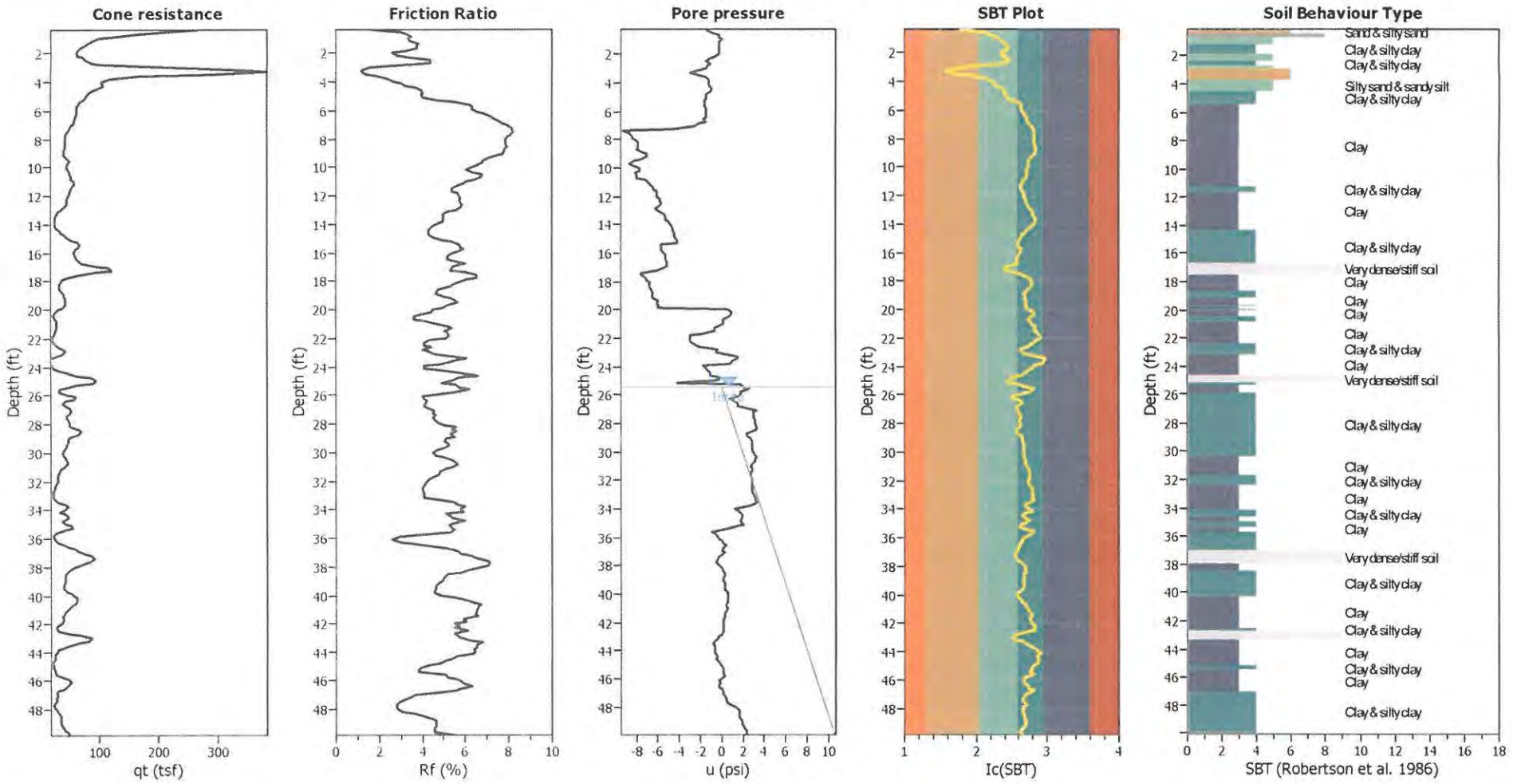






Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A': Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength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

CPT basic interpretation plots



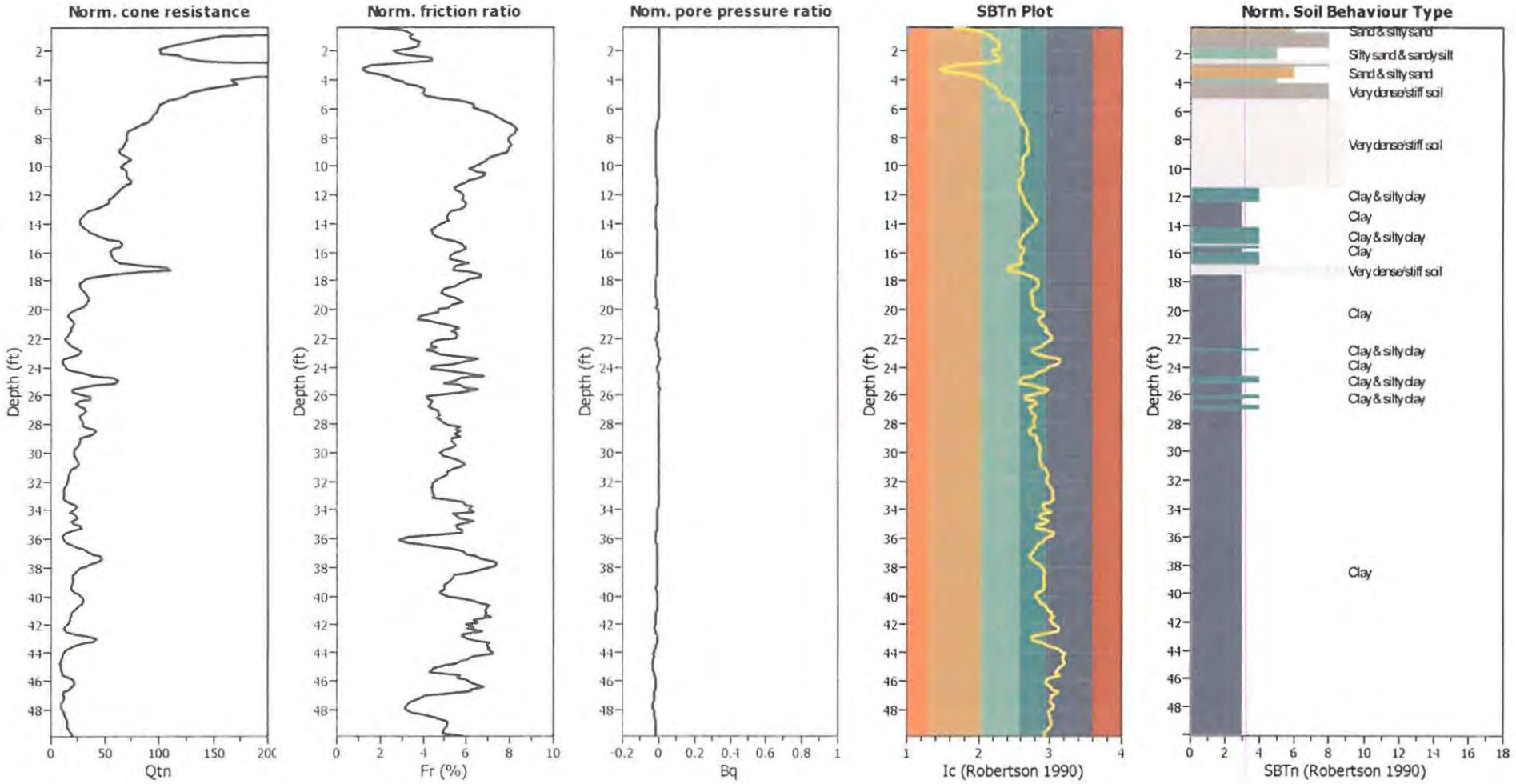
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



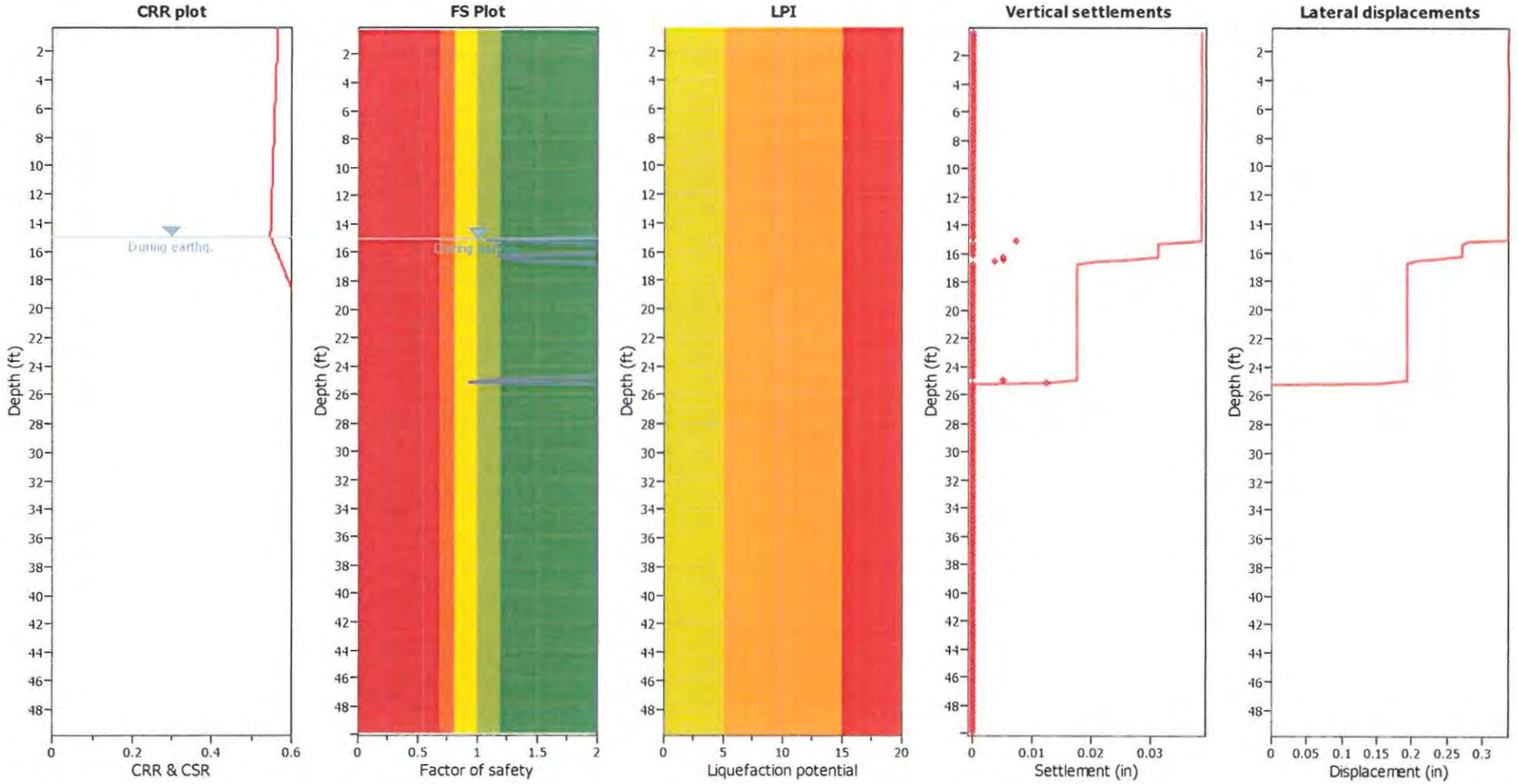
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
Expect Excellence

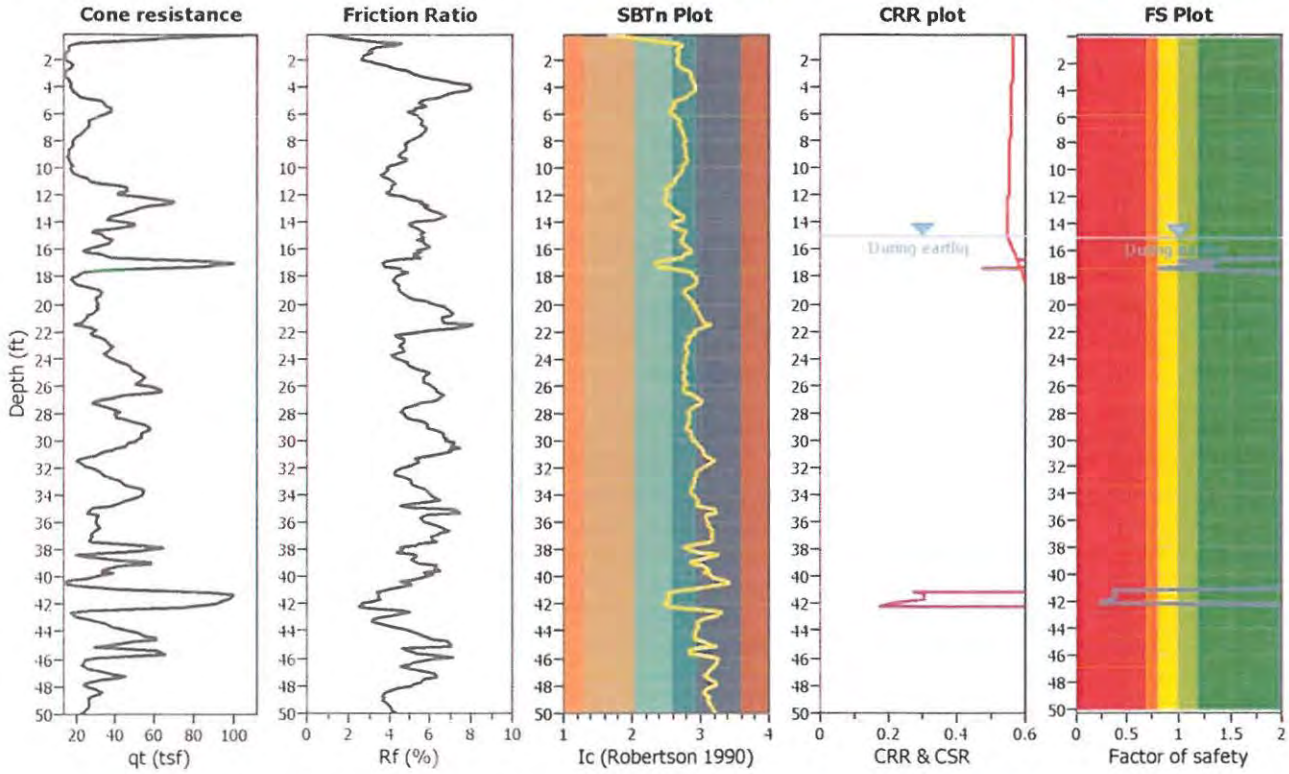
LIQUEFACTION ANALYSIS REPORT

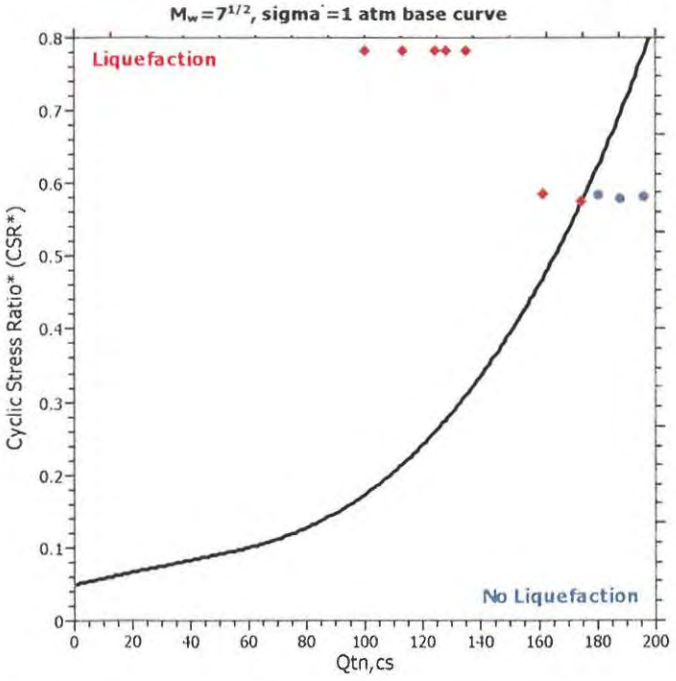
Project title : Dollar Street **Location : Hayward, CA**

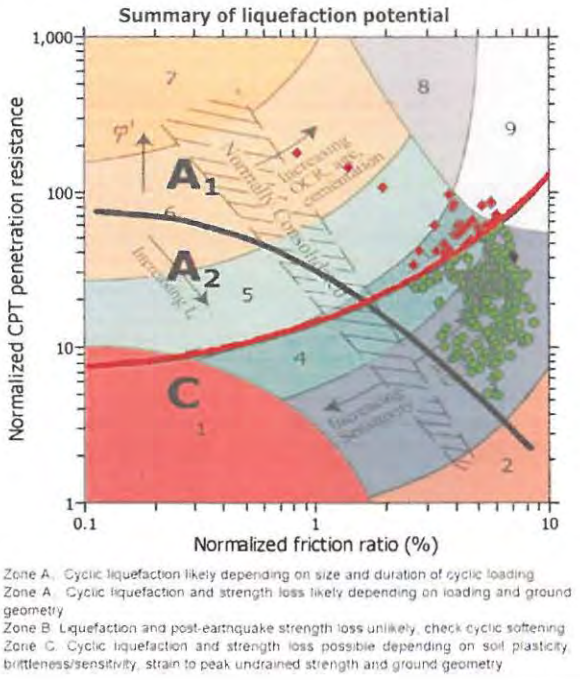
CPT file : 1-CPT04

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	37.50 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.93	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

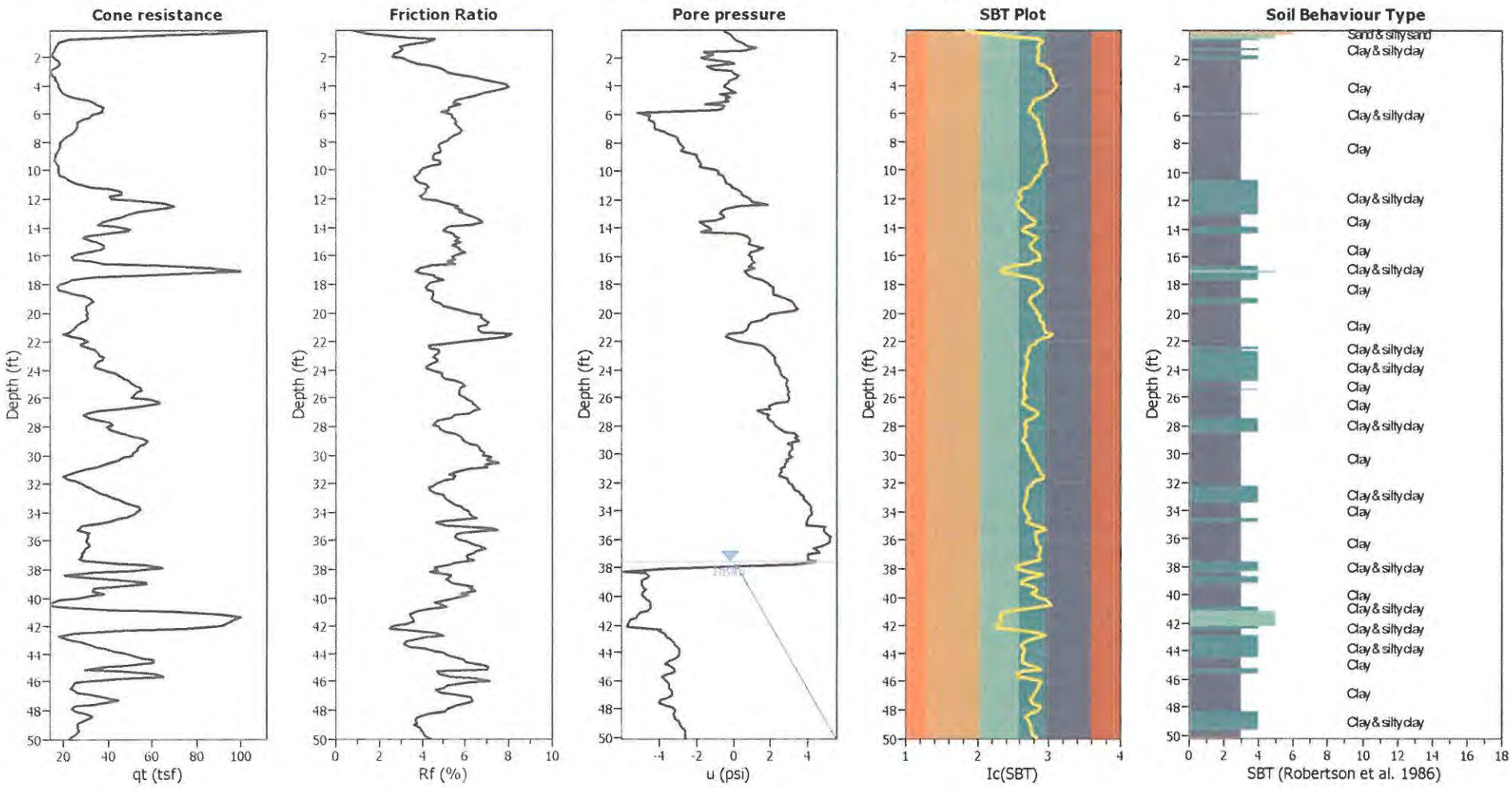






Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A': Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength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

CPT basic interpretation plots



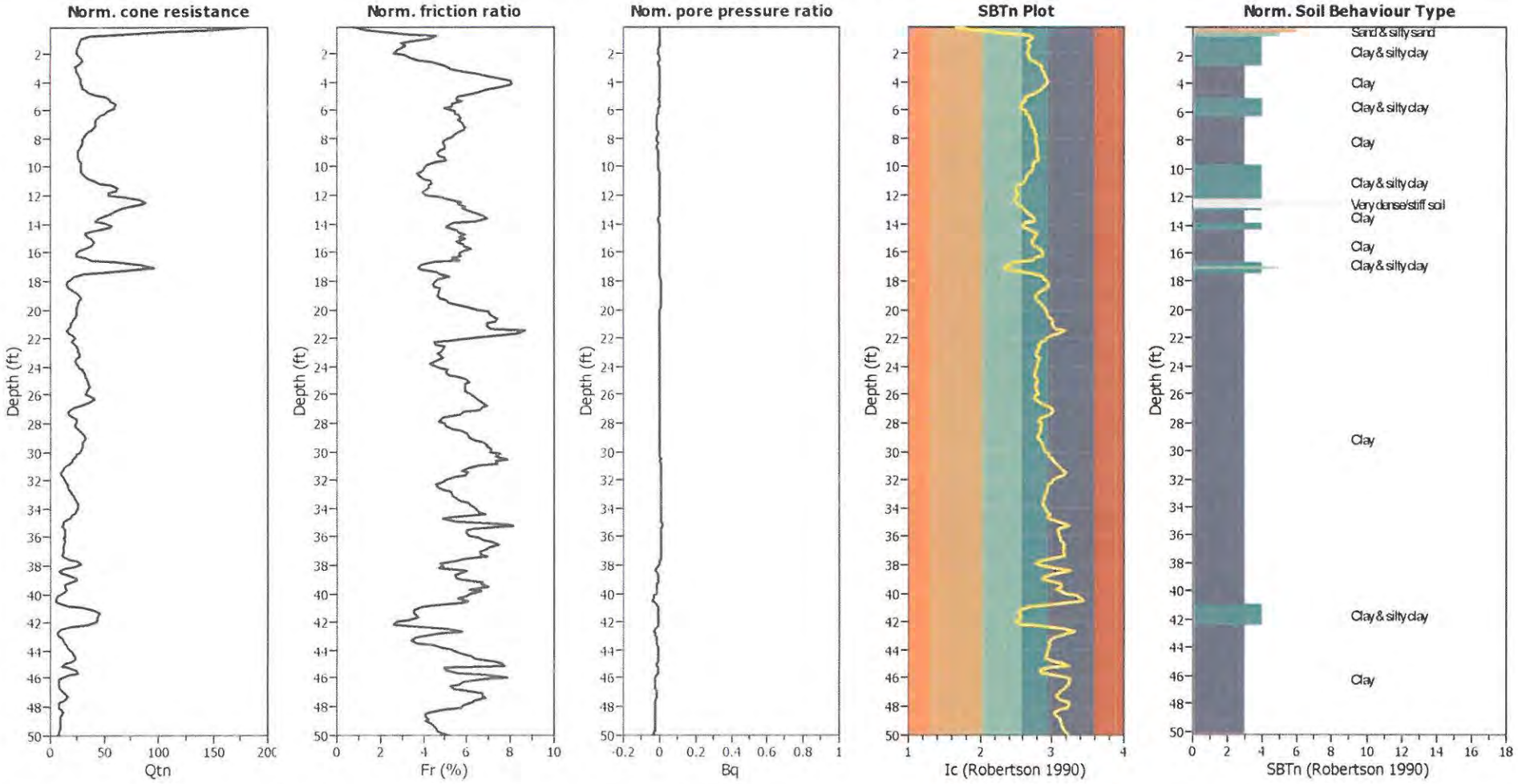
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	37.50 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



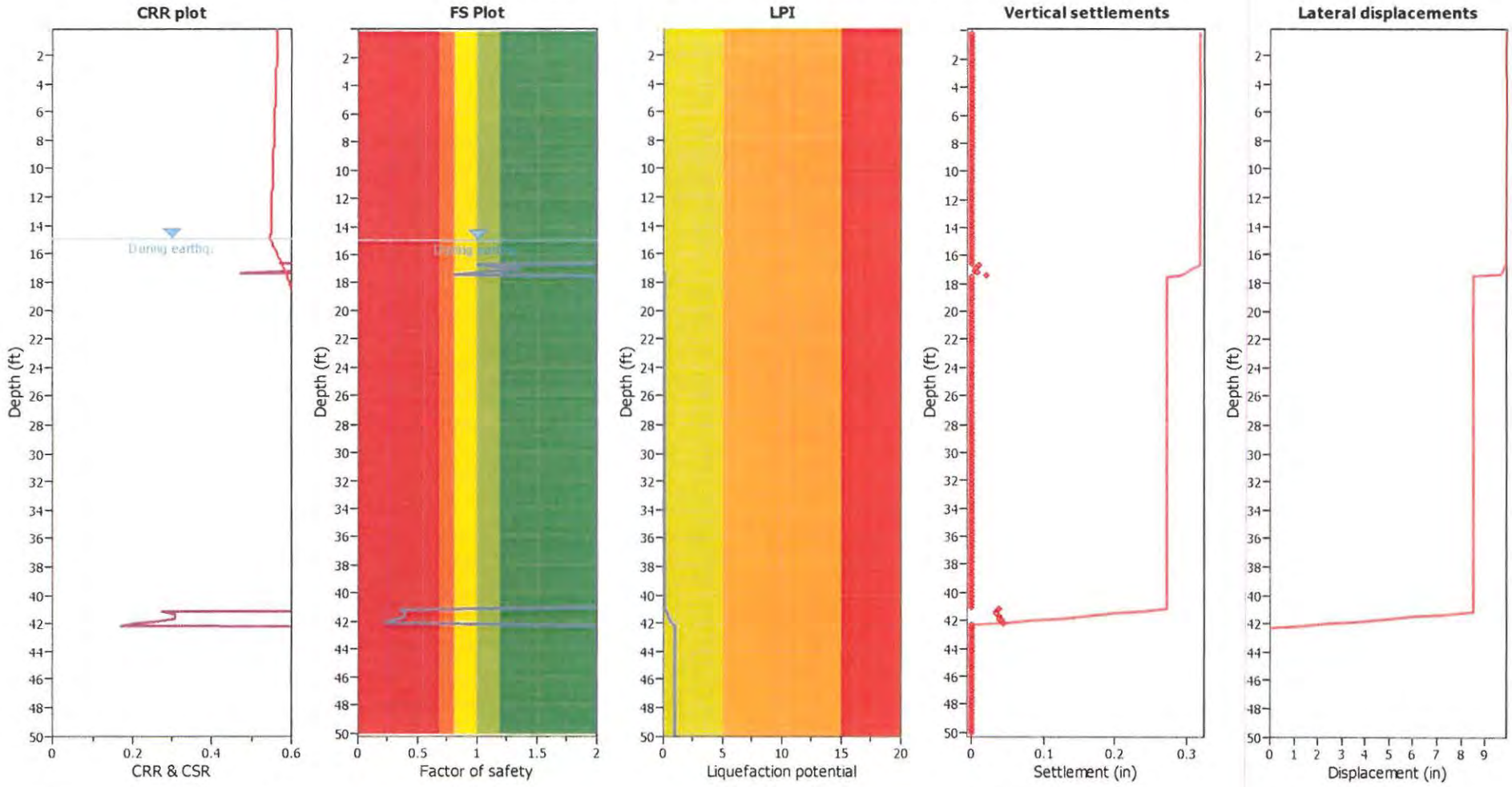
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	37.50 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	37.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

ENGEO
Expect Excellence

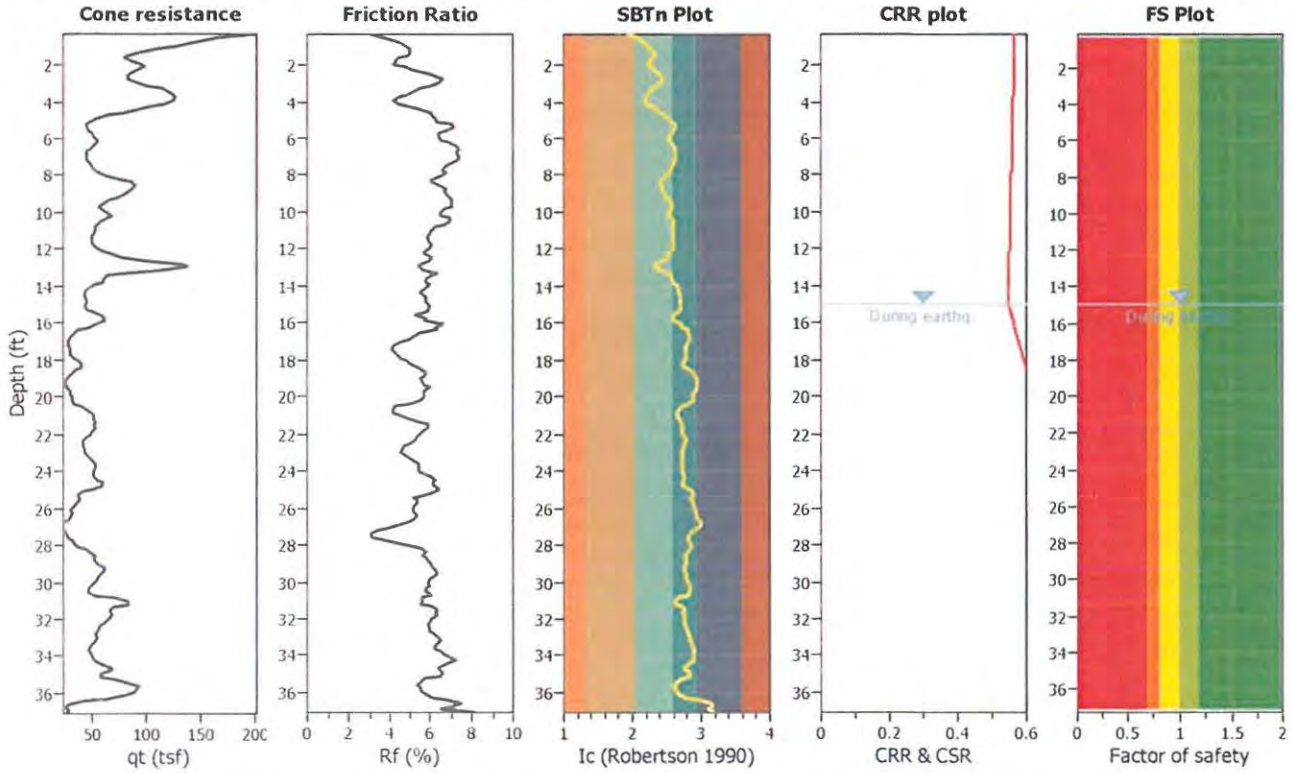
LIQUEFACTION ANALYSIS REPORT

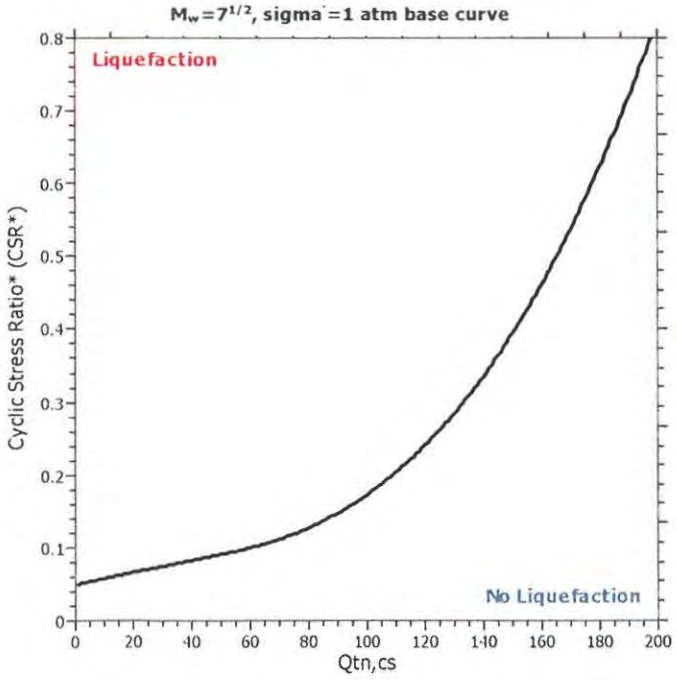
Project title : Dollar Street **Location : Hayward, CA**

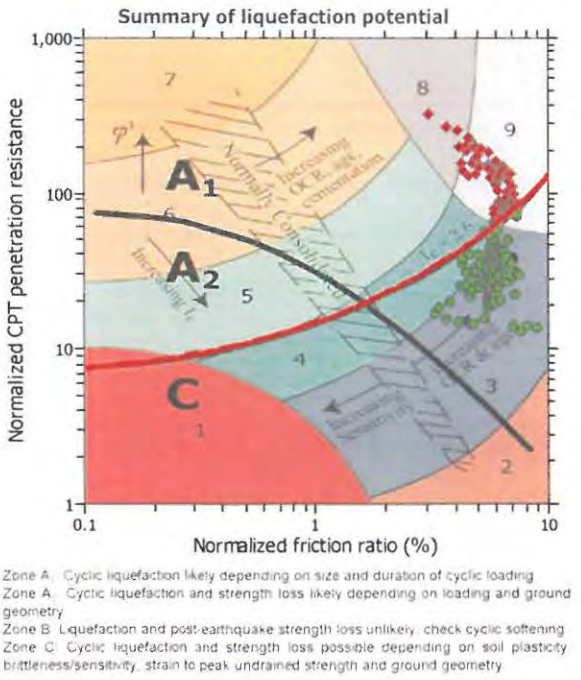
CPT file : 1-CPT05

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	19.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.93	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

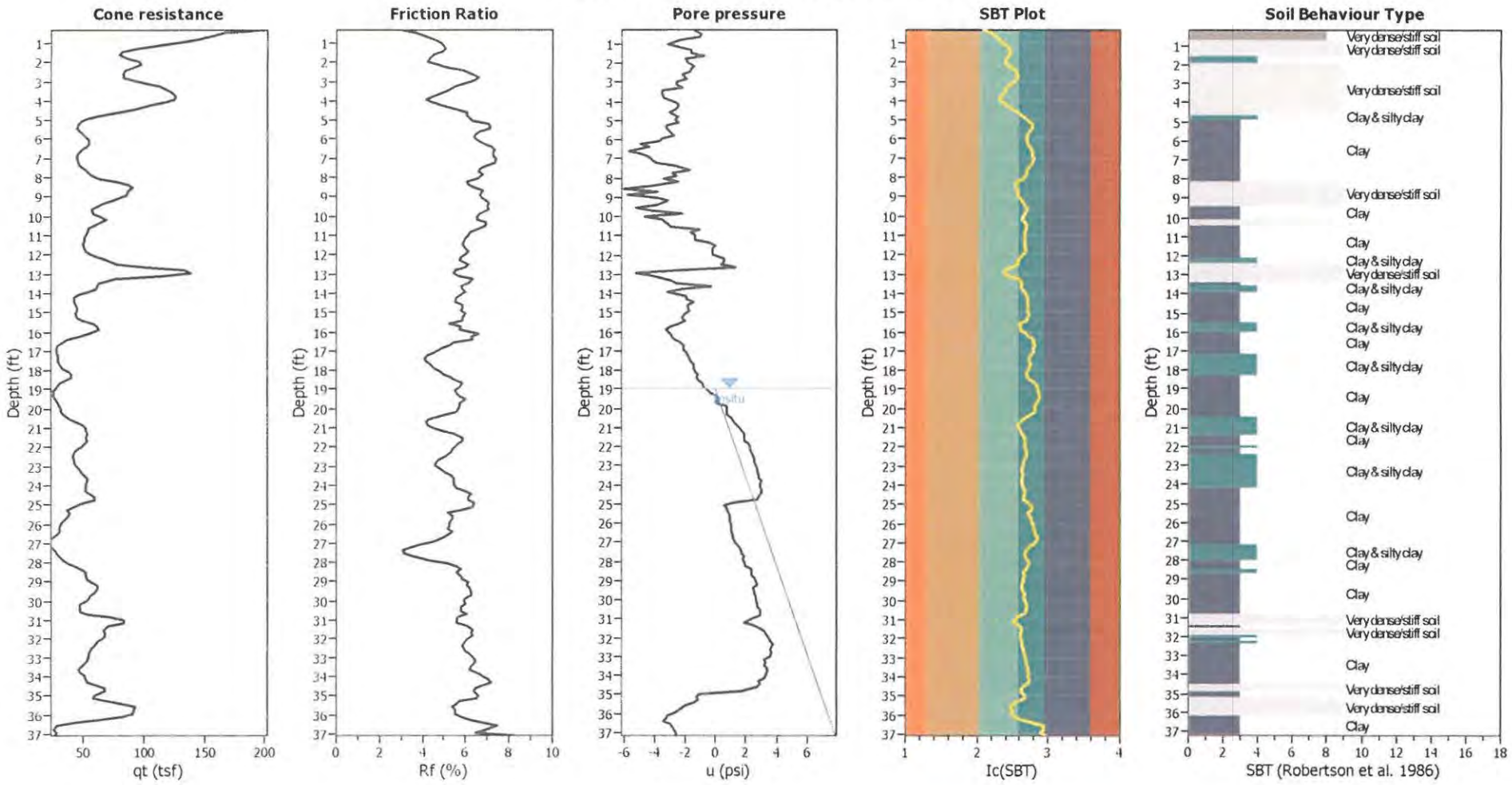






Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A': Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength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

CPT basic interpretation plots



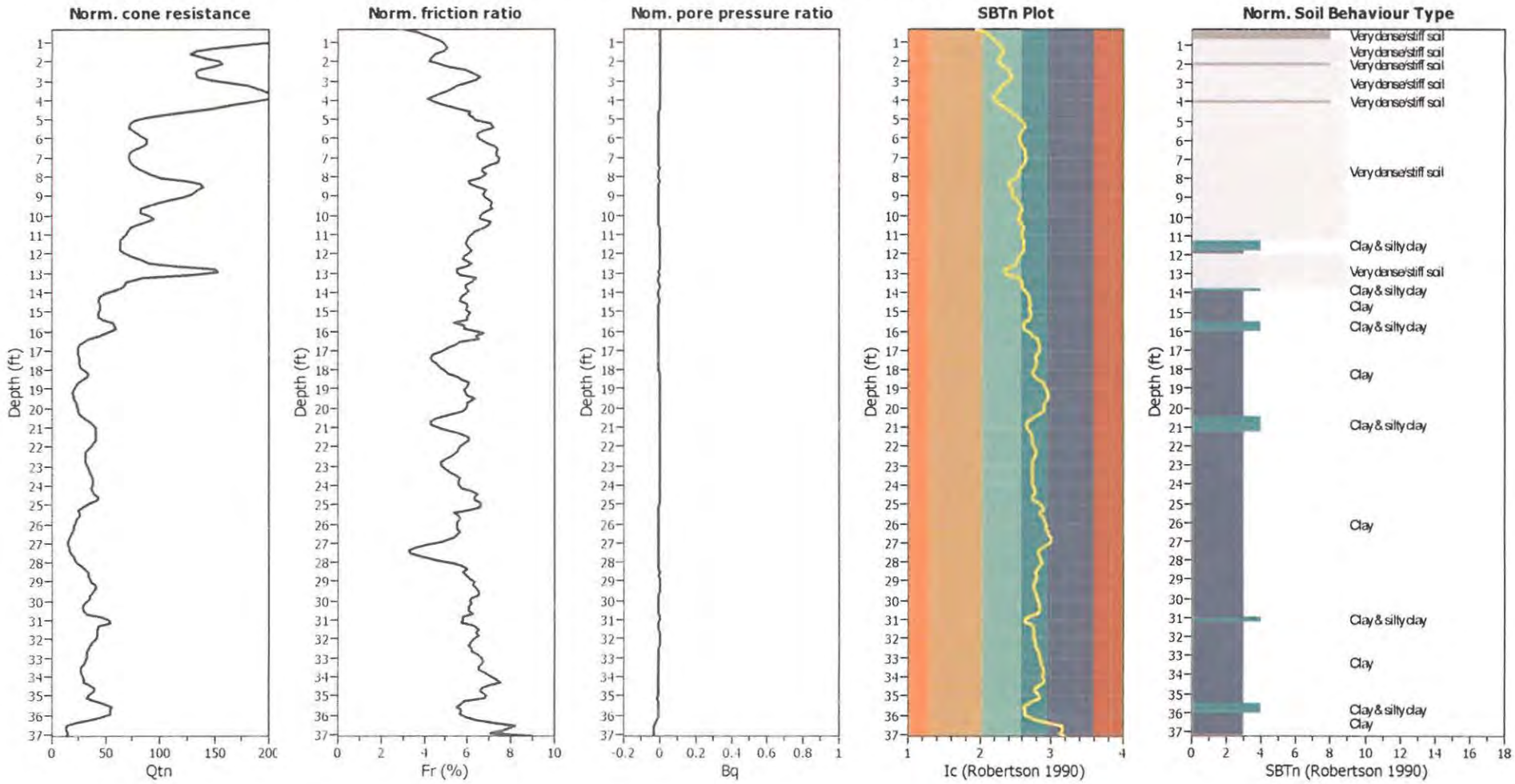
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	19.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	19.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
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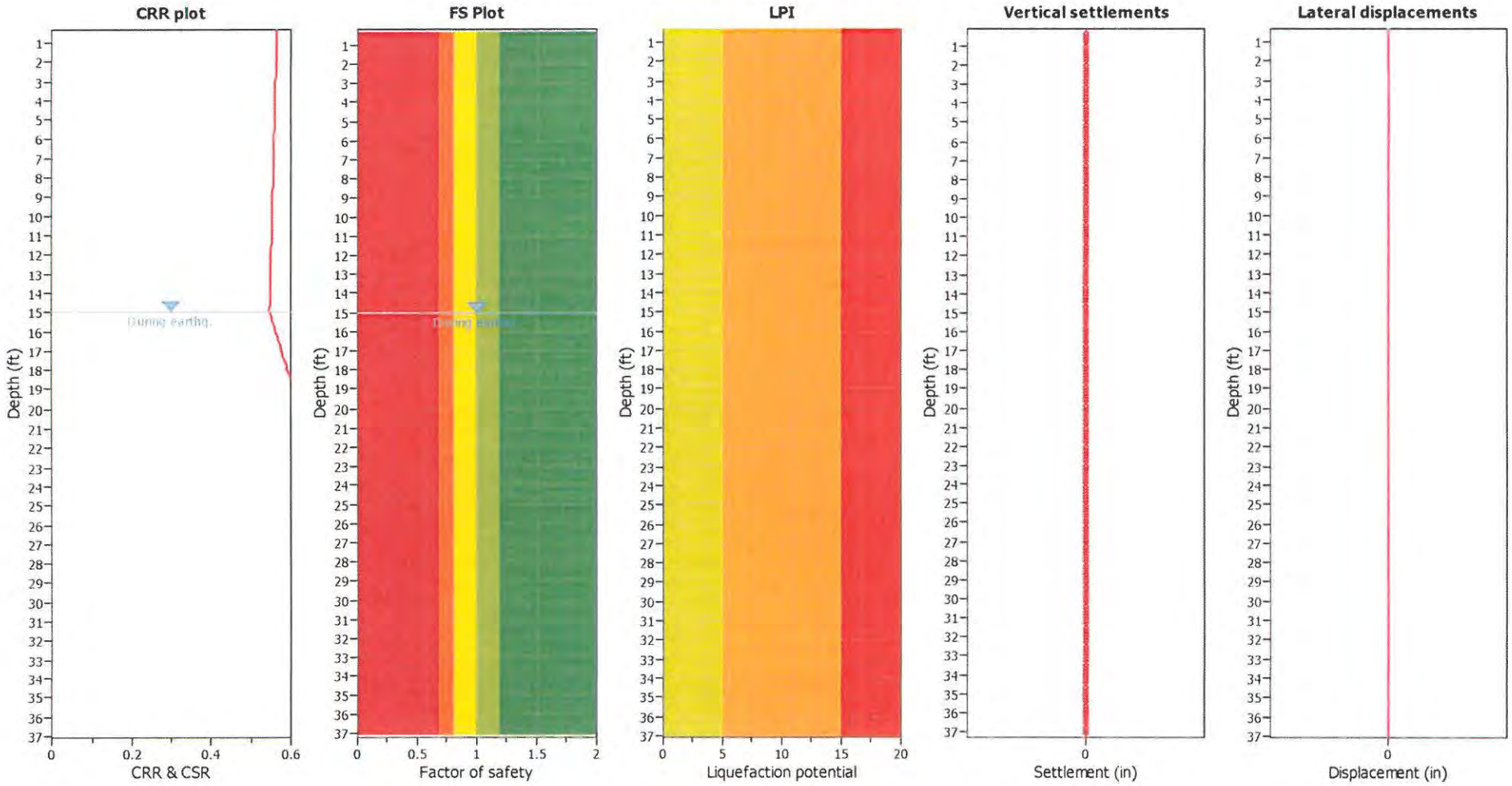
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.93	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	19.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
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- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk