DUE-DILIGENCE GEOTECHNICAL AND FAULT EVALUATION
GRAND AVENUE/LAKESIDE 35 ACRE, TRACT 32585
CITY OF LAKE ELSINORE
CALIFORNIA

Prepared for:

PARDEE HOMES
1250 Corona Pointe Court, Suite 600
Corona CA 92879

Project No. 12894.002

October 30, 2020

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Pardee Homes
1250 Corona Pointe Court, Suite 600
Corona, CA 92879

Attention: Mr. Chris Willis

Subject: Due-Diligence Geotechnical and Fault Evaluation
Grand Avenue/Lakeside 35 Acre, Tract 32585
City of Lake Elsinore, California

In accordance with our proposal dated September 15, 2020, Leighton and Associates, Inc. (Leighton) is pleased to present this report summarizing our due-diligence geotechnical and fault evaluation of the subject project. The purpose of this report is to provide our professional opinion with respect to the feasibility of developing the site for the proposed residential lots (totaling 145 lots) and to further evaluate remedial earthwork and fault setback requirements for the project.

Based on our review and evaluation, remedial grading will be required to reduce the potential for excessive dynamic and consolidation settlement, more specifically along the eastern portion of the site. However, it is our opinion that the development of the site is feasible from a geotechnical perspective provided our recommendations included herein are implemented during design and construction phases. Please note that this report incorporates pertinent data from previous reports, which are considered no longer needed for continued design and construction of this project

We appreciate this opportunity to be of service. If you have any questions regarding this report, please call us at your convenience.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Simon I. Saiid, GE 2641
Principal Engineer

Robert F. Riha, CEG 1921
Senior Principal Geologist

Distribution: (1) addressee (pdf via email)

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1.0 SITE/PROJECT DESCRIPTION

The subject site is located immediately east, of the intersection of Riverside Drive and Grand Avenue, in the City of Lake Elsinore, California. The overall property consists of three vacant parcels, (379-060-005, 379-060-022, and 379-060-027). The western portions of the combined parcels form the proposed development of 145 residential lots for Tract Map 32585 (Site) and as depicted on Figure 1, Site Location Map. The Site vicinity and surrounding areas generally consist of vacant land, with single-family residential, and light commercial properties. Based on our review of provided geotechnical reports and site plan, the site development can be summarized as follows:

- ***Overall Site:*** The project site covers approximately 35 acres with slight to locally moderate ground cover and local trees. The proposed residential development will require rough grading of the western approximately 18-acres of the property. The site is currently vacant and undeveloped.
- ***Previous Grading***: The site is in generally undeveloped natural condition with the exception of some minor grading for the previous single residential house and out building(s) and associated roads and minor improvements.
- ***Overall Site Topography**:* Based on rough grading plan (WEBB, 2006) overall site topography varies from a low of approximately 1267 (MSL) in the eastern areas of proposed development to a high of 1295 near the intersection of Grand Avenue and Riverside Drive at the western project boundary.

2.0 PREVIOUS REPORTS

A previous geotechnical report was prepared for this site by Southern California Geotechnical (SCG, 2006). The SCG investigation included subsurface exploration with (8) hollow-stem auger borings and a separate fault investigation report. However, the fault report was not available for our review at the time of this investigation. A summary of the major findings and recommendations from the previous geotechnical report for this site is provided as follows:

- Onsite, artificial fill. topsoil, and limited portion of the near-surface alluvial soils present are considered compressible and require removal and recompaction in building areas.
- Over excavation of unsuitable soils within the building areas was recommended to include the upper 5 feet of existing soils and to extend at least 3 feet in depth below proposed pad grade.
- Onsite soils were tested to exhibit “negligible” sulfate concentrations and low to very low expansion potential.
- Groundwater was encountered ranging from approximately 2 to 14 feet depth below the surface during drilling.
- Potential for unstable subgrade conditions at the overexcavation subgrade depth(s) were identified and recommendations for subgrade stabilization were presented in the report.
- The report provided analysis of site liquefaction potential with an estimate of 4.5 inches total and approximately 2.5 to 3 inches differential (50’ span) dynamic settlement during the design seismic event for the site.
- Based on the significant potential for liquefaction settlement, post-tension foundation systems were recommended with perimeter foundations embedment of at least 18 inches.

3.0 FIELD EXPLORATION

3.1 Field Exploration

As a part of the geotechnical exploration, we performed a subsurface investigation utilizing cone penetrometer testing with Cone Penetrometer Test (CPT) soundings for both supplemental liquefaction analysis and linear transects of CPT soundings as a method to screen for the indication of faulting related subsurface features. Our field exploration program consisted of 20 CPT performed at the approximate locations shown on the Exploration Map (Figure 5). The CPTs were conducted by Kehoe Testing & Engineering, Inc. and Logs are included in Appendix A.

3.2 Aerial Photograph Review

A review of vertical, sequential, stereo aerial photograph pairs was conducted to identify possible geomorphic evidence of faulting and evaluate previous workers' findings regarding the presence faulting. Various aerial photos taken between 1949 and 1999 were reviewed. A listing of photographs is presented at the end of References.

Geomorphic features contained in the historic photos were enhanced through the use of a magnifying stereoscope. During this review, a very weak tonal lineament was identified crossing the eastern portion of this property in a general northwest to southeast direction. This photo-lineament consists of weekly-aligned topographic depression as identified on the adjacent site to the north west (SCG, 2004). To further evaluate this lineament, a series of cone penetrometer soundings (CPT's) were performed as part of this study. The results are described later in this report.

4.0 GEOLOGIC SETTINGS

4.1 Regional Geology

The site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. This province is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the central portion of the Perris block. The Glen Ivy Faults, Wildomar and Willard Faults are part of the prominent and youthful Elsinore Fault Zone, which extends for more than 200 kilometers from Corona on the north to the international border with Mexico and south. The right lateral and left stepping faults, separate the metamorphic basement rocks of pre-Cretaceous to Cretaceous age on the west and east from the poorly consolidated sediments within the Elsinore Valley. As shown on Regional Geology Map (Figure 2), the subject site is primarily located within Quaternary-age younger alluvial valley deposits (Qyv) underlain and partially within younger lacustrine (lake) deposits (Ql). The site-specific geology/subsurface conditions are provided in Section 4.2 below. Detailed descriptions of the earth materials encountered in each excavation are provided in Appendix A

4.2 Subsurface Soils Conditions

Based on review of the available documents (*References*), and our supplemental exploration, the site is underlain by local artificial fill and alluvial deposits. The existing alluvium is characterized as locally loose, medium dense to dense, silty to clayey sand and sandy to silty clay. Descriptions of the earth materials encountered during previous field exploration are presented on the boring logs of the referenced reports (Appendix A.

4.3 Surface and Groundwater

No standing or other surface water was observed at the time of our exploration. Groundwater was encountered in the previous borings and within the current CPT soundings at depths of 2 to 12 feet. Groundwater will be a constraint to future development.

4.4 Faulting

Evidence for active or potentially active fault(s) have been previously mapped across the project site (SCG, 2006). However, the site is not located within a current Alquist-Priolo Earthquake Fault Zone based on published geologic hazard maps (CGS, 1979 and 2018, Bryant and Hart, 2007). Furthermore, the northeastern-most (lake margin) part of the site is located within an established Riverside County Fault Hazard Zone for the Wildomar Fault (See Figure 3). Our supplemental CPT exploration identified subsurface anomalies that may be indicative of faulting. Based on our subsurface evaluation and previous fault studies in this vicinity, a fault setback for habitable structures is recommended and depicted on Figure 5.

4.5 Ground Shaking / 2019 CBC Site-Specific Seismic Coefficients

The seismic design parameters based on the 2019 CBC were calculated utilizing an interactive program based on current United States Geological Survey (USGS) website using ASCE 7-16 procedures, as well as OSHPD seismic maps. Based on our exploration, the site is classified as a Class D site and a site-specific strong motion analysis is required to derive the seismic coefficients. However, we understand that based on the proposed structures (one- to two-story wood structures), the code allows for the use of "alternative method" to calculate S_{D1}, which means that "..the structure has a fundamental period, T, that does not exceed 0.5s." If this is not the case, the design/structural engineer should notify us so that a site-specific strong motion analysis is performed.

Site Seismic Coefficients / Coordinates		Value
Latitude		33.66357
Longitude		-117.38165
Mapped Spectra (OSHPD)	Spectral Response – Class D (short), S_S	2.2
	Spectral Response – Class D (1 sec), S_1	0.77
	Site Modified Peak Ground Acceleration, PGA_M	1.102
	Max. Considered Earthquake Spectral Response Acceleration (short), S_{MS}	2.58
	Max. Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	1.30
	5% Damped Design Spectral Response Acceleration (short), SDS	1.72
	5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.87
	Site-Specific Peak Ground Acceleration, PGA	0.92

The results of our analysis are presented in Appendix C. Based on this analysis, the Peak Horizontal Ground Acceleration (PGA) is 0.92.

4.6 Secondary Seismic Hazards

Ground shaking can induce “secondary” seismic hazards such as liquefaction, dynamic densification, and differential subsidence along ground fissures, Seiches and tsunamis.

4.6.1 Dynamic Settlement (Liquefaction/Dry Settlement)

The subject site is located within a liquefaction hazard area (Figure 4). Assuming that loose, near-surface soils will be removed and recompacted in accordance with the recommendations of Section 5.0 of this report in the areas of development, the potential for liquefaction or dynamic settlement due to the design earthquake event to affect structures at this site is estimated to be on the order of 1 to 3 inches (see Appendix C). Due to relatively homogenous subsurface conditions (deep alluvium), differential settlement is not expected to exceed 1-inch in a 30-foot horizontal distance.

4.6.2 Lateral Spreading

Based on proposed grading plan, sites grades will slope very mildly in an easterly direction (<2 percent), except for the approximately 7-foot high slope along the eastern edge of site. Due to the clayey and interbedded nature of the near surface soils, lateral spread is expected to be minimal or not expected to exceed 6 inches. This potential hazard generally applies to the most easterly portion of the site or within proposed road and slope.

4.6.3 Seiches

Due to the site distance and planned elevation above Lake Elsinore, the possibility of Seiches impacting the site is considered low. This report does not address conventional flood hazard risk.

4.7 Collapsible Soils

The near surface alluvium is considered locally collapsible. This hazard may be mitigated by the remedial grading recommendations of Section 5.0.

5.0 RECOMMENDATIONS

5.1 General

The proposed development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development. Rough grading plans should be reviewed to confirm settlement/lateral spread values provided herein and update general earthwork recommendations as needed. The main geotechnical concern associated with this site is the potential for excessive dynamic/liquefaction and consolidation/elastic settlements. As such, we recommend that remedial grading be performed as further described below to reduce the long-term differential settlement.

5.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* Appendix D. The recommendations contained in Appendix D, are general grading specifications provided for typical grading projects and some of the recommendations may not be strictly applicable to this project. The specific recommendations contained in the text of this report supersede the general recommendations in Appendix D. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place the fill properly in accordance with the recommendations of this report, the specifications in Appendix D, applicable County Grading Ordinances, notwithstanding the testing and observation of the geotechnical consultant.

5.2.1 Site Preparation and Remedial Grading

Prior to grading, the proposed structural improvement areas (i.e. all structural fill areas, pavement areas, buildings, etc.) of the site should be cleared of surface and subsurface obstructions, heavy vegetation, root balls and boulders. Roots and debris should be disposed of offsite. Septic tanks or seepage pits, if encountered, should be abandoned in accordance with the County of Riverside Department of Health Services guidelines.

Undocumented fill, surficial topsoil, and the upper 3 to 5 feet of alluvial deposits are potentially compressible in their present state and may settle under the surcharge of fills or foundation loading. As such, these materials should be removed and re-compacted prior to any additional fill or foundation construction. The removal depth may be limited to 3 feet below ground surface (BGS) or shallower in the eastern portion of the site (slope/basin/G Street area) in order to keep at least 2 feet separation from groundwater. Due to limited removal and anticipated 7 feet of additional fill, we recommend that grading begins in this area and underlying alluvium be allowed at least 30 days to consolidate prior to placing any settlement sensitive improvements. This time of settlement duration should be reviewed when grading plans become available. Settlement monuments may be recommended or required for this area.

The removal limit should be established by a 1:1 projection from the edge of fill soils supporting settlement-sensitive structures downward and outward to competent material identified by the geotechnical consultant. Removals will also include benching into competent material as the fills rise. Areas adjacent to existing structures, including roadways, may require special monitoring. Temporary slopes in these areas should be no steeper than 1:1 (horizontal:vertical). Friable materials, if encountered, may require additional layback. Stabilization of approved removal areas will be needed in areas of shallow groundwater. For preliminary planning, subgrade stabilization may consist of a geotextile fabric such as Mirafi 500X and/or 18 to 24 inches of course crushed rock (2 to 4 inches). The actual stabilization method to be determined during site grading.

5.2.2 Suitability of Site Soils for Fills

The onsite soils are generally suitable for re-use as compacted fill, provided they are free of debris, organic matter, and possibly dried back to near optimum moisture content. All structural fill should be compacted throughout to 90 percent of the ASTM D 1557 laboratory maximum density, at or slightly above optimum moisture.

Areas to receive structural fill and/or other surface improvements should be approved by the geotechnical consultant then scarified to a minimum depth of 8 inches, conditioned to at least optimum moisture content, and recompacted. Fill soils should be placed at a minimum of 90 percent relative compaction (based on ASTM D1557) and near or above optimum moisture content. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in thickness.

Fills placed on slopes steeper than 5:1 (horizontal:vertical) should be benched into dense soils (see Appendix D for benching detail). Benching should be of sufficient depth to remove all loose material. A minimum bench height of 2 feet into approved material should be maintained at all times. A grading contractor with experience in the handling and placement of oversize rock should be selected for this project.

5.2.3 Shrinkage and Bulking

The volume-change of excavated onsite materials upon recompaction is expected to vary with materials, density, insitu moisture content, location, and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust import quantities to accommodate some variation. Based on our experience with similar materials, the following values are provided as guidelines:

Table 1. Earthwork Shrinkage and Bulking Estimates

Geologic Unit	Estimated Shrinkage/Bulking
Undocumented Fill/Surficial Soils	10 to 20 percent shrinkage
Alluvium (upper 3 to 5 ft.)	10 to 15 percent shrinkage

5.2.4 Import Soils

Import soils and/or borrow sites, if needed, should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), rocks smaller than 12-inches (6 inches to cap pads), have low expansion potential (with an Expansion Index less than 21) and have a low corrosion impact to the proposed improvements.

5.2.5 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* (“Greenbook”), 2018 Edition. Fill material above the pipe zone should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 1½ inches in diameter and organic matter. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *“Greenbook”*. The contractor should be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe if all safety precautions are not properly implemented. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Leighton does not consult in the area of safety engineering.

5.2.6 Drainage

All drainage should be directed away from structures a minimum of 1% by means of approved permanent/temporary drainage devices. Adequate surface drainage of any building pad should be provided to avoid wetting of foundation soils. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings.

5.2.7 Slope Construction

Compacted fill or cut slopes at 2:1 (horizontal:vertical) are considered grossly stable for static and pseudostatic conditions. However, we recommend that proposed slope along the eastern boundary of the site be no steeper than 3:1 to reduce potential for lateral spreading and slope instability under seismic loading. Any new slopes using the onsite soils compacted to minimum 90 percent should also be stable under short and long term conditions. The outer portion of new fill slopes should be either overbuilt by 2 feet (minimum) and trimmed back to the finished slope configuration or compacted in vertical increments of 5 feet (maximum) by a weighted sheepsfoot roller as the fill is placed.

The slope face should then be track-walked by dozers of appropriate weight to achieve the final slope configuration and compaction to the slope face.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and irrigation. Landscaping and slope maintenance should be conducted as soon as possible in order to increase long-term surficial stability. Berms should be provided at the top of fill slopes. Drainage should be directed such that surface runoff on the slope face is minimized

5.3 Preliminary Foundation Design

5.3.1 Bearing and Lateral Pressures

Based on our review, proposed single-family residential structures may be founded on Post Tension slab-on-grade system based on prevailing finish pad soils conditions and settlement estimates after grading. The compacted fill is anticipated to be very low expansion potential. As such, we recommend that the structural consultant and/or foundation engineer presents foundation design categories based on actual expansion potential of subgrade soils of each pad at completion of grading. Foundation footings may be designed with the following geotechnical design parameters:

Allowable Bearing Capacity:	2,000 psf at a minimum depth of embedment of 12 inches (minimum width of 12 inches). This bearing capacity may be increased by ⅓ for short-term loading conditions (e.g., wind, seismic).
Sliding Coefficient:	0.35
Total Settlement:	3 inches
Differential Settlement:	1 inch in 30 feet

5.3.2 Post-Tension Design Parameters

PTI design parameters can be considered for the subject tract as presented below. The following PTI design parameters were derived using VOLFLO 1.5 computer program developed by Geostructural Tool Kit, Inc. and the laboratory test results summarized above:

PTI Method Design Parameters (3rd Edition)

Design Parameters	Category I
Thornthwaite Moisture Index	-20
Depth to Constant Soil Suction	9.0 feet
Constant Soil Suction	3.9 feet
Edge Moisture Variation Distance, e_m -Edge Lift -Center Lift	 4.9 feet 9.0 feet
Soil Differential Movement, y_m -Edge Lift - Swell -Center Lift - Shrink	 0.90 inches 0.45 inches

The allowable pressures provided in Section 5.3.1 above may be used for slab-on-grade design using the PTI method. Moisture content for the upper 12 inches of subgrade should be near optimum moisture content (±2%) prior to placing concrete.

Based on past experience with similar compacted fills and application of elastic settlement due to weight of additional fill, settlement is expected to be less than 2 inches. As such, a differential settlement of 1-inch across a lateral distance of 30 feet should be considered for design in addition to the shrink/swell settlement given in table above.

5.3.3 Vapor Retarder

It has been a standard of care to install a moisture-vapor retarder underneath all slabs where moisture condensation is undesirable. Moisture vapor retarders may retard but not totally eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. Leighton and Associates, Inc. does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

However, based on our experience, the standard of practice in Southern California has evolved over the last 15 to 20 years into a construction of a vapor retarder system that generally consisted of a membrane (such as 10-mil thick or greater), underlain by a capillary break consisting of 4 inches of clean ½-inch-minimum gravel or 2-inch sand layer (SE>30). The structural engineer/architect or concrete contractor often require a sand layer be placed over the membrane (typically 2-inch thick layer) to help in curing and reduction of curling of concrete. If such sand layer is placed on top of the membrane, the contractor should not allow the sand to become wet prior to concrete placement (e.g., sand should not be placed if rain is expected).

In conclusion, the construction of the vapor barrier/retarder system is dependent on several variables which cannot be all geotechnically evaluated and/or tested. As such, the design of this system should be a design team/owner decision taking into consideration finish flooring materials and manufacture's installation requirements of proposed membrane. Moreover, we recommend that the design team also follow ACI Committee 302 publication for "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" (ACI 302.2R-06) which includes a flow chart that assists in determining if a vapor barrier /retarder is required and where it is to be placed.

5.4 Retaining Walls

Retaining wall earth pressures are a function of the amount of wall yielding horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive soils should be designed using the following equivalent fluid pressures:

Table 2. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	35	55
At-Rest	55	65
Passive*	300	150 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 3,000 psf at depth. If sloping down (2:1) grades exist in front of walls, then they should be designed using passive values reduced to ½ of level backfill passive resistance values.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low to low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design, or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill other than a 2:1 (horizontal:vertical) be constructed above the wall (or a backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated in Appendix D, *Retaining Wall Backfill and Subdrain Detail*. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless otherwise approved by the Structural Engineer.

5.5 Foundation Setback from Slopes

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, flatwork, building footings, pools, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or the face of a retaining wall) and should be a minimum of H/2, where H is the slope height (in feet).

Table 3. Footing Setbacks

Slope Height	Recommended Footing Setback
<5 feet	5 feet minimum
5 to 15 feet	7 feet minimum
>15 feet	H/2, where H is the slope height, not to exceed 10 feet to 2:1 slope face

The soils within the structural setback area generally possess poor lateral stability and improvements (such as retaining walls, pools, sidewalks, fences, pavements, decorative flatwork, etc.) constructed within this setback area will be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback described above. Modifications of slope inclinations near foundations may increase the setback and should be reviewed by the design team prior to completion of design or implementation.

5.6 Geochemical Characteristics

Previously reported laboratory test results (SCG, 2020) indicate that onsite soils at shallow depth have “negligible” soluble sulfate content (per Section 4.3 of ACI 318). Concrete structures in contact with the on-site soils may be designed for negligible sulfate exposure in accordance with ACI 318 (ACI, 2014). If the concrete is expected to be in contact with reclaimed water, Type V cement and a water/cement ratio of 0.45 should be used.

The results of the resistivity test indicate that the underlying soil is corrosive to buried ferrous metals per ASTM STP 1013. The samples tested for water-soluble chloride content indicate a low potential for corrosion of steel in concrete due to the chloride content of the soil.

5.7 Concrete Flatwork

Sidewalk/Flatwork should conform to applicable City standards. A representative of Leighton should verify subgrade soil expansion, moisture conditions and compaction prior to formwork and reinforcement placement. If subgrade soils possess expansion index greater than 21, we recommend a minimum 8-inch deepened edge be constructed for all flatwork to reduce moisture variation in subgrade soils along concrete edges adjacent to open (unfinished) or irrigated landscape areas.

Concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints. Additional provisions such as ascending/descending slope conditions, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/heave should be incorporated into the design of exterior improvements. Additional exterior slab details are suggested in the American Concrete Institute (ACI) guidelines

5.8 Preliminary Pavement Design Parameters

Pavement design should follow the City of Lake Elsinore and Caltrans Highway Design Manual. Pavements sections should be determined based on R-value testing of actual subgrade after utilities installation in all streets. For planning and estimating purposes, a preliminary minimum pavement section is 0.25-foot Asphalt Concrete over 0.5-foot of Aggregate Base may be used for the local interior streets. Pavement for adjacent Grand Avenue and Riverside Drive (Highway 74) should consider City and State minimum requirements and standards.

5.9 Continued Geotechnical Services

Our geotechnical recommendations are contingent upon Leighton and Associates, Inc., providing geotechnical observation and testing services during continued earthwork and foundation construction. Leighton and Associates, Inc. should review site foundation and landscape plans when available, to comment further on geotechnical aspects of this project and check to see general conformance of final project plans to recommendations presented in this report, or provide additional recommendations as considered necessary.

Leighton and Associates, Inc. should be retained to provide geotechnical observation and testing during excavation and all phases of earthwork. Our conclusions and recommendations should be reviewed and verified by us during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided during:

- Review of ground improvement design, by others;
- Testing ground post-ground improvements to confirm adequate densities are achieved;
- Preparation of subgrade in all areas to receive fill;
- Excavation and installation of foundations;
- After excavation of all slabs and footings and prior to placement of steel or concrete to confirm the slabs and footings are founded in firm, compacted fill from of loose debris;
- Utility trench backfilling and compaction.
- Pavement/sidewalk subgrade and aggregate base compaction.

6.0 LIMITATIONS

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time. This investigation was performed with the understanding that the subject site is proposed for residential development. The client is referred to Appendix C regarding important information provided by the Geoprofessional Business Association (GBA) on geotechnical engineering studies and reports and their applicability.

This report was prepared for Pardee Homes. (Client), based on their needs, directions, and requirements at the time of our investigation. This report is not authorized for use by and is not to be relied upon by any party except our Client, and its successors and assignees as owner of the property, with whom Leighton and Associates, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton and Associates, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton and Associates, Inc.

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Aerial Photographs Reviewed

Flight Date	Photograph No.
03-02-99	C135- -39-142 & 143
09-11-97	C110 – 39, 38 & 39
02-02-93	C86-9-21
02-15-77	RIV-7 – 5 & 6
05-15-67	3HH-191 & 192
05-06-49	3F-123 & 124

Project: 12894.002	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020

Author: Leighton Geomatics (mmurphy)

SITE LOCATION MAP

Pardee Homes

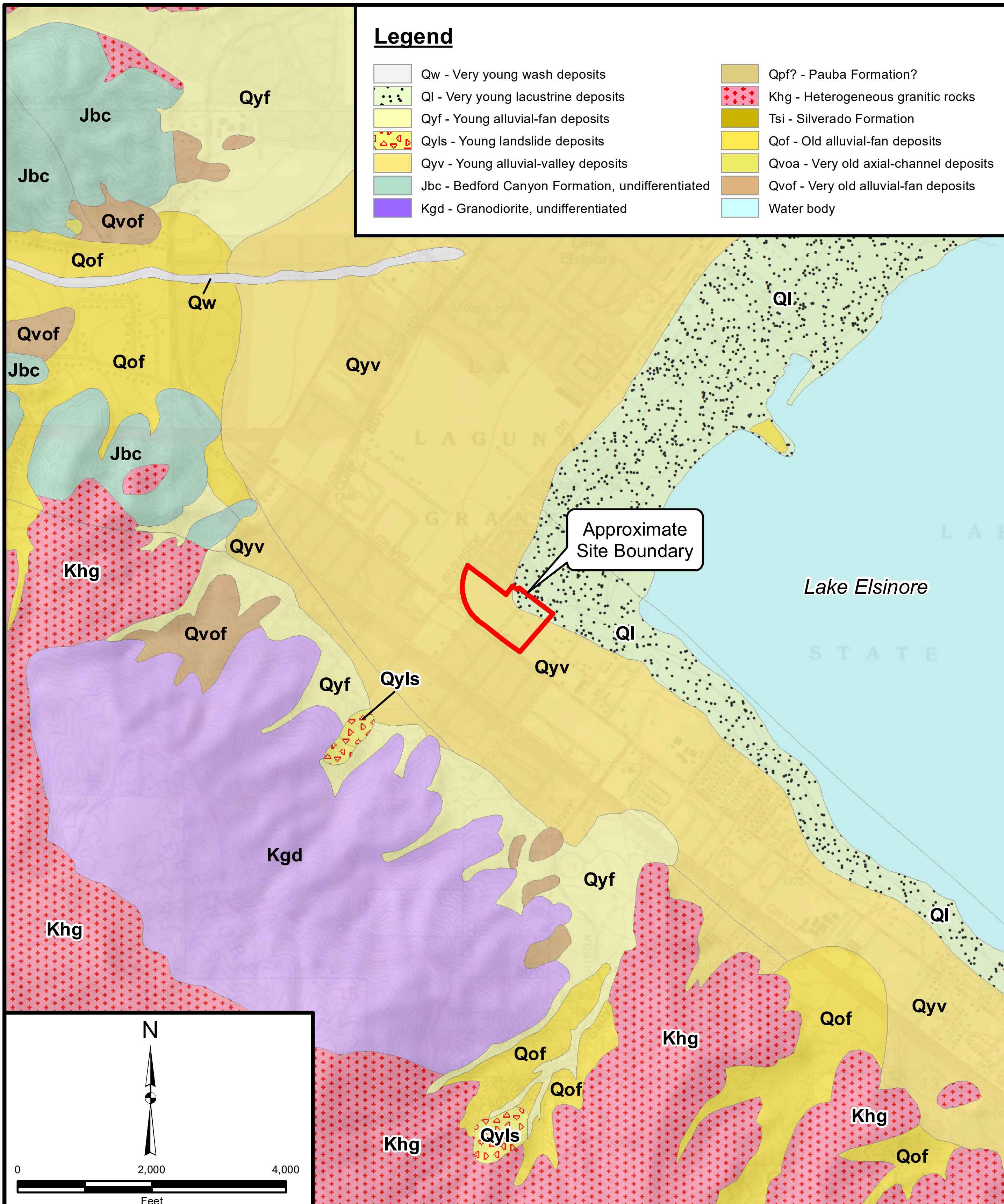
Lakeside 35 Acre

Lake Elsinore, California

Figure 1

Leighton

Map Saved as V:\Drafting\12894\002\Maps\12894-002_F01_SLM_2020-09-16.mxd on 9/18/2020 4:10:39 PM



Project: 12894.002	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: October 2020

Reference: USGS, 2006 Geologic map of the San Bernardino and Santa Ana 30'x60 quadrangle, California Version 1,0 Open File Report 2006-1217.

Author: Leighton Geomatics (mmurphy)

REGIONAL GEOLOGY MAP

Pardee Homes
Lakeside 35 Acre
Lake Elsinore, California

Figure 2

Leighton

Map Saved as V:\Drafting\12894\002\Maps\12894-002_F02_RGM_2020-09-16.mxd on 9/18/2020 4:27:27 PM

Project: 12894.002	Eng/Geol: SIS/RFR
Scale: 1 " = 800 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020

Author: Leighton Geomatics (mmurphy)

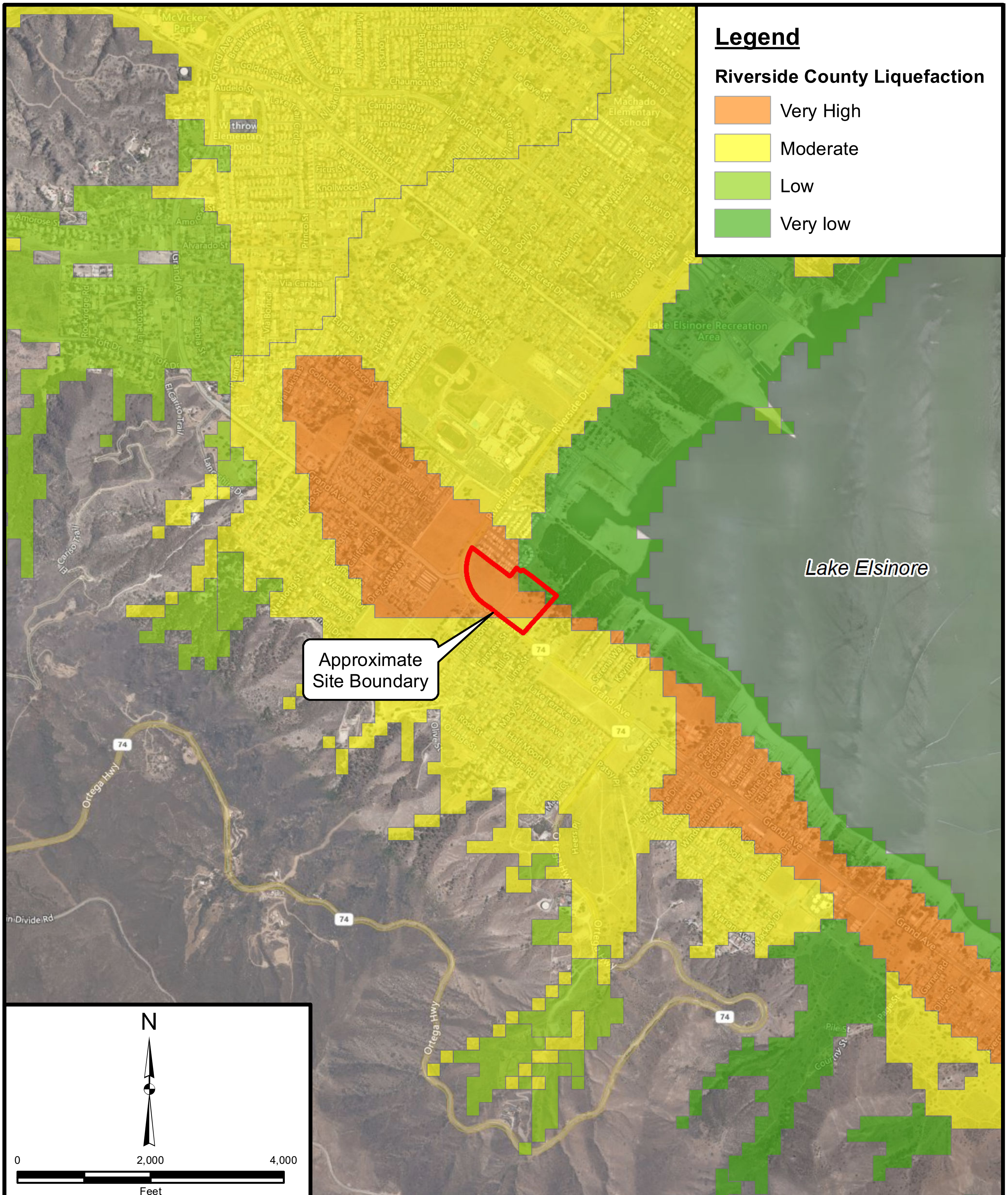
LOCAL FAULT MAP

Pardee Homes
Lakeside 35 Acre
Lake Elsinore, California

Figure 3

Leighton

Map Saved as V:\Drafting\12894\002\Maps\12894-002_F03_LFM_2020-09-16.mxd on 9/18/2020 4:47:50 PM



Project: 12894.002	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: October 2020

Base Map: ESRI ArcGIS Online 2020

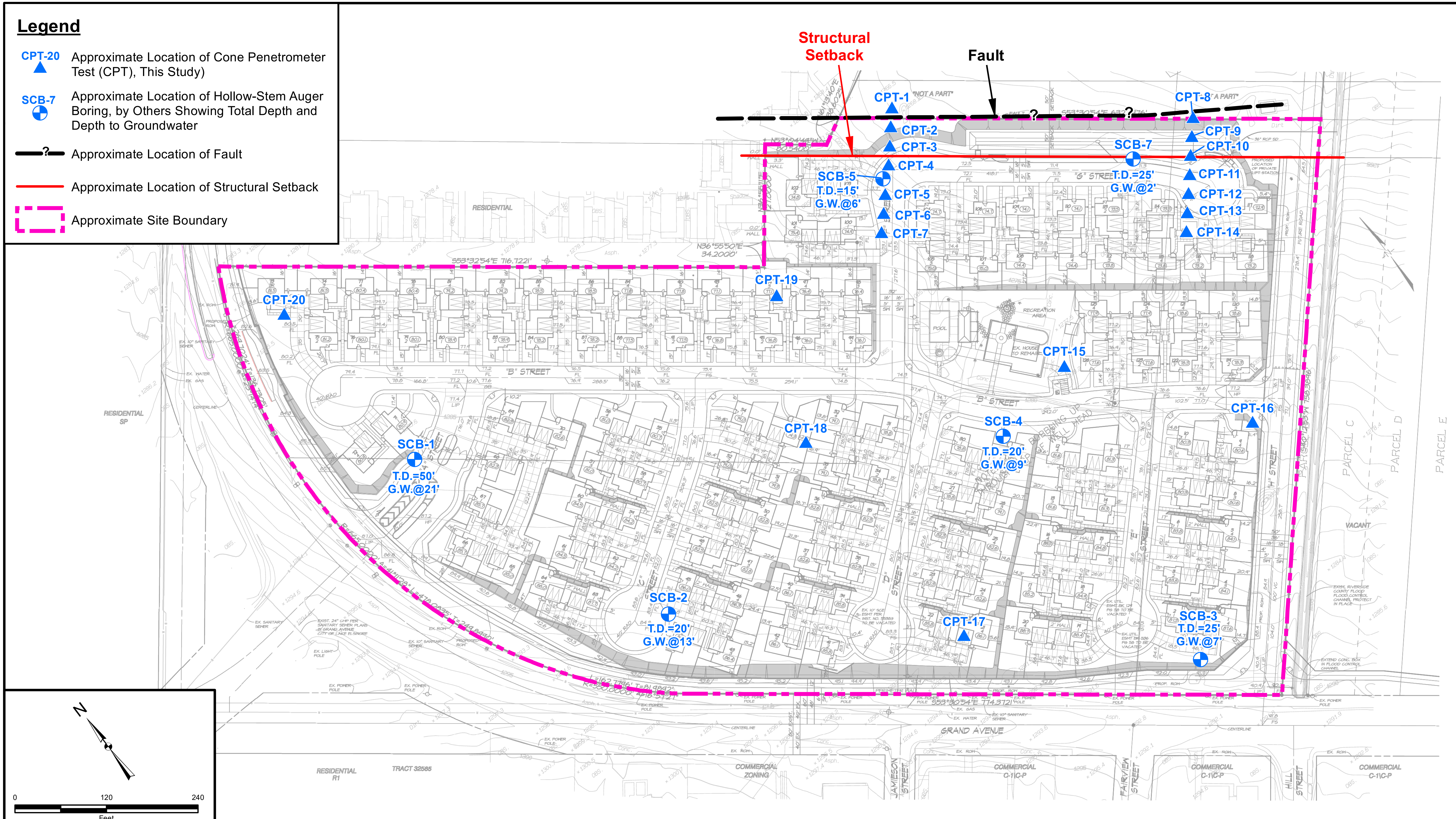
Author: Leighton Geomatics (mmurphy)

LIQUEFACTION MAP

Pardee Homes
Lakeside 35 Acre
Lake Elsinore, California

Figure 4

Leighton



Project: 12894.002	Eng/Geol: SIS/RFR
Scale: 1 " = 120 '	Date: October 2020

Base Map: Sheet 1, Conditional Use Permit No. 2006-000 Design Review No. R2006-00 by Alvert A. Webb Associates, dated 11/2006.

Author: Leighton Geomatics (mmurphy)

EXPLORATION MAP

Pardee Homes
Lakeside 35 Acre
Lake Elsinore, California

Figure 5

Leighton

Map Saved as V:\Drafting\12894\002\Maps\12894-002_P01_GM_2020-09-25.mxd on 10/29/2020 8:09:25 AM

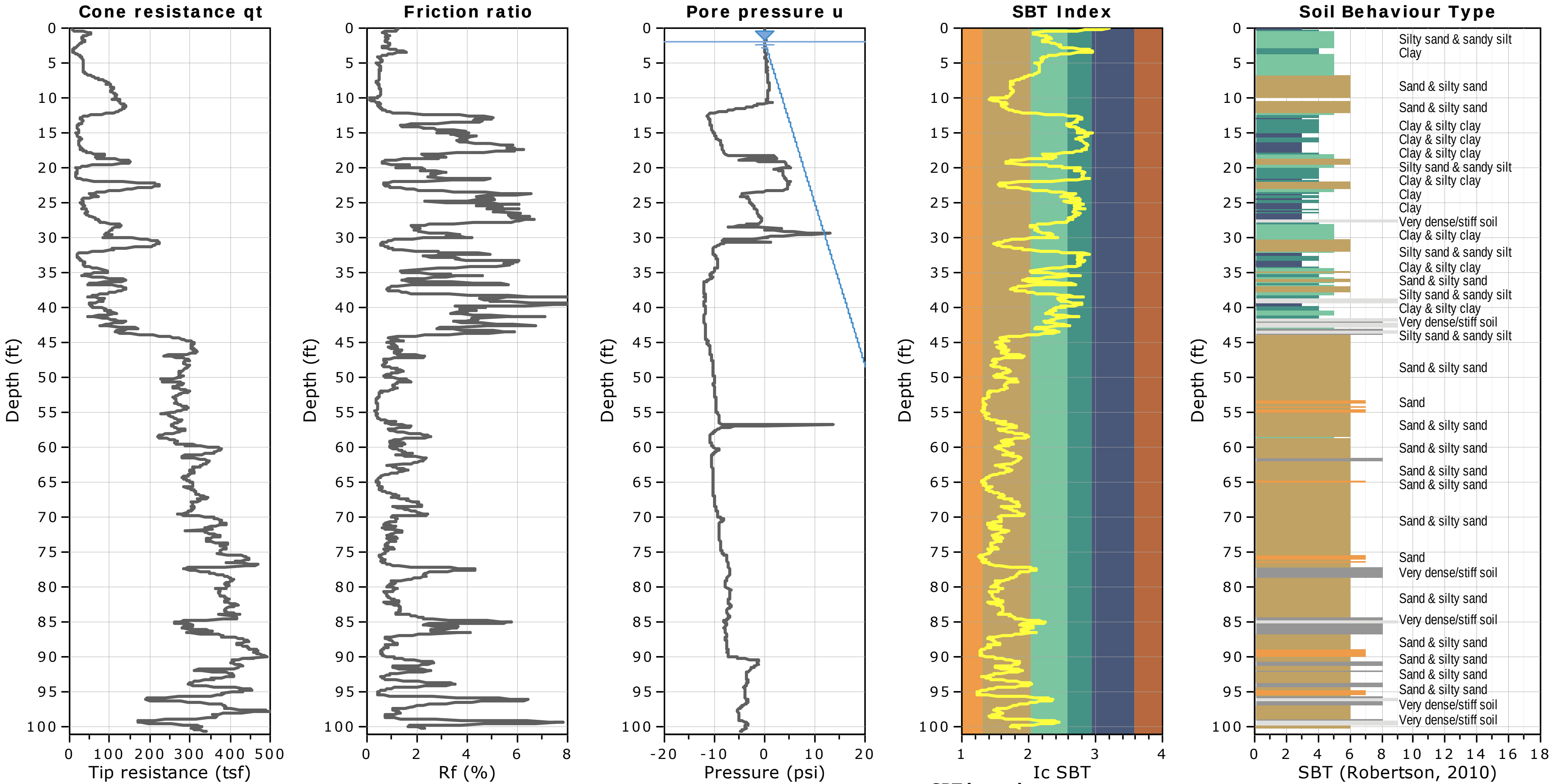
APPENDIX A

Exploration Logs

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT: CPT-1
Total depth: 100.53 ft, Date: 9/30/2020
Surface Elevation: 1266.00 ft
Coords: X:0.00, Y:1.00
Cone Type: Uknown
Cone Operator: Uknown

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA



SBT legend

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

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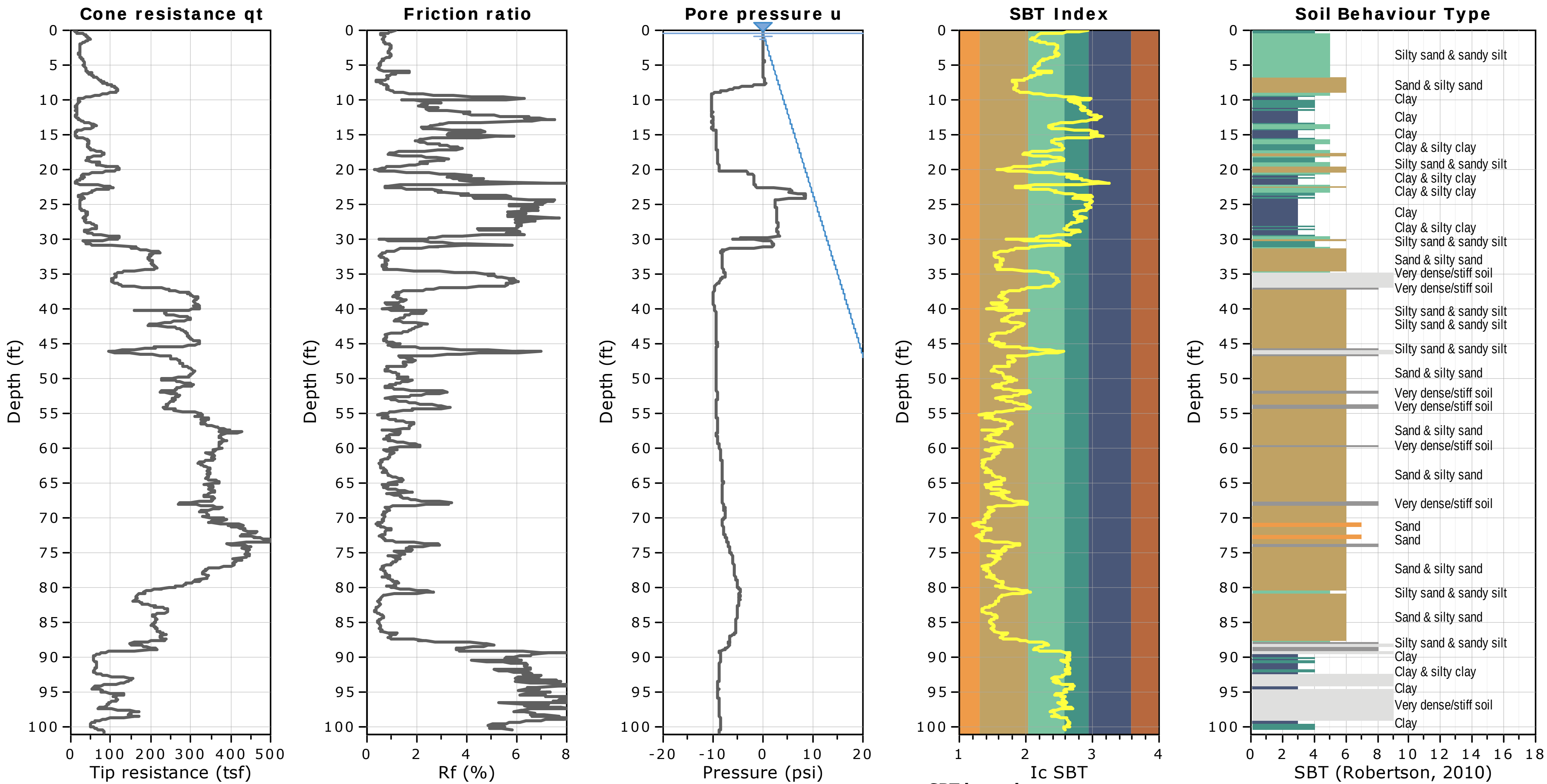
CPT: CPT-2
Total depth: 100.68 ft, Date: 9/30/2020
Surface Elevation: 1266.50 ft
Coords: X:25.00, Y:1.50
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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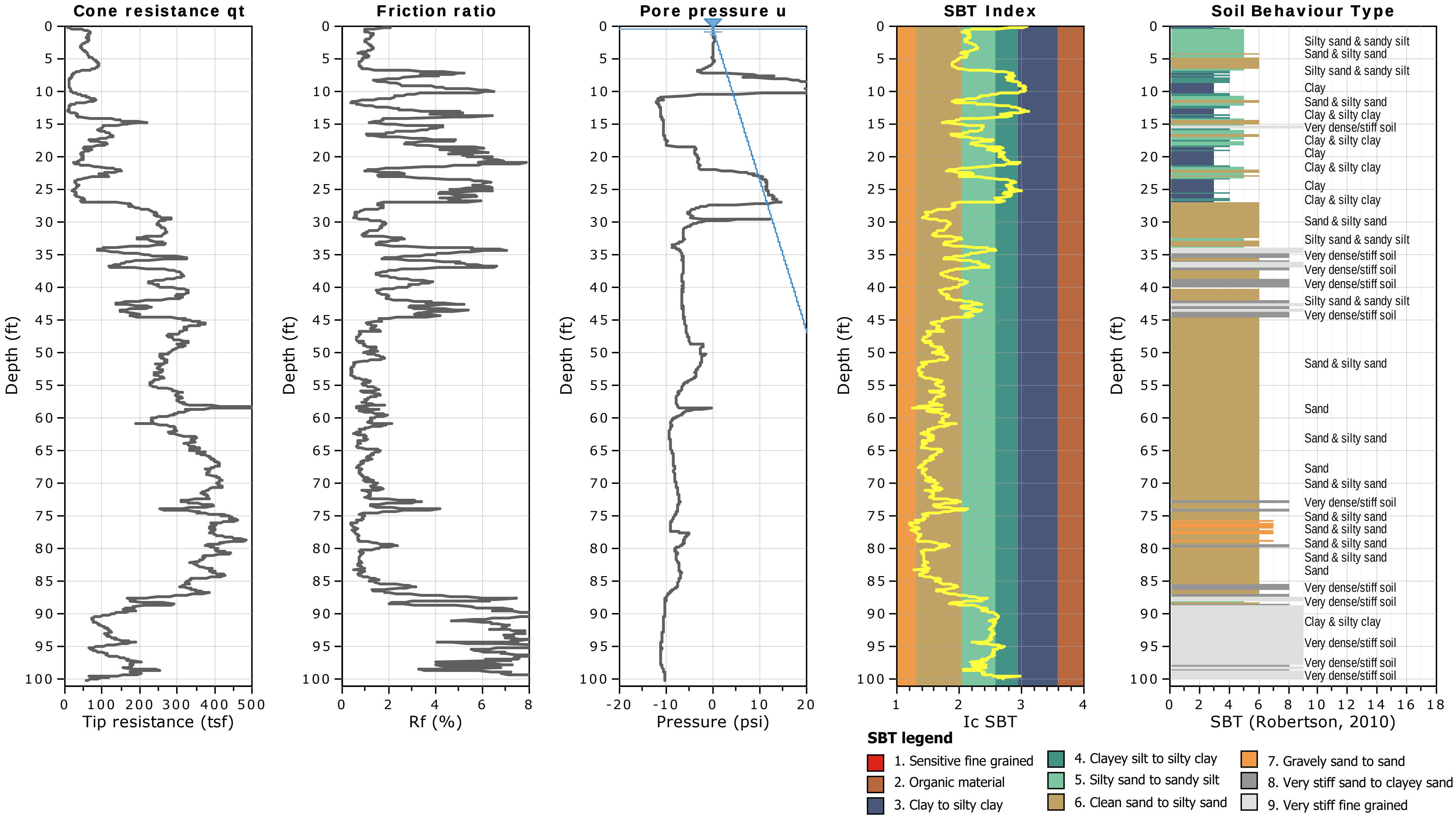
CPT: CPT-3
Total depth: 100.21 ft, Date: 9/30/2020
Surface Elevation: 1267.50 ft
Coords: X:50.00, Y:2.50
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



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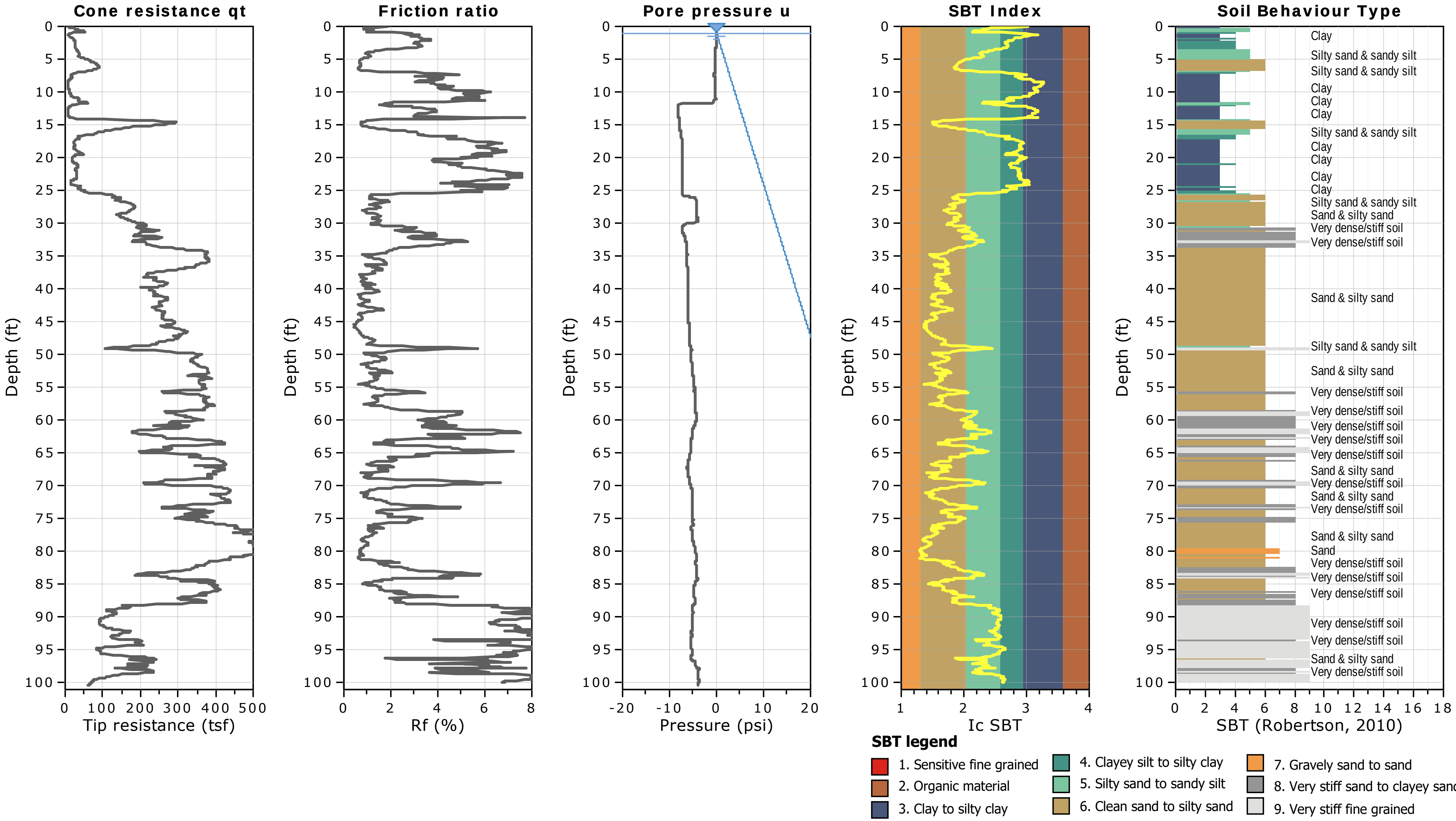
CPT: CPT-4
Total depth: 100.34 ft, Date: 9/30/2020
Surface Elevation: 1269.00 ft
Coords: X:75.00, Y:4.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



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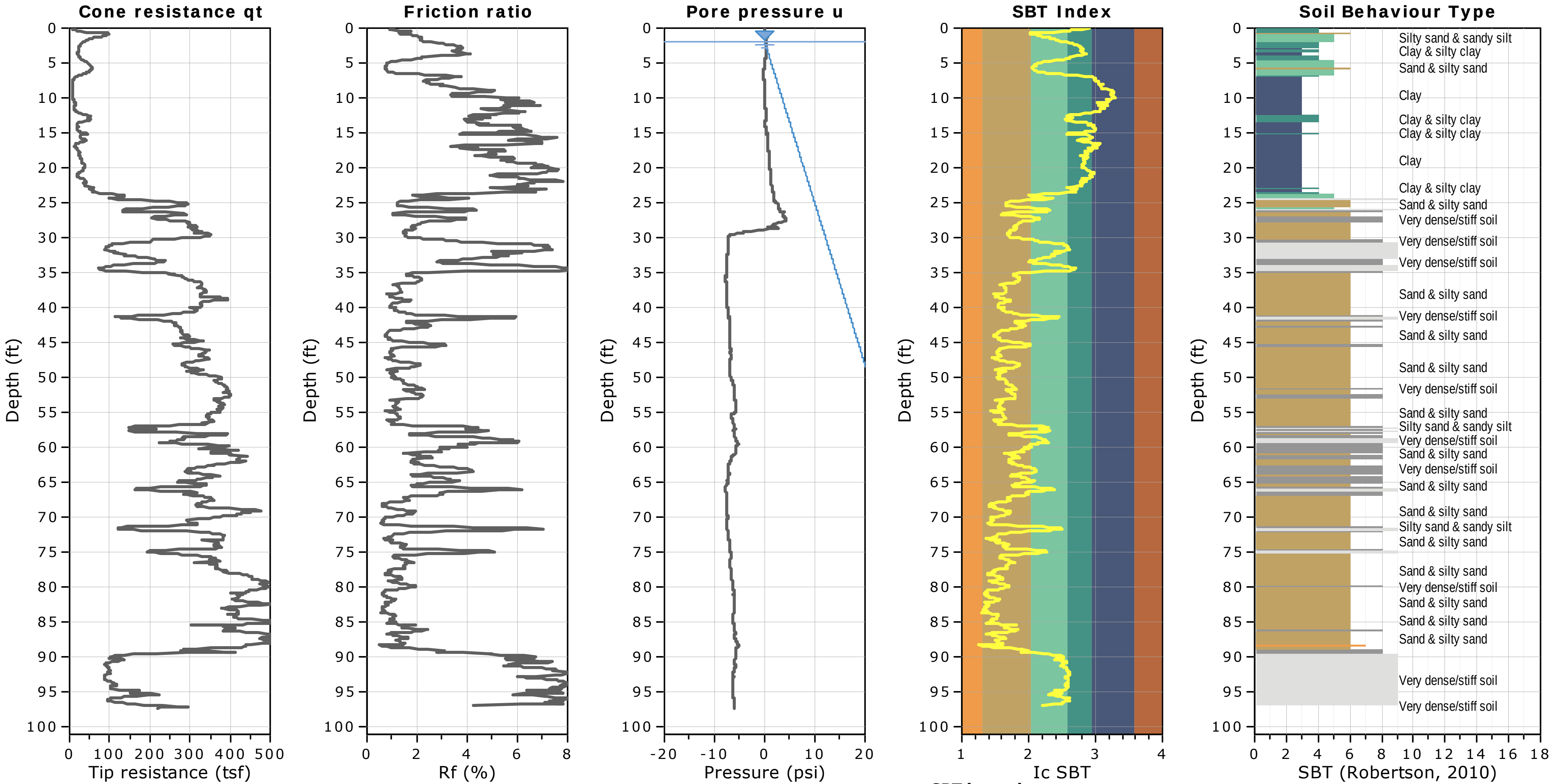
CPT: CPT-5
Total depth: 97.24 ft, Date: 9/30/2020
Surface Elevation: 1270.50 ft
Coords: X:100.00, Y:5.50
Cone Type: Uknown
Cone Operator: Uknown

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA



SBT legend

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

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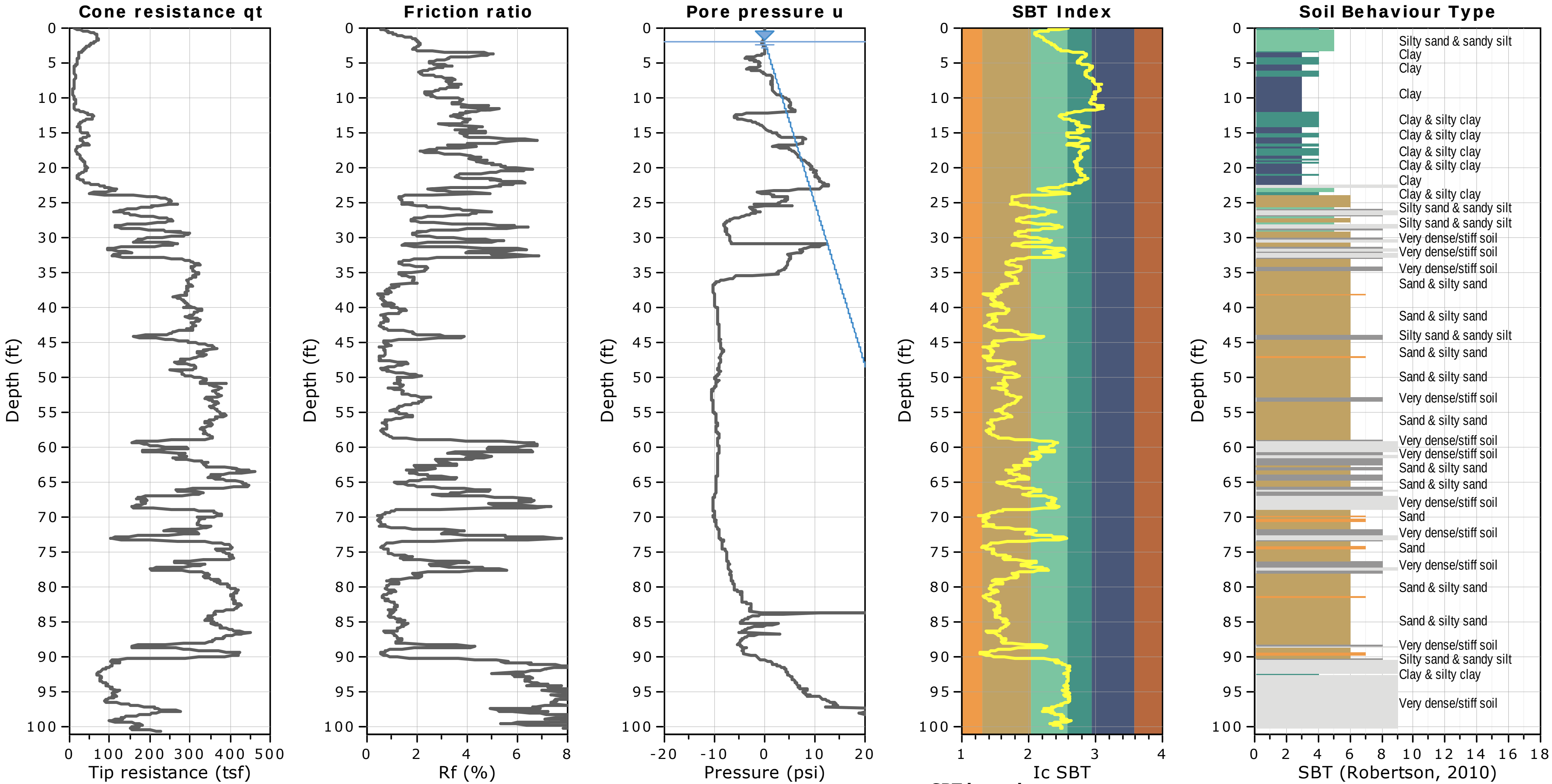
CPT: CPT-6
Total depth: 100.53 ft, Date: 9/30/2020
Surface Elevation: 1272.50 ft
Coords: X:125.00, Y:7.50
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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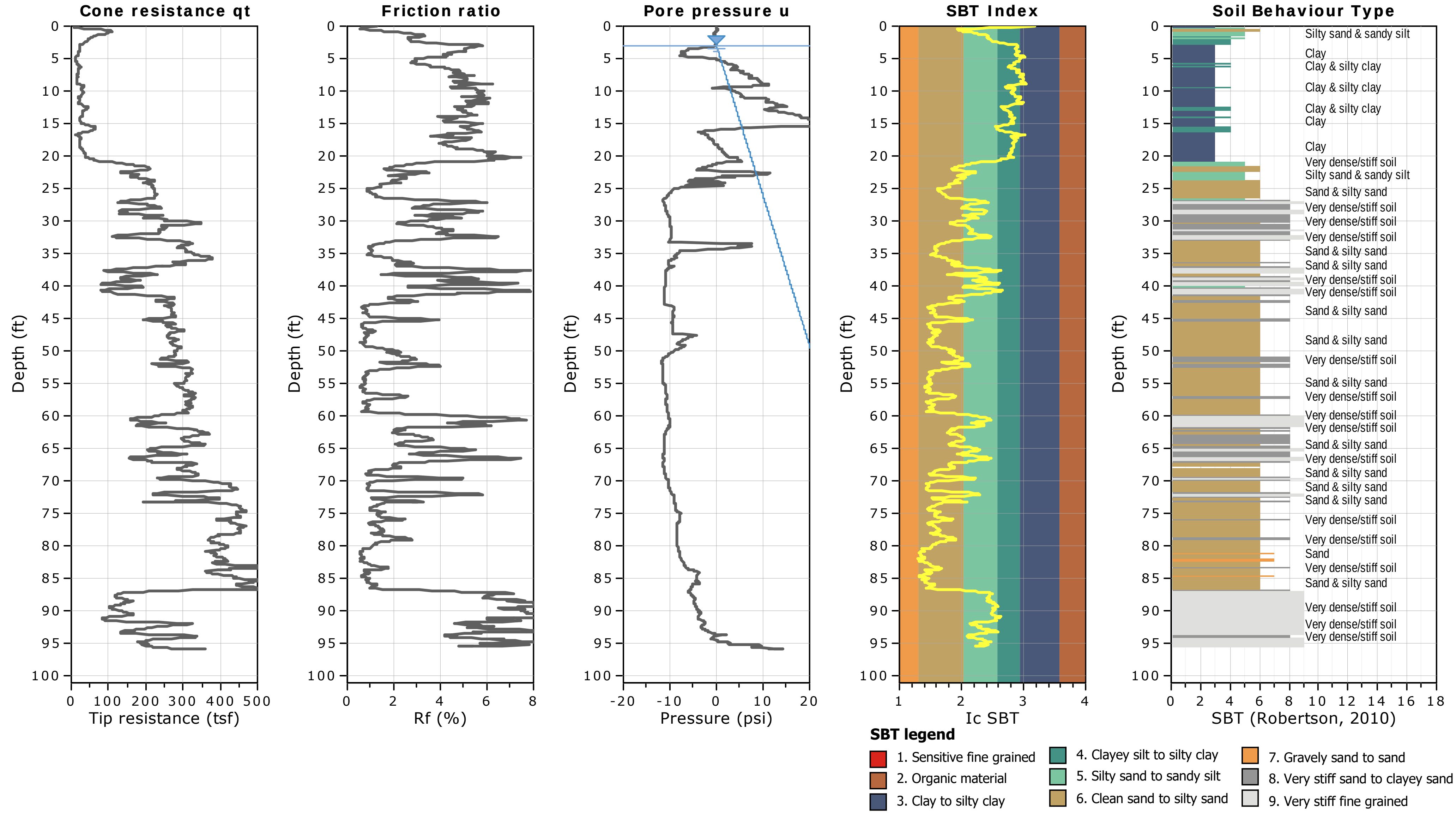
CPT: CPT-7
Total depth: 95.80 ft, Date: 10/1/2020
Surface Elevation: 1273.75 ft
Coords: X:150.00, Y:8.75
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



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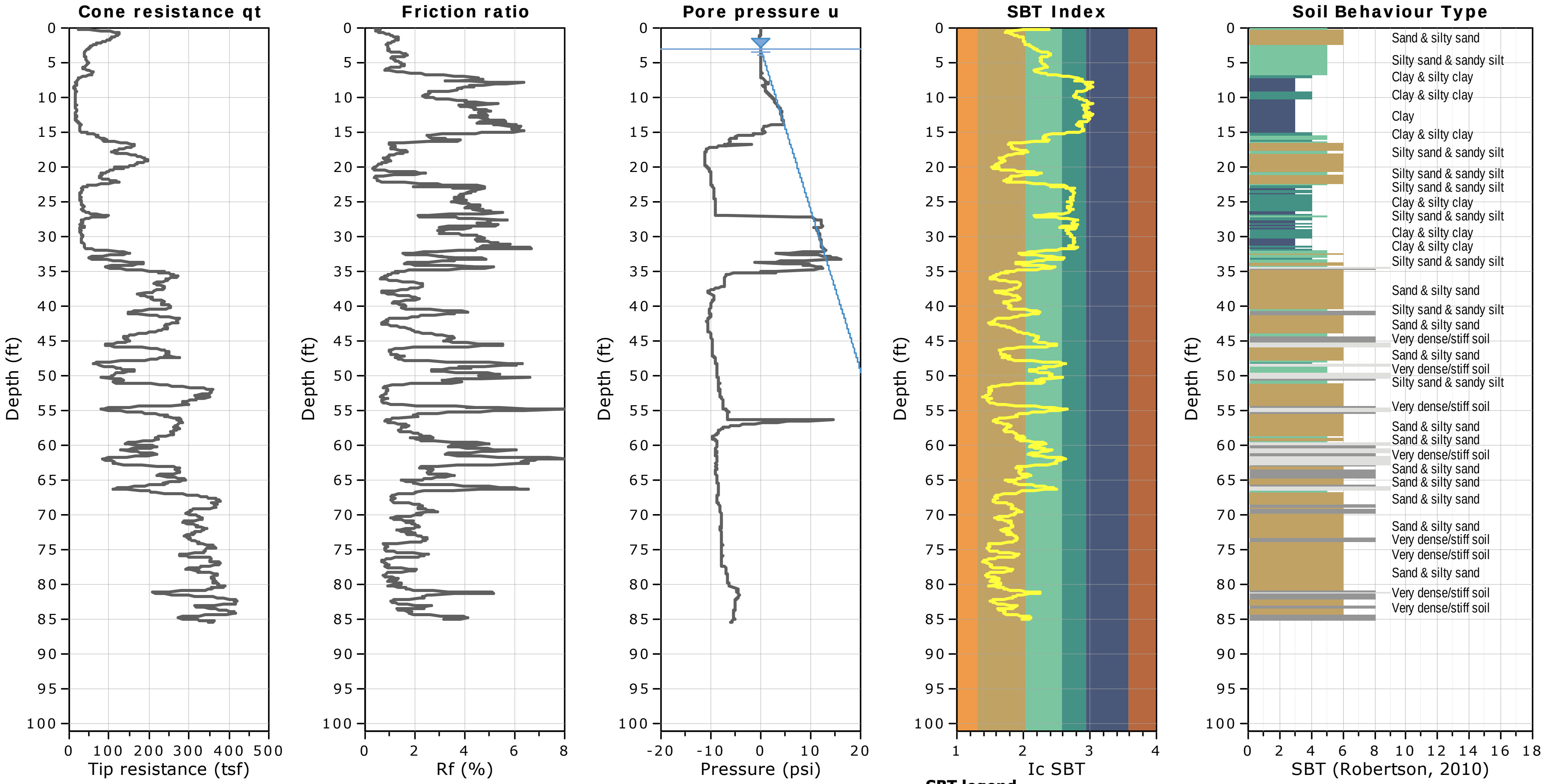
Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA

CPT: CPT-8
Total depth: 85.37 ft, Date: 10/1/2020
Surface Elevation: 1263.25 ft
Coords: X:0.00, Y:-1.75
Cone Type: Uknown
Cone Operator: Uknown



SBT legend

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

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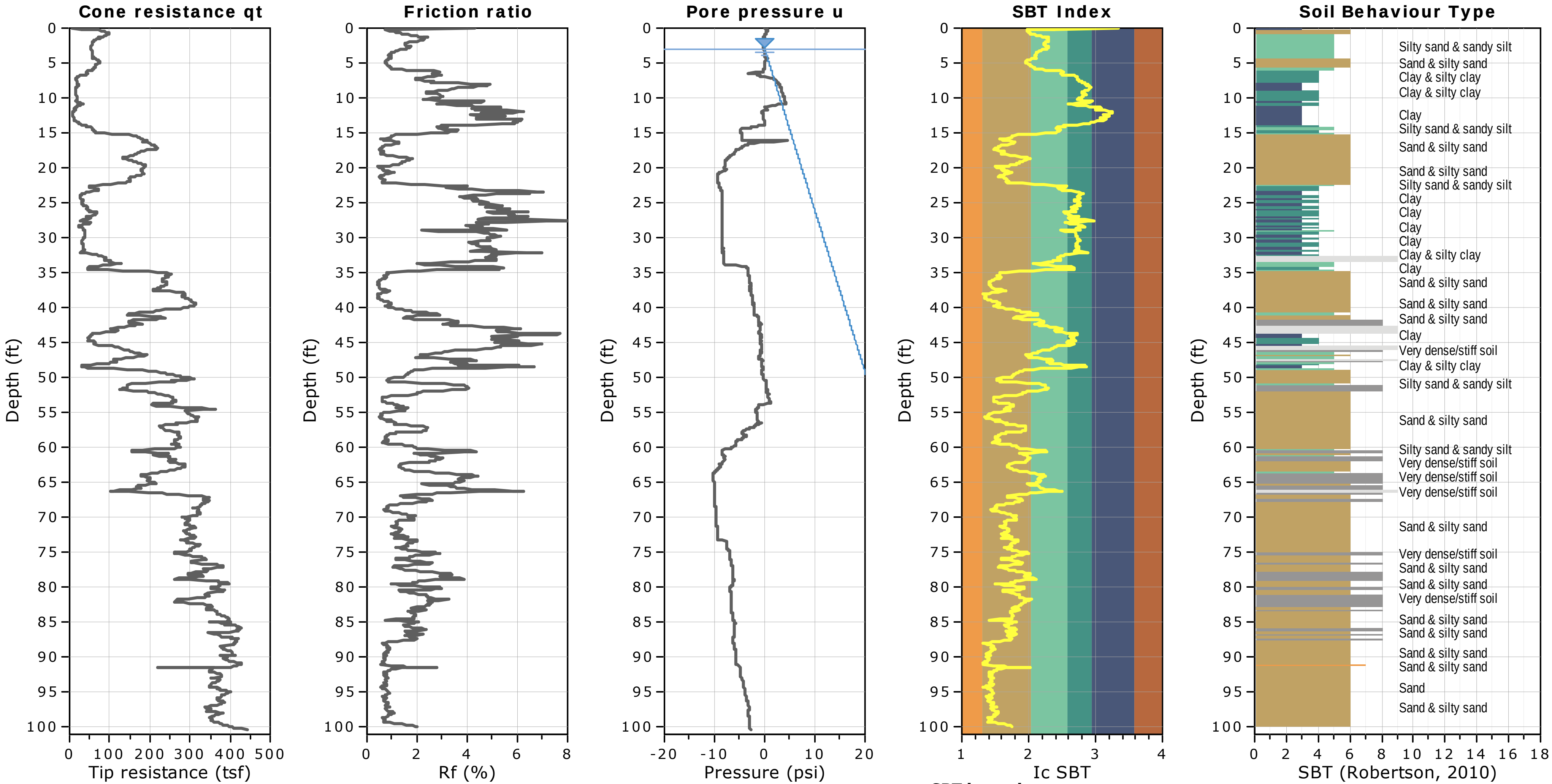
CPT: CPT-9
Total depth: 100.27 ft, Date: 10/1/2020
Surface Elevation: 1265.50 ft
Coords: X:25.00, Y:0.50
Cone Type: Uknown
Cone Operator: Uknown

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA



SBT legend

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

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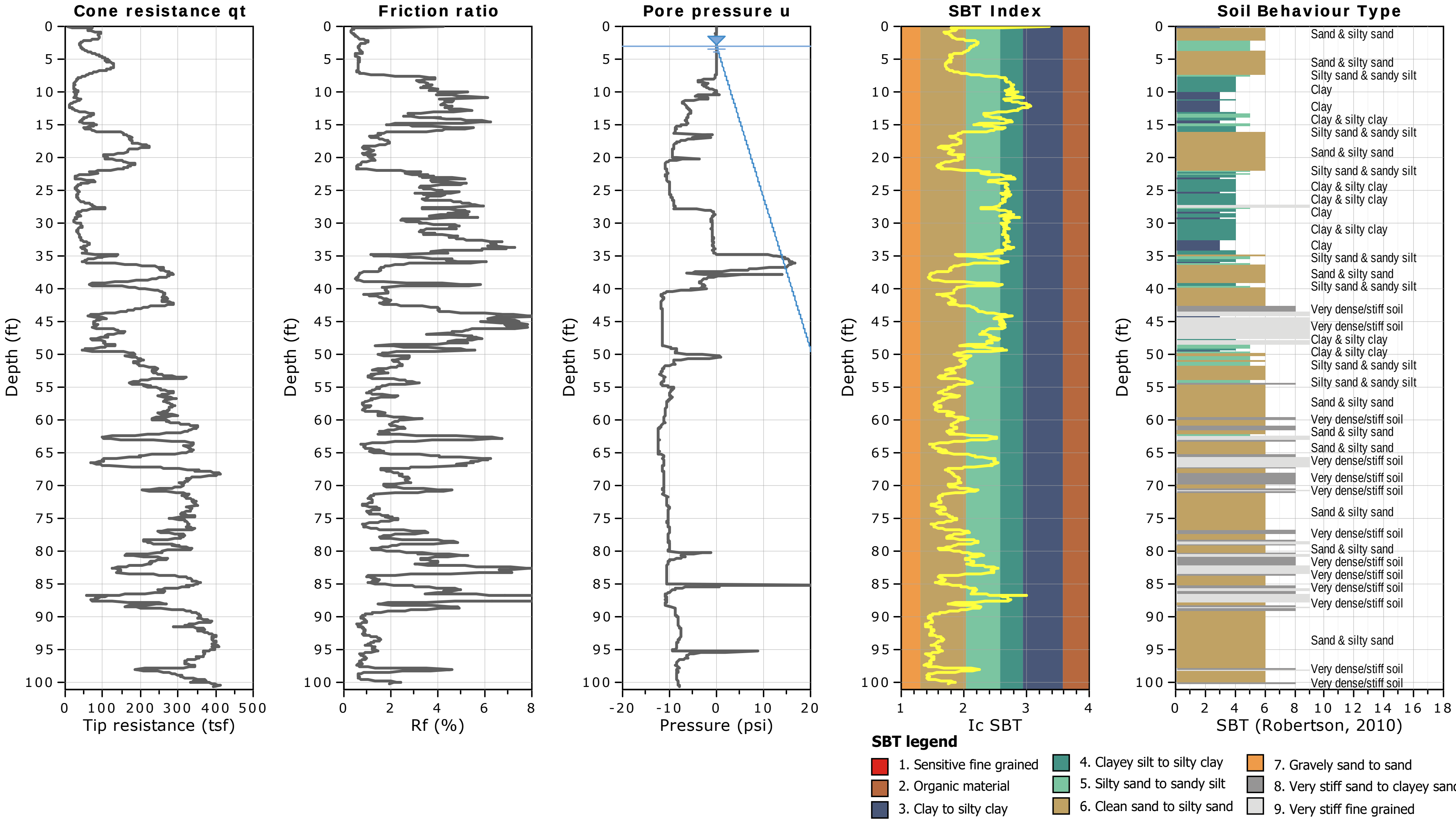
CPT: CPT-10
Total depth: 100.47 ft, Date: 10/1/2020
Surface Elevation: 1266.50 ft
Coords: X:50.00, Y:1.50
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



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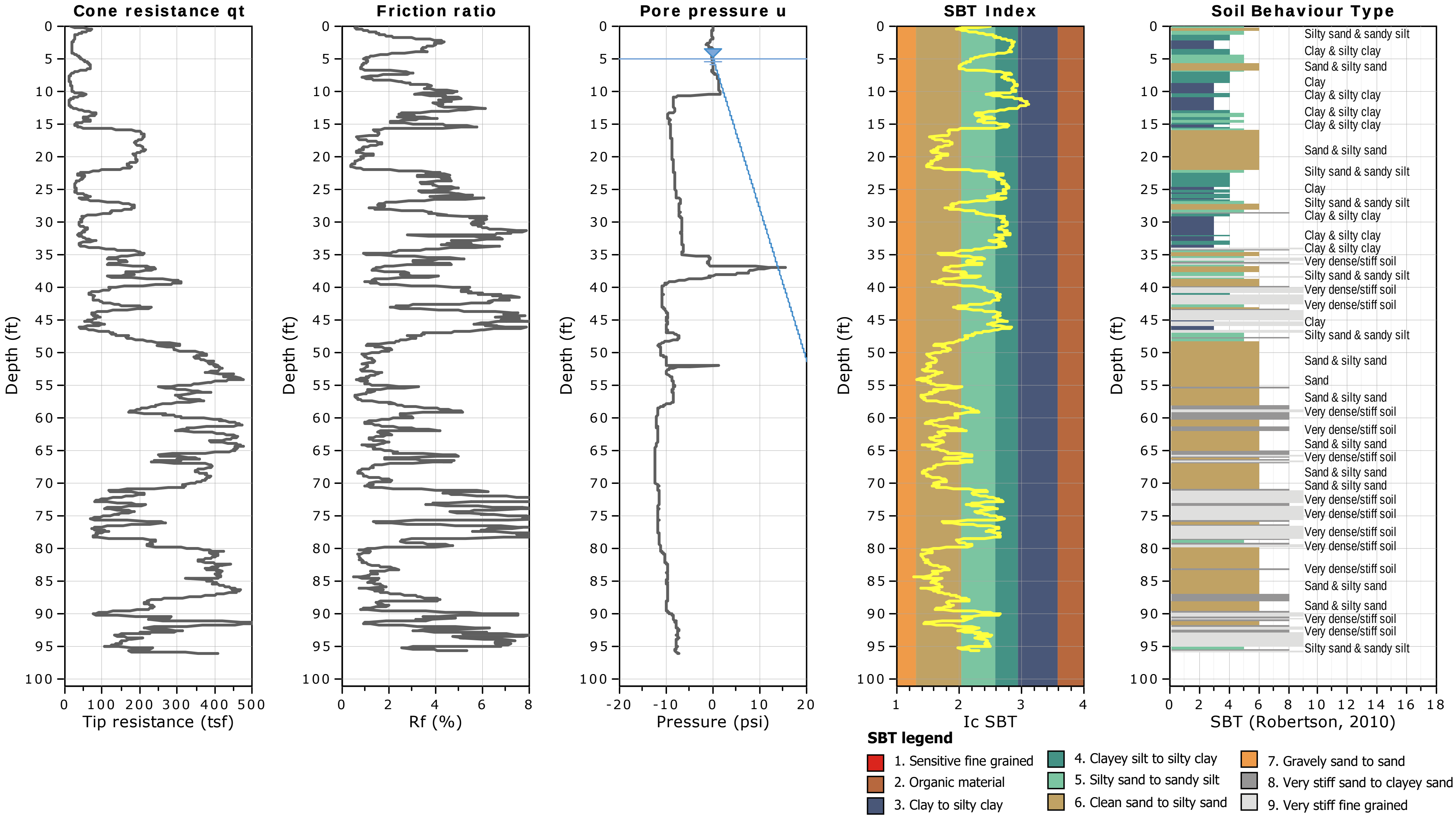
www.kehoetesting.com

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA

CPT: CPT-11
Total depth: 96.07 ft, Date: 10/1/2020
Surface Elevation: 1268.00 ft
Coords: X:75.00, Y:3.00
Cone Type: Uknown
Cone Operator: Uknown



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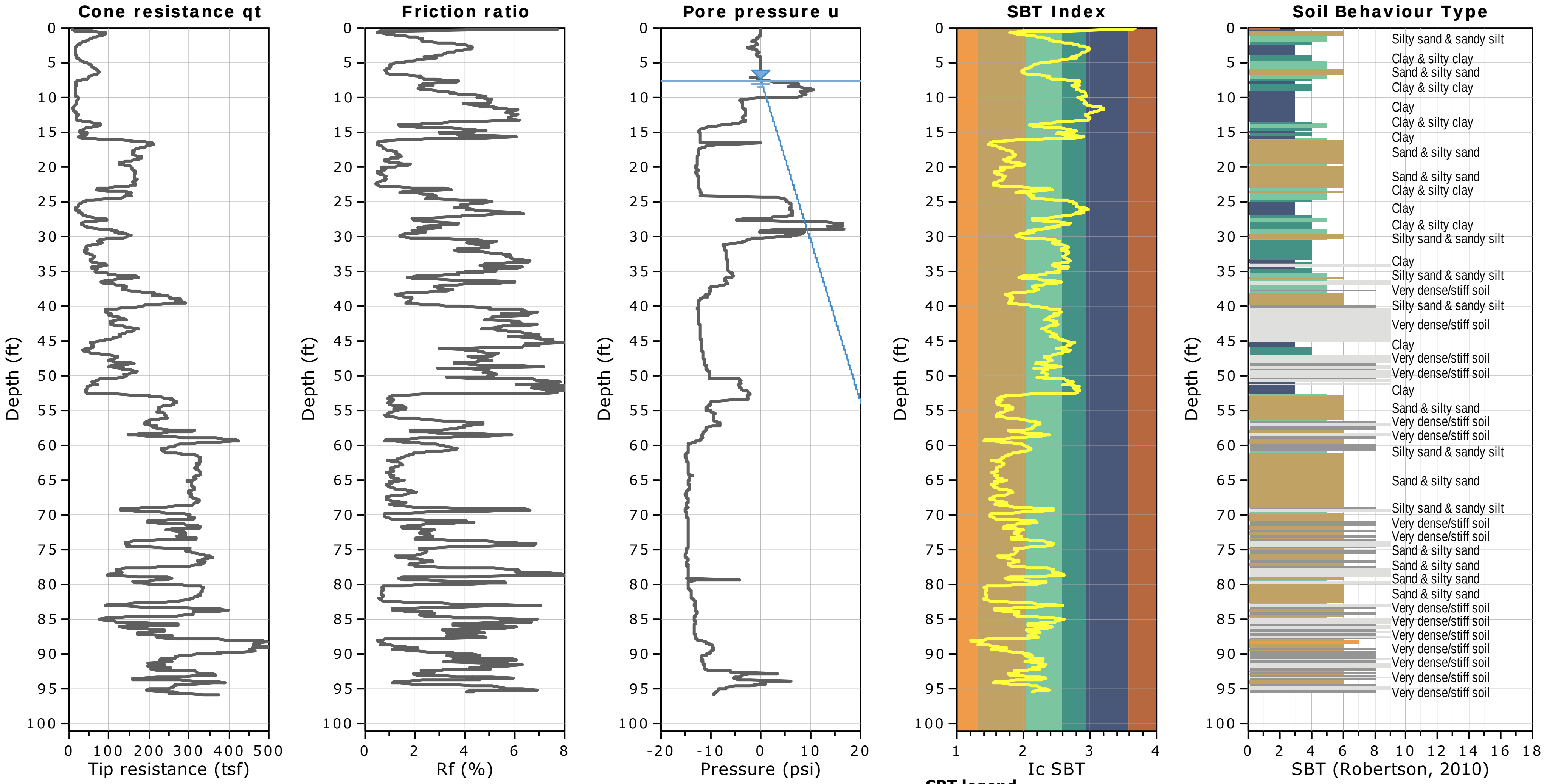
CPT: CPT-12

Total depth: 95.80 ft, Date: 10/2/2020
Surface Elevation: 1268.25 ft
Coords: X:100.00, Y:3.25
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**

Location: **Lake Elsinore, CA**



SBT legend

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

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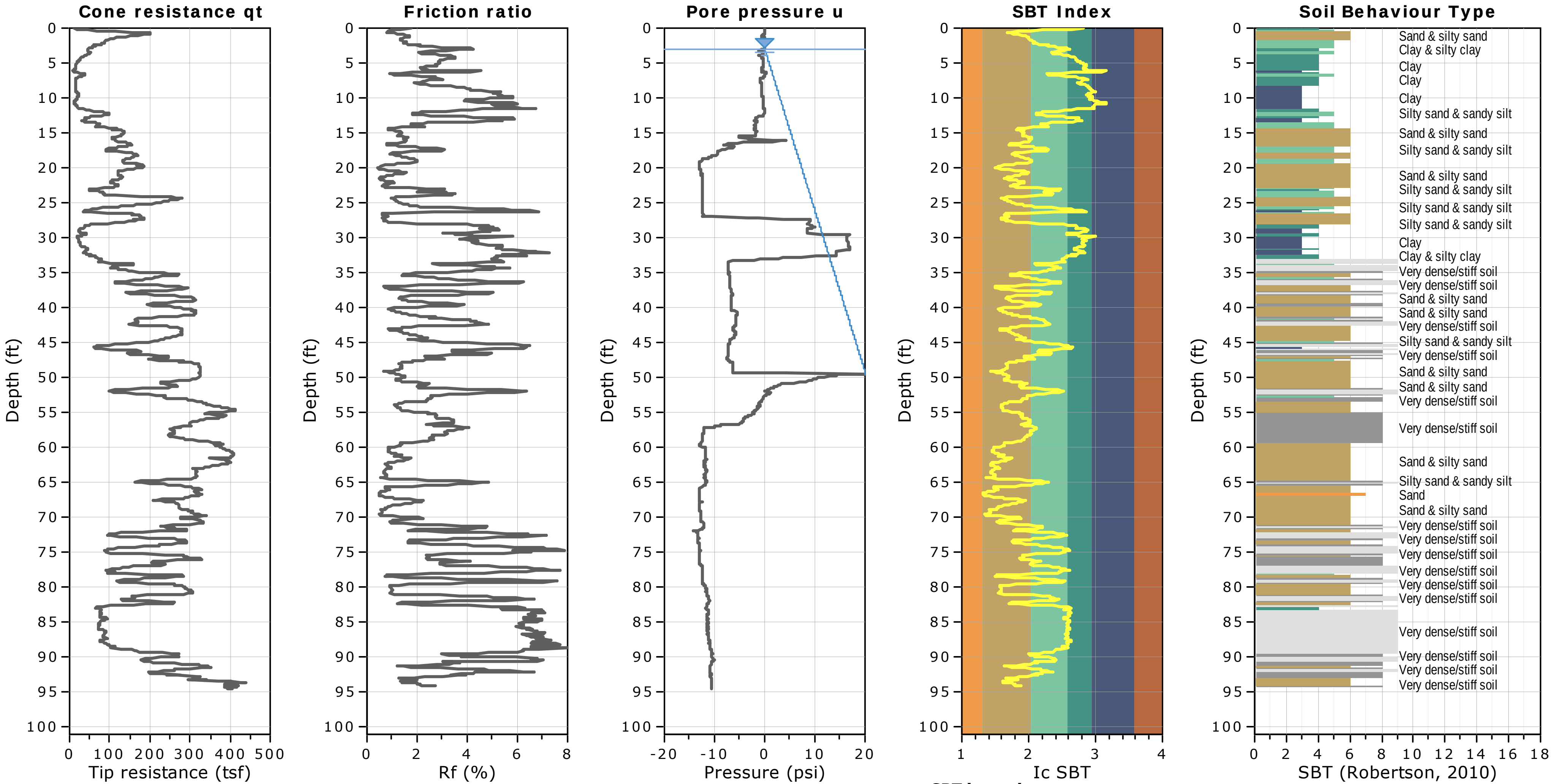
CPT: CPT-13
Total depth: 94.49 ft, Date: 10/2/2020
Surface Elevation: 1269.00 ft
Coords: X:125.00, Y:4.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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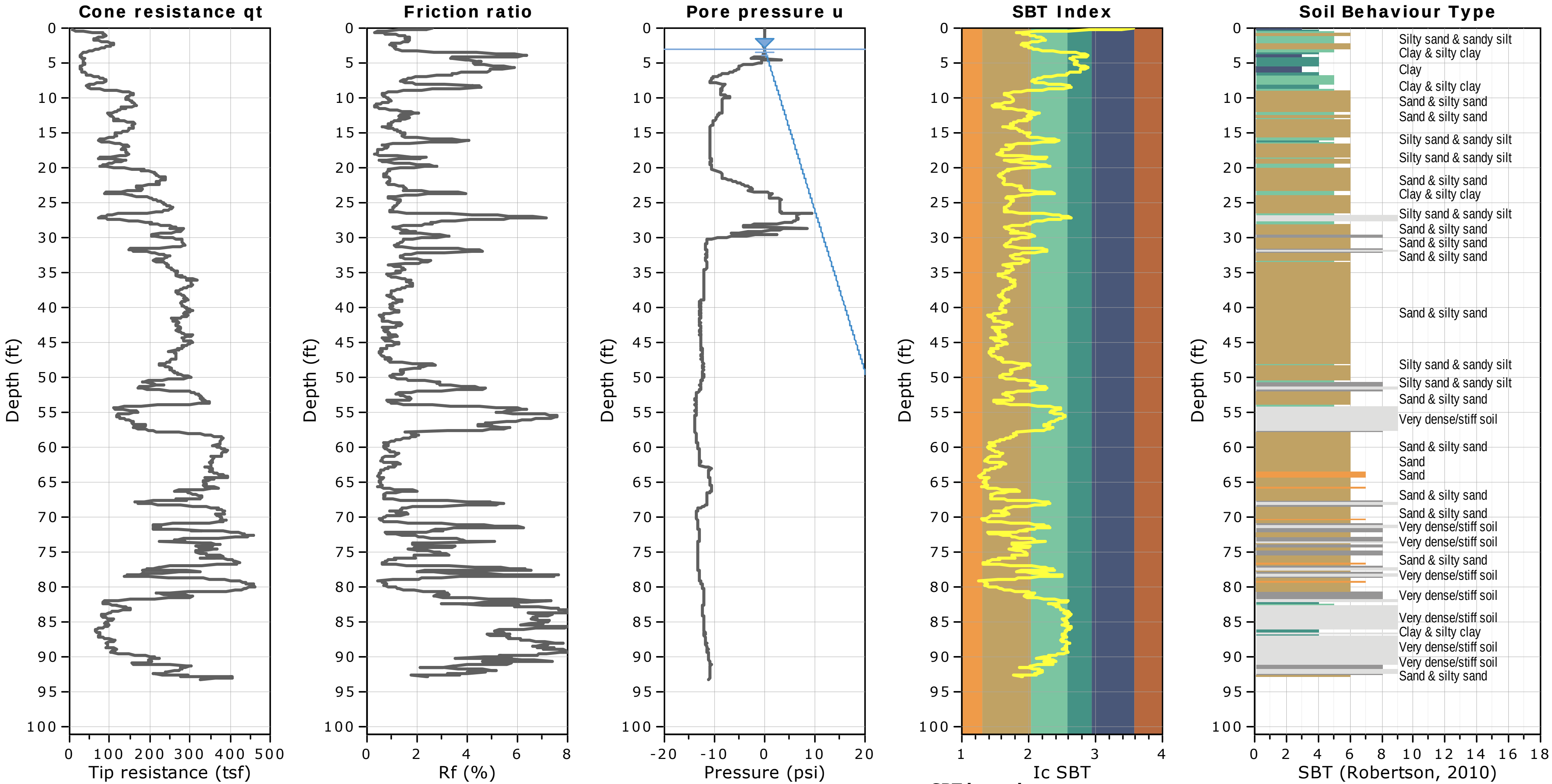
CPT: CPT-14
Total depth: 93.11 ft, Date: 10/2/2020
Surface Elevation: 1269.50 ft
Coords: X:150.00, Y:4.50
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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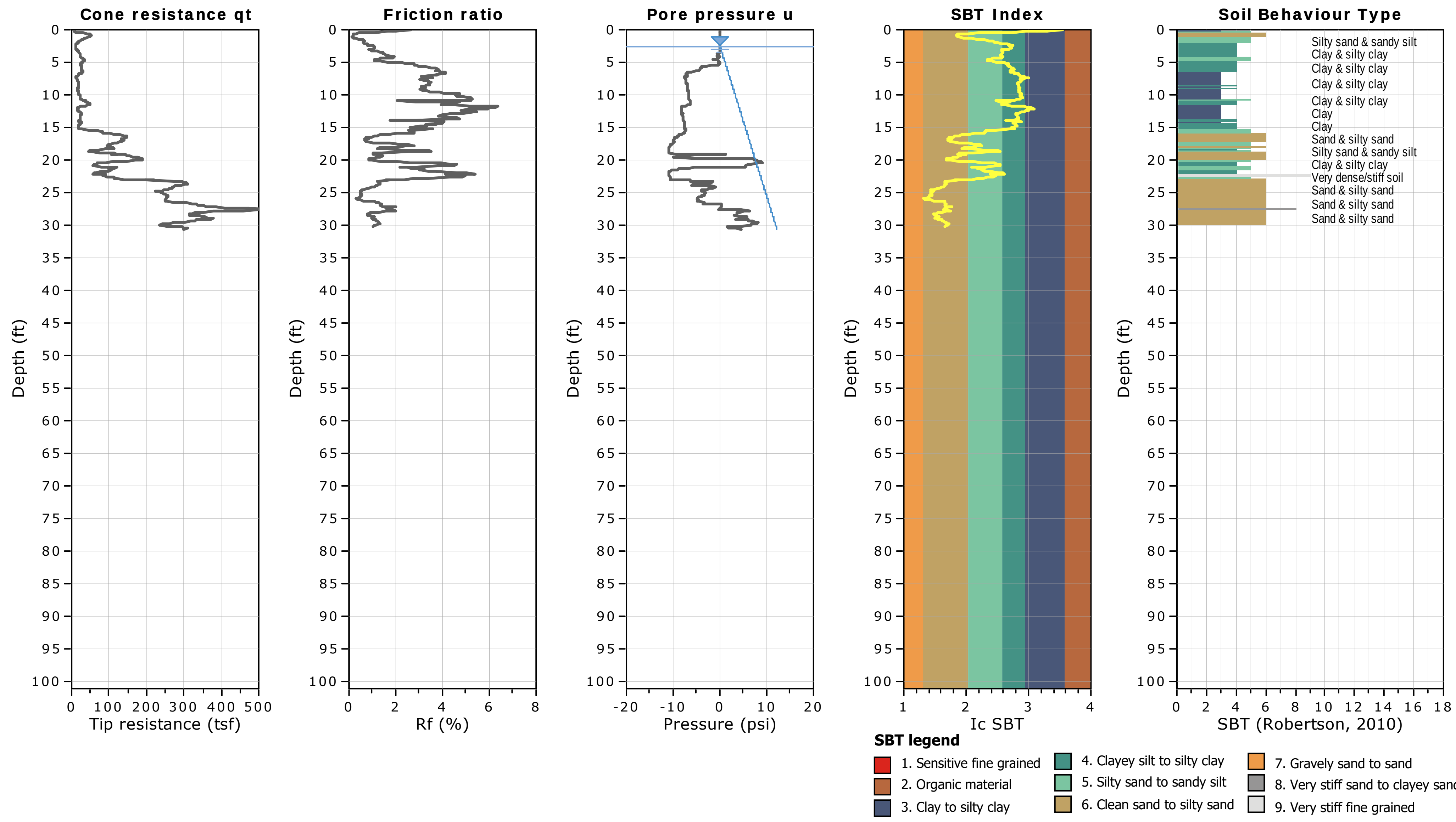
CPT: CPT-15
Total depth: 30.52 ft, Date: 10/2/2020
Surface Elevation: 1277.50 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA



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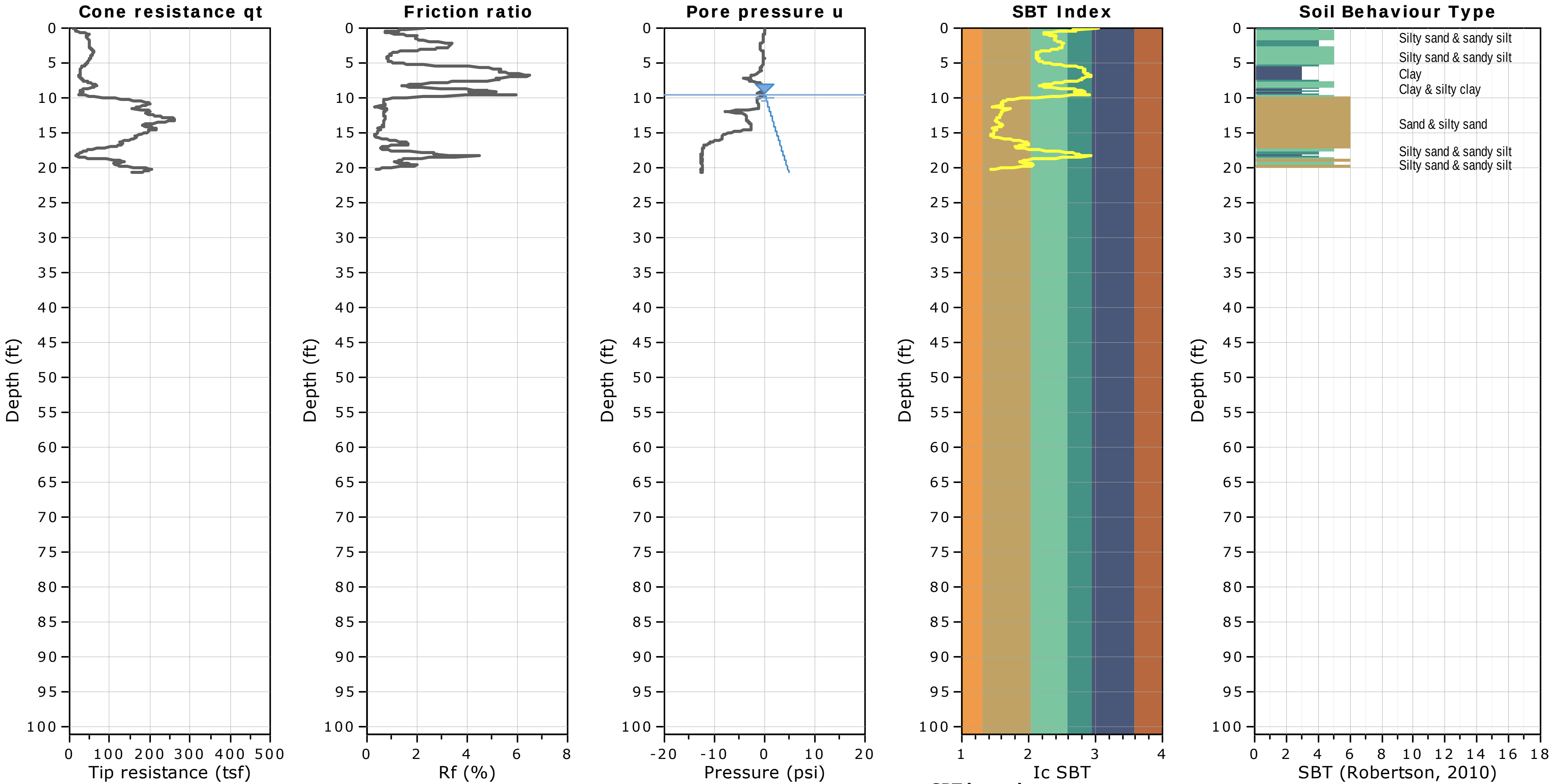
CPT: CPT-16
Total depth: 20.61 ft, Date: 10/2/2020
Surface Elevation: 1278.50 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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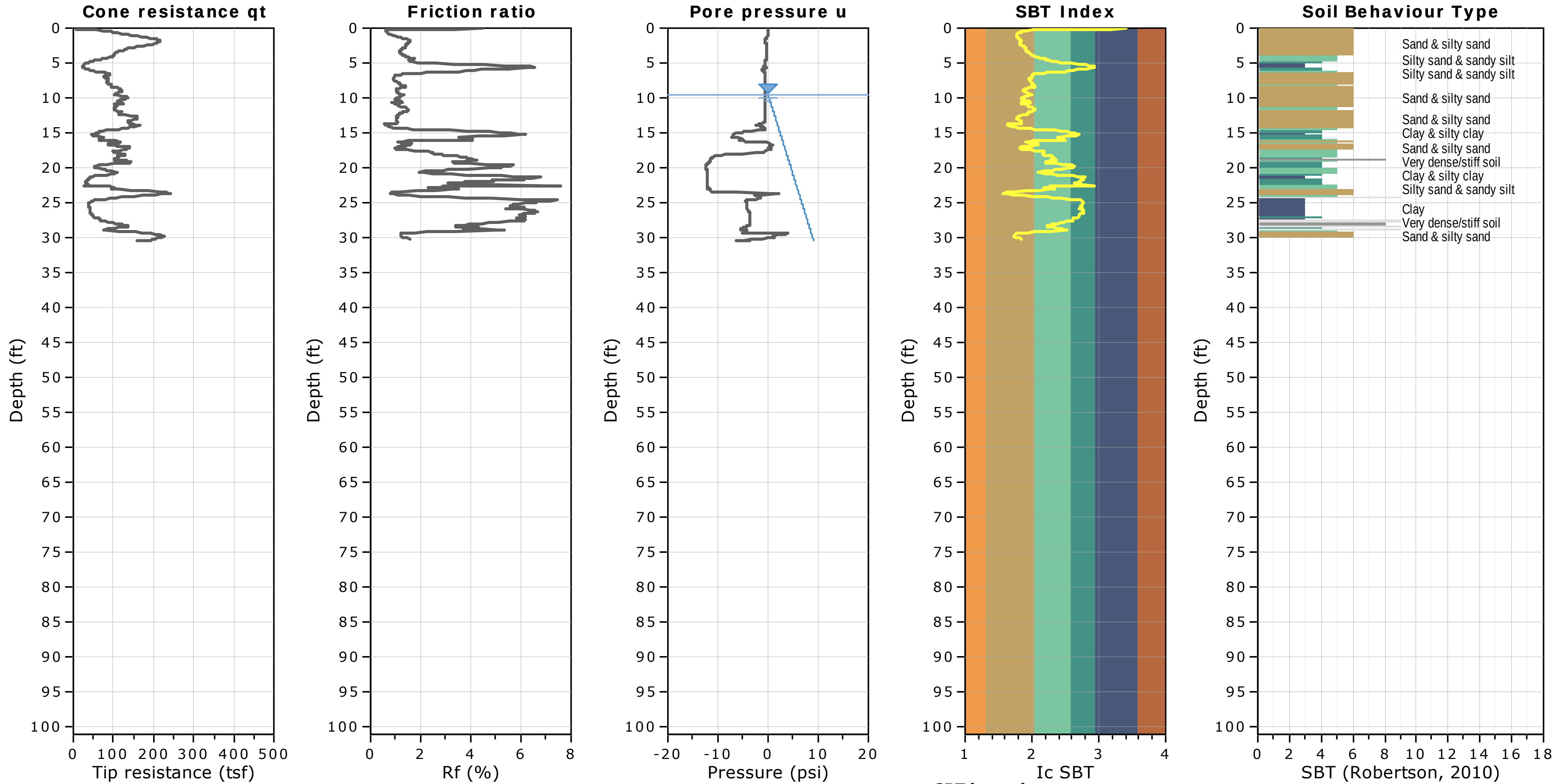
CPT: CPT-17
Total depth: 30.52 ft, Date: 10/2/2020
Surface Elevation: 1289.50 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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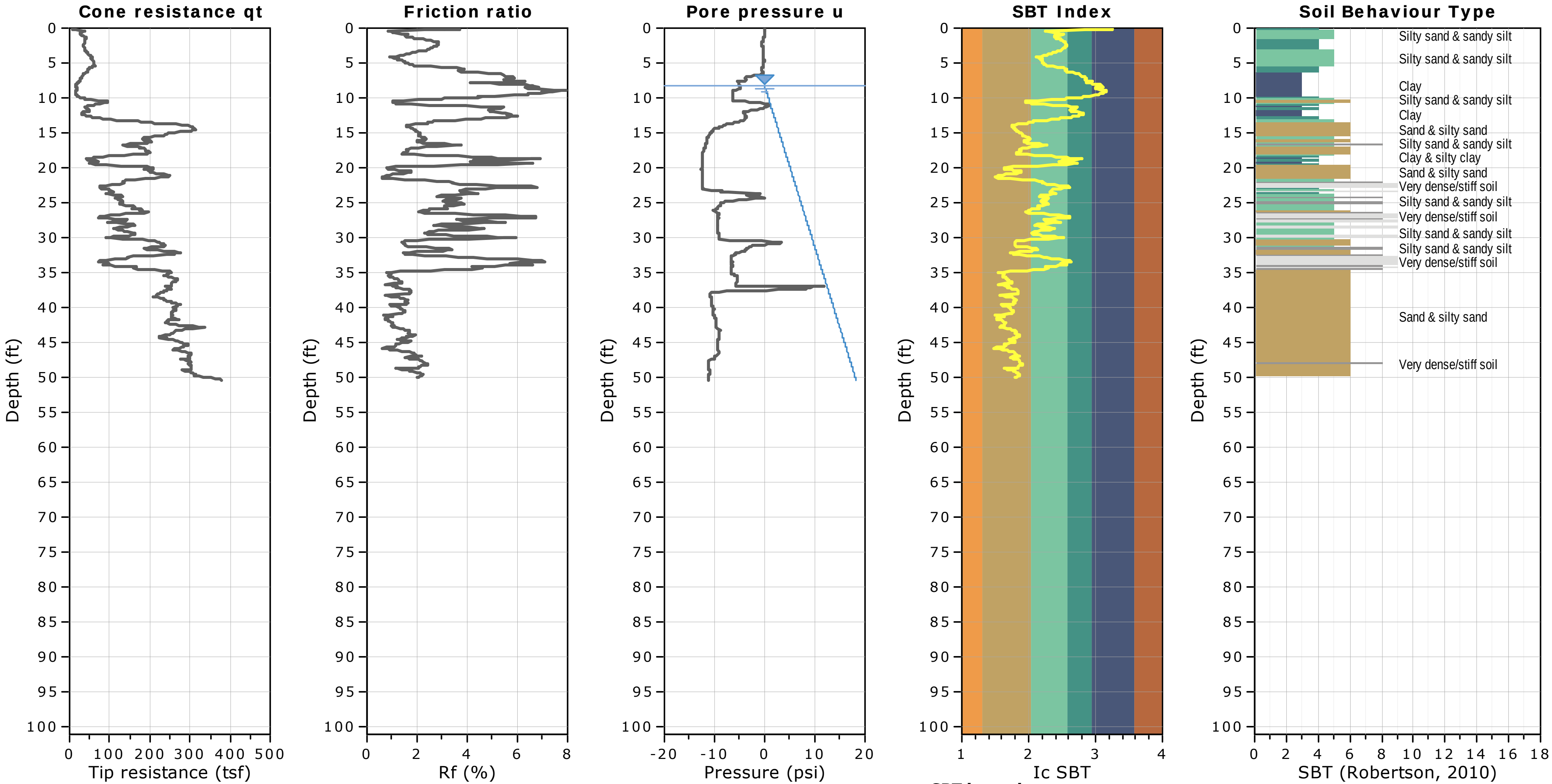
CPT: CPT-18
Total depth: 50.34 ft, Date: 10/2/2020
Surface Elevation: 1284.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

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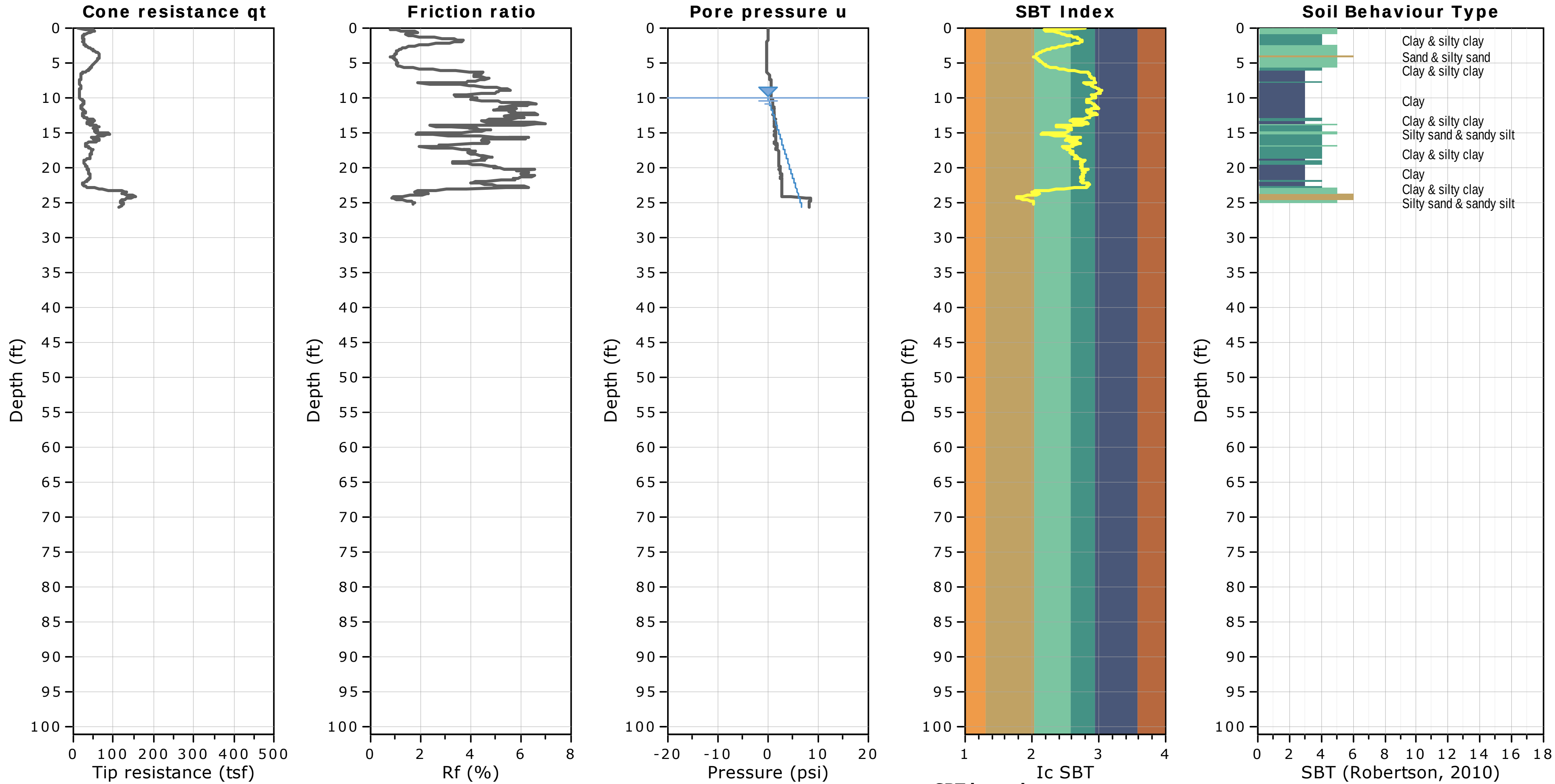
CPT: CPT-19

Total depth: 25.54 ft, Date: 10/2/2020
Surface Elevation: 1278.50 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: Leighton & Associates / Pardee Elsinore 35
Location: Lake Elsinore, CA



SBT legend

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

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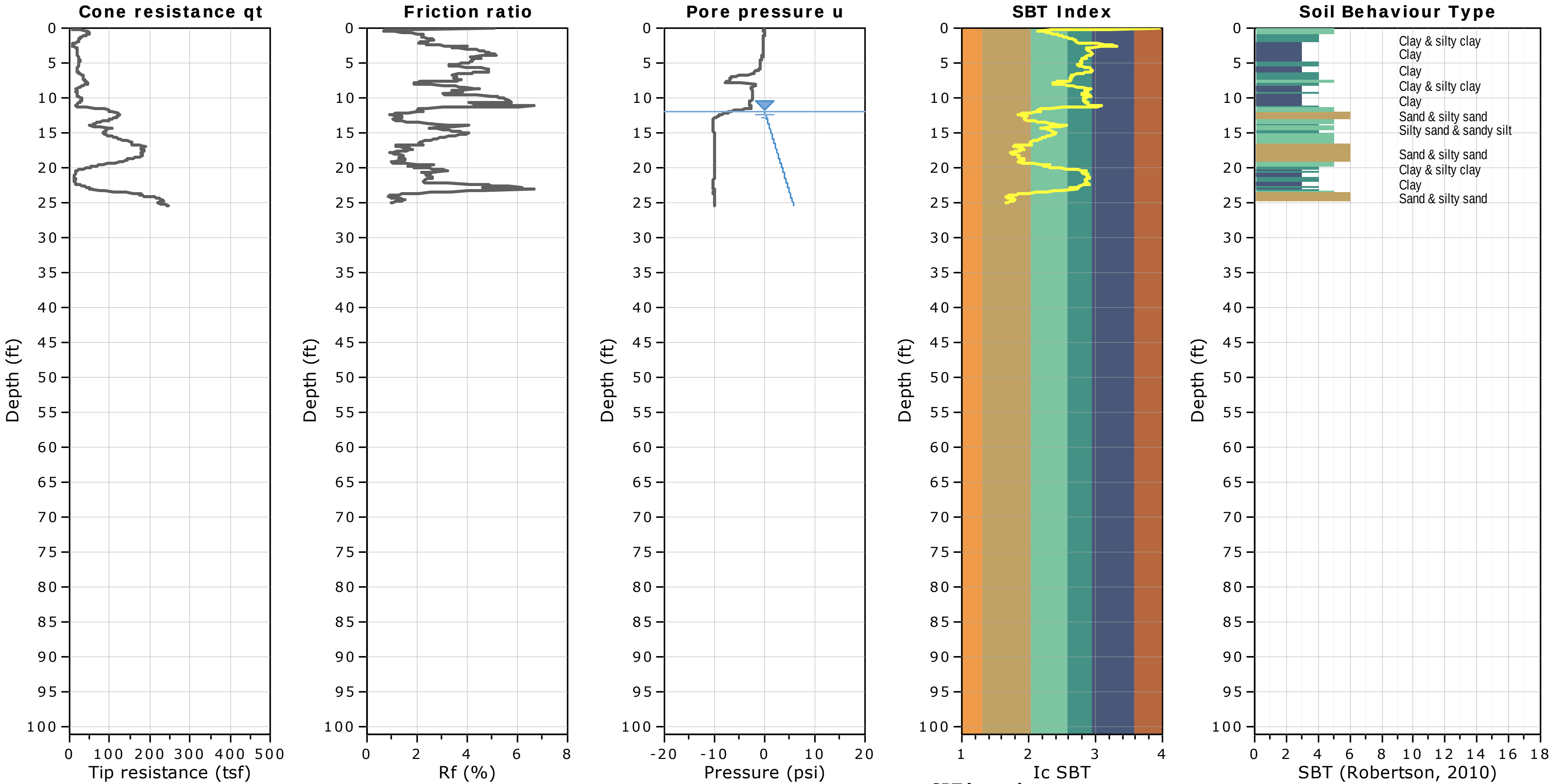
CPT: CPT-20
Total depth: 25.40 ft, Date: 10/2/2020
Surface Elevation: 1283.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

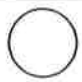
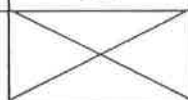
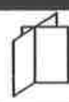
Project: **Leighton & Associates / Pardee Elsinore 35**
Location: **Lake Elsinore, CA**



SBT legend

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

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVER: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHEBLY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blow required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Southern California Geotechnical INC.

BORING NO. B-1

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 14 feet
CAVE DEPTH: 23 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1303± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					6± inches Topsoil/Root mat material							
	X	8			ALLUVIUM: Black to Dark Brown Clayey fine Sand, loose-damp to moist		7					EI = 12 @ 0 to 5'
5	X	14				120	8					
					Light Gray Brown to Gray Brown Silty fine to medium Sand, trace to little Clay, loose to medium dense-moist to wet							
10	X	10					16			23		
15	X	21					17			12		
20	X	18					22			8		
					Gray Brown Silty fine to medium Sand, trace Clay, medium dense-wet							
					Light Gray Brown fine to medium Sand, trace coarse Sand, medium dense-wet							
					Gray Brown to Light Gray Brown Clayey fine to medium Sand, trace Iron oxide staining, medium dense-wet							
25	X	14					13			34		
30	X	16					16			25		
					Red Brown to Gray Brown Clayey fine to medium Sand, some Iron oxide staining, medium dense to very dense-wet							
	X	25					17			29		

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-1

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 14 feet
CAVE DEPTH: 23 feet
READING TAKEN: At Completion

FIELD RESULTS: DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (Continued)	LABORATORY RESULTS: DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					Red Brown to Gray Brown Clayey fine to medium Sand, some Iron oxide staining, medium dense to very dense-wet							
40	X	50					14			11		
					Red to Gray Brown Silty fine Sand to fine Sandy Silt, trace Clay, trace Iron oxide staining, dense-wet							
45	X	41					20			46		
					Light Brown to Gray Brown fine to medium Sand, trace to little Silt, dense-wet							
50	X	39					16			17		
					Gray Brown Clayey fine to medium Sand, dense-wet							
					Boring Terminated at 50'							

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

Southern California Geotechnical INC.

BORING NO. B-2

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 14 feet
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1269± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					6± inches Topsoil/Root mat material							
	X	20			ALLUVIUM: Dark Brown to Black Clayey fine Sand, medium dense-damp to moist	105	10					
	X	16				107	12					
5	X	16			@ 5 to 6 feet, Gray Brown to Dark Brown, trace coarse Gravel	113	11					
	X	18			Gray to Light Brown Clayey fine to medium Sand, medium dense-moist	117	14					
	X	18			Brown Clayey fine Sand, medium dense-moist	122	13					
10												
					Gray Brown to Light Brown to Red Brown Clayey fine Sand, trace medium Sand, loose-wet							
	X	9			▽		19					
15												
					Gray Brown Clayey fine to medium Sand, some coarse Sand, medium dense-wet							
	X	17					13					
20												

Boring Terminated at 20'

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-3

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 7 feet
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

SURFACE ELEVATION: 1319± ft MSL

DEPTH (FEET)	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
0			8± inches Topsoil/Root mat material							
	17		ALLUVIUM: Dark Brown to Black Clayey fine Sand, little medium Sand, loose to medium dense-damp to moist	117	13					
	15			119	12					
5	7			101	12					
	11		Gray Brown to Brown Clayey fine Sand, trace Silt, loose-wet							No Sample Recovered
10	10			115	15					
			Gray Brown to Gray Silty fine to medium Sand, trace coarse Sand, medium dense-wet							
15	25				15					
			Orange Brown to Light Gray to Dark Gray fine to coarse Sand, some Silt, dense-wet							
20	35				15					
			Red Brown to Brown Silty fine to coarse Sand, trace Clay, some Iron oxide staining, dense-wet							
25	33				15					
			Boring Terminated at 25'							

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

Southern California Geotechnical INC.

BORING NO. B-4

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 9 feet
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1290± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					8± inches Topsoil/Root mat material							
	X	9			ALLUVIUM: Black Clayey fine Sand, loose-damp		14					
	X	12			Gray Brown to Dark Gray Brown to Brown Clayey fine Sand, some medium Sand, abundant Iron oxide staining, loose to medium dense-damp to moist		15					
5	X	9					17					
	X	16			Brown to Gray Brown Silty to Clayey fine to medium Sand,loose to medium dense-wet		17					
10												
	X	10					16					
15												
					Gray to Dark Gray Silty fine to medium Sand, dense-wet							
	X	44					14					
20												

Boring Terminated at 20'

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-5

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 6 feet
CAVE DEPTH: 13 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: 1269± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					8± inches Topsoil/Root mat material							
	X	5			ALLUVIUM: Black Clayey fine Sand, trace fine root fibers, loose-very moist to wet	106	20					EI = 21 @ 0 to 5'
	X	11										No Sample Recovered
5	X	16										No Sample Recovered
	X	7					27					Disturbed Sample
10	X	9				95	26					
					Gray fine to medium Sand, some Clay, medium dense-wet							
	X	21					16					
15					Boring Terminated at 15'							

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-6

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 3 feet
CAVE DEPTH: 6 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1295± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					12± inches Topsoil/Root mat material							
		3			ALLUVIUM: Gray to Dark Brown Clayey fine Sand, very loose-moist	100	24					
		3										No Sample Recovered
5		9			Gray Brown Silty fine to coarse Sand, trace fine root fibers, loose to medium dense-wet	117	14					
		19				118	14					
10		30				118	13					
					Black Clayey fine Sand, trace medium Sand, loose-wet							
15		9					17					
					Blue Gray to Blue Green fine Sandy Clay, soft to stiff-wet							
20		19	4.5+				16					

Boring Terminated at 20'

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-7

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 2 feet
CAVE DEPTH: 18 feet
READING TAKEN: At Completion

SURFACE ELEVATION: 1283± ft MSL

DEPTH (FEET)	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
			POSSIBLE FILL: Brown to Dark Brown fine to medium Sandy Clay, abundant roots/organic material, soft-wet							
	16	0.5	ALLUVIUM: Black fine Sandy Clay, abundant roots/organic material, medium stiff-wet	99	21					
	25									No Sample Recovered
5	14		Light Gray Brown to Dark Gray Brown Clayey fine Sand, loose-wet	116	15					
	7			113	18					
	13	2.0	Gray to Light Brown fine Sandy Clay, soft to medium stiff-wet	114	18					
10			Orange Brown fine to medium Sand, some Clay, abundant Iron oxide staining, micaceous, medium dense-wet							
15	15				18					
			Red Brown to Brown Clayey fine to medium Sand, some Iron oxide staining, medium dense-wet							
20	12				19					
			Blue fine Sandy Clay, medium stiff-wet							
25	15	4.0			17					

Boring Terminated at 25'

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

Southern California Geotechnical INC.

BORING NO. B-8

JOB NO.: 05G255
PROJECT: Proposed SFR Tract
LOCATION: Lake Elsinore, California

DRILLING DATE: 9/30/05
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daniel Nielsen

WATER DEPTH: 7 feet
CAVE DEPTH: 12 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION — SURFACE ELEVATION: 1277± ft MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					POSSIBLE FILL: Dark Brown fine to medium Sand, trace Clay, medium dense-damp							
	X	21				116	9					
					POSSIBLE FILL: Gray Brown to Dark Brown Clayey fine to medium Sand, medium dense-damp to moist							
	X	17				111	19					
5	X	15				104	11					
					ALLUVIUM: Dark Gray Brown Silty fine to medium Sand, trace Clay, very loose to loose-wet							
	X	3				108	20					
10	X	9				115	15					
					Dark Gray Brown fine to medium Sand, trace coarse Sand, trace Silt, medium dense-wet							
15	X	22					15					
					Brown fine to medium Sand, little Silt, trace Clay, medium dense-wet							
20	X	14					16					
25	X	23			@ 23½ to 25 feet, some Iron oxide staining		21					
30	X	11			@ 28½ to 30 feet, some Clay		16					
					Boring Terminated at 30'							

TBL 05G255.GPJ SOCALGEO.GDT 1/5/06

TEST BORING LOG

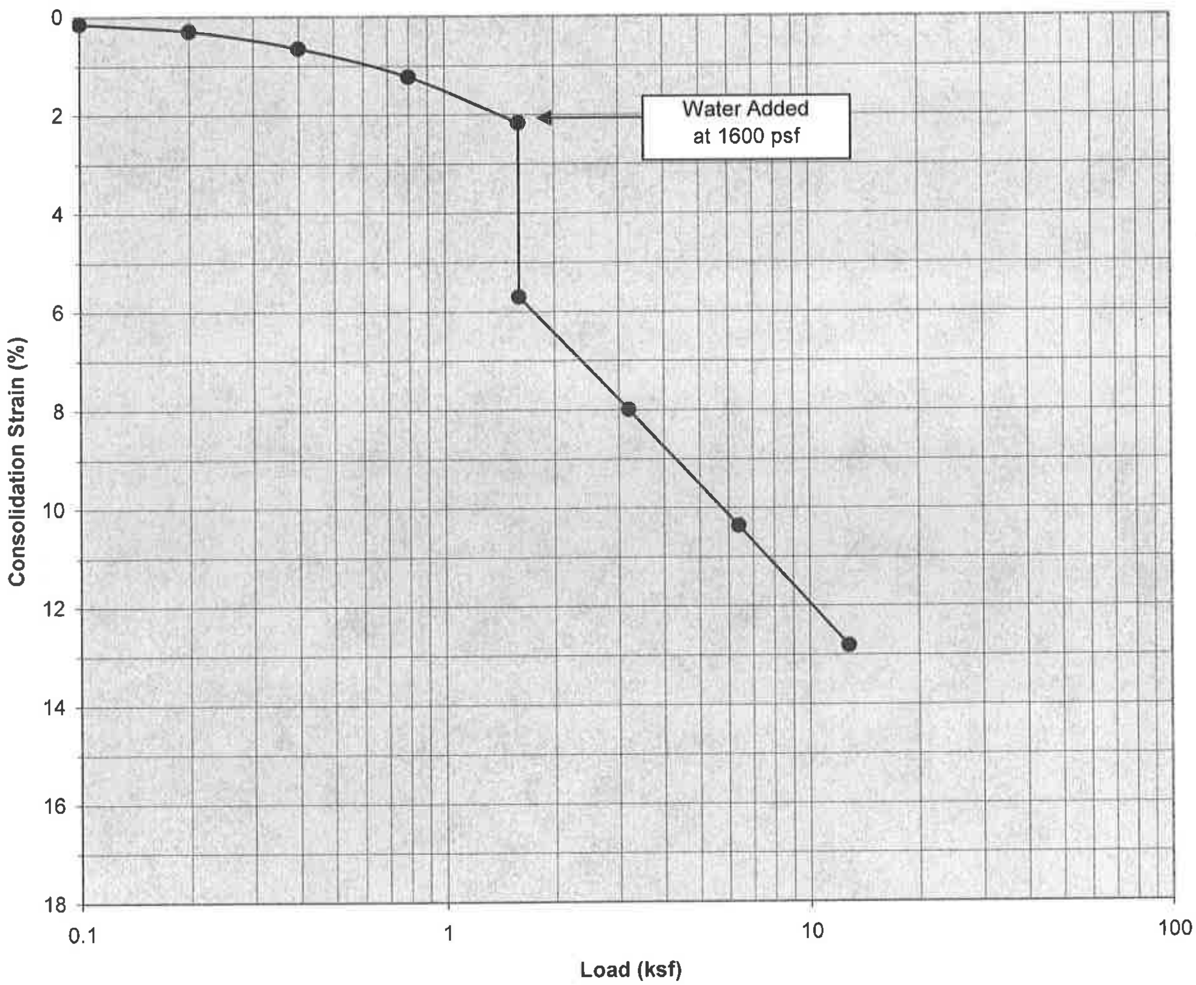
APPENDIX B

Geotechnical Laboratory Testing

APPENDIX C

LABORATORY TESTING

Consolidation/Collapse Test Results



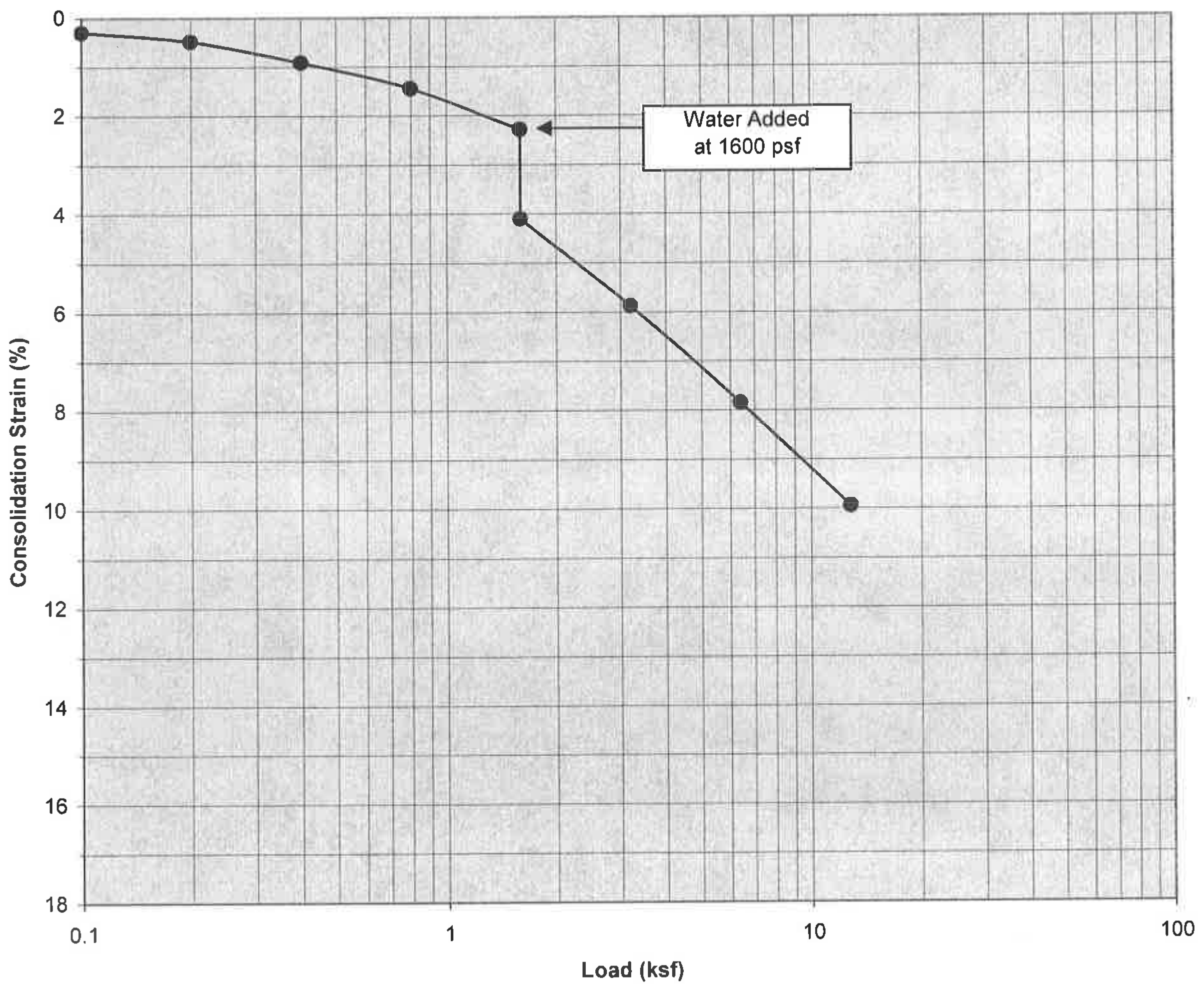
Classification: ALLUVIUM: Dark Brown to Black Clayey fine Sand

Boring Number:	B-2	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	1 to 2	Initial Dry Density (pcf)	104.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.53

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 1

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



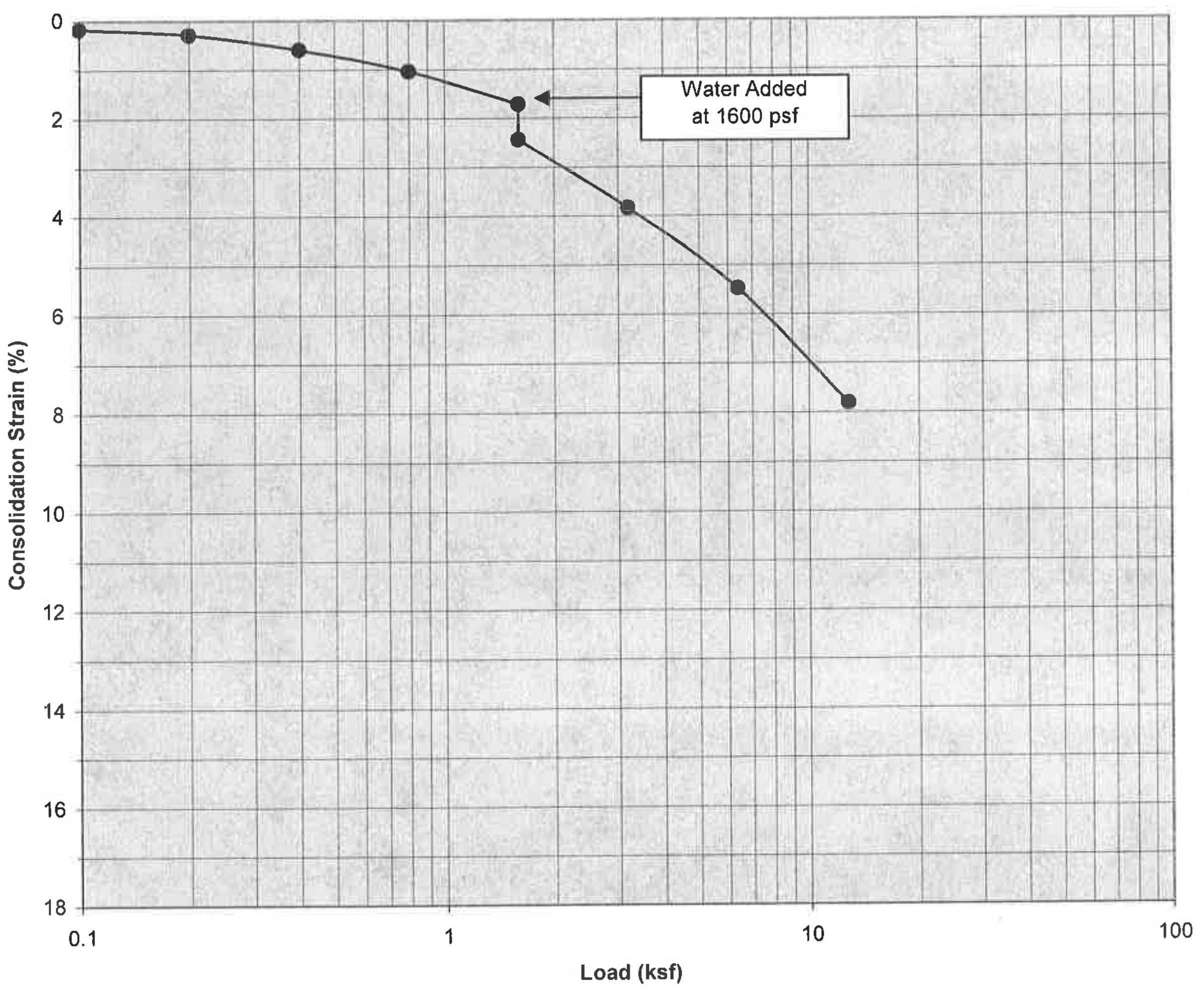
Classification: ALLUVIUM: Dark Brown to Black Clayey fine Sand

Boring Number:	B-2	Initial Moisture Content (%)	10
Sample Number:	----	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	107.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.81

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 2

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



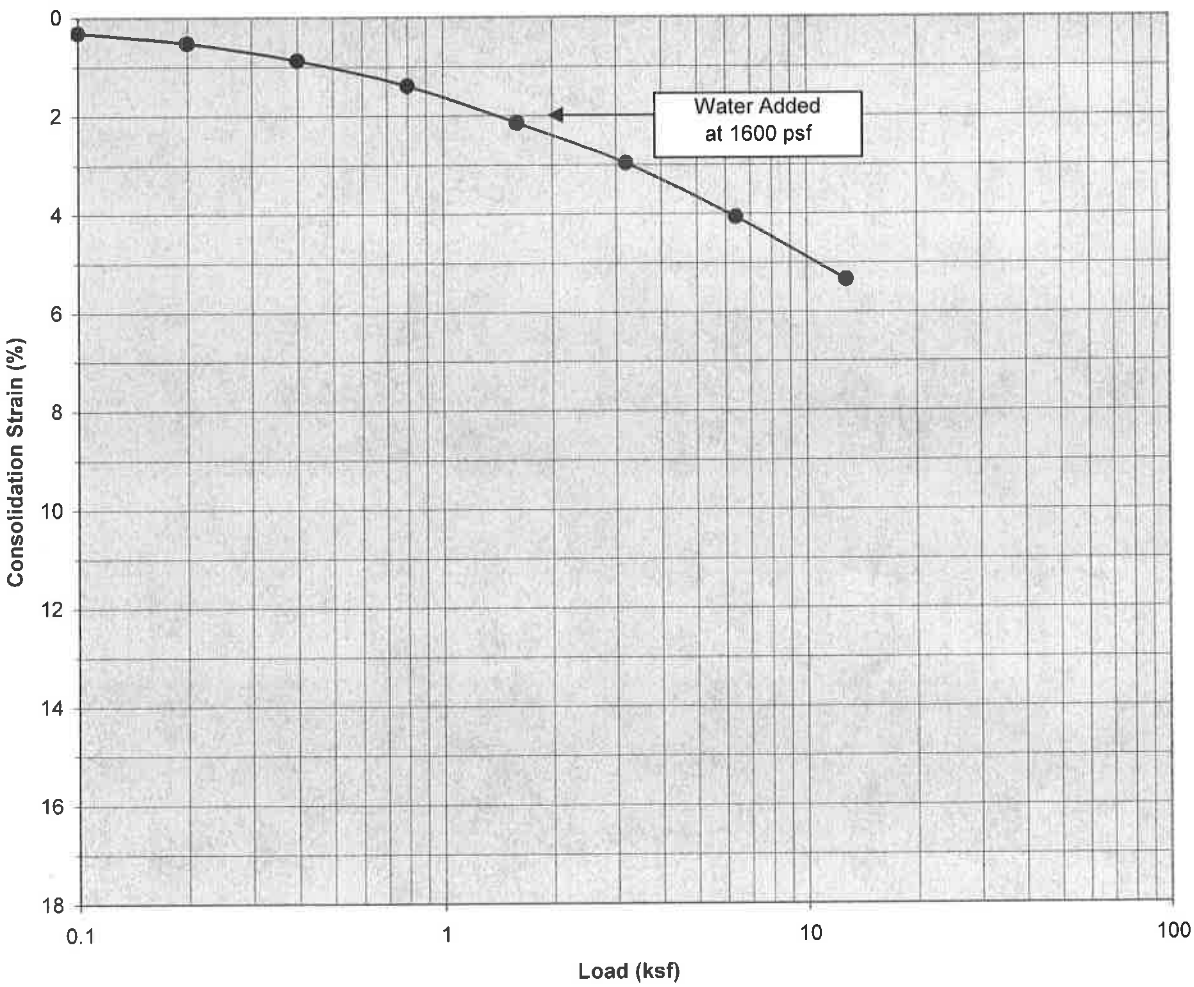
Classification: ALLUVIUM: Dark Brown to Black Clayey fine Sand

Boring Number:	B-2	Initial Moisture Content (%)	10
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	5 to 6	Initial Dry Density (pcf)	112.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.72

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 3

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



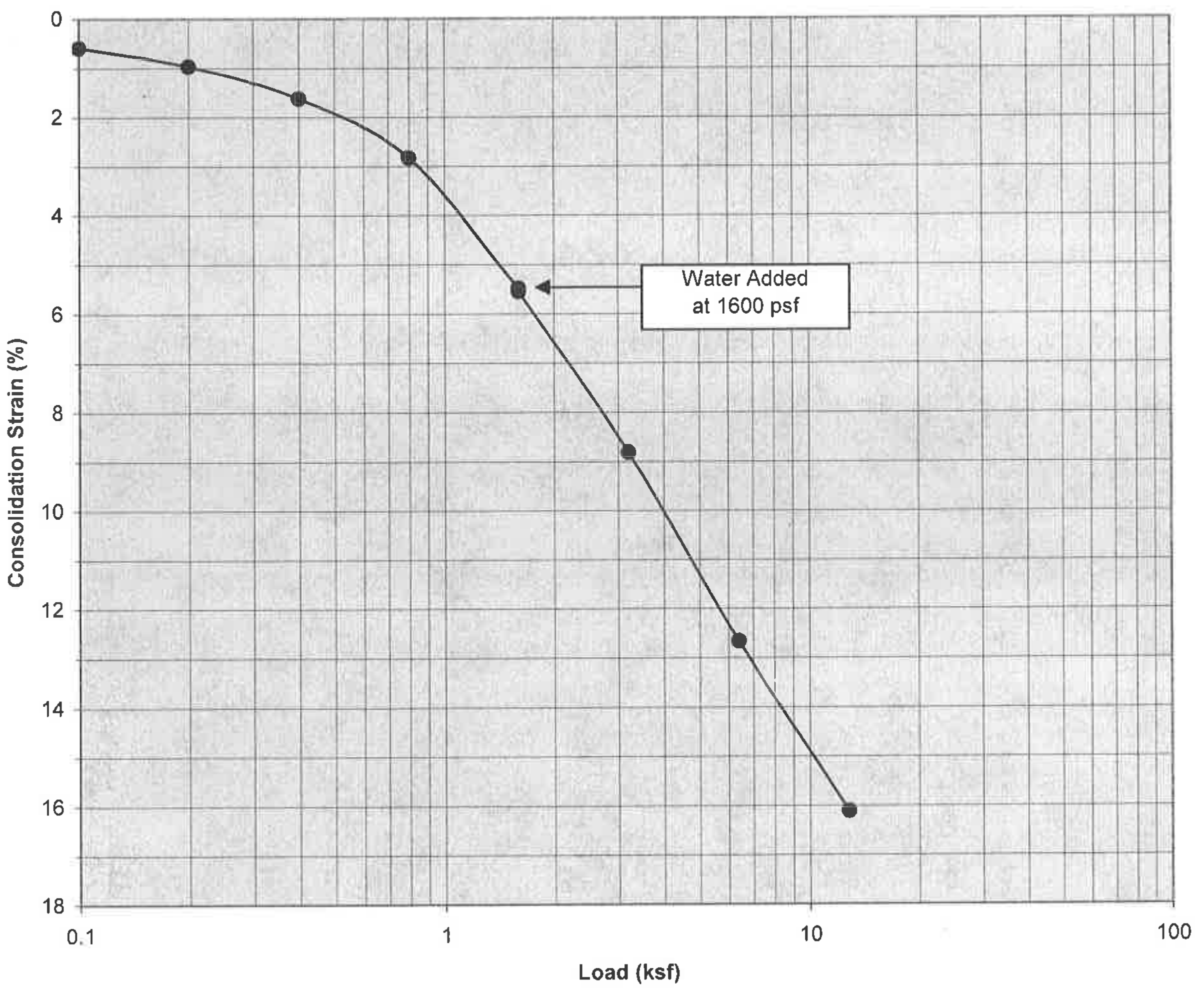
Classification: ALLUVIUM: Dark Brown to Black Clayey fine Sand

Boring Number:	B-2	Initial Moisture Content (%)	13
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	7 to 8	Initial Dry Density (pcf)	120.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	126.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.01

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 4

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



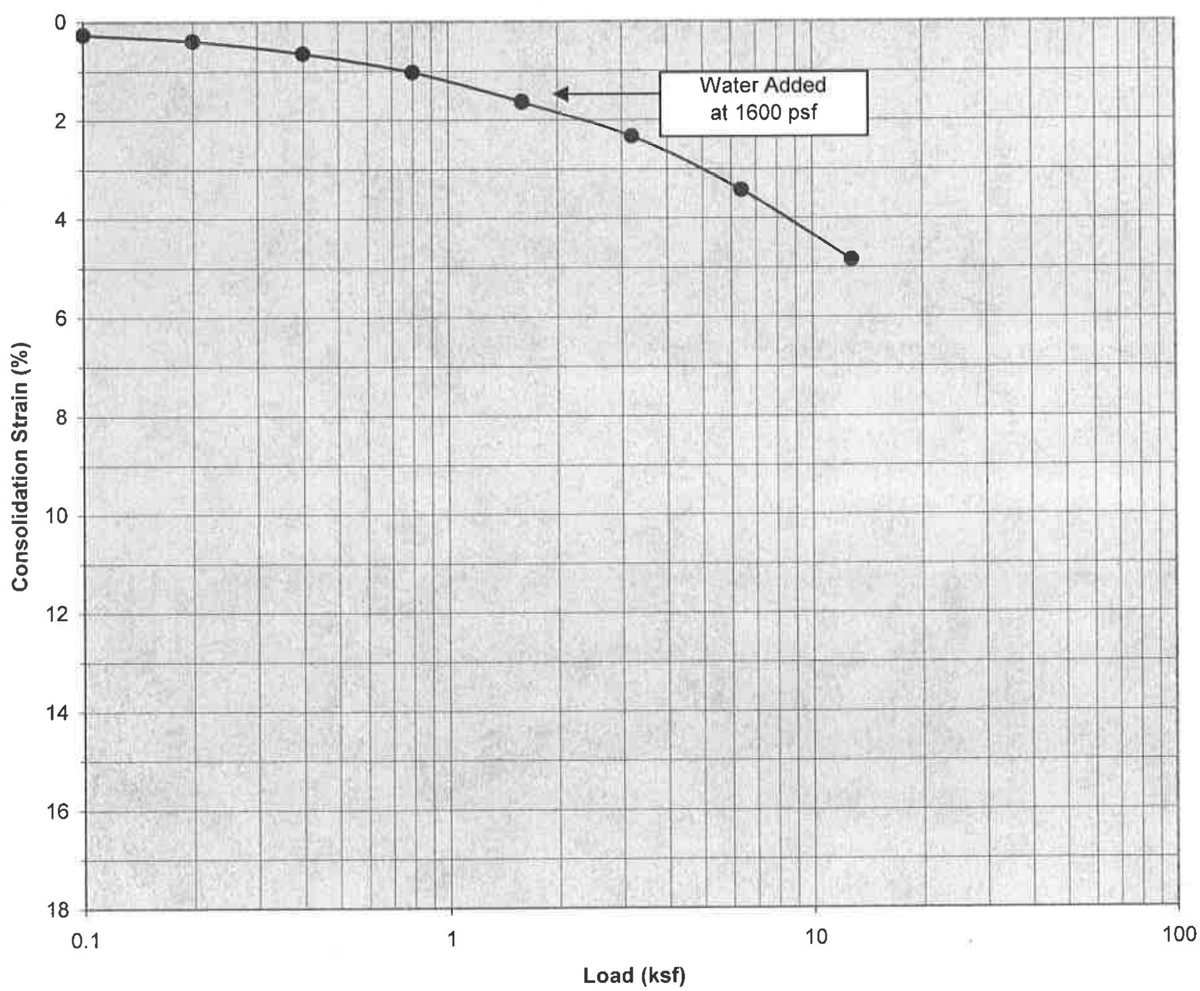
Classification: POSSIBLE FILL: Brown to Dark Brown fine to medium Sandy Clay

Boring Number:	B-7	Initial Moisture Content (%)	23
Sample Number:	----	Final Moisture Content (%)	19
Depth (ft)	1 to 2	Initial Dry Density (pcf)	96.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.06

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 5

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



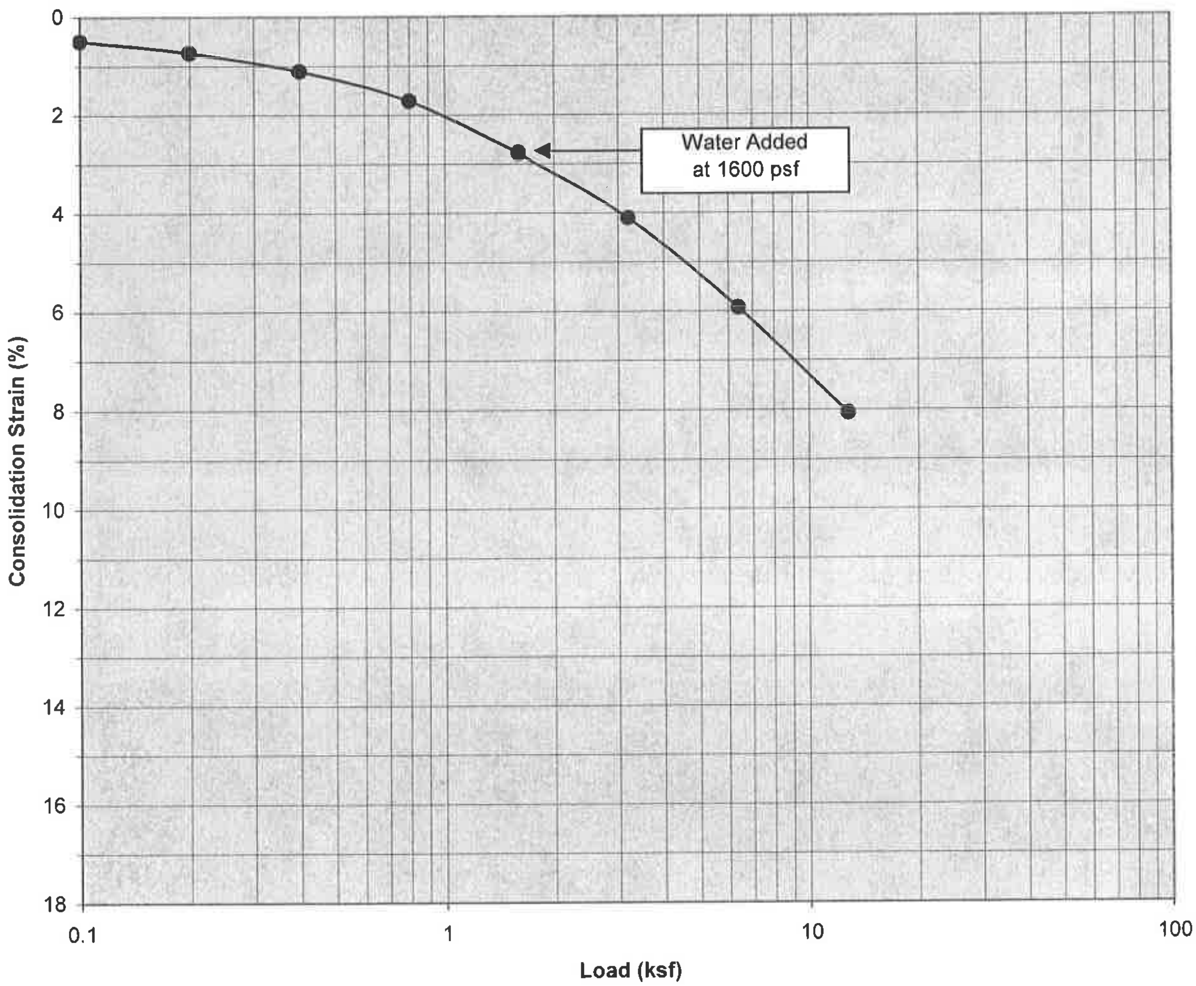
Classification: Light Gray Brown to Dark Gray Brown fine Sandy Clay to Clayey fine Sand

Boring Number:	B-7	Initial Moisture Content (%)	14
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	5 to 6	Initial Dry Density (pcf)	117.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.01

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 6

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results

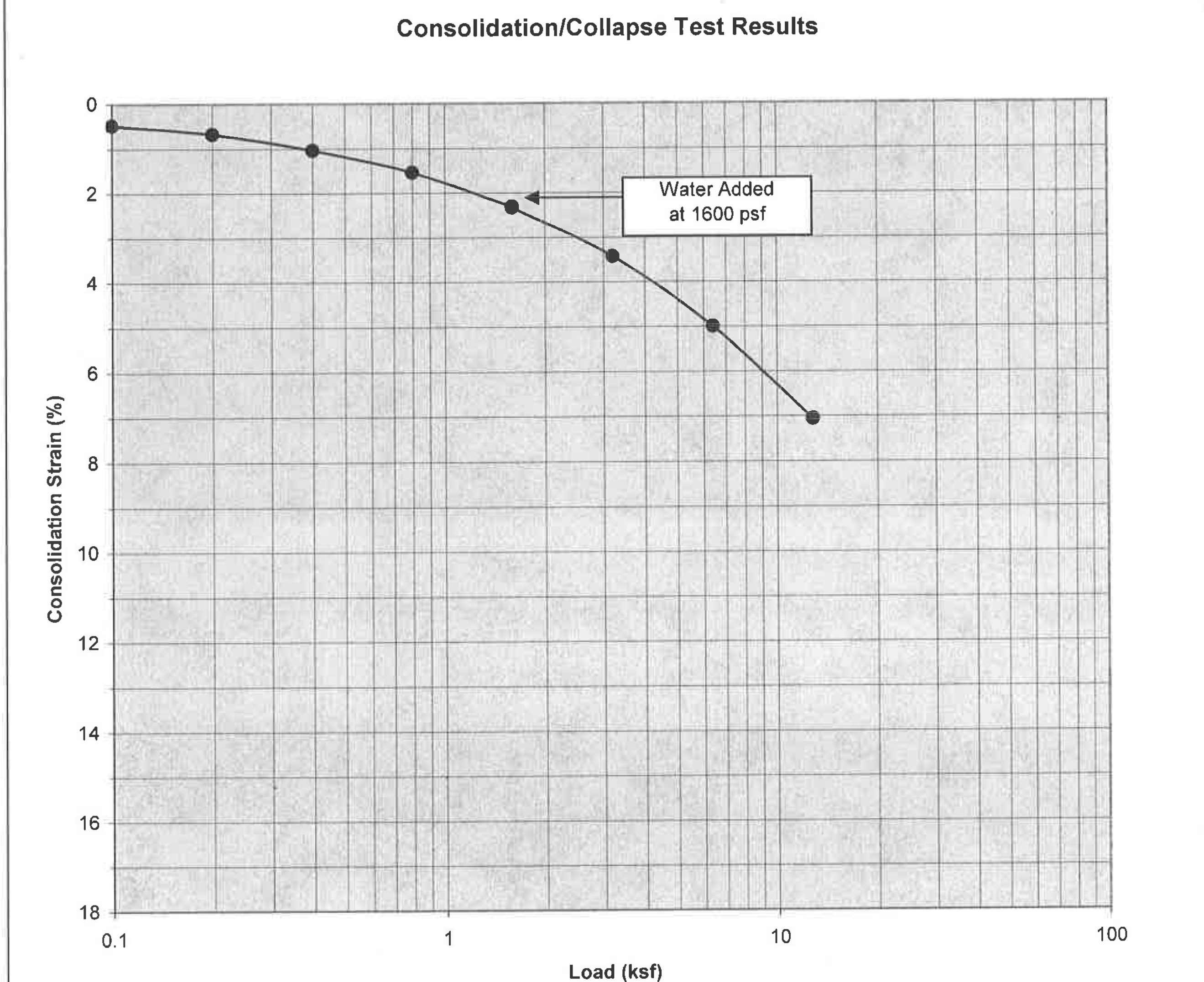


Classification: Light Gray Brown to Dark Gray Brown fine Sandy Clay to Clayey fine Sand

Boring Number:	B-7	Initial Moisture Content (%)	17
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	7 to 8	Initial Dry Density (pcf)	113.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	123.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.01

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 7

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398



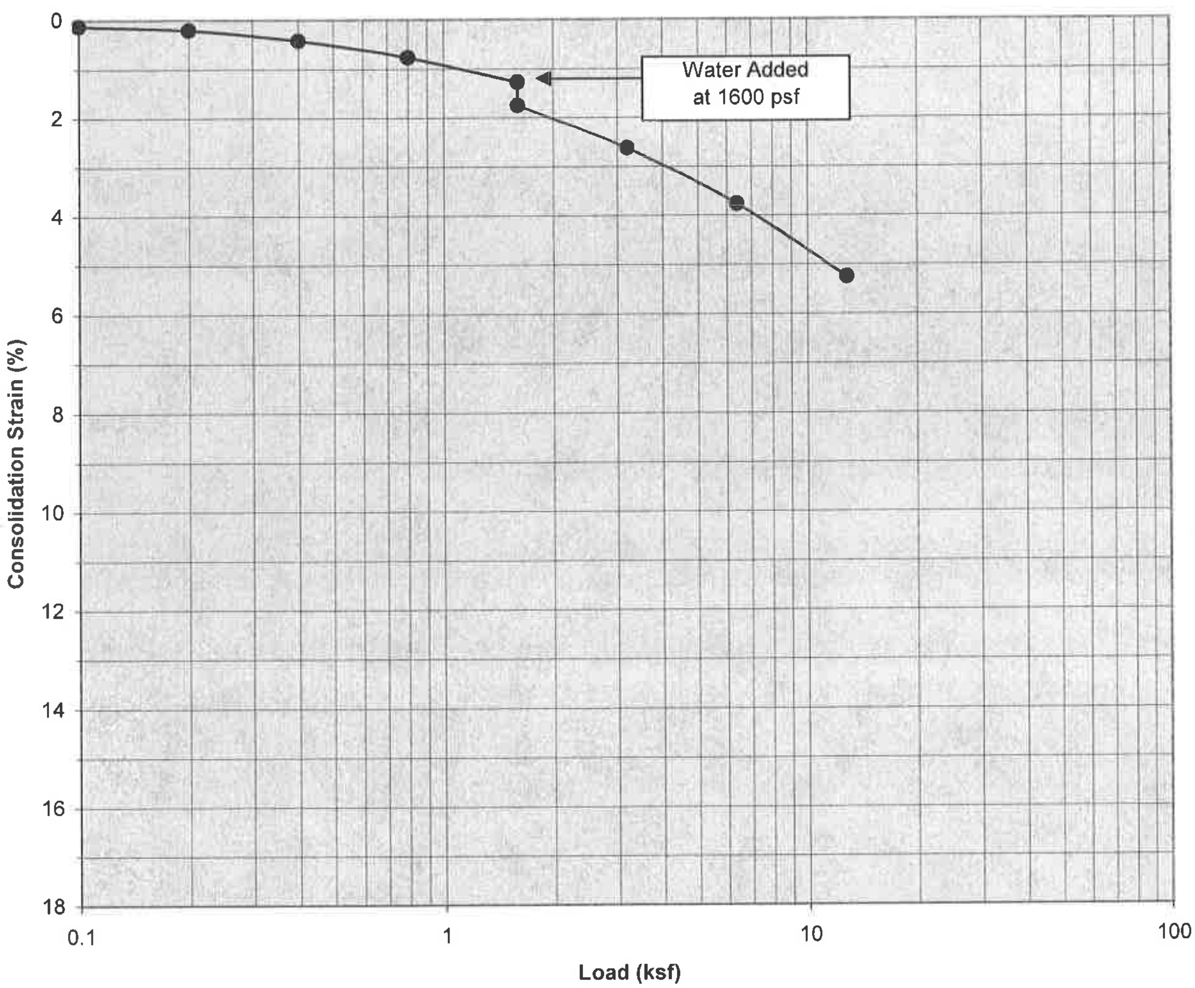
Classification: Gray to Light Brown fine Sandy Clay

Boring Number:	B-7	Initial Moisture Content (%)	17
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	9 to 10	Initial Dry Density (pcf)	113.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.02

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 8

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results

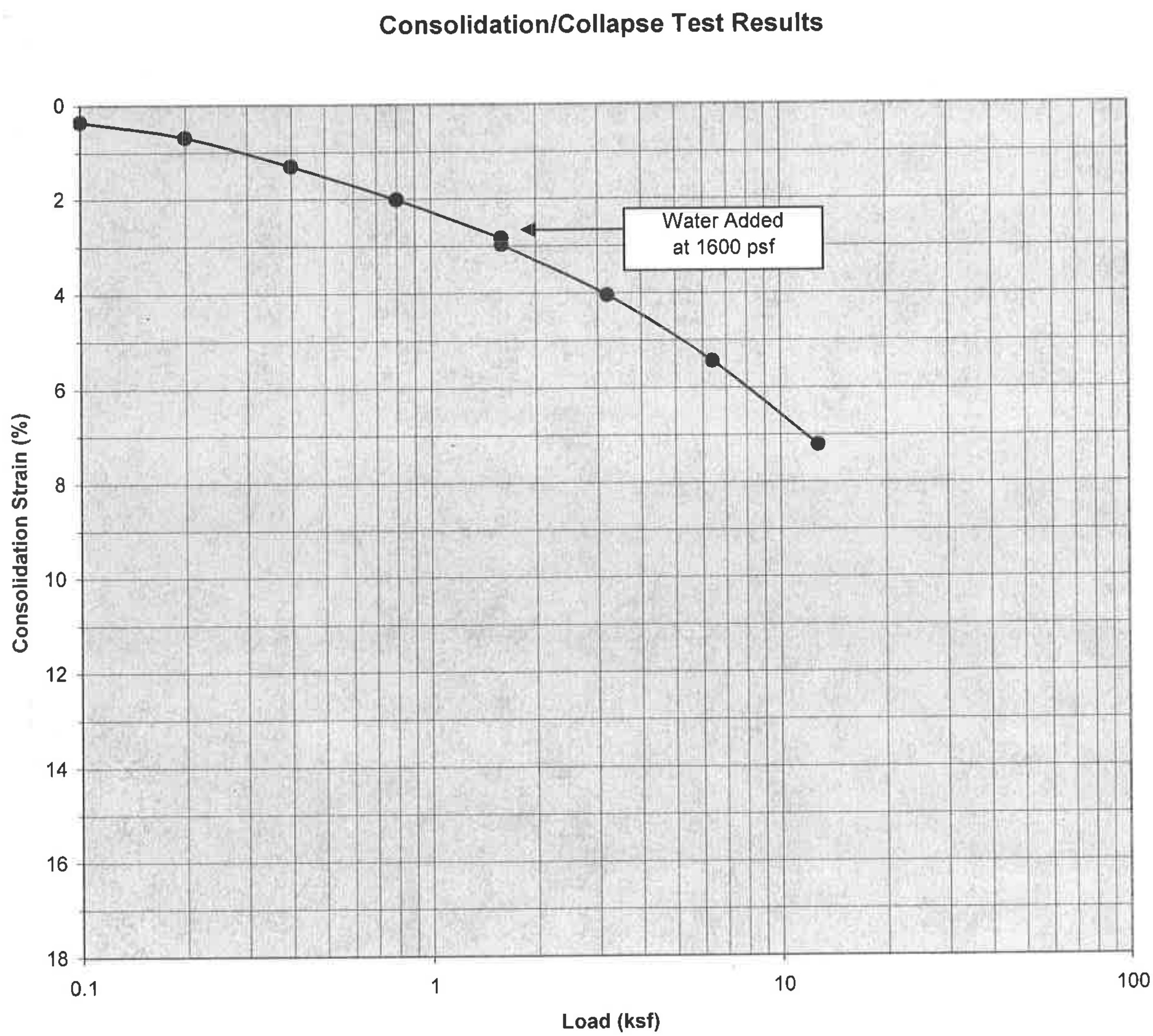


Classification: POSSIBLE FILL: Dark Brown fine to medium Sand, trace Clay

Boring Number:	B-8	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	1 to 2	Initial Dry Density (pcf)	116.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.48

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 9

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398



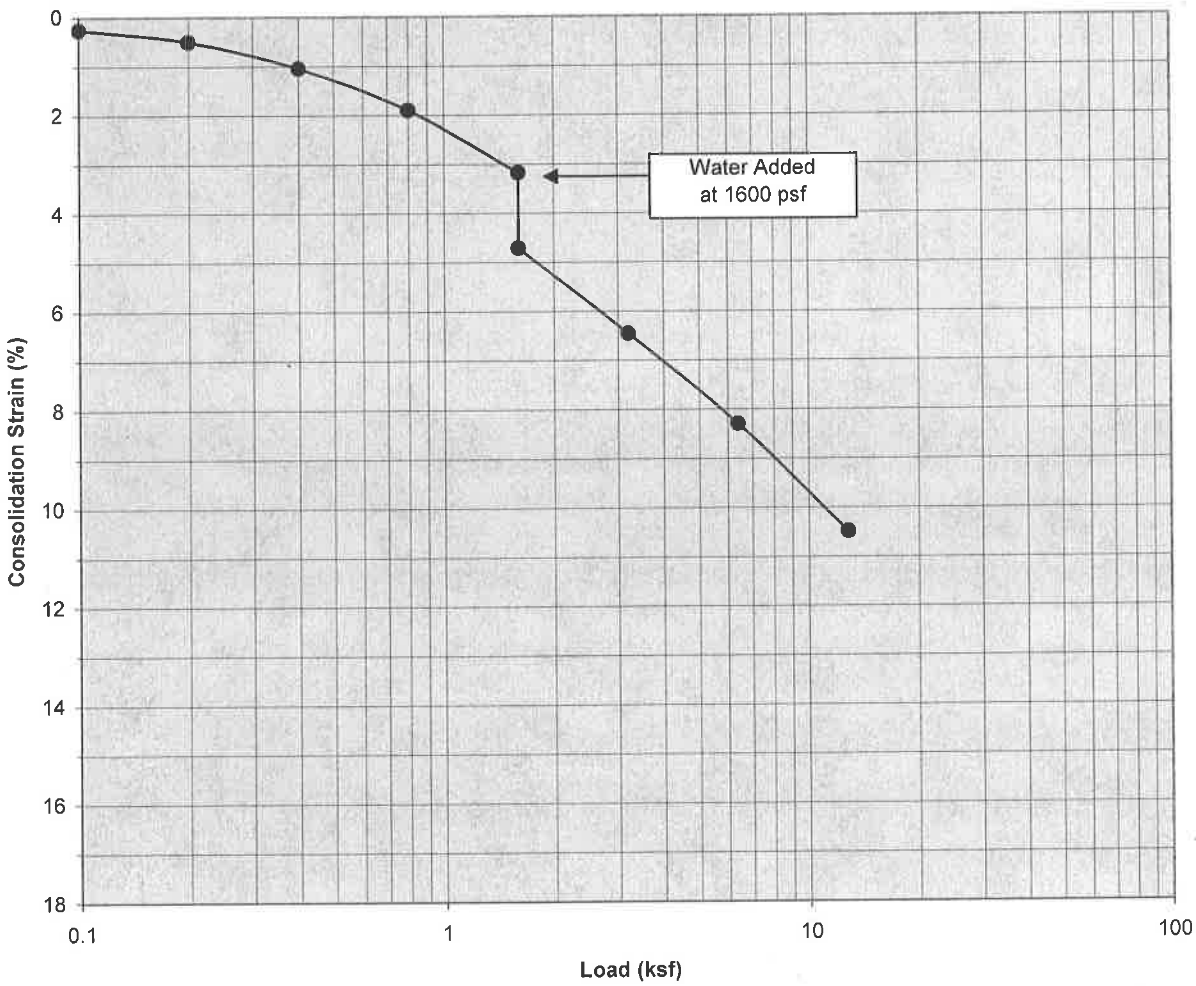
Classification: POSSIBLE FILL: Gray Brown to Dark Brown Clayey fine to medium Sand

Boring Number:	B-8	Initial Moisture Content (%)	19
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	3 to 4	Initial Dry Density (pcf)	109.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.14

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 10

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



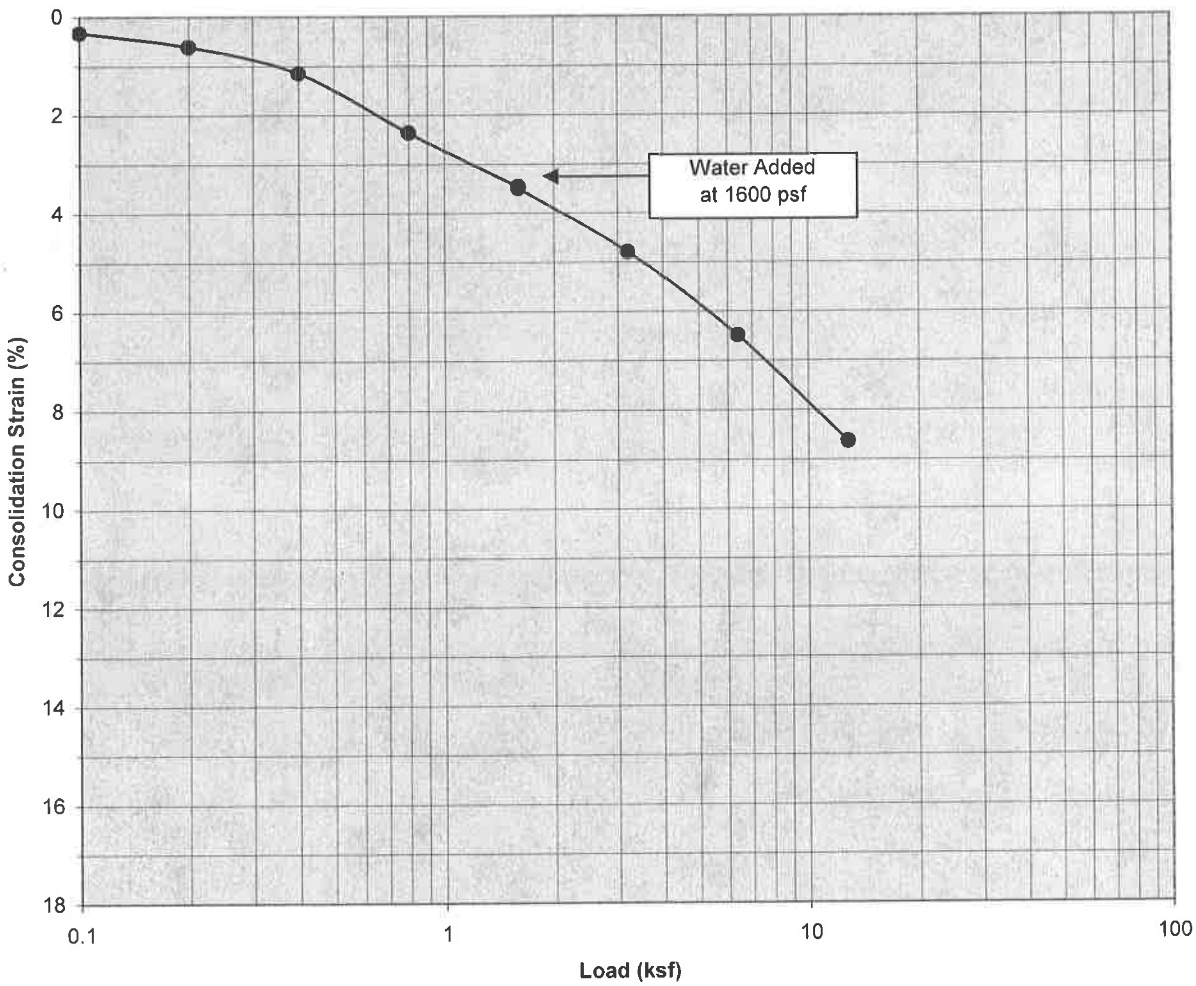
Classification: POSSIBLE FILL: Gray Brown to Dark Brown Clayey fine to medium Sand

Boring Number:	B-8	Initial Moisture Content (%)	11
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	5 to 6	Initial Dry Density (pcf)	103.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.53

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 11

Southern California Geotechnical INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



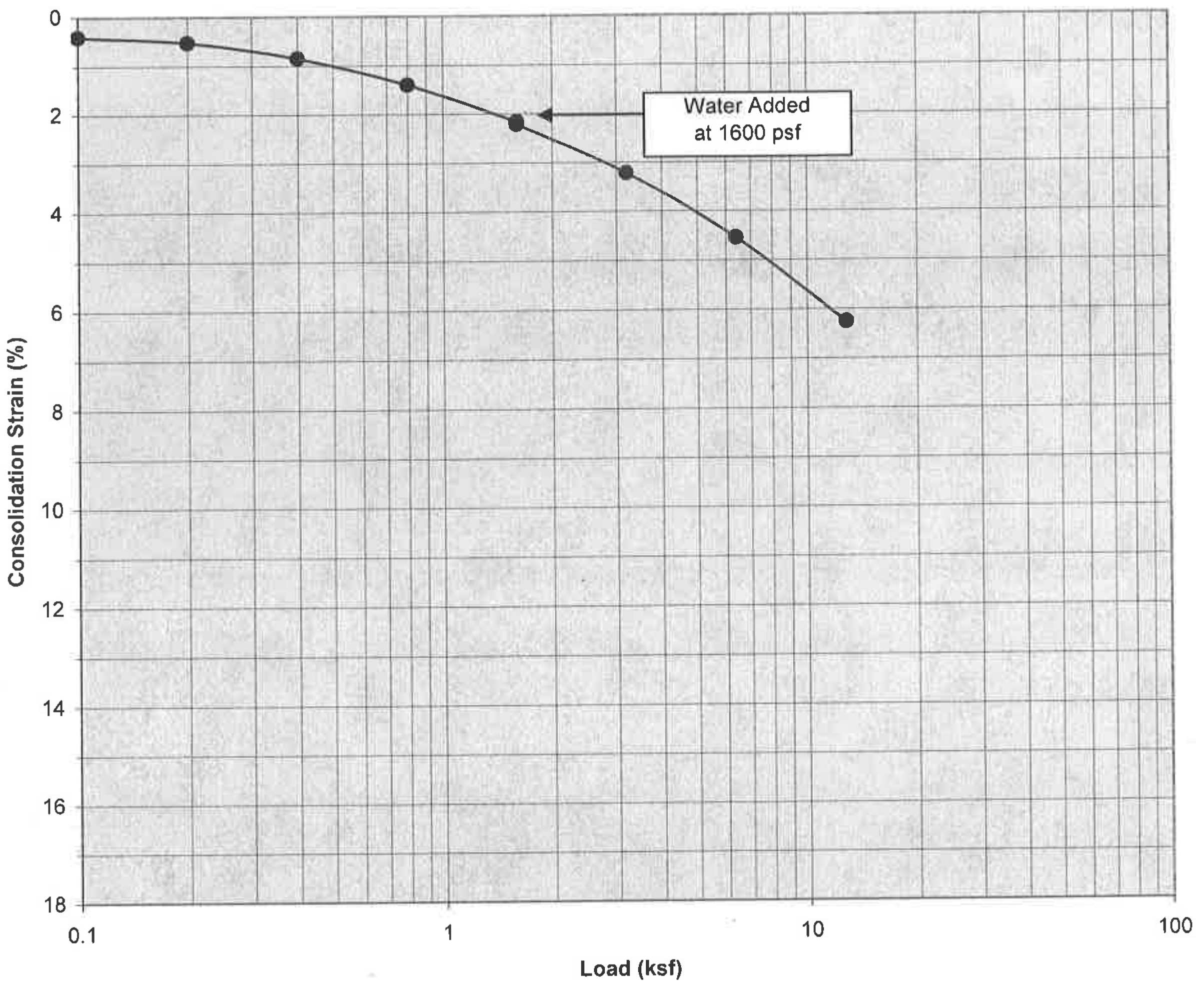
Classification: ALLUVIUM: Dark Gray Brown Silty fine to medium Sand, trace Clay

Boring Number:	B-8	Initial Moisture Content (%)	18
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	7 to 8	Initial Dry Density (pcf)	108.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.03

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 12

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

Consolidation/Collapse Test Results



Classification: ALLUVIUM: Dark Gray Brown Silty fine to medium Sand, trace Clay

Boring Number:	B-8	Initial Moisture Content (%)	14
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	9 to 10	Initial Dry Density (pcf)	114.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.06

Proposed SFR Tract
Lake Elsinore, California
Project No. 05G255
PLATE C- 13

Southern California Geotechnical
INC.
1260 North Hancock Street, Suite 101
Anaheim, California 92807
Phone: (714) 777-0333 Fax: (714) 777-0398

APPENDIX C

Seismic and Settlement Analyses

Latitude, Longitude: 33.663565, -117.381649

Date	9/25/2020, 12:41:09 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	2.15	MCE_R ground motion. (for 0.2 second period)
S_1	0.766	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.58	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.72	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	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.918	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	1.102	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.15	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.392	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.311	Factored deterministic acceleration value. (0.2 second)
S1RT	0.766	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.853	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.916	Factored deterministic acceleration value. (1.0 second)
PGAd	0.974	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.899	Mapped value of the risk coefficient at short periods
C_{R1}	0.898	Mapped value of the risk coefficient at a period of 1 s

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

33.663565

Longitude

Decimal degrees, negative values for western longitudes

-117.381649

Site Class

259 m/s (Site class D)

Spectral Period

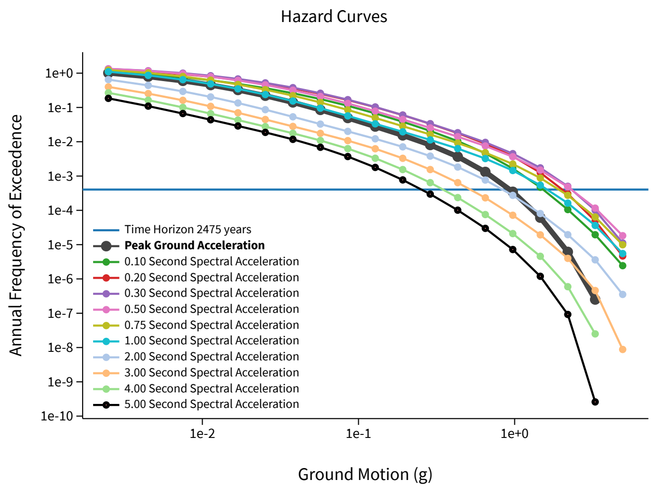
Peak Ground Acceleration

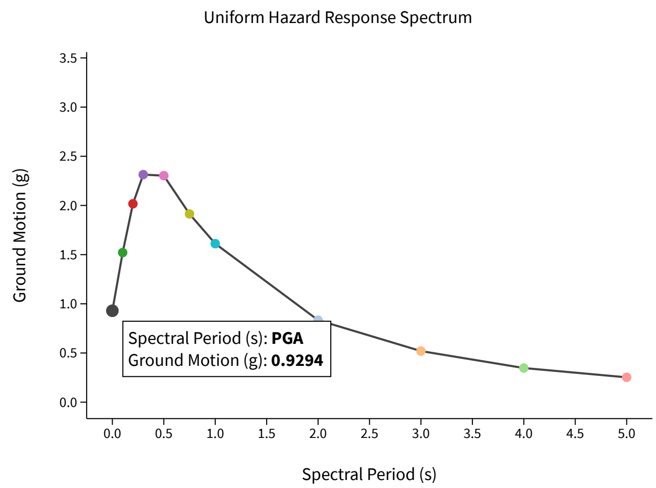
Time Horizon

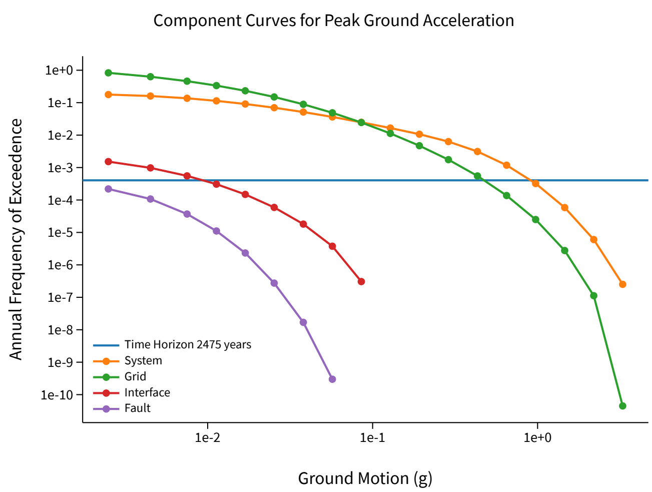
Return period in years

2475

Hazard Curve





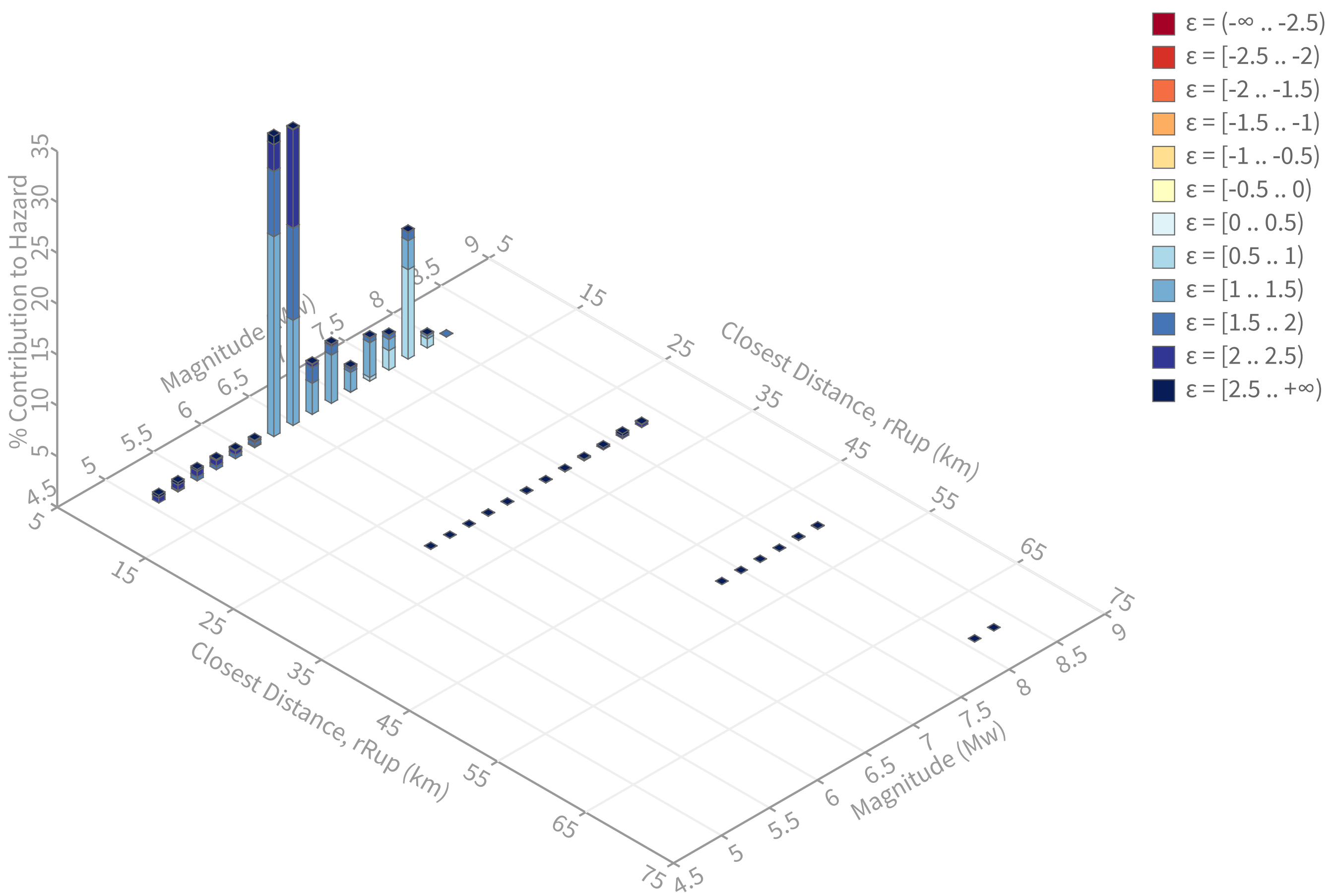


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.92937277 g

Recovered targets

Return period: 2899.1243 yrs
Exceedance rate: 0.00034493175 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (over all sources)

m: 6.68
r: 4.85 km
ε_0: 1.51 σ

Mode (largest m-r bin)

m: 6.25
r: 3.45 km
ε_0: 1.5 σ
Contribution: 29.51 %

Mode (largest m-r-ε_0 bin)

m: 6.25
r: 2.86 km
ε_0: 1.32 σ
Contribution: 19.66 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

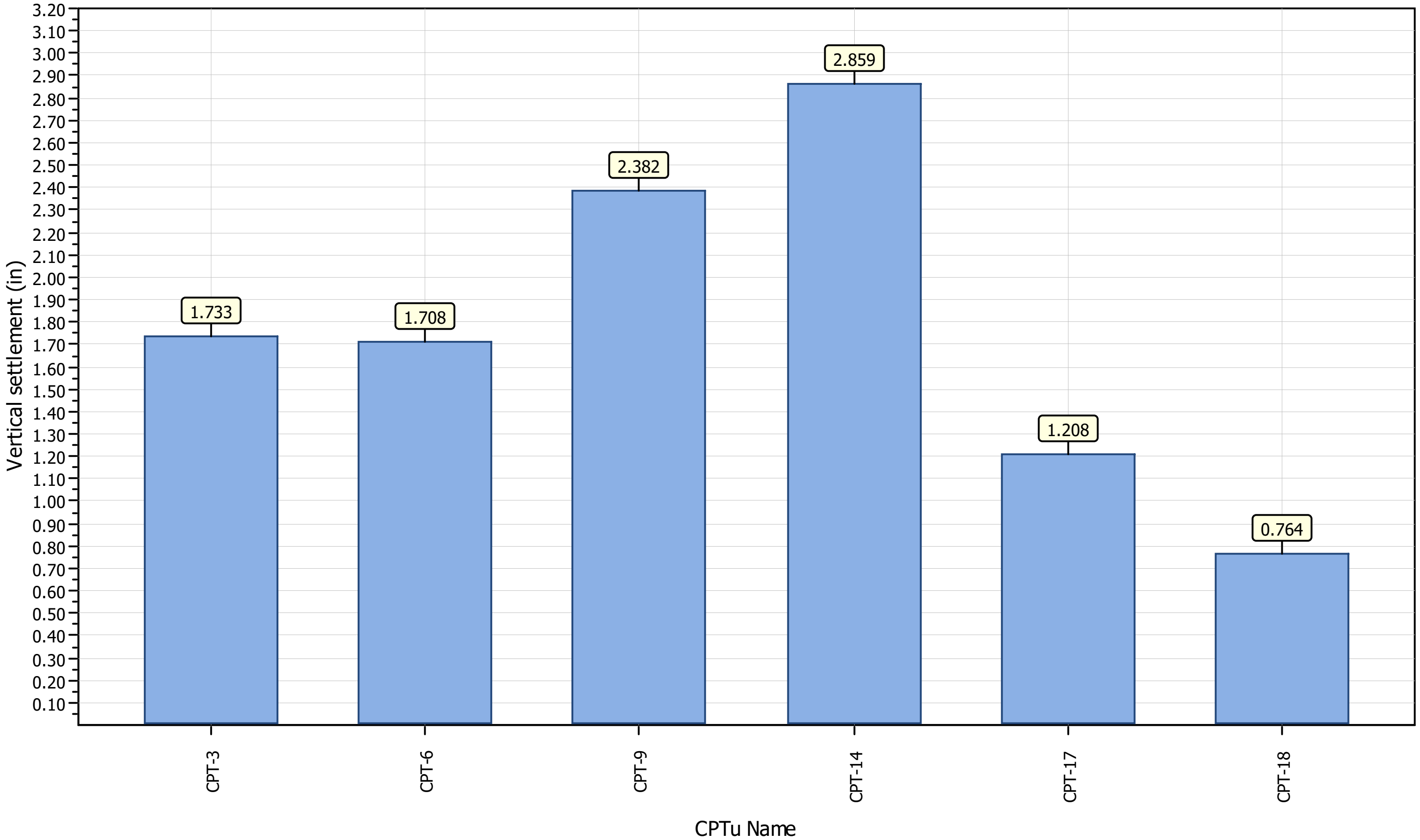
Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							47.16
Elsinore (Glen Ivy) rev [3]		2.87	6.37	1.40	117.373°W	33.685°N	18.98	19.73
Elsinore (Stepovers Combined) [0]		2.69	7.36	1.13	117.365°W	33.679°N	41.66	15.49
Elsinore (Glen Ivy) rev [2]		7.78	6.48	1.97	117.428°W	33.721°N	326.11	10.50
UC33brAvg_FM31	System							46.60
Elsinore (Glen Ivy) rev [3]		2.87	6.38	1.40	117.373°W	33.685°N	18.98	19.23
Elsinore (Stepovers Combined) [0]		2.69	7.33	1.13	117.365°W	33.679°N	41.66	15.55
Elsinore (Glen Ivy) rev [2]		7.78	6.47	1.97	117.428°W	33.721°N	326.11	10.36
UC33brAvg_FM31 (opt)	Grid							3.12
UC33brAvg_FM32 (opt)	Grid							3.12

Project title : Leighton & Associates / Pardee Elsinore 35

Location : Lake Elsinore, CA

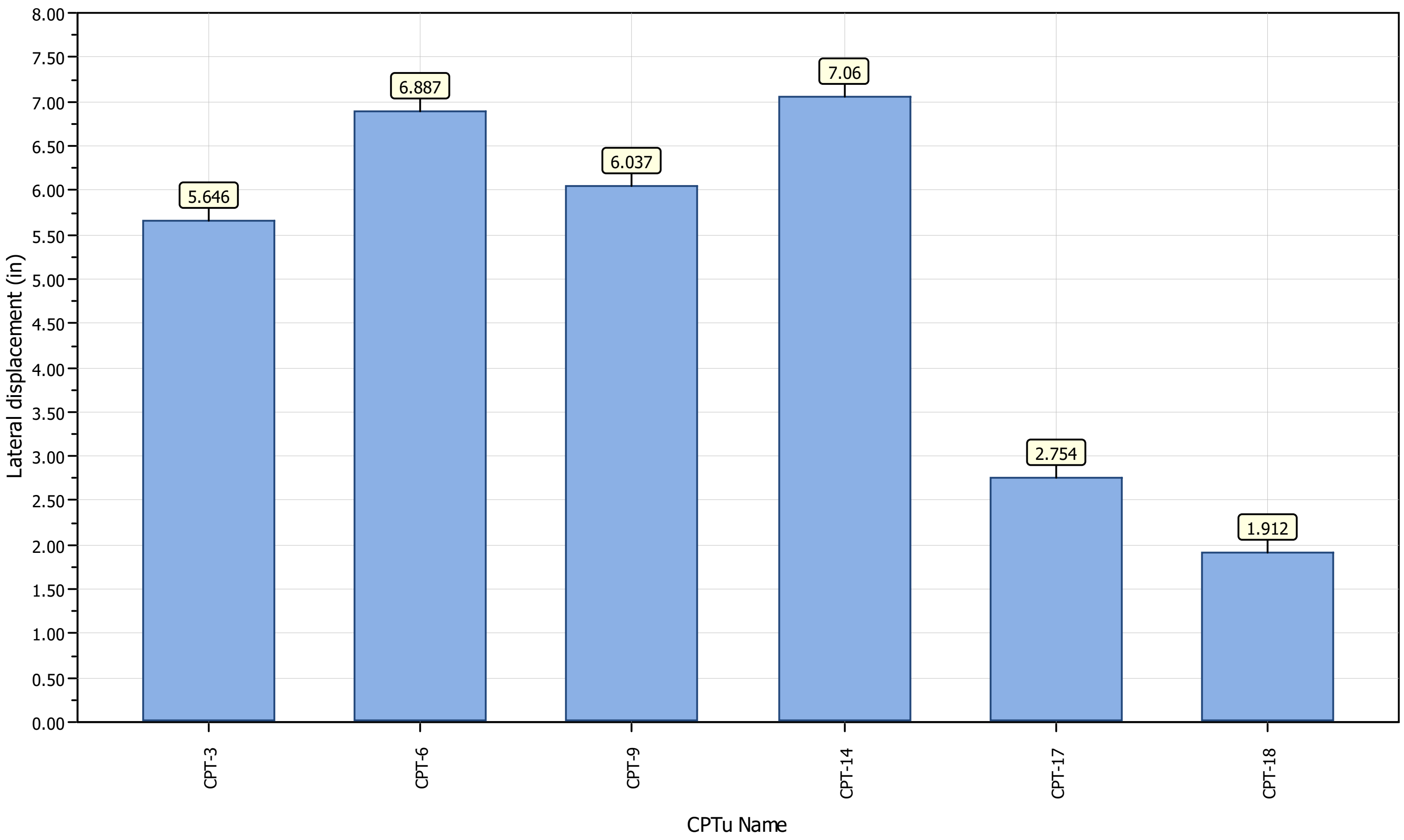
Overall vertical settlements report



Project title : Leighton & Associates / Pardee Elsinore 35

Location : Lake Elsinore, CA

Overall lateral displacements report



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

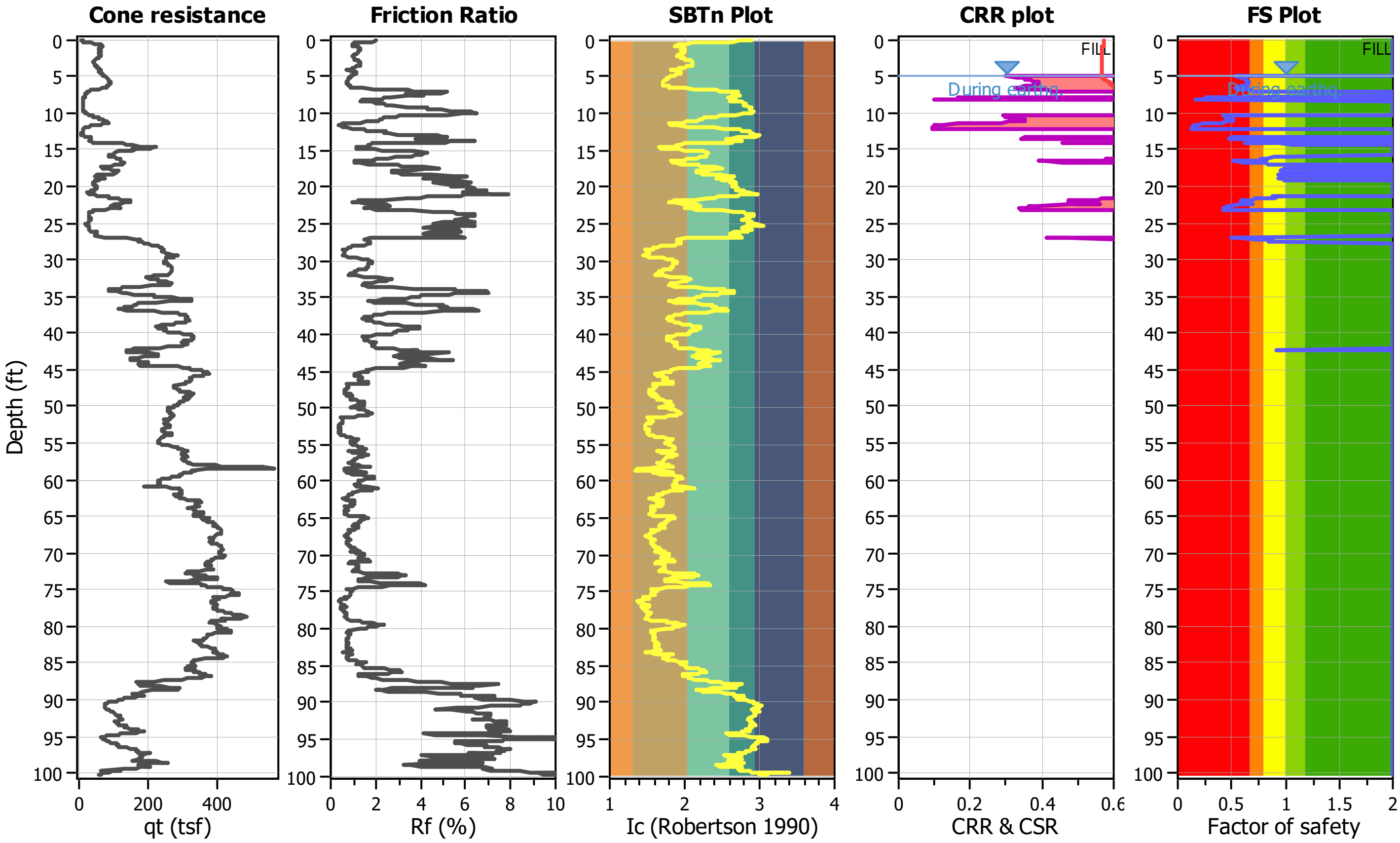
LIQUEFACTION ANALYSIS REPORT

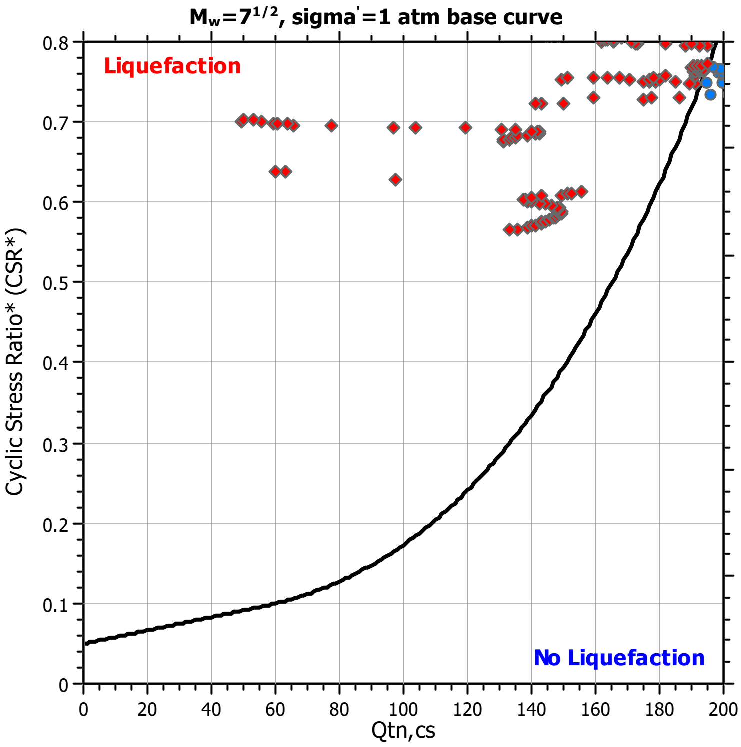
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

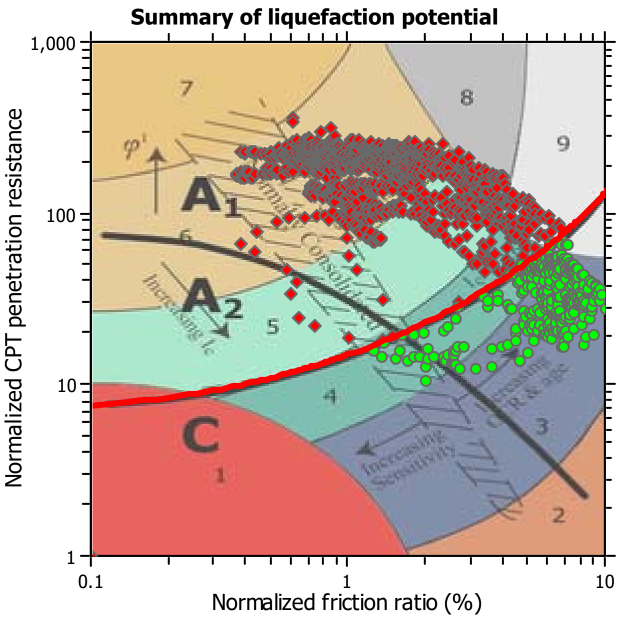
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	11.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	11.00 ft	Fill height:	6.00 ft		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	120.00 lb/ft^3	Limit depth applied:	Yes
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

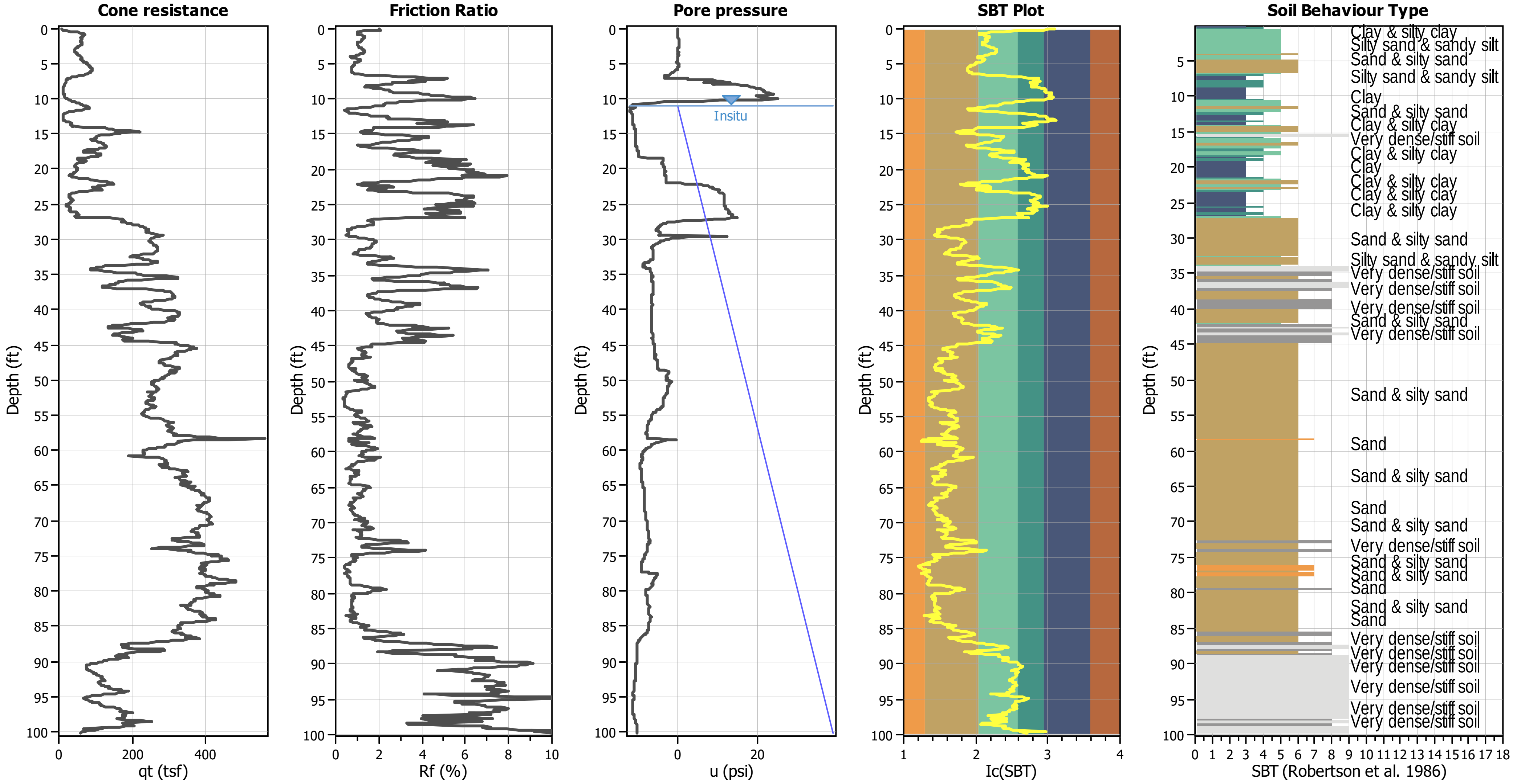






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



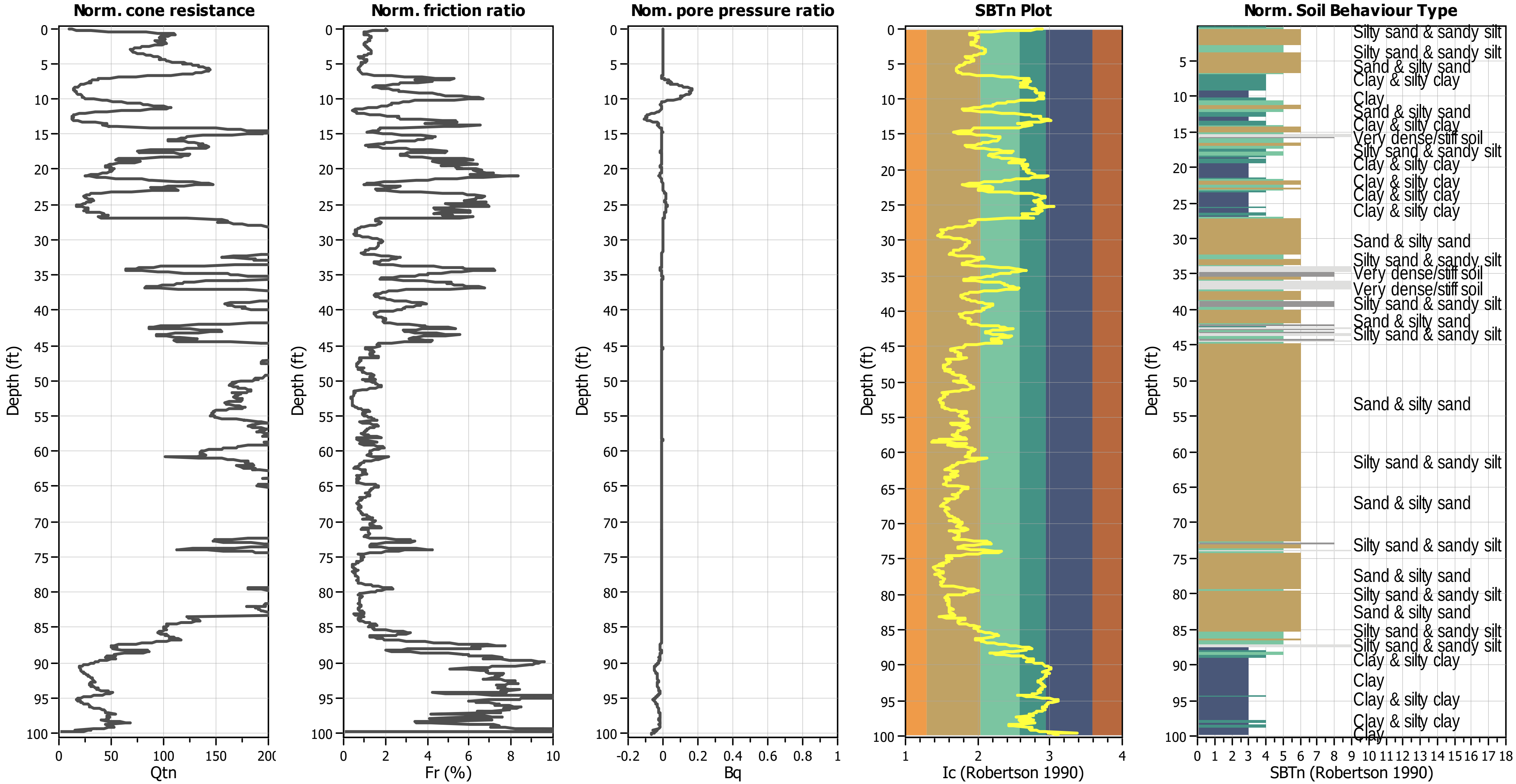
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	11.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	11.00 ft	Fill height:	6.00 ft	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



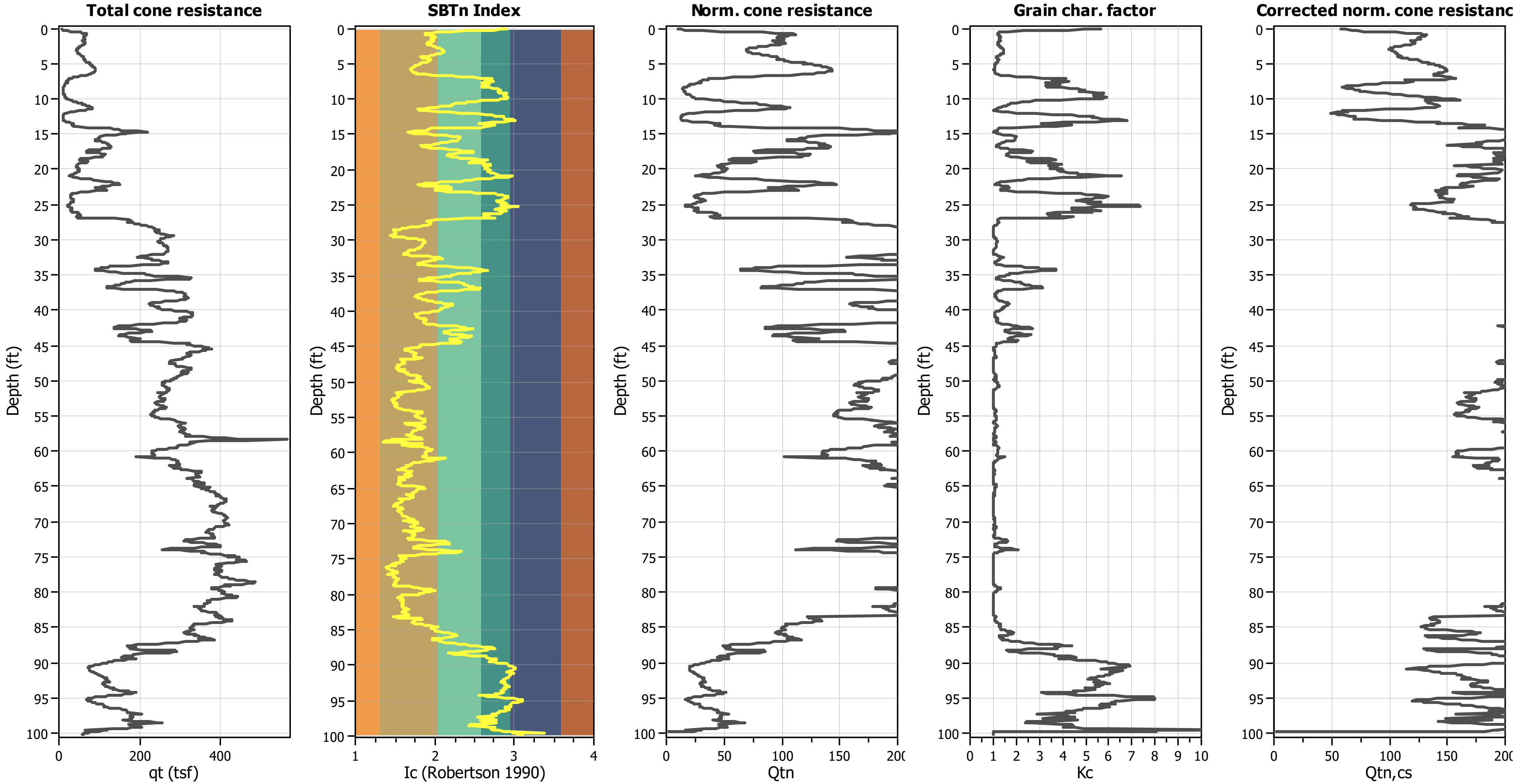
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	11.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	11.00 ft	Fill height:	6.00 ft	Limit depth:	50.00 ft

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

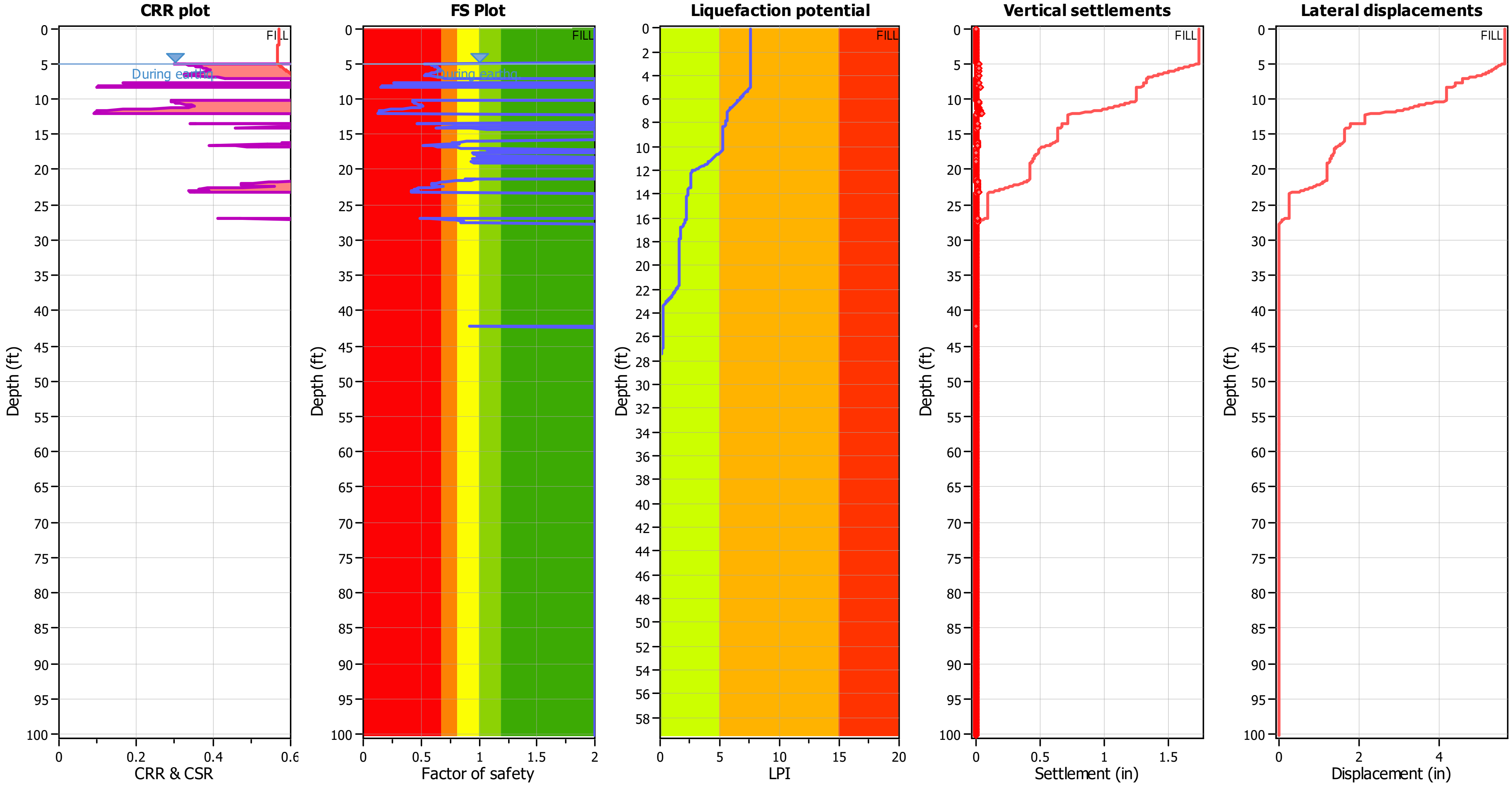
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	11.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	11.00 ft	Fill height:	6.00 ft	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	11.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	11.00 ft	Fill height:	6.00 ft	Limit depth:	50.00 ft

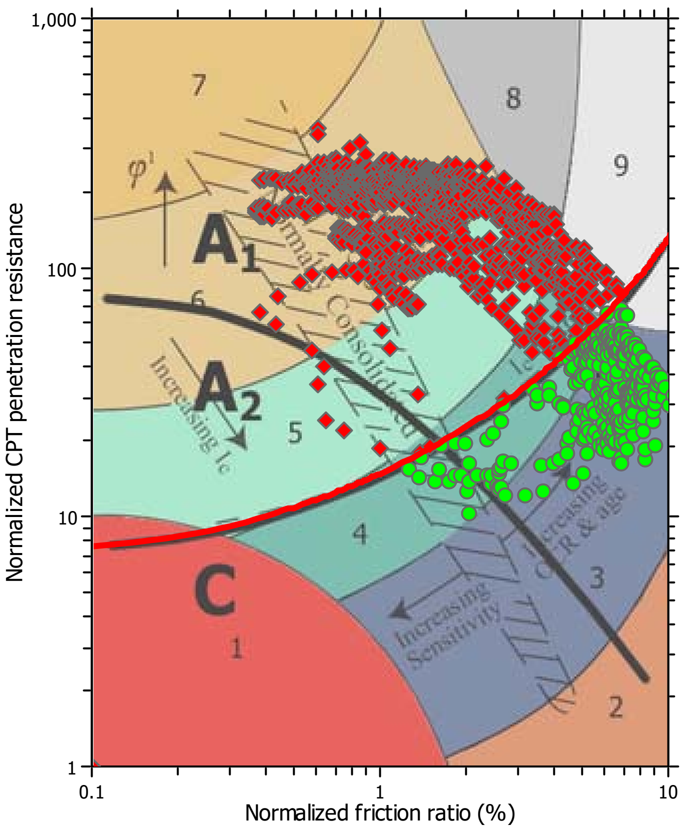
F.S. color scheme

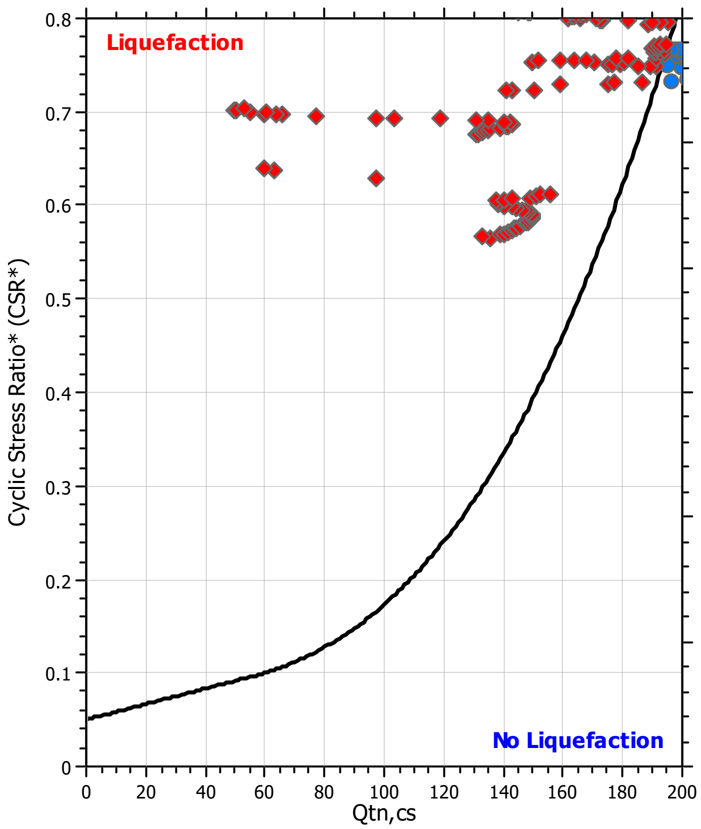
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

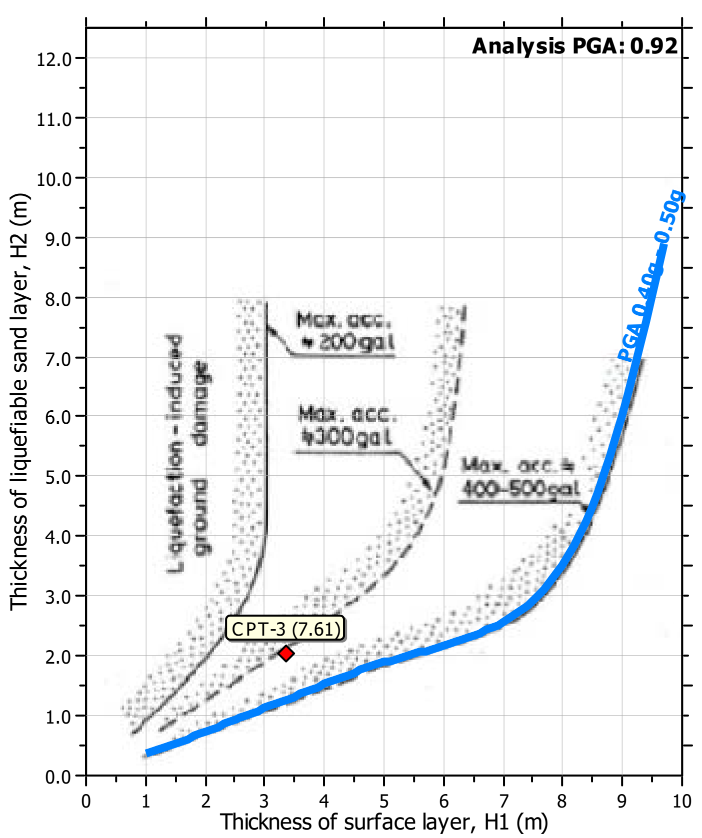
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	11.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	11.00 ft	Fill height:	6.00 ft	Limit depth:	50.00 ft

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

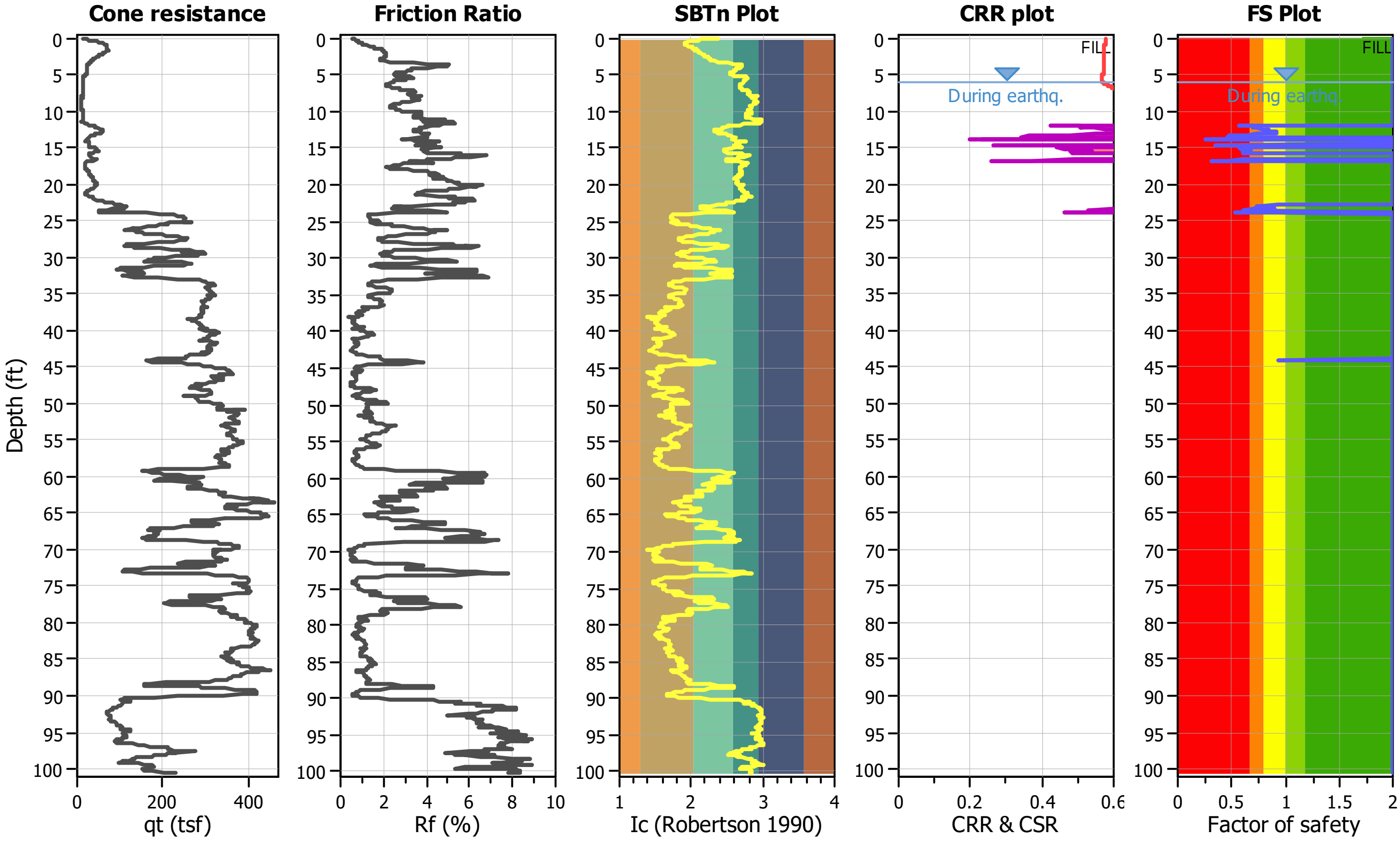
LIQUEFACTION ANALYSIS REPORT

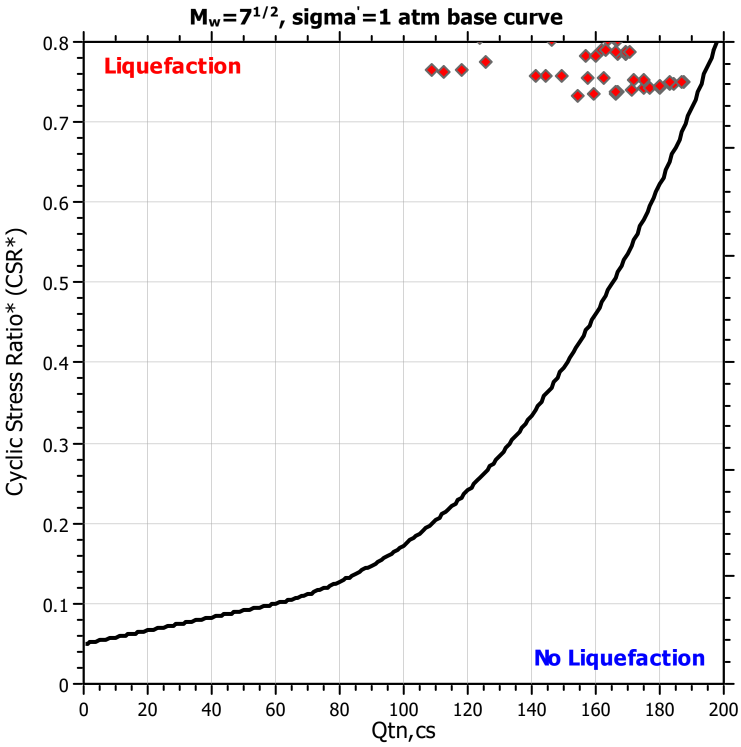
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

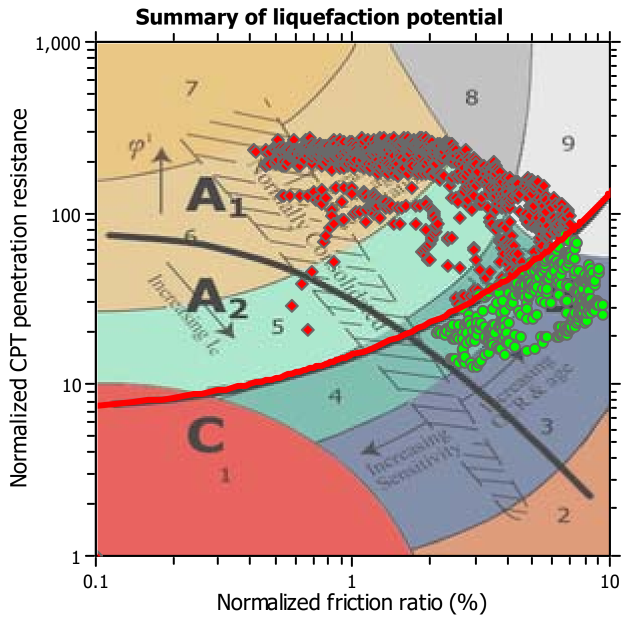
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	2.00 ft		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	120.00 lb/ft^3	Limit depth applied:	Yes
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

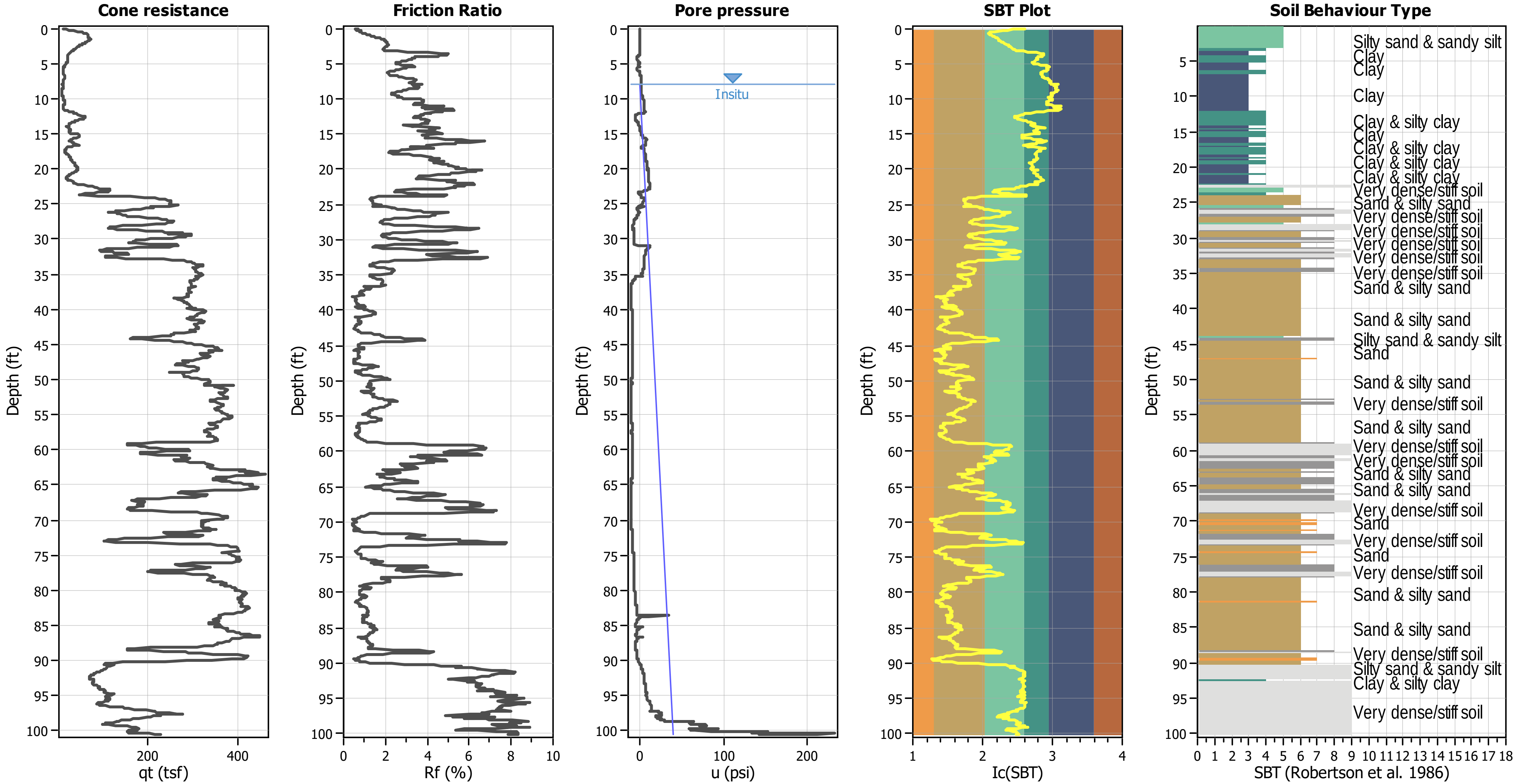






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



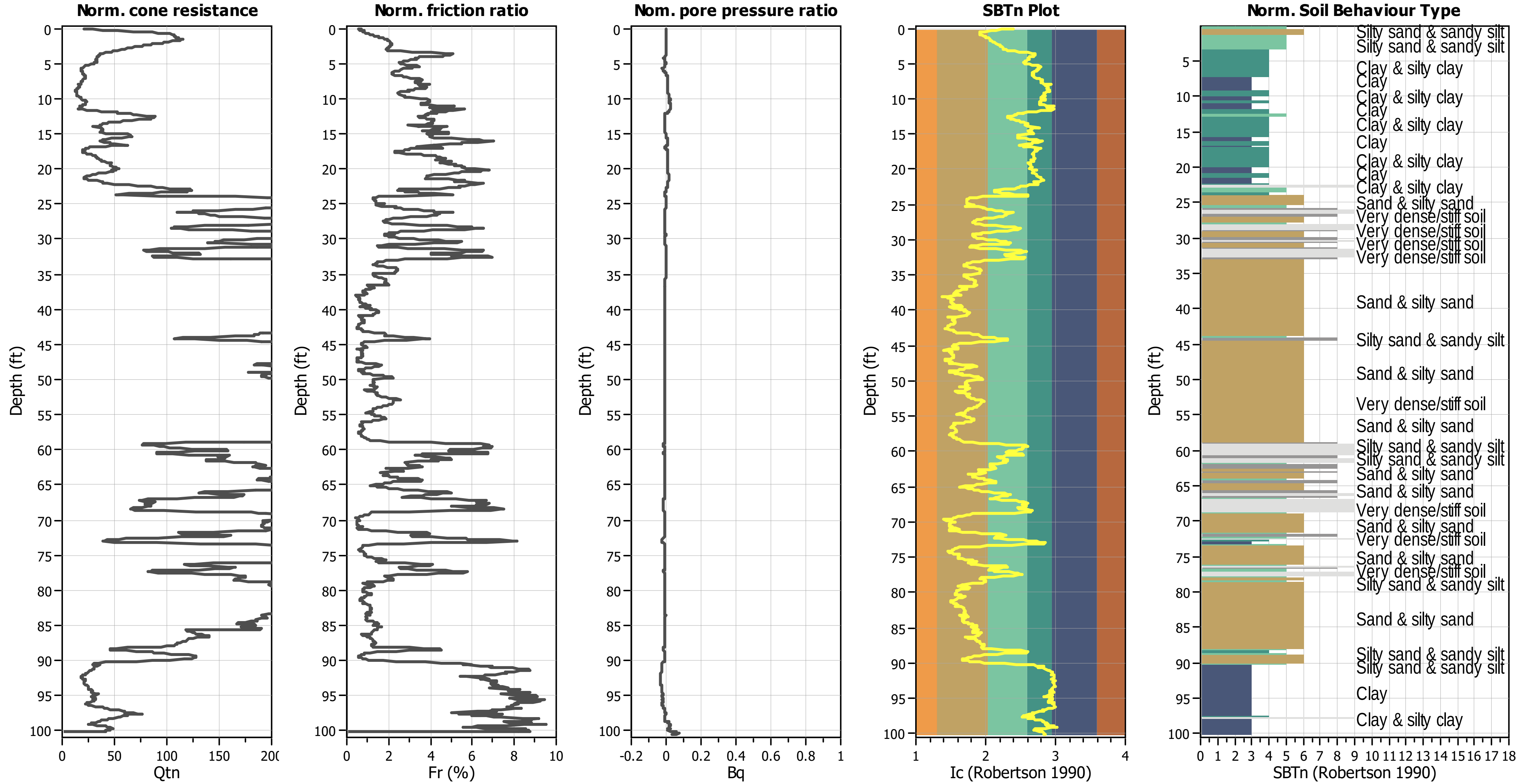
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	2.00 ft	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



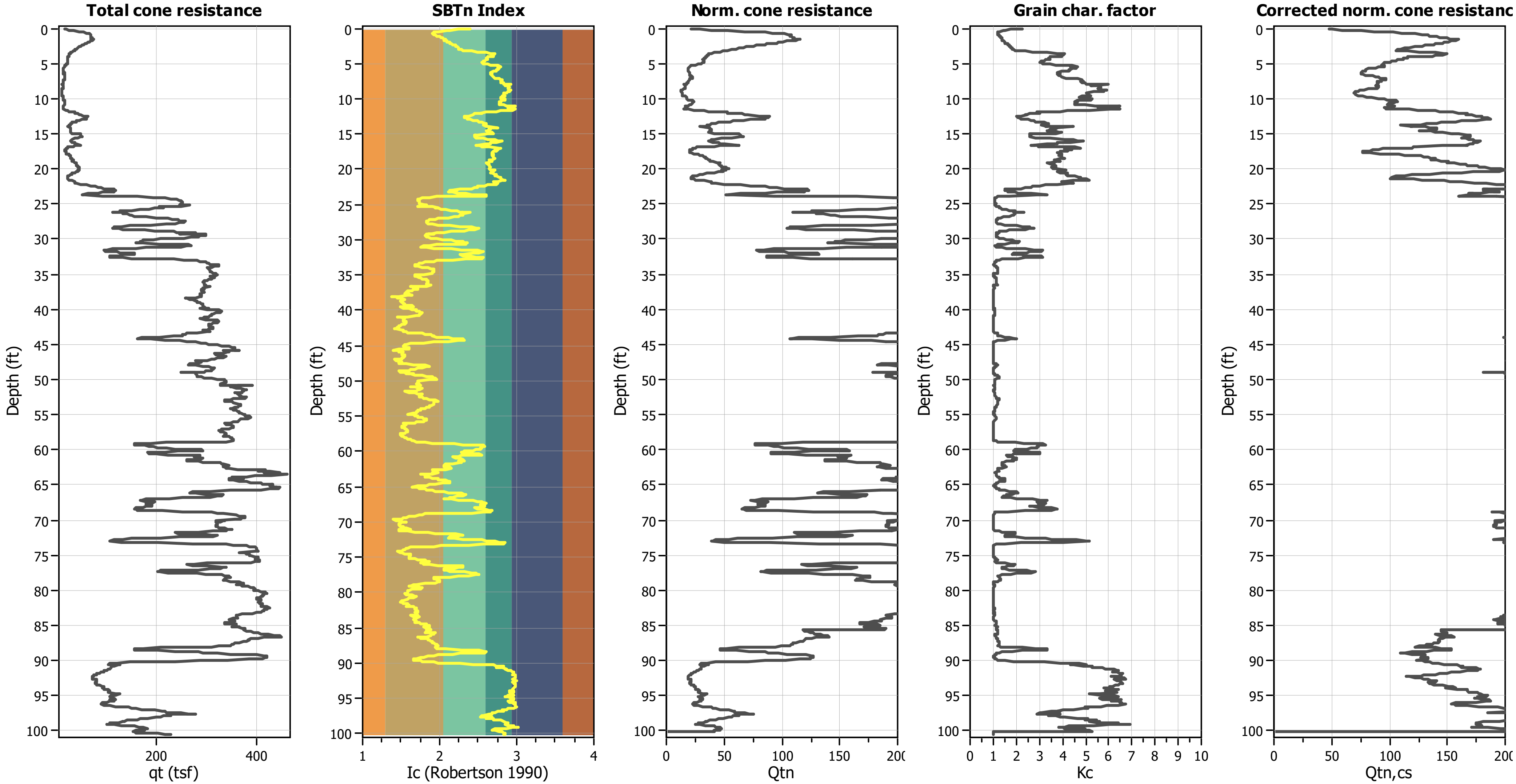
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	2.00 ft	Limit depth:	50.00 ft

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

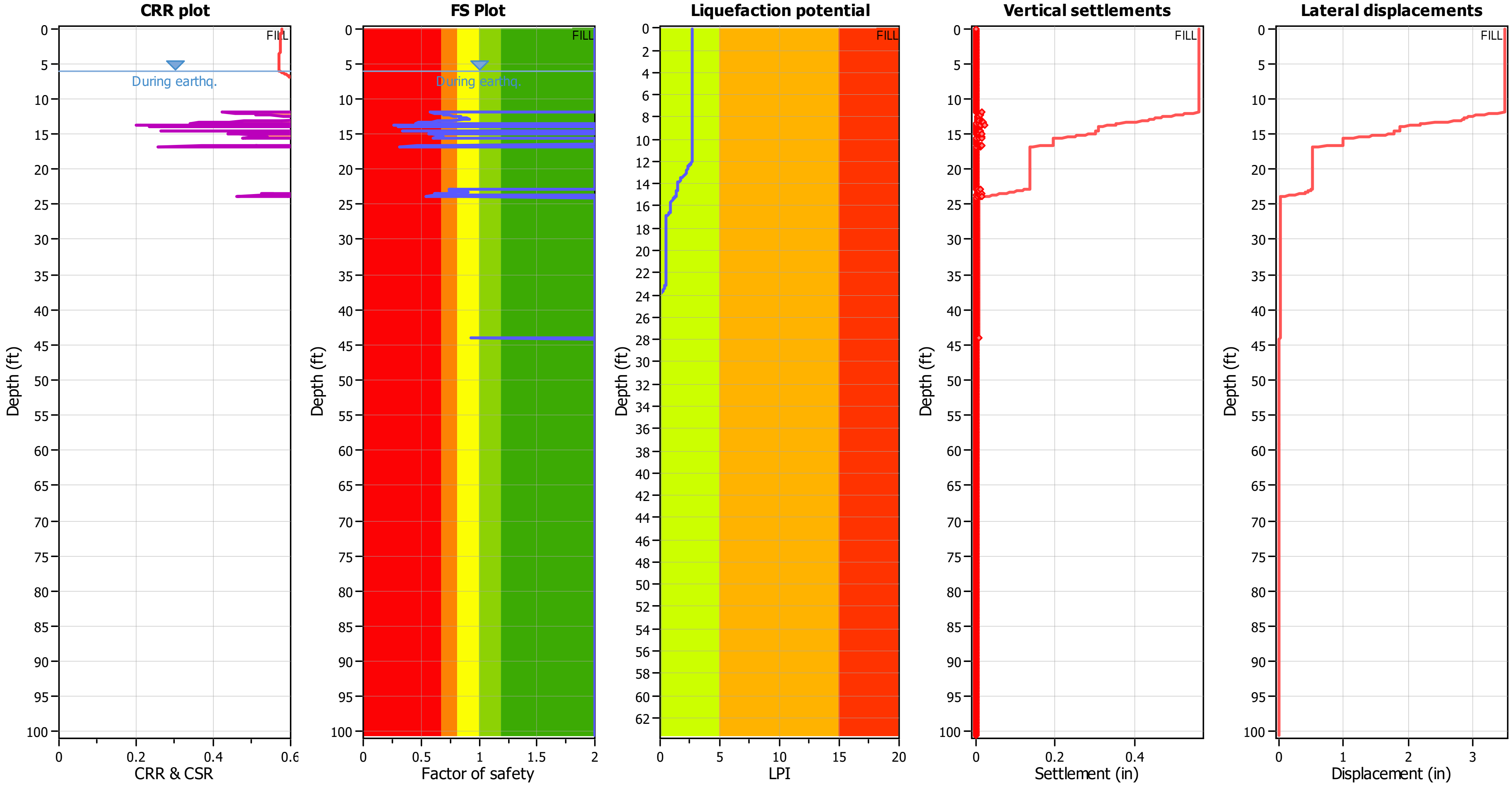
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	2.00 ft	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	2.00 ft	Limit depth:	50.00 ft

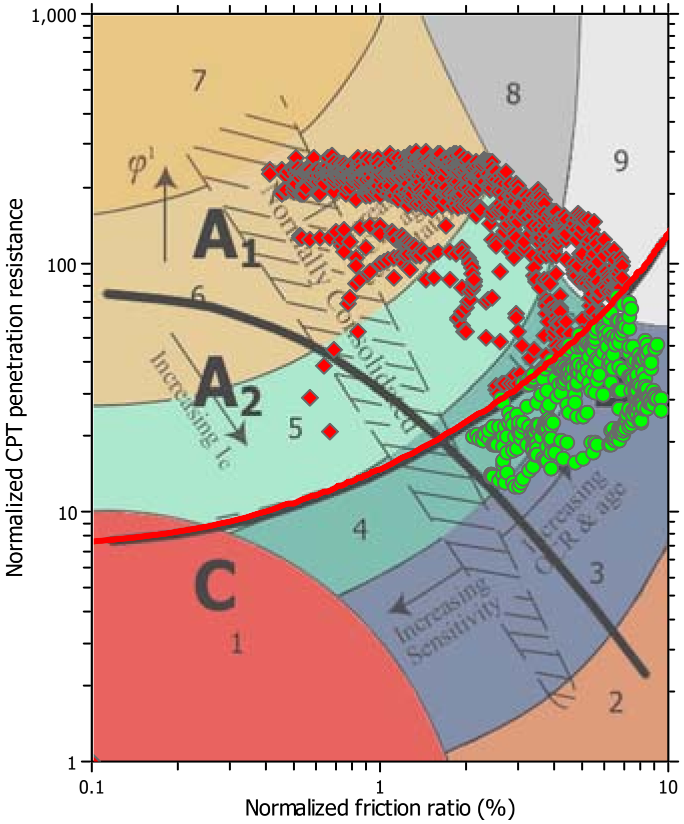
F.S. color scheme

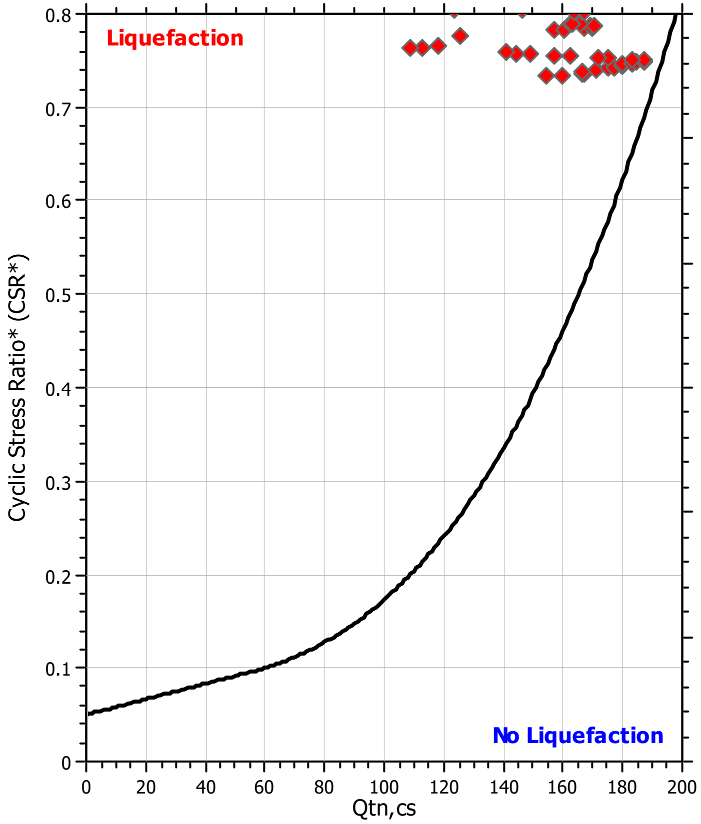
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

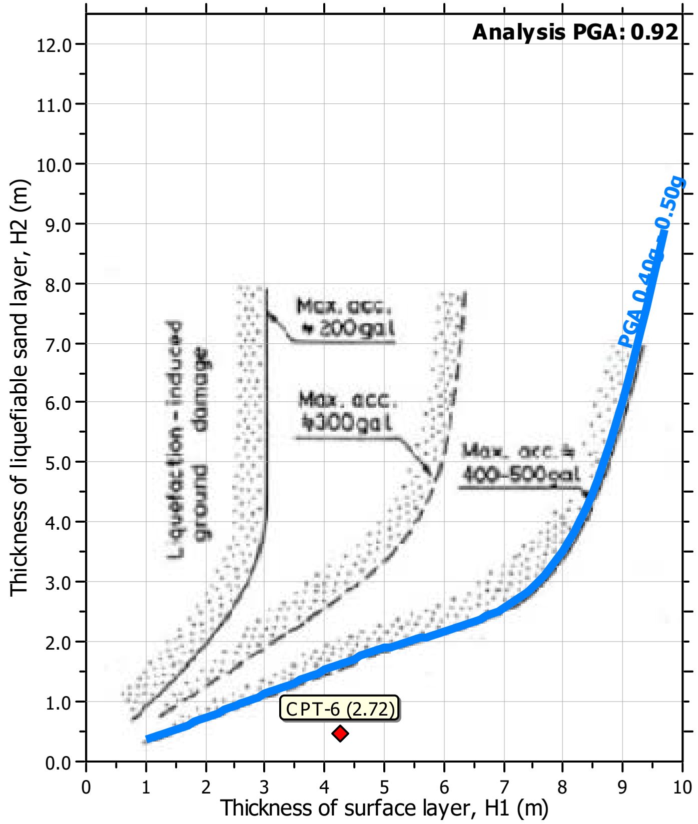
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	2.00 ft	Limit depth:	50.00 ft

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

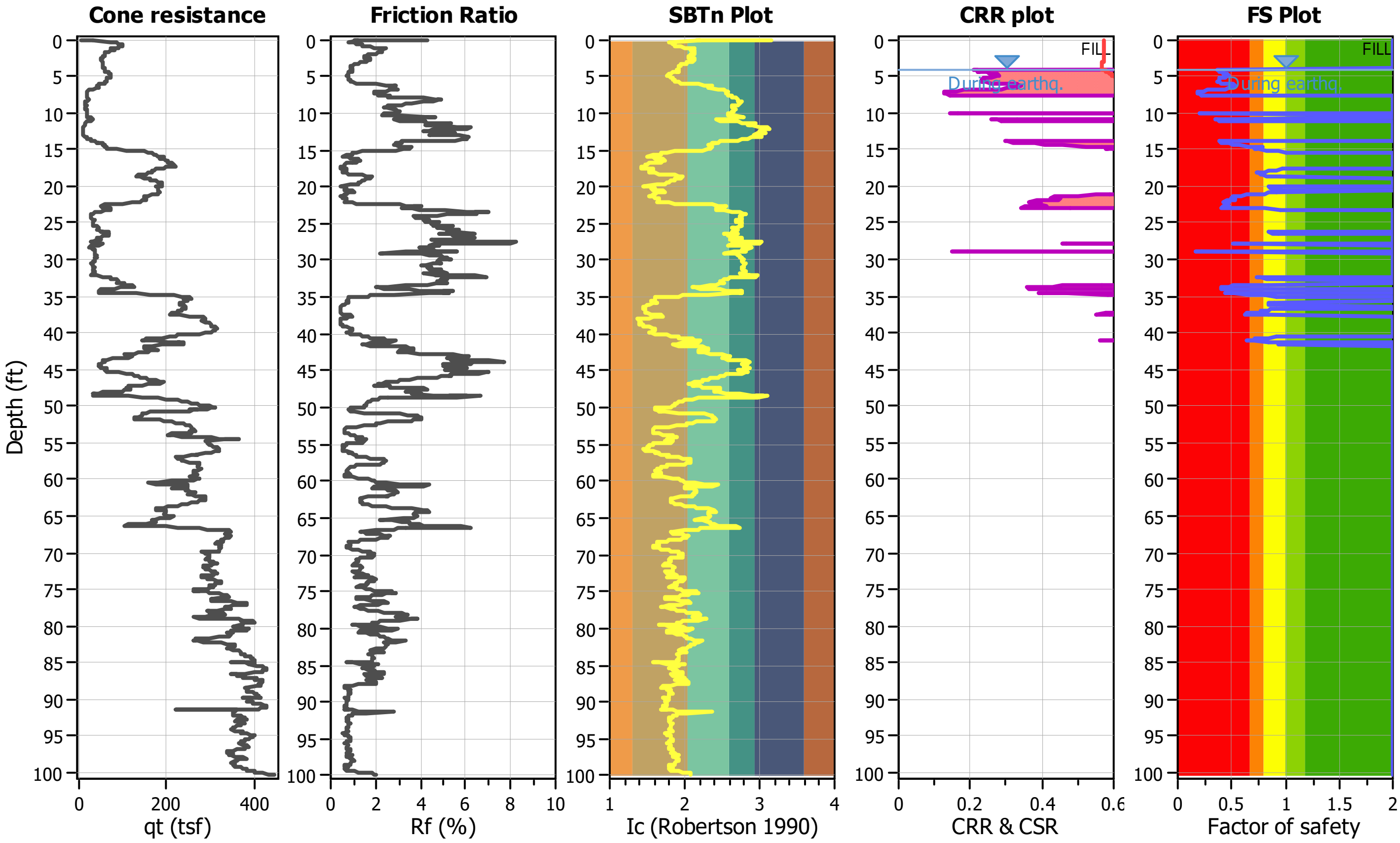
LIQUEFACTION ANALYSIS REPORT

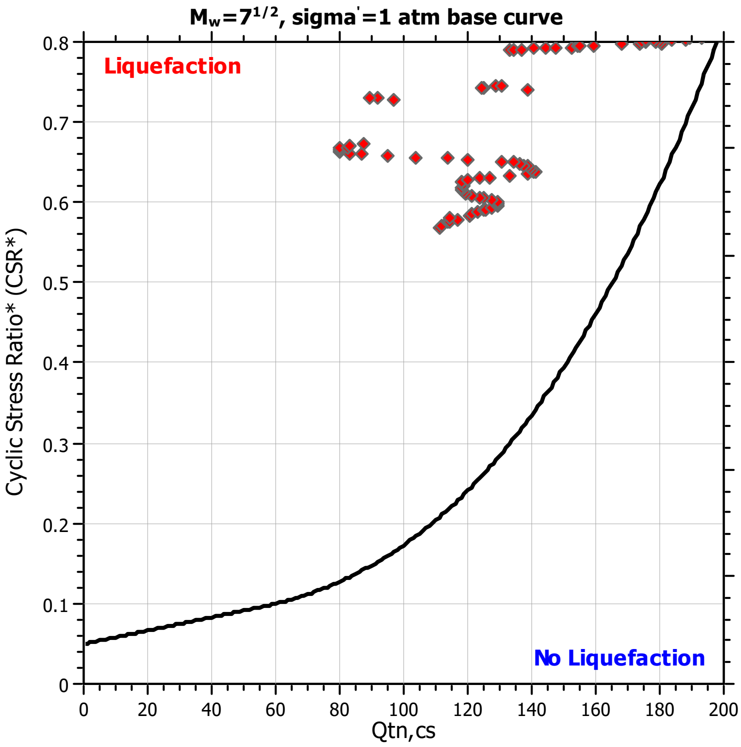
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

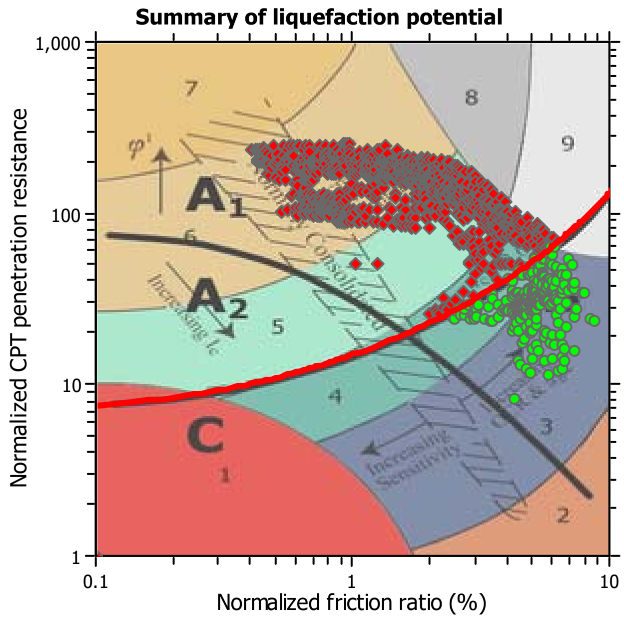
CPT file : CPT-9

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	4.00 ft	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	120.00 lb/ft^3	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

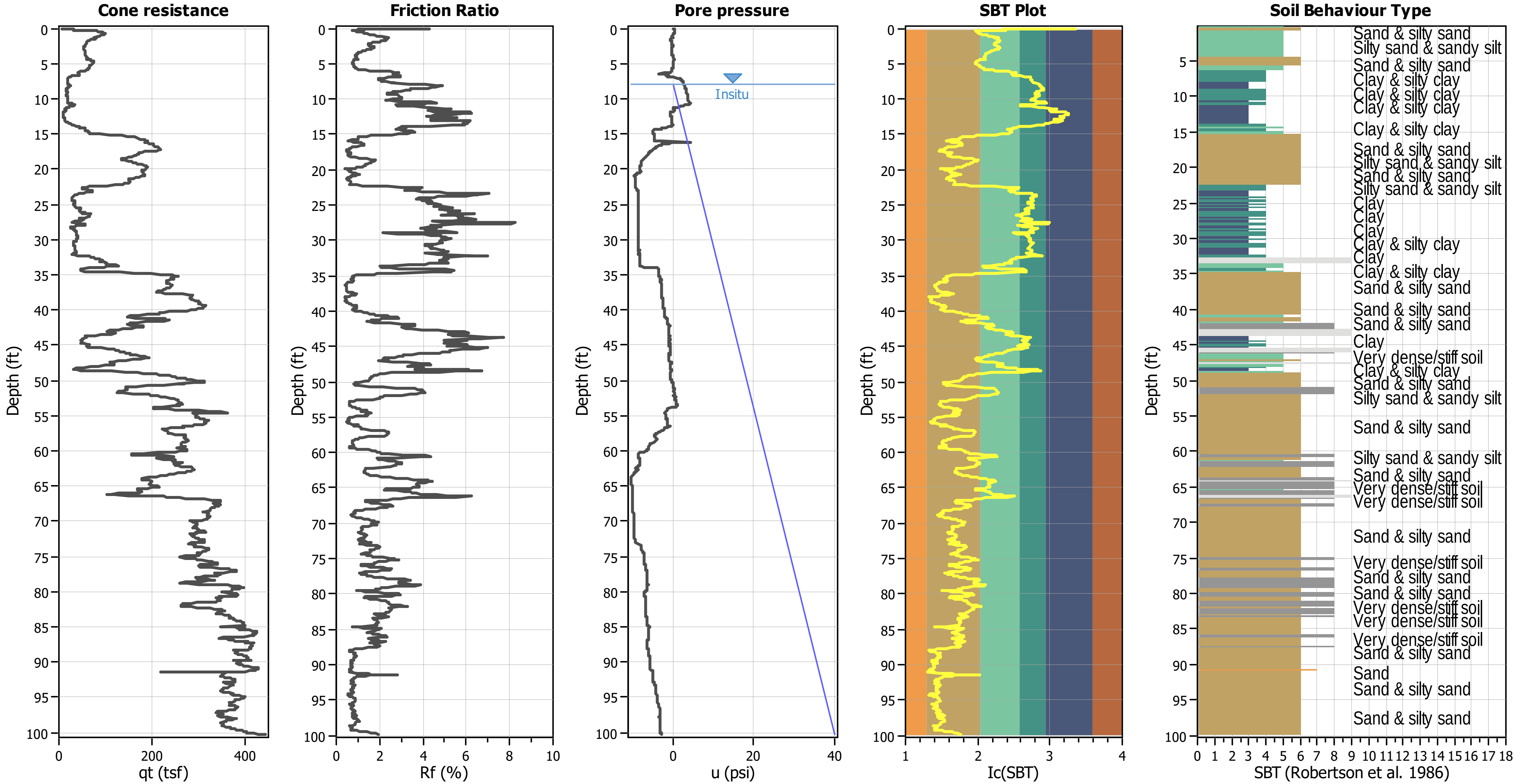






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



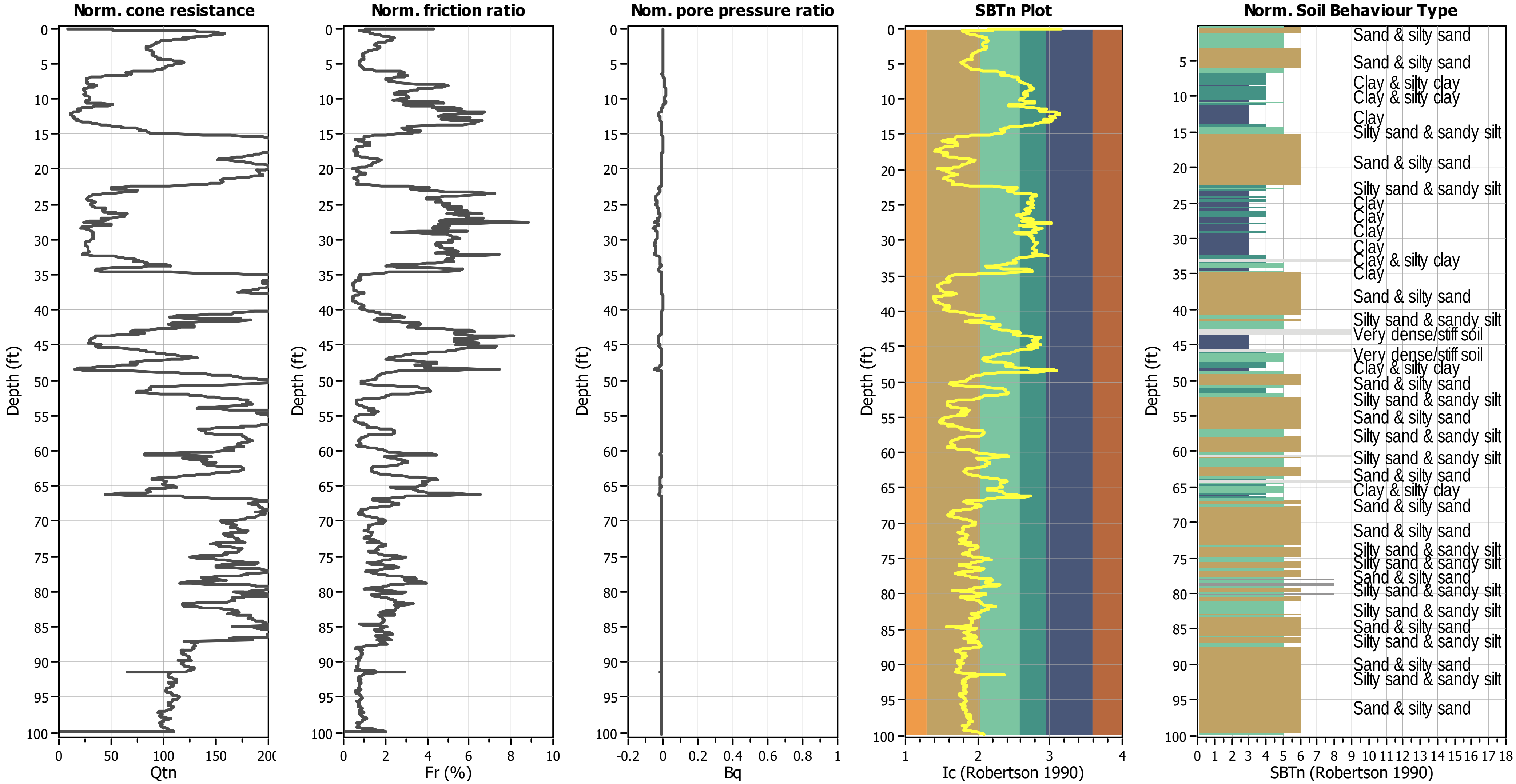
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	4.00 ft	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



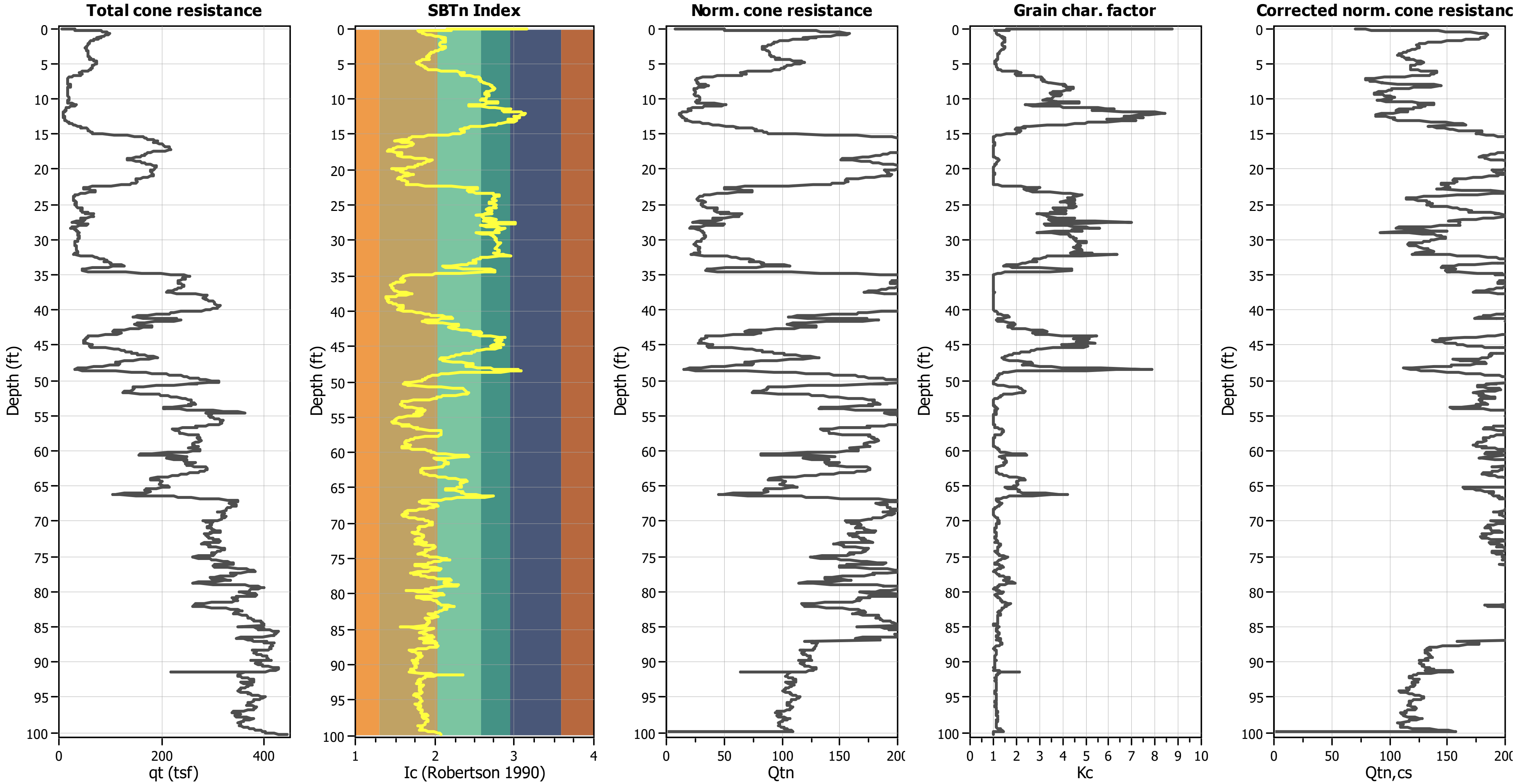
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	4.00 ft	Limit depth:	50.00 ft

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

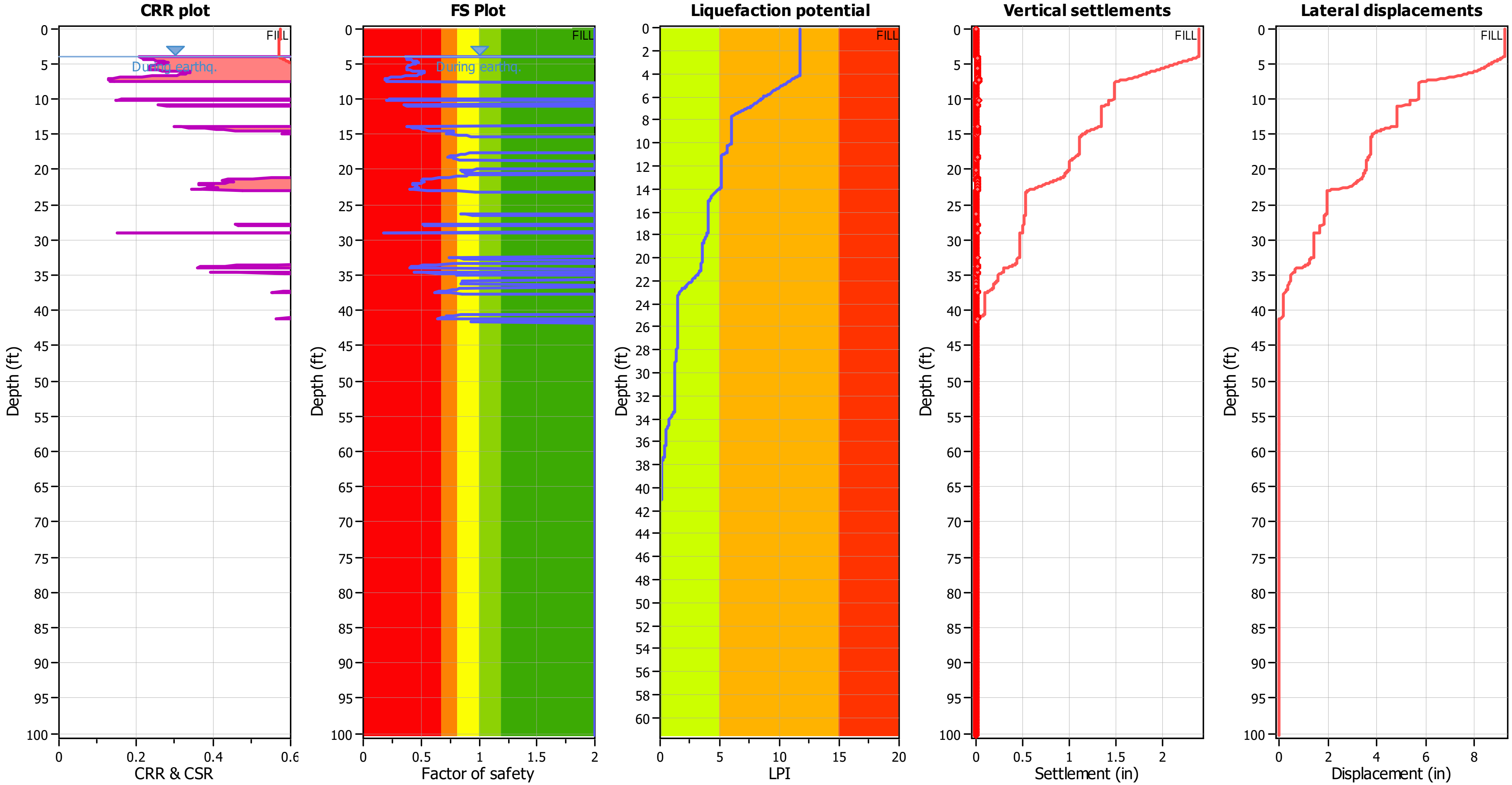
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	4.00 ft	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	4.00 ft	Limit depth:	50.00 ft

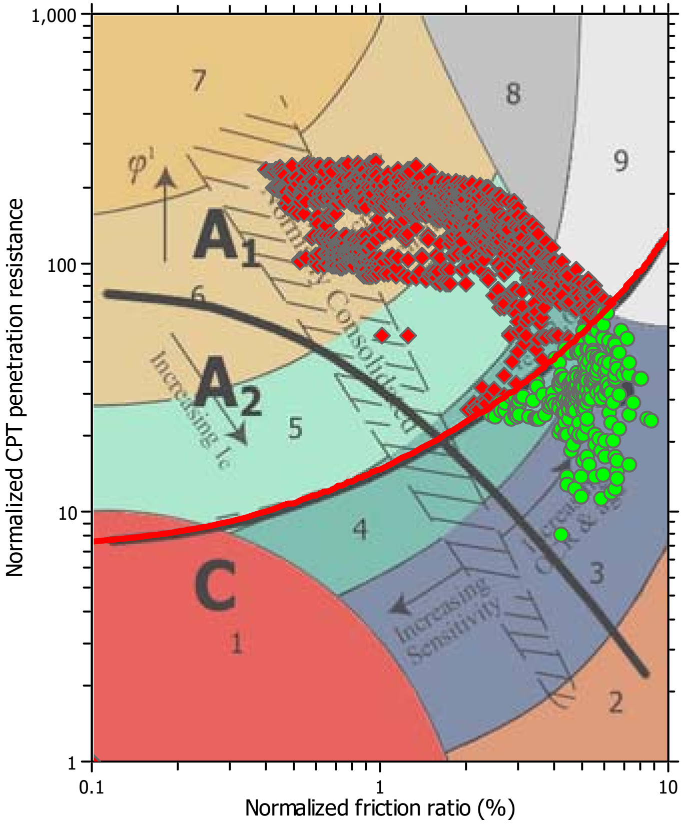
F.S. color scheme

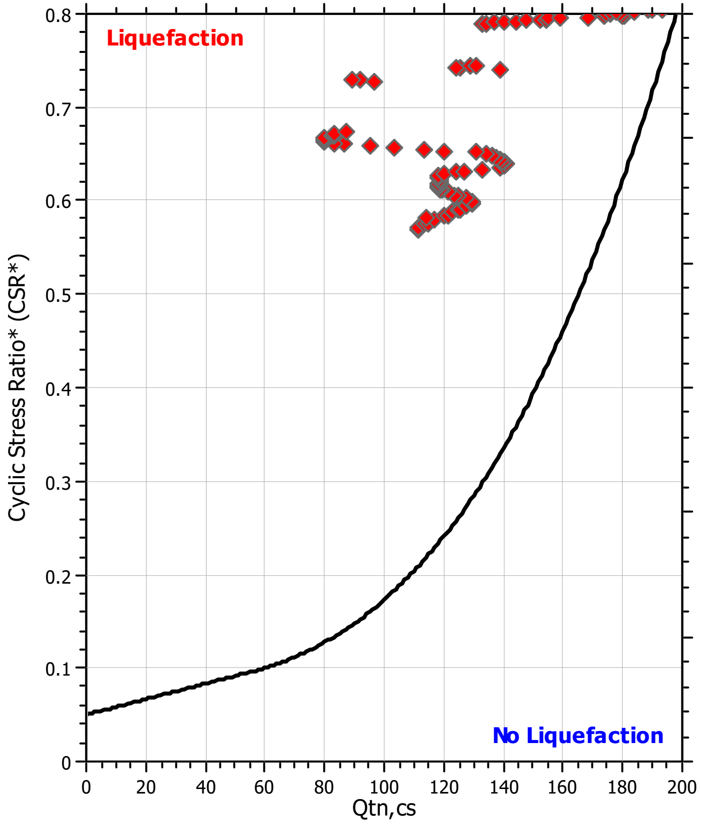
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

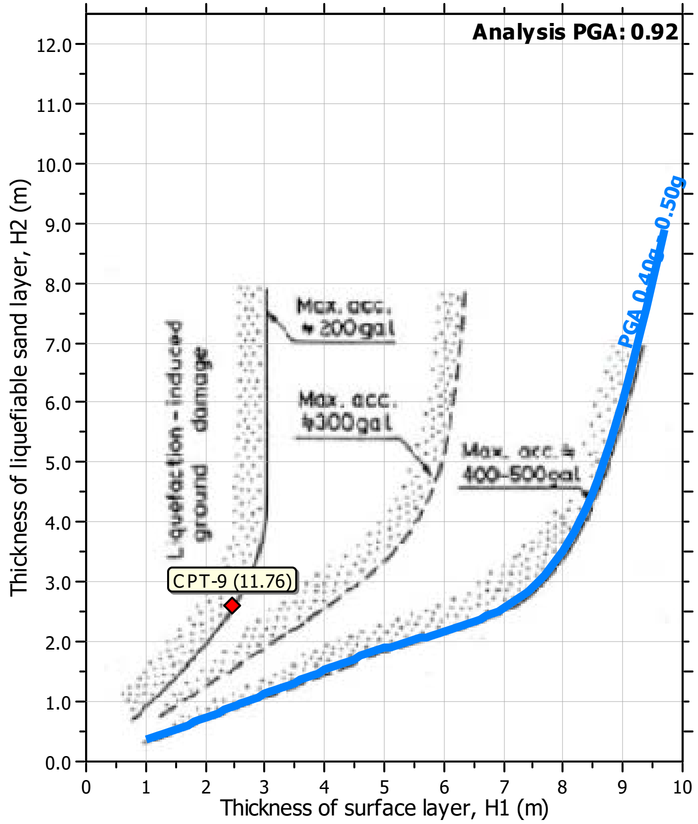
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	8.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	4.00 ft	Limit depth:	50.00 ft

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

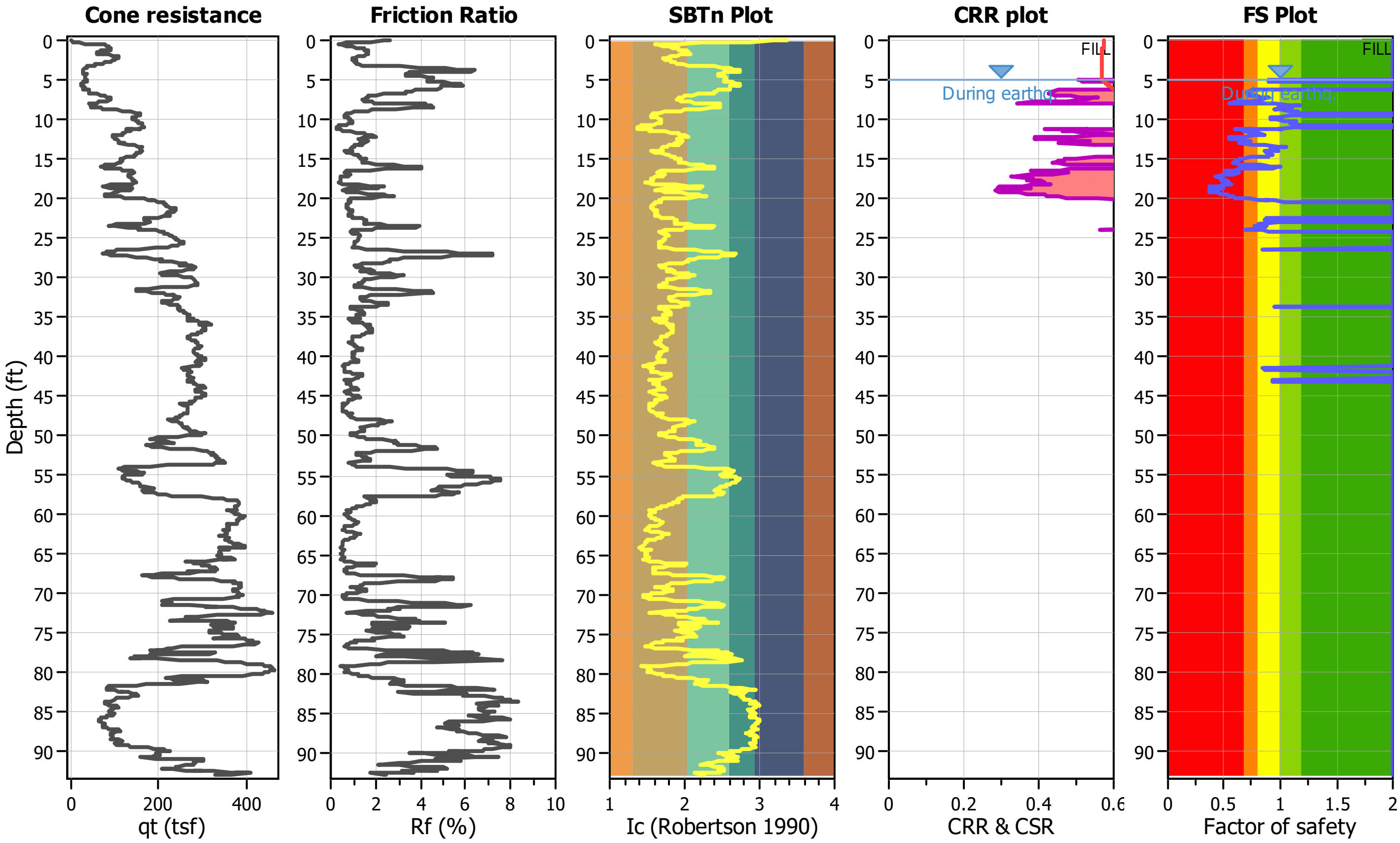
LIQUEFACTION ANALYSIS REPORT

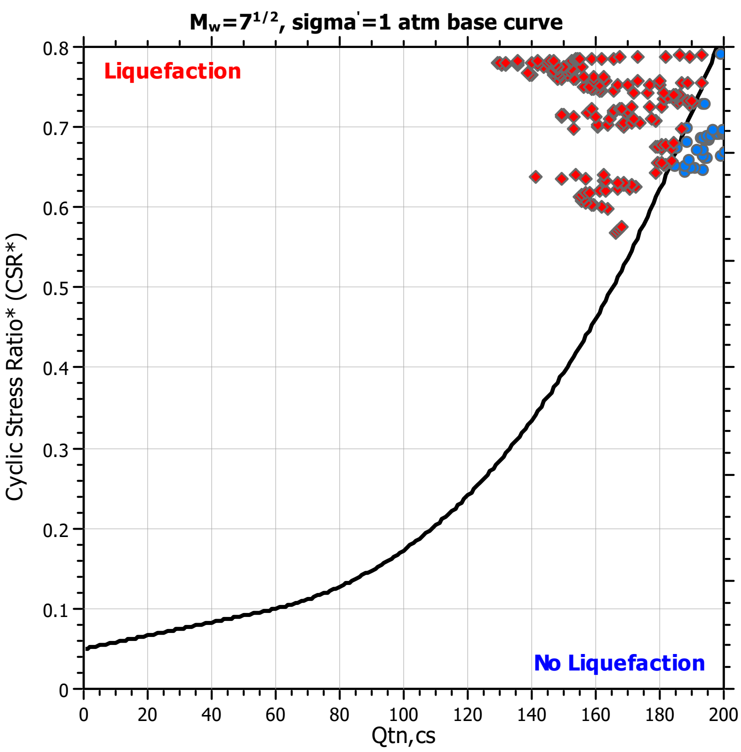
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

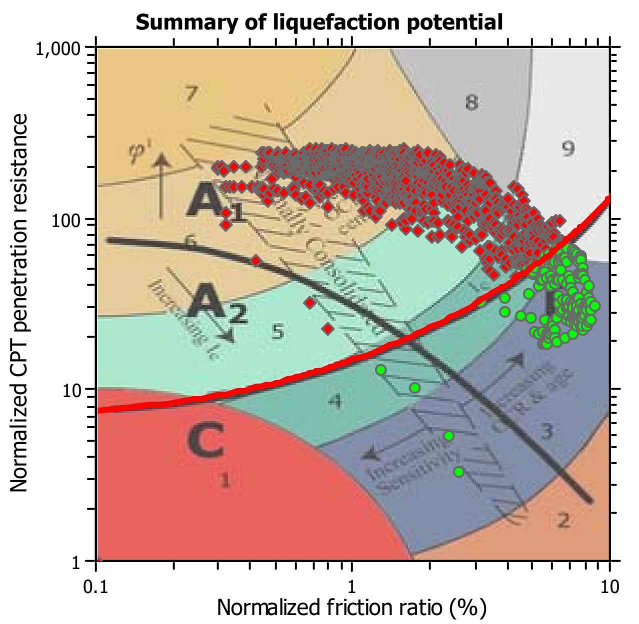
CPT file : CPT-14

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	5.00 ft	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	120.00 lb/ft^3	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

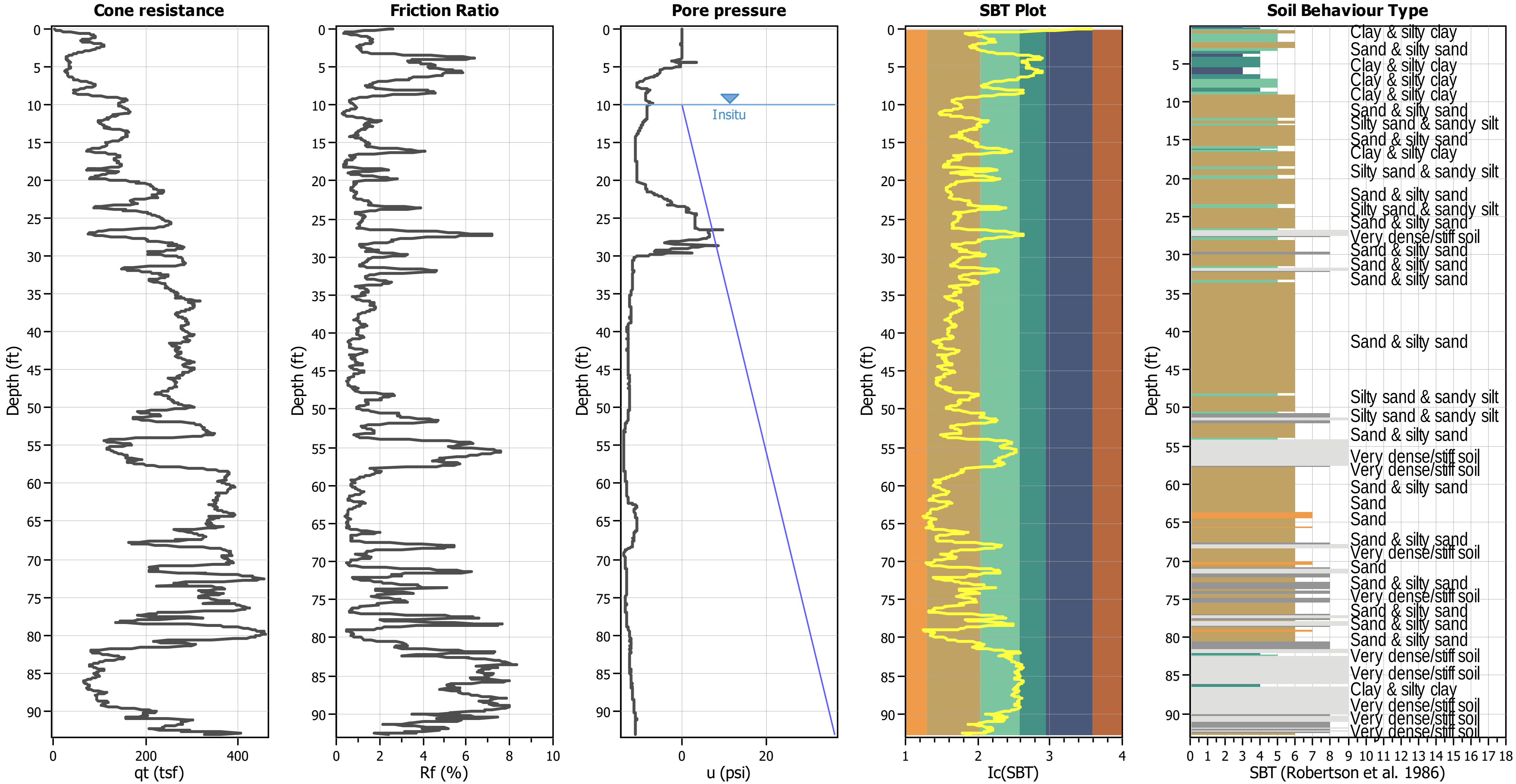






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



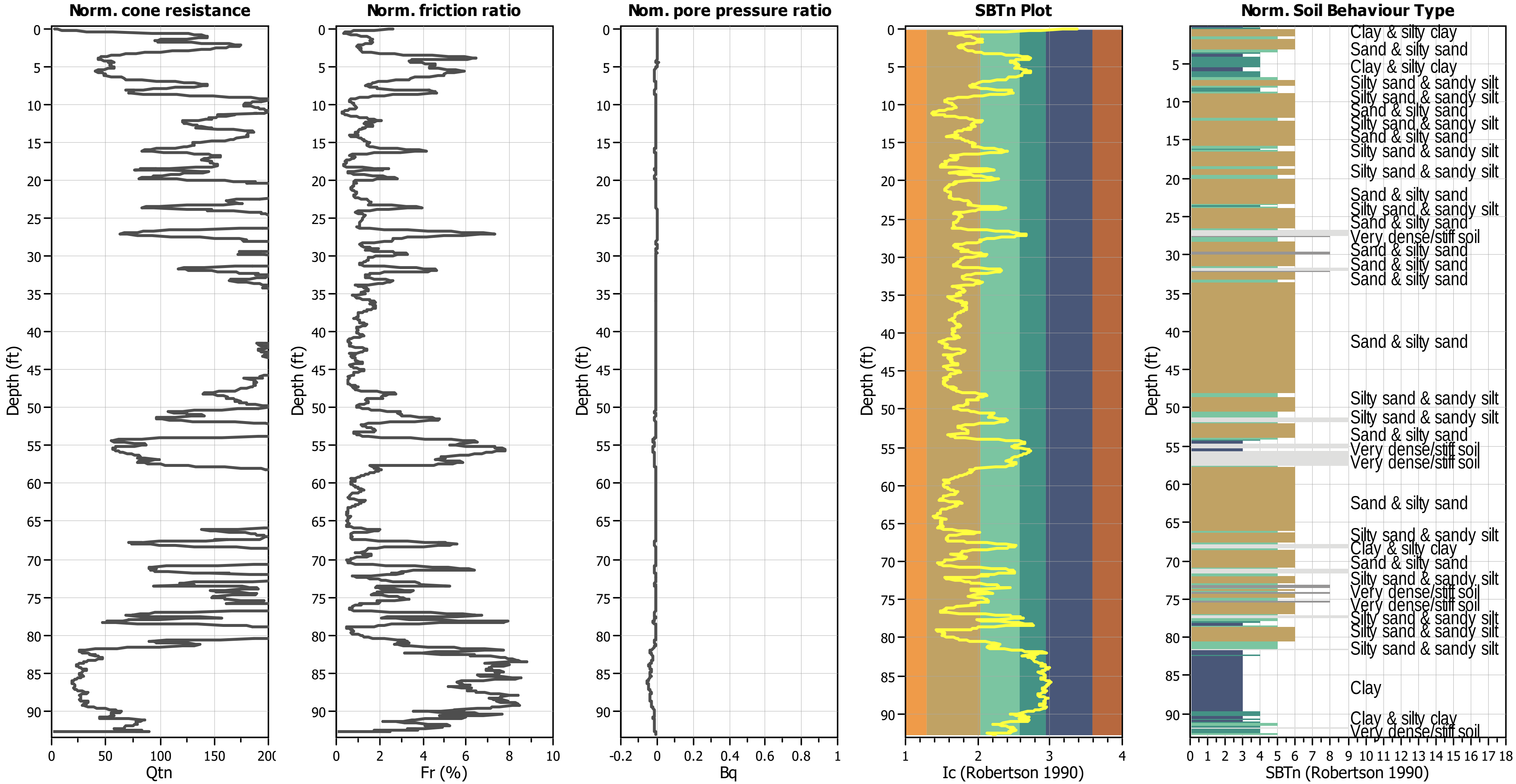
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



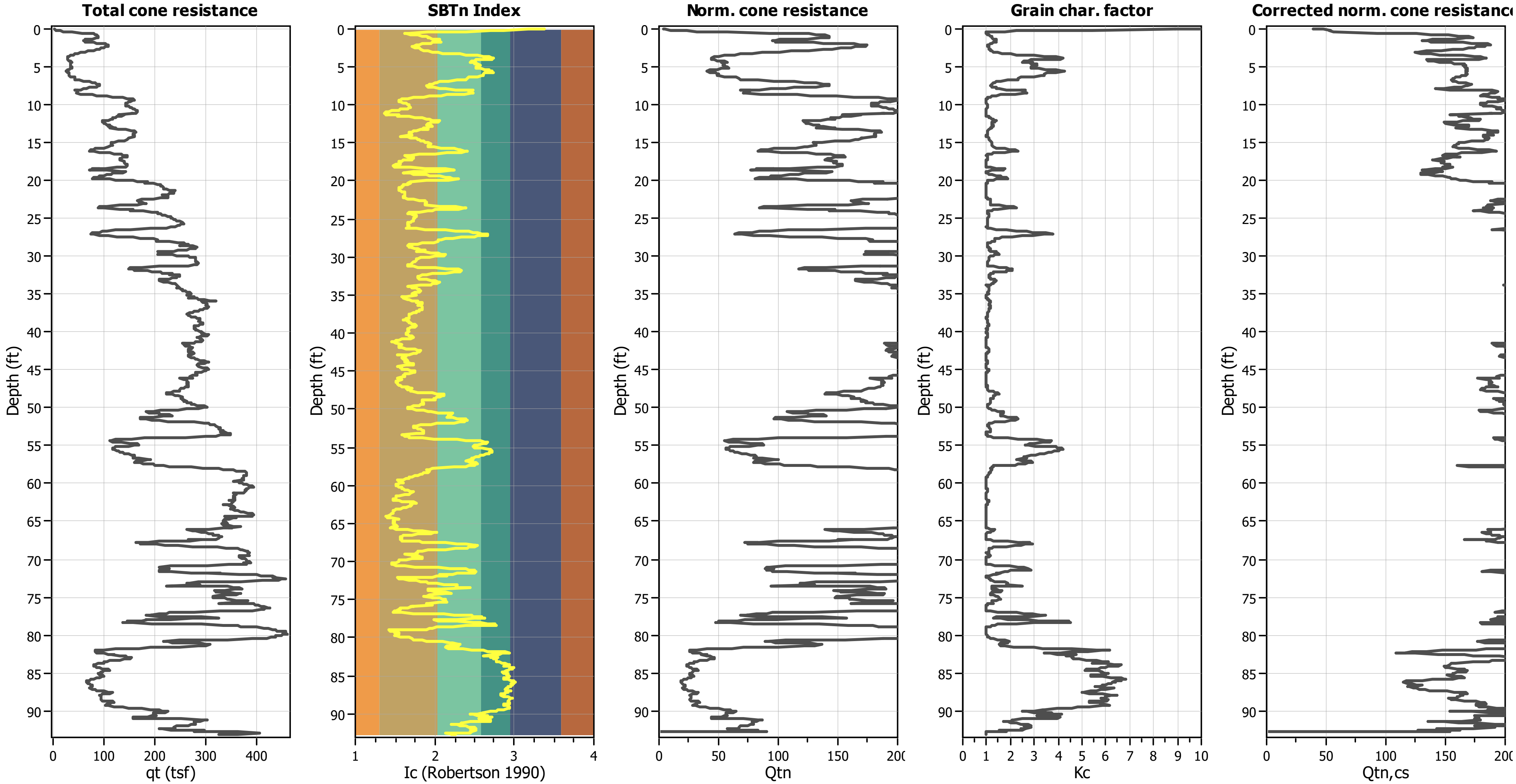
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

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

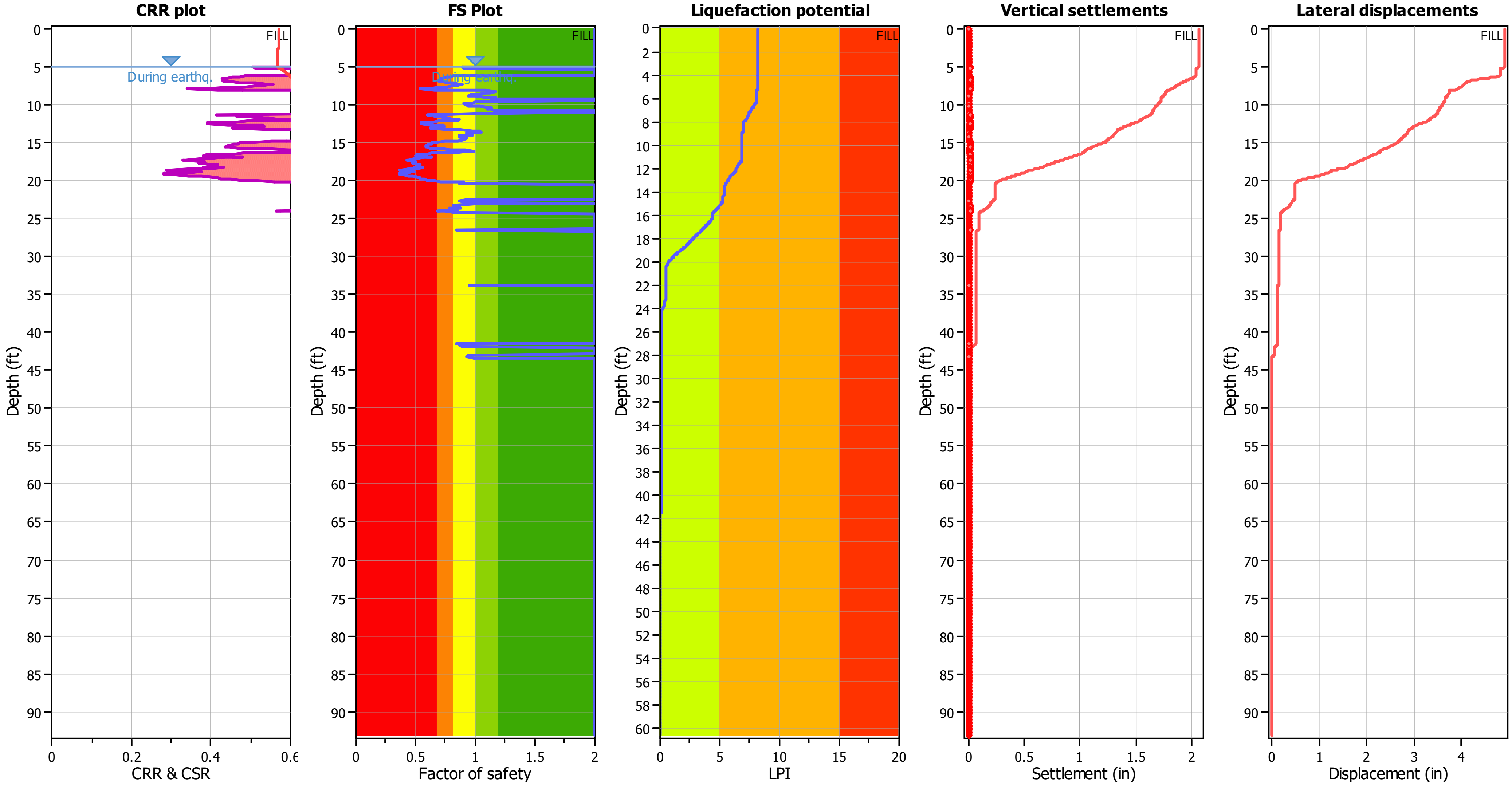
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

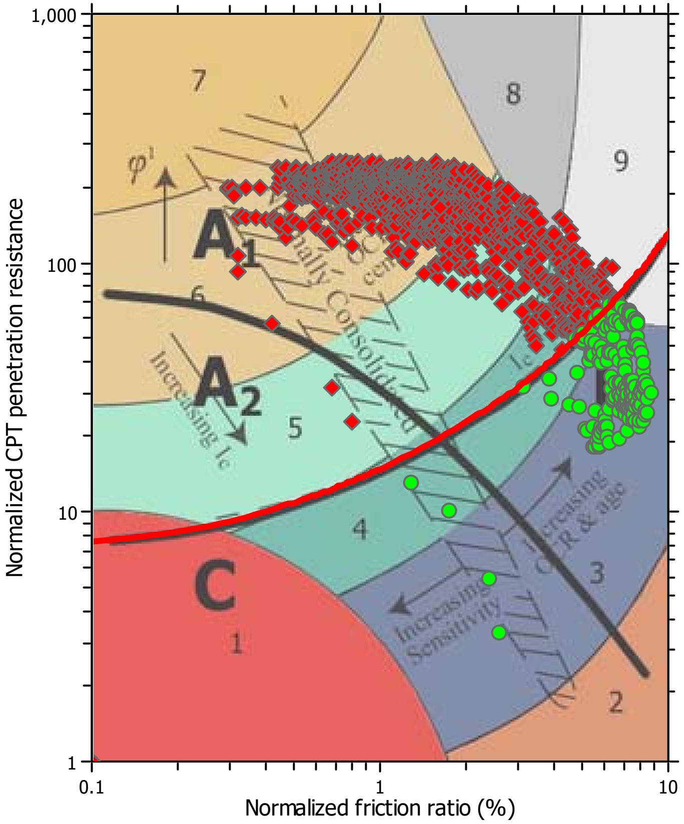
F.S. color scheme

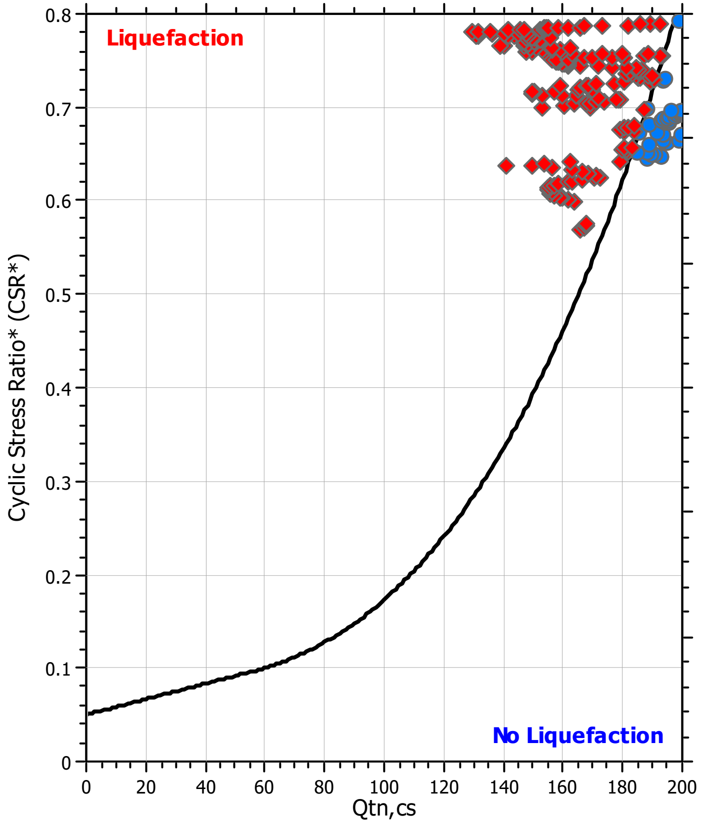
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

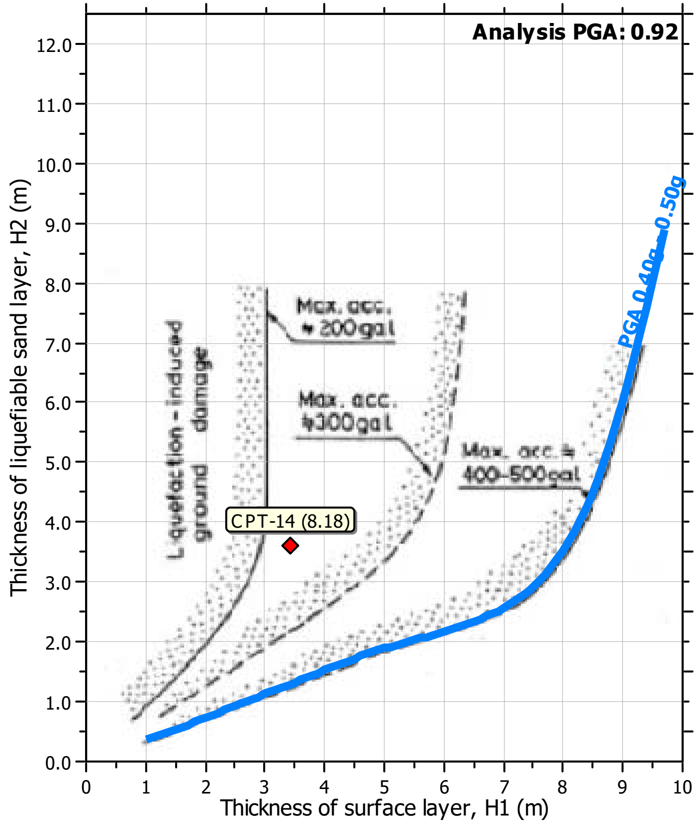
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



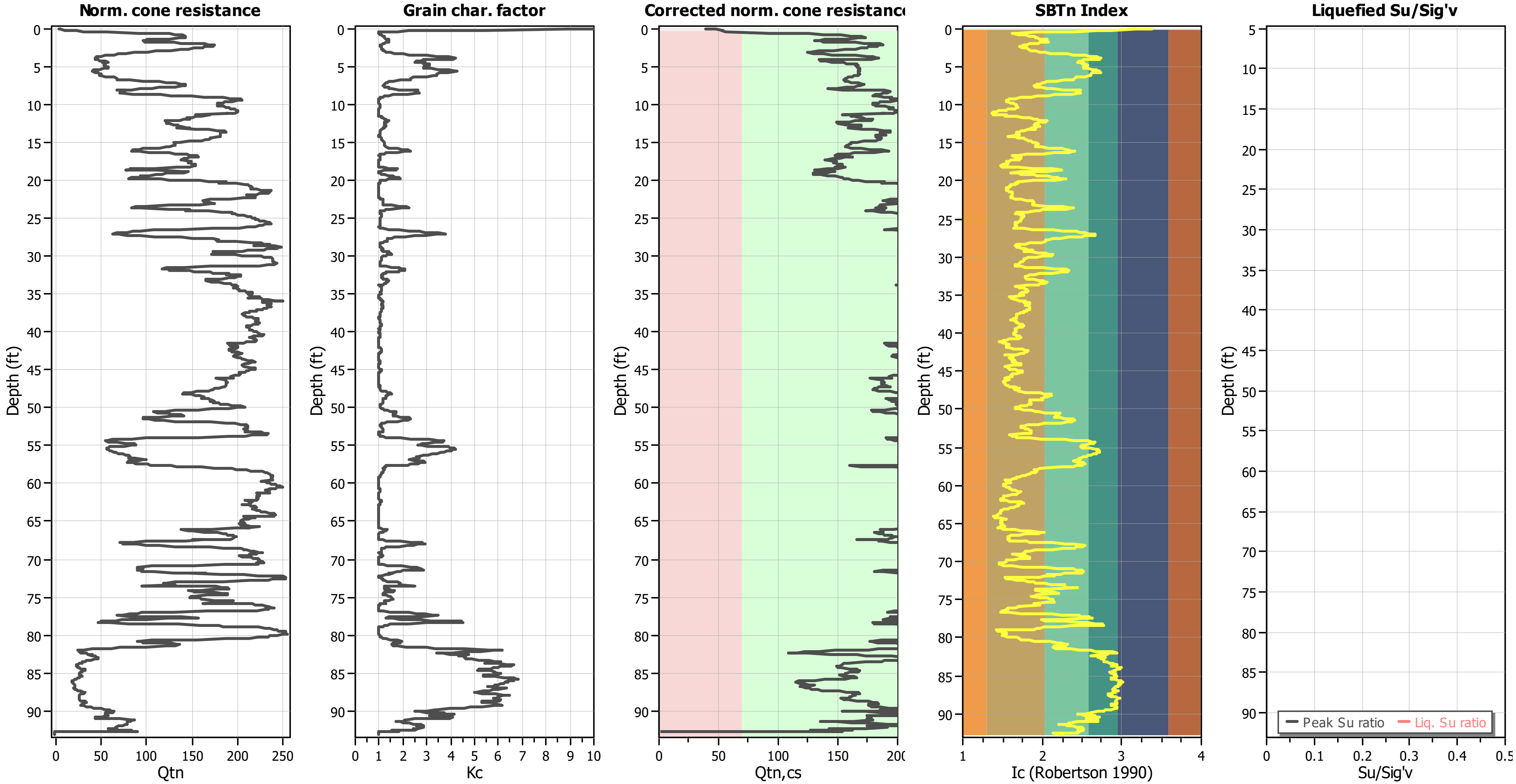




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	5.00 ft	Limit depth:	50.00 ft

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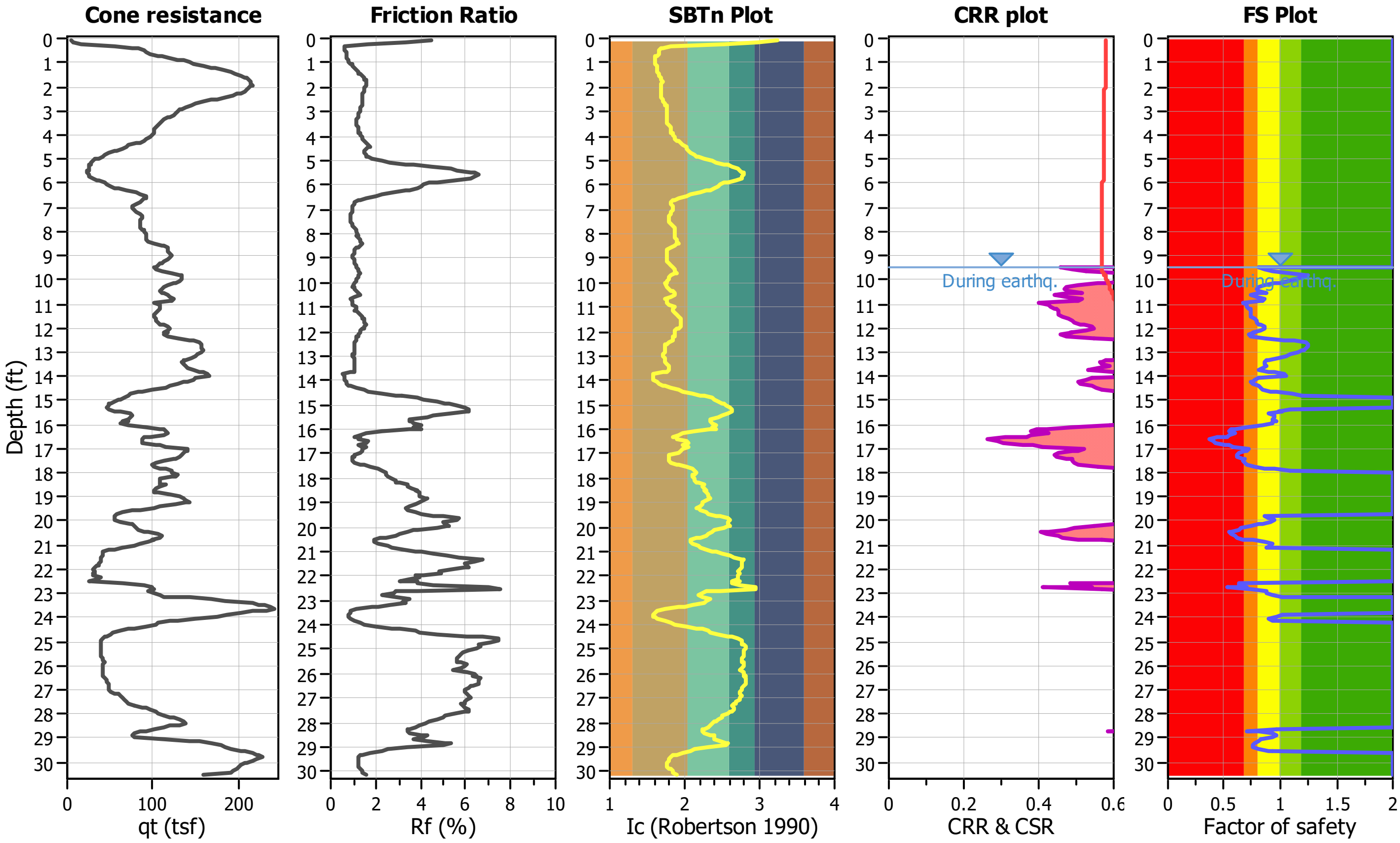
LIQUEFACTION ANALYSIS REPORT

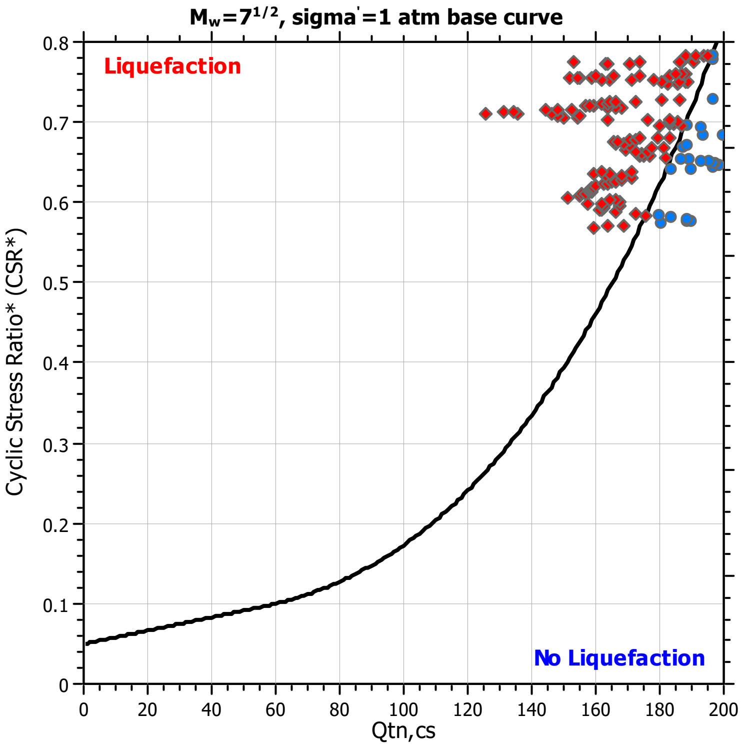
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

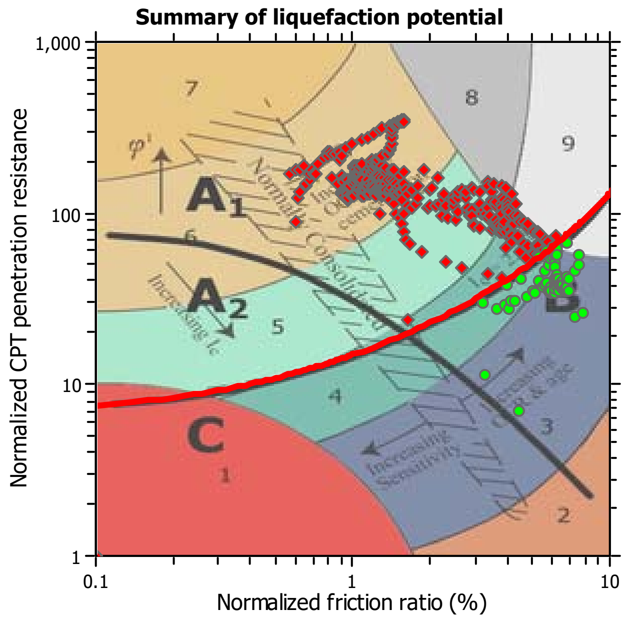
CPT file : CPT-17

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.50 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	9.50 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

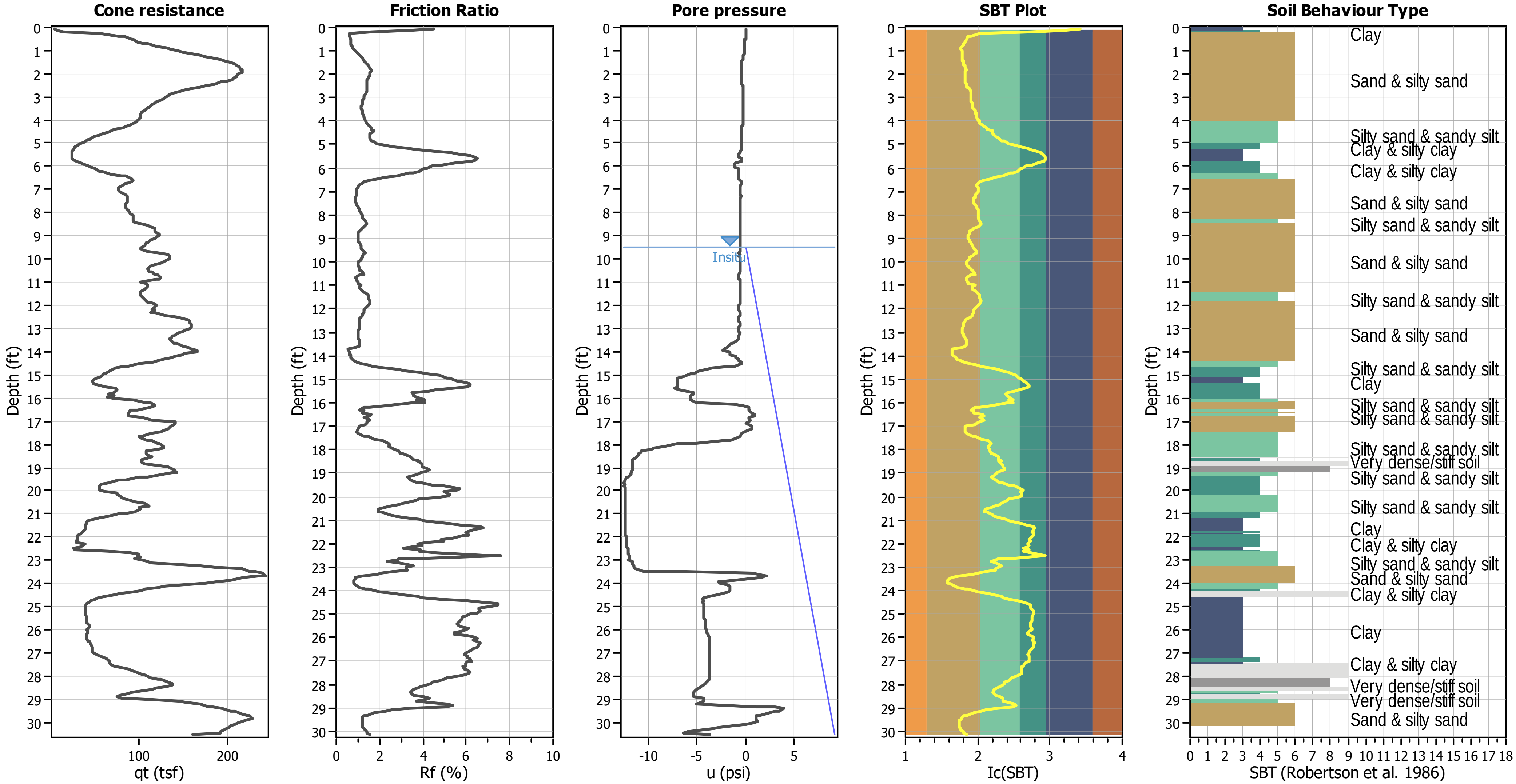






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



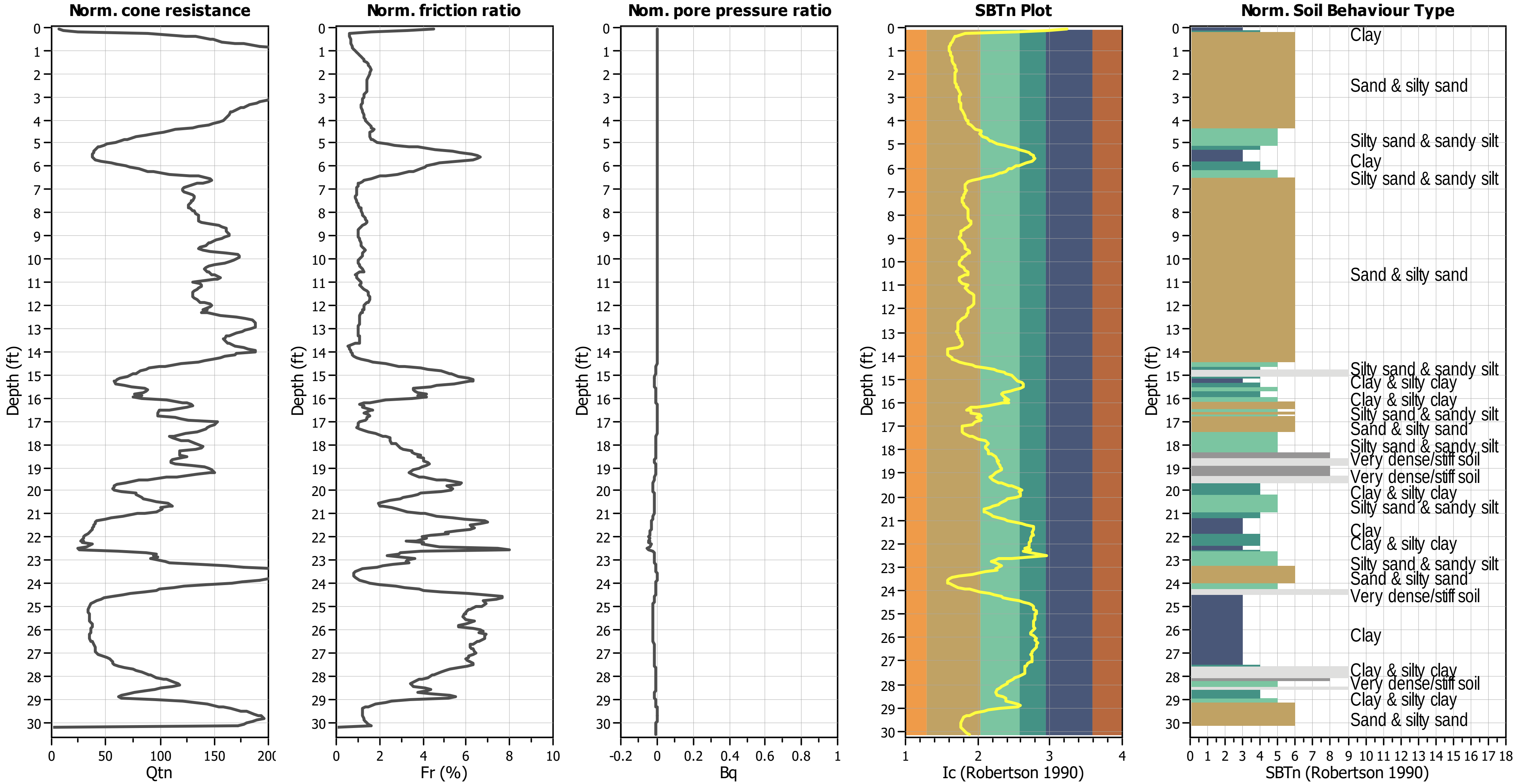
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	9.50 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



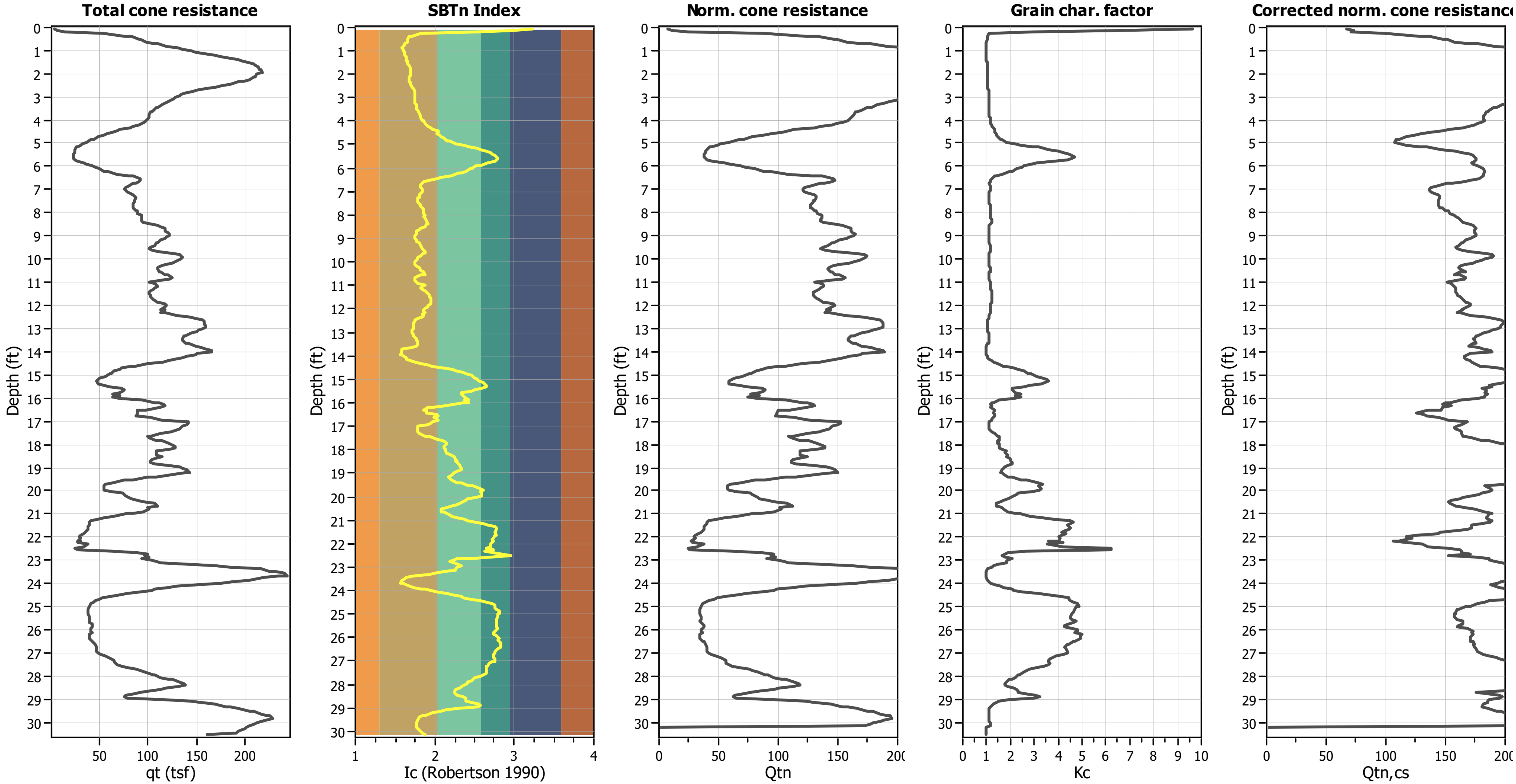
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	9.50 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

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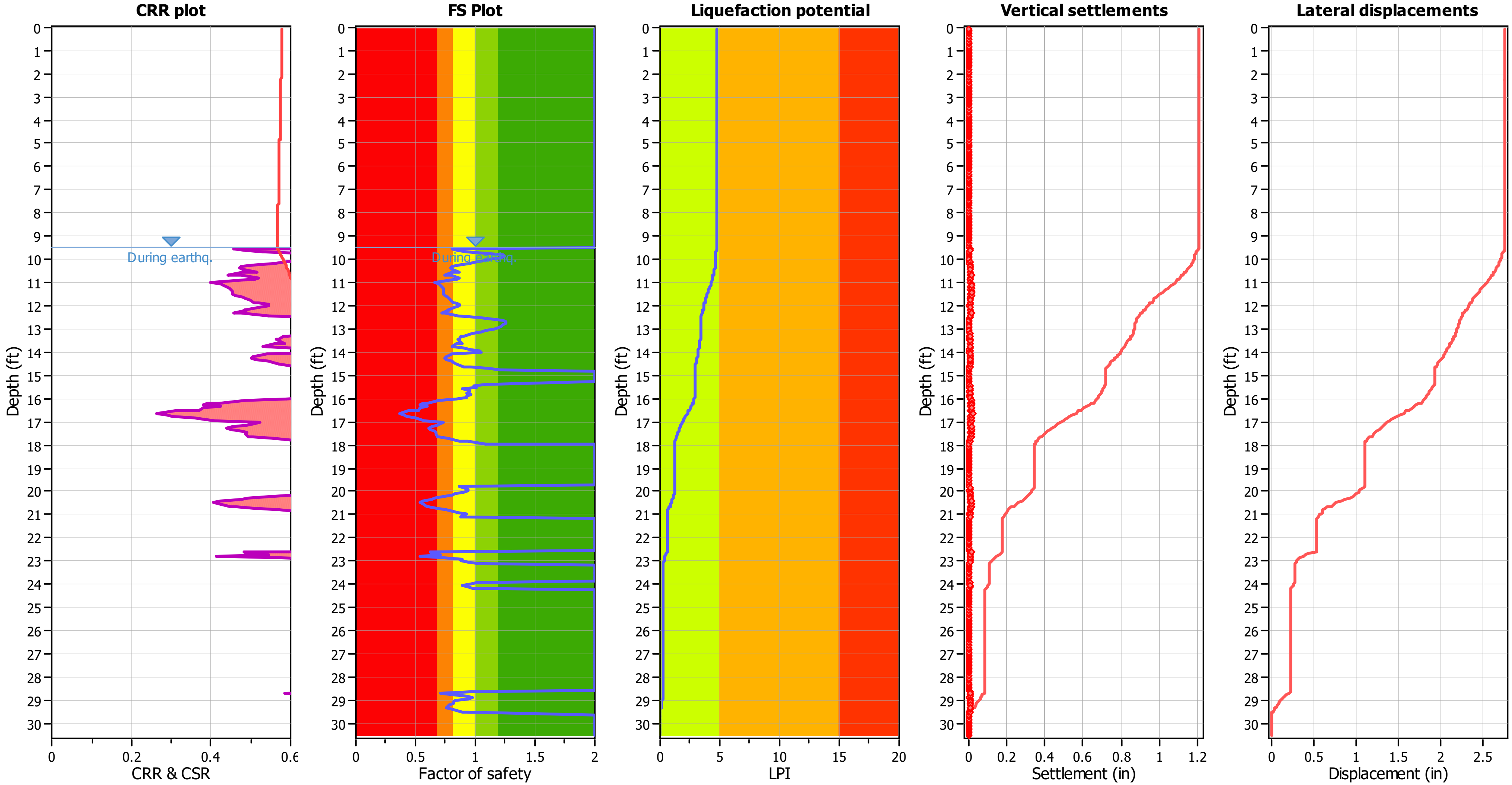
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

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Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

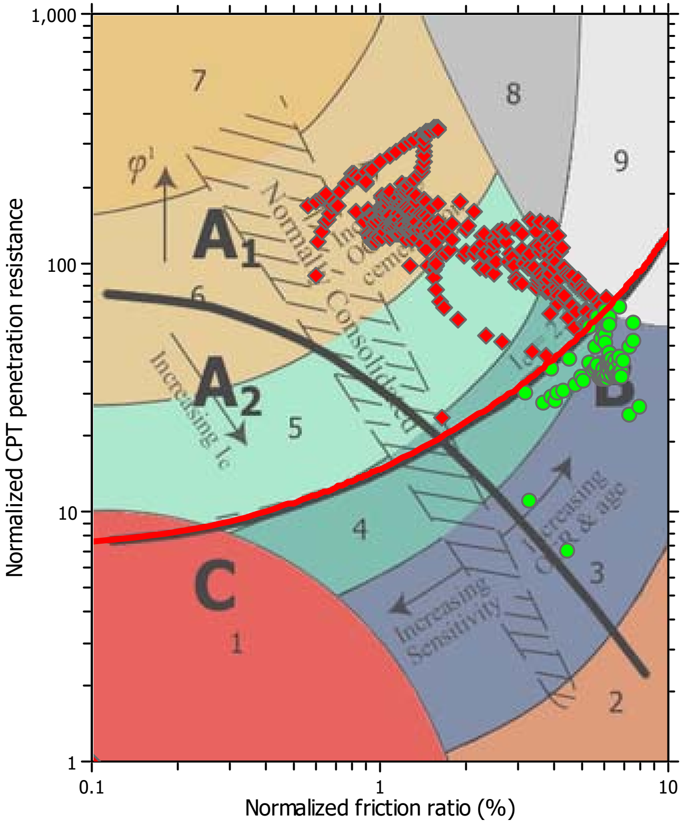
F.S. color scheme

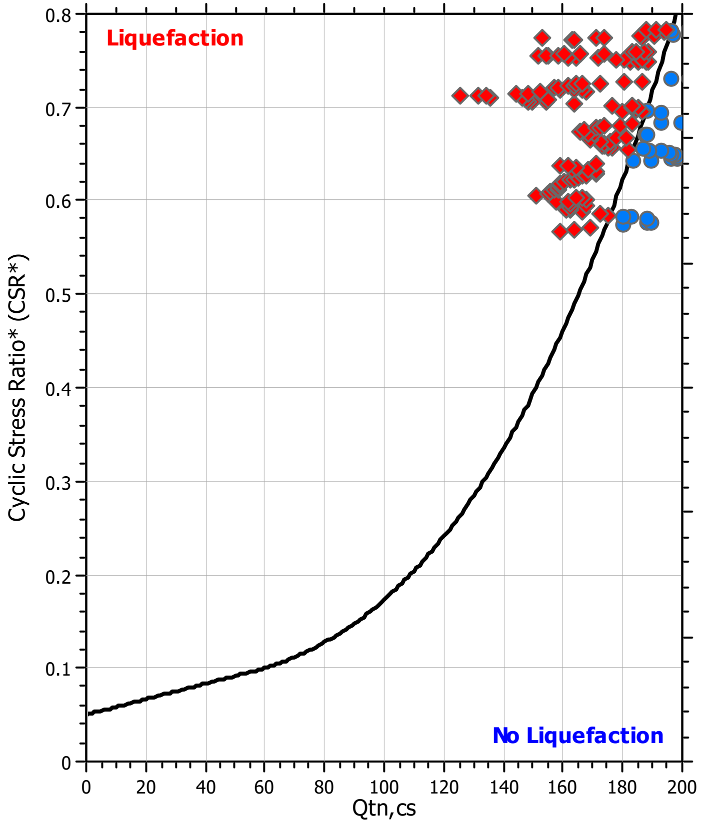
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

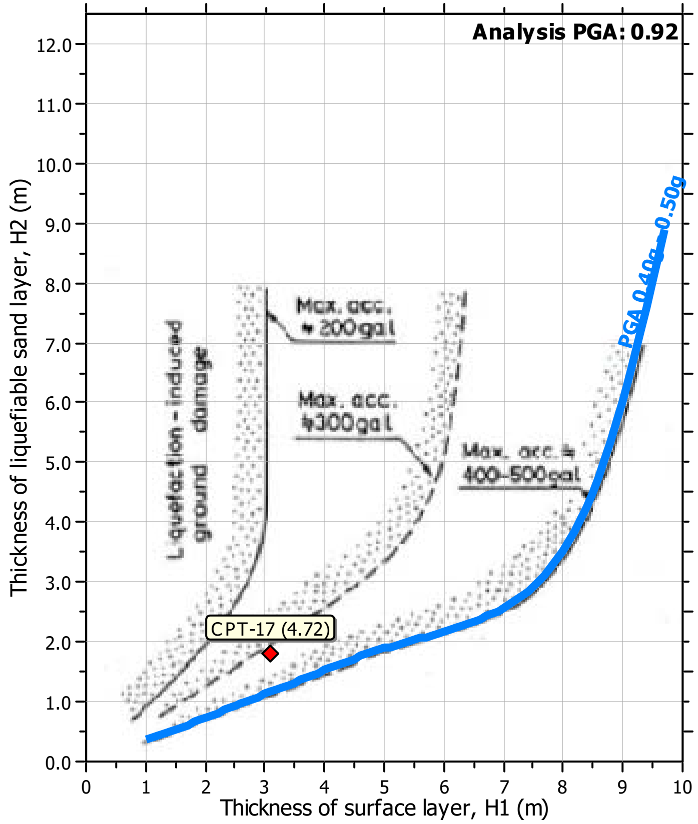
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



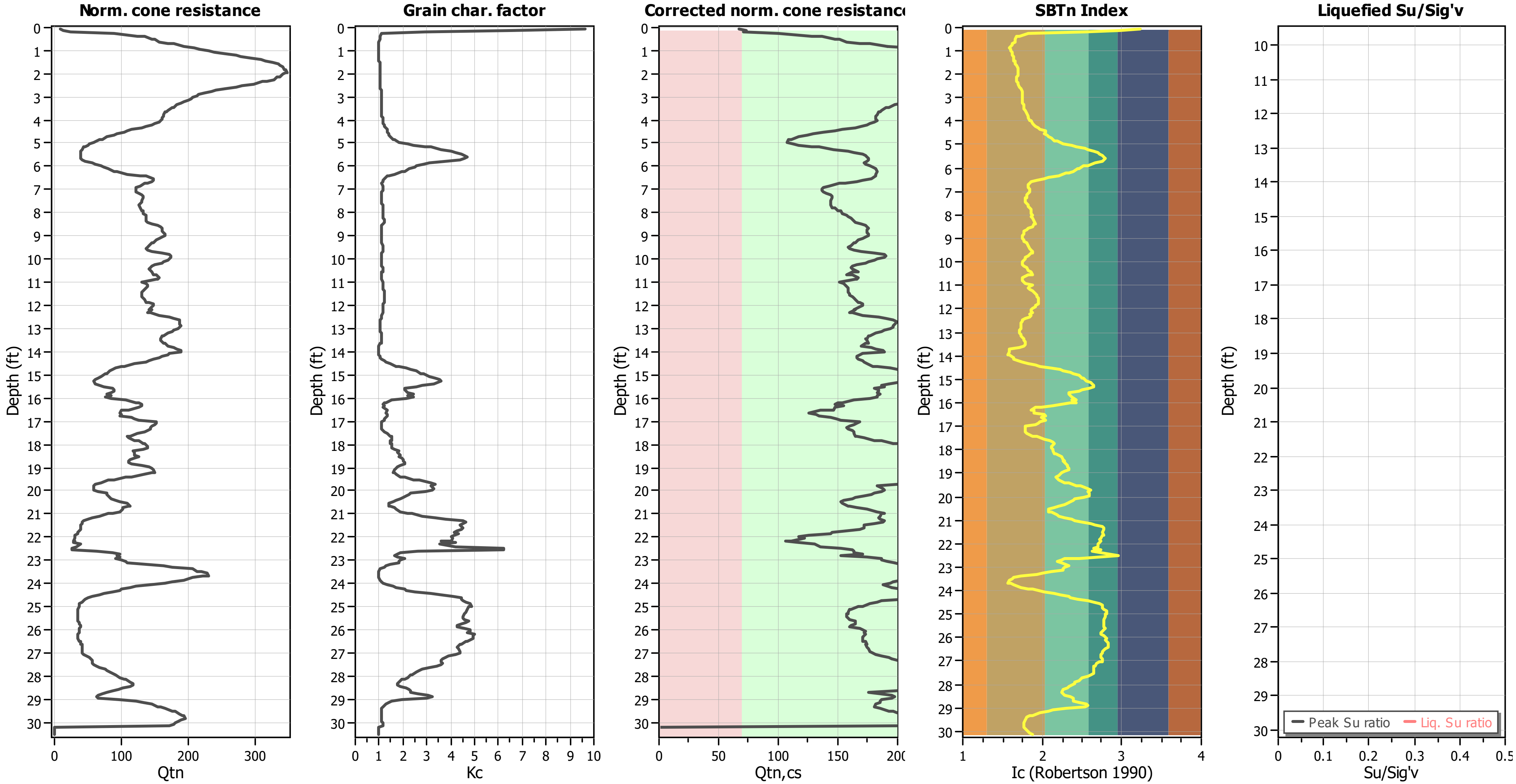




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	9.50 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	9.50 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	N/A

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

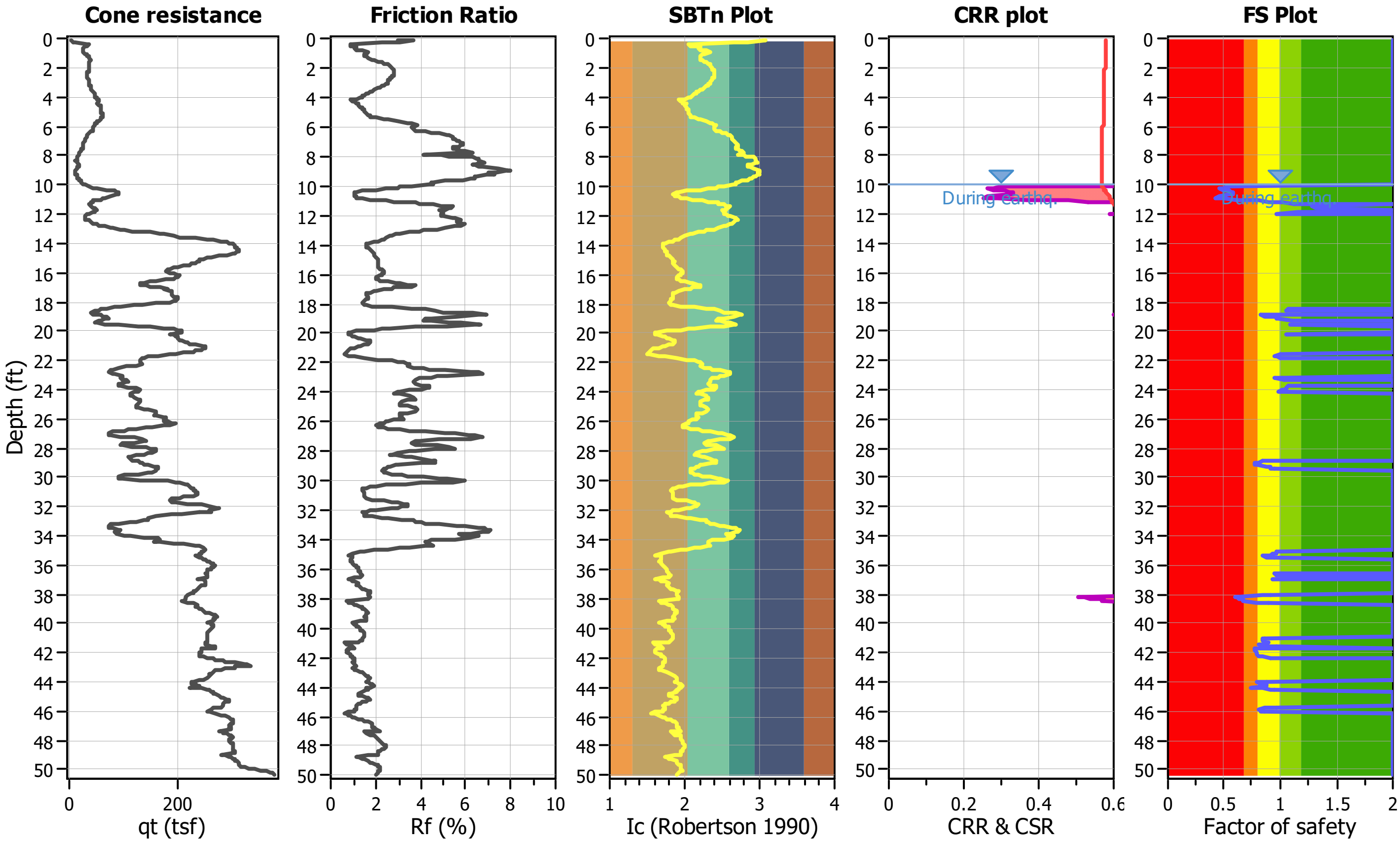
LIQUEFACTION ANALYSIS REPORT

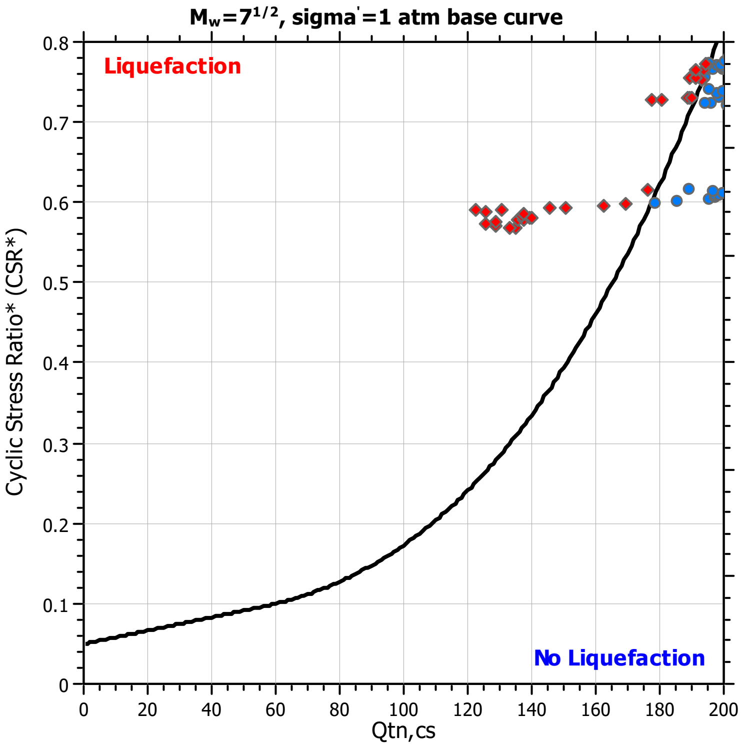
Project title : Leighton & Associates / Pardee Elsinore 35 **Location : Lake Elsinore, CA**

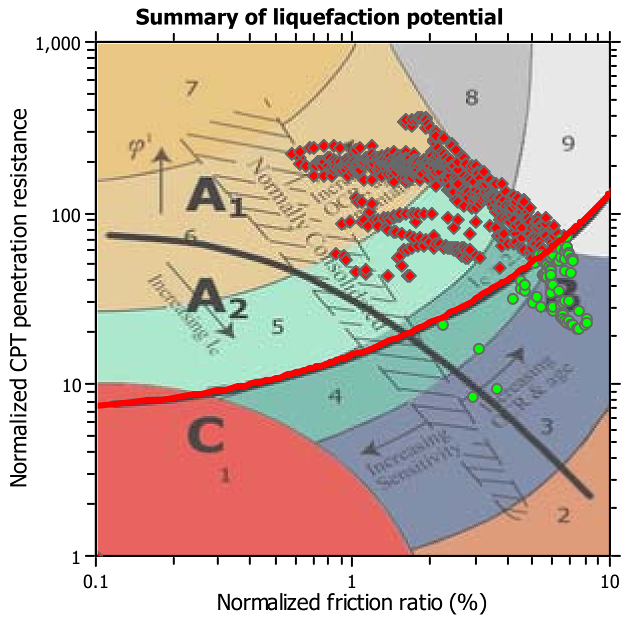
CPT file : CPT-18

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	0.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	0.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	7.40	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.92	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

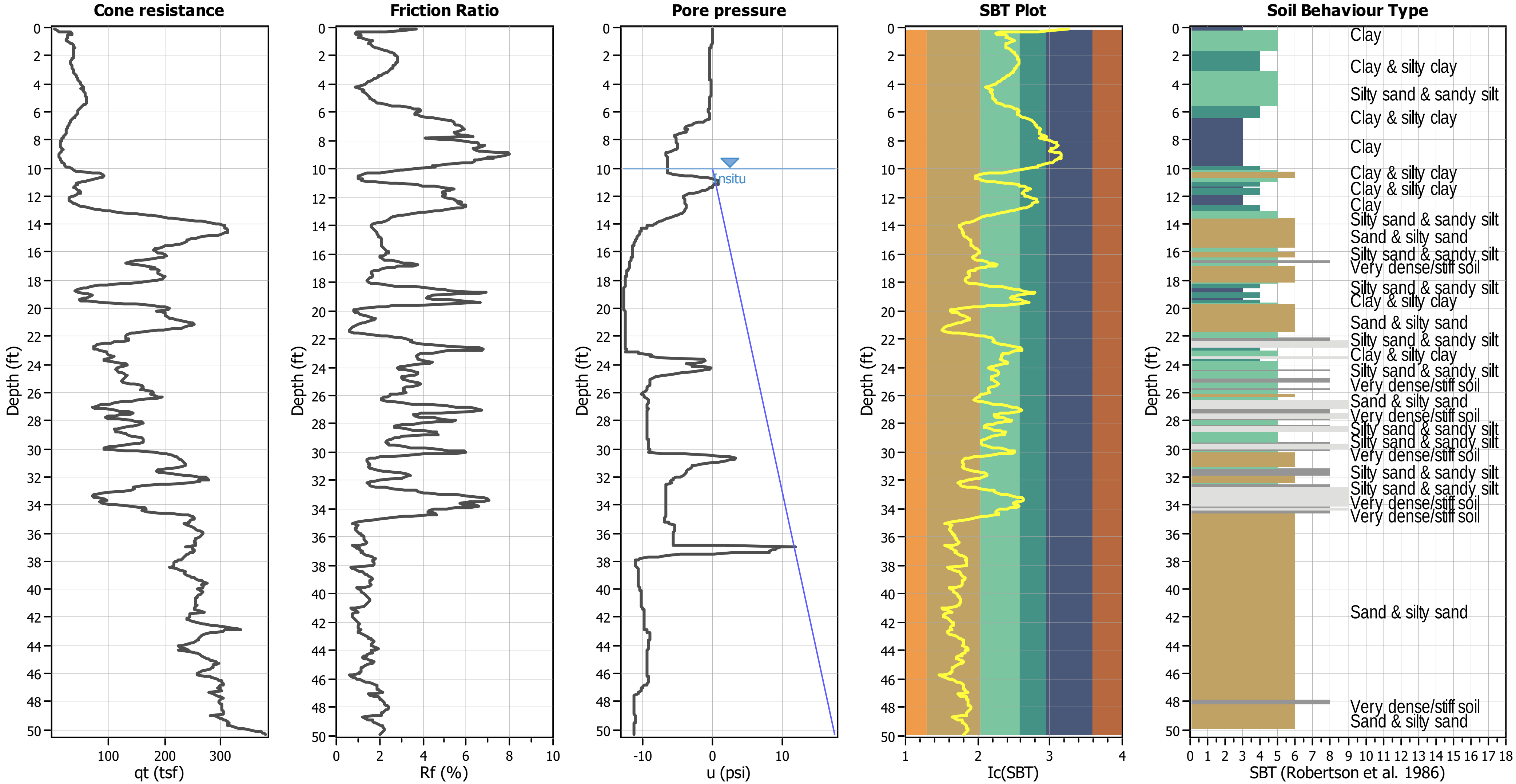






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



Input parameters and analysis data

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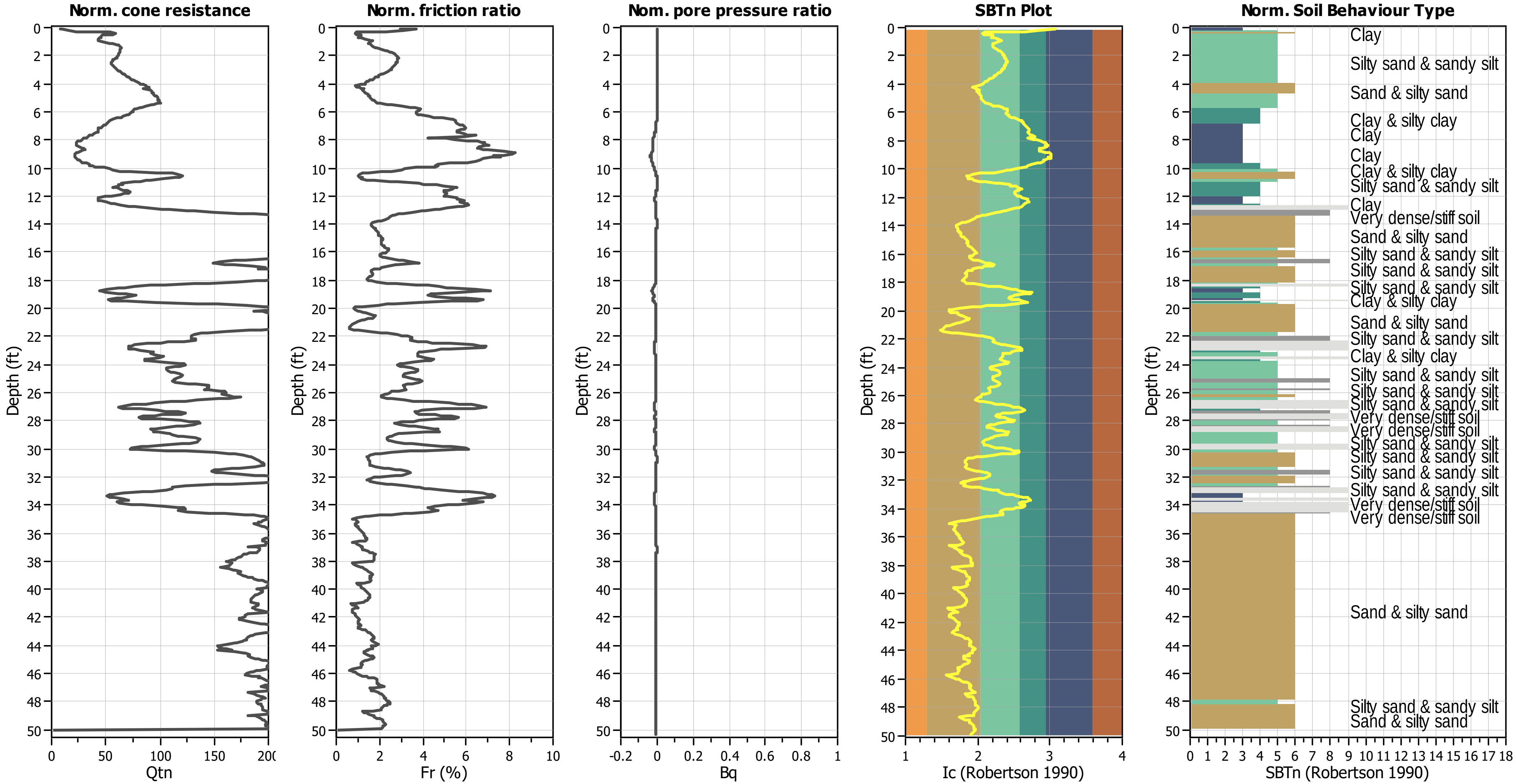
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	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)



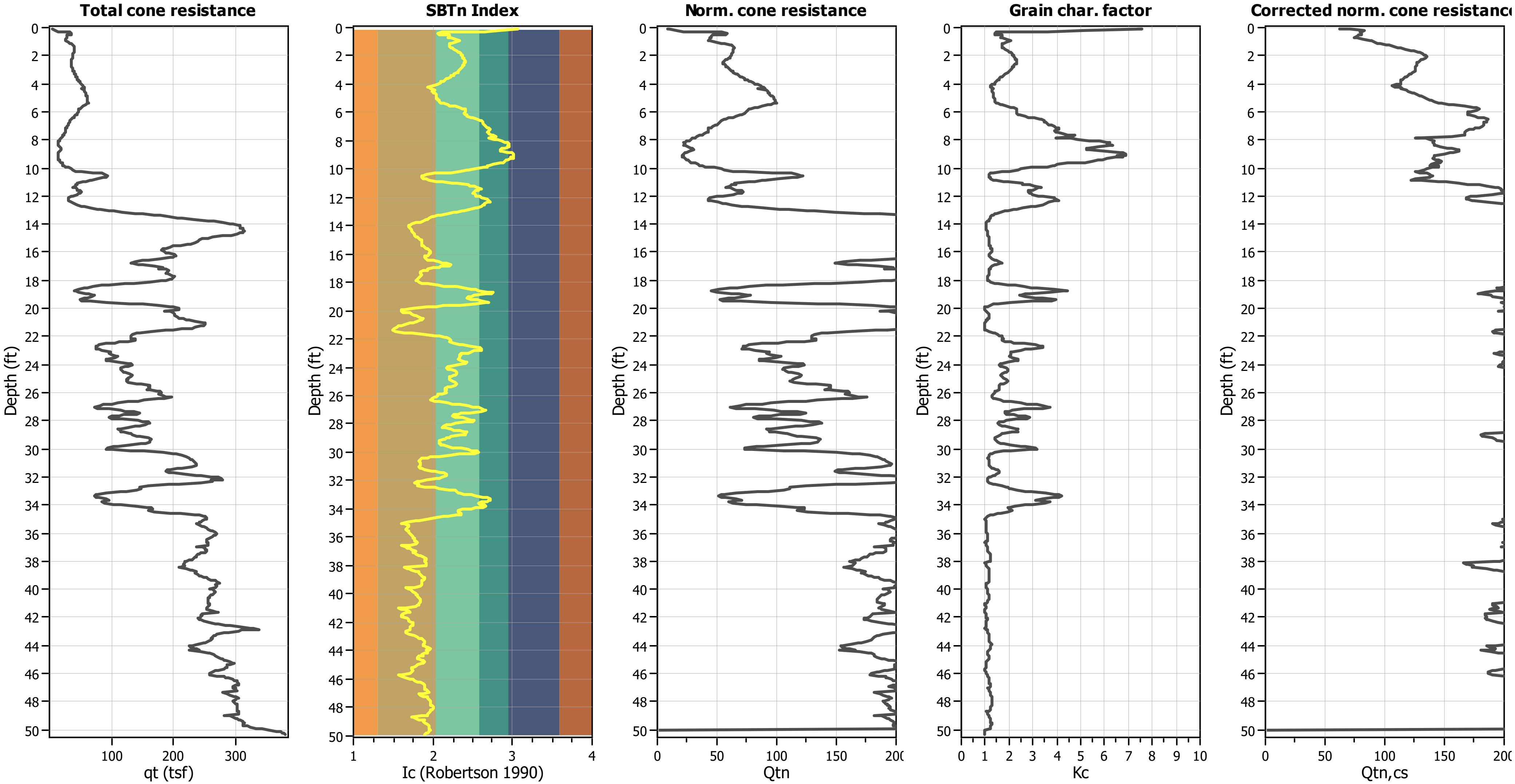
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	0.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	0.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
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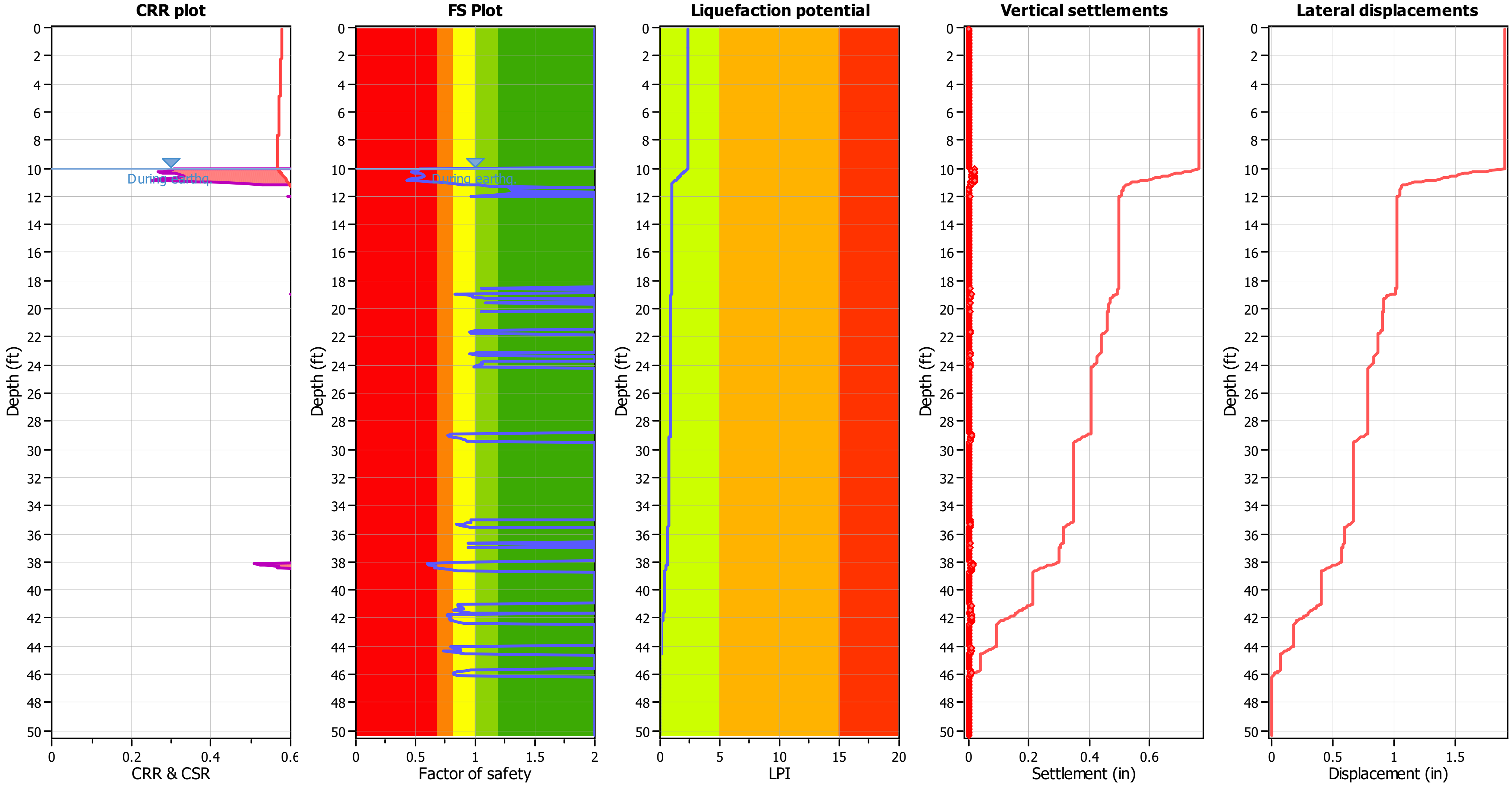
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

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Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	Limit depth:	N/A

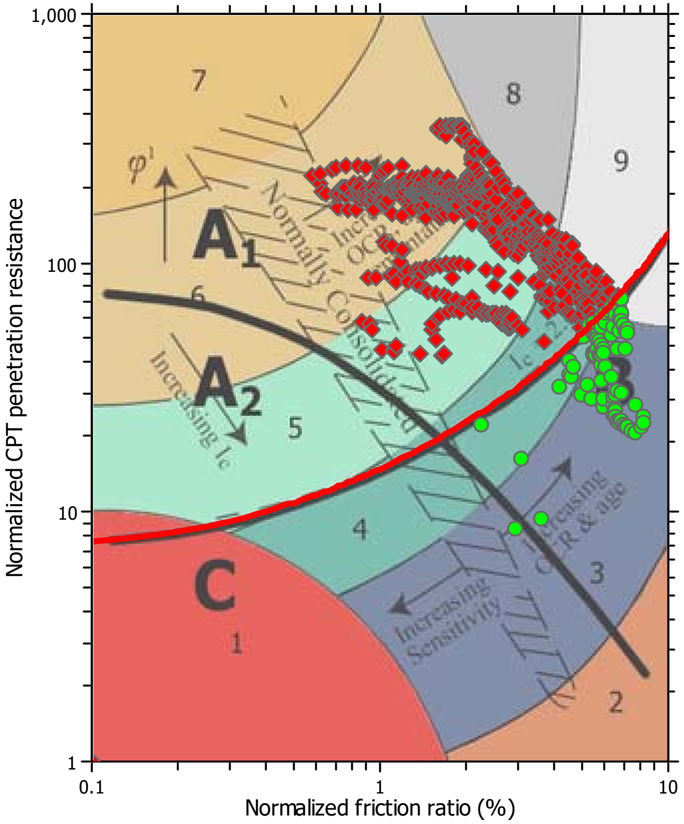
F.S. color scheme

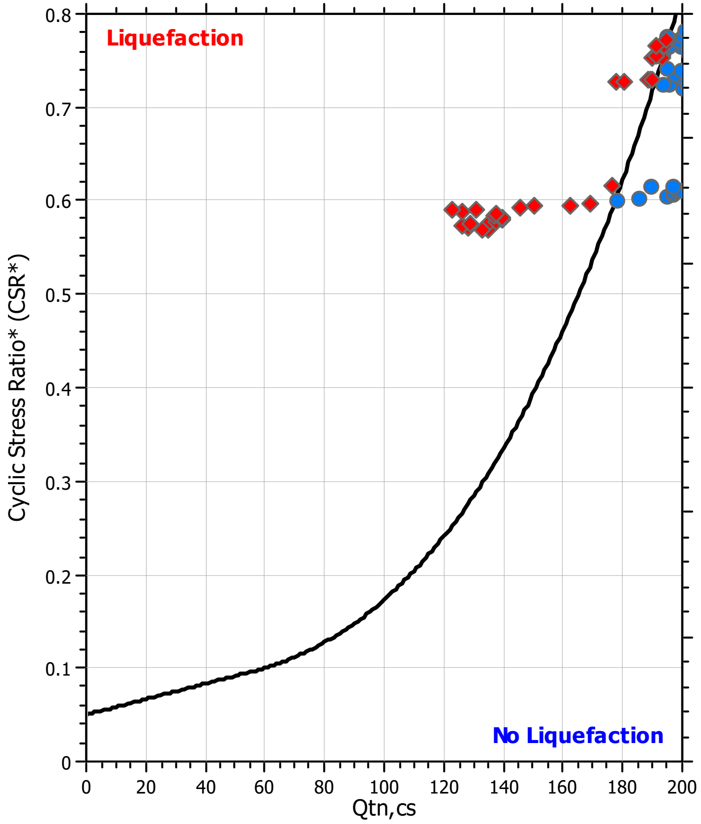
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

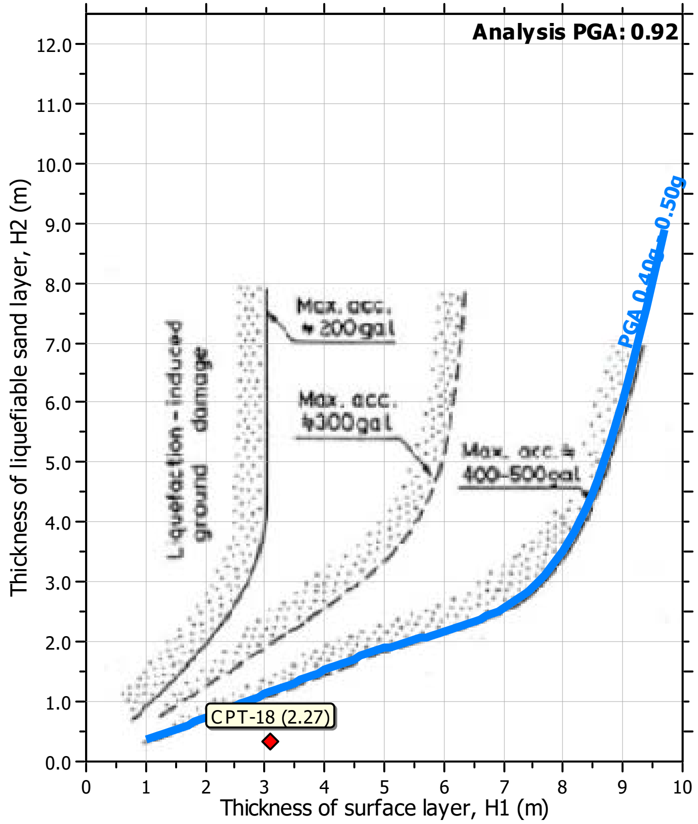
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



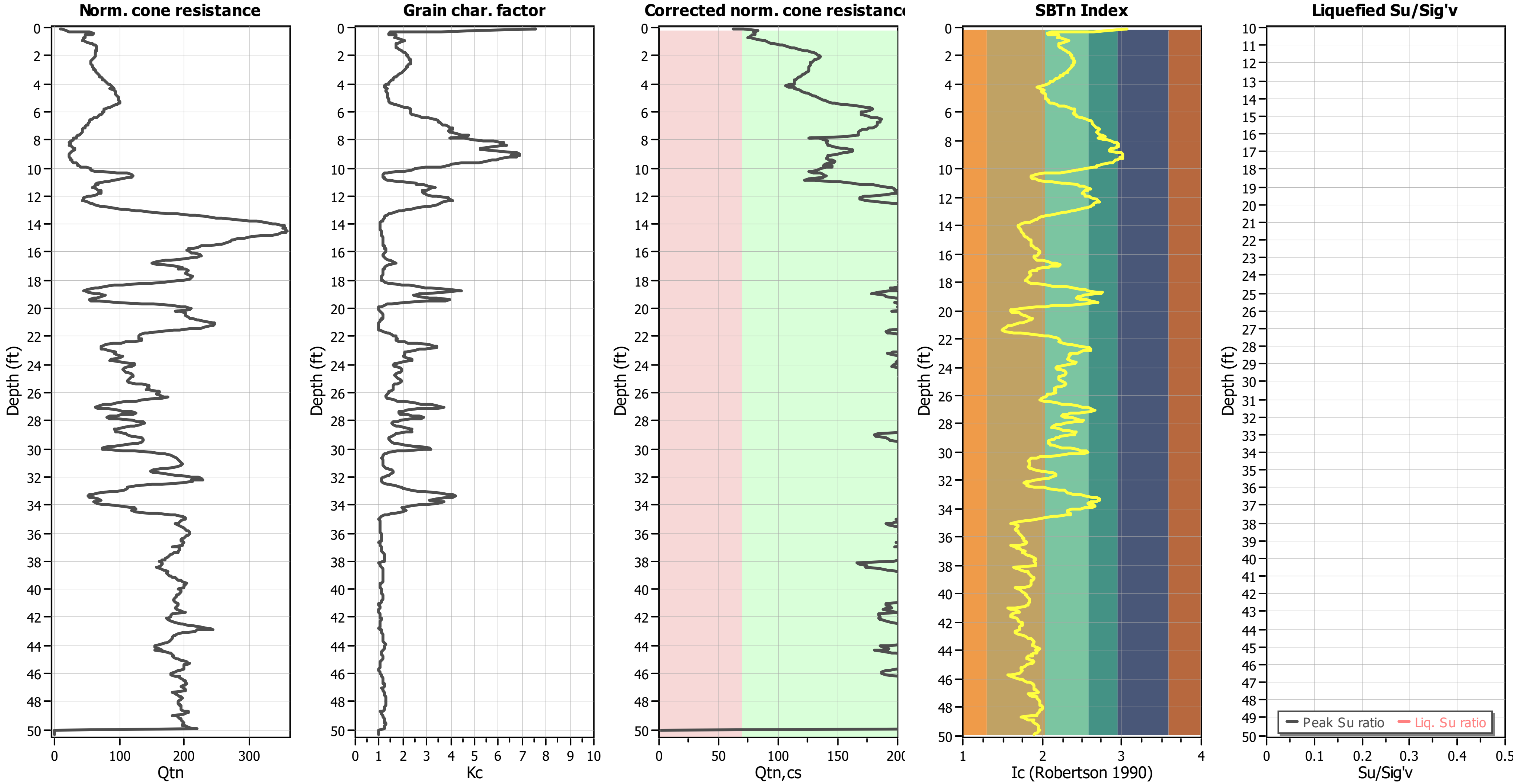




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	0.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	0.00 lb/ft^3
Fines correction method:	NCEER (1998)	Average results interval:	1	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:	7.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.92	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	0.00 ft	Limit depth:	N/A

APPENDIX D

General Earthwork & Grading Specifications

APPENDIX D

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

TABLE OF CONTENTS

Standard Details

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill

All bedding and backfill of utility trenches shall be performed in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of relative compaction from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

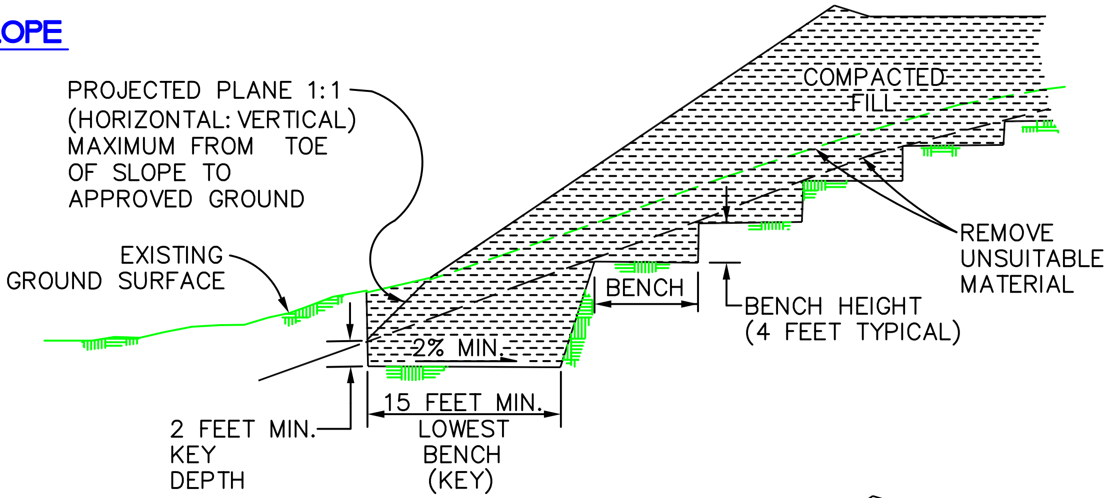
7.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

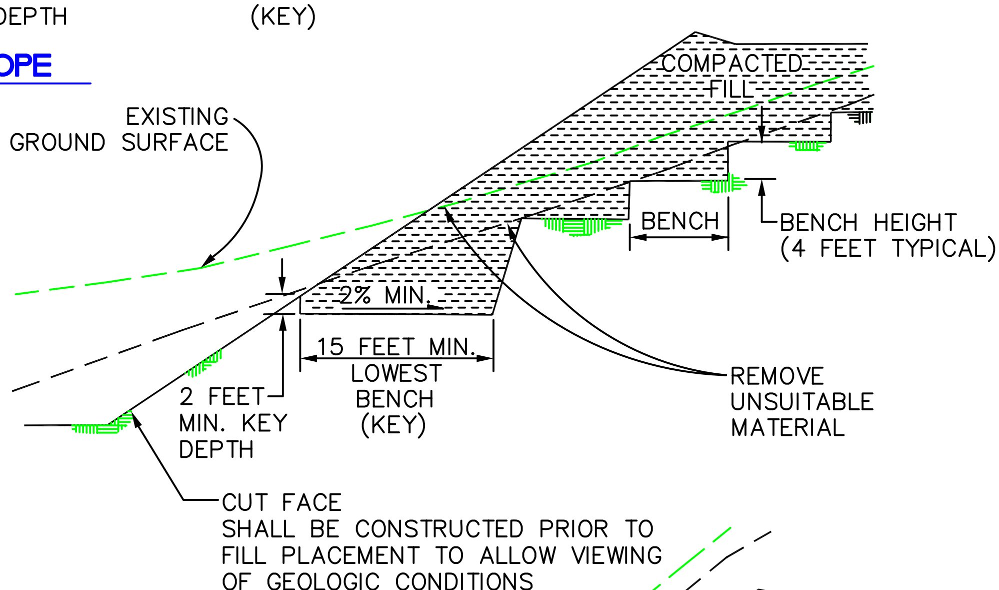
7.4 Observation and Testing

The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

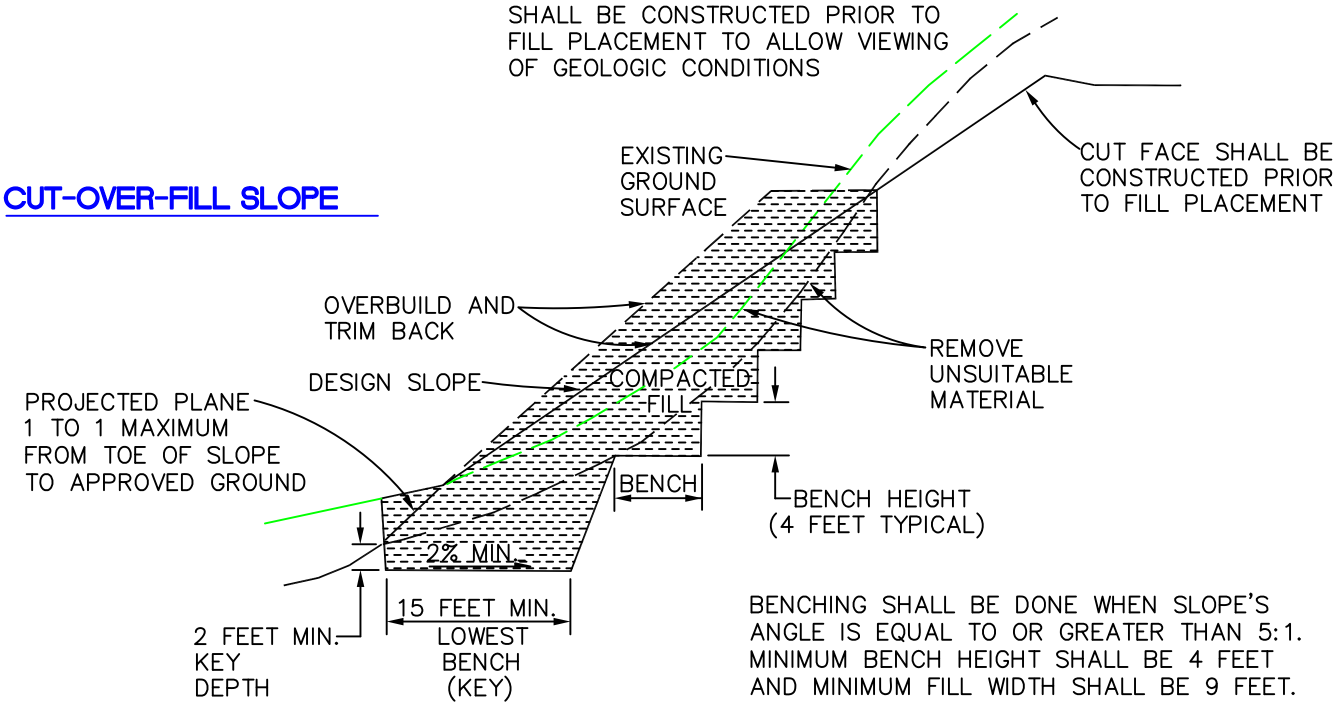
FILL SLOPE



FILL-OVER-CUT SLOPE



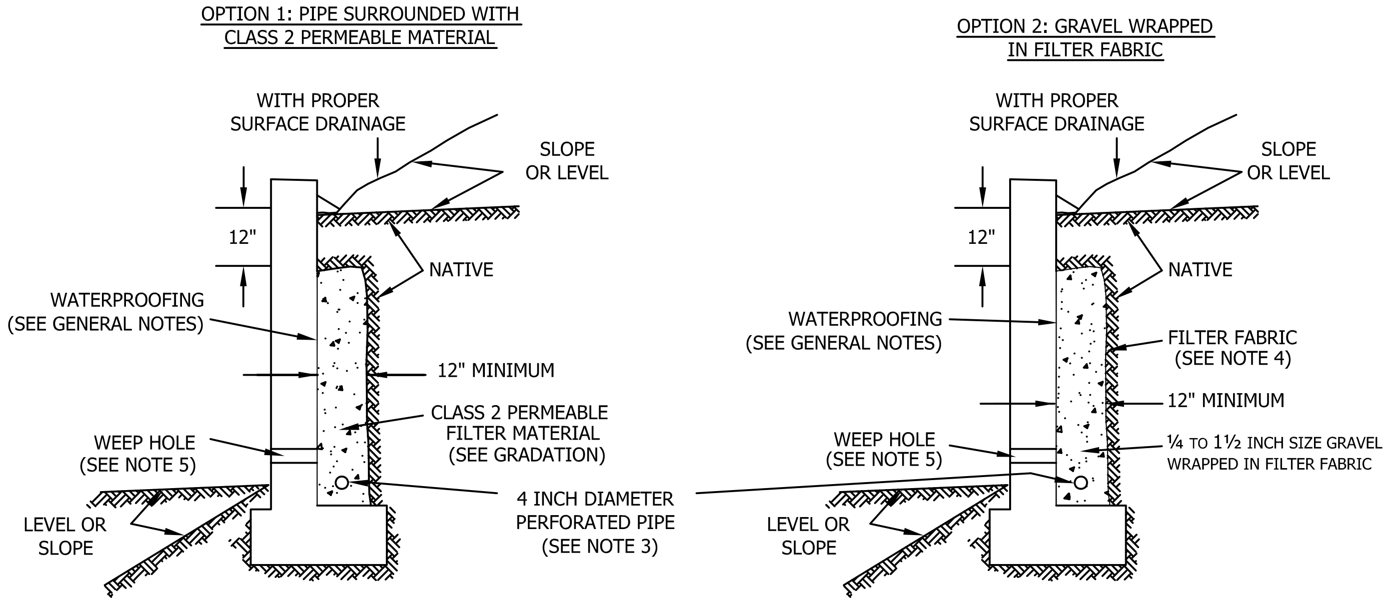
CUT-OVER-FILL SLOPE



BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

Figure

APPENDIX E

GBA Guidelines

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org