Appendix D

Updated Geotechnical Investigation

UPDATE GEOTECHNICAL INVESTIGATION
PROPOSED JEFFERSON OCEANSIDE
OCEANSIDE, CALIFORNIA, 92054

Prepared For **JPI REAL ESTATE ACQUISITION, LLC**
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Attention: Mr. William Morrison

Subject: Update Geotechnical Investigation
Proposed Jefferson Oceanside
Oceanside, California, 92054

In accordance with the request and authorization of representatives of JPI, we have conducted an updated investigation of the proposed development of Jefferson Oceanside in Oceanside, California (Figure 1). The purpose of this updated geotechnical study was to evaluate the pertinent geotechnical conditions of the site relative to the updated grading concepts and design of the proposed project. The accompanying report presents a summary of our evaluation and provides geotechnical findings, conclusions, and recommendations relative to the proposed development.

If you have any questions regarding our report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

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1.0 INTRODUCTION

1.1 Introduction and Purpose

This report presents the results of our updated geotechnical investigation for the proposed development of Jefferson Oceanside in Oceanside, California (Figure 1). The purpose of this update geotechnical investigation was to evaluate the existing geotechnical conditions of the site and to provide updated conclusions and recommendations relative to the proposed development of the property. This report presents a summary of the findings, conclusions, and recommendations of our update geotechnical investigation for the site. The topographic plans prepared by Fuscoe Engineering were utilized as our base map for the geotechnical investigation (Plate 1).

1.2 Scope of Services

Our scope of services performed during this update geotechnical investigation included the following:

- Review of available pertinent, published, and unpublished geologic literature and maps and aerial photographs applicable to the site (Appendix A).
- Review of available geotechnical reports applicable to the site (Appendix A).
- Coordination with an Underground Service Alert for identification of existing underground utilities.
- Geologic field reconnaissance of the property and general vicinity.
- An additional subsurface investigation consisting of the excavation of six additional Cone Penetration Test (CPT) soundings (CPT-1 through CPT-6). Logs of the soundings from our current field investigation are provided in Appendix B. The approximate locations of the borings and soundings are presented on the Geotechnical Map (Plate 1).
- Analysis of the findings, conclusions, and recommendations of the previous geotechnical investigations by Leighton and Associates and others (Action Geotechnical Consultants, 1984a and 1984b; G.A. Nicoll and Associates, 1992; and Leighton, 1985a and 1986a, 2005, 2018). The previous excavated borings and trenches (including excavations performed by others) are presented in Appendix B and shown on the Geotechnical Map (Plate 1). Appropriate laboratory

testing applicable to the project is included as Appendix D.

- Update of seven geologic cross-sections (Cross-Sections A-A' through G-G'): The geologic cross-sections are presented as Plates 2 through 5. The approximate locations of the cross-sections are presented on the Geotechnical Map (Plate 1).
- Previous laboratory testing of representative soil samples obtained from the subsurface exploration. Results of these tests are presented in Appendix C, with the exception of moisture/density determinations, which are provided on the boring logs (included in Appendix B).
- Geotechnical analysis of the data accumulated during our supplemental investigation including slope and landslide stability analysis (Appendix D) and liquefaction analysis (Appendix E).
- Preparation of this report presenting our findings, conclusions, and geotechnical recommendations relative to the proposed project. The recommendations include our General Earthwork and Grading Specifications for Rough Grading presented in Appendix F.

1.3 Site Description

The irregular-shaped property encompasses approximate 26 acres in the western portion of Oceanside, California (Figure 1). The property is located southwest of the intersection of Oceanside Boulevard and Crouch Street and is bisected by Crouch Street. The site is bounded on the west and southwest by existing commercial and residential developments, on the south by Grandview Street, on the east and northeast by open space, and on the north by the AT&SF railroad right-of-way, Alta Loma Creek, and Oceanside Boulevard.

Topographically, the site generally consists of a north to northwest-facing hillside with a relatively level ridgeline on the southeastern portion of the site and a relatively flat area at the base of the hillside on the north side of the property. Elevations on the site range from approximately 187 feet mean sea level (msl) at the southeast corner of the site to approximately 24 feet msl at the northwest comer of the property. Site drainage is generally to the north or northwest to the northern property boundary then west along Loma Alta Creek.

Natural vegetation on the site is generally restricted to the northwest-facing hillside (including the manufactured fill slope on the western side of the site) and

the lowlands along the northwestern property boundary. The vegetation generally consists of native and non-native grasses, shrubs, and trees. The relatively level areas of the mesa and at the base of the hill (including areas that were previously graded) generally consist of disturbed habitat and grasses and weeds.

1.4 Prior Site Grading and Improvements

Prior grading activities has modified portions of the site. The first of the grading activities included the placement of fill soils creating the relatively level area at the base of the hillside in 1964 (Benton, 1964). The prior grading also included the construction of Crouch Street and the placement of the City of Oceanside water main (which is present in the southwest portion of Crouch Street and crosses the lower hillside and the relatively level area at the base of the hillside north of Crouch Street).

The relatively level area graded in 1964 was re-graded in the mid 1980's under the observation of Leighton (Leighton, 1986b). The grading operations included: 1) the removal of the previously placed fill soils; 2) limited removals of the alluvial soils; 3) excavation of a buttress for the proposed cut slope on the western side of the property, installation of buttress subdrains and fill placement creating the buttress; and 4) the placement of compacted fill creating the relatively level sheet-graded pad. Additional grading operations included the excavation of fill (creating a borrow site in the northern portion of the sheet- graded pad) that was used to complete the buttress fill.

Since the existing landslides present on the north-facing hillside were not stabilized as part of the grading operations, a building setback line was provided, inside of which, construction of buildings or other improvements were not recommended (Leighton, 1985c). The previously placed fill soils were removed across the entire site except for the fill soils over the existing City of Oceanside water main (crossing the site in a northwest/southeast direction). In general, the alluvial soils were removed to within 2 feet of the existing ground water elevation prior to the fill placement operations.

At the same time that the buttress was being constructed, the proposed residential development southwest of the property was graded (Action, 1984). The grading operations included the placement of the offsite upper portion of the buttress, partial

removal and stabilization of the landslide along the southwestern side of the property, placement of a fill slope key, and placement of fill.

In 1989, the borrow site was filled in with compacted fill and a fill area was placed along the northern property boundary just west of Crouch Street under the observation of GA Nicoll (Nicoll, 1989).

1.5 Proposed Development

The proposed development of the property will include five multi-story residential buildings with 295 units, parking areas (including carports), and associated improvements. The multi-story buildings are anticipated to be four (4) stories in height. These residential structures are anticipated to have with conventional mat or slab-on- grade foundations with wood-frame and stucco construction. Several retail spaces are planned along South Oceanside Boulevard. Other site improvements include parking areas, underground utilities, landscaping, etc.

1.6 Subsurface Investigation

Our most recent subsurface investigation was performed on February 10, 2021 consisting of the excavation of six CPT soundings (CPT-1 through CPT-6). Excavation depths ranging from of approximately 29 feet to 79 feet below the existing ground surface (bgs). Logs of the explorations are presented in Appendix B. The approximate location of the explorations are shown on the Geotechnical Map (Plate 1). Subsequent to the subsurface investigation, the CPT's were backfilled with bentonite.

1.7 Previous Subsurface Investigation and Laboratory Testing

Our previous subsurface investigation was performed between July 29, 2019 and August 3, 2019 consisting of the excavation, logging, and sampling three large diameter borings (B-1 through B-3), and three CPT soundings (CPT-1 through CPT-3). Excavation depths ranging from of approximately 26 feet to 80 feet below the existing ground surface (bgs). Logs of the explorations are presented in Appendix B. The approximate location of the explorations are shown on the Geotechnical Map (Plate 1). Subsequent to the subsurface investigation, the borings and test pits were backfilled with tamped soils and/or bentonite.

Previous subsurface investigations within the property included small-diameter and large- diameter borings and exploratory trenches by Leighton and Associates (Leighton, 1985a and 2003); Action Geotechnical Consultants, (Action Geotechnical, 1984a and 1984b); and GA Nicoll (Nicoll, 1992). The approximate location of the borings and trenches are presented on the Geotechnical Map (Plate 1) and the appropriate Geologic Cross-Sections (Plates 2 through 5). The borings and trench logs are presented in Appendix B.

Previous laboratory testing was performed on representative soil samples to evaluate their pertinent engineering properties (Leighton, 1985a, 1986b, 2003, and 2019; and Nicoll, 1992). Previous laboratory tests applicable to the proposed development included in-place moisture and density, maximum dry density, expansion potential, grain size distribution (i.e. sieve analysis), direct shear and consolidation potential tests. The laboratory test results are presented in Appendix C. The density/moisture determinations of the undisturbed samples obtained from the borings are shown on the boring logs (Appendix B).

2.0 SUMMARY OF GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is located in the coastal section of the Peninsular Range Province, a geomorphic province with a long and active geologic history throughout Southern California. During the last 54 million years, the area known as the “San Diego Embayment” has undergone several episodes of marine inundation and subsequent marine regression, resulting in the deposition of a thick sequence of marine and nonmarine sedimentary rocks on the basement rock of the Southern California batholith.

Gradual emergence of the region from the sea occurred in Pleistocene time, and numerous wave-cut platforms, most of which were covered by relatively thin marine and nonmarine terrace deposits, formed as the sea receded from the land. Accelerated fluvial erosion during periods of heavy rainfall, coupled with the lowering of the base sea level during Quaternary times, resulted in the rolling hills, mesas, and deeply incised canyons which characterize the landforms we see in the general vicinity of the site today.

2.2 Site-Specific Geology

Based on our current subsurface explorations, aerial photographic analysis, and review of pertinent geologic literature and maps (Appendix A), the geologic units underlying the site and the general area consist of artificial fill, topsoil, Alluvium and Colluvium, Quaternary Terrace Deposits, Quaternary Landslide Deposits, and the Tertiary-aged Santiago Formation.

A brief description of the geologic units encountered on the site and general area is presented below. The approximate extent of these materials is presented on the Geotechnical Map (Plate 1).

2.2.1 Topsoil (Unmapped

The ungraded portions of the hillside on the site are generally mantled by topsoil, composed of soil formed in place. The topsoil consists primarily of brown to dark brown, clayey sand to sandy clay. The topsoil was generally encountered to depths of approximately 2 to 5 feet. Due to the potentially compressible nature of the topsoil, these soils should be removed to

competent material within the limits of the proposed grading. Provided the topsoil is relatively free of organics and debris, it may be reused as fill.

2.2.2 Artificial Fill (Af and Afo)

There are several areas of artificial fill within the site. These include both documented fills placed under the observations of Leighton (map symbol -Af) and documented and undocumented fill placed by others (map symbol Afo). The documented fills are associated with the grading of the sheet-graded pad in the northern portion of the site, grading of the buttress and residential development in the southwestern portion of the site, and fill soils placed during the construction of Crouch Street. The fill soils placed in 1964, any undocumented fill, and/or desiccated documented fills that are encountered during the anticipated future grading operations are considered potentially compressible in their present condition and will require remedial treatment, such as removal and recompaction during site grading.

In addition, the laboratory test methods utilized to determine the maximum dry density and relative compaction of the soils at the time of the fill placement operations (i.e. 1960's) have changed somewhat relative to the current standards used today. As a result, we drilled borings and performed laboratory tests on the existing fill soils to analyze competency and to verify the fill was compacted to meet relative compaction of today's standard.

2.2.3 Alluvium/Colluvium, Undifferentiated (Map Symbol Qal)

Saturated alluvium/colluvium (undifferentiated) is present beneath the fill soils of the sheet-graded pad on the north side of the property. Based on the project geotechnical documents previous geotechnical explorations and results of our current CPT soundings, the alluvial soils predominately consist of sandy to silty clays and clayey silts with minor interbedded zones of clayey to silty sands. In general, the alluvium/colluvium is estimated to be up to 60+ feet in depth. A relatively shallow ground water elevation (generally less than 10 to 15 feet below the existing ground surface) was observed in the alluvial soils. Due to the shallow ground water elevation, potential liquefaction of the saturated alluvial soils is possible. Our liquefaction analysis is summarized in Section 3.5 and Appendix E.

2.2.4 Landslide Deposits (Map Symbol -Qls)

A relatively large landslide complex consisting of 3 to 4 landslides is present on the north-facing hillside on the property. The cause of the landslides appears to be the slightly dipping (i.e. 8 to 12 degrees) out-of-slope interbedded claystone and sandstone units of the Santiago Formation. The approximate limits of these landslides are shown on the Geotechnical Map (Plate 1) and the appropriate Geologic Cross Sections (Plates 2 through 5). It should be noted that most of these landslides are located above and outside the limits of grading for the development. The eastern most landslide also extends beyond the northeastern property boundary.

The landslide deposits include graben material (and associated slope wash/colluvial soils) in the upper portion of the landslide complex, relatively undisturbed blocks of formational material and weathered formational material within the center of the slide mass, and highly weathered, jumbled and disturbed material in the toe (or lower portion) of the landslide complex. The landslide material is generally massive to moderately fractured and jointed at depth and highly weathered and jumbled near the surface and at the toe of the landslides. The landslide basal rupture surfaces, as observed in the borings, typically consisted of a paper-thin to 1/8-inch to 1/2-inch thick remolded clay seams. In general, the landslide basal rupture surfaces appear to correspond to an existing clay seam, bedding plane shear zone or a weak zone in the formational siltstone or claystone.

Due to potentially instability concerns and compressible nature, the landslide deposits within the southern limits of the site are considered unsuitable for structural support in their present condition therefore a Landslide Structural Setback has been recommended. If development is planned south of the landslide setback remedial measures (i.e. shear pins, buttressing with fill and/or removals of the unstable and potentially compressible portions) will be required. Recommendations for the Landslide Structural Setback is presented in Section 5.2.

2.2.5 Quaternary Terrace Deposits (Map Symbol Qt)

Pleistocene-aged Terrace Deposits exist on the ridgeline in the southern portion of the property unconformably overlying the Santiago Formation. Based on our geologic logging of the borings excavated along the ridgeline, the terrace deposits range from approximately 6.5 to 29 feet in depth below the existing ground surface. The base of the terrace deposits ranges from an approximate elevation of 165 feet (msl) on the eastern side of the property to an approximate elevation of 145 feet (msl) on the western side. The soil comprising the Terrace Deposits is generally composed of fine to medium grained silty sand with minor sandy silt and clayey sand zones and occasional rounded gravel and fine cobble.

2.2.6 Tertiary Santiago Formation (Map Symbol - Tsa

The Tertiary-aged Santiago Formation, as encountered on the site, consists primarily of massively bedded clayey to silty sandstones with interbedded silty claystone. The siltstones and claystones generally are olive green to gray (unweathered), damp to moist, stiff to hard, moderately weathered, fractured and sheared. The sandstone generally consists of orang- brown (iron oxidized staining) to light brown, damp to moist, dense to very dense, silty fine to medium grained sandstone.

2.3 Geologic Structure

The general structure of the bedrock appears to be near horizontal to slightly dipping to the west. Based on the subsurface data, bedding within the Santiago Formation generally exhibits variable bedding with strikes ranging from northwest to northeast and dips typically 8 to 12 degrees to the northwest. Locally, cross bedding was observed with dips steeper than 10 to 15 degrees. Clay seams and/or landslide rupture surfaces encountered in the borings generally trend parallel to the bedding. Geologic mapping also indicates that the Terrace Deposits present on the site are generally massive to thickly bedded (with bedding dipping 3 to 8 degrees to the west to northwest). Folding or faulting of the onsite sedimentary units is not known or expected.

Jointing on-site is very variable, but predominantly trends subparallel to the existing hillside. Jointing dips were found to be generally moderately to steeply dipping.

Jointing is anticipated to be mainly encountered in the upper portion of the bedrock becoming less pronounced with depth.

Randomly oriented shears were encountered mainly in the Santiago Formation claystone and siltstone. Numerous wide, diffuse zones of shearing, as well as more well-defined zones, were encountered in the bedrock, and are thought to be the result of regional tectonic shearing of the relatively stiff and unyielding siltstone and claystone.

2.4 Ground Water

The static ground water elevation was encountered below the sheet-graded pad in the northern portion of the site. The ground water elevation is assumed to be perched ground water within the alluvial soils. Based on the recent and previous explorations, the ground water elevation was encountered approximately 10 to 16 feet below the existing ground surface. The corresponding elevation of the ground water ranged from approximately 23 to 26 feet (msl).

Ground water seepage zones were also encountered in a number of the exploratory borings excavated across the site. The seepage zones were generally encountered within permeable sand beds present above a relatively impermeable claystone unit and/or clayseam. Some of the seepage zones were encountered at higher elevations relative to the static ground water elevation present in the alluvial soils. The ground water seepage is assumed to be the result of irrigation infiltration from properties upslope (and to the south) of the project. The approximate depths of the ground water elevation and seepage zones are depicted on the boring logs (presented in Appendix B). Seasonal fluctuations of surface water and the ground water elevation and seepage zones should be expected.

2.5 Engineering Characteristics of On-site Soils

Based on the results of our geotechnical investigation of the site laboratory testing of representative on-site soils (Appendix C), and our professional experience on near-by sites with similar soils, the engineering characteristics of the on-site soils are discussed below.

2.5.1 Expansion Potential

The expansion potential of the on-site soils ranges from very low to very high. The terrace deposits, sandy fills, and the sandstone within the Santiago Formation are anticipated to be in the very low to low expansion range. The siltstone and claystone of the Santiago Formation, as well as the clayey topsoil, alluvium/colluvium and clayey fill soils are anticipated to have a medium to very high expansion potential. Geotechnical observation and/or laboratory testing upon completion of the graded pads are recommended to determine the actual expansion potential of finish grade soils. To reduce the possibility of having expansion soils at or near finish pad grades, the clayey soils should be placed in deeper fill areas or outside the limits of the building pads.

2.5.2 Soil Corrosivity

Based on our professional experience on nearby sites, the on-site soils should possess a negligible to moderate soluble sulfate content. However, some of the soils may possess a high sulfate content. Laboratory testing should be performed on the soils placed at or near finish grade after completion of site grading.

2.5.3 Settlement and Collapse Potential

Based on the results of our current and previous subsurface explorations and laboratory testing for the subject site, the settlement and potential for collapse of the underlying materials is considered low for the anticipated loading conditions. In summary, the consolidation testing performed on the existing fill soil samples indicated relatively low compressible characteristics and a low collapse potential (i.e., values less than 1.7 percent). Our opinion is also supported by our observation of in-place drive samples, which indicated generally a medium dense to dense, very fine to medium grained sand, and damp to moist for the underlying fill soils.

2.6 Slope Stability

As part of our study, we evaluated and analyzed for gross stability using the computer program Slide 6.0 (RocScience, 2018). The analysis included static and seismic loading conditions of Geologic Cross-Sections A-A' and D-D' (Plates 2 and 3), which were prepared in areas of natural hillsides and/or landslide areas, and used to

establish a fixed line for the Structural Setback. The seismic analysis used a pseudo-static method with a seismic coefficient, Kh, of 0.15.

The parameters utilized in our slope stability analysis are presented on Table 1 and were based on our geotechnical investigation, our experience with similar soil types, and our professional judgment. A discussion of the results of the slope stability analyses is presented below.

Table 1
Slope Stability Soil Parameters

Material	*Unit Weight (pcf)*	*Friction Angle (degrees)*	*Cohesion (psf)*
Artificial Fill Soils	120	25	400
Quaternary Alluvium	120	10	100
Landslide Material	120	13	200
Terrace Deposits	120	35	800
Santiago Formation	130	35	800

The analysis indicates the existing slope with a landslide do not possess a factor of safety greater than 1.5 for static conditions and 1.15 for pseudo-static conditions. The computer program Slide calculation plots for the analyses of Geologic Cross-Sections A and D are presented in Appendix D, Slope Stability Analyses.

In summary, the relatively large landslide complex consisting of 3 to 4 landslides is present on the north-facing hillside on the property. The cause of the landslides appears to be the slightly dipping (i.e., 8 to 12 degrees) out-of-slope interbedded claystone and sandstone units of the Santiago Formation. However, these landslides are located outside the limits of the proposed multi-family development (i.e., beyond the recommended “Structural Setback Limits” line). If structural improvements were proposed within the “Structural Setback Limits” line, the landslides would need to be mitigated and/or stabilized by slope grading. The aerial limits of landslide deposits and the “Structural Setback Limits” are depicted on the Geotechnical Map, Plate 1.

2.7 Earthwork Shrinkage and Bulking

The volume change of excavated on-site materials upon recompaction as fill is expected to vary with materials and location. Typically, the surficial soils and bedrock materials vary significantly in natural and compacted density, and therefore, accurate earthwork shrinkage/bulking estimate cannot be determined. However, the following factors (based on evaluation of our previous subsurface investigation, laboratory testing, geotechnical analysis and professional experience on adjacent sites) are provided on Table 2 as guideline estimates. If possible, we suggest an area where site grades can be adjusted be provided as a balance area.

Table 2
Earthwork Shrinkage and Bulking Estimates

Geologic Unit	*Estimated Shrinkage/Bulking*
Artificial Fill	0 to 2 percent bulking
Topsoil/Undocumented fill	5 to 15 percent shrinkage
Alluvium/Colluvium	5 to 15 percent shrinkage
Landslide Debris	4 to 8 percent shrinkage
Landslide Block Material	2 to 5 percent bulking
Santiago Formation	2 to 10 percent bulking

3.0 FAULTING AND SEISMICITY

3.1 Regional Tectonic Setting

The California Mining and Geology Board in 1972 (now referred to as the California Geologic Survey or CGS) defines an active fault as a fault which has "had surface displacement within Holocene time (about the last 11,700 years)." The City of San Diego (1999) further defines a Pre-Holocene fault, as a fault that has had activity within the last 1.6 million years (Quaternary Period) and can be demonstrated to be inactive during the last 11,700 years (Holocene Epoch).

The site is located within the Peninsular Ranges Geomorphic Province, which is traversed by several major active faults. The Whittier-Elsinore, San Jacinto, and the San Andreas faults are major active fault systems located east of the site, and the Rose Canyon, Newport-Inglewood (offshore), and Coronado Bank are active faults located west to southwest of the site (Jennings, 2010). The primary seismic risk to the site area is the Rose Canyon/Newport Inglewood fault zone located approximately 5.2 miles west of the site.

The Rose Canyon fault zone consists predominantly of right-lateral strike-slip faults that extend south-southeast bisecting the San Diego metropolitan area. Various fault strands display strike-slip, normal, oblique, or reverse components of displacement. The Rose Canyon fault zone extends offshore at La Jolla and continues north-northwest subparallel to the coastline. The offshore segments are poorly constrained regarding location and character. South of downtown, the fault zone splits into several splays that underlie San Diego Bay, Coronado, and the ocean floor south of Coronado (Treiman, 1993 and 2000; Kennedy and Clarke, 1999). Portions of the fault zone in the Mount Soledad, Rose Canyon, and downtown San Diego areas have been designated by the State of California (CGS, 2018) as being Earthquake Fault Zones.

3.2 Local Faulting

Our review of available geologic literature (Appendix A) indicates that there are no known Active or Potentially Active faults transecting the site. The subject site is also not located within any State Mapped Earthquake Fault Zones or County of San Diego mapped fault zones. The nearest active fault is the Rose Canyon/Newport Inglewood fault zone located approximately 5.2 miles west of the site.

3.3 Seismicity

The site is considered to lie within a seismically active region, as is all of Southern California. As previously mentioned above, the Rose Canyon/ Newport Inglewood fault zone located approximately 5.2 miles west of the site is considered the 'active' fault having the most significant effect at the site from a design standpoint.

3.4 Seismic Hazards

Severe ground shaking is most likely to occur during an earthquake on one of the regional active faults in Southern California. The effect of seismic shaking may be mitigated by adhering to the California Building Code or state-of-the-art seismic design parameters of the Structural Engineers Association of California.

3.4.1 Shallow Ground Rupture

As previously discussed, no active faults are mapped transecting or projecting toward the site. Therefore, surface rupture hazard due to faulting is considered very low. Ground cracking due to shaking from a seismic event is not considered a significant hazard either, since the site is not located near slopes.

3.4.2 Mapped Fault Zones

The site is not located within a State mapped Earthquake Fault Zone (EFZ). As previously discussed, the subject site is not underlain by known active or potentially active faults.

3.4.3 Site Class

The onsite soils are considered to be liquefiable under a California Building Code design level earthquake. Liquefiable sites are to be classified as Site Class F, requiring a site-specific response analysis. However, per Section 20.3.1 of ASCE 7-16, for structures having fundamental periods of vibration less than 0.5s, Site Class may be determined in accordance to Section 20.3. It is understood that the proposed structures will have a fundamental period less than 0.5 s; therefore, we have utilized a Site Class D for determining spectral acceleration parameters. If it is determined by the structural engineer that the proposed structure has a fundamental period of vibration greater than 0.5 s, a site-specific response analysis will be required.

3.4.4 Building Code Mapped Spectral Acceleration Parameters

he effect of seismic shaking may be mitigated by adhering to the California Building Code and state-of-the-art seismic design practices of the Structural Engineers Association of California. Provided below in Table 1 are the spectral acceleration parameters for the project determined in accordance with the 2019 CBC (CBSC, 2019) and the SEA/OSHPD Web Application. Since the site has an S_1 value greater than 0.2g a ground motion hazard analysis was also performed according to ASCE 7-16 Section 11.4.8.

Table 3
2019 CBC Mapped Spectral Acceleration Parameters

Site Class	*D*		
Site Coefficients	F_a	=	1.093
	F_v	=	null
Mapped MCE Spectral Accelerations	S_S	=	1.019g
	S_1	=	0.373g
Site Modified MCE Spectral Accelerations	S_{MS}	=	1.113g
	S_{M1}	=	null
Design Spectral Accelerations	S_{DS}	=	0.742g
	S_{D1}	=	null
Transitional Period	Fv	=	1.927g
	Sm1*	=	0.719g
	Sd1*	=	0.479g

*Site-specific ground motion hazard analysis is required for determination of S_{M1} and S_{D1} for use in seismic design. Values of S_{M1} and S_{D1} presented are only for the purposes of determining T_S as per Supplement 1 to ASCE 7-16 (ASCE, 2018).

Utilizing ASCE Standard 7-16, in accordance with Sections 11.8.2 and 11.8.3, the following additional parameters for the peak horizontal ground acceleration are associated with the Geometric Mean Maximum Considered Earthquake (MCE_G). The mapped MCE_G peak ground acceleration (PGA) is 0.41g for the site. For a Site Class D, the F_{pga} is 1.154 and the mapped peak ground acceleration adjusted for Site Class effects (PGA_M) is 0.514g for the site.

Since the mapped spectral response at 1-second period is less than 0.75g, then all structures subject to the criteria in Section 1613.2.5 of the 2019 CBC are assigned Seismic Design Category D.

3.5 Secondary Seismic Hazards

In general, secondary seismic hazards can include soil liquefaction, seismically-induced settlement, lateral displacement, surface manifestations of liquefaction, land sliding, seiches, and tsunamis. The potential for secondary seismic hazards at the subject site is discussed below.

3.5.1 Liquefaction and Dynamic Settlement

Liquefaction and dynamic settlement of soils can be caused by strong vibratory motion due to earthquakes. Both research and historical data indicate that loose, saturated, granular soils are susceptible to liquefaction and dynamic settlement. Liquefaction is typified by a loss of shear strength in the affected soil layer, thereby causing the soil to behave as a viscous liquid. This effect may be manifested by excessive settlements and sand boils at the ground surface.

Our updated liquefaction analysis utilizing the computer program CLiq Version 2.1.6.11, used the Maximum Considered Earthquake event with a mean magnitude M6.8 (i.e., associated with the Design Earthquake Ground Motion). The peak horizontal ground acceleration associated with the Maximum Considered Earthquake Ground Motion is 0.51g. Based on the results of the liquefaction analysis, several discontinuous and variable thickness liquefiable layers of saturated alluvial materials are located between a depth of approximately 12 to 52 feet. As encountered in the CPT explorations, the saturated layers located above 50 feet are considered susceptible to liquefaction at the design earthquake ground motion.

Total dynamic settlement at the site as a result of the Design Earthquake Ground Motion is roughly estimated at between approximately 0.6 to 2.6 inches. Differential dynamic settlement and angular distortion for each building are provided in the table below. The building numbers have been provided on the the Geotechnical Map (Plate 1). A summary plot showing idealized profile, relevant CPT data, calculated cyclic stress and resistance ratio, factor of safety, and liquefaction-induced settlement is provided in Appendix E.

Table 4
Liquefaction Settlement by Building

Building Number	*Differential Settlement (inches)*	*Angular Distortion*
1	1.5	1/880
2	1.25	1/2880
3	1.25	1/1825
4-north	1.75	1/585
4-south	0.5	1/2040
5	1.0	1/2040
Retail	1.5	1/1240

3.5.2 Lateral Spread

Empirical relationships have been derived (Youd et al., 1999) to estimate the magnitude of lateral spread due to liquefaction. These relationships include parameters such as earthquake magnitude, distance of the earthquake from the site, slope height and angle, the thickness of liquefiable soil, and gradation characteristics of the soil.

The susceptibility to earthquake-induced lateral spread was evaluated at the site because of the nature of the underlying liquefiable layers, topography, and proximity to the Alta Loma Creek channel. Therefore, we have performed six (6) additional Cone Penetration Tests (CPT) subsurface explorations and reviewed the previous site explorations to further evaluate liquefaction and lateral spreading adjacent to Alta Loma Creek. As such we specifically reviewed the geologic layers across the site that are susceptible to lateral spreading and their lateral extent across the site. Based on our analysis sandy liquefiable layers are generally discontinuous between subsurface explorations throughout the site. Therefore, the susceptibility to earthquake-induced lateral spread is considered to be low for the site.

3.5.3 Tsunamis and Seiches

Based upon the California Emergency Management Agency Tsunami Inundation Map (CalEMA, 2009), the site is not located within a tsunami inundation area. In addition, based on the distance between the site and large, open bodies of water, and the elevation of the site with respect to sea level, the possibility of seiches and/or tsunamis is considered to be nil.

4.0 CONCLUSIONS

Based on the results of our update geotechnical investigation of the site, it is our professional opinion that the proposed Jefferson Oceanside development is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans and specifications and utilized during the grading and construction phases of site development.

The following is a summary of the significant geotechnical factors that we expect may affect development of the site.

- Based on our subsurface exploration and review of pertinent geotechnical reports, the site is underlain Tertiary Santiago Formation, Quaternary Terrace Deposits, landslide deposits, undifferentiated alluvium/colluvium, topsoil and documented and undocumented fill soils.

- The undocumented fill, topsoil, alluvium, compressible landslide deposits, and weathered formational materials are considered unsuitable in their present state and will require removal and recompaction in areas of proposed development or future fill.

- Clayey soils of the Santiago Formation, surficial units or the existing fill soils may be moderate to highly expansive. These expansive soils should not be placed within 5 feet of finish pad grades (unless a special foundation design [i.e. a post-tensioned foundation] is planned.

- The upper 2 to 3 feet older documented artificial fill, if present, are unsuitable and will require removal within the limits of settlement sensitive improvements. In order to mitigate potential differential settlement of the proposed structures, remedial grading will need to be implemented. Recommendations concerning the remedial grading are presented in Section 5.1.2.

- A relatively large landslide complex consisting of 3 to 4 landslides is present on the north-facing hillside on the property. A Landslide Structural Setback will be used to limit the proposed building locations. The setback limits are provided on the Geotechnical Map and Geologic Cross-sections (Plates 1 through 5). Landslide stabilization measures will not be performed for this project.

- The static ground water elevation and ground water seepage conditions have been encountered on the site. Ground water conditions on the site are not anticipated to be a significant factor during site grading and subsequent development. If ground water

seepage conditions are encountered during site development, recommendations to mitigate the conditions can be made on a case-by-case basis at that time.

- Laboratory testing of representative soil samples in the vicinity of the site indicate a very low to high expansion potential. Moderate to highly expansive soils should not be placed within the upper 5 feet of the finish grade and/or within 3 feet of the bottom of the proposed foundations.
- Laboratory test results also indicate the soils have a negligible potential for sulfate attack on concrete, a moderate to severe potential for corrosion to buried uncoated metal conduits.
- The existing on-site soils appear to be suitable material for use as fill provided they are relatively free of organic material and debris.
- Active faults are not known to exist on or in the immediate vicinity of the site. The main seismic hazard that may affect the site is from ground shaking from one of the active regional faults.
- In general, the recompaction of fill soils is anticipated to shrink while the formational materials are likely to bulk.

5.0 RECOMMENDATIONS

5.1 Earthwork

We anticipate that earthwork at the site will consist of site preparation, remedial grading and placement of compacted fill. We recommend that earthwork on the site be performed in accordance with the following recommendations and the General Earthwork and Grading Specifications for Rough Grading included in Appendix F. In case of conflict, the following recommendations shall supersede those in Appendix F.

5.1.1 Site Preparation

Prior to grading, all areas to receive structural fill, engineered structures, or surface improvements should be cleared of surface and subsurface obstructions, including any existing debris; asphalt; concrete; abandoned underground utility lines; loose, desiccated, or disturbed fill soils; and stripped of vegetation. Removed vegetation and debris should be properly disposed off-site. Areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 8 inches, brought to 2 percent above-optimum moisture condition, and recompacted to at least 90 percent relative compaction (based on American Standard of Testing and Materials [ASTM] Test Method D1557).

5.1.2 Removal of Unsuitable Soils

As previously discussed, the site is underlain by unsuitable soils including topsoil, undocumented fill, and weathered formational material that may settle under the surcharge of fill and/or foundation loads. Unsuitable soil within the limits of the proposed structures or other settlement sensitive improvements not removed by the planned grading should be excavated to competent material or older documented fill. The material may be re-used provided it is moisture conditioned or dried back (as needed) to 2 percent above-optimum moisture condition and recompacted prior to additional fill placement or construction of improvements. The actual depth and extent of the required removals should be determined during grading operations by the geotechnical consultant; however, anticipated removal depths are summarized below.

Existing Documented Fill

The desiccated upper portion of the existing documented fills located in the northern portion of the site should be removed to competent fill prior to placement of additional fill. These materials can be utilized as fill materials provided, they are moisture conditioned and free of deleterious materials. The estimated removal depths of the desiccated documented fills are anticipated to be on the order of 1 to 5 feet. However, deeper removals may be required along the edges of the fill where left-in-place unsuitable soils may be present along the edges of the previously excavated removal areas.

Existing Undocumented Fill/Topsoil

The existing undocumented fill soils placed during 1964 (present above the existing water main in the northern portion of the site) and any newer undocumented fills (if encountered) should be completely removed prior to placement of additional fill. These materials can be utilized as fill materials provided, they are moisture conditioned and free of deleterious materials. All trash, construction debris, and decomposable material should be removed and disposed of off-site.

Alluvium/Colluvium

The alluvium/colluvium if encountered above the static ground water elevation should be removed to within 2 feet of the ground water. In areas without groundwater, the alluvium/colluvium should be completely removed to competent formational material.

5.1.3 Excavations and Oversize Material

Excavations of the on-site fill and sedimentary materials may generally be accomplished with conventional heavy-duty earthwork equipment. All oversized rock that is encountered should be placed as fill in accordance with the recommendations presented Appendix F, or hauled off site for disposal.

5.1.4 Fill Placement and Compaction

The on-site soils are generally suitable for reuse as compacted fill, provided they are free of organic materials and debris. Areas to receive structural fill and/or other surface improvements should be scarified to a minimum depth of 8 inches; brought to at least 2 percent above optimum moisture content; and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D1557). 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. Placement and compaction of fill should be performed in general accordance with the current City of Oceanside grading ordinances under the observation and testing of the geotechnical consultant, sound construction practices, and the General Earthwork and Grading Specifications for Rough Grading presented in Appendix F.

In vehicular pavement areas, the upper 12 inches of subgrade soils should be scarified then moisture conditioned to a moisture content at or above optimum content and compacted to 95 percent or more of the maximum laboratory dry density, as evaluated by ASTM D1557.

If any proposed fills are to be placed on existing slopes steeper than 5 to 1 (horizontal to vertical), they should be keyed and benched into dense formational or competent fill soils maintaining a fill width of at least 15 feet or half of the slope height (see Appendix F for benching and replacement fill details).

Fills placed within 5 feet of finish pad grades should consist of granular soils of very low to medium expansion potential and contain no materials over 8 inches in maximum dimension. Oversize material, if encountered, may be incorporated into structural fills if placed in accordance with the recommendation of Appendix F.

5.1.5 Expansive Soils and Selective Grading

Laboratory testing and our experience with similar materials on nearby sites indicate that the on-site soils possess a low to medium expansion potential. In order to provide the proposed buildings with suitable bearing material and to reduce the negative impacts of expansive soils at finish grade, we recommend that grading be performed to ensure that material within 3 feet of the bottom of

proposed foundations and within 5 feet of finish grade be of very low to low expansive material. Expansion potential testing of the soils within 5 feet of finish grade should be tested where proposed building is located upon completion of the grading operations. The presence of expansive soils close to finish grade may require special foundation and slab design. The allowable bearing capacity included in the following sections assumes that the foundation is underlain by granular fill or formation material.

5.1.6 Transition and Overexcavation in Building Pads

In order to reduce the potential for differential settlement in areas of cut/fill transition conditions, we recommend that the entire cut portion of building pads containing cut/fill transition conditions be overexcavated and replaced with properly compacted fill of very low to low expansion potential. The cut/fill transition overexcavations should be made to a minimum depth of 6 feet below finished grade or 4 feet below the proposed footing bottoms, whichever is lower. In order to mitigate effects of differential settlements in areas of deep fills, an overexcavation should be performed during site grading once final building pad locations are known. The actual location and depth of overexcavation should be determined in the field based upon exposed conditions. The overexcavated area should be graded with a 1 percent gradient toward deep fill areas or the street.

5.2 Landslide Building Setback

Based on our analysis, we recommend that a building setback line be used for the development. The limits of structural setback are provided on the Geotechnical Map and Geologic Cross-sections (Plates 1 through 5). This line is located approximately of 50 feet from where the failure surface of where the landslide would daylight. The previous structural setback from the 1985 Leighton report was analyzed during our analysis and was found to not meet pseudostatic failure surfaces, and has been updated in this report. No structures should be constructed south of this setback line, unless appropriate landslide stabilization measures are taken. However, this area south of the setback line may be suitable for nonstructural uses such as a park, parking spaces, open space.

5.3 Surface Drainage and Erosion

Surface drainage should be controlled at all times. The proposed structure should have appropriate drainage systems to collect roof runoff. Positive surface drainage

should also be provided to direct surface water away from proposed structures or the top of slopes toward the parking area, driveway, or other suitable drainage facilities. Positive drainage may be accomplished by providing a minimum 2 percent gradient from the structure or slope for a distance of at least 5 feet.

Below grade planters should not be situated adjacent to structures or pavements unless lined, and provisions for drainage such as catch basins and drains are made. In general, ponding of water must be avoided adjacent to structures, tops of slopes, or pavements.

In order to help reduce the potential for excessive erosion of graded slopes, we recommend berms and/or swales be provided along the top of the slopes and drainage directed such that surface runoff on the slope faces is minimized. Protective measures to mitigate excessive site erosion during construction should also be implemented in accordance with the latest pertinent grading ordinances.

Regarding Low Impact Development (LID) measures, we are of the opinion that bioswales, infiltration basins, and other onsite retention and infiltration systems can potentially create adverse perched ground water conditions both on-site and off-site. In particular, this site is underlain by fill or formations that are known to contain both permeable and impermeable layers which can transmit and perch ground water in unpredictable ways. Therefore, given the site geologic conditions and project type, some types of LID measures may not be appropriate for this site and project.

5.4 Temporary Excavations

Sloped excavations may be utilized when adequate space allows. Based on findings, we provide the following recommendations for sloped excavations in fill soils or competent formational materials without seepage conditions.

Table 5 Temporary Excavation Recommendations		
Excavation Depth Below Adjacent Surface (feet)	*Maximum Slope Ratio In Landslide and Fill Soils*	*Maximum Slope Ratio In Competent Formational Material*
0 to 5	3/4 : 1 (H : V)	Vertical
5 to 45	1.5 : 1 or 1 : 1	1 : 1

Excavations greater than 20 feet in height will require an alternative sloping plan or shoring plan prepared by a California registered civil engineer. The above values are based on the assumption that no surcharge loading, or equipment will be placed within 10 feet of the top of slope. All excavations should comply with OSHA requirements. Care should be taken during excavation adjacent to the existing structures so that undermining does not occur. The contractor's "competent person" should review all excavations on a daily basis for signs of instability.

5.5 Foundation and Slab Considerations

The foundation and slab should be designed in accordance with structural considerations and the following recommendations. These recommendations assume that the soils encountered within 5 feet of the finish grade or within 3 feet of building foundation are granular with a very low to medium potential for expansion. If soils other than very low to medium expansive soils are encountered during site grading, additional foundation design will be necessary. These recommendations should be confirmed after the completion of grading based on the actual as-graded geotechnical conditions.

5.5.1 Preliminary Foundation Design

The proposed structures may be designed by the structural engineer utilizing the following geotechnical parameters. Note that it is assumed that entire building will be underlain by uniform layer of compacted fill at least 5 feet thick. For isolated square and continuous foundations, an allowable bearing capacity of 2,500 psf on compacted fill may be utilized for footings with a minimum width of 18 inches at a depth of at least 24 inches below the adjacent grade. The

allowable pressure may be increased by one-third when considering loads of short duration such as wind or seismic forces.

5.5.2 Preliminary Floor Slab Design

The slab-on-grade should be at least 5 inches thick and be reinforced with No. 3 rebars 18 inches on center each way. All reinforcing should be placed at mid-height in the slab. Slabs should be underlain by a 2-inch layer of clean sand over a 10-mil plastic sheeting moisture barrier and an additional 2 inches of sand below the moisture barrier. We recommend control joints be provided across the slab at appropriate intervals as designed by the project architect/structural engineer.

Prior to the placement of the floor slab, the subgrade soils may need to be presaturated. The need to presaturate the subgrade soils will be based on the expansion potential of the finish grade soils of the building pad. In order to help facilitate moisture penetration, the contractor may elect to construct the foundations prior to the pouring of the slabs to help retain water on the slab subgrade soils. For planning purposes, a minimum moisture content of 120 percent of the optimum moisture content of the soil to a depth of at least 12 inches should be assumed.

The potential for slab cracking may be reduced by careful control of water/cement ratios. The contractor should take appropriate curing precautions during the pouring of concrete in hot weather to minimize cracking of slabs. We recommend that a slip-sheet (or equivalent) be utilized if grouted tile, marble tile, or other crack-sensitive floor covering is planned directly on concrete slabs. All slabs should be designed in accordance with structural considerations. If heavy vehicle or equipment loading is proposed for the slabs, greater thickness and increased reinforcing may be required as determined by the structural engineer.

5.5.3 Foundation Design for Liquefaction Area

For the proposed four-story buildings within the area susceptible to liquefaction (see Plate 1), we recommend either a mat foundation or a conventionally-reinforced ribbed mat foundation that incorporates continuous or isolated spread footings. For the conventionally-reinforced ribbed mat foundation, spread footings should extend a minimum of 24 inches beneath

the lowest adjacent finish grade. At these depths, footings may be designed for a maximum allowable bearing pressure 1,800 pounds per square foot (psf) if founded in properly compacted fill soils. The allowable pressures may be increased by one-third when considering loads of short duration such as wind, but not for seismic forces. The minimum recommended width is 18 inches for continuous footings and 24 inches for square or round footings. Minimum recommended depth of the ribs (or grade beams between spread footings) is 20 inches. Footing reinforcement should be designed in accordance with the structural engineer's requirements, but not less than four No. 5 reinforcing bars (two top and two bottom) for continuous footings.

All floor slabs should have a minimum thickness of 6 inches, structurally isolated from column footings, and reinforced in accordance with structural engineer. As a minimum we recommend No. 3 rebars 12 inches on center or No. 4 rebars at 18 inches on center each way (minimum) placed at midheight in the slab. Slabs subjected to heavy loading may require greater thickness and increased reinforcement. We emphasize that it is the responsibility of the contractor to ensure that the lab reinforcement is placed at proper height.

For the mat foundation a soil modulus of 75 psi/inch is recommended for static design. To accommodate differential settlement that could result from a major seismic event, mat or the conventionally-reinforced ribbed mat foundation should be designed by the project structural engineer for total and differential settlement.

Total and differential settlements for footings designed in accordance with the above recommendations should be less than 1 inch and 1/2 inch, respectively, based on static conditions.

Under seismic conditions, the foundations and site walls may experience a differential movement. To accommodate this tendency, settlement on the and the angular distortion was provided in Table 4. Differential settlement should be accommodated by increased foundation and structure rigidity or by flexible structural detailing.

5.5.4 Settlement

The recommended allowable-bearing capacity is based on a maximum total of 1 inch and differential settlement of 3/4 inch, if founded on competent fill soils with non-liquefiable conditions. Since foundation settlements are in part a function of footing size and contact bearing pressures, some differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. However, for most cases, differential settlements between adjacent footings are considered unlikely to exceed 1/2 inch in 20 feet. With increased footing depth/width ratios, differential settlement should be less.

5.5.5 Post-Tension Foundation Recommendations

As an alternative to the conventional foundations for the buildings, post-tensioned foundations may be used. We recommend that post-tensioned foundations be designed using the geotechnical parameters presented in table below and criteria of the 2019 California Building Code and the Third Edition of Post-Tension Institute Manual. A post-tensioned foundation system designed and constructed in accordance with these recommendations is expected to be structurally adequate for the support of the buildings planned at the site provided our recommendations for surface drainage and landscaping are carried out and maintained through the design life of the project. Based on an evaluation of the depths of fill beneath the building pads, the attached Table 6 presents the recommended post-tension foundation category for residential buildings on subject site. Final post-tension recommendations should be revised once grading and expansion testing is performed at the completion of grading.

Table 6
Post-Tensioned Foundation Design Recommendations

Design Criteria		*Category I* *Very Low to Low Expansion Potential and Fill Less 20 Feet Thick* *(EI 0 to 50)*	*Category II* *Medium Expansion Potential and Fill Between 20 and 30 Feet* *(EI 50 to 90)*	*Category III* *High Expansion Potential and Fill Between 30 and 40 feet* *(EI 90 to 130)*
Edge Moisture Variation, e_m	Center Lift:	9.0 feet	8.3 feet	7.0 feet
	Edge Lift:	4.8 feet	4.2 feet	3.7 feet
Differential Swell, y_m	Center Lift:	0.46 inches	0.75 inches	1.09 inches
	Edge Lift:	0.65 inches	1.09 inches	1.65 inches
Perimeter Footing Depth:		18 inches	24 inches	30 inches
Allowable Bearing Capacity		2,000 psf		

The post-tensioned (PT) foundation and slab should also be designed in accordance with structural considerations. For a ribbed PT foundation, the concrete slabs section should be at least 5 inches thick. Continuous footings (ribs or thickened edges) with a minimum width of 12 inches and a minimum depth of 12 inches below lowest adjacent soil grade may be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot. For a uniform thickness “mat” PT foundation, the perimeter cut off wall should be at least 8 inches below the lowest adjacent grade. However, note that where a foundation footing or perimeter cut off wall is within 3 feet (horizontally) of adjacent drainage swales, the adjacent footing should be embedded a minimum depth of 12 inches below the swale flow line. The allowable bearing capacity may be increased by one-third for short-term loading. The slab subgrade soils should be presoaked in accordance with the recommendation presented in Table 5 above prior to placement of the moisture barrier.

The slab should be underlain by a moisture barrier as discussed in Section 5.5.2 above. Note that moisture barriers can retard, but not eliminate moisture vapor movement from the underlying soils up through the slabs. We recommend that

the floor covering installer test the moisture vapor flux rate prior to attempting applications of the flooring. "Breathable" floor coverings should be considered if the vapor flux rates are high. A slip-sheet or equivalent should be utilized above the concrete slab if crack-sensitive floor coverings (such as ceramic tiles, etc.) are to be placed directly on the concrete slab. Additional guidance is provided in ACI Publications 302.1R-04 Guide for Concrete Floor and Slab Construction and 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Floor Materials.

5.5.6 Setbacks for Settlement Sensitive Improvements From Slope Faces

Foundations or settlement-sensitive improvements should be setback from slopes in accordance with the minimum City of Oceanside code regulations, CBC requirements, or the following criteria, whichever is greater. We recommend a minimum horizontal setback distance from the face of descending slopes for all structural footings and settlement-sensitive structures. This distance is measured from the outside bottom edge of the footing or improvement, horizontally to the slope face (or to the face of a retaining wall) and should be a minimum of H/3, where H is the slope height (in feet). The setback should not be less than 10 feet.

Please note that the soils within the structural setback area possess poor lateral stability, and improvements (such as retaining walls, utility lines, sidewalks, fences, and other improvements) constructed within this setback area may be subject to lateral movement and/or differential settlement. These improvements should be designed so as to accommodate potential movement due to slope creep. Such design typically includes the frequent use of construction joints, and soft-scape between features. Structures that cannot tolerate minor lateral and vertical movement should not be located in this slope setback zone.

5.6 Lateral Earth Pressures and Retaining Wall Design Considerations

For design purposes, the following lateral earth pressure values for level or sloping backfill are recommended for retaining walls backfilled with onsite soils of low to medium expansion potential (expansion potential less than 70 per ASTM Test Method D4829).

Table 7 Static Equivalent Fluid Weight (pcf)		
Conditions	*Level*	*2:1 Slope*
Active	35	55
At-Rest	55	75
Passive	350 (Maximum of 3 ksf)	150 (Sloping Down)

Unrestrained (yielding) cantilever walls up to 15 feet in height should be designed for an active equivalent pressure value provided in table above. For the design of walls restrained from movement at the top (nonyielding) such as basement walls, the at-rest pressures should be used. If conditions other than those covered herein are anticipated, the equivalent fluid pressure values should be provided on an individual case basis by the geotechnical engineer. A surcharge load for a restrained or unrestrained wall resulting from automobile traffic may be assumed to be equivalent to a uniform horizontal pressure of 75 psf which is in addition to the equivalent fluid pressure given above. For other uniform surcharge loads, a uniform horizontal pressure equal to 0.35q should be applied to the wall (where q is the surcharge pressure in psf).

To account for potential redistribution of forces during a seismic event, basement walls, if any, that fall within the requirements of ASCE 7-10 should also be checked considering an additional uniform seismic pressure distribution equal to 10H psf, where H equals the overall retained height in feet. The wall pressures assume walls are backfilled with free draining materials and water is not allowed to accumulate behind walls. A typical wall drainage design is provided in Appendix F. Importing or selective grading may be necessary to obtain retaining wall backfill material.

Wall backfill should be brought to at least 2 percent above the optimum moisture content and compacted by mechanical methods to at least 90 percent relative compaction (based on ASTM D1557). Wall footings should be designed in accordance with the foundation design recommendations and reinforced in accordance with structural considerations. The bearing pressure for retaining walls should be limited to 2,500 psf for footing founded in compacted fill and Santiago Formation. Footing embedment depth should be at least 24 inches below the lowest adjacent grade. For

all retaining walls, we recommend a minimum horizontal distance from the outside base of the footing to daylight of 10 feet.

Lateral soil resistance developed against lateral structural movement can be obtained from the passive pressure value provided above. Further, for sliding resistance, the friction coefficient of 0.33 may be used at the concrete and soil interface. These values may be increased by one-third when considering loads of short duration including wind or seismic loads. The total resistance may be taken as the sum of the frictional and passive resistance provided that the passive portion does not exceed two-thirds of the total resistance.

For the design of a mechanically stabilized earth (MSE) retaining walls, the recommended soil parameters presented on Table 8 should be utilized. Temporary sloping should be performed in accordance with current OSHA requirements.

Table 8
Retaining Wall Soil Parameters

Soil Parameter	*Reinforced Zone*	*Retained Zone*	*Foundation Zone*
Internal Friction Angle (degrees)	30	30	30
Cohesion (psf)	0	0	0
Total Unit Weight (pcf)	125	125	125

Additional details relevant to the design of the MSE wall are presented on Detail G - Segmental Retaining Walls in Appendix F - General Earthwork and Grading Specifications. In addition, we recommend that water should be prevented from infiltrating into the reinforced soil zone. All drains and swales should outlet to suitable locations as determined by the project civil engineer. In general, the project civil engineer should verify that the subdrain is connected to the proper drainage facility.

Note, we also recommend a 7-foot minimum horizontal setback distance from the face of slopes for all (MSE) retaining wall footings. This distance is measured from the outside bottom edge of the footing, horizontally to the slope face and is based on the slope height and type of soil. Appropriate surcharge pressures should also be applied for walls influenced within the retained or reinforced zones by improvements or vehicular traffic. The wall design engineer should also select grid design strength

based on deflections tolerable to the proposed improvements. Final retaining wall plans should be reviewed by Leighton and Associates. For conformance with the intent of our geotechnical recommendations and for evaluation of global stability.

5.7 Geochemical Considerations

Geochemical screening of the onsite soils was performed. The screening is meant to serve as an indicator for the design professionals in determining the level of input necessary from a qualified corrosion engineer. Review of geochemical test results by a corrosion engineer is recommended.

Concrete in direct contact with soil or water that contains a high concentration of soluble sulfates can be subject to chemical deterioration commonly known as “sulfate attack.” Soluble sulfate results (Appendix C) indicated a soluble sulfate content of 0.045 percent or less for the on-site soils.

Chloride content, minimum resistivity, and pH tests were also performed on representative samples of on-site soils (Appendix C). Based on our results, the site soils are believed to be moderately to severely corrosive to buried uncoated metal conduits and pipes.

5.8 Preliminary Pavement Design

The onsite pavement sections presented on Table 9 are based on the Caltrans Highway Design Manual Method and the City of Oceanside Pavement Design Guidelines. Final pavement designs should be completed after R-value tests have been performed on actual subgrade materials.

Table 9
Recommended Asphalt Pavement Section
Utilizing Class II Aggregate Base

Location	*Traffic Index*	*Design Subgrade R-Value*	*Asphalt Concrete Thickness (in)*	*Class 2 Aggregate Base Thickness (in)*
South Oceanside Boulevard East (Local Collector) (existing)	6	8	4	13.5
North Crouch Street (Local Street) (existing)	5	20	3	9.5
South Crouch Street (Local Street) (existing)	5	51	3	6
Onsite Private Drive (proposed)	5	20	3	9.5
South Oceanside Boulevard West (Local Collector) (proposed)	5	*20	3	9.5

Asphalt Concrete (AC) and Class 2 aggregate base should conform to and be placed in accordance with the latest revision of California Department of Transportation Standard Specifications. Prior to placing the pavement section, the subgrade soils should have a relative compaction of at least 95 percent to a minimum depth of 12 inches (based on ASTM Test Method D1557). Aggregate Base should be compacted to a minimum of 95 percent relative compaction (based on ASTM Test Method D1557) prior to placement of the AC. All concrete curbs and gutters, should be underlain by at least 6 inches of aggregate base (AB) compacted to 95 percent relative compaction.

The following table presents recommendations for the concrete pavement sections based on an assumed R-value of at least 15.

Table 10 Preliminary Concrete Pavement Design	
Traffic Index	*Minimum PCC Section (MR = 600 psi min.)*
4.5	6.0 inches PCC
5	6.5 inches PCC
6	7.0 inches PCC

For areas subject to unusually heavy truck loading (i.e., trash trucks, delivery trucks, etc.), we recommend a full depth of Portland Cement Concrete (PCC) section of 7 inches with appropriate steel reinforcement and crack-control joints as designed by the project architect. We recommend that sections be as nearly square as possible. A 3,500-psi mix that produces a 600-psi modulus of rupture should be utilized. The actual pavement design should also be in accordance with City of Oceanside and ACI design criteria.

5.9 Concrete Flatwork

Concrete sidewalks and other flatwork (including construction joints) should be designed by the project civil engineer and should have a minimum thickness of 4 inches with No. 4 bars at 24 inches on center or No. 3 bars at 18 inches on center. For all concrete flatwork, the upper 12 inches of subgrade soils should be moisture conditioned to at least 2 to 4 percent above optimum moisture content depending on the soil type and compacted to at least 90 percent relative compaction based on ASTM Test Method D1557 prior to the concrete placement. Moisture testing should be confirmed 24 hours prior to concrete placement. Where medium to high expansive soil present in portions of the site, we recommend the flatwork near curbs and the interior and exterior entryways for the inclusion of dowels between curbs and/or exterior flatwork.

5.10 Landscaping and Post-Construction

Landscaping and post-construction practices carried out by the owner and their representatives exert significant influences on the integrity of structures founded on expansive soils. Improper landscaping and post-construction practices, which are beyond the control of the geotechnical engineer, are frequently the primary cause of

distress to these structures. Recommendations for proper landscaping and post-construction practices are provided in the following paragraphs within this section. Adhering to these recommendations will help in minimizing distress due to expansive soils, and in ensuring that such effects are limited to cosmetic damages, without compromising the overall integrity of structures.

Initial landscaping should be done on all sides adjacent to the foundation of a structure or associated improvements, and adequate measures should be taken to ensure drainage of water away from the foundation or improvement.

Locating planters adjacent to buildings or structures should be avoided as much as possible. If planters are utilized in these locations, they should be properly designed so as to prevent fluctuations in the moisture content of the subgrade soils. Planting areas at grade should be provided with appropriate positive drainage. Wherever possible, exposed soil areas should be above paved grades. Planters should not be depressed below adjacent paved grades unless provisions for drainage, such as catch basins and drains, are made. Adequate drainage gradients, devices, and curbing should be provided to prevent runoff from adjacent pavement or walks into planting areas.

Watering should be done in a uniform, systematic manner as equally as possible on all sides of the foundation, to keep the soil moist. Irrigation methods should promote uniformity of moisture in planters and beneath adjacent concrete flatwork. Overwatering and underwatering of landscape areas must be avoided. Areas of soil that do not have ground cover may require more moisture, as they are more susceptible to evaporation. Ponding or trapping of water in localized areas adjacent to the foundations can cause differential moisture levels in subsurface soils and, therefore, should not be allowed. Trees located within a distance of 20 feet of foundations would require more water in periods of extreme drought, and in some cases, a root injection system may be required to maintain moisture equilibrium. During extreme hot and dry periods, close observations should be carried out around foundations to ensure that adequate watering is being undertaken to prevent soil from separating or pulling back from the foundation.

5.11 Construction Observation and Testing and Plan Review

The geotechnical consultant should perform construction observation and testing during the fine, and post grading operations, future excavations and foundation or retaining wall construction at the site. Additionally, footing excavations should be observed and moisture determination tests of the slab subgrade soils should be performed by the geotechnical consultant prior to the pouring of concrete. Foundation design plans should also be reviewed by the geotechnical consultant prior to excavations.

6.0 LIMITATIONS

The recommendations contained in this report are based on available project information. Changes made during design development, should be reviewed by Leighton Consulting, Inc. to determine if recommendations are still applicable. Any questions regarding the contents of this report should be directed to the attention of Mike Jensen, CEG, (858) 300-8494 of Leighton and Associates, Inc.

The nature of many sites is such that differing geotechnical or geological conditions can occur over small areal distances and under varying climatic conditions. The conclusions and recommendations in this report are based in part upon data that were obtained from a limited number of observations, site visits, excavations, samples, and tests. Such information is by necessity incomplete and therefore preliminary. The findings, conclusions, and recommendations presented in this report are considered preliminary and can be relied upon only if Leighton has the opportunity to observe the subsurface conditions during grading and construction of the proposed improvements, in order to confirm that our preliminary findings are representative for the site.

This report was prepared for the sole use of JPI for application to the design of the proposed improvements in accordance with generally accepted geotechnical engineering practices at this time in California. Our evaluation was limited to assessment of the preliminary geotechnical aspects of the project and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials. In addition, we recommend that the GBC insert included in Appendix G be reviewed prior to the utilization of this report.

FIGURES

Project: 12085.004	Eng/Geol: WDO/MDJ
Scale: 1 " = 2,000 '	Date: June 2022
Base Map: ESRI ArcGIS Online 2022 Author: (mmurphy)	

SITE LOCATION MAP

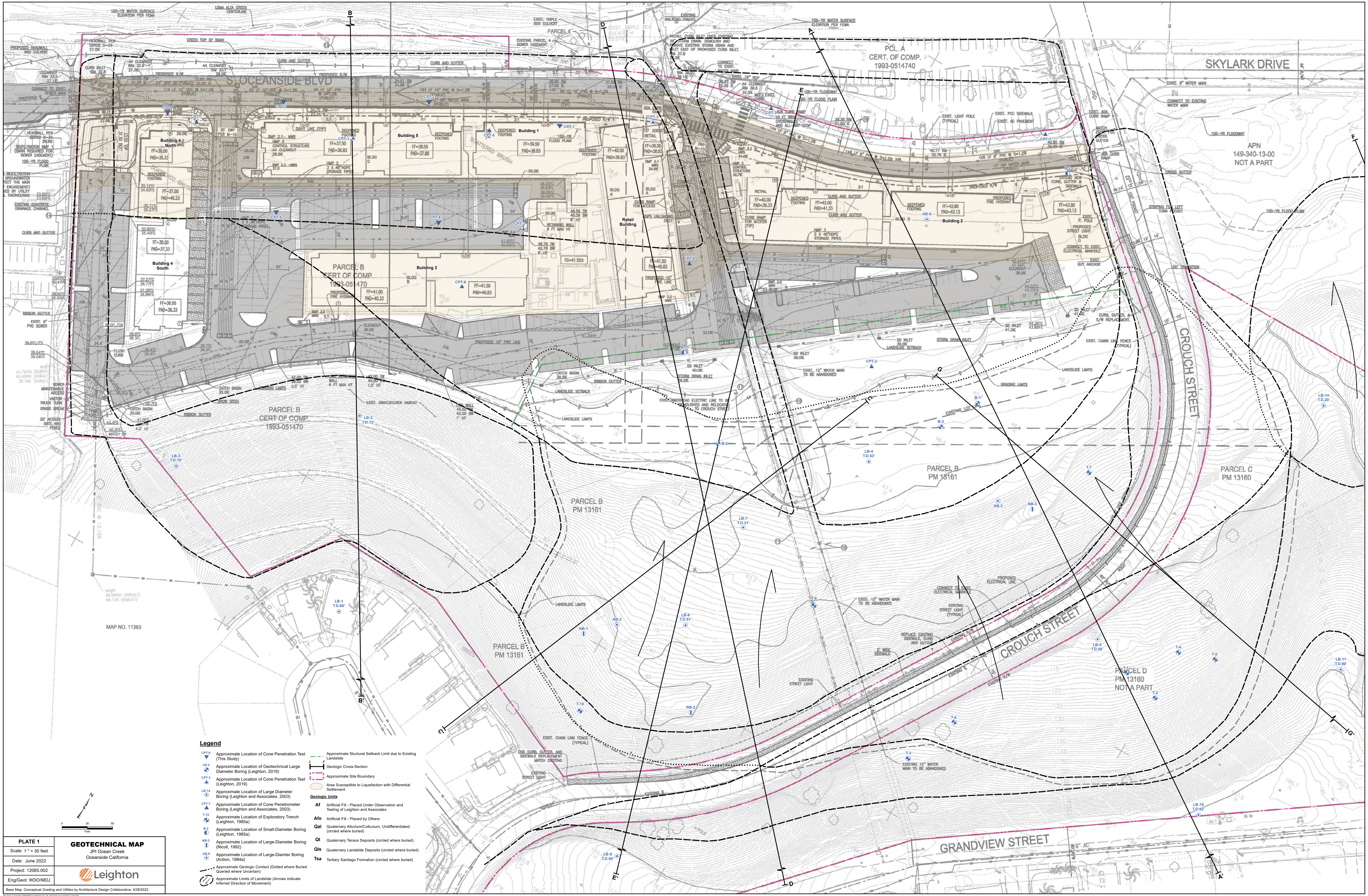
Ocean Creek Town Center
Oceanside, California

FIGURE 1

Leighton

Map Saved as V:\Drafting\12085\004\Maps\12085-004_F01_SLM_2022-06-22.mxd on 6/2/2022 12:55:19 PM

PLATES



Legend

- CPT-6 — Approximate Location of Cone Penetration Test (This Study)
- LB-3 — Approximate Location of Geotechnical Large Diameter Boring (Leighton, 2019)
- CPT-3 — Approximate Location of Cone Penetration Test (Leighton, 2019)
- LB-14 — Approximate Location of Large Diameter Boring (Leighton and Associates, 2003)
- CPT-7 — Approximate Location of Cone Penetrometer Boring (Leighton and Associates, 2003)
- T-10 — Approximate Location of Exploratory Trench (Leighton, 1985a)
- B-2 — Approximate Location of Small-Diameter Boring (Leighton, 1985a)
- NB-3 — Approximate Location of Large-Diameter Boring (Nicoll, 1992)
- AB-6 — Approximate Location of Large-Diamter Boring (Action, 1984a)
- ? — Approximate Geologic Contact (Dotted where Buried Queried where Uncertain)
- Approximate Limits of Landslide (Arrows indicate Inferred Direction of Movement)
- Approximate Stuctural Setback Limit due to Existing Landslide
- J–J' — Geologic Cross-Section
- Approximate Site Bouindary
- Area Susceptible to Liquefaction with Differential Settlement

Geologic Units

Af	Artificial Fill - Placed Under Observation and Testing of Leighton and Associates
Afo	Artificial Fill - Placed by Others
Qal	Quaternary Alluvium/Colluvium, Undifferentiated, (circled where buried)
Qt	Quaternary Terace Deposits (circled where buried)
Qls	Quaternary Landslide Deposits (circled where buried)
Tsa	Tertiary Santiago Formation (circled where buried)

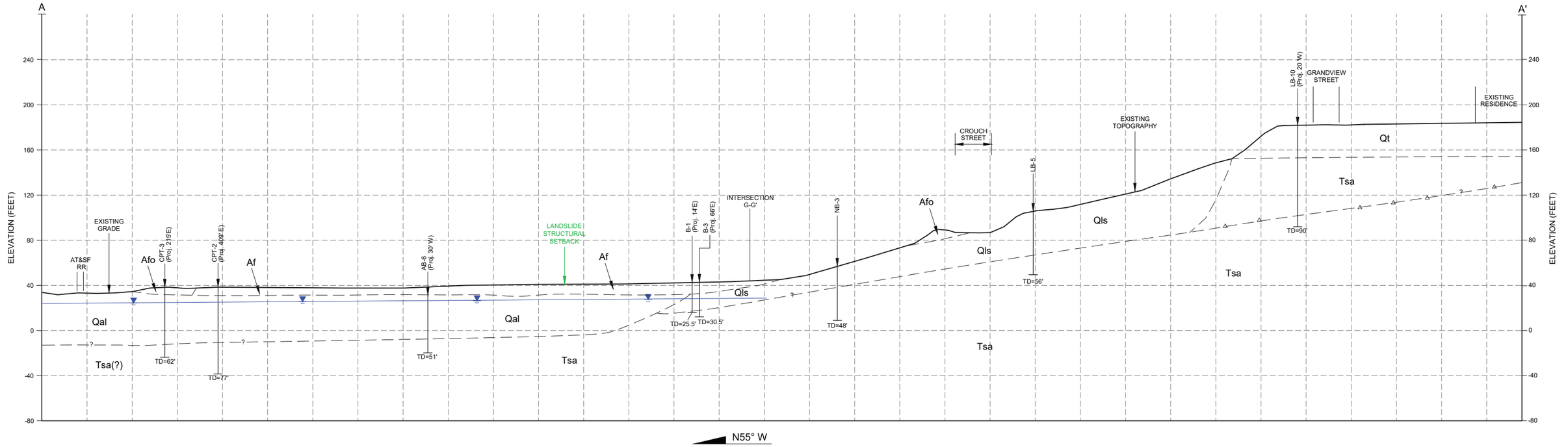
N

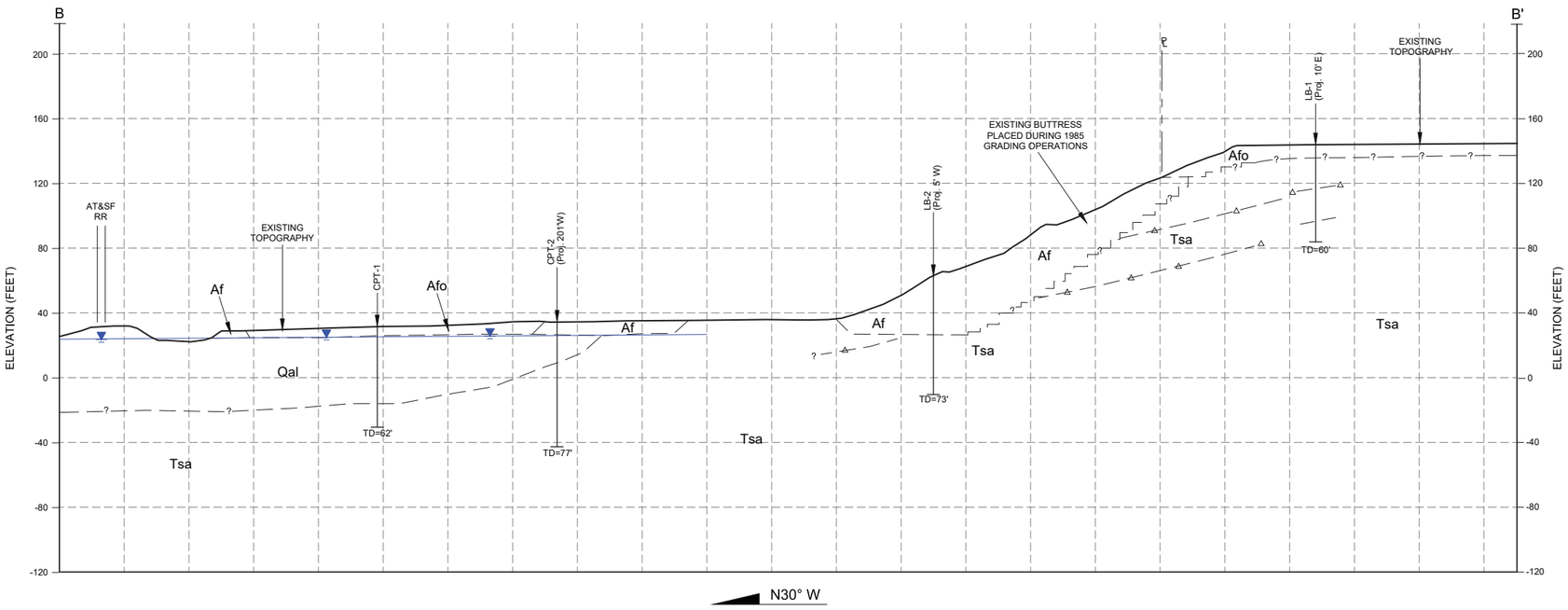
0 30 60
Feet

PLATE 1	GEOTECHNICAL MAP JPI Ocean Creek Oceanside California
Scale: 1 " = 30 feet	
Date: June 2022	
Project: 12085.002	Leighton
Eng/Geol: WDO/MDJ	

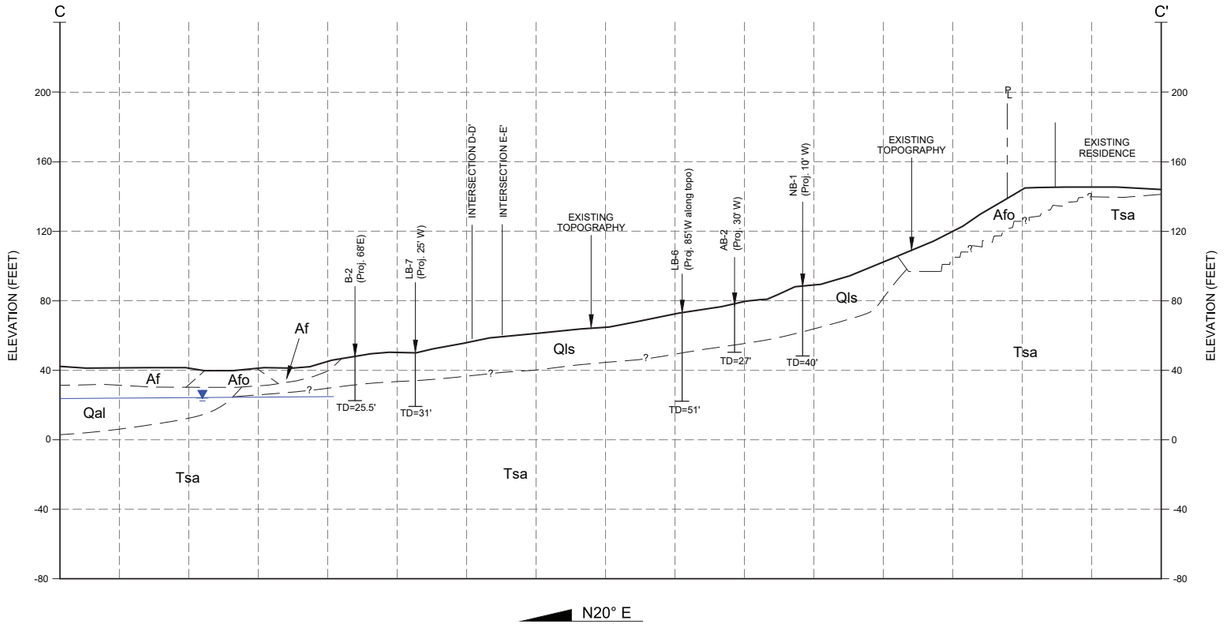
Base Map: Conceptual Grading and Utilites by Architecture Design Collaborative, 4/28/2022.

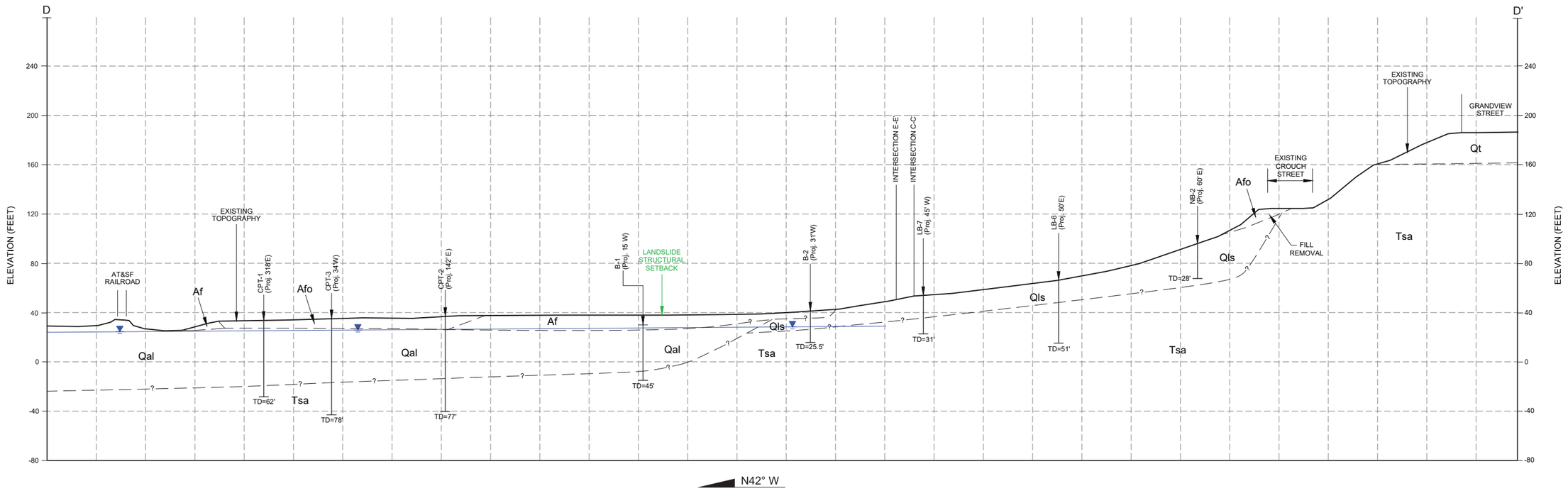
Map Saved as V:\Drafting\12085\004\Maps\12085-004_F01_EM_2022-06-02.mxd on 6/2/2022 12:48:24 PM





GEOLOGIC CROSS-SECTIONS A-A' & B-B' JPI Ocean Creek Oceanside California	**PLATE 2**
	Scale: 1"=40'
	Date: June 2022
Leighton	Proj: 12085.004
	Eng/Geol: WDO/MDJ
Base Map:	



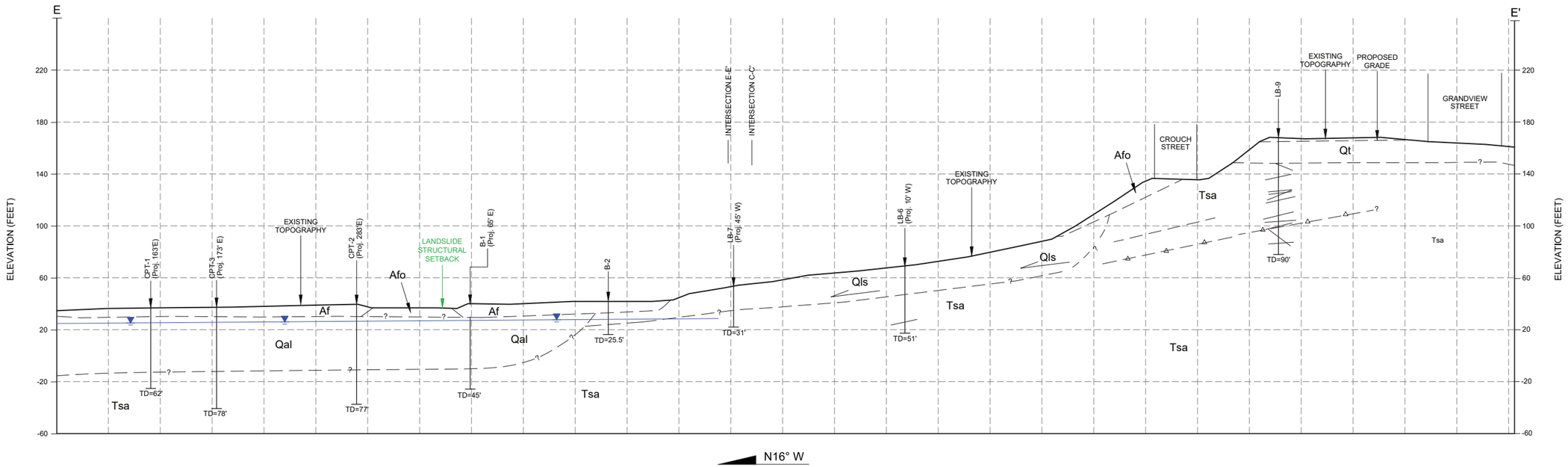


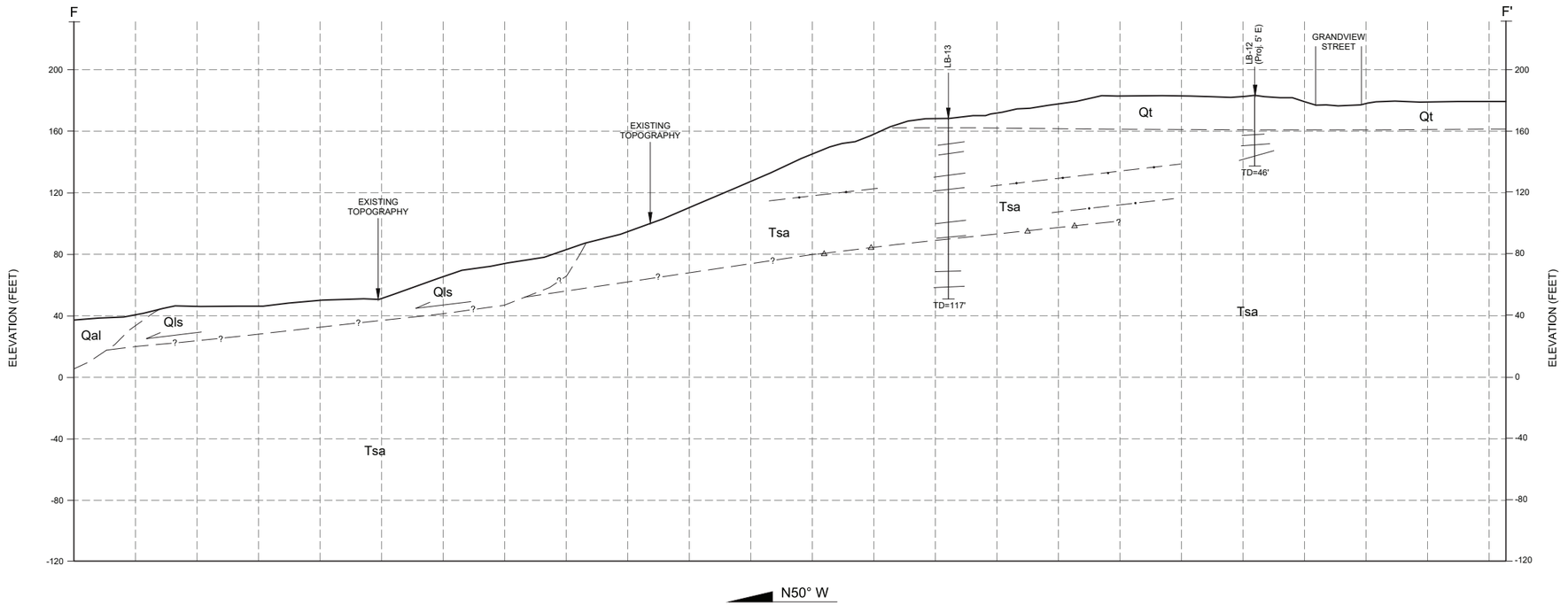
GEOLOGIC CROSS-SECTIONS
C-C' & D-D'
JPI Ocean Creek
Oceanside California

Leighton

PLATE 3	
Scale: 1"=40'	
Date: June 2022	
Proj: 12085.004	
Eng/Geol: WDO/MDJ	

Base Map:



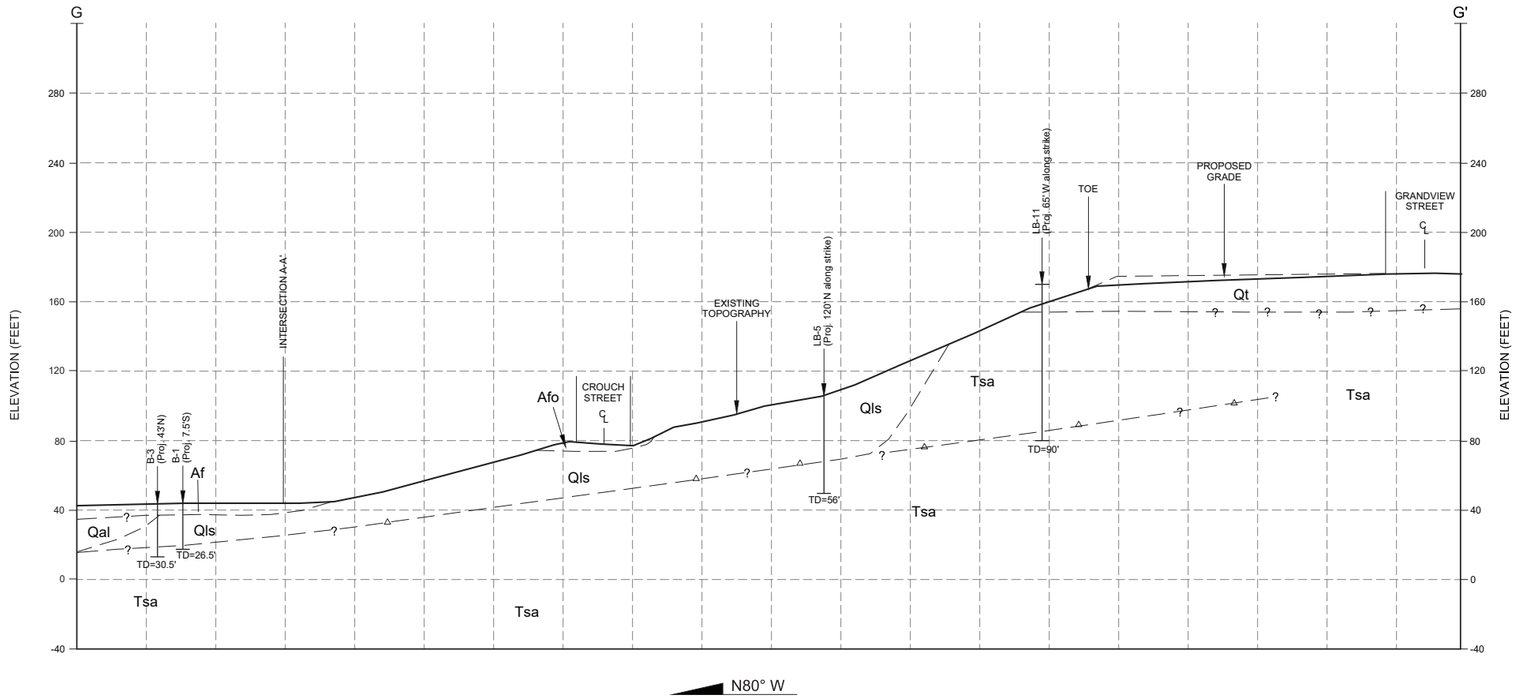


GEOLOGIC CROSS-SECTIONS
E-E' & F-F'
JPI Ocean Creek
Oceanside California

Leighton

PLATE 4	
Scale: 1"=40'	
Date: June 2022	
Proj: 12085.004	
Eng/Geol: WDO/MDJ	

Base Map:



GEOLOGIC CROSS-SECTION G-G' JPI Ocean Creek Oceanside California	**PLATE 5**
	Scale: 1"=40'
	Date: June 2022
Leighton	Proj: 12085.004
	Eng/Geol: WDO/MDJ
Base Map:	

APPENDIX A

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APPENDIX A

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Aerial Photographs

Date	*Source*	*Flight*	*Photo Number*
5-2-53	USDA	AXN-14	36-38

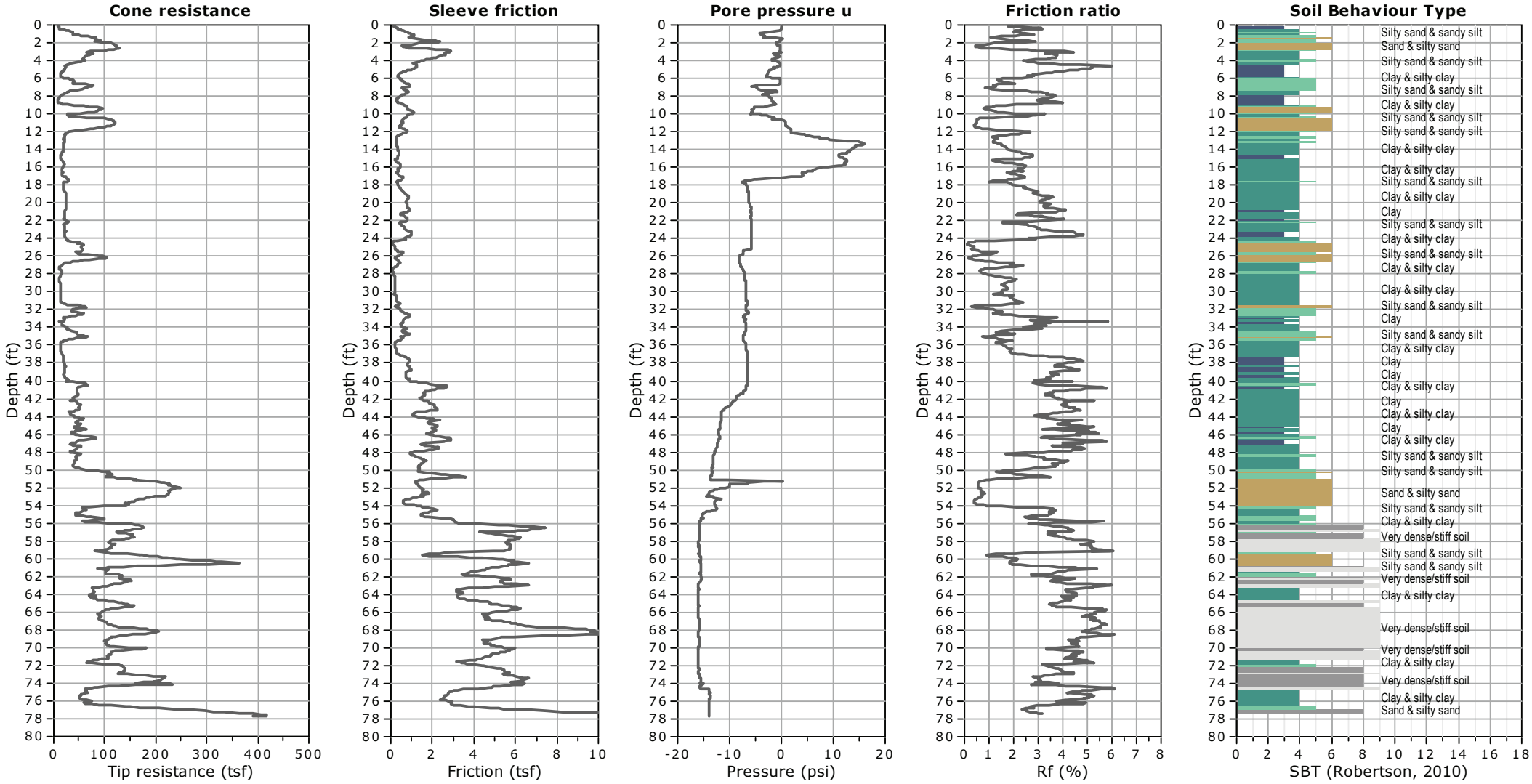
APPENDIX B

Current Explorations

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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

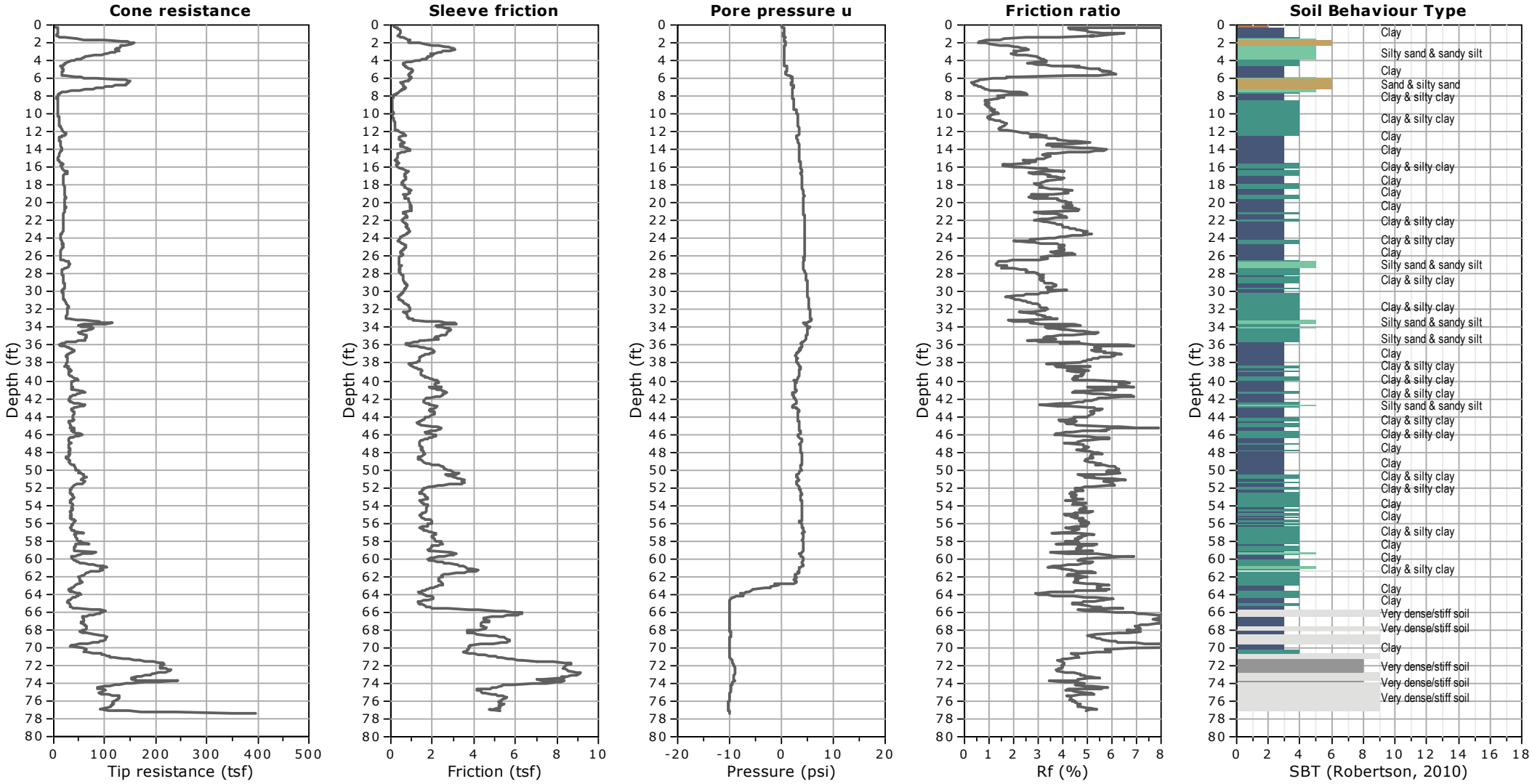
CPT-1
Total depth: 77.77 ft, Date: 2/1/2021



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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

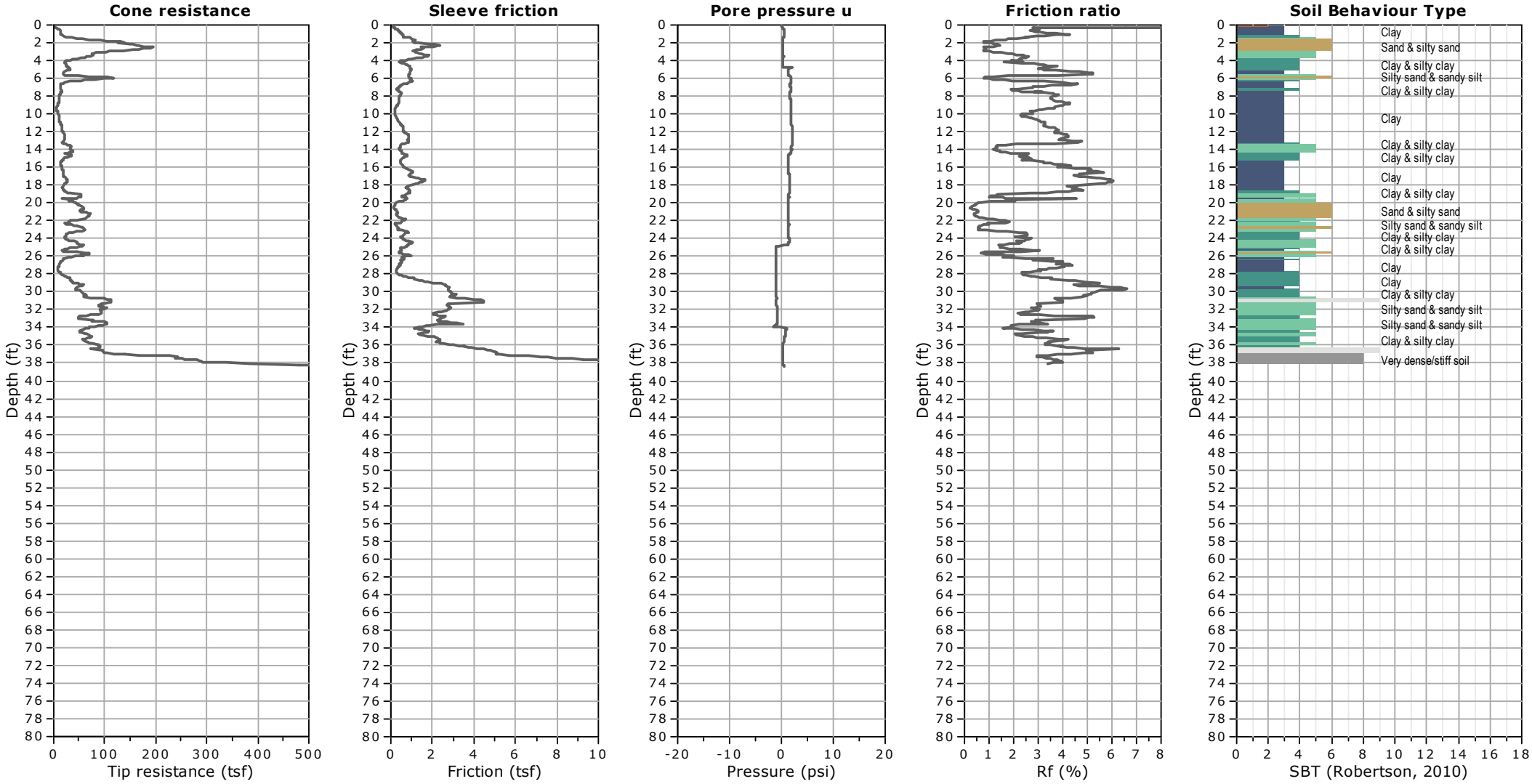
CPT-2
Total depth: 77.43 ft, Date: 2/1/2021



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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

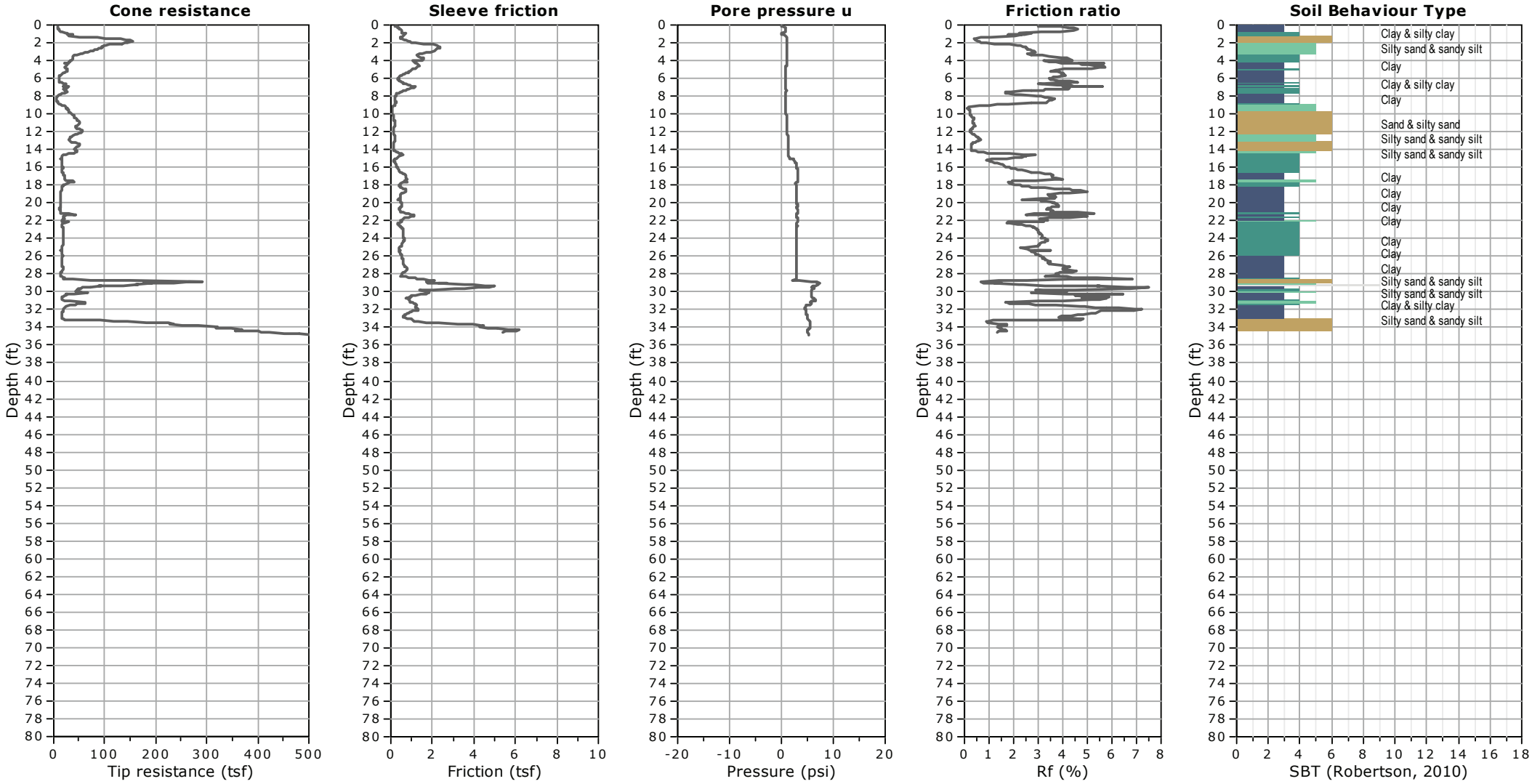
CPT-3
Total depth: 38.46 ft, Date: 2/1/2021



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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

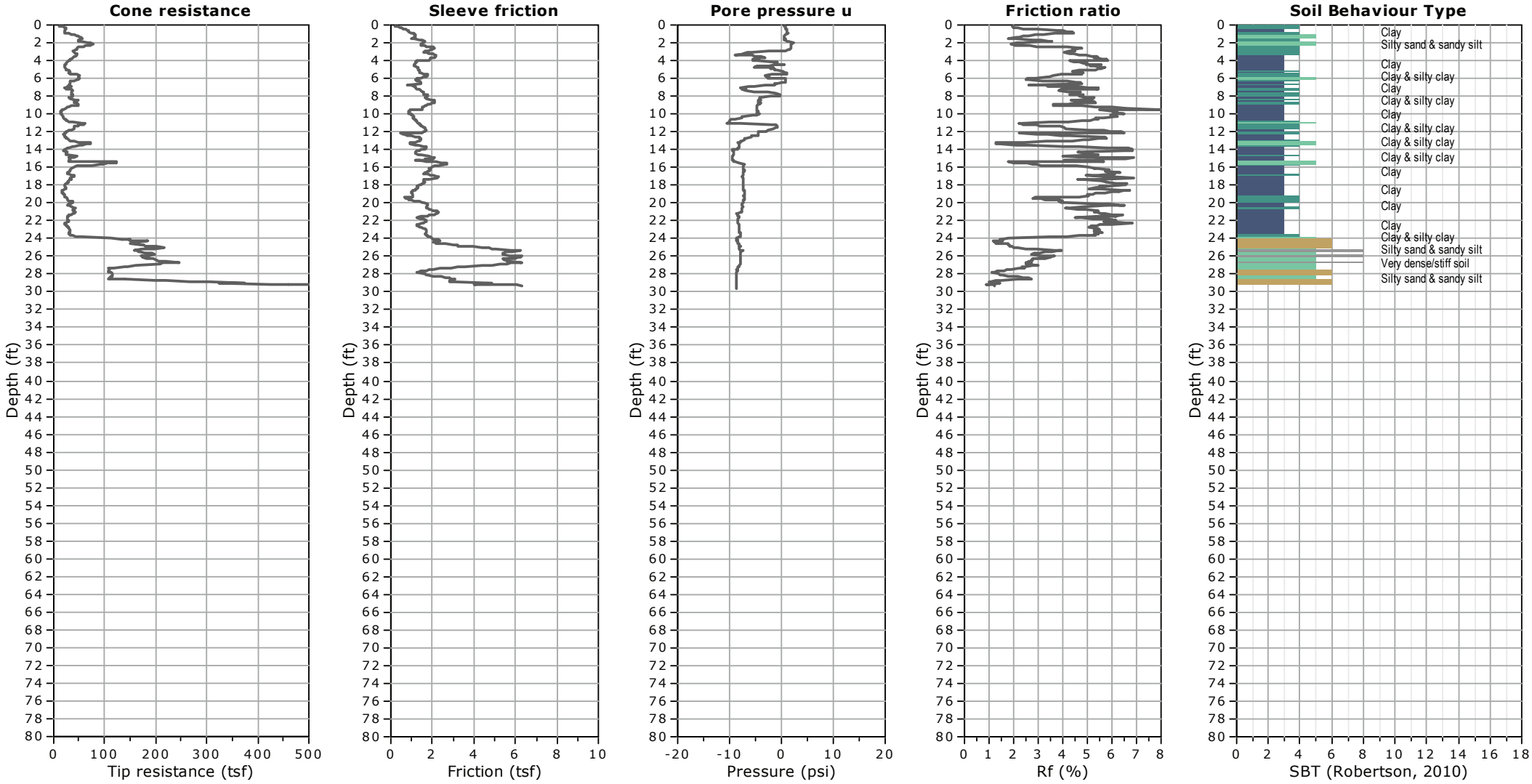
CPT-4
Total depth: 34.91 ft, Date: 2/1/2021



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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

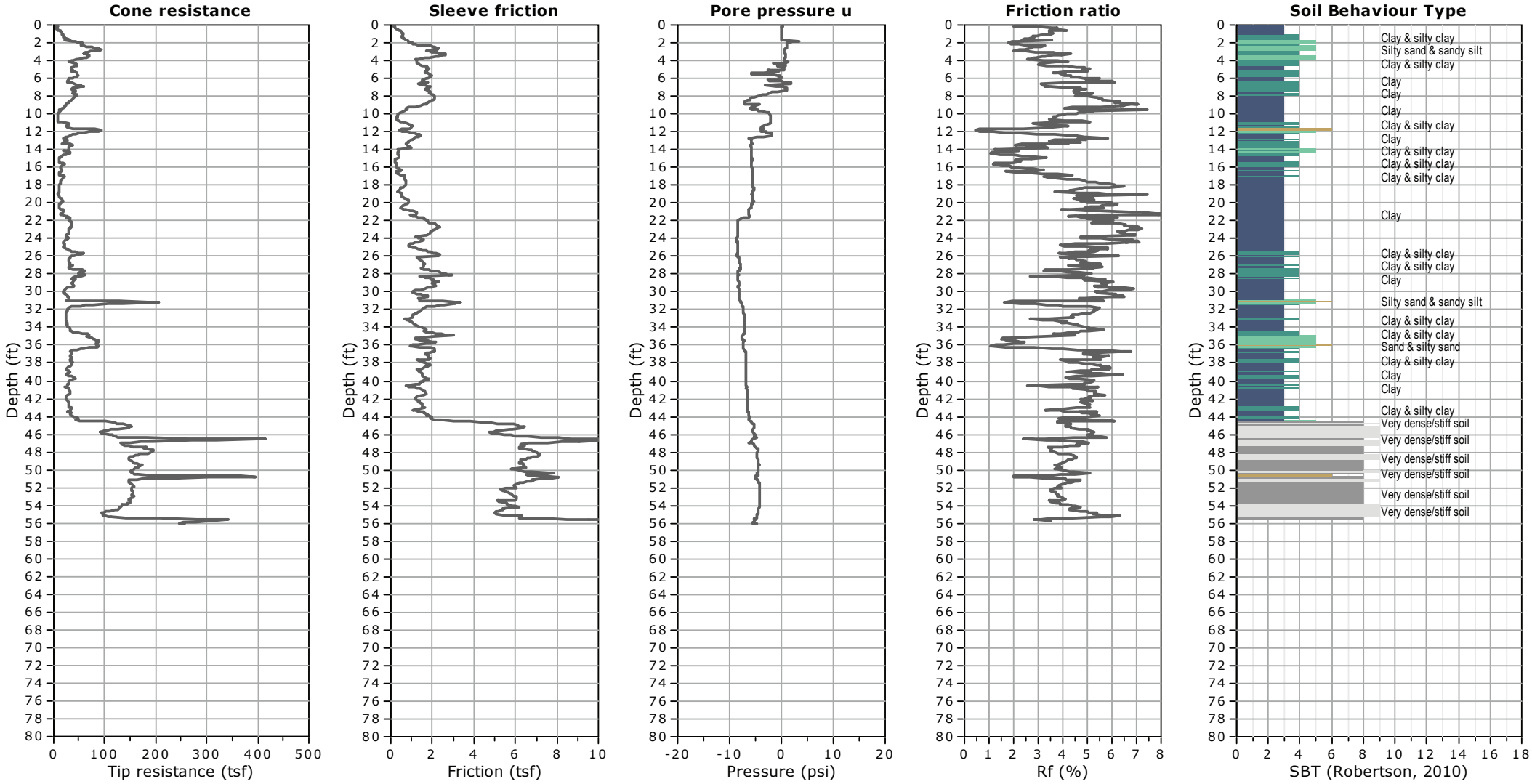
CPT-5
Total depth: 29.37 ft, Date: 2/1/2021



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

Project: **Leighton & Associates / JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

CPT-6
Total depth: 56.11 ft, Date: 2/1/2021



APPENDIX B

Previous Explorations

APPENDIX B

Large Diameter Borings
B-1 through B-3

GEOTECHNICAL BORING LOG KEY

Date _____ **Sheet** 1 **of** 1

Project KEY TO BORING LOG GRAPHICS **Project No.** _____

Drilling Co. _____ **Type of Rig** _____

Hole Diameter _____ **Drive Weight** _____ **Drop** "

Elevation Top of Elevation ' **Location** _____

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								Asphaltic concrete.	
									Portland cement concrete.	
								CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay.	
								CH	Inorganic clay; high plasticity, fat clays.	
								OL	Organic clay; medium to plasticity, organic silts.	
	5							ML	Inorganic silt; clayey silt with low plasticity.	
								MH	Inorganic silt; diatomaceous fine sandy or silty soils; elastic silt.	
								ML-CL	Clayey silt to silty clay.	
								GW	Well-graded gravel; gravel-sand mixture, little or no fines.	
								GP	Poorly graded gravel; gravel-sand mixture, little or no fines.	
	10							GM	Silty gravel; gravel-sand-silt mixtures.	
								GC	Clayey gravel; gravel-sand-clay mixtures.	
								SW	Well-graded sand; gravelly sand, little or no fines.	
								SP	Poorly graded sand; gravelly sand, little or no fines.	
								SM	Silty sand; poorly graded sand-silt mixtures.	
	15							SC	Clayey sand; sand-clay mixtures.	
									Bedrock.	
									Ground water encountered at time of drilling.	
				B-1					Bulk Sample 1.	
	20			B-1					Bulk Sample 2.	
				C-1					Core Sample.	
				G-1					Grab Sample.	
				R-1					Modified California Sampler (3" O.D., 2.5 I.D.).	
				SH-1					Shelby Tube Sampler (3" O.D.).	
	25			S-1					Standard Penetration Test SPT (Sampler (2" O.D., 1.4" I.D.).	
				PUSH					Sampler Penetrates without Hammer Blow.	
									Bulk Sample 2.	
	30									

Logged By _____

Sampled By _____

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- AT ATTERBURG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON

GEOTECHNICAL BORING LOG B-1

Project No.	12085.002	**Date Drilled**	7-29-19
Project	JPI Oceancreek	**Logged By**	XR
Drilling Co.	Tri-Valley Drilling, Inc.	**Hole Diameter**	30"
Drilling Method	Bucket Auger	**Ground Elevation**	42'
Location	See Map	**Sampled By**	XR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
42	0							SM	ARTIFICIAL FILL (Af) @ 0'-2.9': Silty SAND, medium dense, brown, dry to damp, fine-grained, native and concrete clasts	
40										
	5								@ 5': Sandy SILT	
35									@ 6.7'-7.2': Silty SAND, light brown, near horizontal	
									@ 8.2': Concretion 2 to 3" bed with clasts of SANDSTONE in silty SAND fill, light brown, medium dense, poorly-graded	
32	10			R-1	1@6" 1@6"			SM	QUATERNARY LANDSLIDE (Qls) @ 9.8': Silty SAND, dark brown, rootlets @ 10': Silty SAND, light brown, gravel-sized clasts of SANDSTONE nearly horizontal layer, discontinuous around the boring	
30										
									@ 14.5': Heavy caving, silty SAND, medium dense, heavy seepage, red-brown, fine-grained, moist, friable Unable to geologically log below 14.5'	
27	15			R-2	Push 1@6"				@ 15': Silty SAND, loose, orange-brown, wet, roots, friable, iron-oxide blebs	
25										
22	20							ML	@ 20': SILTSTONE, gray-brown, intact, possible landslide	
20										
17	25			R-3	1@6" 2@6"			SM	TERTIARY SANTIAGO FORMATION (Tsa) @ 25': Silty SANDSTONE, medium dense, gray-brown, wet, micaceous, fine-grained, calcium-carbonate blebs/stringers	
								ML	@ 26': SILTSTONE with interbedded SAND, medium dense, gray-brown	
15									**Total Depth = 26.5 Feet** **Groundwater and Seepage Encountered at 14 Feet at Time of Drilling** **Backfilled with Bentonite and Native Soil on 7/29/19**	
12	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG B-2

Project No.	12085.002	**Date Drilled**	7-29-19
Project	JPI Oceancreek	**Logged By**	XR
Drilling Co.	Tri-Valley Drilling, Inc.	**Hole Diameter**	30"
Drilling Method	Bucket Auger	**Ground Elevation**	44'
Location	See Map	**Sampled By**	XR

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
40	0							SM	@ 0-5": TOPSOIL ARTIFICIAL FILL (Af) @ 5": Silty SAND, concrete, brick debris, gray-brown, dry, fine-grained	
	5			R-1					@ 5': Silty SAND, loose, light gray-brown, moist, fine-grained	
35									@ 8': Becomes red-brown	
	10			R-2				SM	QUATERNARY LANDSLIDE DEPOSITS (Qls) @ 9': Disturbed bed broken modeled SANDSTONE not intact 9'-11'	
								SP	@ 10': Silty SAND, light orange-brown, moist @ 11': Moderate caving oxidized on sand layer @ 11.6': Friable SAND, mottled but not intact	
30								CL	@ 13': Sandy SILT with a 2" thick plastic clayseam dipping N, calcium-carbonate blebs stringers	
	15		RS:N80E, 10-11NW					SM ML	@ 15': Silty SANDSTONE, light gray-brown, wet @ 15.2': Landslide rupture surface 1/2" thick CLAYSEAM, around entire boring, moderate seepage along bottom of landslide SANTIAGO FORMATION (Tsa) @ 15.8': SILTSTONE, dense, intact	
25										
	20								@ 20': SILTSTONE, hard, gray-brown, intact	
20								SM	@ 22': Silty SANDSTONE, very dense light brown	
	25							SP	@ 25': Poorly-graded SANDSTONE, light gray, micaceous	
15									**Total Depth = 25.5 Feet** **Groundwater and Seepage Encountered at 14 Feet at Time of Drilling** **Backfilled with Bentonite and Native Soil on 7/29/19**	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG B-3

Project No.	12085.002	**Date Drilled**	7-30-19
Project	JPI Oceancreek	**Logged By**	XR
Drilling Co.	Tri-Valley Drilling, Inc.	**Hole Diameter**	30"
Drilling Method	Bucket Auger	**Ground Elevation**	44'
Location	See Map	**Sampled By**	XR

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
40	0							SM	ARTIFICIAL FILL (Af) @ 0': Silty SANDSTONE, light gray-brown, dry, fine-grained	
	5			R-1	1 1			CL	@ 3.8': CLAY 4", dark brown @ 3.9': SAND, white, friable @ 5': Silty SAND, brown, moist, fine-grained	
35								SM	@ 5.8': Disturbed zone, silty SAND, dark brown	
	10			R-2	1 1			SC SM	@ 7.8': SAND bed, brown, micaceous, clasts of native formation @ 8': Sandy CLAY, medium stiff, dark brown, moist, Possible Topsoil QUATERNARY LANDSLIDE DEPOSITS (Qls) @ 10': Silty SANDSTONE, orange-brown, charcoal, fine-grained, micaceous @ 10.3': Silty SAND, medium dense, dark brown, moist, slightly oxidized @ 11.3': Charcoal and wood chunks	
30	15		N60W 65 degrees	R-3	1 2				@ 14': SANDSTONE clasts 4" high, calcium-carbonate blebs stringers, loose @ 14.7': Highly fractured SILTSTONE, calcium-carbonate blebs, dark gray-brown, moist, randomly fractured, heavy seepage along fractures, calcium-carbonate stringers. @ 15.5': Silty SAND	
25	20		CS:N40W 15-20 degrees RS:N45E 15-17 degrees	R-4	1 2			ML ML	@ 19.8'-20.2': Highly sheared CLAYSTONE, polished, striated, dark gray to red-gray, remolded CLAYSEAM @20.2': 1.5 to 2" thick CLAYSEAM, dark brown, moist, high plasticity, heavy moderate seepage along clayseam and fractures, caving @ 20.3': SILTSTONE, light gray, manganese TERTIARY SANTIAGO FORMATION @ 21': Denser material SANDSTONE, light gray	
20	25			R-5	2 1				@ 25': SILTSTONE, very hard, light green-gray, micaceous @ 26': Standing water	
15	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG B-3

Project No.	12085.002	**Date Drilled**	7-30-19
Project	JPI Oceancreek	**Logged By**	XR
Drilling Co.	Tri-Valley Drilling, Inc.	**Hole Diameter**	30"
Drilling Method	Bucket Auger	**Ground Elevation**	44'
Location	See Map	**Sampled By**	XR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			R-6	5 10			SM	@ 30': SILTSTONE, very dense, light brown, micaceous	
10	35								**Geologically Logged to 25.5 Feet** **Total Depth = 30.5 Feet** **Groundwater and Seepage Encountered at 15 Feet at Time of Drilling** **Backfilled with Bentonite and Native Soil on 7/30/19**	
5	40									
0	45									
-5	50									
-10	55									
-15	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

Kehoe Testing and Engineering
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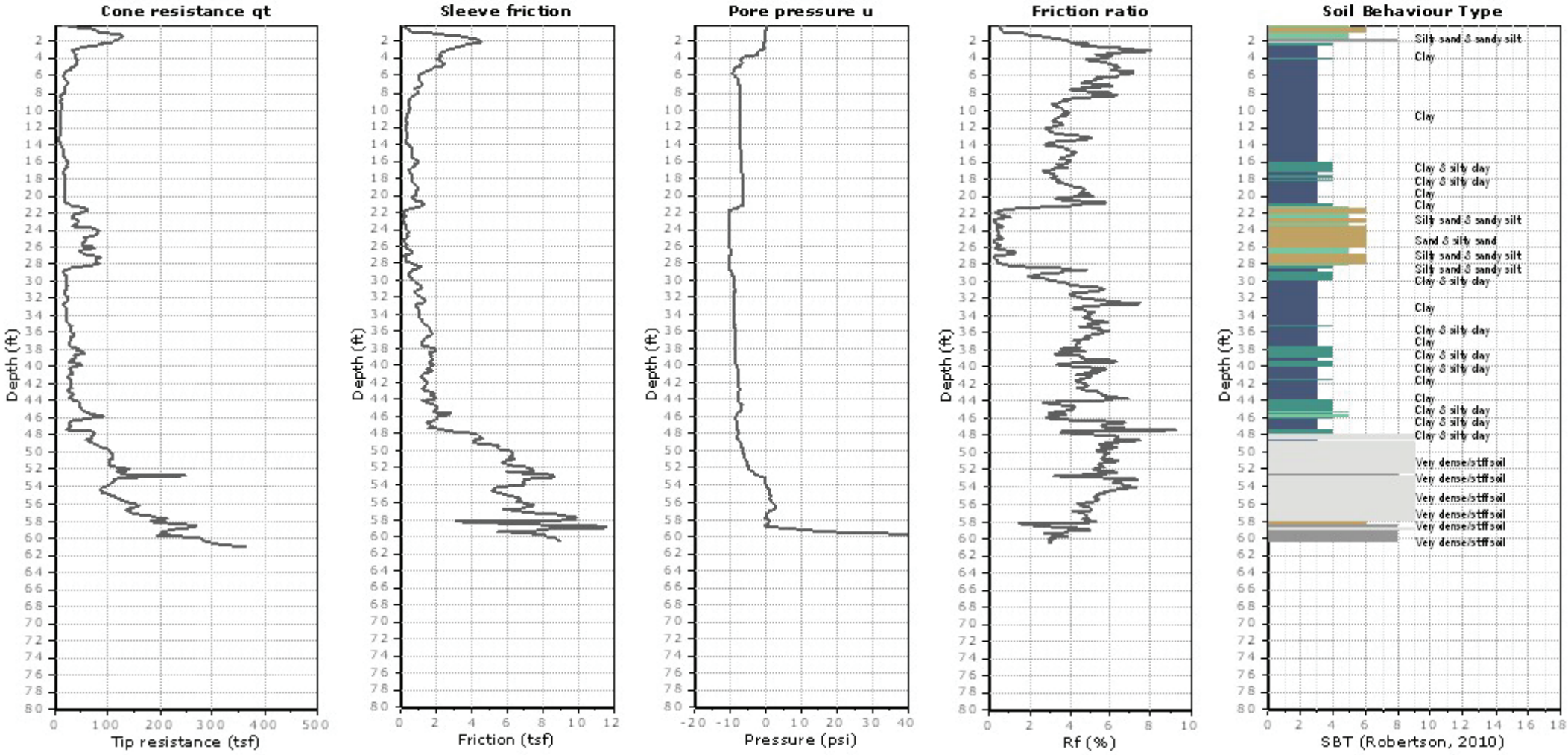
www.kehoetesting.com

Project: **Leighton & Associates - JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

CPT-1
Total depth: 60.96 ft, Date: 8/2/2019



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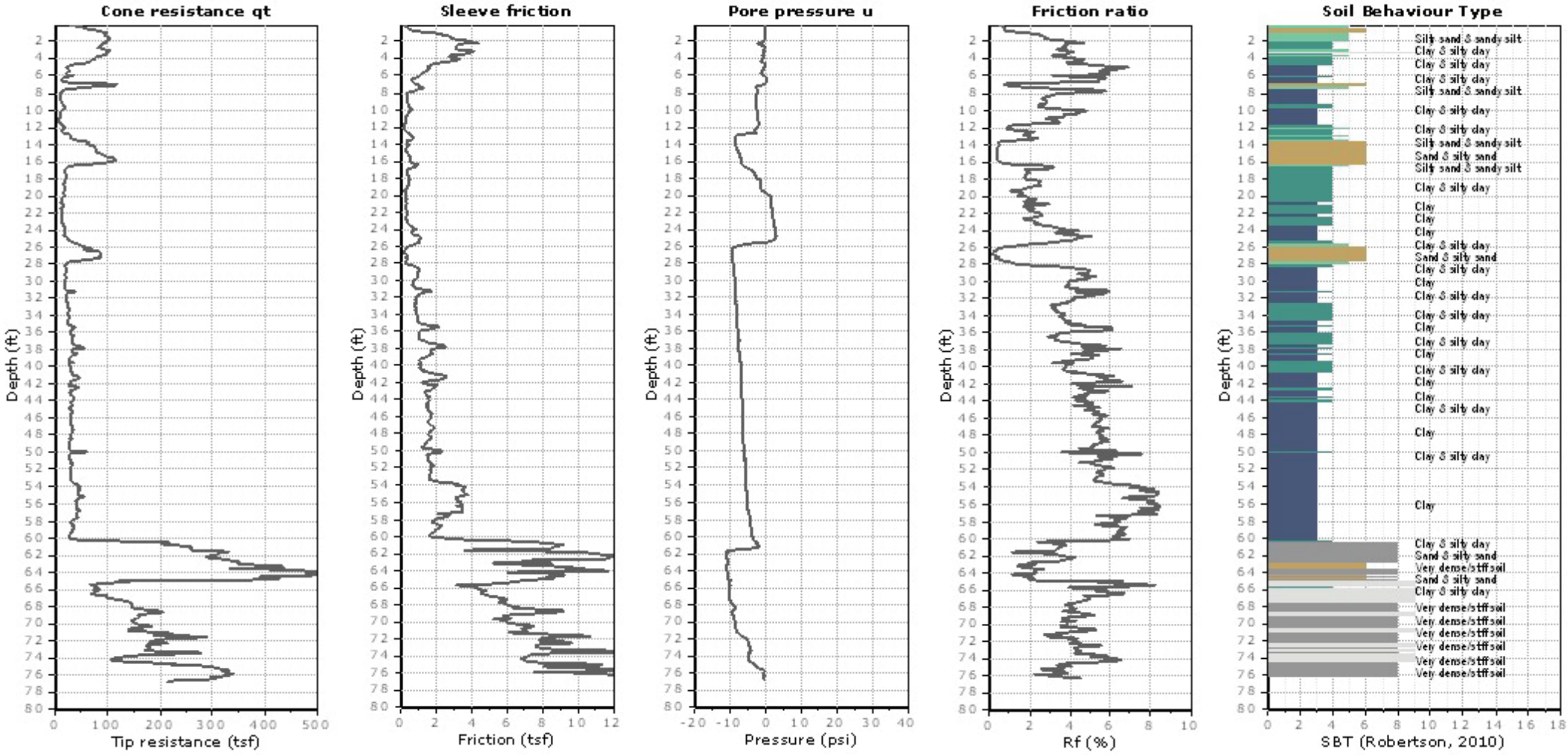
Project: **Leighton & Associates - JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

CPT-2
Total depth: 76.72 ft, Date: 8/2/2019



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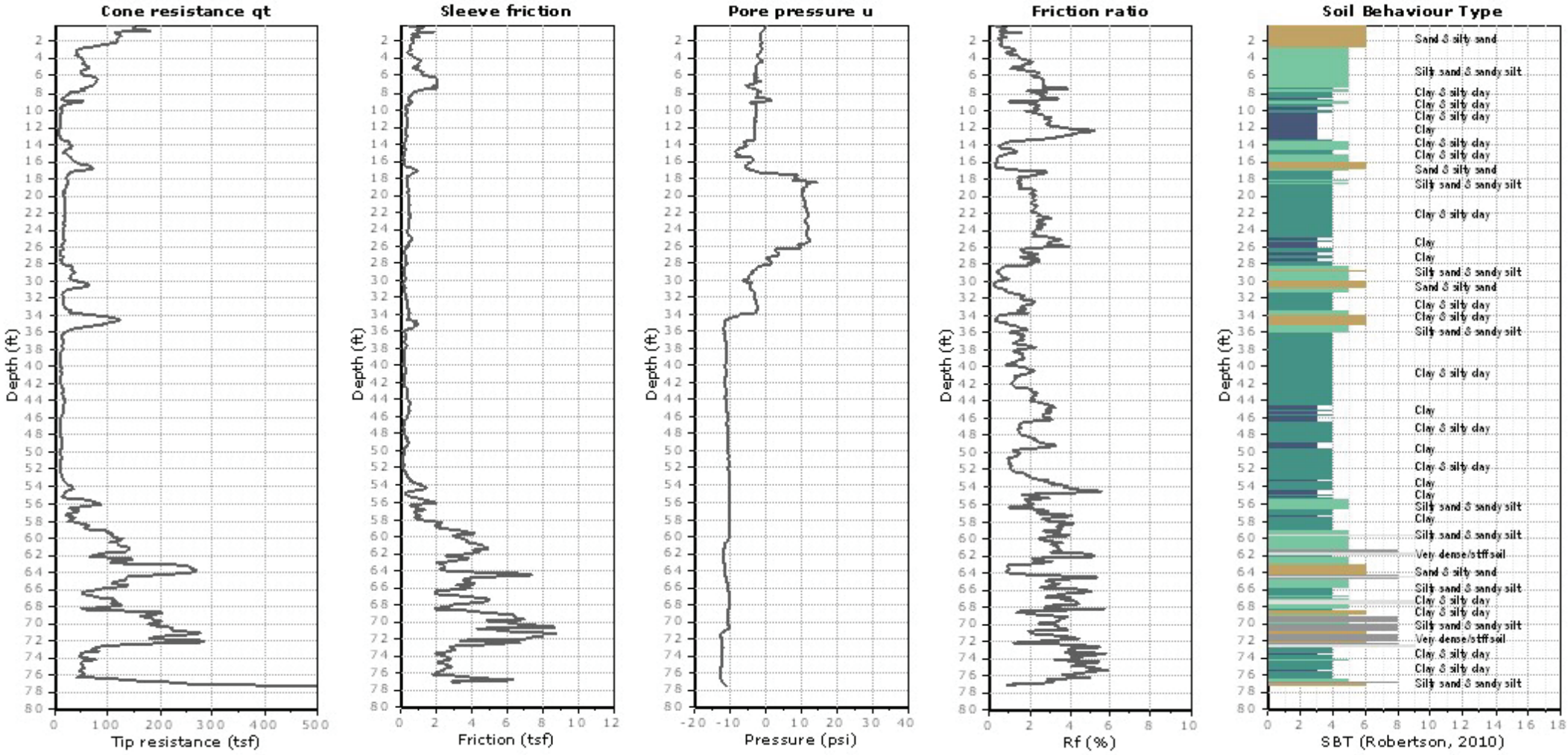
Project: **Leighton & Associates - JPI Ocean Creek Town Center**
Location: **Oceanside, CA**

CPT-3
Total depth: 77.50 ft, Date: 8/2/2019



GEOTECHNICAL BORING LOG LB-8

Date 6-13-03 **Sheet** 1 **of** 1

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 158' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By BJO; Sampled By BJO)	Type of Tests
158	0							SM	QUATERNARY TERRACE DEPOSITS (Qt) @ 0'-2': Light orange-brown silty SAND; dry to slightly moist, very dense, fine grained	
								SC	@ 2'-3': Brown sandy CLAY, moist, stiff, horizontal profile ring holes; cemented along base	
155	5								@ 4': Sample is similar to above; light orange-brown silty SAND, slightly moist, very dense; fine to medium grained	
									@ 6': Grain size and moisture increases, becomes orange-brown silty SAND; moist, dense; fine to medium grained; local stringers and pods of gray color	
150									@ 10': Sample is: Orange-brown silty SAND; moist, dense; medium grained with scattered subangular coarse sand to gravel	
	10								@ 10.5'-11.0': Scattered subrounded gravel and small cobbles supported in matrix similar to above; rare claystone clasts	
				R-1	8(11")	126.1	4.1	SM		
			C:EW, 10N C:EW, 3-8N					SM	TERTIARY SANTIAGO FORMATION (Tsa) @ 11': Light gray silty SANDSTONE; slightly moist, dense; very fine grained; generally massive; rare gray claystone clasts	
145									@ 12': Contact, iron-oxide stained above, generally clean, light gray color below; parallels the contact above, generally dips 3-8 degrees north	
	15								@ 16': Discontinuous pod of orange sand in west wall, horizontal	
140									@ 18': End downhole log	
				R-2	9	120.7	7.7	SM	@ 20': Sample is: gray silty to clayey SANDSTONE, slightly moist, dense to very dense; fine grained; local, gray claystone clasts up to 1/8"	
	20								Total Depth = 20 Feet Downhole Logged to 18 Feet No ground water encountered at time of drilling Backfilled and tamped with native soil on 6/13/03	
135										
	25									
130										
	30									

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-9

Date 6-13-03 **Sheet** 1 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
170	0							SM	QUATERNARY TERRACE DEPOSITS (Qt) @ 0': Light orange-brown silty SAND to sandy SILT, dry, very fine grained; weakly cemented	
165	5								@ 7': Generally coarsens with depth, bulk sample (7-9') is fine to medium grained, slightly moist, otherwise same as above	
160	10			R-1	4	117.9	5.8	SM	@ 10': Sample is: orange-brown SAND, slightly moist, medium dense; fine to medium grained	
155	15								@ 14.9': Gradational contact to orange-brown clayey SAND; moist, medium dense @ 16.5': 6" thick horizontal layer of scattered gravel, matrix supported @ 18.5': Base of clayey coarse SAND with gravel, moist, medium dense to loose; horizontal, slightly undulatory contact	
			C:Horizontal S:N70E, 22S					CL/ML	TERTIARY SANTIAGO FORMATION (Tsa) @ 18.5': Gray silty CLAYSTONE; slightly moist; medium dense to dense; micaceous; weathered, discontinuous oxidized fractures	
150	20			R-2	3	94.3	27.4	CL	@ 19.5': Gray CLAY-lined shear, polished, weathered, continuous @ 20': Sample is similar to above	
			C:N60-70E, 2-3N					SM	@ 23.3': Diffuse contact with light gray SANDSTONE; slightly moist, medium dense; very fine grained	
145	25								@ 25': Grain size coarsens to fine grained	
			GB:N50E, 13NW						@ 29.4': 1/4" to 1" thick gray-brown clayey SANDSTONE, locally cemented	
140	30									

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-9

Date 6-13-03 **Sheet** 2 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By BJO; Sampled By BJO)	Type of Tests
140	30			R-3	18	114.6	6.8	SM	@ 30': Sample is: Light gray silty SANDSTONE; slightly moist, very dense; very fine grained; micaceous; diffuse iron-oxide staining	
									@ 32'-33.5': Coarsens downward, scattered red claystone rip-up clasts	
									@ 33.5': Irregular, generally north dipping, scoured contact, very fine grained sand below	
135	35								@ 37': Weakly cemented SANDSTONE cementation, increases with depth	
									@ 39': Very minor seepage from above cemented layer, 1.5" thick; continuous around hole	
130	40			R-4	20	121.2	10.4	SM	@ 40': Sample is: light gray silty SANDSTONE; moist, very dense; fine grained; micaceous	
			B:N10E, 14NW					SM/CL	@ 41'-42': Yellow-brown CLAYSTONE; moist to wet, soft to medium stiff; clay seam at base, polished, continuous with local seepage	
			B:N15E, 12NW						@ 42'-42.5': Thinly bedded gray-brown, micaceous SANDSTONE and brown to yellow-brown CLAYSTONE, polished surfaces along bedding surfaces	
			S:N36E, 27NW						@ 42.5': Gray fine SANDSTONE, moist, dense	
125	45		STR:15N, N20W						@ 43.7': Well polished shear zone 4" thick, in yellow-brown CLAYSTONE; oriented along bedding; weathered, slightly moist; striated	
									@ 44': Grades sandy and micaceous	
			B:N50E, 15NW						@ 46.5'-47.9': Polished red-brown to yellow-brown CLAYSTONE, slightly undulatory, continuous around hole	
								SM	@ 48': Contact with light gray to light blue-gray, silty SANDSTONE, slightly moist; very dense	
120	50			R-5	32	123.1	12.8	SM	@ 49.5': 4" thick concreted zone, dips northwest, local pink coloration	
									@ 50': Sample is similar to above	
									@ 52': Contact with slightly finer grained material	
115	55		C:N35W, 14NE						@ 55': Contact with brownish gray clayey SANDSTONE, slightly moist, dense; very fine grained, micaceous; 1/2" thick reddish halo at contact; unsheared	
			GB:N80W, 15N							
110	60			R-6	40(5")	101.5	11.1	SM/CL	@ 59': Gray sandy CLAYSTONE to silty SANDSTONE, slightly	

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-9

Date 6-13-03 **Sheet** 3 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
110	60							SM/CL	moist, dense; fine grained; concreted gray sandstone/claystone in sample tip	
			GB:N30-50E, 5NW						@ 64': Discontinuous cemented zone; hard, dry	
105	65							ML	@ 65': Light brownish gray clayey SILTSTONE, slightly moist, very stiff; scattered fine SAND grains; grades to sandy SILTSTONE through 68'	
			S:N30-40E, 20NW						@ 68': Paper thin, planar shear, local discontinuous shears propogate 1" to 2" above surface	
100	70			R-7	30-10"	116.6	18.4	SM	@ 70': Sample is: (at top) light grayish brown, clayey to silty SANDSTONE; slightly moist, very dense to hard (and at bottom) light bluish gray, silty SANDSTONE, slightly moist, very dense; all very fine grained	
			C:N60W, 3-5SW						@ 71.5': Contact-iron stained, generally fine to medium grained	
			F:N57E, 40SE STR:35SE, N60W							
95	75								@ 74.5': Clay-lined fault surface, continuous around hole; dry, tight; sense of offset not evident	
			F:N57E, 40SE STR:35SE, N60W						@ 77.6': Fault surface lined with 2-3 mm of lavender clay, dry, stiff; striated, locally bifurcated, 1-2" apparent offset down to south	
90	80		F:N28E, 55S B:NS-5-10W	R-8	30-10"	115.3	11.9	SM/SC	@ 80': Sample is: light gray to gray silty to clayey SANDSTONE, slightly moist, very dense; very fine grained; slightly micaceous	
									@ 80.1': East dipping shear offsets brown 1" thick claystone seam, 0.5" down to east	
									@ 83'-84': Very minor seepage	
									@ 83.9': 4" thick concretion of gray-brown clayey SAND; continuous around hole	
85	85								@ 85': Grades to moist (darker gray) medium grained SAND, scattered light gray and orange concrete nodules	
				R-9	30-8"	114.8	14.8	SM	@ 90': Sample is: gray SANDSTONE; moist, very dense, fine to medium grained	
80	90									

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-9

Date 6-13-03 **Sheet** 4 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
80	90								Logged By BJO Sampled By BJO	
									Total Depth = 90 Feet Downhole Logged to 87 Feet Very minor seepage from north wall at 39 feet and generally continuous at around hole at 83-84 feet Standing water at 83.5 Feet depth on a.m. of 6/16/03 Backfilled and tamped with native and bentonite on 6/17/03	
75	95									
70	100									
65	105									
60	110									
55	115									
50	120									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-10

Date 6-16-03 **Sheet** 1 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 185' **Location**

Logged By BJO/RKW

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
185	0							SM	QUATERNARY TERRACE DEPOSITS (Qt) @ 5': Orange-brown silty to clayey SAND; slightly moist, medium dense; generally fine grained, very weakly cemented	
180	5								@ 5'-6': Subvertical light brown SAND infilled vein	
175	10			R-1	6	125.3	9.6	SM	@ 10': Sample is same as above	
170	15							SM	@ 14.8-17': Grades to medium grained, scattered coarse grains; generally clayey SAND, moist, medium dense, rare subangular gravel, micaceous	
165	20			R-2	5	103.2	7.7	SM	@ 18.5': 1-3" thick silty fine SAND bed, yellow-brown to orange-brown; moist, medium dense, horizontal; friable; continuous around hole @ 20': Sample is: yellow-brown to orange-brown, silty SAND, slightly moist, medium dense; friable; black mottled pattern to sample top @ 20.8': Contact with 1' thick fine silty SAND, similar to 18.5'; undulatory, horizontal top; gradational bottom; micaceous; friable	
160	25		GB:N60E 6SE						@ 24': Subrounded cobbles and subangular gravel in 5" thick horizontal layer; matrix supported @ 24.5': Low angle cross-bedding of gold mica-rich laminations and thin beds @ 27.2': Horizontal bed of medium to coarse grained SAND; 4-6" thick	
155	30							SM	TERTIARY SANTIAGO FORMATION (Tsa) @ 28.7': Light gray to yellow-gray SANDSTONE; slightly moist,	

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-10

Date 6-16-03 **Sheet** 2 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 185' **Location**

Logged By BJO/RKW

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
155	30		GB:N40-60E 15-20NW	R-3	16	94.3	20.4	ML	dense; very fine grained; minor silt; undulatory but sharp upper contact; generally horizontal @ 30': Sample is: Light gray sandy SILTSTONE; slightly moist, medium dense to dense; very fine grained; orange oxidation stain to upper sample @ 30.5': Generalized bedding based on 4" thick yellow-gray sand band, local claystone rip-ups @ 32.5': Very diffuse, north dipping contact, fine to medium grained below	
150	35								@ 35.5': Generally north dipping iron-stained bands, diffuse	
145	40		C:N30-50W 50-10SW	R-4	10	104.0	22.7	ML-CL ML/CL	@ 41': Sand grades medium to coarse grained @ 41.5': Contact slightly undulatory, drops 4" to southwest across hole, unsheared; stiff material below @ 42': Sample is gray sandy SILTSTONE to silty CLAYSTONE, slightly moist, very stiff; massive @ 43'-45': Local concreted and weathered pods, otherwise very stiff to very stiff and massive	
140	45		J:N30E, 90 C:N40-60, 5NW B:N40-50E, 5-10NW					SM	@ 45': Rare subvertical, discontinuous, tight, unweathered, short joints @ 45.4'-45.7": Contact, cemented, gray, very fine SAND below, slightly moist, very dense @ 47': 3" thick light brown, concrete SILTSTONE bed; dry to slightly moist, hard; fractured; slightly undulatory; drops 4" to northwest across hole, sand above clayey below	
135	50		S:N40-50W, 15-20NE	R-5A R-5B	9	110.0 120.2	18.8 9.5	SC-CL SM	@ 50': Sample is: light gray-brown clayey SILTSTONE to silty CLAYSTONE, slightly moist, very stiff; minor very fine SAND, polished surfaces in sampler tip @ 51.5': Thin, irregular shear zone enters hole, discontinuous, not well developed; short semi-polished surfaces	
130	55		C:N60W, 11NE B:N70-80E, 10NW					SM	@ 53': Contact, thin red clay bands within blue-gray SANDSTONE, moist, dense; local concretion, grades to light brownish gray to light gray SANDSTONE, moist, medium dense to dense; fine to medium grained, minor silt @ 54.1'-54.5': Tight, stiff, sharp CLAYSTONE bed; faintly polished, sharp upper surface	
125	60									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-10

Date 6-16-03 **Sheet** 3 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 185' **Location**

Logged By BJO/RKW

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
125	60							ML	@ 62': Oblong CLAYSTONE rip-up clasts @ 62.5'-63': Blue-gray SAND lenses	
			C:N50E, 8NW	R-6	28	106.3	20.6	CL	@ 63': Generally gray-brown clayey SILTSTONE; slightly moist; very stiff; micaceous, thin (1/8") laminations of pink-gray yellow-brown CLAYSTONE, slightly moist, very stiff, micaceous discontinuous, very short parting surfaces along approximate bedding (contact orientation)	
120	65		C:N60-70E, 9NW						@ 66': Contact; concretion lined; 1" thick planar brown, CLAYSTONE with planar parting surfaces above; slightly moist, soft to medium stiff	
								SM	@ 67': Light blue-gray to light gray SANDSTONE, slightly moist, dense; fine to medium grained; micaceous	
115	70		GB:N60E, 10NW						@ 70': Diffuse contact, gray medium grained below, generalized attitude on red clayey SAND ribbon, dips 0.5' to the northwest	
									@ 72': Minor seepage, sand is very moist to wet to 78'	
110	75									
								CL/CH	@ 78.5': Contact with brown CLAYSTONE, moist to wet along short fractures; soft to stiff; abundant discontinuous shears, continuous around hole	
105	80		S:N48E, 7NW						@ 79'-79.5': Well-developed shear zone, 0.5' thick, attitude on planar lower surface; local concreted nodules to 6" diameter; shears dry up and decrease through 80.5'; possible striae trend N05W	
			S:N51E, 8NW					SM	@ 81.3': Contact with blue-gray SANDSTONE interbed, moist, dense to very dense	
								CL	@ 81.7': Lower shear, immediately above SANDSTONE; continuous, 1" to 2" thick zone @ 82.5'-83.8': Brown CLAYSTONE bed; parallel to above; very moist, soft to stiff; sheared base and top; scattered gold mica; red clayey sand ribbon at base	
100	85							SM	@ 84': Blue-gray SANDSTONE, wet, dense to very dense, weeping seepage continues	
								CL	@ 87': Brown CLAYSTONE, slightly moist, stiff; end downhole log	
95	90									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-10

Date 6-16-03 **Sheet** 4 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 185' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
95	90			R-7	30(10")	116.1	14.3	SM	**Logged By** BJO/RKW **Sampled By** BJO	
									@ 92': Sample is: Gray silty SANDSTONE, slightly moist, dense to very dense; micaceous; fine grained	
									Total Depth = 92 Feet	
									Downhole logged to 87 feet	
									Minor seepage at 72 feet to total depth	
90	95								Standing water at 91 feet	
									Backfilled and tamped with native and bentonite on 6/16/03	
85	100									
80	105									
75	110									
70	115									
65	120									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
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- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-11

Date 6-18-03 **Sheet** 1 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
170	0	Casing						SM/ML	QUATERNARY TERRACE DEPOSITS (Qt) @ 0': Reworked, topsoil-like material consisting of light brown SAND, to clayey SILT, slightly moist, loose to medium stiff; irregular lower contact	
								SM/SC	@ 2.5'-9': Orange-brown silty SAND; moist, medium dense, friable, medium grained; minor clay; fine to medium grained micaceous	
165	5								@ 5.5': Scattered very coarse SAND to subangular gravel in coarse silt, sand matrix	
									@ 9': Horizontal, slightly undulatory contact with orange-brown to silty SAND, moist, dense, very fine grained; not offset by joint at 9.5'; cemented infilling, propgates to 10'	
160	10		J:N62E, 74N	R-1	8	116.2	15.0	SM/SC	TERTIARY SANTIAGO FORMATION (Tsa) @ 10'-13': Light gray to gray silty to clayey SANDSTONE, moist, dense; very fine grained; rare subvertical fractures filled with up to 1/8" thick orange sandy silt; undulatory upper contact, scoured to the southwest	
			C:25-35E 35NW						@ 13': Gradational contact: Light yellow-gray silty SANDSTONE, slightly moist, dense; scattered black stained blebs and subvertical streaks; fine to medium grained	
155	15		C:20-40E 8-10NW					CL	@ 16': Contact with gray-brown silty CLAYSTONE, moist, medium stiff; orange stained above, weathered below for 1-2"; stiff to very stiff through 21', with scattered concreted nodules	
150	20		S:EW-12N						@ 21': Scattered white concretions ring hole, local loose pockets due to subhorizontal shear zone; 2-3" above contact, discontinuous polished surfaces	
			C:N30E 10NW					SM	@ 21.2': Contact with silty to clayey SANDSTONE; moist, dense, blue-gray, with red clayey ribbons at contact, fine grained	
145	25								- coarsens from fine to medium grained through 29'	
140	30									

SAMPLE TYPES:

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- G GRAB SAMPLE
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TYPE OF TESTS:

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GEOTECHNICAL BORING LOG LB-11

Date 6-18-03 **Sheet** 2 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By BJO; Sampled By BJO)	Type of Tests
140	30			R-2	15	114.1	6.3	SM	@ 30': Sample is: Light gray SANDSTONE; slightly moist, medium dense; minor silt; generally fine grained; diffuse orange staining; friable	
									@ 32': 1" to 6" thick layer of red to brown clay and concretions, continuous around hole, pinches and swells, no clear orientation	
135	35								@ 34.1'-35': Concreted SILTSTONE continuous around hole; undulatory, with discontinuous red-orange clayey ribbons at base; local blueish SAND below	
130	40								- SANDSTONE continues, generally massive light gray, fine to medium grained, moist though 44'	
			C:EW-5N S:NS 5-10W					ML	@ 44': Gray-brown clayey SILTSTONE; slightly moist, very stiff; discontinuous but planar, poorly developed shear surfaces in upper 3" below contact	
125	45			R-3	20(11")	112.0	18.1	SC	@ 46': Sample is similar to above, with fine SAND	
120	50							SM	@ 50': Grades to very fine grained silty SANDSTONE, slightly moist, dense to very dense, scattered red-brown claystone, caliche (?) pockets, and cemented siltstone clasts through 55'	
115	55							CL	@ 55'-57': Grades fine to medium grained red-brown CLAYSTONE	
			GB:N30-40W 3-5NE						@ 57': Generalized bedding on thin, nearly continuous red sandy clay lamination	
110	60									

SAMPLE TYPES:

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TYPE OF TESTS:

- DS DIRECT SHEAR
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GEOTECHNICAL BORING LOG LB-11

Date 6-18-03 **Sheet** 3 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
110	60			R-4	30(10")	103.2	11.5	SM	@ 60': Minor seepage through 63' @ 60': Sample is: Light brownish gray SANDSTONE; moist, very dense	
			B:N-45E, 16NW						@ 63': 1' thick concreted gray-brown SILTSTONE bed, intact unsheared; wet above; clear upper contact, iron stained	
105	65							CL	@ 68': 4 to 6" thick, semi-continuous light brown concreted SILTSTONE/CLAYSTONE, local pink coloration @ 69': Gray-brown CLAYSTONE bed, similar to above	
100	70		B:N4E, SW 5W	R-5	30(10")	120.0	13.2	SM	@ 70': Sample is: Light blue-gray SANDSTONE; slightly moist, very dense; fine grained with minor silt	
95	75								@ 78': Northwest dipping contact, dips 6" across hole, unsheared, minor seepage from blue-gray sandstone above	
			C:N20-40E					CL	@ 78.5': Brownish gray silty CLAYSTONE, slightly moist, very stiff to hard; generally homogeneous and massive, with scattered gravel-sized concreted nodules	
90	80			R-6	30(11")	112.3	19.0	CL	@ 80': Sample is similar to above	
								SC	@ 84': Blue-gray SANDSTONE bed; very stiff to hard material, interbedded blue-gray clayey SANDSTONES, dry to slightly moist, very dense to hard; locally cemented; and brown clayey SILTSTONES, dry to slightly moist, very stiff	
85	85									
80	90			R-7	25(10")	114.8	16.1	SC	@ 90': Sample is: Gray clayey SANDSTONE, slightly moist, very stiff; finely micaceous; sand is very fine grained	

SAMPLE TYPES:

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TYPE OF TESTS:

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GEOTECHNICAL BORING LOG LB-11

Date 6-18-03 **Sheet** 4 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 170' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
80	90								**Logged By** BJO **Sampled By** BJO	
									Total Depth = 90 Feet Downhole Logged to 88 Feet Minor seepage at 60 to 63 feet and at 78 feet Backfilled and tamped with native and bentonite on 6/18/03	
75	95									
70	100									
65	105									
60	110									
55	115									
50	120									

SAMPLE TYPES:

- S SPLIT SPOON
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- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
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- CN CONSOLIDATION
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-12

Date 6-19-03 **Sheet** 1 of 2

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 187' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
187	0							SM	QUATERNARY TERRACE DEPOSITS (Qt) @ 0': Orange-brown sandy SILT and silty SAND, dry to slightly moist, medium dense; fine to locally medium grained	
185										
	5								@ 5': 1/2" diameter, solitary, root @ 5-14': Subvertical sand filled veins, narrow and pinch out with depth; infilling is light brown, friable, fine- to medium-grained SAND; locally roots along plane	
180										
	10			R-1	9	117.7	9.4	SM	@ 10': Sample is: Orange-brown silty SAND; slightly moist, dense; fine to medium grained	
175										
									- grades to medium grained through 14'	
	15								@ 15': Contact with fine-grained material	
170			C:Horizontal							
	20		J:N5E, 90	R-2	11	111.3	8.5	SM	@ 19-20': Scattered coarse to very coarse grains, rare fine gravel; root-lined joint, no offset @ 20': Sample similar to above @ 20'-23': Thin, generally horizontal beds of fine grained silty and coarse grained material; rare subangular gravel	
165										
								SM	TERTIARY SANTIAGO FORMATION (Tsa) @ 23.2': Horizontal contact with light orange-gray silty SANDSTONE, slightly moist, dense; fine grained, friable; abundant threads of black mottling though 24	
	25		C:N50-70W, 5-15NE					ML SM	@ 24.5': Gray-brown clayey SILTSTONE; slightly moist; soft to medium stiff; weathered; abundant dark brown mottling irregular, northwest dipping contact @ 25.5': Contact with light gray to white SANDSTONE, dry, dense; fine to very fine grained; minor stiff @ 27'-28': Bands of colored stains ring hole, generally horizontal brown, yellow, red-gray silty to clayey SANDSTONE	
160										
157	30									

SAMPLE TYPES:

- S SPLIT SPOON
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- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-12

Date 6-19-03 **Sheet** 2 **of** 2

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 187' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
155	30		C:5-15W, 7SW	R-3	12	111.1	5.2	SM	@ 31': Sample is: Light yellow-gray SANDSTONE; dry to slightly moist, dense; fine grained with minor silt; friable; coarsens downward through 32'	
									@ 32'-38': Gray-brown silty CLAYSTONE to fine sandy SILTSTONE; slightly moist, very stiff; very finely micaceous and siltier with depth	
	35							CL	@ 35': Irregular cemented yellow-brown CLAYSTONE; continuous around hole	
150									@ 35'-37': Scattered cemented nodules	
	40		S:N62E, 24NW B:N69E, 18NW						@ 39': Yellow-brown CLAYSTONE bed; discontinuous but planar polished surfaces, very minor discontinuous shears along; upper contact	
								SM	@ 40.5': Light blue-gray silty SANDSTONE; slightly moist, very dense; very fine grained	
145				R-4	20(11")	122.3	10.5	SM		
	45								@ 43,5': Semi-continuous, reddish clayey sandy SILTSTONE layer, 1" thick	
									@ 44': Concreted SANDSTONE, 3-4" thick, discontinuous	
									@ 46': Sample is: Gray to light gray silty SANDSTONE; slightly moist; very dense; very fine grained; friable to weakly cemented	
140				R-5	(20(11")	120.7	11.5	SM	Total Depth = 46 Feet	
									Downhole logged to 44 feet	
									No ground water encountered at time of drilling	
									Backfilled and tamped with native and bentonite on 6/19/03	
	50									
135										
	55									
130										
	60									

SAMPLE TYPES:

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TYPE OF TESTS:

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GEOTECHNICAL BORING LOG LB-13

Date 6-23-03 **Sheet** 1 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 172' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
170	0								QUATERNARY TERRACE DEPOSITS (Qt) @ 0-2': Light brown sandy SILT; dry, loose; very friable; scattered roots through 3' @ 2'-6.5': Orange-brown silty SAND; dry to slightly moist, dense, generally fine grained; weakly cemented	
	5							SM	- scattered subrounded gravel along basal contact TERTIARY SANTIAGO FORMATION (Tsa) @ 6.5': Very light gray to light orange-gray silty SANDSTONE, dry, medium dense; friable to locally cemented; generally coarsens downward, fine to medium grained through 11'	
165			C:Horizontal GB:N5-8E, 10-15NW J:N70E, 90						@ 8': Generalized bedding along medium grained SAND layer 1/2-1" thick	
	10			R-1	7	111.6	9.6	SM CL/ML	@ 10': Sample is: Light orange-gray to yellow-gray silty SANDSTONE; slightly moist; medium dense to dense; fine grained; weakly cemented; tight red-orange stained joint surfaces @ 11': Scoured, irregular, but generally northwest dipping contact with gray-brown SILTSTONE to CLAYSTONE; slightly moist, stiff; weathered; abundant dark brown and black streaks/staining; stiffens/less fractured through 14 feet	
160										
	15		JN83E, 77S							
155			C:N20-50E, 7-8NW						@ 17'-17.5': Generally northwest dipping concreted CLAYSTONE, 4"-6" thick, generalized contact	
			S:N10E, 20-35W J:N41W, 72NE						@ 18.5': Discontinuous shear, steepens and dies out to the north	
	20			R-2	8(10")	121.9	9.2	SM	@ 19.5': Short, tight, brown/root-lined joint @ 20': Grades to blue-gray silty SANDSTONE, slightly moist, dense to very dense; very fine grained; local northwest dipping, disc. red-orange band below contact	
150										
			GB:N20-30E, 5-7NW						@ 23': Generalized bedding on red and orange stained, fine to medium grained SANDSTONE, attitude on upper contact	
	25									
145										
	30									

SAMPLE TYPES:

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- R RING SAMPLE
- B BULK SAMPLE
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- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-13

Date 6-23-03 **Sheet** 2 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 172' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By BJO; Sampled By BJO)	Type of Tests
140	30			R-3	20(7")	119.2	4.4	SM	@ 30': Sample is: Generally similar to above; cemented in sampler tip, with local white powder (caliche?) @ 30.5'-31.5': Irregular, concretion, generally 1" thick, orange stained medium grained SANDSTONE above, clayey SILTSTONE below @ 30.5-36.5': Weakly to moderately cemented light gray, sandy SILTSTONE to silty SANDSTONE, dry, very dense/stiff to hard	
135	35									
			GB:N35E, 8NW					ML	@ 37': Gradational contact with gray-brown to gray sandy to clayey SILTSTONE, slightly moist, very stiff; micaceous @ 38.1'-40': Micaceous sandy laminations, clearly traceable around hole, dips to the northwest	
130	40			R-4	20	126.2	6.8	SM	@ 40': Light gray SANDSTONE; slightly moist, dense to very dense; fine grained, grades to medium with scattered coarse and very coarse grains through 41'; moist material at 41-43', scattered claystone rip-ups	
								CL	@ 41.2'-43.3': Very irregular, extremely scoured contact with brown; very stiff to hard; clayey SILTSTONE to silty CLAYSTONE at top, slightly moist, blue-gray SANDSTONE to SILTSTONE, slightly moist, dense; very fine grained; local red-brown staining	
125	45		C:N20-40E, 10NW	R-5	21	112.7	16.3	ML SM	@ 46': Sample is similar to above @ 47': Contact with light gray silty SANDSTONE, slightly moist, dense; very fine grained; generally friable; very minor, very discontinuous yellow-brown CLAYSTONE laminations along upper contact	
120	50								@ 49': Lenticular concreted SILTSTONE; fractured, with local pink coloration	
115	55								@ 57'-58': Concretion nodule; sand is fine to medium grained below	
	60								@ 59.5': Dark red to orange, moist, medium grained SAND along contact	

SAMPLE TYPES:

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- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
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GEOTECHNICAL BORING LOG LB-13

Date 6-23-03 **Sheet** 3 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 172' **Location**

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							**Logged By** BJO **Sampled By** BJO	
110	60			R-6	30(11")	120.5	14.0	SM	@ 60': Cemented contact, undulatory, gently west dipping @ 61': Sample is: Light gray silty SANDSTONE; slightly moist, very dense; very fine grained to fine grained; micaceous; diffuse blue-gray interbeds @ 62.5': Thin red-orange-lined contact, micaceous laminations in gray sandy SILTSTONE to silty SANDSTONE through 63'	
105	65								@ 65': Grades to SANDSTONE, gray to light blue-gray, moist, very dense; very weak weeping seepage at 68' to 77'	
	70		B:N15E, 7-8NW	R-7	27	121.4	13.1	SM	@ 68.3': Thin brown clayey SILT lamination, planar; unpolished; continuous; local concretions, weak weeping seepage continues @ 70': Sample is: Light gray SANDSTONE; moist, very dense; fine grained with minor silt and medium grained material; friable	
100										
95	75								@ 76'-78': Scattered CLAYSTONE rip-ups	
			S:N54E, 6NW					CL/ML	@ 77.7'-78': Slightly undulatory, cemented, unsheared contact, local red staining; below is brownish-gray SILTSTONE, slightly moist, very stiff	
90	80		S:N18W, 5SW S:N36E, 4NW	R-8	28	109.8	20.2	CL	@ 78.2'-78.6': Upper, planar contact with 3-4" thick shear zone, local; yellow-brown concreted CLAYSTONE rolled into silt and clay; moist, soft to locally stiff @ 78.9': Zone exists hole, planar lower contact @ 80': Sample is: Brownish gray to brown silty CLAYSTONE; slightly moist, very stiff @ 81'-82': Scattered cemented nodules	
85	85							ML	@ 87': Grades to gray sandy SILTSTONE, slightly moist, very stiff; scattered very fine SAND and mica	
	90									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-13

Date 6-23-03 **Sheet** 4 **of** 4

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 172' **Location**

Logged By BJO

Sampled By BJO

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	90			R-9	25(10")	120.3	12.5	ML/SM	@ 89.5'-90': White and red-orange and blue-gray bands ring hole, very shallow northwest dip @ 90': Sample is: Gray sandy SILTSTONE to silty SANDSTONE, slightly moist, very stiff/very dense; very fine grained; weak to moderate cementation; finely micaceous	
80										
	95								- very minor seepage at 94-97'	
75										
								CL	@ 97.6': Contact: yellow-brown CLAYSTONE laminations along surface, continuous around hole @ 100': Sample is: Light brownish gray silty CLAYSTONE to clayey SILTSTONE, dry to slightly moist, very stiff; scattered very fine SAND, including mica	
	100			R-10B R-10A	24	107.2 113.2	20.7 19.0	CL-ML SM		
			C:N80E, 3-4N						@ 101': Light gray SANDSTONE, dry to slightly moist, very dense; generally fine grained, friable with local concreted pockets; massive	
70										
	105									
65										
	110			R-11	25(10")	119.2	5.4	SM	@ 110': Sample is similar to above	
60			GB:N70-80E, 3-5N						@ 112': Generalized attitude on medium grained diffuse, sand lamination	
									@ 114': End downhole log	
	115								- similar to total depth	
55									Total Depth = 117 Feet Downhole logged to 114 feet Light weeping seepage at 55 to 77 feet and 94 to 97 feet Backfilled and tamped with native and bentonite on 6/24/03	
	120									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-14

Date 6-25-03 **Sheet** 1 **of** 1

Project Weese Family Trust - Oceanside **Project No.** 040963-001

Drilling Co. Larive **Type of Rig** Bucket Auger

Hole Diameter 30" **Drive Weight** 3500#@0-28'; 2500#@28-55'; 1300#@55-85'; 1800#@85-100' **Drop** 12"

Elevation Top of Hole 65' **Location**

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By BJO/RKW; Sampled By BJO)	Type of Tests
65	0							CL	QUATERNARY LANDSLIDE DEPOSITS (Qls) @ 0-6': Topsoil consisting of brown silty generally subvertical CLAY; moist, medium stiff; scattered sand and very fine gravel; caliche threads; roots in upper 12"	
60	5			R-1	2	107.3	19.6	CL	@ 5': Sample is: similar to above	
									@ 6.5'-8': Gradational moderately northwest dipping contact with lighter color, sandier material @ 7'-16.5': Generally disturbed beds, pockets, and packages of light brown sandy to silty CLAY, moist, soft, and light gray to light gray-brown, clayey to silty SAND, moist, loose to medium dense; rare dark brown pods of soil-like silty clay (krotovina?)	
55	10			R-2	1	105.9	17.9	CL/SC	@ 10': Sample is: Light brown sandy silty CLAY; moist, soft to medium stiff; darker brown laminations, possible remnant bedding, dips 40-50 degrees; local caliche threads and pockets; mottled coloration	
			S:N73E, 33N						@ 13.7': Undulatory, subhorizontal with contact with 2-8" thick layer of dark brown silty CLAY, moist, soft; local shearing within light brown, clay above, very soft material above and below	
50	15							SM	@ 16.5'-18': Contact, irregular and gradational with light gray-brown silty SAND, moist, loose; fine grained; massive; loose material continues to total depth	
			C:N70-80E, 30-35S						@ 20': Sample is: Light gray-brown to light gray SAND, moist, loose to locally medium dense; friable	
45	20			R-3	2	114.0	12.1	SM	Total Depth = 20 Feet Downhole logged to 18 feet No ground water encountered at time of drilling Backfilled and tamped with native soil on 6/25/03	
40	25									
35	30									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

Appendix B (continued)

CPT-1 through CPT-7

Cone Penetration Test Soundings

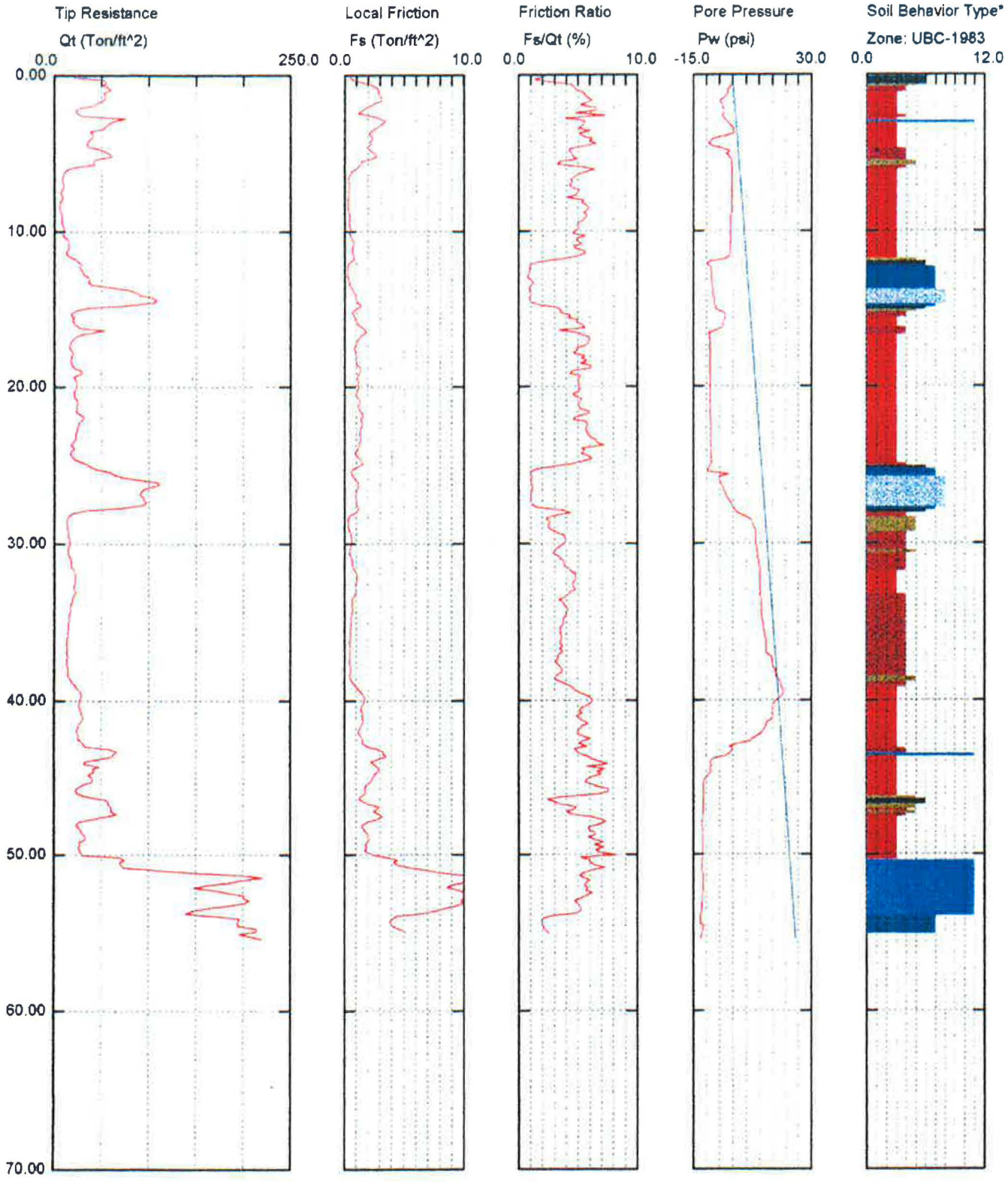
From:

Current Investigation

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT199
Cone Used: 510

CPT Date/Time: 08-04-03 08:01
Location: CPT-01
Job Number: WEESE

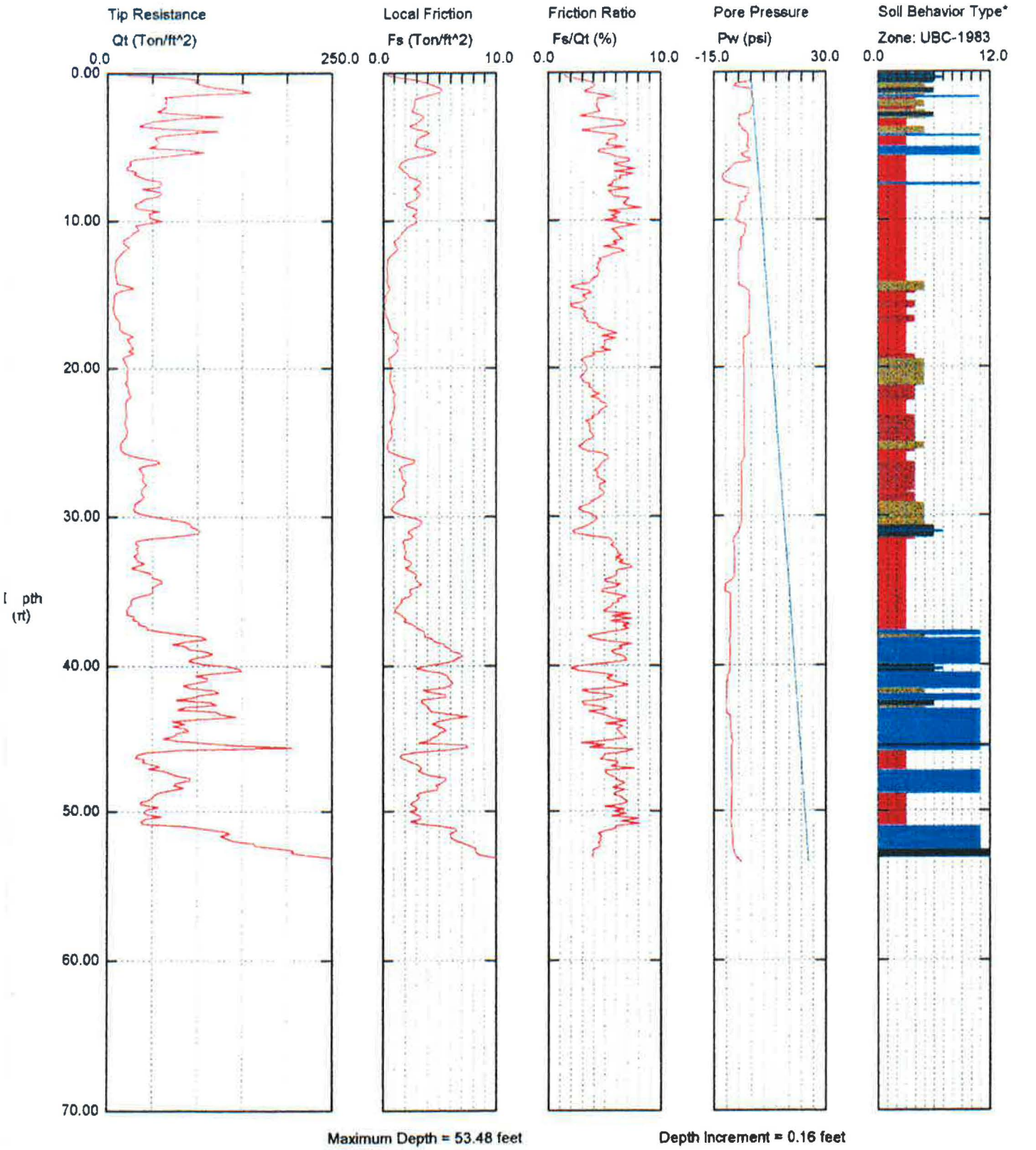


Behavior type and SPT based on data from UBC-1983

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT200
Cone Used: 510

CPT Date/Time: 08-04-03 09:03
Location: CPT-02
Job Number: WEESE



Maximum Depth = 53.48 feet

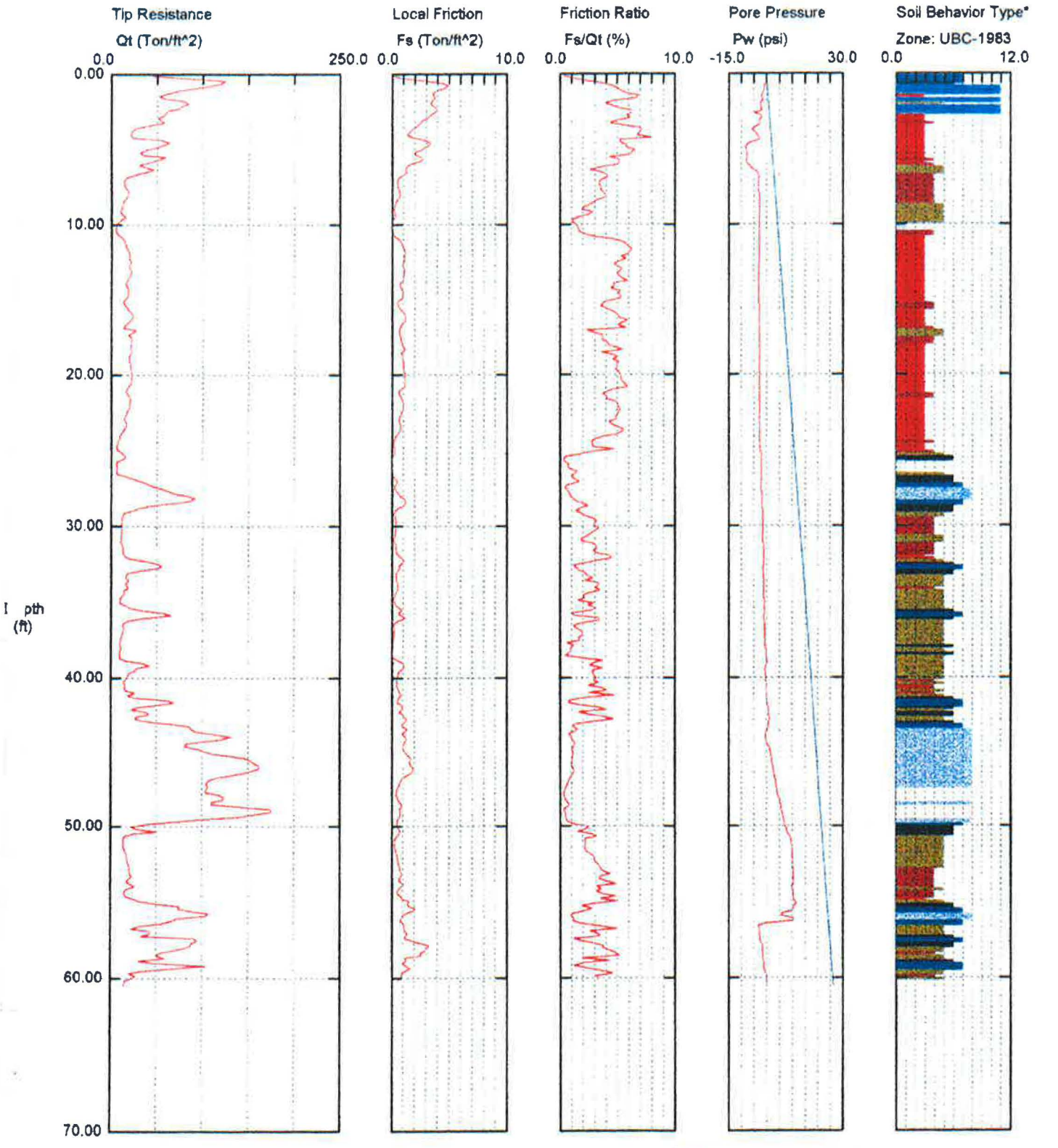
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT201
Cone Used: 510

CPT Date/Time: 08-04-03 10:02
Location: CPT-03
Job Number: WEESE



Maximum Depth = 60.53 feet

Depth Increment = 0.16 feet

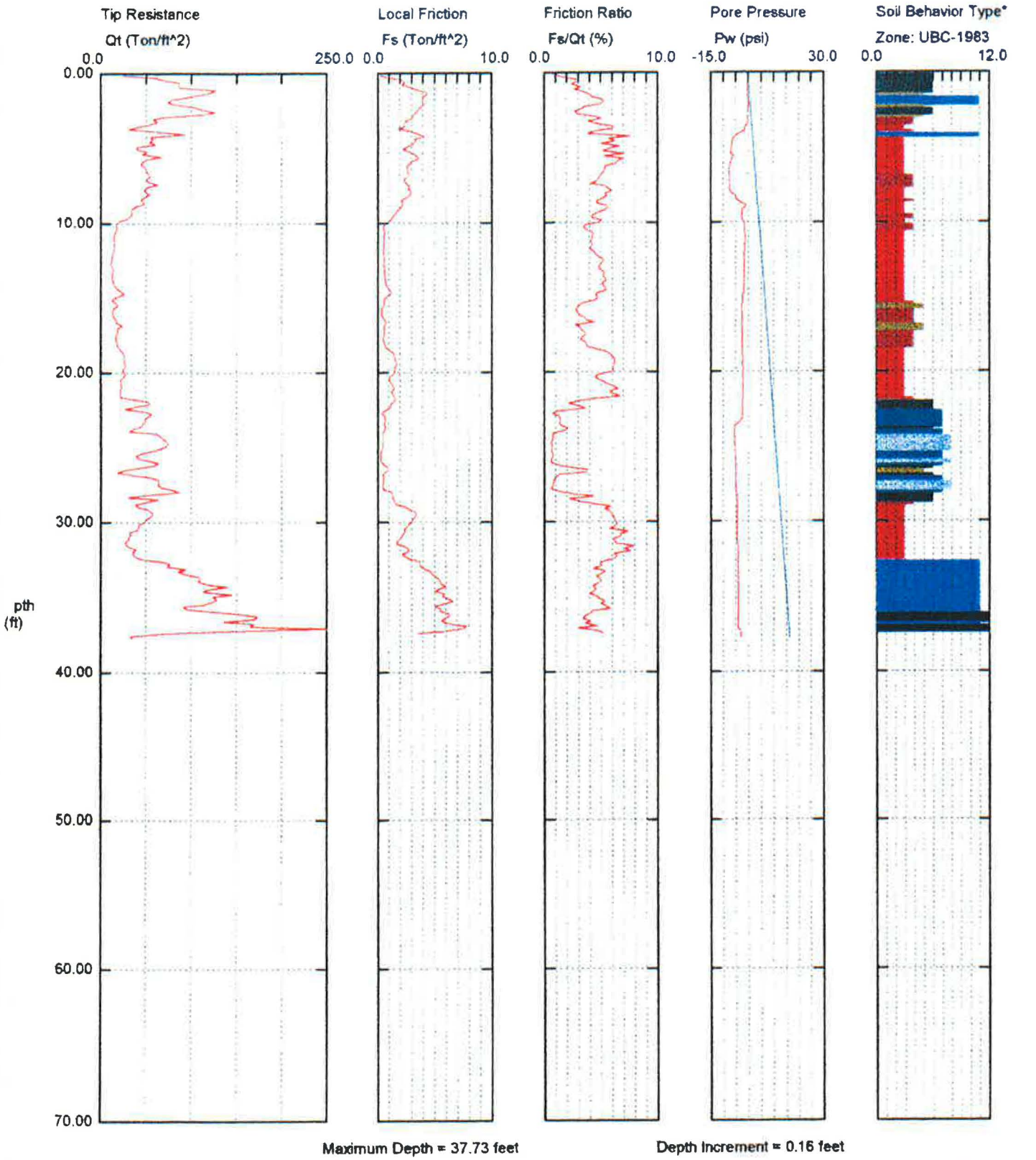
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Behavior type and SPT based on data from UBC-1983

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT202
Cone Used: 510

CPT Date/Time: 08-04-03 11:28
Location: CPT-04
Job Number: WEESE



Maximum Depth = 37.73 feet

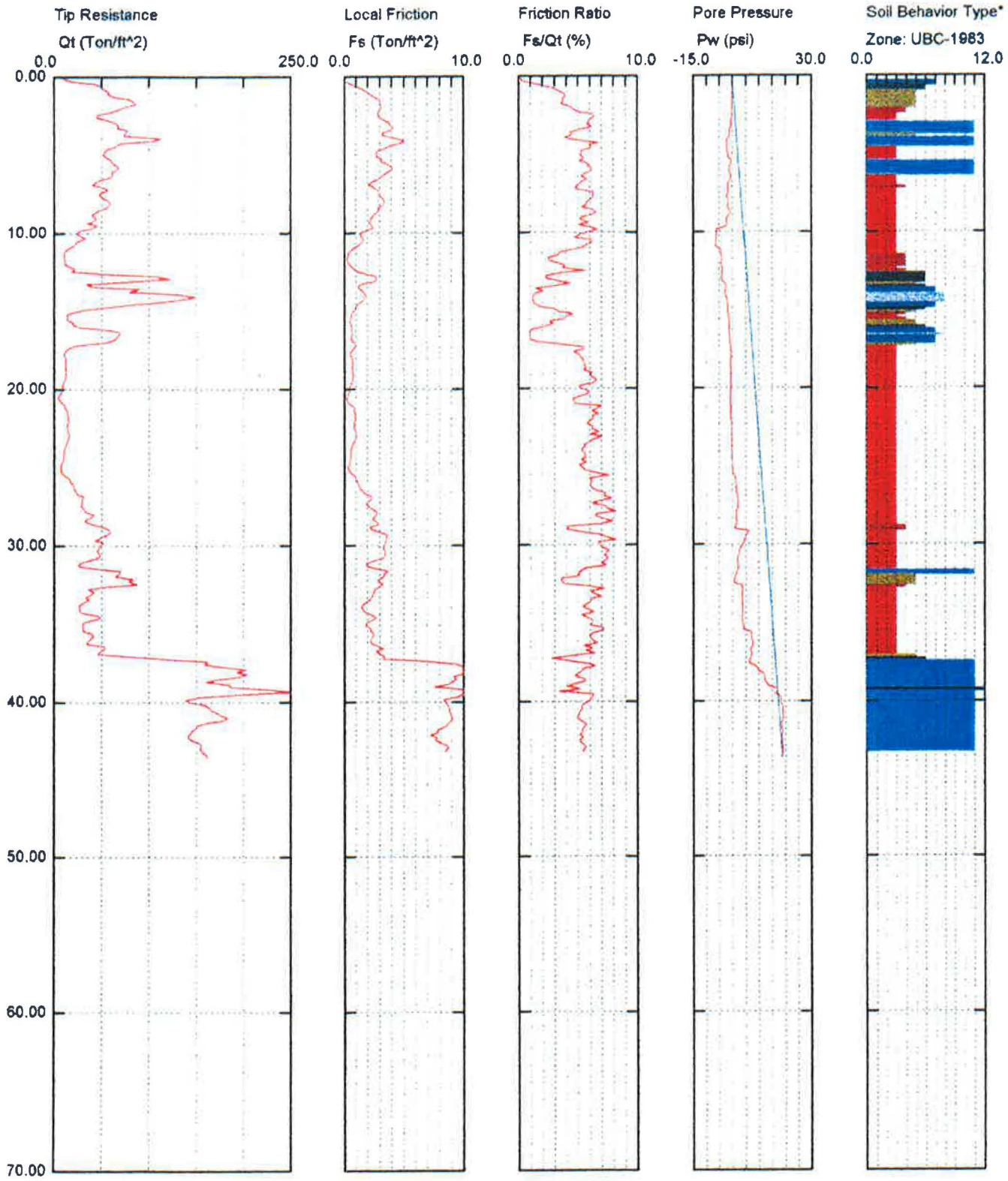
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT203
Cone Used: 510

CPT Date/Time: 08-04-03 11:55
Location: CPT-05
Job Number: WEESE



Maximum Depth = 43.64 feet

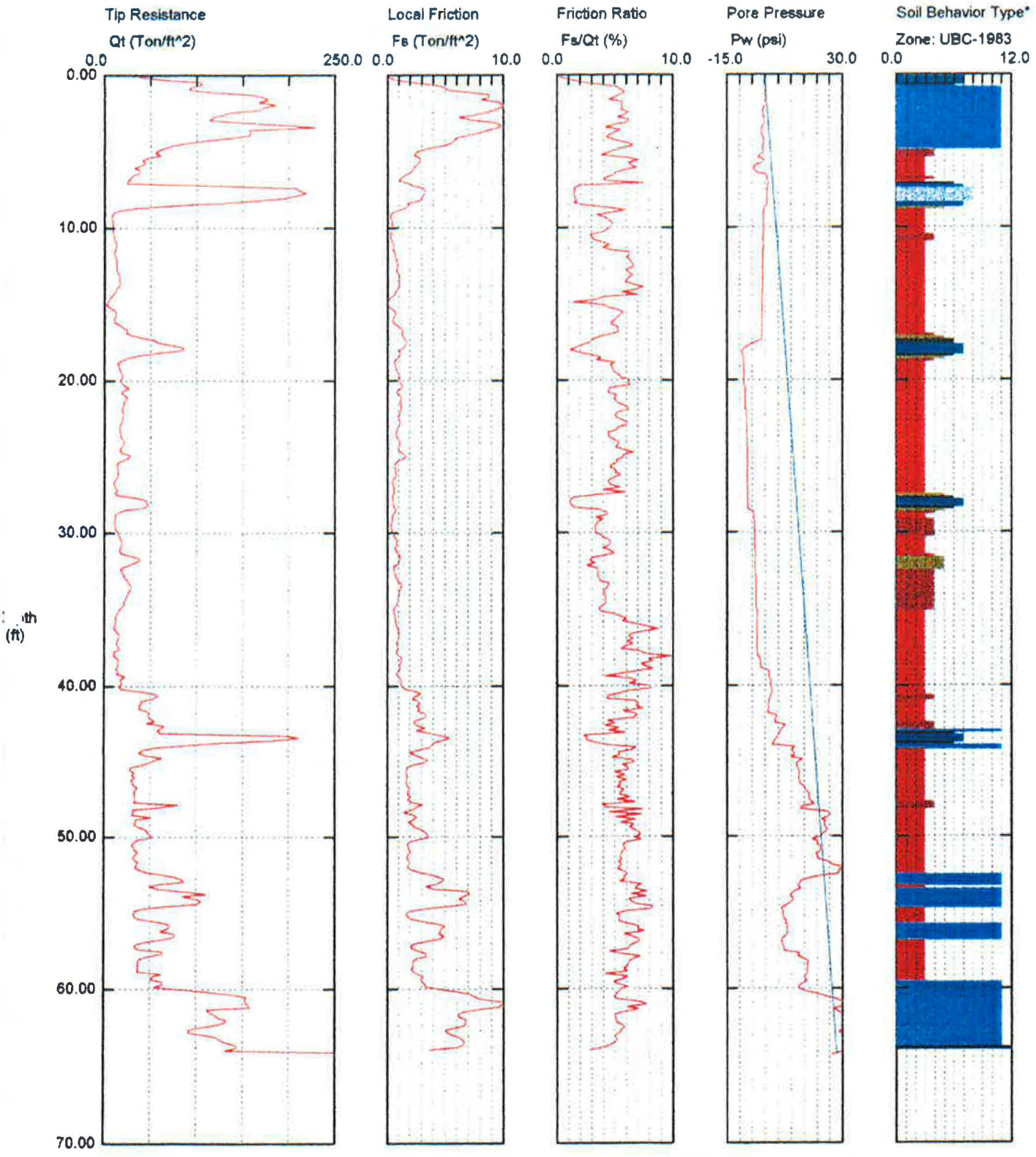
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT204
Cone Used: 510

CPT Date/Time: 08-04-03 12:53
Location: CPT-06
Job Number: WEESE



Maximum Depth = 64.30 feet

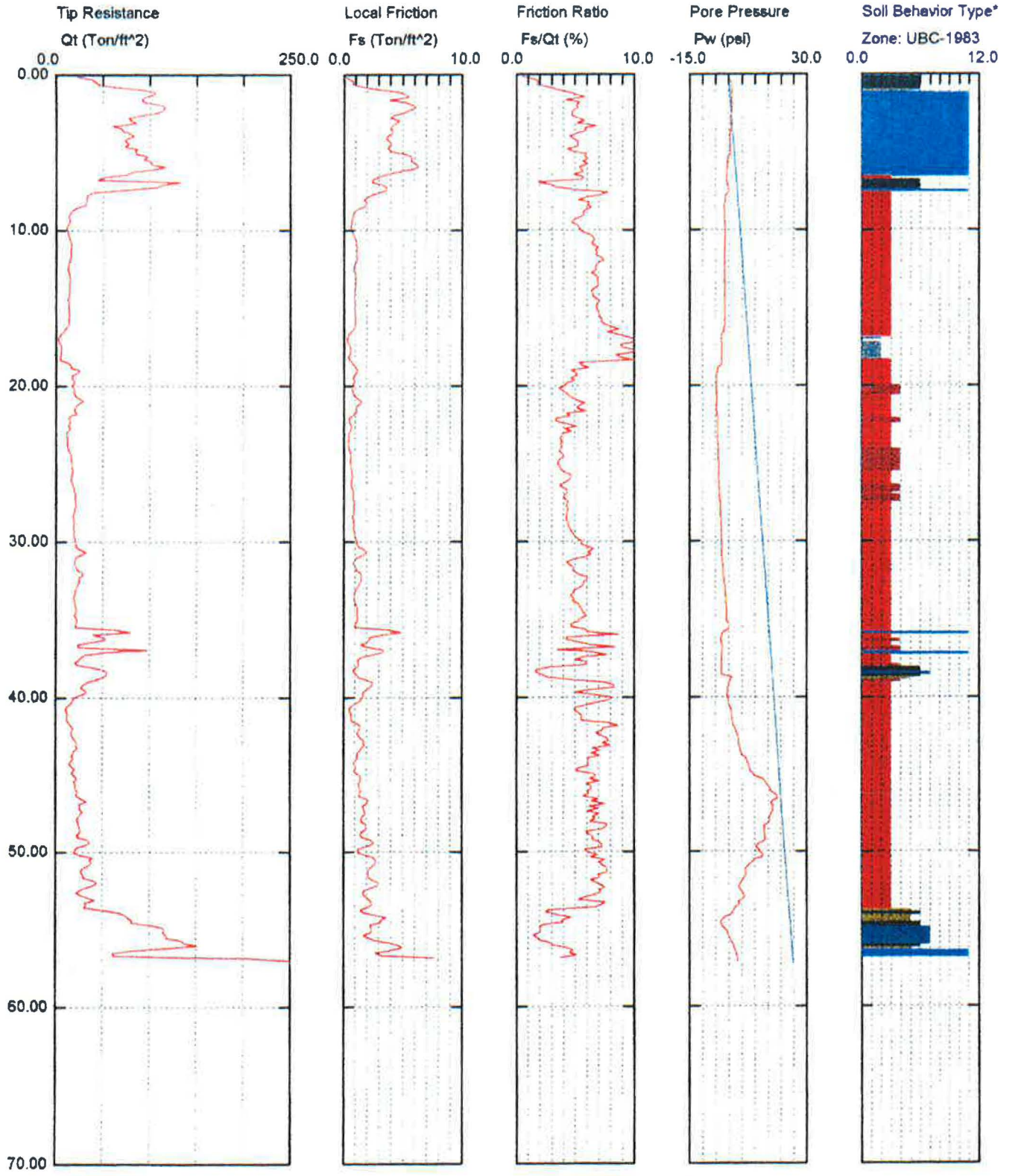
Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

WEST HAZMAT DRILLING CORP.

Operator: B. BUCKNAM
Sounding: CPT205
Cone Used: 510

CPT Date/Time: 08-04-03 14:08
Location: CPT-07
Job Number: WEESE



Maximum Depth = 57.25 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Appendix C

LB-1 through LB-7

Large-Diameter Borings

From:

Leighton and Associates, 1985a

GEOTECHNICAL BORING LOG

DATE 4/18/85 DRILL HOLE NO. LB-1 SHEET 1 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700lbs to 27', 2600lbs to 55', 1400lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±143 REF. OR DATUM Mean Sea Level

LOGGED BY MRS/SJ

SAMPLED BY MRS

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							CL	Topsoil: Dark brown, damp, soft, silty clay; very fractured, abundant rootlets.
		C: gradational					CL	Santiago Formation: Dark greenish brown, damp, stiff, claystone; very fractured, calcium carbonate filled fractures upto 2" thick.
		calcium carbonate filled fractures						
5		B: EW 12-14 N						@6', 2" layer of greenish brown, damp, hard, sandy claystone.
		claystone open fracture	①				SM	White to light gray, damp, dense, silty sandstone; minor calcium carbonate filled fractures, moderately weathered, minor roots. @7½', 1" discontinuous layer of pinkish brown sandy clay with minor roots. @8', ¼ to ⅜" open fracture, near vertical, discontinuous.
		C: horizontal						
10		striation: EW 65N					CL	Brown, very stiff, claystone; zone of red oxidation staining, 2" above sharp contact, approximately 1½" thick. @11', Striated claystone, some minor red oxidization staining.
		B: EW 5N						
15			②	6/10"	113.4	16.9	CL	@14', cemented 1½" to 2" thick bed. @14½', medium brown, damp, hard, claystone;
		striation: EW 50N	③				SM/SC	Medium brown, damp, dense, clayey to silty sandstone; striated fracture surface, some claystone chunks.
		claystone						
		Fault F: N45E 50NW						@19' to 22½', Fault, slickensided surface @ 20', minor apparent offset.
20							SM	@21', Gray, damp, dense, silty coarse sandstone
		C: gradational						@23', Light to medium gray, damp, dense, silty fine sandstone
			④					@25', Coarse grained small concretion.
25								@26', slightly lighter gray, some red oxidation staining.
							CL	@27', brown to light greenish brown, damp, hard, siltstone to claystone; ≈1' thick
		CS: N55E 5-8 NW	⑤				CH	@27½' Remolded clayseam, continuous, dark chocolate brown, moist, soft, clay; sheared.
							SC	@28', medium brown, damp, dense, clayey sandstone.
30								@29½', concretionary layer, 2" thick

GEOTECHNICAL BORING LOG

DATE 4/18/85 DRILL HOLE NO. LB-1 SHEET 2 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±143 REF. OR DATUM Mean Sea Level

LOGGED BY MRS/SJ

SAMPLED BY MRS

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			2	20/9"	121.8	11.7	SM	Santiago Formation: White to light gray, damp, very dense, sandstone; with minor cemented layers.
		C: gradational						@32', silty to slightly clayey sandstone.
								@34', light gray, damp, very dense, silty sandstone; massive, minor red oxidation staining.
35								
								@39', minor discontinuous claystone layers.
40			(6)					
		C: horizontal and sharp					SC	Brown, damp, dense, slightly clayey sandstone; some red oxidation staining above contact, very cemented along contact.
		B: N10E 15N					SM	Grayish brown, silty fine sandstone; sharp contact.
45			3a&b	20	117.4	7.0		@45', coarser, very dense, sandstone.
								@47', finer, very dense, sandstone.
								@48', red oxidation stain, 3" to 4" wide.
50								
								@51', 2" thick cemented layer.
			(7)					@52', brown, damp, very dense, silty fine sandstone; slightly clayey.
								@53', light gray, damp, very dense, silty sandstone.
55								@55', medium gray.
			4	40/10"	122.2	9.3		Total Depth = 60' Geologically logged to 57' Dry at time of drilling Backfilled 4/18/85
60								

GEOTECHNICAL BORING LOG

DATE 4/18/85 DRILL HOLE NO. LB-2 SHEET 1 OF 3

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±84' REF. OR DATUM Mean Sea Level

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								LOGGED BY SJ/RH SAMPLED BY RI/RH
0		B: N40W 8N C: gradational					SM	Santiago Formation: Off-white, damp, dense, silty fine sandstone; root zone to 4½', lower part has red oxidation staining.
							CL	Dark gray, damp, hard, claystone; very fractured, blocky, blebs of calcium carbonate upto 1" thick.
5								@6', red clay clasts upto 3" long, hard, ductile.
		C: gradational					ML	@7½', white, damp, hard, very clayey fine sandy siltstone.
							CL	@8', dark olive brown, claystone; ~2' thick
10		C: N55E 0-10N					SM/SC	White, damp, very dense, silty fine to medium sandstone; upper ½" red oxidized staining.
			①					@14', blebs of reddish material, becomes clayey.
15		C: N60E B: 4-10N	1	8	123.9	12.9		@16' discontinuous clay seam.
								@18', cemented layer, 1" thick.
20		B: N60E 10N						@21', coarser sandstone, with rip-up clasts of dark olive claystone.
								@23', red oxidized stained zone, ½" thick.
							CL	@24', dark olive brown, hard, claystone; blebs of calcium carbonate upto 2" thick.
25		B: undulating 5-20N C: undulating C: N40E 10-15					SM/SC	@26', white, damp, very dense, silty sandstone; becomes clayey at contact.
			②					@29', discontinuous clay seam; ½" to 1½" interbeds.
30								

GEOTECHNICAL BORING LOG

DATE 4/18/85 DRILL HOLE NO. LB-2 SHEET 2 OF 3

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±84' REF. OR DATUM Mean Sea Level

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								LOGGED BY SJ/RH SAMPLED BY RI/RH
30			2	14	110.9	16.8	SM	Santiago Formation: White to gray, damp, very dense, silty fine to medium sandstone, massive.
								@30', semi-cemented zone.
							SM/CL	@30½', brown to gray interbedded sandstone, siltstone, and claystone; 2½' thick
								@34', oxidation staining.
35								
								@37', becomes coarser sandstone.
								@39', slightly cemented zone.
40		C: abrupt & gradational N45E 6NW B: N40E 8NW						
			③					@42½', oxidation staining, continuous around boring.
45			3	11	114.8	17.5		@45', increasing silt and clay content, sand slightly coarser.
								@46', becomes finer grained.
								@48', 6" thick cemented zone.
50		C: N45E 8-10NW						
		CS: N5 65W					CL	Brown, moist, hard, sandy claystone.
		C: gradational						@53' Discontinuous, bentonitic appearing, high angle clay seam.
55							SC	Off-white, moist, very dense, clayey sandstone
		C: gradational					SM	@57½', gray to off-white, dense, silty sandstone; massive no apparent bedding surfaces.
60		C: undulating generally dips to NW						

GEOTECHNICAL BORING LOG

DATE 4/18/85 DRILL HOLE NO. LB-2 SHEET 3 OF 3

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±84' REF. OR DATUM Mean Sea Level

DEPTH FEET	GRAPHIC LOG	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION LOGGED BY SJ/RH SAMPLED BY RI/RH
60			4	35			CL	Santiago Formation: Dark olive gray, damp, very stiff to hard, claystone; massive, concoidal fractures, occasional manganese oxide staining developed on fractures.
							SM	Off-white to light gray, moist to wet, very dense, silty sandstone.
		F: vertical						@64', large open fractures, wet
65						♀		@66', rapid groundwater seepage from open fractures upto 6" wide.
		C: N60E 14NW						@67½', continuous brecciated zone
70							CL	Dark olive gray, damp, hard claystone.
			5	38				
								Total Depth = 73' Geologically logged to 71' Seepage at 66' Backfilled 4/19/85
75								
80								
85								
90								

GEOTECHNICAL BORING LOG

DATE 4/19/85 DRILL HOLE NO. LB-3 SHEET 1 OF 3

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larvie TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±94' REF. OR DATUM Mean Sea Level

LOGGED BY RH/SJ

SAMPLED BY RH

Depth Feet	Graphic Log (W E)	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density PCF	Moisture Content, %	Soil Class. (U.S.C.S.)	Geotechnical Description
0			①				SM	Santiago Formation: Gray to white, damp, dense, silty fine sandstone; weathered
		c: N70E 14NW to undulating	②				CL/SM	Dark gray, damp, hard, claystone; red oxidized interbedded cemented silty sand
5		c: gradational						
		F: N30E 75NW					ML/CL	Gray, damp, very dense, slightly sandy siltstone to claystone; with irregular, discontinuous red oxidized stained seams upto ½" thick, some steeply dipping to the west, upto 16" long.
							SM	@8', cemented zone of pink fine sandstone, discontinuous, calcium carbonate filled fracture.
10		c: gradational					CL	@10', dark olive gray, very stiff claystone; 1' thick.
							ML	@11', siltstone becomes friable.
		c: gradational					SM	@12½', white fine sandstone.
15		c: N35E 15NW to undulating	1	8	127.3	7.8	CL	@15', pink stained zone. Dark gray to brown, damp, hard, silty claystone.
		c: undulating					CL/ML	@19', Zone of red claystone and siltstone; ½" thick.
20		B: EW 8-12N					SM/CL	@19', Interbedded sandstone and claystone.
		B: N5E 5NW						
		c: undulating					CL	@22', brown claystone layer; 1" thick.
		c: generally horizontal					SM	@23', white silty sandstone; massive.
25		c: abrupt & gradational					CL	@25½', dark brown claystone; 2" thick.
							ML	@26', dark gray, siltstone; micaceous, 6" thick.
							CL	@28', cemented sandy clay; 1' thick.
							SM	@29', white sandstone; well cemented.
30								

GEOTECHNICAL BORING LOG

DATE 4/19/85 DRILL HOLE No. LB-3 SHEET 2 OF 3

PROJECT Weese Property PROJECT No. 4850512-01

DRILLING Co. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±94 REF. OR DATUM Mean Sea Level

LOGGED BY RH/SJ

SAMPLED BY RH

DEPTH FEET	GRAPHIC LOG (W–E)	ATTITUDES	TUBE SAMPLE No.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30		C: Horizontal	2	13	112.3	19.5	CL	Santiago Formation: Dark olive brown, damp, hard, slightly silty claystone.
								@33', several blebs upto 4" of calcium carbonate.
35		C: undulating					SC	White, damp, very dense to hard, clayey sandstone; at contact zone of pink staining.
		B: N10E 8-25NW						
		B: N10W 15SW generalized						@40', clay content increases.
40		B: N20E 5NW					CL	@42' dark brown, claystone; 2" thick.
							SC	@42 1/4', sandstone becomes dark brown.
							CL	@44', thin clay seam, fracture parallel to seam filled with calcium carbonate.
45			3	20/8"	127.9	8.4	SM/ML	@45 1/2', white to gray, moist, very dense silty sandstone to sandy siltstone; slightly clayey.
								@46' becomes coarser sandstone.
		CS: N10W 45NE					SC/CL	@47', interbedded sandstone and claystone; locally claystone is crushed, 6" thick.
		B: N20E 15NW					CL	@48' gray claystone; cemented.
		C: N20E 15NW						@49' fracture, 1/16" thick, gypsum filled.
50		C: N30E 15-20NW						@50' moisture content increases to wet.
								@51 1/2', brown clay seam; 1/4" thick, along bedding.
		B: N45E 15N						
		C: N10E 5-15N					CL/SC	Interbedded dark gray to brown, silty claystone with sandstone
55							SC	White, wet, dense, silty sandstone.
		CS: N-S 40E					CL	@57', clay seam; hard, with gypsum infilling, pink staining, 6" thick.
60								

GEOTECHNICAL BORING LOG

DATE 4/19/85 DRILL HOLE NO. LB-3 SHEET 3 OF 3

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±194 REF. OR DATUM Mean Sea Level

LOGGED BY RH/SJ

SAMPLED BY RH

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60			4	40	124.2	12.2	SM	Santiago Formation: White, damp, very dense, silty fine sandstone; micaceous, cross bedding.
								@63', slight belling of the hole, becomes massive, slightly clayey.
65		C: sharp horizontal						@64½', cemented zone, 2½' thick.
						9		@66' Seepage through vertical fracture; slow.
								@66 to 67', numerous high angle, polished, clay surfaces, generally dipping north.
		C: gradational to N30E, 20NW					ML/CL	Dark brown, damp, hard, siltstone and claystone.
70								@69½', disturbed zone, 6" thick.
			5	38	117.8	15.2		Sandstone.
								Total Depth = 72' Geologically logged to 71' Seepage at 66' Backfilled 14/19/85
75								

GEOTECHNICAL BORING LOG

DATE 4/21/85 DRILL HOLE NO. LB-4 SHEET 1 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700lbs to 27', 2600 lbs to 55', 1400lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±34' REF. OR DATUM Mean Sea Level

LOGGED BY RLW

SAMPLED BY RLW

DEPTH FEET	GRAPHIC LOG (W–E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM	Alluvium: Medium gray brown, very moist, medium dense, silty fine sand; scattered clasts of dense silty sand upto 3" in diameter roots and rootlets.
		c: undulating and abrupt					CL/CH	Colluvium: Very dark brown, very moist, firm, slightly sandy clay.
		c: undulating and gradational	①					@4', high concentration of calcium carbonate blebs.
5		c: gradational					SM	Ancient Landslide: Light brown, very moist to wet, medium dense to dense, very silty fine sand; animal burrows.
		F: N55E 85SE					SM	Light gray to off-white, very moist to wet, dense, silty fine sand; highly fractured with hairline to 1/8" wide openings, fractures are steeply dipping, calcium carbonate developed along majority of fracture surfaces.
						▽		@8', very rapid groundwater seepage; several gallons per minute.
10			② 1	4	123.3	13.9		
		C: N68E 40NW					CL	Medium brown to olive green, very moist, stiff to very stiff, slightly silty clay; very disturbed, contains blebs of calcium carbonate upto 4" thick, numerous shears.
		cs: N25E 35NW	③				CL	Medium brown to olive green, wet, firm, slightly silty clay; crushed and very disturbed.
15		RS: N40E 18NW					CH	@16', Rupture Surface; continuous, very polished, 1/8" to 1/2" thick, olive green, very moist to wet, plastic clay seam.
							SM	Santiago Formation: Very light brown gray, moist to very moist, dense to very dense, silty fine sandstone.
20			2	6	117.2	15.8		
25							SM	Light gray brown, very moist to wet, dense to very dense, silty fine sandstone.
30								

GEOTECHNICAL BORING LOG

DATE 4/21/85 DRILL HOLE NO. LB-4 SHEET 2 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±34' REF. OR DATUM Mean Sea Level

DEPTH FEET	GRAPHIC LOG W E	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION LOGGED BY RLW SAMPLED BY RLW
30			④ 3	19	122.3	13.1	SM	Santiago Formation: Light gray brown, very moist to wet, dense to very dense, silty fine sandstone
							CL	Medium olive gray, moist, very stiff, silty claystone.
35							SM	Mottled olive, red, and medium brown, very moist to wet, dense to very dense, silty fine sandstone
							SM	Light gray brown, very moist to wet, dense to very dense, silty fine to medium sandstone.
40			4	29/9"	125.2	10.3		
45								
50								
55								Total Depth = 53' Geologically logged to 25' Seepage at 8' Caving below 8' Backfilled 4/21/85

GEOTECHNICAL BORING LOG

DATE 4/22/85 DRILL HOLE NO. LB-5 SHEET 1 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±108 REF. OR DATUM Mean Sea Level

LOGGED BY RLW/SJ

SAMPLED BY RLW

Depth Feet	Graphic Log (W E)	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density PCF	Moisture Content, %	Soil Class. (U.S.C.S.)	Geotechnical Description
0							SC	Topsoil: Medium brown, damp, dense, very clayey fine sand; roots and rootlets, very scattered gravel sized clasts upto 1" in diameter.
5		c: gradational					SM	Ancient Landslide: Medium orange brown, damp, dense, silty fine sand; rare cobble sized clasts upto 6" in diameter, occasional rip-up clasts of brown clayey sand upto 3" in diameter, massive, no apparent bedding surfaces.
		cs: N78E 6NW					ML	@9', dark gray, moist, firm to stiff, very silty clay seam; continuous, ± 1" thick, abundant calcium carbonate veins throughout, slightly remolded appearance, moderately laminated.
10		c: gradational	1	5	107.1	20.6		Light to medium gray, moist, firm, very fine sandy silt; slightly micaceous, moderate increase in sand content with depth.
							SM	Light to medium gray, moist, dense, very silty fine sand, @13' and 14', two discontinuous concretionary nodules.
15		cs: N80E 20NW					CL	@15.5', medium brown, moist, firm to stiff, clay seam; remolded, laminated with numerous shears and polished surfaces, underlain by 1" thick olive green silty sand, overlain by numerous discontinuous concretionary nodules.
							SM	Light gray, moist, medium dense, silty fine to medium sand; micaceous, very friable, contains high angle fractures with hairline to 1/8" wide openings.
20		F: N68E 71NW					CL	@19.5', discontinuous 1" thick lense of brown clay pods, continuous around the boring.
								@22', becomes wet.
		cs: N88W 11NE				9	CL	@23', abrupt change to ± 1" thick continuous medium brown, firm, clay seam; laminated, at base of the clay seam is a slightly polished, moderately sheared clay seam, water seepage above clay seam.
25		cs: undulating to N14W 55NE	2	5	105.4	21.4	CL	Medium brown gray, moist to wet, stiff, silty clay; moderately laminated.
		c6: N68E 2NW					SM	@25', continuous olive green clay seam; highly polished and sheared, striations are in dip direction, scattered concretionary nodules developed above clay seam, water seepage above clay seam.
		cs: undulating to N12E 19NW						@27', 1/4" to 1/2" thick medium brown, continuous laminated clay seam.
30								

GEOTECHNICAL BORING LOG

DATE 4/22/85 DRILL HOLE NO. LB-5 SHEET 2 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±108 REF. OR DATUM Mean Sea Level

LOGGED BY RLW/SJ

SAMPLED BY RLW

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30		c: undulating					SM	Ancient Landslide: Medium brown gray, moist to wet, stiff, silty clay; moderately laminated.
								Medium gray, wet to saturated, dense, silty fine sand.
								@28.5', 3" to 4" thick continuous olive gray, laminated, clay seam; not remolded, one preferred surface.
35							ML	Medium gray, wet, stiff, clayey silt, slightly fine sandy; discontinuous concretionary nodules above and below contact, scattered concretionary nodules throughout.
		cs/rs: undulating to E-W, 4N					CL	@39', ½" to 1½" thick, continuous, brown laminated, stiff, plastic clayseam/rupture surface; one preferred surface.
40			3	18	124.1	12.3	SM	Santiago Formation: Light to medium gray, wet, dense to very dense, silty fine sandstone; slightly micaceous.
		c: gradational					SM	@42', light to medium gray, wet, very dense, silty fine to medium sandstone; slightly micaceous, approximately ½' thick.
		c: N60E 15NW					SM	Medium gray, wet, dense, silty fine sandstone.
45		c: gradational					ML	@46', medium brown, wet, very stiff, siltstone; 1' thick.
		c: gradational					SM	Medium gray brown, wet, dense to very dense, silty fine sandstone.
50								
55			4	16	129.9	11.8		
60								Total Depth = 56' Geologically logged to 53' Seepage at 23' and 25' No caving Backfilled 4/22/85

GEOTECHNICAL BORING LOG

DATE 5/21/85 DRILL HOLE NO. LB-6 SHEET 1 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±72' REF. OR DATUM Mean Sea Level

LOGGED BY RLW

SAMPLED BY RLW

DEPTH FEET	GRAPHIC LOG W E	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SC	Ancient Landslide: Medium to dark brown, damp, very loose to loose, very clayey fine to medium sand; scattered subrounded gravel sized clasts upto 1½" in diameter, roots and rootlets.
		C: undulating					CL	Dark brown, moist, firm to stiff, very sandy clay; minor root development, small gravel size clasts upto ½" in diameter.
5		C: gradational					SM	Medium orange brown and mottled off-white, moist to wet, loose, silty fine to medium sand; pods of off-white silty fine sand upto 2" in diameter, slightly micaceous.
		C: undulating	①				ML	Light olive green, mottled medium olive and dark brown, very moist to wet, soft, sandy silt; rip-up clasts of dark brown sandy clay and off-white silty sand; blocky texture, calcium carbonate veinlets, locally stained with iron oxide, slightly micaceous.
10			1	push				@13' to 15', numerous calcium carbonate in-filled voids upto 2" in diameter.
		C: undulating to N55E 33SE					SM	Medium gray, mottled off-white and orange brown, wet to very wet, loose, silty fine to medium sand.
15		C: very undulating				♀	ML	Medium olive green, very moist to wet, soft to firm, slightly sandy silt; very blocky, locally stained with iron oxide. @17', numerous calcium carbonate pods upto 3" in diameter, moderate groundwater seepage.
		C: undulating	②			♀	SM	Light gray, saturated, medium dense, silty fine to medium sand. @20', very rapid groundwater seepage, some caving in this zone.
20			2	push 9" +1				@21.5', medium olive gray, 1/16" to 1/8" thick, continuous clay seam / rupture surface; straited, laminated, plastic.
		CS/RS: undulating to N18E, 6NW to N36E, 15NW to E-W, 8N to N40E, 7NW					SM	Santiago Formation: Medium gray, moist, dense, silty fine to medium sandstone; micaceous, very massive, no apparent bedding surfaces, locally cemented.
25		C: undulating to N78E, 10NW				▽	SM	@25', very rapid groundwater in flowing.
		C: N52E 8NW					SM	Medium green, wet, dense to very dense, silty fine sandstone; micaceous.
		C: N10W 2NE					SM	Very light gray, wet to saturated, dense, silty fine to medium sandstone; micaceous.
30								

GEOTECHNICAL BORING LOG

DATE 5/21/85 DRILL HOLE NO. LB-6 SHEET 2 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±72' REF. OR DATUM Mean Sea Level

LOGGED BY RLW

SAMPLED BY RLW

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			③ 3	14			SM	Santiago Formation: Very light gray, wet to saturated, dense, silty fine to medium sandstone; micaceous. Medium olive, very moist, dense to medium dense, silty fine to medium sandstone; micaceous, contact with overlying unit is slightly cemented.
35		c: gradational					SM-ML	Medium to dark olive, very moist to wet, dense to hard, fine sandy siltstone to silty fine sandstone; contact with overlying unit is moderately cemented.
40		cemented zone: N32W 17NE	④ 4	17				@40', continuous, ±3" thick cemented layer.
45		c: N15E 12W					CL	Dark olive green, very moist, hard, silty claystone.
50			5	12				
55								Total Depth = 51' Geologically logged to 49' Seepage at 17' and 20' Water table at 25' Caving at 20' Backfilled 5/21/85
60								

GEOTECHNICAL BORING LOG

DATE 5/21/85 DRILL HOLE NO. LB-7 SHEET 1 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±54' REF. OR DATUM Mean Sea Level

LOGGED BY RLW

SAMPLED BY RLW

DEPTH FEET	GRAPHIC LOG (W E)	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							CL	**Topsoil:** Medium brown, moist, stiff, very sandy clay; roots and rootlets, scattered gravel and cobble sized clasts.
		c: gradational					SM	**Ancient Landslide:** Medium brown orange, moist, medium dense, silty fine to medium sand.
5		c: gradational					SM	Light orange brown to light gray, moist to wet, medium dense, silty fine to medium sand. @ 8', moisture content becomes wet to saturated. @ 9', caving of saturated sand.
10			① 1	push 6" +1				
		c: gradational					SM	Light gray, very wet to saturated, medium dense, silty fine to medium sand; micaceous, heavy caving. @ 13', rapid groundwater seepage. @ 15', very heavy caving, unsafe to log below this depth, very rapid groundwater seepage.
15						▽	CL	@ 16', Medium brown, polished, striated, continuous, clay seam.
		cs/RS(?)					SM	**Santiago Formation:** Light gray, moist, very dense, silty fine to medium sandstone; micaceous.
20			② 2	7				
25							ML	Medium olive gray, moist, very stiff, fine sandy siltstone; micaceous
30								

GEOTECHNICAL BORING LOG

DATE 5/21/85 DRILL HOLE NO. LB-7 SHEET 2 OF 2

PROJECT Weese Property PROJECT NO. 4850512-01

DRILLING CO. Larive TYPE OF RIG Bucket

HOLE DIAMETER 30" DRIVE WEIGHT 3700 lbs to 27', 2600 lbs to 55', 1400 lbs to 80' DROP 12 IN

ELEVATION TOP OF HOLE ±54' REF. OR DATUM Mean Sea Level

DEPTH FEET	GRAPHIC LOG W E	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								LOGGED BY RLW SAMPLED BY RLW
30			③ 3	9			ML	Santiago Formation: Medium olive gray, moist, very stiff, fine sandy siltstone; micaceous.
								Total Depth = 31' Geologically logged to 15' Seepage at 13' Water table at 15' Caving at 9' and 12' to 15' Backfilled 5/21/85
35								
40								

Appendix C (continued)

B-1 and B-2

Small-Diameter Borings

From:

Leighton and Associates, 1985a

GEOTECHNICAL BORING LOG

Date 4/17/85 Drill Hole No. B-1 Sheet 1 of 2

Project Weese Property Job No. 4850512-01

Drilling Co. Morrison Type of Rig B-53/Rotary Wash

Hole Diameter 4" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole ±30' Ref. or Datum Mean Sea Level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by RH Sampled by RH
0			①				CL	Alluvium: Light brown, damp, soft clay.
5			1	11	92.3	31.9	CL/CH	Dark gray to black, moist, stiff, clay; numerous roots and organics.
10			2	14	109.9	18.9	CL/SC	Very dark gray, moist, stiff, sandy clay to clayey sand. @12', becomes harder drilling.
15			3	17	92.4	32.4	CL	Dark olive gray, moist to wet, stiff, sandy clay.
20			4	8 12 14			CL/CH	Dark brown to black, moist, very stiff, sandy clay; numerous rootlets. @22', becomes harder drilling.
25			5	30	101.1	24.7	ML	Mottled light to medium brown, moist, very stiff, clayey silt; slightly sandy, micaceous.
30			6	29	94.2	30.4	CL	Mottled mix of olivebrown to gray, moist, very stiff, silty clay; numerous blebs of calcium carbonate, micaceous

GEOTECHNICAL BORING LOG

Date 4/17/85 Drill Hole No. B-1 Sheet 2 of 2-

Project Weese Property Job No. 4850512-01

Drilling Co. Morrison Type of Rig B-53/Rotary Wash

Hole Diameter 4" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole ± 30' Ref. or Datum Mean Sea Level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by RH Sampled by RH
30							CL	Alluvium: Mottled mix of olive brown to gray, moist, very stiff, silty clay; numerous blebs of calcium carbonate, micaceous.
35			7	13 15 17			CL	Mottled intermixed olive brown, dark gray, and medium gray, moist, very stiff, silty clay; some clay and sandy clay material, minor amounts of calcium carbonate.
40			8	77			CL/SC	Santiago Formation: Medium gray to white, damp, hard, sandy claystone; slightly silty. @43', becomes harder drilling.
			9	75/4"				
45								Total Depth = 45' Piezometer installed to 45' Groundwater at 2.29', measured on 5/14/85

GEOTECHNICAL BORING LOG

Date 4/17/85 Drill Hole No. B-2 Sheet 1 of 2

Project Weese Property Job No. 4850512-01

Drilling Co. Morrison Type of Rig B-53/ Rotary Wash

Hole Diameter 4" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole ±35' Ref. or Datum Mean Sea Level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by RH Sampled by RH
0			①				CL/CL-SC	**Artifical Fill:** Dark olive brown, moist, stiff, clay; contains chunks and bits of hard claystone and grayish white sandy clay.
5			1	15	101.8	25.2		
							ML	**Alluvium:** Black, moist, stiff, very clayey silt, trace of roothairs and organics.
10			2	13	97.4	25.7		
15								
20			3	30			CL	Dark brown to black, wet, very stiff, clay.
25			4	15			CL	Gray, wet, stiff, clay; minor amounts of sand, micaceous.
30			5	10 10 12			CL/SC	Light gray to white, wet, very stiff, sandy clay; micaceous, blocky.

GEOTECHNICAL BORING LOG

Date 4/17/85 Drill Hole No. B-2 Sheet 2 of 2

Project Weese/Oceanside Job No. 4850512-01

Drilling Co. Morrison Type of Rig B-53/Rotary Wash

Hole Diameter 4" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole ± 35' Ref. or Datum Mean Sea Level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by RH Sampled by RH
30							CL/SC	Alluvium: Light gray to white, wet, very stiff, sandy clay; micaceous, blocky. @ 32', becomes very hard drilling.
35			6 7	24 7 9 12				Medium red brown, moist, very stiff, clayey silt with abundant fine sand; micaceous, with numerous zones of blocky, dark gray claystone and gray slightly sandy clay.
								Total Depth = 36.5' Piezometer installed to 12' Groundwater at 7.10', measured on 5/14/85
40								

Appendix C (continued)

T-1 through T-10

Exploratory Trenches

From:

Leighton and Associates, 1985a

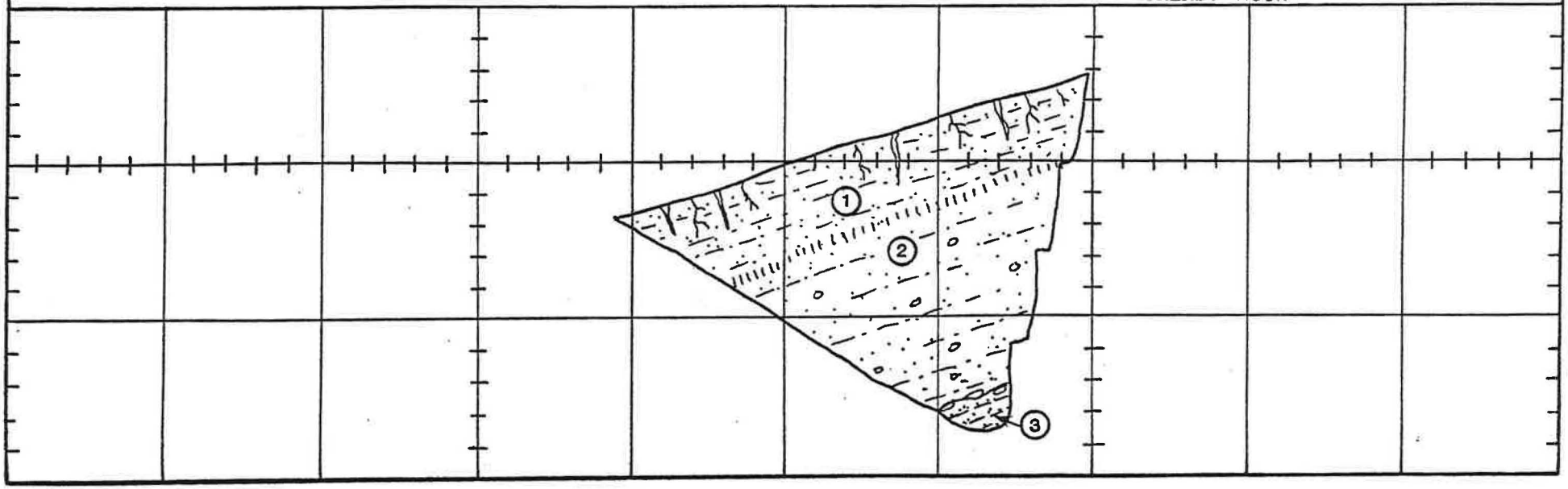
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside	Logged By: RLW		
Project Number: 4850512-01	Elevation: ±115'	TRENCH NO. T-1	
Equipment: JD 510-C/Trackhoe	Location: See Geotechnical Map		

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium brown, damp, medium dense to dense, silty to clayey fine sand; roots and rootlets, minor amount of desiccation cracks.	Topsoil	SM/SC			
c:gradational						
	LANDSLIDE DEBRIS					
	② Medium slightly red-brown, moist, dense, silty fine sand; jumbled, rip-up clasts of light brown silty sand, very scattered gravel-sized clasts to 1" in diameter.	Qls	SM			
c:undulating						
	③ Medium red-brown, moist to very moist, firm, very fine sandy clay; high concentration of calcium carbonate near contact, very jumbled in appearance.	Qls	CL			
	Total depth = 12' No ground water encountered	No caving Backfilled 4/23/85				

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 18° TREND: N68W



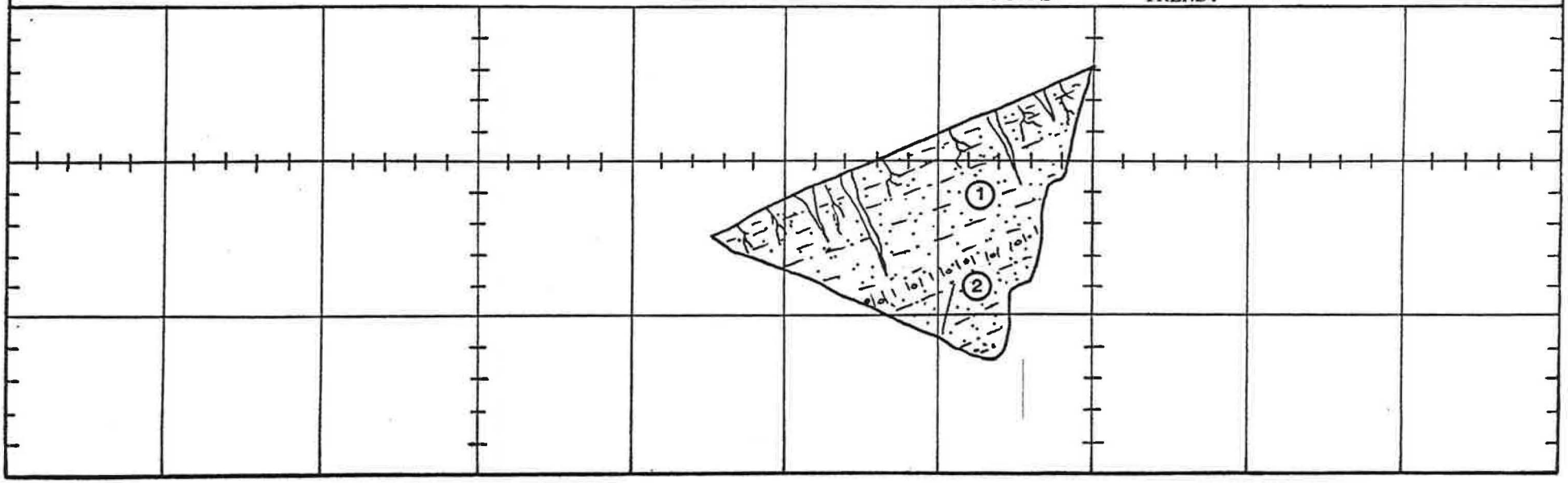
LOG OF TRENCH NO. T-1

501-A - (3/77)

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD510-C/Trackhoe
Logged By: RLW
Elevation: ±125'
Location: See Geotechnical Map
TRENCH NO. T-2

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium brown, damp, medium dense to dense, very silty to clayey fine sand; roots and rootlets, abundant amount of desiccation cracks with openings 1/8" to 1/4" wide.	Topsoil	SM/SC			
c:gradational (over 1')						
	LANDSLIDE DEBRIS					
j:N41°W;85°NE	② Light to medium red-brown, damp to moist, dense, silty fine to medium sand; massive, no apparent bedding surfaces, jointed, manganese oxide staining developed on majority of joint surfaces.	Qls	SM			
	Total depth = 10' No ground water encountered No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 25° TREND: N70°W



LOG OF TRENCH NO: T-2

Leighton & Associates

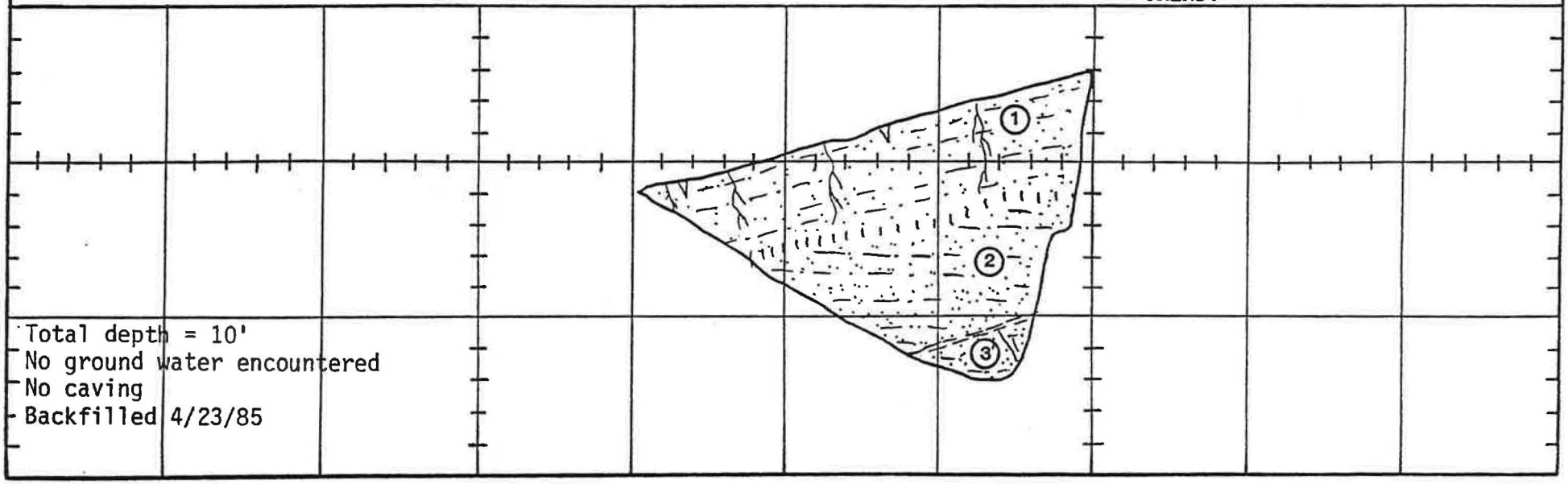
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD 45C-C/Trackhoe
Logged By: RLW
Elevation: ±138'
Location: See Geotechnical Map
TRENCH NO. T-3

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
c:gradational (over ±6')	① Medium brown, damp, medium dense, very silty to clayey fine sand; roots and rootlets, minor amount of desiccation cracks.	Topsoil	SM/SC			
	SANTIAGO FORMATION					
c:cs:N64°W; 11°NE	② Light to medium slightly red-brown, damp to moist, dense, silty fine to medium sand; very minor amount of calcium carbonate stringers, weathered.	Ts	SM			
j:N62°E;85°SE (approximate)	③ Light gray to off white, moist, dense to very dense, silty fine to medium sand; high angle joints, calcium carbonate and iron oxide developed on these joints, at contact with overlaying unit is a 1/8" to 1/2" thick, continuous clay seam.	Ts	SM			

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 16° TREND: N



Total depth = 10'
No ground water encountered
No caving
Backfilled 4/23/85

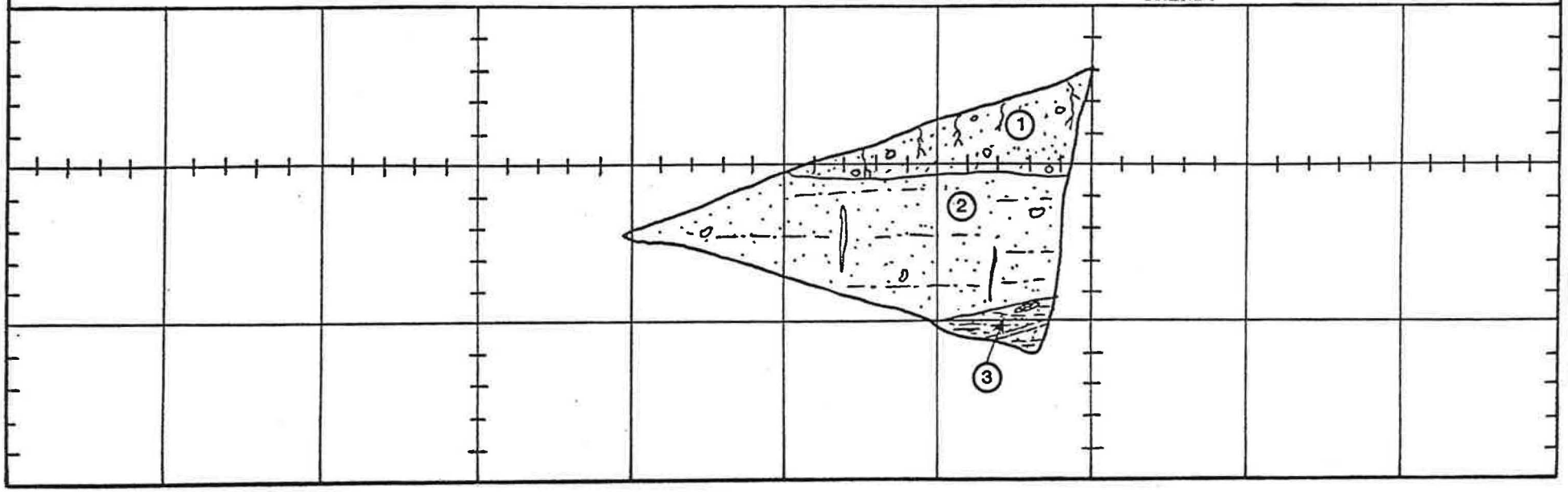
LOG OF TRENCH NO: T-3

501-A - (3/77)

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD 450-C/Trackhoe
Logged By: RLW
Elevation: ±115'
Location: See Geotechnical Map
TRENCH NO. T-4

GEOLOGIC ATTITUDES	DESCRIPTION: (DATE: 4/23/85)	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium brown, moist, medium dense, clayey fine to medium sand; roots and rootlets, very scattered gravel and cobble-sized clasts.	Topsoil	SC			
c:undulating						
	LANDSLIDE DEBRIS					
	② Light slightly red-brown, moist, dense, silty fine to medium sand; minor calcium carbonate stringers, rare cobble-sized clasts.	Qls	SM			
c:undulating						
	③ Medium gray-brown, moist, stiff, very silty clay; abundant amount of calcium carbonate blebs to 3" in diameter near contact, 1" thick, continuous sheared clay seam @ 9.5', very jumbled and disturbed.	Qls	CL			
cs:N10°E;30°NW (approximate)						
	Total depth = 10'					
	No ground water encountered					
	No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 21° TREND: N-S



LOG OF TRENCH NO: T-4

Leighton & Associates

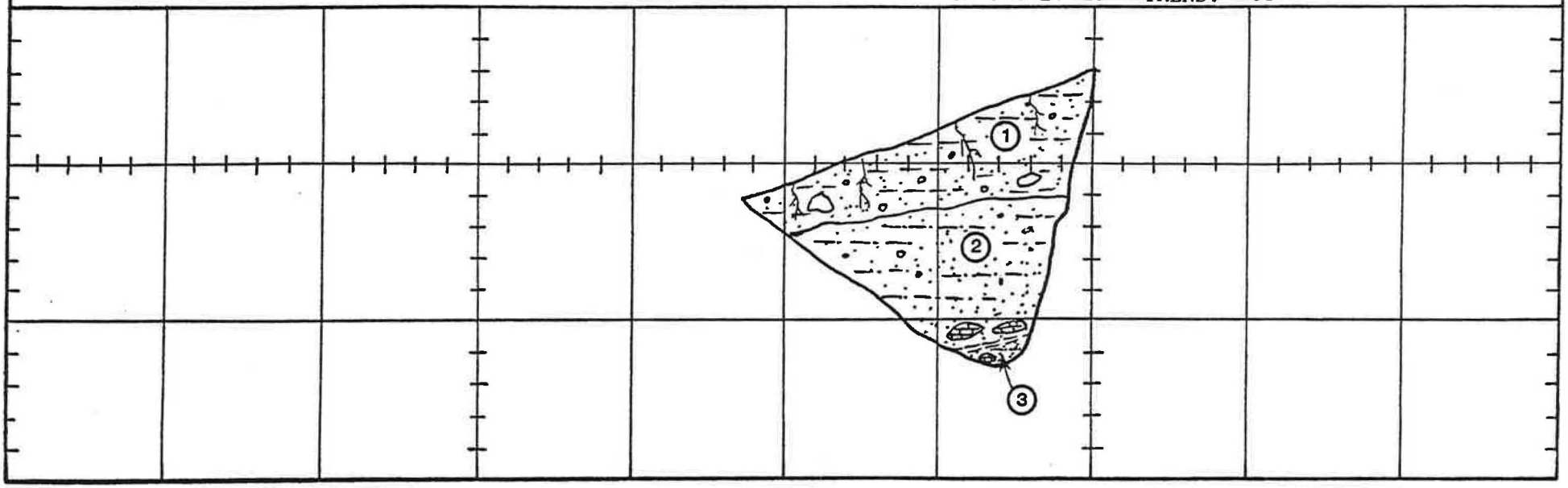
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD 450-C/Trackhoe
Logged By: RLW
Elevation: ±125'
Location: See Geotechnical Map
TRENCH NO. T-5

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium brown, moist, medium dense, clayey fine sand; gravel and cobble-sized clasts to 6" in diameter; roots and rootlets.	Topsoil	SC			
c:undulating	LANDSLIDE DEBRIS					
	② Light to medium brown, moist, dense, silty fine sand; scattered gravel-sized clasts, minor rip-up clasts of brown silty clay, contact with underlaying unit has abundant calcium carbonate blebs to 4" in diameter, above 1/8" to 1/2" wide, discontinuous silty clay seam.	Qls	SM			
c:undulating	③ Light brownish white, mottled yellow-brown, moist, medium dense, silty fine sand; rip-up clasts of brown silty sand to 3" in diameter, calcium carbonate blebs.	Qls	SM			
	Total depth = 9.5'					
	No ground water encountered					
	No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 21° TREND: N88°W



LOG OF TRENCH NO: T-5

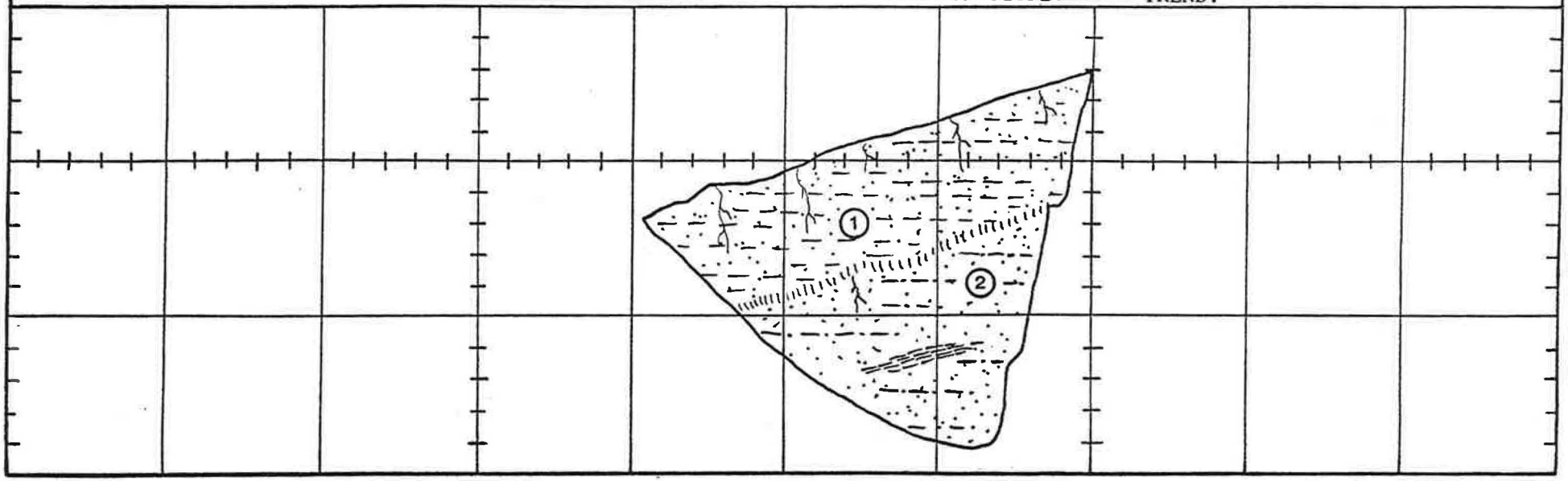
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside	Logged By: RLW		
Project Number: 4850512-01	Elevation: ±128'	TRENCH NO. T-6	
Equipment: JD 450-C/Trackhoe	Location: See Geotechnical Map		

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
c: gradational	TOPSOIL ① Medium brown, damp, medium dense, very clayey fine sand; roots and rootlets.	Topsoil	SC			
	LANDSLIDE DEBRIS ② Medium slightly orange-brown, damp, dense, silty fine sand; minor root development, @ 9' discontinuous 1" thick, dark brown clay lens, slight lightening of color with depth.	Qls	SM			
	Total depth = 12' No ground water encountered No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 18° TREND: N



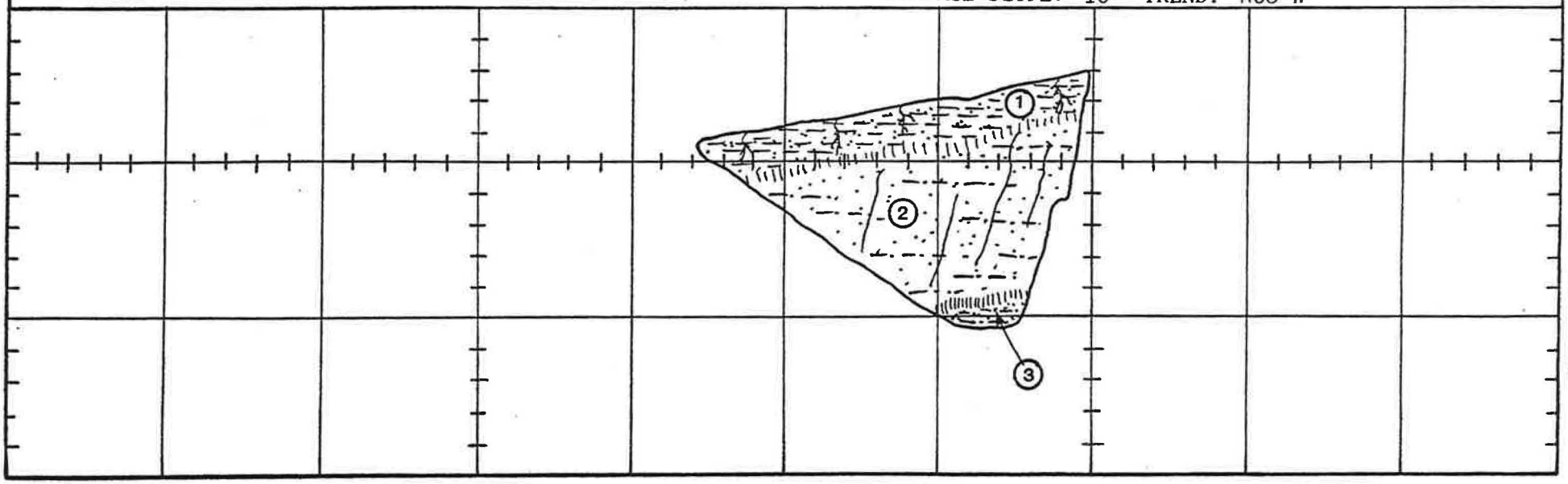
LOG OF TRENCH NO: T-6

501-A - (3/77)

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD 450-C/Trackhoe
Logged By: RLW
Elevation: ±58'
Location: See Geotechnical Map
TRENCH NO. T-7

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium gray-brown, damp, stiff, very fine sandy clay; roots and rootlets.	Topsoil	CL			
c:gradational						
	LANDSLIDE DEBRIS					
	② Medium orange-brown, damp to moist, dense, silty fine to medium sand; high angle fractures with openings hairline to 1/8" wide, calcium carbonate developed on fracture surfaces.	Qls	SM			
c:gradational						
	③ Medium gray-brown, moist, firm, very fine sandy silt; very jumbled.	Qls	ML			
	Total depth = 8.5'					
	No ground water encountered					
	No caving					
	Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 10° TREND: N68°W



LOG OF TRENCH NO. T-7

Leighton & Associates

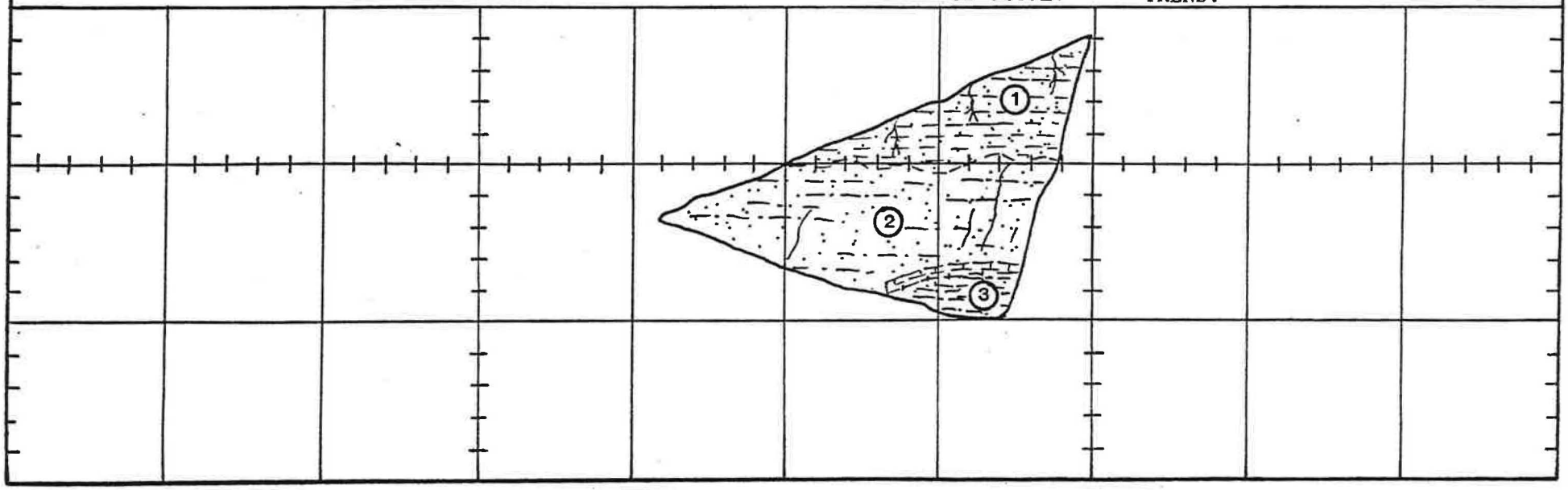
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside	Logged By: RLW		
Project Number: 4850512-01	Elevation: ±68'	TRENCH NO. T-8	
Equipment: JD 450-C/Trackhoe	Location: See Geotechnical Map		

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL					
	① Medium to dark brown, damp, stiff, fine sandy clay; roots and rootlets.	Topsoil	CL			
c:gradational						
	LANDSLIDE DEBRIS					
	② Off white, damp, dense, very silty, very fine sand; calcium carbonate filled fractures with openings hairline to 1/8", at base ±4" thick zone of calcium carbonate enrichment.	Qls	SM			
c:gradational						
	③ Medium gray, moist, stiff, clayey silt; very broken and jumbled.	Qls	ML			
	Total depth = 9'					
	No ground water encountered					
	No caving					
	Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 23° TREND: N68°W



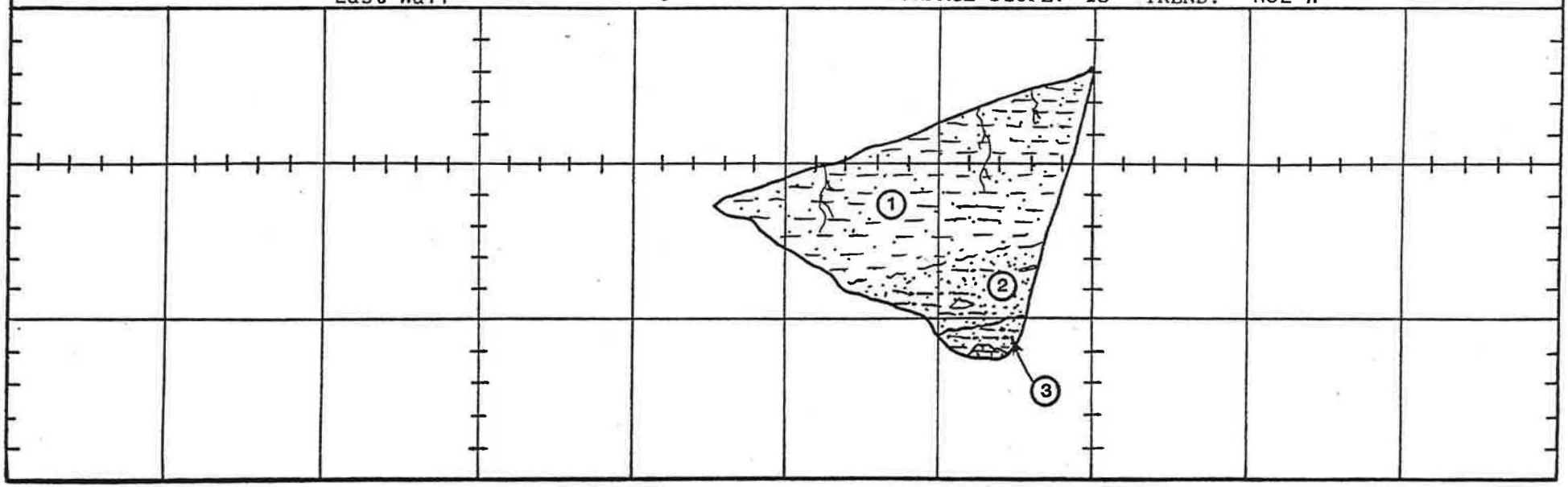
LOG OF TRENCH NO: T-8

501-A - (3/77)

Project Name: Weese/Oceanside
Project Number: 4850512-01
Equipment: JD 450-C/Trackhoe
Logged By: RLW
Elevation: ±110'
Location: See Geotechnical Map
TRENCH NO. T-9

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	DATE: 4/23/85					
	TOPSOIL					
	① Medium brown, damp, stiff, very fine sandy clay; roots and rootlets.	Topsoil	CL			
c:gradational						
	LANDSLIDE DEBRIS					
	② Medium orange-brown to light brown, moist, dense, silty fine sand; rip-up clasts of dark brown silty clay to 2" in diameter, minor root development.	Qls	SM			
c:undulating						
	③ Medium gray-brown, moist, firm, fine sandy silt; very jumbled in appearance, voids to 3" in diameter in-filled with soft calcium carbonate.	Qls	ML			
	Total depth = 9' No ground water encountered No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 18° TREND: N32°W



LOG OF TRENCH NO: T-9

Leighton & Associates

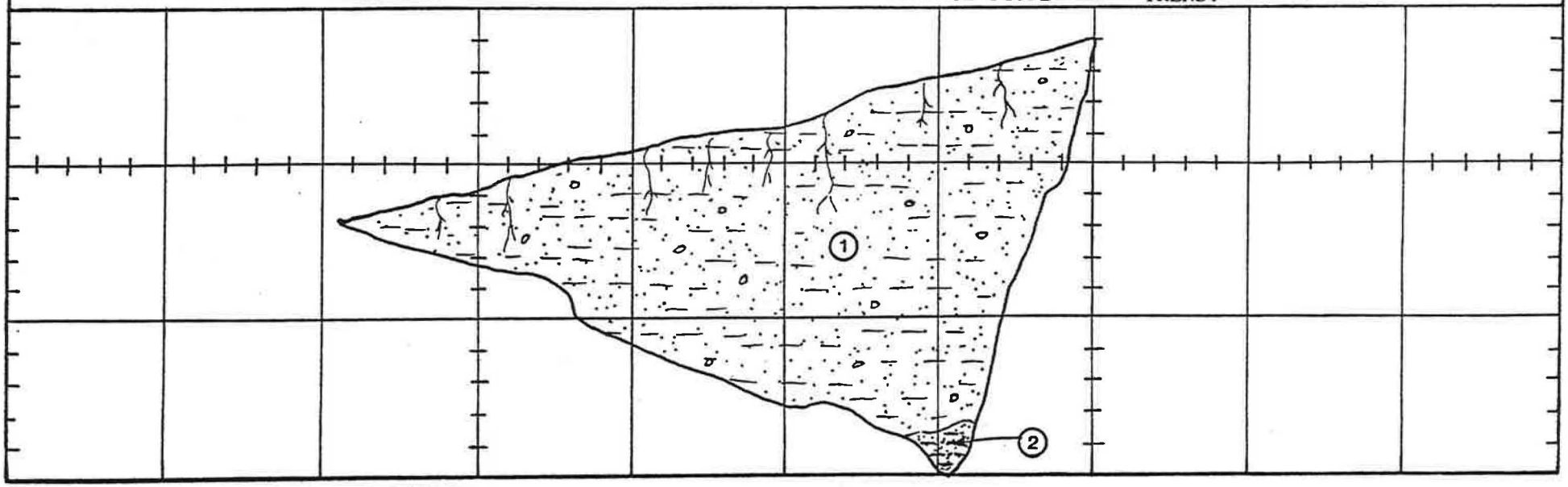
501-A - (3/77)

Leighton & Associates

Project Name: Weese/Oceanside	Logged By: RLW		
Project Number: 4850512-01	Elevation: ±105'	TRENCH NO. T-10	
Equipment: JD 450-C/Trackhoe	Location: See Geotechnical Map		

GEOLOGIC ATTITUDES	DATE: 4/23/85 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL/LANDSLIDE DEBRIS					
	① Dark brown, moist, dense, clayey fine sand; abundant roots and rootlets, very scattered gravel-sized clasts.	Topsoil/ Qls	SC			
c:undulating	LANDSLIDE DEBRIS (?)					
	② Off white, moist, dense, silty fine to medium sand.	Qls (?)	SM			
	Total depth = 14' No ground water encountered No caving Backfilled 4/23/85					

GRAPHIC REPRESENTATION East Wall SCALE: 1" = 5' SURFACE SLOPE: 11° TREND: N25°E



LOG OF TRENCH NO: T-10

Appendix C (continued)

AT-1 to AT-12

Exploratory Trenches

From:

Action Geotechnical Consultants, 1984a

LOG OF EXPLORATORY PITS

Pit No.	Depth	Description	Attitudes
1	0-1'	GREY/WHITE SAND with SILT and SANDSTONE fragments (old cut surface)	B N30E/5NW
	1-4' (bedrock)	GREY/WHITE SANDSTONE, massive, dense, very hard bed @ 1'	J E-W/82S J N55W/88SW
2	0-0.5'	GREY/WHITE SAND with SANDSTONE fragments (old cut surface)	
	0.5-7' (bedrock)	GREY/WHITE SANDSTONE, dense, massive	J N85W/85SW J N70W/85SW J N15W/88NE B N30E/5NW
3	0-5' (bedrock)	WHITE SANDSTONE, soft	
	5-6.5'	GREY/WHITE, clayey SANDSTONE, firm	
	6.5-7.5'	BROWN, sandy, clayey mudstone	
4	0-1.5- (bedrock)	WHITE SANDSTONE, firm	
	1.5-3.5'	GREY, clayey SANDSTONE	
	3.5-5'	GREY SANDSTONE, firm, very dense, WHITE SANDSTONE @ 5'	
5	0-6' (colluvium)	DARK GREY, silty CLAY with SAND, porous and scattered caliche and rock fragments, moist	
		Grades to DARK BROWN color and denser state @ 8'	
	8-10' (bedrock)	LIGHT BROWN, silty, fine SANDSTONE, moist and soft	
6	0-4' (slide debris/ colluvium)	DARK GREY to BLACK, silty CLAY with SAND and speckled with caliche	
	4-7.5'	DARK BROWN, silty CLAY with SAND and occasional round pebbles	
	7.5-13' (weathered bedrock)	BROWN, silty, fine SAND	
	13-14' (bedrock)	WHITE, fine SANDSTONE	

W.O. 413701

Pit No.	Depth	Description	Attitudes
7	0-3' (colluvium/ slide debris)	DARK GREY to BLACK, silty CLAY with SAND, porous	
	3-5'	DARK BROWN, silty, sandy CLAY, speckled with caliche	
	5-6.5'	Mottled BROWN and RUST BROWN clayey SAND	
	6.5-10'	LIGHT BROWN SAND, soft with pockets of DARK GREY CLAY and scattered SANDSTONE cobbles	
	10-12' (bedrock)	GREY/WHITE SANDSTONE, firm	
8	0-2' (slide debris)	GREY/BROWN, silty, fine grained SAND, very porous and dry	
	2-8'	DARK GREY, clayey SAND, slightly porous, speckled with caliche from 5'-6'	
	8-12'	BROWN, slightly clayey, fine to medium grained SAND with WHITE SANDSTONE fragments and pockets of DARK GREY, silty CLAY	
	12-14'	BROWN and WHITE, mottled SAND with traces of iron staining and organic material	
	14-19.5'	BROWN, fine to medium grained SAND with WHITE SANDSTONE fragments	
		Groundwater Seepage @ 16' and 19.5'	
9	0-5' (slide debris)	DARK GREY to BLACK, sandy CLAY with caliche @ 4'-5'	
	5-7'	BROWN and BLACK clayey SAND	
	7-16'	LIGHT BROWN, slightly clayey SAND, soft, locally contains intergrained caliche and rust staining	

W.O. 413701

Pit No.	Depth	Classification	Attitudes
10	0-5' (fill)	LIGHT BROWN/WHITE, fine grained SAND	
	0.5-1.5'	BLUE/GREY CLAY with dry grass (organic smell)	
	1.5-3'	GREY/WHITE SAND	
	3-5' (alluvial)	Very fat, BLUE/GREY CLAY	
		Groundwater @ 5'	
11	0-7' (Fill)	LIGHT BROWN/WHITE, fine, clayey SAND with SANDSTONE fragments and trace of DARK GREY CLAY	
	7-8.5 (alluvial)	Very fat, BLUE/GREY CLAY	
	8.5-10'	GREY, fine SAND, damp	
		Groundwater @ 10'	
12	0-3' (alluvial)	LIGHT BROWN and GREY/WHITE, fine grained SAND (caves)	
	3-8'	BLACK, fat CLAY with trace of SAND	
	8-11'	GREY, sandy CLAY, damp	
		Groundwater @ 9'	

Appendix C (continued)

AB-1 through AB-8

Large-Diameter Borings

From:

Action Geotechnical Consultants, 1984a

SUMMARY SHEET

PROJECT Mr. Thomas O. Weese

GEOLOGICAL DESCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Bedrock					2				GREY/BROWN, sandy CLAY
					4				WHITE, fine grained sandstone
					6				GREY/BROWN, clayey sandstone, moderately cemented
					8				WHITE, medium to coarse sandstone, with cemented layers
	133		6		10		x		WHITE, fine to medium sandstone
					12				Very difficult drilling @ 16'
					14				Refusal @ 17.5'
					16				End @ 17.5'
					18				No Water or Caving

BORING No. 1

SURFACE ELEV. see map

EQUIP. Bucket Auger HOLE DIA. 24"

LOGGED BY GW

JOB NO.	DATE	SHEET
413701	6/11/84	1 OF 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

SUMMARY SHEET

PROJECT: Mr. Thomas Weese

GEOLOGICAL DESCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Slide Debris					2				GREY, silty SAND, dry, loose
					4				DARK GREY, clayey SAND/ sandy CLAY
					6				
					8				
	112		13		10		x		RED, clayey, fine to medium SAND, mottled with DARK GREY, sandy clay stringers, weathered sandstone boulders @ 10'
					12				
					14				BROWN and BLACKSAND with trace of CLAY, weathered chunks of sandstone @ 16'
					16				
					18				GREY/WHITE, medium SAND with trace of BLACK CLAY. WHITE clay seam @ 18'
					20				GREY, clayey SAND, seepage @ 20'
Bedrock					22				
					24				WHITE, fine to medium sandstone, 1/8" clay seam & seepage @ 21'
	119		13		26		x		
									Dense SANDSTONE @ 27'
									End @ 27'
									Seepage @ 20' & 21'
									Caving @ 16' to 21"

BORING No. 2

SURFACE ELEV. see map

EQUIP. Bucket Auger HOLE DIA. 24"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/11/84	2 9

SUMMARY SHEET

OJECT Mr. Thomas O. Weese

OLOGICAL SCRIPTION	DEPTH IN FEET	ENGINEERING CLASSIFICATION/DESCRIPTION
lide ebris	2 4	DARK GREY to BLACK, sandy CLAY, speckled with caliche @ 3'
	6 8	GREY/BROWN, fine to medium SAND with pockets of DARK GREY sandy CLAY and WHITE SAND
	10 12 14	LIGHT BROWN SAND with WHITE SAND, very moist @ 11'
edrock	16 18	Heavy Seepage @ 16' LIGHT BROWN, fine to medium SANDSTONE, firm
	20	WHITE, fine SANDSTONE, firm
	22	End @ 22' Groundwater @ 16' Severe Caving 11' to 17'

DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION
116		15		22		x	

BORING No. 3
SURFACE ELEV. see map
EQUIP. Bucket Auger HOLE DIA. 24"
LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/11/84	3 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

SUMMARY SHEET

OJECT Mr. Thomas O. Weese

OLOGICAL SCRIPTION	DEPTH IN FEET	ENGINEERING CLASSIFICATION/DESCRIPTION
Bedrock	2	LIGHT BROWN CLAY, fine SANDSTONE
	4	LIGHT GREY, fine SANDSTONE with clayey SANDSTONE lenses @ 4'
	6	WHITE, fine SANDSTONE
	8	Pinkish tone @ 6'
	10	Clayey SANDSTONE lenses @ 11'
	12	GREY/BROWN, sandy, clayey MUDSTONE
	14	GREY, clayey SANDSTONE
	16	BROWN SANDSTONE with trace of CLAY, very dense
	18	WHITE, fine SANDSTONE, very dense, refusal
		Refusal @ 18'
		End @ 18'
		No Groundwater or Caving

DRY DENSITY lbs./cu. ft. | RELATIVE COMPACTION | MOISTURE % | PENETRATION N | DEPTH IN FEET | LOG AND LOCATION OF SAMPLE (CORE) | UNIFIED SOIL CLASSIFICATION

BORING No. 4

SURFACE ELEV. see map

EQUIP. Bucket Auger HOLE DIA. 24"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/11/84	4 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

SUMMARY SHEET

OJECT Mr. Thomas O. Weese

OLOGICAL SCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N (STP)	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Slide Debris			26	4 3 5	5	x		DARK GREY, sandy CLAY Mottled LIGHT BROWN, silty CLAY with caliche
			16	8 8 11	10	x		Firms @ 7' GREY/WHITE SAND
			19	11 20 24	15	x		BROWN, clayey SAND, bentonite seam @ 15' groundwater @ 18'
Bedrock			15	38 50 (4")	20	x		WHITE, fine to medium SANDSTONE WHITE to LIGHT BROWN SANDSTONE, difficult drilling below 25'
			17	25 36 50 (5")	25	x		WHITE, fine to medium SANDSTONE
			11	50 (5")	30	x		End @ 30'

TP:
tandard
enetration

CORE

BORING No. 5

SURFACE ELEV. see map

EQUIP. Hollow Stem Auger HOLE DIA. 8"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/13/84	5 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

SUMMARY SHEET

OJECT Mr. Thomas O. Weese

OLOGICAL SCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N (STP)	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Fill	99	87	21	5 17			x		LIGHT GREY/WHITE, clayey SAND
	98	86	22	9 16	5		x		
lluvium	103		27	10 15	10		x		DARK GREY, fat CLAY Groundwater @ 13'
	109		16	12 17	15		x		GREY, sandy CLAY, wet
	102		24	8 15	20		x		GREY, clayey SAND with coarse SAND lenses
			13	9 11	25		x		GREY, coarse SAND
			21	4 7 6	30		x		GREY/BROWN, clayey SAND Dense below 34' BROWN to REDDISH BROWN, fine to medium SAND with trace of coarse SAND
			16	6 9 16	35		x		
			16	9 10 12	40		x		BROWN to REDDISH BROWN, medium to coarse SAND with pebbles

BORING No. 6

SURFACE ELEV. see map

EQUIP. Hollow Stem Auger HOLE DIA. 8"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/13/84	6 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

SUMMARY SHEET

PROJECT Mr. Thomas O. Weese

GEOLOGICAL DESCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N (STP)	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Bedrock			12	14 31 42	45		x		LIGHT BROWN/TAN, medium to coarse SANDSTONE
			13	17 22 42	50		x		WHITE, fine to medium SANDSTONE
									End @ 51'

BORING No. 6 (continued)

SURFACE ELEV. see map

EQUIP. Hollow Stem Auger HOLE DIA. 8"

LOGGED BY GW

JOB NO.	DATE	SHEET
413701	6/13/84	7 OF 9

SUMMARY SHEET

PROJECT Mr. Thomas O. Weese

GEOLOGICAL DESCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N (STP)	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Alluvium			22	1 2 1	5		x		DARK GREY, clayey, medium to course SAND
				4 7 9	10		x		DARK GREY, clayey, fine SAND, wet
			17	4 4 6	15		x		DARK OLIVE GREY, fine sandy CLAY
Bedrock			14	31 50 (2")	20		x		WHITE, medium to course SANDSTONE

BORING No. 7

SURFACE ELEV. see map

EQUIP. Hollow Stem Auger HOLE DIA. 8"

LOGGED BY PA

JOB NO.	DATE	SHEET
413701	6/13/84	8 OF 9

SUMMARY SHEET

PROJECT Mr. Thomas O. Weese

GEOLOGICAL DESCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N (STP)	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
Alluvium				4					DARK GREY to BLACK CLAY, fat, trace of SILT
				5	5		x		GREY/BROWN, clayey SAND
				7					@ 7', water @ 10'
				5					
			17	8	10		x		WHITE and LIGHT BROWN SAND
				11					
Bedrock									Firmer below 12'
				12					
			11	15	15		x		WHITE and REDDISH, fine grained sandstone
				15					
									End @ 16'
									Water @ 10'

BORING No. 8

SURFACE ELEV. see map

EQUIP. Hollow Stem Auger HOLE DIA. 8"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
413701	6/13/84	9 9

1630-G South Sunkist Street Anaheim, California 92806 (714) 634-2092 (213) 852-4710

Appendix C (continued)

AB-9

Large-Diameter Borings

From:

Action Geotechnical Consultants, 1984b

SUMMARY SHEET

OJECT Mr. Thomas Weese

LOGICAL CRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
edrock					0				WHITE, fine to medium SANDSTONE
					5				BROWN SANDSTONE, dense, slightly clayey
									WHITE, fine to medium SANDSTONE
					10				BROWN SANDSTONE, dense, slightly clayey
									WHITE, fine to medium grained SANDSTONE
					15				
					20				Cemented SANDSTONE layer
									BROWN, clayey SANDSTONE
					25				WHITE, fine to medium grained SANDSTONE Clayey seams noted @ 28'
					30				Cemented fine to medium SANDSTONE
					35				BROWN, clayey, fine to medium SANDSTONE, very dense
									LIGHT BROWN SANDSTONE
					40				WHITE, fine to medium grained SANDSTONE
emolded 26°,c=375 psf					45				

BORING No. 9

SURFACE ELEV. see map

EQUIP. Bucket Auger HOLE DIA. 24"

LOGGED BY GW

JOB NO.	DATE	SHEET OF
4137	10/5/84	1 2

SUMMARY SHEET

OJECT Mr. Thomas Weese

OLOGICAL SCRIPTION	DRY DENSITY lbs./cu. ft.	RELATIVE COMPACTION	MOISTURE %	PENETRATION N	DEPTH IN FEET	LOG AND LOCATION OF SAMPLE	CORE	UNIFIED SOIL CLASSIFICATION	ENGINEERING CLASSIFICATION/DESCRIPTION
					50				WHITE SANDSTONE (con't.) BROWN, slightly clayey, fine SANDSTONE lense @ 50' Hard drilling @ 53'
					55				
					60				End @ 60' No Groundwater Encountered No Caving Occurred

BORING No. 9

SURFACE ELEV. see map

EQUIP. Bucket Auger HOLE DIA. 24"

LOGGED BY GW

JOB NO.	DATE	SHEET
4137	10/5/84	2 OF 2

Appendix C (continued)

GB-1 through GB-3

Large-Diameter Borings

From:

G.A. Nichols, 1992

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	85± feet	B-1
Date Drilled: 12/21/89 CHP	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								SC	Clayey Silty SAND: fine- to medium-grained, light to dark brown, dry, loose, abundant, organic debris PAD FILL
		11.0	15.4	104.6				CL	Silty CLAY: black to dark brown, dry, stiff, adobe, open fractures to 2 feet @ 3½ feet-5 feet, caliche in pods, occasional pebbles @ 4 feet, Sandy, dark brown, moist TOPSOIL
		13.2	15.9	102.1		5			Sandy Clayey SILT: light brown, moist, medium stiff, occasional pebbels to 2"ø
								ML	Clayey SAND: fine- to medium-grained, medium brown, moist, medium dense @ 10½ feet, becomes occasionally coarse-grained, 4" discontinuous Silty SAND, light yellow-brown, fragments of upper and lower Clayey SAND
		11.0	21.1	109.1		10		SC	
								ML	Clayey SILT: light gray-brown with heavy white mottling @ 12½ feet, 1"-4' thick red-brown Silty SAND, broken with up to 6¼ offsets @ 14 feet, start of shear (fault): N80E,80SE (crosshole)
		8.8	8.2	107.4		15		SC	Silty Clayey SAND: fine-grained, medium brown, moist, medium dense @ 15.2 feet, CLAY bed 2"-4" thick @ 15½ feet, white, abundant broekn CLAY fragments mottled, crosshole bedding: N88E,20SE, very irregular @ 17 feet, Clayey on south side of hole, shear from 14' about 1" thick offsets CLAY bed about 6"
								CL	
		8.8	16.8	111.3		20		SM	Silty CLAY: gray-brown, moist, medium stiff, thin, dark red-brown SAND beds, $CaCO_3$ mottling
			31.7	91.1					Clayey Silty SAND: gray to red-brown, fine-grained @ 20 feet, crosshole bedding: N80W,15SW, abundant vertical gypsum filled fractures @ 21 feet, medium-grained, gray-brown with dark red interbeds, moist, medium dense @ 23-23.8 feet, Clayey @ 23.8 feet, bed truncated by 16" shear rupture surface: N48E,5N (crosshole)
		21.6	19.2	109.9		25		BEDROCK	

(Continued on Figure B-2.2)

G.A. NICOLL & ASSOCIATES, INC.
EARTH SCIENCE CONSULTANTS
Tustin, California

Weese - Oceanside

Project No.:	Figure No.:
4142-02	B-2.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	85± feet	B-1
Date Drilled: 12/21/89 CHP	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
									(Continued from Figure B-2.1)
		31.2	11.9	125.1					Clayey SILTSTONE: brown, moist, highly sheared, and broken
									@ 24.2 feet, undulatory shear: EW,35N striations N52W
									@ 24.3 feet, planar shear: N45W,8NE
									@ 25 feet, polished shear: N60W,39N
									@ 25.3 feet, sheared contact with underlying SANDSTONE: N52W,14N
									LANDSLIDE DEBRIS
						35		BEDROCK	Silty SANDSTONE: fine- to medium-grained, gray white, moist, dense, thick bedded
									@ 27 feet, 2' concretion, discontinuous, gray to gray-white
									@ 28.8 feet, seepage
						40			@ 36 feet, siltier, medium gray-white
									@ 39 feet, light yellow-brown
									SANTIAGO FORMATION
						45			Bottom of Boring at 40 feet.
									Note:
									1) No caving.
									2) Seepage at 28.8 feet.
						50			3) Boring backfilled.
						55			

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Tustin, California

Weese - Oceanside

Project No.: 4142-02

Figure No.: B-2.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	96± feet.	B-2
Date Drilled: 12/27/89 AK	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								SC	Clayey SAND: fine-grained, medium brown, dry, loose PAD FILL
		11.0	7.4	113.4		5		SM	Clayey Silty SAND: fine-grained, light orange-brown, dense, dry, scattered crushed bedrock cobbles and pebbles, some roots present @ 5.5 feet, becomes slighly moist TOPSOIL
		11.0	13.1	111.5				CL	Silty CLAY: fine-grained, white to light gray, soft to medium stiff @ 6½ feet, shear: ¼-½" thick CLAY zone, faint striations, abundant caliche present N28E,20NW
		39.6	11.7	117.4		10		SM	@ 6.6 feet, Silty SAND: fine-grained, orange-brown, very dense, massive
								CL	@ 12.8-13.3 feet, Rs, CLAY zone, fine-grained, dark green brown, stiff, faint striations down dip N73W,31NE; thin dark red brown Silty SAND interbed present N5W,41NE
		37.4	12.7	124.4		15		CL	@ 13.5-17.5 feet, Silty CLAY: fine-grained, light gray, soft to medium stiff
						20		BEDROCK	@ 17.5 feet, SANDSTONE: medium- to coarse-grained, very hard white to light gray, massive @ 19 feet, moderate to heavy seepage @ 23 feet, becomes less hard @ 24 feet, heavy seepage SANTIAGO FORMATION
		77.0	9.0	110.5		25			Bottom of Boring at 28 feet. Notes: 1) No caving. 2) Boring backfilled. 3) Seepage at 19 feet and 24 feet. 4) 6½ feet of standing water in bottom.

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Project No.:	Figure No.:
4142-02	B-3

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	59± feet	B-3
Date Drilled: 12/27/89 AK	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								SC	Silty CLAY: fine-grained, dark gray-brown, medium stiff, dry, very moist, contains roots TOPSOIL
		6.6	12.1	106.8					
						5		CL	@ 3.5-5 feet, Silty CLAY: fine-grained, light gray, very soft, mosit, caliche banding very abundant @ 5 feet, Silty SAND bed: fine-grained, light orange-brown, loose to medium dense @ 6 feet, Silty CLAY: fine-grained, light greenish-brown, soft, moist, abundant caliche bands
		4.4	8.2	103.7					
		6.6	27.6	95.2		10			@ 6½ feet, becomes very moist @ 9 feet, Sandy CLAY bed: fine-grained, light gray, soft, N79E,34NW @ 10 feet, Silty CLAY: light gray to white, very soft, very moist, some organics present @ 12-13 feet, sheared surface: N10E,26nW, CLAY zone, dark brown, very mosit, distinct polishing, zone highly disturbed, abundant caliche, very faint striations @ 14 feet, heavy seepage, caving
		4.4	33.9	92.3		15		CL	@ 14 feet, Sandy CLAY: dark green, sheared, contains small pieces of CLAYSTONE, very moist @ 18 feet, heavy seepage
						20			@ 20 feet, SANDSTONE: light gray, very hard @ 21 feet, heavy seepage and caving @ 25 feet, Silty CLAY: fine-grained, light gray-brown, very stiff
		28.6	12.3	124.7				SC	@ 26 feet, shear surface: highly polished, dark green brown @ 29 feet, bulk of shear surface obtained
		12.0	NR	NR		25			
		H.S.	25.1	104.1					

(Continued on Figure B-4.2)

NR = No Recovery
H.S.= Hand Sampled

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Tustin, California

Weese - Oceanside

Project No.:	Figure No.:
4142-02	B-4.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	59± feet	B-3
Date Drilled: 12/22/89 AK	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
									(Continued from Figure B-4.1)
		20.4	28.3	100.1				CL	Silty CLAY layer: sheared, polished, dark greenish-gray, very moist
		14.4	15.3	118.1		35			@ 35 feet, caving
									LANDSLIDE DEBRIS
						40		BEDROCK	@ 39 feet, Silty SANDSTONE: fine- to medium-coarse-grained, light, moist, dense
		33.6	10.4	125.1		45			SANTIAGO FORMATION
						50			Bottom of Boring at 48 feet.
									Notes:
									1) Caving intermittently from 14 feet to bottom of boring.
									2) Heavy seepage from 14 feet to 39 feet.
									3) Boring downhole logged to 14 feet.
									4) Boring backfilled.
						55			5) 7 feet of water existed upon completion of drilling.

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EARTH SCIENCE CONSULTANTS
Tustin, California

Weese - Oceanside

Project No.:	Figure No.:
4142-02	B-4.2

APPENDIX C

Previous Laboratory Testing Procedures and Test Results

APPENDIX D

Laboratory Testing Procedures and Test Results

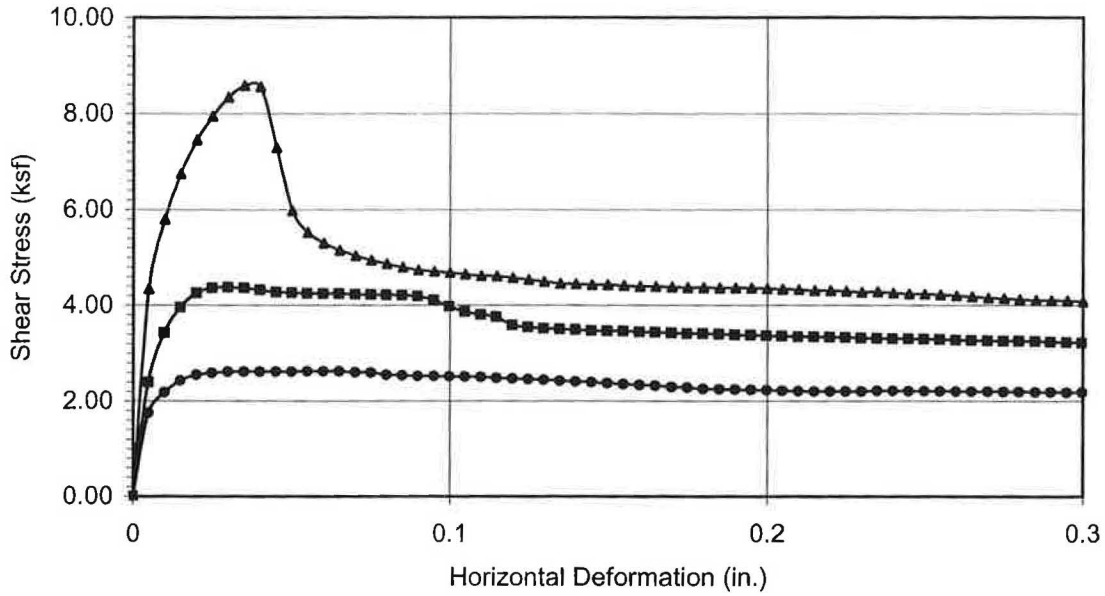
Consolidation Tests: Consolidation tests were performed on selected, relatively undisturbed samples recovered from the sampler. Samples were placed in a consolidometer and loads were applied in geometric progression. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The consolidation pressure curves are presented in the test data. Where applicable, time-rates of consolidation were also recorded. A plot of these rates can be used to estimate time of consolidation.

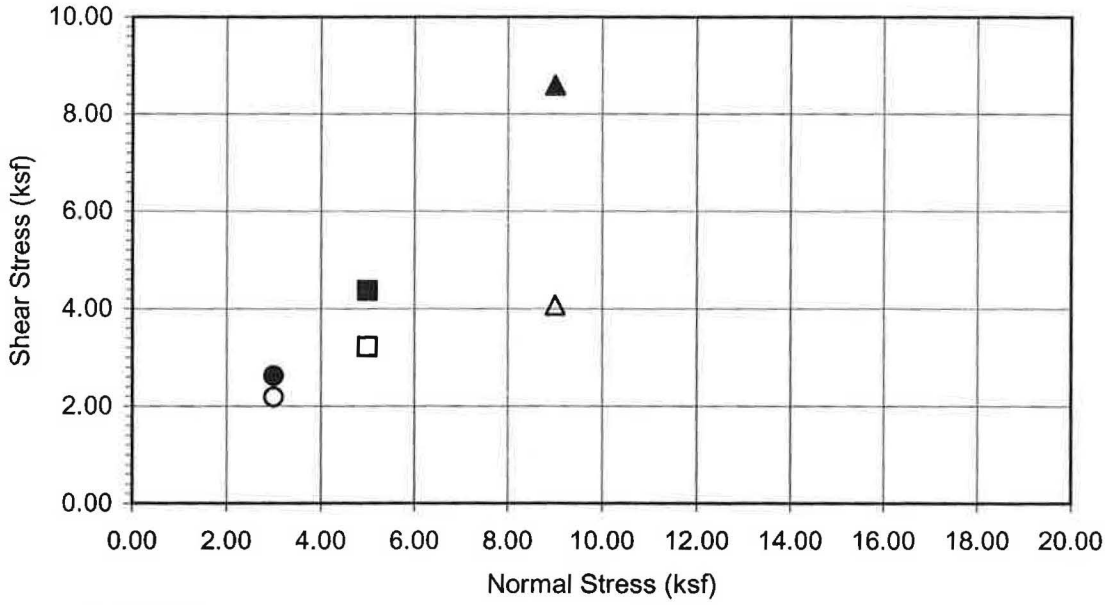
Direct Shear Tests: Direct shear tests were performed on selected remolded and/or undisturbed samples that were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of 0.005 inches per minute.

Expansion Index Tests: The expansion potential of selected finish grade materials was evaluated by the Expansion Index Test, ASTM Test Method 4829. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the following tables.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557-78 (five layers). The results of these tests are presented in the test data.

Moisture and Density Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.





Boring No.	**LB-13**
Sample No.	**R-5**
Depth (ft)	**46**
Sample Type:	
Drive	
Soil Identification:	
Brown Silt, Siltstone (ML)	

Normal Stress (kip/ft²)	3.000	5.000	9.000
Peak Shear Stress (kip/ft²)	● 2.622	■ 4.374	▲ 8.586
Shear Stress @ End of Test (ksf)	○ 2.182	□ 3.221	△ 4.075
Deformation Rate (in./min.)	0.0010	0.0010	0.0010
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.29	16.29	16.29
Dry Density (pcf)	107.6	111.9	117.9
Saturation (%)	77.5	86.8	102.3
Soil Height Before Shearing (in.)	0.9923	0.9900	0.9905
Final Moisture Content (%)	23.8	20.6	33.4

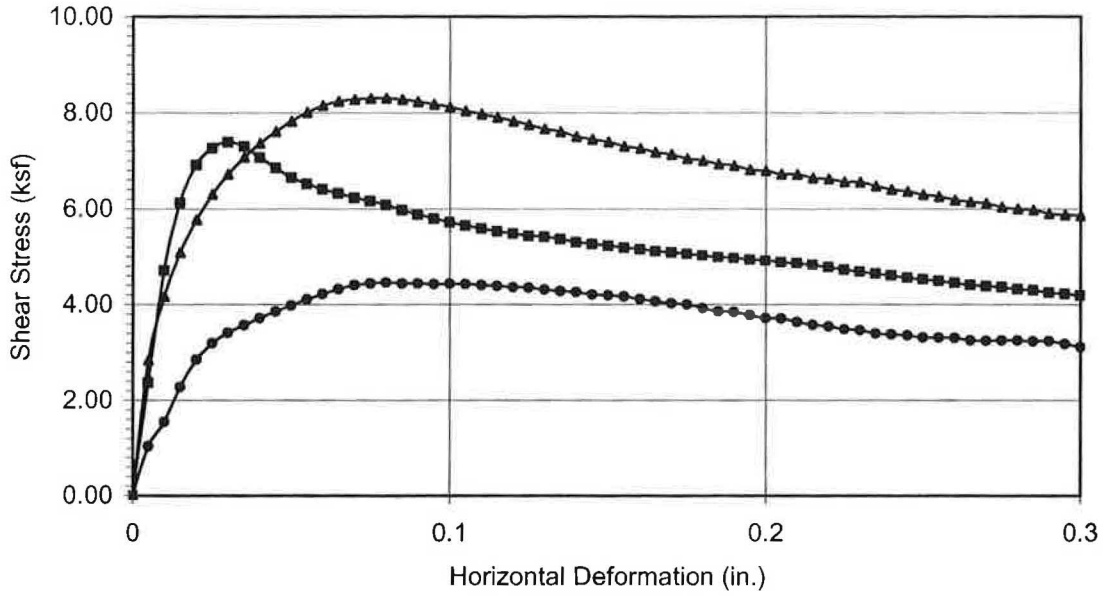
Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

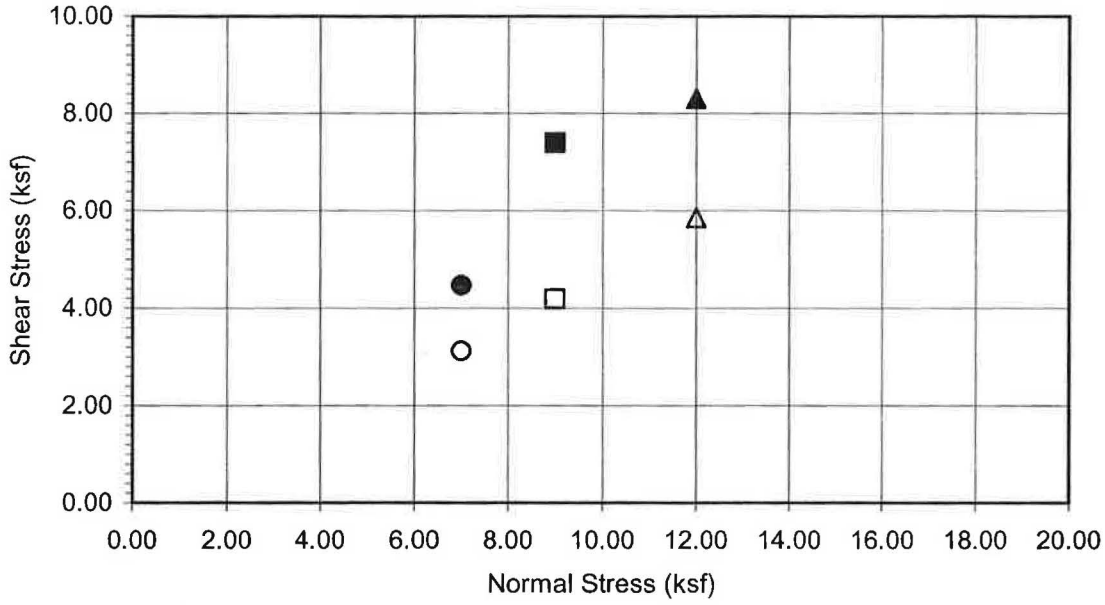
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 040963-001

Weese / Oceanside

07-03





Boring No.	**LB-13**
Sample No.	**R-10a**
Depth (ft)	**100**
Sample Type: Drive	
Soil Identification: Brown Lean Clay (CL)	

Normal Stress (kip/ft²)	7.000	9.000	12.000
Peak Shear Stress (kip/ft²)	● 4.462	■ 7.392	▲ 8.303
Shear Stress @ End of Test (ksf)	○ 3.115	□ 4.190	△ 5.858
Deformation Rate (in./min.)	0.0010	0.0010	0.0010
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.97	18.97	18.97
Dry Density (pcf)	111.5	113.0	113.7
Saturation (%)	100.2	104.0	106.2
Soil Height Before Shearing (in.)	0.9799	0.9838	0.9903
Final Moisture Content (%)	23.1	20.9	22.7

Teratest Labs, Inc.
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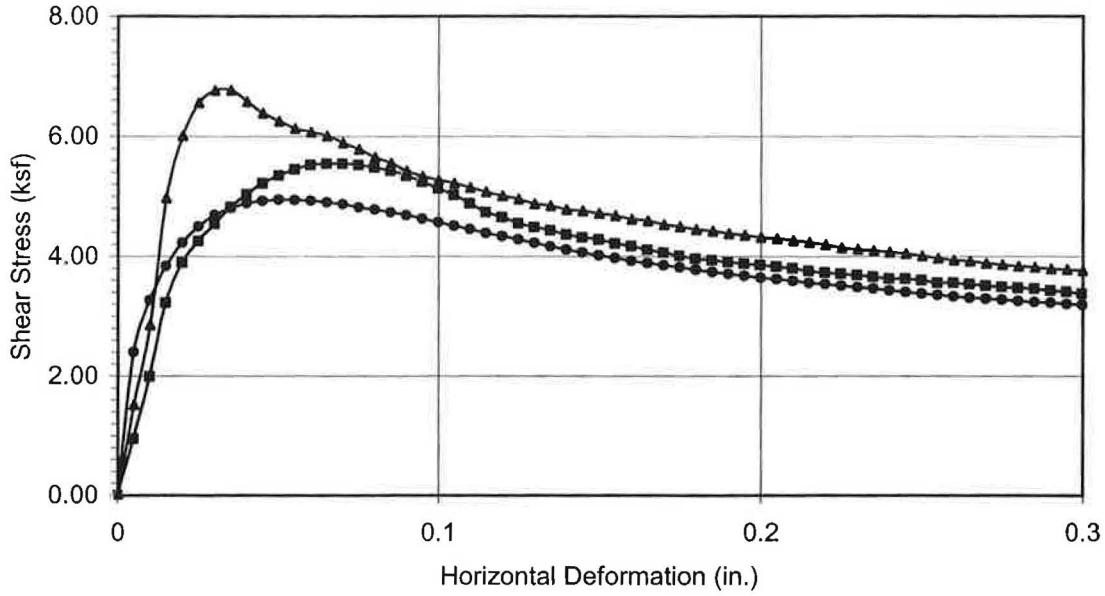
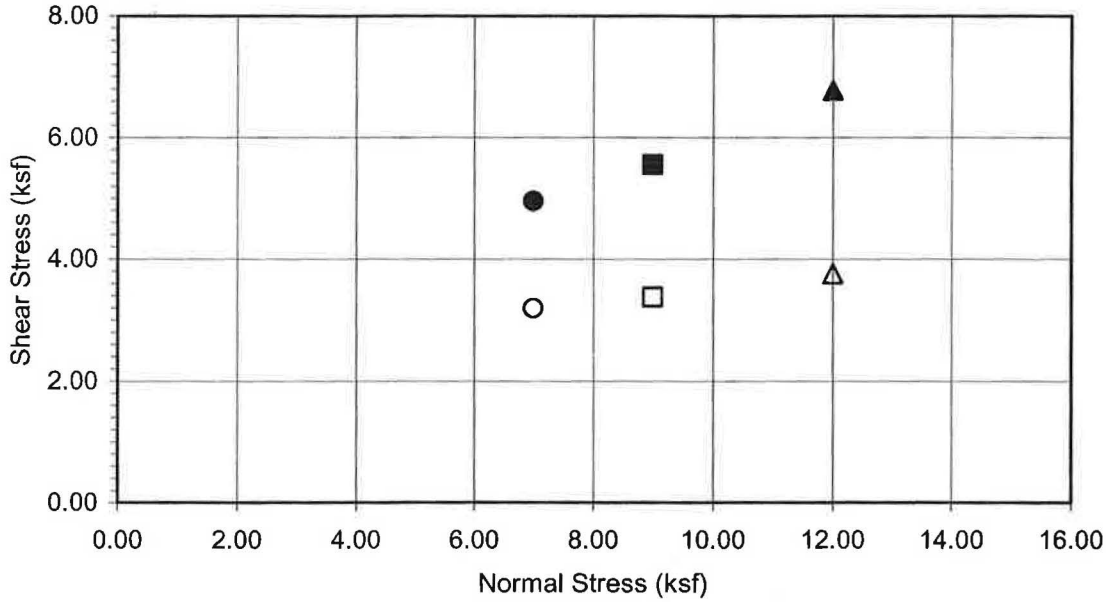
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 040963-001

Weese / Oceanside

07-03





Boring No.	**LB-13**
Sample No.	**R-10b**
Depth (ft)	**100**
Sample Type: Drive	
Soil Identification: Brown Silty Clay (CL-ML)	

Normal Stress (kip/ft²)	7.000	9.000	12.000
Peak Shear Stress (kip/ft²)	● 4.948	■ 5.550	▲ 6.772
Shear Stress @ End of Test (ksf)	○ 3.190	□ 3.377	△ 3.760
Deformation Rate (in./min.)	0.0010	0.0010	0.0010
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.70	20.70	20.70
Dry Density (pcf)	106.8	107.9	108.7
Saturation (%)	96.6	99.4	101.4
Soil Height Before Shearing (in.)	0.9965	0.9931	0.9956
Final Moisture Content (%)	25.3	25.6	25.7

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 040963-001
Weese / Oceanside

07-03

EXPANSION INDEX TEST RESULTS

TEST NO.	SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSIVE POTENTIAL
1	Qal Area	11.2	89.9	34.3	14.1	141	Very High
2	Qal Area	8.3	94.9	32.3	13.1	131	Very High

MAXIMUM DENSITY TEST RESULTS

SAMPLE	DESCRIPTION	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
1	Very dark brown clay	101.5	19.0
2	Dark gray sandy clay	106.0	15.0
3	Dark brown topsoil	123.0	9.0
4	Light brown to brown sandy silt	102.5	14.0
5	Pale brown silty sand	117.5	11.0
6	Reddish gray clayey sand	116.0	14.0

LEIGHTON and ASSOCIATES

Project No.
4850512-02

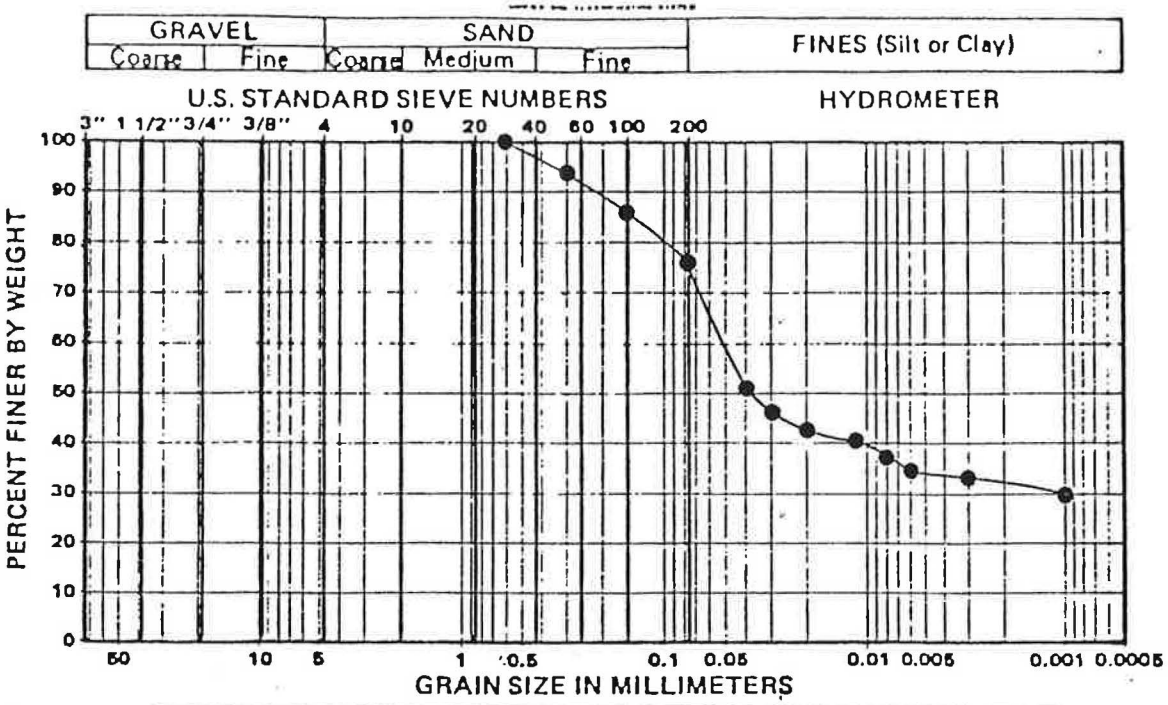
WEESE PROPERTY
OCEANSIDE, CALIFORNIA

MAXIMUM DENSITY TEST RESULTS

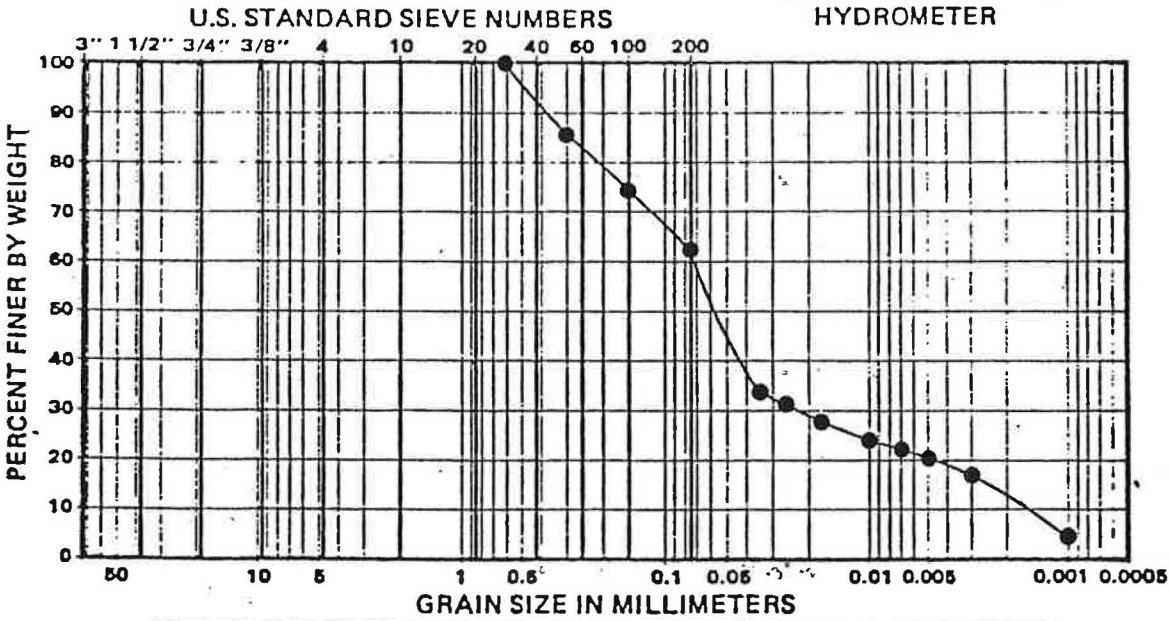
SAMPLE LOCATION	SOIL DESCRIPTION	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (PCF)
B-2 No. 1	Dark olive-brown clay with chunks of sandy clay	12.0	120.0

EXPANSION INDEX TEST RESULTS

TEST NO.	SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSION POTENTIAL
1	LB-1 No. 5	12.3	94.4	34.4	151	15.1	Very High
2	LB-2 No. 2	13.4	94.0	34.6	154	15.4	Very High



SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH (FEET)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
●	B-2	2	9				ML



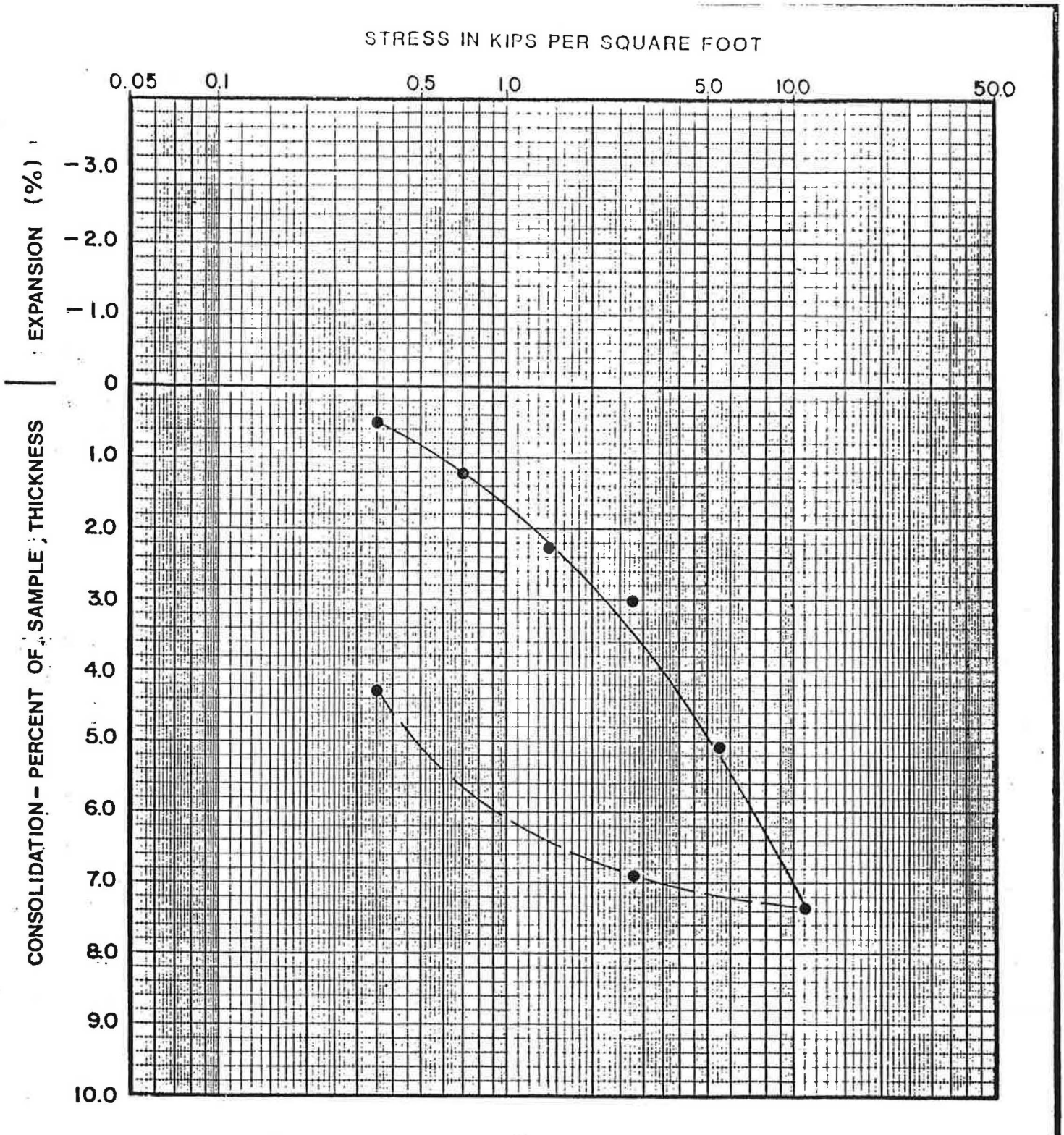
SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH (FEET)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
●	B-1	5	24				ML

LEIGHTON and ASSOCIATES

Project No. 4840512-01

WEESE PROPERTY

GRAIN SIZE DISTRIBUTION CURVES



O FIELD MOISTURE

● SATURATED

—— LOADING

---- REBOUND

BORING NO.: B-1

SAMPLE NO.: 3

DEPTH (FT) : 14 - 15

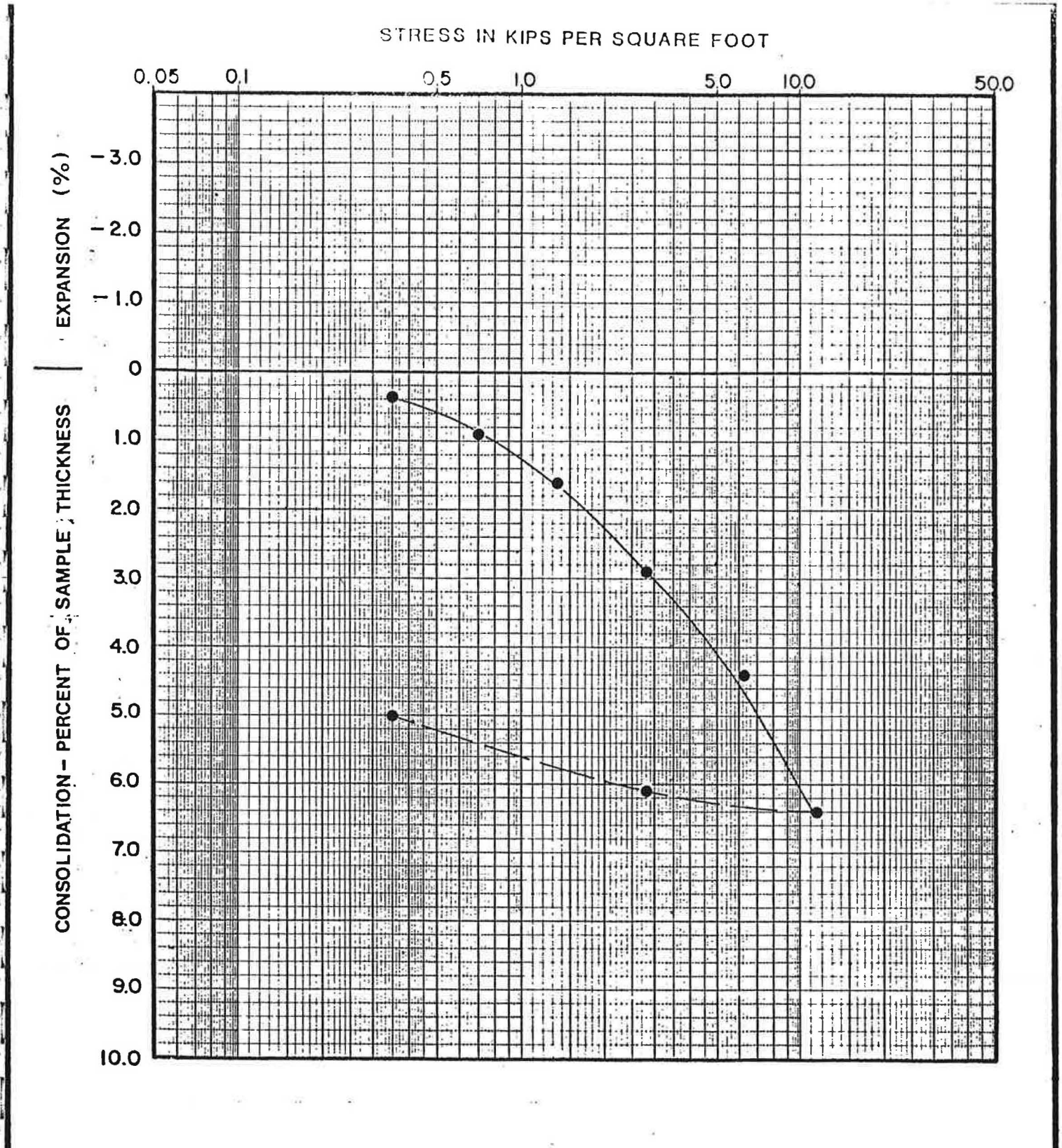
SOIL TYPE : CL

LEIGHTON and ASSOCIATES INCORPORATED

Project No. 4850512-01

WEESE/OCEANSIDE

CONSOLIDATION TEST RESULTS



O FIELD MOISTURE

● SATURATED

——— LOADING

– – – REBOUND

BORING NO.: B-1

SAMPLE NO.: 5

DEPTH (FT) : 24 - 25

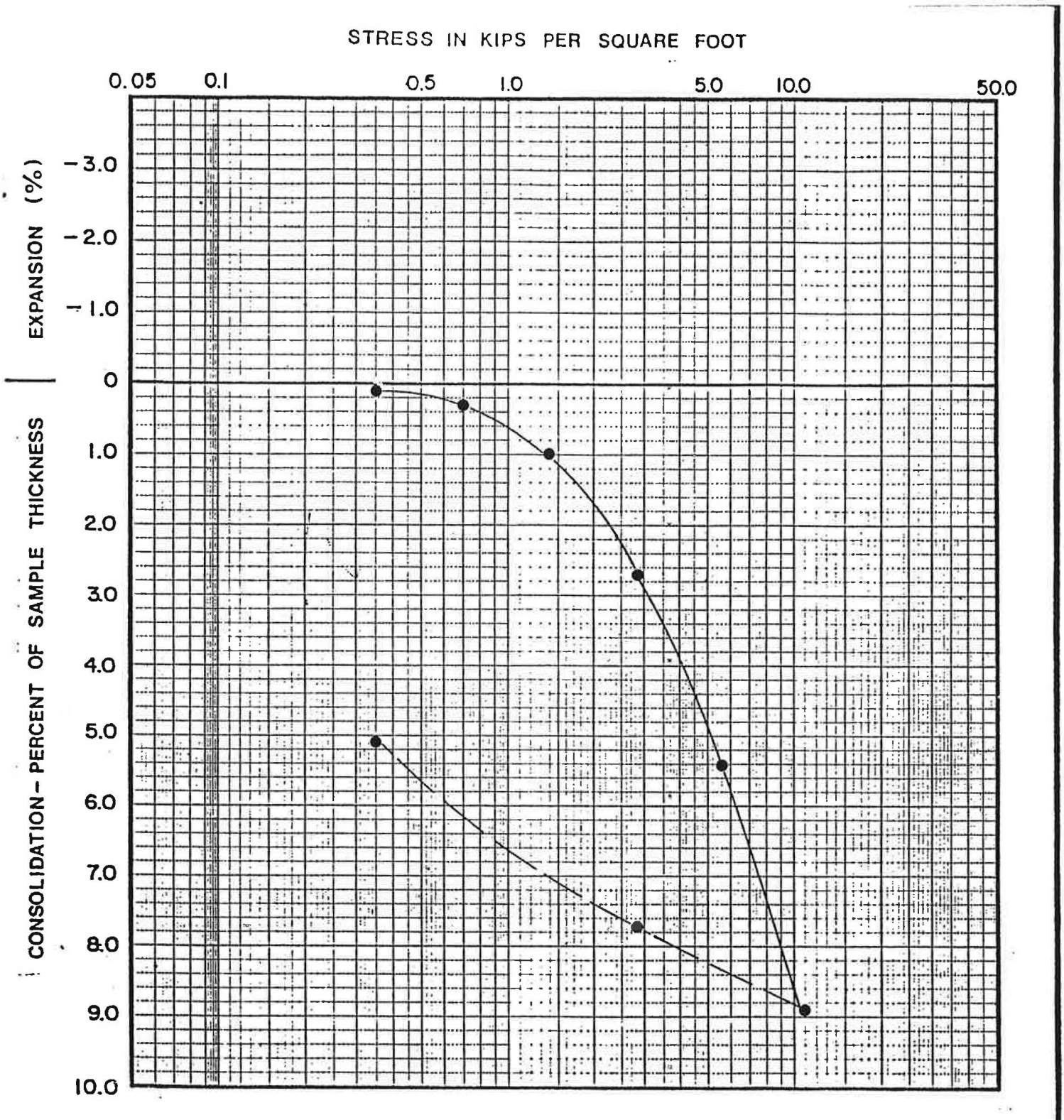
SOIL TYPE : CL

LEIGHTON and ASSOCIATES INCORPORATED

Project No. 4850512-01

WEESE/OCEANSIDE

CONSOLIDATION TEST RESULTS



O FIELD MOISTURE

● SATURATED

—— LOADING

- - - REBOUND

BORING NO.: B-2

SAMPLE NO.: 2

DEPTH (FT) : 9 - 10

SOIL TYPE : CL

LEIGHTON and ASSOCIATES

Project No. 4850512-01

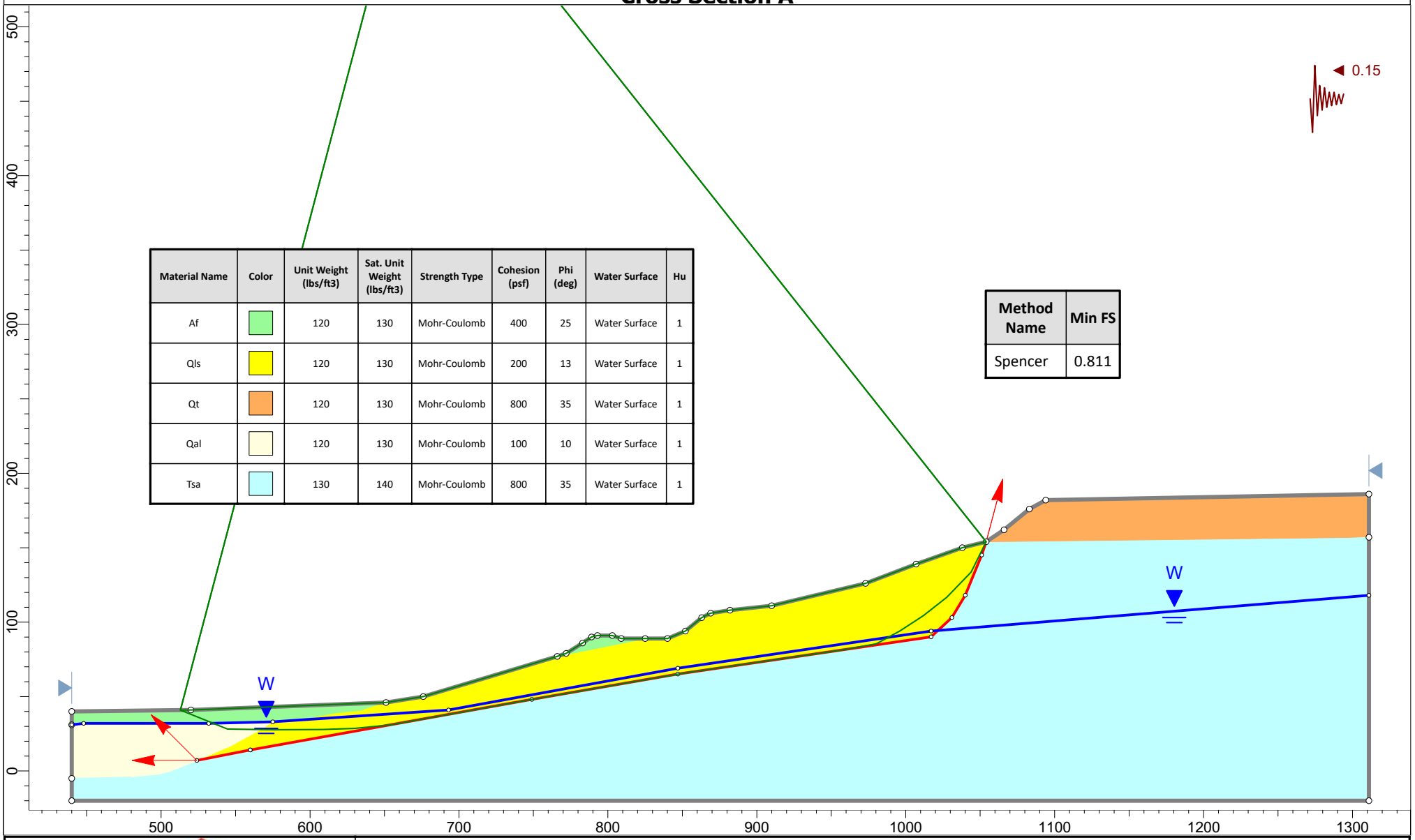
WEESE/OCEANSIDE

CONSOLIDATION TEST RESULTS

APPENDIX D

Slope Stability Analyses

Cross Section A



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	1

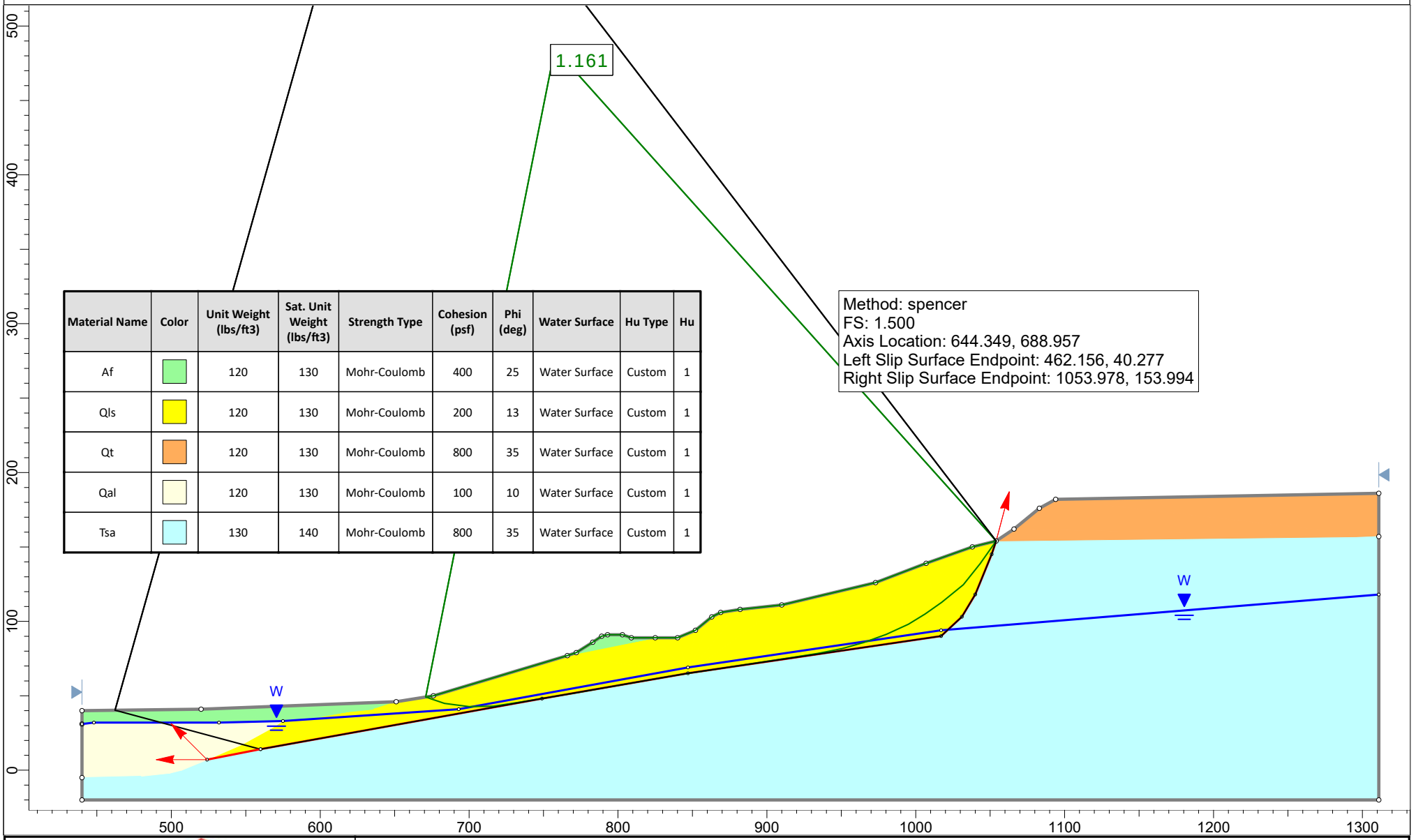
Method Name	Min FS
Spencer	0.811

Leighton

SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qal		
Drawn By: EDB	Unit: Feet	Scale: 1:1080	Company: Leighton
Date: 9/19/2019			File Name: Section A - Existing 9-18-19.slmd

Cross Section A



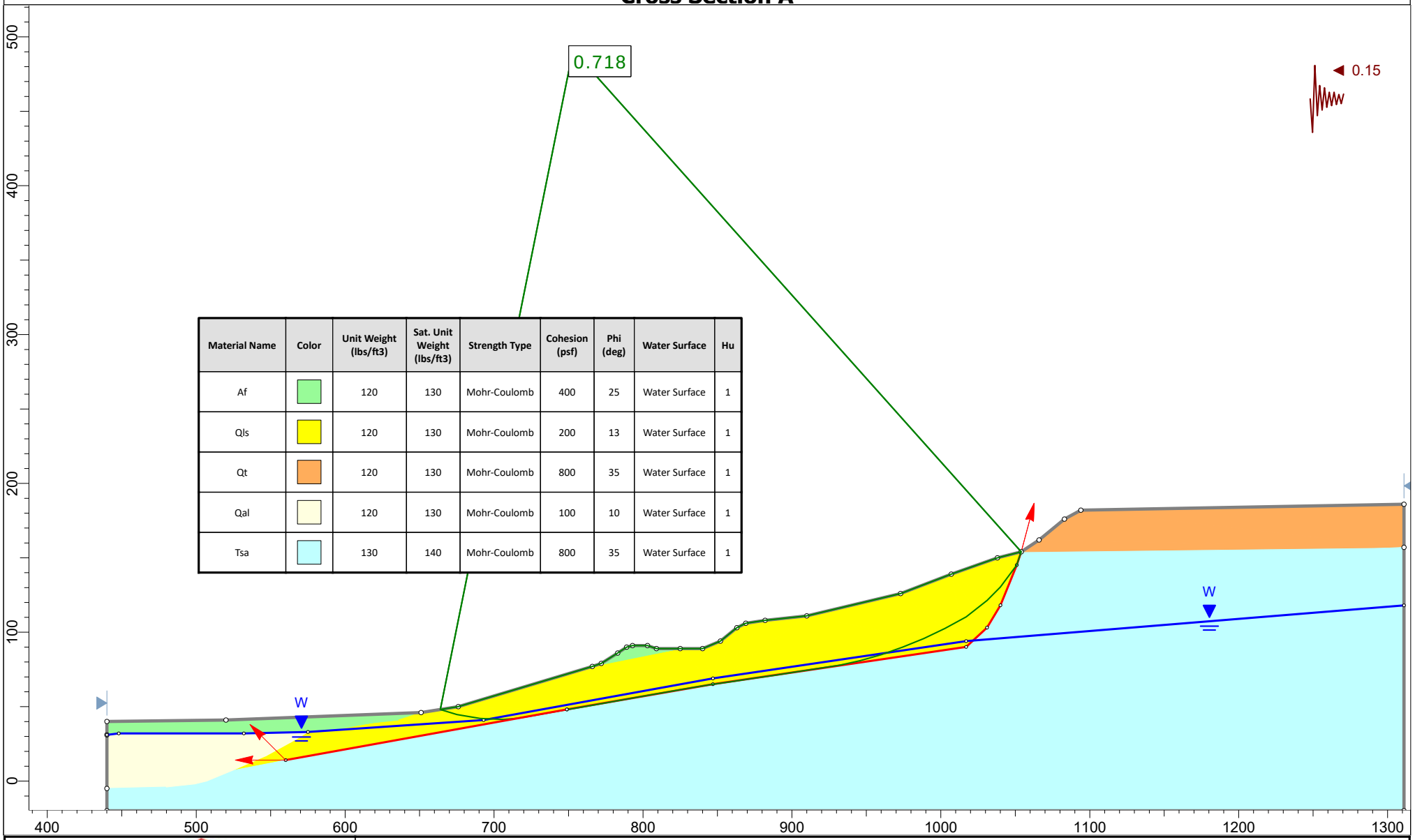
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek			
Analysis Description	Existing Site - Check Failure Through Qal			
Drawn By: EDB	Unit: Feet	Scale: 1:1080	Company: Leighton	
Date: 9/18/2019			File Name: Section A - Existing 9-18-19.slmd	

Cross Section A



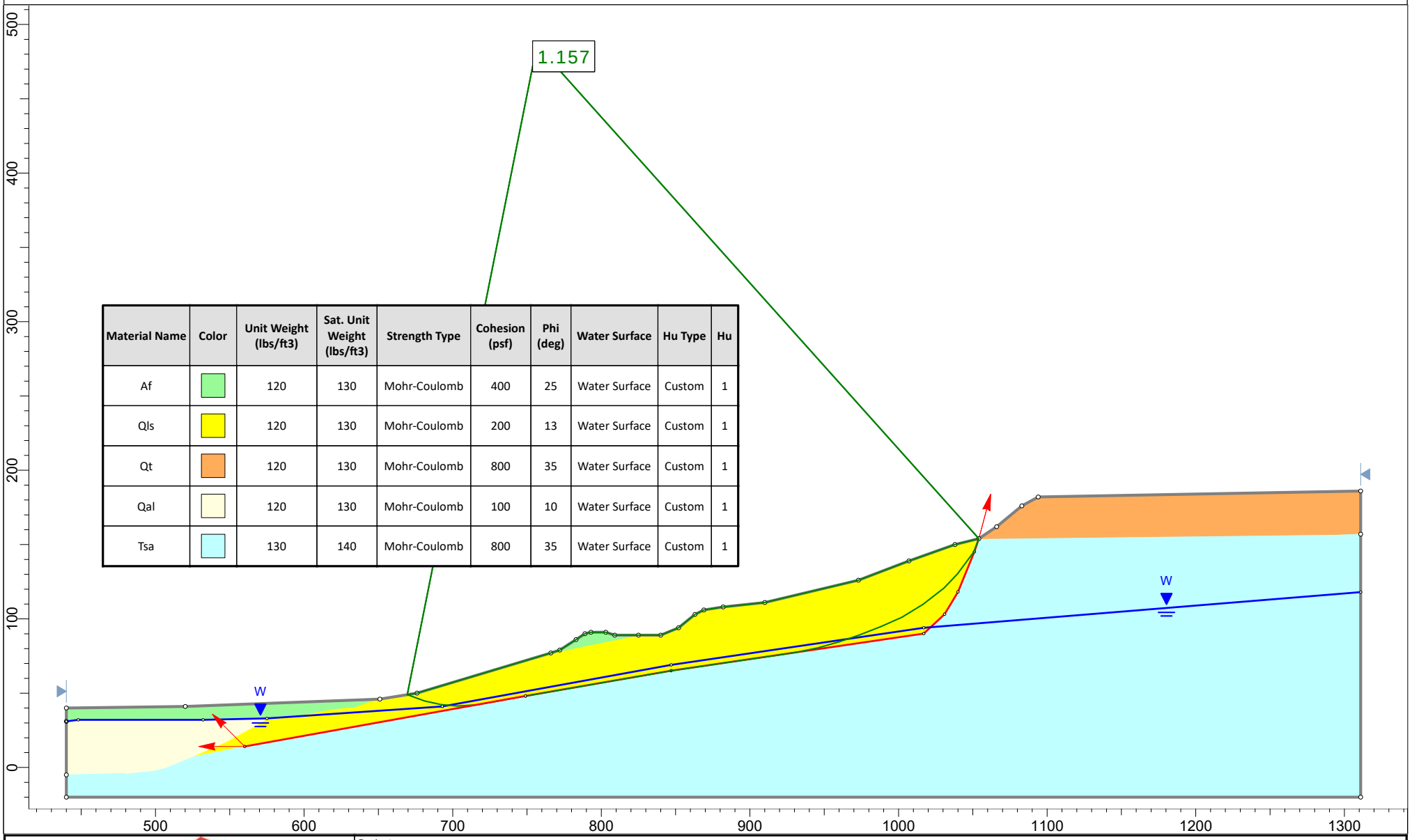
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	1

Leighton

SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Lower Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:1080	*Company* Leighton
Date 9/19/2019			*File Name* Section A - Existing 9-18-19.slmd

Cross Section A



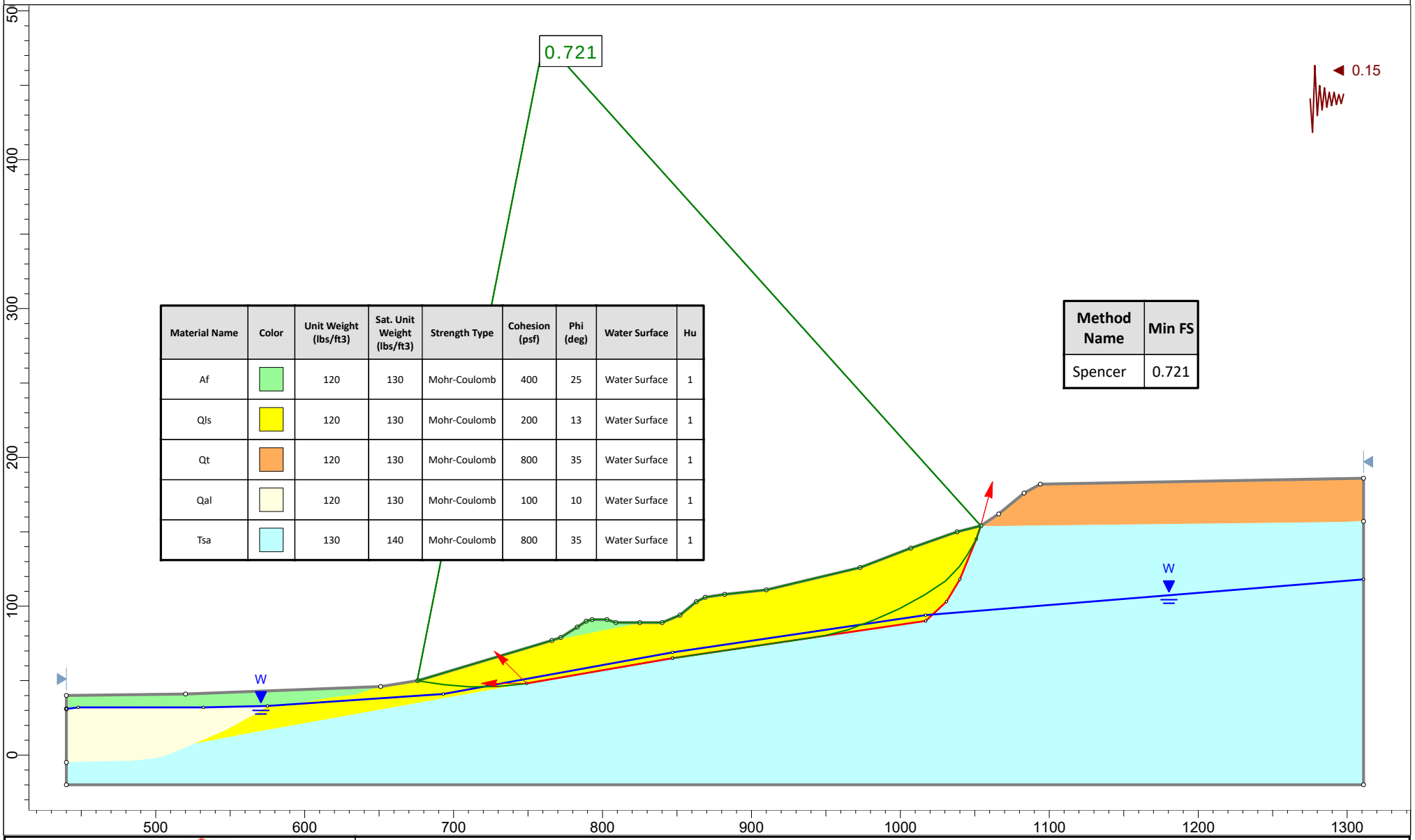
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Lower Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:1080	*Company* Leighton
Date 9/18/2019			*File Name* Section A - Existing 9-18-19.slmd

Cross Section A



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	1

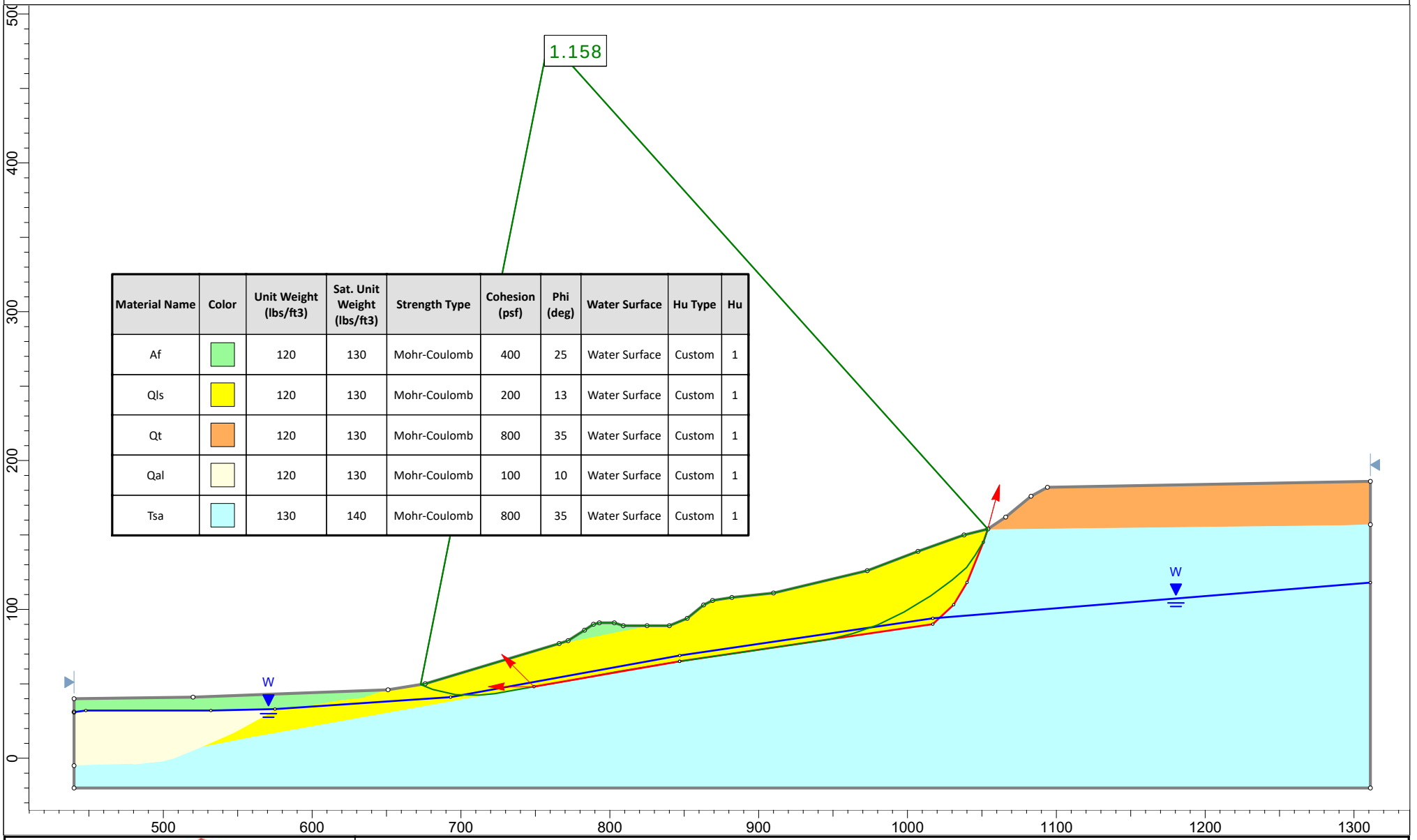
Method Name	Min FS
Spencer	0.721

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Mid Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:1080	*Company* Leighton
Date 9/18/2019			*File Name* Section A - Existing 9-18-19.slmd

Cross Section A



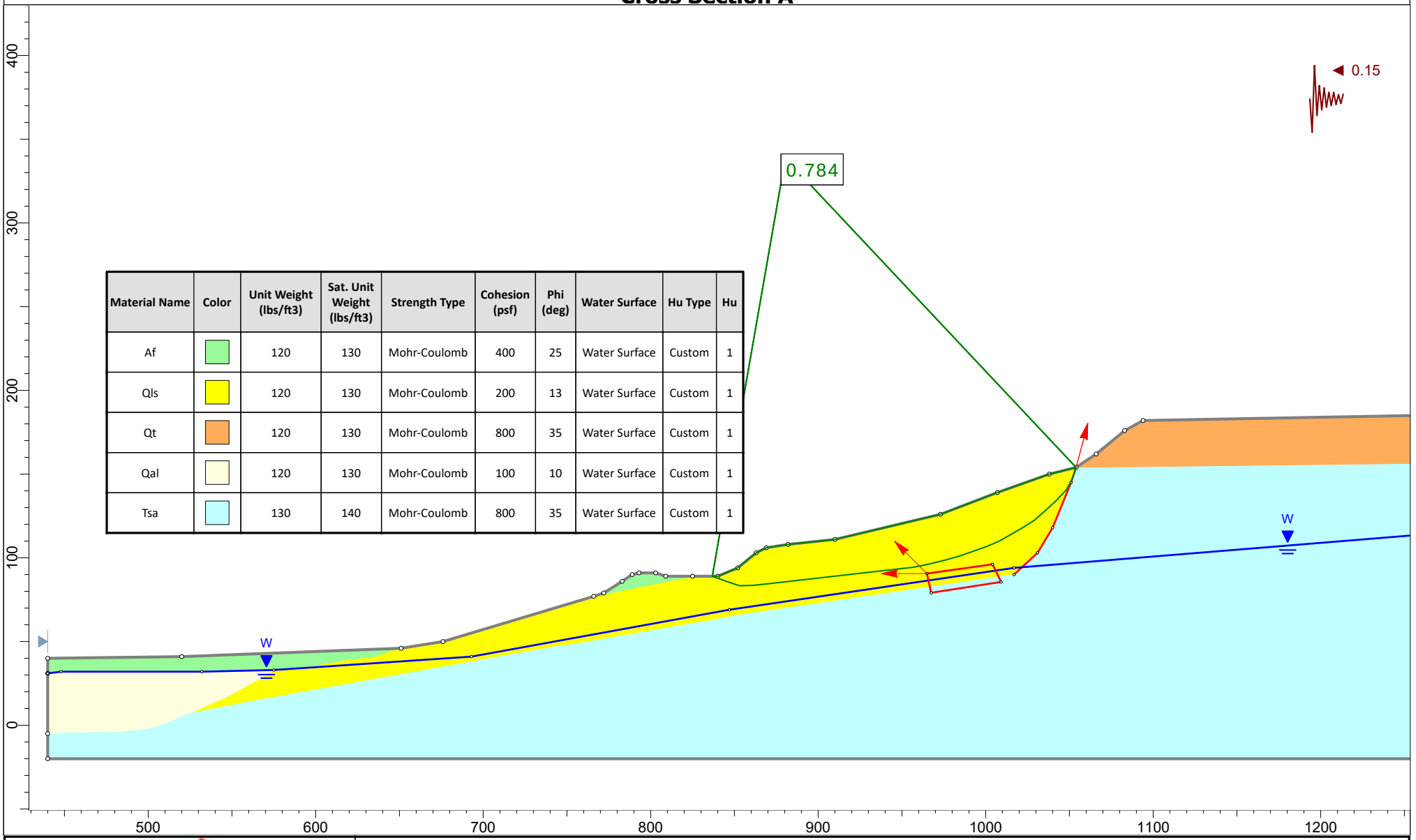
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek			
Analysis Description	Existing Site - Check Failure Through Qls Mid Slope			
Drawn By EDB	*Unit* Feet	*Scale* 1:1080	*Company* Leighton	
Date 9/18/2019			*File Name* Section A - Existing 9-18-19.slmd	

Cross Section A



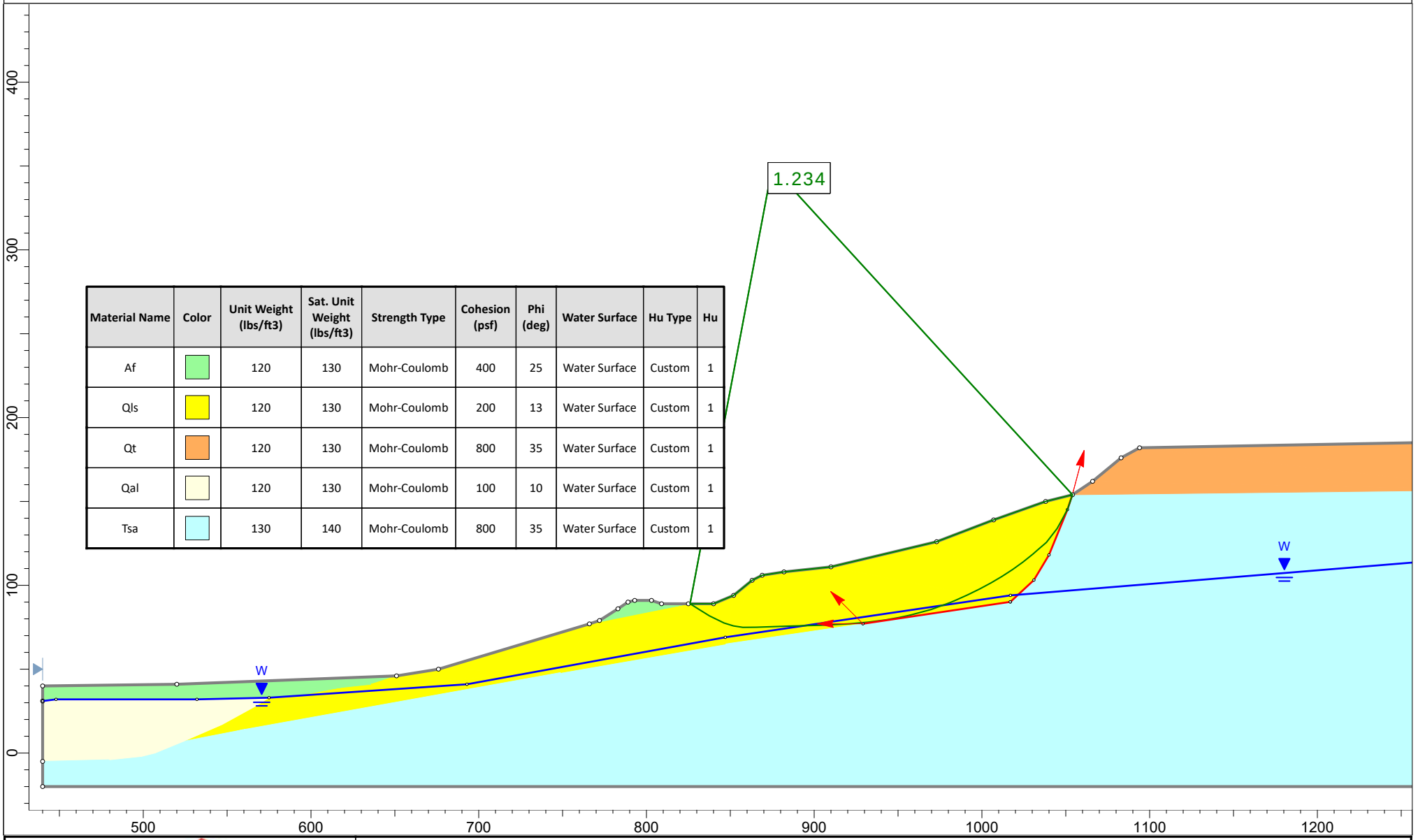
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Upper Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:960	*Company* Leighton
Date 9/19/2019			*File Name* Section A - Existing 9-18-19.slmd

Cross Section A



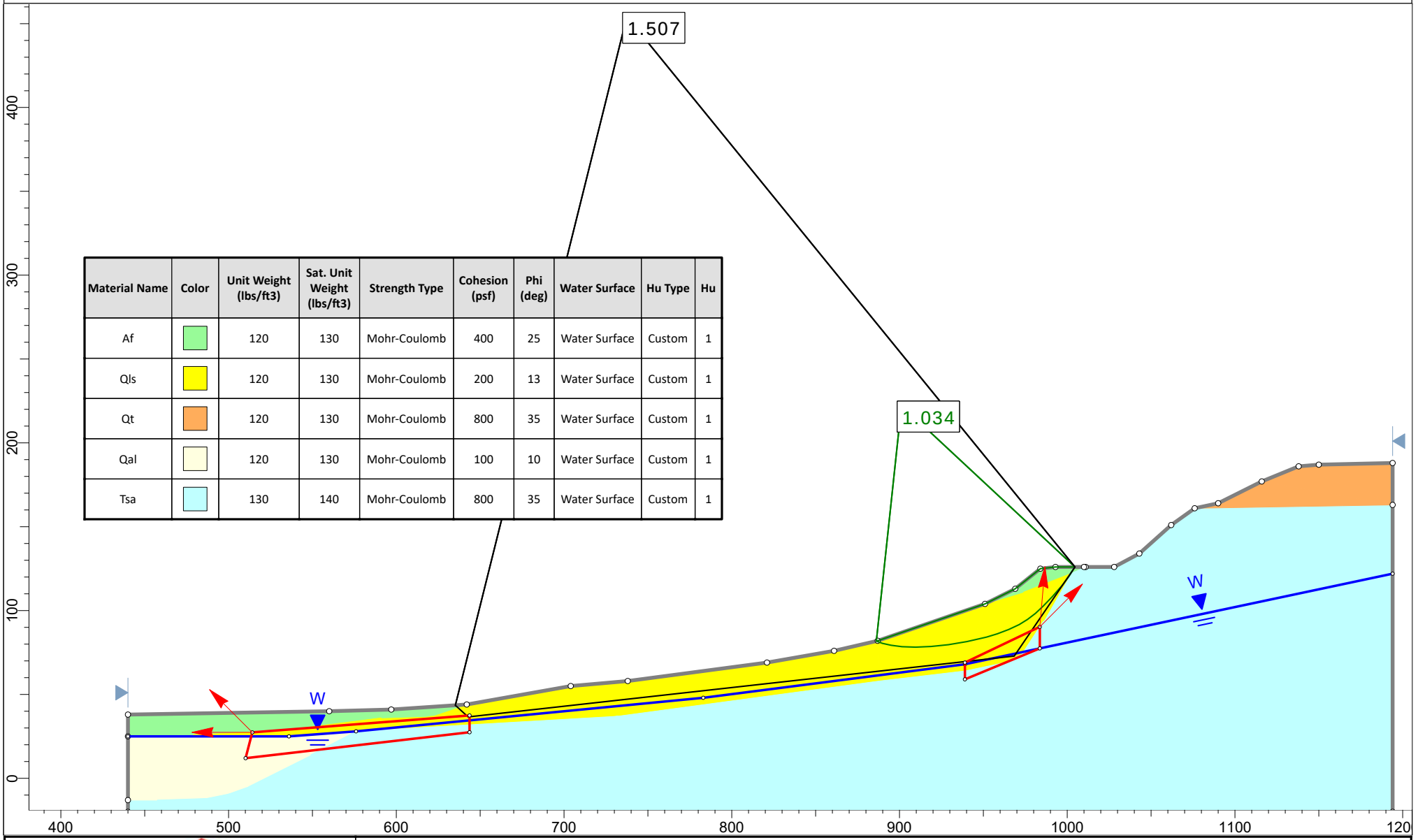
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Upper Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:960	*Company* Leighton
Date 9/18/2019			*File Name* Section A - Existing 9-18-19.slmd

Cross Section D



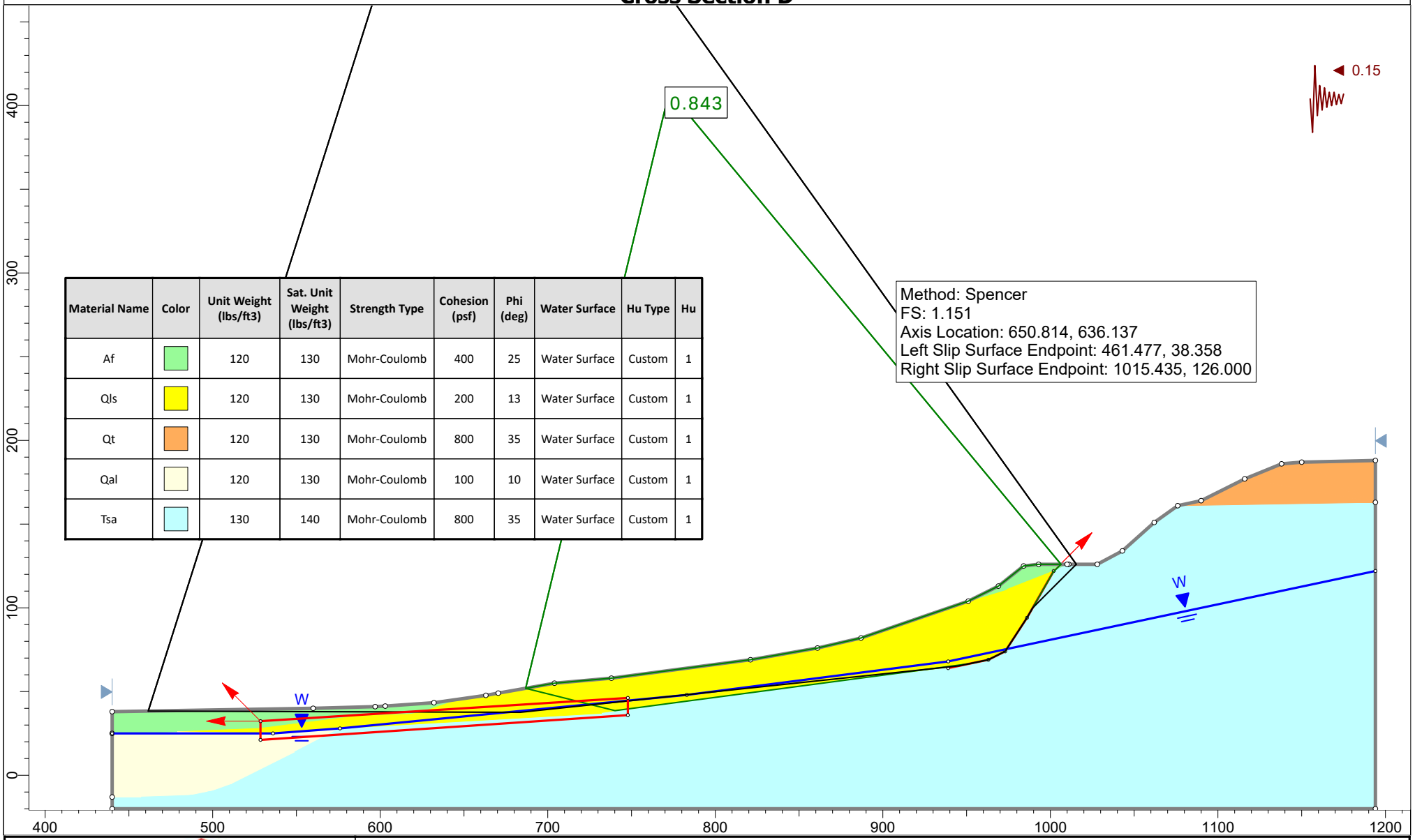
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qal		
Drawn By EDB	*Unit* Feet	*Scale* 1:960	*Company* Leighton
Date 9/18/2019			*File Name* Section D - Existing.slmd

Cross Section D



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

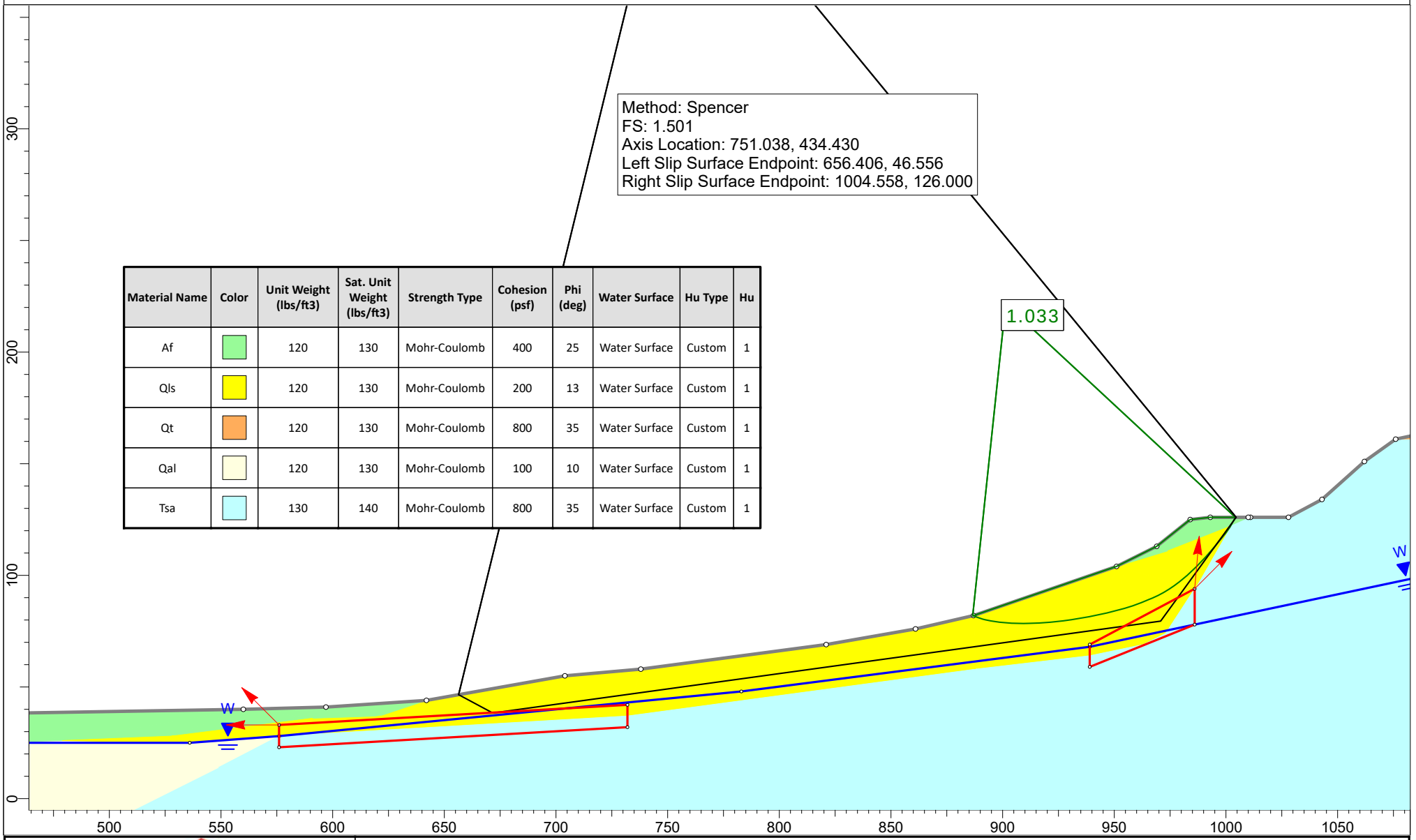
SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Cross Section D - Existing Site - Check Failure Through Qal		
Drawn By: EDB	Unit: Feet	Scale: 1:960	Company: Leighton
Date: 9/19/2019			File Name: Section D - Existing revised.slmd

Cross Section D

Method: Spencer
FS: 1.501
Axis Location: 751.038, 434.430
Left Slip Surface Endpoint: 656.406, 46.556
Right Slip Surface Endpoint: 1004.558, 126.000

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

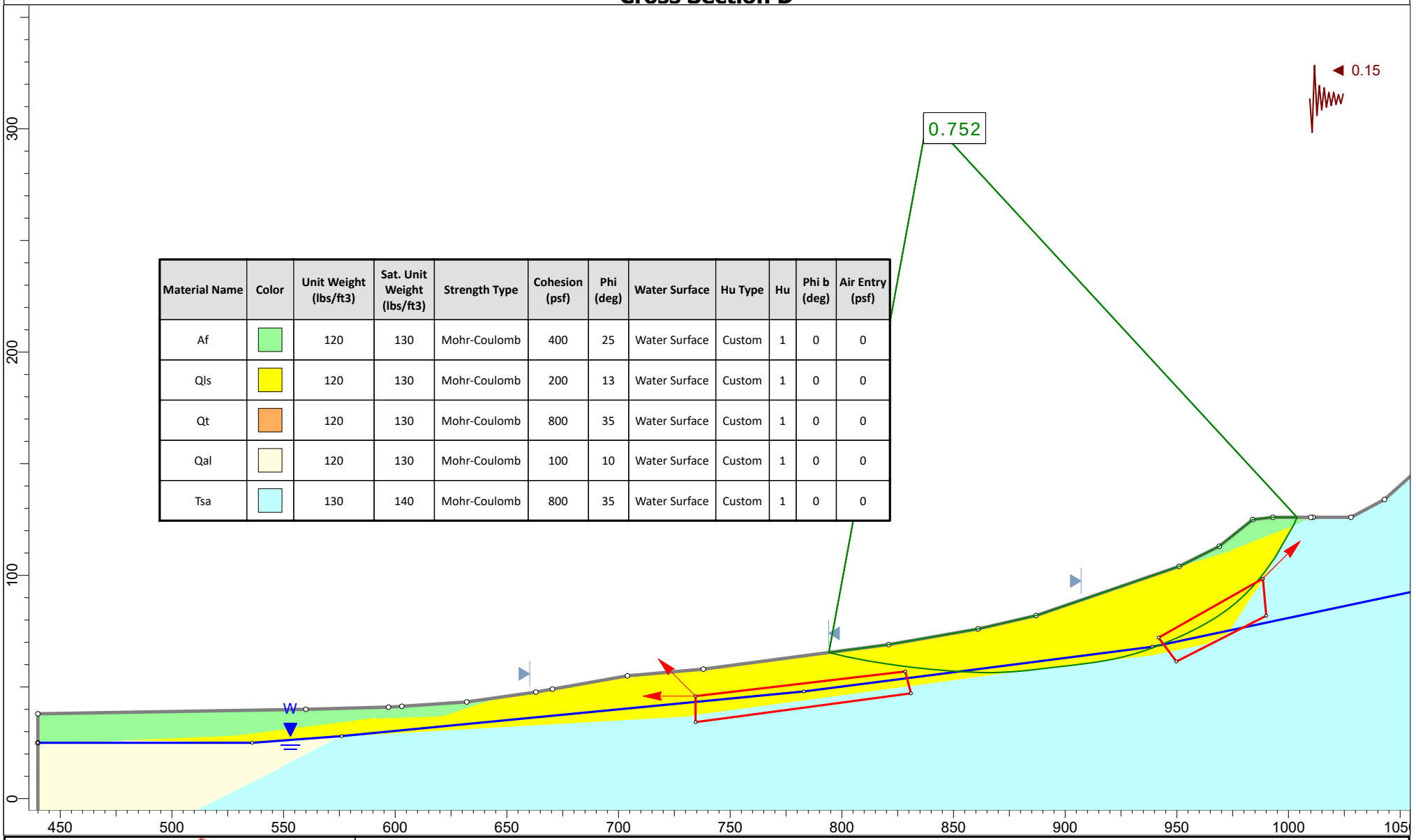


Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Lower Slope		
Drawn By: EDB	Unit: Feet	Scale: 1:720	Company: Leighton
Date: 9/18/2019			File Name: Section D - Existing.slmd

Cross Section D



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Phi b (deg)	Air Entry (psf)
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1	0	0
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1	0	0
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1	0	0
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1	0	0
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1	0	0

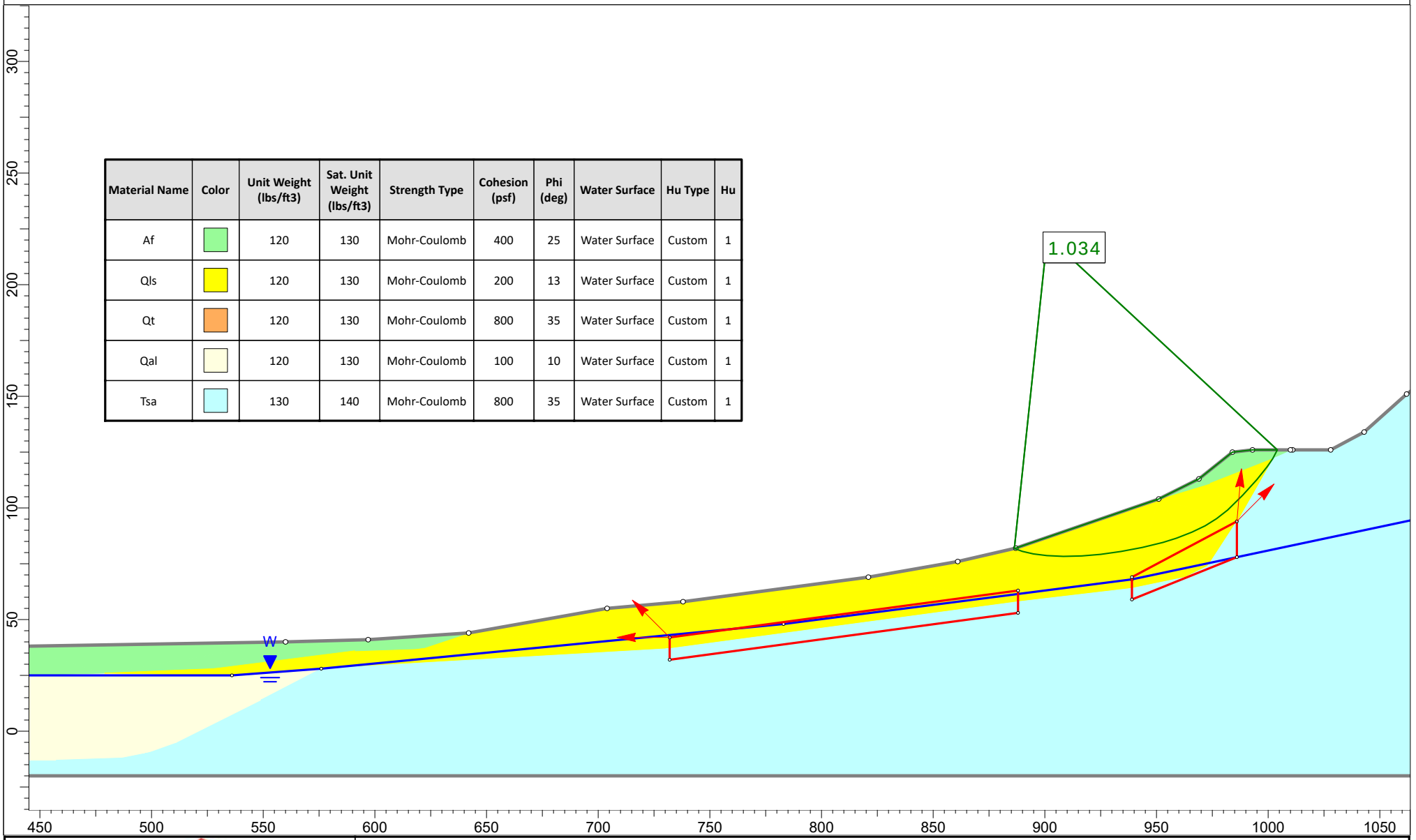
Leighton

SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Mid Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:720	*Company* Leighton
Date 9/19/2019			*File Name* Section D - Existing revised.slmd

Cross Section D

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1



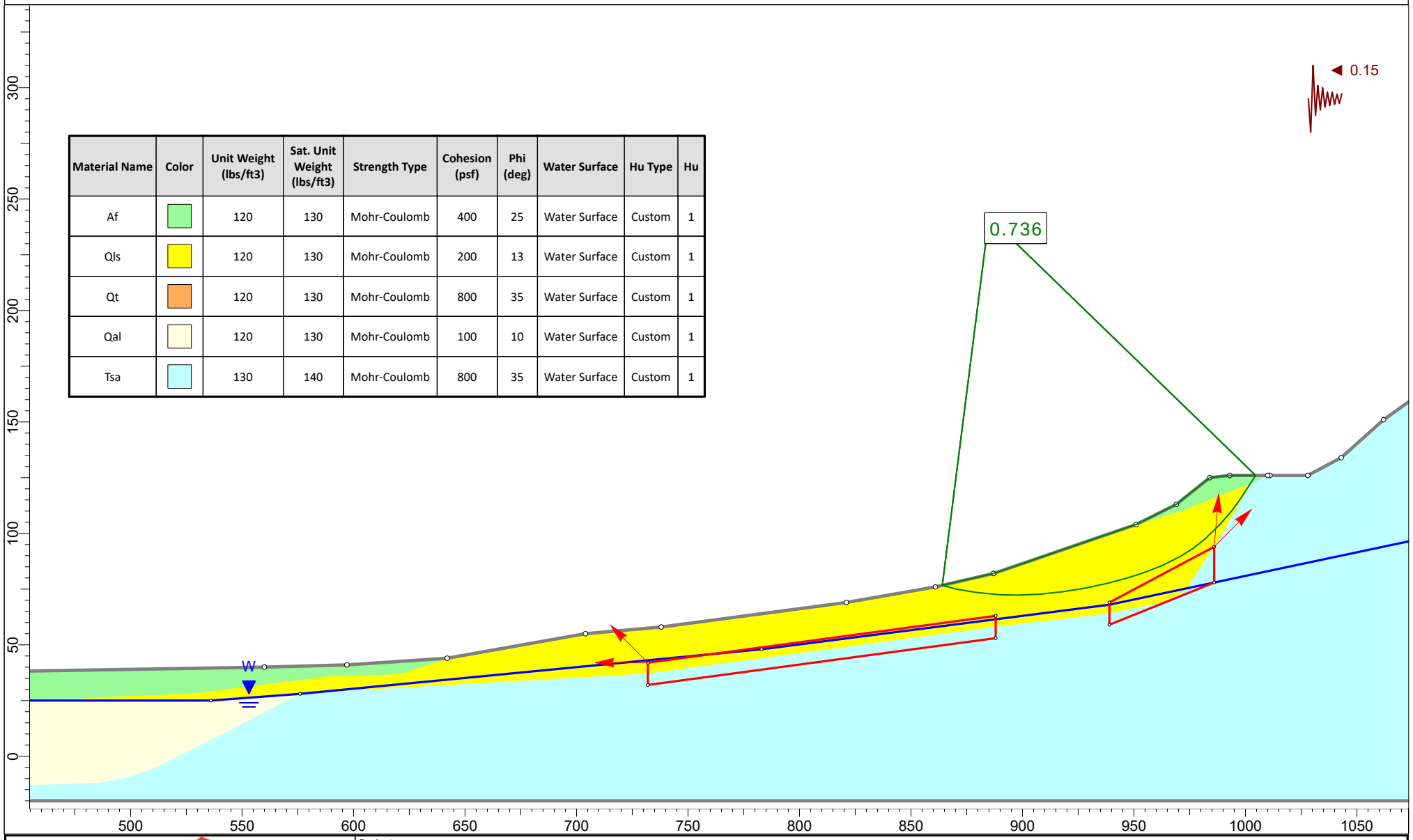
Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek			
Analysis Description	Existing Site - Check Failure Through Qls Mid Slope			
Drawn By EDB	*Unit* Feet	*Scale* 1:720	*Company* Leighton	
Date 9/18/2019			*File Name* Section D - Existing.slmd	

Cross Section D

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1



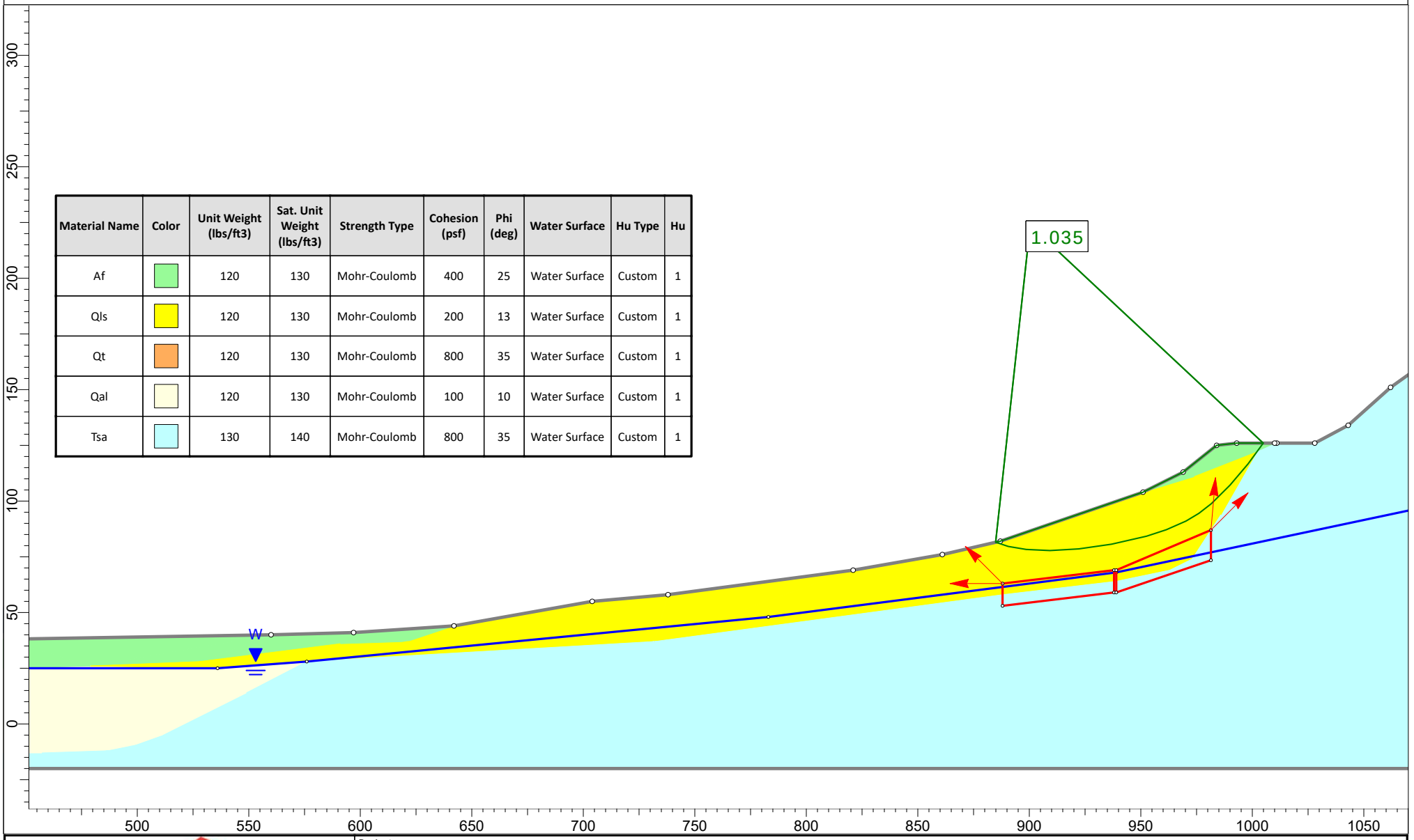
Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Mid Slope		
Drawn By	EDB	Scale 1:720	Company Leighton
Date	9/20/2019		File Name Section D - Existing.slmd

Cross Section D

Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

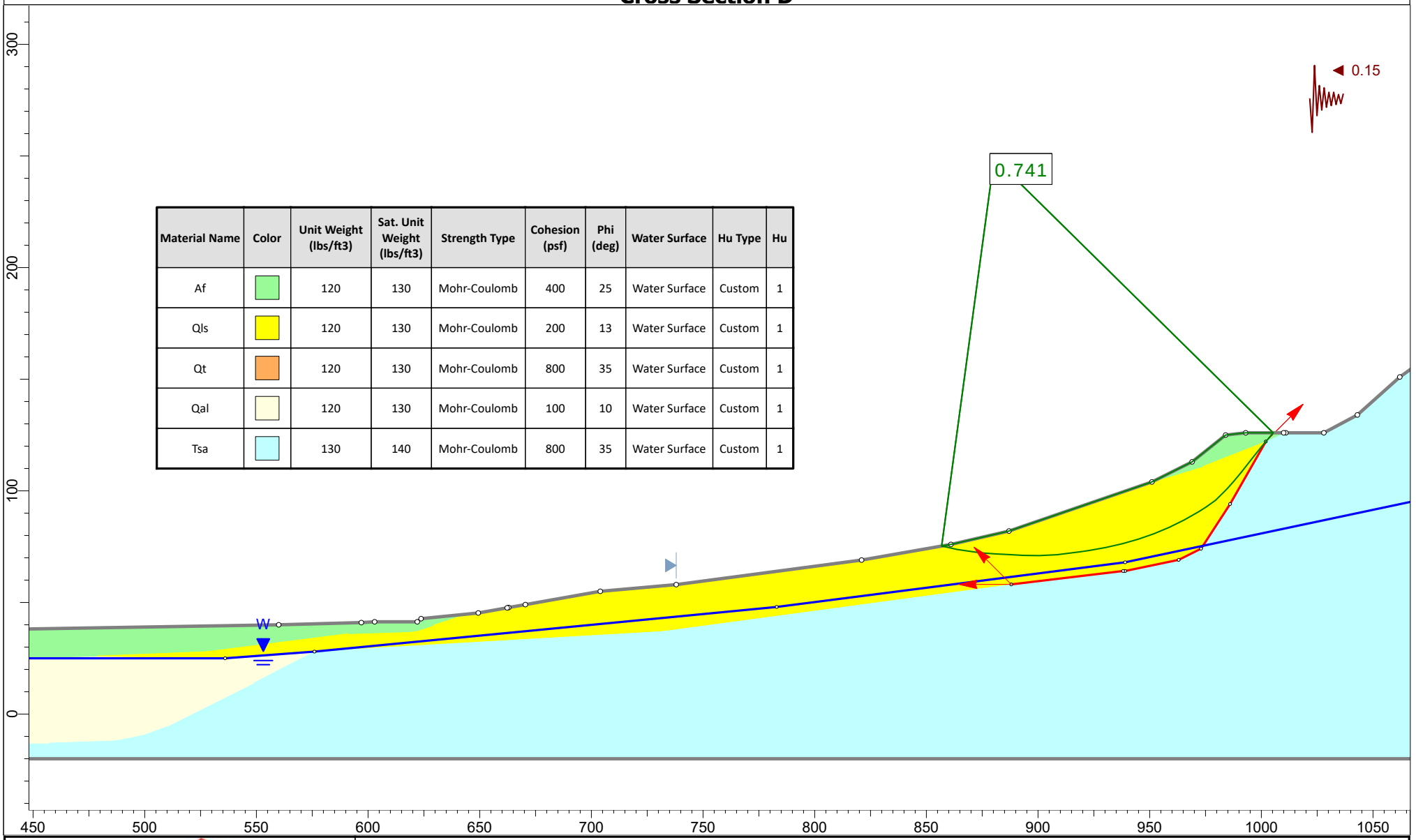


Leighton

SLIDEINTERPRET 8.022

Project	12085.002 Ocean Creek		
Analysis Description	Existing Site - Check Failure Through Qls Upper Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:720	*Company* Leighton
Date 9/18/2019			*File Name* Section D - Existing.slmd

Cross Section D



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Af		120	130	Mohr-Coulomb	400	25	Water Surface	Custom	1
Qls		120	130	Mohr-Coulomb	200	13	Water Surface	Custom	1
Qt		120	130	Mohr-Coulomb	800	35	Water Surface	Custom	1
Qal		120	130	Mohr-Coulomb	100	10	Water Surface	Custom	1
Tsa		130	140	Mohr-Coulomb	800	35	Water Surface	Custom	1

Leighton

SLIDEINTERPRET 8.023

Project	12085.002 Ocean Creek		
Analysis Description	Cross Section D - Existing Site - Check Failure Through Qls Upper Slope		
Drawn By EDB	*Unit* Feet	*Scale* 1:720	*Company* Leighton
Date 9/19/2019			*File Name* Section D - Existing revised.slmd

APPENDIX E

Liquefaction Analysis

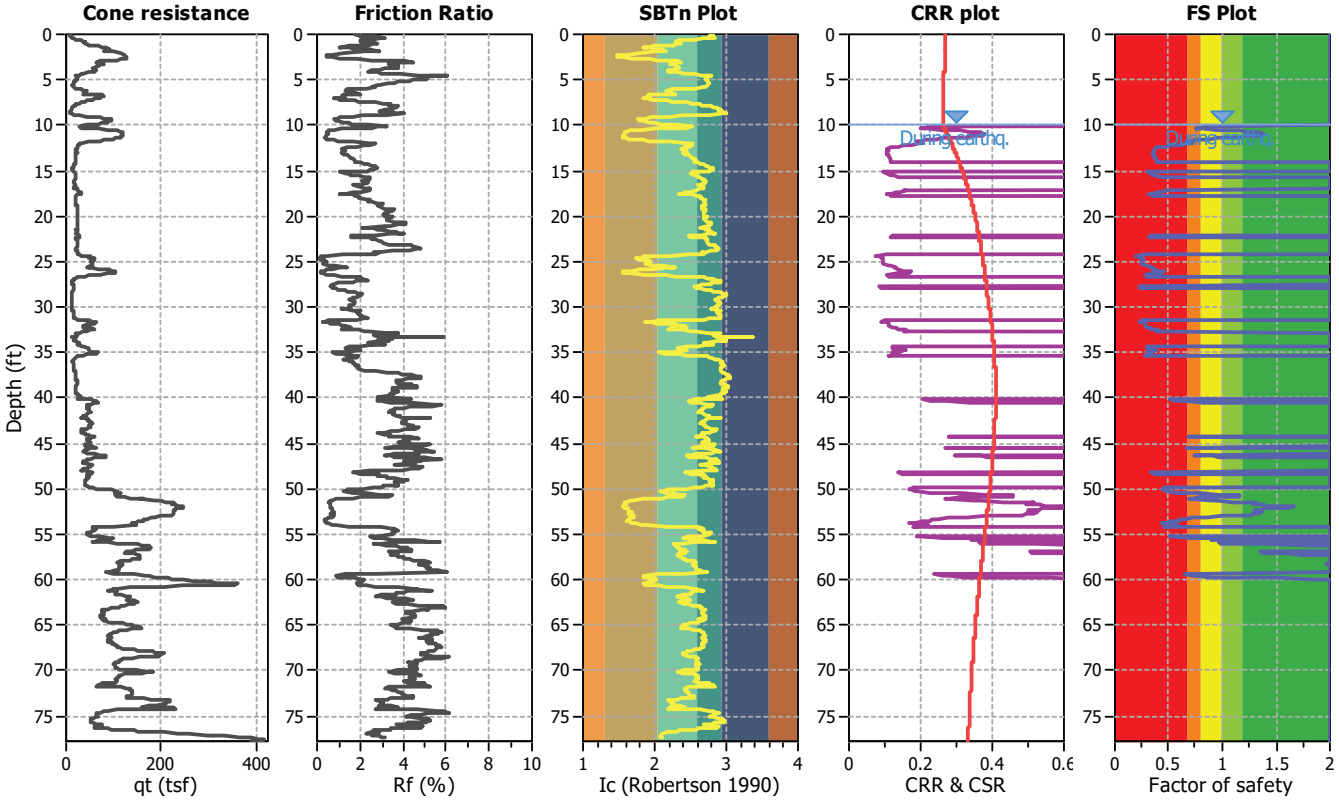
LIQUEFACTION ANALYSIS REPORT

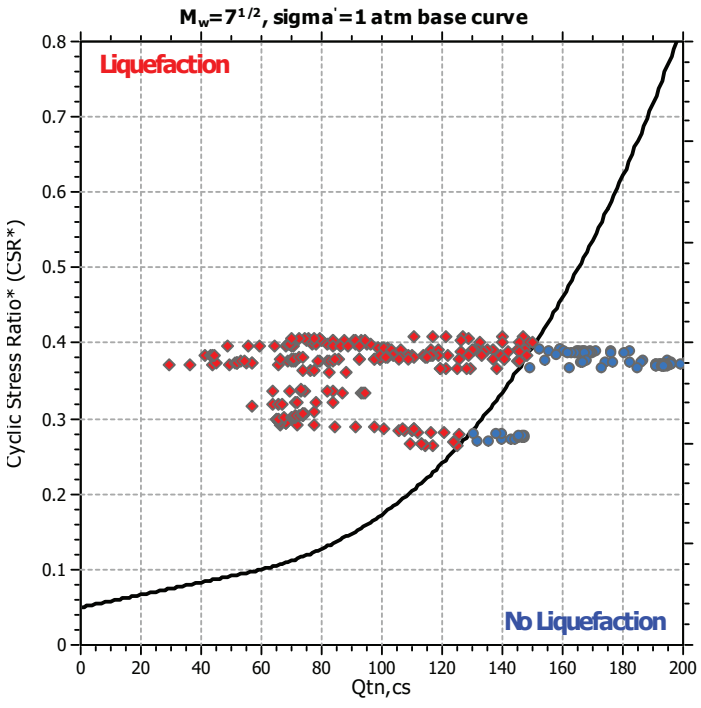
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

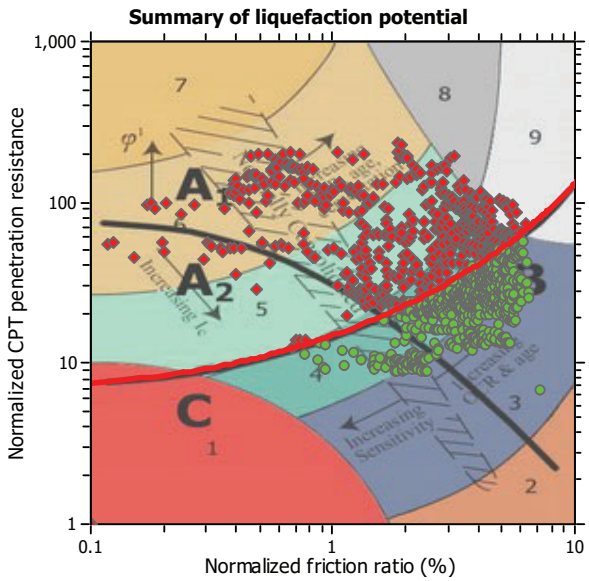
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

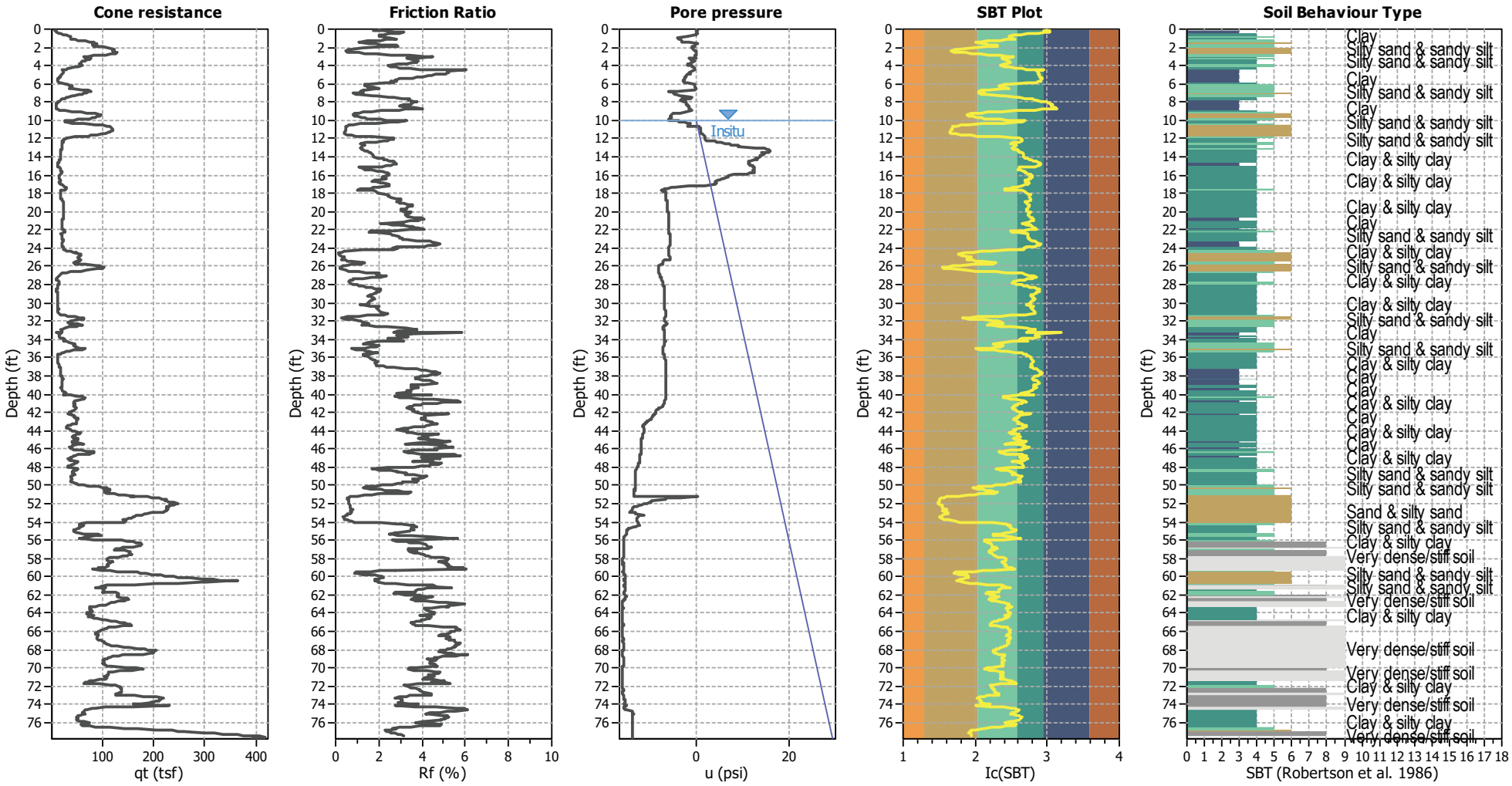






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



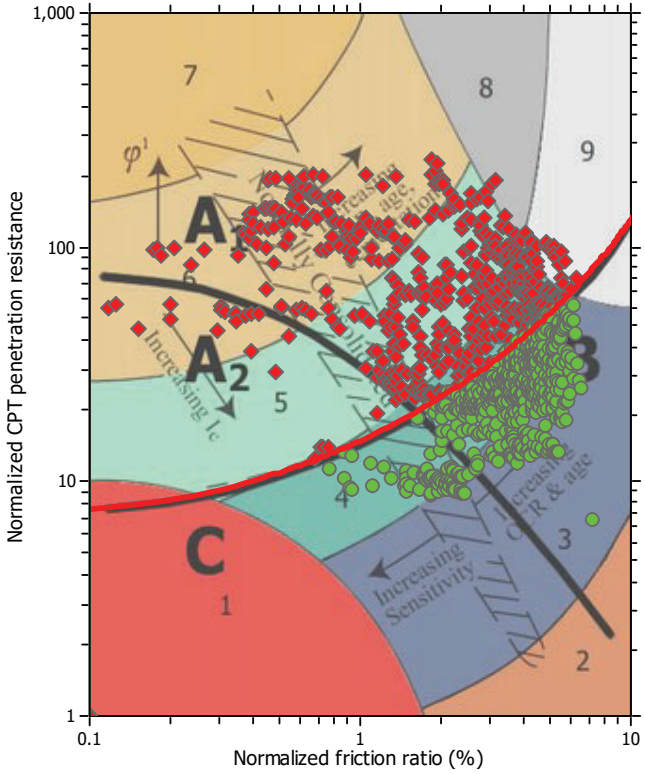
Input parameters and analysis data

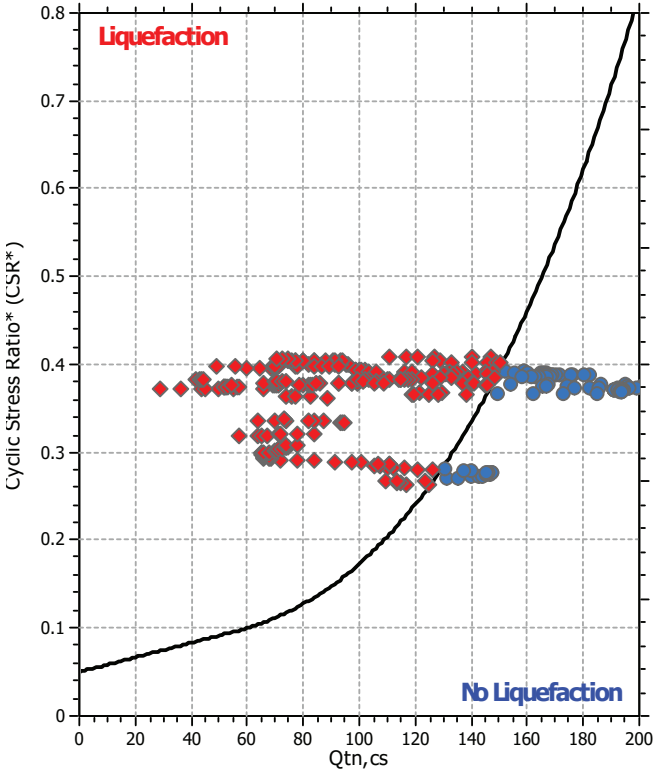
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

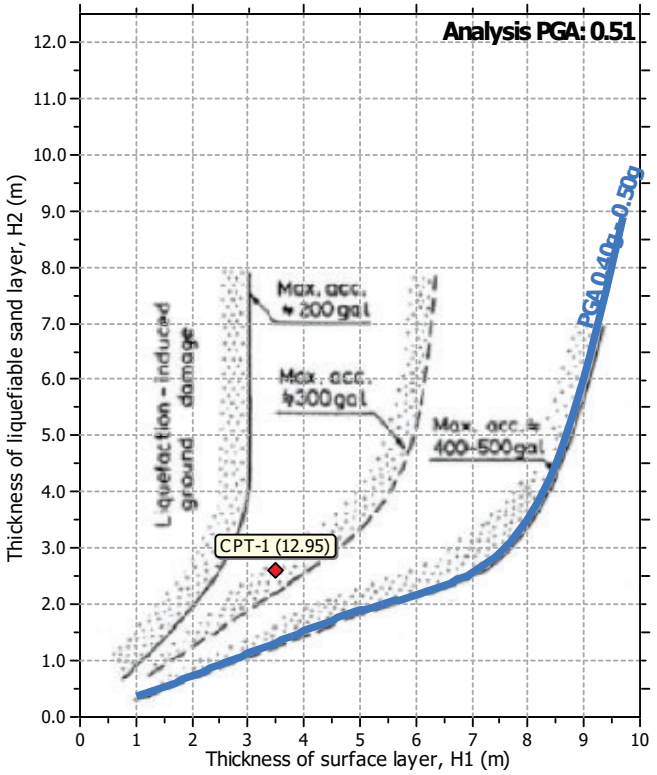
SBT legend

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

Liquefaction analysis summary plots



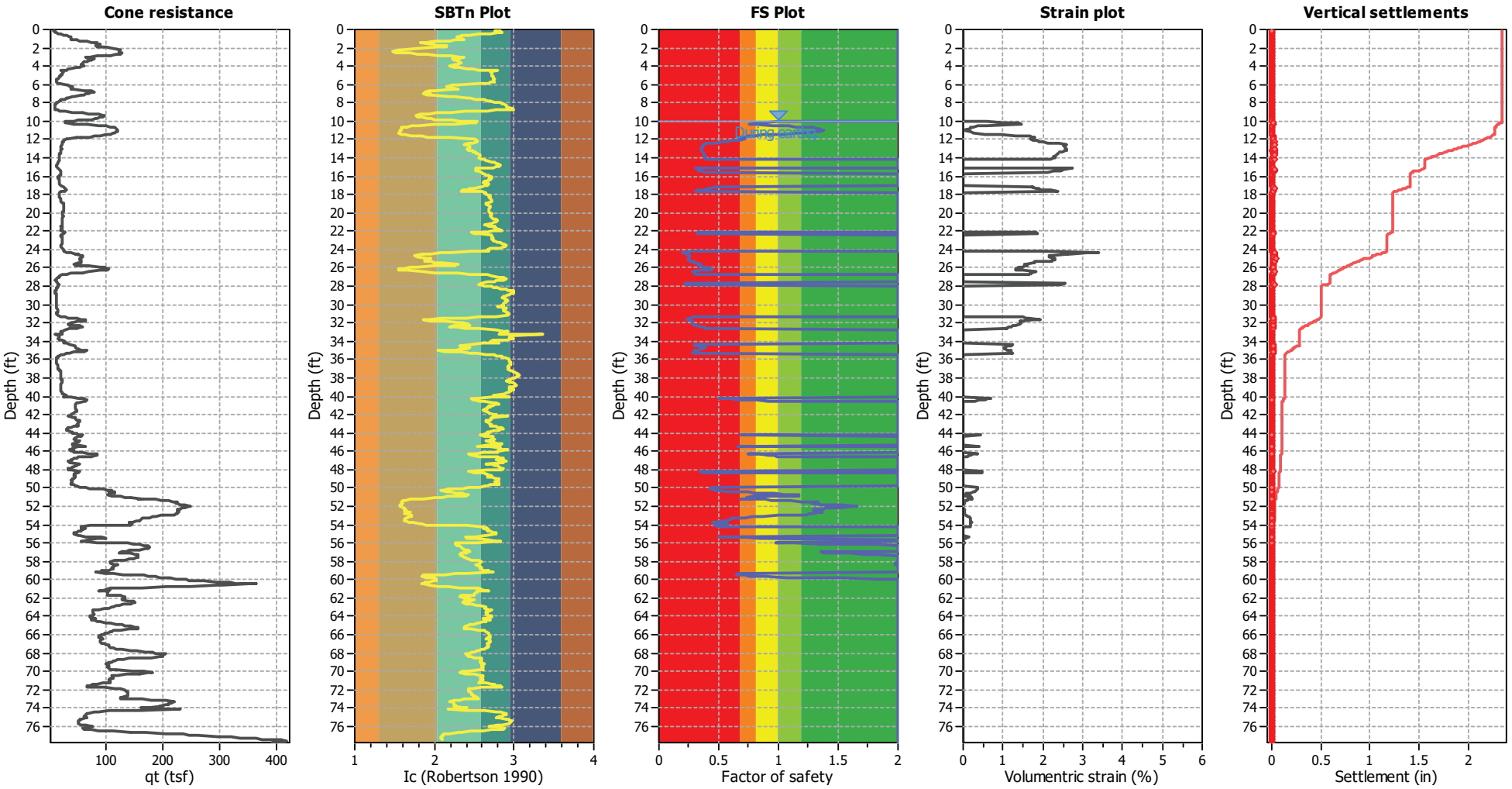




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

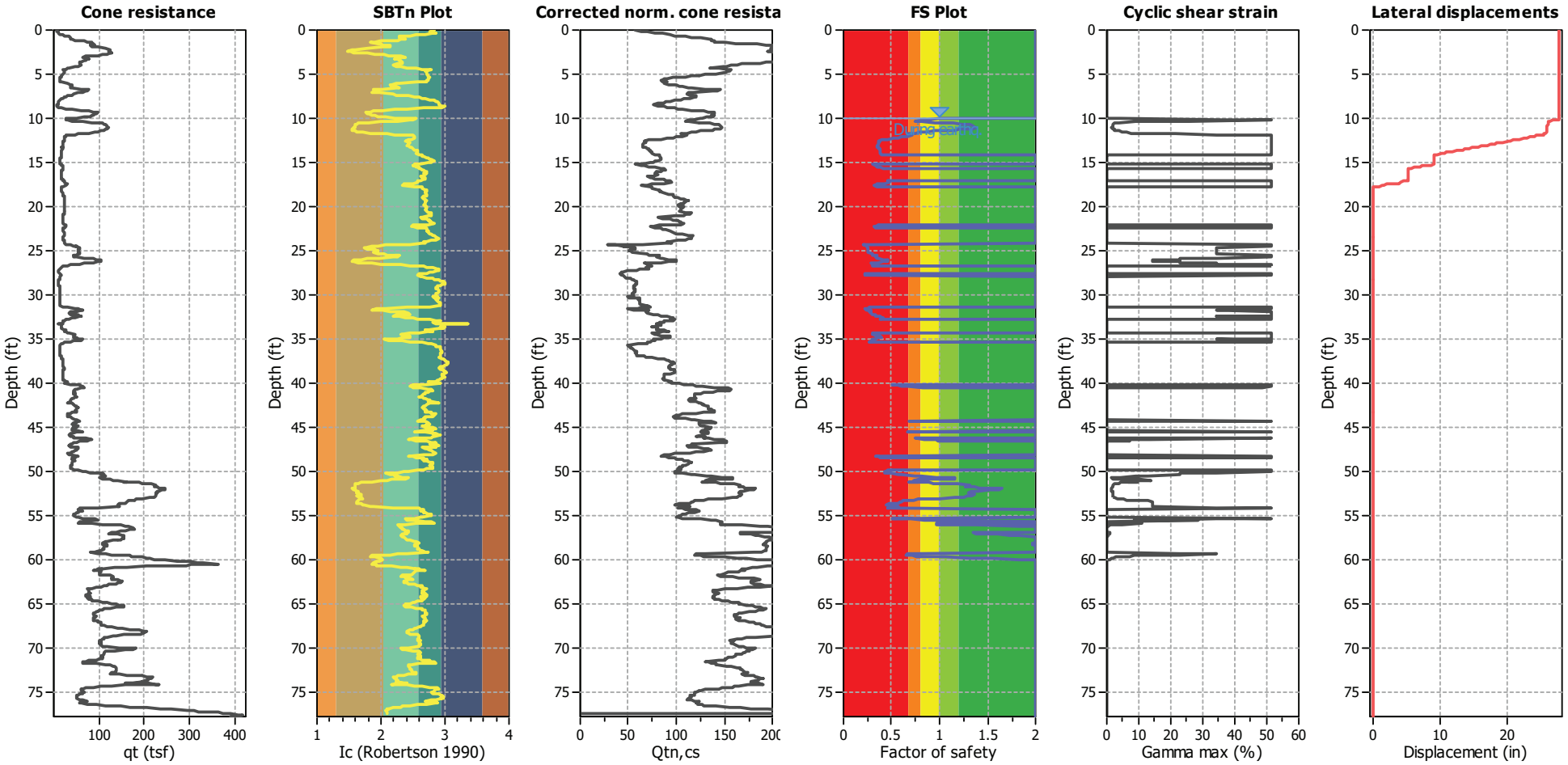


Abbreviations

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

Estimation of post-earthquake lateral Displacements

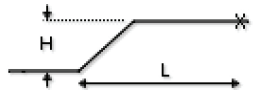
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



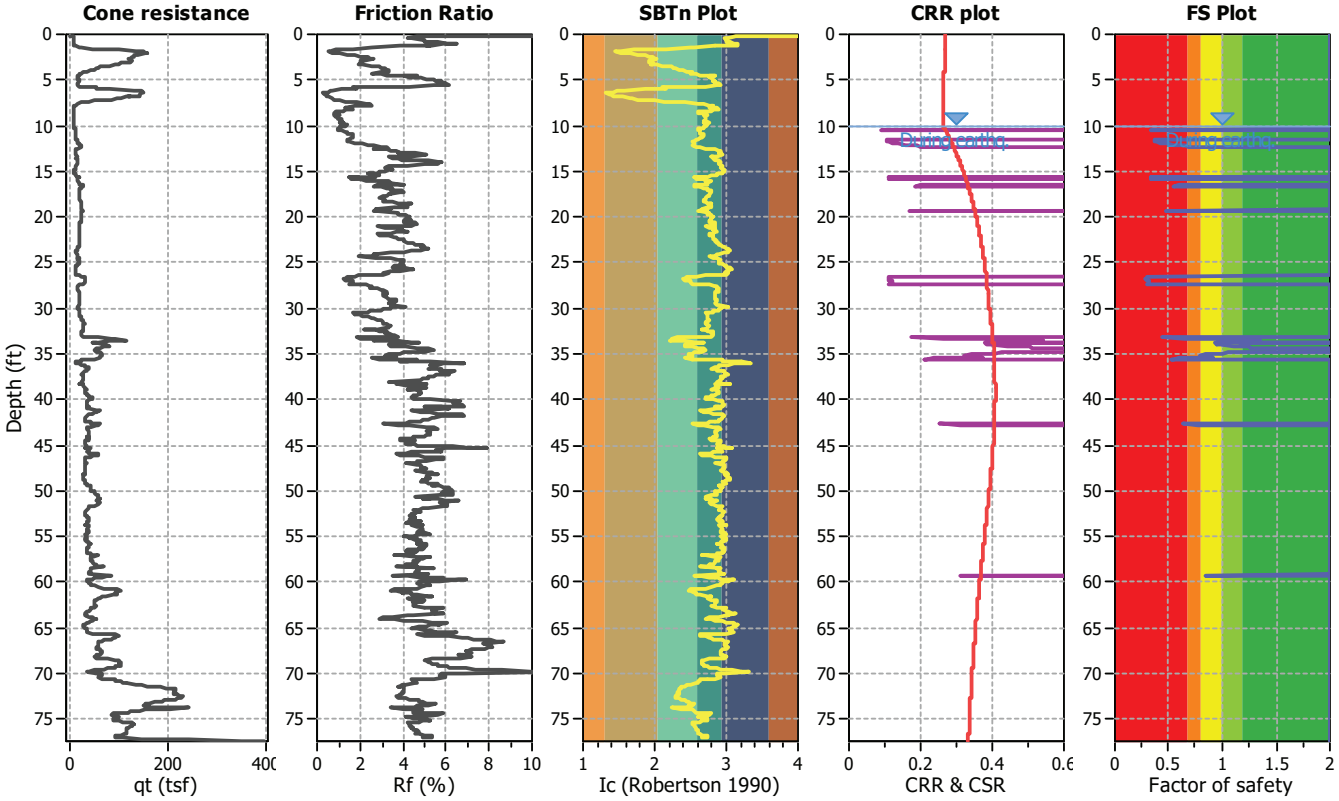
LIQUEFACTION ANALYSIS REPORT

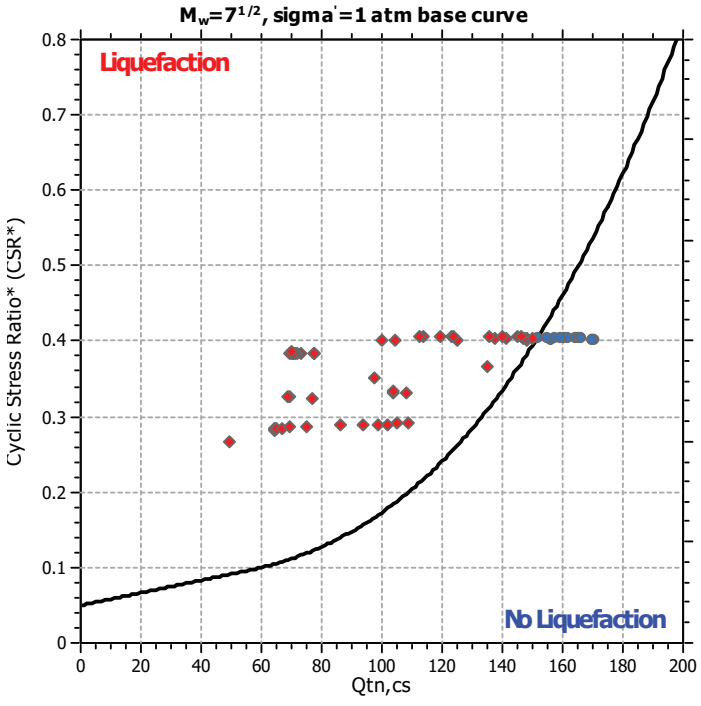
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

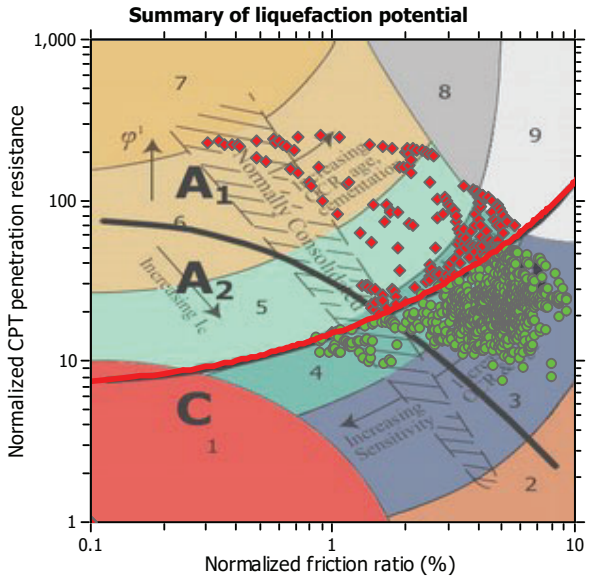
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

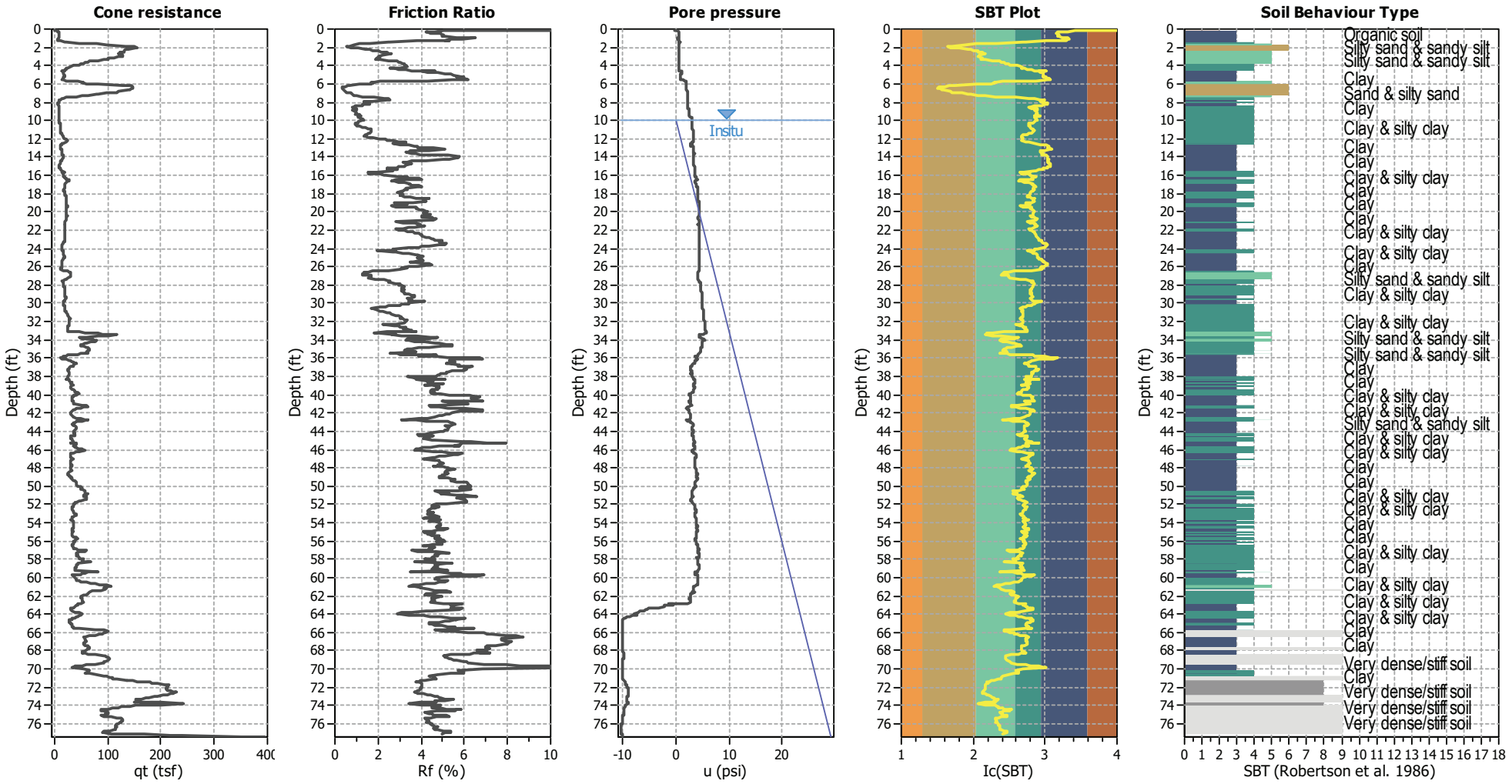






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



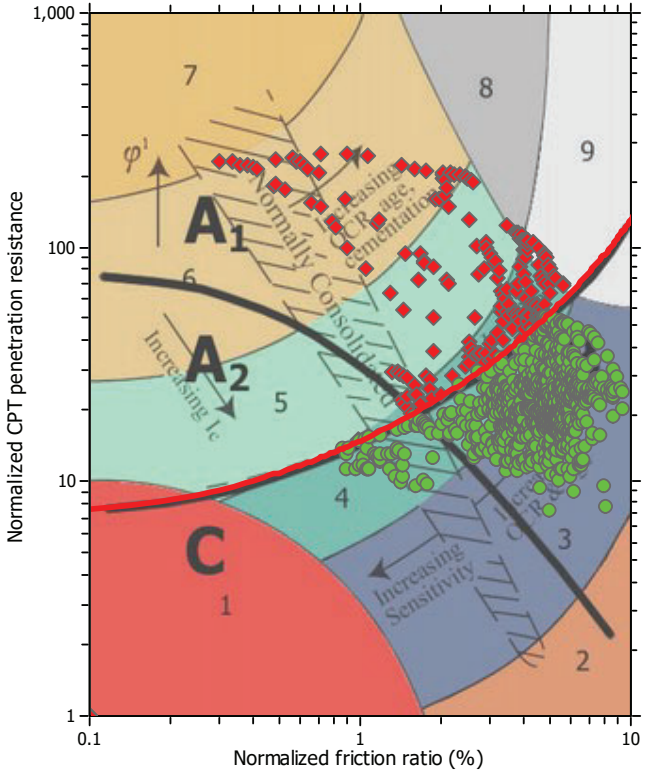
Input parameters and analysis data

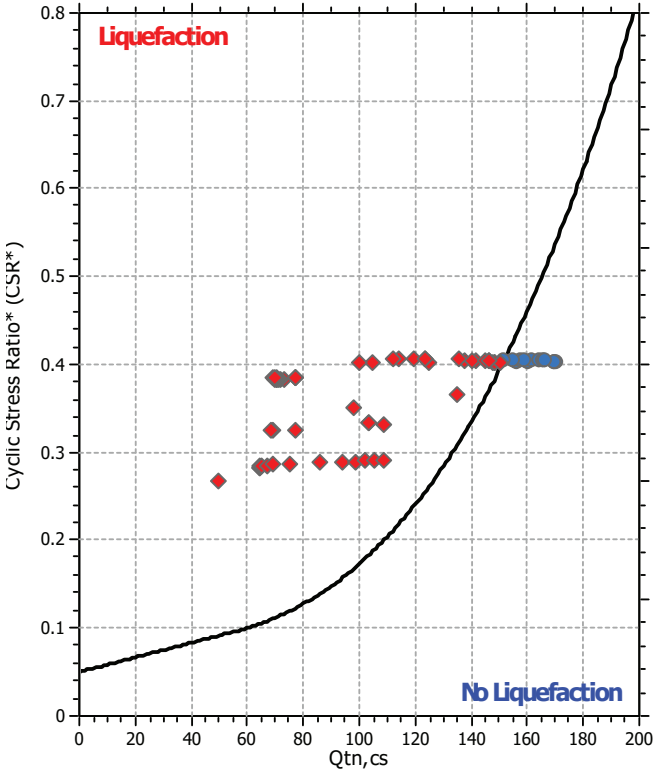
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

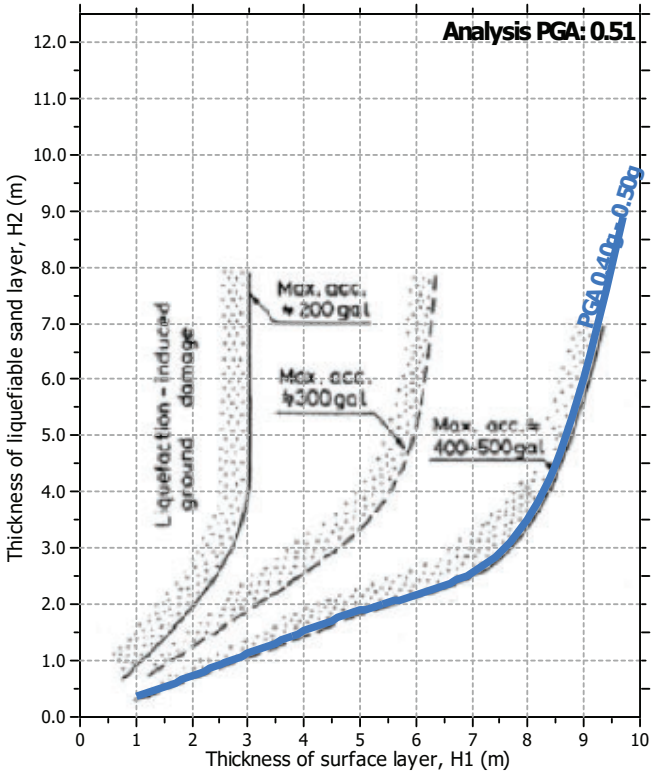
SBT legend

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

Liquefaction analysis summary plots



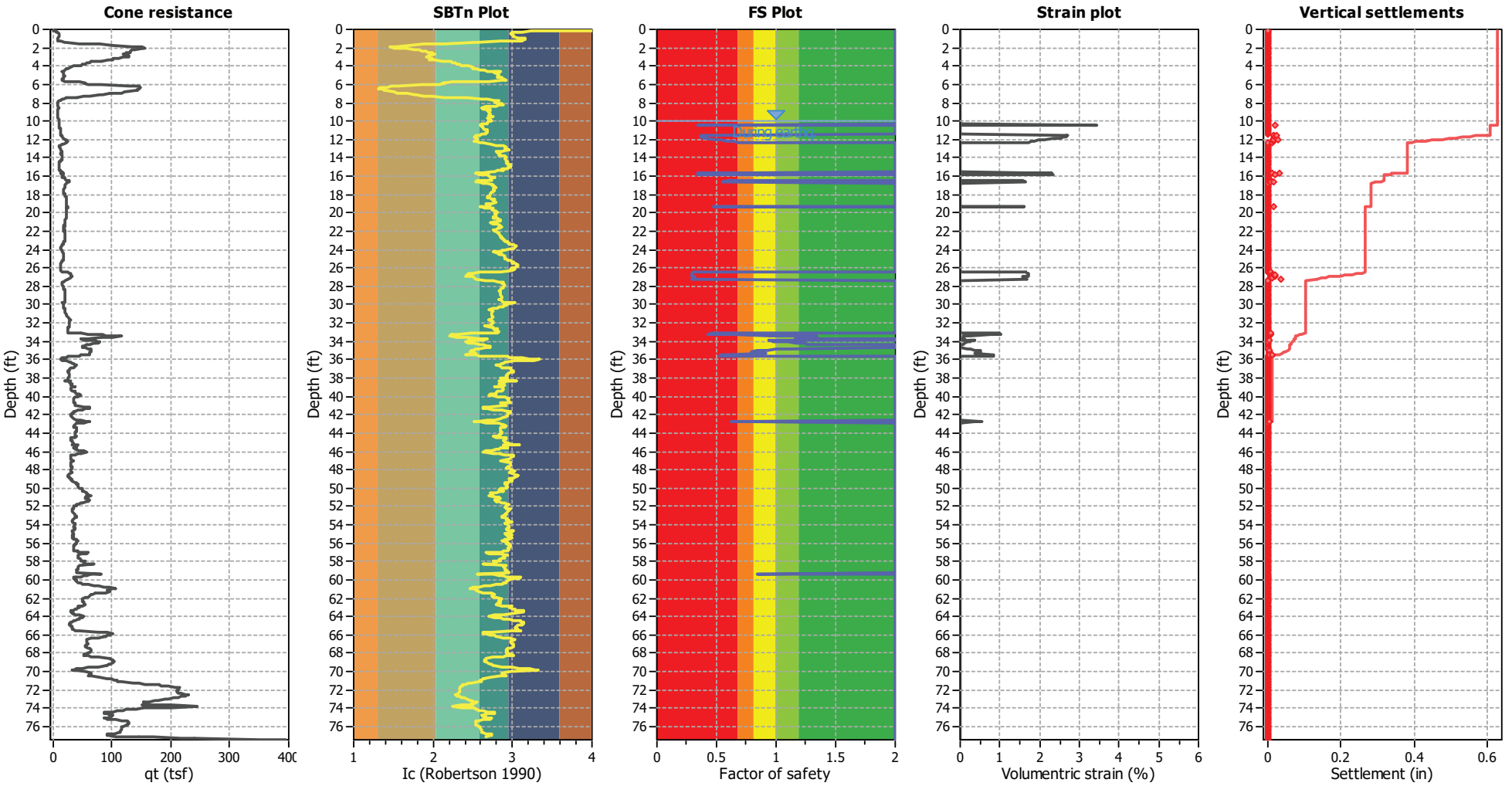




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

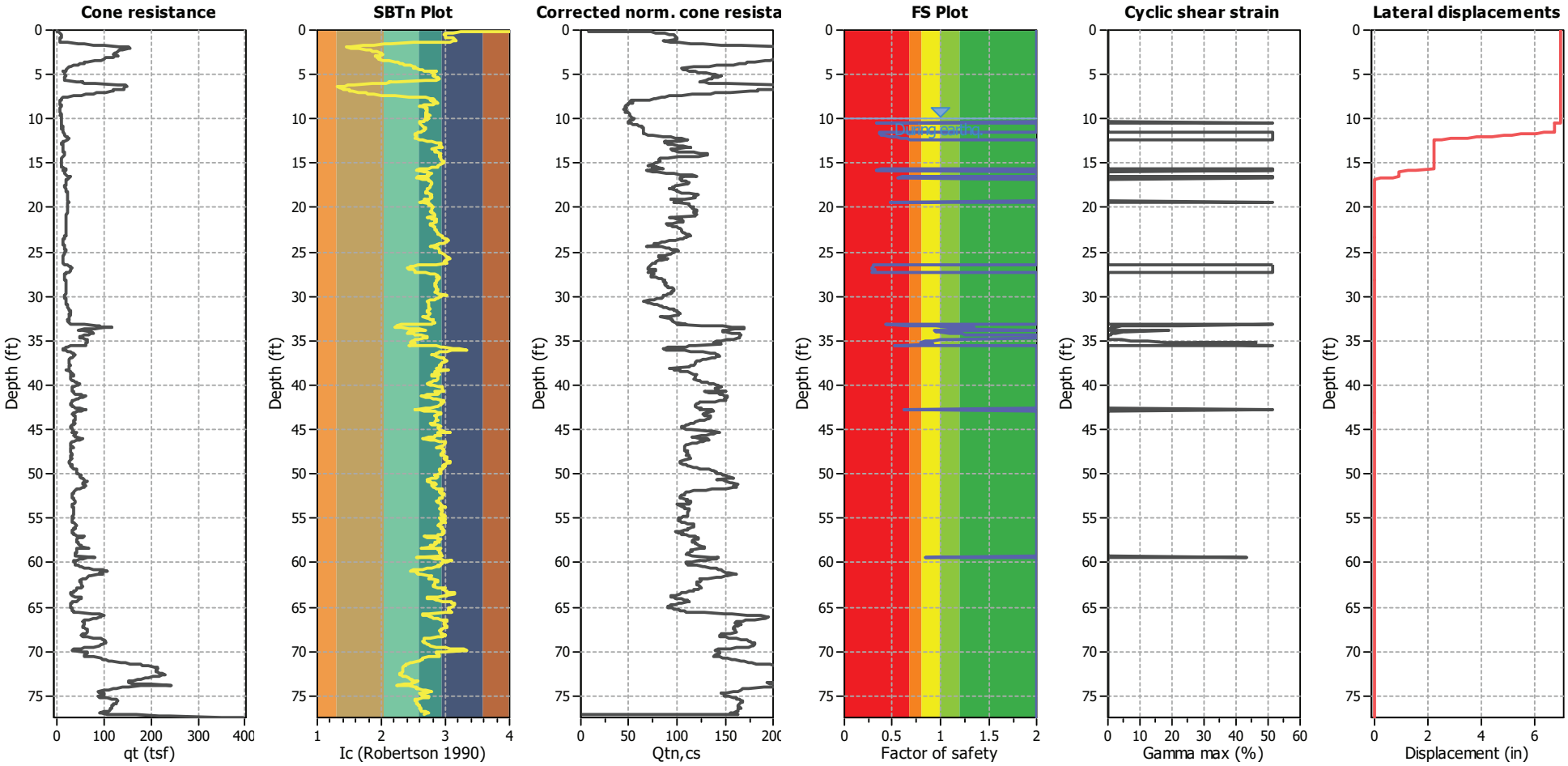


Abbreviations

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

Estimation of post-earthquake lateral Displacements

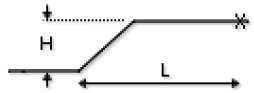
Geometric parameters: Level ground (or gently sloping) with free face (L: 100.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



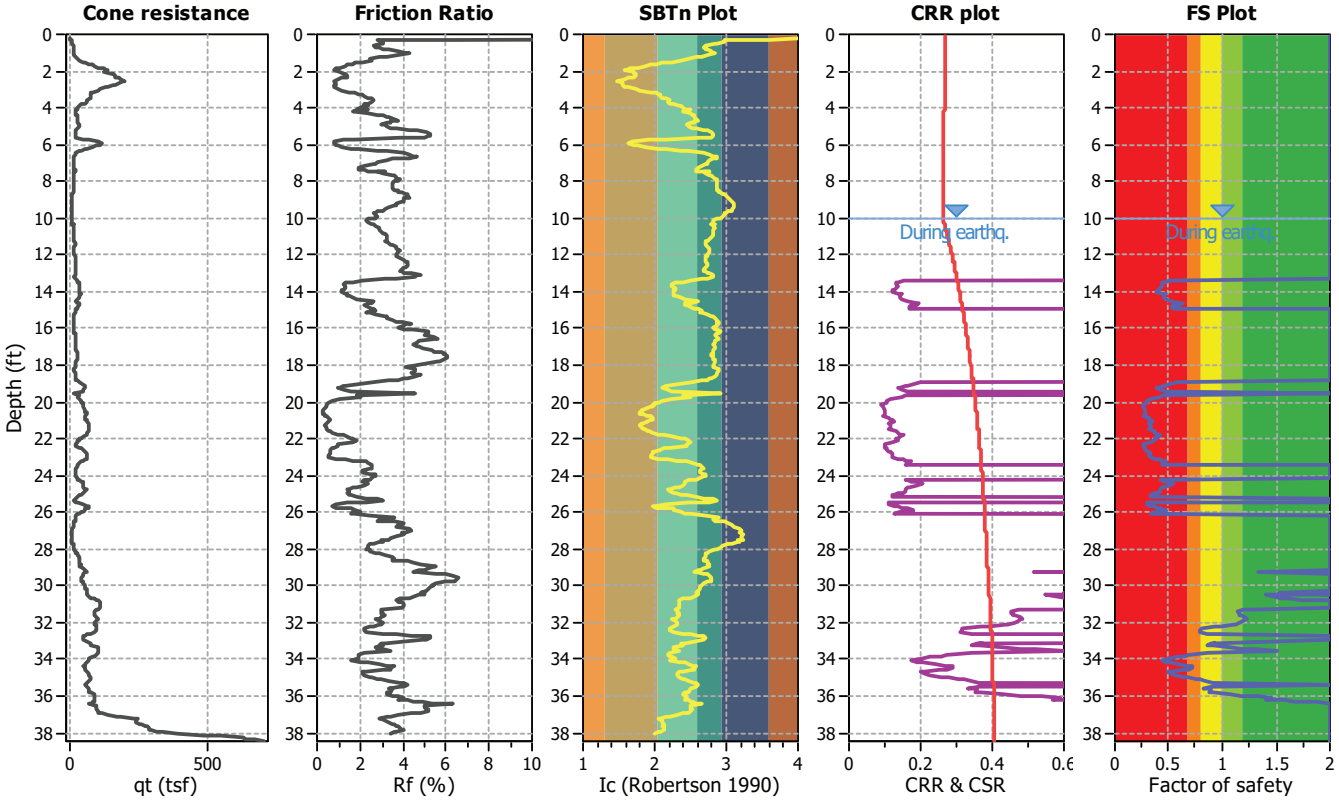
LIQUEFACTION ANALYSIS REPORT

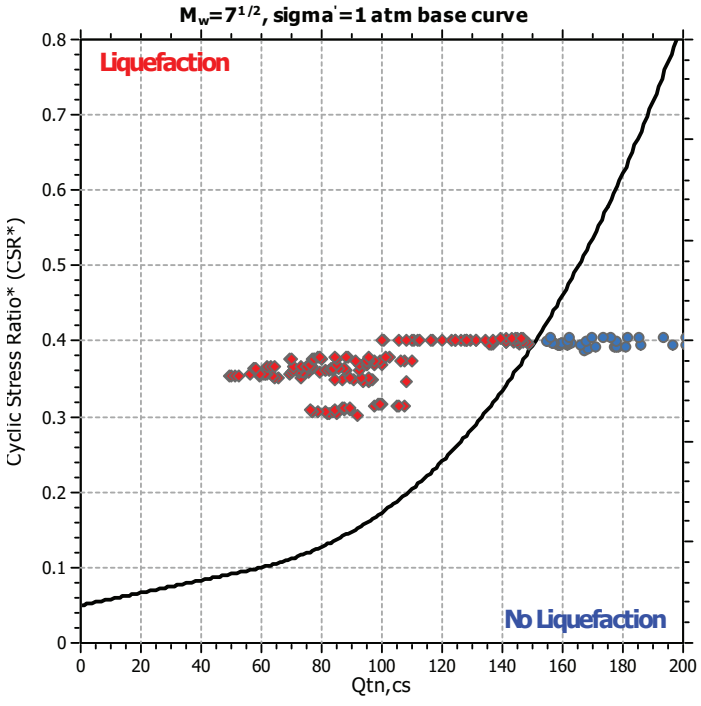
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

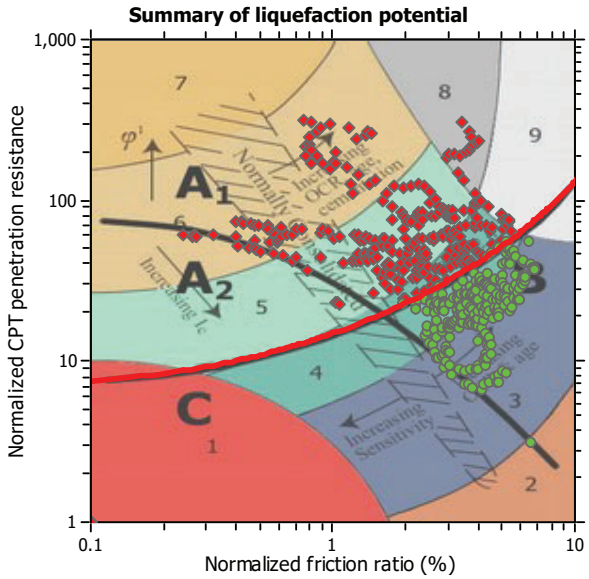
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

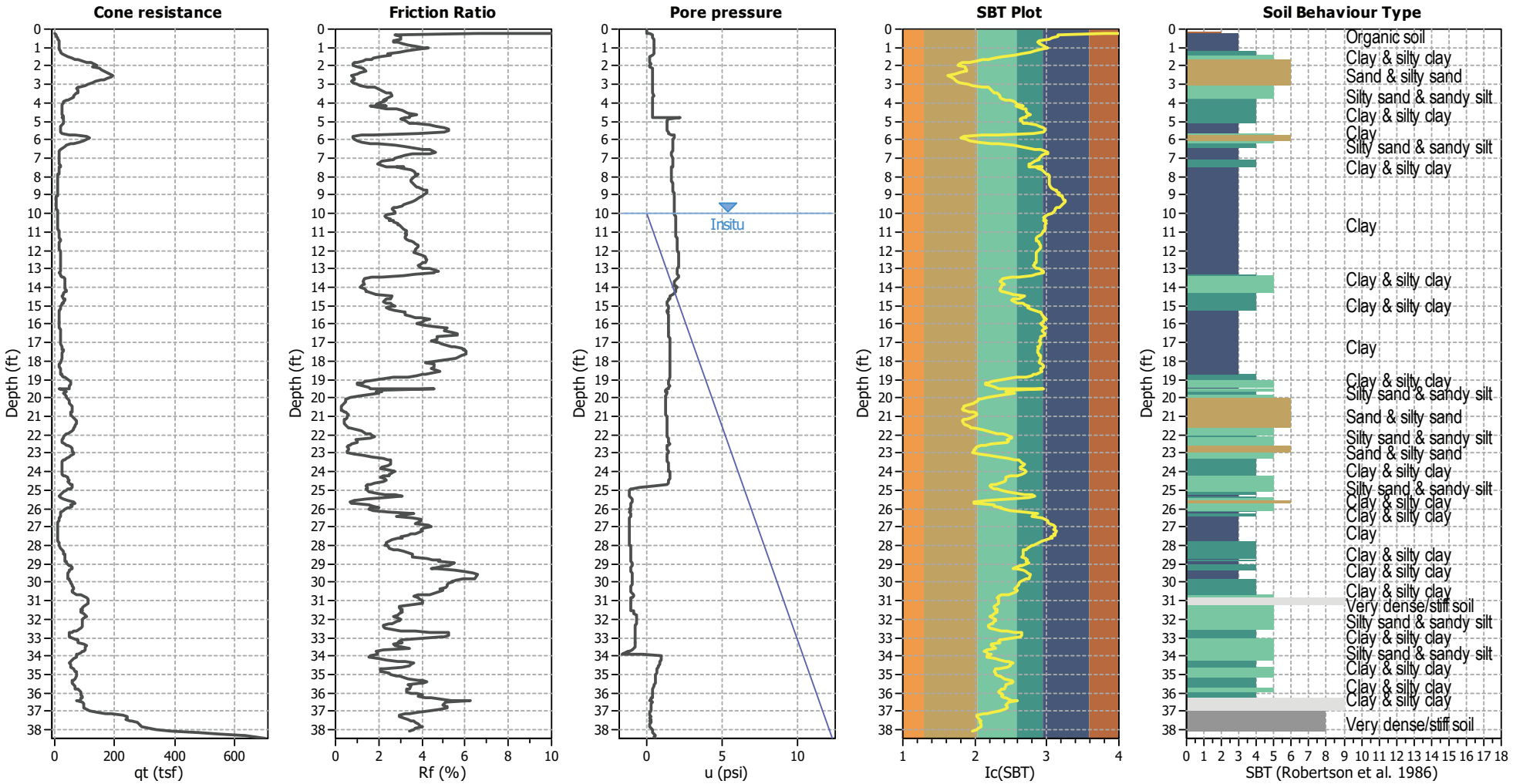






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



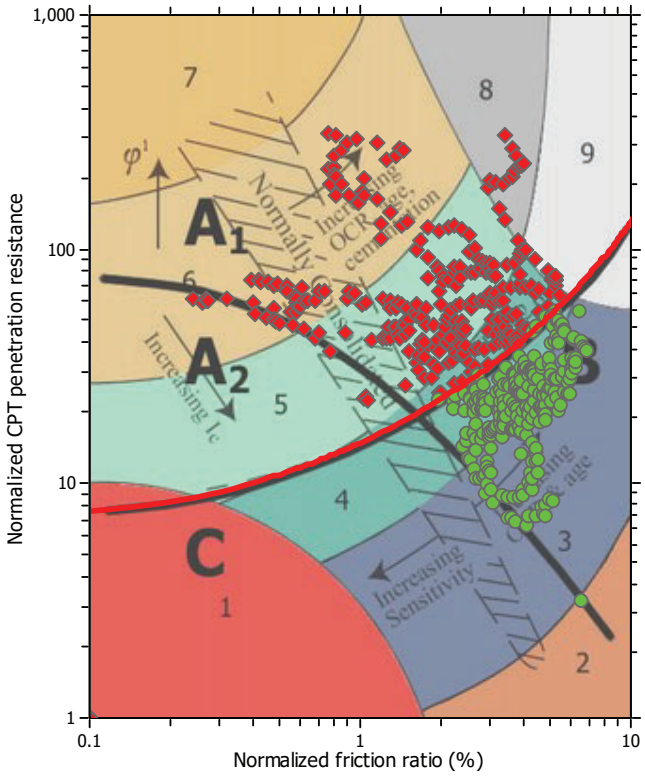
Input parameters and analysis data

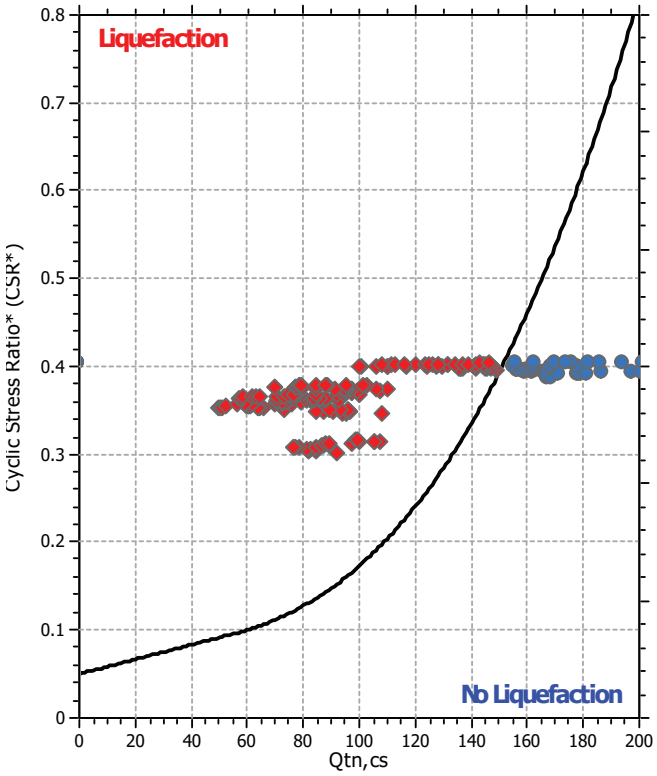
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

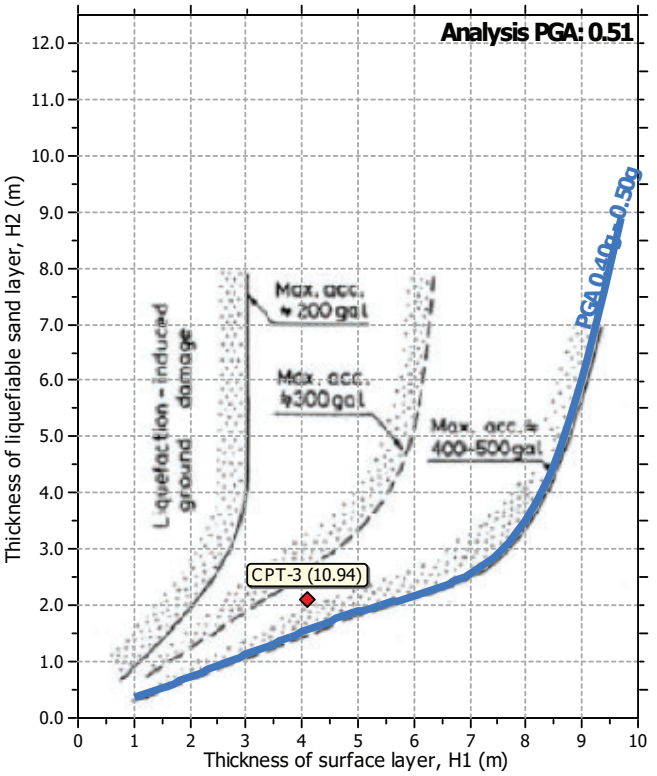
SBT legend

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

Liquefaction analysis summary plots



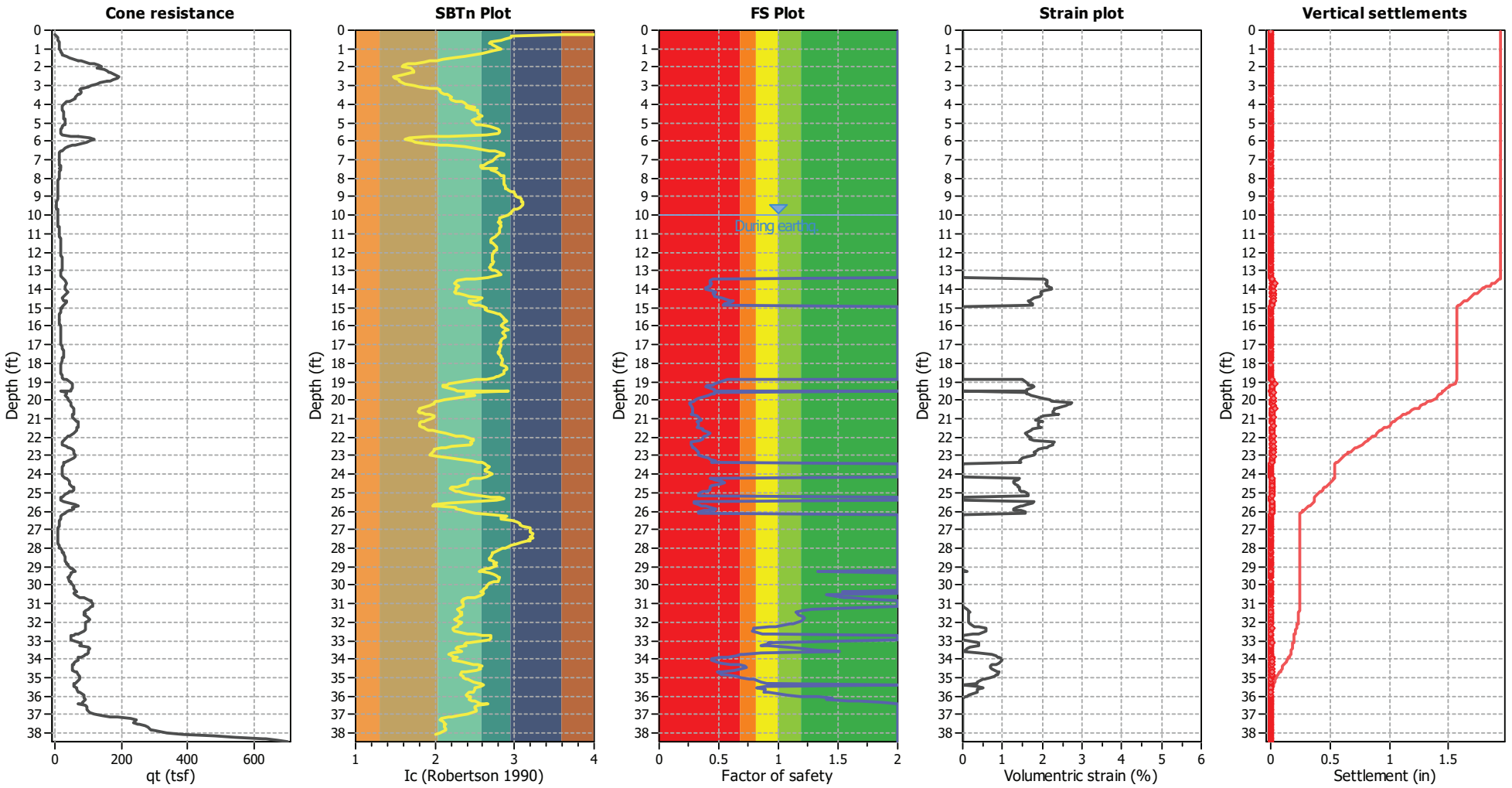




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

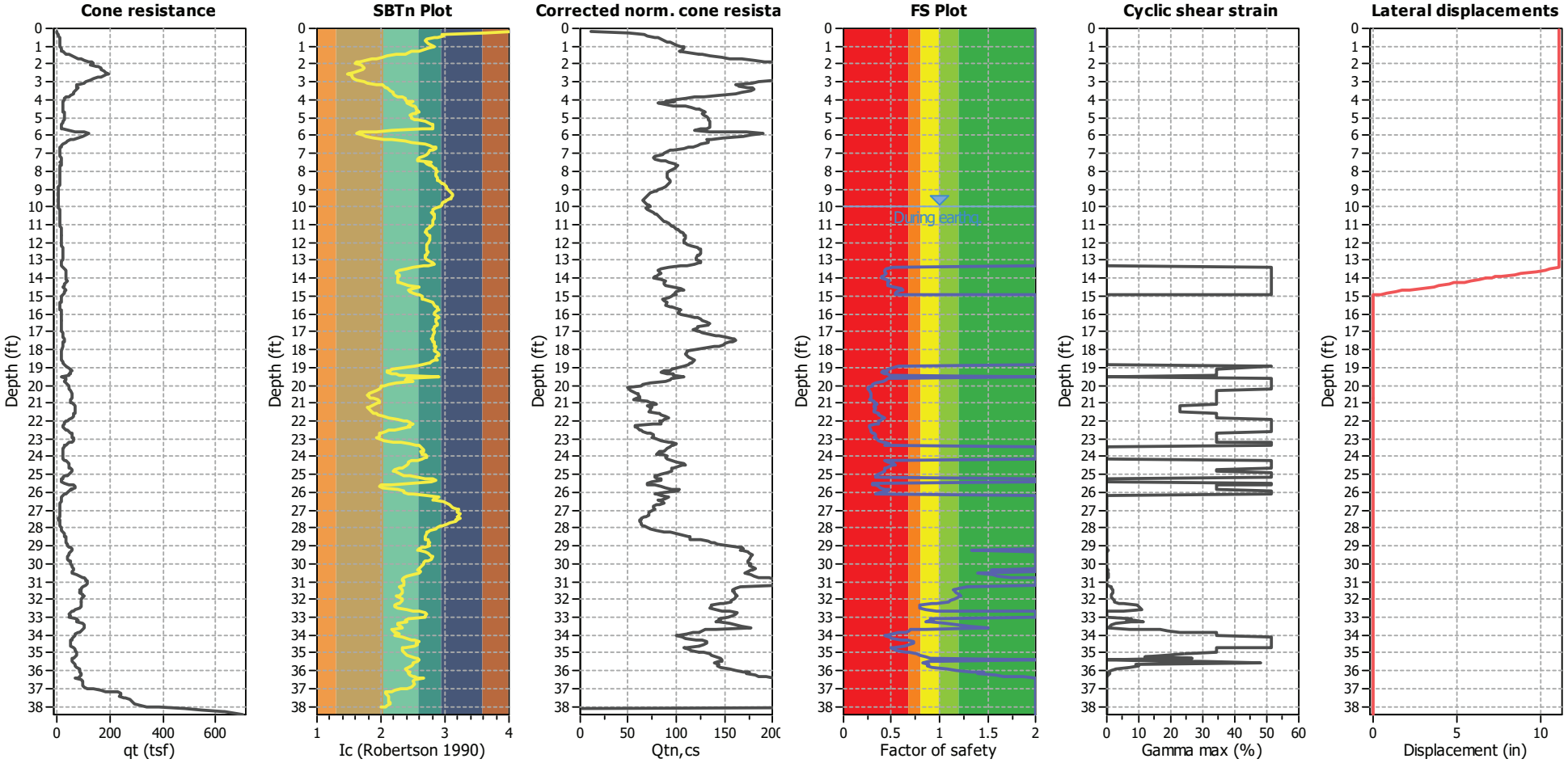


Abbreviations

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

Estimation of post-earthquake lateral Displacements

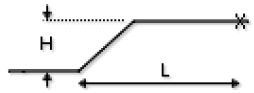
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



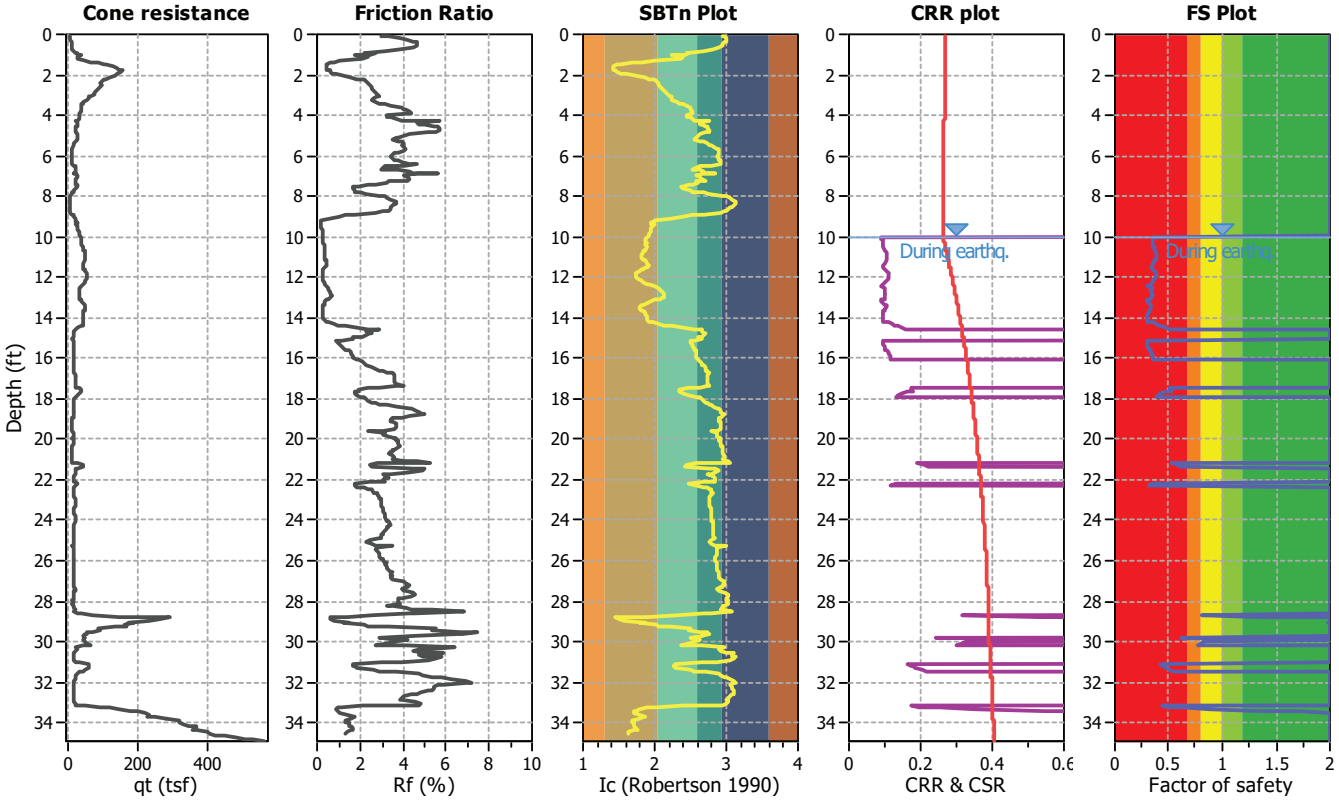
LIQUEFACTION ANALYSIS REPORT

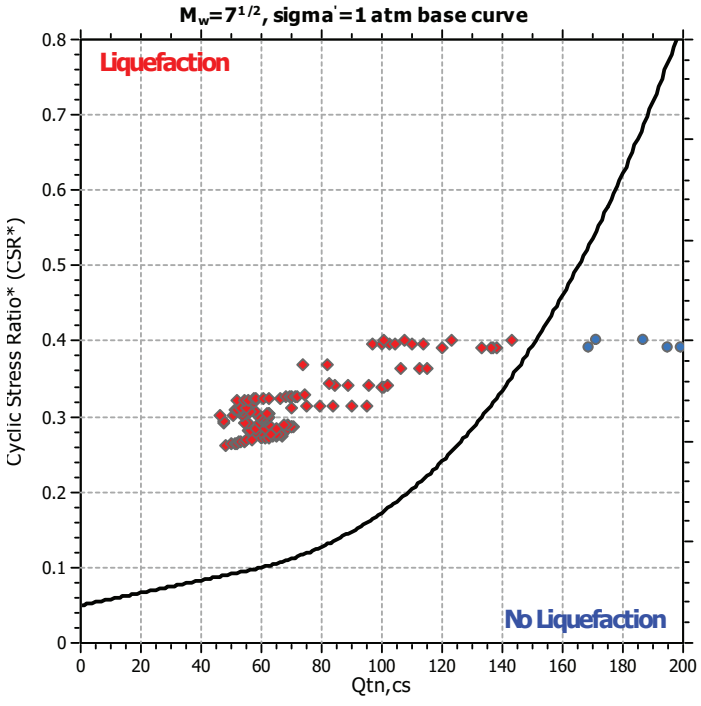
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

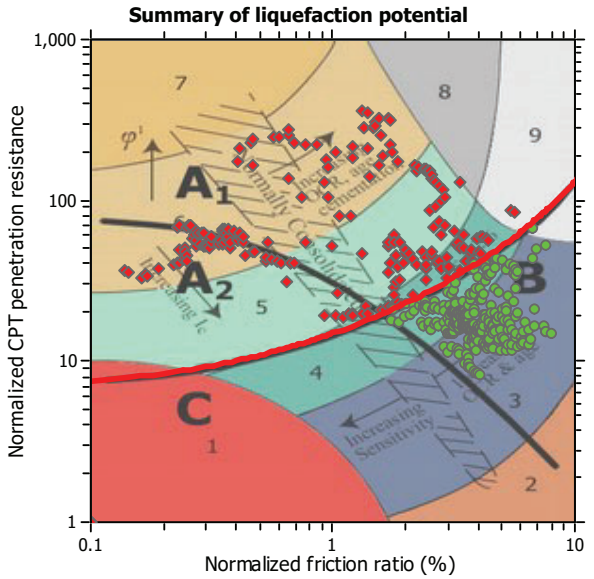
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

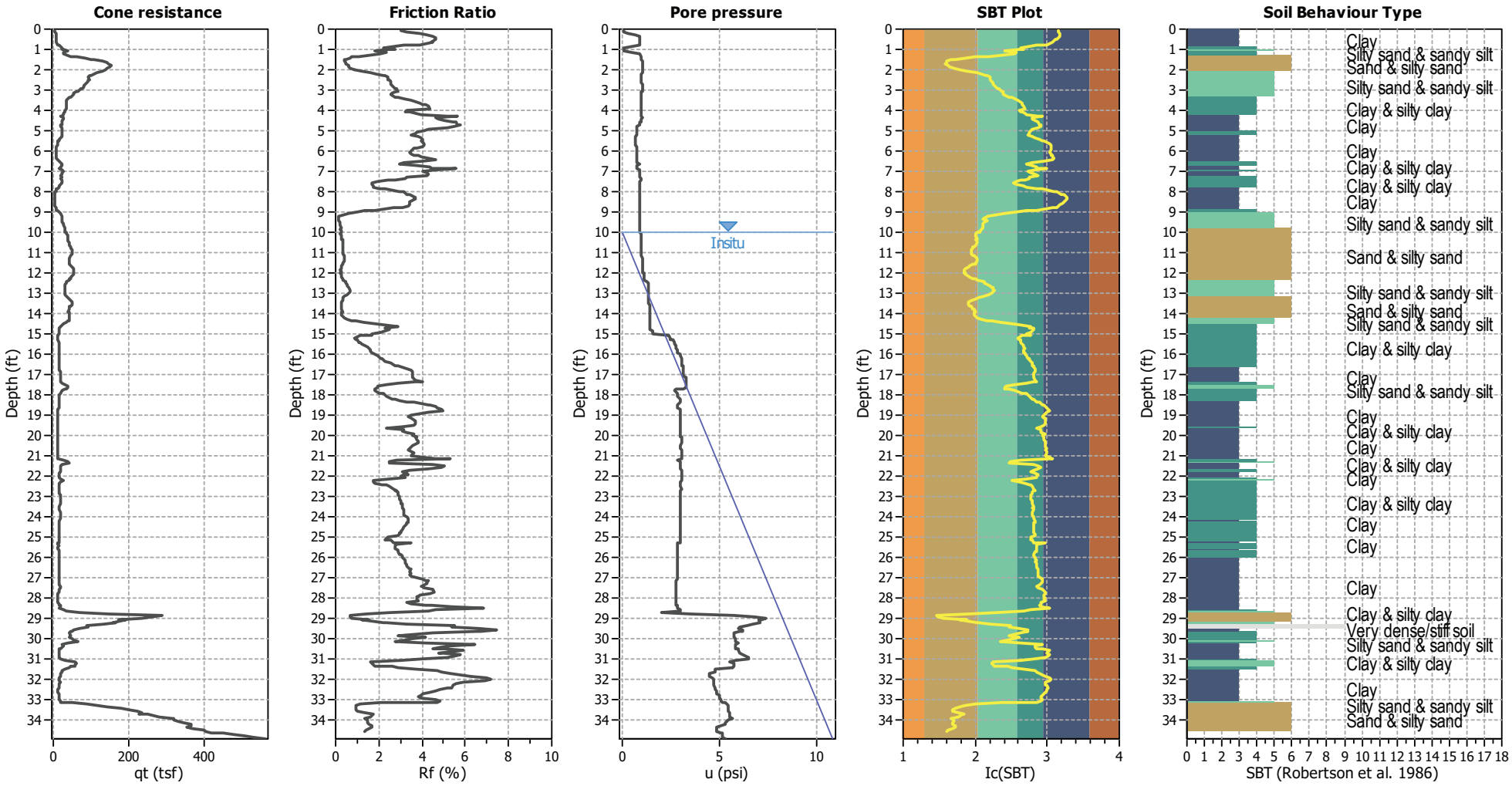






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



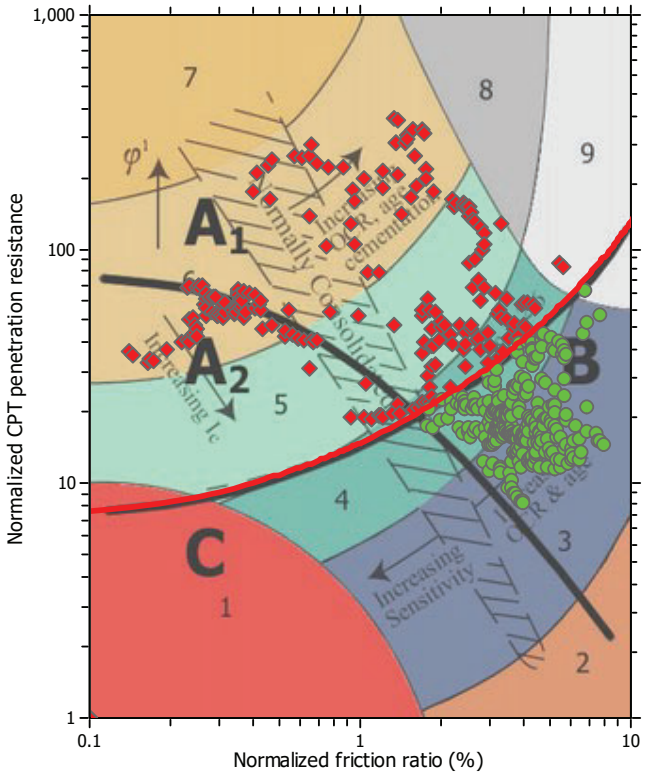
Input parameters and analysis data

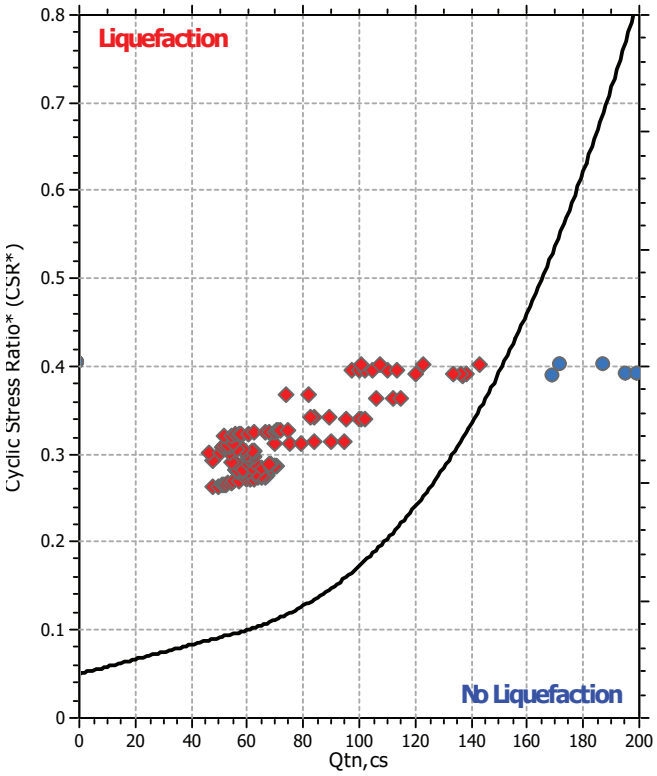
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

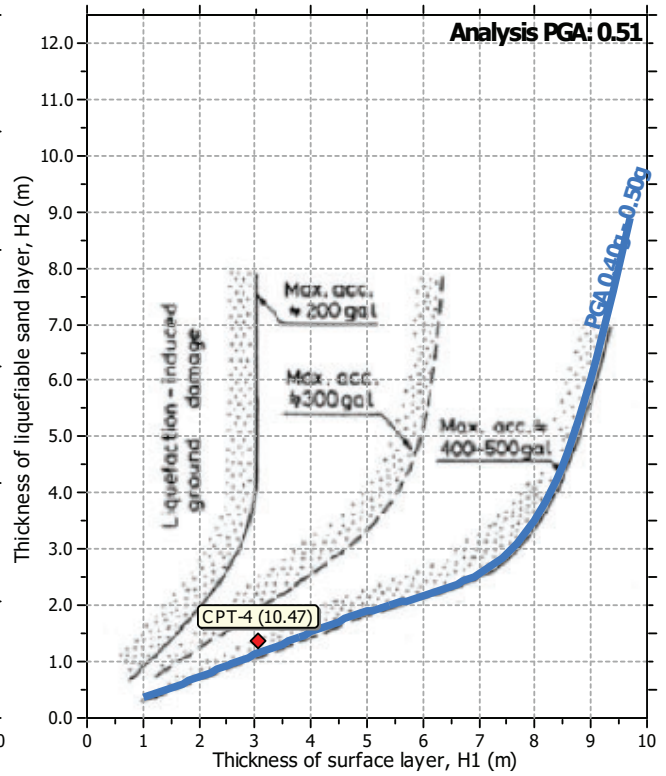
SBT legend

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

Liquefaction analysis summary plots



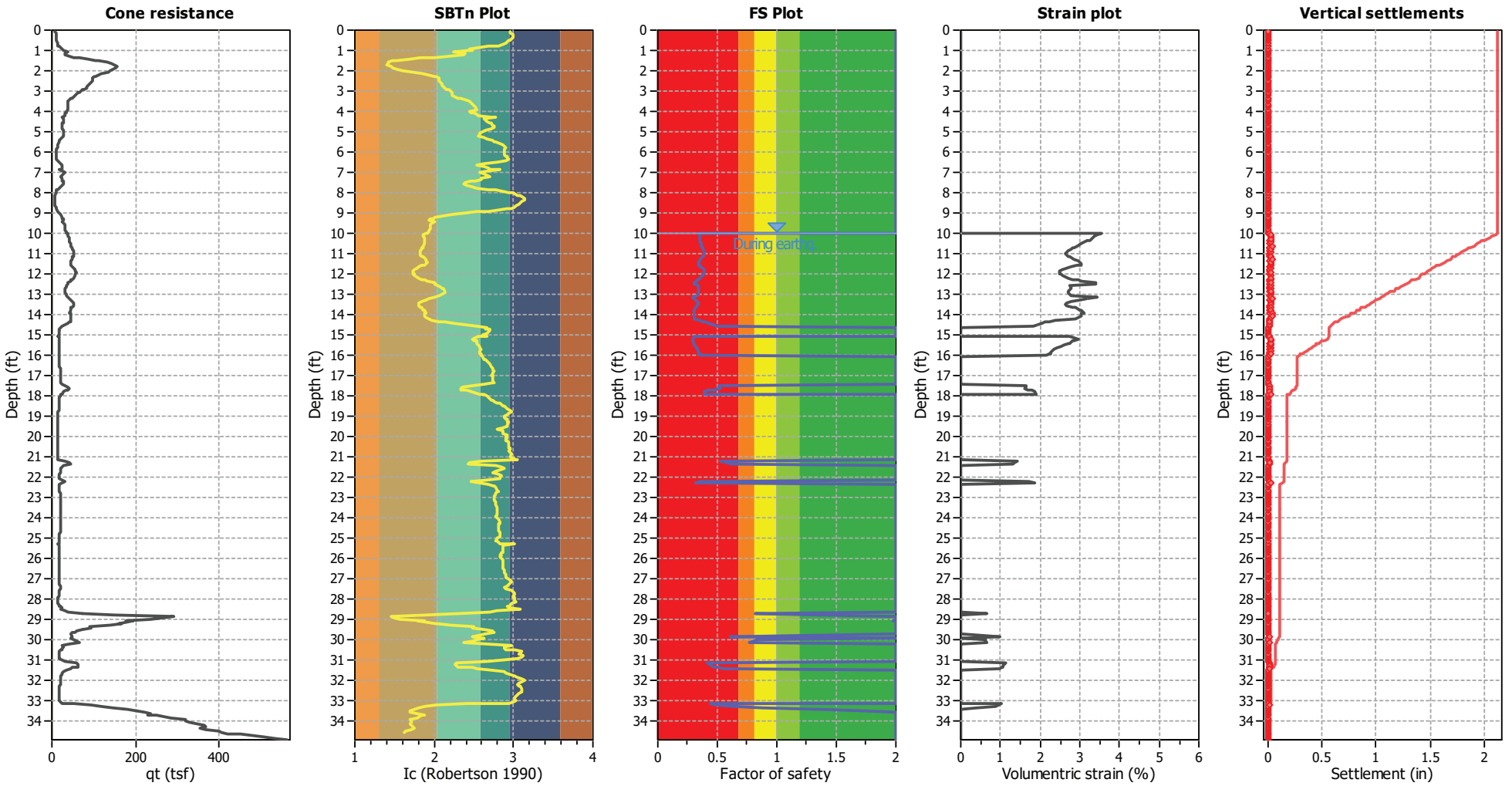




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

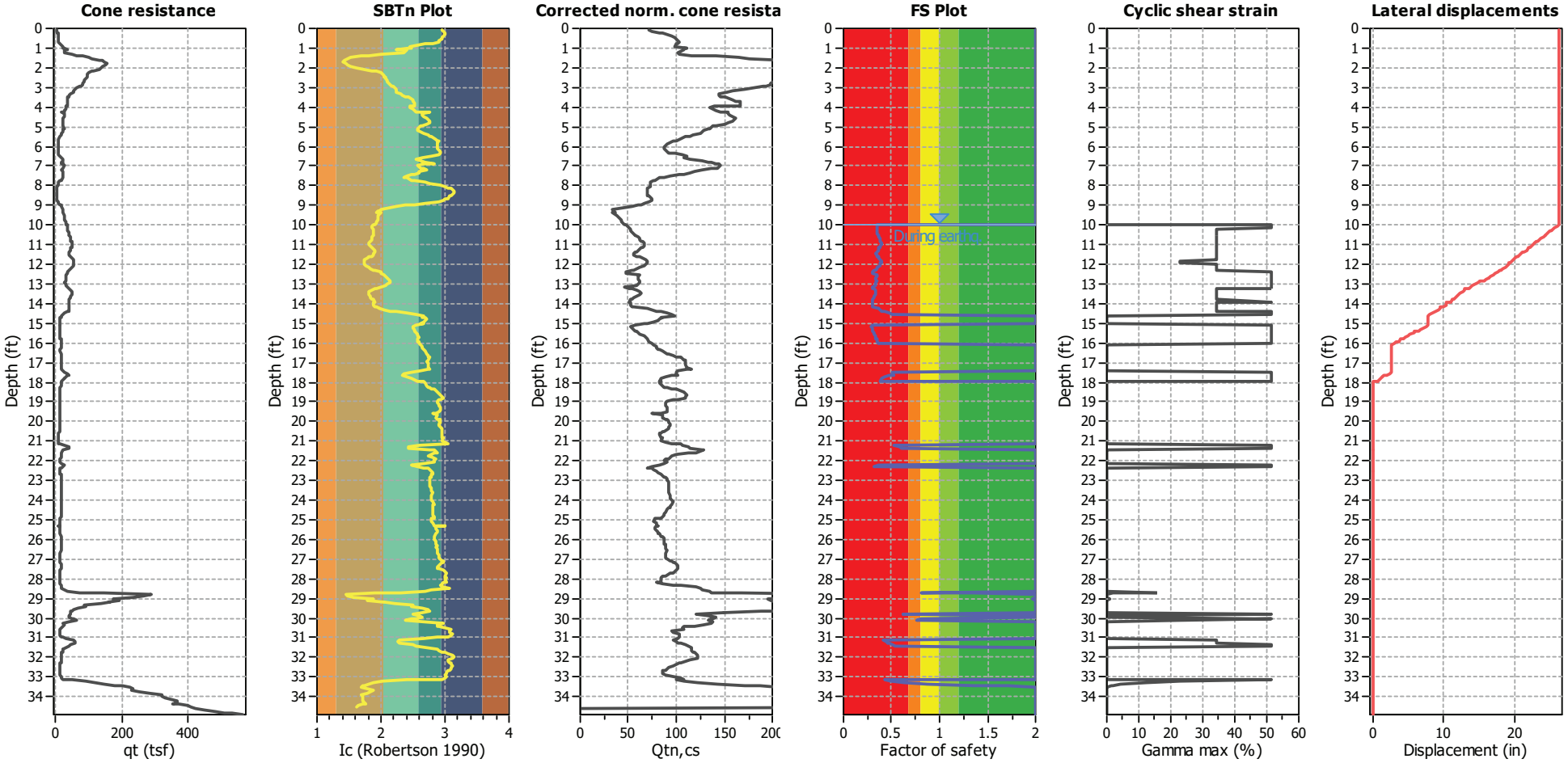


Abbreviations

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

Estimation of post-earthquake lateral Displacements

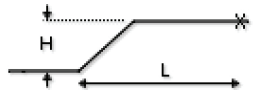
Geometric parameters: Level ground (or gently sloping) with free face (L: 100.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



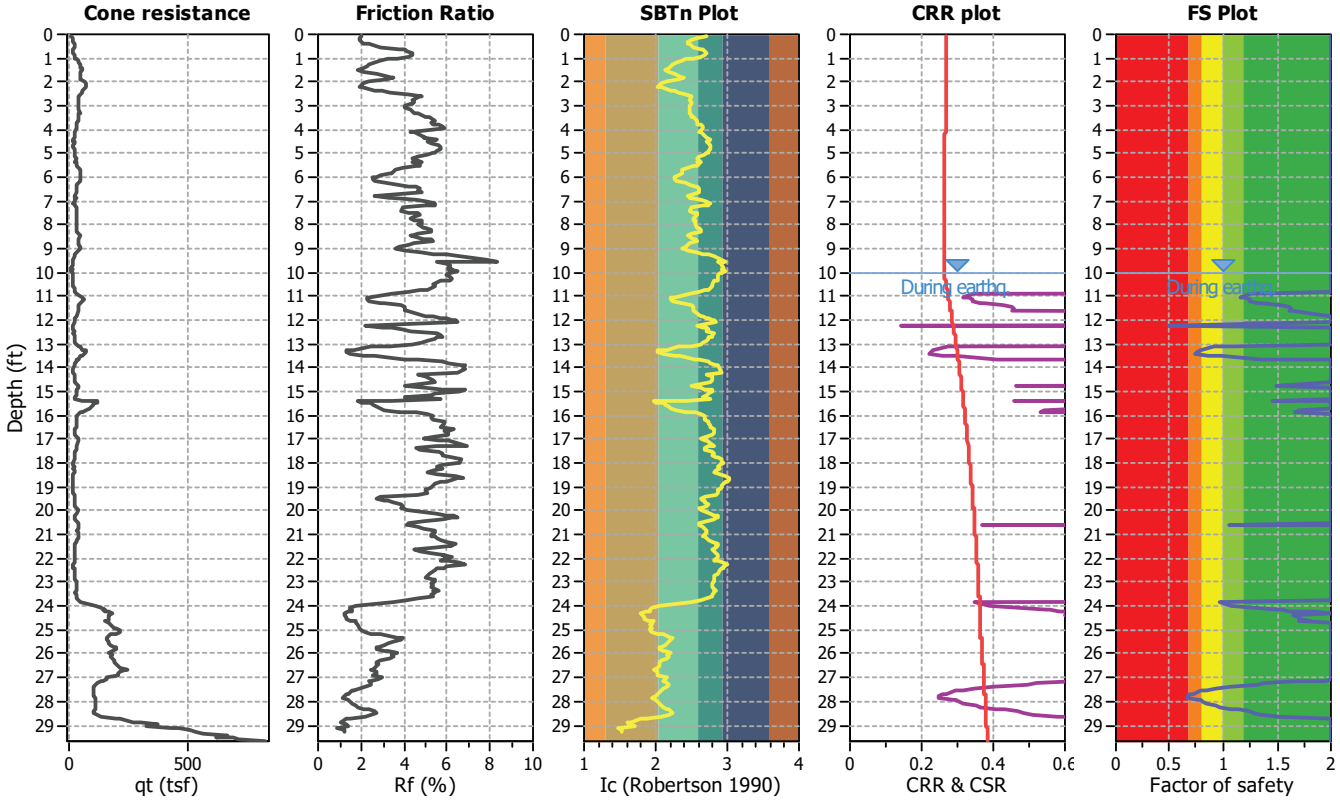
LIQUEFACTION ANALYSIS REPORT

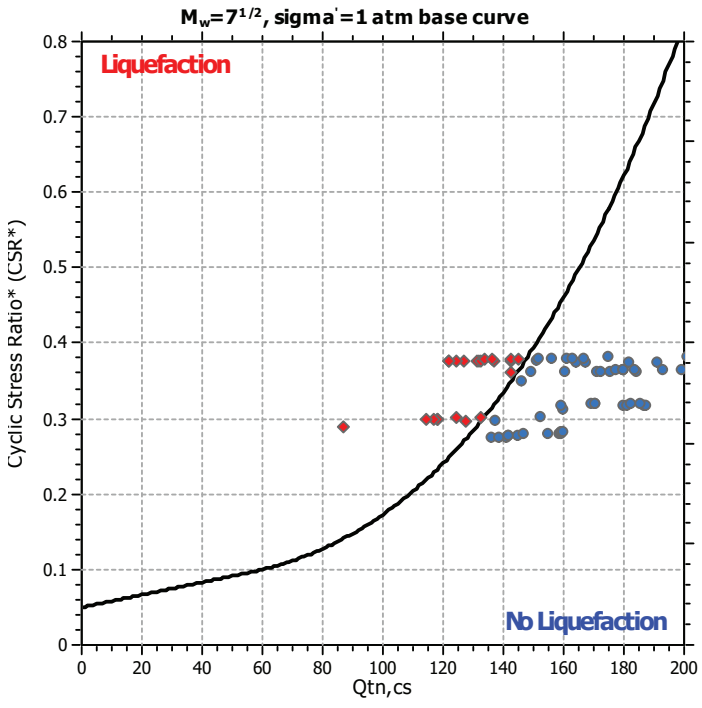
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

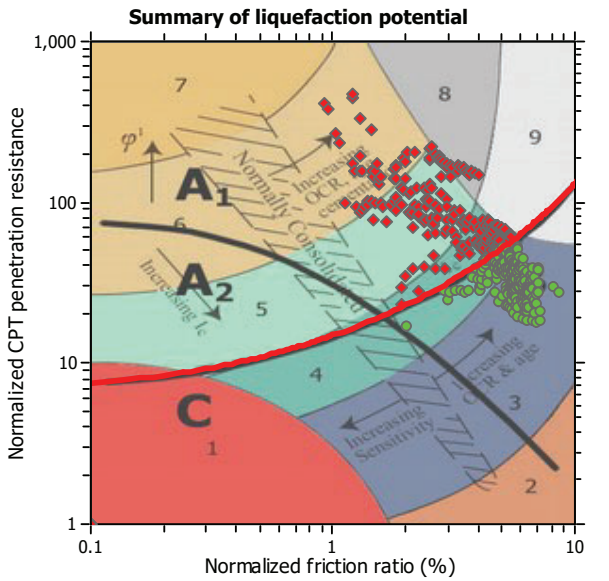
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	60.00 ft
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

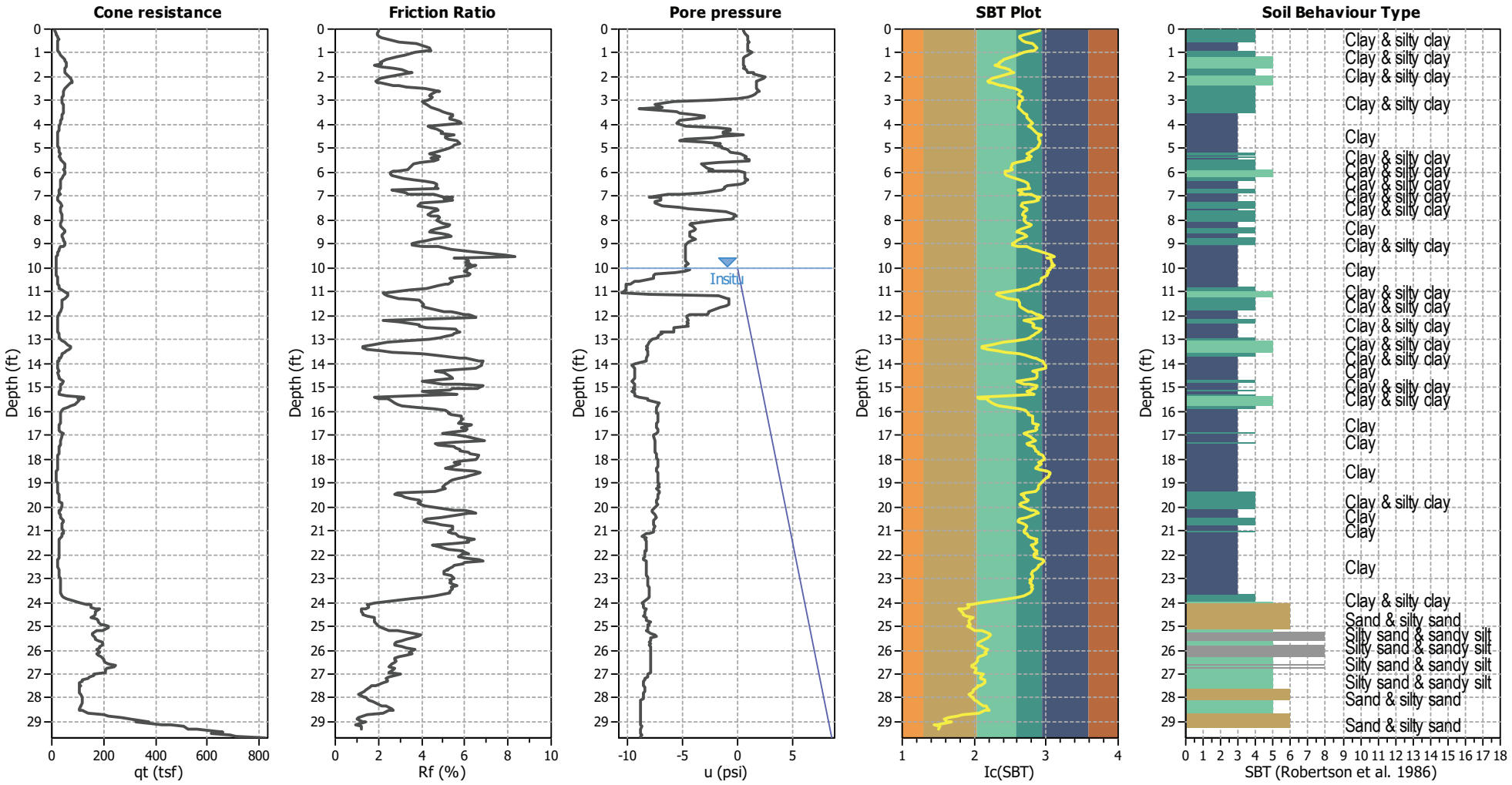






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



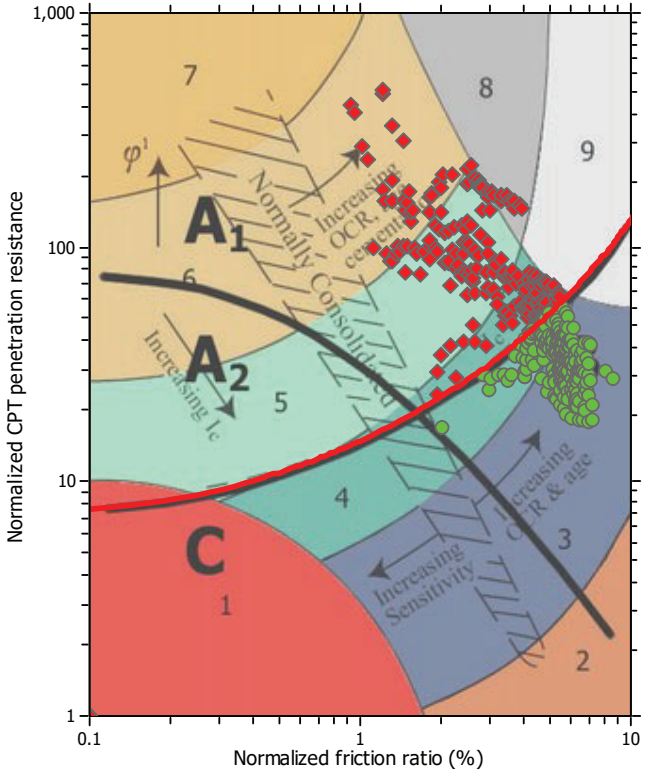
Input parameters and analysis data

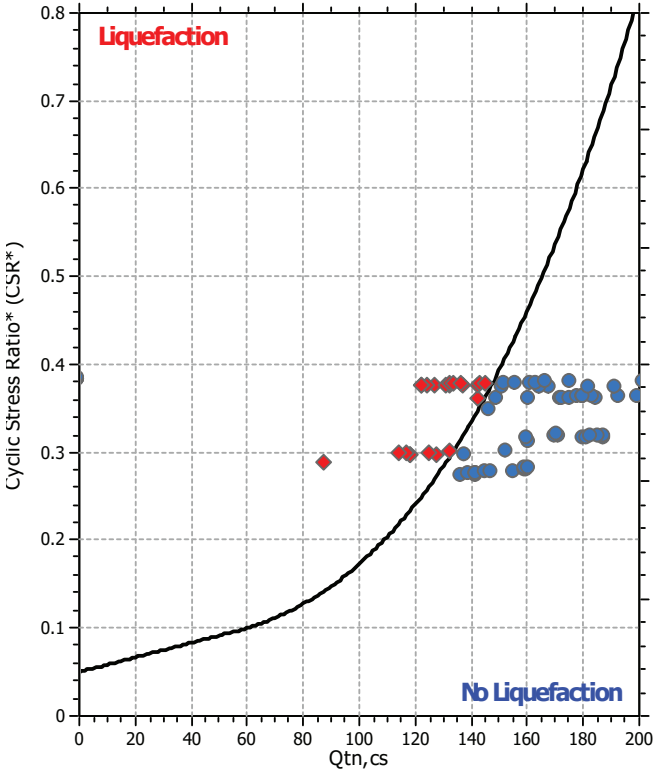
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

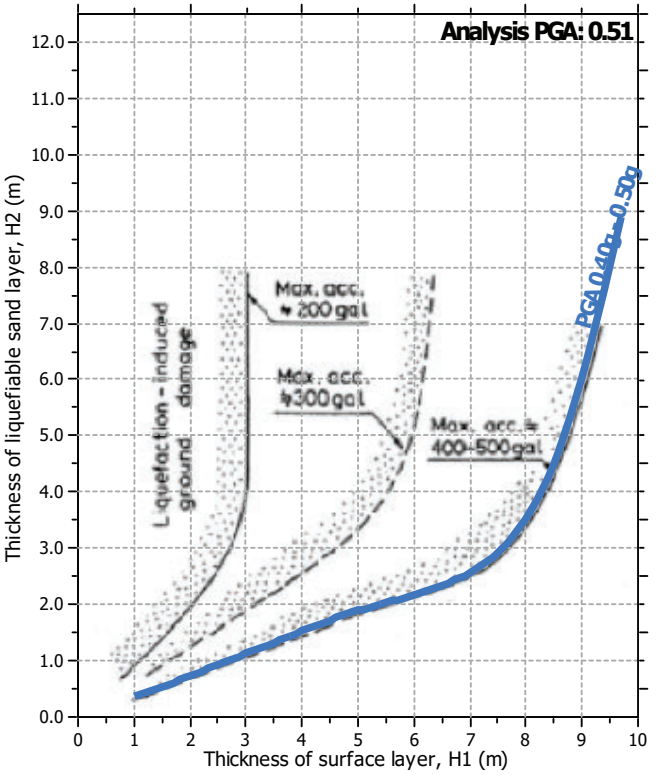
SBT legend

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

Liquefaction analysis summary plots



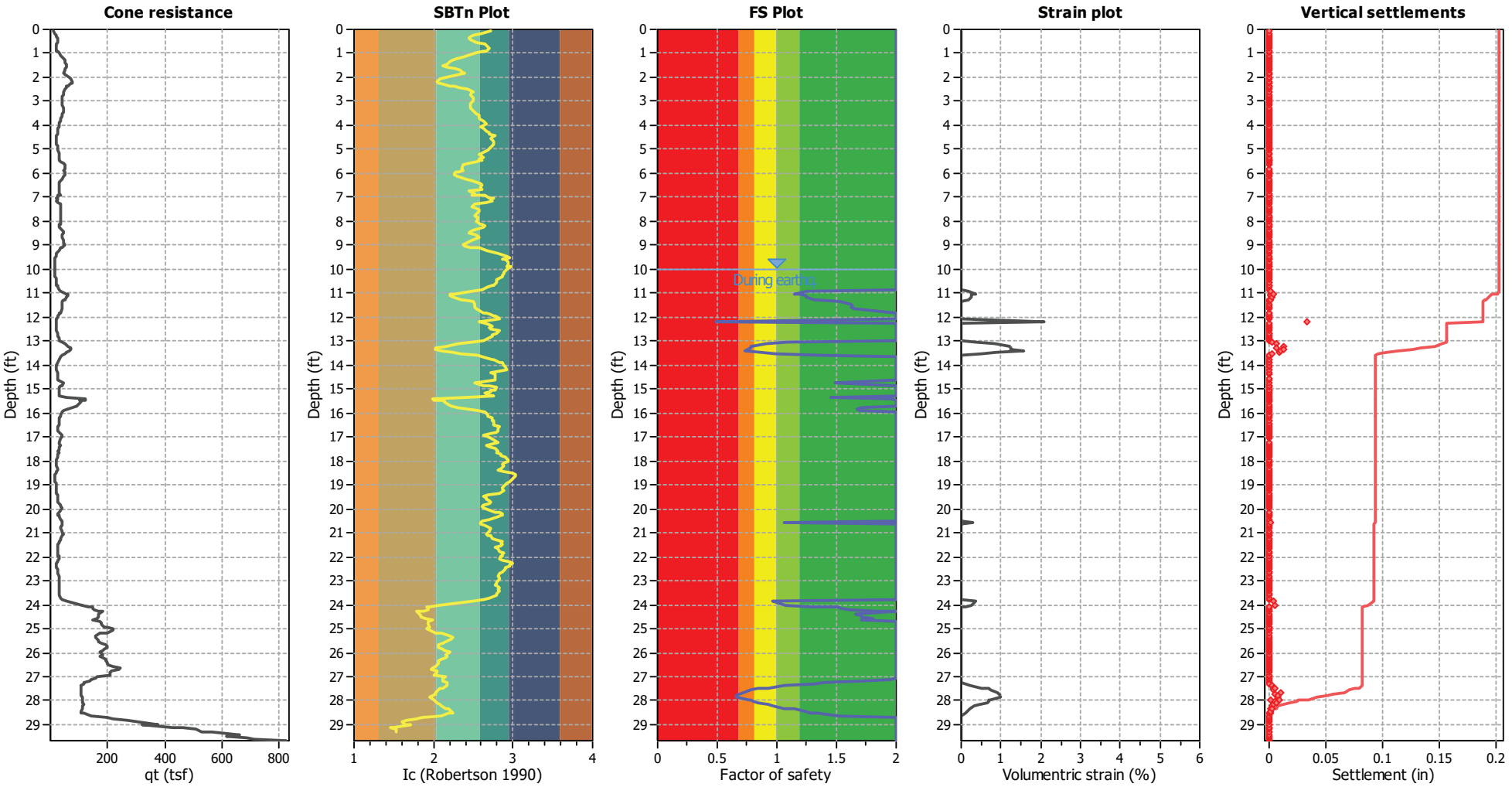




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

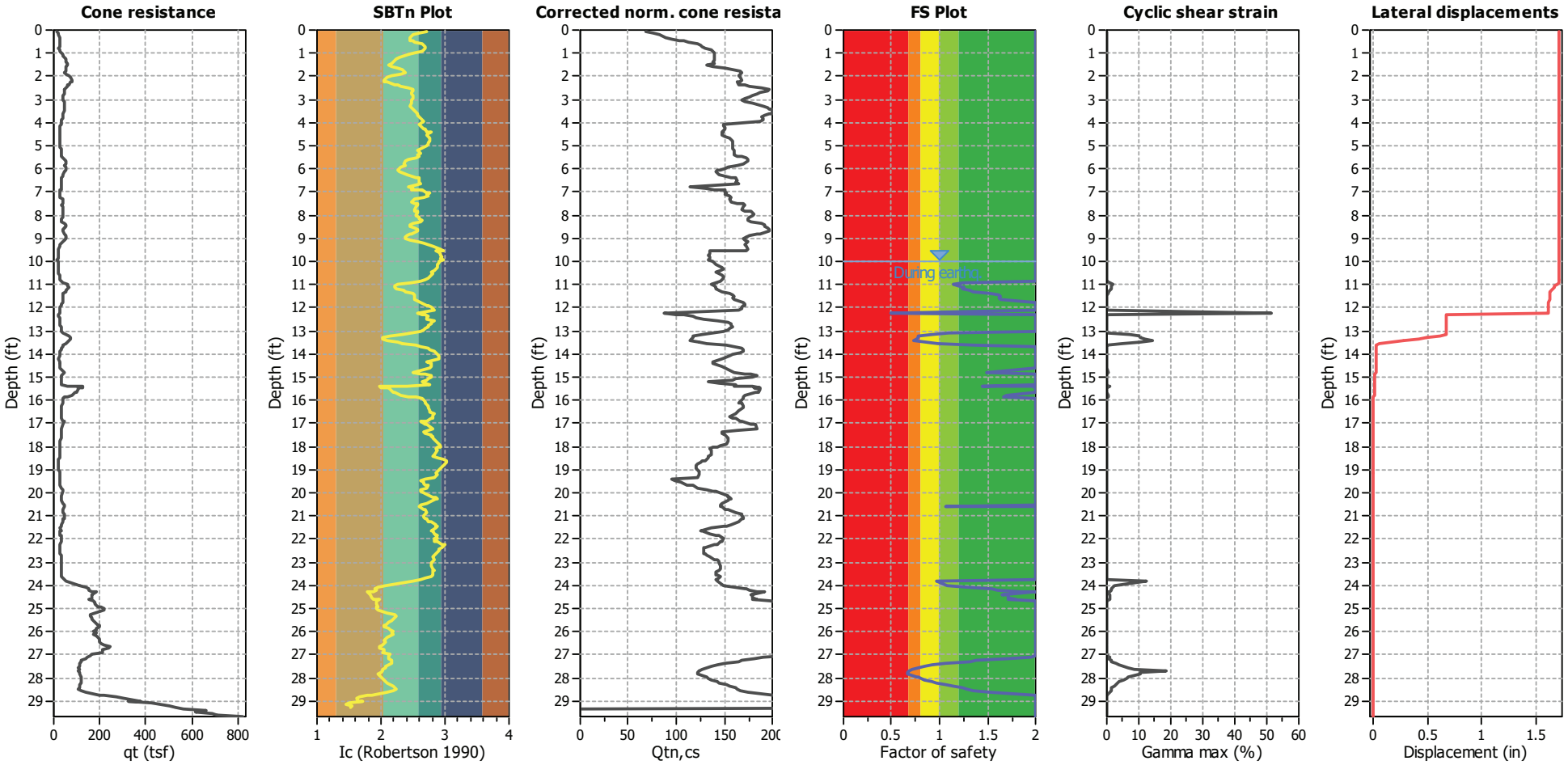


Abbreviations

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

Estimation of post-earthquake lateral Displacements

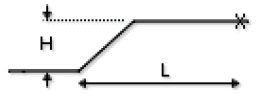
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



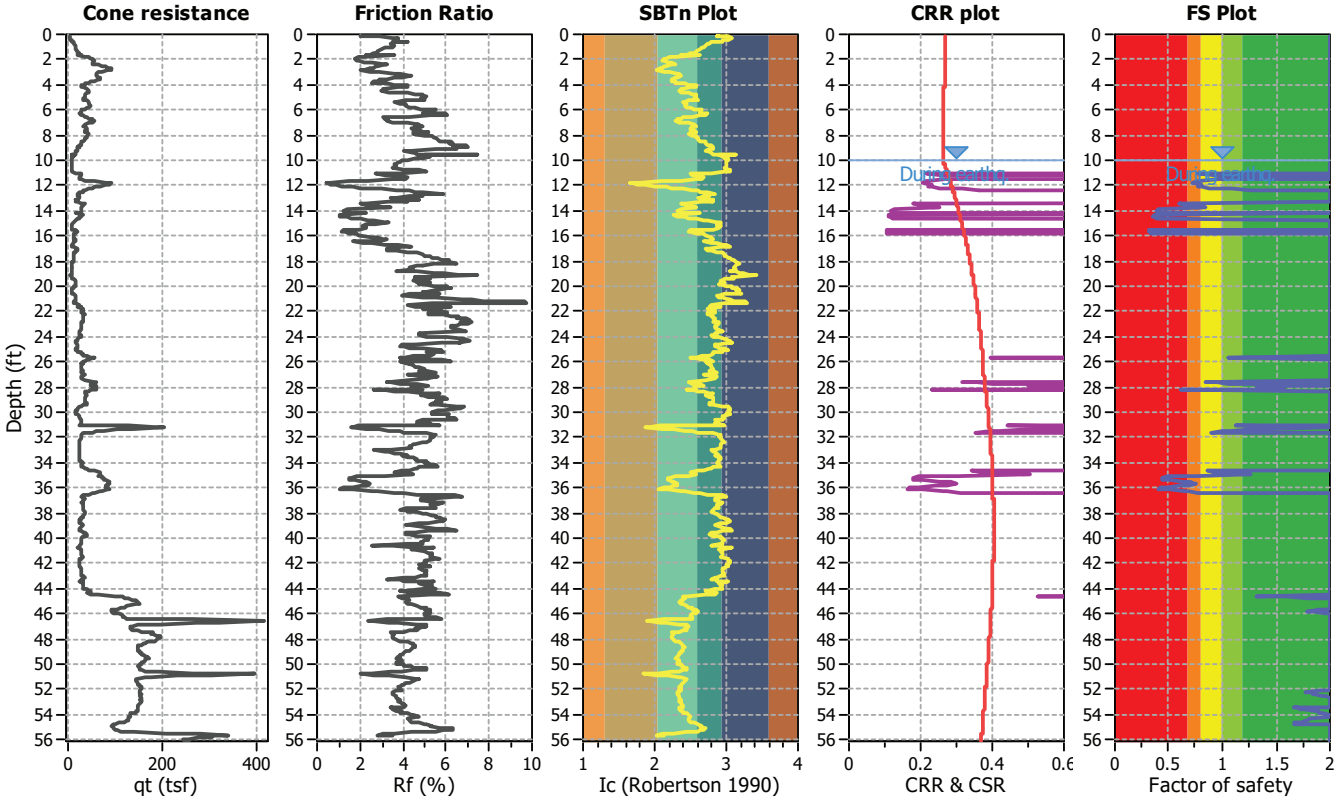
LIQUEFACTION ANALYSIS REPORT

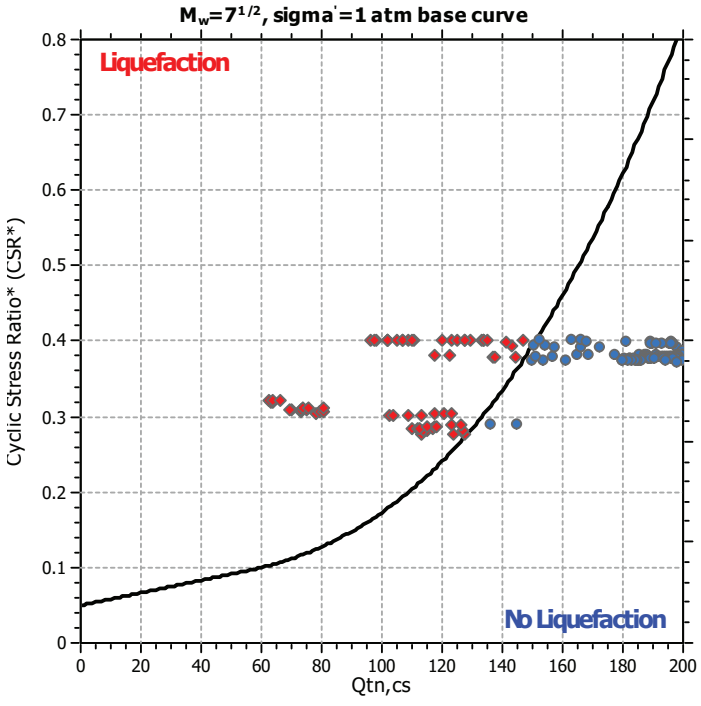
Project title : 12085.004 Ocean Creek Tower Center **Location : Oceanside, CA 92054**

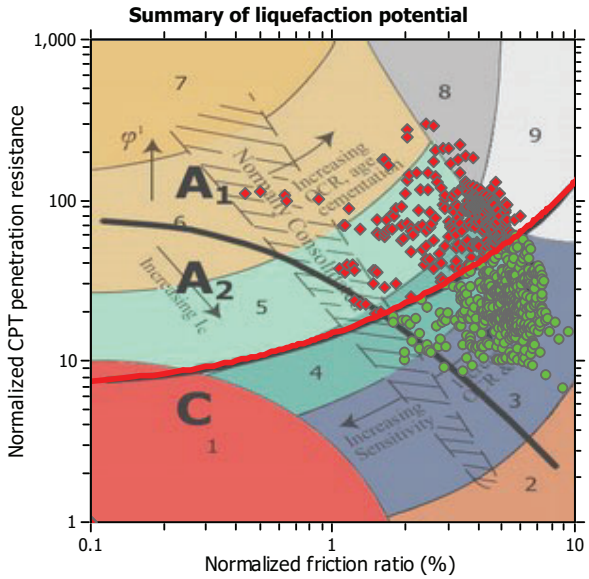
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

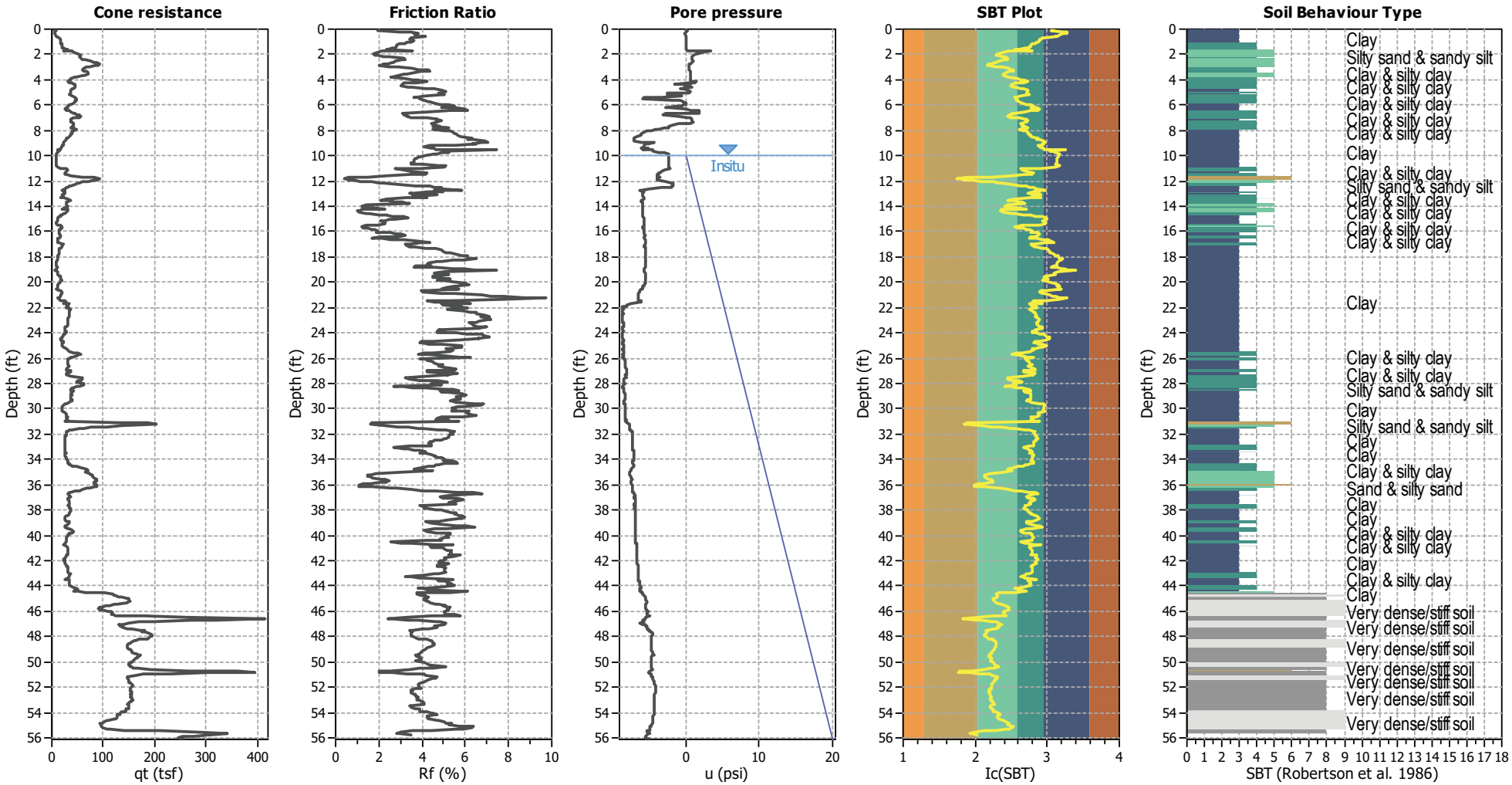






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



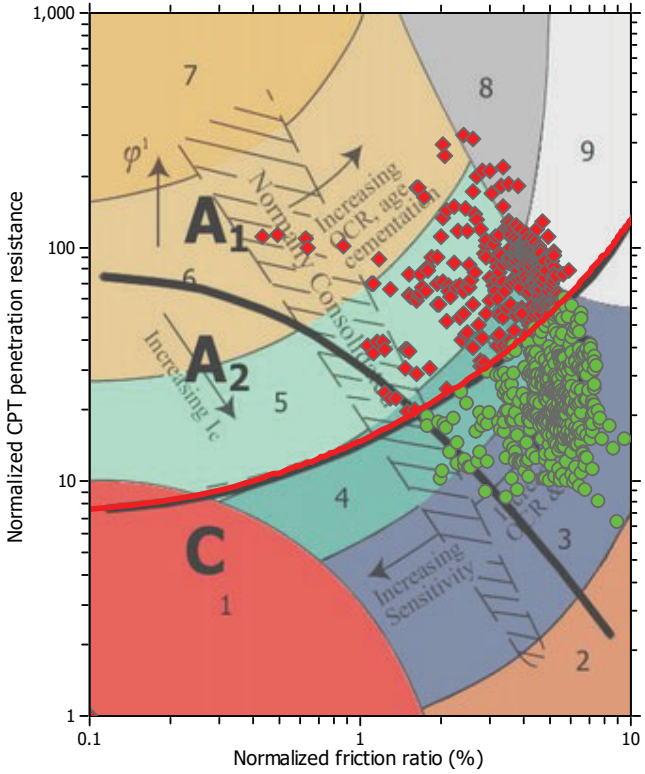
Input parameters and analysis data

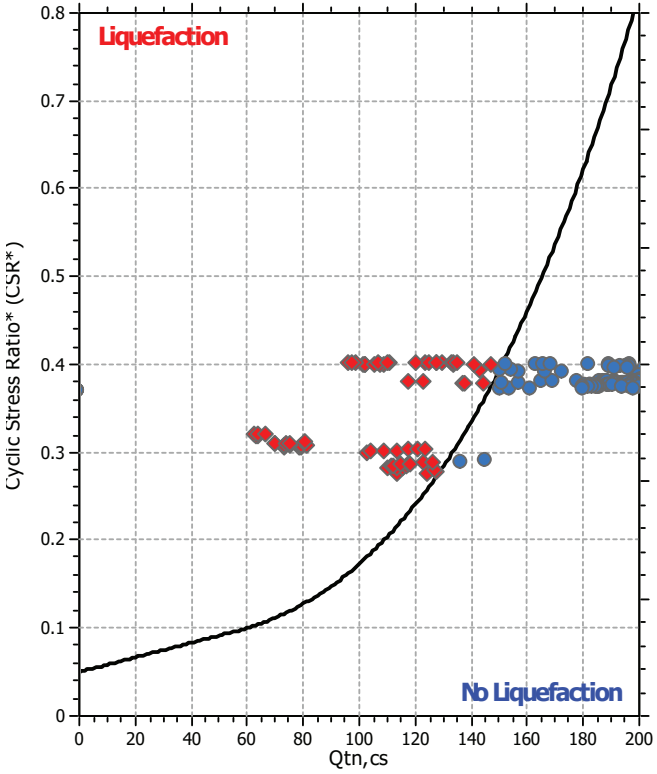
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

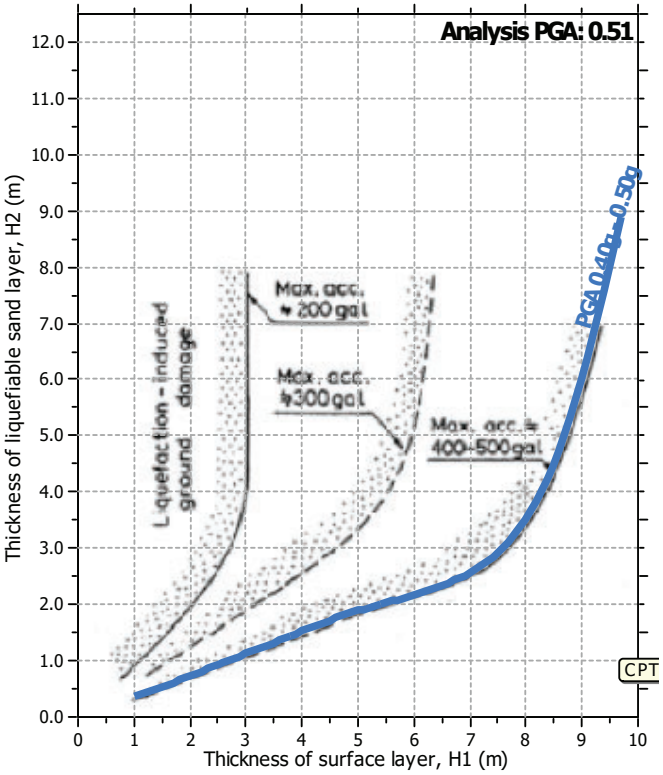
SBT legend

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

Liquefaction analysis summary plots



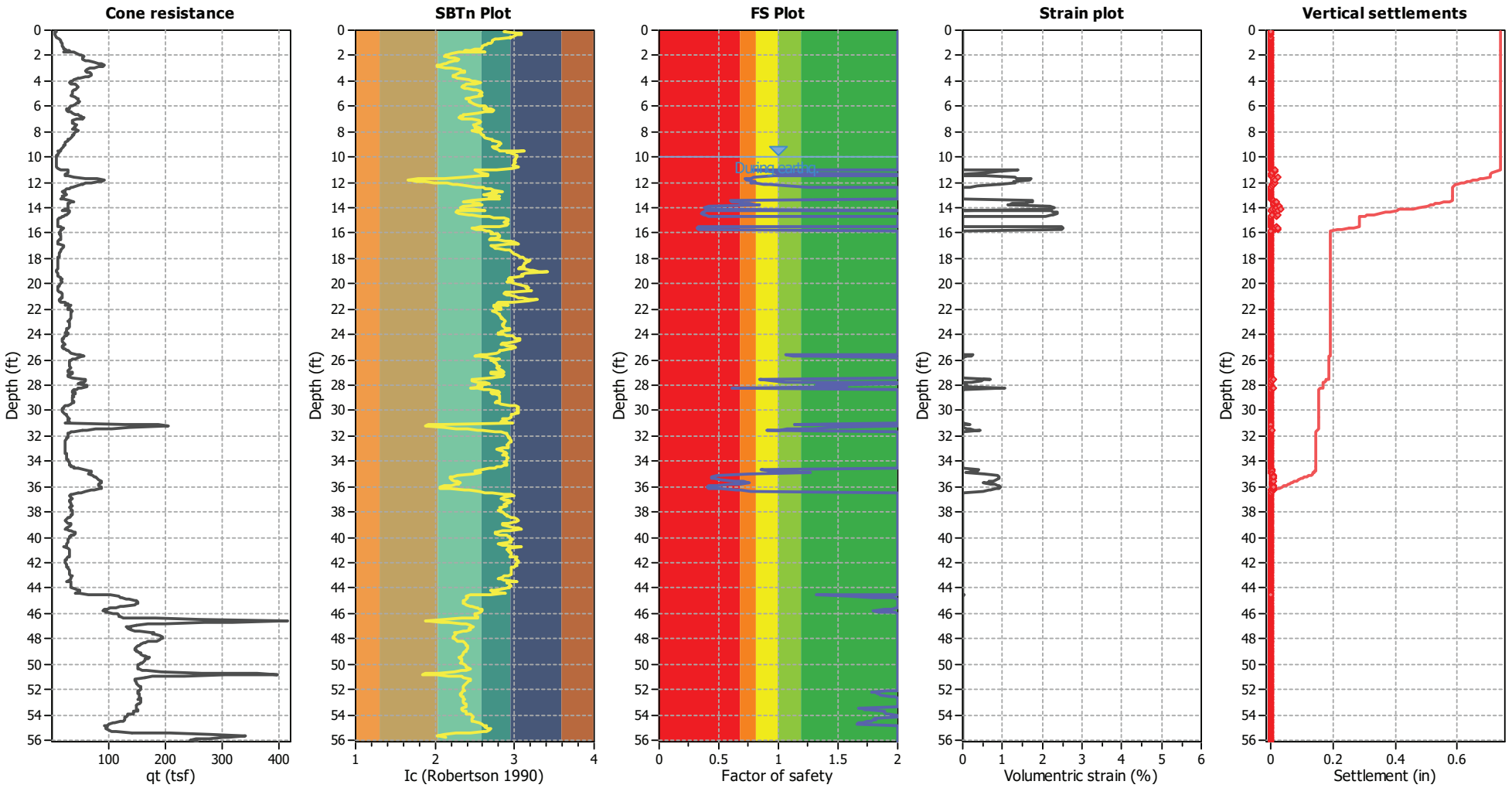




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 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_o applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

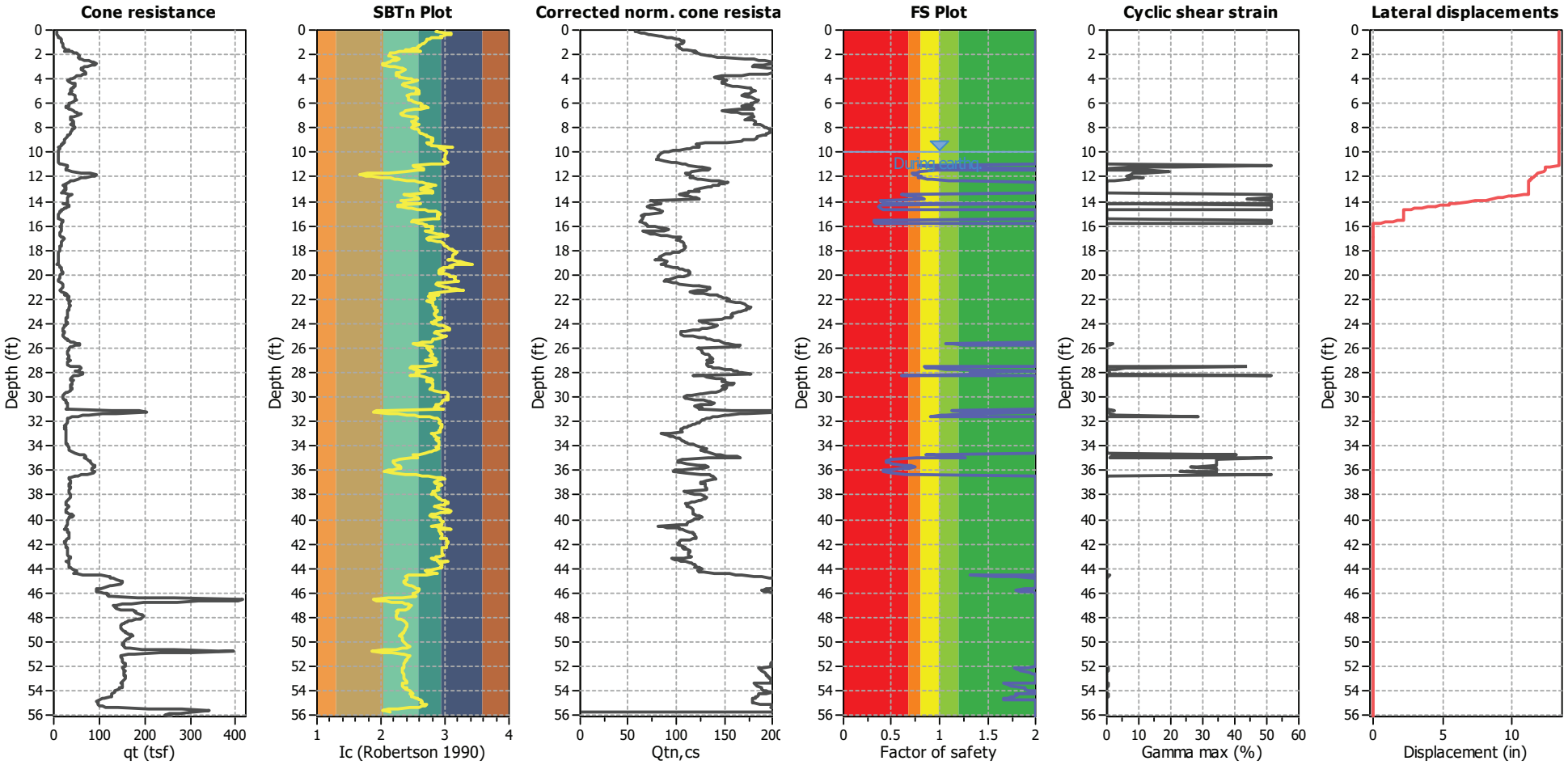


Abbreviations

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

Estimation of post-earthquake lateral Displacements

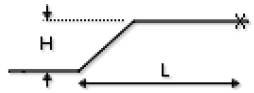
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



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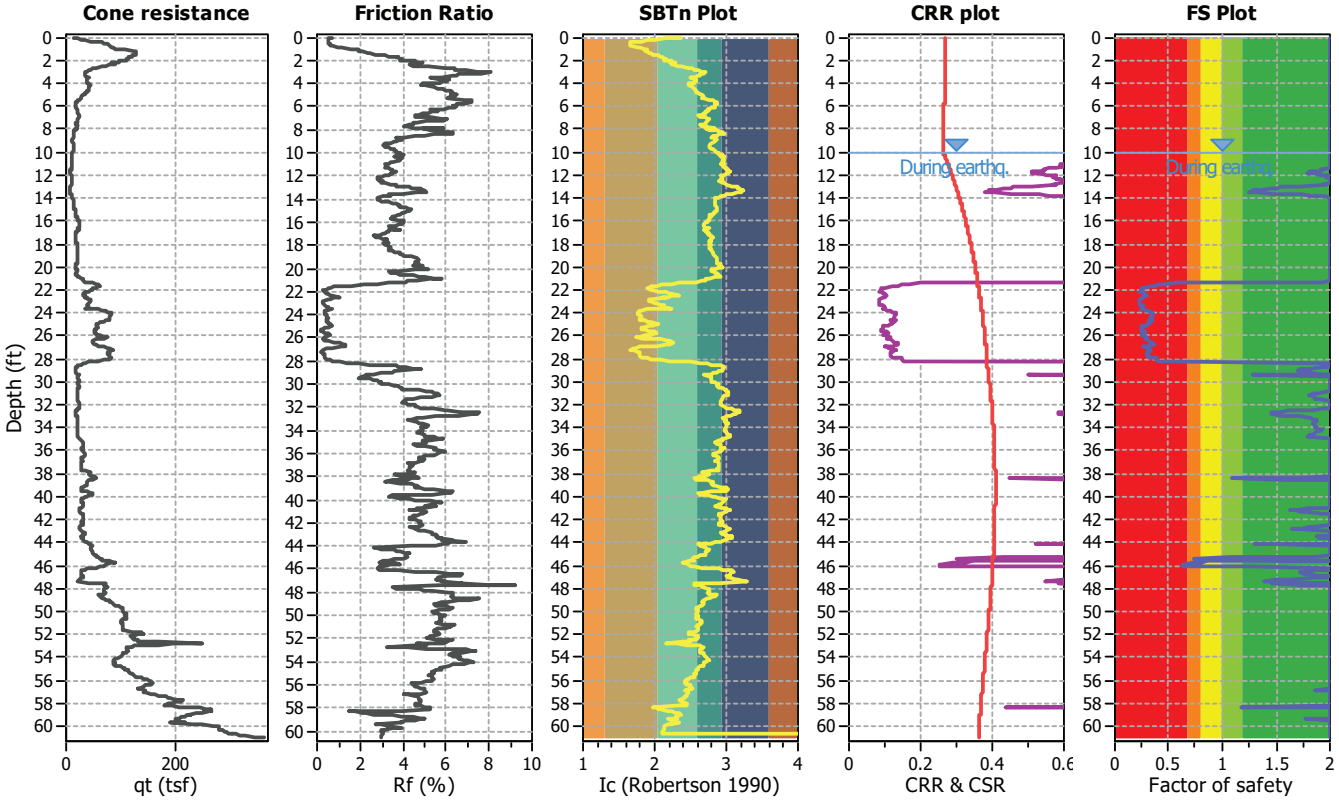
LIQUEFACTION ANALYSIS REPORT

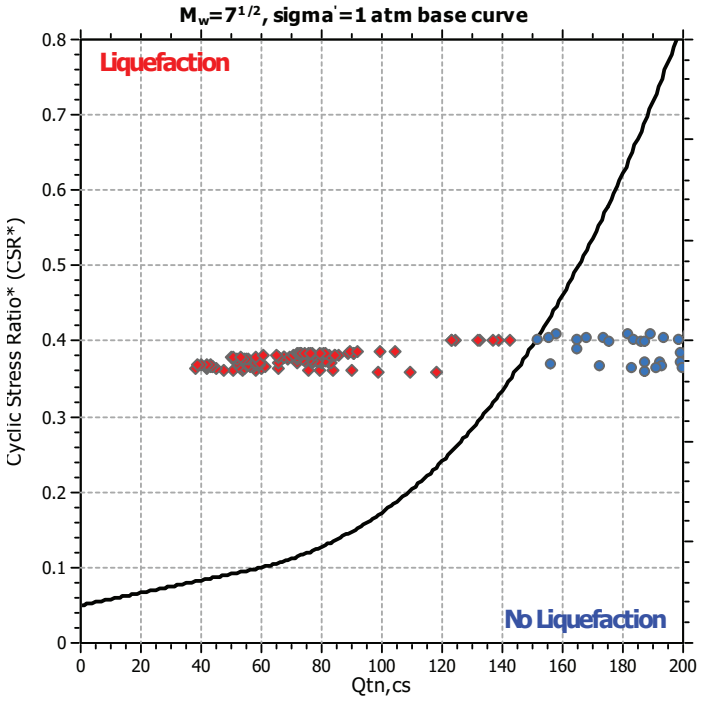
Project title : 12085.002 - JPI Ocean Creek **Location :**

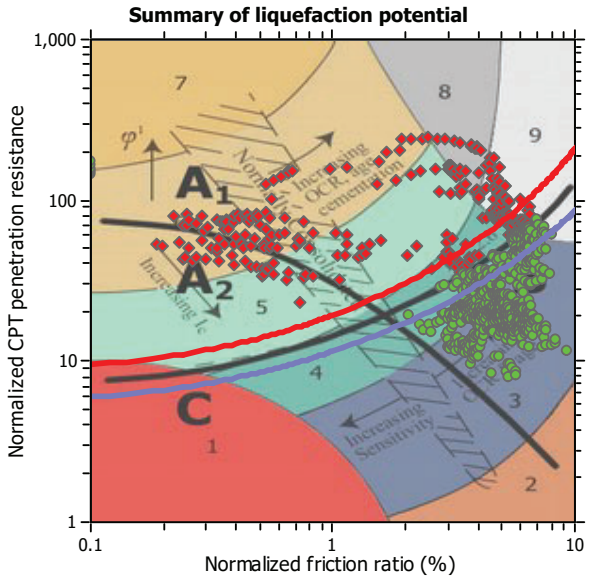
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.91	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

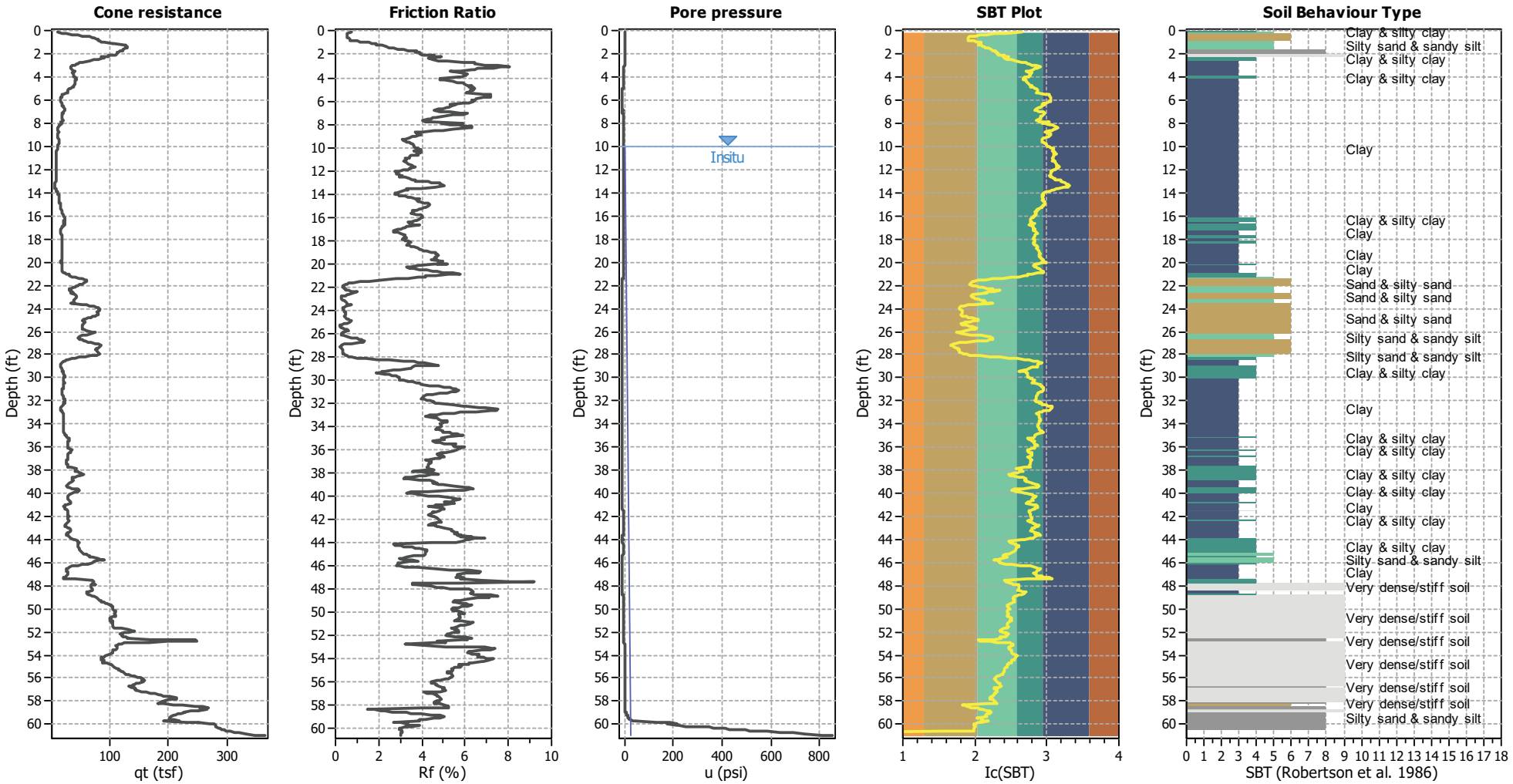






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.91	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

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
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7. Gravely sand to sand
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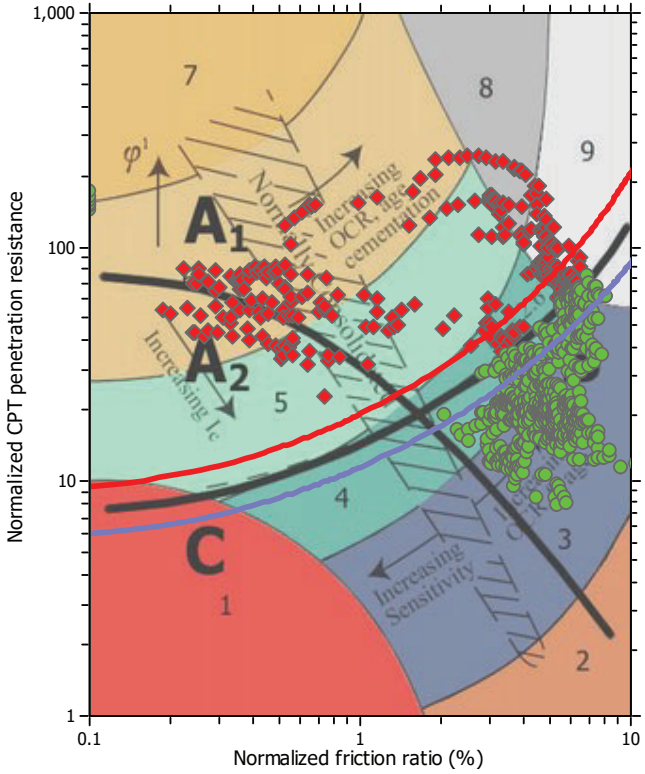
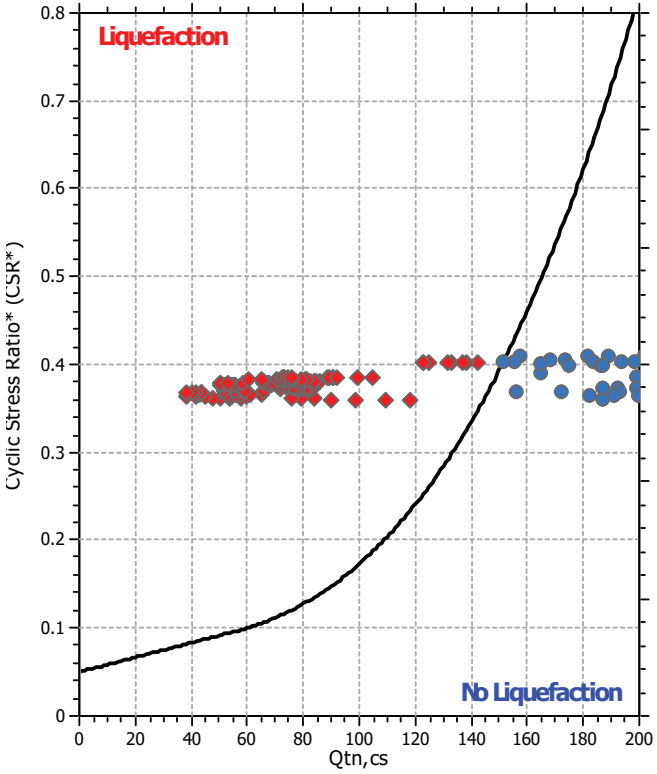
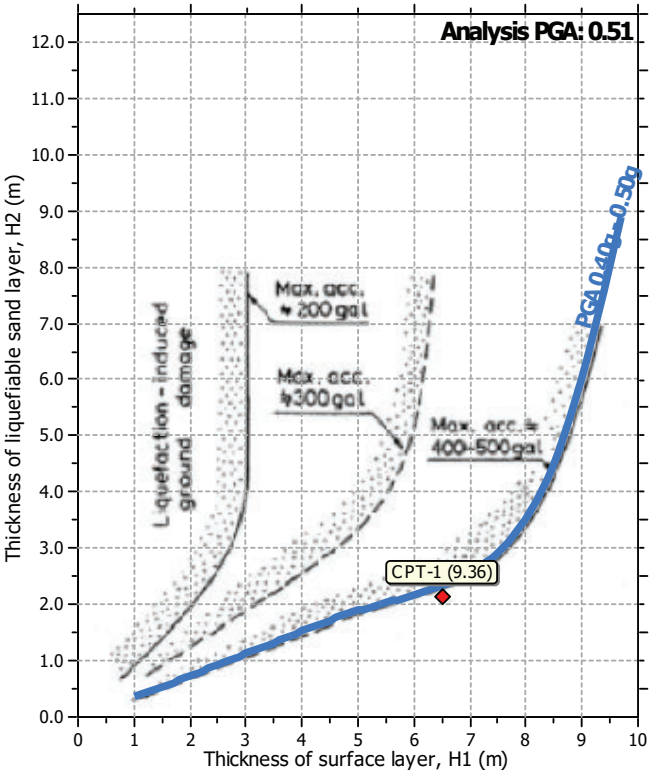
9. Very stiff fine grained

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.91	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
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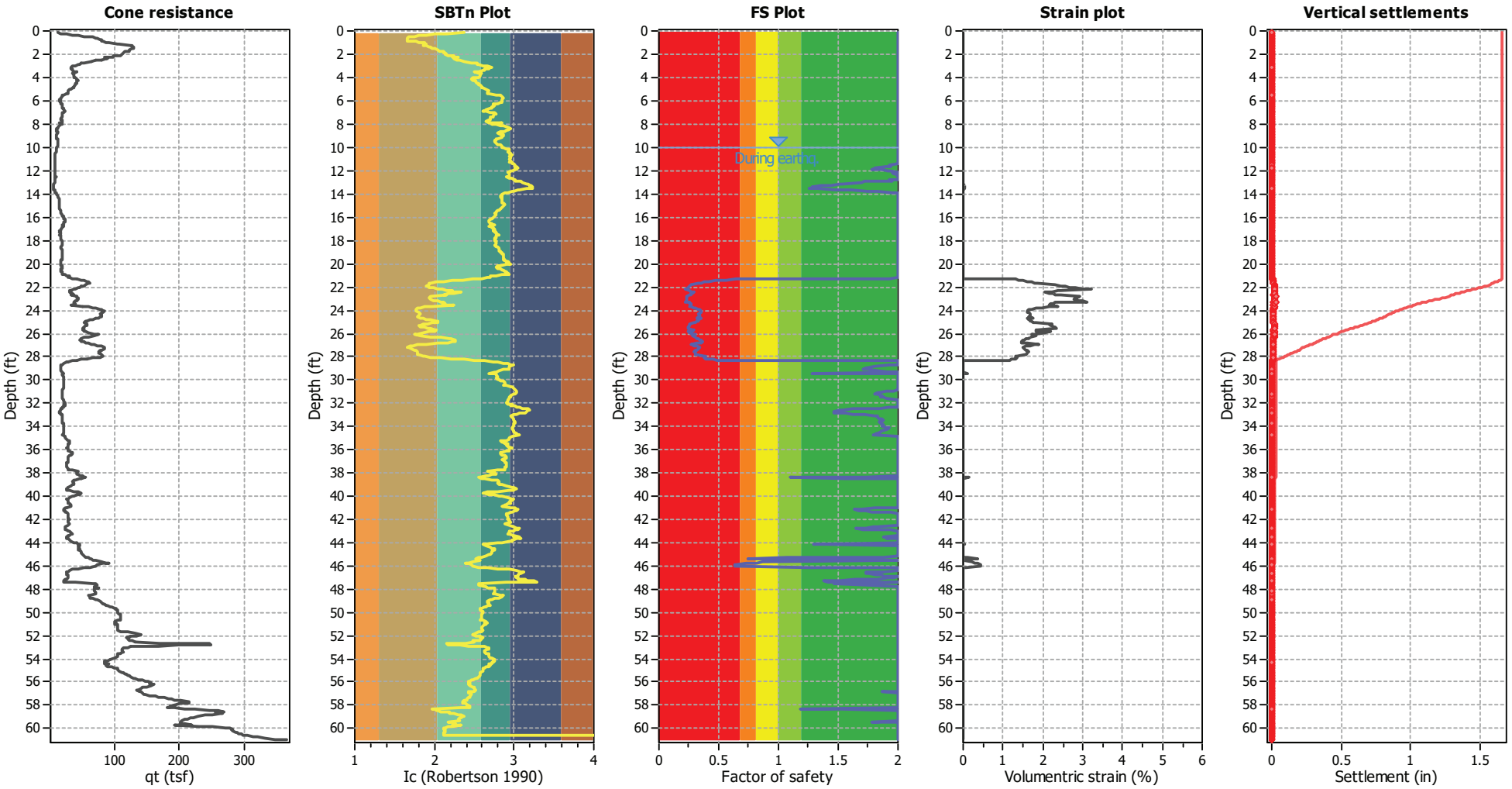
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

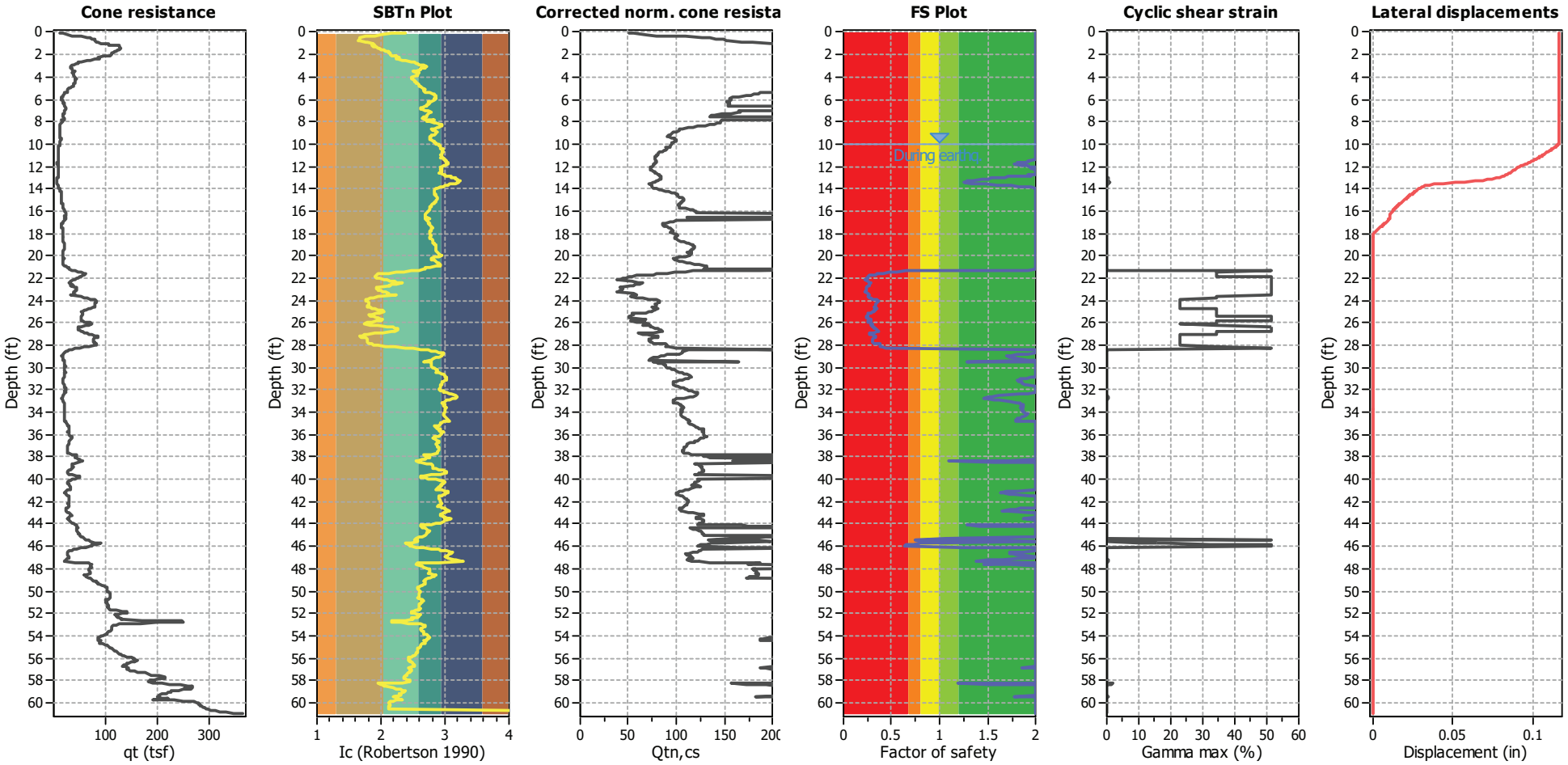


Abbreviations

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

Estimation of post-earthquake lateral Displacements

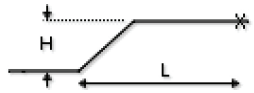
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



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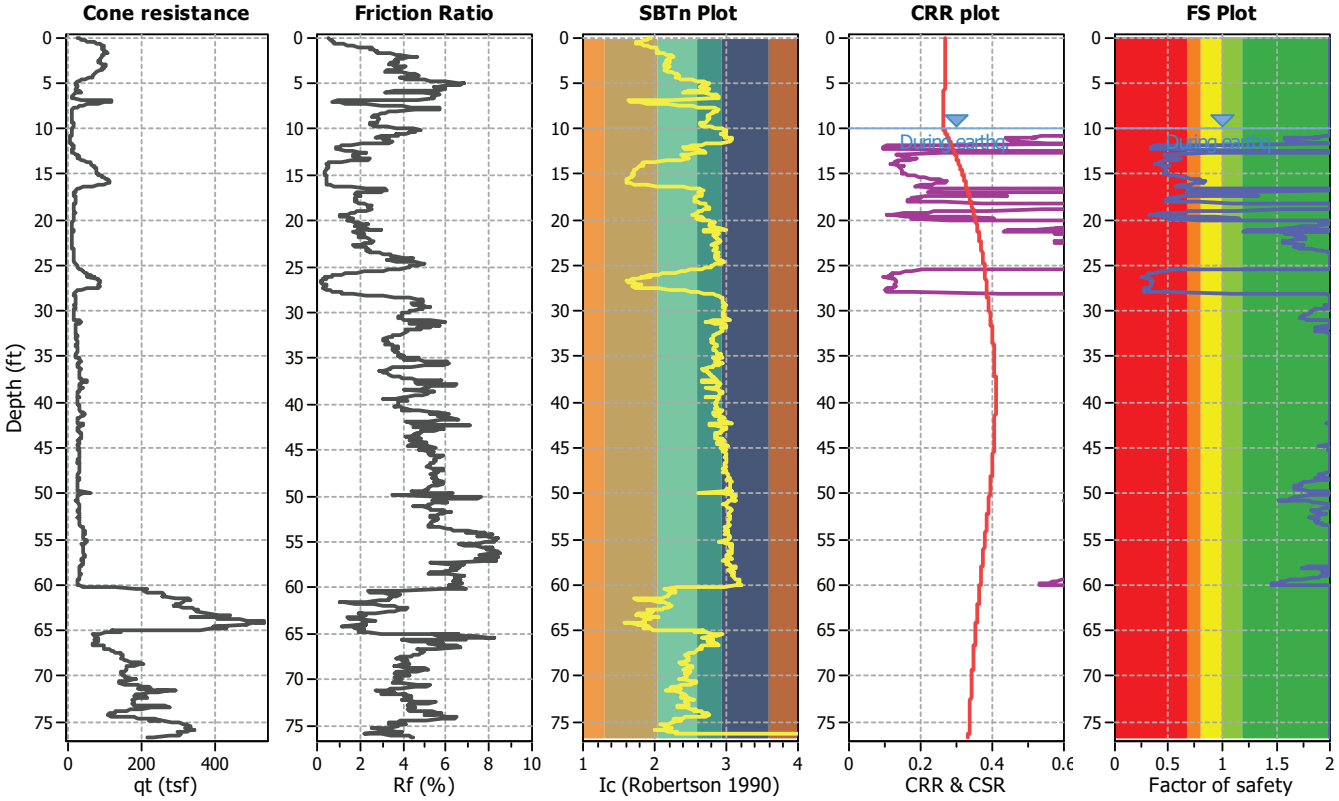
LIQUEFACTION ANALYSIS REPORT

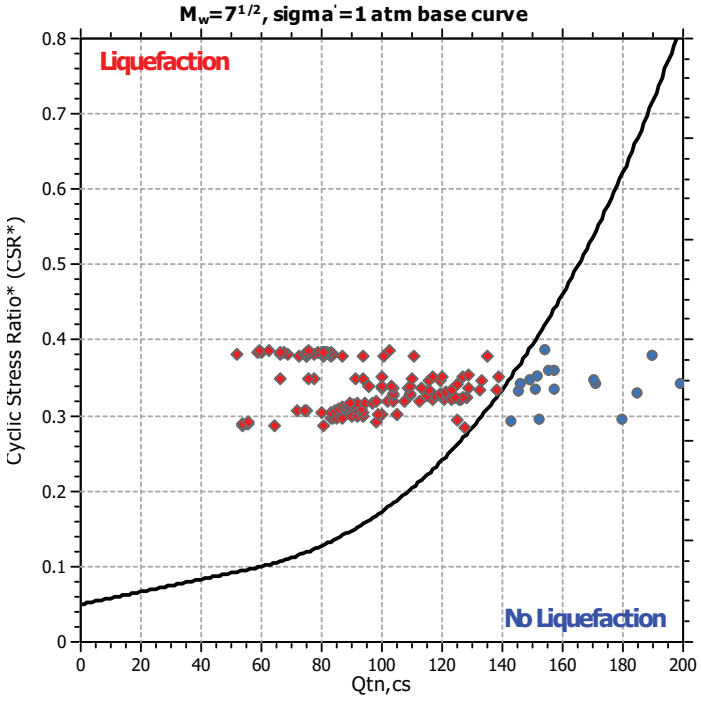
Project title : 12085.002 - JPI Ocean Creek **Location :**

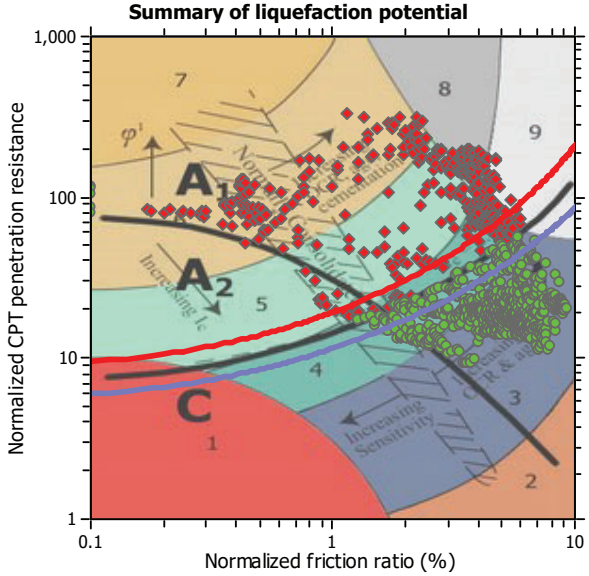
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.91	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

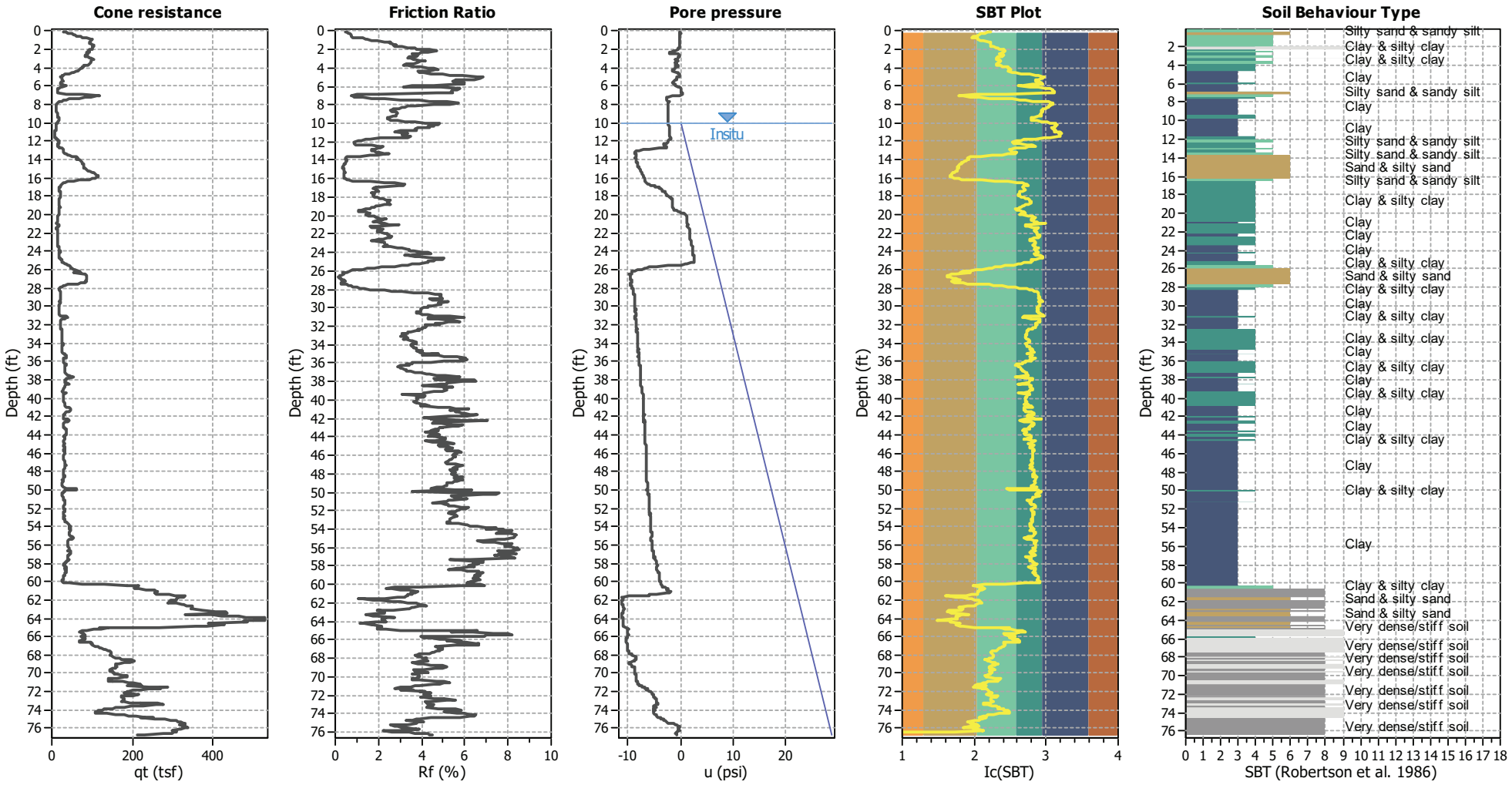






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



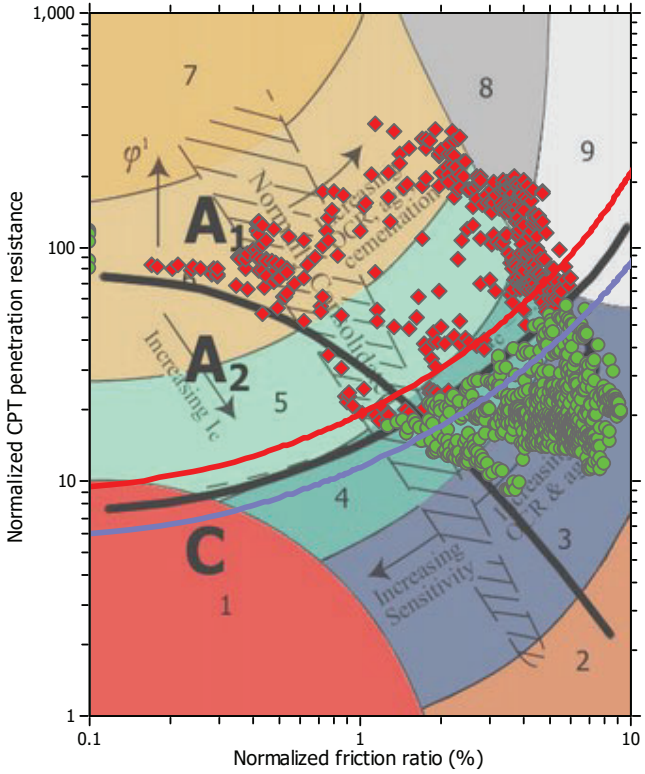
Input parameters and analysis data

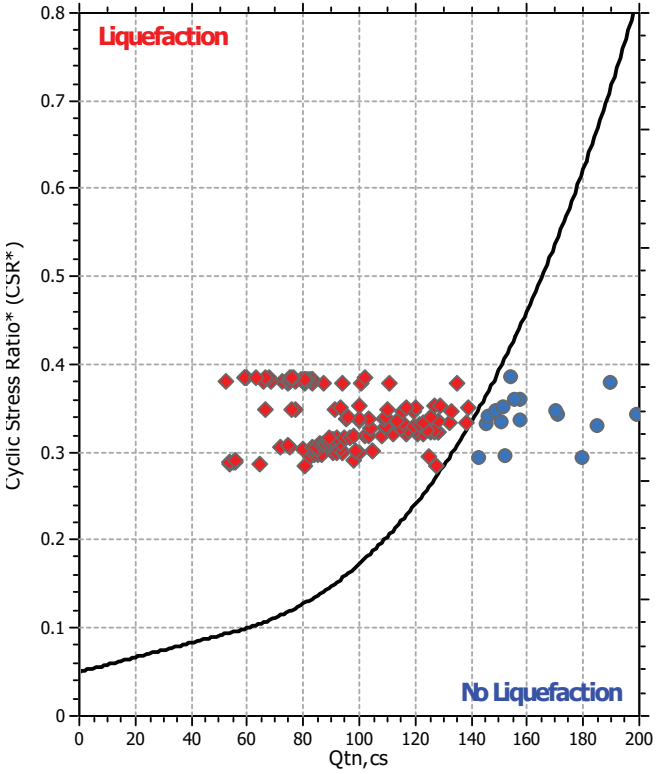
Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.91	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

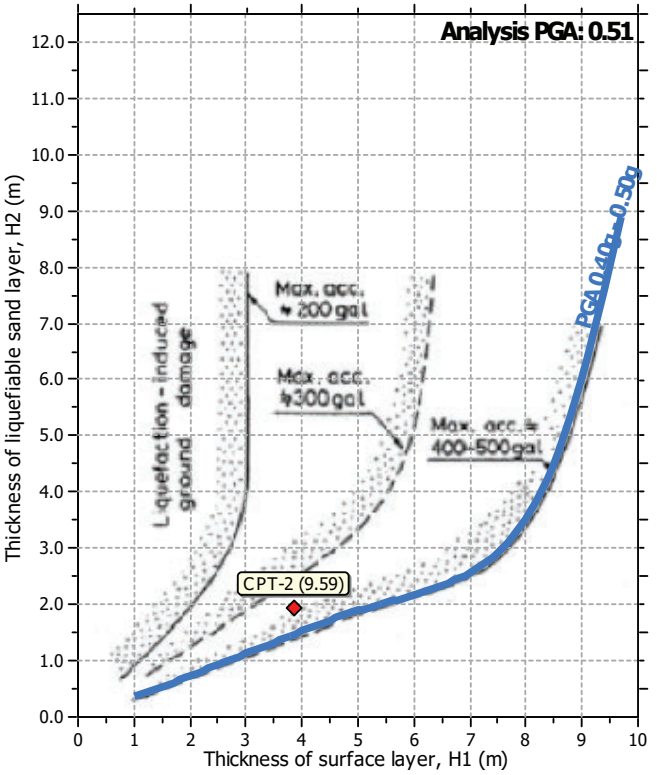
SBT legend

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

Liquefaction analysis summary plots







Input parameters and analysis data

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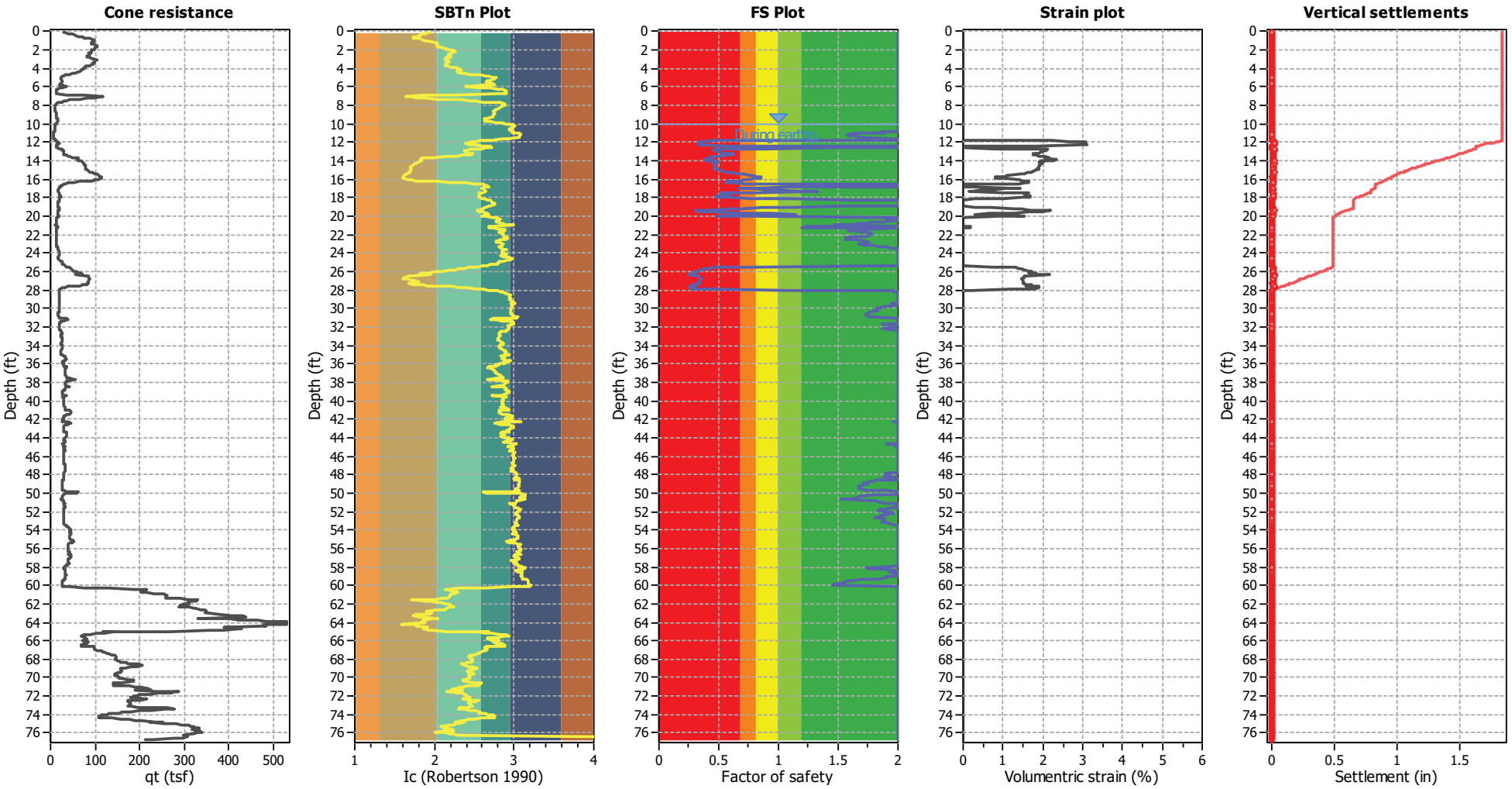
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.91	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.51	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements

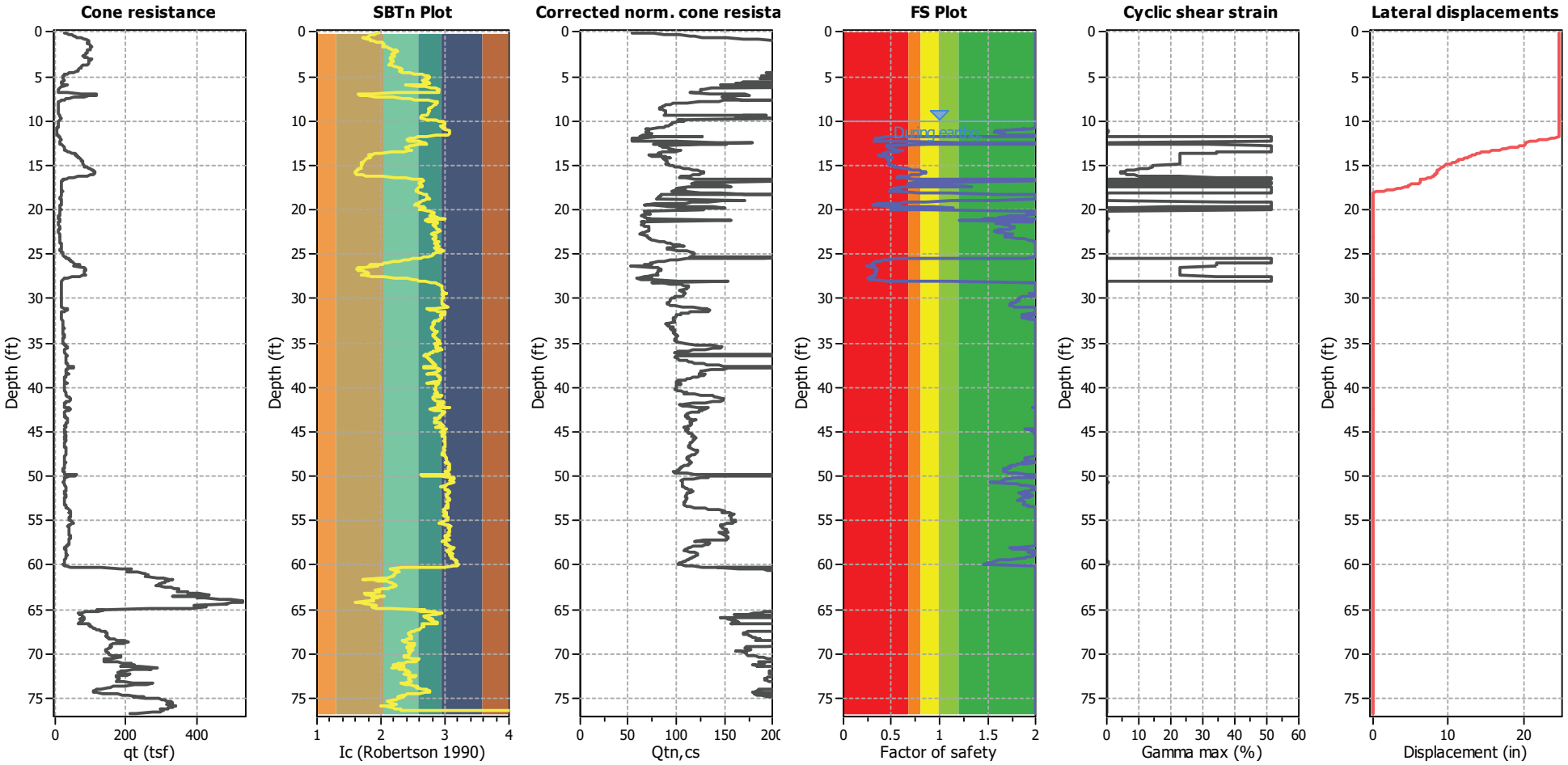


Abbreviations

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

Estimation of post-earthquake lateral Displacements

Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 9.00 ft)



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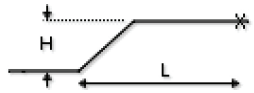
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



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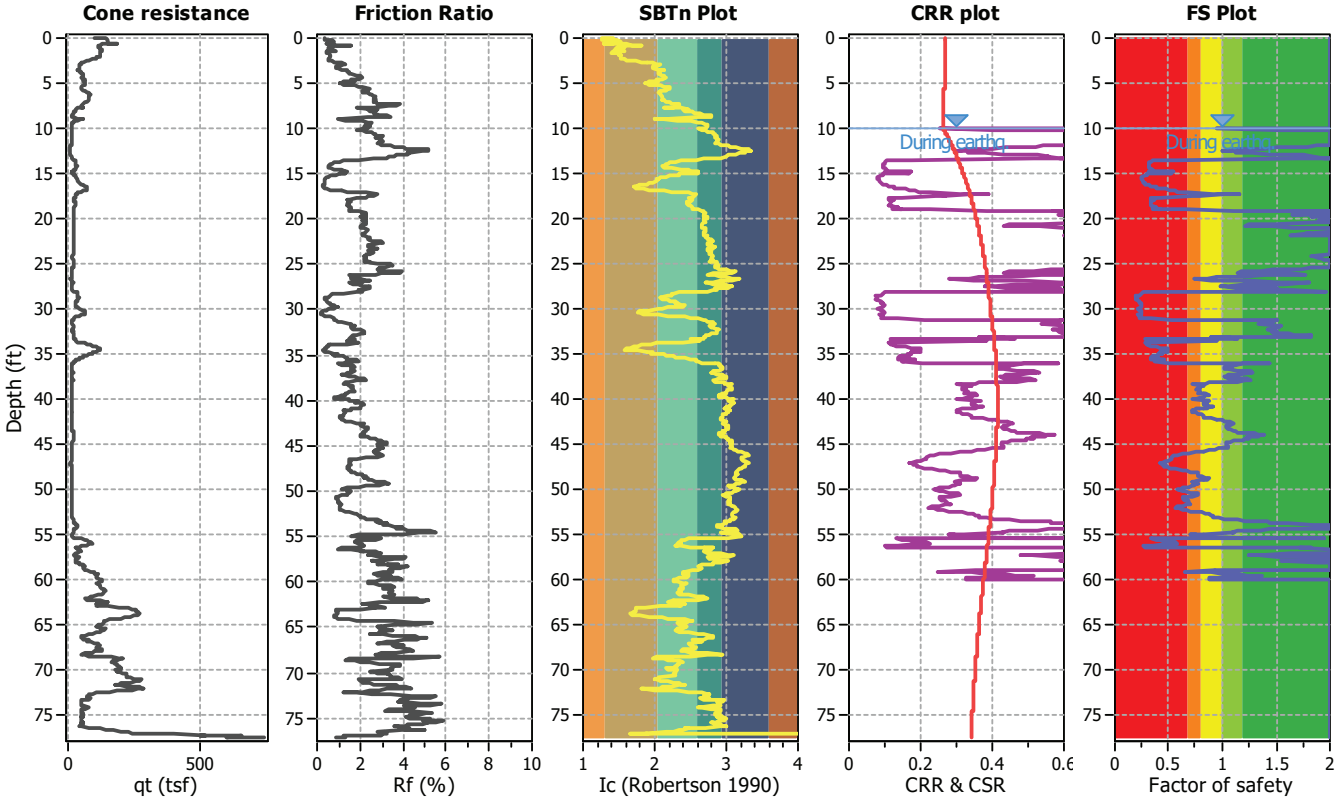
LIQUEFACTION ANALYSIS REPORT

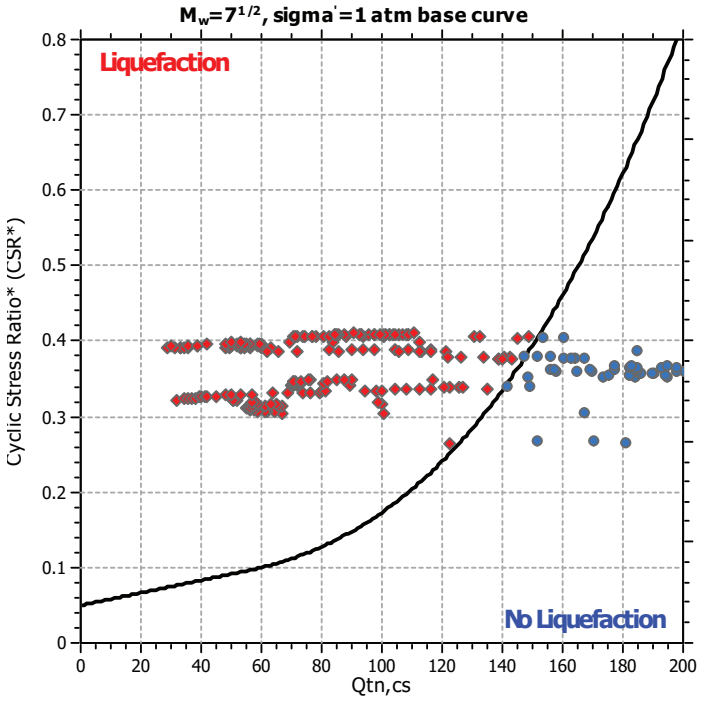
Project title : 12085.002 - JPI Ocean Creek **Location :**

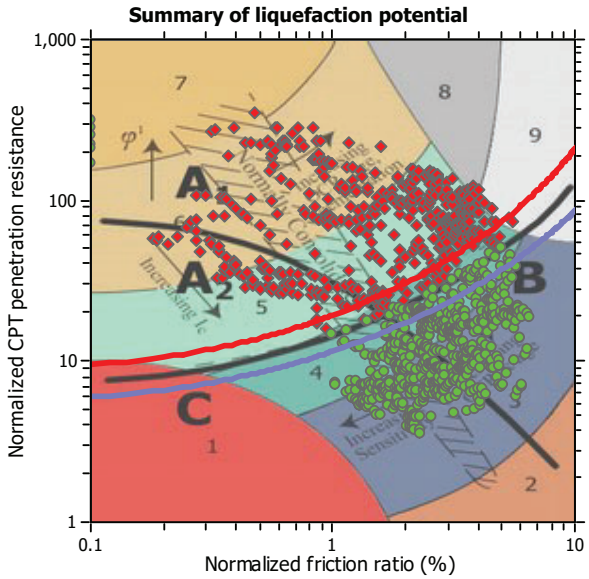
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	10.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.91	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.51	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
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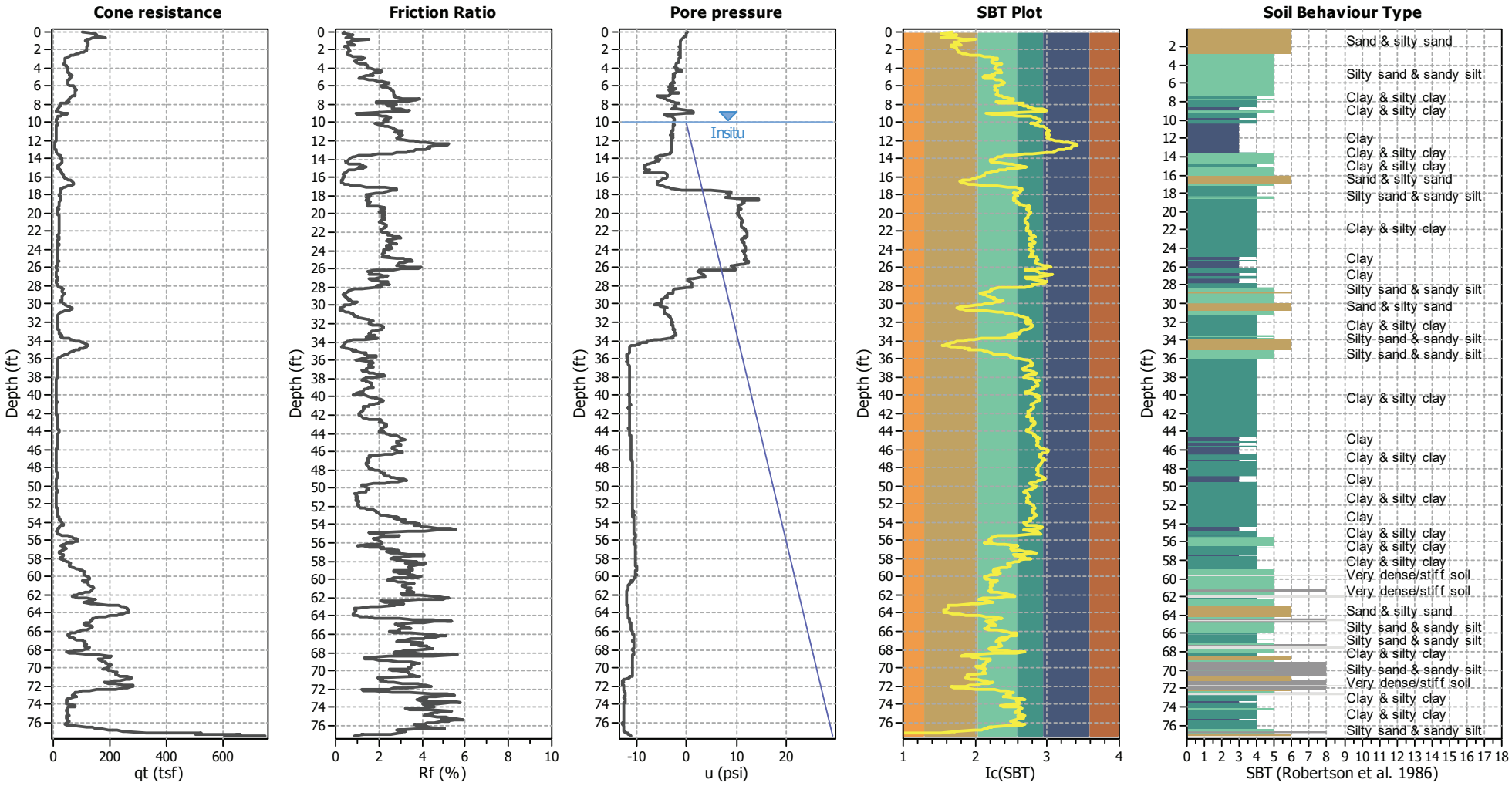
CPT basic interpretation plots



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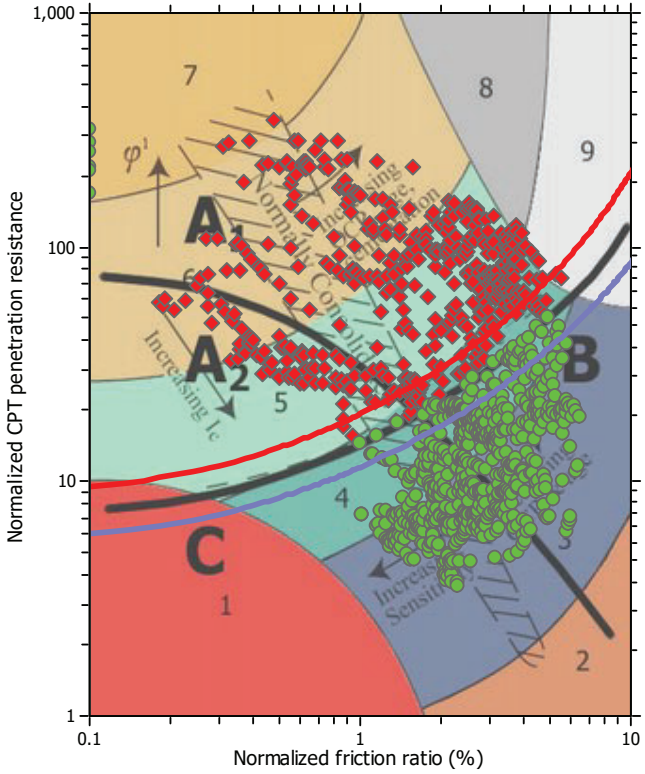
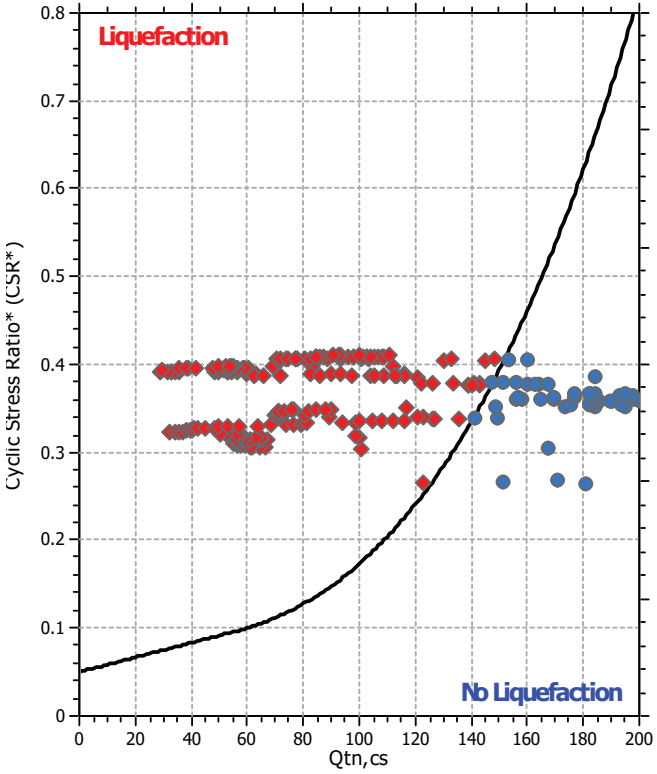
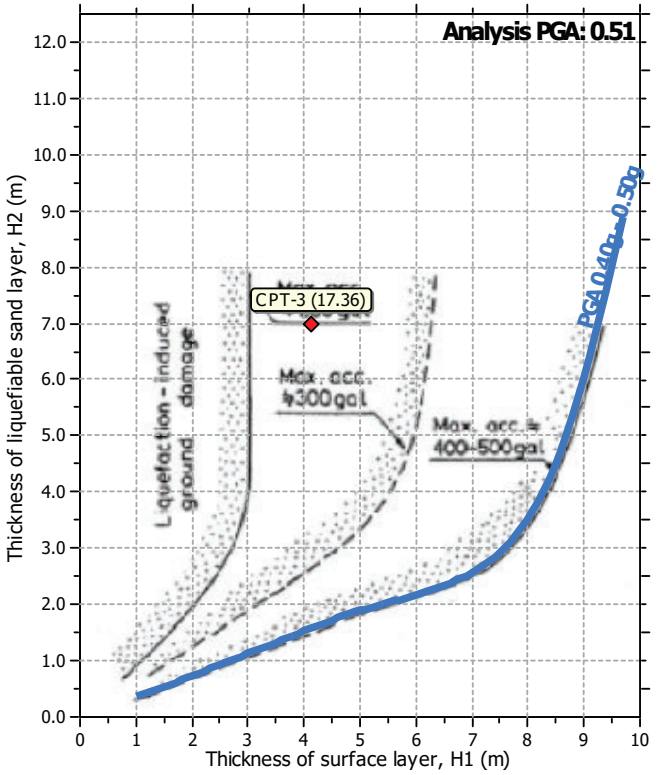
Liquefaction analysis summary plots







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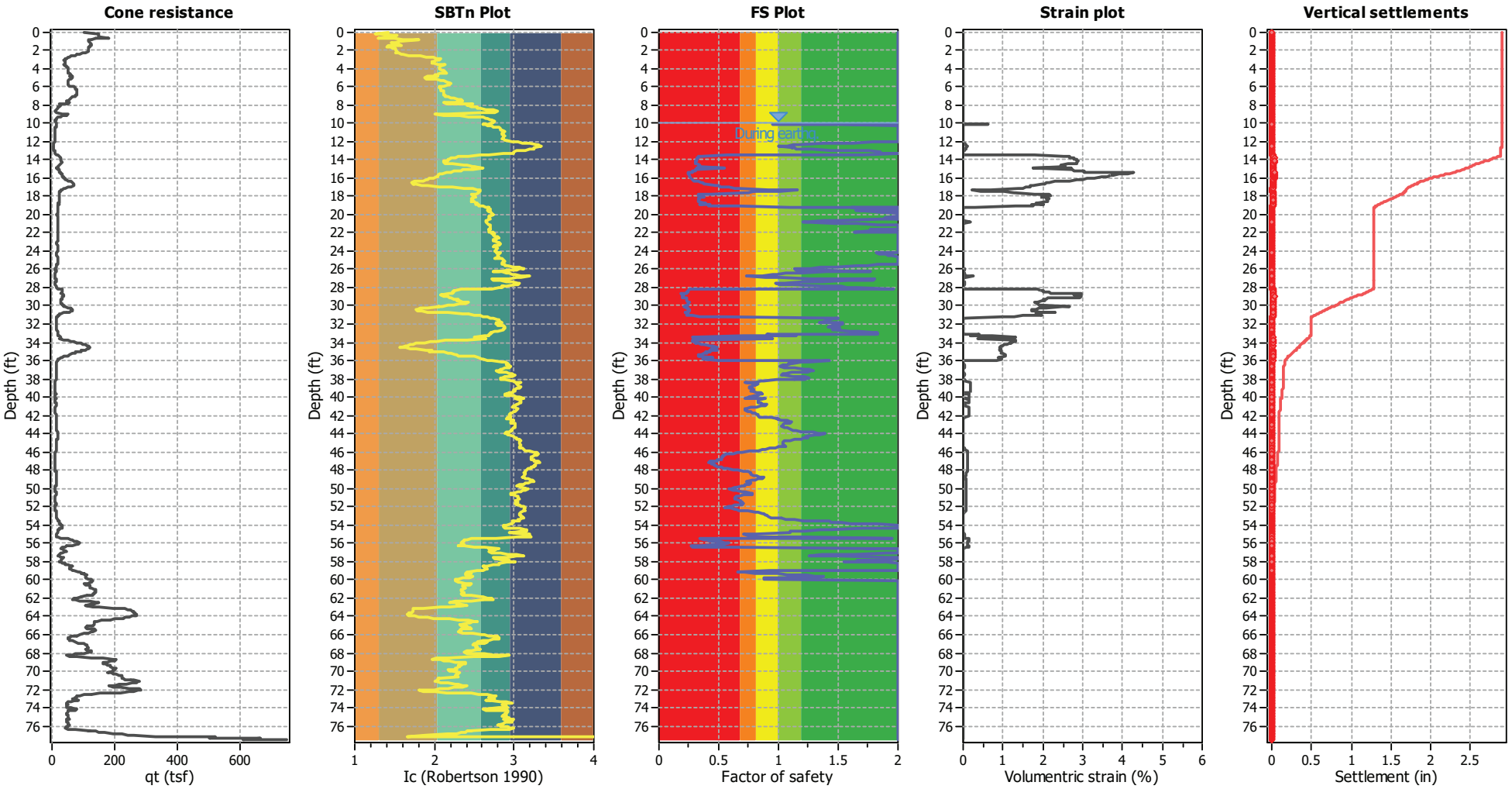

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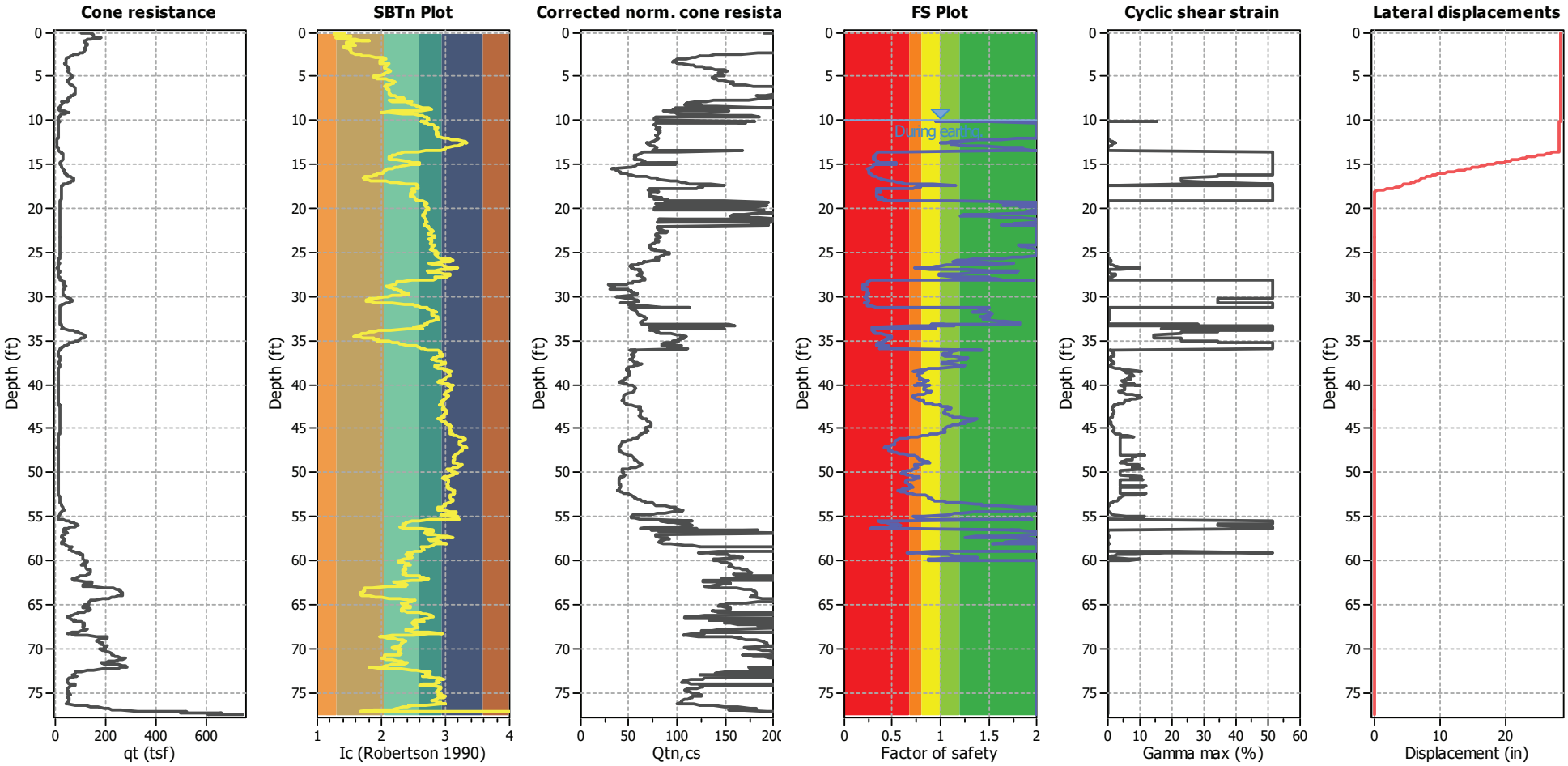

Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent dean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
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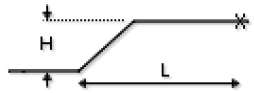
Surface condition



APPENDIX F

General Earthwork and Grading Specifications

Leighton

APPENDIX F
LEIGHTON AND ASSOCIATES, INC.
GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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. Please see the Standard Details for a graphic illustration. 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, and the Standard Details. 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.

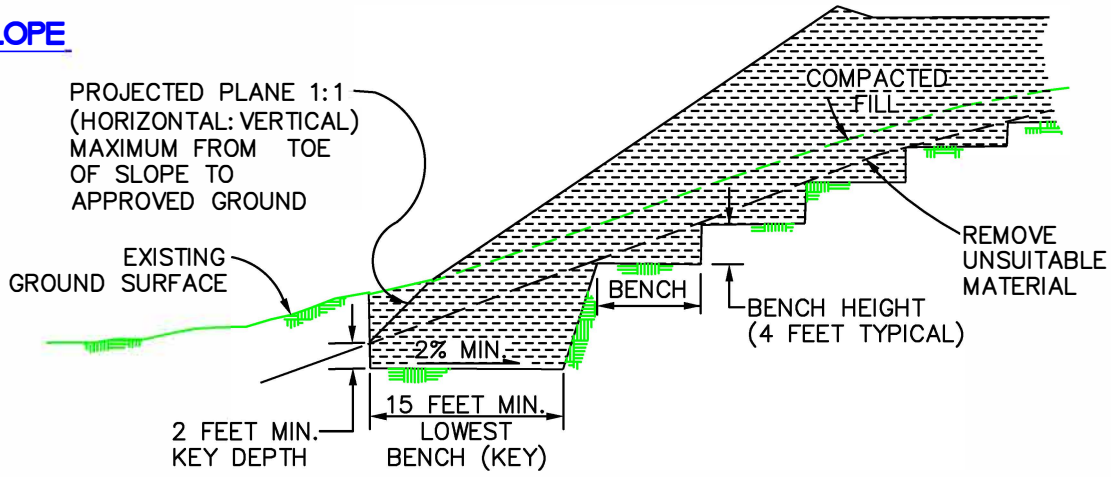
7.3 Lift Thickness

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.

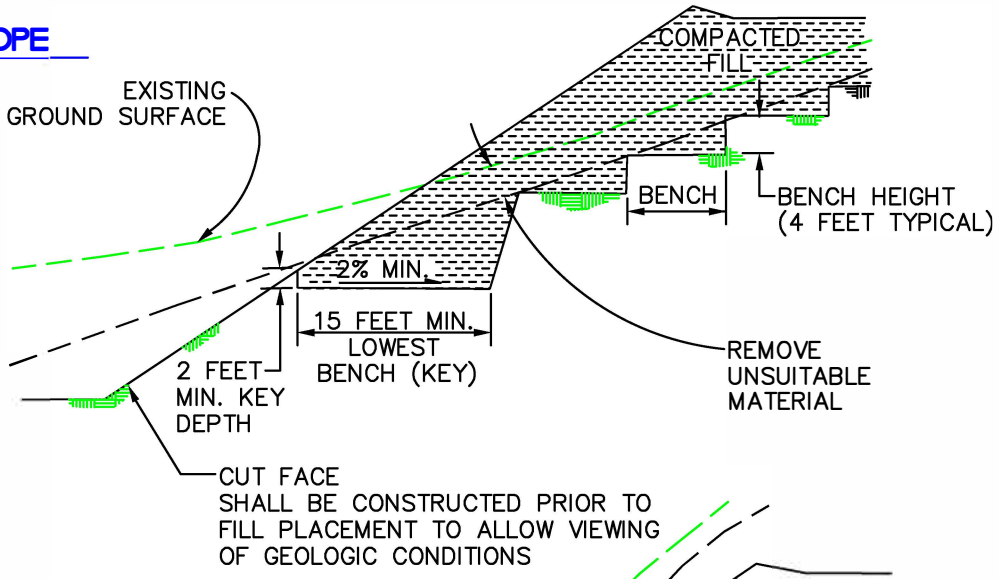
7.4 Observation and Testing

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

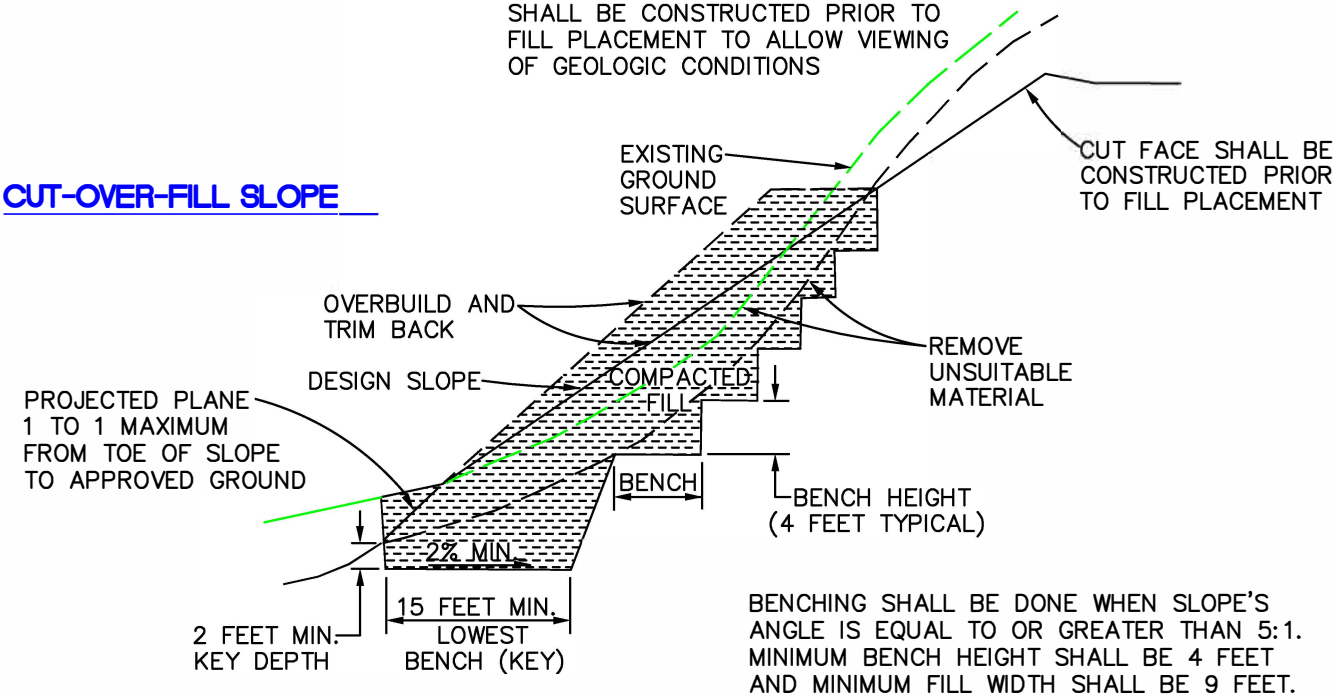
FILL SLOPE



FILL-OVER-CUT SLOPE

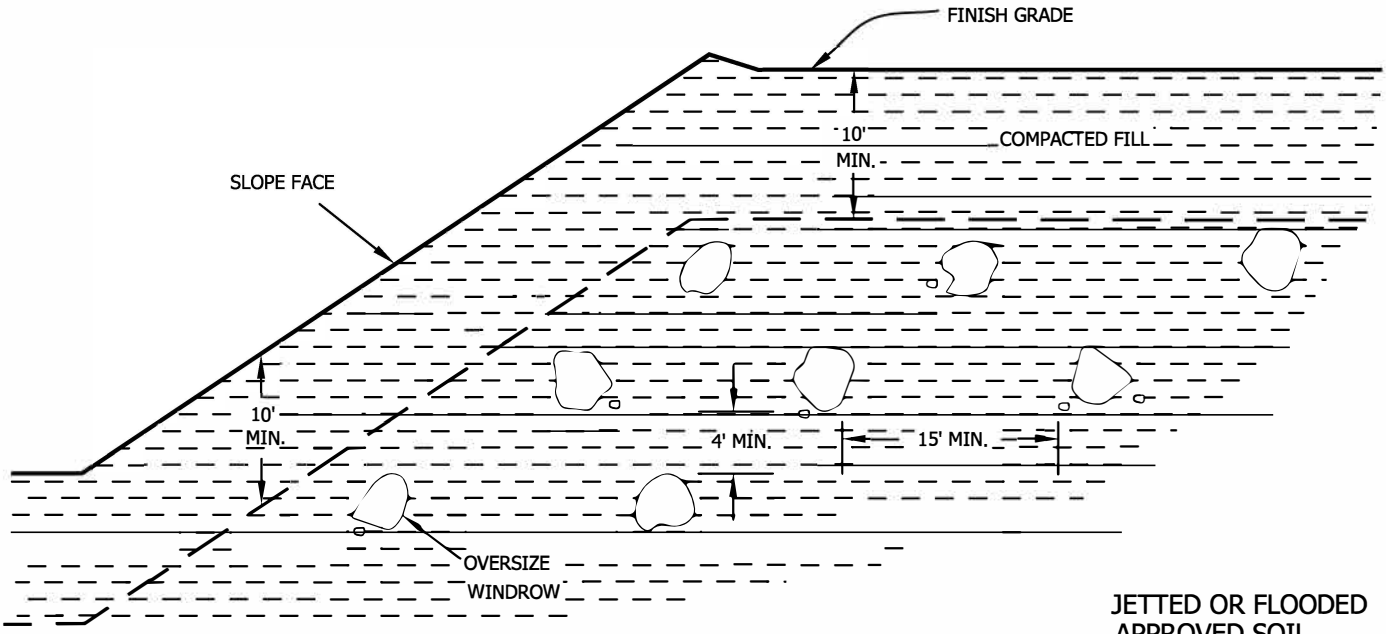


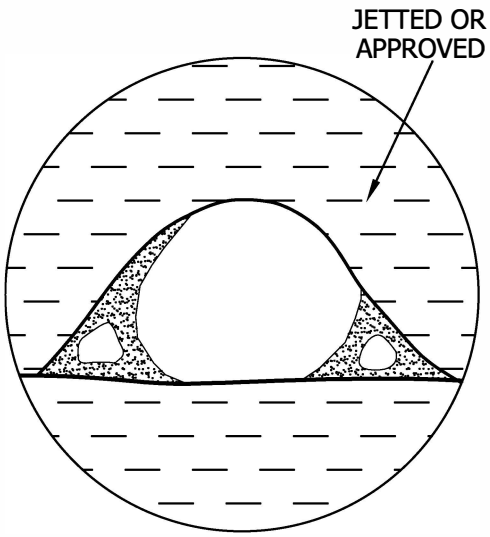
CUT-OVER-FILL SLOPE



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

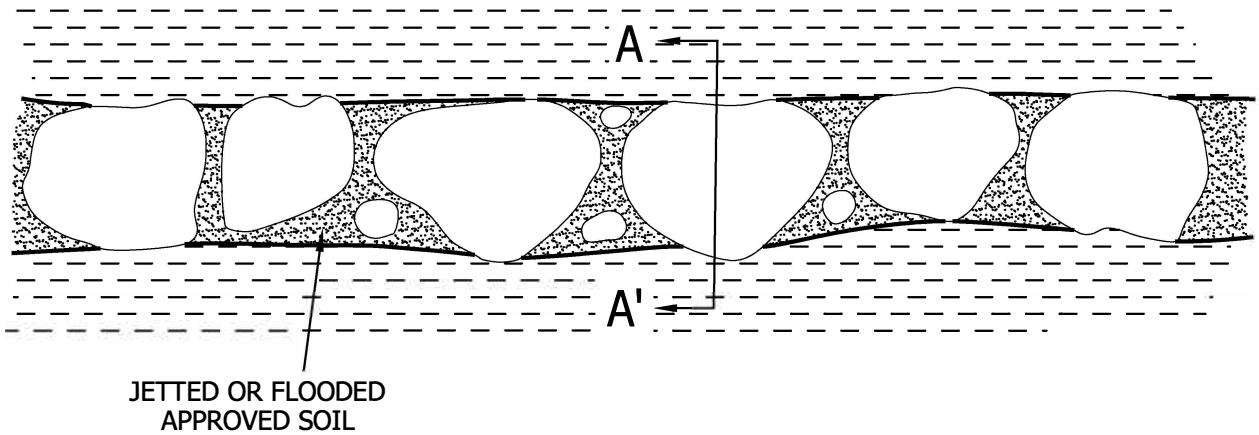




SECTION A-A'

- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.

PROFILE ALONG WINDROW



OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS B

Leighton

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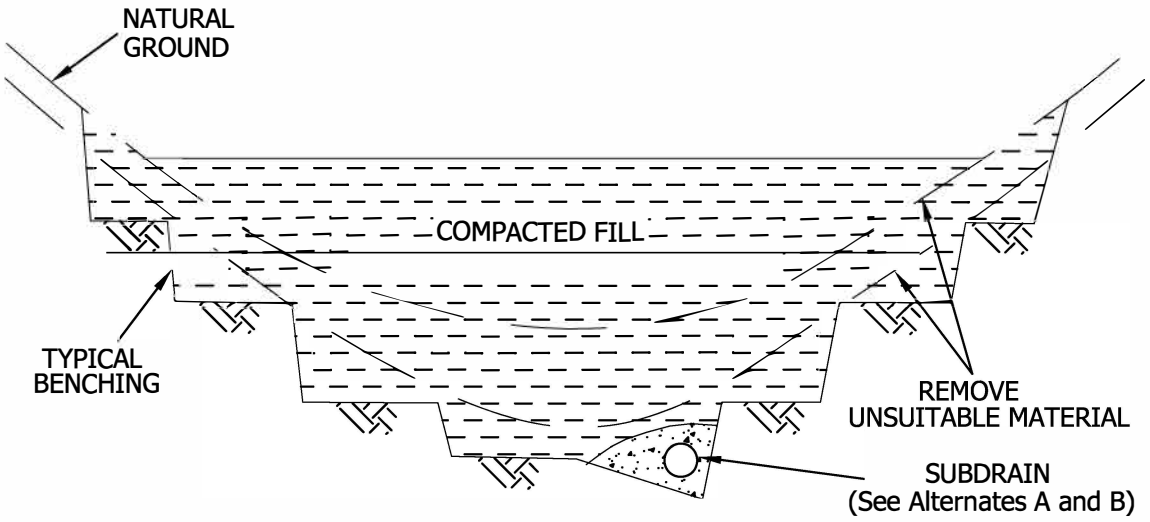
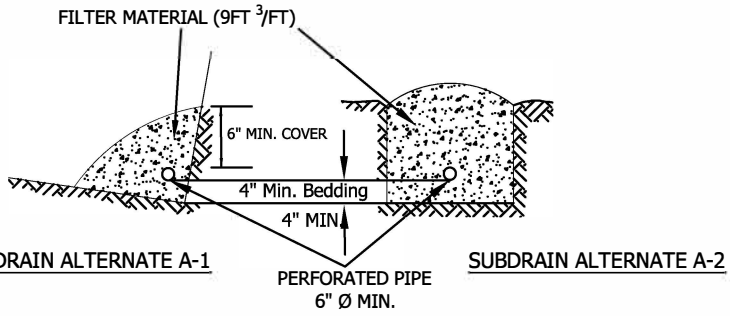


SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

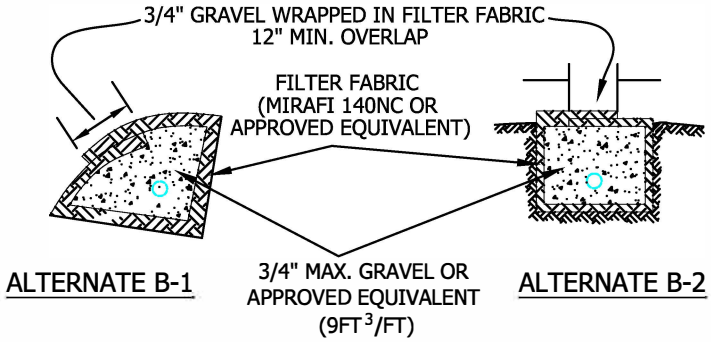


FILTER MATERIAL

FILTER MATERIAL SHALL BE CLASS 2 PERMEABLE MATERIAL PER STATE OF CALIFORNIA STANDARD SPECIFICATION, OR APPROVED ALTERNATE. CLASS 2 GRADING AS FOLLOWS:

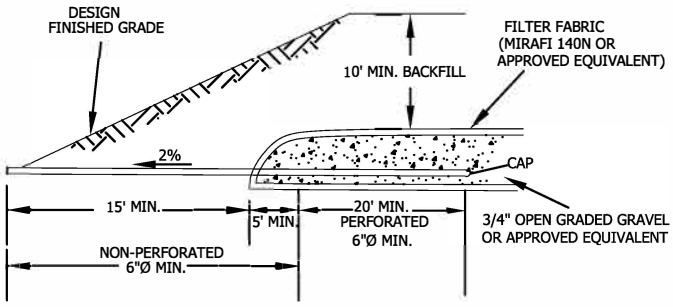
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



○ PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

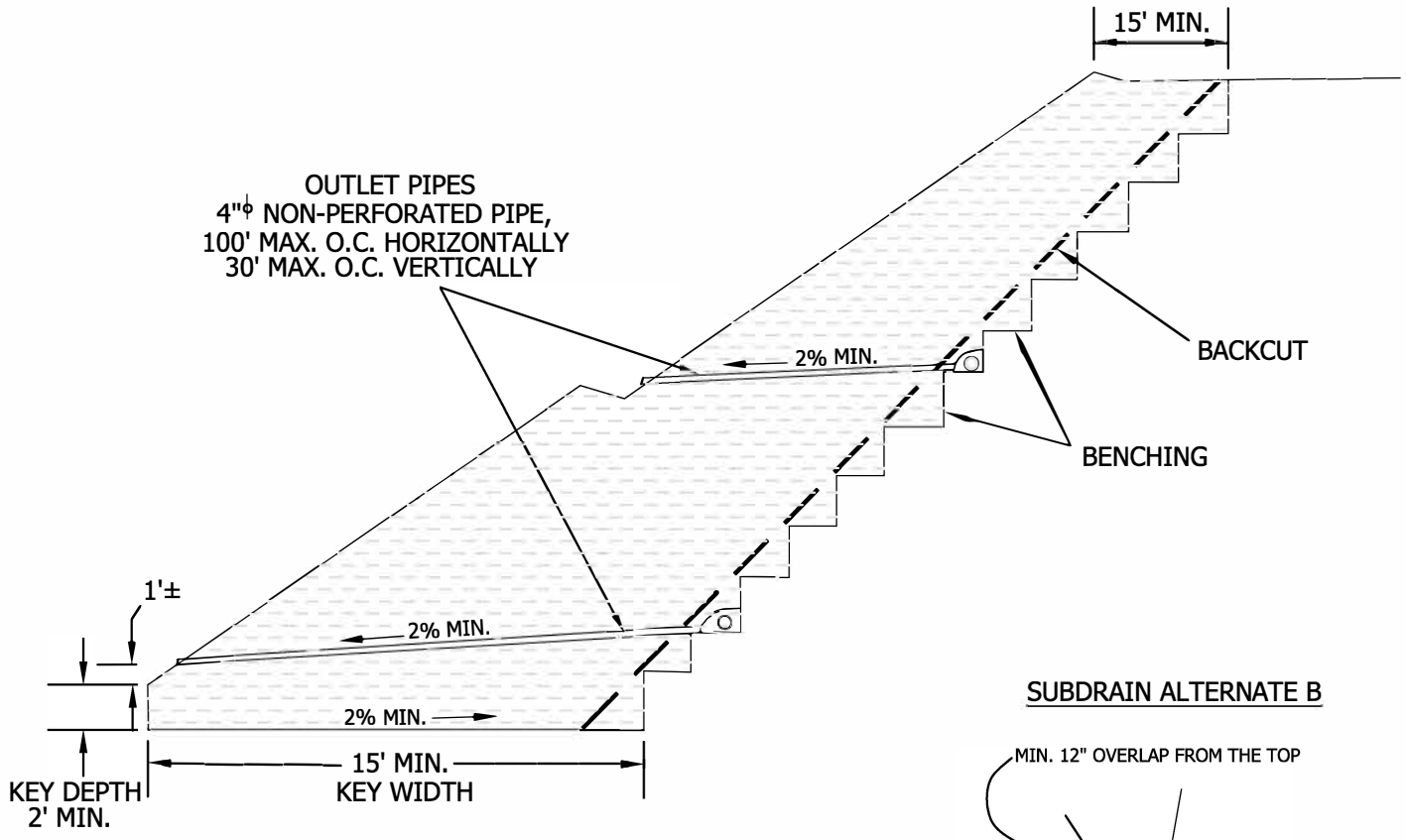
DETAIL OF CANYON SUBDRAIN TERMINAL



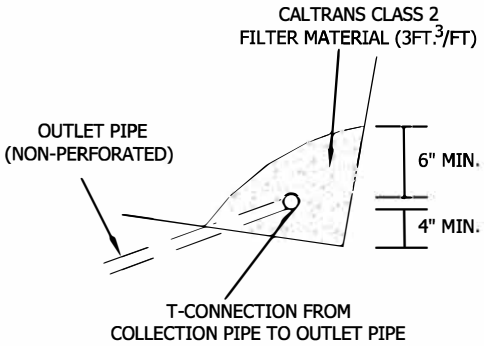
CANYON SUBDRAIN

GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C

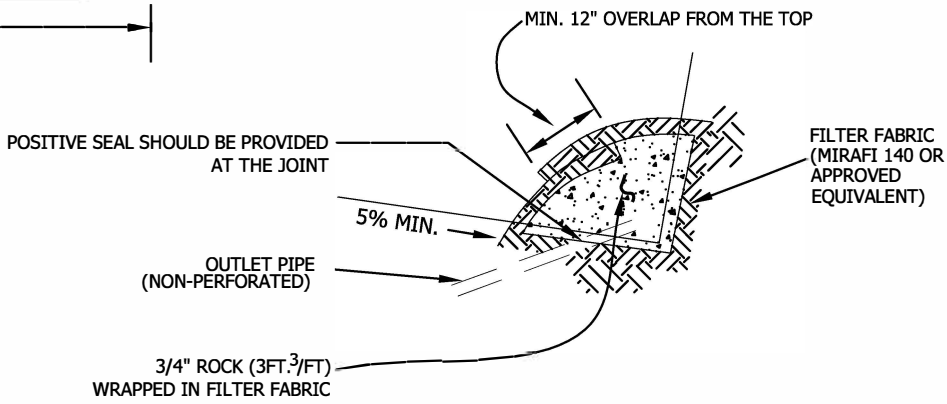
Leighton



SUBDRAIN ALTERNATE A



SUBDRAIN ALTERNATE B



- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" to 1/2" if drilled holes are used. All subdrain pipes shall have a gradient at least 2% towards the outlet.
- SUBDRAIN PIPE - Subdrain pipe shall be ASTM D2751, ASTM D1527 (Schedule 40) or SDR 23.5 ABS pipe or ASTM D3034 (Schedule 40) or SDR 23.5 PVC pipe.
- All outlet pipe shall be placed in a trench and, after fill is placed above it, rodded to verify integrity.

BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS D	Leighton

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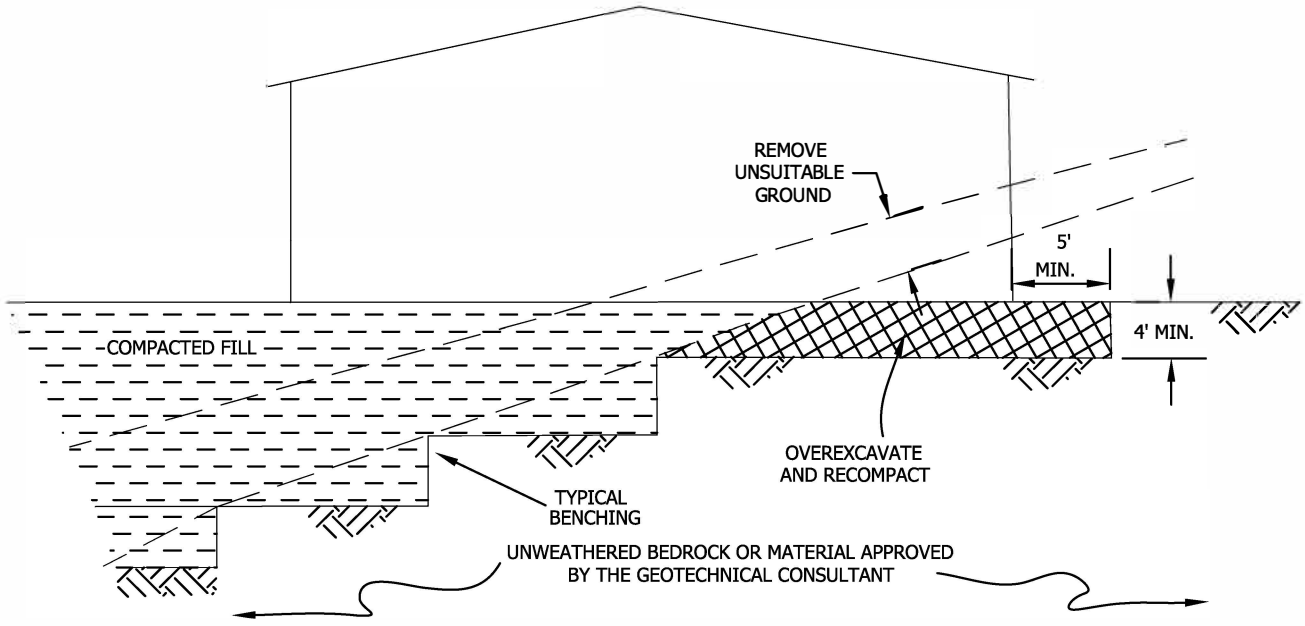
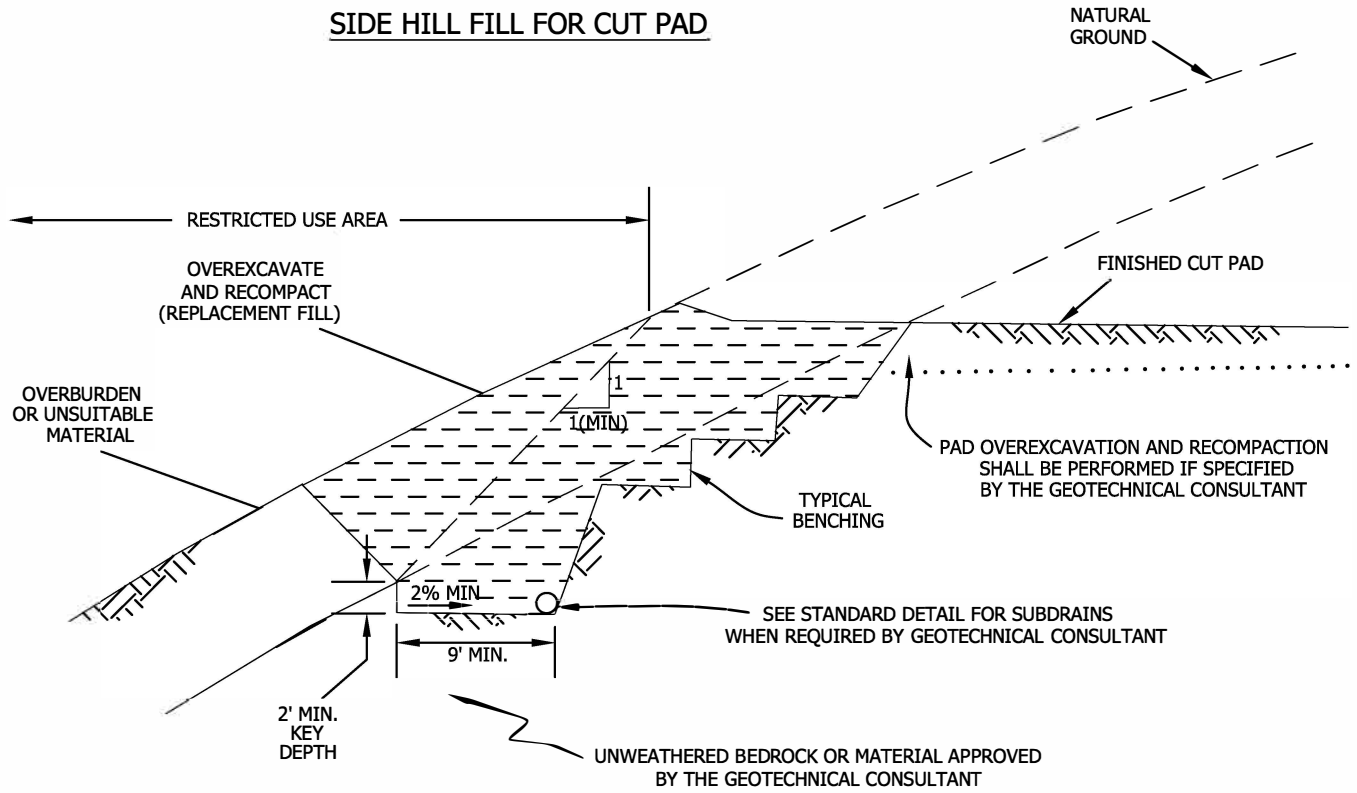
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS E

Leighton

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APPENDIX G

GBC Insert