PRELIMINARY GEOTECHNICAL INVESTIGATION
100-ACRE PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

Prepared for:

Lowe Enterprises Real Estate Group

300 Spectrum Center Drive, Suite 1460
Irvine, California 92618

Project No. 10695.001

September 19, 2014

(Revised April 24, 2015)

Leighton and Associates, Inc.

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300 Spectrum Center Drive, Suite 1460
Irvine, California 92618

Attention: Mr. Robert Reitenour, Senior Vice President

Subject: Preliminary Geotechnical Investigation
100-Acre Parcel
Former El Toro Marine Corps Air Station
Irvine, California

In accordance with your request, Leighton and Associates, Inc. (Leighton) has performed a preliminary geotechnical investigation and percolation study for the proposed master planning and entitlement of the "100-Acre Parcel" at the former El Toro Marine Corps Air Station (MCAS) in the City of Irvine, California. Cone penetrometer test (CPT) soundings, hollow stem auger borings, and hand-dug test pits were excavated as part of this study.

Based on the results of our exploration, the project site is underlain predominantly by deep alluvial soils. Some areas are mantled with undocumented fill. Groundwater is generally deeper than 50 feet below the existing ground surface (bgs).

This report presents the results of our document review, field exploration, laboratory testing, percolation testing, and engineering analysis. It provides our preliminary conclusions and recommendations for the proposed improvements.

17781 Cowan ▪ Irvine, CA 92614-6009
949.250.1421 ▪ 949.250.1114 Fax

The proposed master planned community will likely consist of multi-story residential, commercial office, retail, and hospitality buildings. The development is deemed feasible from a geotechnical standpoint provided the findings, conclusions, and recommendations presented in this report are taken into consideration in the design and construction of the project.

Due to the nature of the limited geotechnical exploration and testing, as well as the present lack of specific development and grading plans; it should be emphasized that the findings, conclusions, and recommendations presented herein are preliminary and are intended to assist in the initial planning phases of the project. Site and development specific geotechnical exploration, testing, analysis and recommendations can be provided once grading and specific development plans become available for each area.

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

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Joe Roe, PG, CEG 2456
Associate Geologist

Carl Kim, PE, GE 2620
Senior Principal Engineer

EBP/JAR/CCK/lr

Distribution: (1) Addressee

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1.0 INTRODUCTION

1.1 Purpose and Scope of Geotechnical Exploration

The purpose of this investigation was to evaluate the subsurface characteristics at the project site (see Figure 1, *Parcel Location Map*) and to provide preliminary recommendations for initial planning of grading and foundation design. When specific development designs have been chosen and grading plans become available, additional field exploration should be conducted reflecting the planned land use and type(s) of structures planned.

The scope of our current work included the following tasks:

- Review of readily available geotechnical reports, including previous reports prepared by Leighton for properties located within the former El Toro Marine Corps Air Station (MCAS) as well as regional studies. References used in preparation of this report are listed in Section 6.0.

- Conducting field exploration consisting of cone penetrometer test soundings at 13 locations (CPTs 1-10 and 19-21) to depths of 50 to 75 feet below existing ground surface (bgs). In addition, 4 test pits (TP-1 though TP-4) were excavated around Building 317 to evaluate the condition of existing foundations. See Plate 1, *Site Exploration Map*, for exploration locations. Relatively undisturbed ring and bulk soil samples were obtained from the test pits. Six (6) concrete cores were collected from the building foundations. The CPT and test pit logs performed are presented in Appendix A, *Current Explorations.*

- Review of prior explorations conducted by Leighton within the MCAS applicable to this project. The boring logs from prior explorations are included in Appendix B, *Prior Explorations.* Locations of the prior borings performed in support of the realignment of Marine Way are shown on Plate 1.

- Laboratory testing of representative samples of the on-site soils to determine their physical and engineering characteristics. The test results from the current and prior studies are presented in Appendix C, *Laboratory Test Results*.

- In-situ percolation testing in accordance with (County of Orange, 2013). Percolation data is included Appendix F, *Percolation Study.*
- Geotechnical analyses of the collected data.
- Preparation of this report documenting our preliminary findings, conclusions, and recommendations for the planned development.

1.2 Site Location and Existing Conditions

The project site consists of a portion of the former El Toro Marine Corps Air Station (100-Acre Parcel), located within the city of Irvine. The approximate area boundary is shown on Figure 1.

In general, the 100-Acre Parcel is an irregular shaped area located west-southwest of the existing main runway and southerly of Marine Way. The area is bounded by open land and railroad lines to the southwest, Marine Way and existing buildings to the north and northeast, and existing buildings to the southeast. This area currently consists of unoccupied land and abandoned warehouse buildings with adjacent rail lines and other ancillary improvements. Building 317 is located in the central portion of the 100-Acre Parcel along the southwestern boundary (Plate 1). The ground surface varies from approximately Elevation +224 feet mean sea level (msl) at the southwestern corner to approximately Elevation +276 feet msl at the eastern area of the 100-Acre Parcel.

1.3 Proposed Development

We understand that conceptual plans are currently being developed and detailed information is not yet available. The proposed project will likely consist of multi-story buildings at grade or over basement parking levels. Ancillary developments will include roadways, driveways, surface parking, utilities, private parks, and associated improvements. It is also understood that the existing Building 317 may be seismically retrofitted for adaptive re-use.

1.4 Field Exploration

Prior to field exploration, a site reconnaissance was performed by a certified engineering geologist from our staff to mark the locations of CPT soundings and

test pits, with consideration for access of exploration equipment and avoidance of known subsurface utilities. The CPT soundings were performed from June 11 through June 13, 2014. Thirteen (13) CPT soundings (CPT-1 through CPT-10 and CPT-19 through CPT-21) were performed to a maximum depth of 75 feet bgs. The CPT holes were backfilled with hydrated bentonite pellets.

The test pits were excavated on June 24 and June 25, 2014. Four (4) test pits (TP-1 through TP-4) were excavated with hand tools to a maximum depth of approximately 6 feet bgs. The test pits were backfilled with soil cuttings after completion. The approximate locations of the CPT soundings and test pits are shown on Plate 1, *Site Exploration Map*.

The test pits were geotechnically logged and sampled by our geologist. Relatively undisturbed samples were collected from the borings using a Ring sampler and concrete cores were collected from the foundations using a concrete coring machine. In addition, representative bulk soil samples were also collected from each test pit. Each soil sample collected was described in general conformance with the Unified Soil Classification System (USCS). The samples were sealed, packaged, and transported to our soil laboratory. The test pits were backfilled with soil cuttings. The report of the cone penetration test data and CPT logs, prepared by a subcontractor, Kehoe Testing & Engineering, and our trench logs are included in Appendix A.

Hollow stem auger borings conducted by Leighton during prior explorations of the former El Toro Marine Corps Air Station applicable to this project are included in Appendix B.

1.5 Laboratory Testing

Laboratory tests were performed on representative samples to determine the geotechnical properties of the subsurface materials. The following laboratory tests were performed on selected samples:

- In-situ moisture content and density (ASTM D2216 and ASTM D2937);
- Percent passing No. 200 Sieve (ASTM D1140);
- Atterberg Limits (ASTM D4318);
- Maximum dry density and optimum-moisture content (ASTM D1557); and
- Unconfined Compressive Strength of Concrete (ASTM C-42).

The laboratory tests were performed in general conformance with ASTM and/or Caltrans procedures. The results of our laboratory tests from our current and prior applicable explorations are presented in Appendix C, *Laboratory Test Results*. The results of the in-situ moisture contents and dry densities of the ring samples are presented on our geotechnical test pit logs (Appendix A). Results of laboratory testing performed by Leighton (Leighton 2007a, 2007b) reviewed in preparation of this report are also included in Appendix C.

1.6 Percolation Testing

The purpose of our preliminary percolation study was to determine subsurface soil and groundwater characteristics and to evaluate infiltration rates to aid in the preliminary design of stormwater infiltration systems. The scope of work included the following tasks:

- *Background Review* – Reviewed the *County of Orange Technical Guidance Document* (TGD) for percolation testing (County of Orange, 2013). We also reviewed available geotechnical literature pertinent to the subject site including previous geotechnical reports prepared by Leighton. Information used in preparation of this report is included in Section 6.0, *References.*

  Pre-Field Exploration Activities – Boring locations were marked and Underground Service Alert (USA) was notified to locate and mark existing underground utilities prior to our subsurface exploration. Leighton obtained a water meter from the Irvine Ranch Water District (IRWD), which was affixed to a local water hydrant in order to provide the water supply required for testing.

- *Field Exploration* – Our field exploration in support of the percolation evaluation was performed on December 9, 2014. We advanced 5 hollow-stem auger borings, P-1 through P-5, drilled to a maximum depth of 15 feet below the existing ground surface (bgs). Approximate boring locations from the current and past explorations performed by Leighton are shown on Plate 1. During drilling, both bulk and relatively undisturbed drive samples were obtained from the borings for evaluation. Relatively undisturbed samples were collected utilizing a Modified California Ring sampler conducted in accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were performed in the hollow stem auger borings in general accordance with ASTM Test Method D1586. The samplers were driven for a

total penetration of 18 inches, unless practical refusal, using a 140-pound automatic hammer falling freely for 30 inches. The number of blow counts per 6 inches of penetration was recorded on the boring logs. Logging and sampling of the borings were conducted by an engineer under the direct supervision of an engineering geologist from our firm. Logs of the boring are presented in Appendix A.

- *Field Percolation Tests* – In-situ percolation testing was performed in accordance with County of Orange Technical Guidance Document (County of Orange, 2013). After sampling and logging, the borings were converted to test wells and pre-soaked for testing. A 2-inch-diameter polyvinyl chloride (PVC) section of 0.020-inch slotted pipe was installed within the zones where percolation rates were to be determined. The remaining installed pipe sections were solid where applicable. The depths of borings and screen interval are presented in Table 1. Filter pack consisting of No. 3 Monterey Beach Sand was placed in the annulus from the bottom of the boring to approximately 1 foot above the slotted pipe section. A 3-foot-thick bentonite seal was placed above the filter pack where applicable and balanced with onsite soils to the top of pipe.

  After pre-soaking, the test wells were filled to a water level at least 12 inches above the slotted pipe to determine the standard time interval for the percolation test. The standard time interval for all the test wells was 10 minutes. However, for test wells where the water was draining very fast, the time interval was reduced to better evaluate infiltration rate. Once the standard time interval was established for each well, the wells were filled to the top of the slotted pipe. The water drop was then generally measured at 10 minute intervals using a manual water sounder. At the end of the time interval, the wells were refilled to the top of the slotted pipe and the procedure repeated. Testing was terminated after a minimum of one hour from the beginning of the test. The data obtained from our in-situ percolation testing program were evaluated and analyzed to obtain infiltration rates presented in Table 1 included in Section 2.4 of this report. The percolation test results collected during the study is included in Appendix F, *Percolation Study*. After the conclusion of percolation testing, the PVC pipes were removed from the test hole. The test holes were backfilled with the soil cuttings.

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Setting

The project site is located in the eastern portion of the Tustin plain within the southeastern margin of the Los Angeles Basin, a large, structural depression within the Peninsular Ranges geomorphic province of California. The southeastern extension of the Los Angeles Basin includes an area known as the Tustin Plain (Singer, 1973). Streams emerging from the highlands have produced the Tustin Plain, a complex alluvial fan emanating from the Santa Ana Mountains and San Joaquin Hills. The Tustin Plain is comprised of relatively flat-lying, unconsolidated to semi-consolidated clastic sediments that are approximately 1,000 to 1,100 feet thick (Singer, 1973; Sprotte et al., 1980a and 1980b). Beneath the site, the near surface, unconsolidated, relatively fine grained sediments are Holocene age (<11,000 years old) and consist of predominately youthful alluvial fan deposits (Sprotte et al., 1980a and 1980b). These sediments in turn are underlain at depth by sedimentary bedrock of Tertiary age. The regional geology in the area of the site is shown on Figure 2 - *Regional Geology Map*.

In general, alluvial materials were generated from mass wasting of the uplifted sandstone and siltstone bedrock located north-northeasterly of the project. As observed within the subsurface investigations on the project site and nearby locations investigated by this firm, these materials are interbedded and interfingered strata containing lenses of silty sands, clayey sands and sands. Minor interbedded gravelly sands are also present. As erosion and transport of sediment occurred within the Santa Mountains, these materials were deposited in a generally north-northeast to south-southwesterly direction.

2.2 Earth Materials

Our explorations encountered a relatively thin mantle of undocumented fill materials overlying Quaternary-age young (Holocene) and very old (Pleistocene age) alluvial fan and channel deposits. Our interpretation of the subaerial distribution of these materials as they relate to the site is shown on Plate 2, *Geologic Cross Section A-A'.* These materials are described below.

2.2.1 Artificial Fill, Undocumented (Afu)

Based on our review of available aerial photographs, topographic maps, and explorations in the project area, it is interpreted that man-made fills are present within portions of the parcel. In our current explorations, we encountered up to 5½ feet of fill at select locations (Plate 1). Undocumented fill materials are expected to consist predominately of silty sand, sandy silt, and silty clay.

Railroad ballast placed for support of rail lines within the 100-Acre Parcel consist of crushed rock material predominately 2 to 3 inches in size. Reuse of crushed rock to provide subgrade support where applicable can be considered.

Additionally, fill soils are expected to be encountered within areas of pre-existing drainages since filled by the placement of storm drains during earlier development of the air base. These materials are anticipated to be approximately 5 to 10 feet in thickness. It is not known if these fills were placed as engineered fill. Further research should be undertaken to determine if this grading was performed under the observation and testing of a geotechnical engineer and to identify the exact depth and extent of fill material. Undocumented artificial fill, railroad ballast, and near surface desiccated alluvium are not considered suitable for support of proposed improvements and should be removed and replaced as compacted fill.

Building 317 is supported on shallow spread footings founded on engineered fill or alluvium. Where exposed, foundation soils were found to be competent. Documentation of the engineered fill under Building 317, should it exist, should be provided to Leighton for review and acceptance.

2.2.2 Young Alluvial Fan Deposits (Map Symbol: Qal)

At the 100-Acre Parcel, the young, Holocene age alluvial fan deposits were encountered at or near the ground surface consisting mostly of interbedded loose to medium dense sands, silty sands, and clayey sands to firm to very stiff sandy silts, silty clay, sandy clay, and clay. Data generated by the CPT soundings and collected from the borings suggest the young alluvial materials are interfingered lenses and not discrete strata that would be continuous over large areas. Contact between units would

range from gradational fining upward sequences to abrupt erosional contacts between units.

2.2.3 Very Old Alluvial Fan Deposits (Qvof)

Very old, Pleistocene age alluvial fan deposits were encountered underlying the young alluvial fan deposits to the maximum depth explored of 75 feet bgs. These materials consist predominantly of dense to very dense sand, silty sand, and gravel and stiff to hard sandy silt, silty clay, and clay.

2.3 Groundwater Conditions

Within the study area, possible perched water was detected at several CPT soundings at depths of 49 to 57 feet bgs. It should be noted that similar subsurface conditions and perched water were encountered at depths generally between 48 and 56 feet within nearby adjacent properties to the 100-Acre Parcel, previously investigated by this firm.

The Orange County Water District June 2014 Groundwater Elevation Contours Map (OCWD, 2014) has estimated groundwater within the 100-Acre Parcel from approximate Elevation +120 feet msl at the northwest corner to Elevation +180 feet msl at the southeast corner. These groundwater levels correspond to depths on the order of 100 feet bgs or greater at the site.

Based on our review of Seismic Hazard Report for the Tustin and El Toro Quadrangles prepared by California Division of Mines and Geology (CDMG, 1998 and 2000), the historic high groundwater was reported to be as shallow as 40 feet bgs.

Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall and storm water runoff. Irrigation of landscape areas can also cause a fluctuation of local perched groundwater levels.

2.4 Percolation Testing

The measured infiltration rates at tested locations and depths are summarized in the table below. The percolation test locations (P-1 through P-5) are shown on Plate 1. The borings are included in Appendix A. Field data and calculated infiltration rate for each percolation test well is presented in Appendix F.

Based on our percolation test results the measured soil infiltration rates range from 0.8 to 7.9 inches per hour at the tested locations within the 100-Acre Parcel. It should be emphasized that the infiltration test results are only representative of the tested location and depth where they are performed. Varying subsurface conditions will exist outside of test locations, which could alter the calculated infiltration rate indicated below.

Table 1 – Infiltration Rates

Boring No.	Drilled Depth (ft)	Screen Interval Depth (ft)	Observed Infiltration Rate (Inches/Hour)	Measured Infiltration Rate (Inches/Hour)
P-1	15	5-15	4.4	2.2
P-2	10	0-10	15.7	7.9
P-3	10	5-10	1.5	0.8
P-4	15	5-15	3.7	1.8
P-5	15	10-15	7.1	3.6

Per the county guidelines, the “measured” infiltration rates include a mandatory factor of safety of 2.0 be applied to the testing results (“observed” infiltration rates) to account for uncertainty in observed data and potential for long term clogging. Note that the design (“measured”) infiltration rate is obtained by applying a factor of safety to the measured infiltration rate.

It is possible that the long term rate of transmissivity of permeable soil strata may be much lower than the values obtained by testing. This could be influenced by the highly variable vertical character and limited lateral extent of the more permeable soil strata, reduction of permeability rates over time due to silting of the soil pore spaces, and other factors. Accordingly, the possibility of future surface ponding of water as well as shallow groundwater impacts on subterranean structures such as basements, underground utilities, etc. should be

anticipated as possible future conditions in all design aspects of the site. Infiltration devices should be located away from building foundations, below grade walls and other sensitive structures.

The measured infiltration rates presented in Table 1 may be used for the preliminary design phase for site planning. Once the locations of proposed infiltration facilities/systems are known, it is recommended to conduct additional percolation testing as close to the proposed facilities as possible to verify these values and to determine the impacts to local groundwater levels and or contamination plumes that exist below the site. Review of the development plans should be performed by the geotechnical engineer prior to construction of any infiltration device to ensure the recommendations are properly incorporated into the design plan(s).

2.5 Slope Stability

No landslides are known to be located at the project site or were observed during our field review. However, localized debris flows have been observed originating from canyons northeast of the El Toro Marine Corps Base during the 2005-2006 rainy season.

2.6 Building 317

The existing Building 317 is planned to be seismically retrofitted for adaptive re-use. Four (4) test pits were excavated with hand tools to expose the existing foundations (shallow spread footings). Once exposed, the foundation dimensions were documented and a total of 6 concrete cores were collected per the direction the project structural engineer.

Along the northwest building wall (TP-1), a column footing was observed from 2½ feet to 3½ feet bgs that extended 20 inches outward from the building wall. When the column footing terminated, the building footing extended 12 inches outward from the building wall from 2½ to 3½ feet bgs. In concrete core TP-1/C-2, taken from the column footing, ¾-inch-diameter and 3/8-inch-diameter rebar was observed 2½ inches and 3 inches from the face of footing, respectively. No rebar was observed in concrete core TP-1/C-2, taken from the stem wall.

Along the southwest building wall (TP-2 and TP-3), a column footing was encountered from 3 to 4½ feet bgs that extended 20 inches outward from the building wall. The 7¾-inch thick stem wall terminated 28 inches to 30 inches bgs. In concrete cores TP-2/C-2 and TP-3/C-1, taken from the stem wall, ¼-inch-diameter rebar was observed 1inch from the face of the stem wall and ¾-inch-diameter rebar was observed 2¼ inches and 5½ inches from the face of the stem wall, respectively. No rebar was observed in concrete core TP-2/C-1, taken from the column footing.

Along the southeast of the building (TP-4), a footing was encountered 6 feet bgs that to an unknown depth and extended outward from the building wall 12 inches. The stem wall was 9½ inches thick where concrete core TP-4/C-1 was taken at 26 inches bgs. In the concrete core, 3/8-inch-diameter rebar was observed 7 inches from the face of the stem wall. Detailed logs of our test pits and core locations are included in Appendix A.

Unconfined compressive strength testing was performed on the concrete cores per ASTM C-42 procedures. The results of the testing ranged from 4,950 psi to 4,800 psi for the column footings and from 4,910 psi to 5,410 psi for the stem walls. The results of the unconfined compressive strength testing are presented in Appendix C.

2.7 Expansive Soil Characteristics

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and shrink when dried. Foundations constructed on these soils are subject to uplifting forces caused by the swelling. Without proper mitigation measures, heaving and cracking of both building foundations and slabs-on-grade could result. Standard engineering and earthwork construction practices, such as foundations designed to accommodate or resist anticipated swell and shrinkage cycles or the placement of non-expansive engineered fill blankets will reduce the impacts associated with expansive soils.

Based on our exploration and experience in the general area, the near surface on-site soils consist predominantly of intermittent and laterally discontinuous stratigraphy characterized as silty sand, sandy silt, to clay. The on-site near surface soils are generally considered to have a low to high potential for expansion depending on whether sandy or clayey soils are encountered. Based

on our previous laboratory test results (Leighton, 2007a, 2007b, 2007c) of representative composite samples from within and nearby the project area showed low to medium expansion potential when wetted (Appendix C).

Variance in expansion potential of on-site soils in anticipated, therefore tests should be conducted on samples of near-surface soils during future site evaluations and upon the completion of rough grading. For preliminary planning purposes, near surface soils should be assumed to have medium expansion potential.

2.8 Soil Corrosivity

Leighton has previously tested bulk samples obtained within or nearby the project area to determine the pH, minimum resistivity, soluble sulfate content, and chloride content of the on-site soils. In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5.

Based on prior testing of recovered samples (Leighton 2007a and 2007c), the corrosion potential to buried concrete can be assumed “negligible”, i.e., exposure class S0, per ACI 318, Table 4.2.1. If the concrete is expected to be in contact with reclaimed water, Type V cement and a water/cement ratio of 0.45 should be used. The samples previously tested for water-soluble chloride content indicates a low potential for corrosion of reinforcing steel in concrete due to the chloride content of the soil (Appendix C).

The resistivity tests indicated minimum resistivity values ranging from 605 ohm-centimeters to 1,540 ohm-centimeters. Based on these results, the on-site soil is considered to range from non-corrosive to corrosive to ferrous metals per Caltrans specifications.

Additional tests should be conducted on samples of near-surface soils during future site evaluations. We recommend that a competent corrosion engineer be retained to evaluate the corrosion potential of the site to proposed improvements, to recommend further testing as required, and to provide specific corrosion mitigation methods appropriate for the project.

2.9 Excavation Characteristics

Based on our subsurface exploration and experience from grading jobs in the vicinity of the site, we anticipate that soils at the site will be readily rippable. Significant oversized materials are not anticipated to be generated during grading. Some miscellaneous debris may be encountered in any buried channels. Abandoned pipes, foundations and other subsurface structures associated with existing, previously demolished and other underground structures should also be anticipated. It is our understanding the issue of contaminated soils, debris and groundwater contamination plumes are being evaluated by others.

3.0 GEOLOGIC/SEISMIC HAZARDS

Geologic and seismic hazards include surface faulting, seismic shaking, landslides, liquefaction, seismically induced settlement, lateral spreading, seismically induced landslides, seiches and tsunamis, and flooding. The following sections discuss these hazards and their potential impact at the project site.

3.1 Surface Fault Rupture

Our review of available in-house literature (Section 6.0) indicates that there are no known active or potentially active faults that traverse the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). For a general overview of regional faults in close proximity to the site is shown on Figure 3, *Regional Fault Map.* The potential for surface fault rupture is, therefore, considered to be low at the site.

The location of the closest active faults to the site was generated using the United States Geological Survey (USGS) Earthquake Hazards Program (USGS, 2008a). The closest active faults to the site are the San Joaquin Hills Blind Thrust located in the subsurface and the Newport-Inglewood fault zone located approximately 0.6 miles and 10.8 miles from the site, respectively. The San Andreas fault, which is the largest active fault in California, is approximately 43.9 miles northeast of the site.

The site is likely to experience strong ground shaking during the life of any project developed thereon. On July 5, 1938 a magnitude 4.5 earthquake ruptured at a seismogenic depth of 10.0 km (6.2 mi) and epicentral surface projection (N33.6820° and W-117.5530°) located approximately 10.5 miles east of the site resulting in ground accelerations of 0.09g Other historical earthquakes of magnitude 4.0 and greater in relation to the site is shown on Figure 4, *Historical Seismicity Map*.

3.2 Secondary Seismic Hazards

In general, secondary seismic hazards for the site could include soil liquefaction, seismically induced settlement, lateral spreading, seismically induced landsliding, seiches and tsunamis. These potential secondary seismic hazards are discussed below.

3.2.1 Liquefaction Potential

Liquefaction is the loss of soil strength or stiffness due to increasing pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils.

As shown on the State of California Seismic Hazard Zones Map for the El Toro and Tustin Quadrangle (CGS, 2001a and 2001b), this site is not located within an area that has been identified by the State of California as being potentially susceptible to liquefaction (Figure 5, *Seismic Hazard Map*).

Our subsurface explorations (Appendix A) revealed youthful Holocene age alluvial deposits comprised of loose to medium dense sandy soils at various depths underlying the subject site. Such soil deposits, when saturated, will have the potential to liquefy and may settle under the effects of dynamic shaking, such as during a strong-motion earthquake. Our subsurface exploration did not reveal the presence of a shallow groundwater table at the subject site.

We have performed preliminary liquefaction analyses of the CPT data utilizing procedures outlined by Youd et al. (2001). The groundwater level of 40 feet was used in the analyses. Our analyses indicate that the potential for liquefaction at the project site is low.

Based on our preliminary analyses, the liquefaction-induced settlement was estimated to be negligible Results are included in Appendix D.

3.2.2 Seismically Induced Settlement

During a strong seismic event, seismically induced settlement can occur within loose to moderately dense, unsaturated granular soils, separate from liquefaction. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement. Based on our data from the CPTs, the seismically induced settlement under buildings is anticipated to be less than ¼ inch.

3.2.3 Lateral Spreading

Lateral spreading is a phenomenon in which large blocks of intact, non-liquefied soil move downslope on a liquefied soil layer. Lateral spreading is often a regional event. For lateral spreading to occur, the liquefiable soil zone must be laterally continuous, unconstrained laterally, and free to move along sloping ground. Due to the low susceptibility for liquefaction and laterally confined topography of the site, the potential for lateral spreading is considered low.

3.2.4 Seismically Induced Landslides

Significant slopes are not located on or near the project site. Based on the State of California Seismic Hazard Zones Map for the El Toro and Tustin Quadrangles (CGS, 2001a and 2001b), the site is not located within an area that has been identified by the State of California as being potentially susceptible to seismically induced landslides (Figure 5).

3.2.5 Seiches and Tsunamis

Seiches are large waves generated in very large enclosed bodies of water or partially enclosed arms of the sea in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. The site is situated well above the tsunami inundation line, therefore the risk of tsunami inundation is very low. Additionally, based on the lack of large enclosed water bodies nearby, seiche risks are considered negligible.

3.2.6 Subsidence

Subsidence is sinking of the Earth's surface in response to geologic or man-induced causes. In Southern California, subsidence can be induced by mining or by the extraction of water or petroleum. Since none of these activities are taking place or planned at this site, the potential for subsidence at the site is low.

3.3 Flooding Hazards

According to a Federal Emergency Management Agency (FEMA) flood insurance rate map (FEMA, 2009), the site is not located within a flood zone.

4.0 CONCLUSIONS

4.1 General

Based on our geotechnical investigation and our general understanding of the overall development goals, it is Leighton's opinion that the project site is suitable for the proposed development, provided the recommendations in this report are taken into account during design and construction of the planned improvements, and, implemented for the maintenance of the site through the project design life. We did not encounter significant geotechnical constraints within the subject site that cannot be mitigated by proper planning, design, and sound construction practices.

As plans for site development are developed, it is recommended that additional review and site specific investigation be undertaken to determine the subsurface conditions in proposed improvement areas and to develop specific recommendations for grading, foundation, site drainage, etc.

The conclusions and recommendations in this report are based in part upon data that were obtained from a limited number of observations, CPTs, borings, test pits, laboratory tests, and our previous work performed in the project area. Such information is by necessity incomplete. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if Leighton has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site.

4.2 Environmental

The scope of this investigation does not include the evaluation of environmental conditions and/or issues. As a geotechnical consultant, it is within our area of expertise and obligation to assess limited aspects of the potential impact of site development on the groundwater system as affected by geotechnical conditions. We present the following comments to be considered by those responsible for site assessment and design relative to environmental issues.

A Remedial Investigation conducted at the former El Toro Marine Base identified volatile organic compounds (VOCs), primarily trichloroethene (TCE), in

groundwater that migrated as a plume more than three miles off base to the west. The primary source of the groundwater contamination was two large aircraft hangars (El Toro, 2006). Review of Figure VIII.2 *North Orange County Groundwater Basin Protection Boundary and Plume Protection Boundaries* within the Orange County TGD (County of Orange, 2013), indicates the 100-Acre Parcel falls within the OCWD groundwater basin plume protection boundary. Infiltration is prohibited within plume protection boundaries identified by the Orange County Water District. Prior to implementation of any and all infiltration devices the type of planned devices should be thoroughly reviewed by governing applicable groundwater agencies, civil and geotechnical engineers to determine that direct infiltration would not adversely impact groundwater conditions.

Due to the vertical and lateral variation in subsurface soils, and the introduction of surface water associated with sustainable design elements, it is our opinion, that any remnant areas of existing contaminated soils or groundwater may be affected by surface water percolation. The present depth to the existing permanent groundwater surface may also be affected by surface water infiltration.

Between the existing groundwater surface and the ground surface, interfingered strata of relatively low and highly permeable soils are present to great depth beneath the site. The relatively impermeable strata, hindering downward percolation of surface water, may result in localized perched water conditions. Such perched water table conditions may vary considerably in lateral extent. Groundwater mounding and lateral groundwater movement may occur, possibly over large areas. Lateral groundwater movement conceivably could remobilize contamination within soils previously unaffected by the presence of groundwater or have an effect on dissolved groundwater contamination.

A decrease in the depth to the permanent groundwater surface may occur, having similar effects on the mobilization of contamination within the soils or groundwater. In general, it would be difficult to quantify the change in depth of groundwater, lateral and vertical flow rates, etc., without detailed evaluation. Based upon the geomorphology of the area and our understanding of the history and environment of deposition, it is our opinion that movement of groundwater would be in a south-southwesterly direction. It is possible that such movement could extend offsite.

5.0 GENERAL RECOMMENDATIONS

The purpose of this feasibility level geotechnical investigation was to evaluate the geotechnical conditions and characteristics at the project site and to provide general recommendations for initial planning of grading and preliminary foundation design. Soil conditions may vary widely between exploratory excavations

When the type of development choices have been made and specific grading plans are available; additional field investigations should be conducted for each parcel reflecting the planned land use and type(s) of structures and which will identify specific soil and geologic conditions.

The following recommendations should be considered preliminary in nature and may be revised once development plans, type of construction and grading plans become available – allowing for site-specific geotechnical investigations to be conducted specific to the development. It should be noted that all recommendations are considered minimal and may be superseded by more stringent requirements of the owner, architect, structural engineer, building code, the City of Irvine (City), or the County of Orange (County).

The following sections also provide preliminary geotechnical design recommendations for construction. This information is for planning purposes only and should not be used for final design. Final design should be based on actual soil conditions encountered during future investigation and revised during rough grading if applicable and be provided by the geotechnical consultant for each individual builder and site on the former air base.

5.1 Earthwork and Grading

Grading shall be accomplished under the observation and testing of the project geotechnical consultant and their representatives in accordance with the recommendations contained herein, the current grading ordinance of the County and the General Earthwork and Grading Specifications included in Appendix E.

5.1.1 Deleterious Material

Vegetation, debris, and other deleterious materials should be removed and disposed of offsite prior to the commencement of grading operations.

No significant debris and vegetation were observed during the subsurface exploration.

5.1.2 Existing Utilities and Foundations

Any underground utilities, including irrigation lines, should be located prior to the start of grading and abandoned or relocated as necessary. Abandoned utility trenches should be excavated to competent native material and backfilled under observation and testing of the geotechnical engineer.

Any existing foundations for the warehouse buildings or other existing structures and improvements within the 100-Acre Parcel that are not to be repurposed should be removed as necessary. The foundation footprints should then be excavated to competent native material and backfilled under observation and testing of the geotechnical engineer.

5.1.3 Removal and Recompaction

Highly compressible/collapsible materials onsite should be removed from fill areas or where exposed at final grade and replaced with engineered fill. Removals should expose competent materials and be observed by the geotechnical consultant prior to fill placement. The exact extent of removals can best be determined during grading when direct observation and evaluation of materials are possible. Other local conditions may be encountered which could require additional removals. The existing Bee Canyon drainage channel within the 100-Acre Parcel, for example, will require removals to competent material prior to backfilling.

In addition, unless proper documentation can be established, the existing fill at the site is considered unsuitable for support of proposed structures and will require removal and replacement with engineered fill.

For building pads, the depth of removals is estimated to be about 5 feet bgs. Prior to replacing the overexcavated material, the area should be scarified a minimum of six inches, moisture-conditioned as necessary, and recompacted to a minimum 90 percent relative compaction (ASTM, 1557).

For streets, park site, trails, and other non-structural areas, removals may be on the order of 3 feet bgs.

5.1.4 Fill Materials and Placement

Prior to fill placement, the recommended remedial removals should be made in the areas to receive fill. The onsite soils, less any deleterious material (construction debris) or organic matter, are anticipated to be suitable for the required fills.

The reuse of potential onsite clayey soils may be suitable for fills with proper soil mixing techniques and/or placement in areas of deeper fills or non-structural fills. Onsite clayey soils should not be used as wall backfill or within the upper 2 feet below concrete slabs-on-grade, including sidewalk and curb and gutter areas. Because sufficient quantities of relatively non-expansive soils are present at the site, importing select fill material to replace onsite clayey soils is not anticipated.

Oversized material greater than 6 inches in maximum dimension should not be placed in the fill. Any vegetation, accumulation of silt, and weathered surface soils developed subsequent to remedial earthwork should be removed prior to fill placement. Unless otherwise approved by the geotechnical consultant, soils containing significant amounts of organic materials should be removed and disposed of offsite. The exposed subgrade should be scarified to a depth of at least 6 inches, moisture-conditioned as necessary, and recompacted to the minimum specified compaction standard per ASTM, 1557.

Fill soils should be free of deleterious materials and should be placed in loose, horizontal lifts not exceeding 8 inches in thickness, moisture-conditioned to approximately 2 to 3 percent above optimum moisture content, and compacted to at least the specified compaction standard. Each lift should be compacted before the next lift is placed, except when and where specifically approved by the geotechnical consultant to facilitate mixing of dissimilar materials. Fill materials, unless otherwise indicated by the geotechnical consultant, should be compacted to at least 90 percent of the maximum dry density as determined by test method ASTM D1557.

5.1.5 Slope Stability

Although no grading plans have currently been developed, any permanent fill slopes within the proposed parcel should be grossly and surficially stable, provided our recommendations are followed for design and construction.

5.1.6 Excavation Stability and Shoring Requirements

In general, temporary excavations, including utility trenches, retaining wall excavations, and other excavations should be performed in accordance with project plans, specifications, and applicable OSHA requirements. Excavations 5 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. Soil types are expected to vary across the site, for purposed of this report soil type “C” may be assumed for site soils.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the “competent person” required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

Typical cantilever shoring where deflection of the shoring will not impact the performance of adjacent structures may be designed based on the active fluid pressures 35 pcf. Braced or tie back shoring is recommended in areas where the shoring will be located close to existing structures to limit shoring deflections. Braced shoring can be designed using a uniform rectangular soil pressure of 23H psf, where H is equal to the depth of the excavation being shored. Braces should be installed and pre-loaded as the excavation progresses to reduce shoring deflections.

5.1.7 Trench Backfill

Trench excavations for utility pipes may be backfilled with onsite soils under the observation of the geotechnical consultant. After utility pipes have been laid, the space under and around the pipe should be backfilled with clean sand or gravel, having a sand equivalent of 30 or greater, to a

depth of at least 1 foot over the top of the pipe. More stringent requirements of the governing agencies or utility owners may supersede our recommendations.

5.1.8 Surface Drainage

Ponding of water adjacent to structures should be avoided. During and after construction, positive drainage should be provided to direct surface water away from structures and towards suitable, non-erosive drainage devices. Locating planters adjacent to buildings or structures should be avoided as far as possible. Where unavoidable, planters should be properly lined, such as with a membrane, to reduce penetration of irrigation water into the adjacent footing subgrades or should be avoided wherever possible. Wherever possible, exposed soil areas should be above paved grades. Planters should not be depressed below adjacent paved grades unless drainage, such as catch basins and area drains are provided

5.2 Seismic Design Parameters

To accommodate effects of ground shaking produced by regional seismic events, seismic design can, at the discretion of the designing Structural Engineer, be performed in accordance with the 2013 edition of the California Building Code (CBC). Table 1, *2013 CBC Seismic Parameters*, lists seismic design parameters based on the 2013 CBC methodology, which is based on ASCE/SEI 7-10:

Table 1 - 2013 CBC Seismic Parameters

Seismic Design Parameters	Value
Site Latitude (decimal degrees)	33.6663
Site Longitude (decimal degrees)	-117.7431
Site Class Definition (ASCE 7-10 Table 20.3-1)	D
Mapped Spectral Response Acceleration at 0.2s Period, S_s (Figure 1613.3.1(1))	1.473
Mapped Spectral Response Acceleration at 1s Period, S_1 (Figure 1613.3.1(2))	0.547
Short Period Site Coefficient at 0.2s Period, F_a (Table 1613.3.3(1))	1.0
Long Period Site Coefficient at 1s Period, F_v (Table 1613.3.3(2))	1.5
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS} (Eq. 16-37)	1.506
Adjusted Spectral Response Acceleration at 1s Period, S_{M1} (Eq. 16-38)	0.840
Design Spectral Response Acceleration at 0.2s Period, S_{DS} (Eq. 16-39)	1.004
Design Spectral Response Acceleration at 1s Period, S_{D1} (Eq. 16-40)	0.560
Peak Ground Acceleration, PGA_M (Eq. 11.8-1 of ASCE 7-10)	0.566

5.3 Foundations

We recommend that the proposed buildings be supported on a shallow spread footing foundation system established on undisturbed alluvium or engineered fill. Foundations may be designed to impose an average bearing pressure of 3,000 pounds per square foot (psf). A one-third increase in the bearing value for short duration loading, such as wind or seismic forces, may be used. The recommended bearing value is a net value, and the weight of concrete in the footings can be taken as 150 pounds per cubic foot (pcf); the weight of soil backfill can be neglected when determining the downward loads.

Footings should have a minimum width of 12 inches for continuous footings and 18 inches for isolated footings. Footings should have a minimum embedment of 12 inches below the lowest adjacent grade.

Lateral loads can be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.35 can be used between the footings and the floor slab and the supporting soils. The ultimate passive resistance of undisturbed natural soils or engineered fill soils can be assumed to be equal to the pressure developed by a fluid with a density of 300 pounds per cubic foot

(pcf). The friction resistance and the passive resistance of the soils can be combined without reduction in determining the total lateral resistance.

The estimated total settlement of the structures supported on spread footings as recommended above is less than ½ inch. The differential settlement between adjacent columns is estimated to be less than ¼ inch over a horizontal distance of 30 feet.

5.4 Slab-On-Grade

Concrete slabs may be designed using a modulus of subgrade reaction of 150 pci provided the subgrade is prepared as described above. From a geotechnical standpoint, we recommend slab-on-grade be a minimum 5 inches thick with No. 3 rebar placed at the center of the slab at 24 inches on center in each direction. The structural engineer should design the actual thickness and reinforcement based on anticipated loading conditions. Where moisture-sensitive floor coverings or equipment is planned, the slabs should be protected by a minimum 10-mil-thick vapor barrier between the slab and subgrade. A coefficient of friction of 0.35 can be used between the floor slab and the vapor barrier.

Minor cracking of concrete after curing due to drying and shrinkage is normal and should be expected; however, concrete is often aggravated by a high water/cement ration, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low-slump concrete or low water/cement ratios can reduce the potential for shrinkage cracking. Additionally, our experience indicates that the use of reinforcement in slabs and foundations can generally reduce the potential for concrete cracking.

To reduce the potential for excessive cracking, concrete slabs-on-grade should be provided with construction or weakened plane joints at frequent intervals. Joints should be laid out to form approximately square panels.

5.5 Preliminary Infiltration Recommendations

No plans regarding the design of stormwater infiltration devices were presented for our review. Often, a combination of methods is implemented to reduce storm

water runoff and increase infiltration including permeable pavements, grass-lined swales, retention areas and/or drywells.

In general, a vast majority of geotechnical distress issues are related to improper drainage. Distress in the form of foundation movement could occur. Soil saturation could lead to a loss of soil support of foundations and pavements, settlement or collapse, internal erosion (piping) and expansion. Offsite properties could be affected and those improvements may become subjected to seeps, springs, slope instability, foundation movement or other geotechnical issues related to infiltration and water migration. Additionally, infiltration water can migrate along pipe backfill (typically sand or gravel bedding) thereby impacting improvements far away from the point of infiltration. Any proposed infiltration system should not be located near existing or proposed improvements in order to reduce the geotechnical distress issues related to infiltration where sufficient distance from improvements can be achieved. Additional recommendations should be provided and anticipated during a plan review.

Due to the intermittent and laterally discontinuous nature of the underlying permeable sand layers and less permeable clayey sand to sandy clay zones, stormwater infiltration may lead to ponding and/or seepage behind and below proposed or adjacent improvements. Depending on the location and depth of any desired infiltration system, it is prudent to perform additional site infiltration studies more specific to the planned locations and depths of which the infiltration will be designed to occur. Not all infiltration types and designs will be feasible at this site. It should also be noted that pretreatment of runoff to remove debris, soil particles, etc. should be performed to reduce siltation and plugging of the infiltration system that would reduce the effectiveness of the system.

As with all systems that are designed to concentrate surface flow and direct water into the subsurface soils, some type of nuisance water and other geotechnical water related issues is anticipated. Should infiltration devices be considered, we recommend sufficient distances between infiltration devices and sensitive improvements be maintained. Routine maintenance should be required of any infiltration system.

Projects that propose to infiltrate groundwater are required to consult with the Orange County Groundwater District (OCWD) to ensure that groundwater quality is protected. In addition, LID infiltration facilities may potentially be categorized as

Class V Injection Wells under the federal Underground Injection Control (UIC) Program, which is regulated in California by U.S.EPA Region 9. The EPA defines a Class V well as any bored, drilled, or driven shaft, or dug hole that contains piping to enhance infiltration capacities. Such devices may require a UIC permit.

Incorporation of sustainable design elements in site planning should consider all possible effects of changes to the present groundwater conditions over time. Several regulatory agencies may have oversight and may include but not limited to such agencies as Base Realignment and Closure Environmental Coordinator; Department of Toxic Substances Control; United States Environmental Protection Agency; Orange County Water District and Regional Water Quality Control Board for the Santa Ana Region.

5.6 Lateral Earth Pressures

Earth-retaining structures or walls should be designed using the lateral earth pressures provided below. These values do not contain an appreciable factor of safety, so the civil and/or structural engineer should apply the applicable factors of safety and/or load factors during design.

Conditions	**Equivalent Fluid Pressure (psf per foot)**
Active	35
Seismic Increment (Additive to Active Pressure)	20
At-Rest	60
Passive	300
Coefficient of Friction	0.3

Care should be taken to provide appropriate drainage so as no water is allowed to remain behind the retaining wall for any significant length of time. In addition to the recommended earth pressures, walls below grade adjacent to existing structures or streets and areas of traffic should be designed to accommodate surcharge loads. For traffic surcharge, a uniform lateral pressure of 100 pounds per square foot acting as a result of an assumed 300 pounds per square foot surcharge behind the wall due to normal traffic; the traffic surcharge load may be neglected provided a minimum of 10 foot clearance between the wall and the traffic is maintained. We will provide surcharge loading from adjacent

foundations after reviewing details of the planned basement walls in relation to existing foundations.

5.7 Pavement Sections

The current feasibility level investigation involved a limited number of exploratory investigations and therefore limited soil analysis. Soil conditions may vary widely between exploratory excavations. Once additional, site-specific geotechnical field investigations are performed for individual future tracts, these values will be revised to reflect actual site-specific conditions.

The preliminary paving thicknesses presented in the table below are based on our review of available subsurface data. We assumed an average R-value of 20 for design. Accordingly, any clayey soils excavated during grading should not be placed within the upper 2 feet of final subgrade.

5.7.1 Asphalt Concrete Paving

The required paving and base thicknesses will depend on the expected wheel loads and volume of traffic (Traffic Index or TI). Assuming that the paving subgrade will consist of the on-site or comparable soils compacted to at least 90% of the maximum dry density obtainable by the ASTM Designation D1557 method of compaction as recommended, the minimum recommended paving thicknesses are presented in the following table.

Asphalt Concrete Pavement Sections

Area	Traffic Index	Asphalt Concrete (inches)	Base Course (inches)
Car Parking	4	3	6
Light Truck	5	3	8
Heavy Truck	6	4	9
Main Drives	7	4	12

The asphalt paving sections were determined using the Caltrans design method. We can determine the recommended paving and base course thicknesses for other Traffic Indices if required. Careful inspection is recommended to verify that the recommended thicknesses or greater are achieved, and that proper compaction of structural support sections is

achieved. Aggregate base should be compacted to a minimum of 95% relative compaction in accordance with ASTM 1557.

5.7.2 Portland Cement Concrete Paving

Portland cement concrete paving sections as well as all other concrete slabs and walks supported on grade should be underlain by at least 2 feet of properly compacted fill consisting of relatively non-expansive soils. We have assumed that such a subgrade will have an R-value of at least 40, which will need to be verified during grading.

Portland cement concrete paving sections were determined in accordance with procedures developed by the Portland Cement Association. Preliminary concrete paving sections for a range of Traffic Indices are presented in the following table. We have assumed that the Portland Cement Concrete will have a compressive strength of at least 3,000 pounds per square inch.

PCC Paving Sections

Area	Traffic Index	PCC (inches)	Base Course (inches)
Car Parking	4	6½	4
Light Truck	5	7	4
Heavy Truck	6	7½	4

The paving should be provided with expansion joints at regular intervals no more than 15 feet in each direction. Load transfer devices, such as dowels or keys, are recommended at joints in the paving to reduce possible offsets. The paving sections in the above table have been developed based on the strength of unreinforced concrete. Steel reinforcing may be added to the paving to reduce cracking and to prolong the life of the paving. Thickness of structural support sections could be expected to change based on the characteristics of underlying subgrade, which should be determined upon completion of rough grading.

5.7.3 Specifications

The base course should conform to requirements of Section 26 of State of California Department of Transportation Standard Specifications (Caltrans), latest edition, or meet the specifications for untreated base as defined in Section 200-2 of the latest edition of the Standard Specifications for Public Works Construction (Green Book). The existing asphalt paving may be used for base course if it is crushed and processed to meet the requirements of crushed miscellaneous base per the Green Book. The base course should be compacted to at least 95 percent relative compaction. The asphalt concrete should conform to the specifications outlined in Section 203-6 of the Green Book, and asphalt concrete construction methods should meet the requirements of Section 302-5 of the Green Book.

5.8 Geotechnical Observation and Testing of Earthwork Operations

Grading and excavation should be performed under the observation and testing of Leighton at the following stages:

- Upon completion of site clearing;
- Once removals are completed;
- During subgrade overexcavation and recompaction;
- During fill placement;
- During excavation and backfilling of utility trenches; and
- When any unusual or unexpected geotechnical conditions are encountered.

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Youd, T.L, Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.C., Marcuson, W.F. III, Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., Stokoe, K.H. II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, , Vol. 127, No. 10, October 2001.

Important Information about Your

Geotechnical Engineering Report

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

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

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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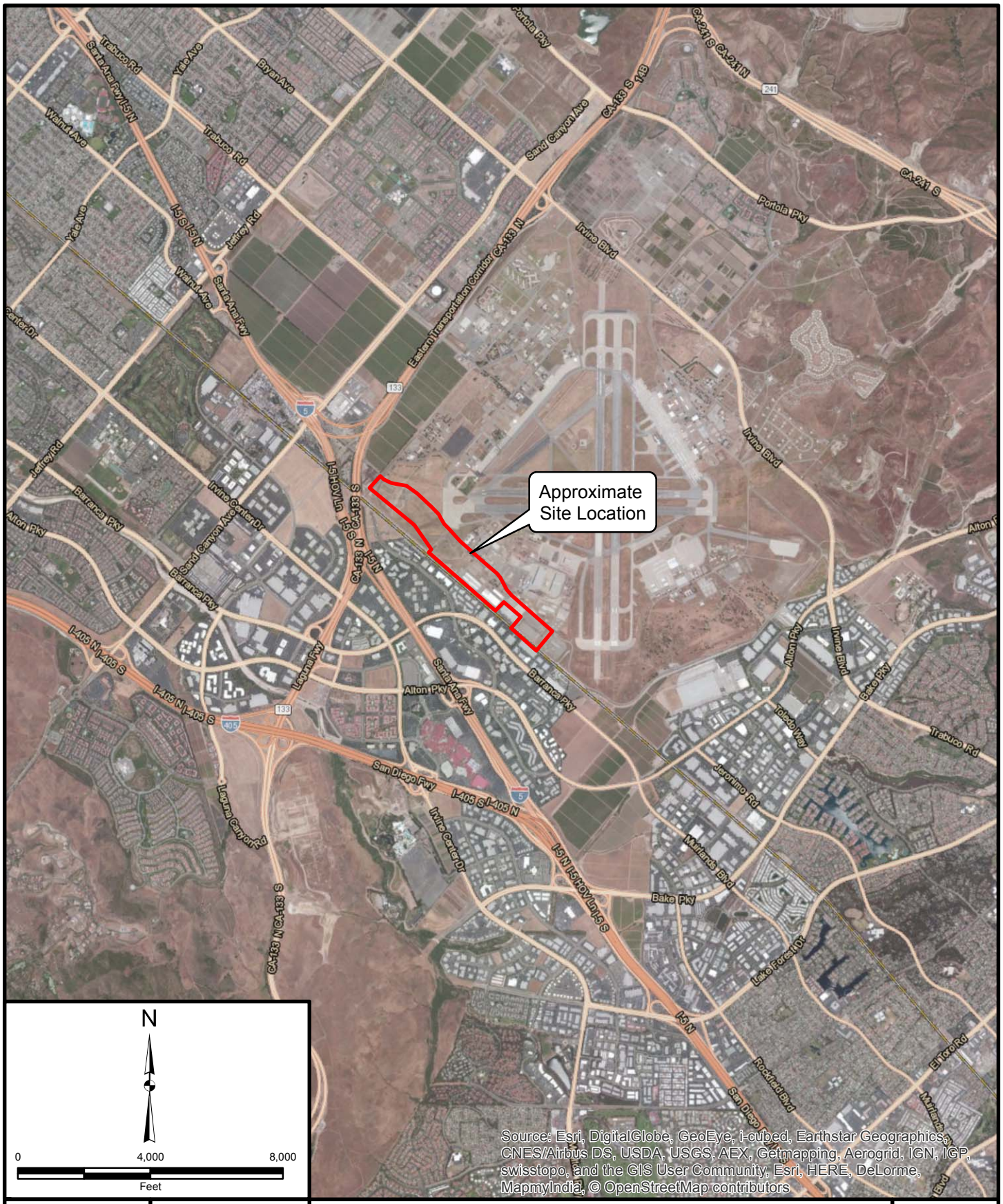
IIGER06085.0MRP



Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 4,000 '	Date: April 2015

Base Map: ESRI ArcGIS Online 2014
Thematic Information: Leighton
Author: Leighton Geomatics (mmurphy)

PARCEL LOCATION MAP

100 Acre Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 1

Leighton

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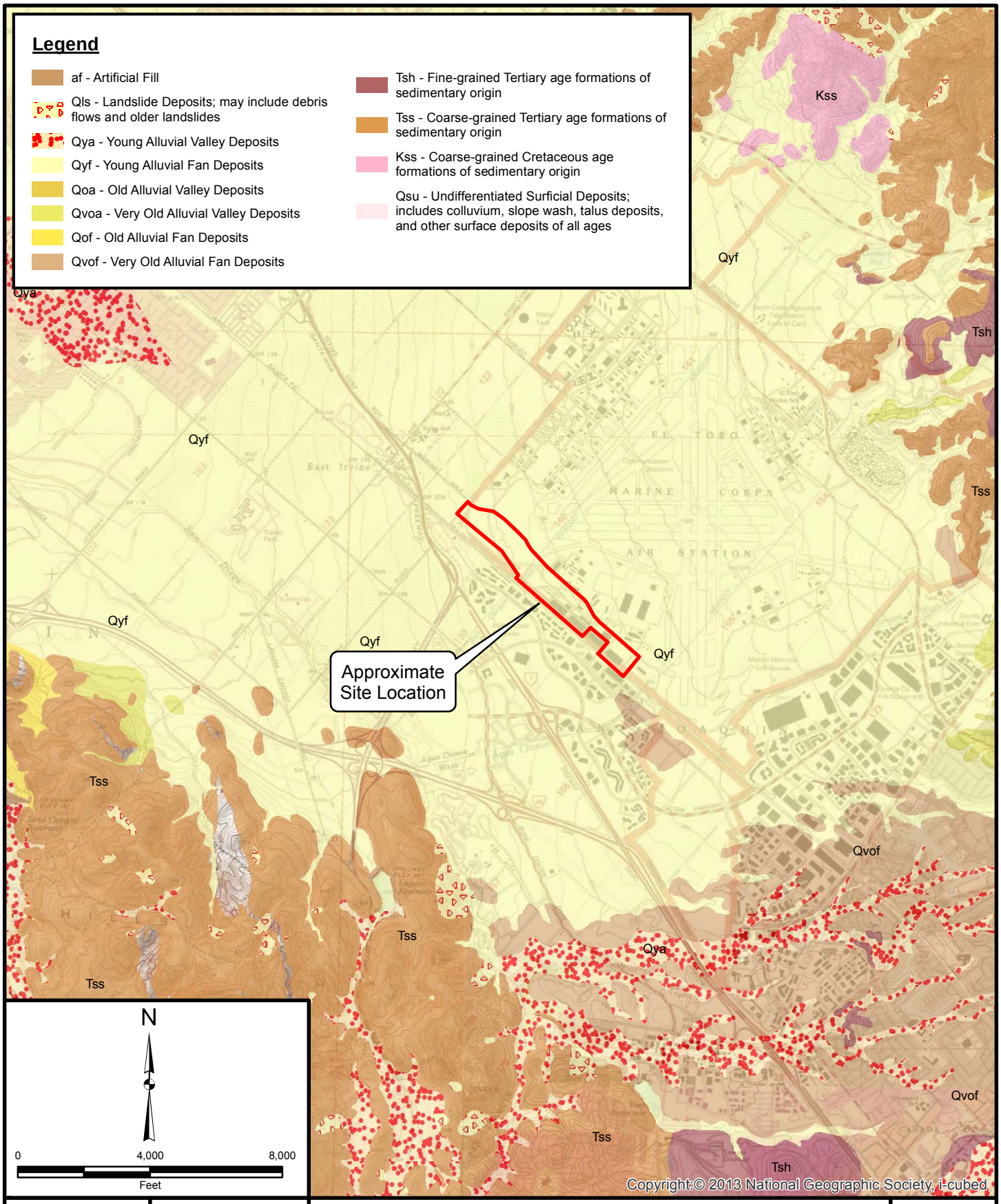


Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 4,000 '	Date: April 2015

Base Map: ESRI ArcGIS Online 2014
USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217
Author: Leighton Geomatics (mmurphy)

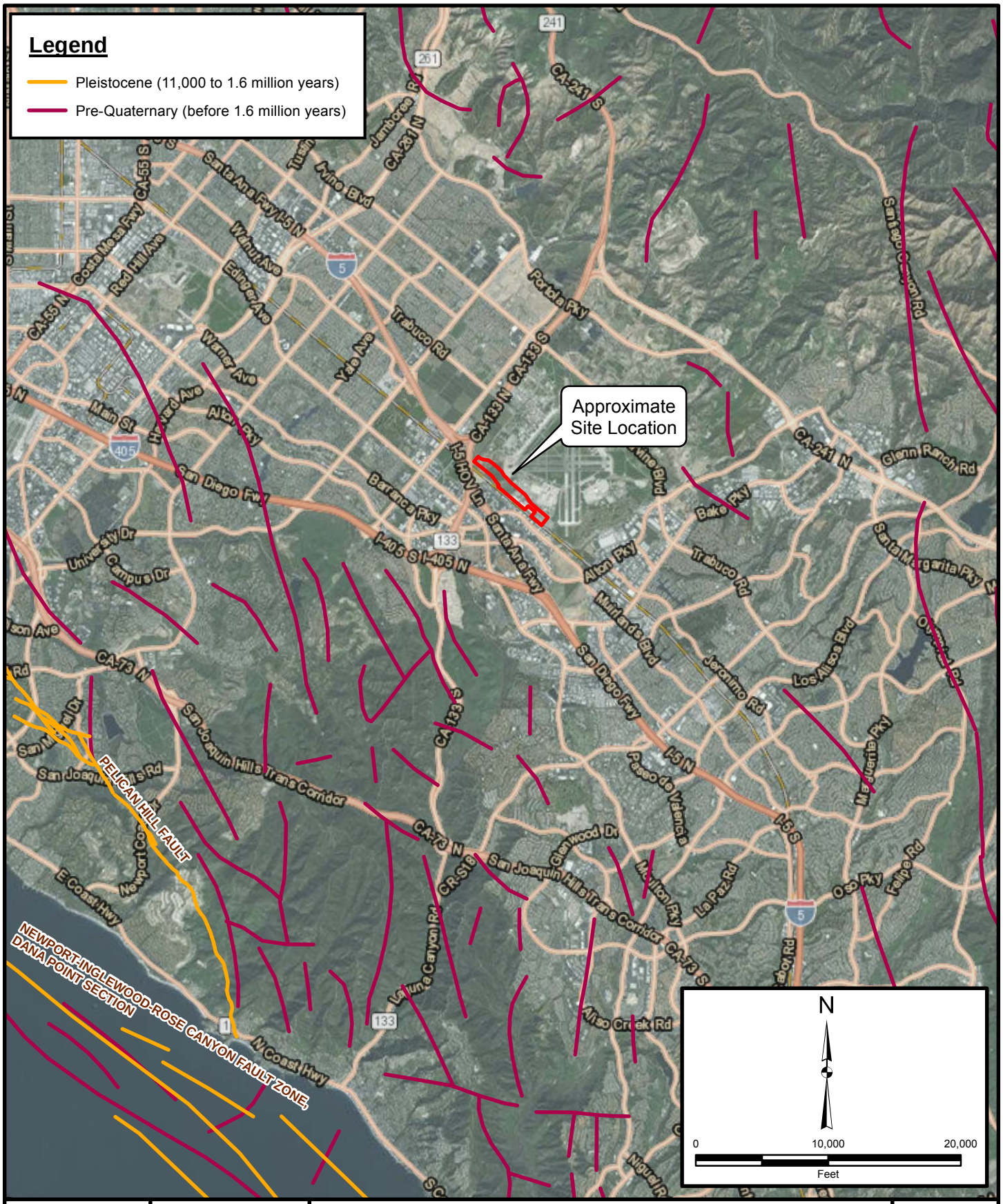
REGIONAL GEOLOGY MAP

100 Acre Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 2

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\100 Acre Parcel\10695.001-Figure2 RGM_100AcreParcel.mxd on 9/11/2014 3:44:31 PM



Project: 10695.001	Eng/Geol: CK/JAR	**REGIONAL FAULT MAP** 100 Acre Parcel Former El Toro Marine Corps Air Station Irvine, California	Figure 3
Scale: 1 " = 10,000 '	Date: April 2015		Leighton
Base Map: ESRI ArcGIS Online 2014 Fault Data: Bryant CGS, 2010 Author: Leighton Geomatics (mmurphy)			

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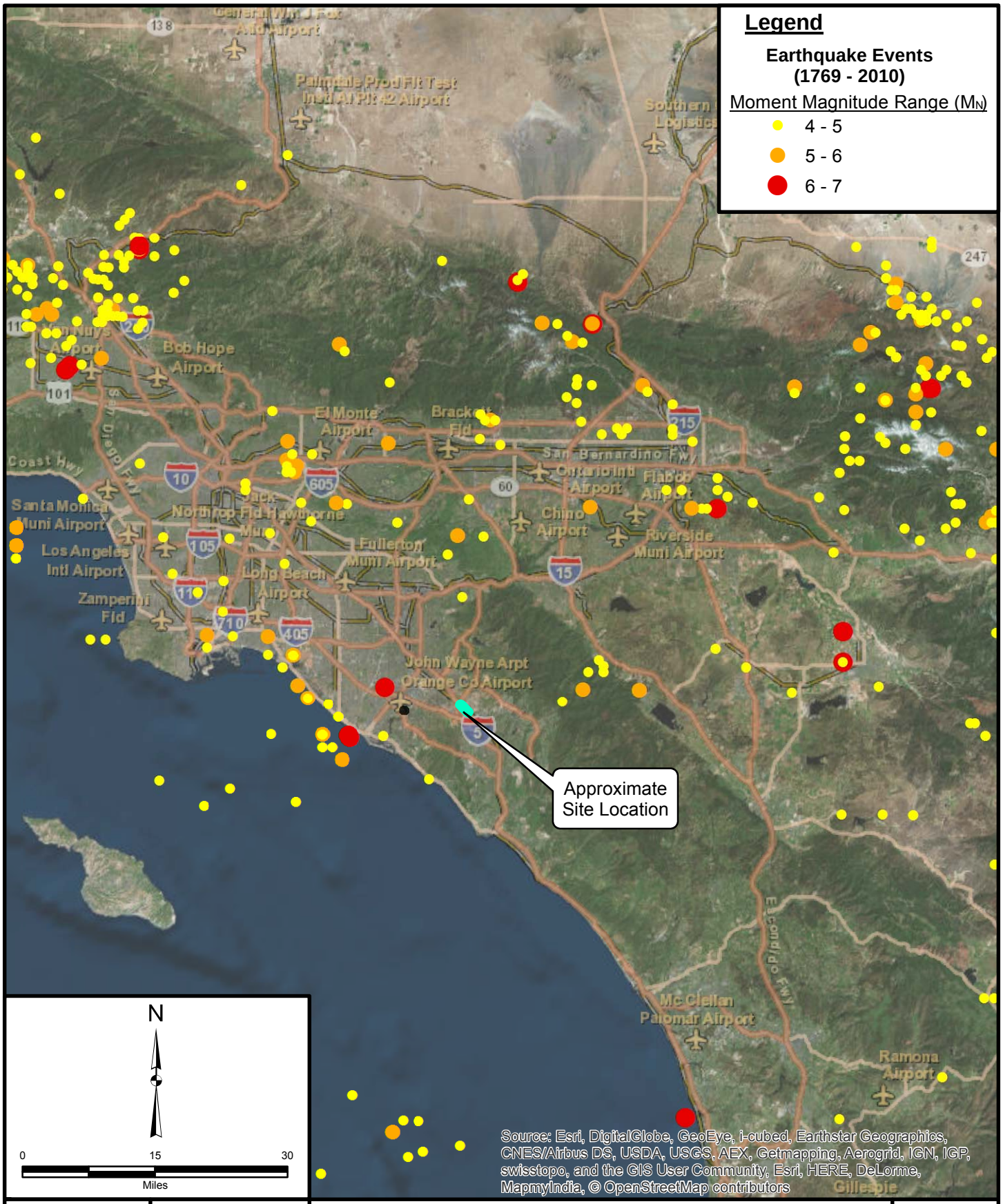


Project: 10695.001	Eng/Geol: CK/JAR
Scale: 1 " = 15 miles	Date: April 2015

Base Map: ESRI ArcGIS Online 2014
Thematic Information: Leighton, USGS, NCEDC

Author: Leighton Geomatics (mmurphy)

HISTORICAL SEISMICITY MAP

100 Acre Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 4

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\100 Acre Parcel\10695.001-Figure4-HSM_100AcreParcel.mxd on 9/11/2014 3:53:00 PM

Project: 10695.001	Eng/Geol: CK/JAR
Scale: 1 " = 4,000 '	Date: April 2015

Base Map: ESRI ArcGIS Online 2014
Seismic Hazard Data: CGS, Seismic Hazards Zonation Program, 2010
Author: Leighton Geomatics (mmurphy)

SEISMIC HAZARD MAP

100 Acre Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 5

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\100 Acre Parcel\10695.001-Figure5-SHM_100AcreParcel.mxd on 9/11/2014 4:01:34 PM

Project: 10695.001	Eng/Geol: CK/JAR
Scale: 1 " = 4,000 '	Date: April 2015

Base Map: ESRI ArcGIS Online 2014
FEMA Q3 Flood Data, Orange County, California

Author: Leighton Geomatics (mmurphy)

FLOOD HAZARD ZONE MAP

100 Acre Parce
Former El Toro Marine Corps Air Station
Irvine, California

Figure 6

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\100 Acre Parcel\10695.001-Figure6-FHM_100AcreParcel.mxd on 9/11/2014 4:10:38 PM

APPENDIX A

CURRENT EXPLORATIONS

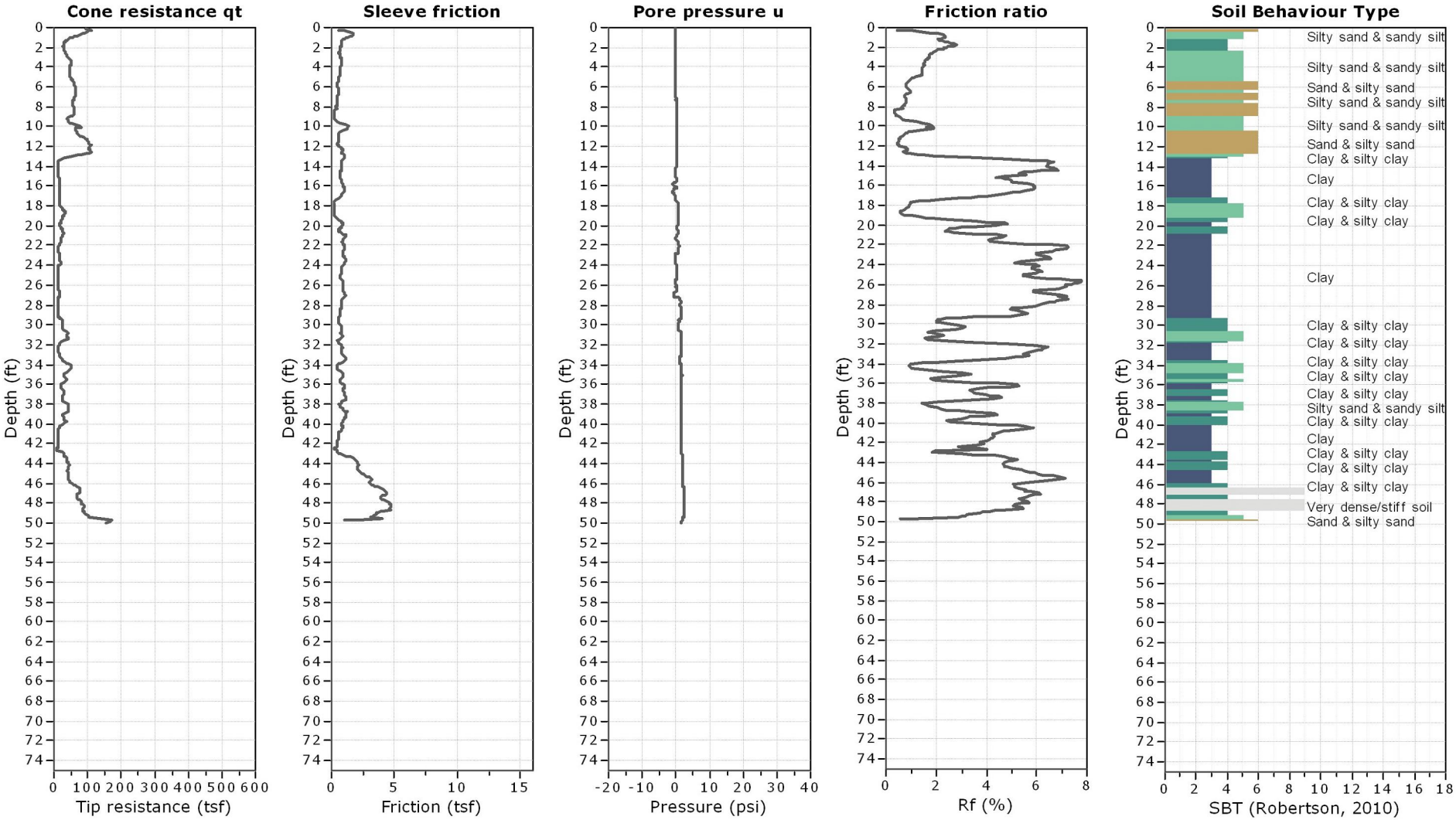
Leighton

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

CPT: CPT-1

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 49.95 ft, Date: 6/11/2014
Cone Type: Vertek

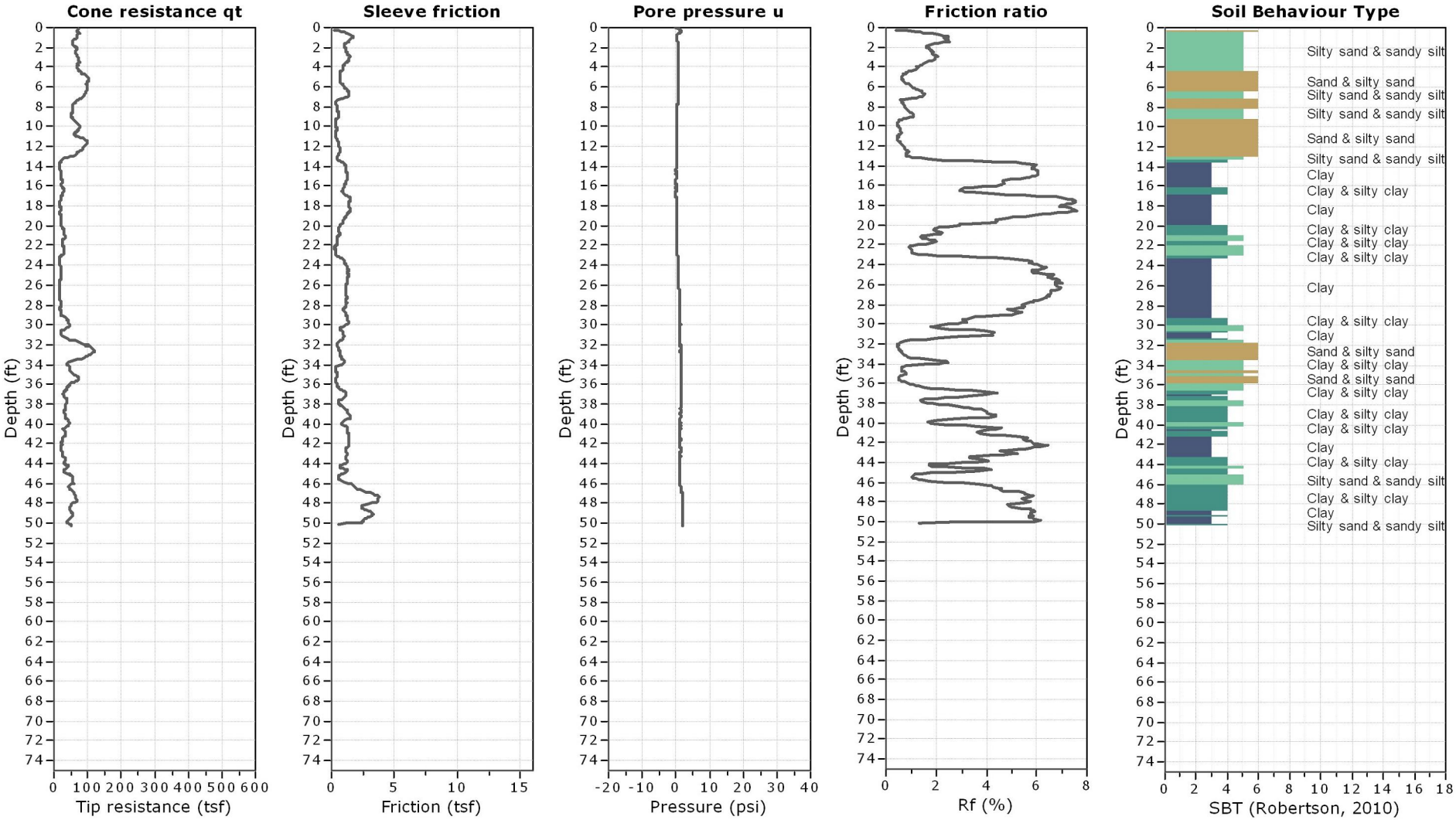


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-2

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.30 ft, Date: 6/12/2014
Cone Type: Vertek



Kehoe Testing and Engineering
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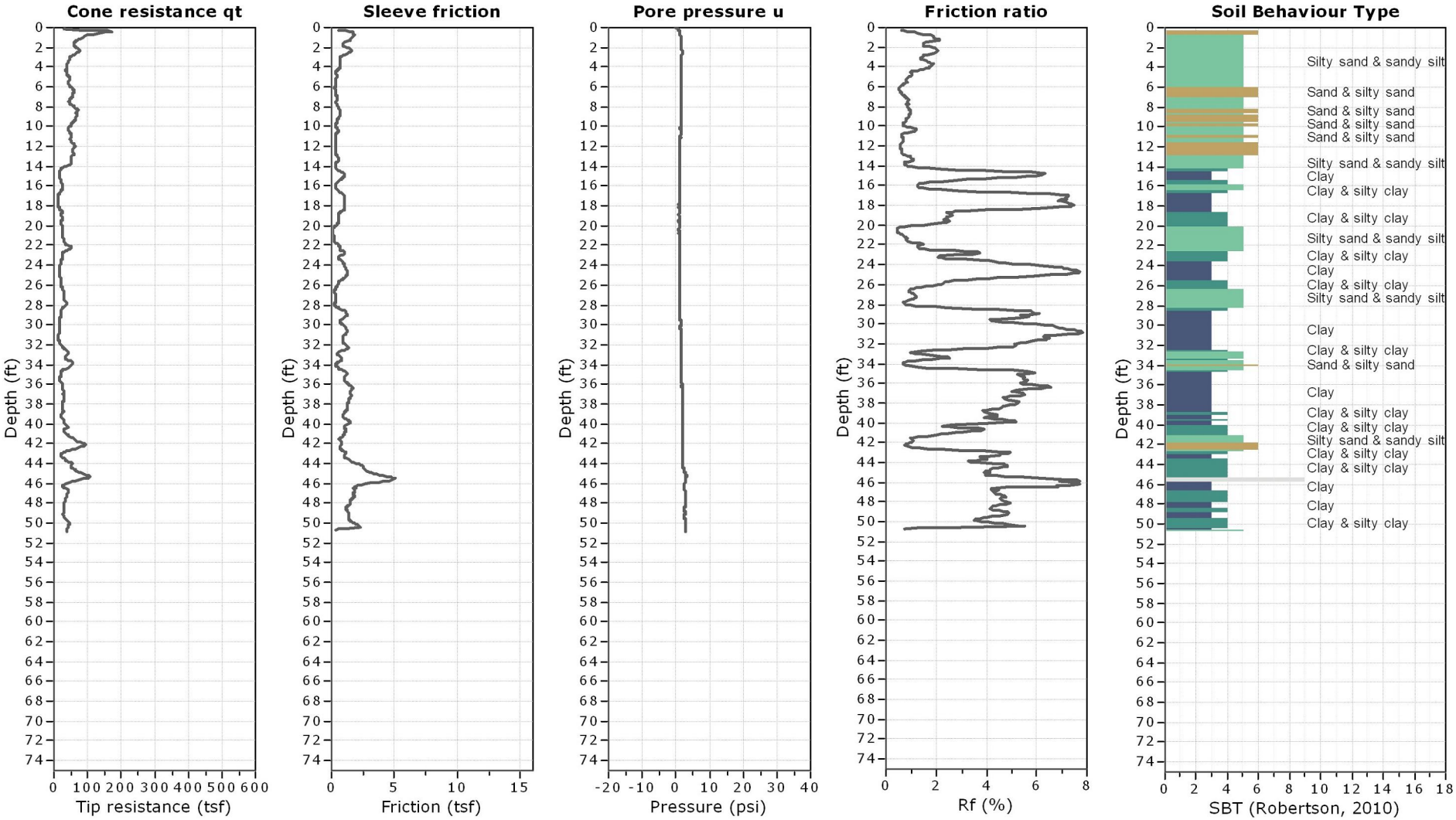
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-3

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.85 ft, Date: 6/12/2014
Cone Type: Vertek



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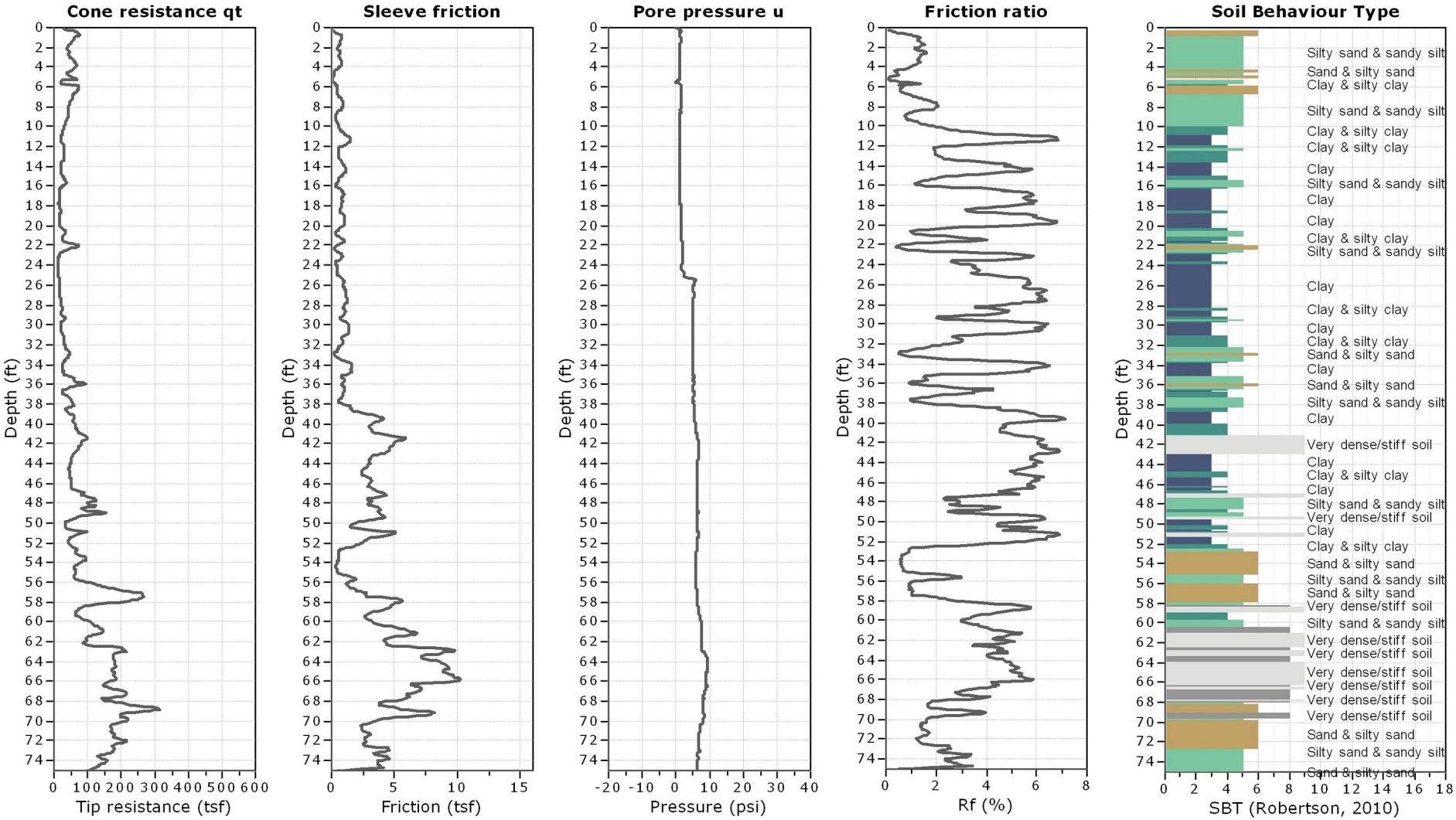
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-4

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 75.17 ft, Date: 6/12/2014
Cone Type: Vertek



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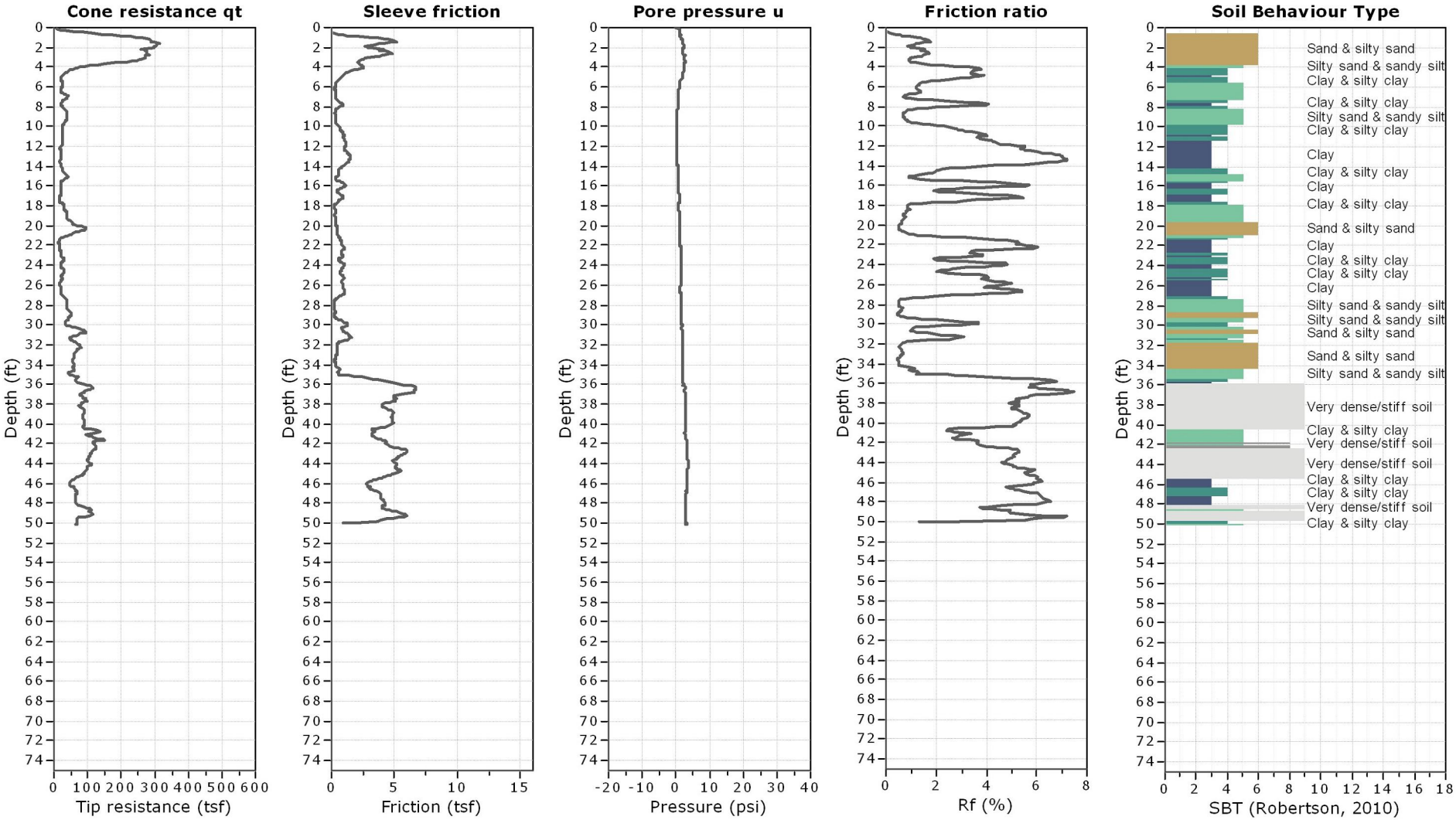
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-5

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.21 ft, Date: 6/12/2014
Cone Type: Vertek



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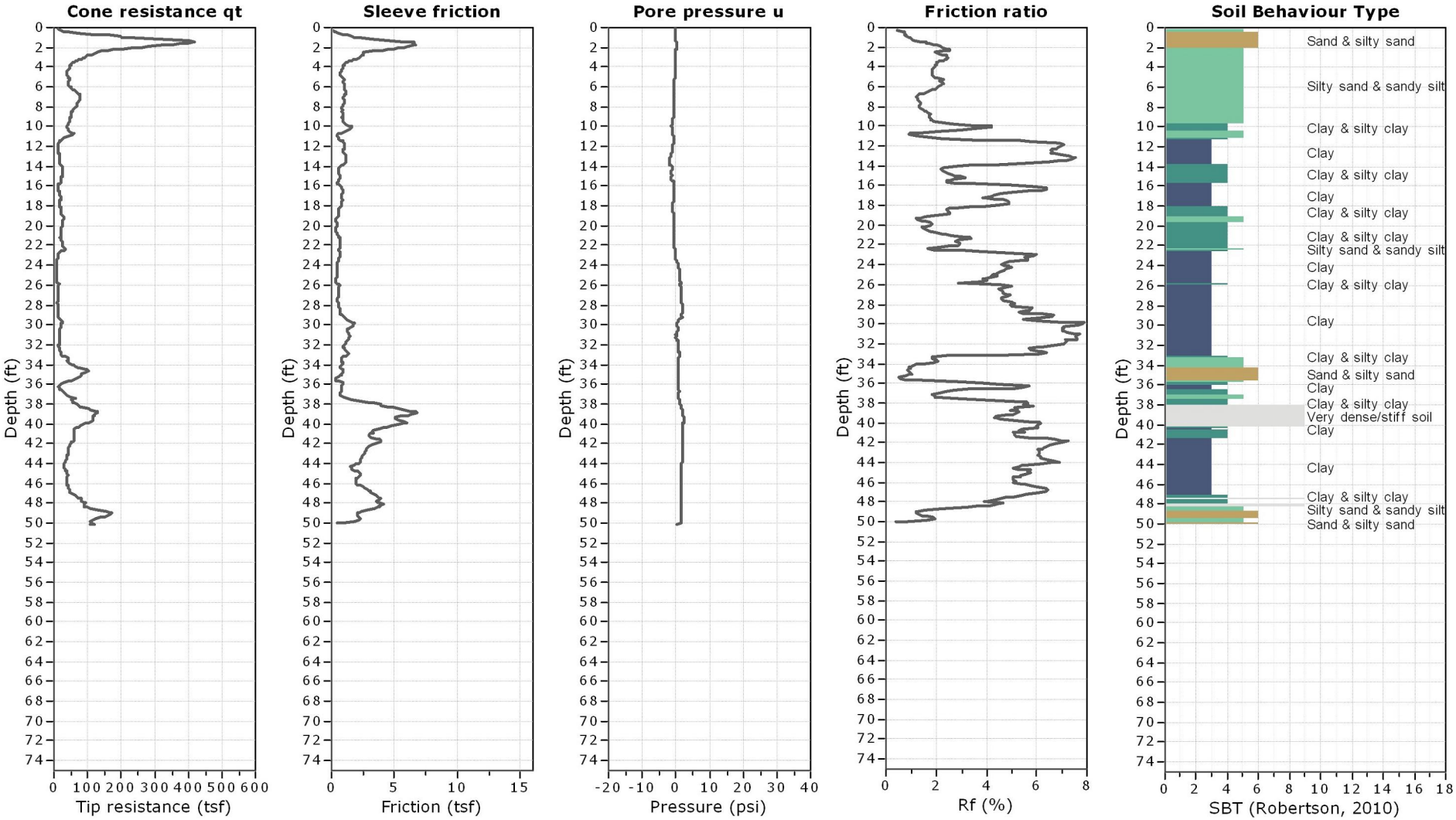
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-6

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.21 ft, Date: 6/11/2014
Cone Type: Vertek



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rich@kehoetesting.com
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CPT: CPT-7

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 75.17 ft, Date: 6/13/2014
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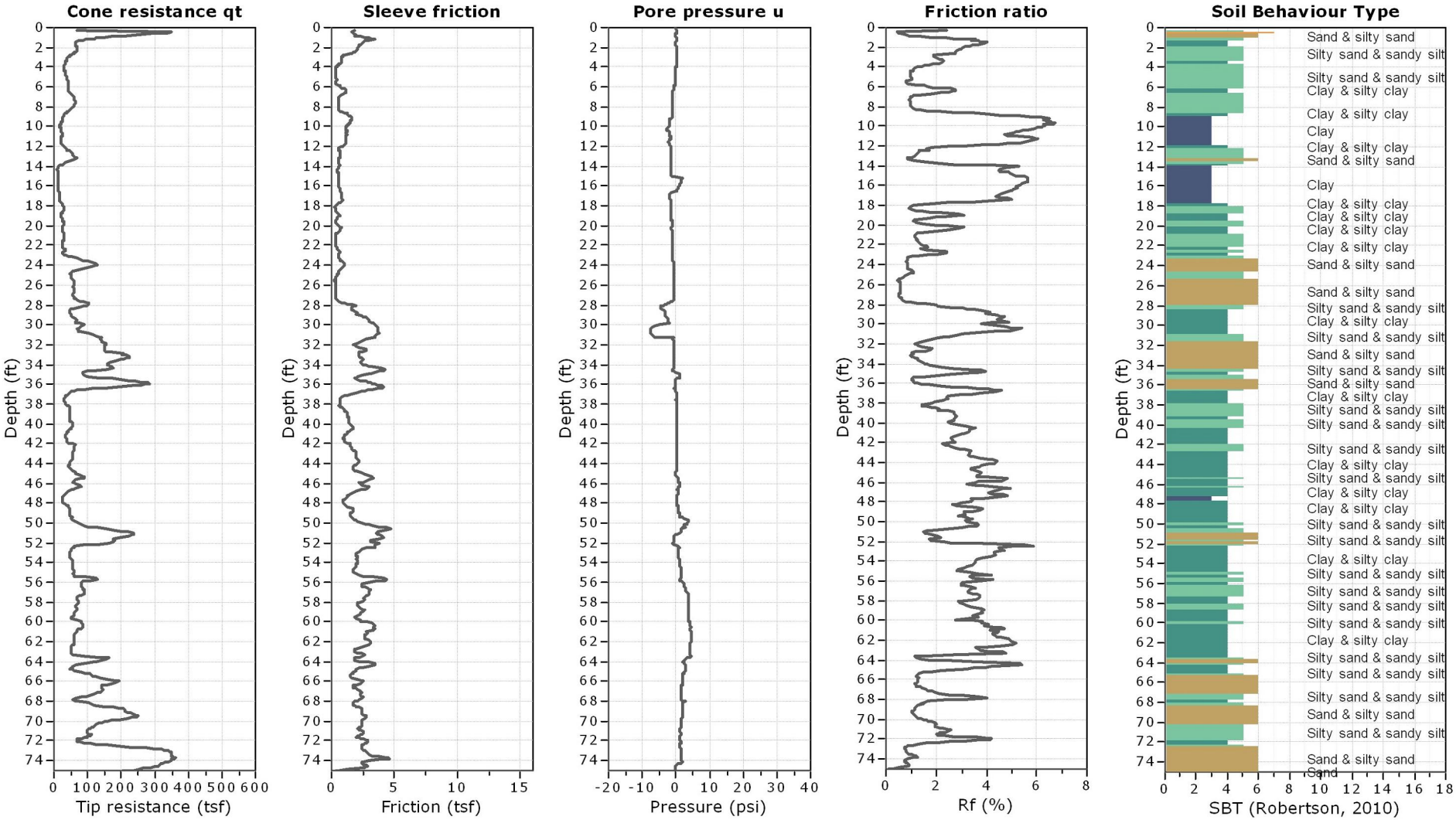

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rich@kehoetesting.com
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CPT: CPT-8

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.16 ft, Date: 6/13/2014
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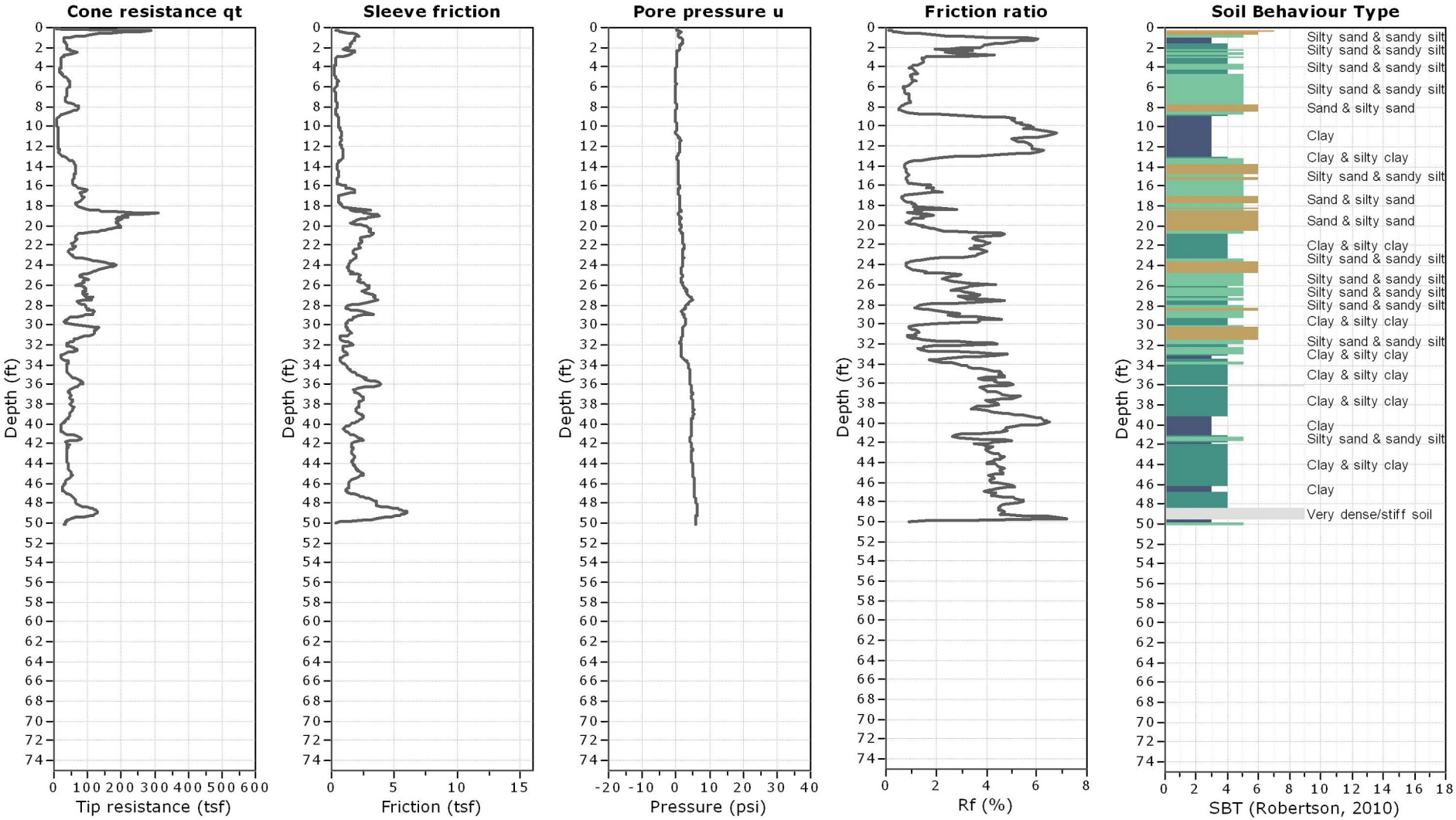

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rich@kehoetesting.com
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CPT: CPT-9

Project: **Leighton & Associates/Lowe Enterprises**
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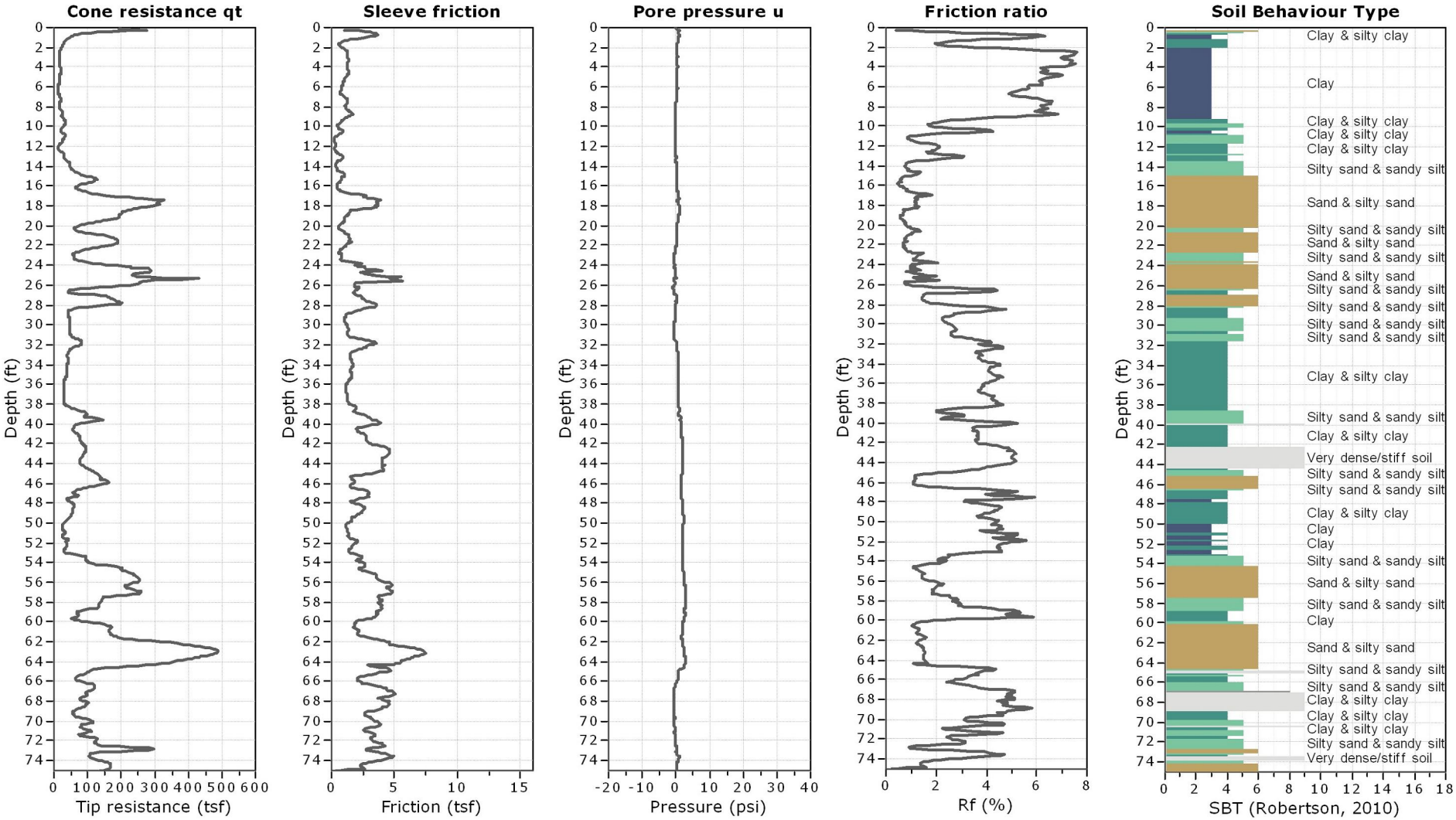

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rich@kehoetesting.com
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CPT: CPT-10

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 70.00 ft, Date: 6/12/2014
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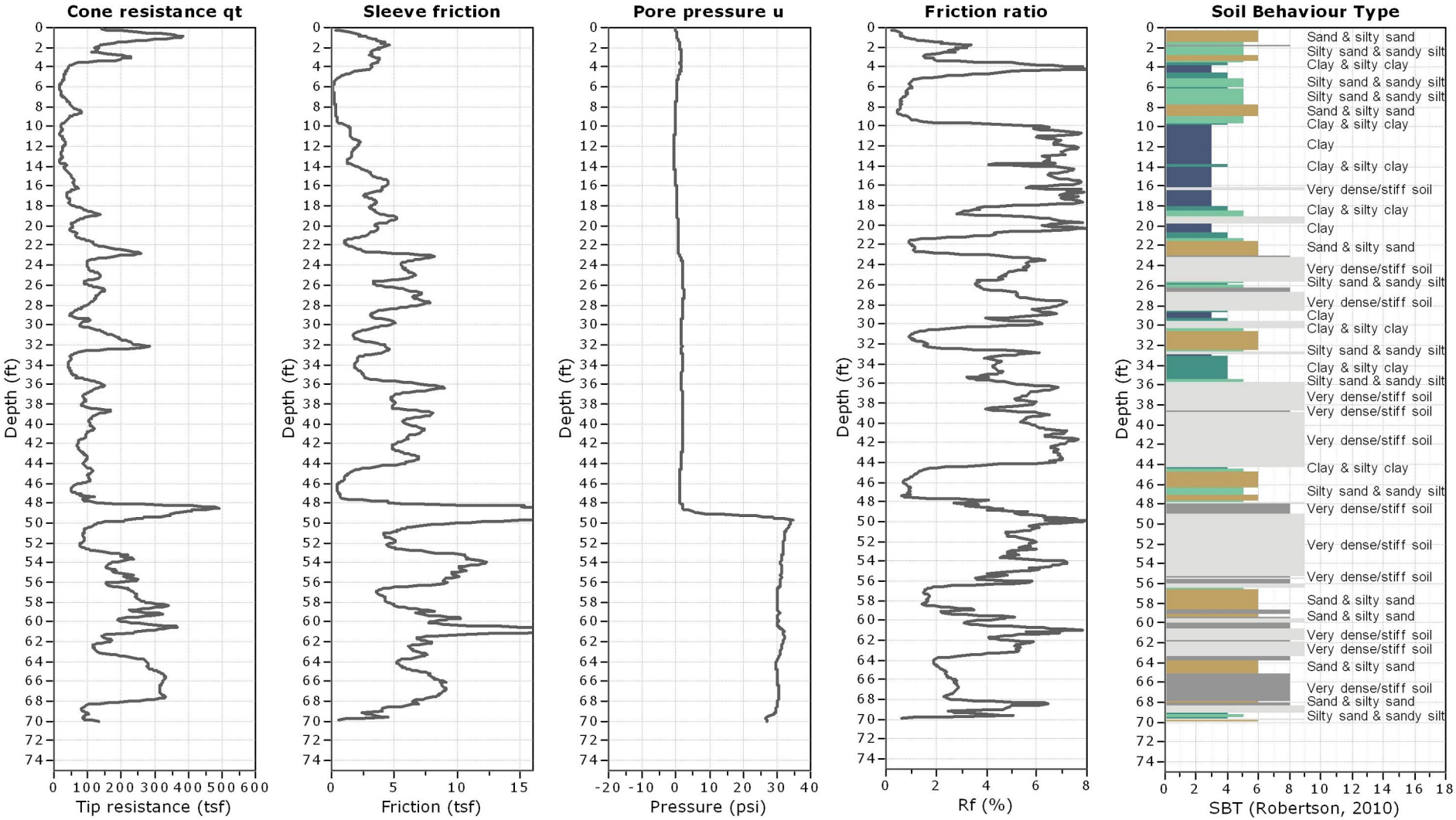

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CPT: CPT-19

Project: **Leighton & Associates/Lowe Enterprises**
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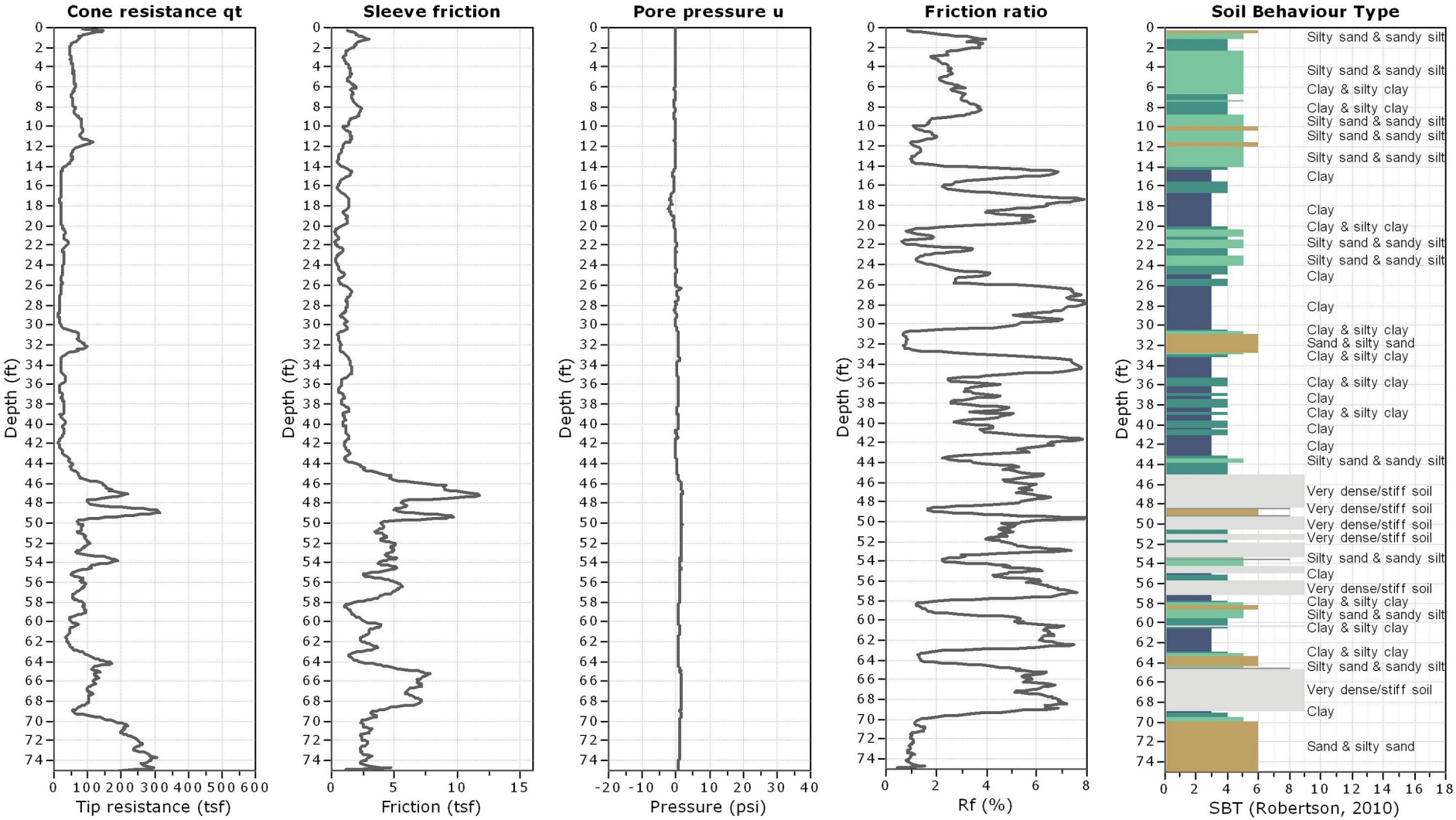

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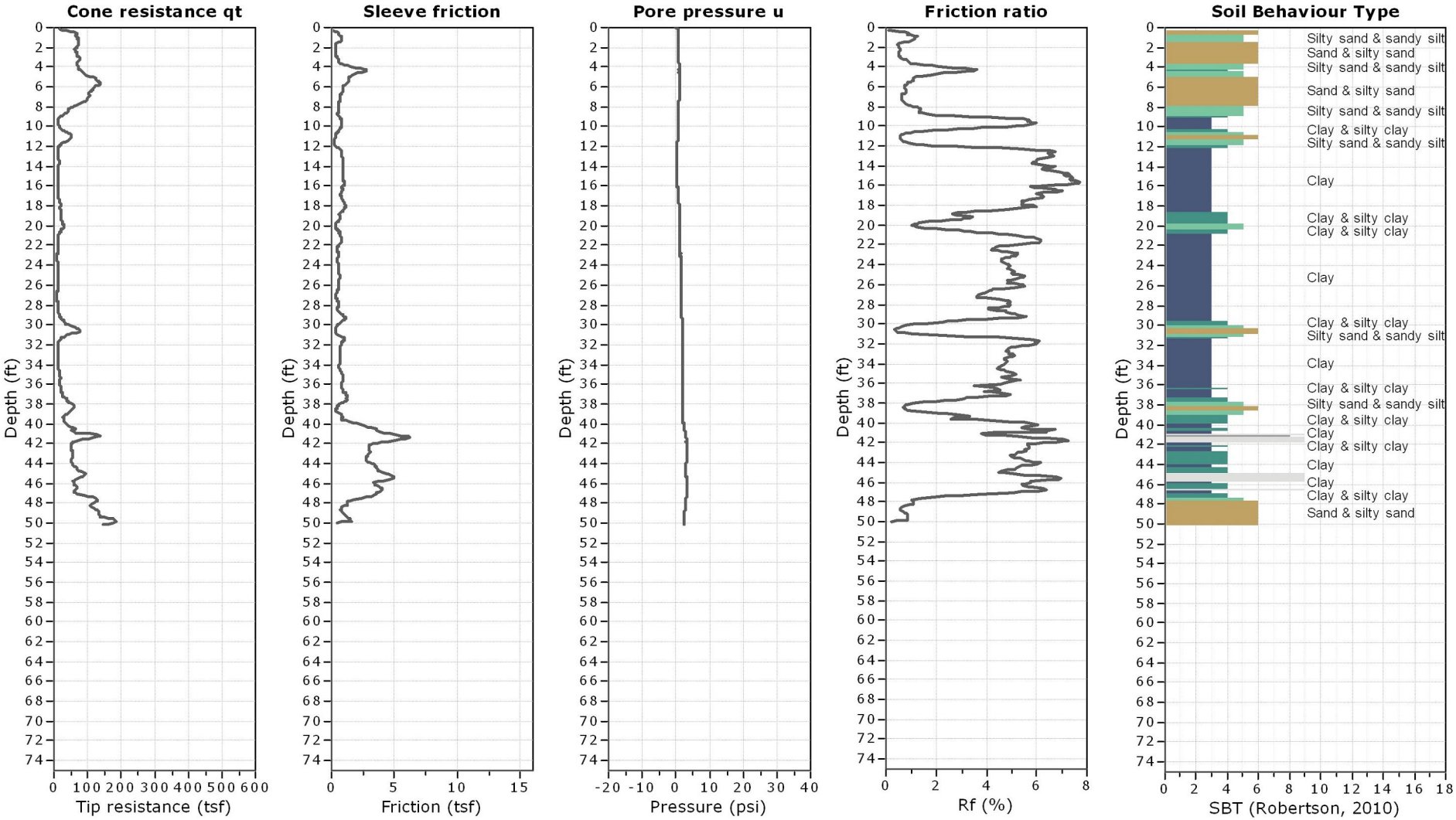
CPT: CPT-20

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.21 ft, Date: 6/12/2014
Cone Type: Vertek



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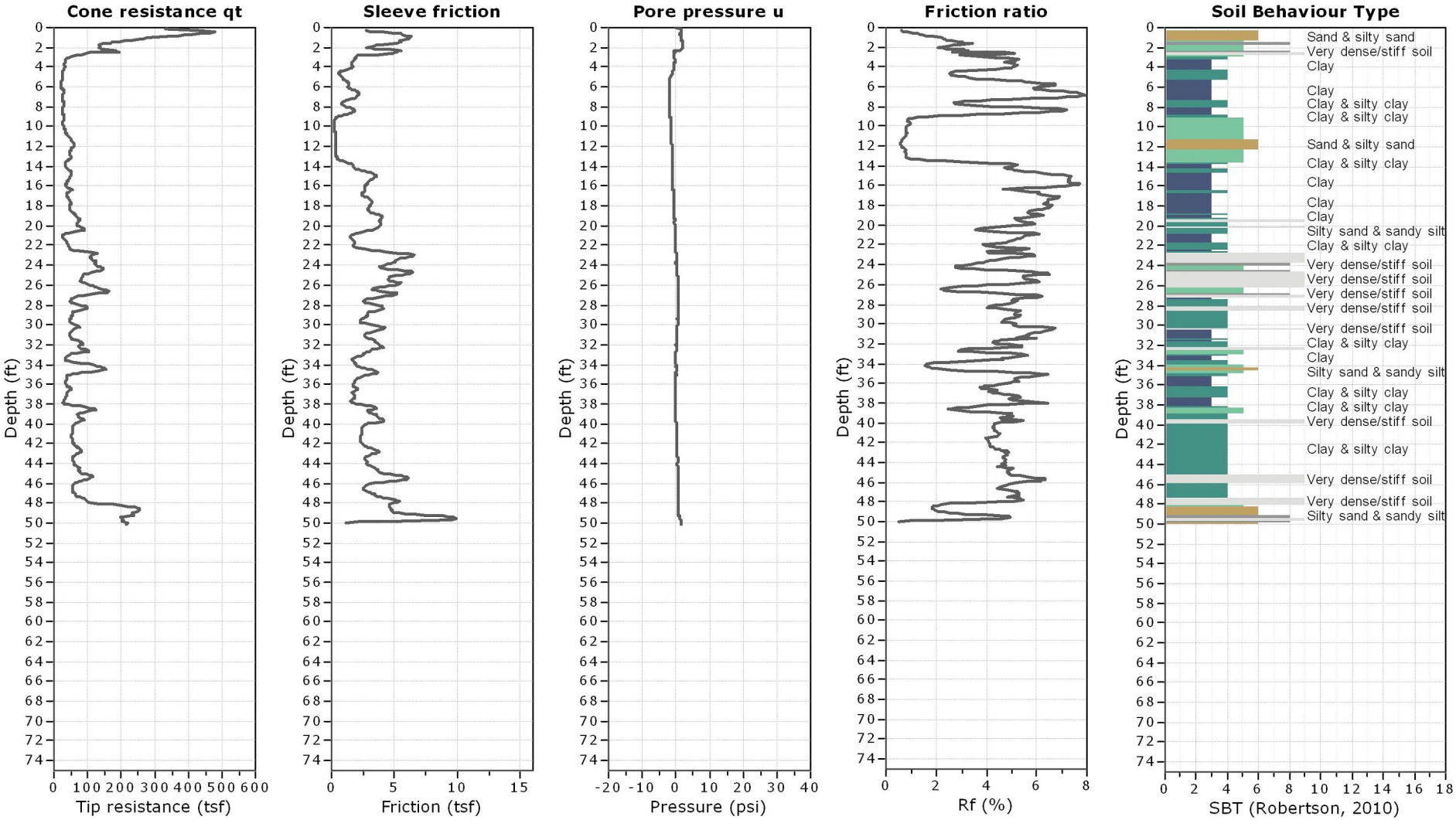
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-21

Project: **Leighton & Associates/Lowe Enterprises**
Location: **Irvine Blvd. & Magazine Rd. Irvine, CA**

Total depth: 50.15 ft, Date: 6/12/2014
Cone Type: Vertek

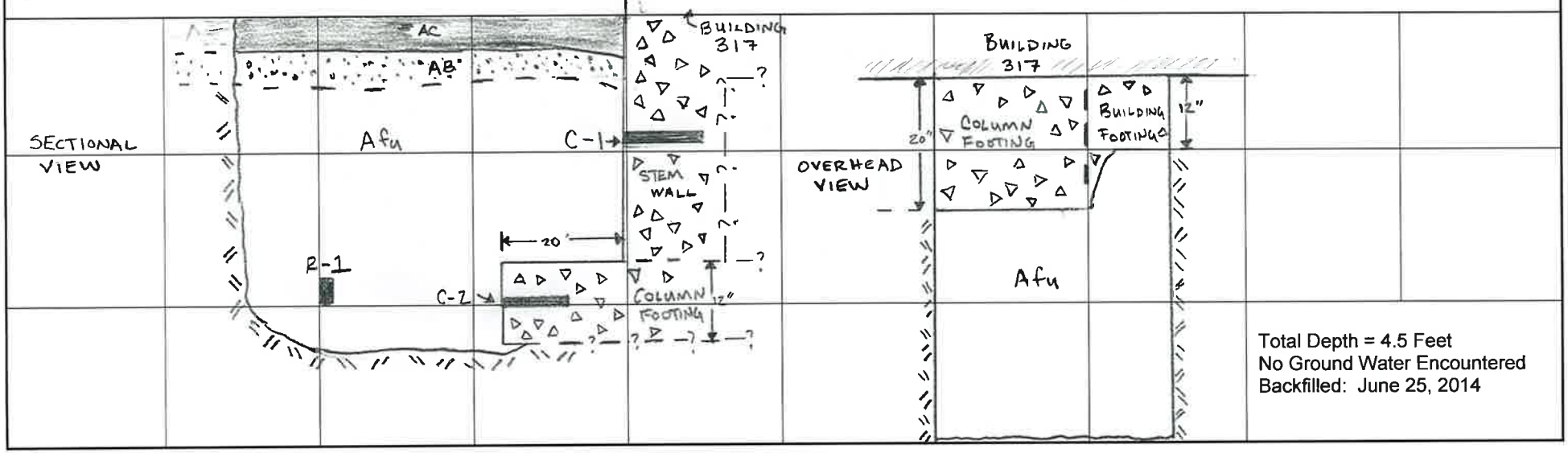


LOG OF TRENCH: TP-1

Project Name:	100-Acre Parcel	Logged by:	Evan Price
Project Number:	10695.001	Elevation:	253 feet
Equipment:	Hand Tools	Location/Grid:	Building 317 - Northwest Wall

GEOLOGIC ATTITUDES	DATE: June 24, 2014 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES USCS	Sample No.	Moisture (%)	Density (pcf)
	6-inches Asphalt Concrete over 6-inches Aggregate Base	AC/AB		BB-1 (0'-3')		
	Artificial Fill, undocumented (Afu): @1': Silty SAND (SM), with clay to Sandy Silty CLAY (CL), medium brown, very moist, fine grained	Afu	SM+ CL	C-1 (1.8')		
				R-1 (2.5'-3')	17	108
				C-2 (3.0')		

GRAPHICAL REPRESENTATION: SCALE: 1" = 2' SURFACE SLOPE: TREND:



Total Depth = 4.5 Feet
No Ground Water Encountered
Backfilled: June 25, 2014

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

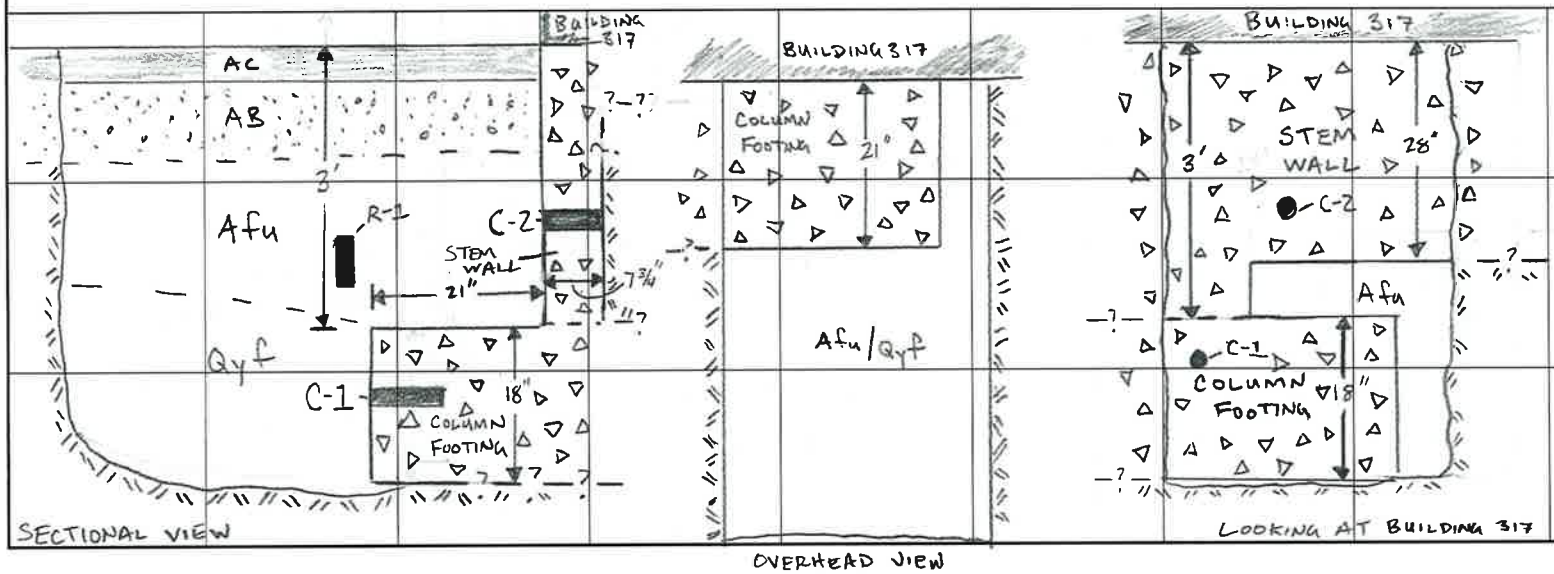
LOG OF TRENCH: TP-2

Project Name:	100-Acre Parcel	Logged by:	Evan Price
Project Number:	10695.001	Elevation:	252 feet
Equipment:	Hand Tools	Location/Grid:	Building 317 - Southwest Wall

GEOLOGIC ATTITUDES	DATE: June 24, 2014 DESCRIPTION:	GEOLOGIC UNIT	USCS	Sample No.	Moisture (%)	Density (pcf)
	5-inches Asphalt Concrete over 10-inches Aggregate Base	AC/AB		BB-1 (1'-3')		
	Artificial Fill, undocumented (Afu): @1.3': Sandy CLAY (CL), dark brown, moist, fine to medium grained, few gravel	Afu	CL	C-2 (1.9')		
	Alluvium (Qyf): @2.5': Clayey SILT (ML), with sand, dark brown, moist, fine grained, trace roots	Qyf	ML	R-1 (2'-2.5')	14	110
				C-1 (3.5')		

ENGINEERING PROPERTIES

GRAPHICAL REPRESENTATION: SCALE: 1" = 2' SURFACE SLOPE: TREND:



Total Depth = 4.5 Feet
No Ground Water Encountered
Backfilled: June 25, 2014

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

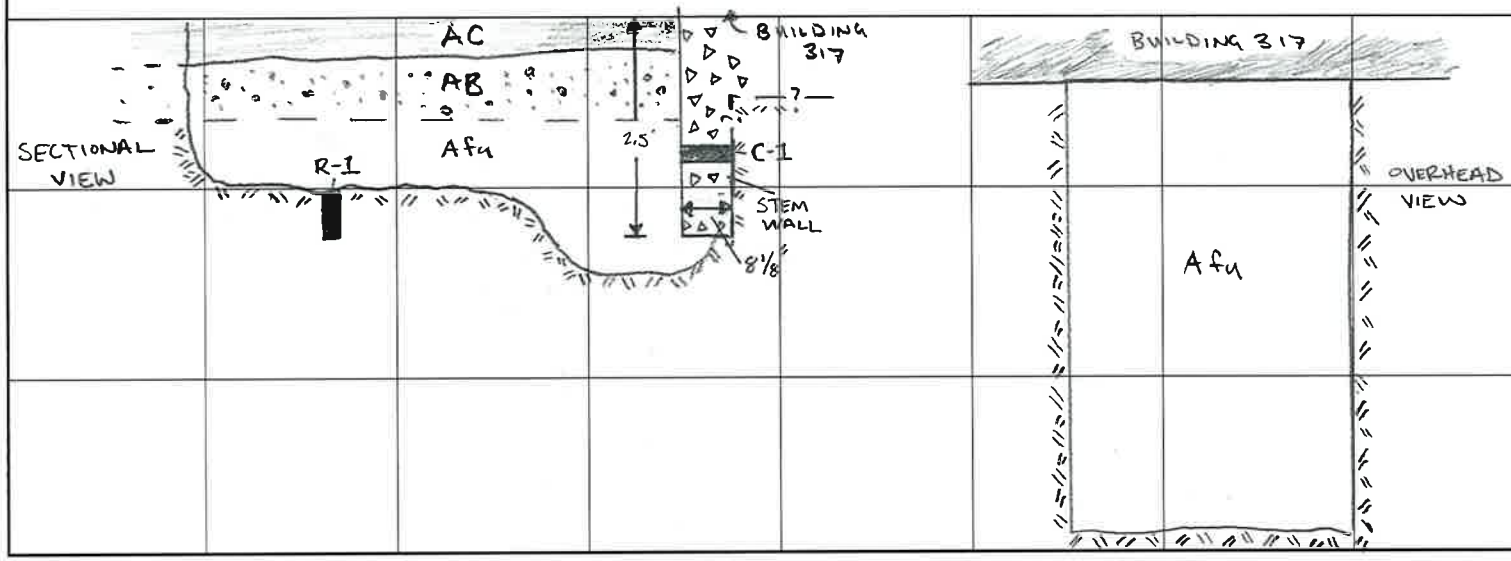
LOG OF TRENCH: TP-3

Project Name:	100-Acre Parcel	Logged by:	Evan Price
Project Number:	10695.001	Elevation:	254 feet
Equipment:	Hand Tools	Location/Grid:	Building 317 - Southwest Wall

ENGINEERING PROPERTIES

GEOLOGIC ATTITUDES	DATE: June 24, 2014 DESCRIPTION:	GEOLOGIC UNIT	USCS	Sample No.	Moisture (%)	Density (pcf)
	4-inches Asphalt Concrete over 10-inches Aggregate Base	AC/AB		BB-1 (1'-3')		
	Artificial Fill, undocumented (Afu): @1.2': Clayey SAND (SC), dark yellowish brown, moist, fine grained, few gravel, trace debris and asphalt	Afu	SC	C-1 (1.5')		
				R-1 (2'-2.5')	13	109

GRAPHICAL REPRESENTATION: SCALE: 1" = 2' SURFACE SLOPE: TREND:



Total Depth = 3 Feet
No Ground Water Encountered
Backfilled: June 25, 2014

Leighton Consulting, Inc.
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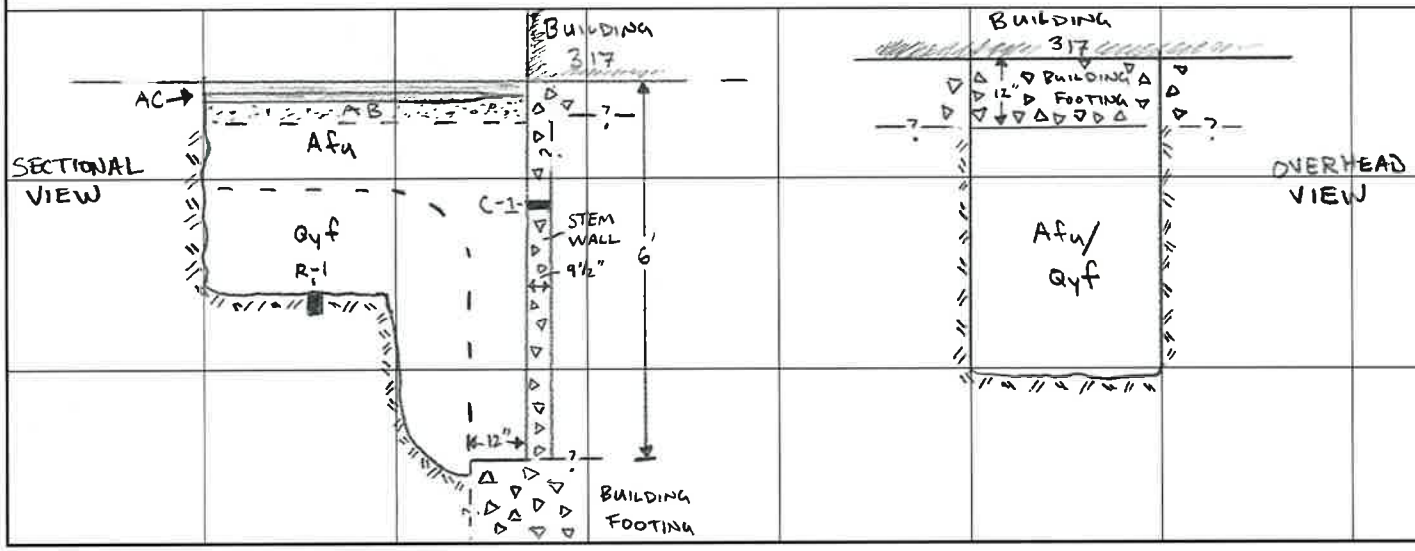
LOG OF TRENCH: TP-4

Project Name:	100-Acre Parcel	Logged by:	Evan Price
Project Number:	10695.001	Elevation:	256 feet
Equipment:	Hand Tools	Location/Grid:	Building 317 - Southeast Wall

ENGINEERING PROPERTIES

GEOLOGIC ATTITUDES	DATE: June 25, 2014 DESCRIPTION:	GEOLOGIC UNIT	USCS	Sample No.	Moisture (%)	Density (pcf)
	2 Sections of 3-inch thick Asphalt Concrete, over 6-inches Aggregate Base	AC/AB				
	Artificial Fill, undocumented (Afu): @1': Clayey SAND (SC), dark yellowish brown, moist, fine grained, trace gravel and debris	Afu	SC	BB-1 (2'-4') C-2 (2')		
	Alluvium (Qyf): @1.8': Sandy SILT (ML), dark grayish brown, moist, fine grained, pinhole porosity	Qyf	ML	R-1 (3'-3.5')	17	98

GRAPHICAL REPRESENTATION: SCALE: 1" = 3' SURFACE SLOPE: TREND:



Total Depth = 6.2 Feet
No Ground Water Encountered
Backfilled: June 25, 2014

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

GEOTECHNICAL BORING LOG P-1

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100-Acre Redevelopment - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	228'
Location	See Plate 1 - *Site Exploration Map*	**Sampled By**	CD

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
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, olive brown, scattered vegetation	
								CL	@1': Sandy CLAY, olive brown, moist, some root hairs	
				S-1	4 5 6			CL	**Quaternary young alluvial fan deposits: (Qal)** @2.5': Sandy CLAY, olive brown, moist, stiff, low plasticity with $CaCO_3$	
225										
	5			R-1	11 14 18				@5': Becomes very stiff	
220										
				R-2	10 13 14			SC	@8.5': Clayey SAND, light yellow brown, slightly moist, medium dense, fine grained sand, trace $CaCO_3$	-200
	10									
215										
				R-3	9 10 11			SM	@13.5': Grades to Silty SAND, trace of fine gravel with fine grained sand, moist	
	15							CL	@14.5': Silty CLAY, brown, moist, stiff, low plasticity	
210									Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	20									
205										
	25									
200										
	30									

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

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-2

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100-Acre Redevelopment - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	241'
Location	See Plate 1 - *Site Exploration Map*	**Sampled By**	CD

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
	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, dark brown, moist, trace clay, root hairs, trace gravel	
240				S-1	4 6 8					-200
								SM	**Quaternary young alluvial fan deposits: (Qal)** @2.5': Silty SAND, yellow brown, dry to moist, medium dense, fine grained	
	5			R-1	11 19 20					
235								SP	@6': Grades to SAND	
				R-2	9 9 7				@ 8.5': No recovery	
	10									
230									Total Depth of Boring: 10 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-10 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	15									
225										
	20									
220										
	25									
215										
	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

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-3

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100-Acre Redevelopment - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	242'
Location	See Plate 1 - *Site Exploration Map*	**Sampled By**	CD

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
	0			B-1				SC	**Artificial fill, undocumented: (Afu)** @0': Clayey SAND, brown, scattered vegetation, hard drilling, thin gravelly layer	
240				R-1	15 27 21			SM	@1': Silty SAND, yellow brown, slightly moist, dense, trace clay, trace gravel	
				R-2	40 15 14					
	5							SM	**Quaternary young alluvial fan deposits: (Qal)** @ 5': Silty SAND, yellow brown, slightly moist	
235										
				S-1	5 3 3			ML	@8.5': Sandy SILT, yellow brown to light brown, moist, stiff, fine grained	-200
	10							CL	@9.5': Silty CLAY, yellow brown, moist, stiff, low plasticity, moderate $CaCO_3$ in matrix	
230									Total Depth of Boring: 10 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 5-10 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
	15									
225										
	20									
220										
	25									
215										
	30									

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

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-4

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100-Acre Redevelopment - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	255'
Location	See Plate 1 - *Site Exploration Map*	**Sampled By**	CD

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
255	0			B-1					@0': 7-inches Asphalt Concrete over 7-inches Aggregate Base	
									Artificial fill, undocumented: (Afu)	
				S-1	2 2 4			CL	@2': Sandy CLAY, dark brown, moist, soft, low plasticity, fine grained sand	
250	5			R-1	2 4 4			SC	**Quaternary young alluvial fan deposits: (Qal)** @5.5': Clayey SAND, dark yellow brown to olive grey, moist, loose, low plasticity, fine grained sand	-200, AL, DS
				R-2	4 7 8				@ 8.5': medium dense	
245	10									
				R-3	6 9 9			SM SP	@14': Silty SAND, light yellow brown, moist, medium dense, fine to medium grained	
240	15								@14.5': SAND, light yellow brown, moist, medium dense, fine grained	
235	20									
230	25									
225	30									

Total Depth of Boring: 15 feet bgs
No free groundwater encountered during drilling
Boring converted into a percolation test well, slotted screen from 5-15 feet, solid PVC Pipe to ground surface.
Percolation testing performed on 12/11/2014.

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

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-5

Project No.	10695.003	**Date Drilled**	12-9-14
Project	El Toro 100-Acre Redevelopment - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	268'
Location	See Plate 1 - *Site Exploration Map*	**Sampled By**	CD

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
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND with Gravel, olive brown, dry, scattered vegetation	
								SM-SC	@1': Becomes Silty SAND to Clayey SAND, yellow brown, trace gravel	
265				S-1	2 3 4			CL	**Quaternary young alluvial fan deposits: (Qal)** @2.5': Sandy CLAY, yellow brown, moist, stiff, low plasticity, fine grained sand	
	5			R-1	11 17 23					
260				R-2	11 12 13			SM	@8.5': Silty SAND, yellow brown, moist, medium dense, fine grained	
	10									
255				R-3	6 8 11				@13.5': Silty SAND, light yellow brown, moist, medium dense, fine grained	-200
	15								Total Depth of Boring: 15 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 10-15 feet, solid PVC Pipe to ground surface. Percolation testing performed on 12/11/2014.	
250										
	20									
245										
	25									
240										
	30									

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

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

APPENDIX B

PRIOR EXPLORATIONS

Leighton

GEOTECHNICAL BORING LOG B-1

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 267' **Location** See Geotechnical Map

Logged By Rick Higley
Sampled By Rick Higley

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ Surface: Approximately 4-inches of asphalt-concrete over 7-inches of aggregate base	
265				R-1	8 9	115.4	10.4	SC	**Quaternary Alluvium (Qal):** @ 2': Clayey SAND (SC), loose, brown, moist, fine grained .	CR, EI
	5			R-2	12 14	116.7	11.9	SM	@ 5': Silty SAND (SM), medium dense, light brown, moist, fine to coarse grained.	
260				R-3	5 7	102.4	7.1	SP	@ 7': SAND to Silty SAND (SP), loose, brown, moist, fine grained.	
	10			R-4	7 10	105.3	17.2	CLs	@ 10': CLAY with Sand (CL), stiff, orange brown, slightly moist, fine to medium grained sand, low plasticity.	
255										
	15			R-5	6 7	98.4	18.7	CL	@ 15': CLAY with Silt (CLs), firm, light brown, moist, low plasticity.	
250										
	20			R-6	6 6			SM	@ 20': Silty SAND (SM), loose, light brown, moist, fine grained.	
245									Total depth of boring: 21 feet No groundwater encountered during drilling Borehole was backfilled with soil cuttings, tamped and patched with cold asphalt	
	25									
240										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG B-2

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 264' **Location** See Geotechnical Map

Logged By Rick Higley
Sampled By Rick Higley

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ Surface: Approximately 4-inches of asphalt-concrete over 7-inches of aggregate base	
									Quaternary alluvium (Qal):	
				R-1	8 9	106.6	17.9	CLs	@ 2': Sandy Lean CLAY (CLs), stiff, dark brown, moist, fine grained sand, low plasticity.	
260				B-1						
	5			R-2	4 5	105.9	12.6	SM	@ 5': Silty SAND (SM), loose, orange brown, moist, fine to medium grained.	
				R-3	5 6	109.6	8.3	SM	@ 7': Same as above, fine to coarse grained.	
255										
	10			R-4	7 7	109.8	13.8	SC	@ 10': Clayey SAND (SC), loose, brown, moist, fine to medium grained.	
									Total depth of boring: 11 feet No groundwater encountered during drilling Borehole was backfilled with soil cuttings, tamped and patched with cold asphalt	
250										
	15									
245										
	20									
240										
	25									
235										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

GEOTECHNICAL BORING LOG B-3

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 263' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By: Rick Higley; Sampled By: Rick Higley)	Type of Tests
	0								@ Surface: Approximately 4-inches of asphalt-concrete over 7-inches of aggregate base	
									Quaternary Alluvium (Qal)	
260				B-1 R-1	5 6	115.0	14.3	SC	@ 2': Clayey SAND (SC), loose, dark brown, moist, fine to medium grained with scattered pebbles.	MD, RV
	5			R-2	3 4	103.8	11.9	SM	@ 5': Silty SAND (SM), loose, dark brown, fine to medium grained.	
255				R-3	2 3	100.5	11.9	SM	@ 7': Same as above.	
	10			R-4	6 6	96.6	20.6	CLs	@ 10': Silty Sandy CLAY (CLs), firm, brown, moist, fine grained sand, low plasticity.	
250									Total depth of boring: 11 feet No groundwater encountered during drilling Borehole was backfilled with soil cuttings, tamped and patched with cold asphalt	
	15									
245										
	20									
240										
	25									
235										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG B-4

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 262' **Location** See Geotechnical Map

Logged By Rick Higley
Sampled By Rick Higley

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0							MLs	**Quaternary Alluvium (Qal)** Sandy SILT (ML), light brown, slightly moist, fine grained sand.	
260				R-1	6 6	96.2	8.3	SM	@ 3': Silty SAND (SM), loose, yellowish brown, slightly moist, fine grained.	
	5			R-2	6 7	95.6	8.8	SC	@ 5': Clayey SAND (SC), firm, brown, slightly moist, fine grained.	
255				B-1						CR
	10			R-3	12 13	103.3	18.8	CLs	@ 10': Sandy Lean CLAY (CLs), stiff, brown, slightly moist, fine grained sand, low plasticity.	
250										
	15			R-4	6 8	95.3	16.5	SM	@ 15': Silty SAND (SM), loose, yellowish brown, slightly moist, fine grained.	
245										
	20			R-5	7 9	91.4	27.9	CL	@ 20': Lean CLAY (CL), stiff, brown, moist, some fine grained sand, low plasticity.	
240									Total depth of boring: 21 feet No groundwater encountered during boring excavation The boring was backfilled with soil cuttings, and tamped	
	25									
235										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG B-5

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 262' **Location** See Geotechnical Map

Logged By Rick Higley
Sampled By Rick Higley

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0	N S							@ 0-2': Crushed rock; railroad ballast	
260									**Quaternary Alluvium (Qal)**	
				R-1	5 7	104.6	14.8	SC	@ 3': Clayey SAND (SC), loose, brown, moist, fine to medium grained.	
	5			R-2	5 6	97.0	21.1	CLs	@ 5': Lean CLAY with Sand (CLs), firm, brown, moist, very fine grained sand, low plasticity.	
255										
	10			R-3	4 5	100.1	15.8	SC	@ 10': Clayey SAND (SC), loose, brown, moist, fine grained.	
250										
	15								@ 15': No recovery.	
				R-4	5 6	104.1	16.7	SM	@ 16': Silty SAND; (SM), loose, light reddish brown, moist, fine grained.	
245									Total depth of boring: 17 feet No groundwater encountered during drilling Borehole was backfilled with soil cuttings, tamped and patched with cold asphalt	
	20									
240										
	25									
235										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG B-6

Date 12-12-06 **Sheet** 1 **of** 1
Project 2nd Harvest **Project No.** 012095-001
Drilling Co. Al-Roy Drilling **Type of Rig** CME-75
Hole Diameter 8" (HSA) **Drive Weight** 140 lbs (Auto hammer) **Drop** 30"
Elevation Top of Hole 263' **Location** See Geotechnical Map

Logged By Rick Higley
Sampled By Rick Higley

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0							SM	@ Surface: Approximately 4-inches of asphalt-concrete over 6-inches of aggregate base **Quaternary Alluvium (Qal):** @1': Silty SAND (SM), dark brown, slightly moist, trace of gravel.	
260				R-1	5 6	105.2	16.2	SC	@ 2': Clayey SAND (SC), loose, brown, slightly moist, fine to medium grained.	
	5			B-1 R-2	4 4	99.1	12.8	SM	@ 5': Silty SAND (SM), loose, brown, moist, fine to medium grained.	
255										
	10			R-3	5 6	91.9	25.3	CL	@ 10': Lean CLAY (CL), firm, brown, moist, trace of fine grained sand, low plasticity.	
250									Total depth of boring: 11 feet No groundwater encountered during boring excavation The boring was backfilled with soil cuttings, tamped and patched with cold asphalt	
	15									
245										
	20									
240										
	25									
235										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICALBORING LOG BH-3

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 280' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
280	0							SC	@0': 8" of Asphalt over 4" of gravel base. **Artificial Fill** @1': Clayey SAND (SC); dark brown, moist, fine to coarse sand, some fine gravel, some CaCO3.	
				R1	5 5 5	113	14	CL SM	@2': Sandy CLAY (CL); dark brown, moist, soft, fine to coarse sand, siltstone fragments, some fine to coarse gravel, grades to Silty SAND (SM); light brown, moist, loose, LL=36, PL=18, PI=18.	CN, AL
275	5			R2	4 5 7	100	4	SM	**Quaternary Alluvium (Qal)** @5': Silty SAND (SM); light brown, moist, loose, fine to coarse sand, some mica.	
				R3	8 9 14	111	15	CL	@7': Sandy CLAY (CL); dark brown, moist, stiff, fine to coarse sand, abundant CaCO3 stringers.	
270	10			R4	5 10 14	106	19	CL	@10': Sandy CLAY (CL); dark brown, moist, stiff, fine to coarse sand, abundant CaCO3 along bedding, some silt, thinly bedded, LL=48, PL=23, PI=25.	CN, AL
265	15			R5 BB-1	15 19 30	117	14	CL	@15': Sandy CLAY (CL); reddish brown, moist, very stiff, fine to coarse sand, thinly bedded, some CaCO3.	
260	20			R6	8 24 31	111	10	CL-SM	@20': Clayey Silty SAND to Sandy SILT (SM/ML); brown, moist, dense to very stiff, fine sand, micaceous, grades to Silty SAND (SM); brown, moist, dense, fine to coarse sand.	
255	25								Total Depth: 21.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
250	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-4

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 267' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
	0							SM	@0': **Artificial Fill (Af)** Silty SAND with Gravel (SMg); brown, moist, medium dense, fine to coarse sand, fine to coarse angular to rounded gravel.	
265				R1	15 23 28			CL	@2': Sandy CLAY (CL); dark brown, moist, very stiff, fine to coarse sand, abundant CaCO3, mild blocky soil fracture.	
									Quaternary Alluvium (Qal)	
	5			R2	5 6 9	116	14	CL	@5': Sandy CLAY (CL); brown, moist, stiff, CaCO3, fine to coarse sand, porous, LL=43, PL=21, PI=22.	CN, AL
260				R3	5 8 13	88	2	SP	@7': SAND (SP); pale brown, medium dense, moist, fine to coarse sand, well graded, some silt, some mica.	
	10			R4 BB-1	3 10 18	96	2	SM	@10': grades to Silty SAND (SM); pale brown, loose, moist, micaceous.	
255										
	15			R5	5 7 14			SP	@15': SAND (SP); white, moist, loose, fine to coarse grained, in sharp contact with Silty CLAY (CL); reddish brown, moist, soft, thinly bedded, micaceous.	
250								CL		
	20			R6	8 8 15	106	15	ML	@20': Sandy SILT (ML); brown, moist, soft, micaceous, thinly bedded, interbedded with some reddish brown clay beds.	
245									Total Depth: 21.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
	25									
240										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-5

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 267' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
	0								@0': 3.5" of Asphalt with 8" of gravel base. **Artificial Fill (Af)** Sandy CLAY (CL); dark brown, moist, fine to coarse sand, some gravel.	CN, AL, RV
265				R1 BB-1	5 8 9	112	12	CL CL	@2': Sandy CLAY (CL); dark brown, moist, stiff, fine to coarse sand, micaceous, LL=40, PL=19, PI=21.	
	5			R2	4 6 8	91	24	SM/SC	**Quaternary Alluvium (Qal)** @5': Silty Clayey SAND (SM-SC); reddish brown, moist, loose, fine to coarse sand, micaceous, mild CaCO3 development, grades to Silty CLAY (CL); reddish brown, moist, soft, highly micaceous, some CaCO3, thin bedding, some fine gravel.	
260				R3	5 6 10	94	28	CL	@7': Silty CLAY (CL); reddish brown, moist, stiff, thinly bedded, highly micaceous, some CaCO3.	
	10			R4	4 5 6	110	11	SM/SC	@10': Silty Clayey SAND (SM/SC); brown, moist, loose, fine to coarse sand, some fine gravel, CaCO3, trace mica.	
255									Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
	15									
250										
	20									
245										
	25									
240										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-6

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 269' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
	0								@0': 6.5" of Asphalt with 8" of gravel base. **Artificial Fill (Af)** Sandy CLAY with gravel (CL); dark brown, moist, fine to coarse sand, fine to coarse angular gravel, micaceous.	CR
				R1 BB-1	4 7 8	100	21	CL CL	@2': Sandy CLAY (CL); dark brown, moist, medium stiff, fine to coarse sand, fine to coarse gravel, cobble in ring, micaceous with silt.	
265	5			R2	2 3 8	95	25	CL	**Quaternary Alluvium (Qal)** @5': Silty Sandy CLAY (CL); dark brown, moist, stiff, fine to coarse sand, plastic, micaceous.	
				R3	3 4 5	106	9	SM	@7': Silty SAND (SM); dark brown, moist, loose, fine to coarse sand, micaceous.	
260	10			R4	5 7 9	107	16	CL	@10': Sandy CLAY (CL); dark brown, moist, stiff, fine to coarse sand, grades to Sandy Silty CLAY (CL); reddish brown, moist, soft, micaceous, fine to coarse sand.	
255	15								Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
250	20									
245	25									
240	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-7

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 258' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
	0								@0': 3.5" of Asphalt and 3" of gravel base. **Artificial Fill (Af)** @0.5': Clayey SAND (SC); dark brown, moist, fine to coarse sand. Hand augered to 5'.	RV
255				BB-1				SC		
	5			R1	5 6 11	112	9	SM	**Quaternary Alluvium (Qal)** @5': Silty SAND (SM); medium dense, dark brown to brown, moist, fine to coarse sand, some CaCO3.	
250				R2	3 4 5	105	8	SM	@7': Silty SAND (SM); light brown, moist, fine to coarse sand, micaceous, grades to Silty CLAY (CL); dark brown, moist, micaceous, abundant CaCO3 along thin bedding surfaces.	
	10			R3	3 5 6	83	30	CL	@10': Silty CLAY with Sand (CL); dark brown, moist, micaceous, fine to coarse sand, abundant CaCO3 along thin bedding surfaces.	
245									Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
	15									
240										
	20									
235										
	25									
230										
	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-8

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 255' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
255	0								@0': **Quaternary Colluvium (Qcol)** Sandy CLAY (CL); dark brown, moist, fine to coarse sand, LL=38, PL=18, PI=20.	AL,RV
				R1 BB-1	2 2 4	105	17	CL CL	@2': Sandy Silty CLAY (CL); soft, dark brown, moist, fine to coarse sand, rootlets, porous, micaceous.	
250	5			R2	5 7 8	110	7	SM	**Quaternary Alluvium (Qal)** @5': Silty SAND (SM); soft, light brown, moist, fine to coarse sand, rootlets, some fine gravel, some clay.	
				R3	2 2 4	79	41	CL	@7': Lean CLAY (CL); soft, brown, moist, micaceous, fine to coarse sand, trace CaCO3.	CN
245	10			R4	3 4 4	88	26	SM CL	@10': Silty SAND with Clay (SM); soft, brown, very moist, micaceous, fine to coarse sand, CaCO3, grades to Silty CLAY (CL); brown, very moist, micaceous, some fine sand.	
240	15								Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
235	20									
230	25									
225	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-9

Date 12-10-07 **Sheet** 1 **of** 1

Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS

Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"

Elevation Top of Hole 250' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
250	0								@0': **Quaternary Colluvium (Qcol)** Silty SAND with Gravel (SM); loose, dark brown, moist, fine to coarse sand, fine to coarse gravel, organic material, rootlets, some clay, disced fields.	CR
				R1 BB-1	8 7 9	95	12	CL SM	@2': Sandy CLAY (CL); very stiff, dark brown, moist, fine to coarse sand, micaceous, rootlets, siltstone fragments, porous.	
245	5			R2	6 7 10	110	10	CL	@5': Sandy CLAY (CL); stiff, dark brown, moist, fine to coarse sand, porous, CaCO3, rootlets, grades to Silty SAND (SM), light brown, moist, fine to coarse sand, micaceous.	
				R3	4 8 10	98	5	SM	**Quaternary Alluvium (Qal)** @7': Silty SAND (SM); medium dense, pale brown, moist, micaceous, fine to coarse sand.	
240	10			R4	4 7 8	98	12	SM	@10': Silty SAND (SM); medium dense, light brown, moist, fine to coarse sand, micaceous.	
235	15								Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
230	20									
225	25									
220	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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GEOTECHNICALBORING LOG BH-10

Date 12-10-07 **Sheet** 1 **of** 1
Project 011783-020 Marine Way Road Alignment **Logged / Sampled By** SMS
Drilling Co. Martini Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8-inches **Drive Weight** 140 lbs (Automatic Trip Hammer) **Drop** 30"
Elevation Top of Hole 245' **Location** Heritage Fields, Irvine, California

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 The Soil Description applies only to a location of the exploration at the time of drilling. 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.	Type of Tests
245	0								@0': **Artificial Fill (Af)** Silty Clayey SAND (SM/SC); dark brown, moist, fine to coarse sand, fine gravel, trace organic material.	RV
				R1 BB-1	11 12 14	100	13	SM/SC SM/SC	@2': Silty Clayey SAND (SM/SC); medium dense, dark brown, moist, fine to medium sand, CaCO3, porous, micaceous, rootlets.	
240	5			R2	4 7 11	108	9	ML	@5': **Quaternary Alluvium (Qal)** Sandy SILT (ML); stiff, brown, moist, fine to coarse sand, CaCO3, some clay	
				R3	6 6 10	99	6	SM	@7': Silty SAND (SM); loose, pale brown, moist, fine to coarse sand, micaceous.	
235	10			R4	4 6 7	101	3	SM ML	@10': Silty SAND (SM); loose, light brown, moist, fine to coarse sand, rootlets, grades to SILT (ML); pale brown, moist, micaceous.	
230	15								Total Depth: 11.5 feet bgs. No groundwater encountered during drilling. Boring backfilled with soil cuttings upon completion.	
225	20									
220	25									
215	30									

SAMPLE TYPES:

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

TYPE OF TESTS:

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

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APPENDIX C

LABORATORY TEST RESULTS

Leighton

Boring No.	P-1	P-2	P-3	P-4	P-5			
Sample No.	R-2	S-1	S-1	R-1	R-3			
Depth (ft.)	8.5	2.0	8.5	5.0	13.5			
Sample Type	Ring	SPT	SPT	Ring	Ring			
Soil Identification	Brown clayey sand (SC)	Brown silty sand (SM)	Brown sandy silt s(ML)	Dark olive gray clayey sand (SC)	Brown silty sand (SC)			
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00			
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00			
Sample Dry Weight Determination								
Weight of Sample + Container (g)	553.4	522.7	491.4	561.6	531.2			
Weight of Container (g)	132.7	126.7	136.8	133.1	144.9			
Weight of Dry Sample (g)	420.7	396.0	354.6	428.5	386.3			
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B			
Dry Weight of Sample + Cont. (g)	463.2	410.2	270.8	388.9	414.6			
Weight of Container (g)	132.7	126.7	136.8	133.1	144.9			
Dry Weight of Sample (g)	330.5	283.5	134.0	255.8	269.7			
% Passing No. 200 Sieve	**21.4**	**28.4**	**62.2**	**40.3**	**30.2**			
% Retained No. 200 Sieve	78.6	71.6	37.8	59.7	69.8			

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Lowe Enterprises/El Toro 100-Acre Redevelopment

Project No.: 10695.003

Tested By: S. Felter Date: 12/18/14

Boring No.	TP-3							
Sample No.	R-1							
Depth (ft.)	2.0							
Sample Type	Ring							
Soil Identification	Dark yellowish brown clayey sand (SC)							
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00							
Dry Weight of Soil + Container (g)	0.00							
Weight of Container (g)	1.00							
Moisture Content (%)	0.00							
Sample Dry Weight Determination								
Weight of Sample + Container (g)	646.9							
Weight of Container (g)	238.7							
Weight of Dry Sample (g)	408.2							
Container No.:								
After Wash								
Method (A or B)	B							
Dry Weight of Sample + Cont. (g)	501.8							
Weight of Container (g)	238.7							
Dry Weight of Sample (g)	263.1							
% Passing No. 200 Sieve	**35.5**							
% Retained No. 200 Sieve	64.5							

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Lowe/El Toro 100 Acre Redevelopment/ Bldg 317

Project No.: 10695.002

Tested By: S. Felter Date: 07/01/14

Leighton

17781 Cowan
Irvine, CA 92614
Tel. (949) 222-5321
Fax (949) 263-8843

Compressive Strength of Cores
ASTM C-42

Project Name:	Lowe/El Toro 100 Acre Redevelopment/Bldg 317	Project No.:	10695.002
Sampled By:	Evan Price	Sample Date:	6/24/14 - 6/25/14

MATERIAL SAMPLE TYPE

Concrete **x**

FOR LAB USE ONLY	**DATE RECEIVED:** 6/30/2014	**By:** R. Densmore

Laboratory Test Data

Specimen No.	Age Days	Test Date	Height (in)	Diam. (in)	Area (sq. in.)	Load (lbs.)	Compr. (psi)	H/D Ratio	Corr. Factor	Compr. (psi)	Failure Type
7077		7/7/2014	6.67	3.74	10.99	58740	5340	1.78	0.98	5240	Cone
7078		7/7/2014	7.47	3.74	10.99	54360	4950	2.00	1.00	4950	Cone
7079		7/7/2014	7.49	3.74	10.99	52730	4800	2.00	1.00	4800	Cone
7080		7/7/2014	6.48	3.74	10.99	60720	5530	1.73	0.98	5410	Cone
7081		7/7/2014	7.48	3.74	10.99	59060	5370	2.00	1.00	5370	Cone
7082		7/7/2014	6.84	3.74	10.99	54520	4960	1.83	0.99	4910	Cone

IMPORTANT "PROTECT ALL SAMPLES" "SPECIFY SAMPLE PICK-UP LOCATION"

Locations:
7077 = TP-1, C-1
7078 = TP-1, C-2
7079 = TP-2, C-1
7080 = TP-2, C-2
7081 = TP-3, C-1 Sample had 4 pieces of rebar in it.
7082 = TP-4, C-1

Leighton

DIRECT SHEAR TEST

Consolidated Undrained

Project Name:	Lowe Enterprises/El Toro 100-Acre Redevelopment	Tested By:	G. Bathala	Date:	12/26/14
Project No.:	10695.003	Checked By:	J. Ward	Date:	12/29/14
Boring No.:	P-4	Sample Type:	Ring		
Sample No.:	R-1	Depth (ft.):	5.0		
Soil Identification:	Dark olive gray clayey sand (SC)				

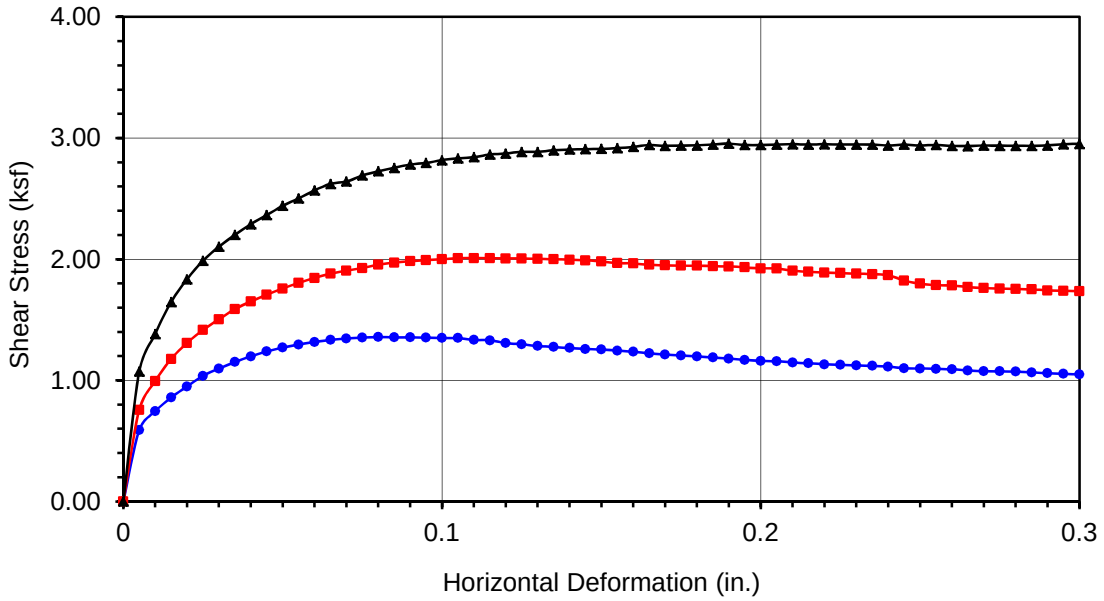
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.71	198.04	199.04
Weight of Ring(gm):	42.12	43.38	44.68

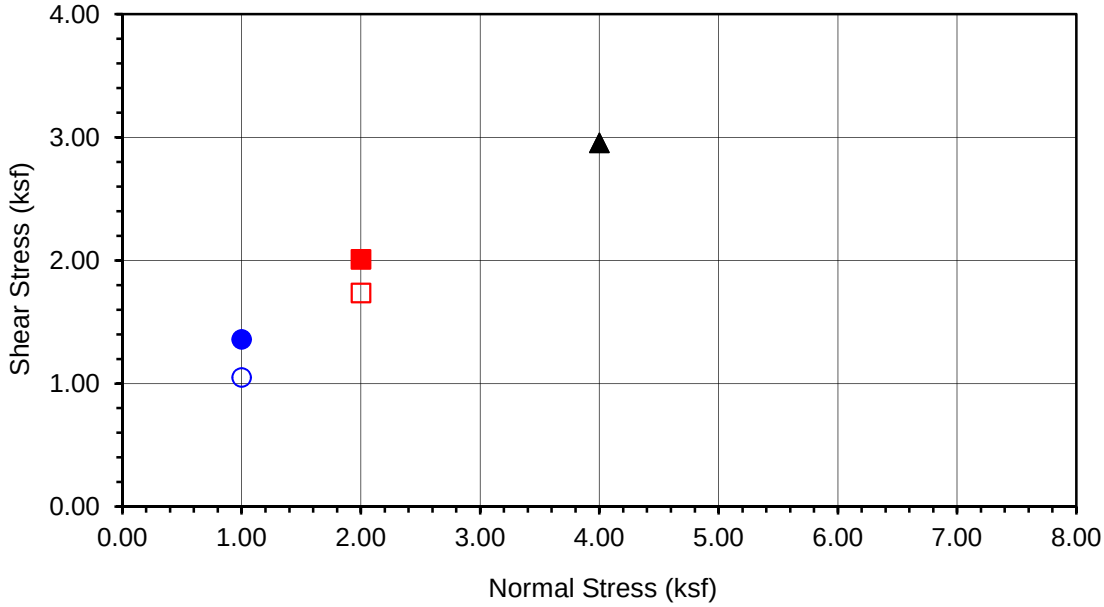
Before Shearing

Weight of Wet Sample+Cont.(gm):	153.59	154.66	154.36
Weight of Dry Sample+Cont.(gm):	131.77	132.72	132.27
Weight of Container(gm):	0.00	0.00	0.00
Vertical Rdg.(in): Initial	0.2644	0.2432	0.0000
Vertical Rdg.(in): Final	0.2706	0.2541	-0.0264

After Shearing

Weight of Wet Sample+Cont.(gm):	193.09	193.24	191.03
Weight of Dry Sample+Cont.(gm):	170.96	171.37	170.13
Weight of Container(gm):	39.19	38.65	37.86
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**P-4**
Sample No.	**R-1**
Depth (ft)	**5**

Sample Type:

Ring

Soil Identification:
Dark olive gray clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.358	■ 2.009	▲ 2.955
Shear Stress @ End of Test (ksf)	○ 1.050	□ 1.735	△ 2.952
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.56	16.53	16.70
Dry Density (pcf)	109.6	110.4	110.0
Saturation (%)	83.1	84.7	84.7
Soil Height Before Shearing (in.)	0.9938	0.9891	0.9736
Final Moisture Content (%)	16.8	16.5	15.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 10695.003
Lowe Enterprises/El Toro 100-Acre Redevelopment

12-14

Boring No.	TP-1	TP-2	TP-3	TP-4				
Sample No.	R-1	R-1	R-1	R-1				
Depth (ft.)	2.5	2.0	2.0	3.0				
Sample Type	Ring	Ring	Ring	Ring				
Soil Identification	Dark brown clayey sand (SC)	Dark olive lean clay with sand (CL)s	Dark yellowish brown clayey sand (SC)	Dark brown lean clay (CL)				
Pocket Penetrometer (tons/ft^2)	2.75	2.00	2.75	2.50				
Weight Soil + Rings / Tube (g)	789.9	780.4	579.6	729.5				
Weight of Rings / Tube (g)	177.6	177.6	133.2	177.6				
Average Length (in.)	4.0	4.0	3.0	4.0				
Average Diameter (in.)	2.415	2.415	2.415	2.415				
Wet. Wt. of Soil + Cont. (g)	318.6	413.1	701.4	232.6				
Dry Wt. of Soil + Cont. (g)	276.9	366.2	646.9	204.1				
Weight of Container (g)	38.0	38.3	238.7	38.6				
Container No.								
Wet Density	127.3	125.3	123.8	114.7				
Moisture Content (%)	**17**	**14**	**13**	**17**				
Dry Density (pcf)	**108**	**110**	**109**	**98**				
Degree of Saturation (%)	84.9	71.9	66.3	64.4				

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: Lowe/El Toro 100 Acre Redevelopment/ Bldg 317

Project No.: 10695.002

Tested By: S. Felter Date: 07/01/14

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	Lowe/El Toro 100 Acre Redevelopment/ Bldg 317	Tested By:	O. Figueroa	Date:	07/10/14
Project No.:	10695.002	Input By:	J. Ward	Date:	07/15/14
Boring No.:	TP-3	Depth (ft.):	1-3		
Sample No.:	BB-1				
Soil Identification:	Dark yellowish brown clayey sand (SC)				

Preparation Method:		
	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	
#3/8	
#4	8.1

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.03320

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3824.0	3930.0	3944.0			
Weight of Mold (g)	1843.0	1843.0	1843.0			
Net Weight of Soil (g)	1981.0	2087.0	2101.0			
Wet Weight of Soil + Cont. (g)	414.50	410.70	368.20			
Dry Weight of Soil + Cont. (g)	394.10	382.80	337.10			
Weight of Container (g)	54.60	54.50	54.10			
Moisture Content (%)	6.01	8.50	10.99			
Wet Density (pcf)	131.5	138.6	139.5			
Dry Density (pcf)	124.1	127.7	125.7			

Maximum Dry Density (pcf) 128.0

Corrected Dry Density (pcf) 130.5

Optimum Moisture Content (%) 9.0

Corrected Moisture Content (%) 8.5

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

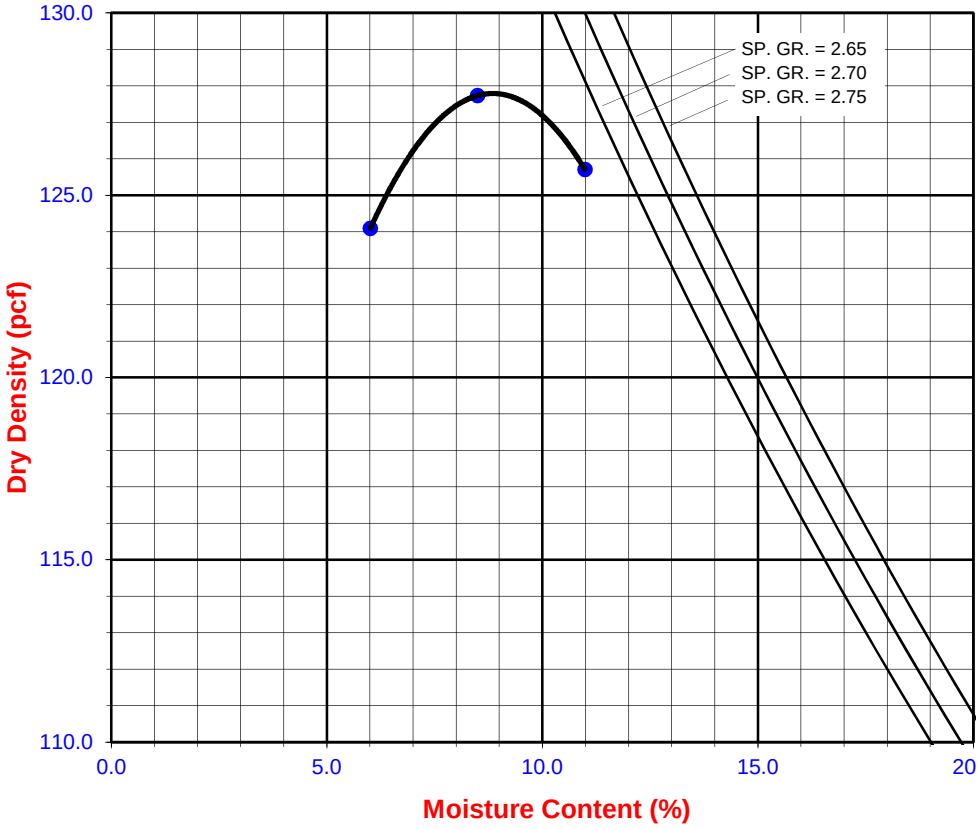
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	Lowe Enterprises/El Toro 100-Acre Redevelopment	Tested By:	A. Santos	Date:	12/29/14
Project No. :	10695.003	Input By:	J. Ward	Date:	12/30/14
Boring No.:	P-4	Checked By:	J. Ward		
Sample No.:	R-1	Depth (ft.)	5.0		
Soil Identification:	Dark olive gray clayey sand (SC)				

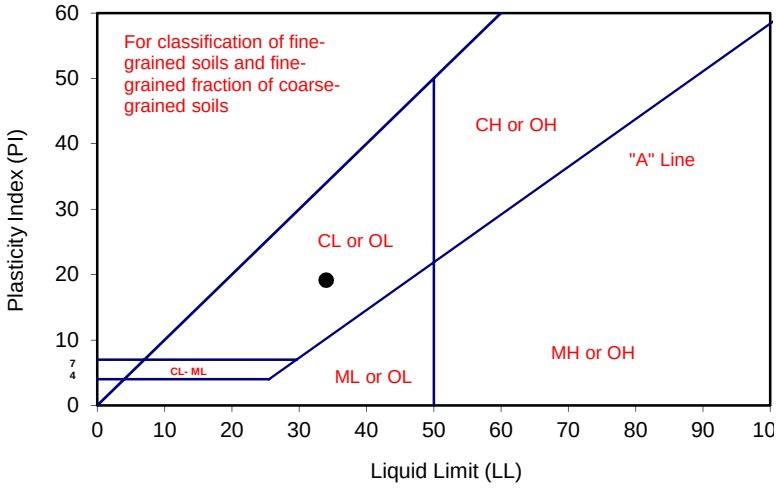
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	26	22	
Wet Wt. of Soil + Cont. (g)	10.80	9.57	25.96	21.76	27.97	
Dry Wt. of Soil + Cont. (g)	9.53	8.48	19.88	16.50	21.02	
Wt. of Container (g)	1.05	1.08	1.12	1.05	1.12	
Moisture Content (%) [Wn]	14.98	14.73	32.41	34.05	34.92	

Liquid Limit	**34**
Plastic Limit	**15**
Plasticity Index	**19**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



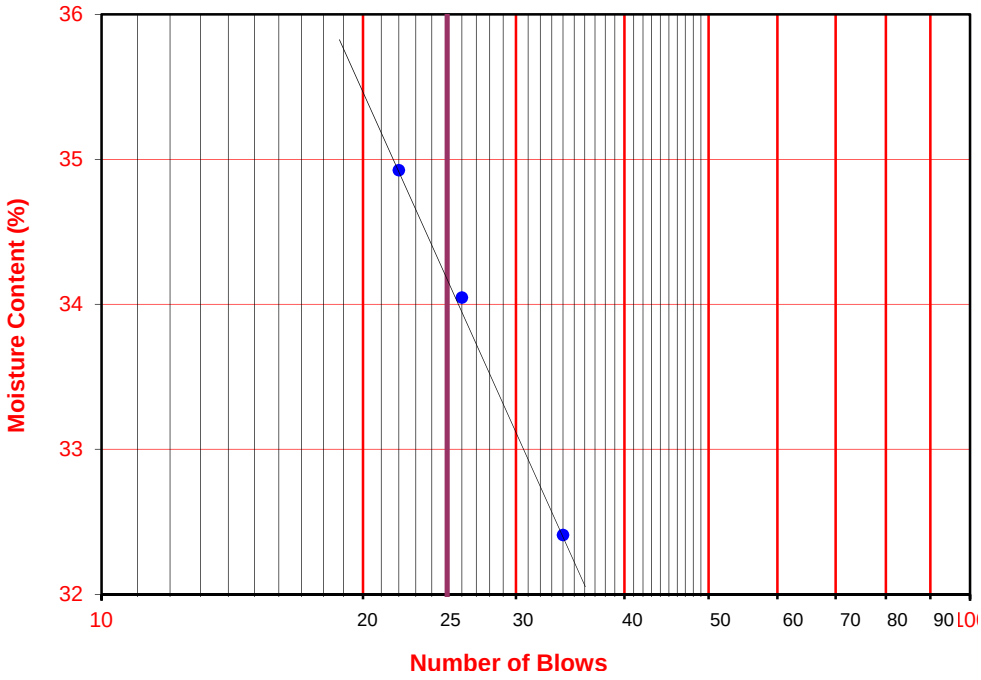
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	Lowe/El Toro 100 Acre Redevelopment/Bldg 317	Tested By:	A. Santos	Date:	07/10/14
Project No. :	10695.002	Input By:	J. Ward	Date:	07/15/14
Boring No.:	TP-2	Checked By:	J. Ward		
Sample No.:	R-1	Depth (ft.)	2.0		
Soil Identification:	Dark olive lean clay with sand (CL)s				

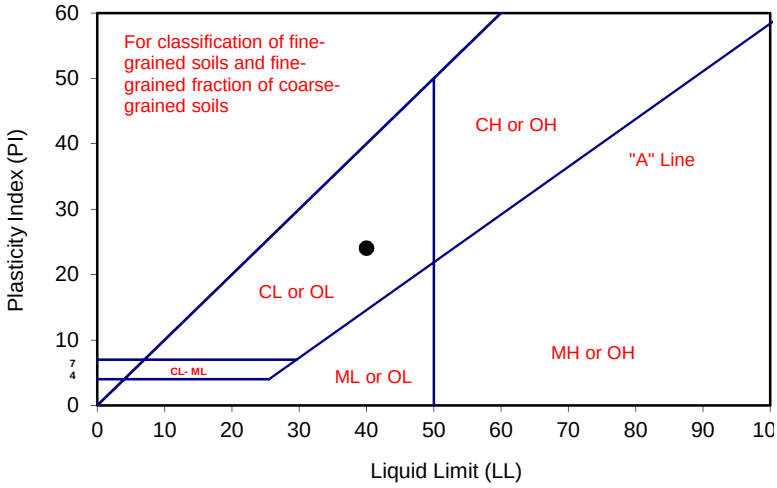
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	28	23	
Wet Wt. of Soil + Cont. (g)	9.77	9.51	23.28	22.78	24.94	
Dry Wt. of Soil + Cont. (g)	8.57	8.35	17.27	16.71	18.10	
Wt. of Container (g)	1.07	1.05	1.06	1.02	1.05	
Moisture Content (%) [Wn]	16.00	15.89	37.08	38.69	40.12	

Liquid Limit	**40**
Plastic Limit	**16**
Plasticity Index	**24**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 14.6

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



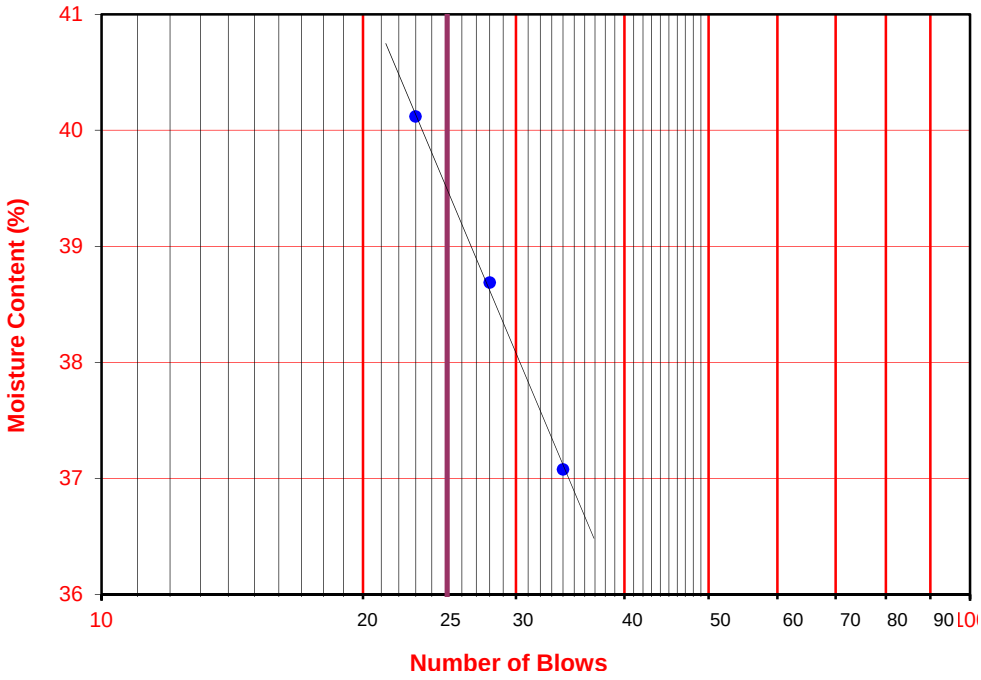
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	2nd Harvest	Tested By:	RAL	Date:	01/03/07
Project No. :	012095-001	Checked By:	LF	Date:	01/17/07
Boring No.:	B-1	Depth (ft.)	2-3		
Sample No. :	B-1				
Soil Identification:	Dark brown clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0505
Wt. Comp. Soil + Mold	(g)	607.50	437.50
Wt. of Mold	(g)	206.70	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	826.90	644.20
Dry Wt. of Soil + Cont.	(g)	760.70	575.40
Wt. of Container	(g)	0.00	206.70
Moisture Content	(%)	8.70	18.66
Wet Density	(pcf)	120.9	125.6
Dry Density	(pcf)	111.2	105.9
Void Ratio		0.516	0.592
Total Porosity		0.340	0.372
Pore Volume	(cc)	70.4	80.9
Degree of Saturation (%) [S_{meas}]		**45.6**	85.1

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
01/03/07	9:32	1.0	0	0.1830
01/03/07	9:42	1.0	10	0.1810
Add Distilled Water to the Specimen				
01/03/07	10:04	1.0	22	0.2230
01/04/07	7:44	1.0	1322	0.2335
01/04/07	8:00	1.0	1338	0.2335

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000		52.5
Expansion Index ($EI)_{50}$ = EI_{meas} - (50 -S_{meas})x((65+EI_{meas}) / (220-S_{meas}))		**50**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Heritage Fields	Tested By:	GEB	Date:	02/15/07
Project No. :	011783-004	Checked By:	LF	Date:	03/01/07
Boring No.:	PAZ19-2	Depth (ft.)	0-5		
Sample No. :	BB1				
Soil Identification:	Yellowish brown clayey / silty sand (SC/SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0235
Wt. Comp. Soil + Mold	(g)	594.40	442.50
Wt. of Mold	(g)	190.40	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	820.50	632.90
Dry Wt. of Soil + Cont.	(g)	752.70	561.00
Wt. of Container	(g)	0.00	190.40
Moisture Content	(%)	9.01	19.40
Wet Density	(pcf)	121.9	130.4
Dry Density	(pcf)	111.8	109.2
Void Ratio		0.508	0.543
Total Porosity		0.337	0.352
Pore Volume	(cc)	69.7	74.6
Degree of Saturation (%) [S_{meas}]		**47.9**	96.4

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
02/15/07	9:48	1.0	0	0.1325
02/15/07	9:58	1.0	10	0.1320
Add Distilled Water to the Specimen				
02/15/07	10:00	1.0	2	0.1450
02/16/07	8:00	1.0	1322	0.1560
02/16/07	8:29	1.0	1351	0.1560

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	24.0
Expansion Index ($EI)_{50}$ = EI_{meas} - (50 -S_{meas})x((65+EI_{meas}) / (220-S_{meas}))	**23**

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Heritage Fields	Tested By:	GEB	Date:	02/20/07
Project No. :	011783-004	Checked By:	LF	Date:	03/01/07
Boring No.:	PAZ19-8	Depth (ft.)	0-5		
Sample No. :	BB1				
Soil Identification:	Light olive brown clayey / silty sand (SC/SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0200
Wt. Comp. Soil + Mold	(g)	574.50	444.20
Wt. of Mold	(g)	164.00	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	809.00	608.20
Dry Wt. of Soil + Cont.	(g)	738.80	538.90
Wt. of Container	(g)	0.00	164.00
Moisture Content	(%)	9.50	18.48
Wet Density	(pcf)	123.8	131.4
Dry Density	(pcf)	113.1	110.9
Void Ratio		0.491	0.521
Total Porosity		0.329	0.342
Pore Volume	(cc)	68.1	72.3
Degree of Saturation (%) [S_{meas}]		**52.3**	95.9

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
02/20/07	8:17	1.0	0	0.2290
02/20/07	8:27	1.0	10	0.2280
Add Distilled Water to the Specimen				
02/20/07	8:56	1.0	29	0.2460
02/21/07	7:56	1.0	1409	0.2490
02/21/07	9:05	1.0	1478	0.2490

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	21.0
Expansion Index ($EI)_{50}$ = EI_{meas} - (50 -S_{meas})x((65+EI_{meas}) / (220-S_{meas}))	**22**

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Life Long Learning District (LLLD)	Tested By:	G. Berdy	Date:	12/08/07
Project No. :	011783-016	Checked By:	LF	Date:	12/11/07
Boring No.:	TP-14	Depth (ft.)	8.0		
Sample No. :	BB-1				
Soil Identification:	Olive brown sandy lean clay s(CL) with caliche				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0570
Wt. Comp. Soil + Mold	(g)	565.10	422.30
Wt. of Mold	(g)	192.00	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	778.10	614.30
Dry Wt. of Soil + Cont.	(g)	701.00	528.10
Wt. of Container	(g)	0.00	192.00
Moisture Content	(%)	11.00	25.65
Wet Density	(pcf)	112.5	120.5
Dry Density	(pcf)	101.4	95.9
Void Ratio		0.663	0.758
Total Porosity		0.399	0.431
Pore Volume	(cc)	82.5	94.3
Degree of Saturation (%) [S_{meas}]		**44.8**	91.4

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
12/08/07	9:02	1.0	0	0.1335
12/08/07	9:12	1.0	10	0.1335
Add Distilled Water to the Specimen				
12/08/07	9:50	1.0	38	0.1835
12/10/07	7:00	1.0	2748	0.1905
12/10/07	8:30	1.0	2838	0.1905

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	57.0
Expansion Index ($EI)_{50}$ = EI_{meas} - (50 -S_{meas})x((65+EI_{meas}) / (220-S_{meas}))	**53**

Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: 2nd Harvest | Tested By : VJ | Date: 01/02/07

Project No. : 012095-001 | Data Input By: LF | Date: 01/09/07

Boring No.	B-1	B-4		
Sample No.	B-1	B-1		
Sample Depth (ft)	2-3	7-9		
Soil Identification:	SC	SC		
Wet Weight of Soil + Container (g)	200.91	230.41		
Dry Weight of Soil + Container (g)	188.34	216.44		
Weight of Container (g)	68.13	72.09		
Moisture Content (%)	10.46	9.68		
Weight of Soaked Soil (g)	100.34	100.48		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	9	10		
Crucible No.	29	30		
Furnace Temperature (°C)	830	830		
Time In / Time Out	7:30 / 8:15	7:30 / 8:15		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	20.1328	17.6234		
Wt. of Crucible (g)	20.1290	17.6204		
Wt. of Residue (g) (A)	0.0038	0.0030		
PPM of Sulfate (A) x 41150	156.37	123.45		
PPM of Sulfate, Dry Weight Basis	**175**	**137**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	1.1	0.9		
PPM of Chloride (C -0.2) * 100 * 30 / B	90	70		
PPM of Chloride, Dry Wt. Basis	**101**	**78**		

pH TEST, DOT California Test 532/643

pH Value	**7.58**	**7.66**		
Temperature °C	19.6	19.4		

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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

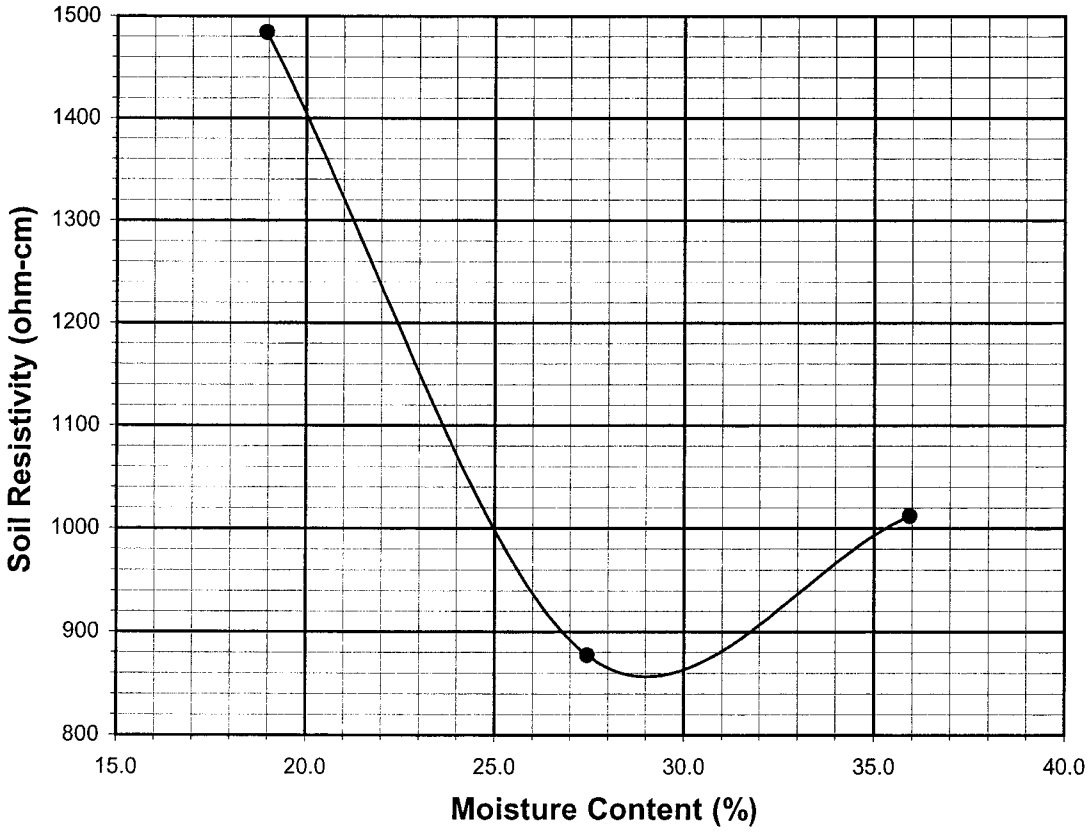
Project Name: 2nd Harvest
Project No. : 012095-001
Boring No.: B-1
Sample No. : B-1
Soil Identification: SC

Tested By : VJ Date: 01/02/07
Data Input By: LF Date: 01/09/07
Depth (ft.) : 2-3

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	18.95	220	1484
2	200	27.45	130	877
3	300	35.95	150	1012
4				
5				

Moisture Content (%) (MCi)	10.46
Wet Wt. of Soil + Cont. (g)	200.91
Dry Wt. of Soil + Cont. (g)	188.34
Wt. of Container (g)	68.13
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
860	**29.0**	**175**	**101**	**7.58**	**19.6**



Leighton

SOIL RESISTIVITY TEST

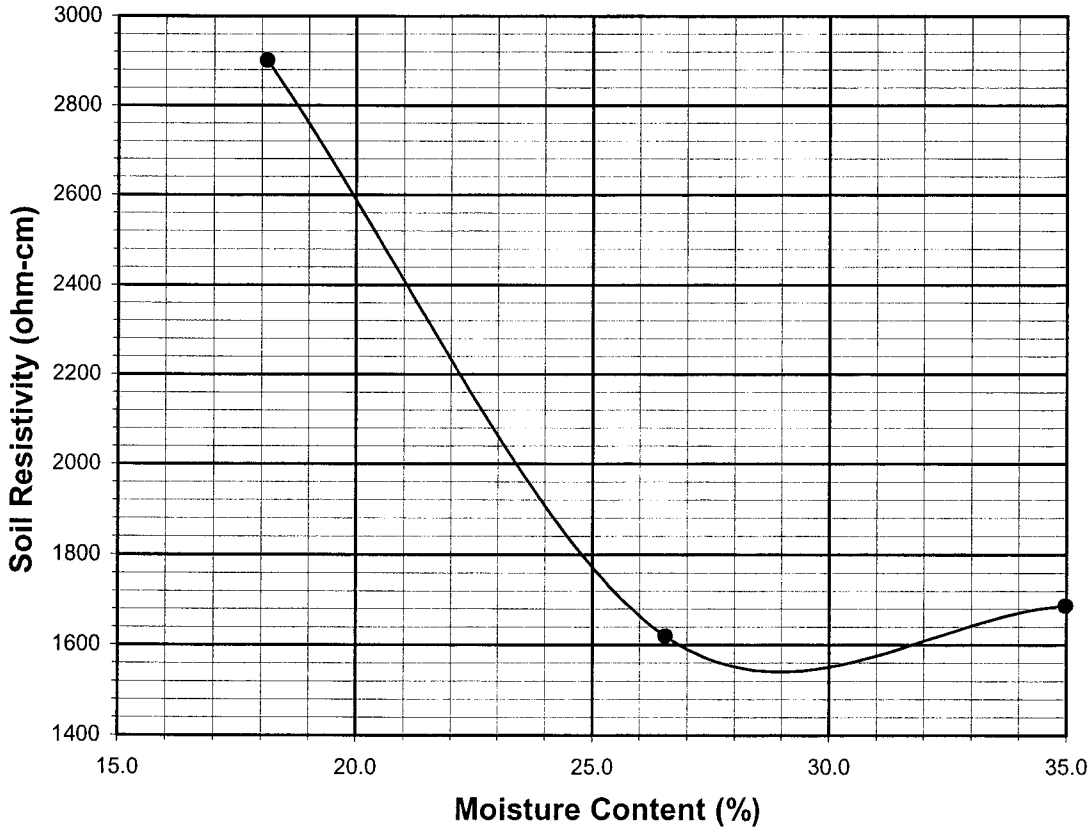
DOT CA TEST 532 / 643

Project Name:	2nd Harvest	Tested By :	VJ	Date:	01/02/07
Project No. :	012095-001	Data Input By:	LF	Date:	01/09/07
Boring No.:	B-4	Depth (ft.) :	7-9		
Sample No. :	B-1				
Soil Identification:	SC				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	18.11	430	2901
2	200	26.55	240	1619
3	300	34.99	250	1687
4				
5				

Moisture Content (%) (MCi)	9.68
Wet Wt. of Soil + Cont. (g)	230.41
Dry Wt. of Soil + Cont. (g)	216.44
Wt. of Container (g)	72.09
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1540	**29.0**	**137**	**78**	**7.66**	**19.4**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: Heritage Fields | Tested By : VJ | Date: 01/28/03

Project No. : 011783-004 | Data Input By: LF | Date: 02/06/03

Boring No.	PAZ19-1	PAZ19-2	PAZ19-5	
Sample No.	BB1	BB1	BB1	
Sample Depth (ft)	0-5	0-5	0-5	
Soil Identification:	SC	SC/SC-SM	SC	
Wet Weight of Soil + Container (g)	189.92	172.38	189.06	
Dry Weight of Soil + Container (g)	178.38	160.53	170.93	
Weight of Container (g)	55.18	56.25	60.99	
Moisture Content (%)	9.37	11.36	16.49	
Weight of Soaked Soil (g)	100.42	100.37	100.29	

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	18	19	20	
Crucible No.	27	28	29	
Furnace Temperature (°C)	840	840	840	
Time In / Time Out	8:00 / 8:45	8:00 / 8:45	8:00 / 8:45	
Duration of Combustion (min)	45	45	45	
Wt. of Crucible + Residue (g)	17.6344	18.9690	20.1368	
Wt. of Crucible (g)	17.6320	18.9662	20.1295	
Wt. of Residue (g) (A)	0.0024	0.0028	0.0073	
PPM of Sulfate (A) x 41150	98.76	115.22	300.40	
PPM of Sulfate, Dry Weight Basis	**109**	**130**	**360**	

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30	
ml of AgNO3 Soln. Used in Titration (C)	0.8	0.9	1.5	
PPM of Chloride (C -0.2) * 100 * 30 / B	60	70	130	
PPM of Chloride, Dry Wt. Basis	**66**	**79**	**156**	

pH TEST, DOT California Test 532/643

pH Value	**7.47**	**7.46**	**6.96**	
Temperature °C	21.3	21.5	20.8	

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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

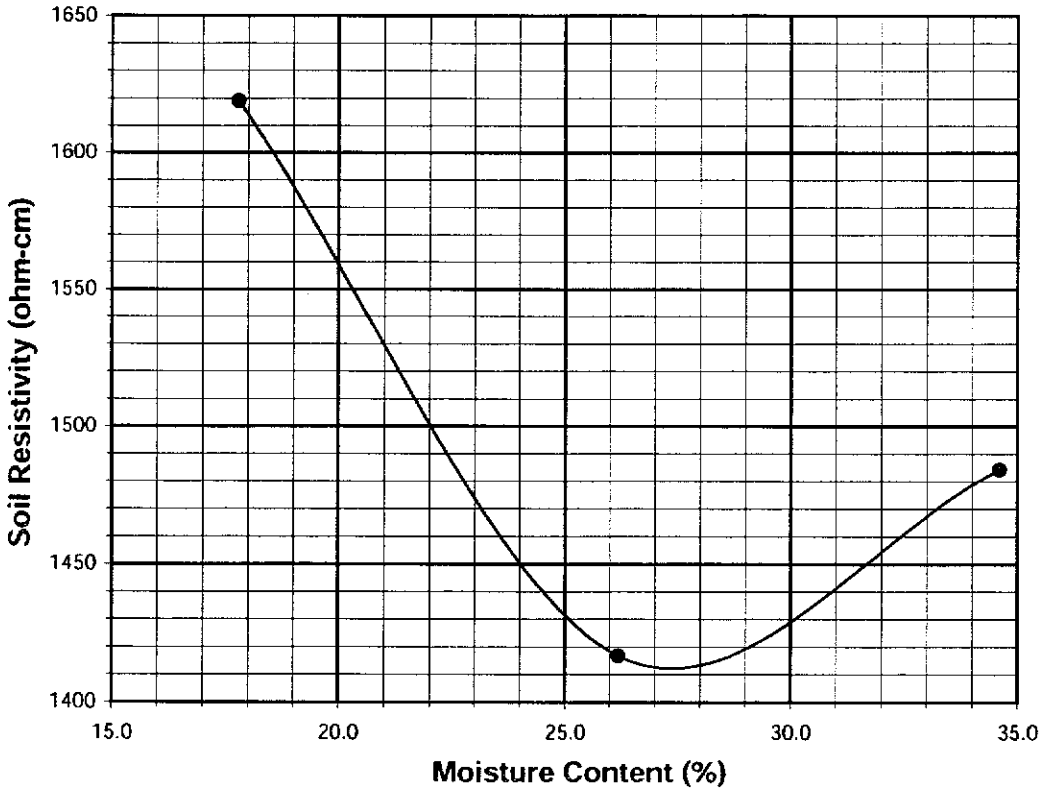
Project Name: Heritage Fields
Project No. : 011783-004
Boring No.: PAZ19-1
Sample No. : BB1
Soil Identification: SC

Tested By : VJ Date: 01/28/03
Data Input By: LF Date: 02/06/03
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	17.78	240	1619
2	200	26.19	210	1417
3	300	34.61	220	1484
4				
5				

Moisture Content (%) (MCi)	9.37
Wet Wt. of Soil + Cont. (g)	189.92
Dry Wt. of Soil + Cont. (g)	178.38
Wt. of Container (g)	55.18
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1412	**27.2**	**109**	**66**	**7.47**	**21.3**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

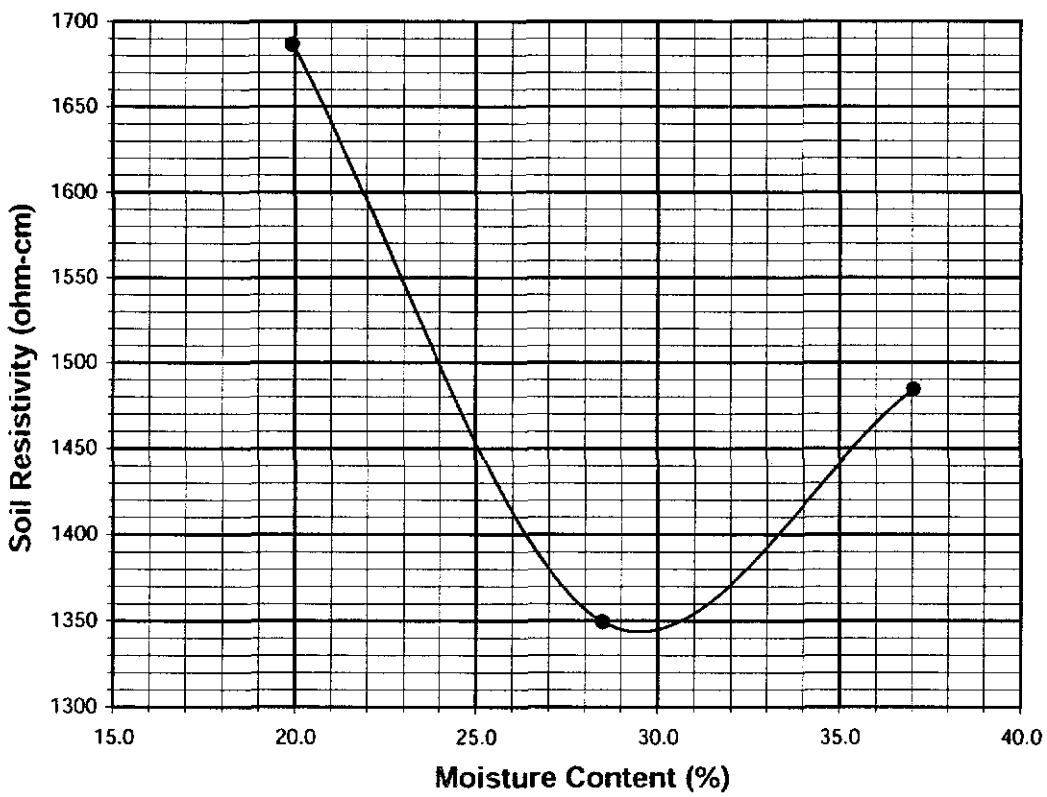
Project Name: Heritage Fields
Project No. : 011783-004
Boring No.: PAZ19-2
Sample No. : BB1
Soil Identification: SC/SC-SM

Tested By : VJ Date: 01/28/03
Data Input By: LF Date: 02/06/03
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	19.93	250	1687
2	200	28.50	200	1349
3	300	37.06	220	1484
4				
5				

Moisture Content (%) (MCi)	11.36
Wet Wt. of Soil + Cont. (g)	172.38
Dry Wt. of Soil + Cont. (g)	160.53
Wt. of Container (g)	56.25
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1343	**29.5**	**130**	**79**	**7.46**	**21.5**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

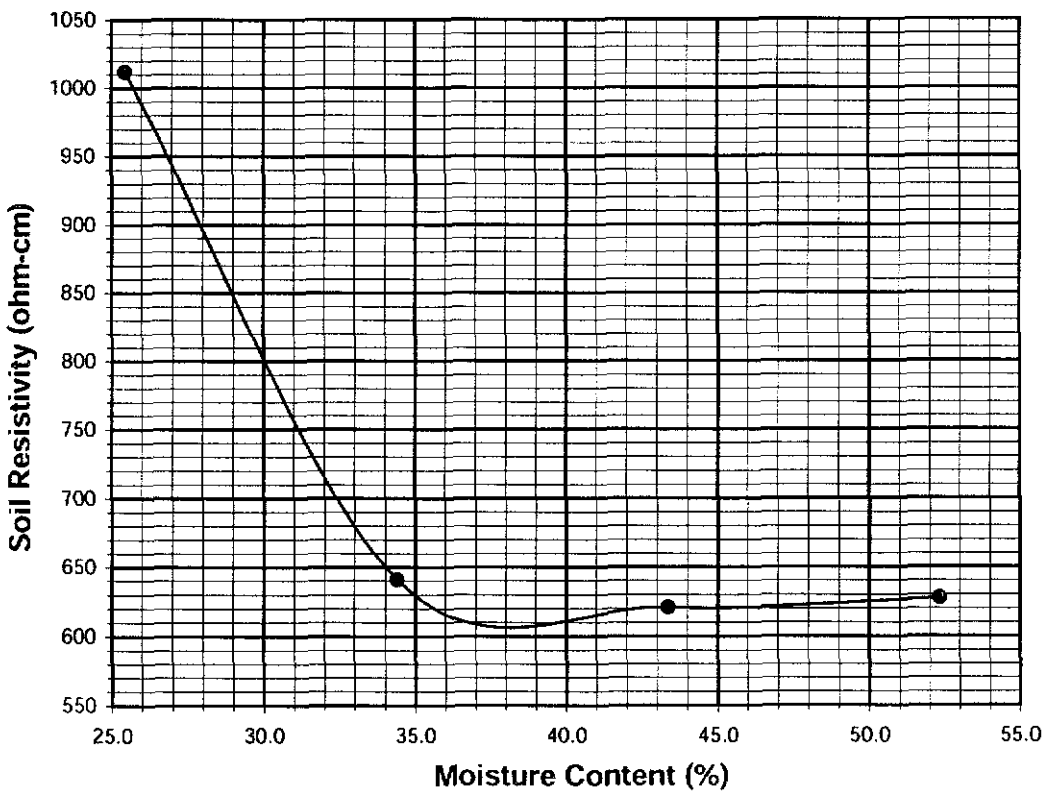
Project Name: Heritage Fields
Project No. : 011783-004
Boring No.: PAZ19-5
Sample No. : BB1
Soil Identification: SC

Tested By : VJ Date: 01/28/03
Data Input By: LF Date: 02/06/03
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	25.45	150	1012
2	200	34.41	95	641
3	300	43.37	92	621
4	400	52.33	93	627
5				

Moisture Content (%) (MCi)	16.49
Wet Wt. of Soil + Cont. (g)	189.06
Dry Wt. of Soil + Cont. (g)	170.93
Wt. of Container (g)	60.99
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
605	**38.0**	**360**	**156**	**6.96**	**20.8**

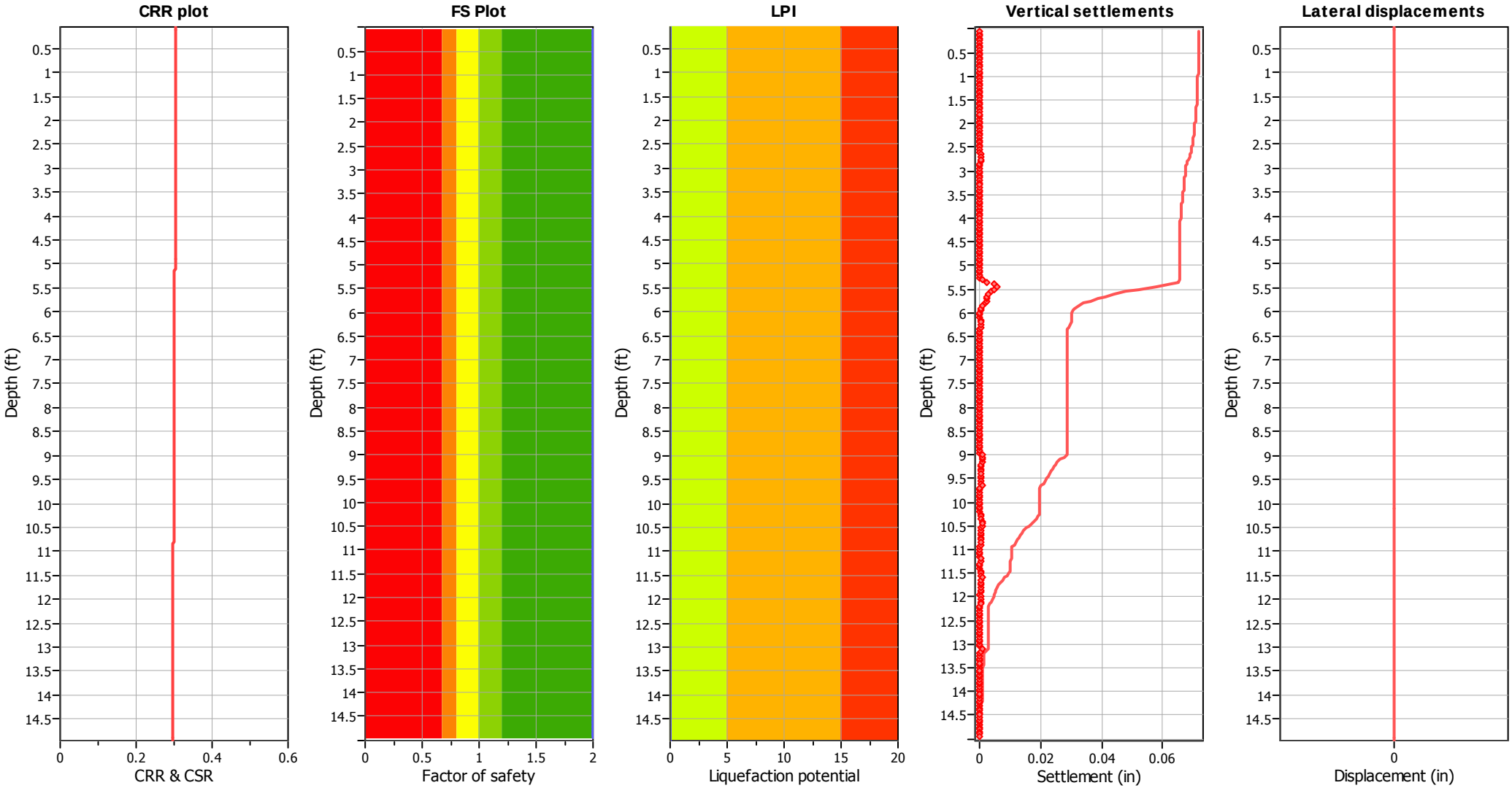


APPENDIX D

LIQUEFACTION AND SEISMICALLY-INDUCED SETTLEMENT

Leighton

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

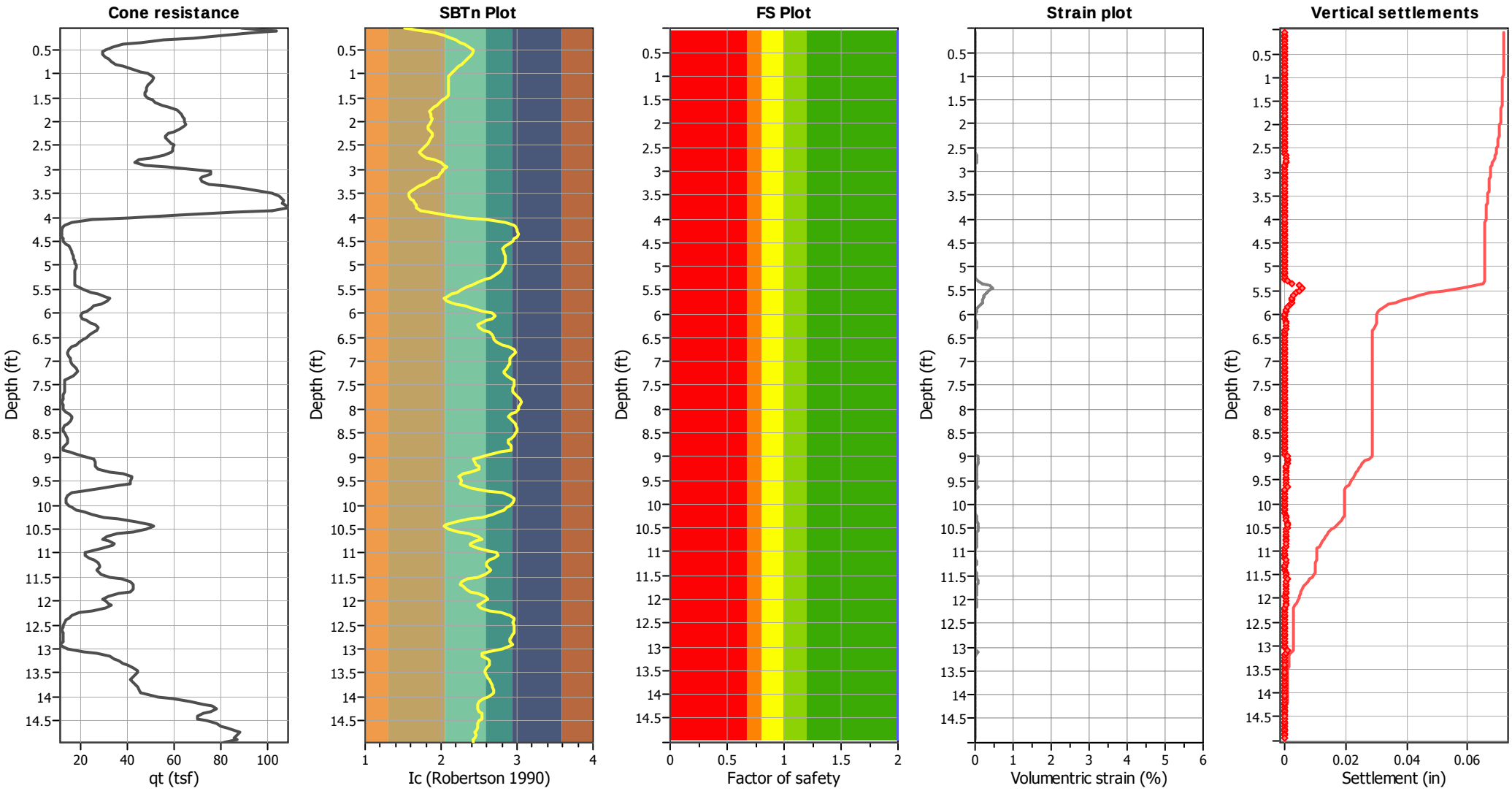
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

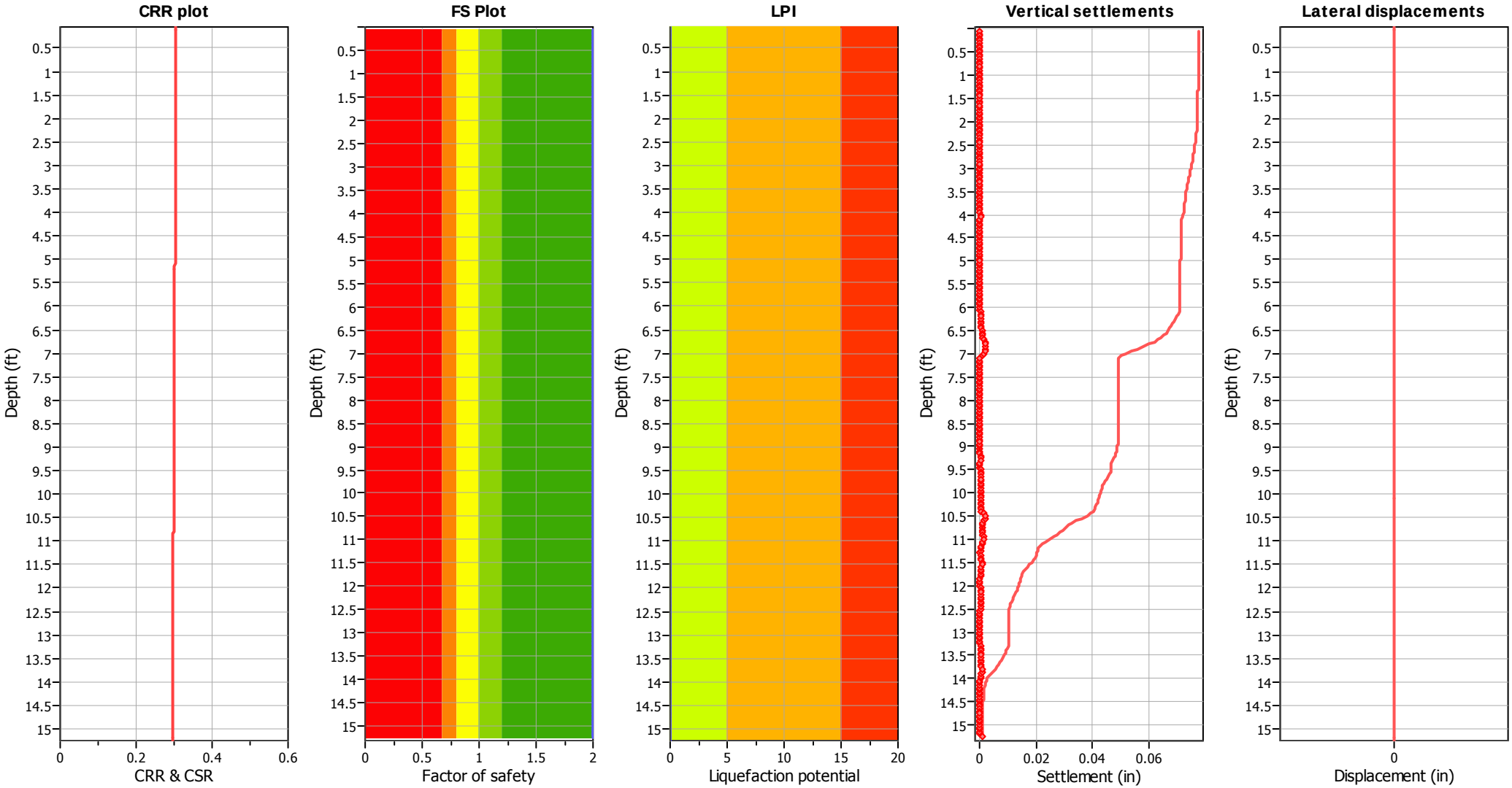
Estimation of post-earthquake settlements



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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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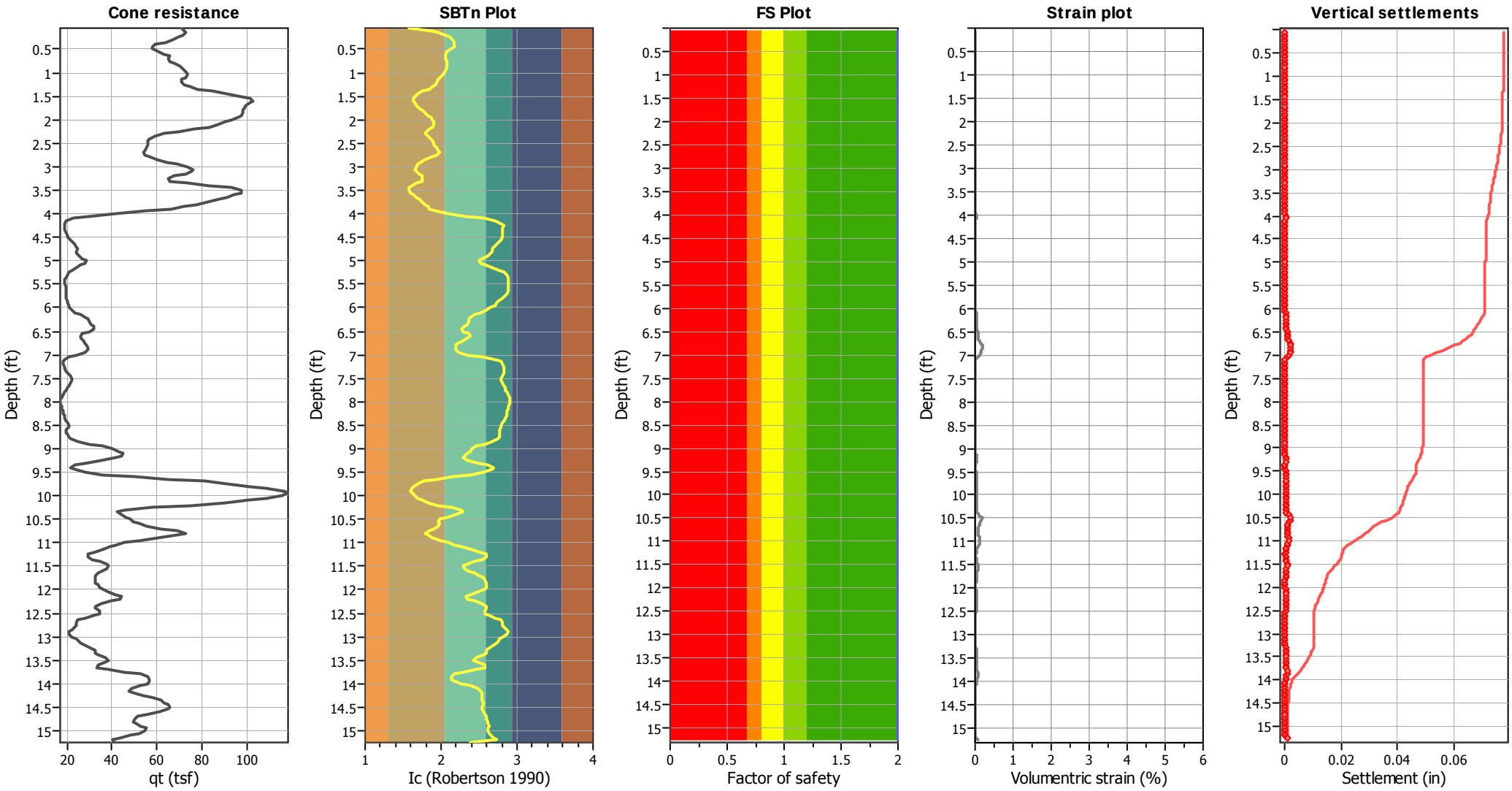
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Estimation of post-earthquake settlements



Abbreviations

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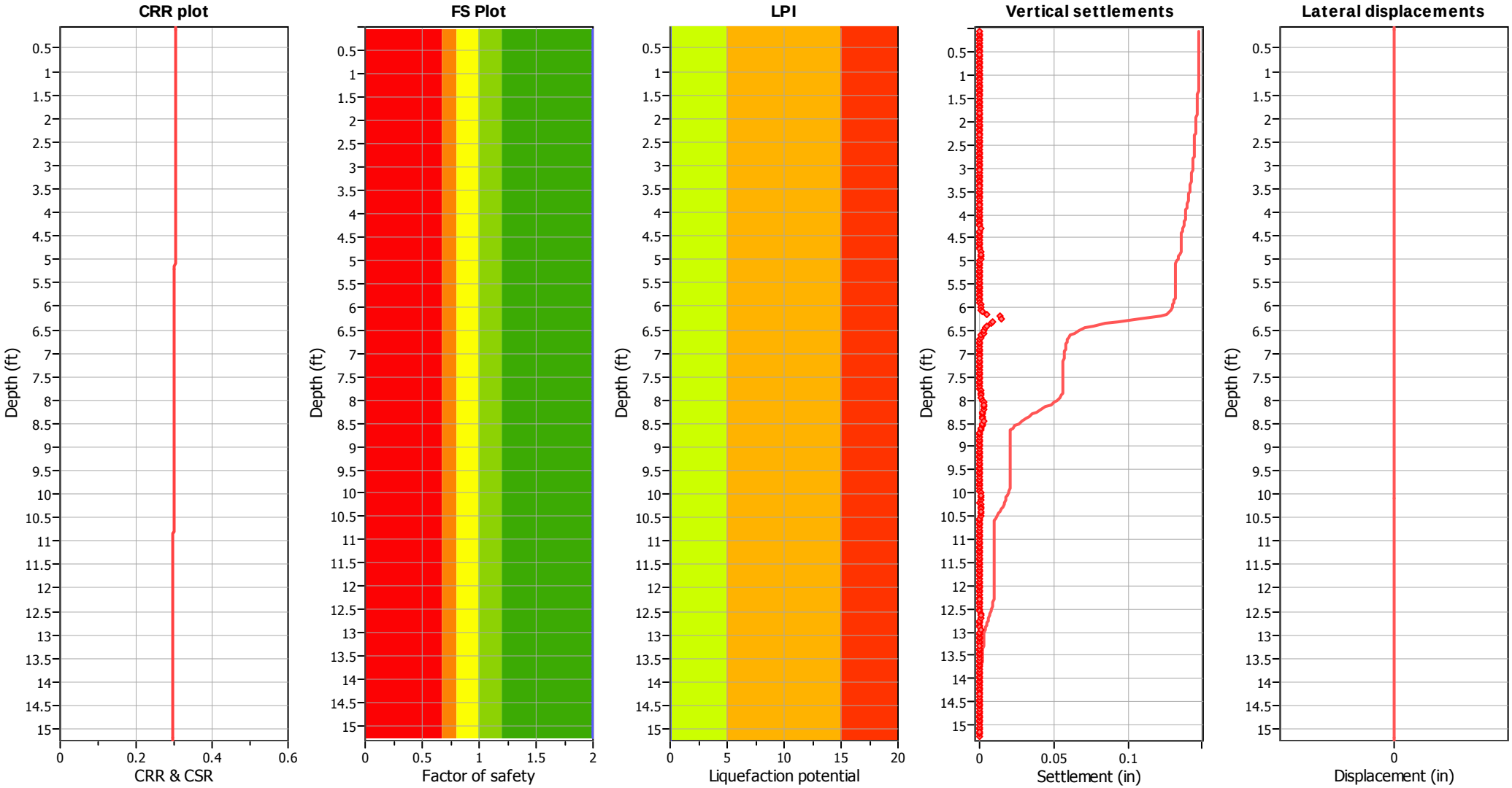
Volumentric strain:	Post-liquefaction volumentric strain

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

- Very high risk
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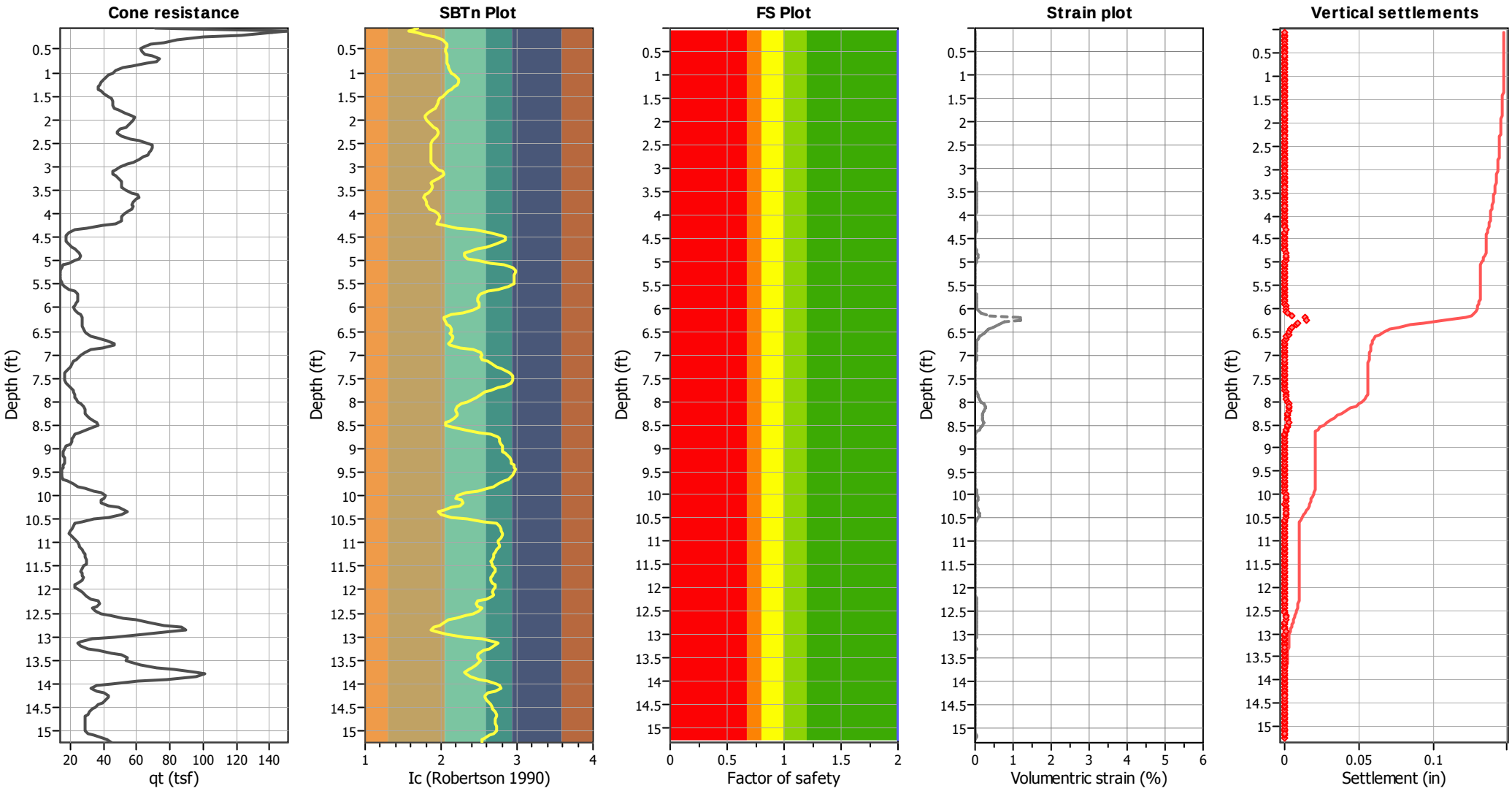
Estimation of post-earthquake settlements



Abbreviations

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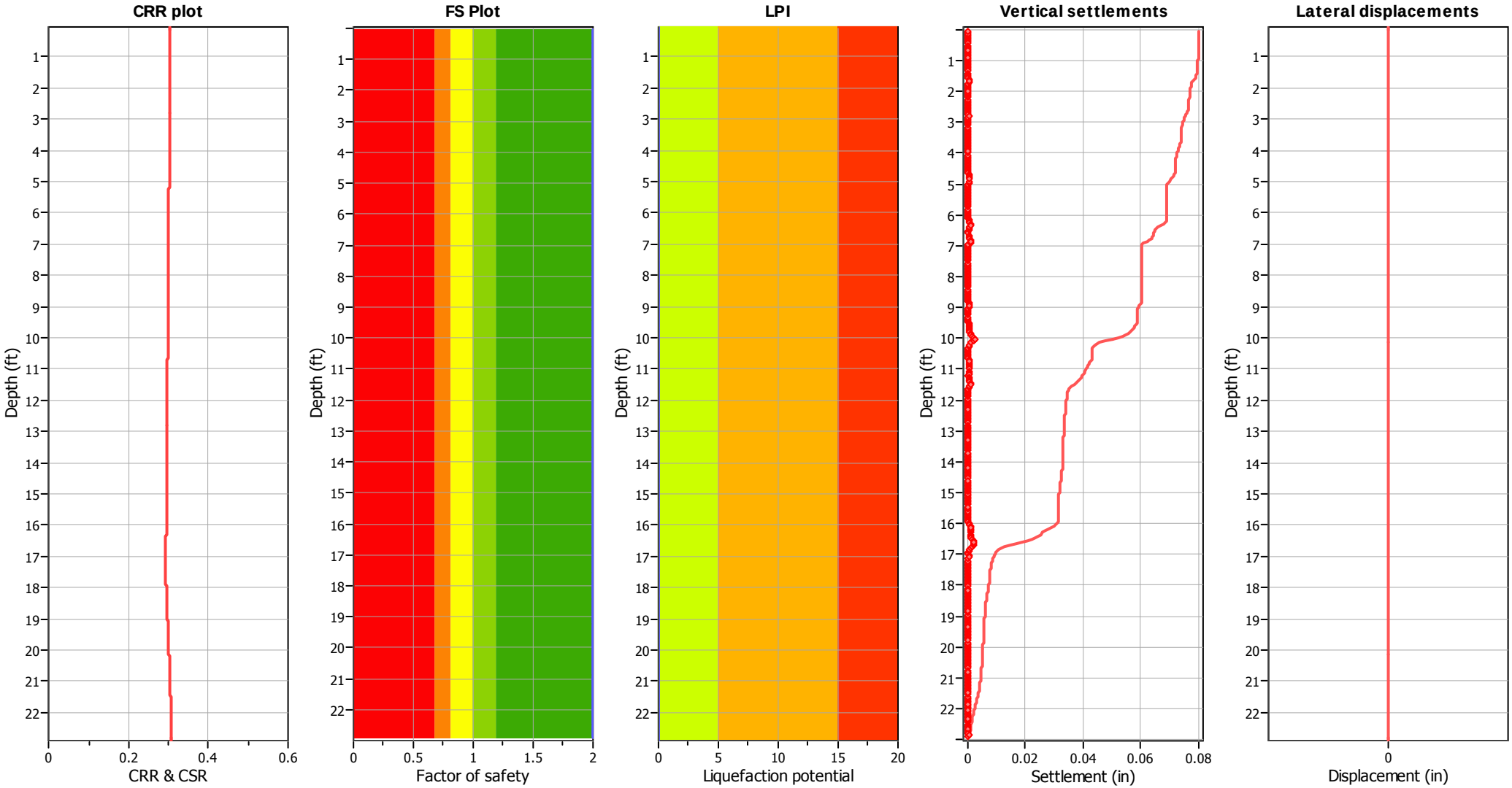
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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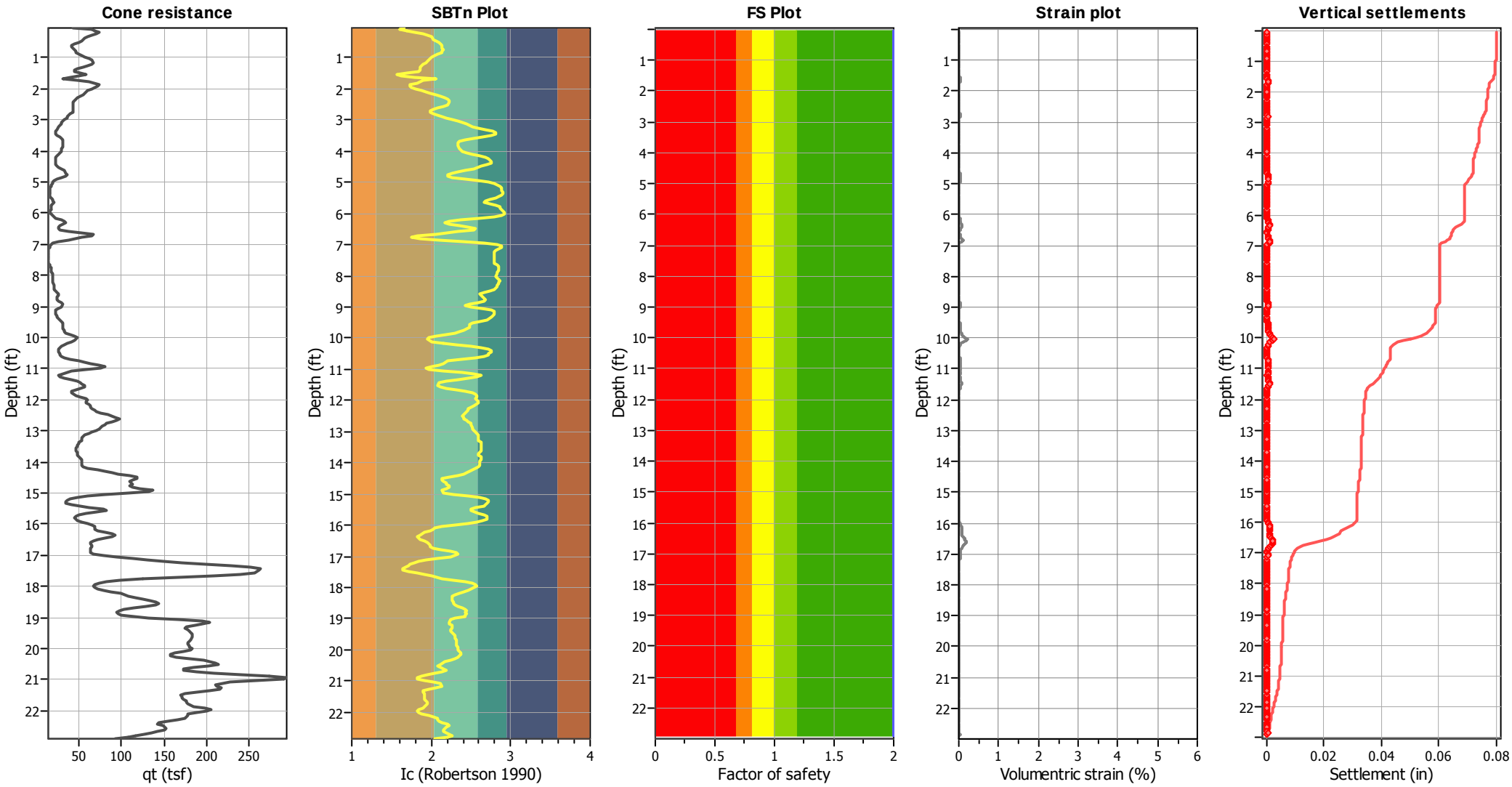
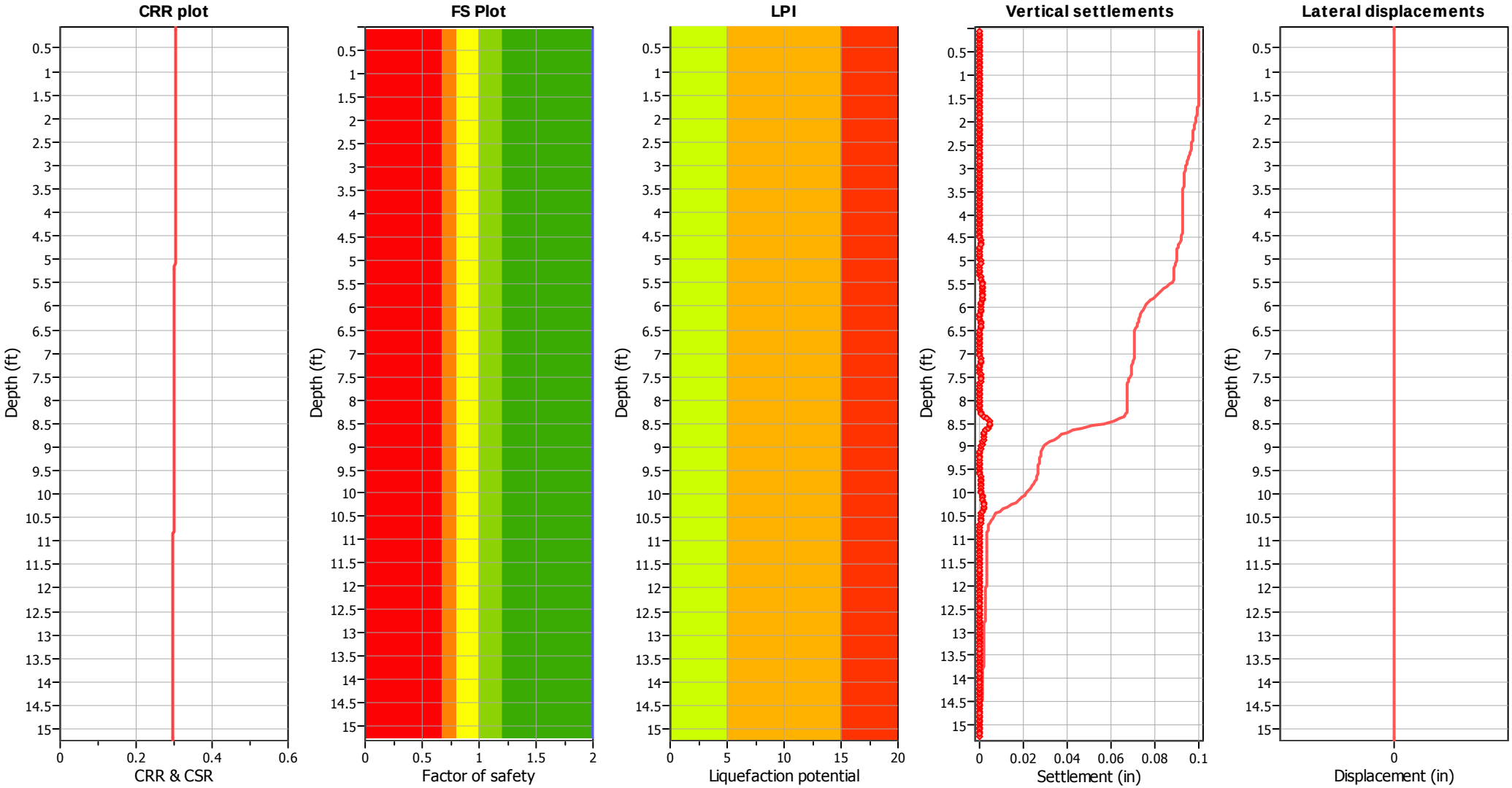
Estimation of post-earthquake settlements



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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

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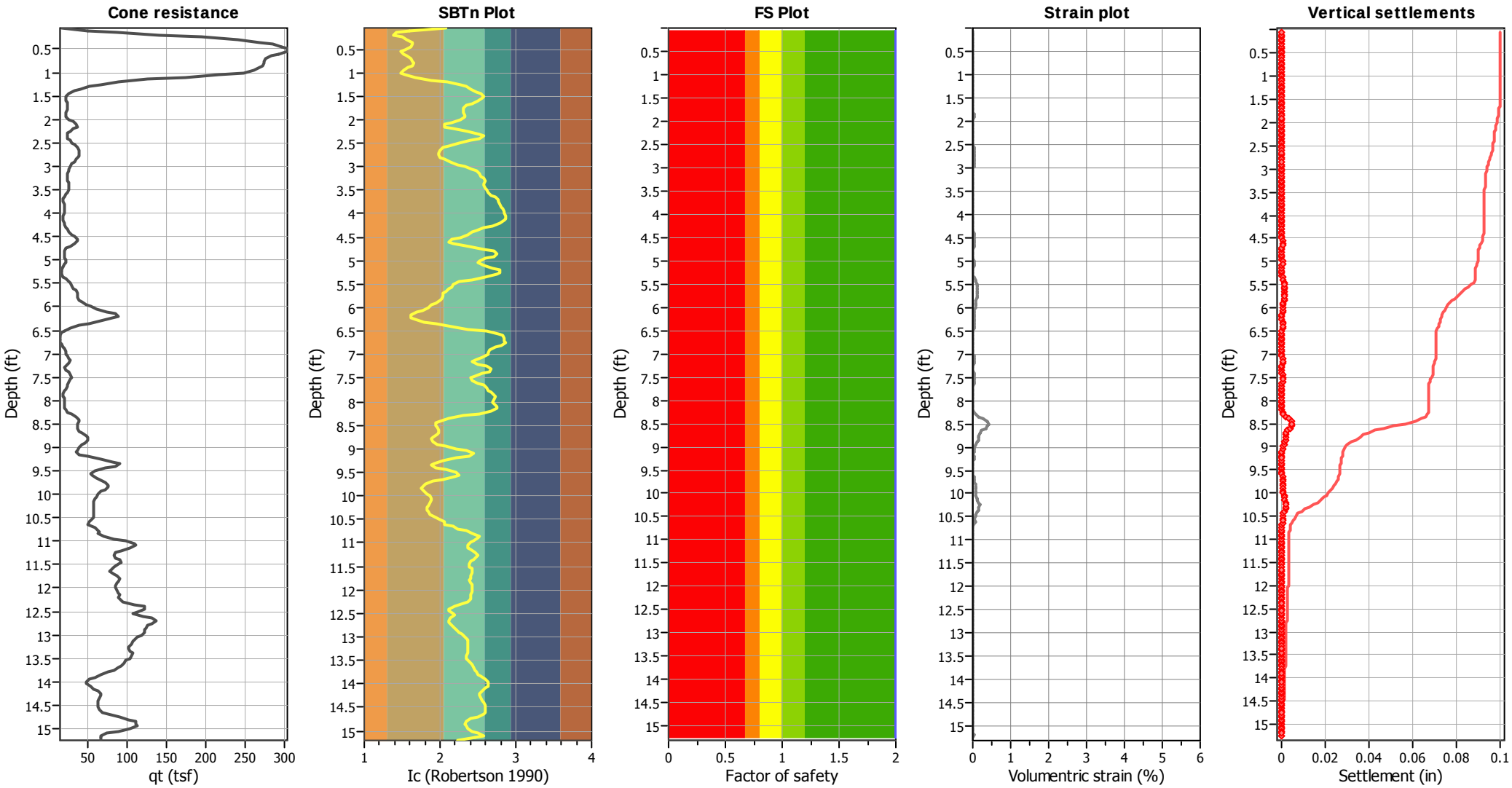
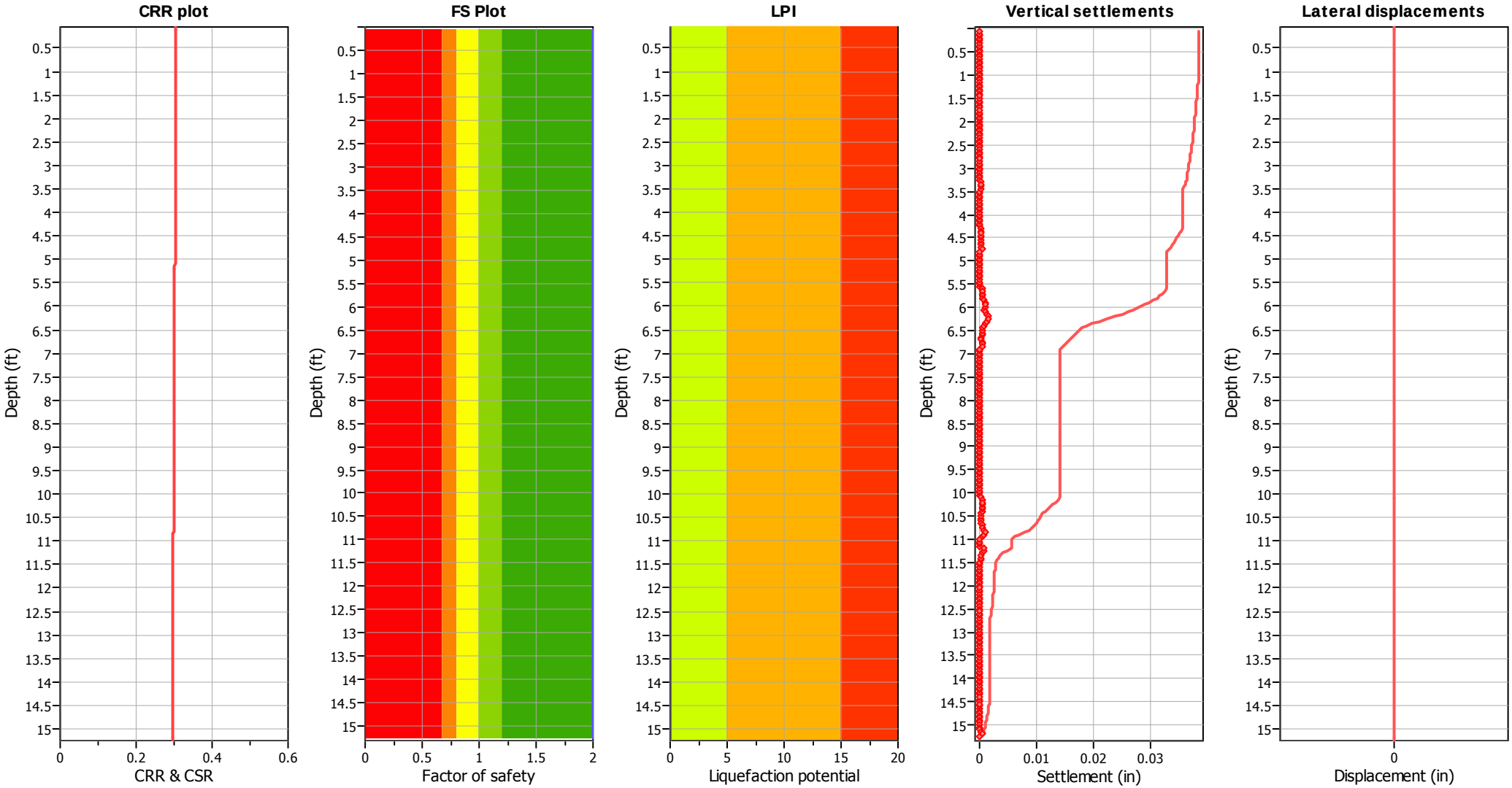
Estimation of post-earthquake settlements



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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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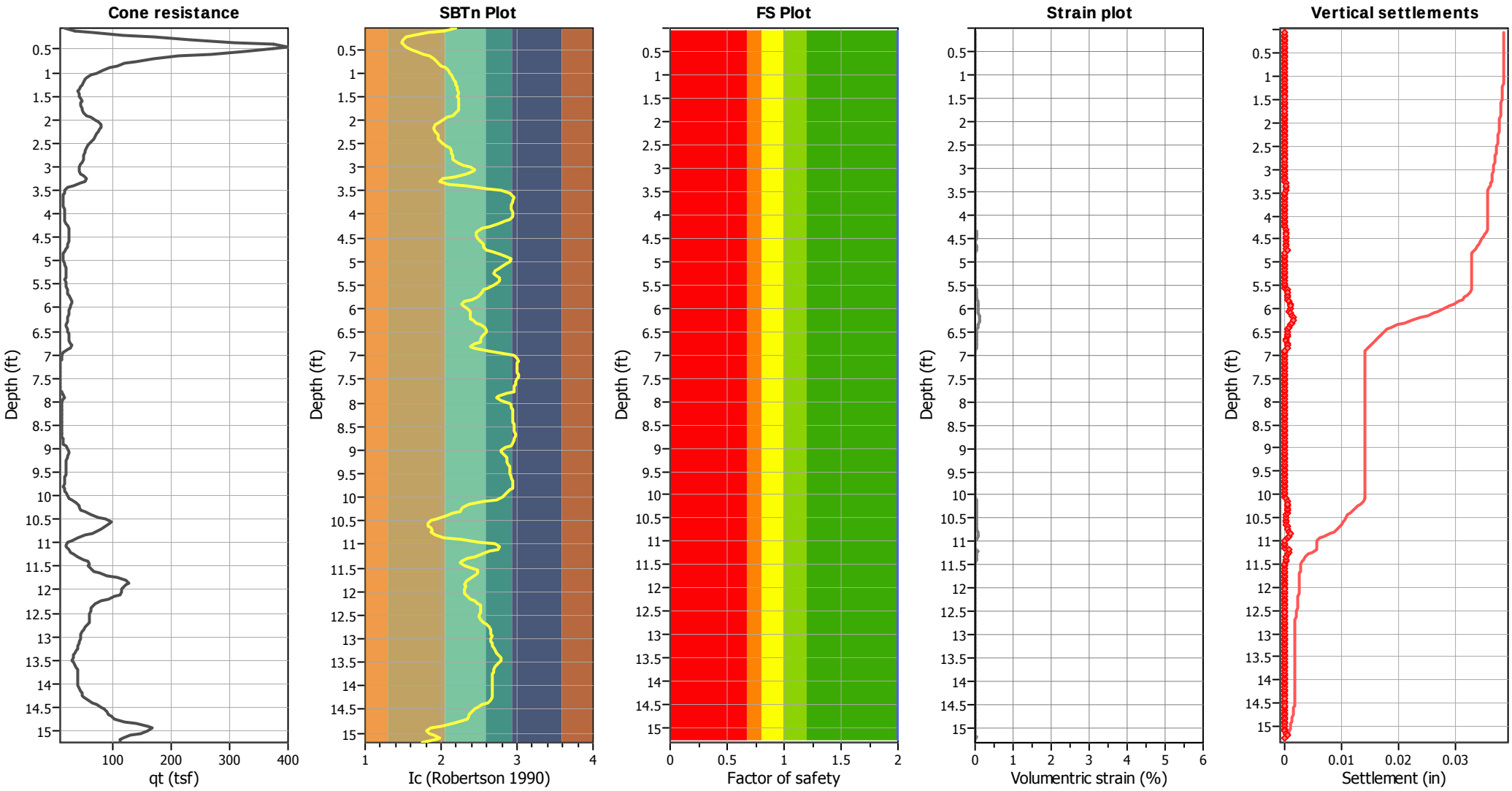
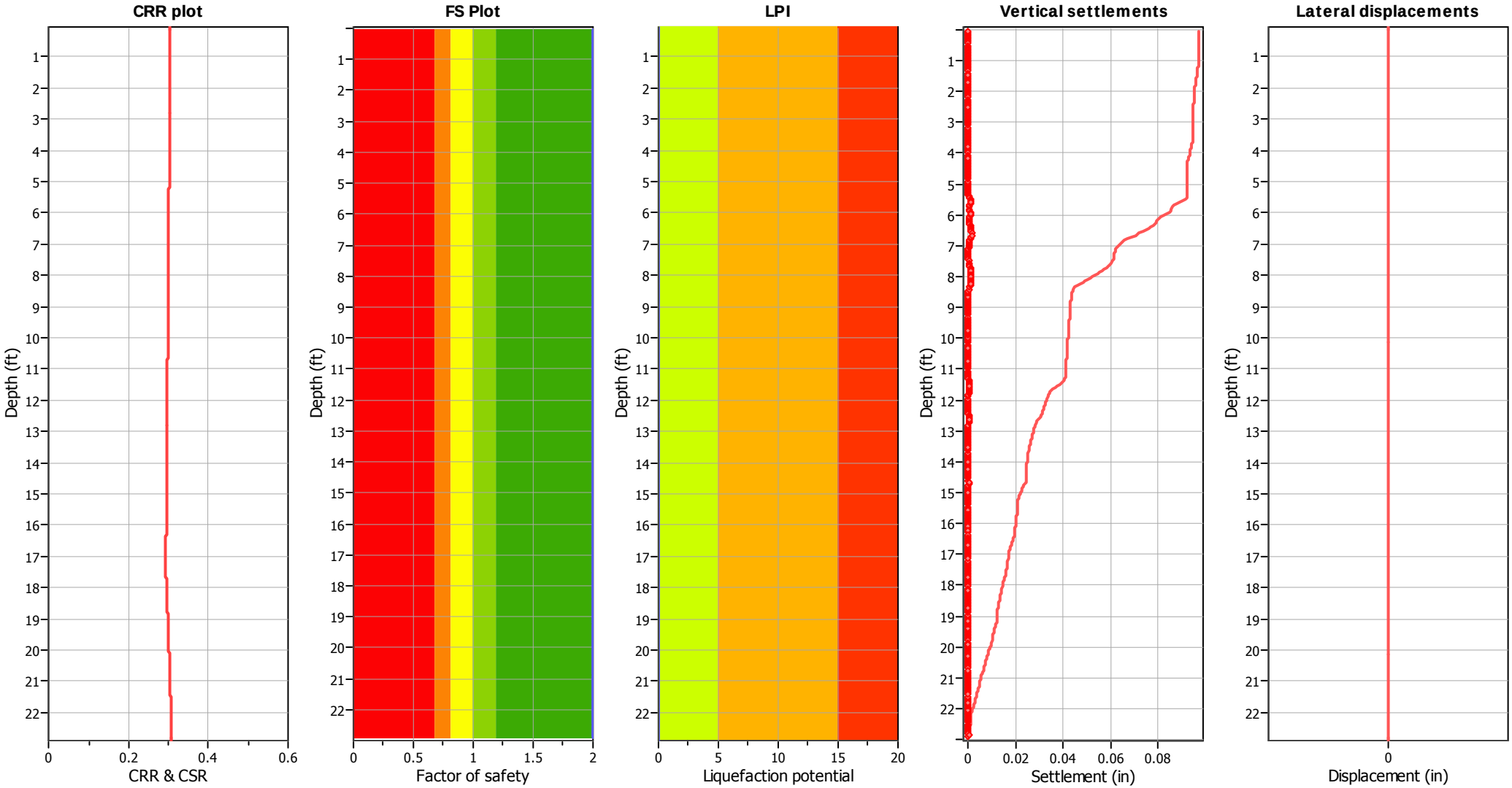
Estimation of post-earthquake settlements



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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.95	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	40.00 ft	Fill height:	N/A	Limit depth:	N/A

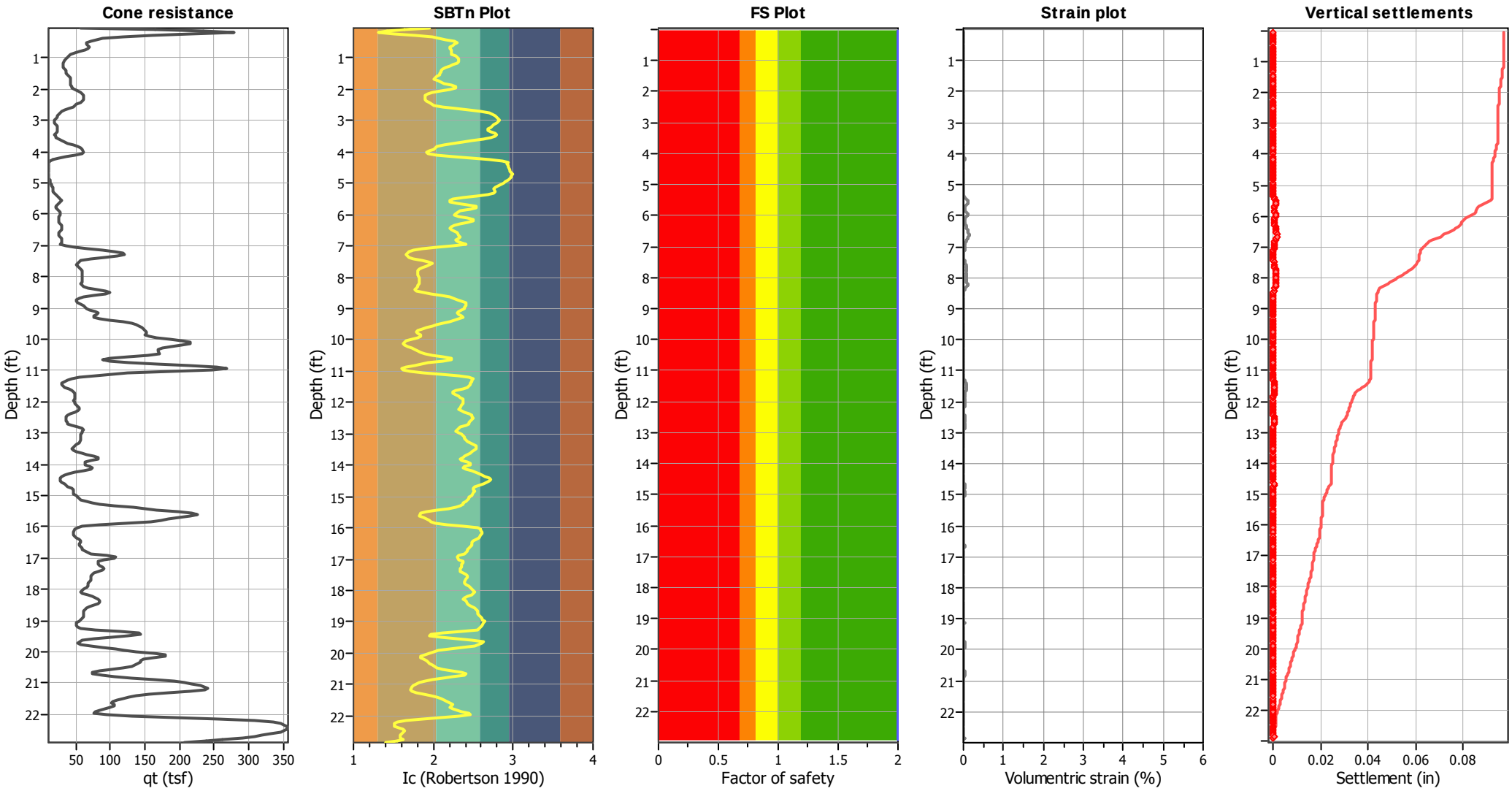
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Estimation of post-earthquake settlements



Abbreviations

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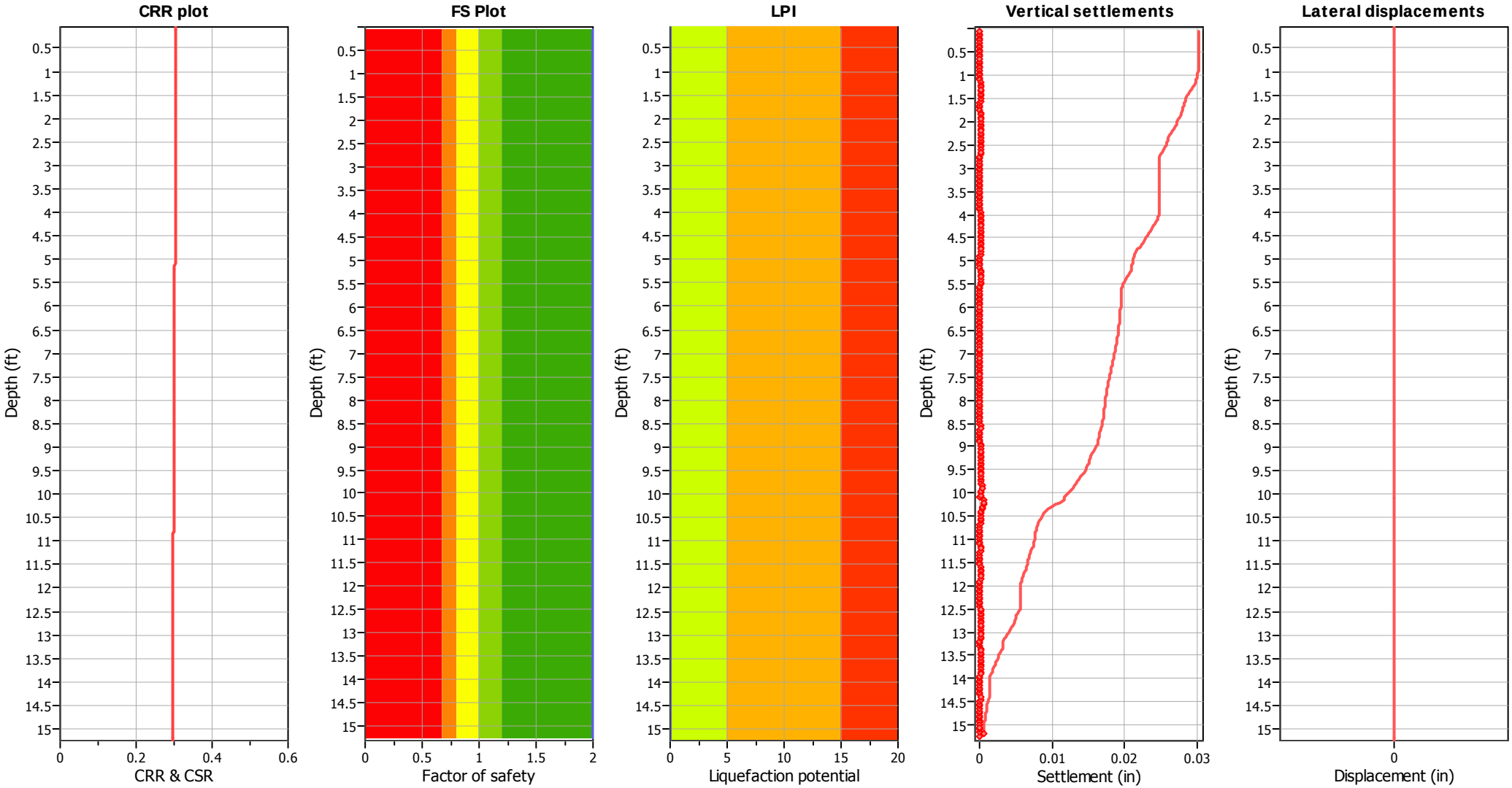
Volumentric strain:	Post-liquefaction volumentric strain

Liquefaction analysis overall plots



Input parameters and analysis data

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Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	No
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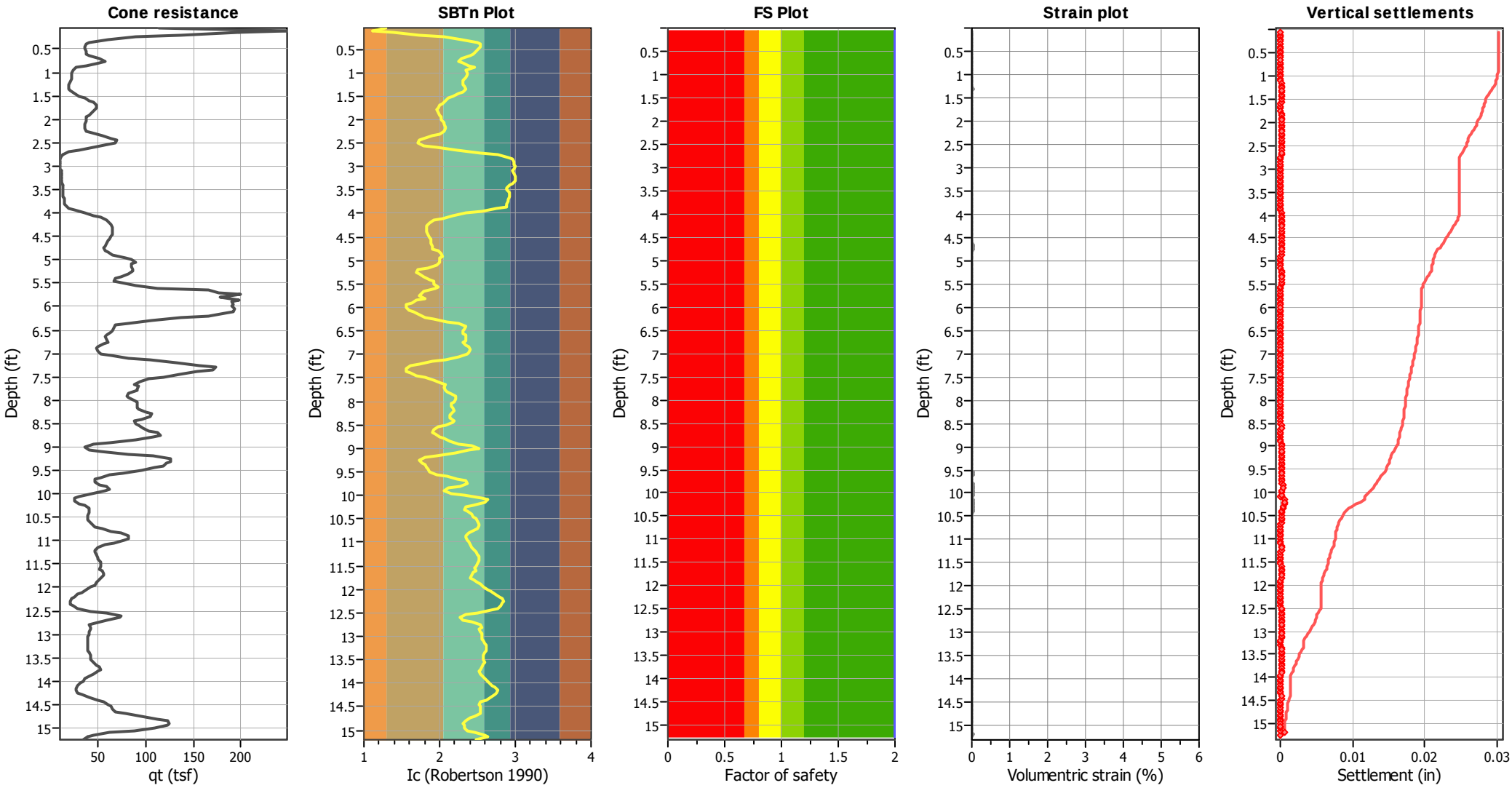

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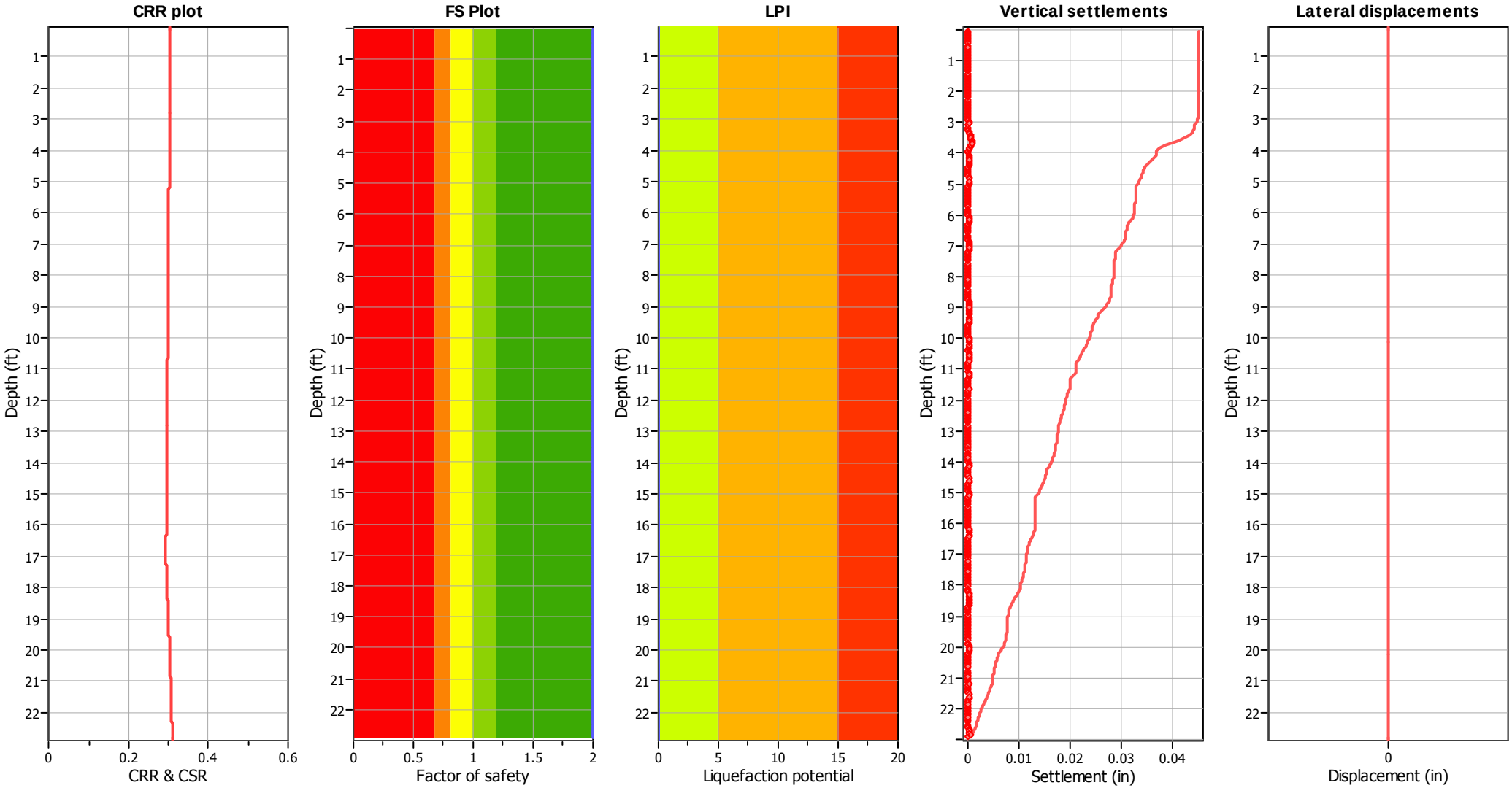

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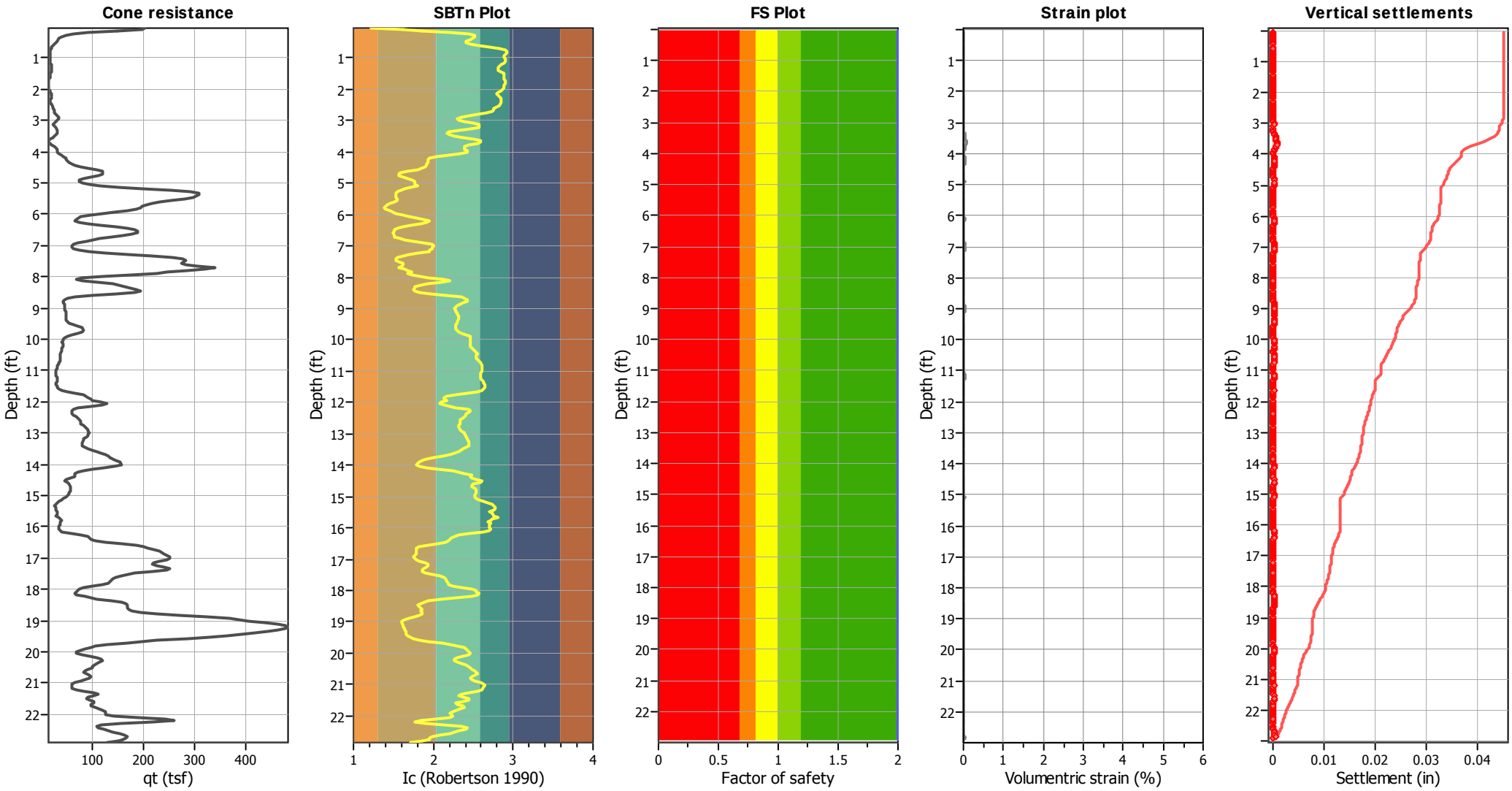

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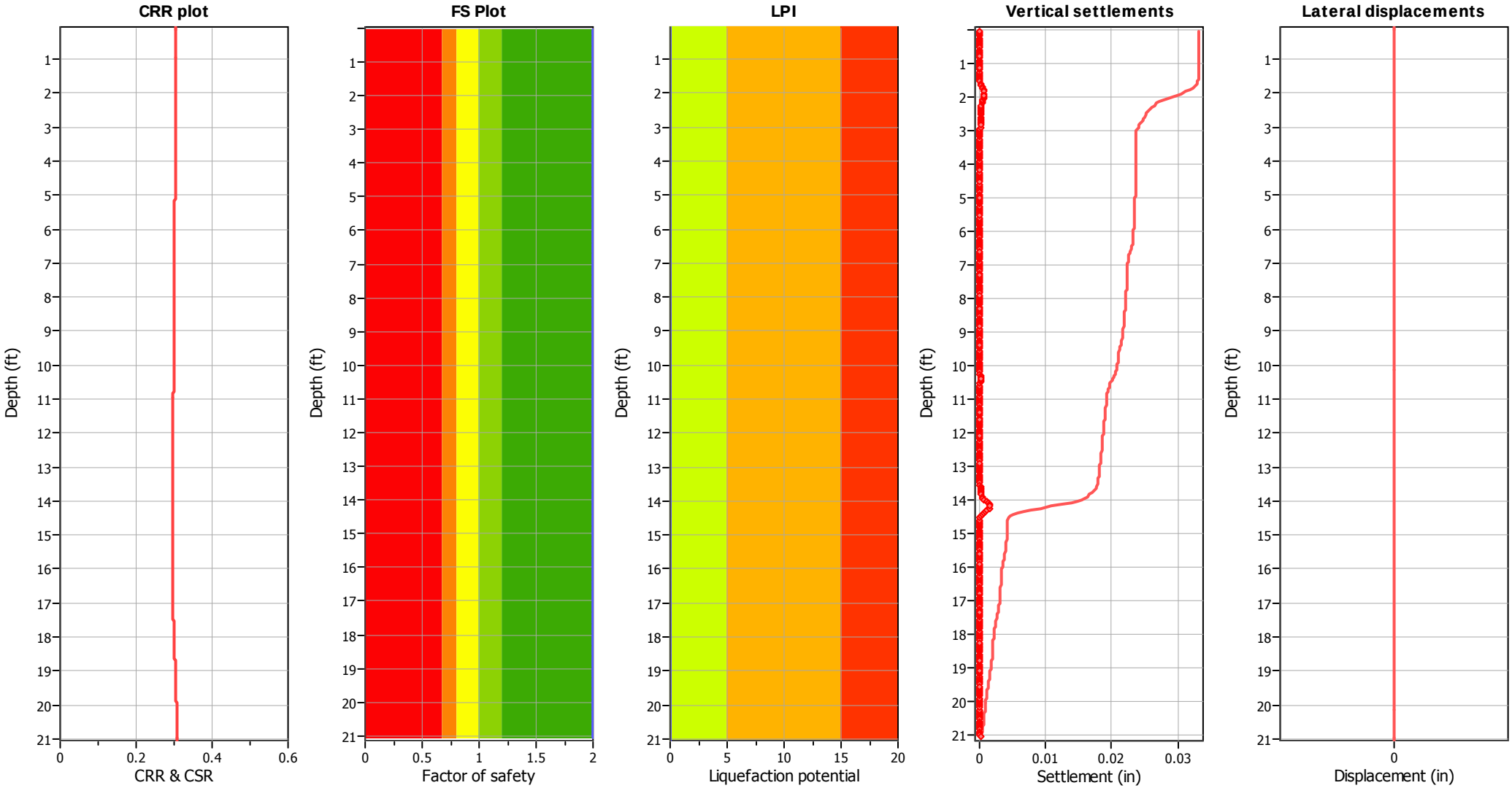

Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
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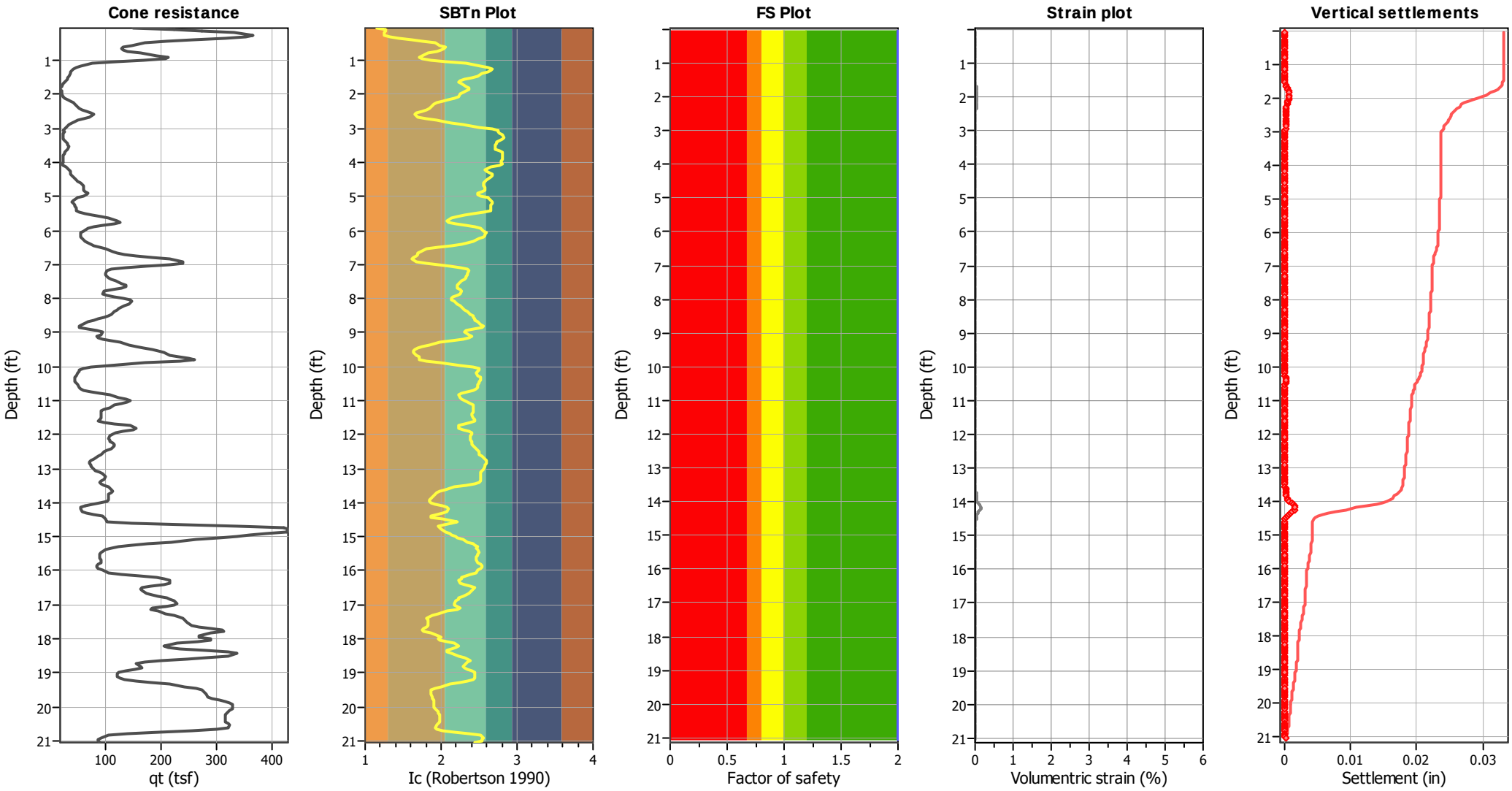

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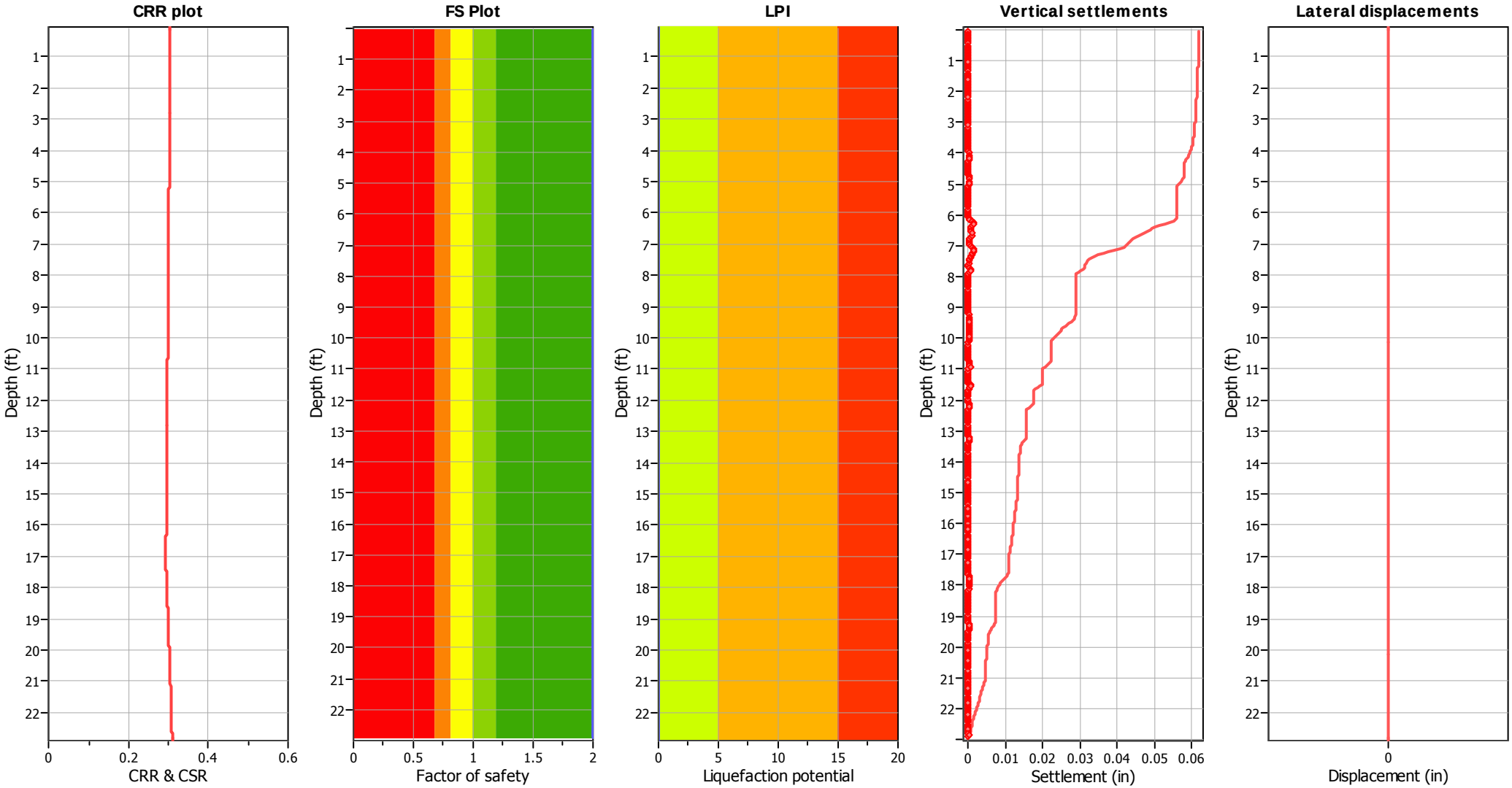

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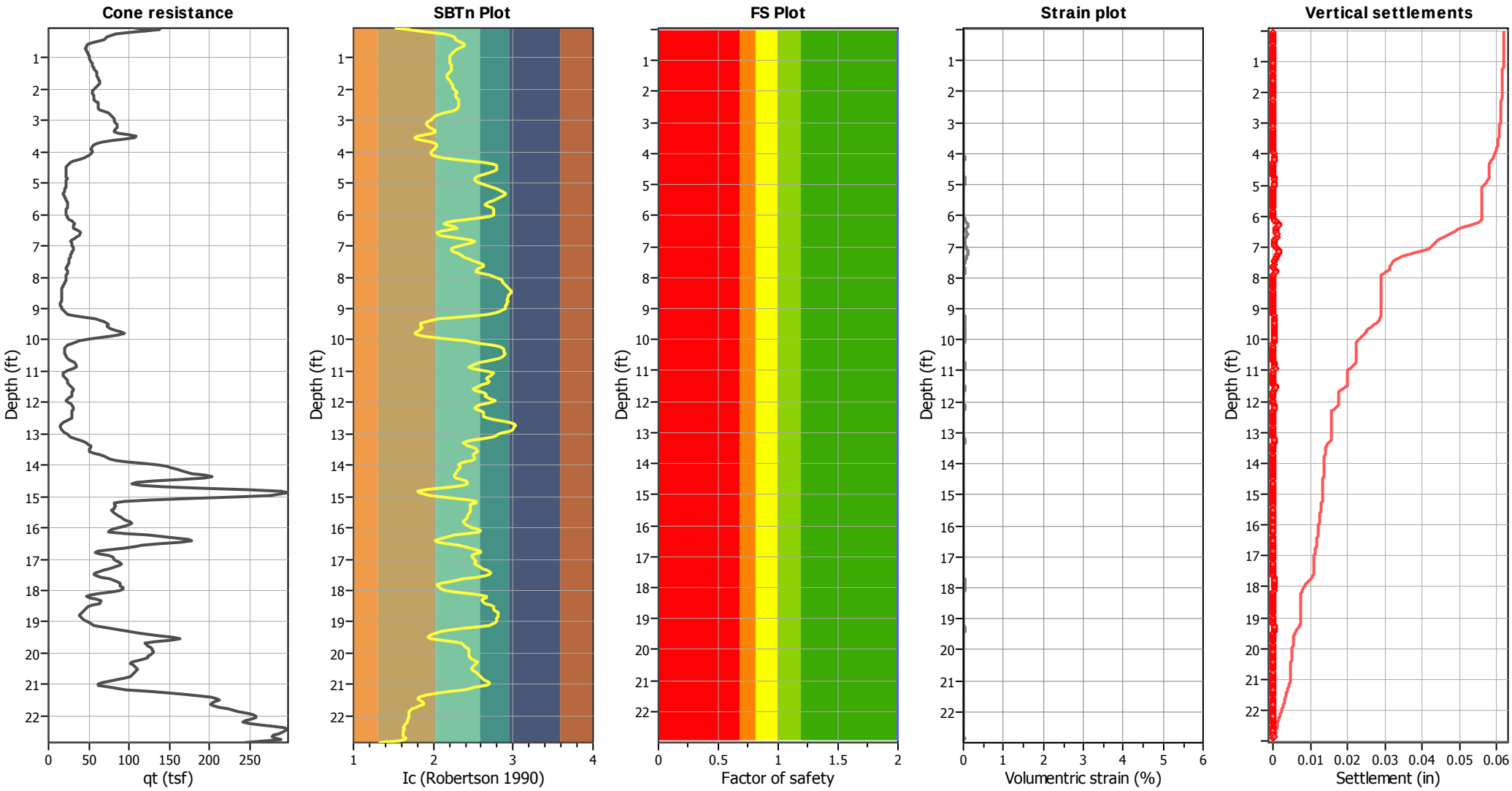

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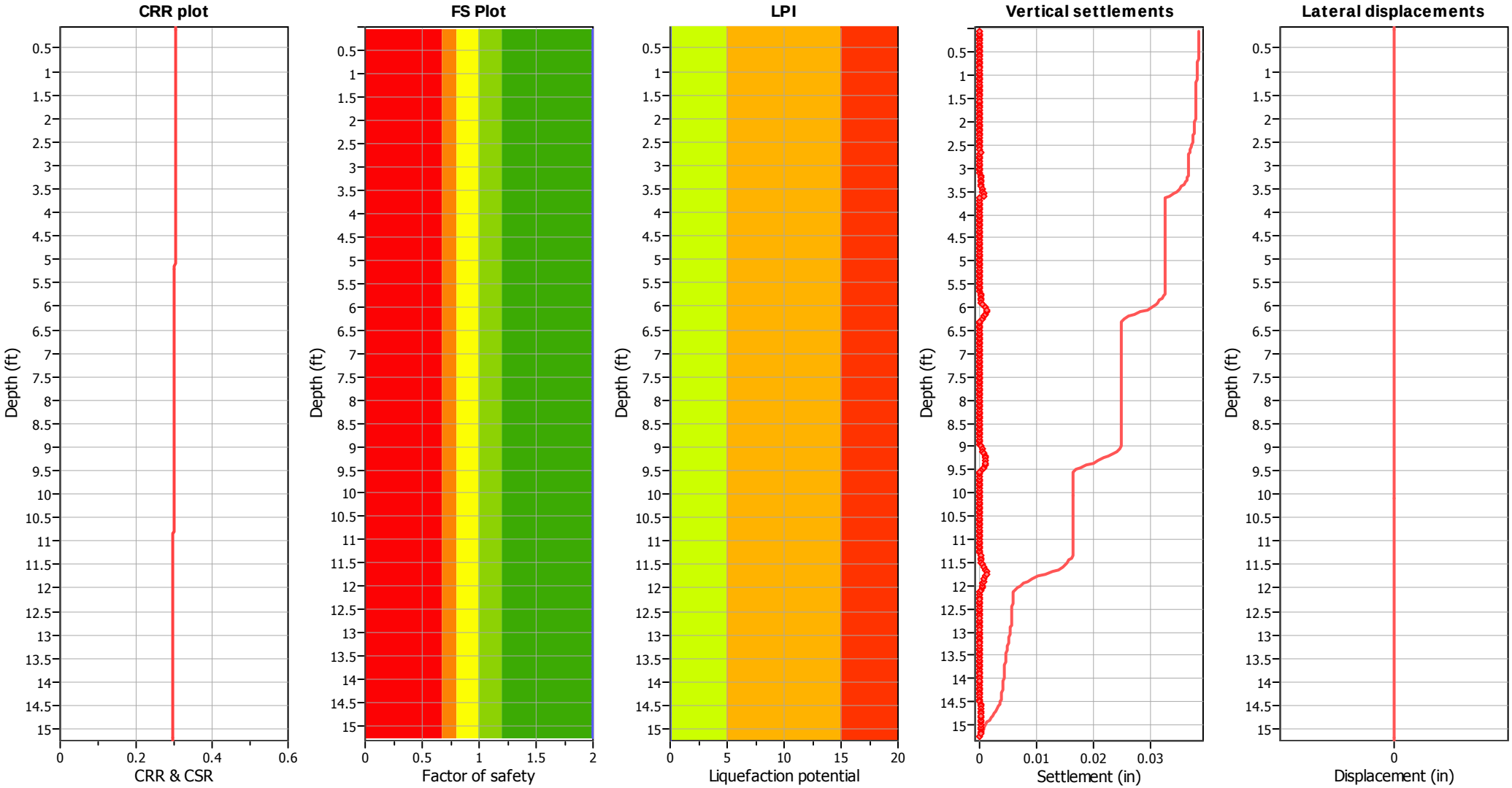

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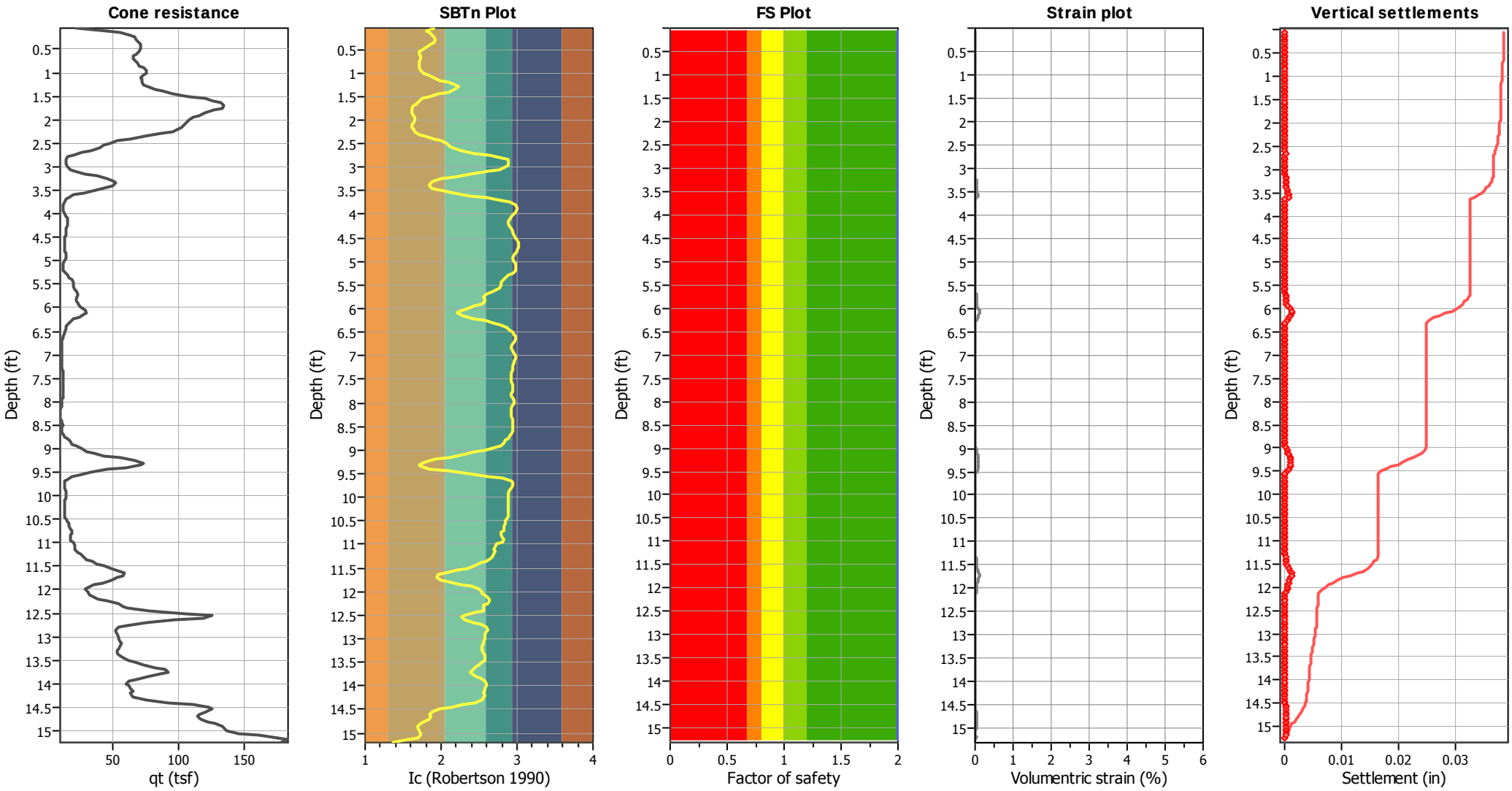

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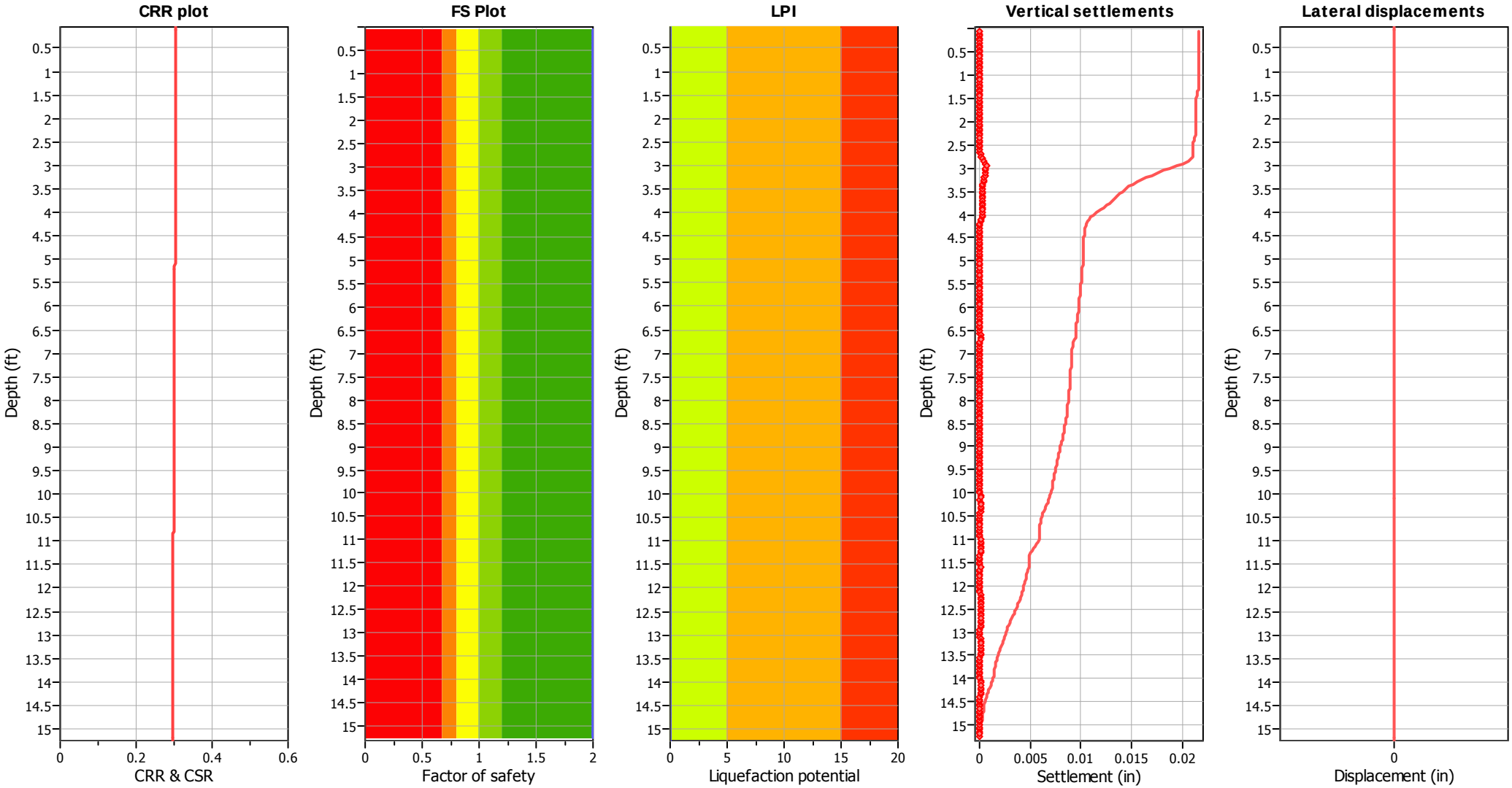

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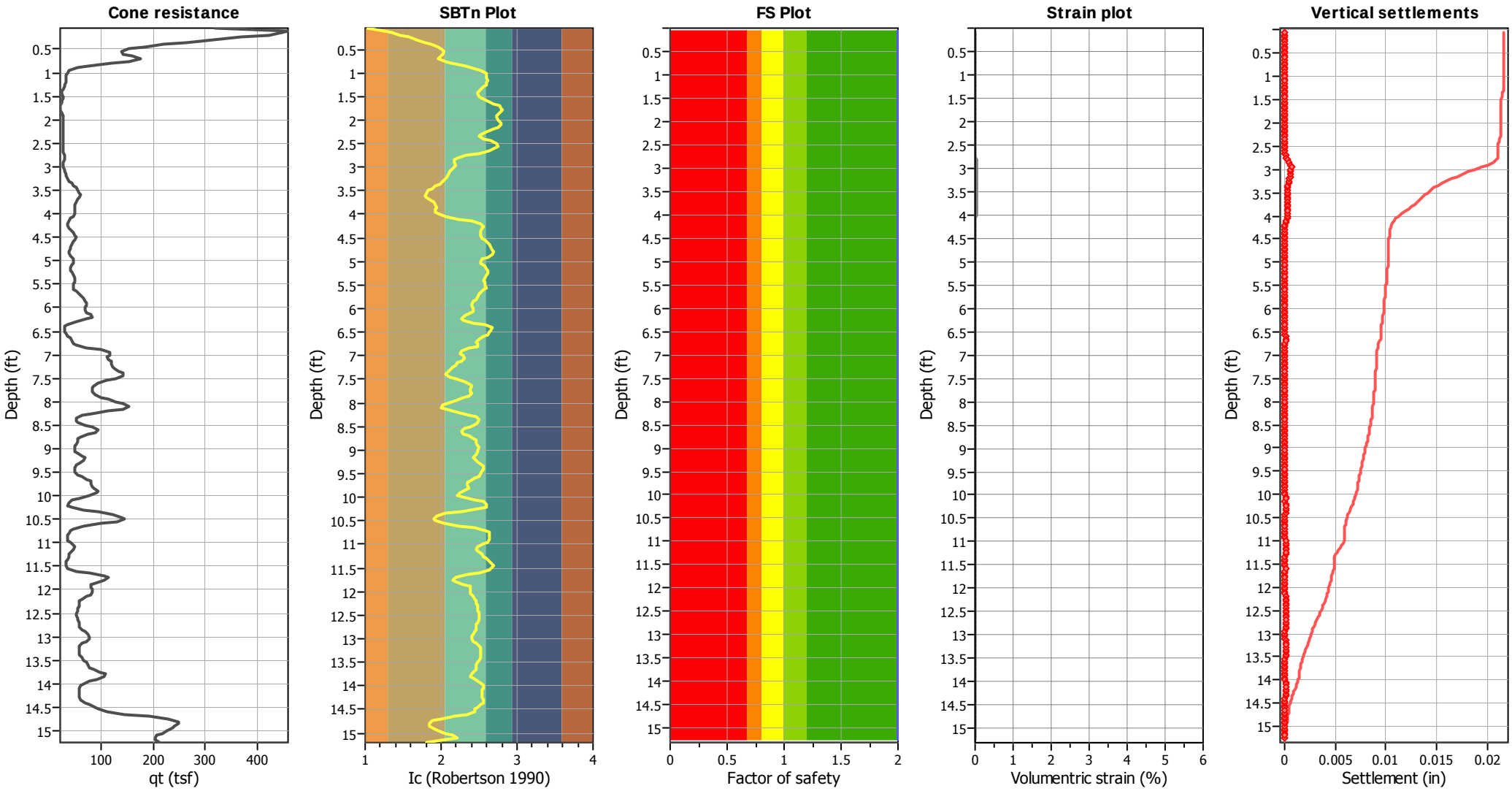

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APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

Leighton

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

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LEIGHTON AND ASSOCIATES, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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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.

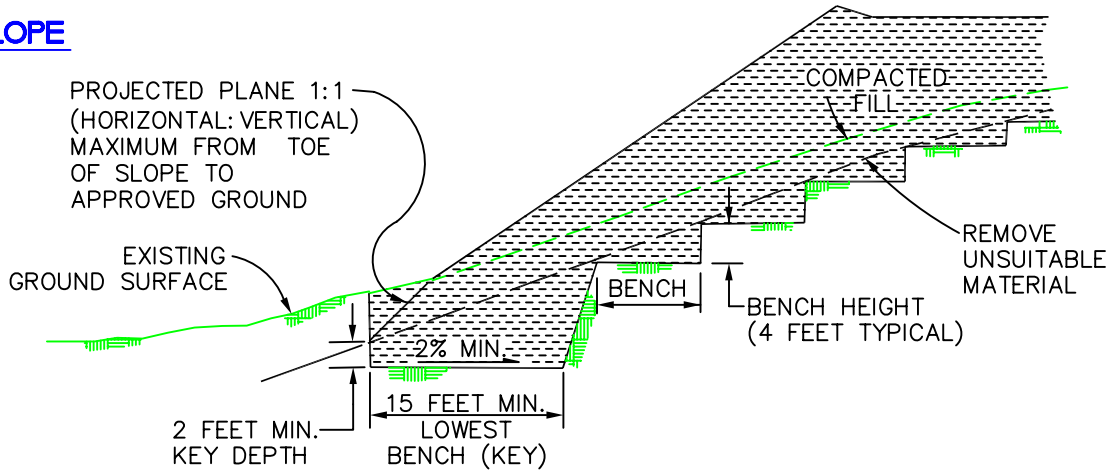
7.3 Lift Thickness

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.

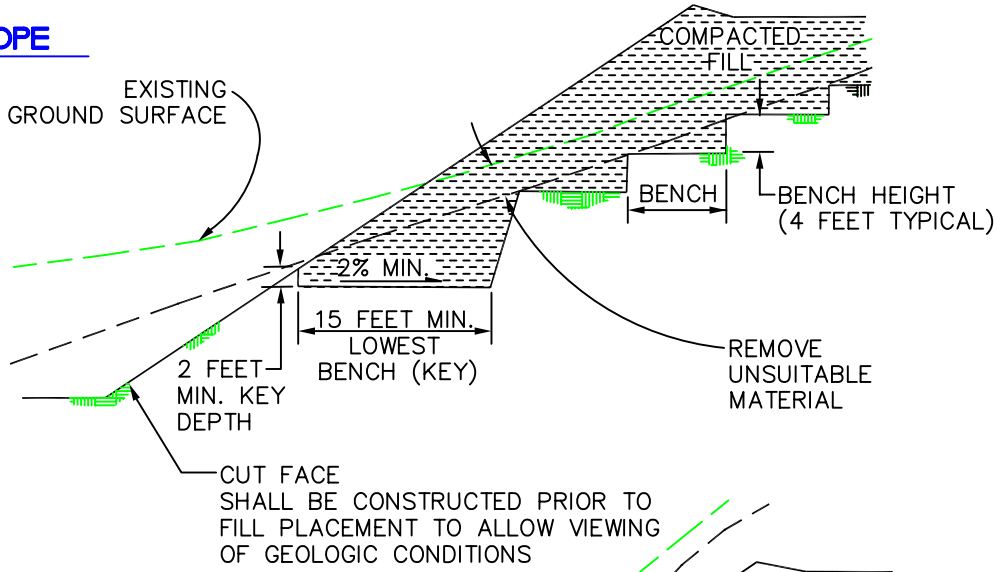
7.4 Observation and Testing

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

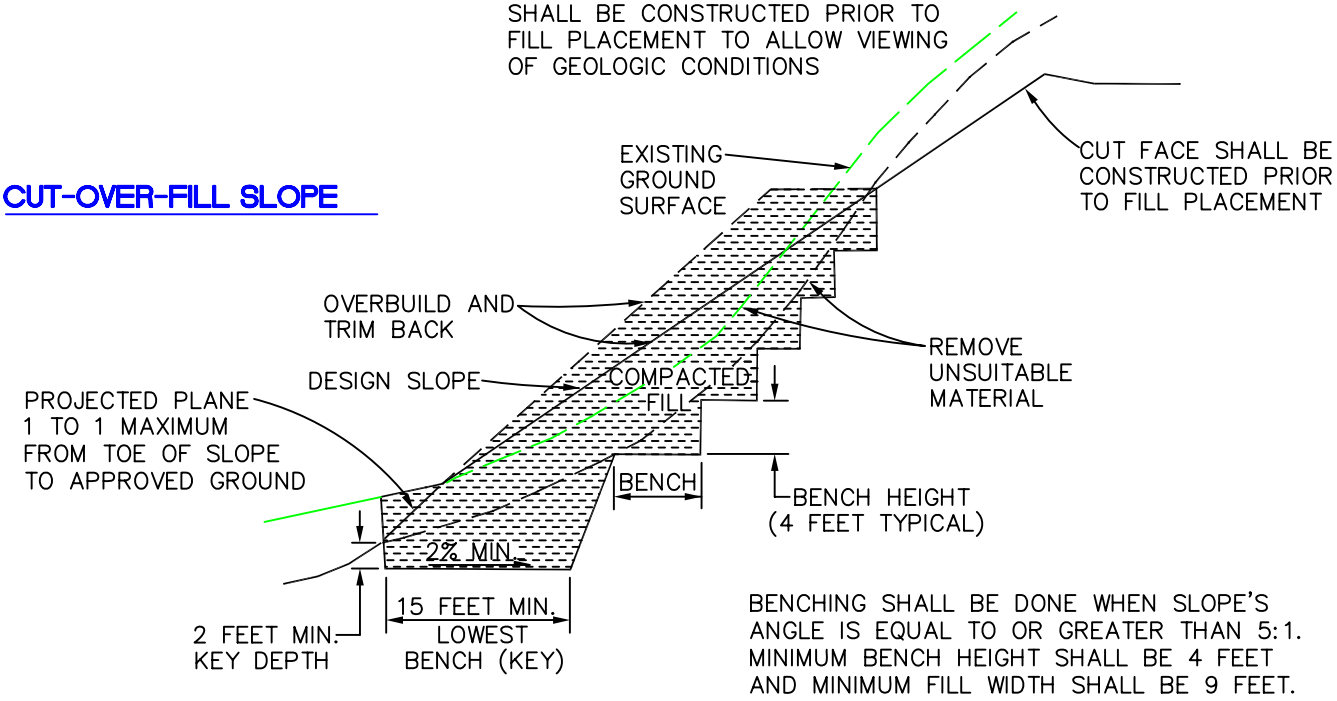
FILL SLOPE



FILL-OVER-CUT SLOPE

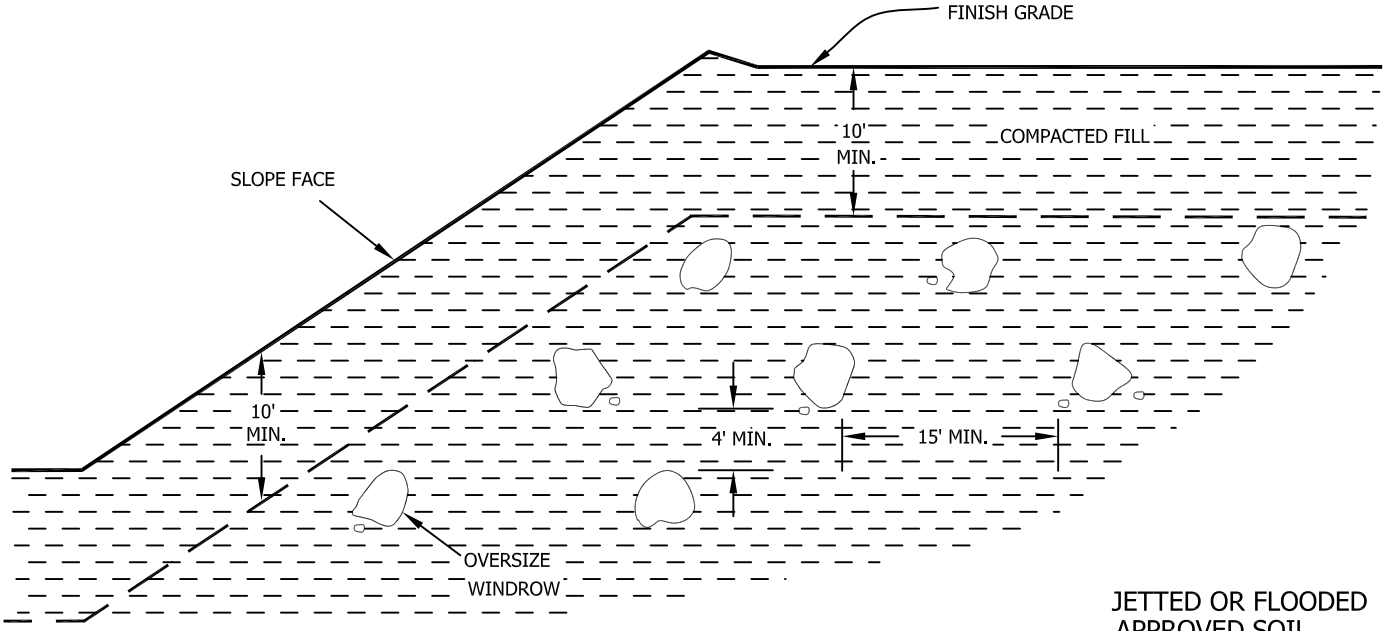


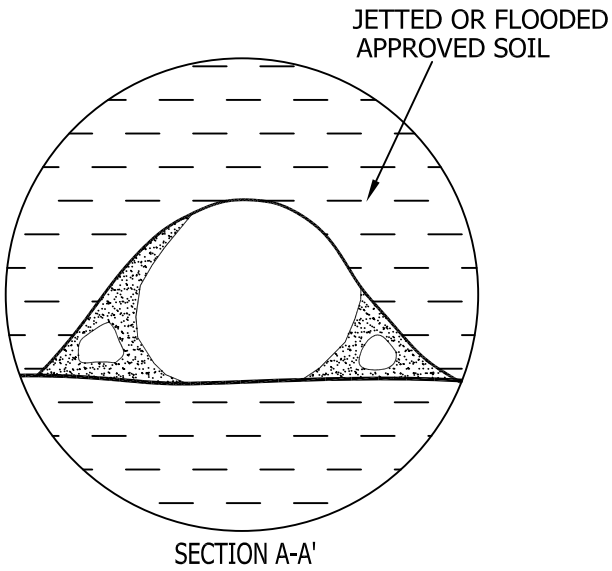
CUT-OVER-FILL SLOPE



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.

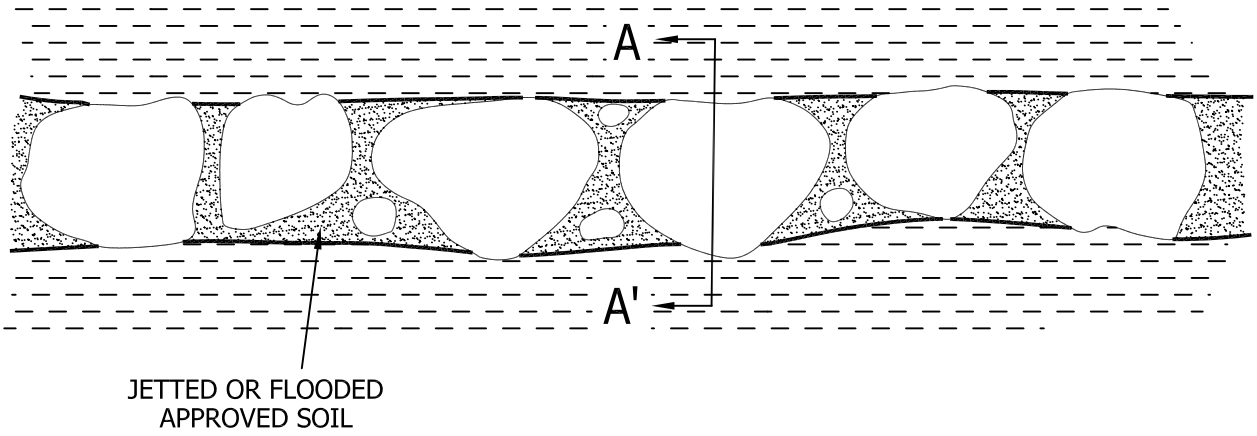
KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton





- 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

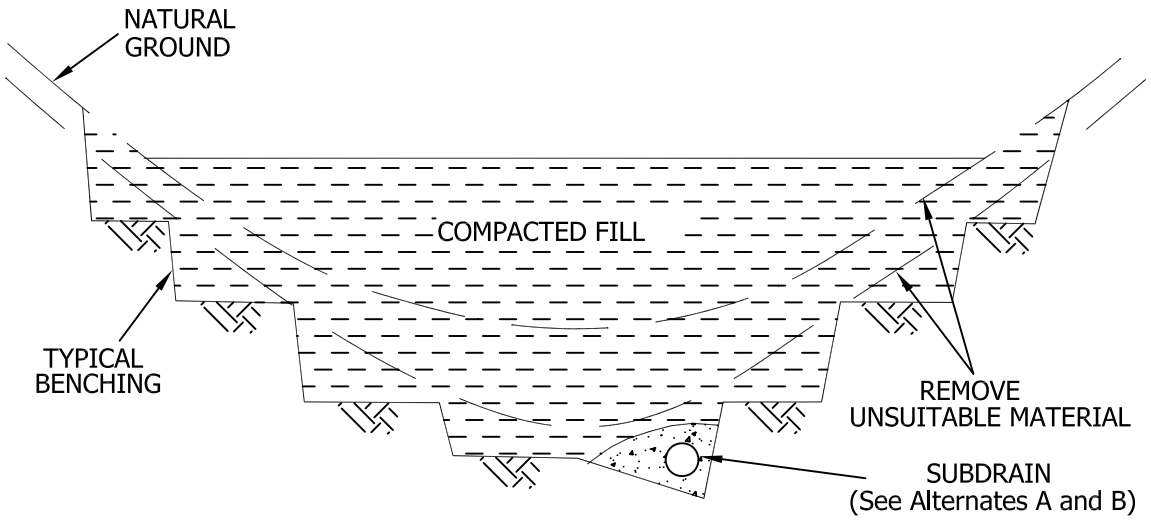


OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING
SPECIFICATIONS
STANDARD DETAILS B

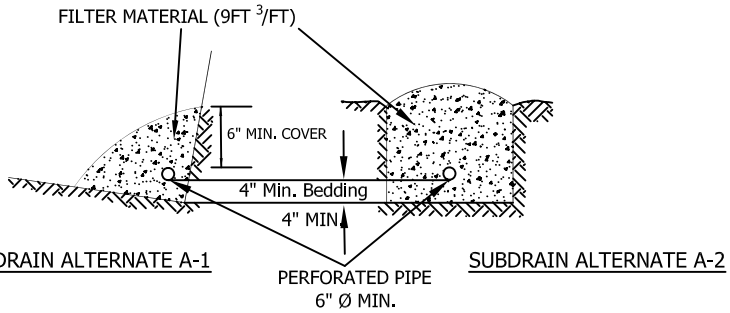
Leighton

P:Drafting\templates\details\over-rock-disp.dwg (7/00)



SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

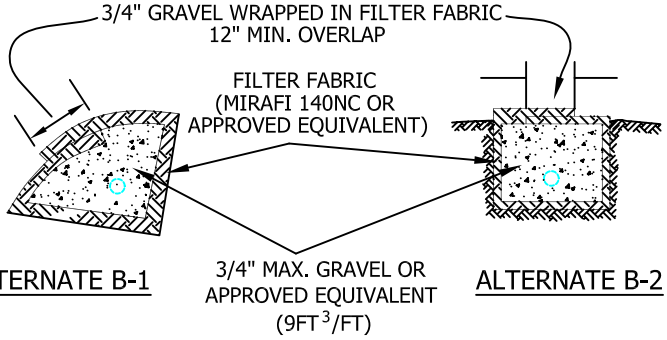


FILTER MATERIAL

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

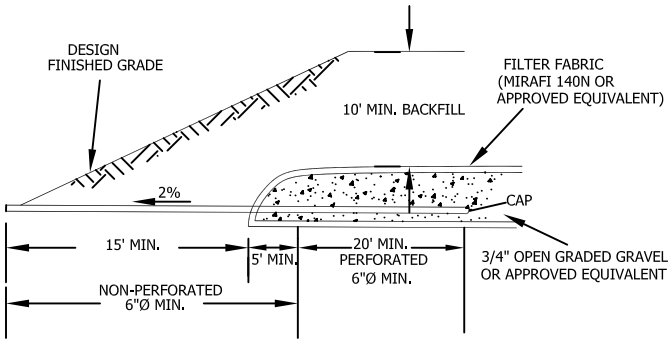
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

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

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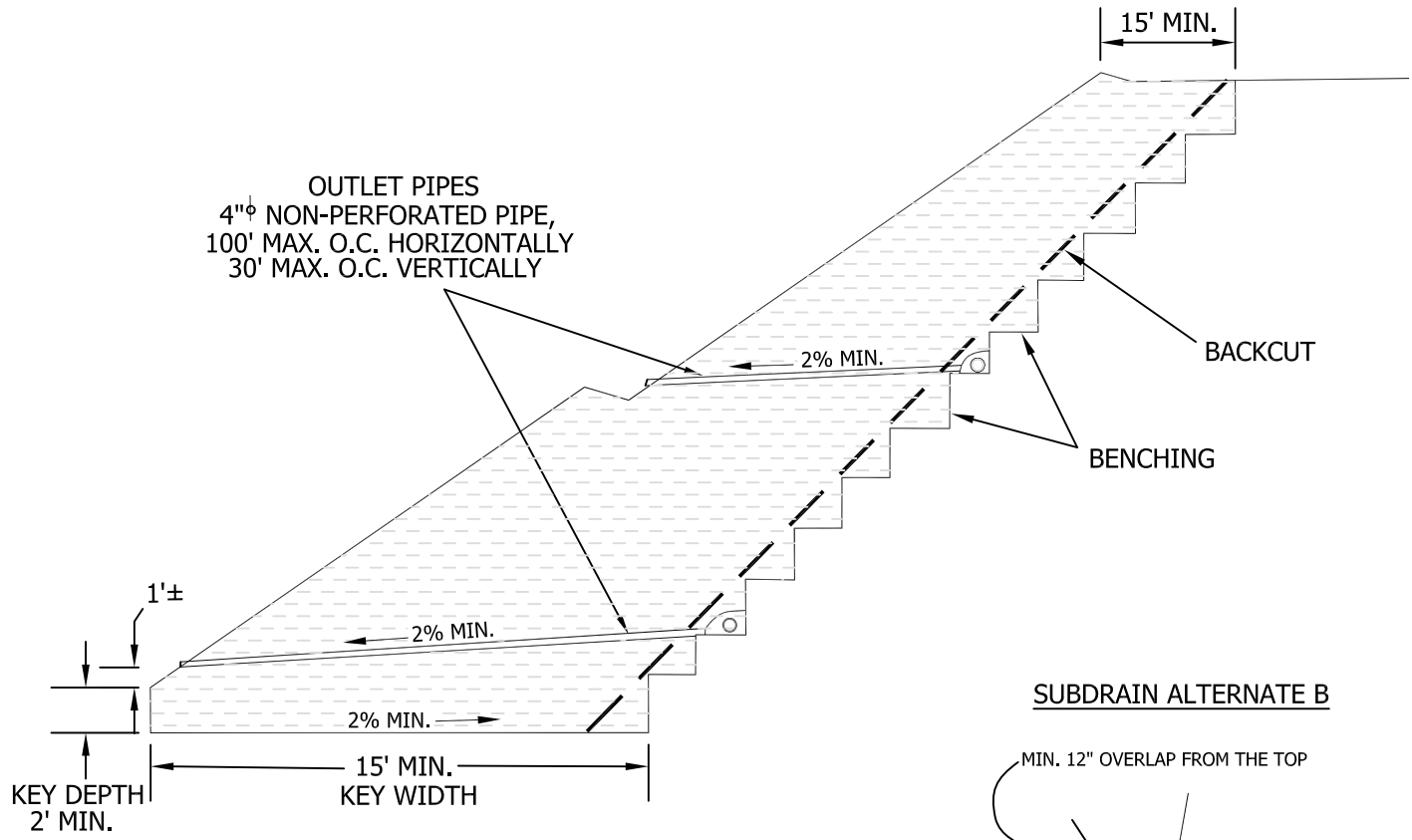
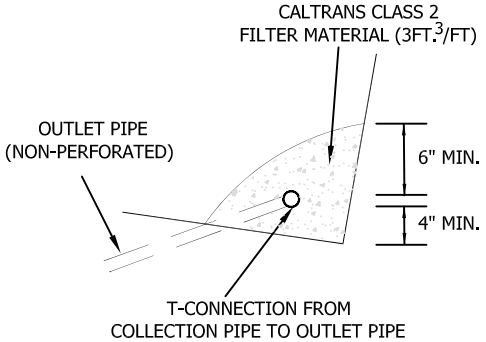
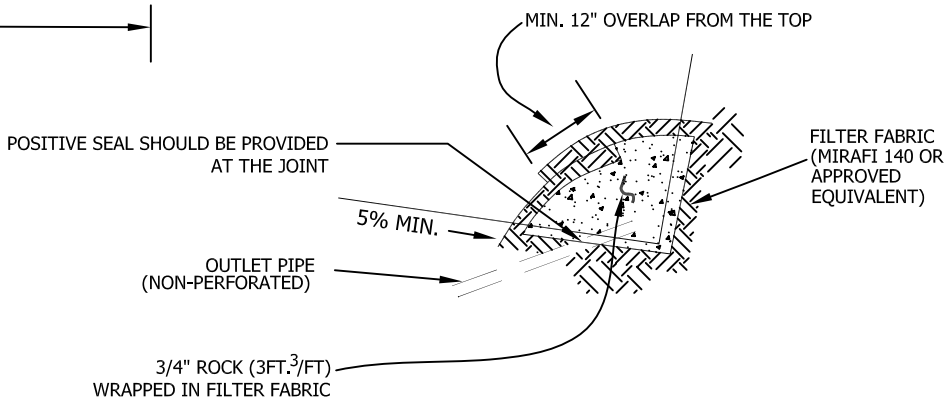


SUBDRAIN ALTERNATE A



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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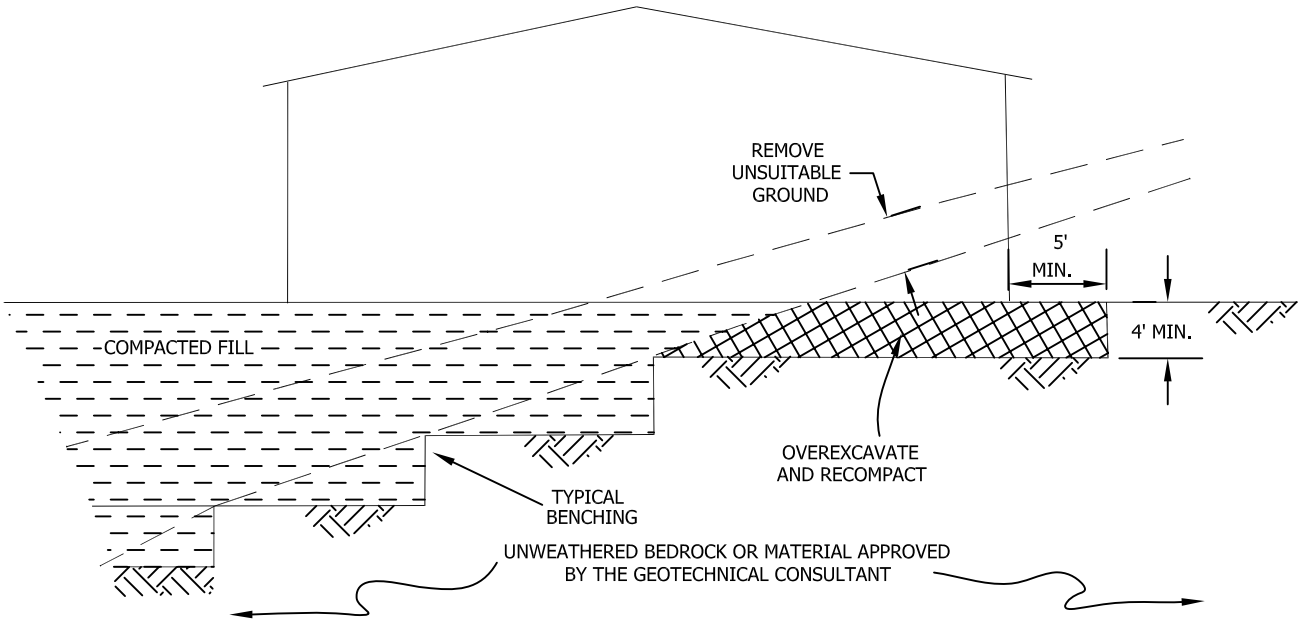
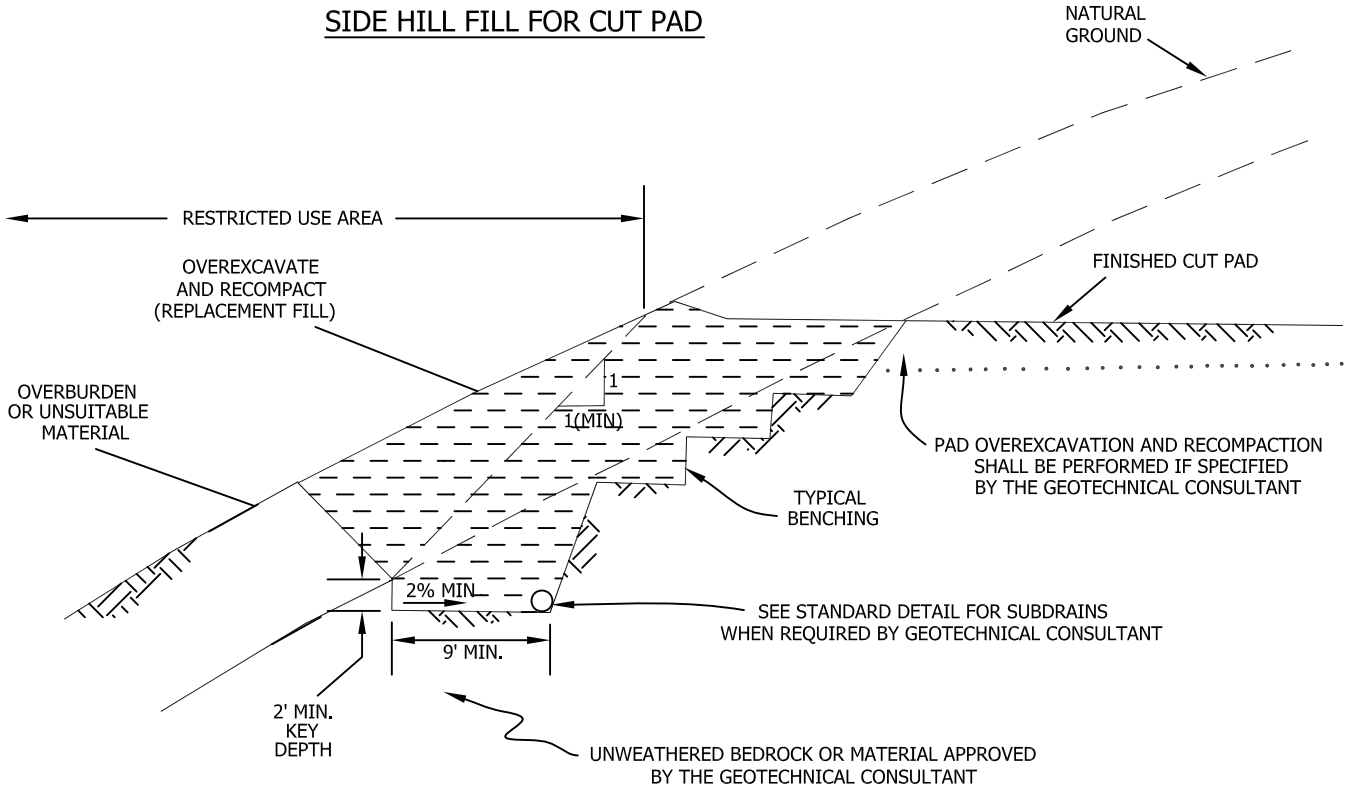
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS E	Leighton

P:Drafting\templates\details\transition_fills.dwg (7/00)

APPENDIX F

PERCOLATION STUDY

Leighton

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SC and SM
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-1
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	12:07 12:32	25	60.0	139.6	79.6	Yes
2	12:41 13:06	25	60.7	131.6	70.9	Yes

;

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
1:10 1:24	14	14	180	63.7	109.8	46.1	197.5
1:27 1:37	10	27	180	68.6	106.3	37.7	226.1
1:38 1:48	10	38	180	67.3	105.6	38.3	229.7
1:51 2:01	10	51	180	69.7	105.1	35.4	212.4
2:02 2:12	10	62	180	67.8	104.2	36.4	218.2
2:14 2:24	10	74	180	68.2	103.2	35.0	210.2

Initial Height of Water (Ho) = 111.84
Final Height of Water (Hf) = 76.8
Change in Height Over Time (ΔH) = 35.04
Average Head Over Time (Havg) = 94.32

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 4.37 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SP and SM
Liquid Description: Clear clean water
Tested By: CD/ZS

Test Hole Number: P-2
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 10
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:56 12:21	25	9.6	111.1	101.5	Yes
2	12:27 12:52	25	11.4	111.4	100.0	Yes

;

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
2:45 2:50	5	5	120	13.2	91.8	78.6	943.2
2:58 3:03	5	18	120	23.4	104.6	81.2	974.9
3:09 3:12	3	27	120	13.4	56.4	43.0	859.2
3:12 3:15	3	30	120	14.0	54.5	40.4	808.8
3:16 3:19	3	34	120	14.2	55.8	41.6	832.8
3:20 3:23	3	38	120	16.3	54.1	37.8	756.0
3:24 3:27	3	42	120	15.4	51.7	36.4	727.2
3:28 3:31	3	46	120	14.0	49.8	35.8	715.2
3:32 3:35	3	50	120	14.2	50.1	35.9	718.0
3:35 3:38	3	53	120	14.4	49.7	35.3	706.0
3:39 3:42	3	57	120	14.1	49.8	35.7	714.0
3:43 3:46	3	61	120	14.2	49.6	35.4	708.0

Initial Height of Water (Ho) = 105.8
Final Height of Water (Hf) = 70.4
Change in Height Over Time (ΔH) = 35.4
Average Head Over Time (Havg) = 88.1

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 15.72 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and ML
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-3
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 10
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	12:16 12:41	25	62.4	89.9	27.5	Yes
2	12:48 13:13	25	60.2	88.2	28.0	Yes

;

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
1:20 1:31	11	11	120	62.4	72.6	10.2	55.6
1:32 1:42	10	22	120	62.4	69.8	7.4	44.6
1:43 1:54	11	34	120	62.0	69.7	7.7	41.9
1:56 2:06	10	46	120	64.4	71.4	7.0	41.8
2:08 2:18	10	58	120	62.8	70.3	7.6	45.4
2:19 2:29	10	69	120	64.9	71.8	6.8	41.0

Initial Height of Water (Ho) = 55.08
Final Height of Water (Hf) = 48.24
Change in Height Over Time (ΔH) = 6.84
Average Head Over Time (Havg) = 51.66

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 1.53 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and CL
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-4
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:26 11:51	25	69.6	141.6	72.0	Yes
2	12:08 12:38	30	70.8	125.0	54.2	Yes

;

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
12:40 12:52	12	12	180	66.0	110.4	44.4	222.0
12:57 13:11	14	31	180	63.6	105.5	41.9	179.5
13:16 13:31	15	51	180	64.2	108.6	44.4	177.6
13:35 13:47	12	67	180	69.5	105.5	36.0	180.0
13:51 14:05	14	85	180	66.8	107.6	40.8	174.9
14:09 14:24	15	104	180	64.7	108.2	43.6	174.2

Initial Height of Water (Ho) = 115.32
Final Height of Water (Hf) = 71.76
Change in Height Over Time (ΔH) = 43.56
Average Head Over Time (Havg) = 93.54

I_t= ΔH(60r)/Δt(r+2Havg)

I_t= 3.65 in/hr

PERCOLATION DATA SHEET

Proj. Name: El Toro 100 Acre Redevelopment
USCS Soil Class.: SM and CL
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-5
Date Excavated: 12-9-14
Date Tested: 12-11-14
Depth of boring (ft): 15
Diameter of boring (in): 8

Sandy Soil Criteria*

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)	Greater than or Equal to 6"?
1	11:40 12:05	25	123.6	169.8	46.2	Yes
2	12:15 12:44	29	114.0	167.6	53.6	Yes

;

*If two consecutive measurements show that six inches of water seeps away in less than 25 min. the test shall be run for an additional hour with measurements taken every 10 min. Otherwise, pre-soak hole overnight. Obtain at least twelve measurements over at least six hours (approx. 30 min. intervals)

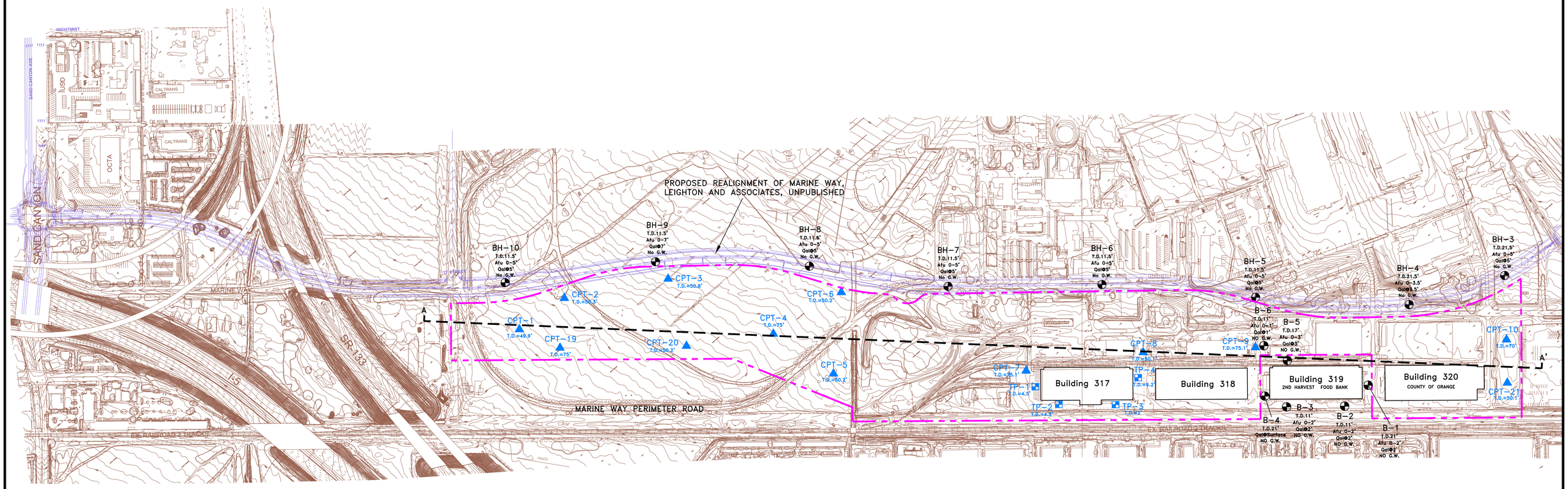
Percolation Data

Time	Time Interval (min.)	Total Elapsed Time (min.)	Depth of Hole (in.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
12:46 13:03	17	17	180	123.6	162.6	39.0	137.6
13:13 13:23	10	37	180	122.9	162.8	40.0	239.8
13:25 13:40	15	54	180	122.5	160.7	38.2	152.6
13:42 13:57	15	71	180	120.6	159.8	39.2	157.0
14:00 14:15	15	89	180	121.1	160.2	39.1	156.5
14:16 14:27	11	101	180	121.8	151.4	29.6	161.7

Initial Height of Water (Ho) = 58.2
Final Height of Water (Hf) = 28.56
Change in Height Over Time (ΔH) = 29.64
Average Head Over Time (Havg) = 43.38

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

I_t= 7.13 in/hr



LEGEND

SURFACE EARTH MATERIAL

Afu — ARTIFICIAL FILL, UNDOCUMENTED. DERIVED PREDOMINATELY FROM UNDERLYING PARRENT MATERIAL. FILL MATERIALS COULD CONSIST OF MIXED SANDS, SILTS AND CLAYS WITH GRAVEL, CONCRETE AND ABANDONED UTILITY DEBRIS. ACCESS ROADS AND PARKING AREAS CONSIST OF EITHER ASPHALT AND CONCRETE UNDERLAIN BY STRUCTURAL BASE MATERIALS OF VARIABLE THICKNESS. RAILROAD BALLAST, 2-3 INCHES IN SIZE CONSISTING OF CRUSHED ROCK UNDERLIES ALL RAIL LINES.

Qal — QUATERNARY AGE YOUTHFUL ALLUVIAL FAN AND ACTIVE WASH DEPOSITS. CONSISTS OF INTERBEDDED AND LATERALLY DISCONTINUOUS BEDS TO MASSIVE STRATIGRAPHY CHARACTERIZED ASO UNCONSOLIDATED SAND, SILT AND CLAY WITH VARYING PROPORTIONS OF GRAVEL. CORRELATES TO UNIT DESIGNATION Qyf, YOUNG ALLUVIAL FAN DEPOSITS USED IN THIS REPORT. COLLUVIUM AND ALLUVIUM UNDIFFERENTIATED.

CPT-21 / T.D.=50.2' — APPROXIMATE LOCATION OF CONE PENETROMETER TEST SHOWN WITH TOTAL DEPTH (T.D.) IN FEET

TP-4 / T.D.=6' — APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) IN FEET

BH-10 / T.D.11.5' / Afu 0-5' / Qal@5' / NO G.W. — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.), AND DEPTH TO EARTH UNITS IN FEET. GROUNDWATER (G.W.) NOT ENCOUNTERED DURING DRILLING. LEIGHTON AND ASSOCIATES, INC., UNPUBLISHED. PROJECT NO. 011783-020

B-6 / T.D.10' / NO G.W. — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) AND DEPTH TO EARTH UNITS IN FEET GROUNDWATER (G.W.) NOT ENCOUNTERED DURING DRILLING. LEIGHTON AND ASSOCIATES, INC., JANUARY 2007a, PROJECT NO. 012095-001

SITE BOUNDARY

A — A' GEOLOGIC CROSS SECTION

N

0 300 600
SCALE FEET

SITE EXPLORATION MAP

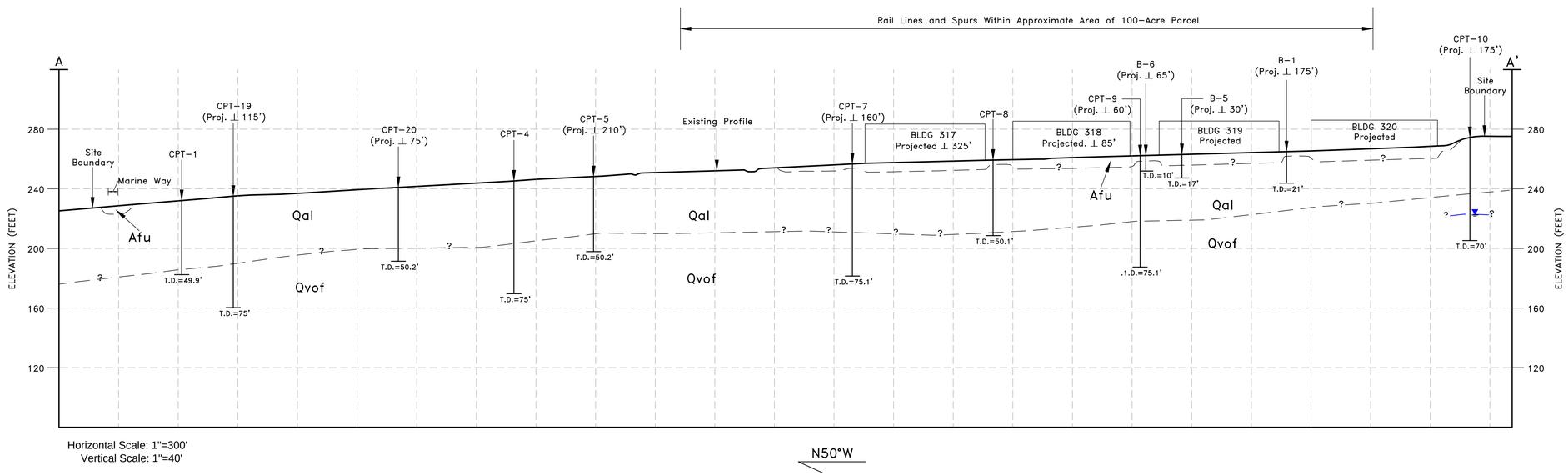
100-ACRE PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

PLATE 1

Proj: 10695.001	Eng/Geol: CCK/JAR
Scale: 1"=300'	Date: 04/2015

Leighton

Drafted By: BGT | Checked By: BGT | P:\DRAFTING\10695\001\CP_2014-05-16\100-ACRE PARCEL\10695-001-PLATE-1-100-ACRE.DWG 09-18-14 9:06:16AM1 Plotted by: bhan



Horizontal Scale: 1"=300'
Vertical Scale: 1"=40'

LEGEND

Afu	ARTIFICIAL FILL, UNDOCUMENTED
Qal	YOUNG ALLUVIUM FAN DEPOSITS
Qvof	VERY OLD ALLUVIUM DEPOSITS
—?— —?—	GEOLOGIC CONTACT, DASHED WHERE BURIED, QUERIED WHERE UNCERTAIN
—?—▼—?—	GROUND WATER, QUERIED WHERE UNCERTAIN

GEOLOGIC CROSS SECTION A-A'
100-ACRE PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

PLATE 2

Proj: 10695.001	Eng/Geol: CCK/JAR
Scale: As Shown	Date: 04/2015

Leighton

Drafted By: BQT | Checked By: BQT | P:\GRAFTING\10695\001\CP_2014-05-16\100-ACRE PARCEL\10695-001-PLATE-2-SECTION-100-ACRE.DWG-04-24-15 1:36 [MP] | Plotted by: Mean