PRELIMINARY GEOTECHNICAL INVESTIGATION
WEST ALTON PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

Prepared for:

Lowe Enterprises Real Estate Group

300 Spectrum Drive, Suite 1460
Irvine, California 92618

Project No. 10695.001

September 19, 2014
(Revised May 15, 2015)

Leighton and Associates, Inc.

A LEIGHTON GROUP COMPANY

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300 Spectrum Drive, Suite 1460
Irvine, California 92618

Attention: Mr. Robert Reitenour, Senior Vice President

Subject: Preliminary Geotechnical Investigation
West Alton 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 "West Alton Parcel" at the former El Toro Marine Corps Air Station (MCAS) in the City of Irvine, California. Cone penetrometer test (CPT) soundings and hollow stem auger borings were performed 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.

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.

The proposed master planned community will likely consist of multi-story residential, commercial office, retail, 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.

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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.

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1.0 INTRODUCTION

1.1 Purpose and Scope of Exploration

The purpose of this investigation was to evaluate the general geotechnical conditions and subsurface characteristics at the project site (Figure 1, *Parcel Location Map*) and provide preliminary recommendations for initial planning of grading and foundation design. Subsurface conditions may vary widely between the current exploratory excavations. When specific development designs have been chosen and grading plans become available; additional field investigations 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 (CPT) soundings at 8 locations (CPT-11 through CPT-18) to depths of 50 to 75 feet below existing ground surface (bgs). Plate 1, *Site Exploration Map*, shows exploration locations. The logs of CPT soundings performed by Leighton for this project are presented in Appendix A, *CPT and Boring Logs.*
- Prior explorations conducted by Leighton within the El Toro Marine Corps Air Station (MCAS) applicable to this project were reviewed in preparation of this report. The boring logs are included in Appendix B, *Prior Explorations.* Locations of the borings 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 the 2013 County of Orange Technical Guidance Document (TGD)

- 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 West Alton Parcel project site consists of an agricultural area adjacent to the eastern boundary of MCAS located within the city of Irvine. The approximate area boundary is shown on Figure 1.

In general, the 20-acre West Alton parcel is roughly triangular shaped in area, located adjacent to the northeastern portion of the MCAS. The area is bordered by Irvine Boulevard to the west, open hillside land to the northeast and existing commercial improvements and the East Alton Parcel to the south and east. Magazine Road crosses the central portion of the site in a roughly east-west direction. This area was previously used for agriculture and currently consists of open land and a mulching and stockpiling operation in the northern area of the parcel. An approximately 9-acre unlined detention basin is located in the southern portion of the site, northerly and coincident with Magazine Way. The basin, constructed of earthen slopes inclined at approximately 2:1 (horizontal:vertical), collect surface runoff from the surrounding terrain and outlets to a concrete-lined channel. An additional small stormwater basin is located in the northwest corner of the parcel.

Based on our review of Tait (2014) ground surface elevation varies from approximately Elevation +423 feet mean sea level (msl) at the western corner to approximately Elevation +510 feet msl at the northeastern corner of the West Alton Parcel, where the gently sloping topography of the agricultural fields give rise to highlands to the north. Additionally, based on review of Tait (2014), a Leases in Furtherance of Conveyance (LIFOC) area is mapped as located in the northeast portion of the West Alton Parcel encompassing the eastern limit of the detention basin and a portion of Magazine Road.

1.3 Proposed Development

We understand 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.

1.4 Field Exploration

Prior to the subsurface field exploration, a site reconnaissance was performed by a certified engineering geologist from our staff to mark the locations of CPT soundings, 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. Eight (8) CPT soundings (CPT-11 through CPT-18) were advanced to a maximum depth of 75 feet bgs. The CPT holes were backfilled with hydrated bentonite pellets after completion.

The approximate locations of the CPT soundings are shown on Plate 1, *Site Exploration Map*. The report of the cone penetration test data and CPT logs, prepared by a subcontractor, Kehoe Testing & Engineering, are included in Appendix A.

Hollow stem auger borings and test pits conducted by Leighton during prior explorations of the MCAS applicable to this project are included in Appendix B, *Prior Explorations.* Locations of these explorations are shown on Plate 1.

1.5 Laboratory Testing

Laboratory tests were performed on representative samples from prior and current explorations to determine the geotechnical properties of the subsurface materials. The following laboratory tests were performed on selected samples over the course of several investigations:

- In-situ moisture content and density (ASTM D2216 and ASTM D2937);
- Percent passing No. 200 Sieve (ASTM D1140); and
- Maximum dry density and optimum-moisture content (ASTM D1557).

The laboratory tests were performed in general conformance with ASTM procedures. The results of our laboratory tests from our current and prior applicable explorations are presented in Appendix C. 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 2006, 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 8, 2014. We advanced 5 hollow-stem auger borings, P-6 through P-13, drilled to a maximum depth of 15 feet 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 at 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

The CPTs, hollow stem auger borings, and test pits 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 subsurface distribution of these materials as they relate to the site is shown on Plate 2, *Geologic Cross Sections B-B' and C-C'.* These materials are described below.

2.2.1 Artificial Fill (Map Symbol: Afu)

Based upon our review of available aerial photographs, topographic maps, and our current and previous exploratory investigations in the project area (Appendices A and B), it is interpreted that man-made fills are present within portions of the parcel due in part to agricultural activities, construction of Magazine Road, and the detention basin. In areas explored using borings (Appendix A), we encountered up to 3½ feet of fill at select locations (Plate 1). Deeper fills could be encountered at unexplored locations within the West Alton Parcel. Undocumented fill materials consist predominately of silty sand with some clayey sand.

Artificial fill and undocumented soil are not considered suitable for support of proposed improvements and should be removed and replaced as compacted fill.

2.2.2 Young Alluvial Fan Deposits (Map Symbol: Qal)

At the West Alton Parcel, located near the mouth of Borrego Canyon Wash, the young upper alluvial fan deposits consist predominantly of interbedded, channelized to massive, loose to medium dense, unconsolidated well graded sands with minor rounded gravels, silty sands, and clayey sands with layers of stiff to very stiff sandy silts. Deposits include laterally discontinuous sandy-silty clay at shallow depths around 5 and 8 feet bgs. 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 alluvial fan deposits were encountered underlying the young alluvial fan deposits to the maximum depth explored of 75 feet bgs and consist predominantly of dense to very dense sand, silty sand, and gravel and stiff to hard sandy silt, silty clay, and clay.

2.2.4 Tertiary Topanga Formation (Tt)

Bedrock of the Topanga Formation was not encountered during our subsurface exploration but is mapped on the hillsides adjacent to the northeastern boundary of the West Alton Parcel and predominately consists of hard, moderately cemented sandstone with pebbley to conglomerate interbeds and occasional siltstone facies. The Topanga formation underlies the very old alluvial deposits, when present. It is believed to dip to an unknown depth in a southwest direction under the West Alton Parcel away from its surface expression in the adjacent hillside. The Topanga Formation may be encountered during excavations for any subterranean structures in the northeast area of the West Alton Parcel and may be difficult to rip and excavate.

2.3 Groundwater Conditions

Within the study area, groundwater was not encountered in any of the current or past explorations advanced to a maximum depth of 75 feet bgs. The young alluvial sediments that comprise a majority of the site consist mainly of highly permeable granular sediments. Due to the coarse-grained and unconfined nature of these sediments, the areas near mouths of canyons and washes are interpreted to be intake areas for recharge of deeper aquifers beneath the Tustin Plain (CDMG, 2000).

Based on our review of Seismic Hazard Report for the El Toro Quadrangles prepared by California Division of Mines and Geology (CDMG, 1998), 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 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-6 through P-13) 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 0.3 to 9.7 inches per hour at the tested locations within the West Alton Parcel (Plate 1). 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 the test location, 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)
West Alton Parcel				
P-6	5	0-5	5.7	2.9
P-7	15	5-15	4.8	2.4
P-8	5	0-5	19.3	9.7
P-9	15	5-15	12.2	6.1
P-10	15	5-15	0.6	0.3
P-11	5	0-5	1.5	0.7
P-12	5	0-5	13.8	6.9
P-13	15	5-15	5.6	2.8

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 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. 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 Borrego Canyon Wash and impacting a portion of the West Alton Parcel and beyond Irvine Boulevard during the 2005-2006 rainy season.

2.6 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 proper foundation design and controlled moisture conditioning or mixing with non-expansive soils will reduce the impacts associated with expansive soils.

Based on our exploration and experience in the general area (Leighton, 2007c), 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 medium potential for expansion depending on whether sandy or interbedded clay soils are encountered. Test results from two samples collected during exploration of the adjacent parcels to the south and west indicated expansion indices of 22 to 23. Variance in expansion potential of on-site soils is 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, based on our experience and results of prior testing, near surface soils should be assumed to have low to medium expansion potential.

2.7 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.

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.

2.8 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. If subterranean structures are planned, bedrock may be encountered in

the northeastern area of the West Alton Parcel depending on the depth and footprint location of the structure. 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. The issue of contaminated soils and debris has been 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 are 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 and the Newport-Inglewood fault zone located approximately 2.4 miles and 12.0 miles from the site, respectively. The San Andreas fault, which is the largest active fault in California, is approximately 42.6 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 8.6 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 are 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 Quadrangle (CGS, 2001), the 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*).

As indicated in our CPT and boring logs (Appendix A), our subsurface exploration revealed youthful alluvial deposits 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 Quadrangle (CGS, 2001), 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, 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.

Due to the vertical and lateral variation in subsurface soils, it is our opinion, that any remnant areas of existing contaminated soils present in LIFOC areas 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 at this site would be downward and in a south-southwesterly direction. It is possible that such movement could extend offsite.

Incorporation of sustainable design elements in site planning should consider all possible effects of changes to the present groundwater conditions over time.

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 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. A portion of the West Alton parcel is being used for mulching and stockpiling activities. Debris, including plant debris, resulting from the activities, if any, should be removed and properly disposed.

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.

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 detention basin within the 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 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)	33.6689
Site Longitude (decimal degrees)	-117.7048
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)	1.473
Adjusted Spectral Response Acceleration at 1s Period, S_{M1} (Eq. 16-38)	0.820
Design Spectral Response Acceleration at 0.2s Period, S_{DS} (Eq. 16-39)	0.982
Design Spectral Response Acceleration at 1s Period, S_{D1} (Eq. 16-40)	0.547
Peak Ground Acceleration, PGA_M (Eq. 11.8-1 of ASCE 7-10)	0.543

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 50 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 0.3 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 40 for design.

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	4
Light Truck	5	3	6
Heavy Truck	6	4	6
Main Drives	7	4	8

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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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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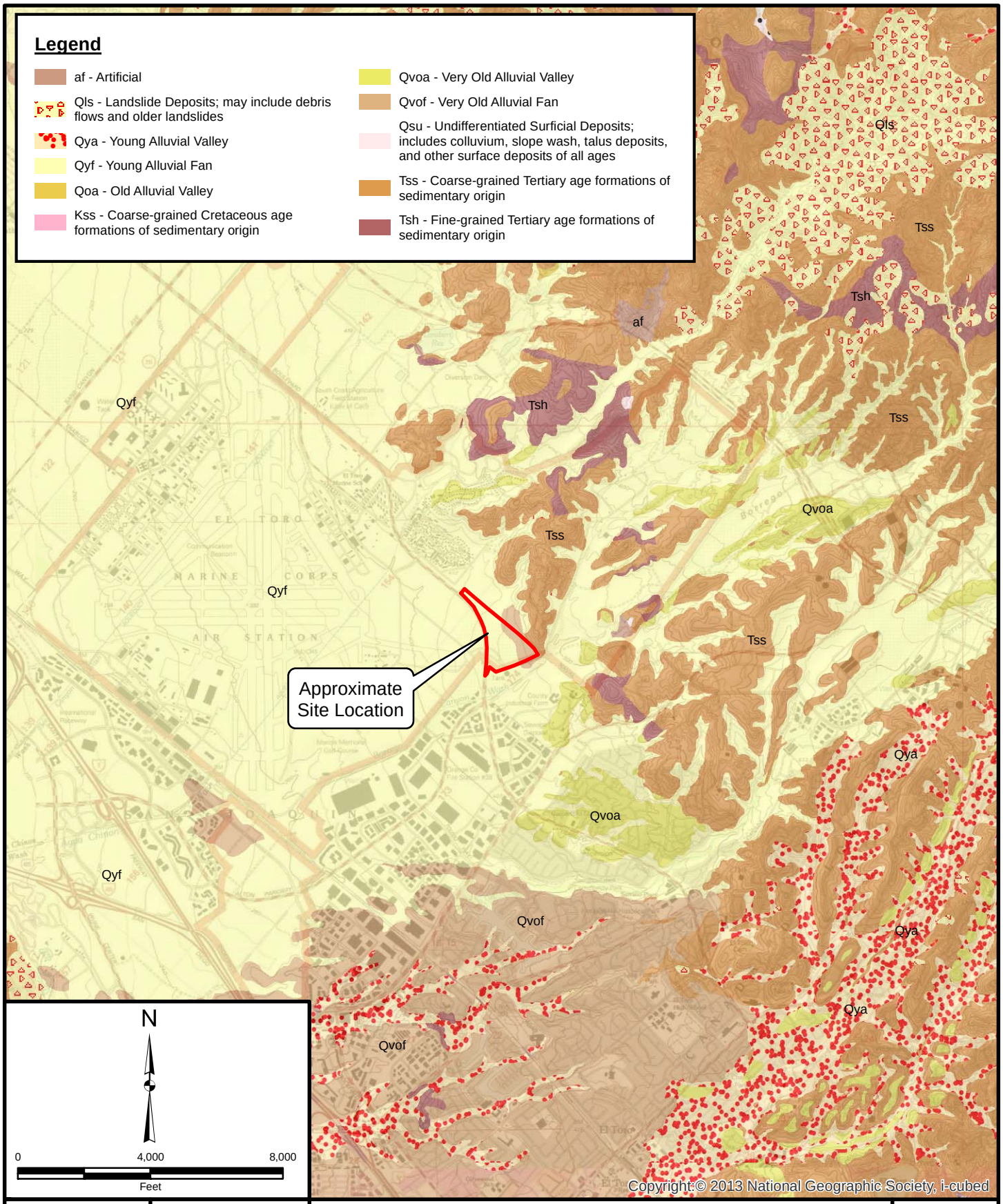
IIGER06085.0MRP

Project: 10695.001	Eng/Geol: CK/JAR	PARCEL LOCATION MAP West Alton Parcel Former El Toro Marine Corps Air Station Irvine, California	Figure 1
Scale:1 " = 4,000 '	Date: September 2014		Leighton
Base Map: ESRI ArcGIS Online 2014 Thematic Information: Leighton Author: Leighton Geomatics (mmurphy)			

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\West Alton Parcel\10695.001-Figure1 SLM_WestAltonParcel.mxd on 9/11/2014 12:28:08 PM



Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 4,000 '	Date: September 2014

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)

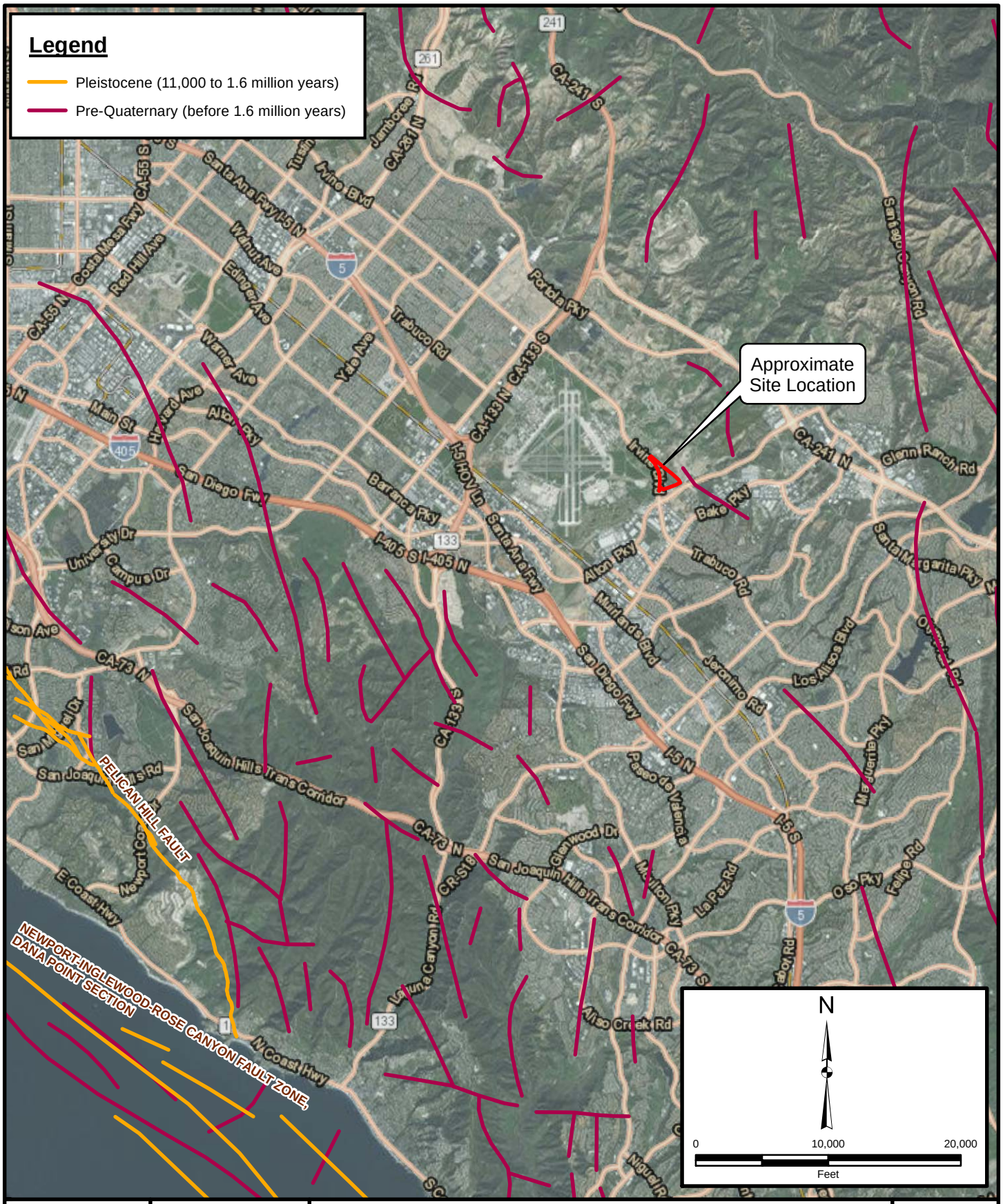
REGIONAL GEOLOGY MAP

West Aston 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\West Alton Parcel\10695.001-Figure2 RGM_WestAstonParcel.mxd on 9/11/2014 3:28:14 PM



Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 10,000 '	Date: September 2014

Base Map: ESRI ArcGIS Online 2014
Fault Data: Bryant CGS, 2010

Author: Leighton Geomatics (mmurphy)

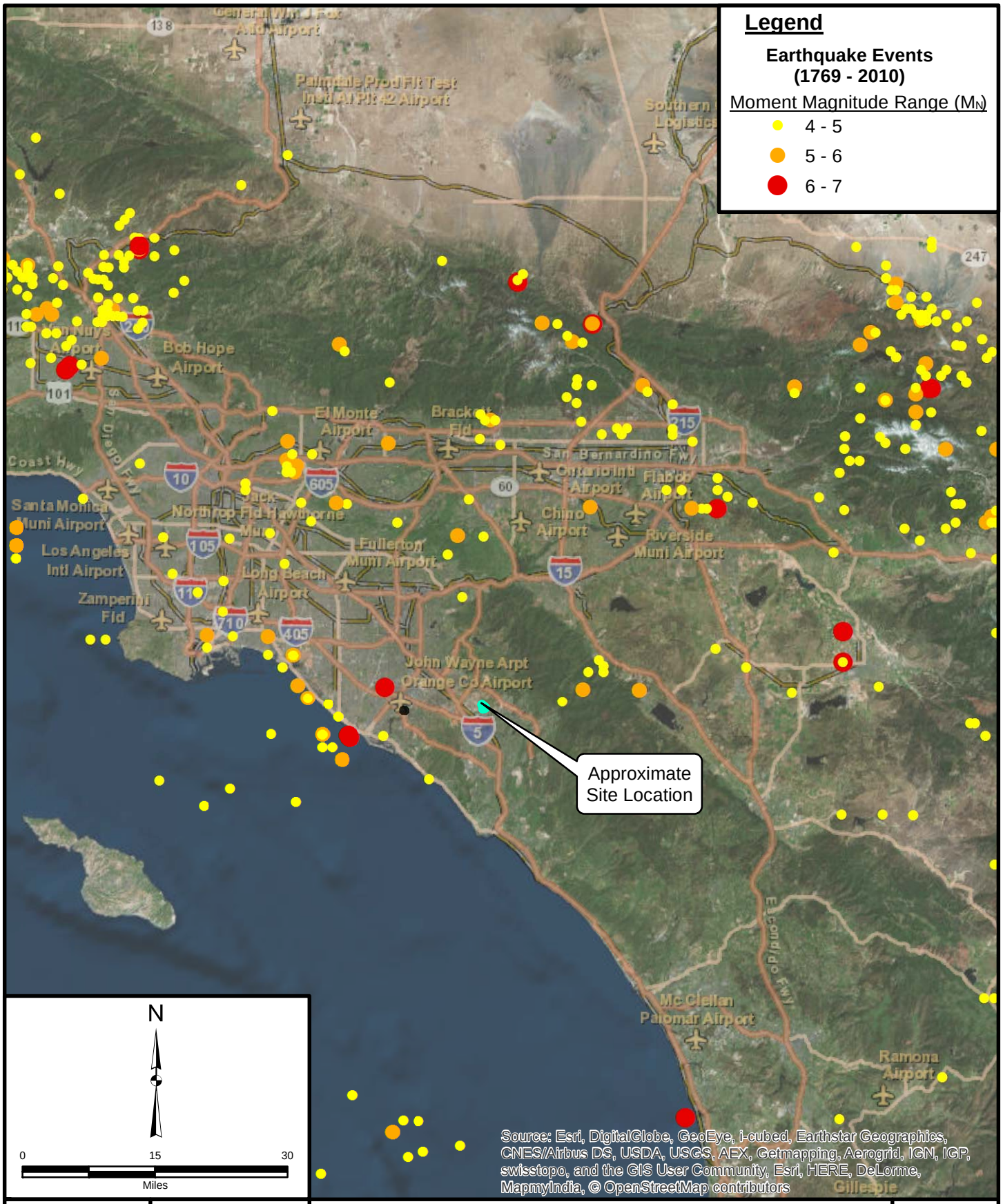
REGIONAL FAULT MAP

West Alton Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 3

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\West Alton Parcel\10695.001-Figure3-RFM_WestAltonParcel.mxd on 9/11/2014 4:03:47 PM



Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 15 miles	Date: September 2014

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

Author: Leighton Geomatics (mmurphy)

HISTORICAL SEISMICITY MAP

West Alton 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\West Alton Parcel\10695.001-Figure4-HSM_100AcreParcel_WestAltonParcel.mxd on 9/11/2014 3:54:35 PM

Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 4,000 '	Date: September 2014

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

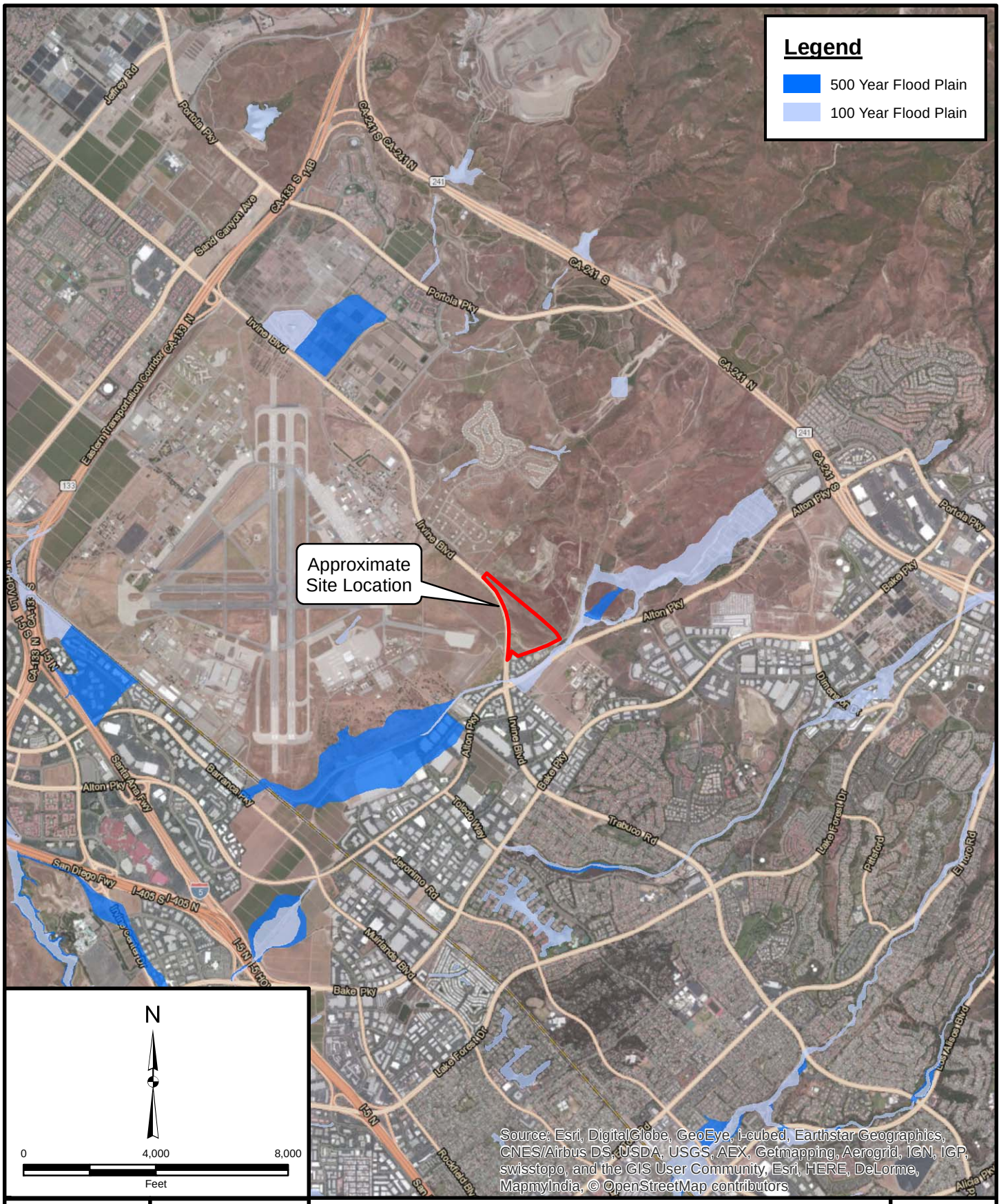
SEISMIC HAZARD MAP

West Alton 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\West Alton Parcel\10695.001-Figure5-SHM_WestAltonParcel.mxd on 9/11/2014 4:01:53 PM



Project: 10695.001	Eng/Geol: CK/JAR
Scale:1 " = 4,000 '	Date: September 2014

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

Author: Leighton Geomatics (mmurphy)

FLOOD HAZARD ZONE MAP

West Alton Parcel
Former El Toro Marine Corps Air Station
Irvine, California

Figure 6

Leighton

Map Saved as P:\drafting\10695\001\GIS\of_2014-08-04\West Alton Parcel\10695.001-Figure6-FHM_WestAltonParcel.mxd on 9/11/2014 4:08:49 PM

APPENDIX A

CPT AND BORING LOGS

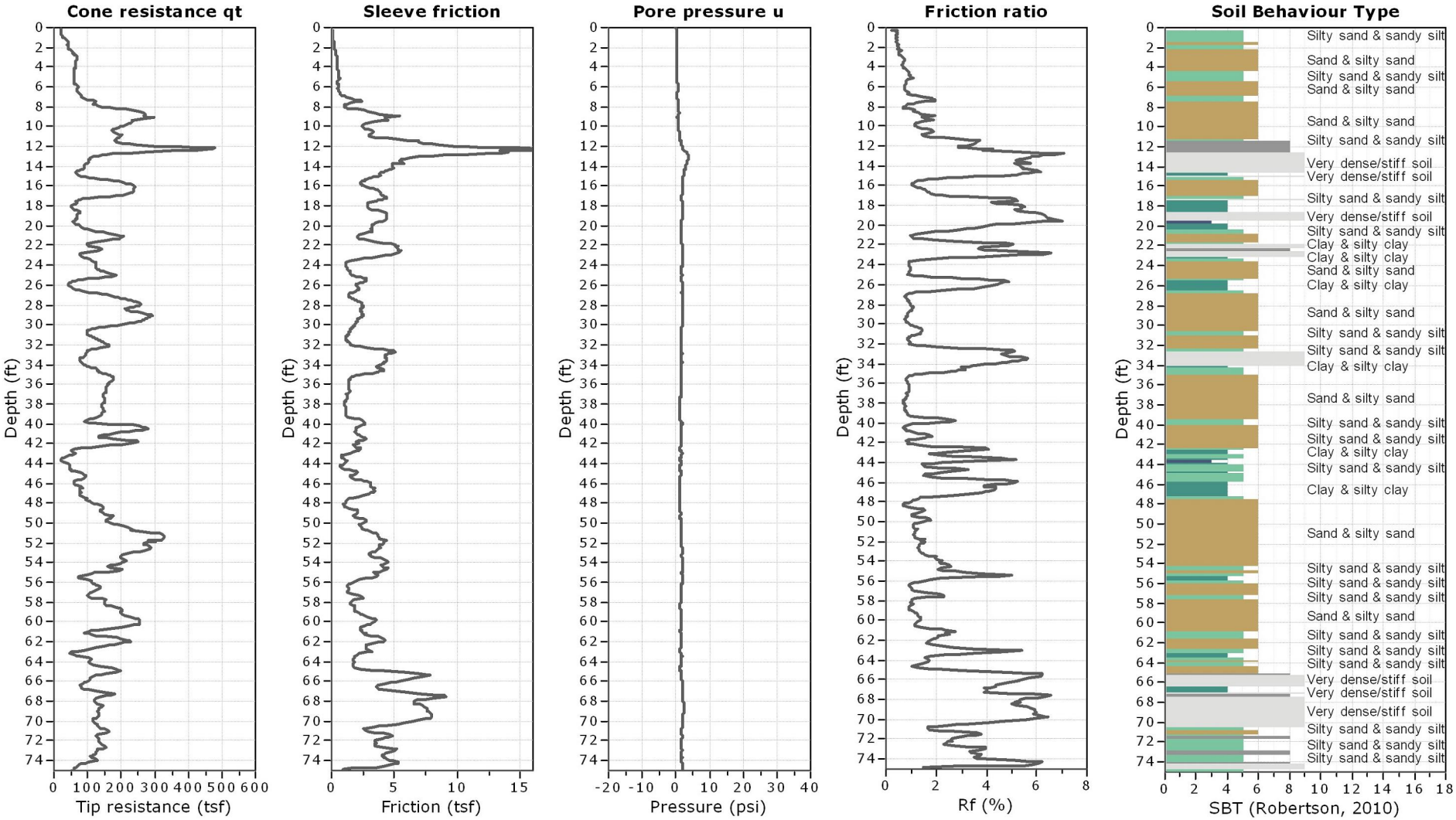
Leighton

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

CPT: CPT-11

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

Total depth: 75.03 ft, Date: 6/11/2014
Cone Type: Vertek

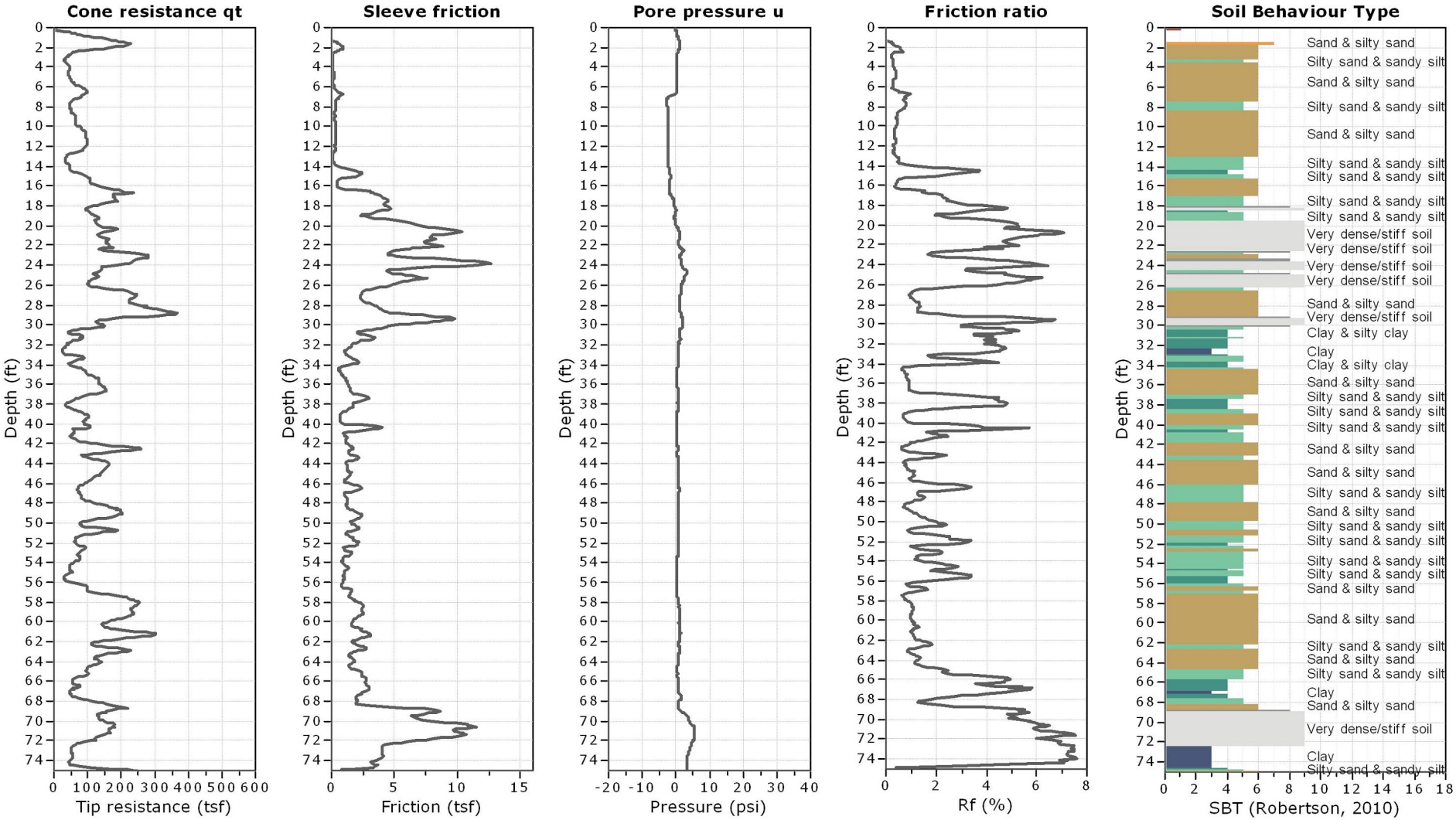


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-12

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

Total depth: 75.06 ft, Date: 6/11/2014
Cone Type: Vertek

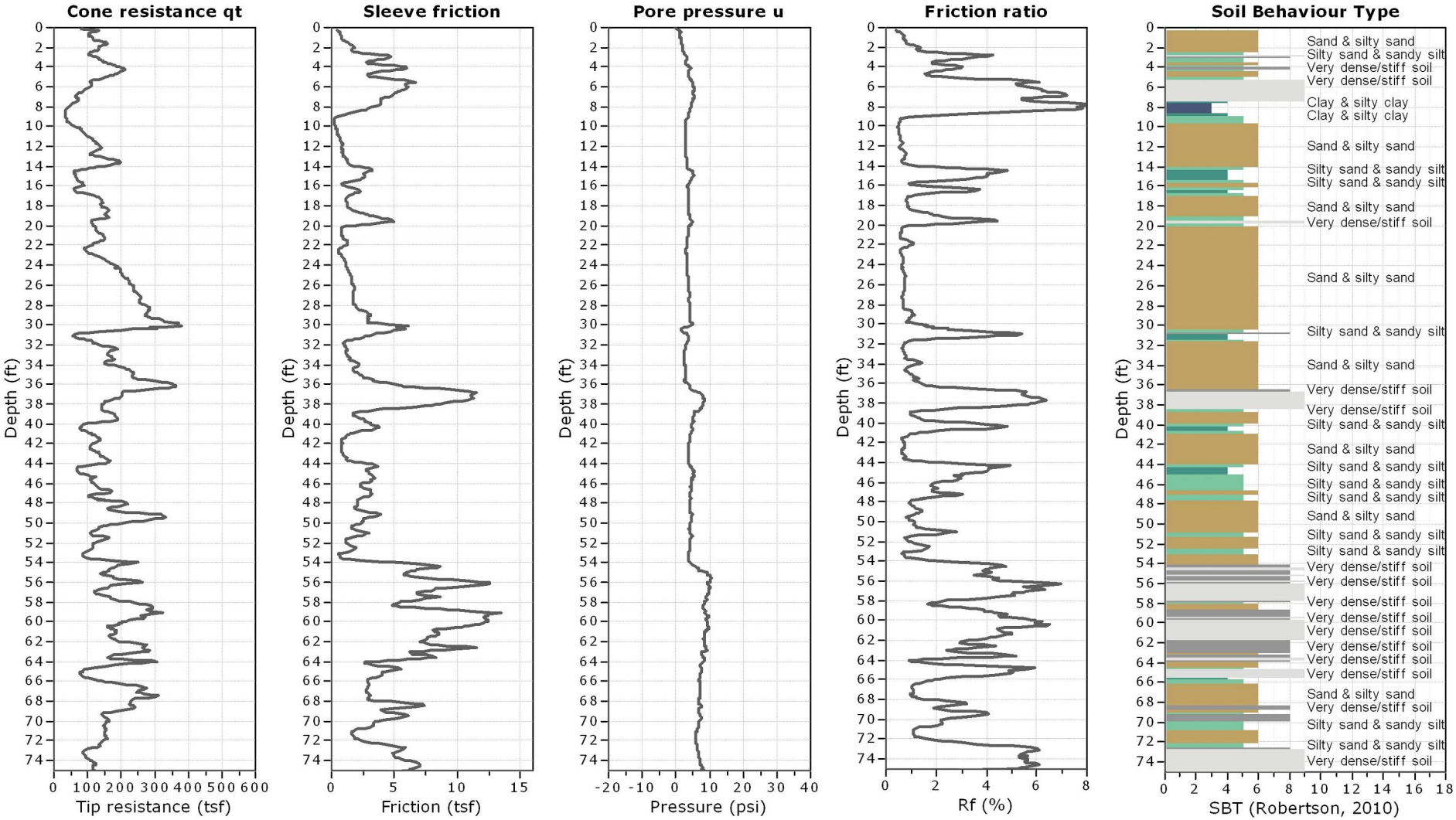


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-13

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

Total depth: 75.43 ft, Date: 6/11/2014
Cone Type: Vertek

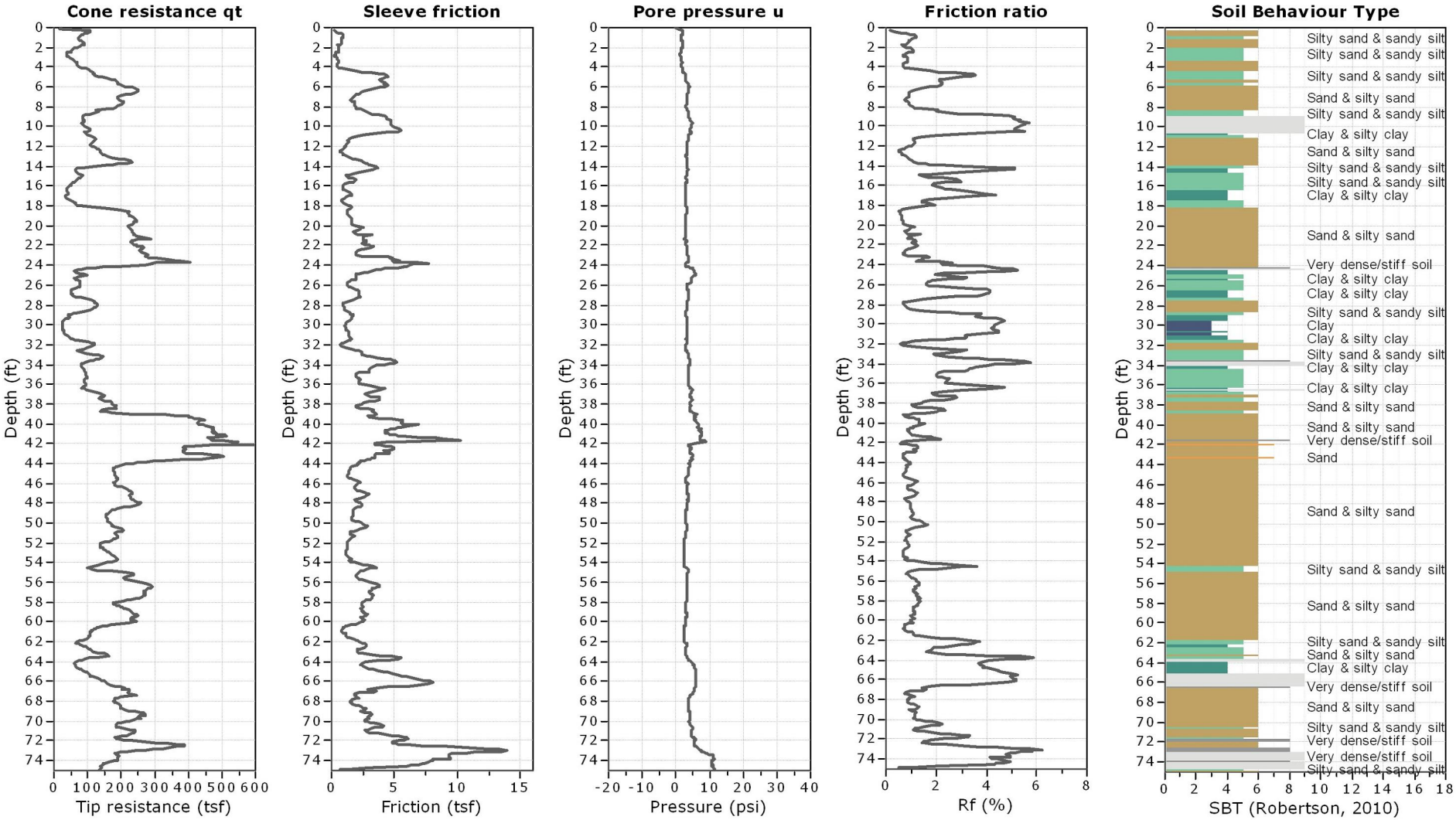


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-14

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

Total depth: 75.06 ft, Date: 6/11/2014
Cone Type: Vertek

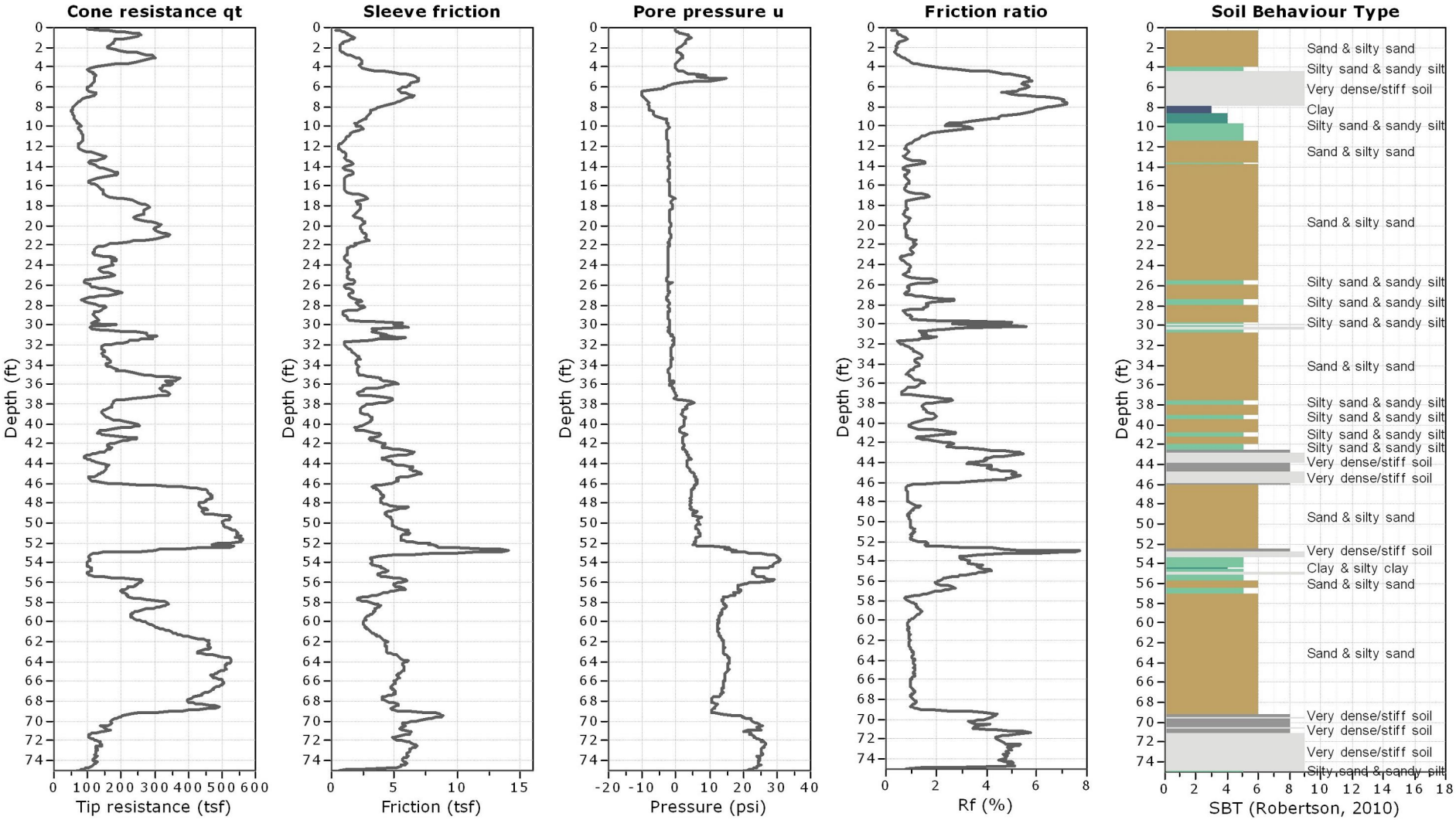


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-15

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

Total depth: 75.16 ft, Date: 6/11/2014
Cone Type: Vertek

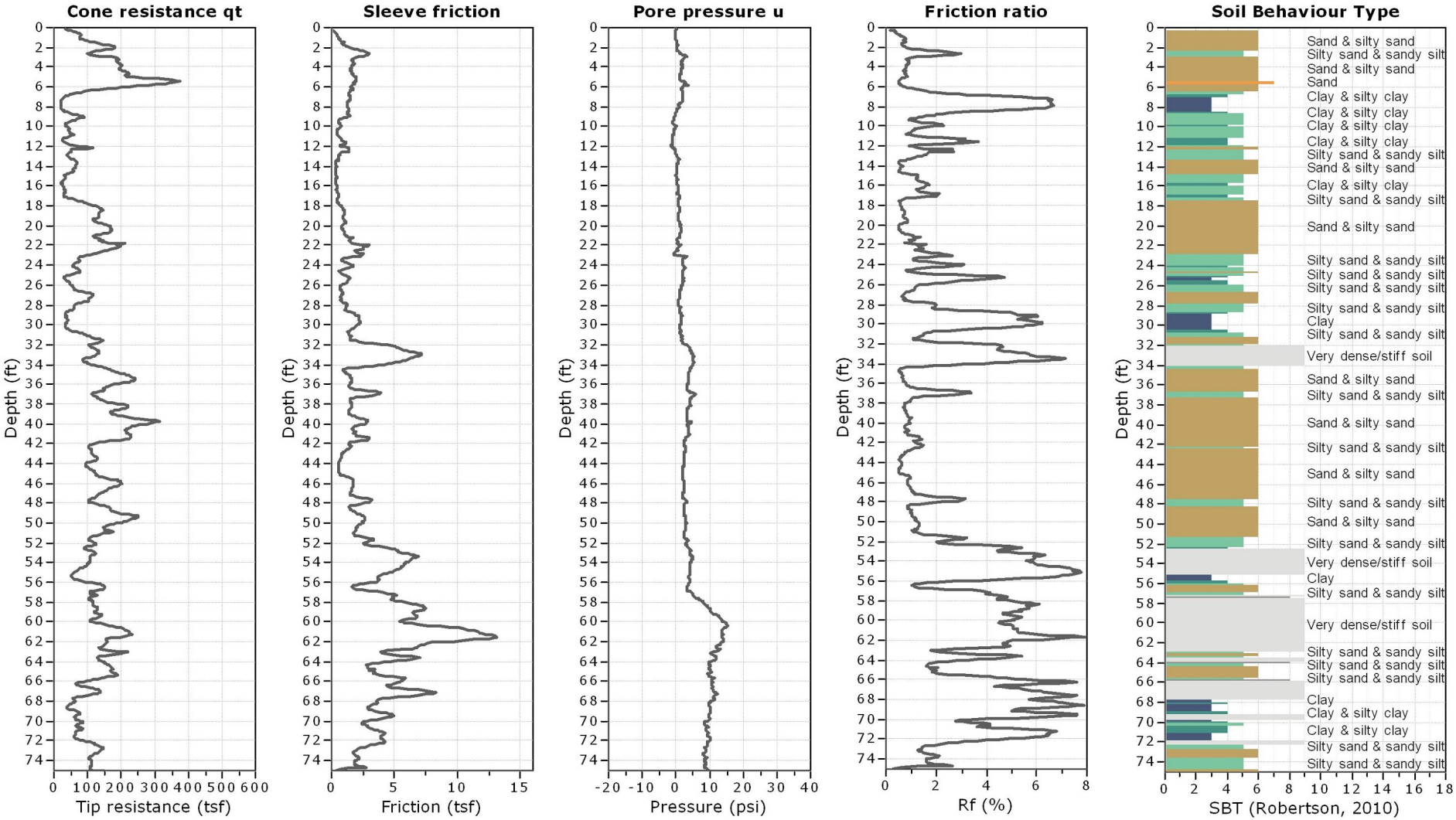


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-16

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

Total depth: 75.11 ft, Date: 6/12/2014
Cone Type: Vertek

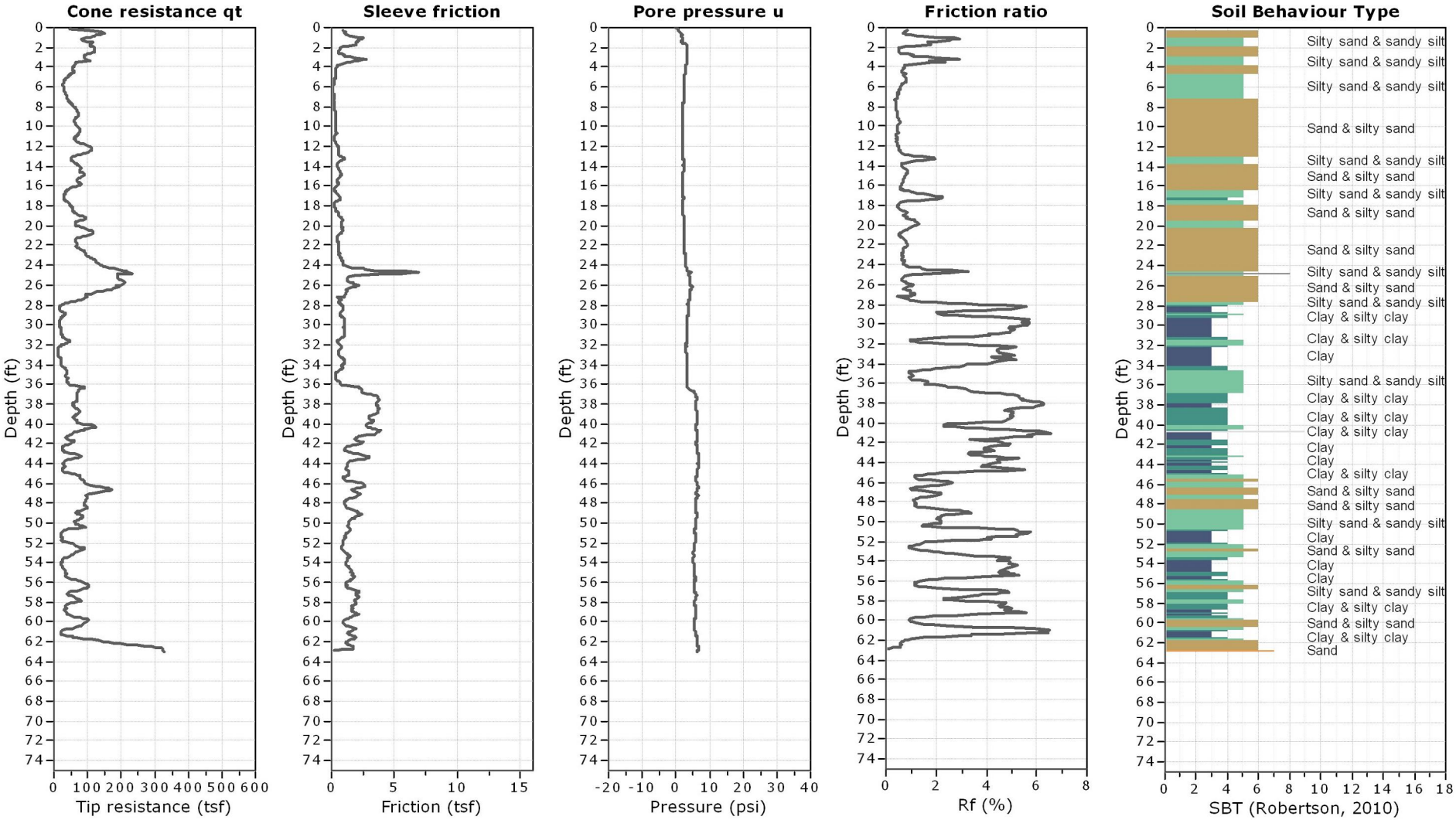


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-17

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

Total depth: 63.06 ft, Date: 6/12/2014
Cone Type: Vertek

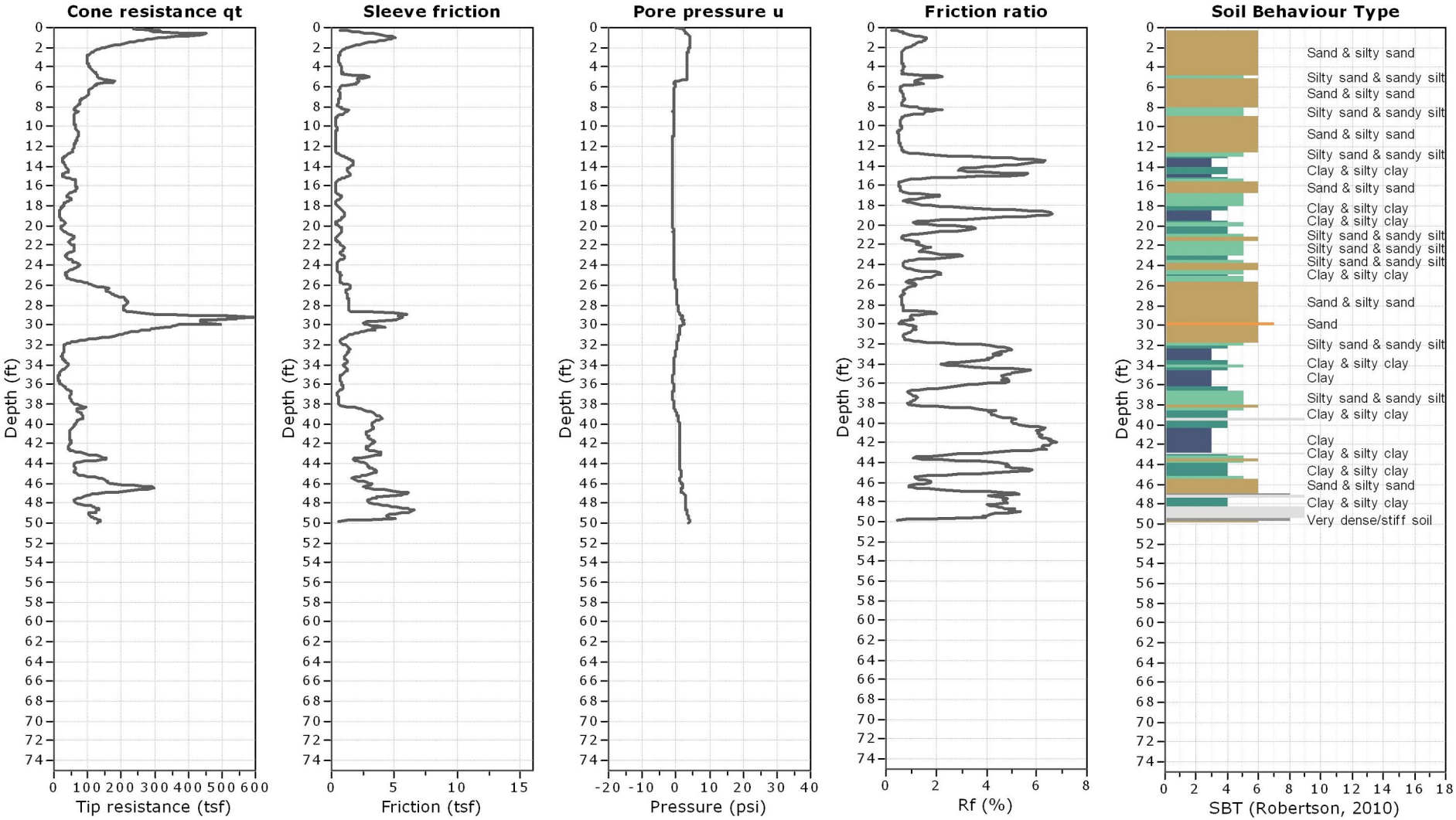


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: CPT-18

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

Total depth: 49.99 ft, Date: 6/12/2014
Cone Type: Vertek



GEOTECHNICAL BORING LOG P-6

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	428'
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 *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.*	Type of Tests
	0							SM	**Artificial fill, undocumented:** @0': Silty SAND, brown, loose, wet, surface water observed	
				R-1	8 14 16	109	4		@1': Becomes dark brown, fine grained, moist	
									Quaternary young alluvial fan deposits: (Qyf) @1.5': Silty SAND, light yellow brown, moist, medium dense, fine to medium grained sand, trace gravel	
425				R-2	7 12 17	105	6		@3.5': Fine grained, medium dense, trace unlined pores, 1 to 3 mm in size	-200
	5								Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/10/2014.	
420										
	10									

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-7

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	430'
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
430	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, brown, moist, loose	
				R-1	10 11 12		4		**Quaternary young alluvial fan deposits: (Qyf)** @1.5': Silty SAND, light yellow brown, moist, medium dense, fine to medium grained, trace gravel	
425	5			S-1	3 4 5	106	5			
420	10			R-2	12 24 40	128	9	SC	@9.5': Clayey SAND, brown, moist, very dense, low plasticity, medium to coarse grained sand, trace gravel	
				R-3	29 18 30	95	30			
415	15							CL	@14.5': Sandy CLAY, yellow brown, moist, hard, low plasticity, fine grained sand, grades to clayey sand	
410	20								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 12/10/2014.	

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-8

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	445'
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
445	0							SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist	
				R-1	8 12 13	106	3		**Quaternary young alluvial fan deposits: (Qyf)** @1': Silty SAND, light olive brown to yellow brown, dry, medium dense, fine grained sand, trace root hairs, grades to medium grained sand, friable	-200
								SP	@2.5': SAND, pale yellow brown, medium dense, dry, medium grained sand, trace gravel, friable	
				R-2	6 7 10	109	2			
440	5								Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/10/2014.	
435	10									

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-9

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	447'
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, yellow brown, loose, moist @1': Becomes dark brown	
445				S-1	4 4 6		2	SP-SM	**Quaternary young alluvial fan deposits: (Qyf)** @1.5': SAND with Silt, light yellow brown, dry, dense, fine to medium grained	
	5			R-1	11 8 13	107	3	SM	@5': Silty SAND, dark brown, moist, medium dense, trace clay	-200
440								SP	@6': SAND, pale yellow brown, dry, medium dense, medium grained	
				R-2	5 7 9	103	4			
	10									
435										
				R-3	8 10 12	102	2		@13.5': Increase in grain size, friable	
	15									
430									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 12/10/2014.	
	20									

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-10

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	458'
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, yellow brown, moist,	
								SC	@1': Clayey SAND, brown, moist	
				S-1	4 3 4		2			
455								SM	**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Silty SAND, light yellow brown, dry, loose, fine grained sand	
	5			R-1	4 7 12	106	15	CL	@5': Sandy CLAY, yellow brown, moist, medium stiff, low plasticity, moderate $CaCO_3$ development	
450				R-2	9 11 14	108	7			-200
	10							SM	@9': Silty SAND, light yellow brown, dry, medium dense, fine grained sand	
445				R-3	18 24 34	120	12	CL	@13.5': Sandy CLAY, yellow brown, moist, hard, low plasticity, fine grained sand, $CaCO_3$ stringers	
	15								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.	
440										
	20									

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-11

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	463'
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, yellow brown, moist	
				R-1	15 28 42	122	10		**Quaternary young alluvial fan deposits: (Qyf)** @1': Silty SAND, yellow brown, moist, dense, fine to medium grained sand, trace subangular gravel, trace clay	-200
460										
				R-2	19 24 40	123	5		@3.5': Some subangular gravel(mechanically fracture), up to 1-inch in long dimension	
	5									
									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/11/2014.	
455										
	10									

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-12

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	456'
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)**	
455				R-1	9 9 7	106	8		@1': Silty SAND, dark yellow brown, moist, medium dense, trace gravel, concrete fragments, trace clay, fine grained sand, friable	
				R-2	6 10 11	108	5		**Quaternary young alluvial fan deposits: (Qyf)** @3.5': Silty SAND, yellow brown, moist, medium dense, fine grained sand	-200
	5									
450									Total Depth of Boring: 5 feet bgs No free groundwater encountered during drilling Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 12/11/2014.	
	10									

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-13

Project No.	10695.003	**Date Drilled**	12-8-14
Project	West Alton Parcel - Percolation Tests	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	462'
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 *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.*	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented: (Afu)** @0': Silty SAND, yellow brown, moist @1': Becomes dark brown, fine to medium grained sand	
460				S-1	2 3 4		4			
								SP-SM	**Quaternary young alluvial fan deposits: (Qyf)** @2.5': Silty SAND to SAND, light yellow brown, moist, loose, fine grained	
	5			R-1	10 8 9	101	9	SP	@5': SAND, pale yellow brown, dry, medium dense, friable, medium grained	
								CL	@6': Sandy CLAY, olive brown, moist, stiff, low plasticity with fine grained sand	
455										
				R-2	14 26 33	86	5	SM	@8.5': Silty SAND, pale yellow brown, dry, dense, friable, fine to medium grained, some mechanically fractured gravel	-200
	10									
450										
				R-3	6 10 13	108	6		@13.5': Silty SAND, light yellow brown, dry, medium dense, fine grained, grades to silty clay, dry	
	15									
445									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									

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

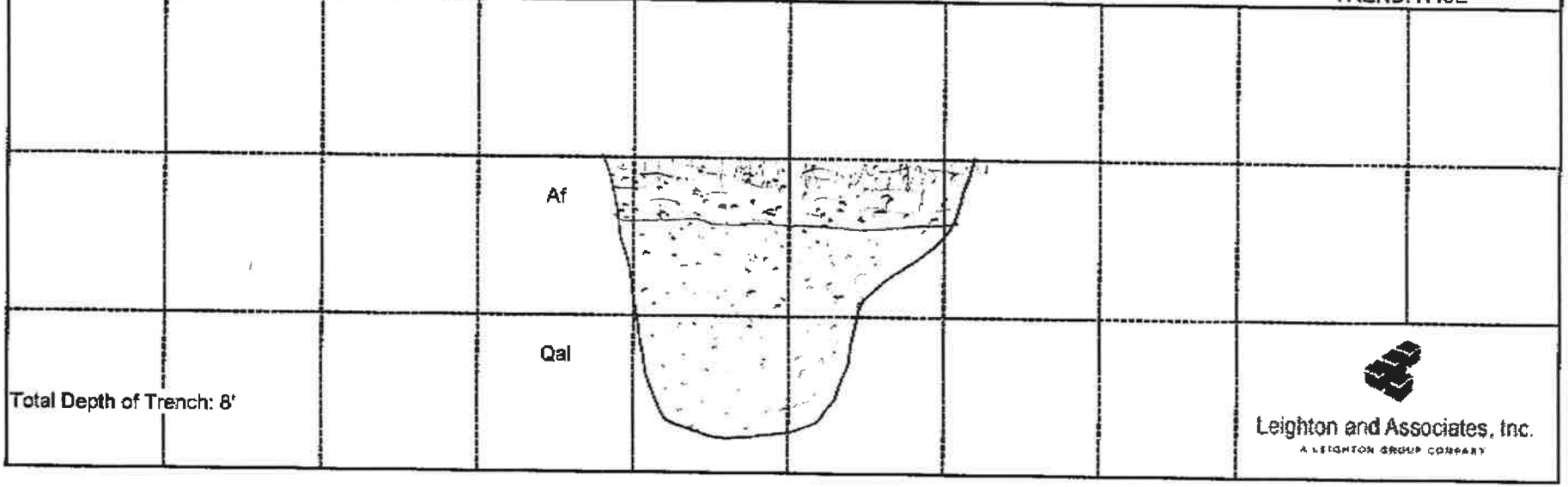
PRIOR EXPLORATIONS

Leighton

Project Name:	Heritage Fields	Logged by:	JMP
Project Number:	011783-001	Elevation:	Trench No. T-27
Equipment:	Backhoe	Location:	See Geotechnical Map

GEOLOGIC ATTITUDES	DATE: 12/6/2005 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)	Other Tests
	@ 0-2': Silty SAND, brown, moist, medium dense, rootlets, fine to medium grained	Fill: (Af)		R1@2	5.0	100.0	6
	@ 2-8': SAND, light brown, damp, fine grained, medium dense, medium grained	Alluvium: (Qal)		B1@5-8'			
				R2@8'	5.9	99.6	8

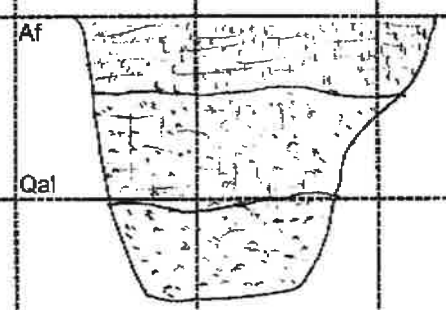
GRAPHIC PRESENTATION: Southeast Wall SCALE: 1" = 5' SURFACE SLOPE:Flat TREND: N40E



Project Name: Heritage Fields	Logged by: JMP		
Project Number: 011783-001	Elevation:	Trench No.	T-32
Equipment: Backhoe	Location: See Geotechnical Map		

GEOLOGIC ATTITUDES	DATE: 12/7/2005 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)	Other Tests
	@ 0-2': Silty SAND, brown, moist, loose, layers of organics @ 1' (1"thick), some pieces of visqueen	Fill: (Af)		R1@2' B1@2-3'	16.3	109.8	15
	@ 2-5': Silty SAND with Clay, brown, moist, medium dense, moderate porosity	Alluvium: (Qal)					
	@ 5-7.5': SAND, light brown, damp, medium dense			R2@7.5'	13.0	105.5	10

GRAPHIC PRESENTATION: Southeast Wall SCALE: 1" = 5' SURFACE SLOPE: Flat TREND: N45W



Total Depth of Trench: 7.5'

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

Trench-new.xlt

Project Name:	Heritage Fileds	Logged by:	Chris Livesey		
Project Number:	011783-012	Elevation:	450'	Trench No.	WLC TP- 1
Equipment:	24-Inch Backhoe	Location:	Irvine, California		

GEOLOGIC ATTITUDES	DATE: 12-Mar-07 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)	Other Tests
	Quaternary Colluvium (Qcol)						
	@0-2.0': Disced Field: Clayey SAND (SC), loose, light brown, moist, fine grained mottled with pockets of brown fine sand, abundant rootlets	Qcol	SC	N @3'	N 8	N 100.6	
				R-1 @3'	5.7	104.1	
	Quaternary Alluvium (Qal)						
	@2.0': Silty SAND (SM), brown, moist, fine sand to coarse grained and fine to coarse well rounded gravel, silt content decreases with depth	Qal	SM	BB1 @0-5'			MD, SA
	@5.0': SAND with silt (SP-SM), brown, moist, fine to medium grained		SP/SM	N @5'	N 22.4	N 87.3	
	@13-14': Minor caving			R-2 @7'	9.4	106.2	
	@14': Clayey SAND (SC), brown, moist, fine to coarse grained		SC	R-3 @14'	14.9	113.0	
	Total Depth 15'	**Note: N @3'** N moisture and density using nuclear gauge		BB2@0-14'			

GRAPHIC PRESENTATION SCALE: 1" = 5' SURFACE SLOPE: Flat TREND: N20E

Log of Trench: WLC TP- 1

Project Name:	Heritage Fileds	Logged by:	Chris Livesey		
Project Number:	011783-012	Elevation:	446'	Trench No.	WLC TP- 2
Equipment:	24-Inch Backhoe	Location:	Irvine, California		

GEOLOGIC ATTITUDES	DATE: 12-Mar-07 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)	Other Tests
	Quaternary Colluvium (Qcol)						
	@0-1.5': Disced Field: Silty SAND (SM), dark brown, moist, fine to coarse grained, abundant rootlets, trace fine, well rounded gravel, abundant plastic debris	Qcol	SM	BB1 @ 0-5'			
				N @3'	[N] 13.3	[N] 97.4	
				R-1@3'	3.8	85.2	
	Quaternary Alluvium (Qal)						
	@1.5': Silty SAND (SM), brown, moist, fine grained, trace fine gravel, some rootlets	Qal	SM	N @5'	[N] 7.8	[N] 95.1	
	@3.5': SAND (SP), light grey, moist; fine to medium grained, some coarse sand		SP				
	@5.0': Grades to a silty SAND (SM), brown, moist, fine to coarse grained		SM	R2@7'	3.4	106.5	SA
	@6.0': SAND (SP), light grey, damp to moist, medium to coarse grained, some fine to coarse gravel and small cobbles to 6-inches in size, grades to Sand with Silt		SP				
	@10.5': Sandy CLAY (CL), brown, very moist, fine grained sand			BB2 @7'			
	buried paleosol	**Note: N @3'**	CL				
	Total Depth: 15.5'	[N] moisture and density using nuclear gauge		BB3 @ 15'			

GRAPHIC PRESENTATION SCALE: 1" = 5' SURFACE SLOPE: Flat TREND: N5E

Log of Trench: WLC TP- 2

Project Name:	Heritage Fields- Sand Investigation	Logged by:	HJN	Trench No. **SD TP- 1**	ENGINEERING PROPERTIES
Project Number:	011783-019	Elevation:	445'		
Equipment:	24-Inch Backhoe	Location:	Irvine, CA		

GEOLOGIC ATTITUDES	DATE: 29-Oct-07 SOIL DESCRIPTION:	Geol. Unit	U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)	Lab Tests
	Quaternary Colluvium (Qcol)						
	@0': Disced Fields: SAND with silt and gravel, light brown, slightly moist, medium dense, fine to coarse sand with silt and gravel sized asphalt debris and scattered plastic debris.	Qcol	SM	N @0.5'	^{N}8.0	^{N}99.4	
				N @2'	^{N}12.6	^{N}91.4	
				N @4'	^{N}20.5	^{N}93.7	
	Quaternary Alluvium (Qal)						
	@2.8': Silty SAND (SM), yellow brown, moist, dense, fine to medium sand with 20-30% silt and occasional subrounded fine to coarse gravel.	Qal	SM	BB-1 @ 3.5'			SA
	@3.5': Silty, Clayey SAND (SC-SM), brown, 63% sand, 37% fines.		SC-SM				
	@5.5': becomes SAND (SP), fine to coarse grained, some silt.		SP	S-1 @10'			-200
	@10': Sandy SILT (ML), brown, moist, low to medium plasticity, 20-25% fine to medium sand, with 73.1% passing -200 sieve.		ML	S-2@13.5'			
	@13.5-14': SAND (SP); yellow brown, moist, 20-30% fine to coarse sand with fine gravel and minor silt		SP				
	@14': Sandy SILT (ML); brown, moist, low to medium plasticity, fine to medium sand, thin bed (0.5' thick).		ML	S-3 @14.5			-200
	@14.5': Silty SAND (SM), reddish brown, moist, medium to coarse sand, weak to patchy cementation, 19.2% passing -200 sieve.		SM				

GRAPHIC PRESENTATION SCALE: 1" = 5' SURFACE SLOPE: Flat TREND: N70E

Total Depth 15.5'

Note: ^{N}moisture and density test results obtained using nuclear gauge.

Log of Trench: SD TP- 1

GEOTECHNICALBORING LOG PAZ 18-4

Date 1-2-07 **Sheet** 1 **of** 1

Project 011783-004 Heritage Fields **Logged / Sampled By** Joe Roe

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

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

Elevation Top of Hole 432' **Location** 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			Bag-1				SM	@0': **Quaternary Colluvium (Qcol)** Silty SAND, dark brown, moist, fine grained.	CR, EI
430				R-1	3 7 9	115	6		**Quaternary Alluvium (Qal)** @2.5': Silty SAND, loose, dark brown, moist, fine to coarse grained.	
	5			R-2	2 5 6	100	7	SM	@5': Silty SAND, loose, light tan, very moist, fine grained, 15.4% passing no. 200 sieve.	SA
425				R-3	3 3 6			SM	@7.5': Silty SAND, loose, brown, very moist to moist, fine grained,	DS
	10			R-4	2 3 5	97	21	ML	@10': Sandy SILT, firm, dark brown, very moist, fine grained sand.	
420										
	15			S-1	1 2 3			SM	@15': Silty SAND with silt, loose, light brown, moist, fine to medium grained, 16.9% passing no. 200 sieve.	SA
415										
	20			R-5	3 7 9	98	3	SP	@20': SAND, loose, light tan, moist, medium grained, trace of fine gravel.	
410										
	25			S-2	3 2 2				@25': Silty SAND, loose, light brown, moist, fine grained sand.	SA
405									Total Depth of borehole: 26.5' No free groundwater encountered during drilling. Borehole backfilled with soil cuttings.	
	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

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

GEOTECHNICAL BORING LOG SD BH-2

Date 10-19-07 | Sheet 1 of 1
Project Herritage Fields Sand Deposits | Project No. 011783-019
Drilling Co. Martini Drilling Corp. | Type of Rig CME-75
Hole Diameter 8" | Drive Weight 140 lbs Autohammer | Drop 30"
Elevation Top of Elevation 442' | Location PAZ 19 - Practice Range

Logged By JAR
Sampled By JAR

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								**Quaternary colluvium (Qcol):** @0': Disced fields: silty SAND with gravel, loose, brown, dry, fine to coarse grained, fine to coarse rounded gravel, occasional small cobbles and boulders.	
440				R-1	10 9 10			SM	**Quaternary alluvium (Qal):** @ 2': Silty SAND, medium dense, reddish brown, moist, fine to medium grained, micaceous, trace clay in matrix, grades to clayey sand. @ 3.5': Clayey SAND, medium dense, orange brown, moist, fine to coarse grained, some mica.	
	5			R-2	4 5 10			CL	@ 5': Sandy CLAY, stiff, orange brown, moist, fine grained sand, with thin interbeds of silty sand, fine to coarse grained sand, loose.	
435				R-3	5 7 7			SP-SM	@ 7': SAND with silt, medium dense, light brown, slightly moist, fine grained.	
	10			R-4	3 5 9			ML	@ 10': SILT, stiff, brown, moist, some fine grained sand, micaceous, thin beds of fine grained sand, trace clay.	
430										
	15			R-5	3 6 6			ML	@ 15': Sandy SILT, stiff, light brown, moist, fine grained sand, micaceous.	
425										
	20			R-6	6 14 20			SP	@ 20': SAND, medium dense, light yellow brown, moist, fine to medium grained, some mica.	
420										
	25			R-7	3 11 10			SP	@ 25': SAND with gravel to 26.5', becomes silty SAND with clay, medium dense, orange brown, moist, fine to coarse grained.	
415									Total depth: 26.5 feet No groundwater was encountered during drilling The boring was backfilled with soil cuttings upon completetion.	
	30									

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

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

LEIGHTON AND ASSOCIATES, INC.

APPENDIX C

LABORATORY TEST RESULTS

Leighton

Boring No.	P-6	P-8	P-9	P-10	P-11	P-12	P-13	
Sample No.	R-2	R-1	R-1	R-2	R-1	R-2	R-2	
Depth (ft.)	3.5	1.0	5.0	8.5	1.0	3.5	8.5	
Sample Type	Ring	Ring	Ring	Ring	Ring	Ring	Ring	
Soil Identification	Brown silty sand (SM)	Brown silty sand (SM)	Light brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	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	0.00	0.00	
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Sample Dry Weight Determination								
Weight of Sample + Container (g)	520.1	556.5	528.2	542.1	610.4	552.2	540.9	
Weight of Container (g)	138.4	135.7	137.9	140.0	142.6	140.8	140.6	
Weight of Dry Sample (g)	381.7	420.8	390.3	402.1	467.8	411.4	400.3	
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	B	B	
Dry Weight of Sample + Cont. (g)	341.0	448.7	470.5	448.2	470.4	482.4	448.2	
Weight of Container (g)	138.4	135.7	137.9	140.0	142.6	140.8	140.6	
Dry Weight of Sample (g)	202.6	313.0	332.6	308.2	327.8	341.6	307.6	
% Passing No. 200 Sieve	**46.9**	**25.6**	**14.8**	**23.4**	**29.9**	**17.0**	**23.2**	
% Retained No. 200 Sieve	53.1	74.4	85.2	76.6	70.1	83.0	76.8	

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Lowe Enterprises/West Alton Parcel
Project No.: 10695.003
Tested By: S. Felter Date: 12/18/14

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: H. F. Wildlife Corridor
Project No.: 011783-012
Exploration No.: TP-1
Sample No.: BB-1
Soil Identification: Light brown well-graded sand with clay (SW-SC)

Tested By: RAL Date: 03/27/07
Checked By: LF Date: 04/04/07
Depth (feet): 0-5

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	A2	750	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	1572.90	415.31	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	226.00	76.89	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	1346.90	338.42	Moisture Content (%)	0.00	0.00

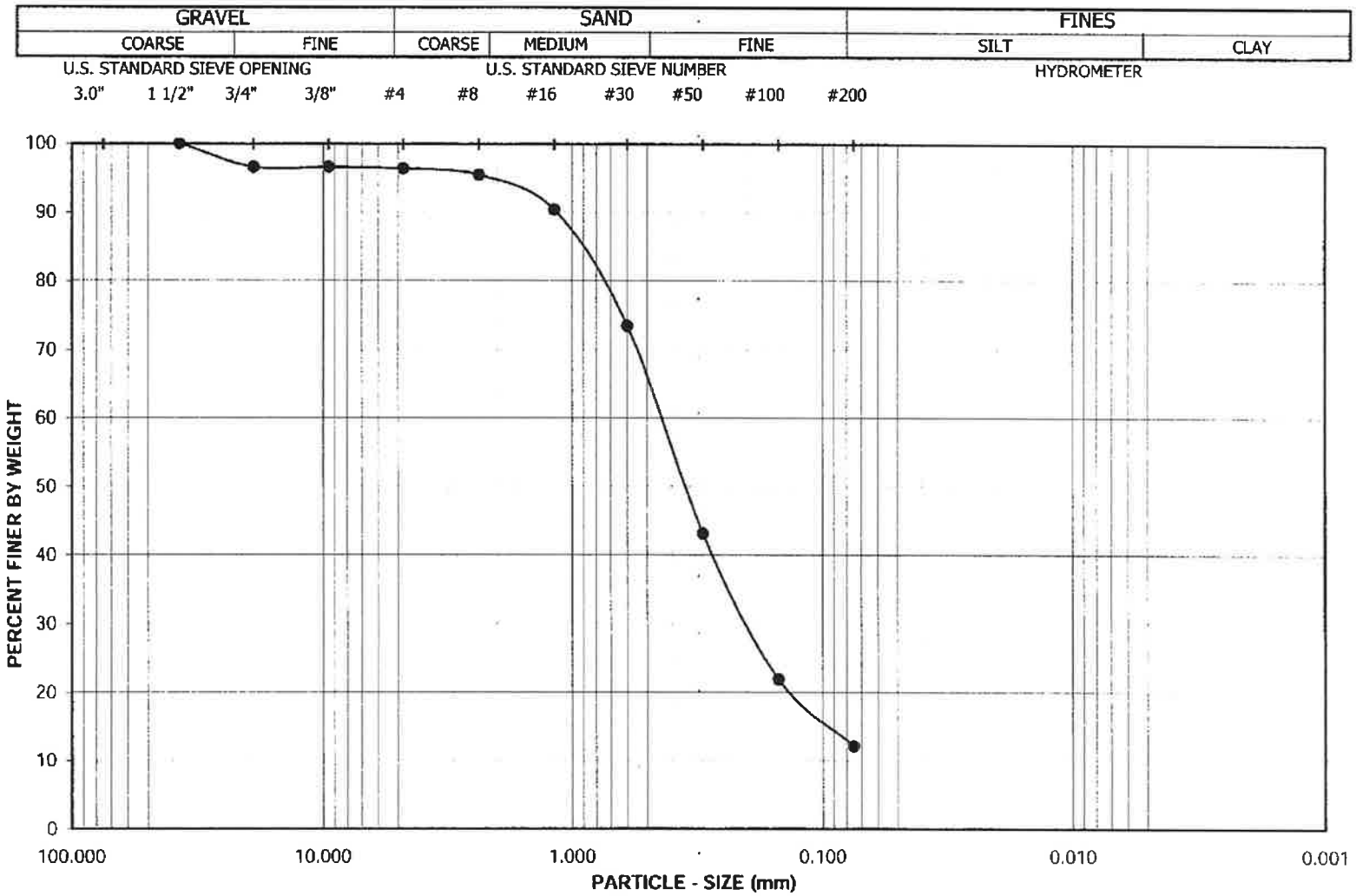
Passing #4 Material After Wet Sieve	Container No.	750
	Wt. of Dry Soil + Container (g)	374.09
	Wt. of Container (g)	76.89
	Dry Wt. of Soil Retained on # 200 Sieve (g)	297.20

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
6"	152.400			
3"	75.000	0.00		
1 1/2	37.500	0.00		100.0
3/4"	19.000	45.40		96.6
3/8"	9.500	45.40		96.6
#4	4.750	48.80		96.4
#8	2.360		3.06	95.5
#16	1.180		21.03	90.4
#30	0.600		80.39	73.5
#50	0.300		187.10	43.1
#100	0.150		261.52	21.9
#200	0.075		296.09	12.1
PAN				

GRAVEL: **4 %**
SAND: **84 %**
FINES: **12 %**
GROUP SYMBOL **SW-SC**

Cu = D60/D10 = 7.33
Cc = $(D30)^2/(D60*D10)$ = 1.52

Remarks:



Project Name: H. F. Wildlife Corridor

Project No.: 011783-012

Exploration No.: TP-1 Sample No.: BB-1

Depth (feet): 0-5 Soil Type : SW-SC

Soil Identification: Light brown well-graded sand with clay (SW-SC)

GR:SA:FI : (%) 4 : 84 : 12

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Apr-07

SA TP-1 BB-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: H. F. Wildlife Corridor
Project No.: 011783-012
Exploration No.: TP-2
Sample No.: BB-2
Soil Identification: Light brown poorly graded sand with silt (SP-SM)

Tested By: RAL Date: 03/27/07
Checked By: LF Date: 04/04/07
Depth (feet): 7.0

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	CP17	884	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	1842.80	379.87	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	223.20	75.02	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	1619.60	304.85	Moisture Content (%)	0.00	0.00

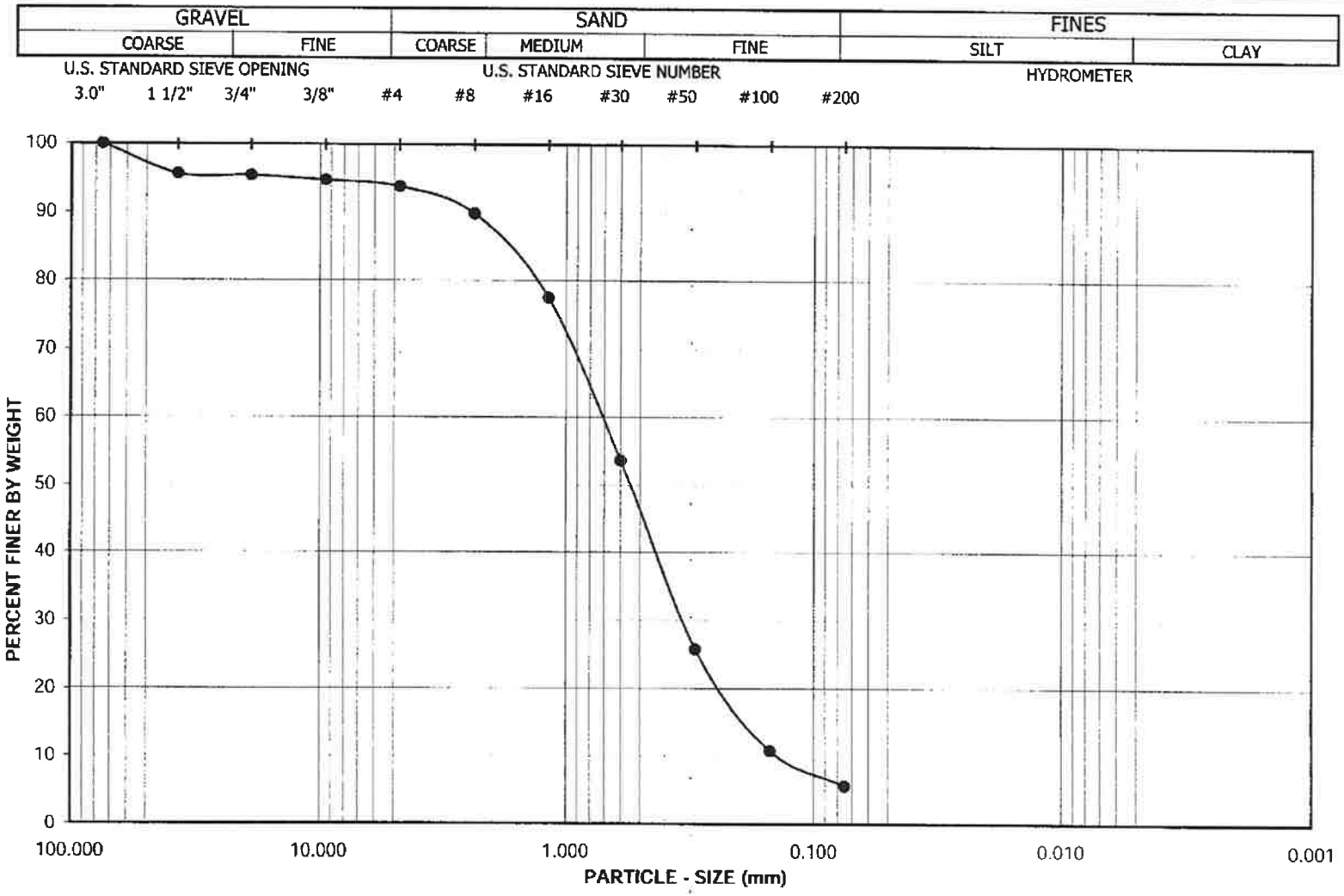
Passing #4 Material After Wet Sieve	Container No.	884
	Wt. of Dry Soil + Container (g)	362.75
	Wt. of Container (g)	75.02
	Dry Wt. of Soil Retained on # 200 Sieve (g)	287.73

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
6"	152.400			
3"	75.000	0.00		100.0
1 1/2	37.500	71.00		95.6
3/4"	19.000	73.70		95.4
3/8"	9.500	86.60		94.7
#4	4.750	99.70		93.8
#8	2.360		12.94	89.8
#16	1.180		52.96	77.5
#30	0.600		130.75	53.6
#50	0.300		221.29	25.7
#100	0.150		269.78	10.8
#200	0.075		286.68	5.6
PAN				

GRAVEL: **6 %**
SAND: **88 %**
FINES: **6 %**
GROUP SYMBOL **SP-SM**

Cu = D60/D10 = 4.83
Cc = $(D30)^2/(D60*D10)$ = 1.14

Remarks: Insufficient sample mass available to meet the ASTM specification for this material



Project Name: H. F. Wildlife Corridor

Project No.: 011783-012

Exploration No.: TP-2 Sample No.: BB-2

Depth (feet): 7.0 Soil Type : SP-SM

Soil Identification: Light brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 6 : 88 : 6

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

Apr-07

SA TP-2 BB-2

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Sand Deposits	Tested By:	S. Felter	Date:	11/06/07
Project No.:	011783-019	Checked By:	LF	Date:	11/13/07
Exploration No.:	TP-1	Depth (feet):	3.5		
Sample No.:	BB-1				
Soil Identification:	Brown silty, clayey sand (SC-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	CT	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	747.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	244.80	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	503.00	Moisture Content (%)	0.00

After Wet Sieve	Container No.	CT
	Wt. of Dry Soil + Container (g)	560.10
	Wt. of Container (g)	244.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	315.30

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	4.90	99.0
#16	1.180	24.70	95.1
#30	0.600	82.30	83.6
#50	0.300	170.20	66.2
#100	0.150	252.80	49.7
#200	0.075	315.30	37.3
PAN			

GRAVEL: **0 %**

SAND: **63 %**

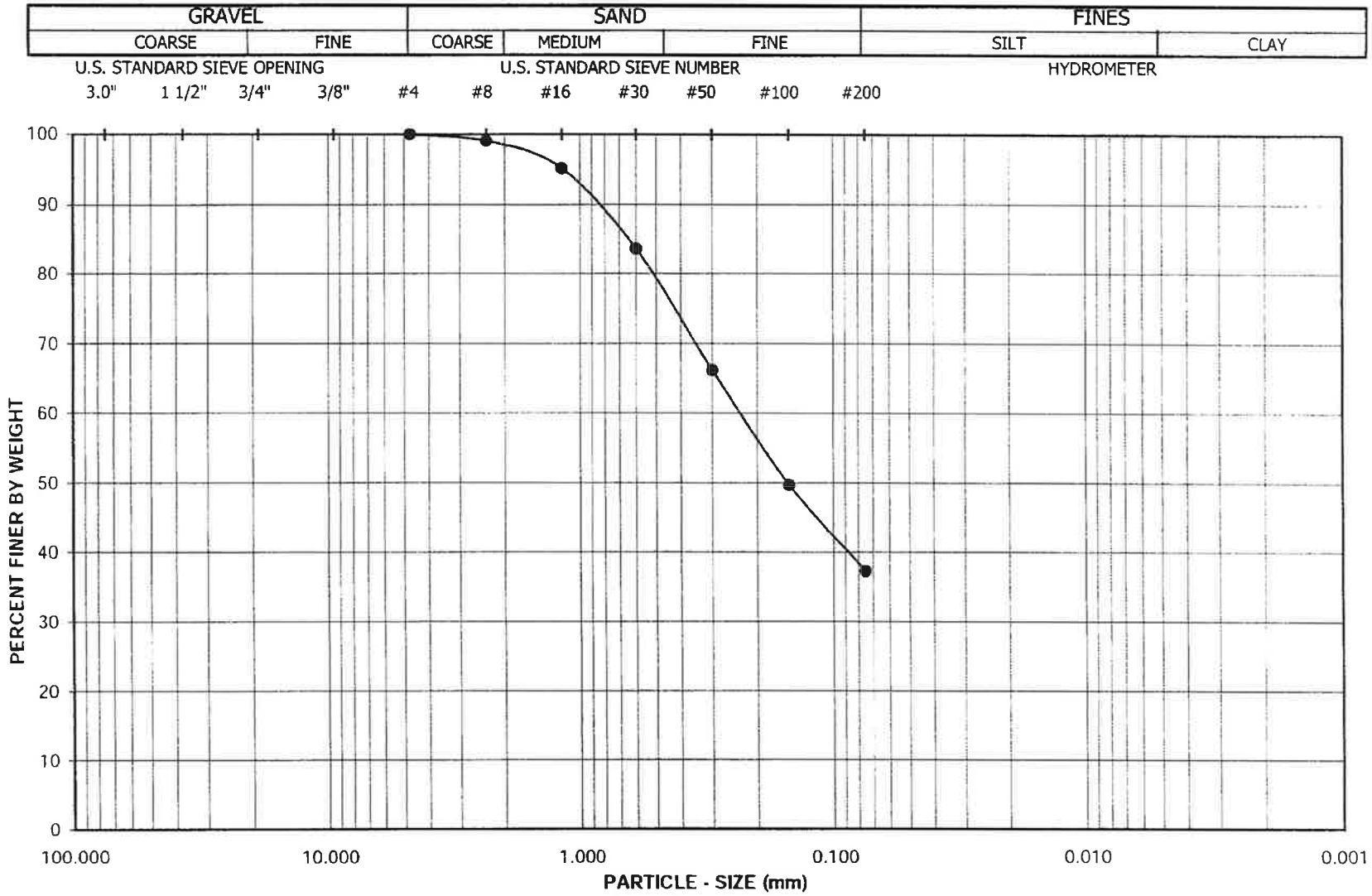
FINES: **37 %**

GROUP SYMBOL: **SC-SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: Sand Deposits

Project No.: 011783-019

Exploration No.: TP-1 Sample No.: BB-1

Depth (feet): 3.5 Soil Type : SC-SM

Soil Identification: Brown silty, clayey sand (SC-SM)

GR:SA:FI : (%) 0 : 63 : 37

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

NOV-07

Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	Heritage District 2	Tested By :	GEB	Date:	01/04/06
Project No.:	011783-001	Input By :	JHW	Date:	02/20/06
Boring No.:	T-32	Depth (ft.)	2-3		
Sample No. :	Bag-1				
Soil Identification:	Dark Brown Clayey Sand / Sandy Lean Clay (SC) / s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03319 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3702.0	3849.0	3819.0	3782.0		
Weight of Mold (g)	1852.0	1852.0	1852.0	1852.0		
Net Weight of Soil (g)	1850.0	1997.0	1967.0	1930.0		
Wet Weight of Soil + Cont. (g)	509.00	491.30	484.20	480.40		
Dry Weight of Soil + Cont. (g)	472.50	445.20	428.40	421.20		
Weight of Container (g)	53.30	51.60	51.20	54.10		
Moisture Content (%)	8.71	11.71	14.79	16.13		
Wet Density (pcf)	122.9	132.6	130.7	128.2		
Dry Density (pcf)	113.0	118.7	113.8	110.4		

Maximum Dry Density (pcf) 119.0 **Optimum Moisture Content (%)** 11.5

PROCEDURE USED

[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

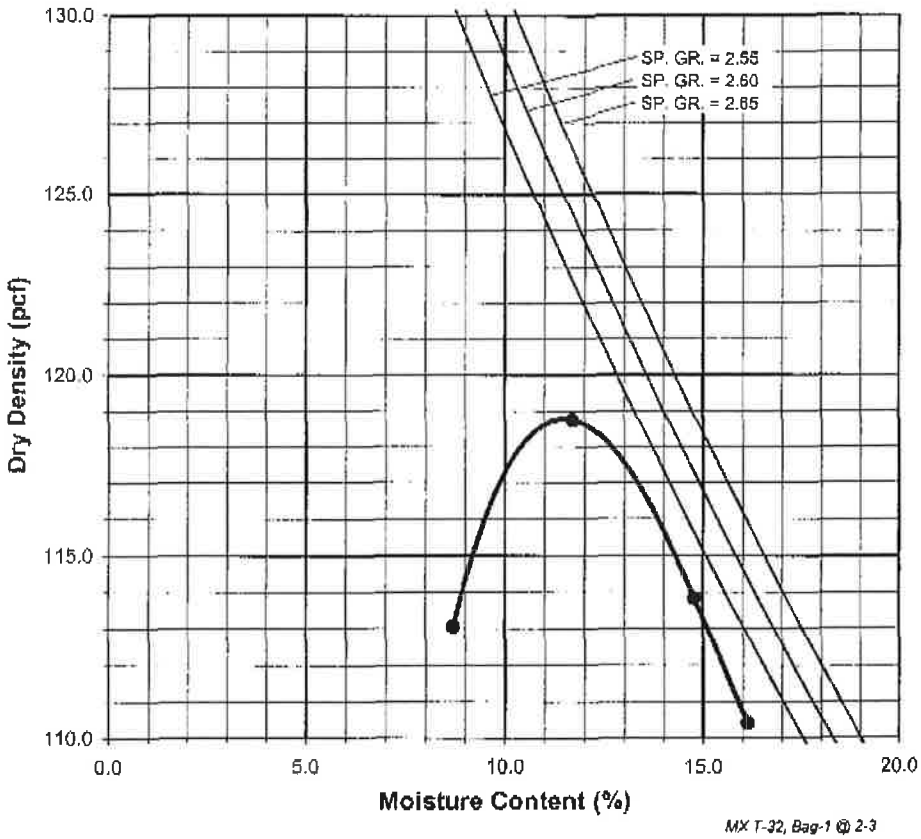
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MX T-32, Bag-1 @ 2-3

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MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	H. F. Wildlife Corridor	Tested By :	RDS	Date:	04/02/07
Project No.:	011783-012	Input By :	LF	Date:	04/04/07
Boring No.:	TP-1	Depth (ft.)	0-5		
Sample No. :	BB-1				
Soil Identification:	Light brown well-graded sand with clay (SW-SC)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03321

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3671.0	3748.0	3811.0	3792.0		
Weight of Mold (g)	1786.0	1786.0	1786.0	1786.0		
Net Weight of Soil (g)	1885.0	1962.0	2025.0	2006.0		
Wet Weight of Soil + Cont. (g)	482.50	490.80	465.80	576.10		
Dry Weight of Soil + Cont. (g)	457.20	455.80	424.30	513.90		
Weight of Container (g)	53.80	53.90	51.40	54.00		
Moisture Content (%)	6.27	8.71	11.13	13.52		
Wet Density (pcf)	125.1	130.2	134.4	133.2		
Dry Density (pcf)	117.7	119.8	121.0	117.3		

Maximum Dry Density (pcf) **121.0** **Optimum Moisture Content (%)** **11.0**

PROCEDURE USED

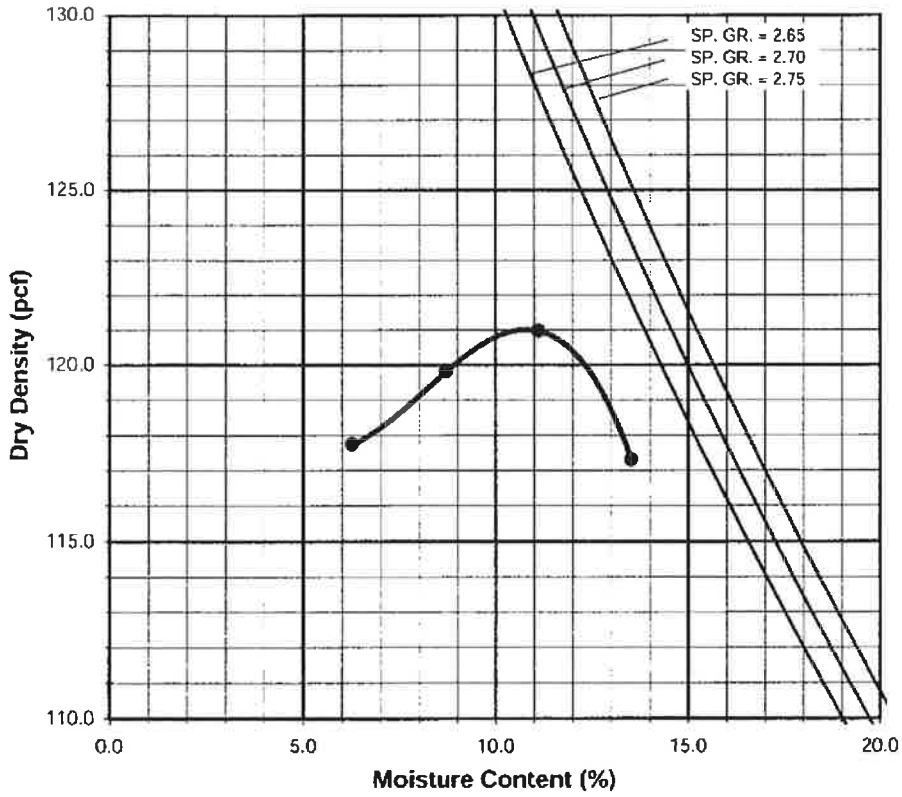
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **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:
4:84:12
GR:SA:FI

Atterberg Limits:
LL,PL,PI



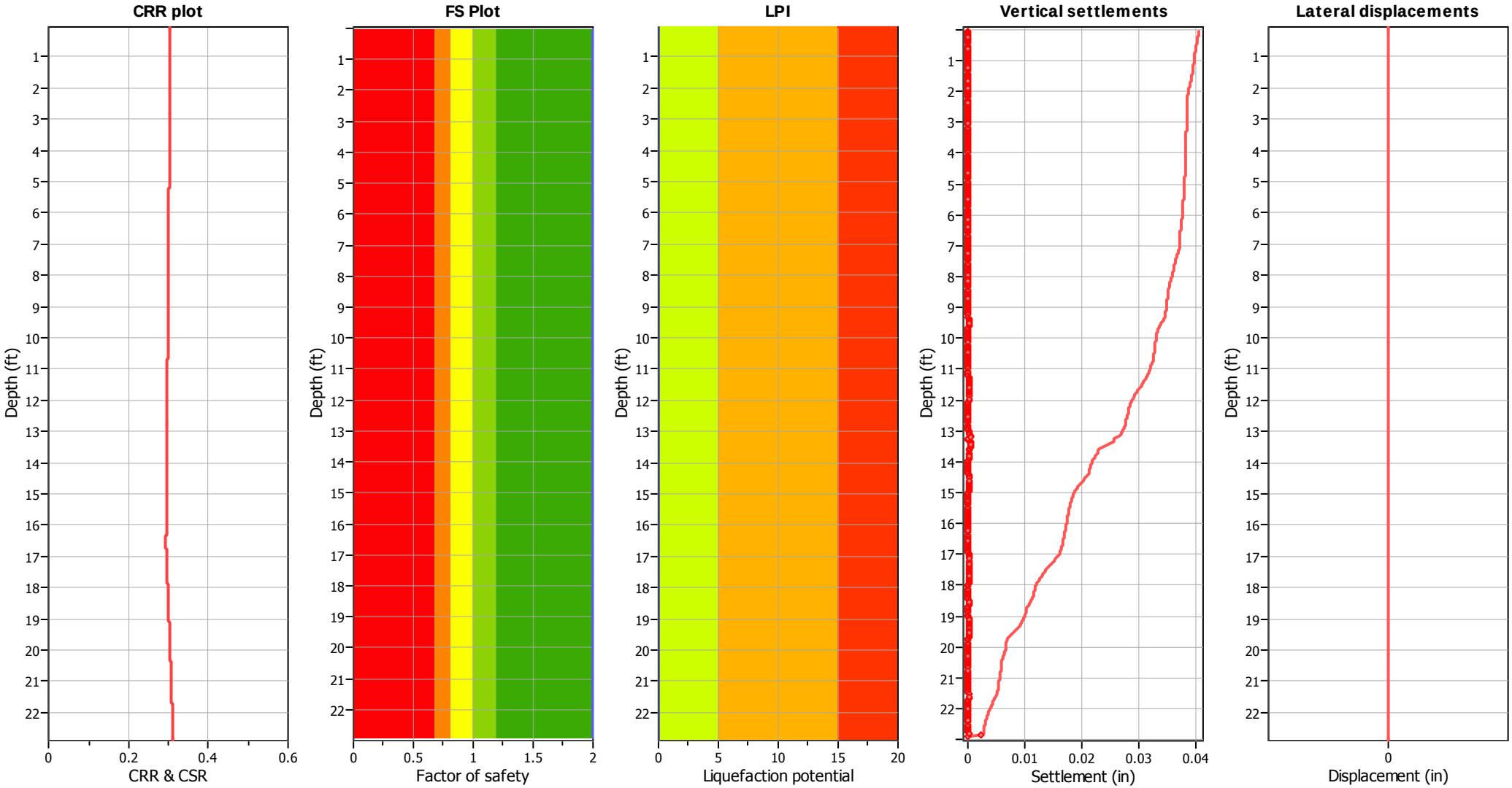
MX TP-1 BB-1

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

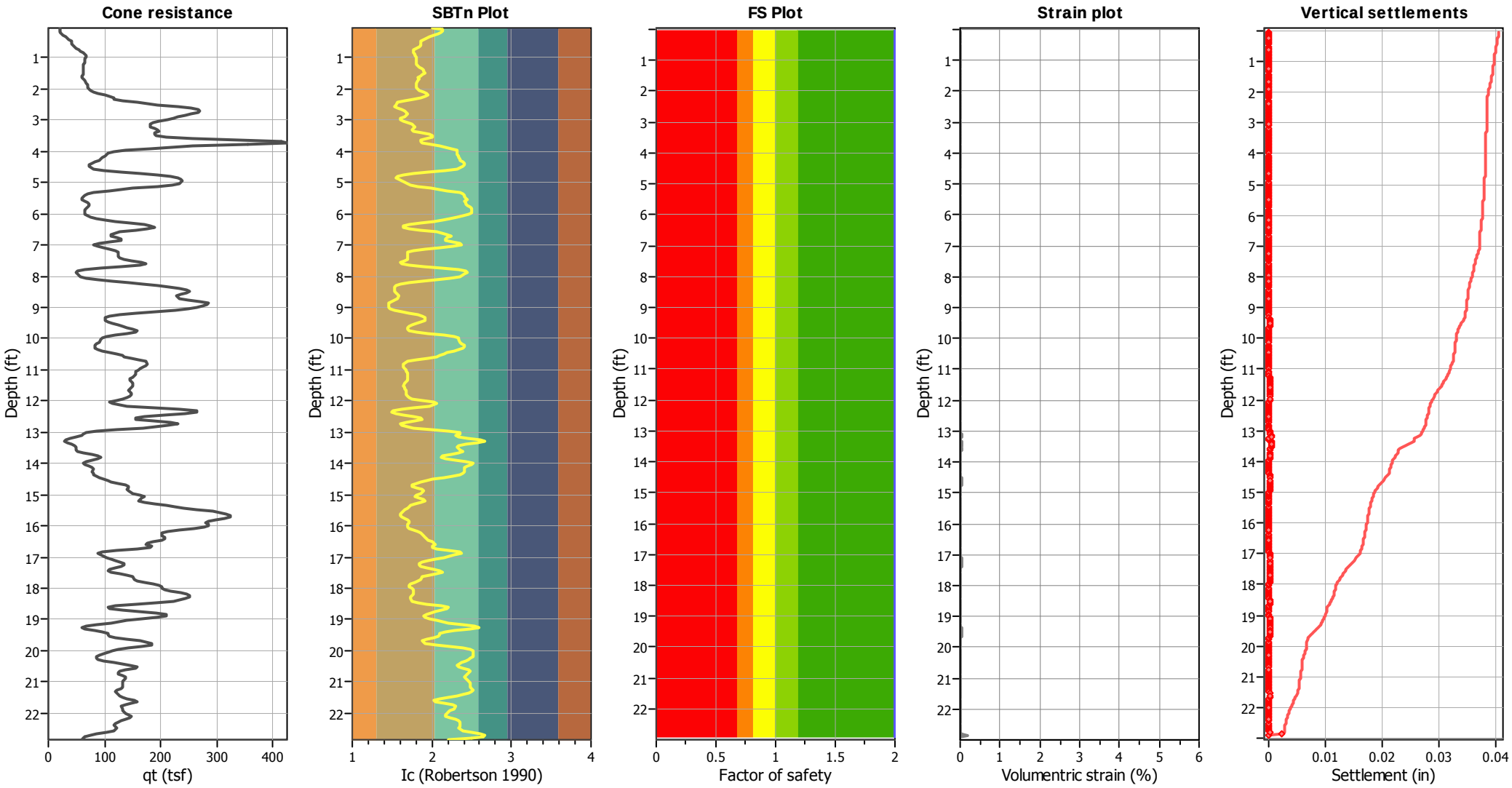
F.S. color scheme

- 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

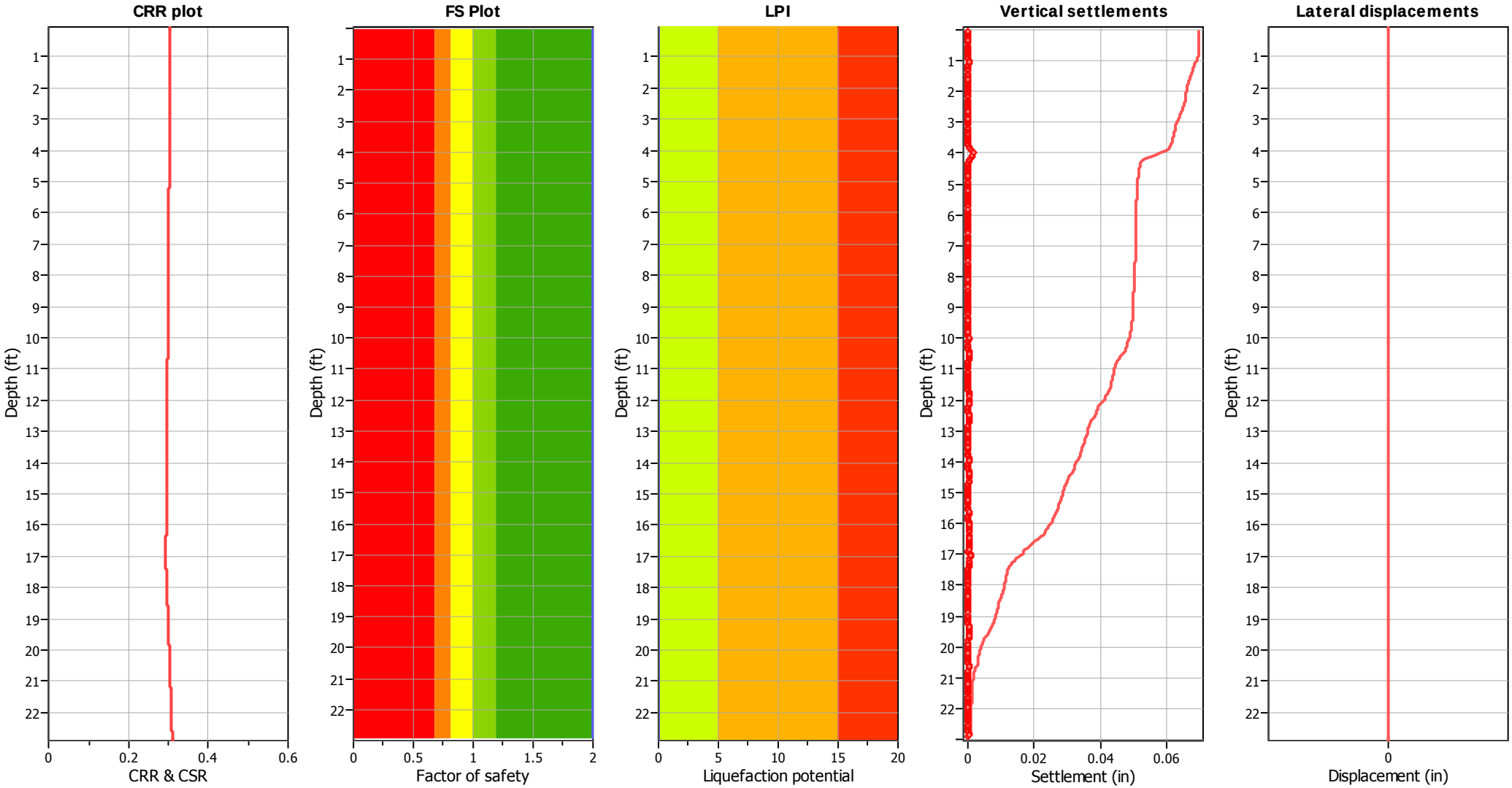
Estimation of post-earthquake settlements



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

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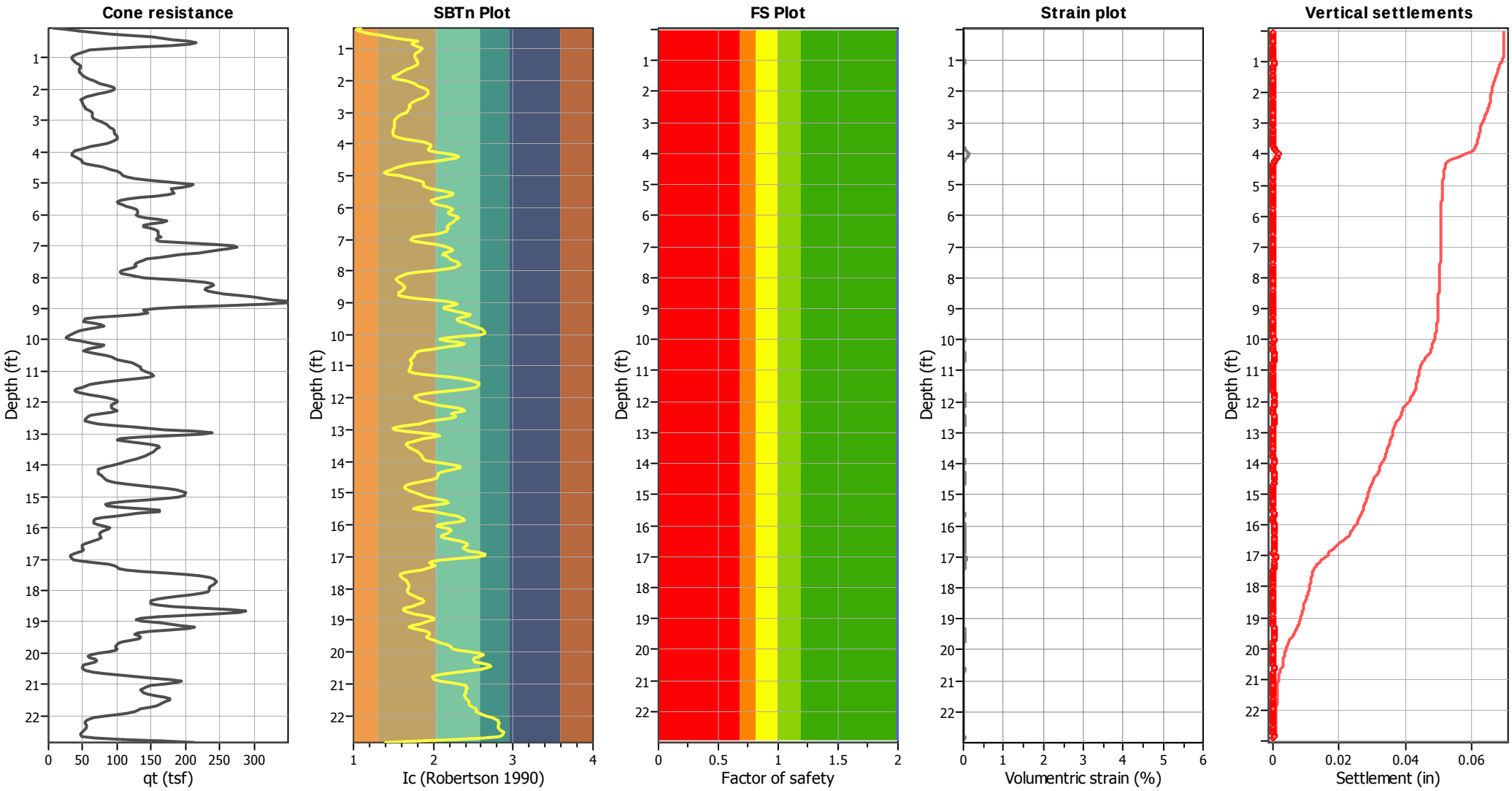
Estimation of post-earthquake settlements



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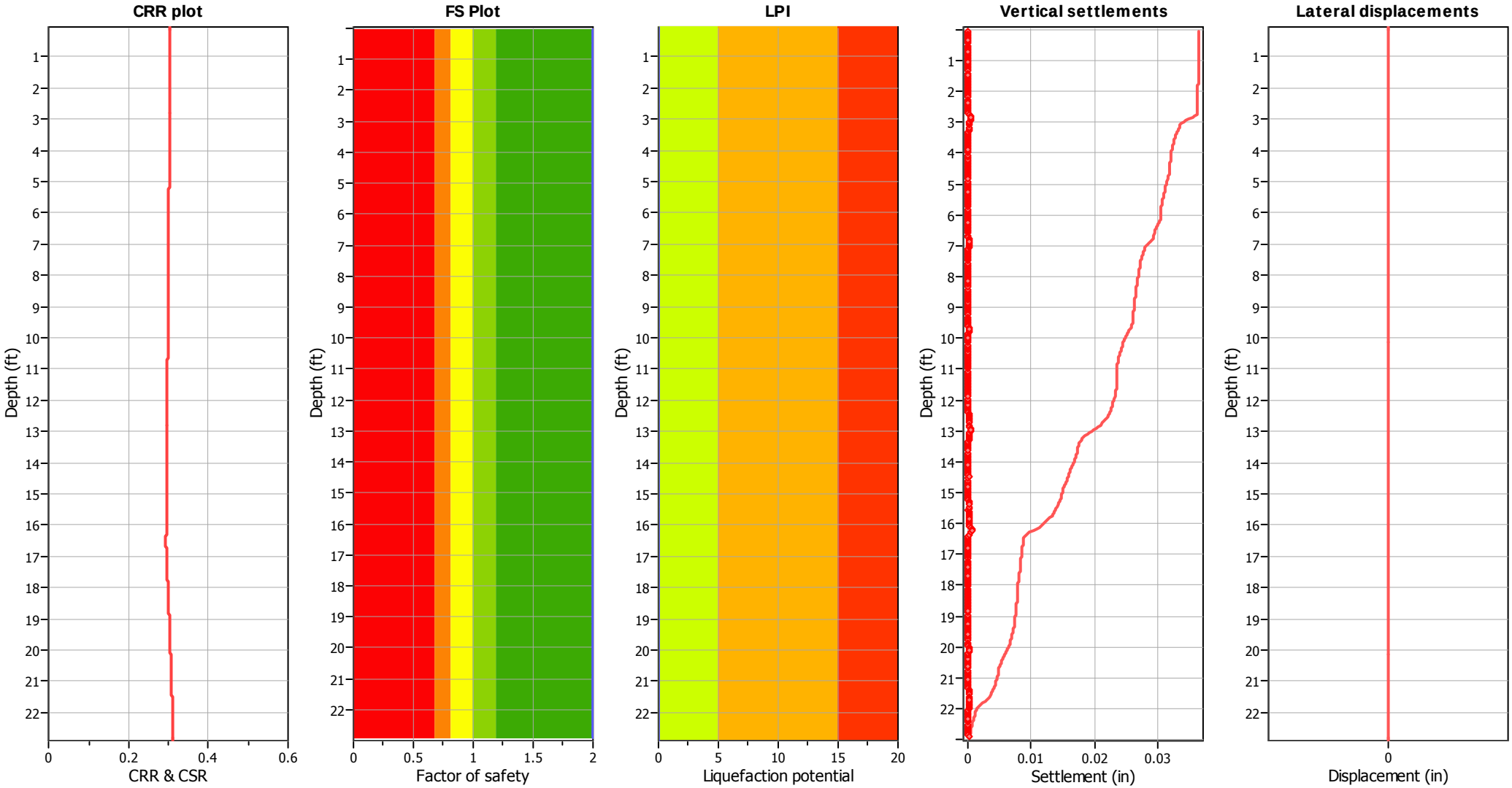
Liquefaction analysis overall plots



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

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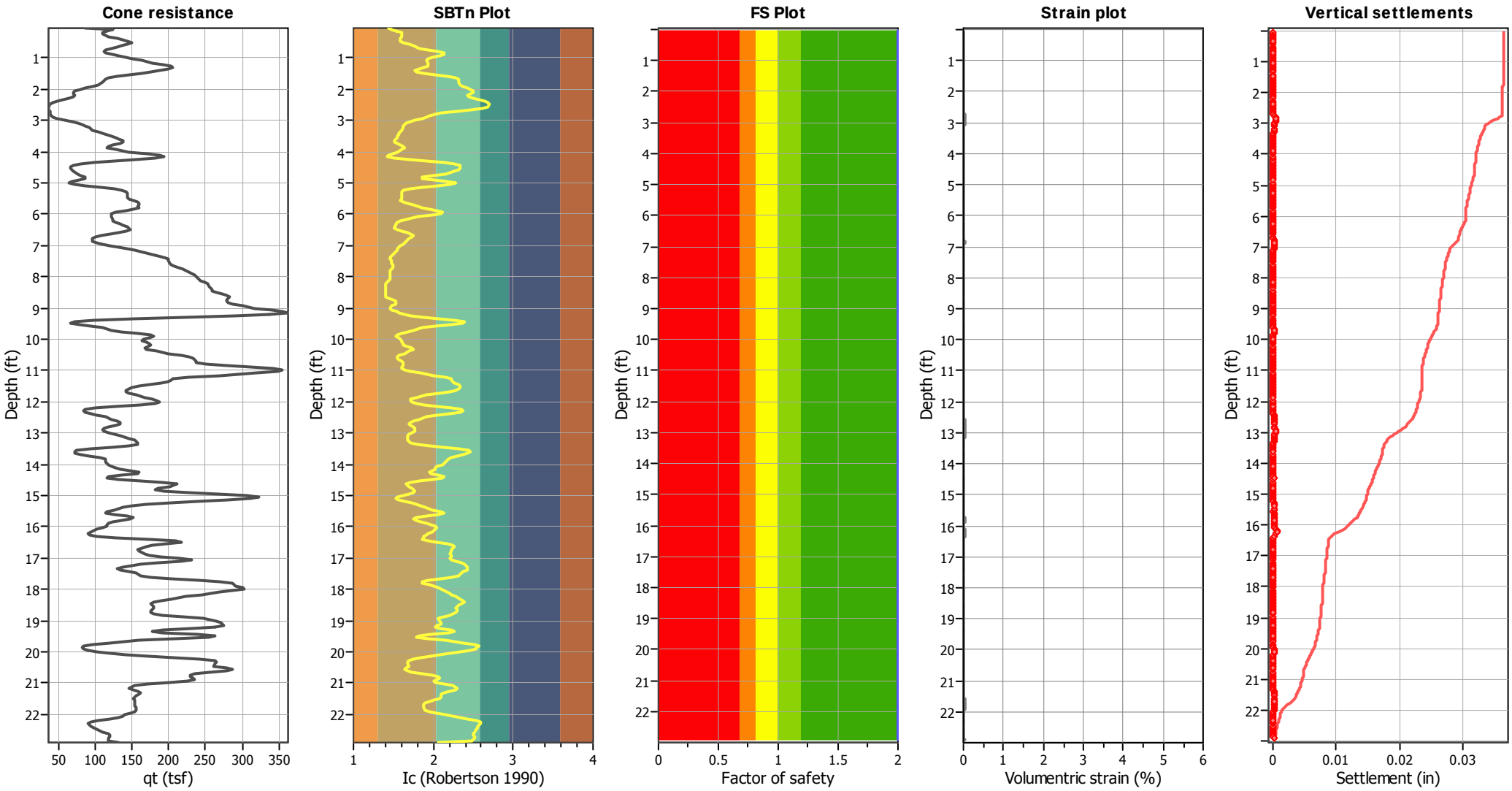
Estimation of post-earthquake settlements



Abbreviations

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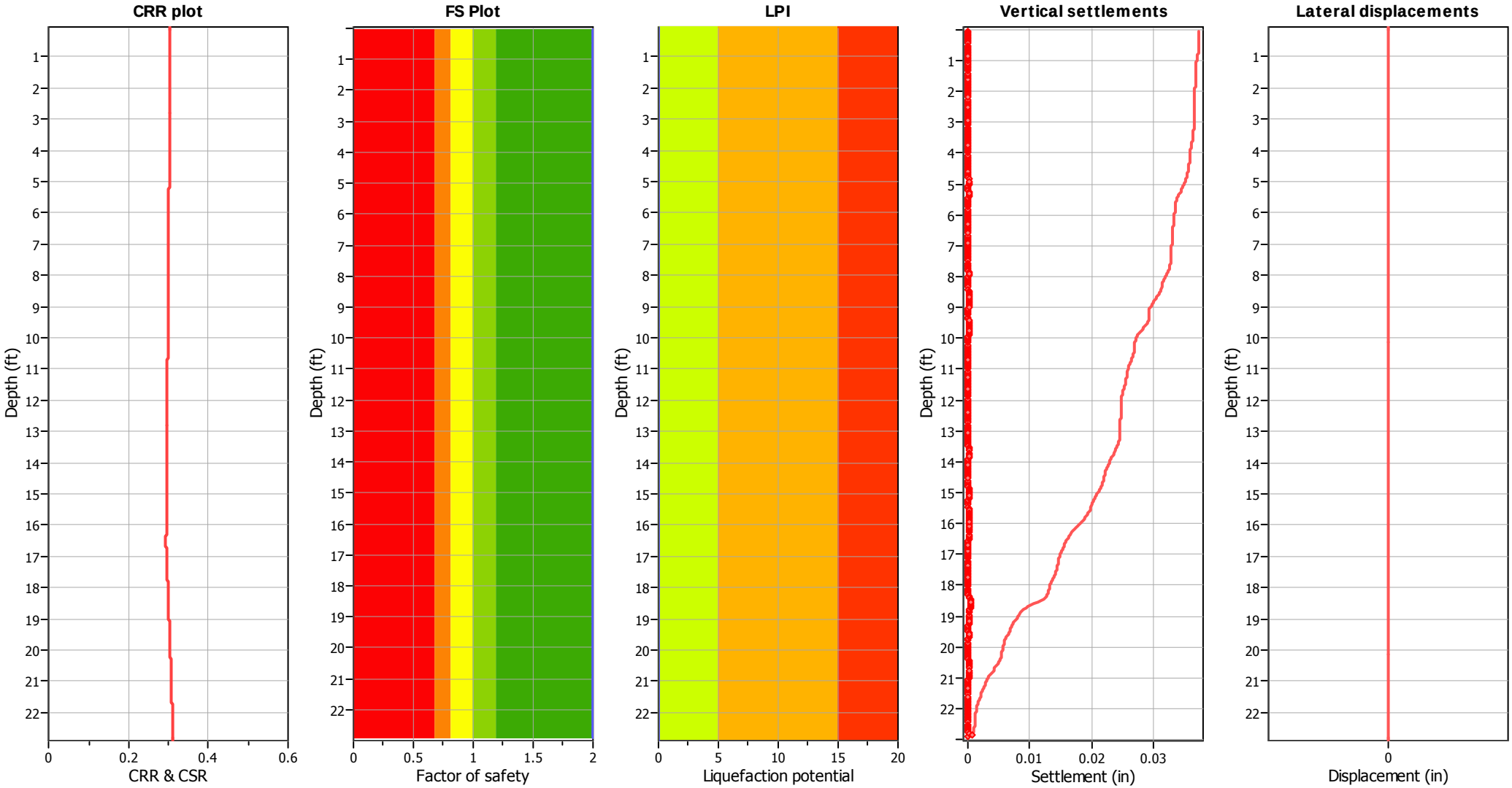
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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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LPI color scheme

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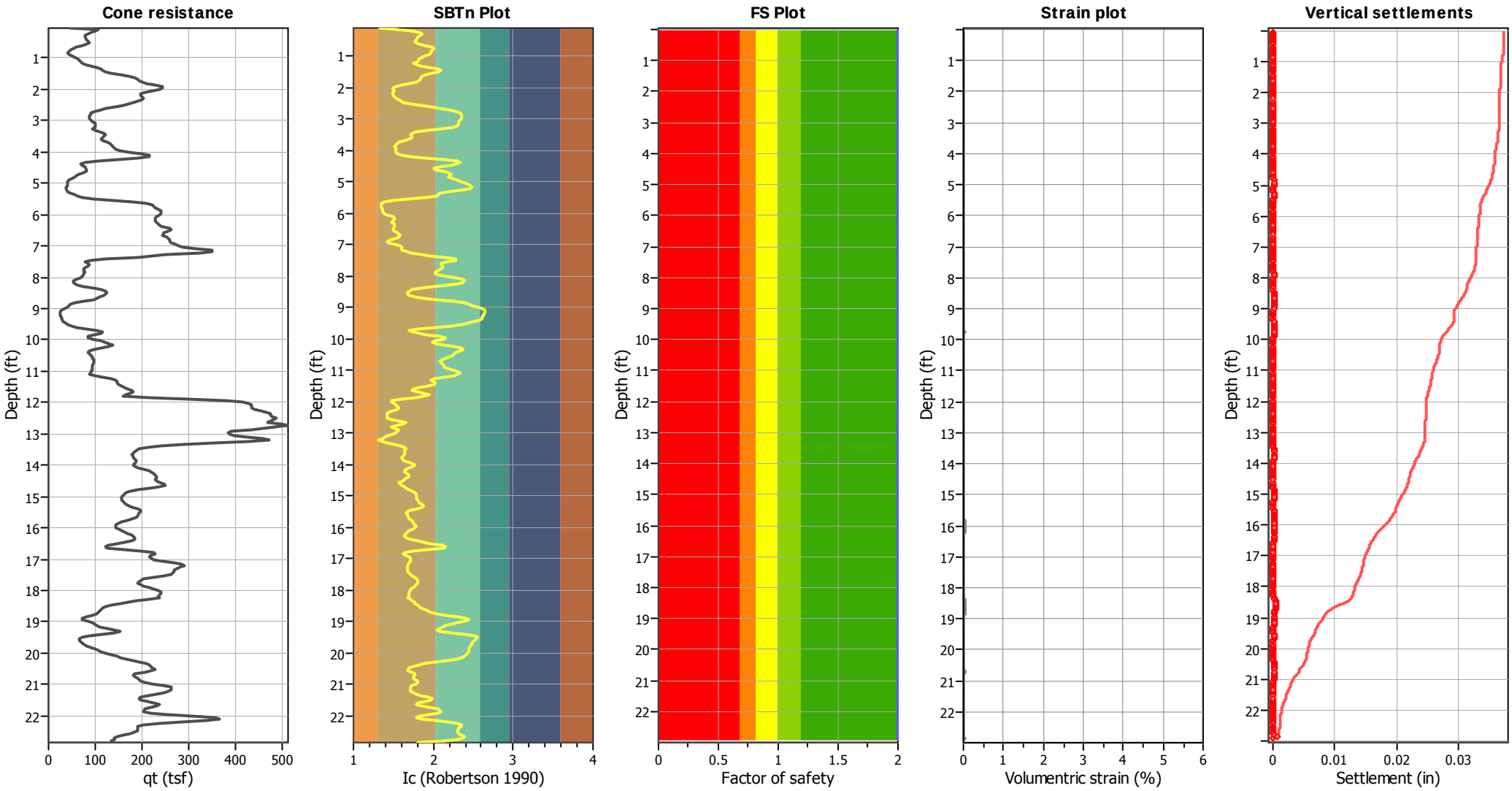
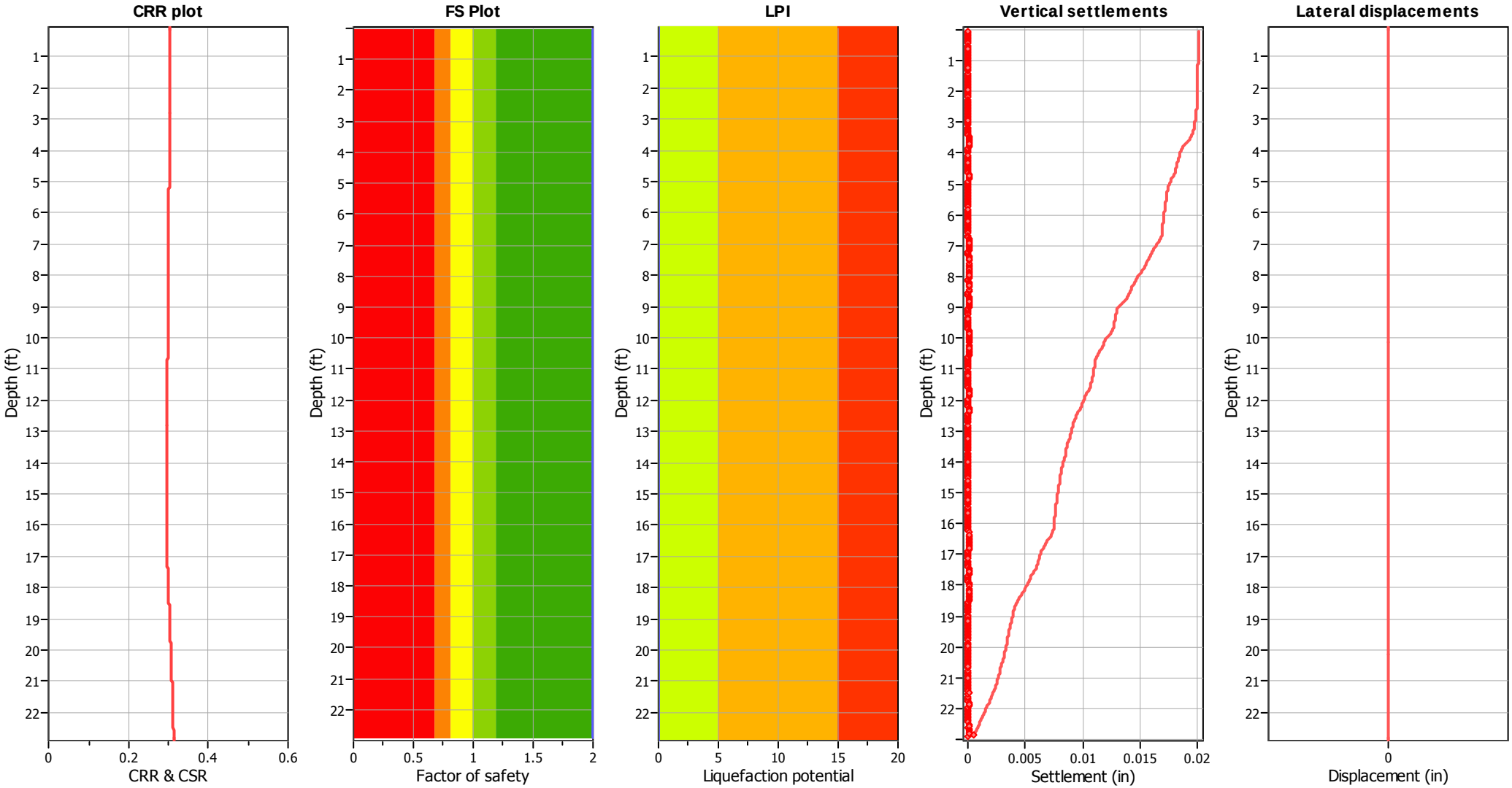
Estimation of post-earthquake settlements



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

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LPI color scheme

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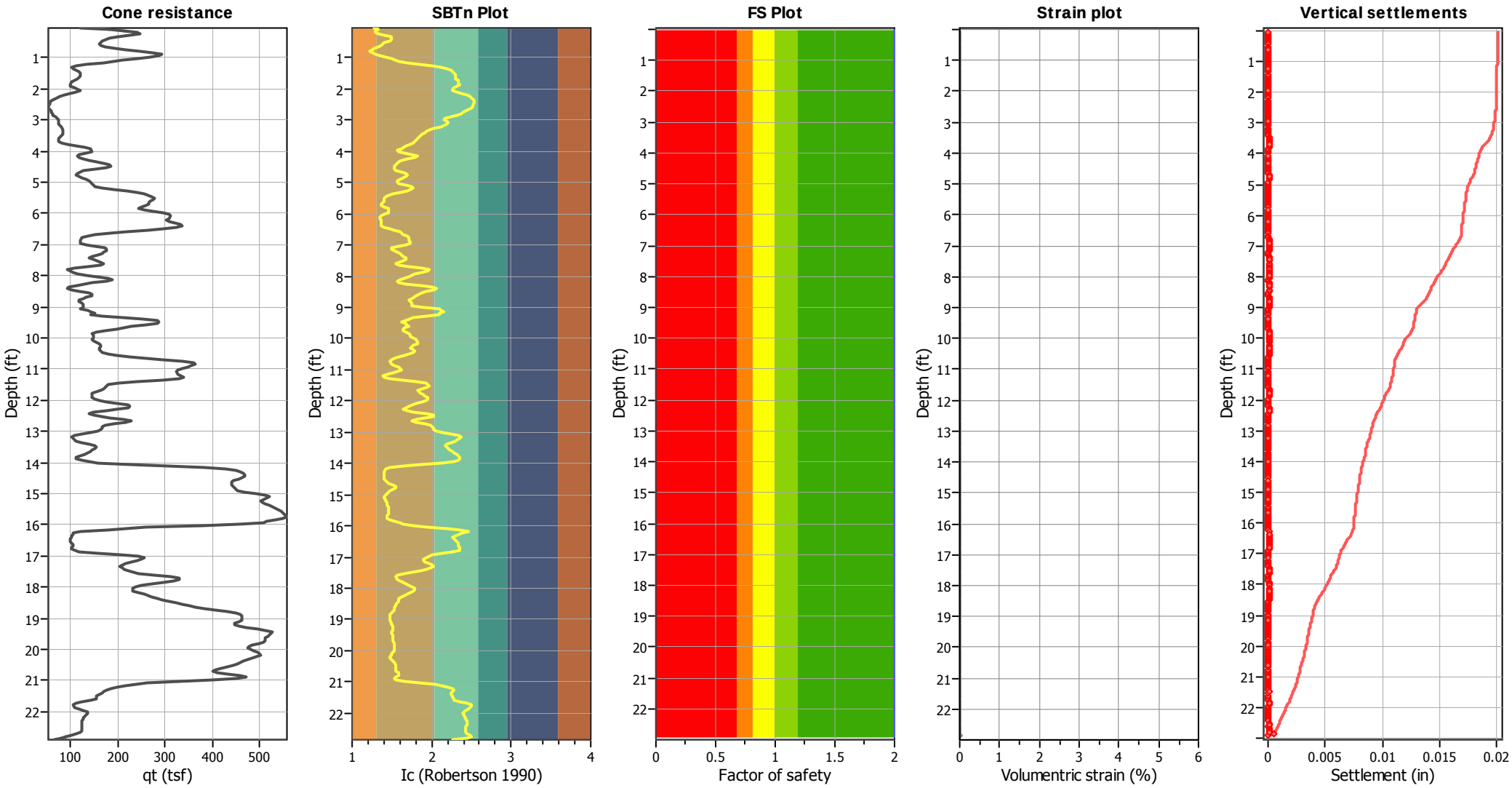
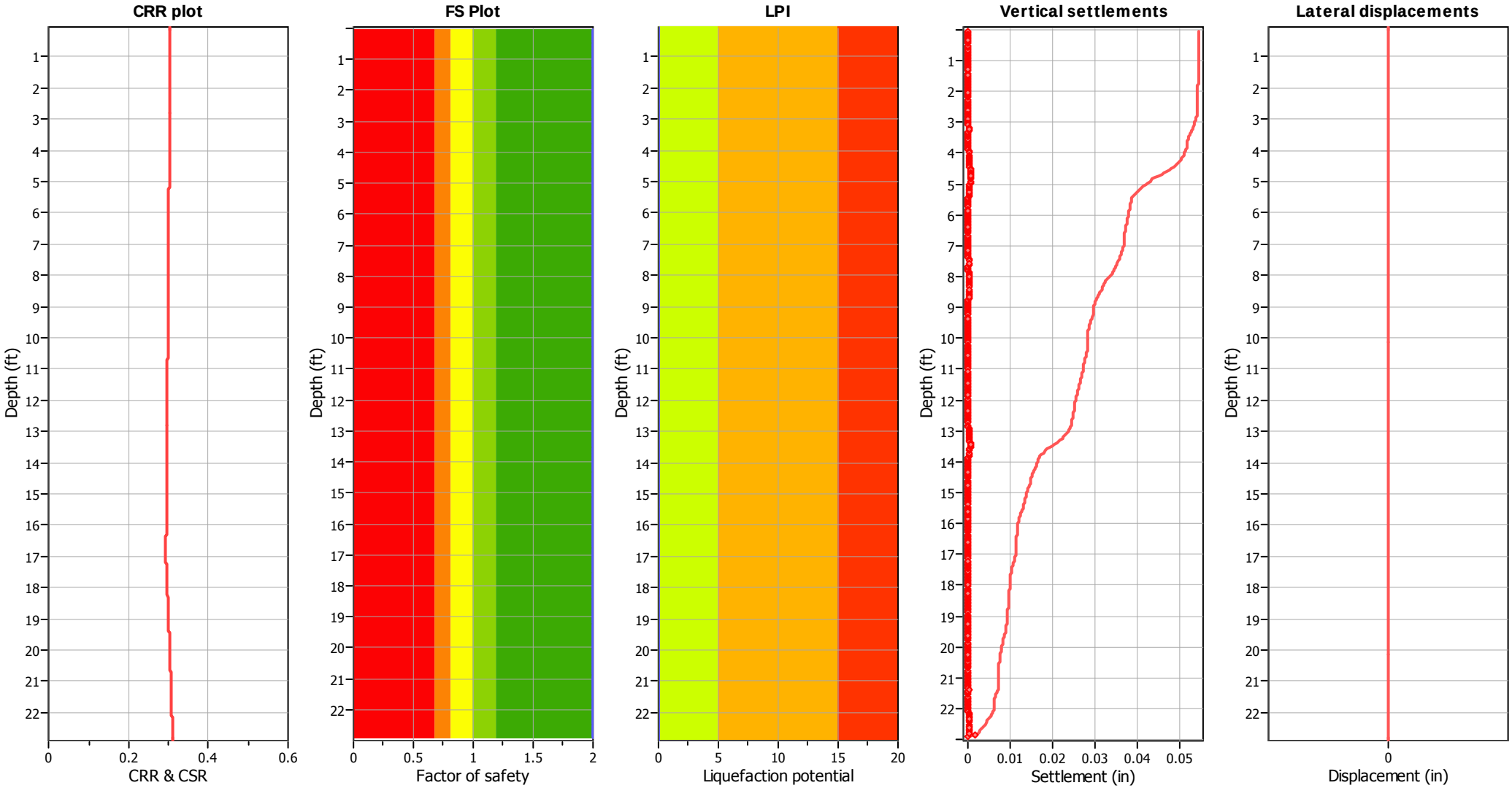
Estimation of post-earthquake settlements



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

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- Liquefaction and no liq. are equally likely
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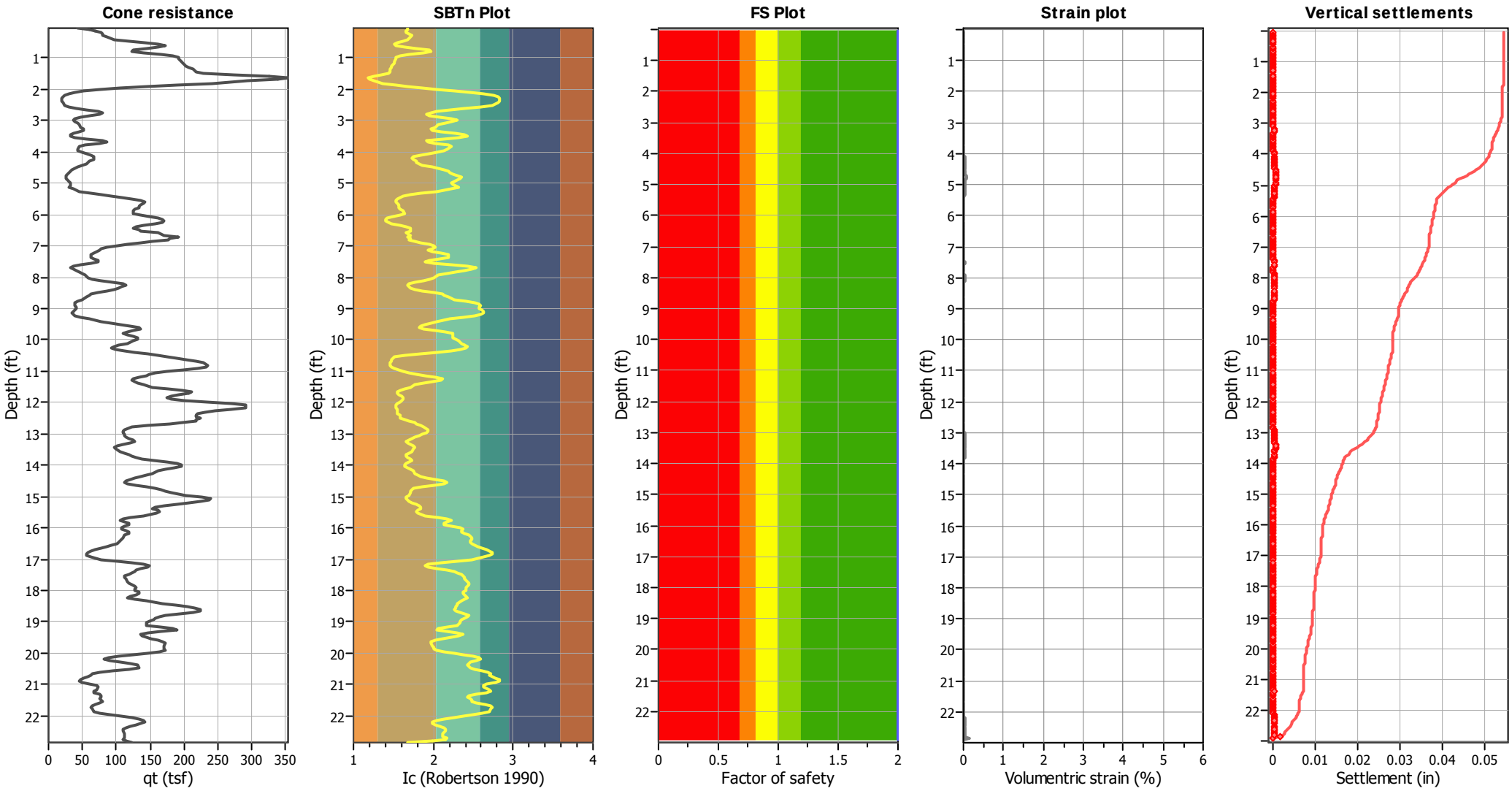
LPI color scheme

- Very high risk
- High risk
- Low risk

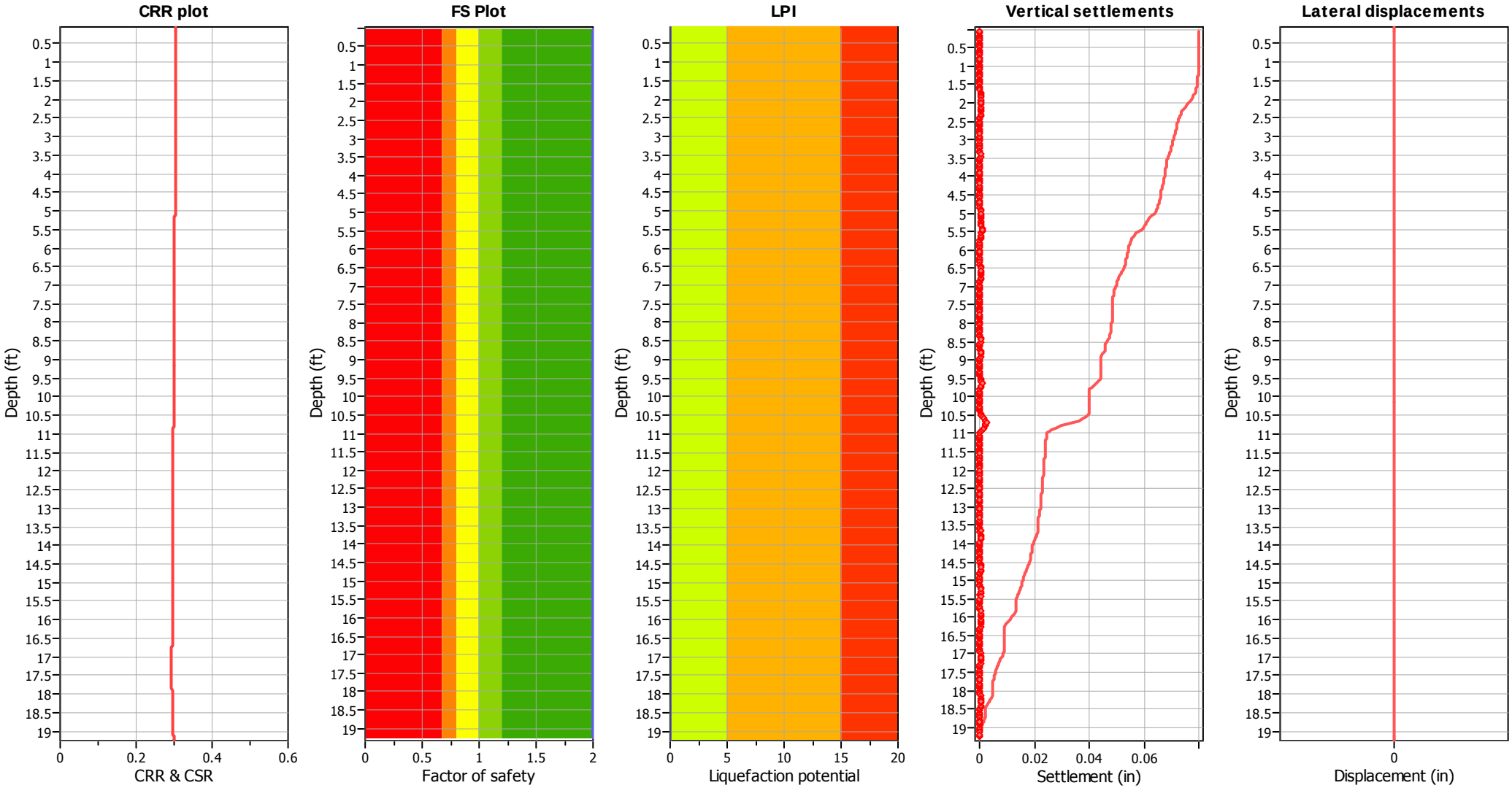
Estimation of post-earthquake settlements



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

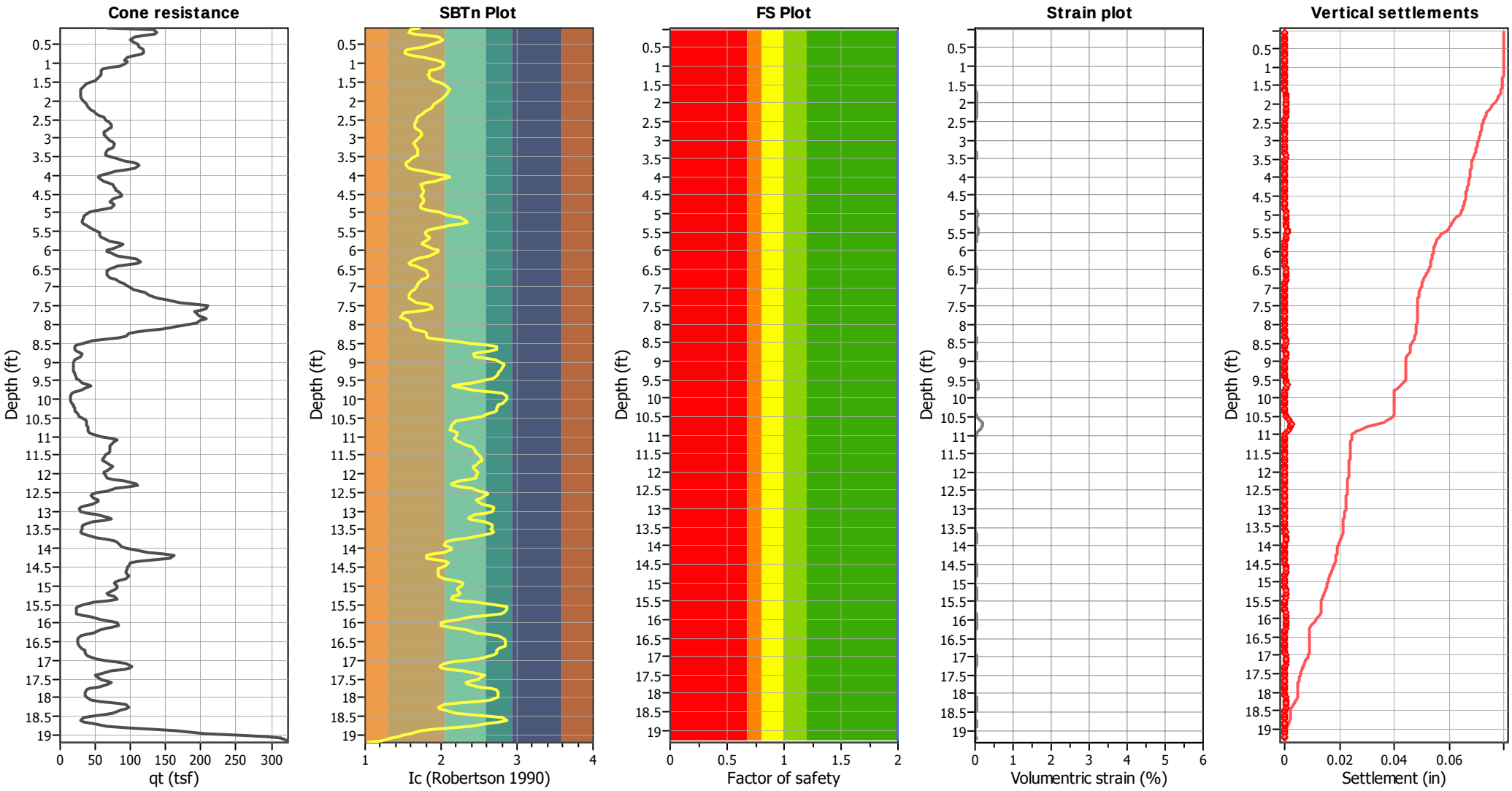
F.S. color scheme

- 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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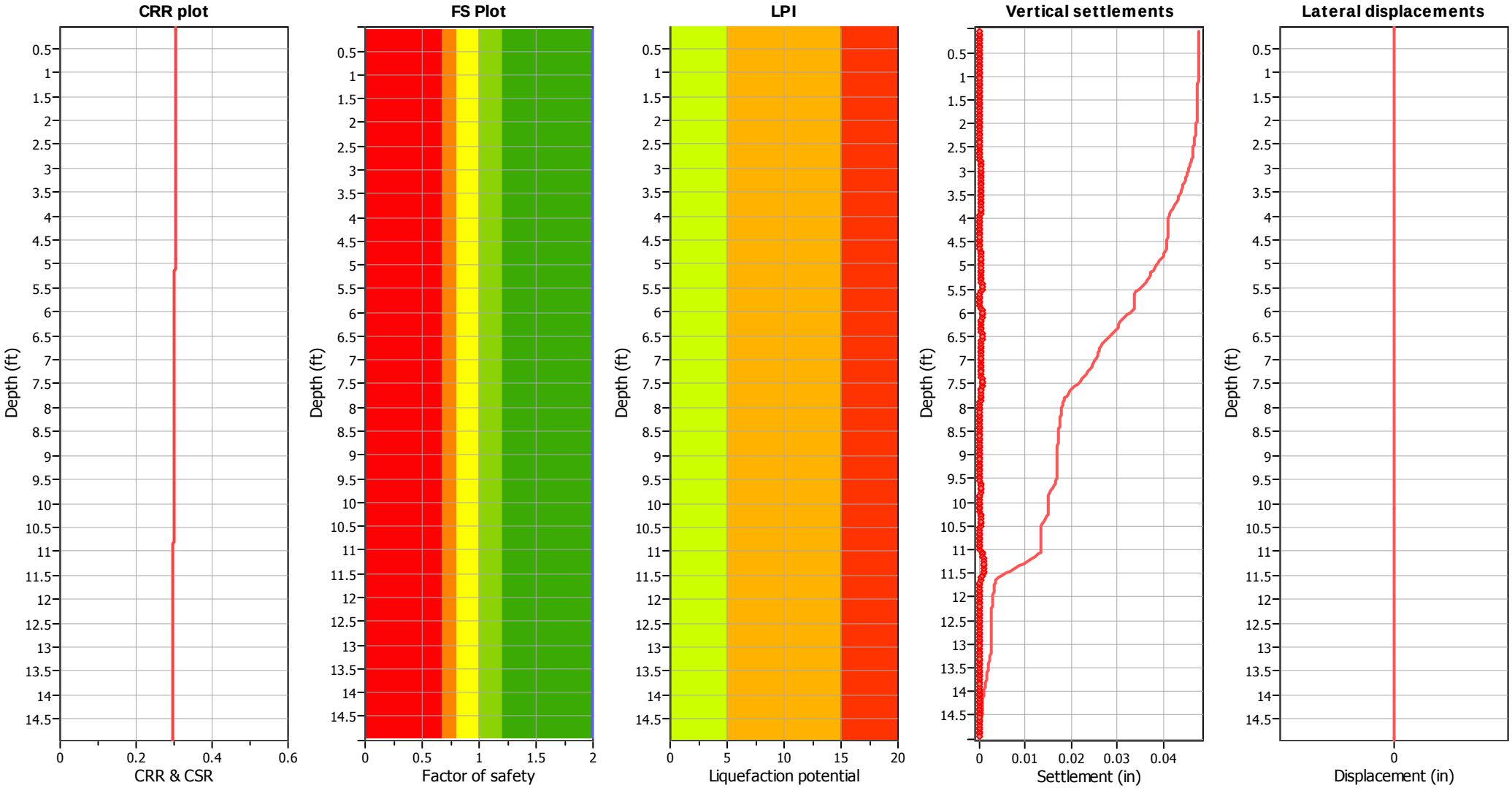
Liquefaction analysis overall plots



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

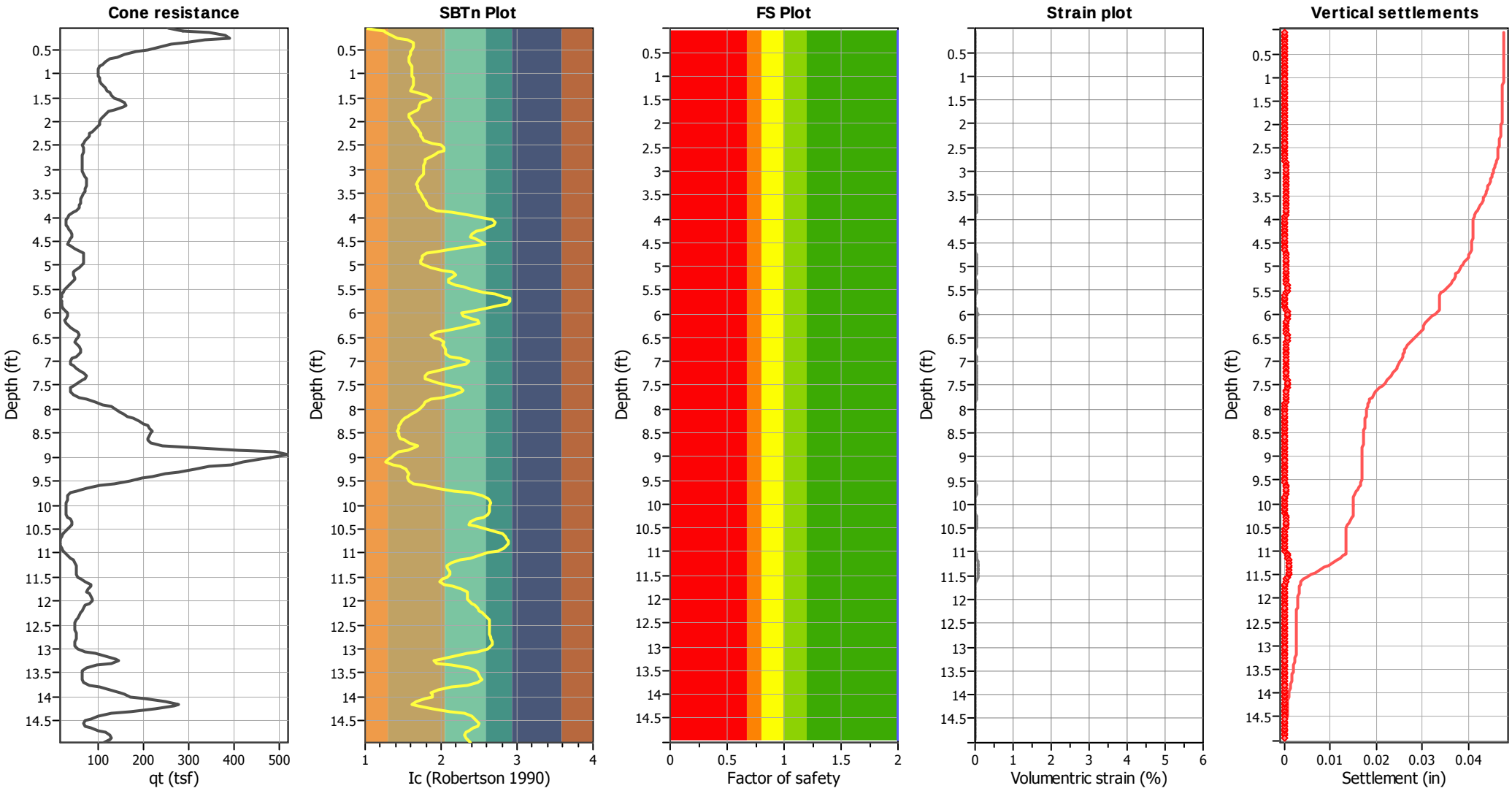
F.S. color scheme

- 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

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

Leighton

APPENDIX E

LEIGHTON AND ASSOCIATES, INC.
EARTHWORK AND GRADING GUIDE SPECIFICATIONS

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E-1.0 GENERAL

E-1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Leighton and Associates, Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Leighton and Associates, Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Leighton and Associates, Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

E-1.2 Role of Leighton and Associates, Inc.

Prior to commencement of earthwork and grading, Leighton and Associates, Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Leighton and Associates, Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Leighton and Associates, Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Leighton and Associates, Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Leighton and Associates, Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

E-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 Guide Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Leighton and Associates, Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Leighton and Associates, Inc. is aware of all grading operations.

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

E-2.0 PREPARATION OF AREAS TO BE FILLED

E-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 Leighton and Associates, Inc. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Leighton and Associates, Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974-00). 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.

E-2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Leighton and Associates, Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section E-2.3. 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.

E-2.3 Overexcavation

In addition to removals and over-excavations 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 over-excavated to competent ground as evaluated by Leighton and Associates, Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

E-2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Leighton and Associates, Inc. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Leighton and Associates, Inc. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

E-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 Leighton and Associates, Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Leighton and Associates, Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

E-3.0 FILL MATERIAL

E-3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Leighton and Associates, Inc. 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 Leighton and Associates, Inc. or mixed with other soils to achieve satisfactory fill material.

E-3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Leighton and Associates, Inc. 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 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

E-3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section E-3.1, and be free of hazardous materials ("contaminants") and rock larger than 3 inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Leighton and Associates, Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

E-4.0 FILL PLACEMENT AND COMPACTION

E-4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section E-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Leighton and Associates, Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

E-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 D 1557-09.

E-4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557-09. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557-09 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557-09 laboratory maximum density. 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.

E-4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Leighton and Associates, Inc. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557-09 laboratory maximum density.

E-4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Leighton and Associates, Inc. Location and frequency of tests shall be at our field representative(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).

E-4.6 Compaction Test Locations

Leighton and Associates, Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Leighton

and Associates, Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

E-5.0 EXCAVATION

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Leighton and Associates, Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Leighton and Associates, Inc. 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, then observed and reviewed by Leighton and Associates, Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Leighton and Associates, Inc.

E-6.0 TRENCH BACKFILLS

E-6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2003 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

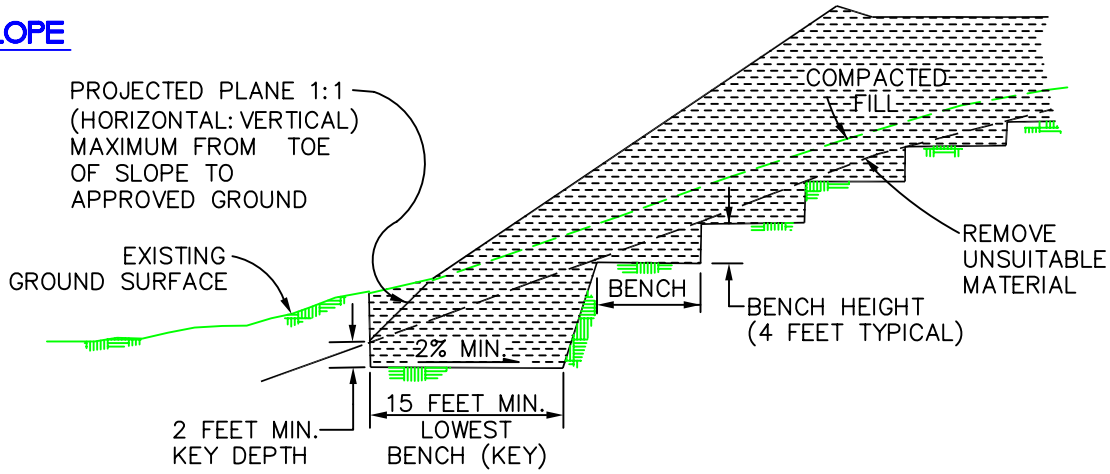
E-6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2012 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2012 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557-09) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Leighton and Associates, Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Leighton and Associates, Inc.

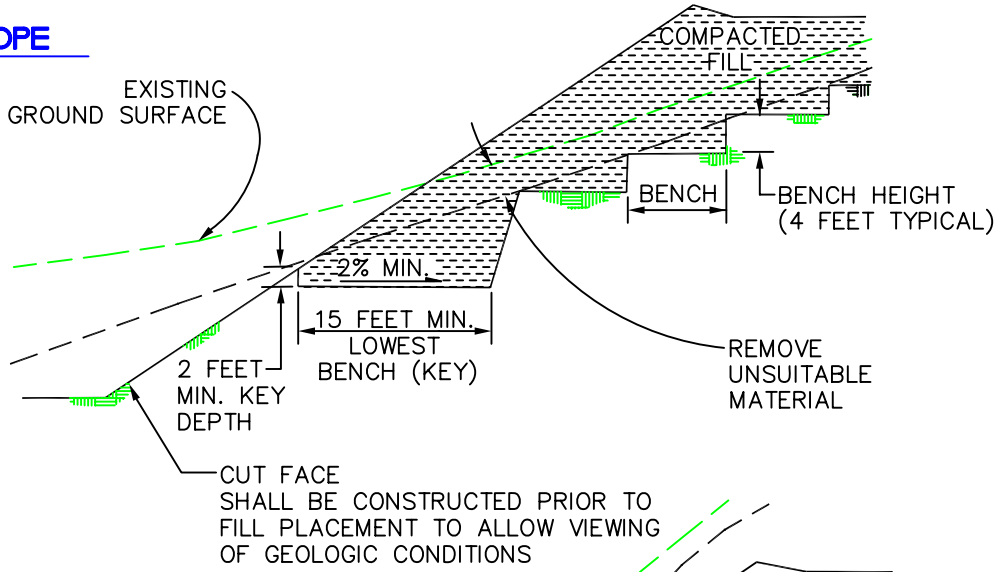
E-6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Leighton and Associates, Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

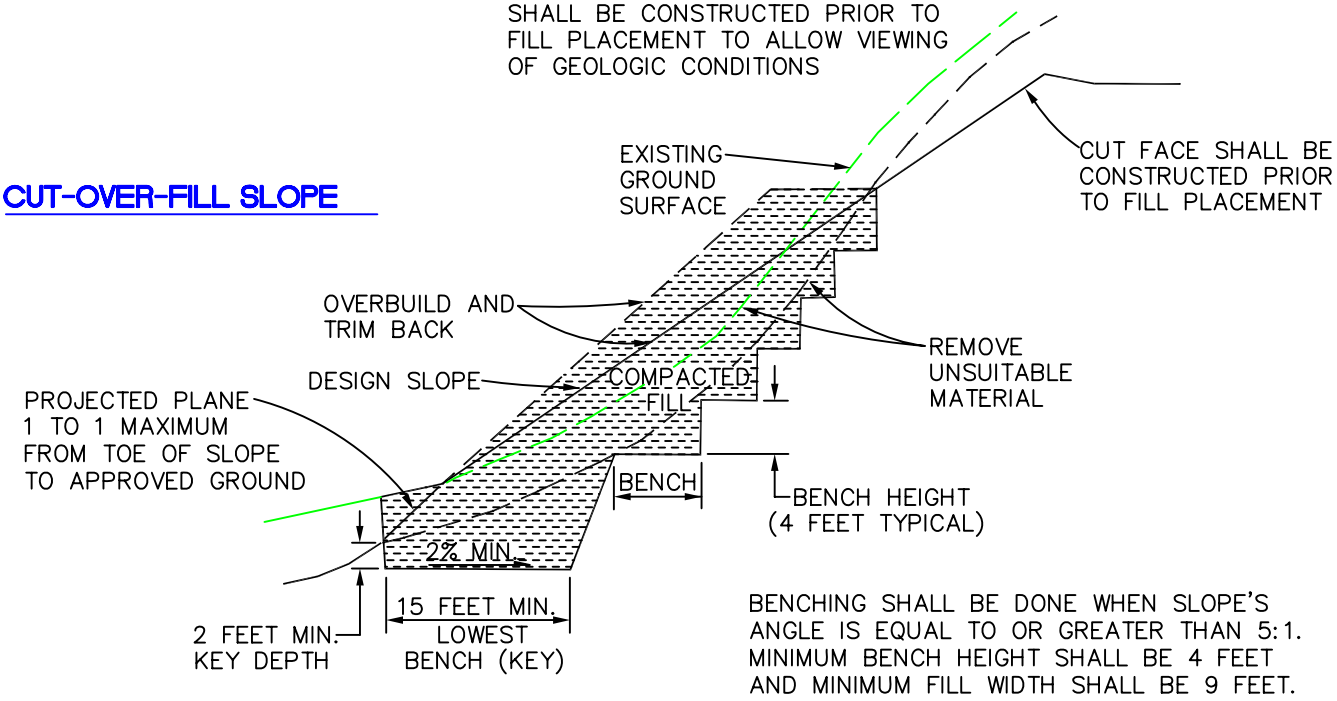
FILL SLOPE



FILL-OVER-CUT SLOPE

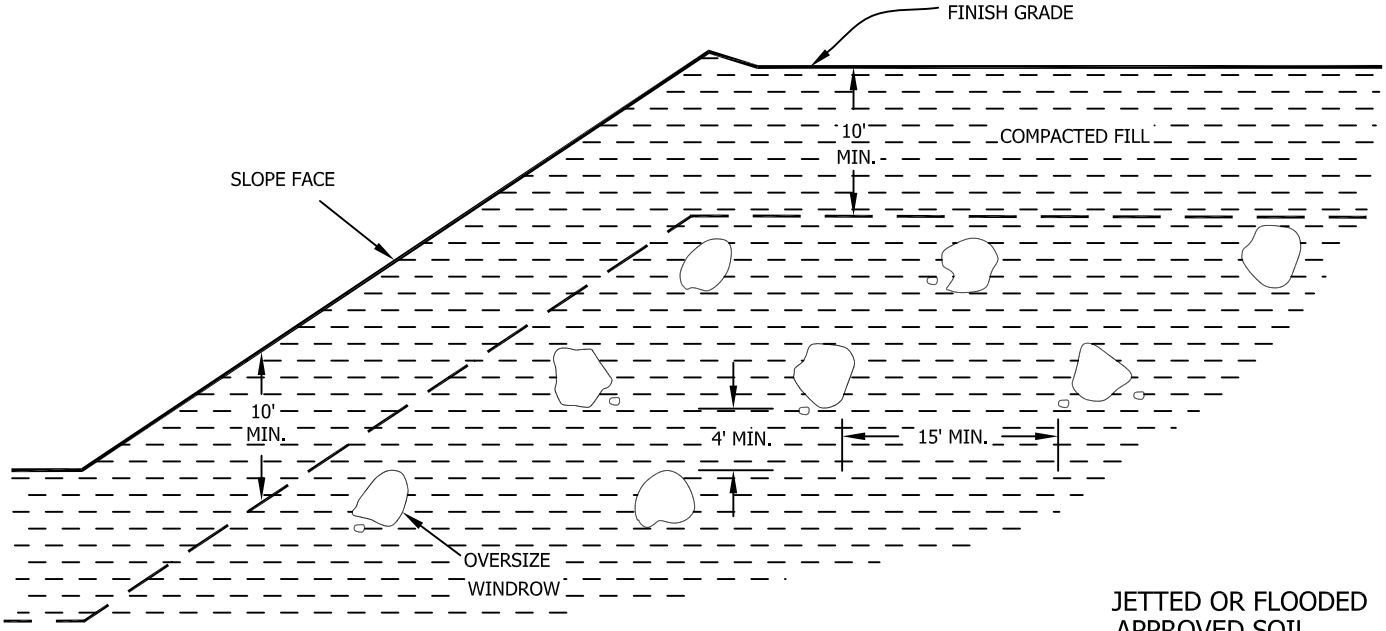


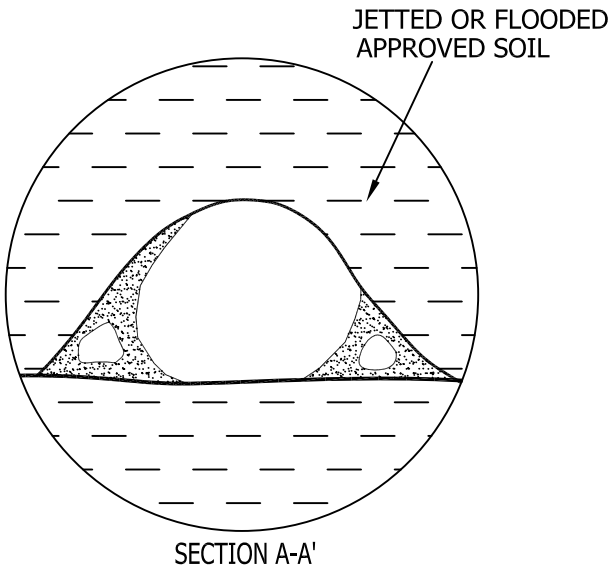
CUT-OVER-FILL SLOPE



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.

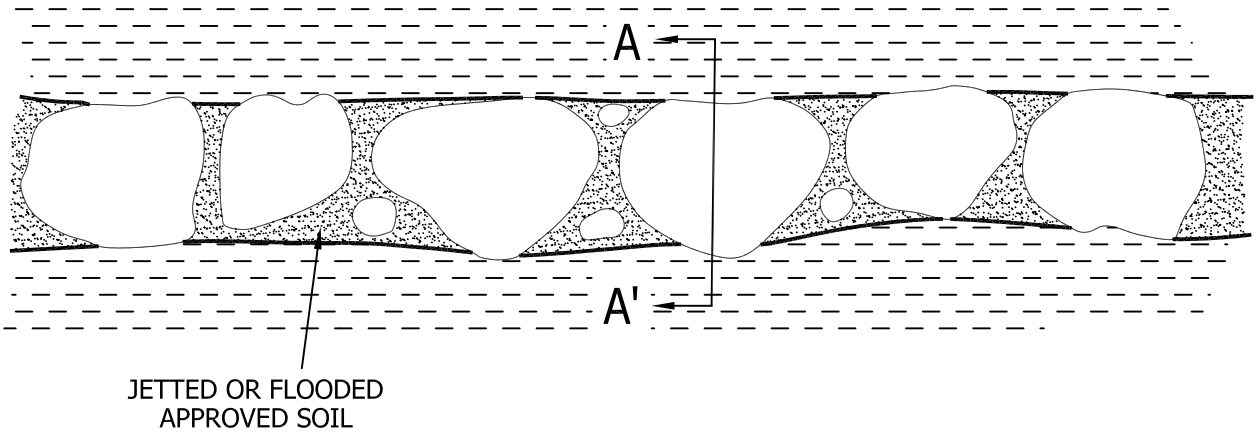
KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton





- 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

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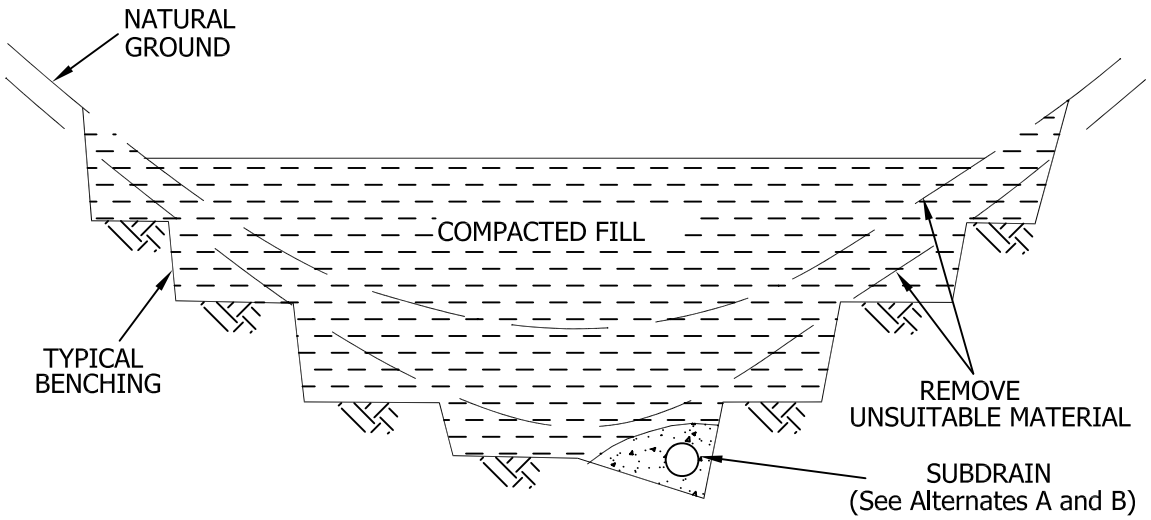
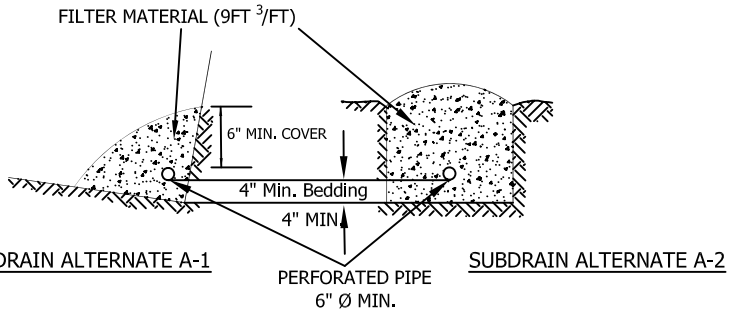


SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

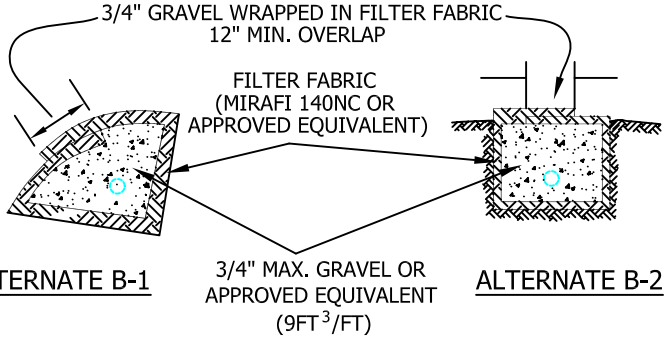


FILTER MATERIAL

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

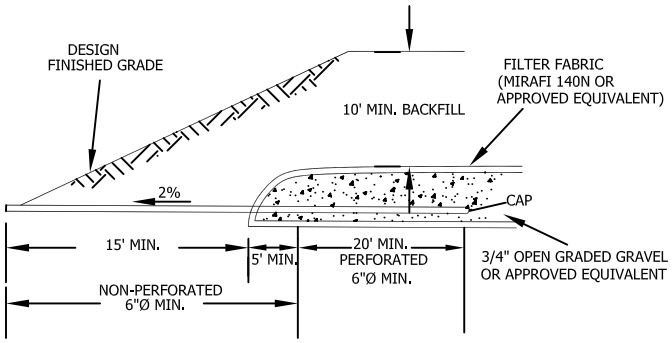
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



○ PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

DETAIL OF CANYON SUBDRAIN TERMINAL



CANYON SUBDRAIN	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C	Leighton

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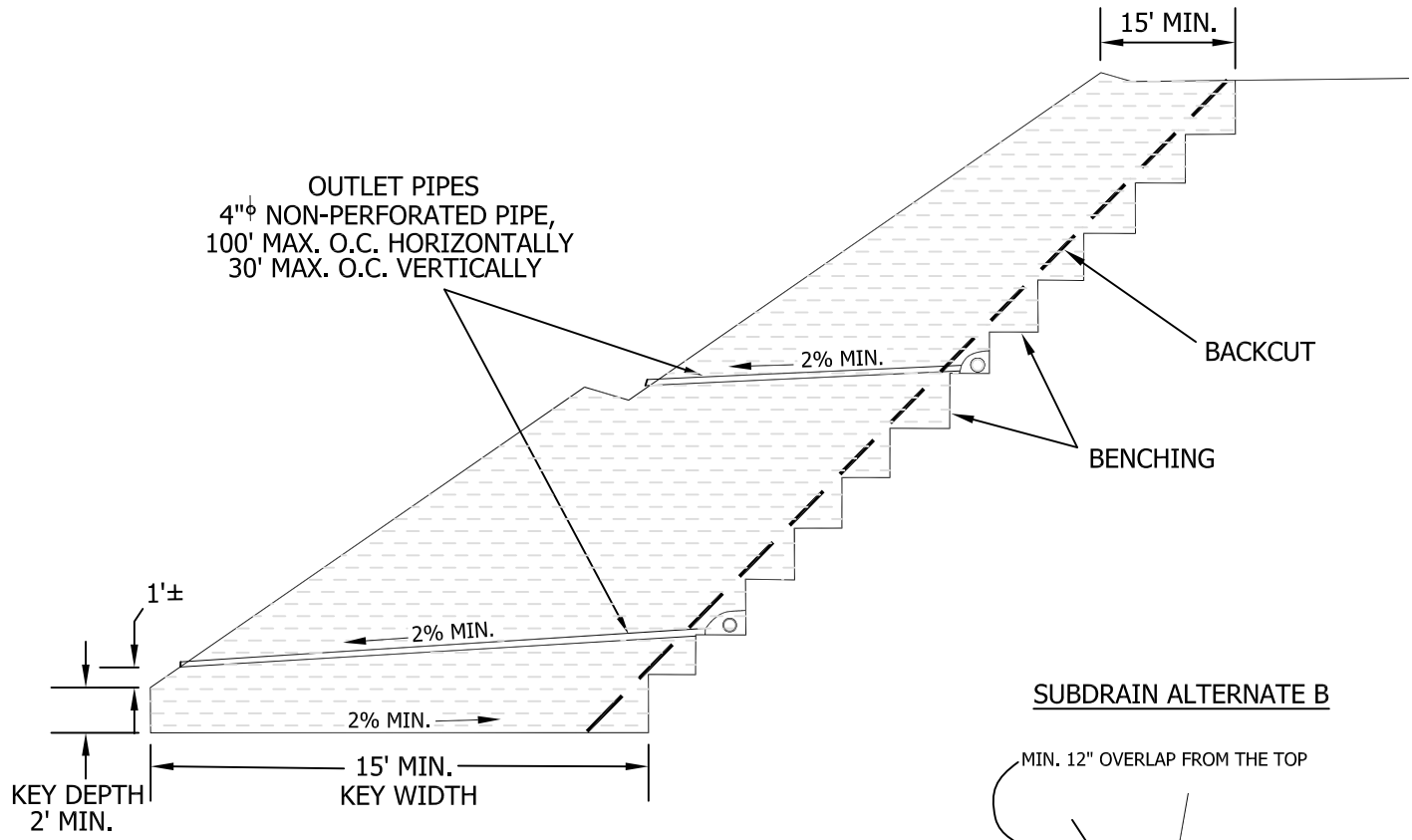
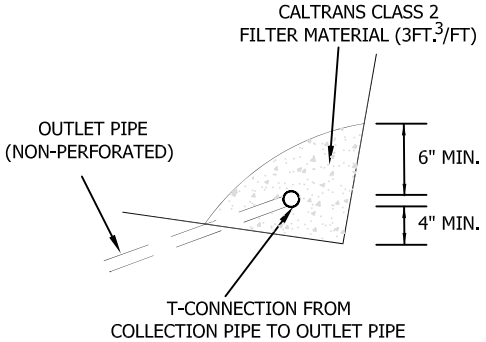
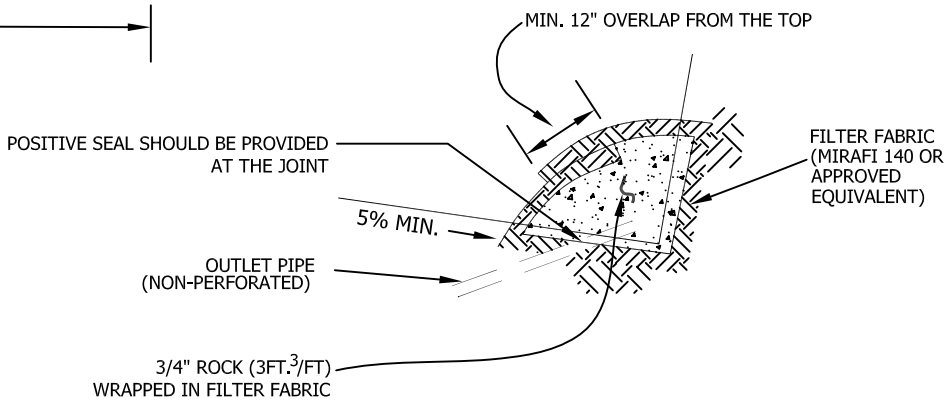


SUBDRAIN ALTERNATE A



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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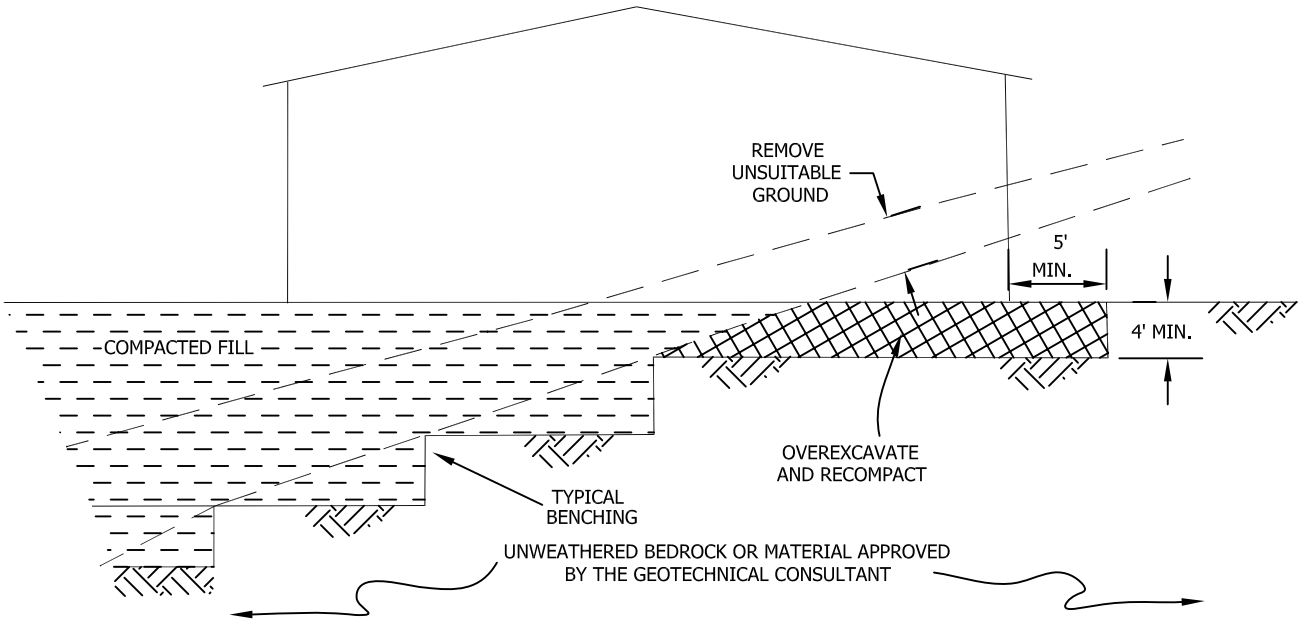
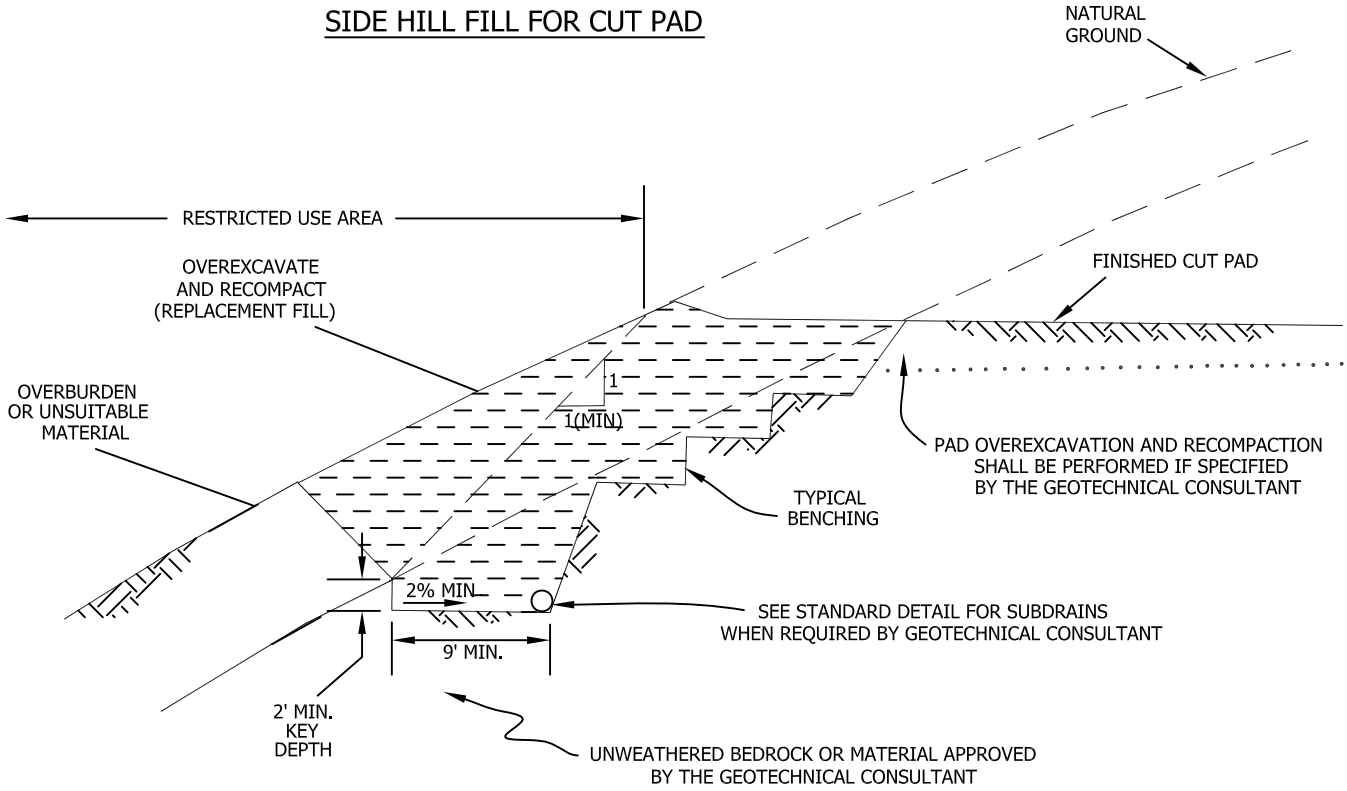
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



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

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APPENDIX F

PERCOLATION STUDY

Leighton

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-6
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 5
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	8:57 9:22	25	11.4	56.4	45.0	Yes
2	9:23 9:48	25	7.8	54.0	46.2	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.)
10:03 10:13	10	10	60	7.2	29.8	22.6	135.4
10:14 10:26	12	23	60	8.4	35.4	27.0	135.0
10:27 10:37	10	34	60	8.0	30.6	22.6	135.4
10:39 10:49	10	46	60	7.8	30.8	23.0	138.2
10:51 11:01	10	58	60	7.4	28.7	21.2	127.4
11:02 11:12	10	69	60	7.6	28.6	21.0	126.0

Initial Height of Water (Ho) = 52.44
Final Height of Water (Hf) = 31.44
Change in Height Over Time (ΔH) = 21
Average Head Over Time (Havg) = 41.94

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

I_t= 5.74 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM and SC
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-7
Date Excavated: 12-8-14
Date Tested: 12-10-14
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	10:06 10:31	25	60.0	148.8	88.8	Yes
2	10:33 10:53	20	60.0	122.4	62.4	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.)
10:57 11:07	10	10	180	64.8	106.2	41.4	248.4
11:09 11:23	14	26	180	68.2	124.8	56.6	242.7
11:24 11:34	10	37	180	67.8	107.2	39.4	236.2
11:37 11:47	10	50	180	67.2	106.2	39.0	234.0
11:49 11:59	10	62	180	65.4	116.4	51.0	306.0
12:00 12:10	10	73	180	66.5	105.2	38.8	232.6

Initial Height of Water (Ho) = 113.52
Final Height of Water (Hf) = 74.76
Change in Height Over Time (ΔH) = 38.76
Average Head Over Time (Havg) = 94.14

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

I_t= 4.84 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-8
Date Excavated: 12-8-14
Date Tested: 12-10-14
Depth of boring (ft): 5
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	9:06 9:31	25	9.0	60.0	51.0	Yes
2	9:33 9:58	25	9.0	60.0	51.0	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.)
11:17 11:23	6	6	60	18.0	55.2	37.2	372.0
11:25 11:30	5	13	60	17.8	51.4	33.6	403.2
12:09 12:15	6	58	60	12.7	47.8	35.0	350.4
12:16 12:22	6	65	60	12.0	47.4	35.4	354.0
12:25 12:30	5	73	60	11.0	40.2	29.2	349.9
12:31 12:36	5	79	60	12.5	42.2	29.8	357.1
12:37 12:42	5	85	60	12.4	42.5	30.1	361.4
12:43 12:48	5	91	60	13.4	43.0	29.5	354.2
12:49 12:54	5	97	60	12.7	40.9	28.2	338.4
12:55 13:00	5	103	60	12.6	40.4	27.8	334.1
13:01 13:06	5	109	60	13.2	40.9	27.7	332.6
13:07 13:12	5	115	60	13.6	41.4	27.8	334.1

Initial Height of Water (Ho) = 46.44
Final Height of Water (Hf) = 18.6
Change in Height Over Time (ΔH) = 27.84
Average Head Over Time (Havg) = 32.52

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

I_t= 19.36 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM and SP
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-9
Date Excavated: 12-8-14
Date Tested: 12-10-14
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	10:21 10:46	25	76.8	180.0	103.2	Yes
2	10:55 11:20	25	74.4	180.0	105.6	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.)
11:21 11:26	5	5	180	66.2	120.0	53.8	645.1
12:08 12:13	5	52	180	64.8	123.6	58.8	705.6
12:14 12:20	6	59	180	74.4	121.8	47.4	474.0
12:22 12:27	5	66	180	65.4	116.6	51.2	614.9
12:29 12:34	5	73	180	67.4	117.2	49.8	597.6
12:35 12:40	5	79	180	66.1	113.8	47.6	571.7
12:41 12:46	5	85	180	67.3	115.2	47.9	574.6
12:47 12:52	5	91	180	66.5	112.8	46.3	555.8
12:53 12:58	5	97	180	65.0	112.4	47.4	568.8
12:59 13:04	5	103	180	66.6	113.8	47.2	565.9
13:05 13:10	5	109	180	66.2	112.8	46.6	558.7
13:11 13:16	5	115	180	66.4	113.2	46.8	561.6

Initial Height of Water (Ho) = 113.64
Final Height of Water (Hf) = 66.84
Change in Height Over Time (ΔH) = 46.8
Average Head Over Time (Havg) = 90.24

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

I_t= 12.18 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: CL and SM
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-10
Date Excavated: 12-8-14
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	7:41 8:04	23	65.9	108.1	42.2	Yes
2	8:08 8:33	25	67.2	109.1	41.9	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.)
8:37 8:47	10	10	180	68.5	78.5	10.0	59.8
8:47 8:57	10	20	180	71.4	77.3	5.9	35.3
8:57 9:07	10	30	180	66.0	72.1	6.1	36.7
9:07 9:17	10	40	180	66.0	72.1	6.1	36.7
9:17 9:27	10	50	180	66.0	72.8	6.8	41.0
9:27 9:37	10	60	180	66.0	72.0	6.0	36.0

Initial Height of Water (Ho) = 114
Final Height of Water (Hf) = 108
Change in Height Over Time (ΔH) = 6
Average Head Over Time (Havg) = 111

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

I_t= 0.64 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM
Liquid Description: Clear clean water
Tested By: ZS

Test Hole Number: P-11
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 5
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	7:35 8:00	25	11.6	28.8	17.2	Yes
2	8:00 8:25	25	8.6	23.2	14.5	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.)
8:31 8:41	10	10	60	12.0	19.2	7.2	43.2
8:41 8:51	10	20	60	12.0	17.5	5.5	33.1
8:51 9:01	10	30	60	12.0	17.2	5.2	31.0
9:01 9:11	10	40	60	11.6	16.7	5.0	30.2
9:11 9:21	10	50	60	10.9	17.8	6.8	41.0
9:21 9:31	10	60	60	12.0	17.8	5.8	34.6

Initial Height of Water (Ho) = 48
Final Height of Water (Hf) = 42.24
Change in Height Over Time (ΔH) = 5.76
Average Head Over Time (Havg) = 45.12

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

I_t= 1.47 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-12
Date Excavated: 12-8-14
Date Tested: 12-11-14
Depth of boring (ft): 5
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	7:58 8:23	25	9.0	55.8	46.8	Yes
2	8:27 8:52	25	9.0	55.6	46.6	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.)
8:56 9:06	10	10	60	11.0	45.6	34.6	207.4
9:08 9:18	10	22	60	12.4	46.7	34.3	205.9
9:19 9:29	10	33	60	9.6	47.2	37.6	225.4
9:30 9:40	10	44	60	14.4	48.6	34.2	205.2
9:43 9:53	10	57	60	12.5	48.7	36.2	217.4
9:55 10:05	10	69	60	12.6	48.7	36.1	216.7

Initial Height of Water (Ho) = 47.4
Final Height of Water (Hf) = 11.28
Change in Height Over Time (ΔH) = 36.12
Average Head Over Time (Havg) = 29.34

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

I_t= 13.83 in/hr

PERCOLATION DATA SHEET

Proj. Name: West Alton Parcel
USCS Soil Class.: SM, SP and CL
Liquid Description: Clear clean water
Tested By: CD

Test Hole Number: P-13
Date Excavated: 12-8-14
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	7:52 8:17	25	60.0	156.6	96.6	Yes
2	8:22 8:47	25	60.0	153.4	93.4	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.)
8:51 9:01	10	10	180	61.2	114.6	53.4	320.4
9:03 9:13	10	22	180	66.7	113.8	47.0	282.2
9:15 9:25	10	34	180	67.8	113.9	46.1	276.5
9:27 9:37	10	46	180	61.2	108.1	46.9	281.5
9:38 9:48	10	57	180	63.7	109.0	45.2	271.4
9:50 10:00	10	69	180	62.6	107.6	45.0	270.0

Initial Height of Water (Ho) = 117.36
Final Height of Water (Hf) = 72.36
Change in Height Over Time (ΔH) = 45
Average Head Over Time (Havg) = 94.86

I_t= ΔH(60r)/Δt(r+2Havg)

I_t= 5.58 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.

Qvof — VERY OLD ALLUVIAL FAN DEPOSITS. INTERBEDDED AND LATERALLY DISCOUNTINUOUS BEDS TO MASSIVE STRATIGRAPHY CHARACTERIZED OF DENSE TO VERY DENSE, SAND AND GRAVEL AND STIFF TO HARD SILT AND CLAY.

Tt — TOPANGA FORMATION, SANDSTONE BEDROCK WEATHERED NEAR SURFACE TO HARD, MODERATELY CEMENTED WITH INCREASING DEPTH. TYPICALLY MASSIVE WITH PEBBLEY TO CONGLOMERATE INTERBEDS AND OCCASSIONAL SILTSTONE FACIES, CIRCLED WHERE BURIED.

CPT-18 T.D.=49.9' — APPROXIMATE LOCATION OF CONE PENETROMETER TEST SHOWN WITH TOTAL DEPTH (T.D.) IN FEET

PAZ18-4 T.D.26.5' NO GW — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) IN FEET GROUND WATER (G.W.) NOT ENCOUNTERED DURING DRILLING LEIGHTON AND ASSOCIATES, INC., UNPUBLISHED PROJECT NO. 011783-004

SD TP-1 T.D.15' — APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., JANUARY 2008a, PROJECT NO. 011783-019

SD-BH-2 T.D.26.5' NO GW — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., JANUARY 2008a, PROJECT NO. 011783-019

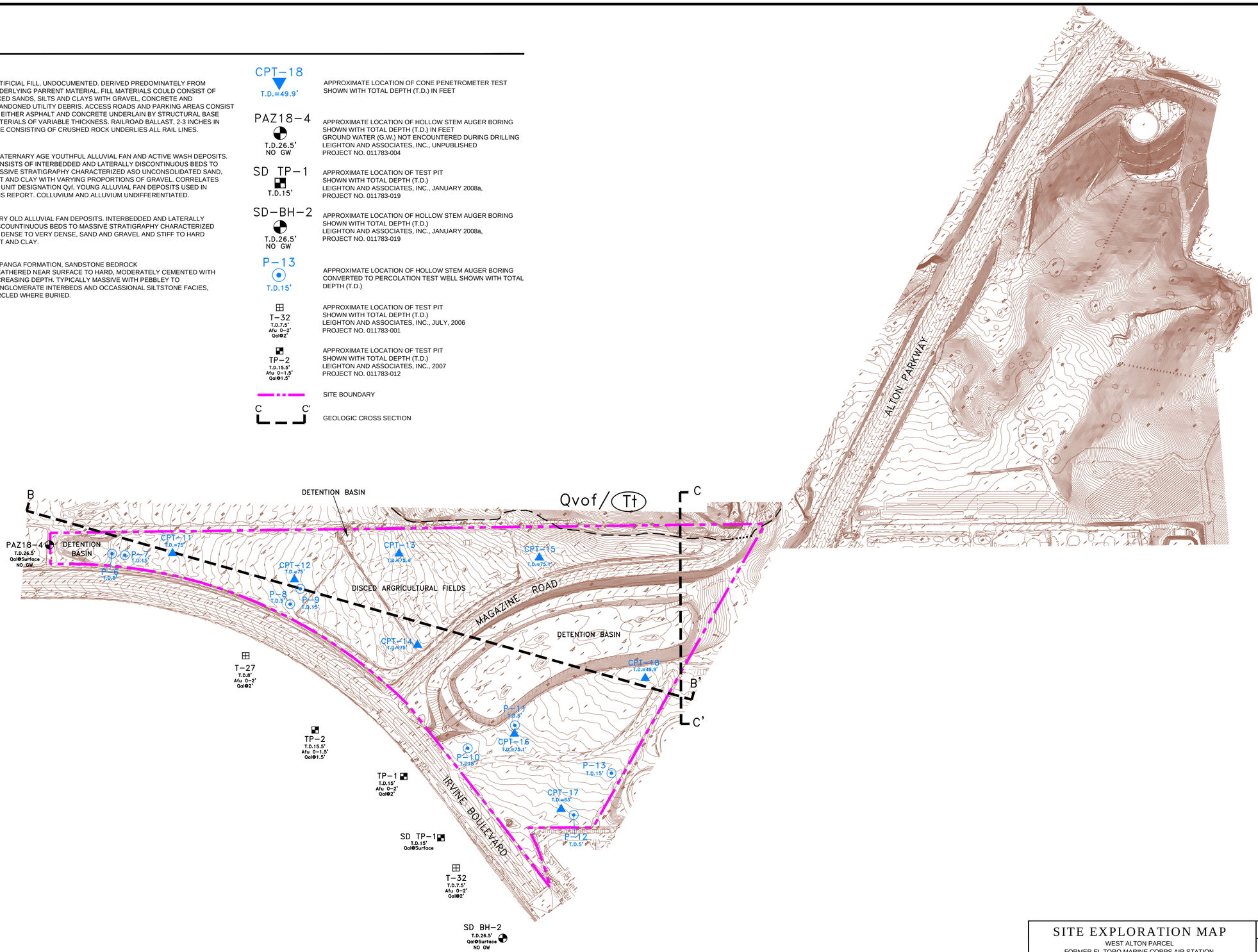
P-13 T.D.15' — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING CONVERTED TO PERCOLATION TEST WELL SHOWN WITH TOTAL DEPTH (T.D.)

T-32 T.D.7.5' Afu 0-2' Qal@2' — APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., JULY, 2006 PROJECT NO. 011783-001

TP-2 T.D.15.5' Afu 0-1.5' Qal@1.5' — APPROXIMATE LOCATION OF TEST PIT SHOWN WITH TOTAL DEPTH (T.D.) LEIGHTON AND ASSOCIATES, INC., 2007 PROJECT NO. 011783-012

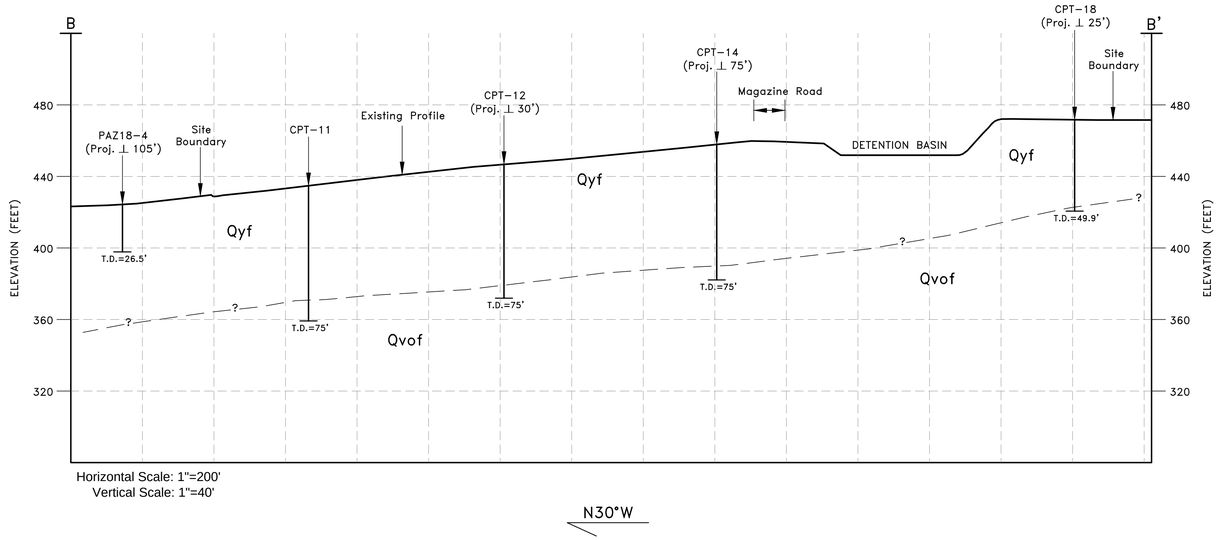
SITE BOUNDARY

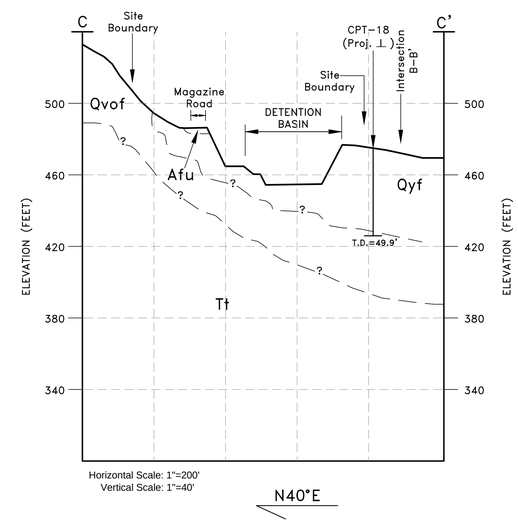
C — C' GEOLOGIC CROSS SECTION



SITE EXPLORATION MAP WEST ALTON PARCEL FORMER EL TORO MARINE CORPS AIR STATION IRVINE, CALIFORNIA		PLATE 1
Proj: 10695.003	Eng/Geol: CCK/JAR	Leighton
Scale: 1"=200'	Date: 05/2015	

Drafted By: BQT | Checked By: BQT | J:\10695\TTING\10695003CAD\10695-003-PLATE 1-WEST PARCEL.DWG 05-15-10 2:21:36PM5 Plotted by: ttran





LEGEND

Afu	ARTIFICIAL FILL, UNDOCUMENTED
Qyf	YOUNG ALLUVIUM FAN DEPOSITS
Qvof	VERY OLD ALLUVIUM DEPOSITS
Tt	TOPANGA FORMATION. SANDSTONE BEDROCK
—?— —?—	GEOLOGIC CONTACT, DASHED WHERE BURIED, QUERIED WHERE UNCERTAIN

GEOLOGIC CROSS SECTIONS
B-B' AND C-C'
WEST ALTON PARCEL
FORMER EL TORO MARINE CORPS AIR STATION
IRVINE, CALIFORNIA

PLATE 2

Proj: 10695.001	Eng/Geol: CCK/JAR
Scale: As Shown	Date: 09/2014

Leighton

Drafted By: BQT | Checked By: BQT | P:\DRAFTING\10695\001\OF_2014-05-16\WEST ALTON PARCEL\10695-001-PLATE 2-SECTIONS WEST.DWG (09-19-14 2:35:00 PM) Plotted by: bmm