Appendix C. Preliminary Geotechnical Investigation

This page is intentionally blank.

ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

December 13, 2017
J.N.: 2501.00

Mr. Kevin Laney
VP of Business Development
Signal Hill Petroleum Inc.
2633 Cherry Ave. Signal Hill, CA 90755

Subject: **Preliminary Geotechnical Investigation, Proposed Warehouse Facility, Southwest Corner of Orange Avenue and East Spring Street, City of Long Beach, California.**

Dear Mr. Laney,

Pursuant to your request, ***Albus-Keefe & Associates, Inc***. is pleased to present to you our geotechnical investigation report for the proposed warehouse facility at the subject site. This report presents the results of our review of readily available geologic publications, reports, and maps for the site and nearby vicinity, subsurface exploration, laboratory testing, engineering analyses, and conclusions and recommendations pertaining to the proposed site development.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS-KEEFE & ASSOCIATES, INC.

David E. Albus
Principal Engineer

TABLE OF CONTENTS

REPORT

TABLE OF CONTENTS

REPORT

FIGURES AND PLATES

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purposes of our investigation were to evaluate geotechnical conditions within the project area and to provide conclusions and recommendations relevant to the design and construction of the proposed improvements at the subject site. The scope of this investigation included the following:

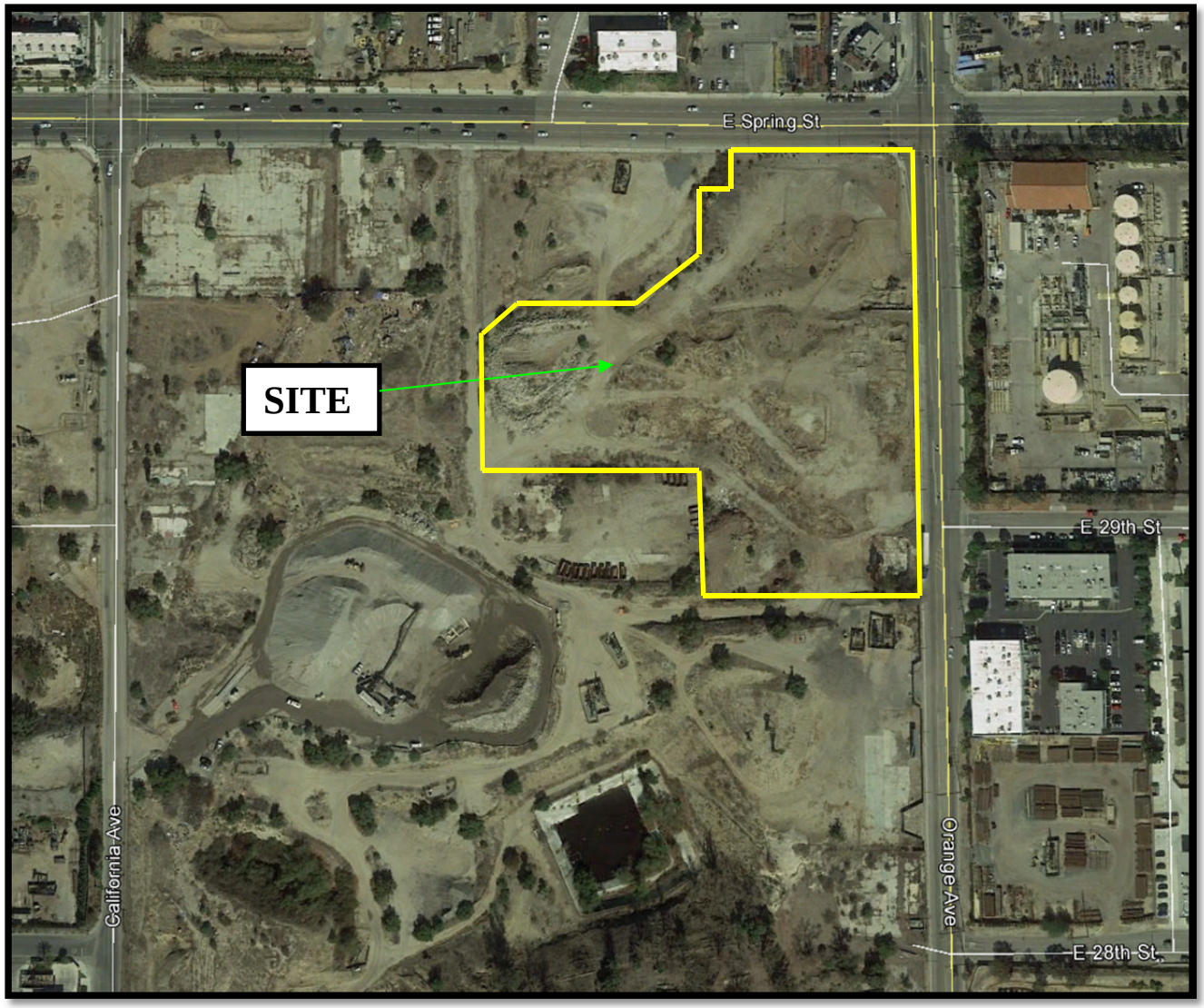
- Review of available geologic publications, reports, and maps for the site and nearby vicinity;
- Review of aerial photographs for the site and surrounding area;
- Exploratory drilling, trenching, cone penetration testing, and soil sampling;
- Laboratory testing of selected soil samples;
- Review of the referenced Preliminary Grading and Drainage Plan;
- Engineering analyses of data obtained from our review, exploration, and laboratory testing;
- Preparation of this report.

1.2 SITE LOCATION AND DESCRIPTION

The subject site is a 7.5-acre property located southwest of the intersection of Spring Street and Orange Avenue in the city of Long Beach, California. The site is bordered by Spring Street to the north, Orange Avenue to the east and largely by oil field, storage yards, and city of Long Beach park properties to the south and west sides. The location of the site and its relationship to the surrounding areas is shown on the Site Location Map, Figure 1.

Currently, the site is relatively vacant except for a large concrete stockpile in the far western portion of the site, some scattered piles of debris, and vestiges of former site improvements including slabs and retaining walls. An existing sewer mainline and two storm drain mainlines are currently present just beyond the western property line and to the north within Spring Street. The approximate locations of the existing offsite sewer mainline and the two storm drain mainlines are indicated on the Geologic Map, Plate 1.

Presently, topography within the site gently slopes in the westerly direction away from Orange Avenue. Surface elevations within the site range from approximately 95 feet above mean sea level (MSL) in the eastern central margin of the site to approximately 69 feet above MSL in the western central portion of the site. Current site drainage is generally directed as sheet flow to the northwest and southwest. Vegetation on site primarily consists of some scattered weeds and occasional small shrubs and trees.



SITE LOCATION MAP

N

Proposed Warehouse Facility Site
Southwest Corner of Orange Avenue and East Spring Street
City of Long Beach, California

NOT TO SCALE

FIGURE 1

1.3 PROPOSED DEVELOPMENT

Based on the referenced preliminary grading and drainage plan, the site will be developed for commercial use and will involve the construction of three large warehouse buildings with associated loading docks and parking lots. Some offsite grading for support of the western margin of the proposed development is also proposed. Other associated improvements will include pavement, retaining walls, hardscaping, landscaping, and underground utilities.

Future development will involve cut and fill grading, slope construction, and retaining wall construction. Proposed fills and cuts are up to approximately 7 feet and 8 feet, respectively. Proposed slope construction will involve 2:1 (H:V) or flatter fill and cut slopes up to a maximum height of approximately 7 feet. Proposed retaining walls are up to a maximum height of approximately 7 feet.

No structural plans were available at the time of preparing this report. However, proposed site development is anticipated to be comprised of concrete tilt-up construction with concrete slabs on grade and supported by conventional foundations. Future foundation loads are expected to range from relatively light to moderate.

2.0 INVESTIGATION

2.1 RESEARCH

We have reviewed the referenced geologic publications, aerial photographs, maps, and plans. A complete list of the documents reviewed is provided in the reference section of this report. We have also reviewed available geotechnical and environmental reports prepared by Environmental Science & Engineering, Inc. (1993 and 2000) and AMEC Earth and Environmental, Inc. (2003) prepared for the site and surrounding area. The report prepared by AMEC (2003) also included exploratory data from an earlier Dames and Moore study in 1988. The locations of pertinent exploratory excavations from the previous geotechnical studies are shown on the Geotechnical Map, Plate 1. Pertinent exploration logs and lab data from this previous work are also included in Appendix C.

Much of the original topographically of the site has been altered substantially as a result of previous site development and adjacent improvements. A review of old topographic maps indicates that a pre-existing south-draining channel once meandered along the western margin of the property before it was mostly buried with fill. Based on the referenced 1960 topographic map, bottom elevations within the former drainage ranged from roughly 54 feet above mean sea level (MSL) at the northern end of the site to roughly 48 feet above MSL at the southern end of the site. The topographic contours of the former drainage, based on the referenced 1960 topographic map, are indicated on the Geologic Map, Plate 1.

We understand that debris created by demolition of structures damaged during the 1933 Long Beach earthquake was likely placed in the drainage primarily along the eastern flank. The timeframe, amount, and locations of such disposal are not known. During the period of 1964 through 2003, the drainage was filled with artificial fill soils associated with construction of commercial buildings and thereby burying the structural debris. Following the infilling of the drainage, the site was occupied by a natural gas plant facility and by Signal Hill Petroleum's office complex. Some previous oil

production activity also took place on the site. In more recent times, the gas plant and office complex were demolished.

2.2 SUBSURFACE EXPLORATION

A significant amount of previous subsurface exploration has been completed by others within the site and its immediate adjacent areas. Based on initial assessment of previous work and discussions with Signal Hill Petroleum's representative regarding the environmental constraints and existing buried debris, we focused our subsurface exploration primarily within the western portion of the site to better evaluate the geologic conditions within the buried drainage course and to develop remedial grading measures. Our subsurface exploration consisted of excavation of eight (8) exploratory trenches, drilling of seven (7) exploratory borings, and conducting twenty (20) CPT soundings. A brief description of our subsurface exploration work is provided below.

Exploratory Trenches:

Exploratory trenches were excavated on October 6, 2016. The trenches were excavated to depths varying from approximately 5 feet to 12 feet using an excavator. The trench excavations were utilized to gain a better understanding of the surficial extent and depth of the existing fill soils along the flank of the buried drainage as well as to assess the amount and size of debris in the existing fill soils. A representative of Albus-Keefe & Associates, Inc., logged the exploratory trenches. Logs of the soil and bedrock conditions encountered were made for the trench excavations and are presented in Appendix A. Bulk samples of representative material types were also collected and returned to the laboratory for testing and analyses. Upon completion of our work, the trench excavations were backfilled with trench spoils using nominal compaction effort to re-establish the ground surface. The approximate locations of the exploratory trenches are shown on the enclosed Geotechnical Map, Plate 1.

Exploratory Borings:

Exploratory borings were drilled between October 24 and 31, 2016. The borings were drilled to depths ranging from 66 to 81 feet below the existing ground surface utilizing a truck-mounted, hollow-stem auger drill rig. The borings were used primarily to evaluate soil and groundwater conditions within the buried drainage course and to obtain bulk, SPT, and relatively undisturbed soil samples for laboratory testing. A representative of *Albus-Keefe & Associates, Inc*. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered and their descriptions are presented in Appendix A. The approximate locations of the exploratory borings are shown on the enclosed Geotechnical Map, Plate 1.

Bulk and relatively undisturbed samples were obtained at selected depths in the borings for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with twelve 1-inch-high brass rings at the bottom, followed by a 6-inch-high drill rod sleeve at the top. During the boring program, the sampler was driven 18 inches with successive drops of a 140-pound automatic hammer. The number of blows required to advance the sampler was recorded for each six inches of advancement. The blow count for the lower 12 inches of advancement of each sample is recorded on the exploratory

logs. All soil samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses and testing.

Upon completion of drilling and sampling, vibrating wire piezometers were installed in 3 of the borings (Borings B-5 through B-7). The piezometers were placed within the alluvium to measure current and future groundwater levels within these soils. The remaining borings were backfilled with a cement-bentonite grout from the bottom to the ground surface upon completion. The investigation-derived waste (IDW) was stored in 55-gallon drums and left onsite during its characterization. Characterization and IDW disposal were not within the scope of our work.

CPT Soundings:

CPT soundings were performed on October 11 and 12 of 2016 by Kehoe Testing and Engineering. The CPT soundings were generally extended to a depth of 50 feet below the ground surface wherever possible. Where refusal was encountered, additional CPT soundings were conducted within the vicinity of the initial CPT. The CPT data was utilized to develop characteristic soil profiles, evaluate liquefaction potential, and to aid in evaluating settlement potential. The CPTs were advanced in general accordance with ASTM D 5778 using an electronic cone penetrometer. Plots of the soundings are provided in Appendix A. The approximate locations of the CPT soundings are shown on the enclosed Geotechnical Map, Plate 1. Upon completion, shafts created by the CPTs were backfilled with a cement-bentonite grout from the bottom to the ground surface.

2.3 LABORATORY TESTING

Selected samples of representative earth materials from the borings excavated at the site were tested in the laboratory. Tests consisted of in-situ moisture content and density, consolidation, and Atterberg limits. Descriptions of laboratory test criteria and a summary of the test results are presented in Appendix B and on the boring logs in Appendix A.

3.0 GEOLOGIC CONDITIONS

3.1 REGIONAL GEOLOGIC SETTING

The subject site is situated within the Peninsular Ranges Geomorphic Province, near the western edge of the Los Angeles Coastal Plain. In closer proximity, site is located at the far northwest extension of the Signal Hill uplift. Signal Hill is one of several low lying hills within the western margin of the Los Angeles Basin that are oriented in the northwesterly direction, creating the surface expression of the Newport-Inglewood structural fault zone (NIFZ). Subsidence and deposition within the Los Angeles Basin is believed to have initiated during mid to late Miocene time. As the basin subsided, it was filled with sediments that eroded from the surrounding highlands through the late Pleistocene. The inception of right-lateral displacement along the Newport-Inglewood Fault Zone (NIFZ) is believed to have occurred some two to five million years ago (Wright, 1991), but the structural features along the NIFZ did not have topographic expression before late Pleistocene time (Yerkes et al., 1965). During the late Pleistocene, the region was continually deformed and gradually uplifted along the fault zone to produce the geomorphic expression of what is now known as Signal Hill.

Signal Hill and the surrounding vicinity are generally underlain by thousands of feet of sediments that rest unconformably above metamorphic basement rock. Both Holocene- and Pleistocene-age sediments make up the current surface expression of Signal Hill and the surrounding areas. The near surface bedrock units that underlie Signal Hill have been assigned to the upper Pleistocene-age Lakewood Formation and the lower Pleistocene-age San Pedro Formation. Holocene-age (recent to 11,000 years b.p.) sediments exposed at the ground surface of Signal Hill are generally comprised of artificial fill materials, colluvium, and alluvium. These deposits typically overlie the Pleistocene-age bedrock units discussed above with the exception of areas that have been locally modified through manmade excavations. The regional geologic conditions of the area are depicted on the Regional Geologic Map, Figure 2.

3.2 GEOLOGIC UNITS

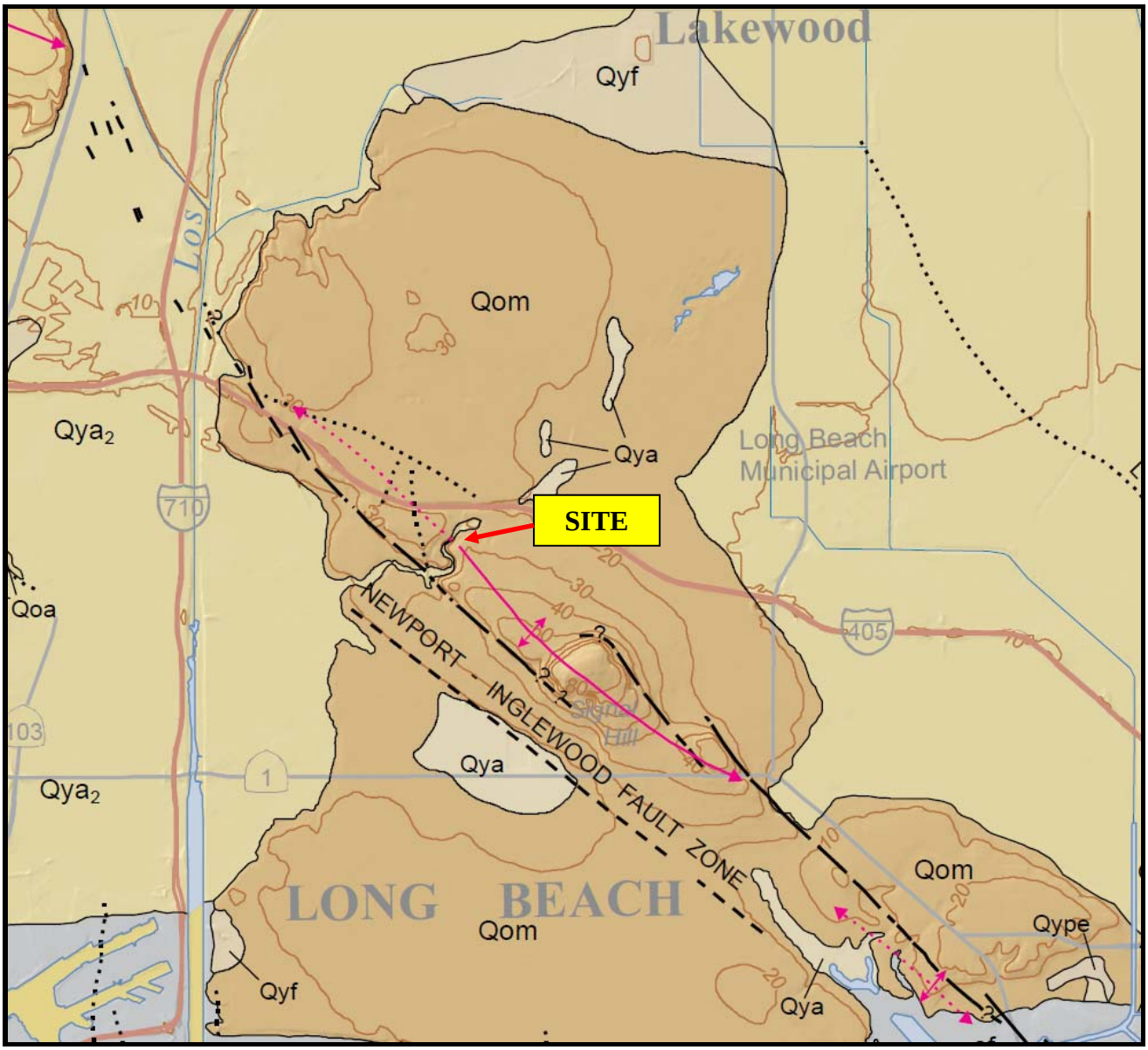
3.2.1 Local Setting

The oldest geologic unit within the site consist of Pleistocene–age sediments assigned to the San Pedro Formation (Qsp). These sediments are generally overlain by artificial fill (Af) and residual soil. Alluvium (Qal) associated with a buried drainage channel that once meandered along the western margin of the site is also present beneath the western margin of the site. The approximate surficial distribution of the geologic units is illustrated on the enclosed Geotechnical Map, Plate 1 and the Geologic Cross Sections depicting the interpreted geologic conditions beneath the site are presented on Plate 2. Detailed descriptions of each of the units based on our subsurface exploration and field observations, as well as from previous exploration work by others, are provided in the following sections.

3.2.2 Artificial Fill (Af)

Artificial fill materials are generally present throughout most of the site and are most extensive in the lower westerly margin of the site within the former drainage course. The artificial fill materials within the upper easterly portion of the site generally consist of fine-grained silty sands and sands that are brown and olive gray in color, dry to moist, and loose. Some local construction debris and petroleum odor was also noted. The thickness of the fills encountered in this area vary from nil to locally as much as 14 feet.

Within the former drainage along the lower westerly portion of the site, the artificial fill materials consist largely of mixtures of sands, silts and clays that are various shades of brown and gray, and are dry to very moist, and loose to very dense or soft to very stiff. Local petroleum staining, organic debris and construction debris consisting of wood, plastic, bricks, concrete and asphalt were also present. Where encountered in our trenches, the construction debris generally appeared to be 12 inches or less in size. However, in our exploratory trenches T-7 and T-8 within the southwesterly portion of the site, concrete and asphalt debris up to 3 feet in size were encountered along the base of the fill. Refusal during this firm's exploratory drilling and CPT soundings and during previous exploration by others was also particularly noted in the southwesterly portion site and could also be attributed to oversize debris. Based on exploration data and review of old topographic maps, the artificial fill materials in the lower westerly portion of the site are up to as much as 25 to 30 feet in thickness.



REGIONAL GEOLOGIC MAP

Proposed Warehouse Facility
Southwest Corner of Orange Avenue and East Spring Street
City of Long Beach, California

From: Saucedo, J. G., Greene, H.G., Kennedy, M.P., Bezore, S.P., 2016, Geologic Map of the Long Beach 30' x 60' Quadrangle, California, Version 2, California Geological Survey

FIGURE 2

Documentation concerning the placement to these fills was not available. However, our research indicates the fills were placed episodically over a long period of time in association with early oil field operations, adjacent street improvements, construction of the gas plant and Signal Hill Petroleum Inc.'s office complex, and various other city of Long Beach municipal activities, including the construction of the adjacent sewer and storm drain improvements. More recent demolition of the gas plant and office complex has also generated some fills. Only those fills of significant thickness and lateral extent are shown on the Geotechnical Map, Plate 1.

3.2.3 Residual Soil (No map Symbol)

Residual soil materials (commonly referred to as topsoil) locally mantle the bedrock materials in areas where remnants of the original natural ground surface have been preserved. As observed in our exploratory trench T-3, the residual soil materials generally consist of fine-grained silty sands that are brown in color, damp, loose to medium dense and are locally porous and contain fine roots. The thickness of this unit encountered varies from 1 foot to 2 feet.

3.2.4 Alluvium (Qal)

Alluvial deposits associated with the former drainage course underlie the fills along the lower westerly margin of the site. The alluvial materials are generally comprised of thinly-interfingered layers and lenses of olive gray to black, fine-grained sands, silty sands, clayey sands, sandy silts, sandy clays, organic silts, lean clays and fat clays. These deposits were generally damp to wet, medium dense to dense or soft to very stiff. The upper portions of the alluvium contained various amounts of organic plant matter (i.e. peat) and typically had an organic odor. Based on exploration data, the alluvial materials are up to as much as 30 feet in thickness.

3.2.5 Bedrock: San Pedro Formation (Qsp)

The San Pedro Formation is a near-shore marine deposit that underlies the entire site at depth. This unit consists primarily of gray to pale yellow, slightly micaceous, silty sandstone to sandstone that is typically dry to damp, slightly friable, moderately hard, and appears primarily massive with some subtle bedding structure. Medium- to coarse-grained sand, gravel beds, and thin siltstone interbeds were occasionally encountered within the predominantly fine-grained sandstone units.

In the near surface where remnants of the original natural ground surface have been preserved, an argillic soil horizon was locally observed within the San Pedro Formation. The argillic soil horizon was recognized by its orange to reddish hues, relatively high clay content and clay films, and distinct, well-developed, angular/blocky ped structure.

3.3 GROUNDWATER

Shallow groundwater was encountered in our exploratory borings B-1, B-3 and B-7 at depths of 29 feet, 20 feet and 19 feet, respectively and occurred in some of the previous borings by others. A compilation of the perched groundwater encountered in borings conducted by AMEC (2003), Dames and Moore (AMEC 2003) and ESE (2000) reveals that perched groundwater has been encountered in 14 out of 67 borings in depths ranging from 14 to 35 feet below the ground.

The groundwater generally occurred within the fill soils as a perched condition upon the alluvium but does appear to penetrate into the lower portion of the underling alluvial materials where the alluvium is somewhat granular. Deeper alluvial materials and the bedrock were found to be unsaturated which supports the interpretation that groundwater is a perched condition generally within the fill and upper portion of the alluvium soils. Because groundwater was not readily observed in four of our borings as well as some borings by others suggests that groundwater is either a very thin perched condition or not present in some areas. Using occurrences of groundwater in our borings and others, we have estimated the apparent shallow groundwater piezometric surface as presented on Plate 1.

A study of the underlying hydrogeologic conditions of the site was performed by Environmental Science & Engineering, Inc., (2000) as part of the Sports Park Project for the city of Long Beach. Their study involved the installation and monitoring of 5 deep groundwater wells beneath the site and general vicinity. Based on their report, regional groundwater was found beneath the site at elevations varying from approximately 48 to 49 feet below Mean Sea level (MSL). Provided that groundwater elevations have not changed significantly since that report, regional groundwater would occur at depths of roughly 118 feet to 143 feet below the existing ground surface. A review of the DMG Seismic Hazard Zone Report for the site indicates that historical high groundwater level is not available in the general site area.

3.4 FAULTING

Based on our review of the referenced publications and seismic data, no faults are known to project through or immediately adjacent the site. Also, the site does not lie within an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Table 3.2 presents a summary of all the major active faults within 10 miles of the site.

4.0 ANALYSES

4.1 SEISMICITY

We have performed probabilistic seismic analyses utilizing the web-based U.S. Seismic Design Maps web application by the U.S. Geological Survey (USGS). We obtain a PGA of 0.627g in accordance with Figure 22-7 of ASCE 7-10. The site coefficient, F_{PGA}, for site class D at this range of PGA is 1.0. Therefore, the PGA_M = 1.0 x 0.627 = 0.627g. The mean event associated with a probability of exceedance equal to 2% over 50 years is estimated to have a moment magnitude of 6.83 and a mean distance to the seismic source of 4.6 miles.

4.2 LIQUEFACTION

Based on the “Seismic Hazard Zone Report for the Long Beach 7.5-Minute Quadrangles, Los Angeles County, California”, Seismic Hazard Zone Report 028 published by the California Department of Conservation, Division of Mines and Geology, a portion of the site that is mainly located on the western half is located within a ”liquefaction” zone of required investigation. To evaluate risks associated with liquefaction potential, we have performed engineering analyses at nine

CPT soundings that reached a minimum depth of 50 feet below ground surface. The analyses followed the guidelines presented in the CGS Special Publication 117A (2008), as modified in the procedures by Youd, et al. (2001) using seismicity parameters discussed in Sections 4.1. The depth to groundwater was based on the interpreted groundwater conditions discussed in Section 3.3. Although exploration data suggest that groundwater is generally present as a perched condition primarily within the fill soils, we have conservatively assumed groundwater is present throughout the full thickness of alluvial soils below the assumed phreatic surface. Soils with a Soil Behavior Type Index, I_C greater than 2.6 were assumed not susceptible to liquefaction. The procedure used and the results of CPT-based liquefaction analyses are provided on Plates D-1 to D-11 within Appendix D of this report.

TABLE 3.2
Summary of Faults

Fault Name	Fault ID	Distance from Site (miles)	Maximum Magnitude	Fault Dip (degrees)	Fault Type
Newport Inglewood fault zone (S. Los Angeles Basin section-southern)	366	0.3	0.3	90	SS
Compton	367	4.6	4.6	20	Rev
Newport Inglewood fault zone (N. Los Angeles Basin section)	342	5.2	5.2	88	SS
Thums-Huntington Beach fault-southern	374	5.8	5.8	90	SS
Palos Verdes	369	7.0	7.0	90	SS
Cabrillo fault (onshore section)	373	7.2	7.2	50	N
Puente Hills (Santa Fe Springs)	359	7.1	7.1	29	Rev
Santa Monica	341	8.0	8.0	75	SS
Anaheim	363	8.0	8.0	71	Rev
Puente Hills (Coyote Hills)	361	9.6	9.6	26	Rev
Puente Hills (LA)	347	10.3	10.3	27	Rev

Based on our analyses, a number of the underlying soils have factors of safety below 1.3 and as such, are considered prone to liquefaction during a strong ground motion event. Layers that exhibit a potential for liquefaction occur at varying depths and with variable thicknesses. As such, no predominate liquefiable sublayers can be identified. The limits of potentially liquefiable zone based on our interpretation of the subsurface conditions and results of analyses are depicted on Plate 1.

We have also estimated the post-liquefaction settlement for saturated and dry sections of the soil profile at each CPT sounding for sublayers with a factor of safety of less than 1.3. In these analyses,

the empirical procedures developed by NCEER (1998) for the CPT data which compares the volumetric strain in the soil with the induced cyclic stress ratios/liquefaction safety factors have been used. As tabulated in Table 4.1 below, we have estimated seismic saturated settlements ranging from 0.1 to 3.2 inches and seismic dry settlement ranging from almost none to about 1.2 inches. Summing the saturated and dry settlement, the total ranges from about 0.5 to 3.5 inches. The procedure used and the profile of the estimated factors of safety against liquefaction and liquefaction-induced vertical settlement profiles are provided on Plates D-12 through D-22 within Appendix D.

TABLE 4.1
Summary of Liquefaction-Induced Settlement

Location	Surface Elevation (feet)	Perched Groundwater Elevation (feet)	Estimated Saturated Settlement (inches)	Estimated Dry Settlement (inches)	Estimated Total Settlement (inches)
CPT-1	72.8	57.8	1.35	1.17	2.52
CPT-2A	72.8	57.8	3.03	0.08	3.11
CPT-3	70.0	56.4	3.18	0.03	3.21
CPT-4	76.3	56.4	3.01	0.49	3.50
CPT-5	68.8	54.9	2.72	0.12	2.84
CPT-6	68.6	55.0	0.09	0.39	0.48
CPT-7B	77.0	52.9	1.36	0.42	1.78
CPT-8	70.6	54.1	0.43	0.17	0.60
CPT-9A	70.8	54.1	1.97	0.16	2.13

4.3 SETTLEMENT

Results of subsurface exploration and laboratory testing indicate the existing bedrock (Qsp) materials encountered on the eastern half of the site are expected to exhibit characteristics of over-consolidation and low compressibility. Due to this condition, settlement due to these materials was assumed to be negligible. The thickness of artificial fill (Af) varies up to about 35 feet across the site and is comprised of materials with variable densities and consistencies. These materials exhibit characteristics of normal consolidation to well over-consolidated and variable compressibility. The thickness of alluvium (Qal) also varies up to about 35 feet and can be divided into three characteristic sublayers. The upper two sublayers are mainly comprised of organic plastic clays and silts exhibiting very high compressibility characteristic and normal consolidation. The lower sublayer exhibits lesser compressibility but is also normally consolidated. Consolidation characteristic parameters were assigned to the various layers based on results of consolidation testing and correlations with CPT soundings. A summary of the assigned parameters are provided in Table 4.2.

TABLE 4.2
Summary of Compression Parameters

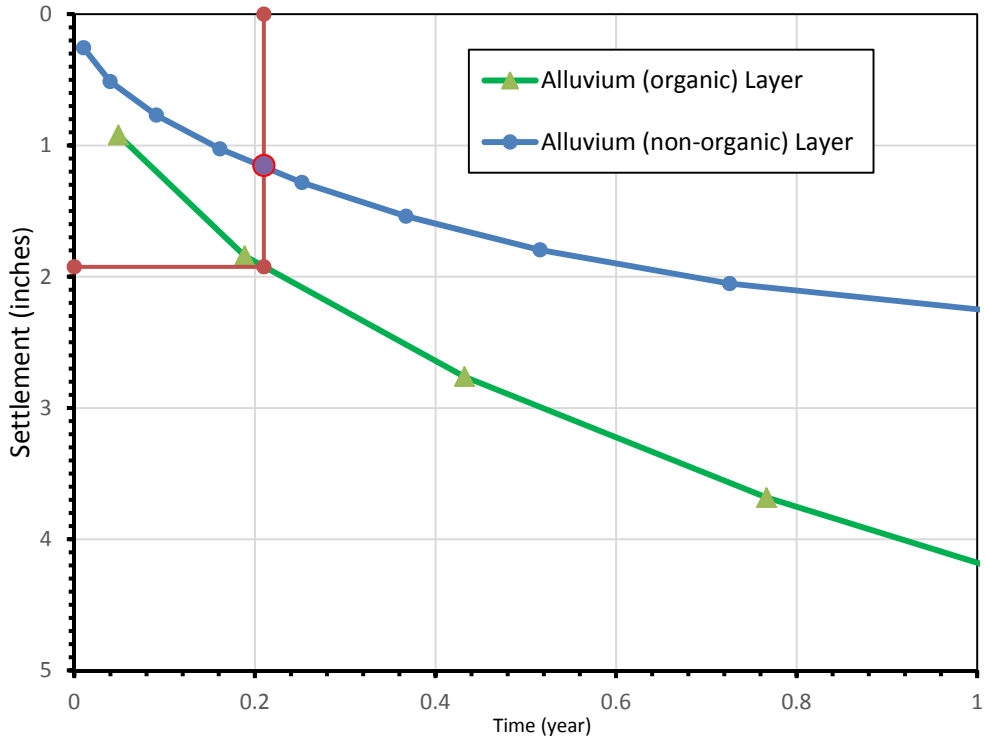
Material	Depth (ft)	Compression Index Rebound	Compression Index Virgin	Preconsolidation Pressure
Recompacted Fill	0-10	0.003	0.03	3,200 psf
Existing Fill	10-25	0.004	0.040	N.C.
Alluvium (organic)	25-31	0.03	0.30	N.C.
Alluvium (organic)	31-38	0.015	0.15	N.C.
Alluvium (non-organic)	38-50	0.008	0.08	N.C.
San Pedro Formation	+50	0.0	0.0	N/A
N.C.- Normally Consolidated				

Analyses were performed to estimate total settlement of the ground surface due to the additional weight of proposed fills and the weight of structures. For our analyses, we have assumed the upper 10 feet of existing soils will be removed and recompacted. Based on the current development plans, the worst-case condition will occur in the northwest corner of the northern building. At this location, the building pad will require an average fill of about 5 feet above current grade. The location also presents the thickest layers of alluvium and existing fill that would influence any of the buildings. To account for the weight of the building, we have included the influence of a strip footing 2 feet wide, 2 feet deep, and using a bearing pressure of 2,500 psf.

Using the parameters indicated in Table 4.2 and the assumptions above, we estimate a total settlement of approximately 4 ¾ inches. Of this settlement, we estimate 2.9 inches will occur in the organic alluvium and 0.8 inches in the non-organic alluvium. Most of the settlement is induced by the blanket fill load with a minor contribution by the footing load. A summary of this analysis is provided on Plate E-1 in Appendix E. Due to the large magnitude of this settlement, we also performed analyses to evaluate the effects of a surcharge fill placed above finish grade to accelerate the anticipated settlement under proposed conditions. Using a surcharge fill that is 15 feet high above the proposed grade, we obtain a total settlement of 14.6 inches. In this analysis, only the weight of proposed fill and surcharge fill are considered. A summary of this analysis is provided on Plate E-2 in Appendix E.

To evaluate the effects to the rate of settlement, we estimated the degree of consolidation at various increments of time for the combined fill load and surcharge fill load condition. We assumed the existing fill will not exhibit a long-term settlement rate compared to the alluvial soils due to the more granular nature of the fill materials and was therefore ignored. For the alluvial soils, we estimate the consolidation coefficients for the alluvium as 6.2×10^{-3} in^2/min. in the upper organic zone and 3.1×10^{-2} in^2/min. in the lower non-organic zone. These values were estimated from time-rate consolidation tests and correlations with Atterberg limit tests. The upper organic alluvial layer was assumed to use one-way drainage up into the existing fill while the lower non-organic alluvial layer was assumed to use one-way drainage down into the underlying San Pedro Formation. Plots of the time rate of settlement for the two organic and non-organic layers under the surcharge load of 15 feet are provided in Figure 3 below.

Since the estimated settlement of the organic layer under final proposed conditions is 2.9 inches and the assumed tolerable settlement is 1 inch, the amount of settlement required to occur in the organic layer before construction in 1.9 inches (2.9 inches – 1 inch). Using the time-rate plot in Figure 3, we see the time required to reach 1.9 inches of settlement in the organic layer is approximately 0.21 years or 2 ½ months. From the same plot, we note the non-organic layer will have experienced about 1.2 inches of settlement during this period. Since the estimated settlement due to final proposed conditions is only 0.8 inches in the non-organic layer, the total settlement potential will have occurred during this period with no remaining settlement potential. Using this approach, a surcharge load of 15 feet of fill placed over the proposed final grade is estimate to result in 1 inch of total settlement remaining after a period of 2 ½ months.



TIME-RATE OF SETTLEMENT

FIGURE 3

5.0 CONCLUSIONS

5.1 FEASIBILITY OF PROPOSED DEVELOPMENT

From a geotechnical point of view, the proposed site development is considered feasible. We also conclude the proposed development will not adversely impact the stability of adjoining properties. The adequacy and sufficiency of the preliminary findings and conclusions provided herein should be assessed based upon the final grading and structural plans. Key geotechnical issues that could impact the proposed site development are discussed in the following sections of this report.

5.2 GEOLOGIC HAZARDS

5.2.1 Ground Rupture

No known active faults project through the site or its vicinity, nor does the site lie within the boundaries of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, potential for ground rupture due to an earthquake beneath the site is considered very low.

5.2.2 Ground Shaking

The site is situated in a seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. The site lies in relative close proximity to several active faults. Therefore, during the life of the proposed structures, the property will probably experience similar moderate to occasionally high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region. Potential ground accelerations have been estimated for the site and are presented in Section 4.1 of this report. Design and construction in accordance with the current California Building Code (CBC) requirements is anticipated to address the issues related to potential ground shaking at the site.

5.2.3 Landsliding

The site is relatively flat and is not located within an area identified by the California Geologic Survey (CGS) as having potential for seismic slope instability. Therefore, geologic hazards associated with landsliding are not anticipated at the site.

5.2.4 Liquefaction

Engineering research of soil liquefaction potential (Youd, et al., 2001) indicates that generally three basic factors must exist concurrently in order for liquefaction to occur. These factors include:

- A source of ground shaking, such as an earthquake, capable of generating soil mass distortions.
- A relatively loose silty and/or sandy soil.
- A relative shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that will allow positive pore pressure generation.

The liquefaction susceptibility of the onsite subsurface soils was evaluated by analyzing the potential concurrent occurrence of the above-mentioned three basic factors. Based on the results of our analyses, some soils below the site are susceptible to liquefaction during a strong ground motion event. Details of these analyses are discussed in Section 4.2.

Liquefaction could result in some ground subsidence. Based on our analyses, total seismic settlement (saturated and dry) ranges between 0.6 and 3.5 inches for various CPT soundings across the site with an average settlement of about 2.3 inches. Assuming the upper 10 feet of existing artificial fill soils is over-excavated and re-compacted, we estimate the differential seismic settlement will be approximately 1/3 of the average total settlement or 0.8 inches over 30 feet.

Based on the State of California Special Publication 117A, hazards from liquefaction should be mitigated to the extent required to reduce seismic risk to "acceptable levels". The acceptable level

of risk means, "that level that provides reasonable protection of the public safety" [California Code of Regulations Title 14, Section 3721 (a)]. Protection of public safety does not require that structures be resistant to cracking or general distress due to differential movements. As such, a greater allowance for differential movement during liquefaction events is acceptable compared to the design requirements for static conditions.

The use of well-reinforced foundations, such as post-tensioned slabs, spread footings tied together with grade beams, or mat foundations have been proven to adequately provide basal support during liquefaction events comparable to the predicted site event. Specific recommendations for mitigation methods using a well-reinforced foundation system are provided in Section 6.3.

5.2.5 Seiches and Tsunami

The site is elevated more than 65 feet above sea level and is located a substantial distance from a significant body of water within an enclosed basin. As such, the potential for hazards related to seiches and tsunami are considered very low.

5.3 SLOPE STABILITY

Based on our experience with earth materials encountered at the site and nearby properties, the proposed slope ratio (2:1 or flatter), and the maximum height of the proposed slopes, the proposed cut and fill slopes at the site are anticipated to be grossly stable under static and pseudo-static conditions. The proposed cut and fill slopes are anticipated to be surficially stable provided that the slopes are constructed and maintained in accordance with the recommendations provided in this report.

5.4 STATIC SETTLEMENT

From our analyses, we estimate that proposed fills and foundation loads will result in an estimated total settlement of up to approximately 4 ¾ assuming the upper 10 feet of existing fill soils is recompacted. This magnitude of settlement is considered beyond tolerable limits of proposed structures. The time required to reach tolerable settlement is estimated to require a few years. However, this condition can be mitigated by placing a surcharge fill above the finish pad grade to accelerate the rate of settlement. We estimate that a surcharge fill placed 15 feet above finish grades in portions of the building areas impacted by high settlement will reduce the time to achieve tolerable settlement to about 2 ½ months.

Specific recommendations for a surcharge fill for building areas are provided in Section 6.1.7. Using the surcharge load is anticipated to reduce the total and differential post-construction static settlement to less than 1 inch and ½-inch over 30 feet, respectively, for the proposed structures assuming recommendations of this report are strictly followed. These levels of settlement are generally considered tolerable for proposed site development. Although the estimated total and differential settlement is anticipated to be within tolerable limits after surcharging, variations in the ground response can occur. As such, additional steps can be taken during design of the structures to provide additional steps of mitigation for potential differential movement. Such steps could include locations and details of joints in wall tilt-up panels that can be addressed during the plan development stage through coordination with the geotechnical consultant.

With regard to potential impacts to retaining and screen walls located over the alluvial areas, excessive settlement can be mitigated by allowing the new fills to settle during the surcharge period before constructing such walls in these areas. Additional mitigation can be provided by including additional jointing in the walls to permit greater relative movement. Specific recommendations regarding these steps are provided in Sections 6.4.5 and 6.4.6.

5.5 SOIL EXPANSION

Previous and current exploration indicates that the near-surface soils within the site are comprised of variable soil materials that are generally anticipated to possess a Very Low to Medium expansion potential. Previous testing for Expansion Index by AMEC (2003) reported values of EI up to 32. Expansive soils tend to swell upon wetting and shrink upon drying. These volumetric changes can cause excessive movement in foundations, pavement, and flatwork. Preliminary recommendations to mitigate this condition are provided under Section 6.0 of this report based on the initial testing reported by AMEC. Supplemental testing for soil expansion will be required subsequent to rough grading and prior to construction of foundations and other concrete work to develop final recommendations for mitigation of expansive soils.

5.6 GROUNDWATER

Data obtained from previous and current investigations indicate a shallow perched groundwater condition has formed within the original drainage featured now buried by artificial fill soils. The depths and occurrences of shallow groundwater have varied significantly over time. However, groundwater levels do not appear to have risen to depths of less than about 20 feet below proposed grades and are not anticipated to do so in the future. As such, groundwater is not anticipated to adversely affect proposed site development.

5.7 EARTHWORK AND MATERIAL CHARACTERISTICS

Based on the results of our subsurface exploration and previous subsurface exploration by others, the onsite near surface soil materials should be readily excavated by conventional heavy earthmoving equipment.

With respects to moisture content, the near surface materials within the site may be dry and will need to be moistened conditioned to near optimum moisture content prior to compaction. The deeper materials below the depth of approximately 15 feet in the lower westerly margin of the site in the former drainage may be locally very moist to wet. As such, these materials may require special handling such as top-loading with an excavator and drying prior to reuse as fill.

Demolition of the existing site improvements has generated a considerable amount of asphaltic and concrete debris at the site. Some of this material may be incorporated in the near-surface soils. In addition, various amounts of oversize asphaltic and concrete debris are present in the existing fills, particularly in the southwestern portion of the site. Where encountered, these over-sized materials will either need to be placed within onsite fills in accordance to this firm's recommendations in Section 6.1.6 or hauled offsite.

The site has been used in the past for oil field operations, as a gas plant and as an office complex. As such, underground pipelines, oil wells, onsite disposal systems, and other underground improvements are likely present beneath the site. If encountered during future rough grading, these improvements will require proper abandonment and/or removal. Any environmentally-impacted soils will need to be addressed by the project environmental consultant.

5.8 SHRINKAGE, BULKING AND SUBSIDENCE

The volume change of excavated materials due to recompaction is expected to vary with material types, depth of excavation, in-situ density, and compaction techniques and effort. Based on laboratory testing and our experience with similar projects, estimates of shrinkage and bulking are summarized in Table 5.1 below.

TABLE 5.1
ESTIMATES OF SHRINKAGE AND BULKING

MATERIAL	VOLUME CHANGE	SHRINKAGE
Artificial Fill (Af)	0-10%	Shrinkage
Alluvium (Qal)	10-15%	Shrinkage
Weathered San Pedro Formation (0'-2') (Qsp)	0-3%	Shrinkage
San Pedro Formation (Qsp)	0-5%	Bulking

Subsidence as a result of scarification and recompaction of removal bottoms in existing artificial fill areas is expected to be 0.05 feet while bedrock areas are expected to be negligible. The existing ground surface is anticipated to undergo an additional general subsidence as a result of new fill placement. The magnitude of subsidence will vary based on the thickness of alluvial soils present in each area. We estimate subsidence will vary from 0 to 0.35 feet within the areas underlain by alluvium.

The above estimates of shrinkage and bulking values are intended as a preliminary aid for project engineers in determining earthwork quantities. However, these estimates should be used with caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and bulking that will occur during site grading.

6.0 RECOMMENDATIONS

6.1 EARTHWORK

6.1.1 General Earthwork and Grading Specifications

All earthwork and grading should be performed in accordance with applicable requirements of Cal/OSHA, applicable specifications of the Grading Codes of the City of Long Beach, California, in addition to the recommendations presented herein.

6.1.2 Pre-Grade Meeting and Geotechnical Observation

Prior to commencement of grading, we recommend a meeting be held between the developer, City Inspector, grading contractor, civil engineer, and geotechnical consultant to discuss the proposed grading and construction logistics. We also recommend a geotechnical consultant be retained to provide soil engineering and engineering geologic services during site grading and foundation construction. This is to observe compliance with the design specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated. If conditions are encountered that appear to be different than those indicated in this report, the project geotechnical consultant should be notified immediately. Design and construction revisions may be required.

6.1.3 Site Clearing

Vegetation, concrete slabs and foundations, underground improvements to be abandoned, and deleterious materials should be removed from the site. Onsite disposal systems consisting of septic tank, seepage pits, and oil wells may be present at the site. If onsite disposal system were encountered during site development, the septic tank should be completely removed from the site and seepage pits should be properly abandoned in accordance with the requirements established by the government agencies.

The project geotechnical consultant should be notified at the appropriate times to provide observation services during clearing operations to verify compliance with the above recommendations. Voids created by clearing and excavation should be left open for observation by the geotechnical consultant. Should any unusual soil conditions or subsurface structures be encountered during site clearing or grading that are not described or anticipated herein, these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations as needed.

Temporary construction equipment (office trailers, power poles, etc.) should be positioned to allow adequate room for clearing and recommended ground preparation to be performed for proposed structures, pavements, and hardscapes.

6.1.4 Ground Preparation

Within the limits of proposed site development, all existing artificial fills should be removed but may be limited to a maximum depth of 10 feet below existing ground surface. However, all artificial fills associated with backfilling of exploratory trenches indicate on the Geotechnical Map, Plate 1, should be completely removed. In addition, the upper weathered portion (1 to 2 feet) of the San Pedro Formation should be removed to expose un-weathered San Pedro Formation within the limits of proposed site development.

Estimated depths of removals are shown on the attached Remedial Earthwork Map, Plate 3. The actual depths of removals should be determined by the geotechnical consultant during site grading and based on potholing and moisture density testing.

Following completion of removals, areas exposing existing artificial fills should be observed tested by the geotechnical consultant to confirm they exhibit a degree of saturation generally exceeding 75%.

Future rough grading will likely create cut to fill transition building pads and shallow fill pads. These pads should be overexcavated to a depth of 2 feet below bottom of proposed footings and replaced with a uniform fill blanket. The overexcavation should extend at least 5 feet beyond the outside edge of the perimeter building foundations.

Following ground preparation and prior to placement of fill, the exposed grade should first be scarified to a depth of 8 inches, brought to at least 100 percent of the optimum moisture content, and then compacted to at least 90 percent of the laboratory standard.

6.1.5 Fill Placement

In general, materials excavated from the site may be used as fill provided they are free of deleterious materials and particles greater than 6 inches in maximum dimension. Fill materials should be placed in loose lifts no greater than approximately 8 inches in thickness. Each lift should be watered or air-dried as necessary to achieve at least 100 percent of the optimum moisture content, and then compacted in place to at least 90 percent of the laboratory standard. The laboratory standard for maximum dry density and optimum moisture content for each soil type should be determined in accordance with ASTM D 1557. Each lift should be treated in a similar manner. Subsequent lifts should not be placed until the project geotechnical consultant has tested the preceding lift. Lifts should be maintained relatively level and should not exceed a gradient of 20:1 (H:V). Fills placed upon ground sloping steeper than 5:1 (H:V) should be benched prior to fill placement.

6.1.6 Oversize Materials

Asphalt and concrete materials greater than 6 inches in maximum dimension should be reduced in size, where practical, and incorporated within the fill materials provided they are mixed with granular materials and spread throughout the fill to eliminate nesting. Materials greater than 6 inches in diameter that cannot be reduced in size can be used in deeper parts of the fill as shown on Plate F-1 in Appendix F.

6.1.7 Fill Surcharge

As mentioned previously, the presence of alluvial soils within the former drainage area will undergo consolidation due to the weight of new fill and structures. This consolidation is anticipated to result in excessive settlement for proposed structures. We recommend the construction of surcharge fills placed 15 feet above the proposed finish grades in selected areas. The recommended limits of the surcharge fills are indicated on the Remedial Earthwork Plan, Plate 3. Based on conditions exposed during grading, these limits may be modified. Only a nominal compaction effort will be required for the surcharge fills.

In most locations, the edges of surcharge fills may be sloped at a 1.5:1(H:V) where space permits. The slope faces need not be compacted aside from a nominal effort. Where insufficient room is present for slopes, a wire basket and geofabric system will be required to provide a temporary vertical edge. A general detail of the wire basket system is provided on Plate F-2 within Appendix F of the report.

The wire basket system is constructed by initially placing a row of baskets along the limits of the surcharge load. Spikes driven into the ground may be needed to hold the first row of baskets in

place. Geofabric is laid on the ground and draped over the basket leaving the necessary excess fabric folded over the front face. Fill is then placed over the fabric within and behind the baskets. The fabric should be kept taught within and behind the basket during the placement of fill. Once the fill has reached the height of the basket, the remaining excess fabric is folded over on top of the fill. The next row of baskets is then placed on top of the fabric and aligned over the previous baskets. The baskets should be tied together with wire or zip strips to prevent shifting of the upper basket. The process is then repeated until the final grade is achieved. At least 2 feet of fill should be placed over the top of the final layer of fabric.

The surcharge fills should remain in place until the remaining settlement due to future final grades is estimated to be less than 1 inch. To confirm this condition has been achieved, we are recommending the surcharge fills be monitored by instruments prior to and after placement of fills above the current grades.

6.1.8 Settlement Monitoring

In order to confirm the predicted behavior of the surcharge fills, we recommend the installation of settlement plates and piezometers. The settlement plates and piezometers should be installed right after the removal and replacement of the upper 10 feet of the existing fill (Af) but before the placement of new fill above the existing grades. Preliminary locations of the instruments are depicted on the Remedial Earthwork Map, Plate 3. The instruments will be installed in clusters of three small-diameter borings adjacent one another in each area. Thereafter, a 30-inch-diameter casing should be installed vertically over each cluster to allow the instruments to extend up through the new fill and surcharge fills. The casing may be embedded a short distance into the ground surface for stability during filling and extended in short sections about 5 feet in length as fill progresses. Compaction of fill materials directly adjacent the casing should be accomplished using hand compactors. Extreme caution should be exercised by the grading contractor and others to avoid disturbing or damaging the casings or instruments during and after grading.

Readings for the instruments will then be obtained as the height of the fills progress. In general, a set of readings should be obtained for each 5 feet of fill placed or once every week, whichever occurs first. Once the surcharge fill is in place, the readings should be obtained once every two weeks or as may be directed by the geotechnical consultant. A general diagram of the monitoring system is provided on Plate F-3 within Appendix F. Readings of the settlement plates will require the use of land survey equipment. The locations of control points and the methodology used to perform the survey should be reviewed by and coordinated with the geotechnical consultant. Specific details for the instrumentation system should be provided by the geotechnical consultant prior to implementation. All data collected from the settlement plates and piezometers should be reviewed by the geotechnical consultant to confirm the intent of the surcharge fills.

6.1.9 Import Materials

If import materials are required to achieve the proposed finish grades, the proposed import soil should be free of deleterious material, and should have an Expansion Index (EI) less than 21, a Plasticity Index less than 15, and be non-corrosive to concrete and ferrous metals. The geotechnical consultant should be informed of import sources prior to hauling the materials to the site so that appropriate testing and evaluation of the proposed import material can be performed in advance.

6.1.10 Fill Slopes

Where practical, fill slopes should be constructed by over filling and trimming back to a compacted core. Where space does not permit over filling and slopes must be constructed "neat", the face of slopes should be compacted by back-rolling with a sheepsfoot as the slope is constructed. We recommend back-rolling no less than every 4 feet vertically.

6.1.11 Cut Slopes

All cut slopes should be observed by an engineering geologist during rough grading to evaluate the competency of the slope. Cut slopes that expose cohesionless granular soils may locally require replacement as stabilization fill slopes. General details for stabilization fill slope construction are presented on Plate F-4 within Appendix F. The project geotechnical consultant should provide specific recommendations during grading based on the actual conditions exposed.

6.1.12 Slope Backdrain

Slope backdrains are generally recommended in the keyway excavations of stabilization fill slopes. The locations and necessity of slope backdrains will be determined by the project geotechnical consultant in the field during rough grading. General details for slope backdrains are presented on Plate F-5 within Appendix F.

6.1.13 Temporary Excavations

Temporary construction slopes and trench excavations exposing non-friable soils can be cut vertically up to a height of 5 feet provided that no surcharging of the excavations is present. Temporary excavations greater than 5 feet in height but no more than 10 feet in height that are not surcharged will generally require a minimum layback to 1:1 (H:V). Temporary excavations greater than 10 feet in height should be reviewed by the geotechnical consultant for specific recommendations. Excavations exposing friable soils should be laid back to 1.5:1 (H:V) at any height.

Excavations with surcharge loads nearby may require laybacks at flatter angles or special grading techniques such as slot cutting, shoring or other acceptable design criteria determined by the geotechnical consultant.

Site materials are granular and may be prone to sloughing and possible caving if allowed to become excessively dry. Excavations should not be left open for prolonged periods of time. The project geotechnical consultant should observe all temporary cuts to confirm anticipated conditions and to provide alternate recommendations if conditions dictate.

6.2 SEISMIC DESIGN PARAMETERS

For design of the project in accordance with Chapter 16 of the 2016 CBC, the following table presents the seismic design factors:

TABLE 6.1
2016 CBC Seismic Design Parameters

Parameter	Value
Site Class	D
Mapped MCE Spectral Response Acceleration, short periods, S_S	1.638
Mapped MCE Spectral Response Acceleration, at 1-sec. period, S_1	0.611
Site Coefficient, Fa	1.0
Site Coefficient, Fv	1.5
Adjusted MCE Spectral Response Acceleration, short periods, S_{MS}	1.638
Adjusted MCE Spectral Response Acceleration, at 1-sec. period, S_{M1}	0.916
Design Spectral Response Acceleration, short periods, S_{DS}	1.092
Design Spectral Response Acceleration, at 1-sec. period, S_{D1}	0.611
Long Period Design Period (sec)	8
Seismic Design Category for Risk Categories I thru IV	D

MCE = Maximum Considered Earthquake

6.3 CONVENTIONAL FOUNDATION DESIGN RECOMMENDATIONS

6.3.1 General

The following recommendations are presented for preliminary design and estimating purposes. These recommendations have been based on typical site materials encountered during our subsurface investigation as well as mitigation of liquefaction hazards as discussed in Section 5.2.4. Final recommendations should be provided by the project geotechnical consultant following observation and testing of site materials during grading. Depending upon actual site conditions and foundation loads, the recommendations contained herein may require modification.

6.3.2 Soil Expansion

The recommendations presented herein are based on soils with a Moderate expansion potential (EI<65, PI<22). Following site grading, additional testing of site soils should be performed by the project geotechnical consultant to confirm the basis of these recommendations. If site soils with higher expansion potentials are encountered or imported to the site, the recommendations contained herein may require modification.

6.3.3 Settlement

Foundations should be designed for total and differential static settlement up to 1 inch and ½-inch over 30 feet, respectively. Mitigation of potential total and differential settlements due to liquefaction are incorporated in the recommendations provided in other parts of Section 6.3.

6.3.4 Allowable Bearing Value

Provided site grading is performed as recommended herein, a bearing value of 2,000 pounds per square foot (psf) may be used for continuous and isolated footings founded at a minimum depth of 12 inches below the lowest adjacent grade and having a minimum width of 12 inches. The bearing value may be increased by 300 psf and 700 psf for each additional foot in width and depth,

respectively, up to a maximum value of 3,000 psf. Recommended allowable bearing values include both dead and live loads, and may be increased by one-third for wind and seismic forces.

6.3.5 Lateral Resistance

Provided site grading is performed as recommended herein, passive earth pressure from an equivalent fluid unit weight of 250 pounds per square foot per foot of depth up to a maximum value of 1,000 pounds per square foot may be used to determine lateral bearing for footings. This value may be increased by one-third when designing for wind and seismic forces. A coefficient of friction of 0.38 times the dead load forces may also be used between concrete and the supporting soils to determine lateral sliding resistance. No increase in the coefficient of friction should be used when designing for wind and seismic forces.

The above values are based on footings placed directly against compacted fill. In the case where footing sides are formed, all backfill against the footings should be compacted to at least 90 percent of the laboratory standard (ASTM D 1557).

6.3.6 Footings and Slabs-on-grade

Exterior continuous building footings should be founded at a minimum depth of 18 inches. Interior bearing wall footings should be founded at a minimum depth of 12 inches below the lowest adjacent slab subgrade. Continuous footings should be reinforced with a minimum of four No. 4 bars, two (2) near the top and two (2) near the bottom. The structural engineer may require different reinforcement and should dictate if greater than the recommendations presented herein.

Exterior isolated pad footings should be a minimum of 18 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. Interior isolated pad footings should be a minimum of 18 inches square and founded at a minimum depth of 12 inches below the lowest adjacent slab subgrade.

Interior concrete slabs constructed on grade should have a minimum thickness of 4 inches and should be reinforced with No. 3 bars spaced 12 inches each way or 6-inch by 6-inch W4 by W4 welded wire mesh. Care should be taken to ensure the placement of reinforcement at mid-slab height. The structural engineer may recommend a greater slab thickness and reinforcement based on proposed use and loading conditions and such recommendations should govern if greater than the recommendations presented herein.

Slabs should be tied to exterior continuous footings and all spread footings. Ties to the footings may be done with No. 3 dowels spaced at 12 inches provided they have a minimum splice length of 12 inches.

Interior slabs should be provided with stiffening beams in both directions at a center to center spacing no greater than 15 feet. The grade beams should be at least 12 inches in width and 12 inches in depth as measured from the top of the slab. The beams should be poured monolithically with the slab and be reinforced with at least two (2) No. 4 bars near bottom.

Portions of slabs that may be subjected to heavy loading such as rack systems or fork lifts should be designed based on a modulus of subgrade reaction (Kv_1) equal to 125 pci. The modulus is based on

an effective loading area of 1 foot by 1 foot. The modulus may be adjusted for other effective loading areas using the equation provided below.

$k_b(pci) = 125 \left\{ \frac{b+1}{2b} \right\}^2$ where "b" is the effective width of loading (minimum dimension) in feet.

Concrete floor slabs in areas to receive carpet, tile, or other moisture sensitive coverings should be underlain with a minimum of 10-mil moisture vapor retarder conforming to ASTM E 1745, Class A. The membrane should be properly lapped, sealed, and underlain with at least 2 inches of sand having a sand equivalent (SE) no less than 30. One inch of the sand may be placed over the vapor barrier for protection during construction. This vapor retarder system is anticipated to be suitable for most flooring finishes that can accommodate some vapor emissions. However, this system may emit more than 4 pounds of water per 1,000 sq. ft. and therefore, may not be suitable for all flooring finishes. Additional steps should be taken if such vapor emission levels are too high for anticipated flooring finishes.

Special consideration should be given to slabs in areas to receive ceramic tile or other rigid, crack-sensitive floor coverings. Design and construction should mitigate hairline cracking through the use of additional reinforcing and careful control of concrete slump.

Block-outs should be provided around interior columns to permit relative movement and mitigate distress to the floor slabs due to differential settlement that will occur between column footings and adjacent floor subgrade soils as loads are applied.

A 12-inch-wide grade beam, founded at the same depth as adjacent footings, should be provided across garage entrances or other large door openings. The grade beam should be reinforced with a minimum of four No. 4 bars, two top and two bottom.

Prior to placing concrete, subgrade soils below slab-on-grade areas should be thoroughly moistened to at least 120 percent of optimum moisture content to a depth of 12 inches.

Design of the proposed slabs in accordance with "Design of Slab-on-Ground Foundations" by Wire Reinforcement Institute (1981 and updated 1996) may be based on an Effective Plasticity Index of 26 (includes factors for sloping ground and overconsolidation).

6.3.7 Foundation Observations

Foundation excavations should be observed by the project geotechnical consultant to verify that they have been excavated into competent bearing soils and to the minimum embedment recommended above. These observations should be performed prior to placement of forms or reinforcement. The excavations should be trimmed neat, level and square. Loose, sloughed or moisture-softened materials and debris should be removed prior to placing concrete.

6.4 RETAINING AND SCREENING WALLS

6.4.1 General

The following preliminary design and construction recommendations are provided for general retaining and screen walls. Final wall designs specific to the site development should be provided for review once completed. The structural engineer and architect should provide appropriate recommendations for sealing at all joints and applying moisture-proofing material on the back of the walls.

6.4.2 Allowable Bearing Value and Lateral Resistance

Design of retaining and screen walls may utilize the bearing and lateral resistance values provided in Section 6.3.4 and 6.3.5.

6.4.3 Active Earth Pressures

Per 2016 CBC, Article 1803.5.12, retaining walls supporting more than 6 feet of soils should be designed for both of static and seismic earth pressures. Retaining walls supporting less than 6 feet of soils may be designed for static earth pressure only. Static and seismic earth pressures for level and 2:1 (H:V) backfill conditions using onsite or imported materials with an EI <21 are provided in Table 6.2 below. Seismic earth pressures provided herein are based on the method provided by Seed & Whitman (1970) using a PGA of 0.38g. This acceleration corresponds to 10% probability of exceedance in 50 years. The values provided in the following table do not consider hydrostatic pressure. Retaining walls should also be designed to support adjacent surcharge loads imposed by other nearby footings or traffic loads in addition to the earth pressure.

6.4.4 Drainage and Moisture-Proofing

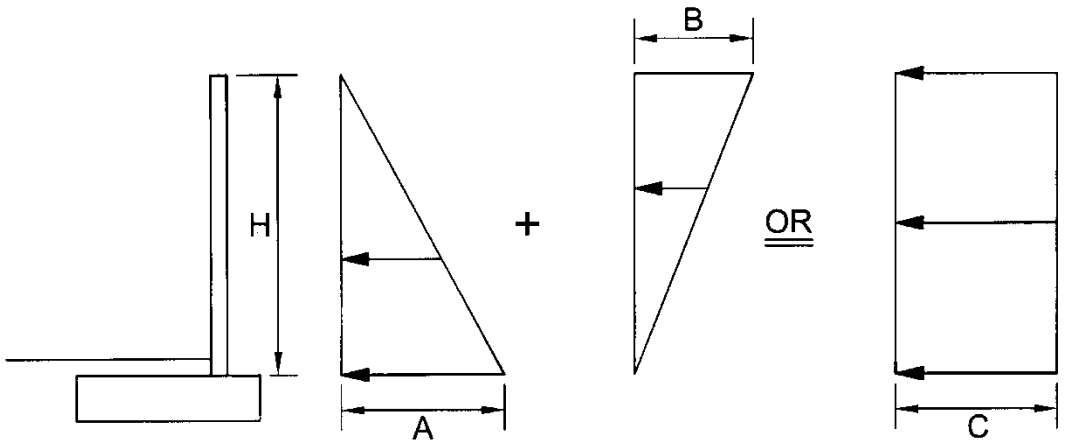
Retaining walls should be constructed with a perforated pipe and gravel subdrain to prevent entrapment of water in the backfill. The perforated pipe should consist of 4-inch-diameter, ABS SDR-35 or PVC Schedule 40 with the perforations laid down. The pipe should be embedded in ¾- to 1½-inch open-graded gravel wrapped in filter fabric. The gravel should be at least one foot wide and extend at least one foot up the wall above the footing and drainage outlet. Drainage gravel and piping should not be placed below outlets and weepholes. Filter fabric should consist of Mirafi 140N, or equal. Outlet pipes should be directed to positive drainage devices.

The use of weepholes may be considered in locations where aesthetic issues from potential nuisance water are not a concern. Weepholes should be 2 inches in diameter and provided at least every 6 feet on center. Where weepholes are used, perforated pipe may be omitted from the gravel subdrain.

Retaining walls supporting backfill should also be coated with a moisture-proofing compound or covered with such material to inhibit infiltration of moisture through the walls. Moisture-proofing material should cover any portion of the back of wall that will be in contact with soil and should lap over and cover the top of footing. A panel drain should be provided between the water proofing and soil. The panel should extend from the top of the gravel backdrain to 12 inches below finish grade. The top of footing should be finished smooth with a trowel to inhibit the infiltration of water through the wall. The project structural engineer should provide specific recommendations for moisture-proofing, water stops, and joint details.

TABLE 6.2
SEISMIC EARTH PRESSURES

Pressure Diagram



Static Component | Seismic Component | Total Force

Pressure Values
Walls Up To 10 Feet High

Value	Backfill Condition	
	Level	**2H:1V Slope**
A	37H	66H
B	12H	12H
C	25H	39H

Note:
H is in feet and resulting pressure is in psf. Design may utilize either the sum of the static component and the seismic component force diagrams or the total force diagram above. SEAOSC has suggested using a load factor of 1.7 for the static component and 1.0 for the seismic component. The actual load factors should be determined by the structural engineer.

6.4.5 Construction Sequencing

To provide mitigation of excessive settlement in areas located above the alluvial soils, we recommend the areas of retaining walls be filled to finish grade using a false fill slope without the retaining walls. We recommend the top of the false fill slope coincide with the wall location where possible. The areas should be allowed to settle during the monitoring period for the buildings. Thereafter, the false fill slopes can be trimmed back to allow for construction and final backfilling of the retaining walls. This approach need not be used in areas where walls are not located above the alluvial soils (Qal) as indicated on the Geotechnical Map, Plate 1.

6.4.6 Footing Reinforcement and Wall Jointing

All continuous footings should be reinforced with a minimum of two No. 4 bars, one top and one bottom. Walls should be provided with cold joints spaced no more than 40 feet apart. Walls to be constructed over the alluvial areas (Qal) indicated on the Geotechnical Map, Plate 1, should be provide with cold joints spaced no more than 10 feet. The structural engineer may require different reinforcement or jointing and should dictate if greater than the recommendations provided herein. Where recommended removals are limited due to space restrictions, greater reinforcement and closer jointing may be recommended. Specific recommendations should be provided by the geotechnical consultant during grading based on as-built conditions exposed in the field.

6.4.7 Footing Observations

Footing excavations should be observed by the project geotechnical consultant to verify that they have been excavated into competent bearing soils and to the minimum embedment recommended herein. These observations should be performed prior to placement of forms or reinforcement. The excavations should be trimmed neat, level, and square. Loose, sloughed or moisture-softened materials and debris should be removed prior to placing concrete.

6.4.8 Retaining Wall Backfill

Onsite soils may generally be used for backfill of retaining walls provided they are free of deleterious materials and particles greater than 4 inches in maximum dimension and have an EI less than 21. The project geotechnical consultant should approve all backfill used for retaining walls. Wall backfill should be moisture-conditioned to slightly over the optimum moisture content; placed in lifts no greater than 12 inches in thickness, and then mechanically compacted with appropriate equipment to at least 90 percent of the laboratory standard. Hand-operated compaction equipment should be used to compact the backfill placed immediately adjacent the wall to avoid damage to the wall. Flooding or jetting of backfill material is not recommended.

6.5 EXTERIOR FLATWORK

Exterior flatwork should have a minimum thickness of 4 inches. Cold joints or saw cuts should be provided at least every 7 feet in each direction. Saw cuts and tooled joints should extend at least 1 inch into the slab. Flatwork more than 7 feet in width across the minimum dimension should be reinforced with 4” by 4”, W4 by W4 welded wire mesh or No 3 bars spaced 12 inches center to center in both directions. Cold joints should be keyed or provided with dowels spaced 24 inches on center. Special jointing detail should be provided in areas of block-outs, notches, or other irregularities to avoid cracking at points of high stress.

Subgrade soils below flatwork should be thoroughly moistened to a moisture content of at least 120 percent of the optimum moisture content to a depth of 12 inches. Moistening should be accomplished by lightly spraying the area just prior to placing concrete.

Drainage from flatwork areas should be directed to local area drains and/or other appropriate collection devices designed to carry runoff water to the street or other approved drainage structures. The concrete flatwork should also be sloped at a minimum gradient of 1 percent away from building foundations and retaining walls.

6.6 CONCRETE DESIGN

The sulfate content of the onsite soils is expected to vary. Testing for soluble sulfate content will be required subsequent to rough grading and prior to construction of foundations and other concrete work to confirm these conditions. We recommend following the procedures provided in ACI 318, Section 4.3, to determine the sulfate exposure.

6.7 CORROSION POTENTIAL

Laboratory testing of the corrosion potential of the onsite soil should be completed due to the expected variability within the site. Corrosion testing should follow be in accordance with California Test Method 643. Structures fabricated from metals should have appropriate corrosion protection if they will be in direct contact with corrosive soils. Under such conditions, a corrosion specialist should provide specific recommendations.

6.8 PRELIMINARY PAVEMENT DESIGN

6.8.1 Preliminary Pavement Structural Sections

Based on the soil conditions present at the site and estimated traffic volume, preliminary pavement sections are provided in the following table. A assumed "R-value" of 30 was used for the near-surface soil in this preliminary pavement design. The sections provided below are for planning purposes only and should be re-evaluated subsequent to site grading. Final pavement sections should be based on actual R-value testing of in-place soils and analysis of anticipated traffic.

TABLE 6.3
Preliminary Pavement Design

Location	Traffic Index	R-Value	AC (inches)	Portland Cement Concrete (inches)	Concrete Pavers (mm)	AB (inches)
Drive Aisle	6.0	30	3.0 4.0	---	--	9.0 7.0
			--	--	80	10
			---	6.5	---	---
Parking Stalls	n/a	30	3.0	---	---	4.0

6.8.2 Subgrade Preparation

Prior to placement of paving elements, subgrade soils should be moisture-conditioned to at least 100 percent of the optimum moisture content then compacted to at least 90 percent compaction within asphaltic paving and 95% within Portland Cement Concrete paving. Areas observed to pump or yield under vehicle traffic should be removed and replaced with firm and unyielding compacted soil or aggregate base materials.

6.8.3 Aggregate Base

Aggregate base should be moisture conditioned to slightly over the optimum moisture content, placed in lifts no greater than 6 inches in thickness, then compacted to at least 95 percent of the laboratory standard (ASTM D 1557). Aggregate base materials should be Class 2 Aggregate Base conforming to Section 26-1 of the 2010 Edition of the Caltrans Standard Specifications, Crushed Aggregate Base conforming to Section 200-2.2 of the 2015 Edition of the Standard Specifications for Public Works Construction (Greenbook) or Crushed Miscellaneous Base conforming to Section 200-2.4 of the Greenbook.

6.8.4 Asphaltic Concrete

Paving asphalt should be PG 64-10 conforming to the requirements of Section 203-1 of the Greenbook. Asphalt concrete materials should conform to Section 203-6 and construction should conform to Section 302 of the Greenbook.

6.8.5 Concrete Pavement

Portland cement concrete used to construct concrete paving should conform to Section 201 of the Greenbook and should have a minimum compressive strength of 3,250 pounds per square inch (psi) at 28 days. Reinforcement and jointing of concrete pavement sections should be designed according to the minimum recommendations provided by the Portland Cement Association (PCA). For rigid pavement, transverse and longitudinal contraction joints should be provided at spacing no greater than 15 feet. Score joints may be constructed by saw cutting to a depth of ¼ of the slab thickness. Expansion/cold joints may be used in lieu of score joints. Such joints should be properly sealed and provided with a key or dowels. Where traffic will traverse over edges of concrete paving (not including joints), the edges should be thickened by 20% of the design thickness toward the edge over a horizontal distance of 5 feet.

6.9 POST GRADING CONSIDERATIONS

6.9.1 Site Drainage and Irrigation

The ground immediately adjacent to foundations should be provided with positive drainage away from the structures in accordance with 2016 CBC, Section 1804.4. However, the minimum gradient may be reduced to 2% for soil and climatic reasons. No rain or excess water should be allowed to pond against structures such as walls, foundations, flatwork, etc.

Excessive irrigation water can be detrimental to the performance of the proposed site development. Water applied in excess of the needs of vegetation will tend to percolate into the ground. Such percolation can lead to nuisance seepage and shallow perched groundwater. Seepage can form on slope faces, on the faces of retaining walls, in streets, or other low-lying areas. These conditions could lead to adverse effects such as the formation of stagnant water that breeds insects, distress or damage of trees, surface erosion, slope instability, discoloration and salt buildup on wall faces, and premature failure of pavement. Excessive watering can also lead to elevated vapor emissions within buildings that can damage flooring finishes or lead to mold growth inside the home.

Key factors that can help mitigate the potential for adverse effects of overwatering include the judicious use of water for irrigation, use of irrigation systems that are appropriate for the type of

vegetation and geometric configuration of the planted area, the use of soil amendments to enhance moisture retention, use of low-water demand vegetation, regular use of appropriate fertilizers, and seasonal adjustments of irrigation systems to match the water requirements of vegetation. Specific recommendations should be provided by a landscape architect or other knowledgeable professional.

6.9.2 Utility Trenches

Trench excavations should be constructed in accordance with the recommendations contained in Section 6.1.13 of this report. Trench excavations must also conform to the requirements of Cal/OSHA.

Trench backfill materials and compaction criteria should conform to the requirements of the local municipalities. As a minimum, utility trench backfill should be compacted to at least 90 percent of the laboratory standard. Trench backfill should be brought to moisture content slightly over optimum, placed in lifts no greater than 12 inches in thickness, and then mechanically compacted with appropriate equipment to at least 90 percent of the laboratory standard. The project geotechnical consultant should perform density testing, along with probing, to test compaction. Site conditions are generally not suitable for jetting of trench backfill and jetting should not be completed without prior approval from the project geotechnical consultant.

Within shallow trenches (less than 18 inches deep) where pipes may be damaged by heavy compaction equipment, imported clean sand having a SE of 30 or greater may be utilized. The sand should be placed in the trench, thoroughly watered, and then compacted with a vibratory compactor. For utility trenches located below a 1:1 (H:V) plane projecting downward from the outside edge of the adjacent footing base or crossing footing trenches, concrete or slurry should be used as trench backfill.

6.10 PLAN REVIEW AND CONSTRUCTION SERVICES

We recommend ***Albus-Keefe & Associates, Inc.*** be engaged to review any future development plans, including rough and precise grading plans, foundation plans, and architectural plans prior to construction. This is to verify that the assumptions of this report are valid and that the preliminary conclusions and recommendations contained in this report have been properly interpreted and are incorporated into the project plans and specifications. If we are not provided the opportunity to review these documents, we take no responsibility for misinterpretation of our preliminary conclusions and recommendations.

We recommend that a geotechnical consultant be retained to provide soil engineering services during construction of the project. These services are to observe compliance with the design, specifications or recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

If the project plans change significantly from the assumed development described herein, the project geotechnical consultant should review our preliminary design recommendations and their applicability to the revised construction. If conditions are encountered during construction that appear to be different than those indicated in this report or subsequent design reports, the project

geotechnical consultant should be notified immediately. Design and construction revisions may be required.

7.0 LIMITATIONS

This report is based on the proposed development and geotechnical data as described herein. The materials encountered on the project site, described in other literature, and utilized in our laboratory testing for this investigation are believed representative of the total project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observation and testing by a geotechnical consultant during the grading and construction phases of the project are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered as a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

This report has been prepared for the exclusive use of **Signal Hill Petroleum Inc.** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

Respectfully submitted,

ALBUS-KEEFE & ASSOCIATES, INC

Michael O. Spira
Principal Engineering Geologist
C.E.G. 1976

REGISTERED GEOLOGIST
MICHAEL O. SPIRA
No. 1976
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Reza Mortezaie, PhD
Associate Engineer
RCE 82579

PROFESSIONAL ENGINEER
AHMADREZA MORTEZAIE
C 82579
CIVIL
STATE OF CALIFORNIA

Reviewed by:

David E. Albus
Principal Engineer
G.E. 2455

REGISTERED PROFESSIONAL ENGINEER
DAVID E. ALBUS
No. 2455
Exp. 12/31/18
GEOTECHNICAL
STATE OF CALIFORNIA

8.0 REFERENCES

Reports

Environmental Science & Engineering, Inc., (1993), *Preliminary Geotechnical Investigation for the South Block of the Proposed Long Beach/405 Retail Center Redevelopment Project, Long Beach, California,* dated July 13, 1993 (Project # 6-92-4862).

Environmental Science & Engineering, Inc., (2000), *Site Assessment and Groundwater Monitoring Report, Sports Park Project, City of Long Beach, California*, dated February 21, 2000 (Project # 6499084).

AMEC Earth and Environmental, Inc., (2003), *"Draft" Geotechnical Evaluation in Support of Conceptual Design and Environmental Impact (EIR), Long Beach Sports Park, South and West of Spring Street and Orange Avenue, Long Beach, California*, dated August 4, 2003 (Job No. 2-212-101700).

Publications

Barrows, A.G., 1974, A Review of the Geology and Earthquake History of the Newport-Inglewood Structural Zone, Southern California, California Division of Mines and Geology Special Report 114.

Bryant, W.A., 1988, Recently Active Traces of the Newport-Inglewood Fault Zone, Los Angeles and Orange Counties, California, California Division of Mines and Geology, Open File Report 88-14, Sheet 1.California Geologic Survey, Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California, 2008.

California Department of Conservation, Division of Mines and Geology , Seismic Hazard Zone Report 028 for the Long Beach 7.5- Minute Quadrangle, Los Angeles County, California, 1998

C.D.M.G., Open-File Report 92-03, 1992, Preliminary Fault Activity Map of California.

C.D.M.G., 1986, State of California, Special Studies Zones, Long Beach Quadrangle, effective July 1, 1986

C.D.M.G., 1999, State of California, Seismic Hazard Zones, Long Beach Quadrangle, effective March 25, 1999.

Freeman, Thomas S., Heath, Edward, G., Guptill, Paul, D., Waggoner, John, T., 1992, Seismic Hazard Assessment, Newport-Inglewood Fault Zone *in* Engineering Geology Practice in Southern California, Association of Engineering Geologists, Southern California Section, Special Publication No. 4, pp. 211 – 231.

Saucedo, J. G., Greene, H.G., Kennedy, M.P., Bezore, S.P., 2016, Geologic Map of the Long Beach 30' x 60' Quadrangle, California, Version 2, California Geological Survey.

REFERENCES (cont.)

NCEER, "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", Technical Report NCEER-97-0022, December 31, 1997.

Southern California Earthquake Center (SCEC), University of Southern California, "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California", March 1999.

Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., and Stokoe, K.H., "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, October, 2001.

Wire Reinforcement Institute (WRI 1996), Design of Slab-On-Ground Foundations, dated March 1996, TF 700-R-03 Update

Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180

Plans and Maps

Preliminary Grading and Drainage Plan, Spring Street Business Park, Long Beach, California, prepared by MSL Engineering Inc., Scale: 1" = 30', dated July 20, 2017.

Topographic Map, City of Signal Hill and Vicinity, Signal Hill, California, prepared by Pacific Air Industries, Scale: 1" = 100', dated June 29, 1960.

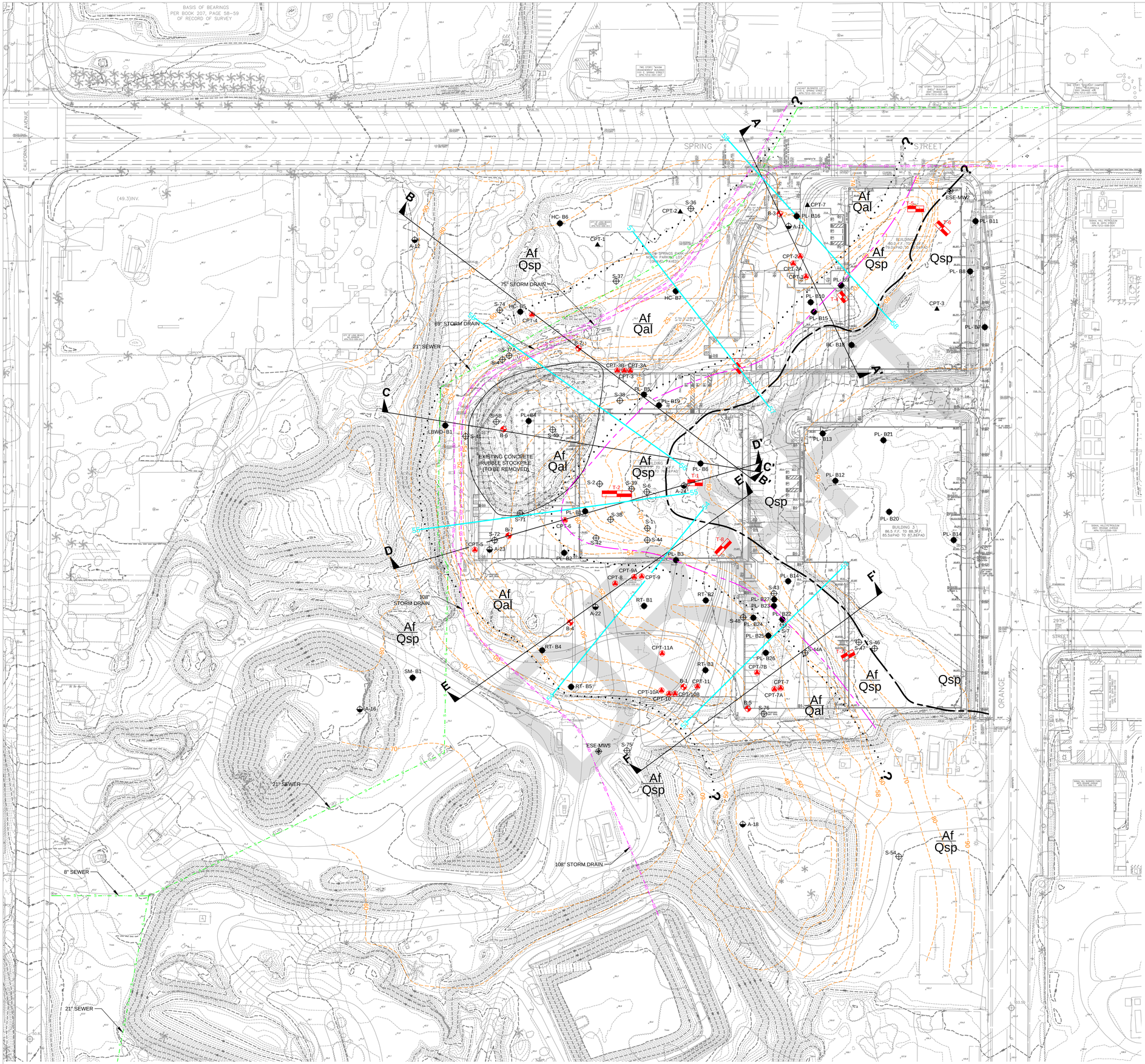
Aerial Photographs

Source	Date Flown	Flight No.	Photo No.	Scale
Continental	11-19-53	14K	95&96	1"=1666'
Continental	4-3-60	311-5	5 & 6	1"=1000'
Continental	1-31-70	61-7	177 &178	1"=4000'
Continental	5-12-79	FC-LA	127 & 128	1"=2800'
Continental	1-27-86	F	352 & 353	1"=2800'
Continental	7-7-88	AF	19206	1"=2200'
Continental	1-29-92	C85-7	29 & 30	1"=2000'
Continental	6-9-93	C93-13	165 & 166	1"=2000'
Continental	1-29-95	C103-35	126 & 127	1"=2000'
Continental	10-15-97	C117-35	240 & 241	1"=2000'

REFERENCES (cont.)

Provided by Environmental Data Resources Inc. Search:

Source	Date Flown	Scale
Fairchild	1928	1"=500'
Fairchild	1947	1"=666'
Fairchild	1956	1"=400'
Teledyne	1968	1"=480'
Teledyne	1976	1"=666'
USGS	1989	1"=666'
USGS	1994	1"=666'



ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

GEOTECHNICAL MAP

Job No.: 2501.00 | Date: 12/13/17 | Plate: 1

EXPLANATION
(LOCATIONS APPROXIMATE)

SURFICIAL UNITS:

- **Af** - Artificial Fill
- **Qal** - Alluvium

BEDROCK UNIT:

- **Qsp** - San Pedro Formation

LINES:

- Geologic Contact
- Geologic Contact, Buried (queried where uncertain)
- 60 - Historic Contour Elevation (Pacific Air Industries, 1960)
- F F' - Geologic Cross-Section
- 55 55 - Approximate Groundwater Contour Elevation
- Eastern Limit of Liquefaction Potential

SYMBOLS:

- Exploratory Boring (Albus-Keefe)
- Cone Penetrometer Test (Albus-Keefe)
- Exploratory Trench (Albus-Keefe)
- Exploratory Hollow Stem Boring (Dames & Moore, 1988)
- Exploratory Hollow Stem Boring (ESC, 1993)
- Cone Penetrometer Test (ESC, 1993)
- Exploratory Hollow Stem Boring (AMEC, 2003)
- Monitoring Well (ESE, 2000)
- Existing Concrete Rubble Stockpile

PARTIAL LEGEND

- 12'X6' PRECAST FILTERRA UNIT FOR THE TREATMENT OF STORM WATER RUNOFF
- 24"X36" CONCRETE DRAIN BOX WITH FLOWGUARD PLUS FOSSIL FILTER INSERT FOR THE ADDITIONAL OVERFLOW TREATMENT OF STORM WATER RUNOFF
- HEAVY DUTY TRENCH DRAIN WITH A FLOWGUARD PLUS FOSSIL FILTER INSERT FOR THE TREATMENT OF STORM WATER RUNOFF
- 85 PROPOSED CONTOUR ELEVATION
- 85 EXISTING CONTOUR ELEVATION
- 7 EXPOSED HEIGHT OF RETAINING WALL IN FEET

N TRUE NORTH
N PROJECT NORTH
0 25 50 100 150
GRAPHIC SCALE
SCALE: 1"=50'

HPA architecture
hpa, inc.
18831 bardeen avenue - ste.
#100 irvine, ca
92612
tel: 949•863•1770
fax: 949•863•0851
email: hpa@hparchs.com

CONSULTANT
M S L ENGINEERING, INC
CIVIL ENGINEERS AND LAND SURVEYORS
SPECIALIZING IN SITE DEVELOPMENT
402 W. ARROW HWY, STE. 4
SAN DIMAS, CA. 91773
(909) 305-2395 FAX (909) 305-2397
Mark S. Lamoureux 08-10-17
MARK S. LAMOUREUX (R.C.E. 38382) DATE
REGISTERED PROFESSIONAL ENGINEER
MARK S. LAMOUREUX
No. 38382
CIVIL
STATE OF CALIFORNIA

Owner:
SIGNAL HILL PETROLEUM
2633 Cherry Ave.
Signal Hill, CA 90755
562-326-5233

Project:
SPRING STREET
BUSINESS PARK
Long Beach, CA

Consultants:

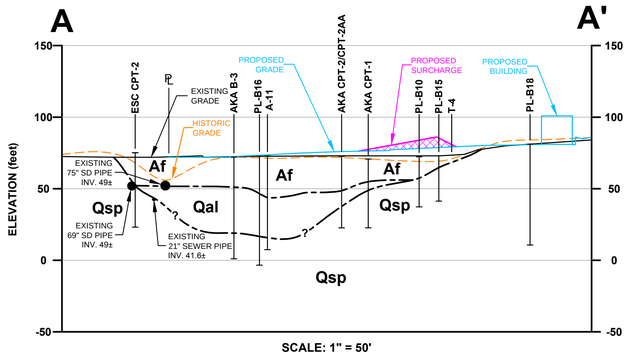
Civil:	MSL ENGINEERING, INC.
Structural:	-
Mechanical:	-
Plumbing:	-
Electrical:	-
Landscape:	KAI CRAIG
Fire Protection:	-
Soils Engineer:	-

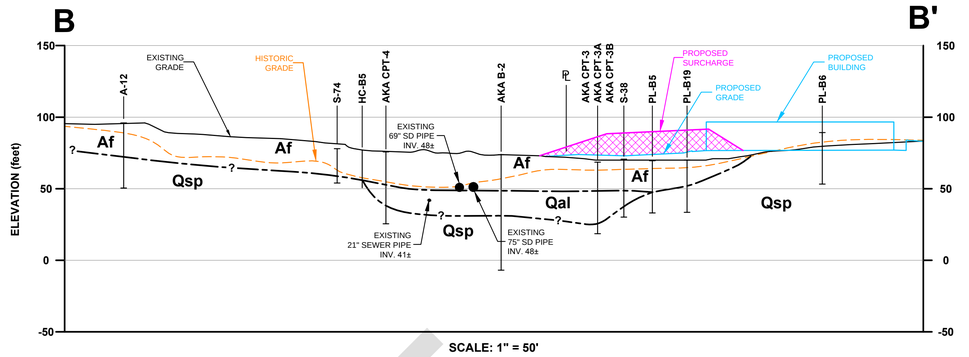
Title:
PRELIMINARY GRADING AND DRAINAGE PLAN

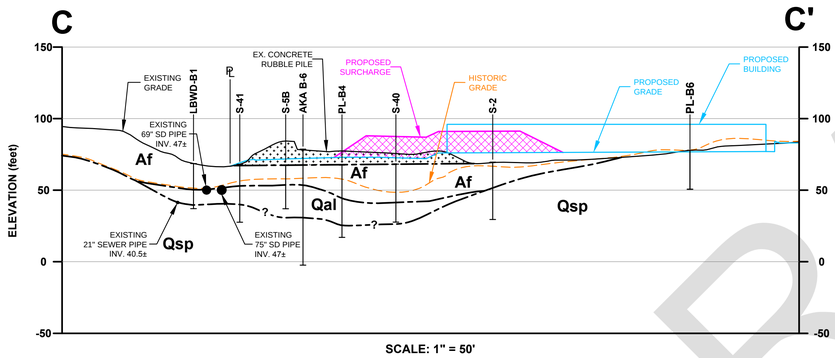
Project Number:	16368
Drawn by:	G.R.H.
Date:	08/10/17
Revision:	

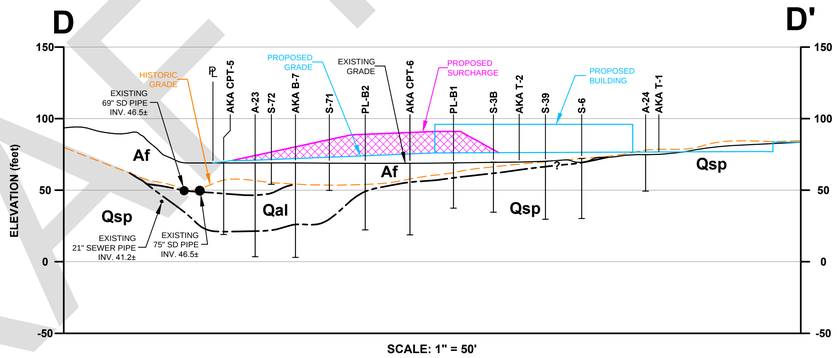
Sheet:
C30

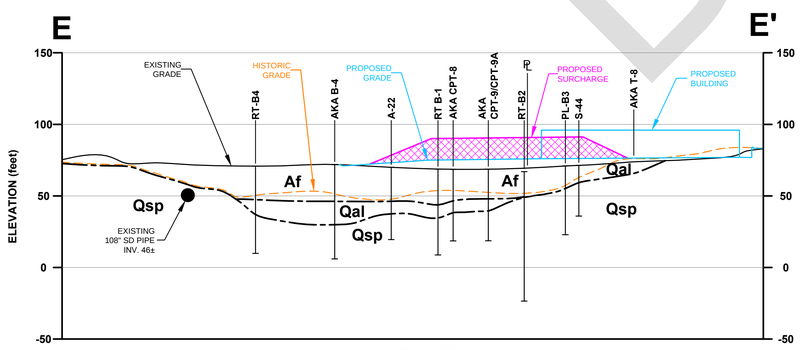
JN 16020-16020 C30pgdp

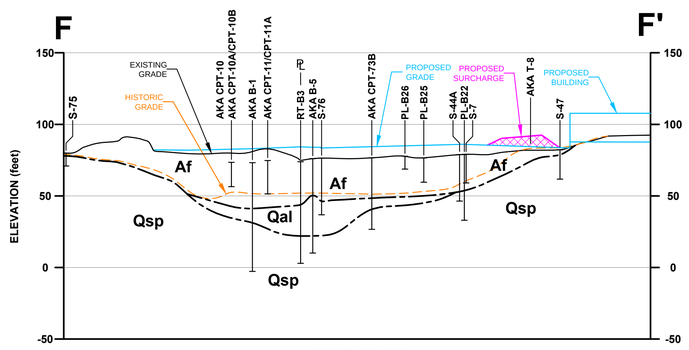








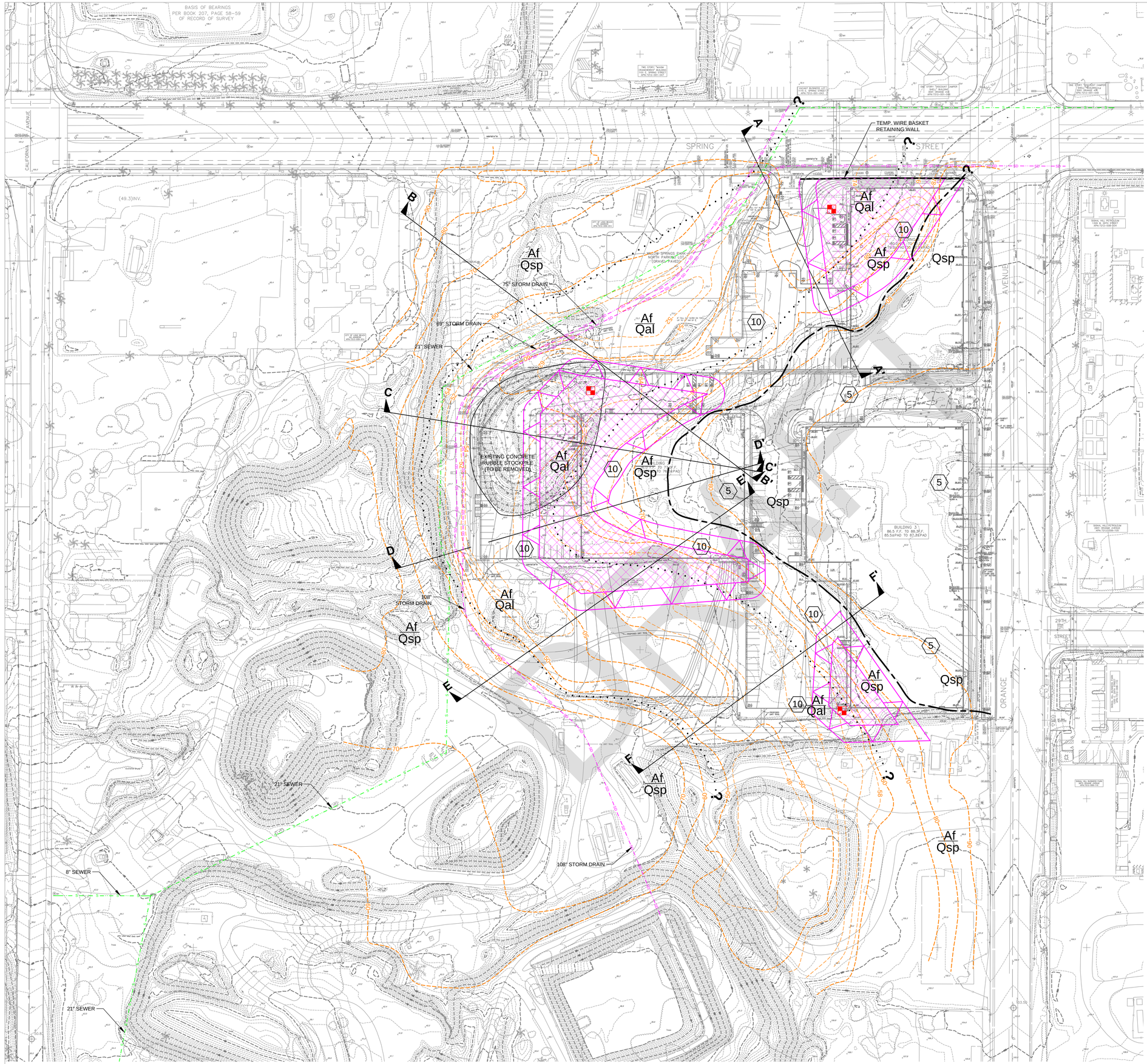




ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

GEOLOGIC CROSS-SECTIONS A - F

Job No.: 2501.00 | Date: 12/13/17 | Plate: 2



ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

REMEDIAL EARTHWORK MAP

Job No.: 2501.00	Date: 12/13/17	Plate: 3

EXPLANATION
(LOCATIONS APPROXIMATE)

SURFICIAL UNITS:

Af - Artificial Fill
Qal - Alluvium

BEDROCK UNIT:

Qsp - San Pedro Formation

LINES:

- Geologic Contact
- Geologic Contact, Buried (queried where uncertain)
- 60 - Historic Contour Elevation (Pacific Air Industries, 1960)
- F F' - Geologic Cross-Section
- Proposed Temp. Wire Basket Retaining Wall for Surcharge Fill

SYMBOLS:

- Preliminary Settlement Monitoring Instrumentation Location
- 10 - Estimated Depth of Unsuitable Materials Below Existing Grade (in feet)
- Existing Concrete Rubble Stockpile
- Area of 15-foot Surcharge Fill Above Proposed Grades

PARTIAL LEGEND

- 12'X6' PRECAST FILTERRA UNIT FOR THE TREATMENT OF STORM WATER RUNOFF
- 24"X36" CONCRETE DRAIN BOX WITH FLOWGUARD PLUS FOSSIL FILTER INSERT FOR THE ADDITIONAL OVERFLOW TREATMENT OF STORM WATER RUNOFF
- HEAVY DUTY TRENCH DRAIN WITH A FLOWGUARD PLUS FOSSIL FILTER INSERT FOR THE TREATMENT OF STORM WATER RUNOFF
- 85 PROPOSED CONTOUR ELEVATION
- 85 EXISTING CONTOUR ELEVATION
- 7 EXPOSED HEIGHT OF RETAINING WALL IN FEET

N (TRUE NORTH) N (PROJECT NORTH)

0 25 50 100 150
GRAPHIC SCALE
SCALE: 1"=50'

HPA architecture
hpa, inc.
18831 bardeen avenue - ste.
#100 irvine, ca
92612
tel: 949•863•1770
fax: 949•863•0851
email: hpa@hparchs.com

CONSULTANT
M S L ENGINEERING, INC
CIVIL ENGINEERS AND LAND SURVEYORS
SPECIALIZING IN SITE DEVELOPMENT
402 W. ARROW HWY, STE. 4
SAN DIMAS, CA. 91773
(909) 305-2395 FAX (909) 305-2397
Mark S. Lamoureux 08-10-17
MARK S. LAMOUREUX (R.C.E. 38382) DATE

REGISTERED PROFESSIONAL ENGINEER
MARK S. LAMOUREUX
No. 38382
CIVIL
STATE OF CALIFORNIA

Owner:
SIGNAL HILL PETROLEUM
2633 Cherry Ave.
Signal Hill, CA 90755
562-326-5233

Project:
SPRING STREET
BUSINESS PARK
Long Beach, CA

Consultants:

Civil:	MSL ENGINEERING, INC.
Structural:	-
Mechanical:	-
Plumbing:	-
Electrical:	-
Landscape:	KAI CRAIG
Fire Protection:	-
Soils Engineer:	-

Title:
PRELIMINARY
GRADING AND
DRAINAGE PLAN

Project Number:	16368
Drawn by:	G.R.H.
Date:	08/10/17
Revision:	

Sheet:
C30

JN 16020-16020 C30pgdp

APPENDIX A

EXPLORATORY LOGS

LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

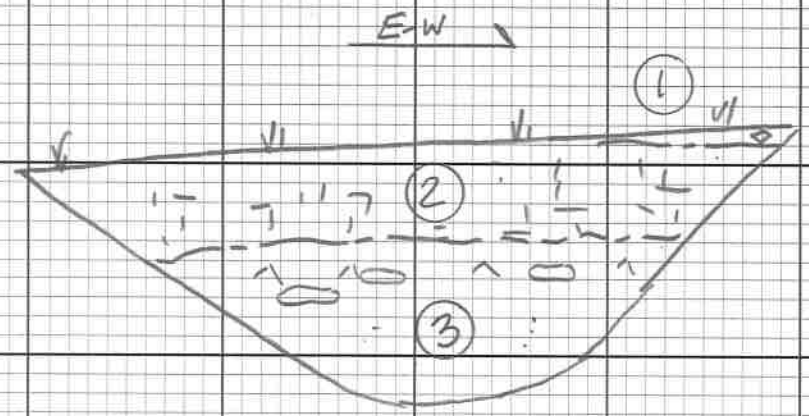
TRENCH NO. 1

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), yellow-brown, dry, loose, fine grained, some red brick debris.	
2	**BEDROCK - San Pedro Formation (Qsp):** "Argillic Horizon" - Silty Sandstone, slightly clayey, red-gray, dry, moderately hard, fine grained, blocky ped development w/ clay films, carbonate and roots along ped surfaces.	
3	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, yellow-brown, dry, moderately hard, fine grained, massive, some orange oxidation staining. Some roots and krotovinas down to 4 feet.	

Scale: 1" = 5'

View to / Trend: N



LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

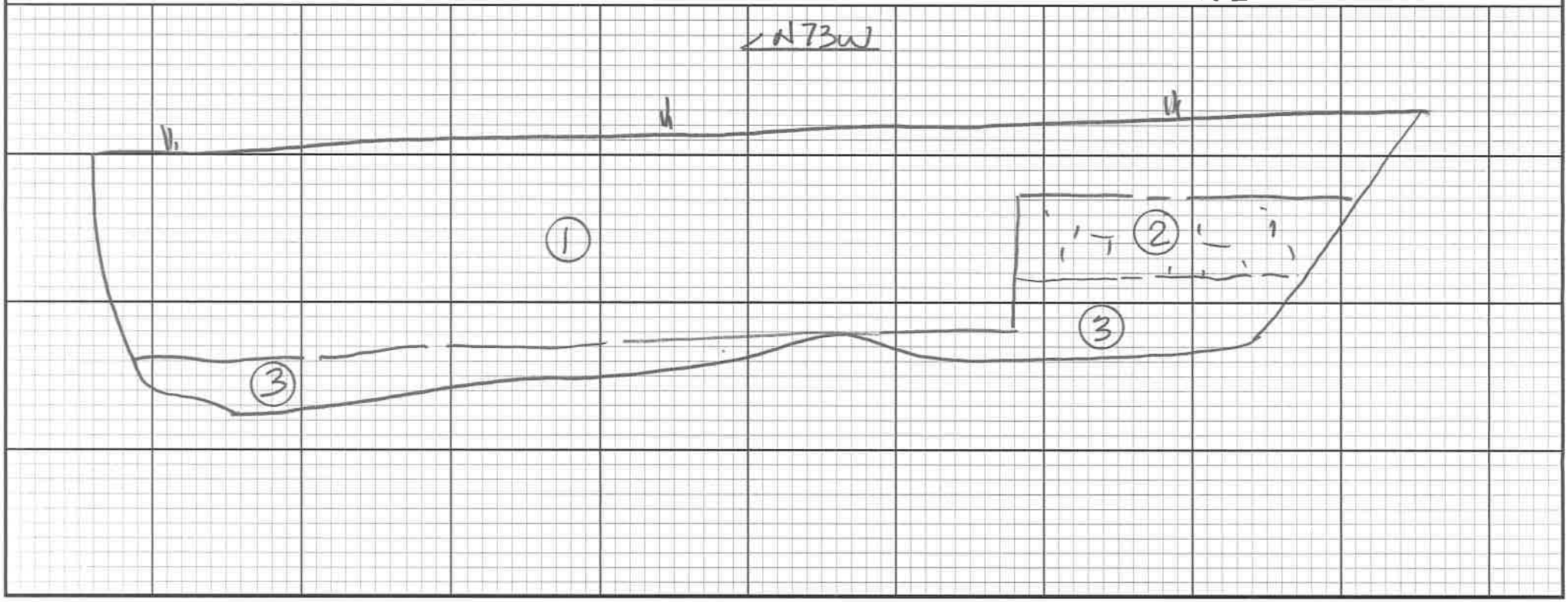
TRENCH NO. 2

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), gray and brown, dry, loose, fine grained with fine to coarse grained layers and lenses, trace gravel and some minor red brick, concrete, wood and plastic debris (up to 12" in size), some local staining and petro odor, and some roots. Becomes medium dense at 3 feet.	
2	**BEDROCK - San Pedro Formation (Qsp):** "Argillic Horizon" - Silty Sandstone, slightly clayey, red-brown, damp to moist, moderately hard, fine grained, blocky ped development w/ clay films, carbonate and roots along ped surfaces.	
3	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, olive-gray, dry, moderately hard, fine grained, massive, some local carbonate and krotovinas, strong petro odor.	

Scale: 1" = 5'

View to / Trend: N E.



LOG OF EXPLORATORY TRENCH

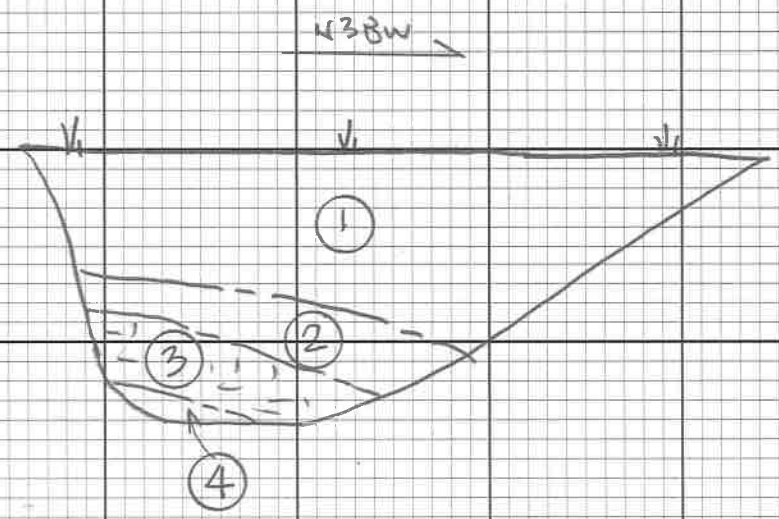
Project Name: Signal Hill Petroleum
Logged By: MOS

TRENCH NO. 3

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), gray and brown, dry, loose, fine grained, some minor red brick, concrete, and asphalt pavement debris (up to 6" in size), and some roots. Becomes medium dense at 2 feet.	
2	**RESIDUAL SOIL (No Map Symbol):** Silty Sand (SM), brown, damp, loose to medium dense, fine grained, some pinhole pores and fine roots.	
3	**BEDROCK - San Pedro Formation (Qsp):** "Argillic Horizon" - Silty Sandstone, slightly clayey, red-brown, damp, moderately hard, fine grained, blocky ped development w/ clay films and roots along ped surfaces, locally porous.	
4	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, light brown to olive-gray, damp, moderately hard, fine grained, massive, micaceous, some orange oxidation staining, strong petro odor.	

Scale: 1" = 5' **View to / Trend: S.W.**



LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

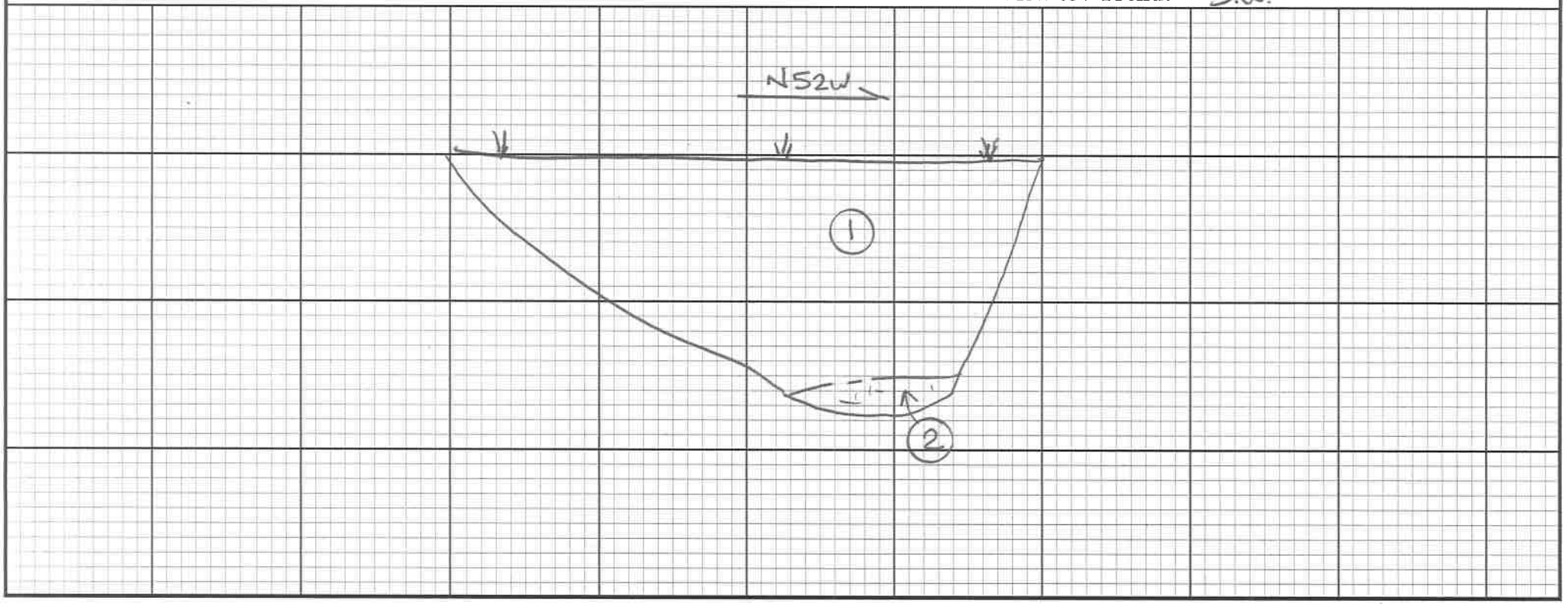
TRENCH NO. 4

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), locally clayey, gray and brown, damp, loose, fine grained, trace gravel, some minor red brick, concrete, and asphalt pavement debris (up to 6" in size), and some roots. Becomes medium dense at 1 feet. Increase in moisture at 4 feet.	
2	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, olive-gray, damp, moderately hard, fine grained, massive, slightly desiccated and some pores.	

Scale: 1" = 5'

View to / Trend: S.W.



ALBUS-KEEFE ASSOCIATES, INC.

Plate A-4

LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

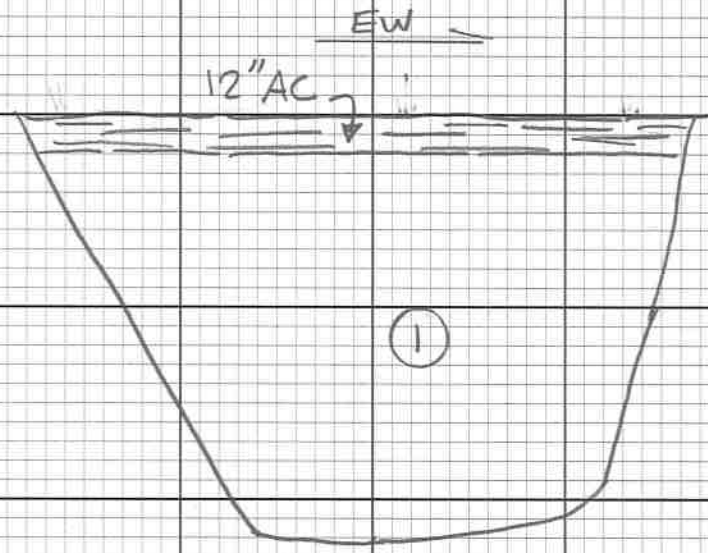
TRENCH NO. 5

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Clayey Sand (SC) and Sandy Clay (CL), olive-gray, brown and black, damp, medium dense and/or firm, fine grained, some minor red brick, and concrete (up to 6" in size), and strong petro odor. Increase in moisture at 4 feet.	

Scale: 1" = 5'

View to / Trend: N.



LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

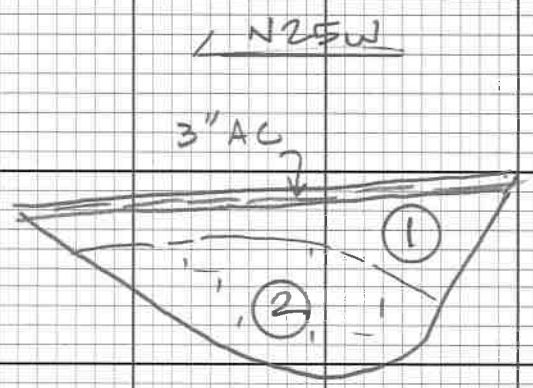
TRENCH NO. 6

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), dark olive-gray and brown, damp, medium dense, fine grained, trace gravel, some chunks of concrete (up to 6" in size).	
2	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, dark olive-gray with black staining, damp to moist, moderately hard, fine grained, massive, slightly micaceous, slightly desiccated and some pores.	

Scale: 1" = 5'

View to / Trend: N.E.



LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

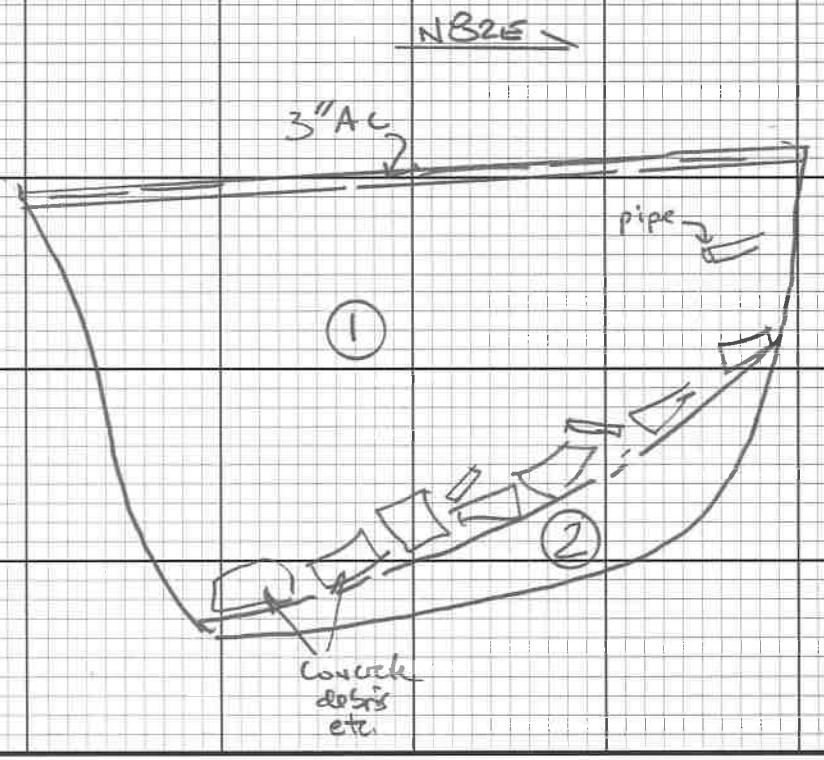
TRENCH NO. 7

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), Sandy Silt (ML) and Clayey Sand (SC), gray and brown, damp, medium dense and/or firm, fine grained, trace gravel and some minor red brick, concrete, and asphalt pavement debris (up to 6" in size), and some roots. Oil staining and large chunks of concrete and asphalt pavement (up to roughly 3 feet) at the base of the fill.	
2	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, olive-gray, damp, moderately hard, fine grained, massive, micaceous, slight petro odor.	

Scale: 1" = 5'

View to / Trend: N.



LOG OF EXPLORATORY TRENCH

Project Name: Signal Hill Petroleum
Logged By: MOS

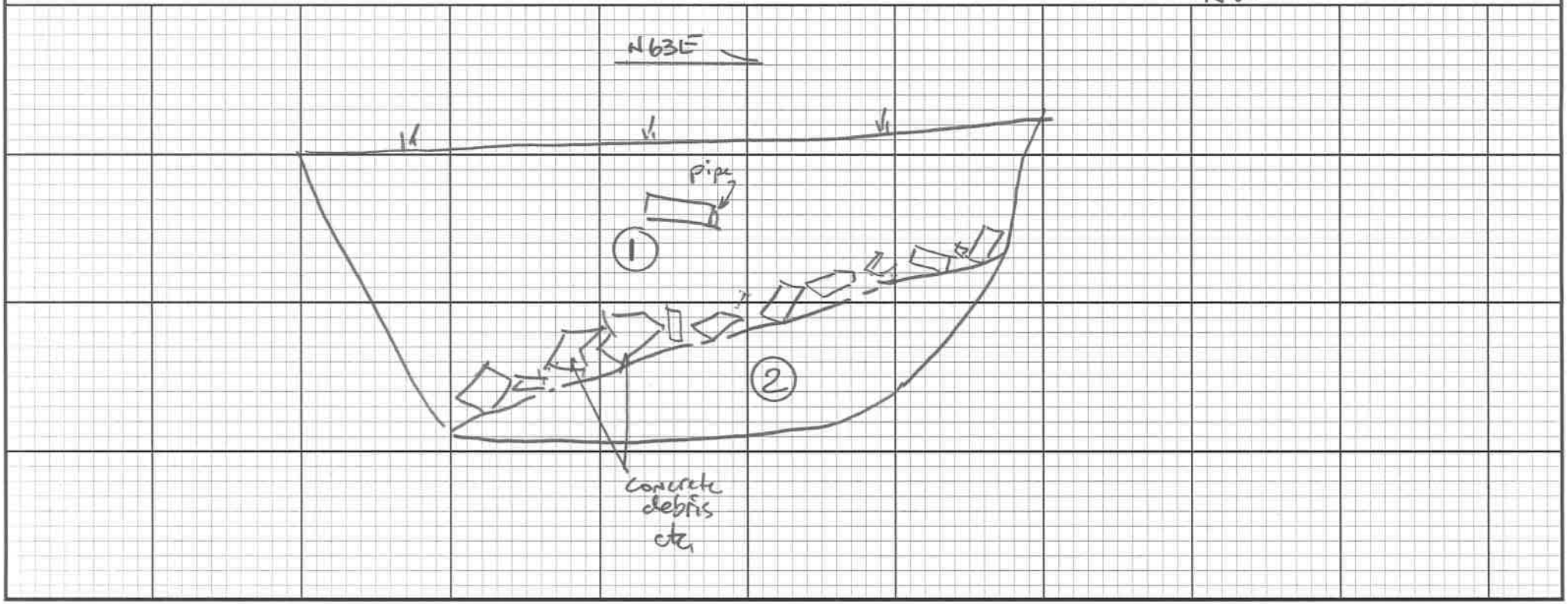
TRENCH NO. 8

J.N.: 2501.00
Date: 10/6/2016

Geologic Unit	Description	Attitudes / Misc Info
1	**ARTIFICIAL FILL (Af):** Silty Sand (SM), Sandy Silt (ML) and Clayey Sand (SC), gray and brown, damp, medium dense and/or firm, fine grained, trace gravel and some minor red brick, concrete, and asphalt pavement debris (up to 6" in size), and some roots. Oil staining and large chunks of concrete and asphalt pavement (up to roughly 3 feet) at the base of the fill.	
2	**BEDROCK - San Pedro Formation (Qsp):** Silty Sandstone, olive-gray, damp, moderately hard, fine grained, massive, micaceous, slight petro odor.	

Scale: 1" = 5'

View to / Trend: NW



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).			■				
		Double triangle in core column represents SPT sampler.			⧗				
10		**Solid black rectangle** in Bulk column respresents large bag sample.				■			
		Other Laboratory Tests: Max = Maximum Dry Density/Optimum Moisture Content EI = Expansion Index SO4 = Soluble Sulfate Content							
15		DSR = Direct Shear, Remolded DS = Direct Shear, Undisturbed SA = Sieve Analysis (1" through #200 sieve) Hydro = Particle Size Analysis (SA with Hydrometer) 200 = Percent Passing #200 Sieve Consol = Consolidation SE = Sand Equivalent							
20		Rval = R-Value ATT = Atterberg Limits							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-1
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/24/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Clayey Sand / Sandy Clay (SC/CL): Light brown, dry to slightly moist, loose/ medium stiff, fine sand, some concrete fragments							
5		Silty Sand (SM): Dark brown to black, damp, loose, fine sand, some concrete fragments		7	■		10.8	103	
10		@ 10 ft, Medium dense, some decomposed plant debris		27	■		5.7	117.4	
15		Clayey Sand / Sandy Clay (SC/CL): Dark gray to black, moist, medium dense/ stiff, fine to medium sand, some asphalt and concrete fragments, slight petrolium odor		20	■		9.4	110.2	Consol
20		Silty Sand (SM): Dark olive gray, moist to very moist, medium dense, fine sand, some concrete fragments, some decomposed plant debris		17	■		15.4	117.1	
25		@ 25 ft, Large concrete fragment in sampler		23/ 2"	■		N.R.		
		@ 29 ft, Groundwater	▽						

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-1
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/24/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				43/ 8"	■		N.R.		
		ALLUVIUM (Qal)							
		Sandy Clay (CL): Dark olive gray, wet, dense/ hard, fine sand, some gravel, some decomposed plant debris							
35				41	■		23	98.6	
		Sand with Silt (SP-SM): Dark gray to olive gray, moist, dense, fine sand, trace fine gravel, micaceous, some decomposed plant debris							
40				49	■		12.4	108.5	
		BEDROCK - San Pedro Formation (Qsp)							
		Sandstone : Gray, hard, fine grained, thinly interbedded, interbedded sand layers							
45					■		32.5	90	
50		@ 50 ft, Trace carbon specs		24	■		23.2	94.6	
		@ 52 ft, Some cemented zones							
55		@ 55 ft, Some claystone interbeds		42	■		27.5	90	
		Gravelly Sandstone : Light gray, wet, hard, fine to coarse gravel							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-1
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/24/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				81/ 11"	■		8.2	115	
65				50/ 6"	■		22.2	105.2	
70		@ 70 ft, Becomes medium to coarse grained gravel		92/ 8"	■		7.3	113.6	
75				83/ 8"	■		35.9	91.8	
		Boring ended at 76 feet. groundwater encountered at 29 feet below ground surface. Backfilled with cement-bentonite grout. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-2
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 74
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
5		**ARTIFICIAL FILL (Af)** Silty Sand (SM): Reddish brown, damp, medium dense, fine to medium sand, trace fine gravel, some concrete and asphalt fragments		17	■		6.6	107.9	
10		Clayey Sand/Sandy Clay (CL/SC): Olive brown to black, moist to damp, very stiff/ medium dense, fine sand, trace fine gravel, some concrete and asphalt fragments		24	■		12.6	110.2	
15		@ 15 ft, Light gray to black, some decomposed plant debris, slight organic odor		13	■		12.7	116.3	Consol
20		@ 20 ft, Slight petrolium odor, large concrete fragments in sampler		24	■			Dist.	
25		**ALLUVIUM (Qal)** Sandy Clay (CL): Black, moist, very stiff, fine sand, slight petrolium and organic odor, trace peat		26	■		19.7	106	
		Fat Clay (CH): Black, moist, very soft, trace fine gravel, slight petrolium and organic odor, trace peat							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-2
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 74
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
							34.1	62.9	
		@ 31 ft, Advanced shelby tube for 2.5 feet					39.5	60	Consol ATT
35		Sandy Silt (ML): Black to olive gray, moist, medium stiff, fine sand, micaceious, trace decomposed plant debris, organic odor		7			24.2	97.2	
40		@ 40 ft, very soft, advanced shelby tube for 2 feet					13.1	94.9	Consol ATT
45		**BEDROCK - San Pedro Formation (Qsp)** Sandstone : Light gray, damp, hard, fine to medium grained, micaceous		42			3.8	97.5	
50				48			3.5	94.4	
55		Silty Sandstone : Gray, damp, hard, fine to medium grained, micaceous, thinly horizontally bedded, trace carbon specs		45			15.6	99.4	

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-2
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 74
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 60 ft, Trace shell fragments		47	■		10.2	106.8	
65		@ 65 ft, Increased fines		52	■		14.7	94.2	
70		@ 70 ft, Interbedded claystone beds		54	■		10	88.7	
		Gravelly Sandstone : Gray, damp, hard, fine to coarse grained							
75				82	■				
80		@ 80 ft, Decreased gravel		82/ 8"	⧗				
		Boring ended at 81 feet. No groundwater encountered. Backfilled with cement-bentonite grout. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-3
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af)							
		Clayey Sand (SC): Dark brown, moist, medium dense, fine sand, micaceous, some brick and concrete fragments							
5				18	■		11.9	110.2	
		@ 7 ft, Increased brick fragments in cuttings							
10		@ 10 ft, Black, loose, increased fines, some roots, slight petroleum smell		7	■		11.6	115.9	
15		@ 15 ft, Medium dense, some decomposed plant matter, some brick and concrete fragments		14	■		14.6	Dist.	
20		@ 20 ft, , Wet	▽	14	■		23.7	101.9	Consol
		ALLUVIUM (Qal)							
		Fat Clay (CH): Very dark gray to black, wet, soft, some peat, slight organic odor, strong petroleum odor							
25		@ 25 ft, Very soft		6	■		N.R.		
		@ 26 ft, Advanced shelby tube for 2 feet			■		N.R.		
		@ 28 ft, Advanced shelby tube for 2 feet			■		55	65.7	Consol ATT

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-3
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
35		Clayey Sand (SC): Black to olive gray, damp, medium dense, fine sand, micaceous, trace decomposed plant matter, slight organic odor		31	■		17.3	62.7	Consol
40		Sandy Clay (CL): Black, wet, hard, fine sand, some decomposed plant matter, some organic odor. @ 41 ft, Steel cable was found wrapped around the lead auger, it is felt that this cable is a piece of construction debris most likely picked up at the fill/alluvium contact. This would account for the uncharacteristically high blow counts between 40 and 50 feet below the current ground surface.		63/ 8"	■		43.1	70	
45				50/ 2"	■		N.R.		
50				50/ 2"	■		N.R.		
55		**BEDROCK - San Pedro Formation (Qsp)** Sandstone : Light gray, damp, hard, fine to medium grained, micaceous, trace iron oxide veins @ 55 ft, Shell fragments		35	■		2.6	101.6	
				50	■		5.4	93.4	
		Silty Sandstone : Medium gray, damp, hard, fine to medium grained, micaceous, slightly laminated							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-3
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 73
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/25/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				36	■		10.9	118	
65				37	■		14.5	118.2	
70		@ 70 ft, Very hard		80/ 10"	■		11.8	99.6	
		Boring ended at 71 feet. Groundwater encountered at 20 feet. Backfilled with cement-bentonite grout. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-4
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 71
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Clayey Sand (SC): Dark brown, damp, very dense, fine sand, trace fine to coarse gravel, small concrete fragments							
		@ 4 ft, Drilling became hard per driller observation							
5				84/ 7"	■		6.6	92.7	
		@ 7.5 ft, Some concrete fragments and rebar in cuttings							
		Sandy Clay (CL): Mottled very dark olive gray and black, moist, very stiff, fine sand, some concrete fragments, strong petroleum odor							
10				30	■		17	110.3	Consol
15		@ 15 ft, Stiff, Increased fines, increased petroleum odor, trace glass and porcelain fragments		16	■		21.1	87.8	
20		@ 20 ft, Olive gray, damp to moist, medium stiff, no odor, trace brick fragments		10	■		20	104.5	
		@ 24 ft, Hard							
25				50/ 2"	■		N.R.		
		ALLUVIUM (Qal) Sandy Lean Clay (CL): Olive gray, moist, stiff, fine to medium sand, dark gray clayey sand lenses, slight organic odor		13	■		25.8	87	
		@ 28 ft, Advanced shelby tube for 2.5 feet			■		25.9	87.9	Consol ATT

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-4
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 71
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 30 ft, Becomes black, decreased fines							
35		@ 35 ft, Very stiff, interbedded sand layers		23			18.2	106.7	
40		@ 40 ft, Trace carbon flecks		20			16.3	Dist.	ATT
		BEDROCK - San Pedro Formation (Qsp)					14.7	Dist.	
		Silty Sandstone : Medium gray to olive gray, moist, hard, fine to coarse gravel, trace fine gravel, trace pores, few roots, some iron oxide staining							
45		@ 42 ft, Advanced shelby tube for 1.5 feet		30			14.7	110.6	
50		@ 50 ft, Fine gravel, faintly laminated, micaceous		26			14.5	112.2	
55		@ 55 ft, Hard		36			22.4	85.3	
		@ 56 ft, Dark gray, fine to coarse grained							
		Gravelly Sandstone : Light gray, damp, hard, fine to coarse grained							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-4
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 71
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				74	■		8	109.8	
65				79/ 8"	■		4.5	101.3	
		Boring ended at 66 feet. No groundwater encountered. Backfilled with cement-bentonite grout. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-5
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 76
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Clayey Sand (SC): Light brown to dark brown, dry to damp, medium dense, fine sand, trace fine to coarse gravel, few pieces of debris (i.e. metal fragments, plastic, etc.)							
5		@ 5.5 ft, 4 inch thick pale brown sand layer		19	■		1.5	116.7	
10		@ 10 ft, Grades to olive gray, increased fines, some construction debris (i.e. concrete, brick, asphalt, etc.)		20	■		13.9	109.1	
		Sandy Clay (CL): Reddish brown to black, damp, hard, fine sand, few fine gravel, some construction debris (i.e. concrete, brick, asphalt, etc.), petroleum odor and staining							
15				46	■		2	116.3	
20		@ 20 ft, Stiff, carbon fragments, increased concrete and brick fragments		12	■		23.2	83.5	Consol
25				10	■		30.4	82.1	
		ALLUVIUM (Qal) Sandy Silt (ML): Black, damp to moist, medium stiff, fine sand, micaceous, trace decomposed plant matter, slight organic odor					41.6	Dist.	

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-5
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 76
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 30 ft, Stiff, interbedded pale gray sandy silt layer, trace carbon fragments		12	■		47.6	65.7	
		@ 31 ft, Advanced shelby tube for 2 feet			■		44.8	62.6	Consol ATT
35		Clayey Sand (SC): Olive gray, moist, loose, micaceous, trace decomposed plant matter		7	■		29.8	89.8	
40		@ 40 ft, Dark olive gray, medium dense, increased fines, increased decomposed plant matter		15	■		17.3	111.3	
45		@ 45 ft, Olive gray, decreased fines, decreased decomposed plant matter		17	■		17.9	109.2	
50		@ 50 ft, Trace fine gravel, decreased fines, few iron oxide stains		22	■		16.5	110.7	
55		**BEDROCK - San Pedro Formation (Qsp)**							
		Silty Sandstone : Light olive gray, damp, hard, fine to medium sand, few iron and manganese oxide veins		34	■		20.9	101.6	
							5.7	Dist.	
		Gravelly Sandstone : Light gray, damp to moist, hard, fine to coarse grained							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-5
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 76
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/29/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 60 ft, Very hard, increased gravel		83	■		3.6	111	
65		@ 65 ft, Medium to coarse gravel, decreased gravel		87	■		3.4	92.9	
		Boring ended at 66 feet. No groundwater encountered. Boring converted into monitoring well with vibrating wire piezometer installed at 30 feet below the existing surface. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-6
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 77
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Crushed Aggregate Base (CAB): stockpile							
5									
		ARTIFICIAL FILL (Af) Clayey Sand (SC): Dark brown, damp, dense, fine to coarse sand, few fine to coarse gravel, trace large concrete fragments		46	■		6.7	120.7	
10									
		Clay with Sand (CL): Olive brown, damp, stiff, fine sand							
15				11	■		19	89.3	Consol
		Sandy Clay (CL): Olive gray to black, moist, stiff, fine to medium sand, few fine gravel, trace roots and concrete fragments, slight petroleum odor							
20				12	■		11.8	103.7	
		Silty Sand (SM): Light olive brown, damp to moist, medium dense, fine to medium sand, micaceous, slight petroleum odor							
25				15	■		16.4	107.6	
		ALLUVIUM (Qal) Sandy Lean Clay (CL): Black, moist, stiff, fine sand, mostly decomposed plant matter, strong organic odor					17.6	Dist.	

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-6
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 77
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				12	■		16.2	92.7	
		@ 31 ft, Advanced shelby tube for 2.5 feet			■		37.9	64.5	Consol
35		@ 35 ft, Very stiff, no decomposed plant matter		25	■		27.7	89.3	
40		@ 40 ft, Grades to olive gray, stiff, decreased fines, increased plasticity, some roots		13	■		19	93.9	Consol ATT
45		@ 45 ft, Advanced shelby tube for 2.5 feet			■		N.R.		
		@ 47.5 ft, Advanced shelby tube for 6 inches			■		N.R.		
		BEDROCK - San Pedro Formation (Qsp)							
50		Sandstone and Silty Sandstone : Light gray, dry to damp, hard, fine to medium grained, micaceous, some iron oxide stains		36	■		3	95.6	
		Silty Sandstone : Light olive gray, damp, hard, fine grained, trace iron and manganese oxide spots, some horizontal laminations							
55				34	■		21.6	101.7	

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-6
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 77
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 60 ft, Decreased fines		40	■		11.2	87	
		Sandstone and Silty Sandstone : Light gray mottled with olive gray, damp, hard, fine grained, micaceous, trace shell fragments							
65				30	■		19.8	92.9	
70		@ 70 ft, Dark olive gray, hard		45	■		11.2	100.7	
		Gravelly Sandstone : Light gray, moist, very hard, fine to coarse grained, micaceous							
75				73/ 11"	■		3.3	116.1	
80				50/ 6"	■		N.R.		
		Boring ended at 80.5 feet. No groundwater encountered. Boring converted into monitoring well with vibrating wire piezometer installed at 35 feet below the existing surface. Cuttings drummed and drums left adjacent to boring.							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-7
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 68
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
5		**ARTIFICIAL FILL (Af)** Silty Sand with Gravel (SM): Light brown to tan, dry, very dense, fine to coarse gravel, fine to coarse sand, few construction debris (i.e. concrete, brick, asphalt, etc.)		63	■		9.4	104.5	
10		Sandy Clay/Clayey Sand (CL/SC): Olive to olive gray, damp to moist, medium dense/ very stiff, fine sand, trace fine gravel, few carbon fragments		19	■		24.1	84	Consol
15		**ALLUVIUM (Qal)** Lean Clay with Sand (CL): Tan mottled with strong brown, moist, very soft, fine sand, trace fine gravel, trace decomposed plant matter			■		23.4	97.3	
					■		22.2	101.3	Consol ATT
		@ 16 ft, Advanced shelby tube for 2.5 feet	▽						
20		Sandy Clay (CL): Olive gray, wet, stiff, fine sand, mostly decomposed plant matter		14	■		14.1	112.7	
25				14	■		19	102.4	
		Organic Silt (OL): Black, moist, stiff, some fine sand, mostly decomposed plant matter							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-7
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 68
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

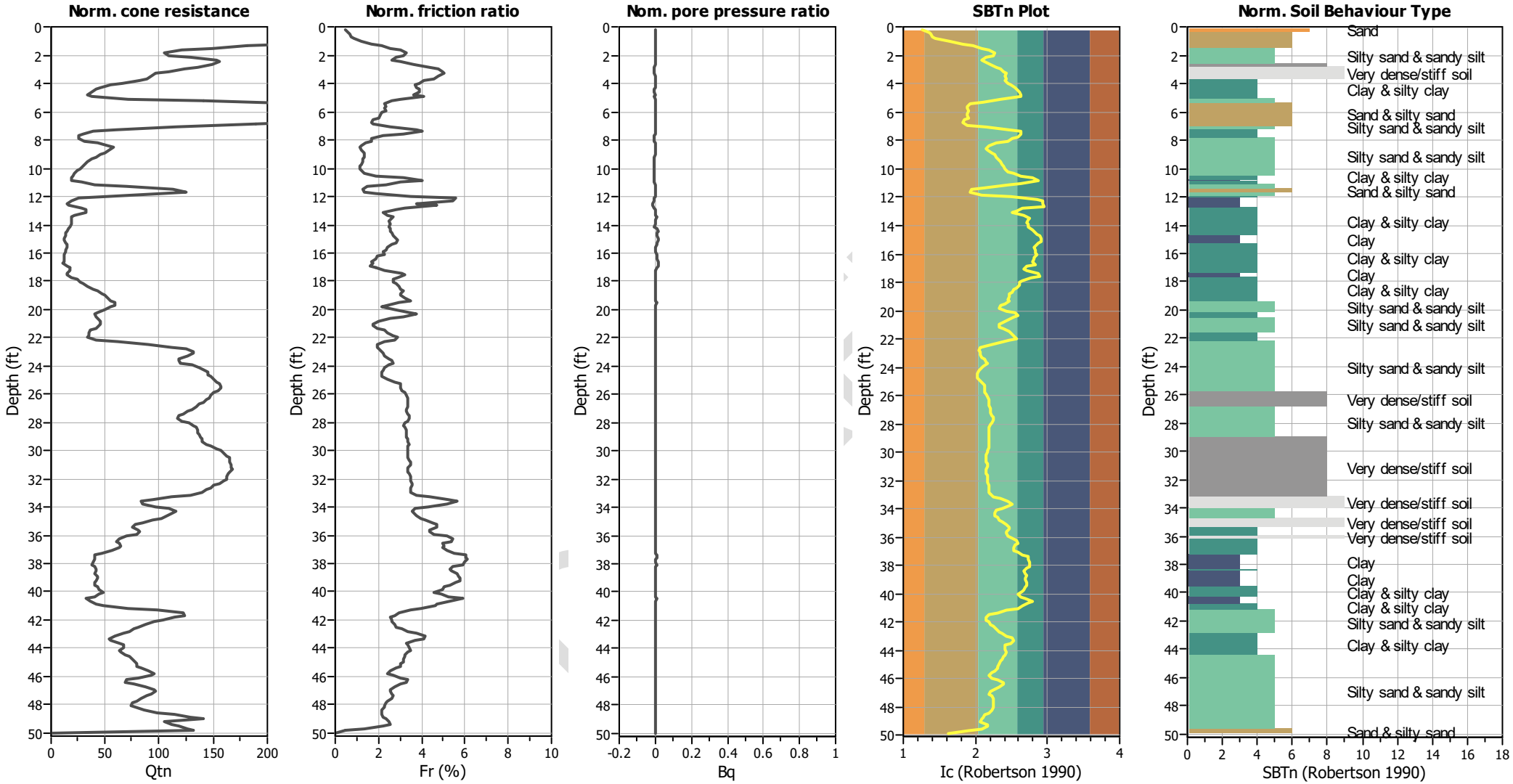
Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				12	■		4.2	70.6	
35		@ 35 ft, Interbedded sand layer		15	■		17.3	108.3	
		Silty Sand (SM): Olive gray, damp to moist, medium dense, fine to medium sand, some carbon specs			■		15.3	Dist.	
		@ 36 ft, Advanced shelby tube for 2 feet							
40		@ 40 ft, Few iron oxide spots, trace decomposed plant matter		21	■		15.4	108.4	
		BEDROCK - San Pedro Formation (Qsp)							
45		Sandstone and Silty Sandstone : Light olive gray, damp to moist, hard, fine to medium grained, micaceous, few iron oxide stains		40	■		8.5	109.5	
		Silty Sandstone : Dark olive gray, damp to moist, hard, fine to medium grained, micaceous, slightly laminated							
50				27	■		24.4	95	
55		@ 55 ft, very dense, no oxide stains		61	■		14.3	90.5	
		Gravelly Sandstone : light olive gray, moist, hard, fine to coarse grained, micaceous							

EXPLORATION LOG

Project: Former AmeriGas Plant, S/W Corner of Spring Street and Orange, Long Beach, CA		Location: B-7
Address: 3001 Orange Ave, Long Beach, CA 90807		Elevation: 68
Job Number: 2501.00	Client: Signal Hill Petroleum	Date: 10/31/2016
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: AJA

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
				70	■		9.3	100.6	
65				72/ 11"	■		3.5	Dist.	
		Boring ended at 66 feet. Groundwater encountered at 19 feet. Boring converted into monitoring well with vibrating wire piezometer installed at 30 feet below the existing surface. Cuttings drummed and drums left adjacent to boring.							

CPT basic interpretation plots (normalized)



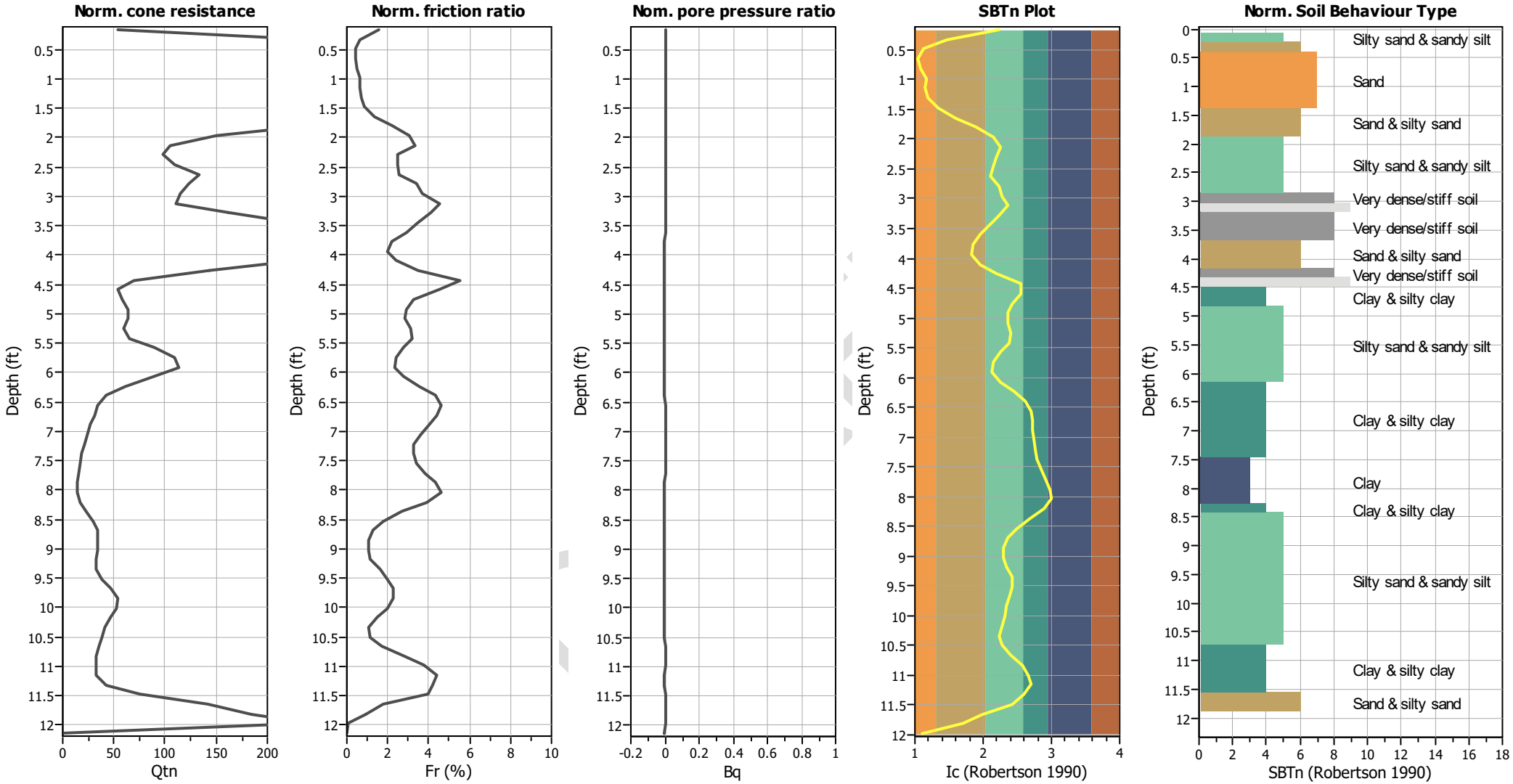
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



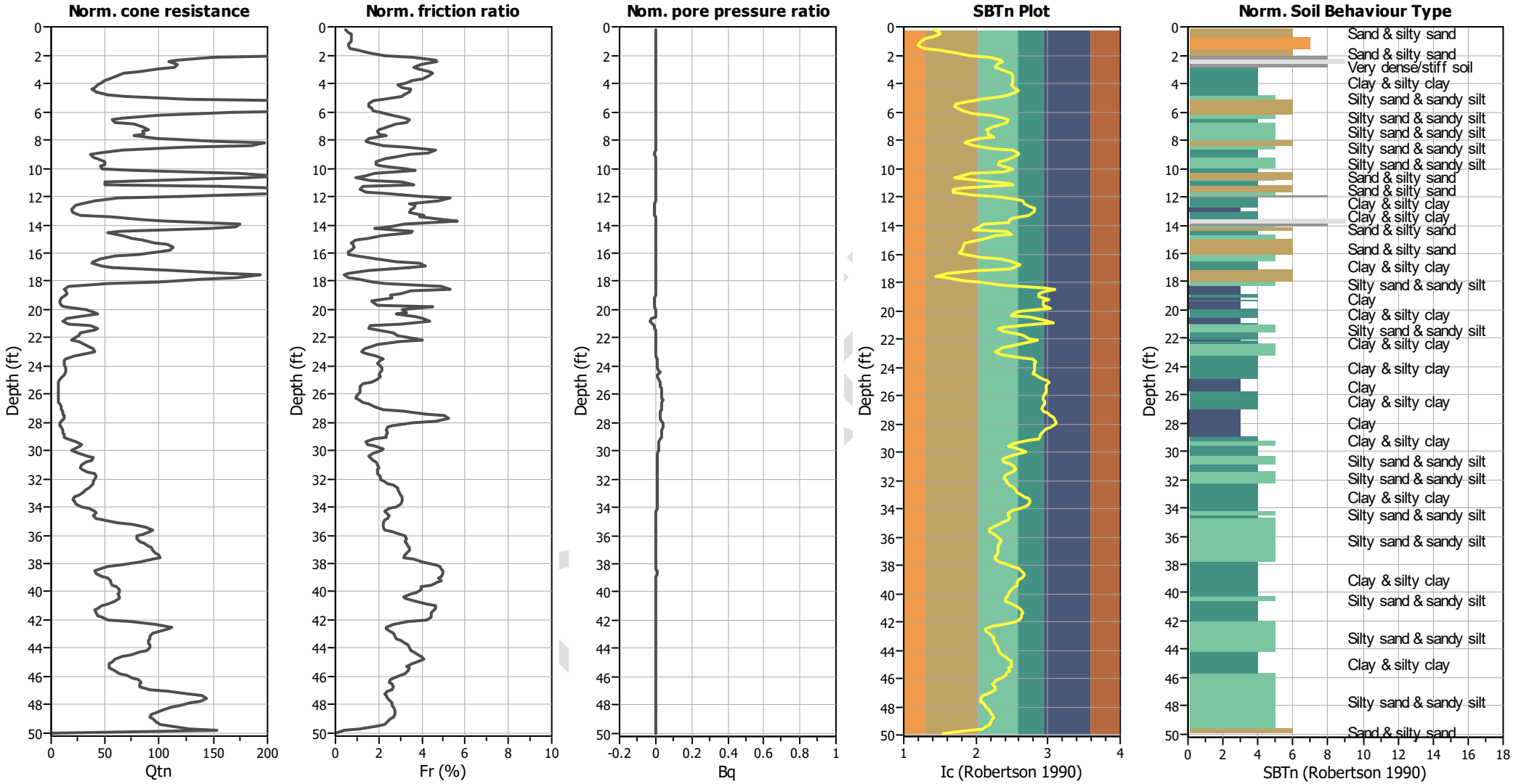
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



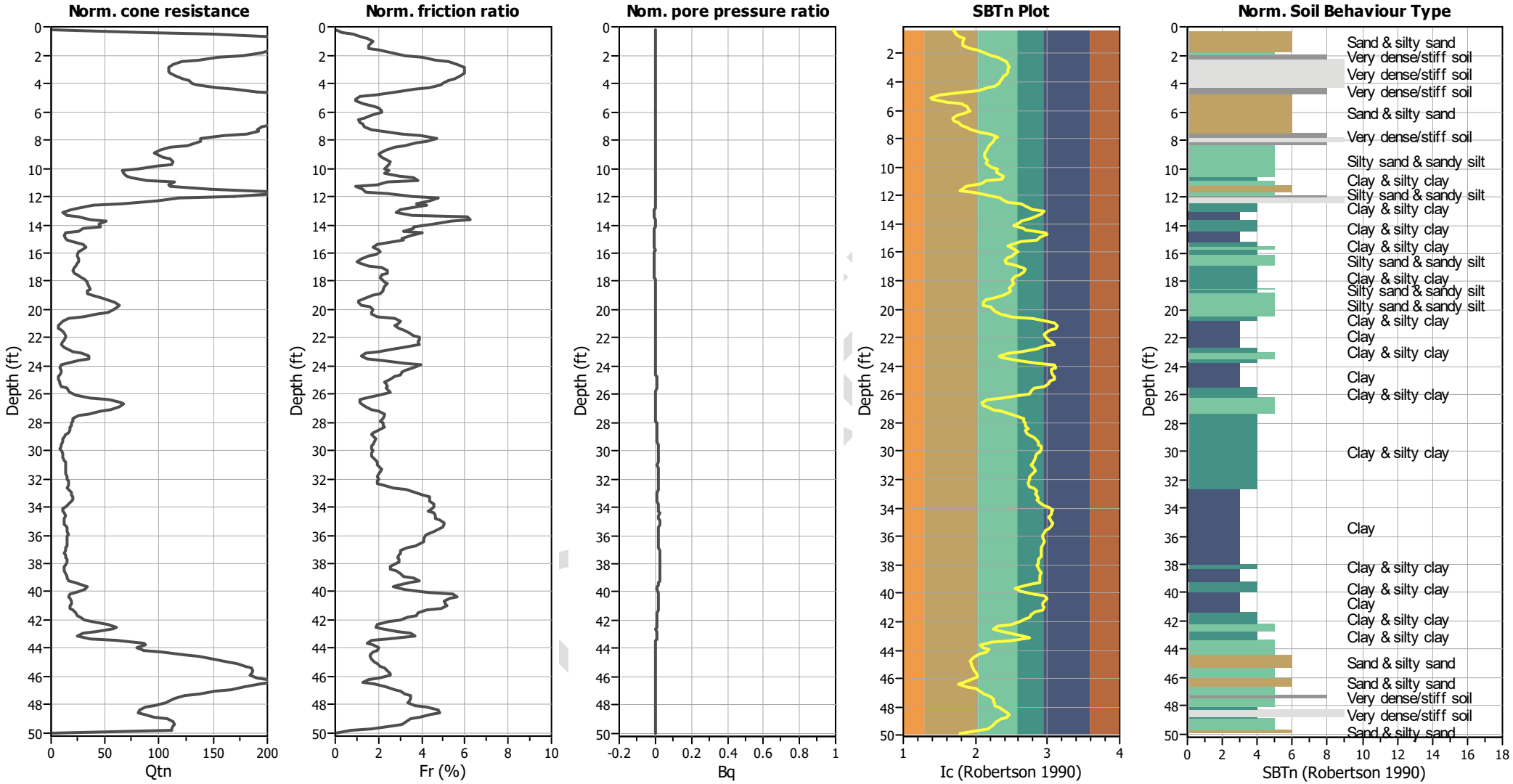
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



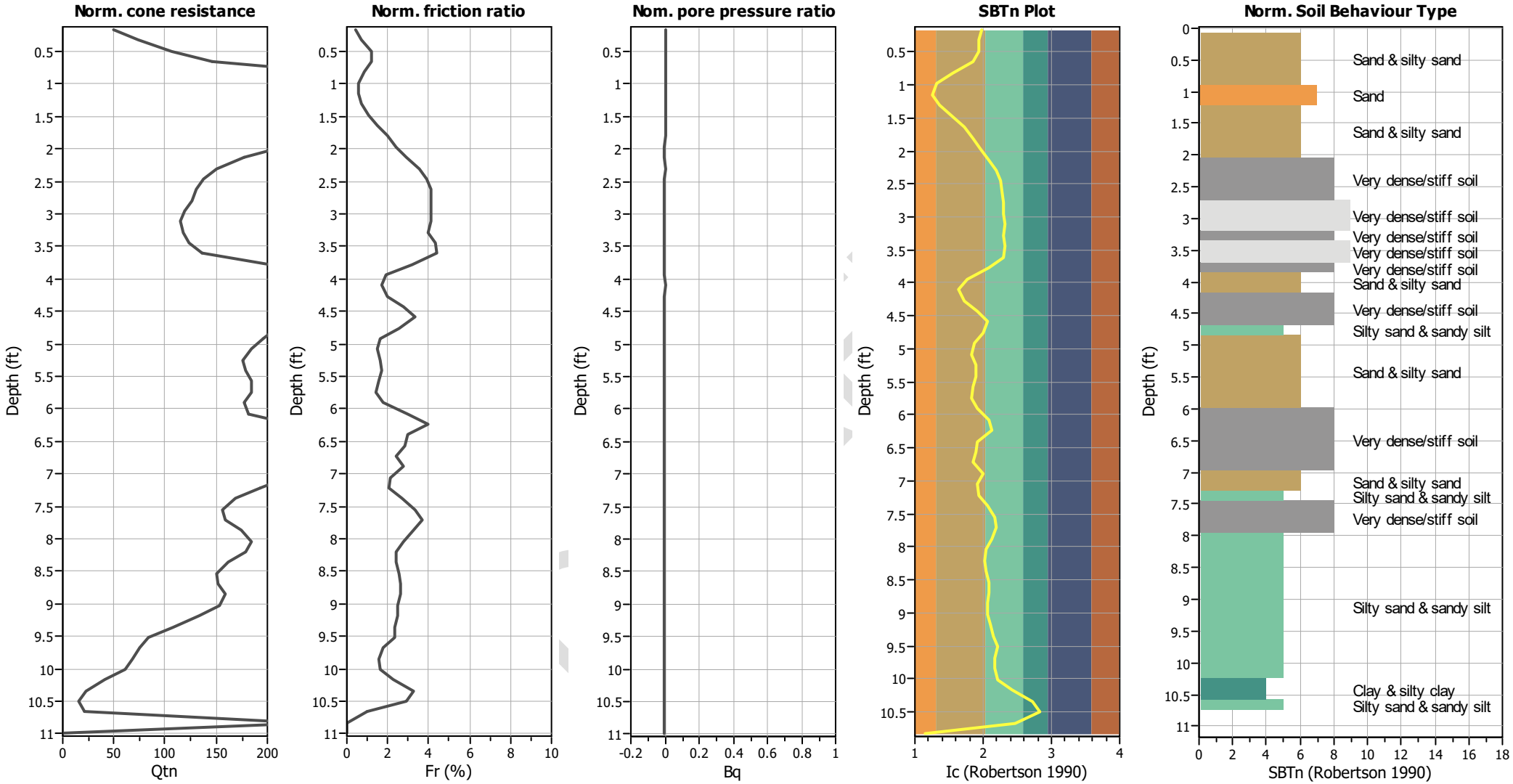
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



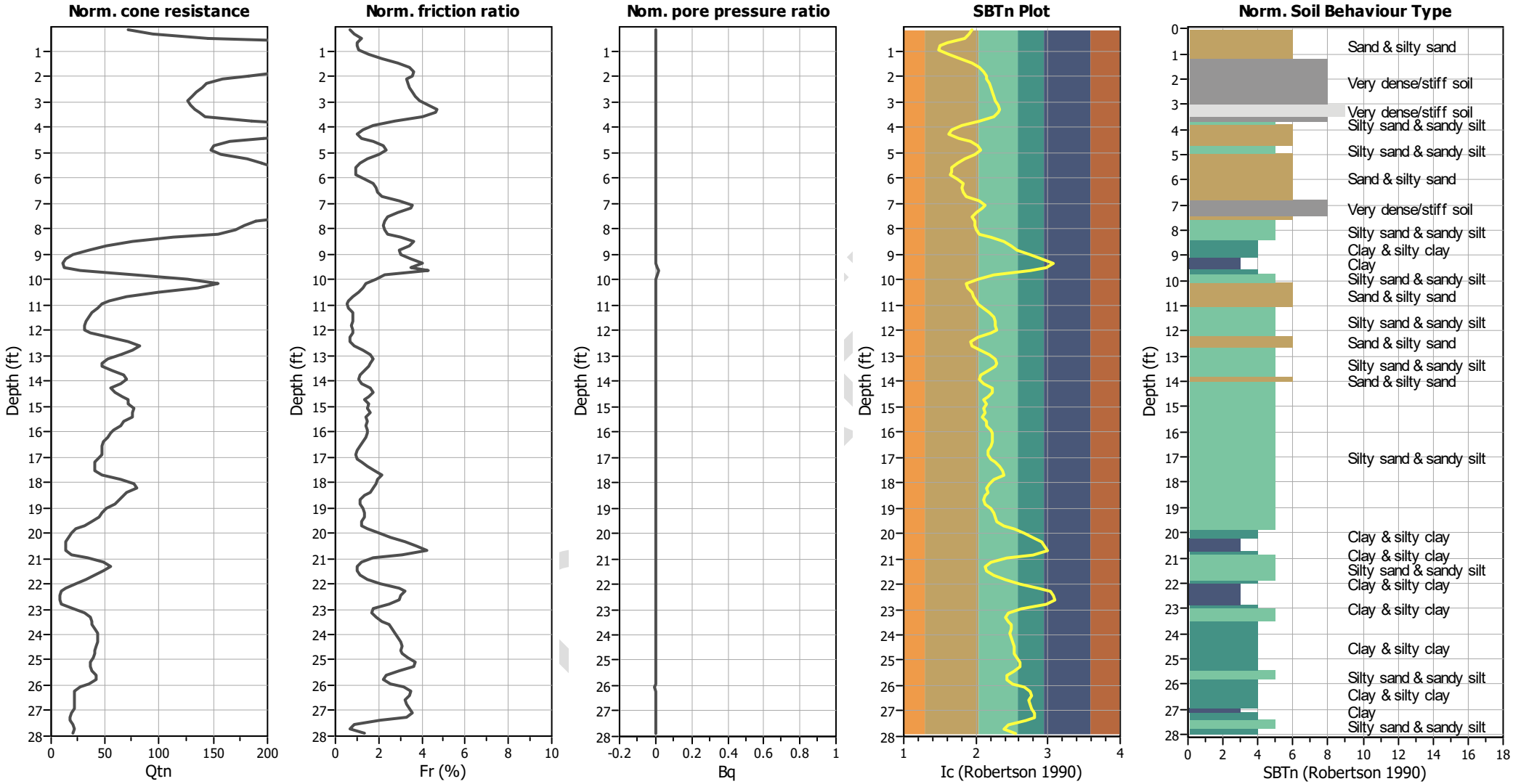
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



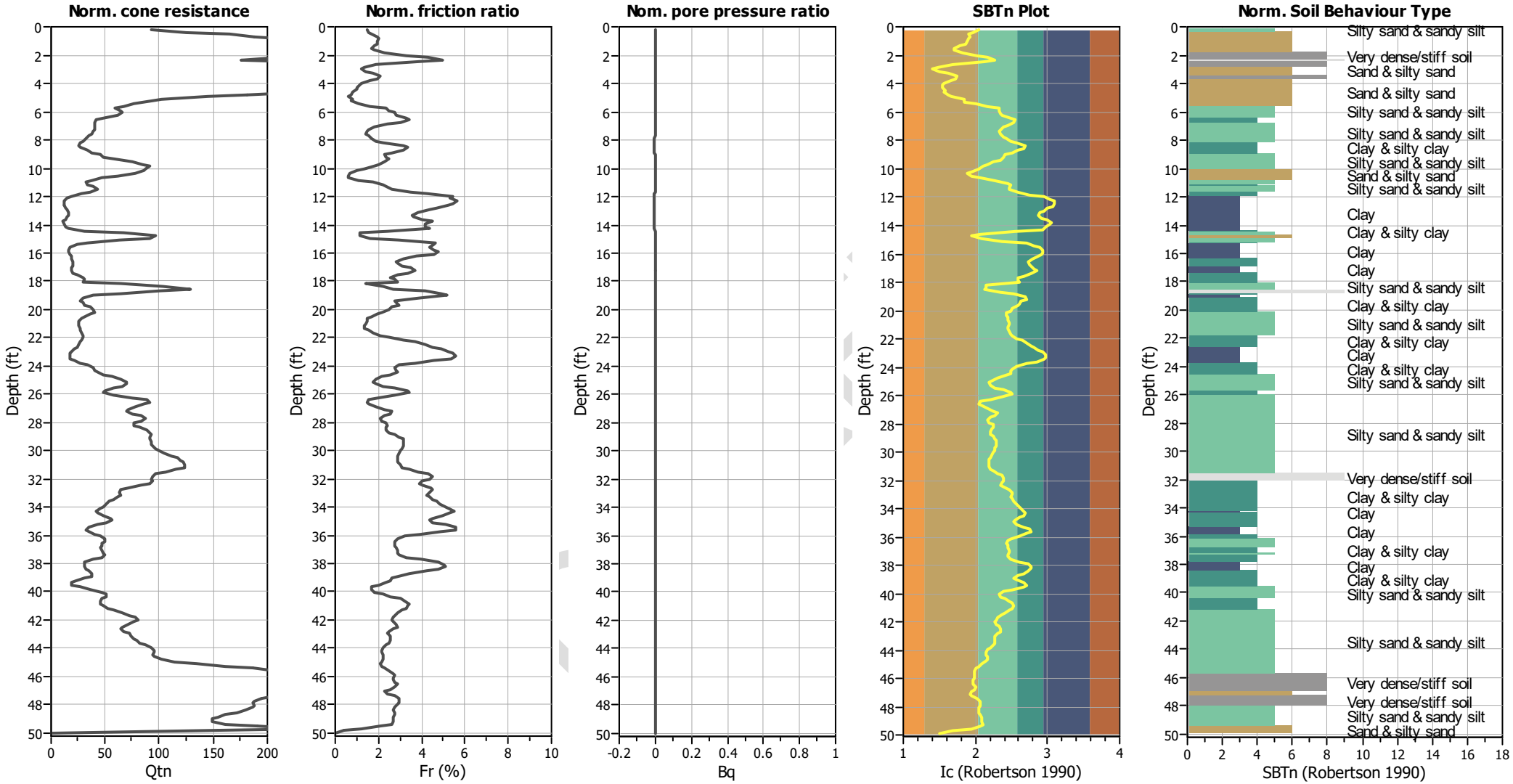
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



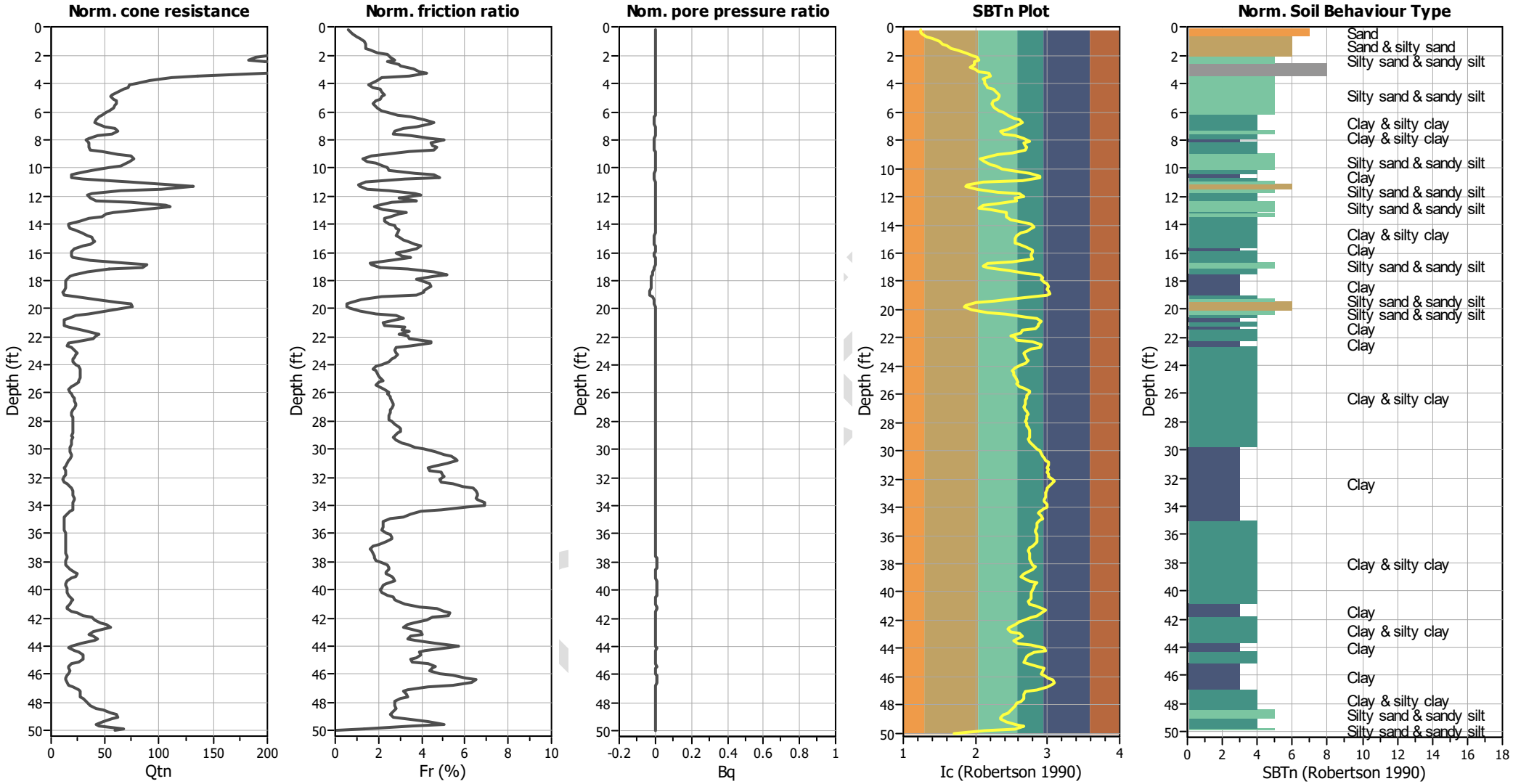
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



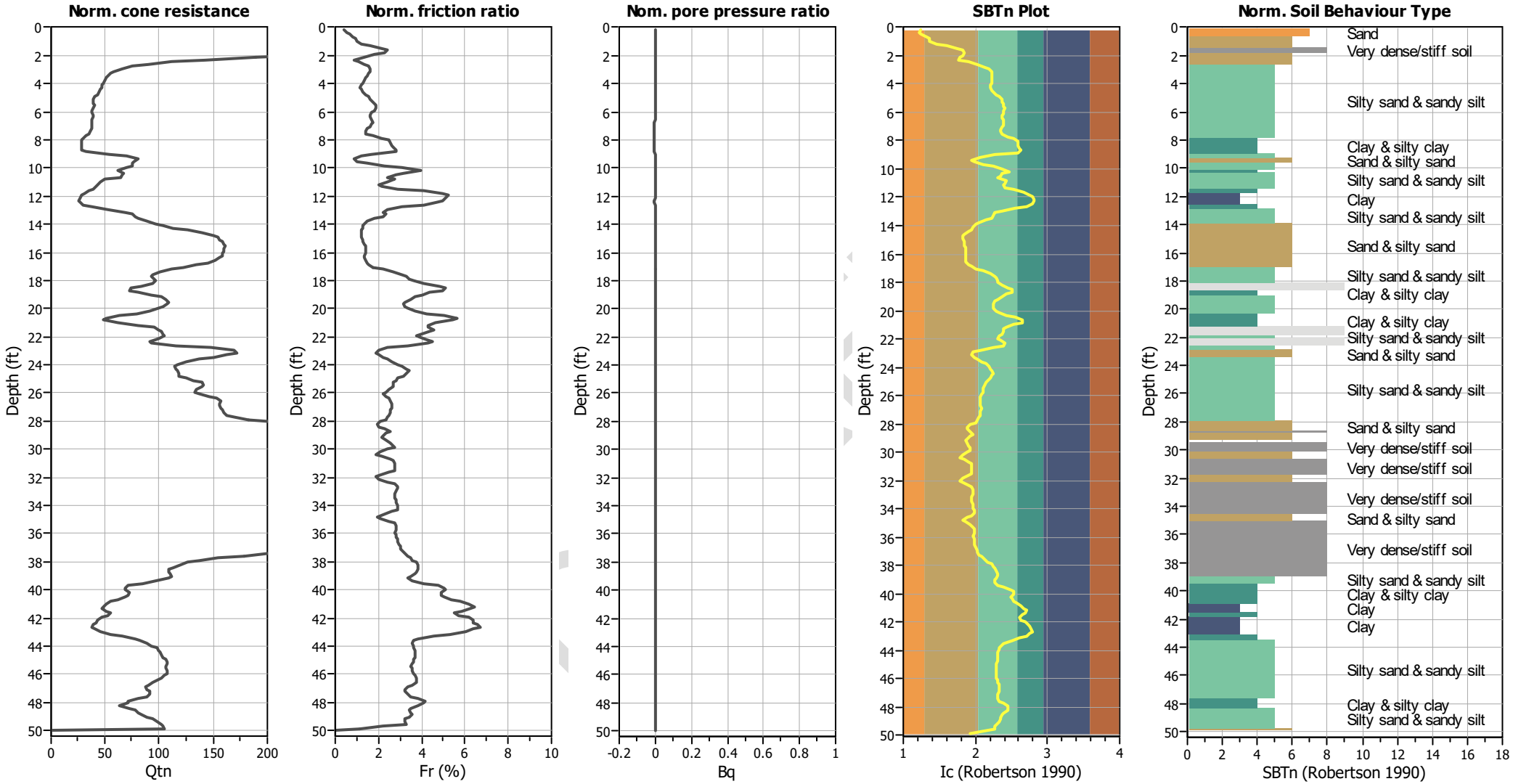
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



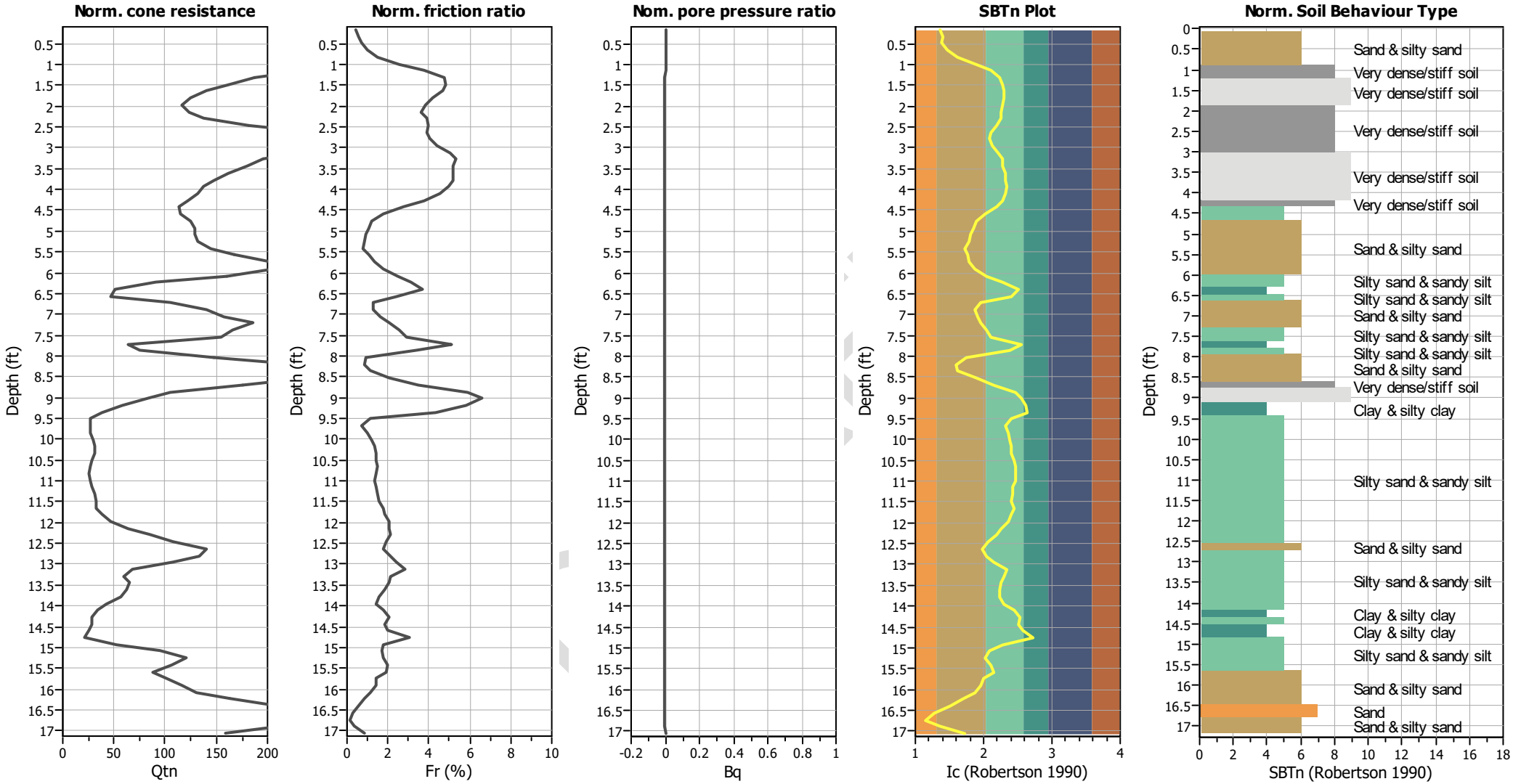
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



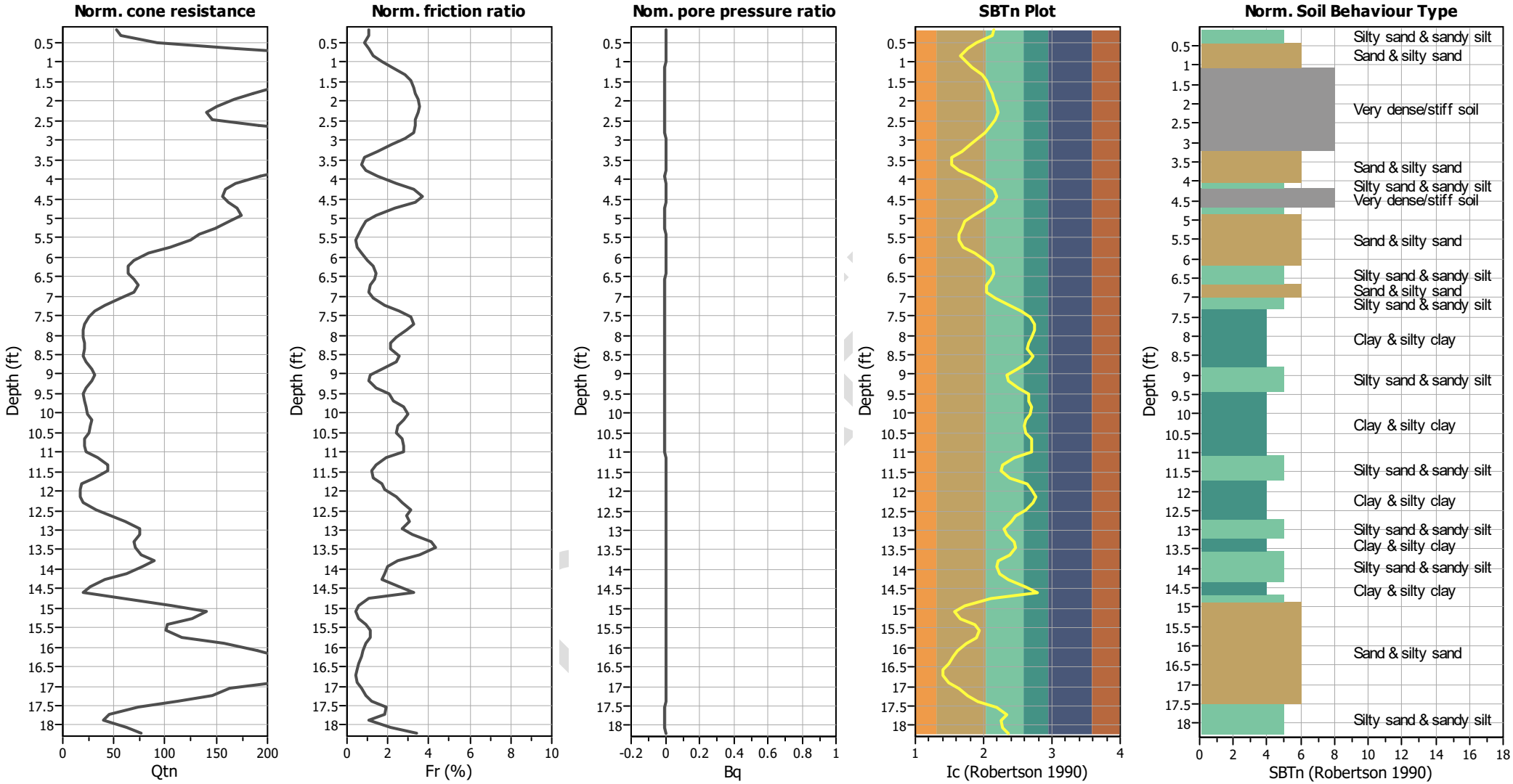
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



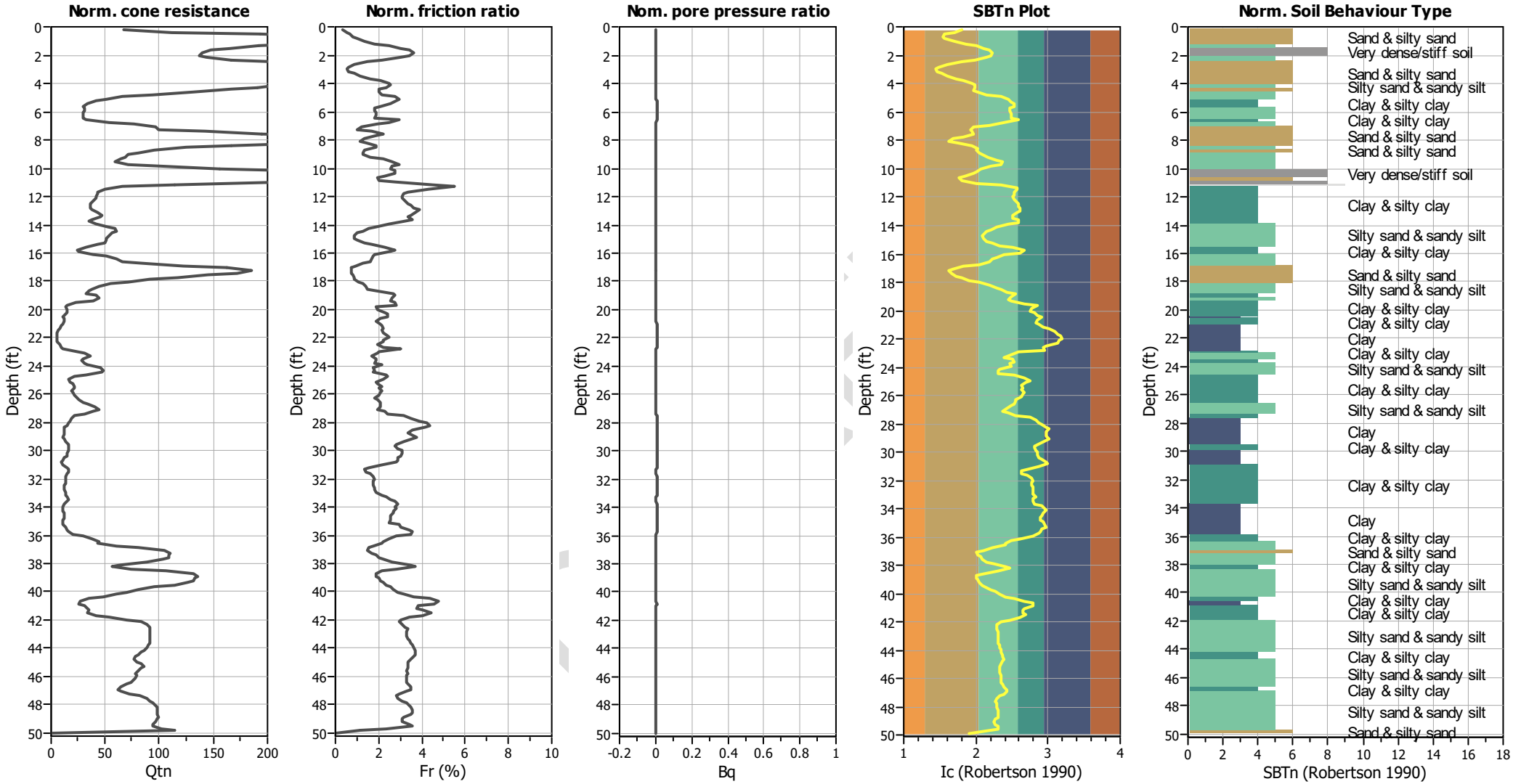
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



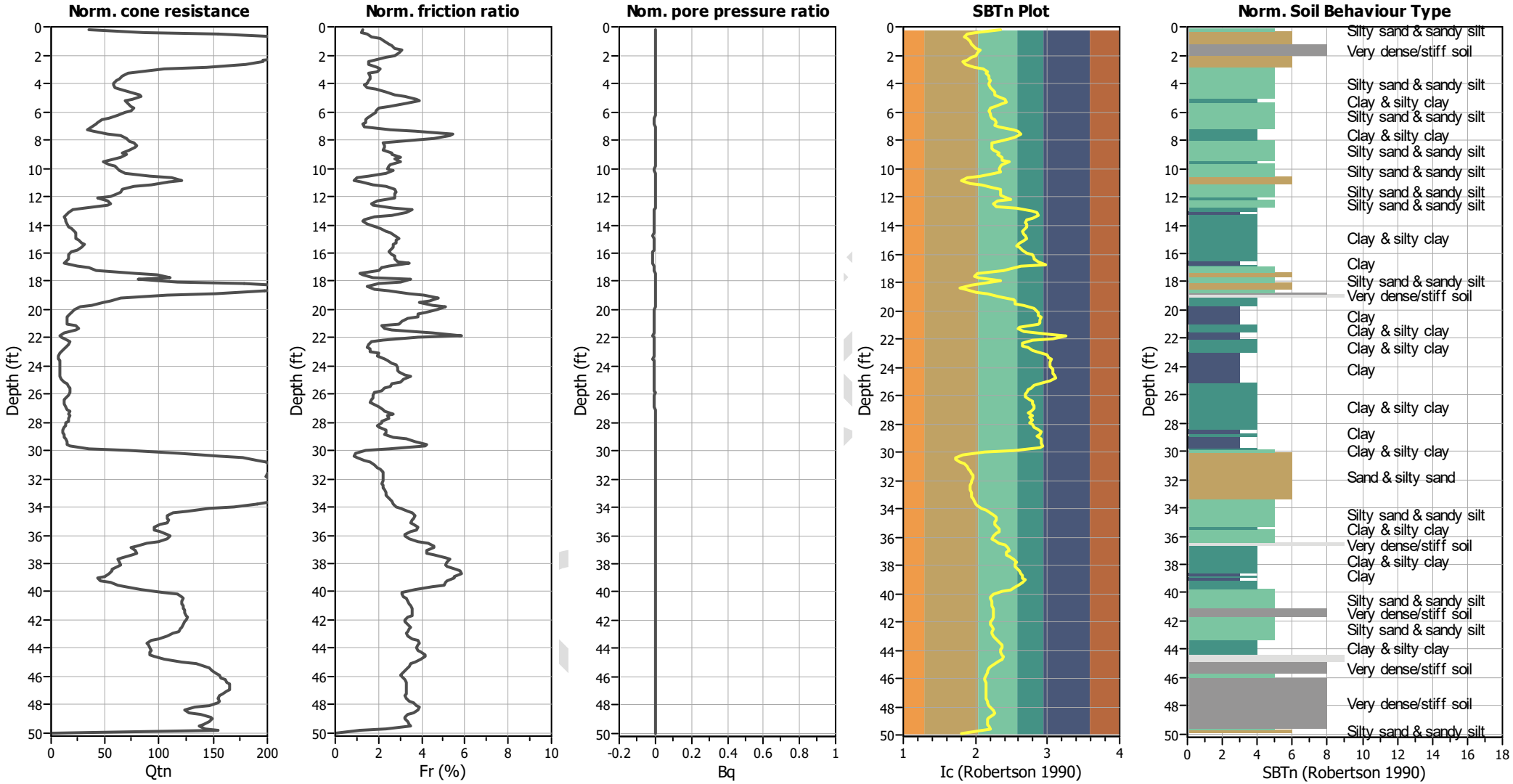
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



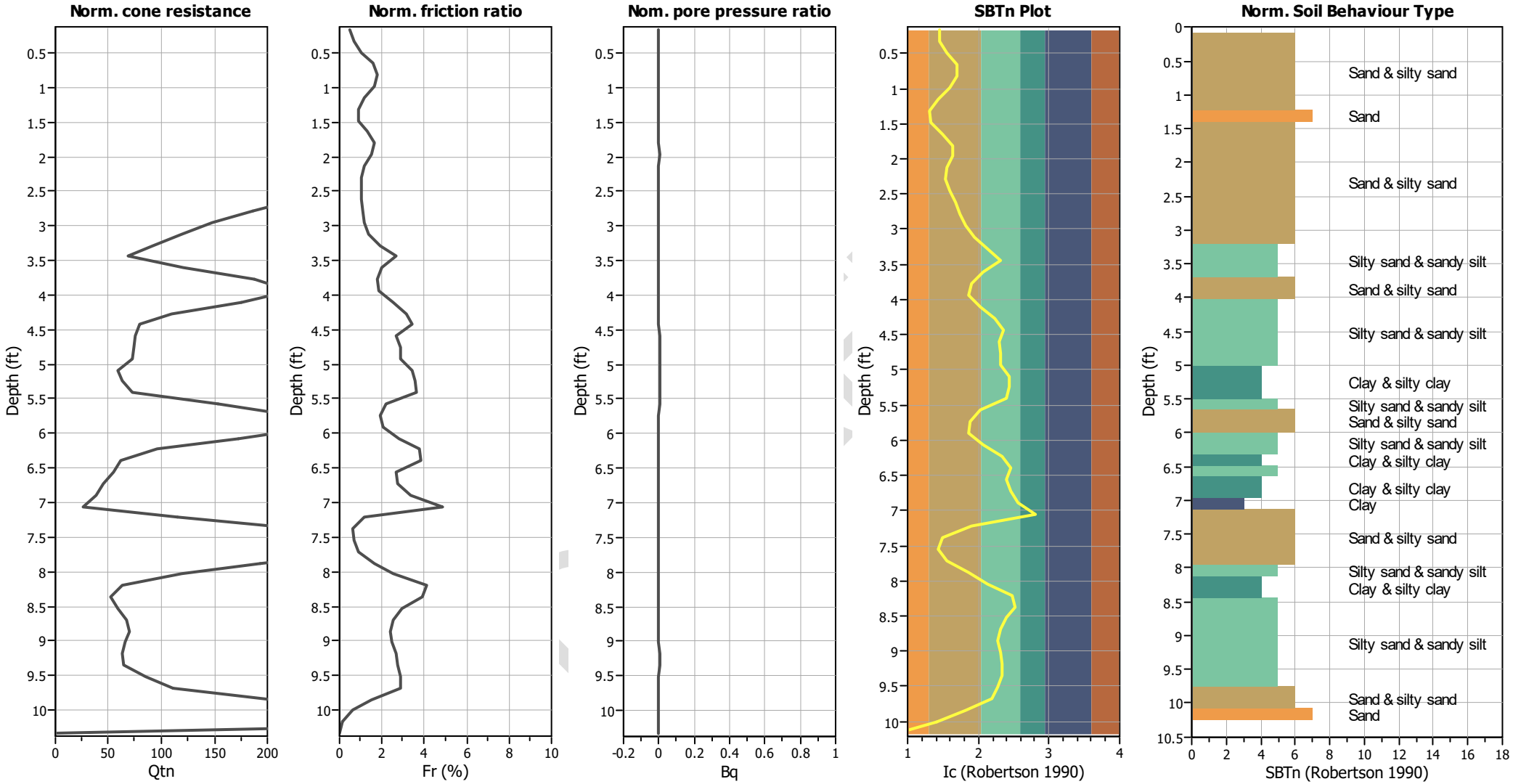
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



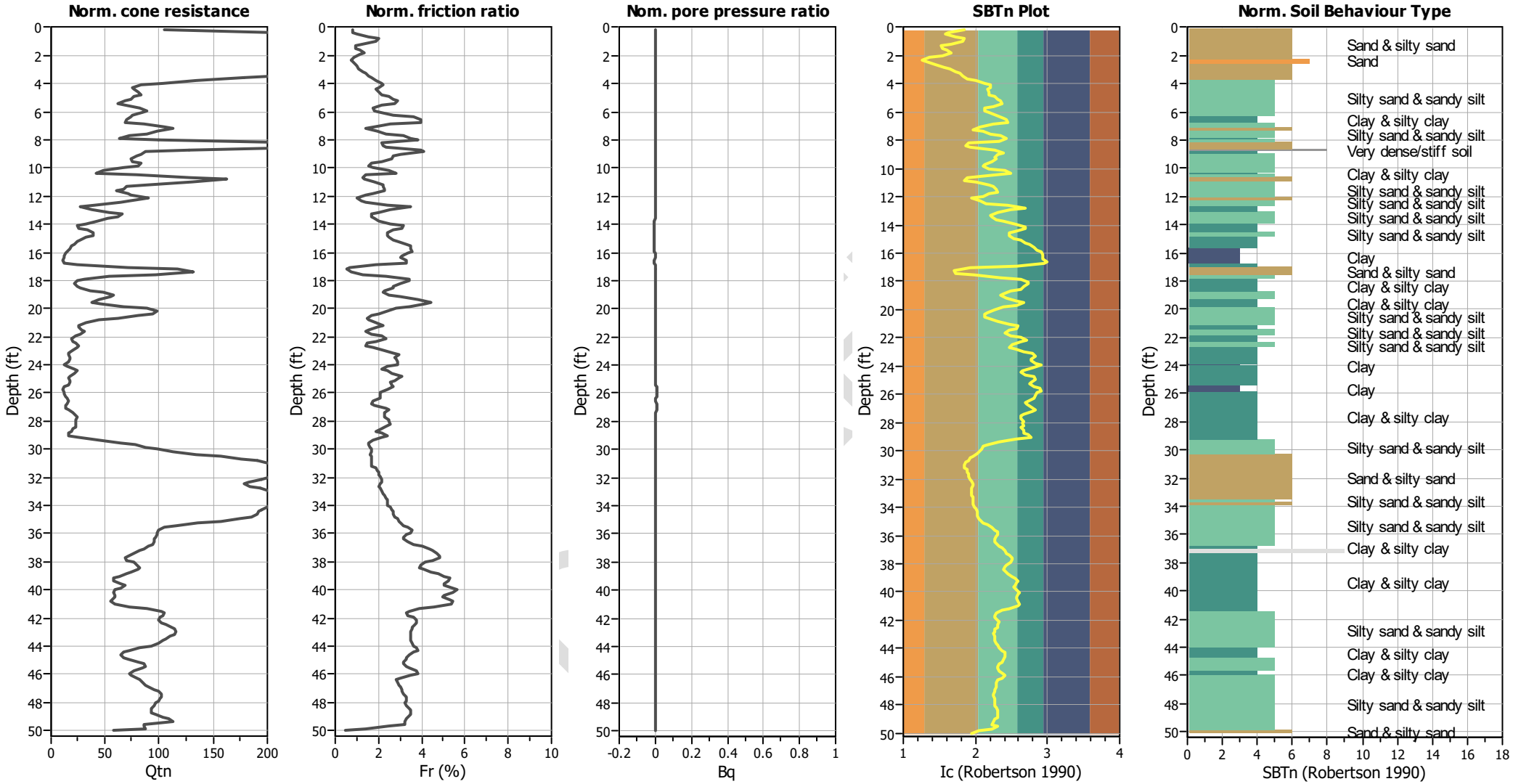
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



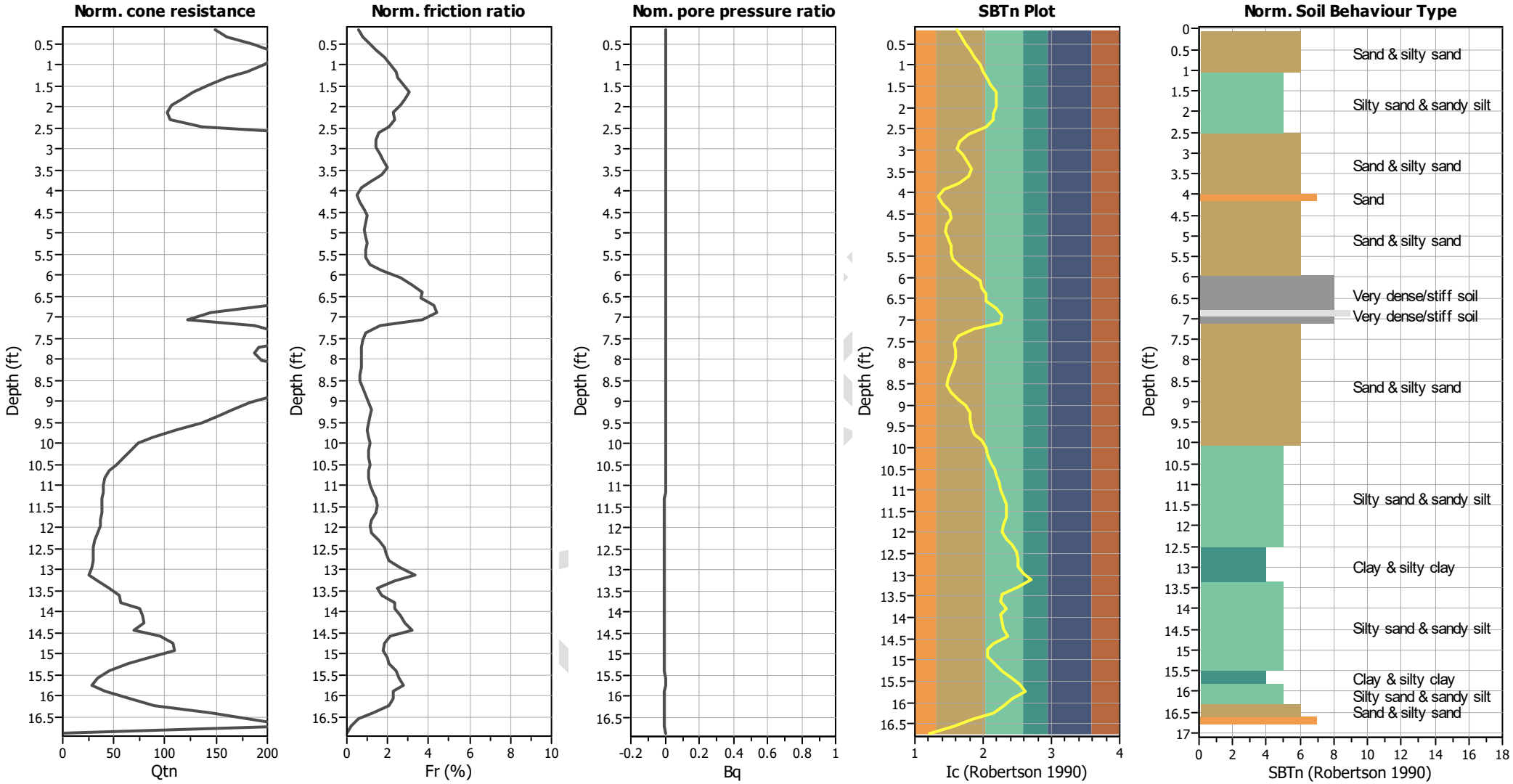
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



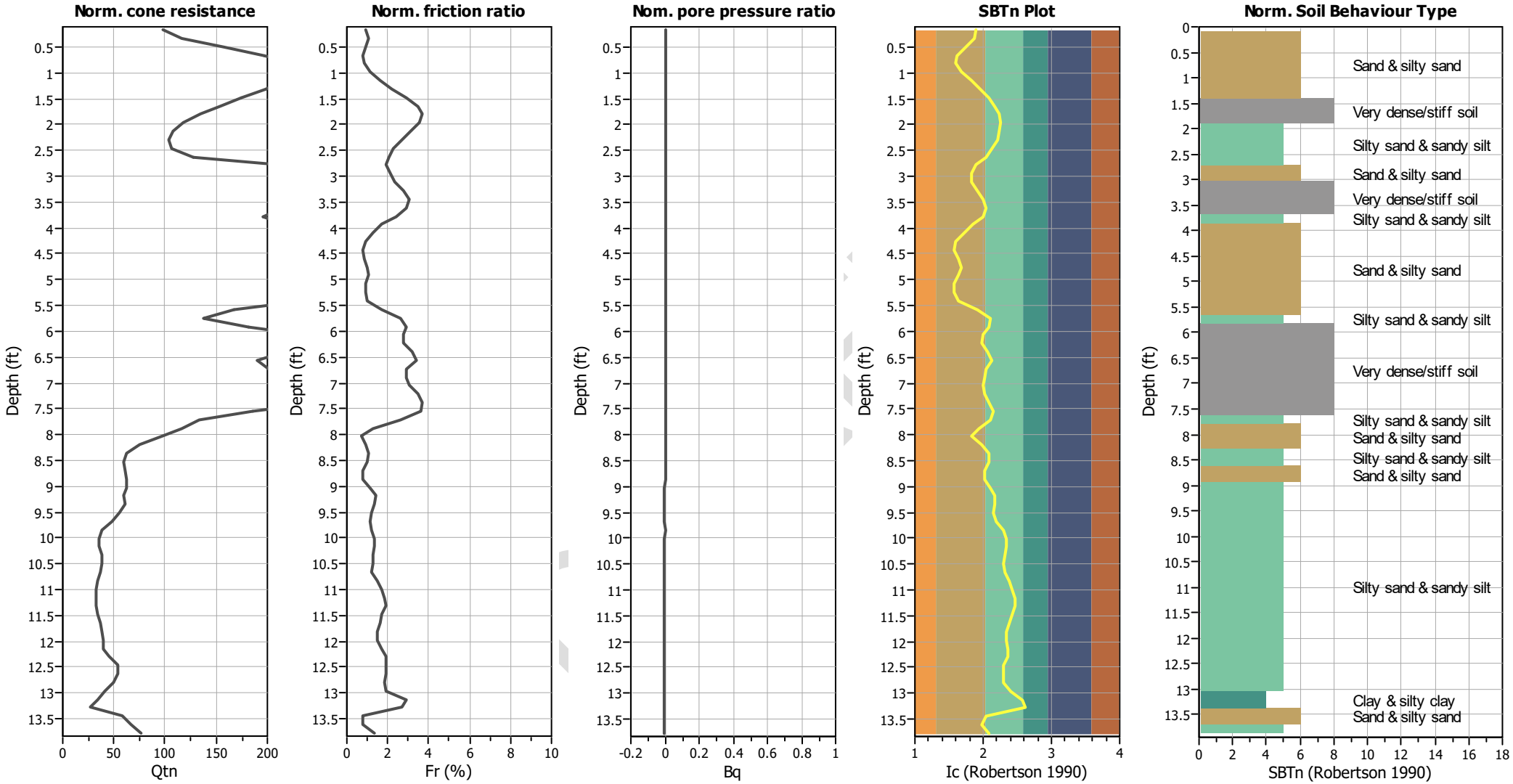
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



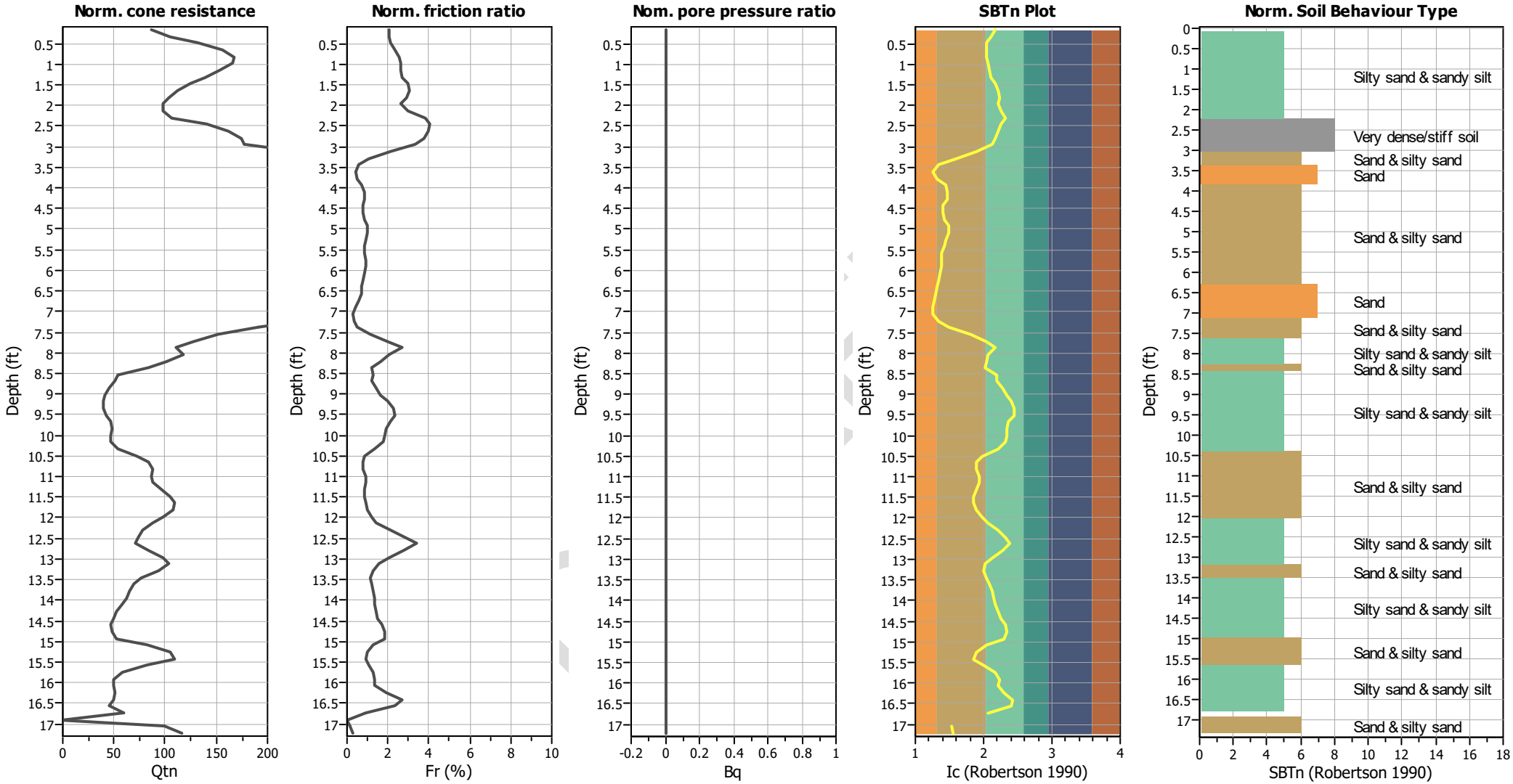
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



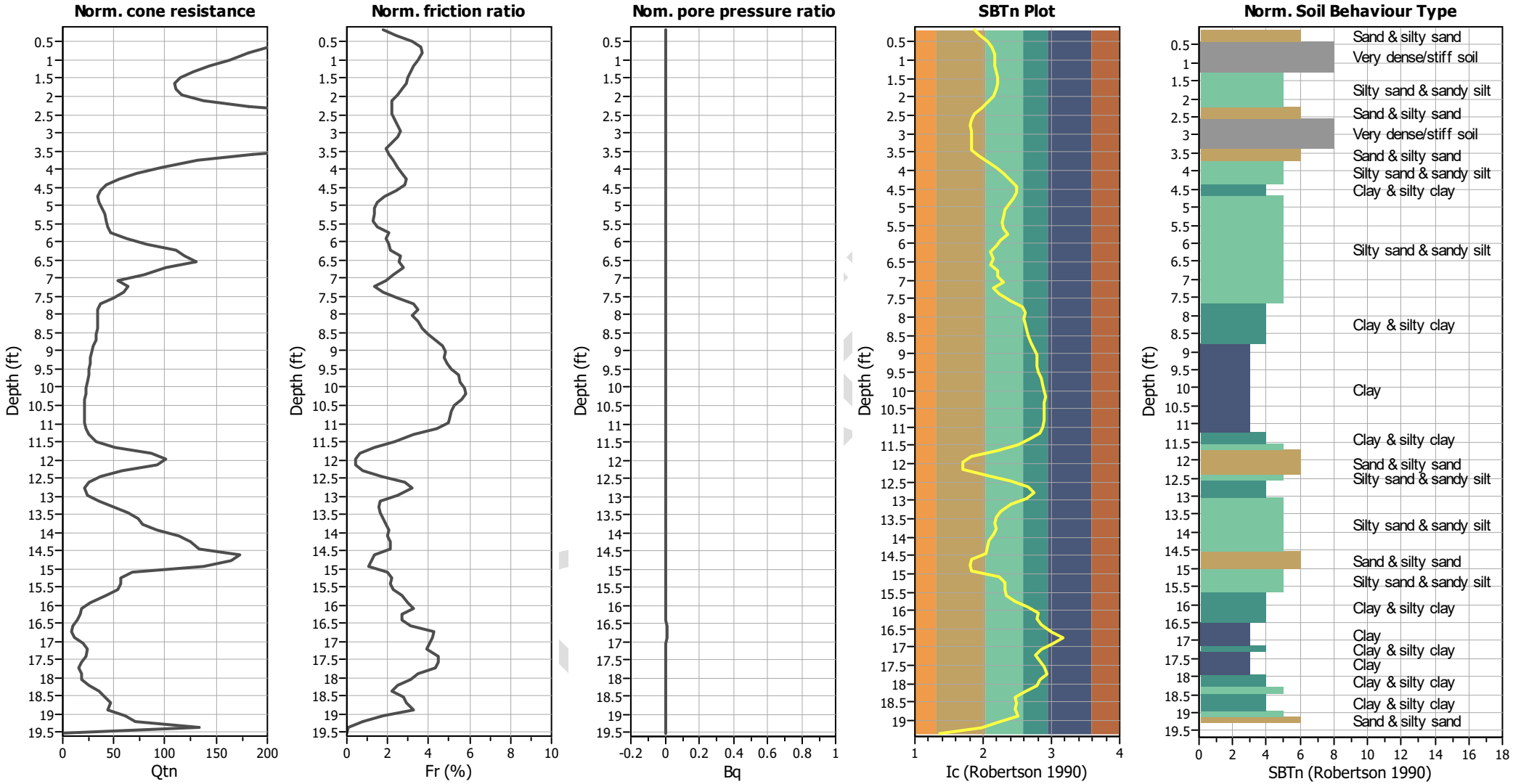
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



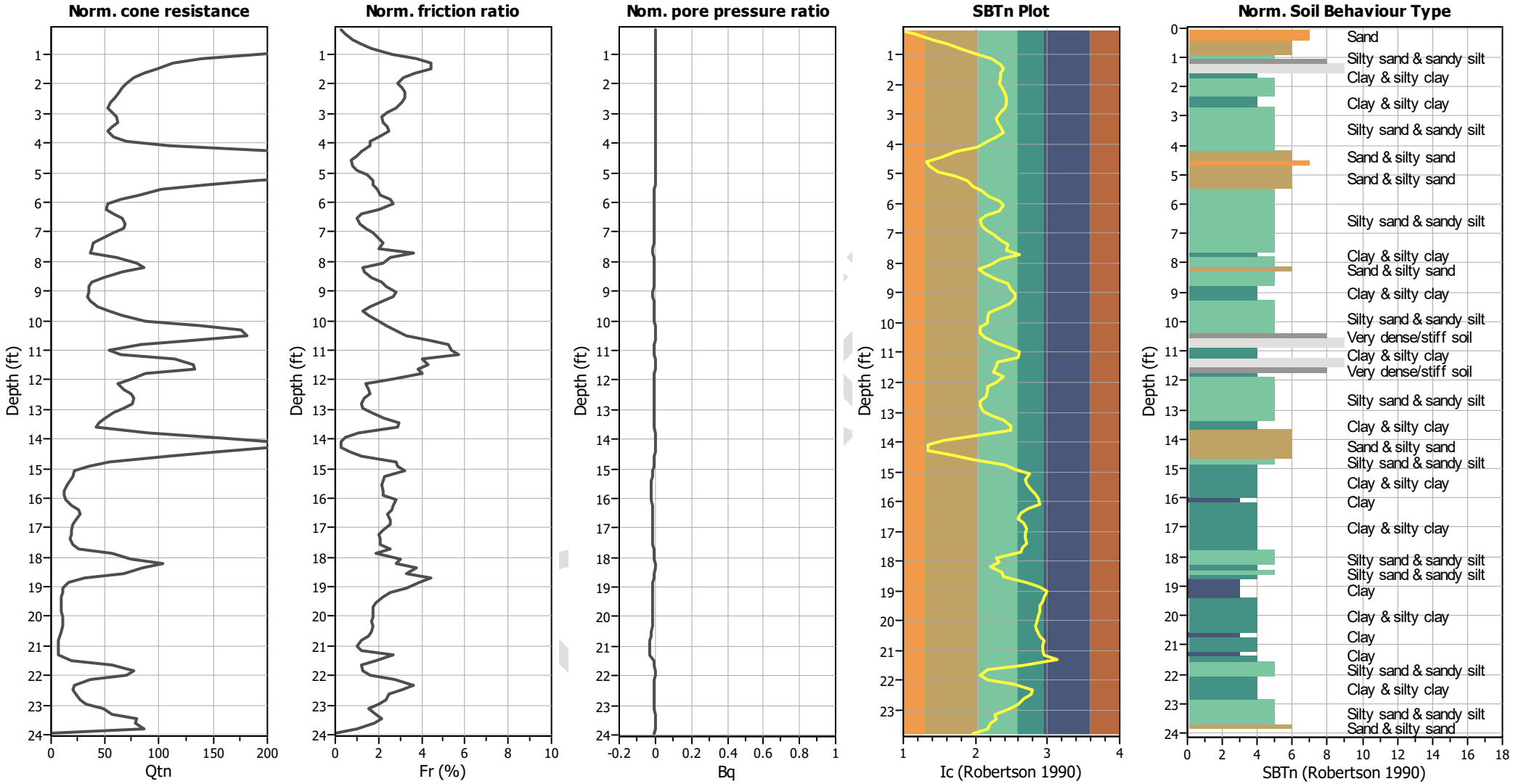
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 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:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.62	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

APPENDIX B

LABORATORY TEST PROGRAM

LABORATORY TESTING PROGRAM

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (Test Method ASTM D 2488). The samples were re-examined in the laboratory and classifications reviewed and then revised where appropriate. The assigned group symbols are presented in the Boring Logs, Appendix A.

In Situ Moisture and Density

Moisture content and unit dry density of in-place soil materials were determined in representative strata. Test data are summarized in the Boring Logs, Appendix A.

Atterberg Limits

Atterberg Limits (Liquid Limit, Plastic Limit, and Plasticity Index) were performed in accordance with Test Method ASTM D-4318. Pertinent test values are presented in Table B-1.

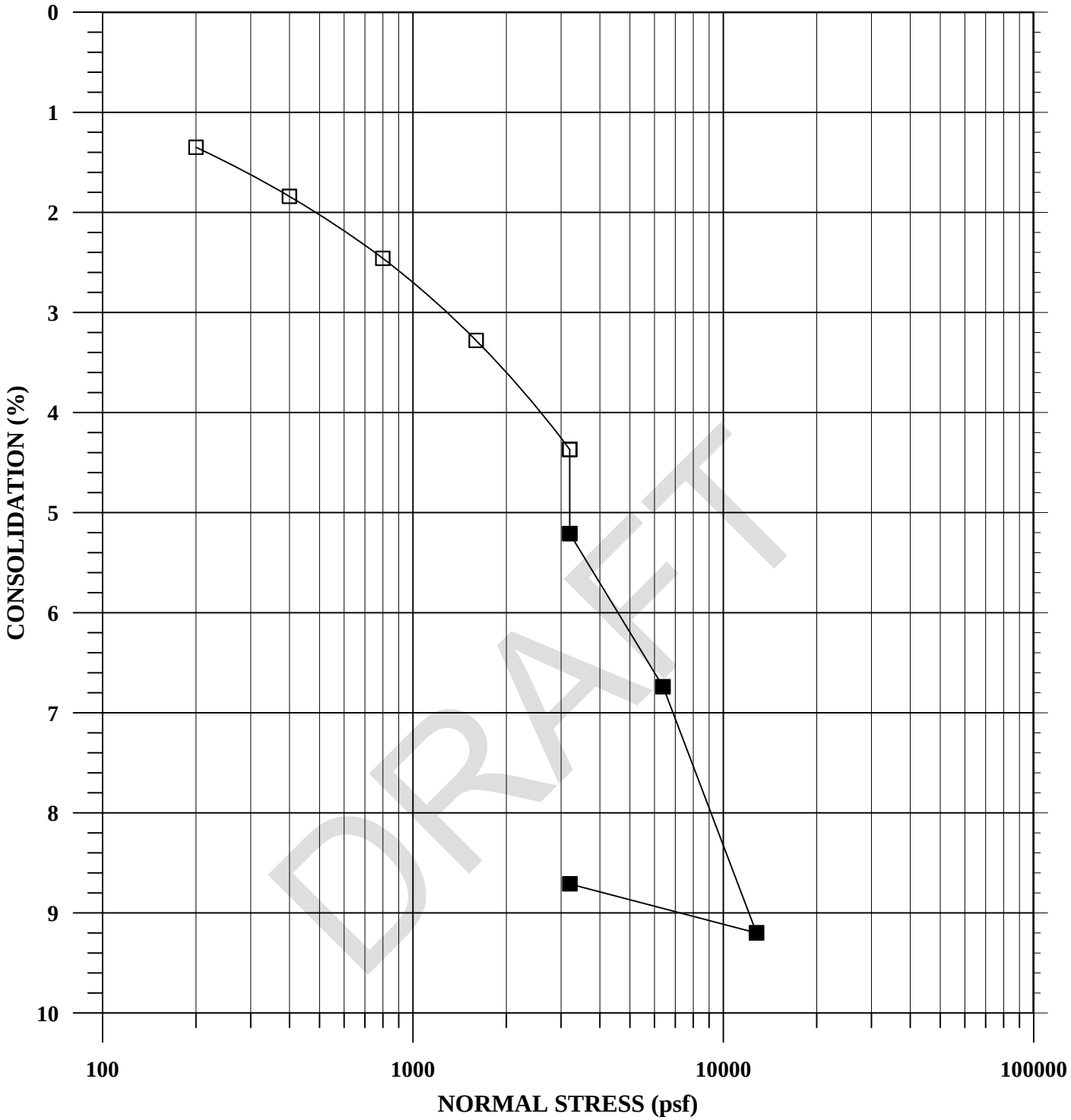
Consolidation

Consolidation Tests were performed in general conformance with Test Method ASTM D 2435. Axial Loads were applied in several increments to a laterally restrained 1-inch-high sample. Loads were applied in geometric progression by doubling the previous load, and the resulting deformations were recorded at selected time intervals. The test samples were inundated at a selected surcharge loading in order to evaluate the effects of a sudden increase in moisture content. Test results are graphically presented on Plates B-1 through B-16 and Plates B-17 through B-20 for the time-rates.

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

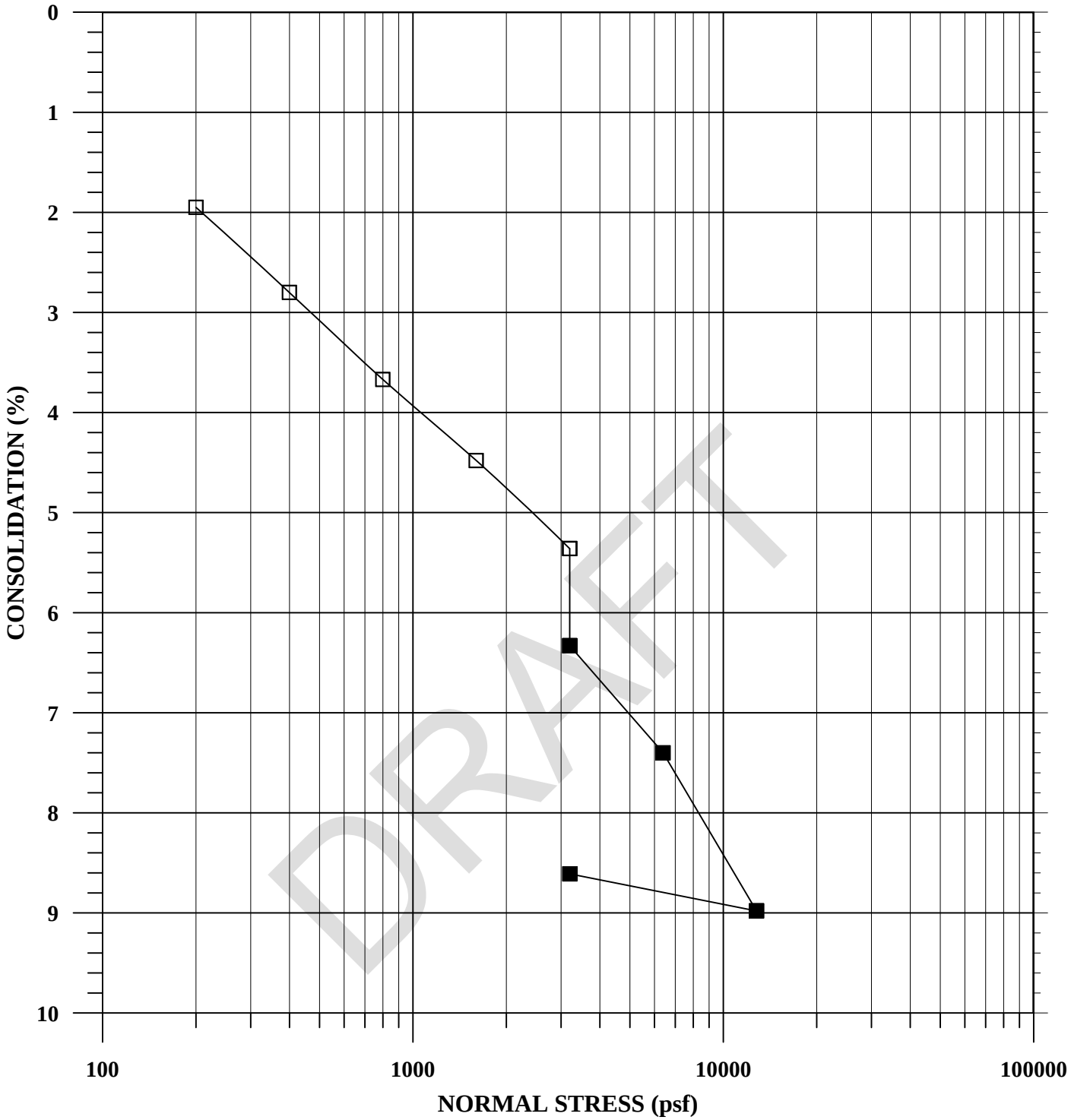
Boring No.	Sample Depth (ft)	Soil Description	Test Results	
B-2	31	Fat Clay (CH)	Liquid Limit: Plasticity Index:	65.0 39.
B-2	40	Sandy Silt (ML)	Liquid Limit: Plasticity Index:	25.0 2.0
B-3	28	Fat Clay (CH)	Liquid Limit: Plasticity Index:	56.0 36.0
B-4	28	Sandy Lean Clay (CL)	Liquid Limit: Plasticity Index:	41.0 23.0
B-4	40	Sandy Lean Clay (CL)	Liquid Limit: Plasticity Index:	25.0 9.0
B-5	31	Sandy Silt (ML)	Liquid Limit: Plasticity Index:	44.0 16.0
B-6	40	Sandy Lean Clay (CL)	Liquid Limit: Plasticity Index:	32.0 17.0
B-7	16	Lean Clay with Sand (CL)	Liquid Limit: Plasticity Index:	35.0 15.0

Note: Additional laboratory test results are provided on the boring logs provided in Appendix A.



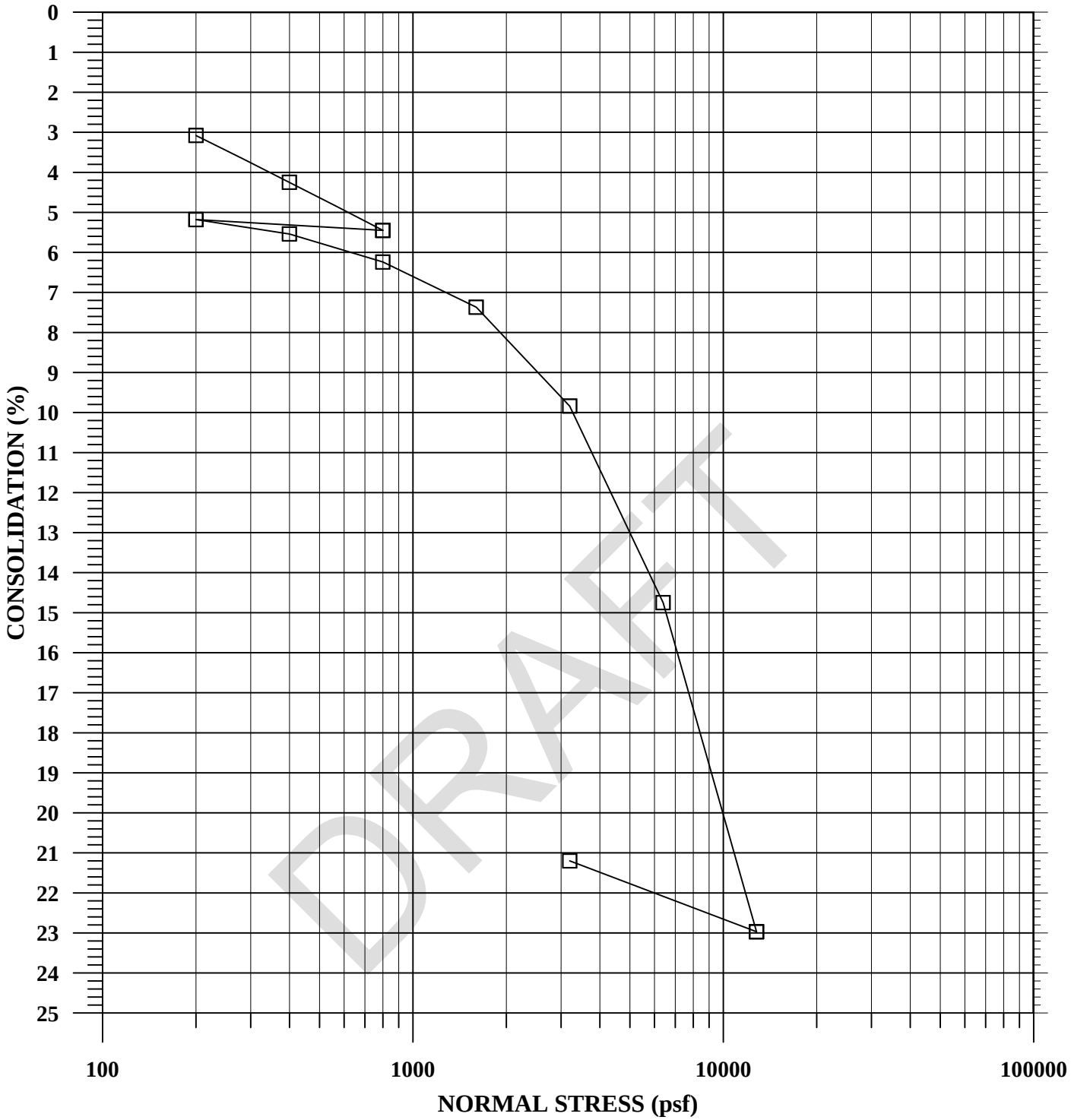
Sample Location:	**B-1**	**Initial Dry Density (pcf):**	**107.5**	**Legend**
Sample Depth:	**15 ft**	**Initial Moisure Content (%):**	**14.6**	□ □ □ Field Moisture ■—■—■ Saturated
Classification:	**SC/CL**	**Final Moisture Content (%):**	**15.8**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00** **Plate No: B-1**



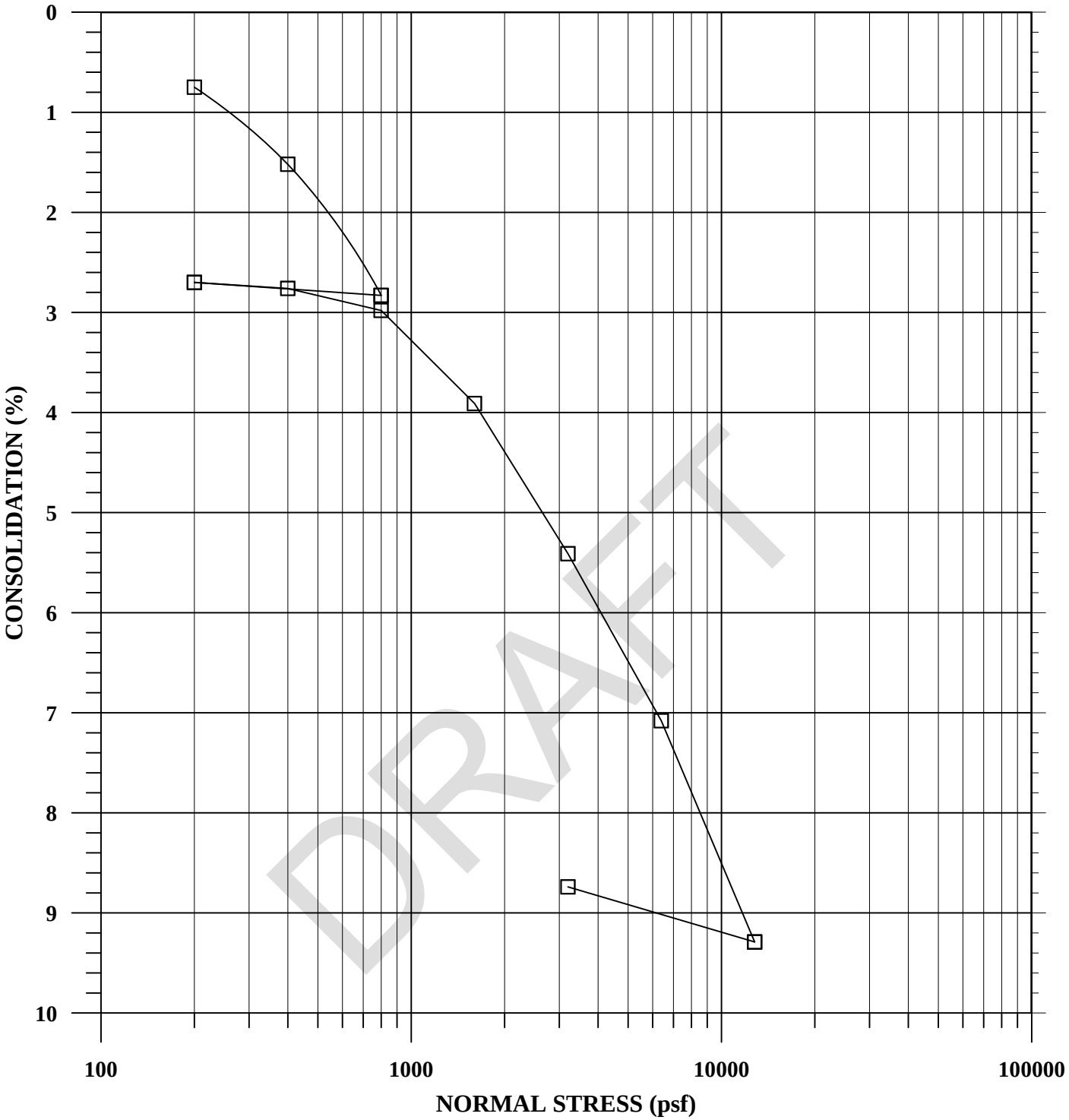
Sample Location:	**B-2**	**Initial Dry Density (pcf):**	**116.4**	**Legend**
Sample Depth:	**15 ft**	**Initial Moisure Content (%):**	**14.1**	□ □ □ Field Moisture ■—■—■ Saturated
Classification:	**CL/SC**	**Final Moisture Content (%):**	**12.4**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00** **Plate No: B-2**



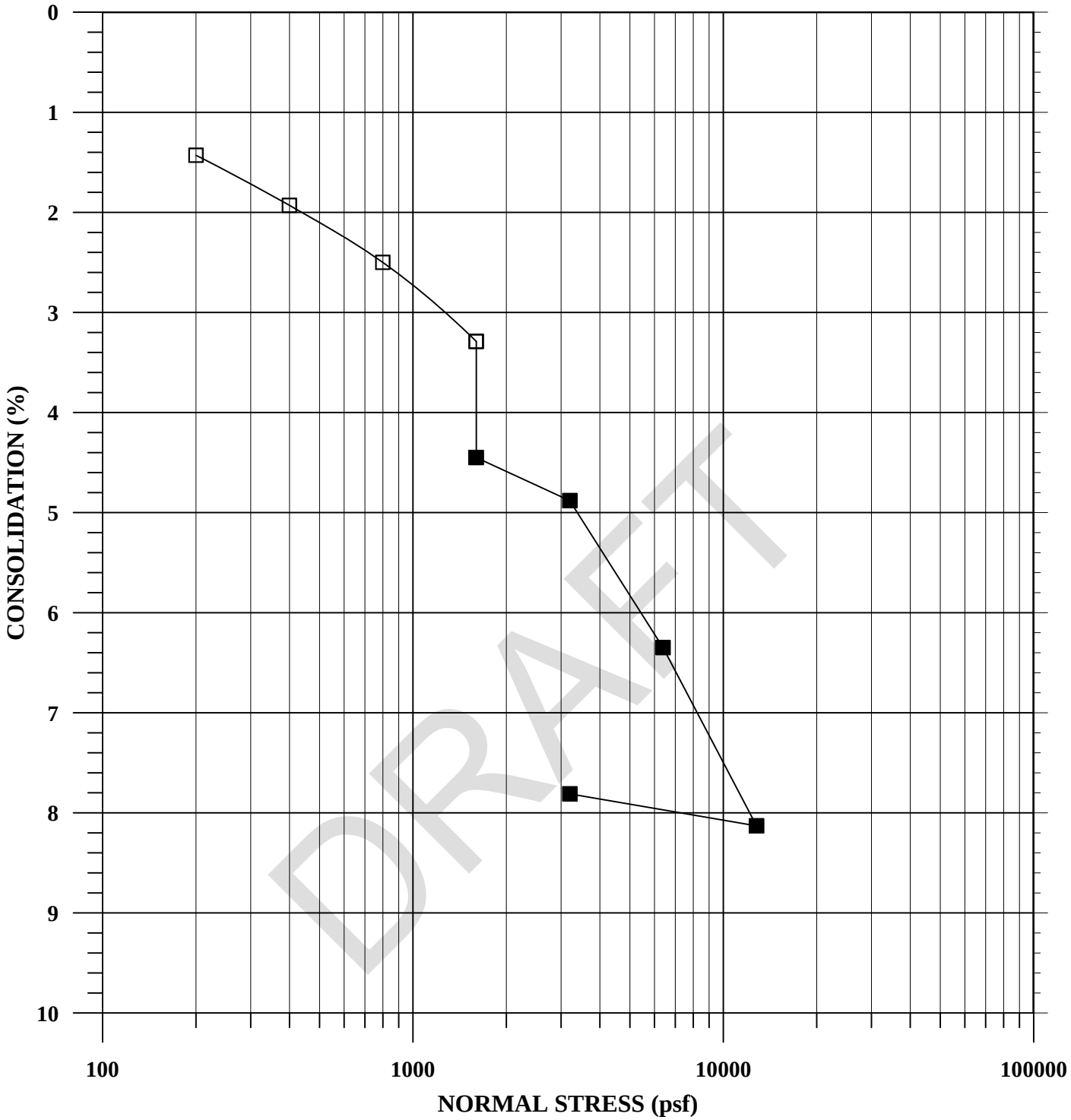
Sample Location:	**B-2**	**Initial Dry Density (pcf):**	**58.7**	**Legend**
Sample Depth:	**31 ft**	**Initial Moisure Content (%):**	**44.4**	□ □ □ **Field Moisture**
Classification:	**CH**	**Final Moisture Content (%):**	**31**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-3



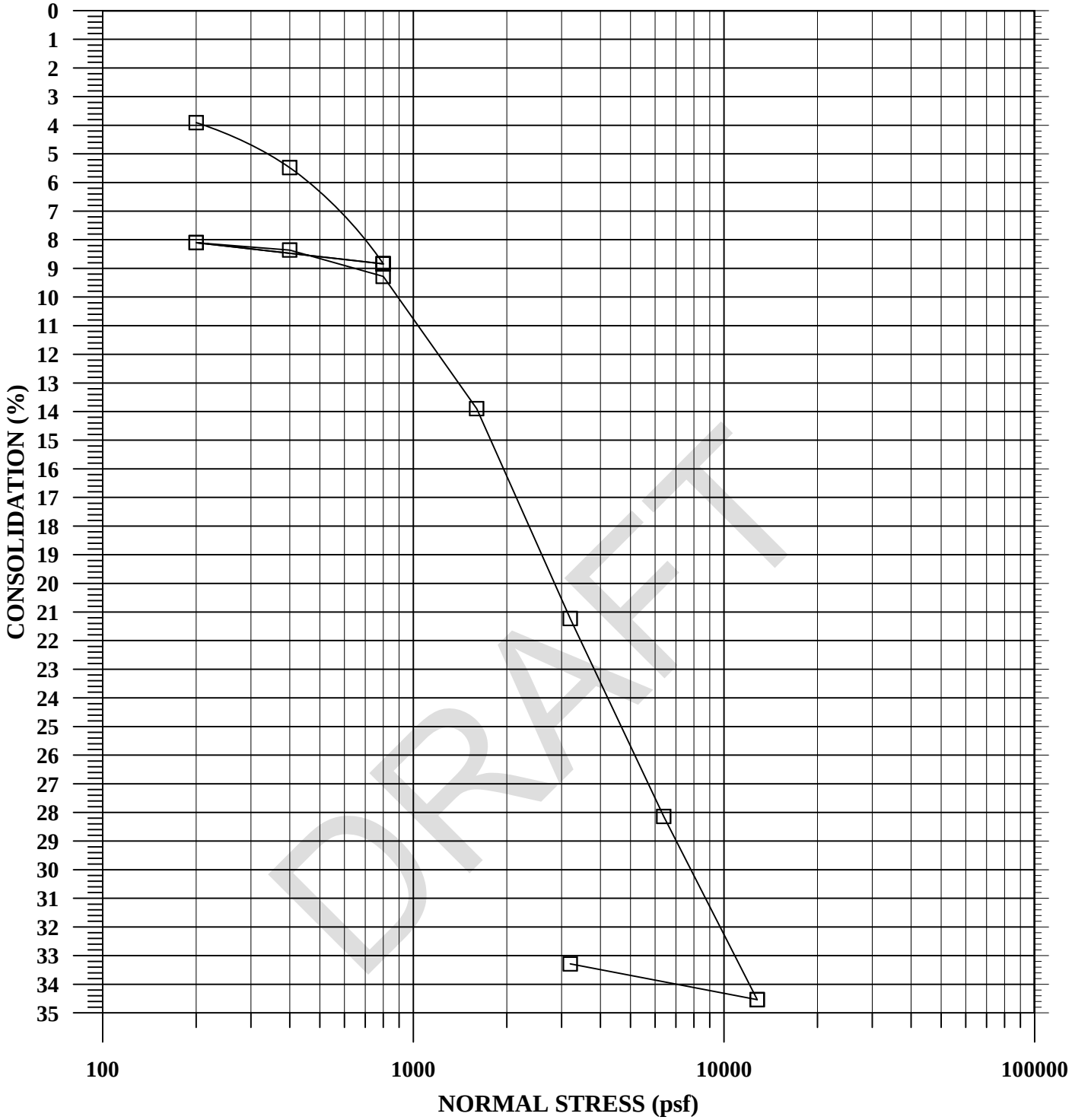
Sample Location:	**B-2**	**Initial Dry Density (pcf):**	**90.9**	**Legend**
Sample Depth:	**40 ft**	**Initial Moisure Content (%):**	**16.1**	□ □ □ **Field Moisture**
Classification:	**ML**	**Final Moisture Content (%):**	**9.8**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-4



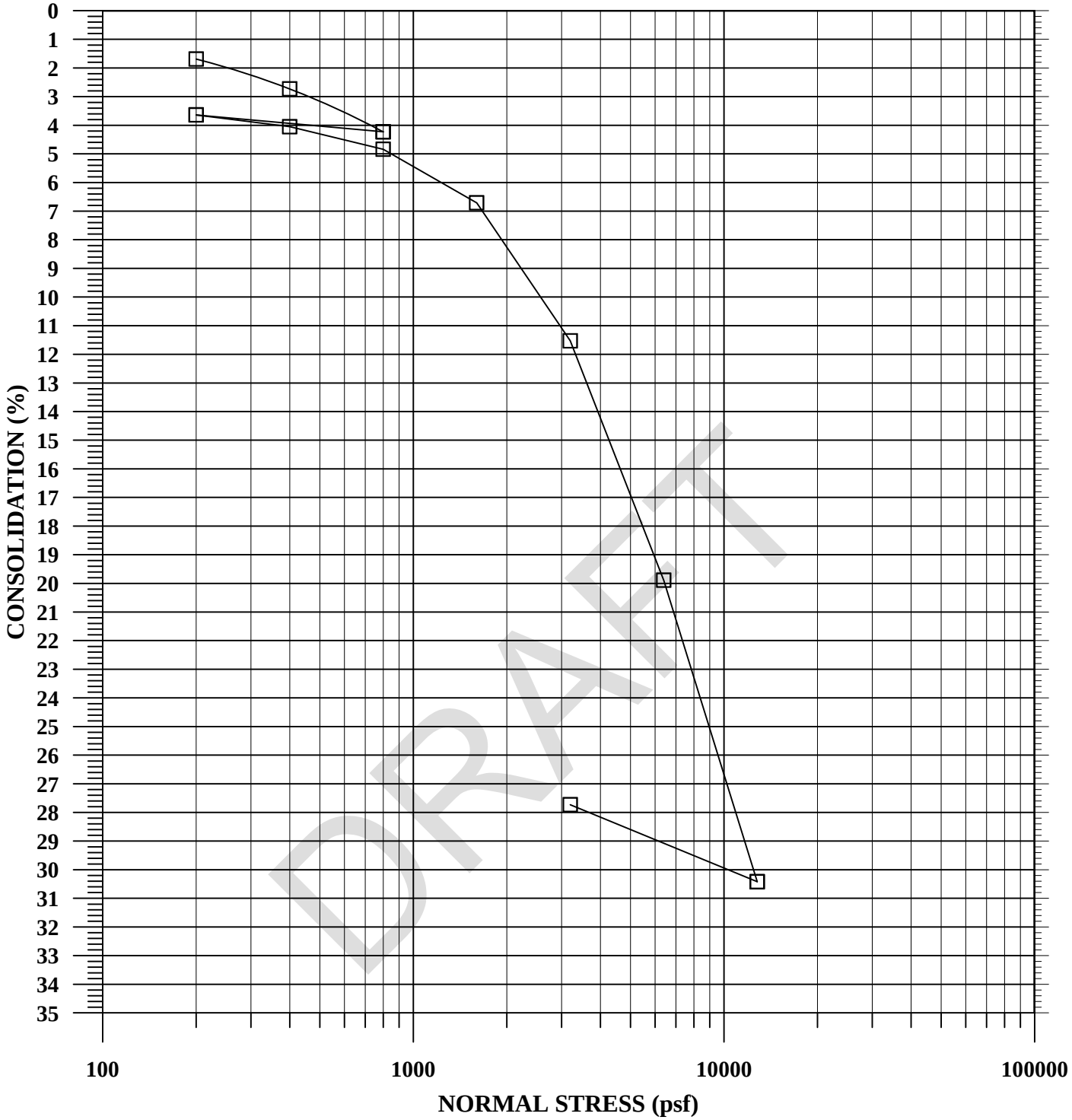
Sample Location:	**B-3**	**Initial Dry Density (pcf):**	**114.6**	**Legend**
Sample Depth:	**20 ft**	**Initial Moisure Content (%):**	**14.2**	□ □ □ Field Moisture ■—■—■ Saturated
Classification:	**SC**	**Final Moisture Content (%):**	**10.3**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00** **Plate No: B-5**



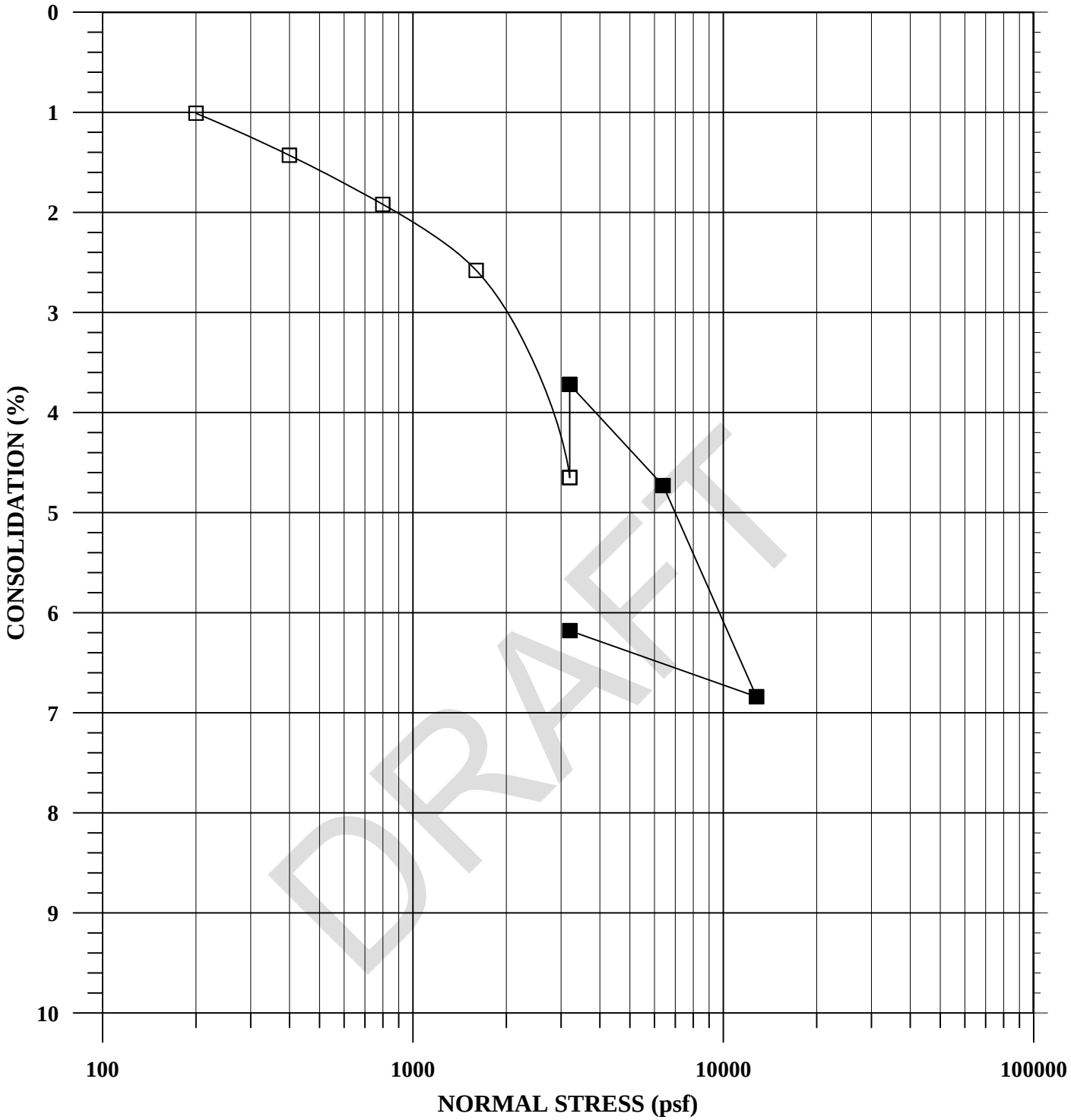
Sample Location:	**B-3**	**Initial Dry Density (pcf):**	**62.1**	**Legend**
Sample Depth:	**28 ft**	**Initial Moisure Content (%):**	**58.3**	□ □ □ **Field Moisture**
Classification:	**CH**	**Final Moisture Content (%):**	**28.4**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-6



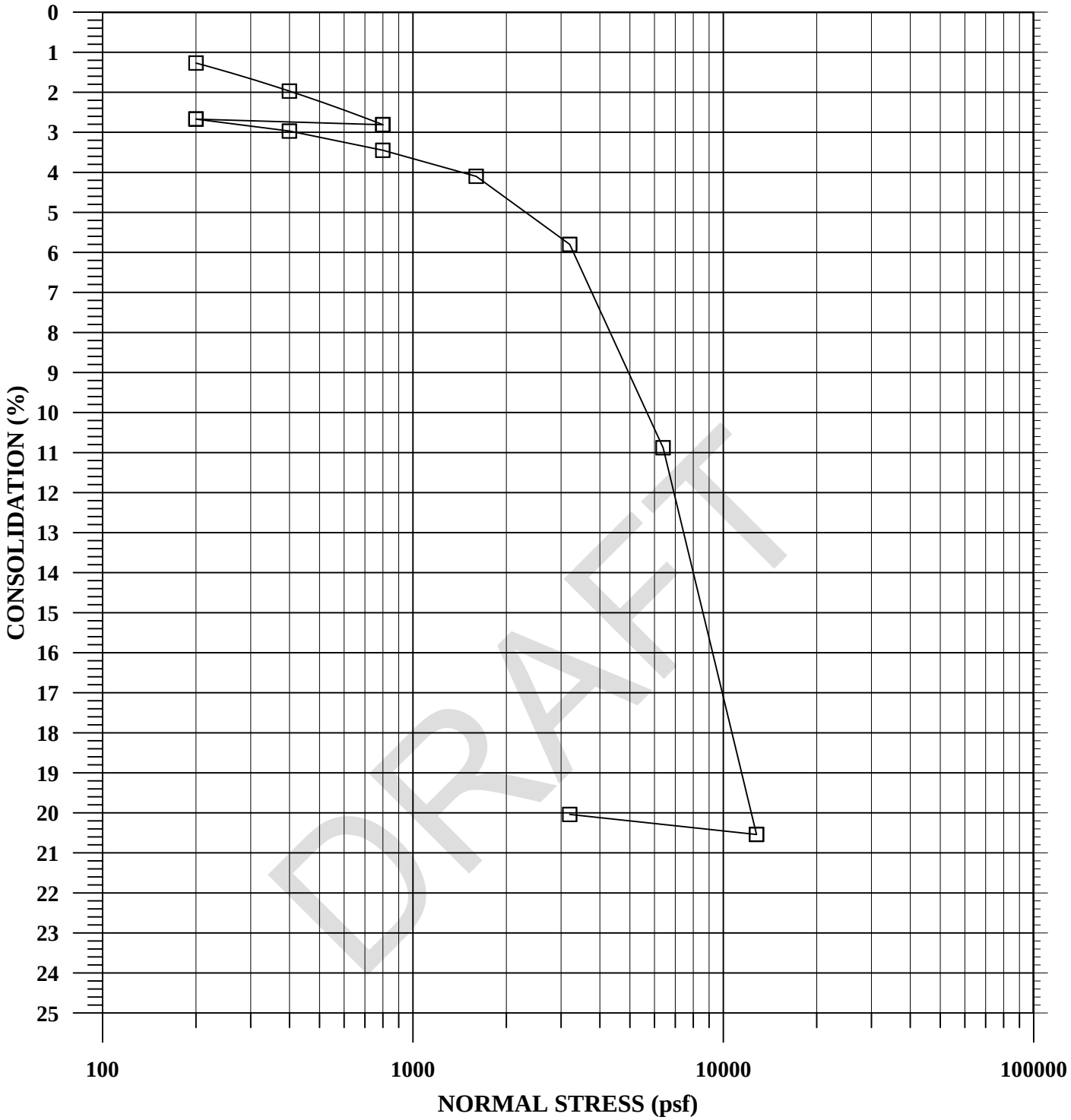
Sample Location:	**B-3**	**Initial Dry Density (pcf):**	**62.7**	**Legend**
Sample Depth:	**35 ft**	**Initial Moisure Content (%):**	**17.3**	□ □ □ **Field Moisture**
Classification:	**SC**	**Final Moisture Content (%):**	**116.9**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-7



Sample Location:	**B-4**	**Initial Dry Density (pcf):**	**99.7**	**Legend**
Sample Depth:	**10 ft**	**Initial Moisure Content (%):**	**24.8**	□ □ □ Field Moisture
Classification:	**CL**	**Final Moisture Content (%):**	**23.8**	■—■—■ Saturated

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-8



Sample Location:	**B-4**	**Initial Dry Density (pcf):**	**77.1**	**Legend**
Sample Depth:	**28 ft**	**Initial Moisure Content (%):**	**43.5**	□ □ □ **Field Moisture**
Classification:	**CL**	**Final Moisture Content (%):**	**30.8**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-9

Albus Keefe # 2501.00

CONSOLIDATION TEST - ASTM D2435

Job No. 2005-011

Boring / Sample No.	B-5	Depth:	20'	Date	11-15-16

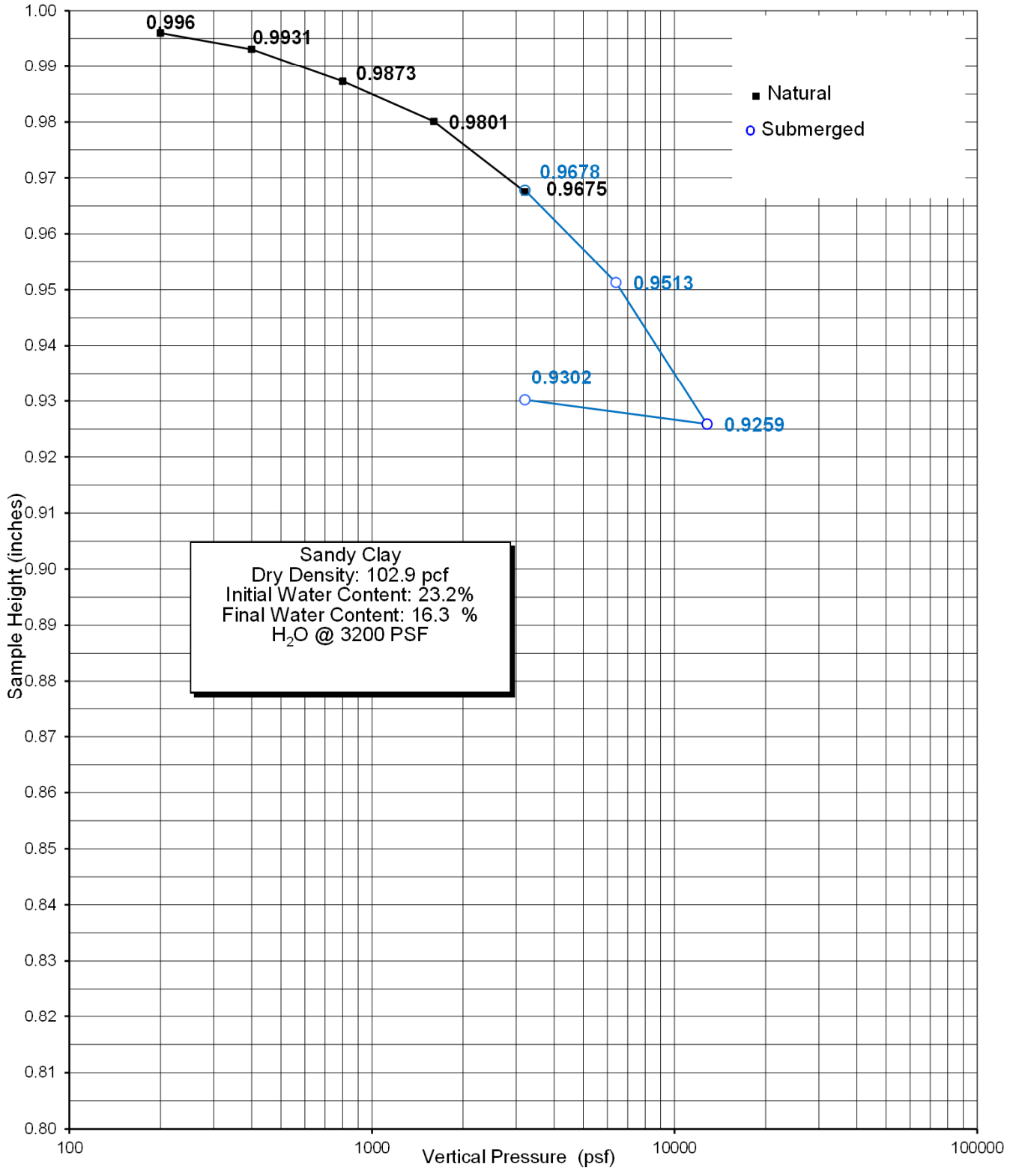
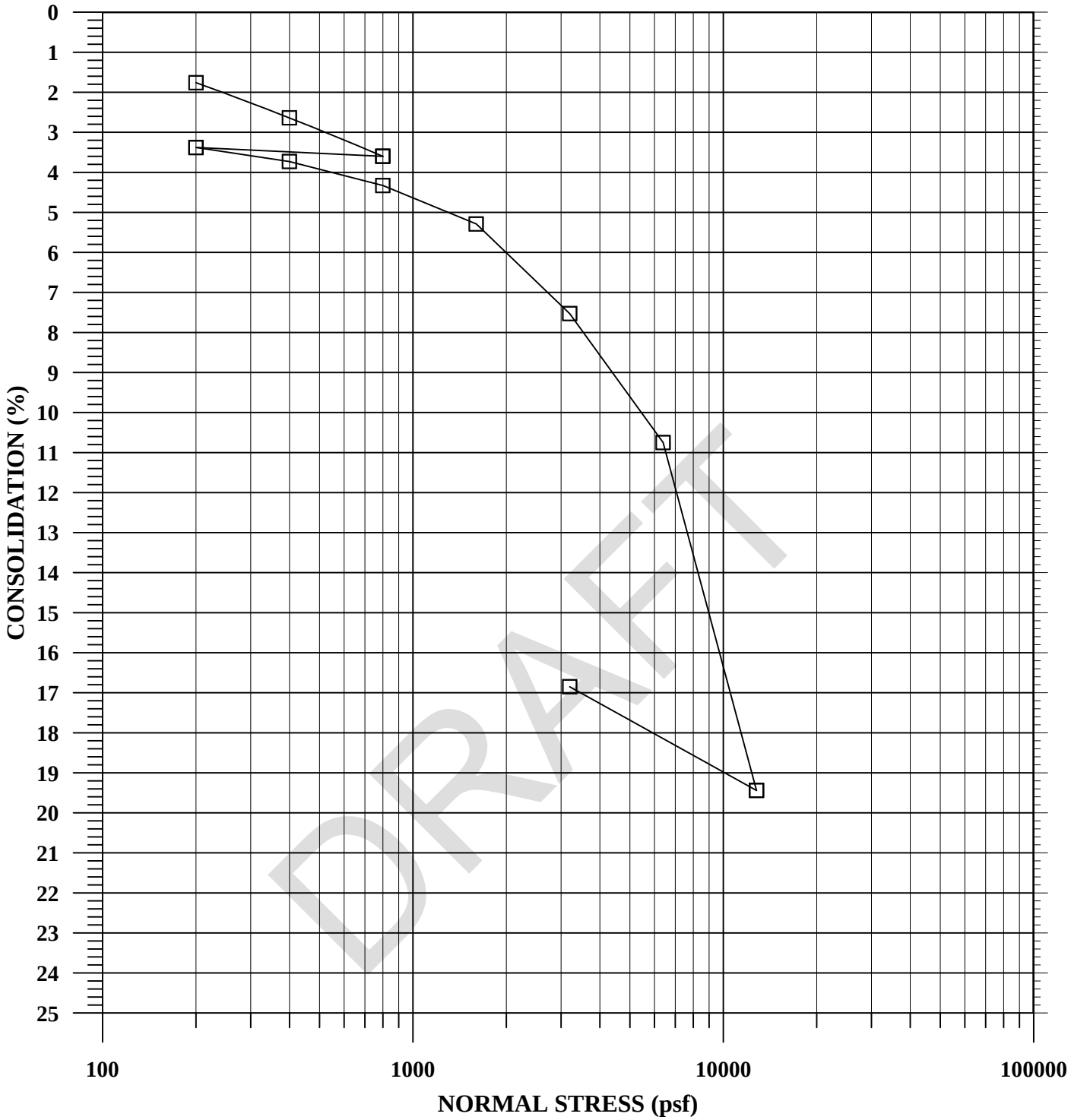


Plate No: B-10

Geo-Logic ASSOCIATES



Sample Location:	**B-5**	**Initial Dry Density (pcf):**	**58.9**	**Legend**
Sample Depth:	**31 ft**	**Initial Moisure Content (%):**	**55.1**	□ □ □ **Field Moisture**
Classification:	**ML**	**Final Moisture Content (%):**	**44.4**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-11

Albus Keefe # 2501.00

CONSOLIDATION TEST - ASTM D2435

Job No. 2005-011

Boring / Sample No.	B-6	Depth:	15'	Date	11-15-16

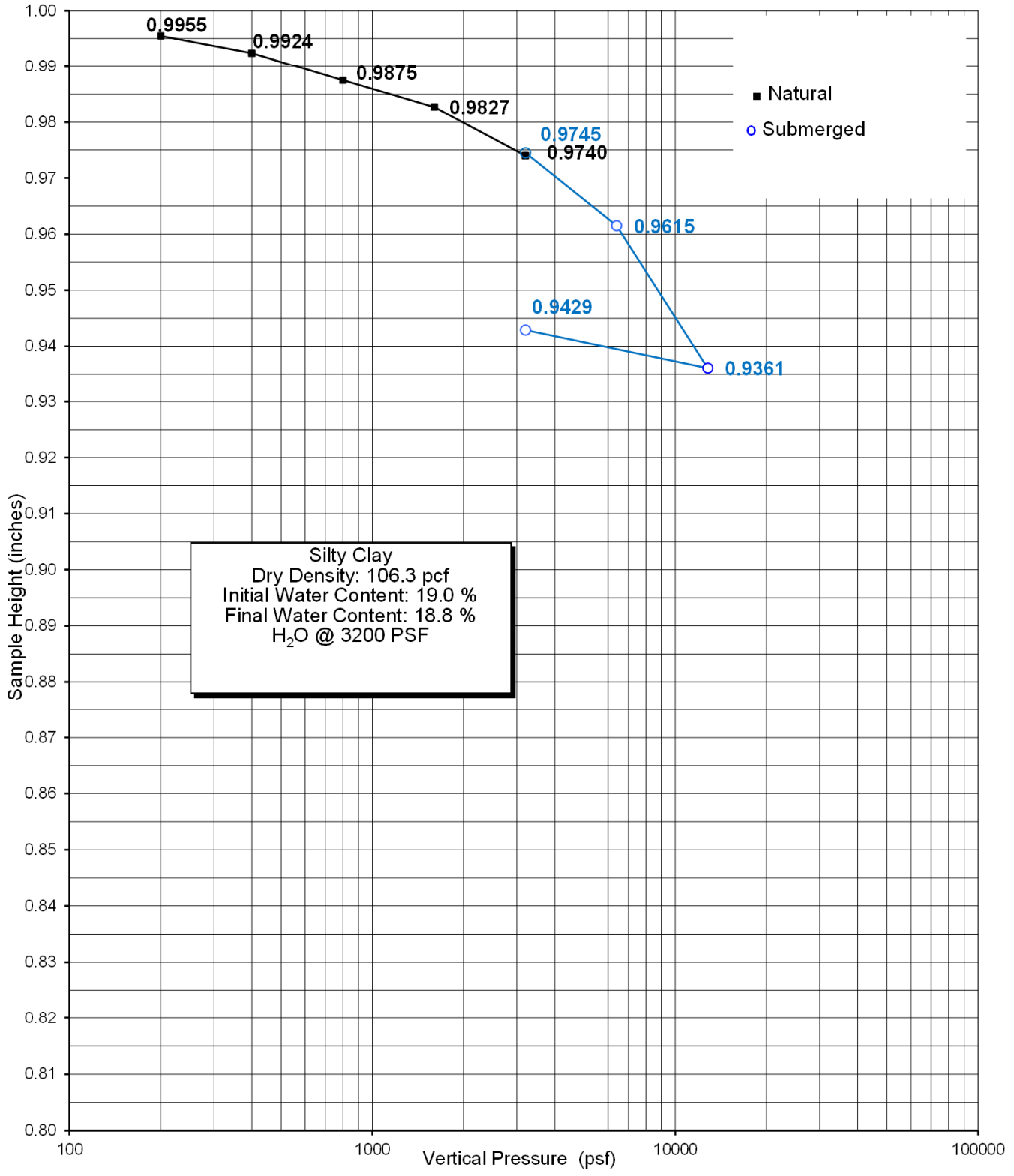
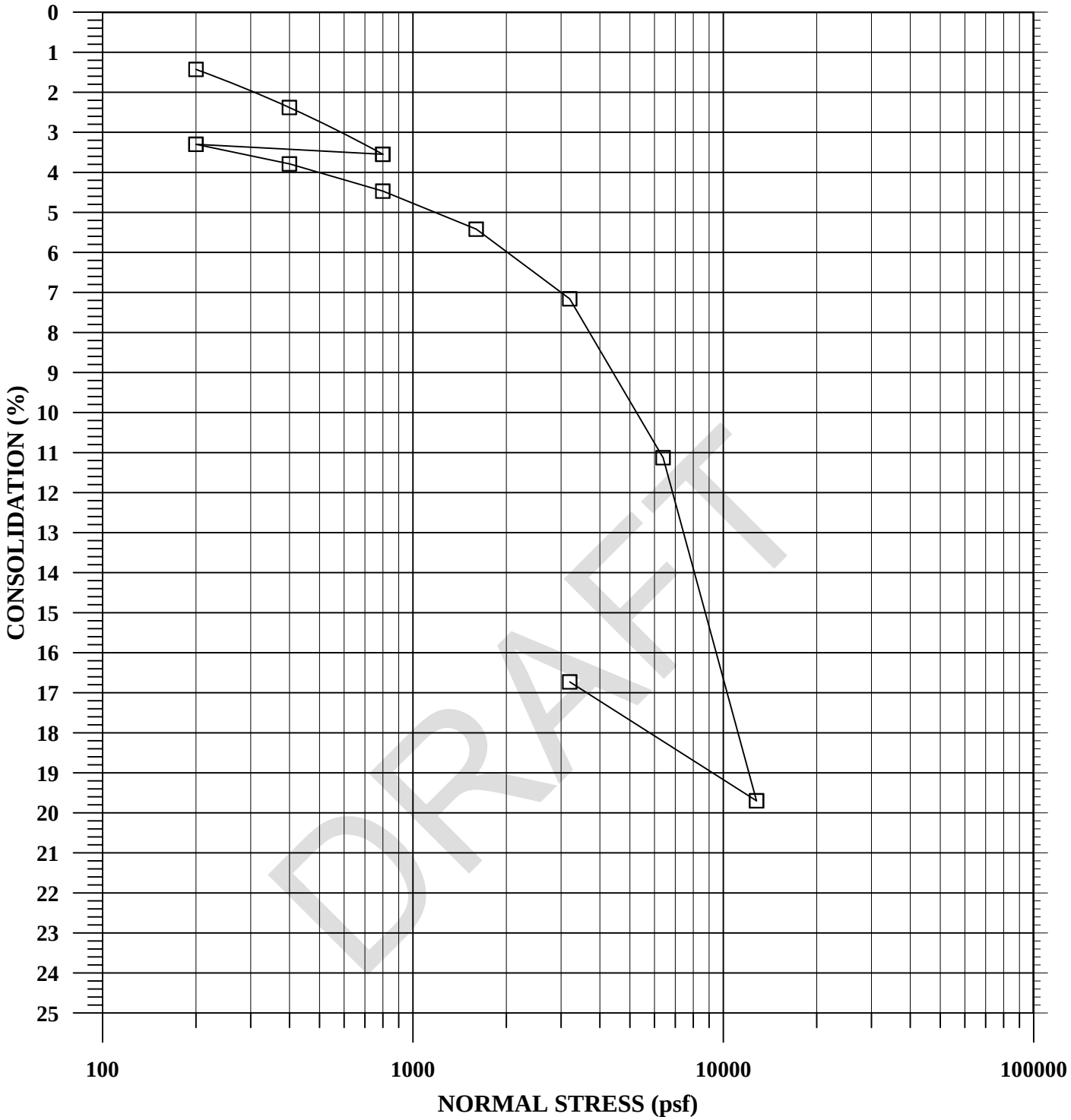


Plate No: B-12

Geo-Logic ASSOCIATES



Sample Location:	**B-6**	**Initial Dry Density (pcf):**	**56.1**	**Legend**
Sample Depth:	**31 ft**	**Initial Moisure Content (%):**	**61.8**	□ □ □ **Field Moisture**
Classification:	**CL**	**Final Moisture Content (%):**	**49.7**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-13

Albus Keefe # 2501.00

CONSOLIDATION TEST - ASTM D2435

Job No. 2005-011

Boring / Sample No.	B-6	Depth:	40'	Date	11-15-16

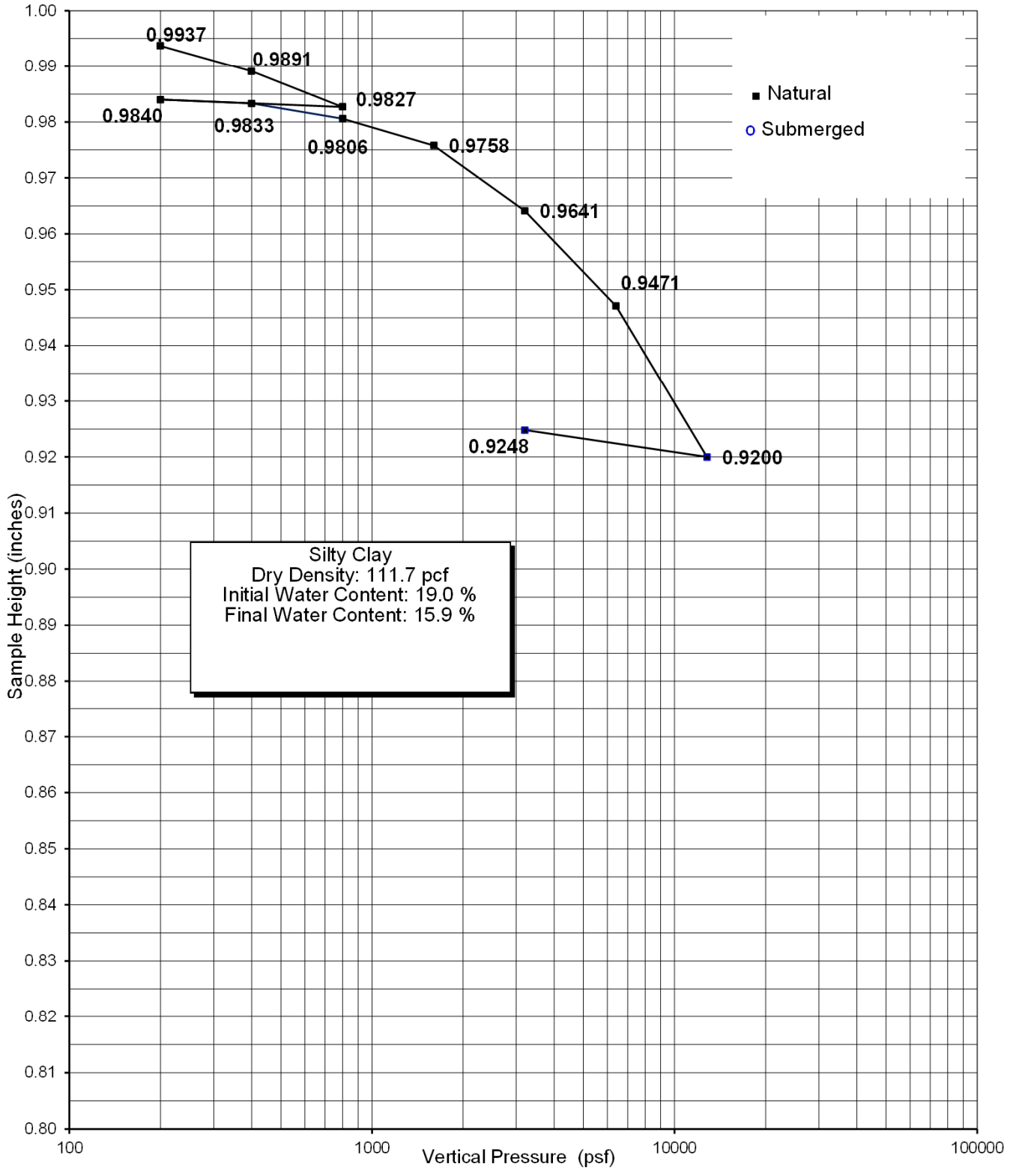


Plate No: B-14

Geo-Logic ASSOCIATES

Albus Keefe # 2501.00

CONSOLIDATION TEST - ASTM D2435

Job No. 2005-011

Boring / Sample No.	B-7	Depth:	10'	Date	11-15-16

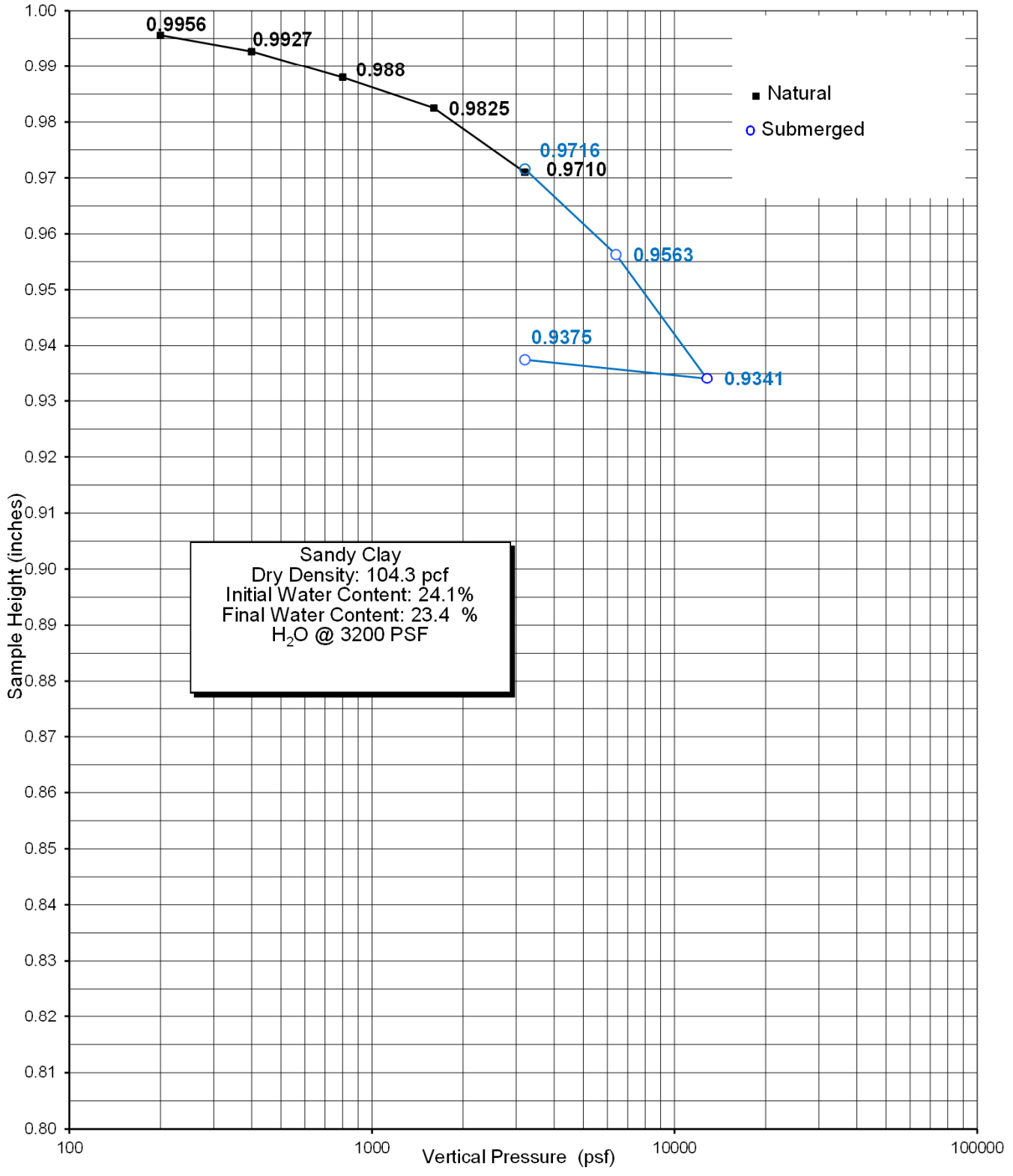
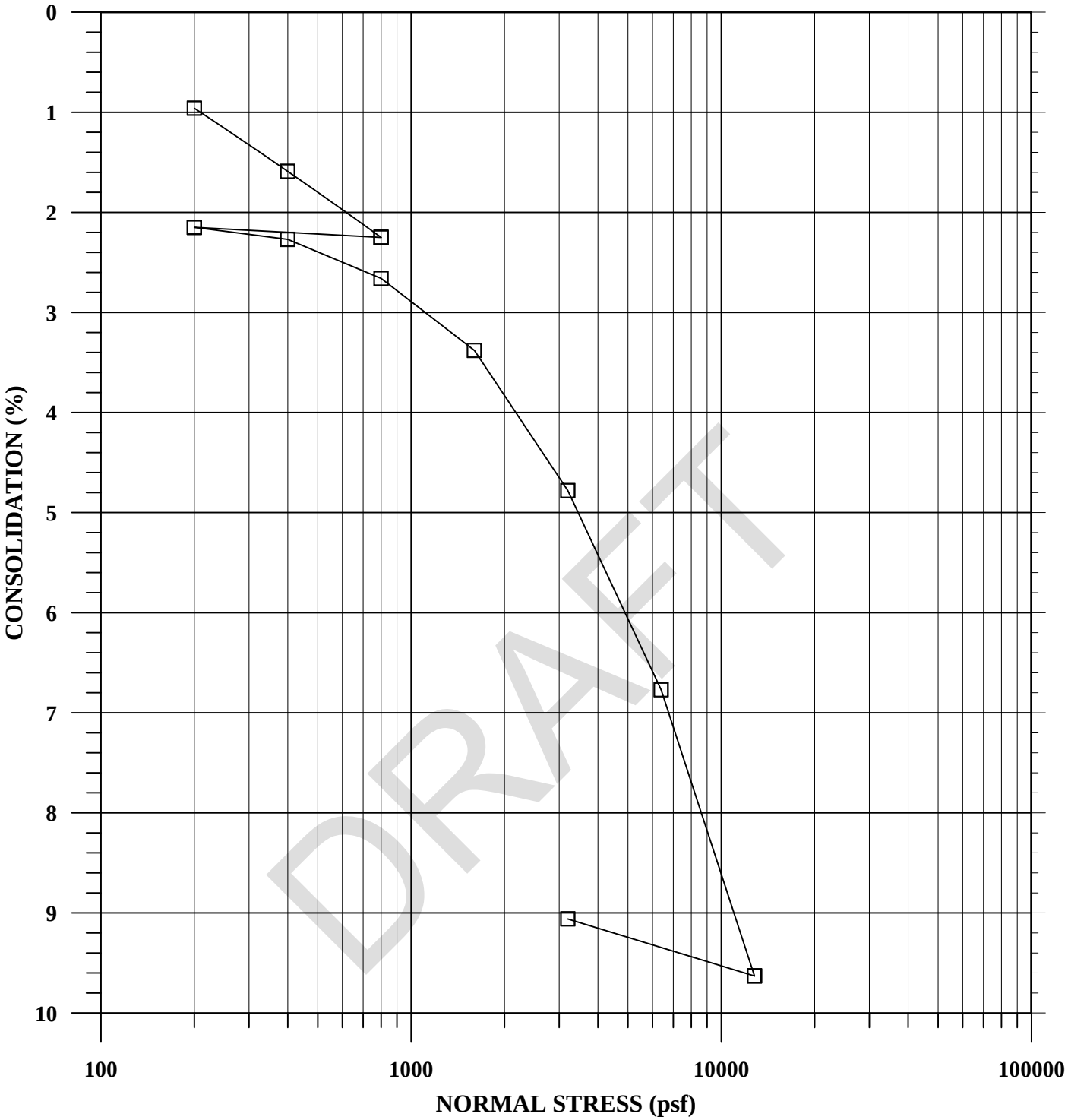


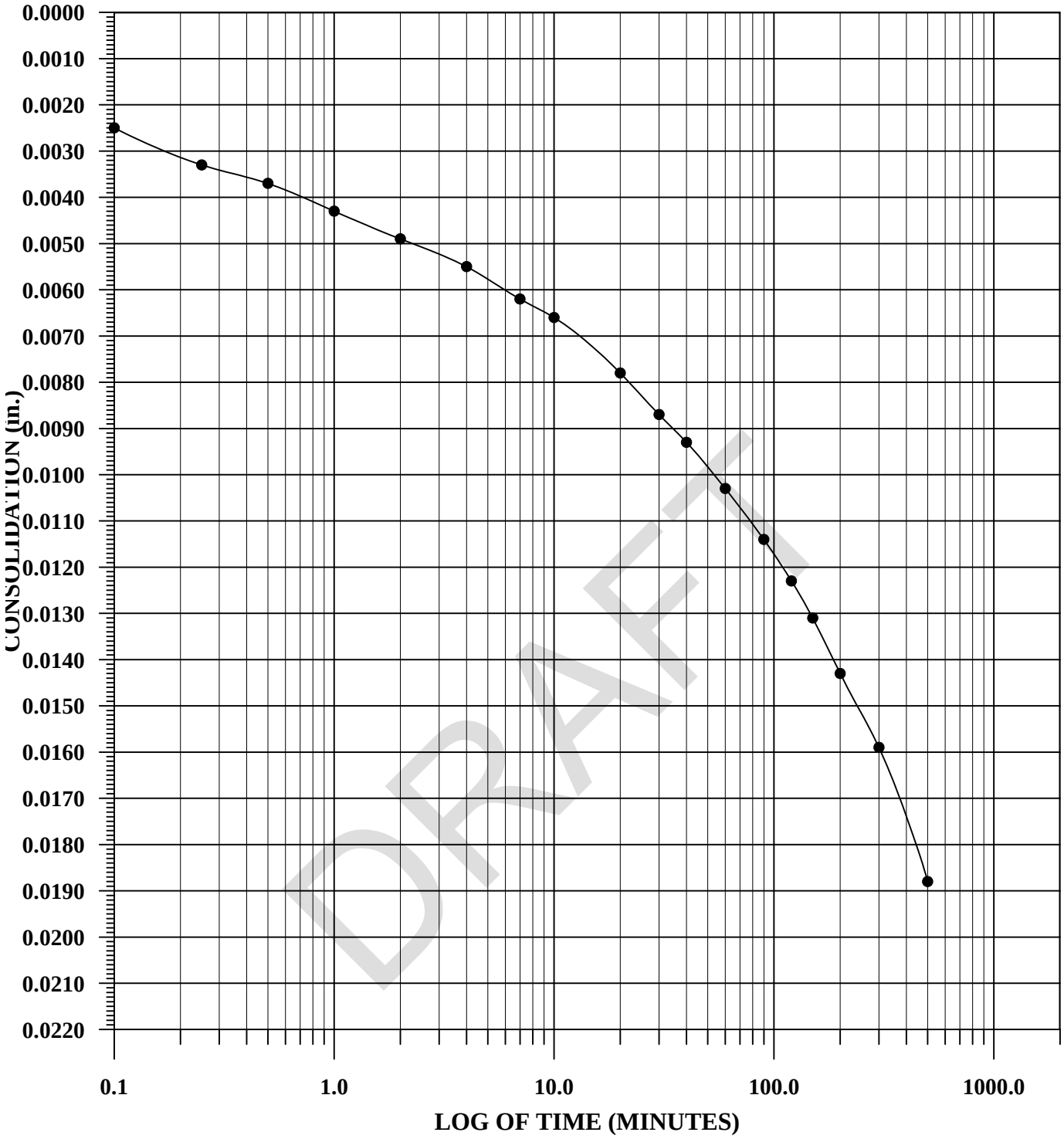
Plate No: B-15

Geo-Logic ASSOCIATES



Sample Location:	**B-7**	**Initial Dry Density (pcf):**	**101.3**	**Legend**
Sample Depth:	**16 ft**	**Initial Moisure Content (%):**	**22.2**	□ □ □ **Field Moisture**
Classification:	**CL**	**Final Moisture Content (%):**	**15.4**	

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION TEST RESULTS**	**Job No: 2501.00**
		Plate No: B-16

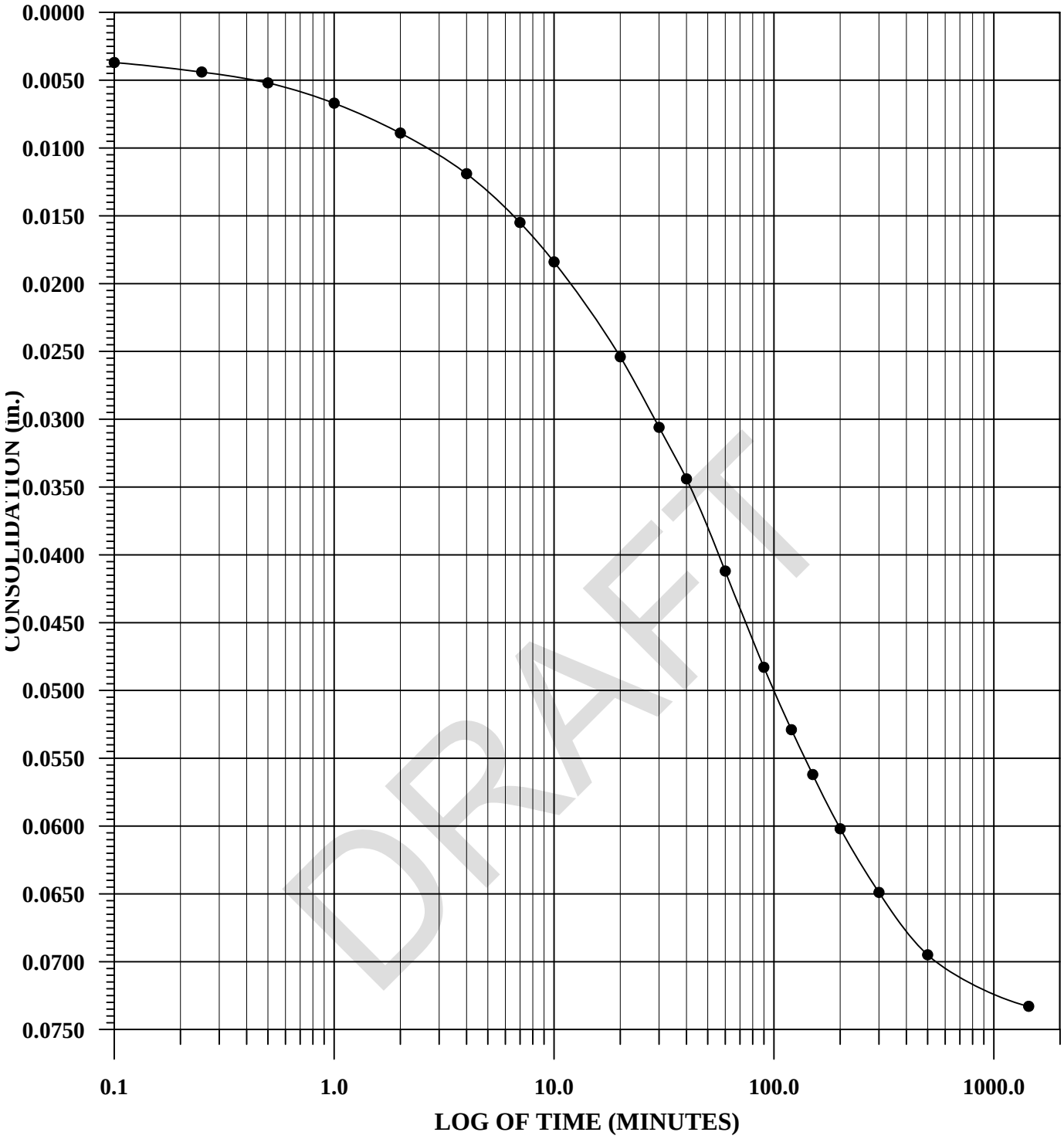


Sample Location:	**B-2**		
Sample Depth:	**31 ft.**	**Time Rate Load (ksf):**	**1.6**
Classification:	**CL**		

Legend

● ● ● **Field Moisture**

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION: TIME RATE TEST RESULTS**	**Job No: 2501.00**
		PLATE: B-17

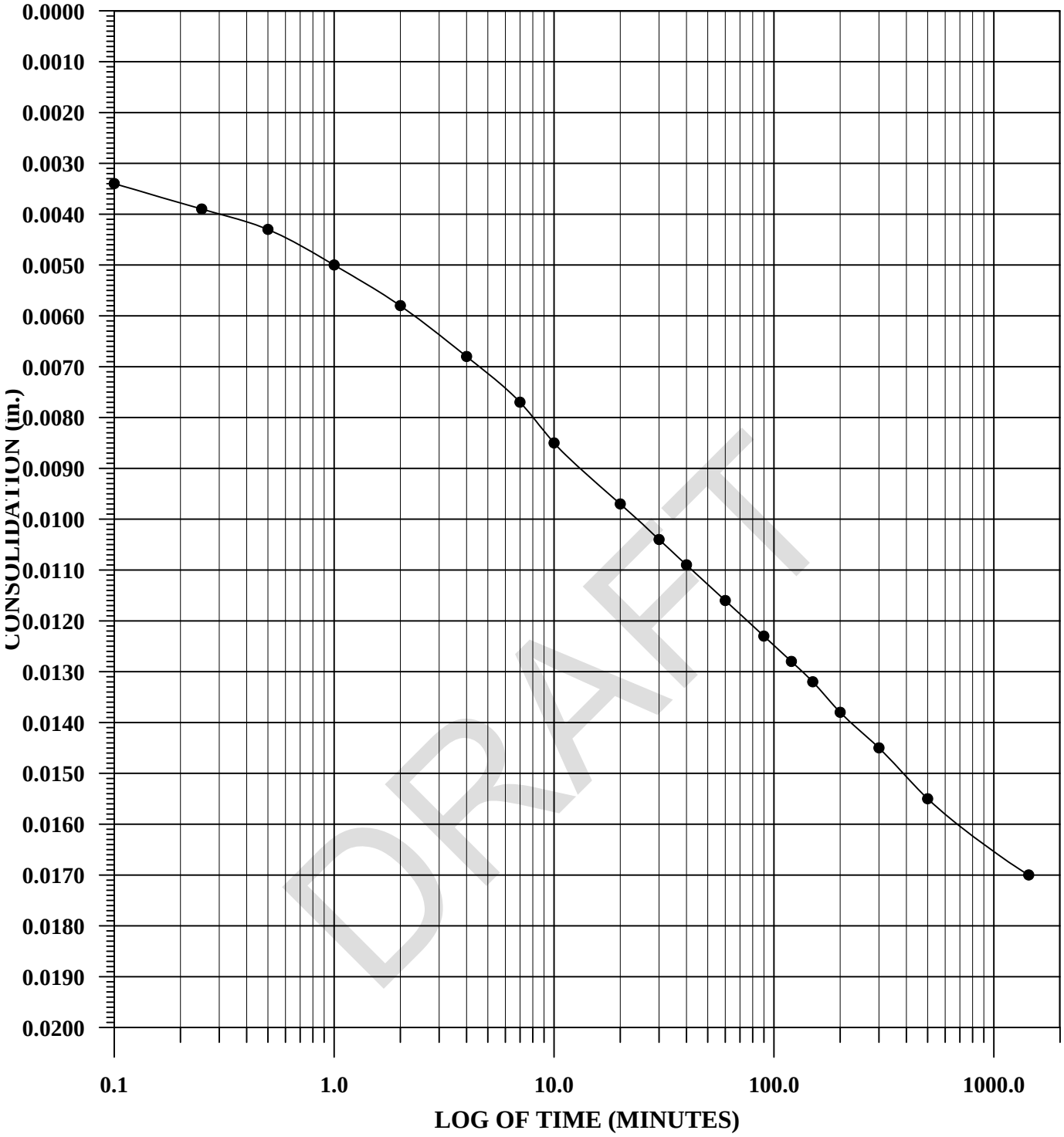


Sample Location:	**B-3**		
Sample Depth:	**28 ft.**	**Time Rate Load (ksf):**	**1.6**
Classification:	**CL**		

Legend

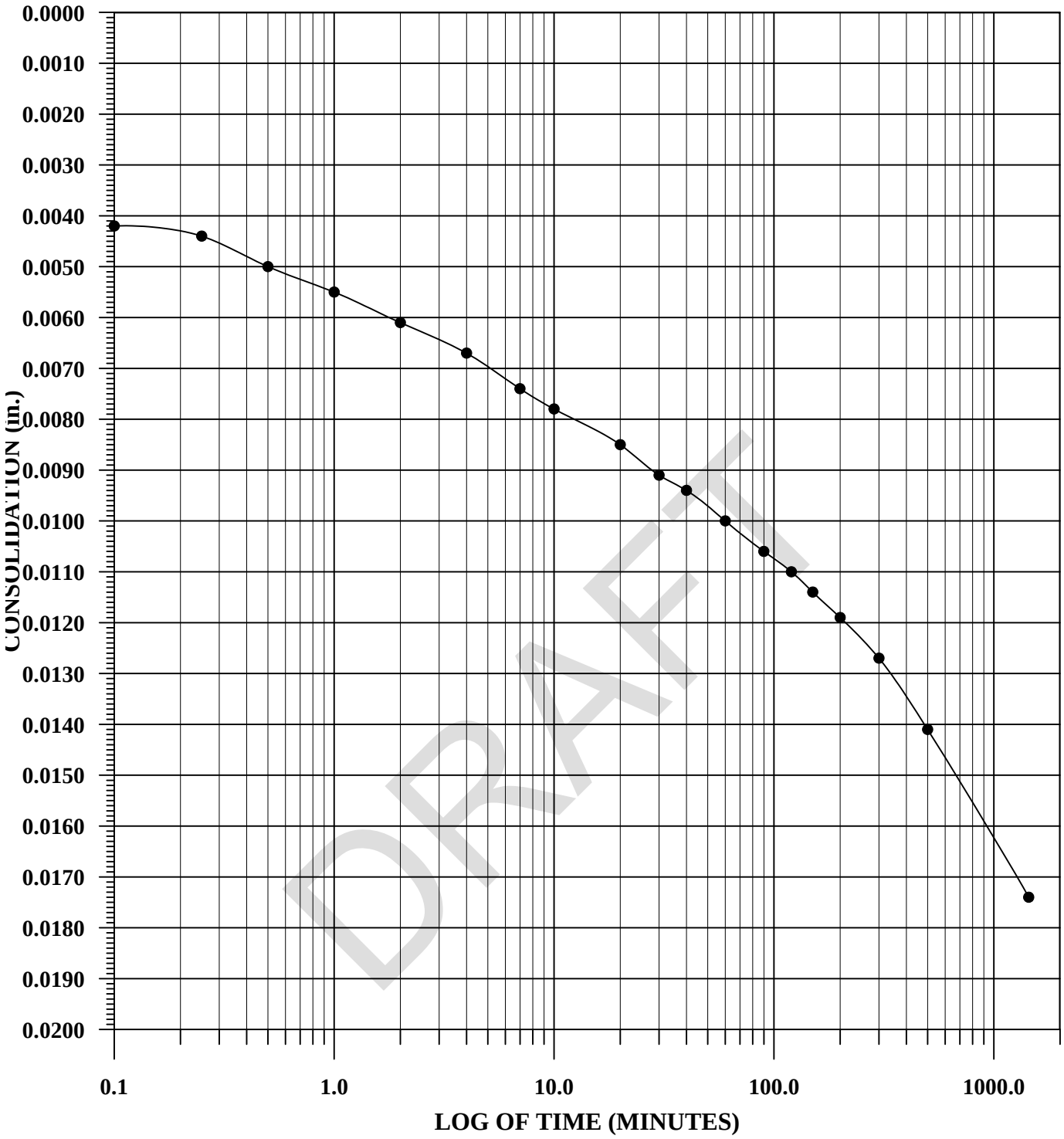
● ● ● **Field Moisture**

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION: TIME RATE TEST RESULTS**	**Job No: 2501.00**
		PLATE: B-18



Sample Location:	**B-4**		
Sample Depth:	**28 ft.**	**Time Rate Load (ksf):** **1.6**	**Legend** ● ● ● **Field Moisture**
Classification:	**CL**		

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION: TIME RATE TEST RESULTS**	**Job No: 2501.00** **PLATE: B-19**



Sample Location:	**B-6**		
Sample Depth:	**31 ft.**	**Time Rate Load (ksf):** **1.6**	**Legend** ● ● ● **Field Moisture**
Classification:	**CL**		

ALBUS-KEEFE & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	**CONSOLIDATION: TIME RATE TEST RESULTS**	**Job No: 2501.00** **PLATE: B-20**

APPENDIX C

Exploration Logs by Others

By

Environmental Science & Engineering, Inc., dated July 13, 1993

LOG OF EXPLORATORY SOIL BORING

A EBLCORP COMPANY

PROJECT NO. 6-92-4598 BORING NO. PL-31
CLIENT: LBRA DATE: 11/13/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: 8' West of concrete sump

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 31.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	9	80	Ring @ 5'	sc		No ring recovery. Resampled with sand catcher. Clayey sand, dark green to black, wet, very loose, free crude oil, strong petroleum hydrocarbon odor, pervasively stained, base of crude @ 5.5'.	
	7	-	Spt	sc		Clayey sand, fine to medium grained, greenish gray, damp, loose, strong petroleum hydrocarbon odor.	
10	24	85	Ring @ 10'	sc		Clayey sand, mottled greenish gray and gray, moist, medium dense, moderate petroleum hydrocarbon odor, scattered pinhole porosity, rootlets.	
15	79	38	Ring @ 15'	sm		Qpu/Qsp Silty sand, fine grained, greenish gray, damp, dense, iron staining, moderate petroleum hydrocarbon odor, micaceous.	
	57	-	Spt	sm/ml		Silty sand, fine grained, greenish gray silt, damp, very dense, abundant iron staining, slight petroleum hydrocarbon odor.	
20	79	9	Ring @ 20'	sm		Silty sand, fine grained, greenish gray, damp, very dense, slight petroleum hydrocarbon odor.	
25	89	5	Ring @ 25'	sm		Silty sand, fine grained, greenish gray, moist, very dense, iron staining, slight petroleum hydrocarbon odor.	
	84	-	Spt	sm		Silty sand, fine to medium grained, greenish gray, moist, very dense, no petrolelum hydrocarbon odor.	
30	100/9	-	Ring @ 30'	sm		Silty sand, fine to medium grained, greenish gray, moist, very dense, no petroleum hydrocarbon odor.	
35						Total Depth: 31.5'	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-82
CLIENT: LBRA DATE: 11/16/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: West of Southwestern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	9	25	Ring @ 5'	sm		Silty sand, fine grained, dark olive, very moist, loose, petroleum hydrocarbon odor.	
10	16	35	Ring @ 10'	sm		Silty sand, fine to medium grained, dark olive, very moist, loose, slight petroleum hydrocarbon odor.	
	16	-	Spt	sm		Silty sand, fine grained, dark olive to black, very moist to wet, petroleum hydrocarbon odor, wood pieces.	
15	60/6"	100	Ring @ 15'	sm		Qpu/Qsp Silty sand, fine grained, black oil stained, very moist, dense, petroleum hydrocarbon odor, oil on outside of rings.	
20	44	14	Ring @ 20'	sp		Sand, fine grained, brown with olive, damp, dense, petroleum hydrocarbon odor, rootlets.	
	54/6"	-	Spt	sp		Sand with silt, fine to medium grained, light and dark olive, damp, dense, slight petroleum hydrocarbon odor.	
25	50/6"	13	Ring @ 25'	sp		Sand with silt, fine to medium grained, olive with gray and light olive, damp, very dense, slight petroleum odor.	
30	77/6"	12	Ring @ 30'	sm		Silty sand, fine grained, light olive-gray and dark olive with brown, damp, very dense, no petroleum hydrocarbon odor.	
	80/6"		Spt	sm		Silty sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor, 5% LEL.	
35	50/9"	13	Ring @ 35'	sm		Silty sand, fine grained, light gray olive, damp, dense, no petroleum hydrocarbon odor. At 36' 10% LEL. At 37' 50% LEL.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A CELCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B2
CLIENT: LBRA | DATE: 11/16/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: West of Southwestern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	90/9"	-	Ring @ 40'	sp		Sand with silt, fine grained, light olive-brown, damp, very dense, slight petroleum hydrocarbon odor.	
45	63	8	Ring @ 45'	sm		Silty sand, fine grained, damp, dense, slight petroleum hydrocarbon odor, 40% LEL.	
						Total Depth: 46.5'	
50							
55							
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B3
CLIENT: LBRA | DATE: 11/16/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: East of Southwestern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	10/6"	0	Ring @ 5'	sm		Silty sand, fine grained, brown.	
10	No Record	13	Ring @ 10'	sm		No ring recovery. Resampled with sand trap, black asphaltic material, wet, visible oil.	
15	26	130	Ring @ 15'	sm		No ring recovery, silty sand, fine grained, brown with black asphalt, very moist to wet, medium dense.	
	11	-	Spt	sm		Qpu/Qsp	
20	53/6"	50	Ring @ 20'	sm		Silty sand, fine grained, gray-olive, damp, loose, petroleum hydrocarbon odor.	
						Silty sand, fine grained, layered light olive gray, olive and gray, damp, medium dense, rootlets.	
25	81/6"	35	Ring @ 25'	sm		Silty sand, fine grained, olive and brown, damp, very dense, no petroleum hydrocarbon odor, 5% LEL.	
	87/6"	-	Spt	sw/sm		Interbedded sand, fine to medium grained, light olive-gray, silty sand, olive and brown, damp, very dense, slight petroleum hydrocarbon odor, 100 % LEL.	
30	50/6"	160	Ring @ 30'			No ring recovery, interbedded sand, fine to medium grained, light olive-gray, silty sand, olive and brown, damp, very dense, slight petroleum hydrocarbon odor.	
35	120/9"	70	Ring @ 35'	sm		Silty sand, fine grained, light olive-gray, damp, very dense, slight petroleum hydrocarbon odor.	
40							

COMMENTS:

Elizabeth A. Robbins

California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B3
CLIENT: LBRA | DATE: 11/16/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: East of Southwestern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	50/6"	60	Ring @ 40'	sm		Silty sand, fine grained, olive, brown, light olive tan, damp, very dense, slight petroleum hydrocarbon odor.	
45	84/10"	30	Ring @ 45'	sm		Silty sand, fine grained, olive, brown, light olive tan, damp, very dense, slight petroleum hydrocarbon odor.	
						Total Depth: 46'	
50						Boring purged with nitrogen at every sample depth between 27.5' and 46'.	
55							
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B4
CLIENT: LBRA DATE: 11/17/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Western portion of property

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 50.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	No Record	-	Ring @ 5'	sc		No ring recovery, sampled on rock, clayey sand, fine to medium grained, dark brown, moist, 0% LEL.	
	37	-	Spt	cl		Silty to sandy clay, fine grained sand, dark brown to black, moist, soft to firm, moderate petroleum hydrocarbon odor, numerous 1/4"-1" rock fragments.	
10	42/8"	22	Ring @ 10'	sc		Clayey sand, fine grained, mottled dark and light gray, moist, firm, moderate petroleum hydrocarbon odor, scattered wood.	
						At 12'-13' hard drilling.	
15	40	10	Ring @ 15'	sc/cl		Clayey sand and sandy clay, black, very wet, loose to medium dense, moderate petroleum hydrocarbon odor, scattered 1/4"-1" rock fragments, 0% LEL.	
	22		Spt				
20	29/9"	90	Ring @ 20'	cl		Sandy clay, fine to medium grained, dark gray, firm, wood fragments.	
						Qpu/Qsp	
25	48	154	Ring @ 25'	sc		Sandy clay, black, wet, medium dense, strong petroleum hydrocarbon odor, visible oil staining, possible sump debris, 0% LEL.	
30	33	40	Ring @ 30'	sc		Clayey sand, fine grained, dark gray, wet, medium dense, moderate petroleum hydrocarbon odor, rootlets.	
	26	-	Spt	sc		Clayey sand, dark gray, moist, dense, strong petroleum hydrocarbon odor.	
35	53/6"	28	Ring @ 35'	sc		Clayey sand, dark gray, moist, dense, strong petroleum hydrocarbon odor, scattered rootlets.	
40							

COMMENTS:

Elizabeth A. Rosario
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CH2M HILL COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B4
CLIENT: LBRA | DATE: 11/17/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Western portion of property

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 50.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	62/6"	24	Ring @ 40'	sc		Clayey sand, olive gray, moist, very dense, slight petroleum hydrocarbon odor, numerous rootlets.	
	86/6"	-	Spl	sp		Sand, fine grained, gray, damp, very dense, slight petroleum hydrocarbon odor, scattered rootlets and 1/4" rock fragments, 0% LEL.	
45	89/10"	9	Ring @ 45'	sc/sm		Clayey to silty sand, gray, damp, very dense, iron staining, no petroleum hydrocarbon odor, scattered rootlets.	
50	100/8"	-	Ring @ 50'	sp		Sand, fine grained, gray, dry to damp, very hard, iron staining, no hydrocarbon odor, shell fragments.	
						Total Depth: 50.5'	
55							
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins

California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B5
CLIENT: LBRA | DATE: 11/17/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS | PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Western portion of property

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 36.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	26	18	Ring @ 5'	cl		No ring recovery, clay, mottled grayish brown and gray, soft, numerous 1/4"-1/2" rock fragments, black grease, no petroleum hydrocarbon odor.	
	9		Spt	sc		Clayey sand, black, moist, loose, coal fragments in tip, abundant tar staining, moderate petroleum hydrocarbon odor, 0% LEL.	
10	48	22	Ring @ 10'			Coal, coal tar, no soil.	
15	27	29	Ring @ 15'			Coal, possibly burned, vesicular inclusions.	
20	28	6	Ring @ 20'	sm		Silty sand, fine grained, gray, wet, loose to medium dense, scattered rootlets, slight petroleum hydrocarbon odor.	
	23	-	Spt			Qpu/Qsp	
25	39	6	Ring @ 25'	cl/sc		Sandy clay and clayey sand, fine grained, gray to black, moist, fine to medium dense, moderate petroleum hydrocarbon odor.	
						Sandy clay, bluish gray, wet, stiff, numerous rootlets, no petroleum hydrocarbon odor.	
30	80/10"	90	Ring @ 30'	sm		Silty sand, dark gray, moist, very dense, numerous shell fragments, no petroleum hydrocarbon odor.	
	65	-	Spt			Silty sand, gray to olive gray, moist, hard, scattered iron staining, no petroleum hydrocarbon odor.	
35	80/9"	10	Ring @ 35'	sp/sm		Sand, medium grained, silty sand, fine grained, gray, moist, hard, no petroleum hydrocarbon odor.	
						Total Depth: 36.5'	
40							

COMMENTS:

Elizabeth A. Robbins

California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A CIL-CORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B6
CLIENT: LBRA | DATE: 11/17/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS | PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Former Boiler Location

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 26
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL Hard drilling from 1'-3'.	
5						Red sand, possible brick, no sample.	
	45	-	spt	sp		Qpu/Qsp Sand, fine grained, reddish orange to yellow, dry, dense, pervasively stained red, iron staining, 0% LEL.	
10	77/6"	-	Ring @ 10'	sm		Silty sand, fine grained, yellow, dry, hard, abundant red iron staining, (color change from red to yellow in sampler).	
15	50/6"	0	Ring @ 15'	sp		Sand, fine grained, yellow, moist, hard.	
	82/6"	-	Spt	sp		Sand, fine grained, mottled gray, tan and orangish red, moist, hard, abundant red iron staining.	
20	50/6"	0	Ring @ 20'	sm		Silty sand, mottled gray and orangish red, abundant red iron staining.	
25	50/6"	-	Ring @ 25'	sm		No ring recovery, silty sand, brown, moist, very dense.	
						Total Depth: 26'	
30							
35							
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CALCOMP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-87
CLIENT: LBRA DATE: 11/17/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS/MRS PAGE: 1 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Adjacent Northern Compressor Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 95
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
						Qpu/Qsp	
5	75/6"	172	Ring @ 5'	sm		Silty sand, gray, moist, dense, scattered iron staining, strong petroleum hydrocarbon odor.	
	42		Spt	sm		Silty sand, gray, moist, very damp, crude bedding, strong petroleum hydrocarbon odor.	
10	64/6"	44	Ring @ 10'	sp		Sand, fine grained, gray, moist, very dense, scattered iron staining, strong petroleum hydrocarbon odor.	
15	73/9"	66	Ring @ 15'	sp		Sand, fine grained, olive gray to gray, moist, hard, moderate petroleum hydrocarbon odor, 0% LEL.	
	77		Spt	sp		Sand, fine grained, olive brown to olive gray, moist, hard, moderate petroleum hydrocarbon odor.	
20	66/6"	54	Ring @ 20'	sm		Silty sand, fine grained, olive brown, damp, hard, scattered carbonate stringers.	
25	50/5"	38	Ring @ 25'	sm		Silty sand, gray to olive brown, moist, hard, slight vegetable odor (carrots or cabbage).	
30	40		Ring @ 30'	sm		No ring recovery, silty sand, fine grained, gray, damp, dense, scattered iron staining, no petroleum hydrocarbon odor, 0% LEL.	
35	50/6"	28	Ring @ 35'	sm		No ring recovery. Silty sand, fine grained, gray to olive gray, damp, dense, iron staining, slight petroleum hydrocarbon odor.	
40							

COMMENTS:

Elizabeth A. Rossmiss

California Registered Geologist

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-57
CLIENT: LBRA | DATE: 11/17/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS/MRS | PAGE: 2 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Adjacent Northern Compressor Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 95
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	80/10"	30	Ring @ 40'	sm		Silty sand, fine grained, gray to olive gray with brown-orange/brown, damp, very dense, slight petroleum hydrocarbon odor, 5% LEL.	
45	46/9"	100	Ring @ 45'	sm		Silty sand, fine grained, gray olive, damp, very dense, petroleum hydrocarbon odor, 0% LEL.	
50	48	70	Ring @ 50'	sm		Silty sand, fine grained, gray olive, damp, dense, petroleum hydrocarbon odor.	
	44	170	Spt @ 52.5'	sm		Silty sand, fine grained, gray olive, damp, dense, slight petroleum hydrocarbon odor.	
55	60/6"	90	Ring @ 55'	sm		Silty sand, fine grained, gray olive, damp, dense, slight petroleum hydrocarbon odor.	
60	78/11"	130	Ring @ 60'	sm		No ring recovery, silty sand, fine grained, gray olive, damp, very dense, petroleum hydrocarbon odor.	
	100/3"	90	Spt @ 62.5'	sp		Sand, with silt, fine grained, olive gray, damp, very dense, petroleum hydrocarbon odor, 0% LEL.	
65	50/5"	-	Ring @ 65'	sp		Sand, with silt, fine grained, gray, damp, very dense, strong petroleum hydrocarbon odor, 10% LEL.	
70	60/6"	140	Ring @ 70'	sm		Silty sand, fine grained, olive gray, damp, dense, strong petroleum hydrocarbon odor.	
	71/6"	130	Spt @ 72.5'	sm		Silty sand, very fine, olive gray, damp, very dense, slight petroleum hydrocarbon odor.	
75	92/8"	110	Ring @ 75'	sm		No ring recovery, silty sand, fine grained, olive gray, damp, very dense, hydrocarbon odor, ~3/8" small rock.	
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-67
CLIENT: LBRA | DATE: 11/17/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS/MRS | PAGE: 3 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Adjacent Northern Compressor Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 95
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
80	75/9"	120	Ring @ 80'	sm		Silty sand, fine grained, dark olive gray, damp, very dense, slight petroleum hydrocarbon odor, shells. At 82.5' 5% LEL.	
85	52/9"	70	Ring @ 85'	sm		Disturbed sample. Silty sand, fine grained, light olive gray, slightly damp, dense, slight petroleum hydrocarbon odor.	
90	91/9"	110	Ring @ 90'	sw/sm		No ring recovery, sand and silty sand, fine grained, dark olive gray and light olive gray, very damp, very dense, slight petroleum hydrocarbon odor, shells.	
95						At 95' 100% LEL. Total Depth: 95'	
100							
105							
110							
115							
120							

COMMENTS:

Elizabeth A. Robbins

California Registered Geologist

ESE
A CIL CORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B8
CLIENT: LBRA | DATE: 11/18/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: North of Northern Compressor Bldg

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 65
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0				sm		FILL Silty sand, fine grained, brown to light olive gray, dry to damp, petroleum hydrocarbon odor.	
5	14	30	Ring @ 5'	sp sm		Sand with silt, fine to medium grained, dark olive gray, petroleum petroleum hydrocarbon odor.	
						No ring recovery, silty sand, fine to medium grained, brown, loose, slight petroleum hydrocarbon odor.	
10	44	140	Ring @ 10'	sm		Qpu/Qsp Silty sand, fine grained, light olive gray with black staining, loose to medium dense, petroleum hydrocarbon odor.	
	66/6"	-	Spt	sm			
15	91/6"	140	Ring @ 15'	sm		Silty sand, fine grained, light olive gray, damp, dense, iron stainings, petroleum hydrocarbon odor. Silty sand, fine grained, light olive gray, damp, very dense, iron staining, petroleum hydrocarbon odor.	
20	46	140	Ring @ 20'	sm		Silty sand, fine grained, light olive gray, light olive and light olive brown, dense, strong petroleum hydrocarbon odor, 0% LEL.	
	88/8"	-	Spt	sm		Silty sand, fine grained, light olive gray with iron staining, damp, very dense, strong petroleum hydrocarbon odor.	
25	93/9"	110	Ring @ 25'	sm		Silty sand, fine grained, light olive gray, dry to damp, very dense, petroleum hydrocarbon odor.	
30	42	100	Ring @ 30'	sm		Silty sand, fine grained, light olive gray, dry to damp, very dense, petroleum hydrocarbon odor.	
	80/6"	-	Spt	sm		Silty sand, fine grained, light olive gray, dry to damp, very dense, petroleum hydrocarbon odor.	
35	86/6"	120	Ring @ 35'	sm		Silty sand, fine grained, light brown with iron staining and light olive gray, damp, very dense, petroleum hydrocarbon odor.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-38
CLIENT: LBRA DATE: 11/18/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: North of Northern Compressor Bldg

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 65
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	67/10"	90	Ring @ 40'	sm		Silty sand, fine grained, light olive gray and olive gray, damp, very dense, petroleum hydrocarbon odor.	
	58	-	Spt	sm		Silty sand, fine grained, light olive gray with some olive gray, damp, dense, petroleum hydrocarbon odor.	
45	65/6"	110	Ring @ 45'	sm		Silty sand, fine grained, light olive gray, damp, dense, possible iron staining in small stripes, petroleum hydrocarbon odor, 0% LEL.	
50	79/6"	110	Ring @ 50'	sm		Silty sand, very fine grained, olive gray, very damp, dense, petroleum hydrocarbon odor, 0% LEL.	
	49	-	Spt	sm		Silty sand, very fine grained, olive gray, damp, dense, petroleum hydrocarbon odor, 0% LEL.	
55	85/6"	135	Ring @ 135'	sm		Silty sand, fine grained, dark olive gray, damp, very dense, petroleum hydrocarbon odor.	
60	57/6"	115	Ring @ 60'	sm		No ring recovery, silty sand, fine grained, olive gray, damp, dense, petroleum hydrocarbon odor.	
	90/7"	-	Spt	sm		Silty sand, fine grained, light olive gray, damp, very dense, slight petroleum hydrocarbon odor, shell fragments.	
65	No Record	-	Ring @ 65'			No ring recovery, 100% LEL.	
						Total Depth: 65'	
70						Used sand trap below 55'.	
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B9
CLIENT: LBRA | DATE: 11/19/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: North of Glycol Reboilers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 30.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	No Record	2	Ring @ 5'	sm		Silty sand and asphalt, brown.	
10	25	35	Ring @ 10'	sm		Silty sand, fine grained, dark olive gray to black, very moist, loose, petroleum hydrocarbon odor, wood and brick fragments, rootlets, asphalt.	
	15	-	Spt	sm		Silty sand, fine grained, olive gray and olive, moist, loose, no petroleum hydrocarbon odor, larger pieces of brick.	
15	50	10	Ring @ 15'	sm		Silty sand, fine grained, olive gray, moist, medium dense, no petroleum hydrocarbon odor, some asphalt.	
20	No Record	90	Ring @ 20'	sm		Qpu/Qsp No ring recovery. Silty sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor, 0% LEL.	
	86/9"	-	Spt	sm		Silty sand, fine grained, light olive gray, damp, very dense, no petroelum hydrocarbon odor.	
25	50/3"	-	Ring @ 25'	sm		Silty sand, fine grained, light olive gray, damp, very dense, no petrolelum hydrocarbon odor.	
30	90/3"	2	Ring @ 30'	sm		Silty sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor, 0% LEL.	
35						Total Depth: 30.5' Used sand trap after 5'.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B1C
CLIENT: LBRA DATE: 11/19/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Adjacent Diesel Fuel Port

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 35.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	60	8	Ring @ 5'	sm		Silty sand and asphalt, dark olive gray, very moist, petroleum hydrocarbon odor.	
10	No Record	-	Ring @ 10'			No sample at 10'.	
		-	Spt	sm/sw		Sampler pitched off to side.	
15	78	130	Ring @ 15'	sm		Silty sand and sand, olive gray and gray, very moist, petroleum hydrocarbon odor, some asphalt.	
						Qpu/Qsp Silty sand, fine grained, olive gray, moist, dense, slight petroleum hydrocarbon odor.	
20	74/6"	140	Ring @ 20'	sm		Silty sand, very fine grained, olive gray, damp, very dense, petroleum hydrocarbon odor.	
	50/6"		Spt	sm		Silty sand, fine grained, light olive gray with iron staining, damp, dense, slight petroleum hydrocarbon odor.	
25	100/8"	40	Ring @ 25'	sm		Silty sand, fine grained, light olive gray, damp, very dense, iron staining, no petroleum hydrocarbon odor.	
30	80/6"	12	Ring @ 30'	sm		Silty sand, fine grained, light olive gray, damp, very dense, faint petroleum hydrocarbon odor.	
35	70/6"	3	Ring @ 35'	sm		Silty sand, very fine grained, olive gray, damp, very dense, no petroleum hydrocarbon odor.	
						Total Depth: 35.5'	
40							

COMMENTS:

Elizabeth A. Robbins

California Registered Geologist

ESE
A CELCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B11
CLIENT: LBRA DATE: 11/19/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Near SW corner of Spring & Orange

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 56
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
						Qpu/Qsp	
5	90/10"	2	Ring @ 5'	sm		Silty sand, fine to medium grained, brown to light olive gray, damp, very dense, slight petroleum hydrocarbon odor.	
	52	-	Spt	sm		Silty sand, fine to medium grained, light olive gray, olive gray to tan gray, very damp, possible staining, petroleum hydrocarbon odor, layered.	
10	86	175	Ring @ 10'	sm		Silty sand, fine grained, light olive gray and olive gray with yellow brown staining, orange brown, damp, petroleum hydrocarbon odor.	
15	90/9"	70	Ring @ 15'	sm		Silty sand, fine grained, light olive gray and olive gray, damp, petroleum hydrocarbon odor, 0% LEL.	
	87/9"	-	Spt	sm		Silty sand, fine grained, damp, very dense, petroleum hydrocarbon odor.	
20	50/2"	130	Ring @ 20'	sm		Silty sand, fine grained, light olive gray to olive gray, damp, slight petroleum hydrocarbon odor, some gravel pieces, micaceous, 0% LEL.	
25	50/4"	90	Ring @ 25'	sm		Silty sand, very fine grained, light olive gray to olive gray with iron staining, damp, petroleum hydrocarbon odor, micaceous.	
30	50/3"	45	Ring @ 30'	sm		Silty sand, very fine grained, light tan and olive gray, damp, very dense, slight petroleum hydrocarbon odor.	
35	50/3"	35	Ring @ 35'	sm		Silty sand, fine grained, olive gray with brownish orange spots, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B11
CLIENT: LBRA DATE: 11/19/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Near SW corner of Spring & Orange

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 56
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	No Record	15	Ring @ 40'	sm		Silty sand, fine grained, olive gray and brown, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
45	50/6"	7	Ring @ 45'	sm		Silty sand, fine grained, olive gray, damp, very dense, slight petrolelum hydrocarbon odor, micaceous, minor clay.	
50	50/1"	14	Ring @ 50'	sm		Silty to clayey sand, fine grained, olive gray, damp, very dense, very slight petroleum hydrocarbon odor, micaceous, minor clay.	
55	No Record		Ring @ 55'	sm		Silty sand, fine grained, olive gray, very dense, moist, no petroleum hydrocarbon odor, micaceous.	
						Total Depth: 56'	
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B12
CLIENT: LBRA DATE: 12/11/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS/TAS PAGE: 1 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: West of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	15	20	Ring @ 5'	sm		Silty sand, fine grained, olive gray, moist, loose, slight petroleum hydrocarbon odor, some debris, asphalt.	
	17	-	Spt	sw/sm		Sand and silty sand, olive gray, moist, loose, petroleum hydrocarbon odor.	
10	90/11"	25	Ring @ 10'	sp/ml		Qpu/Qsp Sand and silt, fine to medium grained, olive gray and light olive, moist, very dense, petroleum hydrocarbon odor.	
15	84/9"	25	Ring @ 15'	sm		Silty sand, fine grained, light olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
	50/6"	-	Spt	sm		Silty sand, fine grained, light olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
20	50/2"	20	Ring @ 20'	sm		Silty sand, fine grained, olive brown and olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
25	50/3"	20	Ring @ 25'	sm		Silty sand, fine grained, light olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
	50/6"	-	Spt	sm		Silty sand, fine grained, light olive gray with some orange brown, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
30	50/3"	-	Ring @ 30'	sm		Silty sand, fine grained, olive gray, moist, very dense, slight petroleum hydrocarbon odor, 95% LEL, purged with nitrogen.	
35	50/6"	65	Ring @35'	sm		No ring recovery, silty sand, gray, damp, very dense, slight petroleum hydrocarbon odor, 0% LEL.	
	50/6"	-	Spt	sm		Silty sand, fine grained, olive gray, damp, very dense, iron staining, moderate petroleum hydrocarbon odor, 0% LEL.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CELCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B12
CLIENT: LBRA DATE: 12/11/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS/TAS PAGE: 2 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: West of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	50/2"	35	Ring @ 40'	sm		Silty sand, fine grained, damp, hard, iron staining, moderate petroleum hydrocarbon odor, micaceous.	
45	30/4"	100	Ring @ 45'	sm		Silty sand, fine grained, gray, damp, hard, strong petroleum hydrocarbon odor, micaceous, 0% LEL.	
50	50/3"	45	Ring @ 50'	sm		Silty sand, fine grained, gray, moist, hard, slight petroleum hydrocarbon odor, shell fragments.	
55	50/7"	65	Ring @ 55'	sm		Silty sand, gray, moist, hard, slight petroleum hydrocarbon odor, crude horizontal parting.	
60	107/12"	75	Ring @ 60'	sp		Sand, fine grained, gray, moist, hard, slight petroleum hydrocarbon odor.	
65	50/2"	45	Ring @ 65'	sm		Silty sand, fine grained, moist, hard, slight petroleum hydrocarbon odor, local clayey, crude horizontal bedding, 0% LEL.	
70	130/6.5"	44	Ring @ 70'	sm		Silty sand, fine grained, gray, damp, very hard, iron staining, slight petroleum hydrocarbon odor, shell fragments.	
75	100/6"	24	Ring @ 75'	sm		Silty sand, fine grained, gray, moist, hard, slight petroleum hydrocarbon odor, 0% LEL.	
80							

COMMENTS:

Elizabeth A. Rossmiss
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B12
CLIENT: LBRA DATE: 12/11/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS/TAS PAGE: 3 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: West of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
80	50/2"	44	Ring @ 80'	sm		Silty sand, fine grained, gray, moist, hard, no petroleum hydrocarbon odor, shell fragments.	
85	100/6"	60	Ring @ 85'	sm		Silty sand, fine grained, gray, moist, very hard, slight petroleum hydrocarbon odor.	
90	150/3"	50	Ring @ 90'	sw		No ring recovery, sand, fine to coarse grained, moist, very hard, no petroleum hydrocarbon odor, rounded gravel up to 1".	
95						Total Depth: 90.5'	
100						Used sand trap after 35'.	
105							
110							
115							
120							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B13
CLIENT: LBRA DATE: 12/14/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Southwest Corner of Northern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 66
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						Qpu/Qsp	
5	22	140	Ring @ 5'	sp		Sand, medium grained, brown, damp, medium dense, strong petroleum hydrocarbon odor.	
	80	-	Spt	sc		Clayey sand, medium grained, olive, moist, damp, strong petroleum hydrocarbon odor, large white concretions.	
10	90	145	Ring @ 10'	sm		No ring recovery, silty sand, fine grained, gray, damp, dense, strong petroleum hydrocarbon odor.	
15	50/3"	122	Ring @ 15'	sm		Silty sand, fine grained, gray, damp, very dense, strong petroleum hydrocarbon odor.	
	80/9"	-	Spt	sm		Silty sand, fine grained, gray, damp, hard, iron staining, strong petroleum hydrocarbon odor.	
20	50/3"	95	Ring @ 20'	sm		No ring recovery, silty sand, brown, damp, hard, strong petroleum hydrocarbon odor.	
25	50/2"	90	Ring @ 25'	sm		Silty sand, brown, damp, hard, strong petroleum hydrocarbon odor.	
	50/6"	-	Spt	sm			
30	100/6"	100	Ring @ 30'	sm		Silty sand, fine grained, damp, hard, iron staining, strong petroleum hydrocarbon odor.	
						Silty sand, fine grained, brown, damp, hard, iron staining, strong petroleum hydrocarbon odor.	
35	50/3"	70	Ring @ 35'	sm		Silty sand, fine grained, gray, damp, hard, iron staining, strong petroleum hydrocarbon odor.	
40							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B13
CLIENT: LBRA DATE: 12/14/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Southwest Corner of Northern Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 66
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	50/1"	-	Ring @ 40'	sm		Silty sand, fine grained, grayish brown, damp, hard, strong petroleum hydrocarbon odor.	
45	50/1.5"	-	Ring @ 45'	sm		Silty sand, fine grained, gray, damp, hard, iron staining, strong petroleum hydrocarbon odor, possible coolent odor.	
50	No Record	-	Ring @ 50'	sm		Silty sand, fine grained, gray, damp, hard.	
55	30/2.5"	-	Ring @ 55'	sm		Clayey sand, fine grained, gray, moist, hard, strong petroleum hydrocarbon odor.	
60	100/4"	95	Ring @ 60'	sm		No ring recovery, silty sand, fine grained, gray, damp, hard, 80% LEL, purged with nitrogen.	
65	200/10"	100	Ring @ 65'	sm		Silty sand, fine grained, gray, damp, hard, strong petroleum hydrocarbon odor, LEL > .00, abandoned boring.	
						Total Depth: 66'	
70						Used sand catcher after 20'.	
75							
80							

COMMENTS:

Elizabeth A. Rollins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 5-92-4598 BORING NO. PL-B14
CLIENT: LBRA DATE: 12/15/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE. 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SW Corner of Southern Compressor Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	50/0"	-	Ring @ 5'			No sample recovery. At 6' hand drilling, concrete and wire in cuttings.	
						Qpu/Qsp	
10	50/6"	-	Ring @ 10'	sm		Silty sand, olive brown, damp, dense, moderate petroleum hydrocarbon odor.	
	78	10	Spt	sp		Sand, fine grained, brown, damp, hard, moderate petroleum hydrocarbon odor.	
15	50/3"	55	Ring @ 15'	sc/sm		Interbedded clayey sand, olive and silty sand, gray brown, moist, hard, iron staining, moderate petroleum hydrocarbon odor.	
20	50/6"	60	Ring @ 20'	sm		Silty sand, fine grained, gray, damp, hard, moderate petroleum hydrocarbon odor, 0% LEL.	
25	50/11	48	Ring @ 25'	sm		Silty sand, fine grained, brown, damp, hard, slight petroleum hydrocarbon odor.	
30	50/3"	-	Ring @ 30'	sm		Disturbed sample. Silty sand, fine grained, brown, damp, hard, no petroleum hydrocarbon odor..	
35	50/3"	46	Ring @ 35'	sm		Silty sand, fine grained, brown, damp, hard, iron staining, no petroleum hydrocarbon odor, crude bedding, 0% LEL.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B14
CLIENT: LBRA | DATE: 12/15/92
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: TAS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SW Corner of Southern Compressor Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	50/3"	12	Ring @ 40	sm		Silty sand, fine grained, gray, damp, hard, iron staining, no petroleum hydrocarbon odor.	
45	50/2"	30	Ring @ 45'	ml/sm		Silty sand to sandy silt, olive brown, moist, hard, no petroleum hydrocarbon odor, crude bedding.	
						Total Depth: 46'	
50							
55							
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A CH2M HILL COMPANY

PROJECT NO. 6-92-4598	BORING NO. PL-B15
CLIENT: LBRA	DATE: 12/16/92
LOCATION: Petrolane-Lomita	DRILLER: Apex
LOGGED BY: TAS	PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger	

FIELD LOCATION: SW of Glycol Dehydrators

BORING DIAMETER: 8"

TOTAL DEPTH IN FT.: 31.5'

BACKFILL MATERIAL: Bentonite

GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	9	7	Ring @ 5'	cl/sm		Clayey sand to sandy clay, blue gray to black, moist, soft to loose, slight petroleum hydrocarbon odor, brick and concrete debris.	
						Qpu/Qsp	
10	33	9	Ring @ 10'	sc		Clayey sand, brown gray, moist to wet, medium dense, slight petroleum hydrocarbon odor.	
	36	-	Spt	sm		Silty sand, medium grained, gray, moist, dense, moderate petroleum hydrocarbon odor.	
15	50/2"	8	Ring @ 15'	sm		Silty sand, medium grained, gray, moist, hard, slight petroleum hydrocarbon odor.	
20	50/4"	9	Ring @ 20'	sm		Silty sand, fine grained, gray, moist, hard, no petroleum hydrocarbon odor, crude horizontal bedding.	
	85	-	Spt	sm		Silty sand, fine grained, gray, moist, hard, iron staining, slight petroleum hydrocarbon odor, crude horizontal bedding.	
25	50/2"	3	Ring @ 25'	sm		Silty sand, fine grained, gray, moist, hard, iron staining, no petroleum hydrocarbon odor.	
30	84	16	Ring @ 30'	sm		Silty sand, fine grained, gray, moist, hard, iron staining, no petroleum hydrocarbon odor.	
						Total Depth: 31.5'	
35							
40							

COMMENTS:

Elizabeth A. Rabbins
California Registered Geologist

ESE
A CELCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B16
CLIENT: LBRA DATE: 12/16/92
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: TAS PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NW Corner of Property

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 76
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Perched at ~ 15'

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	35	6	Ring @ 5'	cl/sc		Clayey sand to sandy clay, mottled gray and brown, moist, firm to medium dense, no petroleum hydrocarbon odor.	
	17	-	Spt	sc		Clayey sand, gray, moist, medium dense, no petroleum hydrocarbon odor.	
10	23	4	Ring @ 10'	sc/sm		Clayey sand to silty sand, dark brown, moist, loose to medium dense, no petroleum hydrocarbon odor, brick and wood debris, rootlets.	
						At 12'-15' glass, brick concrete debris in cuttings.	
15	No Record	-	Ring @ 5'			No recovery, hard obstruction.	
						No recovery, sampler pitched to side.	
20	50/6"	6	Ring @ 20'	sc		Clayey sand, black, saturated, loose, numerous rock fragments (1/4"-3/4"), oil staining.	
25	45	40	Ring @ 25'	sc		Clayey sand, dark brown to black, wet, medium dense, medium petroleum hdyrocarbon odor, visible crude oil, rootlets.	
	32	-	Spt	cl		Qal Sandy clay, olive gray, wet, stiff, visible oil and tar, strong petroleum hydrocarbon odor, rootlets.	
30	55/9	120	Ring @ 30'	cl		Sandy clay, dark brown to black, saturated with water and crude oil, firm, strong petroleum hydrocarbon odor.	
35	87/11"	150	Ring @ 35'	cl		Sandy clay, dark brown to black, wet, stiff, strong petroleum hydrocarbon odor, wood fragments and twigs.	
	80/11"	-	Spt	sc		Clayey sand, dark grayish brown, moist, dense, strong petroleum hydrocarbon odor.	
40						Qpu/Qsp	

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A GILCREST COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B16
CLIENT: LBRA | DATE: 12/16/92
LOCATION: Petrolane-Lom | DRILLER: Apex
LOGGED BY: TAS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NW Corner of Property

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 76
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Perched at ~ 15'

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	50/4"	160	Ring @ 40'	sm		Silty sand, grayish brown, moist, hard, strong petroleum hydrocarbon odor, staining.	
45	91	50	Ring @ 45'	sm		Silty sand, gray, moist, hard, moderate petroleum hydrocarbon odor, rootlets.	
	50/6"	-	Spt	cl		Sandy clay, black to reddish brown, moist, stiff, 1/4"-4" horizontal beds, strong petroleum hydrocarbon odor.	
50	50/6"	100	Ring @ 50'	sm		Silty sand, gray, moist, hard, strong petroleum hdyrocarbon odor.	
55	100/6"	-	Ring @ 55'	sm		Silty sand, tan to gray, moist, hard, slight petroleum hydrocarbon odor.	
	80/6"	-	Spt	sp		Sand, fine grained, gray, damp, hard, very slight petroleum hydrocarbon odor.	
60	100/6"	110	Ring @ 60'	sm		Silty sand, gray, moist to wet, hard, no petroleum hydrocarbon odor.	
65	50/1"	50	Ring @ 65	sc/sm		Clayey to silty sand, fine grained, gray, moist to wet, hard, slight petroleum hydrocarbon odor.	
70	100/9"	19	Ring @ 70'	sm		No ring recovery, silty sand, fine to medium grained, gray, moist, hard, hydrocarbon odor.	
75	200/6"	67	Ring @ 75'	sm		Silty sand, fine to medium grained, gray, moist, hard, no petroleum hydrocarbon odor, shell fragments.	
80						Total Depth: 76' Water in hammer after 15'. All ring samples were collected using a sand trap.	

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-317
CLIENT: LBRA DATE: 01/14/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS/MF PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: South of Laboratory

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 75.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	44	20	Ring @ 5'	sc		Clayey sand, fine grained, olive gray, damp, dense, no petroleum hydrocarbon odor, asphaltic material.	
						Qpu/Qsp	
10	26	400	Ring @ 10'	sm		Silty sand, fine grained, olive gray, damp, medium dense, slight petroleum hydrocarbon odor.	
	44	-	Spt	sm		Silty sand, very grained, light olive gray to light brown, damp, dense, iron staining, slight petroleum hydrocarbon odor, micaceous	
15	51	170	Ring @ 15'	sm		Silty sand, fine grained, light olive gray, damp, very dense, iron staining, slight petroleum hydrocarbon odor, micaceous.	
20	60	115	Ring @ 20'	sm		Silty sand, fine grained, light olive gray to light brown, damp, dense, slight petroleum hydrocarbon odor, micaceous, 0% LEL.	
	36	-	Spt	sm		Silty sand, fine grained, gray to olive gray, damp, dense, slight iron staining, slightly petroleum hydrocarbon odor,	
25	39	85	Ring @ 25'	sm		Silty sand, fine grained, gray to olive gray, damp, dense, slight iron staining, slight petroleum hydrocarbon odor, micaceous, 12.5% LEL.	
30	55	40	Ring @ 30'	sm		Silty sand, very fine grained, gray to light olive gray, damp, very dense, no petroleum hydrocarbon odor, micaceous.	
35	69	25	Ring @ 35'	sm		Silty sand, fine grained, dark olive grave to black, damp, very dense, no petroleum hydrocarbon odor odor, micaceous.	
40							

COMMENTS:

Elizabeth A. Morris
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B17
CLIENT: LBRA | DATE: 01/14/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS/MF | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: South of Laboratory

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 75.5
BACKFILL MATERIAL: Bentontie
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	88/11"	22	Ring @ 40'	sm		Silty sand, fine grained, dark olive gray, damp, very dense, no petroleum hydrocarbon odor, micaceous.	
45	60/6"	22	Ring @ 45'	sm		Silty sand, fine grained, olive gray, damp, very dense, slight iron staining, very slight petroleum hydrocarbon odor.	
50	60/6"	12	Ring @ 50'	sm		Silty sand, fine grained, olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
55	65/6"	20	Ring @ 55'	sm		Silty sand, fine grained, olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, shell fragments. 0% LEL.	
60	66	15	Ring @ 60'	sm		No ring recovery, silty sand, fine grained, olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, shell fragments.	
65	60/6"	18	Ring @ 65'	sm		Silty sand, fine grained, light olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, shell fragments.	
70	60/6"	17	Ring @ 70'	sp		Sand, medium grained, light gray and light olive gray, damp, very dense, slight petroleum hydrocarbon odor.	
75	100/6"	0	Ring @ 75'	sm/sp		Silty sand, fine grained and sand medium grained, olive gray to light olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
80						Total Depth: 75.5 feet	

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A EILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B19
CLIENT: LBRA | DATE: 01/15/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Roadway Southeast of PL-B5

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 36.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT:

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL Wood fragments, concrete.	
5	18	170	Ring @ 5'			Black oily debris (wood fragments), wet, petroleum hydrocarbon odor.	
10	37	90	Ring @ 10'			Coal tar.	
	18	-	Spt @ 12.5'			Coal tar.	
15	17	220	Ring @ 15'			Coal tar.	
20	1	200	Ring @ 20'	sm		Qpu/Qsp Silty sand, fine grained, light olive gray, moist, dense, petroleum hydrocarbon odor, rootlets.	
25	57	190	Ring @ 25'			Silty sand, fine grained, light olive gray with brown, damp, very dense, petroleum hydrocarbon odor, micaceous.	
30	71	-	Ring @ 30'	sm		Silty sand, fine grained, olive gray, very dense, iron staining, slight petroleum hydrocarbon odor, shell fragments.	
35	63	-	Ring @ 35'	sm		Silty sand, fine grained, light olive gray to olive gray, damp, very dense, slight petroleum odor.	
40						Total Depth: 36.5'	

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B20
CLIENT: LBRA DATE: 01/19/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Southwest Corner of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						Qpu/Qsp	
5	31/6"	70	Ring @ 5'	sm		Silty sand, fine grained, olive, moist, dense, petroleum hydrocarbon odor, micaceous.	
10	57	170	Ring @ 10'	sm/sp		Silty sand and sand, fine to medium grained, olive gray, moist, very dense, minor iron staining, petroleum hydrocarbon odor.	
	34		Spt @ 12.5'	sw		Sand, fine to medium grained, light olive gray to olive gray, damp to moist, medium dense, petroleum hydrocarbon odor.	
15	38	120	Ring @ 15'	sw		Sand, fine to coarse grained, light olive gray, damp to moist, medium dense, petroleum hydrocarbon odor, 0% LEL.	
20	54	110	Ring @ 20'	sm		Silty sand, fine grained, olive gray with white and light tan, very moist, dense, iron staining, petroleum hydrocarbon odor.	
	50		Spt			Silty sand, very fine grained, light olive gray, dense, iron staining, petroleum hydrocarbon odor, micaceous.	
25	67	160	Ring @ 25'	sm		Silty sand, fine grained, brown and olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
30	50	160	Ring @ 30'	sm		Silty sand, fine grained, brown and olive gray, damp, very dense, petroleum hydrocarbon odor.	
35	70/6"	150	Ring @ 35'	sm		Silty sand, very fine grained, light olive gray and brown, damp, very dense, iron staining, petroleum hydrocarbon odor, micaceous. 0% LEL.	
	67		Spt @ 37.5'	sm		Silty sand, very fine grained, light olive gray, olive gray, damp, very dense, iron staining, petroleum hydrocarbon odor, micaceous.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A GILCREST COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B20
CLIENT: LBRA | DATE: 01/19/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 2 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Southwest Corner of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	60	-	Ring @ 40'	sm		Silty sand, very fine grained, light olive gray, olive gray with iron staining, damp, very dense, petroleum hydrocarbon odor, micaceous.	
45	60/6"	100	Ring @ 45'	sm		Silty sand, fine grained, olive gray and brown, damp to moist, very dense, petroleum hydrocarbon odor, micaceous.	
	55		Spt	sm			
50	63	130	Ring @ 50'	sm		Silty sand, fine grained, olive gray with light brown and iron staining, damp, very dense, petroleum hydrocarbon odor, micaceous.	
55	50/6"	60	Ring @ 55'	sm		Silty sand, fine grained, olive gray with light olive gray, damp to moist, very dense, petroleum hydrocarbon odor, micaceous, minor fine sand.	
60	60/6"	90	Ring @ 60'	sp		Sand with silt, fine grained, light olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
65	50/6"	60	Ring @ 65'	sp		Sand with silt, fine grained, olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, minor clay.	
70	70/6"	30	Ring @ 70'	sm		Silty sand, fine grained, olive gray to olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous.	
75	100/6"	55	Ring @ 75'	sm		Silty sand, fine grained, olive gray, damp to moist, very dense, petroleum hydrocarbon odor, micaceous.	
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

94
89

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B20
CLIENT: LBRA DATE: 01/19/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 3 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Southwest Corner of Cooling Towers

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
80	100/6"	40	Ring @ 80'	sm		No ring recovery, silty sand, fine grained, olive gray, damp to moist, very dense, slight petroleum hydrocarbon odor, micaceous, minor shell fragments.	
85	100/5"	50	Ring @ 85'	sm		Silty sand, fine grained, light olive gray to dark gray, damp to moist, very dense, slight petroleum hydrocarbon odor, micaceous.	
90	50/2"	25	Ring @ 90'	sw/sm		Sand, fine to coarse with fine grained silty sand and some gravel, light olive gray, moist, slight petroleum hydrocarbon odor.	
						Total Depth: 90.5'	
95							
100							
105							
110							
115							
120							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B21
CLIENT: LBRA | DATE: 01/20/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NW of Cooling Towers & SW of N.Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 91
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	16	95	Ring @ 5'	cl		Sandy clay, olive, very soft, moist to wet, petroleum hydrocarbon odor.	
10	7/6"	20	Ring @ 10'	sp		Sand with silt, fine grained, light olive gray, damp, very loose, petroleum hydrocarbon odor.	
	18		Spt @ 12.5"	sp		Sand with silt, fine grained, brown to olive gray, damp, very loose, petroleum hydrocarbon odor.	
15	50/6"	65	Ring @ 15'	sp		Qpu/Qsp Sand, fine grained, brown to olive, moist, very dense, slight petroleum hydrocarbon odor.	
20	70/6"	180	Ring @ 20'	sp		Sand, fine grained, brown to olive, moist, very dense, slight petroleum hydrocarbon odor.	
	50		Spt @ 22.5'	sm		Silty sand, fine grained, light olive gray, damp, very dense, petroleum hyrocarbon odor, micaceous.	
25	60/6"	160	Ring @ 25'	sm		Silty sand, very fine grained, light olive gray, damp, very dense, petroleum hydrocaarbon odor, micaceous.	
30	100	220	Ring @ 30'	sm		Silty sand, very fine grained, light olive gray to brown, damp, iron staining, petroleum hydrocarbon odor, micaceous, 0% LEL.	
35	100/6"	160	Ring @ 35'	sm		Silty sand, very fine grained, light olive gray to brown, very dense, iron staining, strong petroleum hydrocarbon odor, micaceous.	
40							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. PL-B21
CLIENT: LBRA | DATE: 01/20/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 2 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NW of Cooling Towers & SW of N.Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 91
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	100/5"	80	Ring @ 40'	sm		Silty sand, fine grained, olive gray to brown, very dense, petroleum hydrocarbon odor, micaceous, 10% LEL.	
45	100/5"	100	Ring @ 45'	sm		Silty sand, fine grained, light olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
50	56/6"	70	Ring @ 50'	sm		Silty sand, fine grained, olive gray, damp, very dense, strong petroleum hydrocarbon odor, micaceous, 25% LEL.	
55	56	100	Ring @ 55'	sm		Silty sand, fine grained, olive gray, moist, damp, petroleum hydrocarbon odor, shell fragments, 100% LEL, purged hole with nitrogen.	
60	70	70	Ring @ 60'	sm		Silty sand, fine grained, olive gray, moist, very dense, petroleum hydrocarbon odor, shell fragments.	
65	97	140	Ring @ 65'	sp		Sand with silt, fine grained, light olive gray, moist, very dense, petroleum hydrocarbon odor, rootlets, shell fragments.	
70	50/6"	120	Ring @ 70'	sp		Sand, fine grained, light gray to olive gray, damp, very dense, petroleum hydrocarbon odor, 0% LEL.	
75	55/6"	110	Ring @ 75'	sm		Silty sand, very fine grained, gray to light olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous.	
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B21
CLIENT: LBRA | DATE: 01/20/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS | PAGE: 3 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NW of Cooling Towers & SW of N.Tank Battery

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 91
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
80	130/3"	120	Ring @ 85'	sm		No ring recovery, 0% LEL.	
85	100/5"	–	Ring @ 85'	sm/sp		Silty sand, fine grained, olive gray, damp, very dense, petroleum hydrocarbon odor.	
90	100	150	Ring @ 90'	sm/ml		Silty sand and sand with silt, fine grained, light olive gray and olive gray, damp, very dense, petroleum hydrocarbon odor, micaceous	
						Total Depth: 91'	
95						LEL exceeded. Hole abandoned due to ineffectiveness of purging procedures.	
100							
105							
110							
115							
120							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. PL-B22
CLIENT: LBRA | DATE: 01/21/93
LOCATION: Petrolane-Lomita | DRILLER: Apex
LOGGED BY: MRS |
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: N. of Former Underground Storage Tank

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	DESCRIPTION	OTHER
0					FILL Debris, bricks, asphalt, concrete.	
5	18	90	Ring @ 5'	sc	Clayey sand, fine grained, black, moist to wet, loose, petroleum hydrocarbon odor, some gravel.	
10	No Record	-	Ring @ 10'		No ring recovery, asphalt.	
	17		Spt	sm	Silty sand and asphalt, fine grained, damp, loose, petroleum hydrocarbon odor, micaceous.	
15	15/1"	-	Ring @ 15'			
20	No Record	140	Ring @ 20'	ml	No ring recovery. Sandy silt and asphalt, olive gray, wet, slight petroleum hydrocarbon odor.	
	12	-	Spt	sm	Qpu/Qsp Silty sand, fine grained, light olive gray, damp, loose, iron staining, slight petroleum hydrocarbon odor.	
25	50	100	Ring @ 25'	sm/ml	Silty sand and sandy silt, fine grained, olive and light olive gray, moist, dense, iron staining, slight petroleum hydrocarbon odor, asphalt, 0% LEL..	
30	77	100	Ring @ 30'	ml	Sandy silt, olive brown, moist, very stiff, slight petroleum hydrocarbon odor, micaceous.	
	46		Spt	sm	Silty sand, fine grained, light olive gray to brown, damp to moist, dense, iron staining, slight petroleum hydrocarbon odor, micaceous.	
35	81/6"	25	Ring @ 35'	sm	Silty sand, fine grained, light olive gray to olive gray, damp, very dense, slight petroleum hydrocarbon odor.	
40						

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B22
CLIENT: LBRA DATE: 01/21/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: N. of Former Underground Storage Tank

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 46
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	90/6	80	Ring @ 40'	sp		Sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor, micaceous, some blackish asphalt colored sand.	
	78		Spt	sm		Silty sand, very fine grained, light olive gray to olive gray, moist, iron staining, no petroleum hydrocarbon odor, some interlayered olive silt.	
45	70/6"	50	Ring @ 45'	sm		Silty sand, fine grained, light olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, 100% LEL.	
50						Total Depth: 46'	
55							
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B23
CLIENT: LBRA DATE: 01/21/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: 10' South of S-43

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 15
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	32	50	Ring @ 5'	sm		Silty sand, fine grained, dark olive, damp, medium dense, some gravel.	
10	20	180	Ring @ 10'	cl/		Clay, asphalt debris, rock, concrete, petroleum hydrocarbon odor, 80-100% LEL.	
						Clay, brick and asphalt, 100% LEL.	
15						Total Depth: 15'	
20							
25							
30							
35							
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B24
CLIENT: LBRA DATE: 01/21/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: 15' East of S-48

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 23
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	50/6"	40	Ring @ 5'			No ring recovery, rock debris, 0% LEL.	
10	19	110	Ring @ 10'	sp		Sand, fine grained, olive gray, moist, loose, abundant debris, asphalt, 1% LEL.	
15	21/6"	60	Ring @ 15'			No ring recovery, debris, asphalt, rock, 6% LEL.	
20	55/6"	140	Ring @ 20'	ml		No ring recovery, silt, olive green, slight petroleum hydrocarbon odor, debris, 0% LEL.	
25						Total Depth: 23'	
30							
35							
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B26
CLIENT: LBRA DATE: 01/22/93
LOCATION: Petrolane-Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SW of Former Underground Storage Tank

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 9
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
				sm		Silty sand, olive green, some gravel.	
5	24	-	Ring @ 5'	sm		Debris at 4'	
						Silty sand, olive green asphalt, concrete.	
10						Total Depth: 9' Refusal on concrete at 9'.	
15							
20							
25							
30							
35							
40							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B27
CLIENT: LBRA DATE: 01/22/93
LOCATION: Petrolane Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 1 of
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION:

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 55.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	13/6"	-	Ring @ 5'			No ring recovery, silty sand, fine grained, olive, moist, slight petroleum hydrocarbon odor, concrete.	
10	31	-	Ring @ 10'			No ring recovery, ashalt and concrete, petroleum hydrocarbon odor, 0% LEL.	
15	No Record	-	Ring @ 15'			No ring recovery.	
20	No Record	-	Ring @ 20'			No ring recovery, concrete, 0% LEL.	
						Qpu/Qsp	
25	50/6"	90	Ring @ 25'	sm		Silty sand, fine grained, olive gray and some brown, damp, very dense, slight petroleum hydrocarbon odor, micaceous, 0% LEL.	
30	50/6"	180	Ring @ 30'	sm		Silty sand, very fine grained, olive gray, moist, very dense, petroleum hydrocarbon odor, micaceous.	
35	60/6"	170	Ring @ 35'	sm/ml		Silty sand and sand with silt, fine grained, olive gray and olive, damp to moist, very dense, petroleum hydrocarbon odor, micaceous.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. PL-B27
CLIENT: LBRA DATE: 01/22/93
LOCATION: Petrolane Lomita DRILLER: Apex
LOGGED BY: MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION:

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 55.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	65/4"	20	Ring @ 40'	sp/sm		Sand and silty sand, fine grained, olive gray, damp, very desne, slight petroleum hydrocarbon odor, micaceous.	
45	60/6"	35	Ring @ 45'	sp/sm		Sand and silty sand, fine grained, light olive gray to olive green, damp, some iron staining, slight petroleum hydrocarbon odor, micaceous.	
50	100/6"	50	Ring @ 50'	sm/ml		Silty sand and silt with sand, fine grained, olive to olive gray, very gray, moist, very dense, slight petroleum hydrocarbon odor.	
55	100/6"	70	Ring @ 55'	sp		No ring recovery, sand with silt, fine grained, light olive gray, moist, very dense, slight petroleum hydrocarbon odor, micaceous.	
						Total Depth: 55.5	
60							
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. RT-B1
CLIENT: LBRA | DATE: 12/04/92
LOCATION: Ray's Trashbox | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: East of Wooden Storage Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 60
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	33/6"	18	Ring @ 5'	sm		Silty sand, fine grained, light olive and olive gray, dry, very dense, gravelly debris (concrete, asphalt).	
	12	-	Spt	ml		Sandy silt, olive, moist, no petroleum hydrocarbon odor, abundant debris.	
10	50/6"	19	Ring @ 10'			Debris, asphalt, concete and brick.	
15	50	80	Jar @ 15'	sm		Silty sand, fine grained, black, moist, very dense, slight petroleum hydrocarbon odor, asphalt and concrete debris.	
	11	-	Spt	sm		Silty sand, fine to medium grained, olive to olive brown, very moist, loose, black staining, petroleum hydrocarbon odor, debris, gravel, rootlets.	
20	No Record	-	Ring @ 20'			Concrete debris.	
25	14	39	Ring @ 25'	cl		Clay, black, damp, soft, tar staining, strong petroleum hydrocarbon odor, rootlets, pinhole porosity.	
30	29	7	Ring @ 30'	sc/sm		Qpu/Qsp Clayey sand to silty sand, gray to olive gray, moist, medium dense, moderate petroleum hydrocarbon odor, rootlets.	
	13	-	Spt	cl/sm		Sandy clay and silty sand, gray, moist, dense to firm, iron staining, moderate petroleum hydrocarbon odor, rootlets.	
35	60	5	Ring @ 35'	sc		Clayey sand, medium grained, greenish gray, moist, dense, slight petroleum hydrocarbon odor, crude horizontal laminations.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A GILCREST COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. RT-B1
CLIENT: LBRA DATE: 12/04/92
LOCATION: Ray's Trashbox DRILLER: Apex
LOGGED BY: MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: East of Wooden Storage Building

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 60
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	30	20	Ring @ 40'	sm		Silty sand, fine grained, blue gray, damp, medium dense, moderate petroleum hdyrocarbon odor.	
	75	-	Spt	sm		Silty sand, fine to medium grained, gray, damp, very dense, slight petroleum hydrocarbon odor.	
45	55	22	Ring @ 45'	sm		Silty sand, greenish gray, moist, dense, no petroleum hydrocarbon odor.	
50	70	11	Ring @ 50'	sm		Silty sand, fine grained, gray, moist, dense, slight petroleum hydrocarbon odor.	
	70	-	Spt	sm		Silty sand, fine grained, gray, damp, very dense, slight petroleum hydrocarbon odor.	
55	50/6"	-	Ring @ 55'	sm		Silty sand, fine grained, gray, damp, very dense, slight petroleum hydrocarbon odor.	
60	No Record	-	Ring @ 60'			No sample, LEL > 100%, purged with nitrogen and LEL remained above 100%. Boring terminated due to soil gas.	
						Total Depth: 60'	
65							
70							
75							
80							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

75
-90

ESE
A CH2M HILL COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. RT-B2
CLIENT: LBRA DATE: 12/08/92
LOCATION: Ray's Trashbox DRILLER: Apex
LOGGED BY: TAS PAGE: 1 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NE corner of Ray's Trashbox

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	19	105	Ring @ 5'	ml		Sandy silt, fine grained sand, dark gray, damp, soft, moderate petroleum hydrocarbon odor, wood debris, 0% LEL.	
10	15	130	Ring @ 10'	ml/sm		Sandy silt to silty sand, dark gray, moist, soft, moderate petroleum hydrocarbon odor, fragments, wood debris.	
	11	-	Spt	sm		Silty sand, gray, dry, loose, moderate petroleum hydrocarbon odor, concrete fragments.	
15	21	90	Ring @ 15'	sc		Clayey sand, medium grained, black, damp, loose, strong petroleum hydrocarbon odor, rock and concrete fragments, wire and wood debris, 15% LEL.	
20	28	56	Ring @ 20'	cl		Sandy clay, black, moist, firm, moderate petroleum hydrocarbon odor.	
	28	-	Spt			Concrete debris.	
25	19	75	Ring @ 25'	sm		Qpu/Qsp Silty sand, blue/gray, damp, medium dense, no petroleum hydrocarbon odor, rootlets, 25% LEL.	
30	31	120	Ring @ 30'	sm		Silty sand, blue gray to gray, moist, dense, moderate petroleum hydrocarbon odor, wood fragments.	
35	50/6"	65	Ring @ 35'	sp		Sand, medium grained, grayish brown, damp, dense, moderate petroleum hydrocarbon odor. Sand, medium grained, grayish brown, moist, dense, iron staining, slight petroleum hydrocarbon odor.	
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. RT-B2
CLIENT: LBRA DATE: 12/08/92
LOCATION: Ray's Trashbox DRILLER: Apex
LOGGED BY: TAS PAGE: 2 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NE corner of Ray's Trashbox

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	80/6"	120	Ring @ 40'	cl/sm		Interbedded green clay and green gray silty sand, moist, dense, iron staining, strong petroleum hydrocarbon odor, 0% LEL.	
	44	-	Spt	sm		Silty sand with trace clay interbeds, gray, moist, dense, iron staining, strong petroleum hydrocarbon odor, crude horizontal bedding.	
45	50/6"	110	Ring @ 45'	sm		No ring recovery, silty sand, gray, moist, very dense, scattered iron staining, moderate petroleum hydrocarbon odor, 0% LEL.	
50	60/6"	150	Ring @ 50'	sm		Silty sand, gray, moist, dense, iron staining, slight petroleum hydrocarbon odor.	
	44	-	Spt	sm		Silty sand, gray, moist, very dense, no petroleum hydrocarbon odor.	
55	60/6"	130	Ring @ 55'	sm		Silty sand, gray, moist, dense, slight petroleum hydrocarbon odor, numerous shells, 0% LEL.	
60	50/6"	30	Ring @ 60'	sm		Silty sand, fine grained, gray, moist, dense, slight petroleum hydrocarbon odor.	
	50/5"	-	Spt	sw		Sand, fine to medium grained, gray, damp, hard, slight petroleum hydrocarbon odor.	
65	50/3"	105	Ring @ 65'	sw		Sand, fine to medium grained, moist, hard, slight petroleum hydrocarbon odor, 1/4"-1" rounded gravel.	
70	50/3"	105	Ring @ 70'	sp		Sand, medium grained, gray, moist, hard, slight petroleum hydrocarbon odor.	
75	50/1"	5	Ring @ 75'	sw		Sand, fine to medium grained, gray, slight petroleum hydrocarbon odor.	
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A EXLCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. BT-B2
CLIENT: LBRA | DATE: 12/08/92
LOCATION: Ray's Trashbox | DRILLER: Apex
LOGGED BY: TAS | PAGE: 3 of 3
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: NE corner of Ray's Trashbox

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 90.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
80	50/1"	70	Ring @ 80'	sw		Well graded sand, fine to coarse grained, gray, moist, hard, slight petroleum hydrocarbon odor.	
85	50/1"	20	Ring @ 85'	sw		Sand, fine to coarse grained, gray, moist, hard, slight petroleum petroleum hydrocarbon odor.	
90	100/6"	10	Ring @ 90'	sw		Sand, fine to coarse grained, gray, moist, hard, slight petroleum hydrocarbon odor.	
						Total Depth: 90.5'	
95							
100							
105							
110							
115							
120							

COMMENTS:

Elizabeth A. Koerner
California Registered Geologist

ESE
A CELCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 | BORING NO. RT-B3
CLIENT: LBRA | DATE: 12/08/92
LOCATION: Ray's Trashbox | DRILLER: Apex
LOGGED BY: TAS/MRS | PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SW Corner of Ray's Trashbox

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 71
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL At 3' concrete debris.	
5	14	15	Ring @ 5'	sc		Clayey sand, fine grained, mottled greenish gray and brown, moist, loose, tar inclusions, slight petroleum hydrocarbon odor, concrete fragments.	
10	21	11	Ring @ 10'	sc		Clayey sand, greenish brown, moist, firm, slight petroleum hydrocarbon odor.	
	29	-	Spt	sc		Clayey sand, greenish brown, moist, loose, slight petroleum hydrocarbon odor, abundant brick and glass debris.	
15	40	5	Ring @ 15'	sc		Clayey sand, grayish brown, moist, medium dense, slight petroleum hydrocarbon odor, concrete fragments.	
20	No Record		Ring @ 20'			No sample, obstruction at bit.	
25	40	6	Ring @ 25'	sm		Silty sand, fine grained, olive gray, moist, medium dense, no petroleum hydrocarbon odor, local black clay fragments.	
30	11	25	Ring @ 30'	ml		Clayey silt, dark olive and light olive to black, very moist, very soft, oil staining, strong petroleum hydrocarbon odor.	
	33	-	Spt	sm		Silty sand, very fine grained, black, moist, loose, oil staining, petroleum hydrocarbon odor, wood particles, 0% LEL.	
35	No Record	3	Ring @ 35'	sm		Silty sand, very fine grained, black, moist, loose, oil staining, petroleum hydrocarbon odor, wood particles, 0% LEL.	
40							

COMMENTS:

Elizabeth A. Rossiter
California Registered Geologist

ESE
A GILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4598 BORING NO. RT-B3
CLIENT: LBRA DATE: 12/08/92
LOCATION: Ray's Trashbox DRILLER: Apex
LOGGED BY: TAS/MRS PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SW Corner of Ray's Trashbox

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 71
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	34	1	Ring @ 40'	sm		Silty sand, fine grained, dark olive to black, very moist, medium dense, petroleum hydrocarbon odor, wood fragments.	
	36	–	Spt	sm		Silty sand, fine grained, dark olive to black, very moist, medium dense, slight petroleum hydrocarbon, micaceous, wood fragments. odor.	
45	66	1	Ring @ 45'	sm		Silty sand, fine grained, light to dark olive gray, moist, no petroleum hydrocarbon odor, micaceous.	
						Qpu/Qsp	
50	60	2	Ring @ 50'	sm		Silty sand, fine grained, light olive gray, damp, slightly dense, no petroleum hydrocarbon odor, micaceous, rootlets and wood fragments, 0% LEL.	
	30	–	Spt	sm		Silty sand, fine grained, light olive gray with trace dark olive gray, moist, medium dense, no petroleum hydrocarbon odor, micaceous.	
55	64	4	Ring @ 55'	sm		Silty sand, fine grained, light olive gray, moist, dense, no petroleum hydrocarbon odor, micaceous.	
60	50/5"	1	Ring @ 60'	sw		Sand, fine grained, trace gravel, light olive gray, moist, very dense, no petroleum hydrocarbon odor, micaceous.	
	50/6"	–	Spt	sw		Sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor. odor.	
65	50/4"	1	Ring @ 65'	sw		Sand, fine grained, light olive gray, damp, dense, no petroleum hydrocarbon odor, 0% LEL.	
70	100/5"	–	Ring @ 70'	sw		Sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor. odor.	
75						Total Depth: 71'	
80							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

ESE
A CILCORP COMPANY

LOG OF EXPLORATORY SOIL BORING

PROJECT NO. 6-92-4596 | BORING NO. LBWD-E1
CLIENT: LBRA | DATE. 11/10/92
LOCATION: LBWD | DRILLER: Apex
LOGGED BY: MRS/TAS | PAGE. 1 of 1
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: Road West of Petrolane-Lomita

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 31.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0	No Record	-	Ring @ 1'	sm		FILL Silty sand, fine grained, brown, dense, no petroleum hydrocarbon odor, concrete, cobbles.	
5	No Record	-	Ring @ 5'	sc		Sand, fine grained, brownish gray, moist, no petroleum hydrocarbon odor, local black clay, concrete debris.	
						Clayey sand, dark gray, moist, slight petroleum hydrocarbon odor, numerous 1/4" - 1" rounded rock fragments, wood debris.	
10	No Record		Ring @ 10'	sc		Clayey sand, grayish brown, moist, medium petroleum hydrocarbon odor, concrete and wire debris.	
15	18	30	Ring @ 15'	sc		No ring recovery, debris, black, sandy clay, moist, firm, scattered 1/4" - 1/2" rock fragments.	
	25		Spt	sc		Clayey sand, greenish brown, moist, medium dense, slight petroleum hydrocarbon odor.	
20	38	0	Ring @ 20'	sc/sm		Qpu/Qsp No sample recovery, silt to clayey sand, mottled grayish brown and and greenish brown, moist to wet, iron staining.	
25	40	0	Ring @ 25'	sc		No ring recovery, clayey sand, greenish brown, moist, dense, slight iron staining, no petroleum hydrocarbon odor.	
	No Record		Spt			Clayey sand, greenish brown, moist, dense, iron staining, no petroleum hydrocarbon odor, wood/root fragments, crude horizontal bedding.	
30	54/6"	0	Ring @ 30'	sm		Silty sand, bluish gray, moist, iron staining, no petroleum hydrocarbon odor.	
						Total Depth: 31.5'	
35							
40							

COMMENTS:

Elizabeth A. Robbins
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

A CILCORP COMPANY

PROJECT NO. 6-92-4598 | BORING NO. HC-B7
CLIENT: LBRA | DATE: 12/03/92
LOCATION: Hill Crane | DRILLER: Apex
LOGGED BY: MRS | PAGE: 1 of 2
DRILLING METHOD: Hollow-Stem Auger

FIELD LOCATION: SE portion of Hill Crane

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 76.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC.(PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
0						FILL	
5	32	0	Ring @ 5'	sm		Silty sand, fine grained, brown, damp, medium dense, no petroleum hydrocarbon odor.	
	11	-	Spt			Clay with some silty sand, olive and brown, very moist, slight petroleum hydrocarbon odor, asphalt.	
10	47	2	Ring @ 10'	sm		Silty sand, fine grained, olive gray and brown, moist, medium dense, petrolelum hydrocarbon odor, asphalt.	
15	15	15	Ring @ 15'	sm		Silty sand, fine grained, dark olive to black, moist, strong petroleum hydrocarbon odor.	
	22	-	Spt	sm		Silty sand, fine grained, olive and dark olive to black stained, moist, strong petroleum hydrocarbon odor.	
20	25	3	Ring @ 20'	sm		Silty sand, fine grained, olive and dark olive to black stained, moist, strong petroleum hydrocarbon odor, rootlets.	
25	45	30	Ring @ 25'	sm		Silty sand, fine grained, olive gray to black, wet, medium dense, staining, petroleum hydrocarbon odor, rootlets, asphalt.	
	19	-	Spt	sm		Silty sand, fine grained, olive stained black, loose, pockets of crude oil, petroleum hydrocarbon odor, wood, rootlets.	
30	No Record	50	Ring @ 30'	sm		Silty sand, fine grained, olive stained black, loose, pockets of crude oil, petroleum hydrocarbon odor, wood rootlets.	
35	27	105	Ring @ 35'			Silty sand, fine grained, olive stained black, crude oil, petroleum hydrocarbon odor, rootlets.	
	31	-	Spt			Silty sand, fine grained, light olive gray, very damp, medium dense petroleum hydrocarbon odor, rootlets.	
40						Qpu/Qsp	

COMMENTS:

Christopher D. Rostron
California Registered Geologist

LOG OF EXPLORATORY SOIL BORING

ESE — A CALGON COMPANY

PROJECT NO. 6-92-4598 | BORING NO. HC-87
CLIENT: LBRA | DATE: 12/03/92
LOCATION: Hill Crane | DRILLER: Apex
LOGGED BY: MRS | PAGE: 2 of 2
DRILLING METHOD: Hollow-Stem Auger

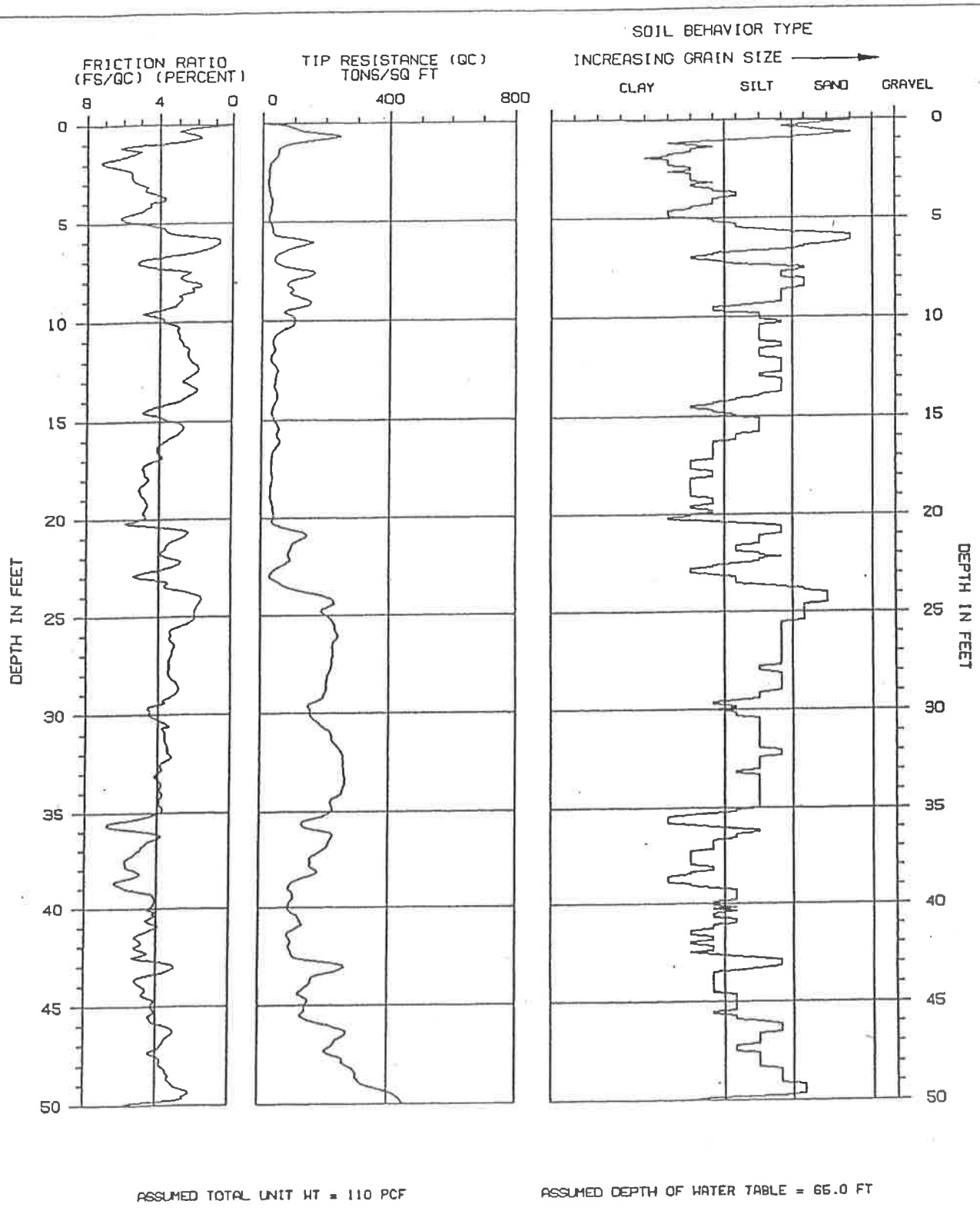
FIELD LOCATION: SE portion of Hill Crane

BORING DIAMETER: 8"
TOTAL DEPTH IN FT.: 76.5
BACKFILL MATERIAL: Bentonite
GROUND WATER ENCOUNTERED AT: Not Found

DEPTH	BLOW/FT	VAPOR CONC. (PPM)	SAMPLE TYPE	USCS SOIL TYPE	GRAPHICS LOG	DESCRIPTION	OTHER
40	44	25	Ring @ 40'	sm		Silty sand, fine grained, olive gray with locally brown, moist, medium dense, slight odor.	
45	84/11"	14	Ring @ 45'	sm		Silty sand, very fine grained, light olive gray, moist, dense, sewage odor, 0% LEL.	
	75/9"	-	Spt	sp		Sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor.	
50	50/8"	10	Ring @ 50'	sp		Sand, fine grained, light olive to olive gray, damp, very dense, no petroleum hydrocarbon odor.	
55	88	17	Ring @ 55'	sp		Sand, fine grained, light olive gray, damp, dense, no petroleum hydrocarbon odor, layers of olive gray silty sand, 40% LEL.	
60	50/11"	15	Ring @ 60'	sm		Silty sand, fine grained, light olive to olive gray, damp, very dense, no petroleum hydrocarobon odor, micaceous.	
						At 63 feet, 100% LEL.	
65	50/9"	9	Ring @ 65'	sm		Silty sand, fine grained, olive gray, very damp, very dense, no petroleum hydrocarbon odor, micaceous.	
	No Record	-	Spt	sm		Silty sand, fine grained, olive gray, very damp, very dense, no petroleum hydrocarbon odor, micaceous, shells, 100% LEL, purged with nitrogen.	
70	60/6"	12	Ring @ 70'	sm		Silty sand, fine grained, light olive gray, damp, very dense, slight petroleum hydrocarbon odor, micaceous, shells, 100% LEL, purged with nitrogen.	
75	79	8	Ring @ 75'	sm		Silty sand, fine grained, light olive gray, damp, very dense, no petroleum hydrocarbon odor, few shells, purged with nitrogen.	
						Total Depth: 76.5'	
80							

COMMENTS:

Elizabeth A. Rosen
California Registered Geologist



ASSUMED TOTAL UNIT WT = 110 PCF

ASSUMED DEPTH OF WATER TABLE = 65.0 FT

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-2 (1 OF 2)

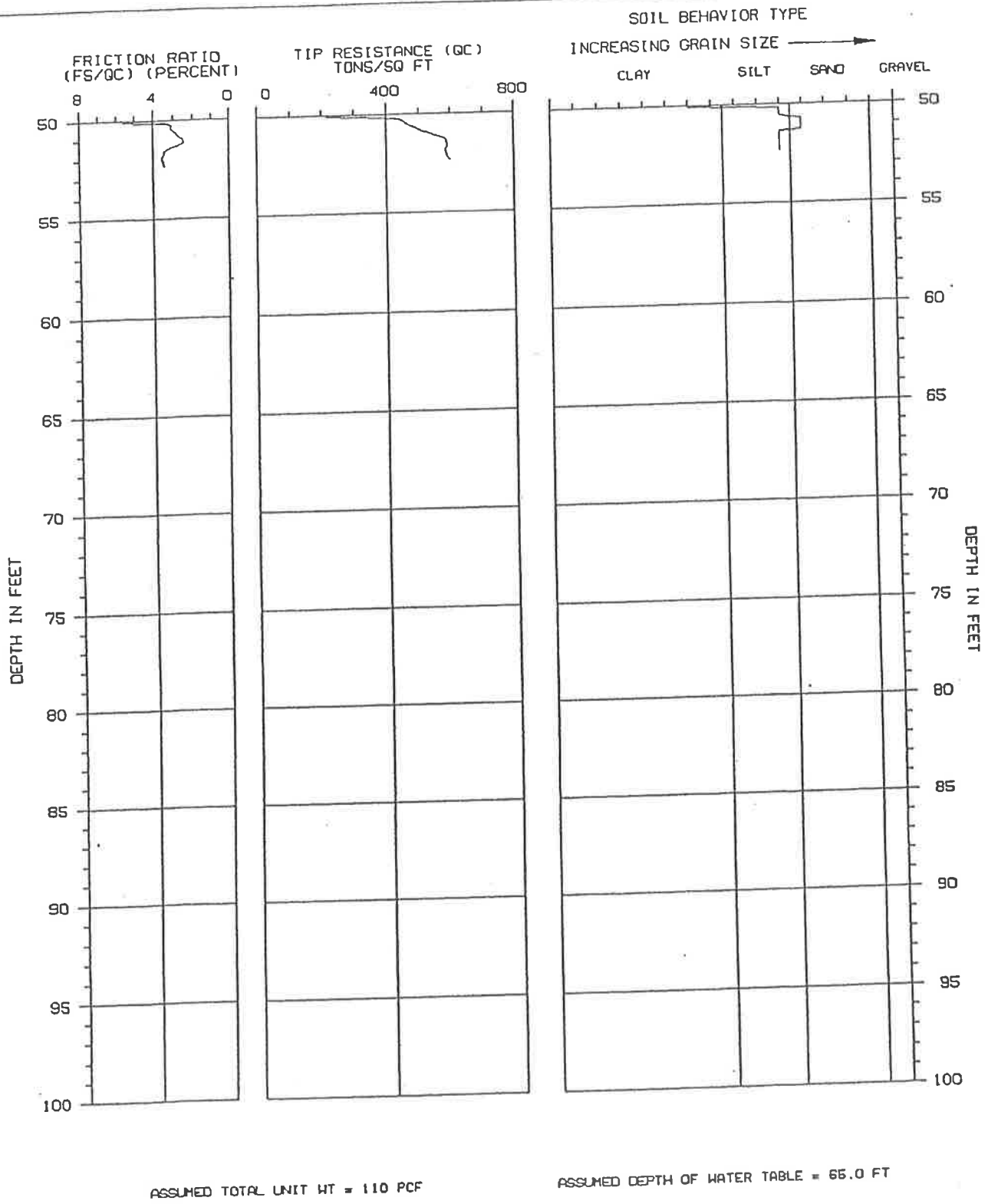
PROJECT NAME : ES&E/LB REDEVELOPMNT

PROJECT NUMBER : 93-380-11802

LOCATION : SIGNAL HILL

DATE : 11-13-1992

THE EARTH TECHNOLOGY CORPORATION



ASSUMED TOTAL UNIT WT = 110 PCF

ASSUMED DEPTH OF WATER TABLE = 65.0 FT

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-2 (2 OF 2)

PROJECT NAME : ES&E/LB REDEVELOPMNT

LOCATION : SIGNAL HILL

PROJECT NUMBER : 93-380-11802

DATE : 11-13-1992

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-2
PROJECT : ES&E/LB REDEVELOPMNT
LOCATION : SIGNAL HILL
DATE : 11-13-1992

PROJECT NO : 93-380-11802
INSTRUMENT : F15CKE095
SYSTEM : BOX-1
OPERATOR : MR/DM

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.0	.0	.00						
.5	396.2	2.56	*SILTY SAND to CLAYEY SAND	>40	>40			
1.0	245.6	3.87	*CLAYEY SAND to SANDY CLAY	>40	>40			
1.5	99.8	5.36	*SANDY CLAY to SILTY CLAY	>40	>40		1.61	
2.0	45.9	7.06	*SANDY CLAY to SILTY CLAY	>40	>40		.79	
2.5	35.7	5.56	*SANDY CLAY to SILTY CLAY	25-40	>40		.64	
3.0	27.6	5.21	CLAYEY SILT to SILTY CLAY	20-25	25-40		1.03	
3.5	36.2	4.33	CLAYEY SILT to SILTY CLAY	25-40	25-40		1.41	
4.0	44.5	4.55	*SANDY CLAY to SILTY CLAY	25-40	>40		.90	
4.5	36.7	5.26	*SANDY CLAY to SILTY CLAY	25-40	>40		.76	
5.0	33.3	5.18	*SANDY CLAY to SILTY CLAY	25-40	25-40		.71	
5.5	47.3	3.56	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90		27-31
6.0	202.7	.78	SAND to SILTY SAND	>40	>40	60-70		42-45
6.5	103.5	2.04	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
7.0	52.1	5.18	*SANDY CLAY to SILTY CLAY	>40	>40		1.23	
7.5	207.1	2.34	*SILTY SAND to CLAYEY SAND	>40	>40			
8.0	122.1	2.49	SILTY SAND to SANDY SILT	>40	>40	80-90		35-40
8.5	124.9	2.19	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
9.0	183.3	2.95	*SILTY SAND to CLAYEY SAND	>40	>40			
9.5	93.3	4.50	*SANDY CLAY to SILTY CLAY	>40	>40		2.45	
10.0	120.6	3.84	*CLAYEY SAND to SANDY CLAY	>40	>40			
10.5	78.5	3.01	SANDY SILT to CLAYEY SILT	>40	>40	80-90		31-35
11.0	41.6	2.80	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70		27-31
11.5	47.8	2.44	SILTY SAND to SANDY SILT	20-25	25-40	60-70		31-35
12.0	34.5	2.25	SANDY SILT to CLAYEY SILT	10-15	15-20	50-60		31-35
12.5	57.8	1.95	SILTY SAND to SANDY SILT	20-25	25-40	50-60		31-35
13.0	48.0	2.76	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70		31-35
13.5	51.8	1.97	SILTY SAND to SANDY SILT	20-25	20-25	50-60		31-35
14.0	50.5	3.01	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80		27-31
14.5	36.1	4.76	*SANDY CLAY to SILTY CLAY	25-40	>40		1.09	
15.0	42.2	3.24	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80		27-31
15.5	56.3	2.78	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80		31-35
16.0	59.1	3.58	SANDY SILT to CLAYEY SILT	>40	>40	90-100		27-31
16.5	43.0	4.10	CLAYEY SILT to SILTY CLAY	25-40	>40		2.74	
17.0	32.2	4.19	CLAYEY SILT to SILTY CLAY	20-25	25-40		2.06	
17.5	31.2	4.82	CLAYEY SILT to SILTY CLAY	25-40	25-40		2.02	
18.0	33.9	4.52	CLAYEY SILT to SILTY CLAY	25-40	25-40		2.23	
18.5	27.7	5.07	CLAYEY SILT to SILTY CLAY	20-25	25-40		1.83	
19.0	28.1	4.72	CLAYEY SILT to SILTY CLAY	20-25	25-40		1.87	
19.5	35.5	4.70	*SANDY CLAY to SILTY CLAY	25-40	25-40		1.21	
20.0	34.9	4.96	*SANDY CLAY to SILTY CLAY	25-40	>40		1.20	

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 115 PCF
ASSUMED DEPTH OF WATER TABLE = 65.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-2

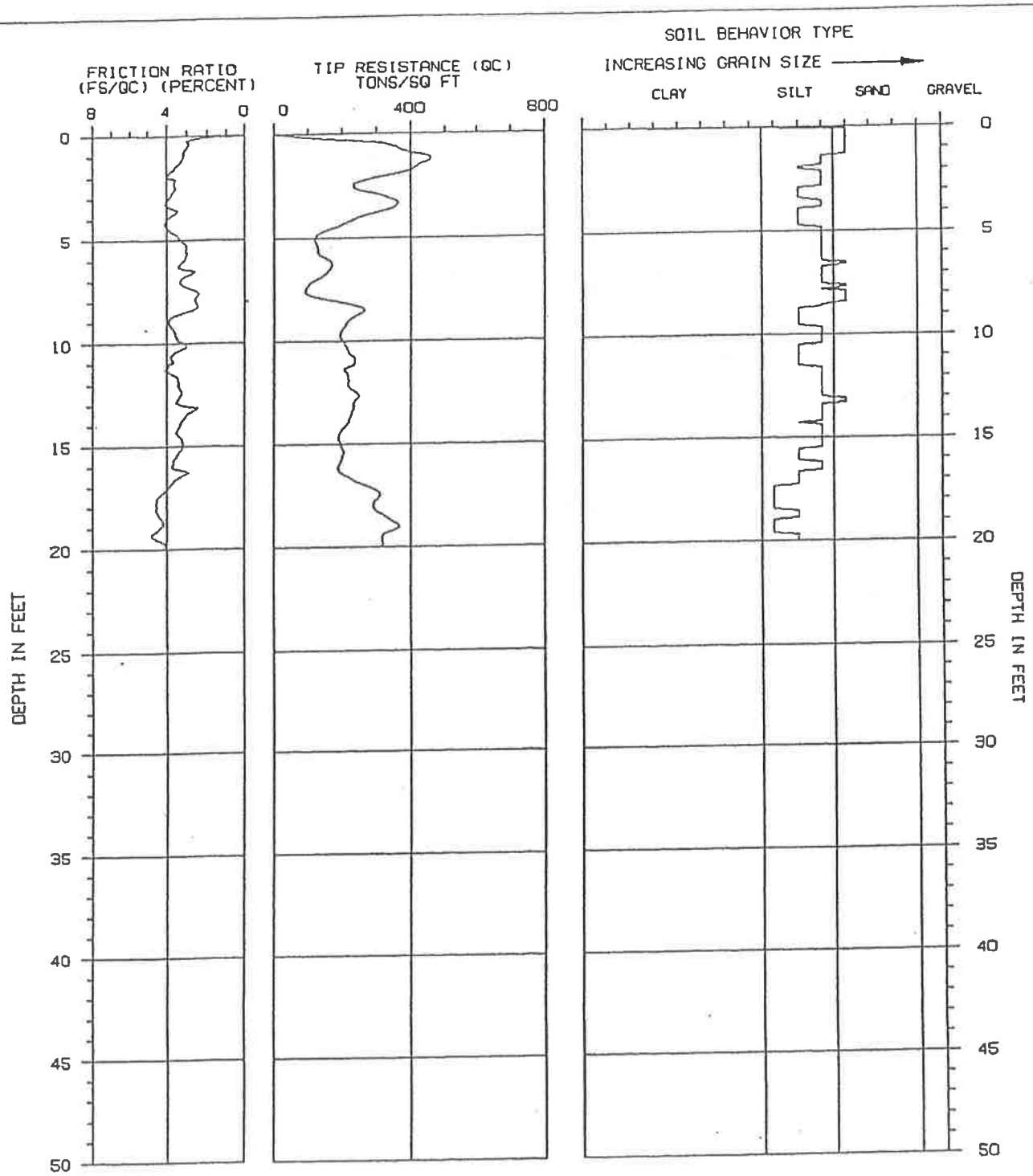
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.5	68.8	3.16	SANDY SILT to CLAYEY SILT	>40	>40	80-90		31-35
21.0	125.5	2.84	*SILTY SAND to CLAYEY SAND	>40	>40	90-100		35-40
21.5	85.2	3.65	*CLAYEY SAND to SANDY CLAY	>40	>40			
22.0	77.9	3.46	*CLAYEY SAND to SANDY CLAY	>40	>40	90-100		31-35
22.5	52.0	3.51	SANDY SILT to CLAYEY SILT	25-40	>40	80-90		27-31
23.0	22.8	5.20	CLAYEY SILT to SILTY CLAY	15-20	25-40		1.65	
23.5	66.4	3.60	*CLAYEY SAND to SANDY CLAY	>40	>40	90-100		27-31
24.0	168.7	1.66	SAND to SILTY SAND	>40	>40	70-80		40-42
24.5	184.6	1.94	SAND to SILTY SAND	>40	>40	80-90		40-42
25.0	173.8	2.01	SILTY SAND to SANDY SILT	>40	>40	80-90		40-42
25.5	193.4	2.86	*SILTY SAND to CLAYEY SAND	>40	>40			
26.0	199.4	3.28	*SILTY SAND to CLAYEY SAND	>40	>40			
26.5	184.0	3.11	*SILTY SAND to CLAYEY SAND	>40	>40			
27.0	183.6	3.27	*SILTY SAND to CLAYEY SAND	>40	>40			
27.5	178.0	3.37	*CLAYEY SAND to SANDY CLAY	>40	>40			
28.0	167.4	3.39	*CLAYEY SAND to SANDY CLAY	>40	>40			
28.5	162.5	2.93	*SILTY SAND to CLAYEY SAND	>40	>40			
29.0	155.7	3.09	*SILTY SAND to CLAYEY SAND	>40	>40			
29.5	117.3	4.07	*CLAYEY SAND to SANDY CLAY	>40	>40			
30.0	116.5	4.52	*SANDY CLAY to SILTY CLAY	>40	>40		5.03	
30.5	138.8	3.46	*CLAYEY SAND to SANDY CLAY	>40	>40			
31.0	164.5	3.58	*CLAYEY SAND to SANDY CLAY	>40	>40			
31.5	171.3	3.46	*CLAYEY SAND to SANDY CLAY	>40	>40			
32.0	188.5	3.33	*SILTY SAND to CLAYEY SAND	>40	>40			
32.5	188.2	3.78	*CLAYEY SAND to SANDY CLAY	>40	>40			
33.0	189.3	4.07	*CLAYEY SAND to SANDY CLAY	>40	>40			
33.5	190.4	3.81	*CLAYEY SAND to SANDY CLAY	>40	>40			
34.0	180.9	3.75	*CLAYEY SAND to SANDY CLAY	>40	>40			
34.5	154.0	3.96	*CLAYEY SAND to SANDY CLAY	>40	>40			
35.0	155.3	3.87	*CLAYEY SAND to SANDY CLAY	>40	>40			
35.5	99.7	6.22	*SANDY CLAY to SILTY CLAY	>40	>40		4.75	
36.0	127.7	4.59	*SANDY CLAY to SILTY CLAY	>40	>40		6.15	
36.5	149.5	4.33	*CLAYEY SAND to SANDY CLAY	>40	>40			
37.0	134.9	4.99	*SANDY CLAY to SILTY CLAY	>40	>40		6.62	
37.5	104.4	5.74	*SANDY CLAY to SILTY CLAY	>40	>40		5.15	
38.0	111.0	5.32	*SANDY CLAY to SILTY CLAY	>40	>40		5.53	
38.5	87.8	5.69	*SANDY CLAY to SILTY CLAY	>40	>40		4.40	
39.0	58.5	5.72	*SANDY CLAY to SILTY CLAY	>40	>40		2.93	
39.5	67.4	4.14	*CLAYEY SAND to SANDY CLAY	>40	>40			
40.0	56.1	4.43	*SANDY CLAY to SILTY CLAY	>40	>40		2.85	
40.5	77.8	4.30	*CLAYEY SAND to SANDY CLAY	>40	>40			
41.0	79.9	4.03	*CLAYEY SAND to SANDY CLAY	>40	>40			
41.5	56.8	5.24	*SANDY CLAY to SILTY CLAY	>40	>40		2.96	
42.0	56.9	5.24	*SANDY CLAY to SILTY CLAY	>40	>40		2.99	
42.5	65.4	5.36	*SANDY CLAY to SILTY CLAY	>40	>40		3.48	
43.0	159.9	3.00	*SILTY SAND to CLAYEY SAND	>40	>40			
43.5	105.2	4.90	*SANDY CLAY to SILTY CLAY	>40	>40		5.74	
44.0	90.3	4.74	*SANDY CLAY to SILTY CLAY	>40	>40		4.96	
44.5	77.7	4.59	*SANDY CLAY to SILTY CLAY	>40	>40		4.29	
45.0	84.1	4.27	*CLAYEY SAND to SANDY CLAY	>40	>40			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 115 PCF
ASSUMED DEPTH OF WATER TABLE = 65.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-2

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
45.5	75.9	4.41	*SANDY CLAY to SILTY CLAY	>40	>40		4.26	
46.0	123.2	3.44	*CLAYEY SAND to SANDY CLAY	>40	>40			
46.5	153.9	3.30	*CLAYEY SAND to SANDY CLAY	>40	>40			
47.0	132.8	3.75	*CLAYEY SAND to SANDY CLAY	>40	>40			
47.5	127.7	4.02	*CLAYEY SAND to SANDY CLAY	>40	>40			
48.0	151.3	3.72	*CLAYEY SAND to SANDY CLAY	>40	>40			
48.5	169.9	3.25	*SILTY SAND to CLAYEY SAND	>40	>40			
49.0	178.5	3.04	*SILTY SAND to CLAYEY SAND	>40	>40			
49.5	228.6	2.32	*SILTY SAND to CLAYEY SAND	>40	>40			
50.0	244.0	5.88	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
50.5	247.8	3.08	*SILTY SAND to CLAYEY SAND	>40	>40			
51.0	282.3	2.53	*SILTY SAND to CLAYEY SAND	>40	>40			
51.5	310.4	3.26	*SILTY SAND to CLAYEY SAND	>40	>40			
52.0	307.2	3.53	*SILTY SAND to CLAYEY SAND	>40	>40			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 115 PCF
ASSUMED DEPTH OF WATER TABLE = 65.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-3

PROJECT NAME : ES&E/LB REDEVELOPMNT

PROJECT NUMBER : 93-380-11802

LOCATION : SIGNAL HILL

DATE : 11-13-1992

THE EARTH TECHNOLOGY CORPORATION

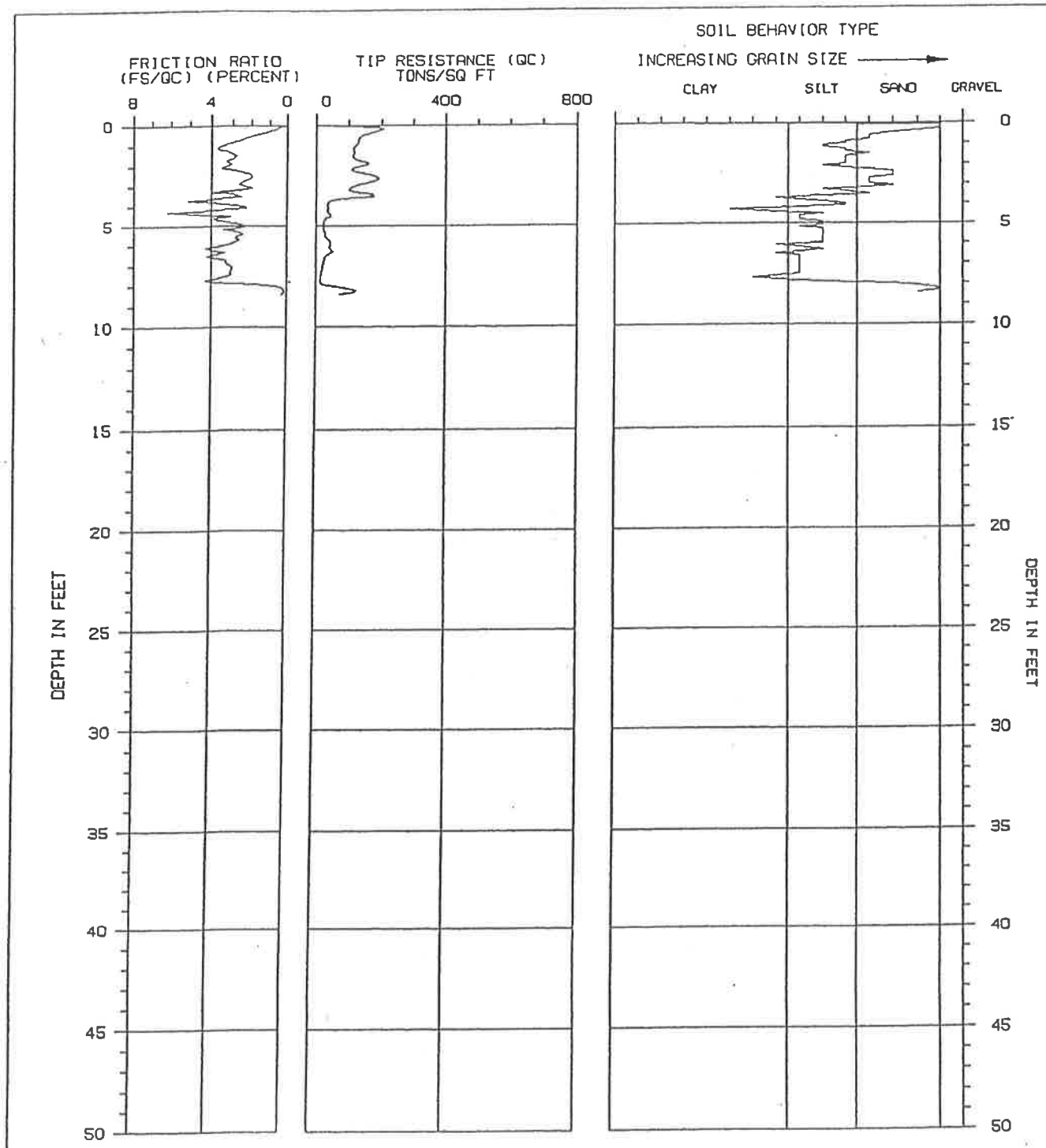
CPT INTERPRETATIONS

SOUNDING : CPT-3
PROJECT : ES&E/LB REDEVELOPMNT
LOCATION : SIGNAL HILL
DATE : 11-13-1992

PROJECT NO : 93-380-11802
INSTRUMENT : F15CKE095
SYSTEM : BOX-1
OPERATOR : MR/DM

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.0	.0	.00						
.5	801.5	2.96	*SILTY SAND to CLAYEY SAND	>40	>40			
1.0	949.1	3.16	*SILTY SAND to CLAYEY SAND	>40	>40			
1.5	879.2	3.54	*SILTY SAND to CLAYEY SAND	>40	>40			
2.0	638.9	3.95	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
2.5	432.0	3.50	*SILTY SAND to CLAYEY SAND	>40	>40			
3.0	574.8	3.92	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
3.5	597.7	3.63	*SILTY SAND to CLAYEY SAND	>40	>40			
4.0	412.1	3.99	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
4.5	276.1	3.86	*CLAYEY SAND to SANDY CLAY	>40	>40			
5.0	184.1	3.31	*SILTY SAND to CLAYEY SAND	>40	>40			
5.5	195.7	3.03	*SILTY SAND to CLAYEY SAND	>40	>40			
6.0	226.1	3.11	*SILTY SAND to CLAYEY SAND	>40	>40			
6.5	234.1	2.60	*SILTY SAND to CLAYEY SAND	>40	>40			
7.0	180.7	3.33	*SILTY SAND to CLAYEY SAND	>40	>40			
7.5	126.2	2.53	SILTY SAND to SANDY SILT	>40	>40	90-100		35-40
8.0	216.0	2.59	*SILTY SAND to CLAYEY SAND	>40	>40			
8.5	350.3	3.08	*SILTY SAND to CLAYEY SAND	>40	>40			
9.0	283.4	3.90	*CLAYEY SAND to SANDY CLAY	>40	>40			
9.5	247.6	3.57	*CLAYEY SAND to SANDY CLAY	>40	>40			
10.0	252.7	3.12	*SILTY SAND to CLAYEY SAND	>40	>40			
10.5	268.3	3.70	*CLAYEY SAND to SANDY CLAY	>40	>40			
11.0	286.1	3.86	*CLAYEY SAND to SANDY CLAY	>40	>40			
11.5	251.7	3.65	*CLAYEY SAND to SANDY CLAY	>40	>40			
12.0	253.6	3.41	*SILTY SAND to CLAYEY SAND	>40	>40			
12.5	280.0	3.29	*SILTY SAND to CLAYEY SAND	>40	>40			
13.0	266.0	3.17	*SILTY SAND to CLAYEY SAND	>40	>40			
13.5	253.3	3.06	*SILTY SAND to CLAYEY SAND	>40	>40			
14.0	236.0	3.37	*SILTY SAND to CLAYEY SAND	>40	>40			
14.5	206.0	3.35	*SILTY SAND to CLAYEY SAND	>40	>40			
15.0	208.1	3.21	*SILTY SAND to CLAYEY SAND	>40	>40			
15.5	213.9	3.48	*CLAYEY SAND to SANDY CLAY	>40	>40			
16.0	196.7	3.75	*CLAYEY SAND to SANDY CLAY	>40	>40			
16.5	206.0	3.27	*SILTY SAND to CLAYEY SAND	>40	>40			
17.0	266.1	3.90	*CLAYEY SAND to SANDY CLAY	>40	>40			
17.5	310.6	4.45	*CLAYEY SAND to SANDY CLAY	>40	>40			
18.0	287.1	4.55	*CLAYEY SAND to SANDY CLAY	>40	>40			
18.5	310.9	4.37	*CLAYEY SAND to SANDY CLAY	>40	>40			
19.0	354.2	4.39	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
19.5	302.9	4.71	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
20.0	297.9	4.06	*CLAYEY SAND to SANDY CLAY	>40	>40			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 115 PCF
ASSUMED DEPTH OF WATER TABLE = 65.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



ASSUMED TOTAL UNIT WT = 110 PCF

ASSUMED DEPTH OF WATER TABLE = 65.0 FT

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-7

PROJECT NAME : ES&E/LB REDEVELOPMNT

PROJECT NUMBER : 93-380-11802

LOCATION : SIGNAL HILL

DATE : 11-13-1992

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-7
PROJECT : ES&E/LB REDEVELOPMNT
LOCATION : SIGNAL HILL
DATE : 11-13-1992

PROJECT NO : 93-380-11802
INSTRUMENT : F15CKE095
SYSTEM : BOX-1
OPERATOR : MR/DM

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.0	.0	.00						
.5	367.4	1.77	*SAND to SILTY SAND	>40	>40			
1.0	269.7	3.47	*SILTY SAND to CLAYEY SAND	>40	>40			
1.5	230.3	2.79	*SILTY SAND to CLAYEY SAND	>40	>40			
2.0	262.7	3.33	*SILTY SAND to CLAYEY SAND	>40	>40			
2.5	341.5	1.92	*SAND to SILTY SAND	>40	>40	90-100		40-42
3.0	206.2	2.28	*SILTY SAND to CLAYEY SAND	>40	>40			
3.5	300.6	2.50	*SILTY SAND to CLAYEY SAND	>40	>40			
4.0	58.2	2.39	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
4.5	73.3	3.12	SANDY SILT to CLAYEY SILT	>40	>40	80-90		31-35
5.0	34.0	2.22	SANDY SILT to CLAYEY SILT	10-15	15-20	50-60		31-35
5.5	40.3	2.80	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70		27-31
6.0	64.1	3.46	SANDY SILT to CLAYEY SILT	>40	>40	90-100		27-31
6.5	44.8	4.24	*SANDY CLAY to SILTY CLAY	25-40	>40		1.03	
7.0	28.7	3.11	SANDY SILT to CLAYEY SILT	15-20	20-25	60-70		27-31
7.5	20.1	3.30	SANDY SILT to CLAYEY SILT	10-15	15-20	50-60		
8.0	46.3	.68	SAND to SILTY SAND	5-10	10-15	30-40		35-40

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 115 PCF
ASSUMED DEPTH OF WATER TABLE = 65.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

By

AMEC Earth and Environmental, Inc., August 4, 2003

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	73 FEET	BORING	A-11

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
			10.5	8	1.4 BULK	1 2	5		SC	**ARTIFICIAL FILL (af):** Brown, fine to coarse CLAYEY SAND with GRAVEL; scattered chunks of brick . . . (4 feet) loose
		105.8	13.3	26	2.4	3	10			
				3	1.4 BULK	NSR 6	15 ▼		SC	Black to dark gray, fine to medium CLAYEY SAND to SANDY CLAY; mottled to massive, very loose . . . (16 feet) groundwater level 14 hours after completion of drilling
		110.4	14.8	8	2.4	4	20			. . . (20 feet) seepage encountered during drilling . . . (20 feet) locally with SANDY SILT
			18.6	8	1.4	5	25			. . . (24 feet) loose consistency, trace petroleum product in sample . . . (25 feet) chunk of asphalt in SPT sample
	Consol	70.5	49.7	6	2.4 BULK	7 8	30		CL SP	**ALLUVIUM (Qal):** Gray SILTY CLAY with lenses of black petroleum saturated SAND; massive, trace decomposing plant material
			180.1	6	1.4	9	35		OL	Black organic SILT and gray SANDY SILT . . . (34 feet) firm consistency
							40		SC	Dark gray CLAYEY SAND, massive, micaceous, trace petroleum product
			14.1	25	1.4	10	45			. . . (44 feet) medium dense . . . (45 feet) groundwater encountered during drilling
		43.3	141.0	12	2.4	11	50		OL	Dark gray and brown organic SILT; trace visible decaying wood fragments

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **GTL** DATE **4-24-03**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	73 FEET	BORING	A-11

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
			34.7	11	1.4	12	55		SM	gray, fine SILTY SAND; massive, micaceous, scattered decomposing wood fragments . . . (54 feet) medium dense
		108.4	2.4	94	2.4	13	60		SM	**SAN PEDRO FORMATION (Qsp):** Gray, fine SILTY SAND; massive, micaceous
			22.1	33	1.4	14	65			. . . (64 feet) dense

NOTES:

1. Total depth of boring 65.5 feet.
2. No caving or sloughing.
3. During drilling seepage encountered at 20 feet and groundwater encountered at 45 feet; water level measured at 16 feet in open boring 14 hours after completion of drilling.
4. Boring location and elevation based on PBS&J survey.
5. Boring backfilled with grout on April 25, 2003.
6. Drive Weights: 2.4-inch and 1.4-inch (SPT) samples driven with 140 lb automatic trip-hammer, dropped 30-inches.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY	GTL	DATE	4-24-03

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	71 FEET	BORING	A-22

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
			14.4	22	1.4 BULK	1 2	5		SC	**ARTIFICIAL FILL (af):** Gray brown and tan, fine CLAYEY SAND with fine to medium GRAVEL; mottled
										. . . (4 feet) medium dense
		109.2	11.7	16	2.4	3	10			. . . (10 feet) scattered chunks of asphalt and concrete
			14.3	8	1.4	4	15			. . . (15 feet) scattered asphalt and brick, loose
CONSOL		116.5	11.5	13	2.4	5	20		CL	Dark gray, gray, brown, and black SANDY CLAY with trace GRAVEL; mottled
			31.7	8	1.4	6	25		CL	**ALLUVIUM (Qal):** Gray to dark gray CLAY with scattered thin lenses of gray, fine SAND; massive, trace decomposing wood fragments, firm to stiff
CONSOL		92.1	18.9	16	2.4	7	30		SC	Dark gray to orange black, fine CLAYEY SAND; massive, scattered decomposing wood fragments
			14.2	24	1.4	8	35		SM	**SAN PEDRO FORMATION (Qsp):** Gray SILTY SAND with trace local CLAY; massive, micaceous, medium dense
		107.5	2.1	49	2.4	9	40		SP	Gray, fine SAND with lenses of CLAYEY SAND and SILTY SAND; micaceous
			18.1	29	1.4	10	45		SM ML	Gray, fine SILTY SAND to SANDY SILT; massive, micaceous, medium dense
		94.1	15.1	47	2.4	11	50			

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY GTL DATE 4-28-03

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	71 FEET	BORING	A-22

NOTES:

1. Total depth of boring 50.5 feet.
2. No caving or sloughing.
3. No groundwater encountered.
4. Boring location and elevation based on PBS&J survey.
5. Boring backfilled with cuttings from 50.5 feet to 40 feet in depth; then filled with bentonite/water mix to 10 feet in depth; then backfilled with cuttings to top of hole on April 28, 2003.
6. Drive Weights: 2.4-inch and 1.4-inch (SPT) samples driven with 140 lb automatic trip-hammer, dropped 30-inches.

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **GTL** DATE **4-28-03**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE 8" DIA. HOLLOW STEM AUGER | ELEVATION 69 FEET | BORING A-23

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
			6.0	46	1.4 BULK	1 2	5		SC	**ARTIFICIAL FILL (af):** Brown CLAYEY SAND with GRAVEL; chunks of asphalt and concrete
		123.5	6.0	32	2.4	3	10			. . . (10 feet) asphalt and concrete
			22.4	3	1.4	4	15		ML	Dark gray brown SANDY SILT and CLAYEY SILT locally with SAND; mottled, micaceous . . . (14 feet) soft
		114.9	15.1	26	2.4	5	20			
			153.8	16	1.4	6	25		OL	**ALLUVIUM (Qal):** Gray and dark gray brown organic CLAY to CLAY with orgaincs with scattered thin layers of fine SAND; micaceous, very stiff
	Consol	27.8	183.3	11	2.4	7	30		OL	Black, organic CLAY to CLAYEY PEAT with abundant decomposing wood fragments
			65.0	5	1.4	8	35		SC	Gray, fine CLAYEY SAND; massive, micaceous, loose . . . (35 feet) seepage
		111.1	19.8	27	2.4	9	40			
			21.7	4	1.4	10	45		CL	Gray to dark gray SANDY CLAY with scattered beds of peaty CLAY, stiff to firm
		103	25.0	26	2.4	11	50		ML	**SAN PEDRO FORMATION (Qsp):** Gray SILT with scattered thin lenses of fine SAND

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY GTL | DATE 4-28-03

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	69 FEET	BORING	A-23

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
			14.3	33	1.4	12	55		SM	Gray, fine SILTY SAND with lenses of fine to coarse SAND and local CLAY; micaceous, dense
		113	3.4	69	2.4	13	60		SW	Gray, fine to coarse SAND
			5.7	50+	1.4	14	65			. . . (64 feet) very dense

NOTES:

1. Total depth of boring 65.5 feet.
2. No caving or sloughing.
3. Seepage encountered at 35 feet.
4. Boring location and elevation based on PBS&J survey.
5. Boring backfilled with cuttings from 65.5 feet to 50 feet in depth; then filled with bentonite/water mix from 50 feet to 20 feet in depth; then backfilled with cuttings from 20 feet to top of hole on April 28, 2003.
6. Drive Weights: 2.4-inch and 1.4-inch (SPT) samples driven with 140 lb automatic trip-hammer, dropped 30-inches.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY GTL | DATE 4-28-03

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	75 FEET	BORING	A-24

STRIKE / DIP	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
					BULK	1		SM ML		**ARTIFICIAL FILL (af):** Orange brown SILTY SAND to SANDY SILT with GRAVEL; chunks of brick, mottled
			7.6	5	1.4	2	5			. . . (4 feet) loose
								SM ML		**SAN PEDRO FORMATION (Qsp):** Tan SILTY SAND to SANDY SILT with scattered thin lenses of fine SAND; local orange oxidation
		97	11.2	38	2.4	3	10			
			13.9	28	1.4	4	15			. . . (14 feet) medium dense
								SM		Tan and gray orange, fine SILTY SAND to SANDY SILT; massive with mottled orange oxidation staining
		100.2	16.1	32	2.4	5	20			
								ML		Gray SANDY SILT; massive with mottled orange oxidation, very stiff
			19.0	25	1.4	6	25			

NOTES:

1. Total depth of boring 25.5 feet.
2. No caving or sloughing.
3. No groundwater encountered.
4. Boring location and elevation based on PBS&J survey.
5. Boring backfilled with cuttings on April 28, 2003.
6. Drive Weights: 2.4-inch and 1.4-inch (SPT) samples driven with 140 lb automatic trip-hammer, dropped 30-inches.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

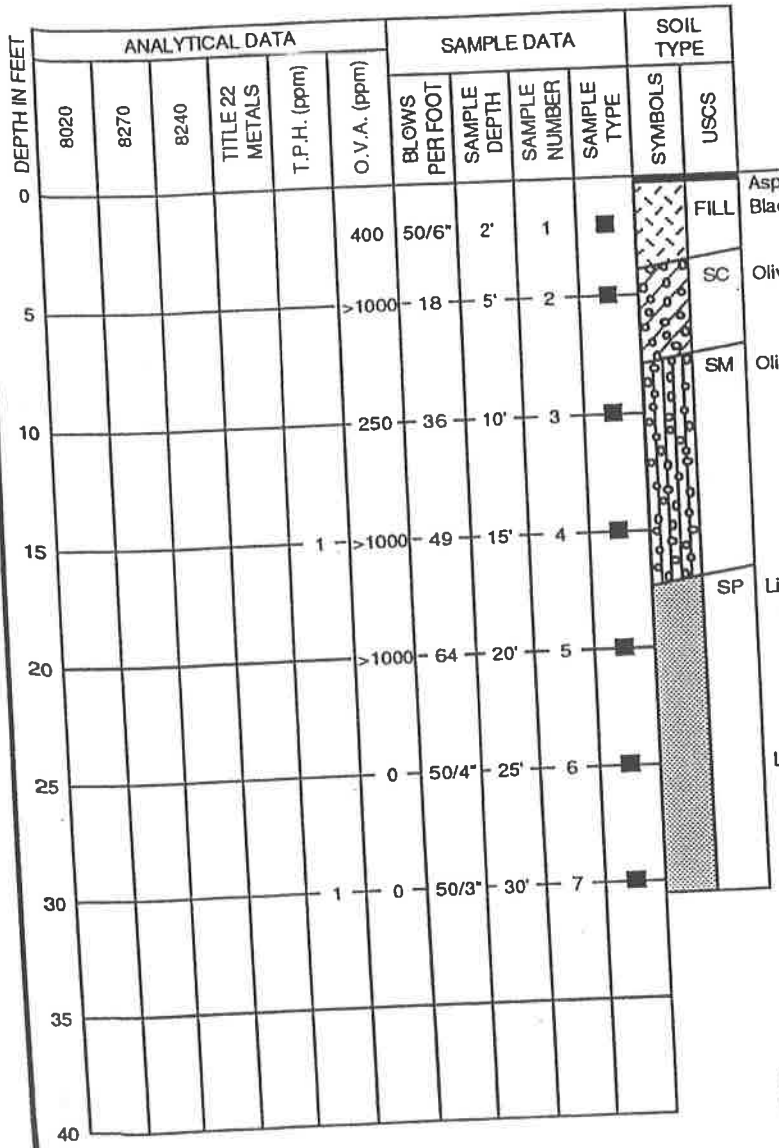
LOGGED BY GTL | DATE 4-28-03

By

Dames and Moore, 1998

BORING S-1

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Asphalt
Black gravelly medium to coarse sand, damp, moderate hydrocarbon odor

Olive-grey clayey fine sand, very moist, moderate hydrocarbon odor
Increasing clay in cuttings

Olive-grey silty fine sand, moist, moderate hydrocarbon odor

As above

As above

Light grey and light brown mottled fine sand, damp, slight hydrocarbon odor

Light brownish-grey fine sand, damp, no odor

Light brown fine sand, dry, no odor

BORING TERMINATED AT A DEPTH OF 30-1/2 FEET ON MARCH 8, 1988
NO WATER ENCOUNTERED

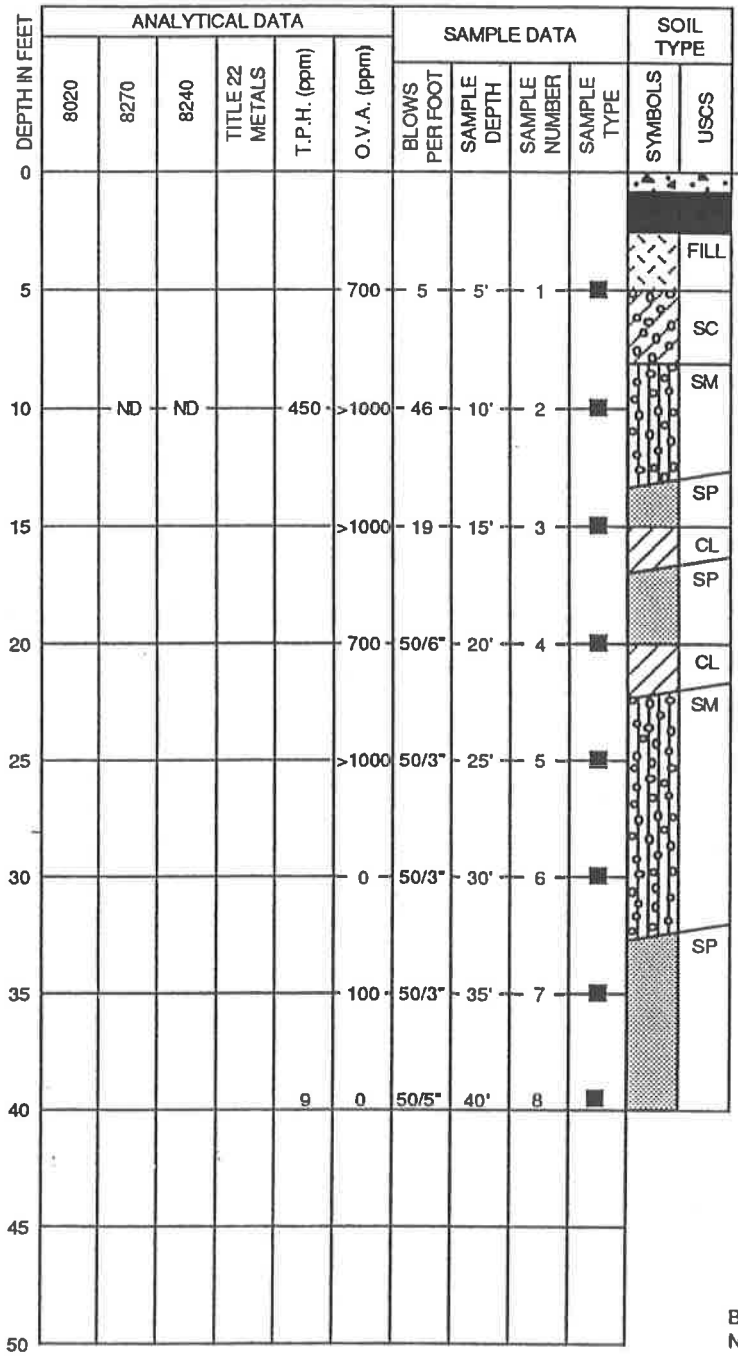
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moor
FIGURE B-56

BORING S-2

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

- Concrete
- Asphaltic concrete
- FILL — Grey gravelly fine to coarse sand
- Black fine sandy silt sludge, very moist, very strong hydrocarbon odor, abundant hydrocarbon staining
- SC — Dark olive clayey fine sand, very moist, strong hydrocarbon odor
- SM — Dark olive silty fine sand, moist, strong hydrocarbon odor
- SP — Olive fine to medium sand
- CL — Dark and light olive-grey silty clay, moist, strong hydrocarbon odor
- SP — Dark olive fine to coarse sand, very moist, strong hydrocarbon odor
- CL — Olive silty clay, moist, strong hydrocarbon odor
- SM — Olive silty fine sand, moist, strong hydrocarbon odor
- As above, no hydrocarbon odor
- SP — Light grey fine to medium sand, damp, slight hydrocarbon odor
- As above

BORING TERMINATED AT A DEPTH OF 40 FEET ON MARCH 8, 1988
NO WATER ENCOUNTERED

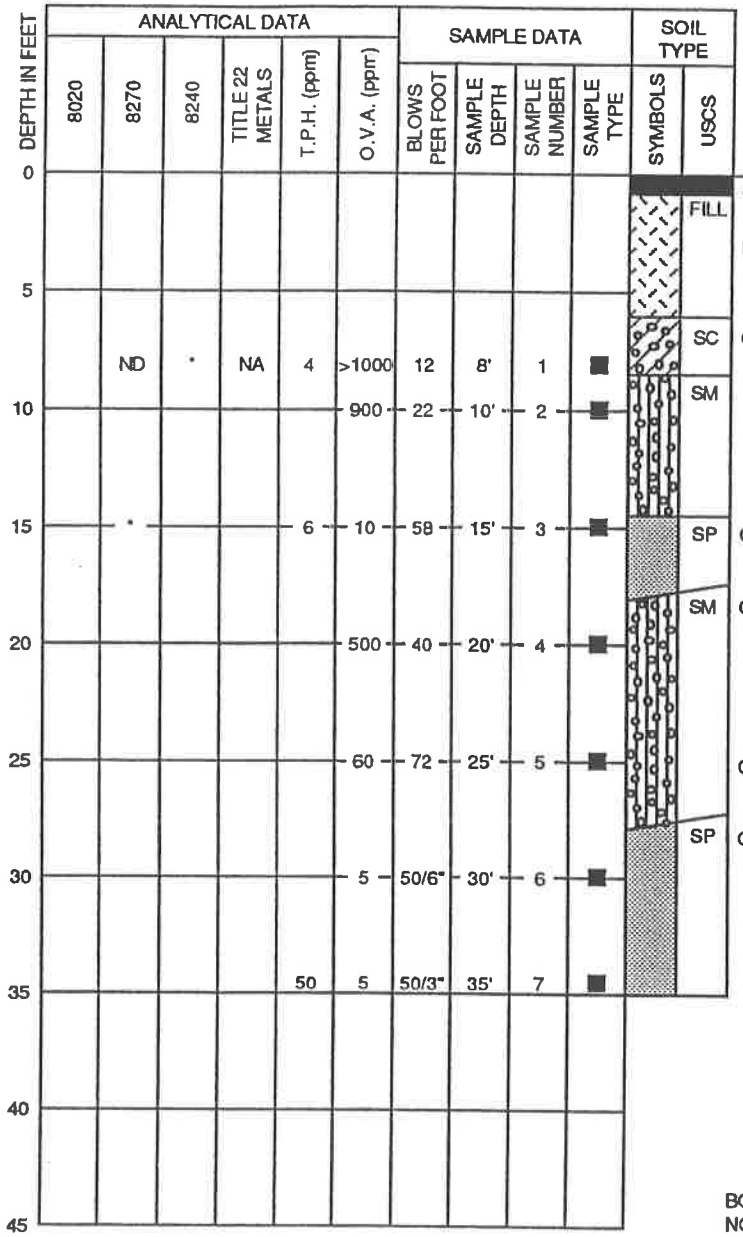
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-57

BORING S-3b

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



BORING TERMINATED AT A DEPTH OF 35 FEET ON MARCH 9, 1988
NO WATER ENCOUNTERED

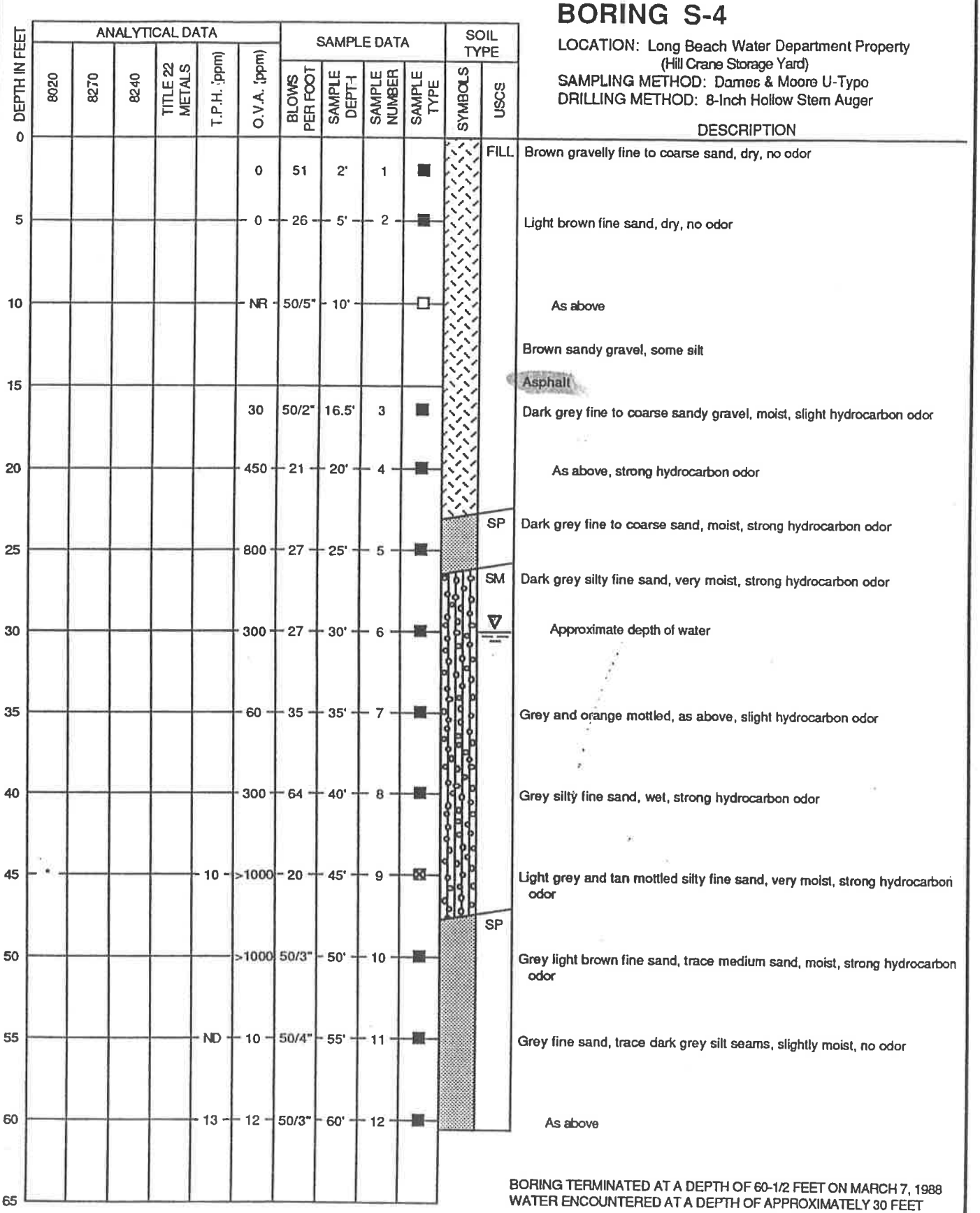
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-58

BORING S-4

LOCATION: Long Beach Water Department Property
(Hill Crane Storage Yard)
SAMPLING METHOD: Dames & Moore U-Typo
DRILLING METHOD: 8-Inch Hollow Stem Auger



BORING TERMINATED AT A DEPTH OF 60-1/2 FEET ON MARCH 7, 1988
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 30 FEET

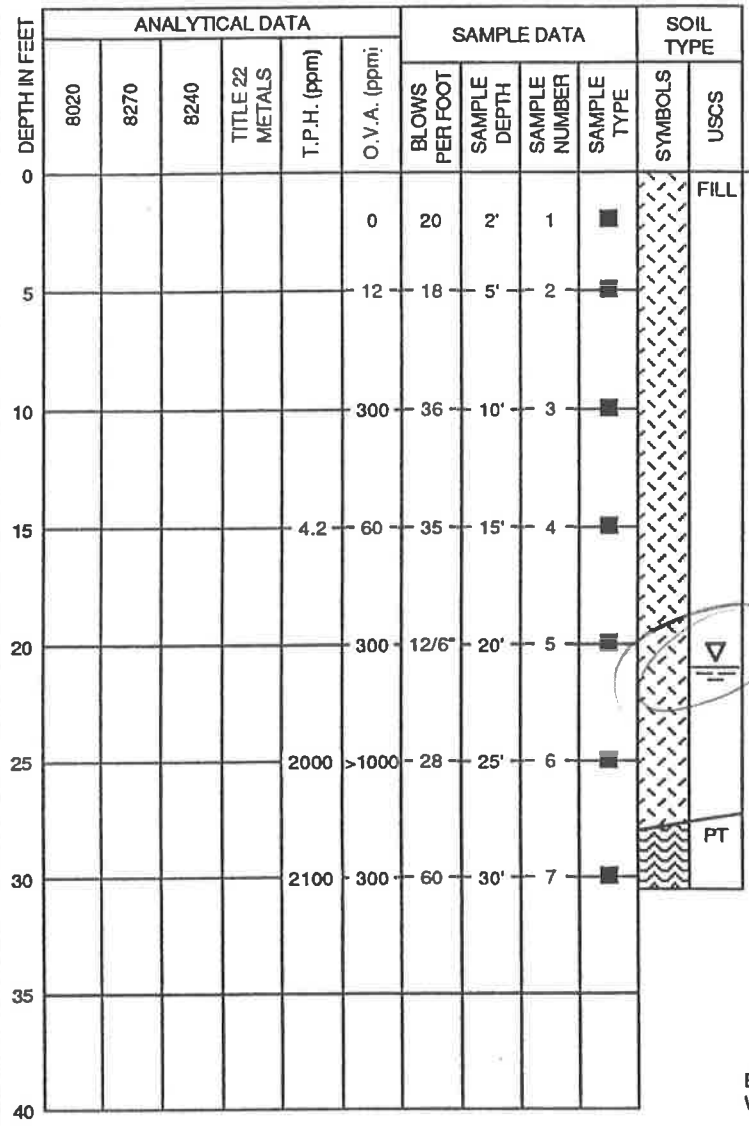
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-59

BORING S-5b

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Brown gravelly silt, some fine to coarse sand (fill), moist, no odor

Some asphalt cobbles

Black at 5-1/2 feet, moderate hydrocarbon odor, black sandy silt at 5-1/2 feet, brick at 7 feet

Difficult drilling

Greyish-black fine sandy silt, very moist at 9 feet, damp at 10-1/2 feet, strong hydrocarbon odor

Brown gravelly silt, some fine to coarse sand, moist, strong hydrocarbon odor

Change to black

As above
Approximate depth of water

Dark grey fine sand with some silt and thin clay layers, wet, strong hydrocarbon odor

Dark brown peat, abundant organic material, soft, spongy, little fine to medium sand seams, moist, moderate organic odor

BORING TERMINATED AT A DEPTH OF 30-1/2 FEET ON MARCH 7, 1988
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 21 FEET

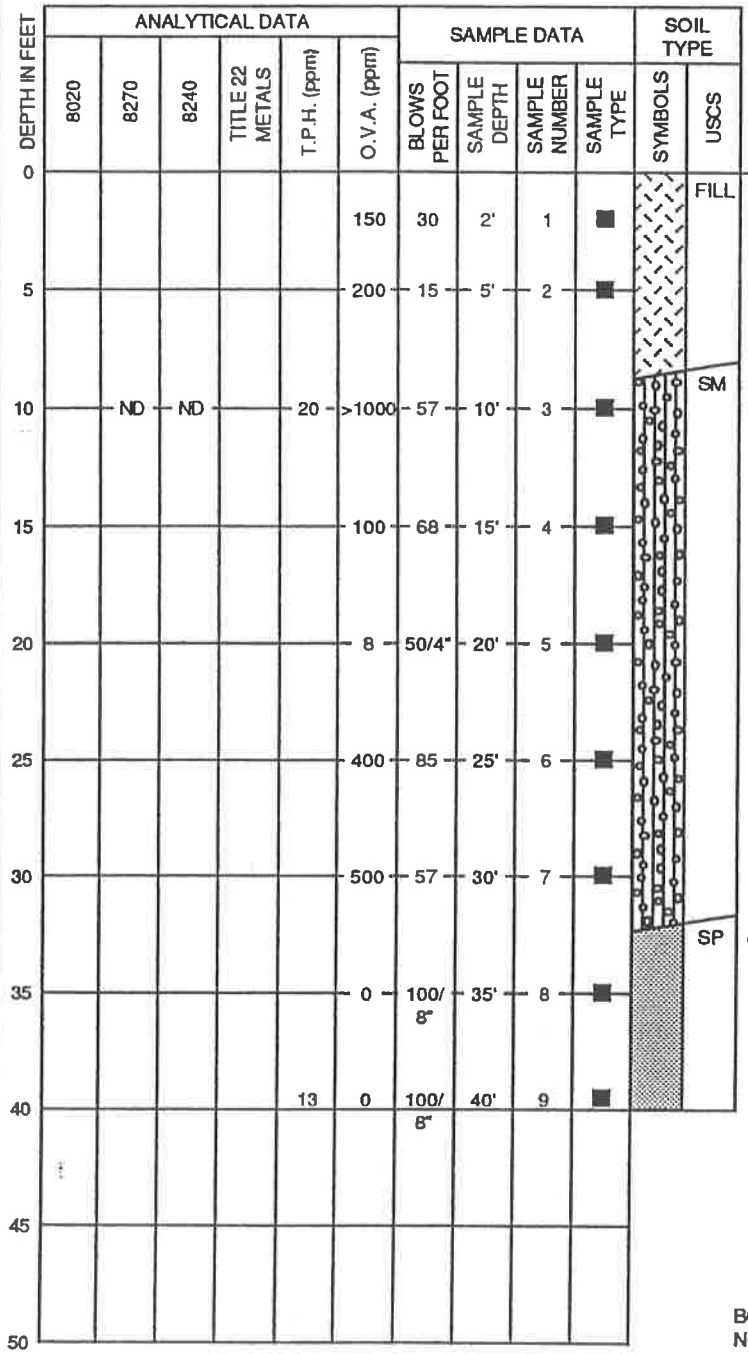
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-60

BORING S-6

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Brown gravelly fine to coarse sand, damp, moderate hydrocarbon odor
Olive clayey fine to medium sand, moist, moderate hydrocarbon odor
Light brown fine sand, dry, slight hydrocarbon odor
Light brown silty fine sand, dry, no hydrocarbon odor
Light brown and grey mottled silty fine sand, damp, no odor
Light brown silty fine sand, dry, no odor
Grey silty fine sand, damp, moderate hydrocarbon odor
Dark grey silty fine sand, damp, no odor
Grey fine sand, damp, slight hydrocarbon odor
As above, no odor

BORING TERMINATED AT A DEPTH OF 40 FEET ON MARCH 8, 1988
NO WATER ENCOUNTERED

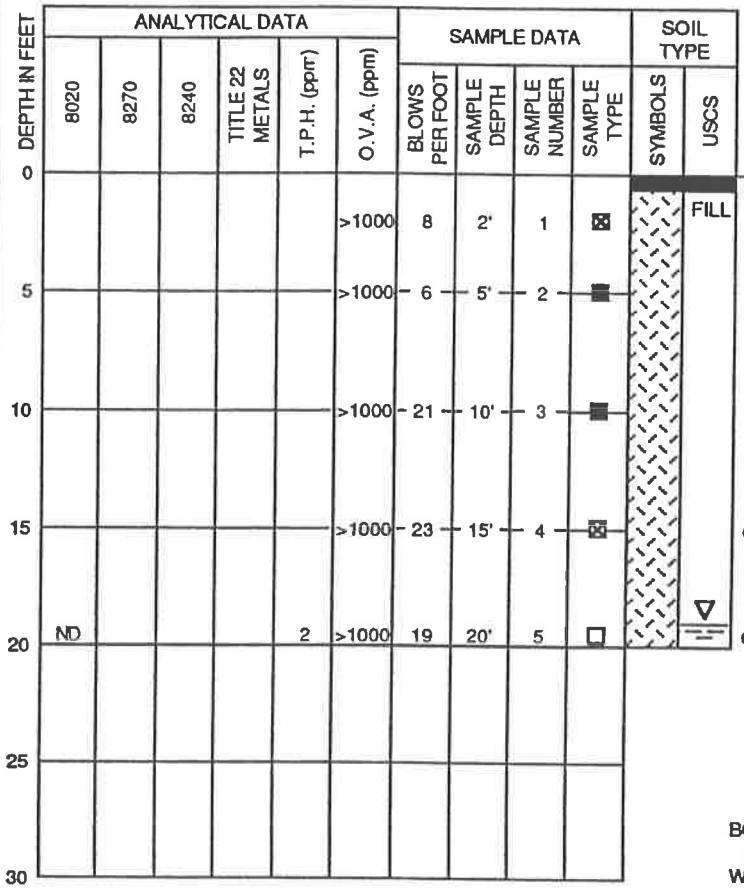
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-61

BORING S-7

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Asphalt
Dark grey gravelly fine to coarse sand, moist, strong hydrocarbon odor

As above

Grey silty fine sand, damp, strong hydrocarbon odor
Grey clayey fine to medium sand, some coarse sand, damp, strong hydrocarbon odor

Grey fine to coarse sand, some fine to coarse gravel, some cobbles, moist, slight hydrocarbon odor

Approximate depth of water
Olive-grey sandy silt with trace fine to coarse sand pockets, wet, no hydrocarbon odor (fill)

BORING TERMINATED AT A DEPTH OF 20 FEET ON MARCH 9, 1988 DUE TO AN OBSTRUCTION
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 19 FEET

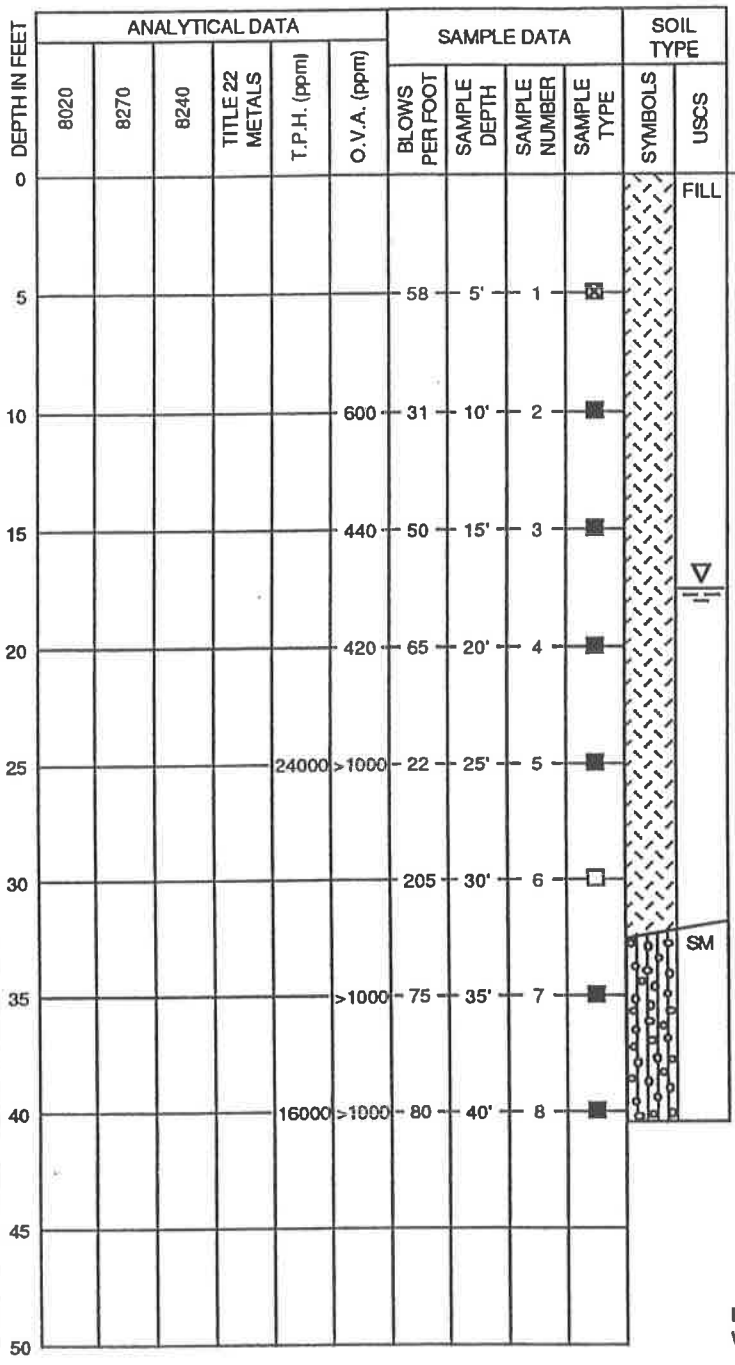
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-62

BORING S-35

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Brown very fine to medium sandy silt with trace clay, concrete debris, very dense, slightly moist, no odor

Brown silt with trace clay, very stiff, very slightly moist, no odor

Black asphaltic concrete, brick debris, very dense, dry, moderate hydrocarbon odor

Approximate depth of water

Black silty very fine to very coarse gravel, very dense, wet, moderate hydrocarbon odor

Black and grey mottled silty clay, free product in pore voids, medium dense, slightly moist to moist, strong hydrocarbon odor

Sample lost

Dark grey very fine to fine sandy silt with trace clay, very dense, slightly moist, moderate hydrocarbon odor

Dark grey to black very fine sandy silt with some clay, free product in pore voids, very dense, moist to very moist, moderate hydrocarbon odor

BORING TERMINATED AT A DEPTH 40-1/2 FEET ON MARCH 24, 1988
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 17-1/2 FEET

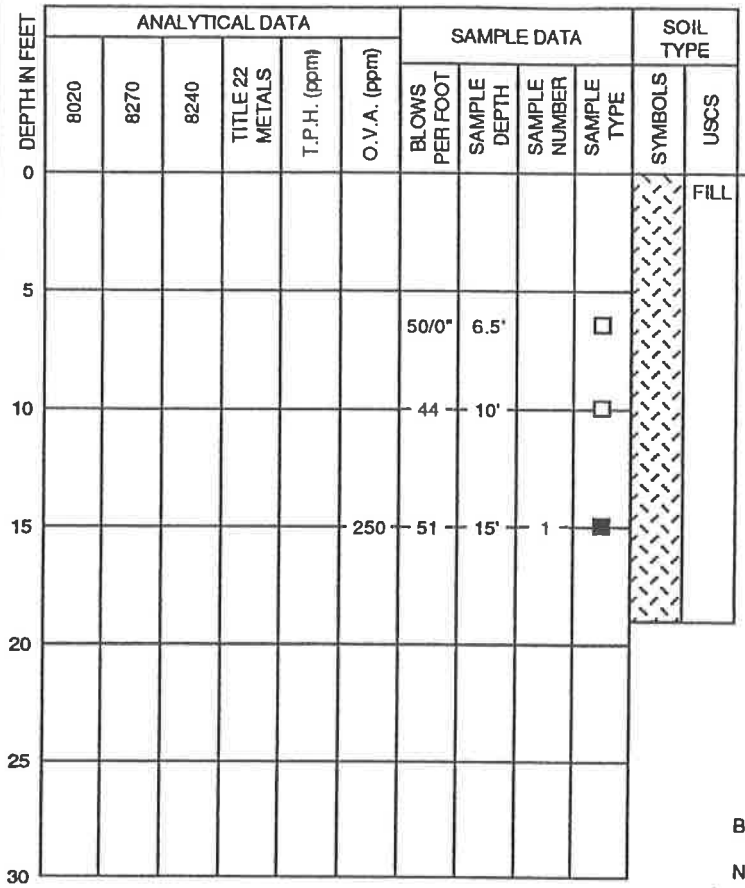
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-84

BORING S-36

LOCATION: Long Beach Water Department Property
(Hill Crane Storage Yard)
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Brown sandy gravel

Brown fine to coarse sand

Trash and concrete

Trash and concrete

Clay at 13-1/2 feet

Brown clay, some silt, sand, and gravel, damp, no odor

BORING TERMINATED AT A DEPTH OF 19 FEET ON MARCH 24, 1988
DUE TO AN OBSTRUCTION
NO WATER ENCOUNTERED

LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-85

BORING S-38

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger

DEPTH IN FEET	ANALYTICAL DATA: 8020	8270	8240	TITLE 22 METALS	T.P.H. (ppm)	O.V.A. (ppm)	SAMPLE DATA: BLOWS PER FOOT	SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SOIL TYPE: SYMBOLS	USCS	DESCRIPTION
0												FILL	
5						>1000	85	5'	1	■			Dark brown silt with some very fine to fine sand, concrete debris, very dense, moist to very moist, moderate hydrocarbon odor
10						>1000	50	10'	2	■			Dark grey silty very fine to medium sand and black pitch, very dense, moist, strong hydrocarbon odor
15	*				59	>1000	35	15'	3	■			Black tar pitch and black very fine to fine sandy silt, dense, moist, strong hydrocarbon odor
20						>1000	24	20'	4	■			Dark grey to black clayey silt to silty clay, medium dense, slightly moist, moderate hydrocarbon odor
25						>1000	35	25'	5	■			Dark brown-black clay, wood fragments, very stiff, slightly moist, moderate hydrocarbon odor
30						>1000	35	30'	6	■			Black or dark grey clay with trace silt and very fine to medium sand, wood fragments, free product in pore voids, dense, slightly moist, strong hydrocarbon odor
35					91	700	50	35'	7	■		SM	Dark grey silty very fine to fine sand, very dense, slightly moist, very slight hydrocarbon odor
40						180	85	40'	8	■			Grey very fine to medium sand with trace silt, very dense, slightly moist, no odor
45													
50													

BORING TERMINATED AT A DEPTH OF 40-1/2 FEET ON MARCH 24, 1988
NO WATER ENCOUNTERED

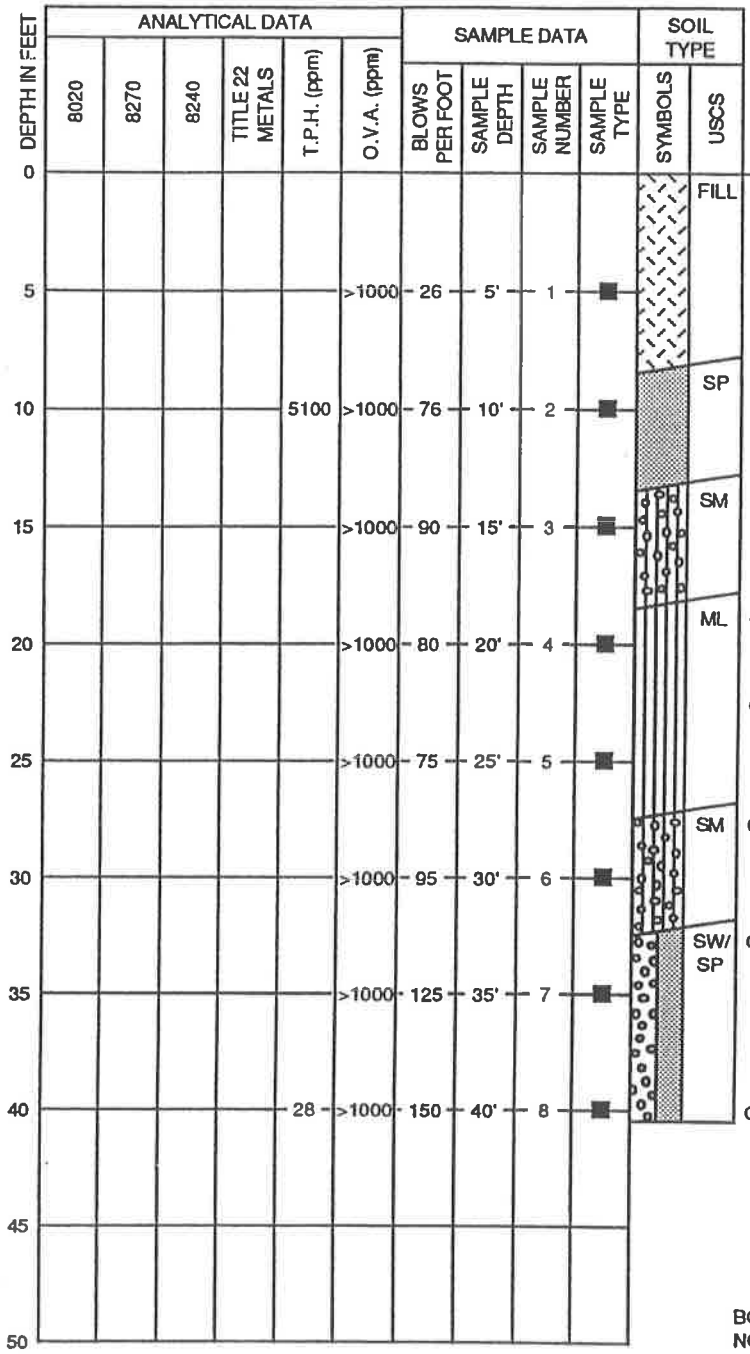
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-88

BORING S-39

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



USCS	DESCRIPTION
FILL	Grey very fine to medium sandy silt, medium dense, slightly moderate hydrocarbon odor
	As above, grading to silty very fine to medium sand
SP	Grey very fine to medium sand, very dense, slightly moist, strong hydrocarbon odor
SM	Grey silty very fine to fine sand, very dense, slightly moist, slight to moderate hydrocarbon odor
ML	Grey and rust mottled silt with some very fine to fine sand, very dense, slightly moist, very slight hydrocarbon odor
	Grey silt with trace clay, very dense, slightly moist, moderate hydrocarbon odor
SM	Grey-tan silty very fine to fine sand, very dense, slighty moist, no odor
SW/ SP	Grey very fine to medium sand, very dense, slightly moist, no odor
	Grey very fine to medium sand, very dense, slightly moist, very slight hydrocarbon odor

BORING TERMINATED AT A DEPTH OF 40-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

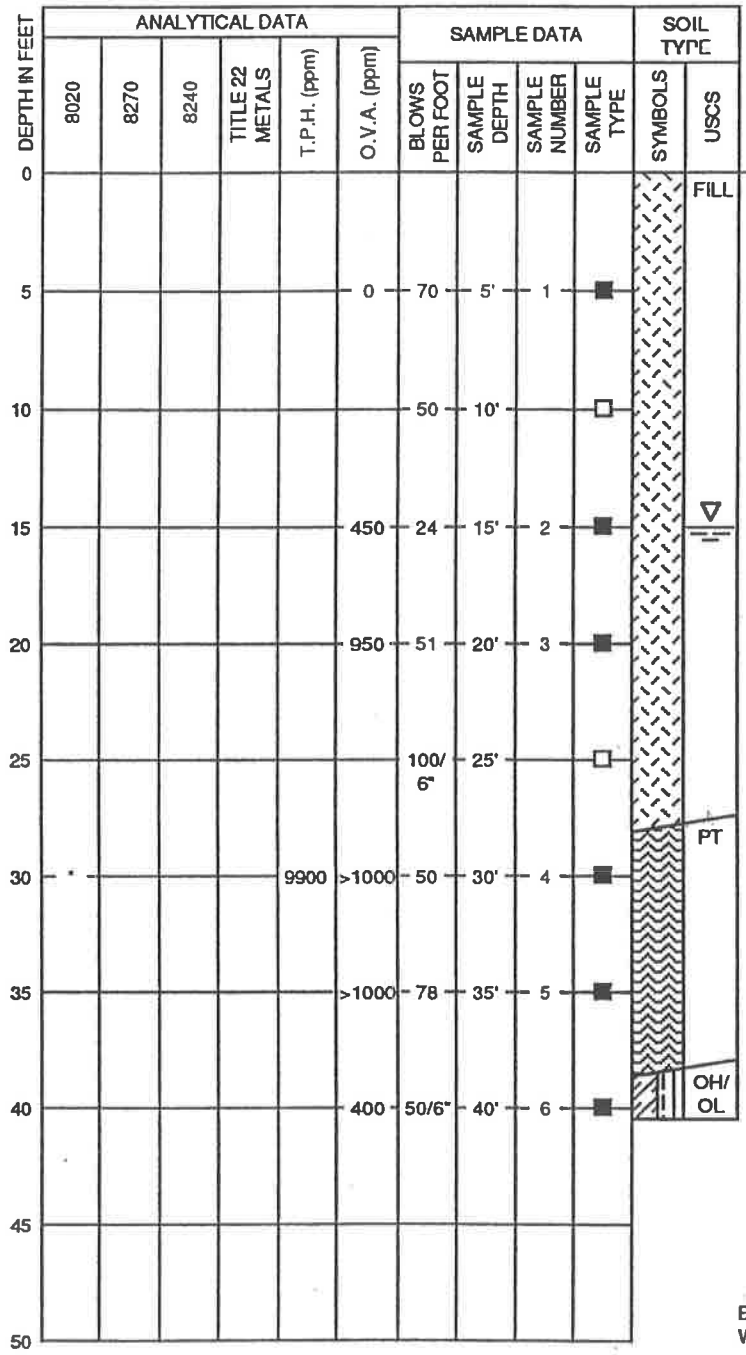
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-89

BORING S-40

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Brown fine to coarse sand and gravel

Brown gravelly fine to coarse sand, asphalt in tip, dry, no odor

Bricks, gravel, and concrete

Concrete

Approximate depth of water

Black silt with some fine sand to coarse gravel, wet, strong hydrocarbon odor

Olive silty fine sand, damp, no odor

Olive-grey and dark grey mottled silty fine to coarse sand with some fine gravel, moist, strong hydrocarbon odor

Dark grey silty gravelly fine to coarse sand

Black peat with some silt, spongy, moist, strong hydrocarbon odor

As above

Black silty clay to clayey silt, soft, highly organic, moderate hydrocarbon odor

BORING TERMINATED AT A DEPTH OF 40-1/2 FEET ON MARCH 24, 1988
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 15 FEET

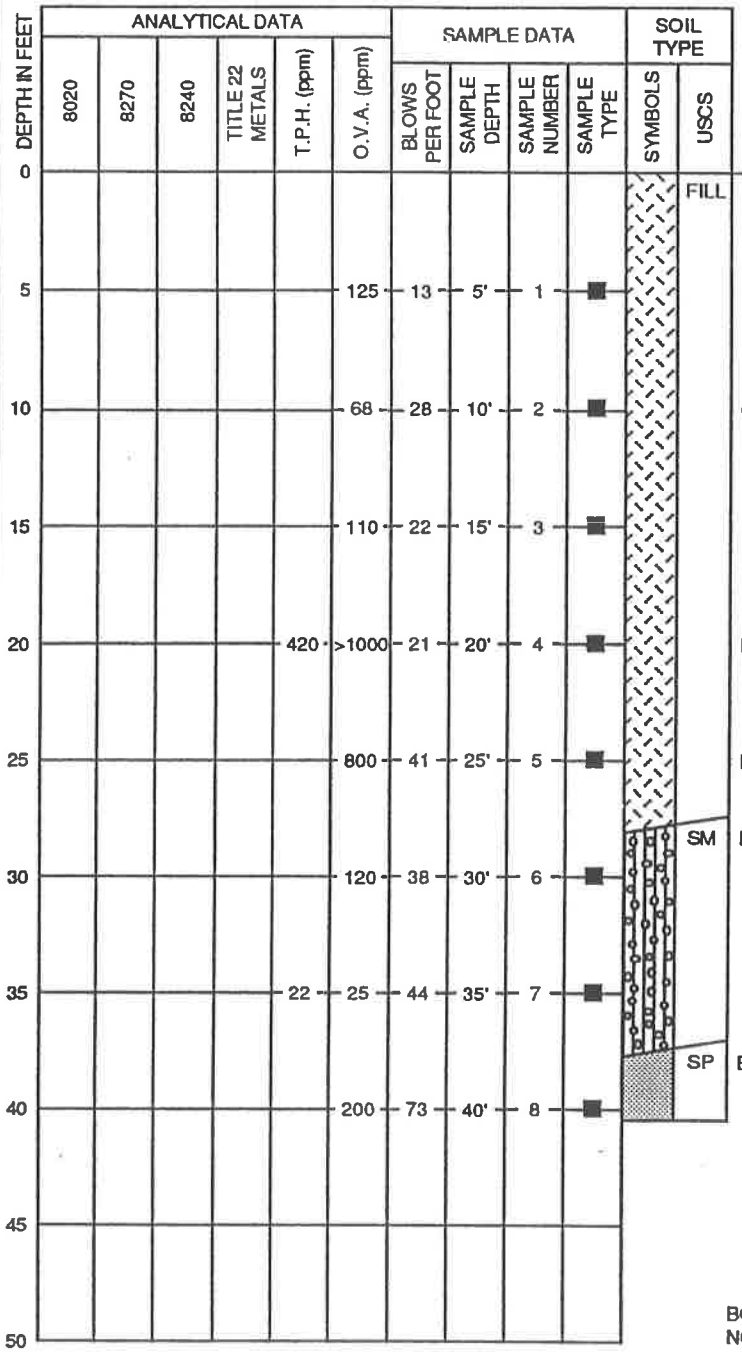
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-90

BORING S-41

LOCATION: Long Beach Water Department Property
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

- FILL: Light brown sandy gravel
- Brown-grey mottled sandy clay with fine to medium sand and fine gravel, moist, no odor
- Grey gravelly sands and asphalt, damp, no odor
- Dark grey-brown silty clayey fine to medium sand, moist, moderate hydrocarbon odor
- Dark olive-grey silty fine sand, moist, strong hydrocarbon odor
- Dark grey-brown silty fine sand, some wood debris, moist, strong hydrocarbon odor
- SM: Dark olive-grey silty fine sand, moist, moderate hydrocarbon odor
- As above, slight hydrocarbon odor
- SP: Brown fine sand, damp, slight sewer odor

BORING TERMINATED AT A DEPTH OF 40-1/2 FEET ON MARCH 24, 1988
NO WATER ENCOUNTERED

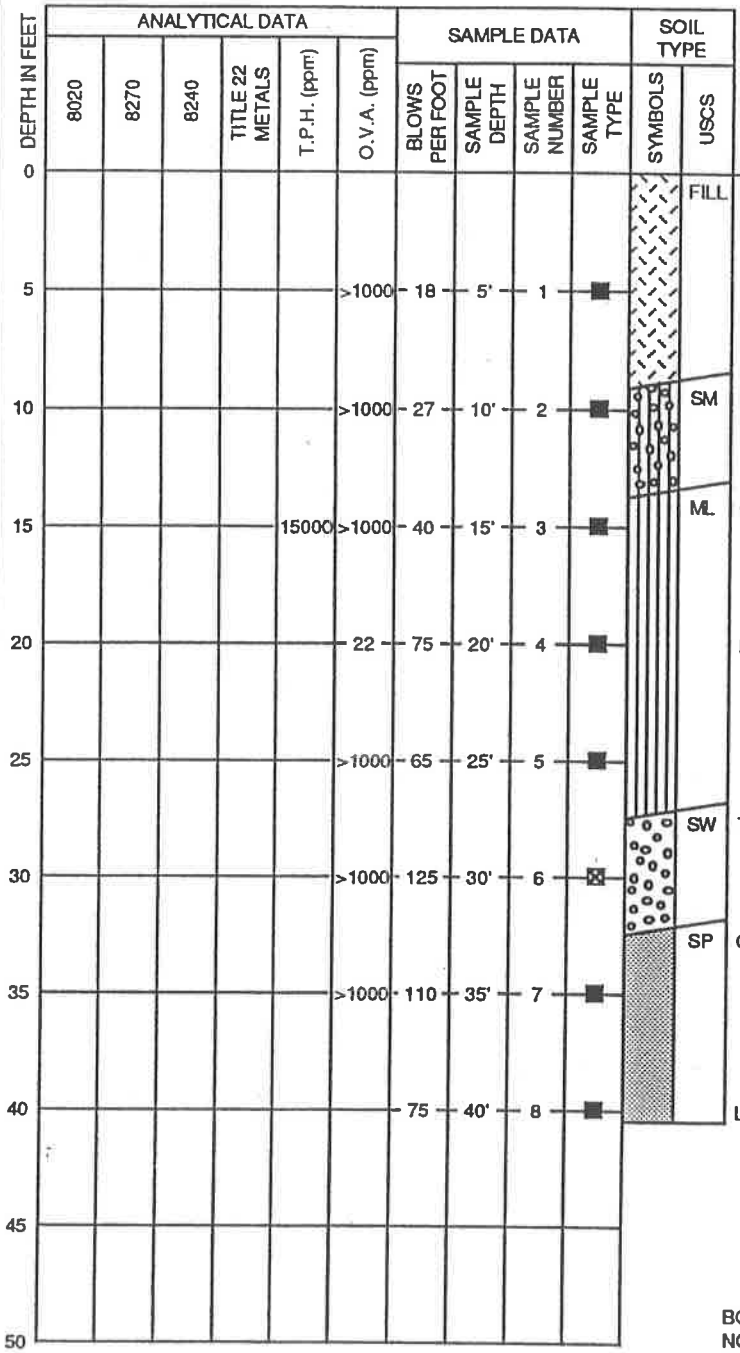
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-91

BORING S-42

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

FILL — Brown-grey silty very fine to medium sand, medium desne, slightly moist, no odor

SM — Brown-grey silty very fine to medium sand, medium dense, slightly moist, moderate hydrocarbon odor

ML — Grey very fine sandy silt, dense, slightly moist, moderate hydrocarbon odor

Mottled grey and rust-colored silt with some very fine sand, very dense, slightly moist, no odor

As above

SW — Tan fine to very coarse sand, very dense, slightly moist, no odor

SP — Grey-tan very fine to medium sand, very dense, slightly moist, no odor

Light brown silty very fine to fine sand, very dense, slightly moist, no odor

BORING TERMINATED AT A DEPTH OF 40-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

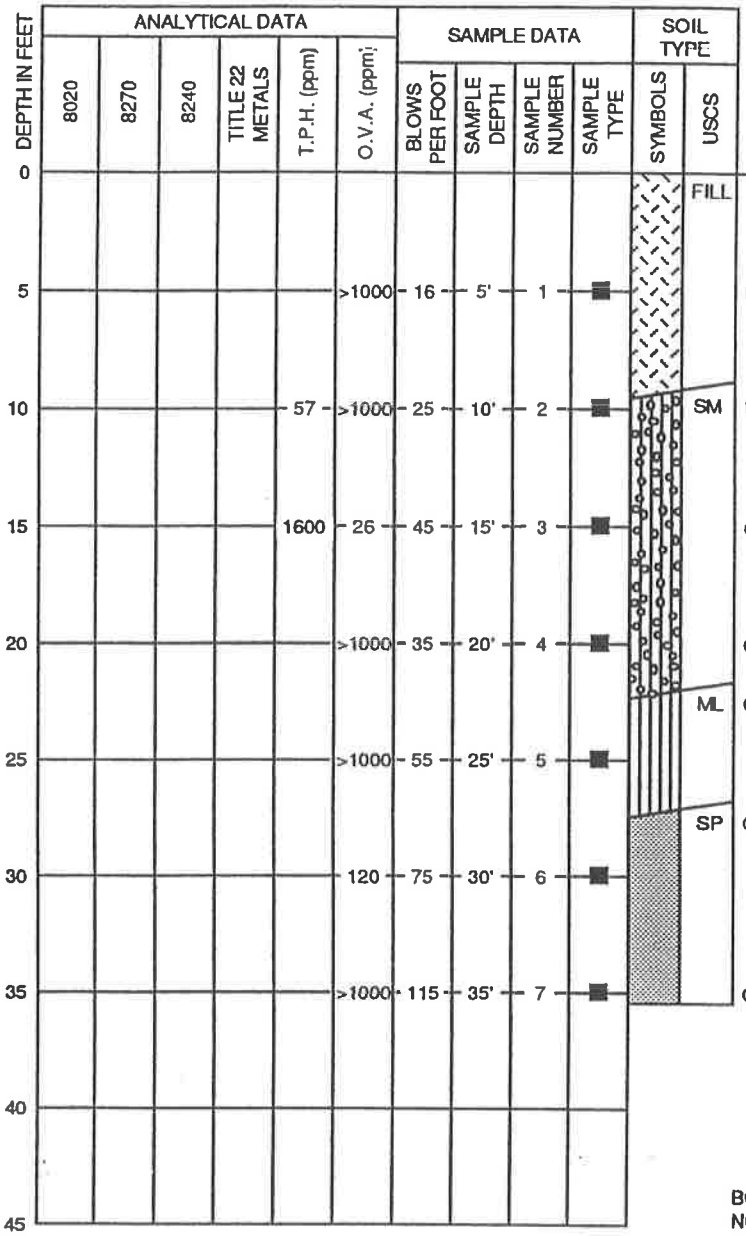
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-92

BORING S-44

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

- FILL — Brown clayey silt, medium dense, moist, no odor
- SM — Dark grey silty very fine to coarse sand, medium dense, slightly moist, no odor
- Grey very fine to fine sand with some silt, dense, slightly moist, no odor
- Grey silty very fine to fine sand, dense, slightly moist, no odor
- ML — Green-grey very fine to fine sandy silt, disarticulated shell fragments, very dense, slightly moist, no odor
- SP — Grey-tan very fine to fine sand with trace silt, very dense, slightly moist, no odor
- Grey-tan very fine to medium sand with trace silt, very dense, slightly moist, no odor

BORING TERMINATED AT A DEPTH OF 35-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

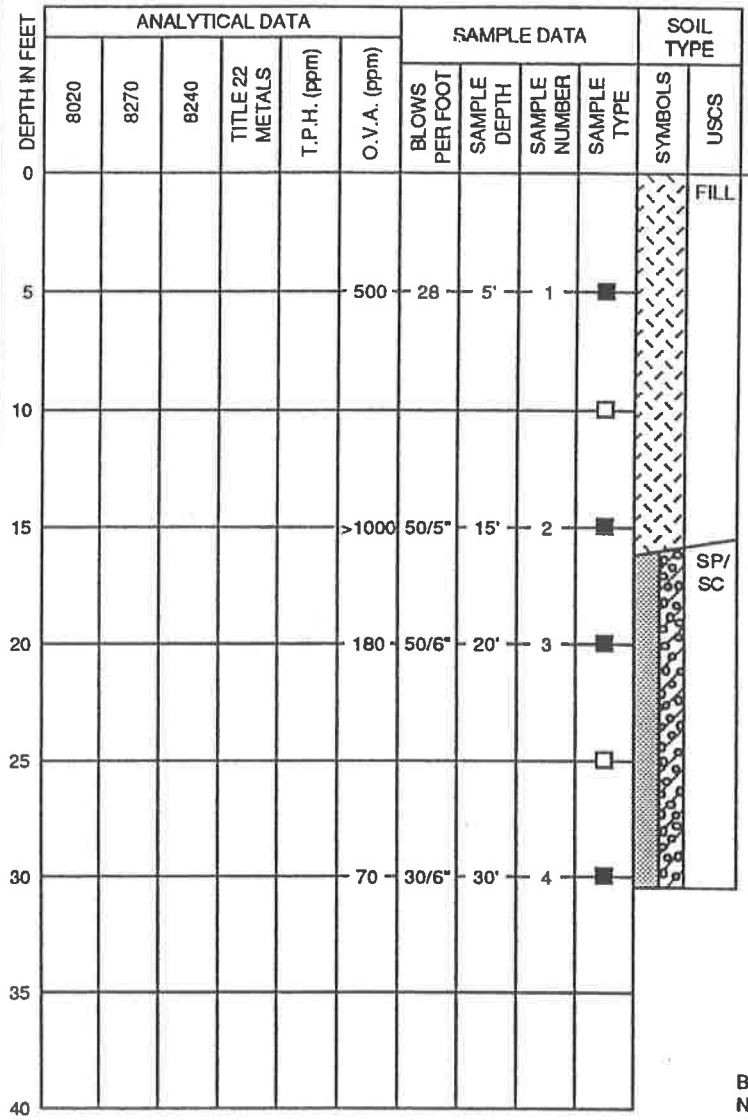
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-94

BORING S-44a

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Dark brown gravelly very coarse sand with clay, damp, moderate hydrocarbon odor

Sample lost

As above, increased clay and cobble content, no odor

Dark brown clayey fine to medium sand to sandy clay, moist, slight hydrocarbon odor

Sample lost

Dark brown clayey fine to medium sand to sandy clay, moist, slight hydrocarbon odor

BORING TERMINATED AT A DEPTH OF 30-1/2 FEET ON MARCH 26, 1988
NO WATER ENCOUNTERED

LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-95

BORING S-46

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger

DEPTH IN FEET	ANALYTICAL DATA: 8020	8270	8240	TITLE 22 METALS	T.P.H. (ppm)	O.V.A. (ppm)	SAMPLE DATA: BLOWS PER FOOT	SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE TYPE	SOIL TYPE: SYMBOLS	USCS	DESCRIPTION
0													Asphalt
												FILL	Light brown sands
													Dark brown gravelly sands
5						440	31	5'	1	■		SM	Olive clayey sandy silt, little caliche, damp, no odor
10						42	89	10'	2	■			Brown silty fine sand, dry, no odor
15						72	70	15'	3	■			As above
20					ND	50	50/8"	20'	4	■			As above
25													
30													

BORING TERMINATED AT A DEPTH OF 20-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

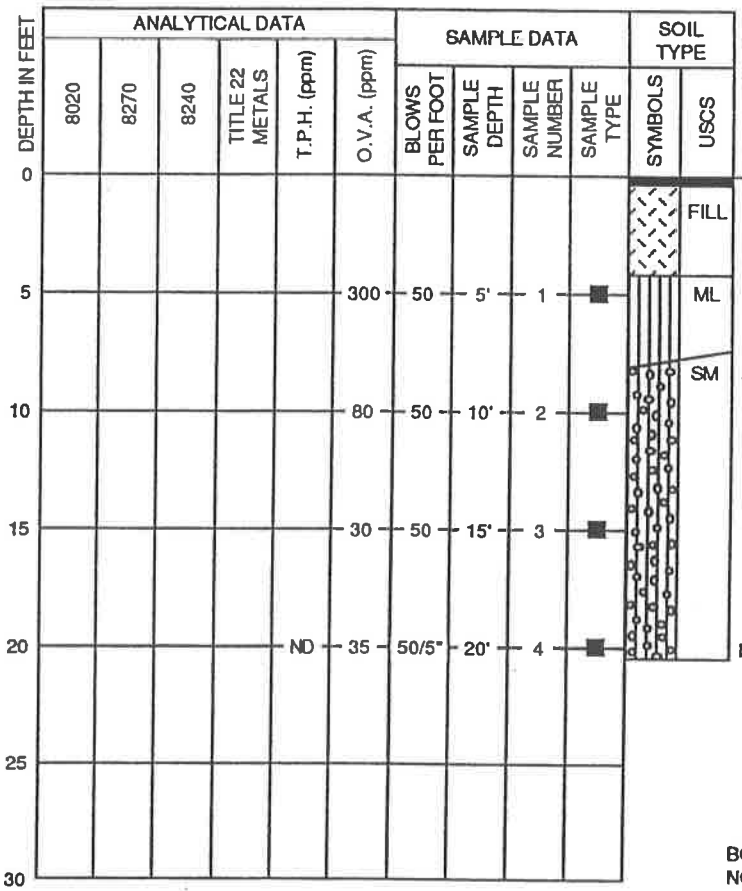
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-96

BORING S-47

LOCATION: Petrolane-Lomita Gasoine Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger



DESCRIPTION

Asphalt
Brown gravelly sands, damp

Olive sandy clay in cuttings
Olive clayey silt, some caliche, stiff, damp, no odor

Mottled olive and light brown silty fine sand, damp, no odor

Grading to light brown

Brown, as above

Mottled olive and brown silty fine sand, slightly damp, no odor

BORING TERMINATED AT A DEPTH OF 20-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

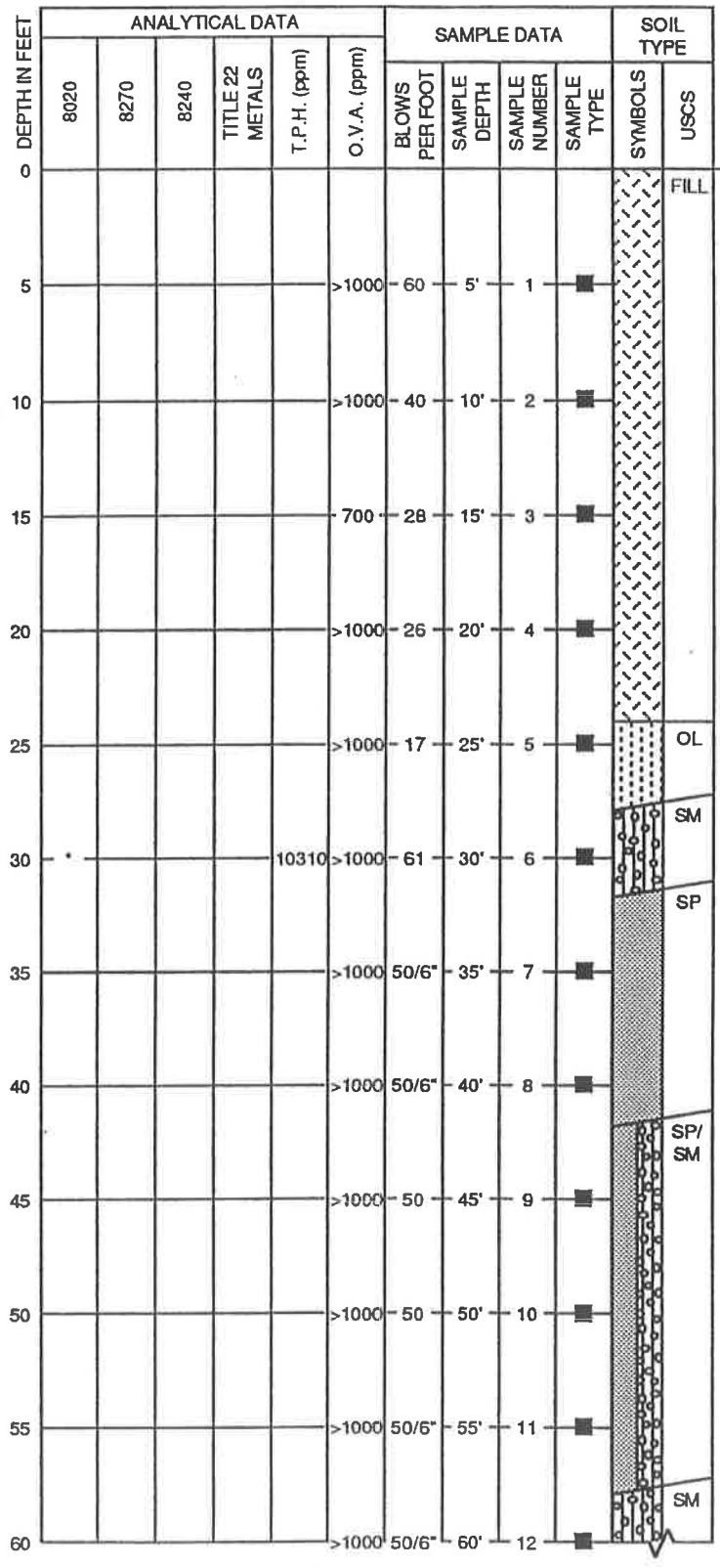
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-97

BORING S-48

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 8-Inch Hollow Stem Auger

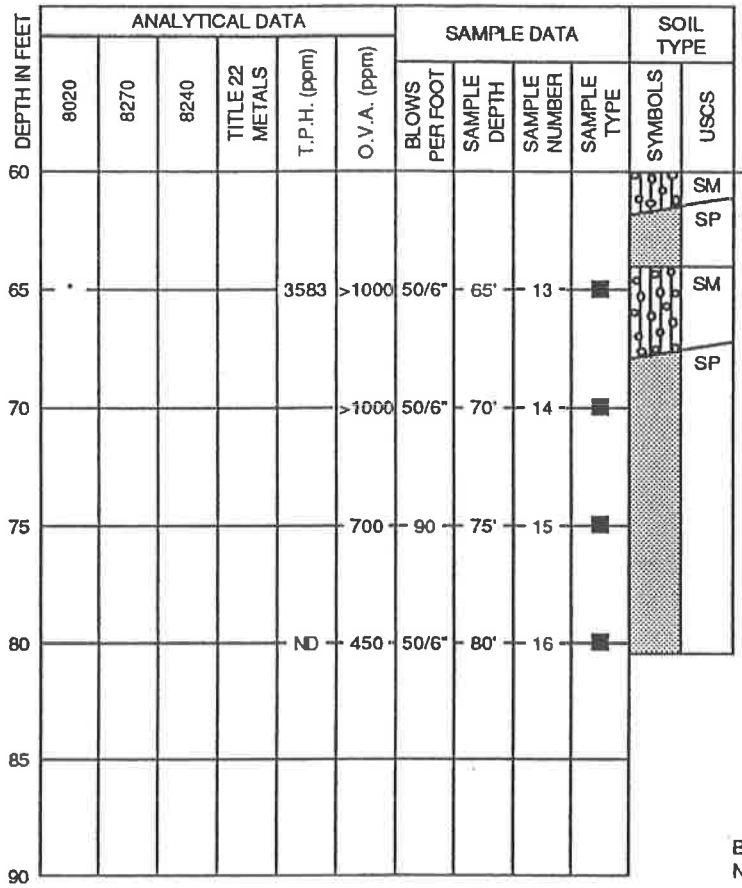


LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-98

BORING S-48 (Cont'd)



BORING TERMINATED AT A DEPTH OF 80-1/2 FEET ON MARCH 25, 1988
NO WATER ENCOUNTERED

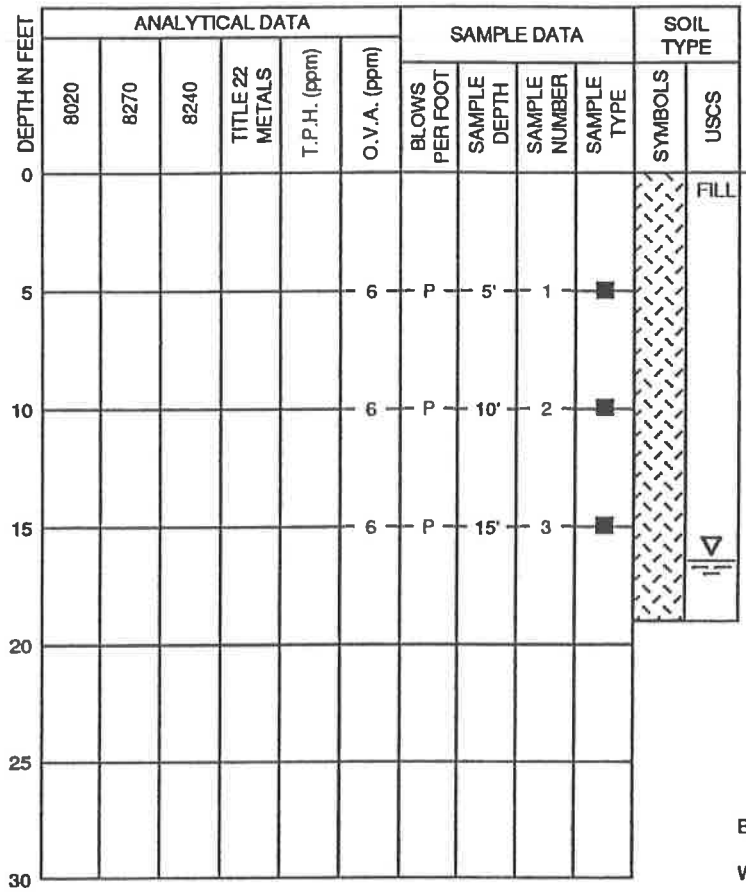
LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-98 (Cont'd)

BORING S-70

LOCATION: Petrolane-Lomita Gasoline Company
SAMPLING METHOD: Dames & Moore U-Type
DRILLING METHOD: 18-Inch Bucket Auger



DESCRIPTION

Yellowish-brown fine sandy silt with concrete, slightly moist

Grading to yellowish-brown silty fine sand, brick fragments

Brown silty clayey fine sand, loose to medium dense, moist, slight hydrocarbon odor

Black silty fine to medium sand, solidified oil , medium dense, slightly moist, moderate hydrocarbon odor

Grey fine sandy silt, wood fragments, medium dense, slightly moist to moist

Approximate depth of water

Grey silty fine sand, free oil, moist

BORING TERMINATED AT A DEPTH OF 19 FEET ON MARCH 29, 1988 DUE TO CAVING
WATER ENCOUNTERED AT A DEPTH OF APPROXIMATELY 16-1/2 FEET

LOG OF BORING

PROPOSED AUTO MALL
CITY OF LONG BEACH REDEVELOPMENT AGENCY
LONG BEACH, CALIFORNIA

Dames & Moore
FIGURE B-115

APPENDIX D

Liquefaction and Liquefaction Induced Settlement Analyses

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

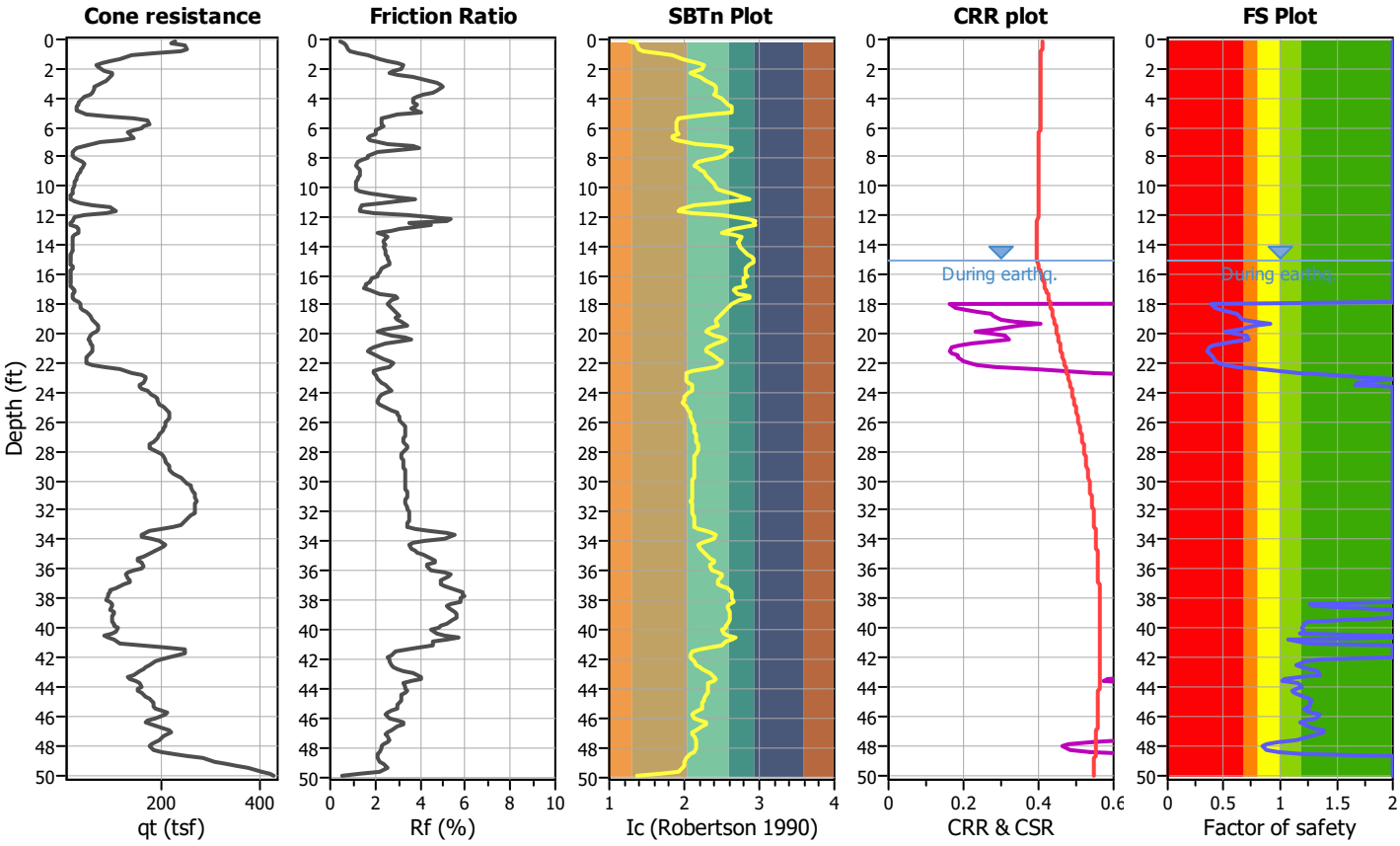
LIQUEFACTION ANALYSIS REPORT

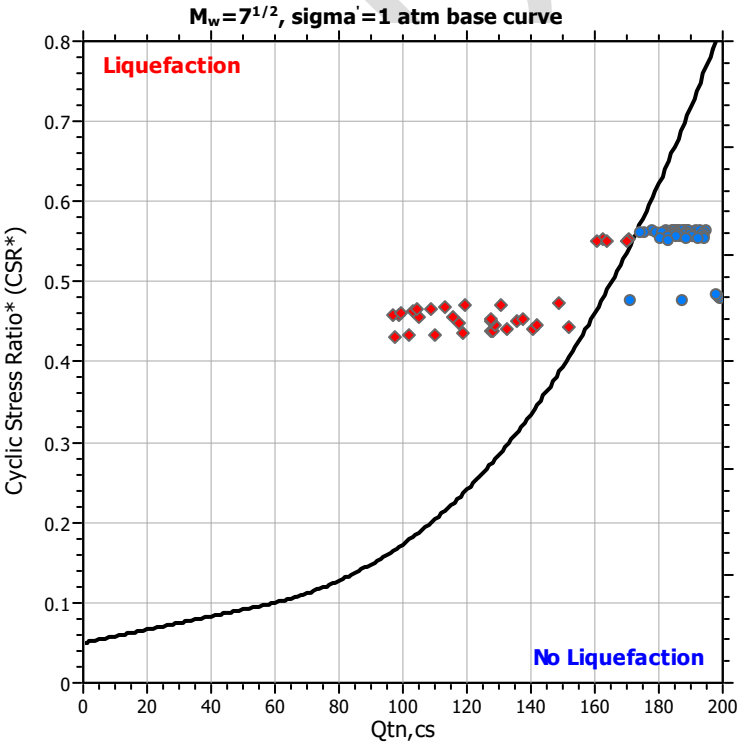
Project title : Signal Hill Petroleum **Location : Signal Hill**

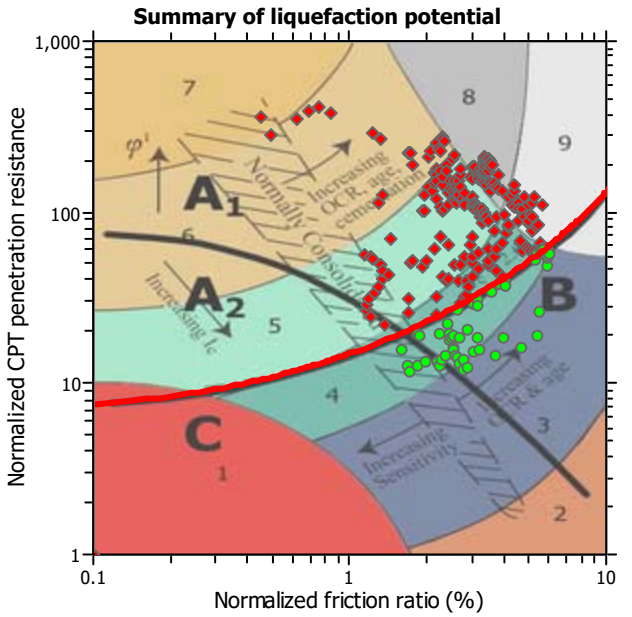
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

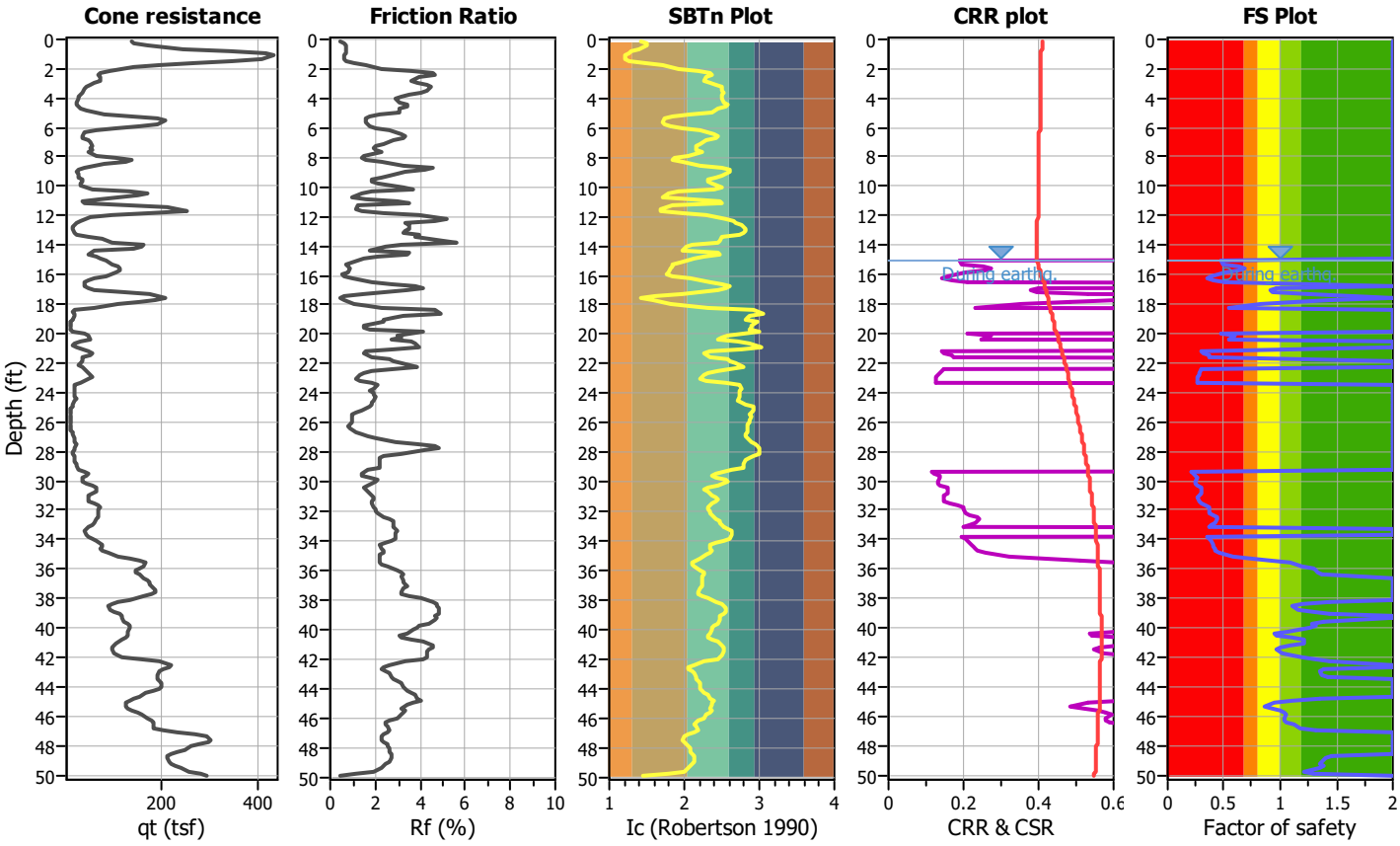
LIQUEFACTION ANALYSIS REPORT

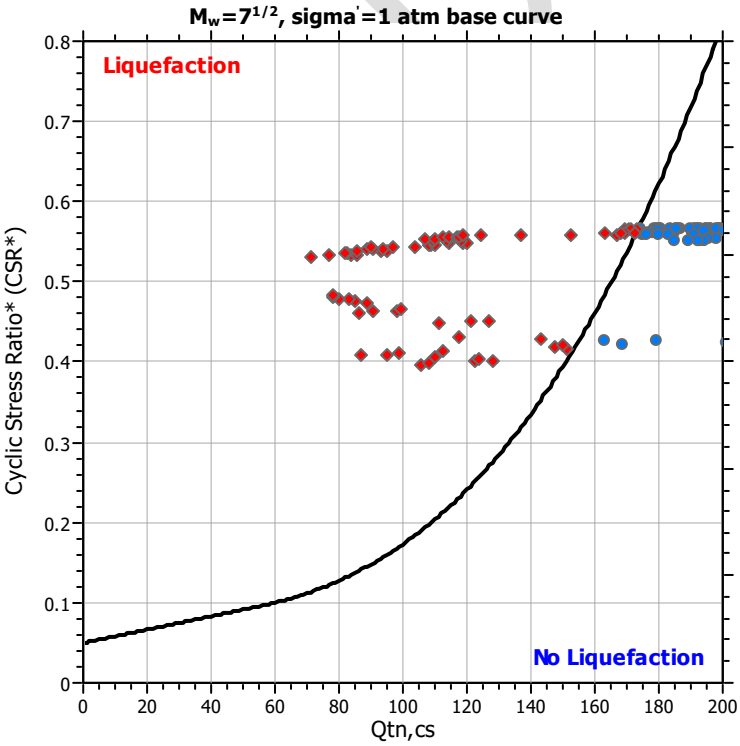
Project title : Signal Hill Petroleum **Location : Signal Hill**

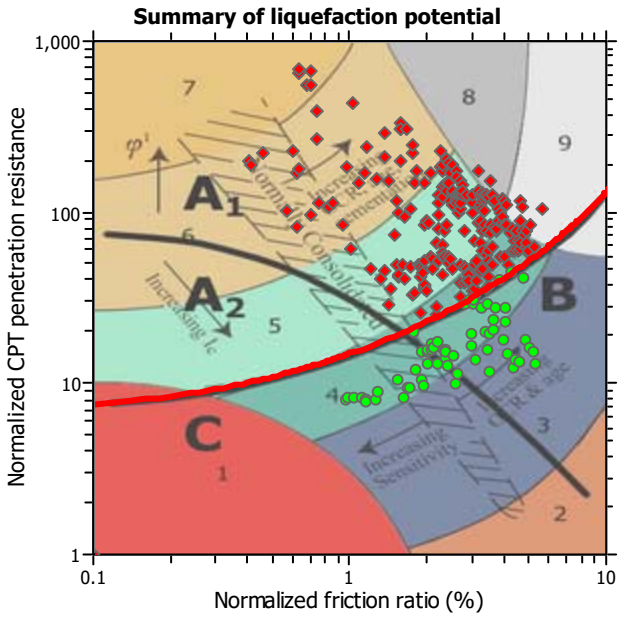
CPT file : CPT-2A

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

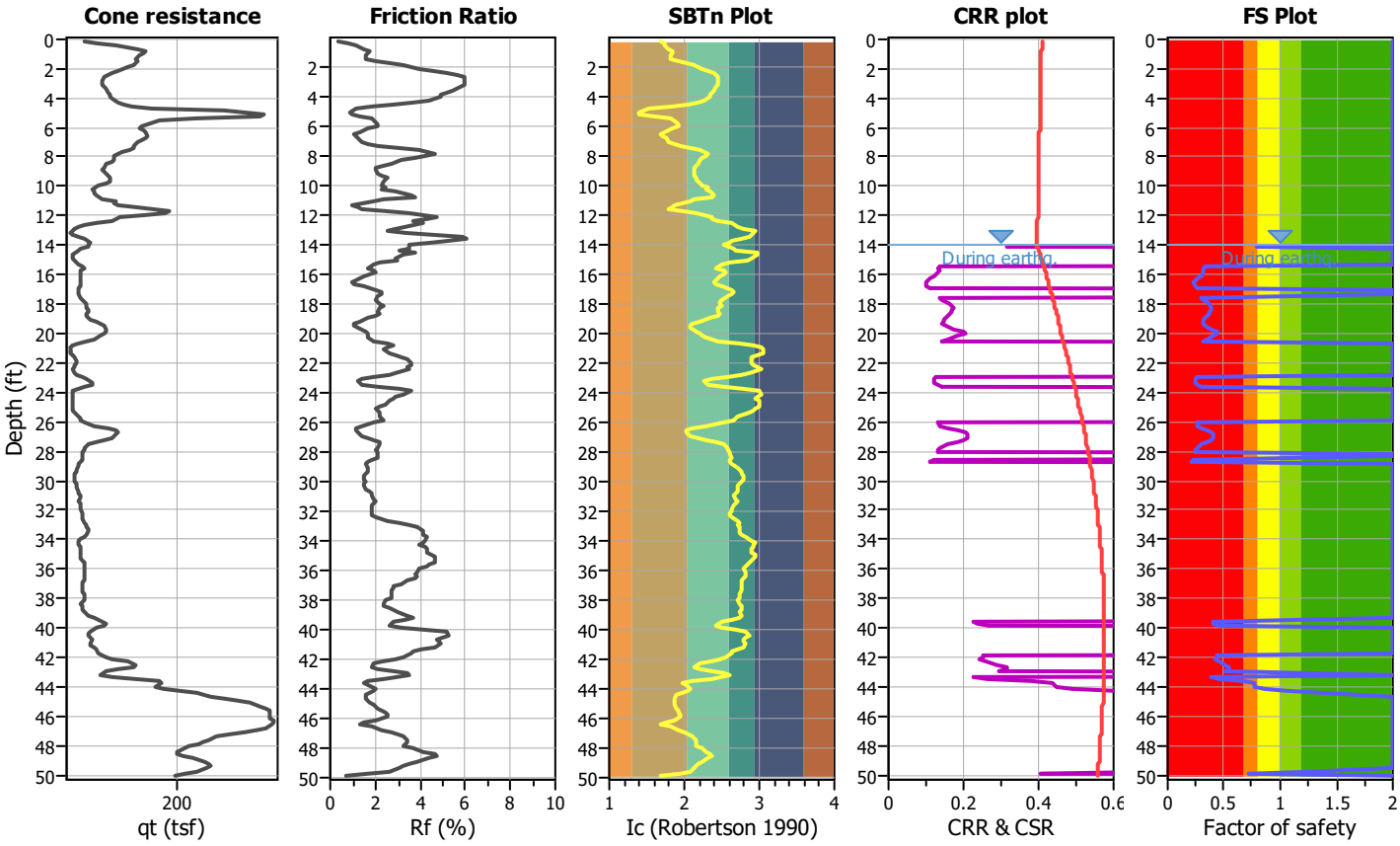
LIQUEFACTION ANALYSIS REPORT

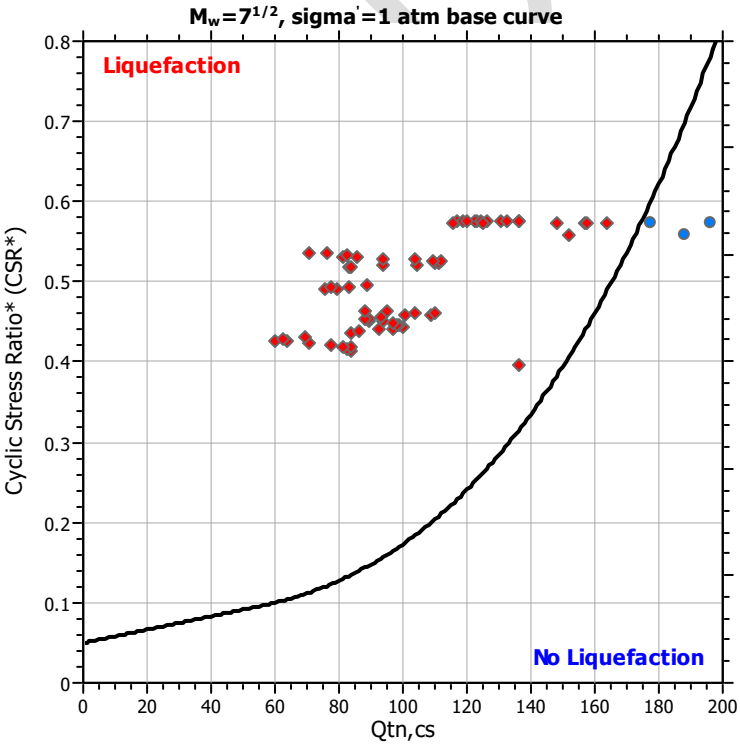
Project title : Signal Hill Petroleum **Location : Signal Hill**

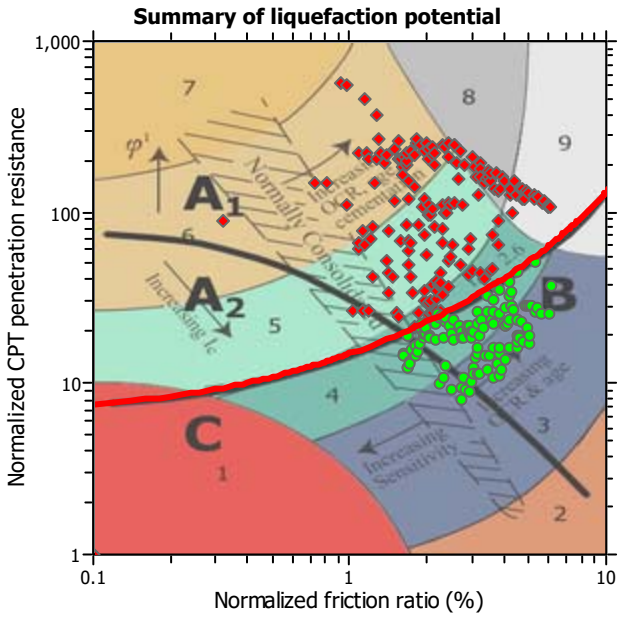
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	14.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

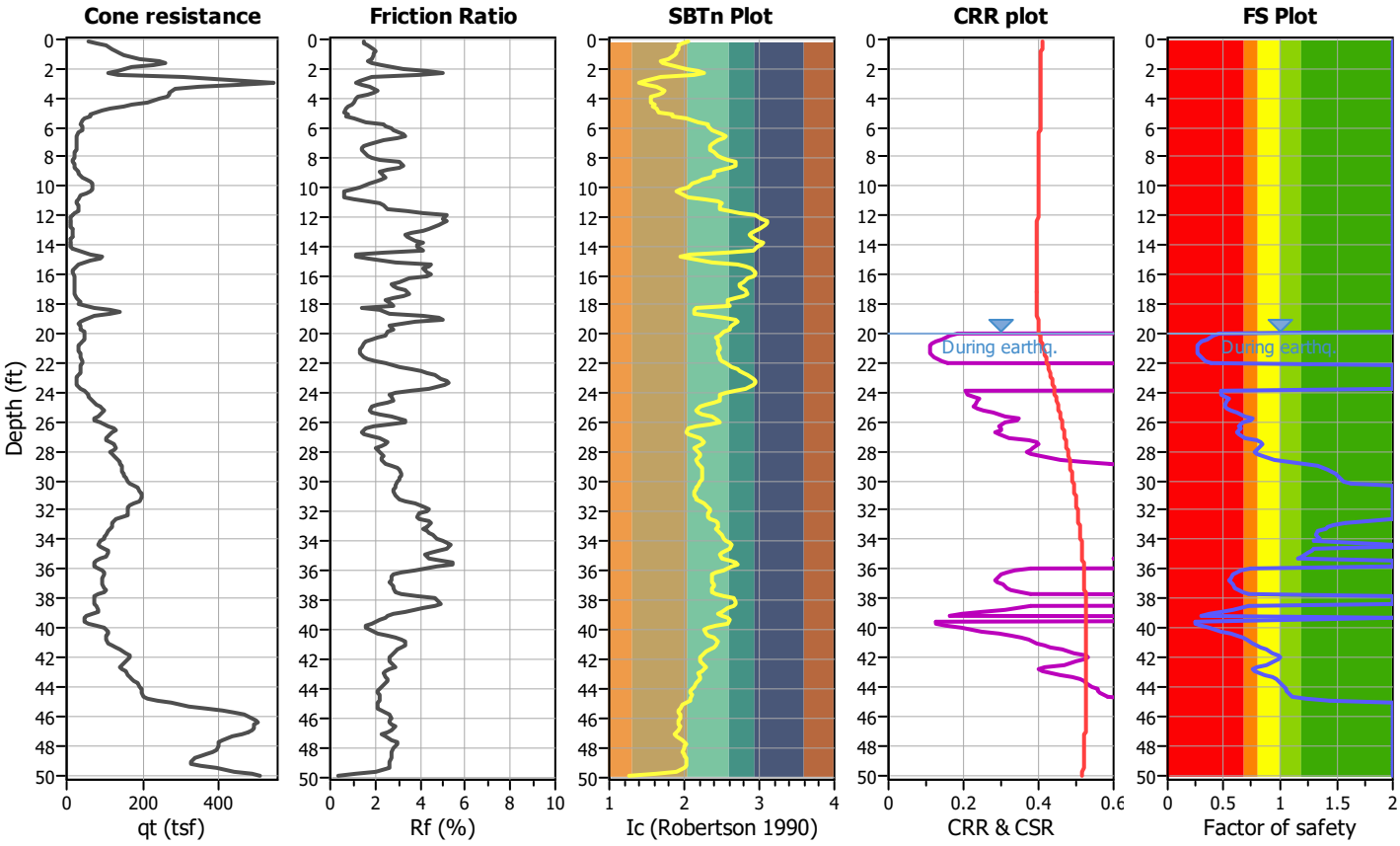
LIQUEFACTION ANALYSIS REPORT

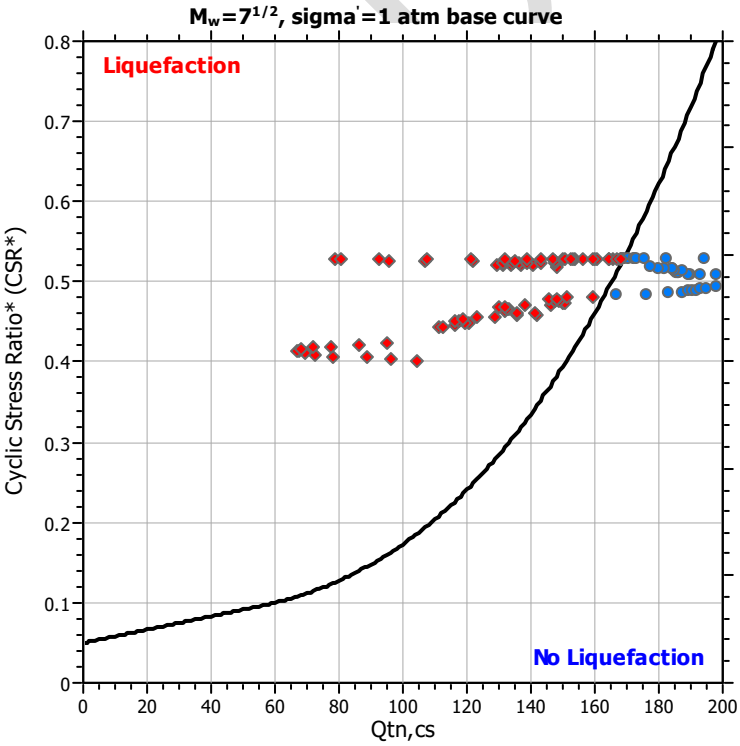
Project title : Signal Hill Petroleum **Location : Signal Hill**

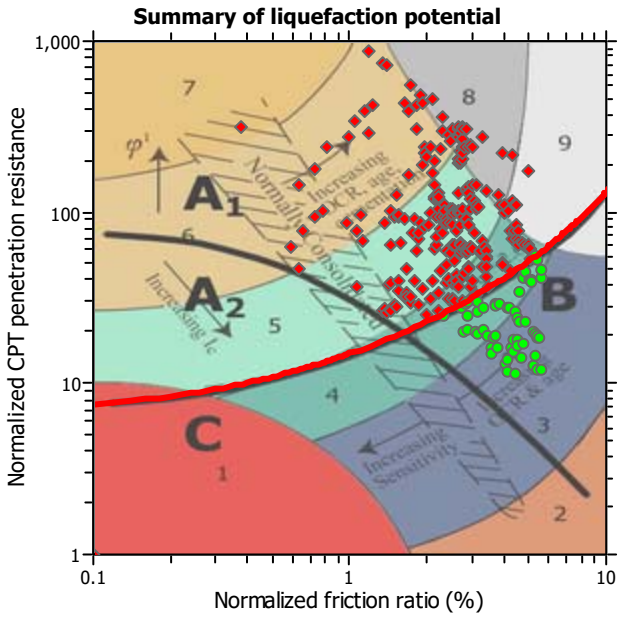
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

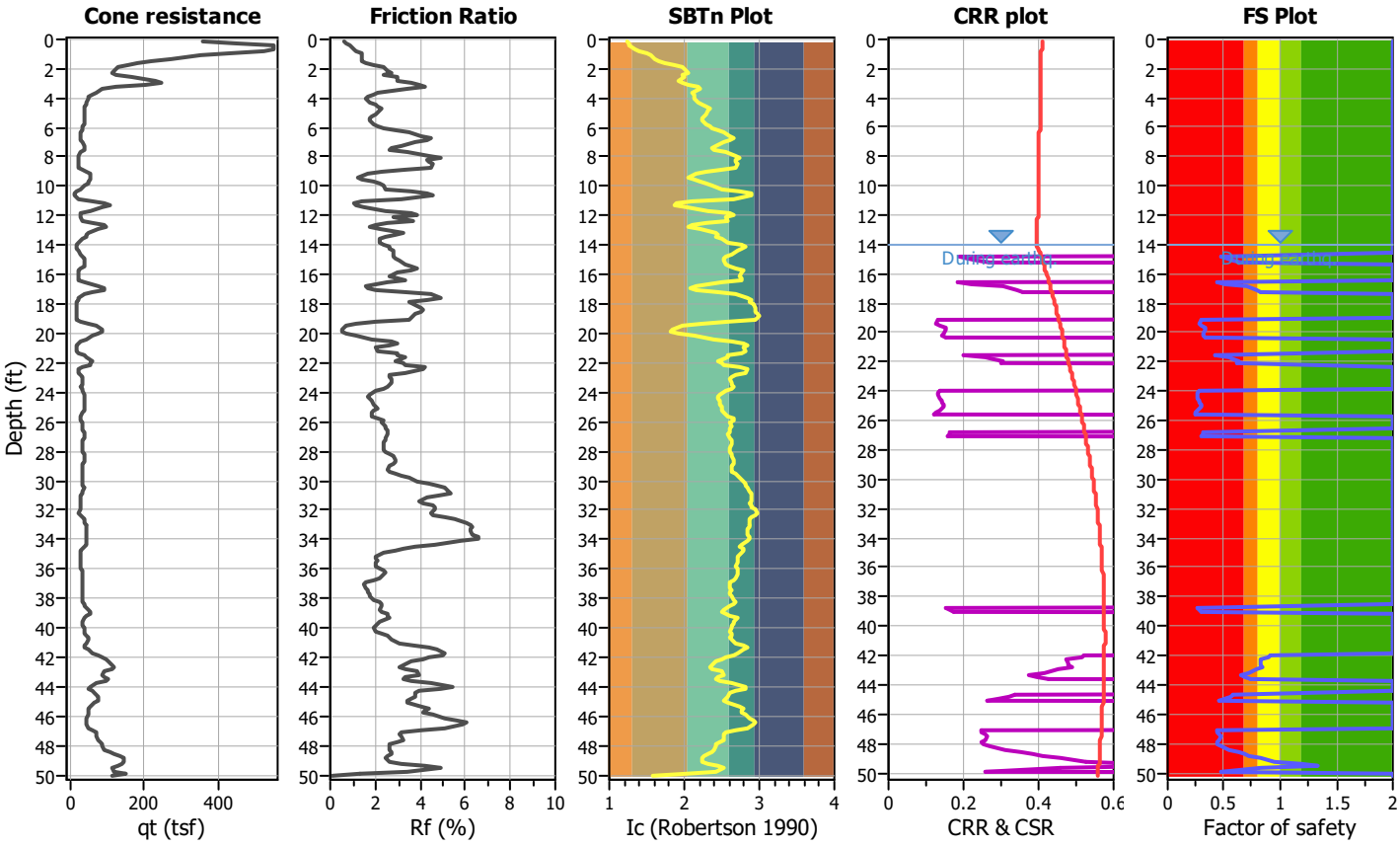
LIQUEFACTION ANALYSIS REPORT

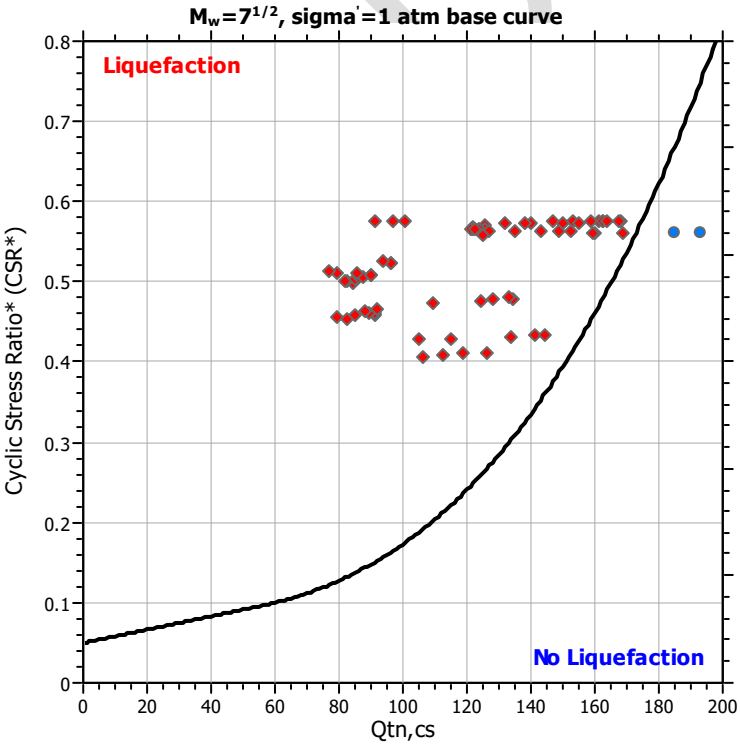
Project title : Signal Hill Petroleum **Location : Signal Hill**

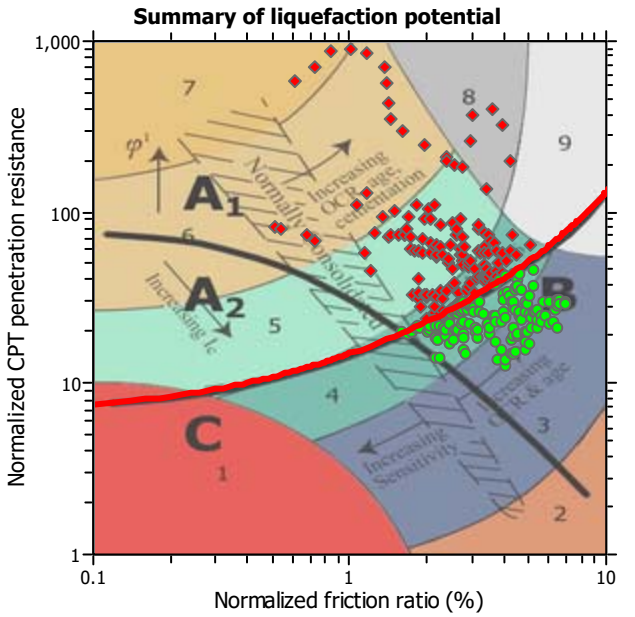
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	14.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

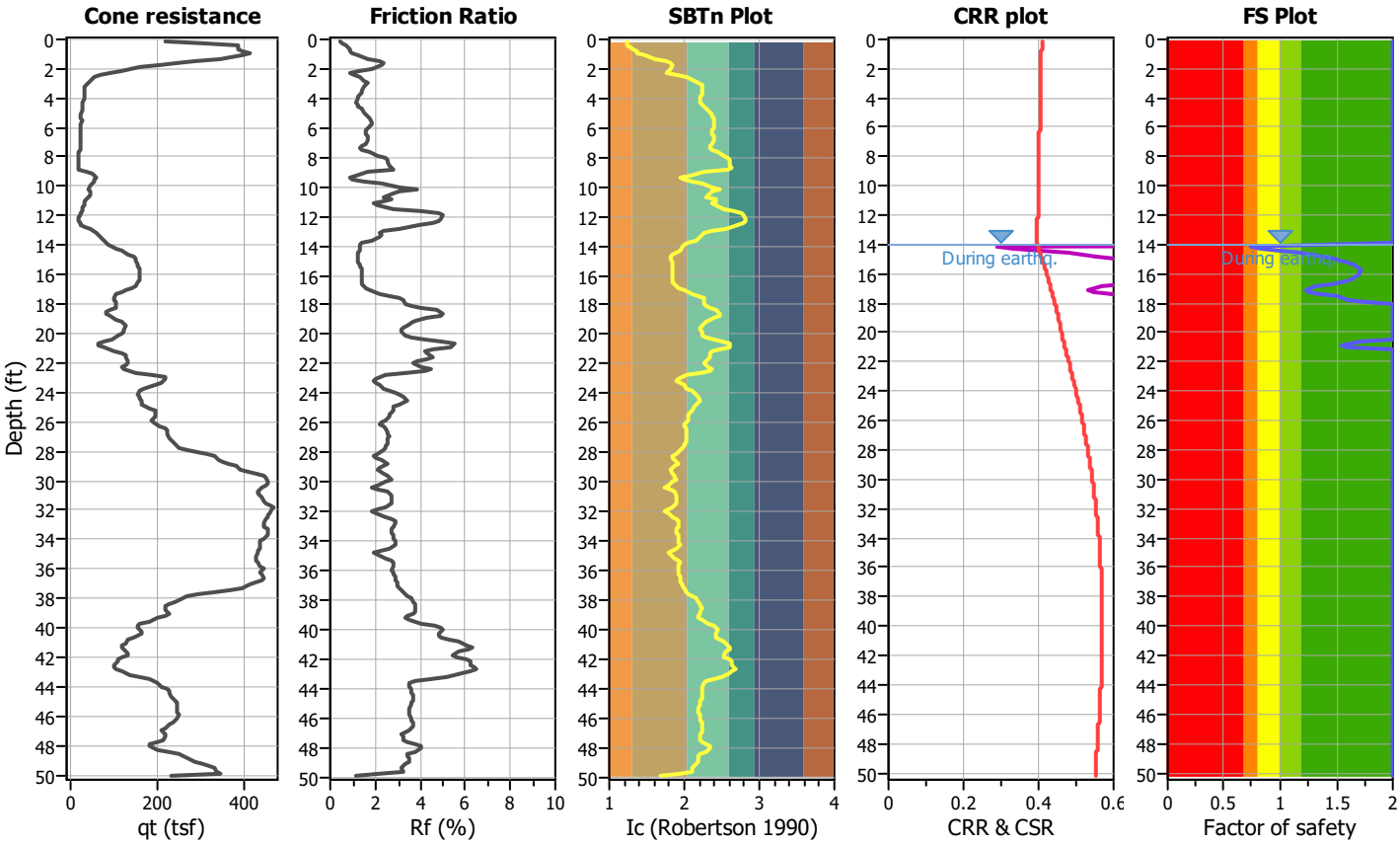
LIQUEFACTION ANALYSIS REPORT

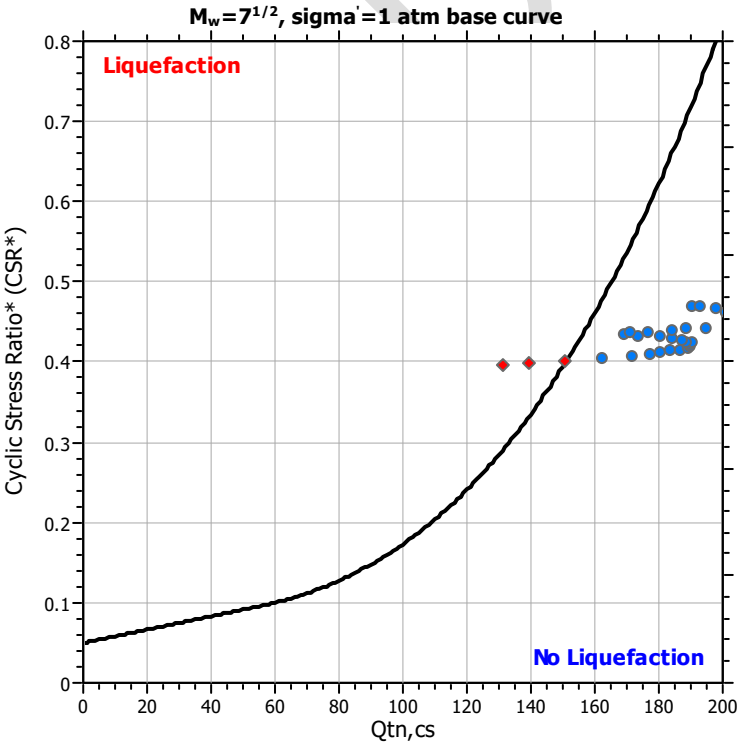
Project title : Signal Hill Petroleum **Location : Signal Hill**

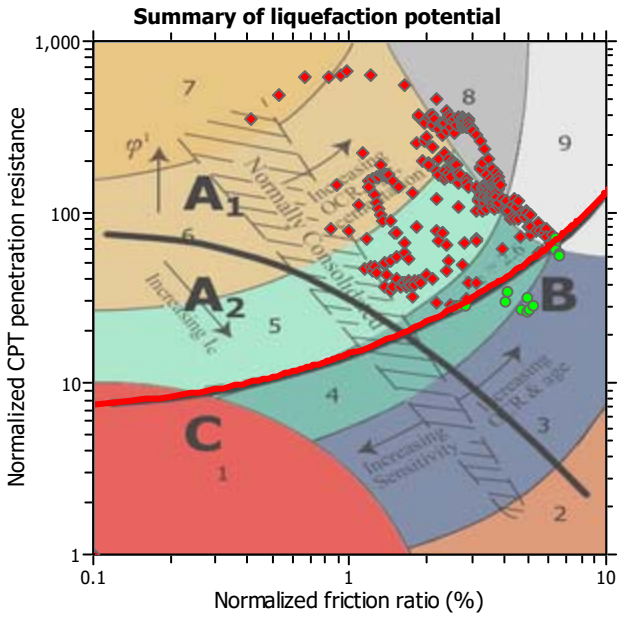
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	14.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

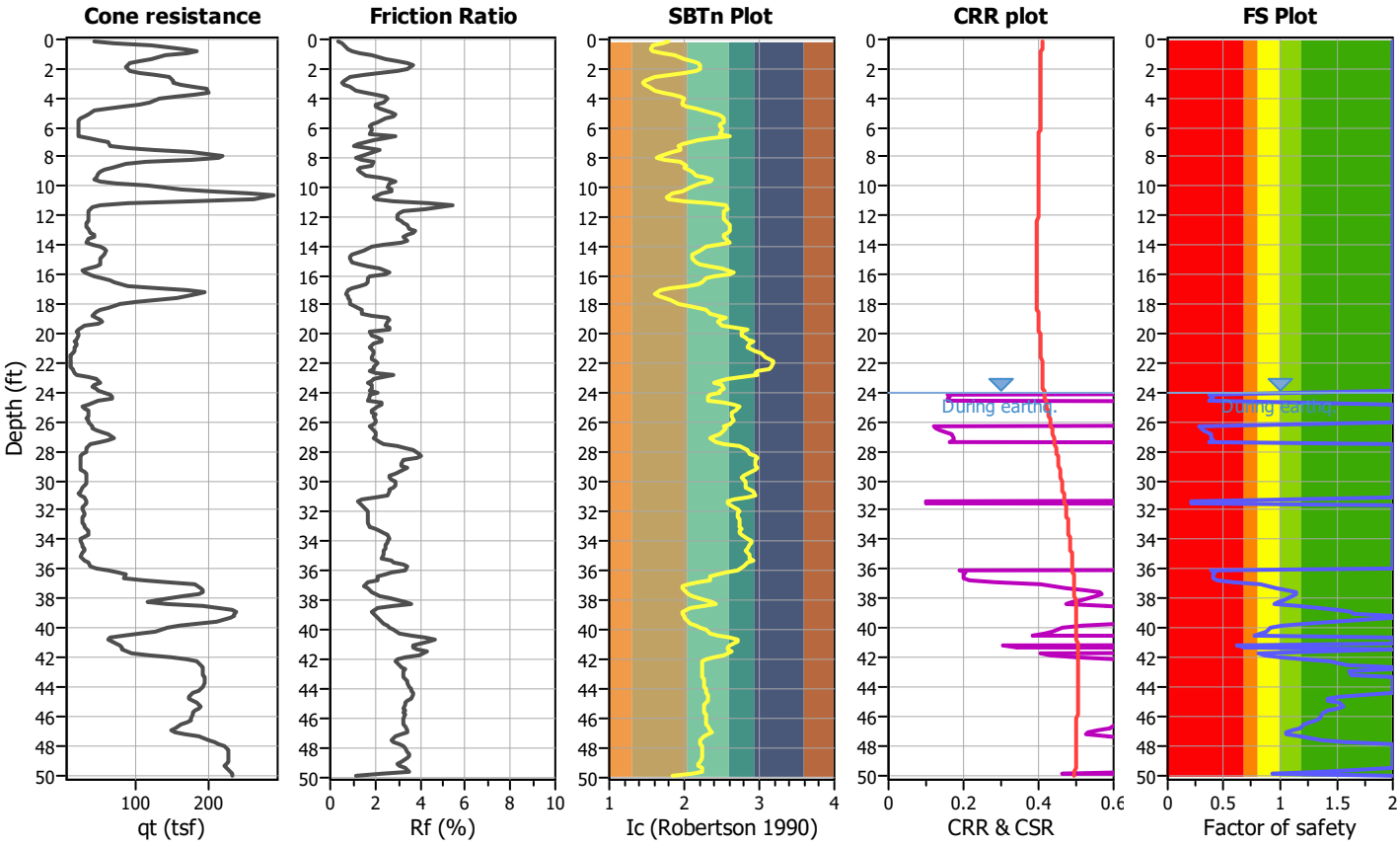
LIQUEFACTION ANALYSIS REPORT

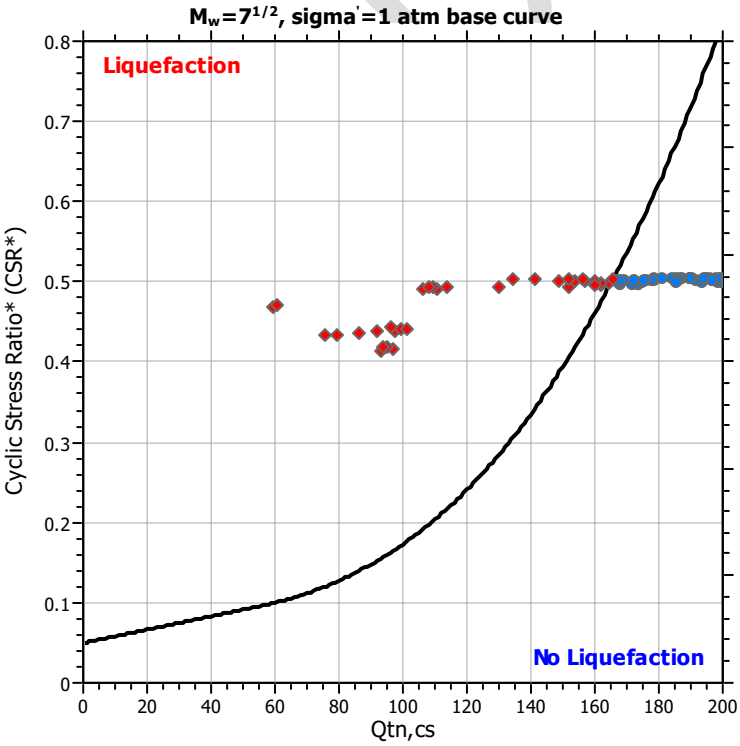
Project title : Signal Hill Petroleum **Location : Signal Hill**

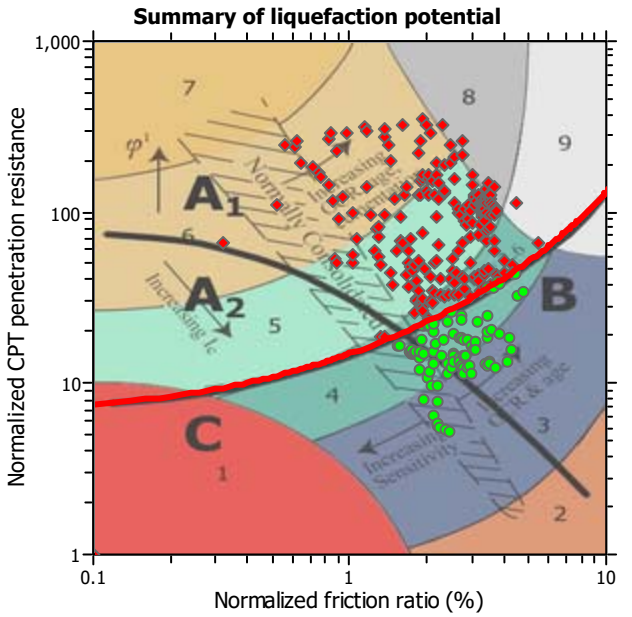
CPT file : CPT-7B

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	24.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

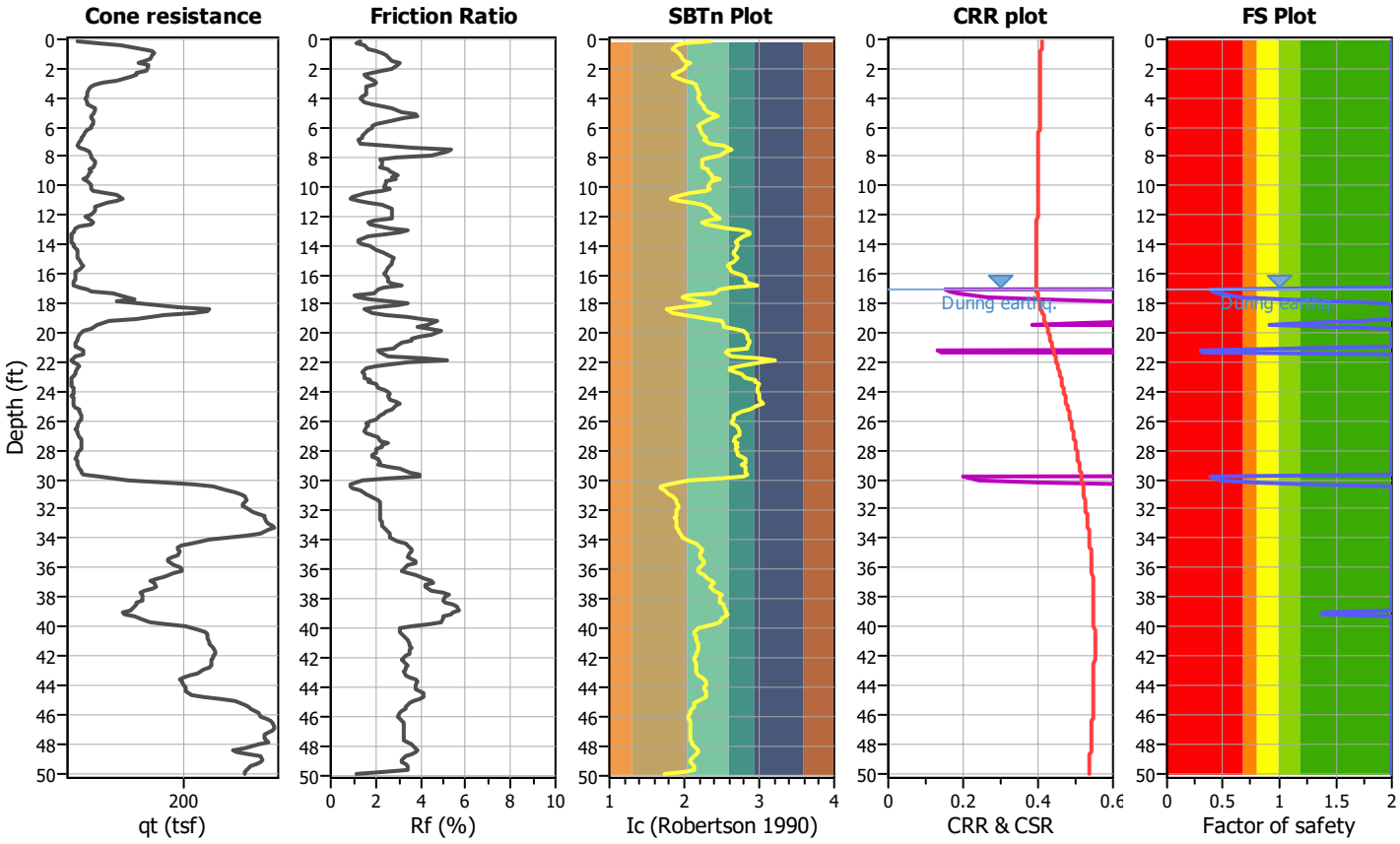
LIQUEFACTION ANALYSIS REPORT

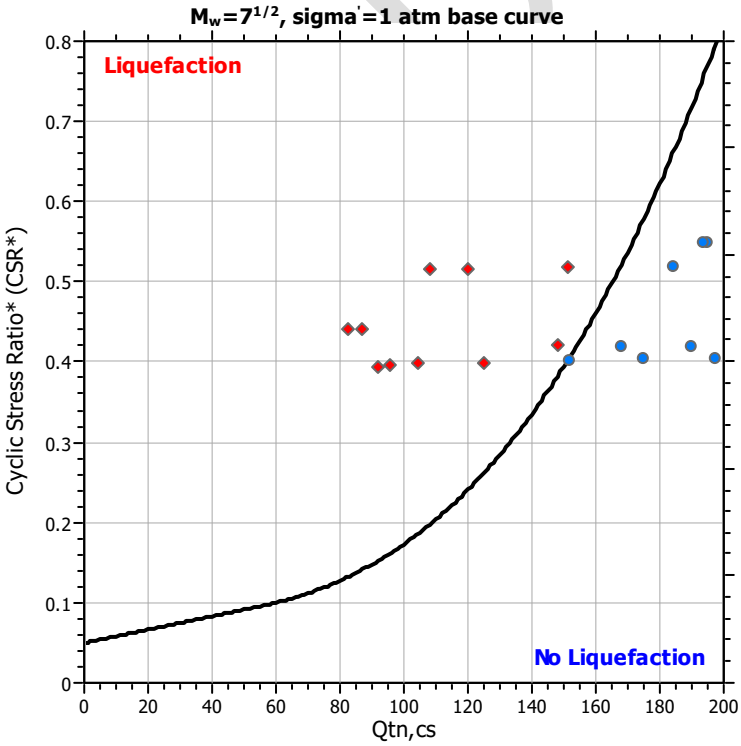
Project title : Signal Hill Petroleum **Location : Signal Hill**

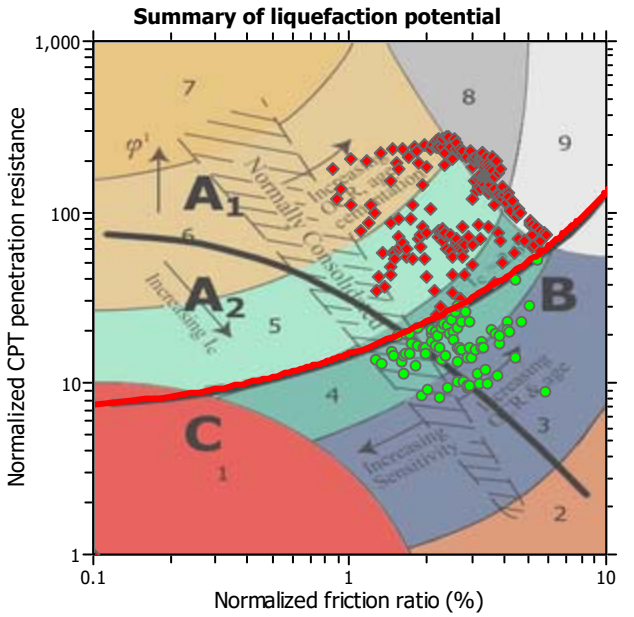
CPT file : CPT-8

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	17.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

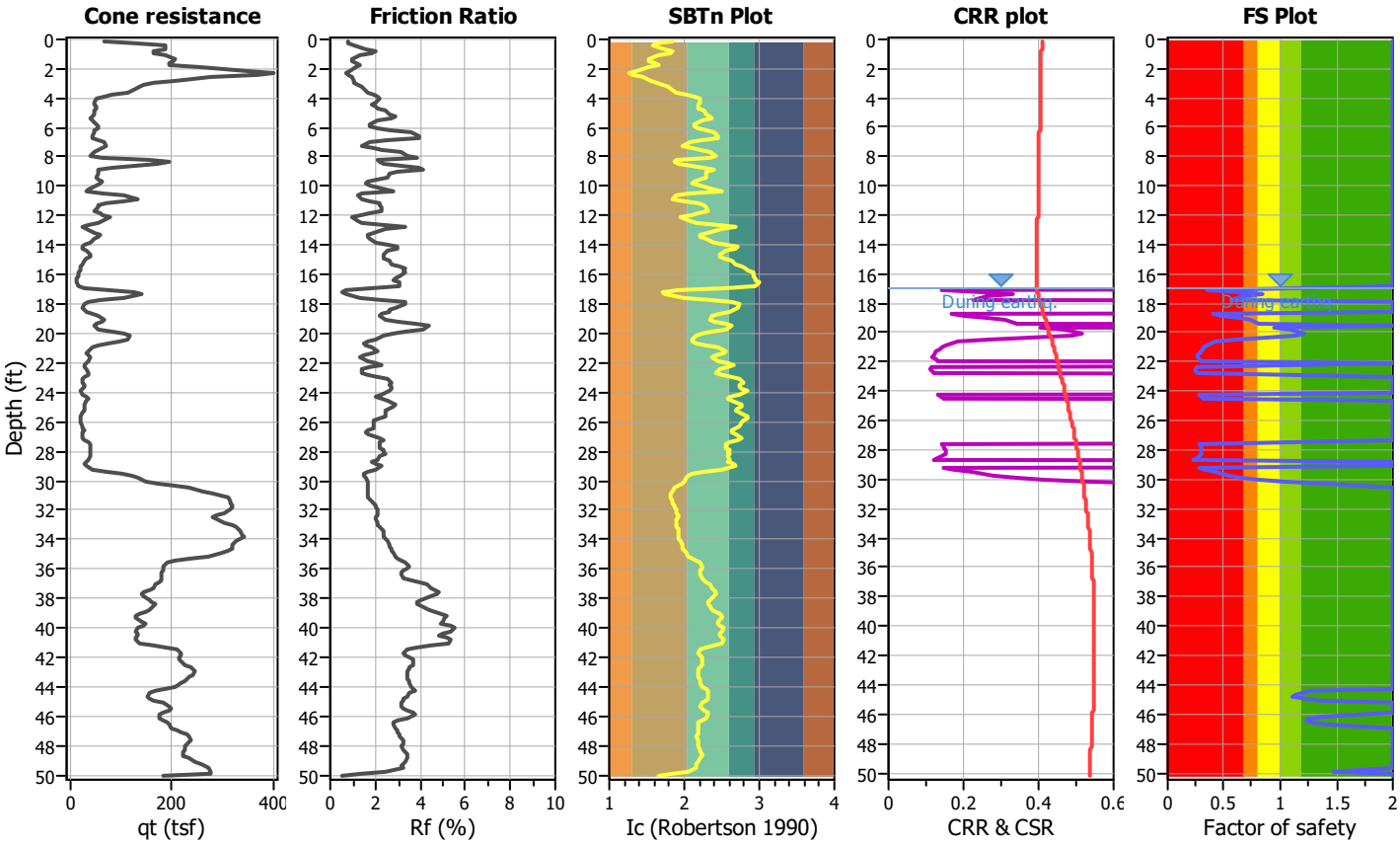
LIQUEFACTION ANALYSIS REPORT

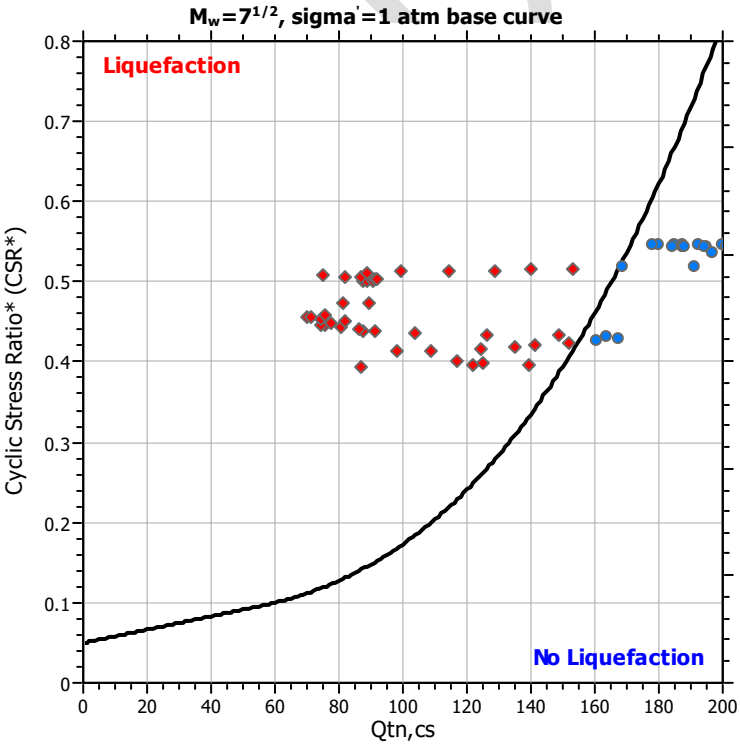
Project title : Signal Hill Petroleum **Location : Signal Hill**

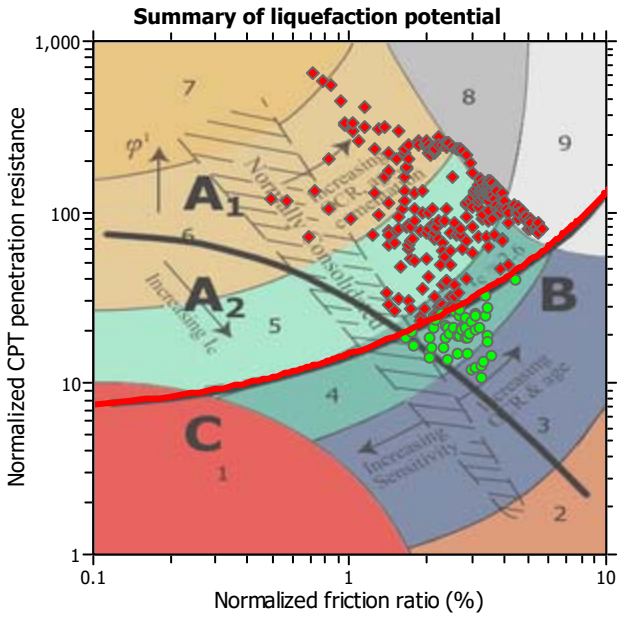
CPT file : CPT-9A

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	17.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	17.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



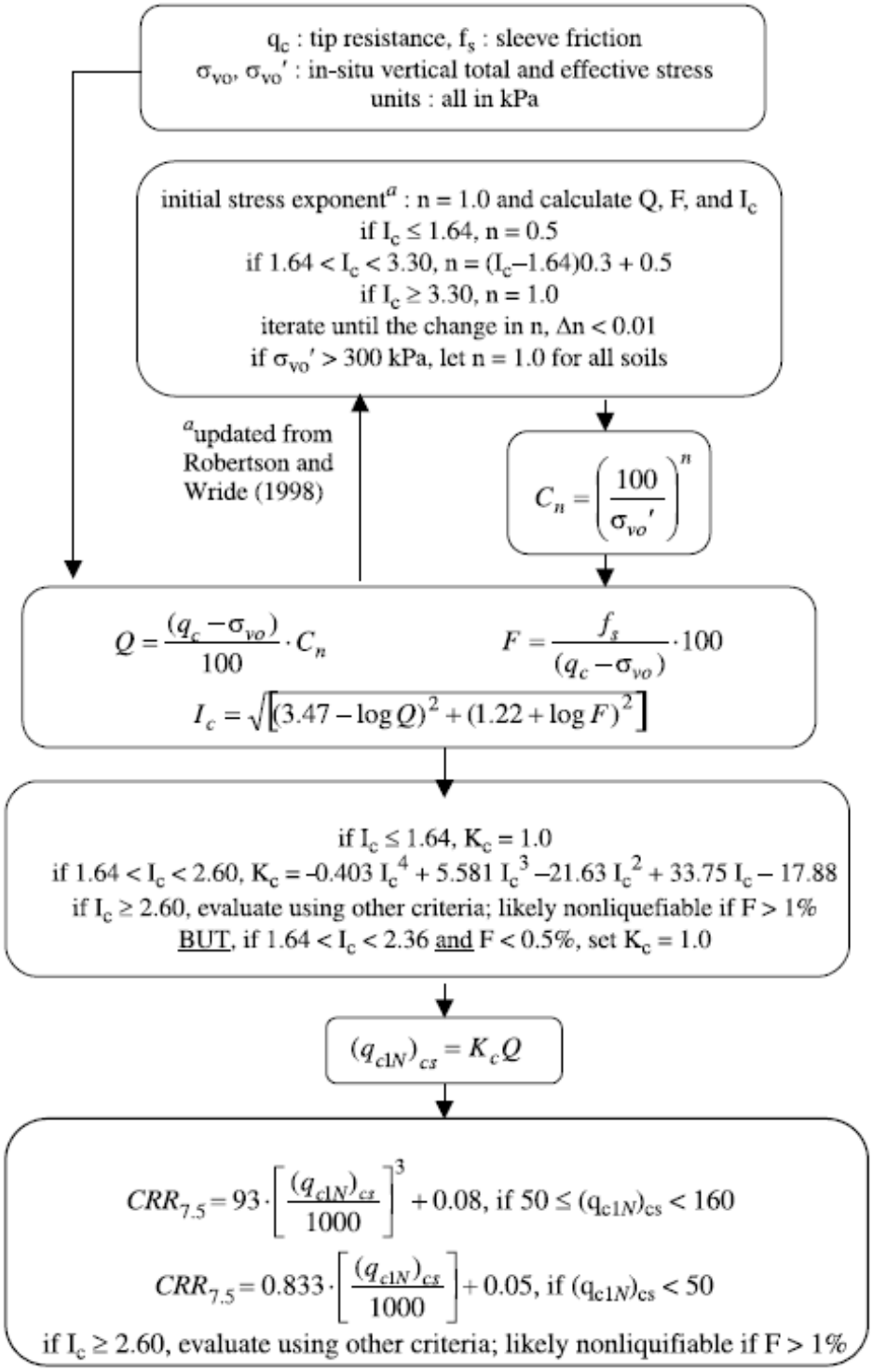




Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

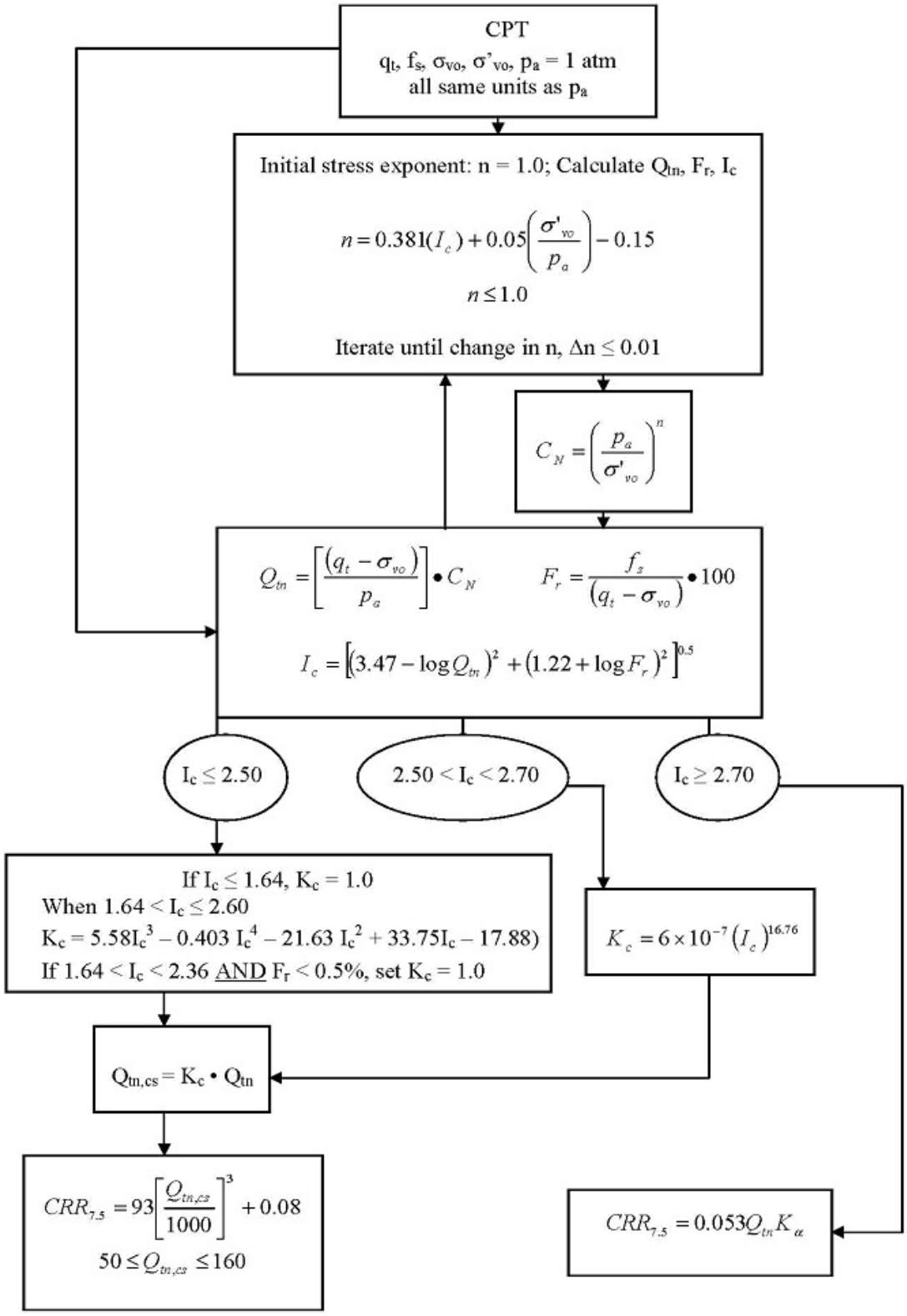
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

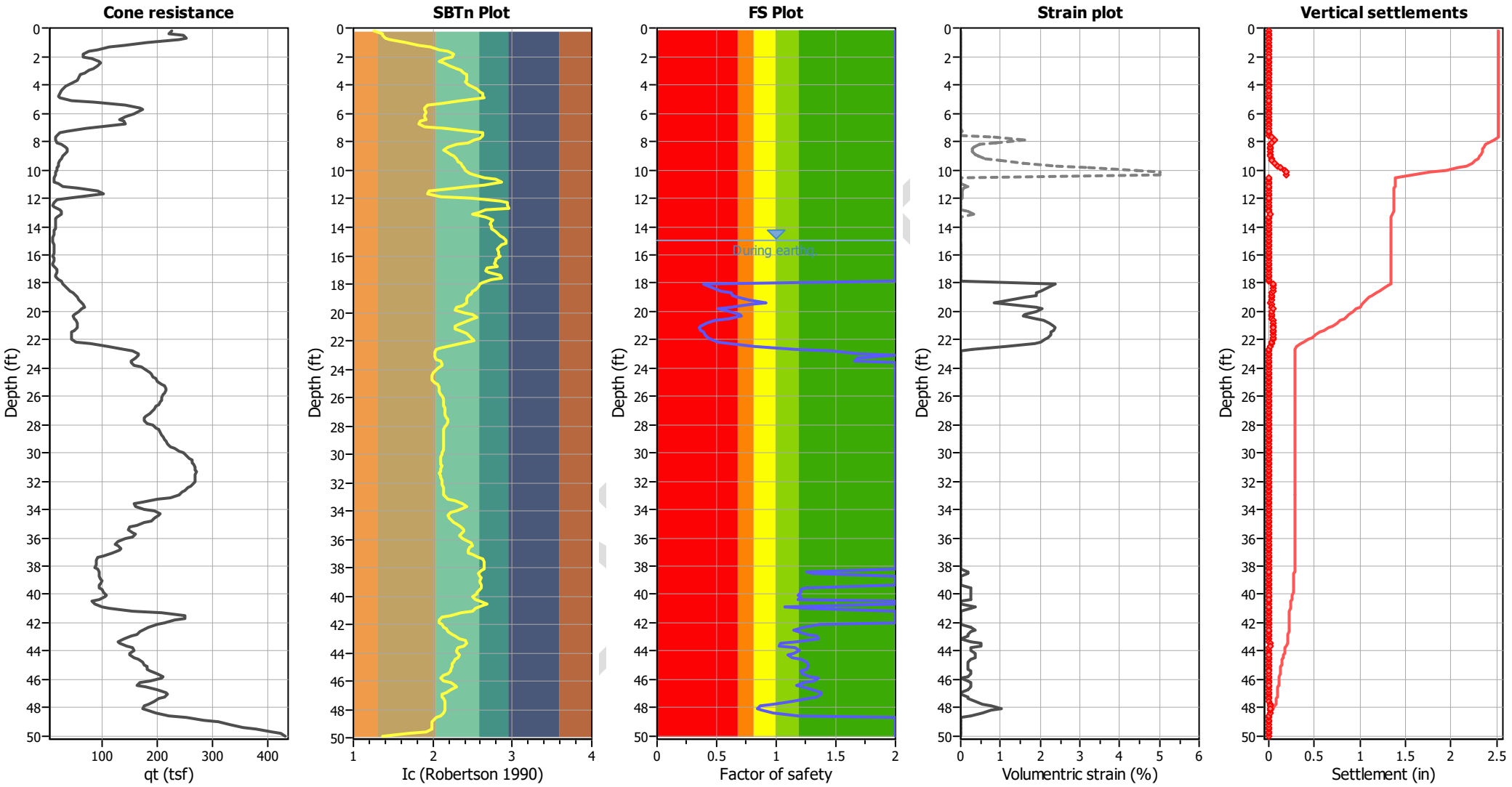
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

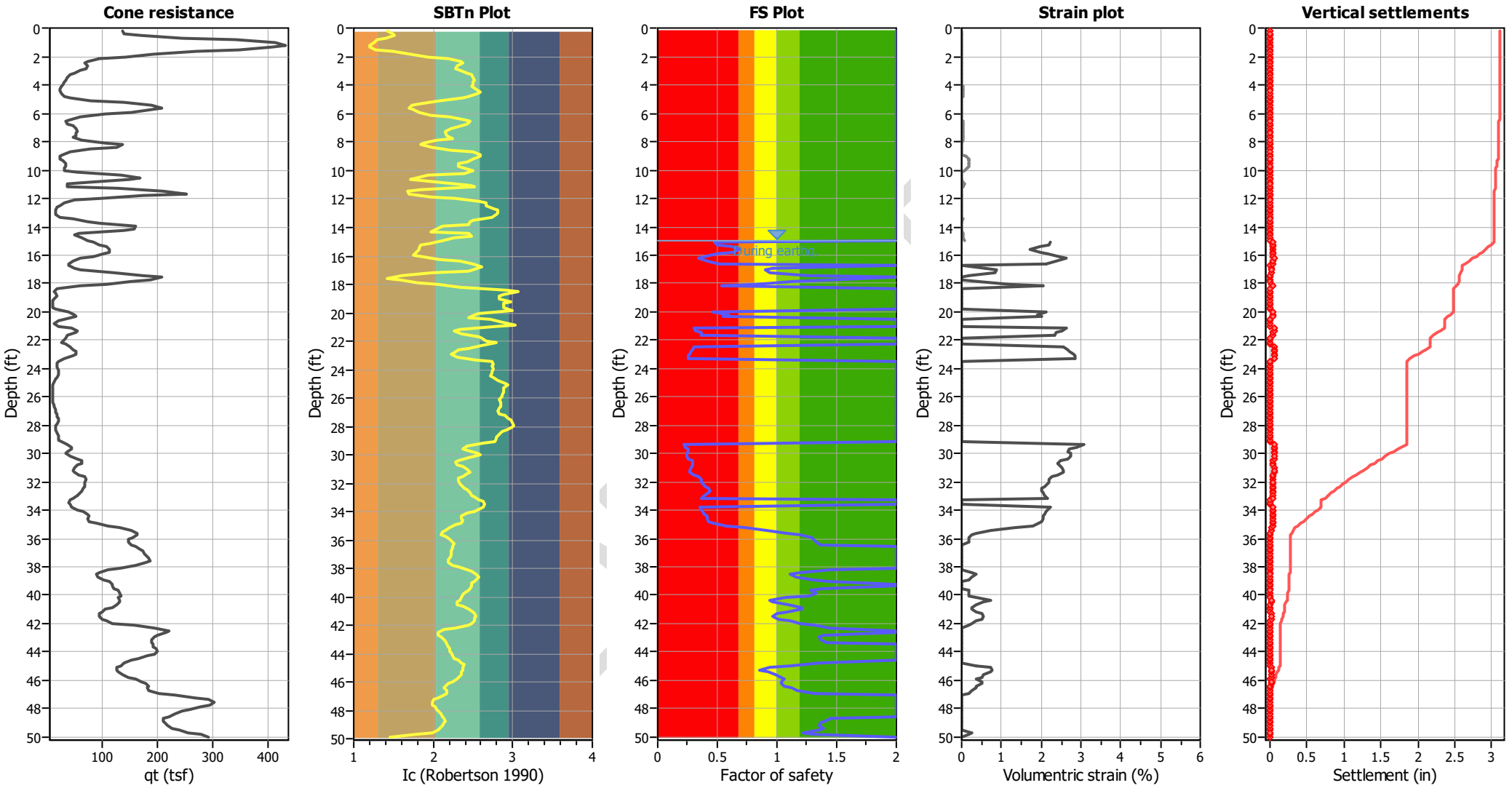
Estimation of post-earthquake settlements



Abbreviations

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

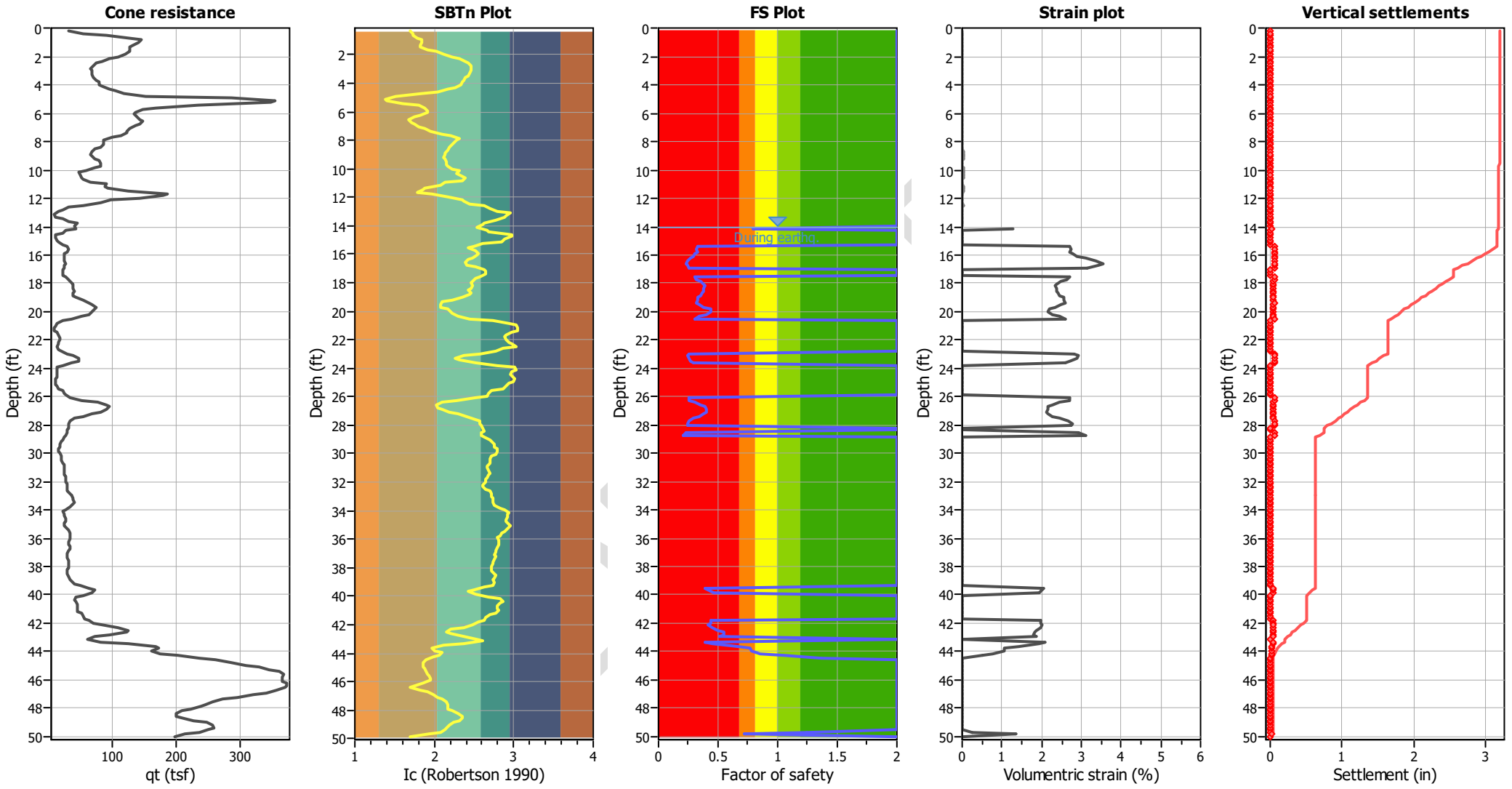
Estimation of post-earthquake settlements



Abbreviations

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

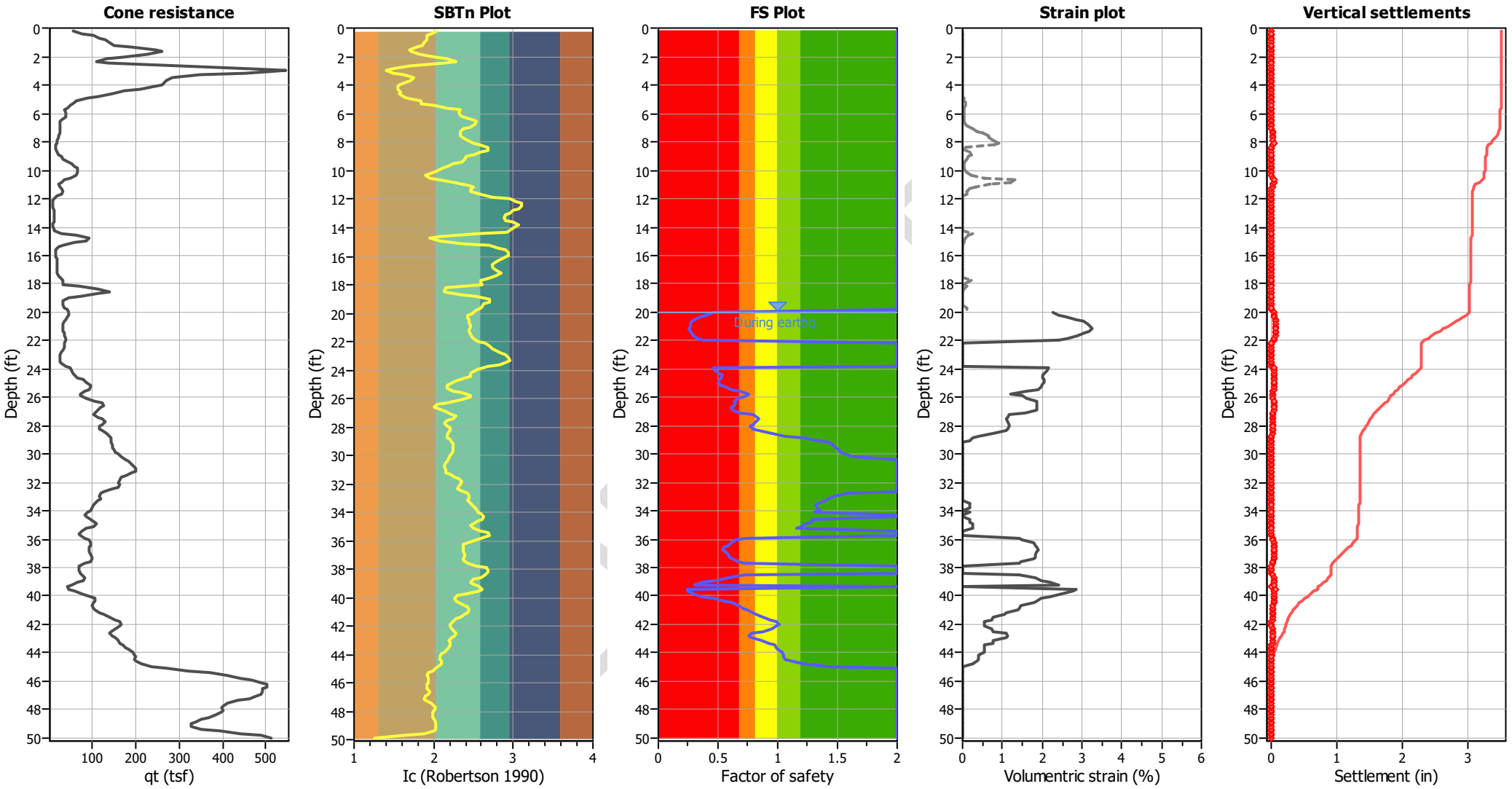
Estimation of post-earthquake settlements



Abbreviations

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

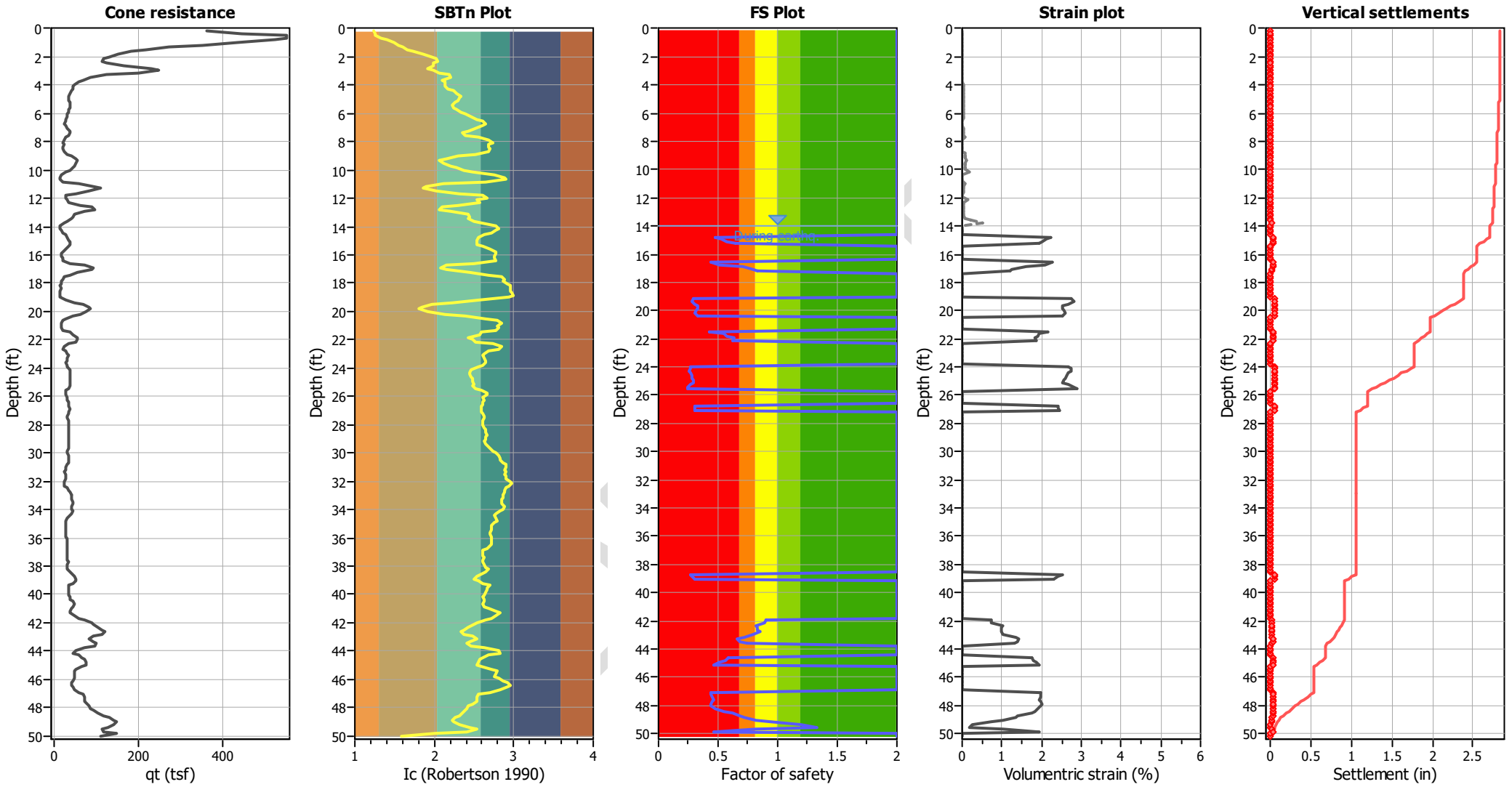
Estimation of post-earthquake settlements



Abbreviations

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

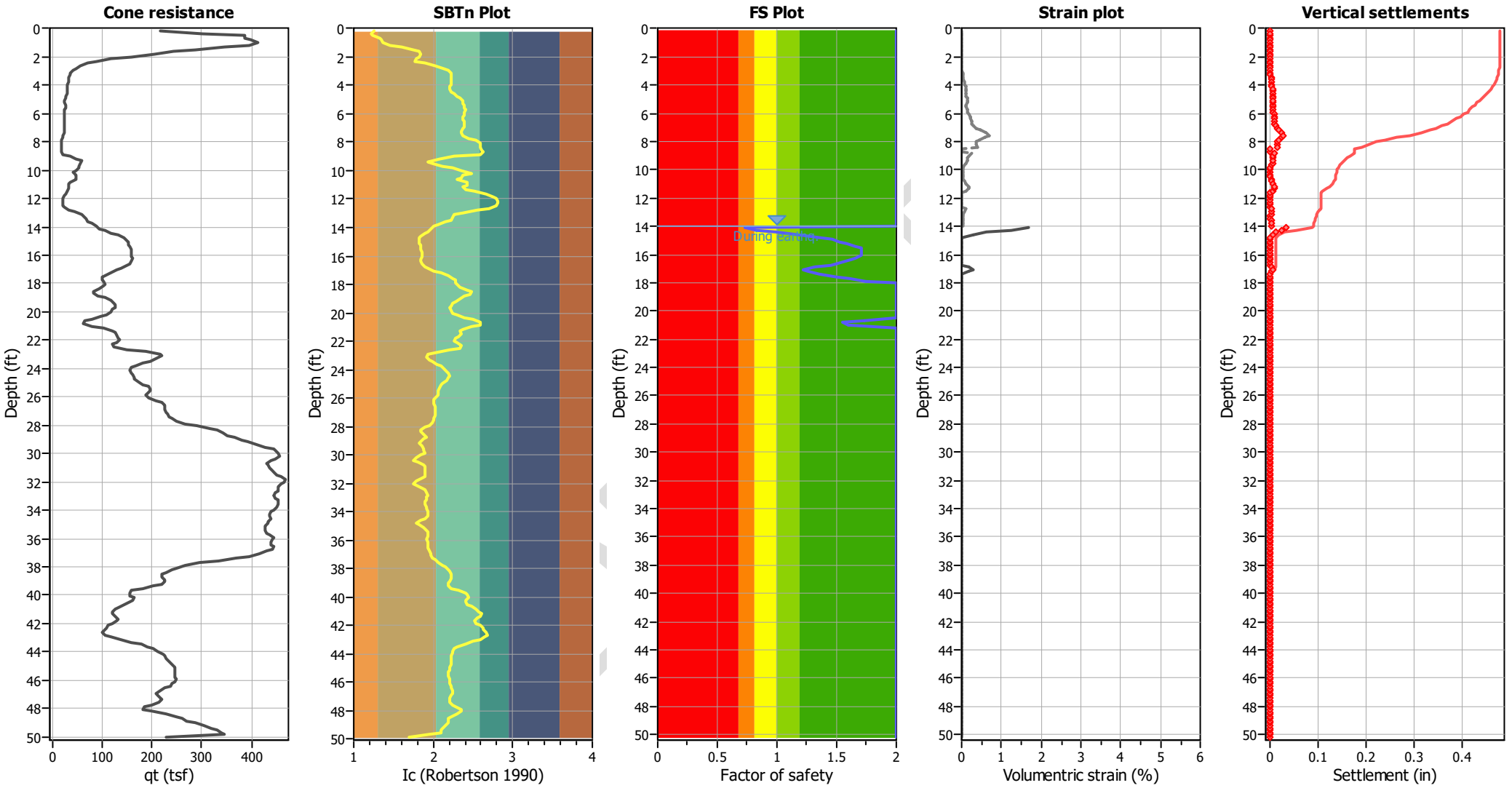
Estimation of post-earthquake settlements



Abbreviations

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

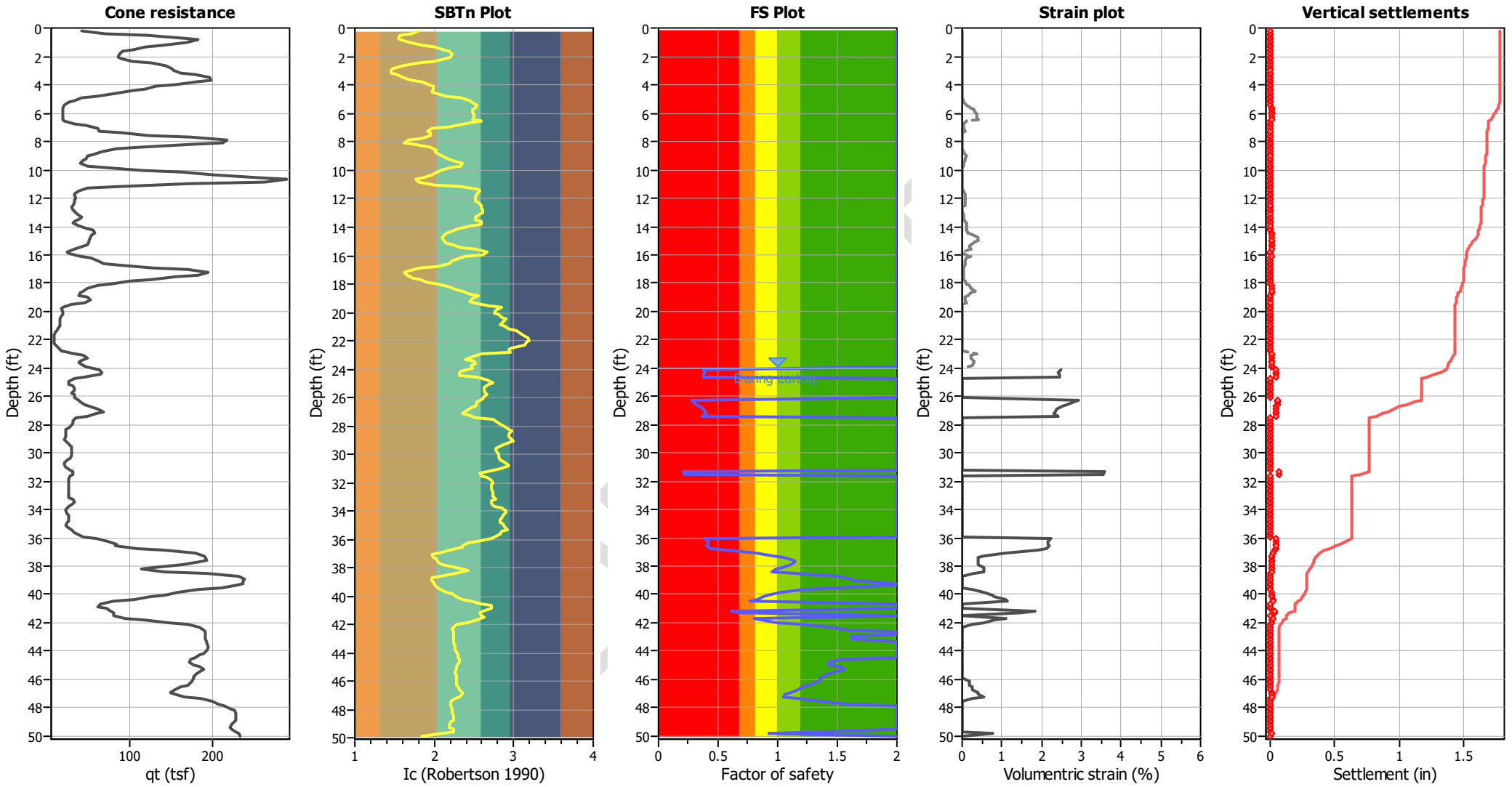
Estimation of post-earthquake settlements



Abbreviations

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

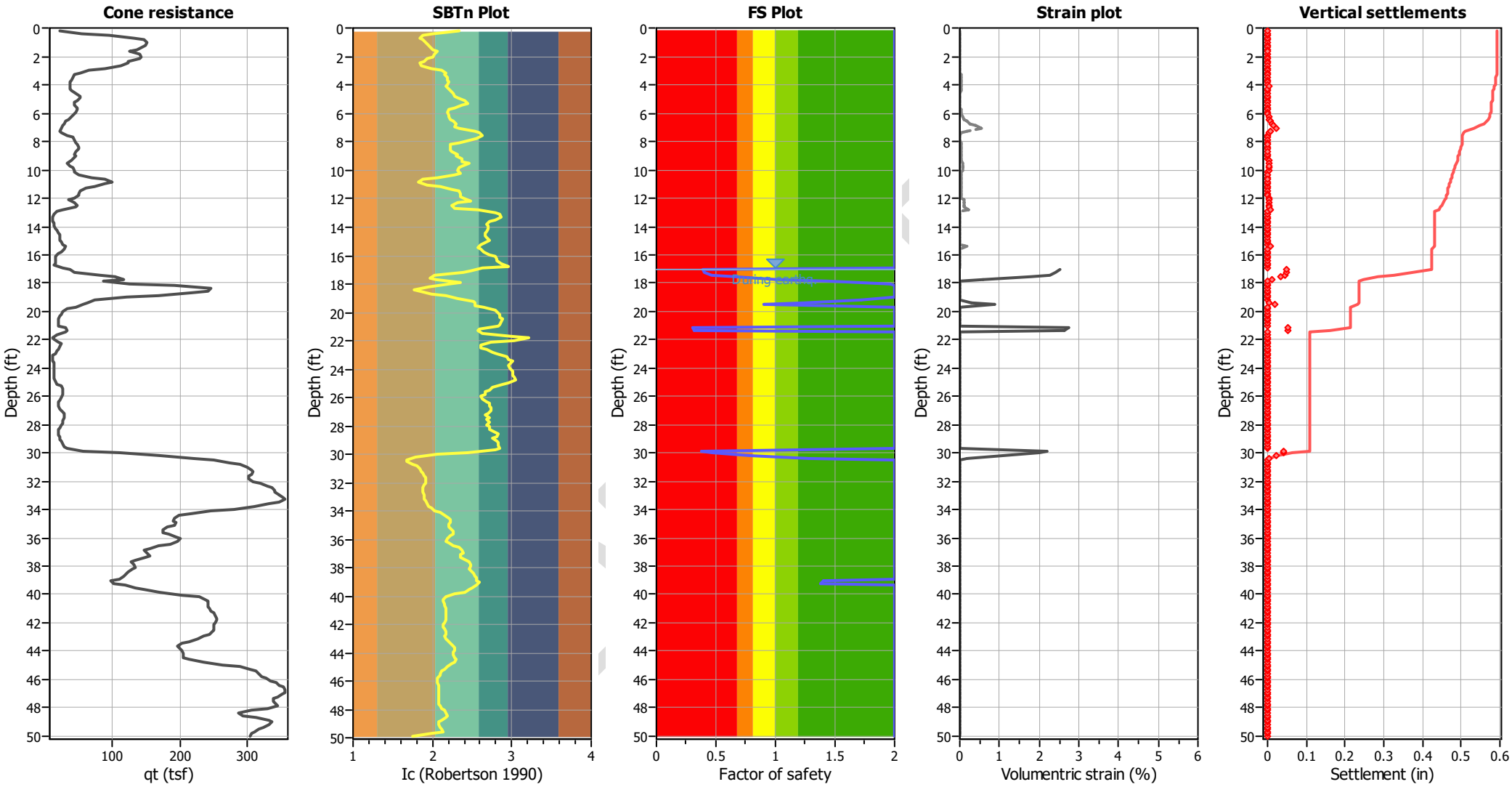
Estimation of post-earthquake settlements



Abbreviations

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

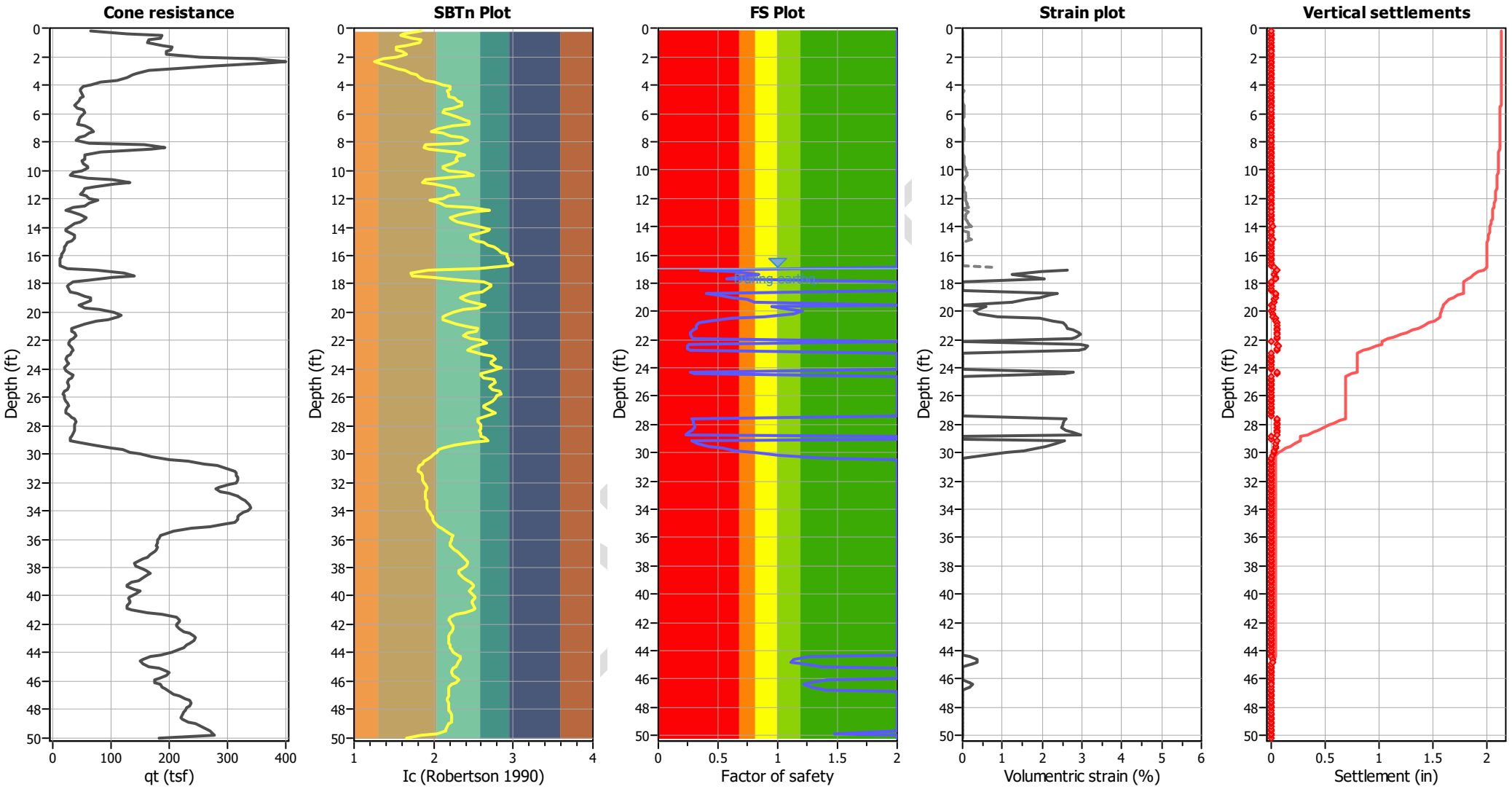
Estimation of post-earthquake settlements



Abbreviations

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

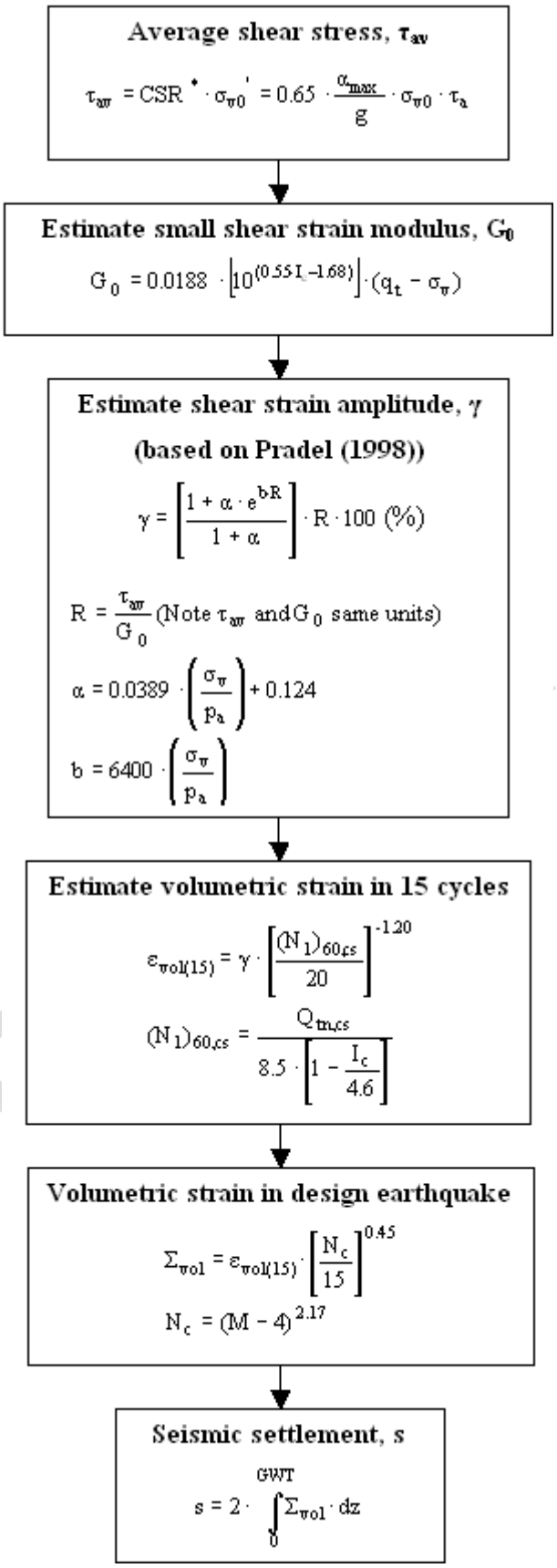
Estimation of post-earthquake settlements



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

Procedure for the estimation of seismic induced settlements in dry sands



Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

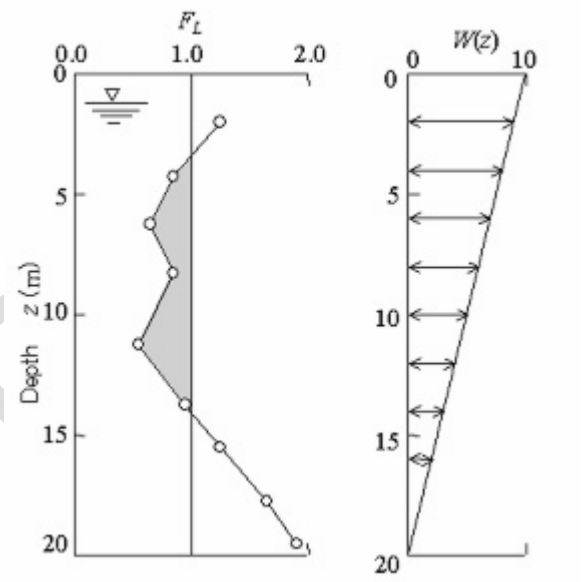
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0{,}5z) \times F_L \times dz$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

APPENDIX E

Settlement Analyses

Settlement Due to Fill to Pad and Foundation Load

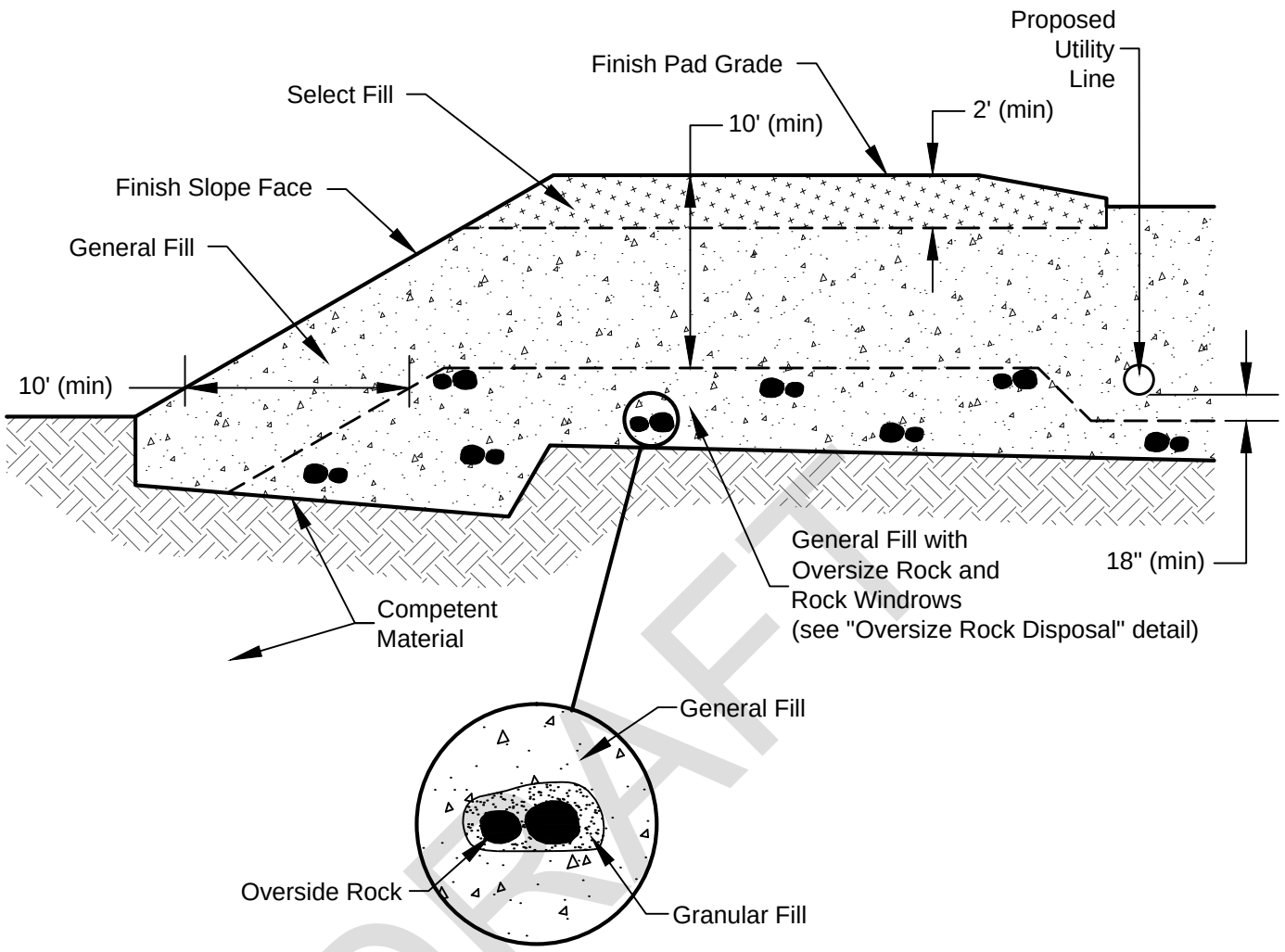
	Depth (ft)	σ'_{v0} (psf)	Ic for Foundation Load	$\Delta\sigma$ (psf)	σ'_f (psf)	σ'_p (psf)	Ce	Cc	Incremental Settlement (in)	Cumulative Settlement (in)
Existing Fill (R&R)	1	109	0.11	878	987	3200	0.003	0.030	0.03	0.03
	2	218	0.08	804	1022	3200	0.003	0.030	0.02	0.06
	3	327	0.06	756	1083	3200	0.003	0.030	0.02	0.08
	4	436	0.05	723	1159	3200	0.003	0.030	0.02	0.09
	5	545	0.04	700	1245	3200	0.003	0.030	0.01	0.11
	6	654	0.03	683	1337	3200	0.003	0.030	0.01	0.12
	7	763	0.03	669	1432	3200	0.003	0.030	0.01	0.13
	8	872	0.02	659	1531	3200	0.003	0.030	0.01	0.14
	9	981	0.02	651	1632	3200	0.003	0.030	0.01	0.14
	10	1090	0.02	644	1734	3200	0.003	0.030	0.01	0.15
Existing Fill (Remaining Place)	11	1199	0.02	639	1838	1199	0.004	0.040	0.09	0.24
	12	1308	0.01	635	1943	1308	0.004	0.040	0.08	0.32
	13	1417	0.01	631	2048	1417	0.004	0.040	0.08	0.40
	14	1526	0.01	628	2154	1526	0.004	0.040	0.07	0.47
	15	1635	0.01	625	2260	1635	0.004	0.040	0.07	0.54
	16	1744	0.01	623	2367	1744	0.004	0.040	0.06	0.60
	17	1853	0.01	621	2474	1853	0.004	0.040	0.06	0.66
	18	1962	0.01	619	2581	1962	0.004	0.040	0.06	0.72
	19	2071	0.01	617	2688	2071	0.004	0.040	0.05	0.77
	20	2180	0.01	616	2796	2180	0.004	0.040	0.05	0.83
	21	2238	0.01	615	2852	2238	0.004	0.040	0.05	0.88
	22	2295	0.01	614	2909	2295	0.004	0.040	0.05	0.93
	23	2353	0.01	613	2966	2353	0.004	0.040	0.05	0.97
	24	2410	0.00	612	3022	2410	0.004	0.040	0.05	1.02
	25	2468	0.00	611	3079	2468	0.004	0.040	0.05	1.07
Alluvium (Organic)	26	2526	0.00	610	3136	2526	0.030	0.300	0.34	1.41
	27	2583	0.00	610	3193	2583	0.030	0.300	0.33	1.74
	28	2641	0.00	609	3250	2641	0.030	0.300	0.32	2.06
	29	2698	0.00	609	3307	2698	0.030	0.300	0.32	2.38
	30	2756	0.00	608	3364	2756	0.030	0.300	0.31	2.69
	31	2814	0.00	608	3421	2814	0.030	0.300	0.31	3.00
	32	2871	0.00	607	3479	2871	0.015	0.150	0.15	3.15
	33	2929	0.00	607	3536	2929	0.015	0.150	0.15	3.29
	34	2986	0.00	607	3593	2986	0.015	0.150	0.14	3.44
	35	3044	0.00	606	3650	3044	0.015	0.150	0.14	3.58
	36	3102	0.00	606	3708	3102	0.015	0.150	0.14	3.72
	37	3159	0.00	606	3765	3159	0.015	0.150	0.14	3.86
	38	3217	0.00	605	3822	3217	0.015	0.150	0.13	3.99
Aluvmium (fines)	39	3274	0.00	605	3880	3274	0.008	0.080	0.07	4.06
	40	3332	0.00	605	3937	3332	0.008	0.080	0.07	4.13
	41	3390	0.00	605	3994	3390	0.008	0.080	0.07	4.20
	42	3447	0.00	605	4052	3447	0.008	0.080	0.07	4.27
	43	3505	0.00	604	4109	3505	0.008	0.080	0.07	4.33
	44	3562	0.00	604	4167	3562	0.008	0.080	0.07	4.40
	45	3620	0.00	604	4224	3620	0.008	0.080	0.06	4.46
	46	3678	0.00	604	4281	3678	0.008	0.080	0.06	4.53
	47	3735	0.00	604	4339	3735	0.008	0.080	0.06	4.59
	48	3793	0.00	604	4396	3793	0.008	0.080	0.06	4.65
	49	3850	0.00	603	4454	3850	0.008	0.080	0.06	4.71
	50	3908	0.00	603	4511	3908	0.008	0.080	0.06	4.77

Settlement Due to Surcharge

	Depth (ft)	σ'_{v0} (psf)	$\Delta\sigma$ (psf)	σ'_f (psf)	σ'_p (psf)	Ce	Cc	Incremental Settlement (in)	Cumulative Settlement (in)
Existing Fill (R&R)	1	109	2400	2509	3200	0.003	0.030	0.05	0.05
	2	218	2400	2618	3200	0.003	0.030	0.04	0.09
	3	327	2400	2727	3200	0.003	0.030	0.03	0.12
	4	436	2400	2836	3200	0.003	0.030	0.03	0.15
	5	545	2400	2945	3200	0.003	0.030	0.03	0.18
	6	654	2400	3054	3200	0.003	0.030	0.02	0.20
	7	763	2400	3163	3200	0.003	0.030	0.02	0.22
	8	872	2400	3272	3200	0.003	0.030	0.02	0.25
	9	981	2400	3381	3200	0.003	0.030	0.03	0.27
	10	1090	2400	3490	3200	0.003	0.030	0.03	0.30
Existing Fill (Remaining Place)	11	1199	2400	3599	1199	0.004	0.040	0.23	0.53
	12	1308	2400	3708	1308	0.004	0.040	0.22	0.75
	13	1417	2400	3817	1417	0.004	0.040	0.21	0.96
	14	1526	2400	3926	1526	0.004	0.040	0.20	1.15
	15	1635	2400	4035	1635	0.004	0.040	0.19	1.34
	16	1744	2400	4144	1744	0.004	0.040	0.18	1.52
	17	1853	2400	4253	1853	0.004	0.040	0.17	1.70
	18	1962	2400	4362	1962	0.004	0.040	0.17	1.86
	19	2071	2400	4471	2071	0.004	0.040	0.16	2.02
	20	2180	2400	4580	2180	0.004	0.040	0.15	2.18
	21	2238	2400	4638	2238	0.004	0.040	0.15	2.33
	22	2295	2400	4695	2295	0.004	0.040	0.15	2.48
	23	2353	2400	4753	2353	0.004	0.040	0.15	2.63
	24	2410	2400	4810	2410	0.004	0.040	0.14	2.77
	25	2468	2400	4868	2468	0.004	0.040	0.14	2.91
Alluvium (Organic)	26	2526	2400	4926	2526	0.030	0.300	1.04	3.96
	27	2583	2400	4983	2583	0.030	0.300	1.03	4.98
	28	2641	2400	5041	2641	0.030	0.300	1.01	5.99
	29	2698	2400	5098	2698	0.030	0.300	0.99	6.99
	30	2756	2400	5156	2756	0.030	0.300	0.98	7.97
	31	2814	2400	5214	2814	0.030	0.300	0.96	8.93
	32	2871	2400	5271	2871	0.015	0.150	0.47	9.41
	33	2929	2400	5329	2929	0.015	0.150	0.47	9.87
	34	2986	2400	5386	2986	0.015	0.150	0.46	10.34
	35	3044	2400	5444	3044	0.015	0.150	0.45	10.79
	36	3102	2400	5502	3102	0.015	0.150	0.45	11.24
	37	3159	2400	5559	3159	0.015	0.150	0.44	11.68
	38	3217	2400	5617	3217	0.015	0.150	0.44	12.12
Alluvium (fines)	39	3274	2400	5674	3274	0.008	0.080	0.23	12.35
	40	3332	2400	5732	3332	0.008	0.080	0.23	12.57
	41	3390	2400	5790	3390	0.008	0.080	0.22	12.79
	42	3447	2400	5847	3447	0.008	0.080	0.22	13.01
	43	3505	2400	5905	3505	0.008	0.080	0.22	13.23
	44	3562	2400	5962	3562	0.008	0.080	0.21	13.45
	45	3620	2400	6020	3620	0.008	0.080	0.21	13.66
	46	3678	2400	6078	3678	0.008	0.080	0.21	13.87
	47	3735	2400	6135	3735	0.008	0.080	0.21	14.08
	48	3793	2400	6193	3793	0.008	0.080	0.20	14.28
	49	3850	2400	6250	3850	0.008	0.080	0.20	14.48
	50	3908	2400	6308	3908	0.008	0.080	0.20	14.68

APPENDIX F

Construction Details

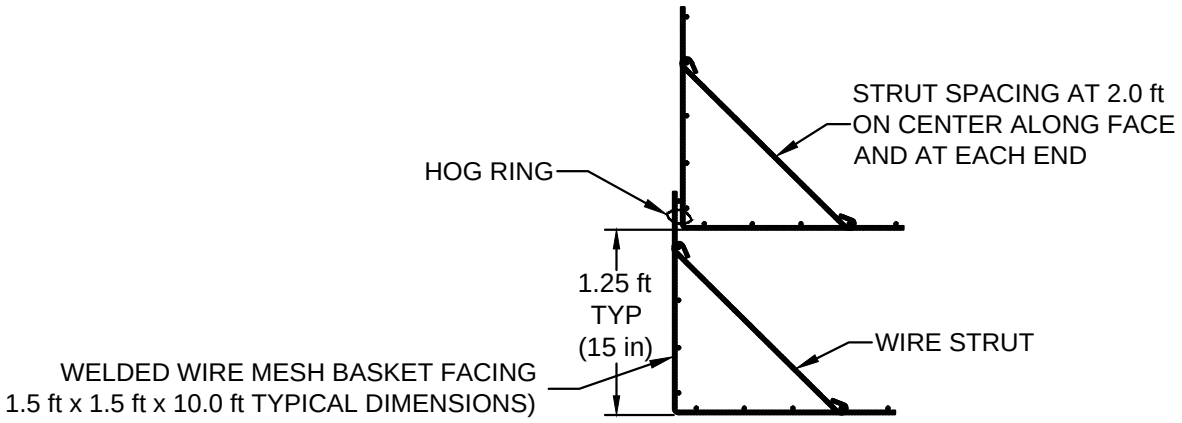


NOTES:

Select Fill:	Soil with rock up to 6" in maximum dimension.
General Fill:	Soil with rock up to 12" in maximum dimension.
Granular Fill:	Soil with rock up to 3" in maximum dimension and with a Sand Equivalent (SE) of 30 or more.
Oversize Rock:	Rock greater than 12" and up to 36" in maximim dimension. (Rock larger that 36" in mimimum dimension should be reduced in size or removed from the site.)

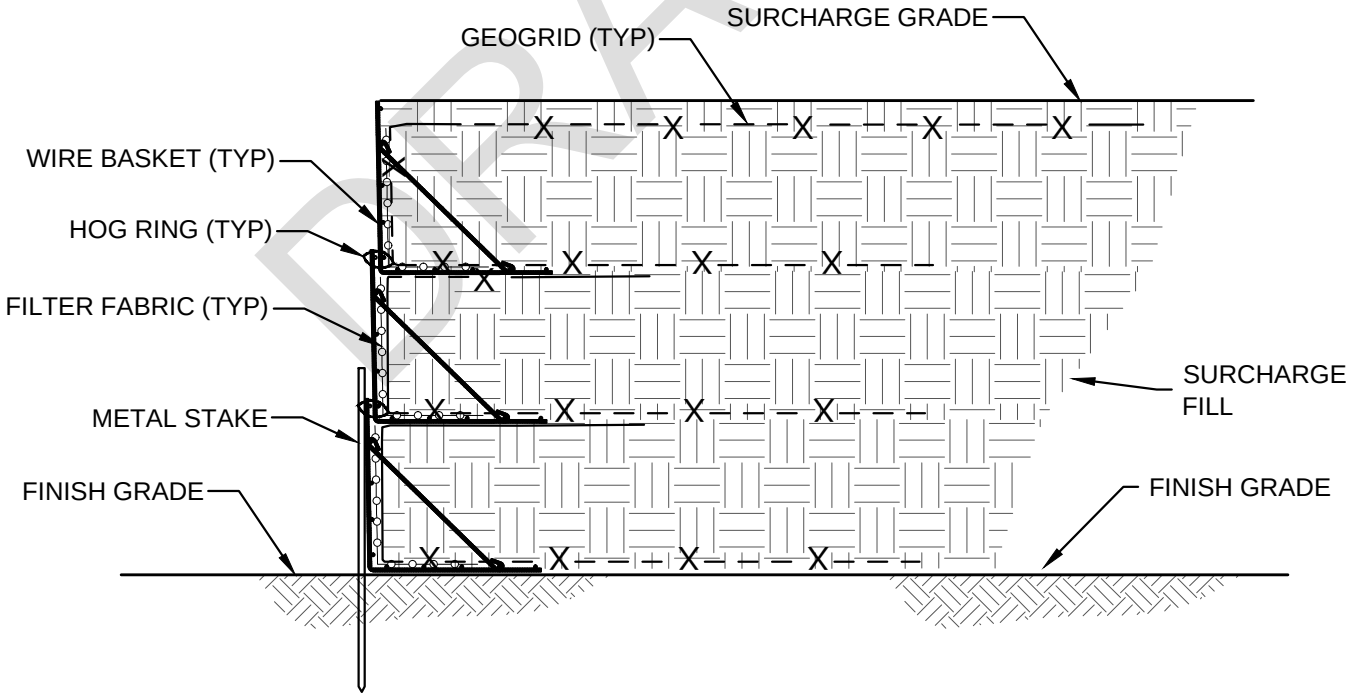
FILL PLACEMENT

PLATE F-1
N.T.S.



TYPICAL WIRE MESH BASKET FACE DETAIL

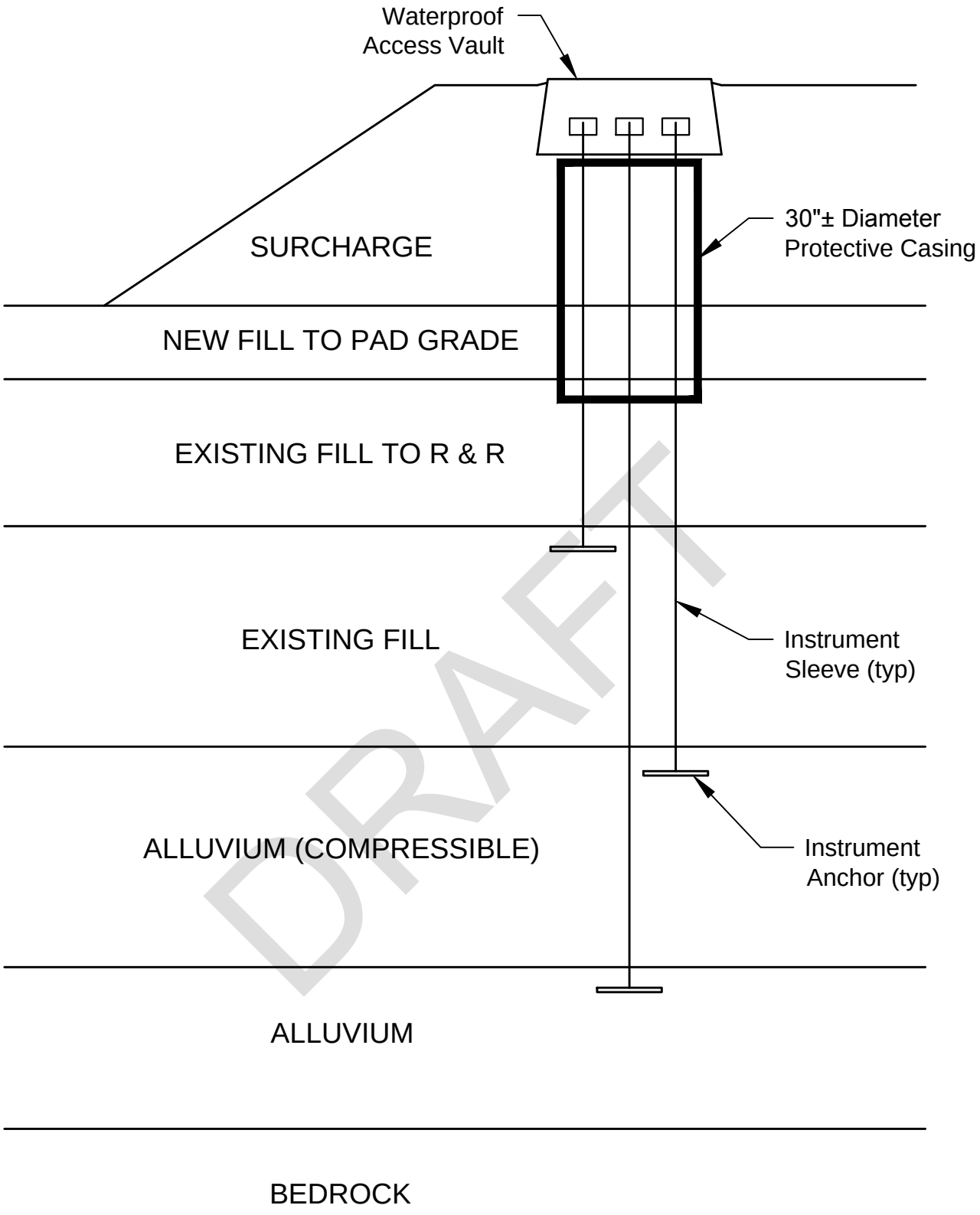
N.T.S.



TEMPORARY WIRE BASKET RETAINING WALL

PLATE F-2
N.T.S.

ALBUS-KEEFE & ASSOCIATES, INC.

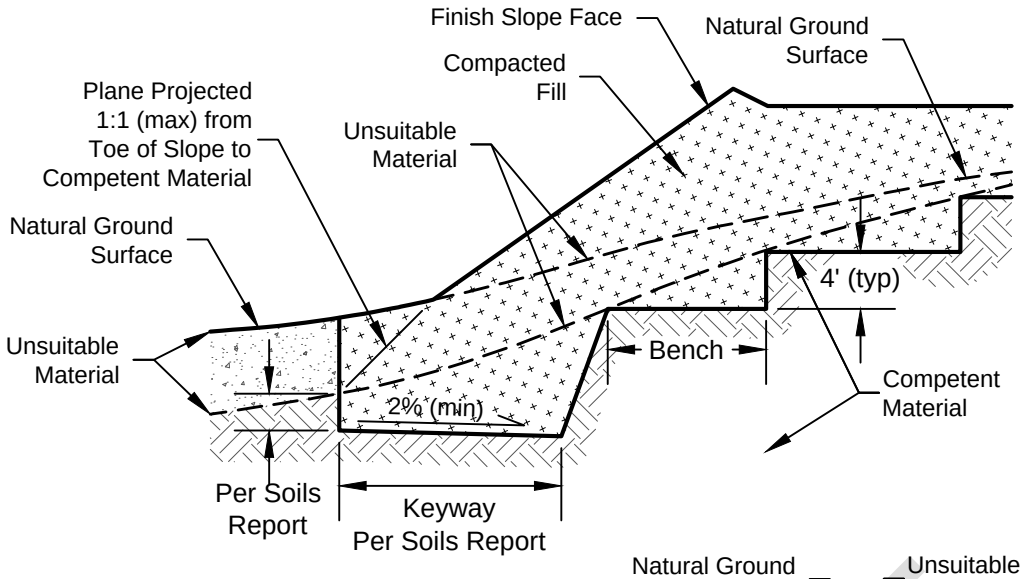


SETTLEMENT MONITORING INSTRUMENT ARRAY

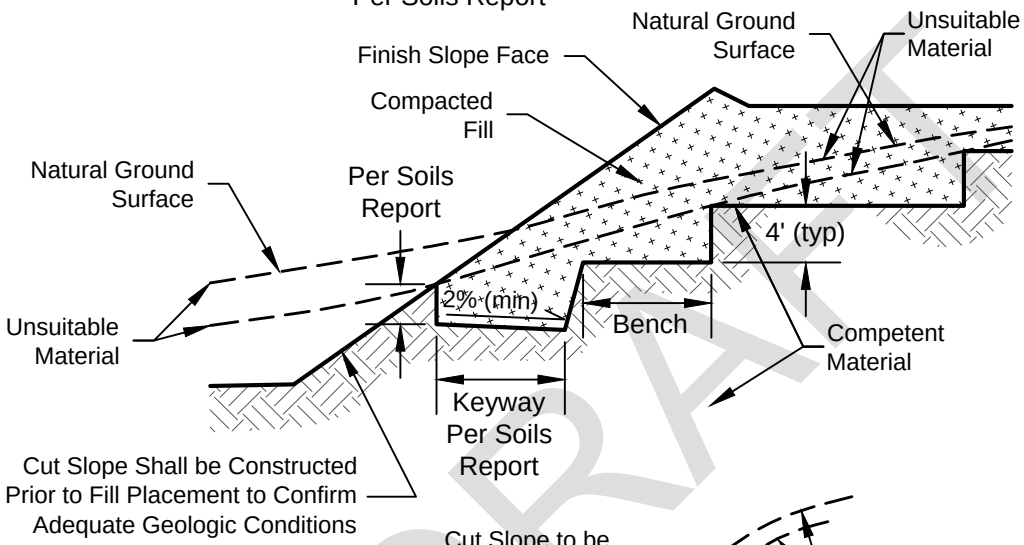
PLATE F-3
N.T.S.

ALBUS-KEEFE & ASSOCIATES, INC.

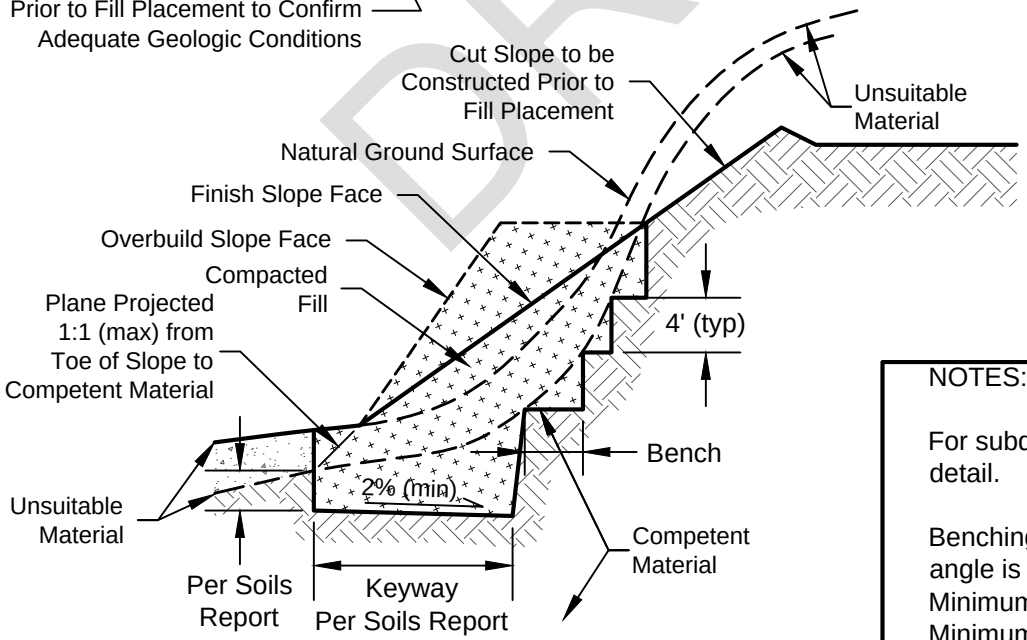
FILL SLOPE



FILL OVER CUT SLOPE



CUT OVER FILL SLOPE



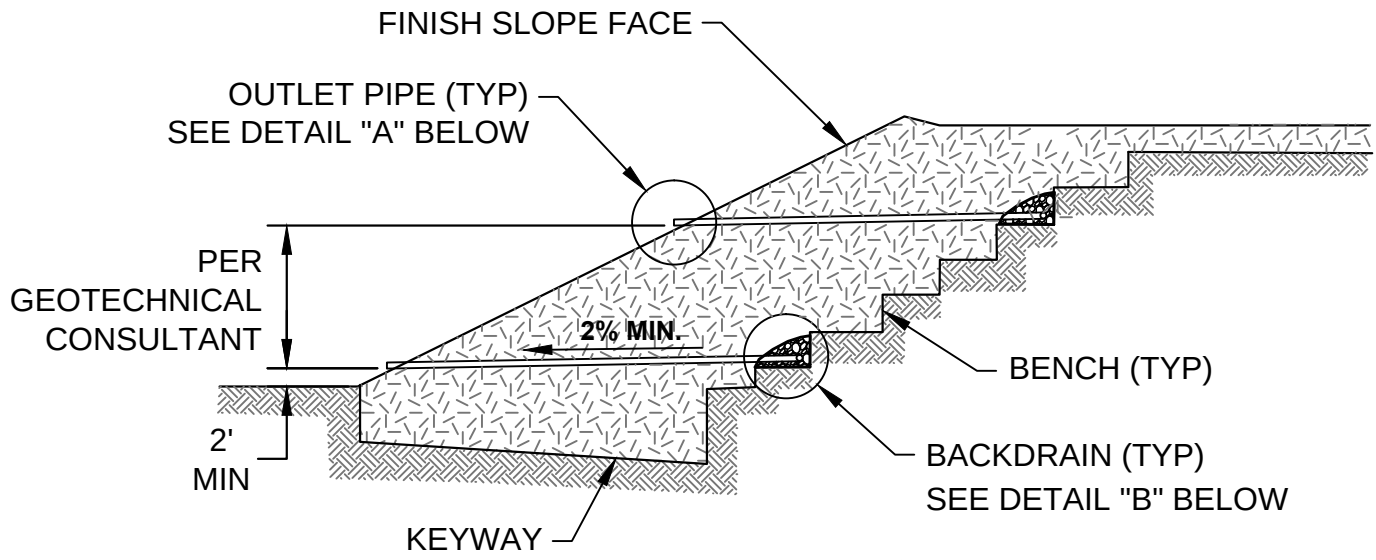
NOTES:

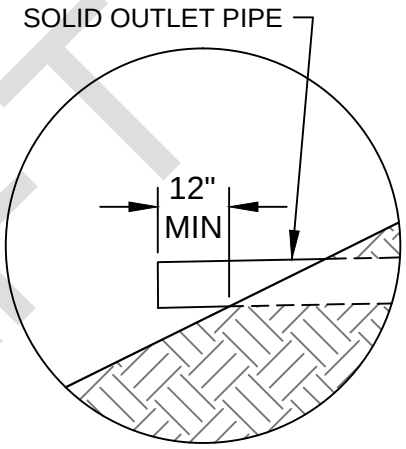
For subdrains see "SLOPE BACKDRAIN" detail.

Benching shall be done when the slope angle is equal to or greater than 5:1. Minimum bench height shall be 4 feet. Minimum fill width shall be 9 feet.

FILL SLOPE CONSTRUCTION

PLATE F-4
N.T.S.





DETAIL "A"

NOTES:

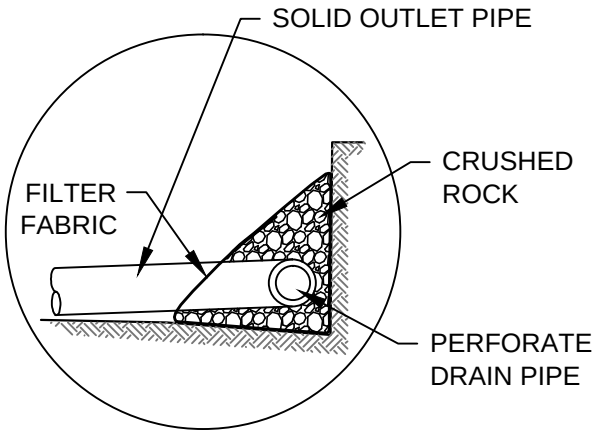
Perforated Drain Pipe should be at least 4 inches in diameter consisting of either Shedule 40 PVC or SDR 35. A min. of 8 perforations per linear foot should be provided along the bottom of pipe. Upstream ends should be provided with a cap. The pipe should slope at a min. 1% gradient toward Outlet Pipes. Glue all joints.

Outlet Pipe should be at least 4 inches in diameter consisting of either shedule 40 PVC or SDR 35. The pipe should slope at a min. 2% gradient toward slope face. Backfill around Outlet Pipe should consist of onsite soils. Provide Outlet Pipe for each 100 feet of Perforated Drain Pipe. Glue all joints. Extend Outlet Pipe 1 foot beyond Finish Slope Face. Glue all joints.

Crushed Rock should conform to the Standard Specifications for Public Works Construction, Section 200-1.2, for 3/4". Provide at least 4 cubic feet per lineal foot of Perforated Drain Pipe. Provide at least 4 inches of gravel below perforated pipe.

Filter Fabric should consist of Mirafi 140N or equivelent. Ends should overlap at least 12 inches.

CALTRANS Class II Permeable Filter Material can be used in lieu of Crushed Rock encased in Filter Fabric.



DETAIL "B"

SLOPE BACKDRAIN

PLATE F-5
N.T.S.

ALBUS-KEEFE & ASSOCIATES, INC.

This page is intentionally blank.