

Appendix 4.7-1:
Preliminary Geotechnical Investigation

HAMILTON
& Associates

1641 Border Avenue • Torrance, CA 90501 T 310.618.2190 888.618.2190 F 310.618.2191 W hamilton-associates.net

Updated April 18, 2023
Project No. 21-2971

16911 Normandie Associates, LLC
134 Lomita St.,
El Segundo, CA 90245

Attention: Mr. Fred Shaffer, President

Subject: Preliminary Geotechnical Investigation, Proposed 5.5-Acre Apartment and Townhome Development, 16831 & 16911 South Normandie Avenue, Gardena, California.

Dear Mr. Shaffer:

Per your request, presented herewith is Hamilton & Associates, Inc. (H&A) Preliminary Geotechnical Investigation Report for the subject project. H&A's work was conducted in accordance with the proposal dated July 21, 2021 and your subsequent authorization. The purpose of this study was to evaluate select conditions at the site and provide recommendations for the design and construction of the proposed project. This evaluation has concluded that the proposed project is feasible from a geotechnical viewpoint provided that the recommendations and design guidelines presented in this report are incorporated in the project plans and design and implemented during construction. The results of the field exploration and laboratory tests are also presented. We thank you for the opportunity to provide professional services on this important project and we look forward to assisting you during construction. If you have any questions or require additional information, please contact the undersigned.

Respectfully submitted,
HAMILTON & ASSOCIATES, INC.

Brendan Miller
Senior Staff Engineer



David T. Hamilton, PE, GE
President/Geotechnical Engineer

TABLE OF CONTENTS

INTRODUCTION 1
PROJECT DESCRIPTION 1
Existing Site Conditions 1
Structural Loading 1
REVIEW OF AVAILABLE REPORTS 2
HISTORICAL TOPOGRAPHIC MAPS AND AERIAL IMAGES 2

FIELD EXPLORATION AND LABORATORY TESTING 4
FIELD EXPLORATION 5
Hollow Stem Auger Borings 5
Cone Penetration Test (CPT) 5
LABORATORY TESTING 5

SITE AND SUBSURFACE CONDITONS 5
GEOLOGIC SETTING 5
GEOLOGIC MATERIALS 6
Fill (Af) 7
Alluvium 7
GROUNDWATER AND CAVING 7
SEISMOLOGICAL AND GEOLOGIC HAZARDS 7
Ground Shaking Analysis 7
Surface Fault Rupture 8
Seismic Settlements (Liquefaction) 8
Seismically Induced Landslides 9
Hydro-Consolidation 9
Expansive Soils 9

ENGINEERING SITE CHARACTERIZATION 9
SOIL PROFILE CHARACTERIZATION 9
CLASSIFICATION AND INDEX PROPERTIES 10

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS 11
SITE PREPARATION AND GRADING 11
Existing Construction Debris, Disturbed Soils 11
Remedial Grading 12
Temporary Excavations 12
New Fills 14
Backfilling and Compaction Requirements 14
Imported Soils 14
Observation and Testing During Construction 15
FOUNDATION DESIGN 16
Foundation Capacity 16
Lateral Resistance 17
Settlements/Displacements 17
SEISMIC DESIGN PARAMETERS 17

RETAINING WALLS 18
SLAB-ON-GRADE 19
PORTLAND CEMENT PAVEMENT 20
ASPHALT PAVEMENT 20
SOIL CORROSIVITY 22
SITE DRAINAGE 23
UTILITY TRENCHES 23
PLAN REVIEW, OBSERVATIONS AND TESTING 23

CLOSURE 24

FIGURES

Figure 1 – Site Location Map
Figure 2 – Regional Geology Map
Figure 3 – Regional Fault Map
Figure 4 – Seismic Hazard Zones Map
Figure 5 – Landslide Inventory Map
Figure 6 – Historic High Groundwater
Figure 7 – Subsurface Soil Stratigraphy based on CPT Soundings
Figure 8 – Soil Property Characterization Profiles vs. Depth

APPENDIX

Appendix A – Field Exploration, Laboratory Results, Geotechnical / Geological Plates
Appendix B – Liquefaction Analysis
Appendix C – Data by Others

INTRODUCTION

This report presents the results of H&A's geotechnical investigation for the Project (described below in Project Concept) conducted at 16831 & 16911 South Normandie Avenue, Gardena, California, approximately 33.8773°N, 118.2996°W (Site). Figure 1, "Site Location Map" presents the Site's location.

Site exploration was conducted to identify and evaluate select surface and subsurface conditions. Geotechnical recommendations for design and construction of the Project were developed based on the review of select published and unpublished documents in conjunction with the findings of this field investigation and laboratory analysis. This report summarizes the data collected and presents geotechnical findings, conclusions, and recommendations.

PROJECT DESCRIPTION

The Project concept was provided during conversations and in emails with Mr. Fred Shaffer of Saiko Investment Corp. and Mr. Richard Solares of Urban Architecture Lab, Project Architect. It is H&A's understanding that the Project will consist of a 328-unit 7-story podium construction residential building that consists of 2 levels of on/above grade parking with 5 levels of wood frame units above. Furthermore, 75 3-story townhomes are planned. Site Plan by Urban Architecture Lab, dated September 26, 2022, is presented on Plate A-1.

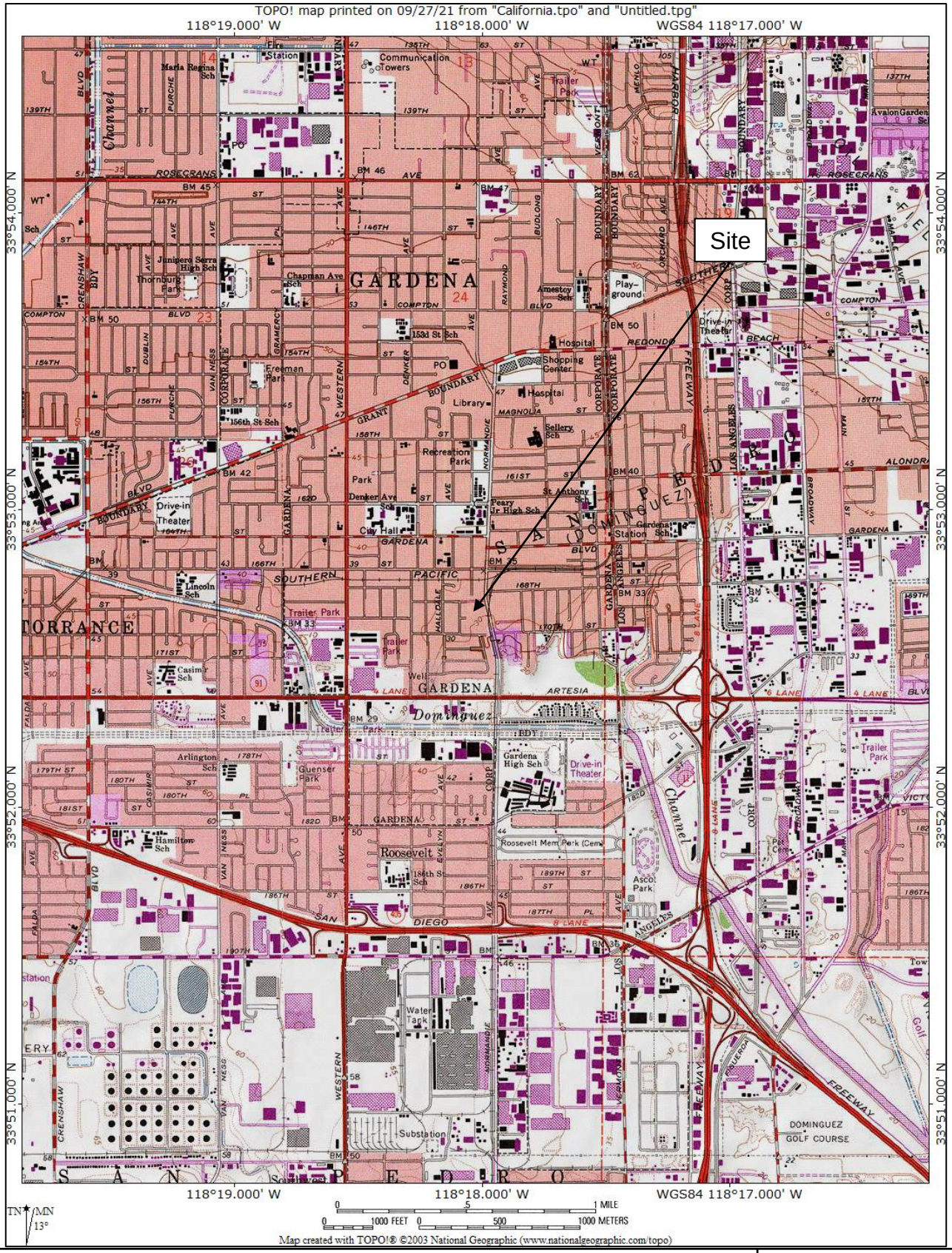
Existing Site Conditions

In general, the Site and surrounding area are relatively level. The lots are occupied by commercial/industrial buildings that are reportedly constructed between 1952 through 1987, according to the office of the Los Angeles County Assessor. The Site is bound to the north by West 169th Street, to the west by Brighton Way, to the east by South Normandie Avenue, and to the south by West 170th Street. Primarily the area contains residential lots surrounding the Site with some commercial/industrial lots to the north.

Structural Loading

The project structural engineering firm was not contracted at the time of issuing this report, therefore building loads have been assumed and shall be confirmed when available. It is assumed that the 7-story podium residential structure will be supported by shallow conventional foundations with maximum column load on the order of 350 kips and maximum continuous footing loads on the order of 5 kips per linear foot. It is assumed that the 3-story townhomes will be supported by shallow conventional foundations with maximum column loads on the order of 75 kips and maximum continuous footing loads on the order of 4 kips per linear foot.

SITE LOCATION MAP



PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 1

Hamilton & Associates

REVIEW OF AVAILABLE REPORTS

H&A submitted a public record request to the City of Gardena for soil, geology, and or/grading documents for the Site. At the time of issuing this report the City has not provided any documents to H&A for review. A list of reviewed documents found on file with the building department and within this firm's records are provided in the "References" section of this report.

A report for a proposed residential development similar to the proposed project for the Site was provided to H&A for review. The report was prepared by Geotechnologies in June of 2021 for 16911 Normandie Avenue. Data from the Geotechnologies report is provided in Appendix C for reference.

HISTORICAL TOPOGRAPHIC MAPS AND AERIAL IMAGES

H&A reviewed historical United States Geological Survey (USGS) topographic maps, Redondo Sheet 1896, Compton and Torrance Quadrangle 1924, Inglewood 1950, Torrance 1951, and Inglewood and Torrance 1964. Portions of these topographic maps are presented on Plates H-1 through H-4 "Historical Topography".

The 1896 topographic map (Plate H-1) depicts the Site as undeveloped. East and south of the Site, the present-day roads of Normandie Avenue and West 170th Street are depicted. South of 170th Street, drainage from the area flows into a slough. The slough is depicted with both marsh and standing water. Of note, the Redondo rail line is north south until diverting to the west to bypass the slough.

The 1924 topographic maps (Plate H-2) depict development of the area. A single structure is on the northern portion of the Site. The Redondo rail line is no longer present. A new rail line, east of the Site extends south across the area previously identified as slough. A fill was placed to accommodate the extension of Normandie Avenue, and the rail line. Standing water within the slough is no longer identified, with only marsh depicted east of the rail line. The area west of the rail line had been drained. By draining and drying the marsh area, better topographic control of the area was achieved, showing a drainage channel/gully at the southeastern portion of the Site.

The 1950/1951 topographic maps (Plate H-3) suggest further development of the area. A new structure is in the southwest corner of the Site, while the structure to the north identified on the 1924 map is no longer present. Development of roads to the west of the Site are similar to present day conditions. The marsh to the south has been further removed, portions of which were occupied by a speedway track and drive-in theater. Furthermore, the Dominguez Channel was constructed in the general path of the old drainage channel to the marsh.

The 1964 topographic maps (Plate H-4) depict the Site and surrounding area as developed, although individual buildings are no longer identified. Up to 14 feet of fill was placed along the southeastern portion of the parcel, filling in the natural drainage/gully, creating a broadly level, southeastern sloped ground surface. Development of the area around the Site is similar to present day conditions.

Historical aerial imagery from 1927 through 1983 was reviewed and is presented on Plates H-5 through H-17.

Plate H-5 “Historical Aerial Image 1927” depicts the Site in general conformance with Plate H-2 “Historical Topographic Map 1924”. Of significance is the that the slough has been drained, and the property to the south of the Site utilized for agriculture. The moisture from the old slough is shown within the image as the dark portions of the agricultural field. The Site, by contrast has been graded, with trees and residences along the northern and southern property lines.

Plate H-6 “Historical Aerial Image 1938” has the graded portion of the Site being utilized for agriculture. South of the Site, 170th street is well defined, and a fill embankment was placed to support and protect it. Agriculture continues within the old marsh area. The areas previously seen as dark and heavy with moisture appear more so in this image.

The 1941 image (Plate H-7) depicts the marsh to the south filled with water up to present day 170th Street, with the fill embankment protecting it. On Site, the residence and farming operations appear to have expanded with new structures. Residential development is shown encroaching from the west and north.

Plate H-8 “Historical Aerial Image 1947” records the standing water from 1941 within the slough being gone, and development rapidly encroaching from the west. Little appears to have changed on Site, save what appears to be a foot trail cross cutting the center of the Site, and the home at the north of property gone. Agriculture on Site appears to have ceased.

The 1951 historical aerial image (Plate H-8) depicts the majority of the Site being covered with vegetation, and the southern portion of the Site being irrigated. South of the Site, farming operations have generally ceased, and the marsh area may have been used as a stormwater catch basin, with an outflow channeled and extending under the rail line and Normandie Avenue.

The 1952 (Plate H-10) image depicts a building constructed near the center of the lot and is similar to a present day building on the Site. This structure concurs with information provided by the LA County Assessor information. Development along the southern property line appears to have been unchanged for years. Along the south side of 170th, the fill embankment is still in place and marsh area appears dried, yet well defined.

More development in the center of the Site is documented on the 1956 historical image (Plate H-11), while the northern and southern property lines appear little changed. 170th Street, west of the Site was widened. The fill embankment persists along the southern side of 170th, and the marsh area appears to be further drained and dried, and partially graded to control the accumulation of water.

Plate H-12 “Historical Image 1960” records the additional development of industrial style buildings on Site. Grading of the southern property line, along 170th appears to be on going. Of most significance is the full residential development of the old slough and marsh area. Drainage for the area has been channeled.

Shown the 1962 historical areal image recorded continued clearing and grading of the southern portion of the property. This is in general accordance with the 1964 historical topographic map (Plate H-4) which indicates that portion of the Site had been filled.

The historical image from 1965 (Plate H-14) depicts further grading along the southern property line, with continued development and paving of the northern and center portions of the Site.

A new, large industrial style building is shown at the southeastern corner of the property on the 1971 historical image (Plate H-15). Buildings and pavement cover all but a strip of land along the northern property line. Little change has occurred on the adjacent properties.

1976 (Plate H-16) depicts little change on Site or otherwise.

The 1983 historical image (Plate H-17) records a new building along the northern property line, with little other changes. The Site’s development in 1983 is similar to today’s configuration.

FIELD EXPLORATION AND LABORATORY TESTING

The field exploration for this report included advancing exploratory excavations and, logging and sampling of Site earth materials. Exploratory locations are presented on Plate A-2, “Geotechnical Exploration Map”.

Logs and descriptions were based on visual and tactile field observations. Exploratory excavations were backfilled with the excavated materials. No locations were surveyed.

Samples of earth materials were secured and transported to H&A's certified geotechnical laboratory for further observation and testing.

This exploration did not include any evaluation or assessment of hazardous or toxic materials, which may or may not exist on or beneath the site.

FIELD EXPLORATION

Hollow Stem Auger Borings

On August 19th and 20th, 2021, three (3) 8-inch diameter hollow stem auger borings were excavated utilizing a truck mounted drill rig. The borings were advanced to depths ranging from 31.5 feet to 61.5 feet below ground surface (bgs). Relatively undisturbed Modified California Ring and bulk samples were retrieved from the exploratory borings for subsequent laboratory testing and analysis. Logs of subsurface observations are presented in Appendix A as Plates B-1 through B-3.

Cone Penetration Test (CPT)

On August 19, 2021, Hamilton & Associates contracted for six (6) CPTs, utilizing a truck mounted push CPT rig. The CPTs were advanced to approximately 60 feet to 100 feet bgs.

LABORATORY TESTING

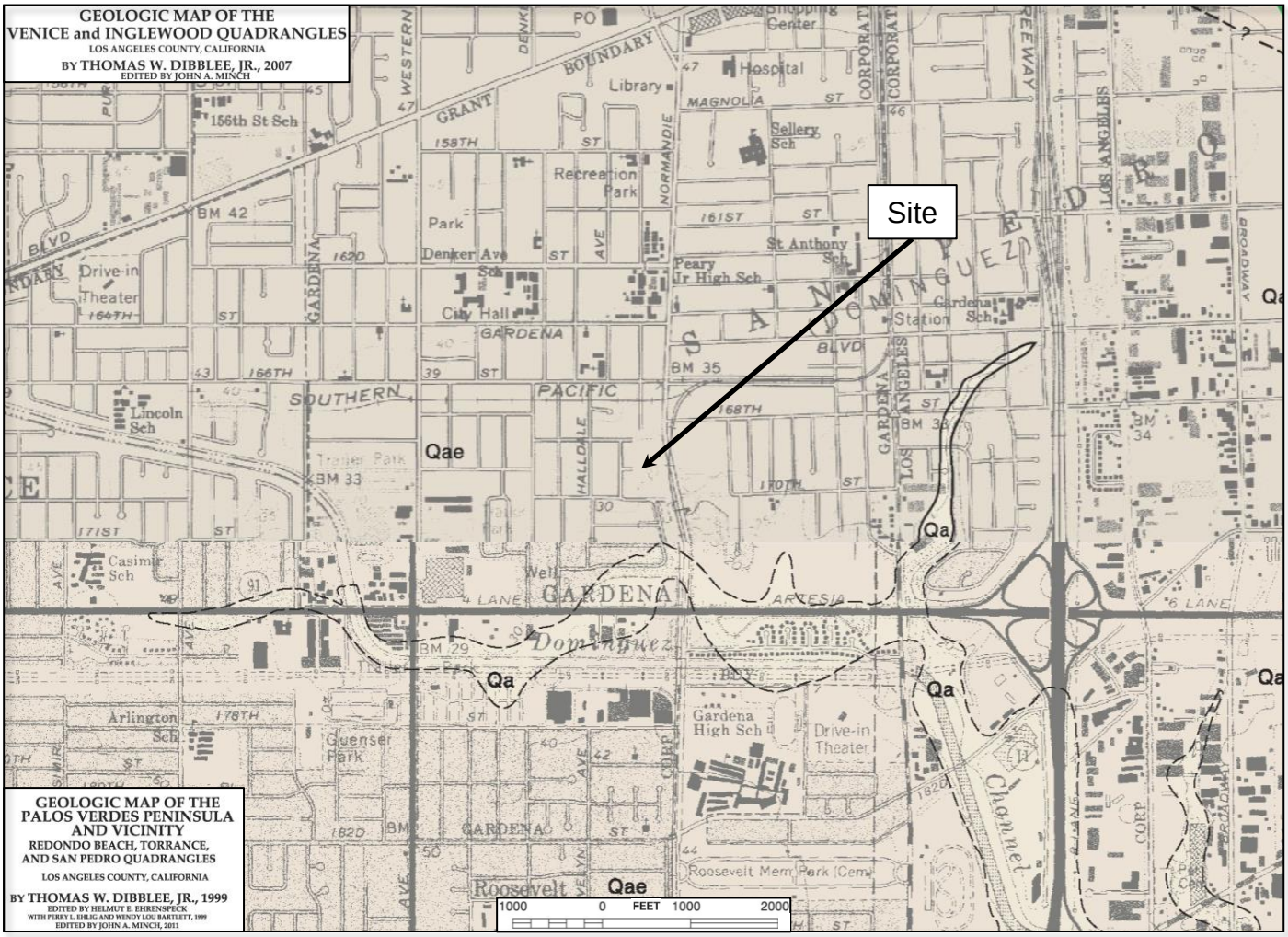
Select field samples were further inspected in Hamilton & Associates', Inc. geotechnical laboratory for subsequent confirmatory soil classification and engineering property testing. This testing included in-situ moisture content (ASTM D2216), dry unit weight (ASTM D2937), maximum density (ASTM D1557), consolidation (ASTM D2435), direct shear (ASTM D3080), Atterberg limits (ASTM D4318), Expansion Index (ASTM D 4829), sieve grain size fines analysis (ASTM D1140), as well as corrosion testing per guidelines of California 417 (Sulfate), California 422 (Chloride), and California 643 (pH and Resistivity) test procedures on a representative sample of the on-Site soils

SITE AND SUBSURFACE CONDITONS

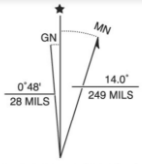
GEOLOGIC SETTING

The Site is located within the City of Gardena located within Los Angeles County. According to Figure 2, Regional Geology Map (Dibblee, 2007), the Site's vicinity is

REGIONAL GEOLOGY MAP



INGLEWOOD QUADRANGLE
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

GEOLOGIC SYMBOLS

not all symbols shown on each map

FORMATION CONTACT — *dashed where inferred or indefinite, dotted where concealed*

MEMBER CONTACT — *between units of a formation* ····· Prominent bed

CONTACT BETWEEN SURFICIAL SEDIMENTS — *located only approximately in places*

FAULT: *Dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement is shown by U/D (U=upthrown side, D=downthrown side). Short arrow indicates dip of fault plane. Sawteeth are on upper plate of low angle thrust fault.*

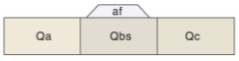
FOLDS: overturned — **ANTICLINE** — **SYNCLINE**

arrow on axial trace of fold indicates direction of plunge; dotted where concealed by surficial sediments

Strike and dip of sedimentary rocks: inclined (18) — inclined (approximate) (20) — overturned (80) — horizontal — vertical

Strike and dip of metamorphic or igneous rock foliation or flow banding or compositional layers: inclined (75) — inclined (approximate) — vertical — overturned (80)

OTHER SYMBOLS: Direction of landslide movement — outline of water bodies shown on map — water well — oil well — springs



SURFICIAL SEDIMENTS

Alluvial sediments, unconsolidated, undissected

af: Artificial cut and fill
Qs: Beach sand
Qc: Clay and sand of predeveloped marshlands
Qa: Alluvial gravel, sand and clay, derived mostly from Santa Monica mountains; includes gravel and sand of minor stream channels



OLDER SURFICAL SEDIMENTS

Unconsolidated to weakly consolidated alluvial sediments, dissected where elevated; age late Pleistocene

Qos: Old sand dune deposits
Qae: Alluvial gravel, sand, and clay, slightly elevated and dissected
Qop: Paleosol in Baldwin Hills (Fox Hills paleosol of Weber et al., 1982) gray to rusty brown, sandy, locally pebbly, moderately indurated "hardpan" on **Qoa**
Qoa: Older alluvium of gray to light brown pebble-gravel, sand and silt-clay, elevated and dissected; in Baldwin Hills designated as Baldwin Hills sandy gravel by Weber et al., 1982, where it is much dissected and eroded

PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 2

Hamilton & Associates

underlain by Older Dissected Surficial Sediments, Qae, described as alluvial gravel, sand and clay, slightly elevated and dissected.

The Site is located within a seismically active region of Southern California within the zone of influence of several active and potentially active faults. Review of selected maps published by the California Geologic Survey (CGS) and the United States Geologic Survey (USGS) include Figure 3 “Regional Fault Map” and Figure 4 “Seismic Hazards Map”. Review of the USGS Interactive Quaternary Faults database and the USGS Unified Hazard Tool, indicate that the faults of most influence to the Site are the:

- Newport, Inglewood, Rose Canyon Fault, located approximately 0.6 miles west of the Site and capable of producing a M7.3 earthquake.
- Palos Verdes Fault, located approximately 6.3 miles south of the Site and capable of producing an M7.2 earthquake,
- Compton Blind Thrust Fault, which is not expressed at the ground surface, capable of producing a M7.2 earthquake,

At this time, the Newport, Inglewood, Rose Canyon faults have been determined to have moved within the last 11,000 years, and therefore is considered to be active and is “zoned” under the Alquist Priolo Fault Zones Act of 1972 and the Seismic Hazards Mapping Act of 1990.

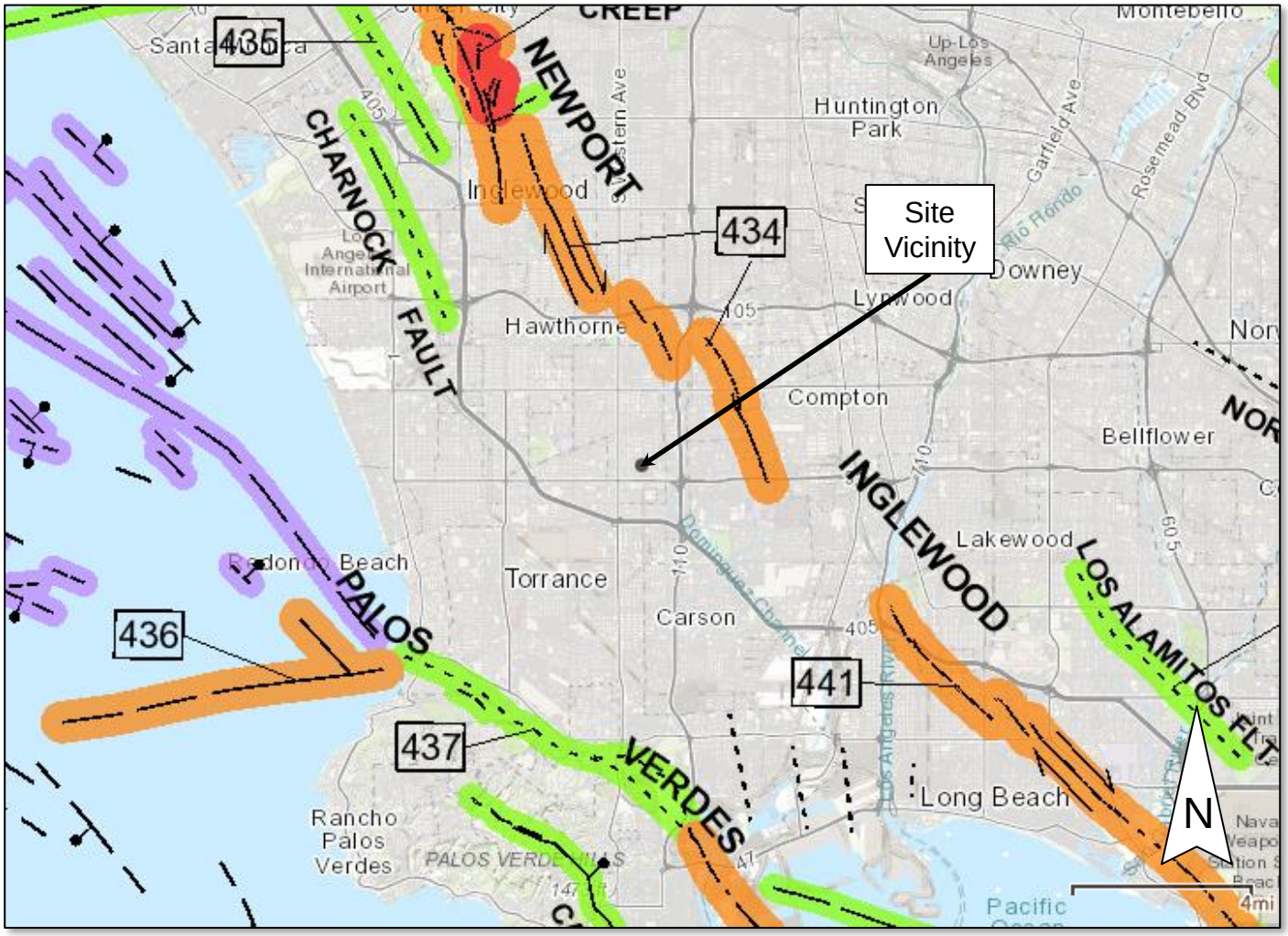
On January 17, 1994 the M6.7 Northridge earthquake occurred at a focal depth of 17.5 km (10.9 miles), on a south-dipping blind thrust fault with no direct surface rupture. The M5.9 Whittier Narrows earthquake occurred October 1, 1987 on a previously unknown, north-dipping blind thrust fault in the eastern Los Angeles region, with no recorded surface rupture (Woods, 1995). On February 9, 1971 the M6.5 San Fernando Earthquake occurred along previously mapped faults, producing 12 miles of ground rupture. And, on March 10, 1933, the historic Long Beach M6.2 earthquake occurred (Ziony, 1985). All of these earthquakes caused considerable damage near their epicenters and in surrounding cities.

Review of select geologic maps of the area published by the CGS and the USGS depict no landslide on or near the Site as shown on Figure 2 and Figure 5, “Landslide Inventory Map”.

GEOLOGIC MATERIALS

Site earth materials identified during this investigation included artificial fill and alluvium. Historical topographic maps and aerial images (as previously described) revealed a small

REGIONAL FAULT MAP



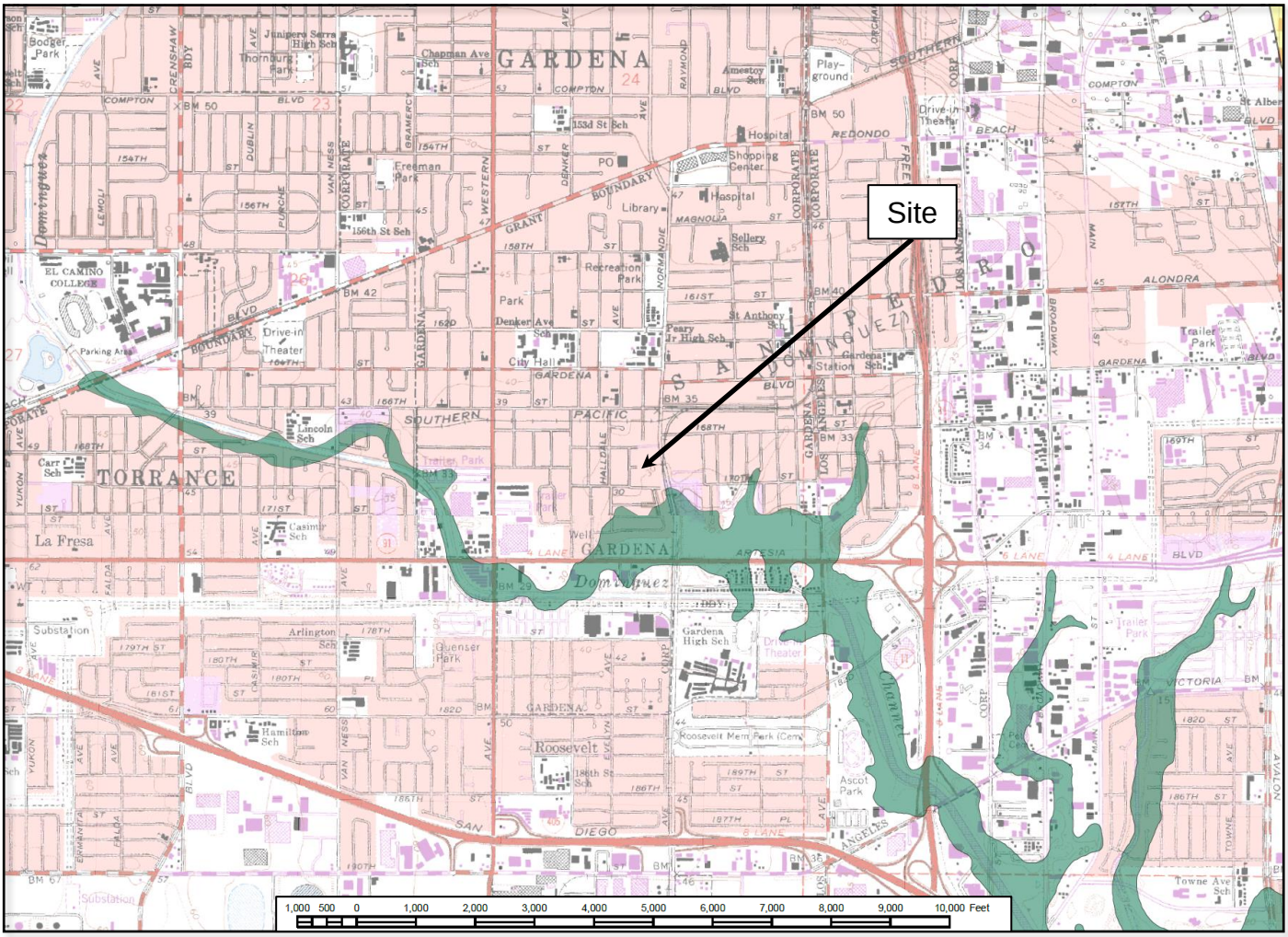
Geologic Time Scale	Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary – Late Quaternary – Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
Quaternary – Late Quaternary – Holocene	11,700		? ? ?	Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
Quaternary – Pleistocene	700,000		? ?	Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
Quaternary – Early Quaternary – Pleistocene	1,600,000		?	Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary	4.5 billion			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

From: "Fault Activity Map of California," compiled by Charles W. Jennings and William A. Bryant, California Geological Survey, Map No. 6, California Geologic Data Map Series, 2010

PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 3

Hamilton & Associates

SEISMIC HAZARD ZONES MAP



Contour Interval 5 Feet

INGLEWOOD QUADRANGLE

EARTHQUAKE FAULT ZONES
Delineated in compliance with Chapter 7.5 Division 2 of the California Public Resources Code (Alquist-Priolo Earthquake Fault Zoning Act)
REVISED OFFICIAL MAP
Released: July 1, 1986
STATE GEOLOGIST

SEISMIC HAZARD ZONES
Delineated in compliance with Chapter 7.8 Division 2 of the California Public Resources Code (Seismic Hazards Mapping Act)
OFFICIAL MAP
Released: March 25, 1999
STATE GEOLOGIST

12°
TRUE NORTH
MAGNETIC NORTH
Approximate Declination, 2016

TORRANCE QUADRANGLE

EARTHQUAKE FAULT ZONES
Delineated in compliance with Chapter 7.5 Division 2 of the California Public Resources Code (Alquist-Priolo Earthquake Fault Zoning Act)
OFFICIAL MAP
Released: July 1, 1986
STATE GEOLOGIST

SEISMIC HAZARD ZONES
Delineated in compliance with Chapter 7.8 Division 2 of the California Public Resources Code (Seismic Hazards Mapping Act)
OFFICIAL MAP
Released: March 25, 1999
STATE GEOLOGIST

12°
TRUE NORTH
MAGNETIC NORTH
Approximate Declination, 2016

SEISMIC HAZARD ZONES

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONES

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 4

Hamilton & Associates

LANDSLIDE INVENTORY MAP



Landslide Types

Deposits:

- Debris Flow
- Debris Slide, Soil Slide, or Soil Topple
- Earth Flow
- Rock Fall, Rock Topple, or Soil Fall
- Rock Slide
- Rock Spread
- Debris Fan
- Uncertain
- Type Undifferentiated

Sources:

- Scarp or Main Scarp
- Internal Scarp
- Debris Flow or Slide Scarp
- Debris Flow Track
- Gully or Rock Fall Chute
- Track or Rock Fall Source
- Inner Gorge
- Small Debris Flow Scarp or Track
- Small Slide Source, Type Undifferentiated
- Source Scarp

Landslide Activity

- Active/Historic
- Dormant Young
- Dormant Mature
- Dormant Old/Relict
- Dormant Age Not Specified

1000 0

FEET

Produced from Landslide Inventory

Retrieved from- https://maps.conservation.ca.gov/cgs/lsi/app/

Date retrieved: September 24, 2021

Information provided by: County of Los Angeles, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA | California Geological Survey, USGS, Cooper-Clark Associates | California Geological Survey

PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 5

Hamilton & Associates

gully/depression on the southern portion of the Site, under the current industrial building. This area may contain deeper, deleterious natural soil and/or undocumented fill.

Subsurface field observations are presented on the Boring Logs found in Appendix A.

Fill (Af)

Artificial fill was encountered in all borings in minor amounts under the asphalt and concrete. The artificial fill was field identified as sandy silt and sandy clay, shades of brown in color, moist, and firm. Construction debris was encounter to a depth of 5 feet in boring 3.

Alluvium

Alluvium was encountered in all borings to final depths explored. It was field identified as layers of clayey silt, sandy clay, clayey sand, sandy silt, and silty sand. The material was generally shades of brown, reddish brown, and grey. Moisture of the material increased with depth. The material was field classified as firm to very stiff and medium dense to dense.

GROUNDWATER AND CAVING

Groundwater was encountered during field exploration at an approximate depth of 22 feet bgs. Figure 6 “Historic High Groundwater” indicates the Site’s historic high groundwater is approximately 15 feet bgs.

Seasonal and long-term fluctuations in the groundwater conditions may occur as a result of variations in irrigation, rainfall, surface run-off and other factors.

The use of hollow-stem augers and mud rotary drilling techniques precluded observation of potential caving conditions which may have otherwise occurred in an uncased hole, however low to moderate caving and/or soil sloughing may be experienced in Site excavations.

SEISMOLOGICAL AND GEOLOGIC HAZARDS

Ground Shaking Analysis

Neither the location nor magnitude of earthquakes can accurately be predicted at the time of this report. In the past, the Site has been periodically subject to moderate to intense earthquake-induced ground shaking from nearby faults. Considerable damage could occur at the Site and structural improvements during a strong seismic event.
There are a number of faults in the area, as presented, that were, at the time of this report, considered ‘active’ and that could produce moderate to strong ground shaking at the Site.

HISTORIC HIGH GROUNDWATER (SHZR #027)

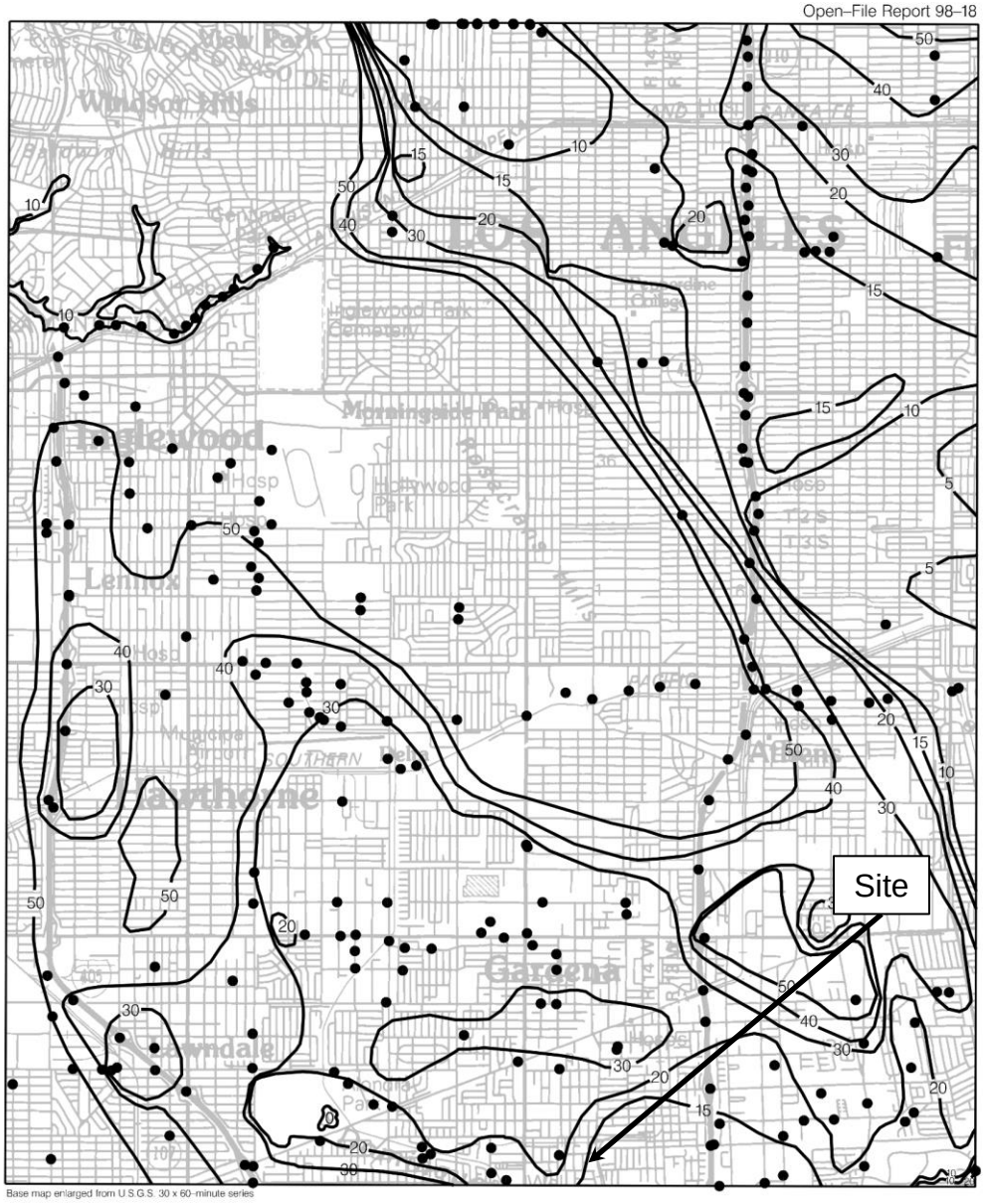


Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Inglewood Quadrangle.

● Borehole Site 30 Depth to ground water in feet

ONE MILE
SCALE

From: "Seismic Hazard Zone Report for the Inglewood 7.5 Minute Quadrangle, Los Angeles County, California" 1998

PROJECT: 16911 Normandie Associates, LLC	PROJECT NO: 21-2971	DATE: October 2021
ADDRESS: 16831 & 16911 S. Normandie Avenue, Gardena, California		FIGURE: 6

Hamilton & Associates

The possibility of ground acceleration or shaking at the Site could be considered as approximately similar to the Southern California region as a whole.

Based on the USGS Degradation Application (2014 V4.2.0), the peak ground acceleration for Site Class “D” earth materials was reported to be 0.46g, with a 10% probability of being exceeded in 50 years, and 0.80g for a 2% probabilistic of exceedance in 50 years.

Surface Fault Rupture

The Site does not lie within a designated Alquist-Priolo Earthquake Fault Zone, Figure 4. Therefore, the potential for surface fault rupture at the Site during the design life of onsite structures is considered low.

Seismic Settlements (Liquefaction)

The term “liquefaction” describes a phenomenon in which a saturated cohesionless soil loses strength and acquires a degree of mobility as a result of strong ground shaking during an earthquake. The factors known to influence liquefaction potential include soil type and depth, grain size, relative density, groundwater level, degree of saturation, and both the intensity and duration of ground shaking. Hazard data published by the State of California is shown on Figure 4 and indicates that the subject site is not within an area identified as having a potential for soil liquefaction.

As described in the Site Characterization section of this report, Site soils consisted predominantly of very stiff fine-grained soils (clays and silts), with one layer of borderline stiff to very stiff fine-grained soil, and occasional layers or lenses of dense sands. Deeper soils are mostly very stiff fine-grained soils with dense to very dense sand layers or lenses. Liquefaction potential of these soil types is characteristically nil to low.

Analysis was performed to evaluate potential seismically induced settlement of earth materials on site during a seismic event, considering historic high groundwater depth of approximately 15 feet below existing grade. Sensitivity Liquefaction Analysis Results are provided in the table below. Results further support that liquefaction potential at the site is considered nil to low.

Sensitivity Analysis Results									
Scenario	Liq. Factor of Safety	Earthquake Magnitude (M)	Ground Acceleration (g)	Settlement (in)					
				CPT-1	CPT-2	CPT-3	CPT-4	CPT-5	CPT-6
10% in 50 Years	1.1	6.61	0.46	0.02	0.14	0.09	0.03	0.39	0.58
2/3 PGAm	1.1	6.61	0.57	0.10	0.21	0.16	0.13	0.43	0.66
Full PGAm	1	6.74	0.85	0.34	0.42	0.38	0.45	0.53	0.76

Per Southern California Earthquake Center (1991), corresponding differential settlement for the liquefiable soils could be on the order of two-thirds (2/3) of the total liquefaction-induced settlement or more based on variability of subsurface soil layers. Liquefaction Analysis printout and details are provided in Appendix B

Significant damage to the structure due to soil liquefaction is not expected. It is this firm's opinion that the proposed development may be supported on shallow conventional foundations.

Seismically Induced Landslides

A landslide is a movement of the ground and is categorized based on the type of material that has failed and the movement type that occurs. A landslide is broadly categorized by its' failure mode, its' movement, and the earth materials involved. Predicting where landslides may occur utilizes this information as well as other factors such as slope steepness, slope height, slope orientation, relative density of the earth materials, groundwater level, degree of saturation, as well as location, intensity, and duration of ground shaking.

As shown on Figure 4 the Site does not lie within an Earthquake-Induced Landslide Zone as identified by the CGS.

Figure 5 shows the Site is not located in any known or inferred landslides.

Hydro-Consolidation

Hydro-consolidation settlement potential is considered to be low, as evidenced by subsurface soil properties, and laboratory engineering and index test results.

Expansive Soils

Laboratory testing on a sample of near surface soils indicated a 'Very Low' soil expansion potential (EI<5) as defined in the latest edition of ASTM D4829. It is H&A's opinion that a 'Medium' soil expansion should be used in project design. The degree of soil expansion should be confirmed by additional tests during or after rough grading operations.

ENGINEERING SITE CHARACTERIZATION

SOIL PROFILE CHARACTERIZATION

Approximate locations of exploratory borings and Cone Penetration Test (CPT) soundings performed by H&A and previous consultants is shown on Plate A-2. Depth of exploratory borings and CPT soundings ranged from approximately 26 feet to 95 feet below the ground surface (bgs). H&A's Boring B-2 extended to approximately 61.5 feet

bgs and H&A's CPT sounding SCPT-4 extended to a depth of 95 feet bgs. Refusal to hollow stem auger drilling and sampling equipment was not encountered in any of the three (3) H&A soil borings. H&A CPT tip refusal was encountered at the maximum depth explored in SCPT-4.

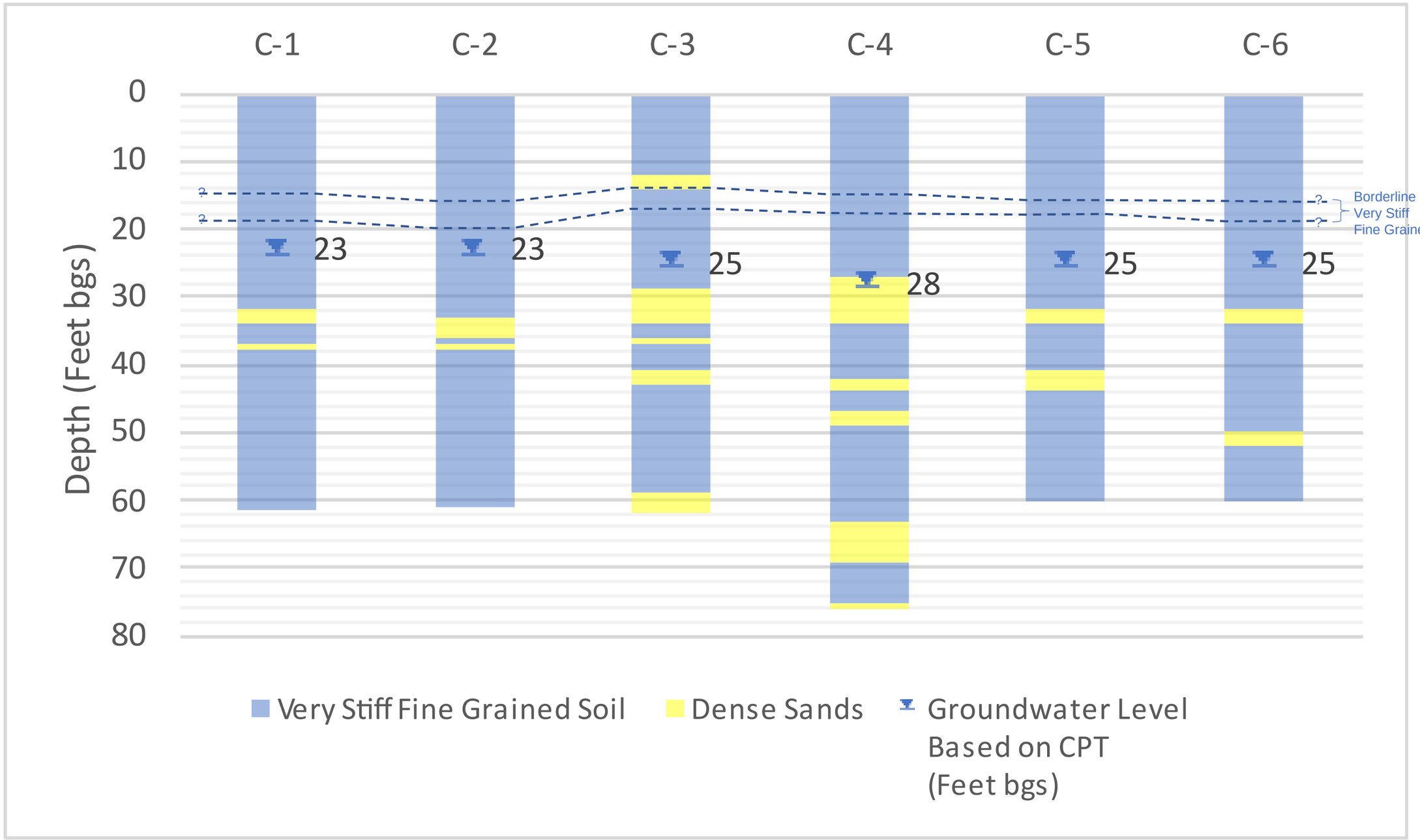
As described in Site and Subsurface Conditions of this report, the Site is located in a relatively level alluvial plain of latest Pleistocene to Holocene sediments. The alluvium generally consisted of mostly fine-grained (silt and clay) sediments (FGS) interbedded with occasional layers or lenses of mostly dense sand, a few (1 to 9) feet in thickness to depths of 60 feet. Below 60 feet of depth, sand layers were very dense in consistency. The CPT soundings indicated a general trend of predominantly silty clay to clayey silt materials (CL-ML, ML) with significant amounts of sand. Subsurface Soils Stratigraphy based on CPT Soundings are presented on Figure 7. The soils encountered at the Site can be described as consisting of Generalized Strata, which are summarized below.

Generalized Stratum (w/ Around Typical Depth Range bgs)	**Description** Soil Classification and Thickness
Stratum I (Ground Surface to 14-15 feet)	Mostly very stiff FGS (clays and Silts) Stratum I thickness is somewhat variable and approximately 15±1 feet, depending on location.
Stratum II (14-16 to 17-21 feet)	Borderline stiff to very stiff FGS. Stratum II varies from 4±1 feet thick.
Stratum III (17-21 to 27-36 feet)	Very stiff FGS (Silts/Clays) Stratum III is approximately 37±3 feet thick.
Stratum IV (27-36 to 38-46 feet)	Mostly very stiff FGS interbedded with layers or lenses of dense sand.
Stratum V (34-46 to 60+ feet)	Very stiff FGS with occasional layers of dense sand. Below 60 feet of depth sand layers or lenses become very dense.

CLASSIFICATION AND INDEX PROPERTIES

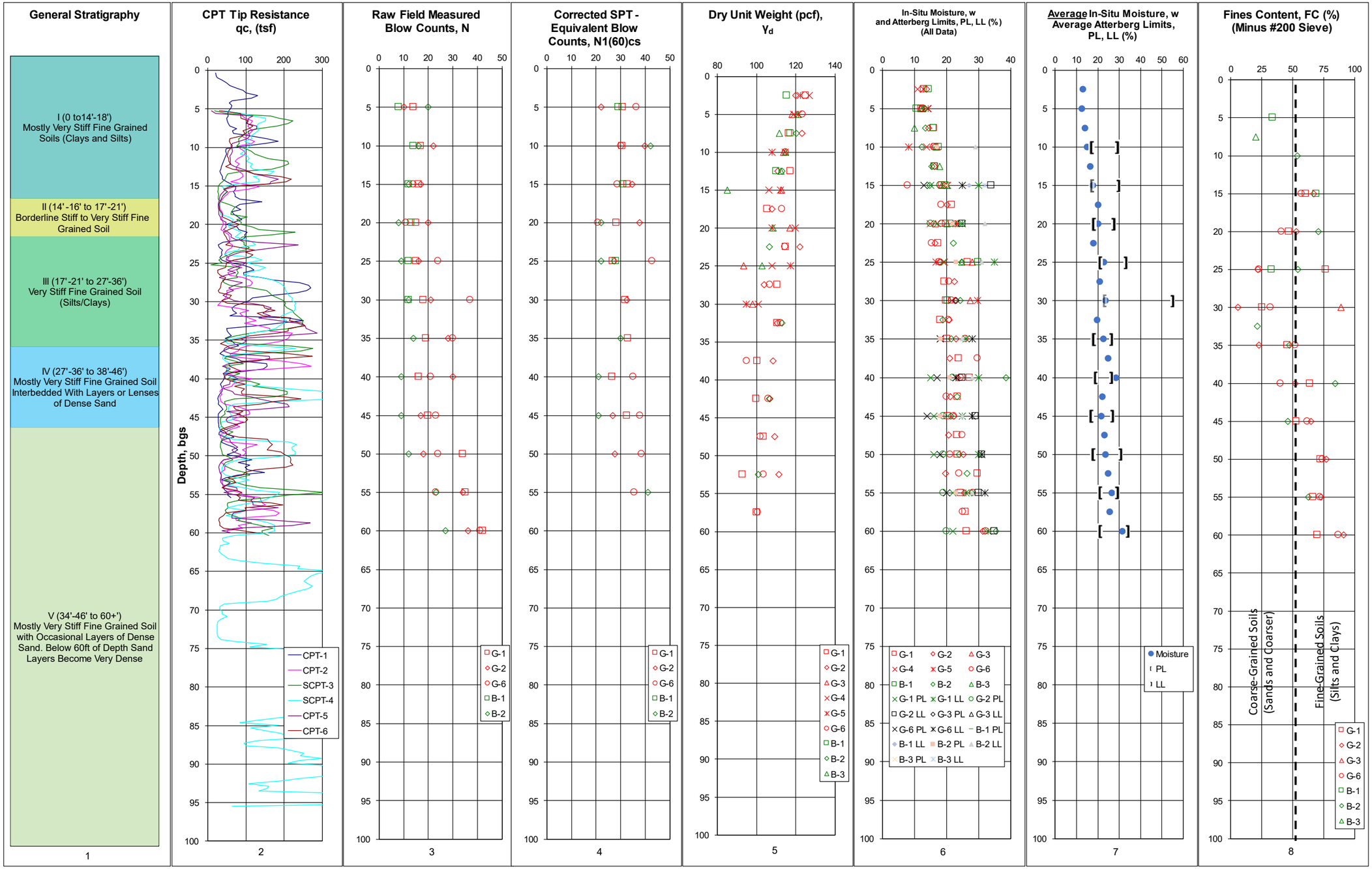
Profiles of soil penetration resistance, classification and index property test data collected from exploratory borings and generalized subsurface soil stratigraphy are presented on Figure 8. A Generalized Stratigraphic column of subsurface conditions is included in Column 1 of Figure 8. Field-measured CPT tip resistance (q_c) and Standard Penetration Test (SPT) blow count data from exploratory borings are shown on the second and third columns, respectively, of Figure 8. SPT-equivalent values were corrected for the effect of

SUBSURFACE SOIL STRATIGRAPHY BASED ON CPT SOUNDINGS



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California	Project No: 21-2971	
Hamilton & Associates	Figure No: 7	Date: October 2021

SOIL PROPERTY CHARACTERIZATION PROFILES VERSUS DEPTH



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Figure No: 8

Date: October 2021

overburden pressure and SPT procedures and designated as $N_1(60)_{cs}$. Field measured SPT values are presented on the boring logs in Appendix A.

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Based on the results of H&A's field exploration and laboratory testing, combined with engineering analysis, experience and judgment, it is this firm's opinion that the project may be developed as planned, provided the Site grading and foundation criteria discussed herein are incorporated into the project plans and specifications and implemented during construction.

The major geotechnical considerations that affect the design and construction of the planned construction included the following:

- Soil disturbance as a result of site excavation and preparation operations.
- Presence of undocumented fill.
- Presence of groundwater within approximately 22 feet below ground surface.
- Grading for an approved compacted fill blanket at least 3 feet below footing bottoms for foundation support.
- Based on historic topography and aerial photos, potential presence of deeper soft soils or fill in southern to southeast portion of the Site that will require deeper removal.
- To provide increased rigidity of heavy structures with higher expected settlements, consideration shall be given to tying isolated foundations with gradebeams in two directions where possible.
- Compaction requirement of 90% for relatively light loaded structures and 95% for relatively high loaded structures.

It is this firm's opinion that the proposed 7-story podium residential building, and 3-story townhomes may be supported by conventional foundations embedded into approved compacted fill. Should the structural engineer desire a more robust foundation system to accommodate static and potential liquefaction induced settlements, alternative recommendations are provided for design of reinforced concrete mat foundations. The following recommendations are provided. Foundation design details such as concrete strength, reinforcements, etc. should be established by the Project Structural Engineer.

SITE PREPARATION AND GRADING

Existing Construction Debris, Disturbed Soils

Prior to grading operations, it will be necessary to remove designated existing construction, including any remaining buried obstructions, which may be in the areas of

proposed construction. Concrete flatwork should also be removed from areas of proposed construction. Concrete fragments from Site demolition operations should be disposed of off-Site. Any undocumented fill or disturbed soils in areas of proposed foundations and slab on grade construction should be excavated to full depth. Historic topography and photos show that potential undocumented fill or disturbed soils may exist at deeper depth in the southerly property.

Remedial Grading

To provide support for the proposed structures, it is recommended that subgrade soil be over-excavated uniformly to a minimum depth of not less than 3 feet below the proposed foundation bottom, existing, or finished subgrade (whichever is lower) and replaced with properly compacted fill to create an approved compacted fill blanket. To provide support for the proposed pavement, it is recommended that subgrade soil be over-excavated uniformly to a minimum depth of not less than 1 feet below existing or finished slab subgrade (whichever is lower) and replaced with properly compacted fill. For relatively lightly loaded structures (i.e.. 3-story townhomes), soils should be recompacted to a minimum of 90 percent relative compaction above optimum moisture content for clayey soils and near optimum moisture content for granular soils. For relatively high loaded structures (i.e.. 7-story residential building), soils should be recompacted to a minimum of 95 percent relative compaction. A six-inch scarification and recompaction of in-place soils may be taken equivalent to six-inches of approved compacted fill, when computing total excavation requirements.

The depth of over excavation should be reviewed by the Geotechnical Consultant during construction. Any subsurface obstruction, buried structural elements, and unsuitable material encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended. Exposed excavation bottoms should be observed by the Geotechnical consultant or his representative.

Temporary Excavations

Excavations of site soils 4 feet or deeper should be temporarily shored or sloped in accordance with Cal OSHA requirements. A temporary shield/shoring system will be required for those excavations where temporary cuts are not feasible. For the purpose of Cal OSHA soil classification and shoring design, site soils should be considered as Type B.

A. Temporary Slopes:

In areas where excavations deeper than 4 feet are not adjacent to existing structures or public right-of-ways, sloping procedures may be utilized for temporary excavations. It is

recommended that temporary slopes in native soils be graded no steeper than 1:1 (H:V) for excavations up to 15 feet in depth. The above temporary slope criteria is based on level soil conditions behind temporary slopes with no surcharge loading (structures, traffic) within a lateral distance behind the top of slope equivalent to the slope height. It is recommended that excavated soils be placed a minimum lateral distance from top of slope equal to the height of slope. A minimum setback distance equivalent to the slope height should be maintained between the top of slope and heavy excavating/grading equipment.

Should running sand conditions be experienced during excavation operations, flattening of cut slope faces, or other special procedures, may be required to achieve stable, temporary slopes. Soil conditions should be reviewed by the Geotechnical Consultant as excavation progresses to verify acceptability of temporary slopes. Final temporary cut slope design will be dependent upon the soil conditions encountered, construction procedures and schedule.

B. Shoring:

Temporary shoring will be required for those excavations where temporary slope cuts as specified above are not feasible.

Temporary cantilever shoring, if used, should be designed to resist active earth pressures of 35 pounds per cubic foot equivalent fluid pressure for level conditions behind shoring. The design of shoring should also include surcharge loading effects of existing structures and anticipated traffic, including delivery and construction equipment, when loading is within a distance from the shoring equal to the depth of excavation.

In addition to the above, a minimum uniform lateral pressure of 100 pounds per square foot in the upper ten feet of shoring should be incorporated in the design when normal traffic is permitted within ten feet of the shoring.

C. Soldier Piles and Lagging Design:

For the design of soldier piles spaced at a minimum of two pile diameters, and a maximum of 8 feet on center, we recommend an allowable passive pressure of 460 psf per foot of depth, below the base of the excavation for the deepened pit, against the projected width of the soldier piles be used for design. These pressures should be limited to a maximum value of 4,600 psf. To develop the full lateral value, provisions should be taken to yield firm contact between the soldier pile and the soil.

The shoring system may consist of steel soldier piles and lagging installed in drilled holes and backfilled with structural concrete for that portion of the soldier pile that is below the

excavation level; and lean mix concrete above the excavation level. We recommend that continuous lagging between soldier piles be used for this excavation. Timber lagging should be treated if lagging is to remain in place after construction of the subterranean walls. Lagging may be designed using a maximum uniform earth pressure of 500 psf.

It is difficult to accurately predict the amount of deflection of a shored excavation. It should be realized that some deflection will occur. To further reduce deflection a greater lateral earth pressure may be used in the shoring design.

New Fills

The upper one foot of Site soils should be excavated and recompacted to a minimum of 90 percent relative compaction near optimum moisture content prior to placement of any new fills, where required, to achieve finish grade elevations. Exposed excavation bottoms should be scarified a minimum 6-inches and recompacted to at least 90 percent relative compaction at near optimum moisture content. Excavation bottoms should be firm and unyielding prior to backfilling.

Backfilling and Compaction Requirements

On-Site and import materials approved for use should be placed in horizontal lifts not exceeding 8-inches in loose thickness, moisture conditioned to above optimum moisture content for clayey soils and near optimum moisture content for granular soil, and compacted to a minimum of 90 percent of the maximum dry density as determined by the latest edition of ASTM Test Method D1557. Existing Site soils, unless indicated otherwise, are considered suitable for re-use during Site grading and backfilling, provided they are free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials, and are to a suitable moisture condition to permit achieving the required compaction.

Imported Soils

Any imported soil required to complete grading operations should consist of predominantly granular material which exhibits an Expansion Index (“EI”) of less than 20 when tested in accordance ASTM Expansion Test Procedures and should be free of debris and particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials, and should be approved by the Geotechnical Consultant or his representative. Potential import material should be identified, sampled and provided to the Geotechnical Consultant at least 72 hours prior to importation to the Site. Final acceptance of any imported soil will be based upon review and testing of the soil actually delivered to the Site.

Observation and Testing During Construction

All pile, grading, compaction, and backfill operations should be performed under the observation of and testing by the Geotechnical Consultant's designated representative. The consultant should be notified at least two days in advance of the start of construction. A joint meeting between the contractor and geotechnical consultant is required prior to the start of construction to discuss specific procedures and scheduling.

A. Grading Observation and Testing:

Prior to placing any fill the exposed excavation bottoms should be observed by the Project Geotechnical Consultant or their representative. If it is determined during grading that site soils require overexcavation to greater depths for obtaining proper support for the proposed structure, this additional work should be performed in accordance with the recommendations of the Geotechnical Consultant. Any subsurface obstruction, buried structural elements, and unsuitable material (such as undocumented fill, natural topsoil, etc…) encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended. Field moisture and density tests should be taken during grading in accordance with this report and local ordinances. All foundation excavations should be observed by the Geotechnical Consultant's representative to verify minimum embedment depths and competency of bearing soils. Such observations should be made prior to placement of any reinforcing steel or concrete.

B. CIDH Pile Observation and Testing:

General guidelines for pile installation are summarized below:

- Pile excavation will require equipment suitable to penetrate fill and natural soil typical to the area.
- Pile excavations should be drilled with suitable equipment and should not be out-of-plumb by more than 0.5 percent of the pier length. The center-to-center distance of constructed piers at the base of pile cap should not vary by more than three inches from the design spacing, or as directed by the Structural Consultant, whichever is more restrictive.
- Casing and slurry should be used during drilling of any piles in the event caving conditions are experienced, such as below the groundwater table. If casing is used, concrete placement and casing removal should be done in stages such that the casing bottom is always as a minimum 3 feet below the top of concrete.
- All pile excavations shall be cleaned of loose soils and cuttings.
- A representative of this office should be present during all pile-drilling operations to verify pile embedment depths and acceptability of strata.

- The placement of reinforcement and concrete should conform to ACI and other applicable code requirements.
- Pile installation specifications should be reviewed by the Geotechnical Consultant.

FOUNDATION DESIGN

It is this firm's opinion that the proposed 7-story podium residential building, and 3-story townhomes may be supported by conventional foundations embedded into approved compacted fill. Should the structural engineer desire a more robust foundation system to accommodate static and potential liquefaction induced settlements, alternative recommendations are provided for design of reinforced concrete mat foundations. The following recommendations are provided. Foundation design details such as concrete strength, reinforcements, etc. should be established by the Project Structural Engineer.

Foundation Capacity

A. Conventional Foundation Capacity

A dead plus live load allowable bearing pressure of 3,150 and 3,600 pounds per square foot may be used in the design of both continuous and spread footings, respectively, when embedded a minimum of 24 inches into approved compacted fill. The bearing capacity increase for each additional foot of width is 100 pounds per square foot. The bearing capacity increase for each additional foot of depth is 580 pounds per square foot. The maximum recommended bearing capacity is 5,000 pounds per square foot. The above bearing pressures may be increased by one-third when considering short term loading from wind or seismic forces.

B. Mat Foundations

Mat foundations should be supported on approved compacted fill. We recommend a minimum slab embedment of 24 inches below the lowest adjacent grade.

For design of the mat foundation, the geotechnical input information is the subgrade reaction modulus, which is a spring constant that can be applied to represent the soil response to applied stress. We recommend a unit vertical subgrade reaction modulus (k_1) equal to 140 pounds per cubic inch (pci). This unit value is applicable for a one-foot square plate and should be reduced by a shape factor to account for larger square and rectangular loaded areas. The unit modulus value should be adjusted using the following equations:

$$k_{square} = k_1 \left(\frac{B+1}{2B}\right)^2$$

$$k_{rectangular} = k_{square} \left(\frac{1 + 0.5\frac{B}{L}}{1.5}\right)$$

where the dimensions B and L are the minimum slab width and length, respectively, in feet.

Lateral Resistance

Conventional and Mat Foundations

Resistance to lateral loads can be assumed to be provided by pressure acting on structural components in contact with approved compacted fill. Lateral resistance on the sides of footings may be computed using a passive pressure of 300 pounds per square foot per foot embedment into alluvium, subject to a maximum of 3,000 pounds per square foot. Friction between the base of the footings, and/or floor slabs, and the underlying material may be assumed as 0.34. Friction and lateral pressure may be combined, provided either is limited to two-thirds of the allowable.

Settlements/Displacements

Settlement analysis for foundations designed and constructed in accordance with the above criteria and supporting maximum assumed column loads of 75 kips and 350 kips are anticipated to be on the order of 0.7- and 1.7-inches, respectively. Total settlements for foundations designed and constructed in accordance with the above criteria and supporting maximum assumed continuous footing loads of 3 klf and 5 klf are anticipated to be on the order of 0.5- and 0.6-inches, respectively. A differential settlement on the order of 0.75 inch is anticipated between similarly loaded pad footings and for continuous wall footings over a distance of approximately 30 feet. Some of the estimated settlement will take place rapidly with the first application of load. This office should be contacted for further evaluation and recommendations, at the time of structural foundation design.

SEISMIC DESIGN PARAMETERS

The Site-specific seismic design parameters were determined as a part of this study in accordance with the 2022 California Building Code, which is based on the 2021 International Building Code (IBC). Additionally, seismic design parameters were determined using the Structural Engineers Association (SEA) website which uses the USGS Seismic Design Web Services for the hazard loads. The 2022 CBC seismic design parameters that apply to the Site are as follows:

2022 CBC Seismic Parameters

CBC Seismic Parameter	Value or Classification
Site Classification (per Table ASCE/SEI 7-10 Table 20.3-1)	D
Mapped Spectral Response at 0.2 Sec Acceleration, S_s	1.778
Mapped Spectral Response at 1.0 Sec Acceleration, S_1	0.632
Maximum Considered Earthquake Spectral Acceleration, S_{MS}	1.778
Maximum Considered Earthquake Spectral Acceleration, S_{M1}	*null
5-Percent Damped Design Spectral Acceleration, S_{DS}	1.186
5-Percent Damped Design Spectral Acceleration, S_{D1}	*null

*See ASCE 7-16 Section 11.4.8

The Structural Consultant should review the above parameters and the 2022 CBC to evaluate the seismic design. Final selection of design coefficients should be made by the structural consultant based on the local laws and ordinances, expected structure response, and the desired level of conservatism.

RETAINING WALLS

Retaining walls planned should be adequately designed to resist the lateral soil pressures and the anticipated construction loadings and service conditions. The earth pressure acting on retaining walls depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following equivalent fluid pressures are recommended for vertical walls with no hydrostatic pressure and no surcharge loading:

Soil Type	Backfill Slope Behind Walls	EARTH PRESSURE	
		Equivalent Fluid Pressure (pcf)	
		Active (Cantilever)	At-Rest (Rigid)
Site Soil Medium Expansive	Level	60	100

These values are applicable for granular expansive Site soils placed between the wall sides and an imaginary plane rising at 45 degrees from below the edges (heel) of wall bottoms. The surcharge effect of anticipated loads on the wall backfill (e.g., traffic, construction equipment, footings) should be included in the wall design. Depending on whether the wall is free to deflect or restrained, 33 or 50 percent, respectively, of a maximum surcharge load located within a distance equal to the retained height of the wall should be used in design.

If it is determined that retaining walls require an additional seismic design pressure in accordance with the CBC, the following is provided for lateral earth pressures of site retaining walls. A resultant lateral force acting on proposed retaining walls as a result of seismic forces may be computed as 25 pcf-equivalent fluid pressure. This seismic resultant force may be applied to the retaining wall at a point located at (2/3)*H, measured from the bottom of the wall.

Positive drainage measures should be incorporated in design. Retaining wall subdrains should be located below the basement slab elevation and consist of a minimum four-inch diameter perforated ABS-SDR-35 or PVC SCH-40, or equivalent, connected to similar non-perforated outlet pipe. The perforated portion of the pipe should be embedded in at least three cubic feet per lineal foot of 3/4 inch crushed rock or equivalent material which has been wrapped in fabric, consisting of Mirafi 140N or equivalent, and approved by the Geotechnical Consultant. The filter fabric should overlap at least 12 inches at the ends of the fabric. Other subdrainage alternatives may be considered but should first be reviewed and approved by the Geotechnical Consultant prior to implementation.

SLAB-ON-GRADE

Concrete slabs should be supported on properly compacted soils in accordance with the site preparation and grading section of this report. Slab subgrade soils should not be allowed to dry out and should be maintained at the placement moisture condition until concreting. From a geotechnical standpoint, as a minimum, slabs should be 5-inches thick and reinforced with #4 reinforcing bars spaced at 16-inches on center each way.

Expansive structural slab and slab-on-grade subgrade should be pre-saturated just prior to construction.

Any interior slab to receive a moisture-sensitive floor covering should include a moisture membrane system. The vapor barrier shall consist of Stego Wrap Vapor Barrier 15 mil extruded poloylefin plastic, or equivalent. No recycled content or woven materials are permitted. Permeance as tested before and after mandatory conditioning (ASTM E 1745 section 7.1 and sub-paragraphs 7.1.1 – 7.1.5): less than 0.01 perms [grains/(ft2 · hr · inhg)] and comply with the ASTM E 1745-11 class a requirements. Install vapor barrier according to ASTM E 1643-11 and the manufactures recommendations, unless directed otherwise by the project structural engineer.

Slabs should be properly designed and reinforced for the construction and service loading conditions. The structural details, such as slab thickness, concrete strength, amount and type of reinforcements, joint spacing, etc., should be established by the Project Structural Engineer.

PORTLAND CEMENT PAVEMENT

The following concrete pavement sections are based on a load safety factor of 1.2, and a modulus of subgrade reaction (k value) of 100 pounds per cubic inch for 6-Inches of base over site soils compacted as a subgrade material, and the design procedures presented in the Portland Cement Association bulletin “Thickness Design for Concrete Highway and Street Pavements” (EB109.01P), 1984. The modulus of subgrade reaction was obtained from the PCC bulletin for interrelationships between ASTM soil classification and bearing values. A design service life of 20 years was assumed for the design of the Portland cement concrete pavement section.

Portland Cement Concrete (PCC) Pavement Design Summary

Concrete Flexural Strength (psi) (1)	Pavement Thickness (Inches) (2),(3)
650	6.0
600	6.5

(1) Represents 90-day flexural strength
(2) Load Safety Factor = 1.2
(3) Assumes no PCC shoulder or curb

The Structural Consultant should establish the design details of the concrete pavement section, including reinforcements, concrete strength, and joint and load transfer requirements.

The PCC pavements shall be underlain by 4-inches of Import Crushed Aggregate Base (CAB) Material with the upper one-foot of exposed subgrade soils compacted to a minimum 95 percent relative compaction near optimum moisture contents. Furthermore, the upper 12-inches of subgrade compacted fill soils should be compacted to a minimum 90 percent relative compaction above optimum moisture contents and exhibit a firm, unyielding surface in addition to the recommended compaction. Final compaction and testing of pavement subgrade should be performed just prior to placement of aggregate base and/or concreting. Other pertinent subgrade preparation measures stipulated in the “Thickness Design for Concrete Highway and Street Pavements” (EB109.01P), 1984, or required by the jurisdictional municipal authorities should be followed accordingly.

ASPHALT PAVEMENT

The finish grade at the subject site is anticipated to be underlain by compacted fill consisting of site soils. For preliminary pavement design purposes, an R-Value of 20 has been assumed considering the site soils as subgrade soils. Five (5) traffic indices (TI) of 4.5, 5.5, 7, 9 and 10 together with the assumed minimum R-Value, have been assumed and utilized for the development of preliminary recommendations for the pavement sections. Analyses performed in accordance with the current edition of the Caltrans

Highway Design Manual, and assuming compliance with site preparation recommendations, it is recommended that the following AC pavement structural sections be used.

Asphalt Pavement Design Summary

Traffic Index (TI)	Pavement Section Alternatives		Remark
	AC(1) (inches)	AB(2) (inches)	
4.5	3.0	6.0	For auto parking stalls
5.5	3.0	9.0	For auto circulation aisles/entry and exits
7.0	4.0	12.0	Drive Aisles w/ Medium Truck Loading
9.0	5.5	16.0	Drive Aisles w/ Heavy Truck Loading
10.0	6.0	18.0	Drive Aisles w/ Heavy Truck Loading

(1) Asphalt Concrete (AC);
(2) Aggregate Base (CAB or CMB), Green book section 200-2.2 and 200-2.4, respectively, compacted to at least 95% relative compaction;
(3) Subgrade: The upper 12-inches of subgrade soils in pavement areas should be compacted to at least 90% relative compaction of the Modified Proctor (ASTM D1557), including deeper removal and recompaction of any encountered undocumented fill, as necessary.

Please be aware that the above preliminary pavement section recommendations have been established based purely on procedures stipulated in the Caltrans Manual. Local government authority should be consulted for minimum pavement section requirements and, if more stringent than that recommended by the Hamilton and Associates, be complied with.

It is recommended that R-Value testing be performed on representative soil samples after rough grading operations on the upper 2 feet to confirm/modify applicability of the above pavement sections.

The asphalt concrete pavement should be compacted to 95% of the unit weight as tested in accordance with the Hveem procedure. The asphalt concrete material shall conform to

Type III, Class C2 or C3, of the Greenbook. All subgrade and aggregate base materials should be proof-rolled by heavy rubber tire equipment to verify that the subgrade and base grade are in a non-yielding condition.

If the paved areas are to be used during construction, or if the type and frequency of traffic is greater than assumed in the design, the pavement section should be re-evaluated for the anticipated traffic.

SOIL CORROSIVITY

Limited soil constituent tests were performed on a select sample of Site soils to give a general idea as to the corrosive nature of on-Site soils to proposed concrete foundations, rebar, and any underground metal conduit. A corrosion engineer/specialist should be consulted for any advanced analysis or recommendations relating to corrosion at the Site. Constituent test results are presented in Appendix A.

Concrete Corrosion

Disintegration of concrete may be attributed to the chemical reaction of soil sulfates and hydrated lime and calcium aluminate within the cement. The severity of the reaction resulting in expansion and disruption of the cement is primarily a function of the soluble sulfates and the water-cement ratio of the concrete. A soluble sulfate content of 0.0232% by weight has been recorded from corrosivity testing conducted on on-Site soils, as indicated in the test results provided in Appendix A. In accordance with Table 19.3.1.1 of ACI 318-19, Building Code Requirements for Structural Concrete, soils exhibiting soluble sulfate content less than 0.1% by weight are classified as 'S0'. 'S0' sulfate class has no type restriction on concrete and a minimum requirement of f_c' of 2500 psi.

Metal Corrosion

In the evaluation of soil corrosivity to metal, the hydrogen ion concentrate (pH) and the electrical resistivity of the Site and backfill soils are the principal variables in determining the service life of ferrous metal conduit. The pH of soil and water is a measure of acidity or alkalinity, while the resistivity is a measure of the soil's resistance to the flow of electrical current.

Currently available design charts indicate that corrosion rates decrease with increasing resistivity and increasing alkalinity. It can also be noted that for alkaline soils, the corrosion rate is more influenced by resistivity than by pH.

The resistivity value of 2000 ohm-cm, as well as a pH-value of 7.00 classifies the on-Site soils tested to be 'Corrosive' to buried ferrous metals. Based on California Test 643, the year to perforation for 18-gauge steel in contact with soils of similar resistivity and pH-

value is approximately 21 years. In lieu of additional testing, alternative piping materials, i.e. coatings, plastic piping, may be used instead of metal if longer service life is desired or required. Where more detailed corrosion evaluation is required, we recommend that a qualified corrosion consultant be engaged to provide further evaluation and recommendations.

A soluble chloride content of 14.8 ppm was recorded and is considered low to the threshold values of 500 ppm per Caltrans Corrosion Guidelines 2018. Therefore, no special measure in terms of rebar protection against chloride corrosion is recommended herein as a result of the low soluble chloride content tested.

SITE DRAINAGE

In accordance with the CBC, the ground immediately adjacent to buildings should be sloped away from the building at a slope of 5% for the first 10 feet. If physical obstructions or lot lines prohibit 10 feet of horizontal distance, the 5% slope should be provided to an alternate method of diverting water from the foundation system, such as swales (sloped at 2%). Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2% away from the building.

UTILITY TRENCHES

All trenches should be backfilled with approved fill material, compacted to relative compaction of not less than 90 percent of maximum density. Care should be taken during backfilling to prevent utility line damage. The on-Site soils may be used for backfilling utility trenches from one foot above the top of pipe to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at a pipe invert should be removed and replaced with properly compacted fill or adequate bedding material. Imported soils for pipe bedding should consist of non-expansive granular soils. The walls of temporary construction trenches may not be stable when excavated nearly vertical due to the potential for caving. Shoring of excavation walls or flattening of slopes will be required for temporary excavations deeper than 4 feet. All work associated with trenches, excavations and shoring must conform to the State of California Safety Code.

PLAN REVIEW, OBSERVATIONS AND TESTING

As foundation and earthwork plans are completed, Hamilton & Associates should be retained to provide plan review for intent of our recommendations. The review will enable us to modify our recommendations should the final design conditions not be as we understand them. During construction, we should provide field observation and testing to check that Site preparation, grading, and foundation installation conform to the intent of our recommendations and to the project plans and specifications. As needed, during

construction, we should be retained to consult on geotechnical questions, construction problems, and unanticipated conditions. This would allow us to develop supplemental recommendations as appropriate for the actual subsurface conditions encountered and the specific construction techniques. Furthermore, we would prepare a construction observation and testing report for the building department.

CLOSURE

This report has been prepared for the exclusive use of Saiko Investment Corp. and their design team for the proposed project at the subject site. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties.

The Owner or their representatives are responsible for ensuring the information and recommendations contained in this report are brought to the attention of the project engineers and architects, incorporated into the project plans, and implemented by project contractors. This report should be named on project grading plans as a part of the project specifications.

We request and recommend notification should any of the following occur:

1. Final plans for site development indicate utilization of areas not originally proposed for construction.
2. Structural loading conditions vary from those utilized for evaluation and preparation of this report.
3. The site is not developed within 12 months following the date of this report.
4. Change of ownership of property occurs.

If changes or delays do occur, this office should be notified and provided with finalized plans of site development for our review to enable us to provide the necessary recommendations for additional work and/or updating of the report. Any charges for such review and necessary recommendations would be at the prevailing rate at the time of performing review work.

The findings contained in this report are based upon our evaluation and interpretation of the information obtained from the subsurface exploration performed and the results of laboratory testing and engineering analysis. As part of the engineering analysis it had been assumed, and is expected, that the geotechnical conditions which exist across the area of study are similar to those encountered in the subsurface exploration. However, no warranty is expressed or implied as to the conditions at locations or depths other than

those excavated. Should any conditions encountered during construction differ from those described herein, this office should be contacted immediately for recommendations prior to continuation of work.

Our findings and recommendations were obtained in accordance with generally accepted current professional principles and local practice in geotechnical engineering and reflect our best professional judgment. We make no other warranty, either express or implied.

These recommendations are, however, dependent on the above assumption of uniformity and upon proper quality control of construction. Geotechnical observations and testing should be provided on a continuous basis during temporary and foundation construction at the site to confirm design assumptions and to verify conformance with the intent of our recommendations. If parties other than Hamilton & Associates, Inc., are engaged to provide geotechnical services during construction they must be informed that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the recommendations in this report or providing alternative recommendations.

This concludes our scope of services as described during our proposal dated July 21, 2021, however, this report is subject to review by the controlling authorities for the project. Any further geotechnical services that may be required of our office to respond to questions/comments of the controlling authorities after their review of the report will be performed on a time and expense basis as per our current fee schedule. We would not proceed with any response to report review comments/questions without authorization from your office.

We appreciate your business and hope that we can assist you during construction related services.

REFERENCES

Hamilton and Associates, Inc., Geotechnical Investigation Report, Proposed 3-Story Mixed-Use Building with One Level Subterranean Parking, 16819 Normandie Avenue, Gardena, California, Project No. 16-2163, dated November 18, 2016.

Hamilton and Associates, Inc., Geotechnical Percolation Report, Proposed Infiltration System, 16819 Normandie Avenue, Gardena, California, Project No. 16-2163-1, dated March 19, 2018.

Hamilton and Associates, Inc., Geotechnical Report Update, Proposed 3-Story Mixed-Use Building with At-Grade Parking Structure, 16819 Normandie Avenue, Gardena, California, Project No. 16-2163-2, dated February 13, 2020.

Hamilton and Associates, Inc., Geotechnical Report Addendum, Proposed 3-Story Mixed-Use Building with At-Grade Parking Structure, 16819 Normandie Avenue, Gardena, California, Project No. 16-2163-3, dated November 25, 2020.

Geotechnologies, Inc. Preliminary Geotechnical Engineering Investigation, Proposed Residential Development, 16911 South Normandie Avenue, Gardena, California, File Number 22079, dated June 4, 2021.

APPENDIX A

Plate A-1	Site Plan
Plate A-2	Geotechnical Exploration Map
Plates B-1 through B-3	Log of Borings
Plates C-1 through C-8	Consolidation Test Results
Plates D-1 through D-4	Direct Shear Test Results
Plates E-1 through E-9	Atterberg Limits Test Results
Plates G-1 through G-12	Grain Size Analysis Test Results
Plates H-1 through H-4	Historical Topographic Map
Plates H-5 through H-17	Historic Aerial Image

LABORATORY TESTS

After samples were visually classified in the field and laboratory, a laboratory testing program was performed to evaluate various geotechnical properties. The results are presented in the following sections.

MOISTURE CONTENT AND DENSITY TESTS

The undisturbed soil retained within the rings of the Modified California barrel sampler was tested in the laboratory to determine in-place dry density and moisture content. Test results are presented in the Logs of Boring and Test Pit(see attached “B” Plates).

CONSOLIDATION AND DIRECT SHEAR TESTS

Consolidation (ASTM D2435) and direct shear (ASTM D3080) tests were performed on selected relatively undisturbed samples to determine the settlement characteristics and shear strength parameters of various soil samples, respectively. The results of these tests are shown graphically on the appended “C” and “D” Plates.

ATTERBERG LIMITS

Atterberg Limits (ASTM D-4318) tests were performed on selected samples to determine the liquid limit, plastic limit, and the plasticity index of soils. The results of these tests are shown on the appended “E” Plates.

NO. 200 SIEVE (ASTM D1140)

No. 200 Sieves (ASTM D1140) were performed on selected samples to determine the fines content. Results are presented in the appended “G” Plates.

MAXIMUM DENSITY TEST

The following maximum density test was conducted in accordance with the latest edition of ASTM D1557-09, Method A, using 5 equal layers, 25 blows each layer, 10-pound hammer, 18-inch drop in a 1/30 cubic foot mold. The results are as follows:

Test Pit No.	Depth, Feet	Maximum Dry Density, pcf	Optimum Moisture Content, %	Material Classification
B-3	2-5	125.5	10.0	Silty Sand

EXPANSION TEST

An expansion test was performed on a soil sample to determine the swell characteristics. The expansion test was conducted in accordance with ASTM D4829, Expansion Index Test. The expansion sample was remolded to approximately 90 percent relative compaction at near optimum moisture content, subjected to 144 pounds per square foot surcharge load and saturated.

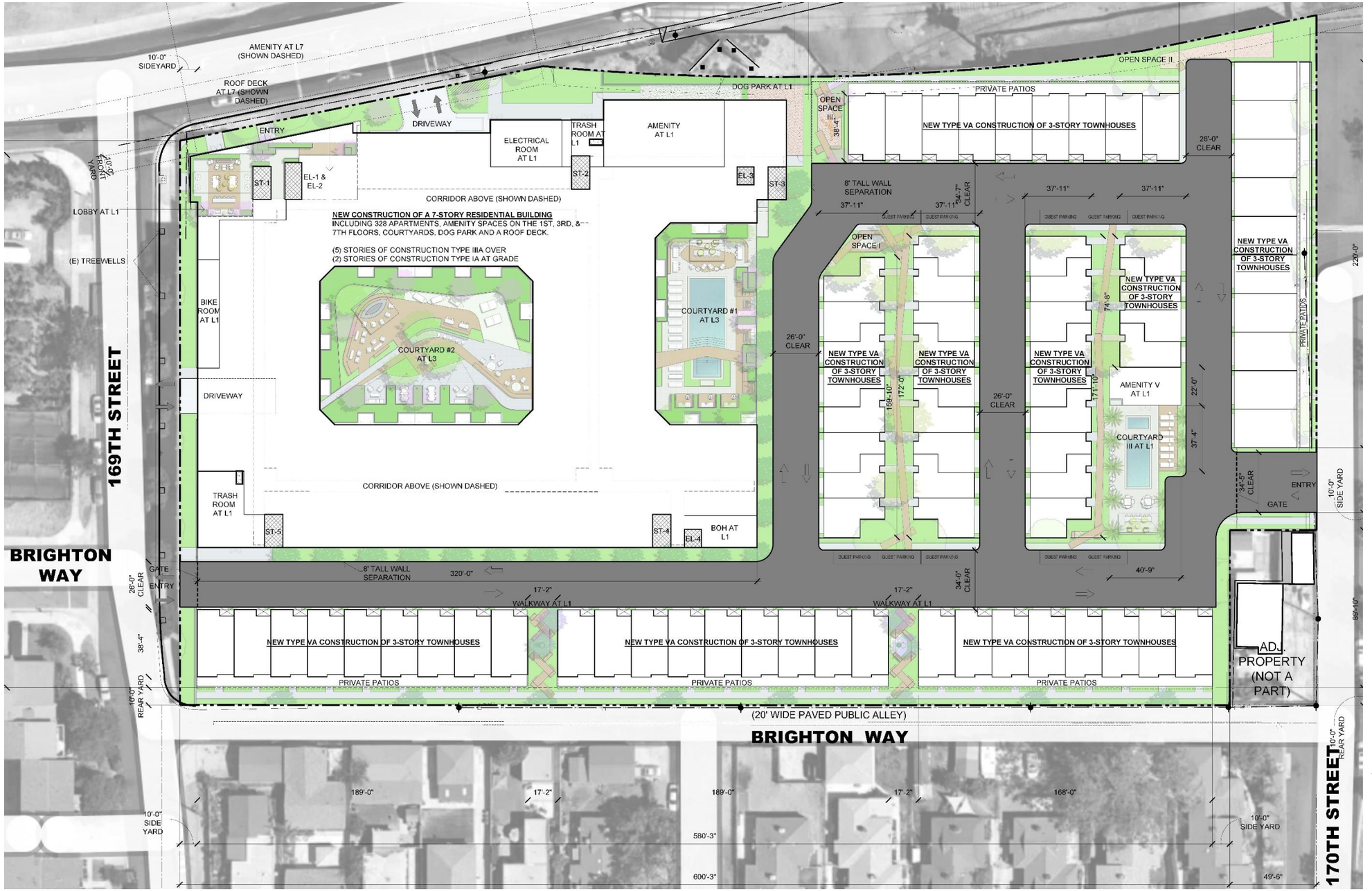
Location	Molded Dry Density, pcf	Molded Moist. Content, %	Degree of Saturation	Expansion Index	Expansion Classification
B-3 (2-5')	107.0	10.8	50.8	0	Very Low

CORROSIVITY TESTING

Laboratory testing was performed per guidelines of California 417 (Sulfate), California 422 (Chloride), and California 532 (pH and Resistivity test procedures on a representative sample of the on-Site soils. This test was intended to provide data for a preliminary assessment relative to the potential for concrete deterioration due to soil sulfate and metal deterioration due to pH, resistivity of the soil and chloride content. The test results are shown below:

SAMPLE	SULFATE CONTENT (% weight, dry soil)	CHLORIDE (ppm)	pH	RESISTIVITY (ohms)
B-3 (2-5')	0.0232	14.8	7.0	2000

SITE PLAN



Site Plan by
Urban Architecture Lab
Project: Normandie Apartments
Sheet Title: First Floor Plan
Sheet No. A0.11
Original Scale: 1/32" = 1'
Dated: September 26, 2022

N

0 60' 120'

Scale in Feet

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: A-1

Date: January 2023

GEOTECHNICAL EXPLORATION MAP



Explanation

- B-3 — H&A Boring
- G-7 — Geotechnologies Boring
- CPT-6 — H&A Cone Penetration Test (CPT)
- GCPT-6 — Geotechnologies Cone Penetration Test (CPT)

N

0 60’ 120’

Scale in Feet

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: A-2

Date: January 2023

FIELD LOG OF BORING NO: B-1

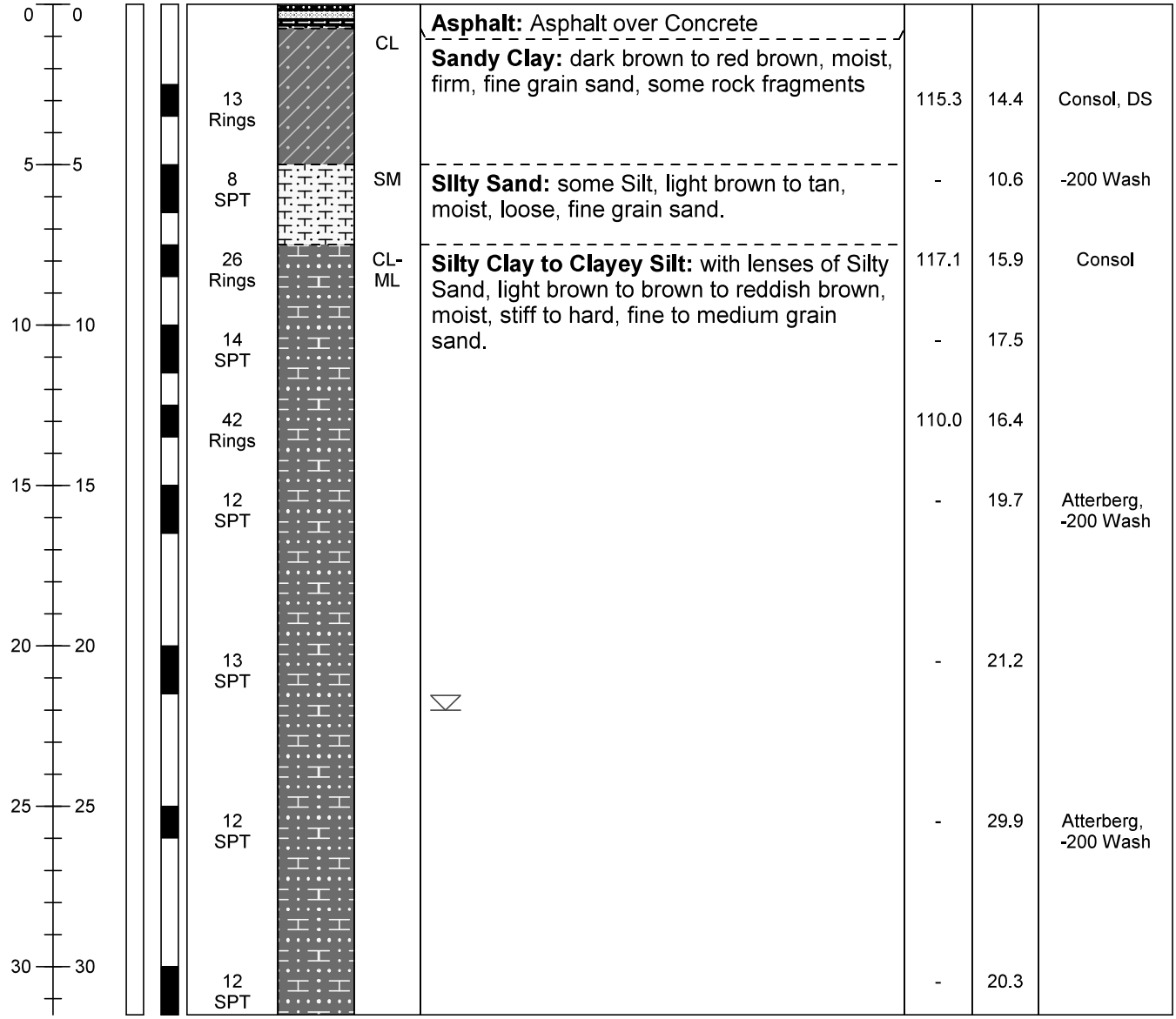
Sheet 1 of 1

HAMILTON & Associates

PROJECT:	**16911 Normandie Associates, LLC**
PROJECT NO:	**21-2971**
LOCATION:	**16911 South Normandie Avenue**

DATE(S) DRILLED:	**August 20, 2021**	LOGGED BY:	**KD**
DRILLED BY:	**Hamilton Drilling Corp.**	TOTAL DEPTH:	**31.5 Feet**
RIG MAKE/MODEL:	**CME 45 C**	HAMMER TYPE:	**Auto Hammer**
DRILLING METHOD:	**Hollow Stem Auger**	HAMMER DROP/ WT:	**140 lbs./30"**
HOLE DIAMETER:	**8-Inch**	SURFACE ELEVATION:	**Unknown**

COMMENTS: **Groundwater encountered at 22 Feet**



DEPTH (FT)	ELEVATION	SAMPLE INT. BULK	SAMPLE INT. DRIVE	BLOWCOUNT (Blows/Ft)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	OTHER TESTS
0	0					CL	**Asphalt:** Asphalt over Concrete **Sandy Clay:** dark brown to red brown, moist, firm, fine grain sand, some rock fragments			
				13 Rings				115.3	14.4	Consol, DS
5	5			8 SPT		SM	**Silty Sand:** some Silt, light brown to tan, moist, loose, fine grain sand.	-	10.6	-200 Wash
				26 Rings		CL-ML	**Silty Clay to Clayey Silt:** with lenses of Silty Sand, light brown to brown to reddish brown, moist, stiff to hard, fine to medium grain sand.	117.1	15.9	Consol
10	10			14 SPT				-	17.5	
				42 Rings				110.0	16.4	
15	15			12 SPT				-	19.7	Atterberg, -200 Wash
20	20			13 SPT			▽	-	21.2	
25	25			12 SPT				-	29.9	Atterberg, -200 Wash
30	30			12 SPT				-	20.3	

FIELD LOG OF BORING NO: B-2

Sheet 1 of 2

HAMILTON & Associates

PROJECT:	**16911 Normandie Associates, LLC**
PROJECT NO:	**21-2971**
LOCATION:	**16911 South Normandie Avenue**

DATE(S) DRILLED:	**August 20, 2021**	LOGGED BY:	**KD**
DRILLED BY:	**Hamilton Drilling Corp.**	TOTAL DEPTH:	**61.5 Feet**
RIG MAKE/MODEL:	**CME 45 C**	HAMMER TYPE:	**Auto Hammer**
DRILLING METHOD:	**Hollow Stem/Mud Rotary**	HAMMER DROP/ WT:	**140 lbs./30"**
HOLE DIAMETER:	**8-Inch**	SURFACE ELEVATION:	**Unknown**

COMMENTS: **Groundwater encountered at 22.5' / Mud Rotary started at 30' BGS**

DEPTH (FT)	ELEVATION	SAMPLE INT. BULK	SAMPLE INT. DRIVE	BLOWCOUNT (Blows/Ft)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	OTHER TESTS
0	0					ML	**Asphalt:** Asphalt over Concrete **Sandy Silt:** with trace Clay, light brown to brown, rock fragments.			
5	5		■	20 SPT		CL	**Sandy Clay:** with some Silt, tan to brown to orange, moist, very stiff, fine grain sand, rock fragments.	-	13.2	
			■	33 Rings				120.1	13.5	Consol, DS
10	10		■	16 SPT		ML	**Sandy Silt:** trace Clay, tan to orange, moist, firm to very stiff, fine grain sand.	-	12.3	Atterberg, -200 Wash
			■	28 Rings				112.8	15.4	Consol
15	15		■	12 SPT				-	14.8	
20	20		■	8 SPT		CL	**Sandy Clay:** trace Silt, light brown, very moist to wet, firm to stiff, fine grain sand. ▽	-	23.5	Atterberg, -200 Wash
			■	16 Rings				106.4	22.1	Consol
25	25		■	9 SPT		ML	**Sandy Silt:** trace Clay, with interbedded layers of Silty Sand, tan to orange, moist, firm to very stiff, fine grain sand.	-	24.8	Atterberg, -200 Wash
30	30		■	12 SPT				-	24.3	

FIELD LOG OF BORING NO: B-2

Sheet 2 of 2

HAMILTON & Associates

PROJECT:	**16911 Normandie Associates, LLC**
PROJECT NO:	**21-2971**
LOCATION:	**16911 South Normandie Avenue**

DATE(S) DRILLED:	**August 20, 2021**	LOGGED BY:	**KD**
DRILLED BY:	**Hamilton Drilling Corp.**	TOTAL DEPTH:	**61.5 Feet**
RIG MAKE/MODEL:	**CME 45 C**	HAMMER TYPE:	**Auto Hammer**
DRILLING METHOD:	**Hollow Stem/Mud Rotary**	HAMMER DROP/ WT:	**140 lbs./30"**
HOLE DIAMETER:	**8-Inch**	SURFACE ELEVATION:	**Unknown**

COMMENTS: **Groundwater encountered at 22.5' / Mud Rotary started at 30' BGS**

DEPTH (FT)	ELEVATION	SAMPLE INT. BULK	SAMPLE INT. DRIVE	BLOWCOUNT (Blows/Ft)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	OTHER TESTS
35	35			46 Rings				112.8	18.8	Atterberg, Consol, -200 Wash
				14 SPT				-	21.5	Atterberg, -200 Wash
40	40			9 SPT		CL-ML	**Clayey Silt:** with Sand, light brown to grey brown, wet, stiff to very stiff, fine grain sand.	-	38.5	Atterberg, -200 Wash
				27 Rings				106.3	23.2	
45	45			9 SPT		SC	**Clayey Sand:** with Silt, light brown to grey, wet, medium dense.	-	21.3	Atterberg, -200 Wash
50	50			12 SPT				-	23.9	
				26 Rings				100.7	26.4	
55	55			23 SPT		ML	**Sandy Silt:** trace Clay, light brown to grey brown, wet, stiff to very stiff, fine grain sand.	-	27.8	Atterberg, -200 Wash
60	60			27 SPT				-	35.5	

FIELD LOG OF BORING NO: B-3

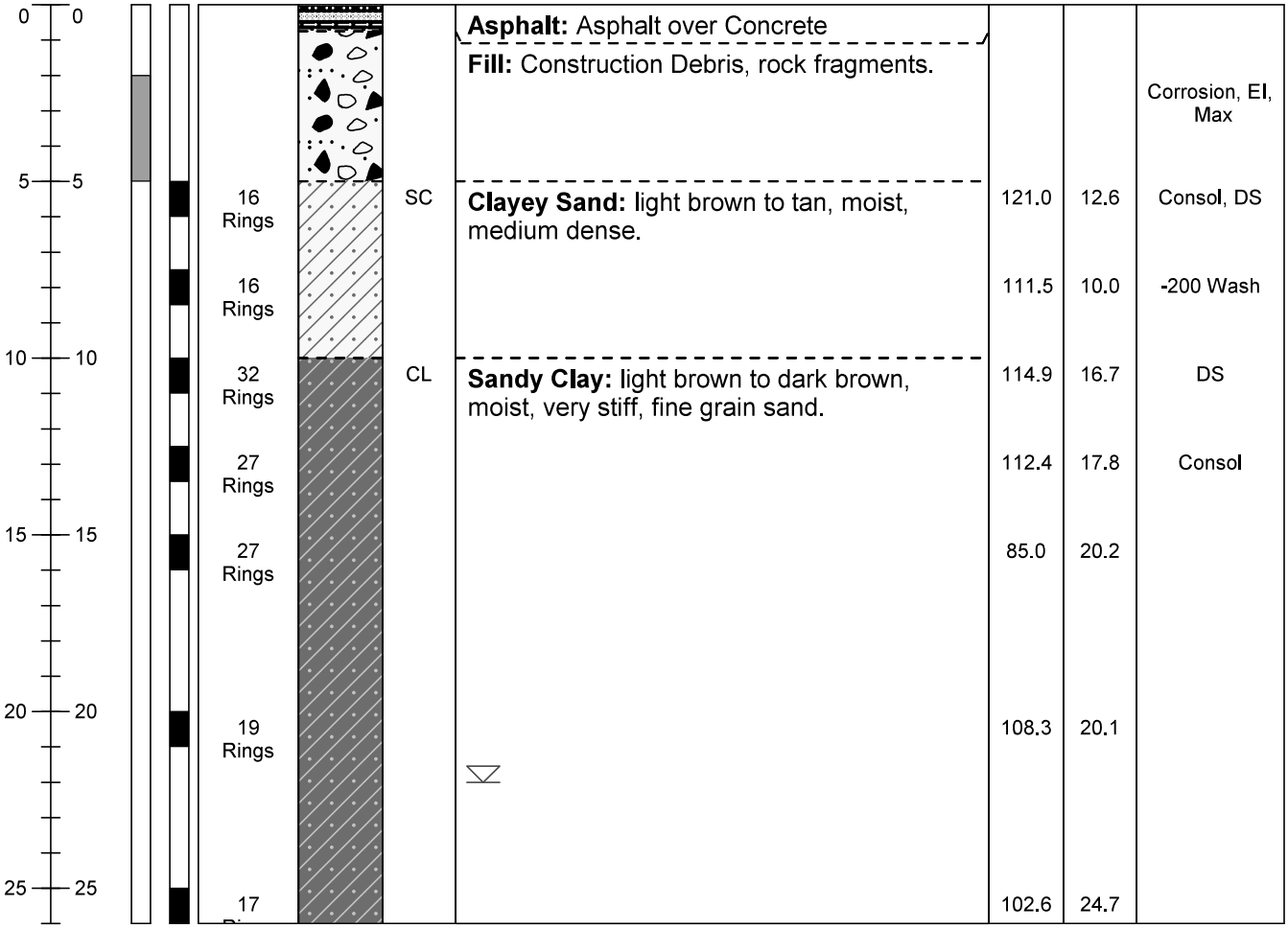
Sheet 1 of 1

HAMILTON & Associates

PROJECT:	**16911 Normandie Associates, LLC**
PROJECT NO:	**21-2971**
LOCATION:	**16911 South Normandie Avenue**

DATE(S) DRILLED:	**August 20, 2021**	LOGGED BY:	**KD**
DRILLED BY:	**Hamilton Drilling Corp.**	TOTAL DEPTH:	**26 Feet**
RIG MAKE/MODEL:	**CME 45 C**	HAMMER TYPE:	**Auto Hammer**
DRILLING METHOD:	**Hollow Stem Auger**	HAMMER DROP/ WT:	**140 lbs./30"**
HOLE DIAMETER:	**8-Inch**	SURFACE ELEVATION:	**Unknown**

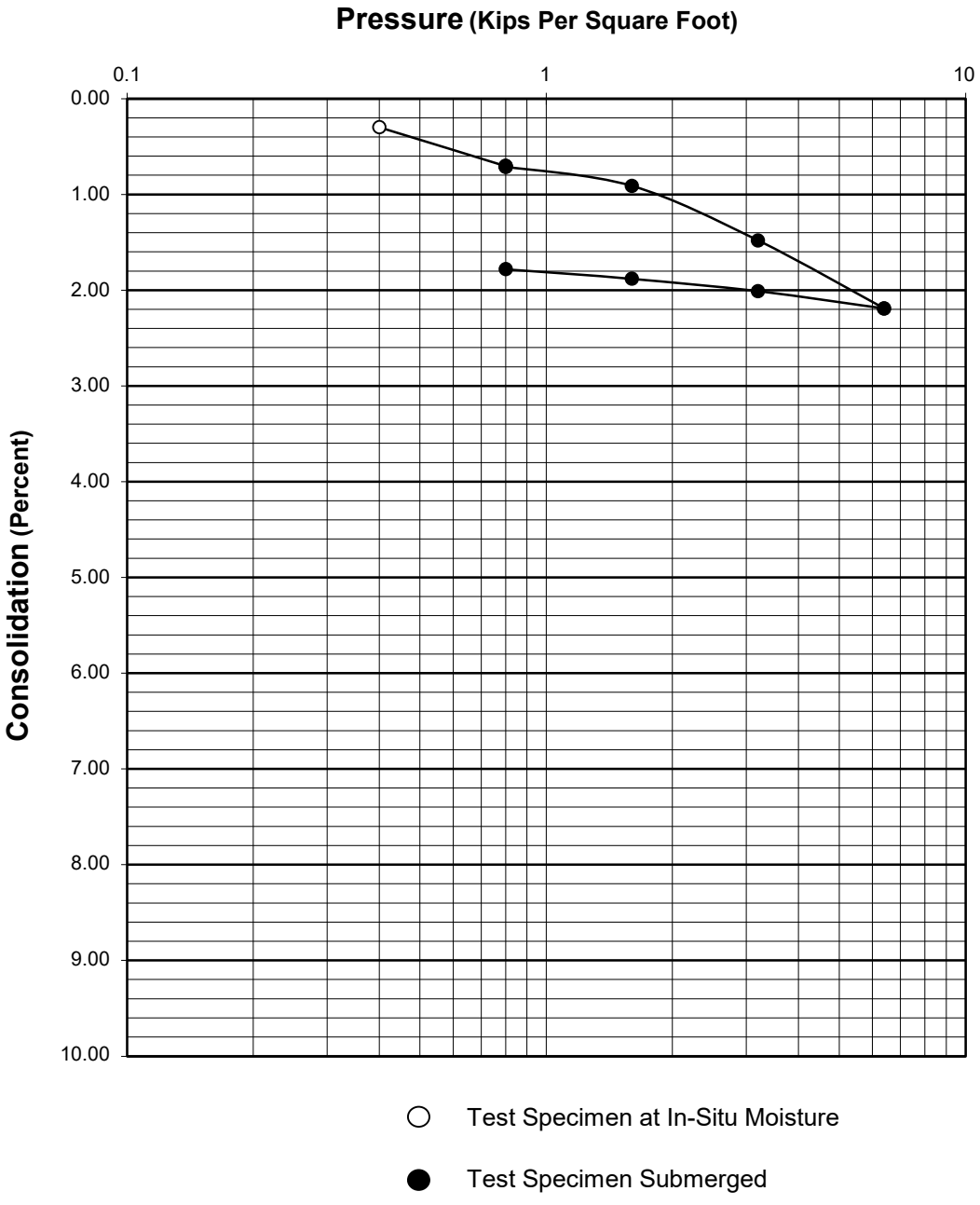
COMMENTS: **Groundwater encountered at 22'**



DEPTH (FT)	ELEVATION	SAMPLE INT. BULK	SAMPLE INT. DRIVE	BLOWCOUNT (Blows/Ft)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	OTHER TESTS
0	0						**Asphalt:** Asphalt over Concrete			
							Fill: Construction Debris, rock fragments.			Corrosion, EI, Max
5	5			16 Rings		SC	**Clayey Sand:** light brown to tan, moist, medium dense.	121.0	12.6	Consol, DS
				16 Rings				111.5	10.0	-200 Wash
10	10			32 Rings		CL	**Sandy Clay:** light brown to dark brown, moist, very stiff, fine grain sand.	114.9	16.7	DS
				27 Rings				112.4	17.8	Consol
15	15			27 Rings				85.0	20.2	
20	20			19 Rings			▽	108.3	20.1	
25	25			17				102.6	24.7	

CONSOLIDATION TEST RESULTS

B-1 at 2.5 Feet

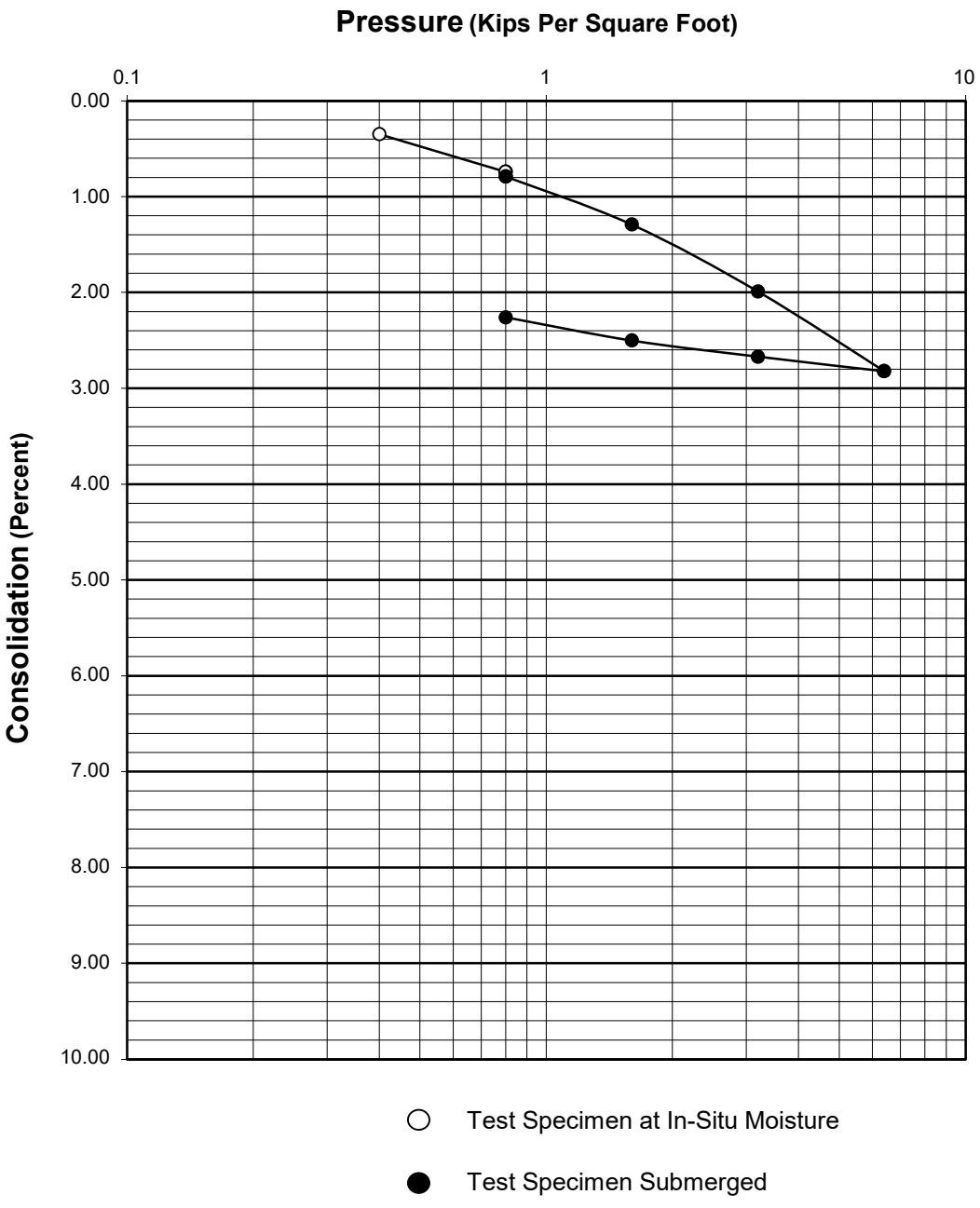


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-1

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-3 at 5 Feet

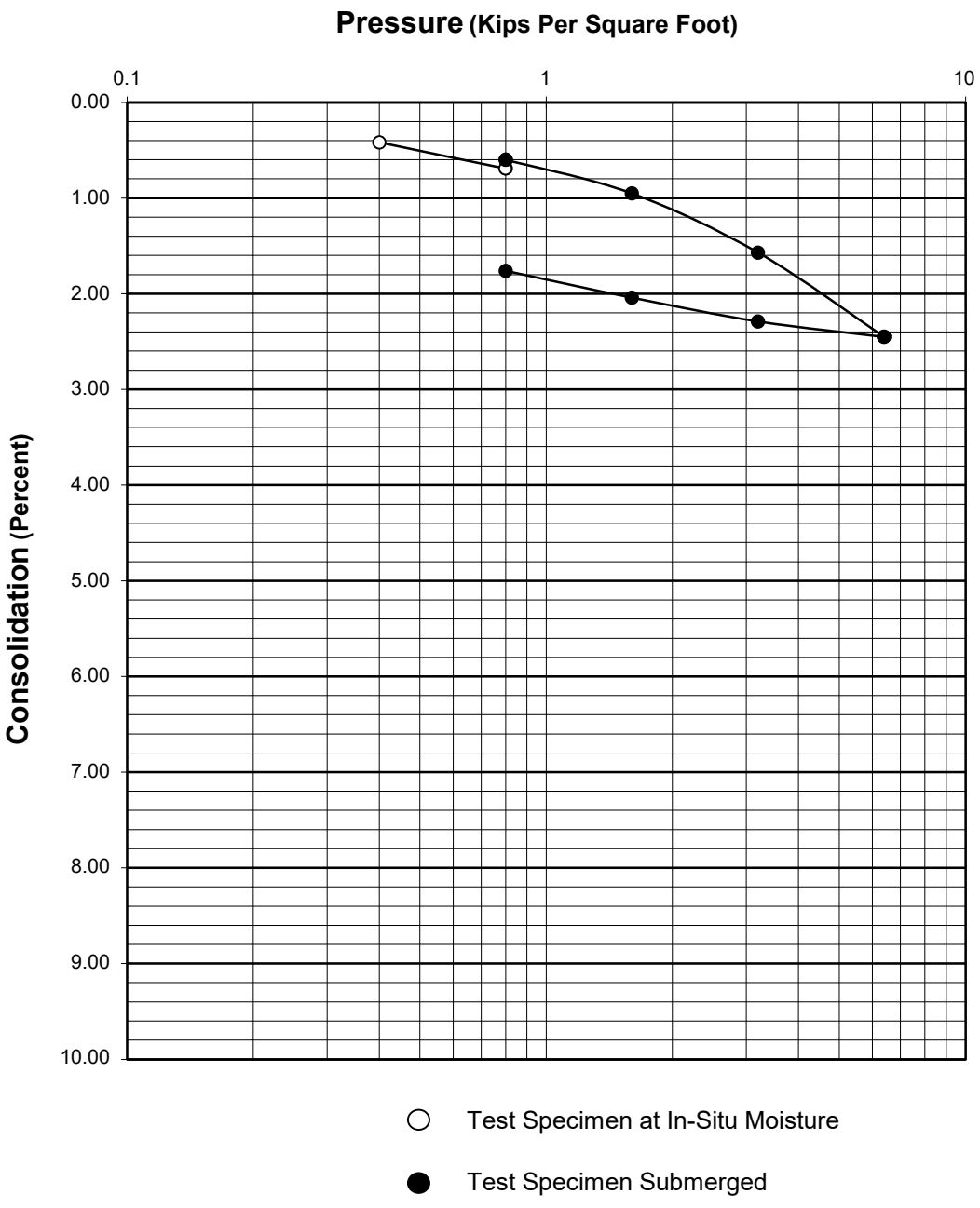


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-2

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-1 at 7.5 Feet

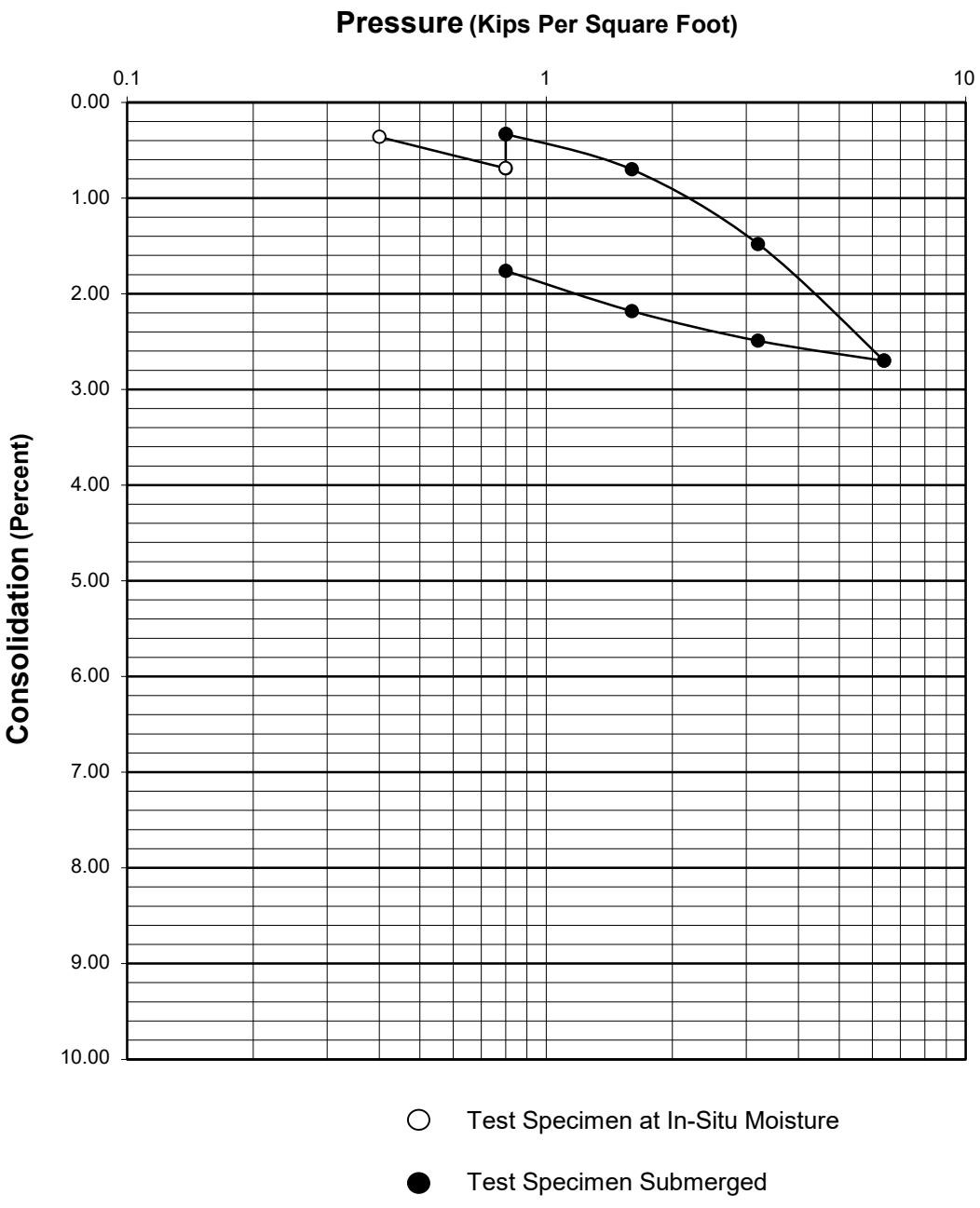


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-3

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-2 at 7.5 Feet

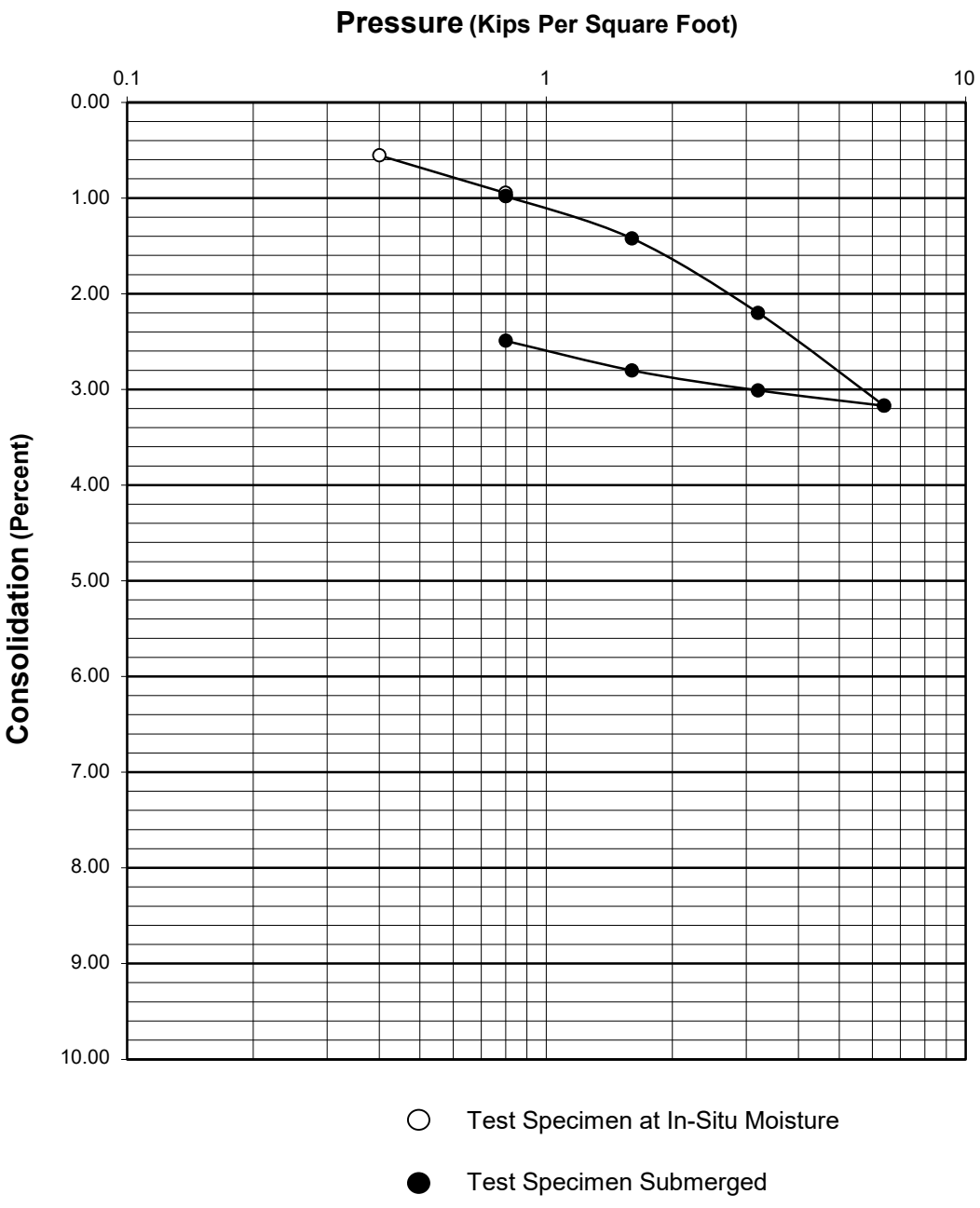


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-4

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-2 at 12.5 Feet

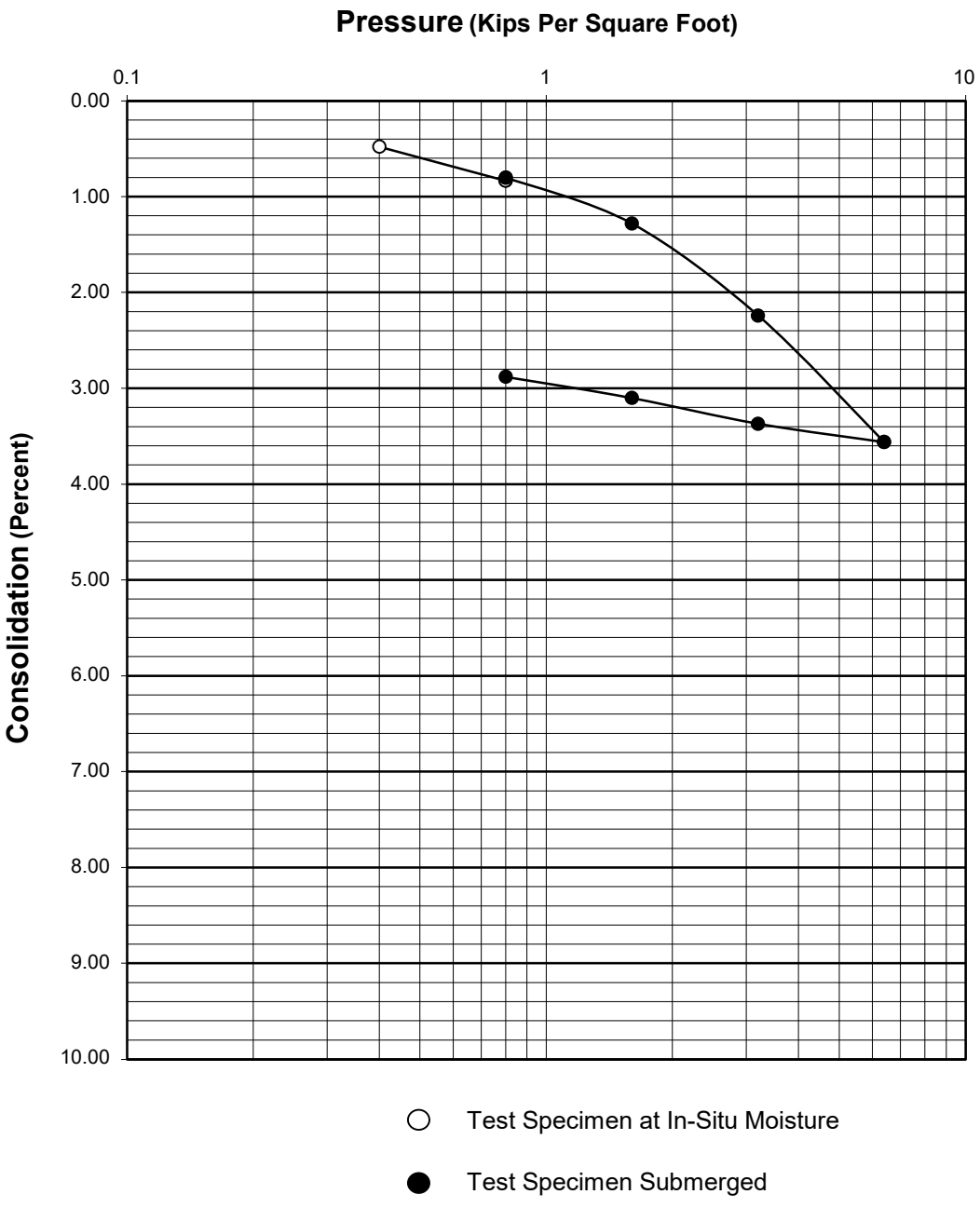


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-5

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-3 at 12.5 Feet

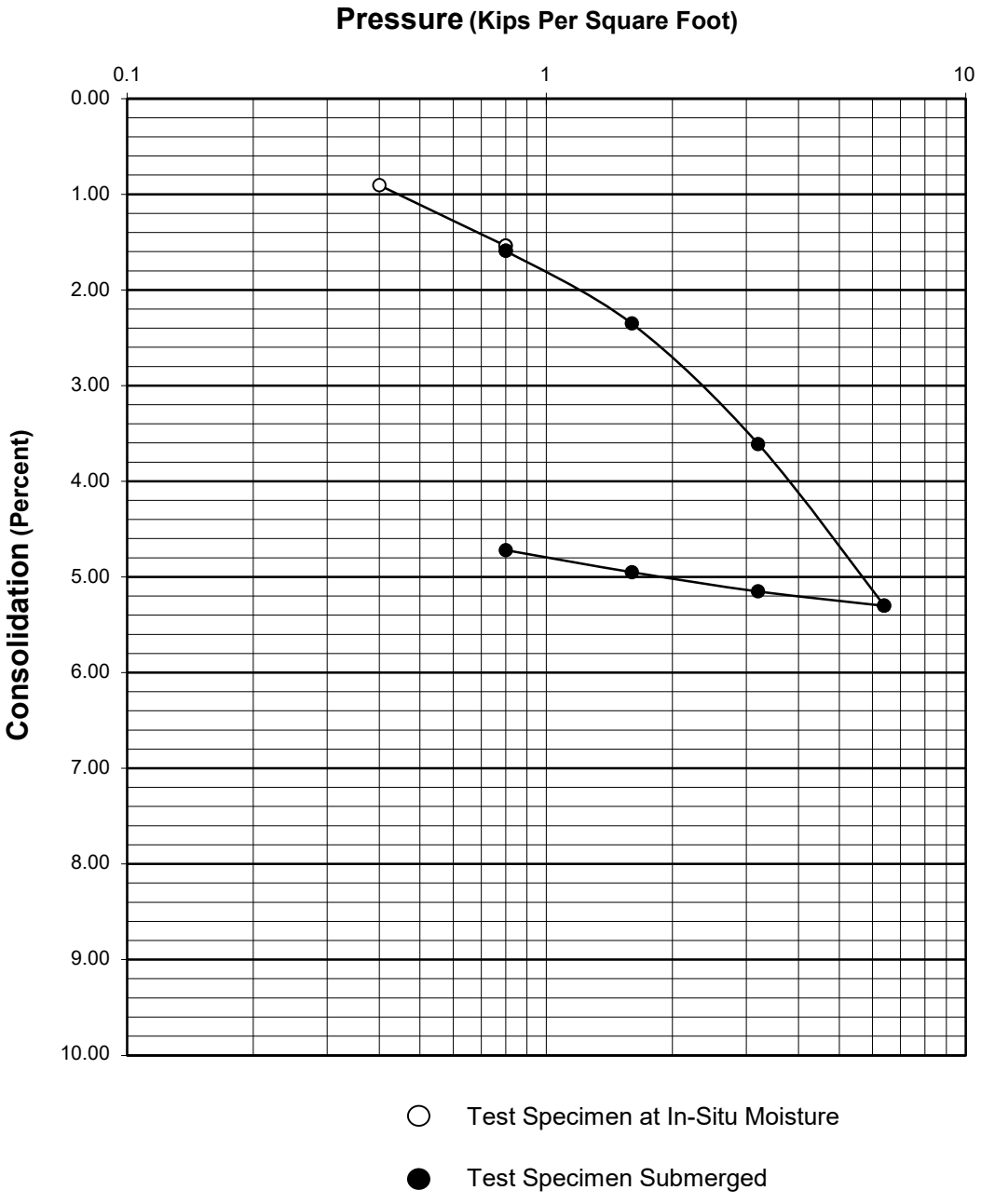


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-6

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

B-2 at 22.5 Feet

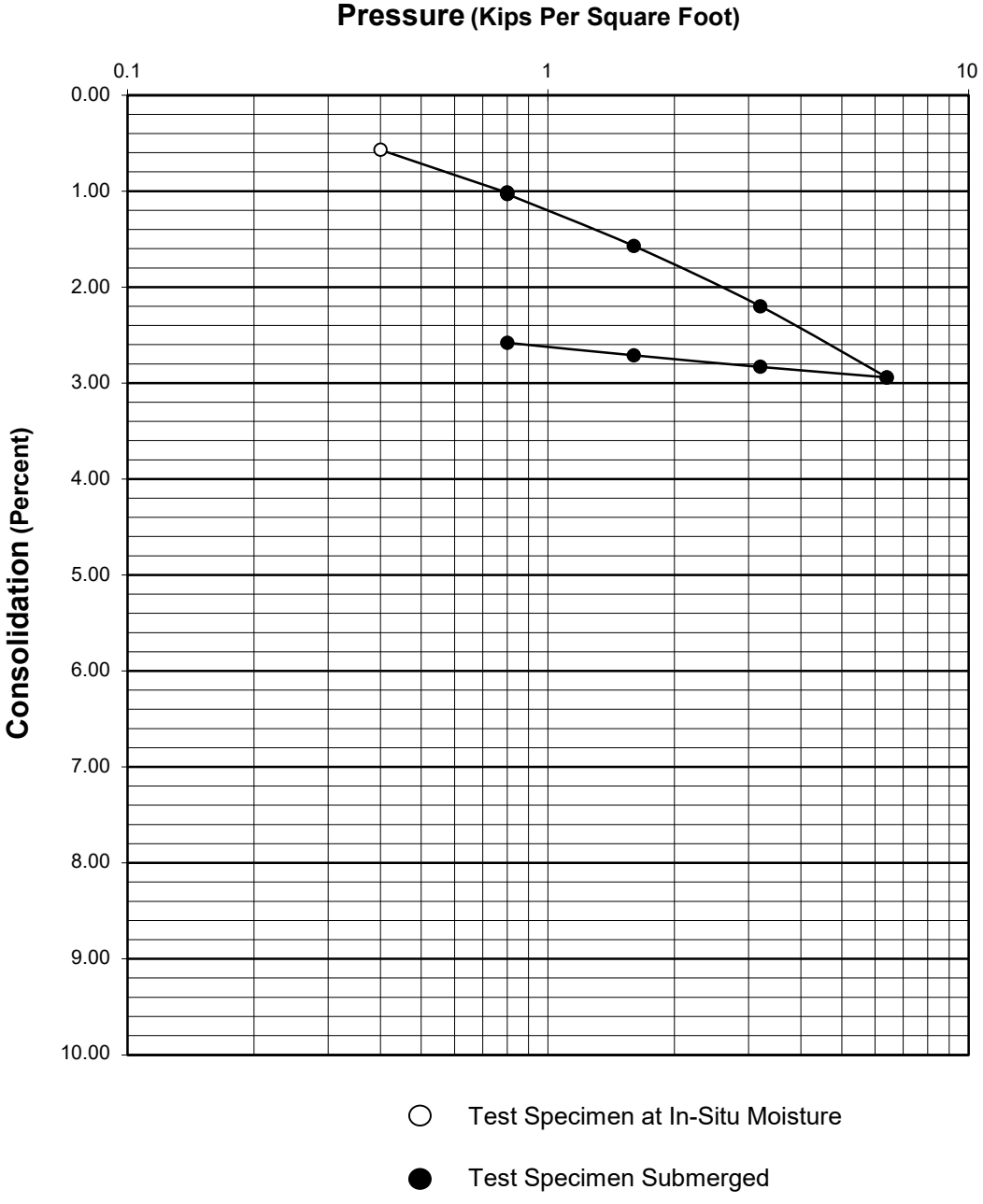


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-7

HAMILTON & ASSOCIATES, INC.

CONSOLIDATION TEST RESULTS

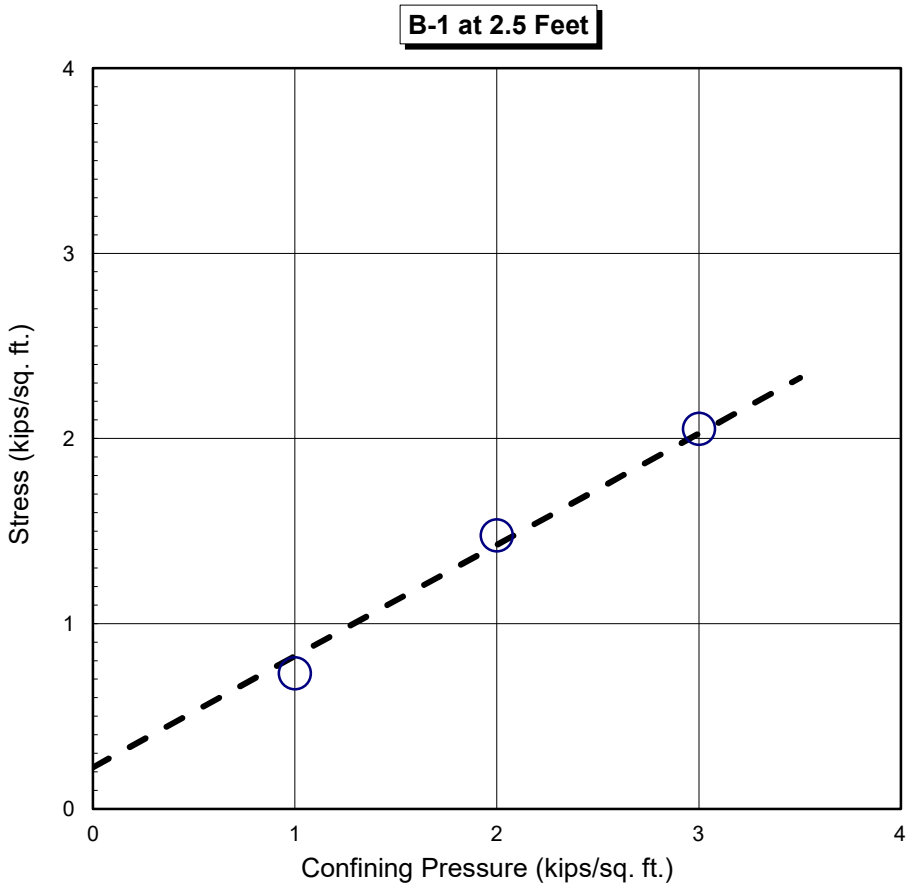
B-2 at 32.5 Feet

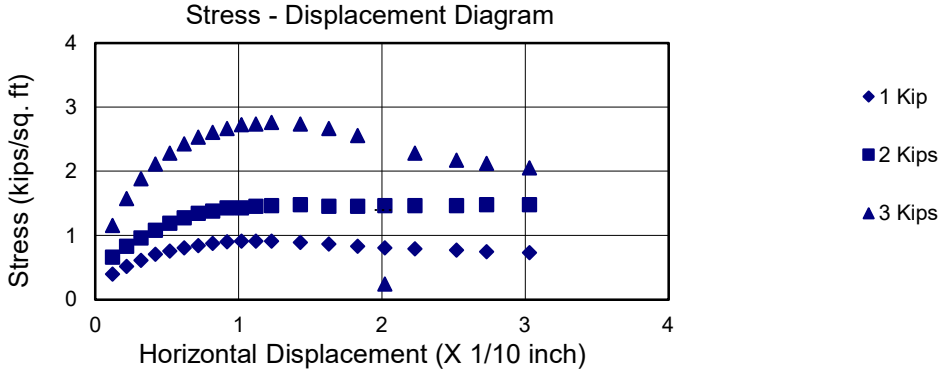


Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate C-8

HAMILTON & ASSOCIATES, INC.

SHEAR TEST RESULTS





Sandy Clay samples were submerged for at least 24 hours.

The samples had a density of 115.3 lbs./cu.ft. and a moisture content of 14.4 %

Cohesion = 225 psf

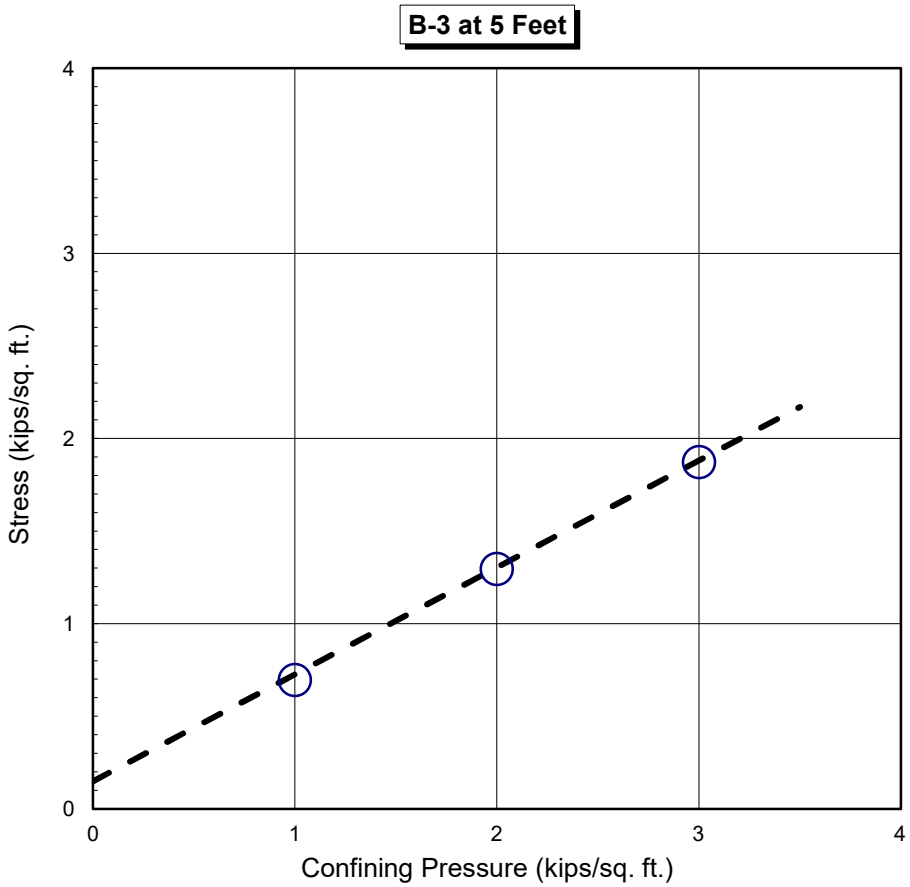
Friction Angle = 31 degrees

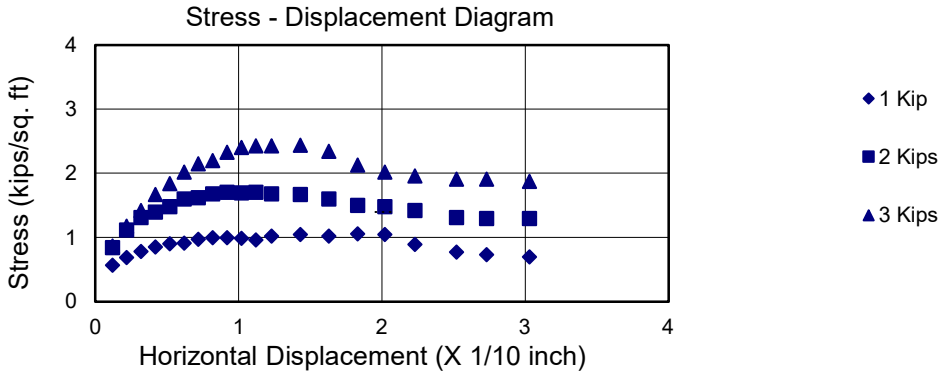
Based on Ultimate Strength

Geotechnical Engineering Investigation 16911 South Normanadie Avene Gardena, California	Project No. 21-2971 Plate D-1

HAMILTON & ASSOCIATES

SHEAR TEST RESULTS





Clayey Sand samples were submerged for at least 24 hours.

The samples had a density of 121 lbs./cu.ft. and a moisture content of 12.6 %

Cohesion = 150 psf

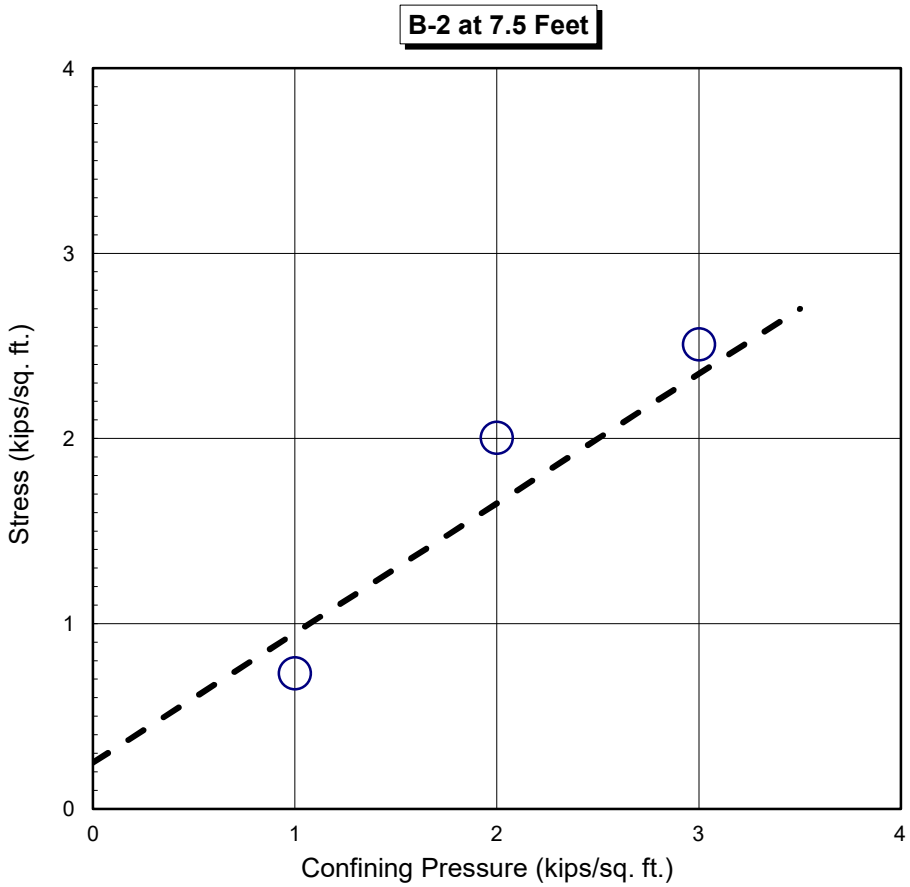
Friction Angle = 30 degrees

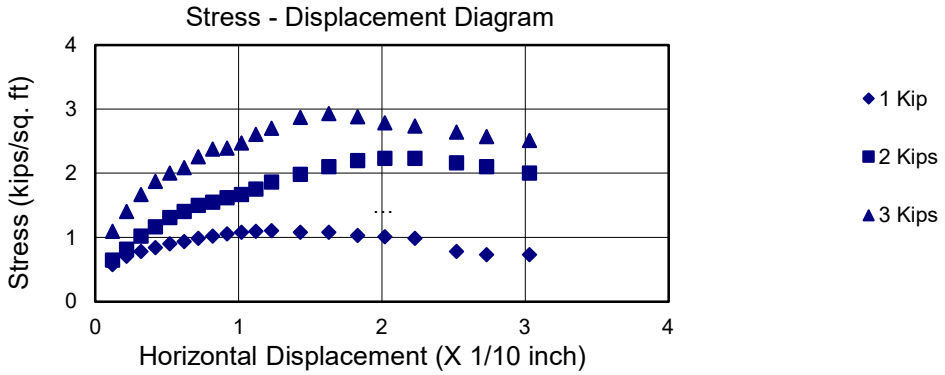
Based on Ultimate Strength

Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate D-2

HAMILTON & ASSOCIATES

SHEAR TEST RESULTS





Sandy Clay samples were submerged for at least 24 hours.

The samples had a density of 120.1 lbs./cu.ft. and a moisture content of 13.5 %

Cohesion = 250 psf

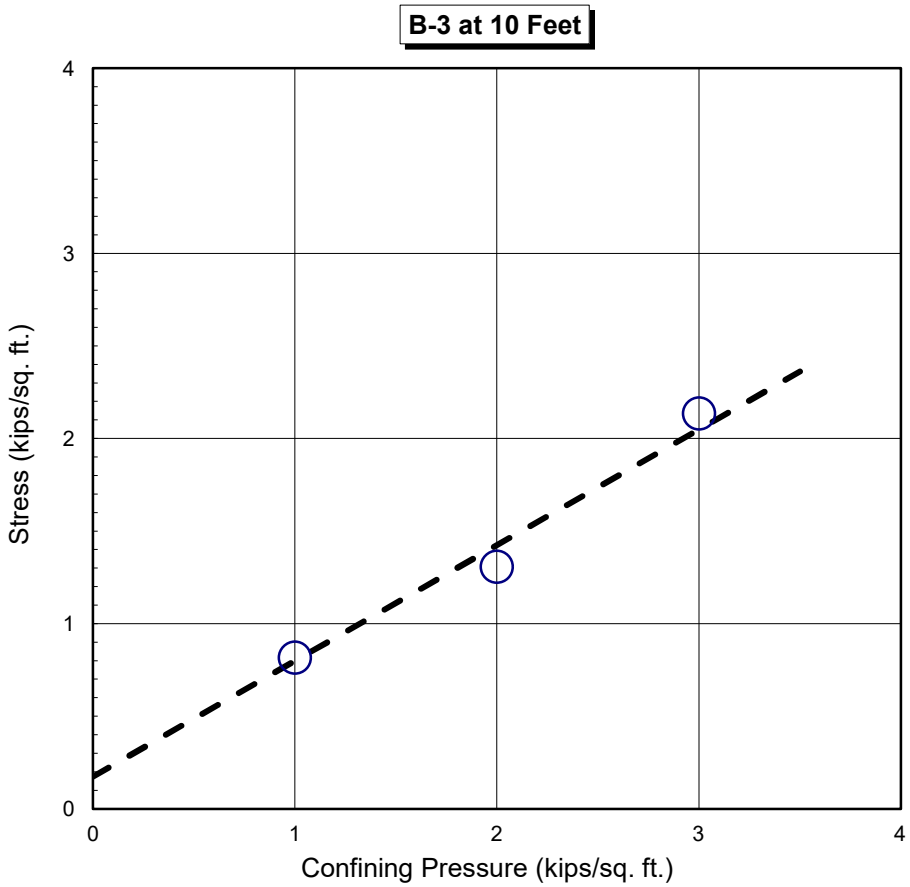
Friction Angle = 35 degrees

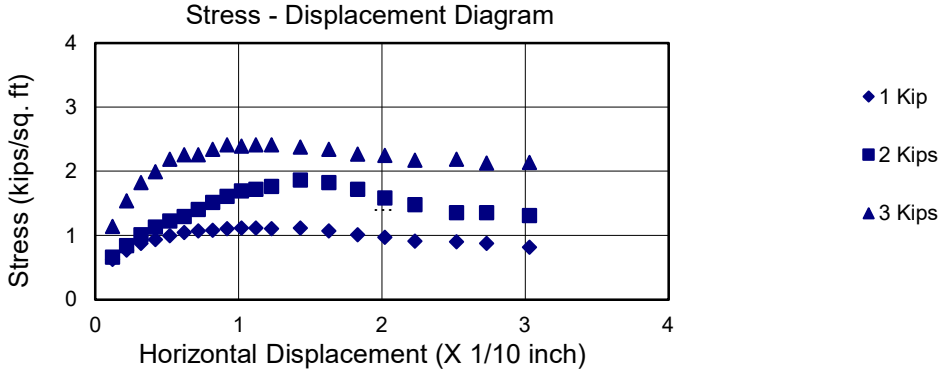
Based on Ultimate Strength

Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate D-3

HAMILTON & ASSOCIATES

SHEAR TEST RESULTS





Clayey Sand samples were submerged for at least 24 hours.

The samples had a density of 114.9 lbs./cu.ft. and a moisture content of 16.7 %

Cohesion = 175 psf

Friction Angle = 32 degrees

Based on Ultimate Strength

Geotechnical Engineering Investigation 16911 South Normandie Avenue Gardena, California	Project No. 21-2971 Plate D-4

HAMILTON & ASSOCIATES

HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: 16911 Normandie Associates, LLC
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 10'
Date: 9/13/2021

Visual Sample Description: Sandy Lean Clay

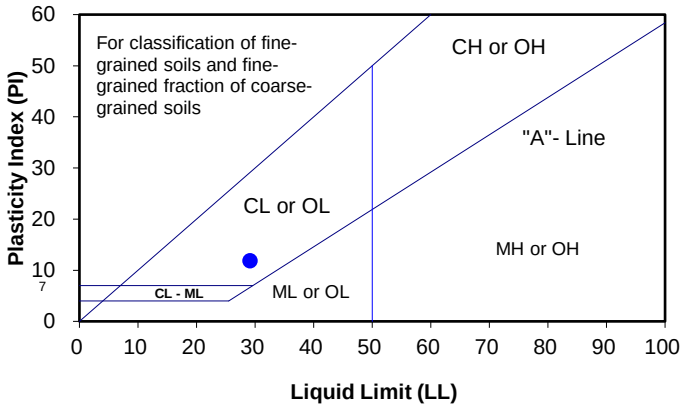
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			33	28	23	
Tare No.:	B-2	A-8	A-3	A-4	A-5	
Wt. of Tare (gm):	15.60	15.60	15.60	15.60	15.60	
Wet Wt. of Soil + Tare (gm):	20.80	20.60	47.70	49.10	47.60	
Dry Wt. of Soil + Tare (gm):	20.00	19.90	40.80	41.60	40.20	
Moisture Content (%) [Wn]:	18.18	16.28	27.38	28.85	30.08	

Liquid Limit	**29**
Plastic Limit	**17**
Plasticity Index	**12**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 6.652774

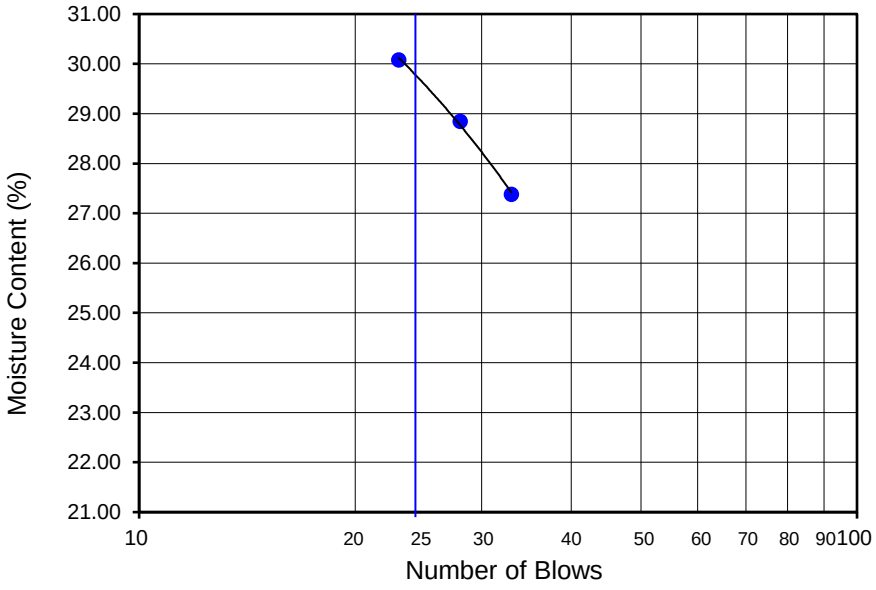
One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-1
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 15'
Date: 9/14/2021

Visual Sample Description: Silty Clay to Clayey Silt

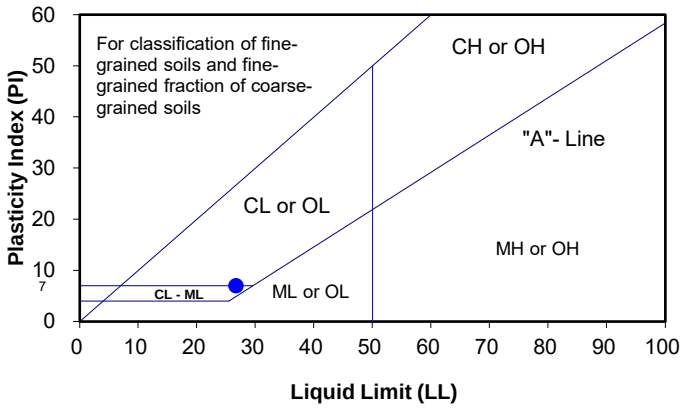
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			34	27	21	
Tare No.:	B-2	A-9	P-2	P-9	P-5	
Wt. of Tare (gm):	15.60	15.50	15.10	15.60	15.70	
Wet Wt. of Soil + Tare (gm):	21.10	20.90	46.10	47.00	50.80	
Dry Wt. of Soil + Tare (gm):	20.20	20.00	40.30	40.20	42.90	
Moisture Content (%) [Wn]:	19.57	20.00	23.02	27.64	29.04	

Liquid Limit	**27**
Plastic Limit	**20**
Plasticity Index	**7**
USCS Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) = 4.921907

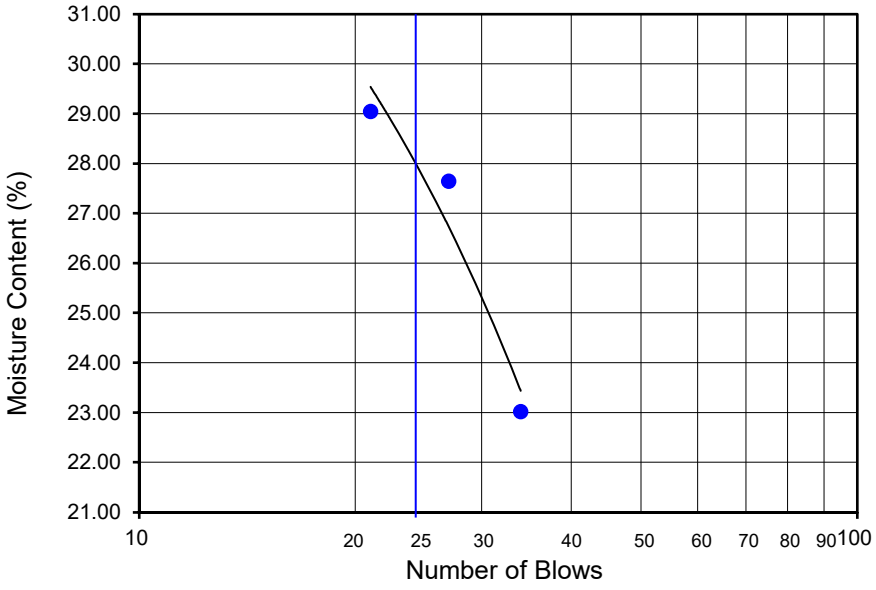
One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-3
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 15'
Date: 9/7/2021

Visual Sample Description: Silty Clay

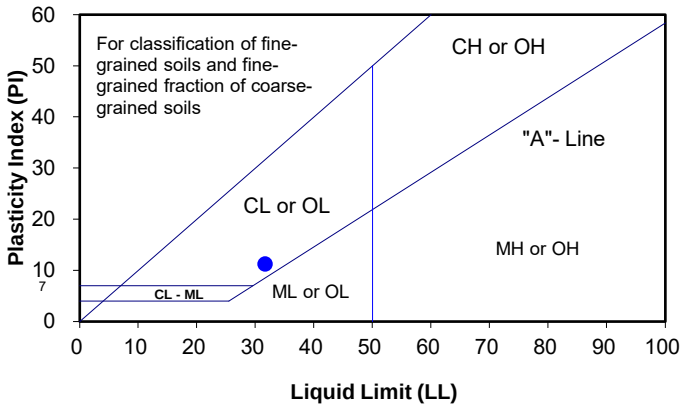
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			34	22	19	
Tare No.:	P-7	P-8	J-1	J-2	J-3	
Wt. of Tare (gm):	15.70	15.70	15.70	15.60	14.90	
Wet Wt. of Soil + Tare (gm):	21.00	21.00	49.30	47.40	49.30	
Dry Wt. of Soil + Tare (gm):	20.10	20.10	41.40	39.70	40.80	
Moisture Content (%) [Wn]:	20.45	20.45	30.74	31.95	32.82	

Liquid Limit	**32**
Plastic Limit	**20**
Plasticity Index	**11**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 8.543666

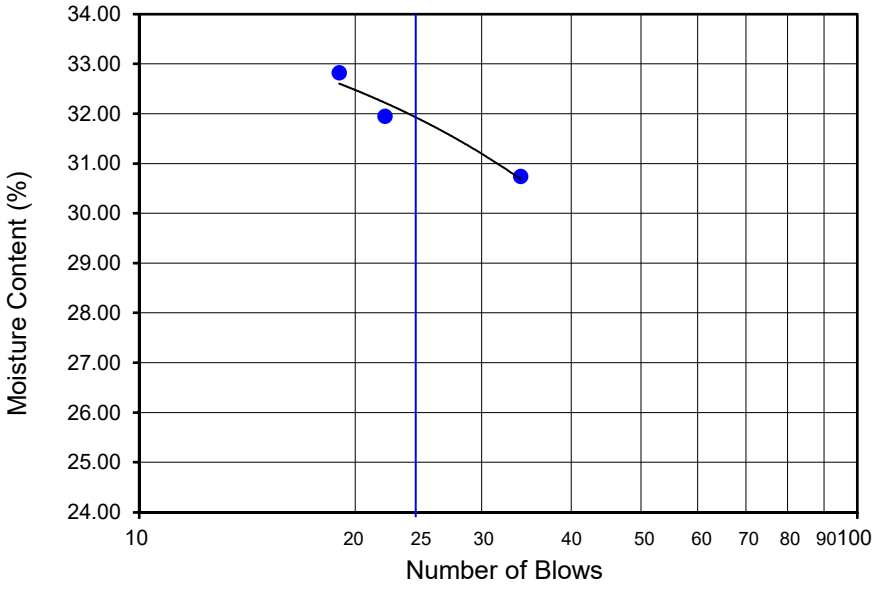
One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 20'
Date: 9/13/2021

Visual Sample Description: Clay

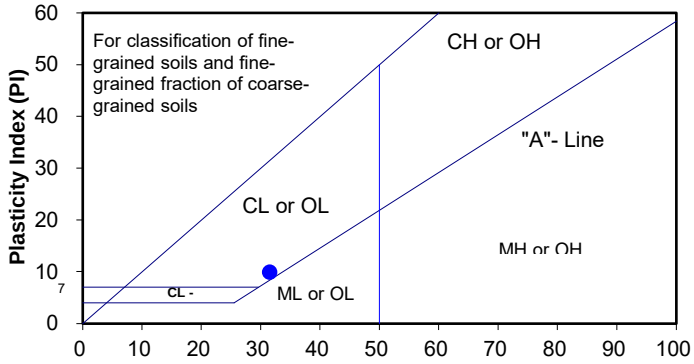
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			26	23	18	
Tare No.:	A-7	A-6	B-3	A-6	B-1	
Wt. of Tare (gm):	15.60	15.60	15.50	15.50	15.60	
Wet Wt. of Soil + Tare (gm):	20.90	21.00	49.10	48.10	47.60	
Dry Wt. of Soil + Tare (gm):	20.00	20.00	41.10	40.20	39.70	
Moisture Content (%) [Wn]:	20.45	22.73	31.25	31.98	32.78	

Liquid Limit	**32**
Plastic Limit	**22**
Plasticity Index	**10**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 8.410587

One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test

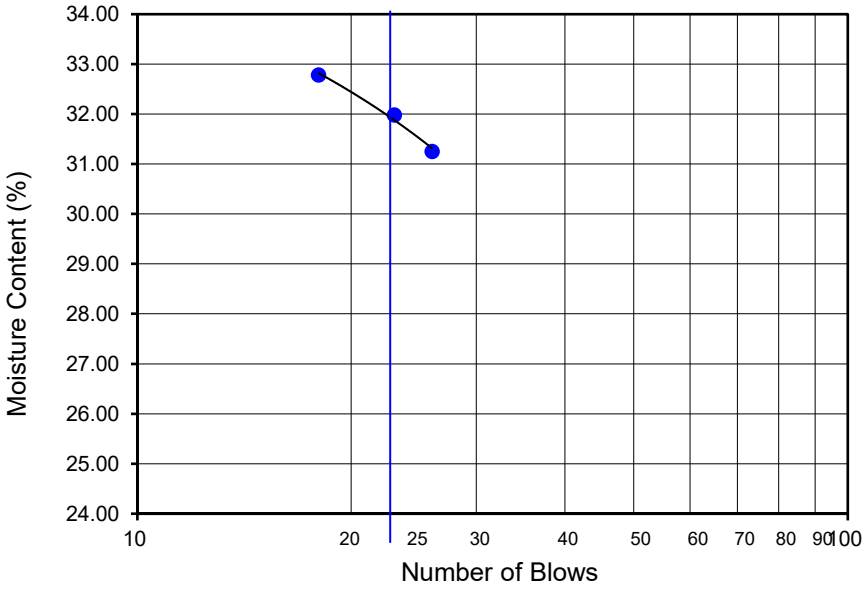


Plate E-4

HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 25'
Date: 9/14/2021

Visual Sample Description: Sandy Silt

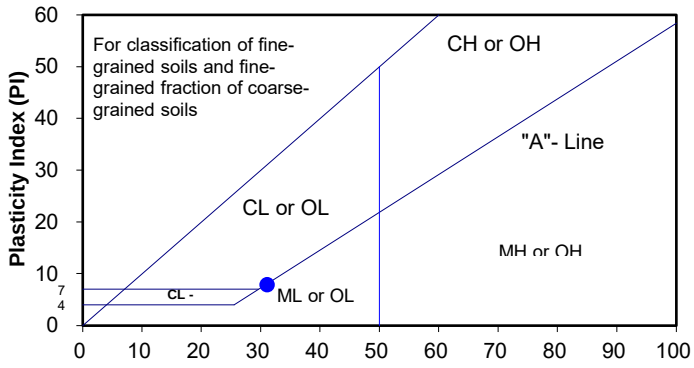
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			34	25	20	
Tare No.:	A-4	A-5	P-7	J-2	P-6	
Wt. of Tare (gm):	15.60	15.60	15.70	15.70	15.60	
Wet Wt. of Soil + Tare (gm):	21.00	20.80	49.40	47.90	49.00	
Dry Wt. of Soil + Tare (gm):	20.00	19.80	41.70	40.20	40.90	
Moisture Content (%) [Wn]:	22.73	23.81	29.62	31.43	32.02	

Liquid Limit	**31**
Plastic Limit	**23**
Plasticity Index	**8**
USCS Classification	**ML**

PI at "A" - Line = 0.73(LL-20) = 8.11018

One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test

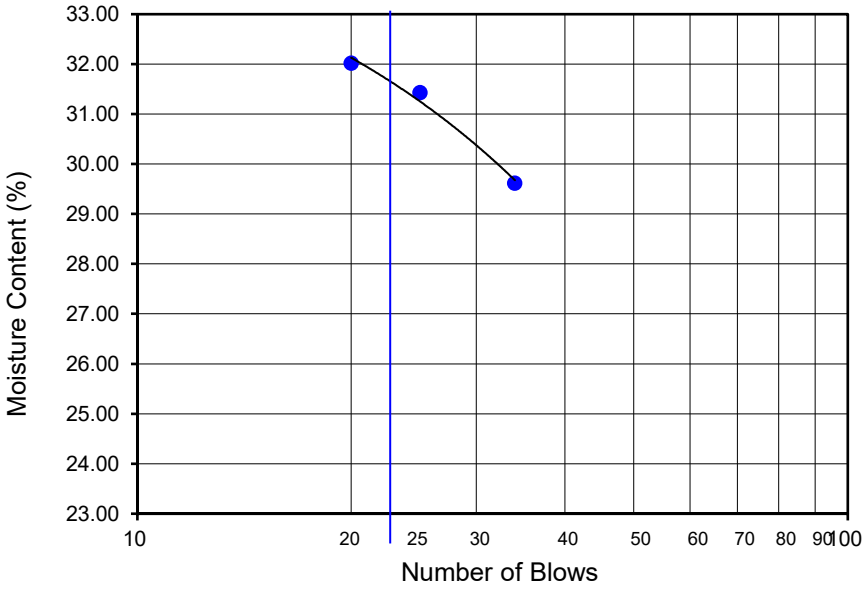


Plate E-5

HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Imvestments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

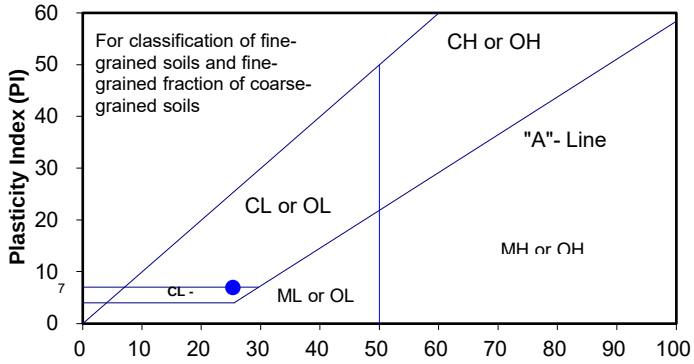
Tested By: BB
Checked By:
Depth (ft.): 35'
Date: 9/10/2021

Visual Sample Description: Sandy Silty Clay

	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			29	20	17	
Tare No.:	A-1	A-2	P-1	P-8	J-3	
Wt. of Tare (gm):	15.50	15.60	15.60	15.70	15.00	
Wet Wt. of Soil + Tare (gm):	20.80	20.60	47.80	48.30	46.20	
Dry Wt. of Soil + Tare (gm):	20.00	19.80	41.30	41.60	39.70	
Moisture Content (%) [Wn]:	17.78	19.05	25.29	25.87	26.32	

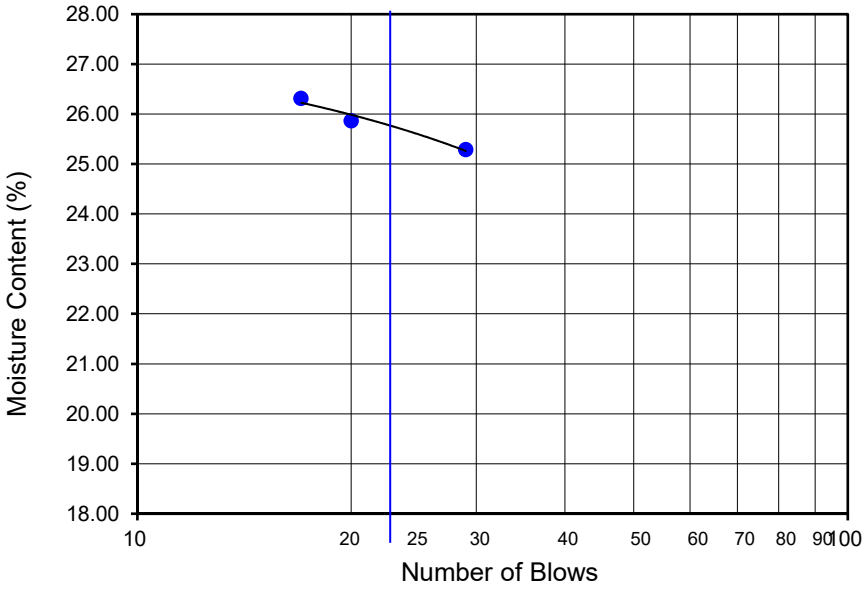
Liquid Limit	**25**
Plastic Limit	**18**
Plasticity Index	**7**
USCS Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) = 3.904459
One - Point Liquid Limit Calculation
LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 40'
Date: 9/21/2021

Visual Sample Description: Silty Clay with Sand

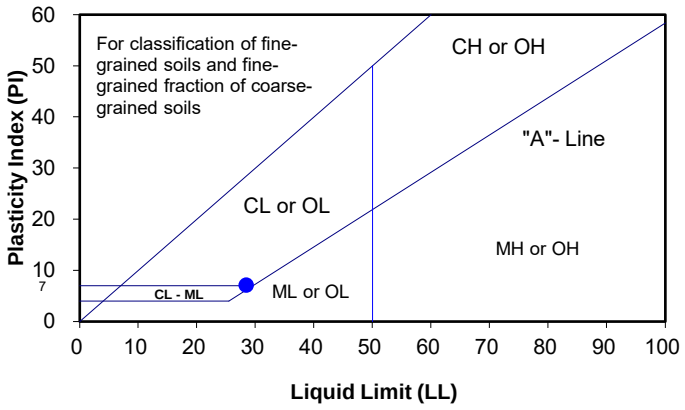
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			26	20	17	
Tare No.:	P-2	P-6	P-9	A-4	A-2	
Wt. of Tare (gm):	15.20	15.60	15.60	15.70	15.60	
Wet Wt. of Soil + Tare (gm):	20.90	20.70	47.70	46.80	46.90	
Dry Wt. of Soil + Tare (gm):	19.90	19.80	40.60	39.80	39.70	
Moisture Content (%) [Wn]:	21.28	21.43	28.40	29.05	29.88	

Liquid Limit	**28**
Plastic Limit	**21**
Plasticity Index	**7**
USCS Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) = 6.161296

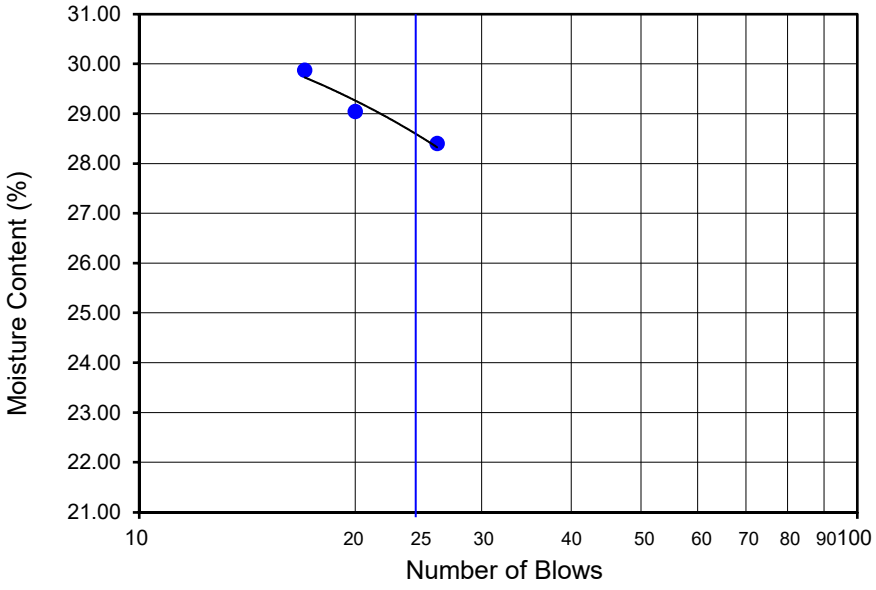
One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 45'
Date: 9/7/2021

Visual Sample Description: Silty Clay to Clayey Silt

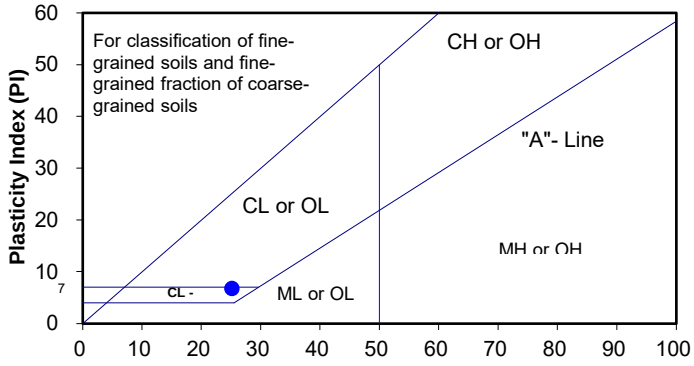
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			29	24	18	
Tare No.:	P-6	P-9	P-1	P-2	P-5	
Wt. of Tare (gm):	15.50	15.60	15.60	15.20	15.60	
Wet Wt. of Soil + Tare (gm):	20.70	20.70	46.90	48.80	50.90	
Dry Wt. of Soil + Tare (gm):	19.90	19.90	40.70	42.00	43.60	
Moisture Content (%) [Wn]:	18.18	18.60	24.70	25.37	26.07	

Liquid Limit	**25**
Plastic Limit	**18**
Plasticity Index	**7**
USCS Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) = 3.760075

One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test

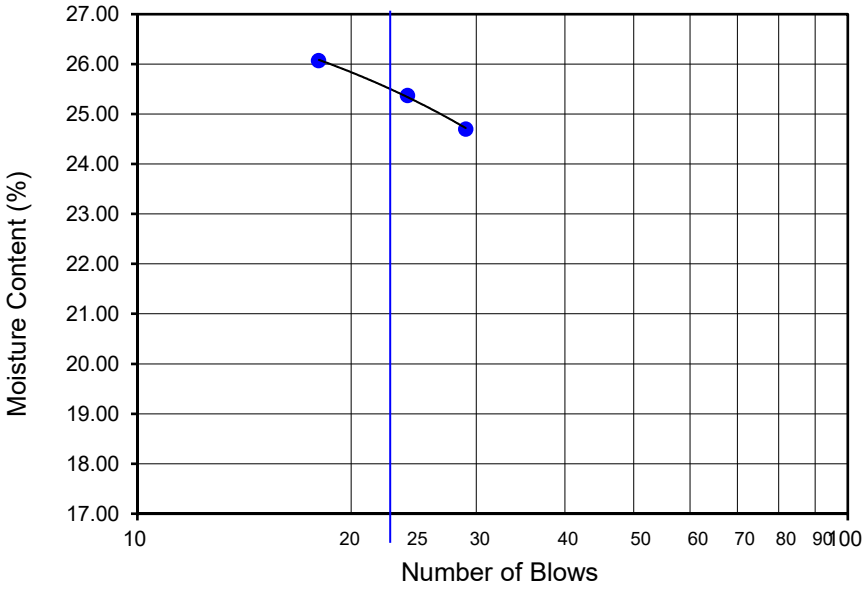


Plate E-8

HAMILTON & Associates

ATTERBERG LIMITS
ASTM D4318

Project Name: Saiko Investments
Project No. : 21-2971
Boring No. : B-2
Sample No. : N/A

Tested By: BB
Checked By:
Depth (ft.): 55'
Date: 9/21/2021

Visual Sample Description: Sandy Silt

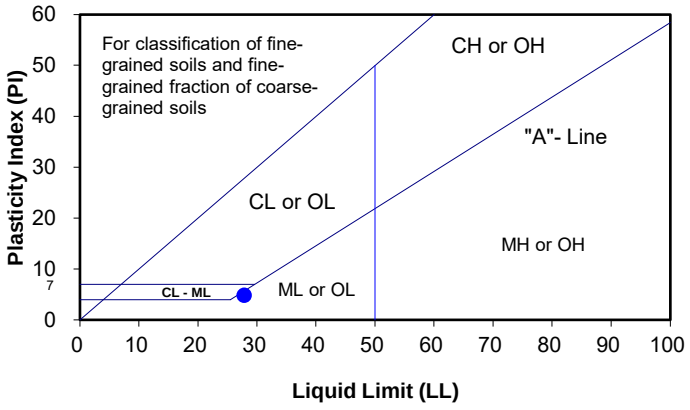
	PLASTIC LIMIT		LIQUID LIMIT			
	1	2	1	2	3	4
Number of Blows [N]:			26	20	15	
Tare No.:	P-5	J-3	A-9	B-2	A-1	
Wt. of Tare (gm):	15.70	14.90	15.50	15.60	15.50	
Wet Wt. of Soil + Tare (gm):	20.90	20.40	46.00	45.80	46.40	
Dry Wt. of Soil + Tare (gm):	19.90	19.40	39.30	39.10	39.40	
Moisture Content (%) [Wn]:	23.81	22.22	28.15	28.51	29.29	

Liquid Limit	**28**
Plastic Limit	**23**
Plasticity Index	**5**
USCS Classification	**ML**

PI at "A" - Line = 0.73(LL-20) = 5.735245

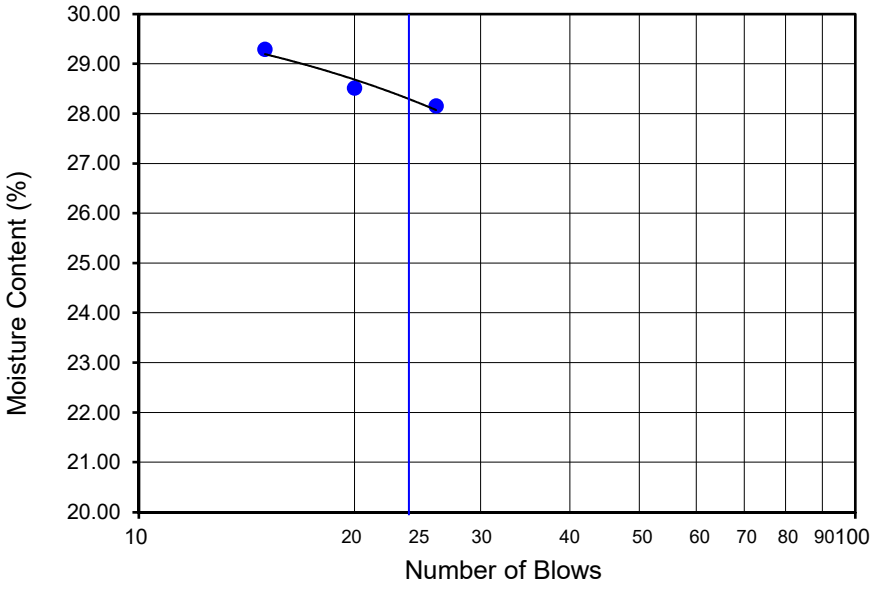
One - Point Liquid Limit Calculation

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



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**16911 Normandie Associates, LLC**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-1**	**Depth (ft.):**	**5'**
Sample No.:	**N/A**	**Date:**	**9/14/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	51.0
Tare Weight (g)	3.9
Wet Weight of Soil plus Tare (g)	113.6
Oven Dried Weight of Soil plus Tare (g)	103.1
Moisture Content (%)	10.6

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	69.7	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
33.7	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-3**	**Depth (ft.):**	**7.5'**
Sample No.:	**N/A**	**Date:**	**9/21/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	H-87
Tare Weight (g)	3.8
Wet Weight of Soil plus Tare (g)	105.7
Oven Dried Weight of Soil plus Tare (g)	96.4
Moisture Content (%)	10.0

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	77.8	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
20.1	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**10'**
Sample No.:	**N/A**	**Date:**	**9/15/2021**

Soil Description: **Sandy Clay**

Moisture Determination

Tare No.	83.0
Tare Weight (g)	3.8
Wet Weight of Soil plus Tare (g)	102.2
Oven Dried Weight of Soil plus Tare (g)	91.4
Moisture Content (%)	12.3

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	44.3	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
53.8	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-1**	**Depth (ft.):**	**15'**
Sample No.:	**N/A**	**Date:**	**9/15/2021**

Soil Description: **Sandy Silt to Sandy Clay**

Moisture Determination

Tare No.	L-240
Tare Weight (g)	3.8
Wet Weight of Soil plus Tare (g)	105.8
Oven Dried Weight of Soil plus Tare (g)	89.0
Moisture Content (%)	19.7

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	30.0	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
69.2	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**20'**
Sample No.:	**N/A**	**Date:**	**9/15/2021**

Soil Description: **Sandy Clay**

Moisture Determination

Tare No.	AM-13
Tare Weight (g)	3.7
Wet Weight of Soil plus Tare (g)	96.6
Oven Dried Weight of Soil plus Tare (g)	78.9
Moisture Content (%)	23.5

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	25.7	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
70.7	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-1**	**Depth (ft.):**	**25'**
Sample No.:	**N/A**	**Date:**	**9/14/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	Z-40
Tare Weight (g)	3.2
Wet Weight of Soil plus Tare (g)	113.6
Oven Dried Weight of Soil plus Tare (g)	88.2
Moisture Content (%)	29.9

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	60.2	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
32.9	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**25'**
Sample No.:	**N/A**	**Date:**	**9/21/2021**

Soil Description: **Sandy Silt**

Moisture Determination

Tare No.	SO-62
Tare Weight (g)	3.7
Wet Weight of Soil plus Tare (g)	103.5
Oven Dried Weight of Soil plus Tare (g)	83.7
Moisture Content (%)	24.8

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	40.5	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
54.0	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**32.5'**
Sample No.:	**N/A**	**Date:**	**9/14/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	AM-6
Tare Weight (g)	3.6
Wet Weight of Soil plus Tare (g)	149.0
Oven Dried Weight of Soil plus Tare (g)	126.0
Moisture Content (%)	18.8

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	99.8	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
21.4	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**35'**
Sample No.:	**N/A**	**Date:**	**9/21/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	L-148
Tare Weight (g)	3.7
Wet Weight of Soil plus Tare (g)	116.0
Oven Dried Weight of Soil plus Tare (g)	96.1
Moisture Content (%)	21.5

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	52.5	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
47.2	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**40'**
Sample No.:	**N/A**	**Date:**	**9/14/2021**

Soil Description: **Silty Clay to Clayey Silt with Sand**

Moisture Determination

Tare No.	Z-85
Tare Weight (g)	3.1
Wet Weight of Soil plus Tare (g)	90.5
Oven Dried Weight of Soil plus Tare (g)	66.2
Moisture Content (%)	38.5

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	13.0	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
84.3	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**45'**
Sample No.:	**N/A**	**Date:**	**9/21/2021**

Soil Description: **Silty Sand**

Moisture Determination

Tare No.	Z-27
Tare Weight (g)	3.2
Wet Weight of Soil plus Tare (g)	90.2
Oven Dried Weight of Soil plus Tare (g)	74.9
Moisture Content (%)	21.3

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	41.7	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
46.3	% Fines

HAMILTON & Associates

No. 200 Wash and Grain Analysis

ASTM D 1140

Project Name:	**Saiko Investments**	**Tested By:**	**BB**
Project No.:	**21-2971**	**Checked By:**	
Boring No.:	**B-2**	**Depth (ft.):**	**55'**
Sample No.:	**N/A**	**Date:**	**9/14/2021**

Soil Description: **Sandy Silt**

Moisture Determination

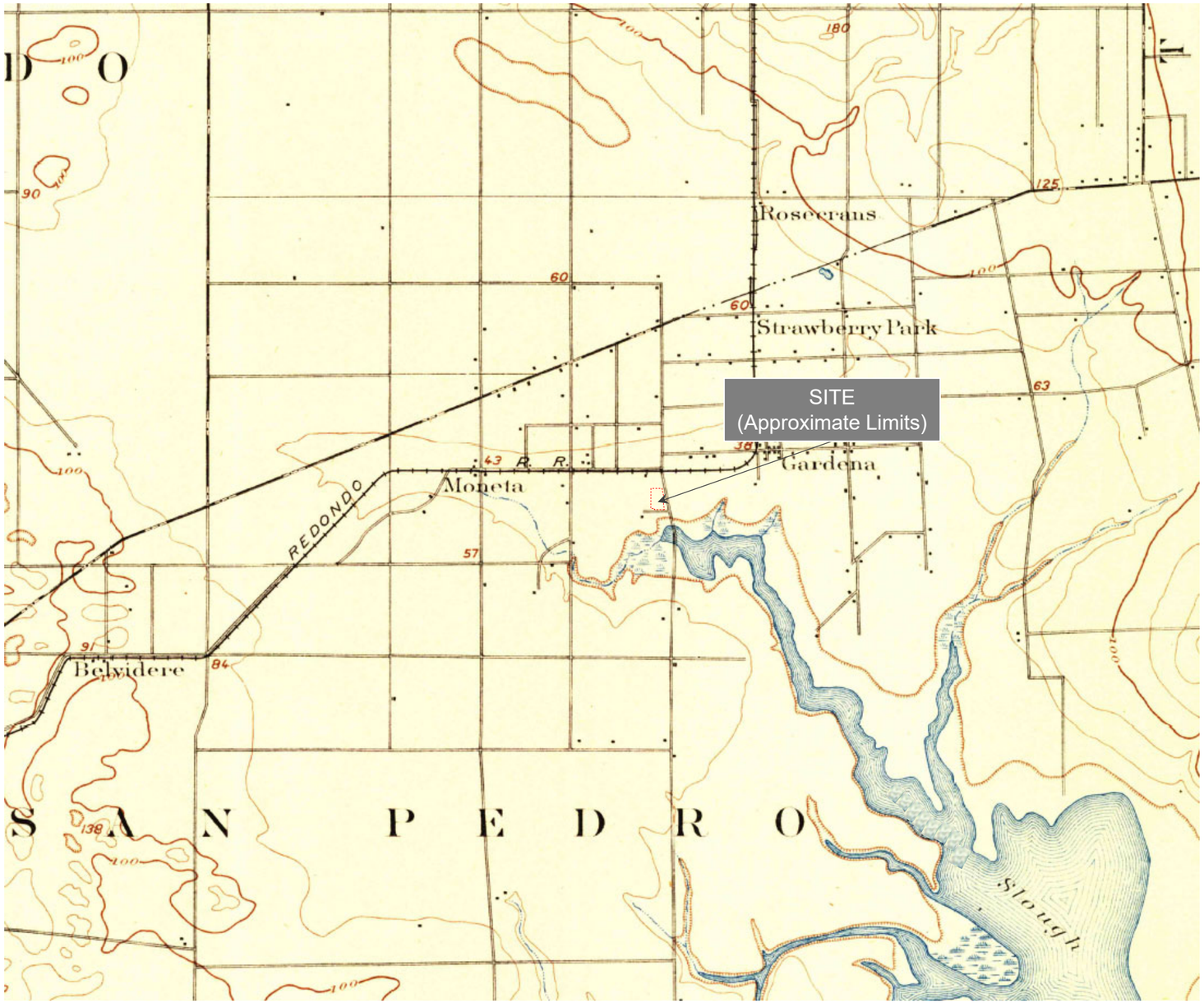
Tare No.	OWL
Tare Weight (g)	3.7
Wet Weight of Soil plus Tare (g)	116.2
Oven Dried Weight of Soil plus Tare (g)	91.7
Moisture Content (%)	27.8

Grain Analysis

Post #200 Wash Mass of Oven Dried Soil for Grain Analysis plus Tare (g)	36.7	
Mass of Soil Retained on Seive (g)	3"	
	1 1/2"	
	1"	
	3/4"	
	3/8"	
	#4	
	#10	
	#20	
	#40	
	#60	
	#100	
	#140	
	#200	
	Pass #200	

0.0	% Gravel
0.0	% Sand
62.5	% Fines

HISTORICAL TOPOGRAPHIC MAP 1896



1 2 0 1 2 3 4 Miles

CALIFORNIA
(LOS ANGELES CO)
REDONDO SHEET

U. S. GEOLOGICAL SURVEY.

Edition of Sept. 1896.

Contour Interval 25 feet
Datum is mean Sea level

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California	Project No: 21-2971	
Hamilton & Associates	Plate No: H-1	Date: October 2021

HISTORICAL TOPOGRAPHIC MAP 1924

CALIFORNIA
(LOS ANGELES COUNTY)
TORRANCE QUADRANGLE

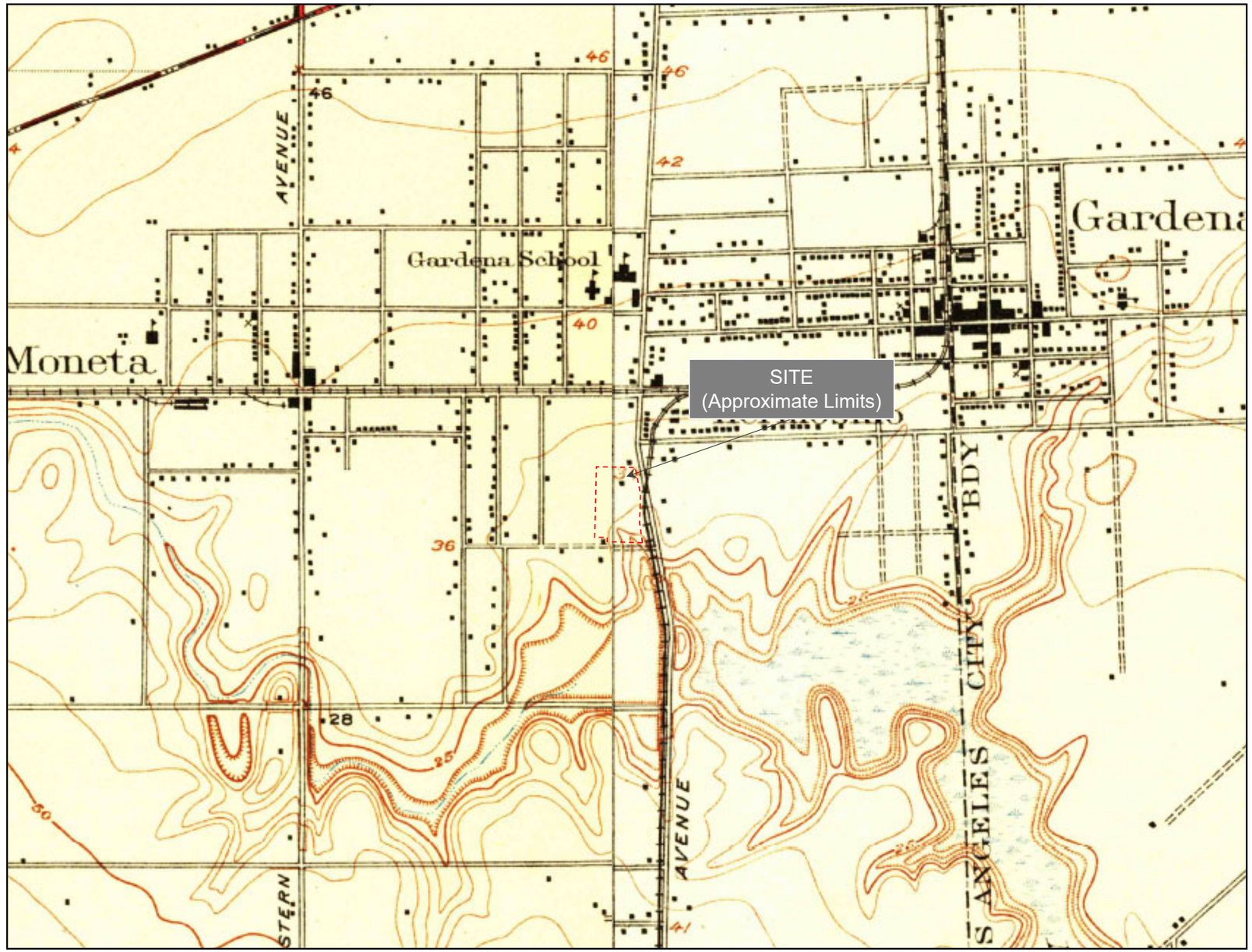
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

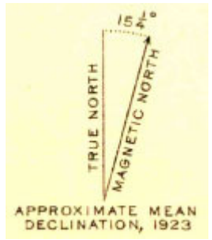
TORRANCE, CALIF.
Edition of 1924.

CALIFORNIA
(LOS ANGELES COUNTY)
COMPTON QUADRANGLE

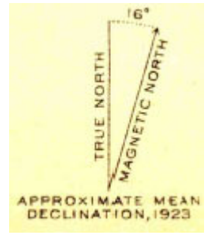
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

COMPTON, CALIF.
Edition of 1924





Contour interval 5 feet.
Datum is mean sea level.



Contour interval 5 feet.
Datum is mean sea level.

5000 4000 3000 2000 1000 0 5000 Feet

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California	Project No: 21-2971	
Hamilton & Associates	Plate No: H-2	Date: October 2021

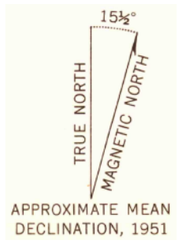
HISTORICAL TOPOGRAPHIC MAP 1950/1951

Lower Map

TORRANCE QUADRANGLE
CALIFORNIA-LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

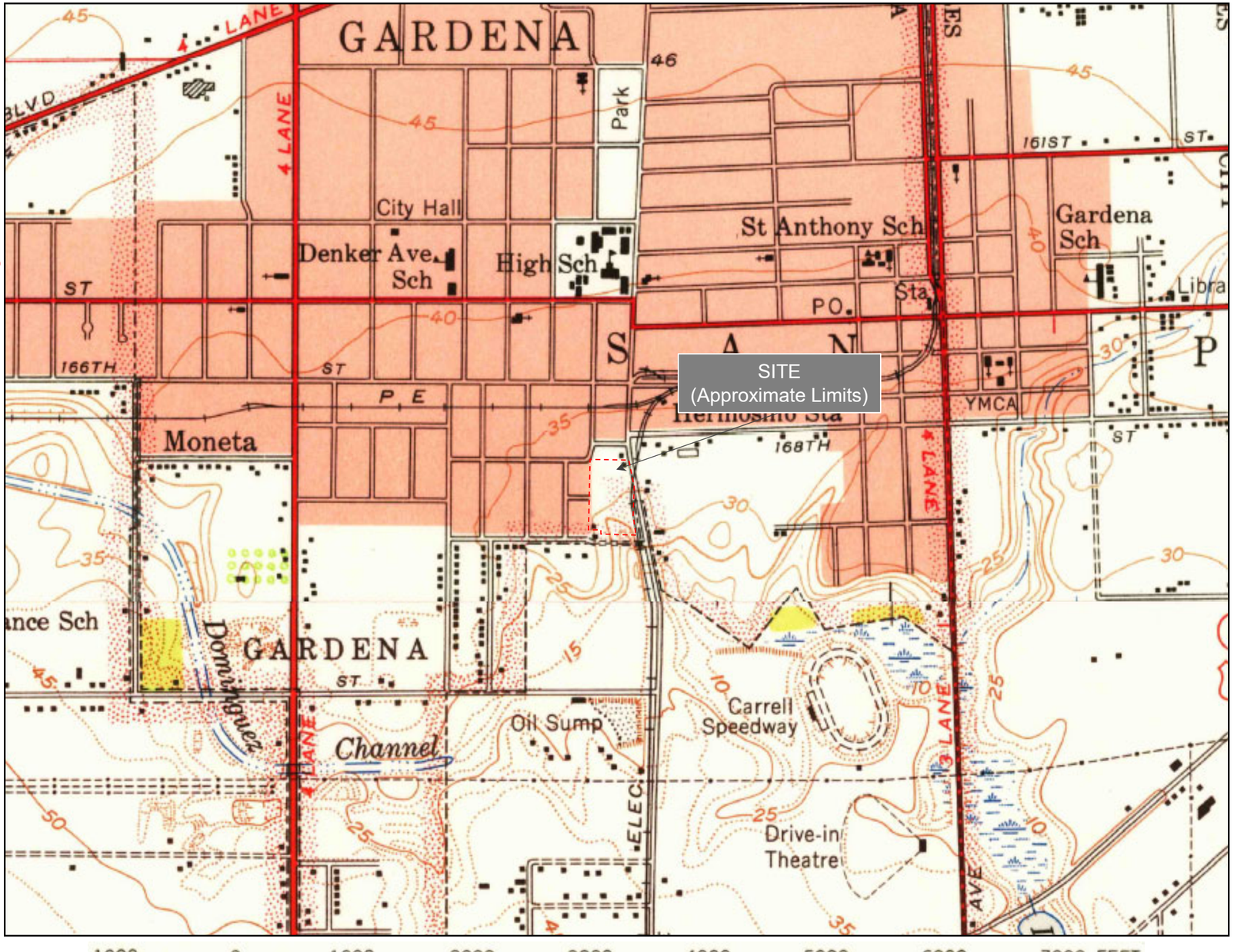
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TORRANCE, CALIF.
N3345—W11815/7.5
1951



APPROXIMATE MEAN
DECLINATION, 1951

CONTOUR INTERVAL 25 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

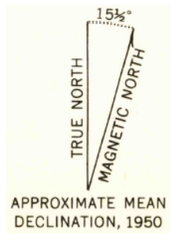


Upper Map

INGLEWOOD QUADRANGLE
CALIFORNIA-LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

INGLEWOOD, CALIF.
N3352.5—W11815/7.5
1950



APPROXIMATE MEAN
DECLINATION, 1950

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-3

Date: October 2021

HISTORICAL TOPOGRAPHIC MAP 1964

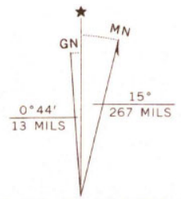
Lower Map

TORRANCE QUADRANGLE
CALIFORNIA—LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

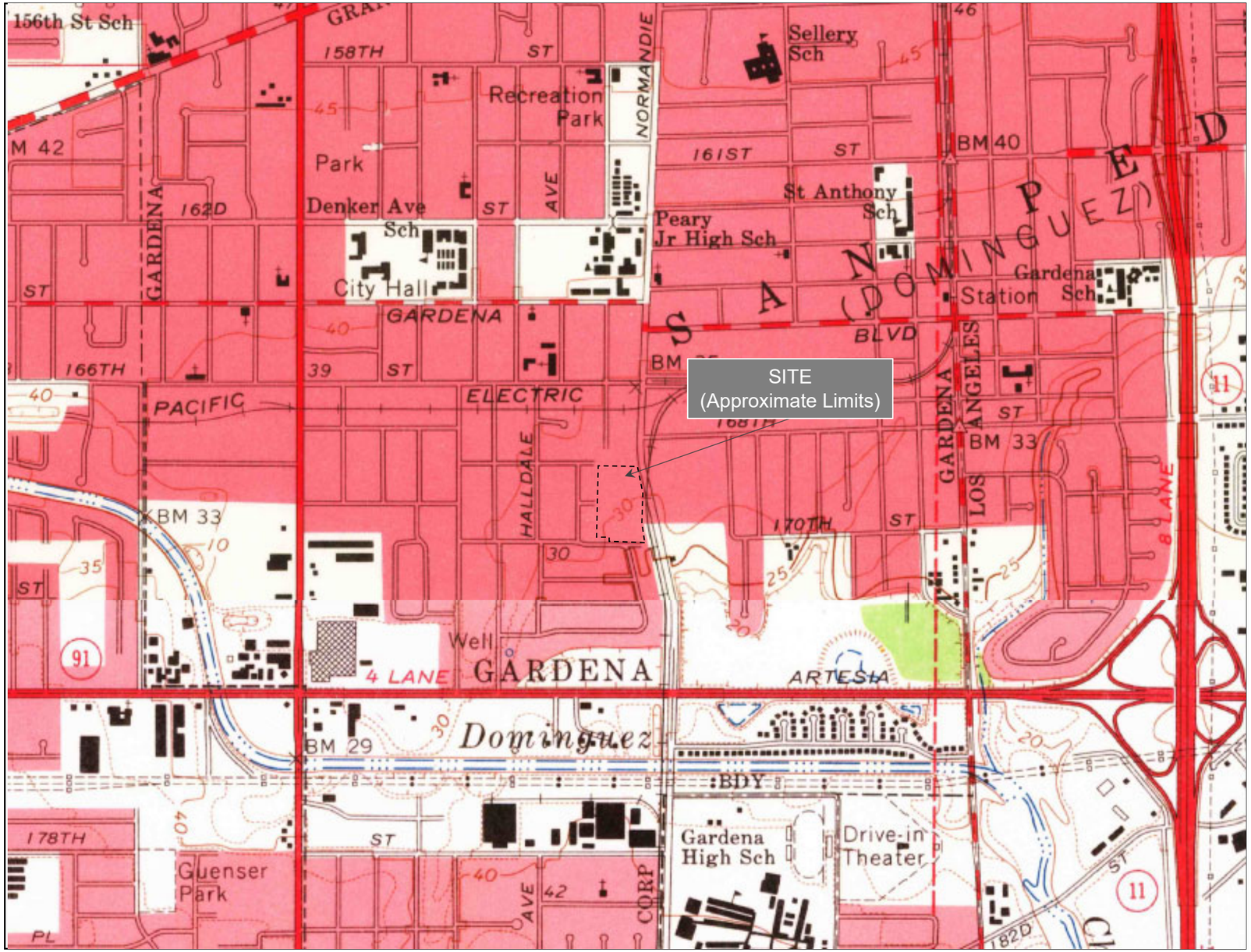
TORRANCE, CALIF.
N3345—11815/7.5

1964



UTM GRID AND 1964 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL



1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

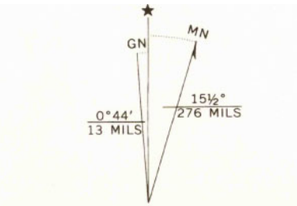
Upper Map

INGLEWOOD QUADRANGLE
CALIFORNIA—LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

INGLEWOOD, CALIF
N3352.5—W11815/7.5

1964



UTM GRID AND 1964 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-4

Date: October 2021

HISTORICAL AERIAL IMAGE 1927





Imagery Report: Flight C-113

Partially Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles, Orange, San Bernardino
Filed by (catalog):	C-113
Filed by (collection):	C-113
Imagery Location:	Map Room--Utility Shelves Off-site storage--UCLA
Index type:	mosaic, SmartIndex
Index scale:	1:135,000
Size:	frames 7 x 9 inches
Height:	7
Width:	9

Begin date:	1927-08-01
End date:	1927-08-31
Scale:	1:18,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	North-South
Altitude:	14,250
Lens focal length:	9.5 inches (241.3mm)
Film type:	Nitrate, Copy
Spectral range:	400-700nm

Note:
Los Angeles County south of Santa Monica Mountains and Interstate 210 and Orange County west of SR 133; vicinity of Chino Hills. Overlap within flightlines in not consistent. Copy negatives acquired from Teledyne, Inc., 1986; nitrate negatives and prints acquired from Whittier College, January 2013. Nitrate negatives scanned, 2015.

Physical Details:	black and white; paper prints; negative transparencies; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Contractor/requestor:	Standard Oil Company
Acquired from:	Teledyne Inc.; Whittier College
Est. frame count:	743

Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

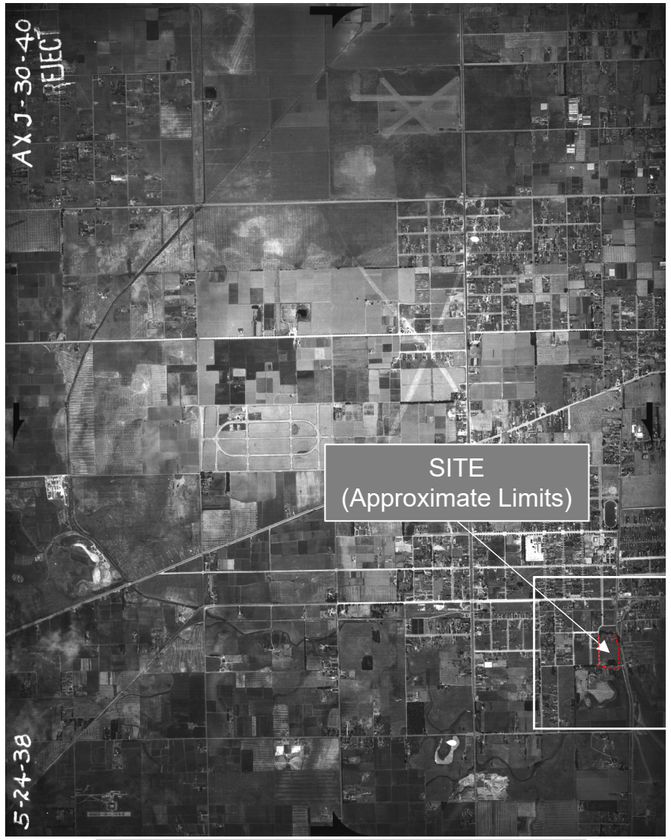
Project No: 21-2971

Hamilton & Associates

Plate No: H-5

Date: October 2021

HISTORICAL AERIAL IMAGE 1938



Imagery Report: Flight AXJ-1938
Digital
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	AXJ-1938
Filed by (collection):	AXJ-1938
Imagery Location:	Map Room--Utility Shelves Room 2552
Index type:	line
Index scale:	1:100,000
Size:	frames 7.25 X 9.25 inches

Begin date:	1938-05-22
End date:	1938-07-28
Scale:	1:20,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	East-West
Altitude:	13,750
Lens focal length:	8.25 inches
Spectral range:	400-700 nm.
Generation held:	2nd generation

Note:
Diapositives purchased from King Visual Technology; paper prints acquired from Whittier College, January 2013. Some analog frames in this flight are filed under AXK-1938 or AXL-1938.

Physical Details:	black and white; paper prints; positive transparencies; cut frame; vertical view;
Copyright:	Reproduction rights held by the Regents of the University of California.
Flown by:	Laval Company Inc.
Contractor/requestor:	USDA, Agricultural Adjustment Administration
Acquired from:	National Archives & Records Administration; Whittier College
Est. frame count:	1245



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-6

Date: October 2021

HISTORICAL AERIAL IMAGE 1941



Imagery Report: Flight C-6972

Partially Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	C-6972
Filed by (collection):	C-6972
Imagery Location:	Map Room--Utility Shelves Room 2552 Off-site storage--UCLA
Index type:	line, SmartIndex
Index scale:	1:50,000
Size:	frames 9 X 9 inches
Height:	9
Width:	9

Begin date:	1941-03-06
End date:	1941-03-06
Scale:	1:12,000
Overlap:	60%
Sidelap:	40%
Altitude:	12,000
Lens focal length:	12 inches
Film type:	Nitrate
Spectral range:	400-700 nm
Generation held:	1st and 2nd generation

Note:
Vicinity of Carson and Avalon Village: Wilmington oil facility. Imagery acquired 1986 and January 2013.

Physical Details:	black and white; paper prints; positive transparencies; negative transparencies; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Contractor/requestor:	Dominguez Estate Company
Acquired from:	Teledyne, Inc.; Whittier College
Est. frame count:	57



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

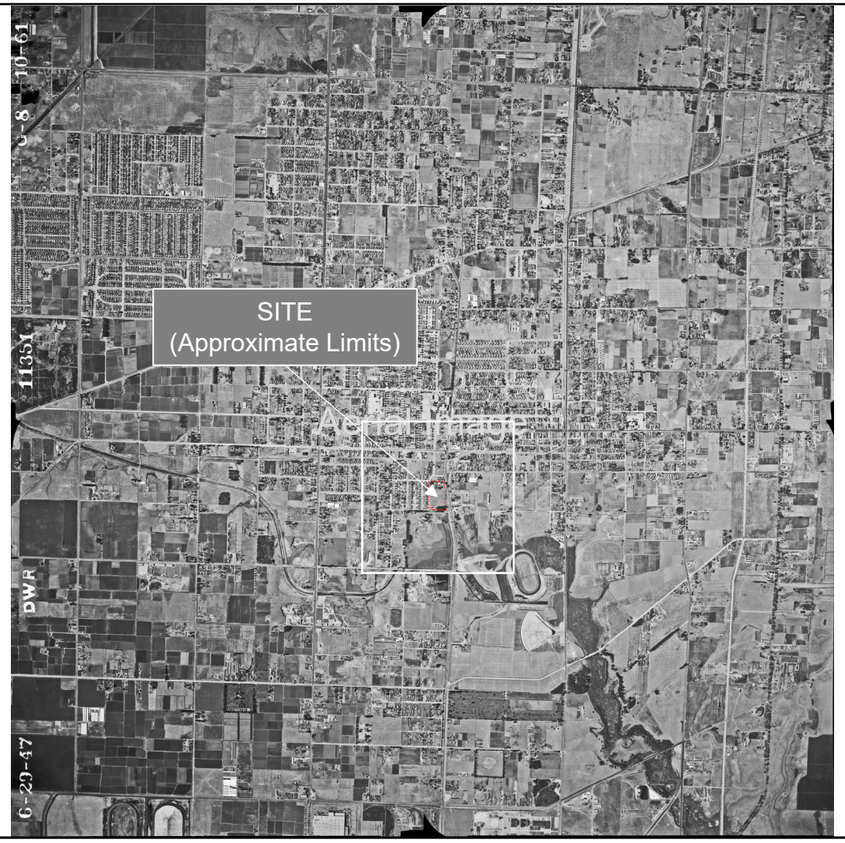
Project No: 21-2971

Hamilton & Associates

Plate No: H-7

Date: October 2021

HISTORICAL AERIAL IMAGE 1947



Imagery Report: Flight C-11351

Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles, Orange
Filed by (catalog):	C-11351
Filed by (collection):	C-11351
Imagery Location:	Map Room--Utility Shelves Room 2552
Index type:	mosaic, SmartIndex
Index scale:	1:100,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1947-05-01
End date:	1947-07-01
Scale:	1:24,000
Overlap:	60%
Sidelap:	10%
Directional orientation:	East-West
Altitude:	16,500
Lens focal length:	8.25 inches (209.55mm)
Camera:	Fairchild
Film type:	Copy
Spectral range:	400-700nm
Generation held:	1st and 2nd generation

Note:
Los Angeles County, south of Santa Monica Mountains; Orange County, west of Highway 55. Imagery acquired 1986 and January 2013. MIL has additional frames not shown on index.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Contractor/requestor:	State of California, Department of Public Works, Division of Water Resources
Acquired from:	Teledyne, Inc.; Whittier College
Est. frame count:	602



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

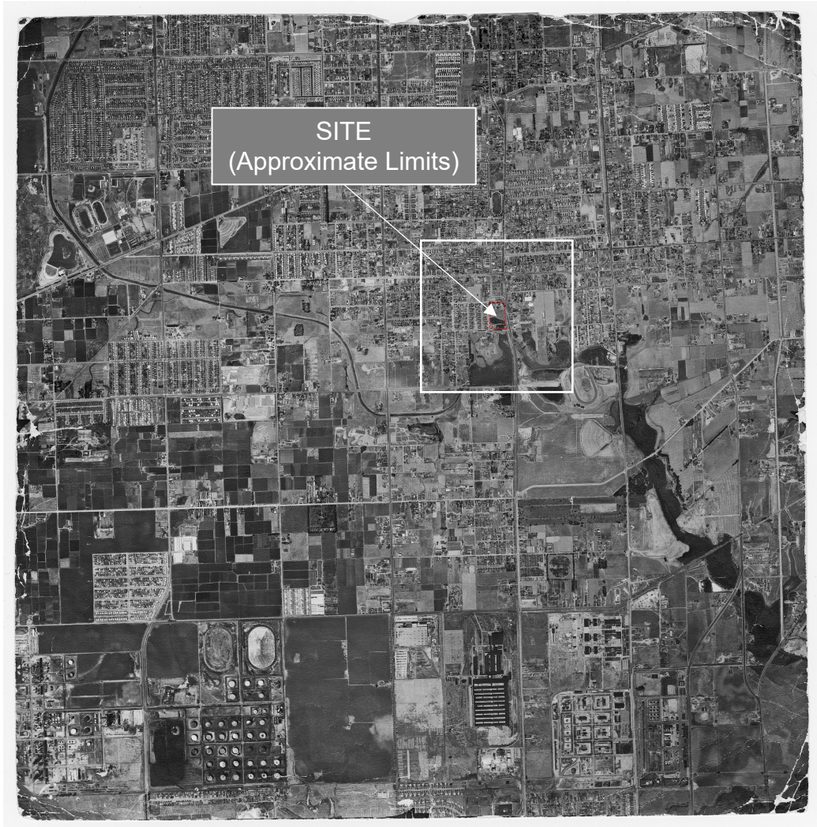
Project No: 21-2971

Hamilton & Associates

Plate No: H-8

Date: October 2021

HISTORICAL AERIAL IMAGE 1951



Imagery Report: Flight C-16580
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	C-16580
Filed by (collection):	C-16580
Imagery Location:	Map Room--Utility Shelves
Index type:	mosaic, SmartIndex
Size:	9 x 9 inches

Begin date:	1951-05-28
End date:	1951-05-28
Scale:	1:24,000
Overlap:	60
Lens focal length:	8.25 inches
Film type:	Copy

Note:
West Los Angeles to El Segundo and Gardena areas. Imagery acquired January 2013.

Physical Details:	black and white; paper prints; vertical view;
Copyright:	Copyright © UC Regents
Flown by:	Fairchild Aerial Surveys
Contractor/requestor:	O'Melveny & Myers
Acquired from:	Whittier College
Est. frame count:	38



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-9

Date: October 2021

HISTORICAL AERIAL IMAGE 1952



Imagery Report: Flight AXJ-1952

Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	AXJ-1952
Filed by (collection):	AXJ-1952
Imagery Location:	Map Room--Utility Shelves
Index type:	mosaic
Index scale:	1:63,360
Size:	frames 9 X 9 inches

Begin date:	1952-11-03
End date:	1954-10-28
Scale:	1:20,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	North-South
Platform id:	Aircraft
Lens focal length:	8.25 inches (209.55mm)
Camera:	mapping camera
Film type:	Panchromatic
Generation held:	2nd generation

Note:
Flight covers entire county, including Santa Catalina Island and San Clemente Island.

Physical Details:	black and white; paper prints; vertical view;
Copyright:	Reproduction rights held by the Regents of the University of California.
Flown by:	Pacific Air Industries
Contractor/requestor:	USDA - Production and Marketing Administration
Acquired from:	USDA (gift to MIL).
Est. frame count:	2388



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-10

Date: October 2021

HISTORICAL AERIAL IMAGE 1956



Imagery Report: Flight C-22555

Digital

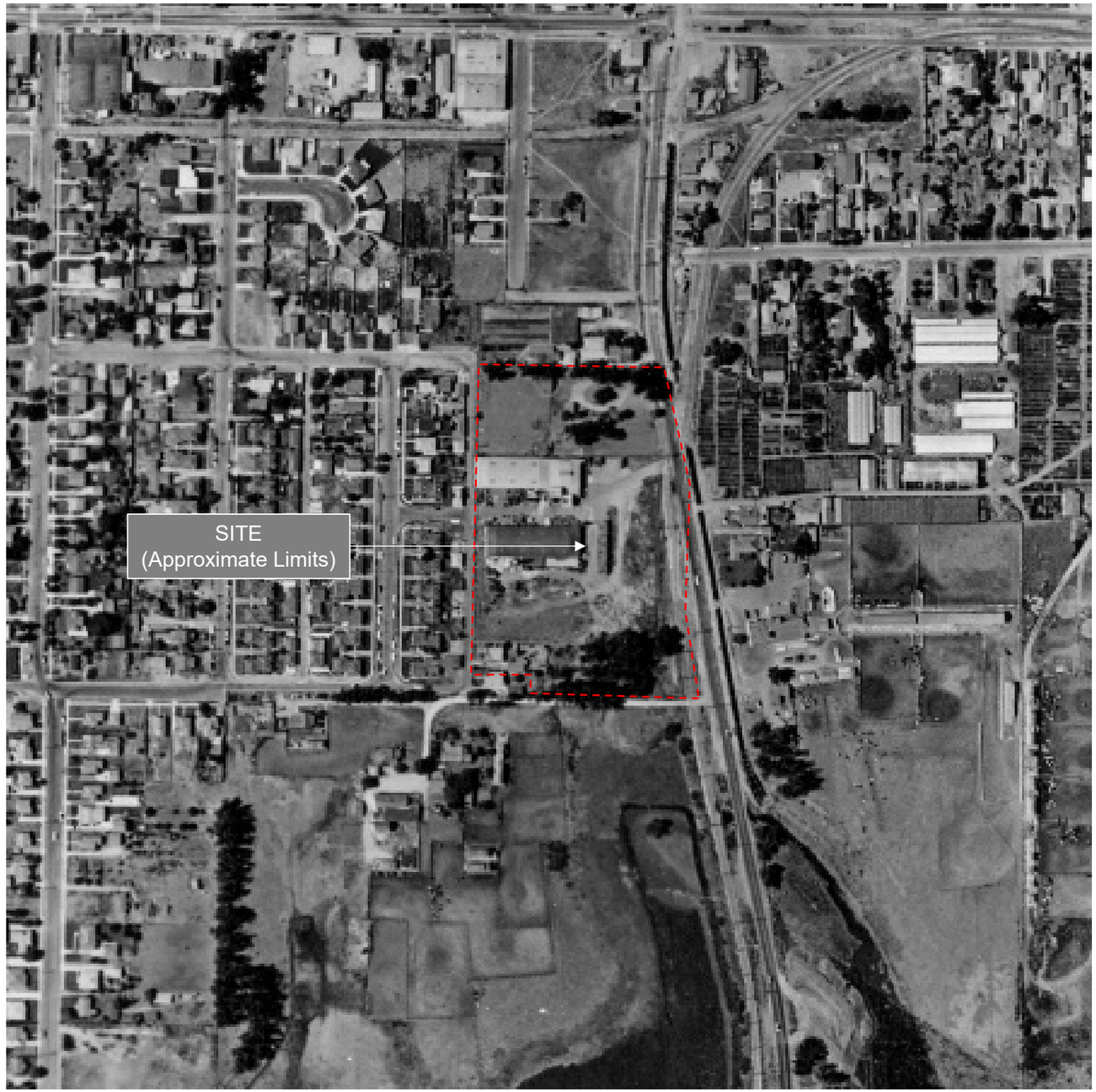
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles, Orange, Ventura
Filed by (catalog):	C-22555
Filed by (collection):	C-22555
Imagery Location:	Map Room--Utility Shelves Room 2552
Index type:	mosaic, SmartIndex
Index scale:	1:140,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1956-07-01
End date:	1956-09-30
Scale:	1:14,400
Scale:	1:12,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	East-West
Altitude:	14,400
Lens focal length:	12 inches (304.8mm)
Film type:	Camera, Copy
Generation held:	1st and 2nd generation

Note:
Photographs and negatives are 1:14,400. Flight also exists as a 3-volume bound atlas of orthophoto quarter (scale: ~1:12,000) quadrangles (stored offsite). Imagery acquired from Whittier College, January 2013.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Acquired from:	Teledyne, Inc.; Whittier College
Est. frame count:	1193



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-11

Date: October 2021

HISTORICAL AERIAL IMAGE 1960



Imagery Report: Flight C-23870

Digital

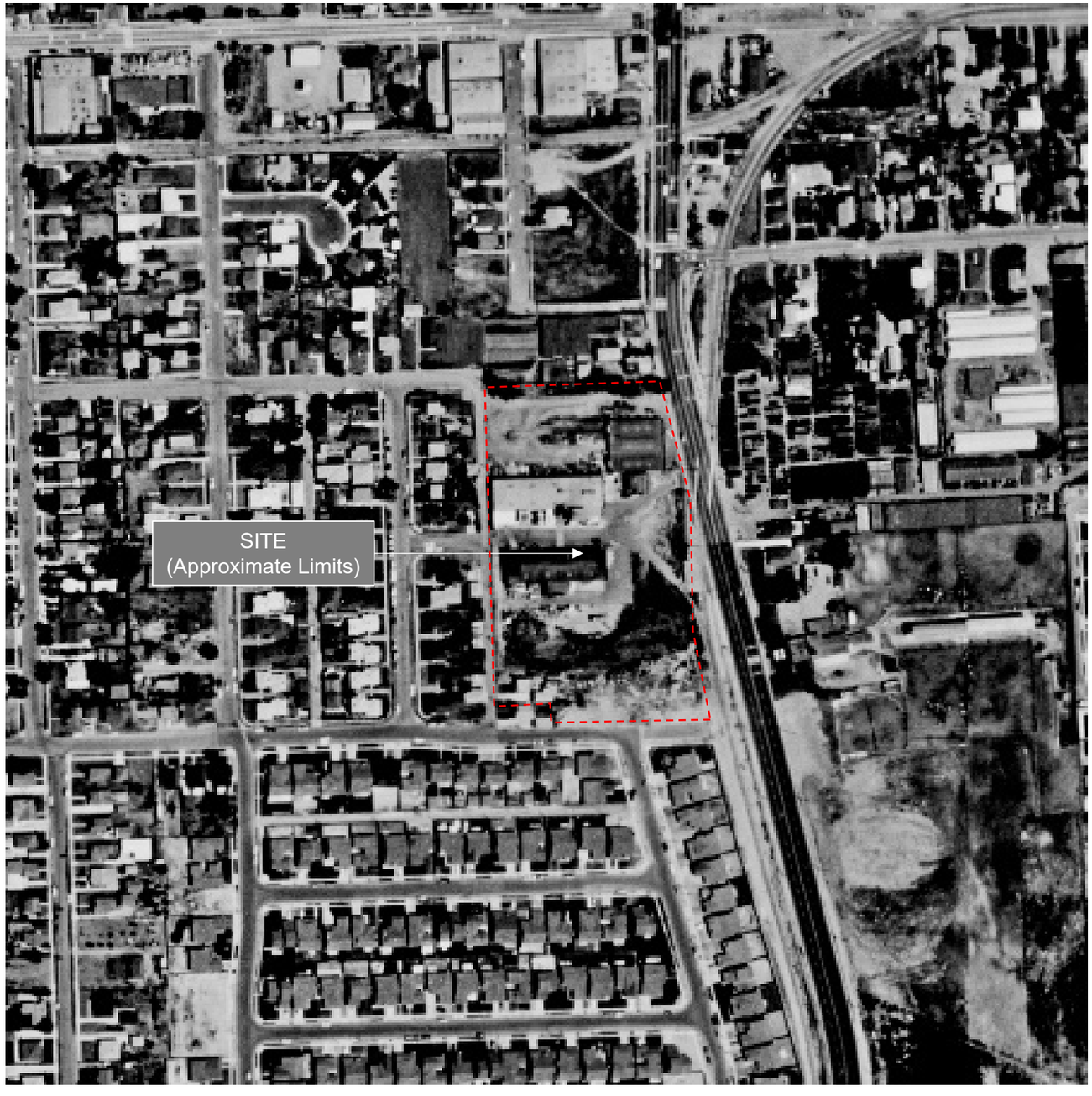
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura
Filed by (catalog):	C-23870
Filed by (collection):	C-23870
Imagery Location:	Map Room--Utility Shelves Room 2552 Refrigerators
Index type:	mosaic
Index scale:	1:72,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1960-05-01
End date:	1960-07-31
Scale:	1:14,400
Overlap:	60%
Sidelap:	20%
Directional orientation:	East-West
Altitude:	7,200
Lens focal length:	6 inches (152.4mm)
Film type:	Camera, Copy
Spectral range:	400-700nm
Generation held:	1st and 2nd generation

Note:
Paper prints stored at Annex2. Roll C-23870-16, 17 has "vinegar syndrome". Imagery acquired from Whittier College, January 2013.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Acquired from:	Teledyne, Inc; Whittier College
Est. frame count:	2790



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-12

Date: October 2021

HISTORICAL AERIAL IMAGE 1962



Imagery Report: Flight C-24400

Digital

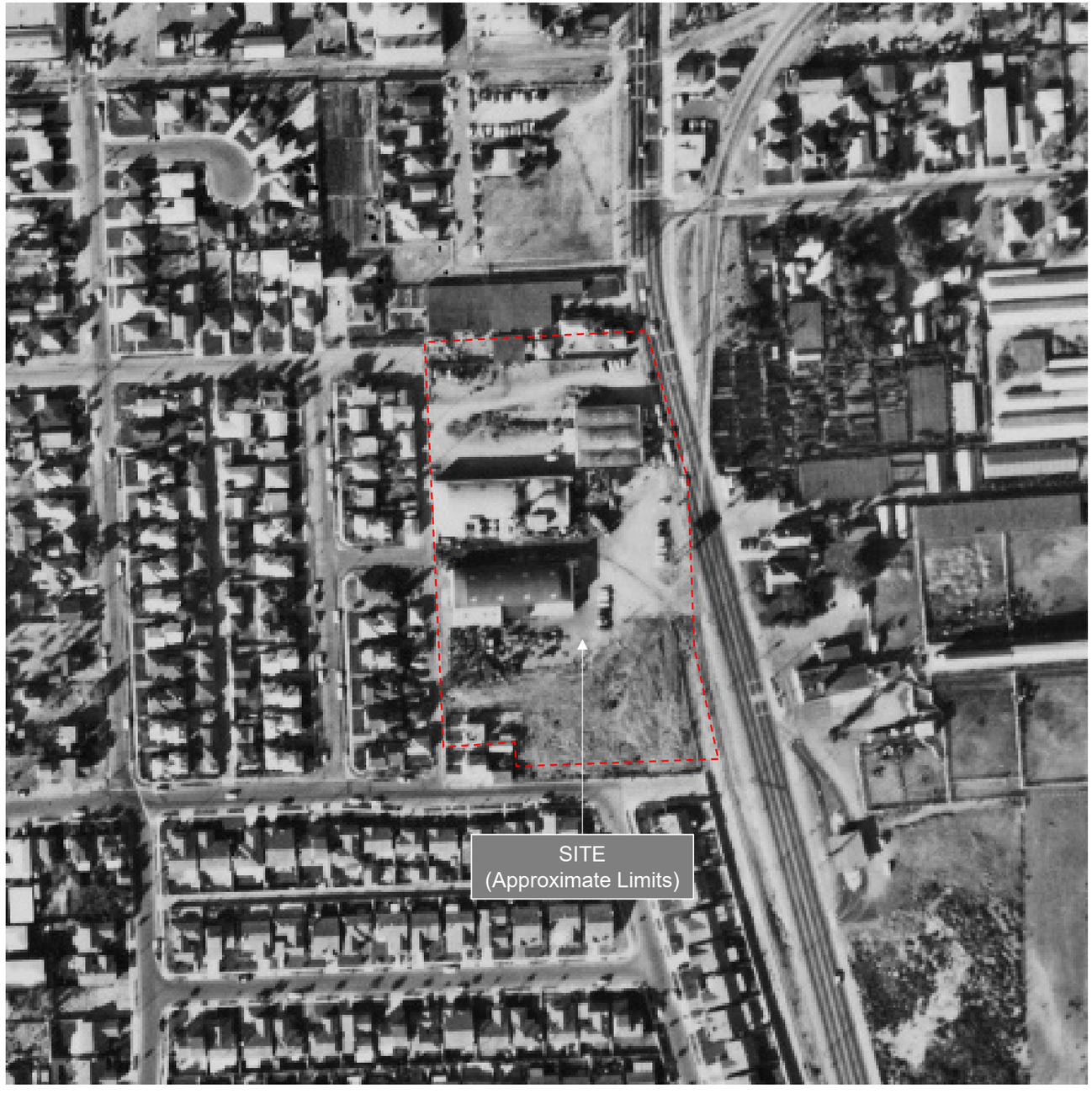
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	C-24400
Filed by (collection):	C-24400
Imagery Location:	Map Room--Utility Shelves
Index type:	mosaic, SmartIndex
Index scale:	1:48,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1962-10-01
End date:	1962-11-30
Scale:	1:12,000
Overlap:	40%
Sidelap:	20%
Film type:	Copy
Spectral range:	400-700nm
Generation held:	2nd generation

Note:
Imagery acquired from Whittier College, January 2013.

Physical Details:	black and white; paper prints; negative transparencies; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Contractor/requestor:	Los Angeles Department of Water and Power
Acquired from:	Teledyne, Inc.; Whittier College
Est. frame count:	358



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-13

Date: October 2021

HISTORICAL AERIAL IMAGE 1965



Imagery Report: Flight C-25019

Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	C-25019
Filed by (collection):	C-25019
Imagery Location:	Map Room--Utility Shelves Room 2552
Index type:	smartindex
Index scale:	1:100,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1965-09-22
End date:	1965-11-28
Scale:	1:24,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	East-West
Spectral range:	400-700nm
Generation held:	1st and 2nd generation

Note:
Southwest region of the county. Imagery acquired 1986.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Fairchild Aerial Surveys
Acquired from:	Teledyne Inc.
Est. frame count:	489



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-14

Date: October 2021

HISTORICAL AERIAL IMAGE 1971



Imagery Report: Flight TG-2755

Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	TG-2755
Filed by (collection):	TG-2755
Imagery Location:	Map Room--Utility Shelves Off-site storage--Iron Mountain
Index type:	line
Index scale:	1:62,500
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1971-03-01
End date:	1971-04-30
Scale:	1:10,440
Overlap:	60%
Sidelap:	20%
Directional orientation:	Various
Altitude:	5,220
Lens focal length:	6 inches
Generation held:	1st and 2nd generations

Note:
Index states flight is color infrared; negatives and prints held in MIL's collection are black and white.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Teledyne Geotronics
Contractor/requestor:	Remote Sensing Community Analysis Bureau, City of Los Angeles
Acquired from:	Teledyne, Inc.
Est. frame count:	1199



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

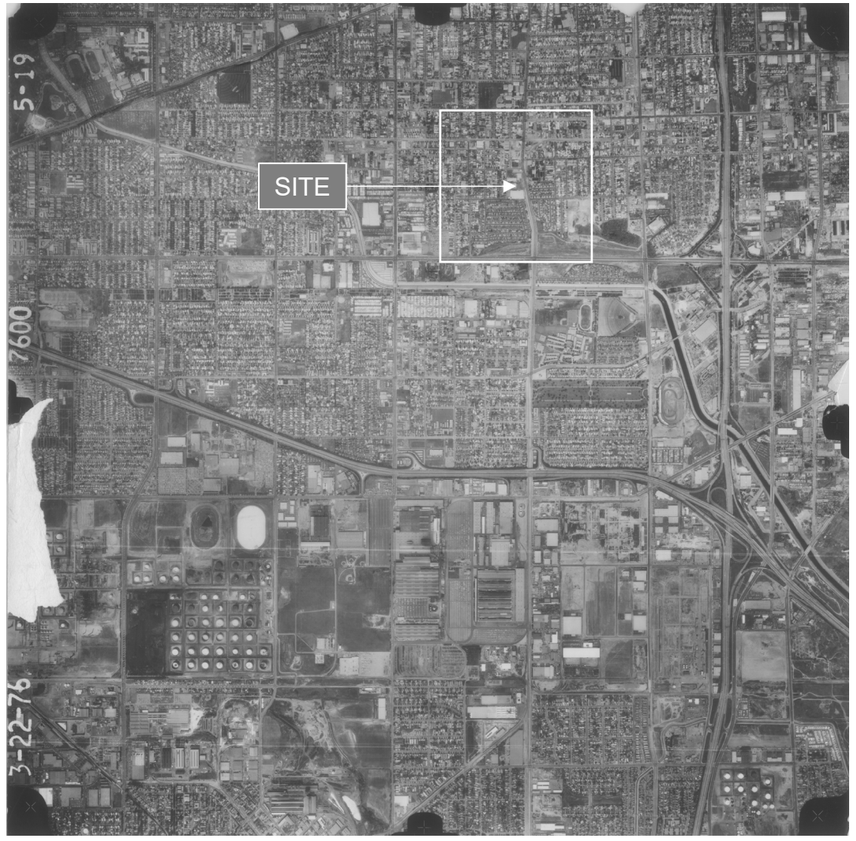
Project No: 21-2971

Hamilton & Associates

Plate No: H-15

Date: October 2021

HISTORICAL AERIAL IMAGE 1976



Imagery Report: Flight TG-7600

Digital

View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles, Orange, San Bernardino, Ventura
Filed by (catalog):	TG-7600
Filed by (collection):	TG-7600
Imagery Location:	Map Room--Utility Shelves Off-site storage--Iron Mountain Room 2552
Index type:	mosaic
Index scale:	1:96,000
Size:	frames 9 X 9 inches

Begin date:	1976-02-01
End date:	1976-04-30
Scale:	1:24,000
Overlap:	60%
Sidelap:	20%
Directional orientation:	East-West
Altitude:	12,000
Lens focal length:	6 inches (152.4mm)
Generation held:	1st and 2nd generations

Note:
South Los Angeles County: LA Basin, San Fernando Valley, and Santa Clarita Valley to Castaic Lake. Coverage extends into Orange, San Bernardino, and Ventura counties.

Physical Details:	black and white; paper prints; negative transparencies; film roll; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Flown by:	Teledyne Geotronics
Acquired from:	Teledyne, Inc.
Est. frame count:	780



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

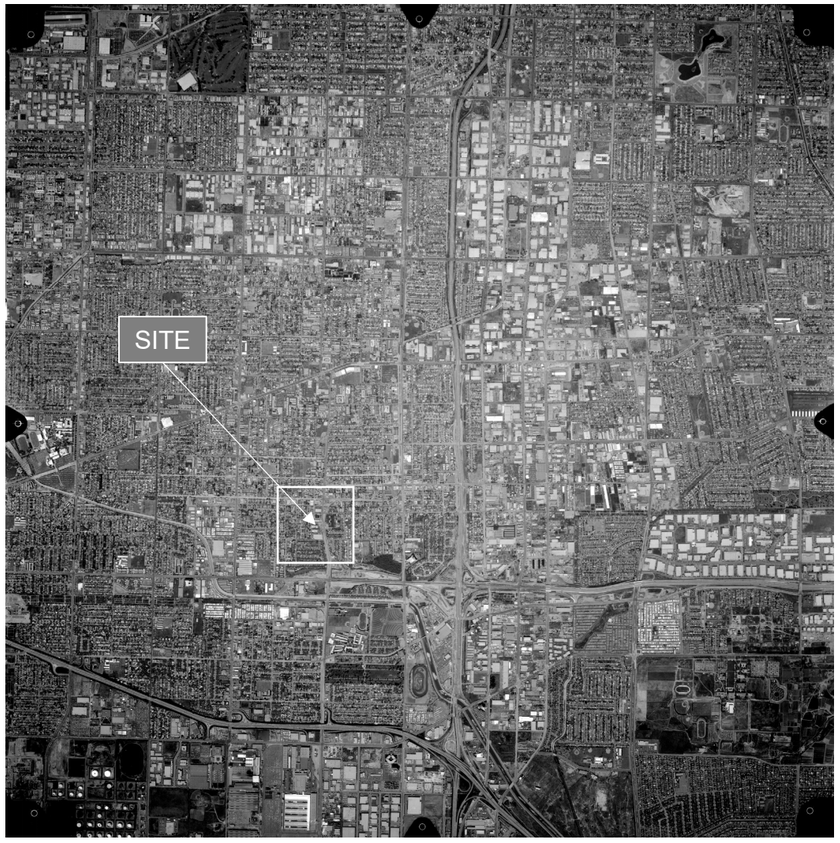
Project No: 21-2971

Hamilton & Associates

Plate No: H-16

Date: October 2021

HISTORICAL AERIAL IMAGE 1983



Imagery Report: Flight AMI-LA-83
Digital
View Index

Country:	United States
State(s):	California
Counties:	California: Los Angeles
Filed by (catalog):	AMI-LA-83
Filed by (collection):	AMI-LA-83
Imagery Location:	Room 2552
Index type:	line, SmartIndex
Index scale:	1:245,000
Size:	frames 9 x 9 inches
Height:	9
Width:	9

Begin date:	1983-04-14
End date:	1983-06-18
Scale:	1:36,000
Overlap:	50%
Sidelap:	20%
Altitude:	18,000
Lens focal length:	6 inches (151.62mm), UAg 1027
Generation held:	1st generation

Note:
Los Angeles Basin and San Fernando Valley.

Physical Details:	black and white; negative transparencies; cut frame; vertical view;
Copyright:	Copyright © UC Regents. All Rights Reserved.
Contractor/requestor:	Aerial Map Industries
Acquired from:	Landiscor Aerial Information
Est. frame count:	131



Project: 16911 Normandie Associates, LLC – 16831 & 16911 S. Normandie Avenue, Gardena, California

Project No: 21-2971

Hamilton & Associates

Plate No: H-17

Date: October 2021

APPENDIX B

LIQUEFACTION ANALYSIS

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

Project title : 21-2971 16911 Normandie Associates, LLC

Location :

Overall vertical settlements report

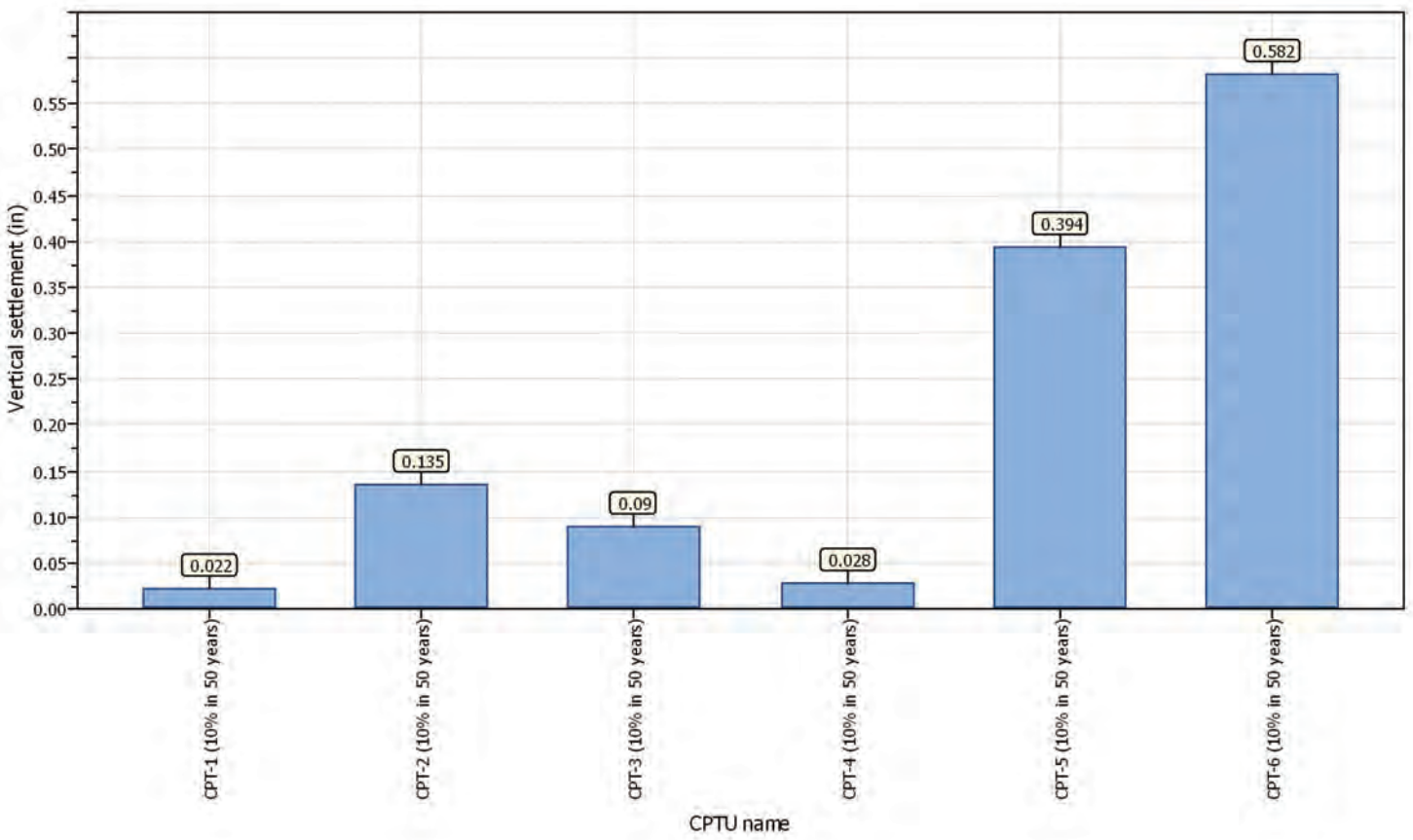


TABLE OF CONTENTS

CPT-1 (10% in 50 years) results
Summary data report 1

CPT-2 (10% in 50 years) results
Summary data report 7

CPT-3 (10% in 50 years) results
Summary data report 13

CPT-4 (10% in 50 years) results
Summary data report 19

CPT-5 (10% in 50 years) results
Summary data report 25

CPT-6 (10% in 50 years) results
Summary data report 31

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

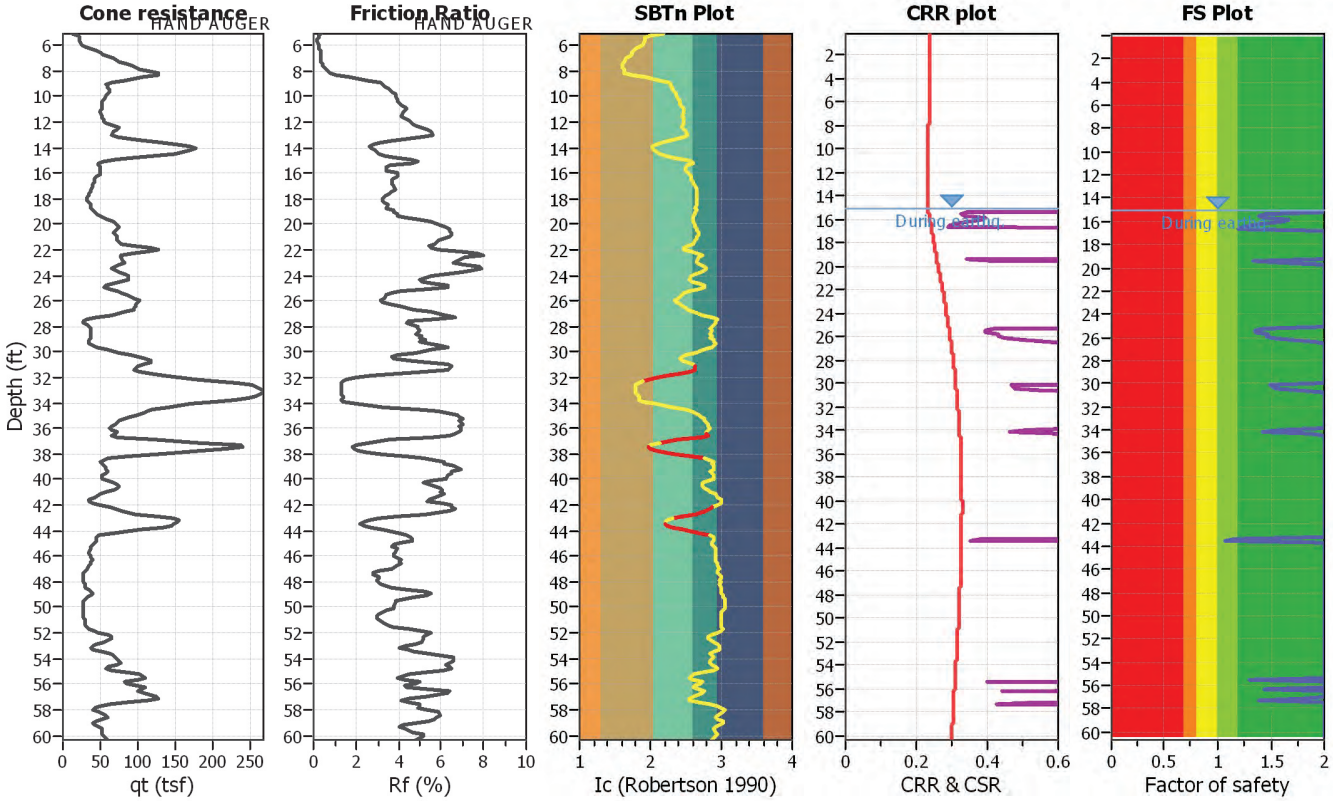
LIQUEFACTION ANALYSIS REPORT

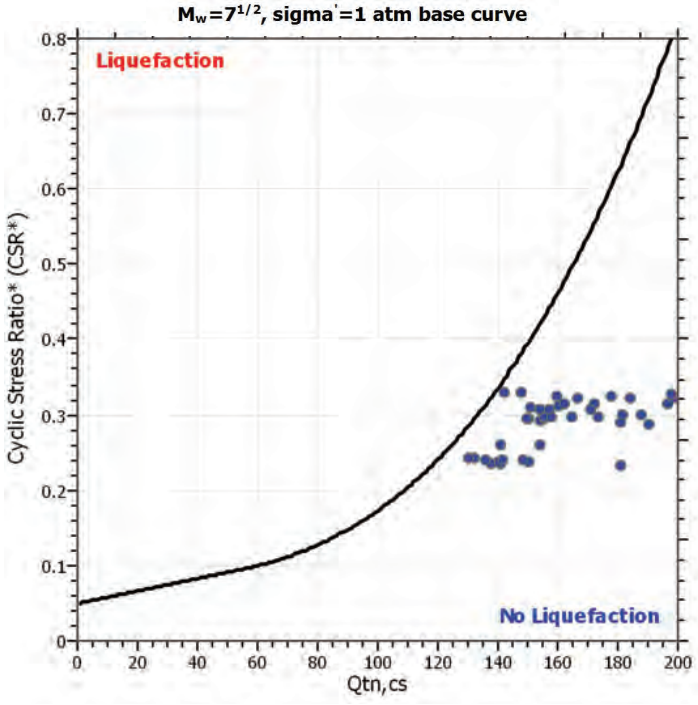
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

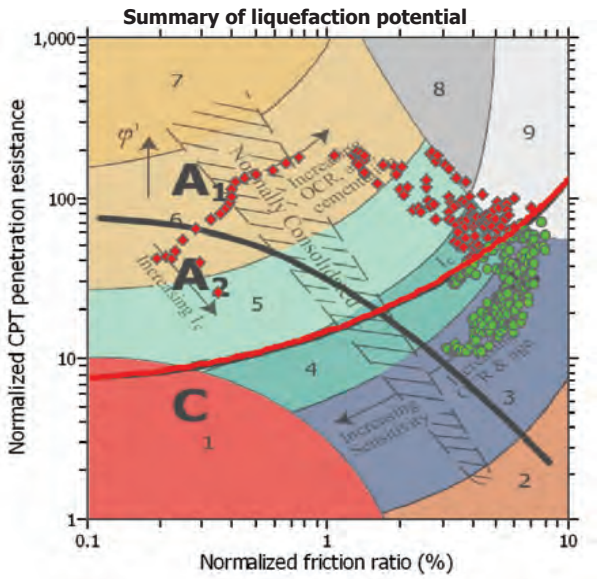
CPT file : CPT-1 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

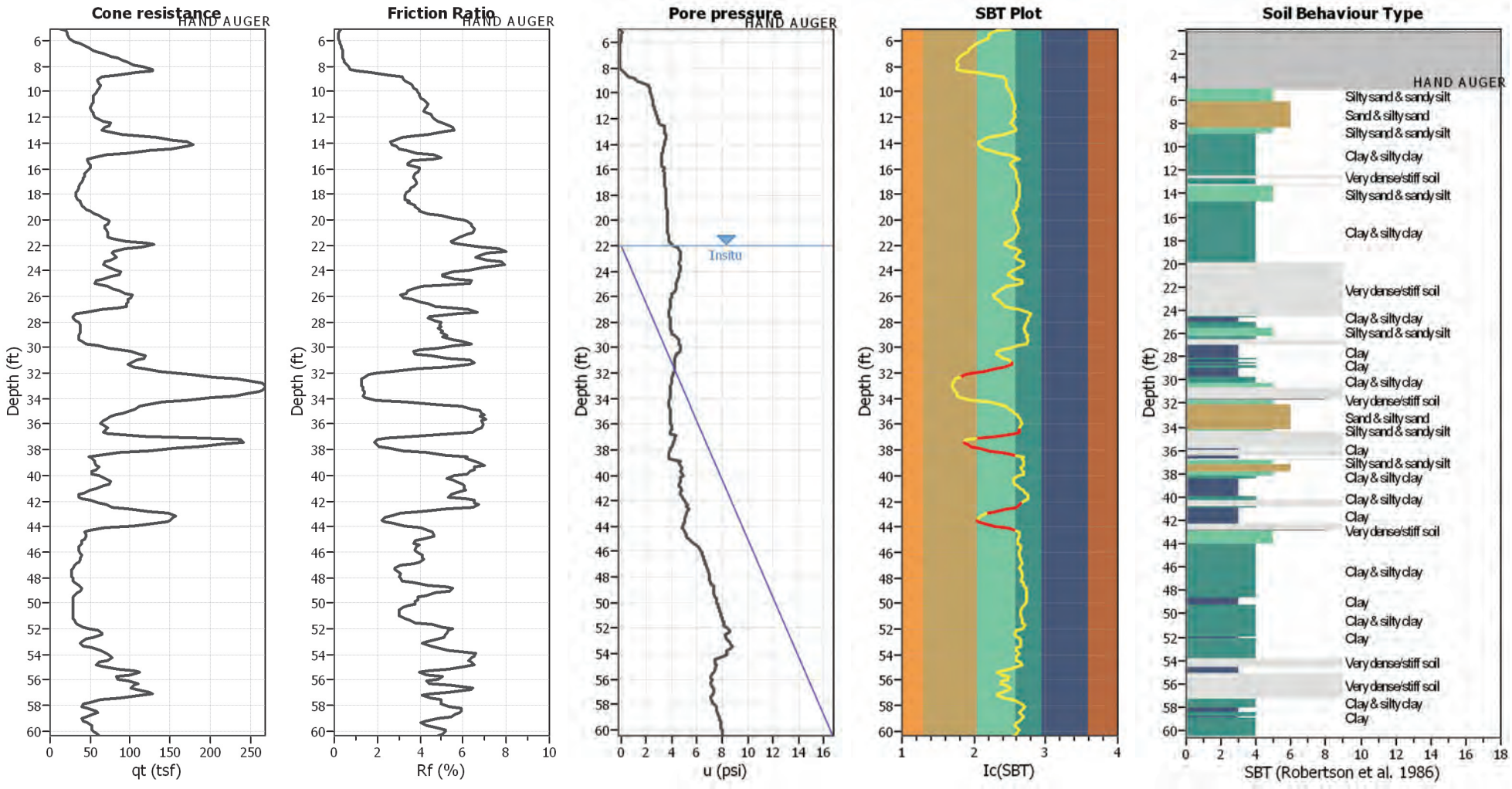






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



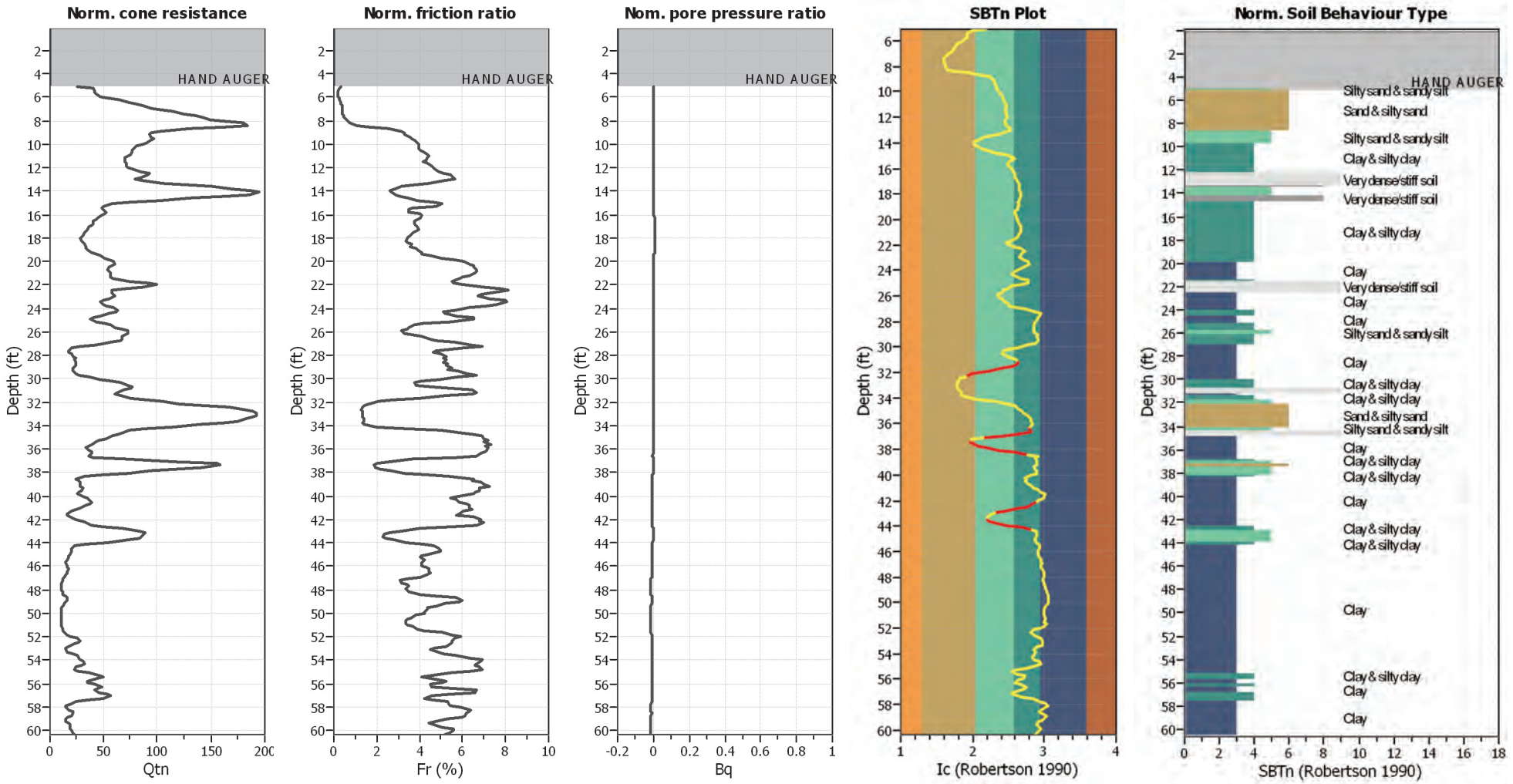
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



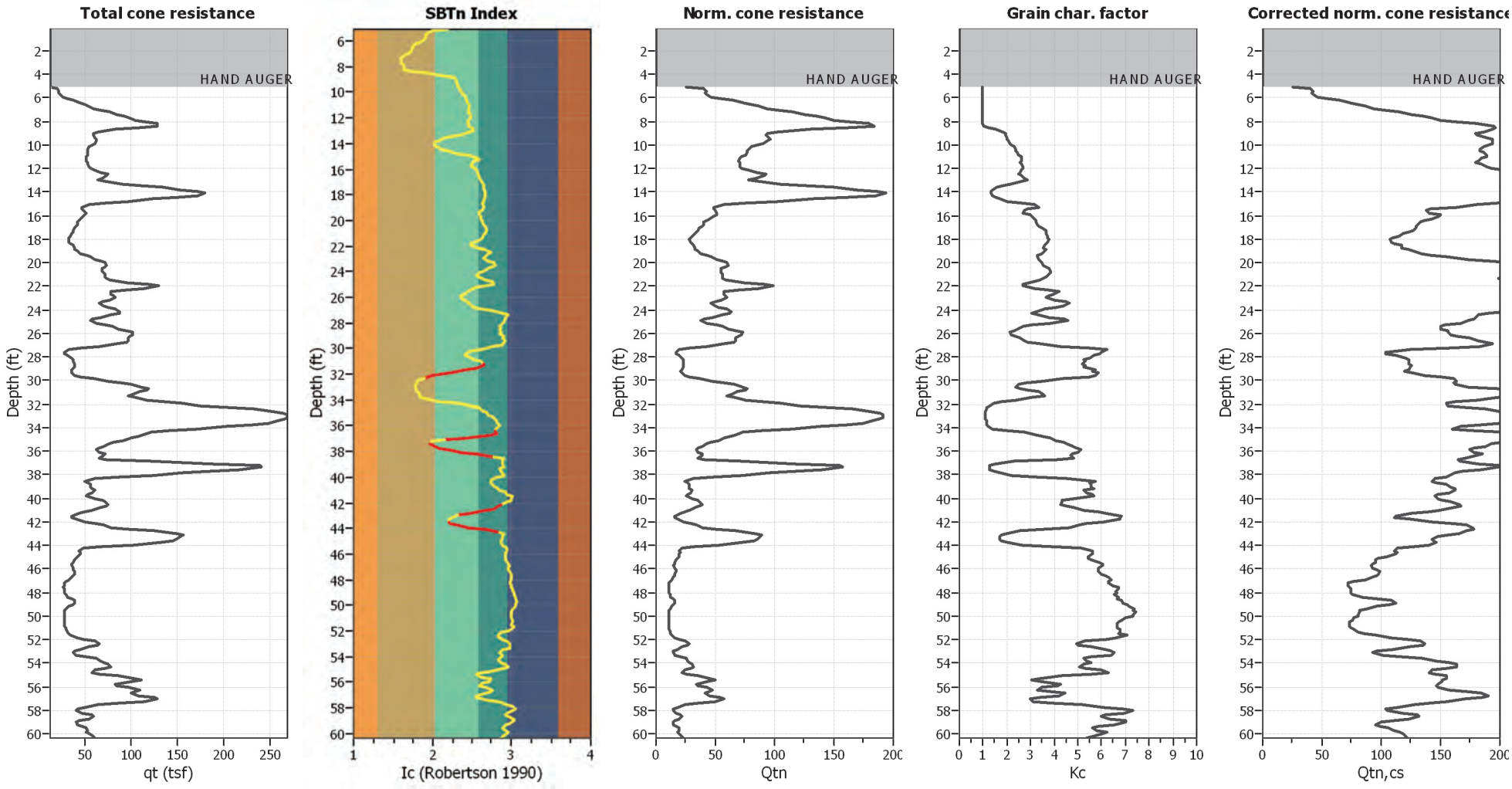
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

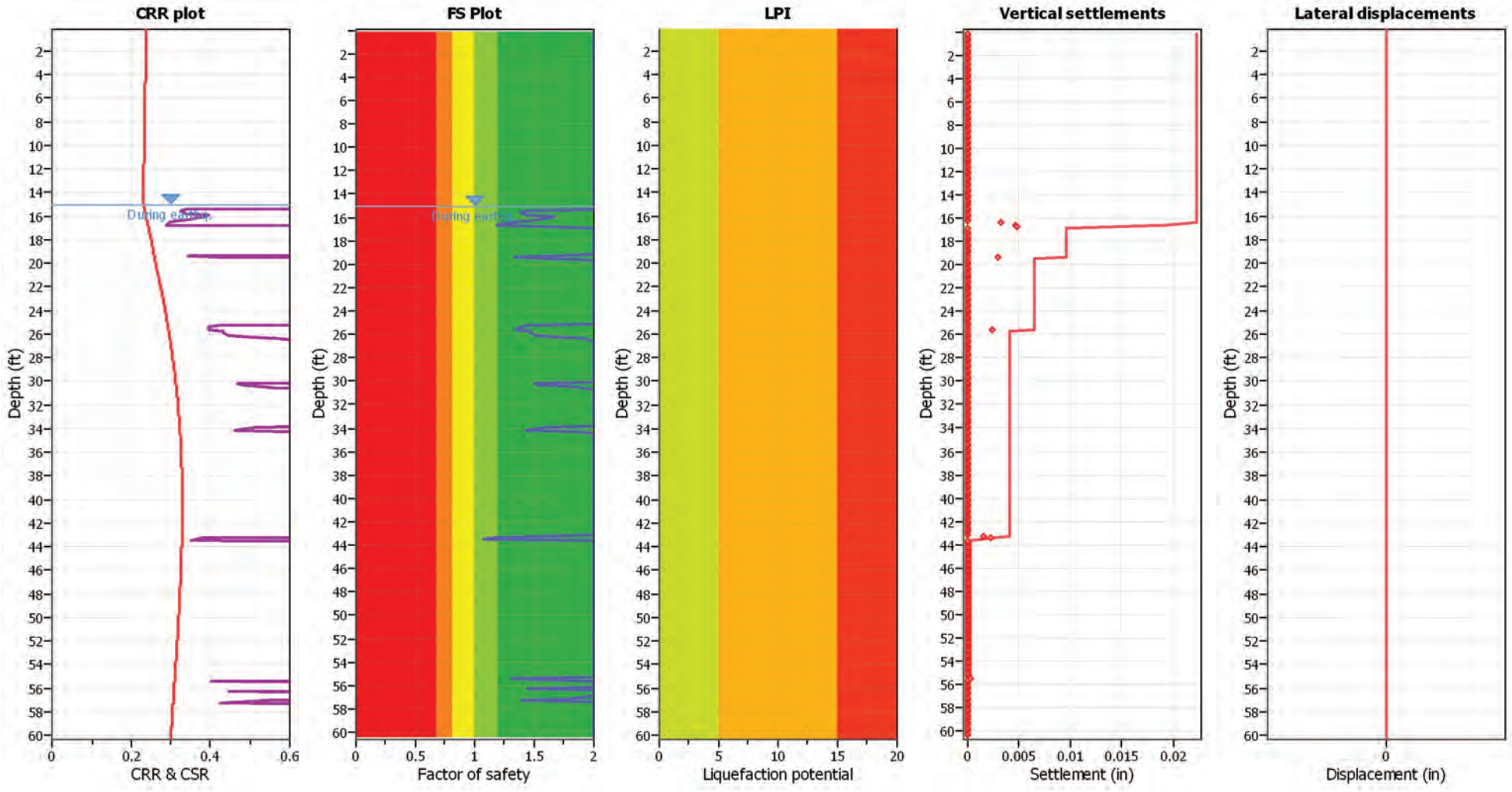
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

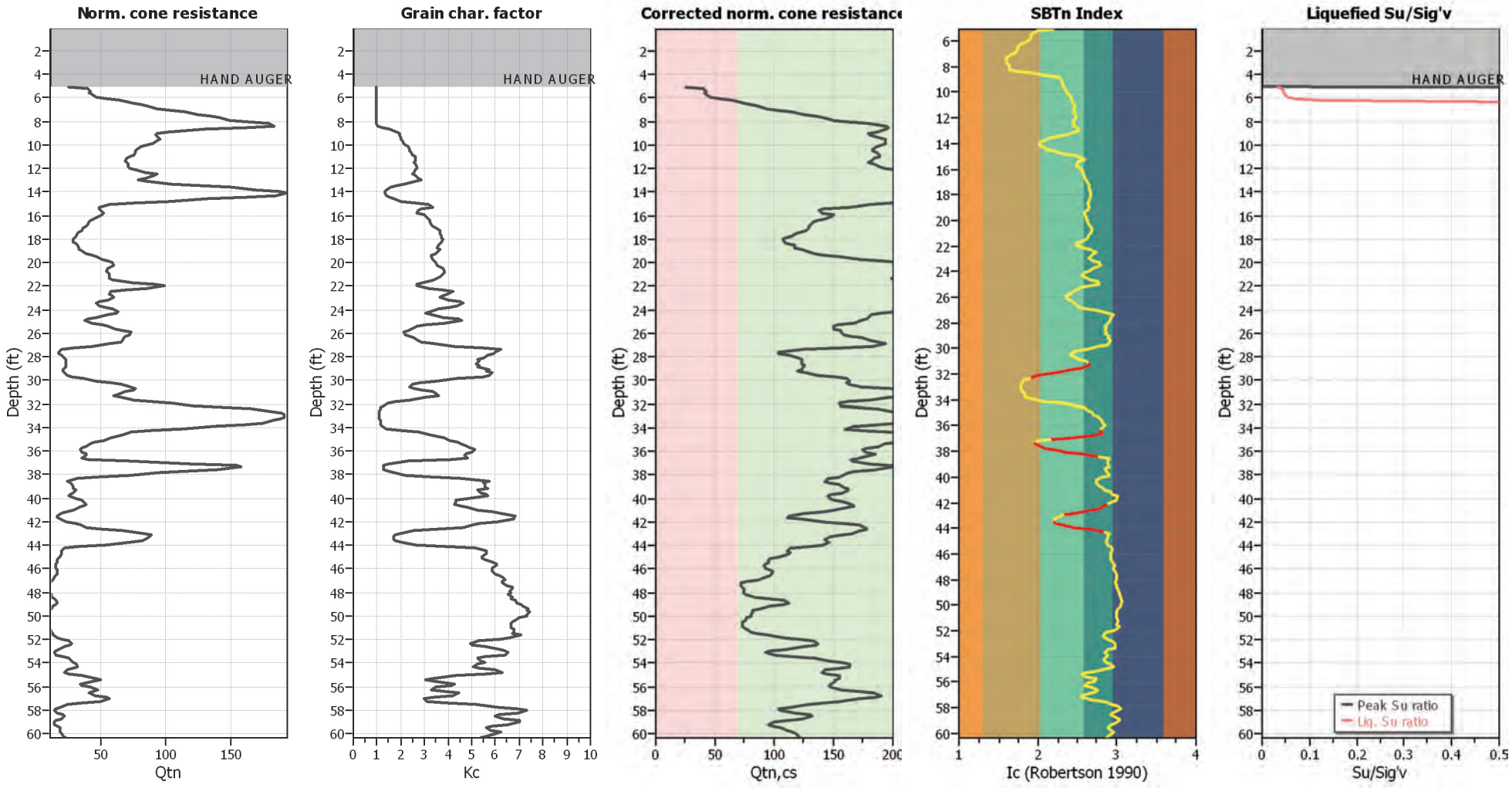
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

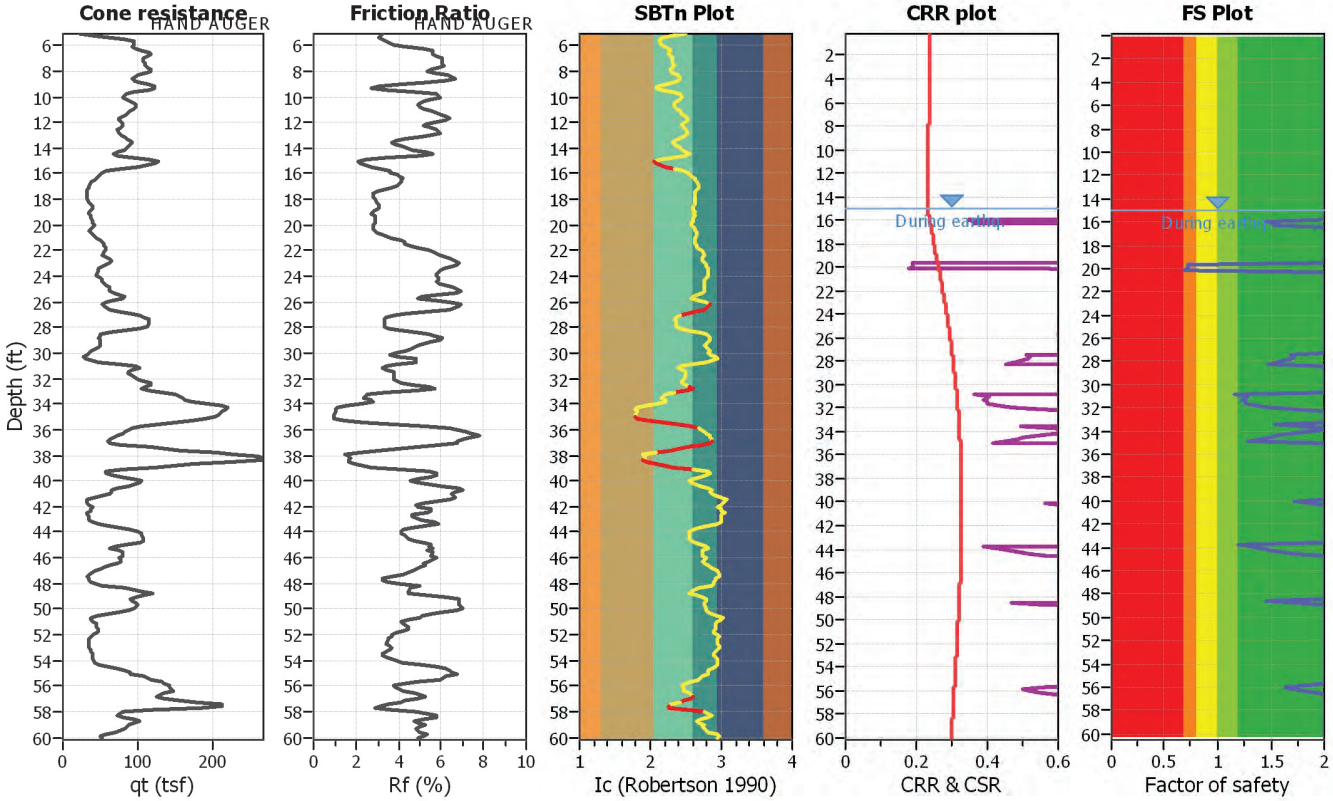
LIQUEFACTION ANALYSIS REPORT

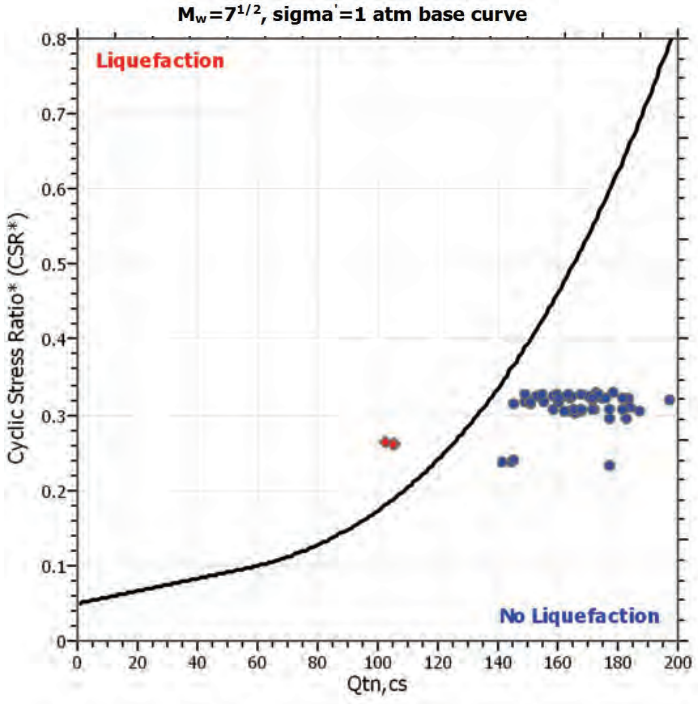
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

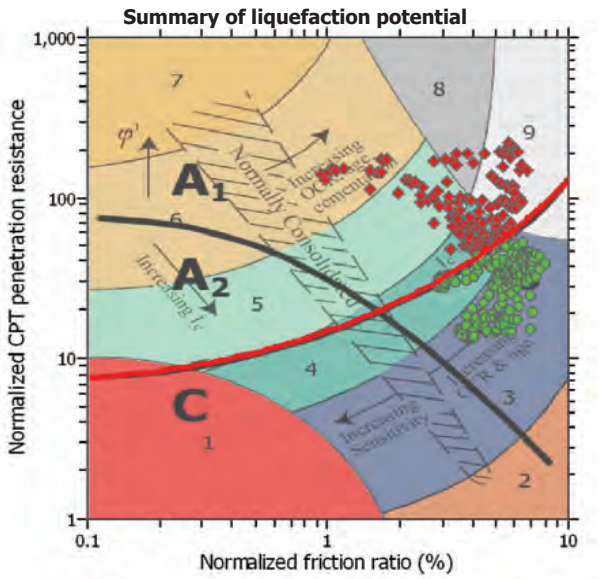
CPT file : CPT-2 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

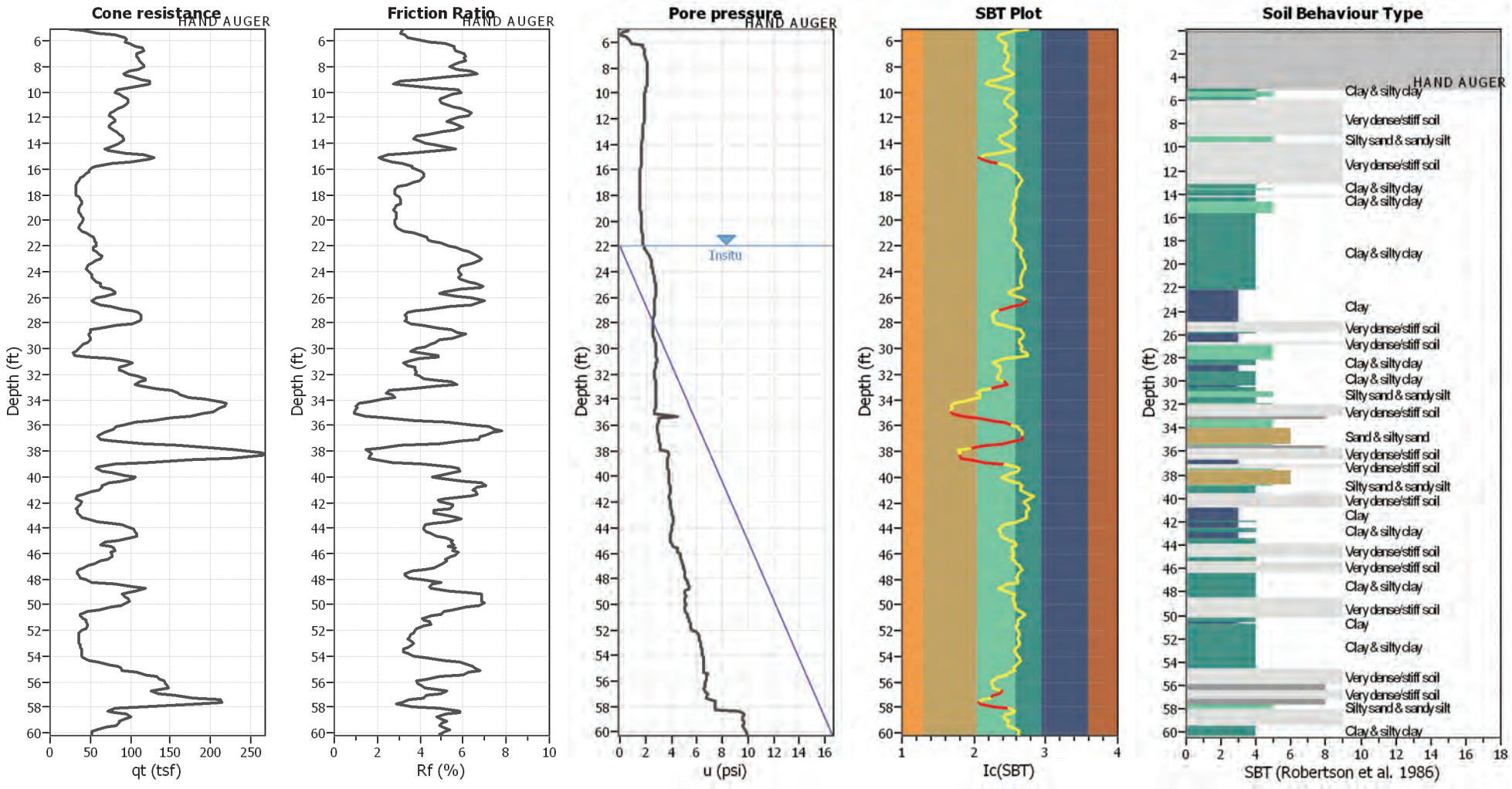






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



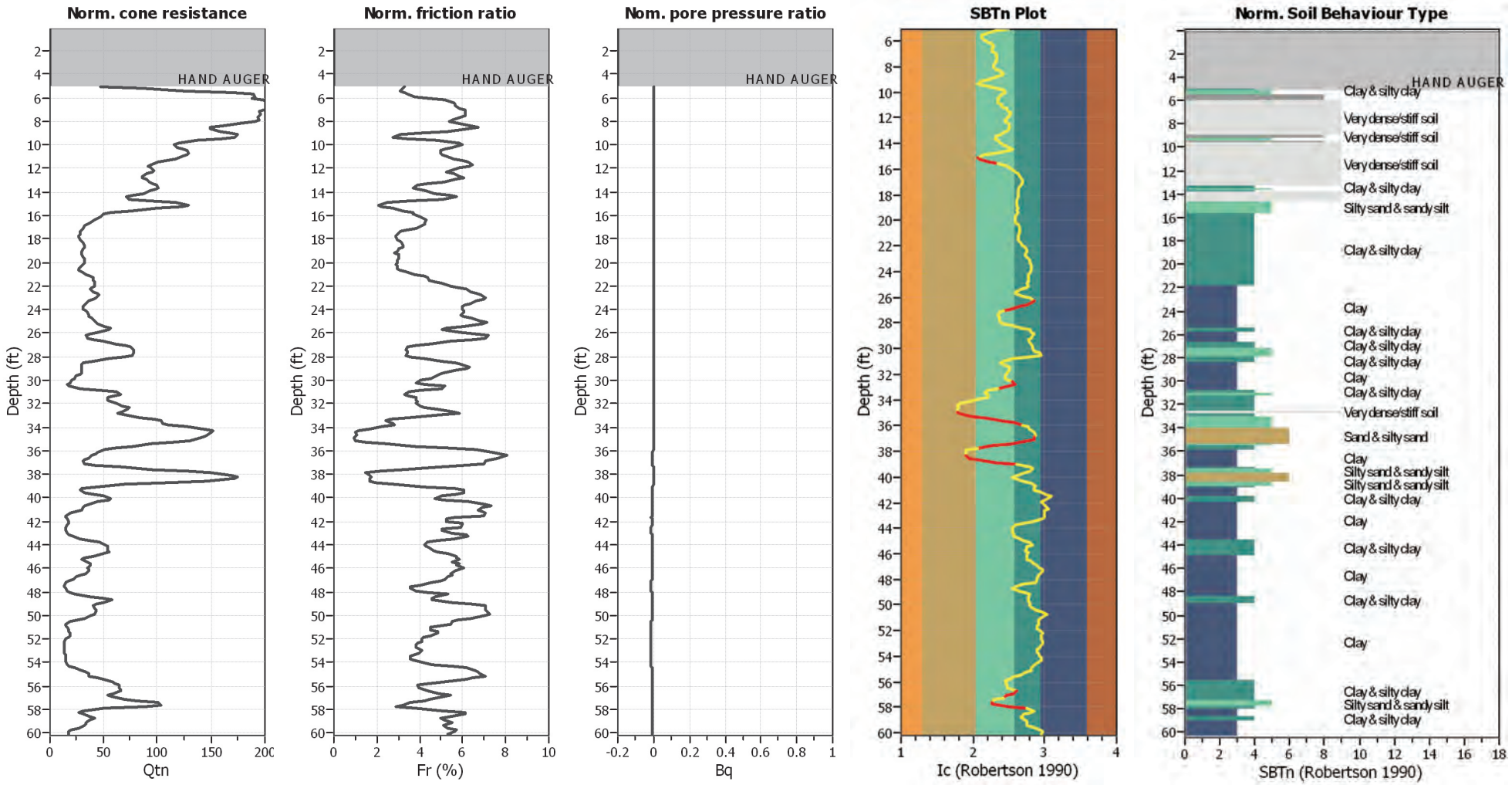
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



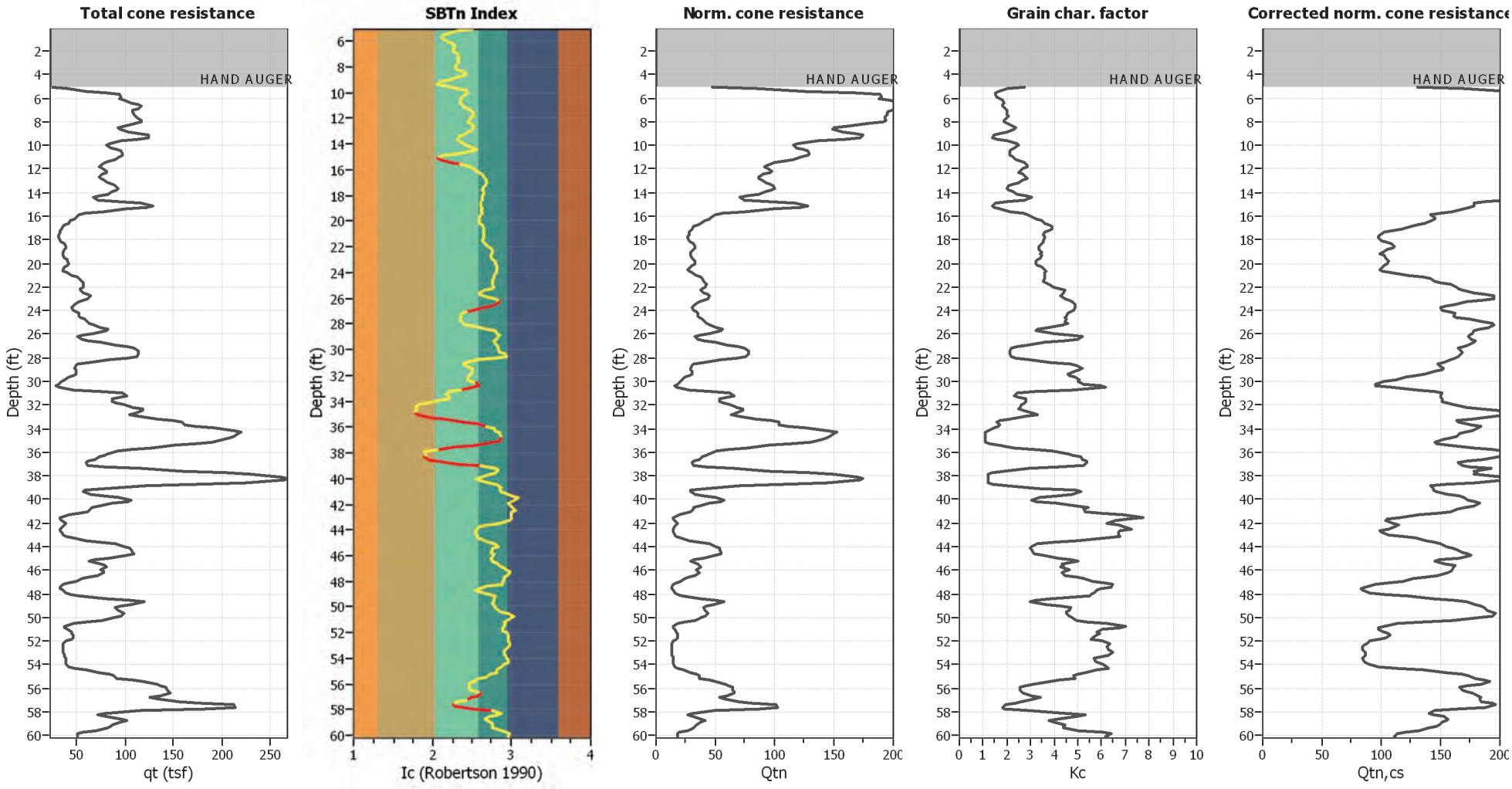
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

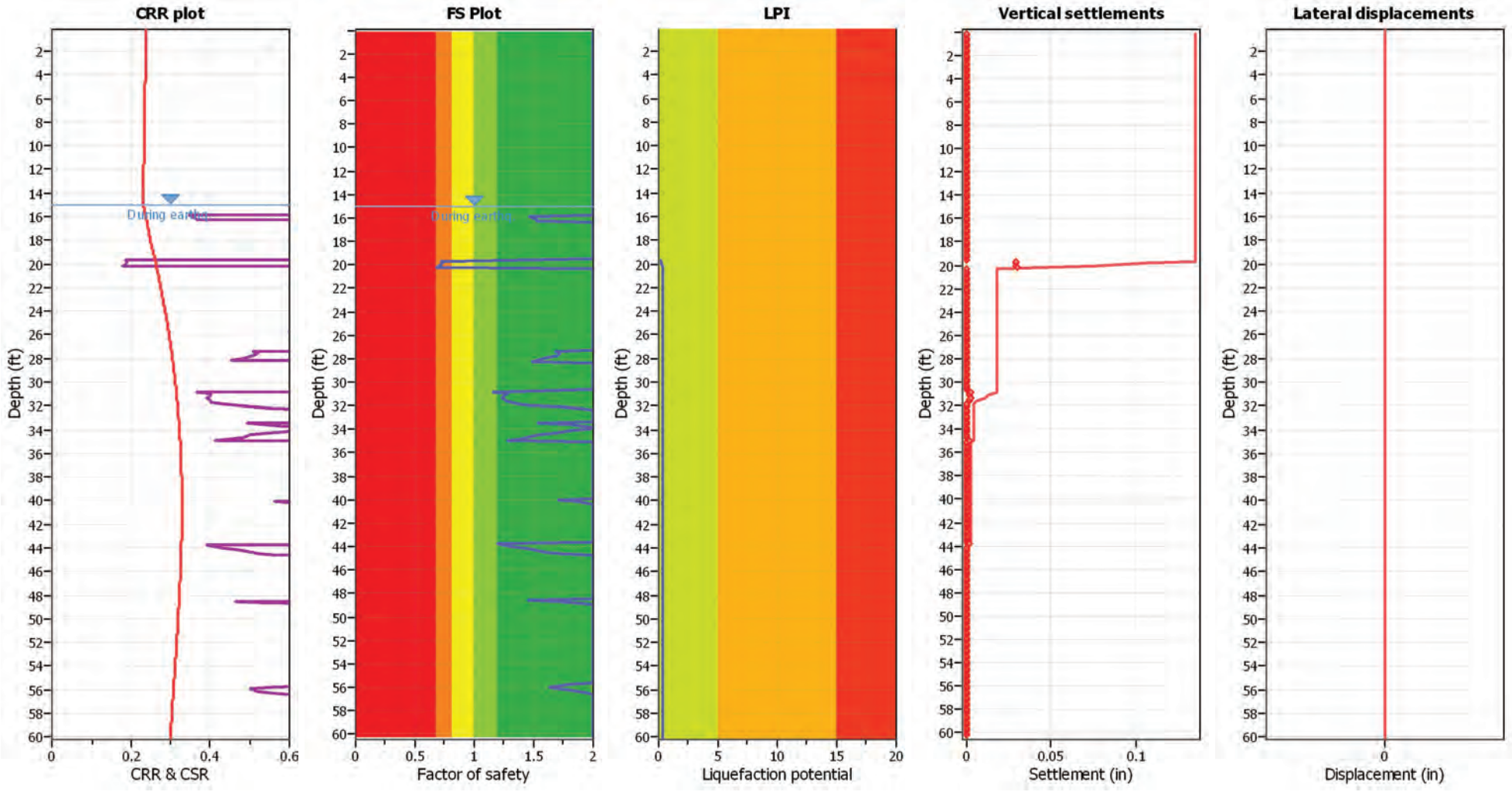
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

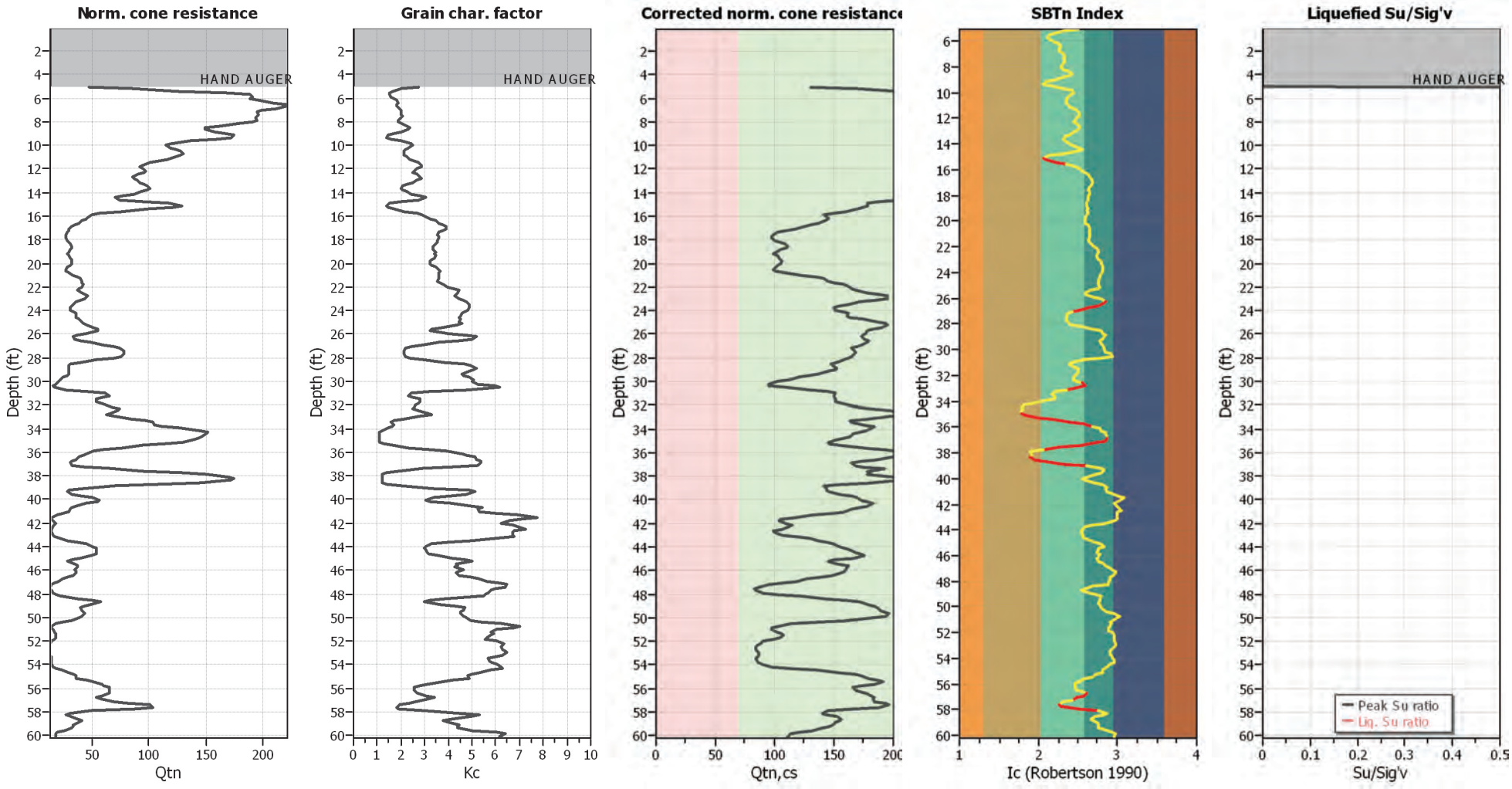
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

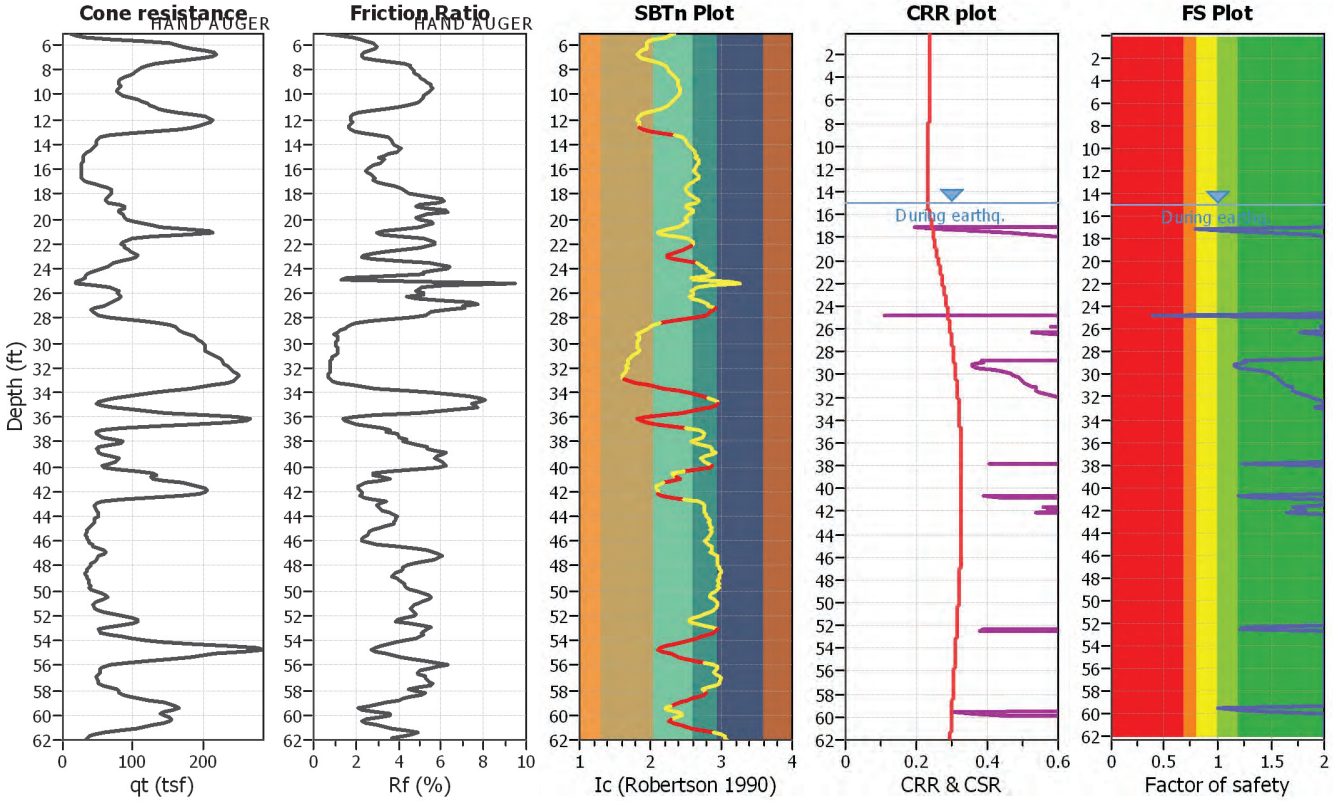
LIQUEFACTION ANALYSIS REPORT

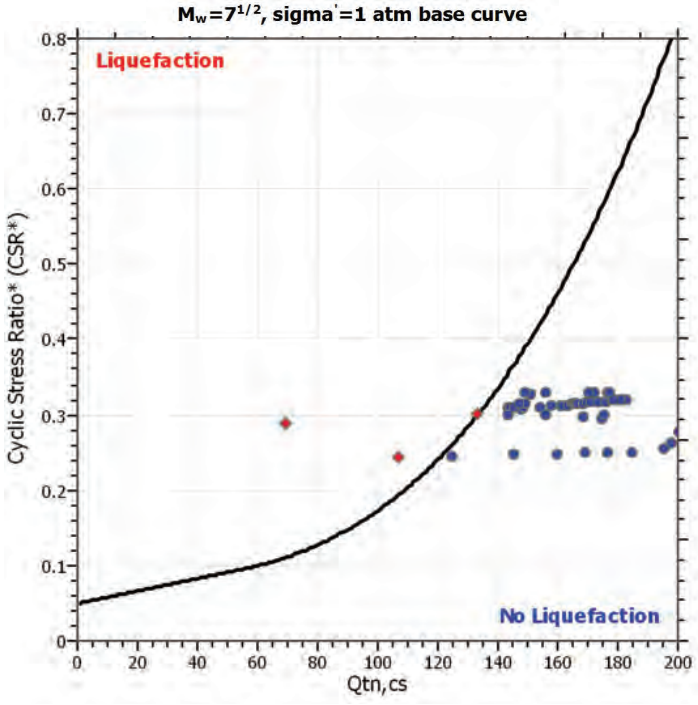
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

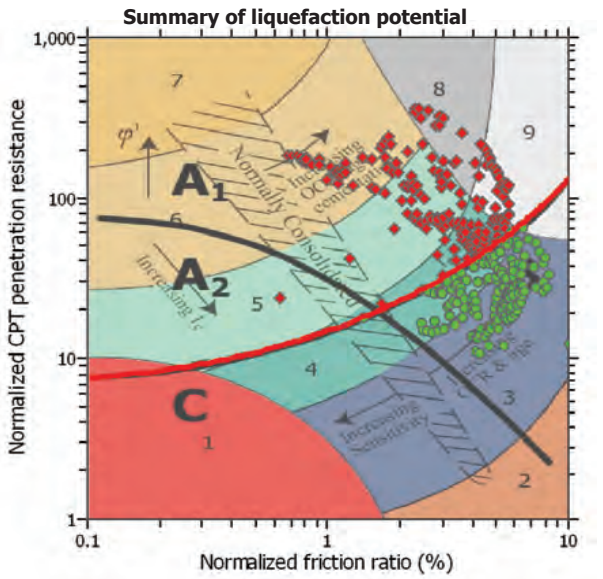
CPT file : CPT-3 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

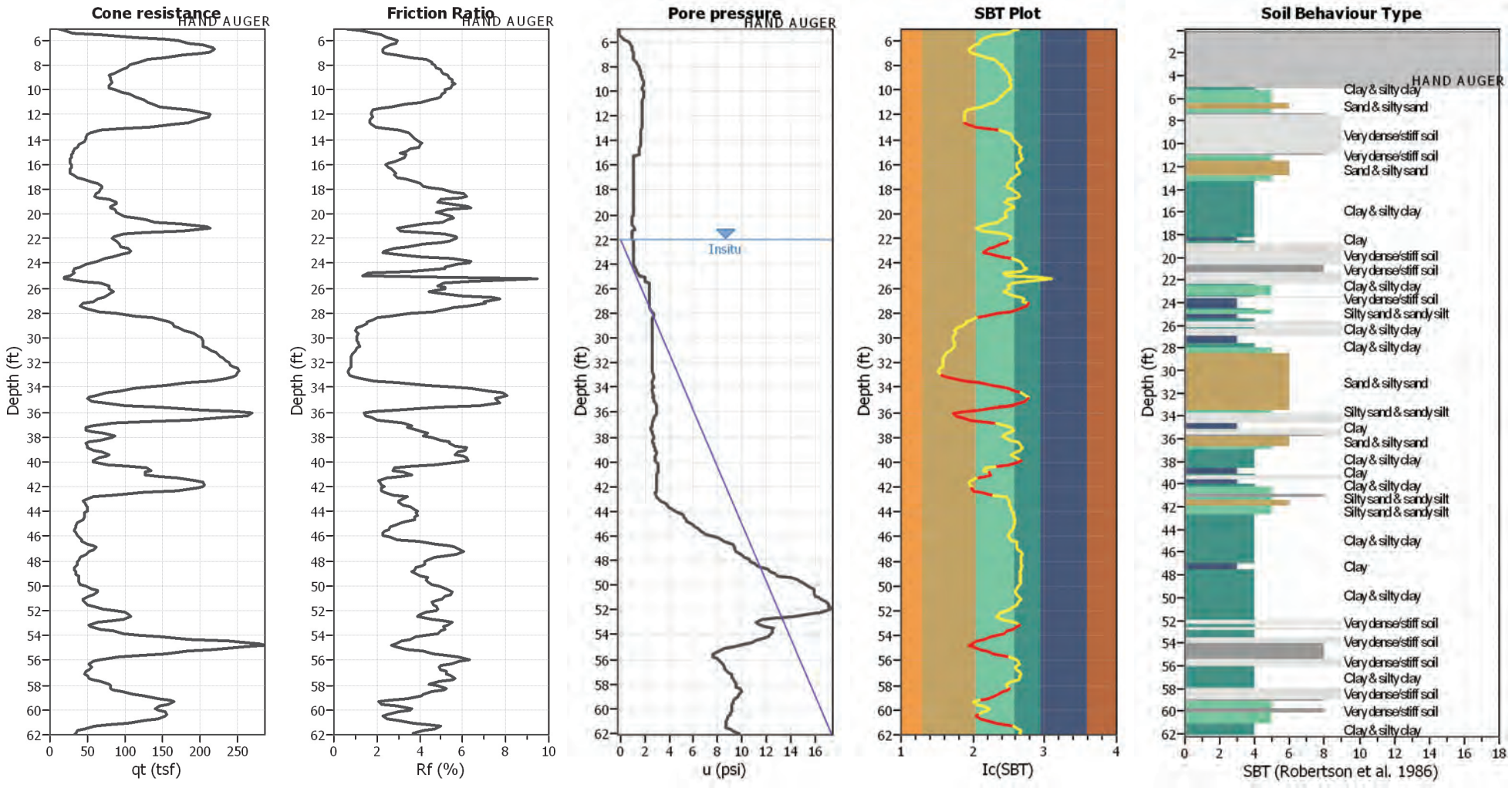






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



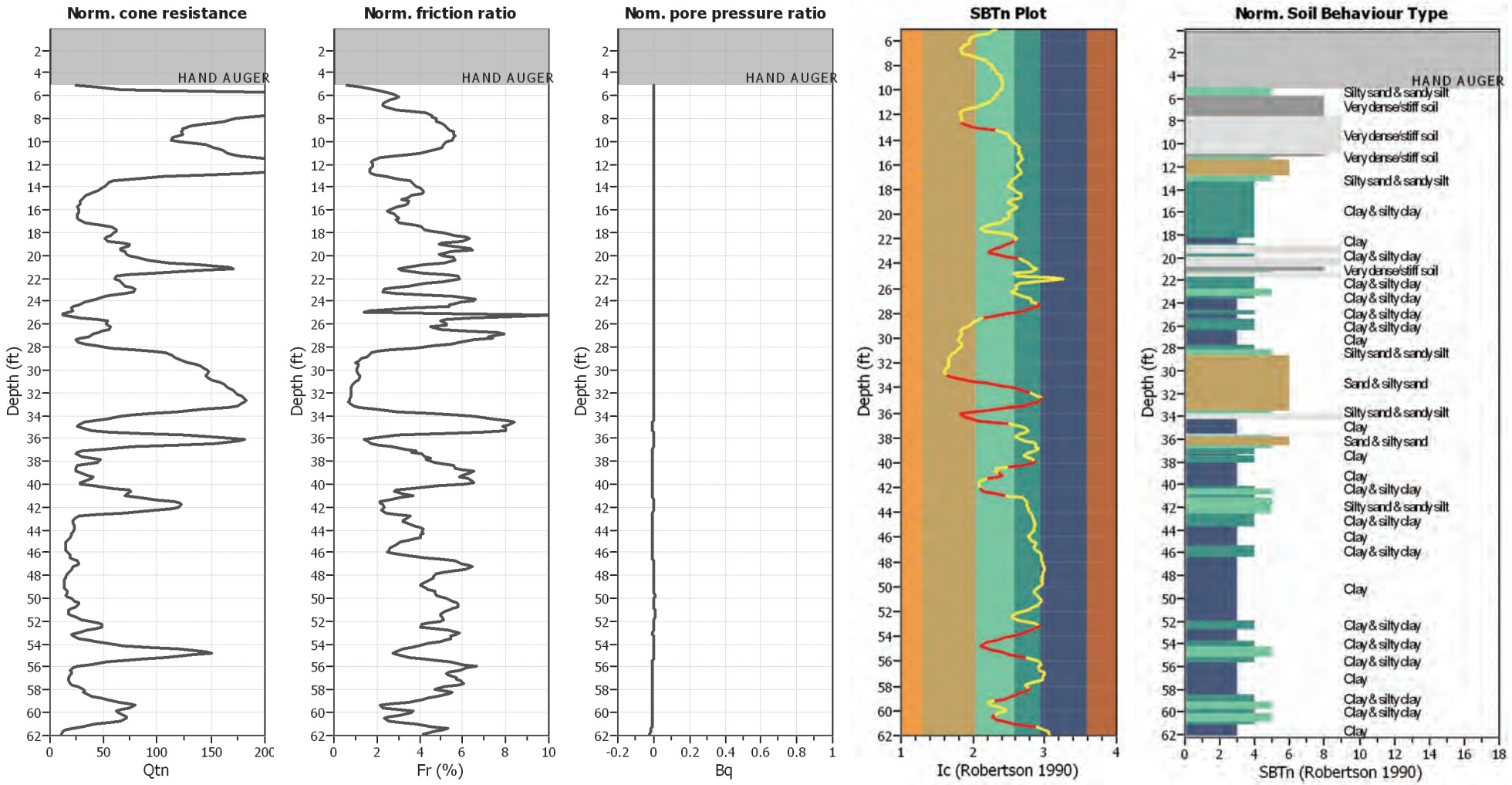
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



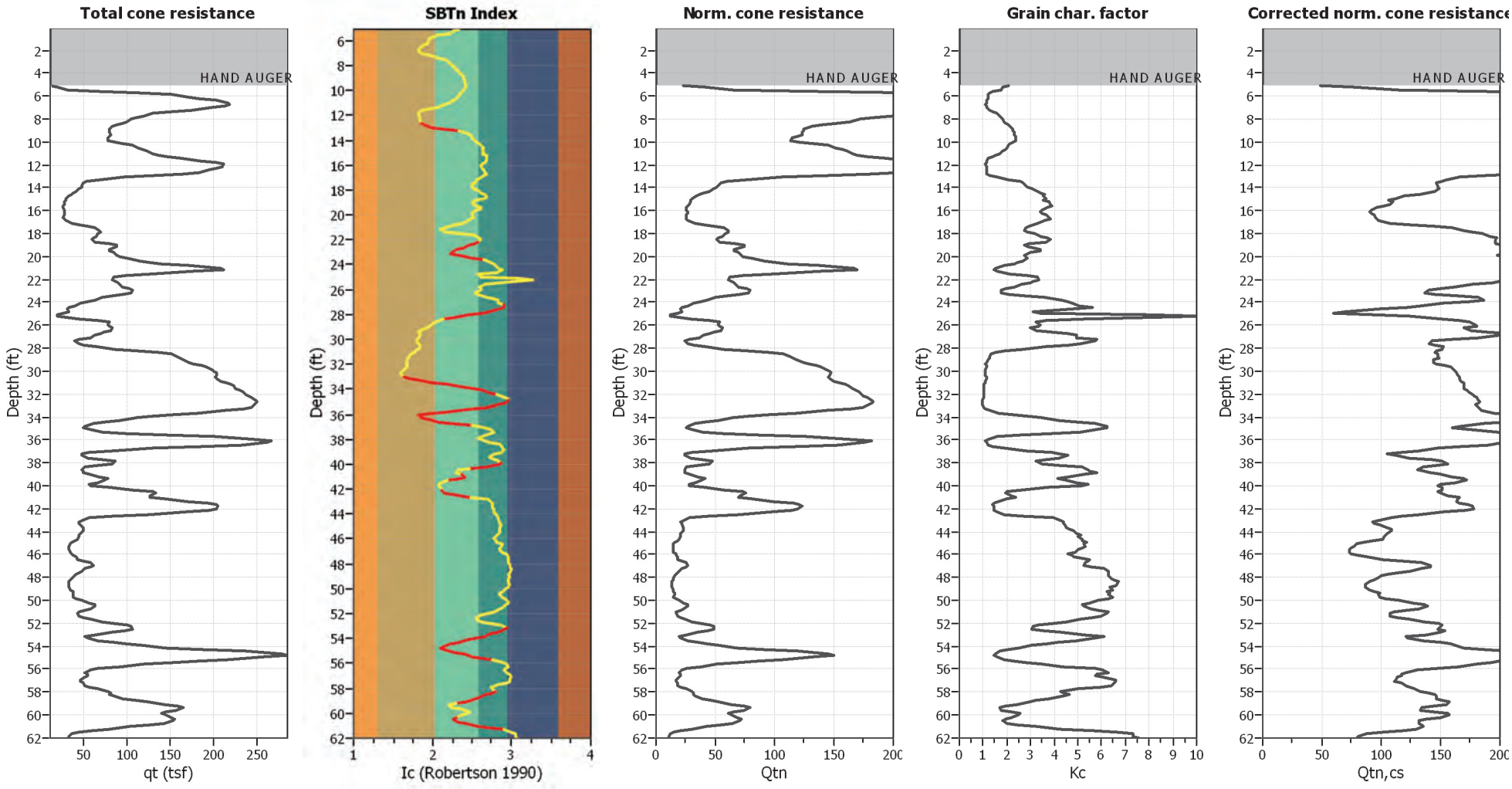
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

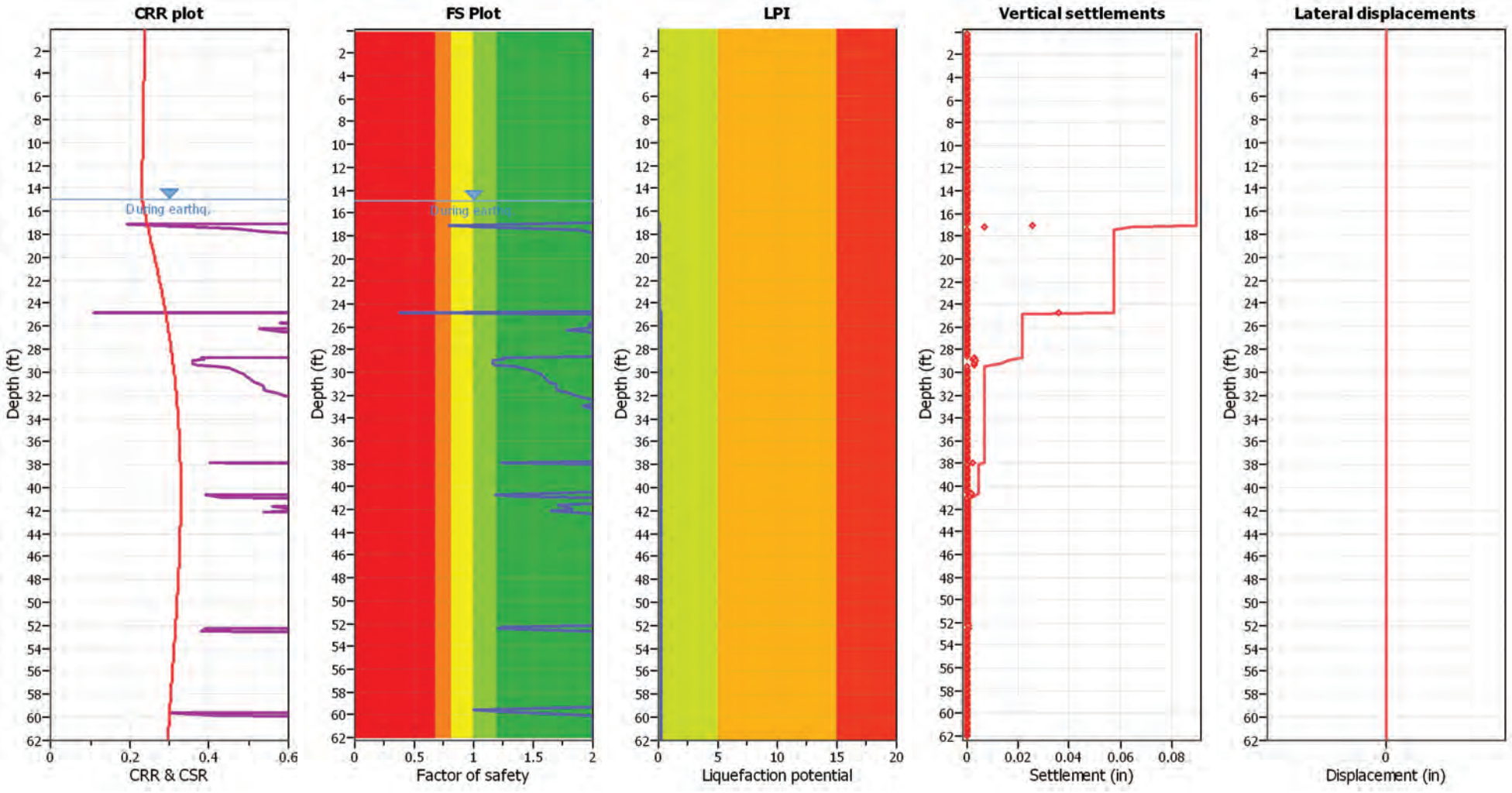
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

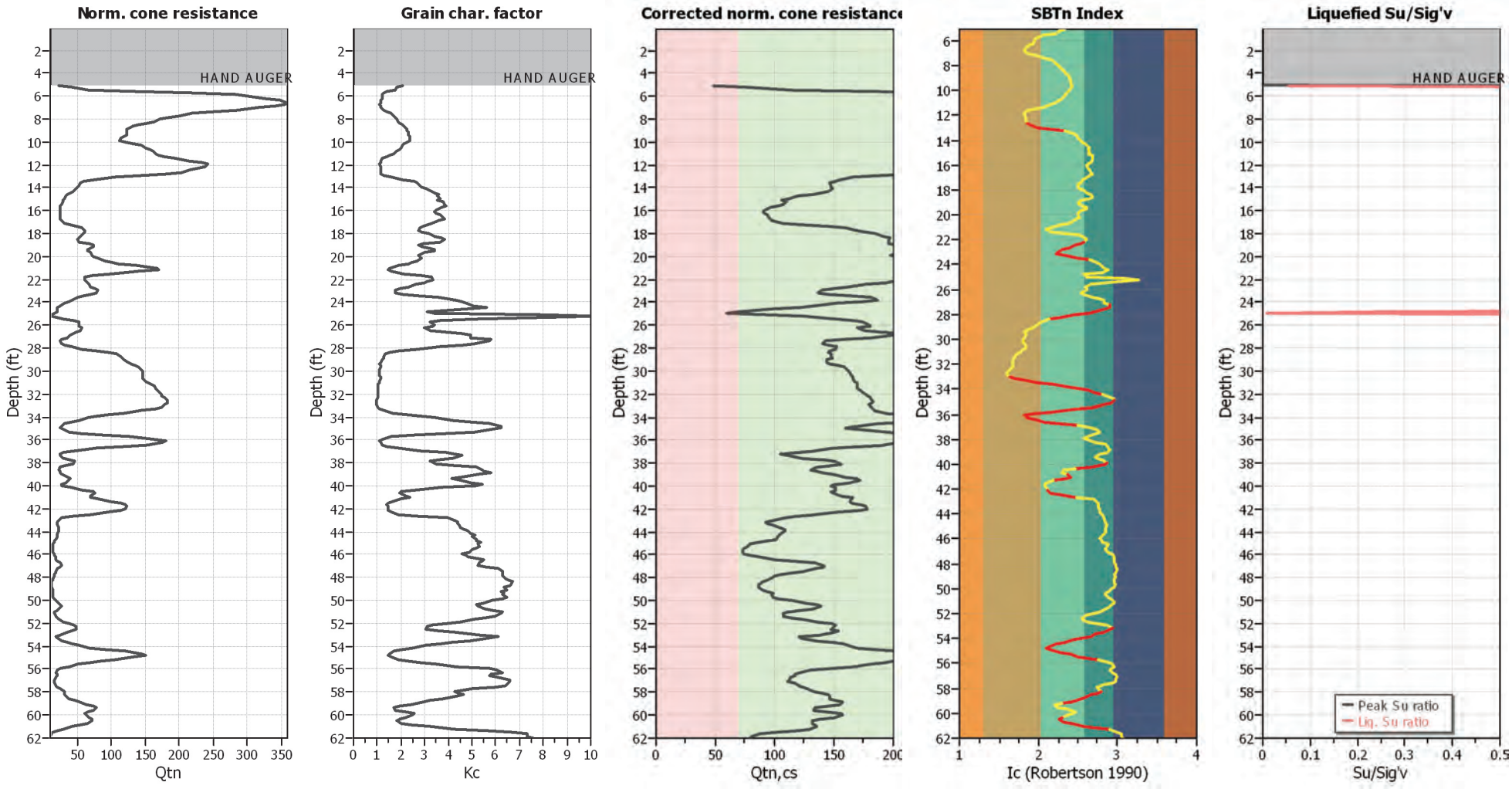
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

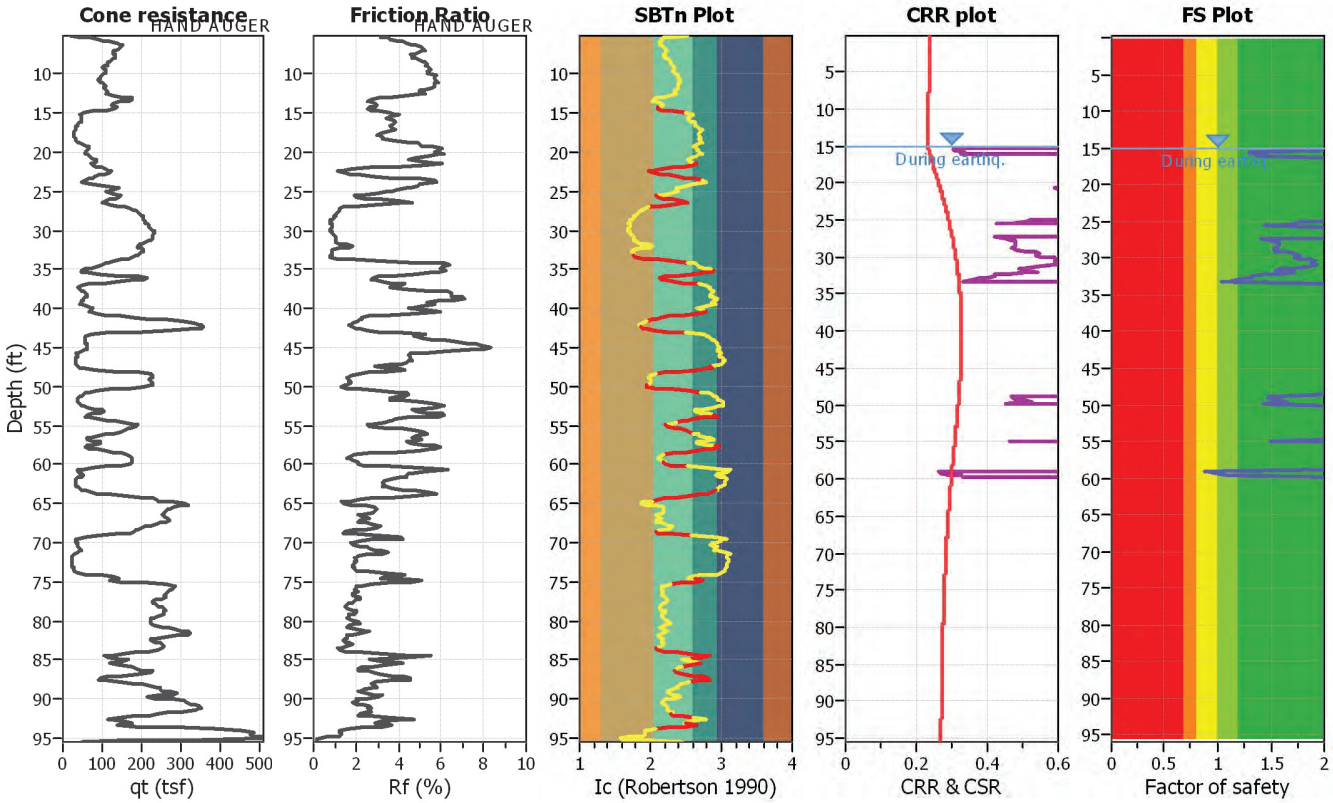
LIQUEFACTION ANALYSIS REPORT

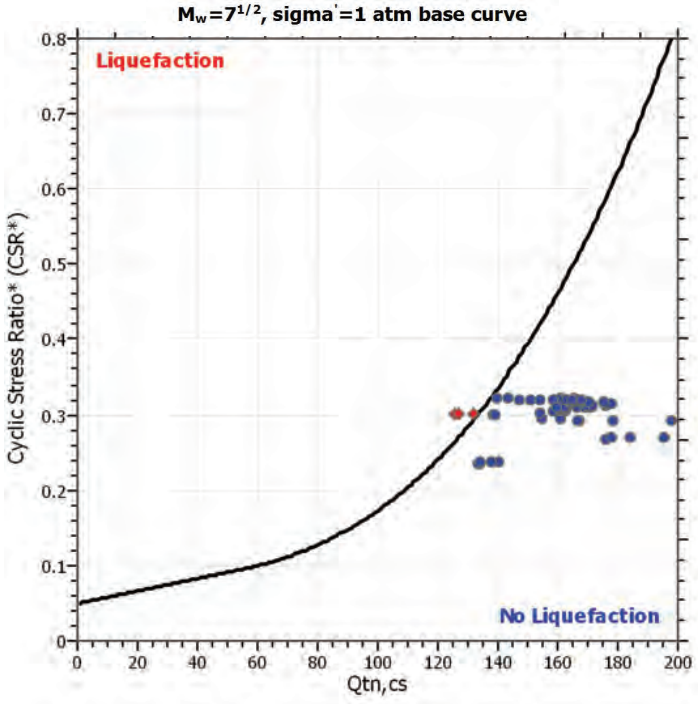
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

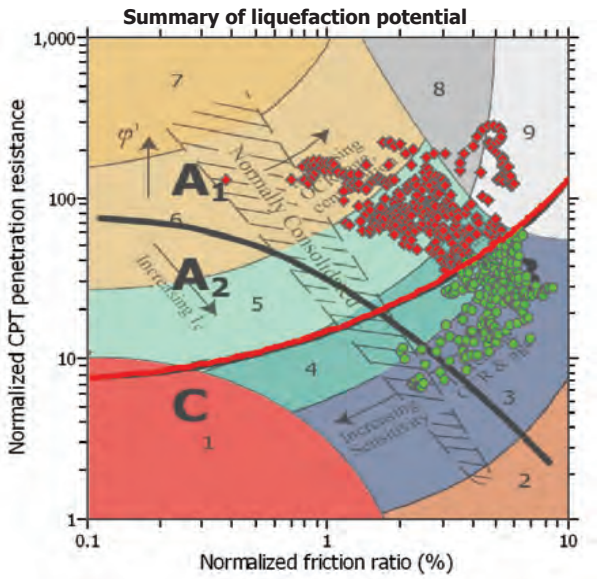
CPT file : CPT-4 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

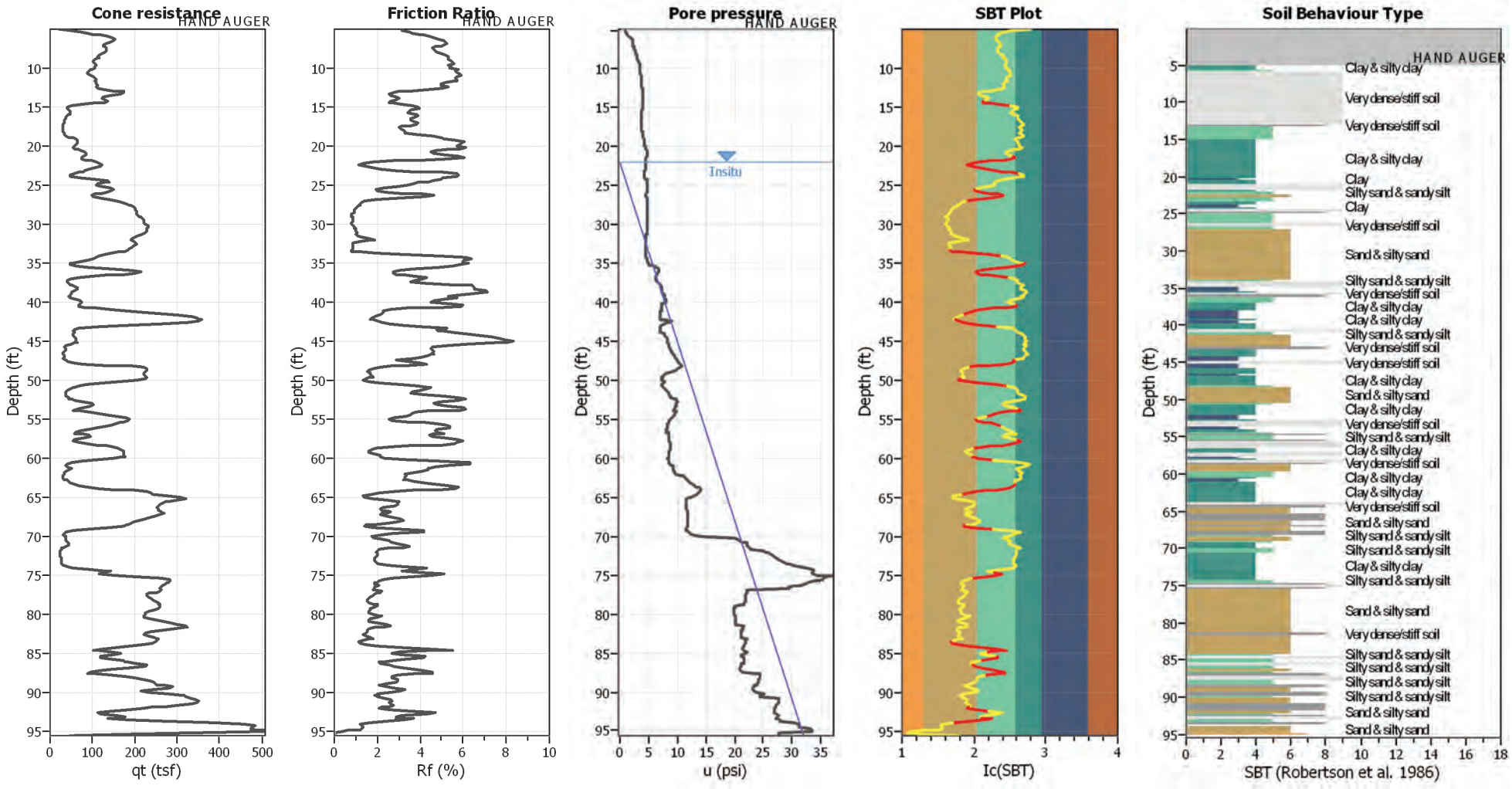






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



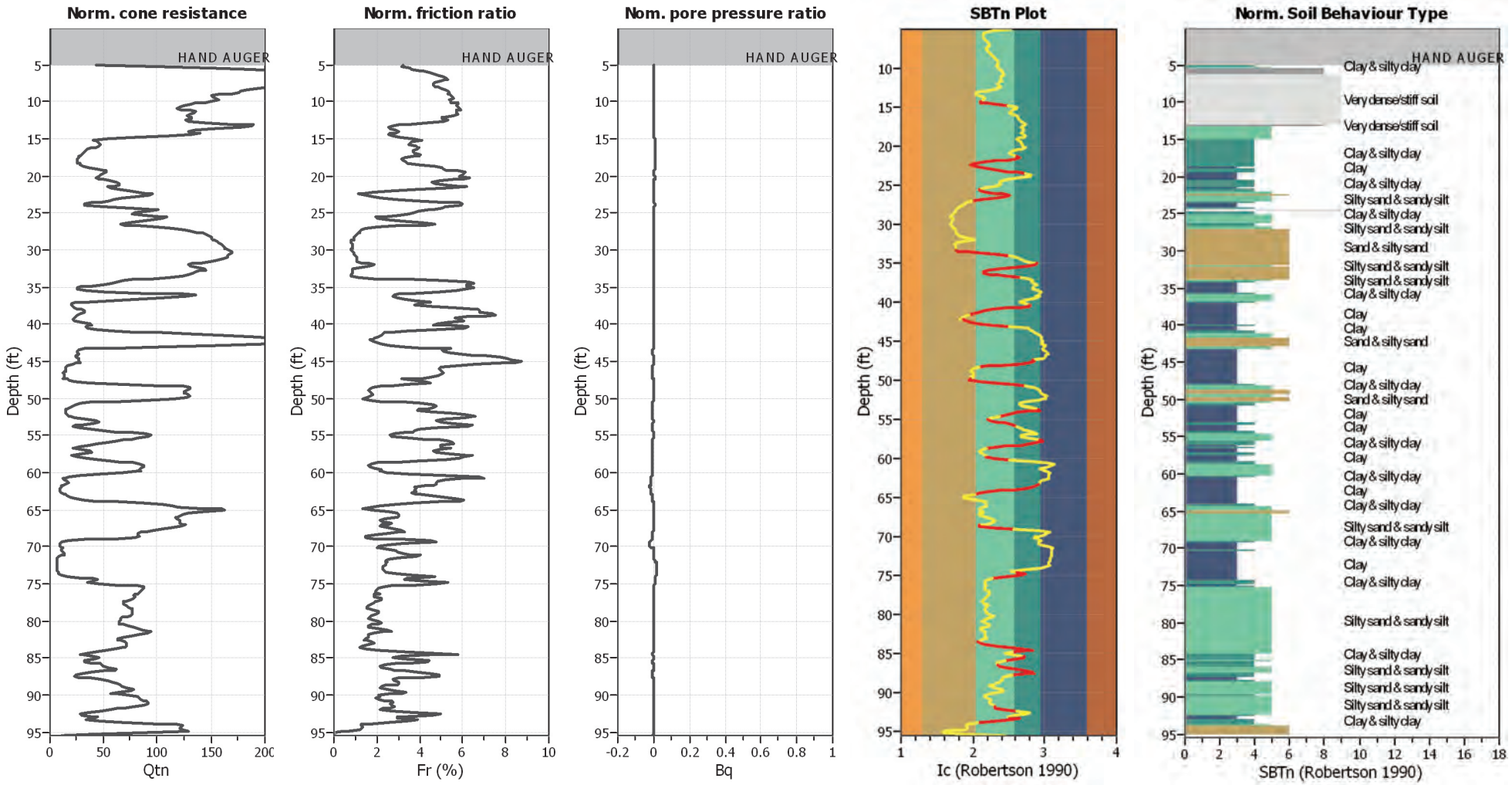
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



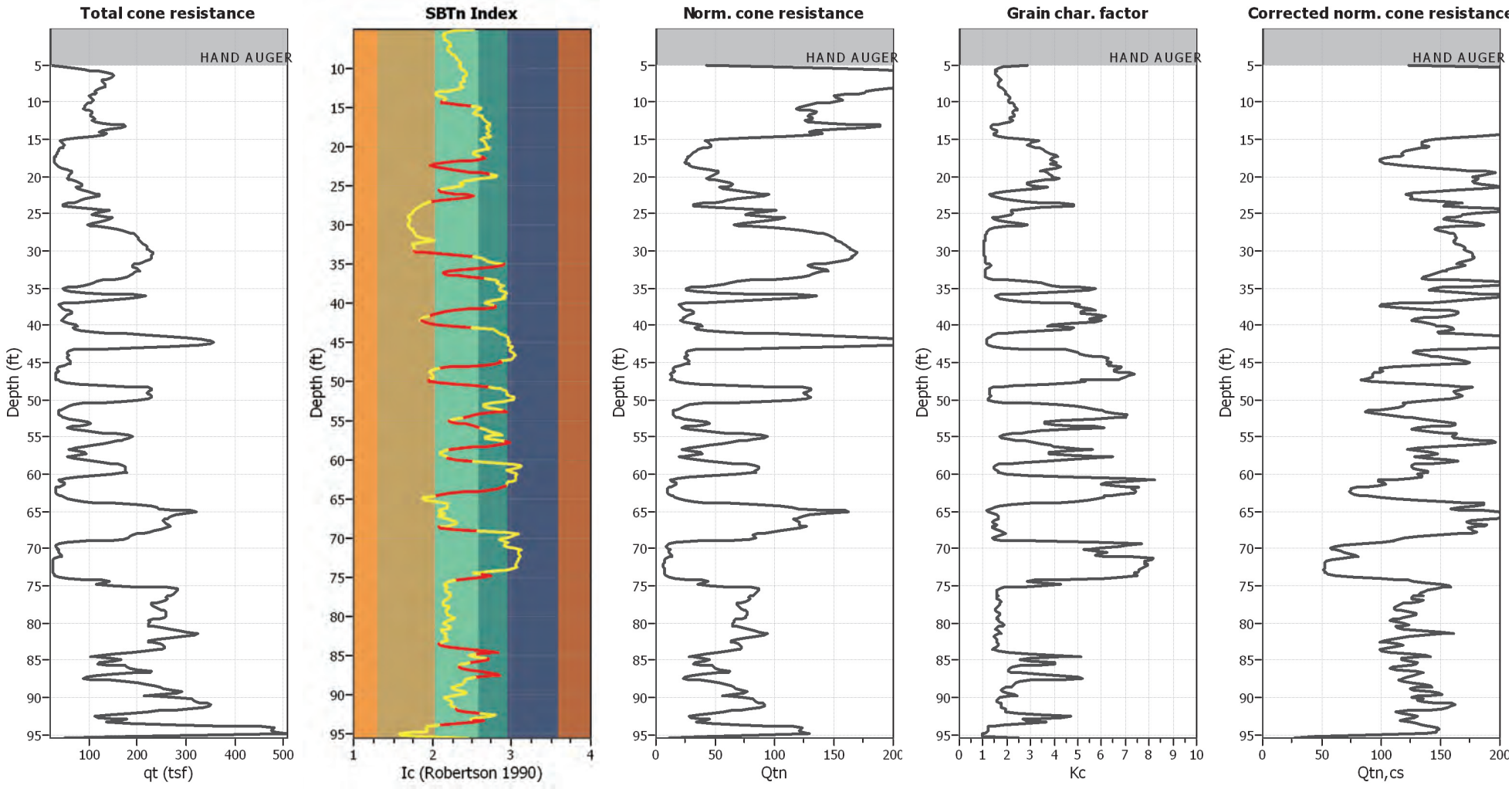
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

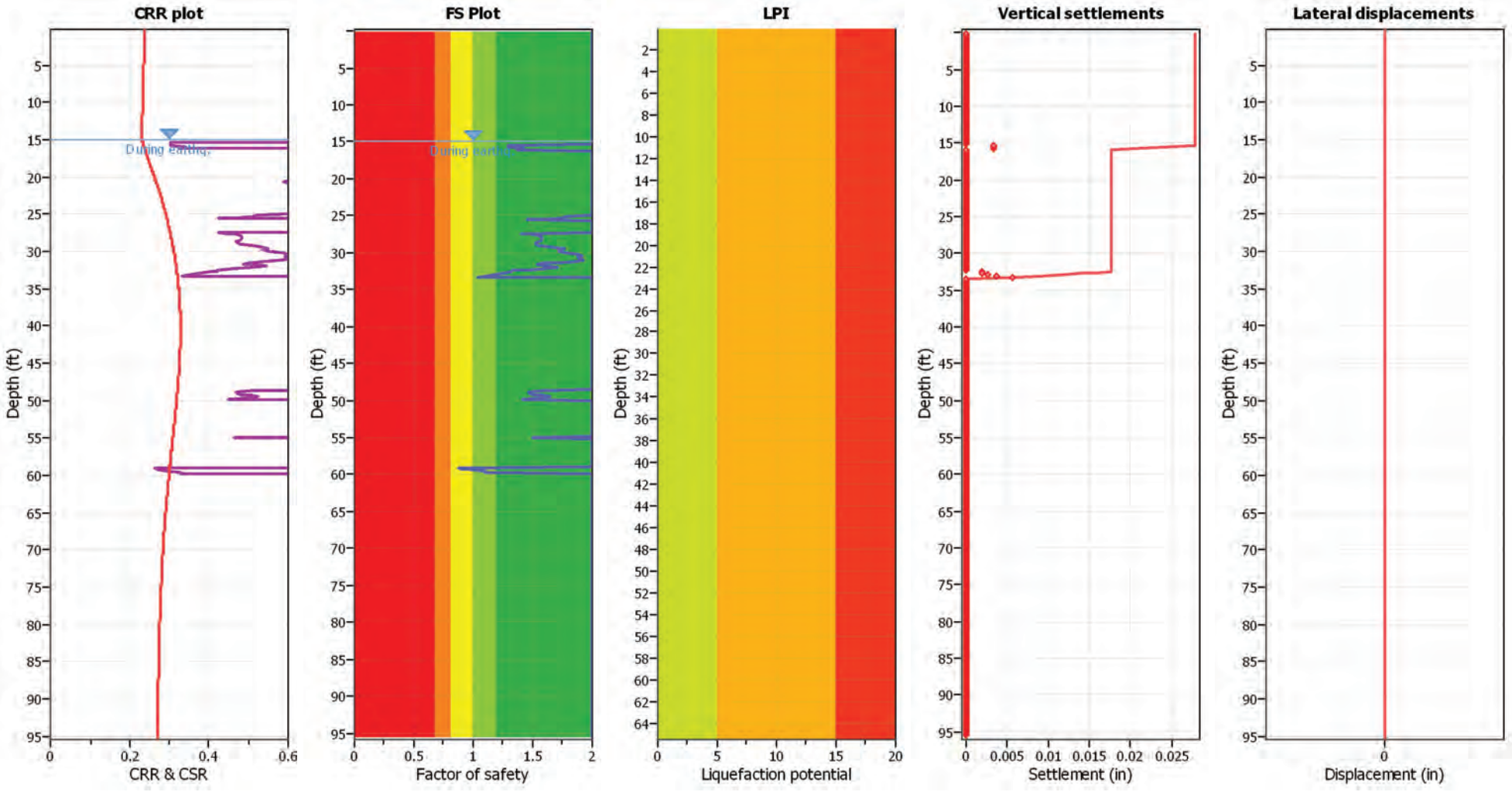
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

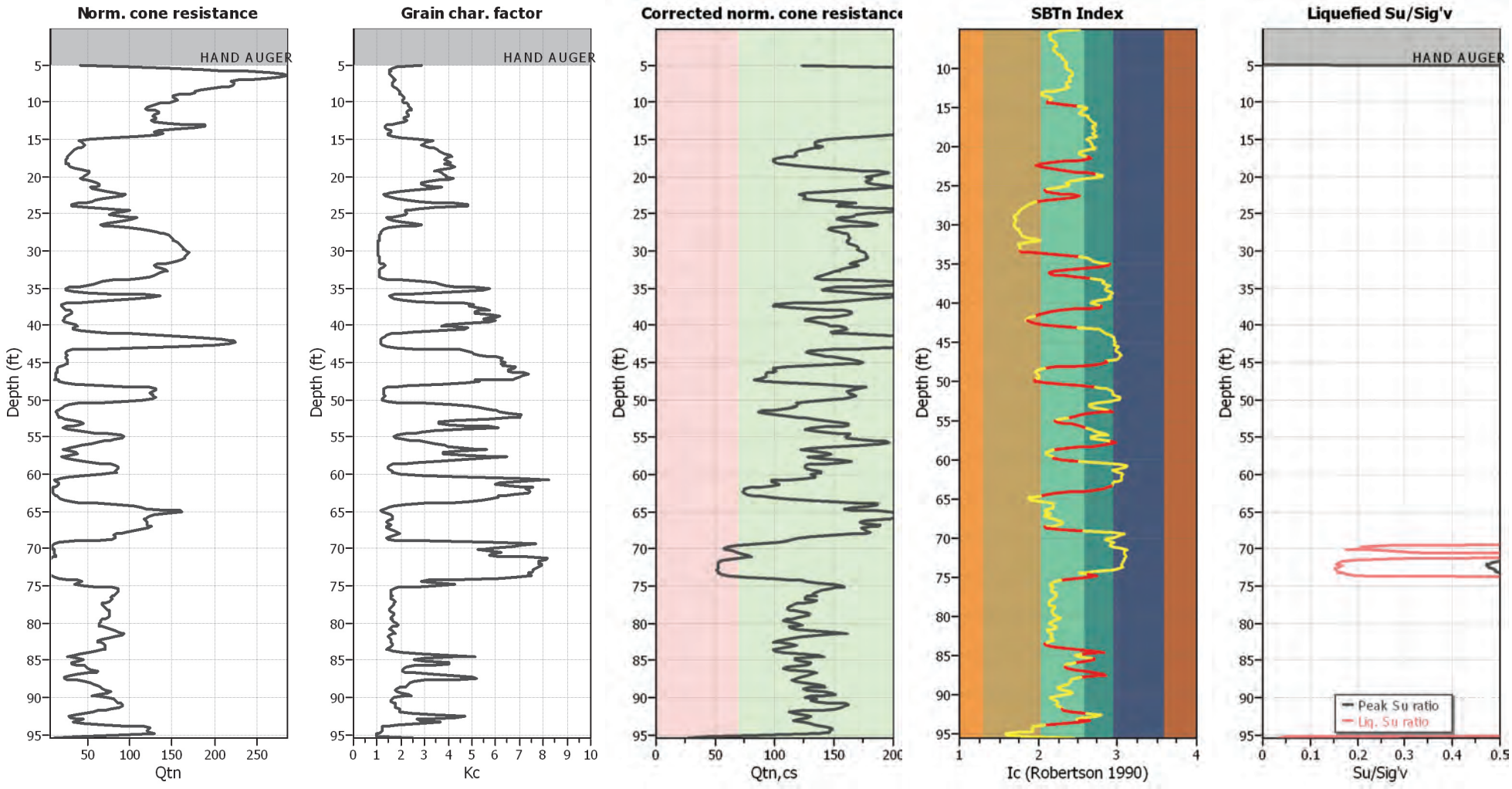
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

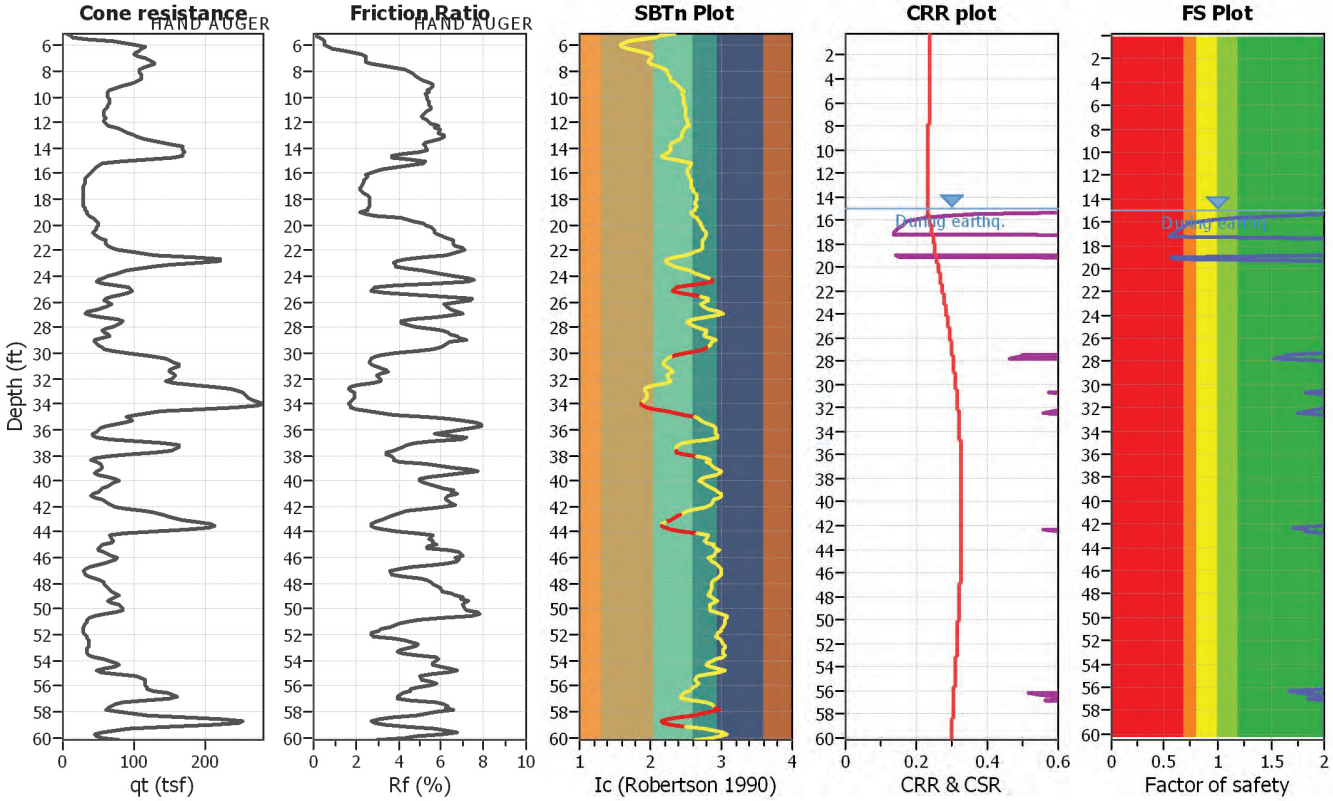
LIQUEFACTION ANALYSIS REPORT

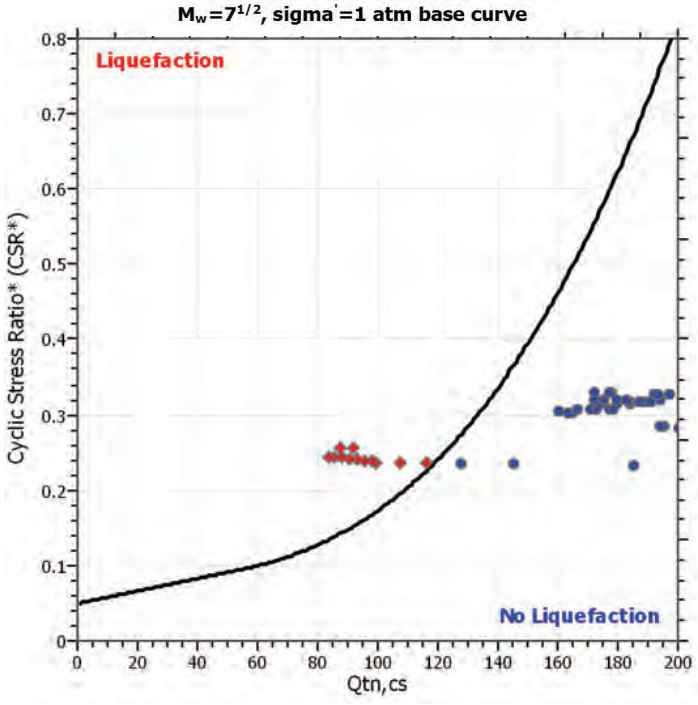
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

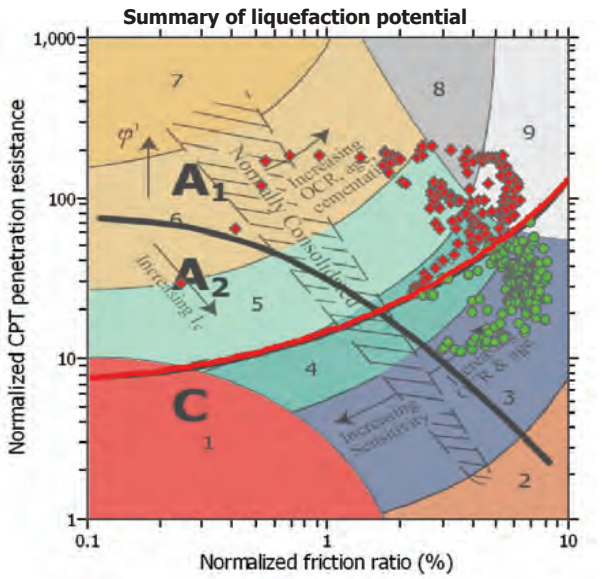
CPT file : CPT-5 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

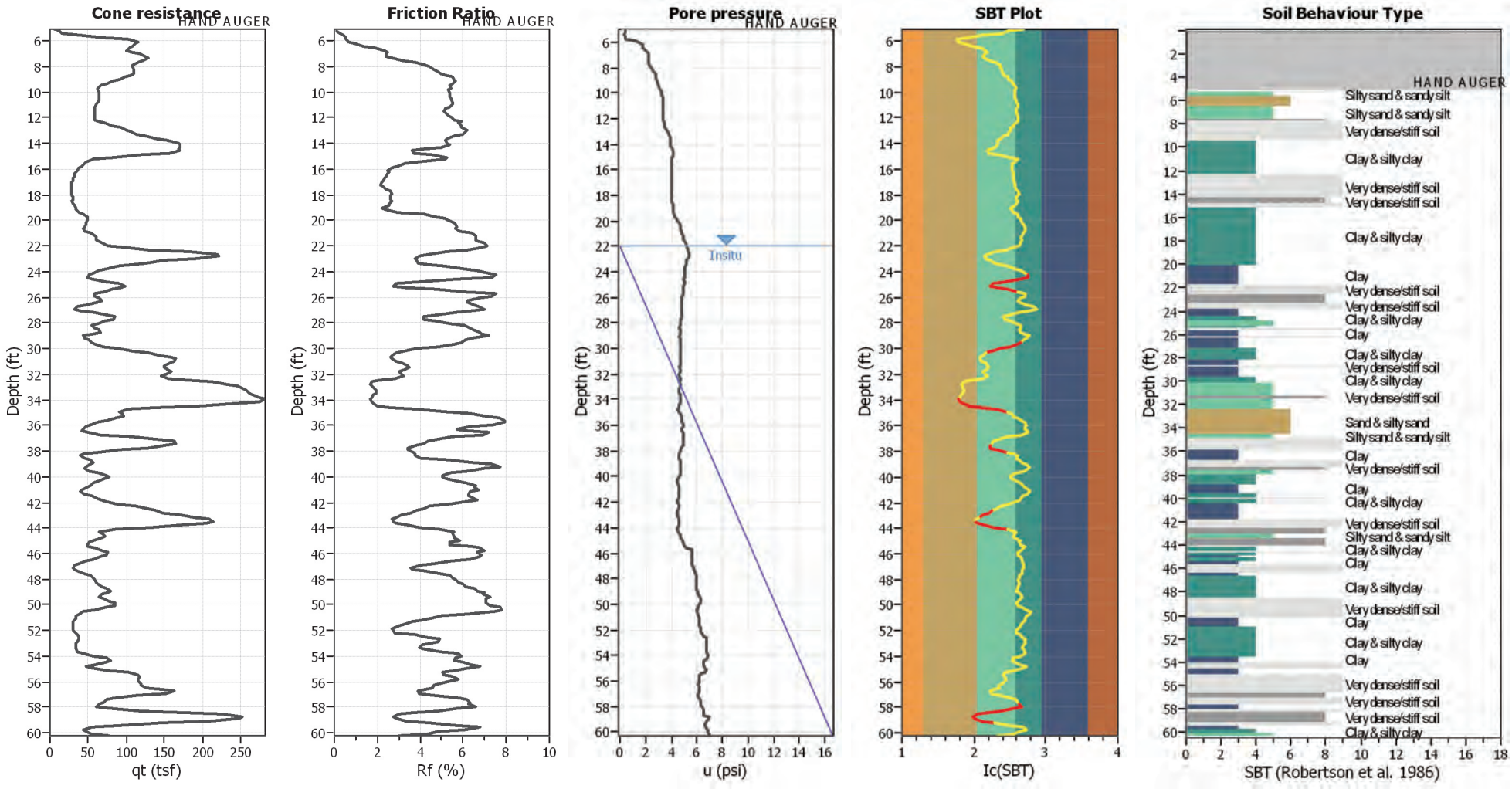






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



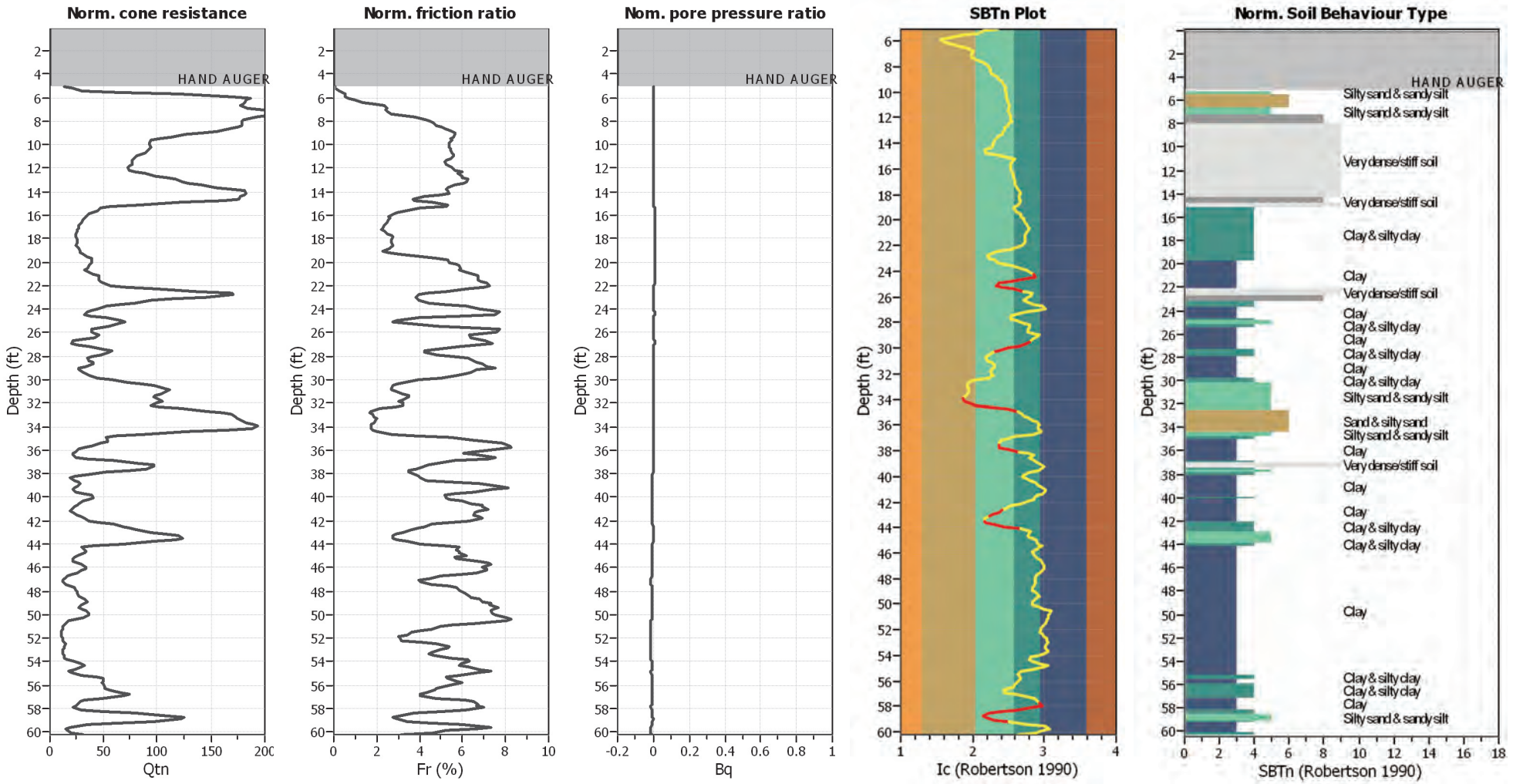
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



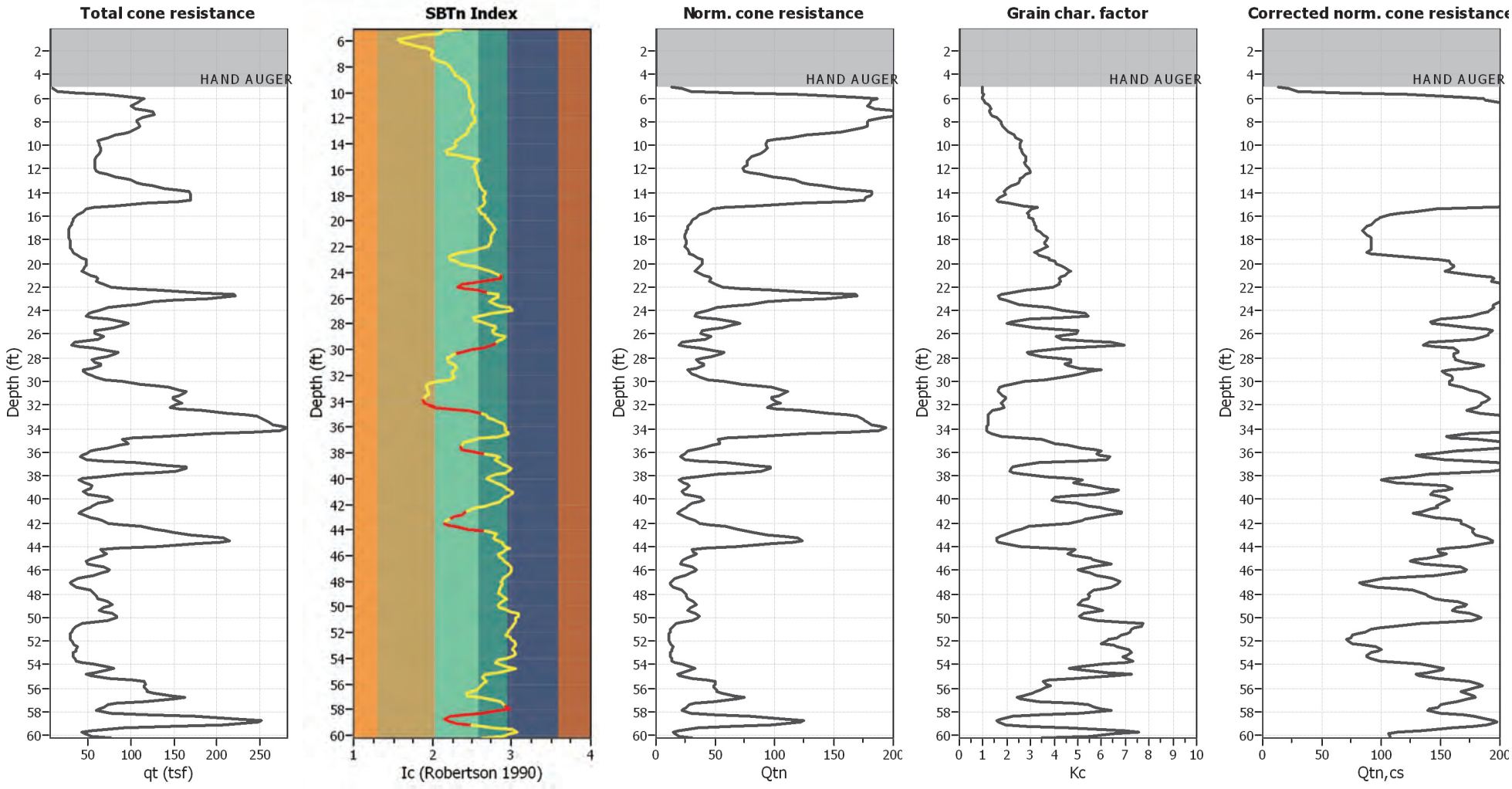
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

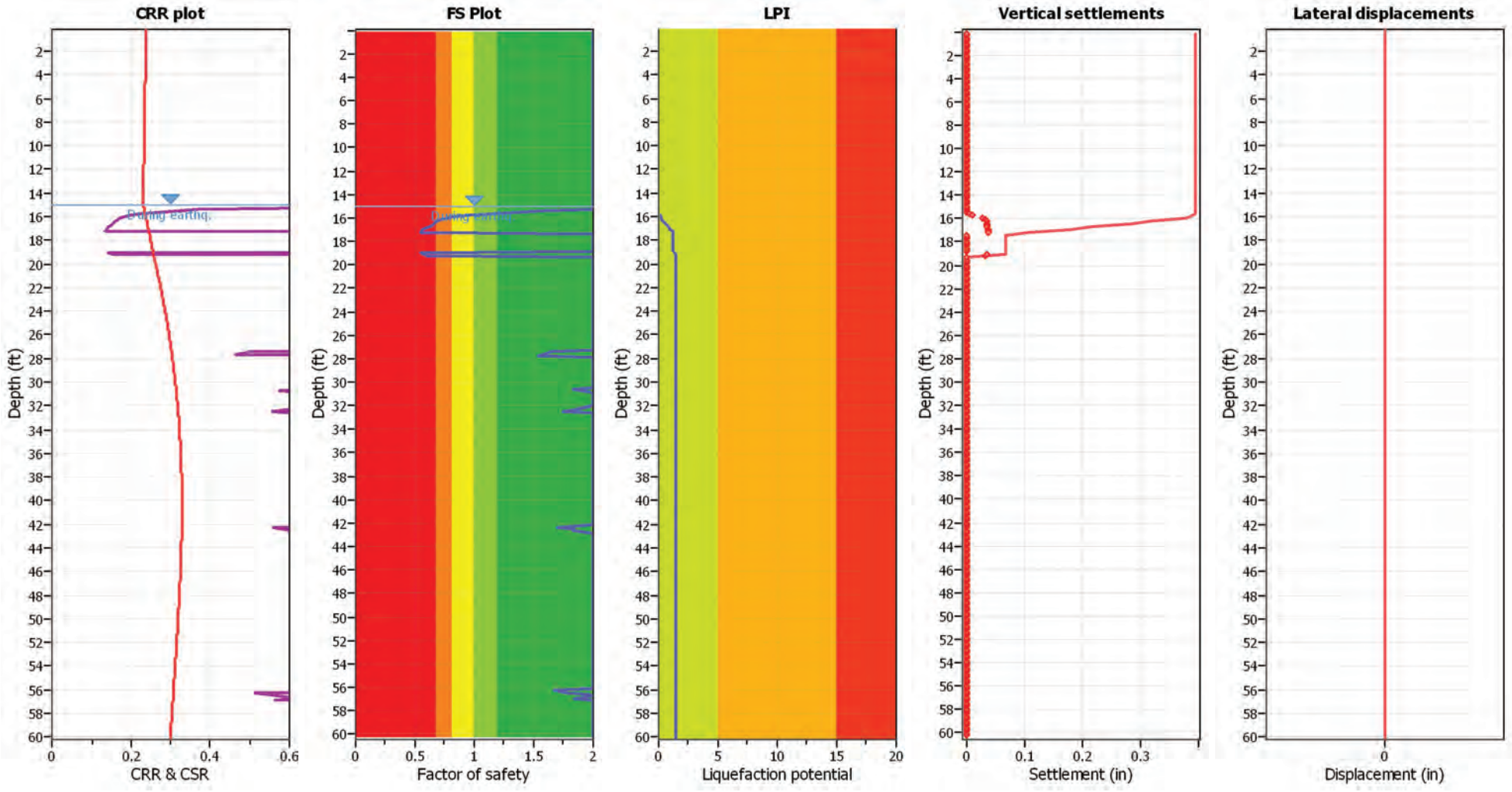
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

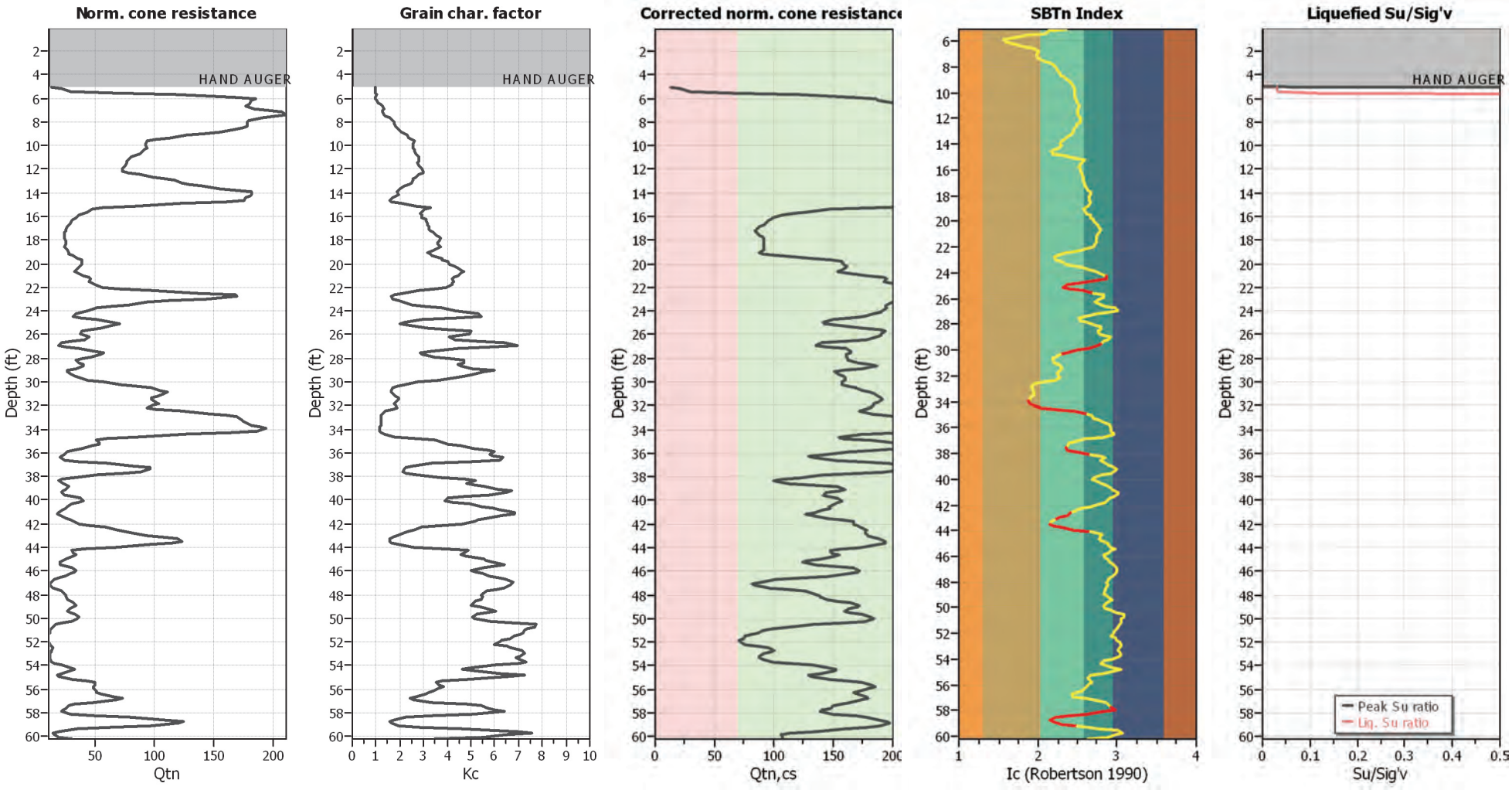
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

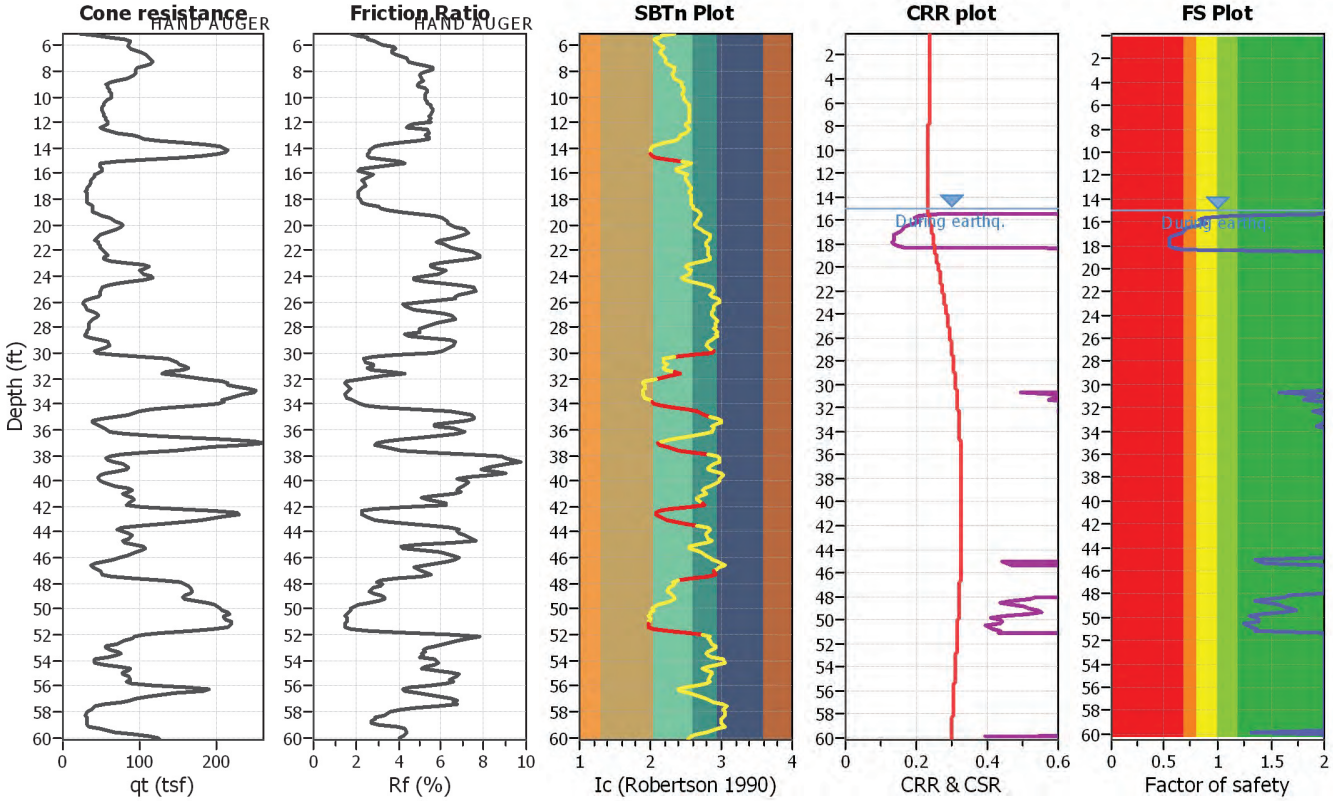
LIQUEFACTION ANALYSIS REPORT

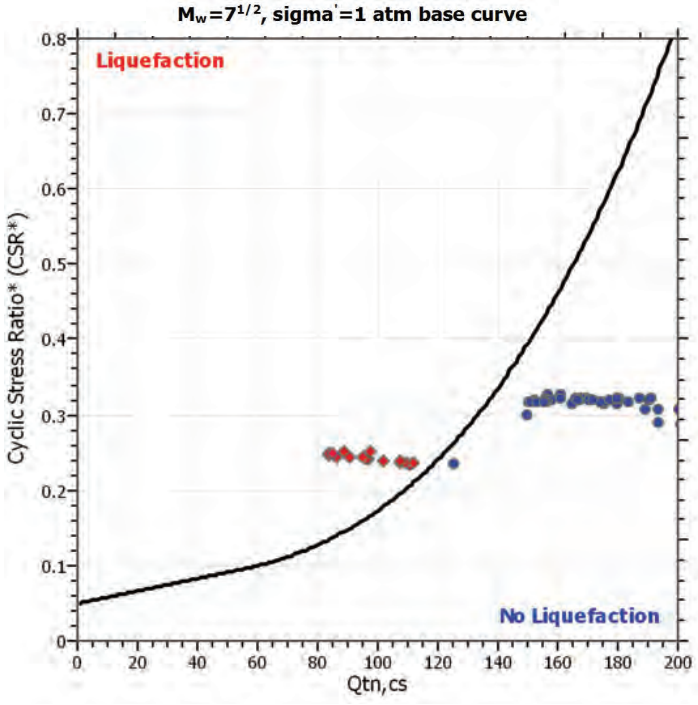
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

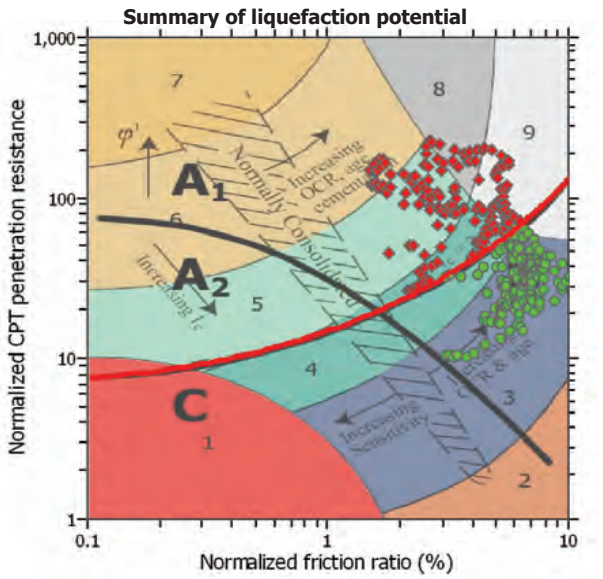
CPT file : CPT-6 (10% in 50 years)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.46	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

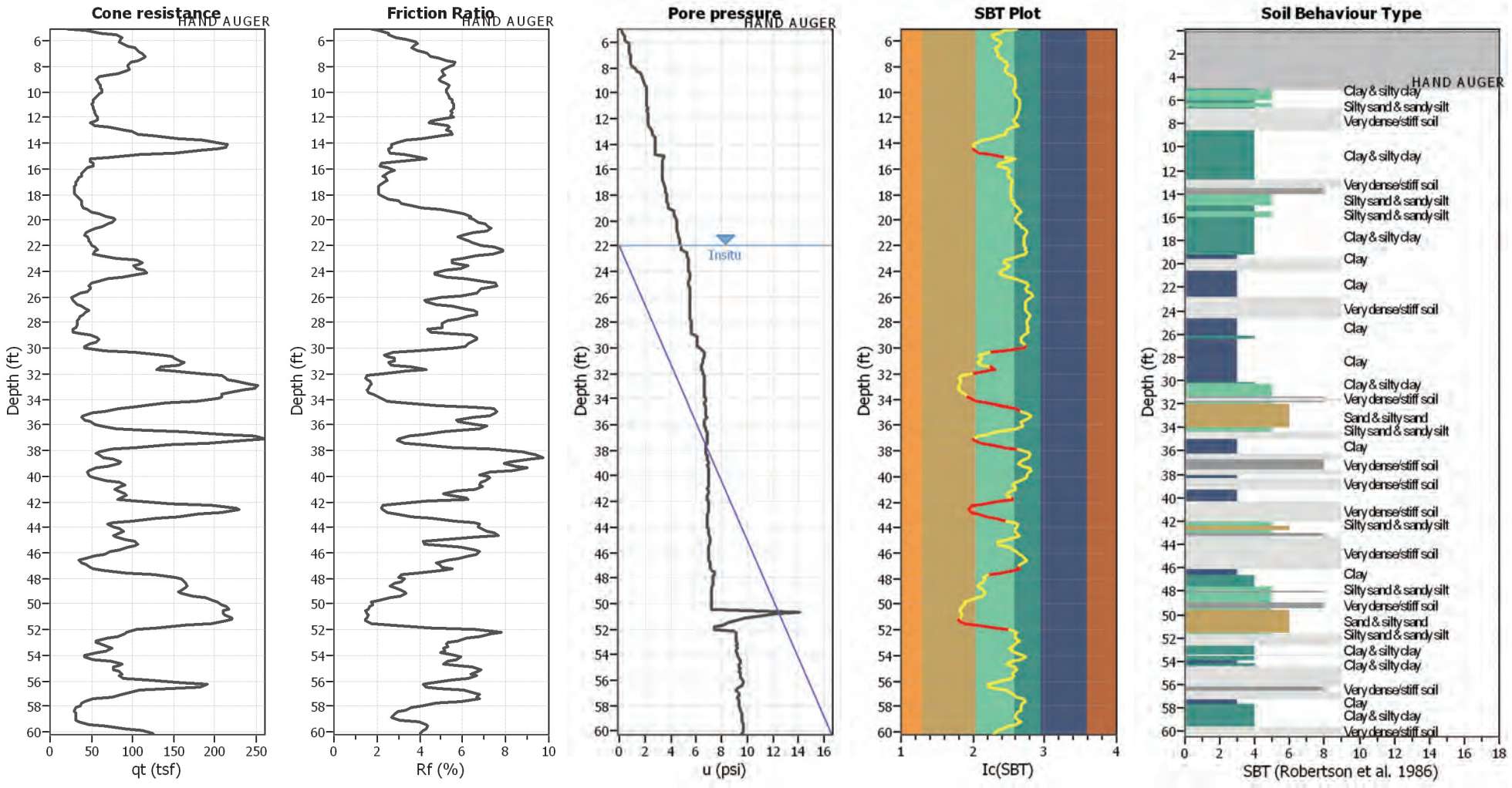






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



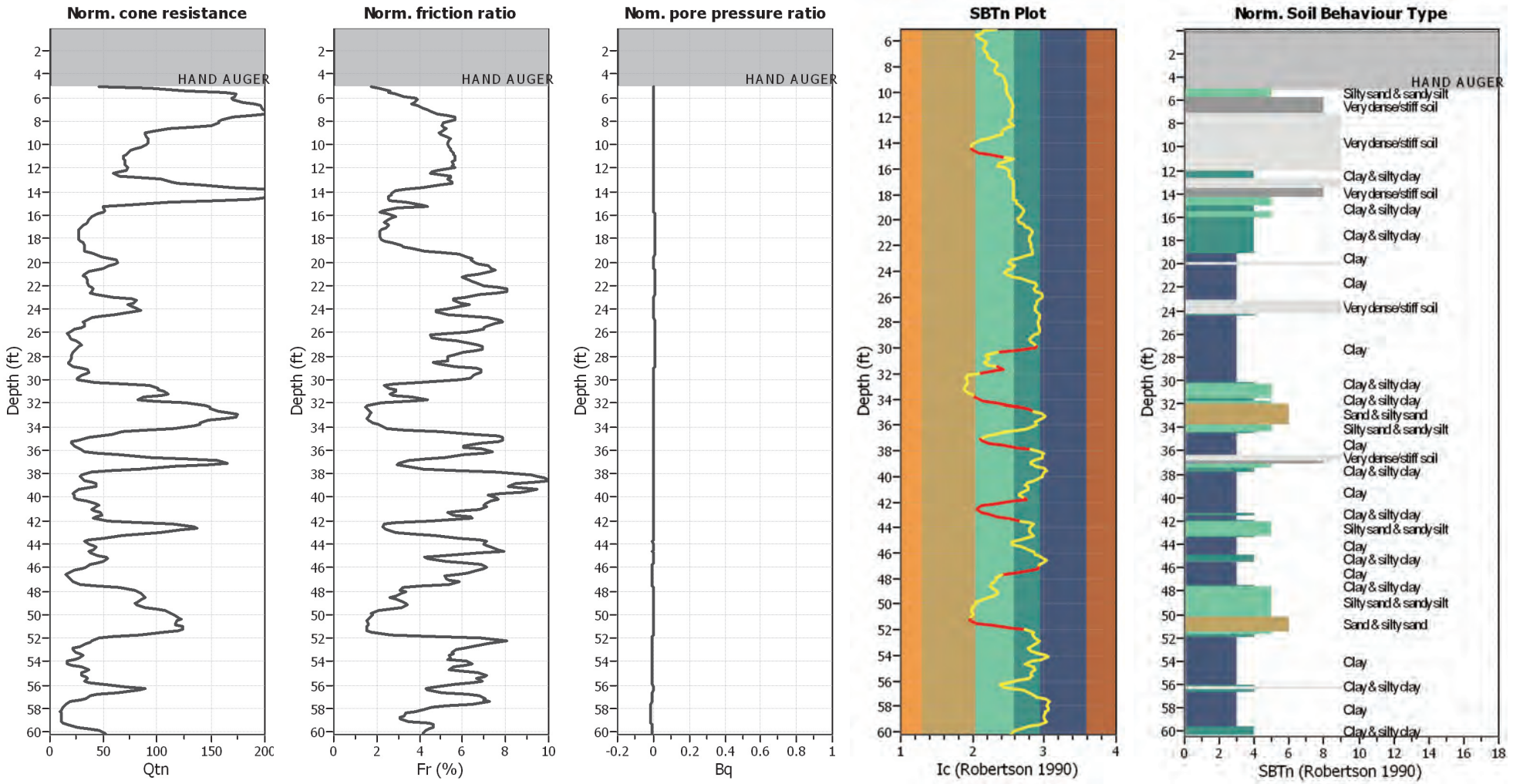
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



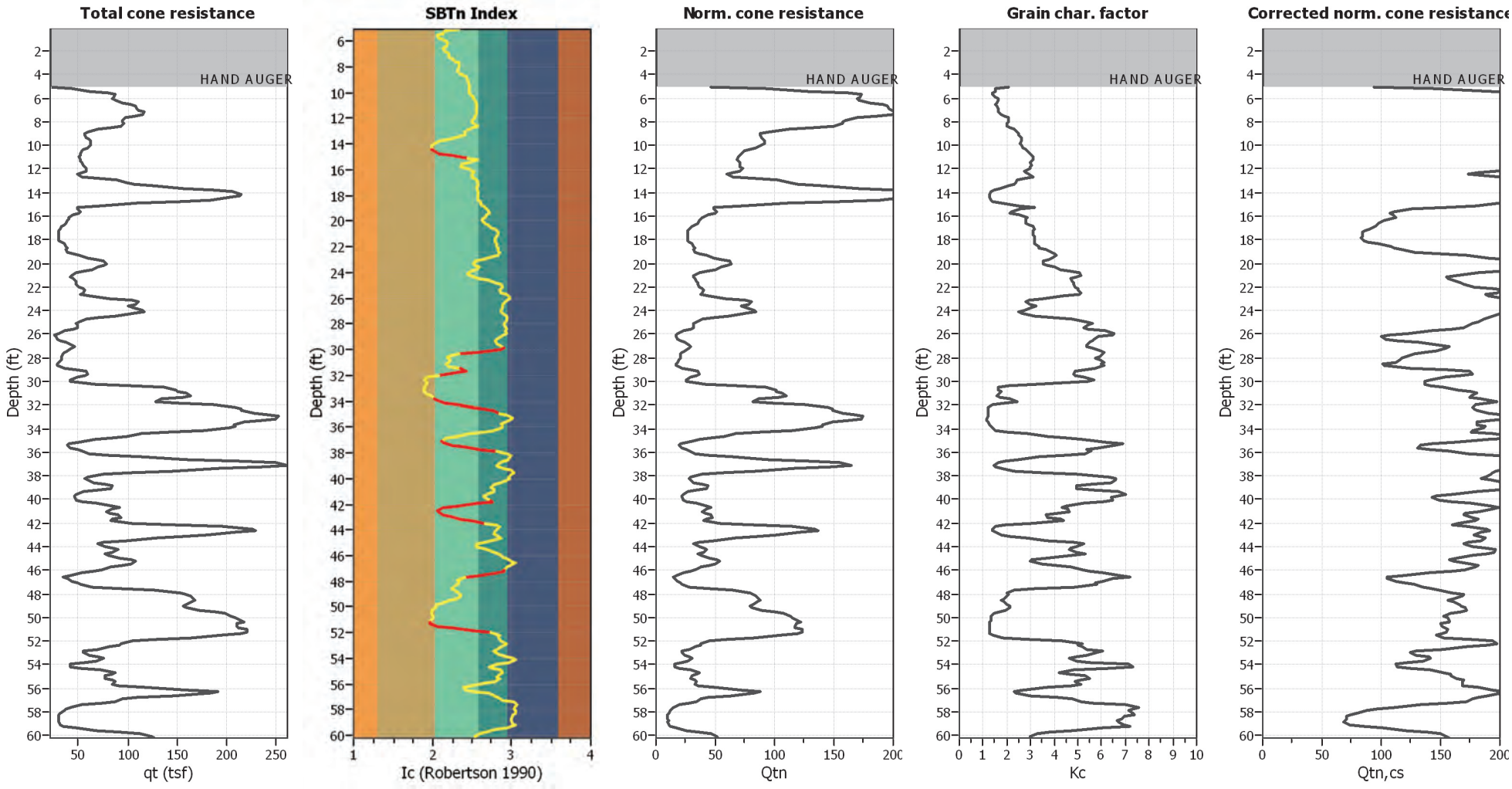
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

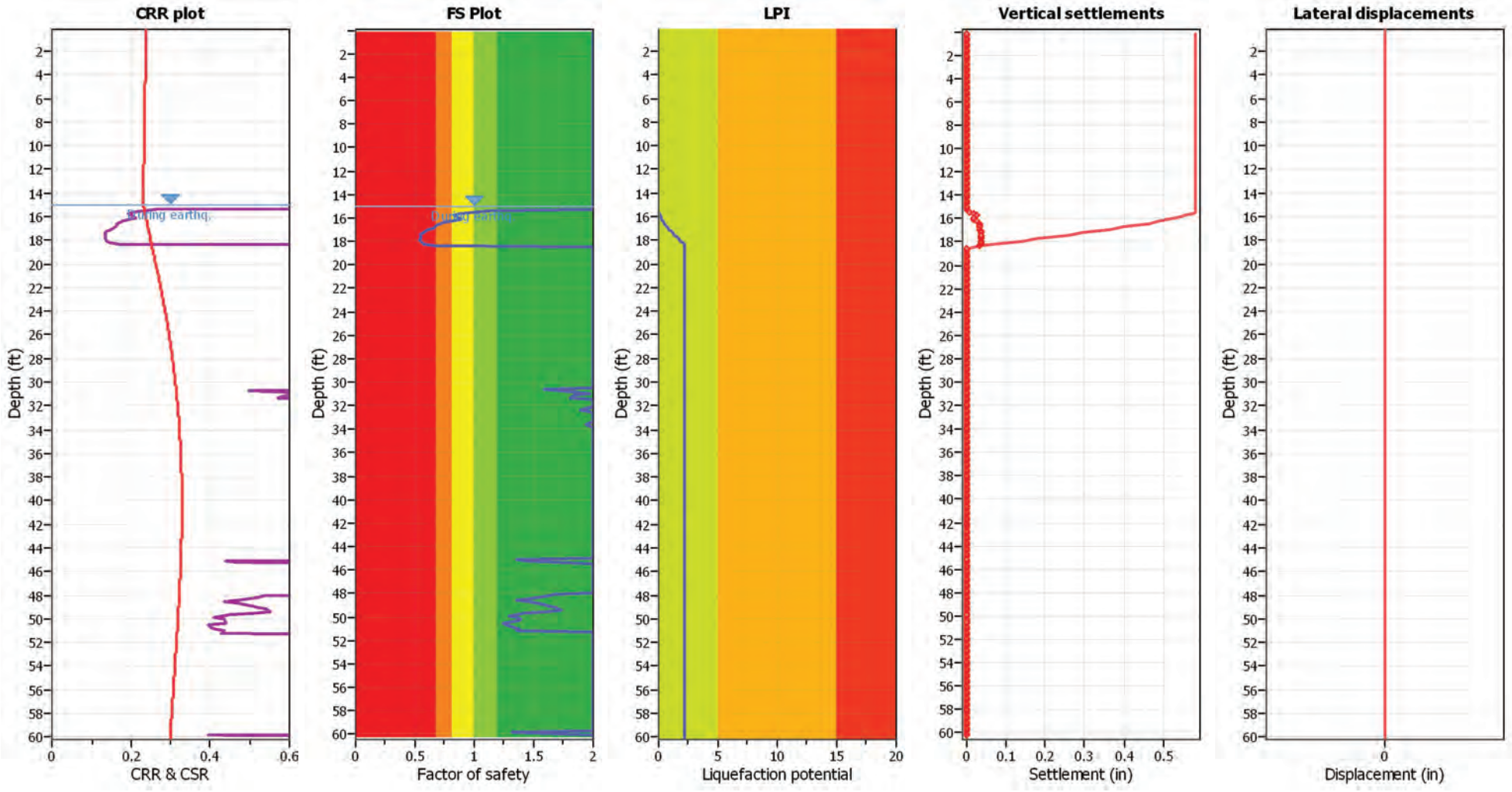
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

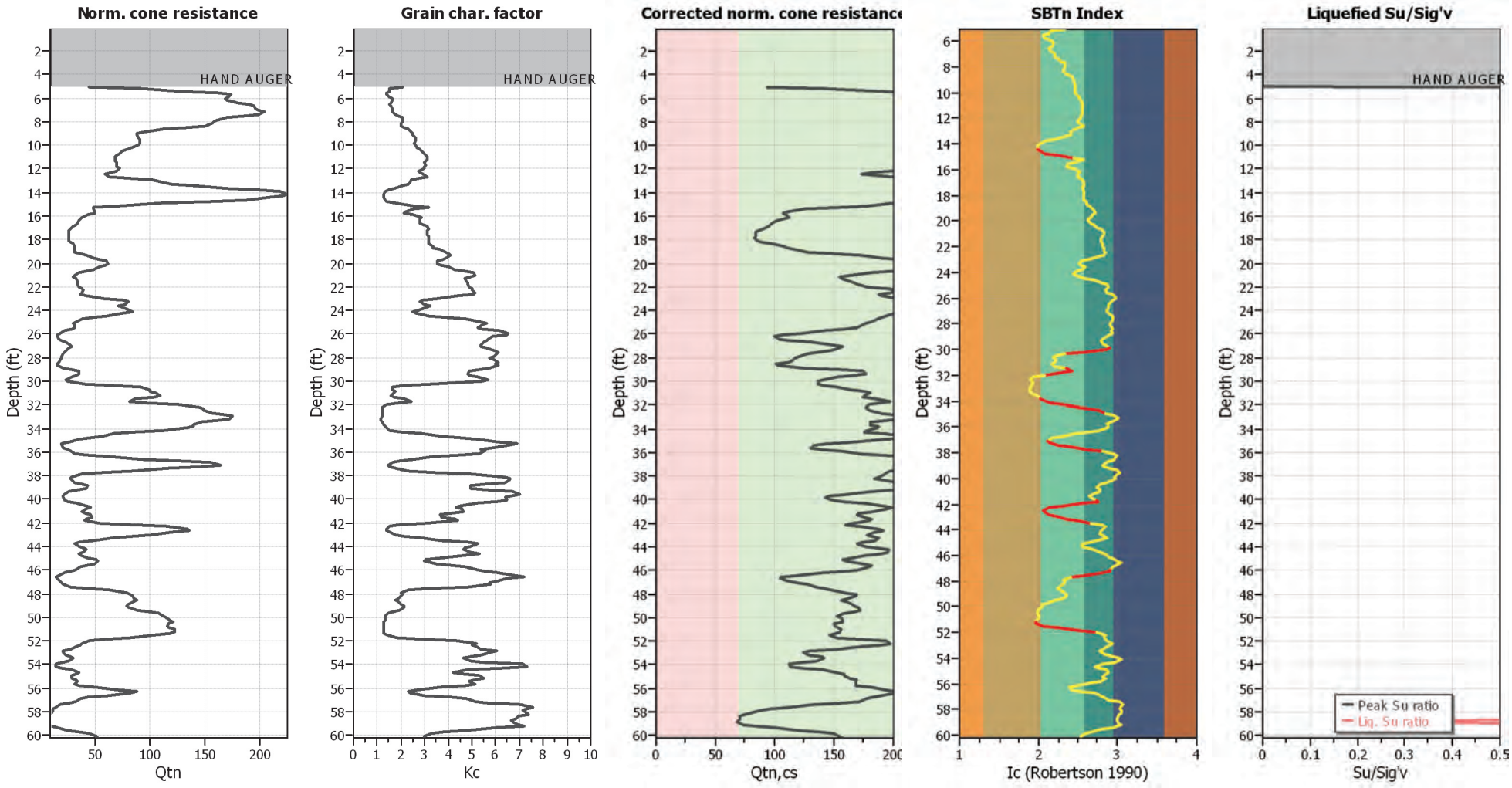
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.46	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

Project title : 21-2971 16911 Normandie Associates, LLC

Location :

Overall vertical settlements report

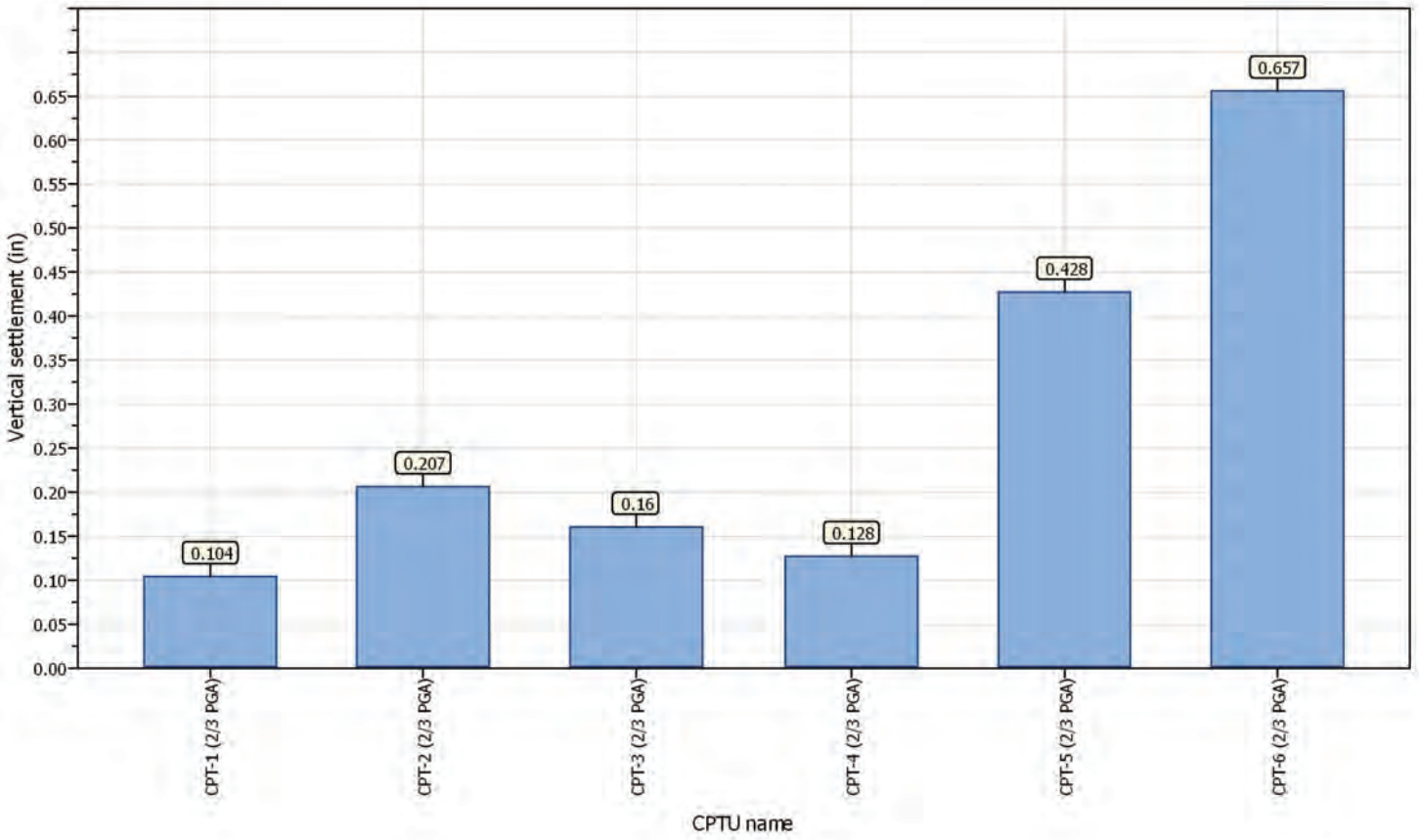


TABLE OF CONTENTS

CPT-1 (2/3 PGA) results
Summary data report 1

CPT-2 (2/3 PGA) results
Summary data report 7

CPT-3 (2/3 PGA) results
Summary data report 13

CPT-4 (2/3 PGA) results
Summary data report 19

CPT-5 (2/3 PGA) results
Summary data report 25

CPT-6 (2/3 PGA) results
Summary data report 31

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

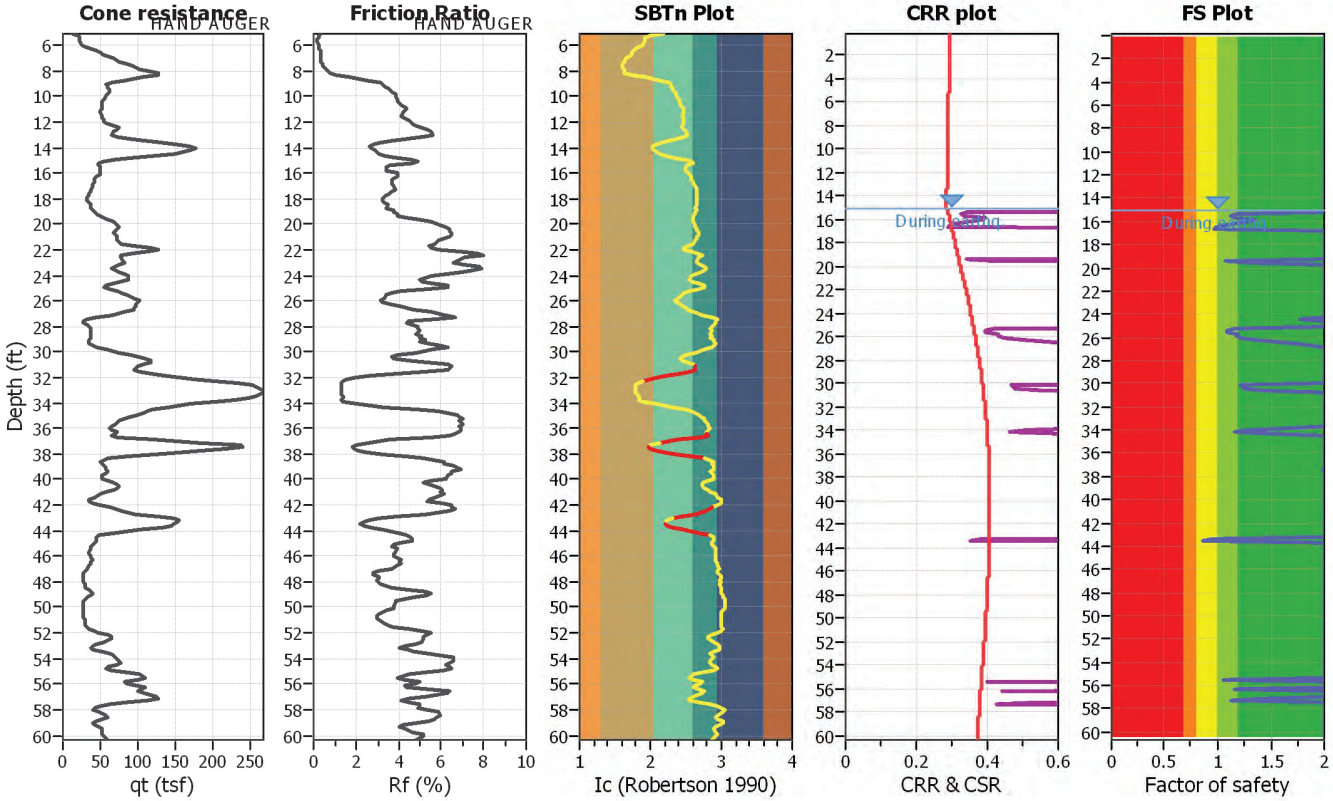
LIQUEFACTION ANALYSIS REPORT

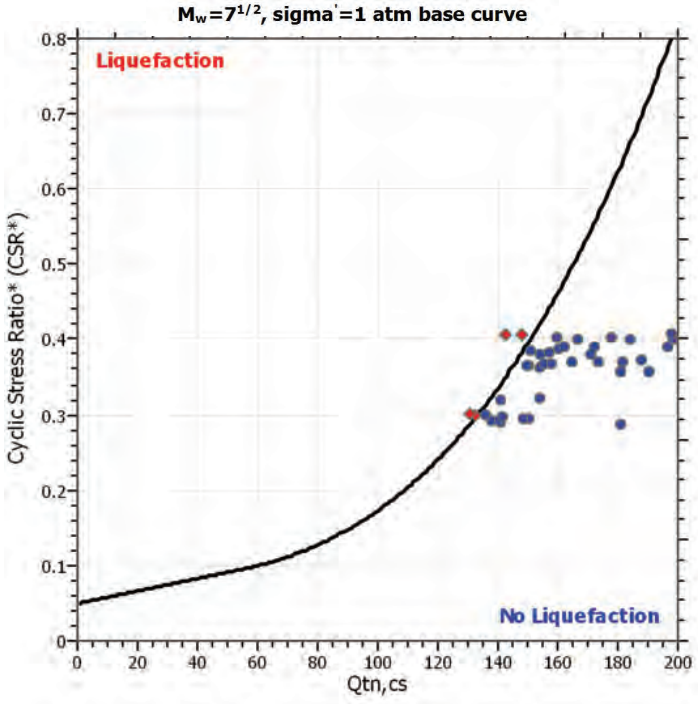
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

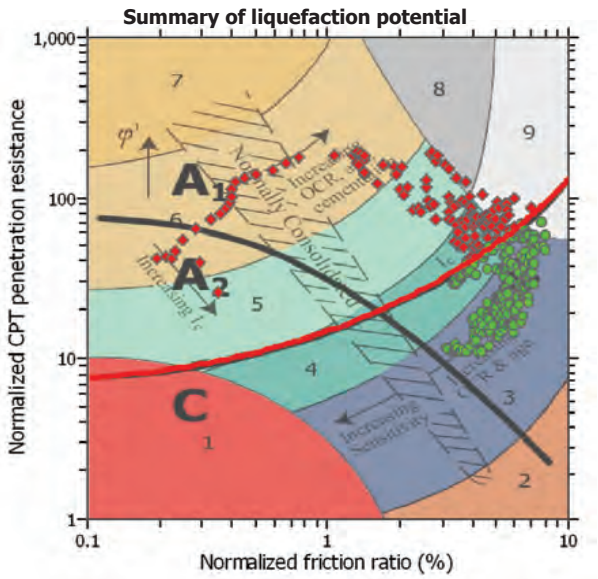
CPT file : CPT-1 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

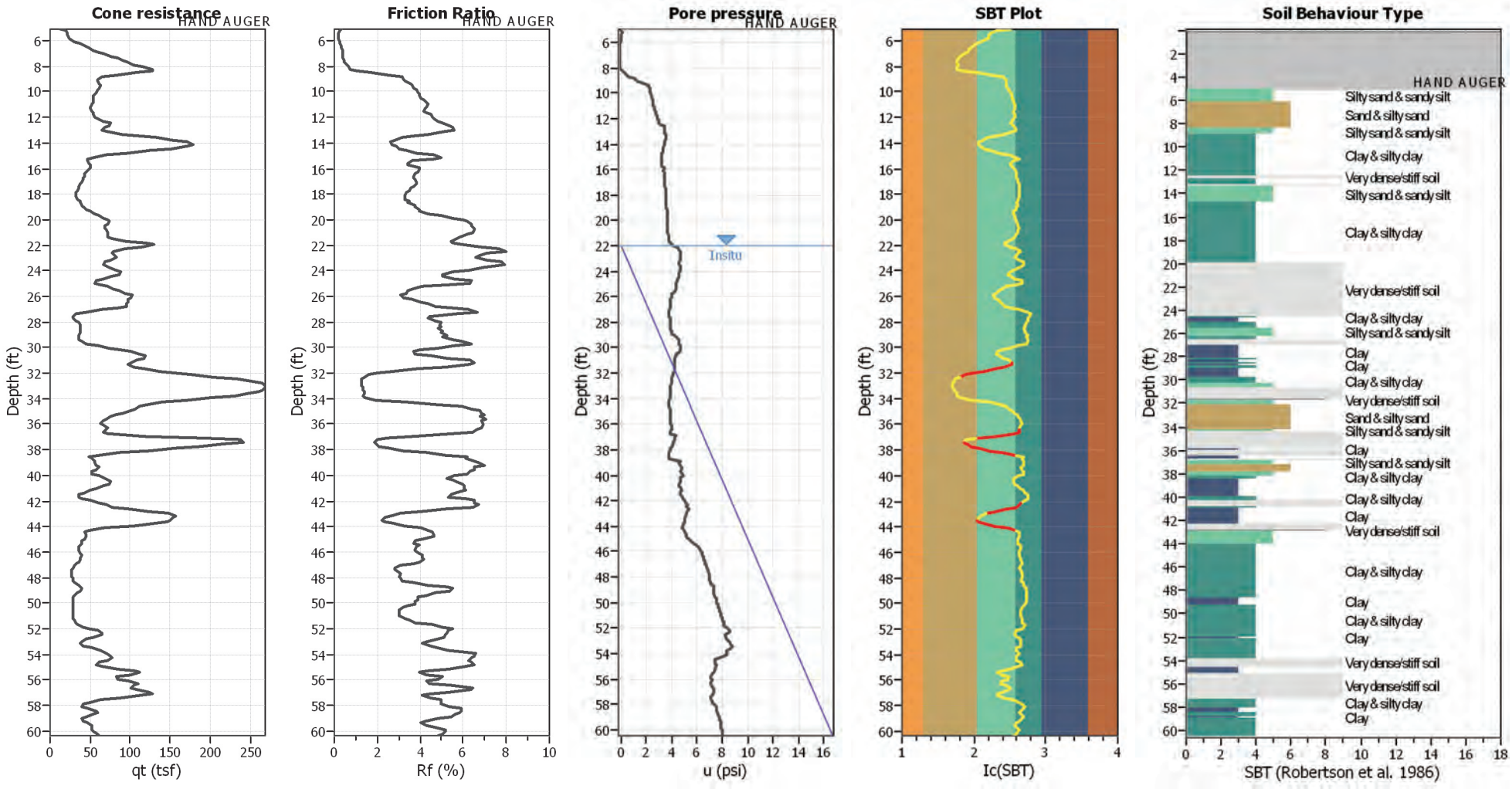






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



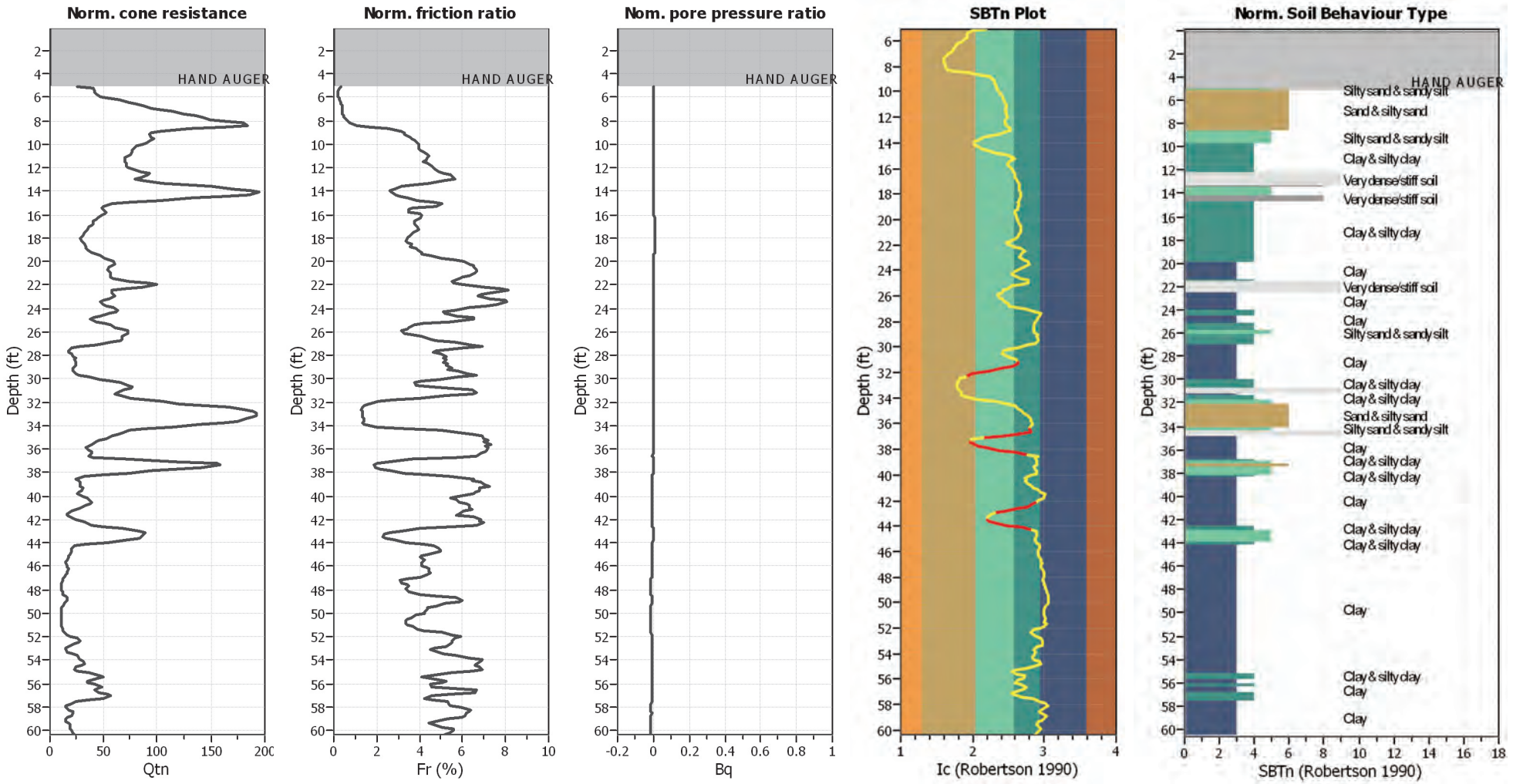
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



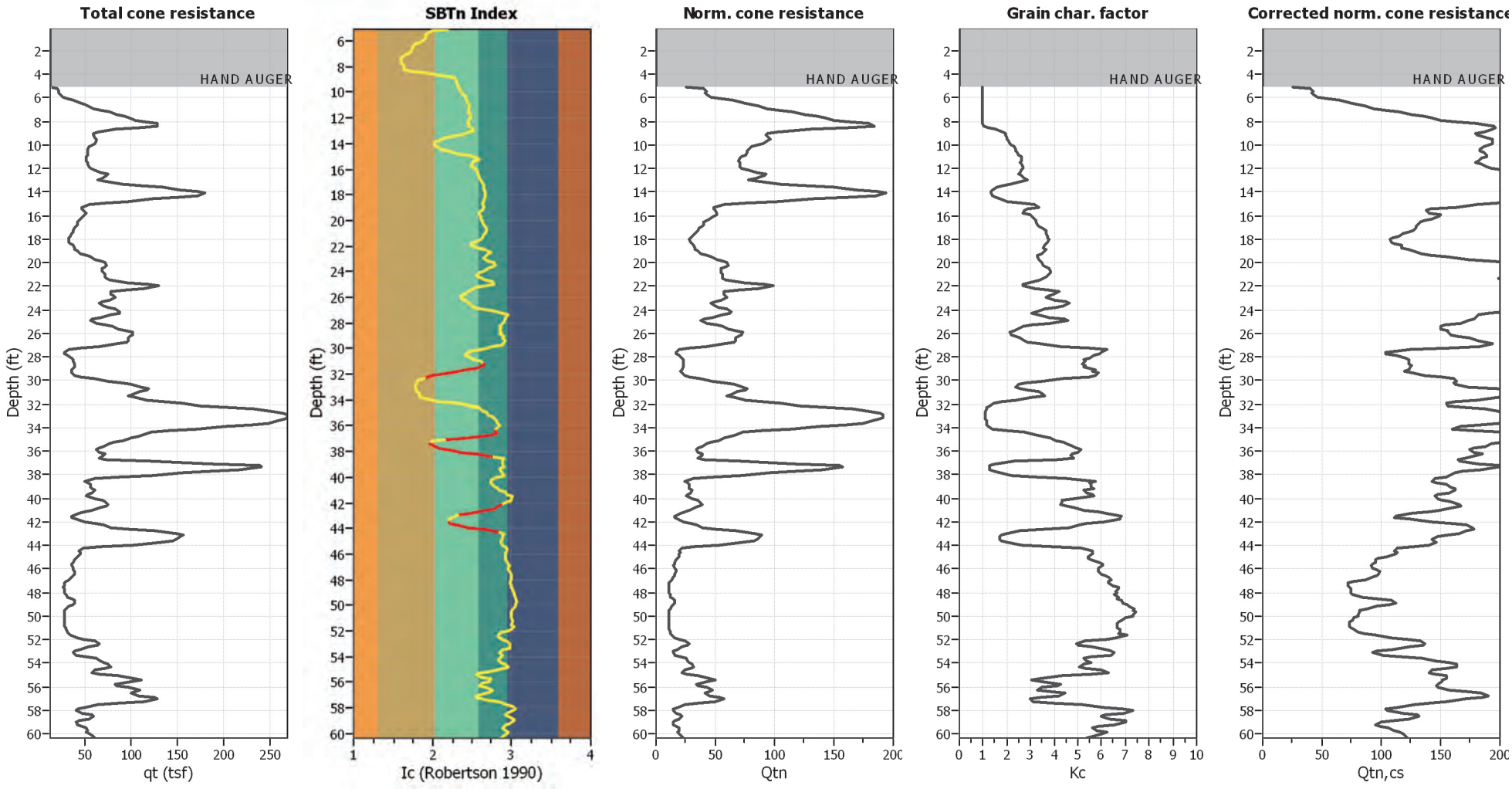
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

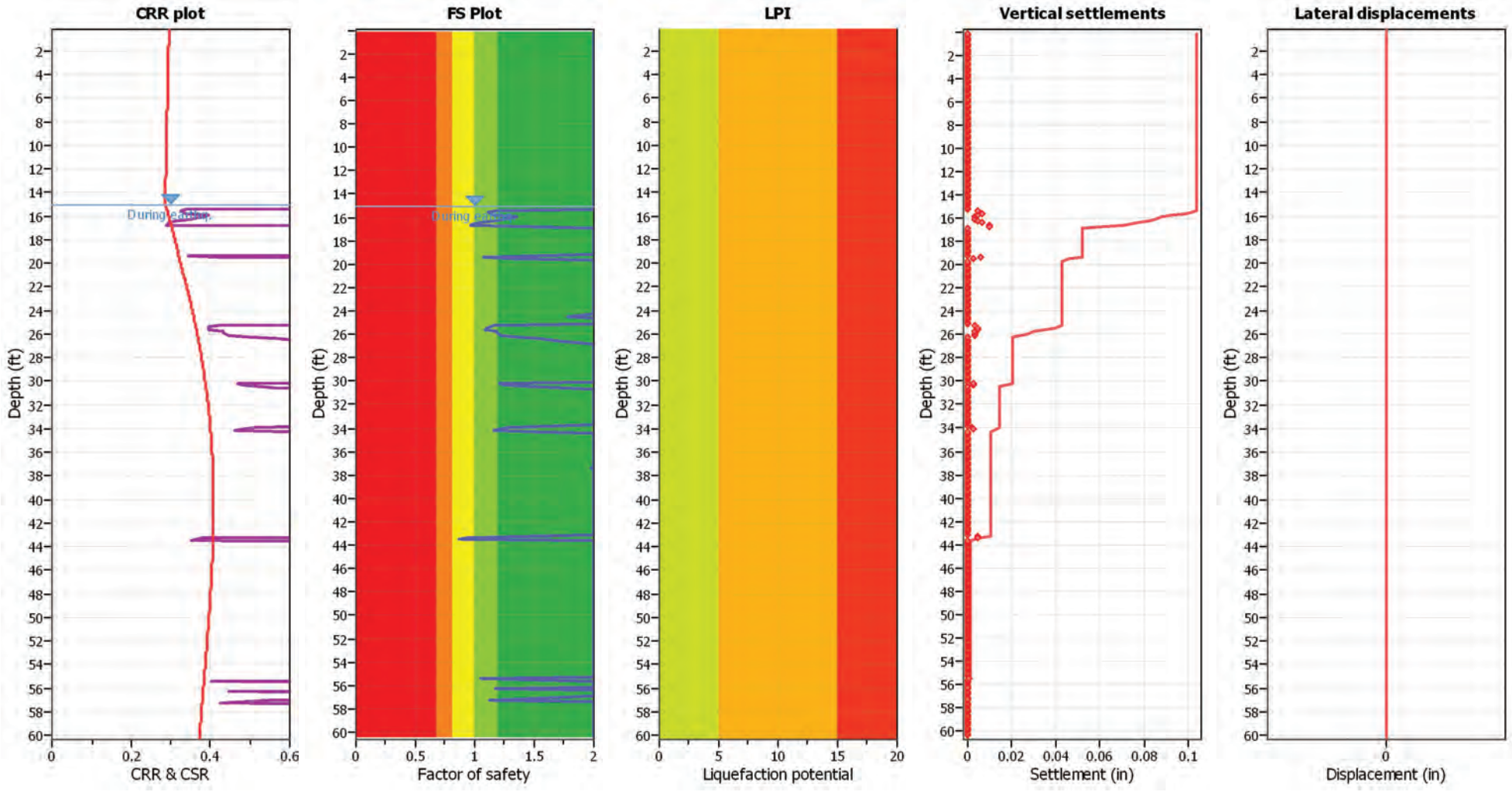
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

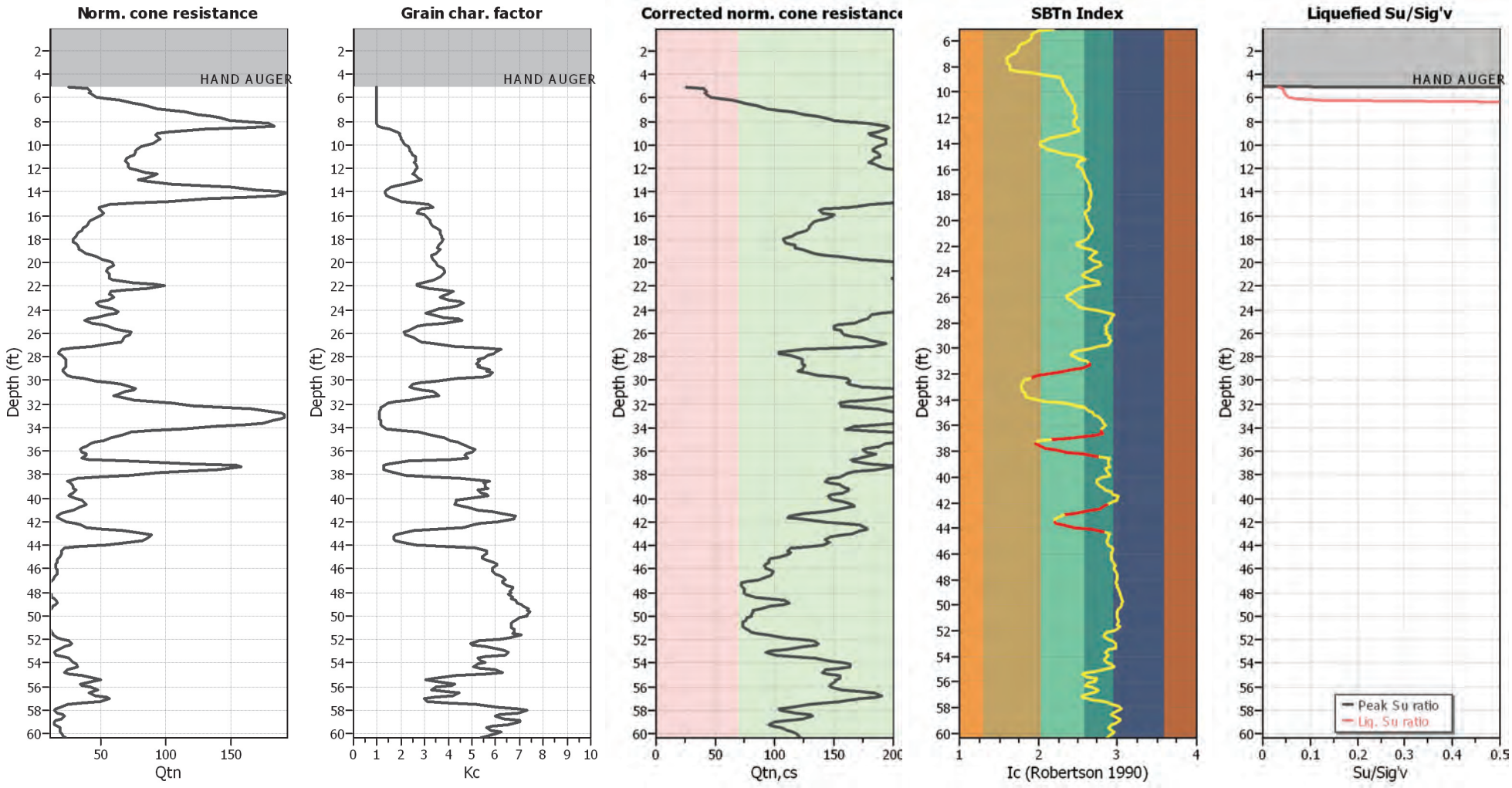
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

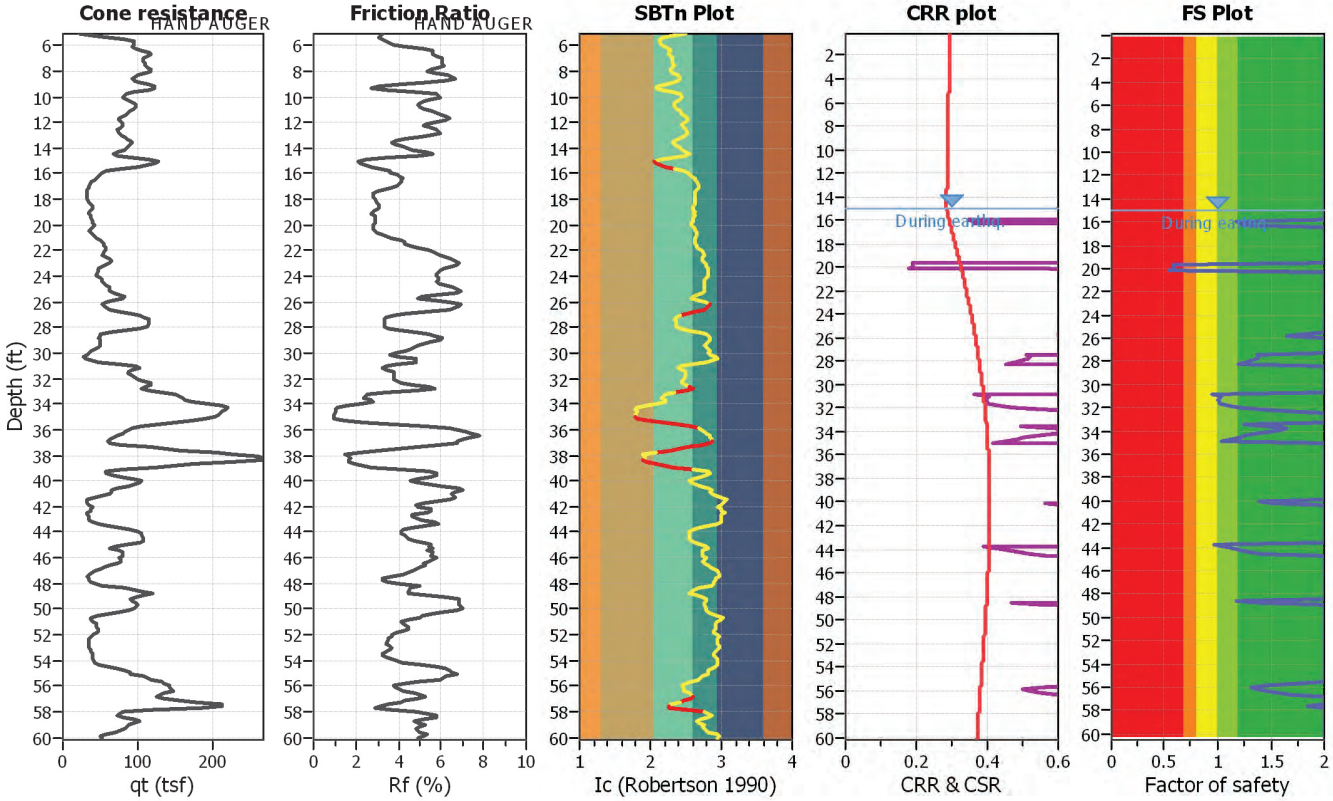
LIQUEFACTION ANALYSIS REPORT

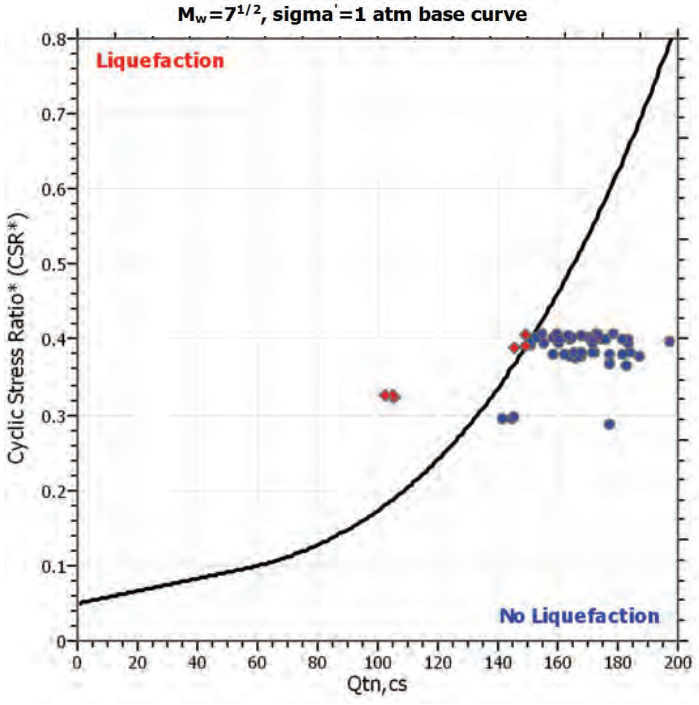
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

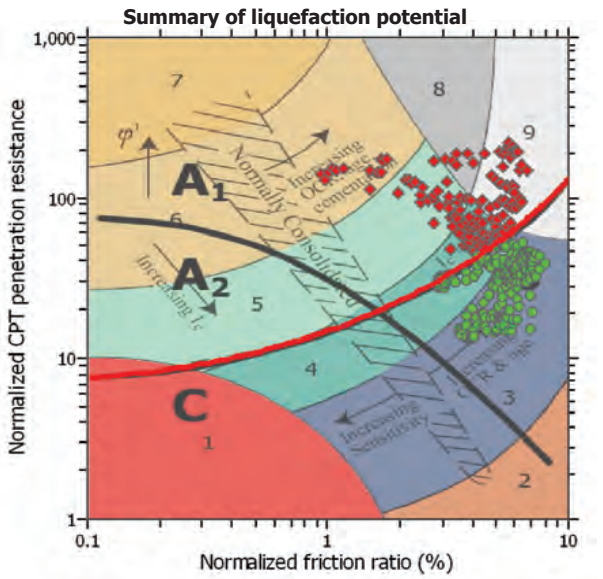
CPT file : CPT-2 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

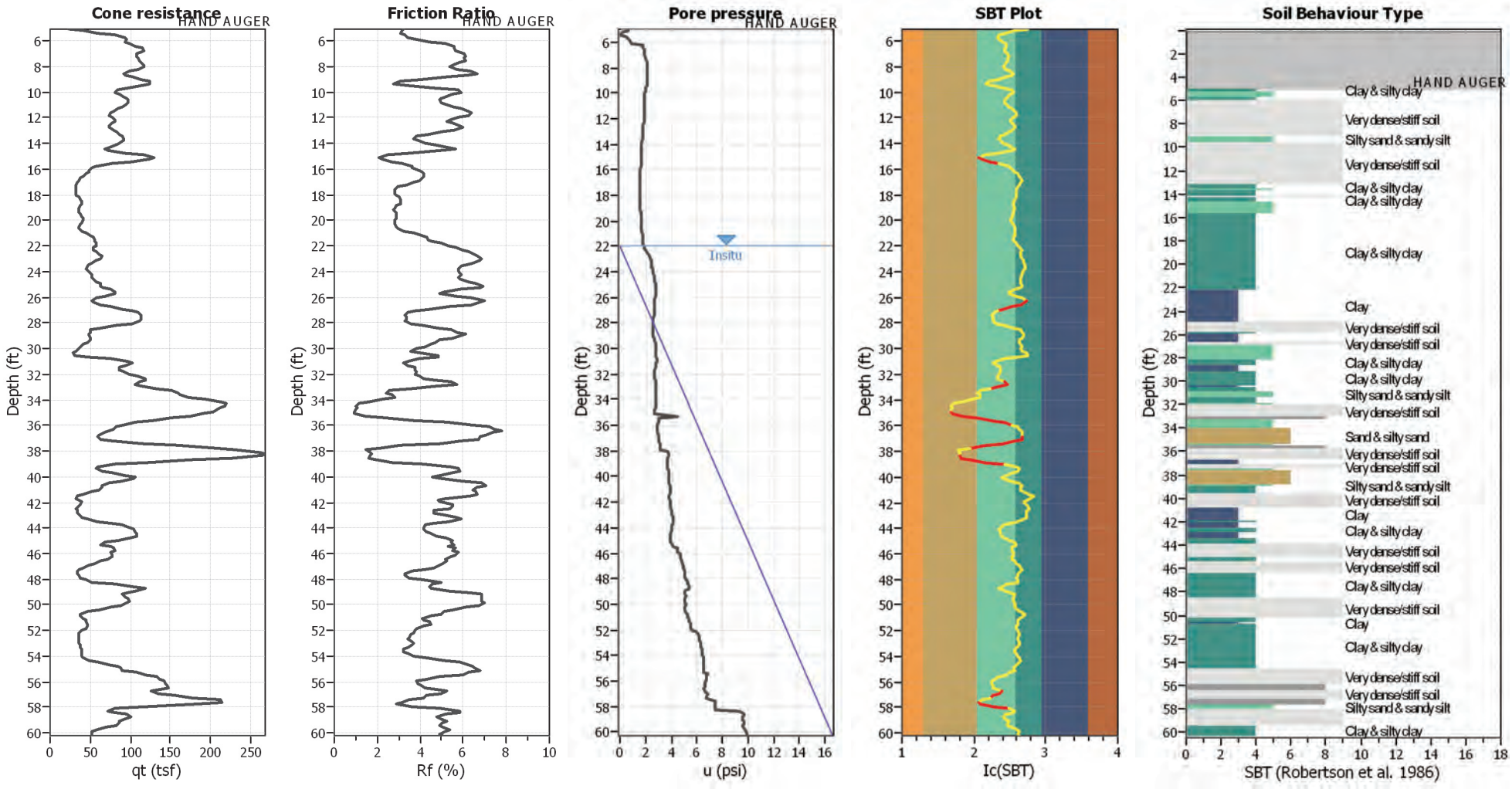






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



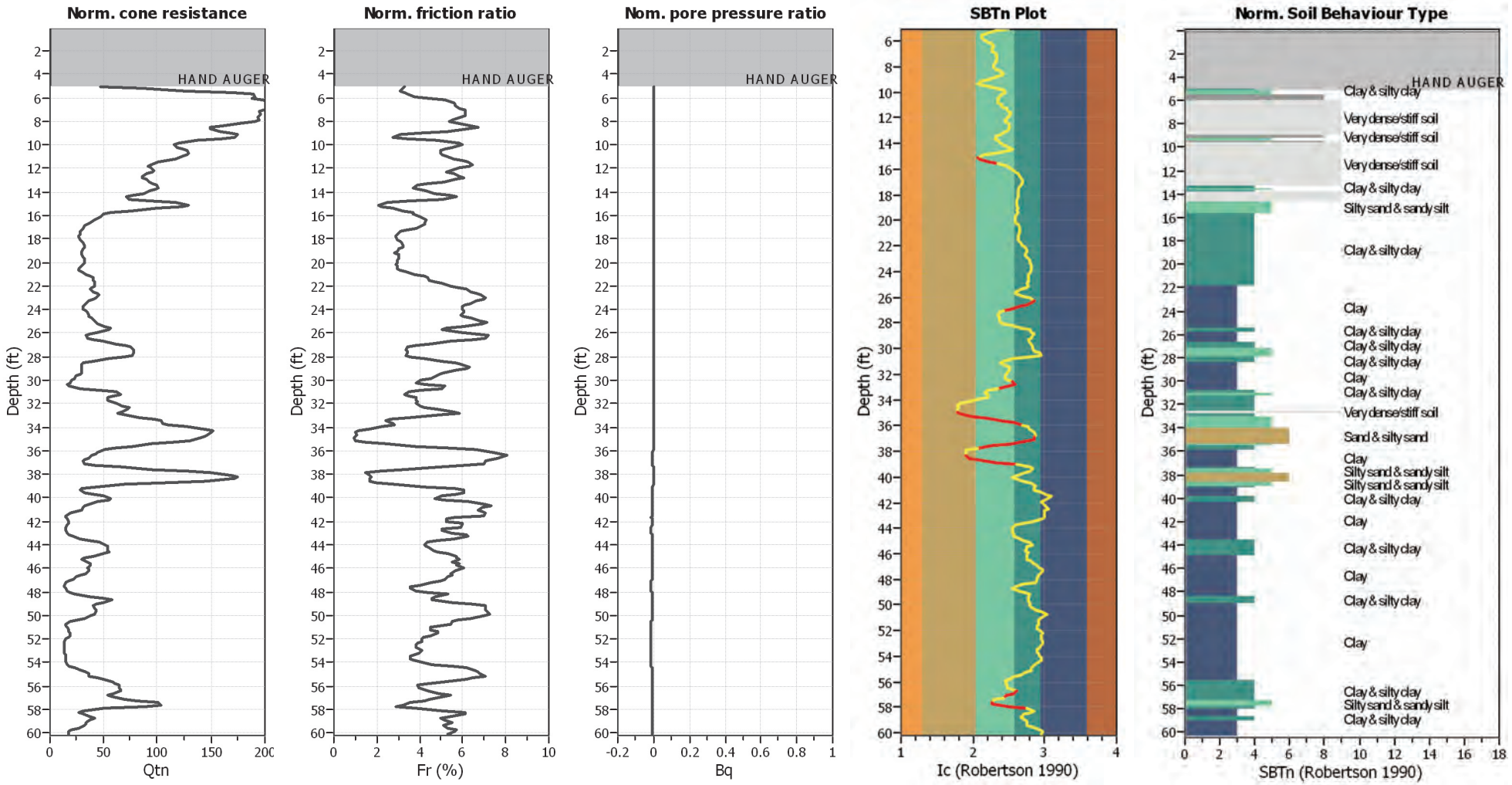
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



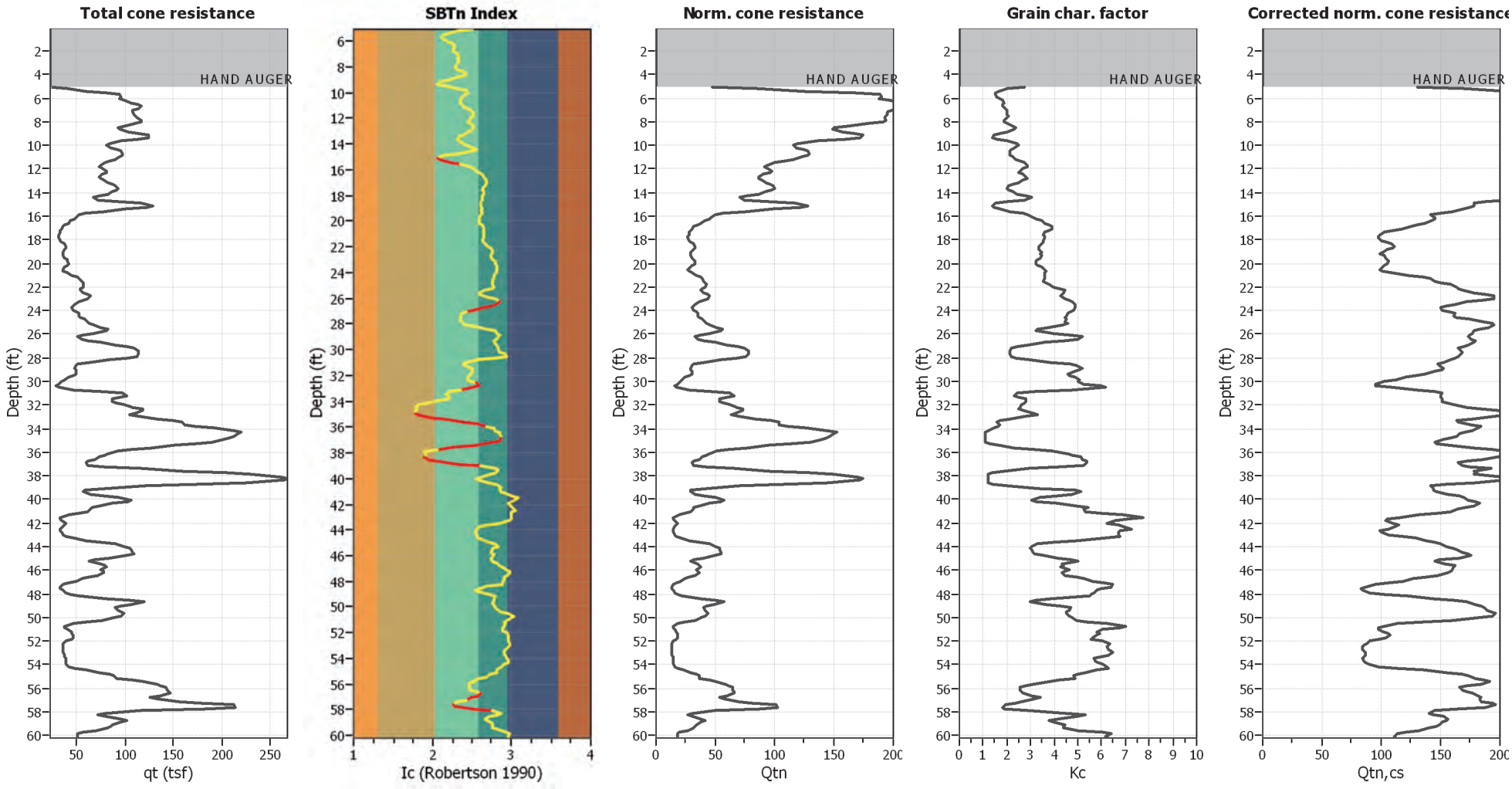
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

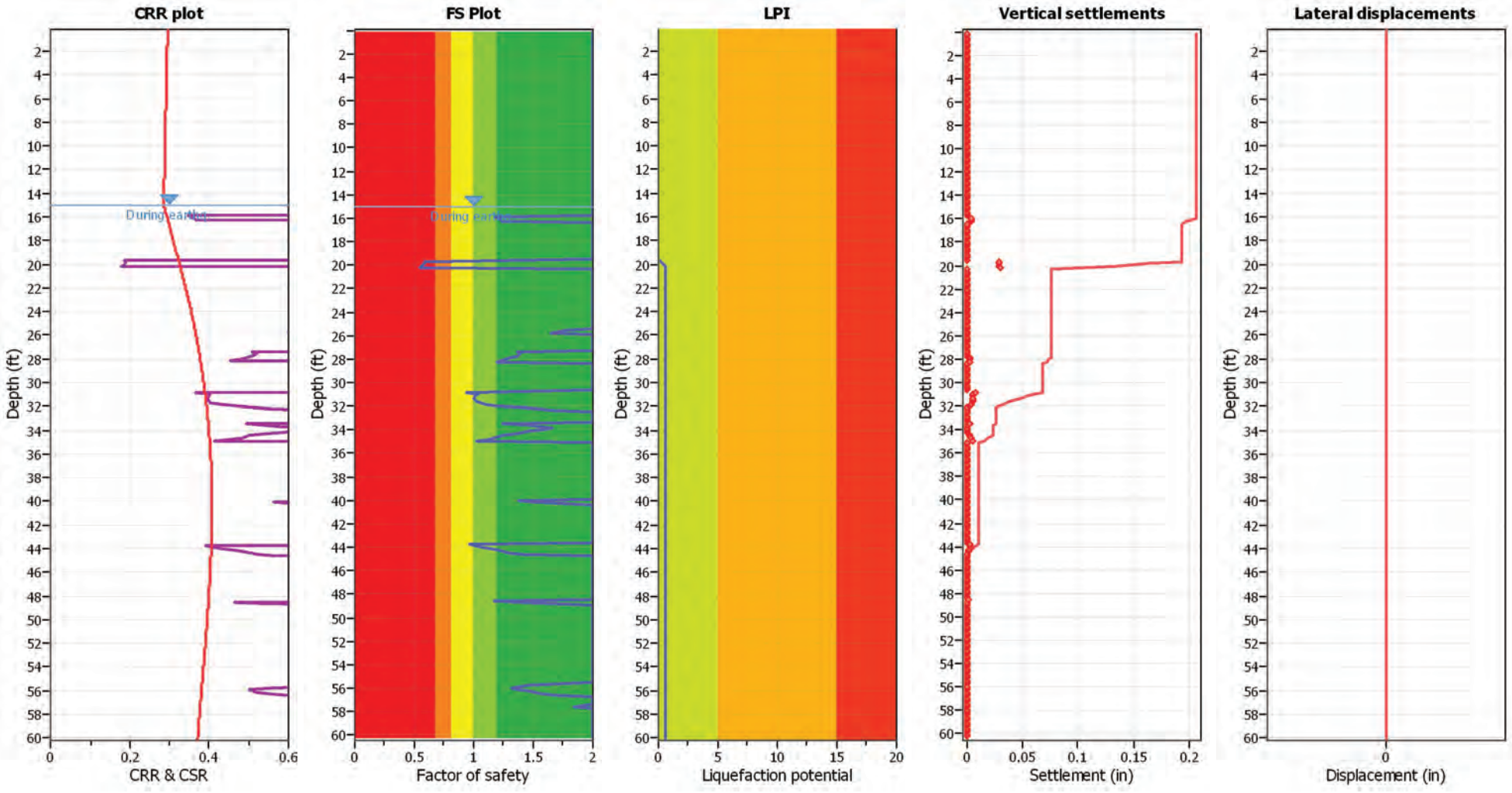
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

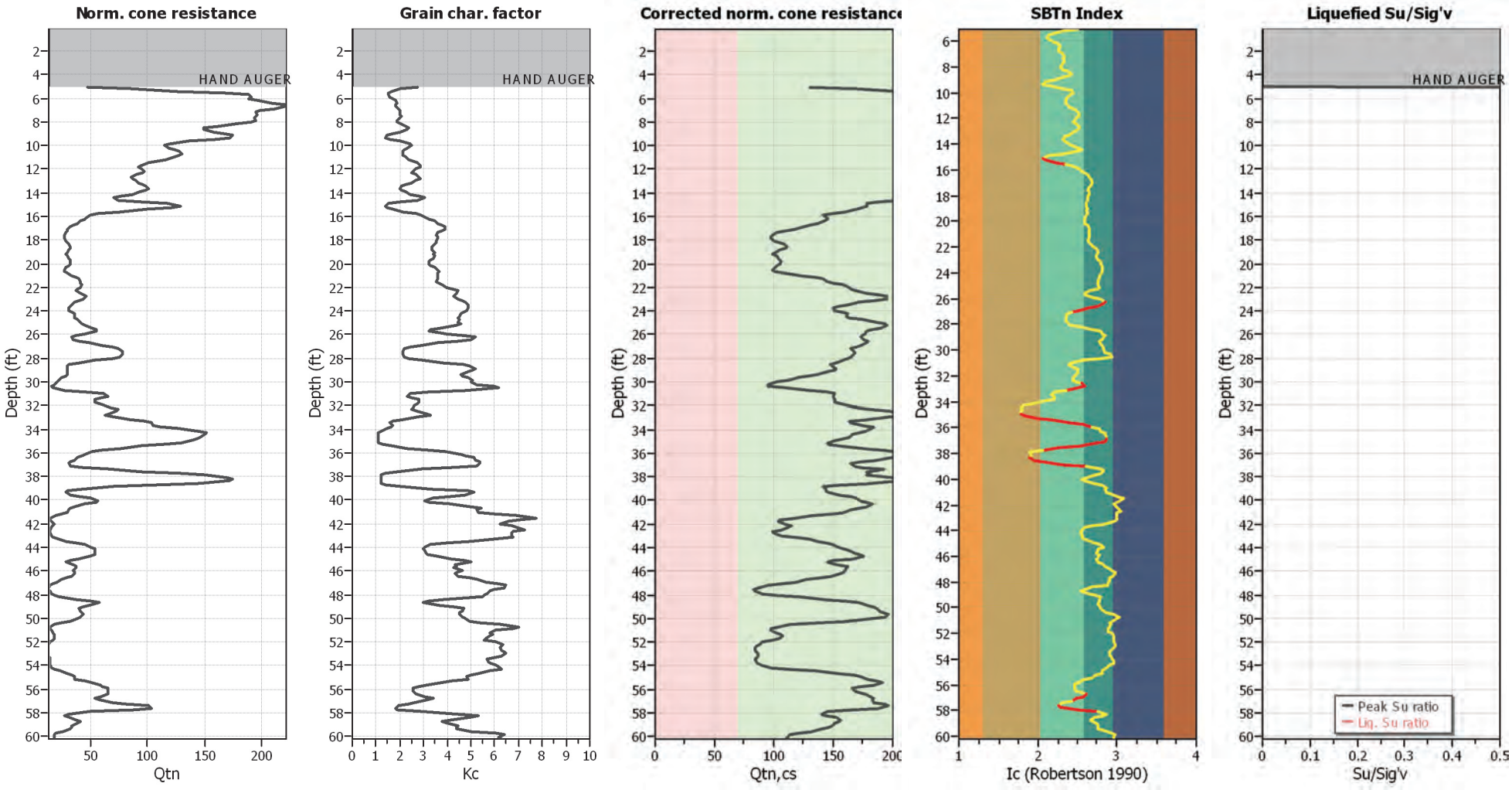
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

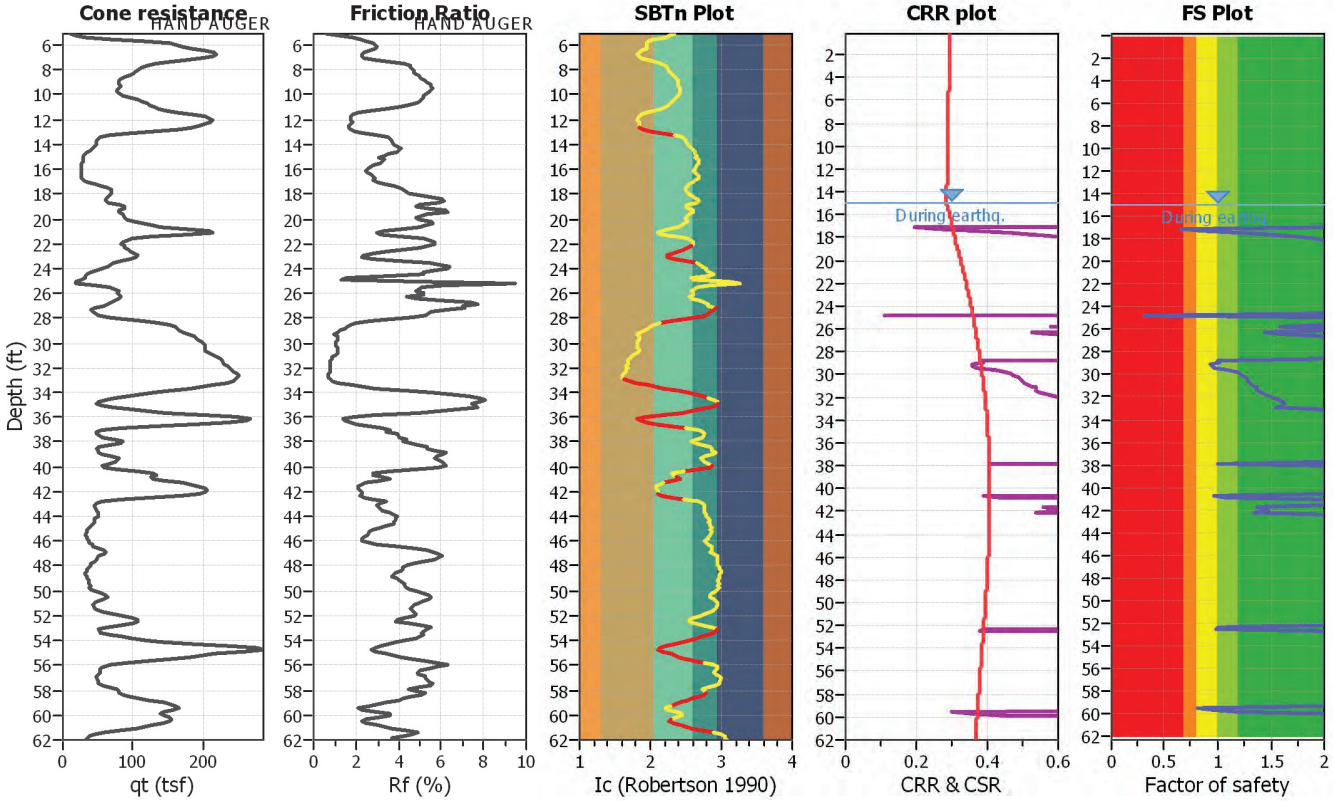
LIQUEFACTION ANALYSIS REPORT

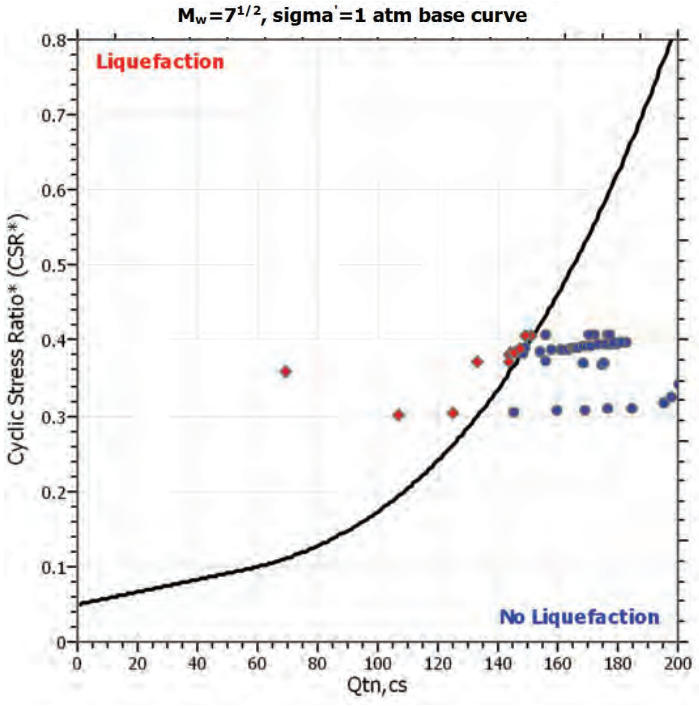
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

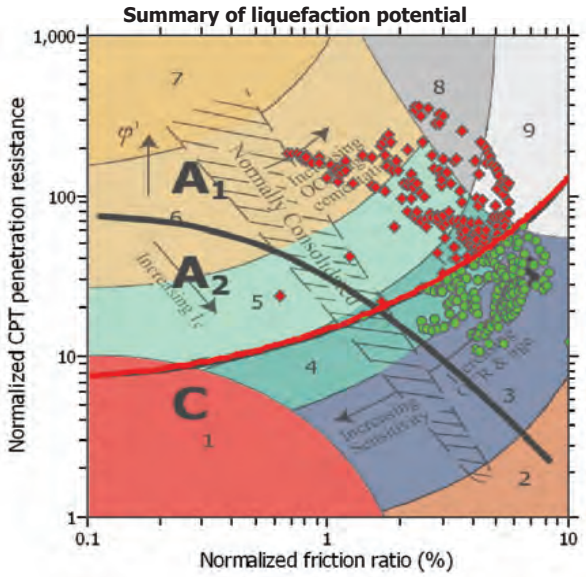
CPT file : CPT-3 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

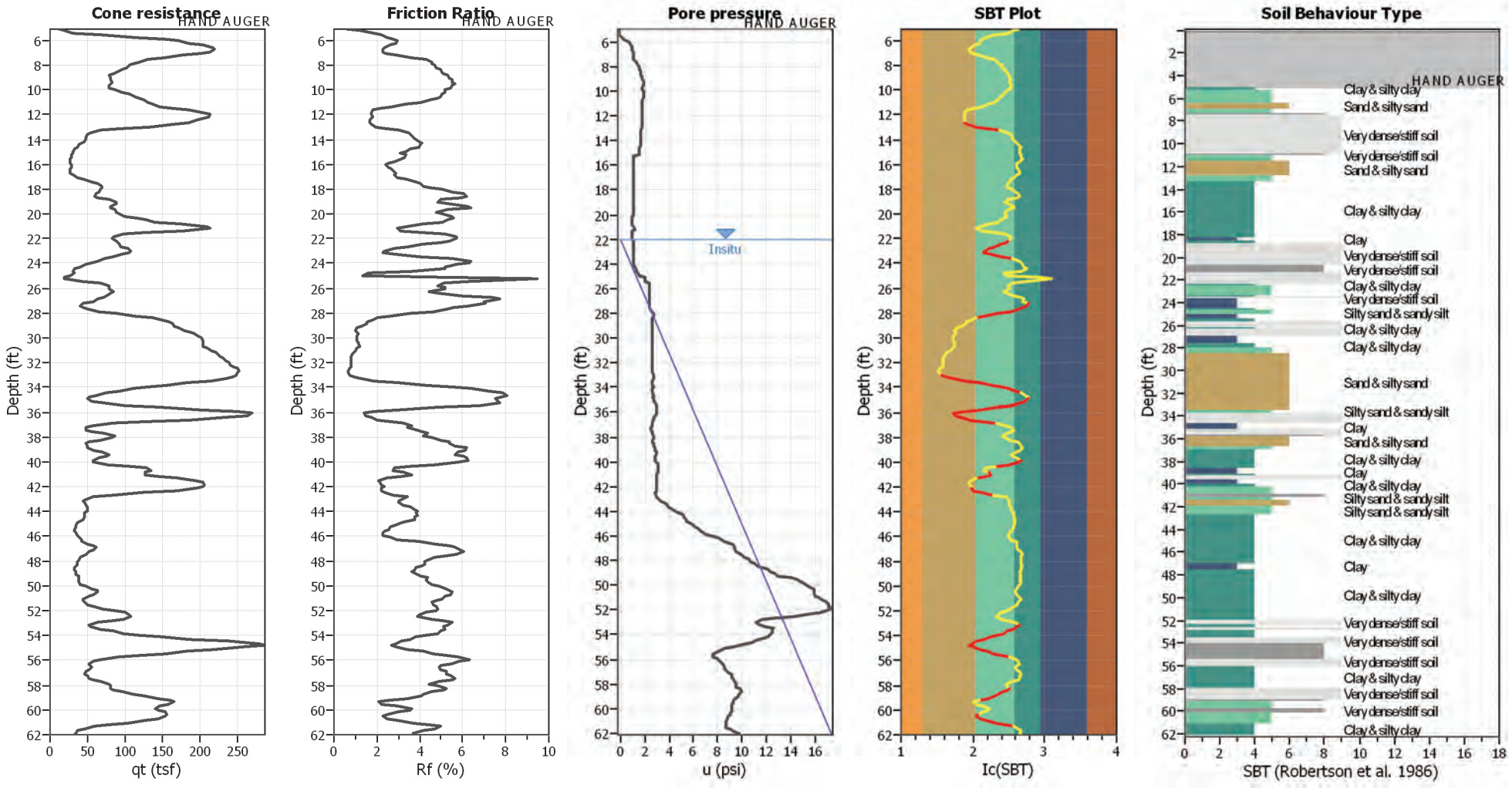






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



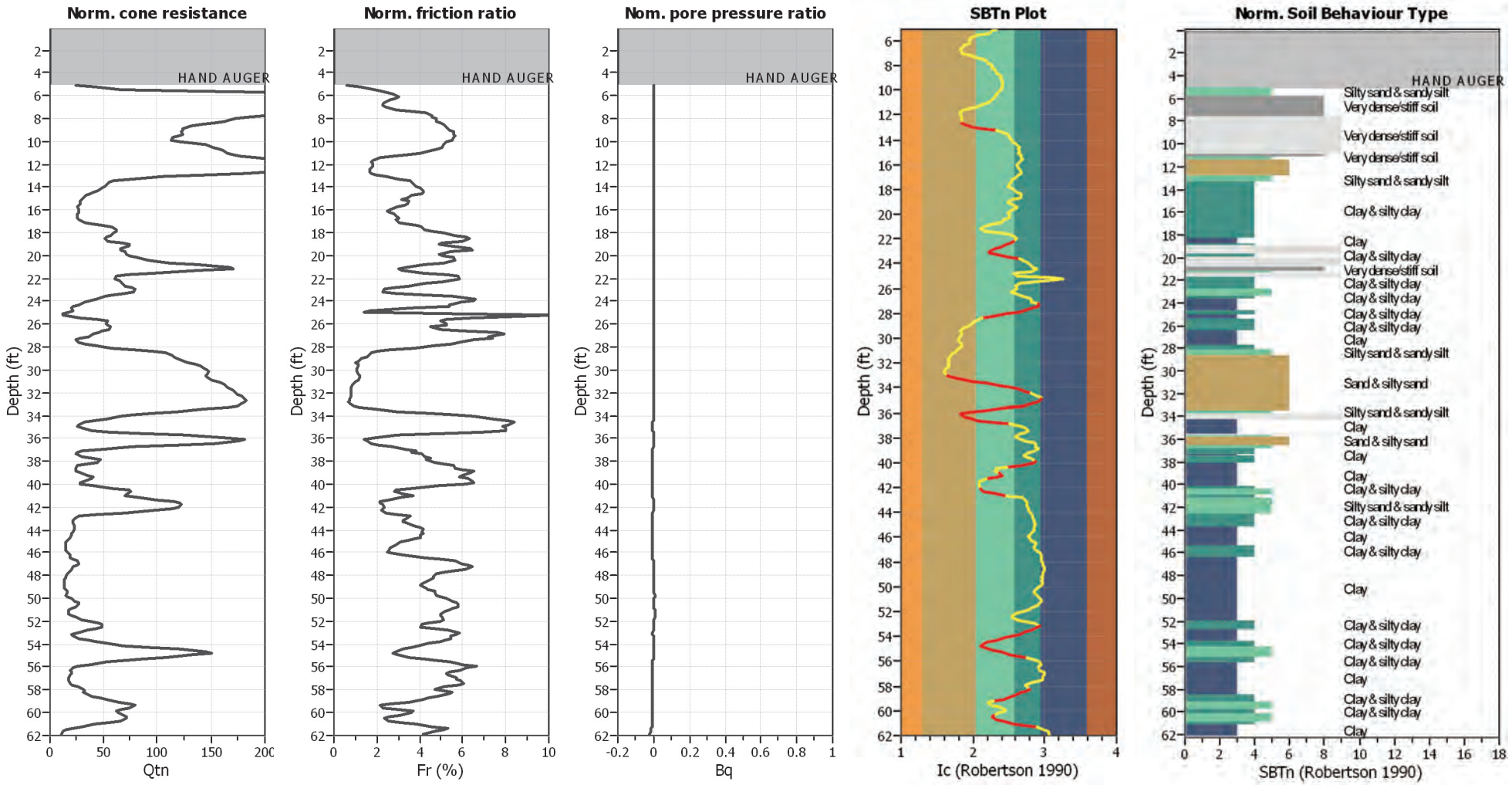
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



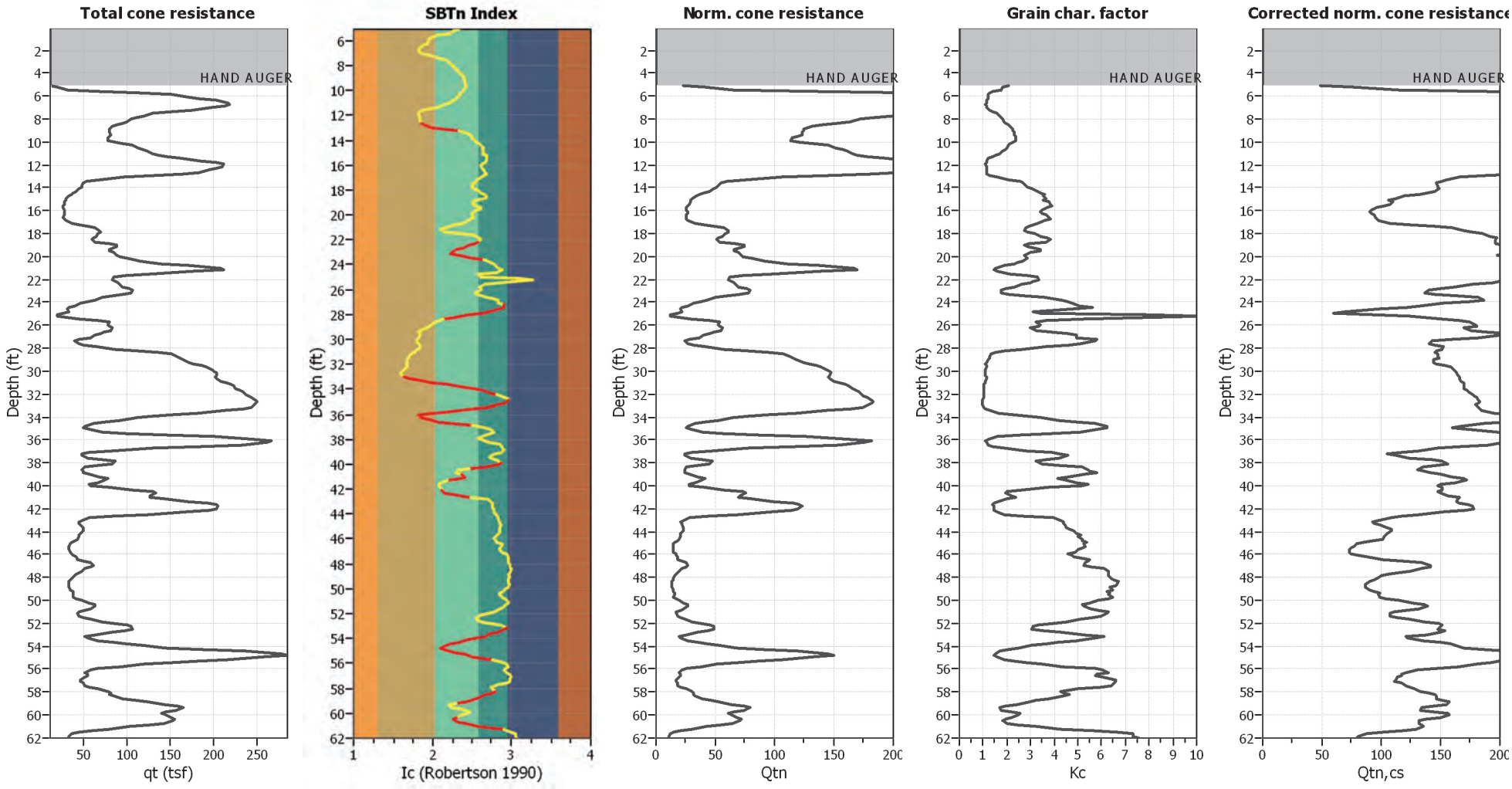
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

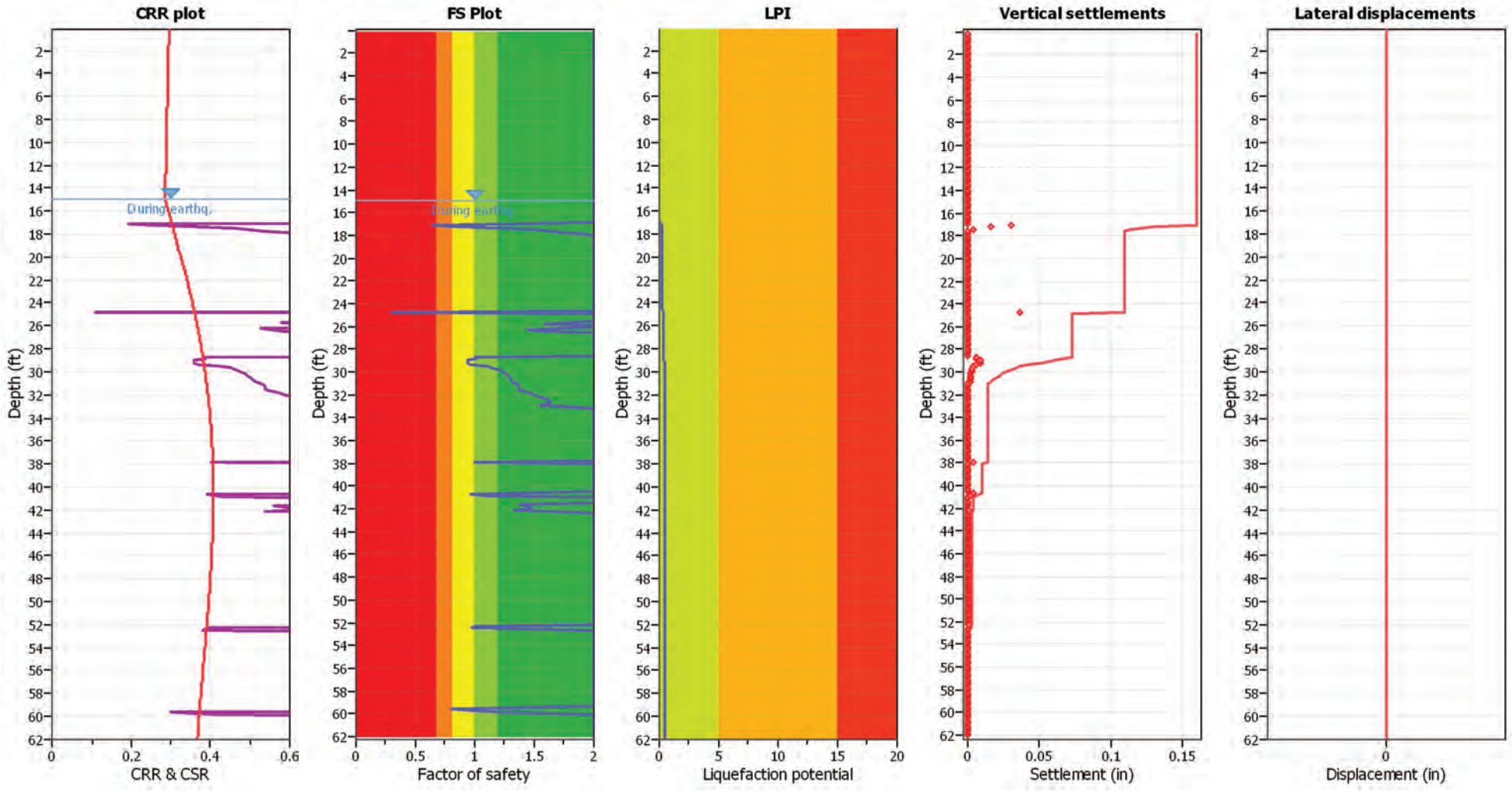
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

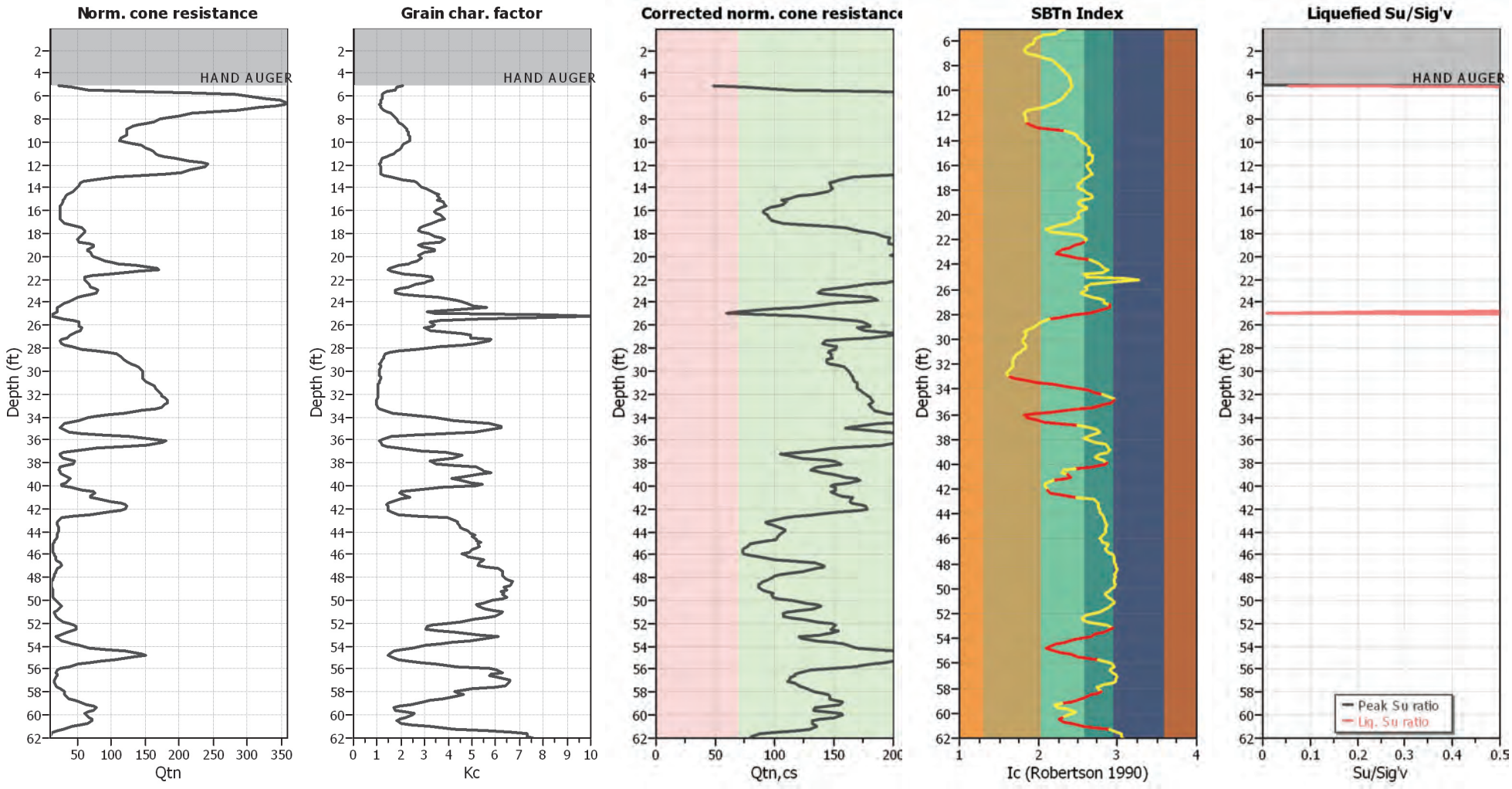
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

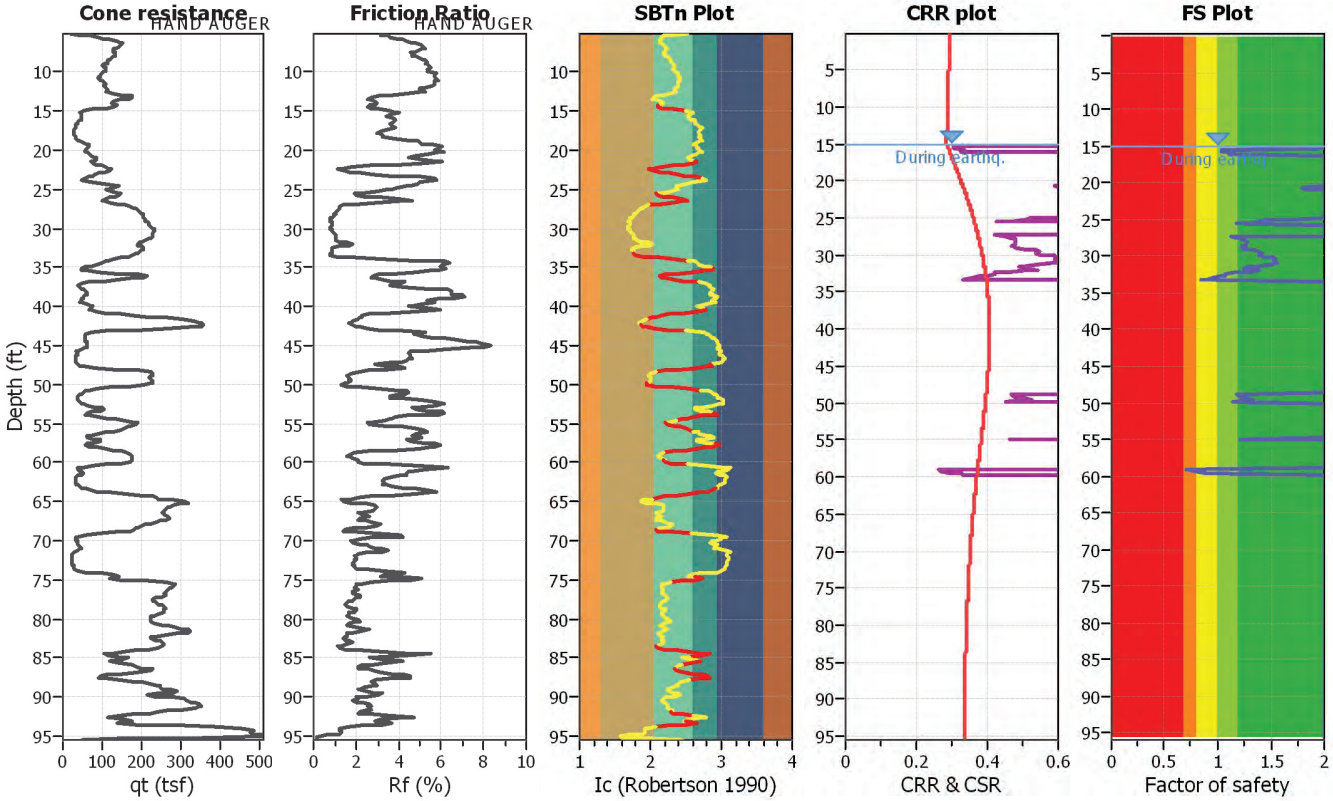
LIQUEFACTION ANALYSIS REPORT

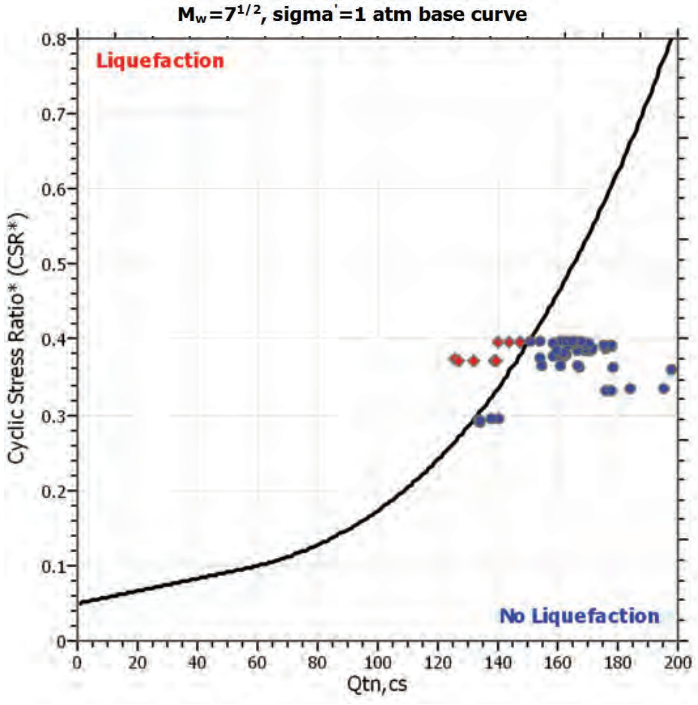
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

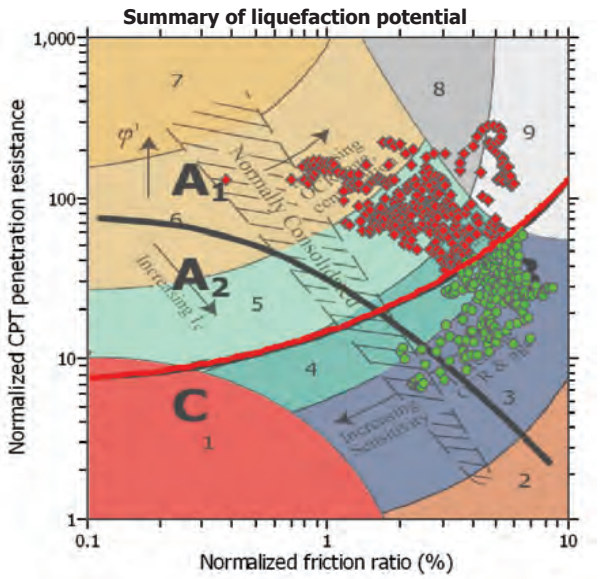
CPT file : CPT-4 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

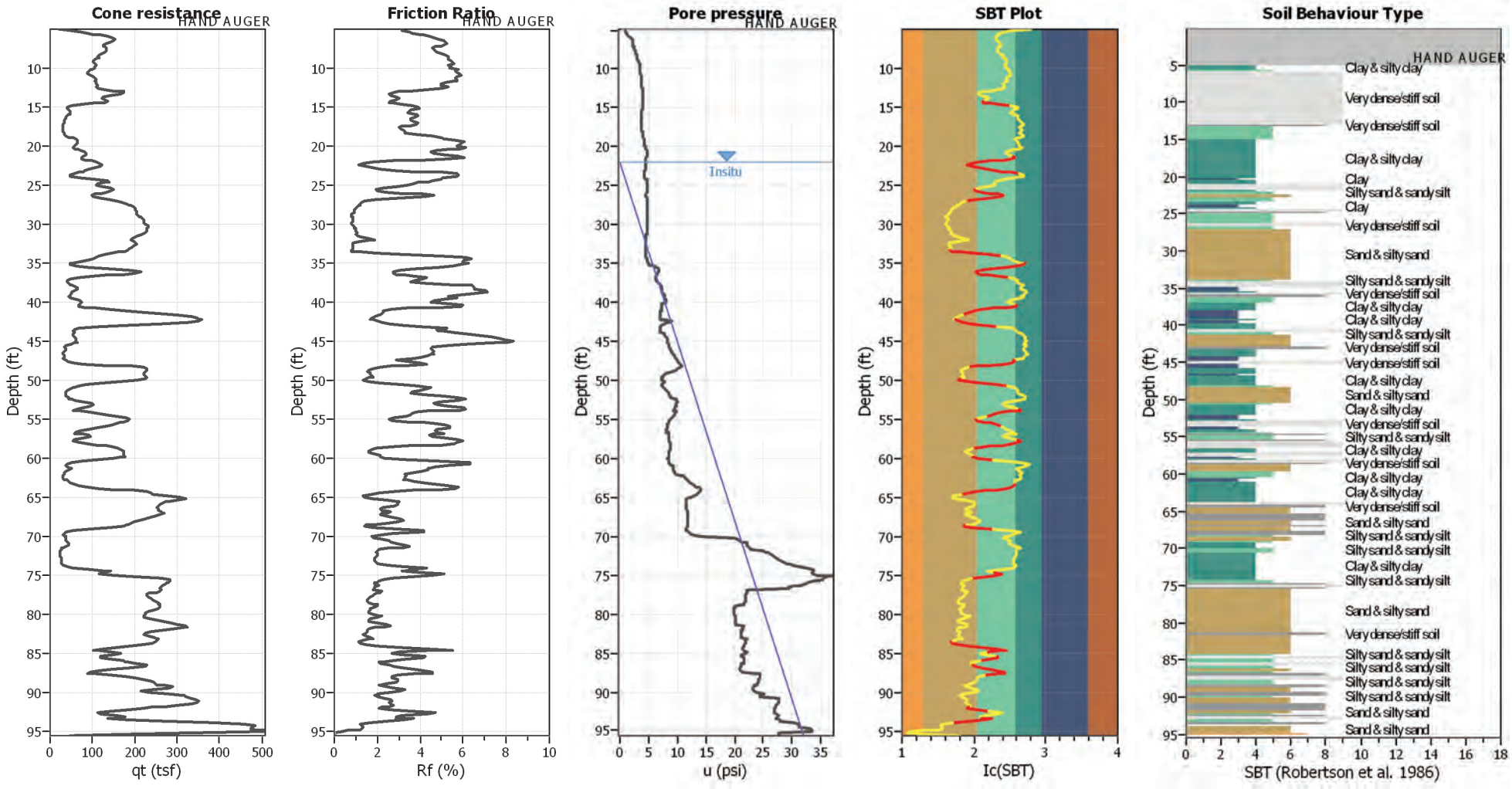






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



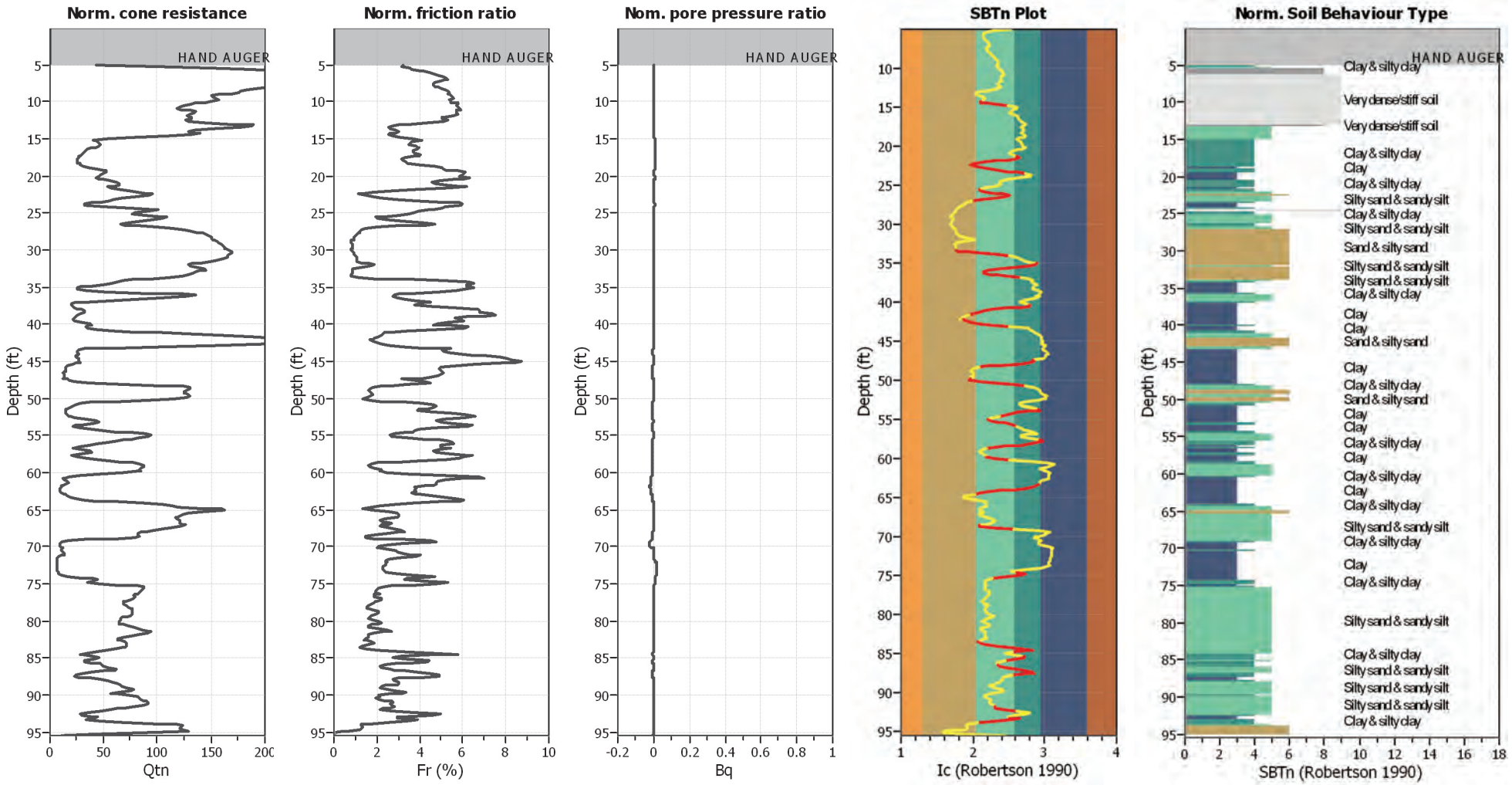
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



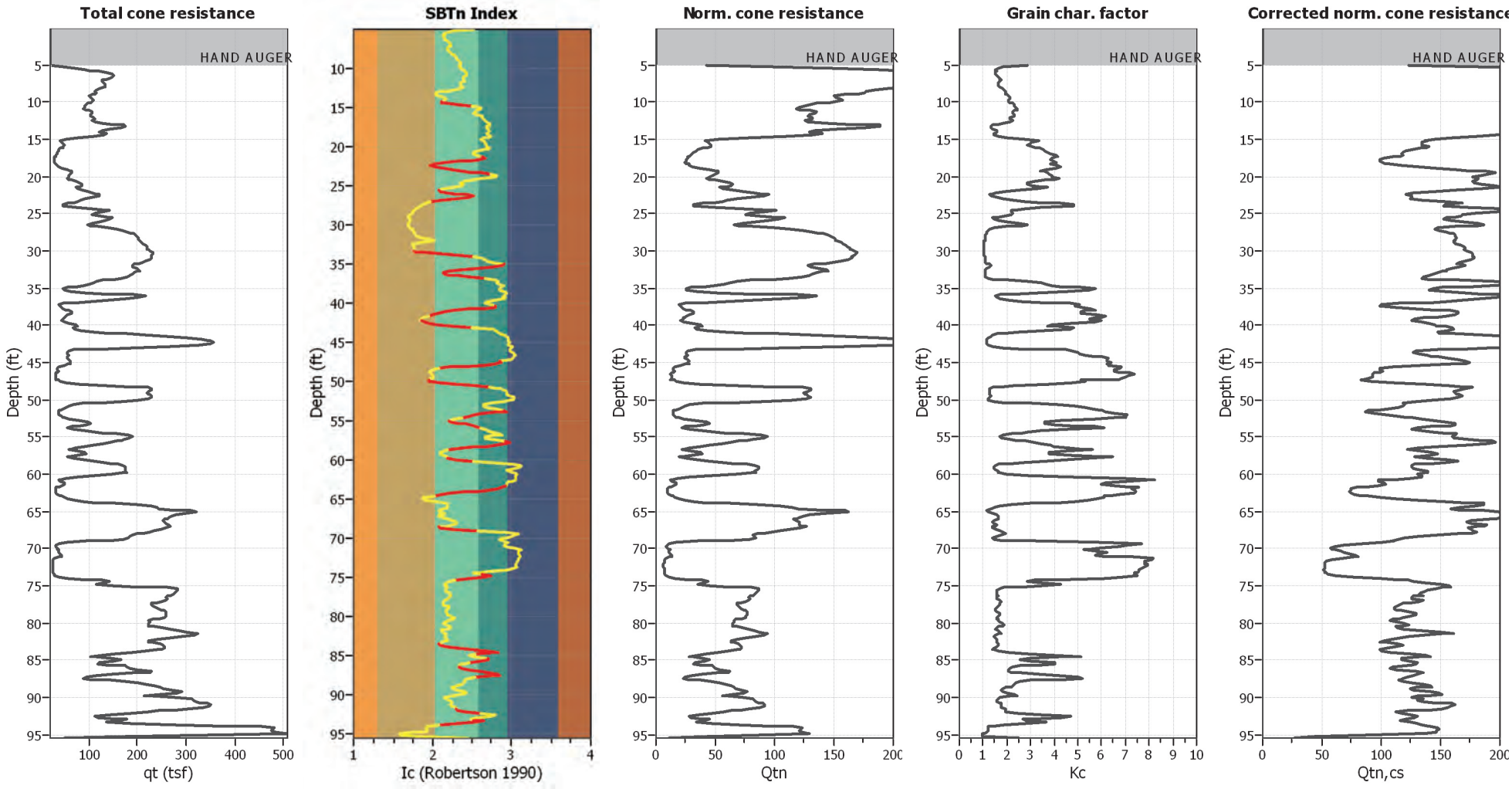
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

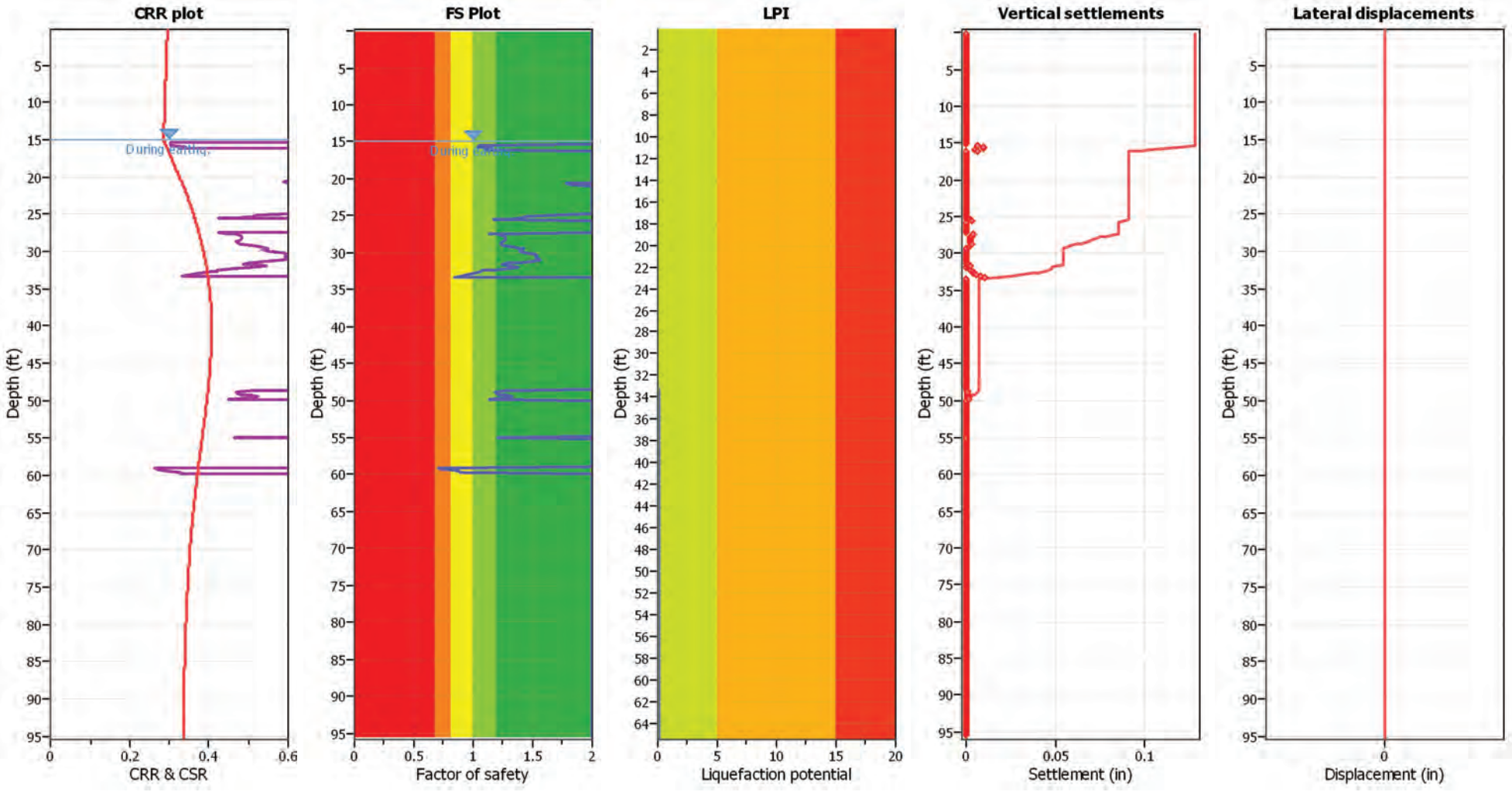
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

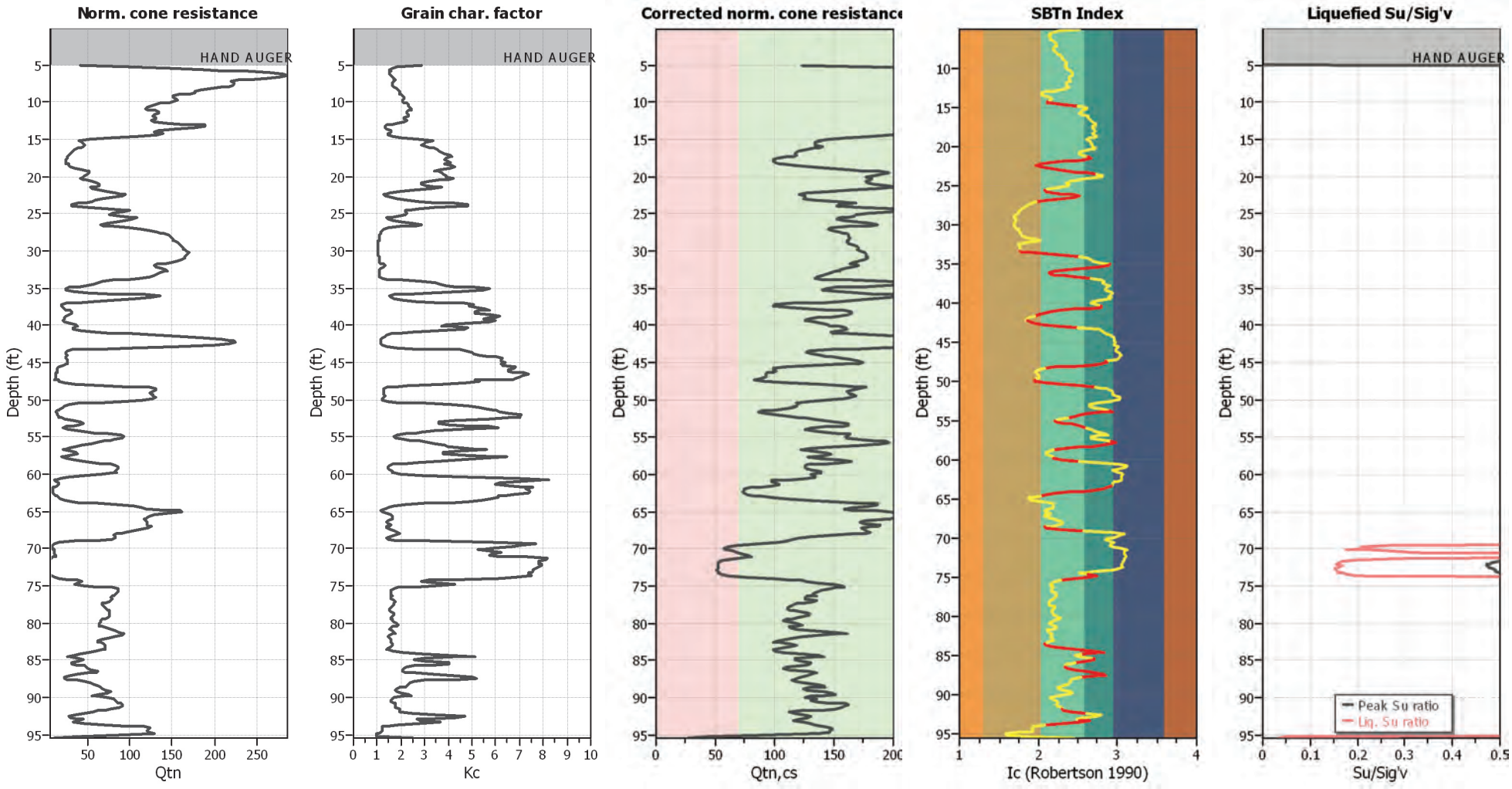
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

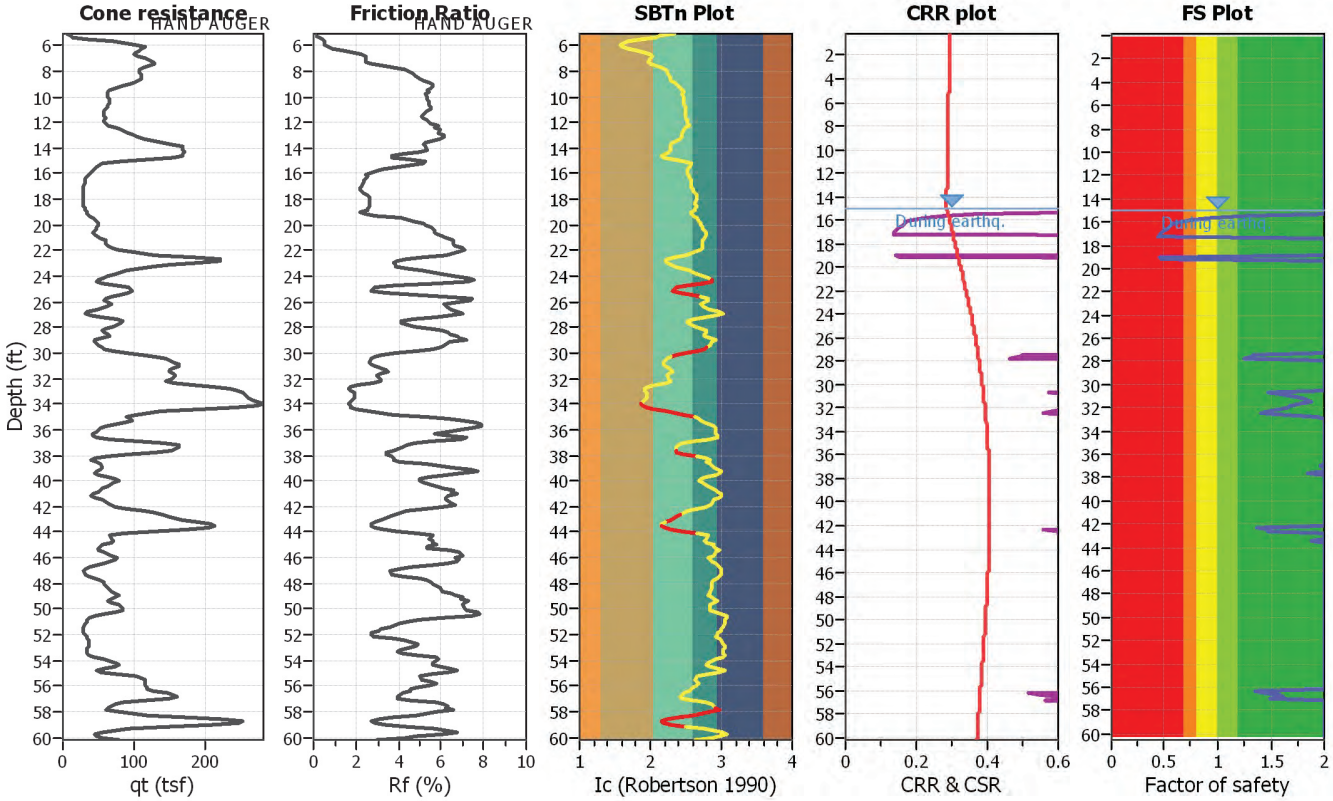
LIQUEFACTION ANALYSIS REPORT

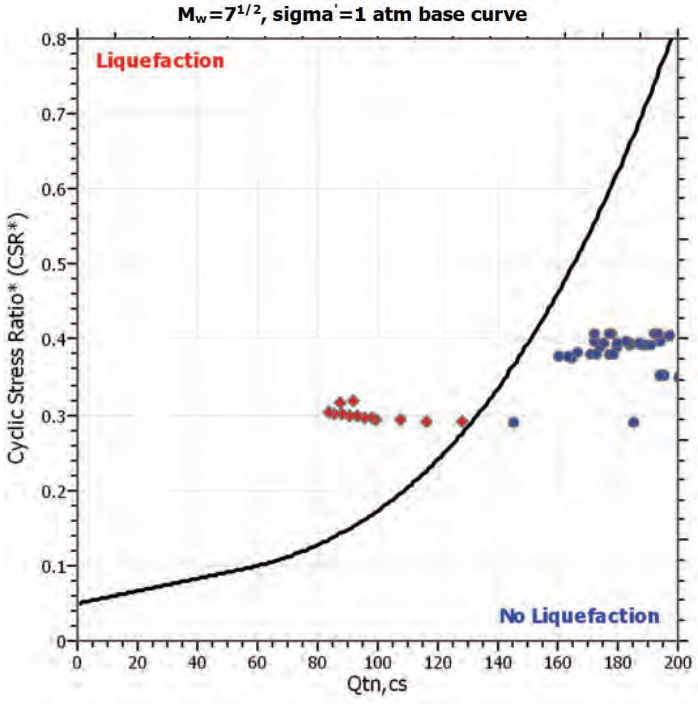
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

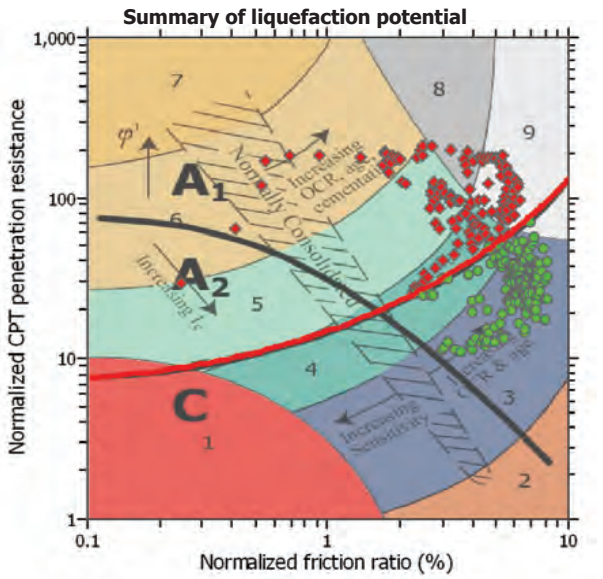
CPT file : CPT-5 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

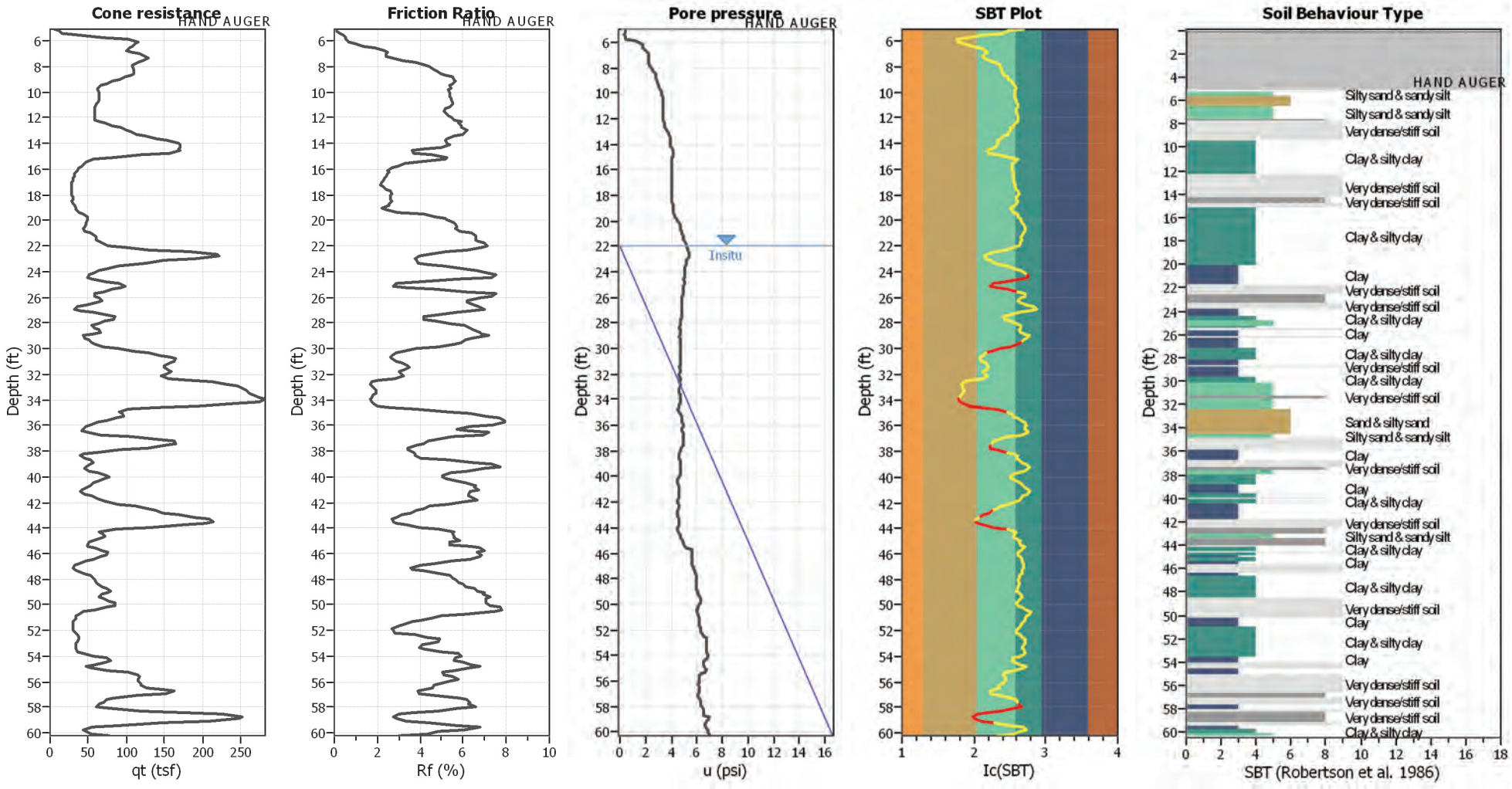






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



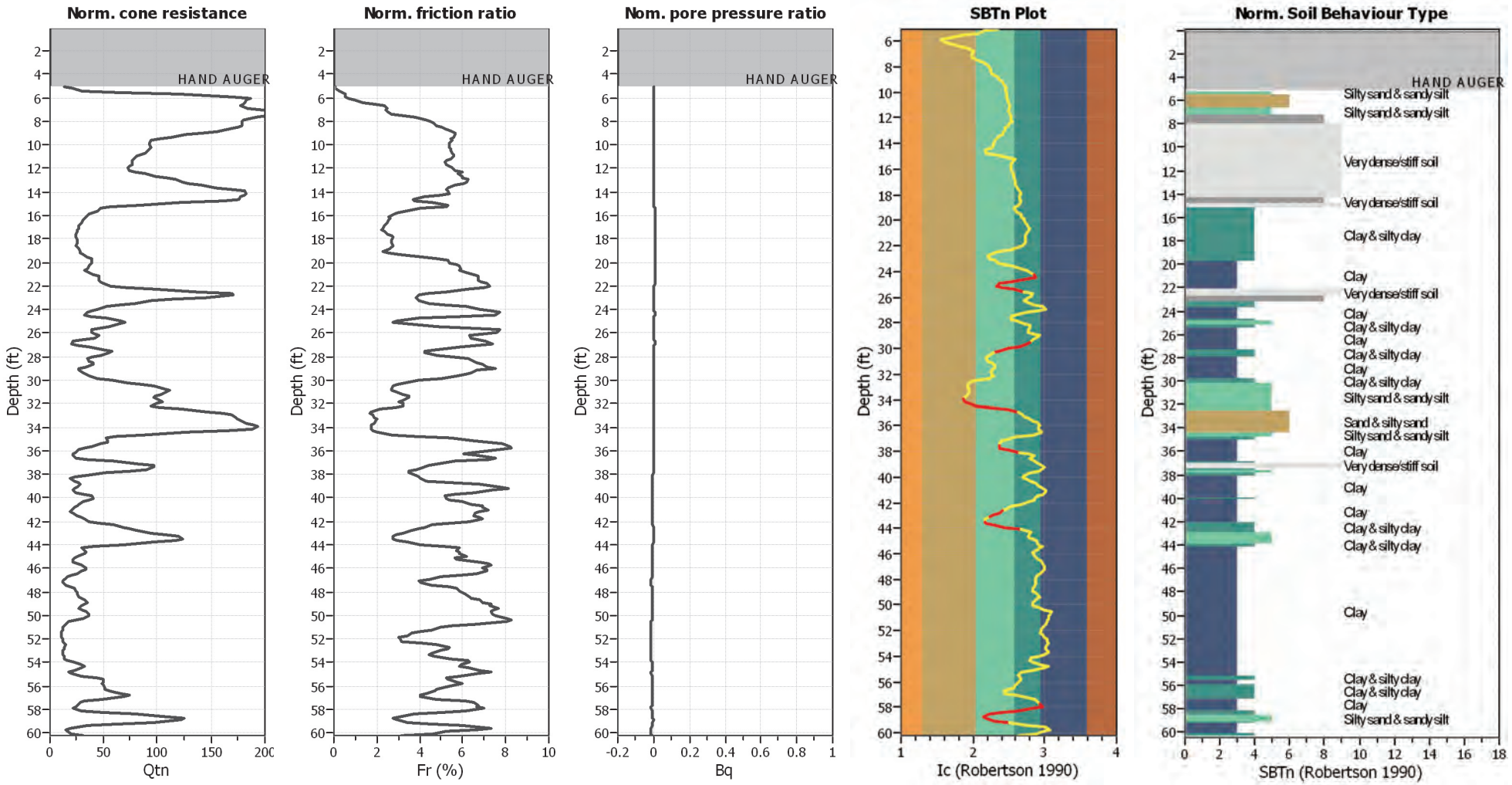
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



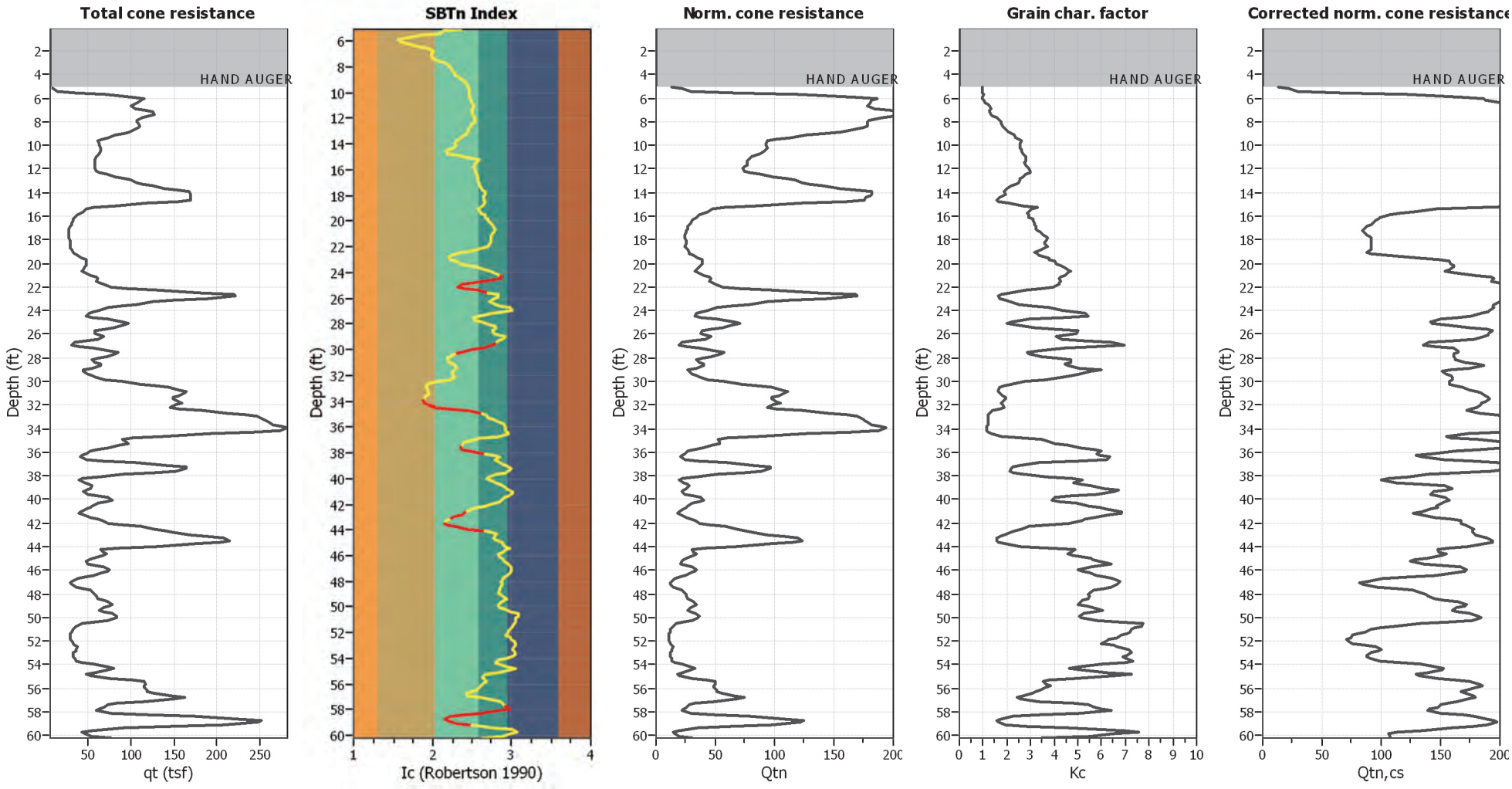
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

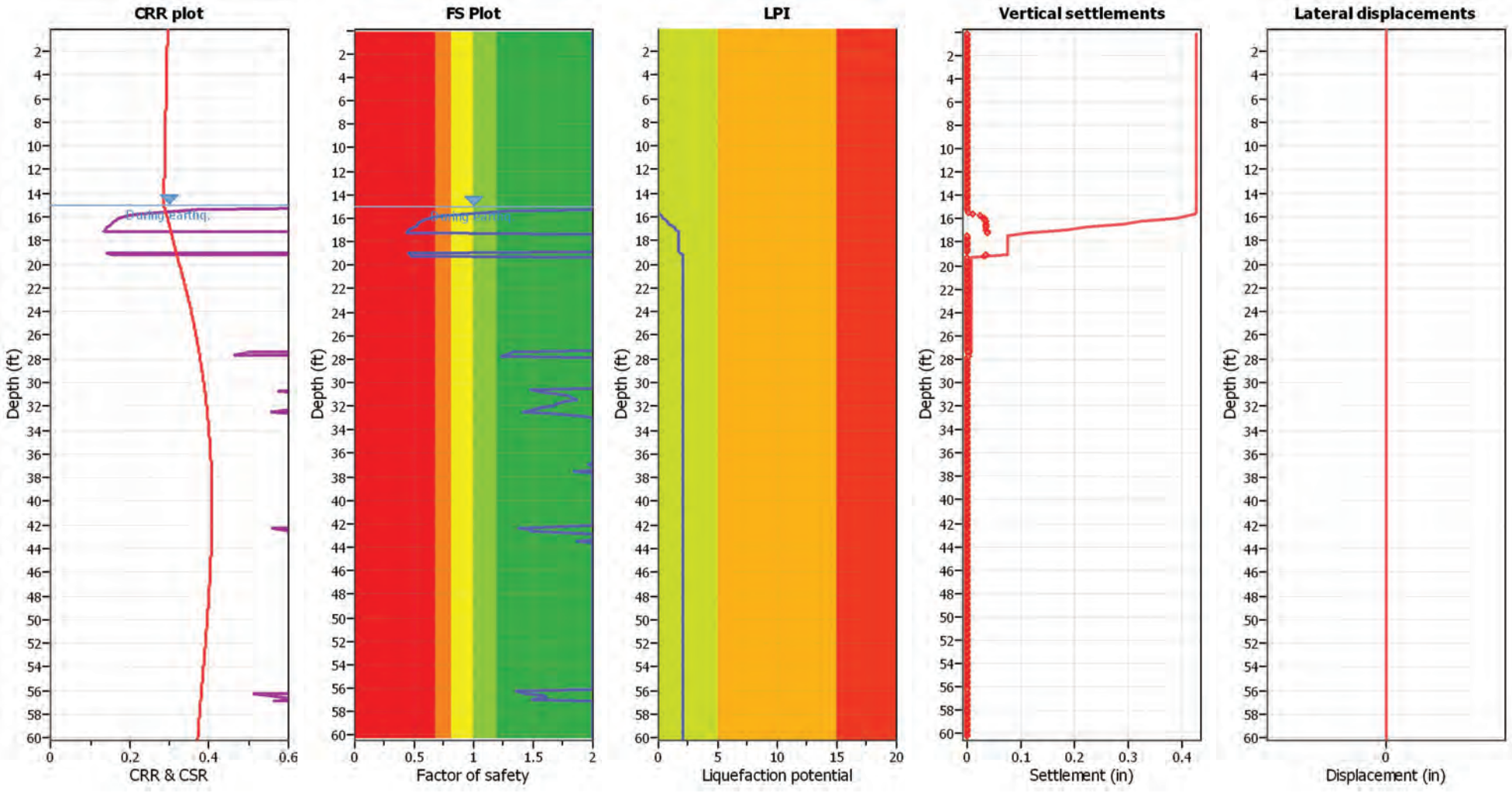
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

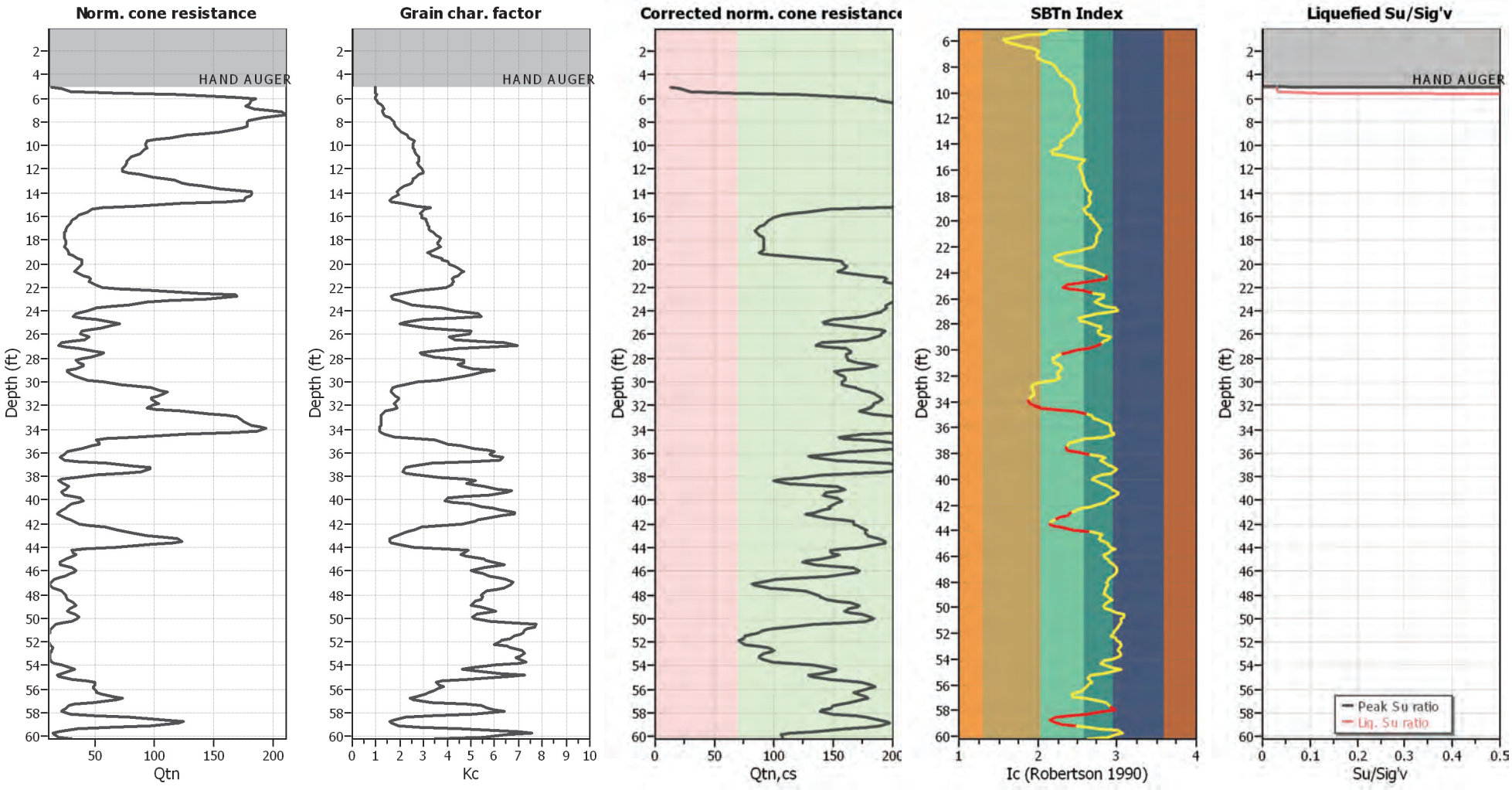
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

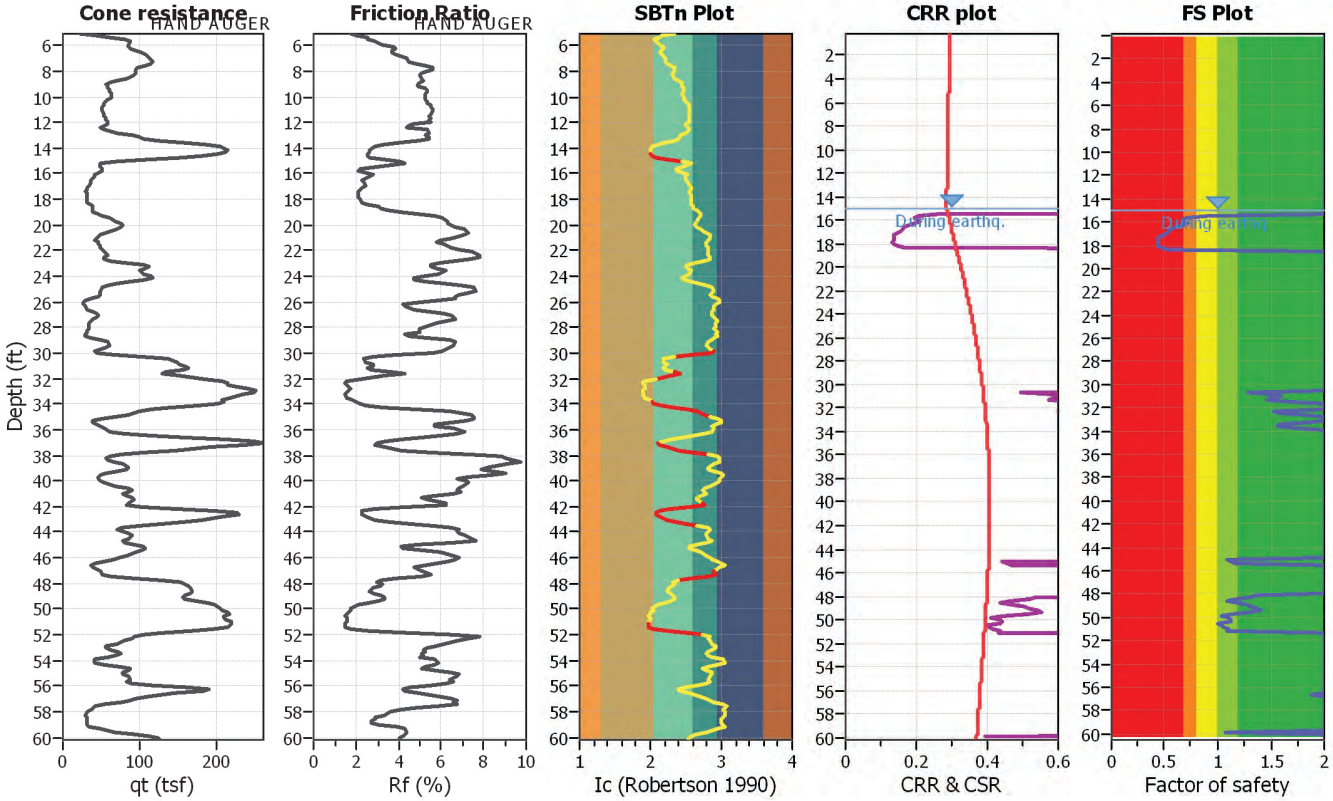
LIQUEFACTION ANALYSIS REPORT

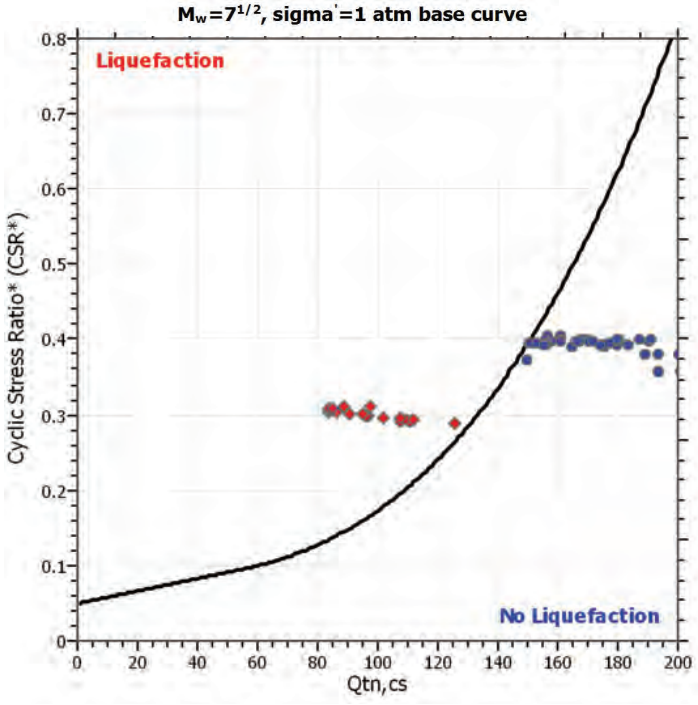
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

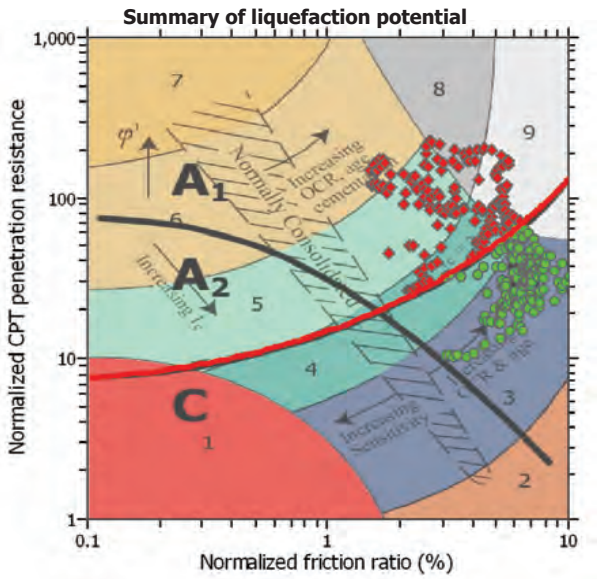
CPT file : CPT-6 (2/3 PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.61	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.57	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

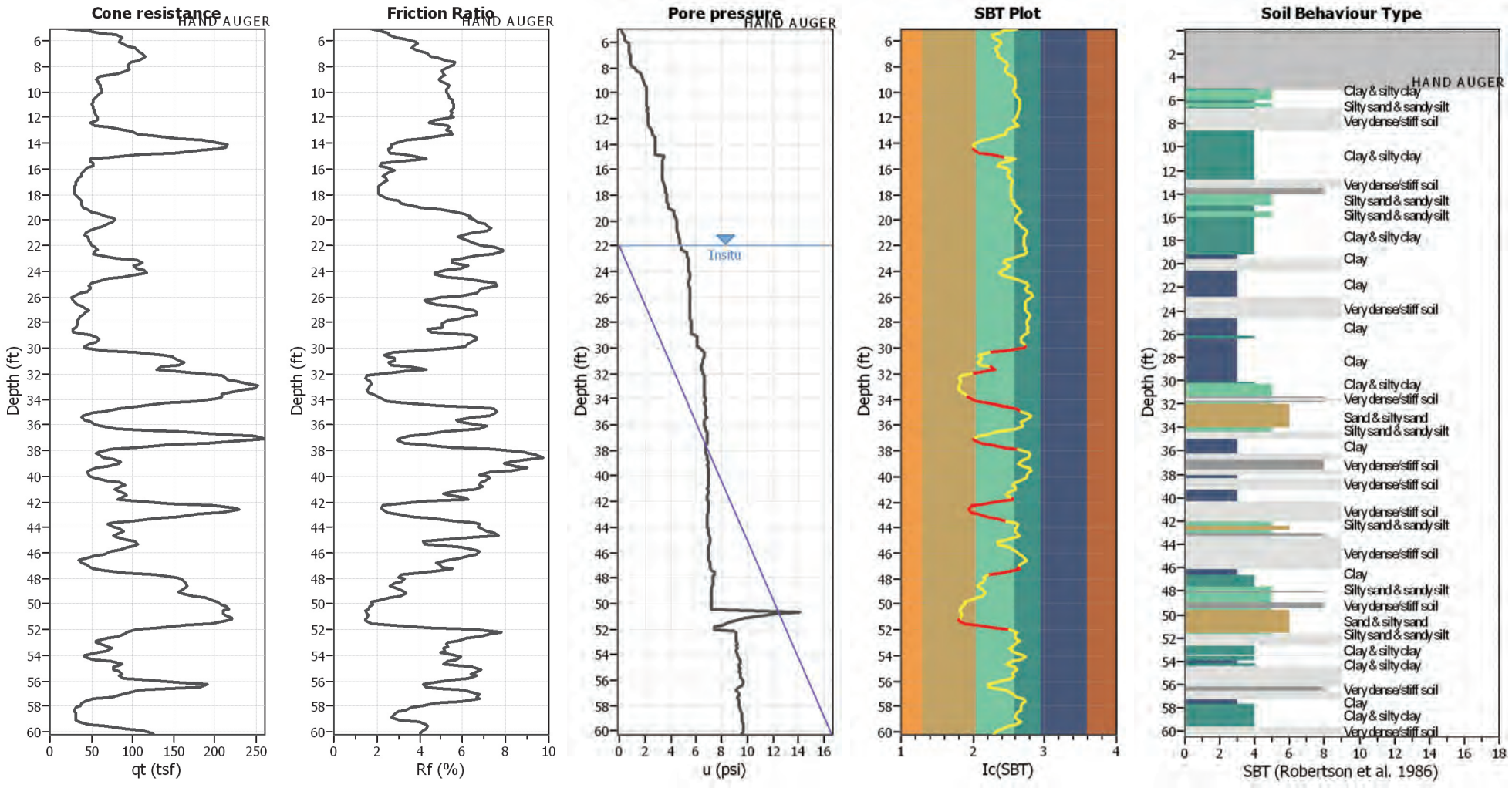






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



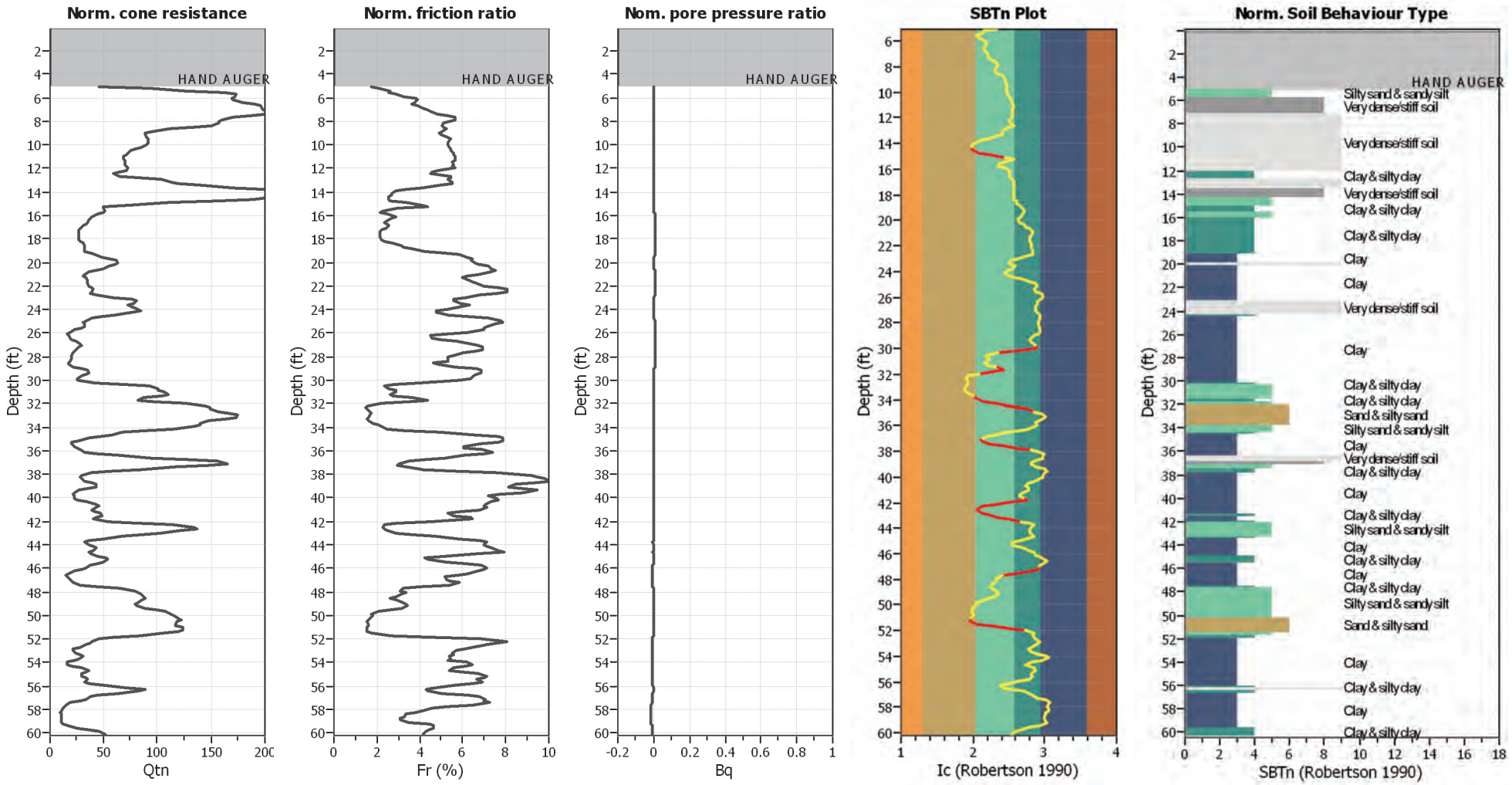
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



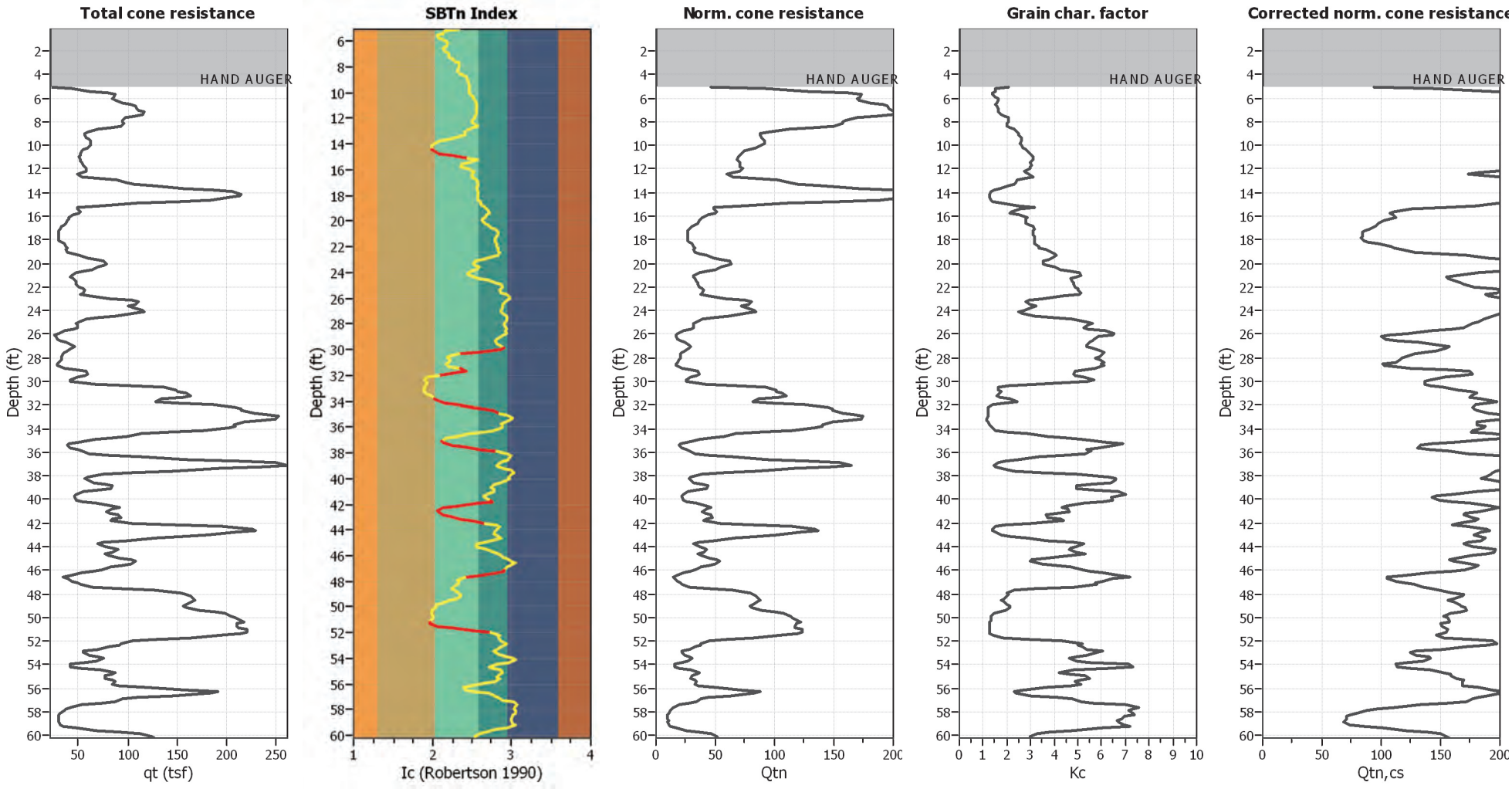
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

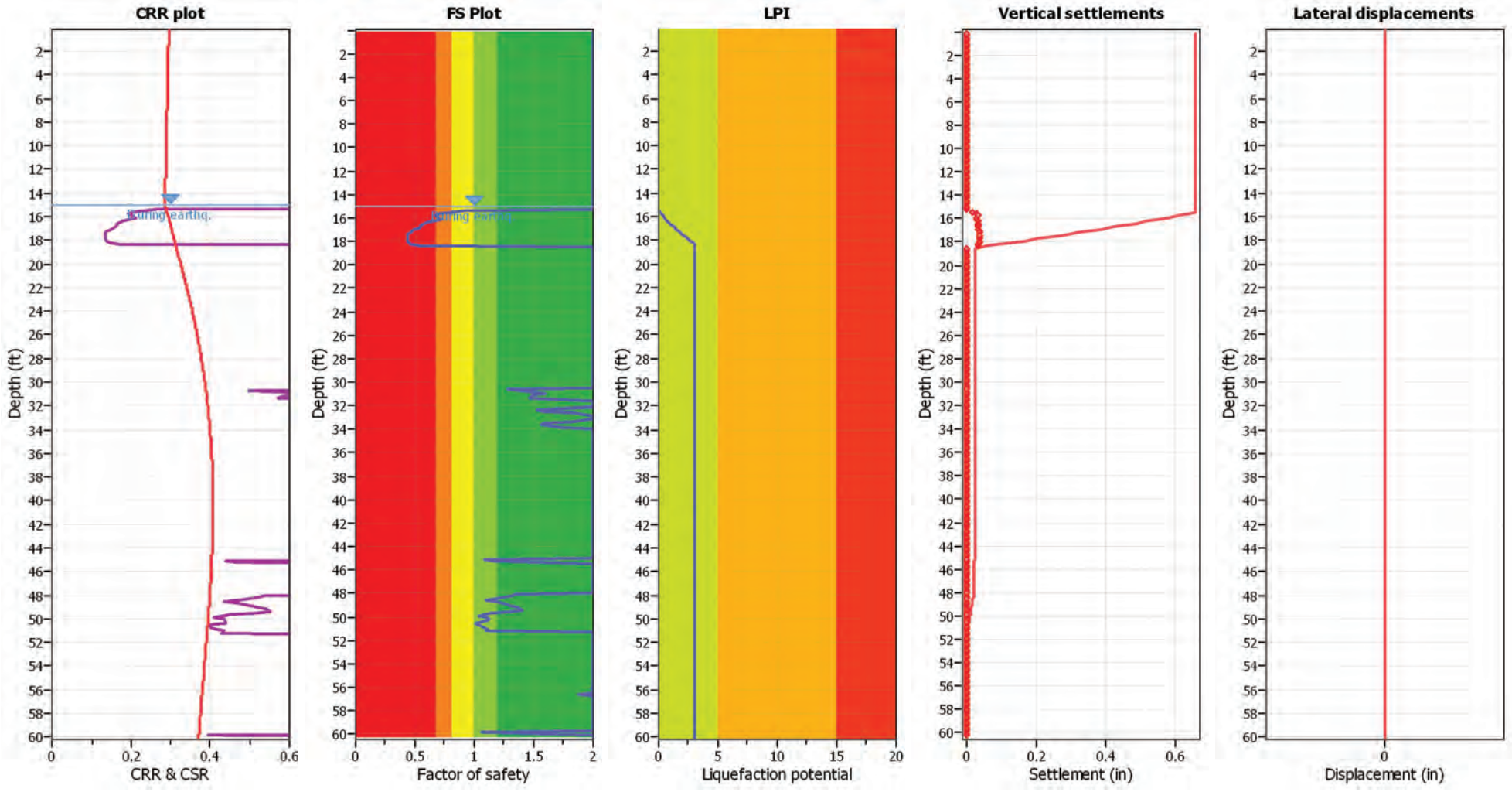
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

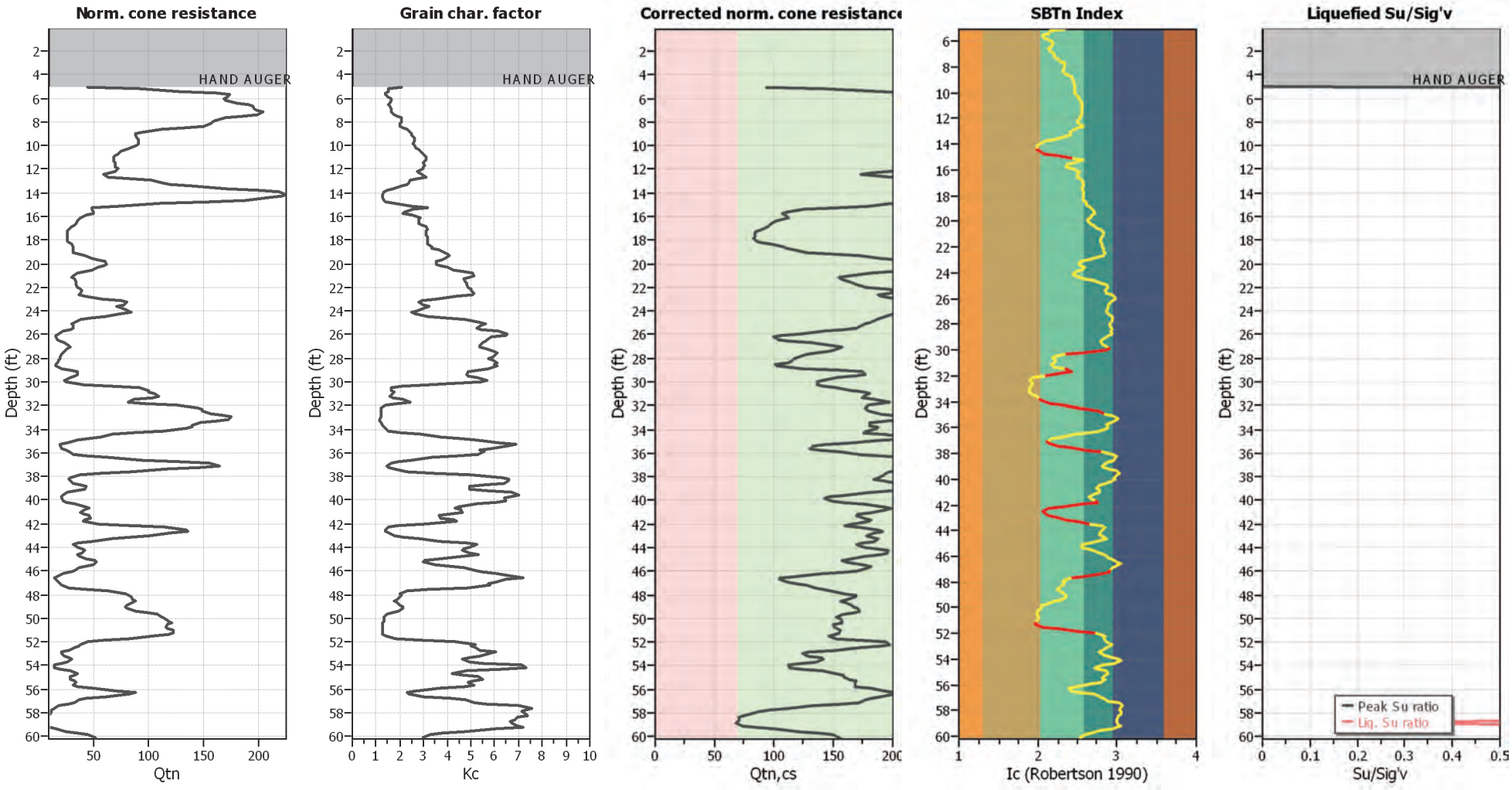
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.61	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.57	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

Project title : 21-2971 16911 Normandie Associates, LLC

Location :

Overall vertical settlements report

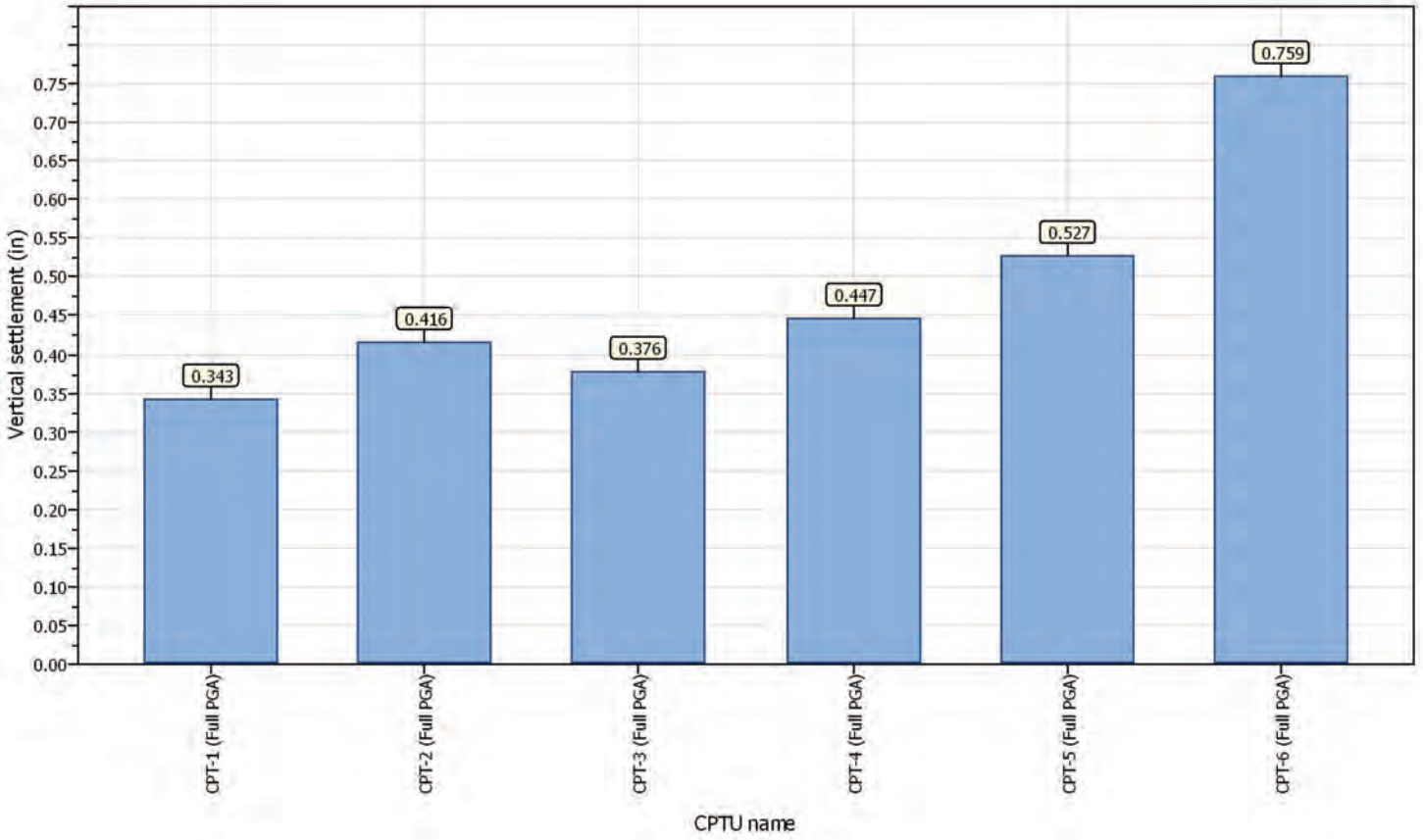


TABLE OF CONTENTS

CPT-1 (Full PGA) results
Summary data report 1

CPT-2 (Full PGA) results
Summary data report 7

CPT-3 (Full PGA) results
Summary data report 13

CPT-4 (Full PGA) results
Summary data report 19

CPT-5 (Full PGA) results
Summary data report 25

CPT-6 (Full PGA) results
Summary data report 31

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

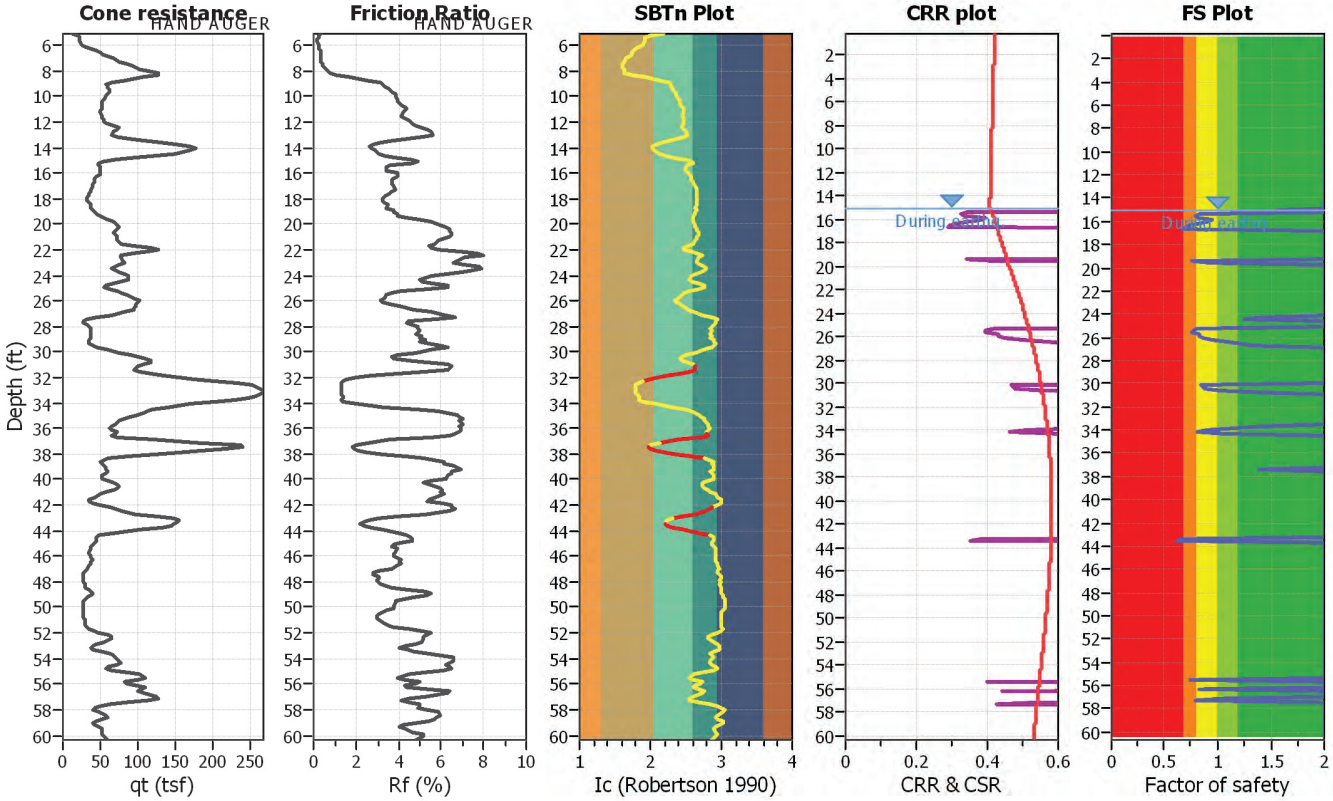
LIQUEFACTION ANALYSIS REPORT

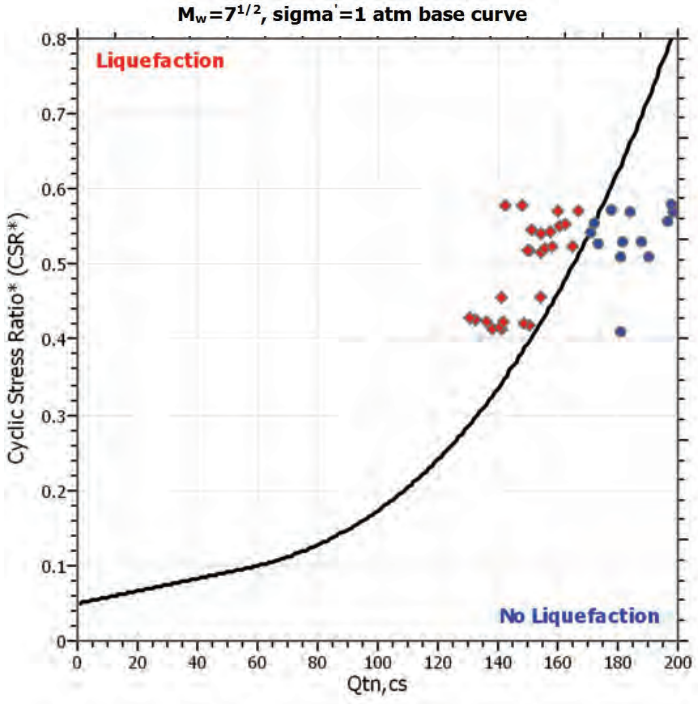
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

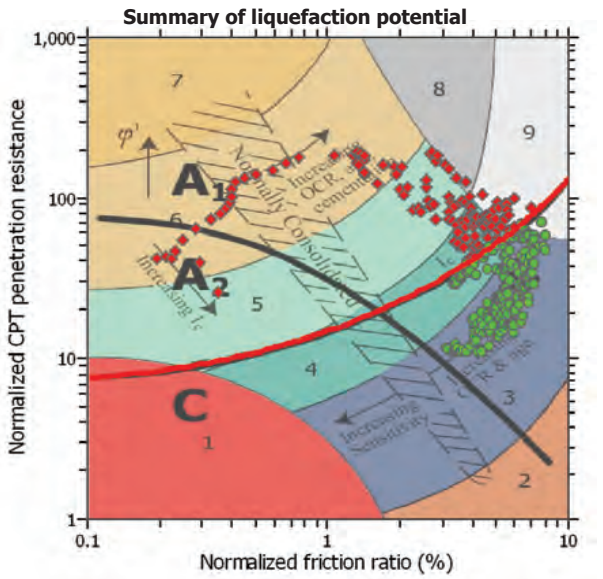
CPT file : CPT-1 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

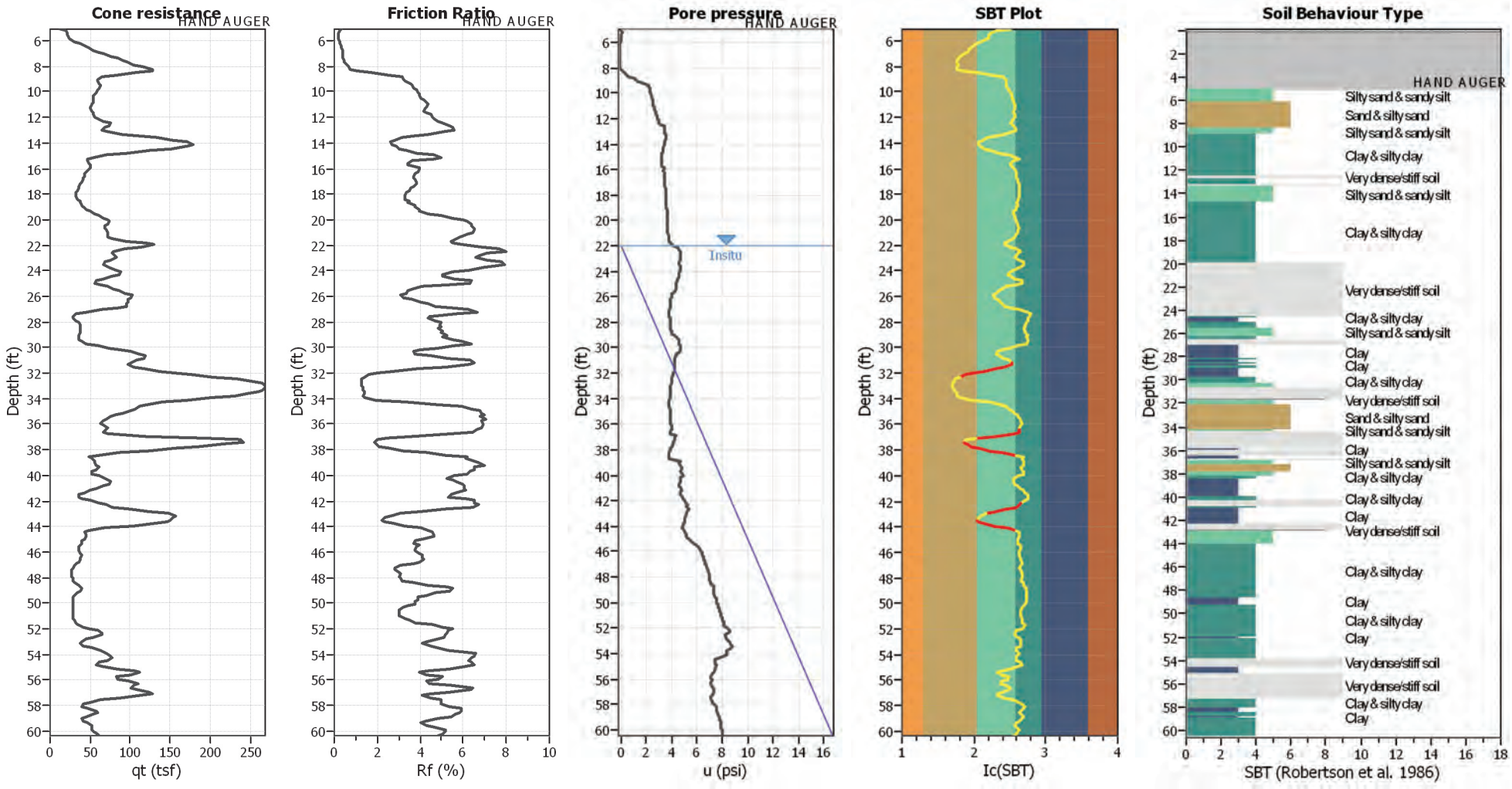






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



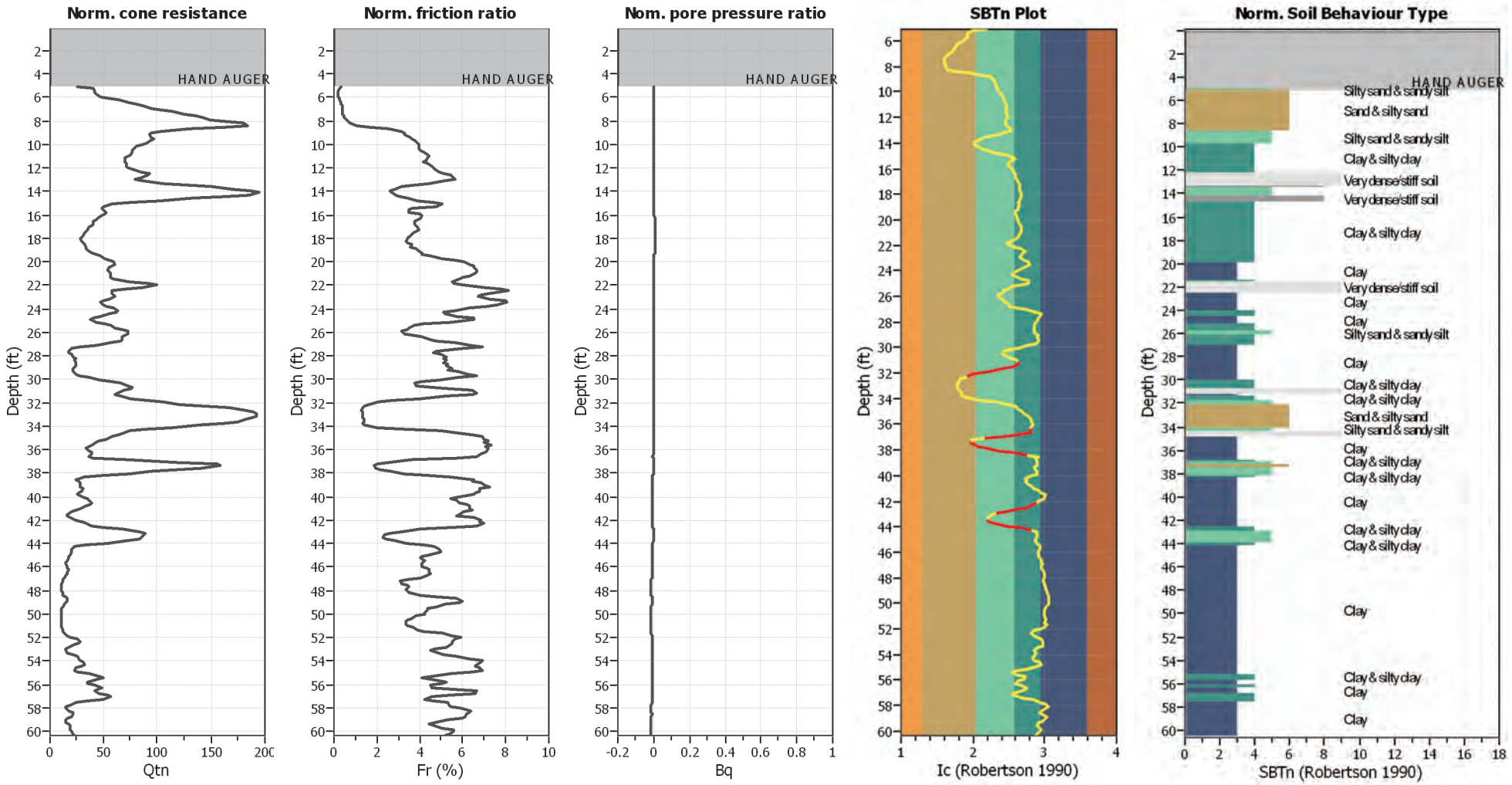
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



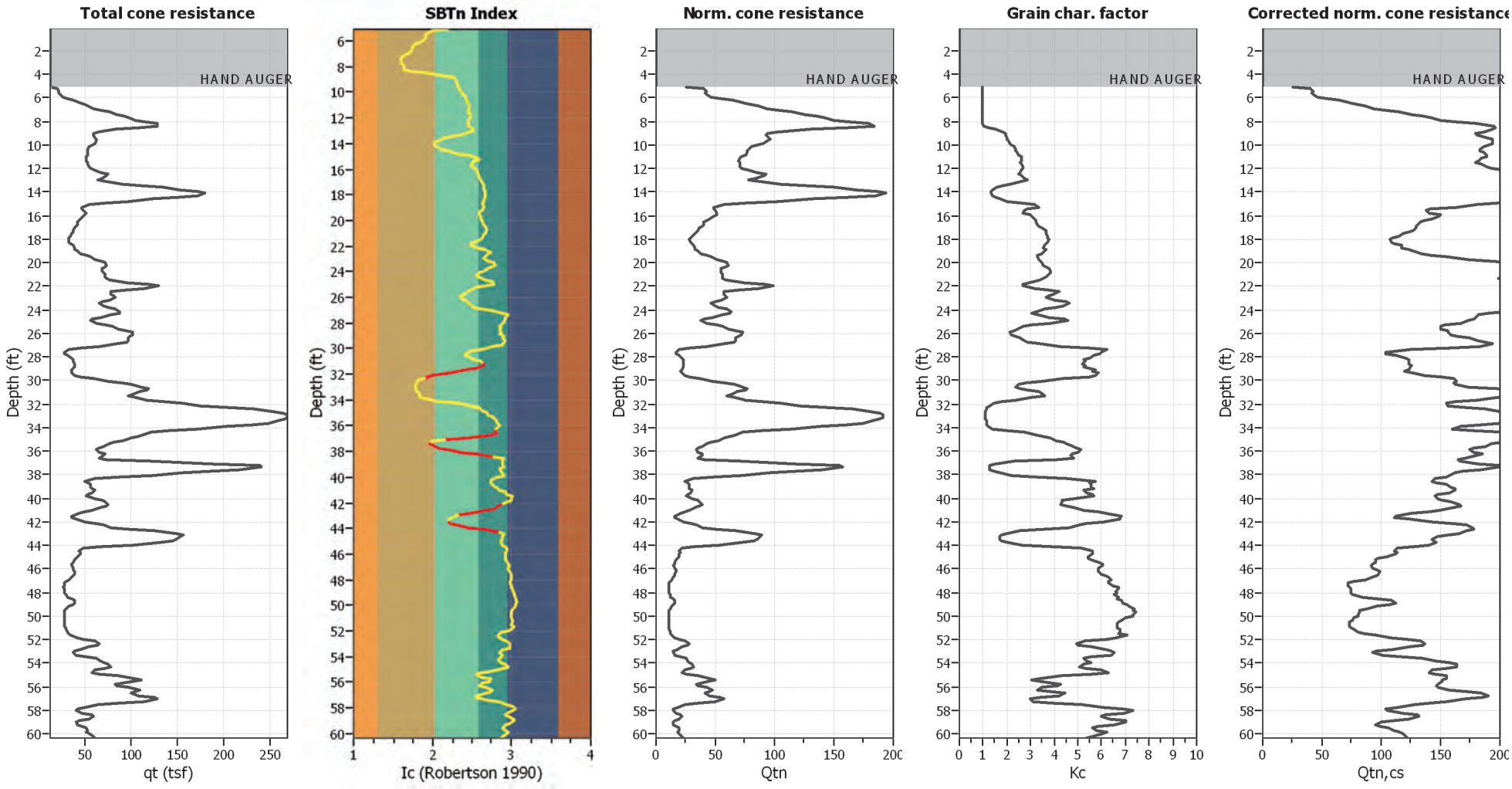
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

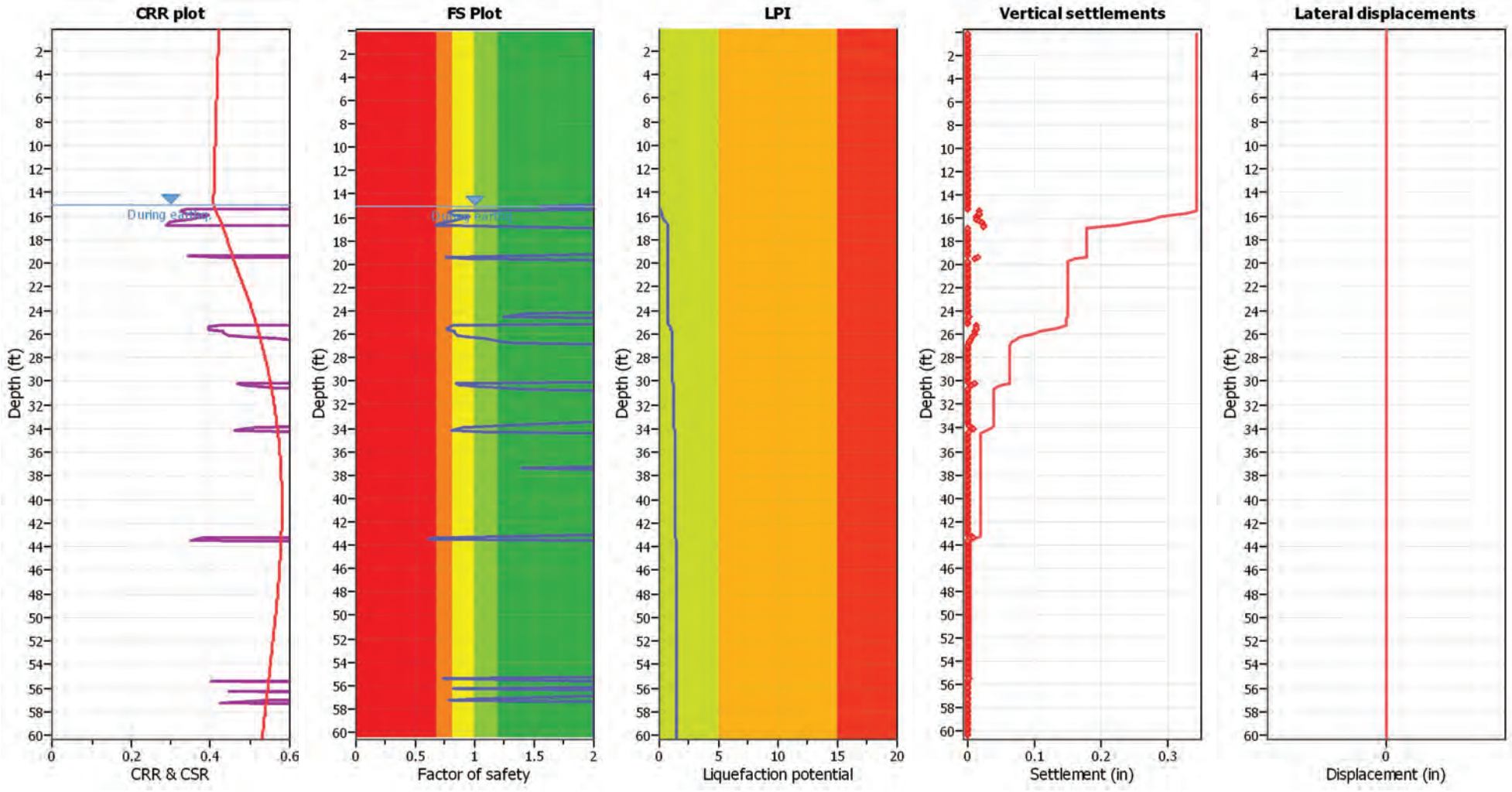
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

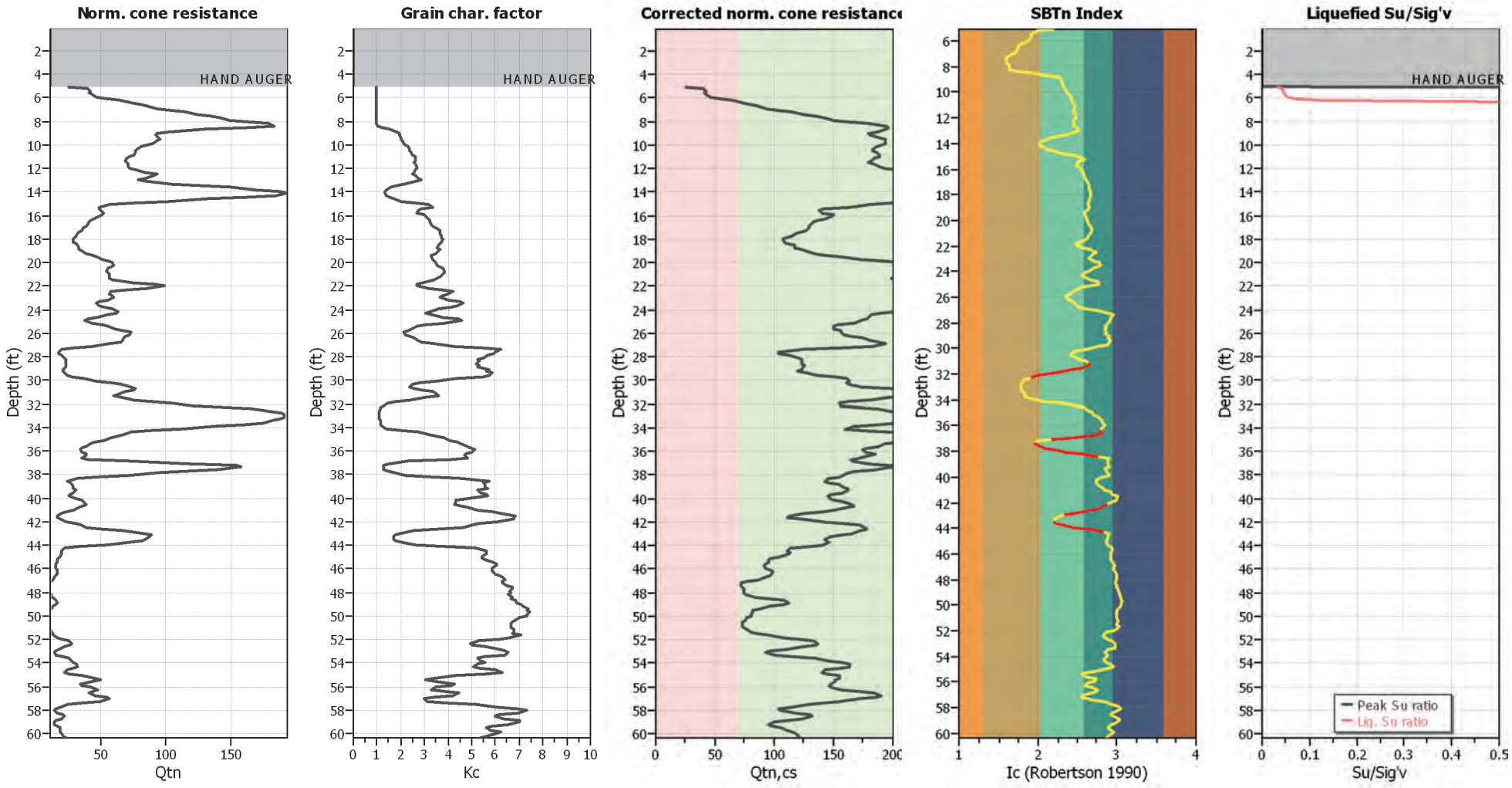
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

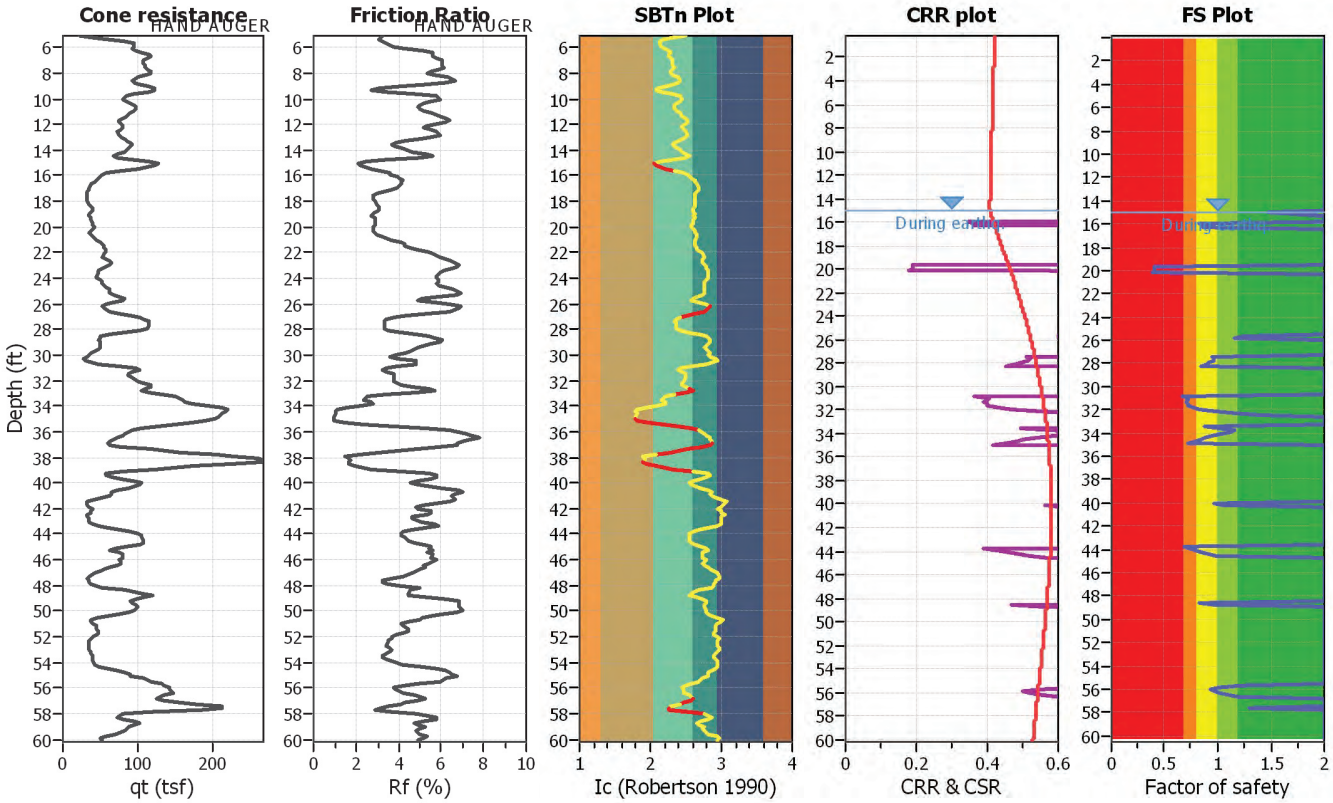
LIQUEFACTION ANALYSIS REPORT

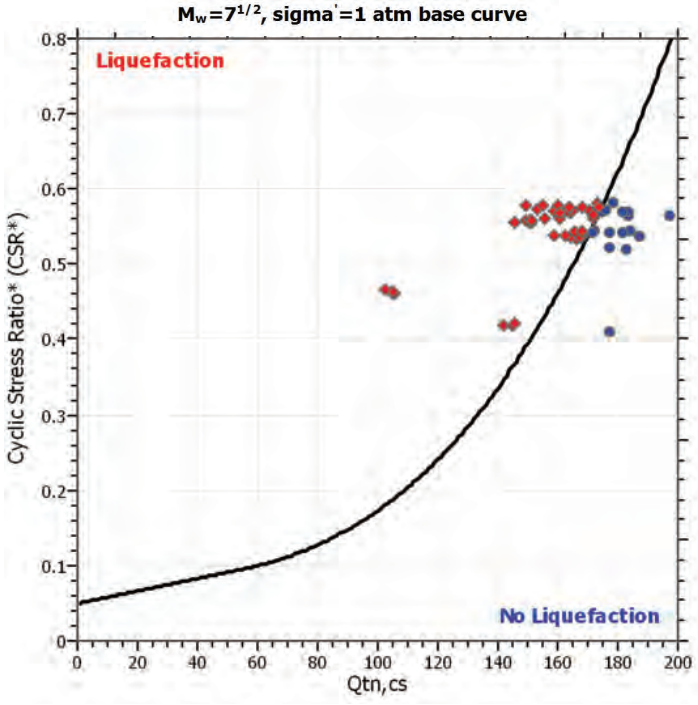
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

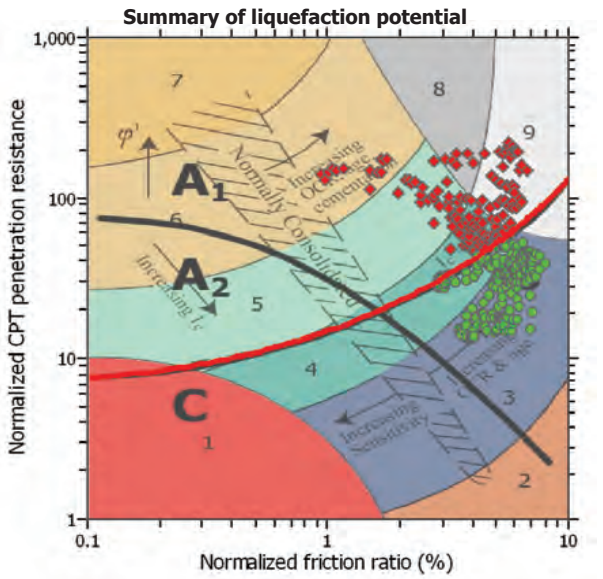
CPT file : CPT-2 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

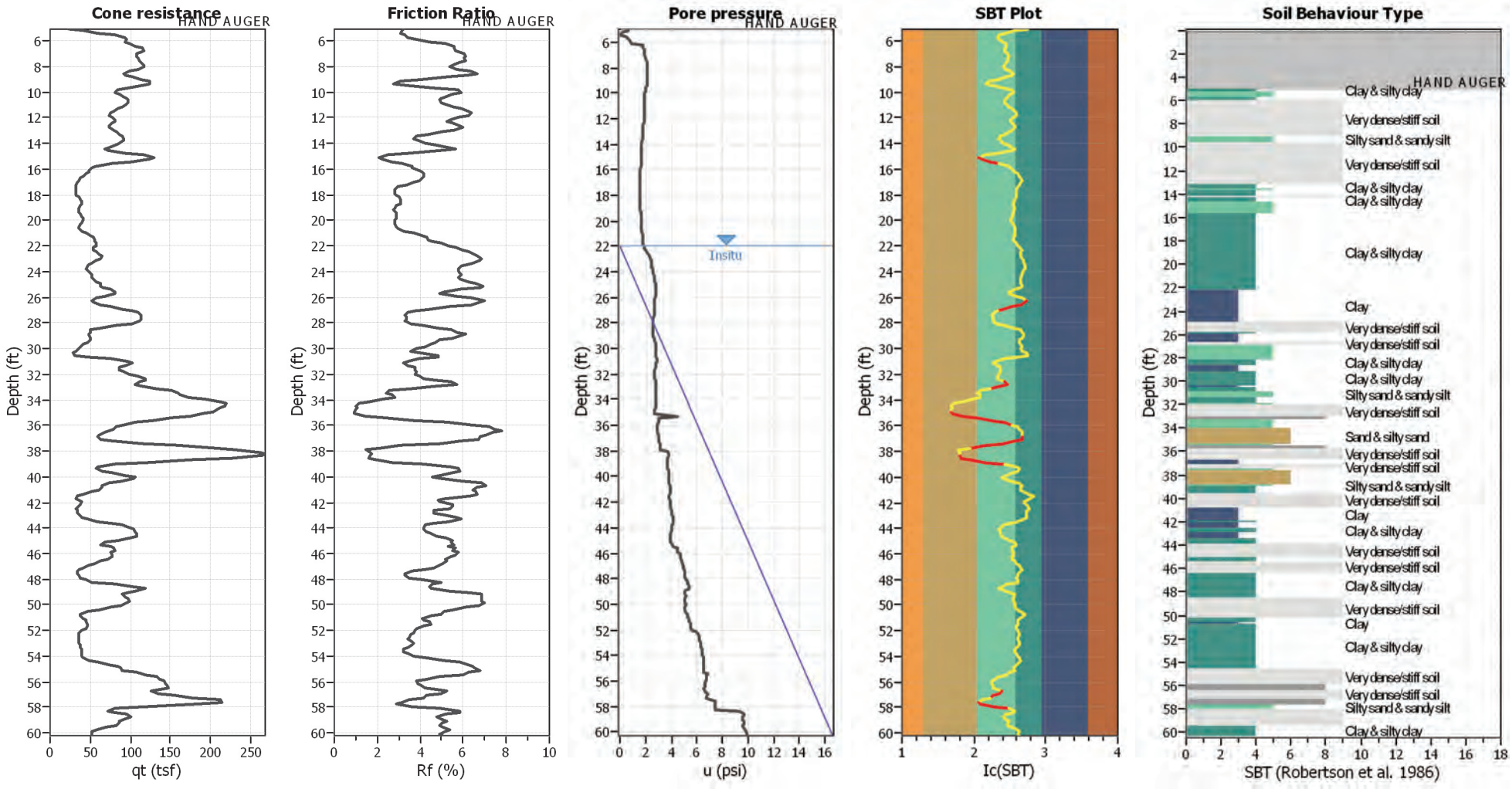






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



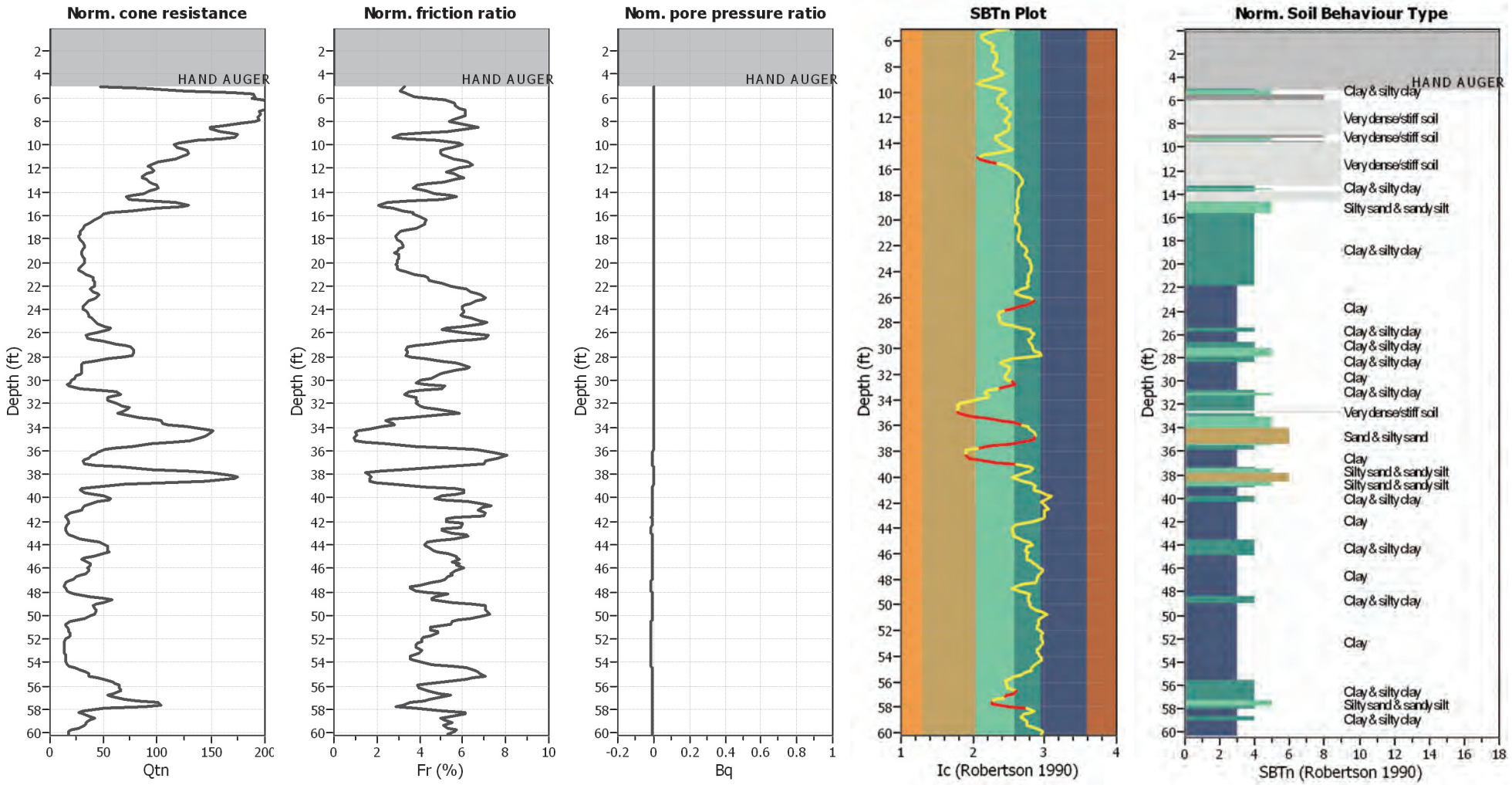
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



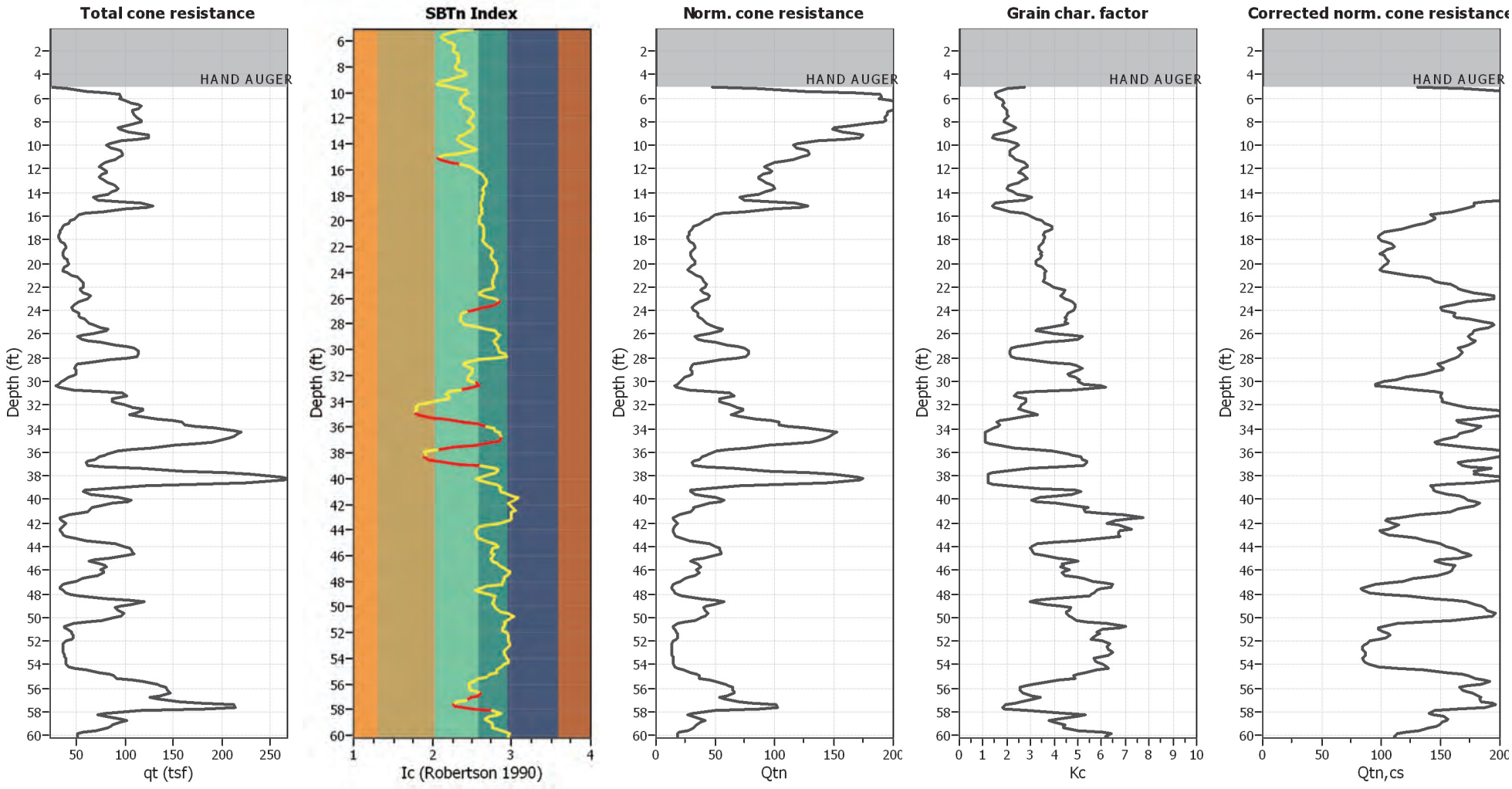
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

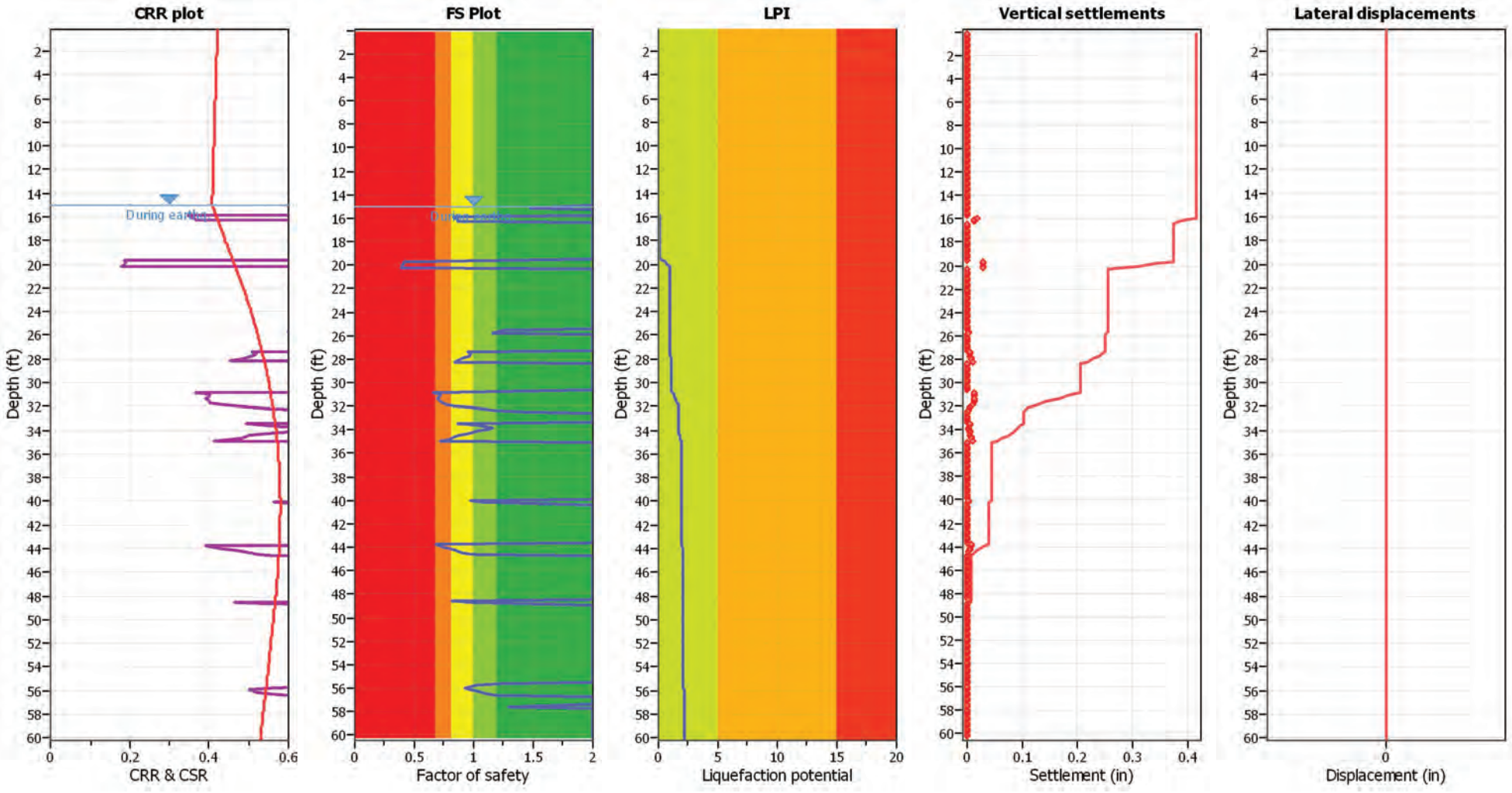
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

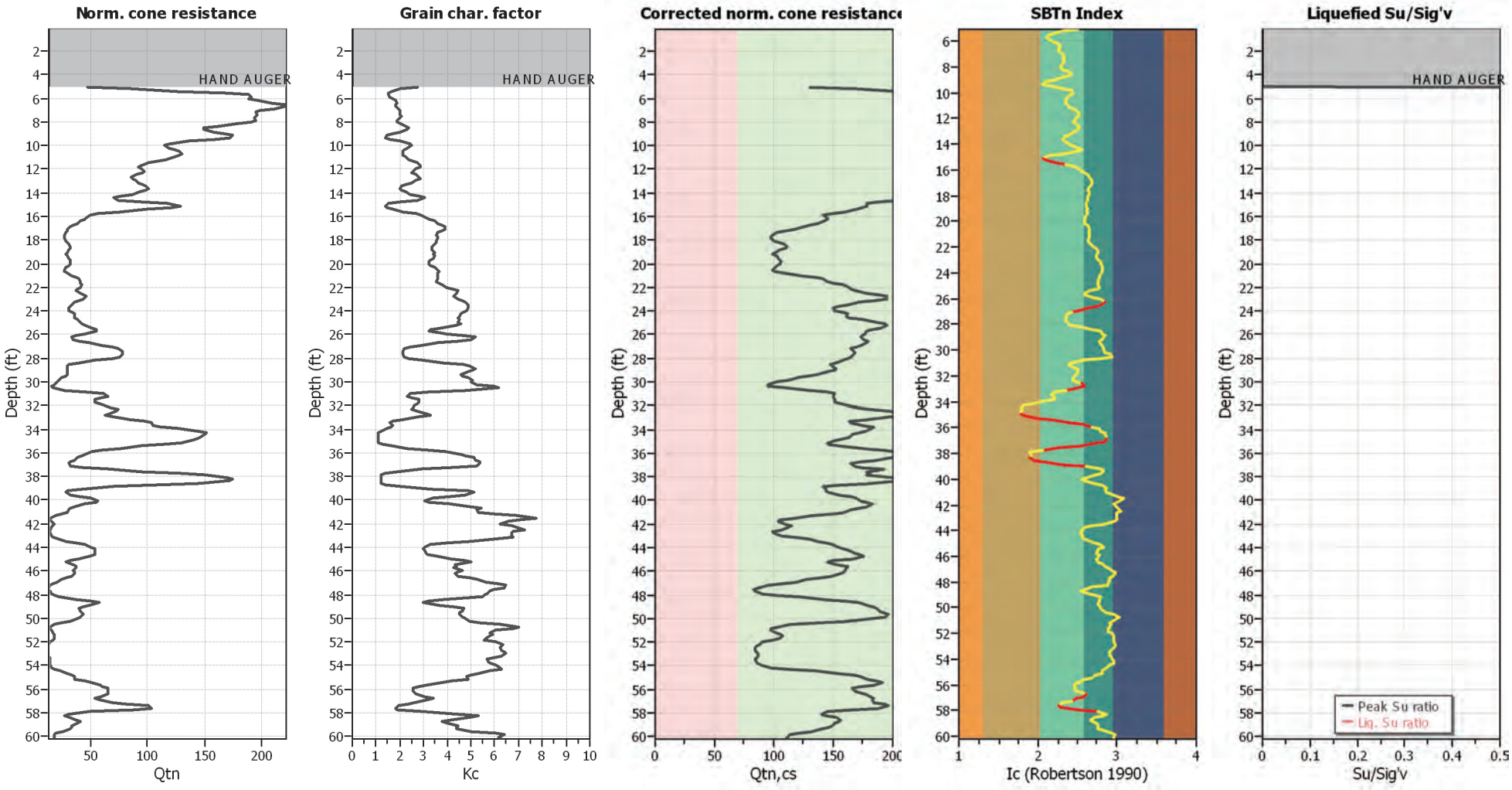
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

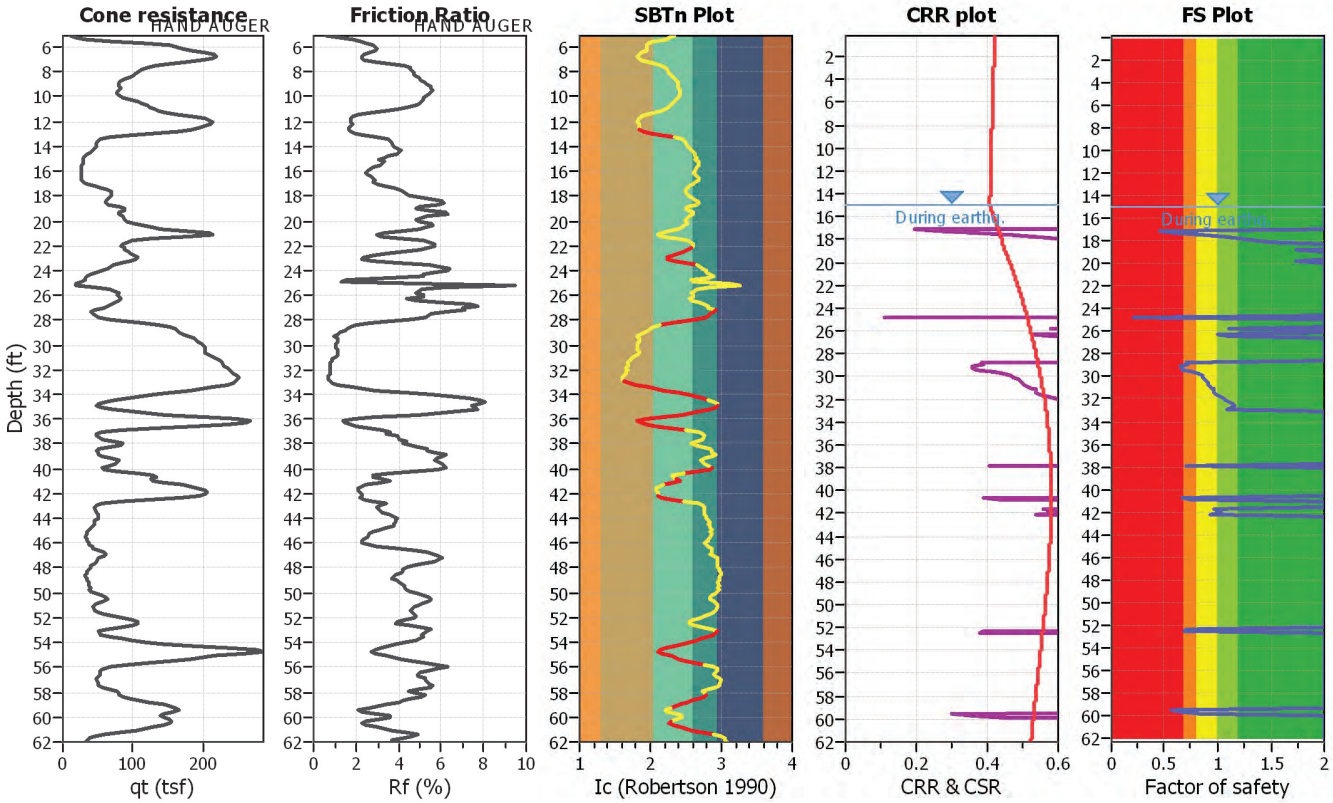
LIQUEFACTION ANALYSIS REPORT

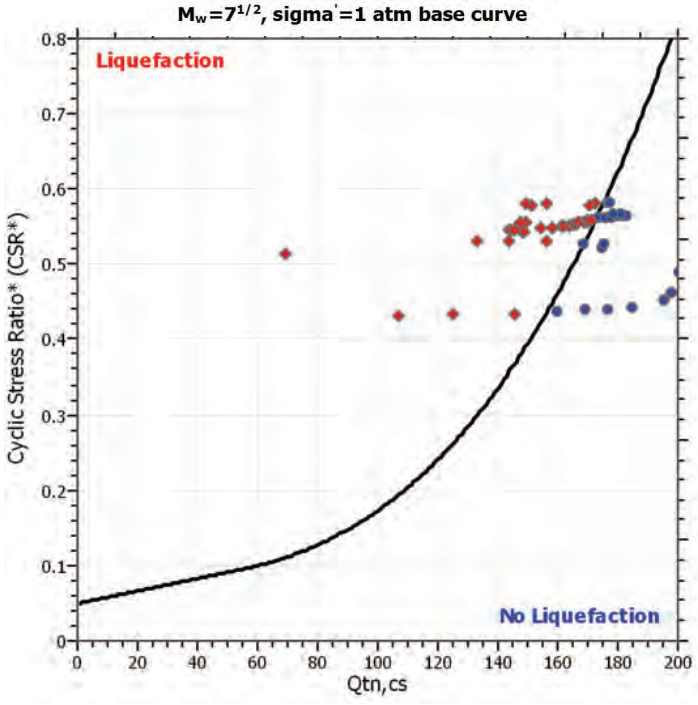
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

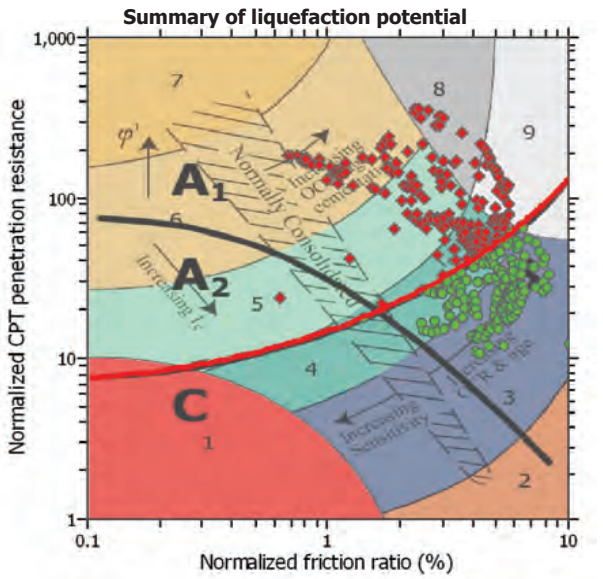
CPT file : CPT-3 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

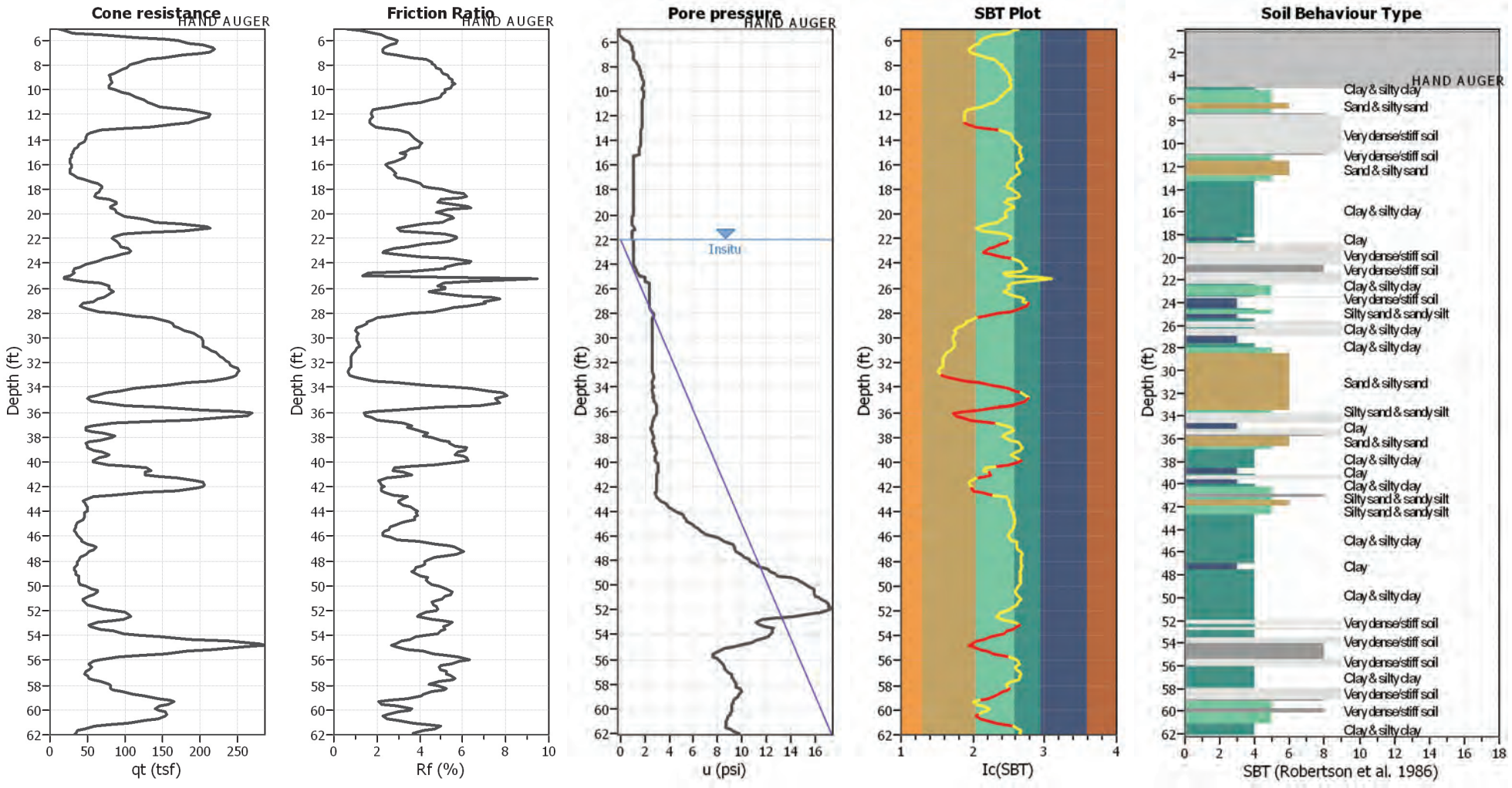






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



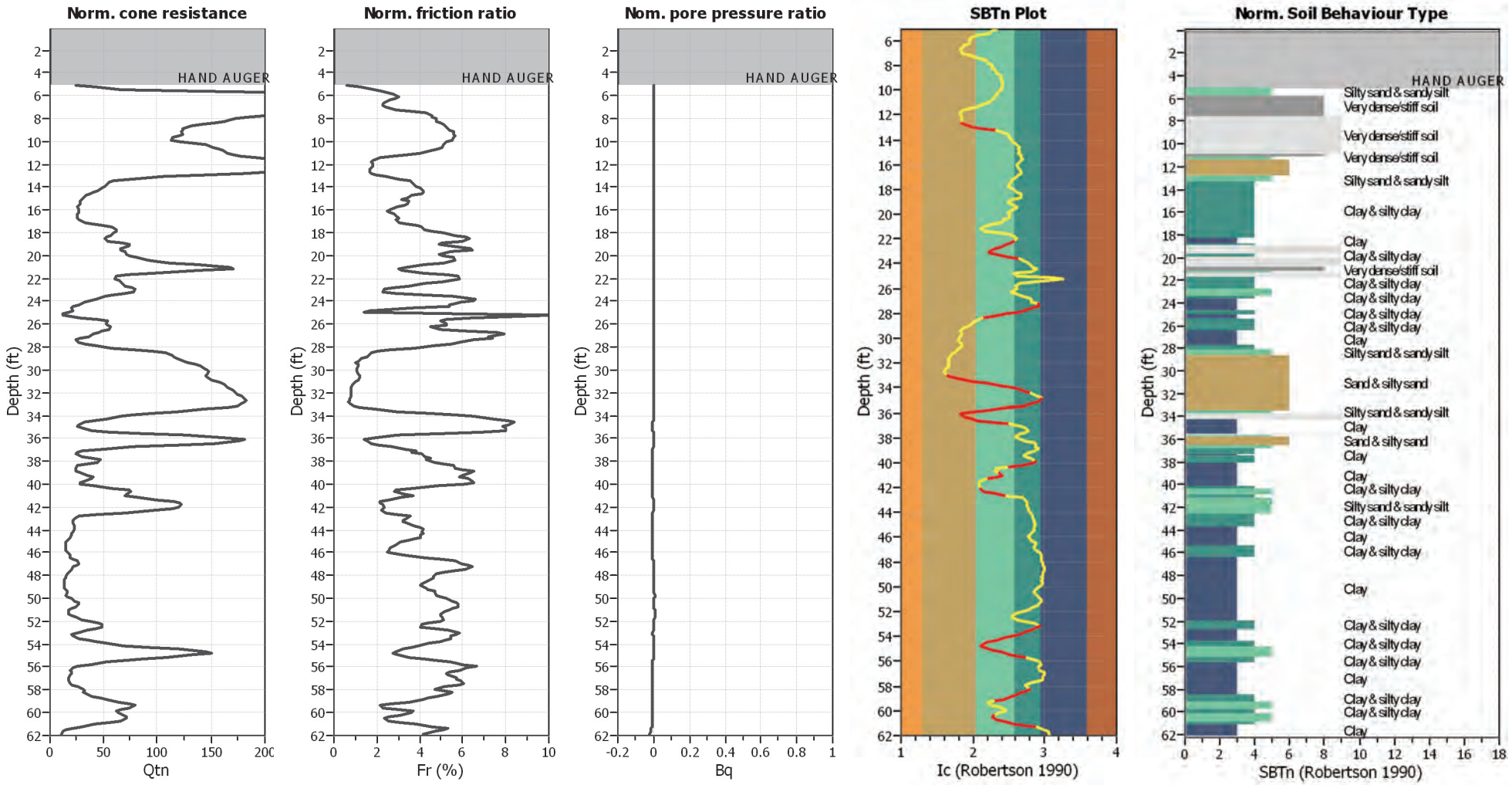
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



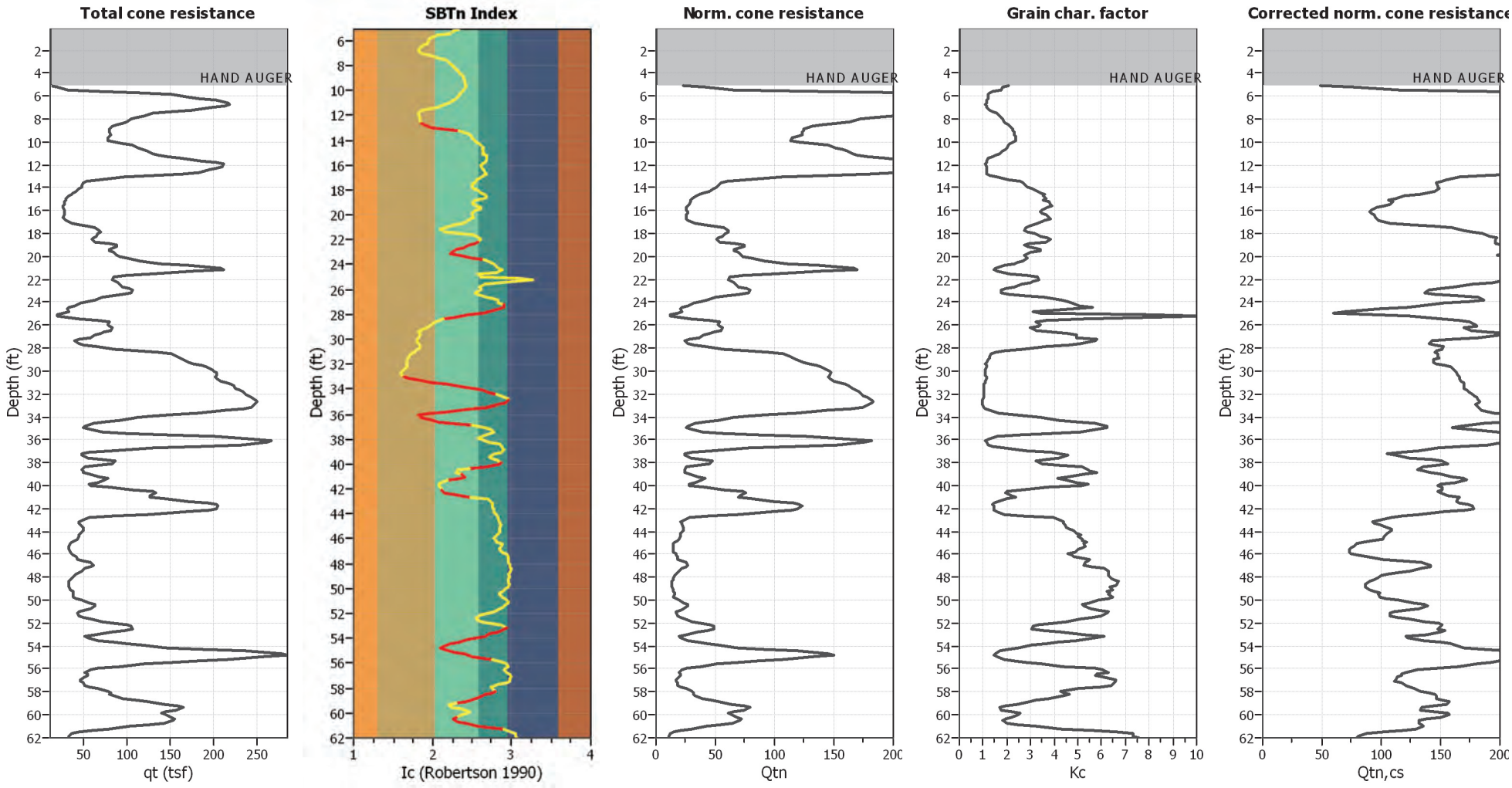
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

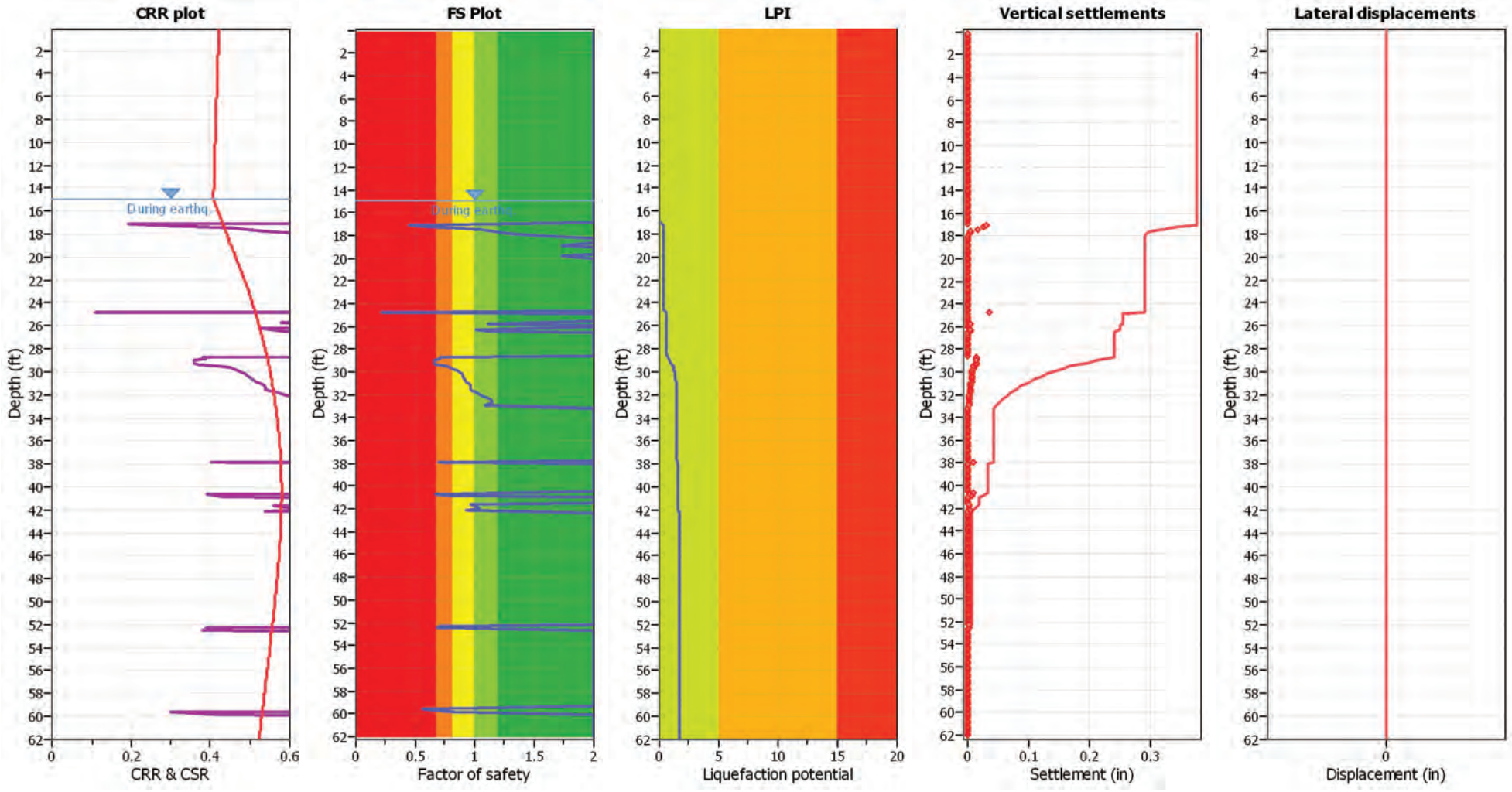
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

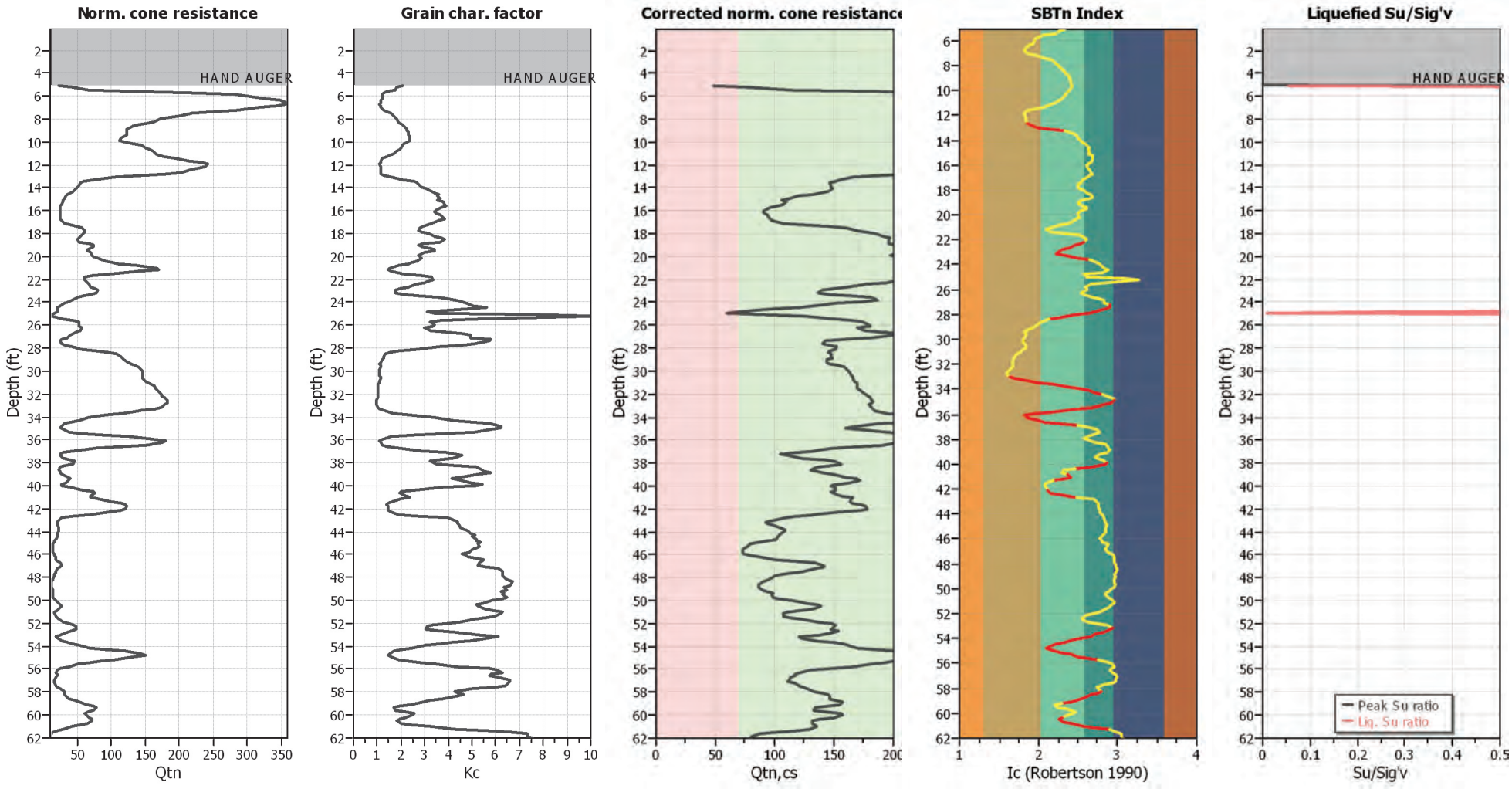
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

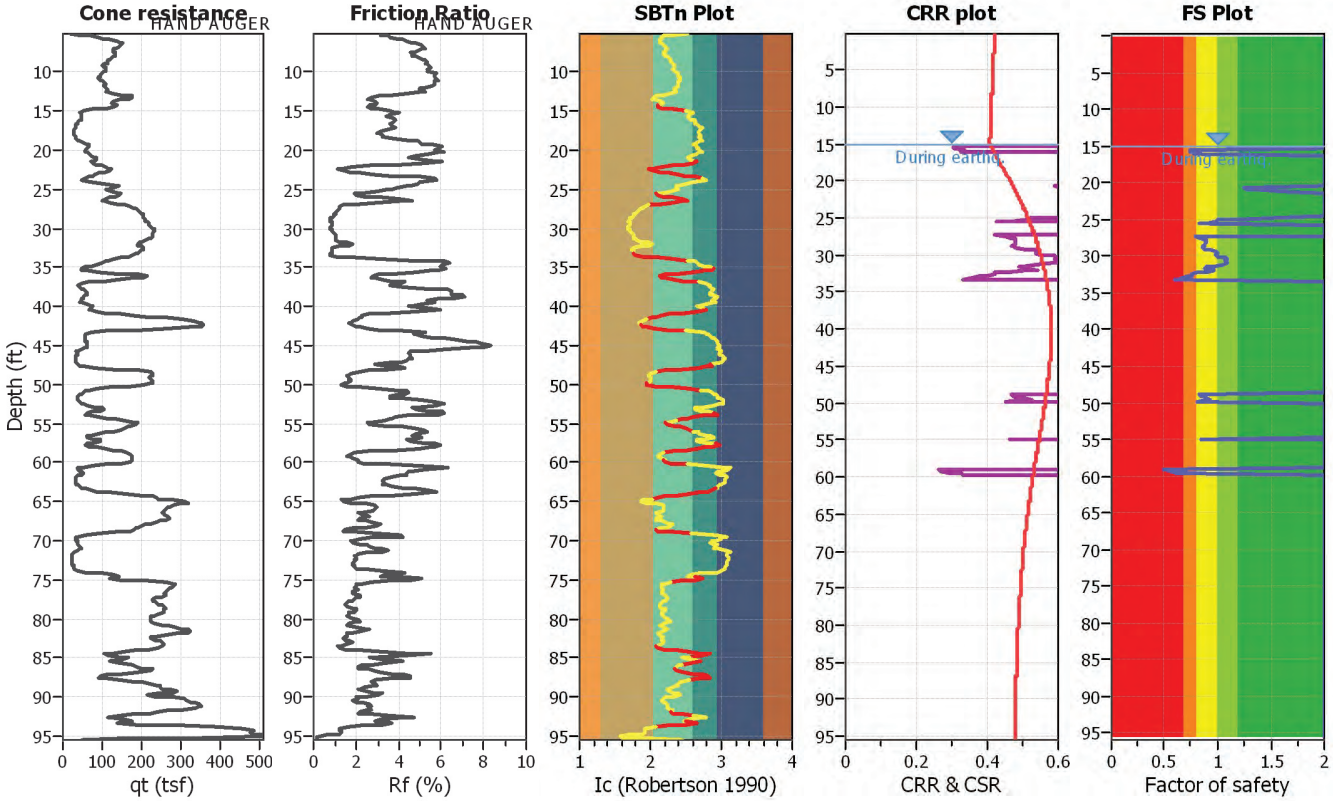
LIQUEFACTION ANALYSIS REPORT

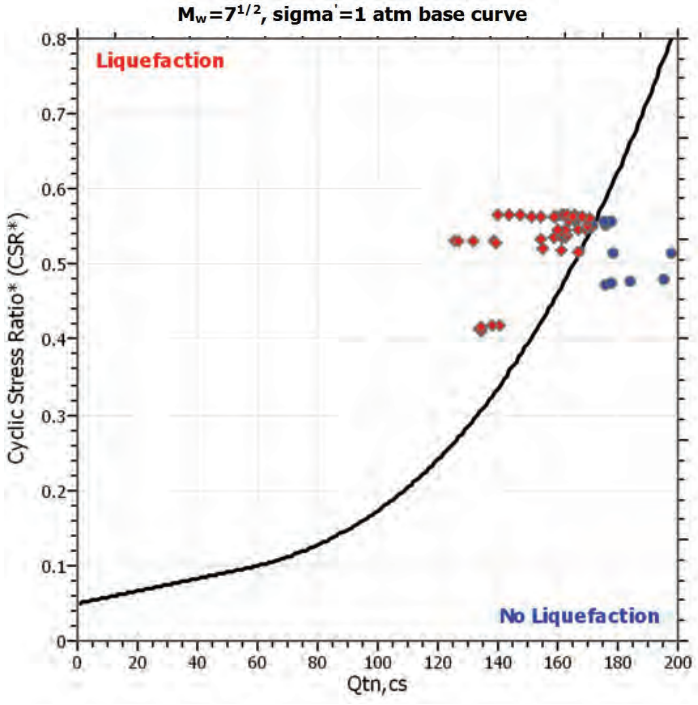
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

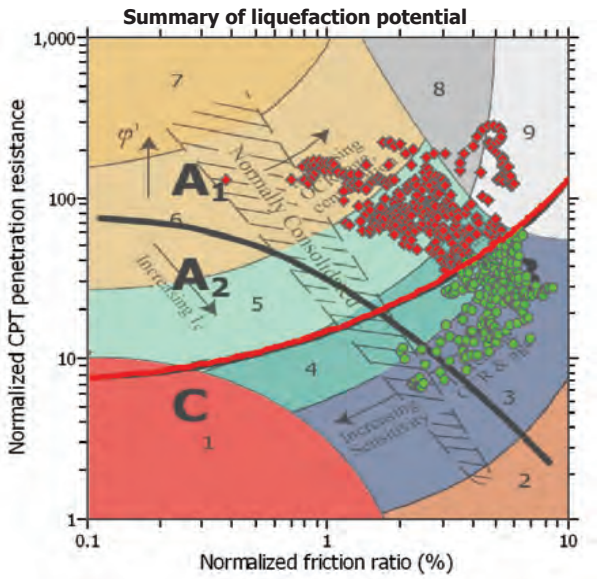
CPT file : CPT-4 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

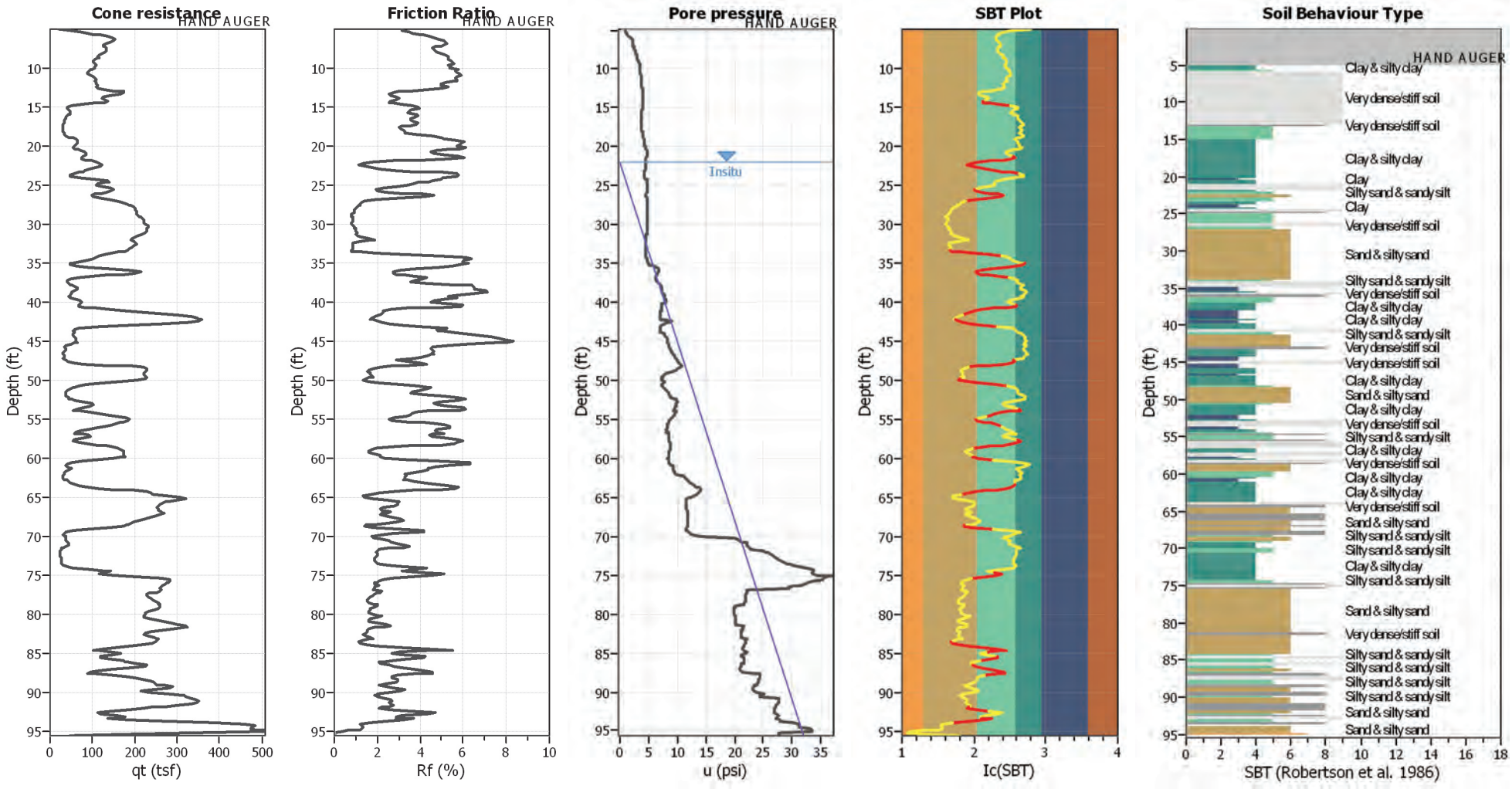






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



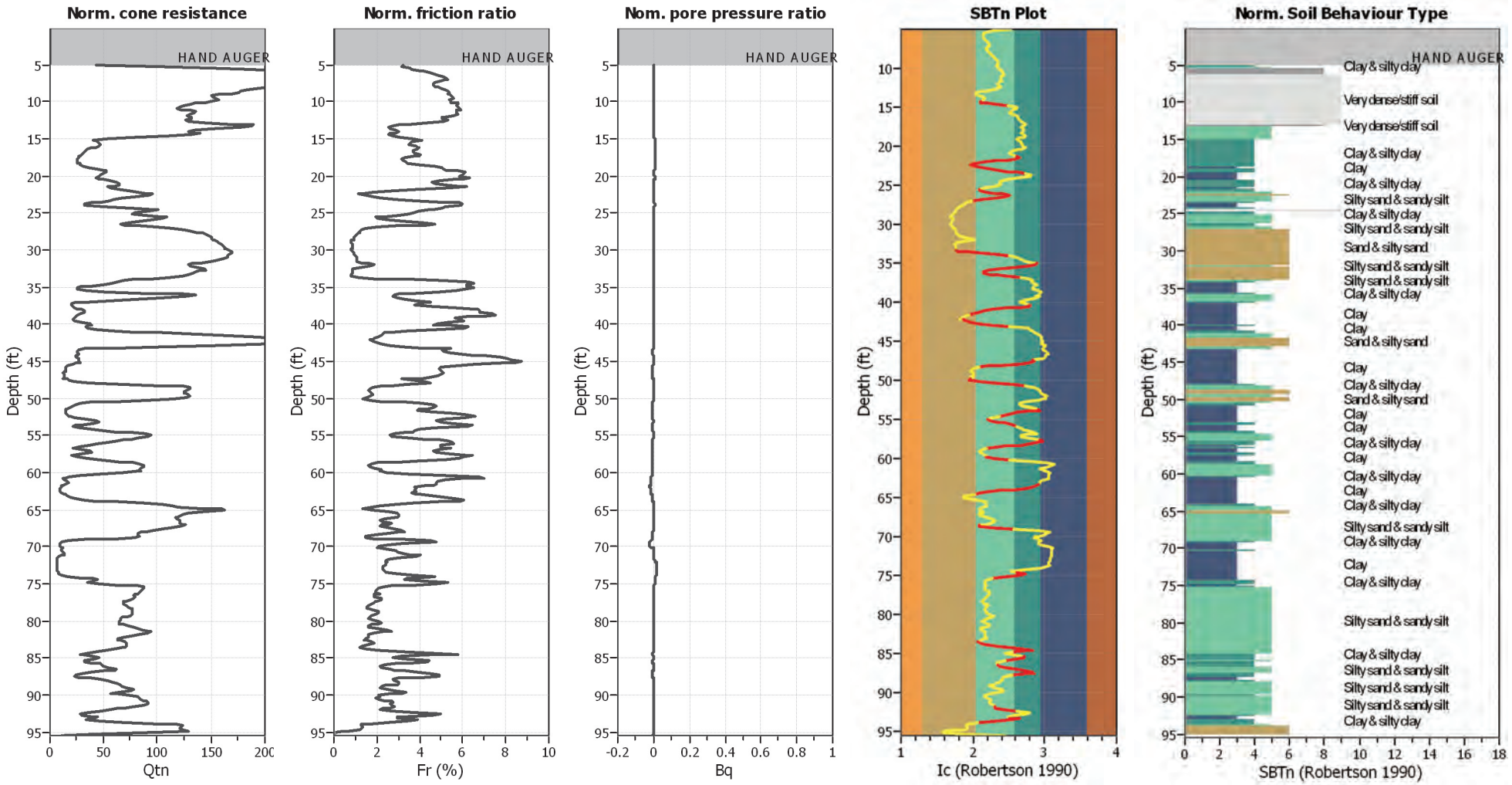
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



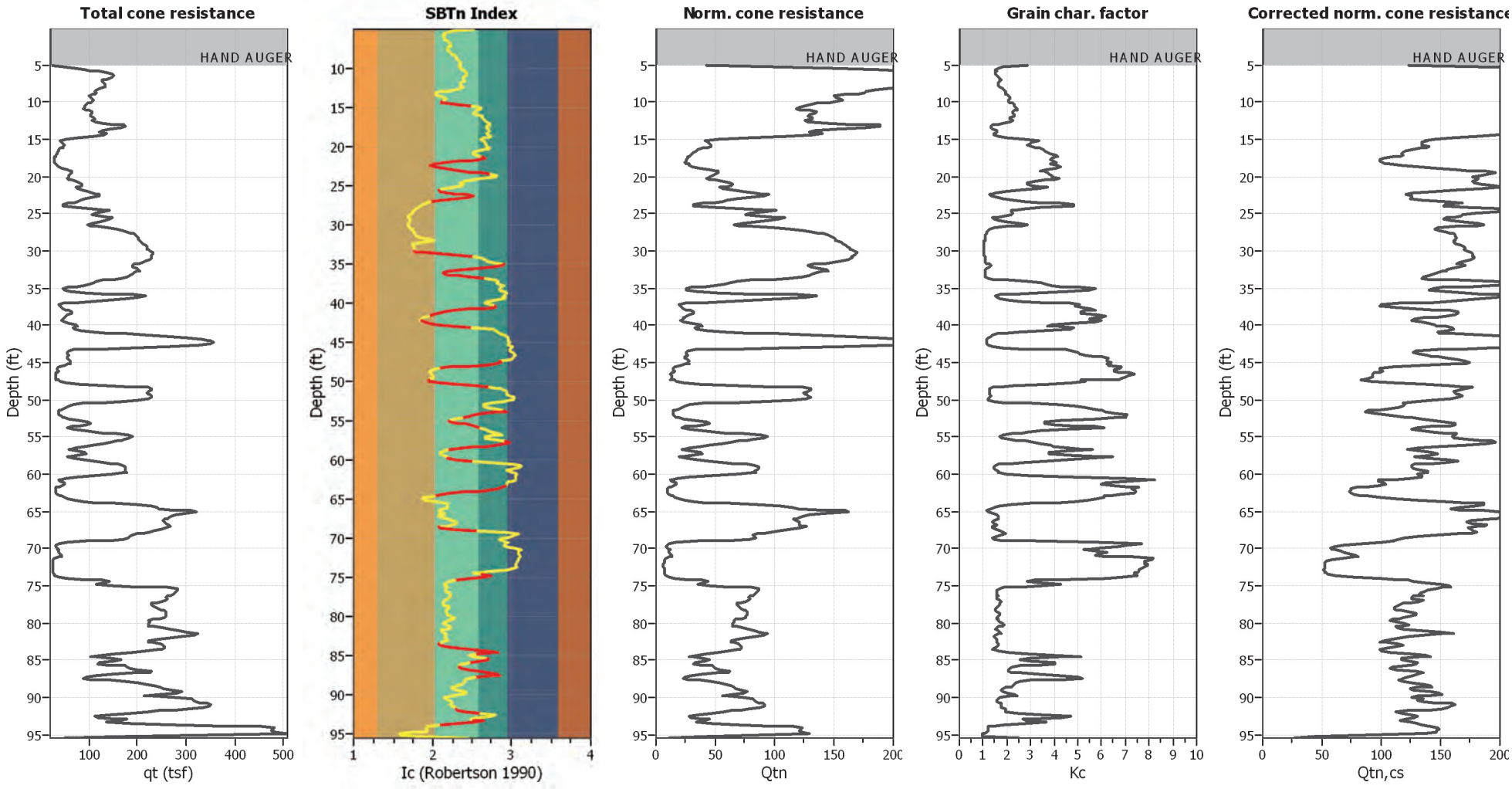
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

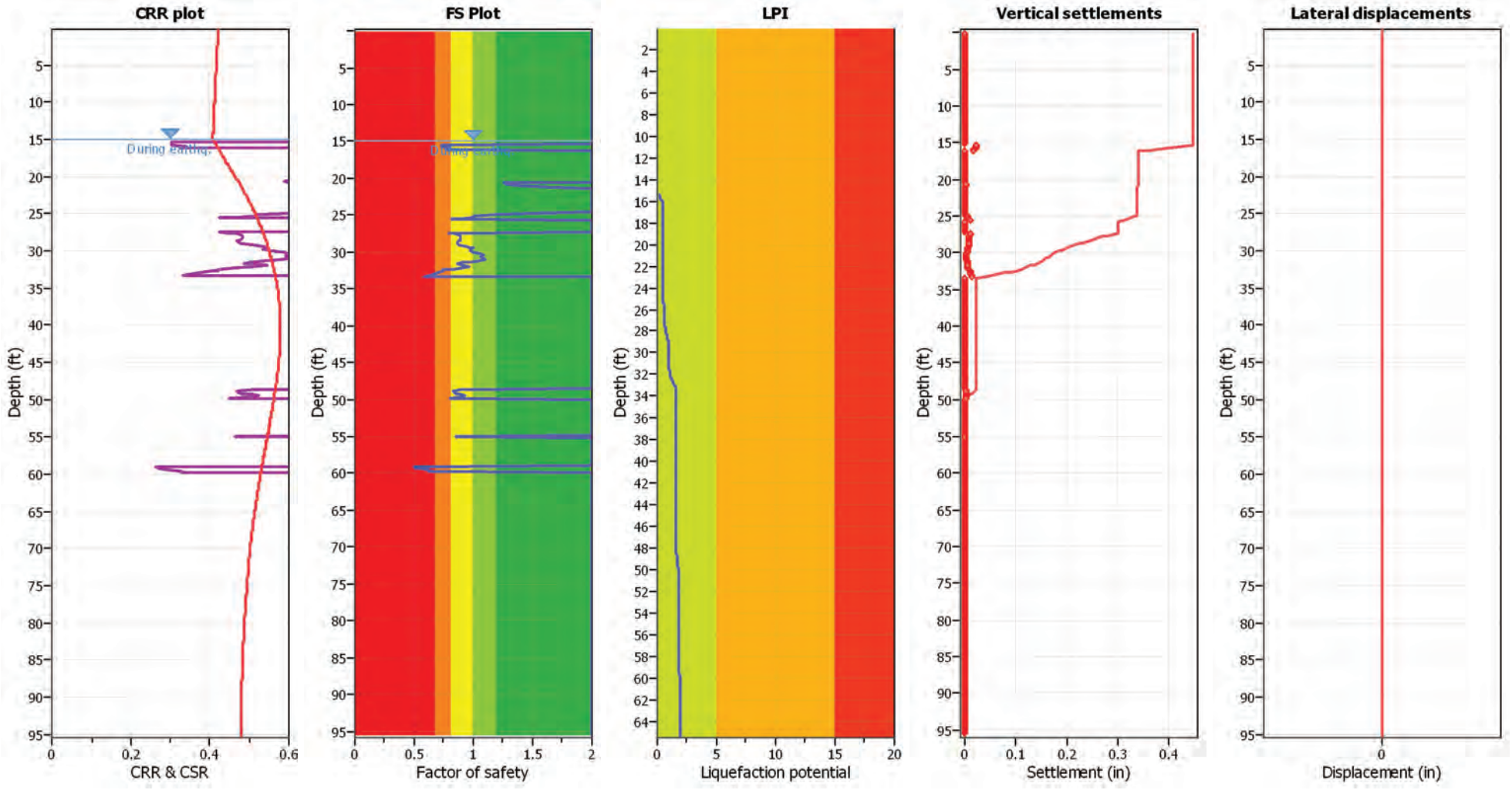
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

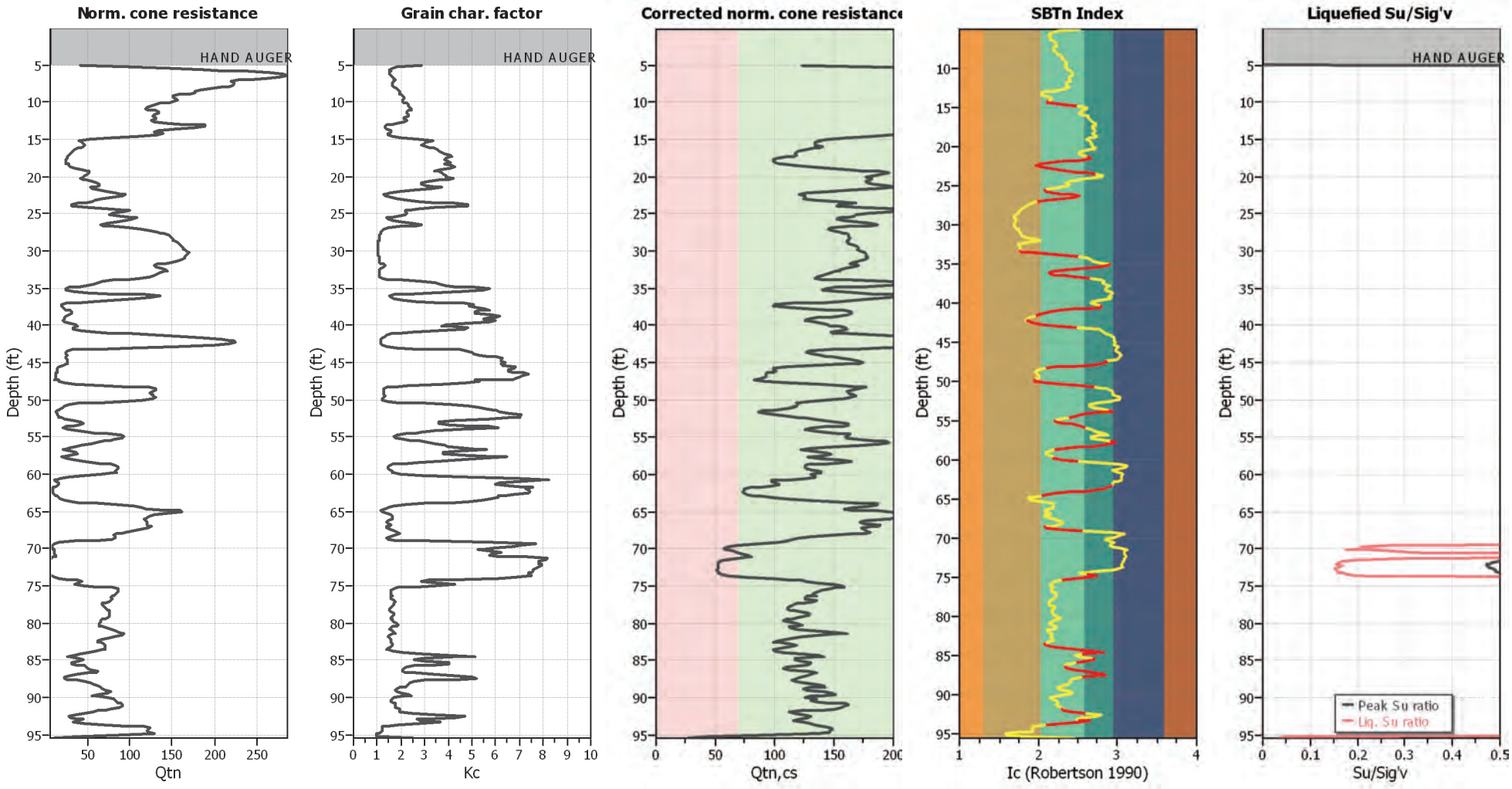
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

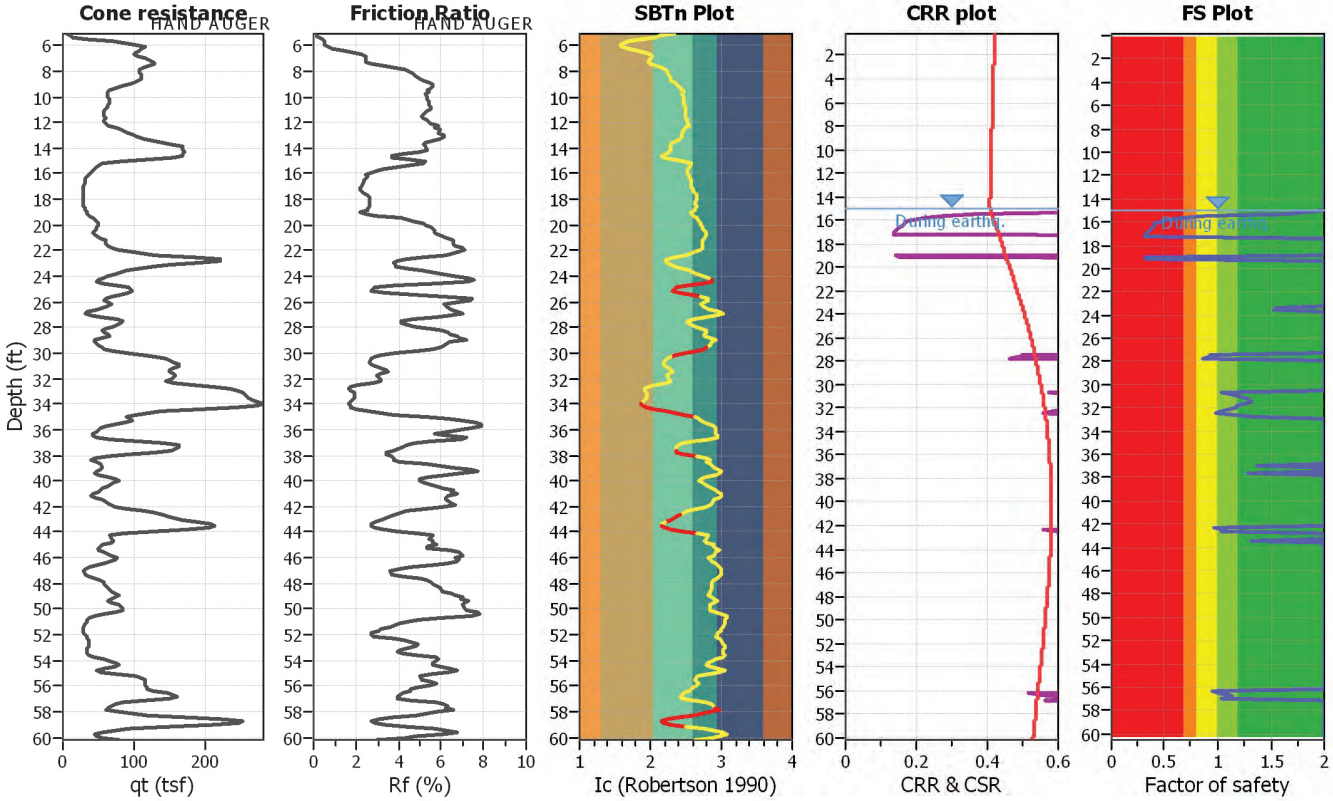
LIQUEFACTION ANALYSIS REPORT

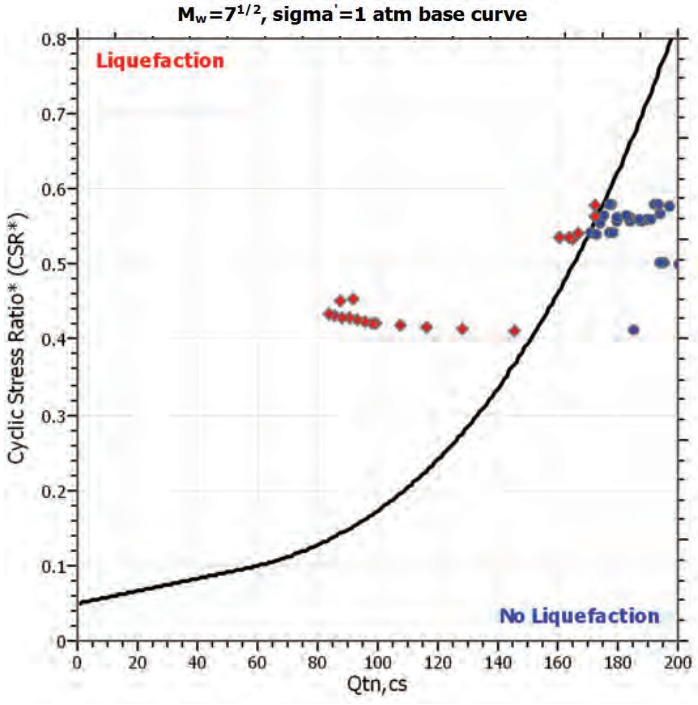
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

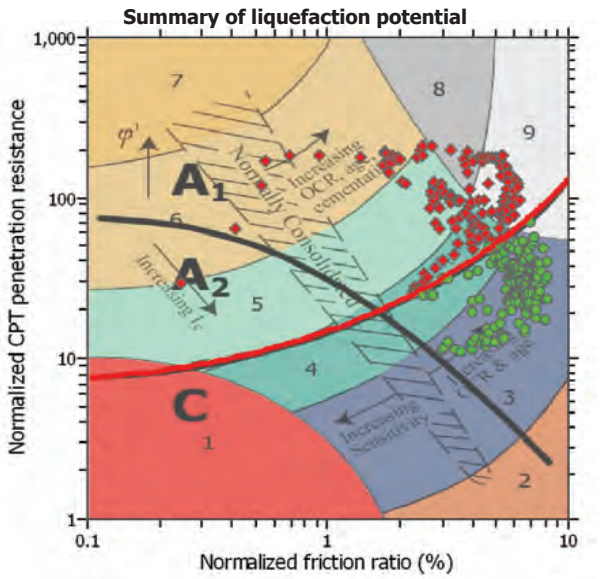
CPT file : CPT-5 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

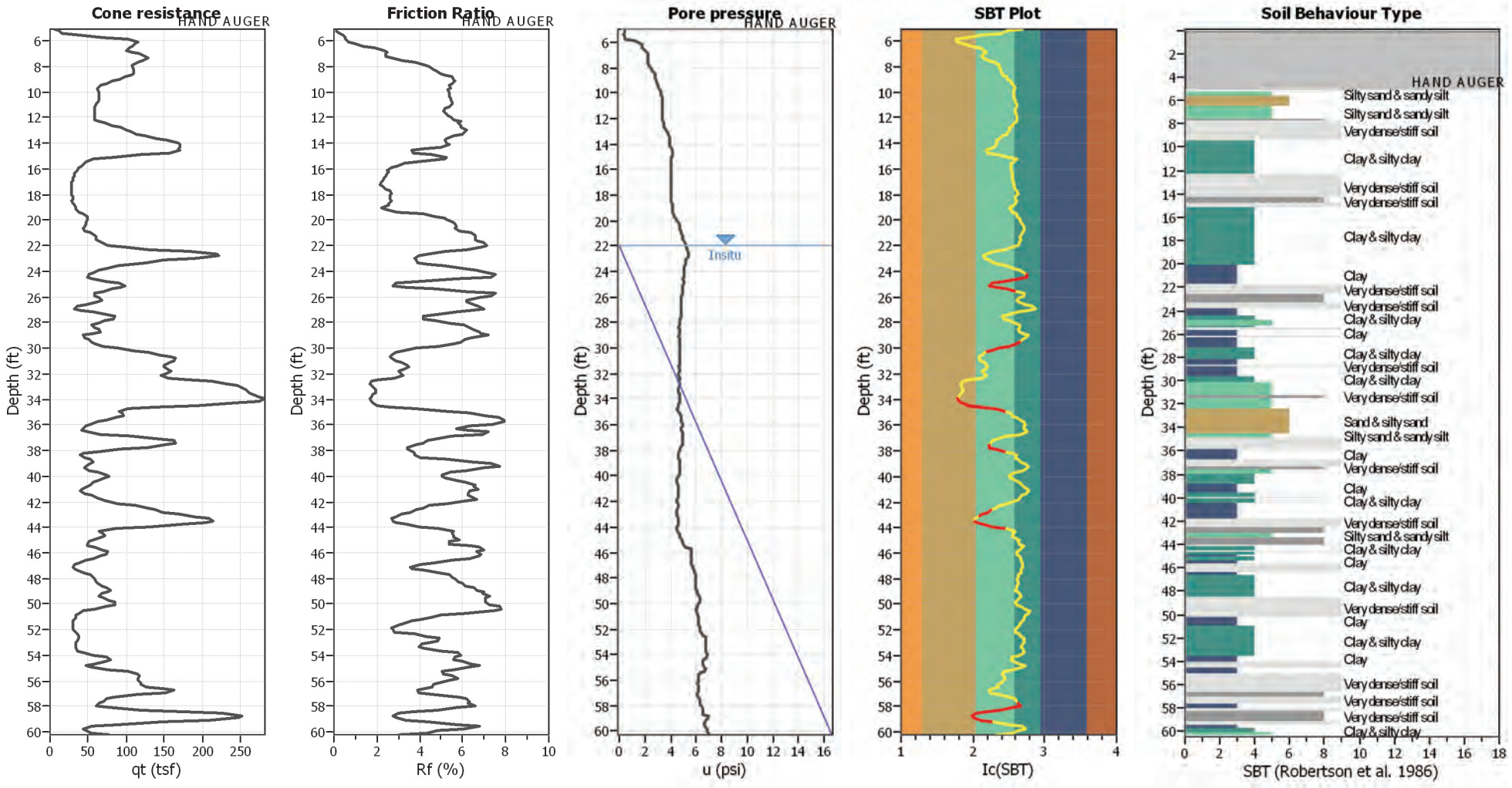






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



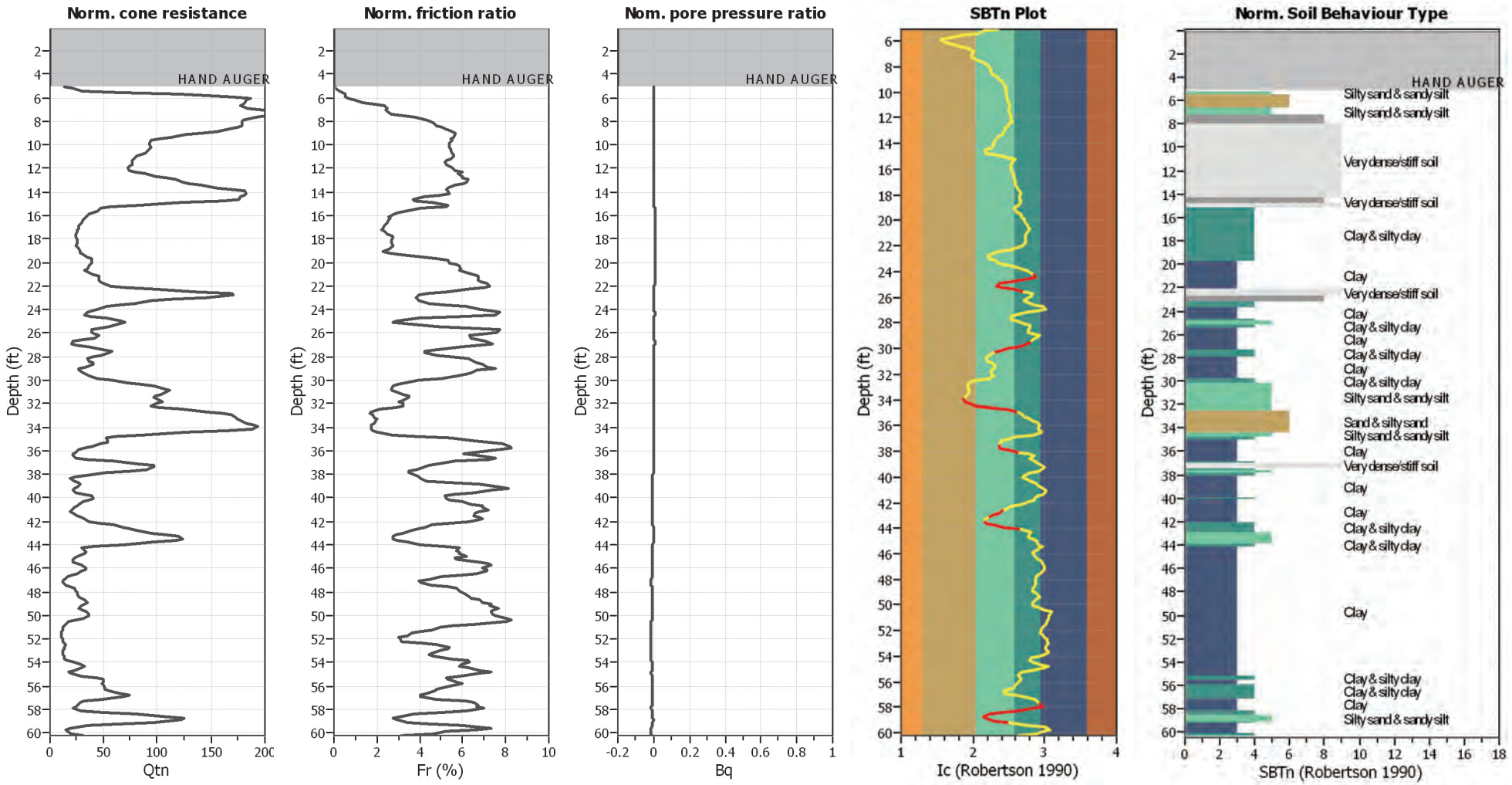
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



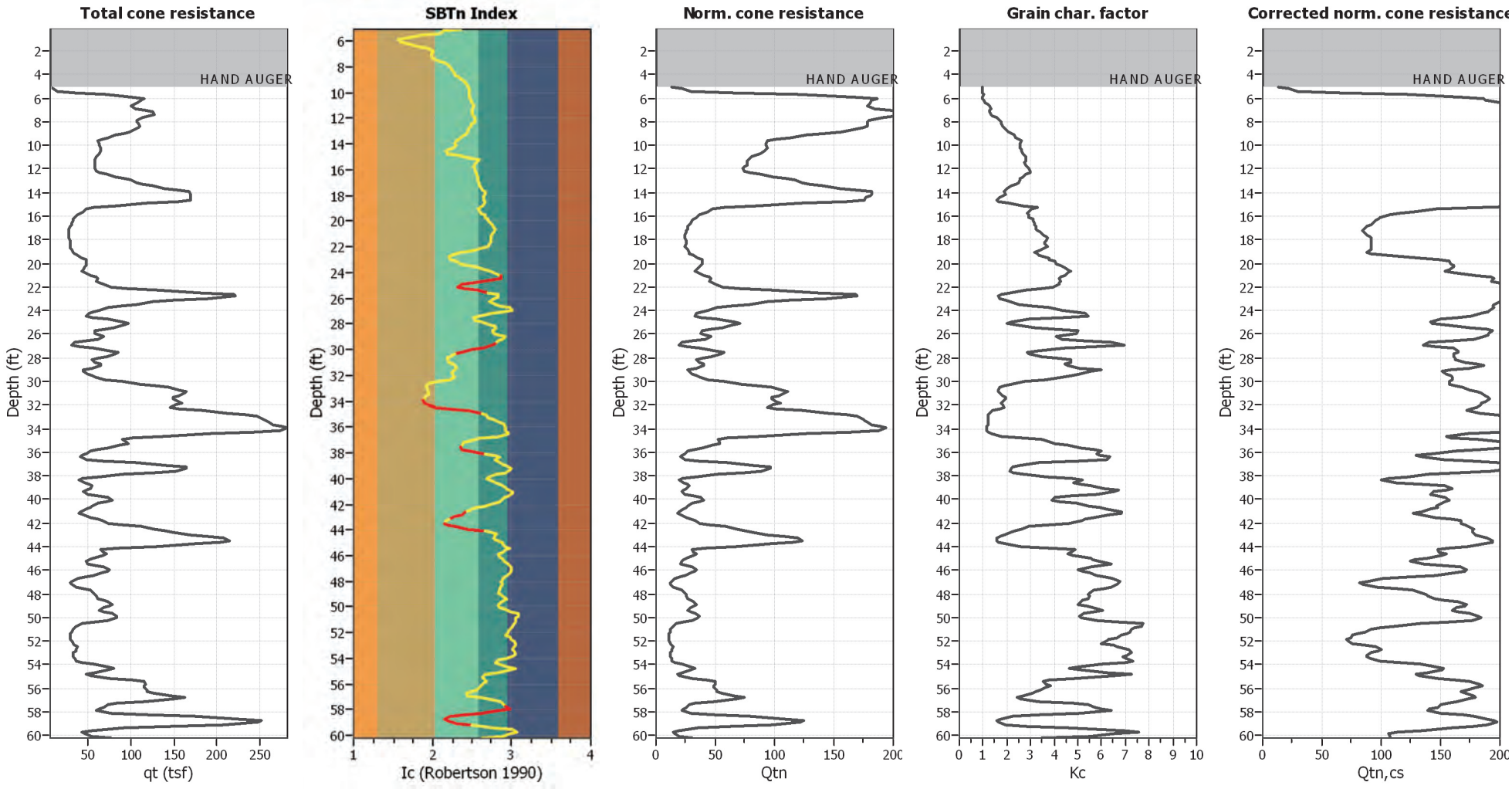
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

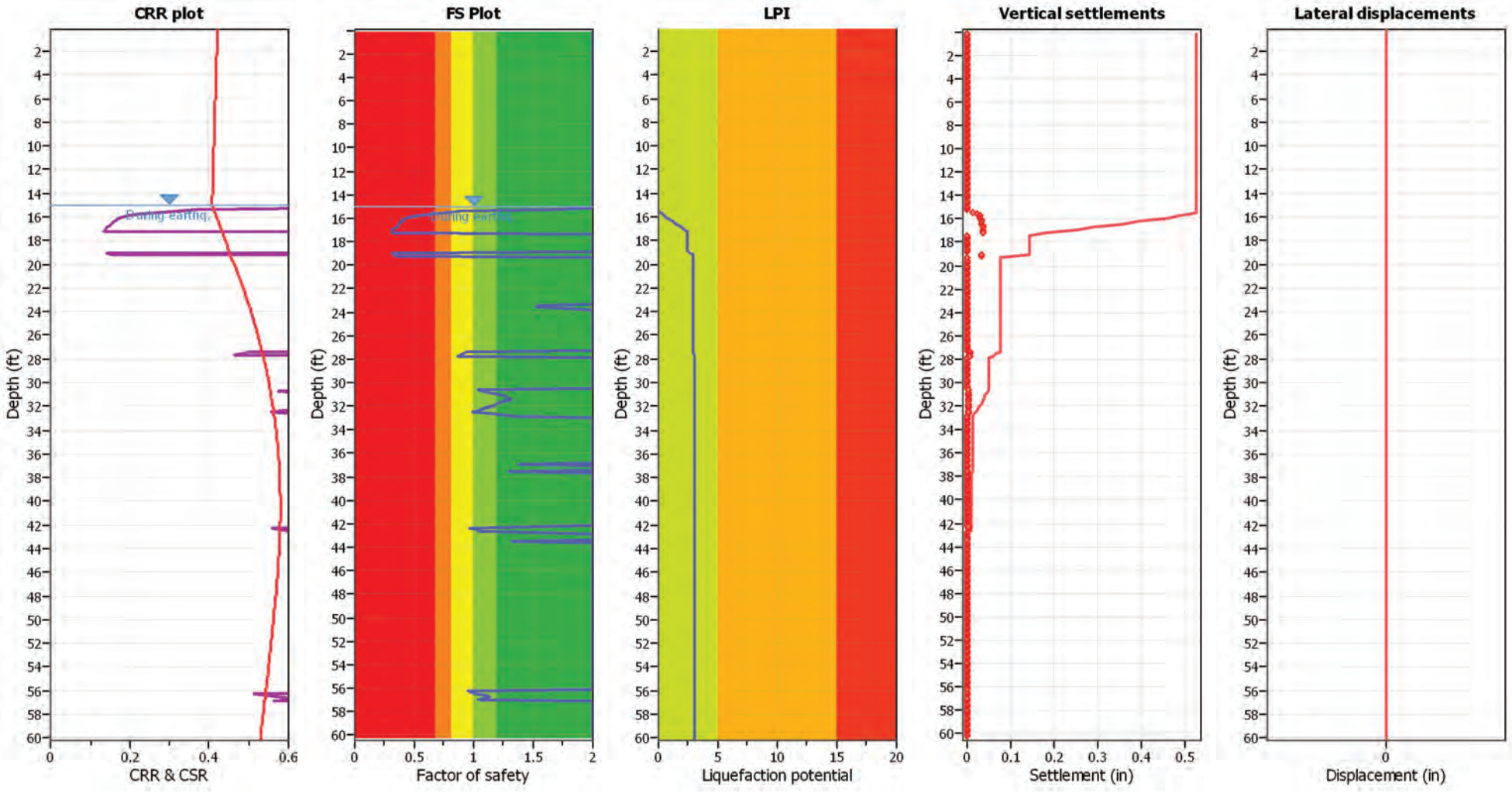
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

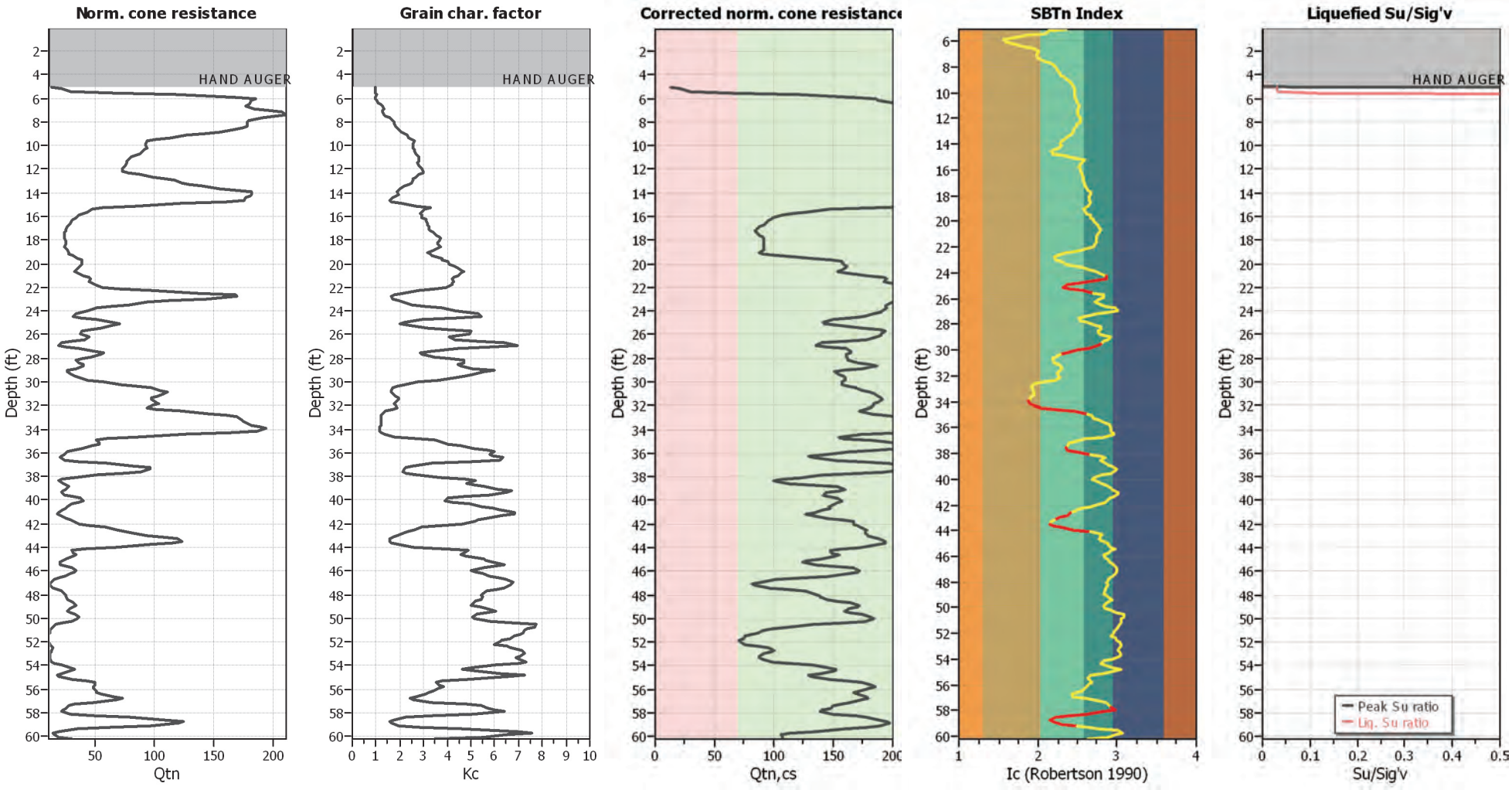
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

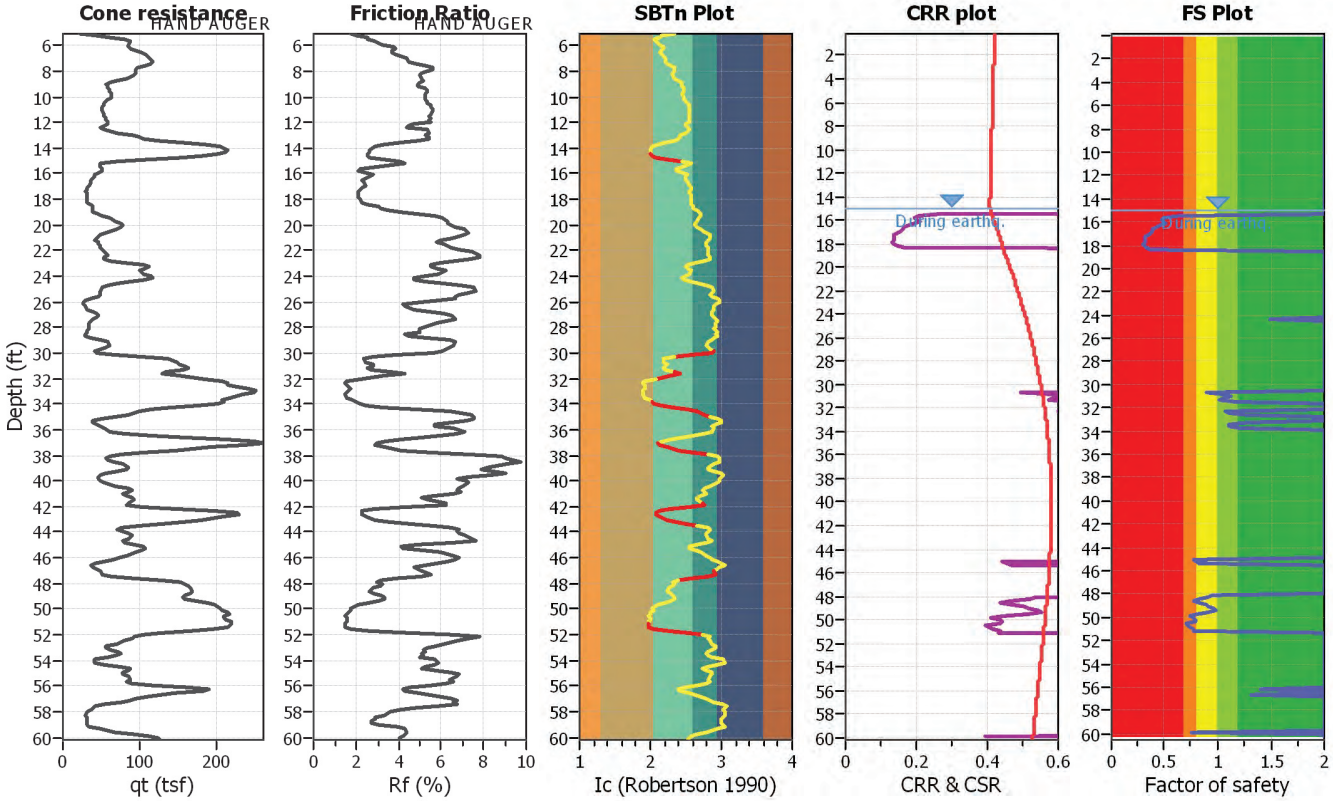
LIQUEFACTION ANALYSIS REPORT

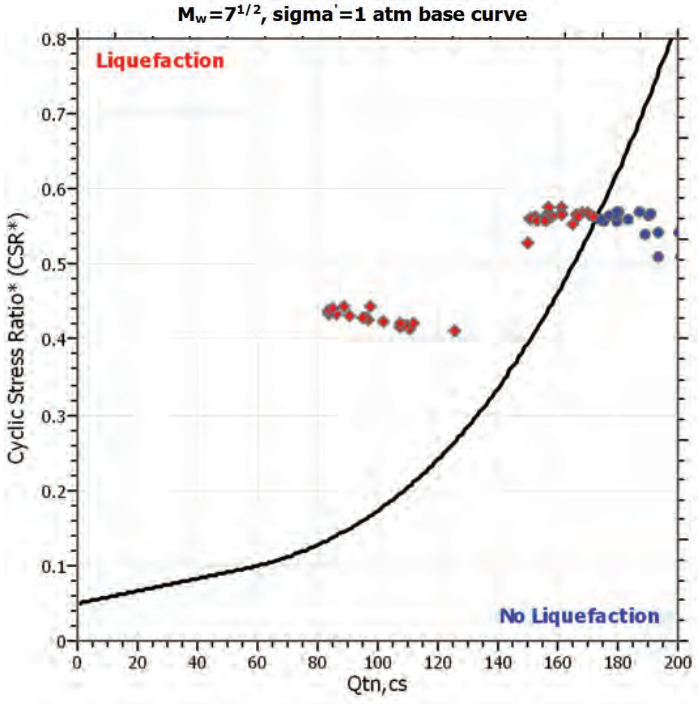
Project title : 21-2971 16911 Normandie Associates, LLC **Location :**

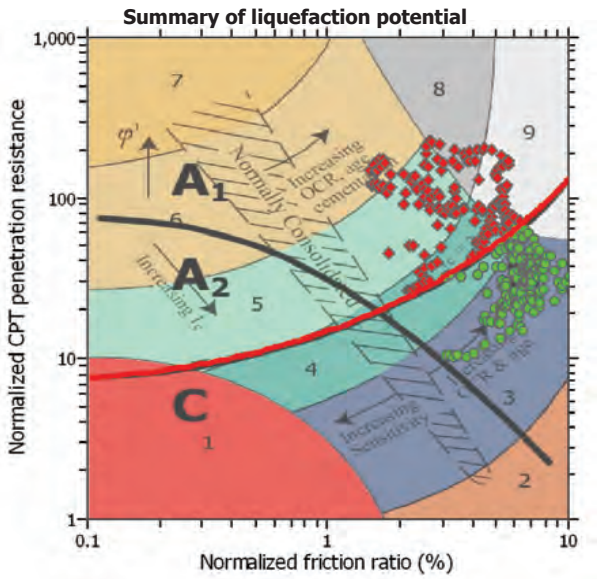
CPT file : CPT-6 (Full PGA)

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	22.00 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:	60.00 ft
Earthquake magnitude M_w:	6.74	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.85	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

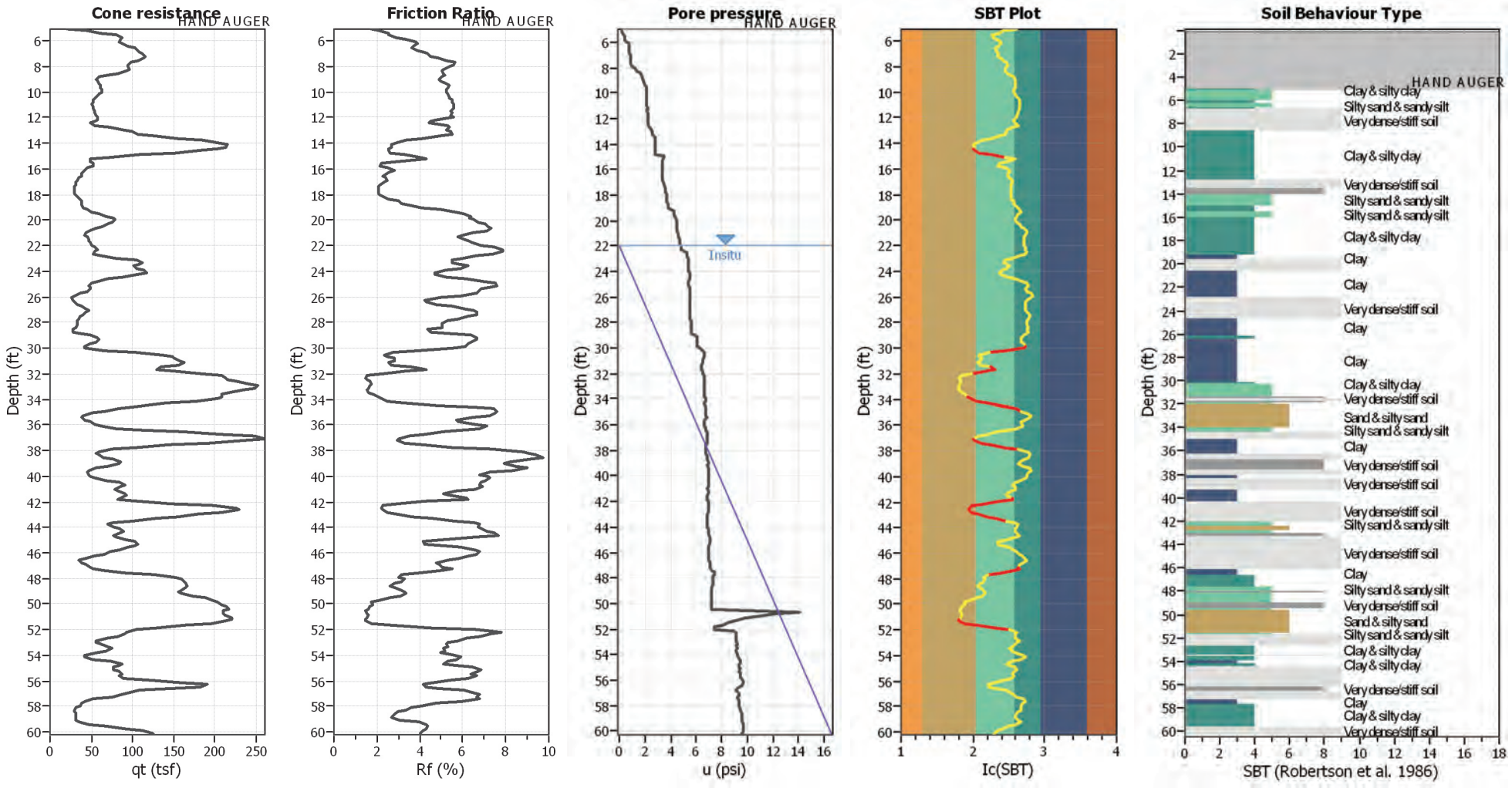






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



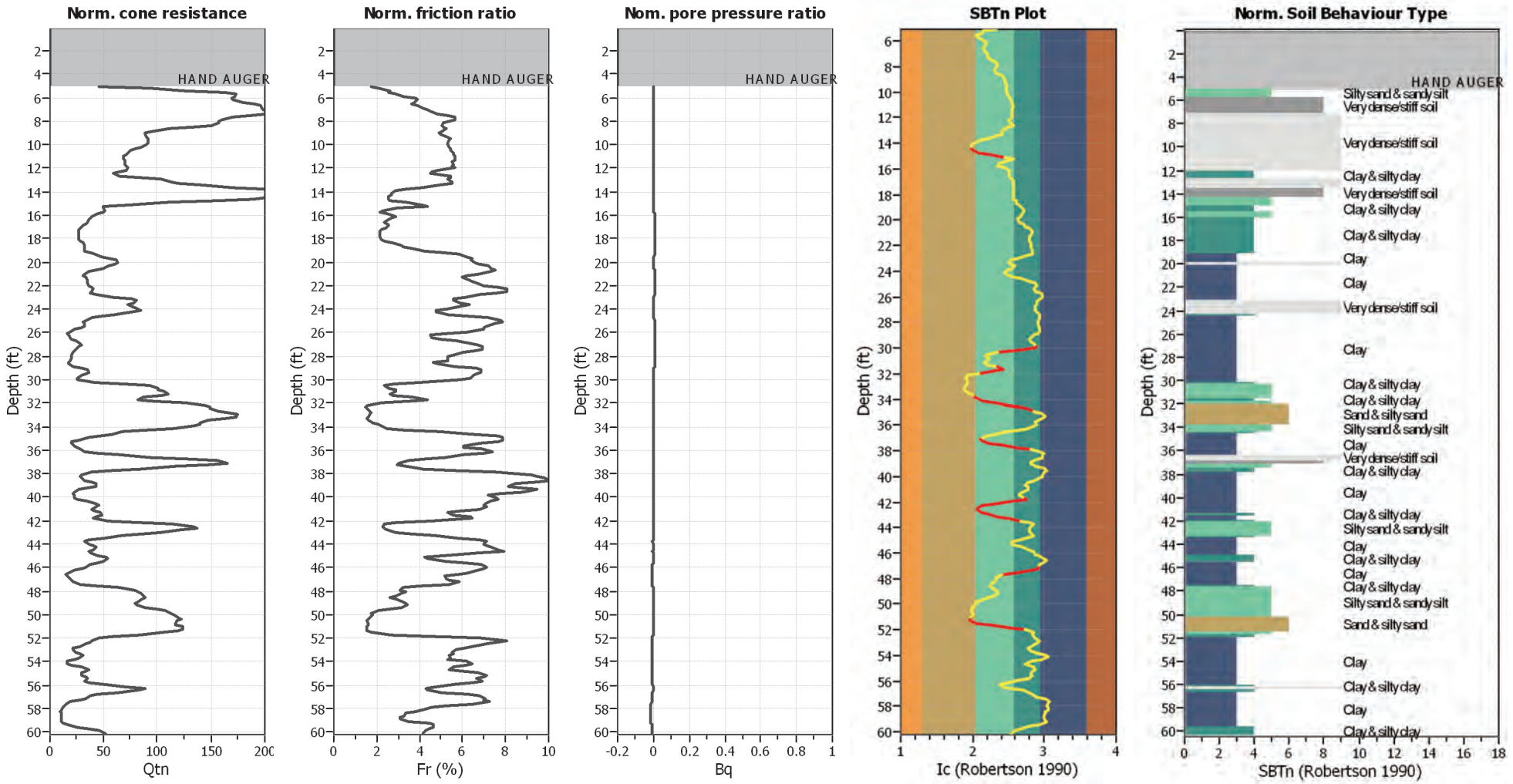
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



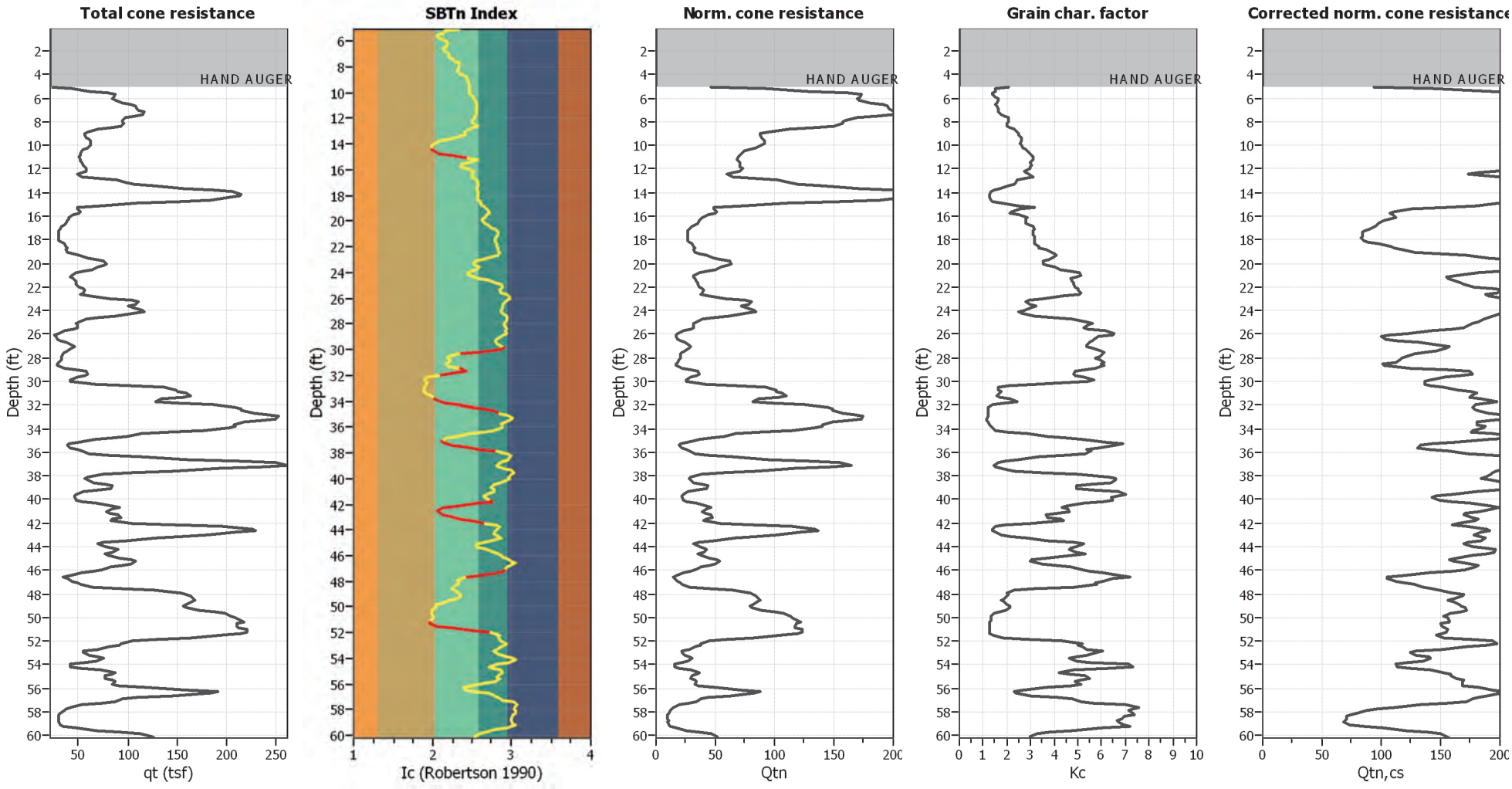
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

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

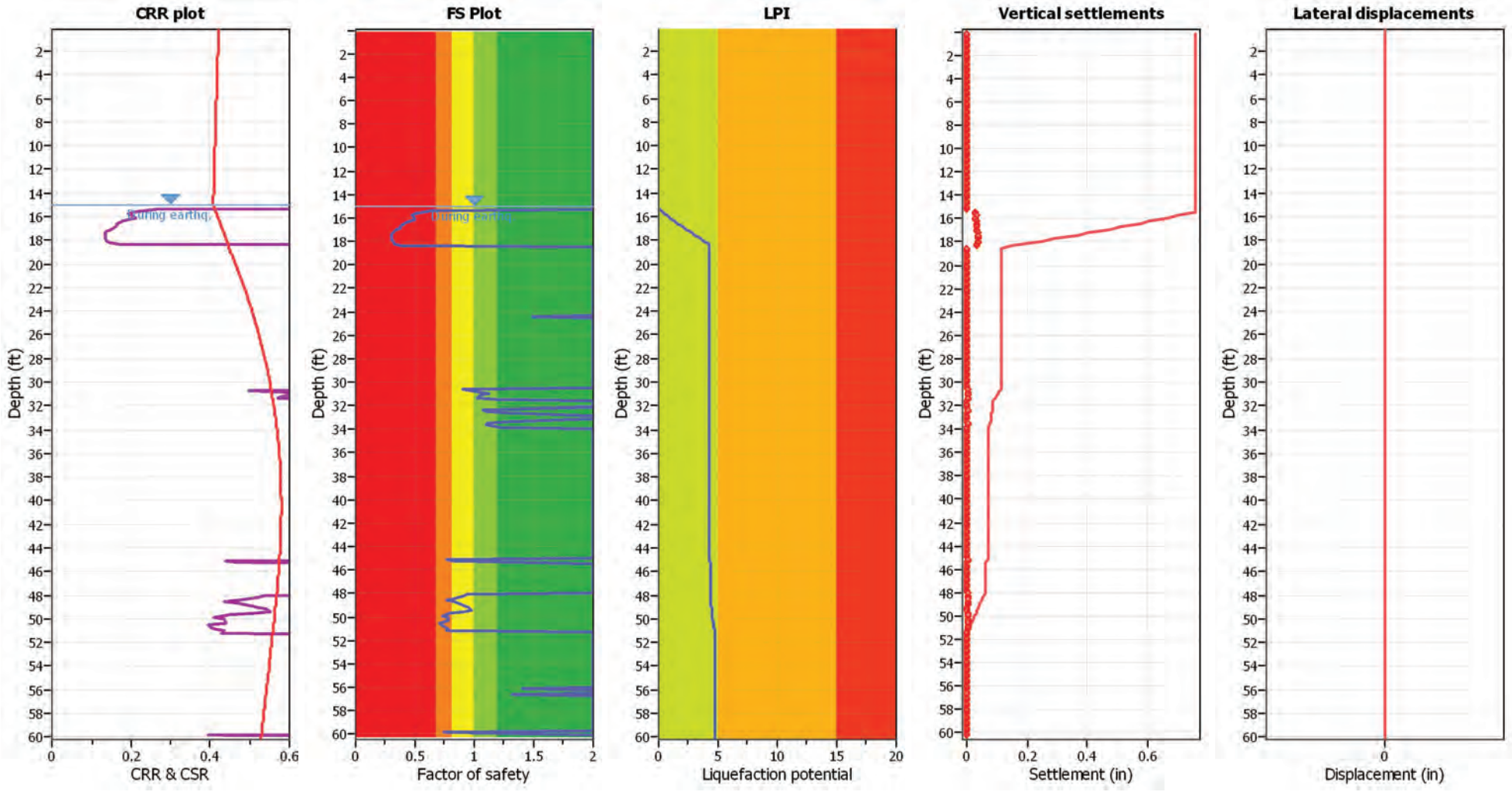
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

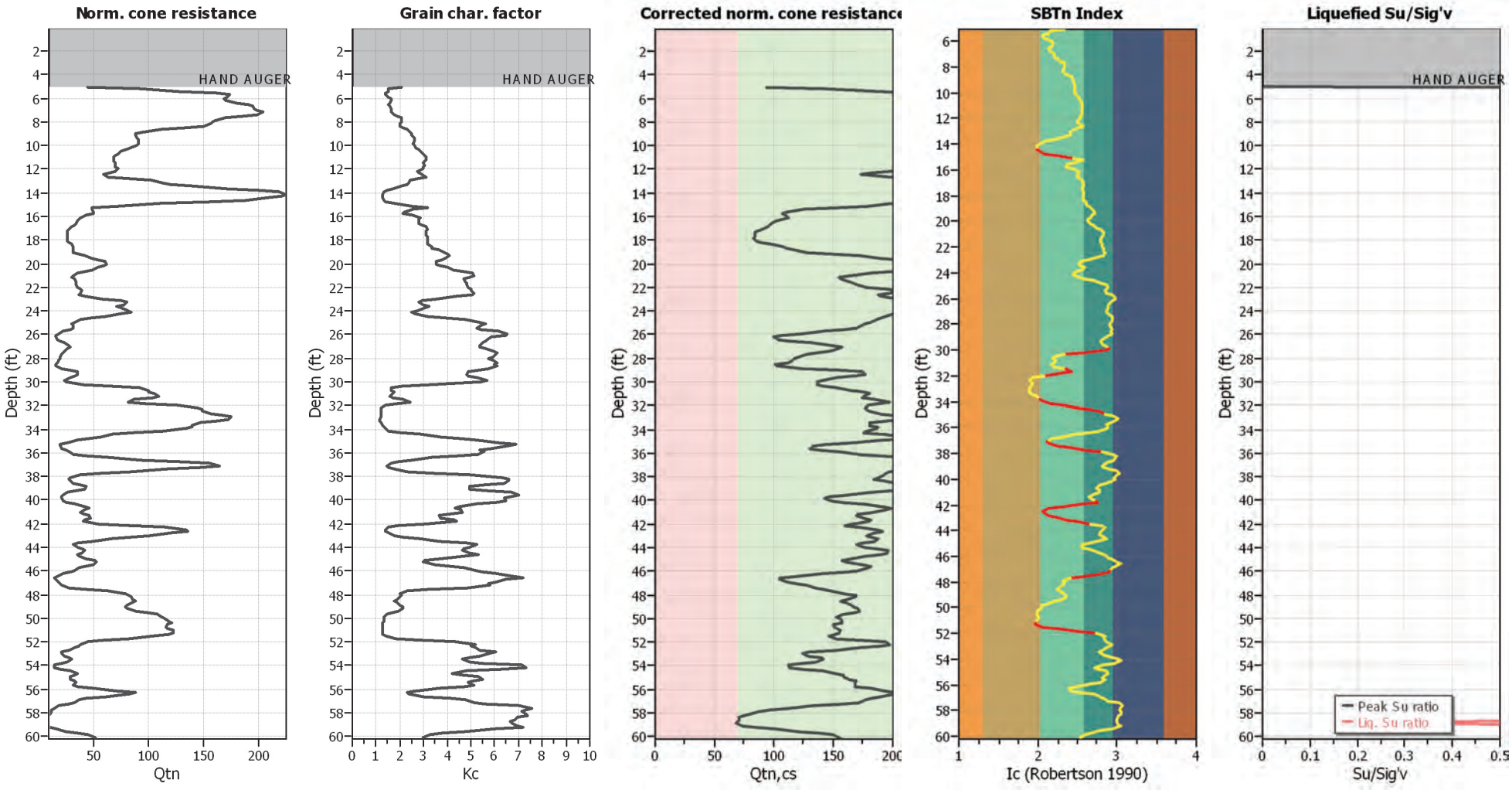
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))

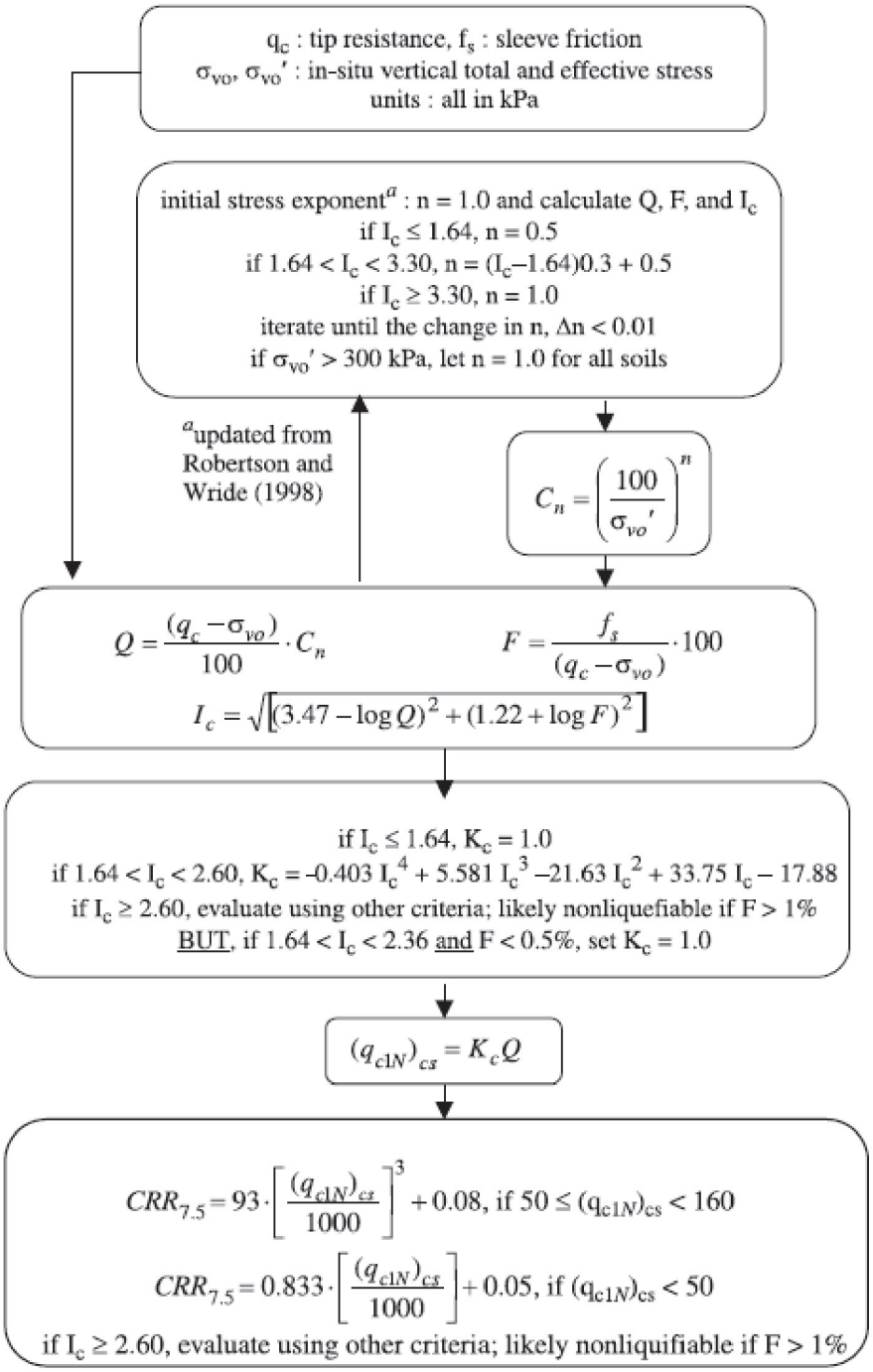


Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.74	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.85	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	22.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

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

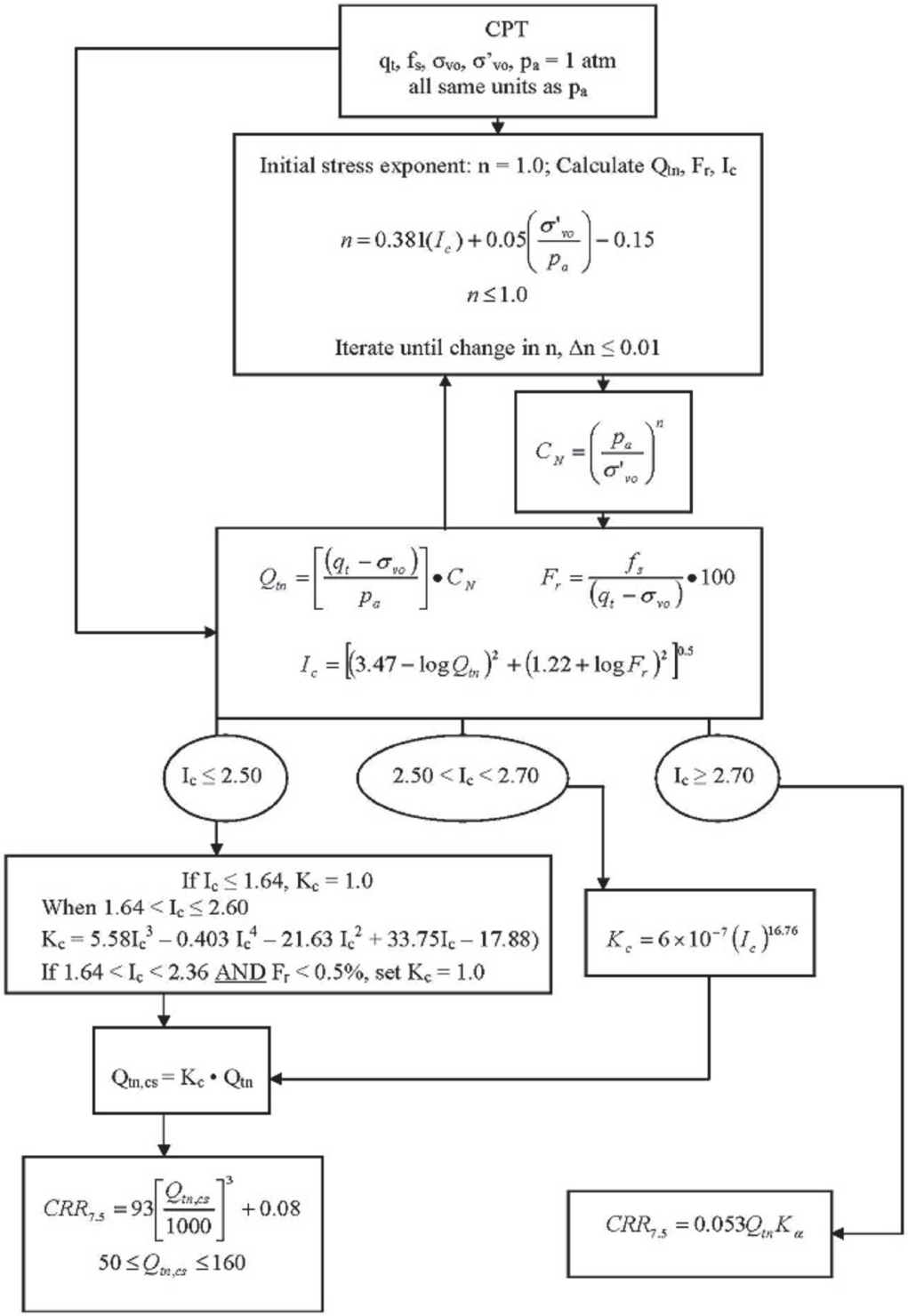
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of 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

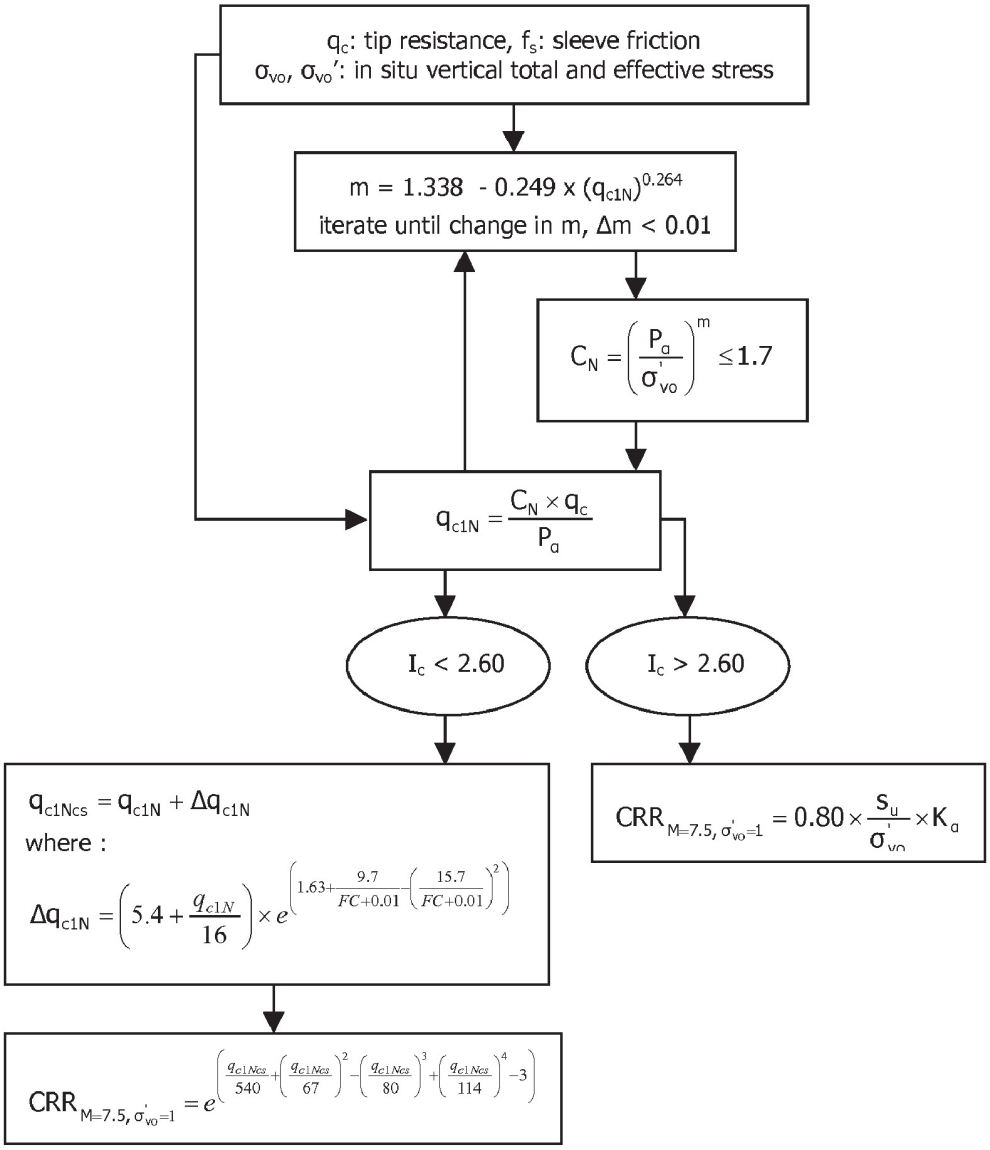
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

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]:

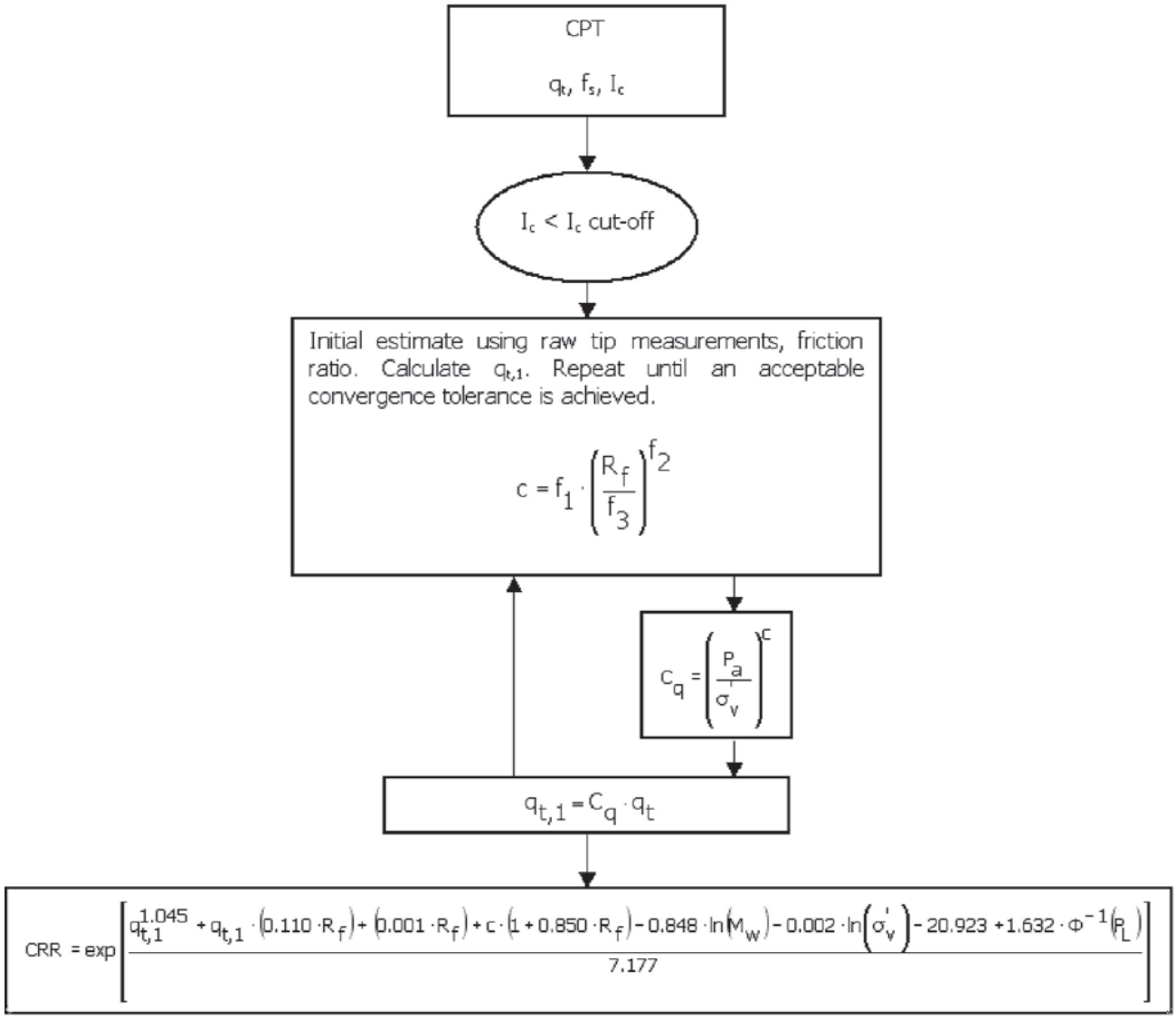


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

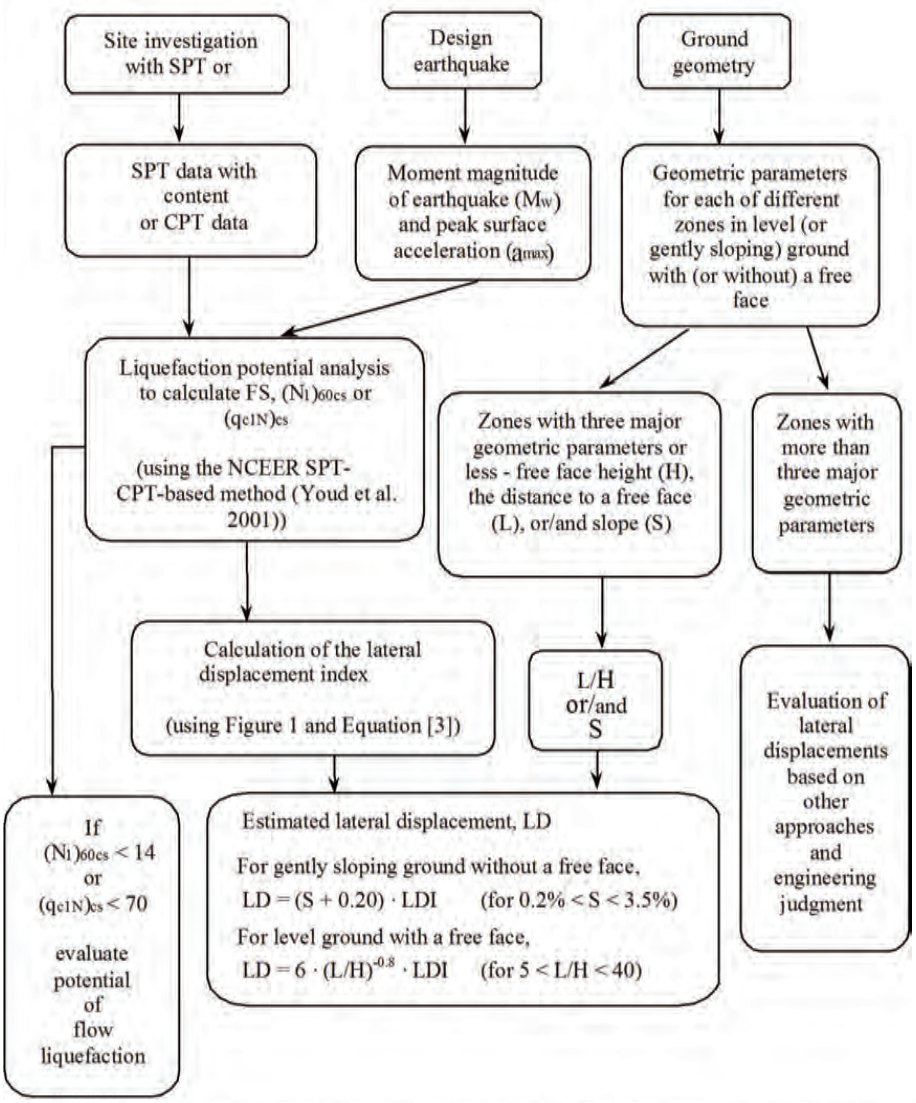
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



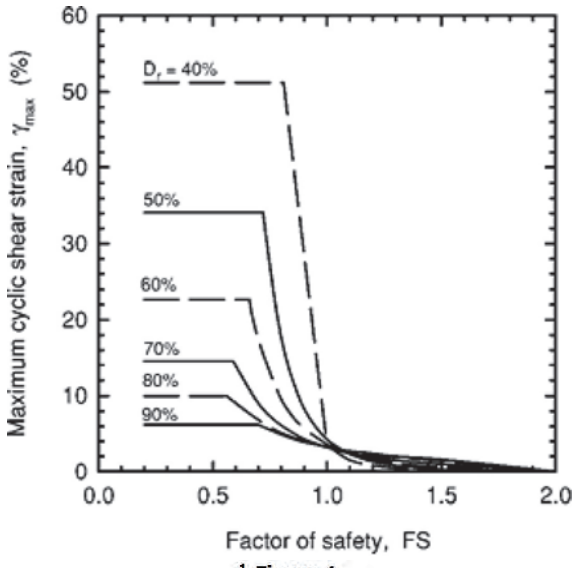
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



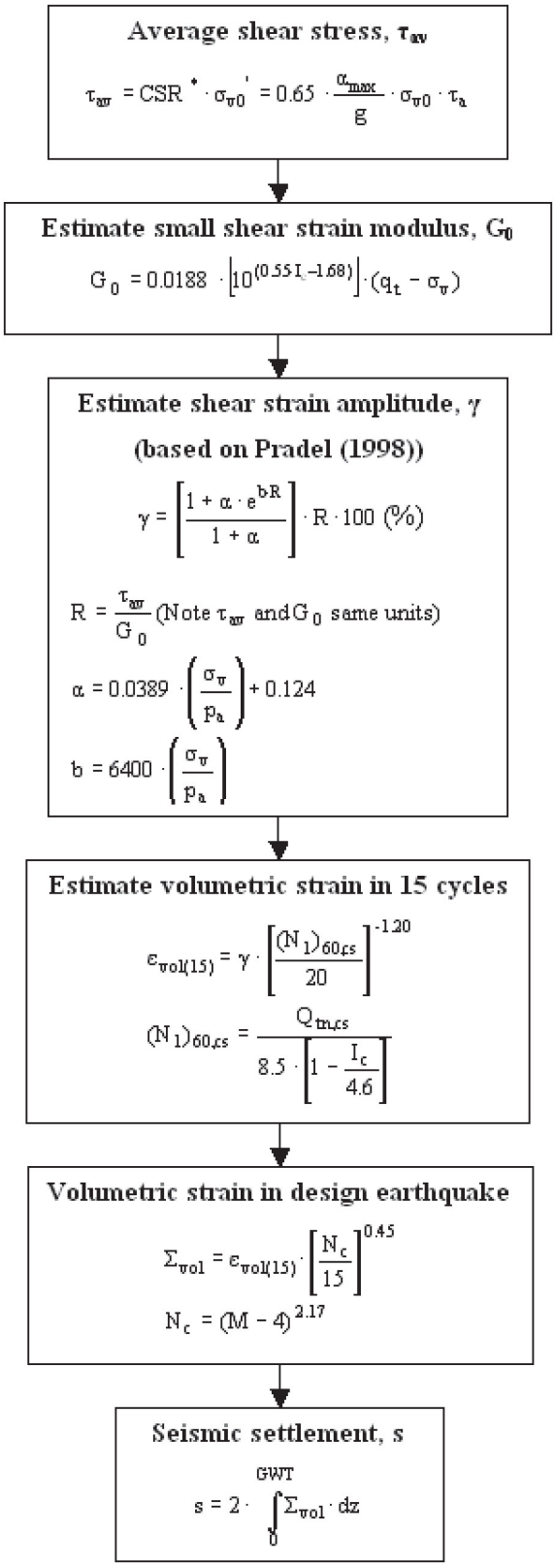
[1] **Figure 1**

$$LDI = \int_0^{z_{max}} \gamma_{max} dz$$

[1] **Equation [3]**

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

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.

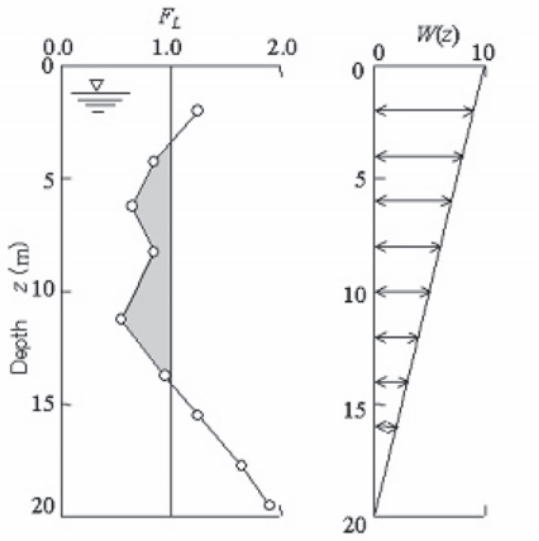
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

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

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

References

- Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.
- Boulanger, R.W. and Idriss, I. M., 2007. Evaluation of Cyclic Softening in Silts and Clays. ASCE Journal of Geotechnical and Geoenvironmental Engineering June, Vol. 133, No. 6 pp 641-652
- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/
- Robertson, P.K. 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27 (1), 151-8.
- Robertson, P.K. and Wride, C.E., 1998. Cyclic Liquefaction and its Evaluation based on the CPT Canadian Geotechnical Journal, 1998, Vol. 35, August.
- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833
- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180
- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871
- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368
- Iwasaki, T., 1986, Soil liquefaction studies in Japan: state-of-the-art, Soil Dynamics and Earthquake Engineering, Vol. 5, No. 1, 2-70
- Papathanassiou G., 2008, LPI-based approach for calibrating the severity of liquefaction-induced failures and for assessing the probability of liquefaction surface evidence, Eng. Geol. 96:94–104
- P.K. Robertson, 2009, Interpretation of Cone Penetration Tests - a unified approach., Canadian Geotechnical Journal, Vol. 46, No. 11, pp 1337-1355
- 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
- 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
- R. E. S. Moss, R. B. Seed, R. E. Kayen, J. P. Stewart, A. Der Kiureghian, K. O. Cetin, CPT-Based Probabilistic and Deterministic Assessment of In Situ Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 8, August 1, 2006

APPENDIX C

DATA BY OTHERS

Geotechnologies, Inc., June 4, 2021, Boring Logs and Lab Data

BORING LOG NUMBER 1

TAS Realty Associates **Date: 01/08/21** **Elevation: 35'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt for Parking Lot
				0		4½-inch Asphalt over 3½-inch Base
				1		FILL: Silty Sand, dark brown, moist, medium dense, fine grained
2.5	32	12.9	125.1	2		
				3	SM	ALLUVIUM: Silty Sand, dark brown, moist, medium dense, fine grained
5	14	12.2	SPT	4		
				5		
				6		
7.5	90	16.1	116.3	7		
				8		
				9		
10	17	16.6	SPT	10	SM/ML	Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained, stiff
				11		
12.5	88	16.2	117.2	12		
				13	SM	Silty Sand, dark and yellowish brown, moist, very dense, fine grained
15	16	18.5	SPT	14		
				15	ML	Sandy Silt, dark and grayish brown, moist, stiff, fine grained
				16		
17.5	56	21.7	105.4	17		
				18	ML/SM	Sandy Silt to Silty Sand, dark brown, moist, medium dense, fine grained, stiff
				19		
20	15	19.9	SPT	20	SM	Silty Sand, dark brown, moist , medium dense, fine grained
				21		
				22		
22.5	52	17.3	114.9	23	SM/ML	Silty Sand to Sandy Silt, dark and grayish brown, moist, medium dense, fine grained
				24		
25	15	26.5	SPT	25		

BORING LOG NUMBER 1

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 – 27 –		
27.5	48	19.4	110.4	28 – 29 –		
30	18	19.8	SPT	30 –	SP	Sand, dark brown, wet, medium dense, fine grained
				31 – 32 –		
32.5	77	18.1	110.5	33 – 34 –		
35	19	20.2	SPT	35 –	SM/ML	Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained
				36 – 37 –		
37.5	64	23.7	100.4	38 – 39 –		
40	16	27.3	SPT	40 – 41 –		
				42 –		
42.5	59	23.4	99.8	43 –	SP/ML	Sand to Sandy Silt, dark brown, wet, medium dense, stiff, fine grained
				44 –		
45	20	20.4	SPT	45 –	SM/ML	Silty Sand to Sandy Silt, dark and yellowish brown, wet, medium dense, stiff, fine grained
				46 – 47 –		
47.5	59	23.3	103.4	48 –	SM	Silty Sand, dark brown, moist, medium dense, fine grained
				49 –		
50	34	23.5	SPT	50 –	ML	Sandy Silt, dark brown, moist, stiff, fine grained

GEOTECHNOLOGIES, INC.

Plate A-1b

BORING LOG NUMBER 1

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51 –		
				52 –		
52.5	71	29.7	92.7	53 –	SM/ML	Silty Sand to Sandy Silt, dark brown, moist to wet, dense, stiff, fine grained
				54 –		
55	35	24.4	SPT	55 –		
				56 –		
57.5	69	25.9	100.1	57 –		
				58 –		
				59 –		
60	42	26.3	SPT	60 –		Total Depth 60 feet Water at 17 feet Fill to 3 feet
				61 –		
				62 –		
				63 –		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				64 –		
				65 –		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				66 –		
				67 –		SPT=Standard Penetration Test
				68 –		
				69 –		
				70 –		
				71 –		
				72 –		
				73 –		
				74 –		
				75 –		

BORING LOG NUMBER 2

TAS Realty Associates **Date: 01/07/21** **Elevation: 34'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt for Parking Lot
				0		3-inch Asphalt over 5-inch Base
				1		
				2		FILL: Clayey Sand, dark brown, moist, medium dense, fine grained, debris fragments
2.5	43	13.8	120.0	3	SC	ALLUVIUM: Clayey Sand, dark brown, moist, medium dense, fine grained
				4		
5	10	12.1	SPT	5		brown, few fine gravel
				6		
				7		
7.5	50 50/5"	14.4	123.1	8	SP/SC	Sand with Clay, mottled brown, moist, dense, fine grained
				9		
10	22	16.2	SPT	10	SC	Clayey Sand, mottled light to yellowish brown, moist, medium dense, fine grained
				11		
				12		
12.5	46	16.2	110.8	13	SM	Silty Sand, light brown, moist, medium dense, fine grained
				14		
15	17	19.4	SPT	15	CL	Sandy Clay, mottled olive brown, moist, stiff, fine grained
				16		
				17		
17.5	28	20.2	107.9	18	SC	Clayey Sand, light brown, very moist, medium dense, fine grained
				19		
20	20	22.7	SPT	20		wet
				21		
				22		
22.5	68	16.4	121.9	23		grayish brown
				24		
25	16	18.0	SPT	25	SP	Sand, brown, wet, medium dense, fine grained, minor clay

BORING LOG NUMBER 2

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
27.5	65 50/5"	22.5	103.8	28		
				29		
30	21	22.7	SPT	30		
				31		
				32		
32.5	46	20.9	110.4	33		mottled grayish brown
				34		
35	28	22.9	SPT	35		
				36		
				37		
37.5	82	21.0	108.3	38	ML	Sandy to Clayey Silt, mottled grayish brown, wet, stiff, fine grained
				39		
40	30	23.4	SPT	40		
				41		
				42		
42	49	21.2	106.8	43	CL	Sandy Clay, grayish brown, wet, very stiff, fine grained
				44		
45	17	22.3	SPT	45		
				46		
				47		
47.5	64	20.6	109.2	48	CL/ML	Sandy Clay to Sandy Silt, grayish brown, wet, stiff. Fine grained
				49		
50	18	25.3	SPT	50		mottled grayish brown

GEOTECHNOLOGIES, INC.

Plate A-2b

BORING LOG NUMBER 2

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	73 50/4"	19.6	111.3	53		
				54		
55	34	25.6	SPT	55		
				56		
				57		
57.5		No Recovery		58		
				59		
					ML	Sandy to Clayey Silt, mottled grayish brown, wet, very stiff
60	36	31.4	SPT	60		
				61		Total Depth 60 feet Water at 18 feet Fill to 2½ feet
				62		
				63		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				64		
				65		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				66		
				67		SPT=Standard Penetration Test
				68		
				69		
				70		
				71		
				72		
				73		
				74		
				75		

BORING LOG NUMBER 3

TAS Realty Associates **Date: 01/08/21** **Elevation: 35'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Concrete Slab for Parking Lot
				0		6½-inch Concrete, No Base
				1		FILL: Sandy Silt to Silty Sand, dark brown, moist, medium dense, stiff, fine grained
				2		
				3		
				4		
5	59	11.9	118.0	5	SM	ALLUVIUM: Silty Sand, dark brown, moist, dense, fine grained
				6		
				7		
				8		
				9		
10	65 50/5"	17.1	113.8	10	SM/ML	Silty Sand to Sandy Silt, dark and grayish brown, moist, very dense, very stiff, fine grained
				11		
				12		
				13		
				14		
15	75	18.5	112.7	15	SM	Silty Sand, dark brown, moist, dense, fine grained
				16		
				17		
				18		
				19		
20	58	16.6	116.8	20	SM/SP	Silty Sand to Sand, dark brown, moist, medium dense, fine grained
				21		
				22		
				23		
				24		
25	41	28.0	93.3	25	ML	Sandy Silt, dark brown, moist, stiff, fine grained

BORING LOG NUMBER 3

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
						Sandy to Clayey Silt, dark brown, moist, stiff, fine grained
30	30 50/5"	27.4	97.9	30		Total Depth 30 feet Water at 18½ feet Fill to 4 feet
				31		
				32		
				33		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				34		
				35		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				36		
				37		
				38		
				39		
				40		
				41		
				42		
				43		
				44		
				45		
				46		
				47		
				48		
				49		
				50		

BORING LOG NUMBER 4

TAS Realty Associates **Date: 01/07/21** **Elevation: 33'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt for Parking Lot
				0		5-inch Asphalt over 2½-inch Base
				1		FILL: Silty Sand to Sandy Silt, dark brown, moist, stiff
2.5	61	11.0	126.8	2		
				3	SM	ALLUVIUM: Silty Sand, dark and grayish brown, moist, medium dense to dense, fine grained
5	72	14.1	118.8	4		
				5		
				6		
				7		
				8		
				9		
10	42 50/3"	13.7	114.5	10	SM/SP	Silty Sand to Sand, dark and grayish brown, moist, very dense, fine grained
				11		
				12		
				13		
				14		
15	49	20.4	106.2	15	SM/ML	Silty Sand to Sandy Silt, dark and grayish brown, moist, medium dense, fine grained
				16		
				17		
				18		
				19		
20	72	14.9	119.5	20		
				21		
				22		
				23		
				24		
25	83	19.3	107.9	25	SM/SP	Silty Sand to Sand, dark and grayish brown, very moist, very dense, fine grained

BORING LOG NUMBER 4

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
					SP	Sand, dark and grayish brown, very dense, fine grained
30	36 50/5"	21.6	100.9	30		Total Depth 30 feet Water at 17 feet Fill to 3 feet
				31		
				32		
				33		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				34		
				35		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				36		
				37		
				38		
				39		
				40		
				41		
				42		
				43		
				44		
				45		
				46		
				47		
				48		
				49		
				50		

BORING LOG NUMBER 5

TAS Realty Associates **Date: 01/07/21** **Elevation: 32'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt for Parking Lot
				0		5-inch Asphalt over 6-inch Base
				1		FILL: Sandy Clay, brown, moist, firm debris fragments
2.5	60	12.7	122.4	2		
				3	SC	ALLUVIUM: Clayey Sand, mottled brown, moist, medium dense, fine grained
5	32 50/6"	14.2	121.2	4 5		
				6 7 8 9		
10	74	8.2	107.9	10	SP	Sand, light brown, slightly moist, dense, fine grained
				11 12 13 14		
15	44	20.0	112.0	15	CL	Sandy Clay, mottled dark and yellowish brown, moist, stiff, fine grained
				16 17 18 19		
20	47	22.9	107.7	20	ML	Sandy Silt, grayish brown, wet, stiff, fine grained
				21 22 23 24		
25	80	16.8	117.3	25	SP/SC	Sand with clay, light brown, wet, dense, fine grained

BORING LOG NUMBER 5

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 – 27 – 28 – 29 –		
30	34 50/6"	29.7	94.7	30 –	SP	Sand, light brown, wet, dense, fine grained
				31 – 32 – 33 – 34 – 35 – 36 – 37 – 38 – 39 – 40 – 41 – 42 – 43 – 44 – 45 – 46 – 47 – 48 – 49 – 50 –		Total Depth 30 feet Water at 16 feet Fill to 3 feet NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted

BORING LOG NUMBER 6

TAS Realty Associates **Date: 01/08/21** **Elevation: 35'**

File No. 22079 **Method: 8-inch diameter Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt for Parking Lot
				0		3½-inch Asphalt over 1½-inch Base
				1		FILL: Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained, stiff
				2		
				3		
				4		
5	68	12.4	123.5	5	SM	ALLUVIUM: Silty Sand, dark and grayish brown, moist, medium dense to dense, fine grained
				6		
				7		
				8		
				9		
10	82	16.1	114.7	10		
				11		
				12		
				13		
				14		
15	14	7.9	SPT	15		
				16		
				17		
17.5	49	18.4	112.8	18	SM/ML	Silty Sand to Sandy Silt, dark brown, moist, medium dense, stiff, fine grained
				19		
20	11	18.6	SPT	20	SM/SP	Silty Sand to Sand, gray to dark gray, moist to very moist, medium dense, fine grained
				21		
				22		
22.5	85	15.4	114.4	23		
				24		
25	24	17.7	SPT	25	SP	Sand, dark and gray, wet, medium dense, fine grained

BORING LOG NUMBER 6

TAS Realty Associates

File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
27.5	74	20.9	106.6	28		Sand, dark brown, wet, dense, fine grained
				29		
30	37	21.7	SPT	30		
				31		
				32		
32.5	69	20.7	112.3	33	SM/SP	Silty Sand to Sand, dark brown, wet, dense, fine grained
				34		
35	30	25.9	SPT	35	SM/ML	Silty Sand to Sandy Silt, dark brown, wet, medium dense, fine grained
				36		
				37		
37.5	64	29.6	94.8	38		
				39		
40	21	24.5	SPT	40	SM/SP	Silty Sand to Sand, dark brown and gray, wet, medium dense, fine grained
				41		
				42		
42.5	62	20.0	105.9	43		
				44		
45	23	22.3	SPT	45	SM/ML	Silty Sand to Sandy Silt, dark brown, moist, medium dense, stiff, fine grained
				46		
				47		
47.5	68	25.0	101.9	48	SM	Silty Sand, dark brown, wet, dense, fine grained
				49		
50	24	21.2	SPT	50	SM/ML	Silty Sand to Sandy Silt, dark brown, moist to wet, medium dense, stiff, fine grained

GEOTECHNOLOGIES, INC.

Plate A-6b

BORING LOG NUMBER 6

TAS Realty Associates

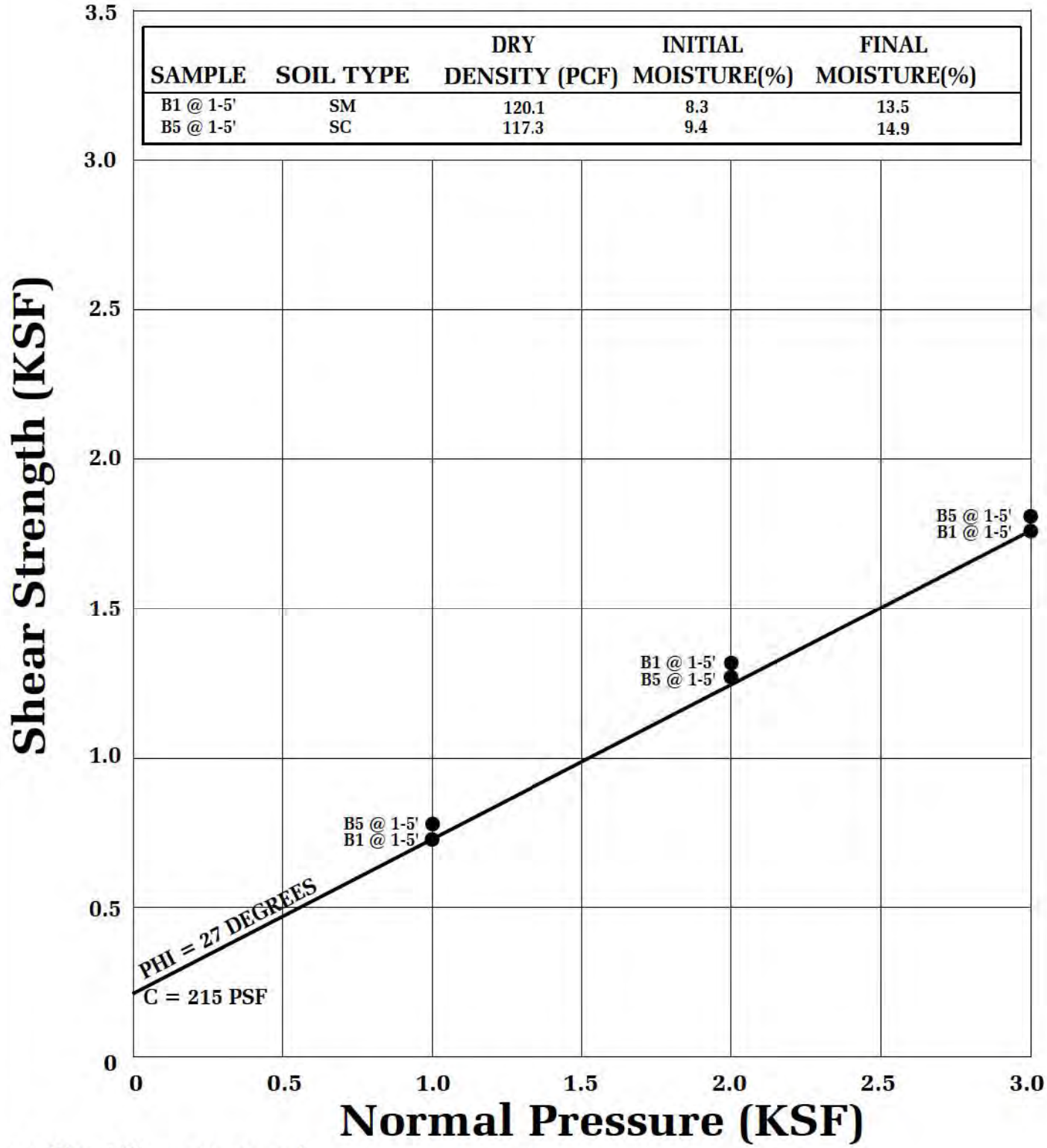
File No. 22079

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	69	23.9	103.4	53		
				54		
55	23	28.2	SPT	55		
				56		
				57		
57.5	75 50/5"	25.1	100.6	58	SM/SP	Silty Sand to Sand, dark and yellowish brown, wet, very dense, fine grained
				59	SM/ML	Silty Sand to Sandy Silt, dark brown and gray, dense, fine grain
60	41	32.3	SPT	60		Total Depth 60 feet Water at 19 feet Fill to 4 feet NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted SPT=Standard Penetration Test
				61		
				62		
				63		
				64		
				65		
				66		
				67		
				68		
				69		
				70		
				71		
				72		
				73		
				74		
				75		

BULK SAMPLE REMOLDED TO 90 PERCENT OF THE MAXIMUM LABORATORY DENSITY

SAMPLE	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE(%)	FINAL MOISTURE(%)
B1 @ 1-5'	SM	120.1	8.3	13.5
B5 @ 1-5'	SC	117.3	9.4	14.9



● Direct Shear, Saturated

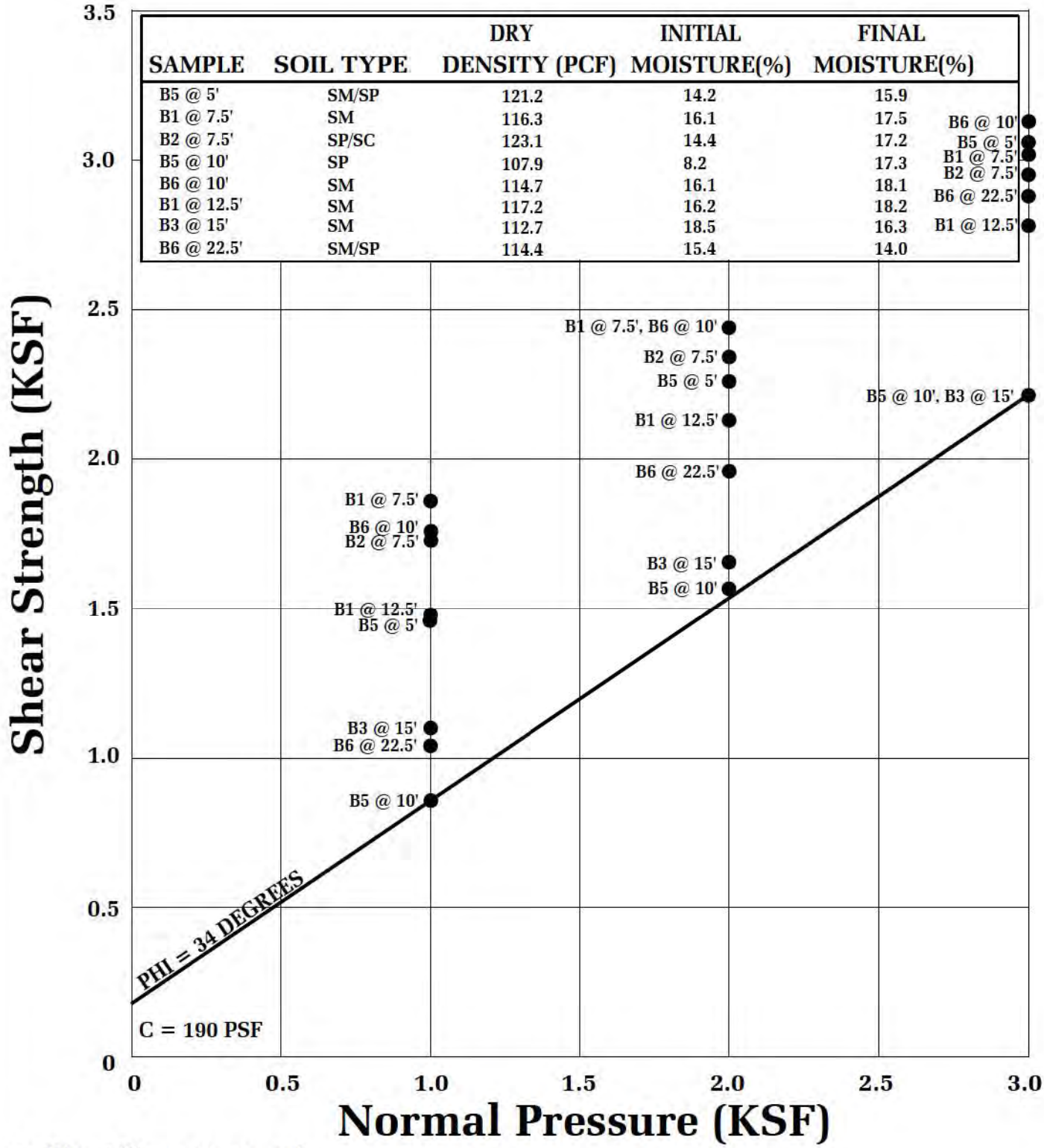
SHEAR TEST DIAGRAM

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC
16911 NORMANDIE AVENUE, GARDENA

FILE NO. 22079 | PLATE: B-1

SAMPLE	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE(%)	FINAL MOISTURE(%)
B5 @ 5'	SM/SP	121.2	14.2	15.9
B1 @ 7.5'	SM	116.3	16.1	17.5
B2 @ 7.5'	SP/SC	123.1	14.4	17.2
B5 @ 10'	SP	107.9	8.2	17.3
B6 @ 10'	SM	114.7	16.1	18.1
B1 @ 12.5'	SM	117.2	16.2	18.2
B3 @ 15'	SM	112.7	18.5	16.3
B6 @ 22.5'	SM/SP	114.4	15.4	14.0



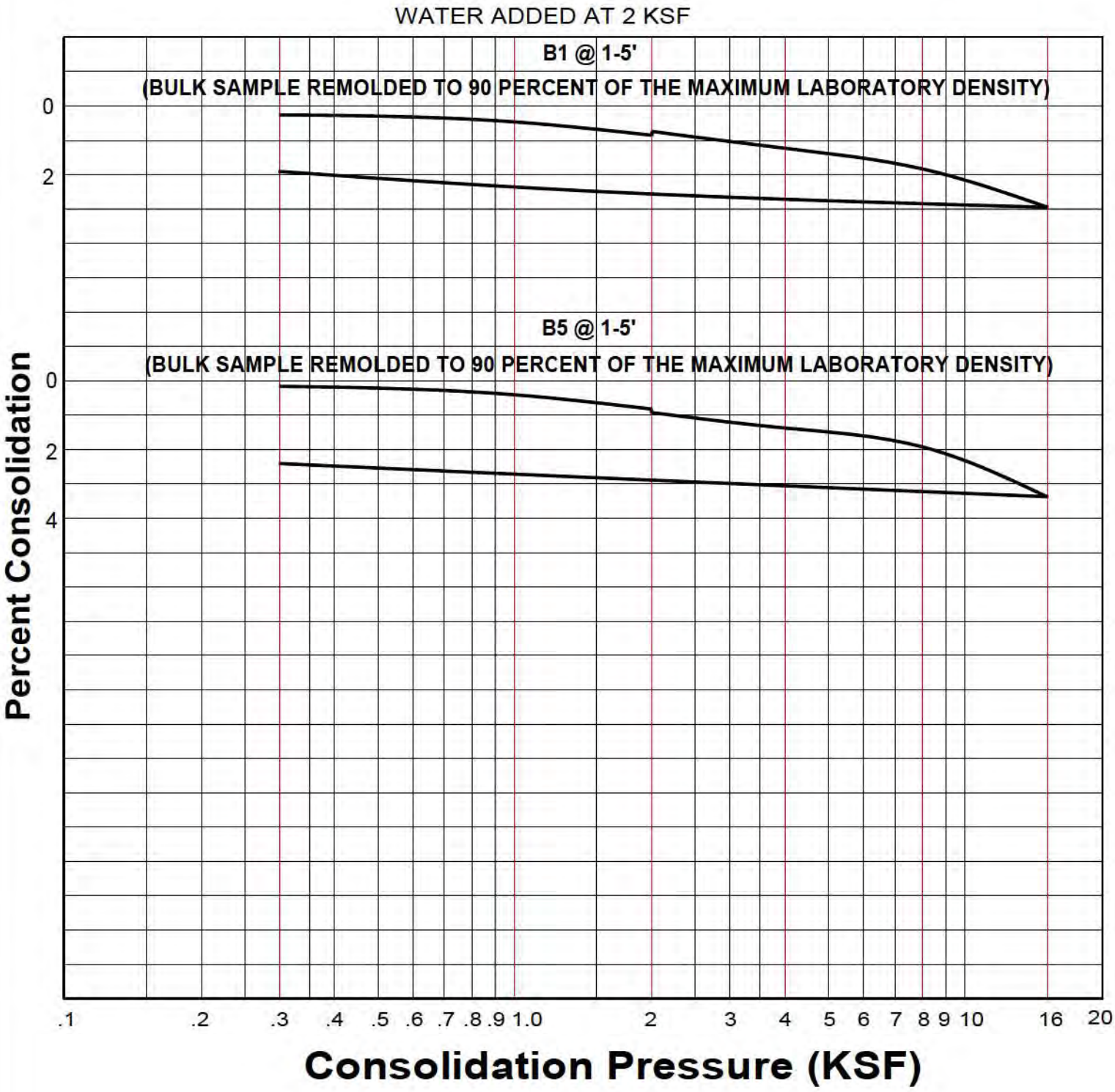
● Direct Shear, Saturated

SHEAR TEST DIAGRAM

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC
16911 NORMANDIE AVENUE, GARDENA

FILE NO. 22079 | PLATE: B-2



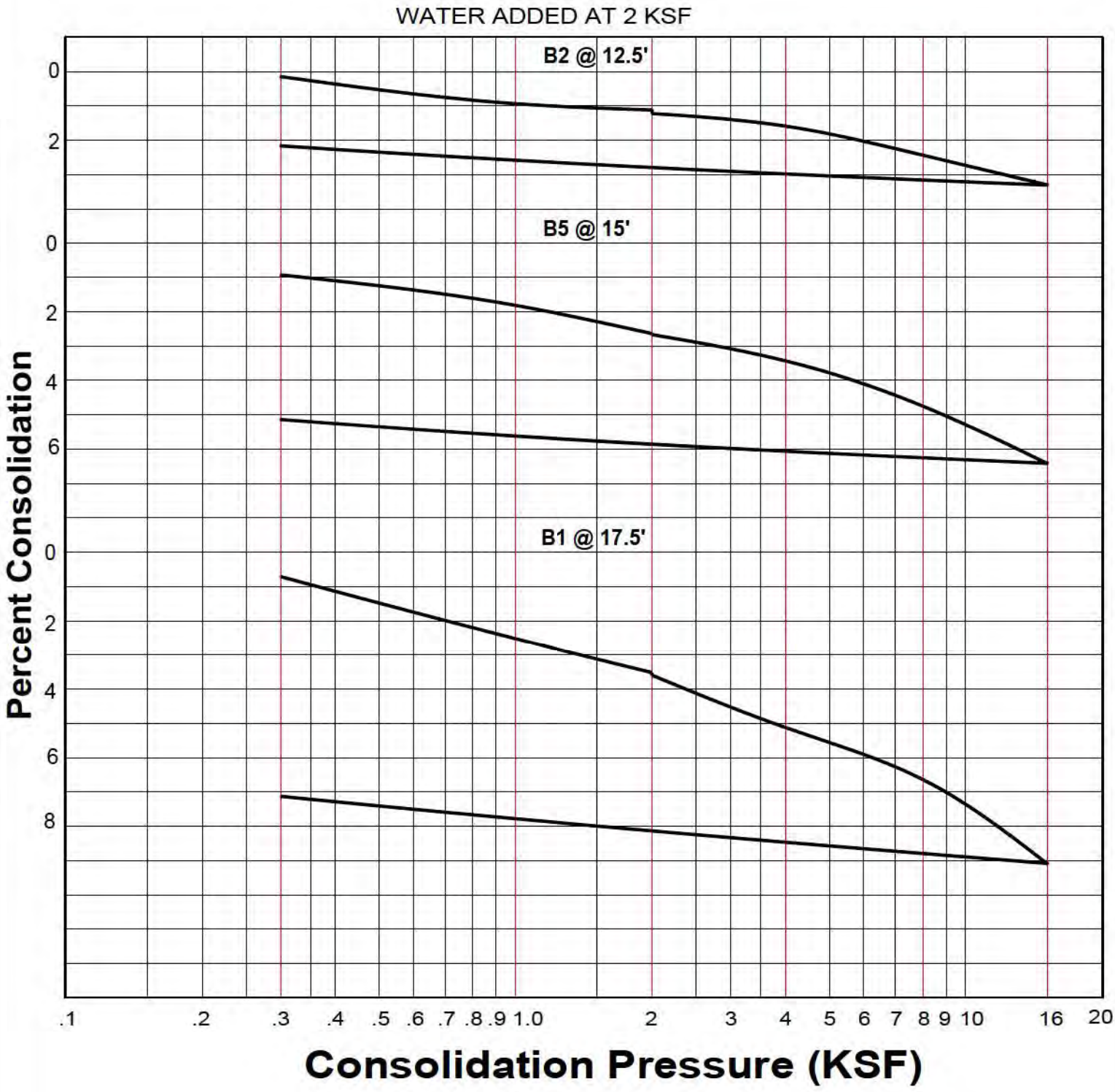
CONSOLIDATION TEST

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079

PLATE: C-1



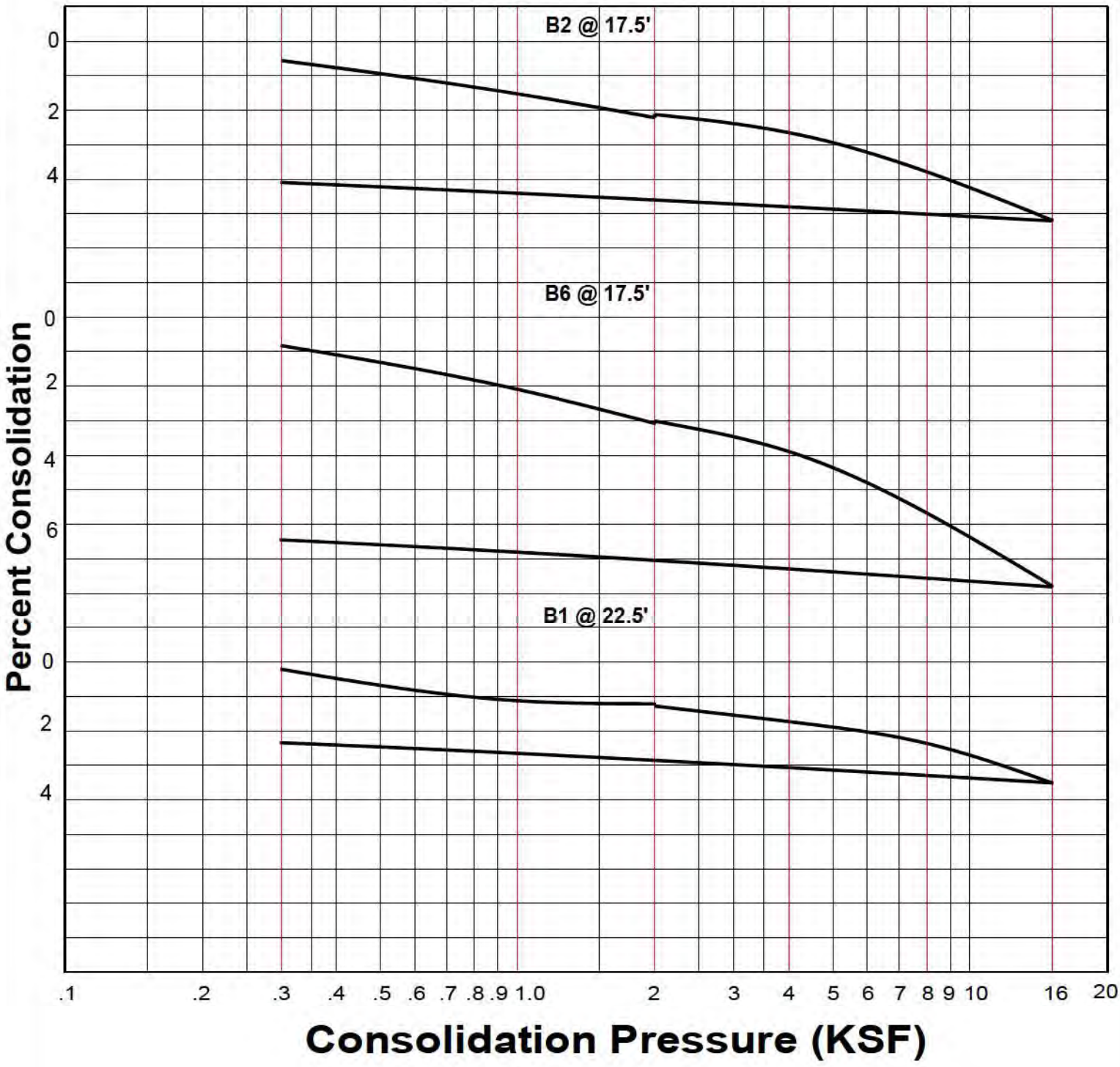
CONSOLIDATION TEST

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | **PLATE: C-2**

WATER ADDED AT 2 KSF

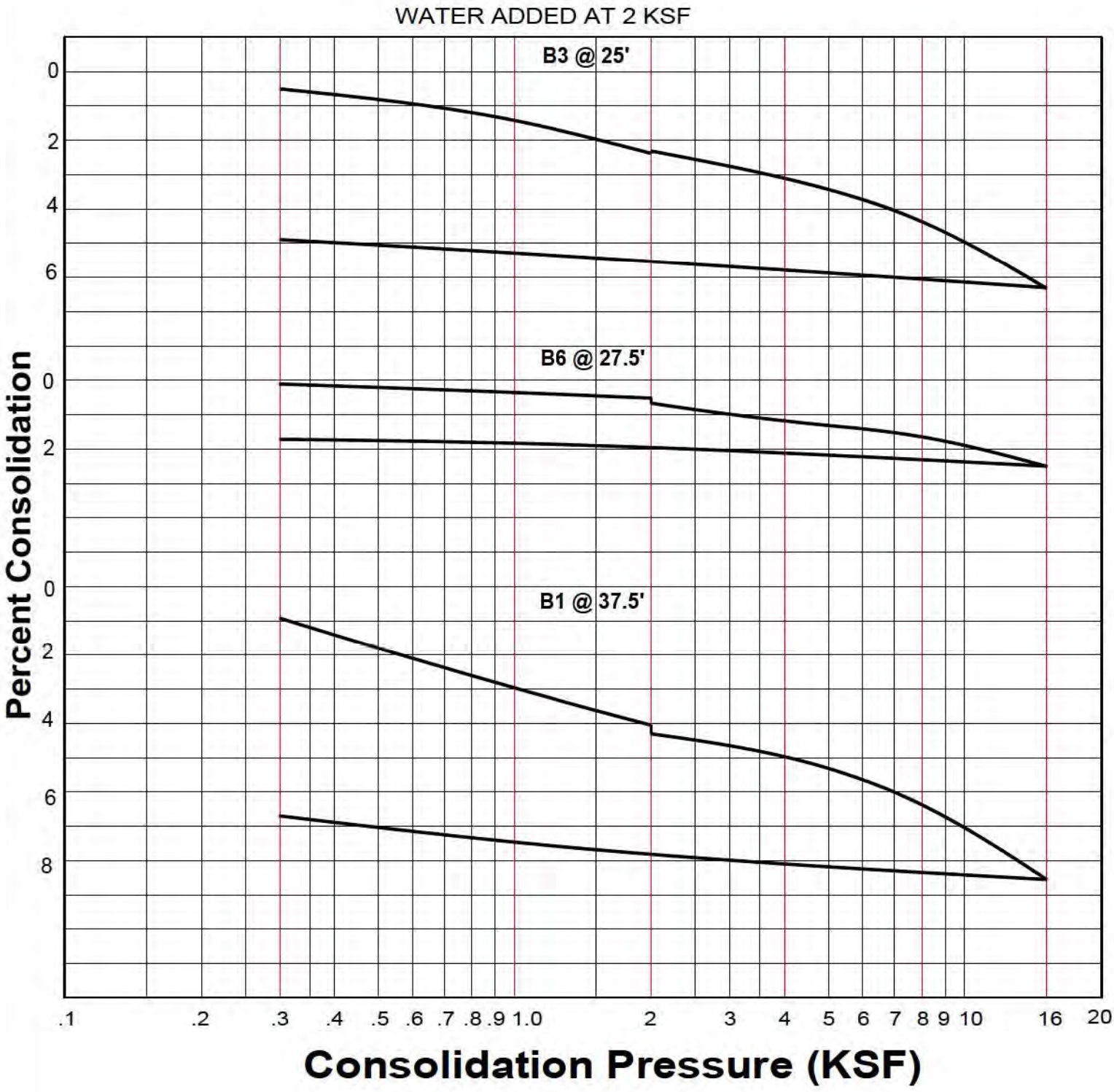


CONSOLIDATION TEST

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | **PLATE: C-3**



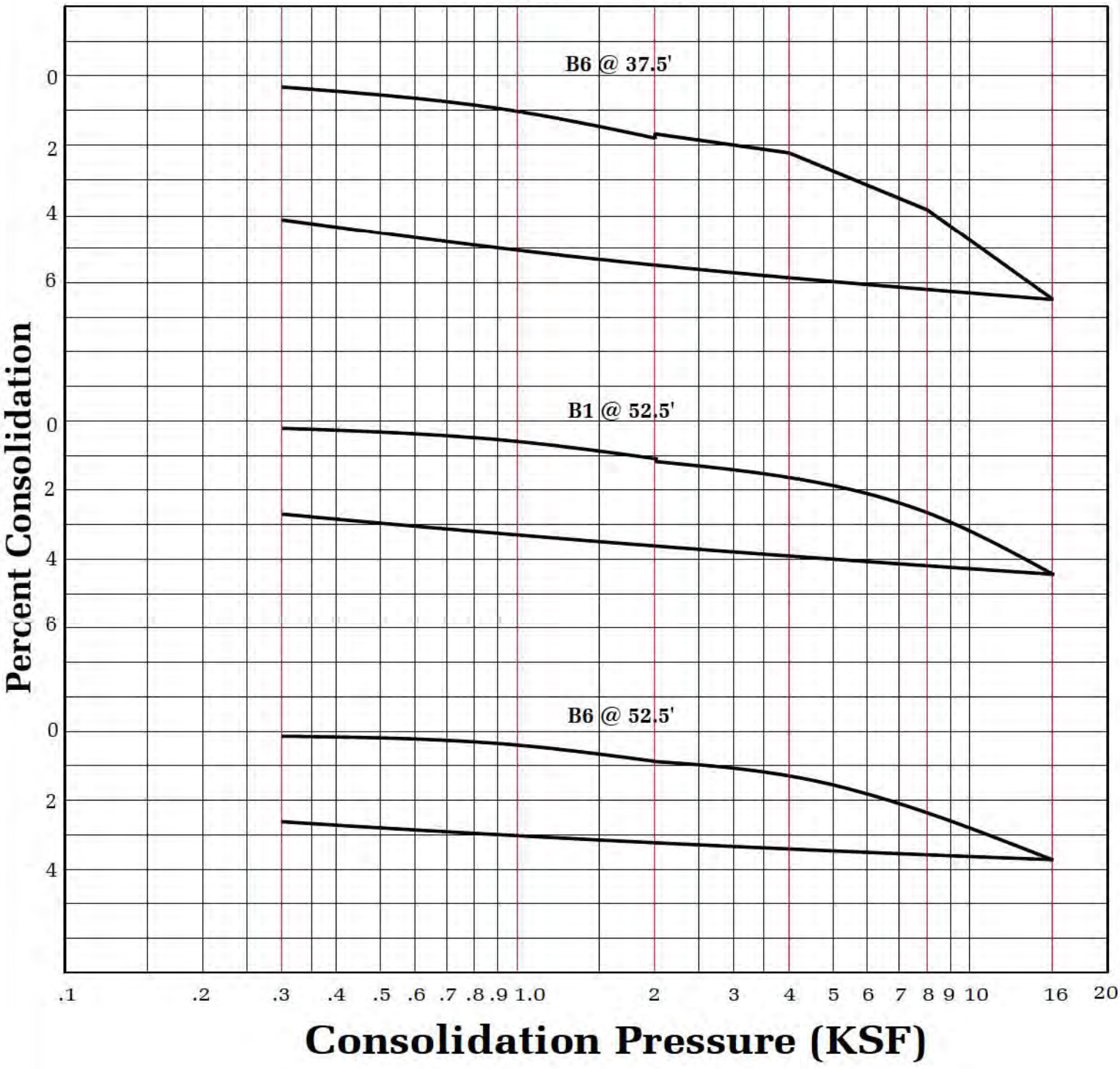
CONSOLIDATION TEST

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | **PLATE: C-4**

WATER ADDED AT 2 KSF



CONSOLIDATION TEST

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | **PLATE: C-5**

ASTM D-1557

SAMPLE	B1 @ 1-5'	B5 @ 1-5'
SOIL TYPE:	SM	SM
MAXIMUM DENSITY pcf.	133.4	130.3
OPTIMUM MOISTURE %	8.3	9.4

ASTM D 4829

SAMPLE	B1 @ 1-5'	B5 @ 1-5'
SOIL TYPE:	SM	SM
EXPANSION INDEX UBC STANDARD 18-2	7	10
EXPANSION CHARACTER	VERY LOW	VERY LOW

SULFATE CONTENT

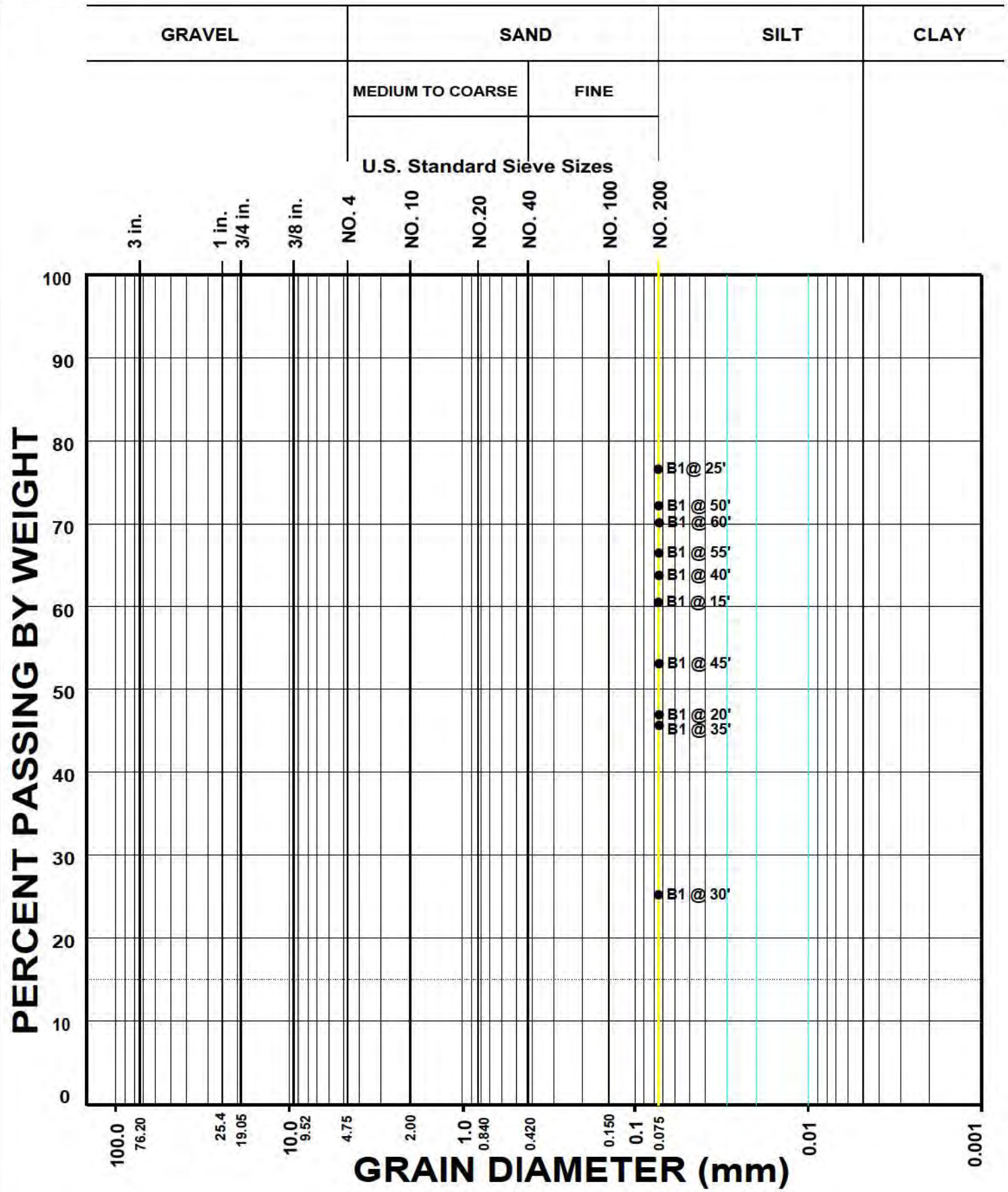
SAMPLE	B1 @ 1-5'	B5 @ 1-5'
SULFATE CONTENT: (percentage by weight)	< 0.10%	< 0.10%

COMPACTION/EXPANSION/SULFATE DATA SHEET

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: D

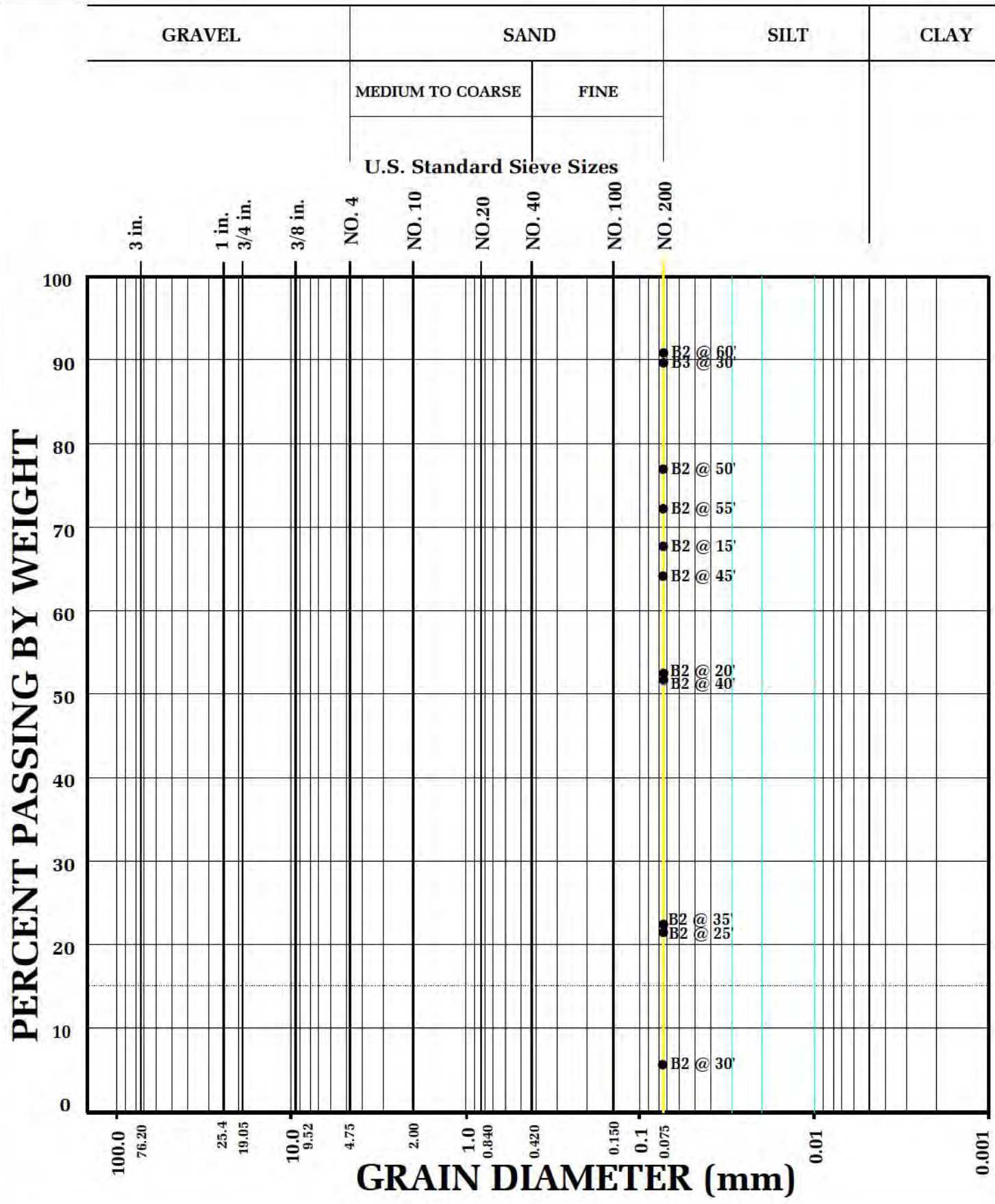


GRAIN SIZE DISTRIBUTION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: E-1

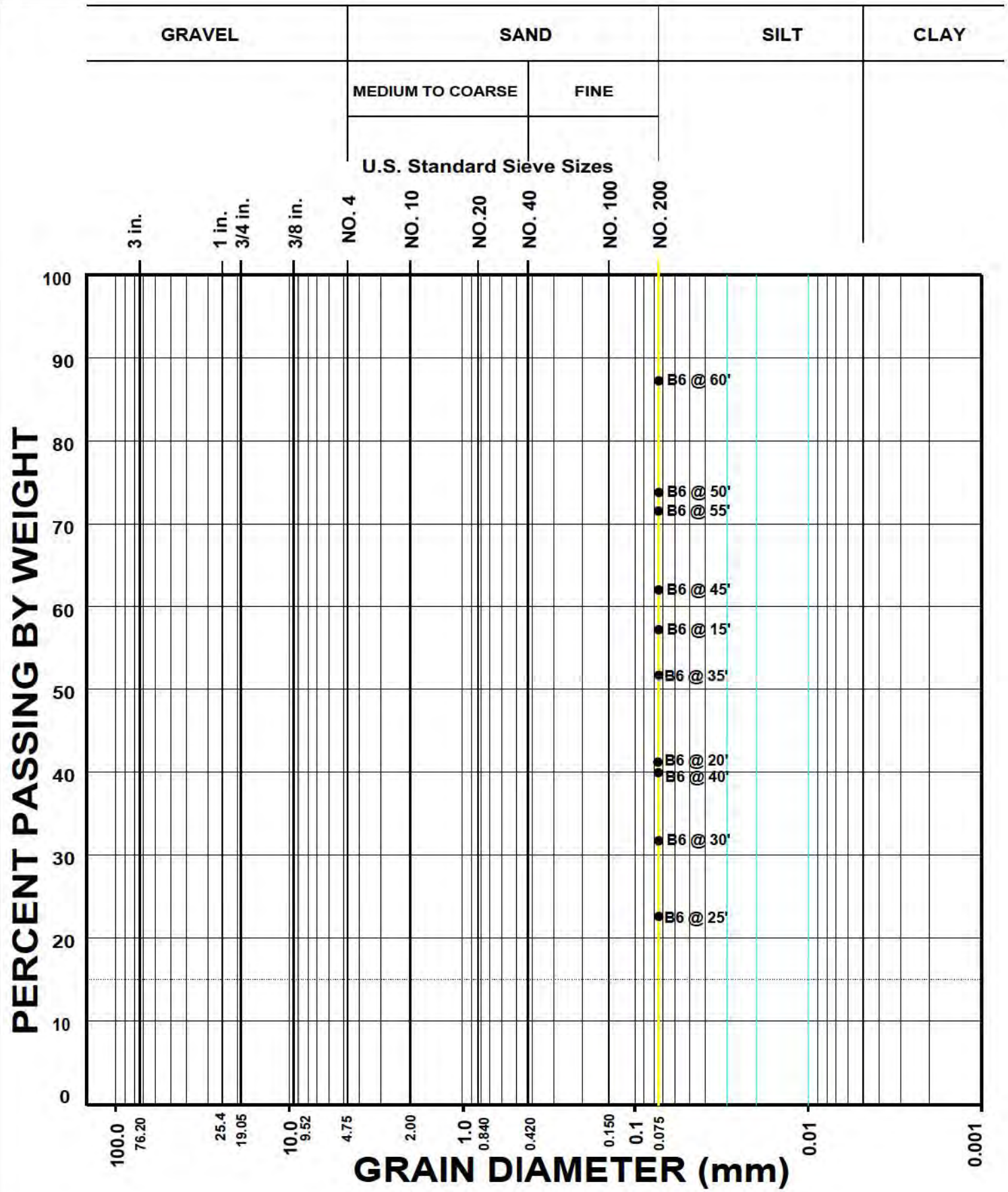


GRAIN SIZE DISTRIBUTION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: E-2



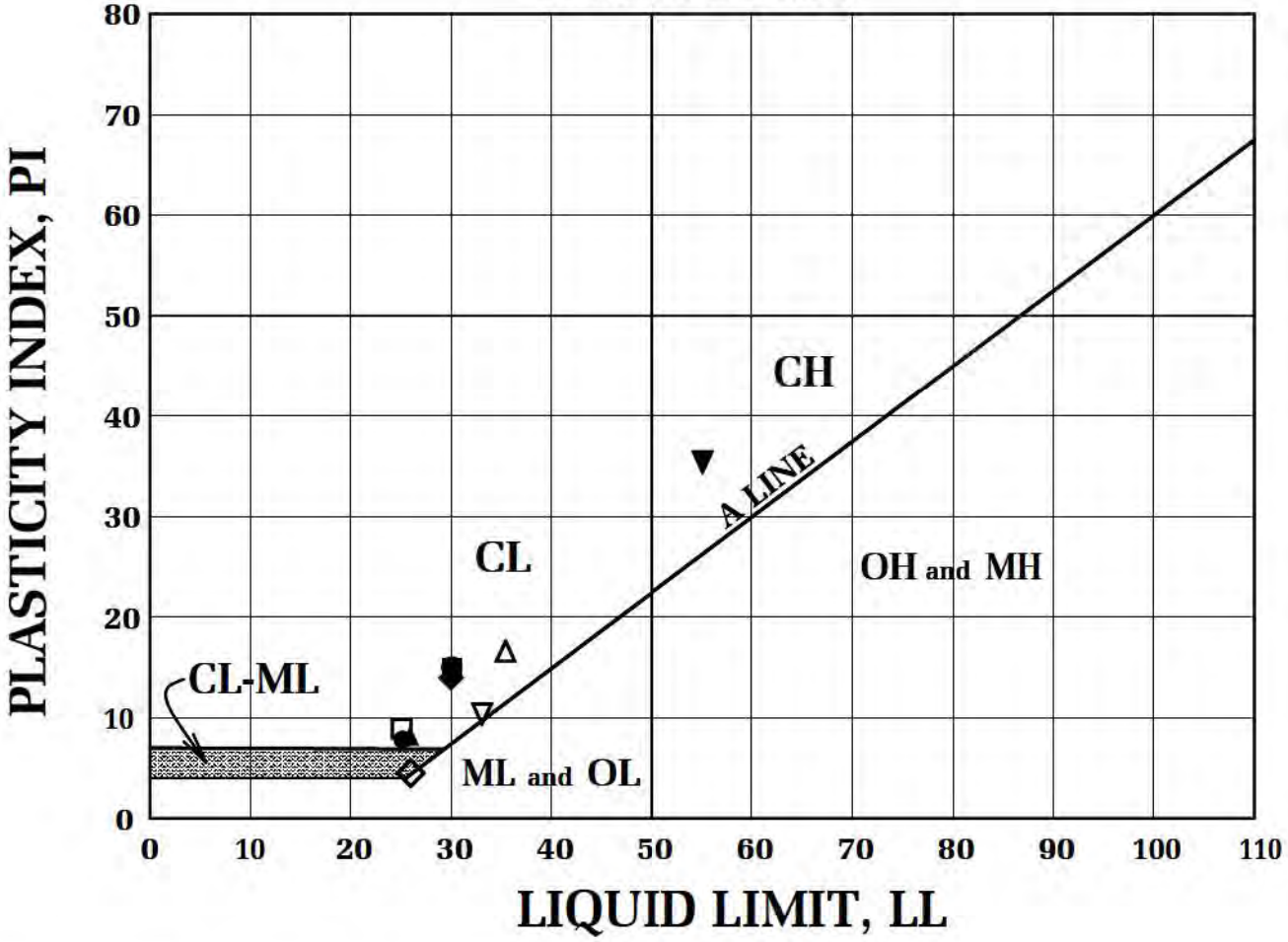
GRAIN SIZE DISTRIBUTION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: E-3

ASTM D4318



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B1	15	○	30	15	15	CL
B1	20	●	25	17	8	CL
B1	25	△	35	19	16	CL
B1	35	▲	26	18	8	CL
B1	40	■	30	15	15	CL
B1	45	□	25	16	9	CL
B1	50	◆	30	16	14	CL
B1	55	◇	26	22	4	ML
B1	60	▽	33	22	11	CL
B3	30	▼	55	23	36	CH

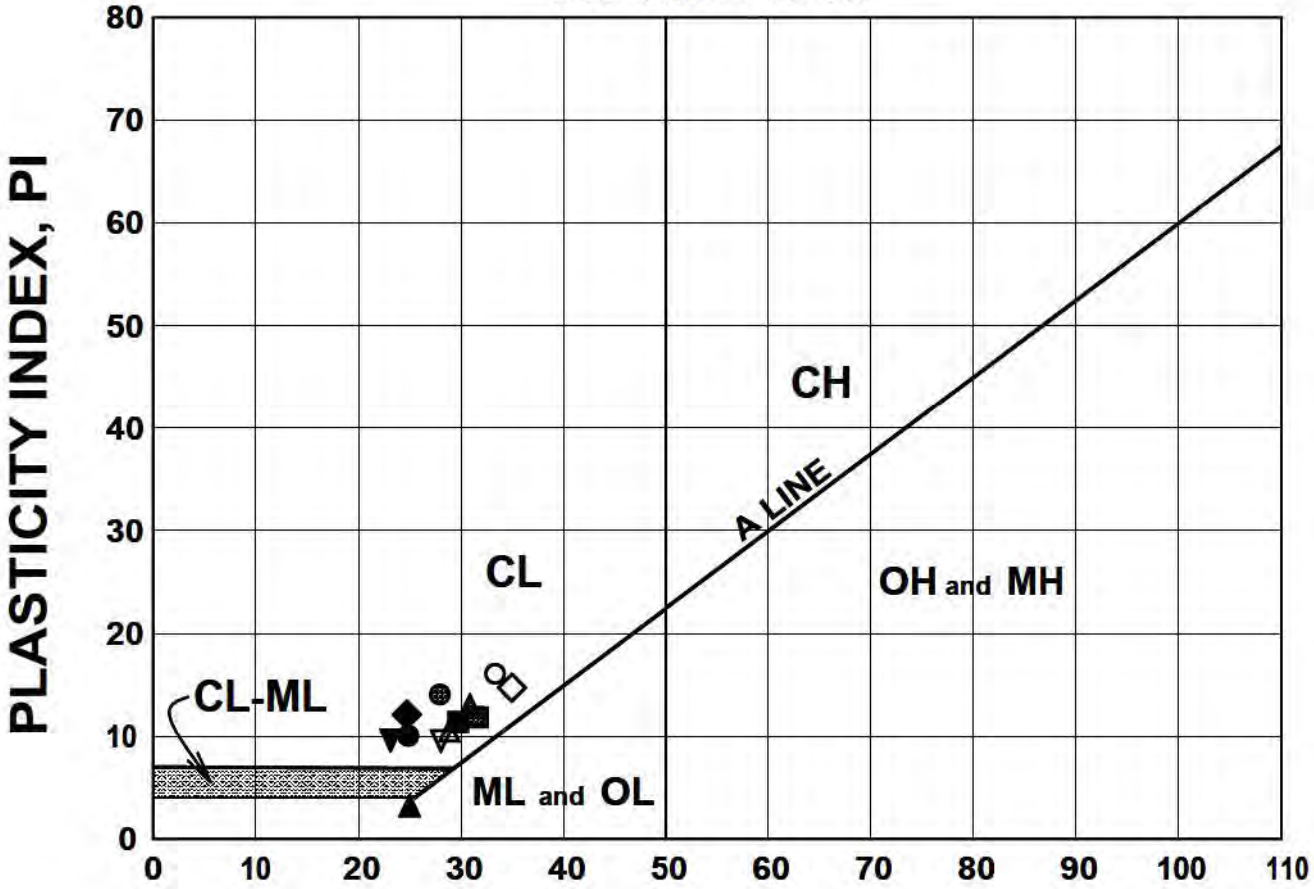
ATTERBERG LIMITS DETERMINATION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: F-1

ASTM D4318



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B2	15	○	34	18	16	CL
B2	20	●	25	15	10	CL
B2	40	▲	25	22	3	ML
B2	45	△	29	19	10	CL
B2	50	□	31	19	12	CL
B2	55	■	30	19	11	CL
B2	60	◇	35	20	15	CL
B6	15	◆	25	13	12	CL
B6	35	▽	28	18	10	CL
B6	40	▼	23	17	6	CL/ML
B6	45	◍	28	14	14	CL
B6	50	▲	31	18	13	CL
B6	55	▩	32	20	12	CL

ATTERBERG LIMITS DETERMINATION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

TAS REALTY ASSOCIATES, LLC

FILE NO. 22079 | PLATE: F-2