APPENDIX F

GEOTECHNICAL REPORTS

This page intentionally left blank

PRELIMINARY GEOTECHNICAL INVESTIGATION

This page intentionally left blank

Preliminary Geotechnical Investigation,
Dana Point Harbor Revitalization,
Hotel Component,
City of Dana Point, California

Prepared For
DANA POINT HARBOR PARTNERS, LLC
c/o R.D. OLSON DEVELOPMENT

Preliminary Geotechnical Investigation,
Dana Point Harbor Revitalization,
Hotel Component,
City of Dana Point, California

Prepared For
DANA POINT HARBOR PARTNERS, LLC
c/o R.D. OLSON DEVELOPMENT

September 10, 2019

GMU Project No. 17-206-01

TRANSMITTAL

DANA POINT HARBOR PARTNERS, LLC
c/o R.D. OLSON DEVELOPMENT
520 Newport Center Drive, Suite 600
Newport Beach, CA 92660

DATE: September 10, 2019

PROJECT: 17-206-01

ATTENTION: Mr. Anthony Wrzosek

SUBJECT: Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, City of Dana Point, California

DISTRIBUTION:

Addressee: electronic copy

WATG
Attn: Mr. Theodore Lin (3 wet signature copies + electronic copy)

Ware Malcomb
Attn: Mr. Gregory Spon (electronic copy)

Tait Engineering
Attn: Mr. Jacob Vandervis (electronic copy)

TABLE OF CONTENTS

Description Page

INTRODUCTION 1
PURPOSE 1
PROPOSED IMPROVEMENTS 1
SITE LOCATION AND DESCRIPTION 1
BACKGROUND HISTORY AND PREVIOUS REPORTS 2
AERIAL PHOTOGRAPHY REVIEW 3
SUBSURFACE EXPLORATION 3
GEOLOGIC FINDINGS 4
GENERAL GEOLOGY AND SUBSURFACE CONDITIONS 4
General 4
Site Specific Conditions 4
Artificial Fill (Qaf) 4
Marine Deposits (Qm) 4
Capistrano Formation (Tc) 5
Summary of Subsurface Conditions 5
GROUNDWATER 5
GEOLOGIC HAZARDS 6
FAULTING AND SEISMICITY 6
LIQUEFACTION 6
LANDSLIDES 7
TSUNAMI, SEICHE, AND FLOODING 7
Tsunamis 7
Seiches 8
Flooding 8
LIQUEFACTION, SEISMIC SETTLEMENT,
AND LATERAL SPREADING ANALYSES 9
Seismic Input 9
Liquefaction Evaluation and Seismic Settlement 9
Lateral Spreading and Cyclic Mobility 9
SLOPE STABILITY 10
SOIL EXPANSION 10
SOIL CORROSION 10
STATIC SETTLEMENT / COMPRESSIBLITY 11
PRELIMINARY INFILTRATION TESTING 11
EXCAVATION CHARACTERISTICS 12
CONCLUSIONS 12
RECOMMENDATIONS 13
REQUIRED SITE MITIGATION 13
GENERAL SITE PREPARATION AND GRADING 13
General 13
Clearing and Grubbing 14

TABLE OF CONTENTS (continued)

Description Page

Corrective Grading ... 14
Additional Grading Recommendations ... 16
Geogrid-Reinforced Fill Slopes ... 16
VOLUME CHANGE ... 16
TEMPORARY EXCAVATIONS ... 17
LATERAL SPREADING MITIGATION ... 17
STRUCTURE SEISMIC DESIGN ... 18
HOTEL 1 "SURF LODGE" (WEST) FOUNDATION RECOMMENDATIONS ... 19
Option A: Mat Foundation ... 19
Option B: Geopiers or Equivalent Gravel Piers ... 20
Slab Subsection and Slab Design ... 21
HOTEL 2 "DANA HOUSE" (EAST) FOUNDATION RECOMMENDATIONS ... 21
Mat Foundation Design Parameters ... 21
BASEMENT WALL DESIGN AND CONSTRUCTION ... 23
Foundation Recommendations ... 23
Wall Design Parameters ... 23
RETAINING WALL AND SCREEN WALL DESIGN CONSTRUCTION ... 24
Retaining Wall Design Parameters ... 24
Foundation Recommendations ... 24
Wall Design Parameters ... 24
Screen Wall Design Parameters ... 25
POLE FOUNDATIONS ... 26
STRUCTURAL CONCRETE ... 26
FERROUS METAL CORROSION ... 27
MOISTURE VAPOR TRANSMISSION ... 27
Moisture Vapor Retarder ... 27
Water Vapor Transmission Discussion ... 28
Floor Coverings ... 28
SURFACE DRAINAGE ... 28
BIORETENTION AREAS ... 28
UTILITY CONSIDERATIONS ... 29
General ... 29
Pipe Bedding ... 29
Trench Backfill ... 29
Other Considerations ... 30
SITE INFILTRATION ... 30
PAVEMENT DESIGN RECOMMENDATIONS ... 30
General ... 30
Asphalt Pavement Design ... 30
Portland Cement Concrete Pavement Design ... 31
Full Depth Reclamation Alternative Design ... 31
Concrete Interlocking Vehicular and Pedestrian Pavement Design ... 33

TABLE OF CONTENTS (continued)

Description Page

CONCRETE FLATWORK DESIGN CONSIDERATIONS ... 34
RECYCLED AC MATERIAL ... 35
PLANTERS AND TREES ... 36
PLAN REVIEW / GEOTECHNICAL TESTING DURING GRADING / ... 36
FUTURE REPORTS ... 36
Plan Review ... 36
FUTURE SERVICES ... 36
Geotechnical Testing ... 36
LIMITATIONS ... 37
CLOSURE ... 38
SITE-SPECIFIC REFERENCES ... 39
AERIAL PHOTOGRAPHS ... 40
TECHNICAL REFERENCES ... 41

PLATES

Plate 1 -- Location Map
Plate 2 -- Geotechnical Map
Plate 3 -- Geotechnical Sections
Plate 4 -- Tsunami Inundation Map for Emergency Planning
Plate 5 -- Retaining Wall Construction Detail

APPENDICES

APPENDIX A: Geotechnical Exploration Procedures and Logs
APPENDIX A-1: CPT Logs
APPENDIX B: Geotechnical Laboratory Procedures and Test Results
APPENDIX C: Infiltration Test Results
APPENDIX D: CPT Liquefaction Analyses
APPENDIX D-1: SPT Liquefaction Analyses
APPENDIX E: Lateral Spread Analysis
APPENDIX F: Geogrid Reinforced Slope Surficial Stability Analysis

INTRODUCTION

PURPOSE

This report presents the results of our geotechnical investigation for the "Hotel" component of the Dana Point Harbor Revitalization Project. The purpose of our investigation was to develop geotechnical recommendations pertaining to site grading and design and construction of the proposed buildings, parking structures, and other site improvements (i.e. roadways, parking lots, site walls, exterior concrete flatwork, etc.). Our investigation included reviewing the current site plans and performing laboratory testing and data analysis.

PROPOSED IMPROVEMENTS

It is our understanding that the proposed development will consist of a 4-story on-grade affordable hotel known as "Surf Lodge" (Hotel 1) with surface parking at the west end of the site, and an up to 4-story "four-star" hotel known as "Dana House" (Hotel 2) over a 1-level cast-in-place concrete parking structure that extends past the northern boundary of the hotel to within approximately 30 feet of Dana Point Harbor Drive (see Plate 2 – Geotechnical Map). We also understand that 1.5H:1V fill slopes are planned to be placed against the parking structure walls.

SITE LOCATION AND DESCRIPTION

The subject site is bounded by Dana Point Harbor Drive on the north, Casitas Place on the east, Island Way on the west, and Dana Point Harbor on the south (see Plate 1 – Location Map).

The majority of the site is relatively flat and drains by sheet flow towards the south to existing storm drain catch basins. However, there is an approximately 10-foot-high slope between the existing parking lot and Island Way, and 5- to 10-foot-high slope along the north side of the existing parking lot adjacent to Dana Point Harbor Drive. In addition, there are minor slopes 5 feet or less in height within the southern portion of the site between the existing Marina Inn hotel building and the southern parking lot area. Elevations range from a high of approximately 19 feet above mean sea level in the northern portion of the site to a low of approximately 10 feet above mean sea level in the southern portion of the site. The majority of the site is covered by either asphalt pavement or concrete flatwork with some planters and landscape areas with flowers, groundcover, shrubs and occasional trees.

BACKGROUND HISTORY AND PREVIOUS REPORTS

In order to research the site history and geologic conditions, we reviewed published geologic maps and reports, previous geotechnical reports by other geotechnical consultants for the subject site and entire harbor area, and a previous report for the existing seawalls.

Based on our research, Dana Point Harbor is located within a cove (Dana Cove) that is bordered on the north by cliffs or bluffs that are approximately 100 to 200 feet high, and on the west by a hard, resistant promontory of land known as The Headlands. Prior to the construction of the harbor, the cove was bordered by a rocky shoreline along the base of the cliffs; however, due to the protection provided by the headland, a sandy shore was able to develop toward San Juan Creek.

Dana Point Harbor was constructed in the late 1960s and early 1970s by the County of Orange and the United States Army Corps of Engineers. It is our understanding that the harbor was constructed by excavating the native soils after the cove was dewatered through the construction of a coffer dam. The construction of the coffer dam included the installation of sheet piling and the placement of fill in a wet condition. The harbor was then de-watered and the water basins were excavated to maximum depths of approximately 10 to 12 feet below sea level with the exception of local areas within the northern portion of the harbor where hard bedrock materials were encountered. Artificial fill was then placed in a relatively dry condition up to existing grades, and the seawalls, boat ramps, docks, and buildings were then constructed. In addition, a rubble breakwater was constructed along the south side of the harbor to protect it from wave action.

In order to provide access to the harbor, the shoreline cliffs were cut back to construct Dana Point Harbor Drive and Street of the Golden Lantern. These slopes were cut to gradients ranging from 1:1 (horizontal to vertical) to 2:1, depending on their geologic structure and material type.

An evaluation of the existing seawalls was performed by Bluewater Design Group in December of 2003. Their evaluation indicated that most of the existing seawalls are “Quay” walls which consist of slightly battered, cantilevered, reinforced-concrete gravity walls constructed directly above 1.5H:1V slopes. The slopes are either covered by concrete panels or are constructed with rock riprap. As a result, the wall footings are supported on either fill materials or rock riprap. The walls are not embedded into the ground and thus rely on their own weight, the weight of the soil over the heel, and the friction between the bottom of the footings and the underlying soil or riprap to prevent overturning and resist sliding forces. Most of the Quay walls are 5 feet in height; however, some local sections are 9 feet in height.

The report by Bluewater Design group also indicated that the north and south sides of the public boat launch ramp are supported by conventional cantilever retaining walls that range from 2 to 15 feet in height with footings founded into fill materials.

AERIAL PHOTOGRAPHY REVIEW

An aerial photo review was performed for the subject site in order to assess historical land use and site development. Continental Aerial Photo provided 20 sets of stereo-paired air photos spanning from 1952 through 1999. Photos taken prior to development of the harbor area show an undeveloped cliff bordered by a rocky shoreline and a relatively natural cove. In 1967, two jetties were constructed on the east and west sides of the cove. By 1970, the alteration of the cove into a man-made harbor was nearing completion and the roadways had been graded. The photos indicate that Dana Point Harbor Drive and the northerly areas of the harbor (generally parking lot and boat storage) are likely underlain by bedrock from the cut operation of the shoreline cliff. By 1975, the harbor appears to be in essentially the same condition as it is currently, with all existing buildings constructed and paved areas completed. Photos reviewed after 1975 show no significant changes to the area.

SUBSURFACE EXPLORATION

GMU conducted a subsurface exploration program to evaluate the soil conditions within the project limits. A total of thirteen (13) exploratory drill holes and ten (10) cone penetration test (CPT) soundings were performed which consisted of the following:

- Ten (10) hollow-stem-auger exploratory drill holes to a maximum depth of 51 feet below the existing ground surface in order to determine site-specific subsurface geologic and groundwater conditions and to obtain bulk and drive samples for geotechnical testing.
- Three (3) hollow-stem-auger exploratory drill holes to a depth of approximately 6.5 feet below the existing ground surface in order to perform preliminary infiltration testing.
- Ten (10) CPT soundings to a maximum depth of 34 feet below the existing ground surface.

The drill holes were logged by our Staff Geologist and samples were collected and transported to our facility for observation and testing. The drill holes and CPT locations are shown on Plate 2 – Geotechnical Map. Drill hole logs are contained in Appendix A and CPT reports are presented in Appendix A-1.

GEOLOGIC FINDINGS

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

General

Published geologic maps indicate that prior to development, the site consisted of a natural cove that was protected by a hard, resistant promontory of land to the west known as The Headlands. The cove was bordered by a rocky shoreline along the base of steep sea cliffs. The sea cliffs are comprised of marine sedimentary rocks of the Capistrano Formation that are capped by marine and non-marine terrace deposits. The base of the sea cliffs was mantled by talus deposits and local deposits of artificial fill while the bottom of the cove was covered by marine deposits. The harbor was constructed by dewatering the cove, partially excavating the native soils along the base of the cliffs and within the cove, and then replacing the excavated materials as compacted fill and creating cut slopes to create roadways to the harbor.

Site Specific Conditions

The proposed Hotel Component site is within the cove area of the harbor and is underlain by artificial fills and marine deposits which in turn overlie bedrock of the Capistrano Formation. These materials are described in more detail in subsequent sections of this report.

Artificial Fill (Qaf)

The artificial fill materials within the site originated from both the marine deposits and bedrock within the cove, and the talus deposits and bedrock materials along the base of the sea cliffs. As a result of the fill materials being comprised of a variety of different geologic units, the fill materials are highly variable and consist of frequently alternating layers of clayey sands, silty sands, sands, sandy clays, and sandy silts with gravel, isolated cobbles and some scattered rock fragments greater than 6 inches in diameter. In general, the granular sand materials were found to be medium dense to dense while the fine-grained clay and silt materials were found to be predominantly firm to very firm. In addition, our laboratory testing indicates that the fill materials have varying degrees of compressibility and hydro-collapse.

Marine Deposits (Qm)

The marine deposit materials within the site are comprised of materials deposited in beach and submarine environments and, where encountered, generally consist of wet, loose to medium dense, silty sands to sands. Marine deposits were encountered underlying the artificial fill within seven of our drill holes (DH-6, DH-42, DH-43, DH-44, DH-45, DH-47, and DH-48).

Capistrano Formation (Tc)

Capistrano Formation bedrock was encountered below the fill and/or marine deposits in all our deeper drill holes and in all our CPT soundings. The bedrock was observed to consist predominantly of hard to very hard, fine- to coarse-grained, massive sandstones with occasional beds of moderately hard to hard, gray to very dark gray claystones and siltstones.

Summary of Subsurface Conditions

Based on the results of past and recent subsurface explorations, the geo-materials underlying the Hotel 1 "Surf Lodge" and Hotel 2 "Dana House" sites are summarized as follows:

- <u>Hotel 1 "Surf Lodge"</u>: The planned westerly hotel building with a surface parking site is underlain by approximately 15 to 25 feet of surficial soils consisting of artificial fill and marine deposits which in turn overlie Capistrano Formation bedrock (see Plate 3 – Geotechnical Sections). Fill depths appear to range from 12 to 25 feet with the deepest depths near the existing sea wall, and the thickness of the marine deposits appear to range from approximately 0 to 8 feet. In general, the depths of the surficial soils across the site increase in a southerly direction towards the ocean.

- <u>Hotel 2 "Dana House" and Underground Parking Structure Extension Area</u>:

  - *Hotel Structure:* The planned easterly hotel building with underground parking is underlain by approximately 15 to 30 feet of surficial soils consisting of artificial fill and marine deposits which in turn overlie Capistrano Formation bedrock (see Plate 3). Fill depths appear to range from 5 to 20 feet, and the thickness of the marine deposits appears to range from approximately 0 to 10 feet.
  - *Northerly Parking Structure Extension Area (North of Hotel 2):* A significant part of the northern portion of the planned below-grade parking structure adjacent to Dana Point Harbor Drive is underlain by bedrock of the Capistrano Formation (see Plate 3 – Geotechnical Sections).

GROUNDWATER

Groundwater was encountered during our subsurface investigation at variable elevations depending on the method by which it was measured. Groundwater levels within the auger during drilling utilized a measuring tape and sensor, and due to the confined space and material type, water did not consistently migrate to the true groundwater elevation. True groundwater levels used in this report were estimated using the in-situ saturation percentage determined in our lab and roughly corresponded to sea level (i.e., between approximately 6 to 20 feet below ground surface (bgs).

Groundwater elevations across the site are controlled not only by the elevation of the water within the adjacent harbor, but also somewhat influenced by the pre-development topography, with lower elevations found closest to the seawalls.

In order to better evaluate the groundwater data collected during our investigation, we compared it to the depth of historically high groundwater shown in the Seismic Hazard Zone Report for the Dana Point Quadrangle (CDMG, 2001). These maps indicate a historical high groundwater of 5 feet bgs. It should be noted that the groundwater elevations measured during our exploration (-2.77 MSL (10 feet bgs) to 2.64 MSL (5 feet bgs)) were affected by the time of day as it relates to the local tidal cycle, and therefore should be assumed to fluctuate with the tides, the lunar cycle, and recent rainfall events.

GEOLOGIC HAZARDS

FAULTING AND SEISMICITY

The site is not located within a published Alquist-Priolo Earthquake Fault Zone, and no known active faults are shown on current geologic maps for the site. The nearest known active fault is the offshore segment of the Newport-Inglewood fault, which is located approximately 3.9 kilometers southwest of the site and is capable of generating a maximum earthquake magnitude (M_w) of 7.1. The site is also located within 11.3 kilometers of the surface projection of the San Joaquin Hills Blind Thrust, which is capable of generating a maximum earthquake magnitude (M_w) of 6.6. Given the proximity of the site to these and numerous other active and potentially active faults, the site will likely be subject to earthquake ground motions in the future.

LIQUEFACTION

The site is located within a zone of required investigation for liquefaction as shown on the Seismic Hazard Zone Map for the Dana Point Quadrangle (CGS, 2001). Consequently, and also based on conditions encountered in the subsurface explorations for this project, the building sites will be subject to significant amounts of seismic settlement and lateral spreading related to liquefaction. Liquefaction, seismic settlement, and lateral spreading were quantitively analyzed, and the results are discussed under “Geotechnical Engineering Findings” (Page 9).

LANDSLIDES

Based on our review of available geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie the site; however, an earthquake-induced landslide is mapped adjacent to the proposed development. The adjacent mapped areas are within the existing bluffs where surficial instability and cracking may occur. However, based on the distance between the bluffs and the project site, there is no potential for landslides to impact the proposed development.

TSUNAMI, SEICHE, AND FLOODING

Tsunamis

Tsunamis or seismic sea waves that have affected coastal southern California are generally produced by submarine fault rupture. Historical records indicate that the coast, from San Pedro to Newport Bay, has been affected by six significant tsunamis since 1868 (Vasily Tito, National Oceanographic and Atmospheric Administration, Personal Communication, June 1998). The largest waves were on the order of 6 to 8 feet. The most extensive recent damage occurred in harbor areas such as Los Angeles (Alaska - 1964, Chile - 1960).

Legg, et al. (2004) investigated the tsunami hazard associated with the Catalina fault offshore of Southern California. They simulated tsunamis based on coseismic deformation of the sea floor and estimated that coastal run-up values are 5 to 13 feet, although run-up could exceed 23 feet depending upon amplification due to bathymetry and coastal configuration. Large earthquakes on the Catalina fault are relatively infrequent, with recurrence intervals of several hundred to thousands of years (Legg, et al., 2004).

<u>Tsunami Inundation Maps</u>

In 2009, the California Emergency Management Agency, California Geological Survey, and University of Southern California partnered in an effort to create tsunami inundation maps for California. The tsunami inundation maps were generated through a modeling process that utilizes the Method of Splitting Tsunamis (MOST). This computational program models tsunami evolution and inundation based on bathymetry and topography. The modeling also utilizes a variety of tsunami source events, including "realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides" (California Emergency Management Agency et al., 2009). Using the source, bathymetry, and topography, the tsunami modeling yields a maximum inundation line. It is important to note that the published map does not represent inundation from a single event. Rather, it is the result of combining inundation lines from multiple source events. Therefore, the entire inundation region will not likely be inundated during a single tsunami event (California Emergency Management Agency, et al., 2009).

The Tsunami Inundation Map states that the "tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only." Furthermore, the map conveys that it is not intended for regulatory purposes. With respect to probability, the map states that it contains "no information about the probability of any tsunami affecting any area within a specific period of time."

A Tsunami Inundation Map for Emergency Planning was published for the Dana Point Quadrangle (California Emergency Management Agency, et al., 2009). In considering the Tsunami Inundation Map with respect to the proposed development, it is critical to note three points: (1) the map is only intended for emergency planning and evacuation planning; (2) the map does not convey any information with respect to probability or timing of tsunami events; and (3) the inundation line is a conservative combination of multiple source events.

Tsunami Hazard Assessment

As shown on the attached Plate 4 – Tsunami Inundation Map for Emergency Planning, the proposed site is located within a tsunami inundation area. Therefore, it should be anticipated that the site will be directly affected by a tsunami. In addition, it should also be noted that the probability and severity of tsunami inundation in the lowland areas cannot be estimated based on current available information.

Seiches

The potential for the site to be adversely impacted by earthquake-induced seiches is considered to be high due to the presence of significant enclosed bodies of water located in the vicinity of the site.

Flooding

According to the County of Orange FEMA Flood Insurance Rate Map, the proposed Boaters Services Buildings are located within "Zone X", an area of 0.2% annual chance flood, 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and protected by levees from 1% annual chance flood. The potential for the site to be adversely impacted by significant flooding is considered low.

GEOTECHNICAL ENGINEERING FINDINGS

LIQUEFACTION, SEISMIC SETTLEMENT, AND LATERAL SPREADING ANALYSES

Seismic Input

Seismic input values for numerical analyses were based on ASCE 7-16 and the 2019 CBC for an MCE event (Magnitude 6.8 and PGA = 0.67).

Liquefaction Evaluation and Seismic Settlement

The site is located within a zone of required investigation for liquefaction as shown on the Seismic Hazard Zone Map for the Dana Point Quadrangle (CGS, 2001).

A liquefaction evaluation was performed on each CPT by means of CLiq, v.1.7.6.49 software and the Robertson (2009) methodology. In addition, SPT data obtained from our drill holes were also utilized to perform liquefaction analysis. The analysis was based on the 2019 CBC and ASCE 7-16 criteria. A historic high groundwater depth of 5 feet was used in the analysis. Our CPT liquefaction analysis is presented in Appendix D, and our SPT liquefaction analysis is presented in Appendix D-1.

The results of our analyses indicate the following:

- Hotel Buildings 1 and 2. The earthquake-induced (EQ-induced) settlement is estimated to be 3.5 inches for the MCE event. A differential EQ-induced settlement of 2.25 inches between foundations should be prudently considered in the design.
- Northerly Parking Structure Extension Area. The northernmost portion of the "Northerly Parking Structure Area" is underlain by bedrock while the southern portion is underlain by surficial soils over bedrock – similar to the hotel building. Seismic settlement in the southern portion was estimated to be on the order of 3.5 inches.

Lateral Spreading and Cyclic Mobility

The proposed development has a high potential for lateral spreading due to the free face geometry of the subject site adjacent to the existing sea wall and harbor and the presence of shallow liquefiable soils with low residual shear strengths (shear strength ratios (S_r/Sig'_v) generally less than 0.4). The lateral displacement was analyzed utilizing Cross Sections A-A' and B-B' for the MCE seismic loading. Our analyses indicated that the post-earthquake slope stability safety factors with liquefied residual shear strengths were less than 1.3, indicating the potential for earthquake-induced flow failure.

Both sections exhibited a post-earthquake safety factor of 0.10 with the yield acceleration of 0.15. Therefore, there will be a high potential for some lateral movements of these slopes after liquefaction of the soils during the design earthquake. The lateral deformations due to the cyclic mobility of the slopes are estimated to be greater than 90 inches (see attached Appendix D – Lateral Spread Analysis). Consequently, lateral spreading mitigation will be required along the southern portion of the site adjacent to the existing sea wall (i.e., such as some type of ground improvement). The lateral deformations may be reduced to an acceptable range through the installation of a series of deep soil mixing columns or rammed aggregate piers as presented on Plate 2 – Geotechnical Map.

SLOPE STABILITY

We understand that some of the building walls of the Dana House hotel will receive planted fill slopes as part of the architectural design. Portions of the fill slopes are anticipated to be constructed at 1.5H:1V inclination using onsite soil and reinforced with geogrid in order to minimize surficial instability. On this basis, we have performed surficial stability analysis for a 15-foot-high geogrid-reinforced fill slope as shown in Appendix F – Geogrid Reinforced Slope Surficial Stability.

SOIL EXPANSION

Surficial Soils. The expansion potentials of the artificial fills mantling the site are highly variable ranging from very low to medium. Consequently, the design of building slabs and exterior hardscape features should consider a medium expansion potential.

Bedrock. The bedrock that will be exposed in the northern portion of the "Northern Parking Structure Extension Area" will likely consist largely of non-expansive sandstone. However, expansive fine-grained beds cannot be ruled out. Thus, expansion mitigation may be required.

SOIL CORROSION

Based on the test results for pH, soluble chlorides, sulfate, and minimum resistivity of the site soils obtained during our subsurface investigation, the on-site soils should be considered to have:

- A moderate sulfate content or "S1" sulfate exposure to concrete per ACI 318, Table 19.3.1.1.
- A moderate to high minimum resistivity indicating conditions that are mildly corrosive to corrosive to ferrous metals.
- A moderate to high chloride content (corrosive to ferrous metals).

STATIC SETTLEMENT / COMPRESSIBLITY

Static settlement of the site will be induced by introducing new building loads to existing grades and subsurface soils. The underlying artificial fill and bedrock soils encountered are slightly to moderately compressible under load with low levels of hydro-collapse (based on laboratory testing performed for adjacent sites). However, the geotechnical engineering characteristics of the underlying surficial soils are highly variable. The static settlement of the site was analyzed with our recommended bearing capacity utilizing assumed building foundation loads based on project experience. The estimated total static settlements for the mat foundation option are less than 0.5 inch.

It should be further noted that since the static settlement analyses is foundation-load and bearing-pressure dependent, and since foundation loads are not yet currently available, additional analyses may be required.

PRELIMINARY INFILTRATION TESTING

Three (3) preliminary infiltration tests were performed in general conformance with the County of Orange Technical Guidance Document (TGD). The drill holes, shown on the attached Plate 2 – Geotechnical Map, were excavated to depths of approximately 6.5 feet below the existing grade using a hollow-stem-auger drill rig. The calculated raw observed infiltration rates are presented in the following table:

Infiltration Rate Results

Drill Hole	Depth Below Finish Grade (feet)	Raw Observed Infiltration Rates (inches/hour) *
DH-2	6.5	0.59
DH-3	7.0	0.04
DH-4	7.0	0.28

**Rates do not incorporate a factor of safety.*

The results of the infiltration testing indicate that the uncorrected raw observed infiltration rates range from 0.04 to 0.59 inch per hour. However, if a minimum factor of safety of 2.0 is applied in accordance with the TGD manual, the observed infiltration rates do not meet the minimum requirement of 0.3 inch per the County of Orange TGD manual; therefore, the tested locations are deemed not feasible for infiltration of stormwater. The preliminary infiltration test hole locations are shown on the attached Geotechnical Map, Plate 2.

EXCAVATION CHARACTERISTICS

The artificial fill and bedrock materials underlying the site can be easily excavated with conventional grading equipment such as dozers, loaders, excavators, and backhoes. We expect that excavation of new utility trenches can be accomplished utilizing conventional trenching machines and backhoes. Furthermore, groundwater could be encountered at a relatively shallow depth of 5 feet bgs. The artificial fill soils should be considered as OSHA Type "C" soils. The Capistrano bedrock soils should be considered as OSHA Type "A" soils, to be verified in the field for stability.

CONCLUSIONS

Based on the geologic and geotechnical findings, it is our opinion that the proposed development is feasible and practical from a geotechnical standpoint if accomplished in accordance with the City of Dana Point grading and building requirements and the recommendations presented herein. It is also the opinion of GMU Geotechnical that proposed grading and construction will not adversely affect the geologic stability of adjoining properties provided grading and construction are performed in accordance with the recommendations provided in this report. A summary of conclusions is as follows:

1. The project area is not underlain by any known active faults. Structure design should be in accordance with the 2019 CBC based on ASCE 7-16.

2. Groundwater was encountered at 6 to 20 feet below existing grade during previous and current investigations, and the California Geological Survey (CGS, 2001) has reported that the historic high groundwater as 5 feet below existing grade.

3. The potential for liquefaction is considered high while the potential for lateral spreading is also considered high along the existing sea wall.

4. Estimated total vertical static settlement is less than 0.5 inch, with differential settlement on the order of 0.25 inch over 40 feet for buildings supported on either a mat foundation system or Geopier option.

5. Estimated total vertical seismic settlements due to liquefaction are on the order of 3.5 inches, with differential settlement on the order of 2.25 inches over a span of 40 feet.

6. Site soils within the foundation influence zone are anticipated to have a low to medium expansion potential based on our recent laboratory test results and local experience. Recommendations herein for the proposed improvements are based on a "medium" expansive condition.

7. Corrective grading will be required to support the proposed improvements. In addition, soil and/or structural mitigation alternatives will be required to address the excessive settlements and lateral spreading.

8. Corrosion testing indicates that the on-site soils have a moderate sulfate exposure level and are corrosive to buried ferrous metals and reinforcing steel. Consequently, any metal exposed to the soil will need protection.

9. Based on our preliminary infiltration testing, infiltration of water into the subsurface soils is deemed not feasible in accordance with the County of Orange TGD manual.

RECOMMENDATIONS

REQUIRED SITE MITIGATION

Due to the nature of the site soils and the planned development, the following site mitigation options are to be considered:

- Remedial grading under buildings, appurtenant structure and site walls, and site pavement areas are to provide a uniform and stable platform for construction.
- Buildings are to be structurally supported on either mat foundations or Geopiers or equivalent gravel piers.
- Planned fills slopes of 1.5H:1V inclination along some of the building walls of the Dana House Hotel (Hotel No.2) will require geogrid-reinforcement.

GENERAL SITE PREPARATION AND GRADING

General

The following recommendations pertain to any required grading associated with the proposed improvements and corrective grading needed to support the proposed improvements. All site preparation and grading should be performed in accordance with the City of Dana Point grading code requirements and the recommendations presented in this report.

Clearing and Grubbing

All significant organic material such as weeds, brush, tree branches, or roots, or construction debris such as old irrigation lines, asphalt concrete, and other decomposable material should be removed from the areas to be graded. No rock or broken concrete greater than 6 inches in diameter should be utilized in the fills.

Corrective Grading

<u>Structures Supported on a Mat Foundation</u>

Remedial grading will serve to create a firm and workable platform for construction of the proposed structures. The fill material encountered during our subsurface investigation will require some corrective grading in order to densify any disturbed soil that may be encountered during the grading operation. We recommend that the mat foundation be supported on 3 feet of engineered fill where existing artificial fill is encountered, and 1 foot of engineered fill where existing bedrock is encountered. Grading recommendations should consist of the following:

- The building pad should be excavated to a depth of at least 3 feet below the bottom of the mat foundation within existing artificial fill materials, and 1 foot below the bottom of the mat foundation where existing bedrock is encountered. The lateral extent of the over-excavation should be at least 3 feet beyond the edge of the mat.

- The bottom of the excavation should then be scarified to a depth of at least 8 inches, moisture conditioned to 2% above optimum moisture content, and recompacted to at least 95% relative compaction.

- The onsite material may then be used as fill material to achieve the planned mat foundation bottom elevation. The fill material should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 2% above optimum moisture content, and compacted to achieve 95% relative compaction.

<u>Structures Supported on Geopiers or Equivalent Gravel Piers</u>

If shallow spread footings supported on Geopiers or equivalent gravel piers are selected to support the proposed hotel structures, then the slab-on-grade (SOG) subgrade will require corrective grading prior to construction of the slab structural section. Grading should consist of the following:

- The SOG subgrade should be excavated to a depth of at least 24 inches below the bottom of the slab section.
- The bottom of the excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to 2% above optimum moisture content, and recompacted to at least 90% relative compaction.

- The onsite material may then be used as fill material to achieve the planned SOG subgrade elevation. The fill material should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 2% above optimum moisture content, and compacted to achieve 90% relative compaction.

<u>Appurtenant Structures / Site Retaining Walls</u>: Grading recommendations for the appurtenant structures and site retaining walls should consist of the following:

- The appurtenant structures should be over-excavated to a depth of at least 24 inches below the bottom of the foundations.

- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 2% above optimum moisture content, and recompacted to at least 90% relative compaction.

- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned foundation bottom elevation.

- The fill material should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 2% above optimum moisture content, and compacted to achieve 90% relative compaction.

<u>Vehicular Pavement</u>: Grading recommendations for the new vehicular pavement areas should consist of the following:

- The vehicular pavement section should be over-excavated to a depth of at least 12 inches below the bottom of the pavement section (i.e., 12 inches below the bottom of the aggregate base).

- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 2% above optimum moisture content, and recompacted to at least 90% relative compaction.

- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned subgrade elevation.

- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to at least 2% above optimum moisture content, and compacted to achieve 90% relative compaction.

Flatwork/Hardscape/Pedestrian Pavers: Grading recommendations for the new concrete flatwork/hardscape/pedestrian pavers areas should consist of the following:

- The flatwork/hardscape/pedestrian pavers section should be over-excavated to a depth of at least 12 inches below the bottom of the pavers sections (i.e., 12 inches below the bottom of the aggregate base).
- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 2% above optimum moisture content, and recompacted to at least 90% relative compaction.
- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to at least 2% above optimum moisture content, and compacted to achieve 90% relative compaction.

Additional Grading Recommendations

If the existing loose fill materials are found to be disturbed to depths greater than the proposed remedial grading, the depth of excavation, scarification, and re-compaction should be increased accordingly in local areas as recommended by the Geotechnical Engineer of Record. The Geotechnical Engineer of Record will need to provide site-specific recommendations based on their observations in the field.

Geogrid-Reinforced Fill Slopes

Based on the geogrid surficial slope stability calculations discussed earlier in this report, the fill slope should be constructed using Mirafi GF-1 bi-directional geogrid reinforcement that is 9 feet long and placed every 3 vertical feet to provide long-term surficial stability. The engineered fill between the geogrid reinforcement shall be placed at a moisture content of 2% above optimum moisture content and compacted to least 90% relative compaction. We highly recommend that the geogrid be located by survey during the installation and grading activities in order to ensure the required embedment length is achieved.

VOLUME CHANGE

In order to aid in planning for the anticipated grading, we estimate that the change in volume of on-site disturbed surficial fills that are excavated and placed as new compacted fill at an average relative compaction of 90% will result in volume losses ranging from approximately 3.5 to 9.5%. For rough planning purposes only, an average volume loss of 6.5% may be assumed.

TEMPORARY EXCAVATIONS

Temporary excavations for demolitions, earthwork, footings, and utility trenches are expected. We anticipate that unsurcharged excavations with vertical side slopes less than 4 feet high will generally be stable; however, all temporary excavations should be observed by a representative of GMU to evaluate their stability. Our recommendations for temporary excavations are as follows:

- Temporary, unsurcharged excavation sides within artificial fill material over 4 feet in height should be sloped no steeper than 1.5H:1V (horizontal:vertical).
- Temporary, unsurcharged excavation sides within bedrock material over 4 feet in height should be sloped no steeper than 1H:1V (horizontal:vertical).
- The tops of the excavations should be barricaded so that vehicles and storage loads do not encroach within 10 feet of the excavations. A greater setback may be necessary for heavy vehicles, such as concrete trucks and cranes. GMU should be advised of such heavy vehicle loadings so that specific setback requirements can be established.
- If the temporary construction excavations are to be maintained during the rainy season, berms are recommended to be graded along the tops of the excavations in order to prevent runoff water from entering the excavation and eroding the slope faces.

Our temporary excavation recommendations are provided only as **minimum** guidelines. All work associated with temporary excavations should meet the minimal safety requirements as set forth by CAL-OSHA. Temporary slope construction, maintenance, and safety are the responsibility of the contractor.

Shoring will be required where the sides of the excavation cannot be laid back to angles required by OSHA. Shoring design (if required) should be based on our geotechnical maps, cross sections, boring logs, and lab testing. Shoring designs are usually performed by a shoring contractor but should be reviewed by our office.

LATERAL SPREADING MITIGATION

Lateral spreading was evaluated along Sections A-A' and B-B' using the residual shear strength of liquefiable soils. Our analysis indicated that post Maximum Considered Earthquake (MCE), lateral spreading greater than 12 inches should be expected along the existing sea wall. Lateral spreading mitigation may be accomplished by installing either Deep Soil Mixing (DSM) columns or engineered Rammed Aggregate Piers (RAP). Based on discussions with specialty contractors, DSM was considered more favorable. Both RAP and DSM should be designed by specialty design-build contractors utilizing the data presented in this report. The approximate limits of mitigation are shown on Plate 2 – Geotechnical Map and Plate 3 – Geotechnical Sections.

The proposed RAPs and DSMs should be designed with sufficient strength, depth, and spacing to decrease the post-earthquake lateral displacement from the maximum displacement of over 90 inches to less than 12 inches after the mitigation. The strength of the RAP or DSM columns may be refined to further reduce the estimated deformations. The RAP and DSM columns should extend to the proposed ground surface. The final design of the lateral spreading mitigation shall be performed by a specialty design-build contractor and reviewed by GMU.

STRUCTURE SEISMIC DESIGN

No active or potentially active faults are known to cross the site, therefore, the potential for primary ground rupture due to faulting on-site is very low. However, the site will likely be subject to seismic shaking at some time in the future.

Based on our field exploration and the site soil profile, the site should be designated as Site Class C. The seismic design coefficients are based on ASCE 7-16 and 2019 CBC and are listed in the following table.

2019 CBC Site Categorization and Site Coefficients

Categorization/Coefficient	Design Value
Site Class Based on Soil Profile (ASCE 7, Table 20.3-1)	C
Short Period Spectral Acceleration S_s**	1.266
1-sec. Period Spectral Acceleration S_1**	0.455
Site Coefficient F_a (Table 11.4-1)**	1.200
Site Coefficient F_v (Table 11.4-2)**	1.500
Short Period MCE* Spectral Acceleration S_{MS}**	1.519
1-sec. Period MCE Spectral Acceleration S_{M1}**	0.682
Short Period Design Spectral Acceleration S_{DS}**	1.012
1-sec. Period Design Spectral Acceleration S_{D1}**	0.455
MCE Peak Ground Acceleration (PGA) *	0.555
Site Coefficient F_{PGA} (Table 11.8-1)**	1.200
MCE Peak Ground Acceleration (PGA_M) *	0.666
Mean Contributing Magnitude to MCE Event	6.8

* MCE: Maximum Considered Earthquake
** Values Obtained from USGS Earthquake Hazards Program website are **based on the ASCE 7-16 and 2019 CBC** and site coordinates of N33.46085º and W117.69342º.

It should be recognized that much of southern California is subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. Design utilizing the 2019 CBC is not meant to completely protect

protect against damage or loss of function. Therefore, the preceding parameters should be considered as minimum design criteria.

HOTEL 1 "SURF LODGE" (WEST) FOUNDATION RECOMMENDATIONS

The following recommendations apply to design and construction of the proposed 4-story Hotel #1 "Surf Lodge" building located on the west side of the property. The proposed building may be supported on either: Option A) a mat foundation with engineered fill, or Option B) shallow spread footings supported on rammed aggregate piers.

Option A: Mat Foundation

- The preliminary design parameters presented below may be used for foundation structural design.
  - Bearing Material: Engineered Fill (see Corrective Grading Section, Page 14)
    - Removal and Re-compaction Depth: 3 feet below bottom of mat
    - A moisture vapor retarder consisting of Stego Wrap 15 mil or equivalent should be placed.

- Minimum Mat Foundation:
    - Based on an assumed building footprint of approximately 50 feet by 140 feet, we estimate that the building load distributed uniformly over the mat foundation footprint may induce an approximate uniform pressure of 500 psf for dead plus live loads.
    - Assumed Minimum Thickness: 24 inches
    - Final mat foundation thickness shall be determined by the structural engineer.

- Allowable Bearing Capacity:
    - Based on the above assumptions, the mat foundation estimate of an approximate uniform pressure of 500 psf can be also used as the allowable bearing capacity. However, for localized loading conditions, a maximum allowable bearing pressure of 2,000 psf may be used.
    - The above value may be increased by 1/3 for temporary wind and seismic loads.

- Settlement:
  - For the purpose of preparing this preliminary settlement estimate, we have assumed a uniform bearing pressure of 500 psf under the mat slab.
  - Static Settlement:
    - Total: 0.5 inch
    - Differential: 0.25 inch over a span of 40 feet

- Seismic Settlement:
  - Total: 3.5 inches
  - Differential: 2.75 inches over a span of 40 feet

- Modulus of Subgrade Reaction (k):
  - 90 pci (static)

- Lateral Foundation Resistance:
  - Allowable passive resistance: 240 psf/ft (disregard upper 6 inches, max 2,400 psf)
  - Allowable friction coefficient: 0.33
  - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

The mat slab should be designed by the project structural engineer. In addition, in order to finalize the mat foundation recommendations, we recommend that the structural engineer model the mat foundation with all anticipated point loads utilizing the provided Modulus of Subgrade Reaction (k) in this section, and provide our office with the analyses, including bearing pressure and settlement contour under the slab.

Option B: Geopiers or Equivalent Gravel Piers

As an alternative to Option A, the hotel structure may be supported on spread footings founded on rammed aggregate piers with the slab-on-grade (SOG) designed in accordance with the recommendations presented in the following Slab Subsection and Slab Design section of this report.

Based on the site conditions, it is our opinion that Geopiers or equivalent gravel piers supported on shallow spread/continuous foundation systems may be used for support of the proposed buildings. The allowable bearing capacity provided by the Geopier or equivalent system is typically up to 5,000 psf, which results in smaller size of shallow foundations based on our assumed structural loads. The gravel piers are anticipated to be 24 inches in diameter and embedded at least 12 inches into bedrock. Below the foundation of each hotel building, the aggregate piers should be installed so they extend 6 to 12 inches above the bottom of the footings so that when the footings are excavated, the upper portions of the piers are shaved off.

We recommend that once a generalized foundation plan is developed, we review the feasibility of Geopier-supported foundations at this site. If suitable, based on the structural loading conditions, Geopier-supported foundations could be a cost-effective solution for structure support, which should be designed by the specialty contractor.

Slab Subsection and Slab Design

Minimum Thickness: The minimum slab thickness shall be 6 inches.

Minimum Slab Reinforcement: Minimum slab reinforcement shall not be less than No. 4 bars placed at 18 inches on center. Welded wire mesh is not recommended. Care should be taken to position the reinforcement bars in the center of the slab.

Slab Subgrade

- The upper 18 inches of the on-site soils and subgrade soil should be moisture conditioned to 2% above the optimum moisture content and compacted to a minimum relative compaction of 90% in accordance with the latest version of ASTM D1557.
- Place moisture vapor retarder per the Moisture Vapor Transmission section of this report (Page 27).
- Sand above the moisture retarder/barrier (i.e., directly below the slab) is not a geotechnical issue. This should be provided by the structural engineer of record based on the type of slab, potential for curling, etc.

It should be noted that rammed aggregate piers will be utilized to mitigate seismic settlement below foundation elements and not below the SOG. Thus, the SOG will be subject to seismic settlement.

HOTEL 2 "DANA HOUSE" (EAST) FOUNDATION RECOMMENDATIONS

The following recommendations apply to design and construction of the proposed up to 4-story over a 1-story parking structure Hotel #2 "Dana House" building located on the east side of the property. Due to the seismic settlement and the cut/fill transition anticipated below the building pad, we recommend that the proposed building be supported on a mat foundation with a structural joint incorporated into the design to span the cut/fill transition.

Mat Foundation Design Parameters

- The preliminary design parameters presented below may be used for foundation structural design.
  - Bearing Material: Engineered Fill (see Corrective Grading Section, Page 14)
    - Removal and Re-compaction Depth: 3 feet below bottom of mat
    - A moisture vapor retarder consisting of Stegowrap 15 mil or equivalent placed.

- Minimum Mat Foundation:
    - Based on an assumed building footprint of approximately 50 feet by 140 feet, we estimate that the building load distributed uniformly over the mat foundation footprint may induce an approximate uniform pressure of 500 psf for dead plus live loads.
    - Assumed Minimum Thickness: 24 inches
    - Final mat foundation thickness shall be determined by the structural engineer.

- Allowable Bearing Capacity:
    - Based on the assumptions made above, the mat foundation estimate of an approximate uniform pressure of 500 psf can be also used as the allowable bearing capacity. However, for localized loading conditions, a maximum allowable bearing pressure of 2,000 psf may be used.
    - The above value may be increased by 1/3 for temporary loads such as wind and seismic.

- Settlement:
    - For the purpose of preparing this preliminary settlement estimate, we have assumed a uniform bearing pressure of 500 psf under the mat slab.
    - Static Settlement:
        - Total: 0.5 inch
        - Differential: 0.25 inch over a span of 40 feet
    - Seismic Settlement:
        - Total: 3.5 inches
        - Differential: 2.75 inches over a span of 40 feet

- Modulus of Subgrade Reaction (k):
    - 90 pci (static)

- Lateral Foundation Resistance:
    - Allowable passive resistance: 240 psf/ft (disregard upper 6 inches, max 2,400 psf)
    - Allowable friction coefficient: 0.33
    - These values assume that the mat foundation subgrade is treated with cement.
    - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

- Structural Joint:
    - A structural joint should be incorporated into the design at the approximate location as shown in the detail on Plate 3 – Geotechnical Sections.
    - The actual location of the joint should be field verified based on the actual transition of cut and fill.

The mat slab should be designed by the project structural engineer. In addition, in order to finalize the mat foundation recommendations, we recommend that the structural engineer model the mat foundation with all anticipated point loads utilizing the provided Modulus of Subgrade Reaction (k) in this section, and provide this office with the analyses, including bearing pressure and settlement contour under the slab.

BASEMENT WALL DESIGN AND CONSTRUCTION

The following criterion is considered applicable to the design and construction of basement walls at the subject site. The design assumes the use of on-site select backfill in accordance with Plate 3 – Retaining Wall Construction Detail.

Foundation Recommendations

It is anticipated that foundations for the basement walls will be integrated into the overall foundation design. Consequently, basement walls foundation may be sized based on the type of foundation selected for each building. The types of foundations (i.e., mat or Geopiers) are discussed previously in this report.

Wall Design Parameters

At-Rest Earth Pressure:	60 pcf – level backfill
Waterproofing:	The back side of all retaining walls should be waterproofed down to the top of the foundation prior to placing subdrains or backfill. The design and selection of the waterproofing system is outside the scope of our report and is outside our purview.
Concrete:	0.50 w/c ratio Type II/V cement (geotechnical perspective only).
Drainage:	The backdrain system should consist of 4” perforated pipe surrounded by at least 1 cubic foot of ¾”-1.5” open graded gravel wrapped in Mirafi 140 filter fabric or equivalent. The perforated pipe should consist of SDR-35 or Schedule 40 PVC pipe or approved equivalent, laid on at least 2” of crushed rock with the perforations laid down. The backdrain gradient should not be less than 1% when possible. The perforated pipe should outlet into area drains or other suitable outlet points of runs of 200 feet or less, if

practical. If the backdrains cannot be outletted by gravity flow, a sump pump system will need be designed and constructed. Redundant back-up pumps or components are recommended. Design of this system is outside of the purview of GMU.

RETAINING WALL AND SCREEN WALL DESIGN CONSTRUCTION

Retaining Wall Design Parameters

The following criterion is considered applicable to the design and construction of site retaining walls at the subject site. The design assumes the use of on-site select backfill in accordance with Plate 3 – Retaining Wall Construction Detail.

Foundation Recommendations

Minimum Foundation Width: 24 inches

Minimum Foundation Depth: Depth below lowest adjacent grade to bottom of footing:
- 24 inches

Bearing Materials: Minimum of 2 feet of engineered fill

Allowable Bearing Capacity: 2,000 psf for footing on level ground
- 1/3 increase for wind or seismic conditions

Allowable Coefficient of Friction: 0.33

Unit Weight of Backfill: 125 pcf

Allowable Passive Earth Pressure: 240 psf/ft of depth (static)
- Disregard upper 6 inches
- Reduce passive by one-third when combined with friction in sliding resistance
- 1/3 increase for seismic conditions

Wall Design Parameters

Active Earth Pressure: 40 pcf – level backfill
(Assumes the use of select soils in backfill zone)

Weight of Backfill:	125 pcf
Control/Construction Joints:	As a minimum, maximum spacing of 15 feet and at angle points (non-basement walls)
Waterproofing:	The back side of all retaining walls should be waterproofed down to the top of the foundation prior to placing subdrains or backfill. The design and selection of the waterproofing system is outside the scope of our report and is outside our purview.
Concrete:	0.50 w/c ratio Type II/V cement (geotechnical perspective only).
Wall Backfill and Drainage:	See Retaining Wall Construction Detail Diagram and Notes (shown on Plate 3) for backfill and drainage requirements.

The values presented above assume that the supported grade is level and that surcharge loads are not applied. In addition, these pressures are calculated assuming that a drainage system will be installed behind the basement walls and that external hydrostatic pressure will not develop behind the walls. Where adequate drainage is not provided behind the walls, further evaluation should be conducted by a geotechnical engineer and the lateral earth pressure values will need to be adjusted accordingly.

The unrestrained (active) values are applicable when the walls are designed and constructed as cantilevered walls allowing sufficient wall movement to mobilize active pressure conditions. This wall movement should not be less than 0.01 H (H = height of wall) for the unrestrained values to be applicable.

Provided that the retaining walls have a maximum height of less than 6 feet, the 2019 CBC indicates that the incorporation of seismic earth pressures is not required.

Screen Wall Design Parameters

For standard screen walls on flat ground, footings should be a minimum of 24 inches deep below the lowest outside adjacent grade. Wall foundations should be reinforced with two #4 bars top and bottom, and joints in the wall should be placed at regular intervals on the order of 10 to 20 feet. The wall foundation shall be underlain by at least a 2-foot-thick section of engineered fill.

POLE FOUNDATIONS

Pole foundations will be required for the light bollards for the new parking areas. As a minimum, the pole foundations should be at least 18 inches in diameter and at least 3 feet deep; however, the actual dimensions should be determined by the project structural engineer based on the following design parameters.

Bearing Materials. The pole foundations may bear into engineered fill approved by a representative from GMU.

Bearing Values. End-bearing capacity and skin friction may be combined to determine the allowable bearing capacities of the pole foundations. An allowable bearing pressure of 2000 pounds per square foot (psf) may be used for pole foundations at least 18 inches in diameter and embedded a minimum of 3 feet below the lowest adjacent grade. A value of 350 pounds per square foot may be used to determine the skin friction between the concrete and surrounding soil.

Lateral Load Design. Lateral loads may be resisted by friction at the base of the foundations and by passive resistance within the adjacent earth materials. A coefficient of friction of 0.33 may be used between the foundations and the recommended bearing material. For passive resistance, an allowable passive earth pressure of 240 pounds per foot of pile diameter per foot of depth into competent bearing material may be used; however, passive resistance should be ignored within the
upper foot due to possible disturbance during drilling. The passive resistance may be assumed to be acting over an area equivalent to two pile diameters.

STRUCTURAL CONCRETE

Laboratory tests indicate that the onsite soils in the general area of the site possess moderate levels of sulfate content or “S1” exposure per ACI 318-14, Table 19.3.1.1. Therefore, any structural features which will be in direct contact with the site soils at depth will have restrictions on the type of Portland cement, water to cement ratio, and the concrete compressive strength per ACI 318-14, Table 19.3.2.1 as follows:

- Type II/V cement with a maximum water to cement ratio of 0.50, and a minimum compressive strength of 4,000 psi (from a geotechnical perspective only).
- NOTE: Any reinforced concrete elements that extend below the water table should be designed for C2 (Severe) exposure to moisture and chlorides.

Wet curing of the concrete per ACI Publication 308 is also recommended.

The aforementioned recommendations regarding concrete are made from a soils perspective only. Final concrete mix design is beyond our purview. All applicable codes, ordinances, regulations, and guidelines should be followed regarding the designing a durable concrete with respect to the potential for sulfate exposure from the on-site soils and/or changes in the environment.

FERROUS METAL CORROSION

The results of the laboratory chemical tests performed on a sample of soil collected within the site indicate that the on-site soils are corrosive to ferrous metals. Consequently, metal structures which will be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal signposts, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to corrosion. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential. Additional provisions will be required to address high chloride contents of the soil per the 2019 CBC to protect the concrete reinforcement. The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary).

The above discussion is provided for general guidance regarding the corrosiveness of the on-site soils to typical metal structures used for construction. Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview. If detailed testing is required, a corrosion engineer should be consulted to perform the testing and develop appropriate mitigation measures.

MOISTURE VAPOR TRANSMISSION

Moisture Vapor Retarder

A vapor retarder or barrier such as Stego 15 Mil Class A or equivalent should be utilized beneath the slab. The retarder/barrier should be installed as follows:

- Below moisture-sensitive floor areas.
- Installed per manufacture's specifications as well as with all applicable recognized installation procedures such as ASTM E1643-98.
- Joints between the sheets and the openings for utility piping should be lapped and taped. If the barrier is not continuously placed across footings/ribs, the barrier should, as a minimum, be lapped into the sides of the footings/rib trenches down to the bottom of the trench.
- Punctures in the vapor barrier should be repaired prior to concrete placement.

A capillary break is not required. Also, sand and/or the amount of sand above the moisture vapor retarder should be specified by the owner. The selection of sand above the retarder is not a geotechnical engineering issue and is hence outside our purview.

Water Vapor Transmission Discussion

The placement of a moisture vapor retarder below all slab areas is recommended where moisture sensitive flooring will be placed. It should be noted that the moisture retarder is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry in building construction in Southern California. It is not intended to provide a "waterproof" or "vapor proof" barrier or reduce vapor transmission from sources above the retarder (i.e., concrete). Sources above the retarder include any sand placed on top of the retarder (i.e., to be determined by the project structural designer) and from the concrete itself (i.e., vapor emitted during the curing process). The evaluation of water vapor from any source and its effect on any aspect of the proposed building space above the slab (i.e., floor covering applicability, mold growth, etc.) is outside our purview and the scope of this report.

Floor Coverings

Prior to the placement of flooring, the floor slabs should be properly cured and tested to verify that the water vapor transmission rate (WVTR) is compatible with the flooring requirements.

SURFACE DRAINAGE

Surface drainage should be carefully controlled during and after grading to prevent ponding and uncontrolled runoff adjacent to building structures and/or other properties. Care will be required during grading to maintain slopes, swales, and other erosion control measures needed to direct runoff toward permanent surface drainage facilities. Positive drainage of at least 2% away from the perimeters of the structures and site pavements should be incorporated into the design. In addition, it is recommended that nuisance water be directed away from the perimeters of the structures using area drains in adjacent landscape and flatwork areas and roof drains tied into the site storm drain system.

BIORETENTION AREAS

We recommend that an impermeable liner be installed at the bottom and sides of all bioretention areas at the subject site to prevent vertical and lateral water migration into the adjacent structures and pavements.

UTILITY CONSIDERATIONS

General

New utility line pipeline trenches should be backfilled with select bedding materials beneath and around the pipes and compacted soil above the pipe bedding. Recommendations for the types of the materials to be used and the proper placement of these materials are provided in the following sections.

Pipe Bedding

The pipe bedding materials should extend from at least 6 inches below the pipes to at least 12 inches above the crown of the pipes. Pipe bedding should consist of either clean sand with a sand equivalent (SE) of at least 30, or crushed rock. If crushed rock is used, it should consist of ¾-inch crushed rock that conforms to Table 200-1.2.1 (A) of the 2018 "Greenbook." Pipe bedding should also meet the minimum requirements of the County of Orange. If the requirements of the County are more stringent, they should take precedence over the geotechnical recommendations. Sufficient laboratory testing should be performed to verify the bedding meets the minimum requirements of the Greenbook and City of Dana Point grading code.

Based on our subsurface exploration and knowledge of the onsite materials, the soils that will be excavated from the pipeline trenches will not meet the recommendations for pipe bedding materials; therefore, imported materials will be required for pipe bedding.

Granular pipe bedding material having a sand equivalent of 30 or greater should be properly placed in thicknesses not exceeding 3 feet, and then sufficiently flooded or jetted in place.

Crushed rock, if used, should be capped with filter fabric (Mirafi 140N, or equivalent) to prevent the migration of fines into the rock.

Trench Backfill

All existing soil material within the limits of the pipeline alignment is considered suitable for use as trench backfill above the pipe bedding zone if care is taken to remove all significant organic and other decomposable debris, and moisture condition the soil materials as necessary.

Imported soils are not anticipated for backfill since the on-site soils are suitable. However, if imported soils are used, the soils should consist of clean, granular materials with physical and chemical characteristics similar to those described herein for on-site soils. Any imported soils to be used as backfill should be evaluated and approved by GMU prior to placement.

Soils to be used as trench backfill should be moistened, dried, or blended as necessary to achieve a minimum of 2% over optimum moisture content for compaction, placed in loose lifts no greater than 8 inches thick, and mechanically compacted/densified to at least 90% relative compaction as determined by ASTM Test Method D 1557. Jetting is not permitted in this trench zone.

No rock or broken concrete greater than 6 inches in maximum diameter should be utilized in the trench backfills.

Other Considerations

The site liquefaction may also affect the utilities, pavements, and pool improvements at the site. These improvements will be affected by total, regional differential, and local differential seismic settlements. In this regard, wherever possible, utilities should not be located under building slabs. We also recommend flexible connections for the utilities connecting to the hotel buildings, and earthquake shut off valves for pressured utilities at their entrance to the site. Significant repair and/or replacement will likely be required for all appurtenant structures and utilities in areas not mitigated for liquefaction, in the event of the design level earthquake. Building mat slabs may require repair and re-leveling after a significant earthquake.

SITE INFILTRATION

The infiltration rates <u>do not meet</u> the minimum requirement of 0.3 inch/hour when a factor of safety of 2 is implemented per the County of Orange TGD manual. Consequently, options include:

- "Contain and treat systems", and
- Permeable paver and bio-swales with collection systems, etc.

PAVEMENT DESIGN RECOMMENDATIONS

General

It is expected that the driveways within the site will be constructed with both asphalt pavement and Portland cement concrete. Therefore, recommendations for both types of pavement areas are provided in the following sections. In order to accommodate fire truck and trash truck loading, a traffic index (T.I.) of 5.5 has been assumed for the drive areas.

Asphalt Pavement Design

Based on the R-value test results, an R-value of 30 was used for the design. The following pavement thicknesses should be anticipated:

Asphalt Concrete Over Aggregate Base Pavement Table

Location	R-Value	Traffic Index	Asphalt Concrete (in.)	Aggregate Base* (in.)
Driveways	30	5.5	4.0	6.0
Parking Stalls	30	4.0	3.0	4.0

** assumed R-Value = 78*

Asphalt Concrete Over Cement Stabilized Pulverized Base (CSPB) Pavement Table

Location	R-Value	Traffic Index	Asphalt Concrete (in.)	CSPB (in.)
Driveways	30	5.5	4.0	8.0
Parking Stalls	30	4.0	3.0	8.0

The above design sections will be verified based on additional testing performed at the completion of future precise grading of the specific locations.

The planned pavement structural sections should consist of aggregate base materials (AB) and asphalt concrete materials (AC) of a type meeting the minimum City of Dana Point standards. The subgrade soils should be moisture conditioned to a minimum 2% above the optimum moisture content to a depth of at least 18 inches and compacted to 90% relative compaction. The AB and AC should be compacted to at least 95% relative compaction.

Portland Cement Concrete Pavement Design

Driveways, vehicular drives, and appurtenant concrete paving such as trash receptacle bays, will require Portland cement concrete (PCC) pavement. Assuming a T.I. of 6 to 7, a design section of 8 inches of PCC over 6 inches AB should be adequate. PCC vehicular pavement should be designed in accordance with the City of Dana Point standards and the requirements presented on the concrete flatwork table (Page 35).

Full Depth Reclamation Alternative Design

Since minor grade changes are planned for the re-grading of the Hotel 1 and 2 parking areas, and based on site conditions and our experience, we believe the most efficient pavement rehabilitation alternative to replacement with a conventional asphalt over base pavement section would be to utilize what is called "full depth reclamation" (FDR) utilizing the pavement sections provided in the Asphalt Pavement Design section (Pages 30 & 31).

Based on our experience with similar projects, AC pavement over Cement Stabilized Pulverized Base (CSPB) section may be a cost-effective alternative. The CSPB section minimizes construction costs mainly through significant reuse of on-site materials as part of the reconstructed pavement section. An added benefit is that the cement treatment process to construct the CSPB section can inherently address unstable and wet subgrade conditions.

The general process of performing CSPB reconstruction is as follows:

- In order to accommodate the new AC section, the existing grade must be graded to the appropriate elevation so that the desired final lot elevation is achieved after the new AC section is constructed;

- Spread cement at a rate that is dependent on the required cement content as determined from a CSPB mix design, treatment area, thickness of the treated section, and representative unit weight of the in-place soil;

- Dry mix the cement using the pulverizer into the pulverized section. Homogenous mixing of the cement is crucial and requires proper equipment to achieve;

- Following dry mixing, perform a second mixing process with the introduction of water to hydrate the cement, if additional moisture is needed. The moisture content of the mixture must be approximately **1 to 3%** above optimum moisture content. From the time initial application of water occurs, the material should be fully mixed (dry and wet) and compacted within **2.5 hours or less**;

- Compaction of the final mixed/treated subgrade section (CSPB section) should be performed using a large sheepsfoot compactor. Depending on the type of equipment, a section as thick as 18 inches can be compacted in one lift. The type of equipment proposed for use should be approved by the engineer based on the lift thickness prior to bringing the equipment on site. The cement-treated section should be compacted to at least **92%** of the maximum dry density as determined by **ASTM D 1557**;

- Upon completion of compaction, the surface should be fine graded and then finish-rolled with a smooth drum roller;

- The surface of the treated material is wetted at least twice daily (possibly more depending on weather) to promote hydration of the cement;

- For at least 24 hours, traffic on the surface after completion of compaction should be minimized to the maximum extent possible, and heavy construction equipment traffic should be completely avoided to prevent breakdown of the treated material prior to the curing process. After 24 hours, the surface can be proof-rolled and checked for yielding under heavy rubber-tire vehicle loads (such as a fully loaded water truck). If the surface indicates signs of yielding or instability, an additional 24 hours of cure time should be implemented while again minimizing heavy traffic loading;

- Within 48 to 72 hours, and upon demonstration of a firm and non-yielding surface under heavy rubber-tire vehicle loading, the surface should be "micro-cracked" to minimize the potential for cement-treated soil shrinkage. Micro-cracking should be performed using a heavy smooth drum roller set to high amplitude vibration. At least 2 passes with the smooth drum roller should be performed on the treated surface.

- As an alternative to micro-cracking, at least 2 inches of granular material (such as sand or aggregate base) can be placed between the bottom of the asphalt concrete section and the top of the cement-treated section to mitigate the potential for reflective cracking to develop. The AC thickness must remain at least 3.5 inches.

- The overlaying AC structural section can be constructed meeting Standard Specification for Public Works Construction requirements.

A mix design should be performed to evaluate the required amount of cement content for the soil-cement section to achieve a 7-day unconfined compressive strength of **400 psi**. Based on the soil types encountered, for bidding purposes, we anticipate that **5 to 7 percent cement** will be sufficient to achieve the design strength.

Greenbook Section 301-3.4 Cement Stabilized Pulverized Base (CSPB) can be used as the specifications to implement this alternative. The recommendations contained within this report shall govern in the event of differences.

Concrete Interlocking Vehicular and Pedestrian Pavement Design

We understand that portions of the project site will utilize 3⅛-inch-thick (80 mm) vehicular concrete interlocking pavers placed on a section of at least 1-inch-thick bedding sand. These vehicular pavers are also planned as a part of the subject project in order to provide fire department vehicle access capable of supporting 73,000 pounds of imposed loading. GMU recommends that the on-site soil subgrade in these site vehicular areas be moisture conditioned to at least 2% above the optimum moisture content to a depth of 18 inches below the pavement section and compacted to at least 90% relative compaction. A geotextile fabric such as Mirafi 600X or equivalent should be placed on top of the compacted subgrade across the entire vehicular interlocking paver area. Based on the on-site soils having an estimated R-value of 30, a 12-inch-thick layer of Class 2 crushed aggregate base (CAB), crushed miscellaneous base (CMB), or equivalent should be moisture conditioned to at least optimum moisture and compacted to at least 95% relative compaction in order to support the interlocking pavers. Concrete bands adjacent to the vehicular interlocking pavers should consist of a design section of 8 inches of PCC over at least 6 inches of AB or equivalent, moisture conditioned to at least optimum moisture, and compacted to at least 95% relative compaction.

We further understand that in certain designated site pedestrian areas, 2⅜-inch-thick (60 mm) concrete interlocking pavers placed on a section of at least 1-inch-thick bedding sand are planned. GMU recommends that prior to the installation of the pavers and bedding sand in these pedestrian areas, the on-site soil subgrade should be moisture conditioned to at least 2% above the optimum moisture content to a depth of 18 inches below the pavement section and compacted to at least 90% relative compaction. A 4-inch-thick layer of Class 2 crushed aggregate base (CAB), crushed miscellaneous base (CMB), or equivalent should then be placed on top of the soil subgrade, moisture conditioned to at least optimum moisture, and compacted to at least 95% relative compaction in order to support the interlocking pavers in these pedestrian areas.

CONCRETE FLATWORK DESIGN CONSIDERATIONS

Due to the variable nature of the on-site soils, we recommend that the subgrade for the subject concrete flatwork be moisture conditioned to 2% over optimum to a depth of 12 inches below finish grade and compacted to 90% relative compaction. A Type II/V cement may be used.

The following Concrete Flatwork Table summarizes our flatwork recommendations:

Concrete Flatwork Table

Description	Subgrade Preparation (1)	Minimum Concrete Thickness	Cut-Off Barrier Or Edge Thickness	Reinforcement (2)	Joint Spacing (Maximum)	Concrete (3)
Concrete Sidewalks and Walkways - ≤6 ft in width (4)	1) 2% over optimum to 12"(1), 2) 2" of sand or well graded rock (i.e., Class II base or equiv.) above moisture conditioned subgrade.	4 inches	Not Required	No. 3 bars @ 18" o.c.b.w. and dowel into building and curb using 9-inch Speed Dowels @ 18"o.c (5)	5 feet	Type II/V
Concrete Patios and Walkways >6 ft in width (4)	1) 2% over optimum to 12"(1), 2) 2" of sand or well graded rock (i.e., Class II base or equiv.) above moisture conditioned subgrade.	5 inches	Where adjacent to landscape areas – 12" from adjacent finish grade. Min. 8" width	No. 3 bars @ 18" o.c.b.w. and dowel into building and curb using 9-inch Speed Dowels @ 18"o.c (5)	5 feet	Type II/V
Concrete Driveways (4)	1) 2% over optimum to 12"(1), 2) 2" of sand or well graded rock (i.e., Class II base or equiv.) above moisture conditioned subgrade.	8 inches	Where adjacent to landscape areas – 12" from adjacent finish grade. Min. 8" width	1) Slab – No. 3 bars @ 18" o.c. (2) bent into cut-off; 2) where adjacent to curbs use dowels: No. 3 bars @ 18" o.c. (5)	10 feet	Type II/V

(1) The moisture content of the subgrade must be verified by the geotechnical consultant prior to sand/rock placement.
(2) Reinforcement to be placed at or above the mid-point of the slab (i.e., a minimum of 2.0 to 2.5 inches above the prepared subgrade).
(3) The site has moderate levels of sulfates as defined by the CBC. Concrete mix design is outside the geotechnical engineer's purview.
(4) Where flatwork is adjacent a stucco surface, a ¼" to ½" foam separation/expansion joint should be used.
(5) If dowels are placed in cored holes, the core holes shall be placed at alternating in-plane angles (i.e., not cored straight into slab).

RECYCLED AC MATERIAL

The use of stockpiled in-place recycled AC and crushed miscellaneous base (CMB) for new engineered fill subgrade, and CMB outside building and landscaped areas and under new asphalt concrete pavement and hardscape, will require GMU to conduct conformance laboratory testing on representative samples of the pulverized recycled asphalt pavement to confirm that the samples meet the 2019 Greenbook Section 200-2.4 standards for Crushed Miscellaneous Base (CMB). GMU recommends that this recycled CMB may be used as engineered fill for exterior subgrade structural support of new asphalt concrete and hardscape improvements outside of the building envelopes. The recycled concrete pavement is not to be used as compacted fill for support under any of the building areas or in the planters on the subject site.

PLANTERS AND TREES

Where new trees or large shrubs are to be located in close proximity to new concrete flatwork, rigid moisture/root barriers should be placed around the perimeter of the flatwork to at least 12 inches in depth in order to offer protection to the adjacent flatwork against potential root and moisture damage. Flatwork areas with existing mature trees should also incorporate a rigid moisture/root barrier placed at least 2 feet in depth below the top of the flatwork.

PLAN REVIEW / GEOTECHNICAL TESTING DURING GRADING / FUTURE REPORTS

Plan Review

Our office should review the final approved precise grading plans and landscape plans for the site and comment on the anticipated effects of any major changes from the plan reviewed for this report. In addition, the final office building foundation plans and final foundation loads will need to be reviewed to confirm that settlements are within tolerable limits.

FUTURE SERVICES

GMU should review the final construction plans to confirm they are consistent with our recommendations provided in this report.

Geotechnical Testing

It is recommended that geotechnical observation and testing be performed by GMU during the following stages of precise grading and construction:

- During site clearing and grubbing.
- During removal of any buried irrigation lines or other subsurface structures.

- During all phases of precise grading including over-excavation, temporary excavations, removals, scarification, ground preparation, moisture conditioning, proof-rolling, and placement and compaction of all fill materials.
- During installation of Geopiers if they are selected.
- During installation of all foundations and floor slab elements.
- During backfill of underground utilities.
- During pavement section placement and compaction.
- When any unusual conditions are encountered.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgements. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and foundation installation will be identical to those observed and sampled during our study or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the grading and use of the property.

Because our conclusions and recommendations are based on a limited amount of current and previous geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during grading of the project. Additionally, our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during grading of the project to observe the actual conditions exposed, to verify our design concepts and the grading contractor's general compliance with the project geotechnical specifications, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report.

Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview.

This report has not been prepared for use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

CLOSURE

If you have any questions concerning our findings or recommendations, please do not hesitate to contact us and we will be happy to discuss them with you. The Plates and Appendices that complete this report are listed in the Table of Contents.

Respectfully submitted,

Nadim Sunna, M.Sc., QSP, PE 84197
Senior Engineer

David R. Atkinson
Project Manager / Senior Engineer

Katie Farrington, M.Sc., PG, CEG 2611
Senior Engineering Geologist

Reviewed By:

Gregory P. Silver, M.Sc., PE, GE 2336
President / CEO
Principal Geotechnical Engineer

dra/17-206-01 (8-29-19)

SITE-SPECIFIC REFERENCES

Bluewater Design Group, 2003, "Dana Point Marina Redevelopment, Bulkhead Structural Evaluation," December 17, 2003.

Diaz-Yourman and Associates, 2005, "Geotechnical Investigation, Dana Point Harbor Launch Ramp Rehabilitation, Dana Point, California," November 29, 2005, Project No. 2005-022.

GMU Geotechnical, July 19, 2013, "Report of Geotechnical Investigation, Dana Point Harbor Revitalization Project, Phase 1, Dana Point Harbor, County of Orange, California," GMU Project No. 11-161-00.

GeoPentech, 2006, "Preliminary Geologic/Geotechnical Assessment Report for the Dana Point Harbor Revitalization Project Environmental Impact Report, January 14, 2004 (updated January 18, 2006).

Leighton Consulting Inc., 2002, "Preliminary Geotechnical Investigation Report for the Dana Point Harbor Master Plan, Dana Point Harbor, City of Dana Point, California." December 12, 2002, Project No. 600024-001.

Leighton Consulting Inc., 2008, "Geotechnical Engineering Exploration and Analysis for the Proposed Renovations to Dana Point Harbor, City of Dana Point, California," January 7, 2008, prepared for URS/Cash and Associates, Project No. 600024-004.

Zeiser Geotechnical, Inc., 1990, "City of Dana Point General Plan, Coastal Erosion Technical Report," Project No. PN 89312-2.

AERIAL PHOTOGRAPHS

DATE	FLIGHT	PHOTO
4-19-99	C136-45	170-171
10-15-97	C117-45	118-119
1-2-95	Cl01-45	10-11
1-14-92	C85-18	2-3
1-9-92	C-7	112-113-114
11-14-87	C-1	0012-0013
1-9-87	F	294-295
5-18-83	218-11	32-33
1-31-81	211-11	24-25
2-26-80	80033	268-269
12-13-78	203-11	43-44
1-24-77	181-11	31
1-13-75	157-11	27-28
10-29-73	132-10	20-21
1-31-70	61-10	223-224-225
3-30-67	2	94-95-96
9-20-65	1FF	86-87
3-28-59	261-R25	77-78
12-12-52	3K	49-50

TECHNICAL REFERENCES

Boore, D.M. and Atkinson, G.M., 2008, Ground-Motion Prediction Equations for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods between 0.01 s and 10 s: Earthquake Spectra, Vol. 24, No. 1, p. 99-138.

California Building Standards Commission and International Conference of Building Officials, 2019, *2019 California Building Code*.

California Department of Conservation, California Geological Survey, 2008, Guidelines for Evaluation and Mitigation of Seismic Hazards in California: Special Publication 117A, 98 pp.

California Geological Survey (CGS), 2001, Earthquake Zones of Required Investigation, Dana Point 7.5 Minute Quadrangle, dated December 21.

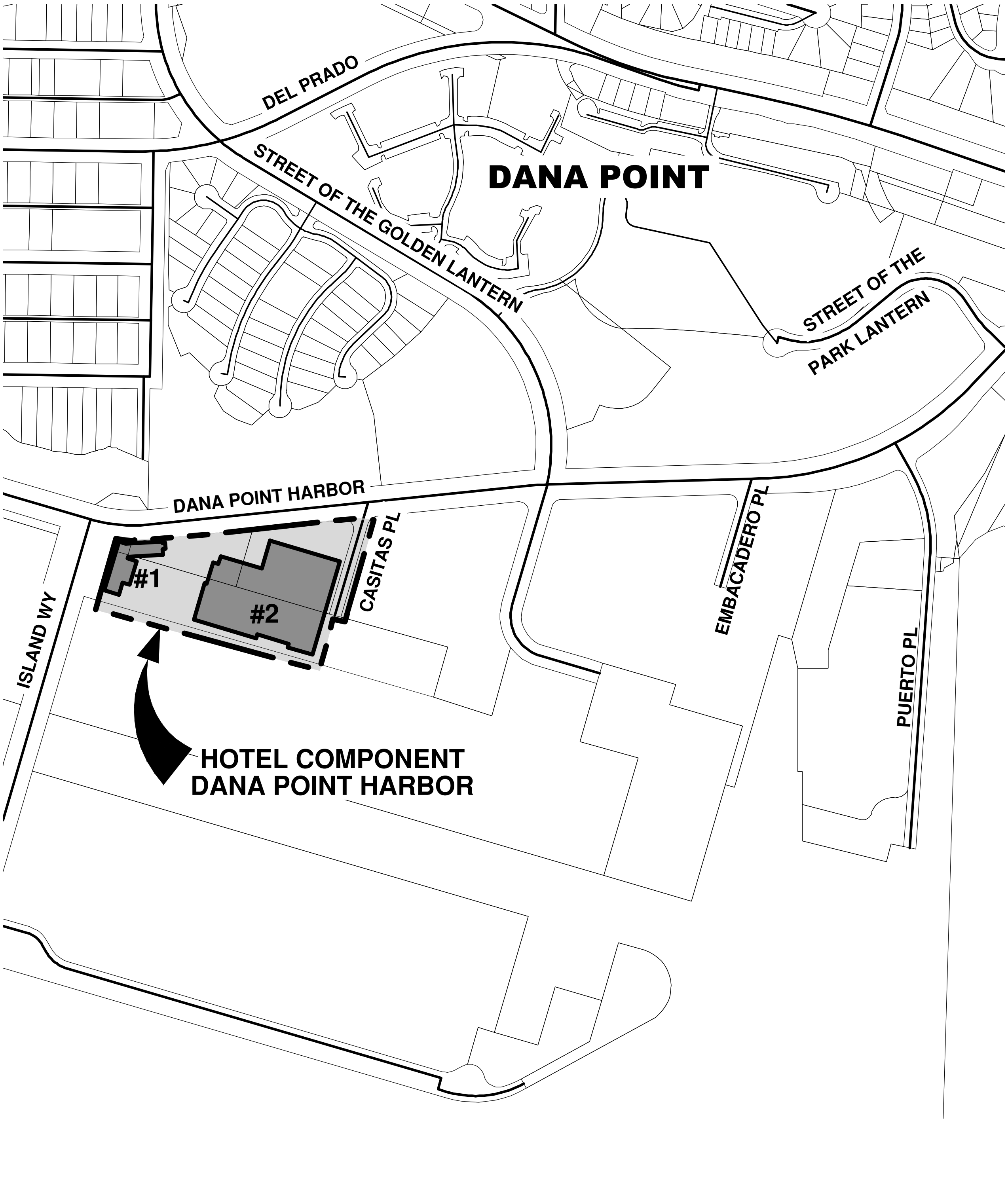
California Department of Conservation, Division of Mines and Geology, 2001, Seismic Hazard Zone Report for the Dana Point 7.5-Minute Quadrangle, Orange County, California, Seismic Hazard Zone Report 049.

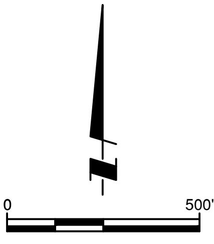
Coduto, Donald P., 1994, Foundation Design: Principles and Practices: Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Federal Highway Administration (FHWA), 1999, "Geotechnical Engineering Circular No. 4, Ground Anchor and Anchored Systems," Publication No. FHWA-IF-99-015, June 1999.

Standard Specifications for Public Works Construction, by Public Works Standards, Inc., 2018, *The Greenbook 2018 Edition*.

U.S. Geological Survey, 2014, 2014 Interactive De-aggregations Program; web site address: https://earthquake.usgs.gov/hazards/interactive/.





Location Map

Hotel Component

Dana Point Harbor Partners, LLC.

GMU	Date:	September 10, 2019	Plate 1
	Project No.:	17-206-01	

DRAWING: q:\2017\17-206-01\dwg\1720601_plate 1_location map.dwg PLOTTED: 9/9/2019 4:31 PM BY: Jmeza

Geotechnical Map

Hotel Component

Dana Point Harbor Partners, LLC.

GMU | Date: September 10, 2019 | Plate 2

Project No.: 17-206-01

GEOTECHNICAL LEGEND

Qaf/Qm/Tc ARTIFICIAL FILL OVER MARINE DEPOSITS OVER CAPISTRANO FORMATION BEDROCK

Qaf/Tc ARTIFICIAL FILL OVER CAPISTRANO FORMATION BEDROCK.

DH — APPROXIMATE DRILL HOLE TEST LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT 17-206-01

CPT — APPROXIMATE CONE PENETROMETER TEST (CPT) LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT NO. 17-206-01

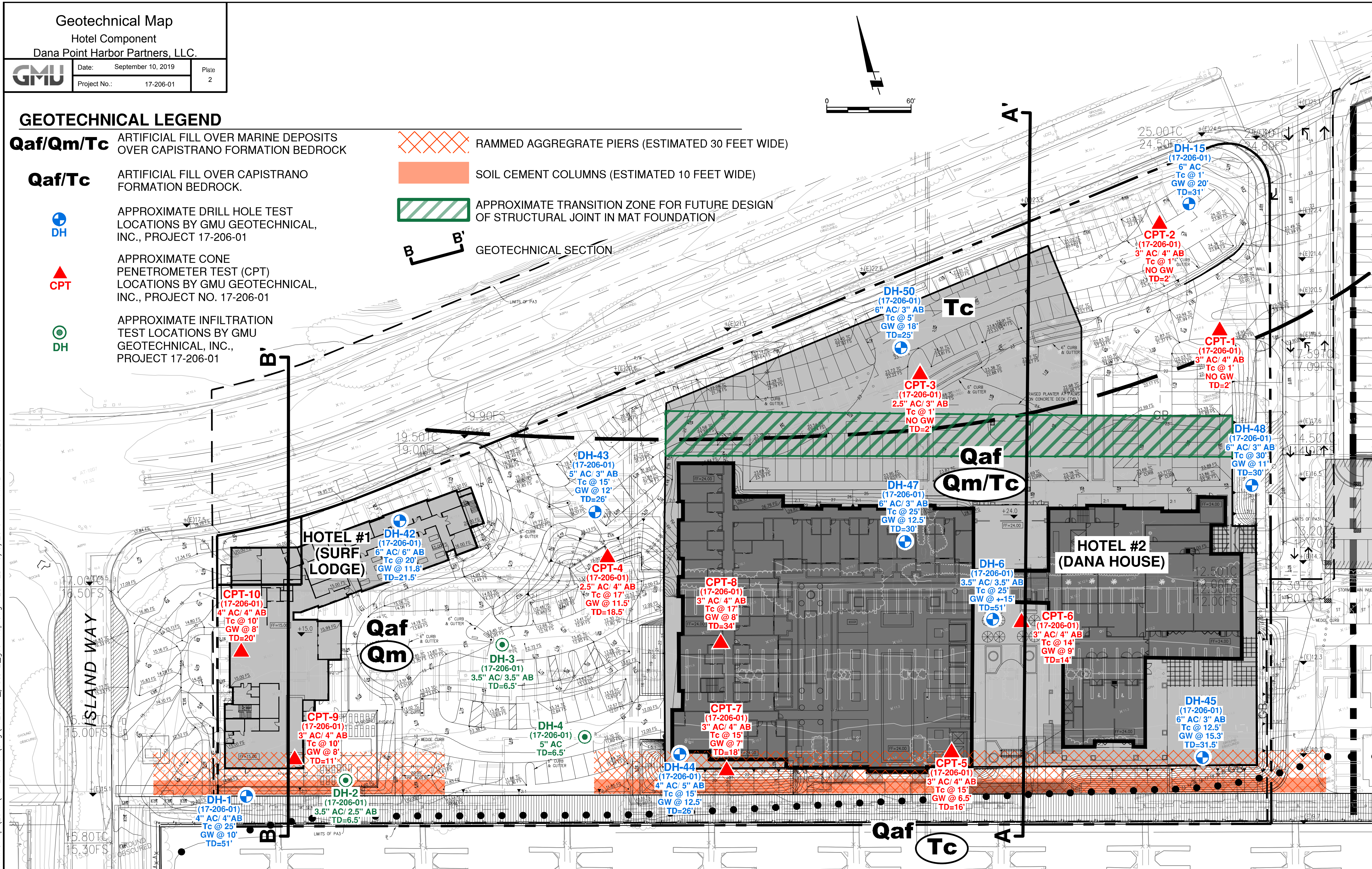
DH — APPROXIMATE INFILTRATION TEST LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT 17-206-01

RAMMED AGGREGATE PIERS (ESTIMATED 30 FEET WIDE)

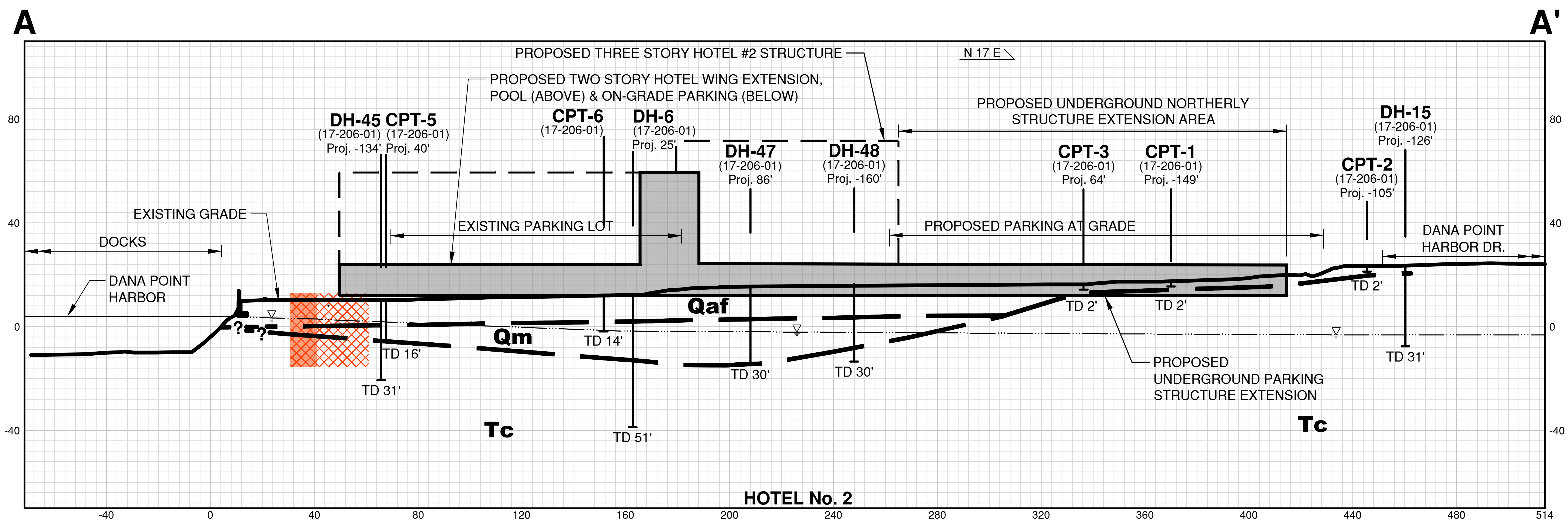
SOIL CEMENT COLUMNS (ESTIMATED 10 FEET WIDE)

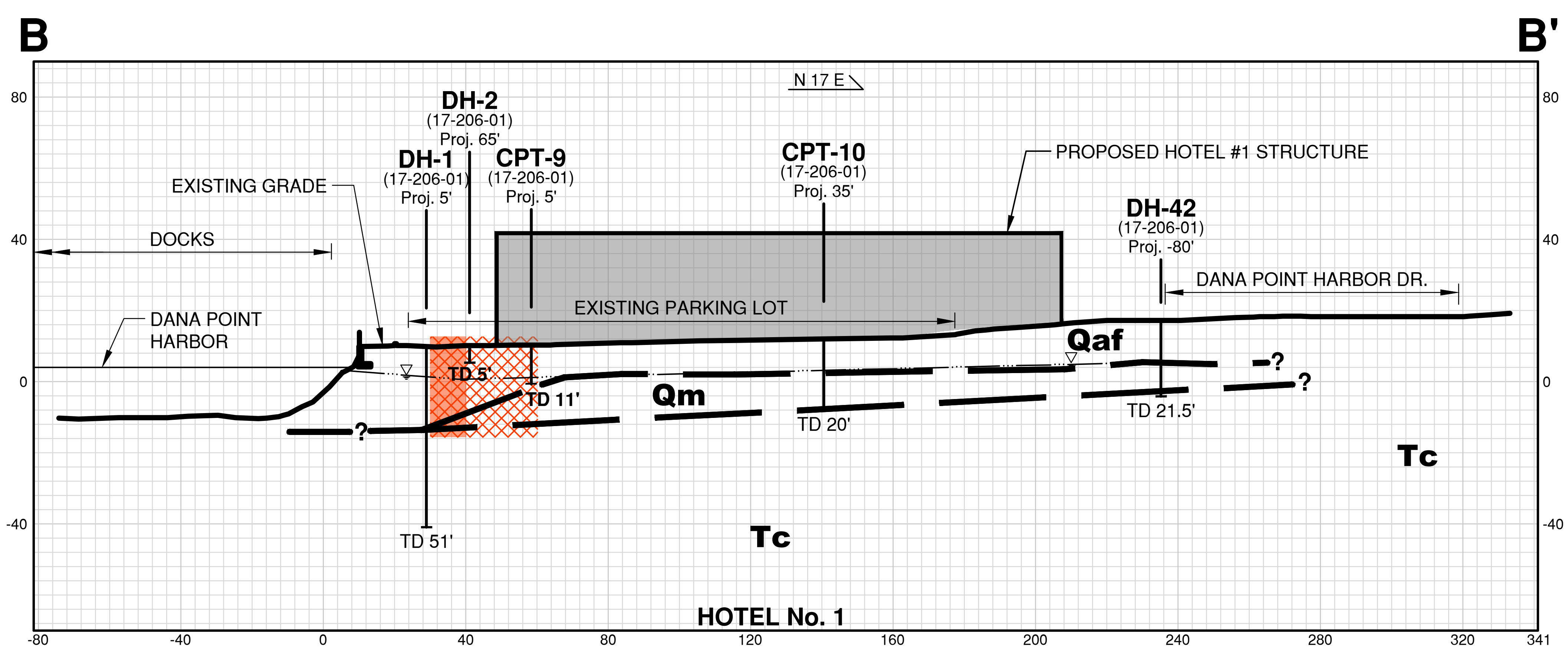
APPROXIMATE TRANSITION ZONE FOR FUTURE DESIGN OF STRUCTURAL JOINT IN MAT FOUNDATION

B — B' GEOTECHNICAL SECTION



DRAWING: q:\2017\17-206-01\dwg\1720601_plate 2_geo map.dwg PLOTTED: 9/9/2019 4:17 PM BY: Jmezo





GEOTECHNICAL LEGEND

- RAMMED AGGREGATE PIERS (30 FEET WIDE)
- SOIL CEMENT COLUMNS (10 FEET WIDE)

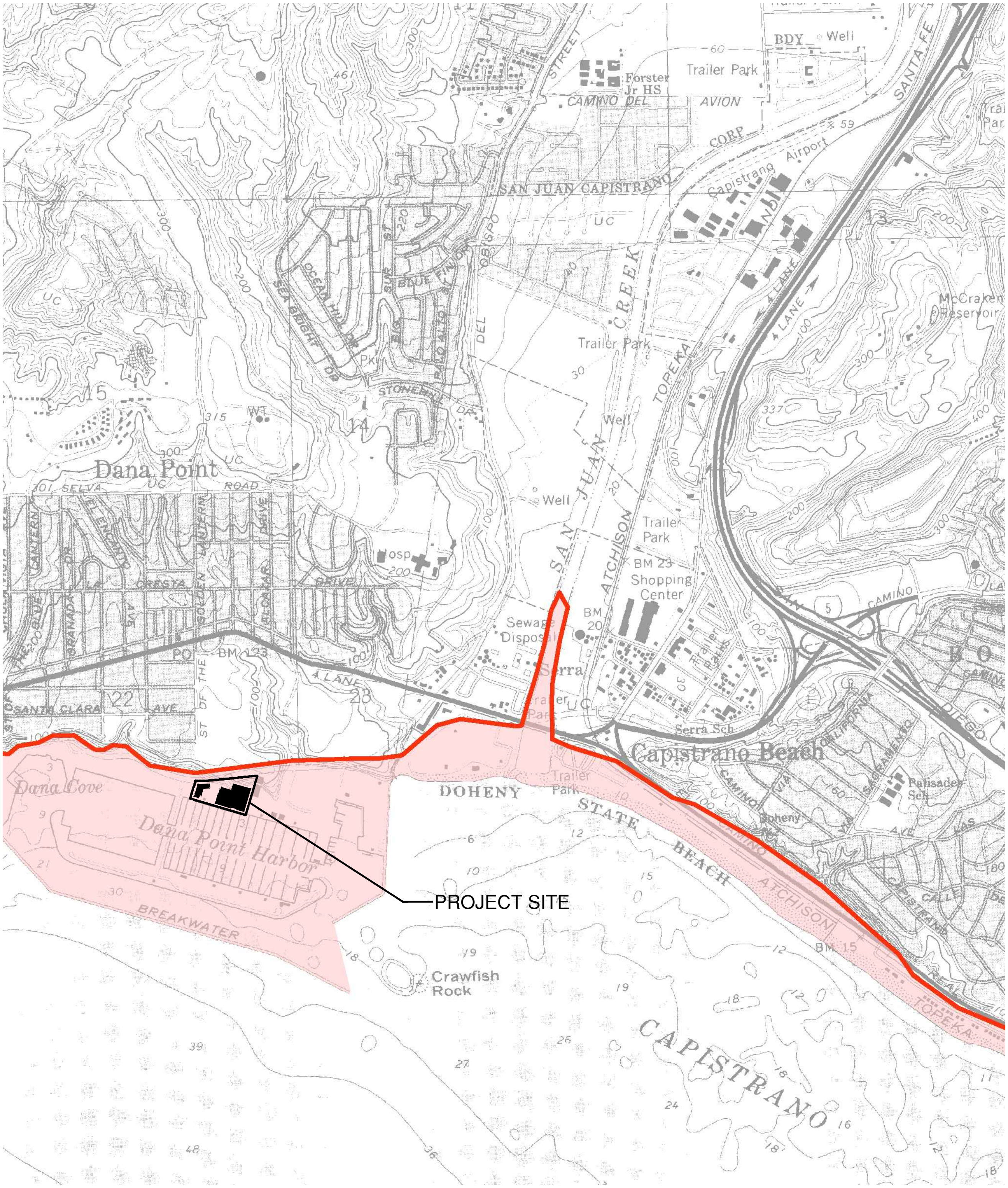
0 40' 80'

DRAWING: q:\2017\17-206-01\dwg\1720601_plate 3_geo section.dwg PLOTTED: 9/9/2019 4:30 PM BY: Jmeza

Geotechnical Sections

GMU

Date:	September 10, 2019	Plate 3
Project No.:	17-206-01	



MAP EXPLANATION

Tsunami Inundation Line

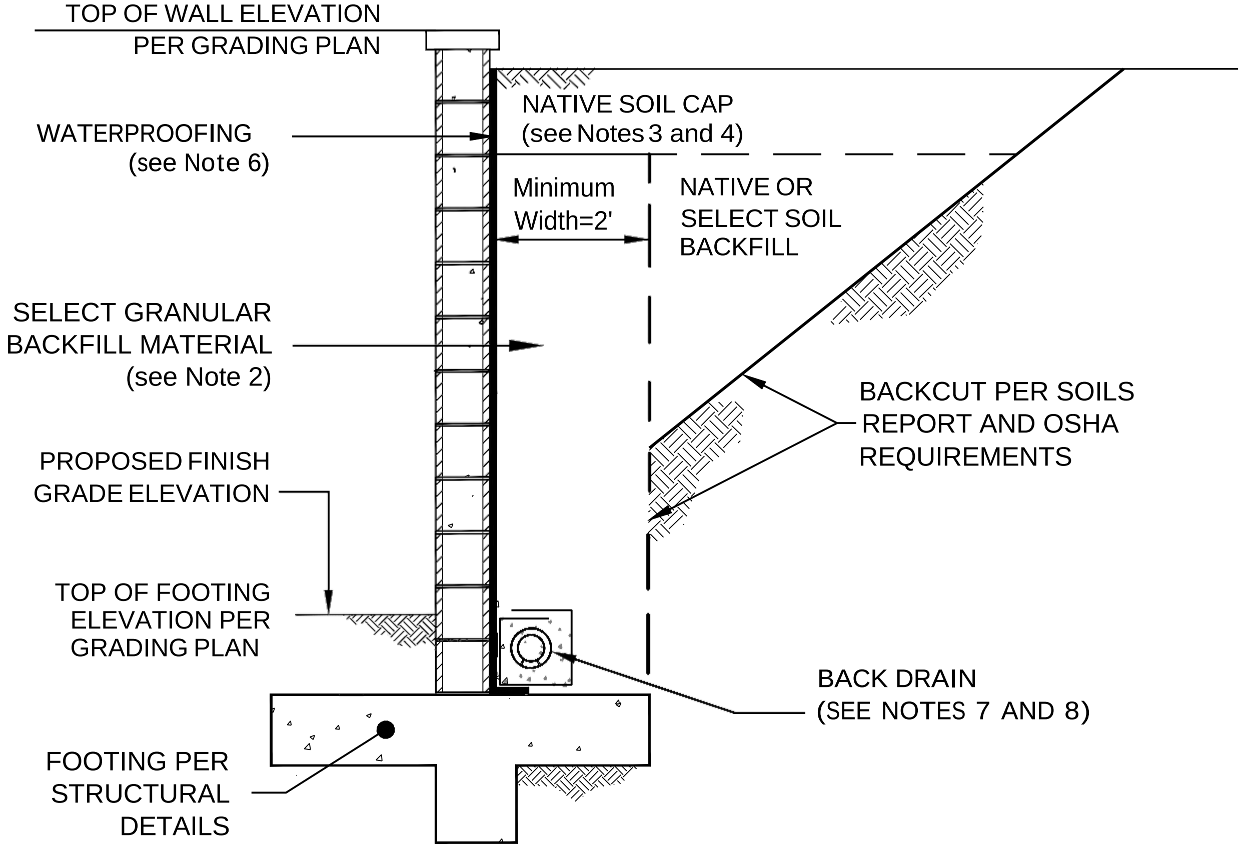
Tsunami Inundation Area

TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

GMU

Date: September 10, 2019		**Plate** 4
Project No.: 17-206-01		

DRAWING: q:\2017\17-206-01\dwg\1716100_plate 4_tsunami inundation map.dwg PLOTTED: 9/9/2019 4:32 PM BY: Jmeza



RETAINING WALL DETAIL

NOT TO SCALE

1. FINAL DETERMINATION OF THE MATERIAL TO BE USED FOR BACKFILL SHALL BE MADE BY GMU.
2. ALL SELECT BACKFILL TO WITHIN 1 TO 2 FEET OF FINAL GRADE SHOULD CONSIST OF FREE-DRAINING GRANULAR MATERIAL (I.E. SE 30 SAND, PEA GRAVEL, OR CRUSHED ROCK). CRUSHED ROCK, IF USED, SHOULD BE WRAPPED IN FILTER FABRIC (MIRAFI 140N OR EQUIVALENT) TO MINIMIZE THE POTENTIAL FOR MIGRATION OF FINES INTO THE ROCK. THE SELECT BACKFILL SHOULD BE MOISTURE CONDITIONED TO ACHIEVE OVER OPTIMUM MOISTURE CONTENT PER THE SOILS REPORT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.
3. FINE-GRAINED NATIVE SOILS SHOULD BE USED TO CAP THE SELECT BACKFILL ZONE.
4. ALL NATIVE OR SELECT SOIL WALL BACKFILL SHOULD BE MOISTURE CONDITIONED AS NECESSARY TO OVER OPTIMUM MOISTURE CONTENT PER THE SOILS REPORT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.
5. THE BACKSIDE OF THE WALLS SHOULD BE WATERPROOFED DOWN TO AND ACROSS THE TOP OF THE FOOTING. THE DESIGN AND SELECTION OF THE WATERPROOFING SYSTEM IS OUTSIDE OF THE PURVIEW OF GMU.
6. THE WATERPROOFING SYSTEM AND ANY DRAIN BOARDS SHOULD BE PROTECTED FROM DAMAGE BY CONSTRUCTION ACTIVITIES. THE TOP EDGE OF THE WATERPROOFING AND ANY DRAIN BOARDS SHOULD BE PROPERLY ADHERED TO THE WALL AND SEALED TO PREVENT THE POSSIBLE ACCUMULATION OF DEBRIS BETWEEN THE DRAINAGE/WATERPROOFING SYSTEM AND THE WALL.
7. THE BACKDRAIN SYSTEM SHOULD CONSIST OF 4" PERFORATED PIPE SURROUNDED BY AT LEAST ONE CUBIC FOOT OF 3/4"-1.5" OPEN GRADED GRAVEL WRAPPED IN MIRAFI 140N FILTER FABRIC (OR EQUIVALENT). THE PERFORATED PIPE SHOULD CONSIST OF SDR-35 OR SCHEDULE 40 PVC PIPE (OR APPROVED EQUIVALENT) LAID ON AT LEAST 2" OF CRUSHED ROCK WITH THE PERFORATIONS LAID DOWN. THE BACKDRAIN GRADIENT SHOULD NOT BE LESS THAN 1% WHEN POSSIBLE. THE PERFORATED PIPE SHOULD OUTLET INTO AREA DRAINS OR OTHER SUITABLE OUTLET POINTS AT RUNS OF 200 FEET OR LESS, IF PRACTICAL. IF THE BACKDRAINS CANNOT BE OUTLETED BY GRAVITY FLOW, A SUMP PUMP SYSTEM WILL NEED TO BE DESIGNED AND CONSTRUCTED. REDUNDANT BACK-UP PUMPS OR COMPONENTS ARE RECOMMENDED. DESIGN OF THIS SYSTEM IS OUTSIDE OF THE PURVIEW OF GMU.
8. THE TIE-IN LOCATIONS FOR BACKDRAIN OUTLETS SHOULD BE SHOWN ON THE PRECISE GRADING, SITE WALL, AND/OR LANDSCAPE PLANS.

GMU	RETAINING WALL CONSTRUCTION DETAIL	PLATE 5

APPENDIX A

Geotechnical Exploration Procedures and Logs

APPENDIX A

GMU GEOTECHNICAL EXPLORATION PROCEDURES AND LOGS

Our exploration at the subject site consisted of thirteen (13) drill holes to a maximum depth of 51 feet below the existing grade, and ten (10) Cone Penetration Testing (CPT) soundings to a maximum depth of 34 feet below the existing grade. Our drill holes were logged by a Certified Engineering Geologist or Engineer, and drive, bulk, and SPT samples of the excavated soils were collected. The logs of each drill hole are contained in this Appendix A, and the Legend to Logs is presented as Plates A-1 and A-2. The CPT data are presented in Appendix A-1. The approximate locations of the drill holes and CPT's are shown on Plate 2 – Geotechnical Map.

"Undisturbed" samples were taken using a 3.25-inch outside-diameter drive sampler which contains a 2.416-inch-diameter brass sample sleeve 6 inches in length. Standard penetration testing (SPT) with a 2.0-inch outside diameter split spoon sampler without liners was performed in the borings during advancement. Blow counts recorded during sampling from the drive sampler and SPT are shown on the drill hole logs.

The geologic and engineering field descriptions and classifications that appear on these logs are prepared according to Corps of Engineers and Bureau of Reclamation standards. Major soil classifications are prepared according to the Unified Soil Classification System as modified by ASTM Standard No. 2487. Since the descriptions and classifications that appear on the Log of Borings are intended to be that which most accurately describe a given interval of a boring (frequently an interval of several feet), discrepancies do occur in the Unified Soil Classification System nomenclature between that interval and a particular sample in that interval. For example, an 8-foot-thick interval in a log may be identified as silty sand (SM) while one sample taken within the interval may have individually been identified as sandy silt (ML). This discrepancy is frequently allowed to remain to emphasize the occurrence of local textural variations in the interval.

MAJOR DIVISIONS			Group Letter	Symbol	TYPICAL NAMES
COARSE-GRAINED SOILS More Than 50% Retained On No.200 Sieve. Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**GRAVELS** 50% or More of Coarse Fraction Retained on No.4 Sieve	Clean Gravels	GW		Well Graded Gravels and Gravel-Sand Mixtures, Little or No Fines.
			GP		Poorly Graded Gravels and Gravel-Sand Mixtures Little or No Fines.
		Gravels With Fines	GM		Silty Gravels, Gravel-Sand-Silt Mixtures.
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures.
	SANDS More Than 50% of Coarse Fraction Passes No.4 Sieve	Clean Sands	SW		Well Graded Sands and Gravelly Sands, Little or No Fines.
			SP		Poorly Graded Sands and Gravelly Sands, Little or No Fines.
		Sands With Fines	SM		Silty Sands, Sand-Silt Mixtures.
			SC		Clayey Sands, Sand-Clay Mixtures.
FINE-GRAINED SOILS 50% or More Passe The No.200 Sieve. Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**SILTS AND CLAYS** Liquid Limit Less Than 50%		ML		Inorganic Silts, Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity.
			CL		Inorganic Clays of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit 50% or Greater		MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts.
			CH		Inorganic Clays of High Plasticity, Fat Clays.
			OH		Organic Clays of Medium To High Plasticity, Organic Silts.
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils.

The descriptive terminology of the logs is modified from current ASTM Standards to suit the purposes of this study

ADDITIONAL TESTS

- DS = Direct Shear
- HY = Hydrometer Test
- TC = Triaxial Compression Test
- UC = Unconfined Compression
- CN = Consolidation Test
- (T) = Time Rate
- EX = Expansion Test
- CP = Compaction Test
- PS = Particle Size Distribution
- EI = Expansion Index
- SE = Sand Equivalent Test
- AL = Atterberg Limits
- FC = Chemical Tests
- RV = Resistance Value
- SG = Specific Gravity
- SU = Sulfates
- CH = Chlorides
- MR = Minimum Resistivity
- pH
- (N) = Natural Undisturbed Sample
- (R) = Remolded Sample
- CS = Collapse Test/Swell-Settlement

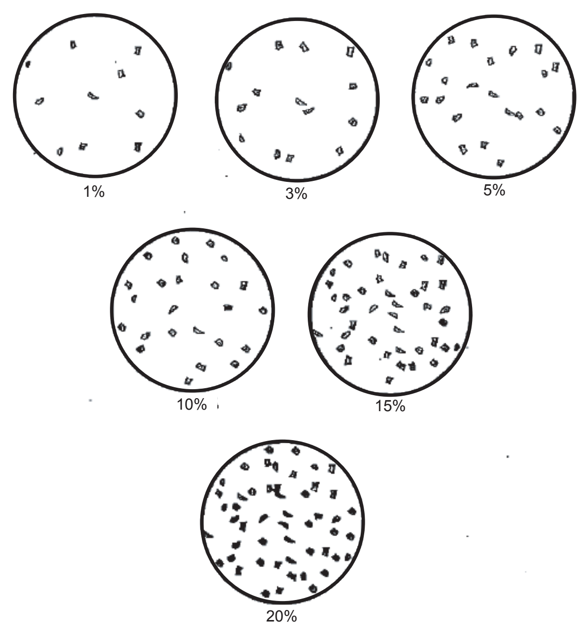
GEOLOGIC NOMENCLATURE

B = Bedding C = Contact J = Joint
F = Fracture Flt = Fault S = Shear
RS = Rupture Surface = Seepage
= Groundwater

SAMPLE SYMBOLS

- Undisturbed Sample (California Sample)
- Undisturbed Sample (Shelby Tube)
- Bulk Sample
- Unsuccessful Sampling Attempt
- SPT Sample

10: 10 Blows for 12-Inches Penetration
6/4: 6 Blows Per 4-Inches Penetration
P: Push
(13): Uncorrected Blow Counts ("N" Values) for 12-Inches Penetration- Standard Penetration Test (SPT)



GMU	**LEGEND TO LOGS** ASTM Designation: D 2487 (Based on Unified Soil Classification System)	Plate **A-1**

P8-11/16/2012

SOIL DENSITY/CONSISTENCY

FINE GRAINED

Consistency	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Soft	Easily penetrated by thumb, exudes between fingers	<2	<3
Soft	Easily penetrated one inch by thumb, molded by fingers	2-4	3-6
Firm	Penetrated over 1/2 inch by thumb with moderate effort	4-8	6-12
Stiff	Penetrated about 1/2 inch by thumb with great effort	8-15	12-25
Very Stiff	Readily indented by thumbnail	15-30	25-50
Hard	Indented with difficulty by thumbnail	>30	>50

COARSE GRAINED

Density	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Loose	Easily penetrated with 0.5" rod pushed by hand	<4	<5
Loose	Easily penetrated with 0.5" rod pushed by hand	4-10	5-12
Medium Dense	Easily penetrated 1' with 0.5" rod driven by 5lb hammer	10-30	12-35
Dense	Dificult to penetrat 1' with 0.5" rod driven by 5lb hammer	31-50	35-60
Very Dense	Penetrated few inches with 0.5" rod driven by 5lb hammer	>50	>60

BEDROCK HARDNESS

Density	Field Test	SPT (#blows/foot)
Soft	Can be crushed by hand, soil like and structureless	1-30
Moderately Hard	Can be grooved with fingernails, crumbles with hammer	30-50
Hard	Can't break by hand, can be grooved with knife	50-100
Very Hard	Scratches with knife, chips with hammer blows	>100

MODIFIERS

Trace	1%
Few	1-5%
Some	5-12%
Numerous	12-20%
Abundant	>20%

GRAIN SIZE

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than a basketball
Cobbles		3-12"	3-12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4-3"	3/4-3"	Thumb-sized to fist-sized
	Fine	#4-3/4"	0.19-0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19"	Rock-salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079"	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017"	Flour-sized to sugar-sized
Fines		passing #200	<0.0029"	Flour-sized and smaller

MOISTURE CONTENT

Dry- Very little or no moisture
Damp- Some moisture but less than optimum
Moist- Near optimum
Very Moist- Above optimum
Wet/Saturated- Contains free moisture

GMU

LEGEND TO LOGS
ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
A-2

Project: Dana Point Harbor, Hotel Component	Log of Drill Hole DH- 1
Project Location: Dana Point Harbor Drive	Sheet 1 of 3
Project Number: 17-206-01	

Date(s) Drilled	**9/10/2018**	Logged By	**WD**	Checked By	**KMF**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**51.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**10.2**
Groundwater Depth [Elevation], feet	**10.0 [0.2]**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks				Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
10			**ARTIFICIAL FILL (Qaf)**		Asphalt Concrete (approximately 4 inches)						
					Aggregate Base (approximately 4 inches)						
					SILTY CLAYEY SAND (SC), yellowish brown, moist, medium dense, medium grained						
							5 4 7	140			
5	5		Interbedded sand, silty sand, and sandy silt		yellow brown to grayish brown, moist, medium dense		10 14 17	140	9	125	
					SAND and CLAYEY SAND (SC), brown, grayish brown and pale brown, moist to very moist, medium dense, medium grained, trace gravel		3 5 7	140			
0	10				∇		7 5 5	140			
-5	15				SAND and SILTY SAND (SM), gray and brownish gray, very moist, very dense, fine grained		4 50/6"	140			

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-10					SILTY SAND (SM), grayish brown to dark gray, wet, medium dense, fine to medium grained, some clay		7 7 8	140	10	115	
-15	25		**<u>CAPISTRANO FORMATION (Tc)</u>** Rare mottles of gray and orange brown. Tip of sampler has SILTSTONE, pale brown and gray, minor fine sand.		SAND (SP), pale brown, wet, very dense, fine grained		35 50/5"	140			
-20	30		Rare gravel up to 0.5"		SANDSTONE (SP) and SILTSTONE (ML), gray with pale brown, slightly moist, very dense to hard, fine grained		30 50/2"	140	18	110	
-25	35		Rare orange brown mottles		SANDSTONE (SP) and SILTSTONE (ML), pale yellowish gray, gray and brownish gray, moist, very dense to hard, fine to medium grained		50/6"	140			
-30	40		Orange brown mottles		SANDY SILTSTONE (ML), dark gray, wet, hard, fine grained		40 50/2"	140	18	107	

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-35			Thinly bedded		SILTSTONE, SANDSTONE and SILTY SANDSTONE (ML), dark gray, gray and black, wet, hard, fine grained		30 50/5"	140			
-40	50				SANDSTONE (SP), dark gray, moist, very dense, fine to medium grained		30 50/4"	140	20	106	
					Total Depth: 51' Groundwater encountered at 10'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

Project: Dana Point Harbor, Hotel Component	**Log of Drill Hole DH- 2**
Project Location: Dana Point Harbor Drive	Sheet 1 of 1
Project Number: 17-206-01	

Date(s) Drilled	**9/10/2018**	Logged By	**WD**	Checked By	**KMF**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**6.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**10.3**
Groundwater Depth [Elevation], feet	**Not encountered []**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks	**Used for percolation testing**			Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
10			**ARTIFICIAL FILL (Qaf)** Interbedded sand and silty sand		Asphalt Concrete (approximately 3.5 inches)						
					Aggregate Base (approximately 2.5 inches)						
					SILTY CLAYEY SAND (SC), pale brown, brown and dark brown, moist, medium dense, medium grained						
			Gravel fragments				8 14 25	140	8	118	
5	5				yellow brown and gray, moist, medium dense		4 6 10	140			
					Total Depth = 6.5' Groundwater not encountered						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component **Project Location: Dana Point Harbor Drive** **Project Number: 17-206-01**	# Log of Drill Hole DH- 3

Date(s) Drilled	**9/10/2018**	Logged By	**WD**	Checked By	**KMF**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**6.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**12.0**
Groundwater Depth [Elevation], feet	**Not encountered []**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks	**Used for percolation testing**			Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL (Qaf)		Asphalt Concrete (approximately 3.5 inches)						
					Aggregate Base (approximately 3.5 inches)						
10					SAND and SILTY SAND (SM), yellow brown, brown and brownish gray, slightly moist, loose, fine to medium grained.						
					SILTY CLAYEY SAND (SC), yellow brown to gray browh, moist, loose		4 3 3	140			
	5						4 5 6	140			
					Total Depth = 6.5' Groundwater not encountered						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component	**Log of Drill Hole DH- 4**
Project Location: Dana Point Harbor Drive	Sheet 1 of 1
Project Number: 17-206-01	

Date(s) Drilled	**9/10/2018**	Logged By	**WD**	Checked By	**KMF**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**6.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**10.9**
Groundwater Depth [Elevation], feet	**Not encountered []**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks	**Used for percolation testing**			Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL (Qaf)		Asphalt Concrete (approximately 5 inches)						
10					SILTY CLAYEY SAND (SC), brown and dark brown, moist, loose, fine to medium grained						
			Rare gravel, black mottles				3 3 4	140			
5	5				yellow brown to grayish brown, moist to very moist, medium dense, medium grained		5 11 18	140	11	108	
					Total Depth = 6.5' Groundwater not encountered						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH- 6

Date(s) Drilled	9/10/2018	Logged By	WD	Checked By	KMF
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling	Total Depth of Drill Hole	51.0 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	12.3
Groundwater Depth [Elevation], feet	15.0 [-2.7]	Sampling Method(s)	Cal-mod sampler with 6-inch sleeve, SPT, and bulk	Drill Hole Backfill	Native and Quickrete
Remarks				Driving Method and Drop	Autohammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		**ARTIFICIAL FILL (Qaf)**		Asphalt Concrete (approximately 3.5 inches)						
					Aggregate Base (approximately 3.5 inches)						
					SANDY CLAY (CL), brown and pale brown, slightly moist, medium dense, some clay						
10			Gravel up to 0.5". Orange brown, brown and black mottles. Rare roots.				5 10 8	140	15	105	
					SILTY CLAYEY SAND (SC), pale yellowish brown to pale greenish brown, moist, loose, fine grained, trace clay						
	5		Rare gravel up to 0.75"				5 4 5	140			
5			Rare gravel up to 0.5"		SILTY SAND (SM) to CLAYEY SAND (SC), pale brownish gray, moist, medium dense, fine grained, fragements of silty clay		6 9 12	140	15	117	
	10		Rare gravel up to 0.75"				4 3 3	140			
0											
	15		**MARINE DEPOSITS (Qm)**		SAND (SP) to SILTY SAND (SM), pale gray, wet, medium dense, medium to fine grained		5 6 8	140	16	101	
-5											

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH- 6

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			Sandstone fragments in tip of sampler		SAND with GRAVEL (SP), brown, wet, very dense, fine to medium grained		50/6"	140			
-10											
	25		**CAPISTRANO FORMATION (Tc)** White mottles		CLAYSTONE (CL) and SILTSTONE (ML), very dark gray, moist to wet, stiff		7 17 50/5"	140	22	95	
-15											
	30		Interbeds of SILTSTONE, dark gray, moist, very dense,		SANDSTONE (SP), gray and orange brown, wet, very dense, fine to medium grained		6 20 40	140			
-20											
	35		Orange brown mottles		SANDSTONE (SP), grayish brown, wet, very dense, medium to fine grained		20 50/5"	140	13	117	
-25											
	40				SANDSTONE (SP), brownish gray, moist to wet, very dense, medium to fine grained		40 50/5"	140			
-30											

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH- 6

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
					SANDSTONE (SP), pale gray, wet, very dense, medium to coarse grained		40 50/5"	140	14	116	
-35											
	50		Tan and orange brown mottles		SANDSTONE (SP), pale brownish gray, wet, very dense, medium to fine grained		40 50/5"	140			
					Total Depth = 51' Groundwater encountered @ 15'						

Project: Dana Point Harbor, Hotel Component Project Location: Dana Point Harbor Drive Project Number: 17-206-01	**Log of Drill Hole DH-15** Sheet 1 of 2

Date(s) Drilled	9/11/2018	Logged By	WD	Checked By	KMF
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling	Total Depth of Drill Hole	31.0 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	19.4
Groundwater Depth [Elevation], feet	20.0 [-0.6]	Sampling Method(s)	Cal-mod sampler with 6-inch sleeve, SPT, and bulk	Drill Hole Backfill	Native and Quickrete
Remarks				Driving Method and Drop	Autohammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					Asphalt Concrete (approximately 6 inches)						
			CAPISTRANO FORMATION (Tc)		SANDSTONE (SP), pale yellowish brown, slightly moist, very dense, fine to coarse grained						
			Gravel up to 1". Orange brown mottles.				40 50/4"	140			
15	5						50/6"	140	6	116	
							50/6"	140			
10	10		Scattered gravel up to 0.25", sand is coarse grained				50/6"	140	7	125	
5	15		Gravel up to 0.5"		SANDSTONE with GRAVEL (SP), yellowish brown, moist, very dense, coarse to medium grained		40 50/4"	140			
0											

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					GRAVELLY SANDSTONE (SP), yellowish brown, wet, very dense, coarse to medium grained		50/5"	140	11	117	
-5											
	25		Rare gravel up to 0.25". Orange brown mottles, thinly interbedded SILTSTONE and SANDSTONE		SILTSTONE and SANDSTONE (SP),olive brown, moist, very dense, fine to medium grained		38 50/5"	140			
-10											
	30				SANDSTONE (SP), olive brown, wet, very dense, fine grained		50/6"	140	16	112	
					Total Depth = 31' Groundwater encountered @ 20'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-42

Date(s) Drilled	9/18/2018	Logged By	WD	Checked By	KMF
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	17.6
Groundwater Depth [Elevation], feet	11.8 [5.8]	Sampling Method(s)	Cal-mod sampler with 6-inch sleeve, SPT, and bulk	Drill Hole Backfill	Native and Quickrete
Remarks				Driving Method and Drop	Autohammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			ARTIFICIAL FILL (Qaf)		Asphalt Concrete (approximately 6 inches)						
					Aggregate Base (approximately 6 inches)						
					CLAYEY SAND (SC), dark brown, slightly moist, medium dense, fine grained						
15			Scattered gravel to 1". Tip of sampler: Sand, pale brownish gray, fine grained.				3 4 6	140			
	5		Orange brown mottles.		SILTY CLAYEY SAND (SC), pale brown and pale brownish gray, slightly moist, very dense, fine grained		12 21 24	140	13	106	
10			Rare gravel		brownish gray and gray, moist, medium dense, fine grained		5 9 14	140			
	10				SAND (SP) and SILTY SAND (SM), brown, slightly moist, dense, fine grained, some clay		6 14 23	140	13	117	
5			**MARINE DEPOSITS (Qm)**		SAND (SP) and SILTY SAND (SM), brown and dark brown, slightly moist, medium dense, fine grained		7 12 11	140			
	15				SAND (SP), dark gray, gray and orange brown, wet, medium dense, medium to coarse grained		4 4 5	140	13	115	
0											

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			CAPISTRANO FORMATION (Tc) Rare gravel up to 1"		SANDSTONE (SP), pale gray and gray, wet, very dense, fine to medium grained		13 35 50/5"	140			
					Total Depth = 21.5' Groundwater encountered @ 11.8'						

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-43

Date(s) Drilled	9/18/2018	Logged By	WD	Checked By	KMF
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling	Total Depth of Drill Hole	26.0 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	16.5
Groundwater Depth [Elevation], feet	12.0 [4.5]	Sampling Method(s)	Cal-mod sampler with 6-inch sleeve, SPT, and bulk	Drill Hole Backfill	Native and Quickrete
Remarks				Driving Method and Drop	Autohammer

ELEVATION, feet	DEPTH, feet	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
16.5	0	**ARTIFICIAL FILL (Qaf)**		Asphalt Concrete (approximately 5 inches)					
				Aggregate Base (approximately 3 inches)					
15				CLAYEY SAND (SC), brown, slightly moist, medium dense, fine grained					
		Scattered gravel to 1".			4 7 8	140			
	5			CLAYEY SAND (SC), brown and reddish brown, moist, very dense, fine grained	7 11 18	140	10	121	
10									
				CLAYEY SAND (SC), brownish gray and gray, moist, medium dense, fine grained	6 6 8	140			
	10	Rare gravel		SAND and SILTY SAND (SM), brownish gray, wet, medium dense, fine grained	5 5 7	140	17	111	
5				∇					
		MARINE DEPOSITS (Qm)		SAND (SP) and GRAVELLY SAND(SP), dark gray, gray and brown, wet, medium dense, fine grained	3 13 10	140			
	15	**CAPISTRANO FORMATION (Tc)** Moderately well defined bedding		SANDSTONE (SP) interbedded with SILTSTONE (ML), pale gray, gray and brown, wet to slightly moist, very dense, medium to fine grained	35 50/3"	140	16	114	
0									

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-43

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-5	25		Sand grades downwards from fine to coarse		SANDSTONE (SP), pale gray, yellow gray and orange brown, wet, very dense, fine to coarse grained		27 50	140			
							50/4"	140			
					Total Depth = 26' Groundwater encountered @ 12'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-44

Date(s) Drilled	9/18/2018	Logged By	WD	Checked By	KMF
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling	Total Depth of Drill Hole	26.0 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	10.7
Groundwater Depth [Elevation], feet	12.5 [-1.8]	Sampling Method(s)	Cal-mod sampler with 6-inch sleeve, SPT, and bulk	Drill Hole Backfill	Native and Quickrete
Remarks				Driving Method and Drop	Autohammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
10			**ARTIFICIAL FILL (Qaf)**		Asphalt Concrete (approximately 4 inches)				9		
					Aggregate Base (approximately 5 inches)						
					SILTY CLAYEY SAND (SC), brown and brownish gray, slightly moist, medium dense, fine grained						
			Scattered gravel to 2".				4 7 8	140			
5	5		Dark brown and brown				10 22 30	140	14	113	
			MARINE DEPOSITS (Qm)		SILTY SAND (SM), brown and gray, wet, loose, fine grained		3 3 3	140			
0	10				SILTY SAND (SM), grayish brown, wet, medium dense, fine to medium grained, some clay		7 9 10	140	12	116	
			Rare gravel to 0.5"		SILTY SAND (SM), brownish gray, wet, medium dense, fine grained, some clay		6 7 6	140			
-5	15		**CAPISTRANO FORMATION (Tc)** Thinly bedded		CLAYSTONE (CL), dark gray, moist, stiff		4 8 16	140	24	94	

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component	Log of Drill Hole DH-44
Project Location: Dana Point Harbor Drive	Sheet 2 of 2
Project Number: 17-206-01	

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-10					SANDSTONE (SP) interbedded with CLAYSTONE (CL), very dark gray and gray, slightly moist, hard		13 34 50/5"	140			
-15	25				SANDSTONE (SP), pale gray, yellow gray and orange brown, wet, very dense, fine to coarse grained		35 50/3.5"	140	21	99	
					Total Depth = 26' Groundwater encountered at 12.5'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component **Project Location: Dana Point Harbor Drive** **Project Number: 17-206-01**	# Log of Drill Hole DH-45

Date(s) Drilled	**9/18/2018**	Logged By	**WD**	Checked By	**KMF**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**10.6**
Groundwater Depth [Elevation], feet	**15.3 [-4.7]**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks				Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
10			**ARTIFICIAL FILL (Qaf)**		SILTY CLAYEY SAND (SC), brown and pale yellowish brown, slightly moist, medium dense, fine to medium grained	bulk					
					brownish gray, moist, dense, fine to medium grained	SPT	6 10 12	140			
5	5		Abundant gravel up to 5"			Cal-mod	8 18 20	140	14	118	
			Scattered gravel		brown, yellow brown and gray, wet, loose, fine to medium grained	SPT	5 4 5	140			
0	10		**MARINE DEPOSITS (Qm)**		SAND (SP), gray, wet, medium dense, fine to coarse grained	Cal-mod	8 7 8	140	20	107	
			CAPISTRANO FORMATION (Tc)		SANDSTONE (SP), pale yellowish gray, wet, very dense, fine to medium grained	SPT	20 25 40	140			
-5	15				▽	Cal-mod	50/6"	140	15	117	

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-45

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-10			Pale gray and pale yellowish gray				21 31 40	140			
-15	25						50/5"	140	16	114	
-20	30		Thinly bedded		CLAYSTONE (CL), dark gray, moist, hard		4 21 45	140			
					Total Depth = 31' Groundwater encountered at 15.3'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component **Project Location:** Dana Point Harbor Drive **Project Number:** 17-206-01	**Log of Drill Hole DH-47** Sheet 1 of 2

Date(s) Drilled	**4/5/2019**	Logged By	**MTF**	Checked By	**DA**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**30.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**15.5**
Groundwater Depth [Elevation], feet	**12.5 [3.0]**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks				Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
15	0		**ARTIFICIAL FILL (Qaf)**		Grass CLAYEY SAND (SC); light brown, very moist, medium dense to dense, fine to medium grained sand	Bulk	NA	NA			
10	5		Large rock in tip of sampler, ~ retaining 2", white, hard, angular		SILTY CLAY (CL); gray, very moist, hard, with some fine grained sand	Drive	20 23 34	140			
5	10				CLAYEY SAND (SC); light grayish brown, saturated, medium dense, fine to medium grained sand ∇	Drive	5 8 12	140			
0	15		**MARINE DEPOSITS (Qm)** Rock in tip of sampler, ~ retaining 1.5", black, hard, angular		POORLY GRADED SAND (SP); light yellowish gray, saturated, very dense	Drive	50/4"	140			

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-47

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
-5							15 50/6"	140			
-10	25		**CAPISTRANO FORMATION (Tc)**		CLAYSTONE (CL) and SILTSTONE (ML); very dark gray, very moist to saturated, hard		50/5"	140			
	30				Total Depth = 30.0' Groundwater encountered @ 12.5' No Caving		50/5"	140			

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component	Log of Drill Hole DH-48
Project Location: Dana Point Harbor Drive	Sheet 1 of 2
Project Number: 17-206-01	

Date(s) Drilled	**4/5/2019**	Logged By	**MTF**	Checked By	**DA**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**30.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**16.5**
Groundwater Depth [Elevation], feet	**11.0 [5.5]**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks				Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		**ARTIFICIAL FILL (Qaf)**		Grass CLAYEY SAND (SC); light grayish brown, moist, medium dense to dense, medium to coarse grained sand	Bulk	NA	NA			
15											
	5				Becomes gray		20 18 32	140			
10											
	10		Large rock at top of sampler, ~ retaining 2", white, hard, angular		Becomes light gray with orange staining, very moist to saturated, medium dense ∇		20 10 8	140			
5			Hard drilling, (rock)								
	15				SILTY SAND (SM); light yellowish brown and orange, very moist to saturated, very dense, fine to coarse sand, some fine to coarse grained gravel		50/5"	140			
0			Hard drilling, (rock)								

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

Project: Dana Point Harbor, Hotel Component
Project Location: Dana Point Harbor Drive
Project Number: 17-206-01

Log of Drill Hole DH-48

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			MARINE DEPOSITS (Qm)		POORLY GRADED SAND (SP); light gray and pale yellow, very moist to saturated, very dense, fine grained sand		50/6"	140			
-5											
	25				Orange staining is present		50/6"	140			
-10											
	30		**CAPISTRANO FORMATION (Tc)**				50/5"	140			
					CLAYSTONE (CL) and SILTSTONE (ML); very dark gray, moist to wet, moderately hard Total Depth = 30.5' Groundwater encountered @ 11.0' No Caving						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

GMU

Project: Dana Point Harbor, Hotel Component	**Log of Drill Hole DH-50**
Project Location: Dana Point Harbor Drive	Sheet 1 of 2
Project Number: 17-206-01	

Date(s) Drilled	**4/17/19**	Logged By	**DW**	Checked By	**DA**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**ABC Drilling**	Total Depth of Drill Hole	**25.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**17.6**
Groundwater Depth [Elevation], feet	**18.0 [-0.4]**	Sampling Method(s)	**Cal-mod sampler with 6-inch sleeve, SPT, and bulk**	Drill Hole Backfill	**Native and Quickrete**
Remarks				Driving Method and Drop	**Autohammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		**ARTIFICIAL FILL (Qafc)**		Asphalt Concrete - approximately 6 inches						
			Very homogeneous		SILTY SAND (SM); olive yellow, damp, dense, fine to medium grained sand	bulk					
15											
	5		**CAPISTRANO FORMATION, OSO MEMBER (Tco)** Some oxidation patches		SANDSTONE (SM); pale yellow with orange staining, damp, moderately hard, fine to coarse grained sand		50/6"	140			
10											
	10		Thin beds of laminated siltstone		CLAYEY SILTSTONE (ML); grayish black, damp, hard		50/6"	140			
					SANDSTONE (SM); yellowish white with orange staining, damp, moderately hard, fine to coarse grained sand						
5											
	15		Approximately 4" zone of heavy oxidation, nearly horizontal contact between oxidized and non-oxidized		Becomes very moist, orange with beds of yellowish white		37 50/4"	140			
0											
			Groundwater		∇						

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			CAPISTRANO FORMATION, OSO MEMBER (Tco) Sample saturated		SANDSTONE (SM); yellowish white, very moist/saturated, moderately hard, fine to coarse grained sand		13 50/4"	140			
-5											
	25						50/6"	140			
					Total Depth = 25' Groundwater encountered at 18'						

DH_REV3 17-206-01 (UPDATED ELEV.).GPJ GMULAB.GPJ 8/15/19

APPENDIX A-1

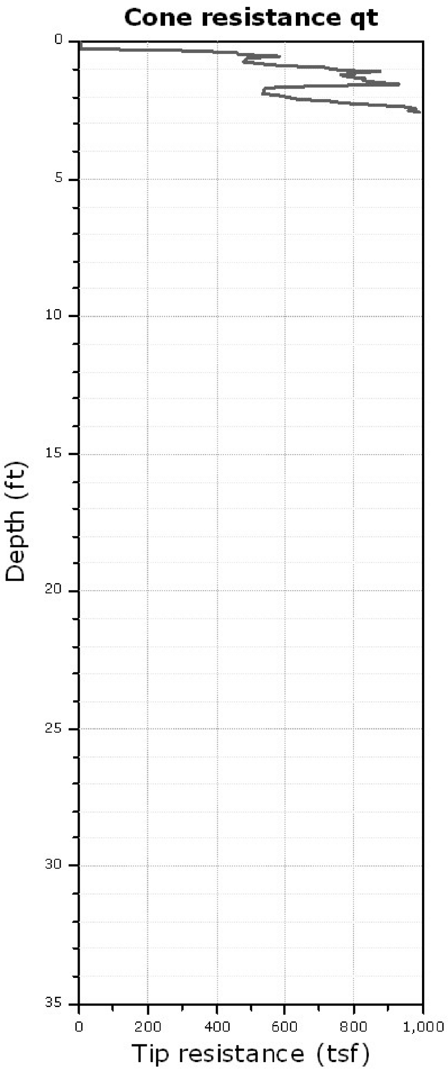
CPT Logs

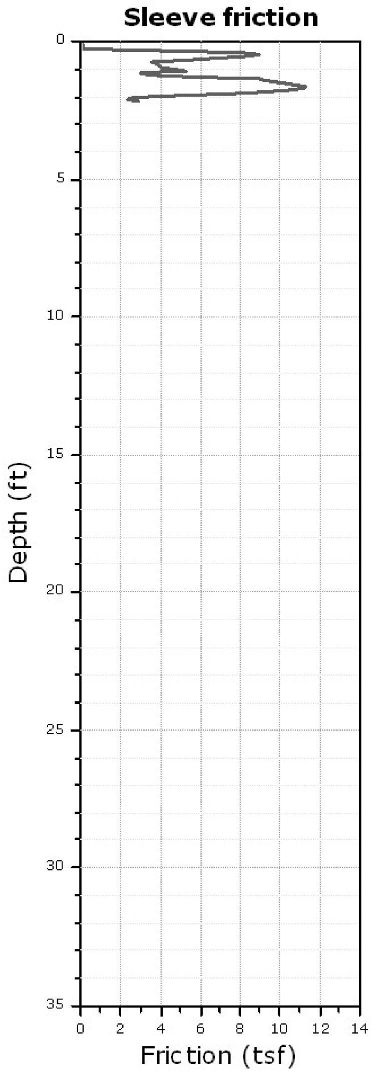
Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

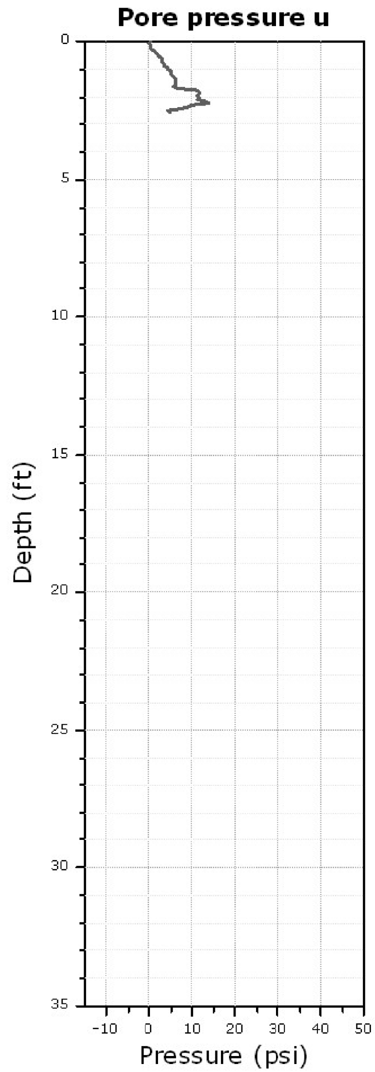
CPT-1

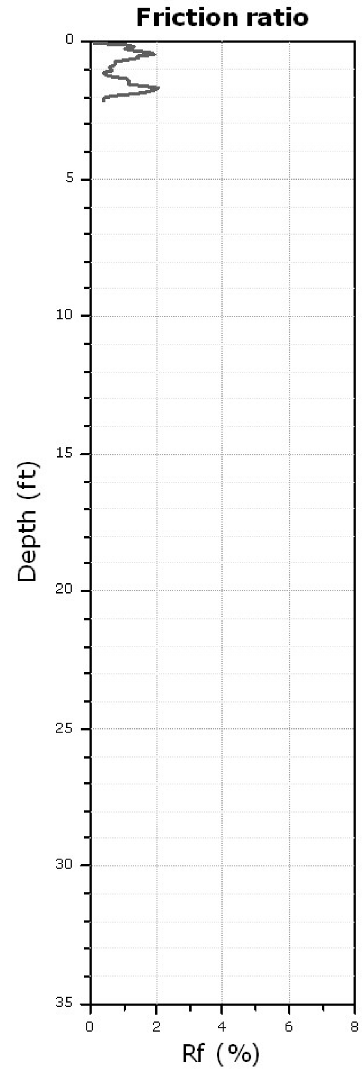
Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

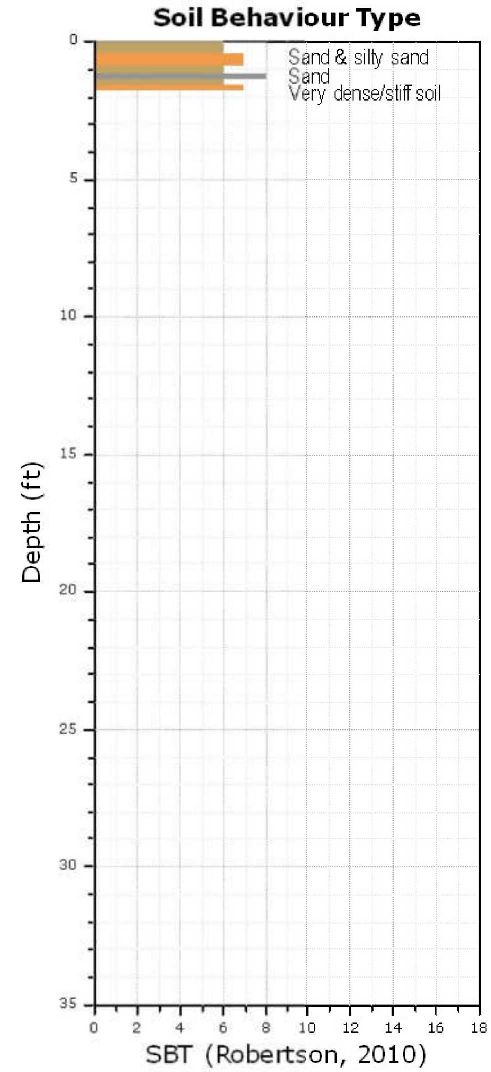
Total depth: 2.56 ft, Date: 9/12/2018
Cone Type: Vertek









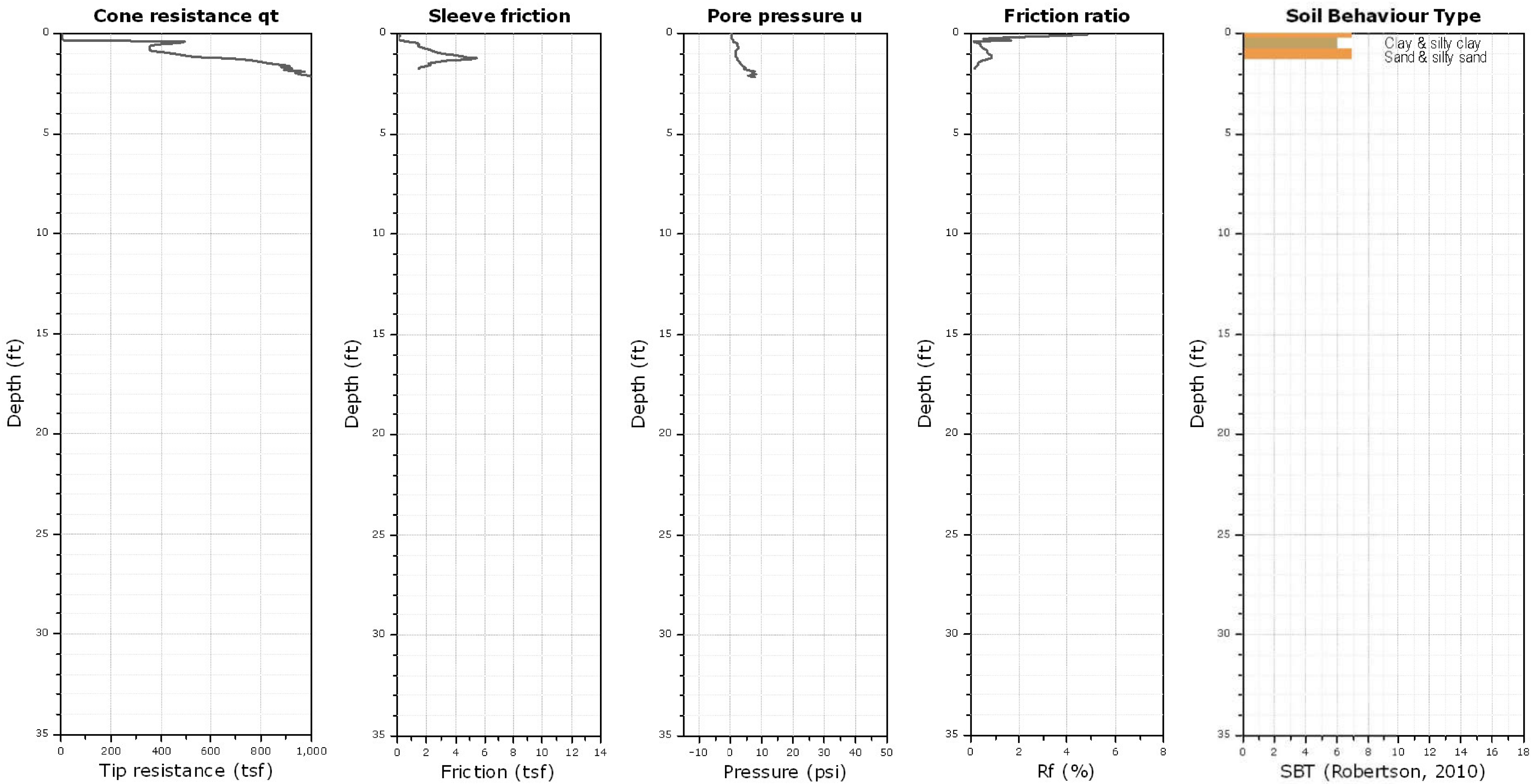


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-2

Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 2.18 ft, Date: 9/12/2018
Cone Type: Vertek

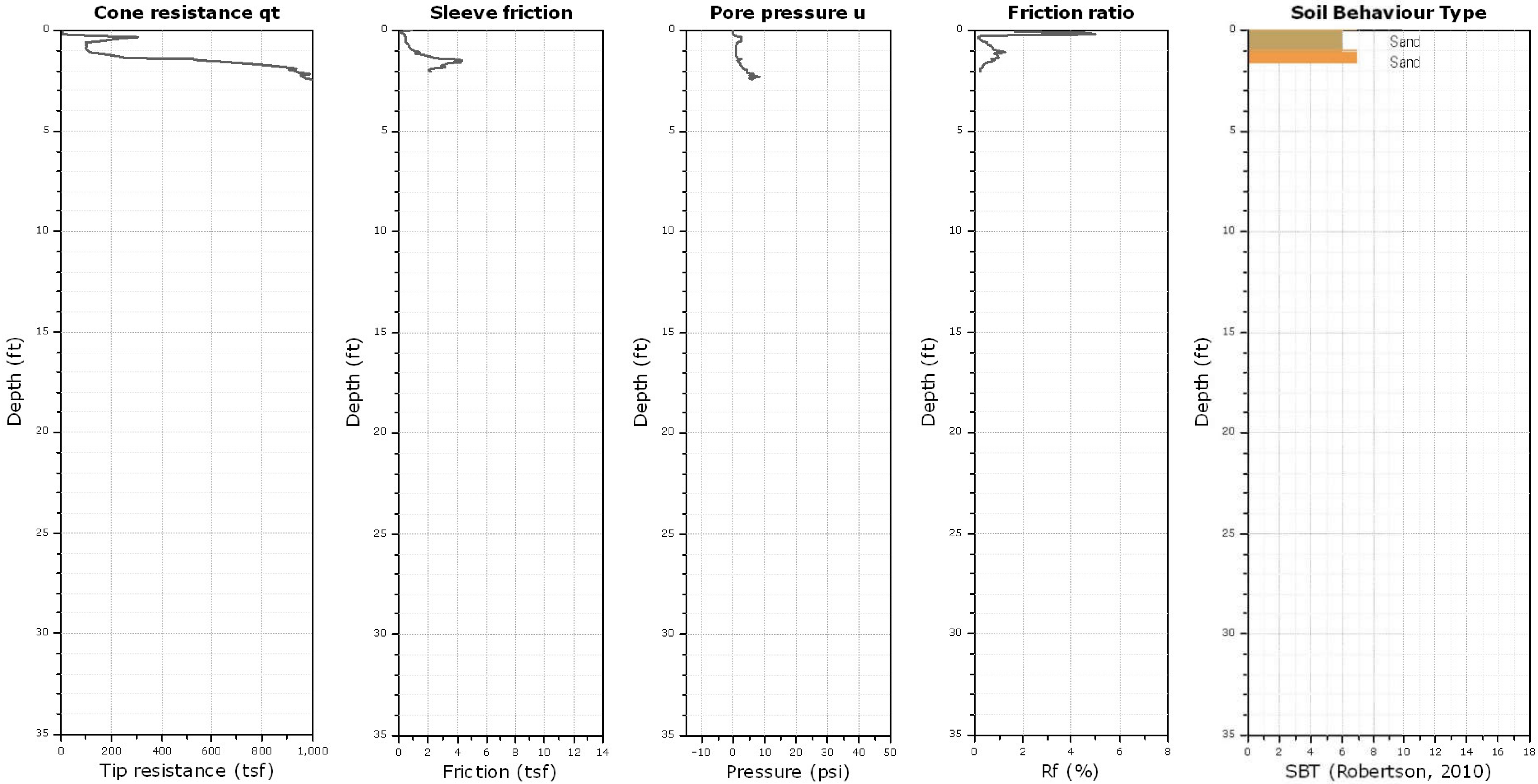


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-3

Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 2.43 ft, Date: 9/12/2018
Cone Type: Vertek

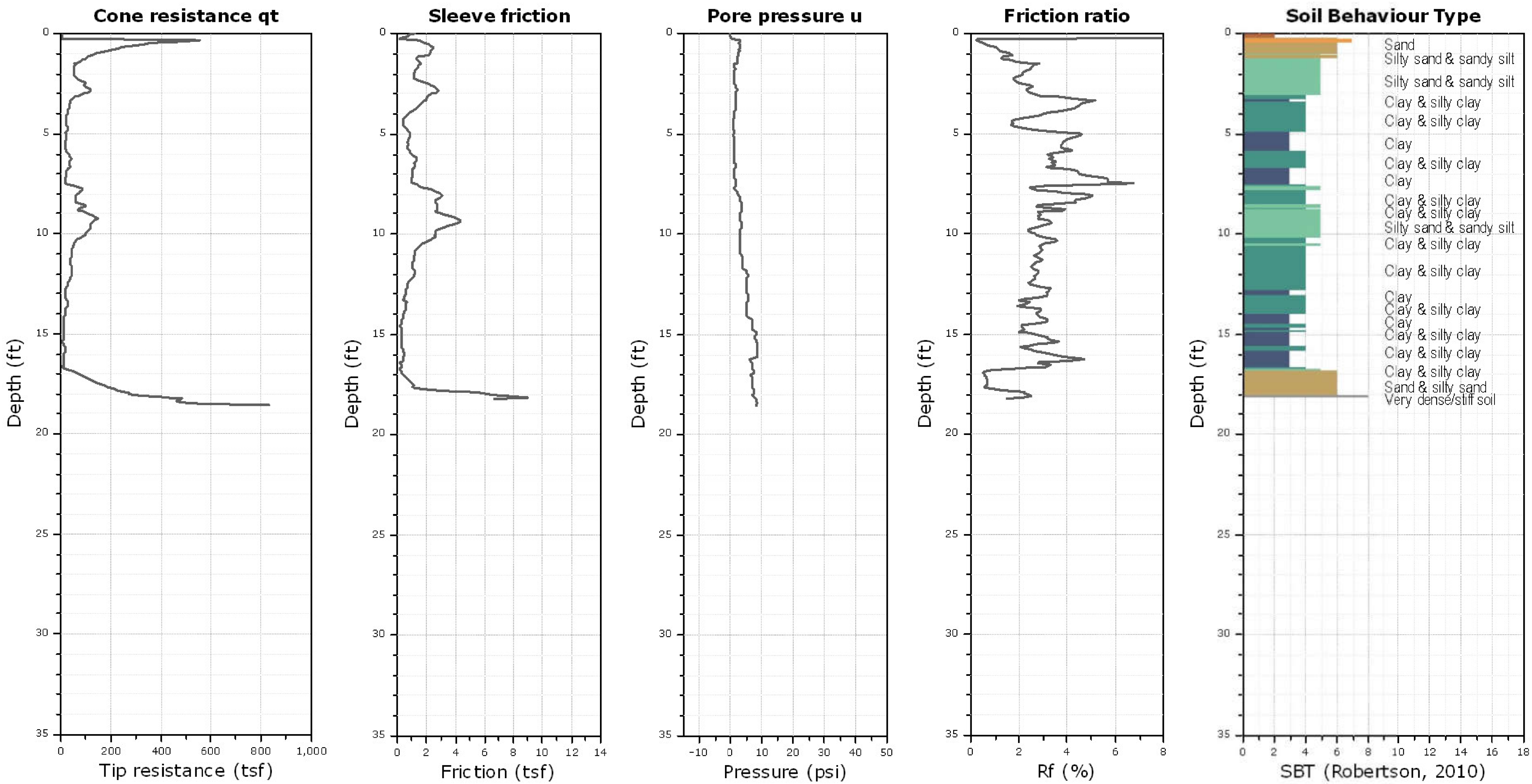


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-4

Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 18.57 ft, Date: 9/12/2018
Cone Type: Vertek



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

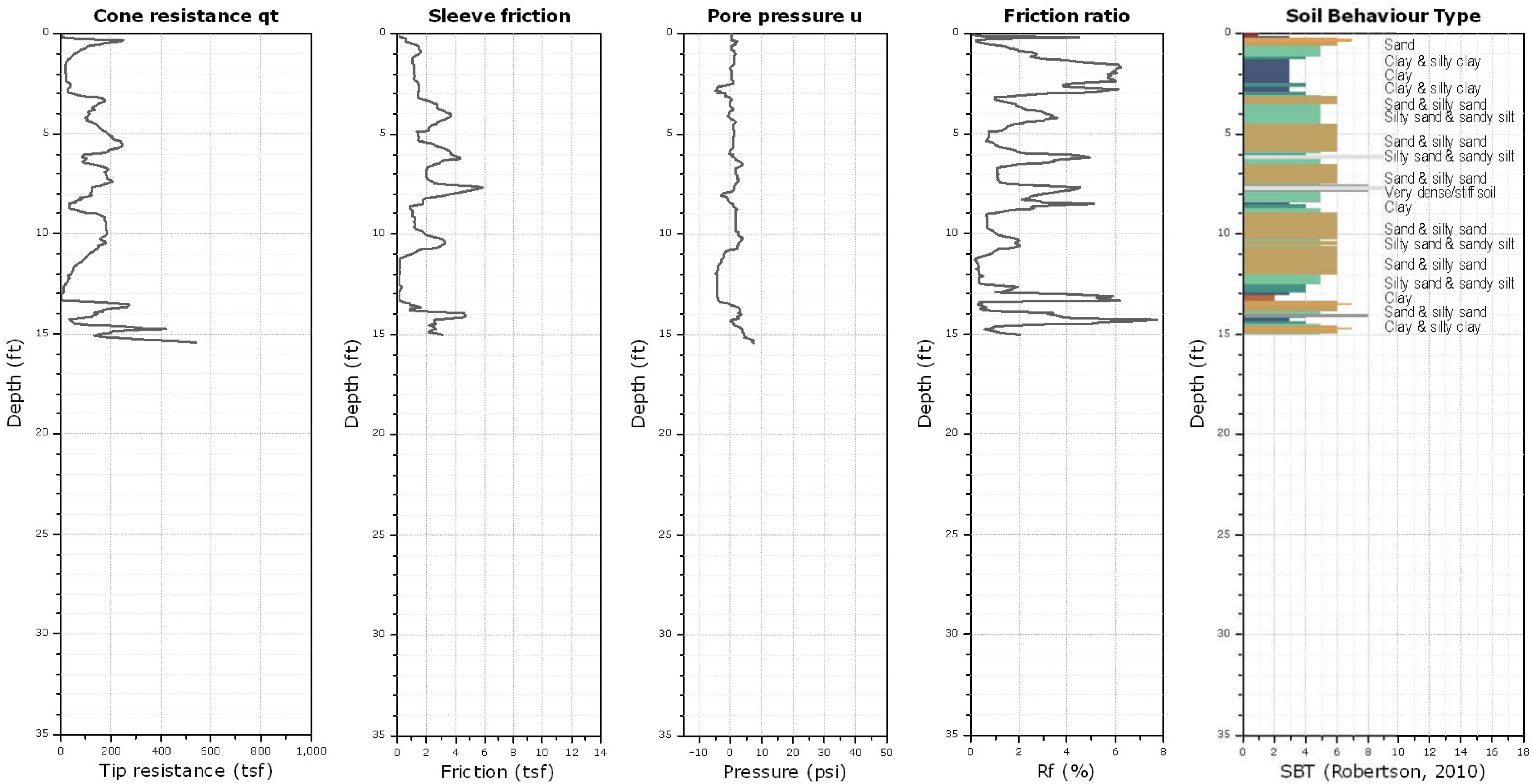
CPT-5

Project: GMU Geotechnical, Inc./Hotel Component

Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 15.42 ft, Date: 9/12/2018

Cone Type: Vertek

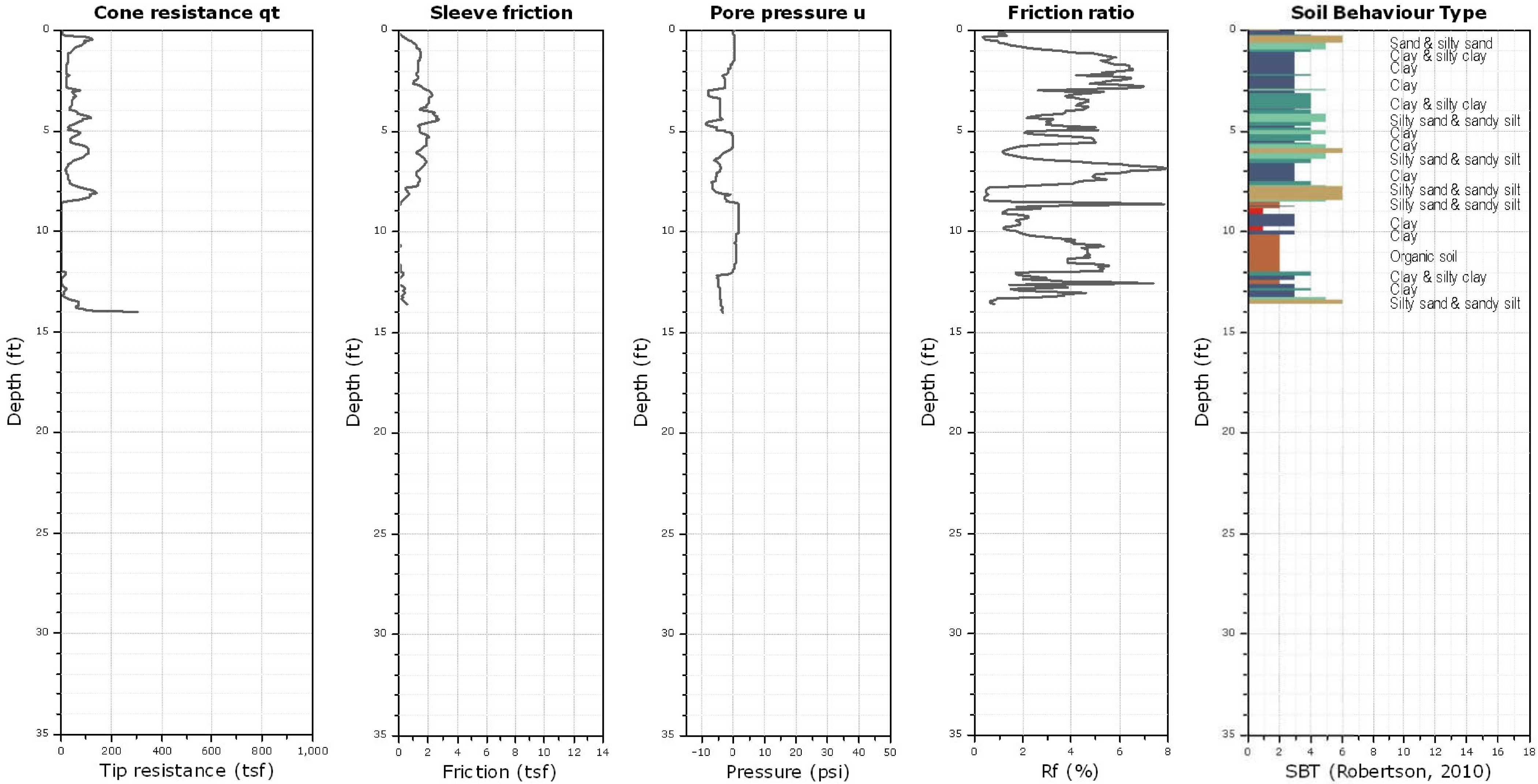


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-6

Project: **GMU Geotechnical, Inc./Hotel Component**
Location: **Casitas Pl & Dana Point Harbor Dr Dana Point, CA**

Total depth: 13.98 ft, Date: 9/12/2018
Cone Type: Vertek

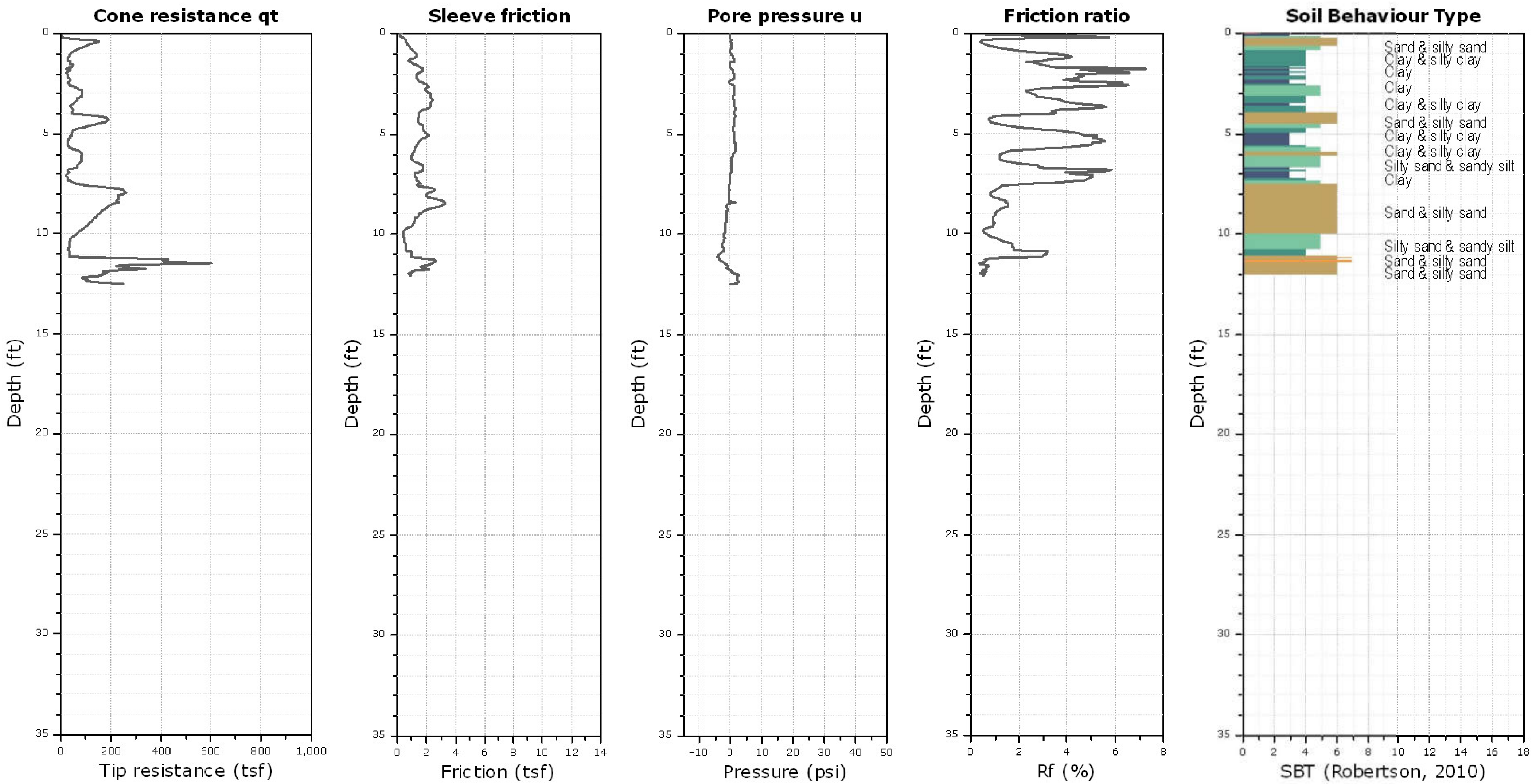


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-6A

Project: **GMU Geotechnical, Inc./Hotel Component**
Location: **Casitas Pl & Dana Point Harbor Dr Dana Point, CA**

Total depth: 12.47 ft, Date: 9/12/2018
Cone Type: Vertek

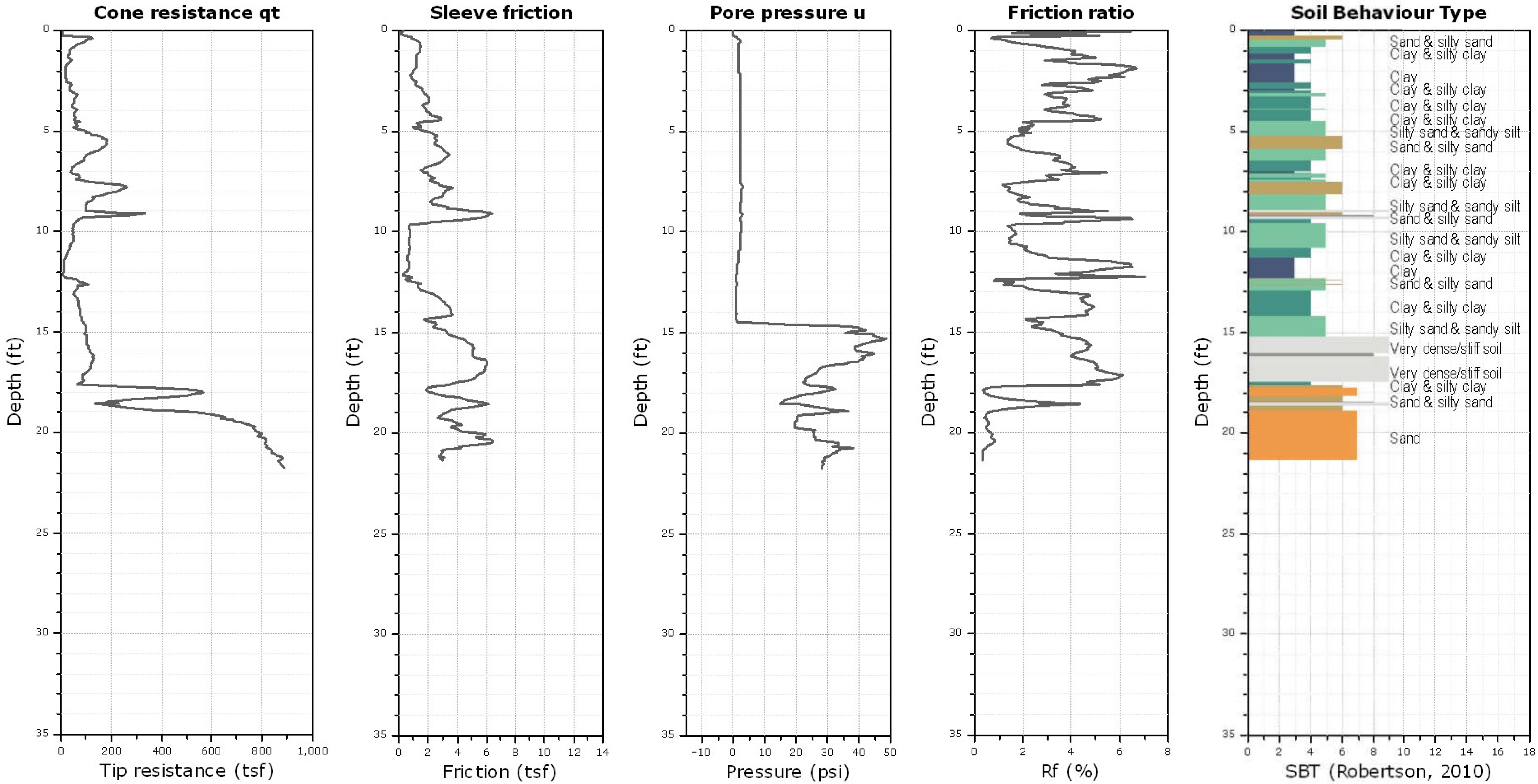


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-6B

Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 21.73 ft, Date: 9/12/2018
Cone Type: Vertek

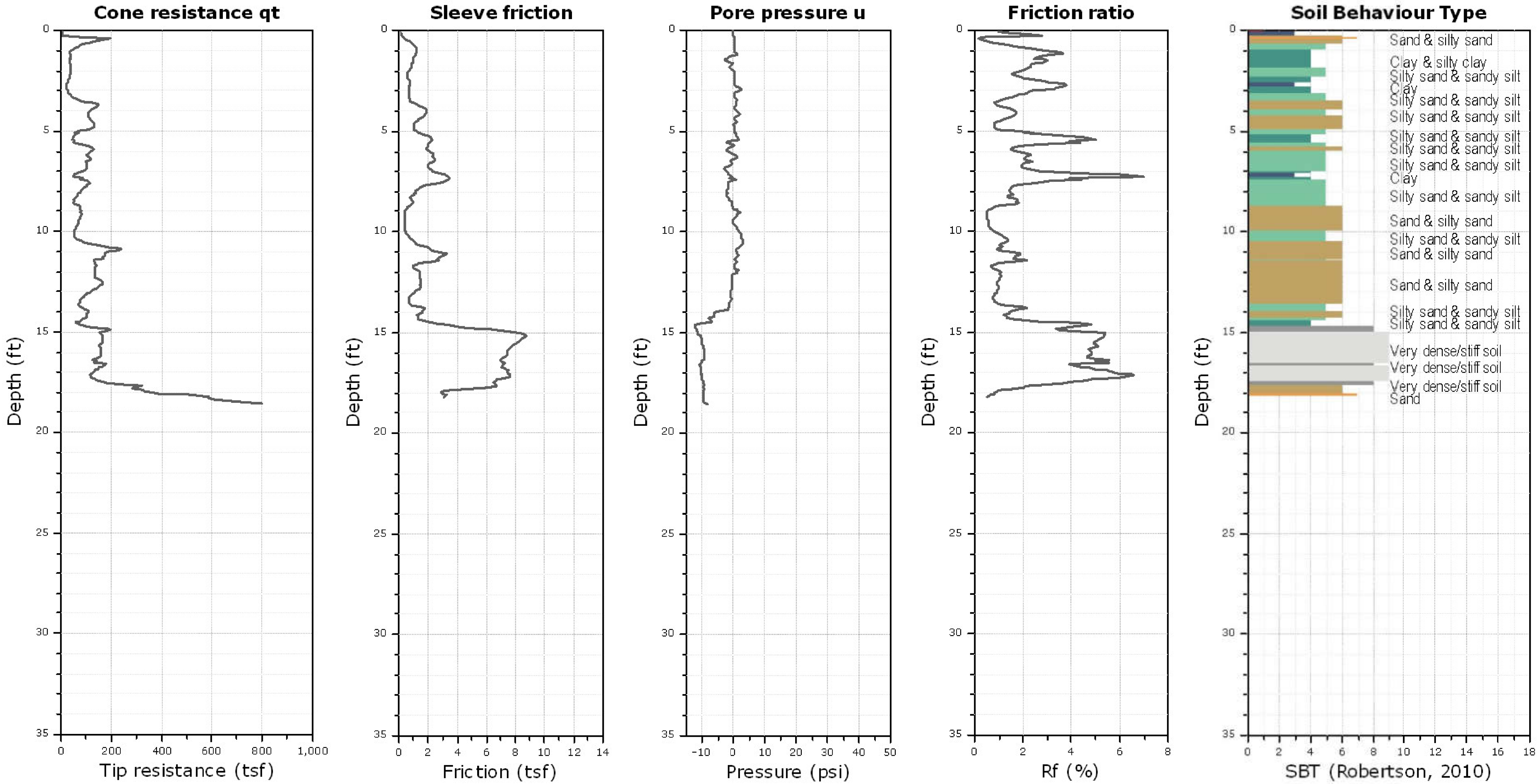


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-7

Project: **GMU Geotechnical, Inc./Hotel Component**
Location: **Casitas Pl & Dana Point Harbor Dr Dana Point, CA**

Total depth: 18.57 ft, Date: 9/12/2018
Cone Type: Vertek

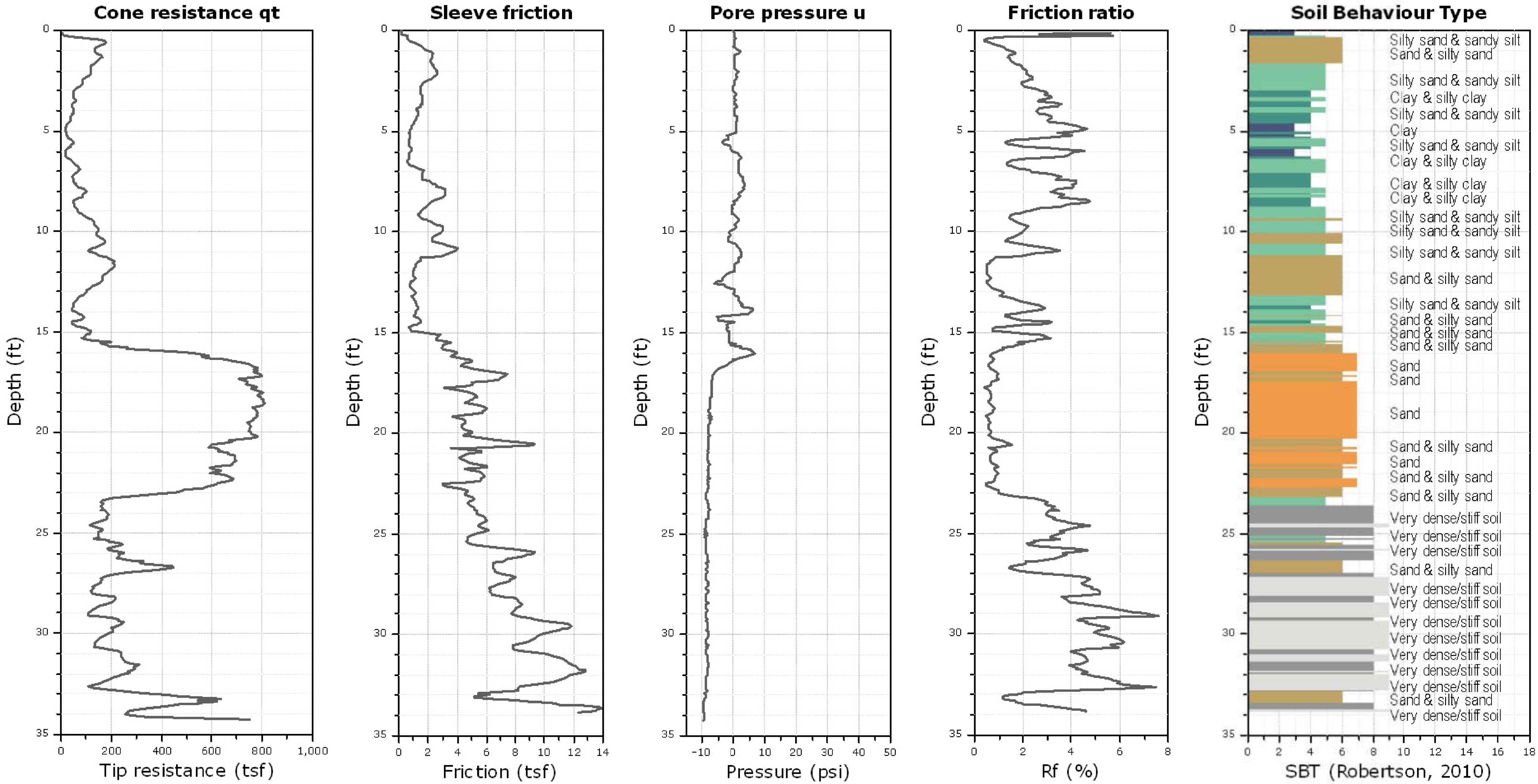


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-8

Project: GMU Geotechnical, Inc./Hotel Component
Location: Casitas Pl & Dana Point Harbor Dr Dana Point, CA

Total depth: 34.26 ft, Date: 9/12/2018
Cone Type: Vertek

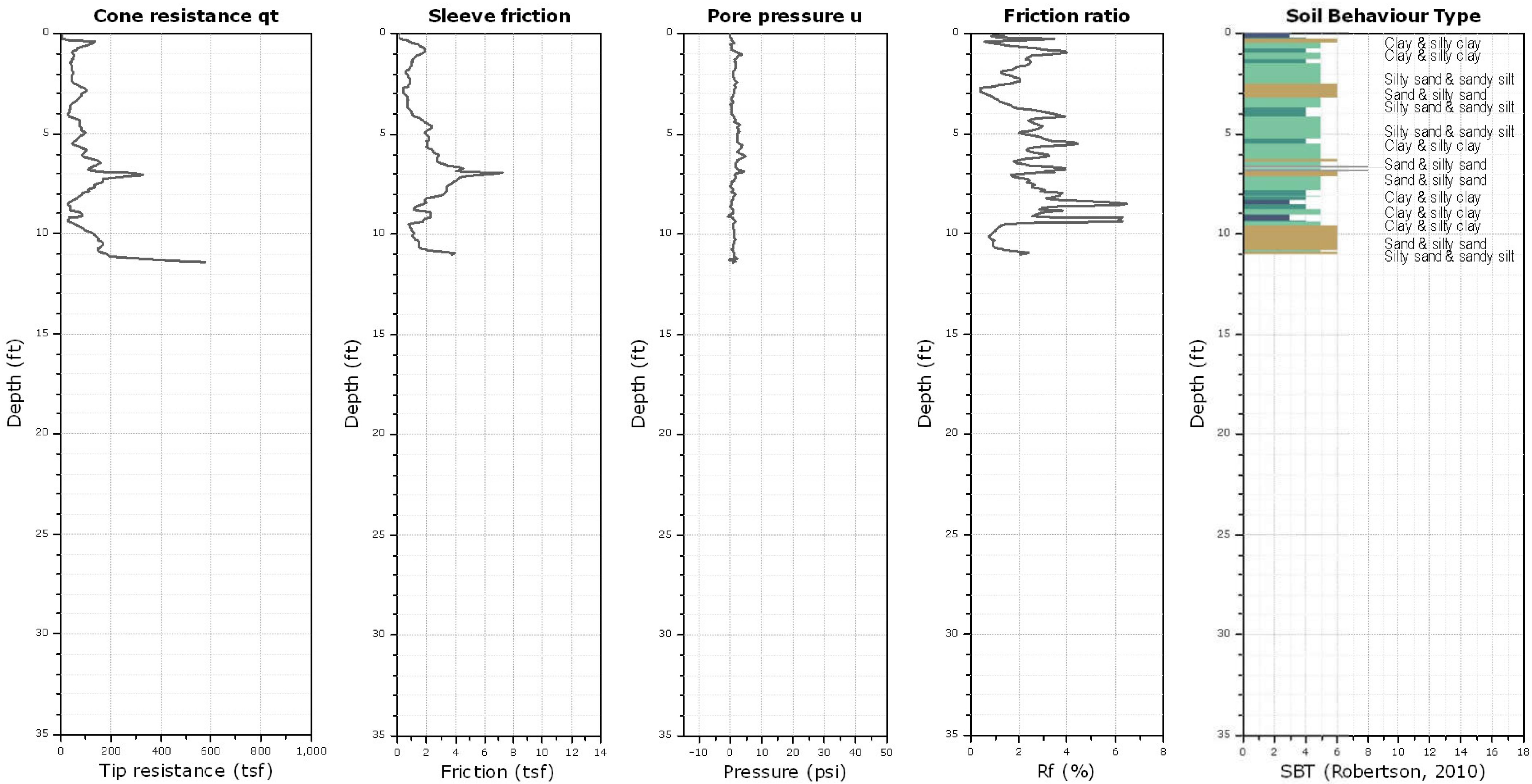


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-9

Project: **GMU Geotechnical, Inc./Hotel Component**
Location: **Casitas Pl & Dana Point Harbor Dr Dana Point, CA**

Total depth: 11.42 ft, Date: 9/12/2018
Cone Type: Vertek

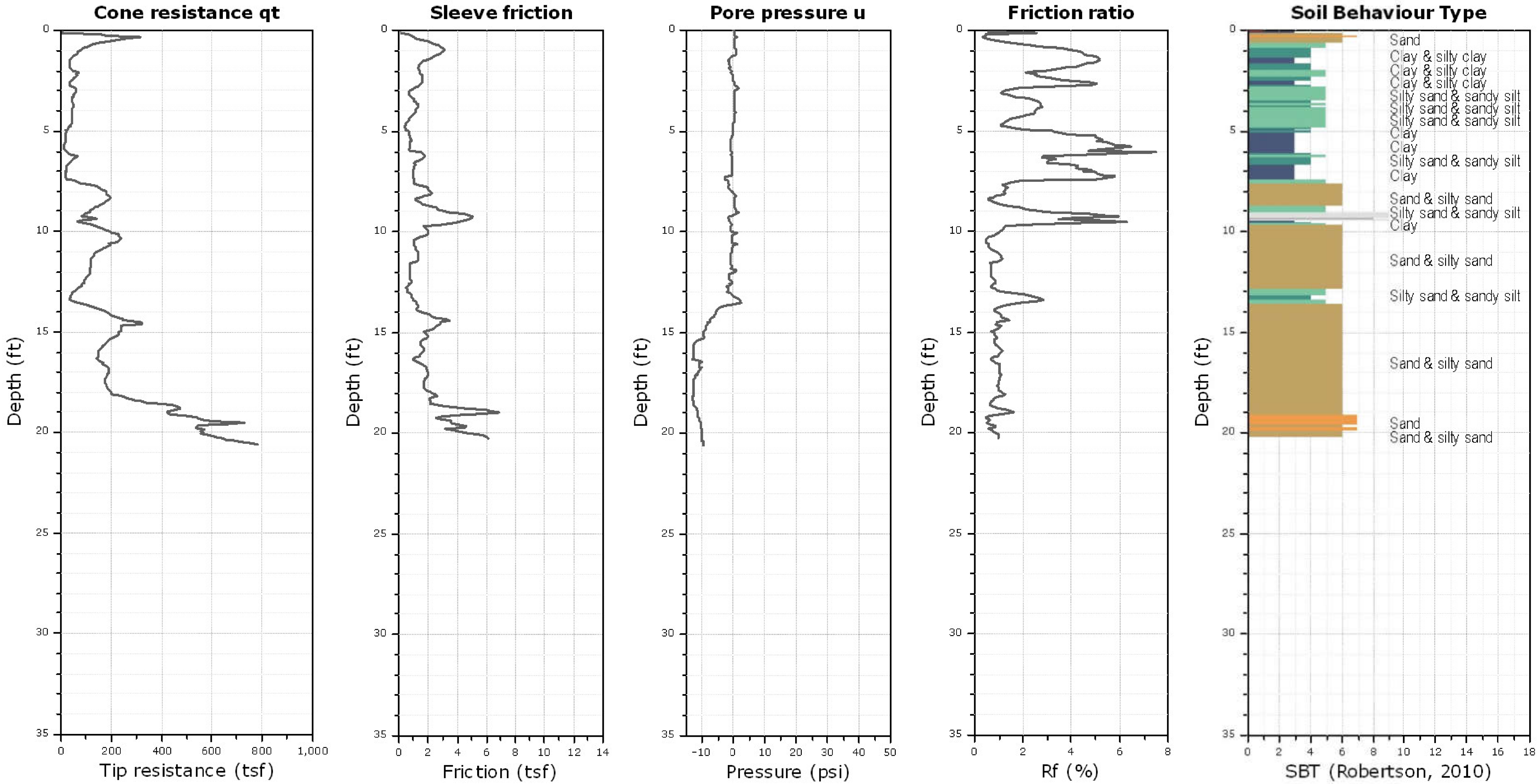


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT-10

Project: **GMU Geotechnical, Inc./Hotel Component**
Location: **Casitas Pl & Dana Point Harbor Dr Dana Point, CA**

Total depth: 20.61 ft, Date: 9/12/2018
Cone Type: Vertek



CPeT-IT v.2.1.1.13 - CPTU data presentation & interpretation software - Report created on: 9/14/2018, 2:27:53 PM
Project file: C:\GMUDanaPt9-18\Plot Data\Plots.cpt

APPENDIX B

Geotechnical Laboratory Procedures and Test Results

APPENDIX B

GMU GEOTECHNICAL LABORATORY PROCEDURES AND TEST RESULTS

MOISTURE AND DENSITY

Field moisture content and in-place density were determined for each 6-inch sample sleeve of undisturbed soil material obtained from the drill holes. The field moisture content was determined in general accordance with ASTM Test Method D 2216 by obtaining one-half the moisture sample from each end of the 6-inch sleeve. The in-place dry density of the sample was determined by using the wet weight of the entire sample.

At the same time the field moisture content and in-place density were determined, the soil material at each end of the sleeve was classified according to the Unified Soil Classification System. The results of the field moisture content and in-place density determinations are presented on the right-hand column of the Log of Drill Hole and are summarized on Table B-1. The results of the visual classifications were used for general reference.

PARTICLE SIZE DISTRIBUTION

As part of the engineering classification of the materials underlying the site, samples were tested to determine the distribution of particle sizes. The distribution was determined in general accordance with ASTM Test Method D 422 using U.S. Standard Sieve Openings 3", 1.5", 3/4, 3/8, and U.S. Standard Sieve Nos. 4, 10, 20, 40, 60, 100, and 200. In addition, on some samples a standard hydrometer test was performed to determine the distribution of particle sizes passing the No. 200 sieve (i.e., silt and clay-size particles). The results of the tests are contained in this Appendix B. Key distribution categories (% gravel; % sand, etc.) are contained on Table B-1.

ATTERBERG LIMITS

As part of the engineering classification of the soil material, a representative sample of the on-site soil material was tested to determine relative plasticity. This relative plasticity is based on the Atterberg limits determined in general accordance with ASTM Test Method D 4318. The results of these tests are contained in this Appendix B and also Table B-1.

EXPANSION TESTS

To provide a standard definition of one-dimensional expansion, a test was performed on typical on-site materials in general accordance with ASTM Test Method D 4829. The result from this test procedure is reported as an “expansion index”. The results of this test are contained in this Appendix B and also Table B-1.

CHEMICAL TESTS

The corrosion potential of typical on-site materials under long-term contact with both metal and concrete was determined by chemical and electrical resistance tests. The soluble sulfate test for potential concrete corrosion was performed in general accordance with California Test Method 417, the minimum resistivity test for potential metal corrosion was performed in general accordance with California Test Method 643, and the concentration of soluble chlorides was determined in general accordance with California Test Method 422. The results of these tests are contained in this Appendix B and also Table B-1.

COMPACTION TESTS

Bulk samples representative of the on-site materials were tested to determine the maximum dry density and optimum moisture content of the soil. These compactive characteristics were determined in general accordance with ASTM Test Method D 1557. The results of this test are contained in this Appendix B and also Table B-1.

DIRECT SHEAR STRENGTH TESTS

Direct shear tests were performed on typical on-site materials. The general philosophy and procedure of the tests were in accord with ASTM Test Method D 3080 - "Direct Shear Tests for Soils Under Consolidated Drained Conditions".

The tests are single shear tests and are performed using a sample diameter of 2.416 inches and a height of 1.00 inch. The normal load is applied by a vertical dead load system. A constant rate of strain is applied to the upper one-half of the sample until failure occurs. Shear stress is monitored by a strain gauge-type precision load cell and deflection is measured with a digital dial indicator. This data is transferred electronically to data acquisition software which plots shear strength vs. deflection. The shear strength plots are then interpreted to determine either peak or ultimate shear strengths. Residual strengths were obtained through multiple shear box reversals. A strain rate compatible with the grain size distribution of the soils was utilized. The interpreted results of these tests are shown in this Appendix B.

R-VALUE TESTS

Bulk samples representative of the underlying on-site materials were tested to measure the response of a compacted sample to a vertically applied pressure under specific conditions. The R-value of a material is determined when the material is in a state of saturation such that water will be exuded from the compacted test specimen when a 16.8 kN load (2.07 MPa) is applied. The results from these test procedures are reported in Appendix B-1.

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Saturation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH- 1	0	8.3	Qaf	SC													36	32				
DH- 1	2.5	5.8	Qaf	SC				1	83	17									8.2	1101	480	7753
DH- 1	5	3.3	Qaf	SC	9.0	125	73															
DH- 1	15	-6.7	Qaf	SM				3	79	18												
DH- 1	20	-11.7	Qaf	SM	9.9	115	60															
DH- 1	30	-21.7	Tc	SP/ML	17.5	110	92															
DH- 1	40	-31.7	Tc	SP/ML	17.9	107	87															
DH- 1	50	-41.7	Tc	SP	19.7	106	93															
DH- 2	2.5	5.8	Qaf	SC	8.5	118	56															
DH- 4	5	3.3	Qaf	SC	10.9	108	55															
DH- 6	2.5	6.8	Qaf	CL/SC	15.1	105	70															
DH- 6	7.5	1.8	Qaf	SM/SC	15.4	117	98															
DH- 6	10	-0.7	Qaf	SM/SC				1	73	27												
DH- 6	15	-5.7	Qm	SP/SM	16.2	101	68															
DH- 6	25	-15.7	Tc	CL/ML	22.3	95	79															
DH- 6	35	-25.7	Tc	SP	13.3	117	84															
DH- 6	45	-35.7	Tc	SP	14.2	116	87															
DH-15	5	12.3	Tc	SP	6.1	116	37															
DH-15	10	7.3	Tc	SP	6.5	125	54															
DH-15	20	-2.7	Tc	SP	11.4	117	74															
DH-15	30	-12.7	Tc	SP	16.2	112	91															
DH-42	5	9.3	Qaf	SC	13.5	106	63															
DH-42	7.5	6.8	Qaf	SC				2	79	19												
DH-42	10	4.3	Qm	SP	13.2	117	84															
DH-42	15	-0.7	Qm	SP	13.3	115	80															

Project: Dana Point Harbor, Hotel Component
Project No. 17-206-01

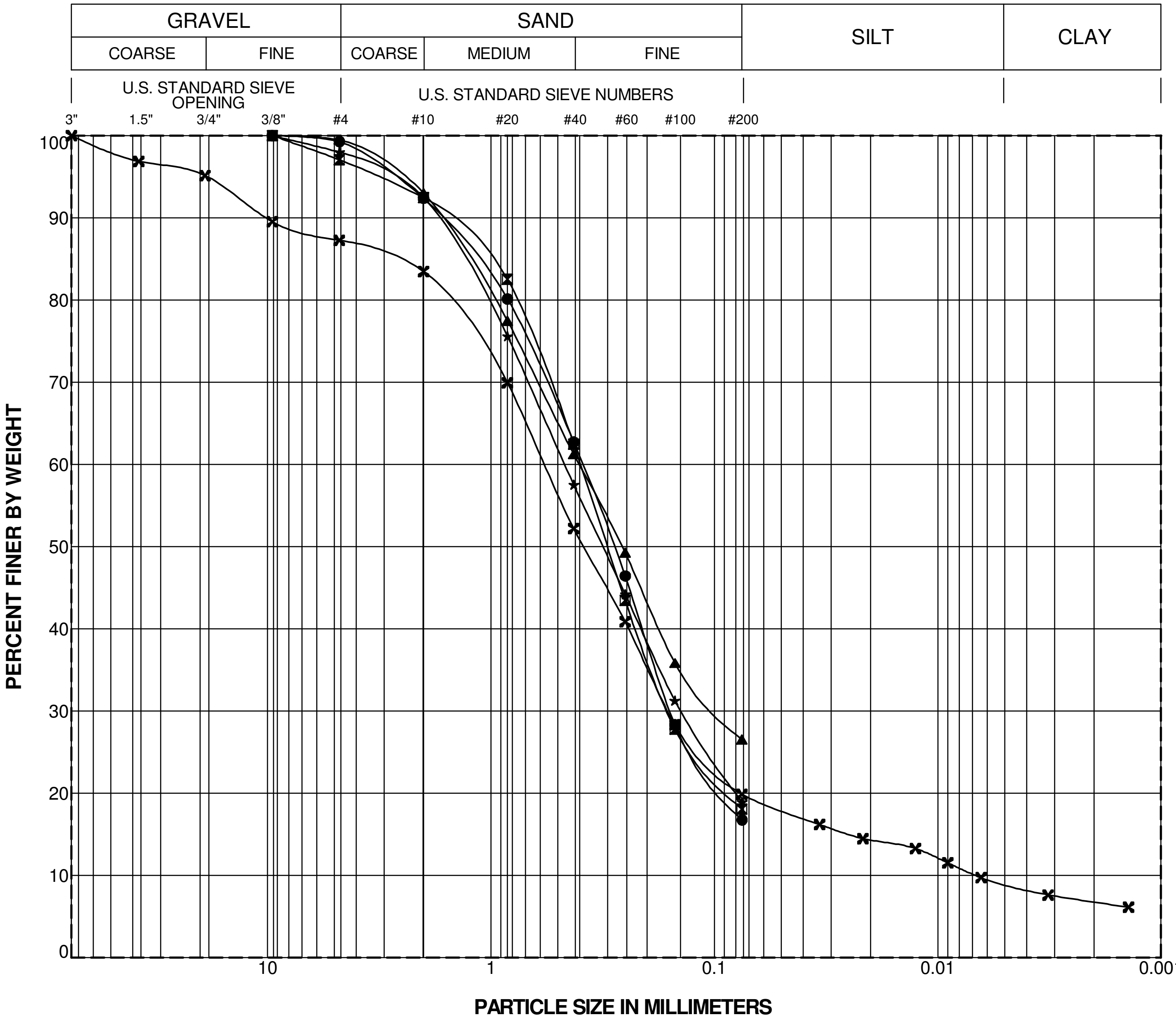
TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur-ation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2µ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-43	0	15.3	Qaf	SC											132.5	8.0		67	7.1	37	144	6197
DH-43	5	10.3	Qaf	SC	10.4	121	76															
DH-43	10	5.3	Qaf	SM	17.3	111	94															
DH-43	15	0.3	Tc	SP/ML	16.4	114	96															
DH-44	0	8.3	Qaf	SC	8.9			13	67	20	7	26	21	5	127.0	8.5	19		5.7	339	120	3078
DH-44	5	3.3	Qaf	SC	13.9	113	79															
DH-44	10	-1.7	Qm	SM	11.9	116	75															
DH-44	12.5	-4.2	Qm	SM				10	75	15												
DH-44	15	-6.7	Tc	CL	23.7	94	82															
DH-44	25	-16.7	Tc	SP	21.4	99	85															
DH-45	5	3.3	Qaf	SC	14.5	118	95															
DH-45	7.5	0.8	Qaf	SC				3	56	40												
DH-45	10	-1.7	Qaf	SP	19.7	107	95															
DH-45	15	-6.7	Tc	SP	15.3	117	97															
DH-45	25	-16.7	Tc	SP	15.9	114	92															

GMU_TABLE_SOIL_LAB_DATA 17-206-01 (UPDATED ELEV.).GPJ FNC AB GWGN01.GDT 7/15/19

GMU GEOTECHNICAL, INC.

Project: Dana Point Harbor, Hotel Component
Project No. 17-206-01



Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH- 1	2.5	Qaf	●			SILTY CLAYEY SAND (SC)
DH- 1	15.0	Qaf	⊠			SILTY SAND (SM)
DH- 6	10.0	Qaf	▲			SILTY SAND TO CLAYEY SAND (SC)
DH-42	7.5	Qaf	★			CLAYEY SAND (SC)
DH-44	0.0	Qaf	✖	26	5	SILTY CLAYEY SAND (SC)

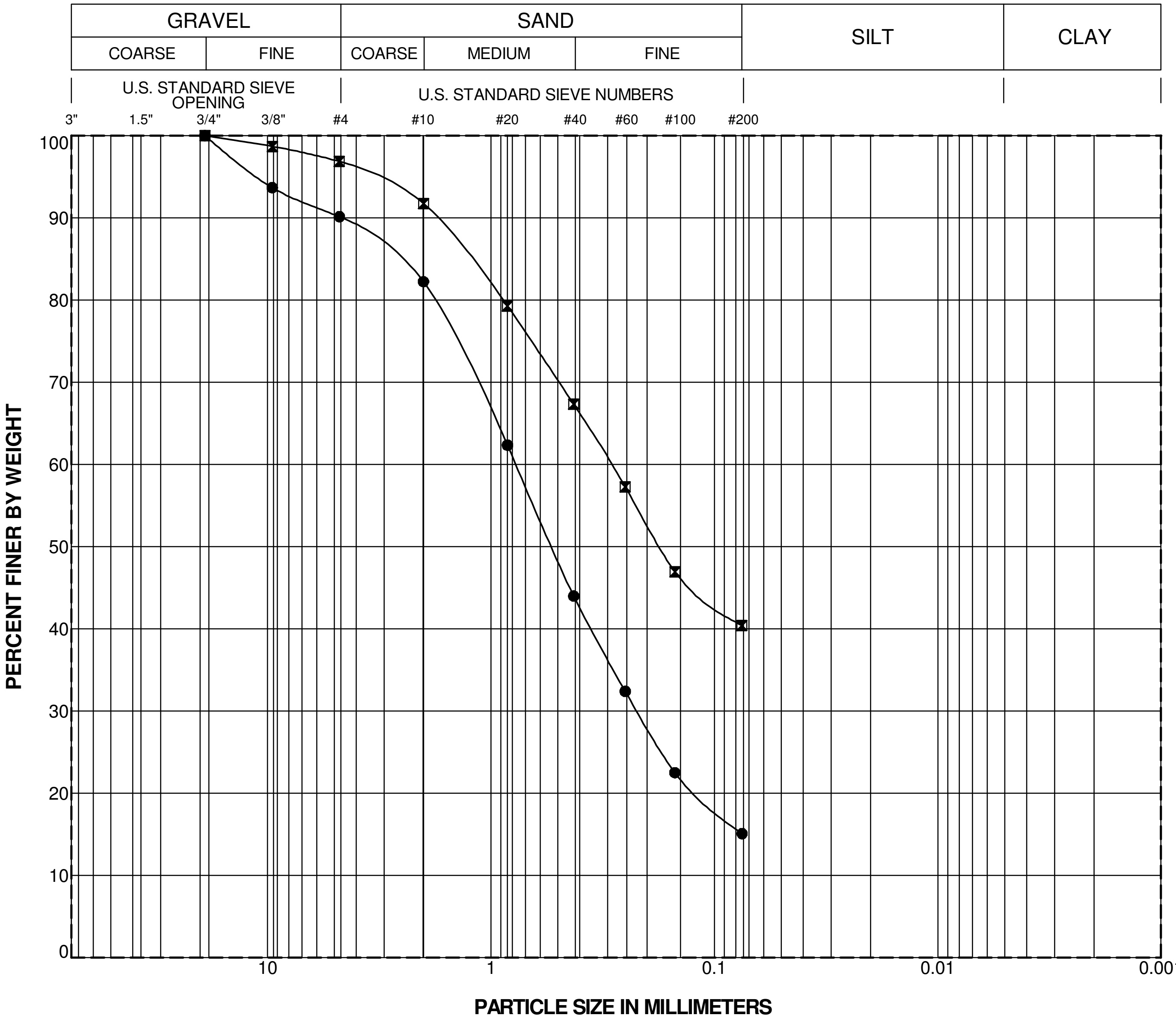
GMU_GRAIN_SIZE 17-206-01 (UPDATED ELEV.).GPJ 7/15/19

PARTICLE SIZE DISTRIBUTION

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH-44	12.5	Qm	●			SILTY SAND (SM)
DH-45	7.5	Qaf	⊠			CLAYEY SAND (SC)

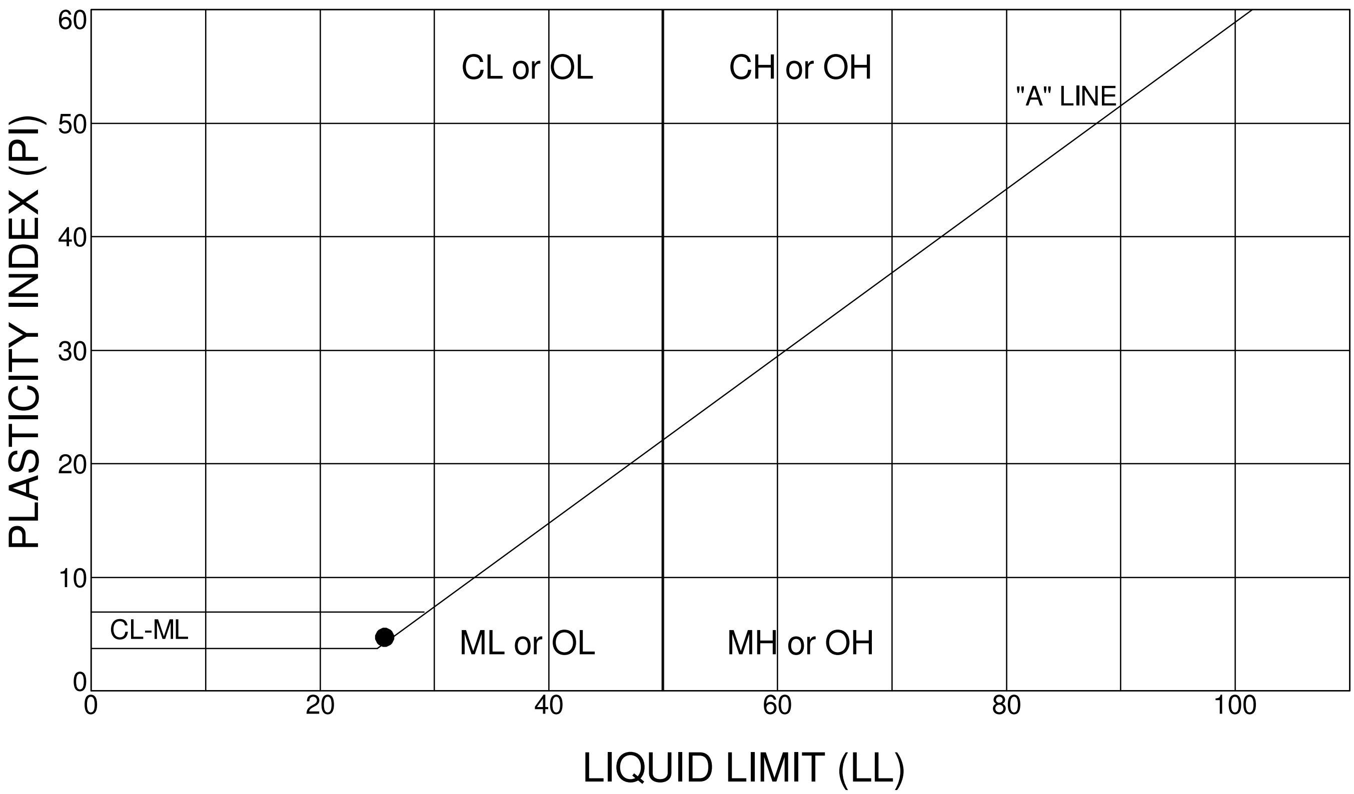
GMU_GRAIN_SIZE 17-206-01 (UPDATED ELEV.).GPJ 7/15/19

PARTICLE SIZE DISTRIBUTION

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



Boring Number	Depth (feet)	Geologic Unit	Test Symbol	Insitu Water Content (%)	LL	PL	PI	Classification
DH-44	0.0	Qaf	●	9	26	21	5	SILTY CLAYEY SAND (SC)

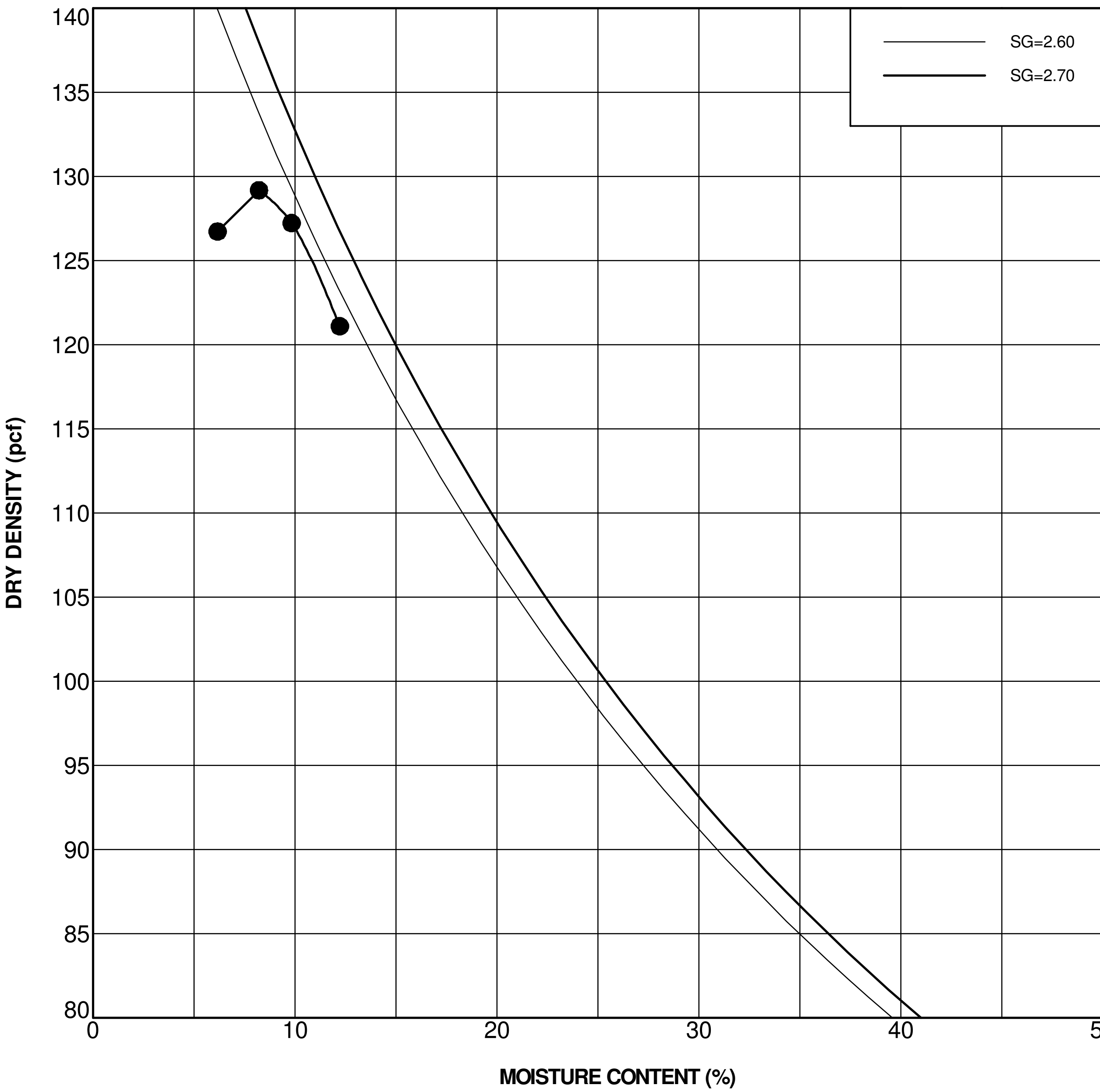
LIMITS 17-206-01 (UPDATED ELEV.).GPJ 7/15/19

ATTERBERG LIMITS

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



DVTCOMP 17-206-01 (UPDATED ELEV.).GPJ 7/15/19

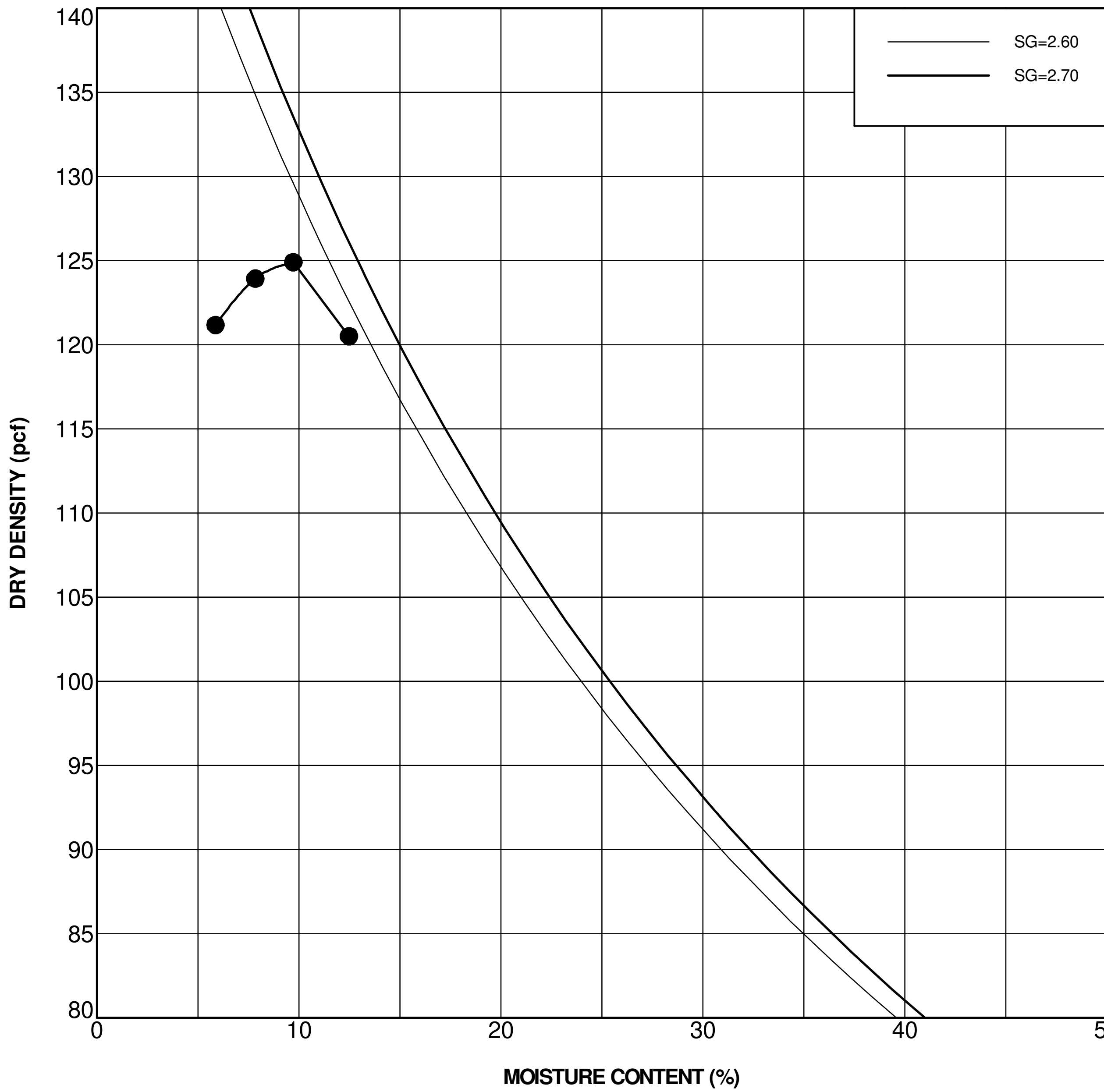
Boring Number	Depth (feet)	Geologic Unit	Symbol	Maximum Dry Density, pcf	Optimum Moisture Content, %	Classification
DH-43	0.0	Qaf	●	132.5	8	CLAYEY SAND (SC)

COMPACTION TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



DVTCOMP 17-206-01 (UPDATED ELEV.).GPJ 7/15/19

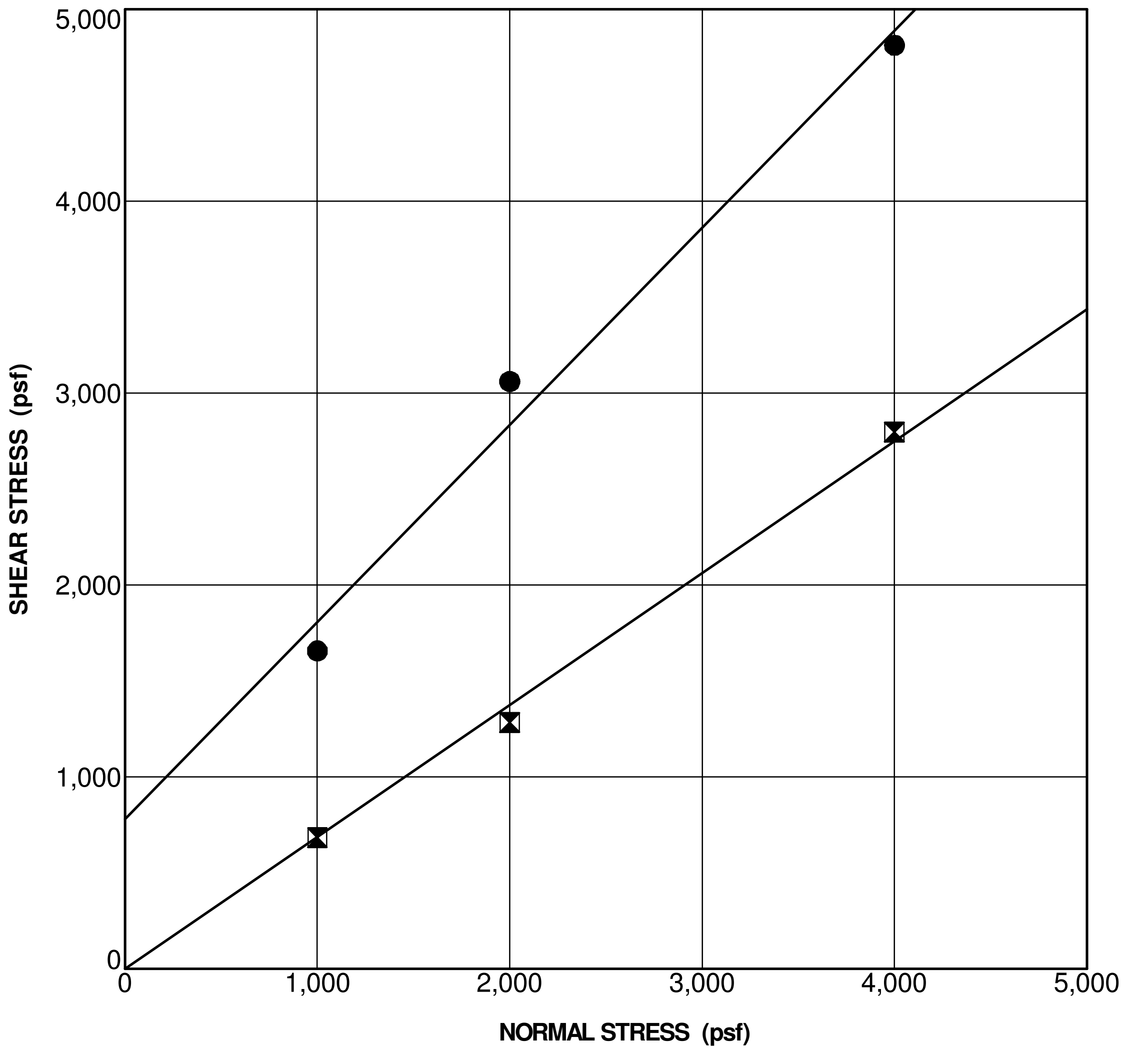
Boring Number	Depth (feet)	Geologic Unit	Symbol	Maximum Dry Density, pcf	Optimum Moisture Content, %	Classification
DH-44	0.0	Qaf	●	127	8.5	SILTY CLAYEY SAND (SC)

COMPACTION TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



GMU_DIRECT_SHEAR 17-206-01 (UPDATED ELEV.).GPJ GM&U.GDT 7/15/19

SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 1 @ 5.0 ft **Geologic Unit:** Qaf **Classification:** CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

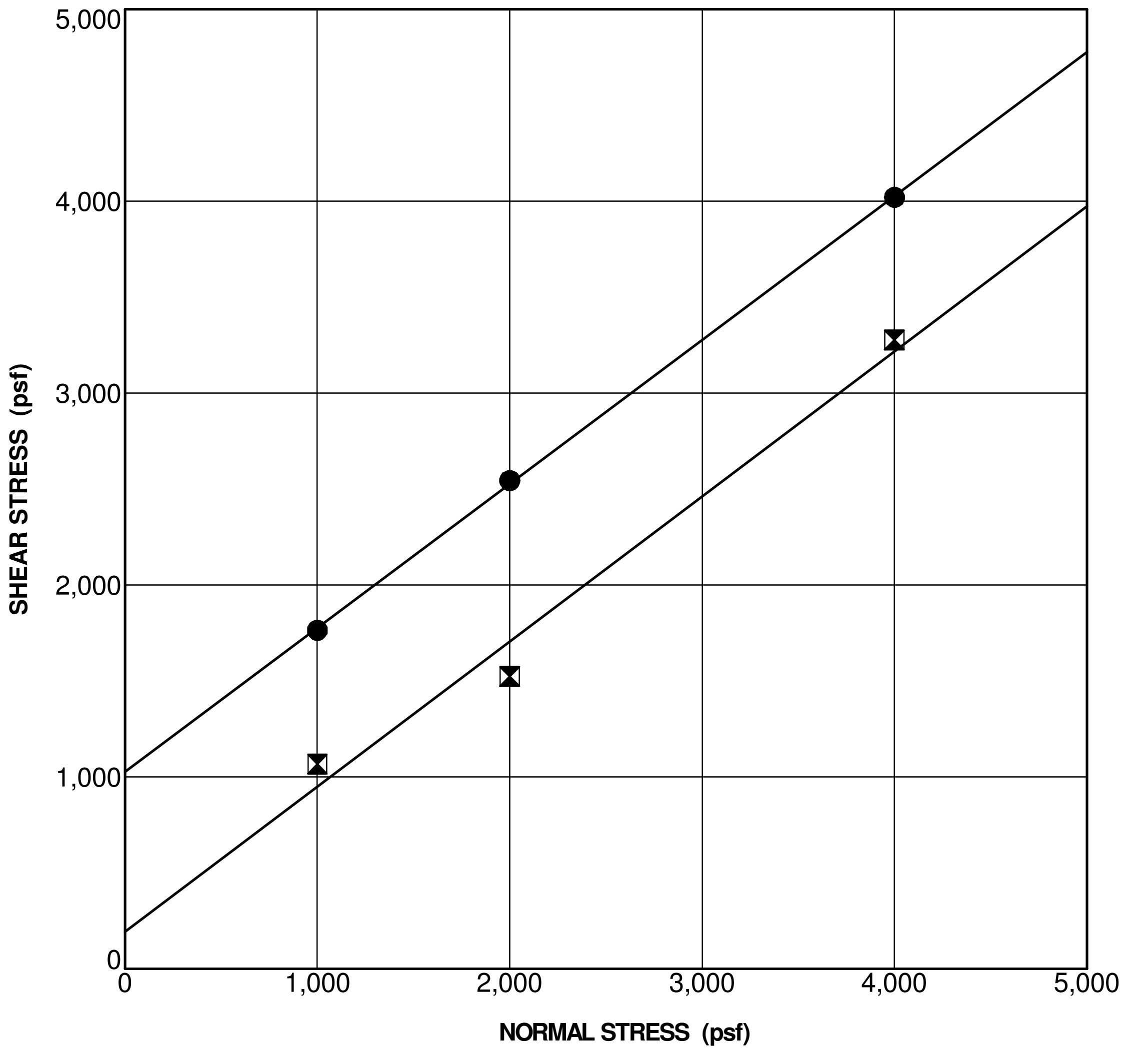
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	780	46.0
⧗ Ultimate Strength	0	35.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 1 @ 30.0 ft **Geologic Unit:** Tc **Classification:** SANDSTONE (SP)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

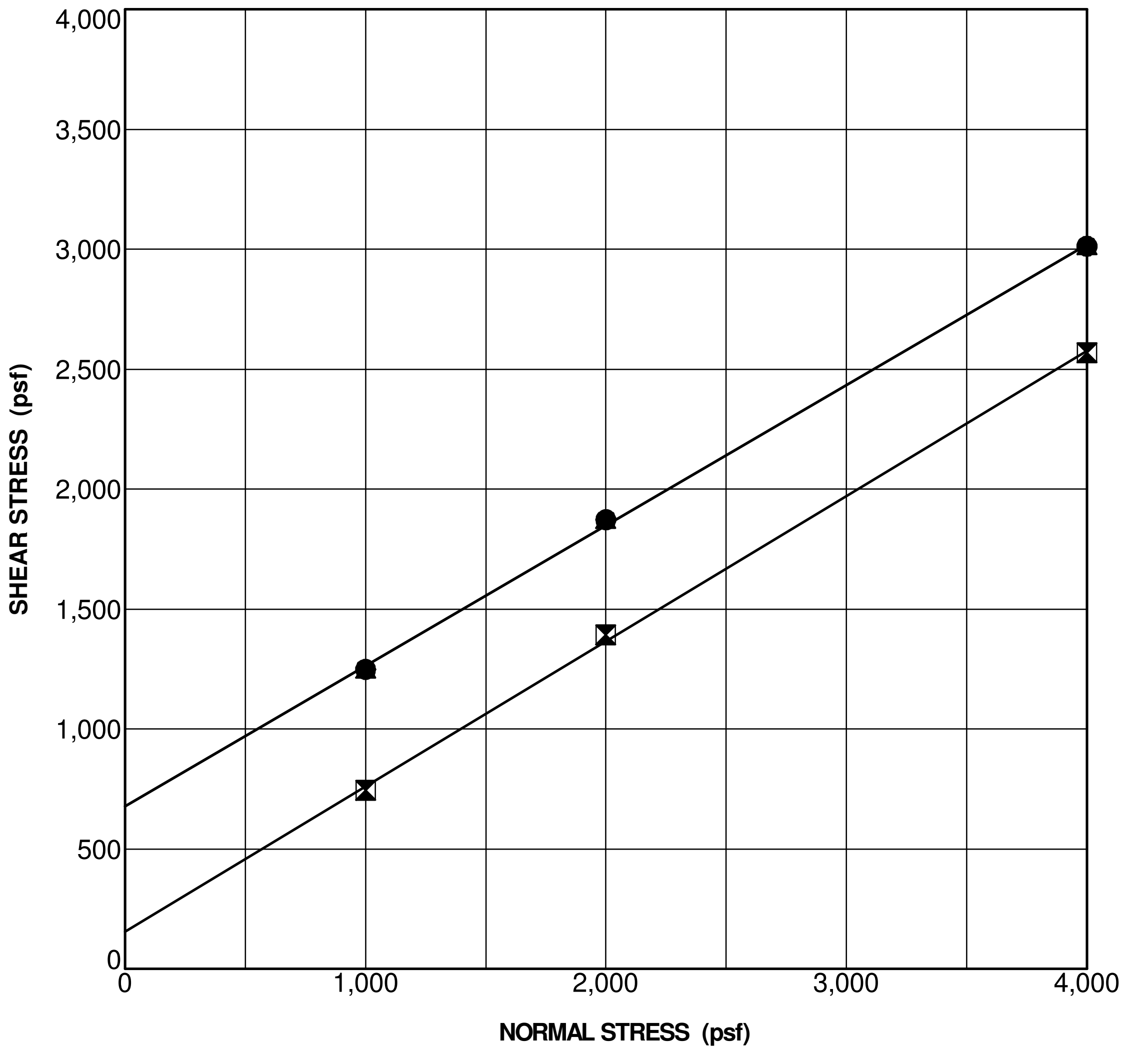
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	1026	37.0
⧗ Ultimate Strength	192	37.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH-15 @ 5.0 ft **Geologic Unit:** Tc **Classification:** SANDSTONE (SP)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

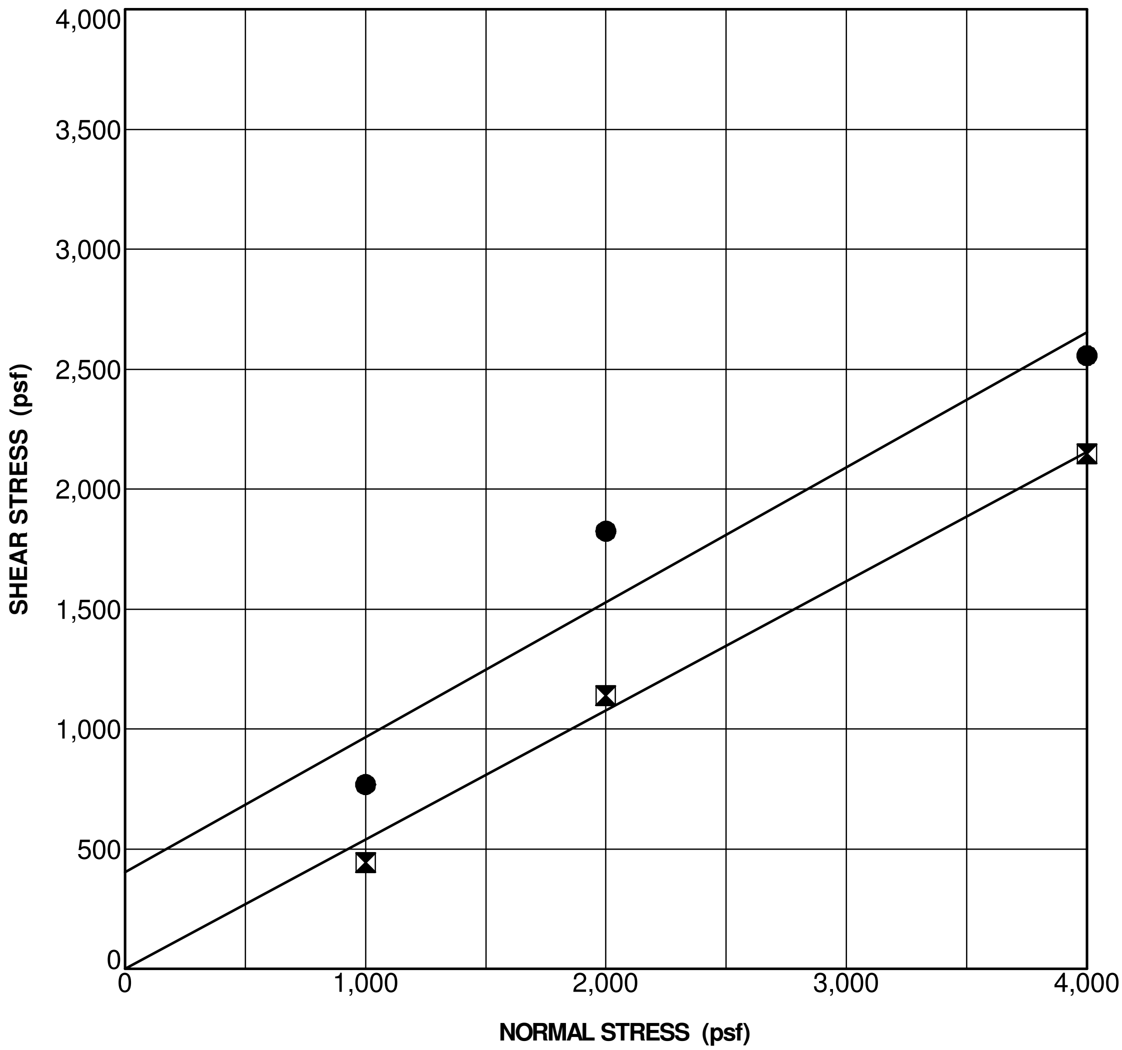
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	678	30.0
⧗ Ultimate Strength	156	31.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



GMU_DIRECT_SHEAR 17-206-01 (UPDATED ELEV.).GPJ GM&U.GDT 7/15/19

SAMPLE AND TEST DESCRIPTION
Sample Location: DH-43 @ 0.0 ft **Geologic Unit:** Qaf **Classification:** CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Remolded
Notes: Remolded 90% compaction at optimum

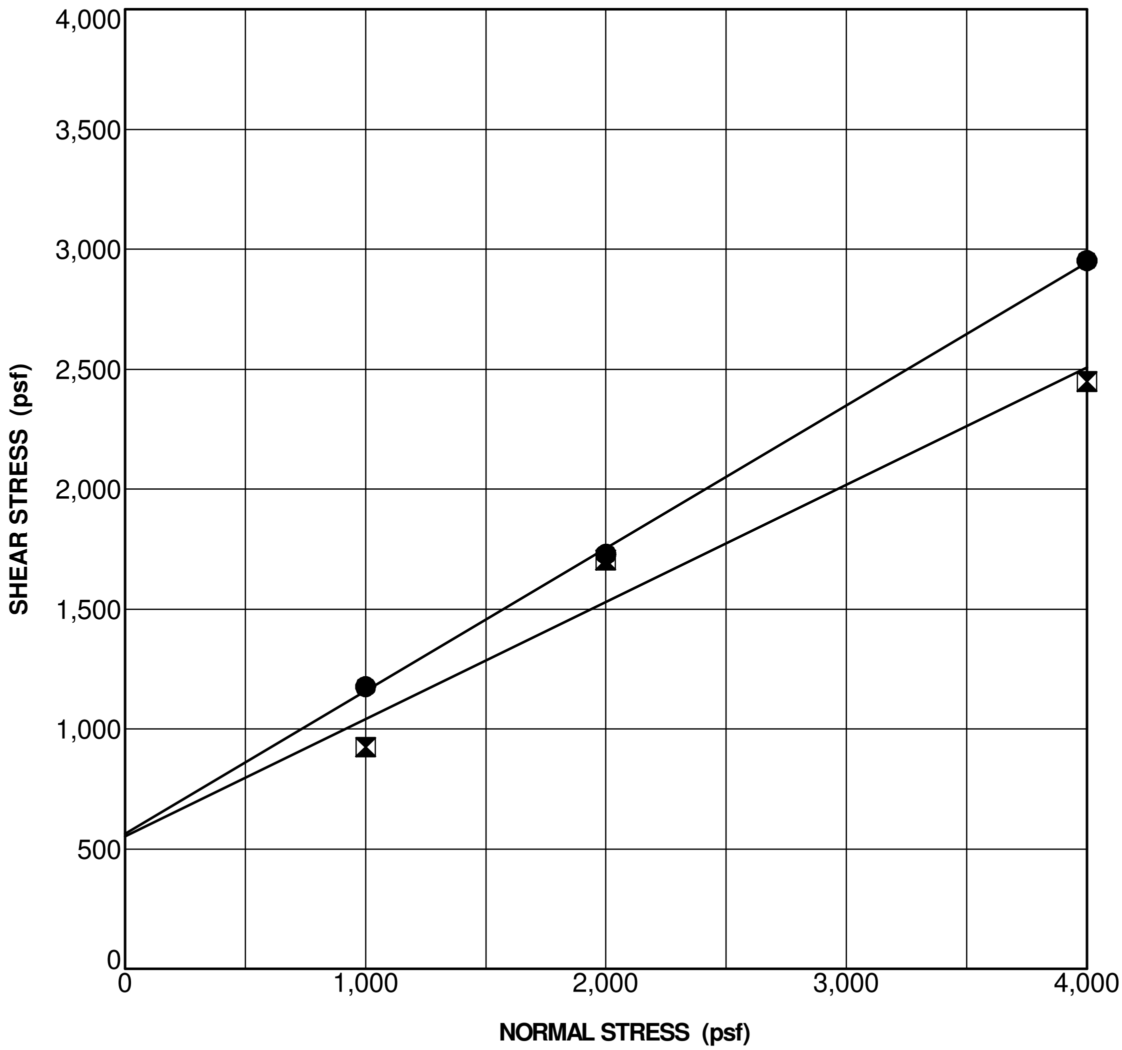
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	402	29.0
⧗ Ultimate Strength	0	28.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH-43 @ 5.0 ft **Geologic Unit:** Qaf **Classification:** CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

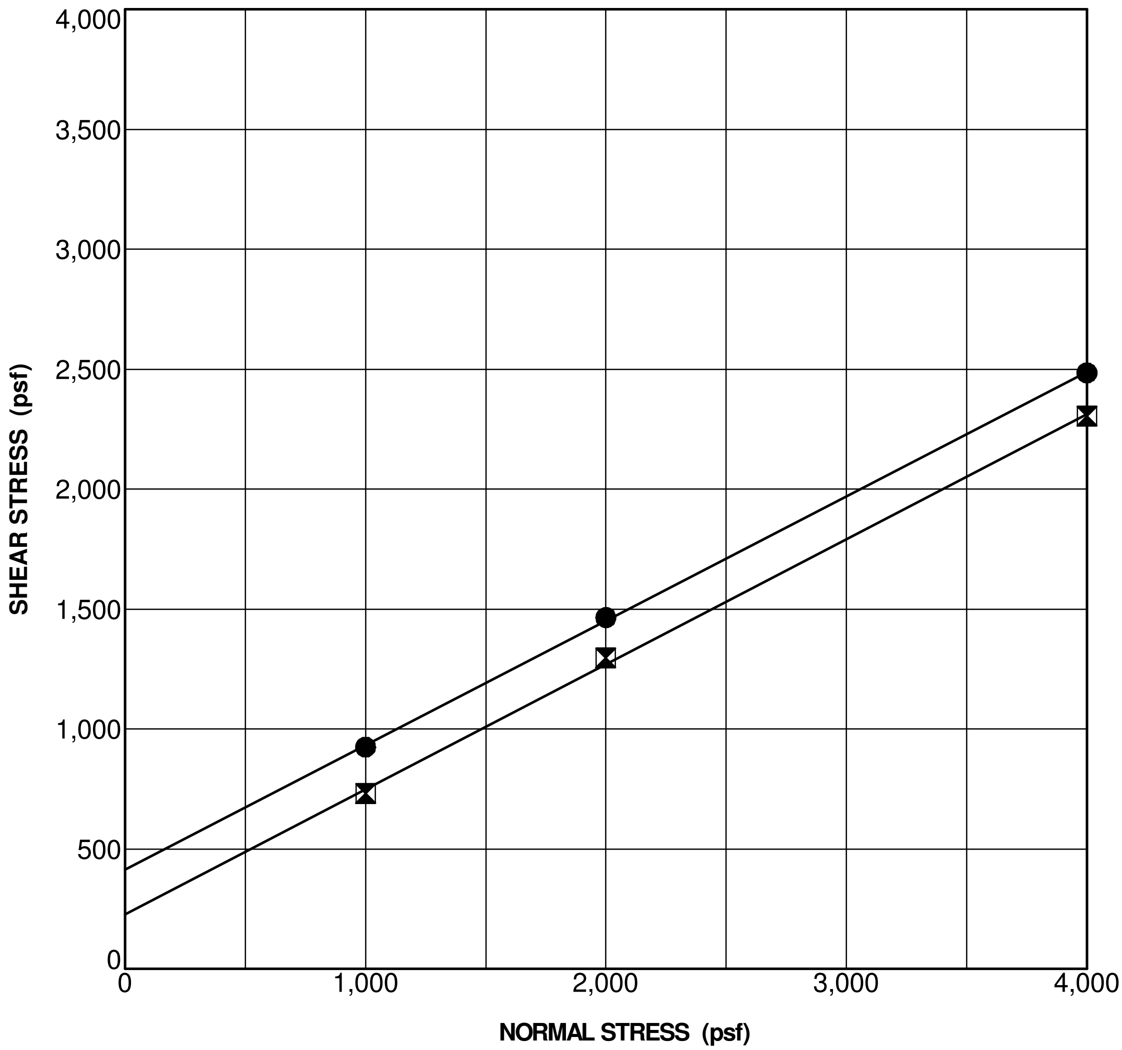
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	564	31.0
⧗ Ultimate Strength	552	26.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH-44 @ 0.0 ft **Geologic Unit:** Qaf **Classification:** SILTY CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Remolded
Notes: 90% compaction at optimum

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	414	27.0
⧗ Ultimate Strength	228	28.0

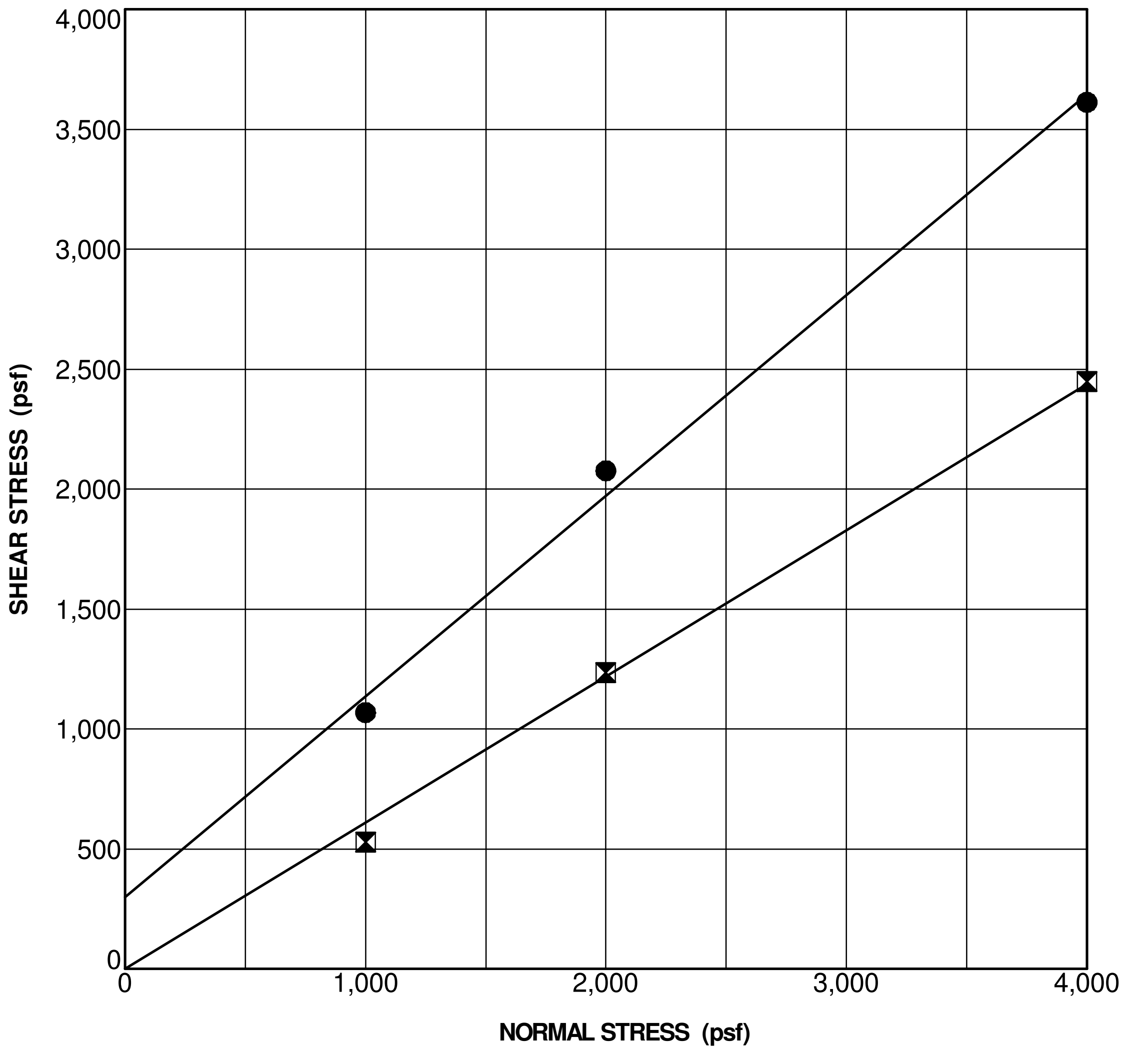
GMU_DIRECT_SHEAR 17-206-01 (UPDATED ELEV.).GPJ GM&U.GDT 7/15/19

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.



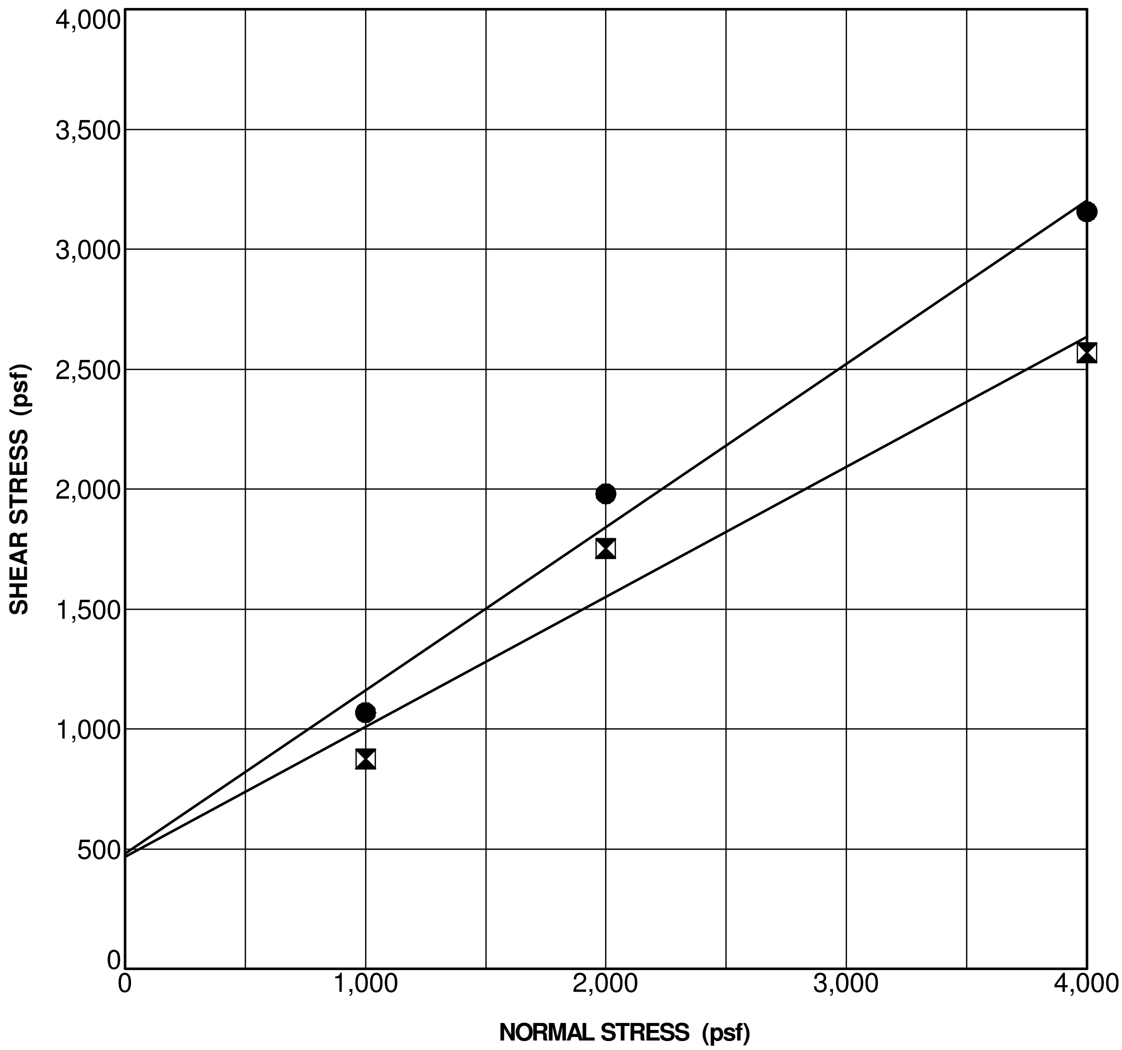
SAMPLE AND TEST DESCRIPTION
Sample Location: DH-44 @ 5.0 ft **Geologic Unit:** Qaf **Classification:** SILTY CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	300	40.0
⧗ Ultimate Strength	0	31.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component
Project No. 17-206-01

GMU GEOTECHNICAL, INC.



GMU_DIRECT_SHEAR 17-206-01 (UPDATED ELEV.).GPJ GM&U.GDT 7/15/19

SAMPLE AND TEST DESCRIPTION
Sample Location: DH-45 @ 5.0 ft **Geologic Unit:** Qaf **Classification:** CLAYEY SAND (SC)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	480	34.0
⧗ Ultimate Strength	468	28.0

SHEAR TEST DATA

Project: Dana Point Harbor, Hotel Component

Project No. 17-206-01

GMU GEOTECHNICAL, INC.

APPENDIX C

Infiltration Test Results

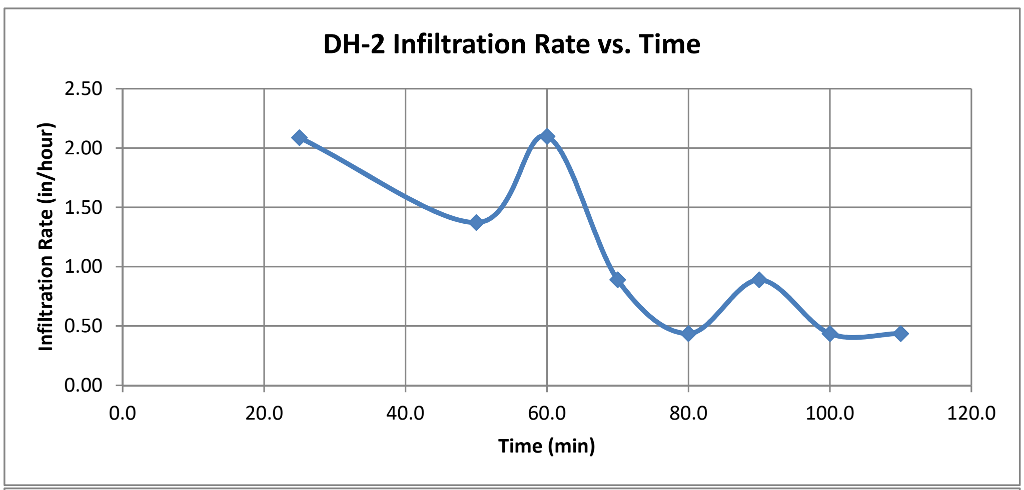
Riverside/Orange County - Infiltration Test in a Boring

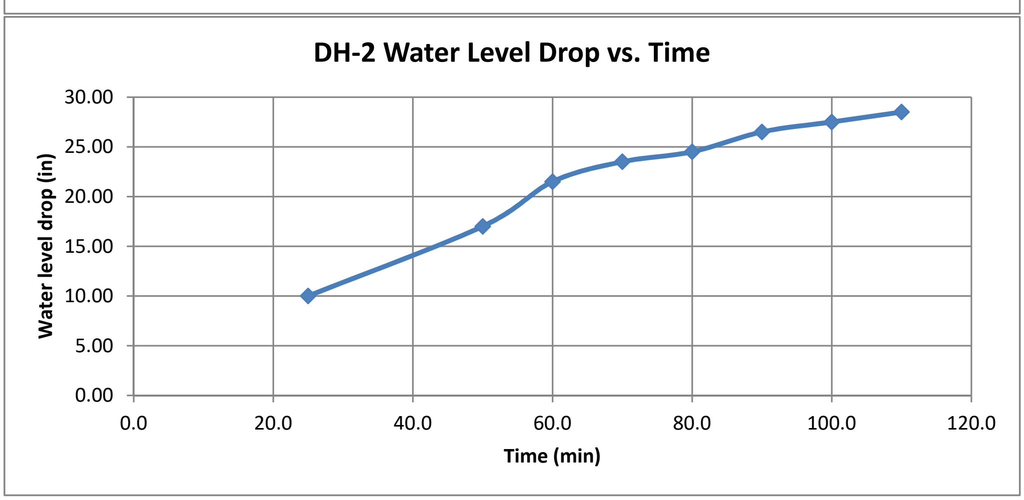
Project Name: DPHP, LLC Hotel Component
Project Number: 17-206-01
Date: 9/11/18

Test Hole Number: DH-2
Total Depth : 3.00 feet 36 inches
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	ΣΔD	ΔHavg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	8:40	9:05	25.0	25.0	0.83	1.67	10.00	10.00	21.00	2.09
2	9:05	9:30	25.0	50.0	0.83	1.42	7.00	17.00	22.50	1.37
3	9:32	9:42	10.0	60.0	0.83	1.21	4.50	21.50	23.75	2.10
4	9:42	9:52	10.0	70.0	0.83	1.00	2.00	23.50	25.00	0.89
5	9:52	10:02	10.0	80.0	0.83	0.92	1.00	24.50	25.50	0.44
6	10:02	10:12	10.0	90.0	0.83	1.00	2.00	26.50	25.00	0.89
7	10:12	10:22	10.0	100.0	0.83	0.92	1.00	27.50	25.50	0.44
8	10:22	10:32	10.0	110.0	0.83	0.92	1.00	28.50	25.50	0.44

Average Infiltration Rate (in/hour) **0.59**
ADJUSTED INFILTRATION RATE (IN/HOUR) **0.29**



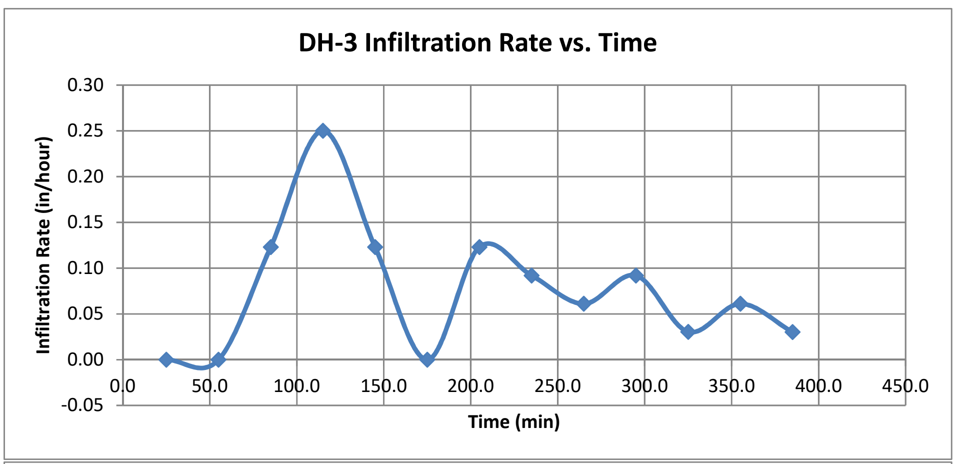


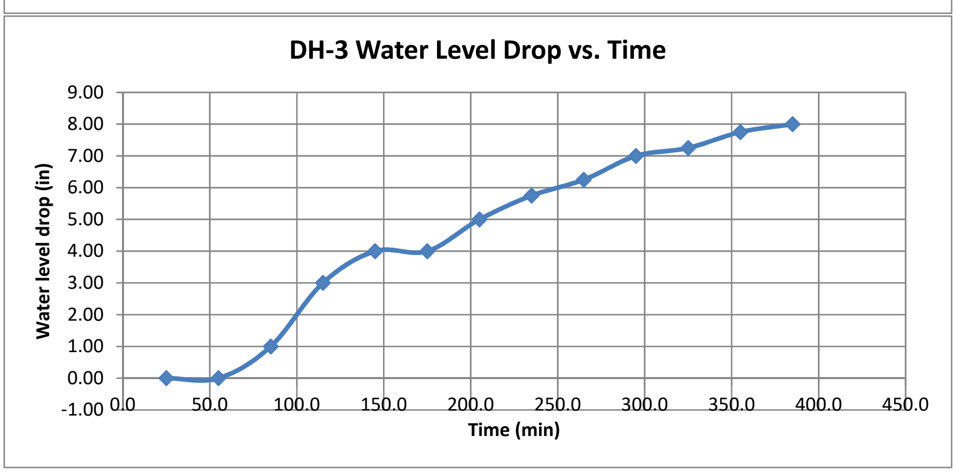
Riverside/Orange County - Infiltration Test in a Boring

Project Name: DPHP, LLC Hotel Component
Project Number: 17-206-01
Date: 9/11/18

Test Hole Number: DH-3
Total Depth : 3.00 feet 36 inches
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	$\sum\Delta D$	ΔH_{avg}	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	9:01	9:26	25.0	25.0	0.42	0.42	0.00	0.00	31.00	0.00
2	9:26	9:56	30.0	55.0	0.42	0.42	0.00	0.00	31.00	0.00
3	9:56	10:26	30.0	85.0	0.42	0.50	1.00	1.00	30.50	0.12
4	10:26	10:56	30.0	115.0	0.42	0.58	2.00	3.00	30.00	0.25
5	10:56	11:26	30.0	145.0	0.42	0.50	1.00	4.00	30.50	0.12
6	11:26	11:56	30.0	175.0	0.42	0.42	0.00	4.00	31.00	0.00
7	11:56	12:26	30.0	205.0	0.42	0.50	1.00	5.00	30.50	0.12
8	12:26	12:56	30.0	235.0	0.42	0.48	0.75	5.75	30.63	0.09
9	12:56	1:26	30.0	265.0	0.42	0.46	0.50	6.25	30.75	0.06
10	1:26	1:56	30.0	295.0	0.42	0.48	0.75	7.00	30.63	0.09
11	1:56	2:26	30.0	325.0	0.42	0.44	0.25	7.25	30.88	0.03
12	2:26	2:56	30.0	355.0	0.42	0.46	0.50	7.75	30.75	0.06
13	2:56	3:26	30.0	385.0	0.40	0.42	0.25	8.00	31.13	0.03
									Average Infiltration Rate (in/hour)	**0.04**



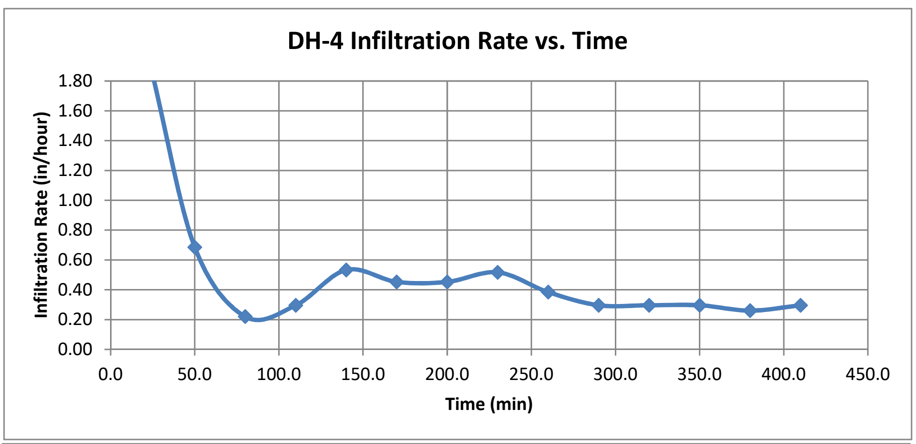


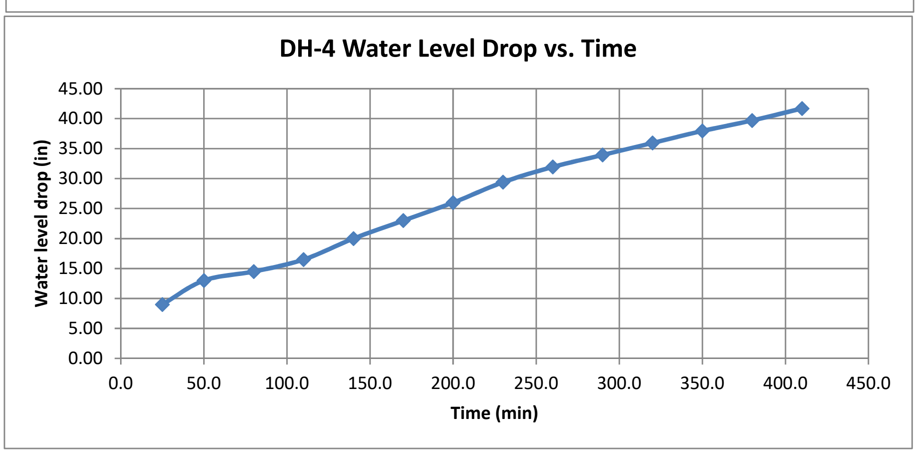
Riverside/Orange County - Infiltration Test in a Boring

Project Name: DPHP, LLC Hotel Component
Project Number: 17-206-01
Date: 9/11/18

Test Hole Number: DH-4
Total Depth : 3.00 feet 36 inches
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	$\Sigma\Delta D$	$\Delta Havg$	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	9:15	9:40	25.0	25.0	0.83	1.58	9.00	9.00	21.50	1.84
2	9:40	10:05	25.0	50.0	0.67	1.00	4.00	13.00	26.00	0.69
3	10:05	10:35	30.0	80.0	0.83	0.96	1.50	14.50	25.25	0.22
4	10:35	11:05	30.0	110.0	0.83	1.00	2.00	16.50	25.00	0.30
5	11:05	11:35	30.0	140.0	0.83	1.13	3.50	20.00	24.25	0.53
6	11:35	12:05	30.0	170.0	0.83	1.08	3.00	23.00	24.50	0.45
7	12:05	12:35	30.0	200.0	0.83	1.08	3.00	26.00	24.50	0.45
8	12:35	1:05	30.0	230.0	0.83	1.12	3.40	29.40	24.30	0.52
9	1:05	1:35	30.0	260.0	0.85	1.06	2.55	31.95	24.53	0.38
10	1:35	2:05	30.0	290.0	0.83	1.00	2.00	33.95	25.00	0.30
11	2:05	2:35	30.0	320.0	0.83	1.00	2.00	35.95	25.00	0.30
12	2:35	3:05	30.0	350.0	0.83	1.00	2.00	37.95	25.00	0.30
13	3:05	3:35	30.0	380.0	0.85	1.00	1.75	39.70	24.88	0.26
14	3:35	4:05	30.0	410.0	0.83	1.00	2.00	41.70	25.00	0.30
									Average Infiltration Rate (in/hour)	**0.28**





APPENDIX D

CPT Liquefaction Analyses

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

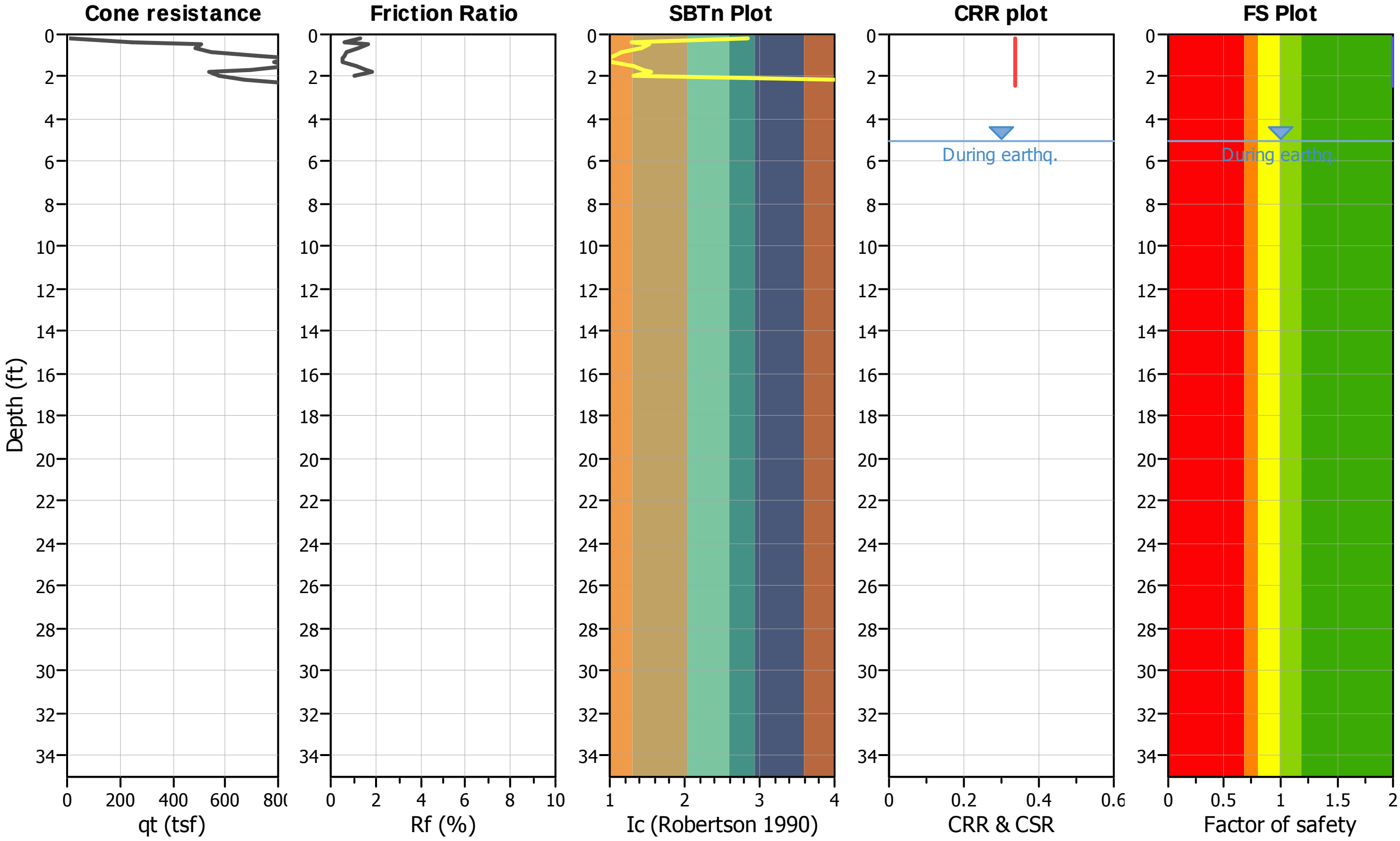
LIQUEFACTION ANALYSIS REPORT

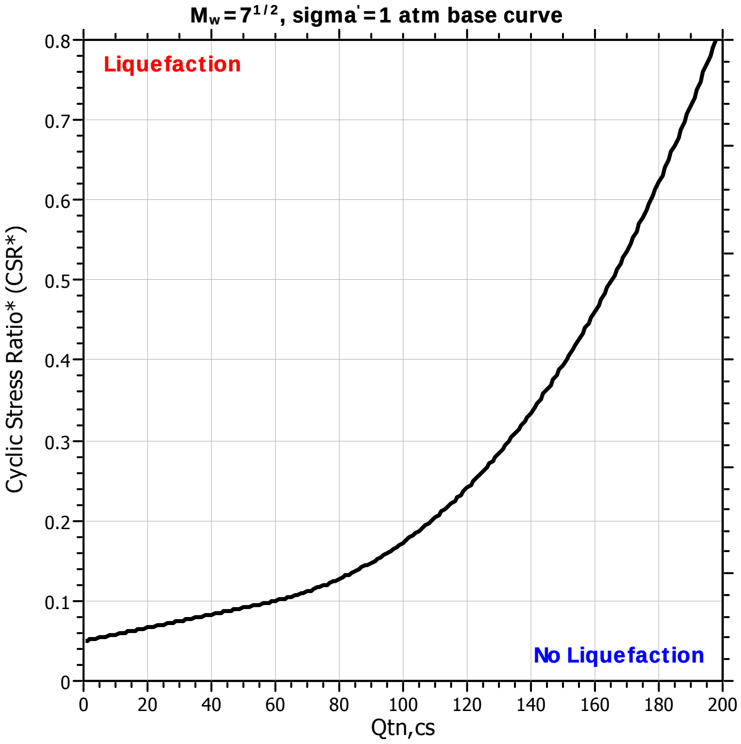
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

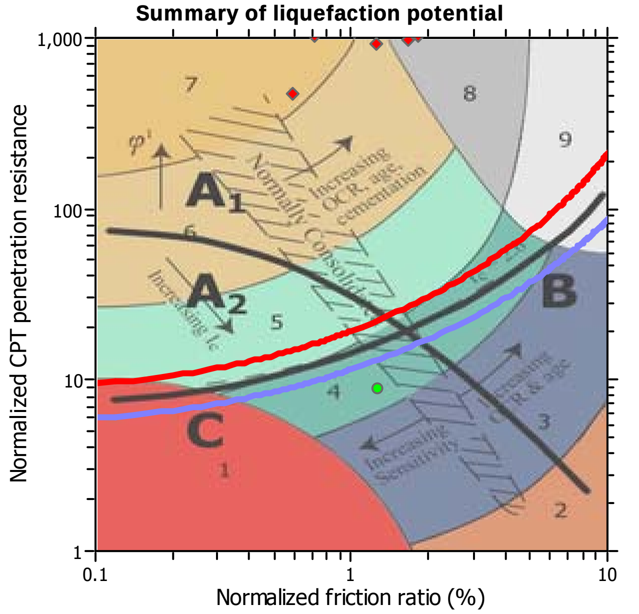
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	26.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

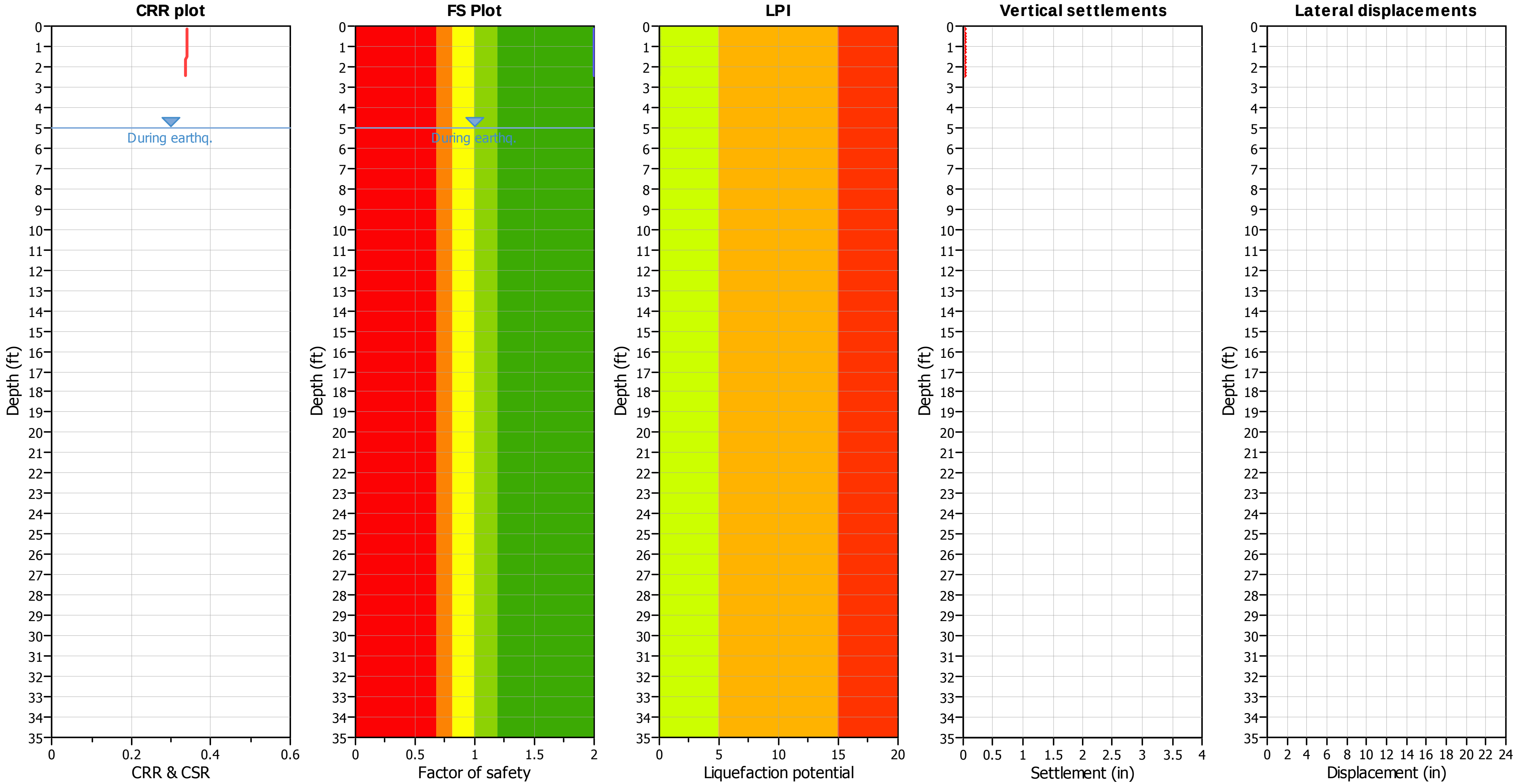






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	26.00 ft	Fill height:	N/A	Limit depth:	N/A

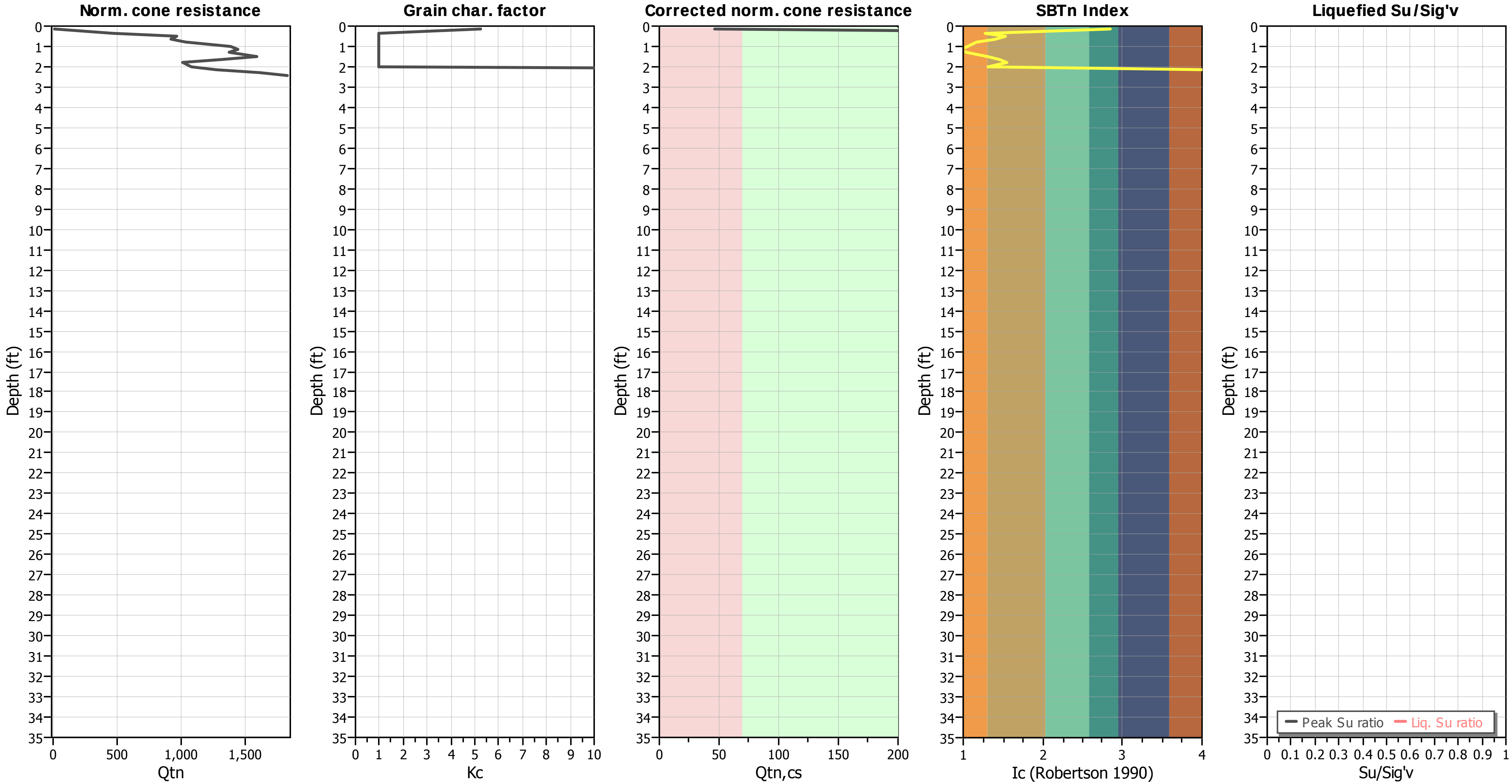
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	26.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

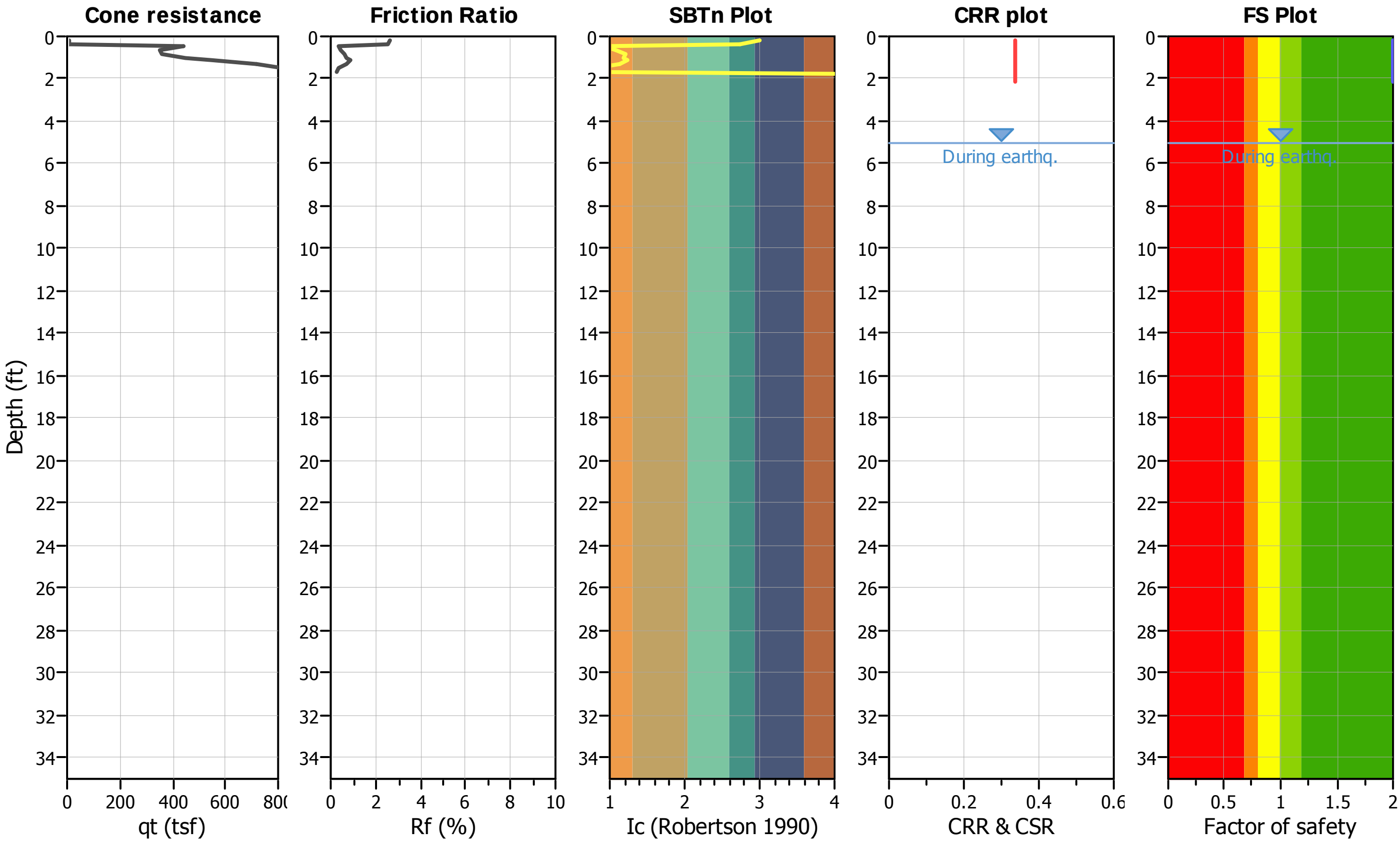
LIQUEFACTION ANALYSIS REPORT

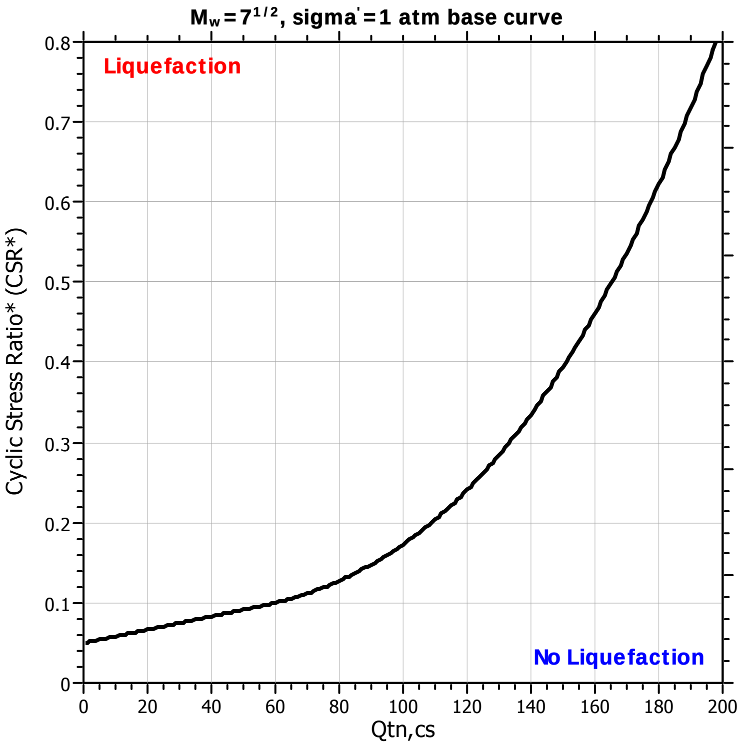
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

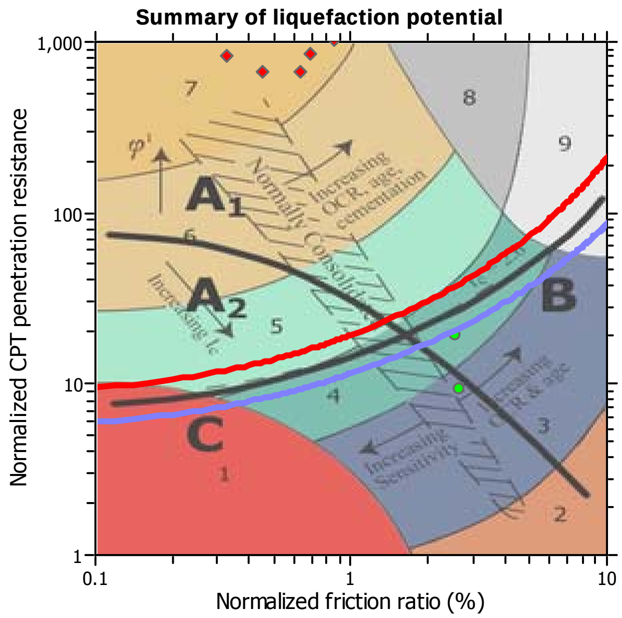
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	26.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

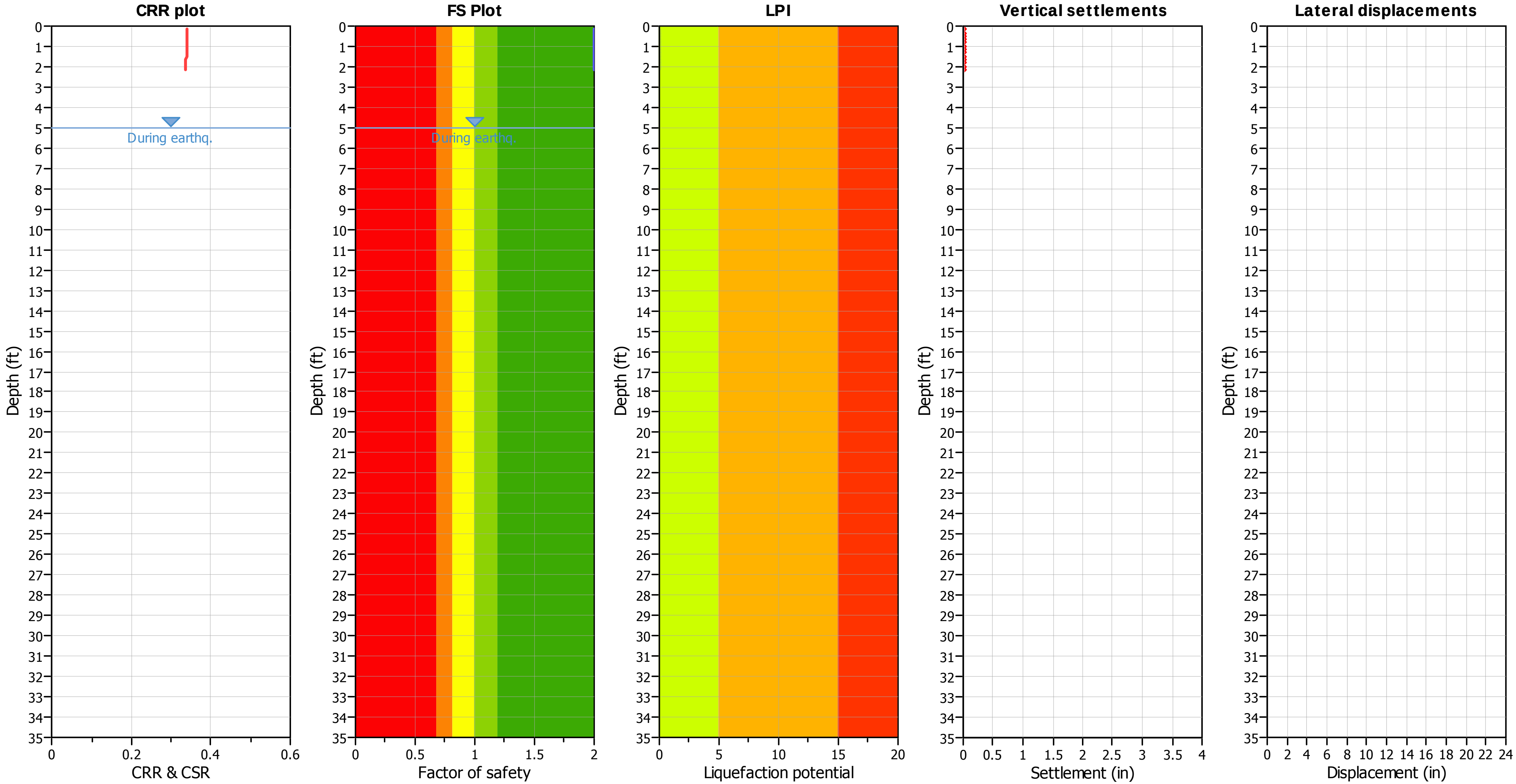






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	26.00 ft	Fill height:	N/A	Limit depth:	N/A

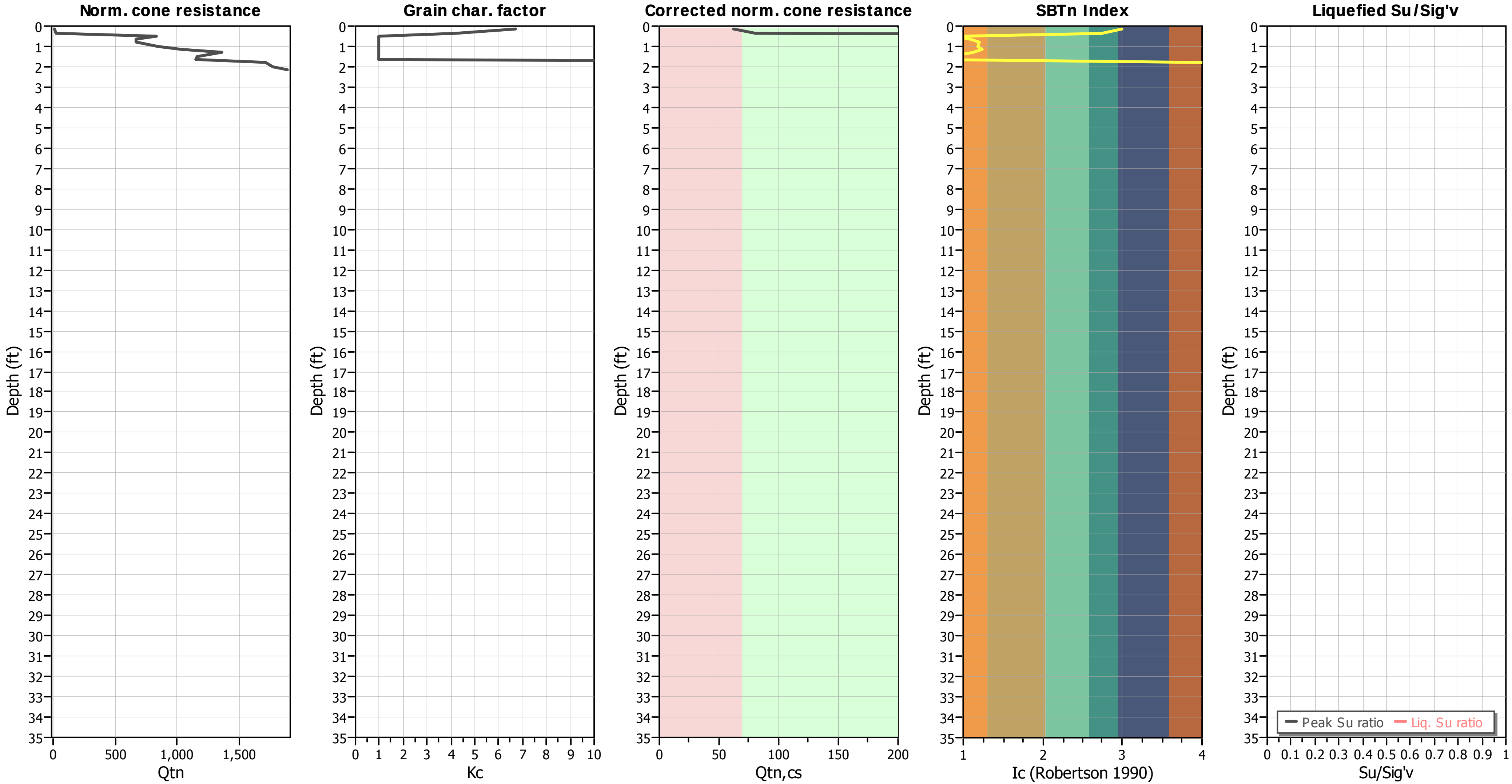
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	26.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

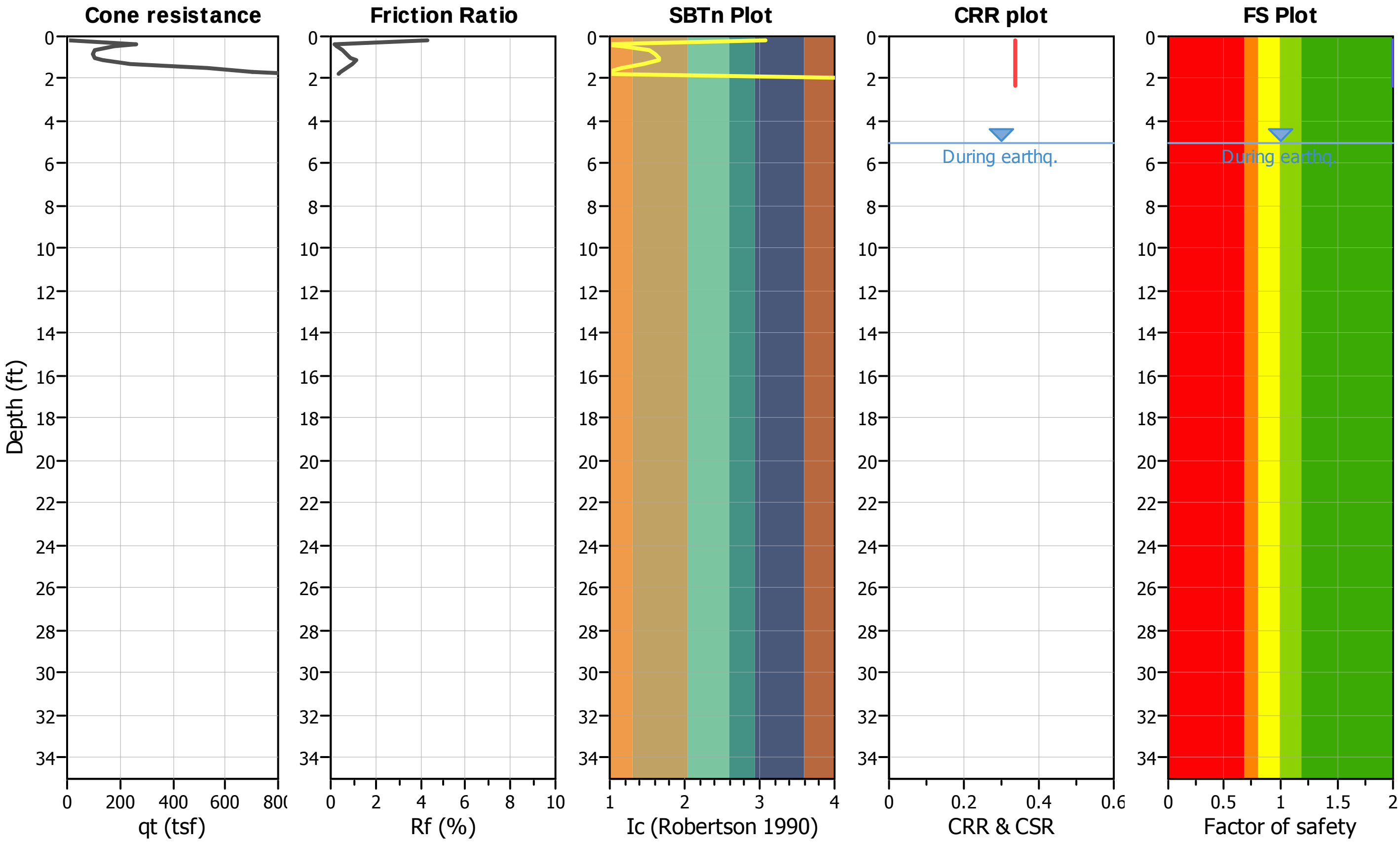
LIQUEFACTION ANALYSIS REPORT

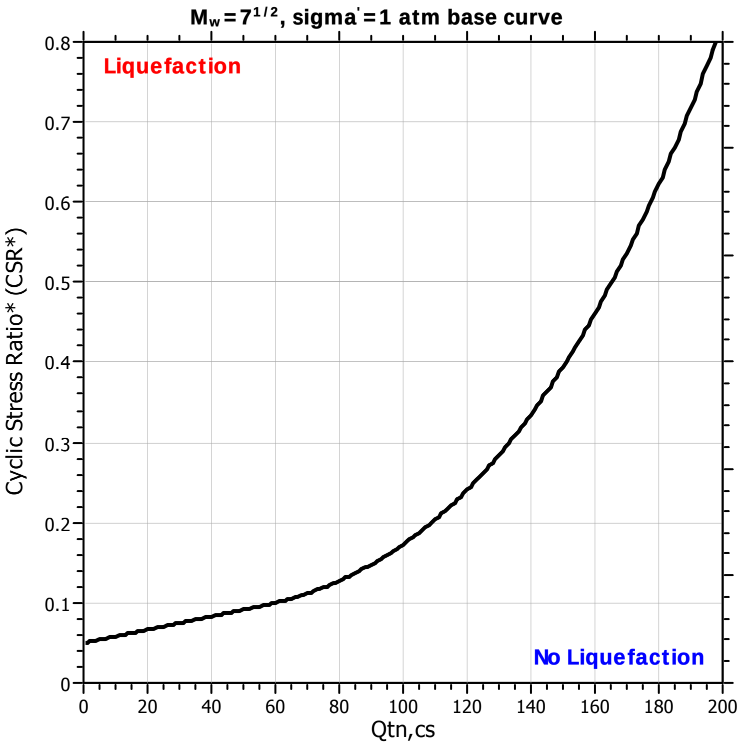
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

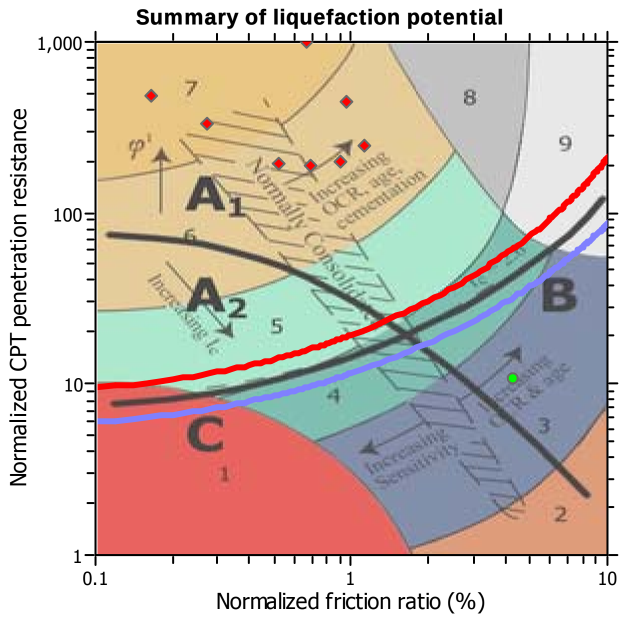
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

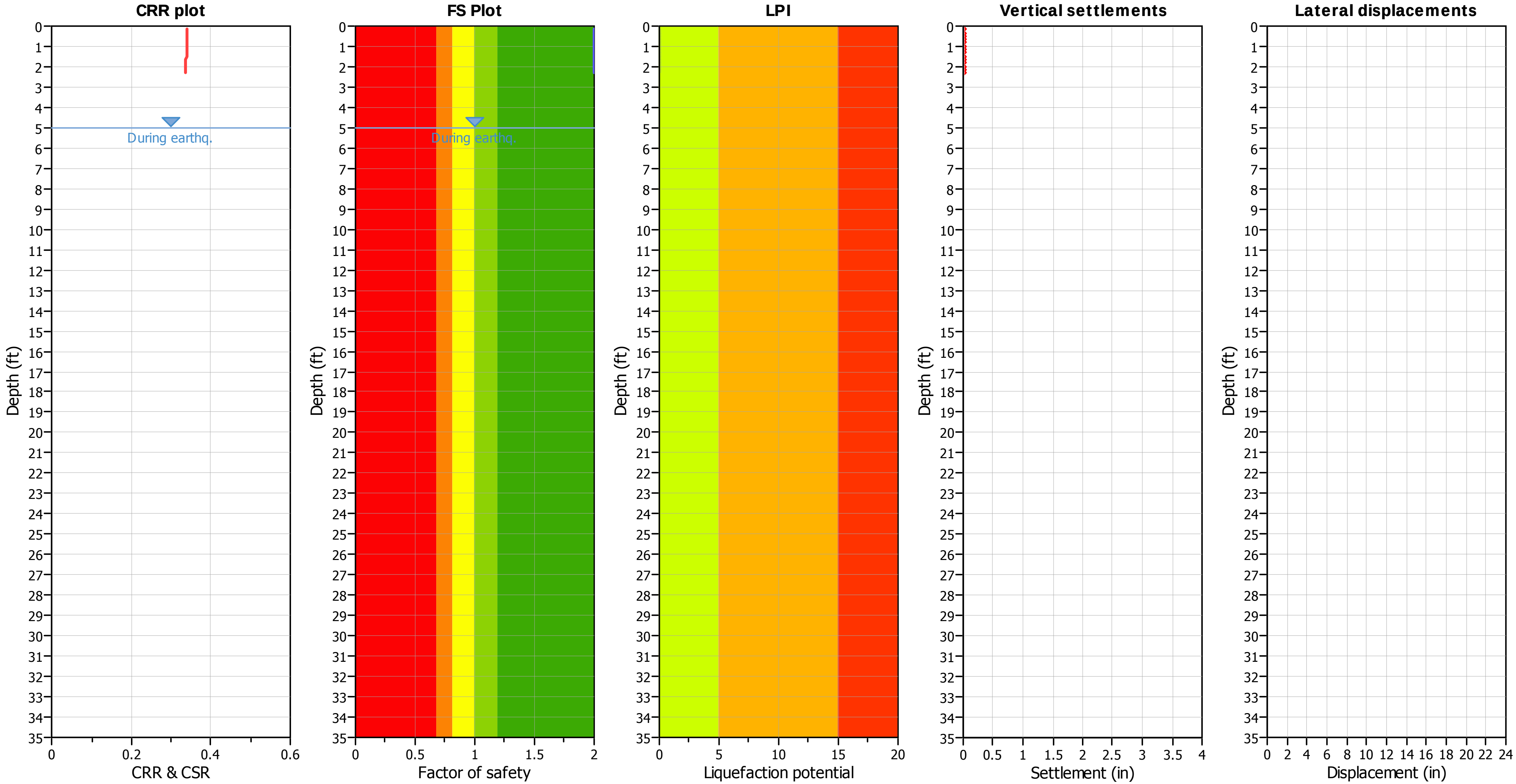






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

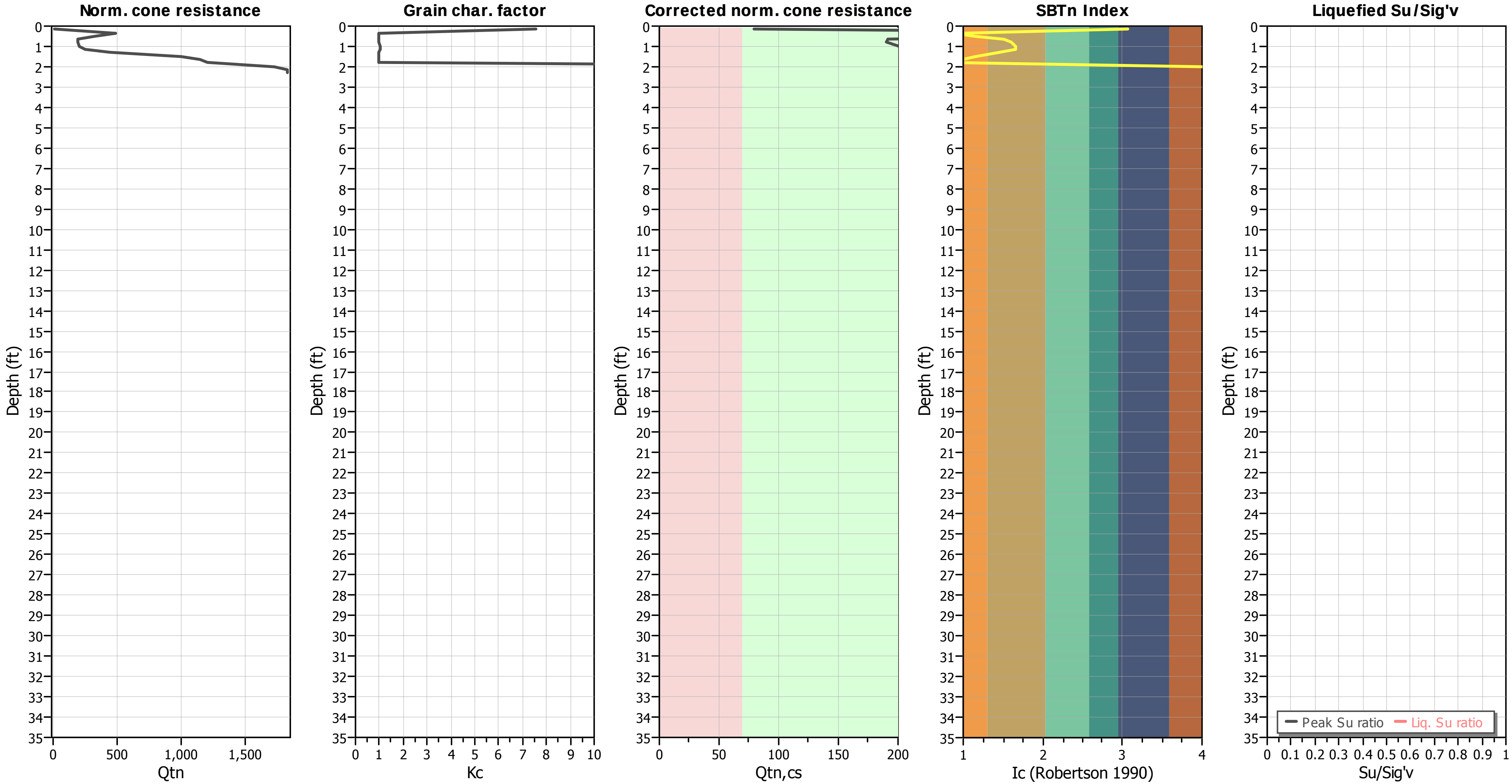
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

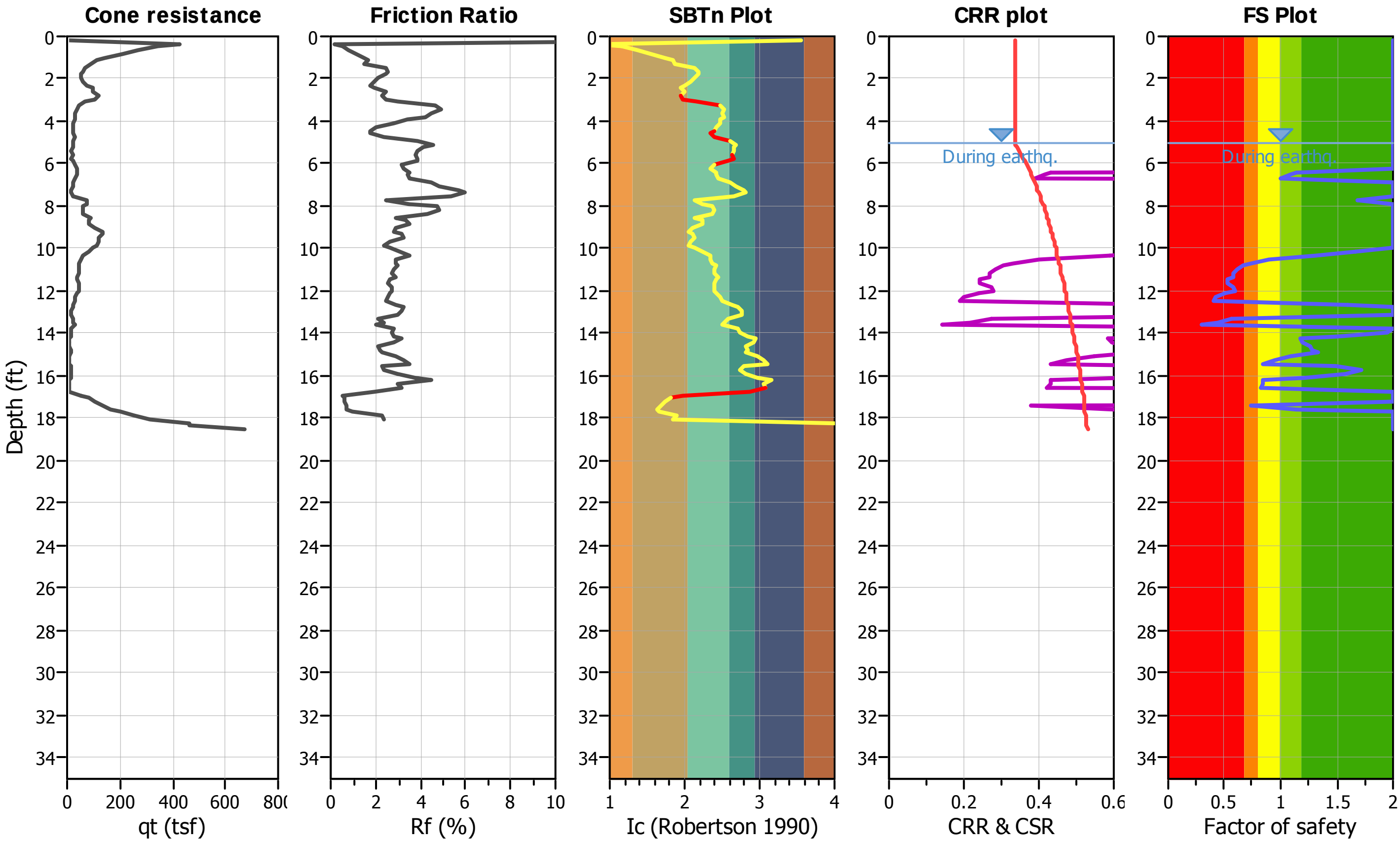
LIQUEFACTION ANALYSIS REPORT

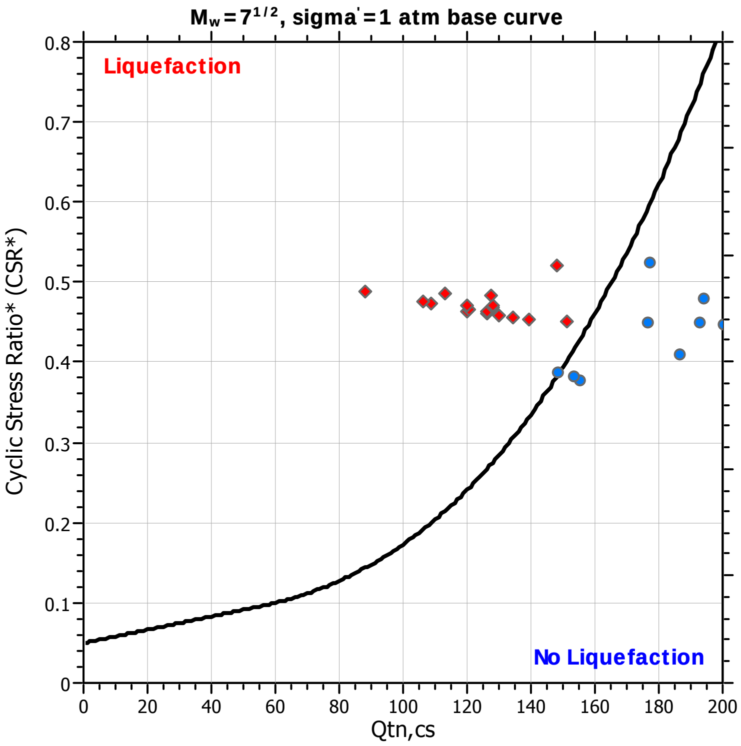
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

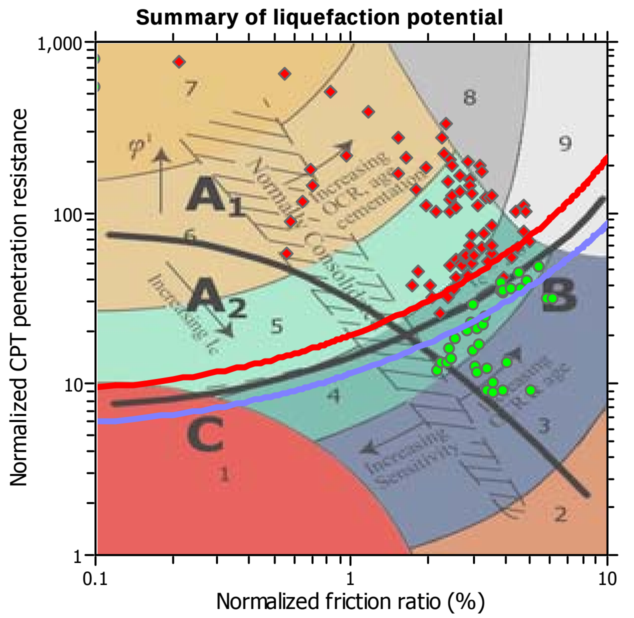
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	11.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

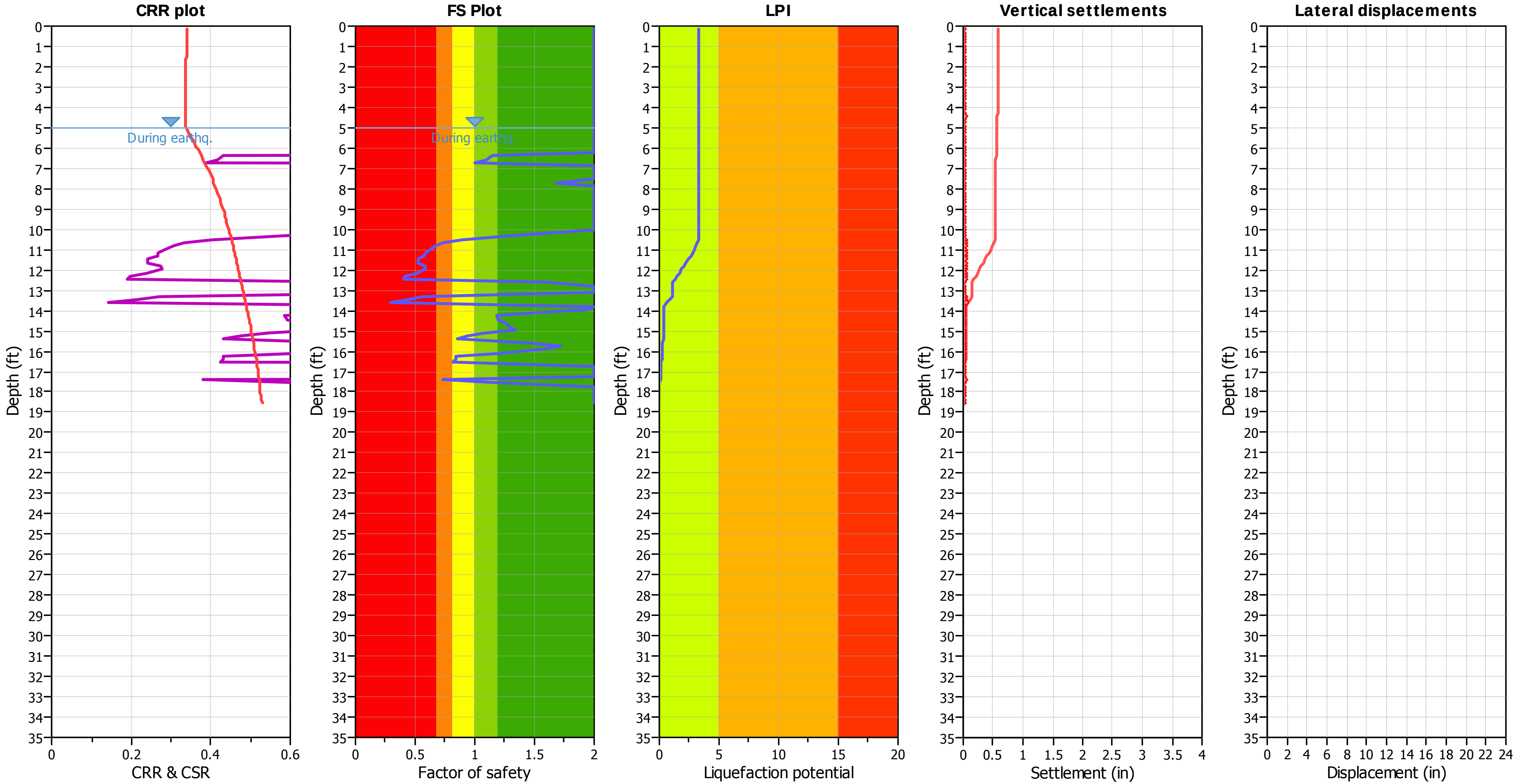






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

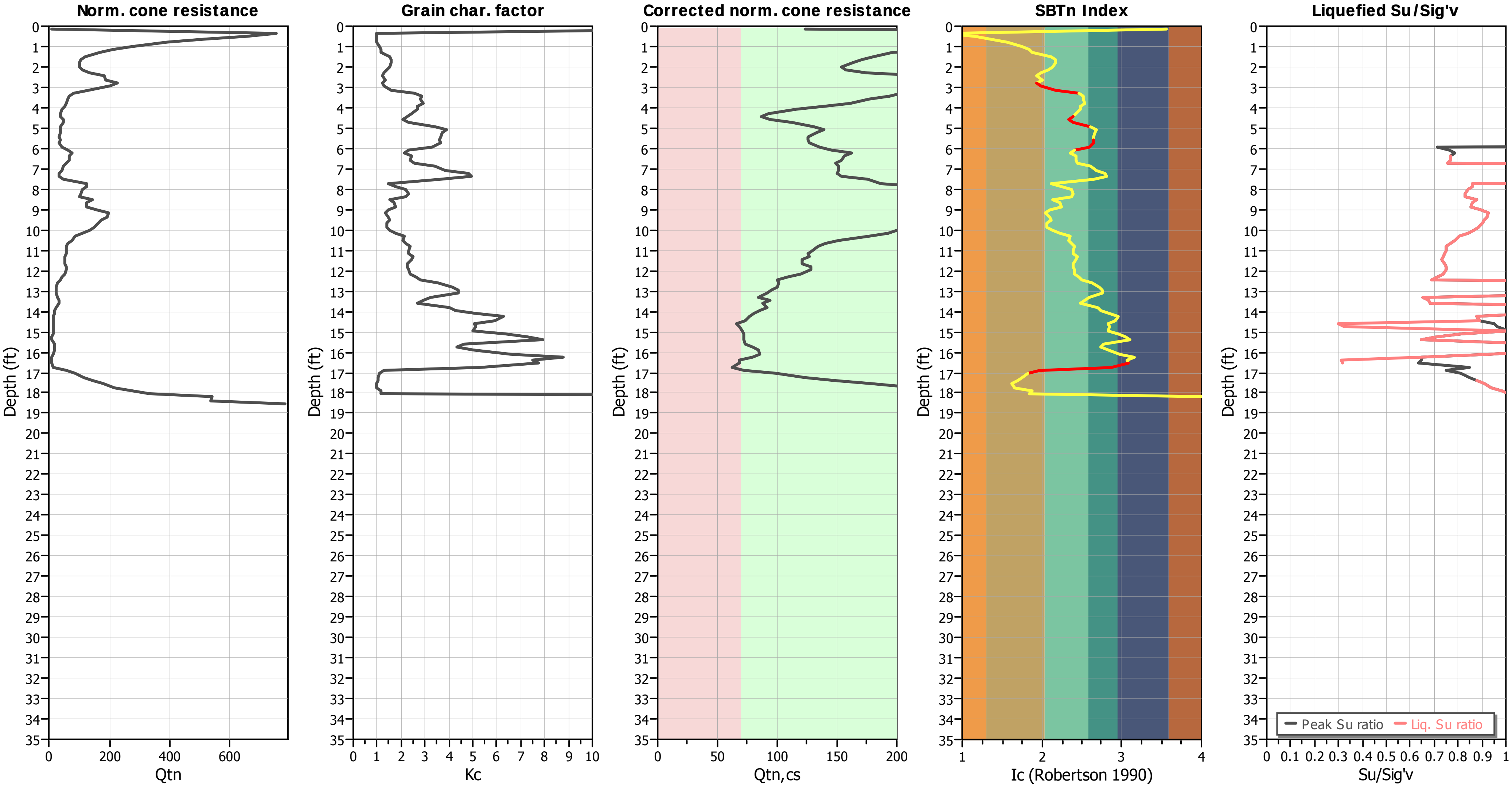
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

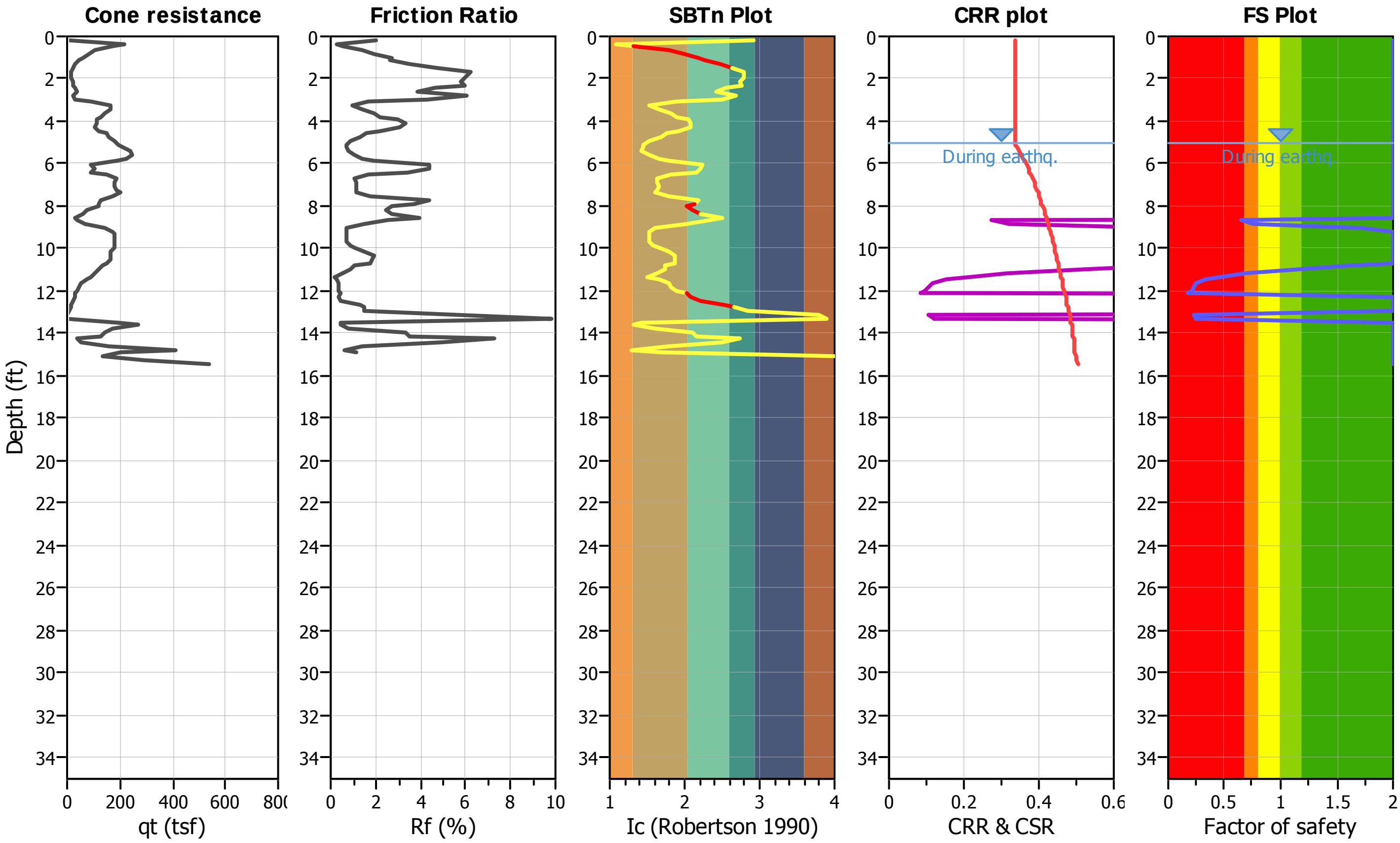
LIQUEFACTION ANALYSIS REPORT

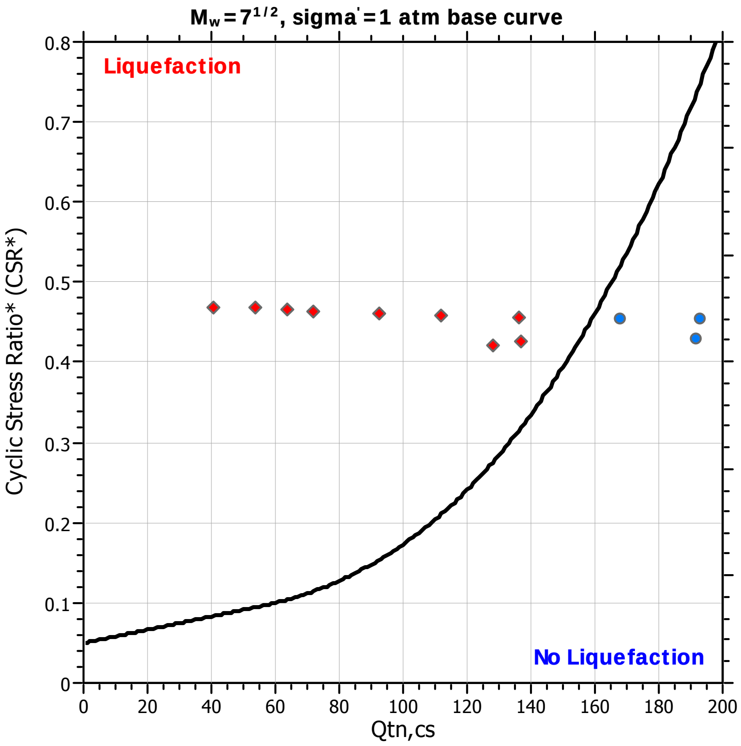
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

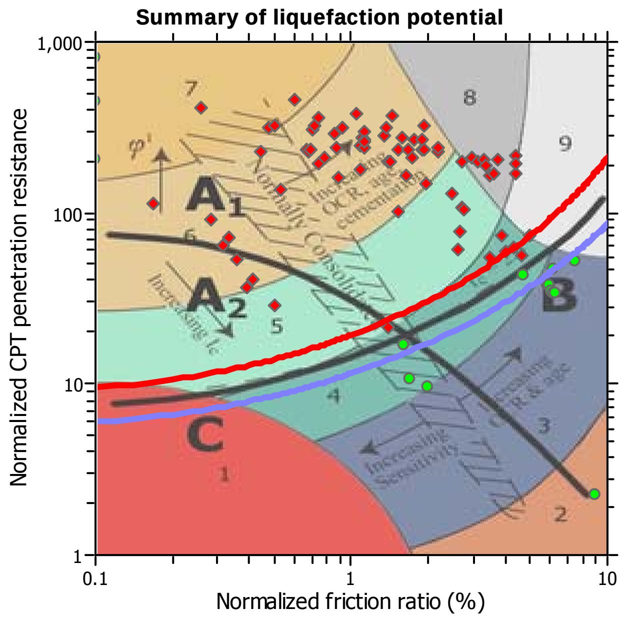
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	6.50 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

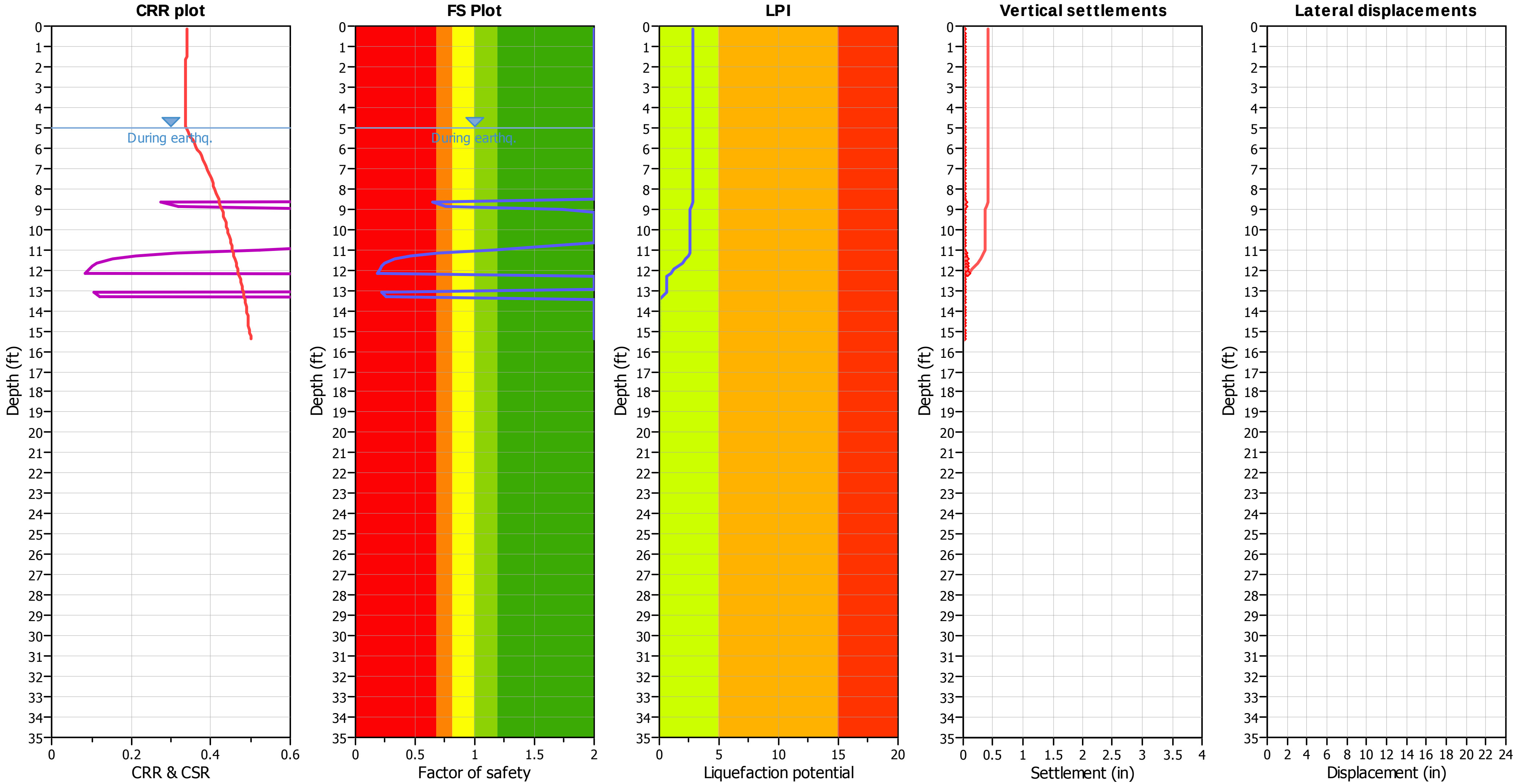






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.50 ft	Fill height:	N/A	Limit depth:	N/A

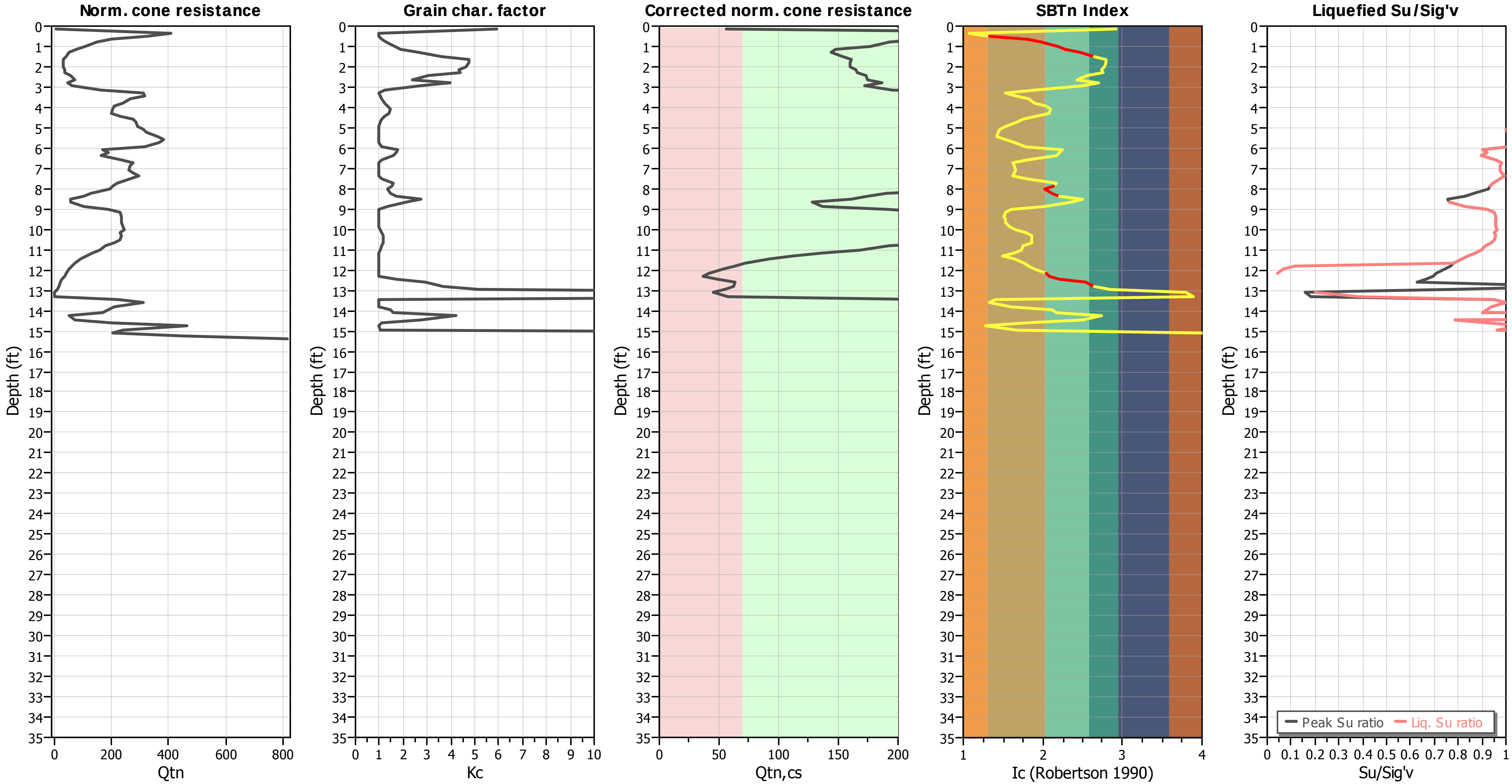
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.50 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

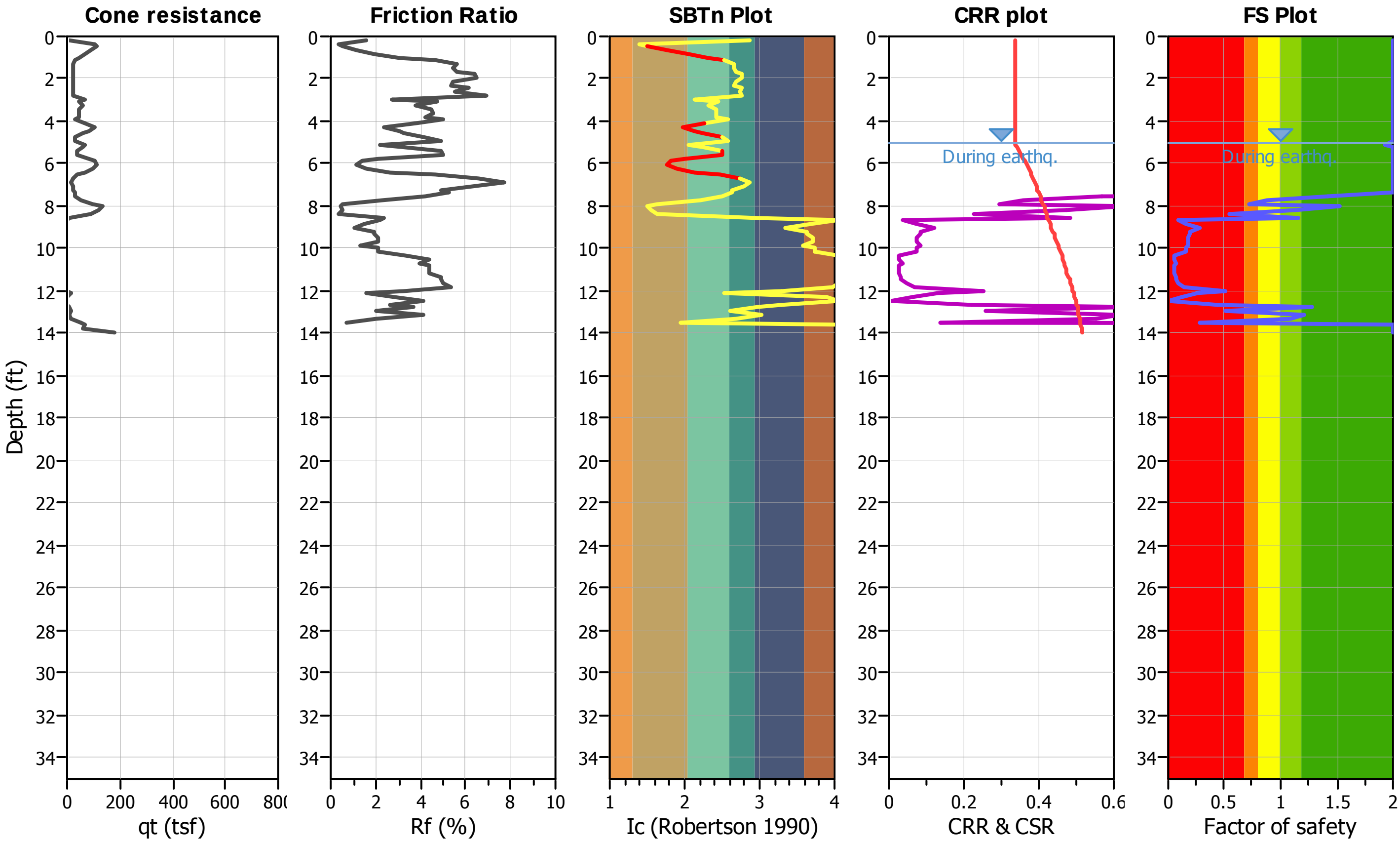
LIQUEFACTION ANALYSIS REPORT

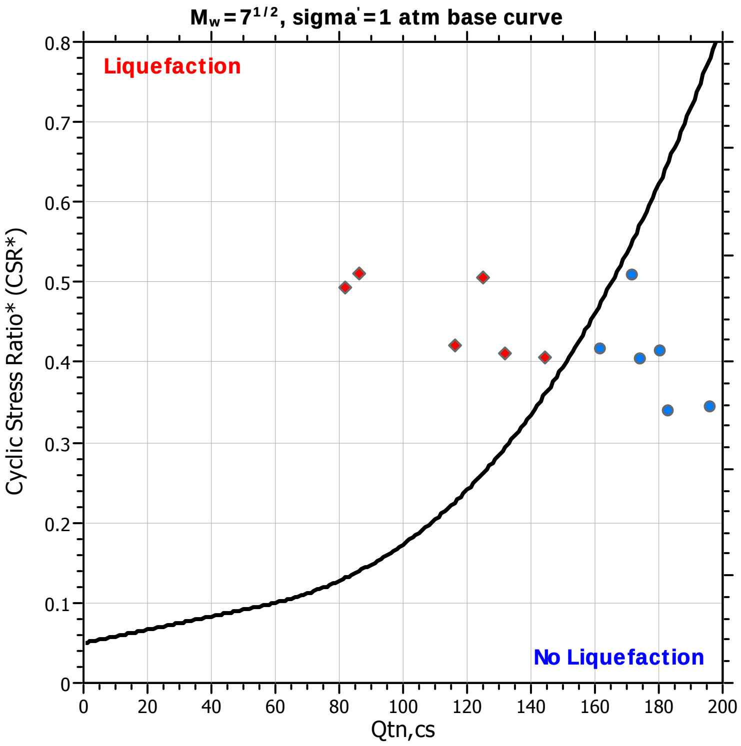
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

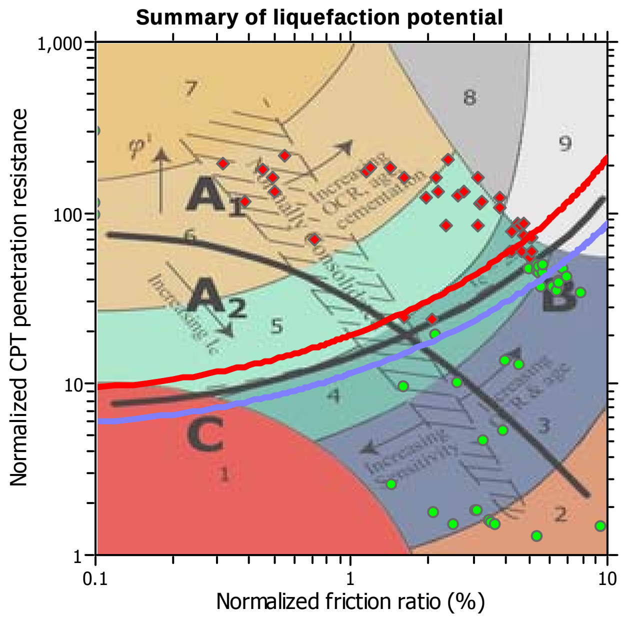
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

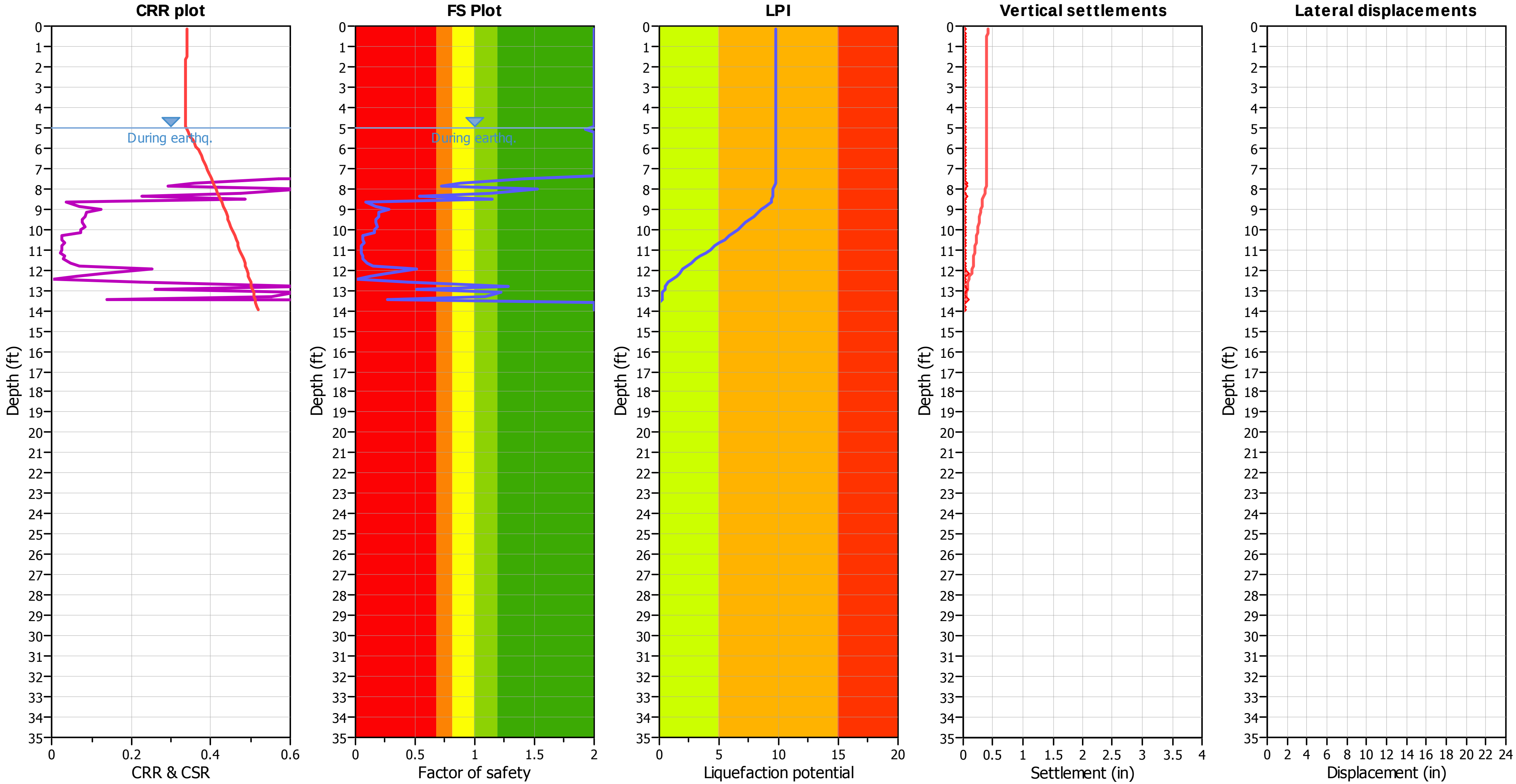






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

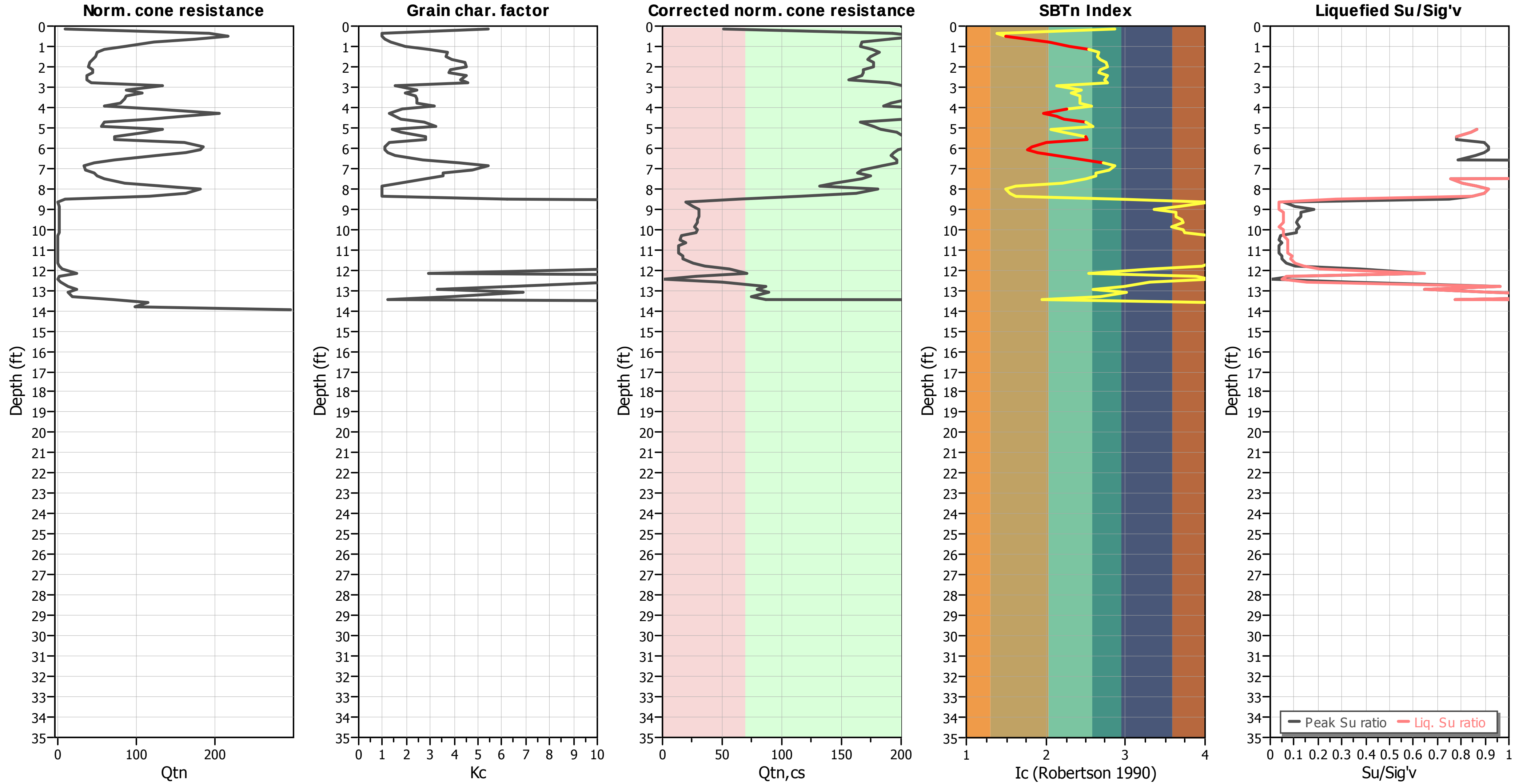
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

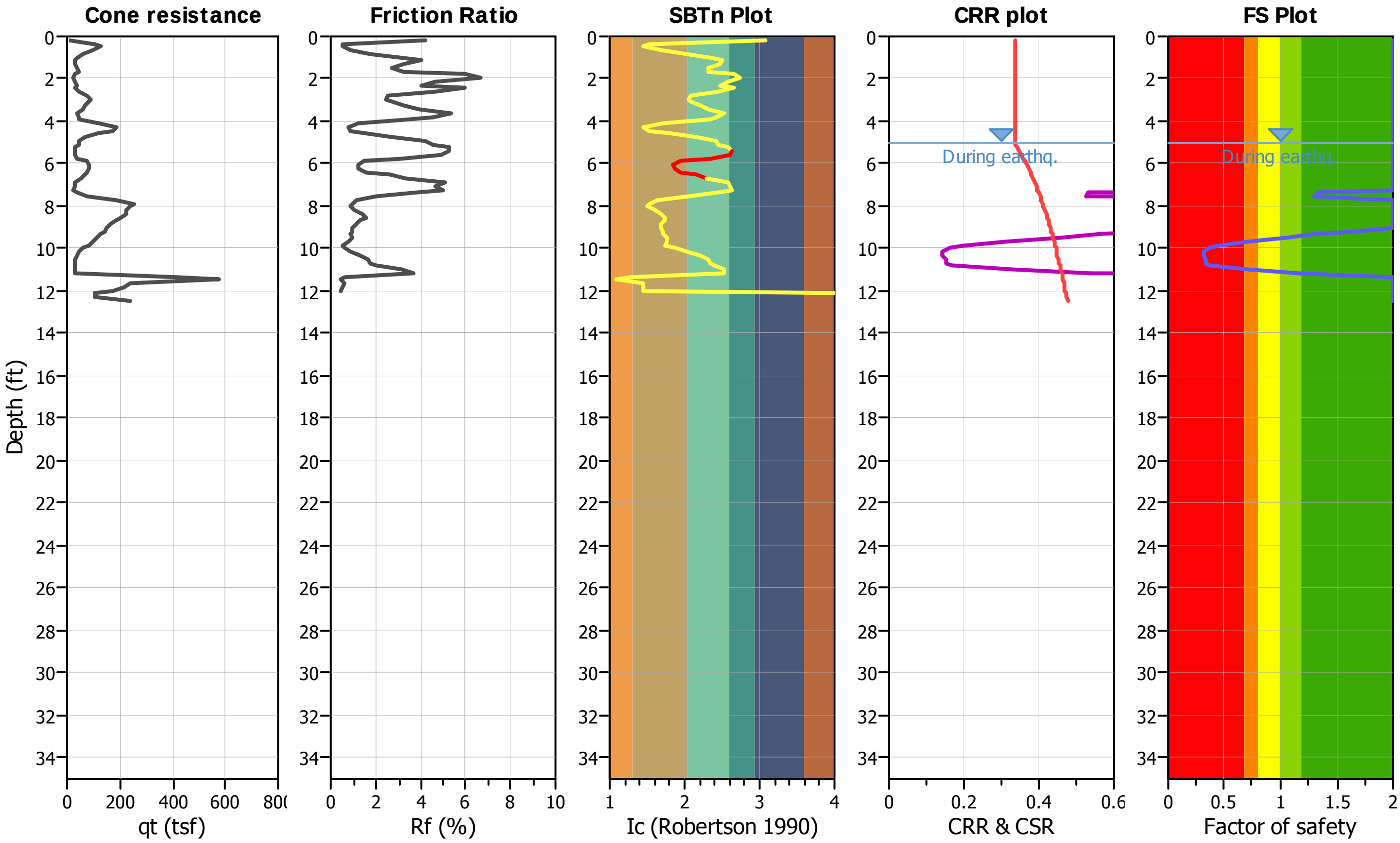
LIQUEFACTION ANALYSIS REPORT

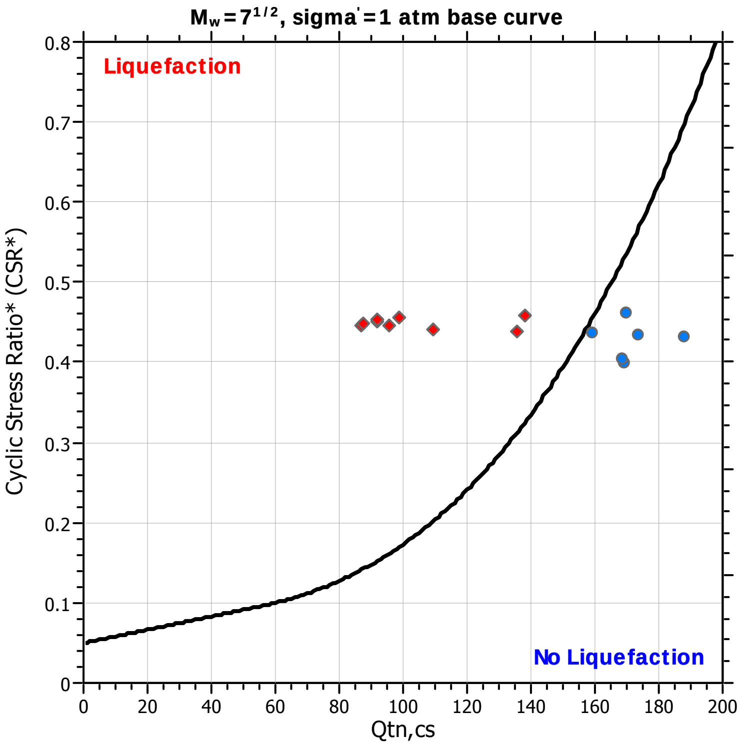
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

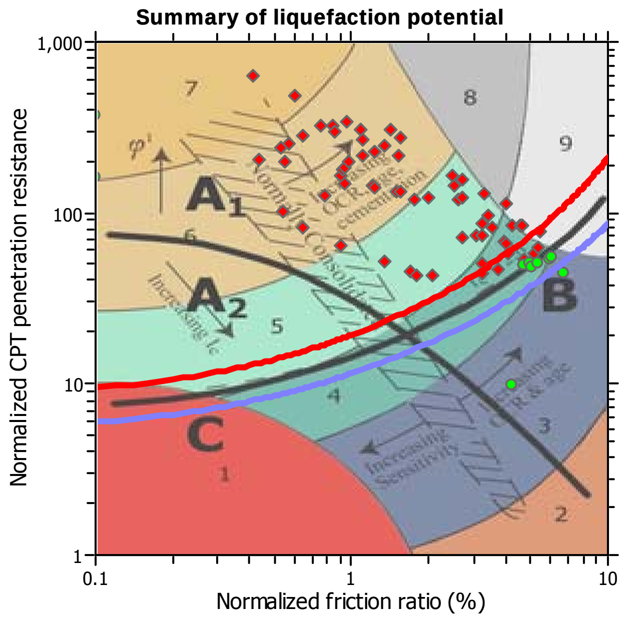
CPT file : CPT-6A

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

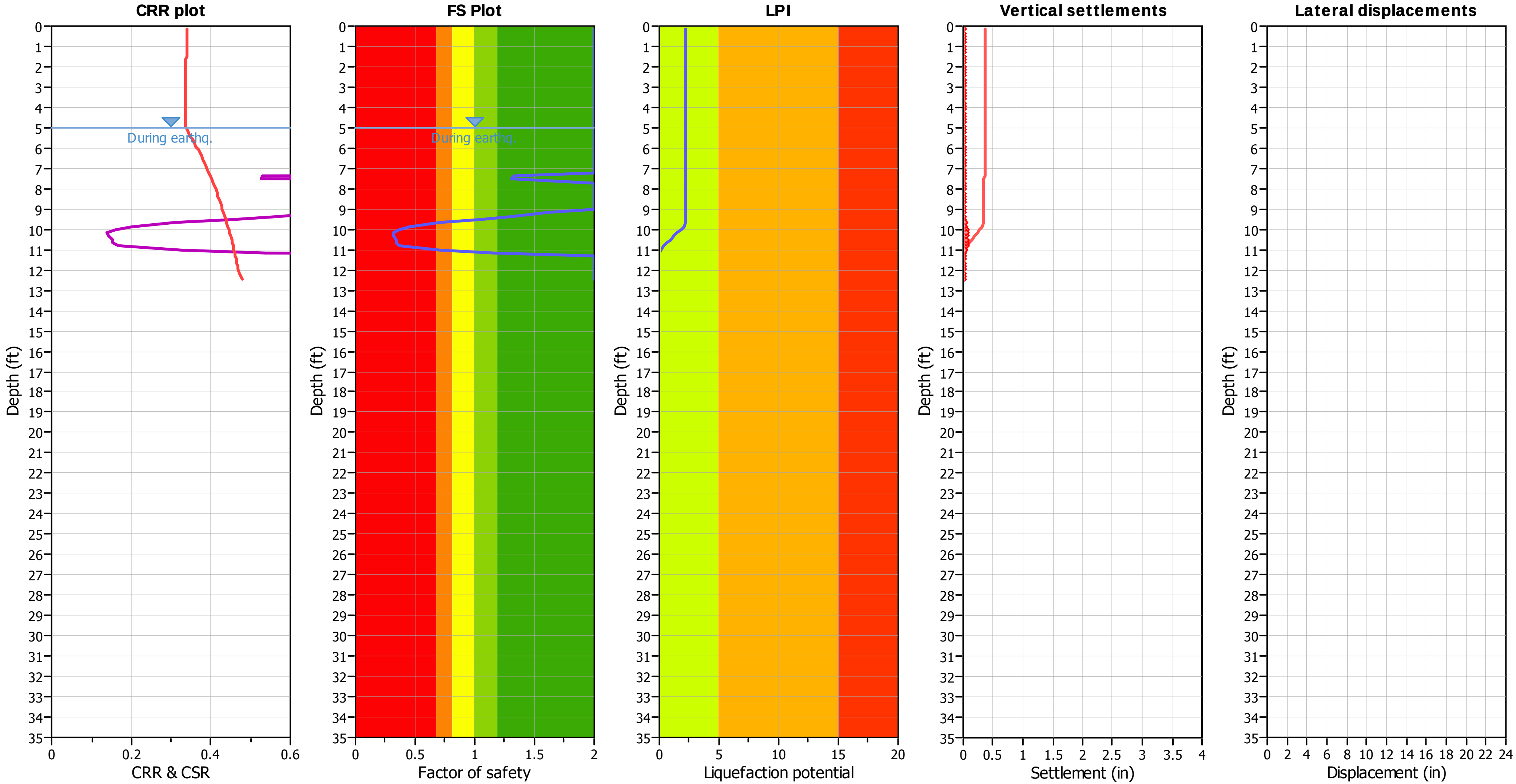






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

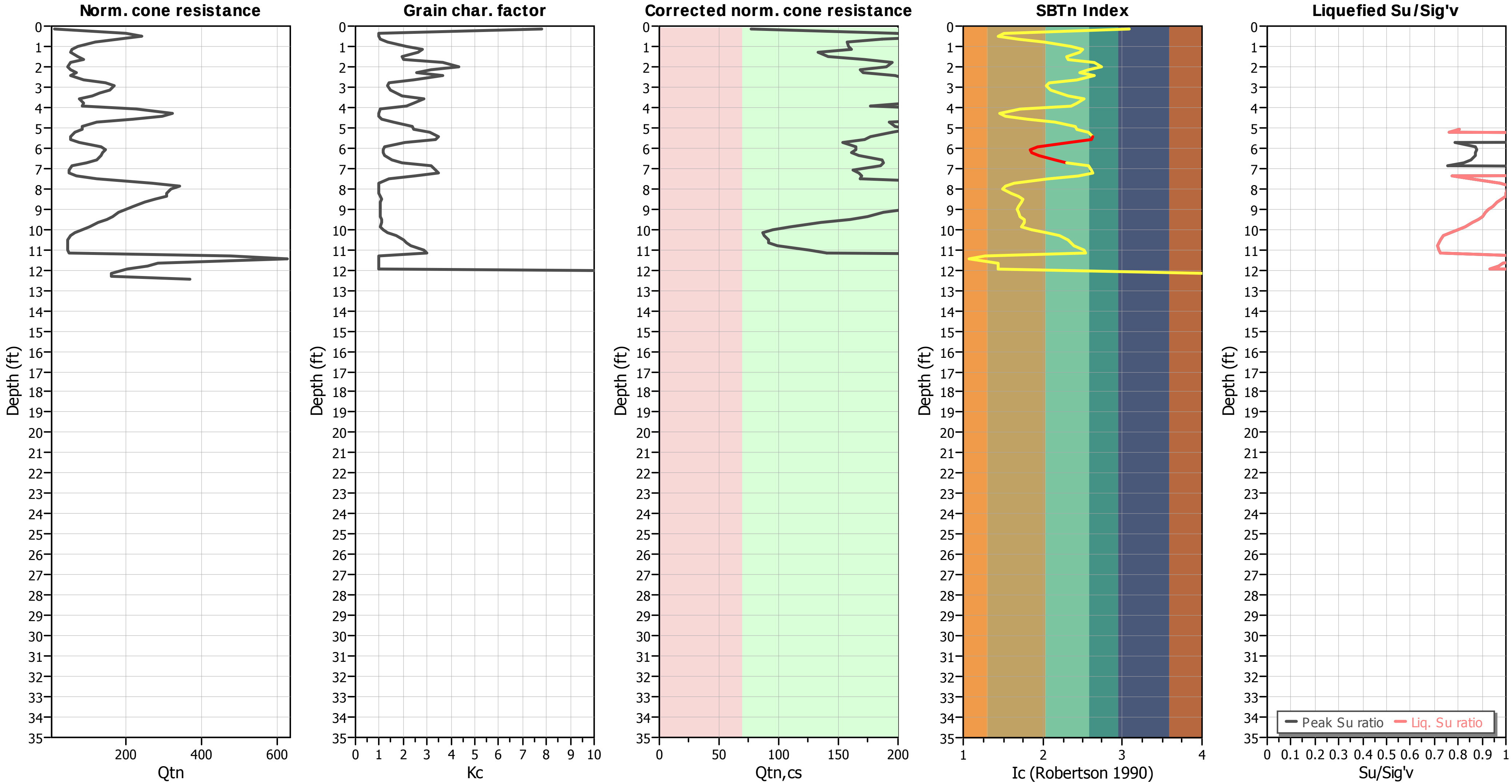
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

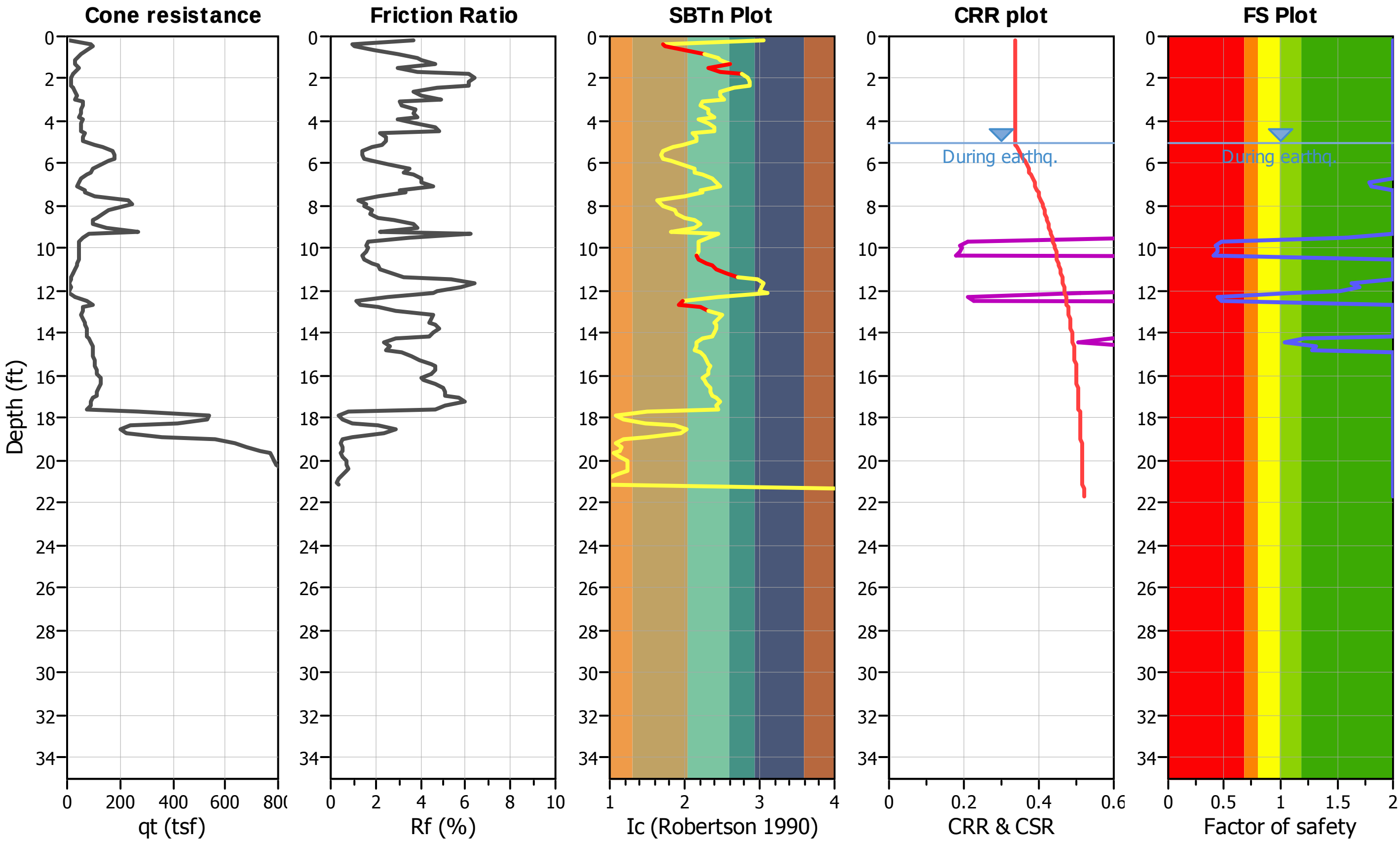
LIQUEFACTION ANALYSIS REPORT

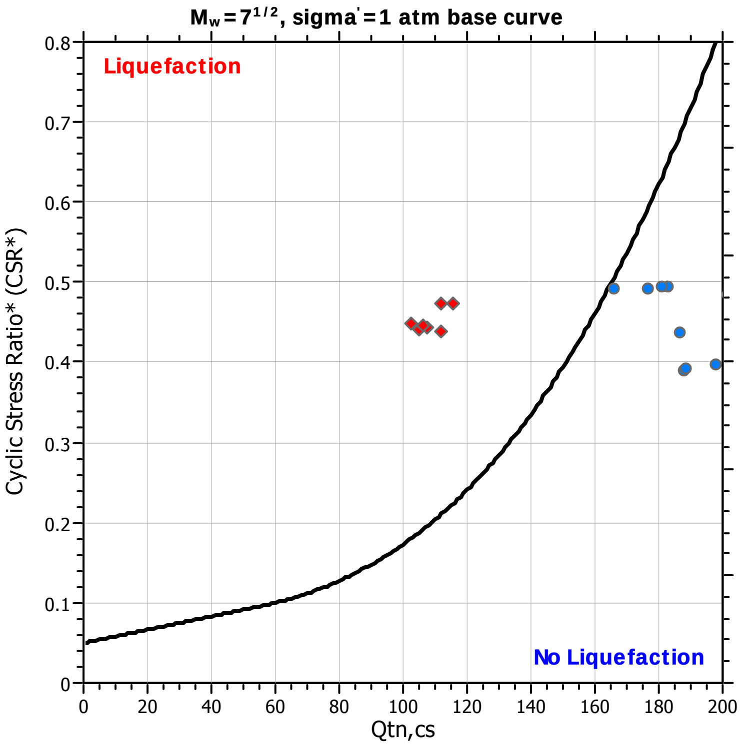
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

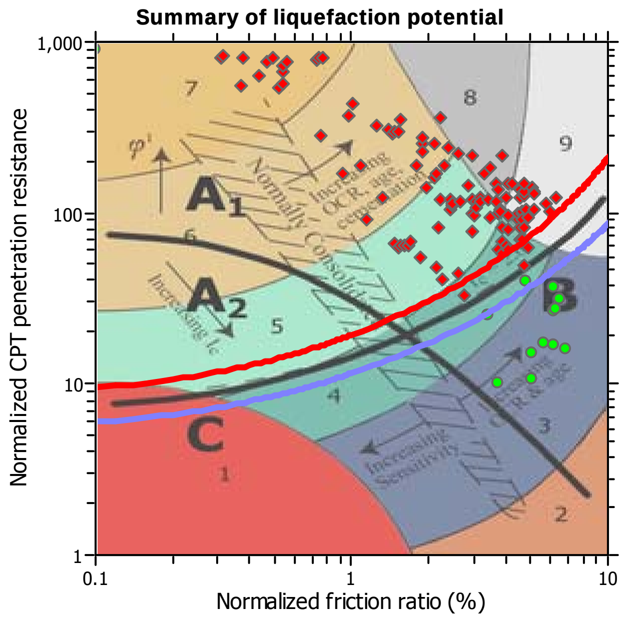
CPT file : CPT-6B

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

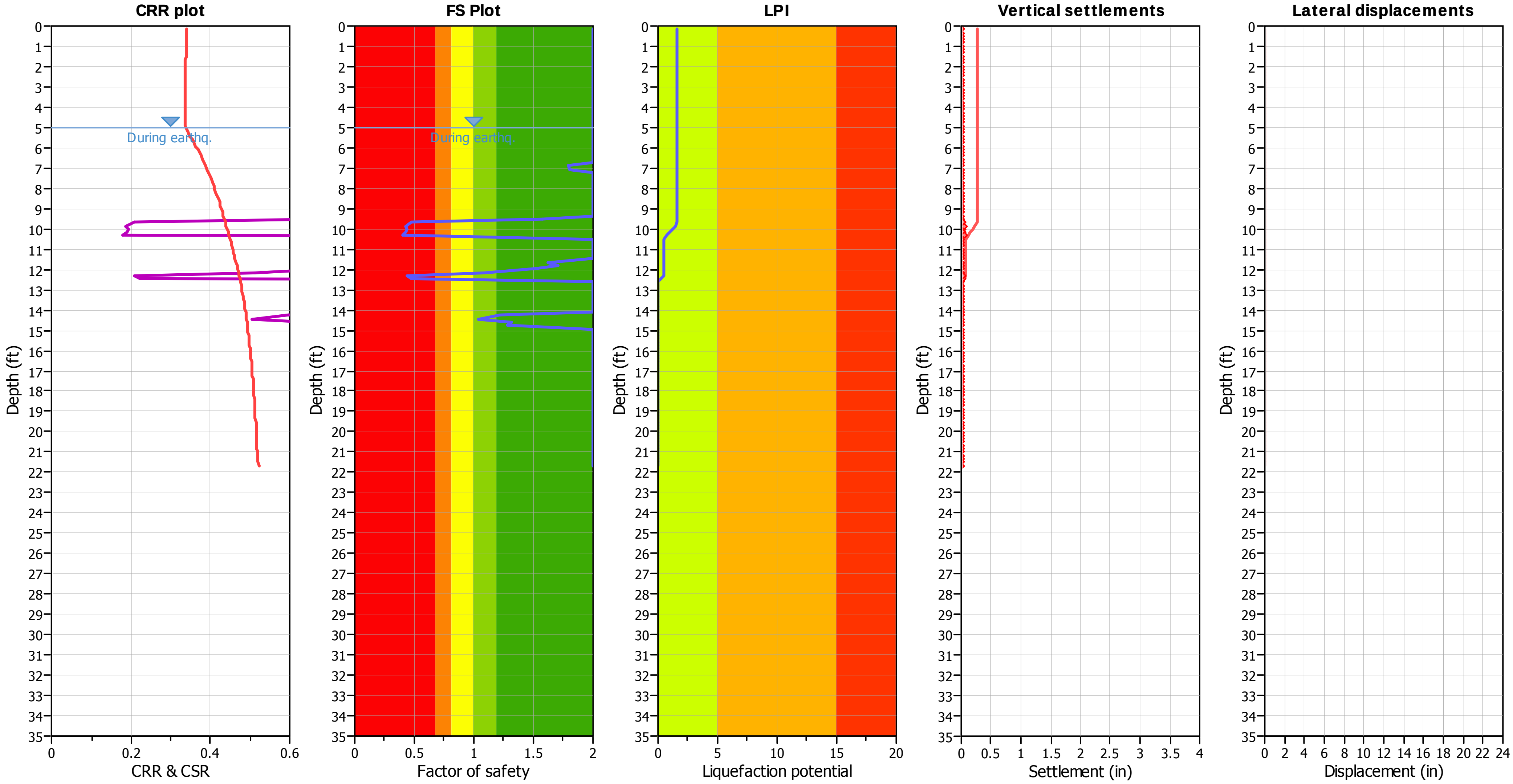






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

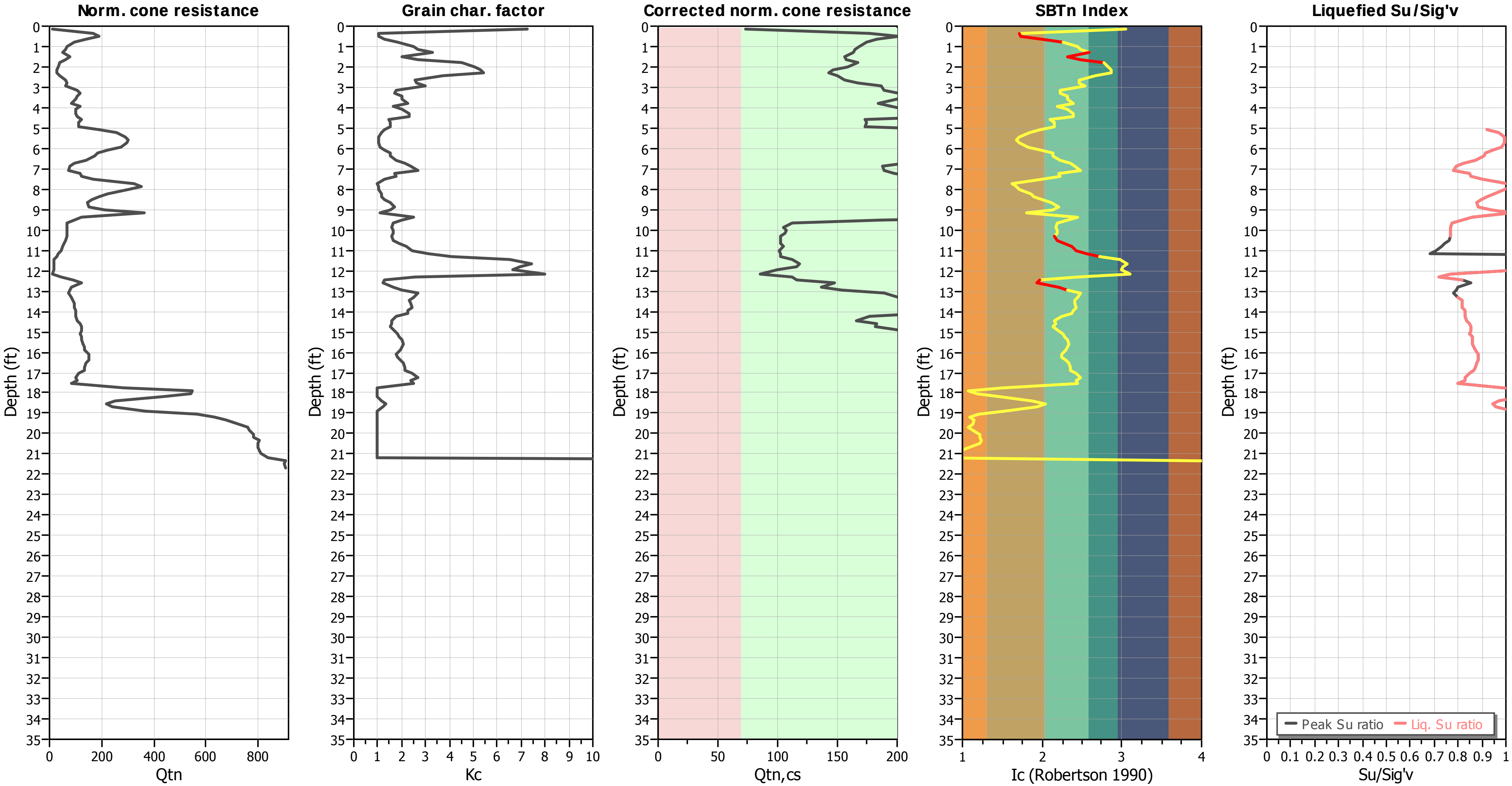
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

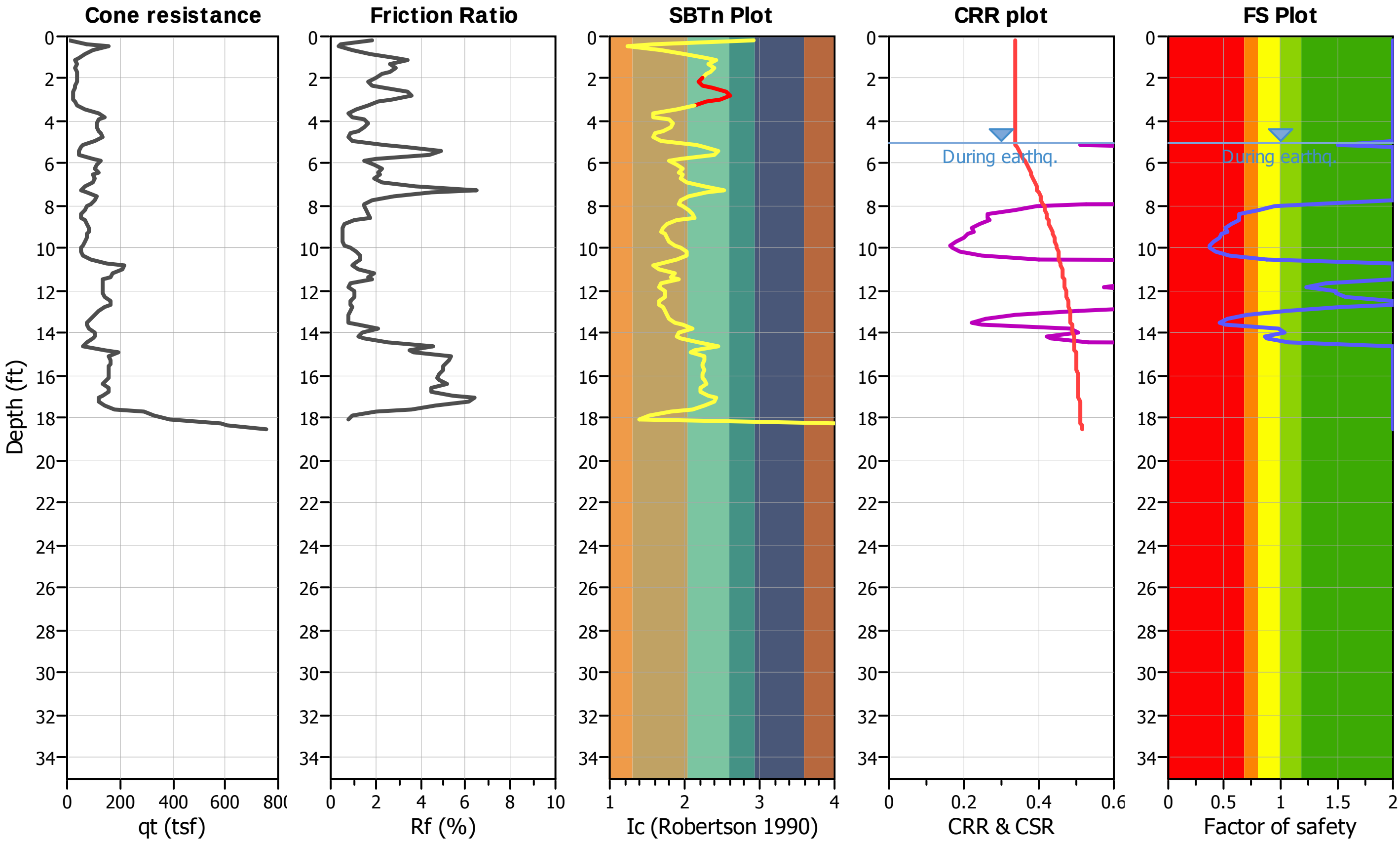
LIQUEFACTION ANALYSIS REPORT

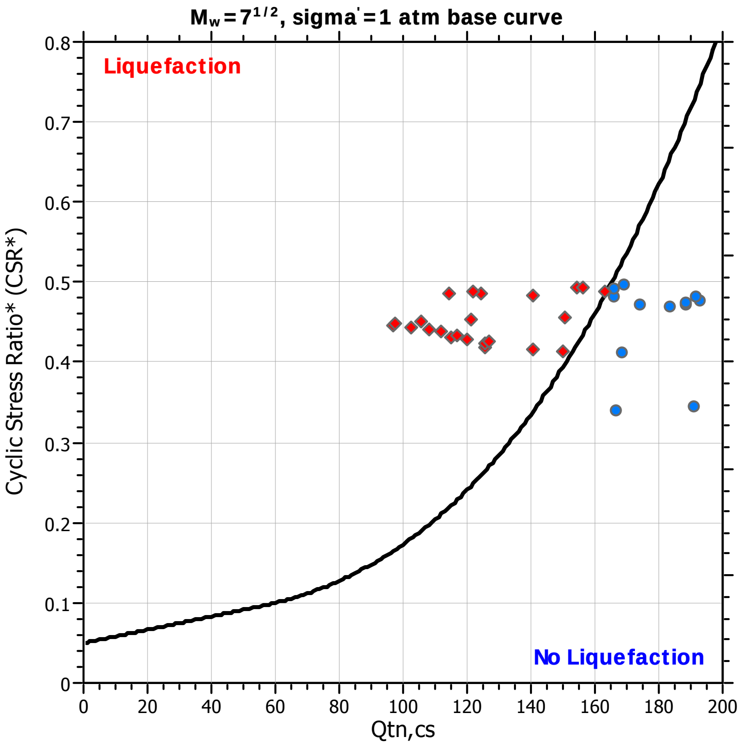
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

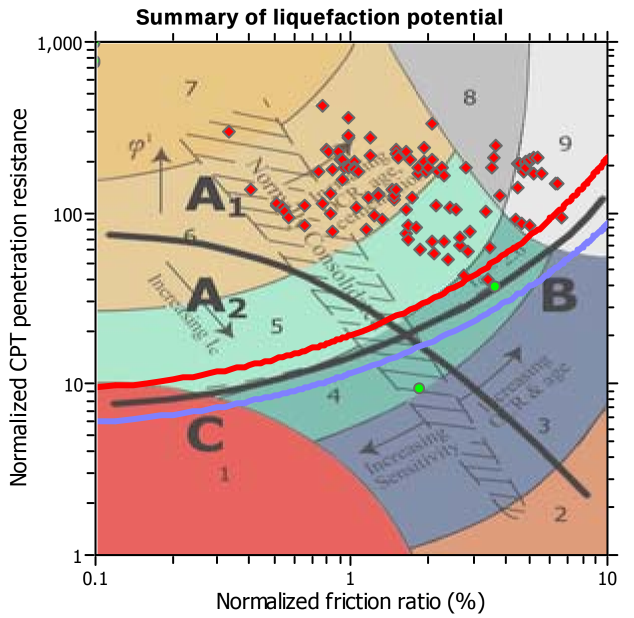
CPT file : CPT-7

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

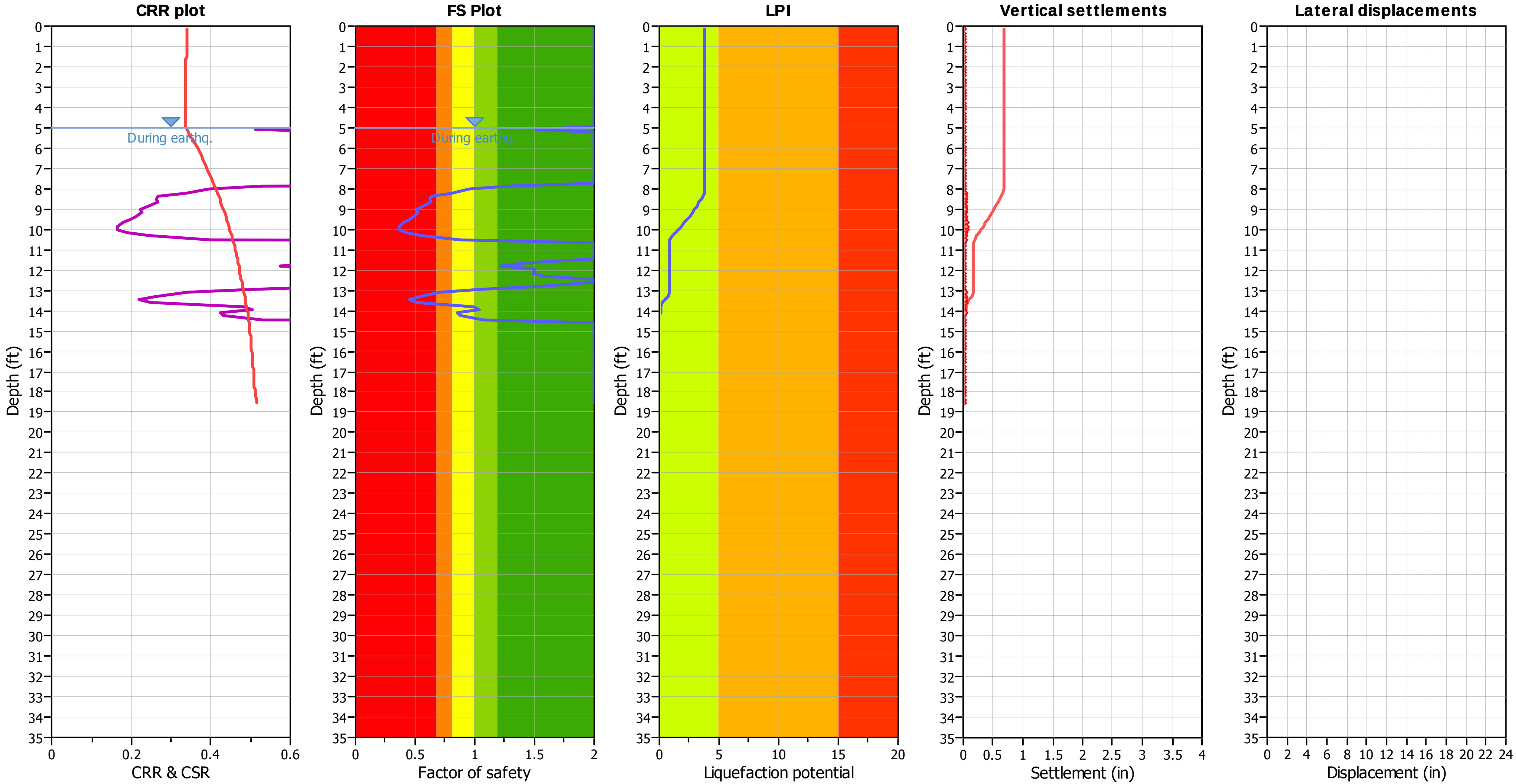






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

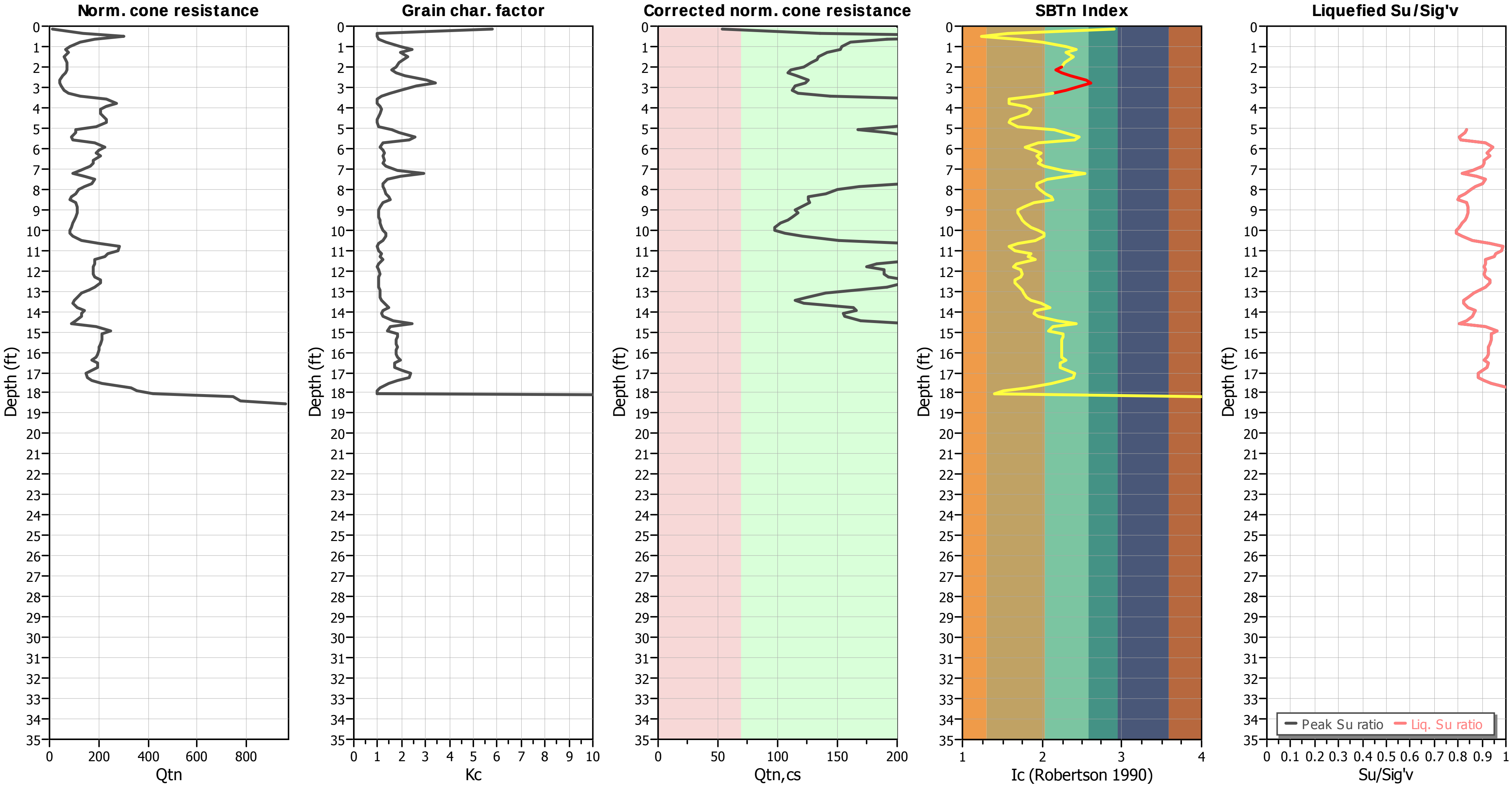
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

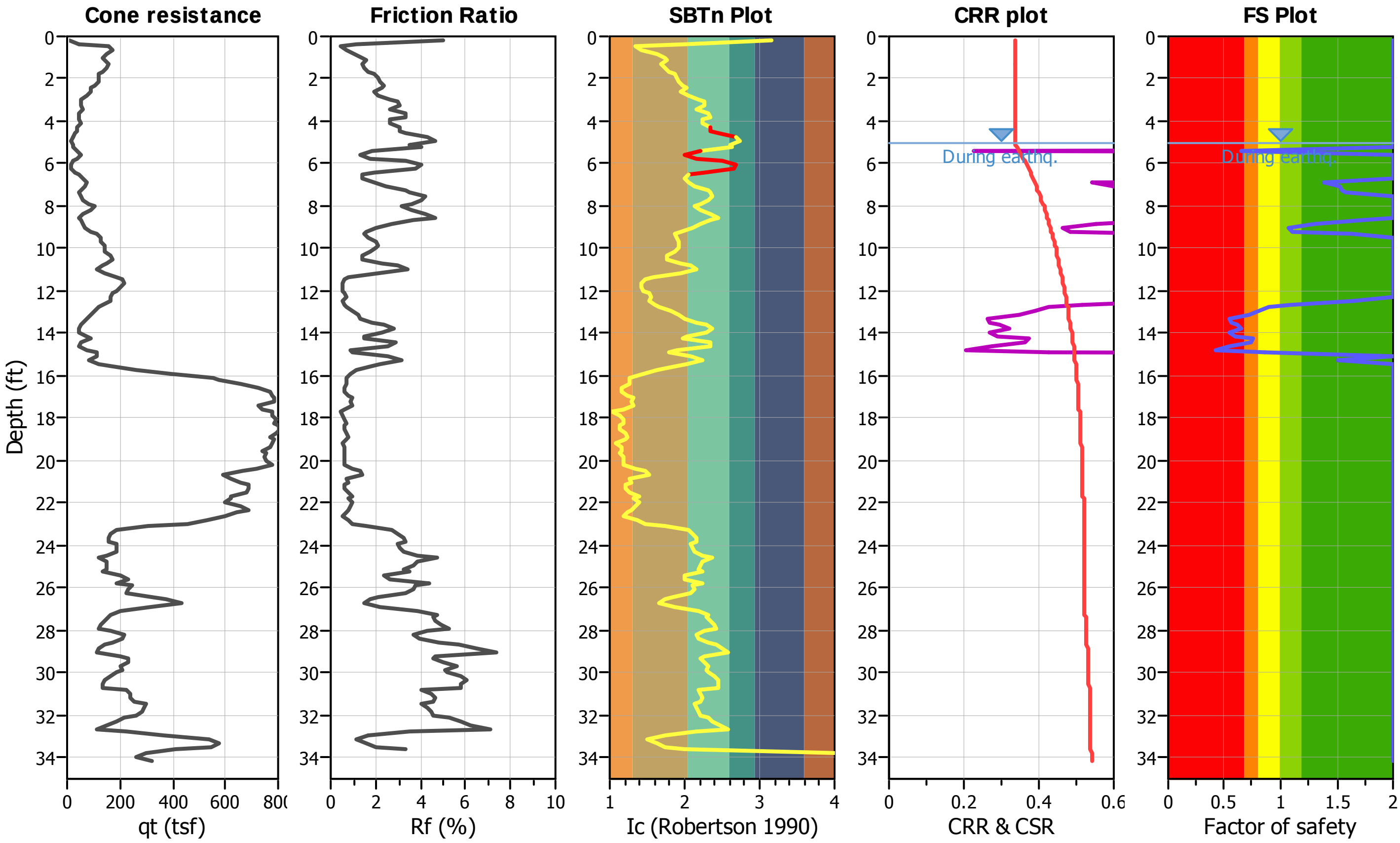
LIQUEFACTION ANALYSIS REPORT

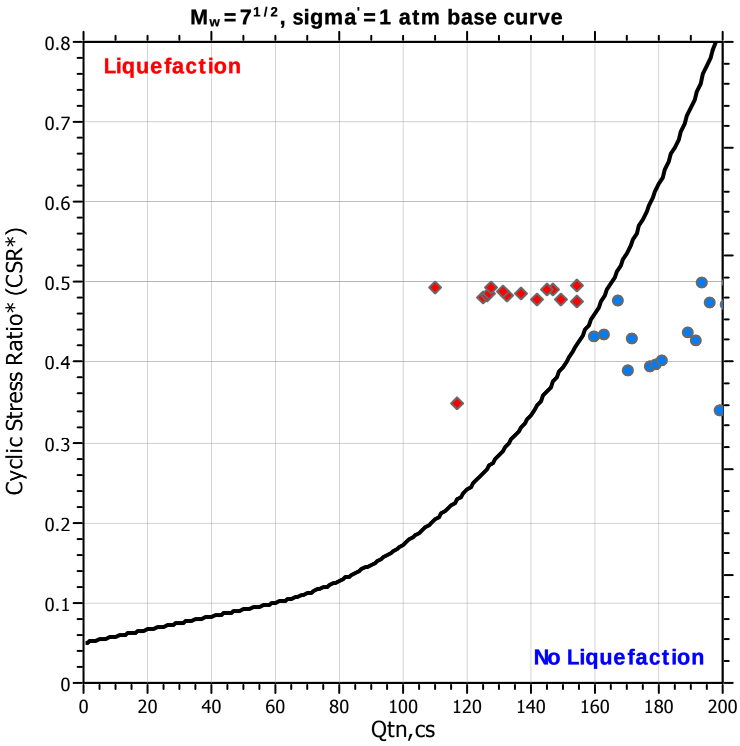
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

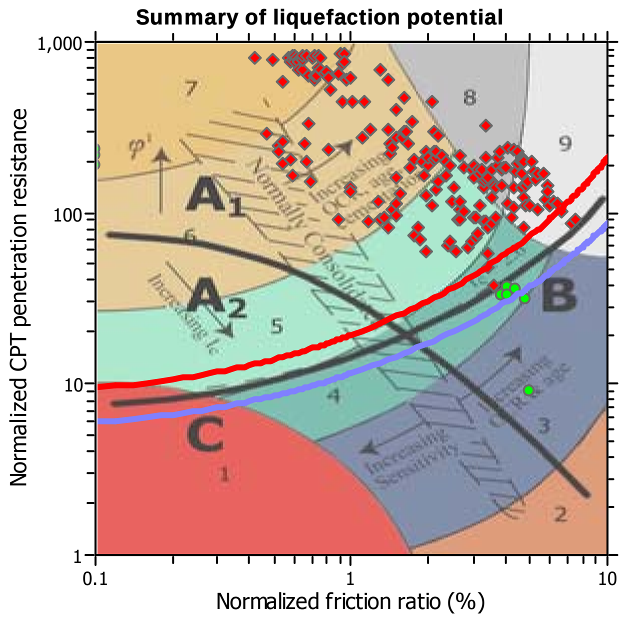
CPT file : CPT-8

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

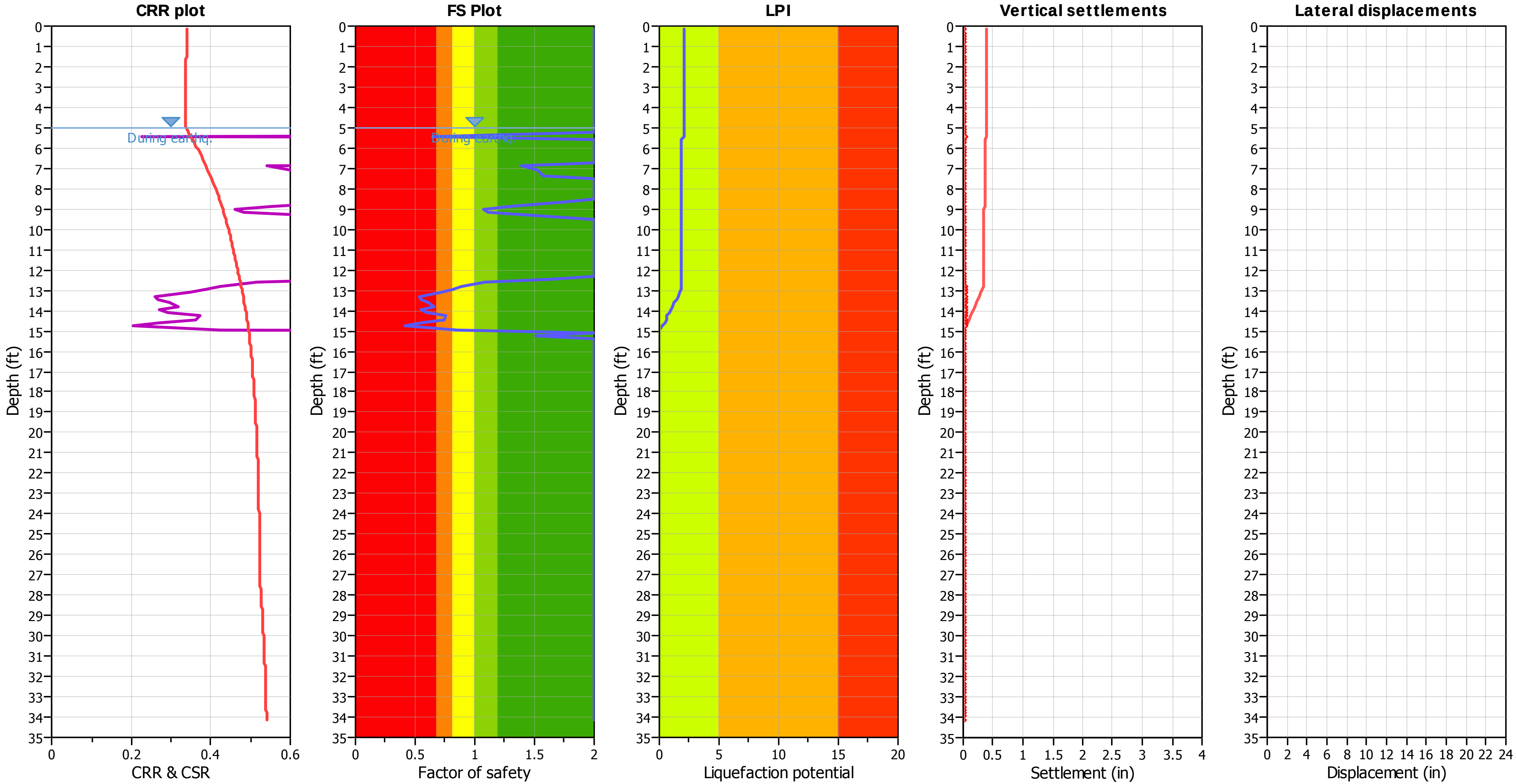






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

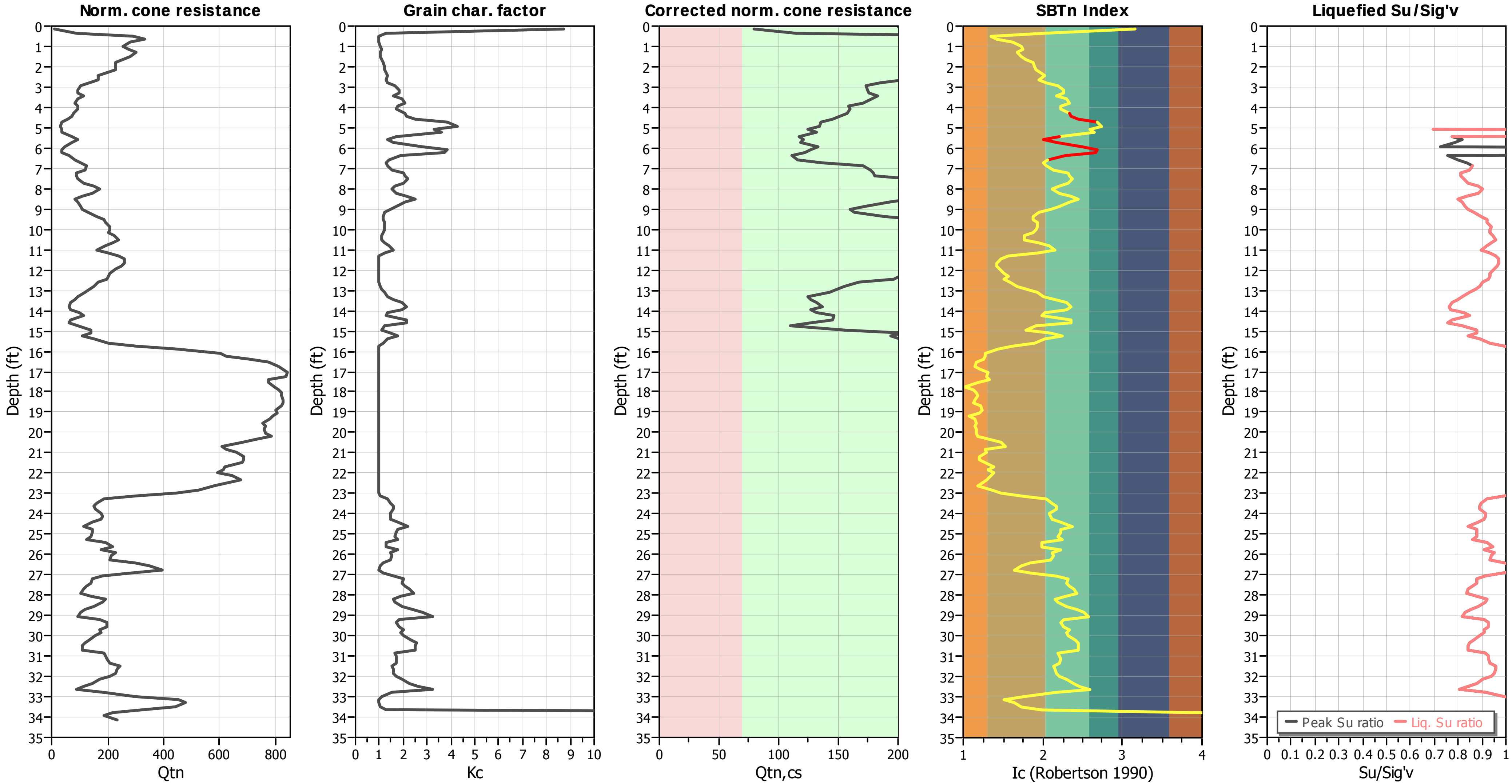
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

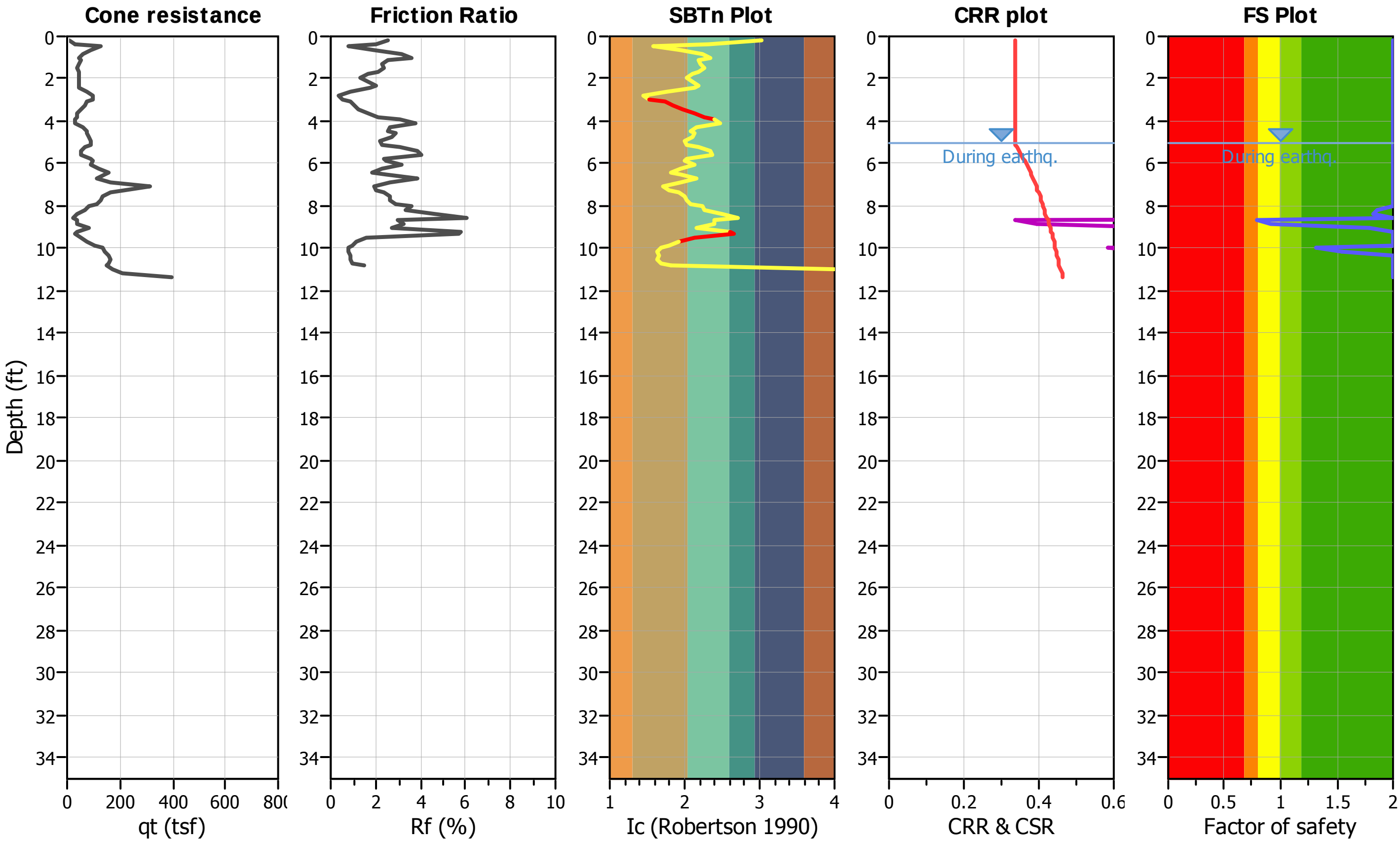
LIQUEFACTION ANALYSIS REPORT

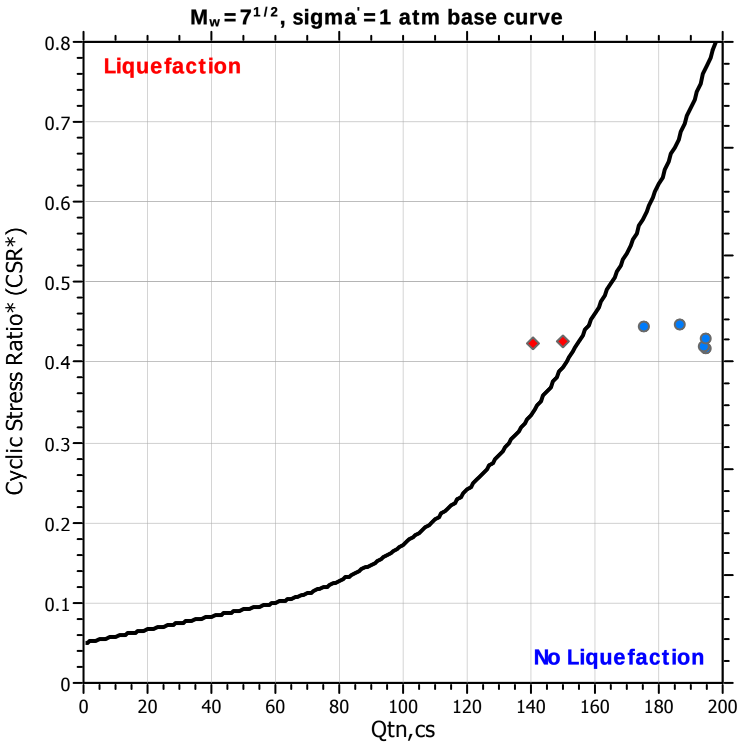
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

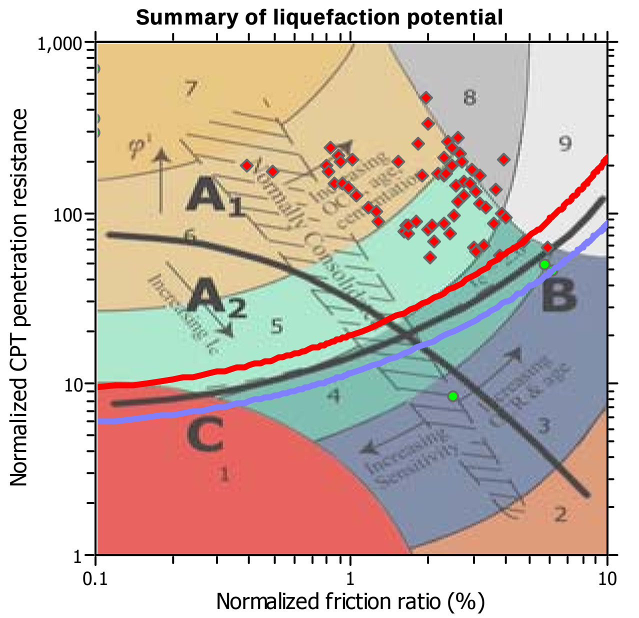
CPT file : CPT-9

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

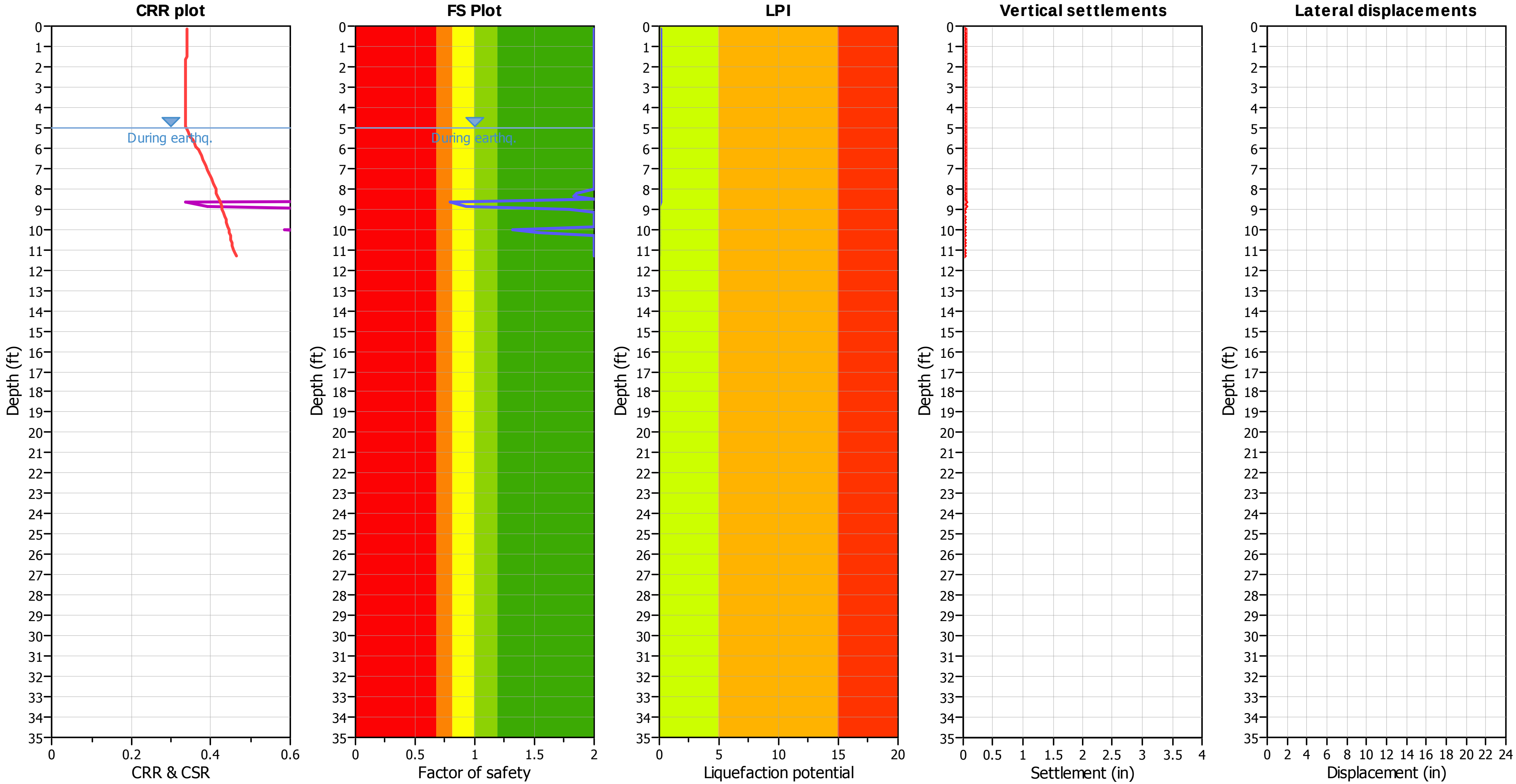






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A

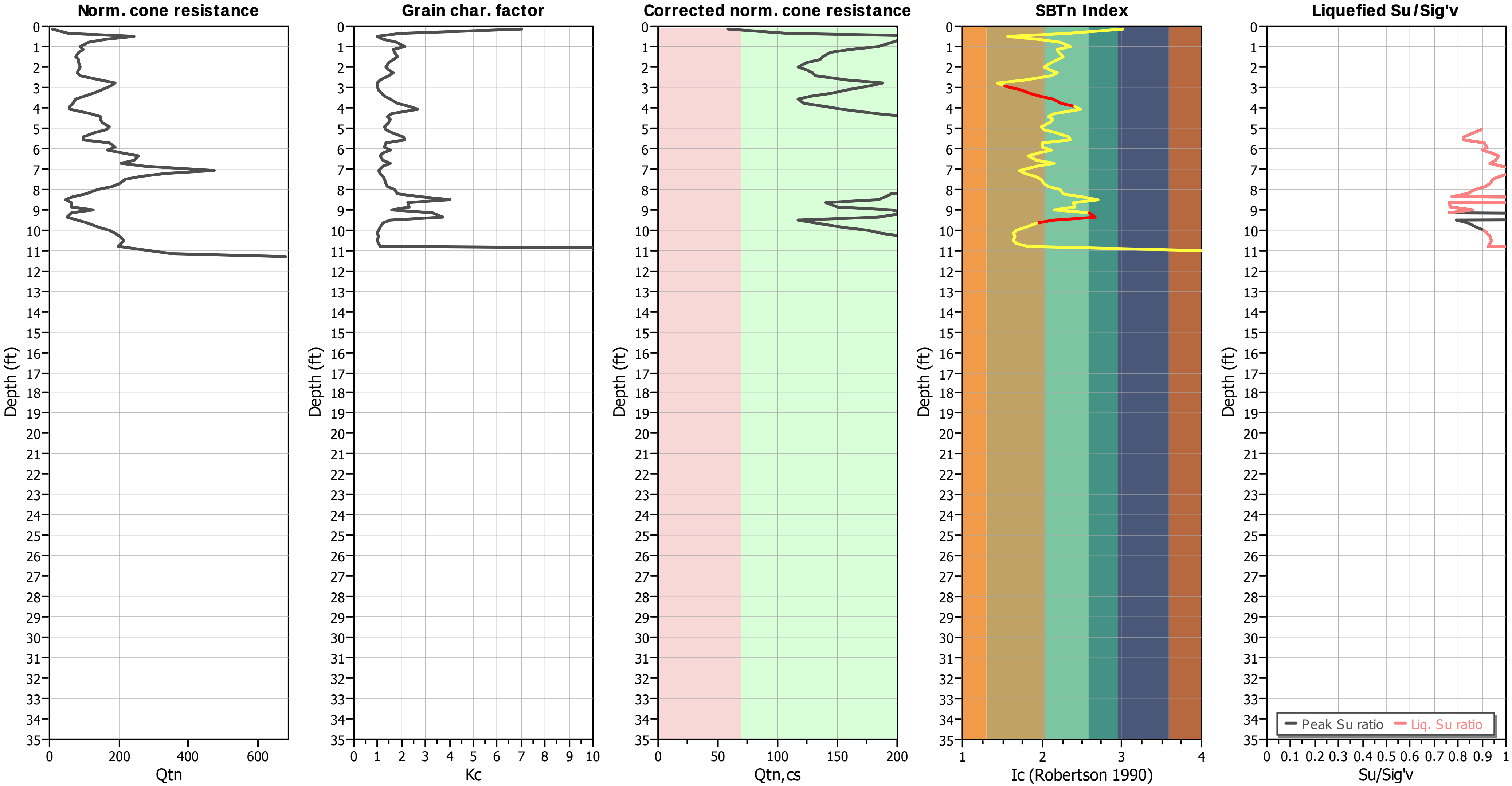
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A

GMU Geotechnical, Inc.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
www.GMUGEO.com

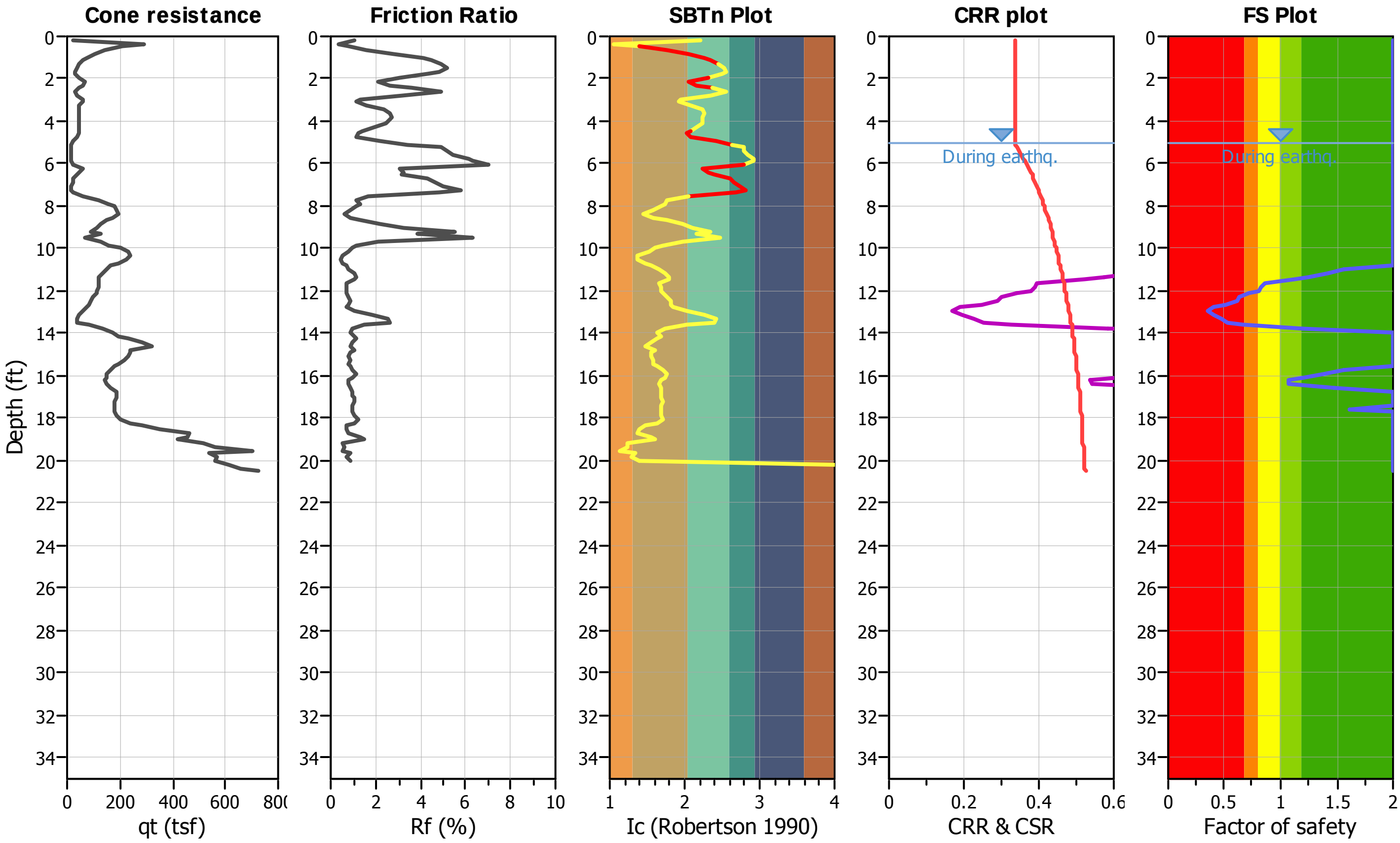
LIQUEFACTION ANALYSIS REPORT

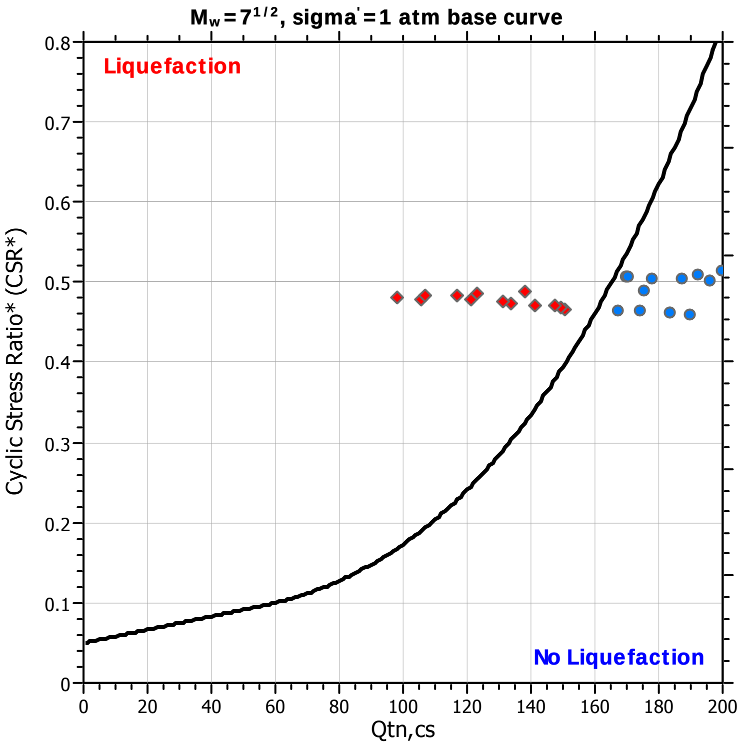
Project title : 17-206-01 **Location : Dana Point Harbor "Hotel"**

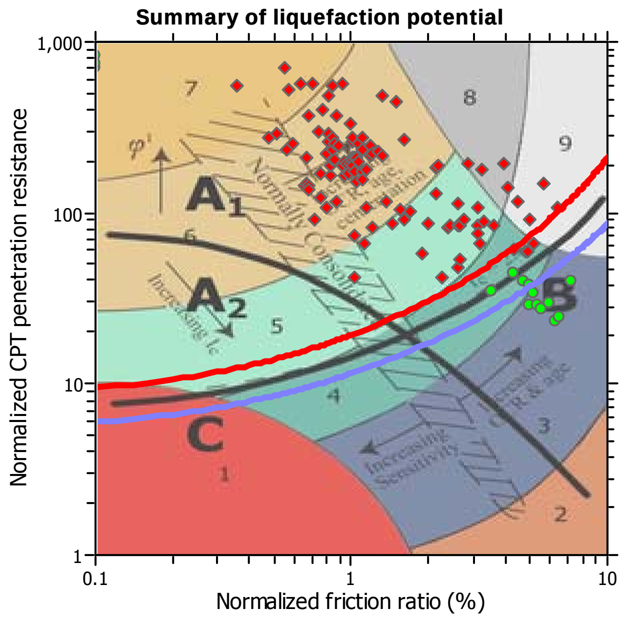
CPT file : CPT-10

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.80	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.67	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

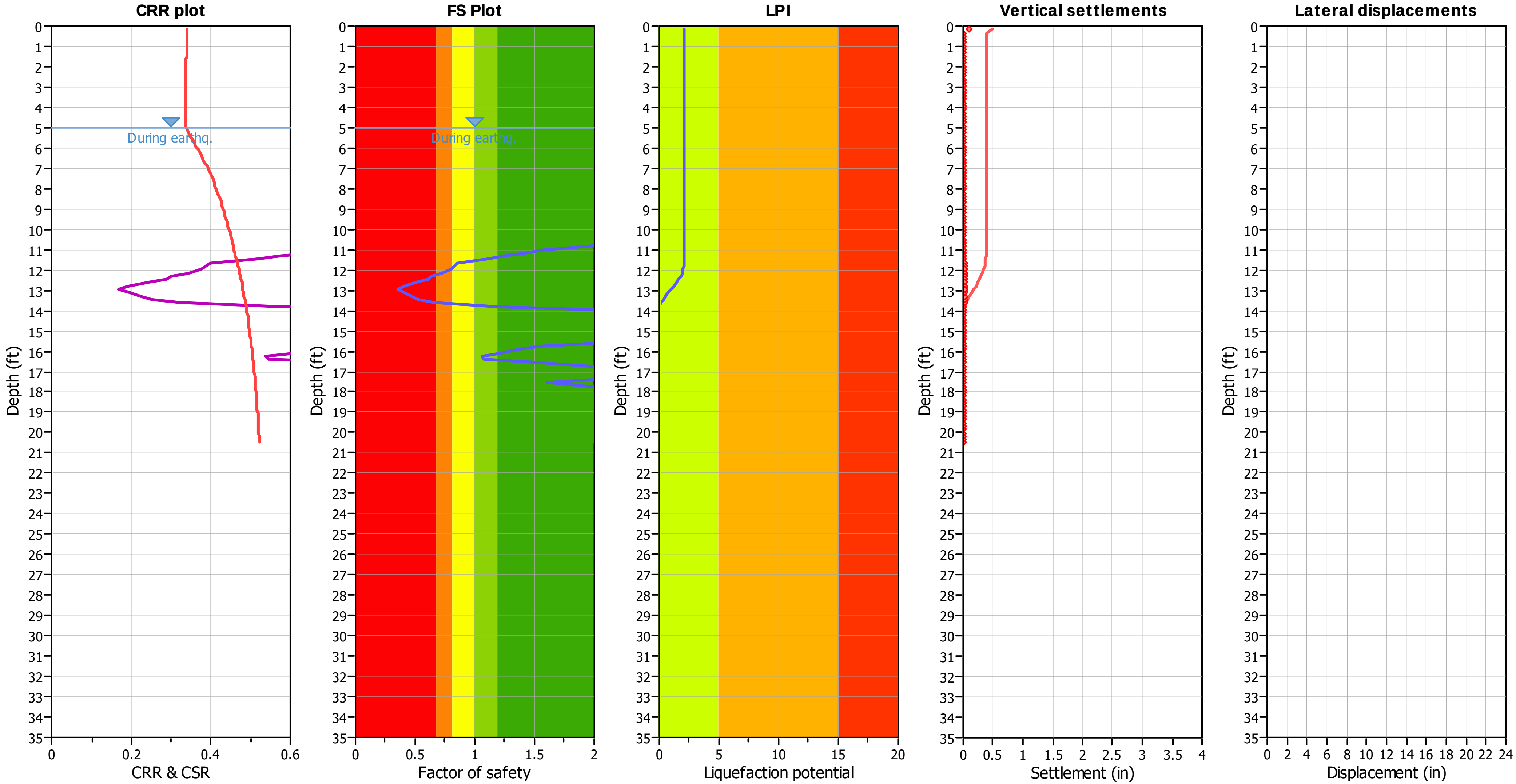






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A

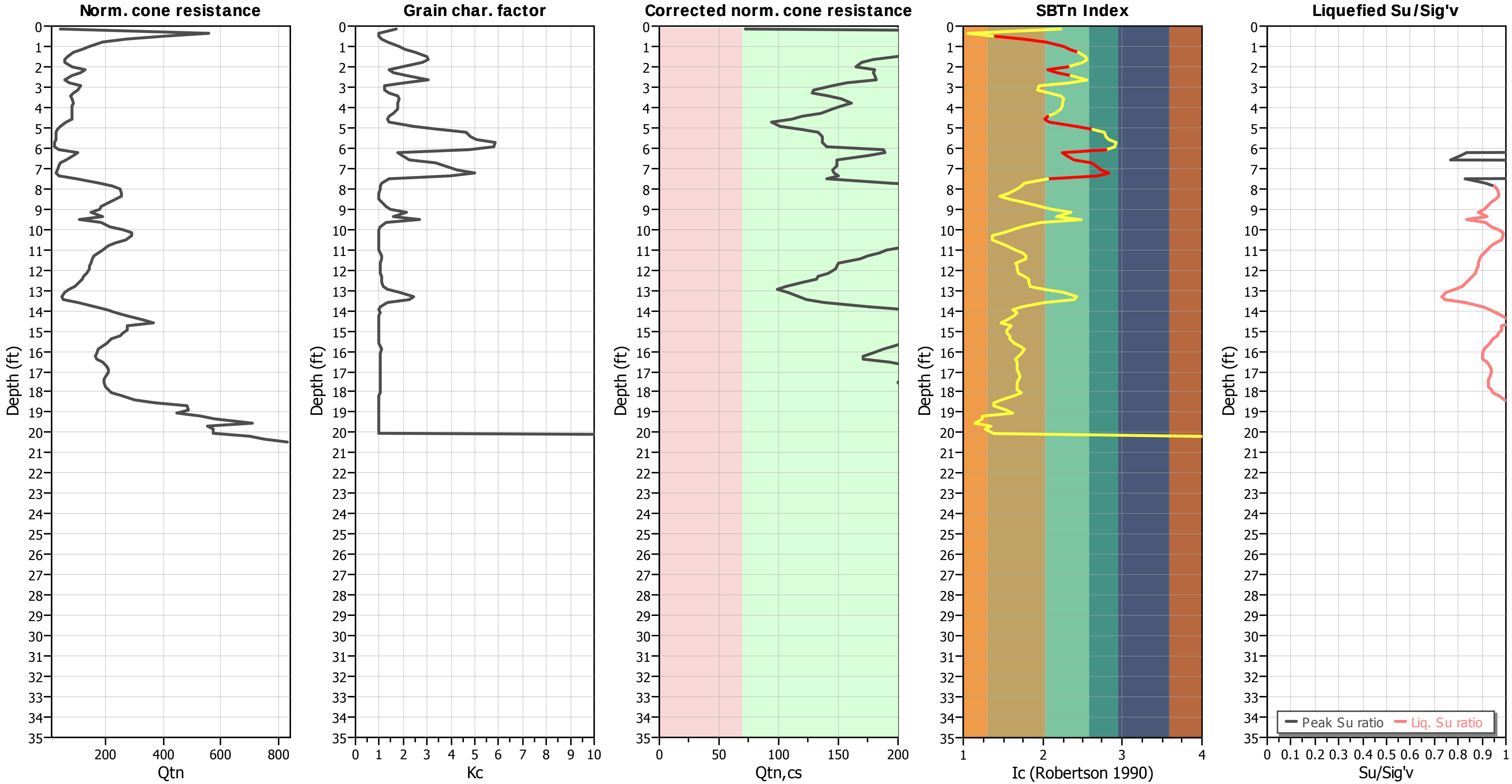
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))

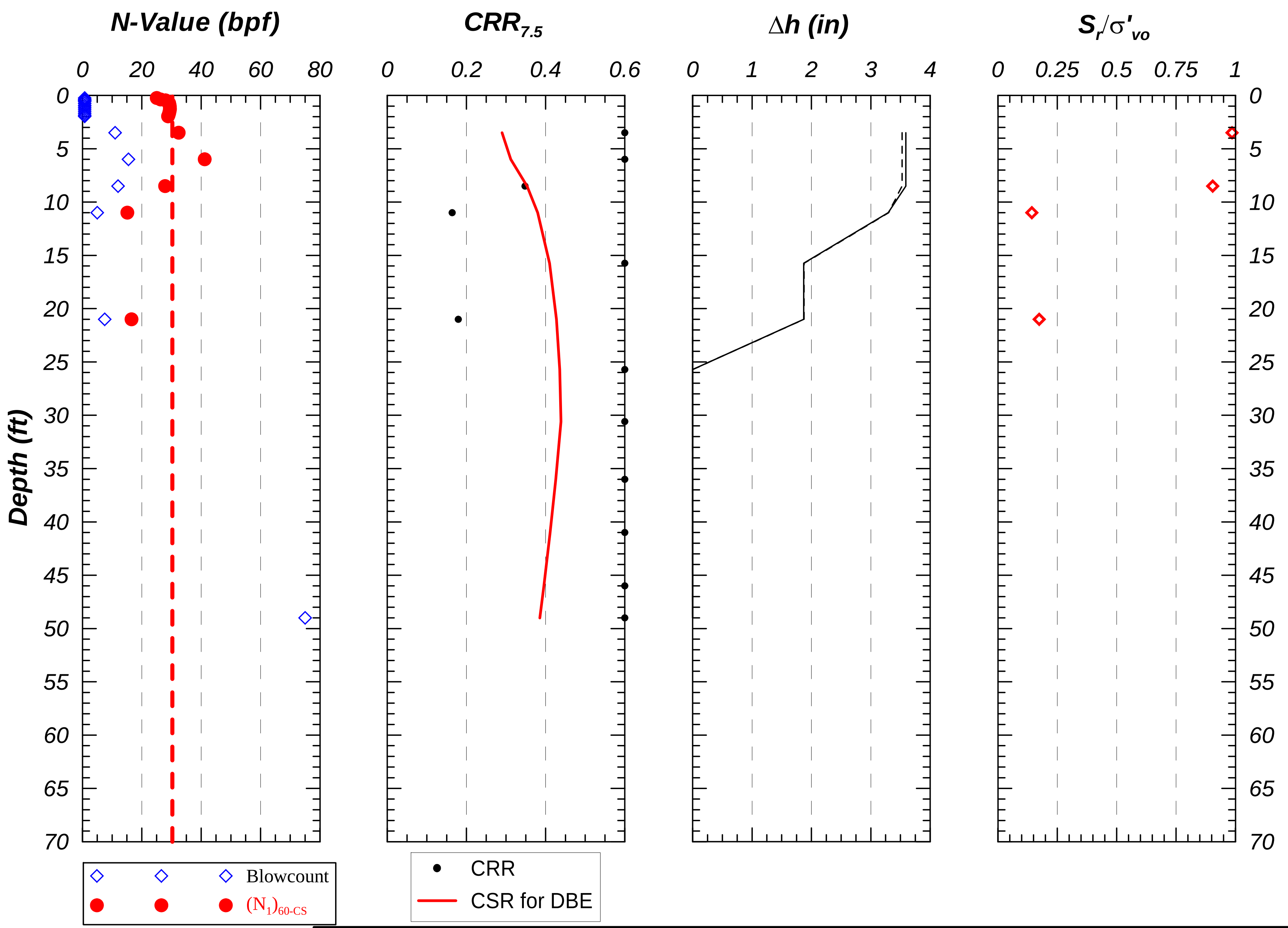


Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.67	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A

APPENDIX D-1

SPT Liquefaction Analyses



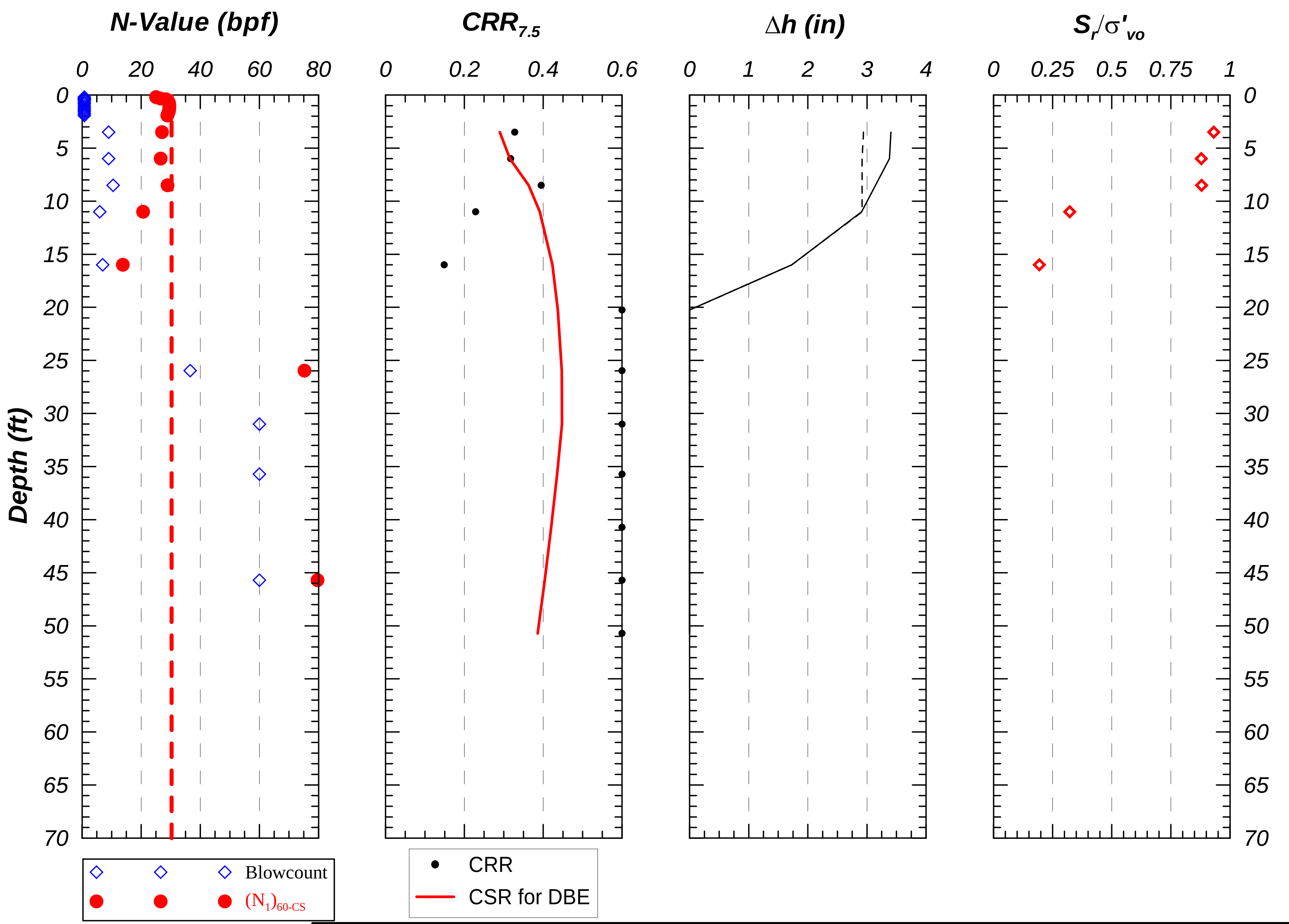
GMU GEOTECHNICAL, INC.

Project Name
Dana Point Harbor
Hotel Component

Project No.
17-206-01

Integrated SPT Method for Estimating Subsurface Stratification & Liquefaction
Drill Hole DH-1

Figure D-1

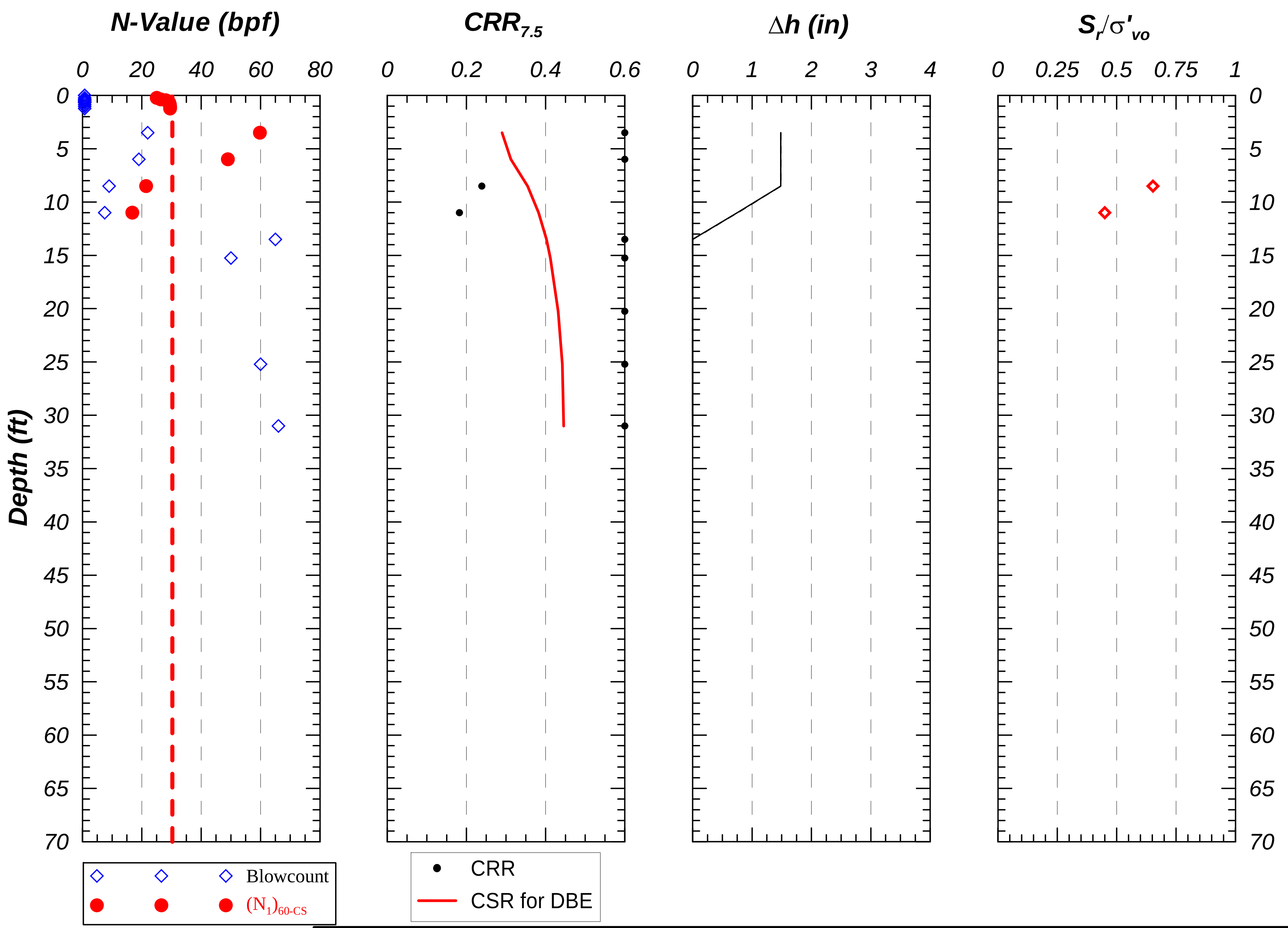


GMU GEOTECHNICAL, INC.

Project Name Dana Point Harbor Hotel Component	Integrated SPT Method for Estimating Subsurface Stratification & Liquefaction Drill Hole DH-6
Project No. 17-206-01	Figure D-2

DH-1.xls, DH-1.grf

Date: Oct. 2013



GMU GEOTECHNICAL, INC.

Project Name
Dana Point Harbor
Hotel Component

Project No.
17-206-01

Integrated SPT Method for Estimating Subsurface Stratification & Liquefaction
Drill Hole DH-45

Figure D-3

DH-1.xls, DH-1.grf

Date: Oct. 2013

APPENDIX E

Lateral Spread Analysis

Project No. 17-206-01
Section A-A'
December, 2018

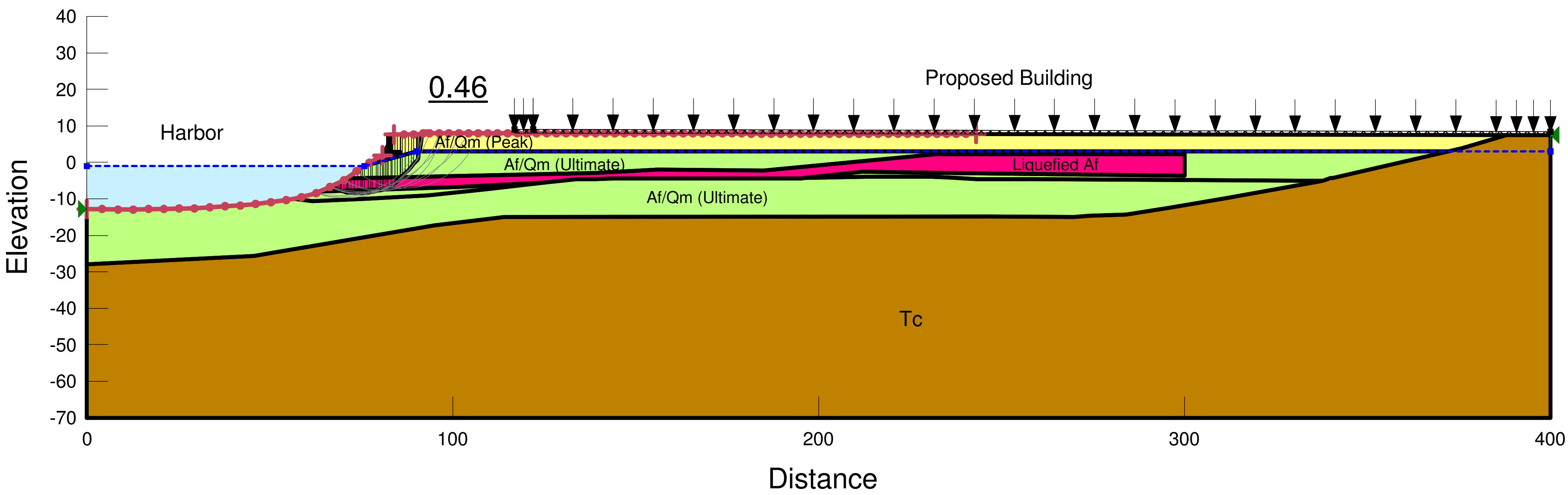
Static Analysis, Run 1.1
Post Earthquake Condition
Horz Seismic Coef.: 0
Entry and Exit

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05



Project No. 17-206-01
Section A-A'
December, 2018

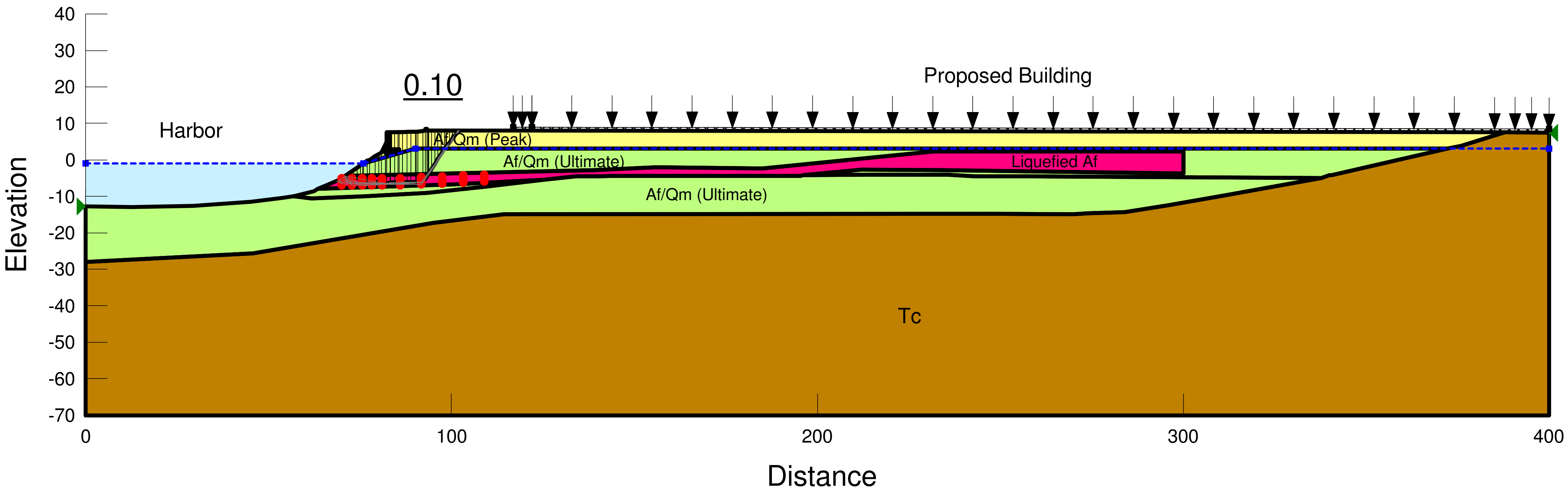
Static Analysis, Run 1.2
Post Earthquake Condition
Horz Seismic Coef.: 0
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05



Project No. 17-206-01
Section A-A'
December, 2018

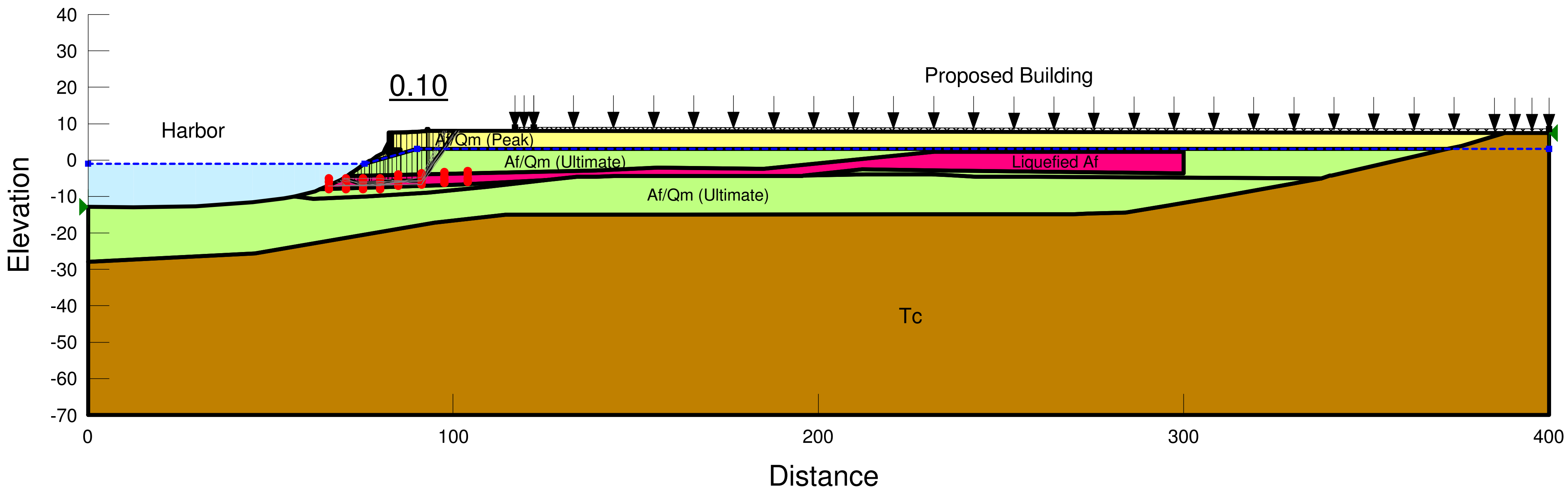
Pseudo-Static Analysis, Run 1.2
Horz Seismic Coef.: 0.15
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05



Project No. 17-206-01
Section A-A'
December, 2018

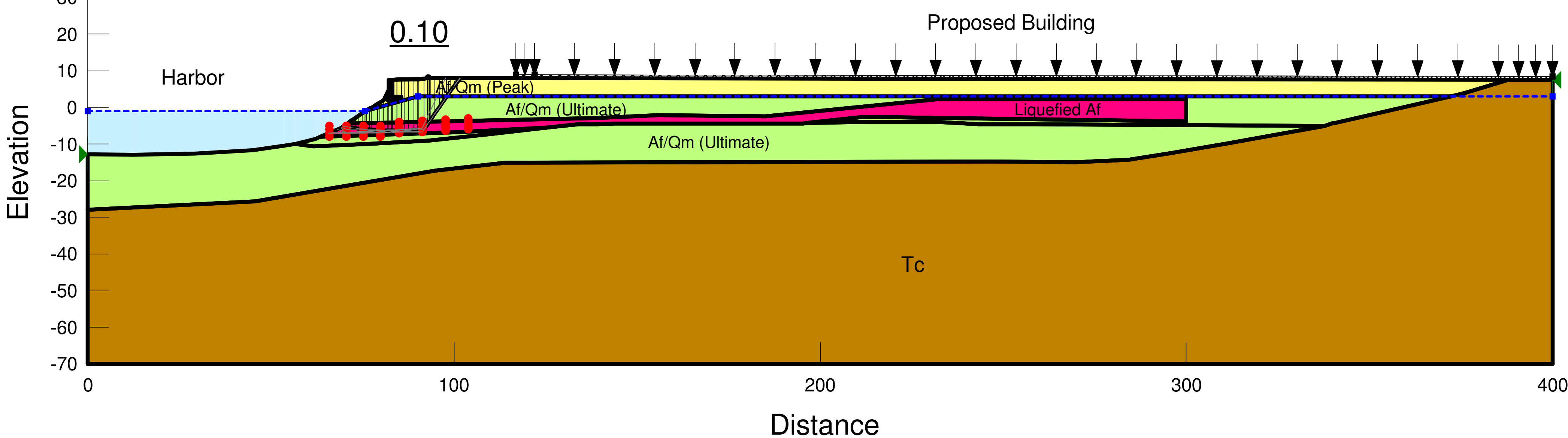
Deformation Analysis, Run 1.2
Horz Seismic Coef.: 0
Deformation > 92 inches
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05



Project No. 17-206-01
Section A-A'
December, 2018

Static Analysis, Run 1.3
Post Earthquake Condition
with Mitigation
Horz Seismic Coef.: 0
Block Search

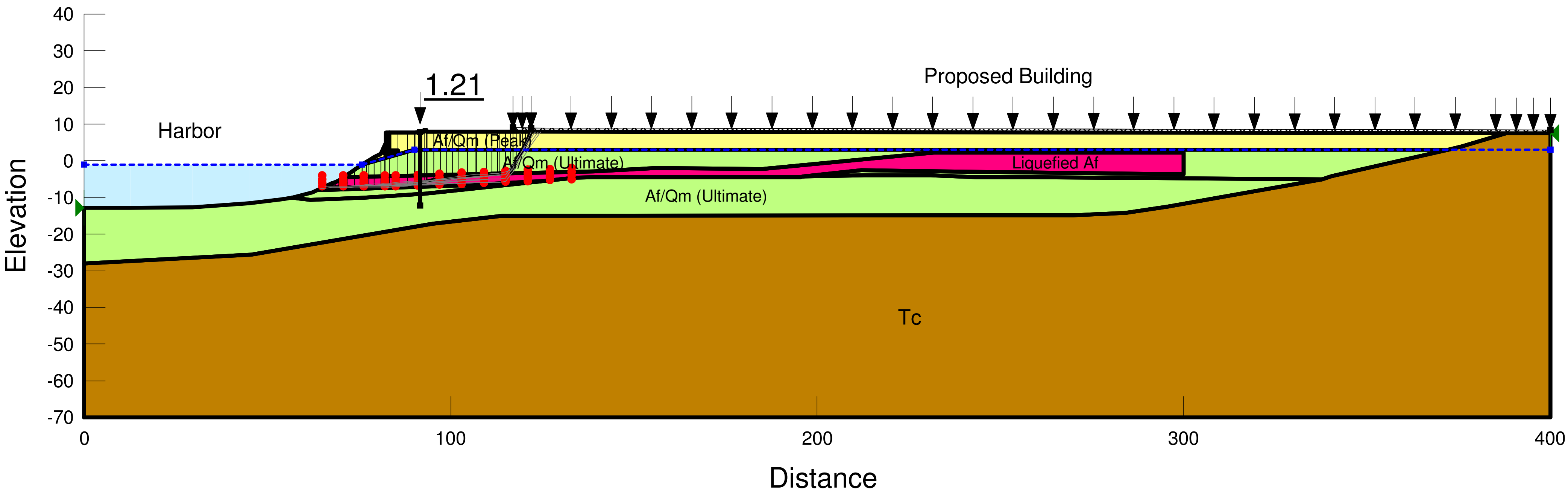
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05

Type: Pile
Total Length: 20 ft
Shear Force: 18,000 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section A-A'
December, 2018

Pseudo-Static Analysis, Run 1.3
with Mitigation
Horz Seismic Coef.: 0.15
Block Search

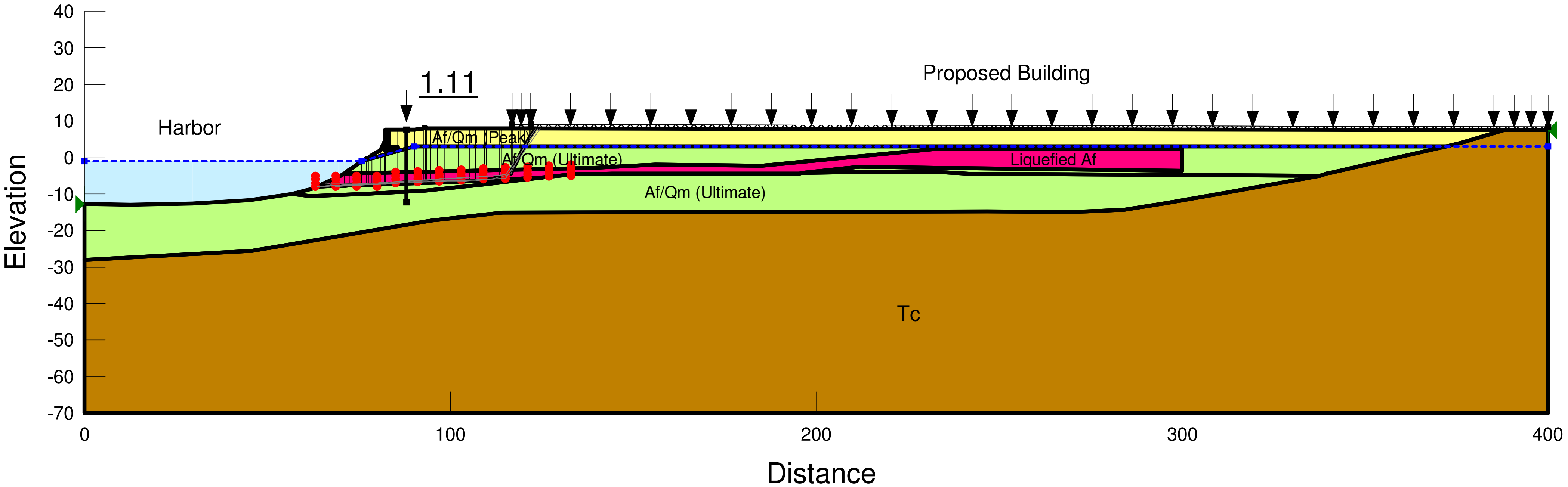
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05

Type: Pile
Total Length: 20 ft
Shear Force: 28,600 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section A-A'
December, 2018

Deformation Analysis, Run 1.3
with Mitigation
Horz Seismic Coef.: 0.206
Deformation = 12-inches
Block Search

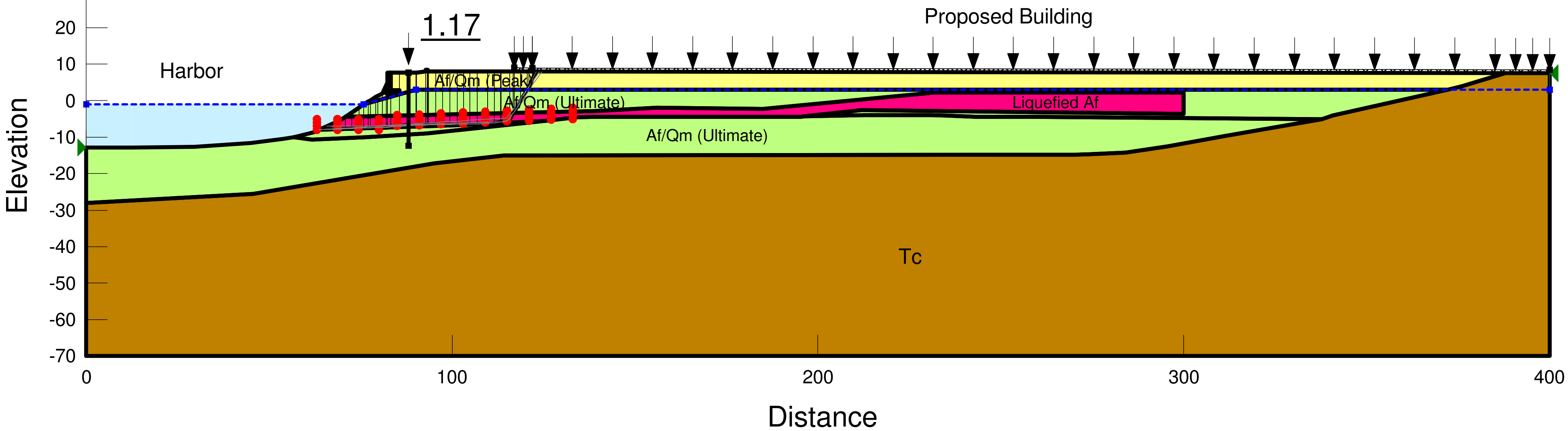
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied Af
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.05

Type: Pile
Total Length: 20 ft
Shear Force: 32,500 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Static Analysis, Run 1.1
Post Earthquake Condition
Horz Seismic Coef.: 0
Entry and Exit

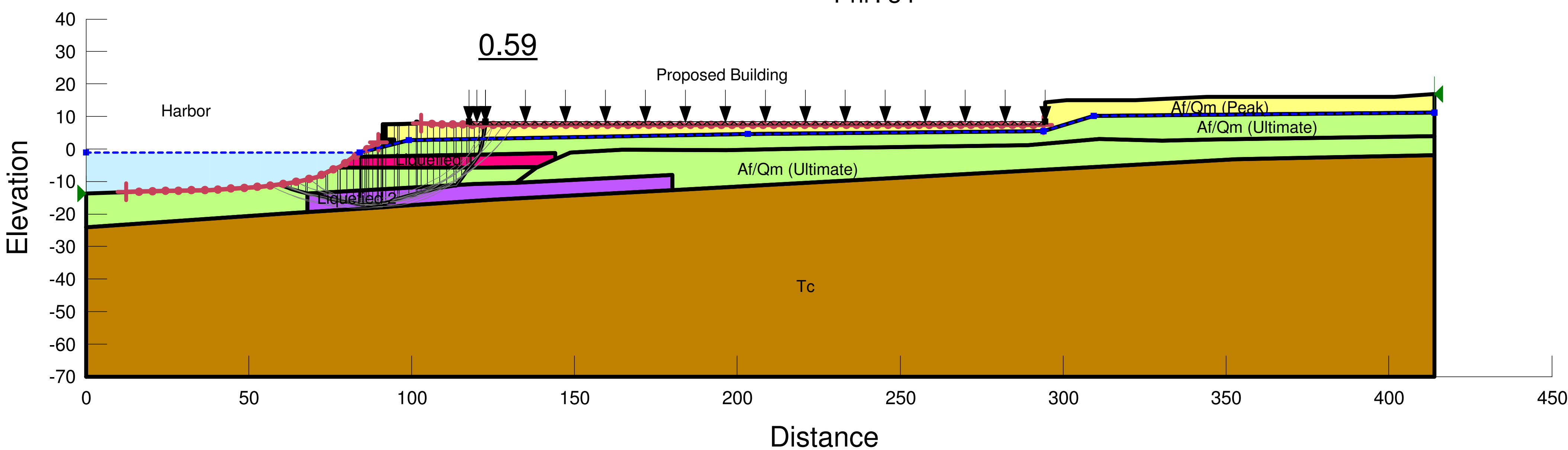
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Static Analysis, Run 1.2
Post Earthquake Condition
Liquefied Layer 1
Horz Seismic Coef.: 0
Block Search

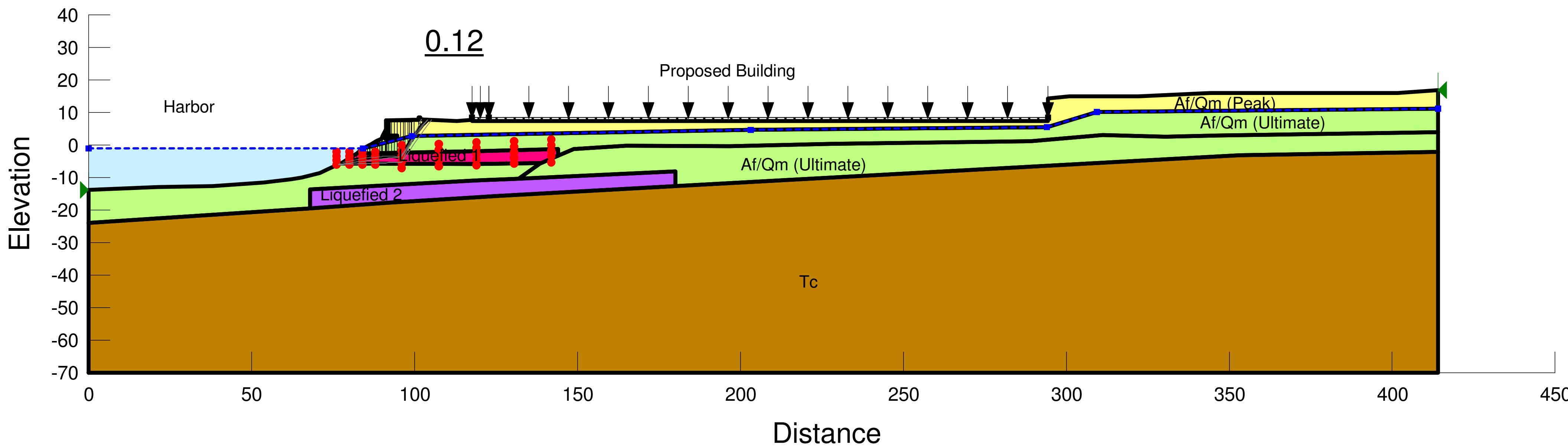
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Pseudo-Static Analysis, Run 1.2
Liquefied Layer 1
Horz Seismic Coef.: 0.15
Block Search

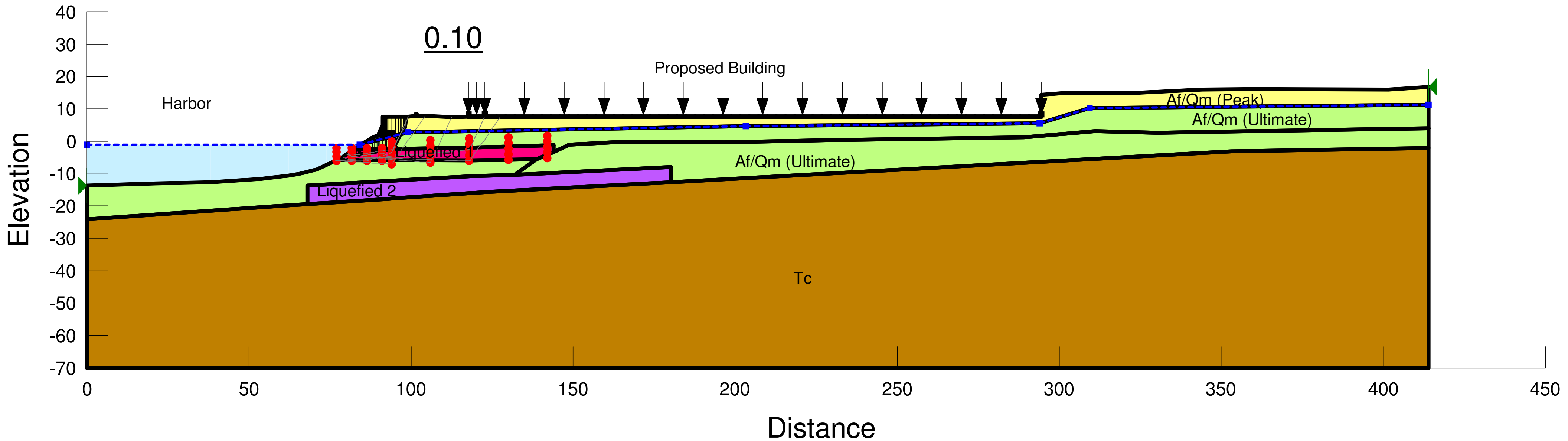
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Deformation Analysis, Run 1.2
Liquefied Layer 1
Horz Seismic Coef.: 0
Deformation > 124 inches
Block Search

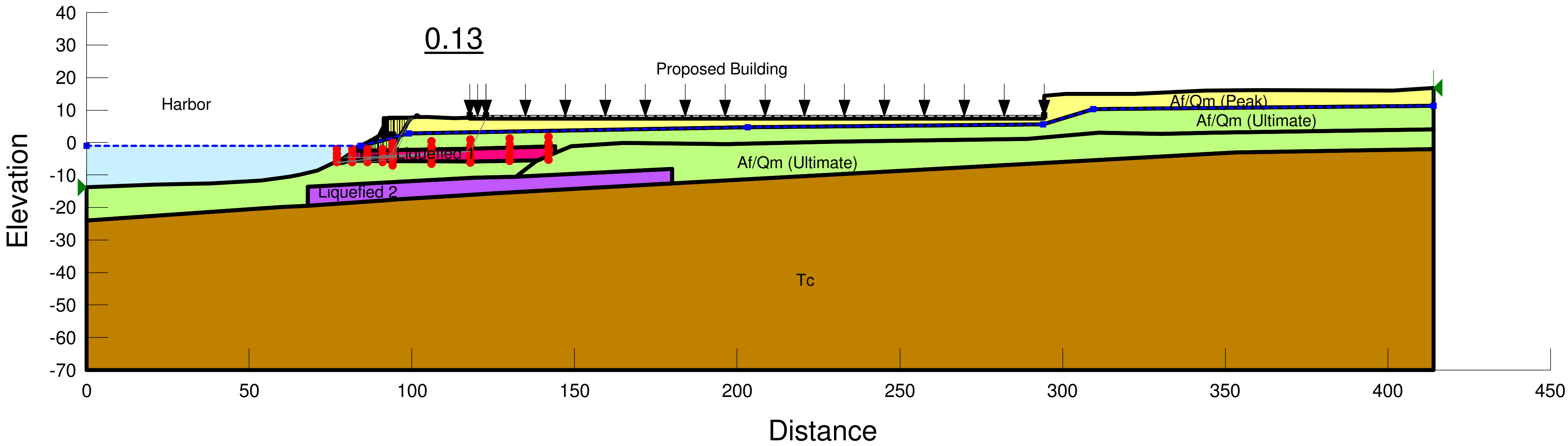
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Static Analysis, Run 1.3
Post Earthquake Condition
Liquefied Layer 2
Horz Seismic Coef.: 0
Block Search

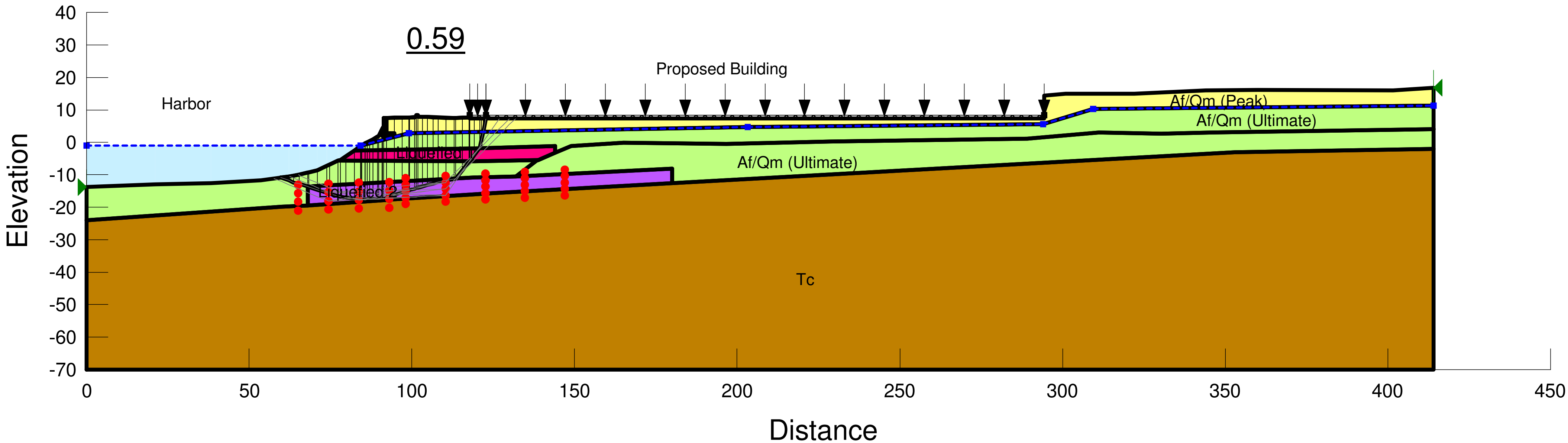
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Pseudo-Static Analysis, Run 1.3
Liquefied Layer 2
Horz Seismic Coef.: 0.15
Block Search

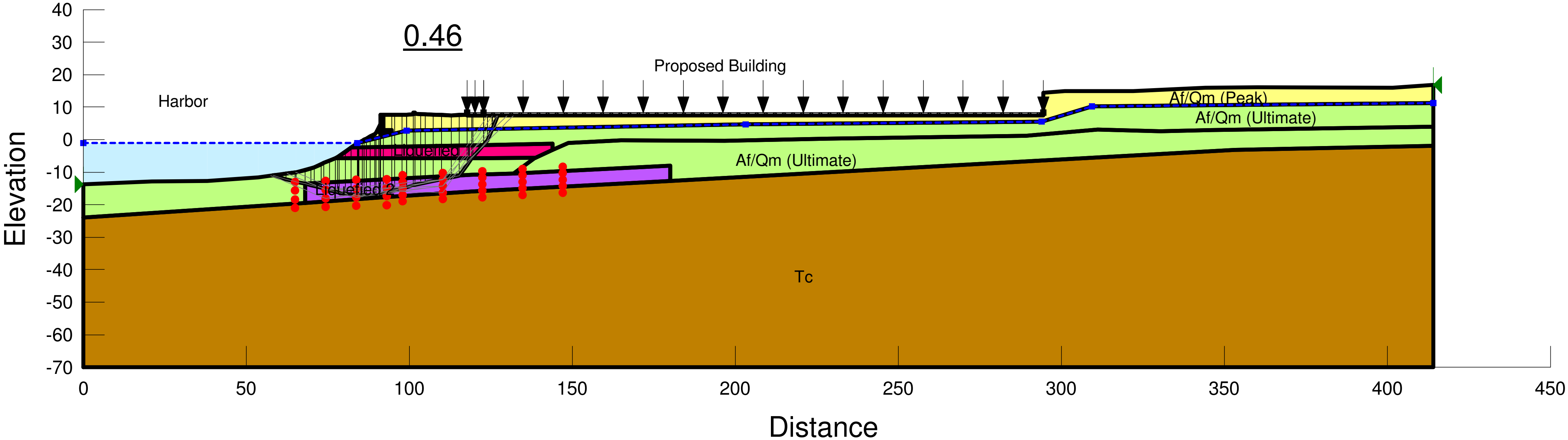
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Deformation Analysis, Run 1.3
Liquefied Layer 2
Horz Seismic Coef.: 0.15
Deformation > 99.17
Block Search

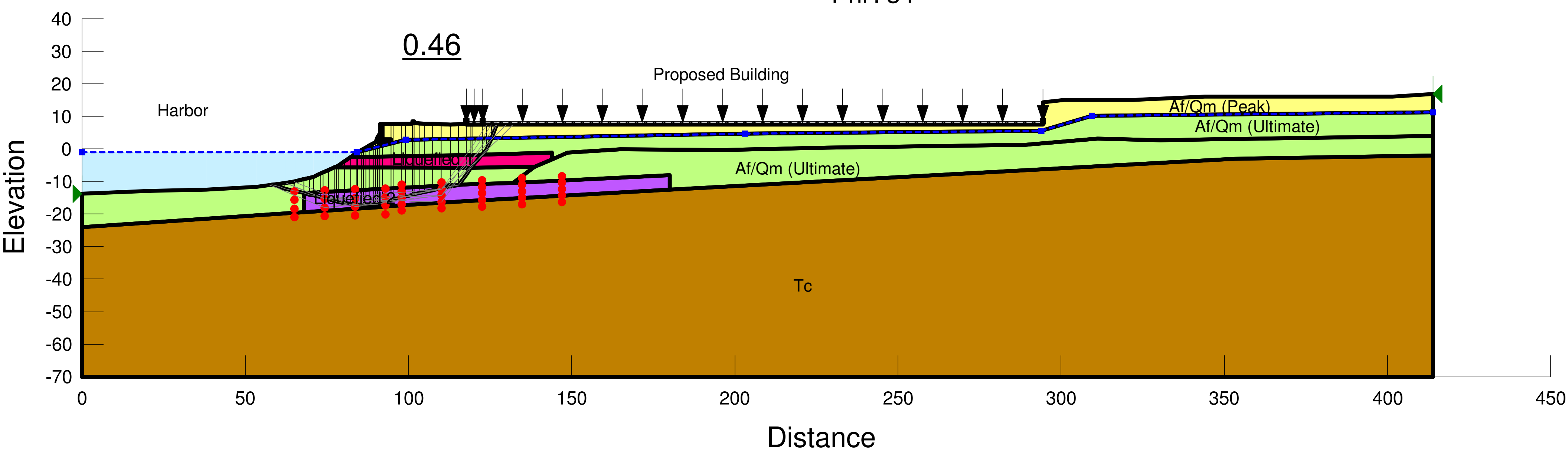
Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17



Project No. 17-206-01
Section B-B'
December, 2018

Static Analysis, Run 1.4
Liquefied Layer 1
with Mitigation
Horz Seismic Coef.: 0
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

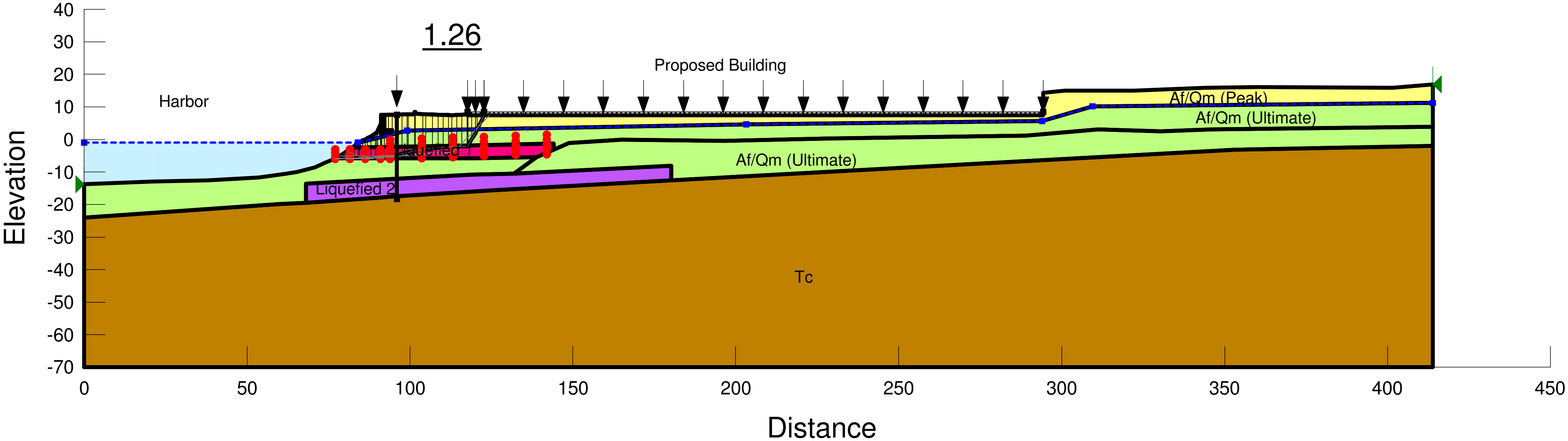
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 26 ft
Shear Force: 16,000 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Pseudo-Static Analysis, Run 1.4
Liquefied Layer 1
with Mitigation
Horz Seismic Coef.: 0.15
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

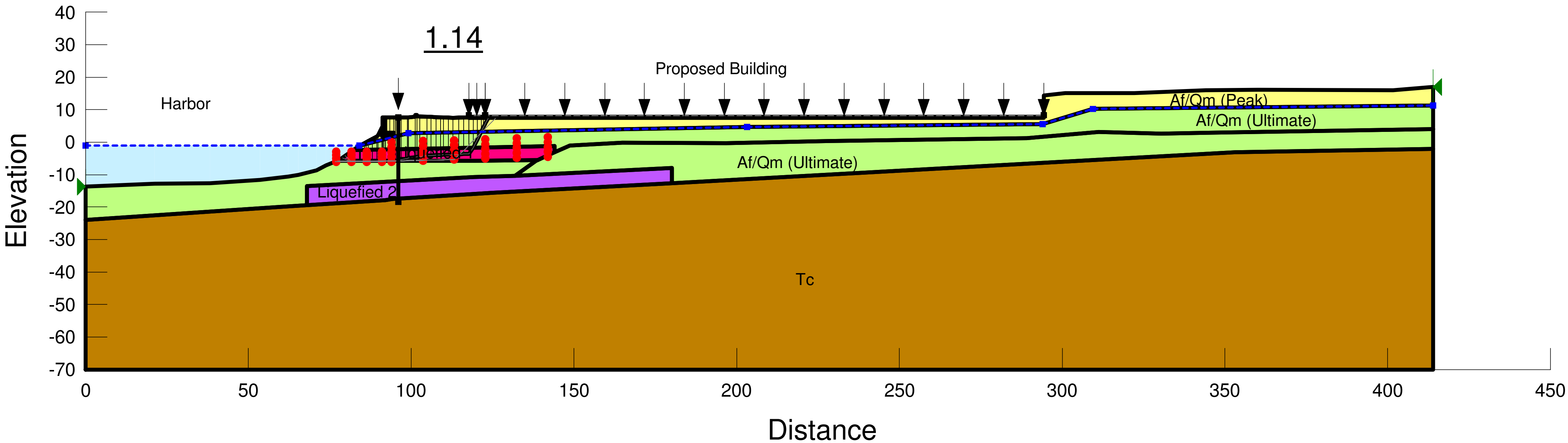
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 26 ft
Shear Force: 23,000 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Deformation Analysis, Run 1.4
Liquefied Layer 1
with Mitigation
Horz Seismic Coef.: 0.215
Deformation = 12 inches
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

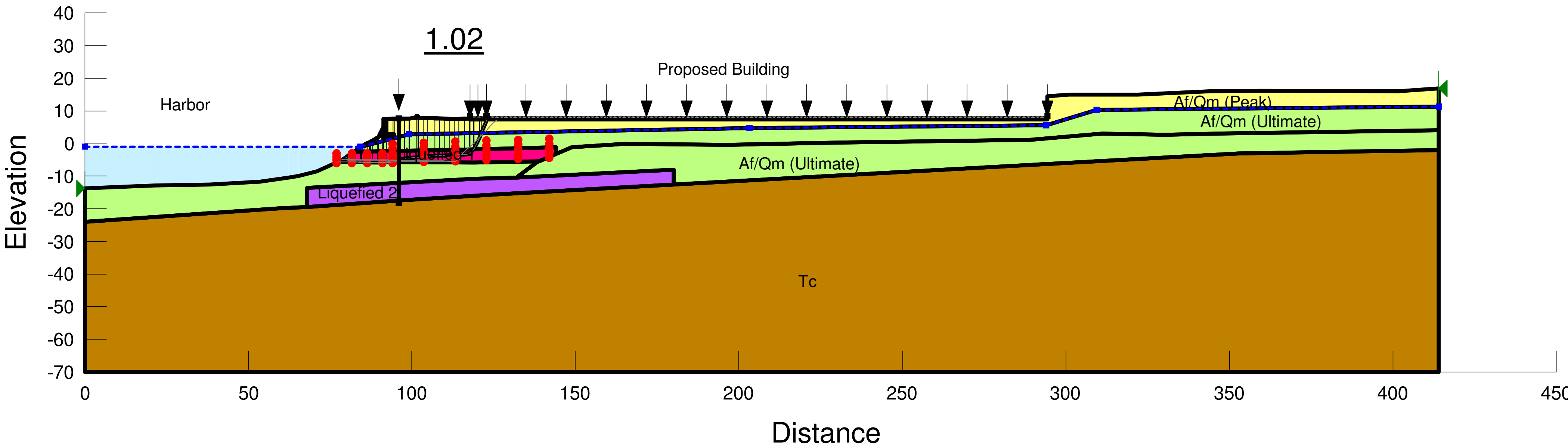
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 26 ft
Shear Force: 24,700 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Static Analysis, Run 1.5
Liquefied Layer 2
with Mitigation
Horz Seismic Coef.: 0
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

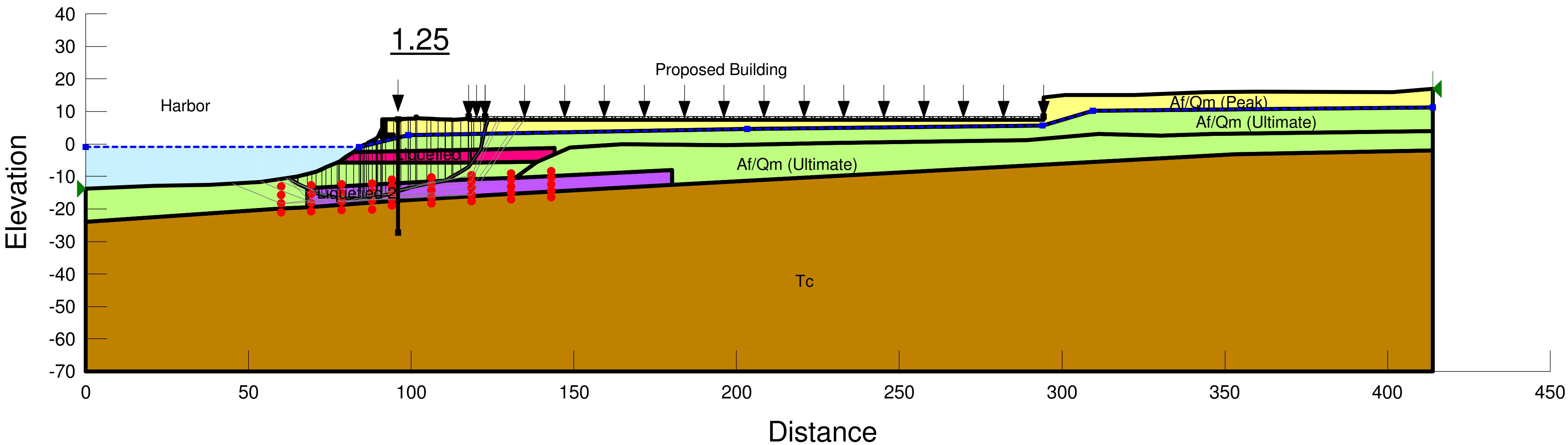
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 35 ft
Shear Force: 22,000 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Pseudo-Static Analysis, Run 1.5
Liquefied Layer 2
with Mitigation
Horz Seismic Coef.: 0.15
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

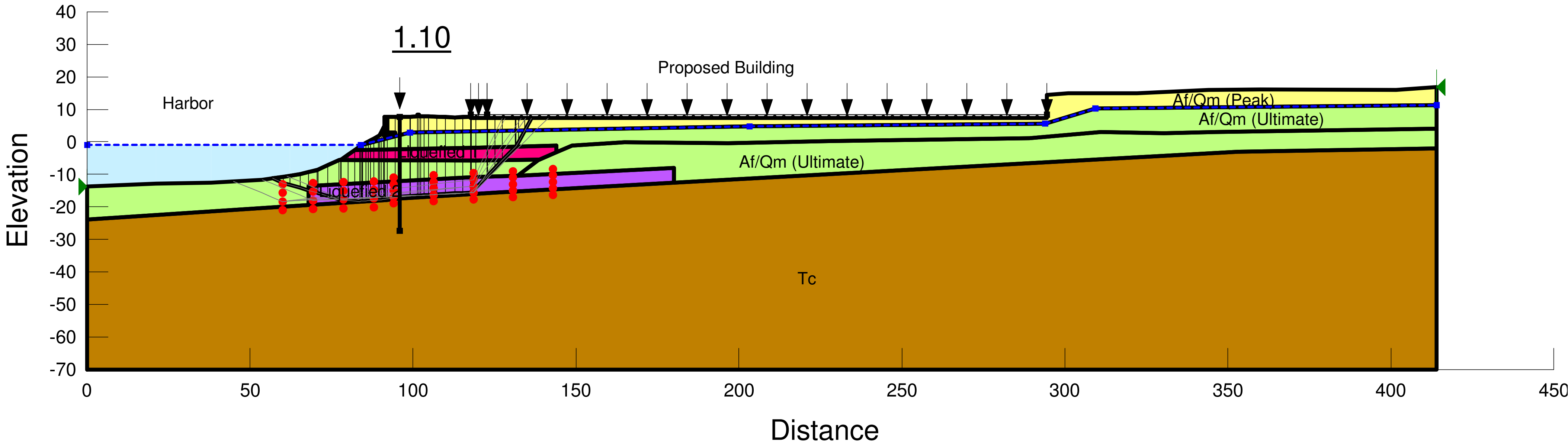
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 35 ft
Shear Force: 33,000 lbs
Pile Spacing: 1 ft



Project No. 17-206-01
Section B-B'
December, 2018

Deformation Analysis, Run 1.5
Liquefied Layer 2
with Mitigation
Horz Seismic Coef.: 0.21
Deformation = 12 inches
Block Search

Name: Af/Qm (Ultimate)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 80 psf
Phi': 30 °

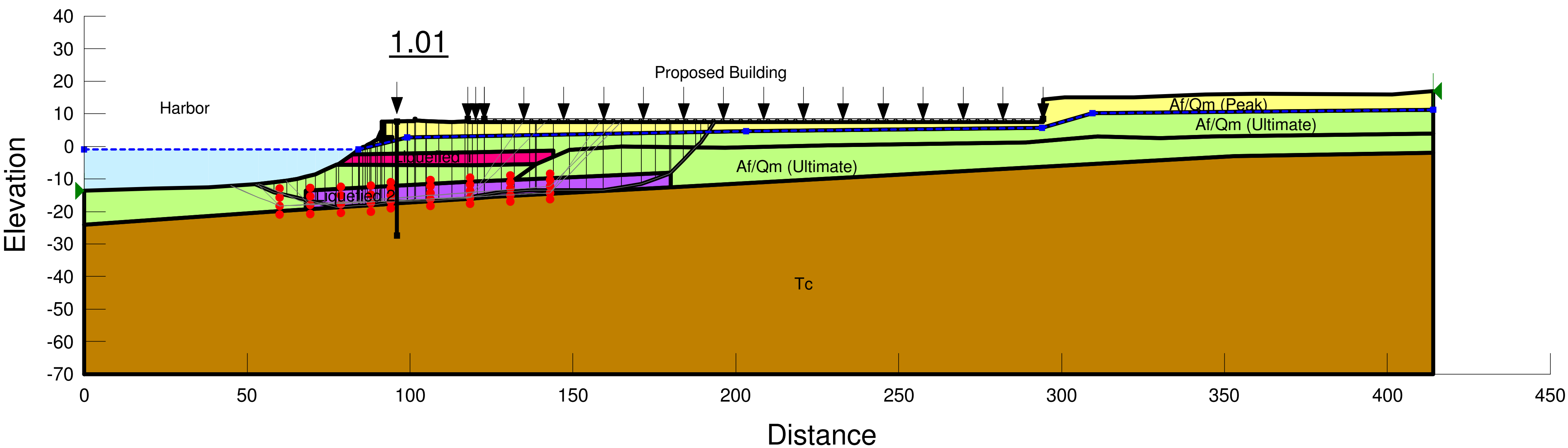
Name: Af/Qm (Peak)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 395 psf
Phi': 31 °

Name: Tc
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 695 psf
Phi': 34 °

Name: Liquefied 1
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.14

Name: Liquefied 2
Model: S=f(overburden)
Unit Weight: 125 pcf
Tau/Sigma Ratio: 0.17

Type: Pile
Total Length: 35 ft
Shear Force: 49,000 lbs
Pile Spacing: 1 ft



APPENDIX F

Geogrid Reinforced Slope Surficial Stability Analysis

CALCULATIONS FOR SLOPE REINFORCED AGAINST SURFICIAL STABILITY BY GEOGRIDS
Spreadsheet Name: SurficialwGrid OC - Miragrid 2XT
DANA POINT HARBOR - HOTEL COMPONENT

References:
(1) Geogrid Reinforcement for Surficial Stability of Slopes by D.L. Thielen and J.G. Collin, *Geosynthetics '93 - Vancouver, Canada*
(2) Controlling surficial stability problems on reinforced steep slopes by James G. Collin, *Geotechnical Fabrics Report,* April 1996
(3) Geosynthetics for Soil Reinforcement, Reinforced Soil Engineering (Download from MIRAFI website.)

Table 3, Ref (3)

Soil Type	Ci
Sands	0.9-1.0
Silts	0.8-0.9
Clays	0.7-0.8

INPUT DATA

Factor of Safety	FS =	1.5		
Slope Height	H =	15	ft	
Vertical Depth of Submergence	z =	4	ft	
Slope Angle	beta =	33.69	deg	0.5880014 rad
Effective Cohesion	c' =	160	psf	
Saturated Soil Unit Weight	gamma =	125	pcf	
Unit Weight of Water	water =	62.4	pcf	
Effective Angle of Int Friction	phi =	27	deg	0.4712389 rad

Step 1: Calculate Total Geogrid Resistance Fg Required to Achieve an Overall Factor of Safety = 1.5 for Slope Height H

Eq (1), Ref (2) **Fg =** 2373 lb/ft of slope width

Step 2: Calculate Available Geogrid Pullout Resistance Per Geogrid as Controlled by Pullout in the Slide Mass, Pos

Eq (3), Ref (3) **Pos =** 500 lb/ft of slope width

Step 3: Calculate Long Term Allowable Strength of Geogrid, Ta, From Partial Factor of Safety Equation

Eq (16), Ref (1) **Ta =** 731 lb/ft of slope width

Step 4: Determine the Required Total Number of Geogrid Layers, N

tg = lesser of Ta or Pos **tg =** 500 lb/ft of slope width

Eq (17), Ref (1) **N = Fg/tg =** 4.7 layers

Step 5: Compute La, the Required Geogrid Length Behind the Slide Plane

Eq (18), Ref (1) **La =** 2.8 ft

Step 6: Finalize Spacing and Length of Geogrids

Eq (19), Ref (1) **Spacing S =** 3.16 ft

Eq (20), Ref (1) **Lg =** 8.8 ft

Calculate Fg

FS*gamma*H*z*Cos(beta)*Sin(beta)	N1 =	5192.303	
c'*H	N2 =	2400	
(gamma-water)*H*z*(Cos(beta))^2*Tan(phi)	N3 =	1324.925	
Sin(beta)*Cos(beta)	N4 =	0.461538	
(SIN(beta))^2*TAN(phi)	N5 =	0.156777	
N4 + N5	N6 =	0.618315	
Fg = (N1-N2-N3)/N6	**Fg =**	2373	lb/ft of slope width

Pullout in Slide Mass

Length of Geogrid in Slide Mass	Ls =	6.0	ft
Average Effective Normal Stress	sigma =	163.5999	psf
Coefficient of Shear Stress Interaction	Ci =	0.75	Table 3, Ref (3)
Factor of Safety Against Pullout	FSpo =	1.5	
	Pos =	500	lb/ft of slope width

Long Term Design Strength

Miragrid 2XT			
	LTDS =	1096	lb/ft of slope width
Orange County Factor of Safety	OCFS =	1.5	
	Ta =	731	lb/ft of slope width

Compute La

Average Effective Normal Stress	sigma =	500	psf
F* = (2/3)*TAN(ø) w/o testing	F* =	0.339684	
α = 0.8 for geogrids	α =	0.8	
Factor of Safety Against Pullout	FSpo =	1.5	
	La =	2.8	ft

RESPONSE TO CITY OF DANA POINT GEOTECHNICAL REPORT REVIEW AND RESPONSE TO CITY OF DANA POINT SECOND ENGINEERING REVIEW

This page intentionally left blank

December 18, 2019

Mr. Anthony Wrzosek
DANA POINT HARBOR PARTNERS, LLC
c/o R.D. OLSON DEVELOPMENT
520 Newport Center Drive, Suite 600
Newport Beach, CA 92660

GMU Project 17-206-01
Plan Check No. PA19-0002

Subject: Response to City of Dana Point Geotechnical Report Review Comments – dated November 14, 2019, Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component

References: Listed on page 8

Dear Mr. Wrzosek:

This correspondence presents our response to the "Geotechnical Comments" 21 through 32 contained on pages 3 through 5 of the reference (1) City of Dana Point Plan Review Comments letter (attached to this correspondence) pertaining to our reference (2) geotechnical investigation report for the Hotel Component of the Dana Point Revitalization Project.

OVERALL COMMENTS

The project is at the EIR stage and is 2 to 3 years away from a final design submittal. Consequently, it is not possible to answer detailed questions with regard to ground improvement (i.e. what size the DSM columns are and where are they going, where shoring is needed, etc.) The answers below address the questions as comprehensively as possible given the early stage of development. It is lastly noted that our subject report is very detailed for what essentially is an EIR level submittal.

COMMENT 21

We expect that the geotechnical report will be reviewed in detail by County of Orange as part of the grading and building plan permitting process, with detailed construction oriented comments relative to the various geotechnical parameters, conclusions, recommendations, etc., provided as necessary as part of that process. Consequently, the comments presented herein by city staff are intended to address the geotechnical report as it relates to the "Dana Point Harbor Revitalization Plan and District Regulations," and not necessarily from a detailed design/construction and permitting standpoint.

> ***GMU Response:***
> *GMU Acknowledges the City's statement.*

COMMENT 22

Review of the submitted geotechnical report indicates the site is susceptible to liquefaction and lateral spreading, and that the potential total vertical settlement (static and seismic) and total differential settlement could exceed the threshold values presented in the City of Dana Point Seismic policy of 4" and 1"/40' respectively. With estimated total vertical settlement of approximately 4" (0.5" static and 3.5" seismic) and total differential settlement of approximately 2.5" over 40' indicated in the report (2.25" seismic and 0.25" static) for the proposed hotel structures, please clarify the recommendations for ground modification (for both hotel structures) that address the anticipated settlements and satisfies the Cities Seismic Policy.

GMU Response:

The following should be noted with regard to the seismic settlement estimates contained in our report: 1) Differential seismic settlements were estimated using both SPT and CPT data. The larger settlement values are from the SPT analyses which are very conservative (i.e. data is averaged over 5'vertical intervals and SPT data is not as reproducible as CPT data, etc.), and 2) CPT seismic settlement estimation are all under 1 inch. Consequently, anticipated seismic settlement for the site as a whole should be well within the City's seismic policy limits. However, for the purposes of design, the most conservative/outlying SPT estimations were considered.

In summary, following construction: 1) the site overall will be subject to total post-earthquake settlements within the City's seismic requirements and 2) the buildings will be founded on either Geopiers to bedrock or mat foundations designed for conservative differential settlement values exceeding those expected for the site as a whole (i.e. approximately 1" over 40')

COMMENT 23

Please indicate the depth of potentially liquefiable soils beneath the subject property.

GMU Response:

- *Based on an MCE earthquake, a historic high groundwater able, and the continuous and more accurate CPT data, liquefaction is predicted to occur in thin zones of a few inches to a few feet in thickness between the depths of 8 and 18 feet below the existing ground surface. The results are contained within Appendix D of the reference 2 report.*

COMMENT 24

Based on the remedial grading recommendations for areas of proposed streets, parking areas, and hardscape improvements, please provide a risk assessment statement addressing potential future ground movement and adverse impacts in the event of a significant earthquake event (liquefaction and lateral spreading). Please note that a minimum the streets and primary access driveways to the hotels should be accessible by emergency vehicles subsequent to the design earthquake. Please clarify recommendations for these areas.

> ***GMU Response:*** *Given the CPT based seismic settlement estimations (i.e. < 1") and the inherent conservative assumptions built into the analysis (i.e. MCE Earthquake, historic high groundwater levels, etc.) the potential for significant functional issues with streets and primary access driveways is very low. The effect on hardscape improvements is similarly low but irrelevant from a post-earthquake safety/service perspective.*

COMMENT 25

Please provide the basis for the static total and differential settlement values that are presented in the report, as no consolidation testing is provided in the report.

> ***GMU Response:*** *Static settlements were estimated using CPT data. Please note that the proposed buildings will be either supported on mat slabs that have a very low bearing pressure (i.e. preliminarily estimated at 500 psf) and designed to withstand conservative estimations of seismic settlement or on Geo-piers to bedrock (option for the westernmost hotel – Surf Lodge). Consequently, static settlements are not a significant design constraint for the project.*
>
> *It should be noted that the project is in the EIR stage and the final design has yet to be established. Additional settlement analyses (if needed) will be addressed when design plans are being developed.*

COMMENT 26

Please discuss the structural geology associated with the bluff backing Dana Point Harbor Drive near the site as it relates to gross stability and potential impacts to the area of the proposed hotel development.

> ***GMU Response:***
> *The bluff backing Dana Point Harbor Drive near the proposed hotel development is approximately 120 feet away at its closest point to a structure and is composed of poorly bedded sandstone of the Capistrano Formation. Due to the proximity of the bluff to the development and the poorly bedded structure of the bluff, the potential for the bluff to impact the proposed development is negligible.*

COMMENT 27

Please discuss the Dana Cove fault as it relates to the proposed development.

GMU Response:
The Dana Cove fault is considered to be inactive based on the following. References for the following statements are included in at the end of this response letter.

- *According to the referenced AMEC geotechnical reports, "truncation of the Dana Cove fault surface by the wave-cut bench at elevation 160 feet shows that no apparent displacement has taken place since deposition of the marine terrace deposits (probably at least 125,000 years ago) and thus the fault is not considered active (Kerwin, 1987).*
- *The Dana Cove fault is mapped on the geologic map within Special Report 109 (Edgington, 1974). The text of this Report indicates all faults mapped within the quadrangle are pre-Holocene in age (Page 7).*
- *The abstract for "Quaternary Geomorphic Development and Seismic Hazards of Orange County", presented at the AAPG Annual Meeting 2007 (Gath and Grant, 2007), indicates the Dana Cove fault was active until the mid-Quaternary, when the Newport Inglewood fault zone stepped to the west, away from the Cristianitos, Mission Viejo, and Dana Cove faults.*
- *Kerwin (1987) dated the fault activity at greater than about 125,000 years ago, based on the age of the overlying terrace deposits.*
- *The Dana Cove fault is not shown on the Fault Activity Map of California (Jennings and Bryant, 2010).*
- *Based on the definitions provided in SP42, Fault-Rupture Hazard Zones in California (Bryant and Hart, Revision 2007), the Dana Cove fault is not "active" or "sufficiently active".*

Based on the above evidence, it is our opinion that the Dana Cove fault will not impact the proposed development.

COMMENT 28

Please discuss the possibility of de-watering as part of the construction of the hotel structures (drilling, excavating, etc.) and provide recommendations as necessary.

GMU Response: *Dewatering is not anticipated for the recommended corrective grading for the site. In fact, our recommendations were developed so as to eliminate the need for dewatering. That is why we ended up with mat slabs, geopiers combined with shallow corrective grading recommendations. Geopiers (if utilized) or DSM columns will encounter groundwater. These installations have specific procedures when groundwater is encountered that avoids conventional dewatering.*

It should be noted that the project is in the EIR stage and the final design has yet to be established. Dewatering (if needed) will be addressed when design plans are being developed. But again, at this point it is our opinion that conventional dewatering will not be needed.

COMMENT 29

Please discuss if shoring will be necessary for construction of the basement level parking for the Dana House hotel or any other part of the over-all development; and provide design parameters and recommendations for piles and lagging as necessary. Please show the location(s) of possible shoring associated with the grading/construction on the Geotechnical Map, and provide all parameters for shoring as necessary.

***GMU Response**: Based on the proposed structures and set-backs from existing improvements, it is anticipated that all temporary excavations can be accomplished utilizing slope lay-backs discussed on Page 17 of the report. Consequently, shoring is not anticipated at this time.*

It should be noted that the project is in the EIR stage and the final design has yet to be established. If the building plans or our recommendations change and shoring is needed, it will be addressed when design plans are being developed. But again, at this point we do not anticipate that shoring will be needed.

COMMENT 30

Please provide setback requirements between the proposed building/improvements and any excavation (including proposed DSM columns, rammed aggregate piers, soil cement columns, etc.) and the adjacent revetment slope/seawalls associated with the harbor.

***GMU Response**: Rammed aggregate piers if used are only recommended beneath new foundations of the Western "Surf Lodge" hotel. When construction commences on this structure, it is anticipated that other structures in the area will be demolished. Based on very preliminary building locations the closest Geo-pier (again – if used) will be approximately 40' away from the seawall.*

With regard to set-back of DSM columns from the seawall, the DSM columns will need to be 20 feet away from the seawall (see Plates 2 & 3). With regard to the set-back of the DSM columns from existing structures, it is anticipated that all significant structures in the vicinity of the planned DSM columns will be demolished prior to construction. Consequently, given the circular configuration of the piles as well as the anticipated demolition, set-back from existing structures is not anticipated to be as significant design constraint. It should be further noted that it is unknown at this time, what the exact construction timing is of the DSM columns which are needed to minimize lateral spreading. Set-back will be re-evaluated once the *building plans and construction sequencing is worked out. Again, this is anticipated to be 1 to 2 years away.*

COMMENT 31

Please provide geotechnical recommendations, as necessary with respect to the possibility of raising the elevation of the top of the seawall associated with the harbor in response to potential sea-level rise.

***GMU Response**: To our knowledge there is no requirement or plan to raise the sea wall. It is further our understanding that the seawall is not part of the proposed project and will remain in-place in its current condition. In addition, this question is beyond our scope and purview. If the City desires more information on this subject, they should contact the County of Orange directly.*

COMMENT 32

Please discuss the estimated differential movement (vertical and horizontal) that should be anticipated along the bedrock/fill transition ("Structural Join" discussed in the report) beneath the northern portion of the Dana House development.

***GMU Response**: The following should be noted with regard to the design of the mat slab beneath the Dana House hotel: 1) The hotel configuration is very preliminary and not yet finalized, 2) Based on the currently planned location and configuration, a rigid mat slab designed with conservative settlement parameters is preliminarily recommended to accommodate differential settlements so as to reduce movements to the superstructure to acceptable levels. and 3) the "structural joint" recommendation is meant as a "belt and suspenders" recommendation to reduce the potential of a crack occurring to the superstructure at the location of the surficial soil-bedrock contact. There is not any significant differential settlement expected right at the joint.*

It should be noted that the project is in the EIR stage and the final design has yet to be established. Final recommendations for the buildings may need to be revised during the design process which is likely 1 to 2 years away. If required, these recommendations will be contained in a revised or updated geotechnical report.

Please do not hesitate to contact us if you have any questions regarding this response.

Respectfully submitted,

Nadim Sunna, M.Sc., QSP, PE 84197
Senior Engineer

David R. Atkinson
Project Manager / Senior Engineer

Katie Farrington, M.Sc., PG, CEG 2611
Senior Engineering Geologist

Reviewed By:

Gregory P. Silver, M.Sc., PE, GE 2336
President / CEO
Principal Geotechnical Engineer

Attachment:

"Plan Check No. PA19-0002, 24800 Dana Point Harbor, First Engineering Review, Dana Point Harbor Revitalization- Hotel Component, Discretionary," dated November 14, 2019.

gps/ns/dra 17-206-01L Response (12-18-19)

REFERENCES

(1) "Plan Check No. PA19-0002, 24800 Dana Point Harbor, First Engineering Review, Dana Point Harbor Revitalization- Hotel Component, Discretionary," prepared by the City of Dana Point, dated November 14, 2019.

(2) Our "Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, City of Dana Point," dated September 10, 2019 (GMU Project 17-206-01).

DANA COVE FAULT REFERENCES

"Geotechnical Review and Evaluation, Rough Grading Plan, Tentative Tract 16631, Headlands Development and Conservation Plan, Dana Point, California," prepared by AMEC Earth & Environmental, Inc., dated September 21, 2004 (Their Project No. 9-212-306100).

"Geotechnical Report of Rough Grading, Lots 120, 121 and 122, Commercial Site, Tentative Tract 16331, Headlands Project, Dana Point, California," prepared by AMEC Earth & Environmental, dated March 18, 2008 (Their Project Job No. 5-212-400100).

Bryant, W.A. and Hart, E.W., 2007, *Fault-Rupture Hazards in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps,* California Department of Conservation, California Geological Survey, Special Publication 42.

Edgington, W.J., 1974, *Geology of the Dana Point Quadrangle, Orange County, California*: California Division of Mines and Geology, Special Report 109.

Gath, E.M., and Grant, L., 2007, *Quaternary Geomorphic Development and Seismic Hazards of Orange County, Southern Los Angeles Basin, California*, AAPG Annual Convention, Long Beach, California.

Jennings, C.W. and Bryant, W.A., 2010, *150th Anniversary Fault Activity Map of California*, California Geological Survey.

Kerwin, S.T., 1987, *Sea Cliff Stabilization Using Long Rock Anchors – A Case History*, In Rock Mechanics: Proceedings of the 28th U.S. Symposium, University of Arizona, Tucson.

CITY OF DANA POINT

PUBLIC WORKS – ENGINEERING SERVICES
33282 Golden Lantern, Suite 212
Dana Point, Ca 92629
949.248.3554
(www.danapoint.org)

November 14, 2019

SUBJECT: PLAN CHECK NO. PA19-0002
24800 DANA POINT HARBOR
FIRST ENGINEERING REVIEW
DANA POINT HARBOR REVITALIZATION – HOTEL COMPONENT
DISCRETIONARY

As requested the City of Dana Point Public Works and Engineering Department has completed its first discretionary review of the submitted plans and geotechnical report for the subject project. The following items were received by the City for review:

Items Submitted by Applicant	***Items Being Returned to Applicant***
• Land Title Survey & Conceptual Grading for Dana Point Harbor Revitalization prepared by Tait & Associates stamped received September 30, 2019	• Plan review comments
• Landscape Entitlement Plan for Dana Point Harbor Revitalization prepared by WATG stamped received September 30, 2019	•
• Conceptual CDP Architectural for Dana Point Harbor Revitalization prepared by RD Olson Development stamped received September 30, 2019	•
• Title Report for Dana Point Harbor Revitalization prepared by First American stamped received September 30, 2019	•
• "Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, City of Dana Point, California," by GMU, dated September 10, 2019.	• Report review comments.

Based on our review, we have included key written comments and recommendations below. Please address all redlined plan and written comments prior to resubmittal.

GENERAL COMMENTS:

1. The architectural, grading and sea level rise documents all refer to different datums. The differing datums does not allow the development and potential impacts to be properly reviewed. The lack of coordination between datums was previously accepted by the City, with a mathematic conversion, for the Commercial

Core Substantial Compliance. However, with the new Coastal Development Permit submittal, conformance to the current County's survey requirements should be updated. Please review the project survey data to coordinate with Vertical Control Data Sheet 3RR-1-82 and 3RR-2-82 provided from the County's GIS. Please update the plans and reports to reflect NAVD88.

2. Please provide the supporting maps for easements 31, 44, 46, 48, 49 and 57 as shown on the conceptual grading plan (numbers corresponding to the title report). Specifically maps recorded in Book 9927 Page 426, Book 10681 Page 159, and Book 10716 Page 761, which were not available through County.
3. Provide supporting documents, namely the affidavit, referenced in the legal description (recorded in Book 7651 Page 69 of Official Records).
4. Please provide a written confirmation of easements and documents numbered in the title report do not impact the proposed development; 18, 19, 34, 40, 41, 42, 45, 49, 50, 51, 53, 54, 55, 56, 58, 59, 60, 61, 62, 65, 66, 75, 76, 79 and 80.
5. The circulation to the Surf Lodge Entry is unclear. It is unclear if a U-Turn is proposed at the Island Way intersection or whether the proposal is to proceed past the hotel and proceed back to the hotel entry along Dana Harbor Drive. Please see Traffic comments.
6. On the plans please show the proposed turn-around for the proposed delivery, trash pick-up, and fire truck access and circulation on Casitas Place. It is unclear the turning movements and circulation on Casitas Place for hotel services.
7. Due to the incomplete submittal (no WQMP and incomplete preliminary grading plans), additional comments may be forthcoming as additional information is provided.
8. Please see the parking and traffic related comments under separate memo.

GRADING COMMENTS:

9. Please provide Finished Floor and PAD elevations for all proposed structures on the submitted "conceptual grading exhibits."
10. Coordinate the grading and landscape plans to clarify the extent of improvements. The limits of work appear to extend to Island Way on the landscape plans and appear to impact Island Way with loading zones.
11. Please provide conceptual grading for the lower parking level as depicted in the architectural plans on the podium level of the structure. Presently the grading plans show the tie in elevation between the podium level parking in the building and the

exposed exterior parking at 12.00', however, this is the only grading information provided for the covered parking area. Provide spot elevations, parking spot and drive aisle dimensions and slopes for traffic and drainage review.

12. At a minimum, provide one North/South and one East/West section of the parking structure.

13. Please revise grading areas shown on the plans so that two separate North arrows are not required on the same page. Presently, the match lines for the Eastern half of the parking lot grading require the reviewer to rotate the orientation of a portion of the plans.

14. Please provide additional construction notes, plan notes and preliminary elevations for the relocation of the storm drain around the proposed development. The current reference indicating the existing storm drain will remain through some phasing of the construction does not refer to what amount of phasing or a final relocation alignment.

15. Please include the recommended "Soil Cement Columns" on all Grading plans and sections, as described in the submitted Geotechnical Report.

16. Please include the recommended "Rammed Aggregate Piers" on all Grading plans and sections, as described in the submitted Geotechnical Report.

17. Please include the recommended "Transition Zone" for the bedrock to graded fill transition, as described in the submitted Geotechnical Report.

18. Clarify what appears to be a property line adjustment. It seems the proposed property line as shown on Parcel Map Book 35 page 39 (attached) is being adjusted. Please confirm the property line adjustment, reasoning, and method of adjustment, (Parcel Map or LLA).

19. Please see additional items on redlined plans for clarity.

WQMP COMMENTS:

20. Please provide the preliminary WQMP in accordance with the South Orange County Model WQMP, Technical Guidance Document and the WQMP template. These documents can be found on the City's website at www.danapoint.org/wqrequirements.

GEOTECHNICAL COMMENTS:

21. We expect that the geotechnical report will be reviewed in detail by County of Orange as part of the grading and building plan permitting process, with detailed construction

oriented comments relative to the various geotechnical parameters, conclusions, recommendations, etc., provided as necessary as part of that process. Consequently, the comments presented herein by city staff are intended to address the geotechnical report as it relates to the "Dana Point Harbor Revitalization Plan and District Regulations," and not necessarily from a detailed design/construction and permitting standpoint.

22. Review of the submitted geotechnical report indicates the site is susceptible to liquefaction and lateral spreading, and that the potential total vertical settlement (static and seismic) and total differential settlement could exceed the threshold values presented in the City of Dana Point Seismic Policy of 4" and 1"/40' respectively. With estimated total vertical settlement of approximately 4" (0.5" static and 3.5" seismic) and total differential settlement of approximately 2.5" over 40' indicated in the report (2.25" seismic and 0.25" static) for the proposed hotel structures, please clarify the recommendations for ground modification (for both hotel structures) that address the anticipated settlements and satisfies the Cities Seismic Policy.

23. Please indicate the depth of potentially liquefiable soils beneath the subject property.

24. Based on the remedial grading recommendations for areas of proposed streets, parking areas, and hardscape improvements, please provide a risk assessment statement addressing potential future ground movement and adverse impacts in the event of a significant earthquake event (liquefaction and lateral spreading). Please note that at a minimum the streets and primary access driveways to the hotels should be accessible by emergency vehicles subsequent to the design earthquake. Please clarify recommendations for these areas.

25. Please provide the basis for the static total and differential settlement values that are presented in the report, as no consolidation testing is provided in the report.

26. Please discuss the structural geology associated with the bluff backing Dana Point Harbor Drive near the site as it relates to gross stability and potential impacts to the area of the proposed hotel development.

27. Please discuss the Dana Cove fault as it relates to the proposed development.

28. Please discuss the possibility of de-watering as part of the construction of the hotel structures (drilling, excavation, etc.); and provide recommendations as necessary.

29. Please discuss if shoring will be necessary for construction of the basement level parking for the Dana House hotel or any other part of the over-all development; and provide design parameters and recommendations for piles and lagging as necessary. Please show the location(s) of possible shoring associated with the grading/construction on the Geotechnical Map, and provide all parameters for shoring as necessary.

30. Please provide setback requirement between the proposed building/improvements and any excavation (including proposed DSM columns, rammed aggregate piers, soil cement columns, etc.) and the adjacent revetment slope/seawalls associated with the harbor.

31. Please provide geotechnical recommendations, as necessary, with respect to the possibility of raising the elevation of the top of the seawall associated with the harbor in response to potential sea-level rise.

32. Please discuss the estimated differential movement (vertical and horizontal) that should be anticipated along the bedrock/fill transition ("Structural Joint" discussed in the report) beneath the northern portion of the Dana House development.

May 4, 2020

Mr. Anthony Wrzosek
DANA POINT HARBOR PARTNERS, LLC
c/o R.D. OLSON DEVELOPMENT
520 Newport Center Drive, Suite 600
Newport Beach, CA 92660

GMU Project 17-206-01
Plan Check No. PA19-0002

Subject: Response to City of Dana Point Geotechnical Report Second Engineering Review Discretionary Comments – dated January 21, 2020, Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component

References: Listed on page 7

Dear Mr. Wrzosek:

This correspondence presents our response to the "Geotechnical Comments" 23, 25, 26, 29, 30, 32, and 33 contained on pages 4 through 6 of the reference (1) City of Dana Point Second Engineering Review Discretionary Comments letter (attached to this correspondence) pertaining to our reference (2) geotechnical investigation report for the Hotel Component of the Dana Point Revitalization Project.

OVERALL COMMENTS

The project is at the EIR stage and is 2 to 3 years away from a final design submittal. Consequently, it is not possible to answer detailed questions with regard to ground improvement (i.e. what size the DSM columns are and where are they going, where shoring is needed, etc.) The answers below address the questions as comprehensively as possible given the early stage of development. It is lastly noted that our subject report is very detailed for what essentially is an EIR level submittal.

COMMENT 23

Review of the submitted geotechnical report indicates the site is susceptible to liquefaction and lateral spreading, and that the potential total vertical settlement (static and seismic) and total differential settlement could exceed the threshold values presented in the City of Dana Point Seismic policy of 4" and 1"/40' respectively. With estimated total vertical settlement of approximately 4" (0.5" static and 3.5" seismic) and total differential settlement of approximately 2.5" over 40' indicated in the report (2.25" seismic and 0.25" static) for the proposed hotel structures, please clarify the recommendations for ground modification (for both hotel structures)

23241 Arroyo Vista
Rancho Santa Margarita | CA 92688
949.888.6513 | FX: 949.888.1380 | www.gmugeo.com

that address the anticipated settlements and satisfies the Cities Seismic Policy. **Repeat Comment. A thorough response to the requested recommendations for ground modification will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

***GMU Response**:*

The following statements are provided in an attempt to provide additional clarification with regards to remediation required to adequately minimize potential lateral spreading deformation and vertical seismic settlement at the site.

- ***Lateral Spreading Mitigation.*** *The harbor edge of the site will be subject to significant lateral spreading. To mitigate lateral spreading to 2019 code levels ground modification will be required in the building areas.*
  - *The location of the required lateral spreading mitigation is shown on Plate 2 of our report.*
    - *The mitigation extends 50 feet on either side of the proposed hotel structures.*
  - *Although two ground improvement options were provided for lateral spreading mitigation, Deep Soil Mixing (DSM) columns have been preliminarily selected.*
    - *The DSMs will extend to the bedrock below the site.*

- ***Vertical Seismic Settlement****. As per the CPT based analyses performed for the site, seismic settlements for the overall site are not expected to exceed 1 inch.*
  - *Site Improvements (Roads, sidewalks, parking areas, etc.)*
    - *Given the anticipated site settlement, ground modification is not required to support the proposed improvements.*
    - *The potential for significant damage to these structures is low.*
    - *All streets and primary access driveways are anticipated to remain fully accessible to emergency access vehicles following the design seismic event.*
  - *Hotel Buildings – Dana House and Surf Lodge*
    - *Given the hotel use and the location of the hotel buildings to the seawall, enhanced building foundations (Mat Foundations) or additional ground improvement (Geopiers/Gravel Piers to Bedrock) are required to adequately minimize seismically related ground movements and their effect on the superstructure.*
      - *Preliminarily, both hotels are planned to be founded on a mat foundation system preliminarily estimated to be 24 inches in thickness.*

- *The mat foundation system will be designed to accommodate higher seismic settlements than what is anticipated throughout the site*

COMMENT 25

Based on the remedial grading recommendations for areas of proposed streets, parking areas, and hardscape improvements, please provide a risk assessment statement addressing potential future ground movement and adverse impacts in the event of a significant earthquake event (liquefaction and lateral spreading). Please note that a minimum the streets and primary access driveways to the hotels should be accessible by emergency vehicles subsequent to the design earthquake. Please clarify recommendations for these areas. **Repeat Comment. A thorough response to recommendations to mitigate seismic ground movement will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

GMU Response*: See response to Item 23.*

COMMENT 26

Please provide the basis for the static total and differential settlement values that are presented in the report, as no consolidation testing is provided in the report. **The discussion provided is adequate for the purposes of this review. This will be a Condition of Approval to be addressed during the construction permit review and approval.**

GMU Response*: No response required at this time.*

COMMENT 29

Please discuss the possibility of de-watering as part of the construction of the hotel structures (drilling, excavating, etc.) and provide recommendations, as necessary. **Repeat Comment. A thorough response addressing the anticipated need for dewatering, will be required to evaluate the project in the Environmental Impact Report (EIR). The submitted Preliminary WQMP discusses the need for de-watering and groundwater table impacts. Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

GMU Response*: Based on our detailed groundwater evaluation contained in our report along with the planned bottom floor elevations provided to us (i.e. finish floor (FF) at el. 12.0) and the Surf Lodge (with finish floor (FF) at el. 15.0), there will be <u>no need for dewatering</u> as a part of the construction of the hotel structures. This is illustrated on the*

Plate 3 of our report entitled Geotechnical sections. An additional geotechnical cross-section C-C' was developed to help further illustrate the lack of need for dewatering, please refer to Plate 3. However, some localized dewatering will be required during project construction in order to support installation of deep utility improvements at or below sea level for the project, which is covered in the WQMP statements regarding dewatering and groundwater table impacts.

COMMENT 30

Please discuss if shoring will be necessary for construction of the basement level parking for the Dana House hotel or any other part of the over-all development; and provide design parameters and recommendations for piles and lagging, as necessary. Please show the location(s) of possible shoring associated with the grading/construction on the Geotechnical Map and provide all parameters for shoring, as necessary. **Repeat Comment. No cross section of the lower level of the Dana House hotel has been provided outlining the temporary slopes not impacting Dana Harbor Drive or Casitas Place. A thorough response to this comment will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

GMU Response*: To aid in the response to this item, we have added a cross-section C-C', going through the lower level of the Dana House Hotel, to the attached Plate 3 - Geotechnical Sections. Please refer to both Section A-A' and C-C' for notation of the locations of temporary excavation limits for the construction of the Dana House Hotel underground parking structure. As stated in our report regarding temporary excavations: "Our recommendations for temporary excavations are as follows:*

- *Temporary, unsurcharged excavation sides within artificial fill material over 4 feet in height should be sloped no steeper than 1.5H:1V (horizontal: vertical).*
- *Temporary, unsurcharged excavation sides within bedrock material over 4 feet in height should be sloped no steeper than 1H:1V (horizontal: vertical).*
- *The tops of the excavations should be barricaded so that vehicles and storage loads do not encroach within 10 feet of the excavations."*

Thus, we believe that <u>shoring will not be necessary</u> for construction of the basement level parking for the Dana House Hotel. Some limited temporary shoring may be required during the installation of deep utility lines to support the development. However, this will likely consist of temporary trench shields provided by the underground contractor.

COMMENT 32

Please provide geotechnical recommendations, as necessary with respect to the possibility of raising the elevation of the top of the seawall associated with the harbor in response to potential sea-level rise. **Repeat Comment. A thorough response to this comment will be required to evaluate the project in the Environmental Impact Report (EIR). No responses were received to the Sea Level Rise document submitted with the application. Anticipated improvements discussed as a part of sea level rise for this project, may require geotechnical recommendations. Again, as necessary, please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

> ***GMU Response****: The seawall is: 1) the responsibility of the County of Orange; 2) outside of the planned development; and, 3) not part of GMU's scope of work. A separate sea level rise report by others is being submitted.*

COMMENT 33

Please discuss the estimated differential movement (vertical and horizontal) that should be anticipated along the bedrock/fill transition ("Structural Join" discussed in the report) beneath the northern portion of the Dana House development. **Repeat Comment. A thorough response to this comment may be addressed by responses to above comments concerning ground modification, with the basis for settlement values acceptable at this point. A discussion of the bedrock/fill transition will be required to evaluate the project in the Environmental Impact Report (EIR).**

> ***GMU Response****: In our submitted geotechnical report dated September 10, 2019, regarding the Dana House Hotel building, we stated at the bottom of page 21: "Due to the seismic settlement and cut/fill transition anticipated below the building pad, we recommend that the proposed building be supported on a mat foundation with a structural joint incorporated into the design to span the cut/fill transition." To explicate upon this further, the joint was suggested as an additional "belt and suspenders" design item to minimize structural cracking to the superstructure. The general location of the proposed joint is shown on the revised and attached Plate 2 – Geotechnical Map and on the corresponding geologic cross-section A-A' shown on the attached Plate 3 – Geotechnical Sections. The differential settlement is estimated to be 1 inch over approximately 90 feet with respect to the bedrock/fill transition.*

Please do not hesitate to contact us if you have any questions regarding this response.

Respectfully submitted,

David R. Atkinson
Project Manager / Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
GREGORY P. SILVER
GE 2336
GEOTECHNICAL
STATE OF CALIFORNIA

Gregory P. Silver, M.Sc., PE, GE 2336
President / CEO
Principal Geotechnical Engineer

Attachments:

"Plan Check No. PA19-0002, 24800 Dana Point Harbor, Second Engineering Review, Dana Point Harbor Revitalization- Hotel Component, Discretionary," dated January 21, 2020.

Plate 2 – Geotechnical Map

Plate 3 - Geotechnical Sections

dra 17-206-01L Response to Second Engineering Review (5-4-20)

REFERENCES

(1) "Plan Check No. PA19-0002, 24800 Dana Point Harbor, Second Engineering Review, Discretionary," prepared by the City of Dana Point, Public Works Department, dated January 21, 2020.

(2) Our "Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, City of Dana Point," dated September 10, 2019 (GMU Project 17-206-01).

CITY OF DANA POINT

PUBLIC WORKS – ENGINEERING SERVICES
33282 Golden Lantern, Suite 212
Dana Point, Ca 92629
949.248.3554
(www.danapoint.org)

January 21, 2020

SUBJECT: PLAN CHECK NO. PA19-0002
24800 DANA POINT HARBOR
SECOND ENGINEERING REVIEW
DISCRETIONARY

As requested the City of Dana Point Public Works and Engineering Department has completed its review for the subject project. The following items were received by the City for review:

Items Submitted by Applicant	*Items Being Returned to Applicant*
• Land Title Survey & Conceptual Grading for Dana Point Harbor Revitalization prepared by Tait & Associates stamped received December 20, 2019	• 1 copy of Plan Review Comments
• Landscape Entitlement Plan for Dana Point Harbor Revitalization prepared by WATG stamped received December 20, 2019	•
• Conceptual CDP Architectural for Dana Point Harbor Revitalization prepared by RD Olson Development stamped received December 20, 2019	•

Based on our review, we have included key written comments and recommendations below. Please address all redlined plan and written comments prior to resubmittal.

GENERAL COMMENTS

1. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #1.** Please provide more clarity on the datum being used (MSL or NAVD88). It appears the ALTA, Hotel Demolition Phasing Plan, and Conceptual Grading Plan are in NAVD88 and the architectural references in MSL. There is an estimated 2.53' difference between these two datums. Please clarify, the finished floor elevation of the Lodge is 15.0ft on both the Conceptual Grading Sheet 1 of 2 and MSL+15' on West Exterior Elevation shown on sheet A4.0.

ARCHITECTURAL COMMENTS

2. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #6.** On sheet **A1-02**, specifically indicate the turning radius for the proposed U-turn at Island Way on Harbor Drive and the AASHTO standard turning template used. Similarly, address both turning radius and drive aisle dimensions for the proposed service loading traffic on Casitas Place. Indicate the size of service vehicle used for the proposed route through the adjacent parking lot. It appears the trash truck will be required to use this route.

3. Reconcile the apparent elevation difference of the Podium Level on sheet A3-01 and A3-03 (one shows 12', the other shows 14').

<u>GRADING COMMENTS</u>

4. On sheet 2 of 2 of the **Land Title Survey**: Provide documentation and descriptions for easements associated with call outs 34, 57 and 68. **Easement 34:** The response to comments indicates the easement does not impact the proposed project, however it appears proposed utility improvement encroach into this easement. Provide recordation documentation and add the easement description to the plan. **Easement 57:** The easement description is listed on the plans and the related supporting documents were provided, however, it is not shown on the plan. Please locate and label easement 57 on the plans. **Easement 68:** The easement is labeled on the land title survey and proposed utility improvements encroach onto the easement. Provide recordation documentation and add the easement description to the plan.

5. On sheet 2 of 2 of the **Land Title Survey**: Reference the redlines for unidentified easement sections (on Casitas Place);

6. On sheet 2 of 2 of the **Land Title Survey**: Revise overlapping text near Casitas Place and in the title block for clarity.

7. The title report was not included in the submittal for reference with the easement documents provided. Please provide the title report AND supporting easement documents with the next submittal for a complete review.

8. On all three sheets of the **Hotel Demolition Phasing Plan,** clarify the hatch used at the end of Casitas Place nearest the Quay Wall. It would appear demolition or improvements are proposed in this area. Update the limits of work to reflect the work proposed.

9. On the **Hotel Demolition Phasing Plan** and the **Conceptual Grading Plan**, address the proposed demolition and improvements within Plan Area 4 as shown

on the Architectural Plans. Show the limits of Plan Area 3 and 4 when both are shown on plan.

10. On the **Hotel Demolition Phasing Plan** clarify how boater parking and access to the docks will be maintained throughout each phase of demolition and construction. *Demolition sheet 2* indicates parking spots on the island will be used during Phase 2. This comment may be addressed in the Parking Management Plan or elsewhere in the plan set.

11. On the **Conceptual Grading Exhibit,** provide 24' minimum drive aisles; standard parking stalls at 9' by 18' minimum. When the parking stall is 16' deep, show the required 2' overhang on the grading plan; parallel parking stalls must be 8' by 22' minimum. See redlines for additional requested dimensions.

12. On the **Conceptual Grading Exhibit,** revise the matchline references to the correct sheets. See redlines.

13. On the **Conceptual Grading Exhibit,** dimension the loading area width and length.

14. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #1.** On the **Land Title Survey, Hotel Demolition Phasing Plan** and **Conceptual Grading Plan**, indicate the benchmark and datum used.

15. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #9.** Please provide a pad elevation for both the Lodge and Dana House, as needed for height and scope of grading.

16. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #10.** Separate from the delineation of the Plan Areas, label a "Limit of Work" boundary. It appears the limit of work expands from Island Way to Casitas Place with encroachments onto Harbor Drive and Plan Area 2. The **Conceptual Utility Plan** suggests sewer improvements encroaching into Plan Area 2, expanding the limit of work beyond what is depicted elsewhere in the plans.

17. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #11.** On the **Conceptual Grading Exhibit,** provide a lower level grading plan to include the information from comments requesting coordination with geotechnical report. It is acknowledged that the drainage of this area will be by others and at a later date, however the scope of the grading and ground modification is still unknown.

18. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #12.** Please provide cross sections for the Lodge and Dana House depicting potential ground modification and sub terrain improvements to approximate depths.

19. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #14.** Clearly identify utilities to be abandoned and label the estimated size of proposed utilities. Please indicate a relative/approximate size for the proposed storm drains and other utilities.

20. **REPEAT COMMENT: Refer to Public Works 1st plan review comment #15.** Please indicate location of recommended improvements and the recommended setbacks from the quay wall from the geotechnical report.

PRELIMINARY WQMP COMMENTS

21. No further comments at this time.

GEOTECHNICAL COMMENTS

22. ~~e expect that the geotechnical report will be reviewed in detail by County of Orange as part of the grading and building plan permitting process, with detailed construction oriented comments relative to the various geotechnical parameters, conclusions, recommendations, etc., provided as necessary as part of that process. Consequently, the comments presented herein by city staff are intended to address the geotechnical report as it relates to the "Dana Point Harbor Revitalization Plan and District Regulations," and not necessarily from a detailed design/construction and permitting standpoint.~~

23. Review of the submitted geotechnical report indicates the site is susceptible to liquefaction and lateral spreading, and that the potential total vertical settlement (static and seismic) and total differential settlement could exceed the threshold values presented in the City of Dana Point Seismic Policy of 4" and 1"/40' respectively. With estimated total vertical settlement of approximately 4" (0.5" static and 3.5" seismic) and total differential settlement of approximately 2.5" over 40' indicated in the report (2.25" seismic and 0.25" static) for the proposed hotel structures, please clarify the recommendations for ground modification (for both hotel structures) that address the anticipated settlements and satisfies the Cities Seismic Policy. **Repeat Comment. A thorough response to the requested recommendations for ground modification will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

24. ~~Please indicate the depth of potentially liquefiable soils beneath the subject property.~~

25. Based on the remedial grading recommendations for areas of proposed streets, parking areas, and hardscape improvements, please provide a risk assessment statement addressing potential future ground movement and adverse impacts in the event of a significant earthquake event (liquefaction and lateral spreading). Please note that at a minimum the streets and primary access driveways to the hotels should be accessible by emergency vehicles subsequent to the design earthquake. Please clarify recommendations for these areas. **Repeat Comment. A thorough response to recommendations to mitigate seismic ground movement will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

26. Please provide the basis for the static total and differential settlement values that are presented in the report, as no consolidation testing is provided in the report. **The discussion provided is adequate for the purposes of this review. This will be a Condition of Approval to be addressed during the construction permit review and approval.**

27. ~~Please discuss the structural geology associated with the bluff backing Dana Point Harbor Drive near the site as it relates to gross stability and potential impacts to the area of the proposed hotel development.~~

28. ~~Please discuss the Dana Cove fault as it relates to the proposed development.~~

29. Please discuss the possibility of de-watering as part of the construction of the hotel structures (drilling, excavation, etc.); and provide recommendations as necessary. **Repeat Comment. A thorough response addressing the anticipated need for dewatering, will be required to evaluate the project in the Environmental Impact Report (EIR). The submitted Preliminary WQMP discusses the need for de-watering and groundwater table impacts. Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

30. Please discuss if shoring will be necessary for construction of the basement level parking for the Dana House hotel or any other part of the over-all development; and provide design parameters and recommendations for piles and lagging as necessary. Please show the location(s) of possible shoring associated with the grading/construction on the Geotechnical Map, and provide all parameters for shoring as necessary. **Repeat Comment. No cross section of the lower level of the Dana House hotel has been provided outlining the temporary slopes not impacting Dana Harbor Drive or Casitas Place. A thorough response to this comment will be required to evaluate the project in the Environmental Impact Report (EIR). Please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

31. ~~Please provide setback requirement between the proposed building/improvements~~

~~and any excavation (including proposed DSM columns, rammed aggregate piers, soil cement columns, etc.) and the adjacent revetment slope/seawalls associated with the harbor.~~

32. Please provide geotechnical recommendations, as necessary, with respect to the possibility of raising the elevation of the top of the seawall associated with the harbor in response to potential sea-level rise. **Repeat Comment. A thorough response to this comment will be required to evaluate the project in the Environmental Impact Report (EIR). No responses were received to the Sea Level Rise document submitted with the application. Anticipated improvements discussed as a part of sea level rise for this project, may require geotechnical recommendations. Again, as necessary, please provide a response to comments for review and approval as a part of the Technical Documents in the EIR.**

33. Please discuss the estimated differential movement (vertical and horizontal) that should be anticipated along the bedrock/fill transition ("Structural Joint" discussed in the report) beneath the northern portion of the Dana House development. **Repeat Comment. A thorough response to this comment may be addressed by responses to above comments concerning ground modification, with the basis for settlement values acceptable at this point. A discussion of the bedrock/fill transition will be required to evaluate the project in the Environmental Impact Report (EIR).**

To assist in completing the next review of your plans and reports, please provide written responses to all comments included in this correspondence.

If you have any questions pertaining to the plan check process or the customer service provided, please contact me at 949.248.3554 or via email at mkunk@danapoint.org.

Sincerely,

Matthew Kunk, P.E.
Senior Engineer
Development Division
Public Works Department

Geotechnical Map

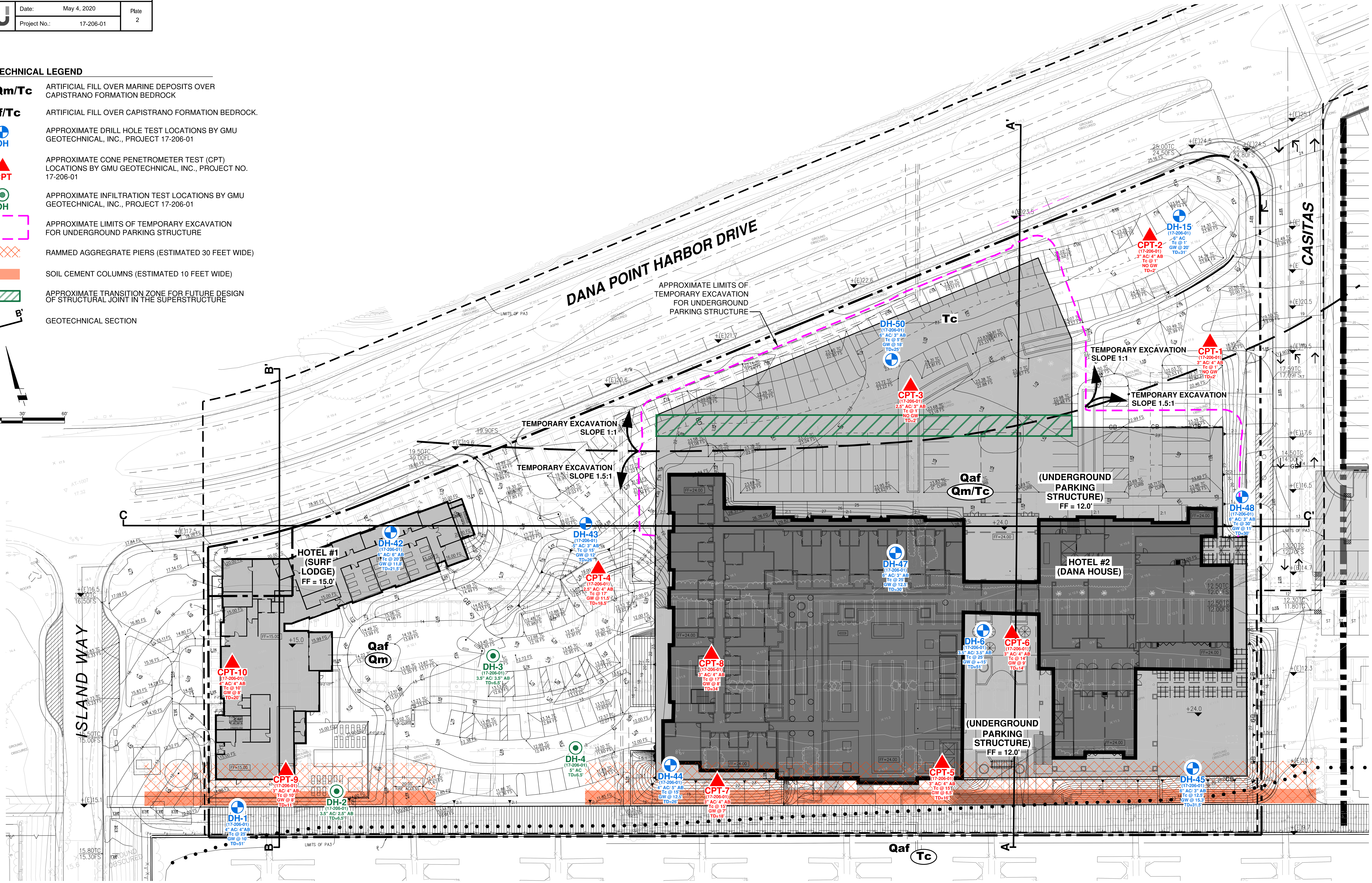
Date:	May 4, 2020	Plate
Project No.:	17-206-01	2

GMU

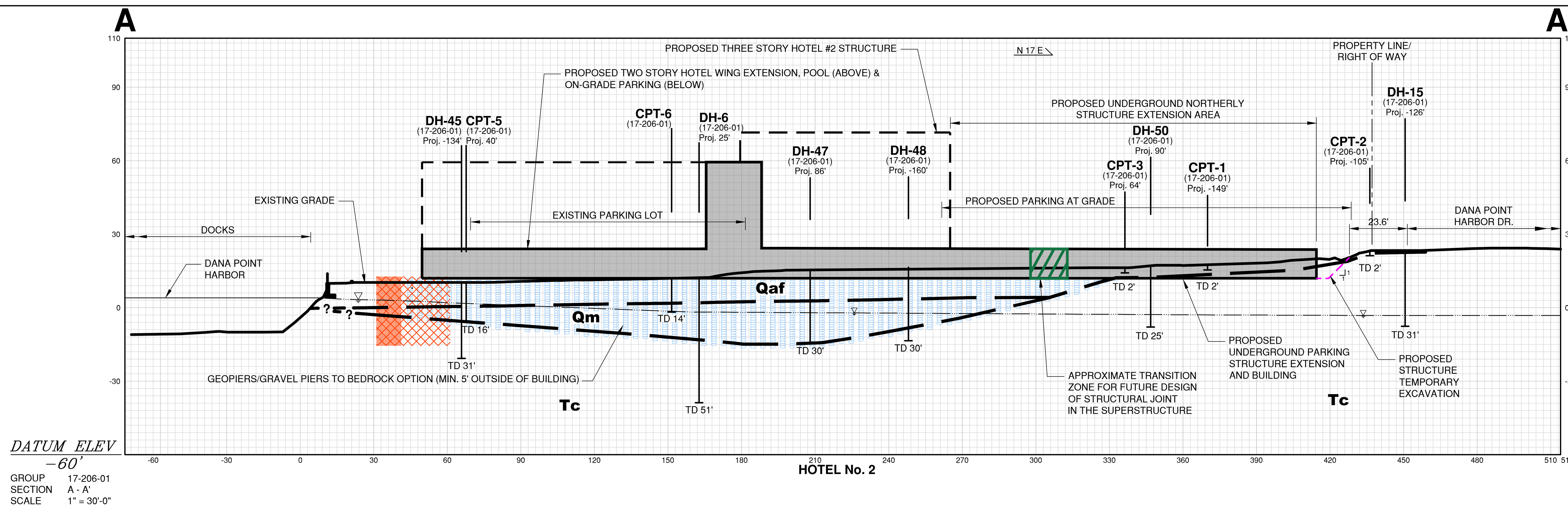
GEOTECHNICAL LEGEND

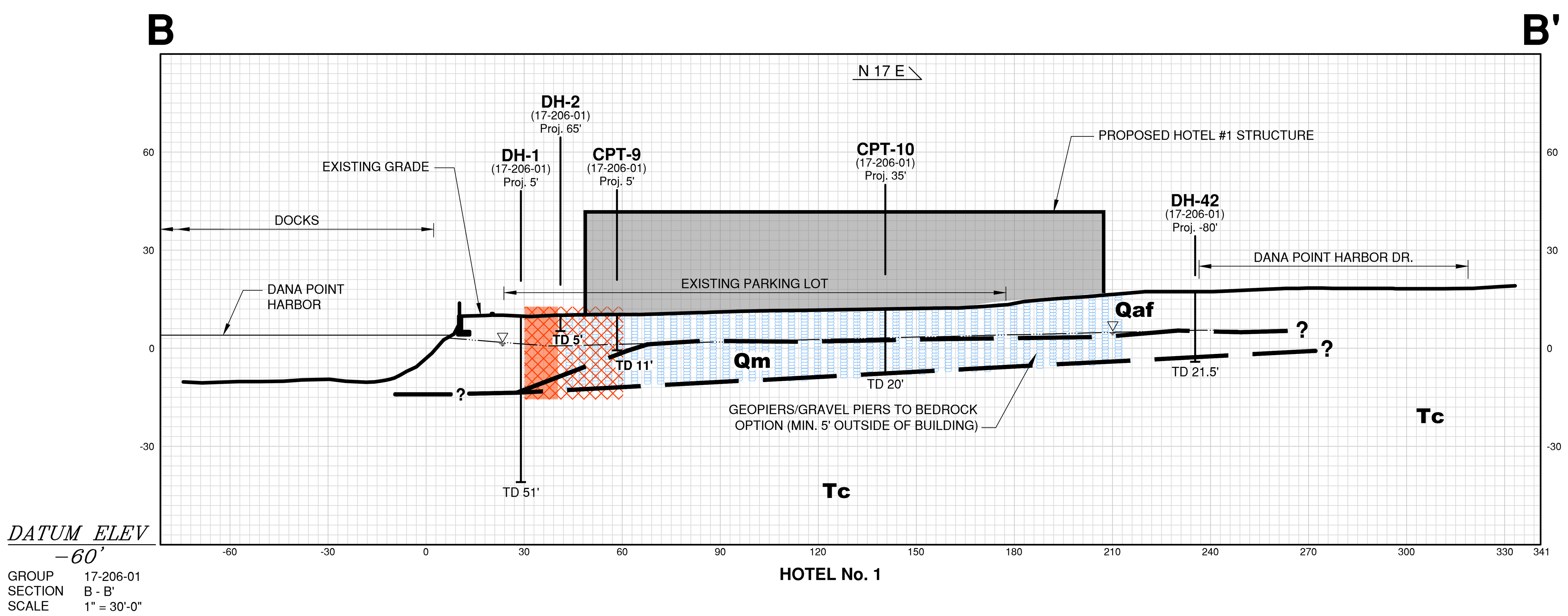
- **Qaf/Qm/Tc** — ARTIFICIAL FILL OVER MARINE DEPOSITS OVER CAPISTRANO FORMATION BEDROCK
- **Qaf/Tc** — ARTIFICIAL FILL OVER CAPISTRANO FORMATION BEDROCK.
- DH — APPROXIMATE DRILL HOLE TEST LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT 17-206-01
- CPT — APPROXIMATE CONE PENETROMETER TEST (CPT) LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT NO. 17-206-01
- DH — APPROXIMATE INFILTRATION TEST LOCATIONS BY GMU GEOTECHNICAL, INC., PROJECT 17-206-01
- APPROXIMATE LIMITS OF TEMPORARY EXCAVATION FOR UNDERGROUND PARKING STRUCTURE
- RAMMED AGGREGATE PIERS (ESTIMATED 30 FEET WIDE)
- SOIL CEMENT COLUMNS (ESTIMATED 10 FEET WIDE)
- APPROXIMATE TRANSITION ZONE FOR FUTURE DESIGN OF STRUCTURAL JOINT IN THE SUPERSTRUCTURE
- B B' — GEOTECHNICAL SECTION

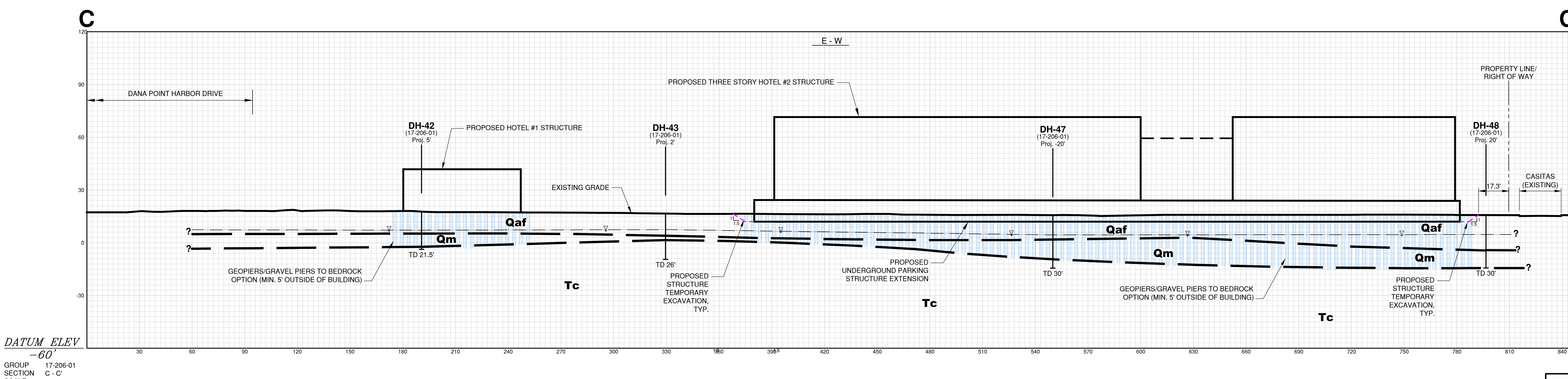
0 30' 60'



DRAWING: g:\2017\17-206-01\dwg\1720601 plate 2_geo map--full size.dwg PLOTTED: 5/4/2020 1:25 PM BY: Jmeza







GEOTECHNICAL LEGEND

- RAMMED AGGREGATE PIERS (30 FEET WIDE)
- SOIL CEMENT COLUMNS (10 FEET WIDE)
- GEOPIERS/GRAVEL PIERS TO BEDROCK OPTION

0 30' 60'

DRAWING: g:\2017\17-206-01\dwg\1720601_plate 3_geo section-full size.dwg PLOTTED: 5/5/2020 9:41 AM BY: Jimezo

Geotechnical Sections

GMU

Date:	May 4, 2020	Plate 3
Project No.:	17-206-01	

GEOTECHNICAL REVIEW

This page intentionally left blank

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

August 6, 2020
Project No. 211485001

Mr. Ryan Bensley, AICP
Associate/Environmental Planner
LSA
20 Executive Park, Suite 200
Irvine, California 92614

Subject: Geotechnical Review
Geotechnical Report and Responses to Review Comments
Dana Point Harbor Revitalization, Hotel Component
Dana Point, California

References: GMU, 2019a, Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, City of Dana Point, California, dated September 10.

GMU, 2019b, Response to City of Dana Point Geotechnical Report Review Comments - dated November 14, 2019, Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, dated December 18.

GMU, 2020, Response to City of Dana Point Geotechnical Report Second Engineering Review Discretionary Comments – dated January 21, 2020, Preliminary Geotechnical Investigation, Dana Point Harbor Revitalization, Hotel Component, dated May 4.

Dear Mr. Bensley:

In accordance with your request, we have performed a geotechnical review of the referenced geotechnical report and responses to comments prepared by GMU, pertaining to the proposed Dana Point Harbor Revitalization, Hotel Component project in Dana Point, California. The response letters (2019b and 2020) were prepared in response to review comments from the City of Dana Point. Our review is based generally on the standards presented in the 2019 California Building Code and current standards of practice.

Based on our review, we understand that the proposed development will consist of a 4-story at-grade affordable hotel known as “Surf Lodge” (Hotel 1) with surface parking at the west end of the site, and an up to 4-story luxury hotel known as “Dana House” (Hotel 2) over a 1-story at and below grade parking structure that extends past the northern boundary of the hotel.

The consultant performed a subsurface evaluation consisting of thirteen hollow-stem-auger exploratory borings to depths ranging from approximately 6.5 to 51 feet below the existing ground surface for geotechnical testing and infiltration testing and ten cone penetrometer test soundings to depths of up to about 34 feet below the existing ground surface

We have noted items that should be addressed by the geotechnical consultant. Our comments are presented below:

1. The consultant should review future development plans including site rough grading plans, and provide updated geotechnical recommendations, as appropriate.

2. The consultant provides preliminary recommendations for supporting both hotel buildings on 2-foot-thick mats. However, considering the uncertainty related to differential settlement of soils induced by liquefaction, the viability of this option should be further evaluated during the final design phase of the project. Mitigating the impact of liquefaction through the use of a ground improvement technique (i.e., geopiers) may prove to be a more robust option for the subject improvements.

3. The use of deep soil mixed columns and rammed aggregate piers in mitigating lateral spread potential of the site soils should be further evaluated in detail during the final design phase.

4. Detailed recommendations should be provided in the final geotechnical design report for various ground improvement options that may be chosen for this project. Recommendations for evaluating the quality of the ground improvement methods should be provided, and criteria for verifying the effectiveness of ground improvement should be established.

We appreciate the opportunity to be of service on this project.

Respectfully submitted,
NINYO & MOORE

CERTIFIED ENGINEERING GEOLOGIST RONALD D HALLUM No. 1484 STATE OF CALIFORNIA

Ronald Hallum, PG, CEG
Principal Geologist

REGISTERED PROFESSIONAL ENGINEER SOUMITRA GUHA NO. GE 2632 GEOTECHNICAL STATE OF CALIFORNIA

Soumitra Guha, Ph.D., PE, GE
Principal Engineer

RDH/SG/sc

Distribution: (1) Addressee (via e-mail)