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14 April 2022

Mr. Ben Morrison
Hines
444 S. Flower Street, Suite 2100
Los Angeles, California 90071

Re: Geotechnical Site Evaluation
Bolsa Chica Senior Living Community
Huntington Beach, California
Langan Project No.: 700101401

Dear Mr. Morrison:

As requested by Hines Langan Engineering and Environmental Services, Inc., (LANGAN) has completed a geotechnical site evaluation for property at the southwest corner (SWC) of Warner Avenue and Bolsa Chica Street, Huntington Beach, California.

This letter report presents a summary of the items listed below:

- Our understanding of the existing site conditions and the proposed development,
- Geological and geotechnical information publicly available,
- Subsurface investigation,
- Anticipated geologic conditions and seismic hazards, and
- Our preliminary comments and recommendations regarding the geotechnical feasibility and construction considerations for the proposed development.

Our recommendations were prepared in accordance with the 2019 California Building Code (CBC) and Orange County Geotechnical Guidelines.

PROJECT OVERVIEW

Existing Site Description

The Site is an approximately 2.7 acre site on the southwest corner of Warner Avenue and Bolsa Chica Street, in Huntington Beach. The site is currently occupied by a two story wood frame commercial buildings and at grade parking. The Site is surrounded by housing developments on the west, a commercial development on the south, Warner Avenue to the north, and Bolsa Chica Street to the east (Figure 1).

Proposed Development

Based on the project description which we received on February 2022, we understand the proposed development is a five-story senior living community that will built on top of a single level subterranean parking garage.

AVAILABLE INFORMATION REVIEW

Information that LANGAN reviewed included reports, maps, and other publicly available information from the United States Geological Survey (USGS), California Geological Survey (CGS), City of Huntington Beach, Federal Emergency Management Agency (FEMA), and our files.

A summary of the available information reviewed is provided in the sections below.

Regional and Local Geology

The site is situated along the southwesterly margin of the Orange County Coastal Plain, a relatively broad lowland area that was formed through alluvial aggradations and the formation of coalescing alluvial fans which were deposited along the ancestral Santa Ana River during late Quaternary time. The Coastal Plain is bounded on the northeast by an alignment of highland areas and foothills (including the Puente and Coyote Hills), and on the southwest by a succession of low coastal hills and mesas that are topographic expressions of deformation along the Newport-Inglewood structural zone. Between these coastal topographic highs occur a total of six gaps through which continuations of the central lowland extend to the Pacific Ocean shoreline.

Published regional geologic information indicates that the subject site is underlain by old shallow marine (terrace) deposits (map symbol Qom, Saucedo et al, 2016). These deposits are reportedly late to middle Pleistocene in age. The terrace deposits are in turn underlain by marine and littoral sedimentary bedrock of the Lakewood and San Pedro Formations.

The referenced literature indicates that the old shallow marine deposits beneath the site consist generally of poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine, and colluvial deposits.

Geologic Hazards Review

Our geologic hazard review was performed in general accordance with CGS Special Publication 117A, "Guidelines for Evaluating and Mitigating Seismic Hazards in California" (2008). The following subsections present the results of our hazard review.

Regional Faulting

Recognized and mapped faults that are located within a 100-kilometer (km) radius of the site, according to the "2014 USGS National Seismic Hazards Maps," are shown on Figure 2. The closest known fault to the site is the Newport-Inglewood alt 2 approximately 0.84 miles east of the site. The next closest faults are the Newport-Inglewood alt 1 Fault approximately 1.03 miles north of the site and the Compton Fault approximately 4.1 miles north of the site.

The site is in an active seismic area that has historically been affected by generally moderate to occasionally high levels of ground motion. Therefore, the proposed development will likely experience moderate to occasionally high levels of ground motion from nearby faults and other active seismic areas of the southern California region. A summary of the reported earthquake events are provided in Appendix A.

Regional Seismicity

A search of the Uniform California Earthquake Rupture Forecast (UCERF3), accessed on 07 July 2021, using a web-based Earthquake Archive Search and URL Builder tool, found that 55 earthquakes with magnitudes greater than 5.0 have occurred within a 100-km radius of the site since 1900. A summary of the reported earthquake events are provided in Appendix A.

Surface Rupture

Earthquake Fault Zones are regulatory zones delineated by CGS around active faults with the potential to cause surface rupture. The zones average approximately ¼-mile wide. A review of the Seismic Hazard Zone Map with the Earthquake Zones Map of Required Investigation revised on 1 January 2018 and the 2017 "City of Huntington Beach Geologic Hazards" indicates that the site is not within a mapped, currently established Alquist-Priolo Special Study Zone or a Fault

Rupture Study Area (Figure 3).

Liquefaction

Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses shear strength resulting from the buildup of excess pore-water pressure, especially during earthquake-induced cyclic loading. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore-pressure generation and liquefaction. Soil susceptible to liquefaction includes loose to medium-dense sands and gravels, low-plasticity silts, and some low-plasticity clay deposits below the groundwater table. According to Seismic Hazard Zone Report 020 and the 2017 "City of Huntington Beach Geologic Hazards" map, the site is mapped, in a "low" liquefaction-potential investigation zone (Figure 3).

Landslides

A review of the 2017 "City of Huntington Beach Geologic Hazards" map and Seismic Hazard Zone Report 020 indicates that the site is not within a mapped, currently established zone of landslide occurrences or areas of significant grading (Figure 3).

Historical High Groundwater

As noted above, the presence of groundwater may increase the susceptibility to liquefaction for loose to medium granular soils, low-plasticity silts and some clays when subjected to sufficient ground shaking. The Seismic Hazard Zone Report 020 indicates that the site's historically highest groundwater is approximately 30 feet below existing grade (Figure 4).

Seismically-Induced Ground Deformations

Seismically induced ground deformations include ground-surface settlement and differential settlement resulting from liquefaction-induced ground deformation and cyclic densification of unsaturated sands and gravels from earthquakes. As discussed above, the site is not within a mapped liquefaction-hazard investigation zone. Therefore, liquefaction-induced settlement of soils below the groundwater table is not an anticipated hazard. Based on subsurface condition, cyclic densification of dry sands above the groundwater is not anticipated seismic hazard at the site.

Lateral Spreading

Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a slope, by earthquake and gravitational forces. Lateral spreading is not anticipated at this site.

Flood Mapping

A review on the FEMA Flood Insurance Rate Map (FIRM) Number 06059C0233K (21 March 2019) indicates that the site is within Zone X, defined as an "area of minimal flood hazard" (Figure 5). Additionally, the 2017 City of Huntington Beach Local Hazard Mitigation Plan indicates that the site is outside the flood zone.

Tsunami and Seiche

A tsunami is a long, high sea wave based by an earthquake, submarine landslide, or other disturbances. A seiche is an oscillation of surface water in an enclosed or semi-enclosed basin such as a lake, bay, or harbor. According to information and maps available from CGS and the City of Huntington Beach Tsunami Inundation Zone, the site is not within a mapped tsunami-inundation hazard zone or flood-control basin (Figure 6).

Subsidence

Land subsidence may be induced from withdrawal of oil, gas, or water. Subsidence, primarily due to groundwater pumping, is a concern in Huntington Beach, however the rate of subsidence from pumping has declined significantly over the years. According to the City of Huntington Beach Local Hazard Mitigation Plan (2017), maximum subsidence rate in the City is approximately 0.8 inches per year, with highest levels near the coast. This site is located in a zone where significantly lower subsidence levels, approximately -0.1 to -0.2 inches, of regional subsidence per year (Figure 7) have been recorded. The groundwater level at the site is deeper than the proposed excavation, so dewatering is not anticipated. Therefore, regional effects of subsidence will be accounted for in the design of the site, this project is not anticipated to induce local ground subsidence.

Expansive Soils

Expansive soils occur when the moisture content in the soil causes swelling or shrinking as a result of cyclic wet/dry weather cycles, installation of irrigation systems, change in landscape plantings, or changes in grading. Swelling and shrinking soils can result in differential movement of structures including floor slabs and foundations, and site work including hardscape, utilities, and sidewalks. The 2019 CBC defines potentially expansive soils as soils with expansion indices (EI) greater than 20. Additional information and recommendations are included in our Preliminary Geotechnical Evaluations section of this report.

SUBSURFACE INVESTIGATION

Geotechnical Exploration

Our geotechnical subsurface exploration program consisted of three hollow-stem auger (HSA) borings (identified as LB-1, LB-2, and LB-3) where LB-2 was drilled to approximately 51.5 feet and LB-1 to approximately 38 feet, and LB-3 were drilled to approximately 36.5 feet. Prior to drilling, the boring location was marked out by a LANGAN field engineer. Underground Service Alert of Southern California (USA/DigAlert) was contacted to locate and mark known public underground utilities within the public right-of-way. A private utility-locating subcontractor also confirmed that the boring locations were clear of conductive underground utilities. Refer to Figure 8 for approximate boring location.

Borings LB-1, LB-2 and LB-3 were drilled by Martini Drilling, on 25 June 2021 using a truck-mounted drill rig under the full-time observation of a Langan field engineer. The boring was hand-augered to a depth of approximately 5 feet and subsequently advanced with the drill rig using conventional drilling techniques. Standard Penetration Tests (SPT)[1] and California Modified Ring sampling were generally performed at 5-foot intervals until boring termination depth, following the guidelines of ASTM D1586 and ASTM D3550. California Modified Ring samples were collected at select locations using a 3.0-inch-outer-diameter split-barrel California sampler lined

[1] The Standard Penetration Test is a measure of the soil density and consistency. The SPT N-value is defined as the number of blows required to drive a 2-inch outer diameter split-barrel sampler 12-inches, after an initial penetration of 6 inches, using a 140-pound automatic hammer free falling of a height of 30 inches (ASTM D1586).

with 2.42-inch-inner-diameter brass rings. SPT N-values were recorded to identify the relative density and stiffness of the cohesionless and cohesive soils, respectively.

Upon completion, the boring was backfilled via tremie method with cement-grout slurry to near ground surface, and the surface was patched with quick-dry set concrete. Excess soil cuttings generated during drilling were temporarily stored on site in Department of Transportation (DOT) approved 55-gallon drums for subsequent characterization and disposal. Excess soil cuttings encountered are pending characterization and disposal.

Retrieved soil samples were visually examined and classified in the field following the Unified Soil Classification System (USCS) and confirmed by re-examination in our office. A copy of the boring logs is provided in Appendix B.

Laboratory Testing

Select representative soil samples retrieved from the borings were delivered to a geotechnical laboratory to determine the sample's physical and engineering index properties. Our laboratory test program included the following analyses:

- Moisture Content (ASTM D2216)
- Unit Weight (ASTM D7623)
- Direct Shear (ASTM D3080)
- Expansion Index (ASTM D4829)
- Percent Fines (ASTM D1140)
- Corrosion Testing (pH, sulfate, chloride, minimum resistivity)

Copies of the laboratory test results are provided in Appendix C.

SUBSURFACE CONDITIONS

Based on our field investigation and interpretation of laboratory tests, the site is generally underlain by fill underlain by alluvial deposits. Details of the subsurface conditions encountered in our boring are summarized below.

- **Fill:** LB-1 was measured to have 3 inches of asphalt and 8 inches of aggregate base, LB-2 was measured to have 1.5-inches of asphalt and 5.5 inches of aggregate base, and LB-3 was measured to have 2.5 inches of asphalt and 4.5 inches of aggregate base. Below the asphalt, we encountered up to 8 feet of undocumented fill, consisting of clay with varying amounts of fine sand and gravel.
- **Terrace Deposits:** Terrace deposits were encountered in LB-1 through LB-3 to the maximum explored depth of 51.5 feet, consisting of medium dense to dense fine sands with varying amounts of silts and clays extending to about 23 to 25 feet below ground surface. Beneath the sand was firm to very stiff clay with trace fine sands extending to approximately to 35' on LB-1 and LB-3. Under the LB-1 and LB-3 clay layer, the final samples encountered medium dense to dense fine sand with some clay. LB-2, however, encountered medium dense sand layers with varying levels of silt and clay closer to the surface in the 30' and 35' samples. Beneath these sand layers a stiff clay layer with some fine sand extended to approximately 51 feet below the ground surface. A medium dense sand layer with some clay was encountered at the bottom of the last sample at 51 feet. The upper sandy samples had SPT blow counts between 10 and 29 with a higher value

of 74 blows for 11.5 inches in LB-2. The middle clay layer had SPT blowcounts of 9 to 37. The middle sandy layers in LB-2 had blowcounts of 18 to 33. The lower clay layers in LB-2 had blowcounts of 14 to 24.

- **Groundwater:** Groundwater was first encountered at the depth of 46.2 feet and measured 15 minutes later at 44.7 feet below grade on LB-2. Groundwater was not detected on LB-1 and LB-3.

PRELIMINARY GEOTECHNICAL EVALUATION

Based on our field exploration, limited soil tests, and review of available documents, the soils at the proposed foundation level are suitable for support of the proposed structure. The proximity of neighboring structures and streets will need to be considered during design and construction.

Presented below are preliminary comments and recommendations based on the available geotechnical information reviewed to date. Confirmatory geotechnical subsurface investigation, laboratory tests, analysis, and evaluation should be performed to confirm recommendations provided in this letter report.

Seismic Design Parameters

Preliminary seismic design parameters in accordance with the 2019 California Building Code and ASCE 7-16 are listed below. The seismic design criteria assumes the structure meets the exceptions of ASCE 7-16 Chapter 12.

Type	Value	Description
S_S	1.454	MCE_R mapped spectral response acceleration at short period
S_1	0.528	MCE_R mapped spectral response acceleration at one-second period
F_a	1.2	Site Amplification Factor at 0.2 second
F_v	1.52	Site Amplification Factor at 1.0 second
S_{MS}	1.746	Site-modified spectral acceleration at short period
S_{M1}	0.802	Site-modified spectral acceleration at one-second period
S_{DS}	1.164	Design earthquake spectral response acceleration at short period
S_{D1}	0.535	Design earthquake spectral response acceleration at one-second period
PGA_M	0.634	MCE geometric mean peak ground acceleration adjusted for site class effects

Notes:
1. Values based on Site Class D - Default.
2. MCE = Maximum Considered Earthquake
3. MCE_R = Risked-Targeted Maximum Considered Earthquake

Based on deaggregation of the probabilistic seismic hazard spectrum from the USGS Unified Hazard Tool, the mean and modal earthquakes for the 2% probability of exceedance in 50 years (2,475-year return period) event are 6.88 and 7.3 moment magnitudes, respectively.

Seismic design parameters were determined for a Site Class D, assuming that the proposed structures have fundamental periods of vibration equal to or less than 0.5 seconds.

The structural engineer should confirm the structural fundamental period of vibration and the seismic design approach. The structural engineer should provide the fundamental period of vibration to LANGAN and confirm if Exception No. 2 of Section 11.4.8 of ASCE 7-16 and if simplified design procedures in accordance with Section 12.14 of ASCE 7-16 will be used for seismic design. If the exception is not being used a site-specific seismic site response analysis will be required for final design.

Foundation Recommendations

Based on our experience with similar projects, we expect approximately 15 feet of overburden removal for the construction of the below-grade parking garage and individual column loads of 300 to 500 kips are expected.

A shallow foundation system (spread or continuous footings) bearing on properly prepared and compacted subgrade can be designed with a preliminary bearing pressures of 3,000 to 4,000 pounds per square foot (psf). Recommended allowable bearing values including both dead and live loads, and may be increased by one-third for transient loads such as wind or seismic forces.

Recommended allowable bearing values including both dead and live loads, and may be increased by one-third for transient loads such as wind or seismic forces.

Permanent Below-Grade Walls

Below-grade walls for the proposed one-level parking garage are presumed to be fixed against rotation. Retained soils behind the below-grade walls are expected to be greater than 6 feet in height and should be designed for seismic loading conditions. Additionally, surcharge loading along the walls should consider adjacent structures, streets, vehicular traffic, and sidewalks.

The below-grade walls along the west and south side of the property should be designed to withstand lateral loading from neighboring foundations. Surcharge loading should be considered where the neighboring building foundations are supported on material above a one horizontal to one vertical (1H:1V) theoretical influence line extending upward along the respective foundation walls. Lateral loading from neighboring building foundations need not be considered if these foundations are supported outside the aforementioned influence line.

The below-grade walls along the north and east sides of the property should be designed to consider surcharges from adjacent streets, vehicular traffic, and sidewalks. Where vehicular traffic will pass within 10 feet of walls, traffic loads should be considered in the design of walls.

Expansive Soil Considerations

Potentially expansive soils are defined by the CBC 2019 as soils with expansion indices (EI) of greater than 20. Expansive soils swell or shrink when the moisture content of the soil changes. A soil's moisture content can change through cyclic wet/dry weather cycles, variations in the groundwater level, installation of irrigation systems, change in landscape plantings, and changes in site grading. Leaking utilities can also drastically change soil moisture content. Expansion index testing of the near-surface material indicates the soil exhibits a "medium" expansion potential (EI of 51).

The site should be designed to promote positive drainage away from the pavements and landscaping should consist of mainly drought-tolerant native planting that requires limited irrigation. Confirmatory expansion index testing should be performed in a design-level final geotechnical investigation to confirm expansion potential of soils near proposed foundation level.

Corrosion Considerations

Chemical analyses performed on select samples obtained in the upper 5 feet across the site are summarized in Table 1 below.

Table 1 – Chemical Analytical Results

Date of Investigation	Sample	Depth (feet)	Resistivity (ohm-cm)	pH	Soluble Sulfate (ppm)	Chloride (ppm)
25 June 2021	LB-2/ Bulk	1 - 5	540	7.8	130	45

Notes:
1. ppm = parts per million
2. NT = not tested for the select sample

According to our review of the minimum resistivity, pH, soluble sulfate, and chloride contents on the select soil samples, the surficial soil is considered class S0 (low sulfate concentration in contact with concrete) and corrosive to ferrous metals (ANSI/AWWA Standard C105/A21.5, ACI 318-19 and ASTM A674).

All subsurface structures and utilities in contact with the native soils should be protected against corrosion. Based on the samples collected to date, ACI 318-14 classified the soil as Exposure Class S0 for sulfate and Exposure Class C1 for chloride. A corrosion expert should be consulted if metal pipe is proposed to be in contact with soil. Based on the laboratory data summarized here, ACI 318-14 requires that concrete should be designed using Type II cement (ASTM C150), a maximum water-to-cement ratio of 0.5, and a minimum specified compressive strength (f'c) of 4,000 pounds per square inch (psi). A copy of the corrosion results is provided in Appendix C.

Confirmatory corrosion testing should be performed in a design-level final geotechnical investigation to confirm corrosivity of native soils at proposed foundation level.

CONSTRUCTION CONSIDERATIONS

Temporary Excavation Support

Based on the anticipated depths and limits of proposed excavation for the below-grade parking garage, temporary excavation support and will be required and will need to be constructed in accordance with CAL-OSHA requirements and City of Huntington Beach Building Code. At this time, we do not have project-specific information to provide preliminary parameters for the design of the shoring system. In areas where sloped excavations cannot be performed, 2H:1V maximum (Horizontal:Vertical), we recommend the shoring system use soldier beams and lagging.

Deflection at the top of the excavation support system will be a function of the design and sequence of installation. Any temporary shoring system should be designed to limit deflections adjacent to existing public streets and neighboring buildings, but in no case should deformations be such that cause damage or loss of support to areas, structures, and utilities beyond the excavation.

Site Drainage

Proper drainage should be maintained at all times. Ponding or trapping of water in localized areas can cause differing moisture levels in the subsurface soil. Drainage should be directed away from the tops of slopes. Erosion protection and drainage control measures should be implemented during periods of inclement weather. Shallow perched water may be encountered at the site depending on seasonal rainfall. During rainfall events, backfill operations may need to be restricted to allow for proper moisture control during fill placement.

RECOMMENDED FUTURE STUDIES

Comments and preliminary recommendations provided herein are based on a review of publicly available documents and geotechnical information pertaining to the site and our subsurface investigation. At this time, we recommend performing the following supplemental studies:

- A design level geotechnical exploration and laboratory testing program to confirm the following:
    - Consistency of geotechnical conditions across the site,
    - Confirm the preliminary geotechnical recommendations,
    - Perform infiltration testing if required,
    - Confirm the magnitude of cyclic densification, and
    - A document search for adjacent structure foundations.

LIMITATIONS

This report has been prepared to assist Hines in their preliminary evaluation of the proposed senior living development of the property at 4952 Warner Ave in Huntington Beach, California. The conclusions and recommendations provided in this report are preliminary and based on publicly available information performed by others, which we have relied upon as being accurate and representative of the conditions at the site. A design-level geotechnical investigation study (including field and laboratory testing) are necessary to develop design and construction recommendations for the proposed development.

This report has been prepared to assist the client in preliminary evaluation of the site and is only applicable to the design of the specific project identified. The information in this report cannot be used or depended on by engineers or contractors who are involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties which are beyond the limits of that which is the specific subject of this report.

A review of environmental issues (such as potentially contaminated soil and groundwater) has not been performed as part of this study, and should be addressed in a separate study.

CLOSURE

We appreciate the opportunity to have provided these services for this project. Should you have any questions regarding this letter, please feel free to contact us.

Sincerely,
Langan Engineering and Environmental Services, Inc.

Enrique A. Riutort, PE, GE
Senior Project Manager
GE 2683

Diane M. Fiorelli, PE, GE
Principal/Vice President
GE 3042

exp 6/30/23

Enclosures: References
Figure 1 – Site Location Map
Figure 2 – Map of Major Faults and Earthquake Epicenters Proximity of Site
Figure 3 – Geologic Hazards Map
Figure 4 – Historical Groundwater Map
Figure 5 – Floor Insurance Rate Map
Figure 6 – Inundation Hazard Map
Figure 7 – Annual Subsidence Rates
Figure 8 – Boring Location Plan
Appendix A – Seismic Research Results
Appendix B – Boring Logs
Appendix C – Laboratory Test Results

\\langan.com\data\IRV\data4\700101401\Project Data_Discipline\Geotechnical\Reports\7001014001 Preliminary Geotechnical Investigation_ac.docx

REFERENCES

American Society of Civil Engineers (2016). Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-16.

California Building Standards Commission (2019). California Building Code, California Code of Regulations, Title 24.

California Department of Conservation (2019). Geologic Map of California, dated 2010, accessed 4 March 2019.

California Department of Conservation, Division of Mines and Geology (DMG). *Seismic Hazard Zone Report for the Seal Beach 7.5-Minute Quadrangle, Los Angeles and Orange Counties, California*, revised17 January 2006 (SHZR 020).

California Geologic Survey (CGS) (2010), "Fault Activity Map of California", California Geologic Data Map Series, Map No. 6.

California Geological Survey (CGS) (2008) "Guidelines for Evaluating and Mitigating Seismic Hazards in California", Special Publication 117A, dated 2008.

California Geological Survey (CGS) (2002) "California Geomorphic Provinces", Note 36, dated 2002

California Geological Survey (CGS) (1999), "Earthquake Zones of Required Investigation Seal Beach Quadrangle",

Federal Emergency Management Agency (2019), National Flood Insurance Map Program, Flood Insurance Rate Map (FIRM) Map Number 06059C0233K, Panel 233, updated 21 March 2019.

Local Hazard Mitigation Plan (2017), City of Huntington Beach.

Saucedo, G.J., Greene, H.G., Kennedy, M.P., and Bezore, S.P., 2016, Geologic Map of the Long Beach 30' x 60' Quadrangle, California, Version 2.0, Regional Map Series, Scale = 1:100,000, 1 Sheet, California Department of Conservation, California Geological Survey.

FIGURES

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NOTES:

1. BACKGROUND IMAGE REFERENCED FROM BING MAPS ON 23 JUNE 2021.

LEGEND:

APPROXIMATE SITE LIMITS

500 250 0 500

SCALE IN FEET

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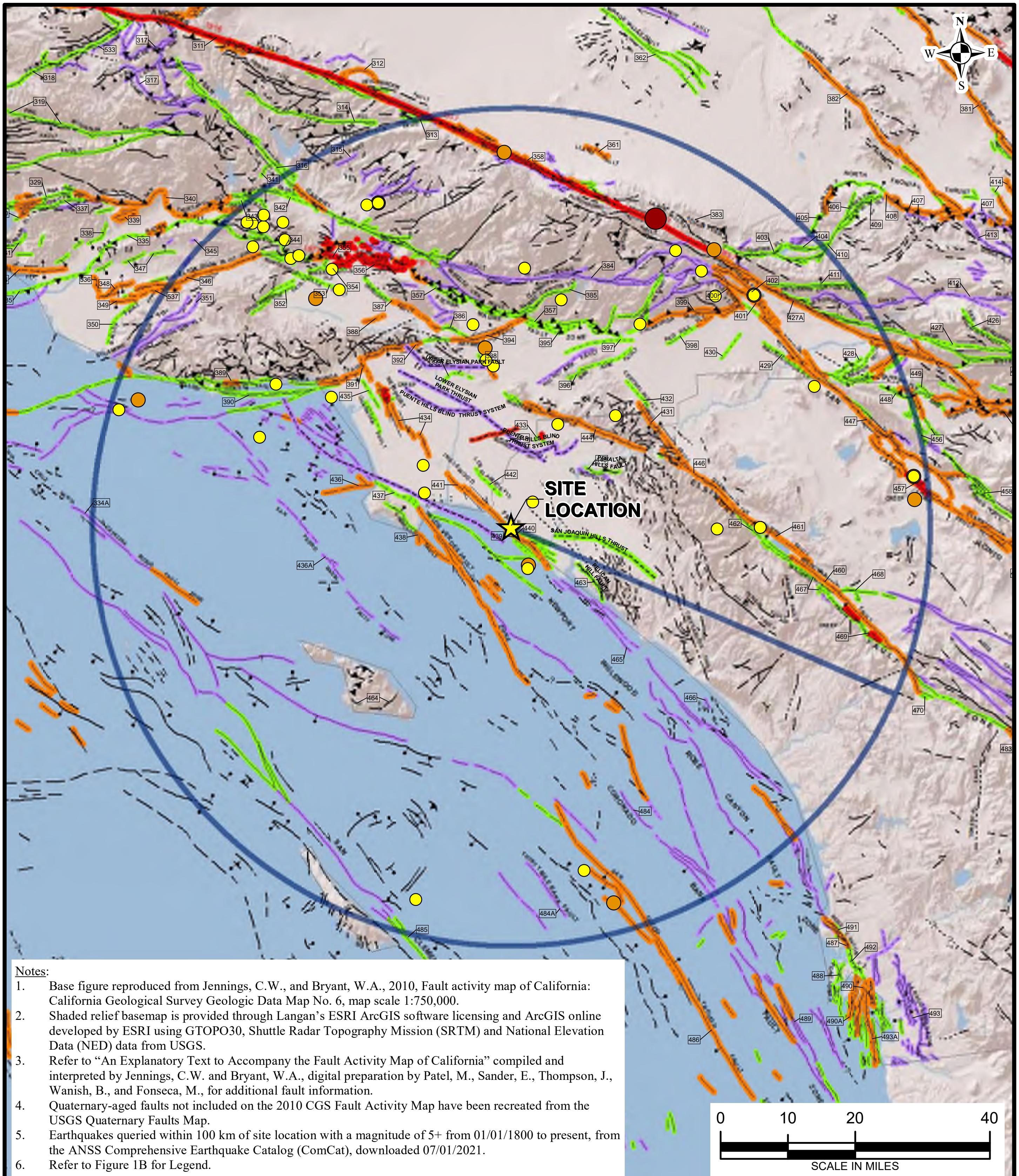
Project	Figure Title	Project No. 700101401	Figure No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH	**SITE VICINITY MAP**	Date 14 APRIL 2022	1
ORANGE COUNTY CALIFORNIA		Scale 1" = 500'	
		Drawn By DJJS	

Filename: \\langan.com\data\IRV\data4\700101401\Project Data\CAD\01\2D-DesignFiles\Figure 1_Site Vicinity.dwg Date: 4/15/2022 Time: 08:54 User: rfanous Style Table: Langan.stb Layout: Site Vicinity Map



Notes:
1. Base figure reproduced from Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
2. Shaded relief basemap is provided through Langan's ESRI ArcGIS software licensing and ArcGIS online developed by ESRI using GTOPO30, Shuttle Radar Topography Mission (SRTM) and National Elevation Data (NED) data from USGS.
3. Refer to "An Explanatory Text to Accompany the Fault Activity Map of California" compiled and interpreted by Jennings, C.W. and Bryant, W.A., digital preparation by Patel, M., Sander, E., Thompson, J., Wanish, B., and Fonseca, M., for additional fault information.
4. Quaternary-aged faults not included on the 2010 CGS Fault Activity Map have been recreated from the USGS Quaternary Faults Map.
5. Earthquakes queried within 100 km of site location with a magnitude of 5+ from 01/01/1800 to present, from the ANSS Comprehensive Earthquake Catalog (ComCat), downloaded 07/01/2021.
6. Refer to Figure 1B for Legend.

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Project	Figure Title	Project No.	Figure
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	QUATERNARY FAULT ACTIVITY AND EARTHQUAKE EPICENTER MAP	700101401 Date: 14 APRIL 2022 Scale: 1 inch = 20 miles Drawn By: OG	2A

Path: \\langan.com\data\IRV\data4\700101401\Project Data\ArcGIS\MXD\Geotech_Figures\Fault Map.mxd Date: 4/15/2022 User: rfanous Time: 9:23:34 AM

LEGEND:

Fault Age

The age classifications are based on geologic evidence to determine the youngest faulted unit and the oldest unfaulted unit along each fault or fault section

- Historic
- Holocene
- Late Quaternary
- Quaternary

Earthquake Epicenter

- Magnitude 5.0 to 5.9
- Magnitude 6.0 to 6.9
- Magnitude 7.0 to 7.4
- Magnitude 7.5 to 8.0

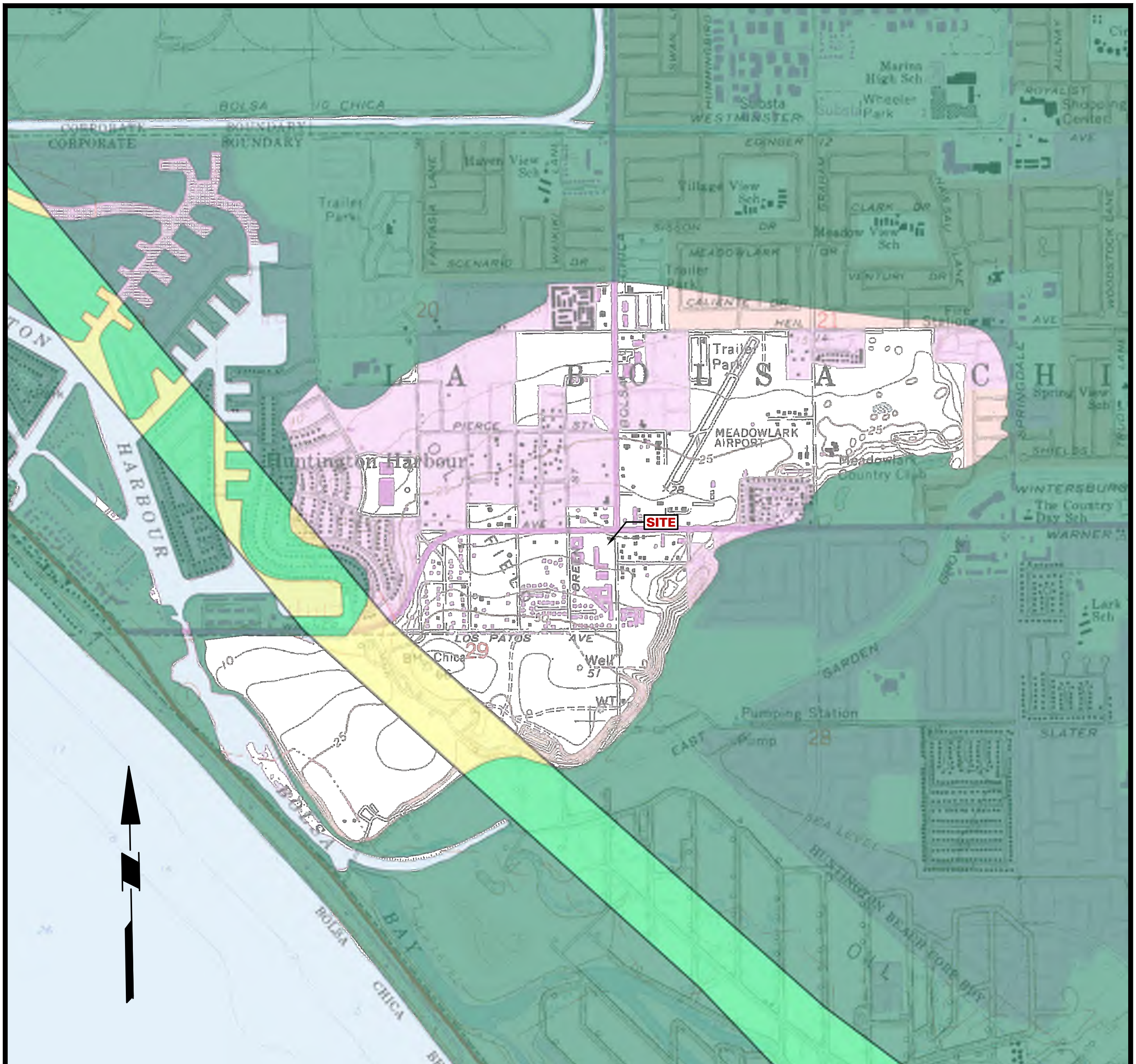
Pre-Quaternary Faults

- fault, certain
- fault, approx. located
- fault, concealed
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, approx. located, queried
- fault, certain
- fault, concealed
- fault, approx. located

Quaternary Faults

- fault, certain
- fault, approx. located
- fault, approx. located, queried
- fault, inferred, queried
- fault, concealed
- fault, concealed, queried
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, concealed
- dextral fault, certain
- dextral fault, approx. located
- dextral fault, concealed
- sinistral fault, certain
- sinistral fault, approx. located
- sinistral fault, concealed
- thrust fault, certain (2)
- thrust fault, approx. located (2)
- thrust fault, concealed (2)
- fault, solid
- fault, dashed
- fault, dotted
- dextral fault, solid
- fault, dotted, queried
- fault, dotted, queried (2)
- fault, solid, dip
- fault, dashed, dip
- fault, dotted, dip
- reverse fault, solid
- reverse fault, dashed
- reverse fault, dotted

LANGAN	Project	Figure Title	Project No.	Figure
Langan Engineering and Environmental Services, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612 T: 949.561.9200 F: 949.561.9201 www.langan.com	PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	QUATERNARY FAULT ACTIVITY AND EARTHQUAKE EPICENTER MAP	700101401 Date: 14 APRIL 2022 Scale: NOT TO SCALE Drawn By: OG	2B



LEGEND:

SITE APPROXIMATE SITE LOCATION

2000 1000 0 2000

SCALE IN FEET

NOTES:

1. BACKGROUND REFERENCED FROM EARTHQUAKE ZONES OF REQUIRED INVESTIGATION SEAL BEACH QUADRANGLE, CALIFORNIA GEOLOGICAL SURVEY, DATED 25 MARCH 1999.

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NEW JERSEY NEW YORK CONNECTICUT PENNSYLVANIA WASHINGTON DC VIRGINIA WEST VIRGINIA OHIO FLORIDA TEXAS ARIZONA CALIFORNIA

ABU DHABI ATHENS DOHA DUBAI ISTANBUL LONDON PANAMA

Langan Engineering & Environmental Services, Inc.

Project	Drawing Title	Project No.	Drawing No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	GEOLOGIC HAZARDS MAP	700101401 Date: 14 APRIL 2022 Scale: 1" = 2000' Drawn By: AC	3

Filename: \\langan.com\data\IRV\data4\700101401\Project Data\CAD\01\2D-DesignFiles\Figure 3-7.dwg Date: 7/13/2021 Time: 13:48 User: djudge Style Table: Langan.stb Layout: 3

Base map enlarged from U.S.G.S. 30 x 60–minute series

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

● Borehole Site

30 Depth to ground water in feet

ONE MILE

SCALE

LEGEND:

SITE APPROXIMATE SITE

NOTES:

1. BACKGROUND REFERENCED FROM SEISMIC HAZARD ZONE REPORT FOR THE SEAL BEACH 7.5–MINUTE QUADRANGLE, ORANGE COUNTY, CALIFORNIA

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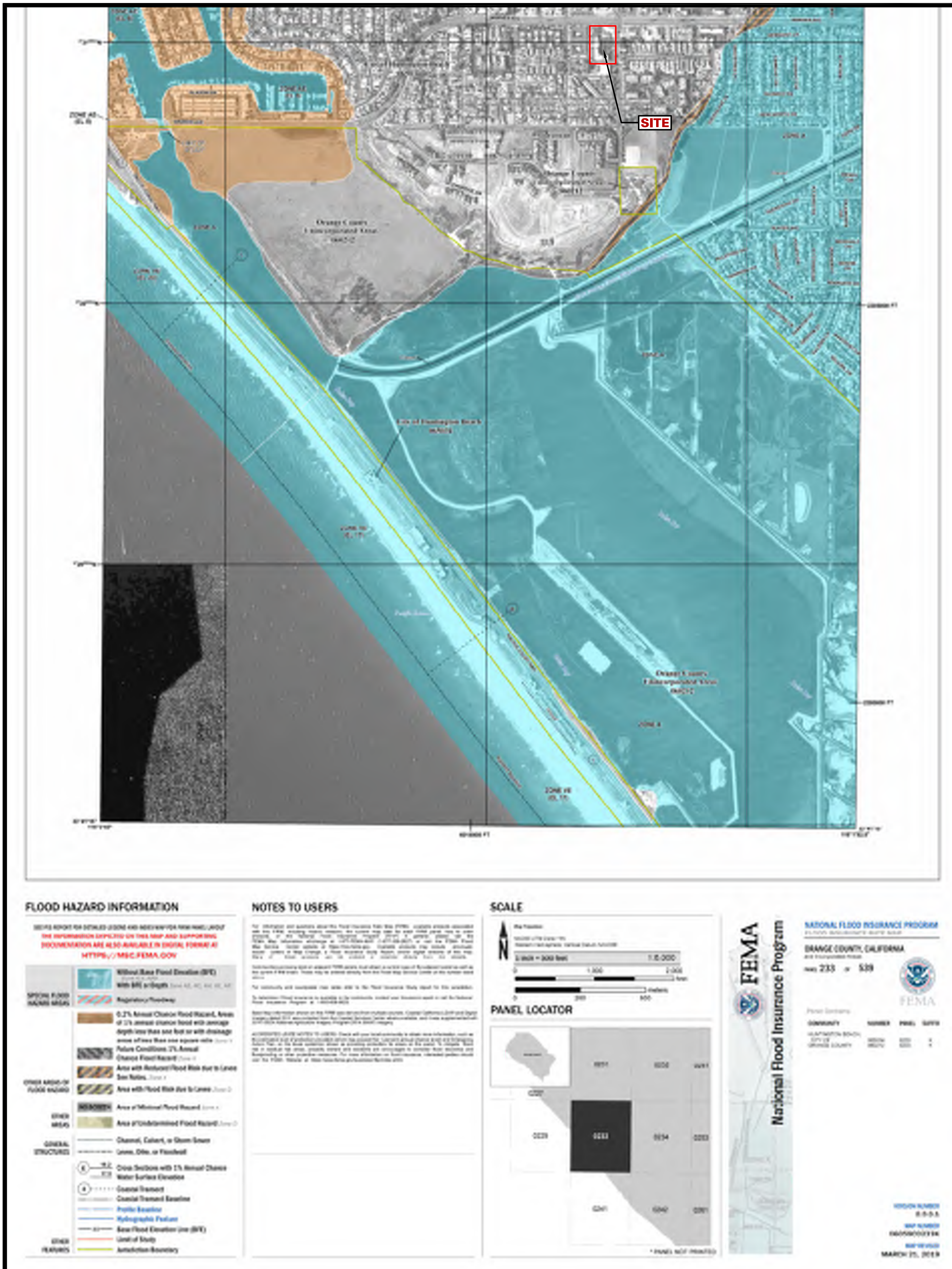
Project	Drawing Title	Project No.	Drawing No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	HISTORIC GROUNDWATER MAP	700101401 Date: 14 APRIL 2022 Scale: AS SPECIFIED ON MAP Drawn By: AC	4



LEGEND:

SITE APPROXIMATE SITE

NOTES:

1. BACKGROUND REFERENCED FROM FEMA FLOOD INSURANCE RATE MAP NUMBER 06059C0233K ACCESSED 28 JUNE 2021

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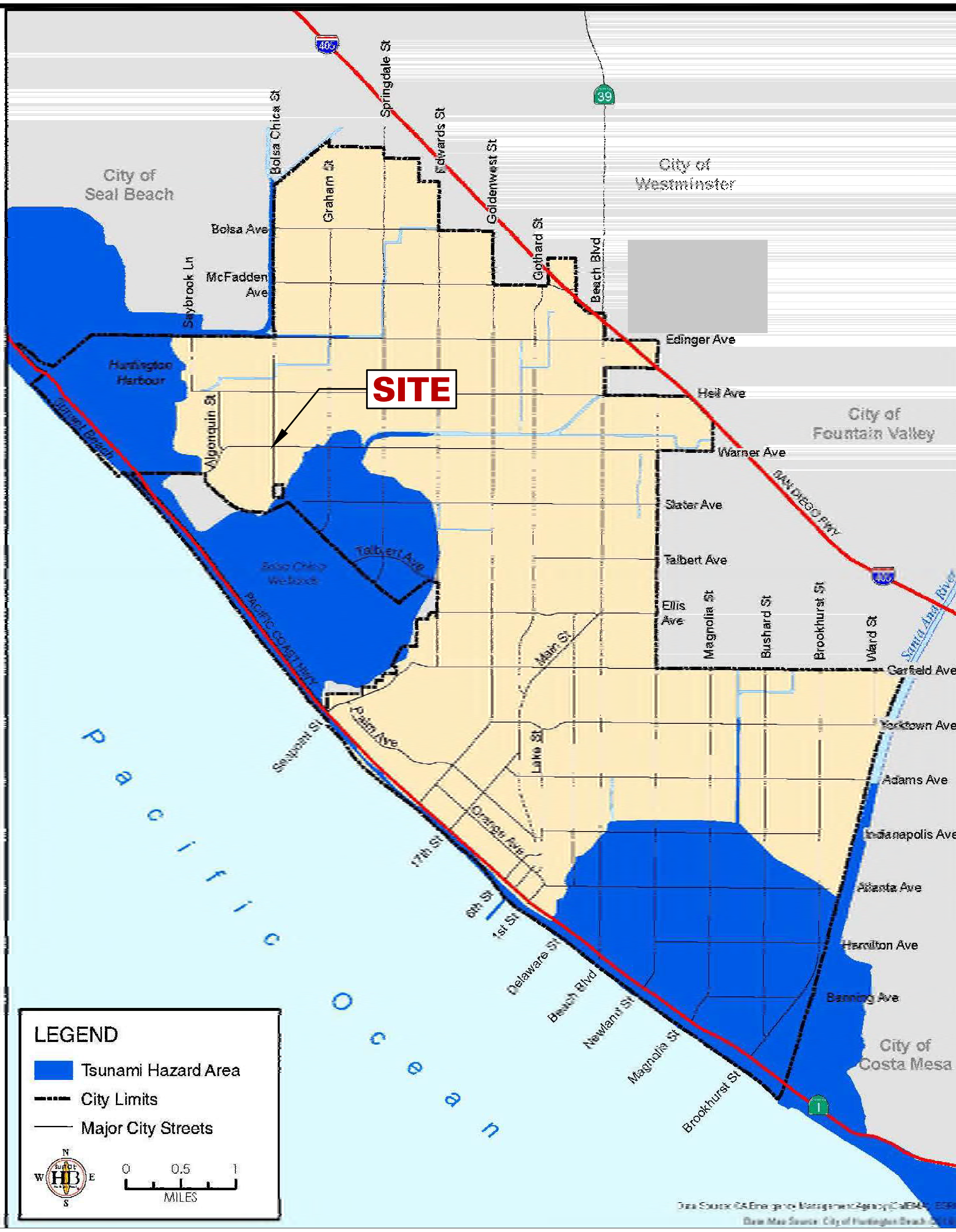

LEGEND:

SITE APPROXIMATE SITE

NOTES:

1. BACKGROUND REFERENCED FROM CITY OF HUNTINGTON BEACH LOCAL HAZARD MITIGATION PLAN, ACCESSED 28 JUNE 2021

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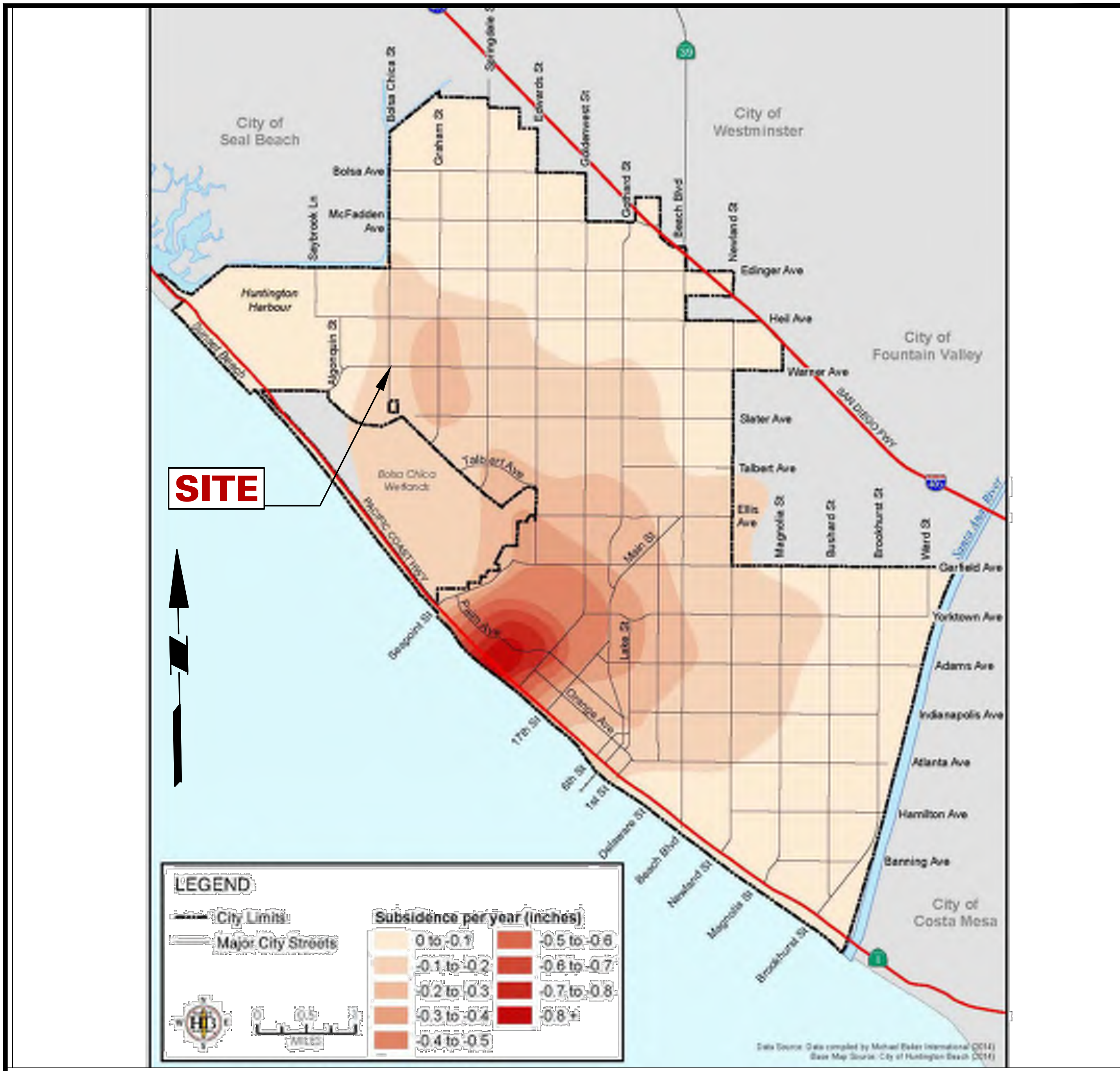
Project	Drawing Title	Project No. 700101401	Drawing No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	TSUNAMI INUNDATION ZONE MAP	Date 14 APRIL 2022 Scale AS SPECIFIED ON MAP Drawn By AC	6



LEGEND:

SITE APPROXIMATE SITE LOCATION

NOTES:

1. BACKGROUND REFERENCED FROM CITY OF HUNTINGTON BEACH LOCAL HAZARD MITIGATION PLAN, ACCESSED 28 JUNE 2021

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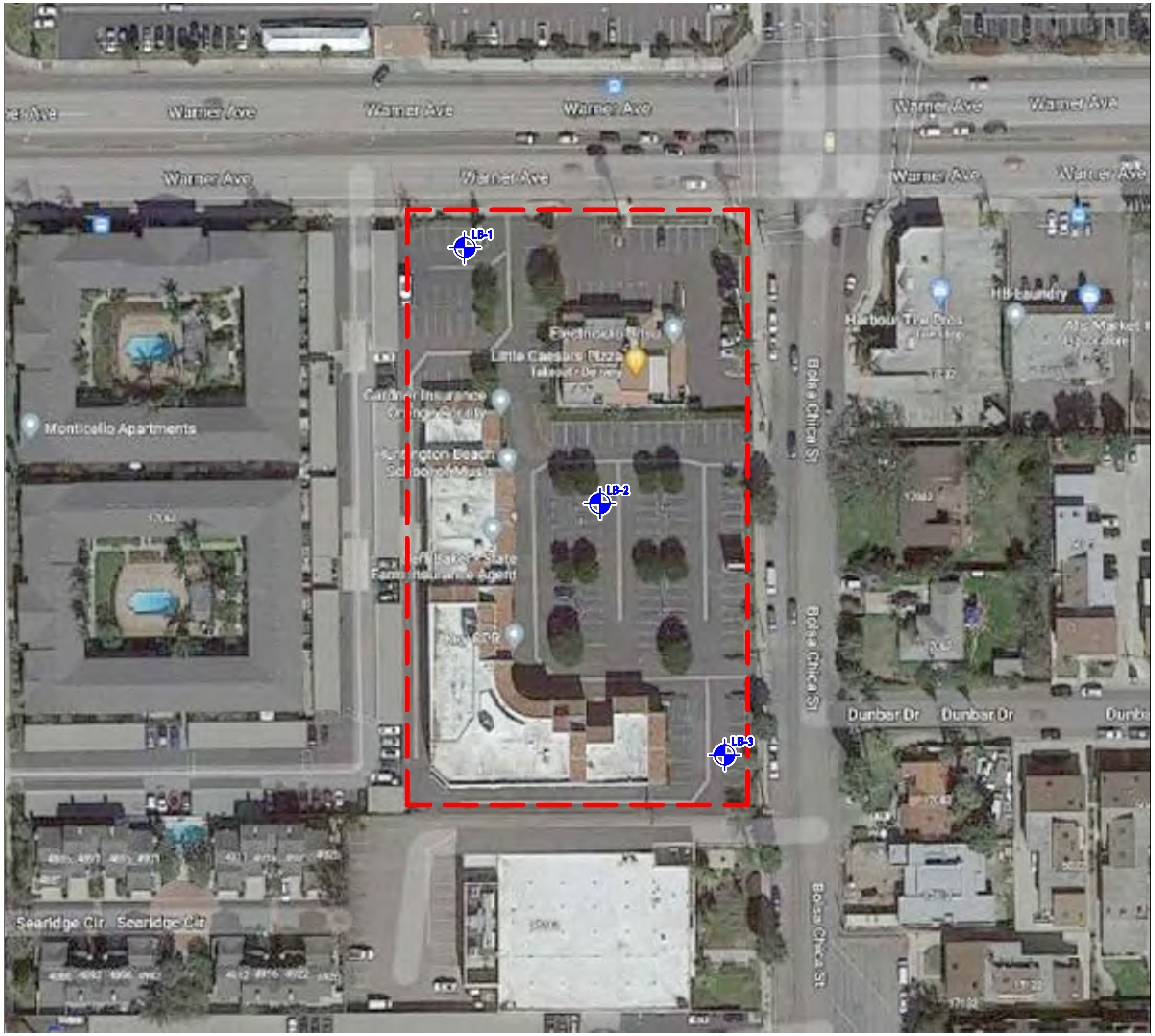
Project	Drawing Title	Project No.	Drawing No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE COUNTY CALIFORNIA	ANNUAL SUBSIDENCE RATES	700101401 Date: 14 APRIL 2022 Scale: AS SHOWN ON MAP Drawn By: AC	7

Filename: \\langan.com\data\IRV\data4\700101401\Project Data\CAD\01\2D-DesignFiles\Figure 3-7.dwg Date: 7/27/2021 Time: 10:58 User: acorob Style Table: Langan.stb Layout: 7



NOTES:

1. BACKGROUND IMAGE REFERENCED FROM GOOGLE MAPS, ACCESSED 29 JUNE 2021
2. LANGAN BORINGS LB–1 THROUGH LB–3 WERE DRILLED BY MARTINI DRILLING ON 25 JUNE 2021 UNDER THE FULL–TIME ENGINEERING OBSERVATION OF A LANGAN FIELD ENGINEER.

LEGEND:

APPROXIMATE SITE LIMITS

LB-2 APPROXIMATE BORING LOCATION

50 25 0 50
SCALE IN FEET

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Project	Figure Title	Project No.	Figure No.
PROPOSED SENIOR HOUSING DEVELOPMENT HUNTINGTON BEACH ORANGE CALIFORNIA	BORING LOCATION PLAN	700101401	8
		Date 14 APRIL 2022	
		Scale 1" = 50'	
		Drawn By AC	

APPENDIX A
Seismic Research Results

TABLE A.1 - USGS 2014 CALIFORNIA SEISMIC SOURCE MODEL PARAMETERS

Fault Name	Distance from Site (km)
Newport-Inglewood alt 2	0.84
Newport-Inglewood alt 1	1.03
Compton	4.1
San Joaquin Hills	10.3
Anaheim	11.2
Palos Verdes	16.2
Elysian Park (Lower CFM)	17.5
Newport-Inglewood (Offshore)	18.1
Puente Hills (Coyote Hills)	18.9
Peralta Hills	20.3
Yorba Linda	21.3
Puente Hills (Santa Fe Springs)	22.5
Richfield	23.1
Puente Hills	24.0
Whittier alt 2	28.3
Whittier alt 1	28.3
Puente Hills (LA)	29.2
Oceanside alt2	30.7
Oceanside alt1	30.8
Redondo Canyon alt 2	33.8
Redondo Canyon alt 1	34.5
San Diego Trough north alt1	36.7
San Pedro Basin	38.3
San Jose	39.0
Elysian Park (Upper)	39.3
San Pedro Escarpment	39.5
Chino alt 1	41.5
Chino alt 2	41.7
Elsinore (Glen Ivy) rev	43.7
San Vicente	45.4
Verdugo	45.4
Raymond	45.4
Hollywood	48.1
North Salt Lake	49.0
Santa Monica alt 2	49.1
Sierra Madre	49.1
Clamshell-Sawpit	51.5
Fontana (Seismicity)	51.9
Santa Monica alt 1	52.1
Cucamonga	53.2
Malibu Coast alt 1	56.7
Malibu Coast alt 2	56.7

Coronado Bank alt2	56.8
Santa Cruz Catalina Ridge alt1	57.8
Anacapa-Dume alt 2	58.1
San Diego Trough north alt2	58.1
Santa Cruz Catalina Ridge alt2	58.8
San Gabriel (Extension)	58.9
Elsinore (Temecula) rev	60.7
Elsinore (Stepovers Combined)	62.2
Sierra Madre (San Fernando)	66.7
Anacapa-Dume alt 1	67.4
Northridge Hills	68.5
Santa Monica Bay	69.2
Mission Hills 2011	69.9
San Gabriel	70.4
Coronado Bank alt1	72.1
Santa Susana alt 2	72.2
Northridge	72.9
Santa Susana East (connector)	73.6
Thirty Mile Bank	73.8
San Jacinto (Lytle Creek connector)	75.8
San Jacinto (San Bernardino)	78.9
Santa Susana alt 1	79.2
San Andreas (Mojave S)	80.1
San Andreas (San Bernardino N)	80.8
San Jacinto (San Jacinto Valley) rev	81.6
San Clemente	83.9
Cleghorn	84.2
Rose Canyon	85.1
Carlsbad	85.9
San Andreas (North Branch Mill Creek)	87.5
Holser alt 1	88.1
San Jacinto (Anza) rev	88.6
Simi-Santa Rosa	89.0
San Andreas (San Bernardino S)	89.9
Malibu Coast (Extension) alt 2	90.4
Malibu Coast (Extension) alt 1	90.4
San Jacinto (Stepovers Combined)	90.7
Holser alt 2	93.4
Del Valle	96.0
North Frontal (West)	97.7
Oak Ridge (Onshore)	98.4

Notes:

1. Seismic source model parameters obtained from USGS 2014 National Seismic Hazard Maps on 01 July 2021.

2. Search results include sources within 62 mi (100 km) of the Site.

TABLE A.2 - USGS ANSS COMPREHENSIVE CATALOG SEARCH RESULTS

Date [1,3]	Latitude [1,3]	Longitude [1,3]	Approximate Magnitude [1,3]	Magnitude Type [2]	Approximate Distance from Site (km) [1,3]
2014-03-29	33.9325	-117.9158	5.1	mw	27
2008-07-29	33.9485	-117.7663	5.44	mw	36
1997-04-26	34.3690	-118.6700	5.07	ml	93
1995-06-26	34.3940	-118.6690	5.02	ml	95
1994-03-20	34.2310	-118.4750	5.24	ml	70
1994-01-29	34.3060	-118.5790	5.06	ml	82
1994-01-19	34.3780	-118.6190	5.07	ml	91
1994-01-19	34.3790	-118.7120	5.06	ml	96
1994-01-18	34.3770	-118.6980	5.24	ml	95
1994-01-17	34.3260	-118.6980	5.58	ml	91
1994-01-17	34.3400	-118.6140	5.2	ml	87
1994-01-17	34.2750	-118.4930	5.89	ml	75
1994-01-17	34.2130	-118.5370	6.7	mw	72
1991-06-28	34.2700	-117.9930	5.8	mw	62
1990-02-28	34.1440	-117.6970	5.51	ml	57
1988-12-03	34.1510	-118.1300	5.02	ml	49
1987-10-04	34.0740	-118.0980	5.25	ml	40
1987-10-01	34.0610	-118.0790	5.9	mw	39
1986-07-13	32.9710	-117.8740	5.45	ml	84
1979-01-01	33.9165	-118.6872	5.21	ml	64
1973-02-21	33.9790	-119.0502	5.3	mw	98
1971-02-09	34.4160	-118.3700	5.3	mh	84
1971-02-09	34.4160	-118.3700	5.8	mh	84
1971-02-09	34.4120	-118.4000	5.8	ml	84
1971-02-09	34.4160	-118.3700	5.8	mh	84
1971-02-09	34.4160	-118.3700	6.6	mw	84
1970-09-12	34.2548	-117.5343	5.22	ml	76
1951-12-26	32.9162	-118.3052	5.75	ml	92
1941-11-14	33.7907	-118.2637	5.12	ml	22
1938-05-31	33.6993	-117.5112	5.23	ml	49
1933-03-11	33.8500	-118.2660	5	ml	26
1933-03-11	33.6238	-118.0012	5.29	mh	11
1933-03-11	33.7667	-117.9850	5.02	mh	8
1933-03-11	33.6308	-117.9995	6.4	mw	10
1930-08-31	34.0300	-118.6430	5.25	ms	66
1927-08-04	34.0000	-118.5000	5.3	uk	53
1923-07-23	34.0000	-117.2500	5.96	mw	80
1918-06-06	33.8000	-117.0000	5	ml	97
1918-04-21	33.7500	-117.0000	6.75	mw	96
1910-05-15	33.7000	-117.4000	5.3	mw	59
1910-05-13	33.7000	-117.4000	5	ml	59
1910-04-11	33.7000	-117.4000	5	ml	59
1899-12-25	33.8000	-117.0000	6.75	mw	97
1899-07-22	34.3000	-117.5000	6.36	mw	82
1899-07-22	34.2000	-117.4000	5.5	ml	80
1894-07-30	34.3000	-117.6000	5.9	ml	77
1893-04-04	34.3000	-118.6000	5.8	ml	83
1892-06-14	34.2000	-117.5000	5.5	ml	74
1889-08-28	34.2000	-117.9000	5.6	ml	55
1858-12-16	34.2000	-117.4000	6	ml	80
1857-01-16	34.5200	-118.0400	6.3	mw	89
1855-07-11	34.1000	-118.1000	6	ml	43
1827-09-24	34.0000	-119.0000	6	mw	94
1812-12-08	34.3700	-117.6500	7.5	mw	81
1800-11-22	32.9000	-117.8000	6.30	mw	93

Notes:

1. Earthquake Catalog Search results obtained from USGS ANSS Comprehensive Catalog accessed on 01 July 2021.
2. Refer to USGS ANSS Comprehensive Catalog and USGS Earthquake Hazards Program for additional information on magnitude types.
3. Earthquake Catalog search results include earthquake events within 100 km of the Site with magnitudes of 5.0 or greater since 1900.

APPENDIX B

Boring Logs

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Log of Boring **LB-1** Sheet 1 of 2

Project: Proposed Senior Housing Development	Project No.: 700101401
Location: 4952 Warner Avenue, Huntington Beach, CA	Elevation and Datum: Approx. 40 feet (WGS84)
Drilling Company: MARTINI DRILLING	Date Started: 06/25/2021 / Date Finished: 06/25/2021
Drilling Equipment: TRUCK MOUNTED CME 75	Completion Depth: 38 ft / Rock Depth:
Size and Type of Bit: 8-INCH O.D. HOLLOW STEM AUGER	Number of Samples: Disturbed 10 / Undisturbed 0 / Core ---
Casing Diameter (in): --- / Casing Depth (ft): ---	Water Level (ft.): First ▽ / Completion ▼ / 24 HR. ▼ ---
Casing Hammer: --- / Weight (lbs): --- / Drop (in): ---	Drilling Foreman: Gene Golar
Sampler: 2-INCH O.D SPLIT SPOON & 3-INCH O.D. CALIFORNIA MODIFIED	Field Engineer: Alexander Corob
Sampler Hammer: AUTOMATIC / Weight (lbs): 140 LBS. / Drop (in): 30-INCH	

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	Asphalt = 3-inches / Aggregate Base = 8-inches	0–1					
	FILL Dark brown, CLAY, (CL), trace fine sand and gravel, dry	1					
	Stiff, dark brown, CLAY, (CL), trace fine sand, moist	5	S-1	CR	18	4 11 14	
	TERRACE	8					
	Medium dense, brown-gray, fine to medium SAND, (SP), trace clay, moist	10	S-2	SPT	18	3 4 6	
	Medium dense, brown-gray, fine SAND, (SP), trace silt, moist	15	S-3	CR	18	7 15 18	
	Very stiff, gray-brown, clayey SILT, (ML), some fine sand, moist	15.8					
		18–20					

\\LANGAN.COM\DATA\IRV\DATA4\700101401\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\700101401 GINT LOGS REV1.GPJ ... 7/26/2021 4:14:49 PM ... Report: Log - LANGAN

Project	Project No.
Proposed Senior Housing Development	700101401
Location	**Elevation and Datum**
4952 Warner Avenue, Huntington Beach, CA	Approx. 40 feet (WGS84)

Depth Scale	Sample Description	Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
20	Medium dense, gray-brown, fine to medium SAND, (SP), dry	S-4	SPT	18	7 13 16	
25	Medium dense, gray-brown, fine to medium SAND, (SP), dry	S-5	CR	18	7 11 12	
25.8	Stiff, brown, CLAY, (CL), trace fine sand, moist					
30	Firm, brown, CLAY, (CL), trace fine sand, moist	S-6	SPT	18	2 4 7	
35	Very stiff, dark brown, sandy CLAY, (CL), moist	S-7	CR	0	9 19 28	Sample S-7: No Recovery
36.5	Dense, gray-brown, fine to medium SAND, (SP), trace clay, moist	S-7	CR	18	19 23 35	
38	End boring at 38 feet Groundwater not encountered Boring backfilled with grout tremie style Surface patch with cold patch asphalt.					

Depth scale: 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45

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Log of Boring LB-2 Sheet 1 of 3

Project: Proposed Senior Housing Development		Project No.: 700101401	
Location: 4952 Warner Avenue, Huntington Beach, CA		Elevation and Datum: Approx. 40 feet (WGS84)	
Drilling Company: MARTINI DRILLING		Date Started: 06/25/2021	Date Finished: 06/25/2021
Drilling Equipment: TRUCK MOUNTED CME 75		Completion Depth: 51.5 ft	Rock Depth:
Size and Type of Bit: 8-INCH O.D. HOLLOW STEM AUGER		Number of Samples: Disturbed 10; Undisturbed 0; Core ---	
Casing Diameter (in): ---	Casing Depth (ft): ---	Water Level (ft.): First 46; Completion 44; 24 HR. ---	
Casing Hammer: --- Weight (lbs): ---	Drop (in): ---	Drilling Foreman: Gene Golar	
Sampler: 2-INCH O.D SPLIT SPOON & 3-INCH O.D. CALIFORNIA MODIFIED		Field Engineer: Alexander Corob	
Sampler Hammer: AUTOMATIC Weight (lbs): 140 LBS.	Drop (in): 30-INCH		

Depth Scale	Sample Description	Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
0	Asphalt = 1.5-inches / Aggregate Base = 5.5-inches					
0.5	**FILL**					
1	Dark brown, sandy CLAY, (CL), some gravel, dry					
5	Dark brown, stiff, brown, CLAY, (CL), trace sand, dry	S-1	SPT	18	5 6 7	
8	**TERRACE**					
10	Medium dense, light brown, silty fine SAND, (SM), dry	S-2	CR	18	6 15 21	
15	Medium dense, light brown, silty fine SAND, (SM), dry	S-3	SPT	18	4 6 11	
18						
20						

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Log of Boring **LB-2** Sheet 2 of 3

Project	Project No.
Proposed Senior Housing Development	700101401
Location	**Elevation and Datum**
4952 Warner Avenue, Huntington Beach, CA	Approx. 40 feet (WGS84)

Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	Dense, light brown, fine to coarse SAND, (SP), some clay, moist	20	S-4	CR	17.5	13 / 24 / 50/5.5"	
	Very stiff, dark brown, CLAY, (CL), trace fine sand, moist	25	S-5	SPT	18	2 / 4 / 13	
	Medium dense, light brown, silty fine SAND, (SM), dry	30	S-6	CR	18	6 / 12 / 21	
	Medium dense, brown, clayey fine SAND, (SC), trace silt, moist	31					
	Medium dense, gray-brown, silty fine to medium SAND, (SM), moist	35	S-7	SPT	18	5 / 8 / 10	
	Stiff, gray-brown, CLAY, (CL), trace fine sand, moist	40	S-8	CR	18	6 / 11 / 13	
		44 (▼)					
		45					

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Log of Boring **LB-2** Sheet 3 of 3

Project	Project No.
Proposed Senior Housing Development	700101401
Location	**Elevation and Datum**
4952 Warner Avenue, Huntington Beach, CA	Approx. 40 feet (WGS84)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Stiff, gray-brown, CLAY, (CL), trace fine sand, moist	45	S-9	SPT	18	3 / 5 / 9	
		∇ (groundwater)	46					
			47					
			48					
			49					
		Stiff, gray-brown, CLAY, (CL), trace fine sand, wet	50	S-10	CR	18	1 / 2 / 14	
		Medium dense, brown, fine to coarse SAND, (SP), some clay, wet	51					
		End boring at 51.5 feet Groundwater First measured @ 46 feet Boring backfilled with grout tremie style Surface patch with cold patch asphalt.	52					
			53					
			54					
			55					
			56					
			57					
			58					
			59					
			60					
			61					
			62					
			63					
			64					
			65					
			66					
			67					
			68					
			69					
			70					

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Log of Boring **LB-3** Sheet 1 of 2

Project: Proposed Senior Housing Development		Project No.: 700101401	
Location: 4952 Warner Avenue, Huntington Beach, CA		Elevation and Datum: Approx. 40 feet (WGS84)	
Drilling Company: MARTINI DRILLING		Date Started: 06/25/2021	Date Finished: 06/25/2021
Drilling Equipment: TRUCK MOUNTED CME 75		Completion Depth: 36.5 ft	Rock Depth
Size and Type of Bit: 8-INCH O.D. HOLLOW STEM AUGER		Number of Samples: Disturbed 7; Undisturbed 0; Core ---	
Casing Diameter (in): ---	Casing Depth (ft): ---	Water Level (ft.): First ---; Completion ---; 24 HR. ---	
Casing Hammer: --- Weight (lbs): --- Drop (in): ---		Drilling Foreman: Gene Golar	
Sampler: 2-INCH O.D SPLIT SPOON & 3-INCH O.D. CALIFORNIA MODIFIED		Field Engineer: Alexander Corob	
Sampler Hammer: AUTOMATIC Weight (lbs): 140 LBS. Drop (in): 30-INCH			

Depth (ft)	Sample Description	Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
0	Asphalt = 2.5-inches / Aggregate Base = 4.5-inches					
0.6	**FILL** Dark brown, sandy CLAY, (CL), some gravel, dry					
5	Dark brown, stiff, brown, CLAY, (CL), dry	S-1	CR	18	7 9 9	
5.75	TERRACE Medium dense, gray, clayey fine to medium SAND, (SC), dry					
8	Medium dense,gray-brown, fine SAND, (SP), some silt, dry	S-2	SPT	18	3 6 8	
15	Medium dense, gray-brown, medium to coarse SAND, (SP), dry	S-3	CR	18	9 13 15	
18						

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Project	Project No.
Proposed Senior Housing Development	700101401
Location	**Elevation and Datum**
4952 Warner Avenue, Huntington Beach, CA	Approx. 40 feet (WGS84)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Medium dense, gray-brown, clayey fine SAND, (SC), trace silt, moist	20	S-4	SPT	18	4 / 8 / 13	
		Very stiff, dark brown, CLAY, (CL), trace fine sand, dry	25	S-5	CR	18	9 / 15 / 22	
		Very stiff, dark brown, CLAY, (CL), trace fine sand and siltstone fragment, dry	30	S-6	SPT	18	4 / 3 / 5	
		Stiff, brown, CLAY, (CL), trace fine to coarse sand, dry	35	S-7	CR	18	7 / 9 / 20	
		Medium dense, gray, fine SAND, (SP), trace silt, dry	36					

End boring at 36.5 feet
Groundwater Not Encountered
Boring backfilled with grout tremie style
Surface patch with cold patch asphalt.

Depth scale: 20 – 45

APPENDIX C
Laboratory Test Results

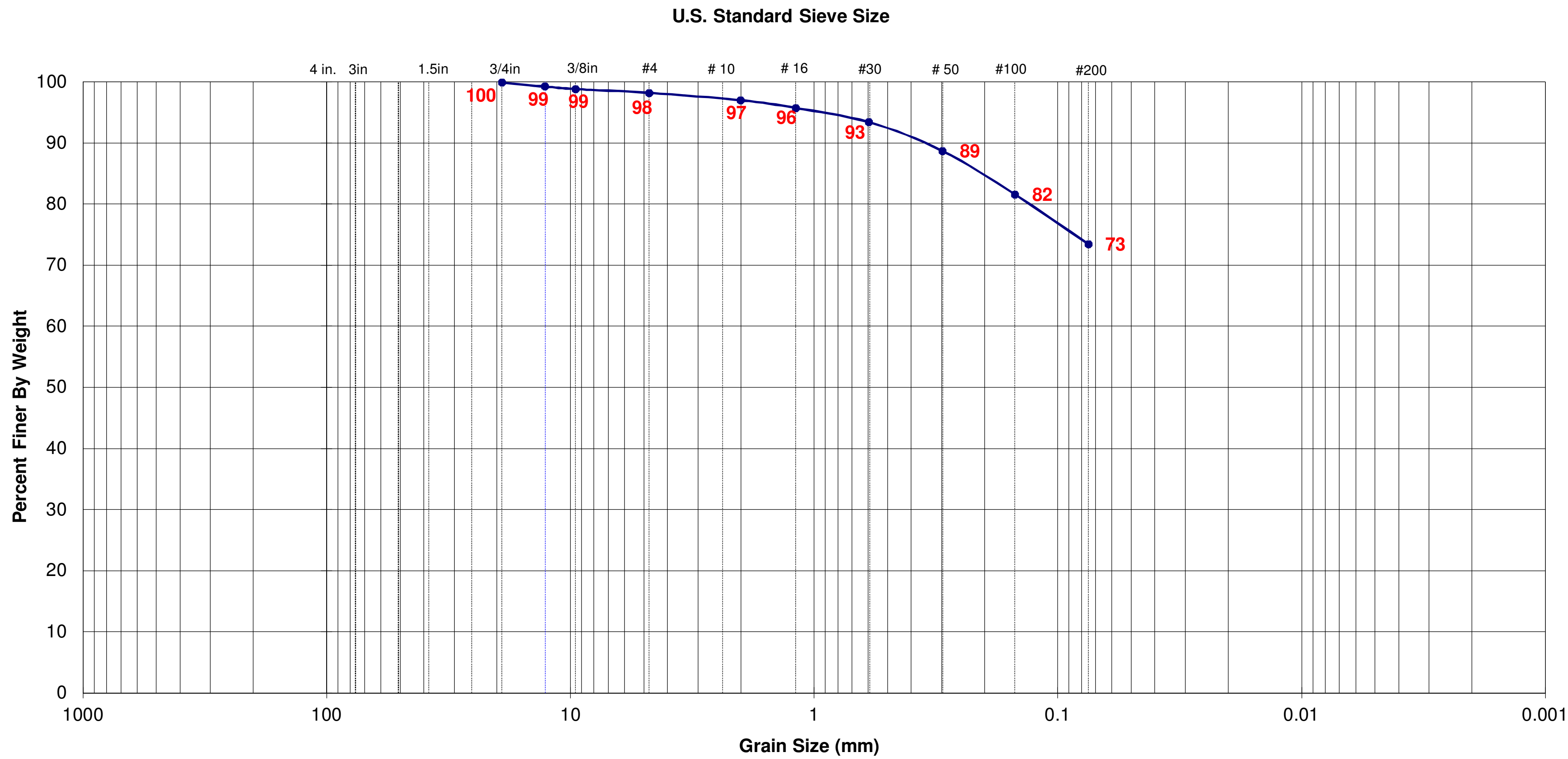
DENSITY TESTS

PROJECT Langan # 700101401 **JOB NO.** 2012-0057 **BY** LD **DATE** 07/02/21

Sample No.	LB-2 / S-4	LB-2 / S-6	LB-3 / S-3	LB-3 / S-5				
Depth (ft)	20.0	30.0	15.0	25.0				
Testing								
Soil Type	Brown, Silty Sand	Brown, Sandy Clay	Brown, Silty Sand	Brown, Sandy Clay				
Wet+Tare	1113.3	935.6	670.4	1041.0				
No. Ring	6	5	4	6				
Wet Weight	137.1	109.7	134.4	158.9				
Dry Weight	134.2	90.4	129.0	138.9				
Wet density	118.2	119.5	103.2	108.1				
% Water	2.2	21.3	4.2	14.4				
Dry Density	115.7	98.5	99.1	94.5				
O.B.Press(psf)								
Sample No.								
Depth (ft)								
Testing								
Soil Type								
Wet+Tare								
No. Ring								
Wet Weight								
Dry Weight								
Wet density								
% Water								
Dry Density								
O.B.Press(psf)								

GRAIN SIZE ANALYSIS - ASTM D 422

Date: 7/2/21



Boring / Sample No.	Initial Dry Density (pcf)	Initial Moist. (%)	Test Dry Density (pcf)	Test Moist. (%)	Permeabilty, k (cm/sec)	LL	PL	PI	Unified Soil Class.	Description
LB-2 / Bulk									CL	

Geo-Logic

EXPANSION INDEX - UBC 18-2 & ASTM D 4829-88

PROJECT Langan # 700101401 JOB NO. 2012-0057

Sample	LB-2 / Bulk	By	LD	Sample		By	
Sta. No.				Sta. No.			
Soil Type	Brown, Silty Clay			Soil Type			
Date	Time	Dial Reading	Wet+Tare	616.4	Date		Dial Reading	Wet+Tare	
6/29/2021	16:20	0.2823	Tare	219.8				Tare	
		H2O	Net Weight	396.6				Net Weight	
6/30/2021	10:00	0.231	% Water	10.1				% Water	
			Dry Dens.	109.1				Dry Dens.	
			% Max					% Max	
			Wet+Tare	659.4				Wet+Tare	
			Tare	219.8				Tare	
			Net Weight	439.6				Net Weight	
INDEX	51	5.1%	% Water	22.0	**INDEX**			% Water	

Sample		By		Sample		By	
Sta. No.				Sta. No.			
Soil Type				Soil Type			

Date		Dial Reading	Wet+Tare		Date		Dial Reading	Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
			% Water					% Water	
			Dry Dens.					Dry Dens.	
			% Max					% Max	
			Wet+Tare					Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
INDEX			% Water		**INDEX**			% Water	

Geo-Logic ASSOCIATES

WASH #200 SIEVE - ASTM D 1140-92

Job Name Langan # 700101401 Date 7-2-21

Job No. 2012-0057 By LD

Sample	LB-1 / S-3	**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water	16.4	% water		% water	
Wet weight	274.1	Wet weight		Wet weight	
Dry weight	235.5	Dry weight		Dry weight	
+ 200 sieve	146.5	+ 200 sieve		+ 200 sieve	
% Retained	62.2	% Retained		% Retained	
%Pass. #200	**38**	**%Pass. #200**		**%Pass. #200**	

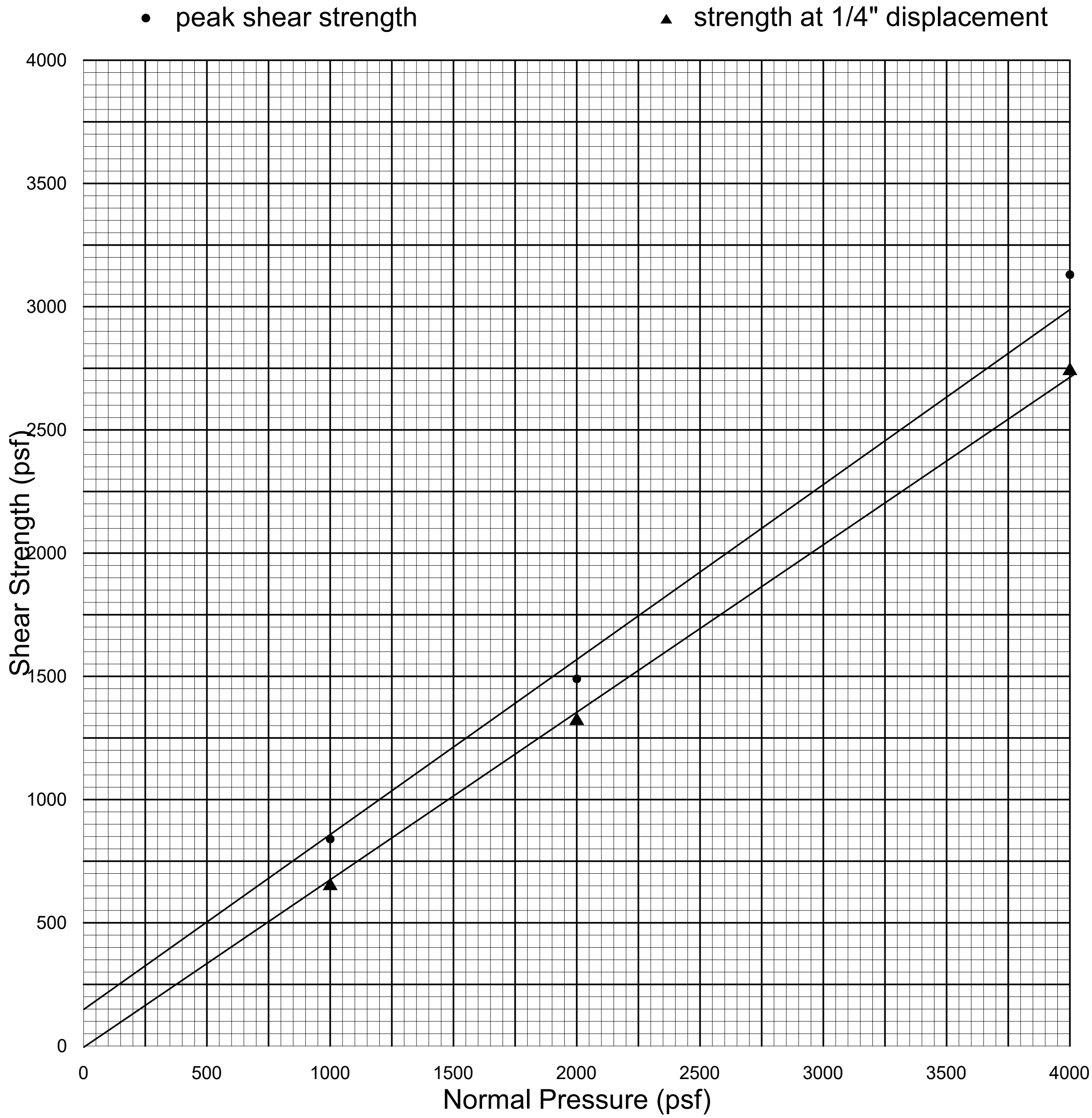
Sample		**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water		% water		% water	
Wet weight		Wet weight		Wet weight	
Dry weight		Dry weight		Dry weight	
+ 200 sieve		+ 200 sieve		+ 200 sieve	
% Retained		% Retained		% Retained	
%Pass. #200		**%Pass. #200**		**%Pass. #200**	

Sample		**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water		% water		% water	
Wet weight		Wet weight		Wet weight	
Dry weight		Dry weight		Dry weight	
+ 200 sieve		+ 200 sieve		+ 200 sieve	
% Retained		% Retained		% Retained	
%Pass. #200		**%Pass. #200**		**%Pass. #200**	

Sample		**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water		% water		% water	
Wet weight		Wet weight		Wet weight	
Dry weight		Dry weight		Dry weight	
+ 200 sieve		+ 200 sieve		+ 200 sieve	
% Retained		% Retained		% Retained	
%Pass. #200		**%Pass. #200**		**%Pass. #200**	

Geo-Logic ASSOCIATES

DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0084 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
LB3/S3	Undisturbed & Saturated	Silty Sand	99.1	4.2	24.5

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	840 @ 0.1155"	650
2000	1490 @ 0.1450"	1320
4000	3130 @ 0.1600"	2740
	C = 150 psf	C = 0 psf
	ϕ = 35 deg.	ϕ = 33.5 deg.

Langan # 700101401　　SOIL TEST RESULTS　　*Job No. 2012-0057*

SAMPLE NO.:	LB-2 / Bulk				
Depth	1' - 5'				
DIRECT SHEAR TEST (type)					
Initial Moisture Content %					
Dry Density (pcf)					
Normal Stress (psf)					
Peak Shear Stress (psf)					
Ultimate Shear Stress (psf)					
Cohesion (psf)					
Internal Friction Angle (degrees)					
EXPANSION TEST UBC STD 18-2					
Initial Dry Density (pcf)					
Initial Moisture Content %					
Final Moisture Content %					
Pressure (psf)					
Expansion Index / Swell %					
CORROSIVITY TEST					
Resistivity (ASTM G57) (ohm-cm)	540				
pH (ASTM D4972)	7.8				
CHEMICAL TESTS					
Soluble Sulfate (ASTM D4327) (%)	0.1296				
Chloride Content (ASTM D4327) (%)	0.0447				
Wash #200 Sieve (ASTM-1140) %					
Sand Equivalent (ASTM D2419)					

Geo-Logic