APPENDIX F

GEOTECHNICAL INVESTIGATION

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Ocean Avenue Project
c/o Jeff Worthe
100 Wilshire Boulevard, Suite 1600
Santa Monica, California 90401

Attention: Jeff Worthe

Subject: Environmental Impact Report, Soils and Geology Issues
Ocean Avenue Project Proposed Mixed-Use Development
1327-1337 Ocean Avenue and 101-129 Santa Monica Boulevard
Santa Monica, California

Dear Mr. Worthe:

1.0 INTRODUCTION

This document is intended to discuss potential soil and geological issues for the proposed development, as required by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. This report includes information from a previous geotechnical investigation performed in the vicinity of the site, engineering analysis, review of published geologic data, review of available geotechnical engineering information and the preparation of this report.

2.0 SITE CONDITIONS

The subject site is approximately 2 acres in area, bounded by 2nd Street to the northeast, Santa Monica Boulevard to the southeast, Ocean Boulevard to the southwest, and a hotel and a movie theater complex to the northwest. The site is bisected by a city alleyway. The subject site is shown relative to nearby topographic features in the enclosed Vicinity Map.

The subject site is currently developed with commercial and office structures, as well as at-grade parking lots. The existing structures range between one and three stories in height. The natural grade observed across the site slopes gently to the south east.

Vegetation at the subject site consists of mature trees, grass lawns, bushes and shrubs, contained in planter areas. Drainage across the site appears to be by sheetflow to the city streets to the southeast.

3.0 PROJECT SCOPE

Preliminary information concerning the proposed development was provided by the client. The proposed mixed-used development will consist of several new buildings that will house a hotel, apartments, ground floor retail/restaurants and a museum. The museum will also include retaining two on-site existing City-designated landmark buildings. The proposed structures will range between one and twelve stories in height. The proposed structures are expected to be built over two subterranean levels.

The proposed structures will be designed in accordance with the provisions of the applicable California Building Code, and City of Santa Monica requirements.

4.0 PROJECTS IN THE VICINITY OF THE SITE BY GEOTECHNOLOGIES, INC.

This firm has provided geotechnical services for a project located immediately to the northwest of the subject site. The location of the project is shown relative to the subject site in the enclosed Plot Plan. A brief summary of this previous project is provided below.

> ***Geotechnologies, Inc., December 29, 2011, Revised April 26, 2013, Geotechnical Engineering Investigation, Proposed Mixed Use Development, 1318 – 1324 2nd Street, Santa Monica, California, File No. 20227.***
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> Exploration for this investigation consisted of two borings to depths of 40 and 70 feet below the ground surface. The location of these borings relative to the subject site is shown in the enclosed Plot Plan. Logs of these two borings are also enclosed.
>
> The exploration encountered between 2 and 2½ feet of existing fill material underlain by natural older alluvium. Groundwater was encountered at a depth of 62½ feet below the ground surface.
>
> The investigation concludes that the proposed development was considered feasible from the geotechnical engineering standpoint and recommends the use of conventional spread footings bearing in natural soils at the proposed basement level (i.e. approximately 20 to 30 feet below the ground surface).
>
> Based on a site-specific liquefaction analysis prepared as part of this investigation, it was determined that the site soils would not be susceptible to liquefaction.

5.0 RESEARCH OF PUBLIC RECORDS

A search of records was performed at the City of Santa Monica Building Department in order to review available geotechnical documents prepared by other consultants on and in the vicinity of the subject site. The purpose of this research was to address the stability of the Santa Monica Palisades Bluffs. The following documents were reviewed:

- *Rincon Consultants, Inc. July 2007, Santa Monica Palisades Bluffs Improvement Project, Final Initial Study/Mitigated Negative Declaration SCH#2007021027.*

The project (now built) included the several slope stabilization and dewatering measures to decrease the rate of erosion and increase stability of the Santa Monica Palisades Bluffs. The following techniques were used:

- Drilling and installation of soil nails to increase stability along entire length of bluff face,
- Installation of anchor block with pre-stressed tieback to strengthen the loose soil at the toe of the slope,
- Spray-on treatment with chemical grout to bluff face in order to bind the surficial soil and reduce surface erosion,
- Driving short soil nails and moisture relief pipes into the slope face to further anchor the slope face and provide drainage behind the treated face,
- Installation of hydraugers to reduce the pore water pressure in the soil behind the bluffs;
- Removal of loose talus and debris.

This report categorizes the Palisades Bluffs slope into several different segments that are defined by either: the type of erosion problem, or the slope treatment (strengthening) methodology. The portion of slope directly below the subject site is identified as Treatment Zone 3 in the report. Treatment Zone 3 is characterized by surface erosion, erosion gullies, talus on top of the old access road, landslide debris below the old access road, and rilling of the slope face. Additional recommended treatments for the slope included cleaning of debris.

- *URS, dated October 20, 2007, Geotechnical Study Santa Monica Palisades Bluffs, Santa Monica, California, URS Project No. 29402057.*

The purpose of this investigation was to develop conceptual design recommendations for improving the stability of the Santa Monica Palisades Bluffs. The investigation included drilling 12 borings ranging in depth for 72 to 152 feet deep and conversion of four of the borings into groundwater observation wells. In addition, 16 horizontal borings were drilled 90 to 150 feet into the bluff.

The investigation identified three main zones of soil: The top soil zone of the bluffs is composed of a thin layer of sand with silt and gravel which is underlain by a thicker layer of silt and clay. The middle zone consists of interbedded gravels, sands and silts with clay which is, in turn, underlain by a layer of silt and clay. The lower zone consists of coarse-grained sand and gravel. Below the elevation of PCH (near elevation 20) the soil consists of alternating layers of sand, gravel and clay.

Groundwater or seepage was identified in all of the borings. The nearest Borings B8, B9, and B10 identified water or seepage at elevations of 5 to 21.5 feet above mean sea level. These elevations correspond to depths over 54 feet below the subject site's ground surface.

- *URS Corporation dated May 12, 2009, Report (Revised) analysis of Slope Stability Above California Incline, Santa Monica Palisades Bluff, Santa Monica, California. No file number.*

  This report is a supplement to the report by URS dated 2007. This report presents additional slope stability analyses for a portion of the Santa Monica Palisades Bluffs. No additional subsurface work was performed in the preparation of this report.

- *California Department of Transportation (Caltrans) April 2012, California Incline Bridge Replacement Project, Final Environmental Impact Report, Replace the California Incline Bridge between State Route 1 and Ocean Avenue (postmile 35.5 to postmile 36.5 in the City of Santa Monica in Western Los Angeles County, SCH# 2006041147, 7-LA-1-PM 35.5/36.5, EA 07-335-965100, 684 pages.*

  Caltrans was assigned environmental review and consultation responsibilities under the National Environmental Policy Act. This report addresses the replacement of the California Incline Bridge which is located west of the subject site. The report considered several replacement alternatives and determined that the preferred build alternative will have no significant impact on the human environment.

  The project also planned to improve the geologic integrity of the upper bluffs. The bridge installation incorporated pile foundations. The report stated that the piles are expected to strengthen the slope because of the pile pinning action. The report further adds that the addition of soil nails to the upper bluff slope would improve the stability of the bluffs.

- *City of Santa Monica, July 10, 2012, Resolution No. 10695 (CGS), A Resolution of the City Council of the City of Santa Monica Certifying the Final Environmental Impact Report. Environmental Assessment on the California Incline Bridge Replacement Project, 5 pages.*

  The City of Santa Monica adopted the resolution to certify the Environmental Impact Report for the California Incline Bridge Replacement Project.

- *City of Santa Monica, July 10, 2012, Resolution No. 10696 (CCS), A Resolution of the City Council of the City of Santa Monica Making Findings Necessary to Approve the California Incline Bridge Replacement Project and Adopting Statement of Overriding Considerations and Mitigation Monitoring and Report Program, 30 pages.*

  The City Council found that mitigation measures were required for the Bridge Replacement Project which will substantially avoid or lessen the potential significant effects with respect to unstable or expansive soils. The following geotechnical-related actions were recommended to be incorporated into the project:

- Removal of unsuitable subgrade soils and replacement with engineered fill
- Support of structure on deep-pile foundations
- Densification of compactable soils with in-situ techniques.

- *Earth Mechanics, Inc. (EMI), December 10, 2013, Final Foundation Report, California Incline Replacement, Santa Monica California, EMI Project No. 02-112.*

  This report addresses the replacement of the 1920's era California Incline that connects Ocean Avenue to Pacific Coast Highway. The California Incline is located approximately 2 blocks to the northwest of the subject site. The project included replacing the existing viaduct with a cast-in-place slab supported on friction piles, strengthening the adjacent bluffs with soil nails, replacing an existing retaining wall, and replacing structural pavement along the incline.

  The investigation included review of earlier subsurface work by EMI in 1997 and work by URS in 2002 and work by EMI in 2009. In all, 14 borings and 5 test pits were excavated for the investigation. The borings were drilled to a maximum depth of 110 feet. The borings and test pits identified Pleistocene-age alluvial fan deposits consisting of lenticular beds of gravel, sand, silt and clay. The beds are relatively horizontal oriented, which is favorable from standpoint of stability. Underlying the Pleistocene alluvium is Pleistocene-age marine deposits that consists of stiff, bluish-gray clay and fine sand.

  The nearest borings to the site, Borings B1 through B6, encountered groundwater between elevations 1 and 7 feet above mean sea level in 1997 and at elevations 4 and 10 feet in 2002. These elevations correspond to depths greater than 65 feet below the subject site.

- *Amec Foster Wheeler Environmental and Infrastructure, Inc., April 2017, City of Santa Monica Downtown Community Plan Project, Final Environmental Impact Report, SCH# 2013091056, 1392 pages.*

  The report describes the impact of the implementation of the Downtown Community Plan which constitutes the development of the Santa Monica Downtown area through the year 2030. The EIR describes the anticipated impact of development and summarizes the work and findings of several recent geotechnical reports, improvements, and adopted policies in the area. The subject site is included within the area described by the Downtown Community Plan.

  The EIR addresses the risk of landsliding on the Palisades bluff. The EIR cites the distance of properties from the bluff to be approximately 200 feet. Additionally, the report cited several proactive stabilization measures originally outlined in the Bluff Stabilization Project of 2009 which included the installation of rodent controls, soil nails and micropiles for support, various methods of subsurface drainage control, as well as soil grouting applications. In addition, the EIR identified that the reconstruction of the

California Incline added soil nails to the upper bluffs to "strengthen the hillside and reduce erosion and landslide concerns". As a result of these measures and other geotechnical analysis, the EIR concluded "future development of Downtown Properties within and adjacent to the High Risk Landslide Susceptibility Zone, including redevelopment of the Established Large Sites on Ocean Avenue (the Miramar Redevelopment is an Established Large Site), would not result in bluff instability and impacts related to landslide risks would be *less than significant*."

- *City of Santa Monica, July 25, 2017, Resolution No. 11059 (CCS), A Resolution of the City Council of the City of Santa Monica Certifying the Final Environmental Impact Report for the Downtown Community Plan, 7 pages.*

  The City Council reviewed and considered the contents of the Final EIR and "independently determined that the Final EIR has been prepared in accordance with the California Environmental Quality Act ("CEQA") and CEQA guidelines". The City Council certified that the "Final EIR reflects the City Council's independent judgement and analysis" and was subsequently adopted and approved.

- *City of Santa Monica, July 25, 2017, Resolution No. 11060 (CCS), A Resolution of the City Council of the City of Santa Monica Making Findings Necessary to Approve the Downtown Community Plan Project, Adopting A Statement of Overriding Considerations, and Adopting a Mitigation Monitoring Plan, 17 pages.*

  The City found that "…impacts of the Downtown Community Plan related to …geology/soils… hydrology/water quality …" would be less than significant without mitigation. No geology/soils or hydrology/water quality impacts that "are less that significant with mitigation", or "significant with unavoidable impacts" were identified. Therefore, there are no geology/soils or hydrology/water quality impacts addressed in the Mitigation Monitoring and Reporting Program.

  The Resolution states that City staff presentations, the Final EIR and Errata, were reviewed and considered and that the Final EIR reflects the City Council's independent judgement and analysis. The Resolution was approved and adopted by the City.

- *City of Santa Monica, July 25, 2017, Resolution No. 11061 (CCS), A Resolution of the City Council of the City of Santa Monica adopting the Downtown Community Plan, 6 pages.*

  After review and consideration of public input and review of several documents including the Final EIR, the City Council adopted the Downtown Community Plan dated April 12, 2017, as corrected by an addenda sheet as the official specific plan for the Downtown area.

The addenda sheet does not contain items related to geology/soils, or hydrology/water quality impacts.

6.0 ANTICIPATED SUBSURFACE CONDITIONS

6.1 Geologic Materials

Based on review of the previous investigation conducted immediately to the northwest of the subject site, and review of published geologic maps, the subject site is likely underlain by fill and older alluvium. In a neighboring site, the fill consists of sandy silt and silty clay that extends to a depth of 2½ feet. The older alluvial soils consist of interlayered mixtures of silts, sands and clays, which are medium dense to very dense, or stiff to very stiff, and contain varying amounts of slate gravel derived from the Santa Monica Mountains. Similar geologic conditions are expected at the subject site.

More detailed descriptions of the earth materials expected at the subject site may be obtained from the enclosed log of the subsurface excavations, which were conducted immediately to the northwest of the site.

6.2 Groundwater

During the previous geotechnical exploration conducted immediately to the northwest of the subject site, Groundwater was encountered at a depth of 62½ feet below ambient site grade in the geotechnical excavations.

Based on groundwater data provided in the Seismic Hazard Zone Report of the Beverly Hills 7½-Minute Quadrangle, the historically highest groundwater level for the subject site ranged between 20 and 30 feet below the ground surface (CDMG, 1998, Revised 2005).

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the site.

7.0 LOCAL GEOLOGY

The subject site is located in the Los Angeles Coastal Plain which is a deep, sediment-filled basin that drains to the southwest. Erosion of the Santa Monica Mountains located to the north of the site has resulted in an accumulation of several hundred feet of alluvium to form a broad southwest-draining alluvial fan. This northwest portion of the Los Angeles basin has been uplifted in the recent geologic time to form the gently rolling topography. The area in turn has been dissected by several south-draining canyons that also begin the Santa Monica Mountains. The geology of the site is shown on the attached Local Geologic Map.

8.0 REGIONAL GEOLOGIC SETTINGS AND FAULTING

8.1 Regional Geologic Settings

The subject site is located within the Los Angeles Basin and Peninsular Ranges Geomorphic Province. The Peninsular Ranges are characterized by northwest-trending blocks of mountain ridges and sediment-floored valleys. The dominant geologic structural features are northwest trending fault zones that either die out to the northwest or terminate at east-west trending reverse faults that form the southern margin of the Transverse Ranges.

The Los Angeles Basin is located at the northern end of the Peninsular Ranges Geomorphic Province. The basin is bounded by the east and southeast by the Santa Ana Mountains and San Joaquin Hills, to the northwest by the Santa Monica Mountains. Over 22 million years ago the Los Angeles basin was a deep marine basin formed by tectonic forces between the North American and Pacific plates. Since that time, over 5 miles of marine and non-marine sedimentary rock as well as intrusive and extrusive igneous rocks have filled the basin. During the last 2 million years, defined by the Pleistocene and Holocene epochs, the Los Angeles basin and surrounding mountain ranges have been uplifted to form the present day landscape. Erosion of the surrounding mountains has resulted in deposition of unconsolidated sediments in low-lying areas by rivers such as the Los Angeles River. Areas that have experienced subtle uplift have been eroded with gullies (Yerkes, 1965).

8.2 Regional Faulting

The enclosed Southern California Fault Map shows the location of many mapped faults in the Southern California area. Buried thrust faults are faults without a surface expression but are a significant source of seismic activity. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the southern California area. Due to the buried nature of these thrust faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential of these buried thrust faults is inferred to be negligible (Leighton, 1990). However, the seismic risk of these buried structures in terms of recurrence and maximum potential magnitude is not well established.

Two major buried thrust fault structures in the Los Angeles area are the Elysian Park fold and thrust belt and the Torrance-Wilmington fold and thrust belt. It is postulated that the Elysian Park structure was responsible for the magnitude 5.9, October 1, 1987 Whittier Narrows earthquake, and that the Torrance-Wilmington structure was responsible for the magnitude 5.0, January 19, 1989 Malibu earthquake. The magnitude 6.7, January 17, 1994 Northridge earthquake was caused by a buried thrust fault located beneath the San Fernando Valley.

8.3 Local Faulting

Faults within 2 miles of the subject site are shown on the enclosed Regional Geologic Map (U.S. Department of the Interior, 2005). Review of the map indicates the Santa Monica Fault is located approximately 1.5 miles north of the subject site. Based on this map, no other faults are located within 2 miles of the subject site. The map also indicates the Newport-Inglewood fault is approximately 6 miles to the east of the site.

The subject site location is also shown on the enclosed City of Santa Monica Geologic Hazards Map (City of Santa Monica, 2014). The map indicates the subject site is located approximately 4,500 feet (0.9 miles) south of the south branch of the Santa Monica Fault. The subject site is located approximately 8,000 feet (1.5 miles) south of the north branch of the Santa Monica Fault.

According to the most recent Earthquake Fault Zones Map of the Beverly Hills Quadrangle (Revised Official Map released on January 11, 2018), published by California Geological Survey (CGS), the subject site is located approximately 5,500 feet southwest of the active fault zone boundaries of the Santa Monica Fault. Based on the most recent 2018 CGS Earthquake Fault Zones Map, the active traces of the Santa Monica Fault are located further away from the project site than the Southern Branch of the Santa Monica Fault, shown on the 2014 City of Santa Monica Geologic Hazards Map. A copy of the CGS map is shown on the enclosed Earthquake Fault Zones Map.

9.0 SOIL AND GEOLOGY ISSUES

a) Fault Activity

Based on criteria established by the California Division of Mines and Geology (CDMG) now called California Geologic Survey (CGS), faults may be categorized as active, potentially active, or inactive. Active faults are those which show evidence of surface displacement within the last 11,000 years (Holocene-age). Potentially-active faults are those that show evidence of most recent surface displacement within the last 1.6 million years (Quaternary-age). Faults showing no evidence of surface displacement within the last 1.6 million years are considered inactive for most purposes, with the exception of design of some critical structures.

Buried thrust faults are faults without a surface expression but are a significant source of seismic activity. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the Southern California area. Due to the buried nature of these thrust faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential of these buried thrust faults is inferred to be low (Leighton, 1990). However, the seismic risk of these buried structures in terms of recurrence and maximum potential magnitude is not well established. Therefore, the potential for surface rupture on these surface-verging splays at magnitudes higher than 6.0 cannot be precluded.

A list of faults located within 60 miles (100 kilometers) from the project sites has been provided in the enclosed table titled: Seismic Source Summary Table. This table is based on information provided by the USGS in their 2008 National Seismic Hazard Maps –

Source Parameters database. The distances provided in this table are measured from a point selected near the center of the studio lot. A Southern California Fault Map has also been enclosed. The following sections describe some of the regional active faults, potentially active faults, and blind thrust faults.

i) Active Faults

Santa Monica Fault

The Santa Monica fault, located approximately 1.14 miles to the north of the subject site, is a part of the Transverse Ranges Southern Boundary fault system. The Santa Monica fault extends east from the coastline in Pacific Palisades through Santa Monica and West Los Angeles and merges with the Hollywood fault at the West Beverly Hills Lineament in Beverly Hills where its strike is northeast. It is believed that at least six surface ruptures have occurred in the past 50 thousand years. In addition, a well-documented surface rupture occurred between 10 and 17 thousand years ago, although a more recent earthquake probably occurred 1 to 3 thousand years ago. This leads to an average earthquake recurrence interval of 7 to 8 thousand years.[a] It is thought that the Santa Monica fault system may produce earthquakes with a maximum magnitude of 7.4.

In 2018, the California Geological Survey established an Earthquake Fault Zone for the Santa Monica Fault. A copy of this map may be fund in the Appendix.

Malibu Coast Fault

The Malibu Coast fault is part of the Transverse Ranges Southern Boundary fault system, a west-trending system of reverse, oblique-slip, and strike-slip faults that extends for more than approximately 124 miles along the southern edge of the Transverse Ranges and includes the Hollywood, Raymond, Anacapa–Dume, Malibu Coast, Santa Cruz Island, and Santa Rosa Island faults.

The Malibu Coast fault zone runs in an east-west orientation onshore subparallel to and along the shoreline for a linear distance of about 17 miles through the Malibu City limits, but also extends offshore to the east and west for a total length of approximately 37.5 miles. The onshore Malibu Coast fault zone involves a broad, wide zone of faulting and shearing as much as 1 mile in width. While the Malibu Coast Fault Zone has not been officially designated as an active fault zone by the State of California and no Special Studies Zones have been delineated along any part of the fault zone under the Alquist-Priolo Act of 1972, evidence for Holocene activity (movement in the last 11,000 years) has been established in

[a] *Southern California Earthquake Center, a National Science Foundation and U.S. Geological Survey Center. Active Faults in the Los Angeles Metropolitan Region, www.scec.org/research/special/SCEC001activefaultsLA.pdf; accessed May 24, 2012.*

several locations along individual fault splays within the fault zone. Due to such evidence, several fault splays within the onshore portion of the fault zone are identified as active.[b]

Large historic earthquakes along the Malibu Coast fault include the 1979, 5.2 magnitude earthquake and the 1989, 5.0 magnitude earthquake.[c] The Malibu Coast fault zone is approximately 1.86 miles northwest of the subject site and is believed to be capable of producing a maximum 7.0 magnitude earthquake.

Palos Verdes Fault

Studies indicate that there are several active on-shore extensions of the strike-slip Palos Verdes fault, which is located approximately 4.6 miles southwest of the subject site. Geophysical data also indicate the off-shore extensions of the fault are active, offsetting Holocene age deposits. No historic large magnitude earthquakes are associated with this fault. However, the fault is considered active by the California Geological Survey. It is estimated that the Palos Verdes fault is capable of producing a maximum 7.7 magnitude earthquake.

Newport-Inglewood Fault System

The Newport-Inglewood fault system is located 6.49 miles to the southeast of the subject site. The Newport-Inglewood fault zone is a broad zone of discontinuous north to northwestern echelon faults and northwest to west trending folds. The fault zone extends southeastward from West Los Angeles, across the Los Angeles Basin, to Newport Beach and possibly offshore beyond San Diego (Barrows, 1974; Weber, 1982; Ziony, 1985).

The onshore segment of the Newport-Inglewood fault zone extends for about 37 miles from the Santa Ana River to the Santa Monica Mountains. Here it is overridden by, or merges with, the east-west trending Santa Monica zone of reverse faults.

The surface expression of the Newport-Inglewood fault zone is made up of a strikingly linear alignment of domal hills and mesas that rise on the order of 400 feet above the surrounding plains. From the northern end to its southernmost onshore expression, the Newport-Inglewood fault zone is made up of: Cheviot Hills, Baldwin Hills, Rosecrans Hills, Dominguez Hills, Signal Hill-Reservoir Hill, Alamitos Heights, Landing Hill, Bolsa Chica Mesa, Huntington Beach Mesa, and Newport Mesa. Several single and multiple fault strands, arranged in a

[b] *City of Malibu Planning Department, Malibu General Plan, Chapter 5.0, Safety and Health Element, http://qcode.us/codes/malibu-general-plan/; accessed October 25, 2012.*
[c] *California Institute of Technology, Southern California Data Center. Chronological Earthquake Index, www.data.scec.org/significant/malibu1979.html; accessed October 25, 2012.*

roughly left stepping en echelon arrangement, make up the fault zone and account for the uplifted mesas.

The most significant earthquake associated with the Newport-Inglewood fault system was the Long Beach earthquake of 1933 with a magnitude of 6.3 on the Richter scale. It is believed that the Newport-Inglewood fault zone is capable of producing a 7.5 magnitude earthquake.

Hollywood Fault

The Hollywood fault is part of the Transverse Ranges Southern Boundary fault system. The Hollywood fault is located approximately 7.09 miles northeast of the subject site. This fault trends east-west along the base of the Santa Monica Mountains from the West Beverly Hills Lineament in the West Hollywood–Beverly Hills area to the Los Feliz area of Los Angeles. The Hollywood fault is the eastern segment of the reverse oblique Santa Monica–Hollywood fault. Based on geomorphic evidence, stratigraphic correlation between exploratory borings, and fault trenching studies, this fault is classified as active.

Until recently, the approximately 9.3-mile long Hollywood fault was considered to be expressed as a series of linear ground-surface geomorphic expressions and south-facing ridges along the south margin of the eastern Santa Monica Mountains and the Hollywood Hills. Multiple recent fault rupture hazard investigations have shown that the Hollywood fault is located south of the ridges and bedrock outcroppings along portions of Sunset Boulevard. The Hollywood fault has not produced any damaging earthquakes during the historical period and has had relatively minor micro-seismic activity. It is estimated that the Hollywood fault is capable of producing a maximum 6.7 magnitude earthquake.

Verdugo Fault

The Verdugo Fault is located approximately 16.2 miles to the northeast of the subject site. The Verdugo Fault runs along the southwest edge of the Verdugo Mountains. The fault displays a reverse motion. According to Weber, et. al., (1980) 2 to 3 meter high scarps were identified in alluvial fan deposits in the Burbank and Glendale areas. Further to the northeast, in Sun Valley, a fault was reportedly identified at a depth of 40 feet in a sand and gravel pit. Although considered active by the County of Los Angeles, Department of Public Works (Leighton, 1990), and the United States Geological Survey, the fault is not designated with an Earthquake Fault Zone by the California Geological Survey. It is estimated that the Verdugo Fault is capable of producing a maximum 6.9 magnitude earthquake.

Raymond Fault

The Raymond fault is located approximately 17.38 miles to the northeast of the subject site. The Raymond fault is an effective groundwater barrier which divides the San Gabriel Valley into groundwater sub-basins. Much of the geomorphic evidence for the Raymond fault has been obliterated by urbanization of the San Gabriel Valley. However, a discontinuous escarpment can be traced from Monrovia to the Arroyo Seco in South Pasadena. The very bold, "knife edge" escarpment in Monrovia parallel to Scenic Drive is believed to be a fault scarp of the Raymond fault. Trenching of the Raymond fault is reported to have revealed Holocene movement (Weaver and Dolan, 1997).

The recurrence interval for the Raymond fault is probably slightly less than 3,000 years, with the most recent documented event occurring approximately 1,600 years ago (Crook, et al, 1978). However, historical accounts of an earthquake that occurred in July 1855 as reported by Toppozada and others, 1981, places the epicenter of a Richter Magnitude 6 earthquake within the Raymond fault. It is believed that the Raymond fault is capable of producing a 6.8 magnitude earthquake. The Raymond Fault is considered active by the California Geological Survey.

Sierra Madre Fault System

The Sierra Madre fault alone forms the southern tectonic boundary of the San Gabriel Mountains in the northern San Fernando Valley. It consists of a system of faults approximately 75 miles in length. The individual segments of the Sierra Madre fault system range up to 16 miles in length and display a reverse sense of displacement and dip to the north. The most recently active portions of the zone include the Mission Hills, Sylmar and Lakeview segments, which produced an earthquake in 1971 of magnitude 6.4. Tectonic rupture along the Lakeview Segment during the San Fernando Earthquake of 1971 produced displacements of approximately 2½ to 4 feet upward and southwestward.

It is believed that the Sierra Madre fault zone is capable of producing an earthquake of magnitude 7.3. The closest trace of the fault is located approximately 19.28 miles northeast of the subject site.

Santa Susana Fault

The Santa Susana fault extends approximately 17 miles west-northwest from the northwest edge of the San Fernando Valley into Ventura County and is at the surface high on the south flank of the Santa Susana Mountains. The fault ends near the point where it overrides the south-side-up South strand of the Oak Ridge fault. The Santa Susana fault strikes northeast at the Fernando lateral ramp and turns east at the northern margin of the Sylmar Basin to become the Sierra Madre fault. This fault is exposed near the base of the San Gabriel Mountains for approximately 46 miles from the San Fernando Pass at the Fernando lateral ramp east to its intersection with the San Antonio Canyon fault in the eastern San Gabriel Mountains, east of which the range front is formed by the Cucamonga fault. The Santa Susana fault has not experienced any recent major ruptures except for a slight rupture during the 6.5 magnitude 1971 Sylmar earthquake.[d] The Santa Susana Fault is considered to be active by the County of Los Angeles. It is believed that the Santa Susana fault has the potential to produce a 6.9 magnitude earthquake. The closest trace of the fault is located approximately 19.88 miles north of the subject site.

San Gabriel Fault System

The San Gabriel fault system is located approximately 24.32 miles northeast of the subject site. The San Gabriel fault system comprises a series of subparallel, steeply north-dipping faults trending approximately north 40 degrees west with a right-lateral sense of displacement. There is also a small component of vertical dip-slip separation. The fault system exhibits a strong topographic expression and extends approximately 90 miles from San Antonio Canyon on the southeast to Frazier Mountain on the northwest. The estimated right lateral displacement on the fault varies from 34 miles (Crowell, 1982) to 40 miles (Ehlig, 1986), to 10 miles (Weber, 1982). Most scholars accept the larger displacement values and place the majority of activity between the Late Miocene and Late Pliocene Epochs of the Tertiary Era (65 to 1.8 million years before present).

Portions of the San Gabriel fault system are considered active by California Geological Survey. Recent seismic exploration in the Valencia area (Cotton and others, 1983; Cotton, 1985) has established Holocene offset. Radiocarbon data acquired by Cotton (1985) indicate that faulting in the Valencia area occurred between 3,500 and 1,500 years before present.

It is hypothesized by Ehlig (1986) and Stitt (1986) that the Holocene offset on the San Gabriel fault system is due to sympathetic (passive) movement as a result of north-south compression of the upper Santa Susana thrust sheet. Seismic evidence indicates that the San Gabriel fault system is truncated at depth by the younger, north-dipping Santa Susana-Sierra Madre faults (Oakeshott, 1975; Namson and Davis, 1988).

[d] *California Institute of Technology, Southern California Data Center. Chronological Earthquake Index, www.data.scec.org/significant/santasusana.html; accessed May 24, 2012.*

Whittier-Elsinore Fault System

The Whittier fault is located approximately 25.83 miles to the southeast of the subject site. The Whittier fault together with the Chino fault comprises the northernmost extension of the northwest trending Elsinore fault system. The mapped surface of the Whittier fault extends in a west-northwest direction for a distance of 20 miles from the Santa Ana River to the terminus of the Puente Hills. The Whittier fault is essentially a strike-slip, northeast dipping fault zone which also exhibits evidence of reverse movement along with en echelon[e] fault segments, en echelon folds and anatomizing (braided) fault segments. Right lateral offsets of stream drainages of up to 8800 feet (Durham and Yerkes, 1964) and vertical separation of the basement complex of 6,000 to 12,000 feet (Yerkes, 1972), have been documented. It is believed that the Whittier fault is capable of producing a 7.8 magnitude earthquake.

The Whittier Narrows earthquakes of October 1, 1987, and October 4, 1987, occurred in the area between the westernmost terminus of the mapped trace of the Whittier fault and the frontal fault system. The main 5.9 magnitude shock of October 1, 1987 was not caused by slip on the Whittier fault. The quake ruptured a gently dipping thrust fault with an east-west strike (Haukson, Jones, Davis and others, 1988). In contrast, the earthquake of October 4, 1987, is assumed to have occurred on the Whittier fault as focal mechanisms show mostly strike-slip movement with a small reverse component on a steeply dipping northwest striking plane (Haukson, Jones, Davis and others, 1988).

San Andreas Fault System

The San Andreas Fault system forms a major plate tectonic boundary along the western portion of North America. The system is predominantly a series of northwest trending faults characterized by a predominant right lateral sense of movement. At its closest point the San Andreas Fault system is located approximately 42.75 miles to the northeast of the subject site.

The San Andreas and associated faults have had a long history of inferred and historic earthquakes. Cumulative displacement along the system exceeds 150 miles in the past 25 million years (Jahns, 1973). Large historic earthquakes have occurred at Fort Tejon in 1857, at Point Reyes in 1906, and at Loma Prieta in 1989. Based on single-event rupture length, the maximum Richter magnitude earthquake is expected to be approximately 8.25 (Allen, 1968). The recurrence interval for large earthquakes on the southern portion of the fault system is on the order of 100 to 200 years.

[e] *En echelon refers to closely-spaced, parallel or subparallel, overlapping or step-like minor structural features*

ii) Potentially Active Faults

Anacapa-Dume Fault

The Anacapa–Dume fault, located approximately 3.16 miles to the northwest of the subject site, is a near-vertical offshore escarpment exceeding 600 meters locally, with a total length exceeding 62 miles. This fault is also part of the Transverse Ranges Southern Boundary fault system. It occurs as close as 3.6 miles offshore south of Malibu at its western end, but trends northeast where it merges with the offshore segments of the Santa Monica Fault Zone. It is believed that the Anacapa–Dume fault is responsible for generating the historic 1930 magnitude 5.2 Santa Monica earthquake, the 1973 magnitude 5.3 Point Mugu earthquake, and the 1979 and 1989 Malibu earthquakes, each of which possessed a magnitude of 5.0.[f] The Anacapa–Dume fault is thought to be capable of producing a maximum magnitude 7.2 earthquake.

iii) Blind Thrusts Faults

Blind or buried thrust faults are faults without a surface expression but are a significant source of seismic activity. By definition, these faults have no surface trace, therefore the potential for ground surface rupture is considered remote. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the Southern California area. Due to the buried nature of these thrust faults, their existence is sometimes not known until they produce an earthquake. Two blind thrust faults in the Los Angeles metropolitan area are the Puente Hills blind thrust and the Elysian Park blind thrust. Another blind thrust fault of note is the Northridge fault located in the northwestern portion of the San Fernando Valley.

The Elysian Park anticline is thought to overlie the Elysian Park blind thrust. This fault has been estimated to cause an earthquake every 500 to 1,300 years in the magnitude range 6.2 to 6.7. The Elysian Park anticline is approximately 13.34 miles to the southeast of the subject site.

The Puente Hills blind thrust fault extends eastward from Downtown Los Angeles to the City of Brea in northern Orange County. The Puente Hills blind thrust fault includes three north-dipping segments, named from east to west as the Coyote Hills segment, the Santa Fe Springs segment, and the Los Angeles segment. These segments are overlain by folds expressed at the surface as the Coyote Hills, Santa Fe Springs Anticline, and the Montebello Hills.

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[f] *City of Malibu Planning Department. Malibu General Plan, Chapter 5.0, Safety and Health Element, http://qcode.us/codes/malibu-general-plan/; accessed May 24, 2012.*

The Los Angeles segment of the Puente Hills blind thrust is located approximately 9.40 miles to the southeast of the subject site.

The Santa Fe Springs segment of the Puente Hills blind thrust fault is believed to be the cause of the October 1, 1987, Whittier Narrows Earthquake. Based on deformation of late Quaternary age sediments above this fault system and the occurrence of the Whittier Narrows earthquake, the Puente Hills blind thrust fault is considered an active fault capable of generating future earthquakes beneath the Los Angeles Basin. A maximum moment magnitude of 7.0 is estimated by researchers for the Puente Hills blind thrust fault.

The Mw 6.7 Northridge earthquake was caused by the sudden rupture of a previously unknown, blind thrust fault. This fault has since been named the Northridge Thrust, however it is also known in some of the literature as the Pico Thrust. It has been assigned a maximum magnitude of 6.9 and a 1,500 to 1,800 year recurrence interval. The Northridge thrust is located 21.45 miles to the north of the subject site.

b) Surface Ground Rupture

In 1972, the Alquist-Priolo Special Studies Zones Act (now known as the Alquist-Priolo Earthquake Fault Zoning Act) was passed into law. The Act defines "active" and "potentially active" faults utilizing the same aging criteria as that used by California Geological Survey (CGS). However, established state policy has been to zone only those faults which have direct evidence of movement within the last 11,000 years. It is this recency of fault movement that the CGS considers as a characteristic for faults that have a relatively high potential for ground rupture in the future.

CGS policy is to delineate a boundary from 200 to 500 feet wide on each side of the known fault trace based on the location precision, the complexity, or the regional significance of the fault. If a site lies within an Earthquake Fault Zone, a geologic fault rupture investigation must be performed that demonstrates that the proposed building site is not threatened by surface displacement from the fault before development permits may be issued.

Surface rupture is defined as surface displacement which occurs along the surface trace of the causative fault during an earthquake. Based on review of the Earthquake Fault Zone Map for the Beverly Hill Quadrangle (CGS, 2018), the nearest Earthquake Fault Zone is located more than one mile to the north of the site, for the Santa Monica Fault. A copy of this map may be found in the Appendix of this report.

Review of the City of Santa Monica Geologic Hazards Map indicates that the subject site is located outside the Fault Hazard Management Zone (City of Santa Monica, 2014). A copy of this map is enclosed.

Based on research of available literature and results of site reconnaissance, no known active or potentially active faults underlie the subject site. Based on these considerations, the potential for surface ground rupture at the subject site is considered low.

c) Seismicity

As with all of Southern California, the subject site is subject to potential strong ground motion, should a moderate to strong earthquake occur on a local or regional fault. Design of any proposed structures on the site in accordance with the provisions of the applicable California Building Code will mitigate the potential effects of strong ground shaking.

d) Deaggregated Seismic Source Parameters

The peak ground acceleration (PGA) and modal magnitude for the subject site was obtained from the USGS Probabilistic Seismic Hazard Deaggregation program (USGS, 2014). The parameters are based on a 2 percent in 50 years ground motion (2475 year return period). A shear wave velocity (Vs30) of 259 meters per second was utilized in the computation. The deaggregation program indicates a PGA of 1.09g and a mean magnitude of 6.75 for the site.

e) 2016 California Building Code Seismic Parameters

Based on information derived from the neighboring subsurface investigation, the subject site is classified as Site Class D, which corresponds to a "Stiff Soil" Profile, according to Table 20.3-1 of ASCE 7-10. This information and the site coordinates were input into the SEAOC/OSHPD U.S. Seismic Design Maps tool to calculate the ground motions for the site.

2016 CALIFORNIA BUILDING CODE SEISMIC PARAMETERS	
Site Class	D
Mapped Spectral Acceleration at Short Periods (S_S)	1.999g
Site Coefficient (F_a)	1.0
Maximum Considered Earthquake Spectral Response for Short Periods (S_{MS})	1.999g
Five-Percent Damped Design Spectral Response Acceleration at Short Periods (S_{DS})	1.333g
Mapped Spectral Acceleration at One-Second Period (S_1)	0.744g
Site Coefficient (F_v)	1.5
Maximum Considered Earthquake Spectral Response for One-Second Period (S_{M1})	1.116g
Five-Percent Damped Design Spectral Response Acceleration for One-Second Period (S_{D1})	0.744g

f) Liquefaction

Liquefaction is a phenomenon in which saturated silty to cohesionless soils below the groundwater table are subject to a temporary loss of strength due to the buildup of excess pore pressure during cyclic loading conditions such as those induced by an earthquake. Liquefaction-related effects include loss of bearing strength, amplified ground oscillations, lateral spreading, and flow failures.

Based on review of the Seismic Hazards Maps of the State of California (CDMG, 1999), the subject site is not located within a "Liquefiable" area. This determination is based on groundwater depth records, soil type and distance to a fault capable of producing a substantial earthquake. A copy of this map is included in the Appendix. Additionally, review of the City of Santa Monica Geologic Hazards Map indicates that the subject site is not located within an area considered susceptible to risk of liquefaction. A copy of this map is also enclosed.

g) Dynamic Settlement

Seismically-induced settlement or compaction of dry or moist, cohesionless soils can be an effect related to earthquake ground motion. Such settlements are typically most damaging when the settlements are differential in nature across the length of structures.

Some seismically-induced settlement of the proposed structure should be expected as a result of strong ground-shaking, however, due to the uniform nature of the underlying geologic materials, excessive differential settlements are not expected to occur.

h) Regional Subsidence

The subject site is not located within a zone on known subsidence due to oil or other fluid withdrawal.

i) Landsliding

The subject site is located immediately northeast of Palisades Park and the coastal bluff that extends along much of the western perimeter of the City of Santa Monica. At the nearest points, the subject site is located approximately 200 feet away from the top of the coastal bluff, which near the site is approximately 65 feet high.

The Seismic Hazards Maps by the State of California (CDMG, 1999, revised 2006, CDMG, 1997, revised 2005) indicate the subject site is not located within an "Earthquake Induced Landslide" zone. However, portions of the coastal bluff are.

According to the Guidelines for Geotechnical Reports by the City of Santa Monica Department of Building and Safety (City of Santa Monica, 2014), zones delineated on the

State of California Seismic Hazard Maps supersede those shown on the City of Santa Monica Geologic Hazards Map. However, the City of Santa Monica Geologic Hazards Map indicates that the southwestern half of the subject site is located in an area designated as "High Risk" for landslide susceptibility. Therefore, a discussion of landslide potential is provided below.

According to the Technical Background Report to the Safety Element of the City of Santa Monica General Plan (Leighton, 1995), failures of the coastal bluff are known to have occurred. This includes sections of the bluff near the toe of the California Incline and below Marguerita Avenue. Historically, failures have been attributed to saturation of the bluff soils from excessive rainfall and/or utility malfunction. Seismic shaking and traffic vibration are also reported to have contributed. The technical report (City of Santa Monica, 2010) states, "slope stability analyses (performed by others) indicate that the bluff slope exhibits a satisfactory factor of safety for gross deep-seated stability. However, the upper near-vertical portion of the slope may be expected to generate 'soil falls' during heavy rains, seismic events, subsurface seepage, or by excessive surface runoff over the slope."

In the "Research of Public Records" Section of this report, a summary of analyses prepared by other consultants, addressing the stability of the bluff, is provided. Based on the results of the research, and this firm's experience in this area of the City of Santa Monica, it is anticipated the soils underlying the subject site consist of older (Pleistocene) alluvium. The older alluvium is typically very dense or stiff and well consolidated. Based on the composition and structure of the underlying soils, the distance of the site to the slope face, as well as the bluff analyses performed by other consultants, it is the opinion of this firm that the potential for deep seated slope instability affecting the subject site is negligible.

j) <u>Collapsible Soils</u>

Based on previous geotechnical investigations conducted by this firm in the vicinity of the site, the soils to underlain the proposed structure would not be considered prone to hydroconsolidation.

k) <u>Tsunamis, Seiches and Flooding</u>

Seiches are oscillations generated in enclosed bodies of water which can be caused by ground shaking associated with an earthquake. Review of the County of Los Angeles Flood and Inundation Hazards Map, (Leighton, 1990), indicates the subject site does not lie within mapped inundation boundaries due to a seiche or a breached upgradient reservoir.

Tsunamis are large ocean waves generated by sudden water displacement caused by a submarine earthquake, landslide, or volcanic eruption. Review of the County of Los

Angeles Flood and Inundation Hazards Map, (Leighton, 1990) and the City of Santa Monica Tsunami Response Plan (2011), indicates the subject site does not lie within mapped tsunami inundation boundaries.

The Technical Background Report of the City of Santa Monica Safety Element of the General Plan (Leighton, 1995) provides detailed discussion of tsunami hazards within the City of Santa Monica. The discussion is based (in part) on earlier work by (Houston and Garcia, 1974), who reported numerically modeled tsunami wave heights for 100 and 500 year return periods were approximately 10.4 and 16.6 feet, respectively, along the coast of Santa Monica. Based on guidelines by the City of Santa Monica, sites at elevations below 35 feet require discussion of potential inundation due to tsunami. Based on the U.S.G.S. Beverly Hills 7½ -Minute Topographic Quadrangle, the subject site elevation ranges between approximately 70 and 80 feet.

More recently, the California Emergency Management Agency (CalEMA), California Geological Survey (CGS), and the University of Southern California - Tsunami Research Center prepared tsunami inundation maps along portions of the California Coast. According to the Tsunami Inundation Map for Emergency Planning, Beverly Hills Quadrangle (CalEMA, 2009), the subject site is not located within a tsunami inundation area. The tsunami inundation line in the vicinity of the subject site is at the bottom of the bluff.

l) <u>Oil Fields and Oil Wells</u>

Based on review of the California State Division of Oil, Gas and Geothermal Resources (DOGGR) On-line Mapping System, the subject site is not located within the limits of an oil field. In addition, no oil or gas wells have been drilled at the site.

m) <u>Temporary Excavations</u>

All required excavations are expected to be sloped, or properly shored, in accordance with the provisions of the applicable California Building Code, and the requirements of the City of Santa Monica. Therefore, the project would not result in any on-site or off-site landslide. Shoring systems may include soldier piles with rakers and/or tiebacks. Tiebacks would extend below adjacent properties and public right of ways. Appropriate notifications and agreements will be obtained by the development team prior to tieback installations. Further discussion is provided in a following section.

n) <u>Ground Failure</u>

The proposed construction will not cause, or increase the potential for any seismic related ground failure on the subject site or adjacent sites. Further discussion is provided in a following section.

o) Expansive Soils

During previous geotechnical investigation conducted in the vicinity of the subject site, the native soils tested were found to be in the low to moderate expansion range. Design of the proposed structures in accordance with the provisions of the applicable California Building Code will mitigate the potential effects of low to moderately expansive soils.

p) Sedimentation and Erosion

Grading, excavation and other earth moving activities could potentially result in erosion and sedimentation. For any grading proposed in the site from November to April (generally considered the rainy season) an erosion control plan consistent with the City of Santa Monica requirements would need to be prepared. Compliance with minimum code requirements will render project impacts related to sedimentation and erosion less than significant.

q) Landform Alterations

There are no significant hills, canyons, ravines, outcrops or other geologic or topographic features on the subject site. Therefore, any proposed project would not adversely affect any prominent geologic or topographic features.

r) Septic Tanks

It is the understanding of this firm that sewers are available at the subject site for wastewater disposal. No septic tanks or alternative disposal systems are necessary or anticipated for any future site projects.

10.0 CONSTRUCTION ACTIVITIES

Construction of the proposed project would be expected to include demolition activities, excavations for the proposed subterranean levels, and construction of the proposed buildings (including superstructure, exterior finishes, and interior finishes). Construction practices on the subject site are expected to be carried out in a manner consistent with industry construction, engineering, and safety standards. Care and maintenance of the subject property during and after construction would be expected to include adequate control of site drainage and proper maintenance of underground utilities.

The potential for each construction phase or activity, and the finished project, to affect the coastal bluff stability are discussed below.

- Demolition activities for the proposed project are expected to include demolition of the existing structures and surface parking lots occupying the site. It is the understanding of this firm that heavy equipment will be used for demolition of the existing structures. The use of explosive and/or collapse type demolition techniques are not anticipated.

Demolition of the existing structures will be expected to produce some vibration. The vibrations will be produced by onsite construction traffic, offsite hauling vehicles, and breaker and/or jackhammering equipment. These vibrations will not be expected to vary substantially from the typical background vibrations due to everyday street traffic and city related activities. Due to the distance of the proposed construction project to the bluffs, vibrations from construction activities will not affect the stability of the Palisades bluffs.

As they are described herein, the potential for the proposed demolition activities to affect the stability of the coastal bluff is considered to be negligible.

- Excavation of the proposed subterranean levels will be expected to incorporate the use of shoring. The shoring and excavation process will include drilling borings and placement of soldier piles, excavation, placement of lagging boards, and drilling tie back anchors. Construction equipment will include drilling machines, excavators, loaders, backhoes, and hauling trucks. The use of this equipment, and the excavation process, could be expected to produce vibrations similar to those during the demolition phase of the project. The potential for these excavation activities to affect the stability of the coastal bluff is considered negligible.

  The excavation itself will reduce the overall amount of soil weight that is present below the site and therefore have negligible effect to bluff stability. The presence of soldier piles and tie backs in the areas of the proposed subterranean levels will also not be expected to affect bluff stability.

- Construction of the proposed development is expected to include the use of standard construction equipment and vehicles (i.e. concrete trucks, mobile cranes, forklifts). The construction equipment and vehicles will be expected to produce vibrations similar to those during the demolition and excavation phases of the project. The potential for the construction related traffic to affect the slope stability is considered negligible.

  Tower cranes will also be expected for construction of the proposed development. The cranes are expected to be constructed in isolated areas that are in excess of 200 feet away from the coastal bluff. Based on the setback and isolated loading below the tower cranes, they are not expected to affect coastal bluff stability.

  Once completed, the proposed structures (at their closest points) will be situated approximately 200 feet away from the top of the approximate 65-foot high coastal bluff. In addition, the proposed project will be designed to direct site drainage to storm drains, and the site utilities will be adequately maintained. Storm water will not be infiltrated into the onsite soils.

Based on the anticipated distance between the base of the proposed structures and the coastal bluff, this firm's extensive research and experience in the vicinity of the subject site, and the anticipated soil conditions, it is the opinion of this firm that the potential for the proposed structures to affect the stability of the coastal bluff is negligible to no impact.

11.0 GENERAL PRELIMINARY CONCLUSIONS

Based upon the exploration, laboratory testing, and research, it is the preliminary finding of Geotechnologies, Inc. that construction of the proposed structure is considered feasible from a geotechnical engineering standpoint.

Currently, an estimation of adequate foundation system cannot be determined until exploration, testing, and analysis is conducted. Structural loading for portions of the proposed structure could be relatively high and may require mat foundations for building support. Pile foundations could also be utilized depending on the structural demands and soil conditions. Detailed analyses based on site specific exploration, laboratory testing, and detailed building load information will be necessary in order to develop final foundation design recommendations suitable for the project.

Due to the depths of the proposed subterranean levels, and the proximity of the property lines and existing structures to the proposed structures, it should be expected that shoring will be required in order to provide stable excavations for construction.

The proposed structure will be built over two subterranean levels. The exact depth of these subterranean levels is unknown at this time, but based on the experience of this firm, they may extend to a depth between 20 and 24 feet below the existing grade. Based on the research described above, actual groundwater below the subject site likely occurs at a depth below 62½ feet, and the historic high-water level was on the order of 20 to 30 feet. The proposed subterranean levels are not expected to extend below the actual groundwater level.

Based on the anticipated groundwater depths and conditions, temporary dewatering measures are not expected to be necessary during construction. If utilized, pile shafts extending below 62½ feet may encounter groundwater. It is anticipated that measures could be implemented during construction to handle groundwater encountered in pile shafts.

A review of the supporting geotechnical reports prepared for the Environmental Impact Report for the California Incline Bridge Replacement Project (URS May 12, 2009, URS October 20, 2007, Earth Mechanics December 10, 2013), the Santa Monica Palisades Bluff Stabilization Project (Rincon Consultants July 2007), and the Final Environmental Impact Report for the City of Santa Monica Downtown Community Plan Project (Amec Foster Wheeler Environmental and Infrastructure, Inc., April 2017) was performed.

The EIR for the Downtown Community Plan concluded "future development of Downtown Properties within and adjacent to the High Risk Landslide Susceptibility Zone, including redevelopment of Established Large Sites on Ocean Avenue, would not result in bluff instability and impacts related to landslide risks would be *less than significant*."

The geotechnical reports for the California Incline and the Palisades Bluff Stabilization project were submitted to the California Coastal Commission, Caltrans, and the City of Santa Monica. Each agency concluded that the planned construction improvements on the bluff would be safe and not cause or contribute to erosion or degradation of the geologic stability of this important City recreational area. Both projects (and supporting Environmental Impact Reports) were approved by the City of Santa Monica, Caltrans, and the California Coastal Commission (by way of procedure) and were deemed to improve the stability of the slopes.

Several slope stabilization and dewatering measures have also been implemented by the City of Santa Monica to decrease the rate of erosion and increase the stability of the bluffs.

Based on our review of these geotechnical reports and implementation of the construction and stabilization work, and the distance between the proposed structure and the Palisades Bluffs, our experience and knowledge of the geologic conditions in the vicinity of the subject site, it is our professional opinion that the Proposed Project will have negligible, if any, impact on the stability of the Palisades Bluffs.

Stormwater infiltration is not allowed or proposed for the subject site in accordance with Chapter 7.10 Runoff Conservation and Sustainable Management ordinance in the City of Santa Monica's Municipal Code, further reducing the risk of bluff erosion.

As with all of Southern California, the site is subject to potential strong ground motion from a moderate to strong earthquake on a local or regional fault. Design of the proposed development in accordance with the provisions of the most current California Building Code will mitigate the potential effects of strong ground shaking.

12.0 CLOSURE

Subsurface exploration of the subject site has not been completed for the proposed project. As indicated above, this evaluation is based on the available geotechnical information and published geologic data. A comprehensive geotechnical engineering investigation including subsurface exploration and testing will be necessary in order to provide final design recommendations for the proposed development.

The conditions identified in this document are typical of sites within this area of the City of Santa Monica, and of a type that are routinely addressed through regulatory measures. Geotechnologies, Inc. appreciates the opportunity to provide our services on this project. Should you have any questions please contact this office.

Respectfully submitted,
GEOTECHNOLOGIES, INC.

GREGORIO VARELA
R.C.E. 8120

REINARD T. KNUR
G.E. 2755, C.E.G 1547

GV/RTK:km

Enclosures: References
Vicinity Map
Plot Plan
Local Geologic Map
Regional Geologic Map
Historically Highest Groundwater Levels Plate
Seismic Source Summary Table
Southern California Fault Map
Earthquake Fault Zone Map
City of Santa Monica Geologic Hazards Map
Logs from Previous Site Explorations (5 pages)

Distribution: (3) Addressee

E-mail to: [jadenr@worthe.com]

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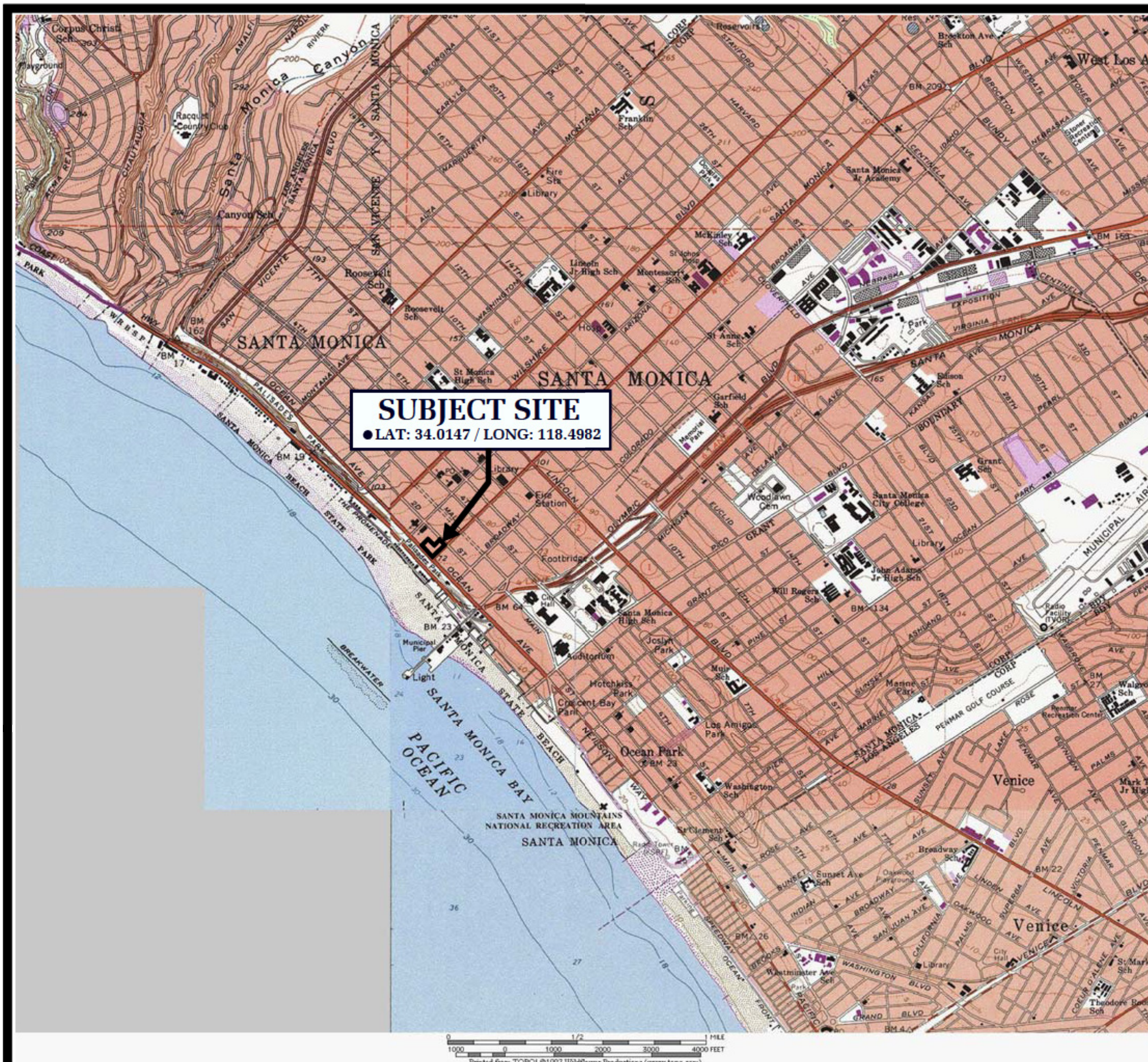


N

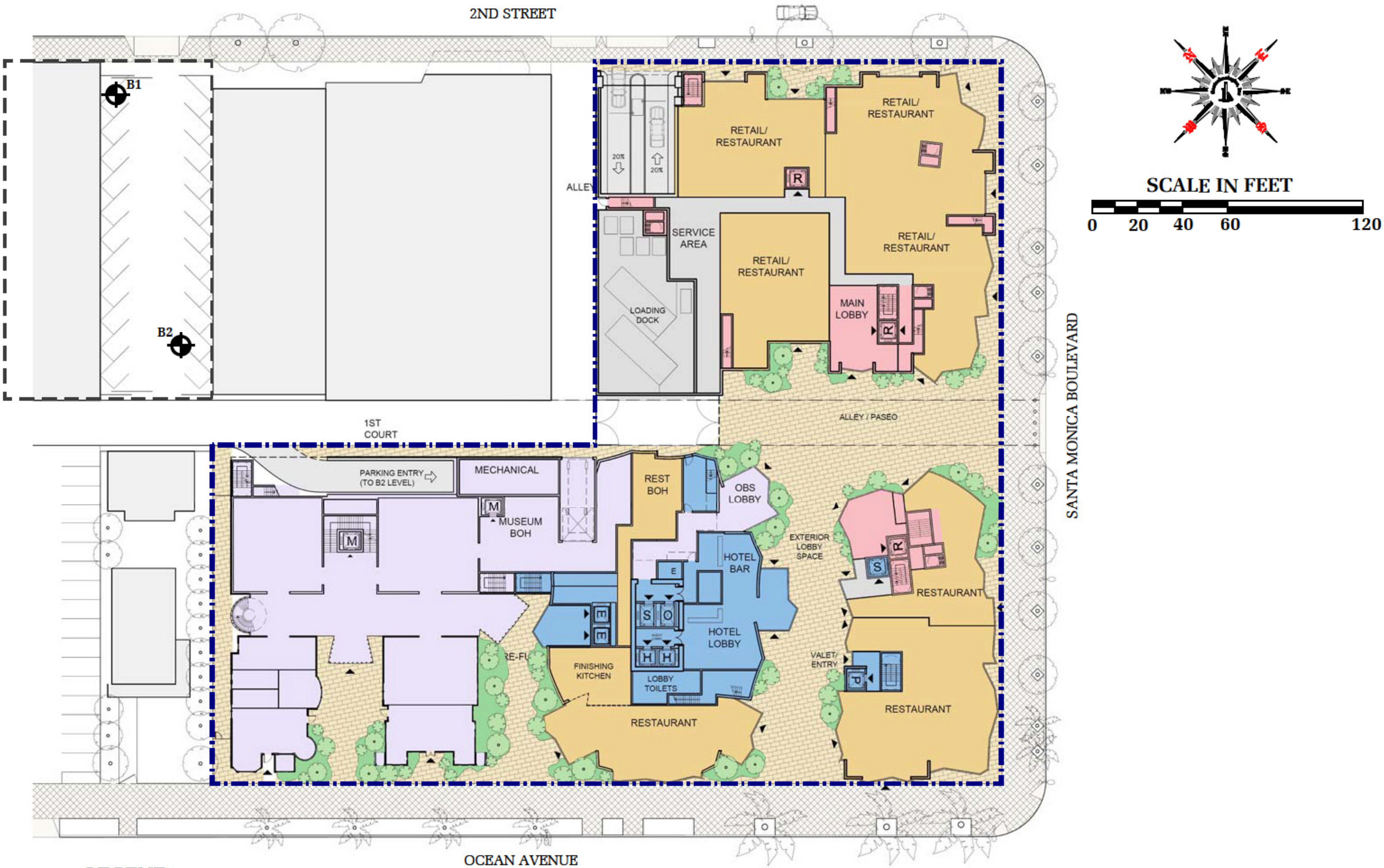
REFERENCE: U.S.G.S. TOPOGRAPHIC MAPS, 7.5 MINUTE SERIES, BEVERLY HILLS, CA QUADRANGLE

VICINITY MAP

Geotechnologies, Inc.
Consulting Geotechnical Engineers

OCEAN AVENUE PROJECT

FILE NO. 19564



LEGEND

LIMITS OF PROJECT SITE

B2 LOCATION & NUMBER OF BORING DRILLED DURING A PREVIOUS EXPLORATION PERFORMED BY GEOTECHNOLOGIES, INC. ON A NEIGHBORING PROPERTY (FILE NO. 20227)

REFERENCE: GROUND FLOOR PLAN PROVIDED BY CLIENT NOT DATED

Geotechnologies, Inc.
Consulting Geotechnical Engineers

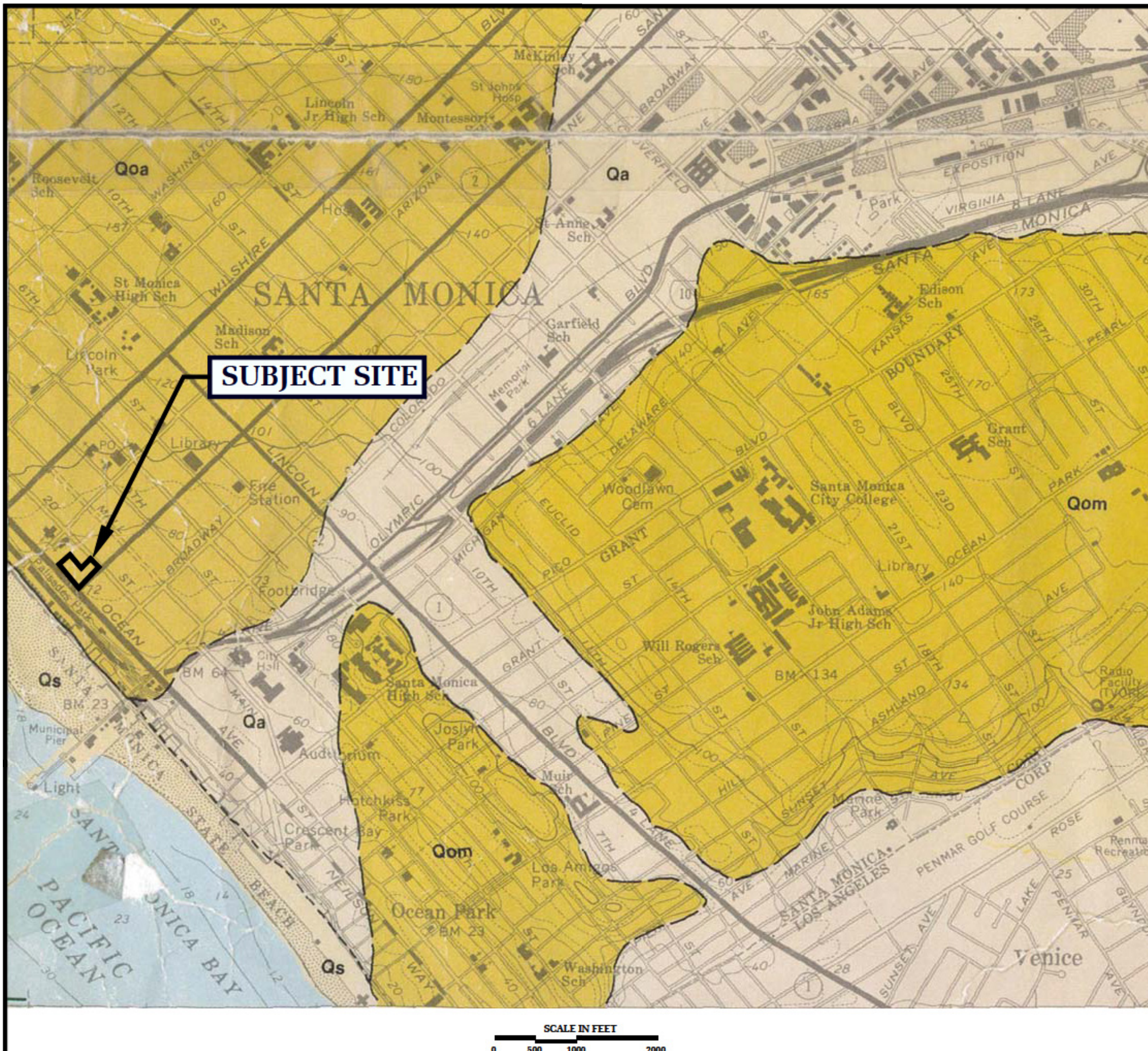
PLOT PLAN

OCEAN AVENUE PROJECT

File No.: 19564

Date: April '19

F-30



LEGEND

Qs: Surficial Sediments - beach sand
Qa: Surficial Sediments - alluvial gravel, sand, and silt-clay
Qoa: Older Alluvium - Gray to light brown pebble gravel, sand, and silt-clay
Qom: Shallow Marine Sediments - marine deposits of Hooots 1931: light gray to light brown sand, pebbly sand gravel and silt
Folds - arrow on axial trace of fold indicates direction of plunge
Fault - dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful

N

REFERENCE: DIBBLEE, T.W., (1991) GEOLOGIC MAP OF THE BEVERLY HILLS AND VAN NUYS (SOUTH HALF) QUADRANGLES (#DF-31)

LOCAL GEOLOGIC MAP - DIBBLEE

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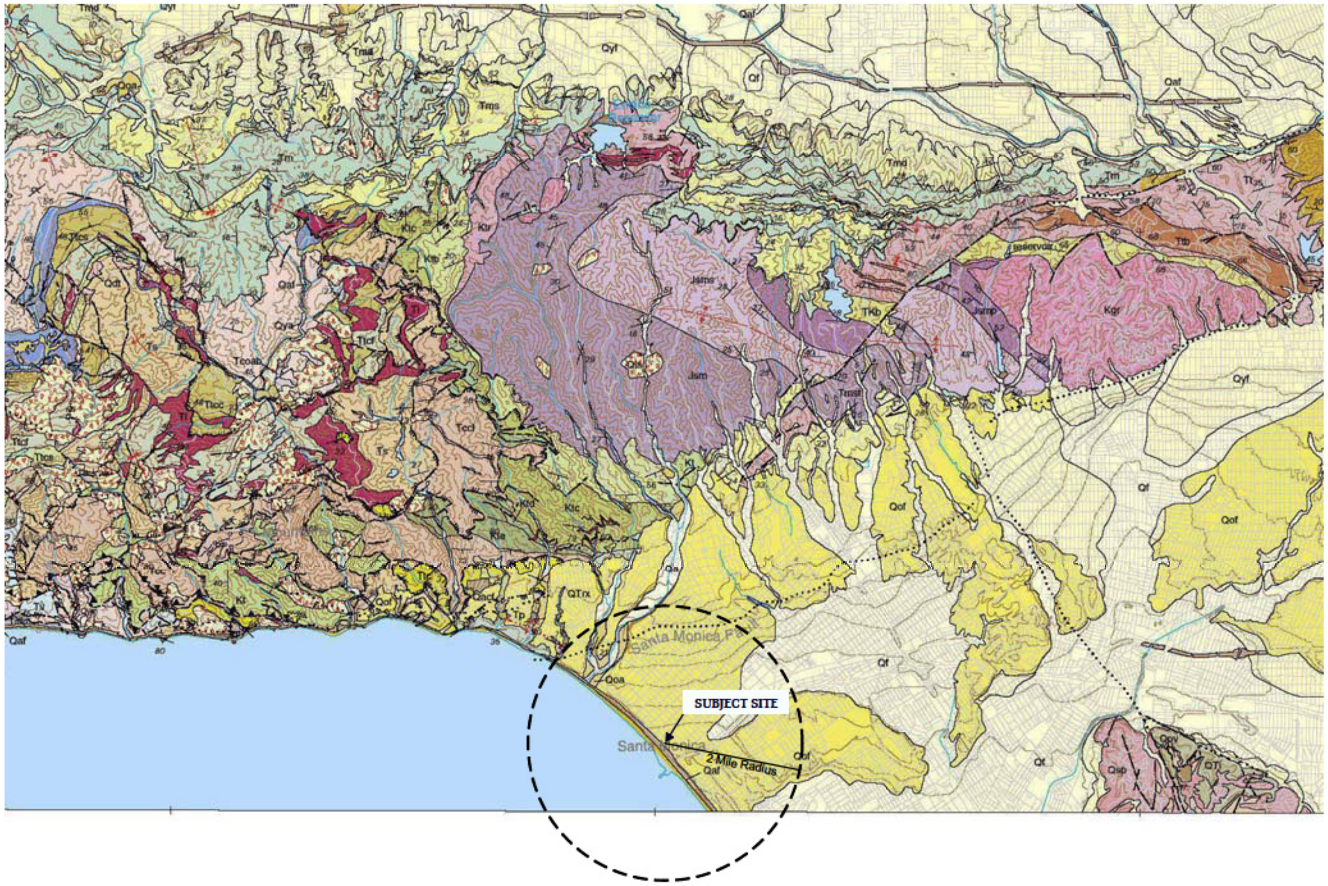
Consulting Geotechnical Engineers

OCEAN AVENUE PROJECT

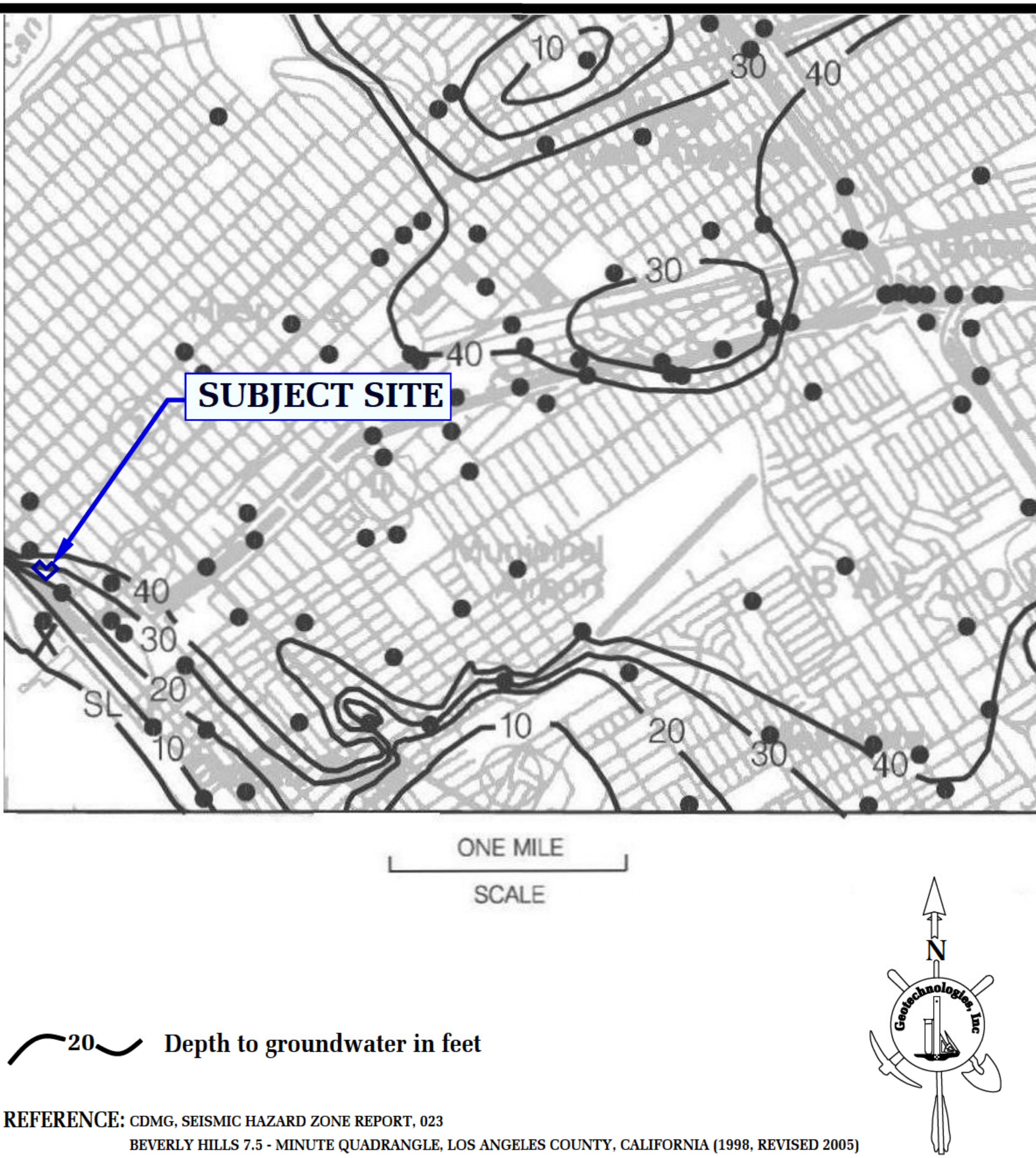
FILE NO. 19564



Contour Interval 40m

REFERENCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, PRELIMINARY GEOLOGIC MAP OF THE LOS ANGELES 30' X 60' QUADRANGLE, SOUTHERN CALIFORINA, VERSION 1.0, 2005, COMPILED BY ROBERT F. YERKES AND RUSSELL H. CAMPBELL.

REGIONAL GEOLOGIC MAP	
Geotechnologies, Inc. Consulting Geotechnical Engineers	OCEAN AVENUE PROJECT
	FILE No. 19564



20 Depth to groundwater in feet

REFERENCE: CDMG, SEISMIC HAZARD ZONE REPORT, 023
BEVERLY HILLS 7.5 - MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA (1998, REVISED 2005)

HISTORICALLY HIGHEST GROUNDWATER LEVELS

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OCEAN AVENUE PROJECT

FILE No. 19564

SEISMIC SOURCE SUMMARY TABLE

Geotechnologies, Inc.

Ocean Avenue Project

File No.: 19564

Based on USGS 2008 National Seismic Hazard Maps

Fault Name	Distance (Miles)	Preferred Dip (degrees)	Dip Direction	Slip Sense	Activity	Reference
Santa Monica	1.14	44		strike slip	A (EFZ)	2
Malibu Coast	1.86	75	N	strike slip	A (EFZ)	2
Anacapa-Dume	3.16	41	N	thrust	PA	3
Palos Verdes	4.60	90	V	strike slip	A	2
Newport-Inglewood	6.49	88		strike slip	A (EFZ)	2
Hollywood	7.09	70	N	strike slip	A (EFZ)	2
Puente Hills (LA)	9.40	27	N	thrust	-	1
Elysian Park (Upper)	13.34	50	NE	reverse	-	1
Verdugo	16.20	55	NE	reverse	A	1,3
Raymond	17.38	79	N	strike slip	A (EFZ)	2
Sierra Madre (San Fernando)	19.28	45	N	reverse	A (EFZ)	2
Santa Susana	19.88	55	N	reverse	A	3
Sierra Madre	20.94	53	N	reverse	A	3
Northridge	21.45	35	S	thrust	A	3
Simi-Santa Rosa	22.96	60		strike slip	A (EFZ)	2
San Gabriel	24.32	61	N	strike slip	A (EFZ)	2
Elsinore (Whittier)	25.83	75	NE	strike slip	A (EFZ)	2
Holser	27.90	58	S	reverse	-	1
Oak Ridge	29.40	53		reverse	-	1
Clamshell-Sawpit	30.70	50	NW	reverse	PA	3
San Cayetano	32.76	42	N	thrust	A (EFZ)	2
San Jose	35.53	74	NW	strike slip	-	1
San Joaquin Hills	39.22	23	SW	thrust	-	1
San Andreas	42.75	90	V	strike slip	A (EFZ)	2
Chino	43.17	65	SW	strike slip		2
Ventura-Pitas Point	43.28	64	N	reverse	A (EFZ)	2
Pitas Point	43.28	55		reverse	A (EFZ)	2
Santa Cruz Island	43.84	90	V	strike slip	A	2
Channel Islands Thrust	43.95	20	N	thrust	-	1
Newport-Inglewood (Offshore)	44.46	90	V	Strike Slip	A	3
Cucamonga	44.73	45	N	reverse	A (EFZ)	2
Santa Ynez	45.61	70		strike slip	A	2
Red Mountain	51.33	56	N	reverse	A (EFZ)	2
San Jacinto	56.78	90	V	strike slip	-	1

Reference:

1 = United States Geological Survey

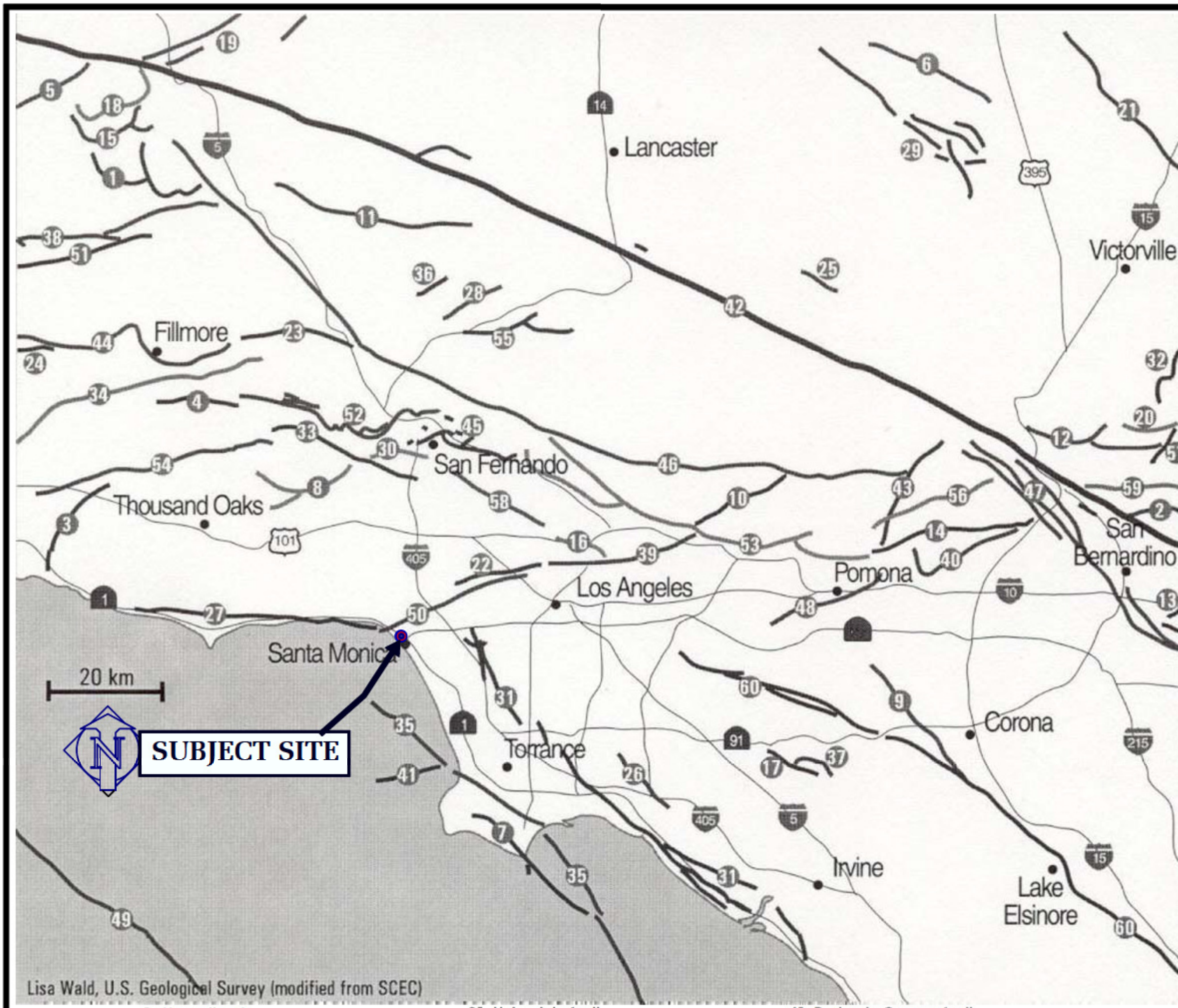
2 = California Geological Survey

3 = County of Los Angeles, Dept. of Public Works, 1990

A = Active

PA = Potentially Active

A (EFZ) = Active (Earthquake Fault Zone)



1 Alamo thrust	21 Helendale fault	41 Redondo Canyon fault
2 Arrowhead fault	22 Hollywood fault	42 San Andreas Fault
3 Bailey fault	23 Holser fault	43 San Antonio fault
4 Big Mountain fault	24 Lion Canyon fault	44 San Cayetano fault
5 Big Pine fault	25 Llano fault	45 San Fernando fault zone
6 Blake Ranch fault	26 Los Alamitos fault	46 San Gabriel fault zone
7 Cabrillo fault	27 Malibu Coast fault	47 San Jacinto fault
8 Chatsworth fault	28 Mint Canyon fault	48 San Jose fault
9 Chino fault	29 Mirage Valley fault zone	49 Santa Cruz-Santa Catalina Ridge f.z.
10 Clamshell-Sawpit fault	30 Mission Hills fault	50 Santa Monica fault
11 Clearwater fault	31 Newport Inglewood fault zone	51 Santa Ynez fault
12 Cleghorn fault	32 North Frontal fault zone	52 Santa Susana fault zone
13 Crafton Hills fault zone	33 Northridge Hills fault	53 Sierra Madre fault zone
14 Cucamonga fault zone	34 Oak Ridge fault	54 Simi fault
15 Dry Creek fault	35 Palos Verdes fault zone	55 Soledad Canyon fault
16 Eagle Rock fault	36 Pelona fault	56 Stoddard Canyon fault
17 El Modeno fault	37 Peralta Hills fault	57 Tunnel Ridge fault
18 Frazier Mountain thrust	38 Pine Mountain fault	58 Verdugo fault
19 Garlock fault zone	39 Raymond fault	59 Waterman Canyon fault
20 Grass Valley fault	40 Red Hill (Etiwanda Ave) fault	60 Whittier fault

REFERENCE: http://pasadena.wr.usgs.gov/info/images/LA%20Faults.pdf

SOUTHERN CALIFORNIA FAULT MAP

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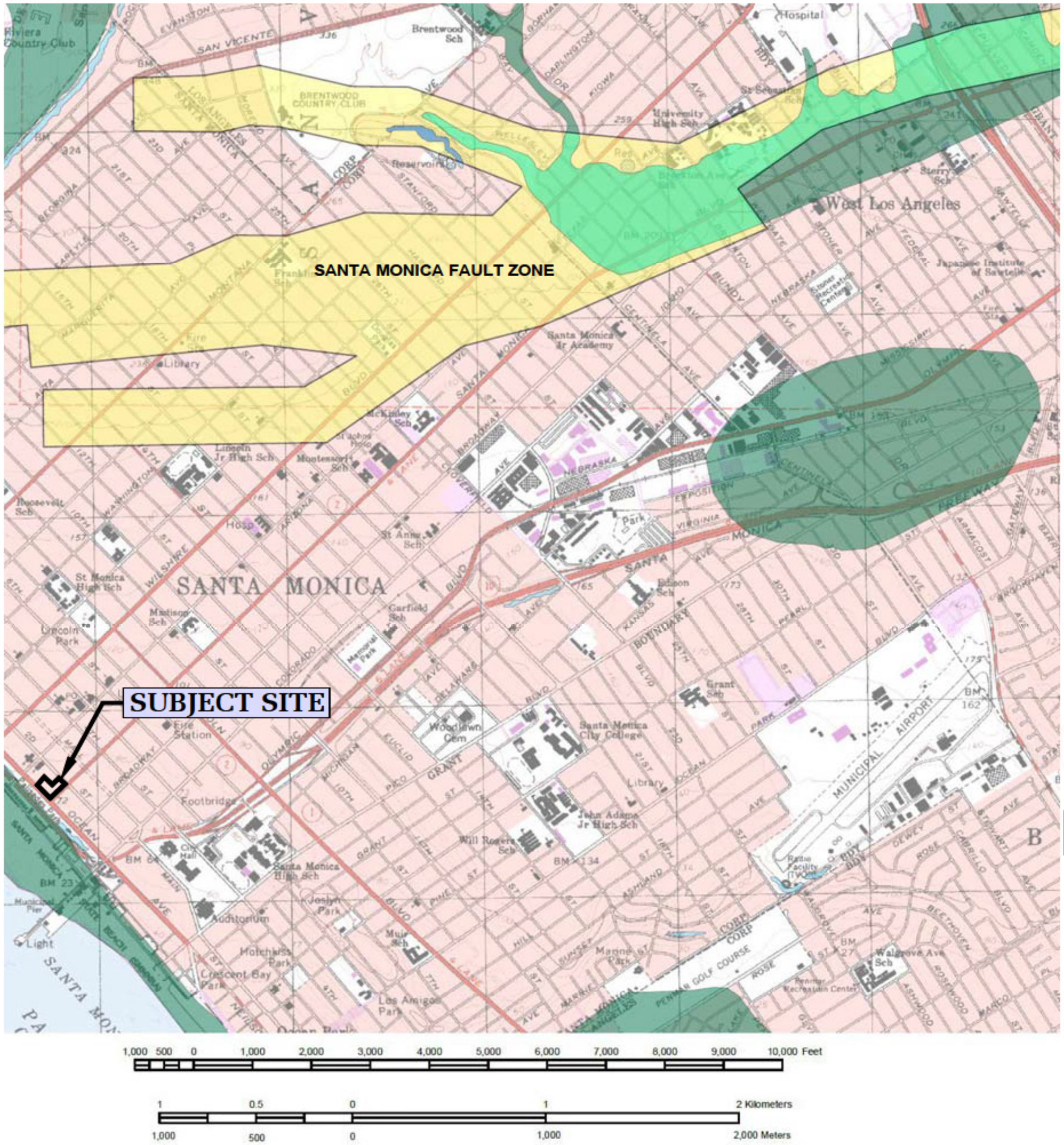
OCEAN AVENUE PROJECT

FILE No. 19564



LEGEND

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

LIQUEFACTION AREA

REFERENCE: EARTHQUAKE ZONES OF REQUIRED INVESTIGATION - BEVERLY HILLS QUADRANGLE (CGS, 1/11/18)

EARTHQUAKE FAULT ZONE MAP

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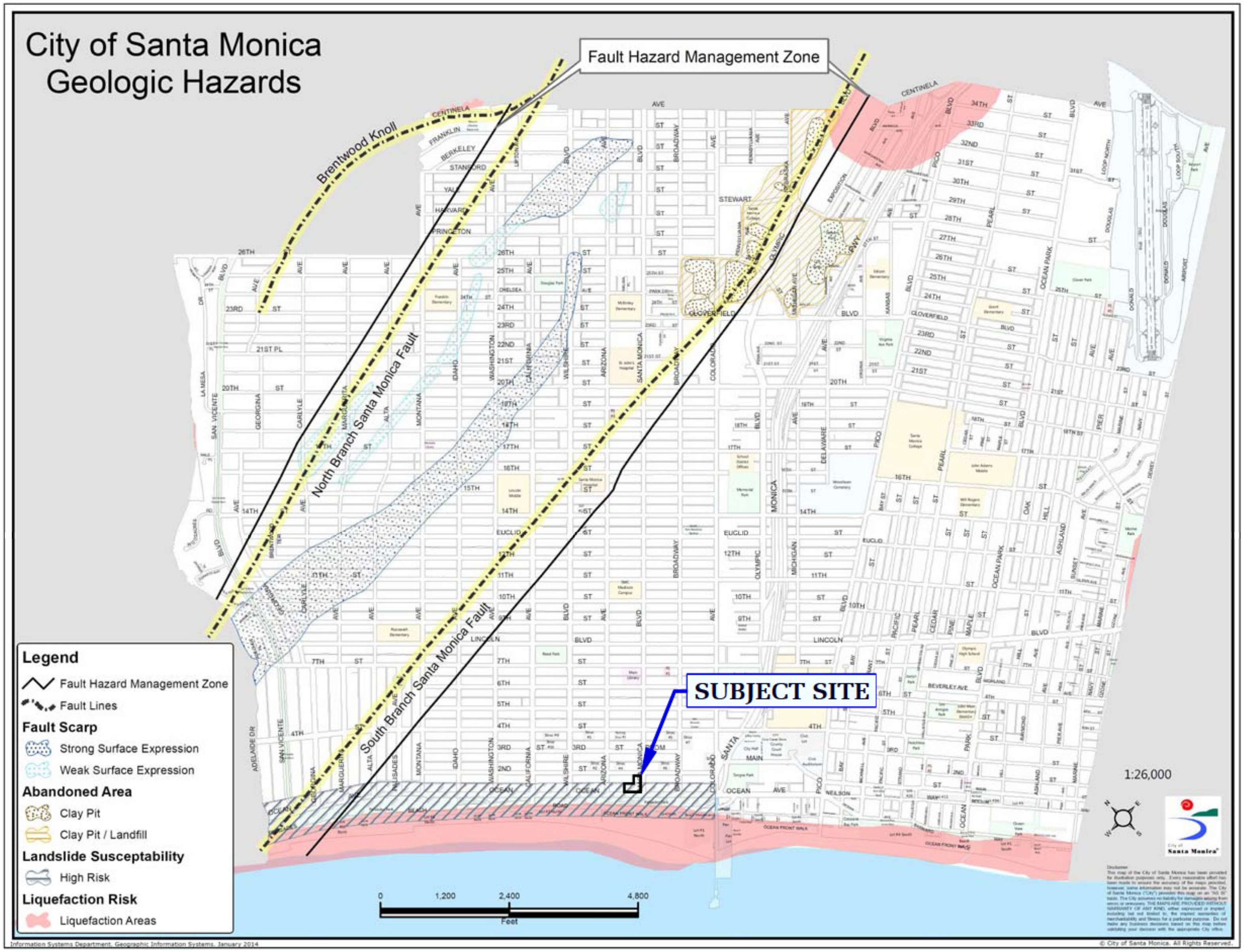
OCEAN AVENUE PROJECT

FILE NO. 19564



GEOLOGIC HAZARD MAP	
Geotechnologies, Inc. Consulting Geotechnical Engineers	OCEAN AVENUE PROJECT FILE No. 19564

EXCAVATION LOG NUMBER 1

FRC Realty, Inc. **Date: 10/17/11** **Elevation:**

File No. 20227 **Method: Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt
				0		4-inch Asphalt, No Base
				1		FILL: Sandy Silt, dark brown, moist, stiff
				2		
2.5	42	17.9	115.1			
				3	ML	Sandy to Clayey Silt, dark brown, moist, stiff
				4		
5	24	15.7	SPT	5		
						Sandy Silt to Clayey Silt, dark grayish brown mottling, moist, stiff
				6		
				7		
7.5	31	19.9	111.9			
				8		
				9		
10	10	15.9	SPT	10		
				11		
				12		
12.5	34	15.3	117.8			
				13		Sandy Silt with Gravel, dark brown, moist, stiff
				14		
15	26	14.5	SPT	15		
				16		
				17		
17.5	51	9.1	132.6			
				18		Sandy Silt with Gravel, dark brown, moist, stiff
				19		
20	36	5.8	SPT	20		
					SM/ML	Sandy Silt to Silty Sand, dark brown, moist, stiff, with slate fragments
				21		
				22		
22.5	47	11.2	116.5			
				23	SM	Silty Sand, dark to yellowish brown, moist, medium dense to dense, fine grained, minor gravel
				24		
25	45	13.6	SPT	25		

EXCAVATION LOG NUMBER 1

FRC Realty, Inc.

File No. 20227

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
27.5	83	14.9	101.0			
				28	SM/ML	Silty Sand to Sandy Silt, dark and yellowish brown
				29		
30	40	26.2	SPT	30		
					ML	Sandy to Clayey Silt, dark and yellowish brown, moist, stiff
				31		
				32		
32.5	50	14.2	113.6			
				33		
				34		
35	41	24.5	SPT	35		
					SM	Silty Sand, dark brown, moist, medium dense, fine grained
				36		
					CL	Silty, dark brown, moist, stiff
				37		
37.5	23 50/4"	13.7	110.6		SM	Silty Sand with Gravel, dark to grayish brown, moist, medium dense, fine grained
				38		
				39	SM/ML	Sandy Silt to Silty Sand, dark and grayish brown mottling, moist, dense to very dense, fine grained, very stiff
40	76	7.1	SPT	40		
					SM	Silty Sand, dark brown to dark gray, moist, very dense, fine grained, some gravel
				41		
				42		
42.5	33 50/5"	5.9	127.6			
				43	SM/SP	Silty Sand to Sand with gravel, dark to grayish brown mottling,
				44		
45	71	9.5	SPT	45		
				46		
				47		
47.5	39 80/4"	7.8	132.0			
				48	SM	Silty Sand, dark brown, moist, dense, fine grained, minor gravel
				49		
50	33	16.1	SPT	50		
					ML	Sandy to Clayey Silt, dark and grayish brown, moist, stiff

EXCAVATION LOG NUMBER 1

FRC Realty, Inc.

File No. 20227

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52	SM	Silty Sand, grayish brown, moist, medium dense, fine grained, minor gravel
52.5	25 50/4"	6.5	121.6	53	SM/SW	Silty Sand to Sand, dark and grayish brown, moist, very dense, fine to coarse grained, some gravel
				54		
55	81	6.3	SPT	55		
				56		
				57		
57.5	100/7"	5.9	116.3	58	SP/SW	Sand to Gravelly Sand, dark and grayish brown, moist, very dense, fine to coarse grained
				59		
60	90	7.6	SPT	60		
				61	SM	Silty Sand, gray, moist, very dense, fine to coarse grained
				62		
62.5	40 50/5"	19.2	115.1	63	SM/SW	Sand with Gravel to Silty, dark to grayish brown, moist to wet, very dense, fine to coarse grained
				64		
65	81	12.6	SPT	65		- - - - - - - - - - - -
				66		Silty Sand to Gravelly Sand, dark and grayish brown, moist to wet, very dense, fine to coarse grained
				67		
67.5	73	15.9	115.7	68	SP	Sand, yellow to grayish brown, wet, very dense, fine to medium grained
				69		
70	100	13.2	SPT	70		
				71		Total depth: 70 feet Water at 62½ feet Fill to 2½ feet
				72		
				73		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual
				74		Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				75		SPT=Standard Penetration Test

EXCAVATION LOG NUMBER 2

FRC Realty, Inc. **Date: 12/15/11**

File No. 20227 **Method: Hollow Stem Auger**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt
				0		4-inch Asphalt, No Base
				1		FILL: Silty Clay, dark brown, moist
2	42	20.0	112.7	2		
					ML/CL	Clayey Silt to Silty Clay, dark and grayish brown mottling, moist, stiff
				3		
4	21	20.4	113.3	4		
				5		
				6		
7	33	19.8	109.5	7		
				8		
				9		
10	21	18.8	112.3	10		
				11		
				12		
				13		
				14		
15	43	16.8	117.8	15		
				16		
				17		
				18		
				19		
20	43	9.5	129.5	20		
					ML/SM	Sandy Silt to Silty Sand with Gravel, dark brown to grayish brown, moist, stiff, medium dense, fine grained
				21		
				22		
				23		
				24		
25	49	8.6	121.2	25	SP/SW	Sand, grayish brown, moist, medium dense to dense, fine to coarse grained, some gravel

GEOTECHNOLOGIES, INC. **Plate A-2a**

EXCAVATION LOG NUMBER 2

FRC Realty, Inc.

File No. 20227

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
30	22	16.8	107.8	30		
				31	SM/ML	Silty Sand to Sandy or Clayey Silt, dark and grayish brown mottling, moist, stiff, medium dense, fine grained
				32		
				33		
				34		
35	36	6.9	122.8	35		
				36	SW/SM	Gravelly Sand to Silty Sand, dark to grayish brown, moist, medium dense, fine to medium grained, coarse grained
				37		
				38		
				39		
40	35	23.5	101.0	40	SM/ML	Silty Sand to Clayey Silt, dark and grayish brown, moist, stiff, medium dense, fine grained
				41		
				42		Total depth: 40 feet No Water Fill to 2 feet
				43		
				44		
				45		
				46		
				47		
				48		
				49		
				50		