Appendix H1

Geotechnical Report

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

for

PROPOSED MENLO AVENUE APARTMENTS
1216-1220 Menlo Avenue
Los Angeles, California

Prepared For:

Cypress Equity Investments
1212 Wilshire Boulevard
Los Angeles, California 90025

Prepared By:

Langan Engineering & Environmental Services
515 South Flower Street, Suite 2860
Los Angeles, California 90071

20 December 2019
700069501

LANGAN

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1.0 INTRODUCTION

As requested and in accordance with our proposal and subsequent authorization by Cypress Equity Investments (CEI), LANGAN Engineering and Environmental Services Inc. (LANGAN) has performed a limited geotechnical investigation for the proposed 6-story residential building (Project) at 1220-1226 Menlo Avenue, Los Angeles, CA (Site). Our scope of services included a limited geotechnical investigation including a subsurface investigation, laboratory testing, and evaluation of the data and preparation of this preliminary geotechnical report.

Provided herein is a summary of our understanding of the proposed project, an overview of the geological and geotechnical information available for the site, the results of our subsurface investigation and our preliminary recommendations pertaining to the geotechnical design and construction considerations of the project. Our recommendations follow the guidelines of the 2016 California Building Code (2016 CBC) and 2017 Los Angeles Building code (LABC).

2.0 PROJECT OVERVIEW

2.1 Existing Site Description

The approximately 40,000-square-foot rectangular-shaped parcel is in the Pico Union neighborhood of Los Angeles. The site is bounded by Menlo Avenue to the west, and residential properties to the east, north, and south as shown on Figure 1. Currently three two-story buildings occupy the site.

2.2 Proposed Improvement

Our understanding of the project is based on an email provided by CEI on 29 July 2019. Based on the information provided to date, it is our understanding that the proposed development will include the demolition of two structures, re-location of a historic structure, and construction of a new 6-story residential building. Column loads have not been provided, but based on similar projects, we anticipate individual column loads to range from 400 to 600 kips.

3.0 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), California Department of Conservation – Division of Mines and Geology (DMG), City of Los Angeles, Los Angeles Building and Safety Department, Federal Emergency Management Agency (FEMA), City of Los Angeles Zone Information and Map Access System (ZIMAS) and California Division of Oil, Gas, & Geothermal Resources (DOGGR). A summary of the available information reviewed includes regional and local geology and geologic hazards.

3.1 Regional and Local Geology

The site is located within the Peninsular Ranges Geomorphic Province of Southern California. According to the CGS's California Geomorphic Provinces, Note 36 dated 2002, the Peninsular Ranges Geomorphic Province consists of a series of mountain ranges separated by northwest trending valleys that are subparallel to faults that branch from the San Andreas Fault. More specifically, the site is within the Central Block of the Los Angeles Basin, an extensive sediment-filled depression bound by the Santa Monica and San Gabriel Mountains in the north, the Pacific Ocean in the west, the Palos Verdes Peninsula in the southwest, the Santa Ana Mountains in the southeast, and the Puente, San Jose, and Chino Hills in the east. The basin's structural history includes extension and strike-slip faulting, followed by oblique contraction via thrusting and strike-slip faulting (Yerkes et al, 1965).

Based on the DMG's "Seismic Hazard Zone Report for the Hollywood 7.5 Minute Quadrangle, Los Angeles County, California" (Seismic Hazard Zone Report 026) revised 13 January 2006, the site is underlain by Pleistocene alluvial deposits (Qoa), described as "fine to coarse clayey sand and sandy clay, with lesser amounts of silt."

3.2 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," dated 2008. The following subsections present the results of our hazard review.

<u>Regional Faulting</u>

We reviewed the CGS 2010 Fault Activity Map of California (Figure 2A) and the accompanying document, An Explanatory Text to Accompany the Fault Activity Map of California (Figure 2B) to identify mapped faults within 100 kilometers of the site. The Fault Activity Map shows that the closest mapped faults are the Hollywood fault approximately 1.4 miles north, the Newport-Inglewood Fault Zone approximately 2.4 miles west and the Santa Monica fault approximately 3 miles west of the site.

Additionally, according to a search within 20 miles (32 kilometers) of the site of the USGS 2008 California Seismic Source Model , the closest known active faults capable of producing the strongest ground shaking are the Puente Hills (LA), 2.3 miles (0.7 kilometers) northwest of the site; the Elysian Park (Upper), 3.1 miles (2.7 kilometers) northwest of the site; and the Santa Monica Connected Alt 2, 3.7 miles (3.7 kilometers) southwest and west of the site. Table A.1 in Appendix A summarizes the individual fault segments and fault segment combinations, the closest rupture distances from the site to the fault, mean characteristic moment magnitudes for each fault segment, slip rate, and fault length for individual fault segments near the site.

<u>Regional Seismicity</u>

Langan conducted a search of the USGS Advanced National Seismic System (ANSS) Comprehensive Earthquake Catalog (ComCat) using a web-based Earthquake Archive Search and URL builder tool. According to the search results, as of 20 November 2019, 40 earthquakes with magnitudes of 5.0 or greater have occurred within a 100-kilometer (62.2-mile) radius of the site since 1900. Table A.2 in Appendix A contains a summary of the USGS ANSS ComCat seismic occurrences and their latitude and longitude coordinates, approximate magnitudes and magnitude types, and approximate distances from the site to the source.

<u>Surface Rupture</u>

Alquist-Priolo Earthquake Fault Zones (APEFZ) are regulatory zones delineated by CGS around active faults with the potentials to cause surface rupture. The zones average approximately ¼-mile in width. A review of the Seismic Hazard Zone Report 026 with the Earthquake Zones of Required Investigation Revised on 6 November 2014 and the "Safety Element of the Los Angeles City General Plan" 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 DMG's Seismic Hazard Zone Report 026 and the City of Los Angeles' Safety Element, the site is not within a mapped, currently established liquefaction-potential investigation zone (Figure 3).

Historic Groundwater

The presence of shallow groundwater may increase the susceptibility to liquefaction for loose to medium granular soils, low-plasticity silts and some clays at the site when subjected to sufficient ground shaking. Groundwater was not encountered during our investigation and DMG's Seismic Hazard Zone Report 026 indicates that the site's historically highest groundwater is approximately 60 to 70 feet below existing grade (Figure 4).

Landslides

A review of the City of Los Angeles' Safety Element and Seismic Hazard Zone Report 026 indicates that the site is not located within a mapped zone of landslide occurrences or areas of significant grading (Figure 5).

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 clean sands and gravels from earthquakes. Based on our subsurface investigation and field classification, seismically-induced ground deformations hazard does not appear to be a seismic hazard to 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. Liquefaction is not anticipated at the Site therefore, lateral spreading is not anticipated.

Flood Mapping

A review on the FEMA Flood Insurance Rate Map (FIRM) Number 06037C1616G, dated 21 December 2018, indicates that the site is within Zone X, defined as an "area of minimal flood hazard" (Figure 6). The City of Los Angeles' Safety Element shows that the site is not within mapped areas of "100-year and 500-Year Flood Plains." Therefore, flooding hazard is not anticipated under the 100-year flood event.

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 Los Angeles' Safety Element, the site is not within a mapped tsunami inundation hazard zone or flood control basin (Figure 7). Furthermore, the site is not within close proximity to large water bodies; therefore, site inundations from a tsunami and seiche are not expected.

Subsidence

Land subsidence may be induced from withdrawal of oil, gas, or water from wells. Based on a search of the Division of Oil, Gas & Geothermal Resources (DOGGR) Well Finder online tool and City Safety Element, the Site is not within a state-designated oil field. In addition, no active oil, gas, or geothermal wells were identified within the Site. According to our review of the available information from DOGGR, the likelihood of land subsidence caused by oil or gas withdrawal from oil wells is low.

Expansive Soils

Expansive soils can result in differential movement of structures including slab heave and cracking, differential movement between foundations, and cracking of pavements and sidewalks. Potentially expansive soils are defined by the 2013 CBC as soils with expansion indicies (EI) greater than 20. Based on the reported Site geologic conditions and subsurface information reviewed to date, soils potentially susceptible to expansion are discussed later in section 6.3.

Methane Zone

Per the City's ZIMAS, the site is not within a 'Methane Hazard Zone'. Based on the City's Methane and Methane Buffer Zones map (March 2014), the site is not located within a 'Methane Zone'.

4.0 SUBSURFACE INVESTIGATION

4.1 Geotechnical Exploration

Our geotechnical subsurface exploration program consisted of two hollow stem auger (HSA) borings drilled to approximately 50 feet below ground surface (bgs). Prior to drilling, a LANGAN field engineer marked out the boring locations on site. Underground Service Alert of Southern California (USA/DigAlert) was contacted to locate and mark known public underground utilities present within the public rights-of-way. A private utility-locating subcontractor also performed underground utility check at the boring location to confirm the location was clear of subsurface utilities and obstructions. Refer to Figure 9 for approximate boring location.

Borings LB-1 and LB-2 was drilled by Martini Drilling on 15 November 2019 using a truck-mounted drill rig under the full-time observation of a LANGAN field engineer. The boring was hand-augered to approximately 5 feet bgs 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. SPTs were performed per ASTM D1586 guidelines; SPT N-values were recorded to identify the relative density and stiffness of the cohesionless and cohesive soils, respectively. Where high resistance was encountered and the sampler did not penetrate the full 12 inches, indicating sampler refusal, the N-value was expressed as the number of blows per number of inches penetrated (i.e. 50/3 inch is equivalent

[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).

to 50 blows per 3 inches of penetration). California Modified ring samples were taken at select locations using a 3.0-inch-outer diameter split barrel California sampler lined with 2.42-inch-inner-diameter brass rings per ASTM D3550 guidelines.

Upon completion, the borings were backfilled via tremie method with cement-grout slurry to near ground surface and the surface pathed with cold patch asphalt. 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 were tested for waste characterization and disposed of as non-hazardous soil by Belshire Environmental Services, Inc.

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 A.

4.2 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 testing program included the following analyses:

- Atterberg Limit – ASTM D4318
- Expansion Index – ASTM D4829
- Direct Shear – ASTM D3080
- Percent Passing #200 Sieve Analyses – ASTM D1140
- Moisture Content and Density – ASTM D2937
- Electrical Resistivity – CTM 643
- Chloride Content – CTM 422
- Sulfate Content – CTM 417
- Soil pH – CTM 643

Laboratory tests were performed by Geo-Logic Associates, a test laboratory approved by the City of Los Angeles. We have reviewed the results of the laboratory test data and take responsibility for use of this data in our analysis. The laboratory test results are included in Appendix B.

5.0 SUBSURFACE CONDITIONS

Based on our field investigation and interpretation of laboratory testing, the site is generally underlain by alluvial deposits. Details of the subsurface condition encountered at our borings are summarized below. A generalized subsurface cross-section is presented in Figure 9.

- **Alluvial Deposits:** Alluvial deposits were encountered in LB-1 and LB-2 to the maximum explored depth of 51.5 feet, consisting of stiff to hard sandy clay and medium dense to very dense silty and clayey sands. SPT N-values generally ranged from 14 blows per foot (bpf) to 49 bpf for cohesive soils encountered and 11 bpf to 55 bpf to sampler refusal (i.e. sampler did not penetrate the full 12 inches) in granular soil encountered. Higher blow counts were encountered in boring LB-2 at 40 feet with 87 blows per foot.
- **Groundwater:** Groundwater was not encountered during this subsurface investigation.

6.0 PRELIMINARY GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATION

6.1 Seismic design parameters

Seismic design for Site Class D in accordance with the provisions of 2017 City of Los Angeles Building Code (LABC), Chapter 16 and ASCE/SEI 7-10 Standard, Chapter 11, should use the following parameters:

Type	Value	Description
S_S	2.256	MCE_R mapped spectral response acceleration at short period
S_1	0.794	MCE_R mapped spectral response acceleration at one-second period
S_{MS}	2.256	Site-modified spectral acceleration at short period
S_{DS}	1.191	Site-modified spectral acceleration at one-second period
S_{DS}	1.504	Design earthquake spectral response acceleration at short period
S_{D1}	0.794	Design earthquake spectral response acceleration at one-second period
PGA_M	0.833	MCE geometric mean peak ground acceleration adjusted for site class effects

Notes:
1. Values based on Site Class D.
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 percent probability of exceedance in 50 years (2,475-year return period) event are 6.7 and 6.52 moment magnitudes, respectively.

Should the structure be designed with 2019 CBC a site specific seismic analysis may be required; discussion with the structural engineering will be required to confirm if site specific seismic hazard analysis is required.

6.1 Foundation Recommendations

Based on the geotechnical conditions identified at the site the soils below the anticipated foundation subgrade level are suitable to support the proposed structure on a shallow foundation such as spread footings.

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). The minimum lateral dimension of isolated footings should not be less than 24 inches and should be embedded at least 24 inches below surrounding grade. 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.

Shallow foundations designed in accordance with the above parameters are anticipated to settle less than 1 inch under static loading with differential settlements less than 0.5-inch between adjacent columns. Settlements under dynamic loading are anticipated to be less than 1 inch.

Footing excavations should be performed using a backhoe bucket fitted with a smooth steel plate welded across the bucket teeth to minimize disturbance during excavation and to provide a smooth bearing surface. Any areas loosened by excavation should be re-compacted or replaced with lean concrete.

The foundation subgrade should be observed and approved by a qualified Geotechnical Engineer and a City of Los Angeles Deputy Grading Inspector prior to steel or concrete placement. Foundations should be constructed as soon as possible following subgrade approval. The contractor shall be responsible for maintaining the subgrade in its approved condition (i.e. free of water, debris, etc.) until the footing is constructed.

Foundations bearing on appropriately prepared subgrade comprised of alluvial soils can be designed to resist lateral sliding using an ultimate coefficient of friction equal to 0.30. If the sliding resistance calculated, using the above coefficient of friction is deemed insufficient, shear keys can be provided in the bearing material to provide supplemental sliding resistance.

6.2 Expansive Soil Considerations

Potentially expansive soils are defined by the CBC 2016 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 82).

Methods commonly used to reduce the effects of expansive soils include controlling the moisture content of the soils prior to placement of surface finishes, use of impermeable barriers around foundations, confinement of expansive soils through the use of non-expansive soil caps, and chemical stabilization. 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 determine special recommendations for slab-on-grade against expansion, if proposed.

6.3 Corrosion Considerations

Chemical analyses performed on selected samples obtained from the borings for this study are summarized below.

Sample	Material	Depth (feet)	Resistivity (ohm-cm)	pH	Soluble Sulfate (ppm)	Chloride (ppm)
LB-1/Bulk	Silty Clay	0 to 5	1,000	8.2	362	82

Based on our review of the minimum resistivity, pH, soluble sulfate, and chloride contents on the select soil samples, the surficial soil at the site is considered to be non-corrosive to concrete foundations and moderately to very corrosive to metals (ANSI/AWWA Standard C105/A21.5, ACI 318-14, and ASTM A674).

A corrosion expert should be consulted if metal pipe is proposed to be in contact with soil. Based on the laboratory data summarized herein, 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 corrosion expert should be consulted during the design phase for confirmation of corrosion protection requirements. A copy of the corrosion test results is provided in Appendix C.

7.0 BUILDING AND SITE PREPARATION

7.1 Excavation and Grading

Prior to the commencement of excavation and grading, a meeting should be held at the site with the owner, city inspector, excavation/grading contractor, civil engineer, and Geotechnical Engineer to discuss the work schedule and geotechnical aspects of the grading.

All pavement, vegetation, and deleterious materials should be disposed of off-site prior to initiation of grading operations.

Any foundation and abandoned utility remnants or construction debris associated with former site structures encountered within excavations should be fully removed, where practical, and any void spaces that may be created should be backfilled with approved compacted structural fill. If utility pipes are too deep to be removed economically in proposed pavement areas, they should be filled with cement and sand grout or equivalent material that will prevent future collapse of the pipe.

After completion of excavation, including removal of all below grade remnants, stripping, grubbing, removal of asphalt, base course material, subgrade soils should be compacted in-place by proofrolling with at least 6 passes of a vibratory roller compactor having a minimum static drum weight of 5 tons. Any areas exhibiting rutting or pumping should be removed and replaced with compacted engineered fill material.

Any soft, loose, or unsuitable soils identified by the City of Los Angeles Deputy Grading Inspector during subgrade preparation should be removed and replaced with approved compacted fill.

Any environmentally unsuitable soils encountered during the excavation process should be removed and properly disposed of off-site in accordance with all state and local regulations.

Surface site elements, such as site pavers, planters, and walkways can be supported on subgrade soils comprised of compacted fill or native alluvial soils prepared in accordance with the recommendations provided herein.

7.2 Fill Material and Compaction Criteria

Fill material (imported or re-used) should be free of organic and other deleterious materials and should have a maximum particle size no greater than 3 inches. The on-site granular portions of the alluvial soils containing less than 12 percent passing the #200 sieve are suitable for use as compacted fill. Any excavated on-site soils not meeting the gradation criteria should be mixed such that the gradation of the excavated soils is acceptable, as determined by the Geotechnical Engineer. All fills should be placed in accordance with the placement and compaction criteria discussed in this report. Imported fill should contain no more than 12 percent passing the #200 sieve by dry weight and have a plasticity index less than 7. Grain size distributions, maximum dry density, and optimum water content determinations should be made on representative samples of the proposed fill material.

All primary and secondary structural backfill, within building footprint, beneath building slabs, pavements, and sidewalks should be placed in uniform lifts (maximum 8-inches thick prior to compaction) and compacted to a minimum of 95 percent of the maximum dry density at a moisture content within 3 percent of optimum moisture content, as determined by ASTM D1557 (Modified Proctor compaction). All fill placement should be subject to controlled engineering observation by the City of Los Angeles Deputy Grading Inspector. No fill material should be placed on areas where free water is standing or on surfaces which have not been approved by the City of Los Angeles Deputy Grading Inspector. All secondary non-structural backfill should be placed in uniform lifts (maximum 8-inches thick prior to compaction) and compacted to at least 90 percent of its maximum dry density at a moisture content within 3 percent of optimum moisture content, as determined by the ASTM D1557 (Modified Proctor compaction).

7.3 Ground Preparation for Structure Relocation

It is our understanding from discussion with the Client that an on-site structure is considered "Historical" and demolition or removal from the site is not feasible. It will however be relocated on the property closer to the public right-of-way adjacent to Menlo Avenue. Therefore, ground preparation recommendations for the proposed new location can be provided when the relocation sequence has been developed.

7.4 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 excavations and existing foundations. Erosion protection and drainage control measures should be implemented during periods of inclement weather. During rainfall events, backfill operations may need to be restricted to allow for proper moisture control during fill placement.

The Project Site should be graded to ensure positive drainage away from the locations of the proposed development.

7.5 Hardscape Elements

Site pavers and walkways can be supported on compacted fill or native soils after excavating to the required subgrade level, then proof-rolled using an approved compactor such as a 5-ton (static drum weight) vibratory roller compactor, or equivalent. Any soft, loose or unsuitable soils identified by the City of Los Angeles Deputy Grading Inspector during proof-rolling should be removed and replaced with approved compacted fill.

8.0 PROTECTION OF NEIGHBORING STRUCTURES

All new construction work should be performed so as not to adversely impact or cause loss of support to structures, hardscape and landscape elements, paving, or utilities to remain. Special care will be required during grading and construction activities to ensure adverse vibrations or movements are not induced in these structures, and site activities do not result in their loss of support or instability. We recommend, a pre-construction condition documentation comprised of photographic and videographic documentation of accessible and visible areas of neighboring landscaped, and hardscaped areas including pavements and sidewalks be performed prior to initiating construction activities at the site. A supplemental monitoring program should also be developed for the historic structure.

9.0 CONSTRUCTION DOCUMENTS AND CONSTRUCTION QUALITY ASSURANCE

A final geotechnical investigation is required and should be coordinated once formal structural loading information is available. During final design we should be retained to consult with the design team as geotechnical questions arise. Technical specifications and design drawings should incorporate LANGAN's recommendations. When authorized, LANGAN will assist the design team in preparing specification sections related to geotechnical issues such as earthwork, shallow and deep foundations, backfill, and excavation support. LANGAN should also, when authorized, review foundation drawings prepared by the Structural Engineer and grading plans prepared by the Civil Engineer, as well as Contractor submittals relating to materials and construction procedures for geotechnical work. When site grading plan and foundation loads are available, LANGAN should review the design information to confirm if recommendations presented herein remain valid or if a geotechnical update report is needed.

LANGAN has preliminarily investigated and interpreted subsurface conditions within the Site and developed the preliminary foundation design recommendations contained herein, and is therefore best suited to perform the final site geotehcnial investigation, along with quality assurance observation and testing of geotechnical-related work during construction. This work requiring quality assurance confirmation includes, but is not limited to, earthwork, backfill, shallow foundations, and deep foundations. Recognizing that construction is essentially the completion of design, LANGAN's quality assurance observation and testing during construction is necessary to maintain our continuity of responsibility on this project.

10.0 RECOMMENDED FUTURE TASKS AND INTERACTION

At this time, we recommend performing the following supplemental study:

- A final geotechnical investigation to confirm:
    - Review of proposed foundation plans as related to the site
    - Subsurface conditions
    - Structure geology review and recommendations
    - foundation recommendations
    - Basement & retaining walls & Drainage recommendations
    - Shoring recommendation and stability analysis
    - Soil corrosivity
    - Utility Support
    - Site drainage considerations
- Review of final foundation, shoring, and civil plans throughout the design process.

To maintain our continuity of responsibility on this project, we recommend the above work be performed by LANGAN.

11.0 LIMITATIONS

The preliminary conclusions and preliminary recommendations provided in this report are based on subsurface conditions inferred from available boring data (which we have relied upon as being accurate), a limited number of borings drilled to date at the Project Site, as well as project information provided to date. Preliminary recommendations provided are dependent upon one another and no recommendation should be followed independent of the others.

A review of structural loading information and the preliminary foundation recommendations is necessary once structural design is advanced. Any proposed changes in structures or their locations should be brought to LANGAN's attention as soon as possible so that we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the location indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to LANGAN's attention for evaluation, as they may affect our recommendations.

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

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FIGURES

NOTES:

1. BACKGROUND IMAGE REFERENCED FROM BING MAPS IMAGERY OBTAINED ON 3 DECEMBER 2019.

LEGEND:

— — APPROXIMATE SITE LIMITS

1000 500 0 1000
SCALE IN FEET

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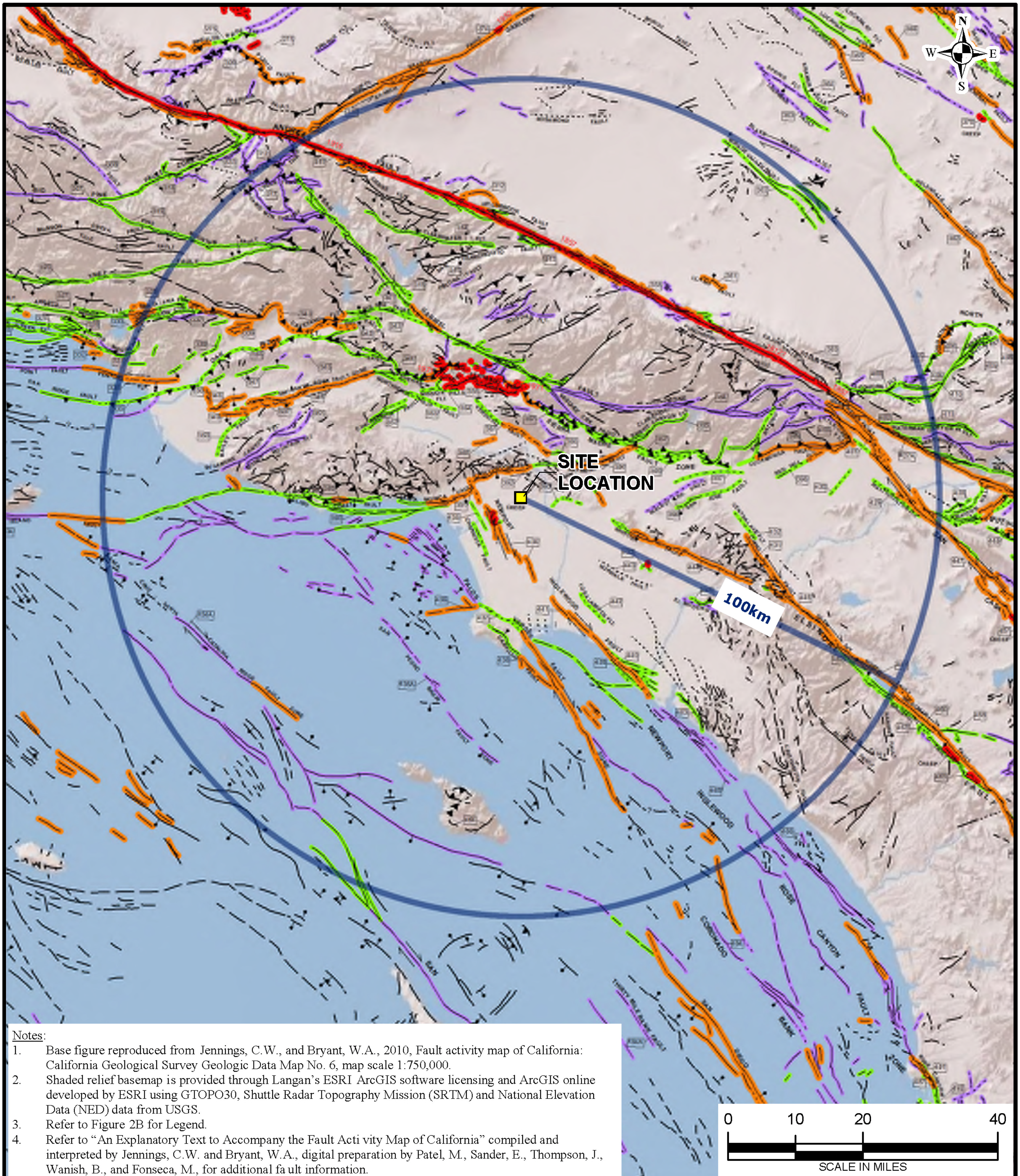
Project	Figure Title	Project No.	Figure No.
PROPOSED MENLO AVENUE APARTMENT LOS ANGELES LOST ANGELES COUNTY CALIFORNIA	SITE VICINITY MAP	700069501 Date: DECEMBER 2019 Scale: 1" = 1000' Drawn By: LAV	1



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 Figure 2B for Legend.
4. Refer to "An Explanatory Text to Accompany the Fault Acti vity 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 fa ult information.

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Project	Figure Title	Project No.	Figure
PROPOSED MENLO AVENUE BUILDING LOS ANGELES LOS ANGELES COUNTY CALIFORNIA	CGS FAULT ACTIVITY MAP OF CALIFORNIA	700069501 Date: DECEMBER 2019 Scale: 1 inch = 20 miles Drawn By: NM	2A

LEGEND:

Site Location

Fault Age

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

- Historic
- Holocene
- Late Quaternary
- Quaternary
- 100 km

Pre Quaternary Faults

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

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, barball
- fault, dashed, barball
- fault, dotted, barball
- dextral fault, solid, barball
- fault, dotted, queried, ballbar
- fault, dotted, queried, ballbar (2)
- fault, solid, dip
- fault, dashed, dip
- fault, dotted, dip
- reverse fault, solid
- reverse fault, dashed
- reverse fault, dotted

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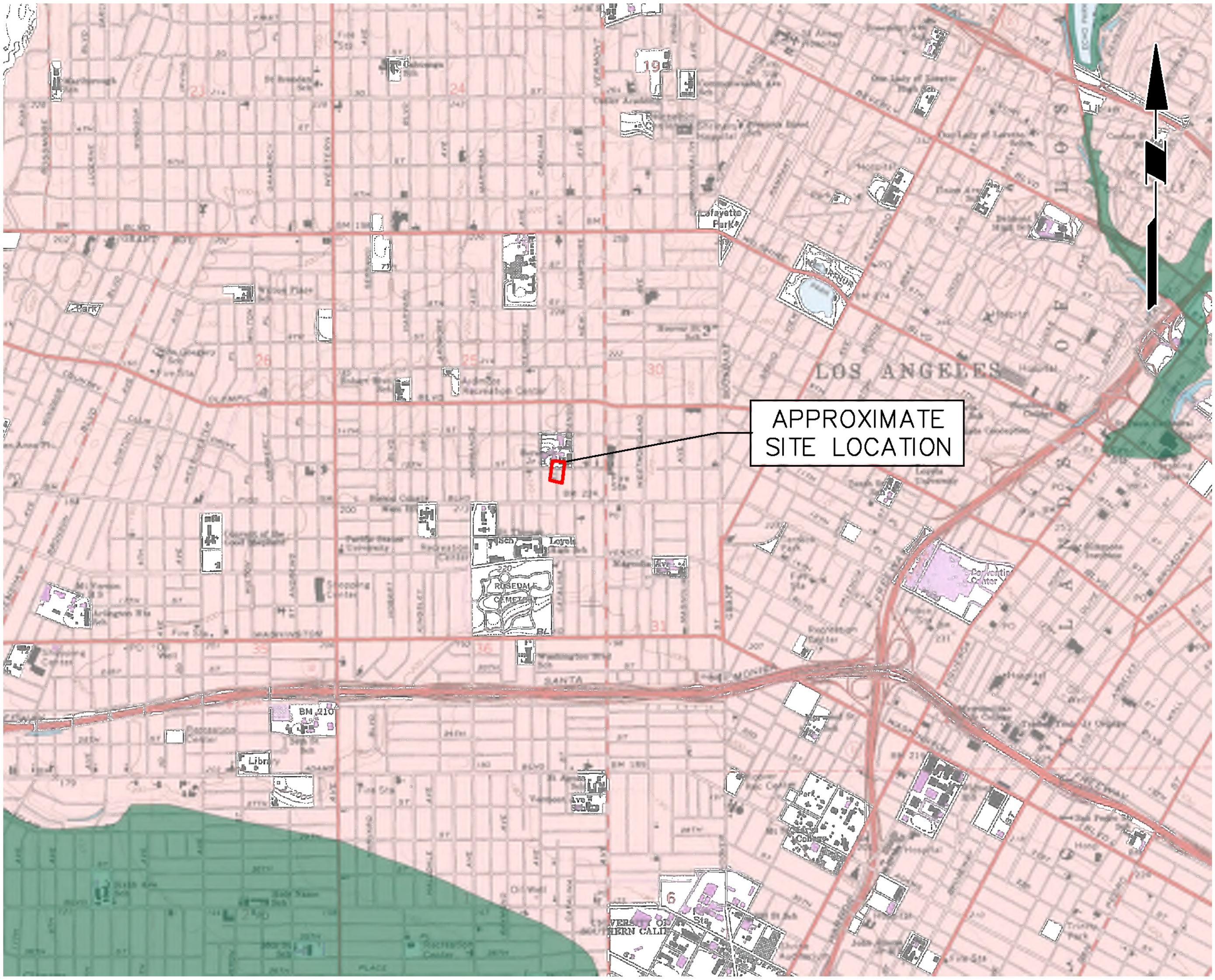
Project	Figure Title	Project No.	Figure
PROPOSED MENLO AVENUE BUILDING LOS ANGELES LOS ANGELES COUNTY — CALIFORNIA	CGS FAULT ACTIVITY MAP OF CALIFORNIA LEGEND	700064601 Date: DECEMBER 2019 Scale: NOT TO SCALE Drawn By: NM	2B



Sources: California Department of Conservation – Division of Mines and Geology (DMG), "Seismic Hazard Zone Report for the Hollywood 7.5–Minute Quadrangle, Los Angeles County, California," Seismic Hazard Zone Report 026, revised 13 January 2016 with the earthquake zones of required investigation revised on 6 November 2014. Base map enlarged from U.S.G.S. 30 x 60–minute series.

NOTES:

1. THE INFORMATION PRODUCED IS BASED ON A "DESK STUDY" OF PUBLICLY AVAILABLE INFORMATION PERFORMED BY OTHERS, WHICH WE HAVE RELIED UPON AS BEING AS ACCURATE AND REPRESENTATIVE OF THE SITE CONDITIONS. THE ABSENCE OF A FEATURE IS NOT A CONFIRMATION THAT THE FEATURE IS NOT PRESENT AT THE SUBJECT LOCATION. INFORMATION PRODUCED IS IN THE PUBLIC DOMAIN AND, UNLESS NOTED, HAS NOT BEEN FIELD VERIFIED OR PROVIDED FOR ANY SPECIFIC USE.

LEGEND:

- APPROXIMATE SITE LIMITS
- ALQUIST–PRIOLO SPECIAL STUDY ZONE
- LIQUEFACTION INVESTIGATION ZONE

1,000 500 0 1,000

SCALE IN FEET

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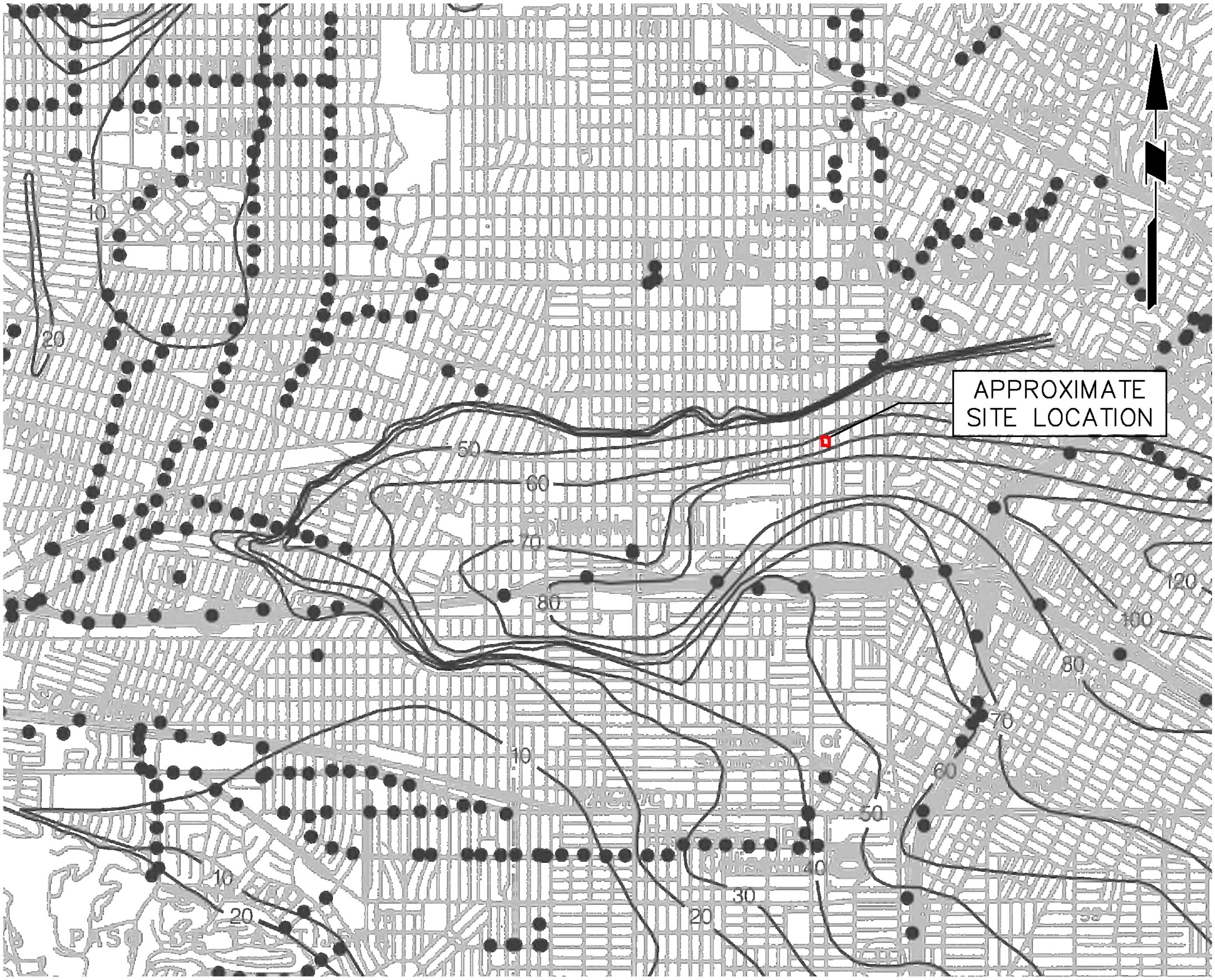
Project	Figure Title	Project No.	Figure No.
PROPOSED MENLO AVENUE APARTMENTS LOS ANGELES LOS ANGELES COUNTY CALIFORNIA	EARTHQUAKE ZONES OF REQUIRED INVESTIGATION	700069501 Date: DECEMBER 2019 Scale: 1" = 1,000' Drawn By: LAV/DJJS	3



<u>Sources:</u> California Department of Conservation – Division of Mines and Geology (DMG), "Seismic Hazard Zone Report for the Hollywood 7.5–Minute Quadrangle, Los Angeles County, California," Seismic Hazard Zone Report 026, revised 13 January 2016 with the earthquake zones of required investigation revised on 6 November 2014. Base map enlarged from U.S.G.S. 30 x 60–minute series.

NOTES:

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LEGEND:

APPROXIMATE SITE LIMITS

30 DEPTH TO GROUNDWATER, IN FEET

5,000 2,500 0 5,000

SCALE IN FEET

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Project	Figure Title	Project No. 700069501	Figure No.
PROPOSED MENLO AVENUE APARTMENTS	HISTORICALLY HIGHEST GROUNDWATER	Date DECEMBER 2019	4
LOS ANGELES		Scale 1" = 5,000'	
LOS ANGELES COUNTY CALIFORNIA		Drawn By LAV/DJJS	

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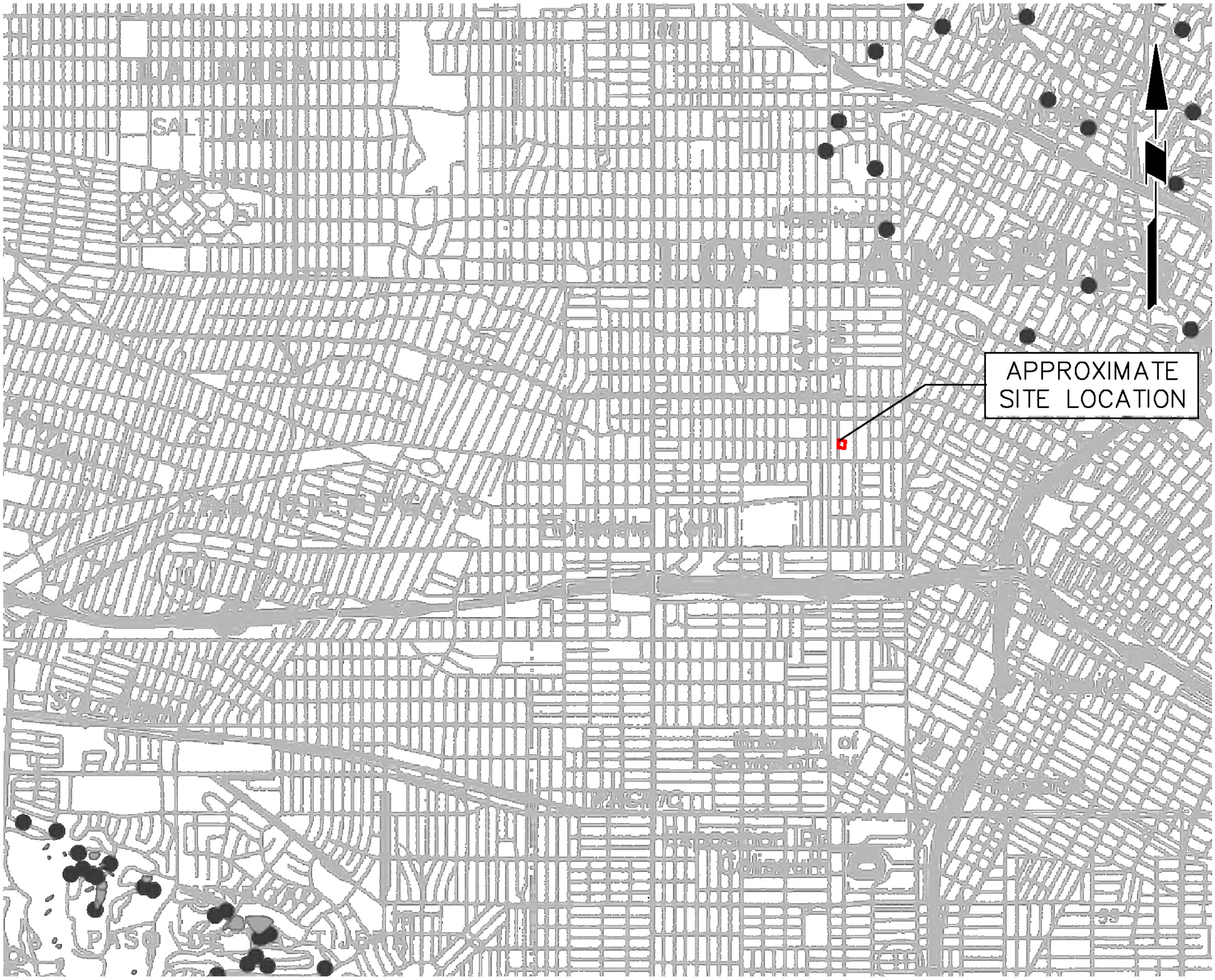

Sources: California Department of Conservation – Division of Mines and Geology (DMG), "Seismic Hazard Zone Report for the Hollywood 7.5-Minute Quadrangle, Los Angeles County, California," Seismic Hazard Zone Report 026, revised 13 January 2016 with the earthquake zones of required investigation revised on 6 November 2014. Base map enlarged from U.S.G.S. 30 x 60-minute series.

NOTES:

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LEGEND:

- APPROXIMATE SITE LIMITS
- AREAS OF LANDSLIDE
- AREAS OF SIGNIFICANT GRADING
- SHEAR TEST SAMPLE LOCATION

5,000 2,500 0 5,000

SCALE IN FEET

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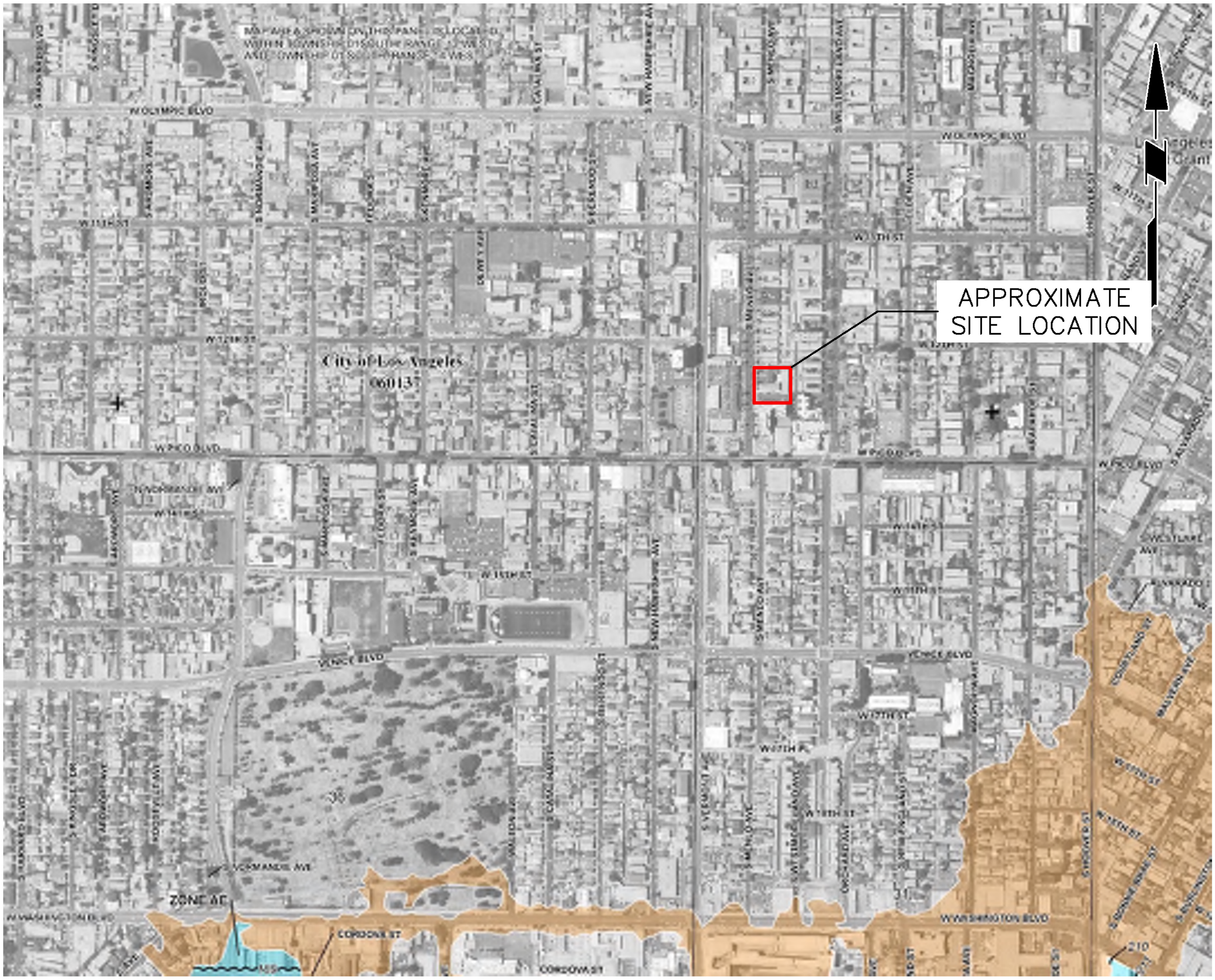

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; FEMA, FEMA RiskMap CDS.

NOTES:

1. THE INFORMATION PRODUCED IS BASED ON A "DESK STUDY" OF PUBLICLY AVAILABLE INFORMATION PERFORMED BY OTHERS, WHICH WE HAVE RELIED UPON AS BEING AS ACCURATE AND REPRESENTATIVE OF THE SITE CONDITIONS. THE ABSENCE OF A FEATURE IS NOT A CONFIRMATION THAT THE FEATURE IS NOT PRESENT AT THE SUBJECT LOCATION. INFORMATION PRODUCED IS IN THE PUBLIC DOMAIN AND, UNLESS NOTED, HAS NOT BEEN FIELD VERIFIED OR PROVIDED FOR ANY SPECIFIC USE.

LEGEND:

APPROXIMATE SITE LIMITS

NO SCREEN 0.2% ANNUAL CHANCE FLOOD HAZARD

ZONE AE AREA OF MINIMAL FLOOD HAZARD

1000 500 0 1000

SCALE IN FEET

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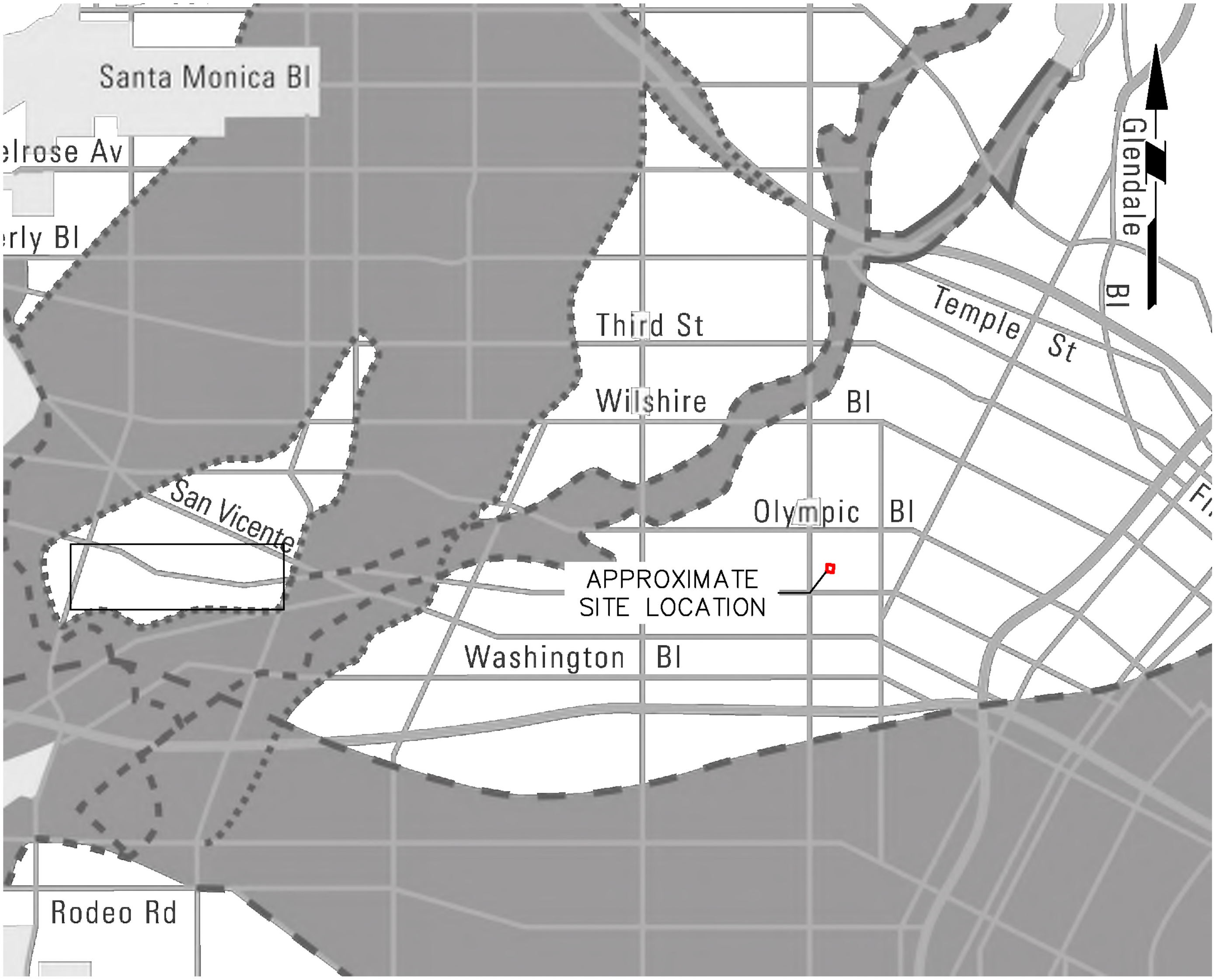

Sources: Department of City Planning Los Angeles, California, "Safety Element of the Los Angeles City General Plan," dated 26 November 1996.

NOTES:

1. THE INFORMATION PRODUCED IS BASED ON A "DESK STUDY" OF PUBLICLY AVAILABLE INFORMATION PERFORMED BY OTHERS, WHICH WE HAVE RELIED UPON AS BEING AS ACCURATE AND REPRESENTATIVE OF THE SITE CONDITIONS. THE ABSENCE OF A FEATURE IS NOT A CONFIRMATION THAT THE FEATURE IS NOT PRESENT AT THE SUBJECT LOCATION. INFORMATION PRODUCED IS IN THE PUBLIC DOMAIN AND, UNLESS NOTED, HAS NOT BEEN FIELD VERIFIED OR PROVIDED FOR ANY SPECIFIC USE.

LEGEND:

- APPROXIMATE SITE LIMITS
- FLOOD CONTROL BASIN
- POTENTIAL INUNDATION AREAS

5,000 2,500 0 5,000

SCALE IN FEET

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Filename: \\langan.com\data\IRV\data5\700069501\Project Data\CAD\01\2D-DesignFiles\Geotechnical\700066901 Section 3 Figures.dwg Date: 12/2/2019 Time: 13:57 User: lvazquez Style Table: Langan.stb Layout: 7

Sources: Department of City Planning Los Angeles, California, "Safety Element of the Los Angeles City General Plan," dated 26 November 1996.

NOTES:

1. THE INFORMATION PRODUCED IS BASED ON A "DESK STUDY" OF PUBLICLY AVAILABLE INFORMATION PERFORMED BY OTHERS, WHICH WE HAVE RELIED UPON AS BEING AS ACCURATE AND REPRESENTATIVE OF THE SITE CONDITIONS. THE ABSENCE OF A FEATURE IS NOT A CONFIRMATION THAT THE FEATURE IS NOT PRESENT AT THE SUBJECT LOCATION. INFORMATION PRODUCED IS IN THE PUBLIC DOMAIN AND, UNLESS NOTED, HAS NOT BEEN FIELD VERIFIED OR PROVIDED FOR ANY SPECIFIC USE.

LEGEND:

APPROXIMATE SITE LIMITS

MAJOR OIL DRILLING AREA (#16 SALT LAKE OIL FIELD)

BOUNDARIES OF STATE–DESIGNATED OIL FIELDS

5,000 2,500 0 5,000

SCALE IN FEET

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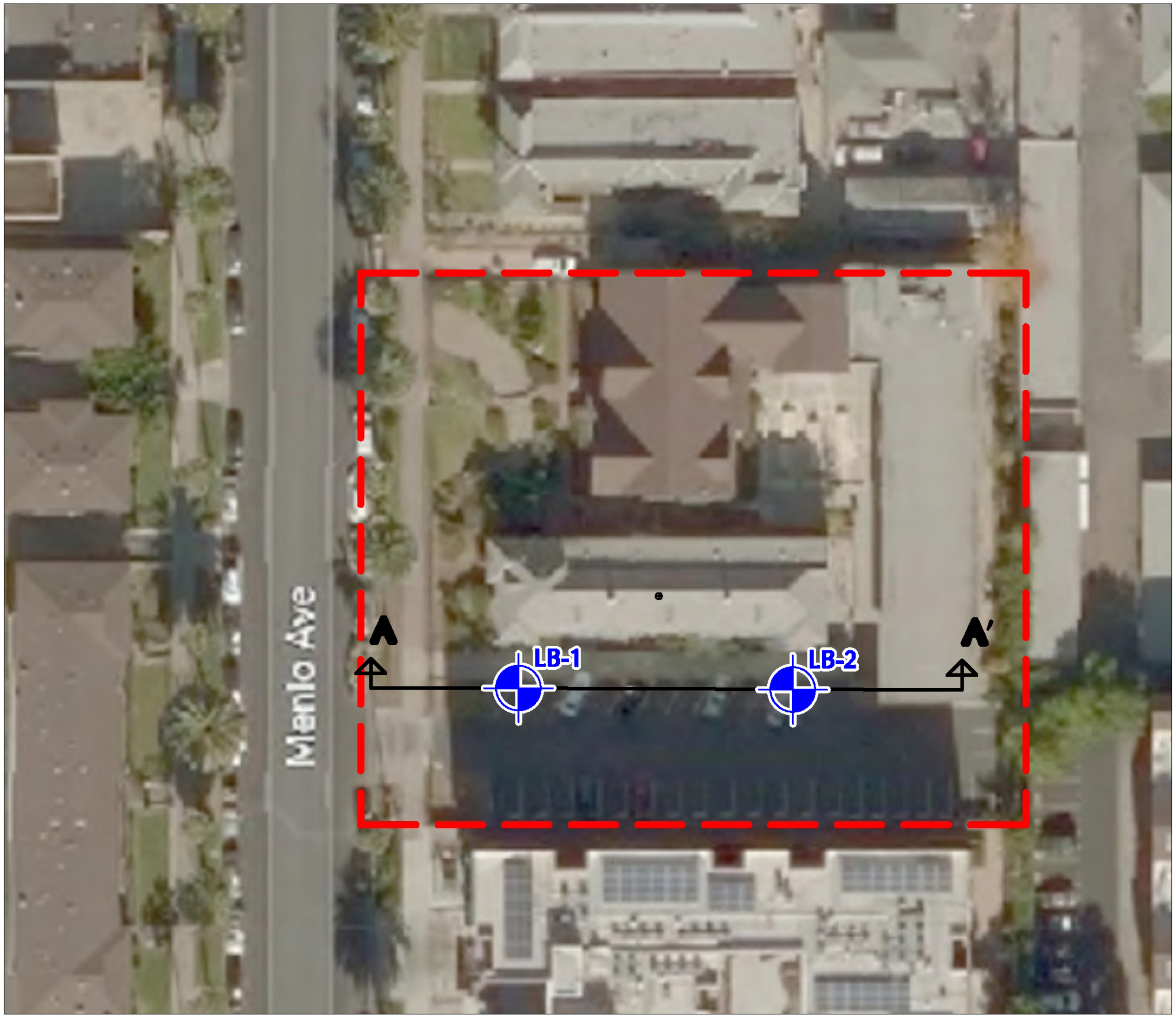
Project	Figure Title	Project No.	Figure No.
PROPOSED MENLO AVENUE APARTMENTS LOS ANGELES LOS ANGELES COUNTY CALIFORNIA	KNOWN OIL FIELD AREAS	700069501 Date: DECEMBER 2019 Scale: 1" = 5,000' Drawn By: DJJS	8



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NOTES:

1. BACKGROUND AERIAL IMAGE OBTAINED FROM BING MAPS ON 23 APRIL 2019
2. LANGAN BORING LB–1 AND LB–2 WERE DRILLED BY MARTINI DRILLING INC ON 15 NOVEMBER 2019 UNDER FULL–TIME OBSERVATION OF A LANGAN FIELD ENGINEER..

LEGEND:

APPROXIMATE SITE LIMITS

LB-2 APPROXIMATE BORING LOCATION

A A' APPROXIMATE CROSS–SECTION LOCATION

60 0 30 60

SCALE IN FEET

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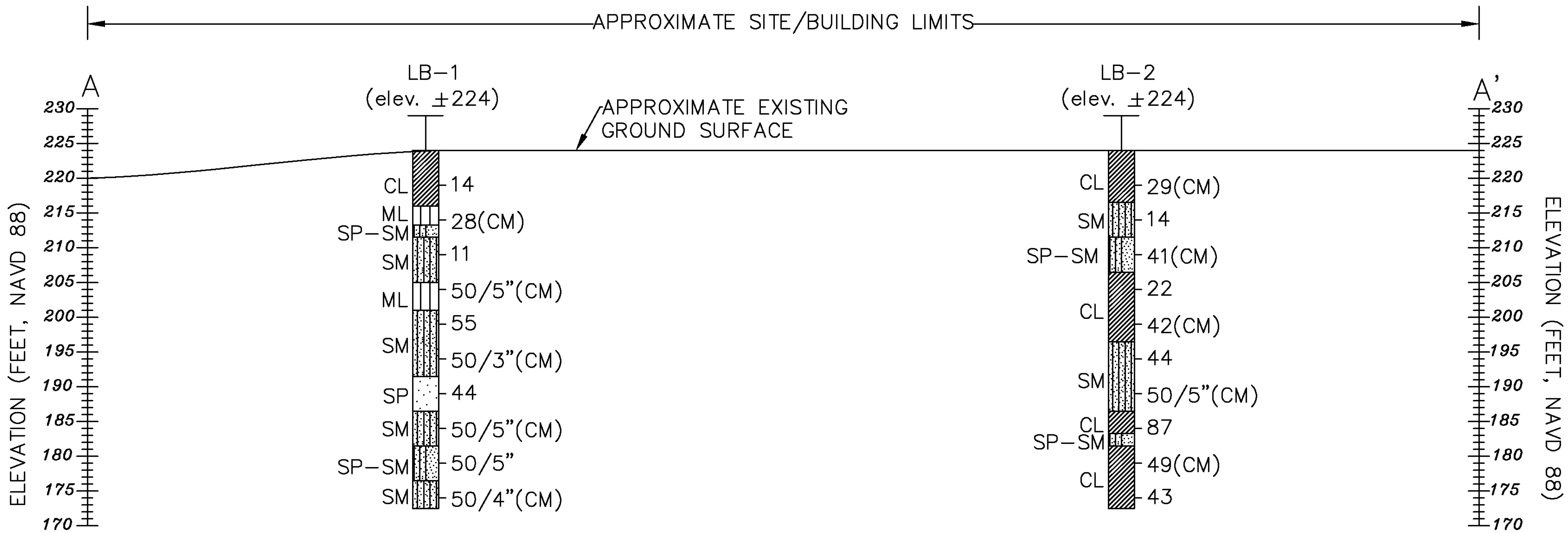
Project	Figure Title	Project No.	Figure No.
PROPOSED MENLO AVENUE BUILDING LOS ANGELES LOS ANGELES COUNTY CALIFORNIA	BORING LOCATION PLAN	700069501 Date: DECEMBER 2019 Scale: 1" = 80' Drawn By: DJJS	9



20 10 0 20
HORIZONTAL/VERTICAL SCALE IN FEET

NOTES:

1. THE FIGURE SHOWS GENERALIZED SUBSURFACE CONDITIONS AT THE RESPECTIVE BORINGS. VARIATIONS IN CONDITIONS SHOULD BE EXPECTED BETWEEN BORINGS. FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED SEE BORING LOGS.

2. LANGAN BORINGS LB−1 AND LB−2 WERE DRILLED BY MARTINI DRILLING INC., ON 15 NOVEMBER 2019 UNDER FULL−TIME ENGINEERING OBSERVATION OF A LANGAN FIELD ENGINEER.

3. SURFACE ELEVATIONS ARE APPROXIMATE AND REFERENCED FROM GOOGLE EARTH.

4. SEE FIGURE 9 FOR LOCATION OF SUBSURFACE CROSS−SECTION A−A'

CL (CLAY)
SM (silty SAND)
SP (poorly graded SAND)
SP−SM (SAND with silt)
ML (SILT)

LEGEND:

LB−2
(elev. ±224)
−#(CM)

LB−1	BORING IDENTIFICATION.
(elev+294)	INFERRED GROUND SURFACE ELEVATION (FEET) AT TIME OF BORING.
#	FIELD STANDARD PENETRATION TEST BLOWCOUNT: NUMBER OF BLOWS OF A 140−LBS AUTOMATIC HAMMER FREE FALLING 30 INCHES TO DRIVE A 2−INCH−O.D. SPLIT SPOON SAMPLER 12 INCHES AFTER AN INITIAL PENETRATION OF 6 INCHES.
#(CM)	FIELD STANDARD PENETRATION TEST BLOWCOUNT: NUMBER OF BLOWS OF A 140−LBS AUTOMATIC HAMMER FREE FALLING 30 INCHES TO DRIVE A 3−IN−O.D. CALIFORNIA MODIFIED SAMPLER 12 INCHES AFTER 6 INCHES OF INITIAL PENETRATION.

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Project
PROPOSED MENLO AVENUE BUILDING
LOS ANGELES
LOS ANGELES COUNTY CALIFORNIA

Figure Title
GENERALIZED CROSS-SECTION A-A'

Project No.	700069501
Date	DECEMBER 2019
Scale	1" = 20'
Drawn By	MAG/DJJS
Figure No.	10

Filename: \\langan.com\data\IRV\data5\700069501\Project Data\CAD\01\2D-DesignFiles\Geotechnical\Cross-Section A-A'.dwg Date: 12/3/2019 Time: 09:22 User: djudge Style Table: Langan.stb Layout: Layout1

APPENDIX A
Seismicity Search Results

TABLE A.1 - USGS 2008 CALIFORNIA SEISMIC SOURCE MODEL PARAMETERS

Fault Name	Distance from Site (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Fault Length (km)
Puente Hills	0.5	Northeast	7.10	0.7	17
Puente Hills (LA)	3.8	Southwest	7.00	0.7	11
Elysian Park (Upper)	5	Northeast	6.70	1.3	20
Santa Monica Connected alt 2	6	Northwest	7.40	2.4	93
Hollywood	7	North	6.70	1	17
Newport Inglewood Connected alt 2	8	West	7.50	1.3	208
Newport Inglewood Connected alt 1	8.6	West	7.50	1.3	208
Newport-Inglewood, alt 1	8.6	West	7.20	1	65
Raymond	10.3	Northeast	6.80	1.5	23
Santa Monica Connected alt 1	11.4	West	7.30	2.6	80
Santa Monica, alt 1	11	West	6.40	1	14
Verdugo	13.2	Northeast	6.90	0.5	29
Sierra Madre	20	Northeast	7.20	2	57
Sierra Madre Connected	20.3	Northeast	7.30	2	76
Puente Hills (Santa Fe Springs)	21	Southeast	6.90	0.7	23
Malibu Coast, alt 1	22	West	6.70	0.3	38
Malibu Coast, alt 2	22	West	7.00	0.3	38
Elsinore;W	23	East	7.03	2.5	46
Elsinore;W+GI	23	East	7.27	n/a	83
Elsinore;W+GI+T	23	East	7.48	n/a	124
Elsinore;W+GI+T+J	23	East	7.77	n/a	200
Elsinore;W+GI+T+J+CM	23	East	7.85	n/a	242
Anacapa-Dume, alt 2	24	West	7.20	3	65
Palos Verdes	24.6	Southwest	7.30	3	96
Palos Verdes Connected	24.6	Southwest	7.70	3	285
Sierra Madre (San Fernando)	25.3	North	6.70	2	18
Puente Hills (Coyote Hills)	28.6	Southeast	6.90	0.7	22
San Gabriel	30	North	7.30	1	71
Northridge	30	North	6.90	1.5	33
Clamshell-Sawpit	30	East	6.70	0.5	16

Notes:

1. Seismic source model parameters obtained from USGS 2008 National Seismic Hazard Maps on 20 November 2019.
2. Search results include sources within 20 mi (32 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]
3/29/2014	33.9325	-117.9158333	5.1	mw	37
7/29/2008	33.9485	-117.7663333	5.44	mw	50
4/26/1997	34.369	-118.67	5.07	ml	50
6/26/1995	34.394	-118.669	5.02	ml	52
3/20/1994	34.231	-118.475	5.24	ml	26
1/29/1994	34.306	-118.579	5.06	ml	39
1/19/1994	34.378	-118.619	5.07	ml	47
1/19/1994	34.379	-118.712	5.06	ml	53
1/18/1994	34.377	-118.698	5.24	ml	52
1/17/1994	34.326	-118.698	5.58	ml	49
1/17/1994	34.34	-118.614	5.2	ml	44
1/17/1994	34.275	-118.493	5.89	ml	31
1/17/1994	34.213	-118.537	6.7	mw	29
6/28/1991	34.27	-117.993	5.8	mw	37
2/28/1990	34.144	-117.697	5.51	ml	56
12/3/1988	34.151	-118.13	5.02	ml	19
10/4/1987	34.074	-118.098	5.25	ml	18
10/1/1987	34.061	-118.079	5.9	mw	20
9/4/1981	33.5575	-119.1195	5.45	ml	94
1/1/1979	33.9165	-118.6871667	5.21	ml	39
2/21/1973	33.979	-119.0501667	5.3	mw	70
2/9/1971	34.416	-118.37	5.3	mh	42
2/9/1971	34.416	-118.37	5.8	mh	42
2/9/1971	34.416	-118.37	5.8	mh	42
2/9/1971	34.416	-118.37	6.6	mw	42
9/12/1970	34.2548333	-117.5343333	5.22	ml	73
11/14/1941	33.7906667	-118.2636667	5.12	ml	29
5/31/1938	33.6993333	-117.5111667	5.23	ml	82
3/11/1933	33.85	-118.266	5	ml	22
3/11/1933	33.6238333	-118.0011667	5.29	mh	54
3/11/1933	33.7666667	-117.985	5.02	mh	42
3/11/1933	33.6308333	-117.9995	6.4	mw	54
8/31/1930	34.03	-118.643	5.25	ms	33
4/18/1928	34.1	-119.3	5.2	uk	93
8/4/1927	34	-118.5	5.3	uk	20
7/23/1923	34	-117.25	5.96	mw	96
10/23/1916	34.7	-119	5.5	ml	97
5/15/1910	33.7	-117.4	5.3	mw	91
5/13/1910	33.7	-117.4	5	ml	91
4/11/1910	33.7	-117.4	5	ml	91

Notes:

1. Earthquake Catalog Search results obtained from USGS ANSS Comprehensive Catalog on 20 November 2019.
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

LANGAN

Project: Modular Apartment		Project No.: 700069501	
Location: 1216-1220 Menlo Avenue		Elevation and Datum: Appxm 224 (Google Earth)	
Drilling Company: Martini Drilling		Date Started: 11/15/19	Date Finished: 11/15/19
Drilling Equipment: Truck Mounted CME75		Completion Depth: 51.5 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. HSA Tooth Bit		Number of Samples: Disturbed 10; Undisturbed; Core	
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.): First ▽; Completion ▼; 24 HR. ▼	
Casing Hammer:	Weight (lbs): ; Drop (in):	Drilling Foreman: Darik Martini	
Sampler: 2-inch O.D. split spoon; 3-inch O.D. Cal Mod, Bulk			
Sampler Hammer: Automatic	Weight (lbs): 140; Drop (in): 30	Field Engineer: Luis Vazquez	

Elev. (ft)	Sample Description	Depth Scale (ft)	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
224.0 – 223.7	Asphalt	0						AC = 4"
223.7 – 216.0	Brown, silty CLAY, [CL], moist.	0.3 – 8						
	Stiff, brown, CLAY, trace fine-grained sand, [CL], moist.	5 – 6.5	S-1	SS	18	3 / 5 / 9	14	
216.0 – 213.3	Very stiff, light brown, clayey SILT, [ML], moist.	8 – 10.7	S-2A	CR	18	3 / 7 / 21	28	
213.3 – 211.5	Medium dense, light brown, fine to coarse-grained SAND, trace silt, [SP-SM], moist.	10.7 – 12.5	S-2B					
211.5 – 205.0	Medium dense, light tannish-brown, silty fine-grained SAND, [SM], moist.	12.5 – 19	S-3	SS	18	4 / 5 / 6	11	
205.0		19 – 20						

Project	Project No.
Modular Apartment	700069501
Location	**Elevation and Datum**
1216-1220 Menlo Avenue	Appxm 224 (Google Earth)

Elev. (ft)	Sample Description	Depth Scale	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
204.0	Hard, light tannish-brown, clayey SILT, [ML], moist.	20	S-4	CR	17	9, 22, 50/5	50/5	
201.0	Very dense, light brown, silty fine-grained SAND, [SM], moist	25	S-5	SS	18	9, 18, 37	55	
	Dense, light brown, silty fine-grained SAND, [SM], moist.	30	S-6	CR	15	8, 28, 50/3	50/3	
191.5	Dense, light yellowish-brown, fine to medium-grained SAND, [SP], moist.	35	S-7	SS	18	13, 17, 27	44	
186.5	Very dense, light yellowish-brown, fine to medium-grained SAND, [SM], moist.	40	S-8	CR	17	10, 33, 50/5	50/5	
181.5		45						

LANGAN

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

Project	Project No.
Modular Apartment	700069501
Location	**Elevation and Datum**
1216-1220 Menlo Avenue	Appxm 224 (Google Earth)

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
179.0	Very dense, light brown, fine to coarse-grained SAND, trace silt, trace fine gravel, [SP-SM], moist.	45	S-9	SS	11	19 50/5	50/5	
176.5	Very dense, light brown, silty fine to coarse-grained SAND, [SM], moist.	50	S-10	CR	16	9 37 50/4	50/4	
172.5	Bottom of boring at 51.5 feet. Grouted with cement slurry. Cold asphalt patch. Groundwater not encountered.	52						

Depth scale: 45 – 70

LANGAN

Project: Modular Apartment		Project No.: 700069501	
Location: 1216-1220 Menlo Avenue		Elevation and Datum: Appxm 224 (Google Earth)	
Drilling Company: Martini Drilling		Date Started: 11/15/19	Date Finished: 11/15/19
Drilling Equipment: Truck Mounted CME75		Completion Depth: 51.5 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. HSA Tooth Bit		Number of Samples: Disturbed 10; Undisturbed; Core	
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.): First ▽; Completion ▼; 24 HR. ▼	
Casing Hammer: Weight (lbs): Drop (in):		Drilling Foreman: Darik Martini	
Sampler: 2-inch O.D. split spoon; 3-inch O.D. Cal Mod, Bulk		Field Engineer: Luis Vazquez	
Sampler Hammer: Automatic; Weight (lbs): 140; Drop (in): 30			

Elev. (ft)	Sample Description	Depth Scale (ft)	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
224.0 – 223.7	Asphalt	0						AC = 4"
223.7 – 216.5	Dark brown, sandy CLAY, (CL), moist.	0.3 – 7.5						
	Very stiff, brown, silty CLAY, trace fine-grained sand, [CL], moist.	5 – 6.5	S-1	CR	18	4 / 12 / 17	29	
216.5 – 211.5	Medium dense, light brown, silty fine-grained SAND, trace clay, [SM], moist.	10 – 11.5	S-2	SS	18	2 / 5 / 9	14	
211.5 – 206.5	Medium dense, light tannish-brown, fine-grained SAND with silt, [SP-SM], moist.	15 – 16.5	S-3	CR	18	4 / 16 / 25	41	
206.5 –		17.5 – 20						

Project	Project No.
Modular Apartment	700069501
Location	**Elevation and Datum**
1216-1220 Menlo Avenue	Appxm 224 (Google Earth)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	204.0		20						
		Very stiff, dark brown, CLAY, trace fine-grained sand, [CL], moist.	21	S-4	SS	18	3 8 14	22	
		Very stiff, light brown, CLAY, trace fine-grained sand, [CL], moist.	26	S-5	CR	18	5 15 27	42	
	196.5		27.5						
		Dense, light olive-brown, silty fine-grained SAND, trace clay, [SM], moist.	31	S-6	SS	18	6 16 28	44	
		Dense, light olive-brown, silty fine-grained SAND, [SM], moist.	35.5	S-7	CR	18	11 50/5	50/5	
	186.5		37.5						
		Hard, light brown, silty CLAY, trace sand, [CL], moist.	40.5	S-8A	SS	18	6 37 50	87	
	183.3		40.7						
		Very dense, light brown, fine to medium-grained SAND, trace silt, trace gravel, [SP-SM], moist.	41	S-8B					
	181.5		42.5						
			45						

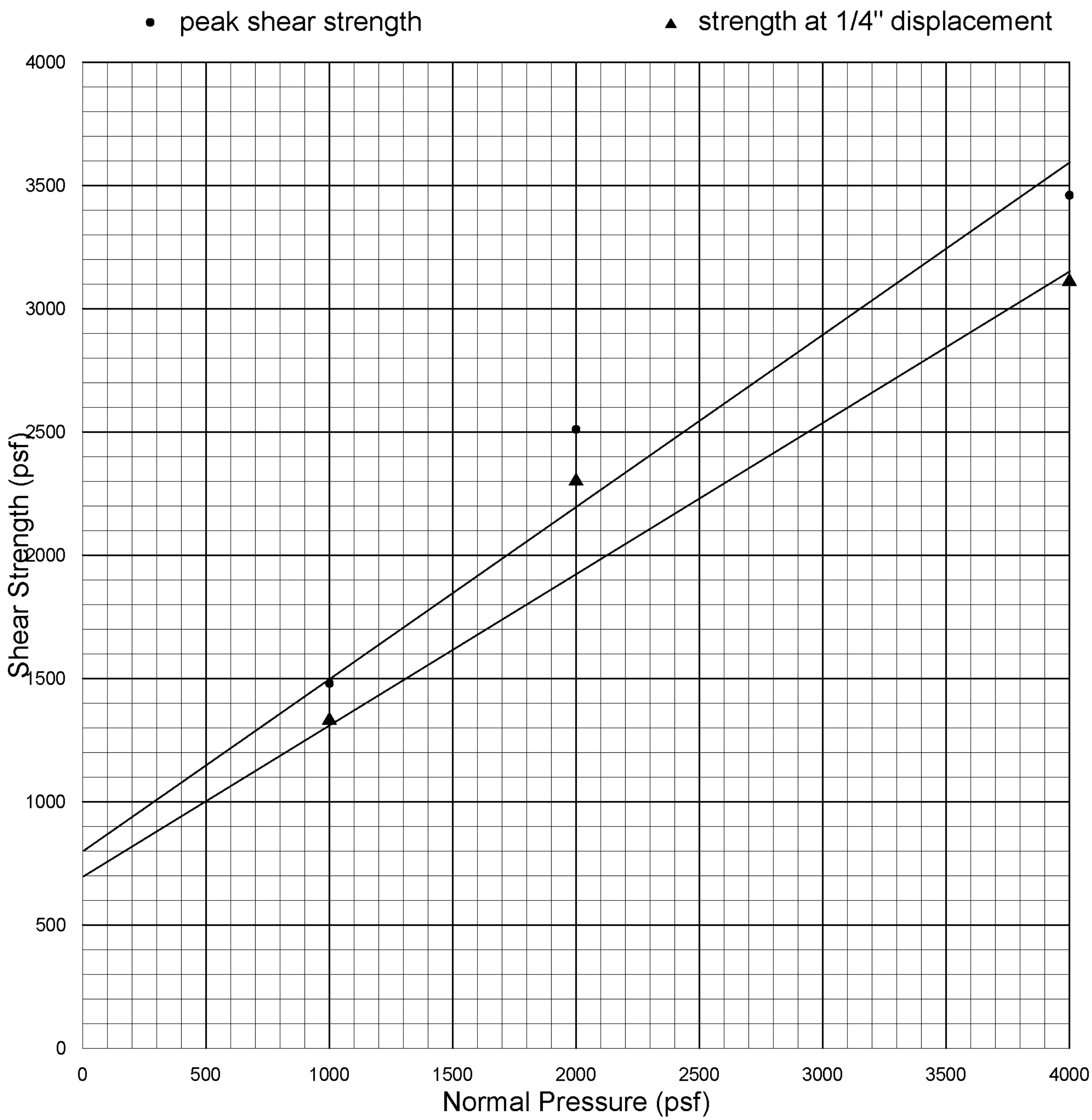
Project	Project No.
Modular Apartment	700069501
Location	**Elevation and Datum**
1216-1220 Menlo Avenue	Appxm 224 (Google Earth)

Elev. (ft)	Sample Description	Depth Scale	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
179.0	Hard, light brown, silty CLAY, trace fine-grained sand, [CL], moist.	45–46.5	S-9	CR	18	6 / 14 / 35	49	
	Hard, light dark-brown, CLAY, trace fine-grained sand, [CL], moist.	50–51.5	S-10	SS	18	5 / 15 / 28	43	
172.5	Bottom of boring at 51.5 feet. Grouted with cement slurry. Cold asphalt patch. Groundwater not encountered.							

Depth scale: 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

APPENDIX C
Laboratory Results

DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
LB-2/S-1	Undisturbed & Saturated	Silty Clay	118.4	15.6	19.4

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1480 @ 0.1050"	1330
2000	2510 @ 0.1550"	2300
4000	3460 @ 0.1300"	3110
	C = 800 psf	C = 700 psf
	ϕ = 35 deg.	ϕ = 31 deg.

Date: 11-21-19

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MOISTURE DENSITY TESTS

PROJECT Langan # 700069501 JOB NO. 2012-0057 BY LD DATE 11/20/19

Sample No.	LB-1 / Bulk	LB-1 / S-2	LB-1 / S-4	LB-2 / S-1	LB-2 / S-3			
Depth (ft)	0 - 5	10.0	20.0	5.0	15.0			
Testing								
Soil Type	Brown, Silty Clay	Brown, Clayey Silt	Brown, Clayey Silt	Brown, Silty Clay	Brown, Silty Sand			
Wet+Tare		776.9	1201.2	1049.0	908.5			
No. Ring		4	6	5	5			
Wet Weight	392.0	153.2	159.4	86.7	134.0			
Dry Weight	333.5	121.5	130.2	75.0	127.4			
Wet density		123.8	128.8	136.9	113.4			
% Water	17.5	26.1	22.4	15.6	5.2			
Dry Density		98.2	105.2	118.4	107.8			
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)								

Geo-Logic ASSOCIATES

Langan # 700069501 SOIL TEST RESULTS *Job No. 2012-0057*

SAMPLE NO.:	LB-1 / Bulk					
DESCRIPTION	Silty Clay					
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 (CTM643) (ohm-cm)	1000					
pH (CTM643)	8.2					
CHEMICAL TESTS						
Soluble Sulfate (CTM 417) (ppm)	362					
Chloride Content (CTM 422) (ppm)	82					
Wash #200 Sieve (ASTM-1140) %						
Sand Equivalent (ASTM D2419)						

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

PROJECT Langan # 700069501 JOB NO. 2012-0057

Sample LB-1 / Bulk By LD
Sta. No.
Soil Type Brown, Silty Clay

Sample By
Sta. No.
Soil Type

Date	Time	Dial Reading	Wet+Tare	585.3	Date		Dial Reading	Wet+Tare	
11/18/2019	13:30	0.448	Tare	220.3				Tare	
		H2O	Net Weight	365				Net Weight	
11/19/2019	12:00	0.3665	% Water	13.5				% Water	
			Dry Dens.	97.4				Dry Dens.	
			% Max					% Max	
			Wet+Tare	642.7				Wet+Tare	
			Tare	220.3				Tare	
			Net Weight	422.4				Net Weight	
INDEX	82	8.2%	% Water	31.3	**INDEX**			% Water	

Sample By
Sta. No.
Soil Type

Sample By
Sta. No.
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	

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WASH #200 SIEVE - ASTM D 1140-92

Job Name Langan # 700069501 Date 11-20-19

Job No. 2012-0057 By LD

Sample	LB-1 / Bulk	**Sample**	LB-1 / S-2	**Sample**	LB-1 / S-4
Soil Type		Soil Type		Soil Type	
% water	0	% water	0	% water	0
Wet weight	134	Wet weight	121.5	Wet weight	130.2
Dry weight	134	Dry weight	121.5	Dry weight	130.2
+ 200 sieve	28.4	+ 200 sieve	17.8	+ 200 sieve	16.4
% Retained	21.2	% Retained	14.7	% Retained	12.6
%Pass. #200	**79**	**%Pass. #200**	**85**	**%Pass. #200**	**87**

Sample	LB-2 / S-3	**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water	0	% water		% water	
Wet weight	127.4	Wet weight		Wet weight	
Dry weight	127.4	Dry weight		Dry weight	
+ 200 sieve	114.4	+ 200 sieve		+ 200 sieve	
% Retained	89.8	% Retained		% Retained	
%Pass. #200	**10**	**%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**	

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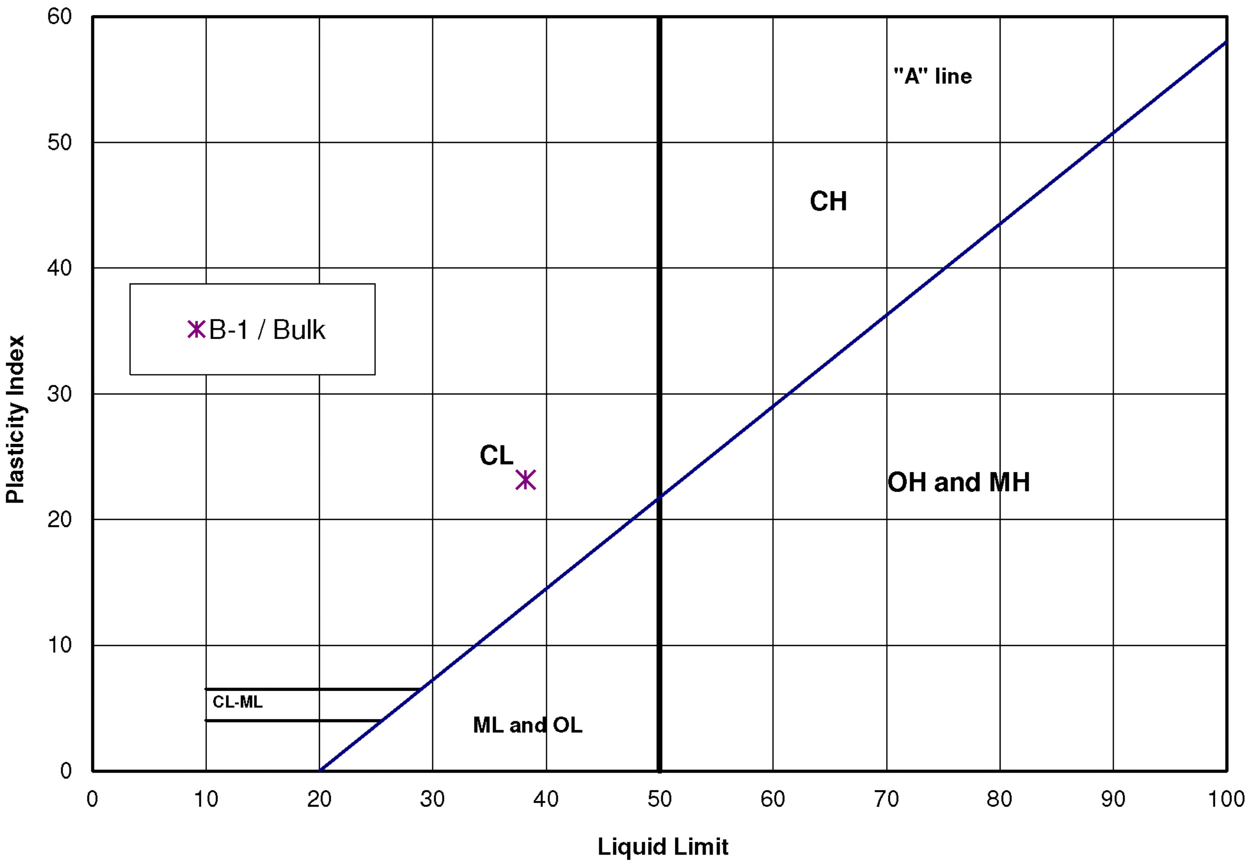
PLASTICITY INDEX _ ASTM D4318



Sample	Depth	LL	PL	PI	USCS	Material Description
B-1 / Bulk	0 - 5'	38	15	23	CL	

Job Name: Langan # 700069501 Date: 11/20/19

Job No.: 2012-0057

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