Communication from Public

Name: jesse barruquin
Date Submitted: 04/14/2025 07:48 AM
Council File No: 25-0287
Comments for Public Posting: Proximity of Proposed Development to the Charnock Fault and Required Geologic Investigation Applicable Building Code Requirements (LA County §113.5) Los Angeles County Building Code Section 113.5 explicitly prohibits constructing any building over or upon the trace of a known active earthquake fault. It further mandates a geologic investigation if a proposed building is within 50 feet of the assumed or probable trace of a known active fault? pw.lacounty.gov . In practice, this means: No structure can be placed directly on top of an active fault's mapped trace (as delineated on official maps maintained by the Building Official)? pw.lacounty.gov . If construction is proposed within 50 feet of the fault trace (or its most likely location on site), a licensed geologist must investigate to determine the fault's exact location and confirm whether the site is underlain by an active fault? pw.lacounty.gov . These requirements reflect both the County's code and the intent of California's Alquist-Priolo Act to prevent surface rupture hazards. Notably, the County's 50-foot investigation zone aligns with state guidelines presuming that the area within 50 feet of an active fault could be underlain by branch faults? pw.lacounty.gov . In summary, if the Charnock Fault (or any active fault) lies within about 50 feet of 6136 W. Manchester/8651 S. La Tijera, a fault rupture hazard study (trenching and geologic analysis) is legally required before project approval? pw.lacounty.gov . Building directly atop the fault, if one is found, would be prohibited by code. Location of the Charnock Fault Near 6136 W. Manchester Ave The Charnock Fault is a northwest–southeast trending fault in West Los Angeles, roughly parallel to the better-known Newport-Inglewood Fault Zone? planning.lacity.gov . It runs through the subsurface of the Westside and has been mapped in the general vicinity of Westchester, LAX, and Culver City. According to geologic studies by the City of Los Angeles, the Charnock Fault is the closest fault to Loyola Marymount University (LMU) in Westchester – lying about 0.9 miles northeast of the LMU campus? planning.lacity.gov . This places the fault's trend in the Westchester area, near Sepulveda Boulevard and West Manchester Avenue, just north of LAX. In fact, the Los Angeles World Airports' seismic studies for LAX indicate that the Charnock Fault likely crosses the eastern end of the airport

property (near Sepulveda Blvd/Airport Blvd) and continues northwestward toward the Westchester community? lawa.org ? lawa.org . Although the exact surface trace is concealed and uncertain in this area, multiple sources consistently project the fault line to cross W. Manchester Blvd in the vicinity of Sepulveda Blvd (just west of the project site) before trending further northwest? planning.lacity.gov ? lawa.org . In essence, the proposed development at 6136 W. Manchester/8651 S. La Tijera appears to lie in immediate proximity to the inferred trace of the Charnock Fault – likely on the order of only a few tens of feet from the fault, if not directly over it. This is based on regional fault maps and reports (see Figure below) that show the Charnock Fault running along the west side of the Westchester area, extremely close to the Manchester/Sepulveda intersection. Figure: Excerpt from Westchester–Playa del Rey Community Plan draft EIR showing major fault traces adjacent to the area. The Charnock Fault (blue outline added) is depicted trending NW-SE near the project site in Westchester? planning.lacity.gov . The Newport-Inglewood Fault Zone is to the east. (City of Los Angeles Planning Dept.) Given this information, it is highly likely that the project site is within 50 feet of the Charnock fault's projected ground trace. Because the fault's exact location can vary and is inferred from geologic data, only a detailed site-specific investigation (e.g. fault trenching by a geologist) can determine if the fault actually runs under the property or just adjacent to it. No such investigation appears to have been completed yet for this development. Active vs. Potentially Active Status of the Charnock Fault A key issue is whether the Charnock Fault is officially classified as "active." Under state definitions (CGS Special Publication 42), an "active" fault is one that has evidence of surface rupture in the Holocene (approximately the last 11,000 years). A "potentially active" fault shows Quaternary movement (past 1.6 million years) but no confirmed Holocene rupture? planning.lacity.gov . The Charnock Fault falls into the latter category. Not Alquist-Priolo Active: The State of California does not presently consider the Charnock Fault to be active in the Holocene sense? lawa.org . It is not included in any official Alquist-Priolo Earthquake Fault Zone mapping, and thus state law did not mandate fault-rupture studies for projects here. Los Angeles World Airports' geology report explicitly notes that "The Charnock Fault is not considered active b

Charnock Fault - Public Comment Reference Packet

Submitted Regarding:

6136 W. Manchester Avenue / 8651 S. La Tijera Boulevard

Main Conditional Use Permit (MCUP), Site Plan Review (SPR), and Appeal

Prepared for public review and submission.

This packet contains verified fault hazard documentation and relevant regulatory materials to support a request for formal geologic investigation prior to development approval.

Prepared by a concerned citizen

April 2025

Proximity of Proposed Development to the Charnock Fault and Required Geologic Investigation

Applicable Building Code Requirements (LA County §113.5)

Los Angeles County Building Code Section 113.5 explicitly prohibits constructing any building over or upon the trace of a known active earthquake fault and requires a geologic investigation if a proposed building is within 50 feet of the fault trace or its probable location. In practice, this means:

- No structure can be placed directly on top of an active fault's mapped trace (as delineated on official maps maintained by the Building Official).
- If construction is proposed within 50 feet of the fault trace (or its most likely location on site), a licensed geologist must investigate to determine the fault's exact location and confirm whether the site is underlain by an active fault.

These requirements reflect both the County's code and the intent of California's Alquist-Priolo Act to prevent surface rupture hazards. Los Angeles County's 50-foot investigation zone aligns with state guidelines. If the Charnock Fault (or any active fault) lies within 50 feet of 6136 W. Manchester/8651 S. La Tijera, a fault rupture hazard study is required before project approval. Building directly atop the fault, if found, is prohibited.

Location of the Charnock Fault Near 6136 W. Manchester Ave

The Charnock Fault is a northwest-southeast trending fault in West Los Angeles, roughly parallel to the Newport-Inglewood Fault Zone. It runs through the subsurface of the Westside and has been mapped in the general vicinity of Westchester, LAX, and Culver City. Geologic studies show that the Charnock Fault likely crosses the eastern end of LAX property (near Sepulveda Blvd/Airport Blvd) and continues northwest toward Westchester. This places the proposed development at 6136 W. Manchester/8651 S. La Tijera very close-likely within 50 feet-of the inferred fault trace.

Active vs. Potentially Active Status of the Charnock Fault

The State of California does not currently classify the Charnock Fault as active (no Alquist-Priolo zoning), but it is geologically classified as potentially active. It has shown movement in the past (late Quaternary) but no evidence of Holocene surface rupture. Sources including USGS and local planning EIRs confirm this status. Therefore, while state law doesn't mandate investigation under the Alquist-Priolo Act, local code and best practice support a geologic investigation due to uncertainty and proximity.

Evidence of Fault Hazard and Past Ground Rupture

No historical surface rupture on the Charnock Fault has been recorded in the Westchester area. However, the absence of observed rupture does not rule out hazard. The fault may be buried or blind. Los Angeles World Airports' reports analyzed what-if rupture scenarios and found that while rupture risk is low, the potential exists. Predicted offsets in the event of rupture could be significant. Therefore, lack of past rupture is not a guarantee of safety.

Implications Under Code and Recommendation for Geologic Investigation

Given that the proposed development sits within the 50-foot threshold of the fault trace, a geologic investigation is required by Los Angeles County Code §113.5. Only trenching and subsurface exploration can determine whether an active fault underlies the property. Without this, construction may violate code and expose future occupants to hazard. Publicly available fault maps and EIRs justify this requirement.

References:

- Los Angeles County Building Code §113.5
- USGS Quaternary Fault Database
- LAX Master Plan EIS/EIR
- City of LA Westchester-Playa del Rey Community Plan Draft EIR (2003)

- Loyola Marymount University Master Plan DEIR (2010)

113.5 - Construction Limitations.

No building or structure shall be constructed over or upon the trace of a known active earthquake fault which is shown on maps maintained by the Building Official. These maps include, but are not limited to, earthquake fault zone maps prepared under Sections 2622 and 2623 of the California Public Resources Code.

The absence of a known active earthquake fault trace at the proposed building location shall be determined by a professional geologist licensed in the State of California in the following cases:

1. When the proposed building is within (50) feet (15.24 m) of that line designated by the Building Official as the assumed location of a known active earthquake fault on the aforementioned maps.
2. When the proposed building is within 50 feet (15.24 m) of the most probable ground location of the trace of a known active earthquake fault shown on the aforementioned maps.

In these cases the Building Official may require the excavation of a trench, for the purpose of determining the existence of an active earthquake fault. Such a trench will be required if a lack of distinguishable fault features in the vicinity prevents the Building Official from determining by a site examination, review of available aerial photographs, or by other means that the fault trace does not underlie the proposed building. The trench shall be approximately perpendicular to the most probable direction of the fault trace, at least 1-1/2 feet (0.15 m) wide, and at least five feet in depth measured from natural grade, or to a depth satisfactory to the Building Official.

The trench must be accessible for mapping and inspection by the Building Official, when requested, and meet the requirements of Title 8 of the California Code of Regulations, Construction Safety Orders. The trench need not extend further than the full width of the proposed structure plus 5 feet (1.52 m) beyond the traversed exterior walls. A known active earthquake fault shall be presumed nonexistent if an exposure is not found by the professional geologist in the walls or floor of the trench.

The Building Official may require a more extensive investigation by a professional geologist as evidence to the absence of a known active earthquake fault prior to the issuance of a permit for Groups A, E, I, H and R, Division 1 Occupancies and B, F, M and S Occupancies over one story in height.

The results of the investigation, conclusions and recommendations shall be presented in a geology report prepared by a professional geologist as defined by Section 113.3. The report shall comply with the guidelines presented in Note 49 prepared by the California Department of Conservation, Geological Survey.

The Building Official may waive the requirements for an active earthquake fault investigation for additions to existing one- or two-family dwelling units when all of the following conditions are met:

1.

Jump to Navigation

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Charnock fault (Class A) No. 277

Last Review Date: 2017-07-01

citation for this record: **Bryant, W.A., compiler, 2017, Fault number 277, Charnock fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:52 PM.**

Synopsis	
Name comments	**Fault ID:** Refers to fault number 435 of Jennings (1994).
County(s) and State(s)	CALIFORNIA
Physiographic province(s)	
Reliability of location	Compiled at 1:24,000 scale. *Comments:*
Geologic setting	
Length (km)	km.

Average strike	
Sense of movement	
Dip	
Paleoseismology studies	
Geomorphic expression	
Age of faulted surficial deposits	
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:*
Recurrence interval	
Slip-rate category	Unspecified
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
References	#8036 Castle, R.O., 1960, Surficial geology of the Beverly Hills and Venice quadrangles, California: U.S. Geological Survey Open-File Report, map scale 1:48,000. #2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000.

4.22 Earth/Geology (CEQA)

4.22.1 Introduction

The earth/geology analysis addresses the potential for the Master Plan alternatives to increase the consequences of adverse geologic conditions and hazards including earthquake-induced ground shaking, earthquake fault surface rupture, earthquake-induced liquefaction and settlement, non-seismic settlement, expansive soils, slope stability, oil field gases, and construction. Information pertaining to other hazards, including tsunami, oil field subsidence, and subsidence due to groundwater withdrawal, is provided in Technical Report 12*, Earth/Geology Technical Report*. Technical Report 12*, Earth/Geology Technical Report,* also includes additional information on the affected environment relative to earth/geology and details about the methodologies used to assess baseline conditions and project impacts. Conclusions regarding the significance of impacts provided in this section are strictly for the purposes of CEQA.

Potential impacts of stormwater drainage are discussed in Section 4.7, *Hydrology and Water Quality*; of contaminated earth and groundwater in Section 4.23, *Hazardous Materials*; and of oil and mineral resources in Section 4.17.2, *Natural Resources*.

4.22.2 General Approach and Methodology

This analysis characterizes baseline earth/geologic conditions, processes, hazards, and landforms within the study area and compares them with those for the No Action/No Project Alternative and the four build alternatives. The study area comprises the Master Plan boundaries, as defined in the introduction to this chapter.

Reports prepared by the California Department of Conservation, Division of Mines and Geology (CDMG), the United States Geological Survey (USGS), and others, dated 1954 through 1999, were reviewed to obtain current information regarding geology and faults and earthquake (seismic) hazards in the LAX and Los Angeles region. The *City of Los Angeles General Plan, Safety Element*, was also reviewed. The *Safety Element* identifies critical facilities and lifeline systems that may be vulnerable to damage from a variety of hazards and to which special hazard resistant design features may apply.[758] Additional details on geologic conditions, hazards, analysis methods, and assumptions used in the analysis are included in Technical Report 12*, Earth/Geology Technical Report*. Technical Report 12*, Earth/Geology Technical Report* also includes the comprehensive list of sources -- published references and unpublished reports of consultants' investigations -- that were consulted for this analysis but not cited in this section. The dates of the unpublished consultants' reports range from 1948 to 1992.

Existing geologic and topographic surface conditions at LAX were observed in the field and by reviewing aerial photographs (see Technical Report 12*, Earth/Geology Technical Report,* for a description of aerial photographs). Using this information, potential geologic hazards were identified by generally following the CDMG guidelines for environmental impact reports,[759] supplemented by industry standards. Potential geologic hazards identified in the study area include seismic hazards, slope failure, expansive soils, settlement, erosion, oil field gases, and subsidence. Geologic conditions that could be potentially affected include landforms or unique geological features.

The potential level of seismic ground shaking expected at LAX caused by earthquakes on nearby faults was quantitatively estimated using currently accepted seismic information and theoretical mathematical relationships. Where sufficient data was available, seismic ground shaking estimates were, in turn, used to make limited quantitative assessments of the potential for other related seismic hazards (liquefaction and seismic settlement) at selected locations. Seismic hazard impacts were also evaluated by referring to published reports by the CDMG and the USGS. Additional information on the seismic hazard evaluations is presented in Technical Report 12*, Earth/Geology Technical Report.*

The significance of topography (landform) alterations was evaluated by screening the project for components that could potentially affect existing prominent geologic or topographic features. Estimates

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758 City of Los Angeles, Los Angeles General Plan, Safety Element, 1996.

759 State of California, Division of Mines and Geology, DMG Note 46: Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports, 1996.

of earthwork quantities[760] were evaluated and used to assess the significance of potential erosion and sedimentation, and landform and topography impacts of the LAX Master Plan build alternatives.

Other potential earth/geology related hazards were evaluated using the data sources described above and making a qualitative determination as to whether they posed a general concern in the LAX area. These hazards included tsunami and construction considerations such as earthwork and tunneling. A detailed summary of the potential geologic hazards associated with the project components of the No Action/No Project Alternative and the four build alternatives is provided in **Table F4.22-1**, Matrix of Potential Earth/Geologic Considerations for Major Master Plan Facilities.

To assess whether a given geologic hazard would result in a significant impact, the major components of the four build alternatives were reviewed and compared with the potential geologic hazards identified. For example, the significance of seismically-induced ground shaking was evaluated by identifying the project components with the potential to be affected by ground shaking and quantitatively estimating the potential magnitude of ground shaking. Based on this review, the potential for individual project components to cause new geologic hazards or accelerate existing ones was evaluated.

4.22.3 Affected Environment/Environmental Baseline

Topography and Physiography

LAX is located on the northwestern margin of the Los Angeles Basin Physiographic Province.[761] The majority of LAX lies within the areas known as the Torrance Plain and the El Segundo Sand Hills as shown in **Figure F4.22-1**, Physiographic Map. The El Segundo Sand Hills consist of a three to six mile wide belt of recent and older wind blown sand dunes stretching along the Pacific coast from the Ballona Escarpment south to the Palos Verdes Hills. The El Segundo Sand Hills overlap onto the relatively flat Torrance Plain to the east.[762] The Torrance Plain and the El Segundo Sand Hills continue south from the LAX area. The Pacific Ocean lies to the west of LAX. To the north of LAX lies Ballona Creek and the Ballona Escarpment; to the northeast and east lie the Baldwin Hills and Rosecrans Hills.

LAX lies on a relatively level area at an elevation of about 100 feet above sea level. Most of the original sand dune area to the east of Pershing Drive was graded relatively flat during initial development phases of LAX during the 1940s and 1950s. Much of the west end of LAX (from Pershing Drive west to the ocean) was previously developed with homes that were subsequently removed due to noise impacts from LAX. This area still retains some of the original sand dune landform character, with sand ridges ranging from 85 to 185 feet above sea level and closed depressions of varying height creating local relief of up to 80 feet. The LAX Northside/Westchester Southside area consists of flat to rolling terrain, with small hills and depressions with less than 20 feet of relief.

Two sites close to LAX are being considered for the construction of an off-site fuel farm under Alternative B: Scattergood Generating Station and an oil refinery located south of the airport. The Scattergood Generating Station lies in the western portion of the El Segundo Sand Hills on recent sand dunes. The oil refinery lies adjacent to, and east of, the Scattergood Generating Station and within the El Segundo Sand Hills on recent and older sand dunes. These areas also retain some of the original sand dune character, with sand ridges ranging from 85 to 185 feet above sea level; however, much of the area has been graded or altered by development.

Geology

The geology of the Los Angeles Basin can be characterized as a broad depression in the underlying "basement" rock,[763] which is overlain by a thick sequence of sediments. The geology of the area is further defined by tectonic and structural conditions, those forces and conditions that cause the earth's crust to move and produce the complex system of faults and folds transecting the basin.

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760 Bechtel Corporation, LAX Master Plan Compilation of DEIS Input Data, Alternative C Construction Impacts, April 28, 2000. MARRS Services, Inc., LAX Master Plan Alternative D Compilation of Draft Environmental Impact Statement (DEIS) Construction Impacts Input Data, Excluding Crossfield Taxiway Projects, May 21, 2003.

761 California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, (CDWR Bulletin 104), 1961.

762 California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, (CDWR Bulletin 104), 1961.

763 A series of rocks, generally with complex structure beneath the predominantly sedimentary rocks.

Table F4.22-1

Matrix of Potential Earth/Geologic Considerations for Major Master Plan Facilities

Master Plan Alternatives and Related Major Facilities	Slope Stability	Oil Field Subsidence	Oil Field Gas	Groundwater/ Dewatering	Settlement	Expansion	Fault Surface Rupture	Ground Shaking	Lique-faction	Seismic Stability	Seismic Slope Settlement	Tsunami, Seiche, Flooding	Tunneling	Grading	Existing Foundations
No Action/No Project Alternative															
New Taxiways (North, South Airfields)	-	-	-	-	X	X	-	-	X	-	X	-	-	X	-
2 Remote Boarding Lounges - Westside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	-
Cargo Facility Improvements	-	-	-	-	X	X	X	X	X	-	-	-	-	X	X
I-405/Arbor Street Interchange	X	-	-	-	X	-	X	X	X	X	-	-	-	X	-
Century Cargo Roadway System	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
LAX Northside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	X
Continental City	X	-	-	X	X	X	X	X	-	-	-	-	-	X	-
Alternative A - Added Runway North Facilities															
New Runway 24L Extension/Taxiways	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
New Taxiways over Aviation	-	-	-	-	X	X	X	-	-	-	-	-	-	X	-
New West Terminal, Satellite Concourses & Parking Structure	X	-	X	X	X	-	-	X	X	-	X	-	X	X	X
Redevelop Century Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New East Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Admin/Maintenance Facilities	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Flight Kitchen	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
Ring Road and Regional Roads															
West Terminal Access – Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Westchester Parkway – Realignment/Grade Separations	X	-	-	-	X	X	X	X	X	X	X	-	-	X	-
Aviation Blvd. – Depressed Between Century & Imperial	X	-	-	X	X	X	X	-	-	X	-	-	-	X	-
I-105/Imperial – Extend South to Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Sepulveda – New Interchange, Tunnel, Westchester to Century	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Arbor Vitae – Interchanges	X	-	-	-	X	X	X	X	-	X	-	-	-	X	-
Demolition and Clearing of Acquisition Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Westchester Southside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	-
New Runway 24R/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Relocate Runway 24C/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Relocate Runway 24L/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Upgrade Runway 25R/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-		X	-
Reconstructed Runway 25L/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	X
Reconfiguration of CTA	-	-	-	-	X	X	-	X	X	-	X	-	-	X	X
Automated People Mover	X	-	X	X	X	-	-	X	X	X	X	-	X	X	X
La Cienega Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
South Cargo Complex East	-	-	-	-	X	-	-	X	X	-	X	-	-	X	X
Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Fuel Farm	X	-	-	-	X	-	-	X	X	X	X	-	-	X	X
LAX Expressway	X	-	-	X	X	-	X	X	-	X	-	-	X	X	-
Lincoln Blvd. Interchange	-	-	-	-	X	-	-	-	X	-	X	-	-	X	-
Green Line to West Terminal	X	-	X	X	X	-	X	X	X	X	X	-	X	X	X
Alternative B - Added Runway South Facilities															
New 24L Runway Extension/Taxiways	-	-	-	-	X	-	X	X	X	-	X	-	-	X	-
New Taxiways over Aviation	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
New West Terminal, Satellite Concourses & Parking Structure	X	-	X	X	X	-	X	X	X	X	X	-	X	X	-
New La Cienega Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New East Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
Redevelop Century Cargo Complex	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
Westchester Parkway Cargo Complex	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
New Admin/Maintenance Facilities	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Flight Kitchens	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
Ring Road and Regional Roads															
West Terminal Access – Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Westchester Parkway – Realignment/Grade Separations	X	-	-	-	X	X	X	X	X	X	X	-	-	X	-
Aviation Blvd. – Depressed Between Arbor Vitae & Imperial	X	-	-	X	X	X	X	-	-	X	-	-	-	X	-
I-105/Imperial – Extend South to Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Sepulveda – New Interchange, Tunnel Westchester to Century	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Arbor Vitae - Interchanges	X	-	-	-	X	X	X	X	-	X	X	-	-	X	-
Aviation Blvd. Tunnel	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Demolition and Clearing of Acquisition Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X

IV.E GEOLOGY

1.0 INTRODUCTION

This section of the Draft Environmental Impact Report (EIR) identifies and evaluates geologic and soils conditions at Loyola Marymount University (LMU) campus that could affect, or be affected by, implementation of the Proposed Project. The information contained in this section is based on a geotechnical evaluation[1] prepared by MACTEC Engineering and Consulting, Inc., (MACTEC) prepared in July 2009, which is provided in **Appendix IV.E**.

2.0 REGULATORY FRAMEWORK

2.1 State and Regional Regulations

2.1.1 Seismic Hazards Mapping Act

Under the Seismic Hazards Mapping Act of 1990, the State Geologist is responsible for identifying and mapping seismic hazards zones as part of the California Geological Survey. The Geological Survey provides zoning maps of non-surface rupture earthquake hazards (including liquefaction and seismically induced landslides) to local governments for planning purposes. These maps are intended to protect the public from the risks involved with strong ground shaking, liquefaction, landslides or other ground failure, and other hazards caused by earthquakes. For projects within seismic hazard zones, the Seismic Hazards Mapping Act requires developers to conduct geological investigations and incorporate appropriate mitigation measures into project designs before building permits are issued. Most of the Southern California region has been mapped.

Established by the Seismic Safety Commission Act in 1975, the State Seismic Safety Commission's purpose is to provide oversight, review, and recommendations to the Governor and State Legislature regarding seismic issues.

2.1.2 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (the Act) (Public Resource Code Section 2621.5) of 1972 was enacted in response to the 1971 San Fernando earthquake, which caused extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. The Act, which has since been amended 10 times, establishes policies and criteria to assist cities, counties, and state agencies

1 MACTEC Engineering and Consulting, Inc, *Geotechnical Evaluation: Proposed Master Plan Project, Loyola Marymount University*, (2009).

in the siting of buildings near active faults, or those that demonstrate surface displacement within the last 10,000 years.

The Act requires that geologic studies be conducted to locate and assess any active fault traces[2] in and around known active fault areas prior to development of buildings for human occupancy. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The law requires the State Geologist to establish regulatory zones (Earthquake Fault Zones) around the surface traces of active faults and to issue appropriate maps of these zones, knows as Alquist-Priolo Maps, to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local cities and counties must regulate certain development projects within the Earthquake Fault Zones, generally by issuing building permits only after geologic investigations demonstrate that development sites are not threatened by future surface displacement. Projects subject to these regulations include all land divisions and most buildings intended for human occupancy.

2.1.3 California Building Code

The California Building Code has been codified in the California Code of Regulations Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for administering California's building codes, including adopting, approving, publishing, and implementing codes and standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the California Building Code is to establish minimum standards for safeguarding public health, safety, and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction.

The California Building Standards Code is based on the International Building Code, with the addition of necessary California amendments based on the American Society of Civil Engineers Minimum Design Standards 7-05. The California Building Standards Code establishes requirements for general structural design and methods for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion in building codes. The provisions of the California Building Standards Code apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any

2 A surface trace, also referred to as a fault trace or surface rupture, is the usually linear surface expression of the intersection of a fault plane with the Earth's surface. Surface traces may be marked by visible horizontal or vertical displacement of the underlying rock and soil units on either side, abrupt elevation differentials, the emergence of springs, or other indicative features.

appurtenances connected or attached to such buildings or structures throughout California. The 2007 California Building Standards Code is based on the 2006 International Building Code.

Earthquake design requirements take into account the occupancy category of a structure, site class, soil classifications, and various seismic coefficients, which are used to determine the appropriate Seismic Design Category for a project. The Seismic Design Category is a classification system that combines occupancy categories with the level of expected ground motions at the site and ranges from Seismic Design Category A (very small seismic vulnerability) to Seismic Design Category E/F (very high seismic vulnerability and near a major fault). Design specifications for the structure are then determined according to the applicable Seismic Design Category.

2.2 Regional Regulations

The South Coast Air Quality Management District's Rule 403, Fugitive Dust, requires projects to comply with specific actions to prevent, reduce, or mitigate fugitive dust emissions during excavation, demolition, and other construction activities.

2.3 Local Regulations

2.3.1 General Plan

The primary regulatory document for the City of Los Angeles is the Safety Element of the City of Los Angeles General Plan (1996). The objective of the Safety Element is to better protect occupants and equipment during various types and degrees of seismic events. In the Safety Element, specific guidelines are included for the evaluation of liquefaction, seismicity, nonstructural elements, fault rupture zones, and engineering investigation reports. The City's Emergency Operations Organization helps to administer geological policies and provisions of the Safety Element, and is a City department comprising all City agencies, pursuant to City Administrative Code, Division 8, Chapter 3. The Administrative Code, Emergency Operations Organization Master Plan, and associated Emergency Operations Organization plans establish the chain of command, protocols, and programs for integrating all of the City's emergency operations, including earthquakes and other geological hazards, into one unified operation. Each City agency in turn has operational protocols, as well as plans and programs, to implement Emergency Operations Organization protocols and programs related to geological hazard emergencies. A geological hazard emergency triggers a particular set of protocols that are addressed by implementing plans and programs. The City's emergency operations program encompasses all of these protocols, plans, and programs. Therefore, its programs are not contained in one comprehensive local or City document. The Safety Element goals, objectives, and policies are broadly stated to reflect the comprehensive scope of the Emergency Operations Organization. These include the following:

4.5 GEOLOGY, SOILS, AND SEISMICITY

4.5.1 METHODOLOGY

This section analyzes the Project's potential impacts on geology, soils and seismicity, based on information from the *Geology, Soils, and Seismicity Technical Memorandum, Inglewood Oil Field Specific Plan* prepared by Kleinfelder, Inc. dated December 2016 and provided in Appendix E-1 of this Draft Environmental Impact Report (EIR). Appendix E-2 contains the Poisson Test- *Seismic Activity in the Inglewood Oil Field* conducted by Dr. Paul Segall dated November 9, 2016. Direct, indirect, and cumulative impacts are addressed for each threshold criteria below, and growth-inducing impacts are described in Sections 6.0, CEQA-Mandated Analyses, of this Draft EIR.

Throughout this Draft EIR, the City's portion of the Inglewood Oil Field (77.8 acres) is referred to as the "Project Site" or the "City IOF." The surface boundary limits[1] of the Inglewood Oil Field (IOF), including lands within both the City and County, is referred to as "Inglewood Oil Field." The portion of the Inglewood Oil Field that is only within the jurisdiction of the County of Los Angeles is referred to as the "County IOF."

The City IOF is located in a seismic area with high historic seismicity, and there are numerous tectonic faults in and around the IOF site. In general, seismic activities can be broadly divided into two categories: (1) tectonic and (2) induced. Tectonic seismic activity is related to natural movements of the faults and an earthquake happens when sudden slip on these faults initiates rupture and may release large amount of energy resulting in ground shaking and other associated hazards such as ground rupture, liquefaction, lateral spreading, sloped failures, and other hazards. Induced seismicity is defined as an event directly related to some manmade activity.

Recently, many parts of the country have experienced induced seismicity due to deep well wastewater disposal associated with oil extraction operations and, more recently, with well stimulation techniques. In areas of low tectonic activities, it is relatively easy to identify induced seismicity from the historical tectonic seismicity. However, in areas of high tectonic seismicity, differentiating induced seismicity from the tectonic seismicity is not simple and may require long term monitoring for assessment. This analysis includes discussions of both tectonic and induced seismicity as related to the City IOF, and the Inglewood Oil Field as a whole.

Independent of the California Environmental Quality Act (CEQA) process, there is a comprehensive regulatory framework implemented at the state and City level to mitigate potential hazards associated with geologic and soils conditions. The design-controllable aspects of building foundation support, protection from seismic ground motion, and soil instability are governed by existing regulations. Compliance with these regulations is required, not optional. Compliance must be demonstrated before permits would be issued. The analysis presented herein assumes compliance with all applicable laws, regulations, and standards.

4.5.2 ENVIRONMENTAL SETTING

Topography and Physiography

Culver City is on the western side of the Los Angeles Basin approximately 1.5 miles from the Pacific Ocean. Much of the terrain of Culver City is mostly level or slight rolling hills that vary in elevation from 40 feet above mean sea level (msl) on the west to approximately 100 feet in the

[1] Surface boundary limit refers to the physical extent of the ground surface for which the Oil Field Operator has access and land owner permission to establish and conduct oil drilling activity. Subsurface and mineral right limits may have different boundaries than the surface boundary.

central part. The Baldwin Hills are in the northeastern portion of the City and rise up to about 400 feet above msl on the Project Site representing 300 feet of relief between the Project Site to Ballona Creek. The Project Site comprises a 77.8-acre portion of the northwestern part of the Baldwin Hills.

The Baldwin Hills are part of a series of low hills that extend from the Santa Monica Mountains southeastward to Newport Beach. The hills are the result of a recent geological deformation along the Newport-Inglewood Fault Zone, which is a geologic structural feature, composed of faults and folds and associated oil fields. The Baldwin Hills are the highest of the hills along this fault zone, reaching a height of 511 feet above msl. They rise gently from the south and east and relatively steep from the north and west. The slopes descending the hills contain numerous scarps on the west, north, and east sides. Numerous canyons and gullies have incised into the scarps and extended to the top of the hills forming intervening flat-topped ridges. The central portion of hills is transected by a north-south trending graben[2] (tectonic depression). The eastern side of the graben is bounded by a west-facing scarp, ranging in height from 75 to 150 feet and is the surface expression of the Newport-Inglewood Fault. The most rugged and steep portions of the oil field have been highly modified over the years by construction of well and tank pads, access roads, treatment plants, oil, water and waste sumps.

Regional Geologic Setting and Geologic Units

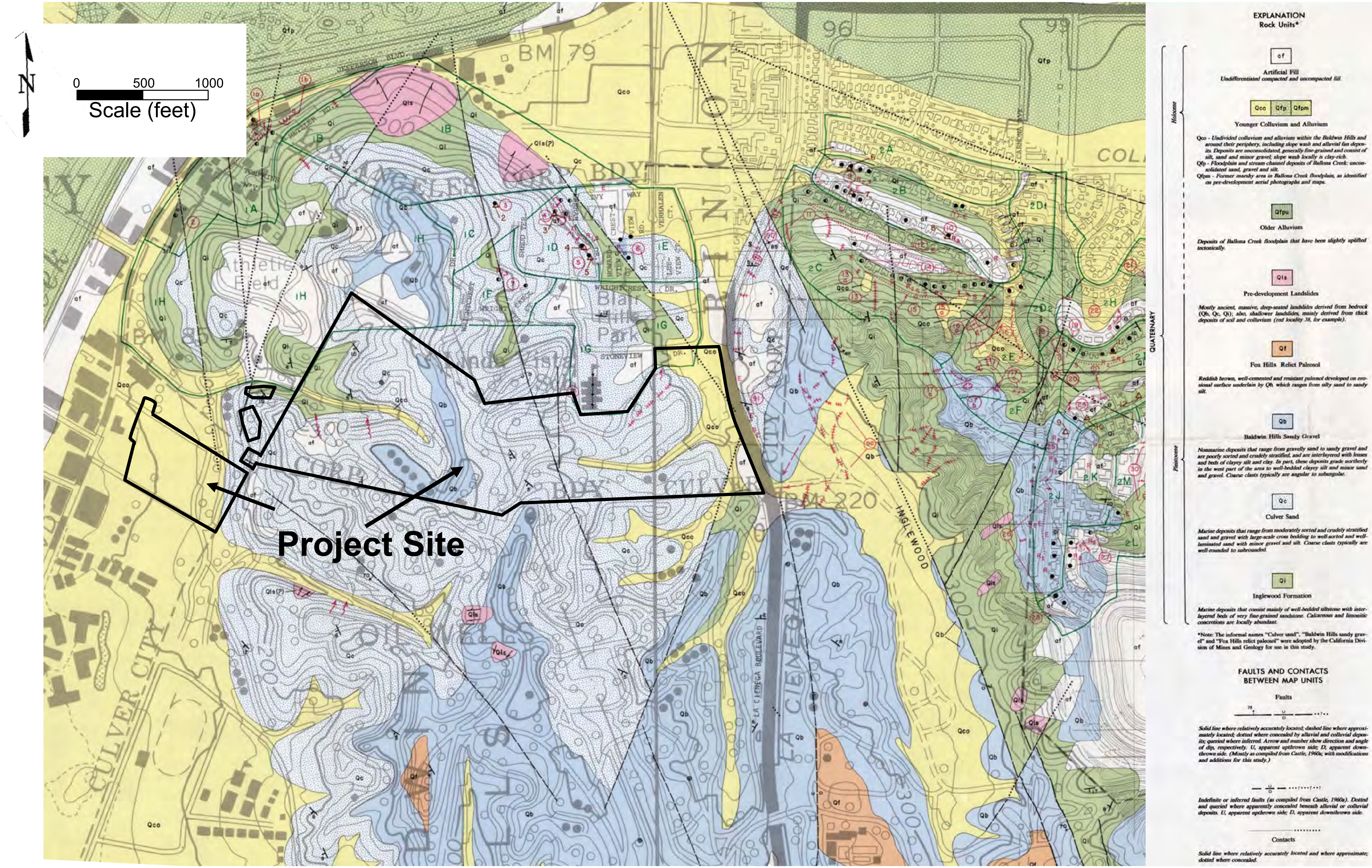
The Baldwin Hills and City IOF are located in the Peninsular Ranges Geomorphic Province and within the Los Angeles Basin. The Peninsular Ranges are characterized by northwest-trending blocks of mountain ridges and sediment-floored valleys. The dominant geologic structure features are northwest-trending fault zones that either fade out to the northwest or terminate at east-trending faults that form the southern margin of the Transverse Ranges. The Los Angeles Basin is bound on two sides by major faults: the Palos Verdes fault to the south, and the San Gabriel-Foothill fault to the north. The basin is bound to the east and southeast by the Santa Ana Mountains and San Joaquin Hills, and to the northwest by the Santa Monica Mountains. Erosion of the surrounding mountains has resulted in deposition of alluvial materials (unconsolidated sediments) in low-lying areas by the Los Angeles River and in the Culver City area, the Ballona Creek.

Deformation in the Baldwin Hills area may have begun as early as the middle Miocene (approximately 15–16 million years ago). Movement along the Newport-Inglewood Fault Zone gently arched and displaced the sedimentary formations comprising the hills. Some of the prominent fault scarps and youthful dissection of the slopes suggest the Baldwin Hills are still actively rising.

The Baldwin Hills and City IOF is underlain by a thick sequence of Tertiary and Quaternary age sedimentary layers and Holocene-age alluvium. The near-surface sedimentary formations exposed on the Project Site consist primarily of the early to middle-Pleistocene, marine San Pedro Formation and the late-Pleistocene, non-marine to shallow marine Inglewood Formation. Colluvial deposits are present at the toe of the slopes and may be present in the drainage channels and gullies emanating from the hill's slopes. The weathering and erosion of the exposed rock layers and colluvium has resulted in a thin mantle of surficial soils and artificial fill in the Project area.

Exhibit 4.5-1, Project Geology Map, depicts the geology map of the City IOF in the context of the surrounding Baldwin Hills and identifies the location of the various soil units described below. The Project Site is underlain by unconsolidated surficial deposits of undocumented artificial fill, in situ

[2] A graben is a down-dropped block of the earth's crust resulting from extension, or pulling, of the crust.



Source: Kleinfelder 2016

Project Geology Map

Exhibit 4.5-1

Inglewood Oil Field Specific Plan Project

PSOMAS

(09/07/17 MMD) R:\Projects\CUL\3CUL000100\Graphics\EIR\Ex4.5-1_geol_map_20170907.pdf

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UNIVERSITY OF

SOUTHERN CALIFORNIA

GEOPHYSICAL LABORATORY

DEPARTMENT OF GEOLOGICAL SCIENCES

A SEISMICITY STUDY FOR PORTIONS OF THE LOS ANGELES BASIN, SANTA MONICA BASIN, AND SANTA MONICA MOUNTAINS, CALIFORNIA

By

James Alexander Buika† and Ta-liang Teng

Technical Report No. 79-9

A Report on Research Project Supported
by the U.S. Geological Survey

Los Angeles, California

September, 1979

†Now at Texaco, Inc., 3350 Wilshire Blvd., Los Angeles, Ca. 90010

EARTHQUAKE HAZARD RESEARCH IN THE LOS ANGELES BASIN AND ITS OFFSHORE AREA

Ta-liang Teng, James Alexander Buika
Thomas L. Henyey, John K. McRaney
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OPEN-FILE NO.81-295

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Communication from Public

Name: JBARRUQUIN
Date Submitted: 04/14/2025 07:54 AM
Council File No: 25-0287
Comments for Public Posting: Proximity of Proposed Development to the Charnock Fault and Required Geologic Investigation Applicable Building Code Requirements (LA County §113.5) Los Angeles County Building Code Section 113.5 explicitly prohibits constructing any building over or upon the trace of a known active earthquake fault and requires a geologic investigation if a proposed building is within 50 feet of the fault trace or its probable location. In practice, this means: - No structure can be placed directly on top of an active fault's mapped trace (as delineated on official maps maintained by the Building Official). - If construction is proposed within 50 feet of the fault trace (or its most likely location on site), a licensed geologist must investigate to determine the fault's exact location and confirm whether the site is underlain by an active fault. These requirements reflect both the County's code and the intent of California's Alquist-Priolo Act to prevent surface rupture hazards. Los Angeles County's 50-foot investigation zone aligns with state guidelines. If the Charnock Fault (or any active fault) lies within 50 feet of 6136 W. Manchester/8651 S. La Tijera, a fault rupture hazard study is required before project approval. Building directly atop the fault, if found, is prohibited. Location of the Charnock Fault Near 6136 W. Manchester Ave The Charnock Fault is a northwest-southeast trending fault in West Los Angeles, roughly parallel to the Newport-Inglewood Fault Zone. It runs through the subsurface of the Westside and has been mapped in the general vicinity of Westchester, LAX, and Culver City. Geologic studies show that the Charnock Fault likely crosses the eastern end of LAX property (near Sepulveda Blvd/Airport Blvd) and continues northwest toward Westchester. This places the proposed development at 6136 W. Manchester/8651 S. La Tijera very close-likely within 50 feet-of the inferred fault trace. Active vs. Potentially Active Status of the Charnock Fault The State of California does not currently classify the Charnock Fault as active (no Alquist-Priolo zoning), but it is geologically classified as potentially active. It has shown movement in the past (late Quaternary) but no evidence of Holocene surface rupture. Sources including USGS and local planning EIRs confirm this status. Therefore, while state law doesn't mandate investigation under the Alquist-Priolo Act, local code and best practice support a geologic investigation due to uncertainty and proximity. Evidence of Fault

Hazard and Past Ground Rupture No historical surface rupture on the Charnock Fault has been recorded in the Westchester area. However, the absence of observed rupture does not rule out hazard. The fault may be buried or blind. Los Angeles World Airports' reports analyzed what-if rupture scenarios and found that while rupture risk is low, the potential exists. Predicted offsets in the event of rupture could be significant. Therefore, lack of past rupture is not a guarantee of safety. Implications Under Code and Recommendation for Geologic Investigation Given that the proposed development sits within the 50-foot threshold of the fault trace, a geologic investigation is required by Los Angeles County Code §113.5. Only trenching and subsurface exploration can determine whether an active fault underlies the property. Without this, construction may violate code and expose future occupants to hazard. Publicly available fault maps and EIRs justify this requirement. References: - Los Angeles County Building Code §113.5 - USGS Quaternary Fault Database - LAX Master Plan EIS/EIR - City of LA Westchester-Playa del Rey Community Plan Draft EIR (2003)

Charnock Fault - Public Comment Reference Packet

Submitted Regarding:

6136 W. Manchester Avenue / 8651 S. La Tijera Boulevard

Main Conditional Use Permit (MCUP), Site Plan Review (SPR), and Appeal

Prepared for public review and submission.

This packet contains verified fault hazard documentation and relevant regulatory materials to support a request for formal geologic investigation prior to development approval.

Prepared by a concerned citizen

April 2025

Proximity of Proposed Development to the Charnock Fault and Required Geologic Investigation

Applicable Building Code Requirements (LA County §113.5)

Los Angeles County Building Code Section 113.5 explicitly prohibits constructing any building over or upon the trace of a known active earthquake fault and requires a geologic investigation if a proposed building is within 50 feet of the fault trace or its probable location. In practice, this means:

- No structure can be placed directly on top of an active fault's mapped trace (as delineated on official maps maintained by the Building Official).
- If construction is proposed within 50 feet of the fault trace (or its most likely location on site), a licensed geologist must investigate to determine the fault's exact location and confirm whether the site is underlain by an active fault.

These requirements reflect both the County's code and the intent of California's Alquist-Priolo Act to prevent surface rupture hazards. Los Angeles County's 50-foot investigation zone aligns with state guidelines. If the Charnock Fault (or any active fault) lies within 50 feet of 6136 W. Manchester/8651 S. La Tijera, a fault rupture hazard study is required before project approval. Building directly atop the fault, if found, is prohibited.

Location of the Charnock Fault Near 6136 W. Manchester Ave

The Charnock Fault is a northwest-southeast trending fault in West Los Angeles, roughly parallel to the Newport-Inglewood Fault Zone. It runs through the subsurface of the Westside and has been mapped in the general vicinity of Westchester, LAX, and Culver City. Geologic studies show that the Charnock Fault likely crosses the eastern end of LAX property (near Sepulveda Blvd/Airport Blvd) and continues northwest toward Westchester. This places the proposed development at 6136 W. Manchester/8651 S. La Tijera very close-likely within 50 feet-of the inferred fault trace.

Active vs. Potentially Active Status of the Charnock Fault

The State of California does not currently classify the Charnock Fault as active (no Alquist-Priolo zoning), but it is geologically classified as potentially active. It has shown movement in the past (late Quaternary) but no evidence of Holocene surface rupture. Sources including USGS and local planning EIRs confirm this status. Therefore, while state law doesn't mandate investigation under the Alquist-Priolo Act, local code and best practice support a geologic investigation due to uncertainty and proximity.

Evidence of Fault Hazard and Past Ground Rupture

No historical surface rupture on the Charnock Fault has been recorded in the Westchester area. However, the absence of observed rupture does not rule out hazard. The fault may be buried or blind. Los Angeles World Airports' reports analyzed what-if rupture scenarios and found that while rupture risk is low, the potential exists. Predicted offsets in the event of rupture could be significant. Therefore, lack of past rupture is not a guarantee of safety.

Implications Under Code and Recommendation for Geologic Investigation

Given that the proposed development sits within the 50-foot threshold of the fault trace, a geologic investigation is required by Los Angeles County Code §113.5. Only trenching and subsurface exploration can determine whether an active fault underlies the property. Without this, construction may violate code and expose future occupants to hazard. Publicly available fault maps and EIRs justify this requirement.

References:

- Los Angeles County Building Code §113.5
- USGS Quaternary Fault Database
- LAX Master Plan EIS/EIR
- City of LA Westchester-Playa del Rey Community Plan Draft EIR (2003)

- Loyola Marymount University Master Plan DEIR (2010)

113.5 - Construction Limitations.

No building or structure shall be constructed over or upon the trace of a known active earthquake fault which is shown on maps maintained by the Building Official. These maps include, but are not limited to, earthquake fault zone maps prepared under Sections 2622 and 2623 of the California Public Resources Code.

The absence of a known active earthquake fault trace at the proposed building location shall be determined by a professional geologist licensed in the State of California in the following cases:

1. When the proposed building is within (50) feet (15.24 m) of that line designated by the Building Official as the assumed location of a known active earthquake fault on the aforementioned maps.
2. When the proposed building is within 50 feet (15.24 m) of the most probable ground location of the trace of a known active earthquake fault shown on the aforementioned maps.

In these cases the Building Official may require the excavation of a trench, for the purpose of determining the existence of an active earthquake fault. Such a trench will be required if a lack of distinguishable fault features in the vicinity prevents the Building Official from determining by a site examination, review of available aerial photographs, or by other means that the fault trace does not underlie the proposed building. The trench shall be approximately perpendicular to the most probable direction of the fault trace, at least 1-1/2 feet (0.15 m) wide, and at least five feet in depth measured from natural grade, or to a depth satisfactory to the Building Official.

The trench must be accessible for mapping and inspection by the Building Official, when requested, and meet the requirements of Title 8 of the California Code of Regulations, Construction Safety Orders. The trench need not extend further than the full width of the proposed structure plus 5 feet (1.52 m) beyond the traversed exterior walls. A known active earthquake fault shall be presumed nonexistent if an exposure is not found by the professional geologist in the walls or floor of the trench.

The Building Official may require a more extensive investigation by a professional geologist as evidence to the absence of a known active earthquake fault prior to the issuance of a permit for Groups A, E, I, H and R, Division 1 Occupancies and B, F, M and S Occupancies over one story in height.

The results of the investigation, conclusions and recommendations shall be presented in a geology report prepared by a professional geologist as defined by Section 113.3. The report shall comply with the guidelines presented in Note 49 prepared by the California Department of Conservation, Geological Survey.

The Building Official may waive the requirements for an active earthquake fault investigation for additions to existing one- or two-family dwelling units when all of the following conditions are met:

1.

Jump to Navigation

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Charnock fault (Class A) No. 277

Last Review Date: 2017-07-01

citation for this record: **Bryant, W.A., compiler, 2017, Fault number 277, Charnock fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:52 PM.**

Synopsis	
Name comments	**Fault ID:** Refers to fault number 435 of Jennings (1994).
County(s) and State(s)	CALIFORNIA
Physiographic province(s)	
Reliability of location	Compiled at 1:24,000 scale. *Comments:*
Geologic setting	
Length (km)	km.

Average strike	
Sense of movement	
Dip	
Paleoseismology studies	
Geomorphic expression	
Age of faulted surficial deposits	
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:*
Recurrence interval	
Slip-rate category	Unspecified
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
References	#8036 Castle, R.O., 1960, Surficial geology of the Beverly Hills and Venice quadrangles, California: U.S. Geological Survey Open-File Report, map scale 1:48,000. #2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000.

Questions or comments?

4.22 Earth/Geology (CEQA)

4.22.1 Introduction

The earth/geology analysis addresses the potential for the Master Plan alternatives to increase the consequences of adverse geologic conditions and hazards including earthquake-induced ground shaking, earthquake fault surface rupture, earthquake-induced liquefaction and settlement, non-seismic settlement, expansive soils, slope stability, oil field gases, and construction. Information pertaining to other hazards, including tsunami, oil field subsidence, and subsidence due to groundwater withdrawal, is provided in Technical Report 12*, Earth/Geology Technical Report*. Technical Report 12*, Earth/Geology Technical Report,* also includes additional information on the affected environment relative to earth/geology and details about the methodologies used to assess baseline conditions and project impacts. Conclusions regarding the significance of impacts provided in this section are strictly for the purposes of CEQA.

Potential impacts of stormwater drainage are discussed in Section 4.7, *Hydrology and Water Quality*; of contaminated earth and groundwater in Section 4.23, *Hazardous Materials*; and of oil and mineral resources in Section 4.17.2, *Natural Resources*.

4.22.2 General Approach and Methodology

This analysis characterizes baseline earth/geologic conditions, processes, hazards, and landforms within the study area and compares them with those for the No Action/No Project Alternative and the four build alternatives. The study area comprises the Master Plan boundaries, as defined in the introduction to this chapter.

Reports prepared by the California Department of Conservation, Division of Mines and Geology (CDMG), the United States Geological Survey (USGS), and others, dated 1954 through 1999, were reviewed to obtain current information regarding geology and faults and earthquake (seismic) hazards in the LAX and Los Angeles region. The *City of Los Angeles General Plan, Safety Element*, was also reviewed. The *Safety Element* identifies critical facilities and lifeline systems that may be vulnerable to damage from a variety of hazards and to which special hazard resistant design features may apply.[758] Additional details on geologic conditions, hazards, analysis methods, and assumptions used in the analysis are included in Technical Report 12*, Earth/Geology Technical Report*. Technical Report 12*, Earth/Geology Technical Report* also includes the comprehensive list of sources -- published references and unpublished reports of consultants' investigations -- that were consulted for this analysis but not cited in this section. The dates of the unpublished consultants' reports range from 1948 to 1992.

Existing geologic and topographic surface conditions at LAX were observed in the field and by reviewing aerial photographs (see Technical Report 12*, Earth/Geology Technical Report,* for a description of aerial photographs). Using this information, potential geologic hazards were identified by generally following the CDMG guidelines for environmental impact reports,[759] supplemented by industry standards. Potential geologic hazards identified in the study area include seismic hazards, slope failure, expansive soils, settlement, erosion, oil field gases, and subsidence. Geologic conditions that could be potentially affected include landforms or unique geological features.

The potential level of seismic ground shaking expected at LAX caused by earthquakes on nearby faults was quantitatively estimated using currently accepted seismic information and theoretical mathematical relationships. Where sufficient data was available, seismic ground shaking estimates were, in turn, used to make limited quantitative assessments of the potential for other related seismic hazards (liquefaction and seismic settlement) at selected locations. Seismic hazard impacts were also evaluated by referring to published reports by the CDMG and the USGS. Additional information on the seismic hazard evaluations is presented in Technical Report 12*, Earth/Geology Technical Report.*

The significance of topography (landform) alterations was evaluated by screening the project for components that could potentially affect existing prominent geologic or topographic features. Estimates

758 City of Los Angeles, Los Angeles General Plan, Safety Element, 1996.

759 State of California, Division of Mines and Geology, DMG Note 46: Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports, 1996.

of earthwork quantities[760] were evaluated and used to assess the significance of potential erosion and sedimentation, and landform and topography impacts of the LAX Master Plan build alternatives.

Other potential earth/geology related hazards were evaluated using the data sources described above and making a qualitative determination as to whether they posed a general concern in the LAX area. These hazards included tsunami and construction considerations such as earthwork and tunneling. A detailed summary of the potential geologic hazards associated with the project components of the No Action/No Project Alternative and the four build alternatives is provided in **Table F4.22-1**, Matrix of Potential Earth/Geologic Considerations for Major Master Plan Facilities.

To assess whether a given geologic hazard would result in a significant impact, the major components of the four build alternatives were reviewed and compared with the potential geologic hazards identified. For example, the significance of seismically-induced ground shaking was evaluated by identifying the project components with the potential to be affected by ground shaking and quantitatively estimating the potential magnitude of ground shaking. Based on this review, the potential for individual project components to cause new geologic hazards or accelerate existing ones was evaluated.

4.22.3 Affected Environment/Environmental Baseline

Topography and Physiography

LAX is located on the northwestern margin of the Los Angeles Basin Physiographic Province.[761] The majority of LAX lies within the areas known as the Torrance Plain and the El Segundo Sand Hills as shown in **Figure F4.22-1**, Physiographic Map. The El Segundo Sand Hills consist of a three to six mile wide belt of recent and older wind blown sand dunes stretching along the Pacific coast from the Ballona Escarpment south to the Palos Verdes Hills. The El Segundo Sand Hills overlap onto the relatively flat Torrance Plain to the east.[762] The Torrance Plain and the El Segundo Sand Hills continue south from the LAX area. The Pacific Ocean lies to the west of LAX. To the north of LAX lies Ballona Creek and the Ballona Escarpment; to the northeast and east lie the Baldwin Hills and Rosecrans Hills.

LAX lies on a relatively level area at an elevation of about 100 feet above sea level. Most of the original sand dune area to the east of Pershing Drive was graded relatively flat during initial development phases of LAX during the 1940s and 1950s. Much of the west end of LAX (from Pershing Drive west to the ocean) was previously developed with homes that were subsequently removed due to noise impacts from LAX. This area still retains some of the original sand dune landform character, with sand ridges ranging from 85 to 185 feet above sea level and closed depressions of varying height creating local relief of up to 80 feet. The LAX Northside/Westchester Southside area consists of flat to rolling terrain, with small hills and depressions with less than 20 feet of relief.

Two sites close to LAX are being considered for the construction of an off-site fuel farm under Alternative B: Scattergood Generating Station and an oil refinery located south of the airport. The Scattergood Generating Station lies in the western portion of the El Segundo Sand Hills on recent sand dunes. The oil refinery lies adjacent to, and east of, the Scattergood Generating Station and within the El Segundo Sand Hills on recent and older sand dunes. These areas also retain some of the original sand dune character, with sand ridges ranging from 85 to 185 feet above sea level; however, much of the area has been graded or altered by development.

Geology

The geology of the Los Angeles Basin can be characterized as a broad depression in the underlying "basement" rock,[763] which is overlain by a thick sequence of sediments. The geology of the area is further defined by tectonic and structural conditions, those forces and conditions that cause the earth's crust to move and produce the complex system of faults and folds transecting the basin.

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760 Bechtel Corporation, LAX Master Plan Compilation of DEIS Input Data, Alternative C Construction Impacts, April 28, 2000. MARRS Services, Inc., LAX Master Plan Alternative D Compilation of Draft Environmental Impact Statement (DEIS) Construction Impacts Input Data, Excluding Crossfield Taxiway Projects, May 21, 2003.

761 California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, (CDWR Bulletin 104), 1961.

762 California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, (CDWR Bulletin 104), 1961.

763 A series of rocks, generally with complex structure beneath the predominantly sedimentary rocks.

Table F4.22-1

Matrix of Potential Earth/Geologic Considerations for Major Master Plan Facilities

Master Plan Alternatives and Related Major Facilities	Slope Stability	Oil Field Subsidence	Oil Field Gas	Groundwater/ Dewatering	Settlement	Expansion	Fault Surface Rupture	Ground Shaking	Lique-faction	Seismic Stability	Seismic Slope Settlement	Tsunami, Seiche, Flooding	Tunneling	Grading	Existing Foundations
No Action/No Project Alternative															
New Taxiways (North, South Airfields)	-	-	-	-	X	X	-	-	X	-	X	-	-	X	-
2 Remote Boarding Lounges - Westside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	-
Cargo Facility Improvements	-	-	-	-	X	X	X	X	X	-	-	-	-	X	X
I-405/Arbor Street Interchange	X	-	-	-	X	-	X	X	X	X	-	-	-	X	-
Century Cargo Roadway System	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
LAX Northside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	X
Continental City	X	-	-	X	X	X	X	X	-	-	-	-	-	X	-
Alternative A - Added Runway North Facilities															
New Runway 24L Extension/Taxiways	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
New Taxiways over Aviation	-	-	-	-	X	X	X	-	-	-	-	-	-	X	-
New West Terminal, Satellite Concourses & Parking Structure	X	-	X	X	X	-	-	X	X	-	X	-	X	X	X
Redevelop Century Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New East Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Admin/Maintenance Facilities	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Flight Kitchen	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
Ring Road and Regional Roads															
West Terminal Access – Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Westchester Parkway – Realignment/Grade Separations	X	-	-	-	X	X	X	X	X	X	X	-	-	X	-
Aviation Blvd. – Depressed Between Century & Imperial	X	-	-	X	X	X	X	-	-	X	-	-	-	X	-
I-105/Imperial – Extend South to Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Sepulveda – New Interchange, Tunnel, Westchester to Century	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Arbor Vitae – Interchanges	X	-	-	-	X	X	X	X	-	X	-	-	-	X	-
Demolition and Clearing of Acquisition Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Westchester Southside	-	-	-	-	X	-	-	X	X	-	X	-	-	X	-
New Runway 24R/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Relocate Runway 24C/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Relocate Runway 24L/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	-
Upgrade Runway 25R/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-		X	-
Reconstructed Runway 25L/Taxiways	-	-	-	-	X	-	X	-	X	-	X	-	-	X	X
Reconfiguration of CTA	-	-	-	-	X	X	-	X	X	-	X	-	-	X	X
Automated People Mover	X	-	X	X	X	-	-	X	X	X	X	-	X	X	X
La Cienega Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
South Cargo Complex East	-	-	-	-	X	-	-	X	X	-	X	-	-	X	X
Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Fuel Farm	X	-	-	-	X	-	-	X	X	X	X	-	-	X	X
LAX Expressway	X	-	-	X	X	-	X	X	-	X	-	-	X	X	-
Lincoln Blvd. Interchange	-	-	-	-	X	-	-	-	X	-	X	-	-	X	-
Green Line to West Terminal	X	-	X	X	X	-	X	X	X	X	X	-	X	X	X
Alternative B - Added Runway South Facilities															
New 24L Runway Extension/Taxiways	-	-	-	-	X	-	X	X	X	-	X	-	-	X	-
New Taxiways over Aviation	-	-	-	-	X	X	X	-	X	-	X	-	-	X	-
New West Terminal, Satellite Concourses & Parking Structure	X	-	X	X	X	-	X	X	X	X	X	-	X	X	-
New La Cienega Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New East Imperial Cargo Complex	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
Redevelop Century Cargo Complex	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
Westchester Parkway Cargo Complex	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
New Admin/Maintenance Facilities	-	-	-	-	X	X	X	X	X	-	X	-	-	X	X
New Flight Kitchens	-	-	-	-	X	-	X	X	X	-	X	-	-	X	X
Ring Road and Regional Roads															
West Terminal Access – Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Westchester Parkway – Realignment/Grade Separations	X	-	-	-	X	X	X	X	X	X	X	-	-	X	-
Aviation Blvd. – Depressed Between Arbor Vitae & Imperial	X	-	-	X	X	X	X	-	-	X	-	-	-	X	-
I-105/Imperial – Extend South to Pershing	X	-	-	-	X	-	-	X	X	X	X	-	-	X	-
Sepulveda – New Interchange, Tunnel Westchester to Century	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Arbor Vitae - Interchanges	X	-	-	-	X	X	X	X	-	X	X	-	-	X	-
Aviation Blvd. Tunnel	X	-	-	X	X	-	X	X	X	X	X	-	X	X	-
Demolition and Clearing of Acquisition Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X

1.0 INTRODUCTION

This section of the Draft Environmental Impact Report (EIR) identifies and evaluates geologic and soils conditions at Loyola Marymount University (LMU) campus that could affect, or be affected by, implementation of the Proposed Project. The information contained in this section is based on a geotechnical evaluation[1] prepared by MACTEC Engineering and Consulting, Inc., (MACTEC) prepared in July 2009, which is provided in **Appendix IV.E**.

2.0 REGULATORY FRAMEWORK

2.1 State and Regional Regulations

2.1.1 Seismic Hazards Mapping Act

Under the Seismic Hazards Mapping Act of 1990, the State Geologist is responsible for identifying and mapping seismic hazards zones as part of the California Geological Survey. The Geological Survey provides zoning maps of non-surface rupture earthquake hazards (including liquefaction and seismically induced landslides) to local governments for planning purposes. These maps are intended to protect the public from the risks involved with strong ground shaking, liquefaction, landslides or other ground failure, and other hazards caused by earthquakes. For projects within seismic hazard zones, the Seismic Hazards Mapping Act requires developers to conduct geological investigations and incorporate appropriate mitigation measures into project designs before building permits are issued. Most of the Southern California region has been mapped.

Established by the Seismic Safety Commission Act in 1975, the State Seismic Safety Commission's purpose is to provide oversight, review, and recommendations to the Governor and State Legislature regarding seismic issues.

2.1.2 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (the Act) (Public Resource Code Section 2621.5) of 1972 was enacted in response to the 1971 San Fernando earthquake, which caused extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. The Act, which has since been amended 10 times, establishes policies and criteria to assist cities, counties, and state agencies

1 MACTEC Engineering and Consulting, Inc, *Geotechnical Evaluation: Proposed Master Plan Project, Loyola Marymount University*, (2009).

in the siting of buildings near active faults, or those that demonstrate surface displacement within the last 10,000 years.

The Act requires that geologic studies be conducted to locate and assess any active fault traces[2] in and around known active fault areas prior to development of buildings for human occupancy. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The law requires the State Geologist to establish regulatory zones (Earthquake Fault Zones) around the surface traces of active faults and to issue appropriate maps of these zones, knows as Alquist-Priolo Maps, to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local cities and counties must regulate certain development projects within the Earthquake Fault Zones, generally by issuing building permits only after geologic investigations demonstrate that development sites are not threatened by future surface displacement. Projects subject to these regulations include all land divisions and most buildings intended for human occupancy.

2.1.3 California Building Code

The California Building Code has been codified in the California Code of Regulations Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for administering California's building codes, including adopting, approving, publishing, and implementing codes and standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the California Building Code is to establish minimum standards for safeguarding public health, safety, and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction.

The California Building Standards Code is based on the International Building Code, with the addition of necessary California amendments based on the American Society of Civil Engineers Minimum Design Standards 7-05. The California Building Standards Code establishes requirements for general structural design and methods for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion in building codes. The provisions of the California Building Standards Code apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any

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2 A surface trace, also referred to as a fault trace or surface rupture, is the usually linear surface expression of the intersection of a fault plane with the Earth's surface. Surface traces may be marked by visible horizontal or vertical displacement of the underlying rock and soil units on either side, abrupt elevation differentials, the emergence of springs, or other indicative features.

appurtenances connected or attached to such buildings or structures throughout California. The 2007 California Building Standards Code is based on the 2006 International Building Code.

Earthquake design requirements take into account the occupancy category of a structure, site class, soil classifications, and various seismic coefficients, which are used to determine the appropriate Seismic Design Category for a project. The Seismic Design Category is a classification system that combines occupancy categories with the level of expected ground motions at the site and ranges from Seismic Design Category A (very small seismic vulnerability) to Seismic Design Category E/F (very high seismic vulnerability and near a major fault). Design specifications for the structure are then determined according to the applicable Seismic Design Category.

2.2 Regional Regulations

The South Coast Air Quality Management District's Rule 403, Fugitive Dust, requires projects to comply with specific actions to prevent, reduce, or mitigate fugitive dust emissions during excavation, demolition, and other construction activities.

2.3 Local Regulations

2.3.1 General Plan

The primary regulatory document for the City of Los Angeles is the Safety Element of the City of Los Angeles General Plan (1996). The objective of the Safety Element is to better protect occupants and equipment during various types and degrees of seismic events. In the Safety Element, specific guidelines are included for the evaluation of liquefaction, seismicity, nonstructural elements, fault rupture zones, and engineering investigation reports. The City's Emergency Operations Organization helps to administer geological policies and provisions of the Safety Element, and is a City department comprising all City agencies, pursuant to City Administrative Code, Division 8, Chapter 3. The Administrative Code, Emergency Operations Organization Master Plan, and associated Emergency Operations Organization plans establish the chain of command, protocols, and programs for integrating all of the City's emergency operations, including earthquakes and other geological hazards, into one unified operation. Each City agency in turn has operational protocols, as well as plans and programs, to implement Emergency Operations Organization protocols and programs related to geological hazard emergencies. A geological hazard emergency triggers a particular set of protocols that are addressed by implementing plans and programs. The City's emergency operations program encompasses all of these protocols, plans, and programs. Therefore, its programs are not contained in one comprehensive local or City document. The Safety Element goals, objectives, and policies are broadly stated to reflect the comprehensive scope of the Emergency Operations Organization. These include the following:

4.5 GEOLOGY, SOILS, AND SEISMICITY

4.5.1 METHODOLOGY

This section analyzes the Project's potential impacts on geology, soils and seismicity, based on information from the *Geology, Soils, and Seismicity Technical Memorandum, Inglewood Oil Field Specific Plan* prepared by Kleinfelder, Inc. dated December 2016 and provided in Appendix E-1 of this Draft Environmental Impact Report (EIR). Appendix E-2 contains the Poisson Test- *Seismic Activity in the Inglewood Oil Field* conducted by Dr. Paul Segall dated November 9, 2016. Direct, indirect, and cumulative impacts are addressed for each threshold criteria below, and growth-inducing impacts are described in Sections 6.0, CEQA-Mandated Analyses, of this Draft EIR.

Throughout this Draft EIR, the City's portion of the Inglewood Oil Field (77.8 acres) is referred to as the "Project Site" or the "City IOF." The surface boundary limits[1] of the Inglewood Oil Field (IOF), including lands within both the City and County, is referred to as "Inglewood Oil Field." The portion of the Inglewood Oil Field that is only within the jurisdiction of the County of Los Angeles is referred to as the "County IOF."

The City IOF is located in a seismic area with high historic seismicity, and there are numerous tectonic faults in and around the IOF site. In general, seismic activities can be broadly divided into two categories: (1) tectonic and (2) induced. Tectonic seismic activity is related to natural movements of the faults and an earthquake happens when sudden slip on these faults initiates rupture and may release large amount of energy resulting in ground shaking and other associated hazards such as ground rupture, liquefaction, lateral spreading, sloped failures, and other hazards. Induced seismicity is defined as an event directly related to some manmade activity.

Recently, many parts of the country have experienced induced seismicity due to deep well wastewater disposal associated with oil extraction operations and, more recently, with well stimulation techniques. In areas of low tectonic activities, it is relatively easy to identify induced seismicity from the historical tectonic seismicity. However, in areas of high tectonic seismicity, differentiating induced seismicity from the tectonic seismicity is not simple and may require long term monitoring for assessment. This analysis includes discussions of both tectonic and induced seismicity as related to the City IOF, and the Inglewood Oil Field as a whole.

Independent of the California Environmental Quality Act (CEQA) process, there is a comprehensive regulatory framework implemented at the state and City level to mitigate potential hazards associated with geologic and soils conditions. The design-controllable aspects of building foundation support, protection from seismic ground motion, and soil instability are governed by existing regulations. Compliance with these regulations is required, not optional. Compliance must be demonstrated before permits would be issued. The analysis presented herein assumes compliance with all applicable laws, regulations, and standards.

4.5.2 ENVIRONMENTAL SETTING

Topography and Physiography

Culver City is on the western side of the Los Angeles Basin approximately 1.5 miles from the Pacific Ocean. Much of the terrain of Culver City is mostly level or slight rolling hills that vary in elevation from 40 feet above mean sea level (msl) on the west to approximately 100 feet in the

[1] Surface boundary limit refers to the physical extent of the ground surface for which the Oil Field Operator has access and land owner permission to establish and conduct oil drilling activity. Subsurface and mineral right limits may have different boundaries than the surface boundary.

central part. The Baldwin Hills are in the northeastern portion of the City and rise up to about 400 feet above msl on the Project Site representing 300 feet of relief between the Project Site to Ballona Creek. The Project Site comprises a 77.8-acre portion of the northwestern part of the Baldwin Hills.

The Baldwin Hills are part of a series of low hills that extend from the Santa Monica Mountains southeastward to Newport Beach. The hills are the result of a recent geological deformation along the Newport-Inglewood Fault Zone, which is a geologic structural feature, composed of faults and folds and associated oil fields. The Baldwin Hills are the highest of the hills along this fault zone, reaching a height of 511 feet above msl. They rise gently from the south and east and relatively steep from the north and west. The slopes descending the hills contain numerous scarps on the west, north, and east sides. Numerous canyons and gullies have incised into the scarps and extended to the top of the hills forming intervening flat-topped ridges. The central portion of hills is transected by a north-south trending graben[2] (tectonic depression). The eastern side of the graben is bounded by a west-facing scarp, ranging in height from 75 to 150 feet and is the surface expression of the Newport-Inglewood Fault. The most rugged and steep portions of the oil field have been highly modified over the years by construction of well and tank pads, access roads, treatment plants, oil, water and waste sumps.

Regional Geologic Setting and Geologic Units

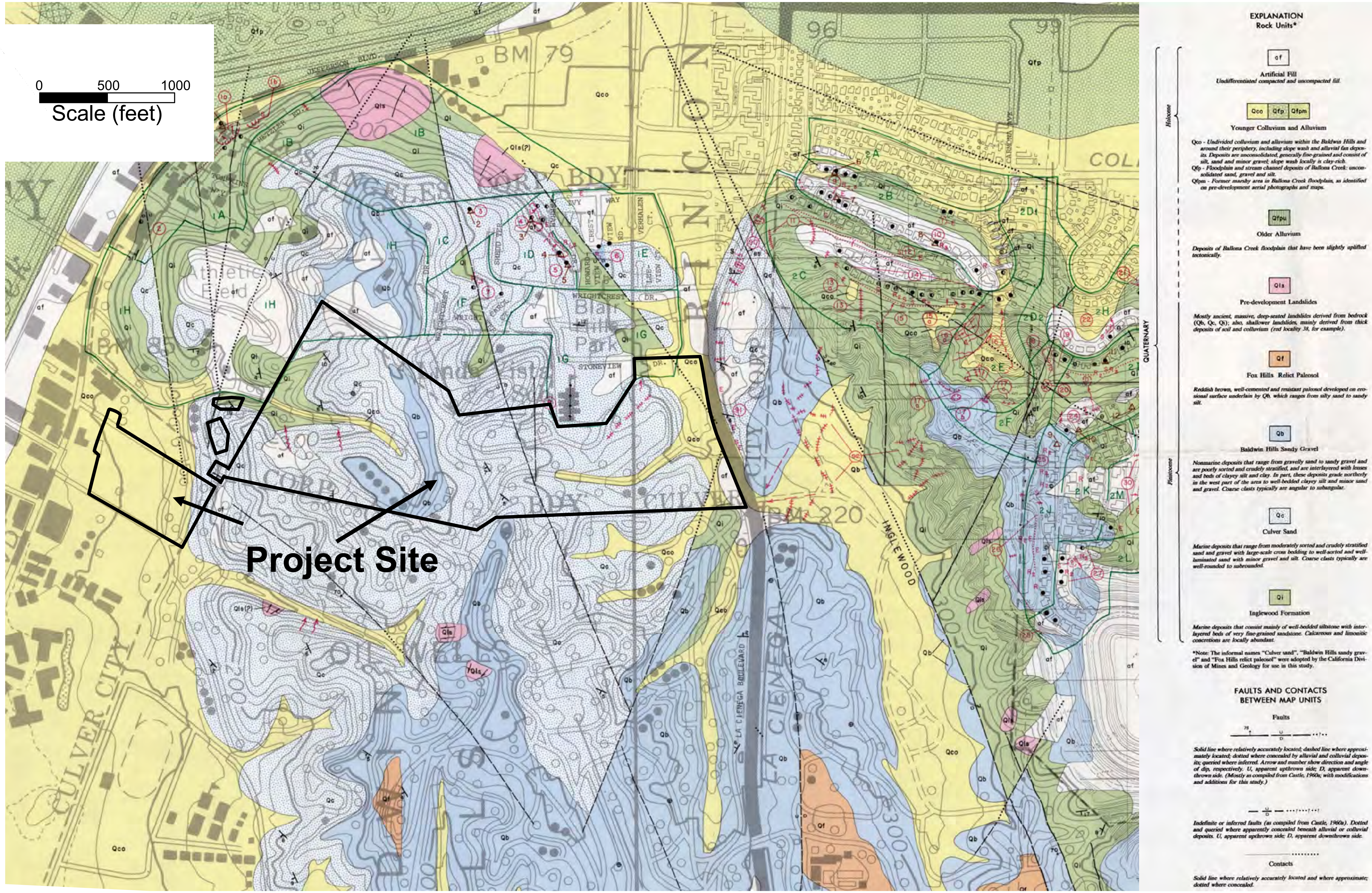
The Baldwin Hills and City IOF are located in the Peninsular Ranges Geomorphic Province and within the Los Angeles Basin. The Peninsular Ranges are characterized by northwest-trending blocks of mountain ridges and sediment-floored valleys. The dominant geologic structure features are northwest-trending fault zones that either fade out to the northwest or terminate at east-trending faults that form the southern margin of the Transverse Ranges. The Los Angeles Basin is bound on two sides by major faults: the Palos Verdes fault to the south, and the San Gabriel-Foothill fault to the north. The basin is bound to the east and southeast by the Santa Ana Mountains and San Joaquin Hills, and to the northwest by the Santa Monica Mountains. Erosion of the surrounding mountains has resulted in deposition of alluvial materials (unconsolidated sediments) in low-lying areas by the Los Angeles River and in the Culver City area, the Ballona Creek.

Deformation in the Baldwin Hills area may have begun as early as the middle Miocene (approximately 15–16 million years ago). Movement along the Newport-Inglewood Fault Zone gently arched and displaced the sedimentary formations comprising the hills. Some of the prominent fault scarps and youthful dissection of the slopes suggest the Baldwin Hills are still actively rising.

The Baldwin Hills and City IOF is underlain by a thick sequence of Tertiary and Quaternary age sedimentary layers and Holocene-age alluvium. The near-surface sedimentary formations exposed on the Project Site consist primarily of the early to middle-Pleistocene, marine San Pedro Formation and the late-Pleistocene, non-marine to shallow marine Inglewood Formation. Colluvial deposits are present at the toe of the slopes and may be present in the drainage channels and gullies emanating from the hill's slopes. The weathering and erosion of the exposed rock layers and colluvium has resulted in a thin mantle of surficial soils and artificial fill in the Project area.

Exhibit 4.5-1, Project Geology Map, depicts the geology map of the City IOF in the context of the surrounding Baldwin Hills and identifies the location of the various soil units described below. The Project Site is underlain by unconsolidated surficial deposits of undocumented artificial fill, in situ

2 A graben is a down-dropped block of the earth's crust resulting from extension, or pulling, of the crust.



Source: Kleinfelder 2016

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Project Geology Map

Exhibit 4.5-1

Inglewood Oil Field Specific Plan Project

PSOMAS

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UNIVERSITY OF

SOUTHERN CALIFORNIA

GEOPHYSICAL LABORATORY

DEPARTMENT OF GEOLOGICAL SCIENCES

A SEISMICITY STUDY FOR PORTIONS OF THE LOS ANGELES BASIN, SANTA MONICA BASIN, AND SANTA MONICA MOUNTAINS, CALIFORNIA

By

James Alexander Buika † and Ta-liang Teng

Technical Report No. 79-9

A Report on Research Project Supported
by the U.S. Geological Survey

Los Angeles, California

September, 1979

†Now at Texaco, Inc., 3350 Wilshire Blvd., Los Angeles, Ca. 90010

EARTHQUAKE HAZARD RESEARCH IN THE LOS ANGELES BASIN AND ITS OFFSHORE AREA

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