4.5 Geology and Soils

4.5.1 Introduction

This section addresses the potential impacts of the proposed Project with regard to geology and soils. Specifically, this section discusses potential environmental impacts related to grading, erosion/sedimentation, subsidence, seismic hazards, tsunami/seiches, liquefaction, slope stability, and other geologic conditions. The analysis presented in this section describes the regulatory framework; the existing above-ground features of the Project site, including man-made structures, and natural and man-made landforms; and the local and regional context for below-ground surface (geological and geotechnical) characteristics. The impacts are addressed in terms of whether implementation of the proposed Project would result in significant risks to people or structures on-site, or would cause a geologic impact to other properties by causing or accelerating instability from erosion or result in sediment runoff or deposition which may not be contained on-site. Issues related to geology and soils, but discussed in detail in other sections, include groundwater, which is more fully described in Section 4.8, Hydrology and Water Quality, and soil gases, which is more fully described in Section 4.7 Hazards and Hazardous Materials. The analysis presented in this section addresses the impacts that would occur for the proposed Project.

The March 2013 Preliminary Geotechnical Assessment, prepared by GeoKinetics and included as Appendix H of this document, was utilized for the analysis of this section. This document includes information obtained from two previously prepared geotechnical reports on file at the City of Los Angeles Department of Building and Safety (LADBS) for projects within the LAX Northside Center District; LAFD Station No. 5 located in Area 12A East, and the First Flight Child Development Center located in Area 13.

4.5.2 Environmental Setting

4.5.2.1 Regulatory Framework

4.5.2.1.1 <u>Federal</u>

Clean Water Act (33 U.S.C. Section 1251 et seq.)

The Clean Water Act (CWA) was enacted in 1972. The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Additionally, the CWA provides guidance for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The applicable sections of the CWA are further discussed below.

<u>National Pollutant Discharge Elimination System (NPDES)</u>

NPDES permit program was introduced in 1972 under the CWA. NPDES establishes measures to control water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. A Storm Water Pollution Prevention Plan (SWPPP) is required under NPDES to identify and mitigate potential sources of pollutants.

4.5.2.1.2 State

California Building Standards Code (California Code of Regulations, Title 24)

The California Building Standards Code (CBC) is the building code for California, and Title 24 of the California Code of Regulations (CCR). It is a maintained by the California Building Standards Commission. Any building construction, alteration, repair or improvement must be monitored to ensure that it meets the standards contained in the building code regulations. The regulations are intended to ensure that accidents are avoided during building construction.

Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621 et seq.)

The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 in order to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act provides policies and criteria to assist cities, counties, and state agencies in the exercise of their responsibility to prohibit the location of developments and structures for human occupancy across the trace of active faults.

Seismic Hazards Mapping Act (Public Resources Code Sections 2690 to 2699.6)

The Seismic Hazards Mapping Act was enacted in 1990 as a result of the Loma Prieta earthquake of 1989. The Seismic Hazards Mapping Act requires the California State Geologist to create maps delineating zones where data suggests amplified seismic hazards. Responsible agencies can only approve projects within seismic hazard zones after site-specific geotechnical investigations have been conducted to identify and evaluate seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy.

Seismic Safety Act

The Seismic Safety Act was enacted in 1975 in order to advise the Governor, Legislature, and state and local governments on ways to reduce earthquake risk through an advisory committee. The subsequent advisory commission investigates earthquakes, researches earthquake-related issues and reports, and recommends to the Governor and Legislature policies and programs needed to accomplish a reduction in earthquake risk.

4.5.2.1.3 Local

City of Los Angeles General Plan Safety Element

The City of Los Angeles General Plan Safety Element (Safety Element), which was adopted in 1996, addresses public safety risks due to natural disasters including seismic events and geologic conditions, as well as sets forth guidance for emergency responders during such disasters. The objective of the Safety Element is to better protect occupants and equipment during various types and degrees of seismic events. The Safety Element also provides maps of designated areas within the City of Los Angeles that are considered susceptible to earthquake-induced hazards such as fault rupture and liquefaction. In addition, specific guidelines are included for the evaluation of liquefaction, tsunamis, seiches, flood hazards, non-structural elements, fault rupture zones, and engineering investigation reports.

City of Los Angeles Building Code

The City of Los Angeles Building Code (Chapter IX of the Los Angeles Municipal Code (LAMC)) is designed to specify a minimum acceptance level of safety for existing constructed structures. The main purpose of the Building Code is to protect public health, safety, and general welfare as they relate to the construction and occupancy of buildings and structures. The Building Code is based on the 2010 CBC and the 2009 International Building Code (IBC). Los Angeles Department of Building and Safety (LADBS) is responsible for implementing the provisions of the Building Code.

City of Los Angeles Grading Standards

The City of Los Angeles grading standards (Division 70 of Chapter IX of the LAMC) present regulations for the control of excavation, grading, and earthwork construction and are intended to safeguard life, property, and public welfare. The grading standards for the City of Los Angeles are based on the CBC, with amendments to meet local conditions. Grading standards also regulate grading design and grading plan preparation; soil and geology investigations and reports; permitting; import and export of earth materials; removal of natural vegetation and groundcover plants; and drainage, erosion, and dust control. The LADBS is responsible for implementing the provisions of the grading standards.

4.5.2.2 Existing Conditions

Regionally, the Project site is located in the Los Angeles Coastal Plain, and locally, within the El Segundo Sand Hills, an ancient floodplain (**Figure 4.5-1**). The regional context and local conditions are described separately under each topical heading in the subsections below.

4.5.2.2.1 <u>Geology</u>

Regional Conditions

The Project site is located in the northwestern extent of the Peninsular Ranges physiographic province within the Los Angeles Basin (**Figure 4.5-1**). The Peninsular Ranges province is comprised of a series of mountain ranges separated by northwest-trending valleys paralleling the northwest-trending faults associated with the San Andreas Fault Zone of Southern California. The geomorphology of the Project site and vicinity is best described as a coastal plain of the Los Angeles Basin. The Los Angeles Basin is bounded on the north by the Santa Monica Mountains, on the east by the Santa Ana Mountains and associated hills, on the south by the San Joaquin Hills and the Pacific Ocean and on the west by the Palos Verdes Hills and the Pacific Ocean.[1] More specifically, the Project site lies entirely on the physiographic area known as the El Segundo Sand Hills. The El Segundo Sand Hills overlap onto the relatively flat Torrance Plain to the east and both physiographic areas continue south from the Project site.

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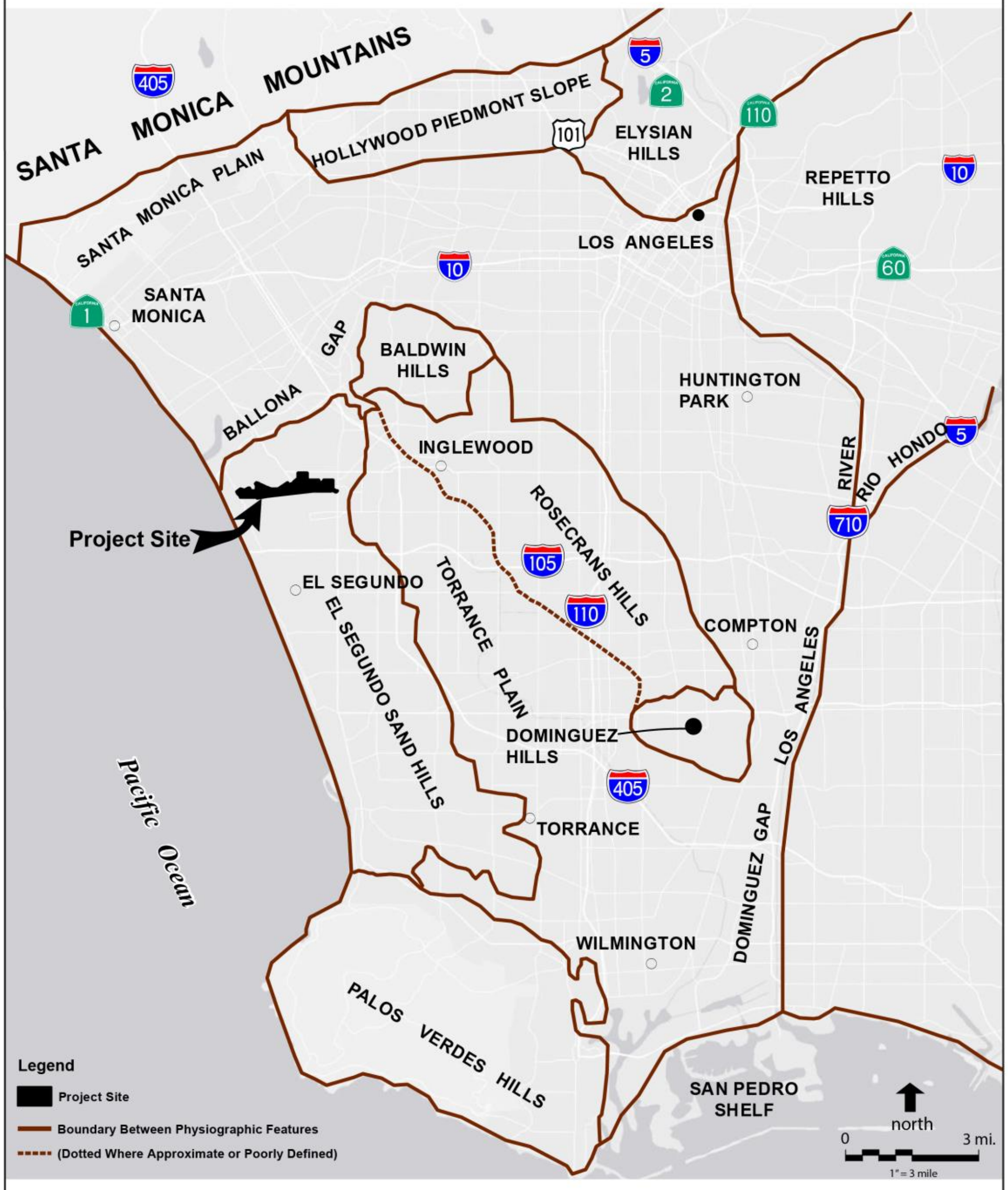
[1] Gust, Sherri and Courtney Richards (Cogstone), <u>Paleontological Resources Assessment for the Los Angeles International Airport (LAX) Northside Plan Update</u>, September 2012.



Source: *Los Angeles International Airport Layout Pl*, December 2009; LAWA 2012; LA County; USGS, January 2004; ESRI Maps and Data - July 2012; Prepared by: URS Corporation, 2014

Physiographic Map	**Draft Environmental Impact Report** **LAX Northside Plan Update**	FIGURE 4.5-1

The El Segundo Sand Hills consist of a wide belt of windblown sand dunes of varying geological age. This sand dune belt ranges in width from approximately three to six miles and stretches along the coast of the Pacific Ocean from the Ballona Escarpment (Ballona Creek) to the north, and to the Palos Verdes Hills to the south. Sand ridges can range from 85 to 185 feet above mean sea level and surround closed topographic depressions of varying depth, creating local reliefs of up to 80 feet. The region consists of flat to rolling terrain, with low hills and shallow depressions with less than 20 feet of relief.[2]

Project Site

The Project site is located on a broad terrace landform within the coastal portion of the Los Angeles Basin. Current site topography varies from relatively level to gently sloping, with ground elevations ranging from approximately 100 to 130 feet. Regional surface drainage is generally directed towards the south, with localized variations from past site grading. Prior to urbanization during the mid-1900s, the terrain consisted of sand dune topography with numerous dome-shaped hills and intervening bowl-shaped depressions. Much of the original undulating topography has been modified by development. Past undocumented grading has consisted of filling low-lying areas and excavating the former sand dunes to create the gently sloping and relatively level landforms present today.[3]

In general, the Project site contains few major structures. These structures consist of the existing animal quarantine facility, Airport support use facilities, fire station, golf course, and child development center. The site is also utilized for temporary construction staging for improvements to LAX. The Project site was essentially vacant land in the early 1900s and remained mostly undeveloped until the 1940s and 1950s when the current JetPets quarantine facility was the site of a Nike-Ajax defense missile installation. In the 1950s, the eastern end of the Project site was developed with residential neighborhoods. By 1980, the land consisting of the central portion of the Project site had been acquired by LAWA and cleared of homes. Street pavement from former streets still remains in some places, and the site contains some vegetation, including shrubs, trees, and grasses. In many areas, access to the Project site is restricted by a chain-link fence.

Published regional geologic mapping indicates the Project site is underlain by alluvial sediments (Qoa) capped by older eolian deposits (Qoe) of Pleistocene geologic (**Figure 4.5-2**). The older eolian deposits generally consist of sand and silty sand while the underlying alluvial sediments generally consist of sand, silty to clayey sand, and lesser amounts of silt, clay, and gravel. Undocumented fill soils ("af") are also present throughout the Project site.[4]

Other deposits within one mile of the Project site include recent beach sand developed marshlands, older alluvium, and deposits of the late-Pleistocene Lakewood formation. These deposits will not be impacted by construction. The cross-section for the Project site is shown on **Figure 4.5-3**. This cross-section is cut roughly parallel to and north of Westchester Parkway and depicts Area 2, Area 3, Area 11, Area 12A West, Area 12A East, and Area 12B.

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[2] City of Los Angeles, LAX Master Plan EIS/EIR, 2004, p. 4-1230, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.
[3] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.
[4] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.

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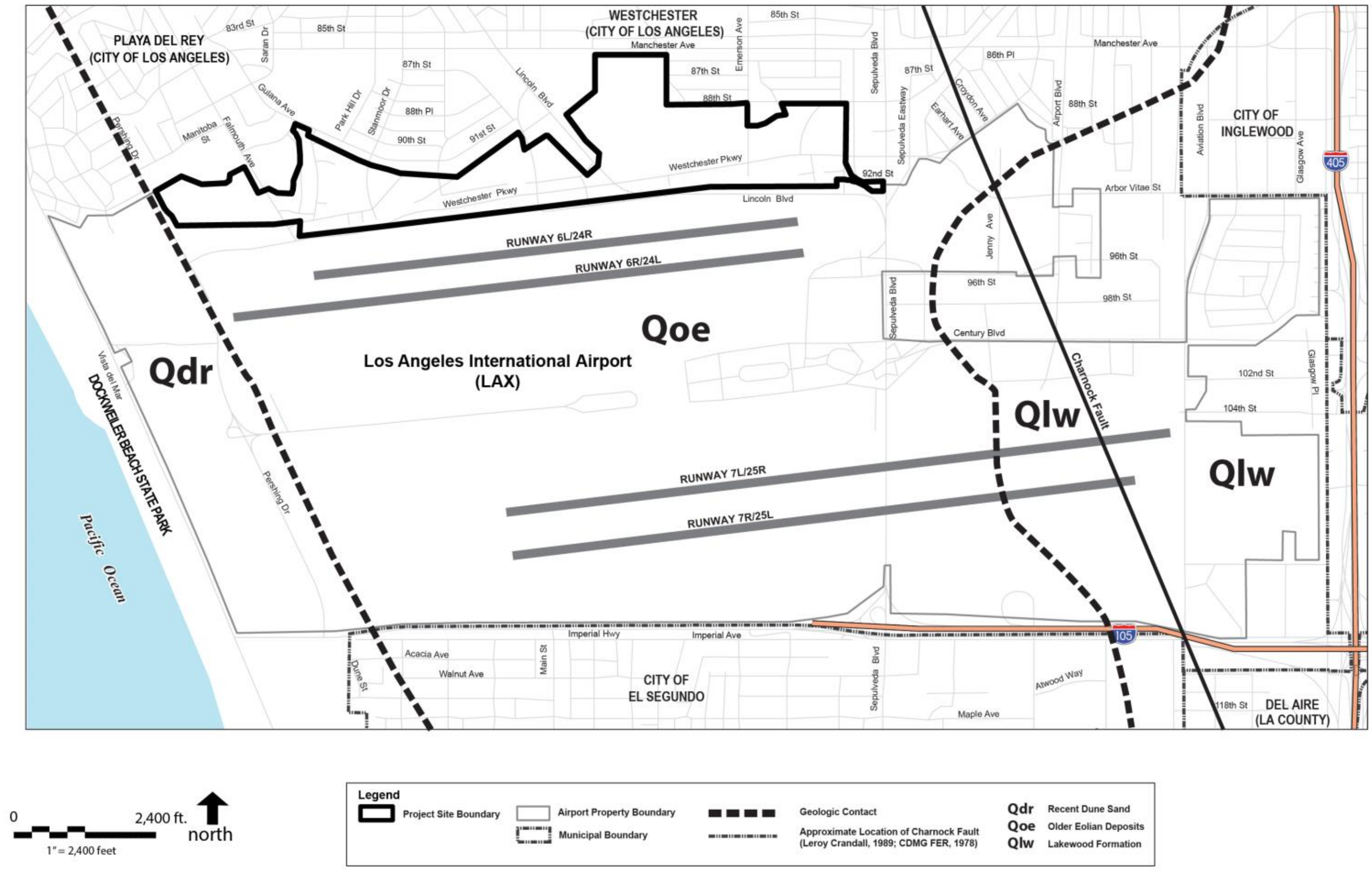
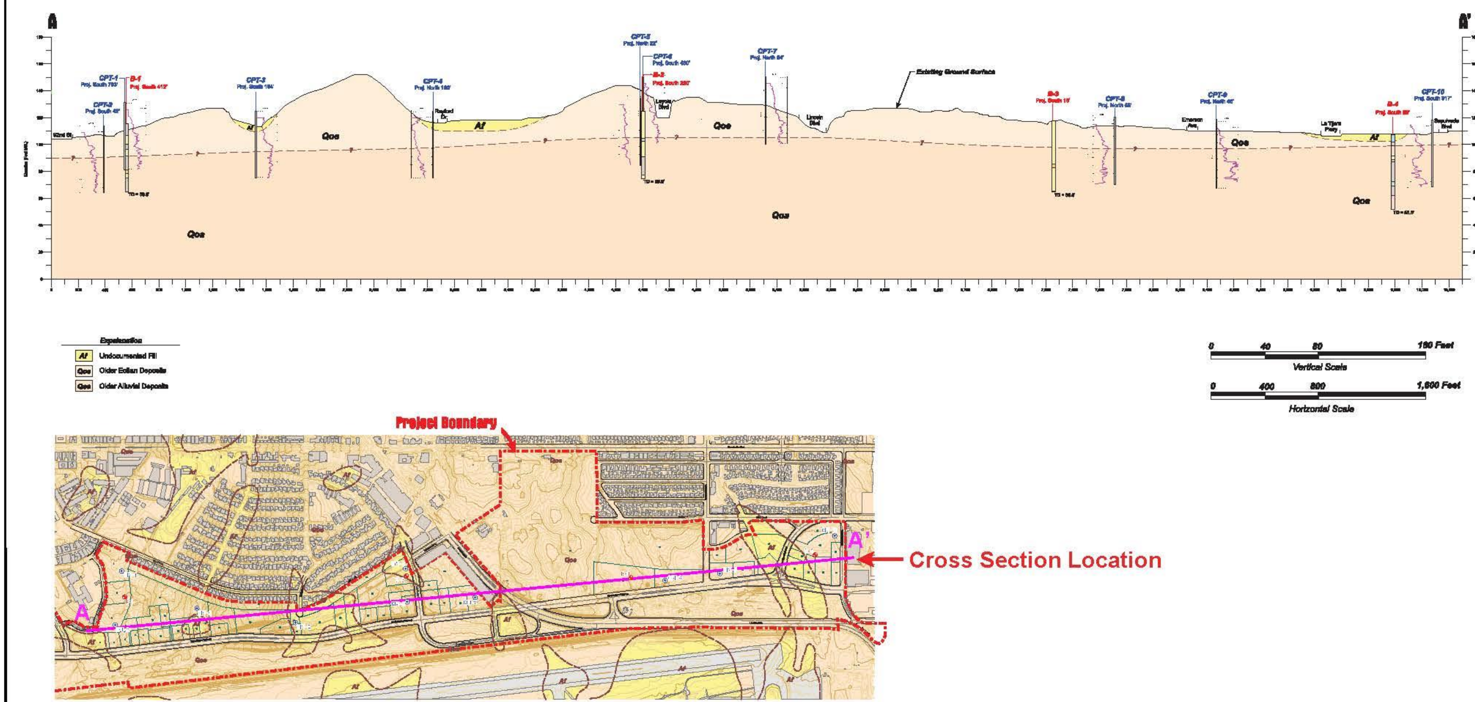


Source: LAX Master Plan EIS/EIR, Earth/Geology Technical Report, January 2001; LAWA, 2012; ESRI Maps & Data, August 2012; Prepared by: URS Corporation, 2014.

Geologic Map	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-2



Source: Geokinetics 2013; Prepared by: URS Corporation, 2014.

Project Site Soil Cross Section	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-3

Hydrogeology

The Project site is situated within the West Coast Groundwater Basin. The West Coast Groundwater Basin is bounded by the Ballona Escarpment to the north, the Newport-Inglewood Fault Zone to the east, the Palos Verdes Hills to the south, and the Pacific Ocean to the west. Regional groundwater flow in the West Coast Basin is generally in a westerly direction toward the Pacific Ocean. Groundwater flow in the West Coast Groundwater Basin is controlled by hydrologic properties of unconsolidated, permeable Quaternary sediments that are partially separated by less permeable aquitards. Although geologic conditions may be possible for water resourcing, groundwater beneath the Project site is not used for drinking water.

Groundwater occurs in several aquifers within the West Coast Groundwater Basin. Water bearing units and aquitards include the localized semiperched aquifer, the upper and lower Bellflower aquitards, and the Gage aquifer, respectively. The Gage Aquifer is underlain by the El Segundo Aquiclude and the Silverado Aquifer. Semiperched groundwater exists in discontinuous, unconfined clay lenses in the Lakewood Formation and older eolian deposits (dune sand). The total pervious area of the West Coast Groundwater Basin is 28,271 acres. The Project site is 338.5 acres and, therefore, comprises 1.2 percent of the total land area within the West Coast Groundwater Basin. In addition, surface recharge of groundwater comprises only 13 percent of aquifer recharge within the West Coast Groundwater Basin, with an approximate recharge rate of 2.88 inches per year, or a volume of 6,700 acre-foot per year (AFY). Based on the annual recharge rate for the entire West Coast Groundwater Basin, the Project site contributes 80.4 AFY of groundwater recharge.[5]

Groundwater was not encountered during subsurface exploration conducted for the proposed Project. The maximum depth explored was 55.5 feet. Review of the seismic hazards report for the Venice 7.5-minute quadrangle indicates historic high groundwater levels greater than approximately 40 feet below the surface. Current groundwater levels are indicated to be more than 100 feet below the ground surface, based on contour maps compiled by the Water Replenishment District of Southern California. Groundwater levels below the Project site will fluctuate over time due to variations in rainfall, irrigation, and groundwater pumping, however, levels shallower than the historic high are not expected in the foreseeable future.[6]

4.5.2.2.2 Faulting and Other Geological Hazards

Regional Faults

Southern California is a highly active seismic region of the United States. The Los Angeles Basin, which contains the Project site, contains a number of faults that are capable of causing earthquakes. Most faults in Southern California are characterized as northwest-trending right-lateral strike-slip faults. A strike-slip fault is defined by vertical or near vertical fractures moving horizontal along the fault. Strike-slip faults are further categorized as right-lateral or left-lateral movement depending on how the movement appears to the observer. An example of a typical strike-slip fault is shown below (**Figure 4.5-4**).

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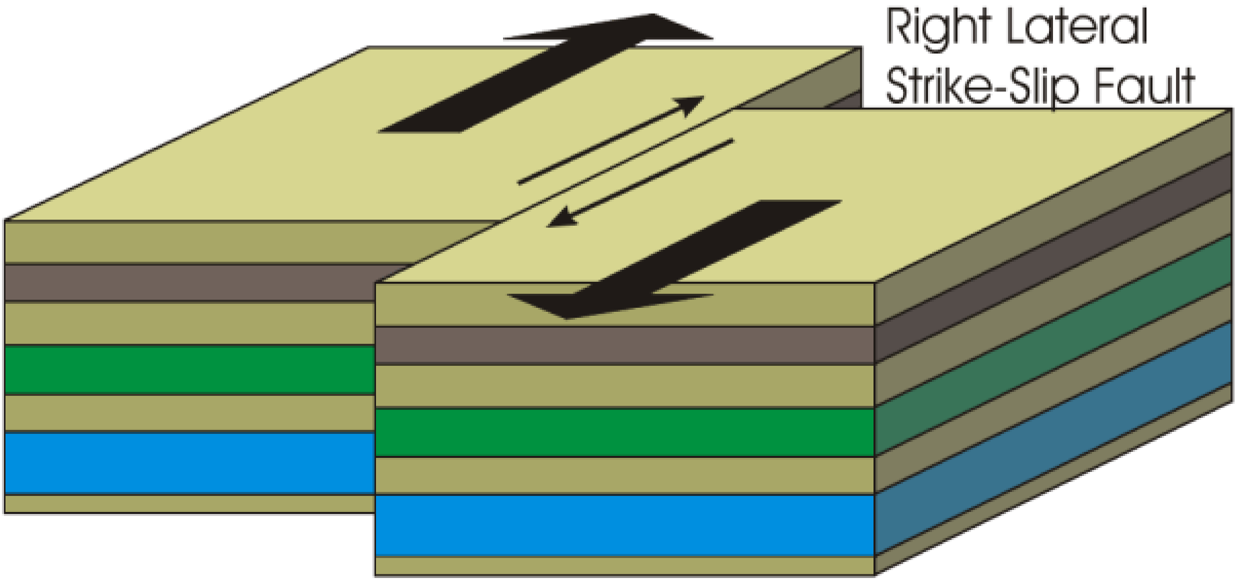
[5] City of Los Angeles, LAX Master Plan EIS/EIR 12. Hydrology and Water Quality Technical Report, 2001, page 20, online at http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.
[6] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.

Figure 4.5-4 – Typical Strike-Slip Fault



Source: USGS

In Southern California, the two major regional plates are known as the Pacific Plate and the North American Plate. Based on forces within the Earth, these two crustal plates move relative to one another. In the Los Angeles Basin, faults and related fold belts are typically responsible for the movement of these plates. If and when movement along one of these faults or fold belts occurs, the resulting sustained movement can vary. The movement can occur relatively slowly and continuously, but it can also occur episodically and relatively quickly. The latter type of fault movement is the type that is responsible for the rapid releases of large amounts of energy and cause earthquakes or related seismic events.[7]

Ground shaking due to earthquakes should be anticipated during the life of the proposed Project. The California Geologic Survey (CGS) classifies active faults as those which have, or are suspected to have, ruptured within the Holocene epoch (approximately within the last 11,700 years). CGS classifies potentially active faults as those that have evidence of activity within the Quaternary period (last 1.6 million years) but with no indication of Holocene seismic events. Active faults are typically identified based upon recorded seismic events or by radiocarbon dating recent (Holocene) sediments that have been offset during prior earthquakes.

The United States Geological Survey (USGS) and CGS have identified 20 active faults located within 50 kilometers of the Project site. Each of these faults is believed to be capable of producing sizeable earthquake events with significant ground motions. These faults are listed in **Table 4.5-1**. **Table 4.5-1** also summarizes the estimated source-site distances and estimated earthquake magnitudes (moment magnitude) for each seismogenic source. The locations of significant regional faults and the epicenters of significant historic earthquakes within the regional area of the Project site are shown in **Figure 4.5-5**.

Active faults within approximately 15 kilometers of the central portion of the Project site include the Newport-Inglewood Fault Zone (five kilometers to the east), the off-shore Palos Verdes Fault

[7] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p.p. 2-13, online at http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.

Zone (seven kilometers to the west), and the Santa Monica Fault (ten kilometers to the north). An inferred trace of the potentially active Charnock-Overland Fault, which trends sub-parallel to the northwest trending Newport-Inglewood Fault Zone, is mapped approximately 0.5 kilometers east of the far eastern portion of the Project site.

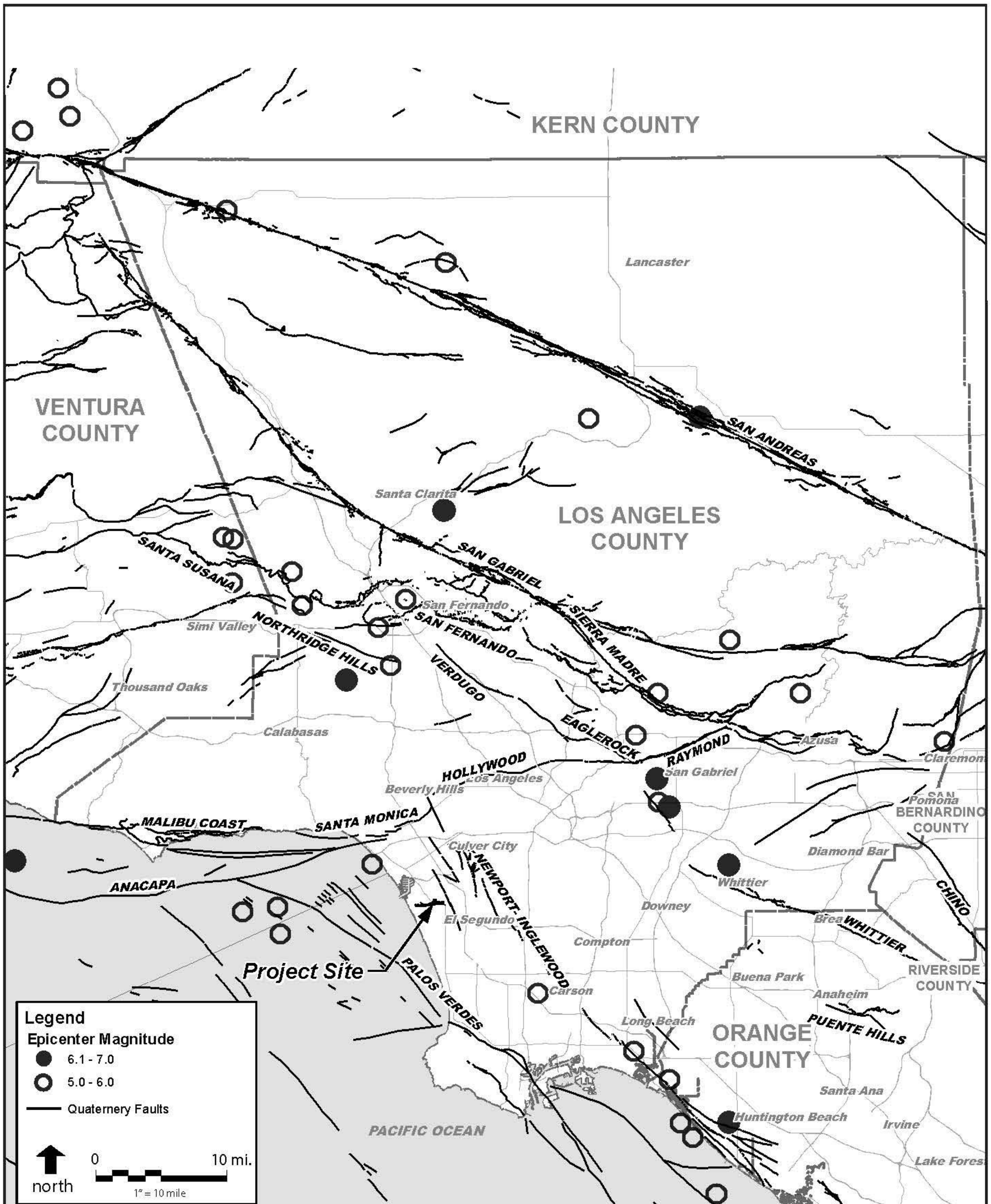
As indicated in **Table 4.5-1**, the maximum credible earthquake magnitudes (MCE) for the Charnock-Overland, Newport-Inglewood, Palos Verdes, and Santa Monica fault zones are 6.9, 7.1, 7.3, and 6.6 respectively. It should be noted that magnitude is a measure of the strength of an earthquake or strain energy released by it, as determined by seismographic observations. This is a logarithmic value originally defined by Charles Richter (1935). An increase of one unit of magnitude (for example, from 4.6 to 5.6) represents a 10-fold increase in wave amplitude on a seismogram or approximately a 30-fold increase in energy released. There is no beginning or end to this scale; however, rock mechanics seem to preclude earthquakes smaller than about –1.0 or larger than about 9.5. A magnitude –1.0 earthquake releases about 900 times less energy than a magnitude 1.0 earthquake.

Table 4.5-1

Regional Faults within 50 Kilometers of Project Site

Fault System	Distance from Site (kilometer)	Moment Magnitude
Newport-Inglewood	5.0	7.1
Palos Verdes	7.0	7.3
Santa Monica	11.9	6.6
Malibu Coast	13.7	6.7
Hollywood	14.3	6.4
Puente Hills Blind Thrust	15.5	7.1
Upper Elysian Park	21.6	6.4
Northridge (E. Oak Ridge)	22.6	7.0
Raymond	25.8	6.5
Anacapa-Dume	25.9	7.5
Verdugo	28.2	6.9
Sierra Madre	34.2	7.2
Sierra Madre (San Fernando)	36.7	6.7
Whittier	36.9	6.8
Santa Susana	40.3	6.7
San Gabriel	42.3	7.2
Clamshell-Sawpit	45.7	6.5
Holser	48.2	6.5
San Jose	49.3	6.4
Simi-Santa Rosa	51.3	7.0

Source: GeoKinetics, 2013.



Source: EHP Earthquake Fault Epicenters IMS, CA Dept of Conservation, CGS, 2000; Quarternery Faults USGS Interactive Maps, 1993. URS Corporation, 2014.

Regional Seismicity	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-5

Local Faults

The CGS categorizes faults as active, potentially active, or inactive according to the most recent seismic activity. "Active" faults are those that have ruptured to the ground surface in the Holocene time (about the last 11,000 years). "Potentially active" faults are those that have offset geologic units from the Quartenary period (the last 1,800,000 years). Nearly all movement between the two crustal plates, and therefore the majority of the seismic hazards, are on well-known faults.[8]

Active Faults

The USGS and CGS have identified 20 active faults located within 50 kilometers of the site. Each of these faults is believed to be capable of producing significant earthquake events. These faults are listed in **Table 4.5-1**. Their mapped locations, as recognized by the CGS, are shown on **Figure 4.5-5**. Active faults within approximately 15 kilometers of the central portion of the Project site include the Newport-Inglewood Fault Zone (five kilometers to the east), the off-shore Palos Verdes Fault Zone (seven kilometers to the west), Santa Monica Fault Zone (11.9 kilometers to the north), and Hollywood Fault Zone (14.3 kilometers to the northeast).

The Project site is not located within a City of Los Angeles Fault Rupture Studies Zone or within an Alquist-Priolo Special Studies Zone. The nearest and most dominant active fault to the Project site is the northwest-trending Newport-Inglewood Fault Zone, which is located approximately 5.0 kilometers to the east of the Project site (**Figure 4.5-6**). [9]

Potentially Active Faults

The closest potentially active fault to the Project site is the Charnock-Overland Fault. The Charnock-Overland Fault is an inferred trace, which trends sub-parallel to the northwest-trending Newport-Inglewood Fault Zone, and is mapped approximately 0.5 kilometers east of the far eastern portion of the Project site (**Figure 4.5-6**). Inferred fault traces are faults whose existence is probable but not yet proven through field investigation. Additionally, categorization of the Charnock-Overland Fault as "potentially active" indicates that it has not had movement between crustal plates in the last 1,800,000 years.

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[8] California Geological Survey, Faults and Earthquakes in California- Note 31, 2003.
[9] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update, 2013.

Source: *Los Angeles International Airport Layout Pl*, December 2009; LAWA 2012; LA County; USGS, January 2004; ESRI Maps and Data - July 2012; Prepared by: URS Corporation, 2014

Fault Map	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-6

Fault Rupture

Prompted by the 1971 San Fernando Earthquake, the State of California has implemented the Alquist-Priolo Earthquake Fault Zoning Act. Regulatory provisions include classification and land-use criteria associated with potential fault rupture hazards, in order to prevent the construction of buildings for human occupancy across the trace of active faults. According to the State Geologist, an active fault is defined as one which has had surface displacement within the Holocene Epoch (roughly the last 11,700 years). Earthquake Fault Zones have been delineated along the traces of active faults within the State of California. Official Maps of new and revised Earthquake Fault Zones issued pursuant to the Alquist-Priolo Earthquake Fault Zoning Act are published by the CGS. Where developments for human occupation are proposed within these zones, the state requires detailed fault investigations to be performed so that engineering geologists can mitigate the hazards associated with active faulting by identifying the location of active faults and allowing for a setback from the fault zone of previous ground rupture.

The Project site is not located within a mapped Earthquake Fault Zone, and no other known faults cross the Project site. Accordingly, the potential for surface fault rupture at the Project site is considered to be low.[10]

Seismic Ground Shaking

Ground shaking occurs during seismic events and is typically measured in two ways: visually observed local site intensity and instrumental recordings of ground movement. Both of these methods are dependent on the magnitude of the earthquake and the distance from the seismogenic fault. The hazards associated with rupture along seismogenic faults include the potential for ground rupture, ground shaking, liquefaction, lurching, tsunamis, and seiches. Local site intensity is a subjective measure based on human perception and observed response of buildings and other structures. The intensity at a point also depends on the distance from the earthquake and the local geology at that point. The intensity scale used in the United States is the Modified Mercalli Intensity Scale which assigns low to high intensity values ranging from I to XII. Most of the Los Angeles Basin could potentially be subjected to a local Modified Mercalli Intensity (MMI) of IX. Alternatively, instrumental recordings of ground movement are the basis for structural design of buildings per the Uniform Building Code (UBC). The Los Angeles Basin, and subsequently the Project site, are in seismic zone 4 (highest) according to the UBC, indicating that the highest seismic acceleration forces be accounted for in the design of structures. Considering this information, the proximity of the Project site to active faults suggests ground shaking would occur.[11]

The MCE peak ground acceleration is defined as the ground motion having a 2 percent probability of exceedance over a 50 year period. The statistical return period for the MCE is approximately 2,475 years. In accordance with American Society of Civil Engineers (ASCE) Standard 7-10, the peak ground acceleration (PGA) is derived from the MCE, with modifications allowed for Site Class (soil behavior type). The USGS Geologic Hazards Science Center's web-based program was used to calculate the PGA for the Project site. The design PGA for the Project site is 0.61g (0.61 times the acceleration of gravity).[12]

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[10] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.
[11] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p.p. 2-13, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.
[12] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.

The 2010 CBC requires that structures are designed and constructed to resist the effects of the design earthquake ground motion. These parameters are formulated from the estimated design earthquake ground motion and the site soil conditions. Based on the site soil properties, the CBC classifies site soils as Site Class A, B, C, D, E, or F. In accordance with Table 1613.5.2 of the 2010 CBC, the soil conditions below the Project site are considered Site Class D corresponding to a relatively stiff soil profile.

Preliminary seismic design parameters, based upon Site Class D soil conditions and the provisions of ASCE 7-10, are provided in **Table 4.5-2**. These parameters were calculated using the USGS Geologic Hazards Science Center's web- based program.[13]

Table 4.5-2

Seismic Design Parameters

Factors	Values
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_V	1.5
Mapped Short Period Acceleration, S_S	1.683
Mapped 1-Second Period Acceleration, S_1	0.617
Short Period Acceleration Adjusted for Site Class, S_{MS}	1.683
1-Second Period Acceleration Adjusted for Site Class, S_{M1}	0.926
Design Short Period Acceleration, S_{DS}	1.122
Design 1-Second Period Acceleration, S_{D1}	0.617
Source: GeoKinetics, 2013.	

Soil Stability and Landslides

Slope failure occurs when the driving force induced by the weight of the earth materials within the slope exceed the shear strength of those materials. During seismic shaking, the ground surface is subjected to accelerations which can cause an increase in the apparent weight and driving force of earth materials, and a slope which was stable under static gravity loads can fail. Review of historic seismicity and close proximity of the area to significant fault zones clearly indicates that the Project site is subject to strong seismic ground shaking.

Review of the Seismic Hazard Zone Map for the Venice 7.5-minute quadrangle indicates that the Project site is not located within a mapped earthquake-induced landslide zone. Graded and natural slopes within the Project site are relatively low in height with gentle gradients. The potential for seismically induced landslides is considered low.[14]

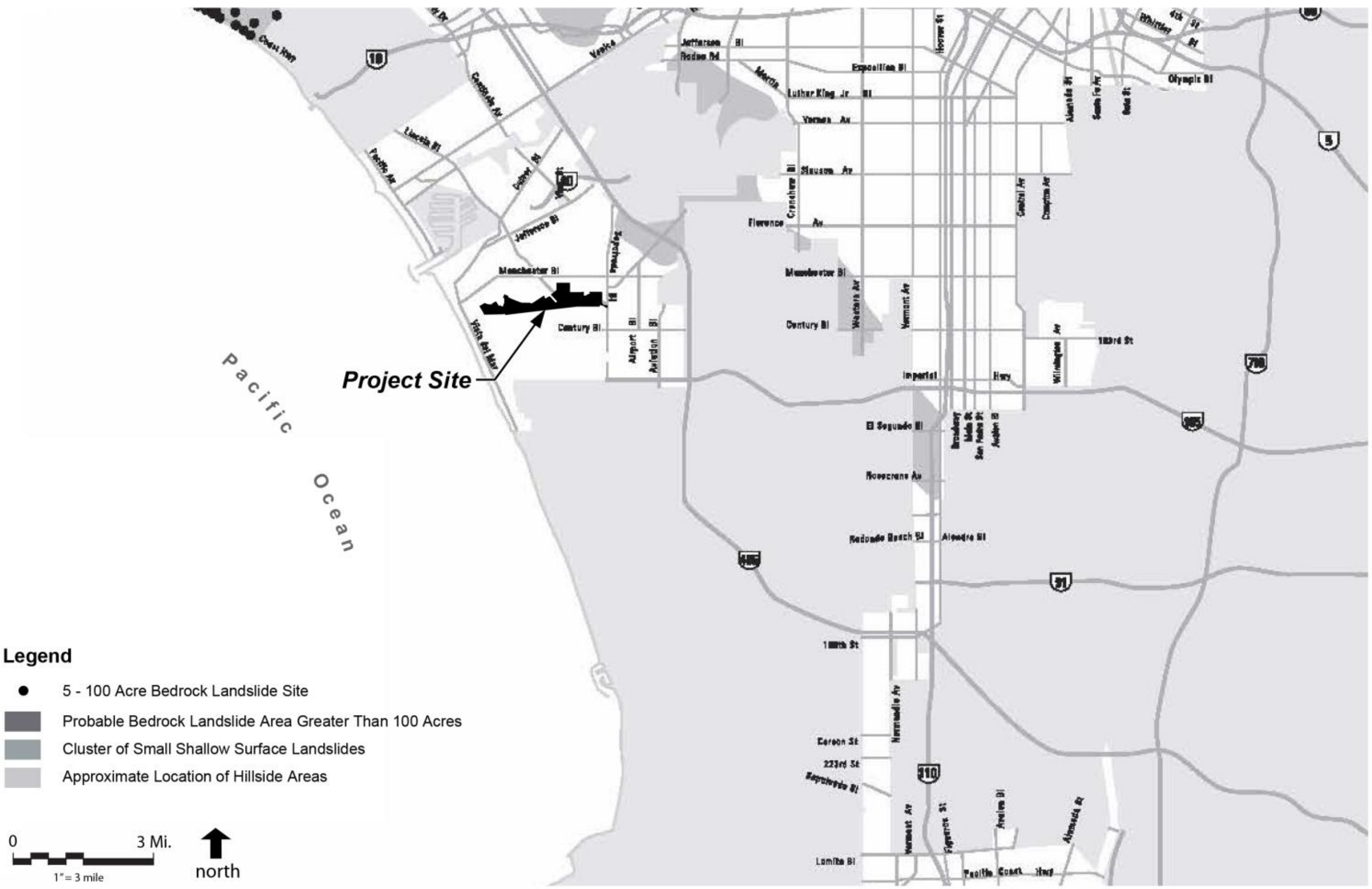
[13] *Ibid.*
[14] *Ibid.*

Shrinkage and Subsidence

Shrinkage and subsidence is the lowering of land surface as a result of the extraction of oil, groundwater, or other materials. The removal of oil, gas, and other fluids from oil field reservoir materials can create voids that can collapse and may result in eventual ground surface subsidence. Ground surface subsidence can result in differential settlement and cause damage to engineered structures. The Project site is not located in an area of known ground subsidence. However, subsidence has been documented in several oil fields in the Project site vicinity, including the Inglewood and Playa Del Rey Oil Fields, which are located to the north and northeast of the Project site (2.25 miles and 0.25 miles, respectively). The Inglewood Oil Field may be experiencing subsidence at a rate of 0.2 feet per year. However, the Project site is not located within the subsidence bowl, the center of which is located about 3.25 miles to the north of the Project site, near the corner of La Cienega Boulevard and Stocker Street.[15] The El Segundo and Hyperion Oil Fields lie directly south of the Project site. Subsidence has not occurred in either the El Segundo or Hyperion Oil Fields.[16]

The removal of groundwater from subsurface aquifers can cause the collapse of voids in aquifer materials and can lead to ground surface subsidence which, in turn, can cause damage to engineered structures. Although groundwater is pumped from, as well as injected into, the West Coast Basin aquifers that lie beneath the Project site, the withdrawals are generally in balance with influx, and no groundwater withdrawal-related subsidence has been reported in the geotechnical investigations reviewed for the proposed Project.[17]

[15] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p.29, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.
[16] *Ibid*.
[17] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p. 30, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.



Source: LAX Northside Plan Update Design Plan and Development Guidelines, LAWA 2013; City of Los Angeles, 2013; URS Corporation; Prepared by: URS Corporation.

Slope Stability	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-7

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Liquefaction Potential

Liquefaction is the loss of strength in generally cohesionless (granular), saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to, or exceeds, the overburden pressure. The primary factors which influence the potential for liquefaction include the groundwater-table elevation; the soil type and grain size characteristics; the relative density of the soil; the overburden or confining pressure; and the intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d50, the grain diameter size in the 50th percentile) grain size in the range of 0.075 to 0.2 millimeters. Clayey (cohesive) soils, or soils which possess a clay content (particle diameter less than 0.005 millimeters) in excess of 20 percent are generally not considered to be susceptible to liquefaction. Although the sandy substrate at the Project site varies in density, the potential for liquefaction is generally low. Borings conducted at the Project site at depths of 50.5 to 55.5 feet did not encounter groundwater. Furthermore, the Project site is not located in a designated liquefaction hazard zone as shown on the "Seismic Hazard Zones" map issued by the State of California.[18] Any settlement would be localized and limited to the previously stated susceptible soil conditions. However, the City of Los Angeles General Plan Safety Element (1996) shows a limited portion of the east side of the Project site, within the LAX Northside Center and LAX Northside Airport Support Districts, as being within a liquefaction zone (**Figure 4.5-8**). The liquefaction areas represent approximately 41 acres of the approximately 338.5 acre Project site. Within the LAX Northside Center District, 12 acres of Area 11; 0.1 acre of Area 12A West; and 11 acres of Area 12A East are within the liquefaction zone. Within the LAX Northside Airport Support District, 10 acres of Area 9 are within the liquefaction zone. There are no liquefaction areas in the LAX Northside Campus District.

Lurching

Seismically induced lateral spreading, or lurching, is a potential hazard characterized by lateral movement of saturated soil due to ground shaking. Unlike landslides which occur on steep slopes, lateral spreading can occur on gentle slopes, generally along river banks and shorelines where loose sediments are commonly found. The movement can cause material to yield in the unsupported direction, forming a series of cracks separating the ground into rough blocks. However, the Project site does not lie within a designated City of Los Angeles Slope Stability Area, which shows areas subject to lurching.[19] Additionally, in the absence of shallow groundwater and unsupported embankments, the potential for lateral spreading at the Project site is low.

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[18] City of Los Angeles Department of Building and Safety, Soils Report Approval Letter for Tentative Tract Map 72148, 2013.
[19] City of Los Angeles, City of Los Angeles General Plan, Safety Element, p. 51,1996.

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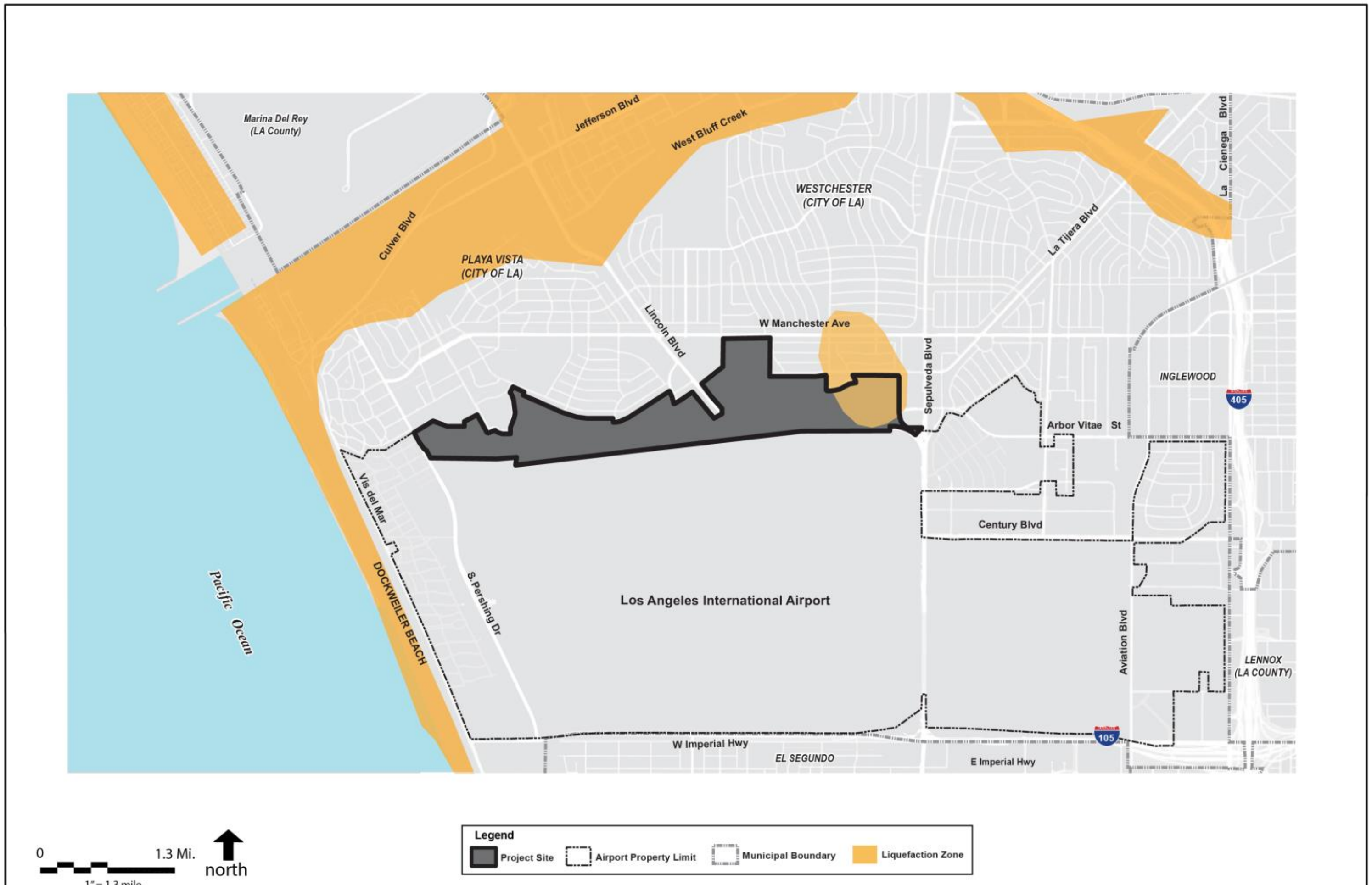

Source: City of Los Angeles General Plan Safety Element, 1993; LAWA, 2013; ESRI Maps and Data, February 2013; Prepared by: URS Corporation, 2014.

Liquefaction Map	Draft Environmental Impact Report LAX Northside Plan Update	FIGURE 4.5-8

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Tsunami and Seiche

Tsunamis are among the most potentially destructive natural phenomena to threaten coastal areas in the State of California. Tsunamis are generated by seismic shaking of the sea floor, submarine landslides, and exploding volcanic islands. These events displace sea water and generate wave trains.

A tsunami's size and intensity relates to: the magnitude and depth of the reasonable earthquake; volume, shape, and magnitude of any sea floor displacement; and, water depth or the amount of water displaced. Thus, most historically significant tsunamis are generated by seismic thrusting events which occur at oceanic trenches. Strike-slip earthquake events historically have not caused significant tsunamis.

In Southern California, plate movement is accommodated primarily by strike slip faults and, thus, there is a low potential for locally-generated tsunamis. Trans-oceanic tsunamis also have negligible effects in Southern California due to the complex basin-ridge bathymetry of the wide Southern California borderland terrace. Essentially, tsunami wave amplitude is diminished by Southern California's complex submerged topography.[20]

Combined historical data and numerical modeling used to predict 100-year and 500-year tsunami heights for the LAX area, which include the Project site, predicted 100-year and 500-year tsunami heights are 4.2 and 6.0 feet, respectively. In reference to the predicted tsunami height values, it should be noted that three important factors exist. First, the historic tsunami record may not be long enough to allow meaningful extrapolation to future events. Secondly, the predicted heights are not the maximum heights that may occur. Lastly, the 100-year and 500-year intervals do not specify a time period, rather they represent a probability over time. Due to the elevation of LAX and its vicinity (approximately 100 feet above sea level), the Project site is not located within a tsunami hazard area.[21] Additionally, based on review of the CGS Tsunami Inundation Map for the Venice 7.5-minute quadrangle, the Project site is not located within a tsunami inundation-hazard area.

The USACE is responsible for constructing and maintaining the breakwaters which are designed to mitigate damaging wave action, particularly in harbor areas. The City of Los Angeles Harbor Department (now referred to as "The Port of Los Angeles") works cooperatively with the USACE relative to maintenance and protection of the breakwater facilities. Along with the fire and police departments, it participates in the federal tsunami alert program to warn potentially affected properties and harbor tenants of tsunami threats and to advise them concerning protective response actions.

The City of Los Angeles Flood Hazard Specific Plan sets forth design criteria for development in coastal zones. LADBS's Flood Hazard Management Specific Plan Guidelines (Flood Hazard Guidelines) address the requirements and standards for construction within flood risk zones based on the Los Angeles Flood Hazard Map (LAFHM). The Flood Hazard Guidelines contain the limitations on construction within Coastal High-hazard Areas (Zones V and VI-30 on the LAFHM), or areas susceptible to tsunamis or other relevant predominant wave activity. According to the LAFHM, no portion of the Project site is within a flood hazard area, as designated by the Federal Emergency Management Agency (FEMA).

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[20] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p.p. 28 to 29, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.
[21] *Ibid*.

Seiches are oscillations and waves generated in an enclosed body of water by seismic shaking. The closest bodies of water which would be susceptible to a seiche would be the marina in Marina Del Rey (1.2 miles north of the Project site), Ballona Creek (1.5 miles north of the Project site), and Argo Drainage Channel (directly south of the Project site along the boundary of Area 4 and the LAX North Airfield). The Project site is over 100 feet above Marina Del Rey and the Ballona Creek and 50 feet above the Argo Drainage Channel making wave oscillation topographically improbable. Because there is no immediate threat to the Project site, seiches are not considered a potential hazard. Additionally, no dams or dikes are located within the Project site vicinity; therefore, flooding due to a dam or dike failure during an earthquake is not considered a potential hazard.

4.5.2.2.3 Existing Surface and Subsurface Installations and Uses

Surface and subsurface installations have been previously installed throughout the Project site. Both types of installations make up a low percentage of the total area for the Project site but still contain the typical characteristics of previous development including utility tie-ins. Surface installations are minimal but exist in the form of a golf course, fire station, animal quarantine facility, child development center, and a small network of streets and street lamps that remain from previous development. The majority of subsurface installations at the Project site are utilities that tie into the existing sewer and water transportation systems previously built along Westchester Parkway in 1990. This infrastructure work was based on the Northside Development Plans in 1986, which aimed to increase the development potential for the Project site. The existing systems run mainly parallel to Westchester Parkway with subsidiary connections branching throughout the Project site. Gas lines also exist throughout the Project site, possibly from the previous housing development. In addition to these utilities, there are also electrical utility lines surrounding the perimeter of the Project site.

4.5.3 Impact Analysis

4.5.3.1 Methodology

The following evaluation of potential impacts is based on published reports and topographic images from the CGS and USGS. These agencies offer information which is used to determine the existence of known geologic formations and historical conditions. Relevant information was also taken from the LAX Master Plan EIS/EIR Earth/Geology Technical Report as needed. Finally, this analysis relies on the findings of the Preliminary Geotechnical Assessment, LAX Northside Plan Update Project prepared by GeoKinetics in March 2013 (included as Appendix H). This report included a document search at the LADBS Records Section for grading plans and geotechnical reports issued for the numerous land parcels comprising the Project site. Subsurface field exploration included the advancement of ten Cone Penetration Tests (CPTs) along with the excavation and sampling of four small-diameter borings spaced across the Project site. After reports and technical information were reviewed, site conditions were compared by evaluating the potential for the proposed Project to impact geologic conditions while also being compared against CEQA thresholds.

4.5.3.2 Significance Thresholds

According to the Los Angeles CEQA Thresholds Guide, a significant geology/soils impact would occur if the direct and indirect changes in the environment that may be caused by the proposed Project would potentially result in one or more of the following future conditions:

- Geologic Hazards:
  - Cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury;
- Sedimentation and Erosion:
  - Constitute a geologic hazard to other properties by causing or accelerating instability from erosion;
  - Accelerate natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition which would not be contained or controlled on-site; and
- Landform Alteration:
  - One or more distinct and prominent geologic or topographic features would be destroyed, permanently covered, or materially and adversely modified as a result of the project. Such features may include, but are not limited to, hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands.

4.5.3.3 LAX Master Plan Commitments and Project Design Features

4.5.3.3.1 <u>LAX Master Plan EIS/EIR Commitments</u>

As part of the LAX Master Plan, LAWA adopted several mitigation measures and commitments pertaining to geology and soils to avoid or reduce environmental impacts. Since the Project site is located within the LAX Master Plan boundaries, LAWA will also fulfill the commitments it has made in the LAX Master Plan for the proposed Project. The following commitments are applicable to the proposed Project and were considered in the geology and soils analysis herein.

- **MM- Air Quality (AQ)-2: Construction Related Measure:** The required components of the construction-related air quality mitigation measure are itemized below. These components include numerous specific actions to reduce emissions of fugitive dust and of exhaust emissions from on-road and nonroad mobile sources and stationary engines. All of these components must be in place prior to commencement of the first Master Plan construction project and must remain in place through build out of the Master Plan. An implementation plan will be developed which provides available details as to how each of the elements of this construction-related mitigation measure will be implemented and monitored. Each construction subcontractor will be responsible to implement all measures that apply to the equipment and activities under his/her control, an obligation which will be formalized in the contractual documents, with financial penalties for noncompliance. LAWA will assign one or more environmental coordinators whose responsibility it will be to ensure compliance with the construction-related measure by use of direct inspections, records reviews, and investigation of complaints with reporting to LAWA management for follow-up action. The estimated ranges of emissions reductions quantified for this mitigation measure for Alternative D are shown in Table F5-8, Estimated Ranges of Emission Reductions for Construction-Related Air Quality Mitigation Measures. Reliable emissions reductions were not able to be quantified for all of these components.

Table F5-8

Estimated Ranges of Emissions Reductions for Construction-Related Air Quality Mitigation Measures

Pollutant	Alternatives A, B, C, and D[1] (tons)
ROG	1 - 10
NO_X	300 - 1,100
CO	10 - 30
PM_{10}	140 - 400
SO_X	1 - 10

[1] In the year of peak construction emissions.

Source: Camp Dresser & McKee Inc., 2004.

The specific components of this construction-related air quality mitigation measure include:

1. Fugitive Dust Source Controls:
    - Apply non-toxic soil stabilizer to all inactive construction areas (i.e., areas with disturbed soil).
    - Following the addition of materials to, or removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing non-toxic soil stabilizer.
    - Post a publicly visible sign with the telephone number and person to contact regarding dust complaints; this person shall respond and take corrective action within 24 hours.
    - Prior to final occupancy, the applicant demonstrates that all ground surfaces are covered or treated sufficiently to minimize fugitive dust emissions.
    - All roadways, driveways, sidewalks, etc. being installed as part of project should be completed as soon as possible; in addition, building pads should be laid as soon as possible after grading.
    - Pave all construction access roads at least 100 feet on to the site from the main road.
2. On-Road Mobile Source Controls:
    - To the extent feasible, have construction employees work/commute during off-peak hours.
    - Make available on-site lunch trucks during construction to minimize off-site worker vehicle trips.
3. Nonroad Mobile Source Controls:
    - Prohibit staging or parking of construction vehicles (including workers' vehicles) on streets adjacent to sensitive receptors such as schools, daycare centers, and hospitals.

    - Prohibit construction vehicle idling in excess of ten minutes.
    - Utilize on-site rock crushing facility, when feasible, during construction to reuse rock/concrete and minimize off-site truck haul trips.

4. Stationary Point Source Controls:
    - Specify combination of electricity from power poles and portable diesel- or gasoline-fueled generators using "cleaner burning diesel" fuel and exhaust emission controls.
5. Mobile and Stationary Source Controls:
    - Specify combination of construction equipment using "cleaner burning diesel" fuel and exhaust emission controls.
    - Suspend use of all construction equipment during a second-stage smog alert in the immediate vicinity of LAX.
    - Utilize construction equipment having the minimum practical engine size (i.e., lowest appropriate horsepower rating for intended job).
    - Require that all construction equipment working on site is properly maintained (including engine tuning) at all times in accordance with manufacturers' specifications and schedules.
    - Prohibit tampering with construction equipment to increase horsepower or to defeat emission control devices.
6. Administrative Controls:
    - The contractor or builder shall designate a person or persons to ensure the implementation of all components of the construction-related measure through direct inspections, records reviews, and investigations of complaints.

- **HWQ-1: Conceptual Drainage Plan.** Once a Master Plan alternative is selected, and in conjunction with its design, LAWA will develop a conceptual drainage plan of the area within the boundaries of the Master Plan alternative (in accordance with FAA guidelines and to the satisfaction of the City of Los Angeles Department of Public Works, Bureau of Engineering). The purpose of the drainage plan will be to assess area-wide drainage flows as related to the Master Plan project area, and at a level of detail sufficient to identify the overall improvements necessary to provide adequate drainage capacity to prevent flooding. The conceptual drainage plan will provide the basis and specifications from which detailed drainage improvement plans will be designed in conjunction with site engineering specific to each Master Plan project. Best Management Practices (BMPs) will be incorporated to minimize the effect of airport operations on surface water quality and to prevent a net increase in pollutant loads to surface water resulting from the selected Master Plan alternative.

  To evaluate drainage capacity, LAWA will use either the Peak Rate Method specified in Part G - Storm Drain Design of the City of Los Angeles' Bureau of Engineering Manual or the Los Angeles County Modified Rational Method, both of which are acceptable to the LADPW. In areas within the boundary of the selected alternative where the surface water runoff rates are found to exceed the capacity of the storm water conveyance infrastructure with the potential to cause flooding, LAWA will take measures to either reduce peak flow rates or increase the structure's capacity. These drainage facilities will be designed to ensure that they adequately convey storm water runoff and prevent flooding by adhering to the procedures set forth by the Peak Rate Method/Los Angeles County Modified Rational Method.

Methods to reduce the peak flow of surface water runoff could include:

- Decreasing impervious area by removing unnecessary pavement or utilizing porous concrete or modular pavement
- Building storm water detention structures
- Diverting runoff to pervious areas (reducing directly-connected impervious areas)
- Diverting runoff to outfalls with additional capacity (reducing the total drainage area for an individual outfall)
- Redirecting storm water flows to increase the time of concentration

Measures to increase drainage capacity could include:

- Increasing the size and slope (capacity) of storm water conveyance structures (pipes, culverts, channels, etc.).
- Increasing the number of storm water conveyance structures and/or outfalls.

To evaluate the effect of the selected Master Plan alternative on surface water quality, LAWA will prepare a specific Standard Urban Stormwater Mitigation Plan (SUSMP) for the selected alternative, as required by the LARWQCB. The SUSMP addresses water quality and drainage issues by specifying source control, structural, and treatment control BMPs with the objective of reducing the discharge of pollutants from the stormwater conveyance system to the maximum extent practicable. Once BMPs are identified, an updated pollutant load estimate will be calculated that takes into account reductions from treatment control BMPs.

These BMPs will be applied to both existing and future sources with the goal of achieving no net increase in loadings of pollutants of concern to receiving water bodies. LAWA will therefore address water quality issues, including erosion and sedimentation, and comply with the SUSMP requirements by designing the storm water system through incorporation of the structural and treatment control BMPs specified in the SUSMP.

The following list includes some of the BMPs that could be employed to infiltrate or treat storm water runoff and dry weather flows, and control peak flow rates.

- Vegetated swales and strips
- Oil/Water separators
- Clarifiers
- Media filtration
- Catch basin inserts and screens
- Continuous flow deflective systems
- Bioretention and infiltration
- Detention basins
- Manufactured treatment units

- Hydrodynamic devices

Other structural BMPs may also be selected from the literature and the many federal, state and local guidance documents available. Performance of structural BMPs varies considerably based on their design. USEPA has published estimated ranges of pollutant removal efficiencies for structural BMPs based on substantial document review.

These ranges of removal efficiencies are presented in Table F5-1, Structural BMP Expected Pollutant Removal Efficiency.

Table F5-1

Structural BMP Expected Pollutant Removal Efficiency

	Typical Pollutant Removal (percent)			
BMP Type	**Suspended Solids**	**Nitrogen**	**Phosphorus**	**Metals**
Dry Detention Basins	30-35	15-45	15-45	15-45
Retention Basins	50-80	30-65	30-65	50-80
Infiltration Basins	50-80	50-80	50-80	50-80
Infiltration Trenches/Dry Wells	50-80	50-80	15-45	50-80
Porous Pavement	65-100	65-100	30-65	65-100
Grassed Swales	30-65	15-45	15-45	15-45
Vegetated Filter Strips	50-80	50-80	50-80	30-65
Surface Sand Filters	50-80	<30	50-80	50-80
Other Media Filters	65-100	15-45	0	50-80

Source: U.S. Environmental Protection Agency, Preliminary Data Summary of Urban Storm Water Best Management Practices Methodology, August 1999.

In addition to the structural BMP types that will be used, non-structural/source control BMPs will continue to be a part of the LAX program to reduce pollutant loadings. Existing practices and potentially new ones will be extended to acquisition areas and to the areas where airport operations will increase in frequency or duration.

These source control BMPs will be incorporated into the LAX Storm Water Pollution Prevention Plan (SWPPP) and will consequently be required of LAWA and all airport tenants at all locations where industrial activities occur that have the potential to impact water quality.

The overall result of Master Plan Commitment HWQ-1 will be a drainage infrastructure that provides adequate drainage capacity to prevent flooding and control peak flow discharges, that incorporates BMPs to minimize the effect of airport operations on surface water quality, and that prevents a net increase of pollutant loads to either receiving water body as a result of the selected Master Plan alternative.

4.5.3.3.2 Project Design Features

Construction

Construction activities for the proposed Project would require earthwork, including grading. It is anticipated that up to approximately 33,420 cubic yards of cut and 40,204 cubic yards of fill would be required in the LAX Northside Center District, up to approximately 439,787 cubic yards of cut and 147,338 cubic yards of fill would be required in the LAX Northside Campus District, and up to approximately 66,329 cubic yards of cut and 20,686 cubic yards of fill would be required in the LAX Northside Airport Support District. In total, it is anticipated that up to approximately 539,536 cubic yards of cut and 208,228 cubic yards of fill would be required for construction of the proposed Project.

The anticipated grading approach for the proposed Project would involve the transfer of excavated materials between development subareas within the Project site in order to reduce the need to import or export these materials from outside of the Project site.

The following Project Design Features (PDFs) apply to construction:

- **PDF Geology/Soils (G)-1:** Site-specific geotechnical investigation and reports for any specific proposed construction or grading shall be submitted to the Grading Division of the LADBS for review. No permits shall be issued until said report(s) have been approved.[22]
- **PDF G-2:** The proposed use of on-site materials for surcharging and backfilling will help reduce the import and export requirements of the proposed Project. Surcharging is defined by the placement of extra fill on an area to use the extra weight of the fill for consolidating and compacting the underlying soils and then, when the desired amount of compaction has occurred, removing the excess materials. Based on the amount of consolidation that occurs, the amount of material removed at the end of the surcharge process would be less than that originally placed.
- **PDF G-3:** The proposed Project would be compliant with specific recommendations for grading guidelines, foundation design, retaining wall design, temporary excavations, slabs on grade, site drainage, design review, construction monitoring, and geotechnical testing to the satisfaction of the LADBS, as conditions to issuance of any grading and building permits.
- **PDF G-4:** Grading would be scheduled, annually, for completion prior to the start of the rainy season (between November 1 and April 15 per the LADBS Building Code, Section 7002.), or detailed temporary erosion control plans would be implemented in a manner satisfactory to the LADBS to minimize potential erosion during construction.
- **PDF G-5:** Provisions will be made for adequate surface drainage away from the areas of excavation as well as protection of excavated areas from flooding.
- **PDF G-6:** The grading contractor will control surface water and the transportation of silt and sediment.
- **PDF G-7:** Appropriate erosion control and drainage devices will be incorporated to the satisfaction of the LADBS. Such measures include interceptor terraces, berms, vee-channels, and inlet and outlet structures.
- **PDF G-8:** Backfilling would be used during the construction of the proposed Project. Backfilling involves mostly the placement and compaction of graded materials around the base of new structures as they are completed.

[22] City of Los Angeles Department of Building and Safety, Soils Report Approval Letter for Tentative Tract Map 72148, 2013.

- **PDF G-9:** As part of the grading program, erosion and sedimentation control measures (e.g., SWPPP and Erosion Control Plan) would be implemented during site grading to reduce erosion impacts.
- **PDF G-10:** With regard to seismic considerations, all construction for the proposed Project would conform to the requirements of the LAMC Building Code, and the most recent UBC, including the provisions related to seismic safety.
- **PDF G-11:** Seismic design for structures and foundations will comply with the most current seismic building code standards for site-specific soil conditions.
- **PDF G-12:** Temporary dewatering activities are not expected during construction of the proposed Project. However, if the water table is unexpectedly discovered during construction, dewatering would be conducted in accordance with the requirements of the Regional Water Quality Control Board (RWQCB) and would also be subject to the review and approval of the LADBS, as appropriate.

Operations

The proposed Project building design and construction would conform to the current building and safety design provision of the CBC and the LAMC Building Code. In addition, individual developments within the Project site would comply with the construction and design recommendations provided within the proposed LAX Northside Design Guidelines and Standards. The following Project Design Features are intended to minimize impacts to geology and soils:

- **PDF G-13:** The grading concept ensures new buildings will comply with applicable FAA height restrictions and orient the LAX Northside project to Westchester Parkway while buffering the existing neighborhoods to the north.
- **PDF G-14:** The grading concept will better link future development to recreational opportunities along Westchester Parkway and lower the grade of development of the proposed Project relative to existing residential neighborhoods to the north.
- **PDF G-15:** Within the LAX Northside Campus District, grading strategies in Areas 2 and 3 will bring building elevations down in height to orient the buildings to Westchester Parkway, while in Area 1 existing grading will be preserved to separate the potential open space uses planned for this area from Westchester Parkway.
- **PDF G-16:** The proposed LAX Northside Design Guidelines and Standards require parking areas to be designed to mitigate stormwater, including sedimentation and erosion, through planters that capture and use runoff and curb cuts that allow stormwater drainage into landscaping islands and fingers. Planters, bioswales, and other catchment areas are designed to capture stormwater runoff. The capture of stormwater would allow for multiple functions, including minimizing sedimentation.
- **PDF G-17:** The proposed Project would permit subterranean parking approximately 45 feet deep. All subterranean parking and structures above parking would be constructed in compliance with CBC and the LAMC Building Code requirements to ensure that future buildings would be adequately supported by the underlying soils.

4.5.3.4 Project Impacts

4.5.3.4.1 Geologic Hazards

Fault Rupture

As discussed above, no known active or potentially active faults underlie the Project site. In addition, the Project site is not located within an Alquist-Priolo Special Study Zone or City of Los Angeles Rupture Study Zone. Accordingly, the potential for surface fault rupture at the Project site is considered to be low. As discussed under Project Design Features, all structures would be designed, located, and built in accordance with LADBS requirements and current seismic design provisions of the CBC. Therefore, the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury involving rupture of a known earthquake fault. Impacts associated with surface fault rupture would be less than significant.

Seismic Ground Shaking

The Project site is located in the seismically active Los Angeles Basin, and, therefore, has the potential to be subjected to strong seismic ground shaking. However, the Project site is not located within an Alquist-Priolo Special Study Zone or City of Los Angeles Rupture Study Zone. Additionally, faults within 50 kilometers of the Project site were evaluated as part of the Preliminary Geotechnical Assessment, prepared for the proposed Project. No active or potentially active faults were discovered within the Project site. Active faults within approximately 15 kilometers of the central portion of the Project site include the Newport-Inglewood Fault Zone (five kilometers to the east), the off-shore Palos Verdes Fault Zone (seven kilometers to the west), and the Santa Monica Fault (ten kilometers to the north). An inferred trace of the potentially active Charnock-Overland Fault, which trends sub-parallel to the northwest trending Newport-Inglewood Fault Zone, is mapped approximately 0.5 kilometers east of the far eastern portion of the Project site.

The Preliminary Geotechnical Assessment calculated the probability that a ground motion would be exceeded at a given site due to earthquakes from all regional seismic sources with their respective probabilities of occurrence. Maximum ground motion for the Project site was calculated for a 2 percent earthquake (i.e., the ground motion having a 2 percent probability of exceedance over a 50 year period or a return period of approximately 2,475 years). Based on information from the USGS, there is a 2 percent probability that a PGA of 0.61g would be exceeded in 50 years in the Project site vicinity.

As with any new development in the State of California, building design and construction for the proposed Project would be required to conform to the current seismic design provisions of the CBC. The 2010 CBC incorporates the latest seismic design standards for structural loads and materials as well as provisions from the National Earthquake Hazards Reduction Program (NEHRP) to mitigate losses from an earthquake and provide for the latest in earthquake safety. These standards are among the strictest standards in the seismic safety requirements contained in the LAMC Building Code. Therefore, the proposed Project would not cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury impacts from strong seismic ground shaking. Impacts related to seismic ground shaking would be less than significant.

Liquefaction

Borings conducted at the Project site at depths of 50.5 to 55.5 feet did not encounter groundwater and the Project site is not mapped as being within a liquefaction hazard zone by the State of California. However, the City of Los Angeles General Plan Safety Element (1996) shows a limited portion of the east side of the Project site, within the LAX Northside Center and LAX Northside Airport Support Districts, as being within a liquefaction zone.

LAX Northside Center District

Area 11

Area 11 is not mapped as being within a liquefaction hazard zone by the State of California, however approximately 12 acres of Area 11 within the LAX Northside Center District are located within a City of Los Angeles-designated liquefaction area (**Figure 4.5-8**). Thus, the potential for liquefaction to occur within Area 11 is considered low to moderate. Furthermore, boring at a depth of 55.5 feet below ground surface (bgs) in Area 11 did not encounter groundwater. The LAMC Building Code and the UBC require that foundation strength, building design, and building materials be adjusted to limit any impact related to liquefaction for construction in liquefaction zones. Therefore, impacts related to liquefaction would be less than significant.

Area 12A East

Area 12A East is not mapped as being within a liquefaction hazard zone by the State of California, however approximately 11 acres of Area 12A East within the LAX Northside Center District are located within a City of Los Angeles-designated liquefaction area (**Figure 4.5-8**). Thus, the potential for liquefaction to occur within Area 12A East is considered low to moderate. The LAMC Building Code and the UBC require that foundation strength, building design, and building materials be adjusted to limit any impact related to liquefaction for construction in liquefaction zones. Therefore, impacts related to liquefaction would be less than significant.

Area 12B

Area 12B is not mapped as being within a liquefaction hazard zone by the State of California, however approximately 0.1 acre of Area 12B within the LAX Northside Center District is located within a City of Los Angeles-designated liquefaction area (**Figure 4.5-8**). The proposed Project does not include any construction on Area 12B. The existing Westchester Golf Course would remain in its existing location and configuration. Therefore, impacts related to liquefaction would not occur.

Area 12A West and Area 13

These areas within the LAX Northside Center District are not located within a State of California- or City of Los Angeles-designated liquefaction hazard zone. Furthermore, boring at a depth of 50.5 feet bgs in Area 12A West did not encounter groundwater. Therefore, impacts related to liquefaction would not occur.

LAX Northside Campus District

Areas 1, 2, and 3

Areas 1, 2, and 3 within the LAX Northside Airport Support District are not located within a State of California- or City of Los Angeles-designated liquefaction hazard zone. Furthermore, borings at 50.5 and 55.5 feet bgs in Area 2 did not encounter groundwater. Therefore, impacts related to liquefaction would not occur.

LAX Northside Airport Support District

Areas 4, 5, 6, 7, 8, and 10

These areas within the LAX Northside Center District are not located within a State of California- or City of Los Angeles-designated liquefaction hazard zone. Therefore, impacts related to liquefaction would not occur.

Area 9

Area 9 is not mapped as being within a liquefaction hazard zone by the State of California, however approximately 10 acres of Area 9 within the LAX Northside Airport Support District are located within a City of Los Angeles-designated liquefaction area (**Figure 4.5-8**). Thus, the potential for liquefaction to occur within Area 9 is considered low to moderate. The Los Angeles Building Code (LABC) and the UBC require that foundation strength, building design, and building materials be adjusted to limit any impacts related to liquefaction for construction in liquefaction zones. Therefore, impacts related to liquefaction would be less than significant.

Landslides

The Project site and surrounding area has an average slope of less than 30 percent, and thus is not susceptible to potential hazards from slope stability. Furthermore, the Project site is not located within a State of California-designated seismic hazard zone for landslide potential or a City of Los Angeles-designated landslide inventory area. Additionally, all construction would reduce slope percentages through grading and would be secured in accordance with the LABC. Therefore, the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk or injury due to landslides. Therefore, impacts related to landslides would be less than significant.

Inundation

Based on a review of the CGS Tsunami Inundation Map for the Venice 7.5-minute quadrangle, the Project site is not located within a tsunami inundation-hazard area (CGS 2009).[23] As such, no impacts associated with tsunamis would occur.

Furthermore, the proposed Project would comply with any applicable strategic plans developed by the State of California Office of Emergency Services and the Los Angeles County Office of Emergency Management, as well as the construction limitations contained in the City of Los Angeles Flood Hazard Management Specific Plan Guidelines (as referenced in the City of Los Angeles General Plan Safety Element).[24]

As previously mentioned, seiches are oscillations and waves generated in an enclosed body of water by seismic shaking. The closest bodies of water which would be susceptible to a seiche would be the marina in Marina Del Rey (1.2 miles north) and Ballona Creek (1.5 miles north) and Argo Drainage Channel (directly south of the Project site along the boundary of Area 4 and the LAX North Airfield). The Project site is over 100 feet above Marina Del Rey and the Ballona Creek and over 50 feet above the Argo Drainage Channel making wave oscillation topographically improbable. Because there is no threat to the Project site, seiches are not a

[23] California Geological Survey (CGS) and California Emergency Management Agency (CEMA), Tsunami Inundation Map for Emergency Planning, Venice Quadrangle, March 1, 2009.
[24] City of Los Angeles, LAX Master Plan EIS/EIR 12. Earth/Geology Technical Report, 2001, p.p. 28 to 29, online at: http://www.ourlax.org/docs/draft_eir_NE/T12_LR.pdf, accessed August 2, 2012.

hazard for the proposed Project. Additionally, no dams or dikes are located within or near the Project site.

Therefore, the proposed Project would not cause or accelerate geologic hazards which would result in substantial damage to structures or infrastructure or expose people to substantial risk of injury due to inundation by a dam or a seiche. Impacts related to inundation by seiche/dam failure would be less than significant.

Soil Conditions

Near-surface soil encountered within borings conducted for the proposed Project were observed to be sand soils estimated to have a very low to low expansion potential. Project site soils are anticipated to have negligible soluble sulfate levels. Additionally, the Project site soils are anticipated to have low to moderate levels of soluble chloride and relatively low electrical resistivity.[25]

Previously developed areas of the Project site may have deep fill. Proposed Project construction could result in excavation of approximately 45 feet Below Ground Surface (bgs) for subterranean parking. Thus, discovery of fill may be encountered during excavation activities for the proposed Project. However, compliance with CBC and the LABC requirements would ensure that future buildings would be adequately supported by the underlying soils. Therefore, the proposed Project would not cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury impacts from soil conditions. Impacts related to soil conditions would be less than significant.

4.5.3.4.2 Sedimentation and Erosion

Erosion

Erosion could potentially occur from exposed soils (active dune sand and alluvium) during construction of the proposed Project. However, construction activities would occur in accordance with City of Los Angeles erosion control requirements that include grading and dust control measures. Additionally, construction would comply with the LABC, which requires necessary permits, plans, plan checks, and inspections to ensure that the proposed Project would reduce erosion effects.

In addition, all construction would be required to comply with the City of Los Angeles grading permit regulations, which require necessary measures, plans, and inspections to reduce sedimentation and erosion. Therefore, construction-related impacts related to soil erosion would be less than significant.

Despite the Project site having an average slope of less than 30 percent, grading would still be required under the proposed Project in order to accommodate all proposed development. Grading would include excavation of earthen material and placement of earthen material. This is otherwise known as cut and fill. It is anticipated that up to 499,536 cubic yards of soil would be cut, 208,228 cubic yards would be used as fill, and 291,308 cubic yards would be exported during construction. Grading has the potential to increase the risk of erosion during Project site preparation and construction activities. However, erosion would be reduced by implementing appropriate erosion control measures during excavation and grading activities. During the

[25] GeoKinetics, Preliminary Geotechnical Assessment, LAX Northside Plan Update Project, 2013.

construction phase of the proposed Project, construction activities will be subject to the requirements of a National Pollutant Discharge Elimination System (NPDES) construction permit. Compliance with the NPDES permit includes implementing BMPs, some of which are specifically implemented to reduce soil erosion and loss of topsoil. Additionally, the proposed Project would comply with LAX Master Plan EIR/EIS commitments and mitigation measures MM-AQ-2 and HWQ-1 that require measures to control erosion.

Therefore, the proposed Project would not constitute a geologic hazard to other properties by causing or accelerating instability from erosion. Impacts related to erosion would be less than significant.

Sedimentation

Sedimentation could potentially occur from exposed soils (active dune sand and alluvium) during construction of the proposed Project. However, construction activities would occur in accordance with City of Los Angeles erosion control requirements that include grading and dust control measures. Additionally, construction would comply with the LABC, which requires necessary permits, plans, plan checks, and inspections to ensure that the proposed Project would reduce sedimentation effects.

Temporary dewatering activities are not expected during construction of the proposed Project. However, if dewatering occurs as a result of unexpected water table discovery during construction it would be conducted in accordance with the requirements of the RWQCB and would also be subject to the review and approval of the LADBS, as appropriate.

In addition, all construction would be required to comply with the City of Los Angeles grading permit regulations, which require necessary measures, plans, and inspections to reduce sedimentation and erosion as well as the LAWA SWPPP. The LAWA SWPPP provides general stormwater plans, such as drainage system layout maps, descriptions of past and present potential sources of pollutants in its stormwater runoff and discharges, and identifies programs that will be implemented to address these runoff pollutants. As part of the SWPPP, BMPs would be implemented during construction to reduce sedimentation and erosion levels to the maximum extent possible. BMPs that would be implemented include, but are not limited to:

- Soil stabilization (erosion control) techniques such as seeding and planting, mulching, and check dams;
- Sediment control methods such as detention basins, silt fences, and dust controls;
- Earth Dikes and drainage swales to divert runoff;
- Contractor training programs;
- Material transfer programs;
- Waste management practices such as providing designated storage areas and containers for specific waste for regular collection;
- Roadway cleaning/tracking control practices;
- Vehicle and equipment cleaning and maintenance practices; and/or
- Fueling practices.

Additionally, the proposed Project would comply with LAX Master Plan EIR/EIS commitments and mitigation measures MM-AQ-2 and HWQ-1 that require measures to control sedimentation.

Therefore, construction-related impacts related to soil sedimentation would be less than significant.

During operation, the proposed Project may result in a limited degree of soil sedimentation effects from non-vegetated areas. However, in accordance with NPDES requirements, the proposed Project would be required to have a SUSMP in place during the operational life of the proposed Project. The SUSMP would include BMPs that would reduce on-site sedimentation from vegetated areas on the Project site through stormwater control devices. These stormwater control devices include, but are not be limited to, vegetated swales and strips, oil/water separators, clarifiers, and catch basin inserts and screens. Additionally, the Project Design Features include the use of bioswales and permeable pavement to capture sediment runoff or deposition and contain and control it on-site.

Therefore, the proposed Project would not accelerate natural processes of wind and water erosion and sedimentation, resultant in sediment runoff or deposition which would not be contained or controlled-on-site. Impacts related to wind and water sedimentation would be less than significant.

4.5.3.4.3 Landform Alteration

There are no distinct and prominent geologic or topographic features (i.e., hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, or wetlands) on the Project site. While the proposed Project would involve grading that will alter the site topography, the majority of the Project site has been previously disturbed and does not contain prominent geologic or topographic features. Therefore, the proposed Project would not destroy, permanently cover, or materially and adversely modify any distinct and prominent geologic or topographic features. Impacts associated with landform alteration would not occur.

4.5.3.5 Transfer Program

The proposed Project would include flexibility to allow for transfers of floor area within Districts (the LAX Northside Center District, LAX Northside Campus District, and LAX Northside Airport Support District) on a per square foot basis. While transfers of floor area across Districts would be permitted, the maximum proposed Project total of 2,320,000 square feet may not be exceeded. Floor area transfers would not result in new impacts with regard to geology and soils. Geological conditions are typically site-specific. Thus, transfers of floor area within Districts would not affect the assessment of the proposed Project site's geological and soil conditions as provided within this Draft EIR section. Furthermore, all new proposed Project development would incorporate the Project Design Features previously described (e.g., compliance with construction and design recommendations provided within site-specific geotechnical reports, CBC, and LADBS Building Code) and would comply with LAX Master Plan EIR/EIS commitments MM-AQ-2 and HWQ-1. As such, floor area transfers would not alter the conclusions with regard to geology and soil impacts. Should floor area be transferred within Districts, the resulting impacts would be similar to those evaluated herein.

4.5.4 Cumulative Impacts

Due to site-specific nature of geological conditions (i.e., soils, geological features, seismic features, etc.), geology impacts are typically assessed on a project-by-project basis, rather than on a cumulative basis. Nonetheless, cumulative growth through 2022 (inclusive of the related projects identified in Section 3, Environmental Setting, of this Draft EIR) would expose a greater number of people to seismic hazards. However, as with the proposed Project, related projects and other future development projects would be subject to the same local, regional, state, and Federal regulations pertaining to geology and soils, including CBC and LABC requirements. Therefore, with adherence to such regulations, cumulative impacts with regard to geology and soils would be less than significant.

4.5.5 Mitigation Measures

The proposed Project will be developed in compliance with all statutory requirements to preclude significant impacts on geology and soils. In addition, implementation of the Project Design Features and compliance with LAX Master Plan EIR/EIS commitments and mitigation measures would ensure that impacts relative to geology and soils associated with the proposed Project would be less than significant. Therefore, no mitigation measures specific to the proposed Project are required.

4.5.6 Level Of Significance after Mitigation

Impacts related to geology and soils are expected to be less than significant as a result of the proposed Project. Adherence to predetermined plans, building standards, and regulatory codes, along with the Project Design Features and compliance with LAX Master Plan EIR/EIS commitments and mitigation measures as discussed above, would ensure any potential impacts related to geology and soils remain at less than significant levels.