4.0 ENVIRONMENTAL IMPACT ANALYSIS
D. GEOLOGY AND SOILS

1. INTRODUCTION

This section describes existing conditions and the regulatory framework associated with geology and soils and analyzes the potential impacts of the Project regarding fault rupture, seismic hazards, ground shaking, liquefaction, soil erosion or the loss of topsoil, expansive soils, and landform/landslide in the unincorporated Los Angeles community of West Carson and in the Project vicinity. Information in this section is based on the analysis and findings provided in the Preliminary Geotechnical Evaluation for the Harbor-UCLA Medical Center Master Plan (Geotechnical Report), prepared by Ninyo & Moore, April 2015. The Geotechnical Report is included in Appendix C of this Draft EIR.

2. ENVIRONMENTAL SETTING

a. Regional Geology

The Project Site is located within the Peninsular Ranges Geomorphic Province of southern California. This geomorphic province encompasses an area that extends approximately 125 miles from the Transverse Ranges and the Los Angeles River Basin south to the Mexican border and beyond another approximately 775 miles to the tip of Baja California. The Peninsular Ranges province varies in width from approximately 30 to 100 miles is characterized by northwest-trending mountain range blocks separated by similarly trending faults.

The predominant rock type that underlies the Peninsular Ranges province is a Cretaceous age igneous rock (granitic rock) referred to as the Southern California batholith. Older Jurassic age metavolcanic and metasedimentary rocks and older Paleozoic limestone, altered schist, and gneiss are present within the province. Cretaceous-age marine sedimentary rocks and younger Tertiary-age rocks comprised of volcanic, marine, and non-marine sediments overlie the older rocks. More recent Quaternary sediments, primarily of alluvial origin, comprise the low-lying valley and drainage areas within the region, including the area where the Harbor-UCLA Medical Center Project Site is located.

The Project is situated in the Los Angeles Basin, a region divided into four structural blocks that include uplifted zones and synclinal depressions. The structural blocks are generally bounded by fault systems. The Project site is situated in the southwestern block of the seaward part of the basin which is bounded by the Newport-Inglewood zone of deformation. This block is a combination of folds and faults and is characterized by overlapping staggering anticlinal hills. Newport-Inglewood and Palos Verdes are the major active fault systems located in proximity to the Project site. The predominant tectonic activity associated with these and other faults within the regional tectonic framework is right-lateral, strike-slip and/or reverse movement.

b. Site Geology

Regional geologic maps indicate that the Project site is underlain by late to middle Pleistocene age alluvial flood plain deposits generally comprised of dissected gravel, sand, silt and clay-bearing alluvium.

(1) Groundwater

The site is located within the west coast sub-basin of the Los Angeles Coastal Groundwater Basin. Historic groundwater monitoring well data from the State of California Water Resources Control Board's GeoTracker Website[1] were reviewed for wells located on adjacent properties east and north of the Project site. Based on the groundwater measurements in these wells from 2007 to 2014, groundwater levels at these locations have ranged from approximately 48 to 60 feet below the ground surface. The Los Angeles County Safety Element indicates that the historic high groundwater in the vicinity of the Project site is approximately 30 feet deep. Groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations. Shallow perched conditions may be present onsite.

(2) Faulting and Seismicity

The Project site is located in a seismically active area, as is the majority of southern California and the potential for strong ground motion at the site is considered significant. Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. According to the preliminary Geotechnical Report (Appendix C), the Project site is not transected by any known active or potentially active faults. However, earthquake events on one of the active or potentially active faults near the Project Site could result in strong ground shaking, which could affect the Harbor-UCLA Medical Center campus.

The Project is not located within a State of California Earthquake Fault Zone, although the active Newport-Inglewood fault is located approximately 3.4 miles northeast. **Figure 4.D-1,** *Regional Fault Locations***,** shows the Project location relative to the principal faults in the region. Blind thrust faults are low-angle faults at depths that do not break the surface and are, therefore, not shown on Figure 4.D-1. **Table 4.D-1,** *Principal Regional Active Faults*, lists selected principal known active faults, including blind thrust faults, within approximately 30 miles of the center of the Project area and their maximum moment magnitude (M_{max})[2].

According to the Geotechnical Report prepared for the proposed Project, the site is not located within an area considered susceptible to liquefaction (**Figure 4.D-2**, *Liquefaction Seismic Hazar*d Zones). In addition, the potential for liquefaction at the site is considered relatively low based on recent groundwater depths of 48 to 60 feet in the site vicinity.

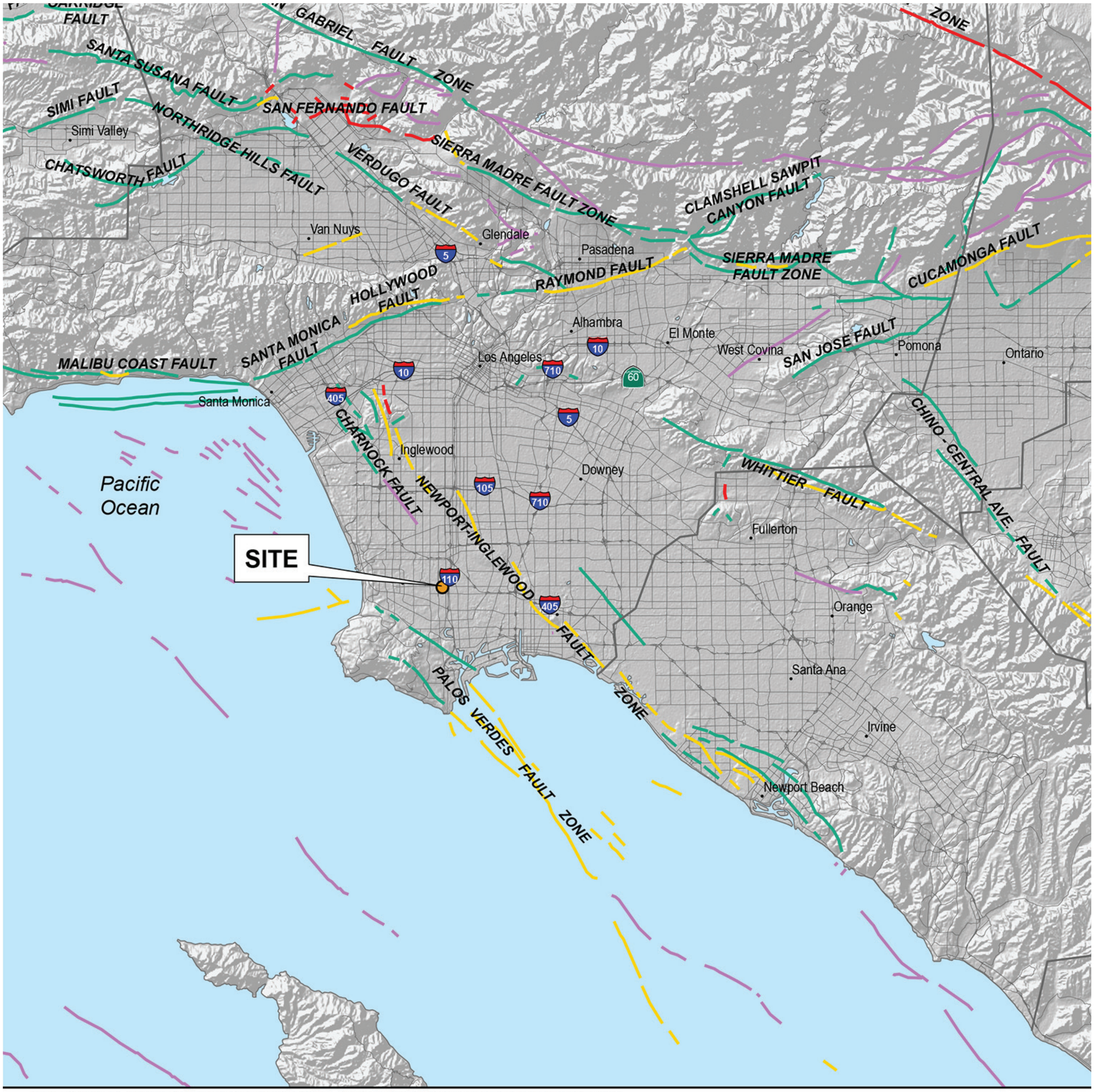
(3) Landslides

Landslides, slope failures, and mudflows of earth materials generally occur where slopes are steep and/or the earth materials are too weak to support themselves. Earthquake-induced landslides may also occur due to seismic ground shaking. A review of geologic maps did not reveal any past landslides at the Project site. In addition, the Project Site has been extensively developed and is primarily covered with pavement, hardscape, and buildings and structures. The Project Site also includes some small graded slopes associated

---

1 *State of California Water Resources Control Board. http://geotracker.waterboards.ca.gov/gama/gamamap/public/default.asp?CMD=runreport&myaddress=harbor+ucla+medical+center%2C+carson%2C+ca. Accessed, April, 2015*

2 *Cao, et al., 2003. The Revised 2002 California Probabilistic Seismic Hazard Maps. http://www.conservation.ca.gov/cgs/rghm/psha/ofr9608/Pages/Index.aspx, Accessed, April 2015*



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
REFERENCE: JENNINGS, 2010, FAULT ACTIVITY MAP OF CALIFORNIA.

LEGEND

FAULT ACTIVITY:

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- COUNTY BOUNDARIES
- LATE QUATERNARY
- QUATERNARY

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

N

0 10 Miles

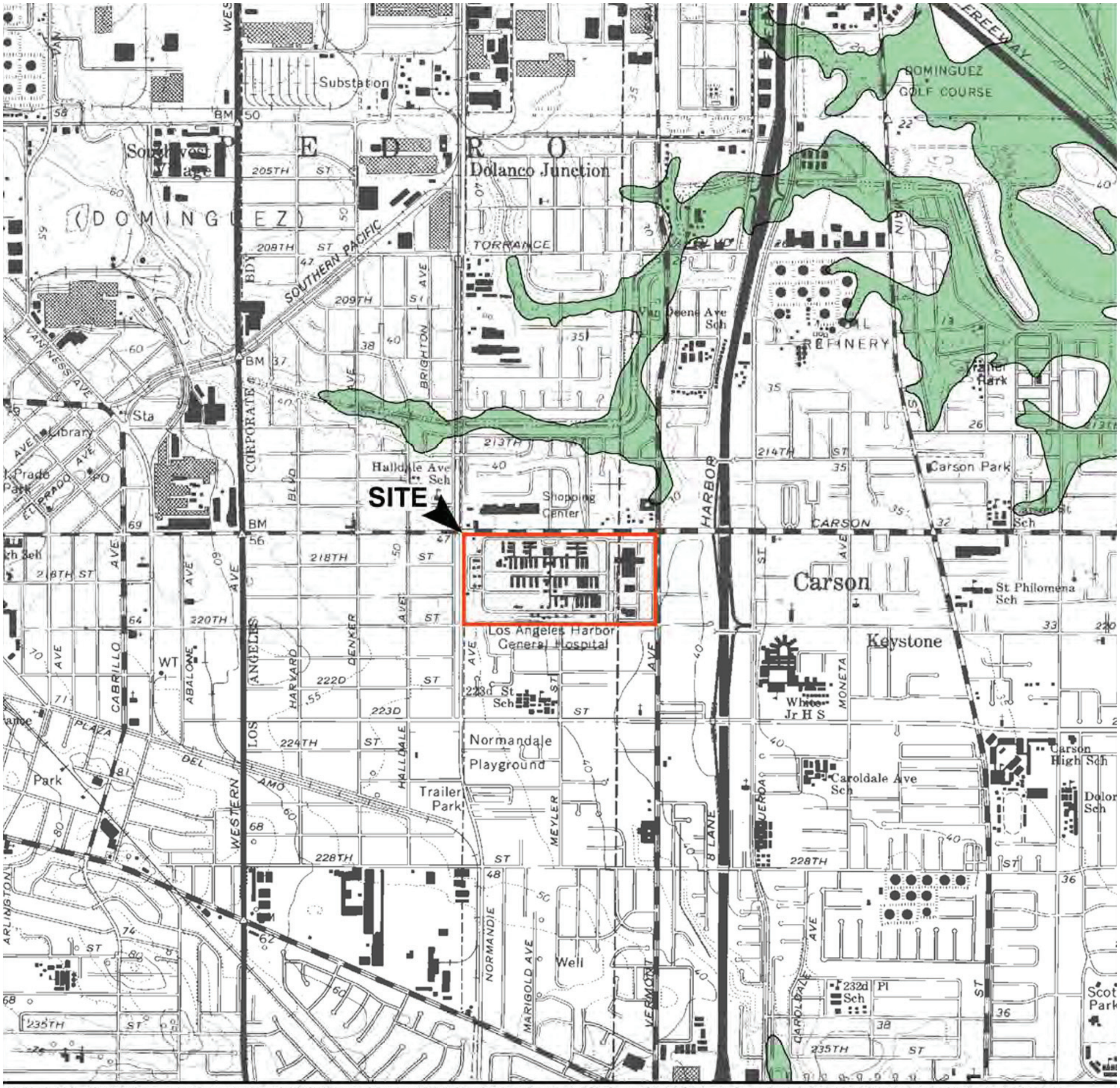
Regional Fault Locations

FIGURE **4.D-1**

Harbor-UCLA Medical Center Master Plan

Source: Ninyo and Moore Geotechnical and Environmental Sciences Consultants, April 2015.

PCR



REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY, STATE OF CALIFORNIA, 1999, SEISMIC HAZARD ZONES MAP OFFICIAL REVISED MAP TORRANCE QUADRANGLE, 7.5-MINUTE SERIES: SCALE 1:24,000.

LEGEND

LIQUEFACTION:
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

N

0 2000 Feet

Liquefaction Seismic Hazards Zone Map

Harbor-UCLA Medical Center Master Plan

Source: Ninyo and Moore Geotechnical and Environmental Sciences Consultants, April 2015.

FIGURE

4.D-2

Table 4.D-1

Principal Regional Active Faults

Fault	Approximate Fault Distance[a] to Site Miles (Kilometers)	Maximum Moment Magnitude (M_{max})
Newport-Inglewood (Los Angeles Basin)	3.4 (5.5)	7.1
Palos Verdes	307 (5.9)	7.3
Puente Hills Blind Thrust	10.3 (16.5)	7.1
Upper Elysian Park Blind Thrust	16.7 (26.8)	6.4
Santa Monica	16.9 (27.1)	6.6
Elsinore	18.1 (29.1)	6.7
Hollywood	18.6 (30.0)	6.4
Malibu	19.1 (30.7)	6.7
Anacapa-Dume	19.8 (31.9)	7.5
Raymond	20.5 (32.9)	6.5
Verdugo	22.2 (35.7)	6.9
San Joaquin Hills Blind Thrust	22.7 (36.5)	6.6
Sierra Madre	26.9 (43.3)	7.2
San Jose	27.8 (44.7)	6.4
Clamshell-Sawpit	29.3 (47.1)	6.5

[a] *USGS, 2008*

Source: Ninyo & Moore, 2015

with landscaping and pedestrian areas. An on-site area northwest of the Existing Hospital Tower contains a slope that descends approximately 25 feet toward the edge of the building. This slope is landscaped and lined at the bottom edge with a drainage system. According to the Geotechnical Report, the potential for future landslides or mudflows to affect developments within the Project area is relatively low.

(4) Site Soils

Exposed materials at the surface of the Project site include clays and silty sandy soils. Sandy soils typically have low cohesion, and have a relatively higher potential for erosion from surface runoff when exposed in cut slopes or utilized near the face of fill embankments. Surface soils with higher amounts of clay tend to be less erodible as the clay acts as a binder to hold the soil particles together.

Soil erosion refers to the process by which soil or earth material is loosened or dissolved and removed from its original location. Erosion can occur by varying processes and may occur in the Project area where bare soil is exposed to wind or moving water (both rainfall and surface runoff). The processes of erosion are generally a function of material type, terrain steepness, rainfall or irrigation levels, surface drainage conditions, and general land uses.

(5) Subsidence

Subsidence is characterized as a sinking of ground surface relative to surrounding areas, and can generally occur where deep soil deposits are present. Subsidence in areas of deep soil deposits is typically associated with regional groundwater withdrawal or other fluid withdrawal from the ground such as oil and natural gas. Subsidence can result in the development of ground cracks and damage to subsurface vaults, pipelines and other improvements.

Historically, subsidence has occurred in the City of Long Beach, but is not known to have occurred at the Project site. The County of Los Angeles Safety Element (1990) does not indicate mapped areas of subsidence. According to the Geotechnical Report, the potential for subsidence in the Project area is low.

(6) Compressible/Collapsible Soils

Compressible soils are generally comprised of soils that undergo consolidation when exposed to new loading, such as fill or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Buildings, structures, and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present.

The Geotechnical Report states that the Project area is underlain by older alluvial deposits which are generally unconsolidated, reflecting a depositional history without substantial loading, and may be subject to collapse. Older, undocumented fill soils related to previous development may be present at the Project Site and, if so, may be potentially compressible or collapsible. Due to the presence of potentially compressible or collapsible soils at the site, the potential exists for differential settlement, which can destabilize areas of hardscape or building components.

(7) Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variation in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors. Volumetric change of expansive soil may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials.

According to the Geotechnical Report, near-surface soils in the Project site are generally clayey and sandy silt soils. Sandy soils typically have a low expansion potential. However, clayey soils are typically expansive.

(8) Corrosive Soils

The geologic environment of the Project site could include soil conditions potentially corrosive to concrete and metals. Corrosive soil conditions may exacerbate the corrosion hazard to buried conduits, foundations, and other buried concrete or metal improvements. Corrosive soils could cause premature deterioration of these underground structures or foundations.

c. Regulatory Setting

The following subsections discuss the various codes, regulations and policies applicable to geology and soils at the federal, state and local levels.

(1) Federal

(a) National Earthquake Hazards Reduction Program Reauthorization Act of 2004

The Earthquake Hazards Reduction Act {(Public Law 95-124, 42 U.S.C. 7701 et. seq.), as amended by Public Laws 101614, 105-47, 106-503, and 108-360.} was enacted in 1977 to "reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards and reduction program." To accomplish this, the Act established the National Earthquake Hazards Reduction Program (NEHRP). The program was significantly amended in November 1990 by NEHRP, which refined the description of agency responsibilities, program goals, and objectives. NEHRP's mission includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improvement of building codes and land use practices; risk reduction through post-earthquake investigation and education; development and improvement of design and construction techniques; improvement of mitigation capacity; and accelerated application of research results. The NEHRP designates the Federal Emergency Management Agency (FEMA) as the lead agency of the program and assigns it several planning, reports, and coordinating responsibilities. Programs under NEHRP inform and guide planning and building code requirements such as emergency evacuation responsibilities and seismic code standards such as those to which the Project would be required to adhere.

In October 2004, NEHRP was reauthorized to develop effective measures for earthquake hazard reduction; promote the adoption of earthquake hazards reduction measures by government agencies, standards and codes organizations, and others involved in planning and building infrastructure; improve the understanding of earthquakes and their effects through interdisciplinary research; and, develop, operate, and maintain both the Advanced National Seismic System (ANSS) and the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES). The act also directed that NEHRP support development and application of performance-based seismic design (PBSD). It also established an Advisory Committee on Earthquake Hazards Reduction (ACEHR) that will assess scientific and engineering trends; program effectiveness; and program management, coordination, and implementation. A NEHRP Interagency Coordinating Committee (ICC) was also established to oversee NEHRP planning, management, and coordination.

(2) State

(a) Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621-2624, Division 2, Chapter 7.5) was enacted in 1972 to address the hazard of surface faulting to structures for human occupancy.[3] The primary purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings intended for human occupancy on the surface traces of active faults. The Alquist-Priolo Earthquake Fault Zoning Act requires the State Geologist to establish regulatory zones, known as "earthquake fault zones", around the surface traces of active faults and to issue maps to assist cities and counties in planning, zoning, and building regulation functions. Local agencies must enforce the Alquist-

[3] *The Act was originally entitled the Alquist-Priolo Geologic Hazards Zone Act.*

Priolo Earthquake Fault Zoning Act in the development permit process, where applicable, and may be more restrictive than state law requires. The Act requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within the lead agency's organization or retained by the lead agency for the project, must prepare this geologic report. A 50-foot building setback from any known trace of an active fault is required. The Alquist-Priolo Earthquake Fault Zoning Act and its regulations are presented in California Department of Conservation, California Geological Survey, Special Publications (SP) 42, Fault-rupture Hazard Zones in California.

(b) Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (Public Resources Code Section 2690-2699) addresses the effects of strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events. Under the Seismic Hazards Mapping Act, the State Geologist is required to delineate "seismic hazard zones." The State Mining and Geology Board provides additional regulations and policies to assist municipalities in preparing the Safety Element of their General Plan and encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. Under Public Resources Code Section 2697, cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard.

State publications supporting the requirements of the Seismic Hazards Mapping Act include the California Geological Survey SP 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, and SP 118, *Recommended Criteria for Delineating Seismic Hazard Zones in California*. The objectives of SP 117 are to assist in the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations and to promote uniform and effective statewide implementation of the evaluation and mitigation elements of the Seismic Hazards Mapping Act. SP 118 implements the requirements of the Seismic Hazards Mapping Act in the production of Probabilistic Seismic Hazard Maps for the State.

(c) Title 24 California Building Standards Code

The California Buildings Standards Commission (Commission) is responsible for coordinating, managing, adopting, and approving building codes in California. On July 1 2014, the 2013 California Building Standards Code (CBSC) became effective and updated all prior codes under California Code of Regulations (CCR) Title 24. The State of California provides minimum standards for building design through the 2013 California Building Code (CBC), a component of the 2013 CBSC. Chapters 16 through 18 of the 2013 CBC regulate structural design, structural tests and inspections, and soils and foundations. The CBC applies to building design and construction in the state and is based on the federal Uniform Building Code (UBC), which is used widely throughout the country (generally adopted on a state by state or district by district basis). The CBC, which has been modified for California conditions, contains numerous provisions that are more stringent than those in the UBC because of California's seismic and environmental conditions. According to Section 1613 of the CBC, "[e]very structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7."[4]

[4] *ASCE 7 is a document published by the American Society of Civil Engineers (ASCE) that specifies minimum design loads for buildings and other structures.*

(d) Senate Bill 1953: The Alquist Hospital Seismic Safety Act

Senate Bill (SB) 1953, signed into law on September 21, 1994, is an amendment to the Alfred E. Alquist Hospital Seismic Safety Act of 1983 and is California's Hospital Seismic Safety Law.[5] The 1983 Act was a response to the damage to hospitals in the 1971 Sylmar quake, and the amendment resulted from assessment of damage to hospitals following the 1994 Northridge earthquake. SB 1953 (Chapter 740) as amended is chaptered into statute in Sections 130000 through 130070 of the California Health and Safety Code. SB 1953 was a result of failures to nonstructural components of hospitals that were built in accordance with the structural provisions of the Act. SB 1953 amended the Act to address the issues of survivability of both structural and nonstructural components of hospital buildings after a seismic event. SB 1953 ensures that by 2030 California hospitals must be capable of remaining operational after a seismic event or other natural disaster. Consisting of two parts, the law requires hospitals to fix or replace buildings with structural problems that may cause them to collapse in an earthquake. Secondly, non-structural features such as electrical, mechanical, plumbing and fire safety systems must be anchored and braced so they do not become falling hazards and a threat to life in the event of a disaster. Licensed acute care facilities such as the Existing Hospital Tower have more stringent rules regarding meeting seismic standards by 2030 than sub-acute care facilities. To achieve compliance with the requirements of SB 1953 before 2030, the Project is proposed to build a New Hospital Tower compliant with SB 1953 to house acute care functions.

(3) Local

(a) Los Angeles County General Plan Update (2035)

California Government Code Section 65300 requires general plans to include "a safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides, subsidence and other geologic hazards known to the legislative body; flooding; and wildland and urban fires." As such, the Los Angeles County General Plan Update (2035) Safety Element (Chapter 12) addresses hazards which must be considered in the physical development of the County, including seismic, geologic, erosion; flooding; hazardous materials; noise control; and emergency/disaster preparedness. Applicable goals and polices from the Safety Element are identified below:

> **Goal S1:** An effective regulatory system that prevents or minimizes personal injury, loss of life and property damage due to seismic and geotechnical hazards.

- **Policy S1.1:** Discourage development in Seismic Hazard and Alquist-Priolo Earthquake Fault Zones.
- **Policy S1.2:** Prohibit the construction of most structures for human occupancy adjacent to active faults until a comprehensive fault study that addresses the potential for fault rupture has been completed.
- **Policy S1.3:** Require developments to mitigate geotechnical hazards, such as soil instability and landsliding, in Hillside Management Areas through siting and development standards.

---

5 *Office of Statewide Health Planning & Development. California's Hospital Seismic Safety Law (2005). Available at http://www.oshpd.ca.gov/fdd/seismic_compliance/SB1953/SeismicReport.pdf, accessed on July 19, 2016.*

- **Policy S1.4:** Support the retrofitting of unreinforced masonry structures to help reduce the risk of structural and human loss due to seismic hazards.

Goal S2: An effective regulatory system that prevents or minimizes personal injury, loss of life, and property damage due to flood and inundation hazards.

- **Policy S2.1:** Discourage development in the County's Flood Hazard Zones.
- **Policy S2.2:** Discourage development from locating downslope from aqueducts.
- **Policy S2.3:** Consider climate change adaptation strategies in flood and inundation hazard planning.
- **Policy S2.4:** Ensure that developments located within the County's Flood Hazard Zones are sited and designed to avoid isolation from essential services and facilities in the event of flooding.
- **Policy S2.7:** Locate essential public facilities, such as hospitals and fire stations, outside of Flood Hazard Zones, where feasible.

3. ENVIRONMENTAL IMPACTS

a. Methodology

The technical analyses supporting the impact conclusions in the following section are based on the analysis contained in the Preliminary Geotechnical Evaluation Report prepared by Ninyo & Moore (Appendix C of this Draft EIR). The conclusions in the Preliminary Geotechnical Evaluation Report were primarily derived from the following tasks:

- Review of readily available topographic and geologic maps, published geotechnical literature, geologic and seismic data, soil data, groundwater data, aerial photographs, and in-house information;
- Review of geotechnical aspects of Project plans and documents pertaining to the site;
- Geotechnical site reconnaissance by a representative of Ninyo & Moore conducted on February 16, 2015, to observe and document the existing site conditions at the Project site;
- Compilation and analysis of existing geotechnical data pertaining to the site;
- Assessment of the general geologic conditions and seismic hazards affecting the area and evaluation of their potential impacts on the Project;
- Preparation of report presenting the results, as well as conclusions regarding the Project's geologic and seismic impacts, and recommendations to address the impacts to be included in the environmental planning documents; and
- Report preparation presenting results and conclusions regarding the Project's geologic and seismic impacts, and recommendations to address the impacts to be included in the environmental planning documents.

Data and conclusions from the analyses in the Preliminary Geotechnical Evaluation Report were used to determine potential impacts from the Project to and from the site geology and soils parameters. These impacts were compared against the Thresholds of Significance set forth below to determine the level of significance of potential impacts.

b. Thresholds of Significance

The potential for geologic impacts is based on thresholds derived from the County's Initial Study Checklist questions, which are based in part on Appendix G of the State *CEQA Guidelines.* These questions are as follows:

(VI) Geology and Soils. Would the project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

   1) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zone map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to *Division of Mines and Geology Special Publication 42*);

   2) Strong seismic ground shaking;

   3) Seismically related ground failure, including liquefaction; or

   4) Landslides.

b) Result in substantial soil erosion or the loss of topsoil.

c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

d) Be located on expansive soils, as defined in Table 18-1-B of the UBC (1994), or corrosive soils, creating substantial risk to life or property.

e) Have soils that would be incapable of adequately supporting the use of septic tanks or alternative waste disposal systems where sewers are not available for the disposal of wastewater.

The Initial Study determined that the Project would have a less than significant impact with respect to Checklist question VI.e). Accordingly, this environmental topic is not evaluated in this EIR.

Based on the above factors, the Project would have a potentially significant impact on Geology and Soils if it would:

GEO-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

   1) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zone map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to *Division of Mines and Geology Special Publication 42*).

2) Strong seismic ground shaking.

3) Seismically related ground failure, including liquefaction.

4) Landslides.

GEO-2: Result in substantial soil erosion or the loss of topsoil.

GEO-3: Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

GEO-4: Be located on expansive soils, as defined in Table 18-1-B of the UBC (1994), or corrosive soils, creating substantial risk to life or property.

c. Project Characteristics or Design Features

There are no specific Project Design Features that relate to geology and soils on the Project Site. However, the Project would comply with all applicable building requirements related to geology and soil conditions. Recommendations from the Geotechnical Report would be incorporated into the Project. In addition, the construction plans for acute care facilities proposed as part of the Project would be reviewed and approved by the California Office of Statewide Health Planning and Development (OSHPD).

Also, with regard to impacts pertaining to soil erosion or the loss of topsoil, the Project would implement numerous BMPs as detailed in the Water Quality Management Plan (WQMP) for the Project. The analysis below refers to Section 4.G., *Hydrology and Water Quality*, of this Draft EIR for a listing of the BMPs proposed for the Project.

d. Project Impacts

Threshold GEO-1: Would the Project expose people or structures to potential substantial adverse effects, including the risk or loss, injury, or death, involving earthquake fault rupture, seismic shaking, ground failure, or landslides?

Impact Statement GEO-1: *The Harbor-UCLA Campus is subject to seismic shaking due to its location in the seismically active southern California region. Based on subsurface geologic conditions and the depth to groundwater, the potential for substantial adverse effects due to fault rupture and ground failure is relatively low, but impacts are nonetheless potentially significant.*

(1) Fault Rupture

As previously stated, the Project site is not transected by any known active or potentially active faults. The active Newport-Inglewood fault is located approximately 3.4 miles northeast and the active Palos Verdes fault is located approximately 3.7 miles southwest of the estimated center of the Project site. The Project is not located within a State of California Earthquake Fault Zone; therefore, the potential for surface rupture at the site is relatively low and is considered a less than significant impact. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible. This is a potentially significant impact.

(2) Seismic Ground Shaking

The Harbor-UCLA Campus is located within a seismically active region, and thus the potential for seismic ground shaking exists at the site. However, the level of ground shaking at a given location depends on many factors, including the size and type of earthquake, the distance from the earthquake, and subsurface geologic conditions. The type of construction also affects how particular structures and improvements perform during ground shaking.

A site-specific analysis was conducted to evaluate the potential levels of ground shaking that could occur. The 2013 CBC recommends that the design of structures be based on spectral response accelerations in the direction of maximum horizontal response (5 percent damped) having a 1 percent probability of collapse in 50 years. These spectral response accelerations represent the Risk-Targeted Maximum Considered Earthquake (MCE_R) ground motion. The horizontal peak ground acceleration (PGA) that corresponds to the MCE_R for the site was calculated at 0.65g using the USGS web-based seismic design tool (USGS, 2014). The mapped and design PGA were estimated to be 0.62g and 0.43g, respectively, using the USGS (2014) calculator and the American Society of Civil Engineers 7-10 Standard. These ground motion estimates do not include near-source factors that may be applicable to the design of the structures on-site. Based on these PGA estimates, ground shaking at the Harbor-UCLA Campus could have a potentially significant impact on people and proposed buildings on the Harbor-UCLA Campus.

(3) Liquefaction

According to the Seismic Hazard Zones Map, the Harbor-UCLA Campus is not in an area susceptible to liquefaction; historic high groundwater depths of 48 to 60 feet in the Project vicinity limit the potential for liquefaction that could adversely affect Project buildings and structures. However, the site could be subject to seismically-induced soil settlement, which could have a significant impact on people and proposed buildings on the Harbor-UCLA Campus.

(4) Landslides

The Project Site has been extensively developed and is primarily covered with pavements, hardscape, and structures. It also includes some graded slopes associated with landscaping. An area northwest of the Existing Hospital Tower contains a landscaped slope that descends approximately 25 feet toward the edge of the building and is lined at the bottom edge with a drainage system. In addition, there have been no historic landslides at the site. Therefore, the potential for future landslides or mudflows to affect developments within the Project site are not anticipated and no significant impacts are expected. Slopes created for future developments within the Project area will be designed to reduce the potential for landslides or mudflows.

Threshold GEO-2: Would the Project result in a significant impact if it would result in substantial soil erosion or the loss of topsoil?

Impact Statement GEO-2: *Compliance with the County's National Pollutant Discharge Elimination System through implementation of a Storm Water Pollution Prevention Program for erosion control would be required during Project construction and with County's Low Impact Development (LID) ordinance requirements during operations. Impacts related to soil erosion and loss of soil would be less than significant.*

As previously stated, the materials exposed at the surface of the Project site include clays and silty sand soils. Sandy soils typically have low cohesion, and have a relatively higher potential for erosion from surface runoff when exposed in cut slopes or utilized near the face of fill embankments. Surface soils with higher amounts of clay tend to be less erodible as the clay acts as a binder to hold the soil particles together.

Future construction at the Project site would result in ground surface disruption during excavation, grading, and trenching that would create the potential for erosion to occur. However, as described in Section 4.G., Hydrology and Water Quality, any project involving grading of an area greater than one acre is required to apply for a National Pollutant Discharge Elimination System permit from the Los Angeles Regional Water Quality Control Board. This permit requires preparation and implementation of a Storm Water Pollution Prevention Program (SWPPP) incorporating Best Management Practices (BMPs) for erosion control. Specifically, construction activity resulting in a land disturbance of one acre or more, or less than one acre but part of a larger common plan of development, must obtain the Construction Activities Stormwater General Permit. Construction activities include clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal and replacement. Positive surface drainage should be accommodated at project construction sites to allow surface runoff to flow away from site improvements or areas susceptible to erosion. To reduce wind-related erosion, wetting of soil surfaces and/or covering exposed round areas and soil stockpiles could be considered during construction operations, as appropriate. The use of soil tackifiers may also be considered to reduce the potential for wind related soil erosion. Implementation of BMPs would ensure that water- and wind-related erosion would be confined to the construction area and not transported off-site. In addition, the topographic gradients at the Project Site are relatively gentle. Therefore, potential soil erosion impacts during construction would be less than significant and no mitigation is required.

BMPs related to ongoing drainage design and maintenance practices would be included in the SWPPP and implemented to reduce soil erosion during operation of the proposed Project. Examples of these procedures could include surface drainage measures for erosion due to water, such as the use of erosion prevention mats or geofabrics, silt fencing, sandbags and plastic sheeting, and temporary devices. Soil erosion during operation can also be mitigated through design procedures such as appropriate surface drainage design of roadways and facilities to provide for positive surface runoff. These design procedures would address reducing concentrated run-off conditions that could cause erosion and affect the stability of Project improvements.

Additionally, as discussed in more detail in Section 4.G., Hydrology and Water Quality, of this Draft EIR, buildout of the Harbor-UCLA Master Plan Project would increase the amount of pervious area on the Campus. However, the Project would be built out in compliance with the County's Low Impact Development (LID) ordinance, which requires new development to include features and practices that provide physical, biological, and chemical controls that remove pollutants from stormwater runoff generated on a project site. Typical LID features include bioretention or infiltration, which are intended to reduce and slow peak stormwater flows discharged off-site compared to existing conditions. Since these and other LID compliance practices and feature area intended to prevent, among other potential impacts, erosion and sedimentation conveyed by stormwater and discharged to off-site storm drain infrastructure and receiving water bodies, compliance with County LID requirements would prevent erosion of soil on the Project Site. Accordingly, following Project buildout, operational impacts related to erosion of on-site soil would be less than significant.

Threshold GEO-3: Would the Project result in a significant impact if it would be located on a geologic unit or soil that is unstable or that would become unstable, potentially resulting in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Impact Statement GEO-3: *Buildout of the Harbor-UCLA Campus could result in potentially significant impacts related to differential soil settlement and liquefaction beneath proposed buildings, due to the presence of alluvium and possible undocumented fill, and relatively shallow depths to groundwater beneath the Campus. Subsidence hazards would be less than significant.*

(1) Subsidence

As previously stated, historic subsidence is not known to have occurred on the Harbor-UCLA Campus and it does not lie within a mapped subsidence area according to the County of Los Angeles Safety Element. Therefore, the potential for subsidence on the Project site is relatively low. Subsidence hazards during construction and operation would be a less than significant impact.

(2) Compressible/Collapsible Soils

The Project area is underlain by older alluvial deposits which are generally unconsolidated, reflecting a depositional history without substantial loading, and may be subject to collapse. Older undocumented fill soils related to the previous development at the Project Site may also be potentially compressible or collapsible. Due to the presence of potentially compressible/collapsible soils at the site, there is a potential for differential settlement, which could cause damage to Project improvements. This is a potentially significant impact.

(3) Shallow Groundwater

Proposed construction activities in the Project area would include excavation and site grading for new medical, office and retail structures, pedestrian areas, landscaping, open space areas, and parking area improvements. Areas of shallower perched groundwater may be encountered during excavations. Groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations. If wet or saturated soil conditions are encountered during excavation, instability could occur and present a constraint to the construction of foundations. This is a potentially significant impact.

Threshold GEO-4: Would the Project result in a significant impact if it would be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), or corrosive soils, creating substantial risk to life or property?

Impact Statement GEO-4: *Buildout of the Harbor-UCLA Campus could result in potentially significant impacts related to expansive and corrosive soils beneath proposed buildings, based on the underlying soil type(s).*

(1) Expansive Soils

As previously stated, the near-surface soils in the Project site are generally clayey and sandy silt soils. Clayey soils are typically expansive when wetted, and could have an adverse effect on proposed Project buildings. This is a potentially significant impact.

(2) Corrosive Soils

The Project site is located in a geologic environment that could potentially contain soil conditions that are corrosive to concrete and metal, which could cause premature deterioration of underground structures or foundations. This is a potentially significant impact.

4. CUMULATIVE IMPACTS

The study area considered for cumulative impacts encompasses the areas that could be affected by Harbor-UCLA Master Plan Project activities as well as by other projects whose activities could directly or indirectly affect the geology and soils of the Project Site. All of the identified related projects would be built in the same seismically active region and could experience ground shaking and other seismically related hazards, similar to the Project. Those projects would also be subject to applicable seismic standards, safety requirements and, standard design specification to keep potential risk of damage from seismic and other geologic hazards to an acceptable level. Geologic and soil impacts are generally site-specific and there is little, if any, cumulative relationship between development projects. Adherence to all relevant plans, codes, and regulations with respect to project design and construction would reduce project-specific and cumulative geologic impacts. Therefore, the Harbor-UCLA Medical Center Campus Master Plan Project, considered together with related projects, would not result in a cumulatively considerable contribution to cumulatively significant geology and seismicity impacts.

During construction of the proposed and related projects, grading and excavation have the potential to expose soils in the area to wind and water erosion, resulting in a loss of soils. As discussed above under Impact Statement GEO-2, any project involving grading of an area greater than one acre is required to apply for a NPDES permit, which requires the use of BMPs for erosion control. Compliance with NPDES requirements would minimize potential soil erosion impacts for the proposed and related projects. Moreover, compliance with the County's LID ordinance would ensure features and practices intended to reduce, among other impacts, sedimentation in stormwater discharge, would be incorporated into Project design and operations. Therefore, the Harbor-UCLA Medical Center Campus Master Plan Project, considered together with related projects, would not result in a cumulatively considerable contribution to cumulatively significant soil erosion impacts.

Operation of the proposed and related projects would not change the geologic properties of the Project area. Seismic and other geologic hazards could still potentially impact the proposed and related projects as they are located in a seismically active region. However, these risks would not increase or decrease as a result of the proposed and/or related projects. Therefore, operation of the Harbor-UCLA Medical Center Master Plan Project, considered together with the related projects, would not result in a cumulatively considerable contribution to cumulatively significant impacts with respect to geology, soils and seismicity.

5. MITIGATION MEASURES

The following measure is required to mitigate Impact GEO-1:

MM-GEO-1: All recommendations included in the Preliminary Geotechnical Evaluation prepared for the Project (provided in Appendix C of this Draft EIR) shall be followed. A detailed subsurface geotechnical evaluation shall be performed to address site-specific conditions at the locations of the planned improvements and provide detailed recommendations for design and construction. The geotechnical evaluation shall include the following measures to mitigate potential fault rupture, seismic ground shaking, and liquefaction hazards identified under Impact GEO-1:

- *Seismicity:* Structural elements of future improvements shall be designed to resist or accommodate appropriate site-specific ground motions and conform to the current seismic design standards.
- *Liquefaction:* An assessment of the liquefaction potential and seismically induced dynamic settlement shall be made prior to detailed design and construction of the proposed Project. Structural design and mitigation techniques, such as in-situ ground modification or supporting foundations with piles at depths designed specifically for liquefaction, shall be included.

  To evaluate the potential liquefaction hazard for the Project, a subsurface evaluation could be performed. Site-specific geotechnical evaluations that assess the liquefaction and dynamic settlement characteristics of the on-site soils shall include the drilling of exploratory borings, evaluation of groundwater depths, and laboratory testing of soils.

  Methods for construction in areas with a potential for liquefaction hazard may include in-situ ground modification, removal of liquefiable layers and replacement with compacted fill, or support of Project improvements on piles at depths designed specifically for liquefaction. Pile foundations can be designed for a liquefaction hazard by supporting the piles in dense soil or bedrock located below the liquefiable zone or other appropriate methods as evaluated during the site-specific evaluation. Additional recommendations for mitigation of liquefaction may include densification by installation of stone columns, vibration, deep dynamic compaction, and/or compaction grouting.

The following measure is required to mitigate Impact GEO-3:

MM-GEO-2: All recommendations included in the Preliminary Geotechnical Evaluation prepared for the Project (provided in Appendix C of this Draft EIR) shall be followed. A detailed subsurface geotechnical evaluation shall be performed to address site-specific conditions at the locations of the planned improvements and provide detailed recommendations for design and construction. The geotechnical evaluation shall include the following measures to mitigate unstable soil hazards identified under Impacts GEO-3:

- *Compressible/Collapsible Soils and Settlement:* An assessment of the potential for soils that are prone to settlement shall be made prior to detailed design and construction of Project improvements, and mitigation techniques shall be developed, as appropriate, to reduce impacts related to settlement to low levels.

During the detailed design phase of the Project components, surface reconnaissance and site-specific geotechnical evaluations shall be performed to assess the settlement potential of the on-site natural soils and undocumented fill. This may include detailed surface reconnaissance to evaluate site conditions, drilling of exploratory borings or test pits, and laboratory testing of soils, where appropriate, to evaluate site conditions.

Prescribed mitigation measures for soils with the potential for settlement include removal of compressible/collapsible soil layers and replacement with compacted fill; surcharging to induce settlement prior to construction of new fills; and specialized foundation design, including the use of deep foundation systems to support structures. Varieties of in-situ soil improvement techniques are also available, such as dynamic compaction (heavy tamping) or compaction grouting.

- *Shallow Groundwater:* A subsurface exploration shall be performed during the detailed design phase of future improvements to evaluate the presence of groundwater, seepage, and/or perched groundwater at the site and the potential impacts on design and construction of Project improvements. Assessment of the potential for shallow groundwater would be evaluated during the design phase of the Project and mitigation techniques would be developed, as appropriate, to reduce the impacts related to shallow groundwater to low levels. Therefore, potential impacts due to groundwater would be reduced with incorporation of techniques such as construction dewatering.

The following measure is required to mitigate Impact GEO-4:

MM-GEO-3: All recommendations included in the Preliminary Geotechnical Evaluation prepared for the Project (provided in Appendix C) shall be followed. A detailed subsurface geotechnical evaluation shall be performed to address site-specific conditions at the locations of the planned improvements and provide detailed recommendations for design and construction. The geotechnical evaluation shall include the following measures to mitigate expansive soils hazards identified under Impacts GEO-4.

- *Expansive Soils:* An assessment of the potential for expansive soils will be conducted during the detailed design and construction phases of the Project. Mitigation techniques such as over excavation and replacement with non-expansive soil, soil treatment, moisture management, and/or specific structural design for expansive soil conditions would reduce the impact from expansive soils to low levels.
- *Corrosive Soils:* An assessment of the potential for corrosive soils will be conducted during the detailed design phase of the Project through a subsurface evaluation including soil testing and analysis of soils at foundation design depths. Laboratory tests would include corrosivity tests to evaluate the corrosivity of the subsurface soils. Data will be reviewed by a corrosion engineer and mitigation techniques suitable for the proposed Project will be implemented as appropriate. Mitigation of corrosive soil conditions could include the use of concrete resistant to sulfate exposure. Corrosion protection for metals used in underground foundations or structures in areas where corrosive groundwater or soil could potentially cause deterioration could include epoxy and metallic protective coatings, the use of alternative (corrosion resistant) materials, and selection of the appropriate type of cement and water/cement ratio. Specific measures to reduce the potential effects would be developed in the design phase and would reduce impacts related to corrosive soils to low levels.

6. LEVEL OF SIGNIFICANCE AFTER MITIGATION

Given compliance with applicable building codes and seismic safety requirements, as well as implementation of applicable mitigation measures, impacts related to geology and soils would be less than significant.