1.0 INTRODUCTION

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

2.0 REGULATORY FRAMEWORK

2.1 State and Regional Regulations

2.1.1 Seismic Hazards Mapping Act

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

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

2.1.2 Alquist-Priolo Earthquake Fault Zoning Act

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

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

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

2.1.3 California Building Code

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

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

\(^2\) A surface trace, also referred to as a fault trace or surface rupture, is the usually linear surface expression of the intersection of a fault plane with the Earth’s surface. Surface traces may be marked by visible horizontal or vertical displacement of the underlying rock and soil units on either side, abrupt elevation differentials, the emergence of springs, or other indicative features.
appurtenances connected or attached to such buildings or structures throughout California. The 2007 California Building Standards Code is based on the 2006 International Building Code.

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

2.2 Regional Regulations

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

2.3 Local Regulations

2.3.1 General Plan

The primary regulatory document for the City of Los Angeles is the Safety Element of the City of Los Angeles General Plan (1996). The objective of the Safety Element is to better protect occupants and equipment during various types and degrees of seismic events. In the Safety Element, specific guidelines are included for the evaluation of liquefaction, seismicity, nonstructural elements, fault rupture zones, and engineering investigation reports. The City’s Emergency Operations Organization helps to administer geological policies and provisions of the Safety Element, and is a City department comprising all City agencies, pursuant to City Administrative Code, Division 8, Chapter 3. The Administrative Code, Emergency Operations Organization Master Plan, and associated Emergency Operations Organization plans establish the chain of command, protocols, and programs for integrating all of the City’s emergency operations, including earthquakes and other geological hazards, into one unified operation. Each City agency in turn has operational protocols, as well as plans and programs, to implement Emergency Operations Organization protocols and programs related to geological hazard emergencies. A geological hazard emergency triggers a particular set of protocols that are addressed by implementing plans and programs. The City’s emergency operations program encompasses all of these protocols, plans, and programs. Therefore, its programs are not contained in one comprehensive local or City document. The Safety Element goals, objectives, and policies are broadly stated to reflect the comprehensive scope of the Emergency Operations Organization. These include the following:
**Goal 1:** A city where potential injury, loss of life, property damage and disruption of the social and economic life of the City of Los Angeles due to fire, water related hazard, seismic event, geologic conditions or release of hazardous materials disasters is minimized.

**Objective 1.1:** Implement comprehensive hazard mitigation plans and programs that are integrated with each other and with the City’s comprehensive emergency response and recovery plans and programs.

**Policy 1.1.1:** Coordinate information, gathering, program formulation and program implementation between City agencies, other jurisdictions and appropriate public and private entities to achieve the maximum mutual benefit with the greatest efficiency of funds and staff.

**Policy 1.1.2:** Reduce, to the greatest extent feasible and within the resources available, potential critical facility, governmental functions, infrastructure and information resource disruption due to natural disaster.

**Policy 1.1.3:** Provide redundancy (back-up) systems and strategies for continuation of adequate critical infrastructure systems and services so as to assure adequate circulation, communications, power, transportation, water, and other services for emergency response in the event of disaster related systems distributions.

**Policy 1.1.4:** Protect the public and workers from the release of hazardous materials and protect City water supplies and resources from contamination resulting from accidental release or intrusion resulting from a disaster event, including protection of the environment and public from potential health and safety hazards associated with program implementation.

**Policy 1.1.5:** Reduce potential risk hazards due to natural disaster to the greatest extent feasible with the resources available, including provision of information and training.
IV.E Geology

Policy 1.1.6: Assure compliance with applicable state and federal planning and development regulations, e.g., A-P Earthquake Fault Zoning Act, State Mapping Act and Cobey-Alquist Flood Plain Management Act.

2.3.2 Los Angeles Building Code

The City of Los Angeles also regulates building design in specific geologic hazard areas in the City of Los Angeles through the Los Angeles Building Code. The Los Angeles Building Code adopts the California Building Code by reference and makes further building design regulations for special hazard areas. These documents include specific requirements for construction, grading, excavations, slope stability, use of fill and foundation work, including type of materials, geologic investigations and reports, soil and rock testing, groundwater, and seismic design and procedures, which are intended to limit the probability of occurrence and the severity of consequences from geological hazards. The City Department of Building and Safety is responsible for implementing the provisions of the Building Code and Grading Standards.

3.0 EXISTING CONDITIONS

The LMU campus is currently occupied by buildings and structures, hardscape, and landscaping. The campus encompasses approximately 142 acres. The campus is bounded by an adjacent bluff on the north and northwest, by Lincoln Boulevard on the west, by McConnell Avenue on the east, and by W. 78th and W. 80th Streets on the south. The campus is approximately 66 feet above mean sea level at the campus entrance located at LMU Drive and Lincoln Boulevard, increasing to approximately 120 feet above mean sea level along the bluff edge in the northeastern corner of campus and approximately 150 feet above mean sea level on Burns Campus. Bluff slopes range from approximately 0.5:1 to 3:1 (horizontal:vertical). The bluff face has been locally modified by construction of a road and a trunk sewer line beneath the road, both of which are off campus. There are no unique geologic features such as hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds, or wetlands within the developed areas of the campus.

3.1 Geologic Setting

Regionally, the campus is located within the Peninsular Ranges geomorphic province, which extends from Southern California to the southern tip of Baja California. This province is characterized by elongate northwest-trending mountain ridges separated by straight-sided sediment-filled valleys. The northwest trend is further displayed in the dominant structural features of the province, which are northwest to west-northwest trending folds and faults, such as the nearby Newport-Inglewood fault zone, approximately 3.3 miles east of the campus.
The campus is located above the Westchester Bluffs (also known as the Ballona Escarpment) on the physiographic feature known as the El Segundo Sand Hills, which are Pleistocene sand dunes.\textsuperscript{3} The Westchester Bluffs extend approximately 3.5 miles inland from the Pacific Ocean and extend from the Ballona Gap (also known as the Ballona Plain) to the north, Torrance Hills to the east, and the Palos Verdes Hills to the south. The Ballona Gap is an ancient floodplain initially formed by headward erosion from the ocean. The Gap is located between Baldwin Hills to the south and Beverly Hills to the north and extends to the ocean.

The relationship of the campus to regional and local geologic features is depicted in Figure IV.E-1, \textit{Regional Geologic Map}, and Figure IV.E-2, \textit{Local Geologic Map}, respectively.

\subsection*{3.1 Geologic Materials}

Artificial fill of variable thickness is locally present throughout the campus from past grading activities for the existing campus improvements. The fills were generally derived from local on-site materials and typically consist of sand and silty sand. The campus is underlain by late Pleistocene eolian (dune) sand deposits (depicted by the symbol Qoe in Figure IV.E-1), which extend to depths of 50 to 90 feet below the ground surface. These materials, encountered in prior borings conducted throughout the campus between 1956 and 2007,\textsuperscript{4} consist of dense, poorly graded sand and silty sand. Crude bedding\textsuperscript{5} in these older dune sand deposits, where mapped in the Ballona Escarpment below the campus, dips very gently to the southwest. The dune sand deposits are generally nonexpansive, but could be mildly to moderately corrosive. Expansive soils are types of soil that shrink or swell as the moisture content decreases or increases. Structures built on these soils may experience shifting, cracking, and breaking damage as soils shrink and subside or expand. Corrosive soils have a high pH, or soluble salt content, or other oil characteristic with the potential to corrode metal and concrete upon contact, under certain conditions.\textsuperscript{6}

\textsuperscript{3} Pleistocene time-period is between approximately 10,000 years before present and about 1,650,000 years before present. See Table IV.E, Geologic Time Scale, in this Draft EIR section for the breakdown of the different geologic periods. (United States Geological Survey, \textit{Visual Glossary: Pleistocene}, http://earthquake.usgs.gov/learning/glossary.php?term=Pleistocene, March 2009.)

\textsuperscript{4} Reports by LeRoy Crandall, LAW/Crandall, and MACTEC Engineering and Consulting, Inc, 1956 – 2007. (Refer to Section 6.0, Bibliography, of the geotechnical evaluation provided in Appendix IV.E.).


\textsuperscript{6} A major factor in determining soil corrosivity is electrical resistivity. Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.
The dune sand deposits are underlain by the Pleistocene-age Lakewood formation (depicted by the symbol Qoa in Figure IV.E-1). Lakewood formation deposits consist of sand, silt, and gravel.\(^7\) The Lakewood formation, not encountered in previous exploratory borings\(^8\) because of its depth, is exposed on the Westchester Bluff face and consists of sand, silt, and clay with pebble and cobble lenses. Bedding, where present, is poorly developed, dipping at low angles in variable directions, rendering visual interpretation of the local structural geology more difficult.

### 3.2 Groundwater

Groundwater was not encountered within 50-foot-deep exploratory borings conducted on the campus between 1956 and 2007.\(^9\) Based on well log and borehole log data collected since the turn of the last century by the California Division of Mines and Geology, which determines historic high groundwater levels in the area, groundwater levels in two monitoring wells north of the campus ranged from 10 to 23 feet above mean sea level between 1937 and 2008, and levels have been declining since the 1900s.\(^10\) Therefore, given the geology of the area, the depth of the groundwater table below the LMU campus also is likely to be 10 to 23 feet above mean sea level.\(^11\) Elevations on LMU’s campus range from approximately 66 feet above mean sea level at the LMU Drive campus entrance to approximately 120 feet above mean sea level near the eastern edge of the bluffs on campus, to approximately 150 feet above mean sea level on the western edge of Burns Campus. The lowest-lying area on the campus surface is near the southwestern corner of Hughes Campus, within the proposed Specific Plan’s Open Space and Academic/Residential Planning Areas. Groundwater in this area is at least 43 feet below the surface. In all other areas of LMU’s campus, groundwater is at least 50 feet below the surface.\(^12\)

### 3.3 Faulting

The numerous faults in Southern California include active, potentially active, and inactive faults. These distinctions are based on criteria developed by the California Geological Survey for the Alquist-Priolo

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\(^8\) Reports by LeRoy Crandall, LAW/Crandall, and MACTEC Engineering and Consulting, Inc, 1956 – 2007. (Refer to Section 6.0, Bibliography, of the geotechnical evaluation provided in Appendix IV.E.).


\(^10\) California Division of Mines and Geology (predecessor agency of the California Geologic Survey), Seismic Hazard Zone Report 036, 1998.


\(^12\) MACTEC Engineering and Consulting, Inc, Geotechnical Evaluation: Proposed Master Plan Project, Loyola Marymount University.
Earthquake Fault Zoning Program. By definition, an active fault is one that has had surface displacement within Holocene time (the last 11,000 years). A potentially active fault is a fault that has demonstrated surface displacement of Quaternary age deposits (within the last 1.6 million years), but has no known Holocene movements. Inactive faults have not moved in the last 1.6 million years. The names and dates of the geologic periods are shown in Table IV.E-1, below. Figure IV.E-3, Regional Faults and Seismicity, shows the locations of major faults in the Proposed Project vicinity and selected earthquake epicenters in Southern California.

<table>
<thead>
<tr>
<th>Eon</th>
<th>Era</th>
<th>Period</th>
<th>Epoch</th>
<th>Age in Million of Years Before Present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quaternary</td>
<td>Holocene</td>
<td>Present to 0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pleistocene</td>
<td>0.01 to 1.6</td>
</tr>
<tr>
<td>Cenozoic</td>
<td></td>
<td>Neogene</td>
<td>Pliocene</td>
<td>1.6 to 5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Miocene</td>
<td>5.3 to 23.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tertiary</td>
<td>Oligocene</td>
<td>23.7 to 36.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Eocene</td>
<td>36.6 to 57.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paleozoic</td>
<td>Paleocene</td>
<td>57.8 to 66.4</td>
</tr>
<tr>
<td>Mesozoic</td>
<td></td>
<td>Cretaceous</td>
<td></td>
<td>66.4 to 144</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jurassic</td>
<td></td>
<td>144 to 208</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Triassic</td>
<td></td>
<td>208 to 245</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Permian</td>
<td></td>
<td>245 to 286</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pennsylvanian</td>
<td></td>
<td>286 to 320</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mississippian</td>
<td></td>
<td>320 to 360</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Devonian</td>
<td></td>
<td>360 to 408</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silurian</td>
<td></td>
<td>408 to 438</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ordovician</td>
<td></td>
<td>438 to 505</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cambrian</td>
<td></td>
<td>505 to 570</td>
</tr>
<tr>
<td>Phanerozoic</td>
<td></td>
<td>Proterozoic</td>
<td></td>
<td>570 to 2500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Archean</td>
<td></td>
<td>2500 to 3800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hadean</td>
<td></td>
<td>3800 to 4550</td>
</tr>
</tbody>
</table>


The LMU campus is not in an established Alquist-Priolo Earthquake Fault Zone; the closest such Zone, associated with the active Newport-Inglewood fault, is approximately 3.2 miles east of the LMU campus.
No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the LMU campus.

### 3.3.1 Active Faults

A list of active faults located within approximately 50 miles of the campus, including distance in miles between the nearest point on the fault and the closest edge of the LMU campus, maximum magnitude, and slip rate for the fault, is shown in Table IV.E-2.

#### 3.3.1.1 Newport-Inglewood Fault Zone

The nearest active fault to the LMU campus is the Newport-Inglewood fault zone, which is located approximately 3.3 miles to the northeast of the closest edge of the campus. This fault zone is composed of a series of discontinuous northwest-trending *en echelon* (parallel and closely spaced) faults extending from Ballona Gap marsh complex southeastward into the Pacific Ocean near Newport Beach. This zone is reflected at the surface by a line of geomorphically young anticlinal hills and mesas formed by the folding and faulting of a thick sequence of Pleistocene age sediments and Tertiary age sedimentary rocks. Fault-plane solutions\(^\text{14}\) for 39 small earthquakes (between 1977 and 1985) show mostly strike-slip faulting\(^\text{15}\) with some reverse faulting along the north segment (north of Dominguez Hills) and some normal faulting\(^\text{16}\) along the south segment (south of Dominguez Hills to Newport Beach). Prior investigations in the Huntington Beach area indicate that the North Branch segment of the Newport-Inglewood fault zone offsets Holocene age alluvial deposits in the vicinity of the Santa Ana River.

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\(^{15}\) Strike-slip faults are vertical (or nearly vertical) fractures where the blocks have mostly moved horizontally. If the block opposite an observer looking across the fault moves to the right, the slip style is termed right lateral; if the block moves to the left, the motion is termed left lateral. (United States Geological Survey, *Visual Glossary: Strike-slip Faults*, http://earthquake.usgs.gov/learning/glossary.php?term=fault-plane%20solution, March 2009.)

\(^{16}\) Dip-slip faults are inclined fractures where the blocks have mostly shifted vertically. If the rock mass above an inclined fault moves down, the fault is termed normal, whereas if the rock above the fault moves up, the fault is termed reverse. A thrust fault is a reverse fault with a dip of 45° or less. Oblique-slip faults have significant components of different slip styles. (United States Geological Survey, *Visual Glossary: Dip-Slip faults*, http://earthquake.usgs.gov/learning/glossary.php?term=fault-plane%20solution, March 2009.)
Table IV.E-2
Major Named Faults Considered to be Active in Southern California

<table>
<thead>
<tr>
<th>Fault (in increasing distance)</th>
<th>Maximum Magnitude and Type</th>
<th>Slip Rate (mm/yr.)</th>
<th>Distance From the Closest Edge of the LMU Campus (miles)</th>
<th>Direction From LMU Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newport-Inglewood Zone</td>
<td>7.1 SS</td>
<td>1</td>
<td>3.3</td>
<td>NE</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>6.6 RO</td>
<td>1</td>
<td>5.8</td>
<td>NNW</td>
</tr>
<tr>
<td>Palos Verdes</td>
<td>7.3 SS</td>
<td>3</td>
<td>6.5</td>
<td>SW</td>
</tr>
<tr>
<td>Puente Hills Blind Thrust</td>
<td>7.1 BT</td>
<td>0.7</td>
<td>6.8</td>
<td>NE</td>
</tr>
<tr>
<td>Hollywood</td>
<td>6.4 RO</td>
<td>1</td>
<td>7.9</td>
<td>N</td>
</tr>
<tr>
<td>Malibu Coast</td>
<td>6.7 RO</td>
<td>0.3</td>
<td>8.2</td>
<td>NNW</td>
</tr>
<tr>
<td>Upper Elysonian Park</td>
<td>6.4 BT</td>
<td>1.3</td>
<td>10</td>
<td>NE</td>
</tr>
<tr>
<td>Northridge Thrust</td>
<td>7 BT</td>
<td>1.5</td>
<td>12</td>
<td>NNW</td>
</tr>
<tr>
<td>Raymond</td>
<td>6.5 RO</td>
<td>1.5</td>
<td>14</td>
<td>NE</td>
</tr>
<tr>
<td>Verdugo</td>
<td>6.9 RO</td>
<td>0.5</td>
<td>16</td>
<td>NNE</td>
</tr>
<tr>
<td>Anacapa-Dume</td>
<td>7.5 RO</td>
<td>3</td>
<td>16</td>
<td>W</td>
</tr>
<tr>
<td>Sierra Madre</td>
<td>7.2 RO</td>
<td>2</td>
<td>21</td>
<td>NE</td>
</tr>
<tr>
<td>San Fernando</td>
<td>6.7 RO</td>
<td>2</td>
<td>22</td>
<td>N</td>
</tr>
<tr>
<td>Whittier</td>
<td>6.8 SS</td>
<td>2.5</td>
<td>22</td>
<td>E</td>
</tr>
<tr>
<td>Santa Susana</td>
<td>6.7 RO</td>
<td>5</td>
<td>23</td>
<td>NNE</td>
</tr>
<tr>
<td>San Gabriel</td>
<td>7.2 SS</td>
<td>1</td>
<td>24</td>
<td>NNE</td>
</tr>
<tr>
<td>Clamshell-Sawpit</td>
<td>6.5 RO</td>
<td>0.5</td>
<td>27</td>
<td>NE</td>
</tr>
<tr>
<td>Simi-Santa Rosa</td>
<td>7 RO</td>
<td>1</td>
<td>28</td>
<td>NW</td>
</tr>
<tr>
<td>San Jose</td>
<td>6.4 RO</td>
<td>0.5</td>
<td>30</td>
<td>ENE</td>
</tr>
<tr>
<td>Oak Ridge</td>
<td>7 RO</td>
<td>4</td>
<td>33</td>
<td>NW</td>
</tr>
<tr>
<td>San Joaquin Hills Blind Thrust</td>
<td>6.6 BT</td>
<td>0.5</td>
<td>34</td>
<td>SE</td>
</tr>
<tr>
<td>Holser</td>
<td>6.5 RO</td>
<td>0.4</td>
<td>35</td>
<td>NNW</td>
</tr>
<tr>
<td>San Cayetano</td>
<td>7 RO</td>
<td>6</td>
<td>37</td>
<td>NW</td>
</tr>
<tr>
<td>Chino-Central Avenue</td>
<td>6.7 NO</td>
<td>1</td>
<td>39</td>
<td>E</td>
</tr>
<tr>
<td>Cucamonga</td>
<td>6.9 RO</td>
<td>5</td>
<td>42</td>
<td>ENE</td>
</tr>
<tr>
<td>San Andreas (Mojave Segment)</td>
<td>7.4 SS</td>
<td>30</td>
<td>43</td>
<td>NE</td>
</tr>
<tr>
<td>Elsinore (Glen Ivy Segment)</td>
<td>6.8 SS</td>
<td>5</td>
<td>44</td>
<td>SE</td>
</tr>
<tr>
<td>San Jacinto (San Bernardino Segment)</td>
<td>6.7 SS</td>
<td>12</td>
<td>53</td>
<td>E</td>
</tr>
</tbody>
</table>

SS: Strike Slip; NO: Normal Oblique; RO: Reverse Oblique; BT: Blind Thrust
3.3.1.2 Santa Monica Fault

The north strand of the Santa Monica fault is located approximately 5.8 miles north-northwest of the closest (northern) edge of the LMU campus. The Santa Monica and Hollywood fault zones form a portion of the Transverse Ranges Southern Boundary fault system. The Transverse Ranges Southern Boundary fault system also includes the Malibu Coast fault to the west of the Santa Monica fault and the Raymond and Cucamonga faults to the east of the Hollywood fault. The Santa Monica fault zone is the western segment of the Santa Monica-Hollywood fault zone. The Santa Monica fault zone trends east-west from the west of the Santa Monica coastline on and to the east of the Hollywood area. Urbanization and development within the greater Los Angeles area has resulted in a poor understanding of the lateral extent, location, and rupture history of the Santa Monica fault zone. However, the surface expression of the Santa Monica fault zone includes fault-related geomorphic features, offset stratigraphy, and groundwater barriers within late Quaternary deposits.

The Santa Monica fault zone is separated into east and west segments, divided by the West Beverly Hills Lineament (aligned with Newport-Inglewood fault). The east segment and the southern portion of the west segment of the Santa Monica fault zone are not considered active, although as of March 2009 it had not yet been included in an Alquist-Priolo Earthquake Fault Zone.

3.3.1.3 Palos Verdes Fault Zone

There are several active on-shore splays of the Palos Verdes fault zone. The nearest splay of the active Palos Verdes fault zone is located offshore approximately 6.5 miles southwest of the closest (southwest) edge of the LMU campus. Based on geophysical data, the dip of the fault is nearly vertical to 55 degrees to the southwest. Vertical separations up to about 5,900 feet deep occur across the fault. However, the configuration of the basement surface and lithologic changes in the Tertiary age rocks across the fault indicate strike-slip movement. Strike-slip movement along a fault during an earthquake where the ground on opposite sides of the fault plane moves horizontally past each other and parallel to the strike (trace) of the fault. Geophysical data also indicate offset at the base of the offshore Holocene age deposits. However, no historic large magnitude earthquakes are associated with this fault.

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18 “Lineaments are mappable linear surface features which differ distinctly from the patterns of adjacent features and presumably reflect subsurface phenomena (O’Leary et al. 1976). They are generally manifested by topography (including straight stream segments), vegetation, or soil tonal alignments.” (Briere, Peter R. and Scanlon, Kathryn M. Lineaments and Lithology Derived from a Side-Looking Airborne Radar Image of Puerto Rico, http://pubs.usgs.gov/of/2000/of00-006/htm/lineamen.htm, March 2009.)
3.3.1.4 San Andreas Fault Zone

The active San Andreas Fault zone is located about 43 miles northeast of the closest (northeast) edge of the LMU campus. This fault zone is California’s most prominent structural feature, trending in a general northwest direction for much of the length of the state. The last major earthquake along the San Andreas Fault zone in Southern California was the magnitude 8.3 Fort Tejon earthquake in 1857.

3.3.1.5 Blind Thrust Faults

Several buried thrust faults (commonly referred to as blind thrusts) underlie the Los Angeles Basin. These faults are called blind because they do not extend to the ground surface and are typically greater than 1.9 miles below the surface. Since they do not extend to the ground surface, these faults do not present a potential surface fault rupture hazard. However, the blind thrust faults discussed below are considered active and potential sources for seismic ground shaking from future earthquakes.

3.3.1.5.1 Puente Hills Blind Thrust Fault

The Puente Hills Blind Thrust fault is defined based on seismic reflection profiles, petroleum well data, and precisely located seismicity. This blind thrust fault system extends eastward from downtown Los Angeles to Brea (in northern Orange County). The Puente Hills Blind Thrust fault includes three north-dipping segments: the Coyote Hills segment, Santa Fe Springs segment, and Los Angeles segment. Folds expressed at the surface as the Coyote Hills, Santa Fe Springs Anticline, and the Montebello Hills, respectively, overlie these segments. The vertical surface projection of the Puente Hills Blind Thrust fault is approximately 6.8 miles northeast of the closest (northeast) edge of the LMU campus.

The Santa Fe Springs segment of the Puente Hills Blind Thrust fault is believed to be the causative fault of the October 1, 1987, Whittier Narrows Earthquake. Postulated earthquake scenarios for the Puente Hills Blind Thrust fault include single segment fault ruptures capable of producing an earthquake of magnitude 6.5 to 6.6 Moment Magnitude and a multiple segment fault rupture capable of producing an earthquake of magnitude 7.1 Moment Magnitude. The Puente Hills Blind Thrust fault is not exposed at the ground surface and does not present a potential for surface fault rupture. However, based on deformation of late Quaternary age sediments above this fault system and the occurrence of the Whittier Narrows Earthquake, the Puente Hills Blind Thrust fault is considered an active fault capable of generating future earthquakes beneath the Los Angeles Basin. An average slip rate of 0.7 millimeter per year and a maximum earthquake magnitude of 7.1 are estimated for the Puente Hills Blind Thrust fault, should an earthquake occur.

3.3.1.5.2 Upper Elysian Park Thrust Fault

The Upper Elysian Park fault is a blind thrust fault that overlies the Los Angeles and Santa Fe Springs segments of the Puente Hills Blind Thrust fault. The eastern edge of the Upper Elysian Park fault
is defined by the northwest-trending Whittier fault zone. The vertical surface projection of the Upper Elysian Park fault is approximately 10 miles northeast of the closest (northeast) edge of the LMU campus. Like other blind thrust faults in the Los Angeles area, the Upper Elysian Park fault is not exposed at the surface and does not present a potential surface rupture hazard; however, the Upper Elysian Park fault should be considered an active fault capable of generating future earthquakes. An average slip rate of 1.3 millimeters per year and a maximum earthquake magnitude of 6.4 are estimated for the Upper Elysian Park fault, should an earthquake occur.

3.3.1.5.3 Northridge Thrust Fault

The Northridge Thrust fault is located beneath the majority of the San Fernando Valley and was the causative fault of the January 17, 1994, Northridge Earthquake. This thrust fault is not exposed at the surface and does not present a potential surface fault rupture hazard. However, the Northridge Thrust is an active feature that can generate future earthquakes. The vertical surface projection of the Northridge Thrust is about 12 miles north-northwest of the closest edge of the LMU campus. An average slip rate of 1.5 millimeters per year and a maximum earthquake magnitude of 7.0 is estimated for the Northridge Thrust fault, should an earthquake occur.

3.3.2 Potentially Active Faults

A list of potentially active faults within approximately 50 miles of the campus and the distance in miles between the nearest point of the fault and the closest edge of the LMU campus and the maximum magnitude and the slip rate, should movement occur, for the fault is shown in Table IV.E-3.

3.3.2.1 Unnamed Fault

A small un-named fault has been mapped in the bluff in the northeastern corner of the campus. It is mapped as displacing the Pleistocene-age Lakewood formation, but not the overlying late Pleistocene sand dune deposits and therefore is considered potentially active.

3.3.2.2 Charnock Fault

The closest named potentially active fault to the LMU campus is the Charnock fault located approximately 0.9 mile to the northeast. The Charnock fault trends northwest-southeast, approximately parallel to the trend of the Newport-Inglewood fault zone and the Overland fault. Differential water levels across the fault occur in the early Pleistocene age San Pedro Formation. However, there is no evidence that this fault has offset late Pleistocene or Holocene age alluvial deposits. The Charnock fault is potentially active (i.e., no displacement of Holocene age alluvium).
Table IV.E-3
Major Named Faults Considered to be Potentially Active in Southern California

<table>
<thead>
<tr>
<th>Potentially Active Fault (in increasing distance)</th>
<th>Maximum Magnitude and Type</th>
<th>Slip Rate (mm/yr.)</th>
<th>Distance From the Closest Edge of the LMU Campus (miles)</th>
<th>Direction From the LMU Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charnock</td>
<td>6.5 SS</td>
<td>0.1</td>
<td>0.9</td>
<td>NE</td>
</tr>
<tr>
<td>Overland</td>
<td>6 SS</td>
<td>0.1</td>
<td>2.2</td>
<td>NE</td>
</tr>
<tr>
<td>MacArthur Park</td>
<td>5.7 RO</td>
<td>3</td>
<td>9.9</td>
<td>NE</td>
</tr>
<tr>
<td>Northridge Hills</td>
<td>6.6 SS</td>
<td>1.2</td>
<td>18</td>
<td>NNW</td>
</tr>
<tr>
<td>Los Alamitos</td>
<td>6.2 SS</td>
<td>1</td>
<td>19</td>
<td>SE</td>
</tr>
<tr>
<td>Norwalk</td>
<td>6.7 RO</td>
<td>0.1</td>
<td>19</td>
<td>ESE</td>
</tr>
<tr>
<td>Duarte</td>
<td>6.7 RO</td>
<td>0.1</td>
<td>27</td>
<td>ENE</td>
</tr>
<tr>
<td>El Modeno</td>
<td>6.5 NO</td>
<td>0.1</td>
<td>29</td>
<td>ESE</td>
</tr>
<tr>
<td>Indian Hill</td>
<td>6.6 RO</td>
<td>0.1</td>
<td>33</td>
<td>ENE</td>
</tr>
<tr>
<td>Peralta Hills</td>
<td>6.5 RO</td>
<td>0.1</td>
<td>35</td>
<td>ESE</td>
</tr>
<tr>
<td>Pelican Hills</td>
<td>6.3 SS</td>
<td>0.1</td>
<td>38</td>
<td>SE</td>
</tr>
</tbody>
</table>

SS: Strike Slip; NO: Normal Oblique; RO: Reverse Oblique; BT: Blind Thrust

1 Measured from the closest edge of the LMU campus.

3.3.2.3 Overland Fault

The potentially active Overland fault is located approximately 2.2 miles northeast of the LMU campus. The Overland fault trends northwest between the Charnock fault and the Newport-Inglewood fault zone. The fault extends from the northwest flank of Baldwin Hills to Santa Monica Boulevard near Overland Avenue. Based on water level measurements, displacement along the fault is believed to be vertical, with an offset of about 30 feet. The west side of the fault has moved downward, relative to the east side, forming a graben\(^1\) between the Charnock and Overland faults. However, there is no evidence that this fault has offset late Pleistocene or Holocene age alluvial deposits. Researchers indicate that the fault is potentially active (no displacement of Holocene age alluvium).

3.3.2.4 MacArthur Park Fault

The MacArthur Park fault is located about 9.9 miles northeast of the LMU campus. The fault, west of downtown Los Angeles, has been located based on south-facing scarps\(^2\), truncated drainages, and other

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geomorphic features. The fault is approximately 5 miles long, extending northwest from the Pershing Square area near downtown Los Angeles, through MacArthur Park to the Paramount Studios area in Hollywood. Current information suggests the fault is potentially active.

3.4 Seismicity

A search for earthquakes that occurred within approximately 62 miles of the LMU campus indicates that 404 earthquakes of magnitude 4.0 and greater occurred between 1932 and 2007; one earthquake of magnitude 6.0 or greater occurred between 1906 and 1931; and one earthquake of magnitude 7.0 or greater occurred between 1812 and 1905. A list of these earthquakes is presented as Table 3 in Appendix B of the geotechnical evaluation contained in Appendix IV.E.

3.4.1 Historic Earthquakes

A number of earthquakes of moderate to major magnitude have occurred in the Southern California area within the last 76 years. A list of Southern California earthquakes with a Magnitude greater than 5.5 is provided in Table IV.E-4, below. A more complete list of historic earthquakes is included as Table 3 of the geotechnical evaluation provided in Appendix IV.E.

<table>
<thead>
<tr>
<th>Earthquake</th>
<th>Date of Earthquake (Oldest to Youngest)</th>
<th>Magnitude</th>
<th>Distance from the Closest Edge of the Campus to Epicenter (Miles)</th>
<th>Direction to Epicenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Beach</td>
<td>3/11/1933</td>
<td>6.4</td>
<td>33</td>
<td>SE</td>
</tr>
<tr>
<td>Tehachapi</td>
<td>7/21/1952</td>
<td>7.5</td>
<td>78</td>
<td>NW</td>
</tr>
<tr>
<td>San Fernando</td>
<td>2/9/1971</td>
<td>6.6</td>
<td>29</td>
<td>N</td>
</tr>
<tr>
<td>Whittier Narrows</td>
<td>10/1/1987</td>
<td>5.9</td>
<td>20</td>
<td>ENE</td>
</tr>
<tr>
<td>Sierra Madre</td>
<td>6/28/1991</td>
<td>5.8</td>
<td>31</td>
<td>NE</td>
</tr>
<tr>
<td>Landers</td>
<td>6/28/1992</td>
<td>7.3</td>
<td>115</td>
<td>ENE</td>
</tr>
<tr>
<td>Big Bear</td>
<td>6/28/1992</td>
<td>6.4</td>
<td>93</td>
<td>ENE</td>
</tr>
<tr>
<td>Northridge</td>
<td>1/17/1994</td>
<td>6.7</td>
<td>21</td>
<td>NNE</td>
</tr>
<tr>
<td>Hector Mine</td>
<td>10/16/1999</td>
<td>7.1</td>
<td>130</td>
<td>NE</td>
</tr>
</tbody>
</table>

Source: MACTEC Engineering and Consulting, Inc., June 2009. (Excerpted from Table 3 in Appendix B of the Geology Report contained in Appendix IV.E.)

The LMU campus could be subjected to strong ground shaking in the event of an earthquake. This hazard is common in Southern California.
3.5  Sedimentation and Erosion

Sedimentation and erosion occur when soils are exposed and are usually wind- or water-driven. Due to the sandy, uncemented nature of the Westchester Bluffs materials, the bluff face along the northern and northwestern portion of the LMU campus is susceptible to erosion and sloughing. The campus elevation ranges from approximately 66 feet above mean sea level at the LMU Drive campus entrance, to approximately 120 feet above mean sea level on the eastern side of campus along the bluffs, and approximately 150 feet above mean sea level on the western edge of Burns Campus.\(^{21}\)

3.6  Slope Stability

Previous geologic mapping\(^{22}\) of the bluff along the northern and western portions of the campus did not indicate the presence of any deep-seated landslides. Bedding planes, (or layers) in the Lakewood formation on which the formation could slide, where present, are horizontal to a very low angle.\(^{23}\) The campus is not located in a Landslide or Hillside Area as designated by the City of Los Angeles. However, the Westchester Bluffs below the campus are located in a State of California Earthquake-Induced Landslide Hazard Zone, because of their steep angle (greater than about 19 degrees or 3:1 [horizontal:vertical]).

3.7  Liquefaction and Seismically Induced Settlement Potential

For liquefaction to occur, all of the following three key ingredients are required: liquefaction-susceptible soils, groundwater within a depth of approximately 50 feet, and strong earthquake shaking. Soils susceptible to liquefaction are generally saturated, loose to medium dense sands and non-plastic silt deposits below the water table.

According to recently published Special Publication 117, “Guidelines for Evaluating and Mitigating Seismic Hazards in California,” prepared by California Geologic Survey, revised and re-adopted September 11, 2008, in order to be susceptible to liquefaction, potential liquefiable soils at the site must be saturated or nearly saturated. If potentially liquefiable materials present at the site are currently unsaturated (e.g., are above the water table), and are highly unlikely to become saturated given


\(^{22}\) Reports by LeRoy Crandall, LAW/Crandall, and MACTEC Engineering and Consulting, Inc, 1956–2007. (Refer to Section 6.0, Bibliography, of the geotechnical evaluation provided in Appendix IV.E.).

\(^{23}\) The lower the angle, the flatter the bedding planes are, and the less likely a landslide would occur due to the presence of the bedding planes.
foreseeable changes in the hydrologic regime, then such soils generally do not constitute a liquefaction hazard that would require mitigation.

According to the State of California Seismic Hazard Zones Map and the City of Los Angeles Safety Element, the LMU campus is not located within an area identified as having potential for liquefaction. Based on previous borings, groundwater is at a depth of greater than 50 feet in areas where liquefiable soils may be present. Therefore, the potential for liquefaction and the associated ground deformation beneath the LMU campus is considered to be very low.

3.9 Tsunamis, Inundation, Seiches, and Flooding

The elevation of the campus ranges from approximately 66 to approximately 150 feet above mean sea level at the campus entrance located at LMU Drive and Lincoln Boulevard and in the northeastern portion of campus, respectively. According to the City of Los Angeles Safety Element, the LMU campus is not located within a tsunami run-up zone, which is the area that might be inundated during a tsunami; the nearest zone begins at the intersection of Lincoln and Jefferson Boulevards. Therefore, tsunamis are not considered a significant hazard on the LMU campus.

According to the City of Los Angeles Safety Element, the campus is not located in a potential inundation area that could adversely affect the campus in the event of earthquake-induced dam failures or seiches (wave oscillations in an enclosed or semi-enclosed body of water). Therefore, the potential for inundation at the campus as a result of an earthquake-induced dam failure is considered low.

Also according to the City of Los Angeles Safety Element, the campus is not located within a 100- or 500-year floodplain; therefore, the risk of flooding is considered low.

24 Reports by LeRoy Crandall, LAW/Crandall, and MACTEC Engineering and Consulting, Inc, 1956–2007. (Refer to Section 6.0, Bibliography, of the geotechnical evaluation provided in Appendix IV.E.).
3.10 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high slit or clay content. The campus is not located within an area of known subsidence, peat oxidation, or hydrocompaction.\(^{30}\)

3.11 Oil Fields and Methane Potential

The campus is approximately 0.5 mile east of the Playa del Rey Oil Field and is mapped as being within a Methane Zone and Methane Buffer Zone, as designated by the Los Angeles Department of Building and Safety. Please refer to Section IV.F, Hazards, for more information.

4.0 ENVIRONMENTAL IMPACT ANALYSIS

4.1 Methodology

This section is based on the geotechnical evaluation prepared by MACTEC Engineering and Consulting, Inc, a review of previous geotechnical reports prepared for the LMU campus, and a review of available published and unpublished geologic and seismic literature pertinent to the area near the campus. A list of the reports reviewed as part of the evaluation is included in Section 6.0, Bibliography, of the geotechnical evaluation provided in Appendix IV.E.

4.2 Significance Thresholds

The Los Angeles CEQA Thresholds Guide indicates a project would normally have a significant geologic hazards impact if it would:

GEO-1 Cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

The Los Angeles CEQA Thresholds Guide indicates a project would normally have significant sedimentation and erosion impacts if it would:

GEO-2 Constitute a geologic hazard to other properties by causing or accelerating instability from erosion; or

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\(^{30}\) MACTEC Engineering and Consulting, Inc, Geotechnical Evaluation: Proposed Master Plan Project, Loyola Marymount University.
GEO-3 Accelerate natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition that would not be contained or controlled on site.

The *Los Angeles CEQA Thresholds Guide* indicates a project would normally have a significant landform alteration impact if:

GEO-4 One or more distinct and prominent geologic or topographic features would be destroyed, permanently covered, or materially and adversely modified. Such features may include, but are not limited to, hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands.

Appendix G of the *State CEQA Guidelines* provides sample questions for use in an initial study to determine a project’s potential for environmental impacts. According to sample questions included in Appendix G under Section VI, Geology and Soils, a project would have a potentially significant impact if it would:

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

   i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning 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)

   ii. Strong seismic ground shaking

   iii. Seismic-related ground failure, including liquefaction

   iv. Landslides

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

VI. 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 on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

VI. d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property; or

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

The Initial Study prepared for the Proposed Project determined that the Proposed Project would have no impact with regard to sample question VI.e of Appendix G of the *State CEQA Guidelines*. The response to
this question is discussed in Section VII, Effects Found Not to be Significant. The Initial Study is provided in Appendix I.

The thresholds used in the Los Angeles CEQA Thresholds Guide to determine significant geological impacts are inclusive of those provided in Appendix G of the State CEQA Guidelines. Therefore, thresholds GEO-1 through GEO-4, above, are used for the following analysis of the Proposed Project’s potential impacts.

4.3 Project Design Features

Project-level geotechnical evaluations will be required prior to finalizing grading and construction plans for individual Proposed Project buildings and campus improvements. The buildings and campus improvements proposed for implementation under the Proposed Project would be designed and constructed in accordance with all applicable requirements, which are outlined in the most current addition of the California Building Code and the Los Angeles Uniform Building Code, including all applicable provisions of Chapter IX, Division 70 of the Los Angeles Municipal Code, which addresses grading, excavations and fills. Design and construction would also adhere to applicable requirements of the Department of the State Architect and federal building code requirements. Project-level hydrology plans will also be required prior to finalizing grading, drainage, and construction plans for individual Proposed Project buildings and campus improvements.

4.4 Project Impacts

4.4.1 Geological Hazards

GEO-1 Would the Proposed Project cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury?

As stated in the geotechnical evaluation contained in Appendix IV.E, Project-level (i.e., building-specific) geotechnical investigations will be required prior to finalizing grading and construction plans for individual Proposed Project buildings and campus improvements. Buildings and campus improvements proposed for implementation under the Proposed Project would then be designed and constructed in accordance with all applicable requirements contained in the most current editions of the California Building Code and the Los Angeles Uniform Building Code, as well as applicable provisions of Chapter IX, Division 70 of the Los Angeles Municipal Code, which addresses grading, excavation, and fill. Design and construction would also be required to adhere to applicable requirements of the Department of the State Architect and federal building code.
IV.E Geology

Proposed Project impacts related to geological hazards would be less than significant with preparation of building-specific geotechnical investigations and adherence to applicable building codes and the Los Angeles Municipal Code. Mitigation measures MM-GEO-1 and MM-GEO-2 are recommended to ensure compliance with building and municipal code requirements pertaining to geological hazards.

4.4.1.1 Expansive and Corrosive Soils

As stated above, expansive soils shrink or swell as the moisture content decreases or increases. Structures built on these soils may experience shifting, cracking, and breaking damage as soils shrink and subside or expand. The campus near-surface soils are generally granular and nonexpansive. Expansion testing will be performed to confirm the expansion potential of any import soils in accordance with UBC Standard 29-2 and ASTM Standard D4829. Any required import fill and at least the upper 2 feet of fill beneath the floor slab and beneath other concrete slabs and walks would consist of relatively non-expansive soils with an Expansion Index of less than 35, which is considered low.\(^\text{31}\)

Proposed Project impacts related to expansive soils would be less than significant with adherence to applicable building codes. Mitigation measure MM-GEO-3 is recommended to ensure compliance with applicable building code requirements governing expansive soils.

Some campus soils are considered mildly to moderately corrosive. Accordingly, corrosion testing would be performed during the comprehensive geotechnical investigation required for individual buildings and structures, as stated in the geotechnical evaluation contained in Appendix IV.E, and proper corrosion protection would be implemented where needed. Proposed Project impacts related to corrosive soils would be less than significant with adherence to the applicable building codes. Mitigation measure MM-GEO-4 is recommended to ensure compliance with applicable building code requirements governing corrosive soils issues.

4.4.1.2 Groundwater

Groundwater was not encountered within 50-foot-deep exploratory borings conducted throughout the campus between 1956 and 2007. Between 1937 and 2008, historic high groundwater levels in wells to the north of the campus ranged from 10 to 23 feet above mean sea level. Therefore, given the geology of the area, the depth of the groundwater table below the LMU campus also is likely to be 10 to 23 feet above mean sea level. Elevations on LMU’s campus range from approximately 66 feet above mean sea level near

\(^{31}\) The classification of potentially expansive soils is accomplished by saturating soil samples and rating the resulting deformation. Expansivity is a basic soil index property; soils are rated according to a standard Expansion Index whereby a deformation in millimeters per hour of 0-20 = very low; 21-50 = low; 51-90 = medium; 91-130 = high; and >130 = very high.
the LMU Drive campus entrance to approximately 120 feet above mean sea level near the eastern edge of the bluffs on campus, to approximately 150 feet above mean sea level on Burns Campus. Therefore, historic high groundwater levels are between 43 and 56 feet below the surface in the low-lying portions of campus near Lincoln Boulevard and between 127 and 140 feet below the surface in the highest-elevation areas of campus.\(^{32}\)

As previously stated, the lower-lying area of campus that is 66 feet above mean sea level is largely designated by the proposed LMU Specific Plan as an Open Space Planning Area, with a small area near the southwestern corner of Hughes Campus designated as an Academic/Residential Planning Area.\(^{33}\) For the vast majority of the campus, and in most non-open space areas in which buildings will be allowed under the Proposed Project, groundwater is at least 50 feet below the surface of the campus; groundwater is at least 43 feet below the surface in the portion of Hughes Campus designated as an Academic/Residential Planning Area by the proposed LMU Specific Plan. Excavation for building foundations, basements, infrastructure, and other subterranean structures would not exceed 35 feet in depth below grade on campus. Therefore, Proposed Project-related excavation and below-grade construction would not approach or intercept groundwater beneath the campus and associated impacts would be less than significant.

### 4.4.1.3 Seismicity

As described above, the campus is not within a currently established Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards. The closest Alquist-Priolo Earthquake Fault Zone, established for the active Newport-Inglewood fault, is located approximately 3.2 miles east of the campus. Based on the available geologic data, no active or potentially active faults with the potential for surface fault rupture are located beneath or projecting toward the campus. Therefore, the potential for surface rupture at the campus due to fault plane displacement propagating to the ground surface during the life of the Proposed Project is considered low.

Although the campus could be subjected to strong ground shaking in the event of an earthquake, this hazard is common in Southern California. The location of the campus relative to known active or potentially active faults indicates that it is not exposed to a greater seismic risk than other sites in the area. Moreover, the effects of ground shaking can be mitigated by proper engineering design and construction in conformance with current building codes and engineering practices. The Proposed Project

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\(^{32}\) MACTEC Engineering and Consulting, Inc., *Geotechnical Evaluation, Proposed Master Plan Project, Loyola Marymount University*.

\(^{33}\) MACTEC Engineering and Consulting, Inc., *Geotechnical Evaluation, Proposed Master Plan Project, Loyola Marymount University*. 
would be designed and built in accordance with the California Building Code, the Los Angeles Uniform Building Code, and applicable federal building codes, which, in general, ensure life safety for occupants in the event of the strong earthquake ground motions expected to occur in the campus vicinity.

Proposed Project impacts related to seismicity would be less than significant with adherence to applicable building codes. Mitigation measures MM-GEO-1 and MM-GEO-2 are recommended to ensure compliance with applicable building code requirements governing seismicity.

4.4.1.4 Slope Stability

The LMU campus is not located within a Landslide or Hillside Area as mapped by the City of Los Angeles. However, the Westchester Bluffs below the campus are located in a State of California Earthquake-Induced Landslide Hazard Zone because the bluffs’ angle is greater than 19 degrees, or 3:1 (horizontal:vertical). A slope is considered safe (e.g., sufficiently stable for proposed uses) if it has a factor of safety of greater than 1.5, which is an expression of the relationship between actual soil/rock strength and the minimum strength required for slope equilibrium. This determines the bearing capacity of the soil, or the maximum weight soil can support without failure.

MACTEC previously performed slope stability analyses for portions of the bluffs on campus and found those slopes to possess the required safety factor. However, because of the sandy, uncemented nature of bluff materials, the bluff face is generally considered susceptible to erosion and sloughing. Project-level geotechnical evaluations, including slope stability studies to verify the factor of safety of the bluff slope, will be required prior to finalizing site selection, grading plans, and foundation and building design for individual Proposed Project buildings and campus improvements adjacent to the bluffs. Remedial design measures will be implemented in accordance with applicable building codes to ensure that the factor of safety is at least 1.5. Such measures may include establishment of building and foundation setbacks, flattening or reinforcing the slope, or construction of buttresses to ensure safe development in areas of unstable slopes. Furthermore, no buildings or structures will be constructed within the northern portion of campus on the bluffs, which is designated by the proposed LMU Specific Plan as a Buffer/Open Space Planning Area.

The Proposed Project’s impacts related to slope stability would be less than significant with preparation of Project-level (i.e., building-specific) geotechnical evaluations, including slope stability analyses, and adherence to applicable building codes governing slope stability. Mitigation measures MM-GEO-1, MM-GEO-2, and MM-GEO-5 are recommended to ensure compliance with code requirements governing slope stability.
4.4.1.5 Liquefaction

As discussed above, the LMU campus is not located within an area identified as having potential for liquefaction. Based on previous borings, groundwater is at a depth of greater than 50 feet in areas where liquefiable soils may be present. Therefore, the potential for liquefaction, and the associated ground deformation beneath the LMU campus, is considered to be very low, and impacts related to liquefaction would be less than significant.

4.4.1.6 Other Geological Hazards

The potential for other geologic hazards such as seismic-induced settlement, tsunamis, inundation, seiches, flooding, volcanic eruption, and subsidence affecting the campus is considered low. Therefore, impacts related to seismic-induced settlement, tsunamis, inundation, seiches, flooding, volcanic eruption, and subsidence would be less than significant.

4.4.2 Sedimentation and Erosion

- GEO-2 Would the Proposed Project constitute a geologic hazard to other properties by causing or accelerating instability from erosion; or
- GEO-3 Would the Proposed Project accelerate natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition that would not be contained or controlled on site?

Erosion and sedimentation are the windborne and waterborne transport of exposed soil. Because of the sandy, uncemented nature of the Westchester Bluffs materials, the bluff face is susceptible to erosion and sloughing (mass erosion or shedding on steep slopes). Project-level (i.e., building-specific) hydrology plans will be required prior to finalizing grading, drainage, and construction plans for individual Proposed Project buildings and campus improvements. Storm drain collection devices for the Proposed Project would be designed in conformance with applicable grading and building codes to ensure that all runoff would be collected and transferred to the proper collection devices. As part of the Proposed Project, LMU is required to comply with the requirements of the National Pollution Discharge Elimination System Permit set forth by the Los Angeles Regional Water Quality Control Board, and to prepare and submit a Storm Water Pollution Prevention Plan. The Storm Water Pollution Prevention Plan would incorporate Best Practices...
Management Practices to ensure that potential water quality impacts during construction from erosion would be reduced to less than significant levels. (Additional measures to control runoff during construction are discussed in Section IV.G, Surface Water Hydrology and Water Quality.) In addition, LMU would adhere to Southern California Air Quality Management District’s Rule 403, Fugitive Dust, during construction activities, which would further prevent impacts associated with dust generation and wind erosion. (More information regarding measures to control fugitive dust during construction is provided in Section IV.B.1, Air Quality.) All grading activities would require grading permits from the Department of Building and Safety, which include requirements and standards designed to control sedimentation and erosion.

Proposed Project impacts related to sedimentation and erosion would be less than significant with adherence to the applicable building codes and current local, state, and federal regulatory requirements governing sedimentation and erosion, which require the preparation of Project-level plans to address surface hydrology and water quality. Mitigation measures MM-GEO-6 through MM-GEO-8 are recommended to ensure compliance with these requirements.

4.4.3 Landform Alteration

GEO-4 Would the Proposed Project destroy, permanently cover, or materially and adversely modify have one or more distinct and prominent geologic or topographic features. Such features may include, but are not limited to, hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands?

As discussed previously, there are no unique geologic features present within the developed area of the campus. Therefore, no impacts related to landform alteration would occur.

4.5 Project Design Features and Mitigation Measures

No Project Design Features are proposed.

The following mitigation measures would address potential geotechnical impacts and ensure that impacts remain less than significant.

4.5.1 Geological Hazards

MM-GEO-1 Project-level (i.e., building-specific) geotechnical investigations shall be required prior to finalizing grading and construction plans for individual Proposed Project buildings and campus improvements.
IV.E Geology

MM-GEO-2 Individual buildings and improvements shall be designed and constructed in accordance with the requirements outlined in the most current edition of the California Building Code and the Los Angeles Uniform Building Code, as well as all applicable provisions of Chapter IX, Division 70 of the Los Angeles Municipal Code, which addresses grading, excavation, and fill, Department of the State Architect requirements, and federal building code requirements.

MM-GEO-3 Prior to issuance of a grading permit for an individual building or improvement, expansion testing shall be performed in accordance with UBC Standard 29-2 and ASTM Standard D4829 to determine the expansion potential of any import soils. Any required import fill and at least the upper 2 feet of fill beneath floor slabs and beneath other concrete slabs and walks shall consist of relatively non-expansive soils with an Expansion Index of less than 35.

MM-GEO-4 Prior to issuance of a grading permit for an individual building or improvement, corrosion testing shall be performed and proper corrosion protection shall be implemented where required in accordance with the Los Angeles Uniform Building Code, including all applicable provisions of Chapter IX, Division 70 of the Los Angeles Municipal Code, which addresses grading, excavations and fills.

MM-GEO-5 Slope stability evaluations shall be performed prior to issuance of a grading permit for buildings and improvements adjacent to bluff slopes. Slope stability evaluations shall be performed along critical cross sections of the slope adjacent to each area of potential development during the design-level geotechnical studies. The design minimum factors of safety under static and pseudostatic loading conditions shall be taken as 1.5 and 1.1, respectively, following accepted geotechnical practices and agency guidelines.

4.5.2 Sedimentation and Erosion

MM-GEO-6 Project-level hydrology plans shall be required prior to finalizing grading and construction plans for individual Proposed Project buildings and campus improvements. Hydrology plans shall be designed in conformance with current local, state, and federal regulatory requirements.

MM-GEO-7 Prior to the start of soil-disturbing activities at the site, a Notice of Intent and Storm Water Pollution Prevention Plan shall be prepared in accordance with, and in order to partially fulfill, the California State Water Resources Control Board Order No. 99-08-DWQ, National Pollution Discharge Elimination System General Permit No. CAS000002.
(General Construction Permit) and Chapter 6 Article 4.4, Stormwater and Urban Runoff Pollution Control from the Los Angeles Municipal Code. The Storm Water Pollution Prevention Plan shall meet the applicable provisions of Sections 301 and 402 of the California Water Act and Chapter 6 Article 4.4, Stormwater and Urban Runoff Pollution Control from the Los Angeles Municipal Code, by requiring controls of pollutant discharges that utilize best available technology economically achievable and best conventional pollutant control technology to reduce pollutants.

MM-GEO-8 General contractors shall implement a fugitive dust control program pursuant to the provisions of SCAQMD Rule 403.

4.6 Level of Impact After Mitigation

No unavoidable significant impacts with respect to geological hazards, sedimentation and erosion, or landform alteration would result from implementation of the Proposed Project.

4.7 Cumulative Impacts

As discussed in Section III, General Description of Environmental Setting, several related projects are proposed and/or planned within the campus vicinity. Potential geologic hazards associated with the Proposed Project are site-specific and would not represent a cumulative impact. Implementation of the Proposed Project and other projects in the Southern California region would cumulatively increase the number of structures and people exposed to geologic- and seismic-related hazards. As long as design and construction of related projects occurs consistent with proper engineering practices and to the requirements of applicable portions of the Municipal Code as they apply to each component of the project, seismic and regional geologic hazards would not be considered cumulatively considerable. Potential sedimentation and erosion and landform alteration associated with the Proposed Project are also site-specific and would not contribute to a cumulative impact.