4.5 Geology and Soils

4.5.1 Regulatory Setting

California Building Standards Code

The California Building Standards Commission is responsible for coordinating, managing, adopting, and approving building codes in California. In January 2014, the 2013 California Building Standards Code became effective, updating all prior codes under CCR Title 24.

The State of California provides minimum standards for building design through the 2013 California Building Code, a component of the 2013 California Building Standards Code (codified under CCR Title 24). Chapters 16 through 18 of the 2013 California Building Code regulate structural design, structural tests and inspections, and soils and foundations. The California Building Code 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 California Building Code, 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 1613A of the California Building Code, "Every 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."[1]

The state earthquake protection law (California Health and Safety Code Section 19100 et seq.) requires structures to be designed to resist stresses produced by lateral forces from wind and earthquake.

A jurisdiction may establish more restrictive building standards because of local climatic, geological, or topographical conditions. LCF has not established more stringent standards but has adopted the 2011 County of Los Angeles Building Code, which is based on the 2010 California Building Code. LCF is in the process of adopting, by reference, the 2014 County of Los Angeles Building Code.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed into law in California to protect structures designed for human occupancy from hazards associated with surface faulting. This state law was a direct result of the 1971 San Fernando earthquake, which damaged numerous homes, commercial buildings, and other structures as a result of extensive surface fault ruptures. Surface rupture is the most easily avoided seismic hazard. The Alquist-Priolo Earthquake Fault Zoning Act provides a mechanism for reducing losses from surface fault rupture on a statewide basis. The intent of the act is to ensure public safety by prohibiting the siting of most structures designed for human occupancy across traces of active faults that constitute a potential hazard from surface faulting or fault creep (California Geological Survey 2007a).

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

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses earthquake hazards from nonsurface fault rupture, including hazards related to liquefaction and seismically induced landslides. The purpose of the Seismic Hazards Mapping Act, which went into effect in 1991, is to identify and map seismic hazard zones. This helps cities and counties when preparing the safety elements of their general plans and encourages land use management policies and regulations that reduce seismic hazards. The act has resulted in the preparation of maps that delineate Liquefaction Zones and Earthquake-Induced Landslide Zones of Required Investigation (California Geological Survey 2007a).

4.5.2 Environmental Setting

Seismic Hazards

LCF is located in a seismically active region. Large earthquakes have occurred in the vicinity and will occur again in the future. Estimates by the Southern California Earthquake Center indicate that a 35% probability exists for a magnitude 7 event occurring in the next 30 years (Southern California Earthquake Data Center 2007a); smaller but still potentially damaging earthquakes can be expected to occur more frequently.

The State of California recognizes two broad categories of hazards associated with earthquake events: 1) *primary seismic hazards,* which include surface fault rupture and ground shaking, and 2) *secondary seismic hazards,* which include corollary results of ground shaking, such as seismically induced landslides and various types of ground failure, including liquefaction and ridgetop shattering. (Ridgetop shattering refers to earthquake-related shattering of bedrock materials along a ridgeline or other topographic high point.) Based on current knowledge of LCF's geology, earthquake ground shaking, liquefaction, and seismically induced landslides are the most serious geologic hazards.

LCF has one fault within its boundaries (the Sierra Madre fault) but is within 5 miles of several other faults (see Figure 4.5-1), none of which is identified under the Alquist-Priolo Earthquake Fault Zoning Act. The California Geological Survey is currently evaluating whether the segment of the Sierra Madre system in the project area warrants zoning under the Alquist-Priolo Earthquake Fault Zoning Act.

Table 4.5-1 shows the distances to the nearby fault zones from the project site.

Table 4.5-1: Fault Zones

Fault	Fault Type	Distance from Project Site (in miles)	Location Relative to Project Site
Eagle Rock	Thrust	2.06	South
Sierra Madre	Reverse	2.14	North
Verdugo	Reverse	3.87	East
Raymond Hills	Left-lateral	3.87	South

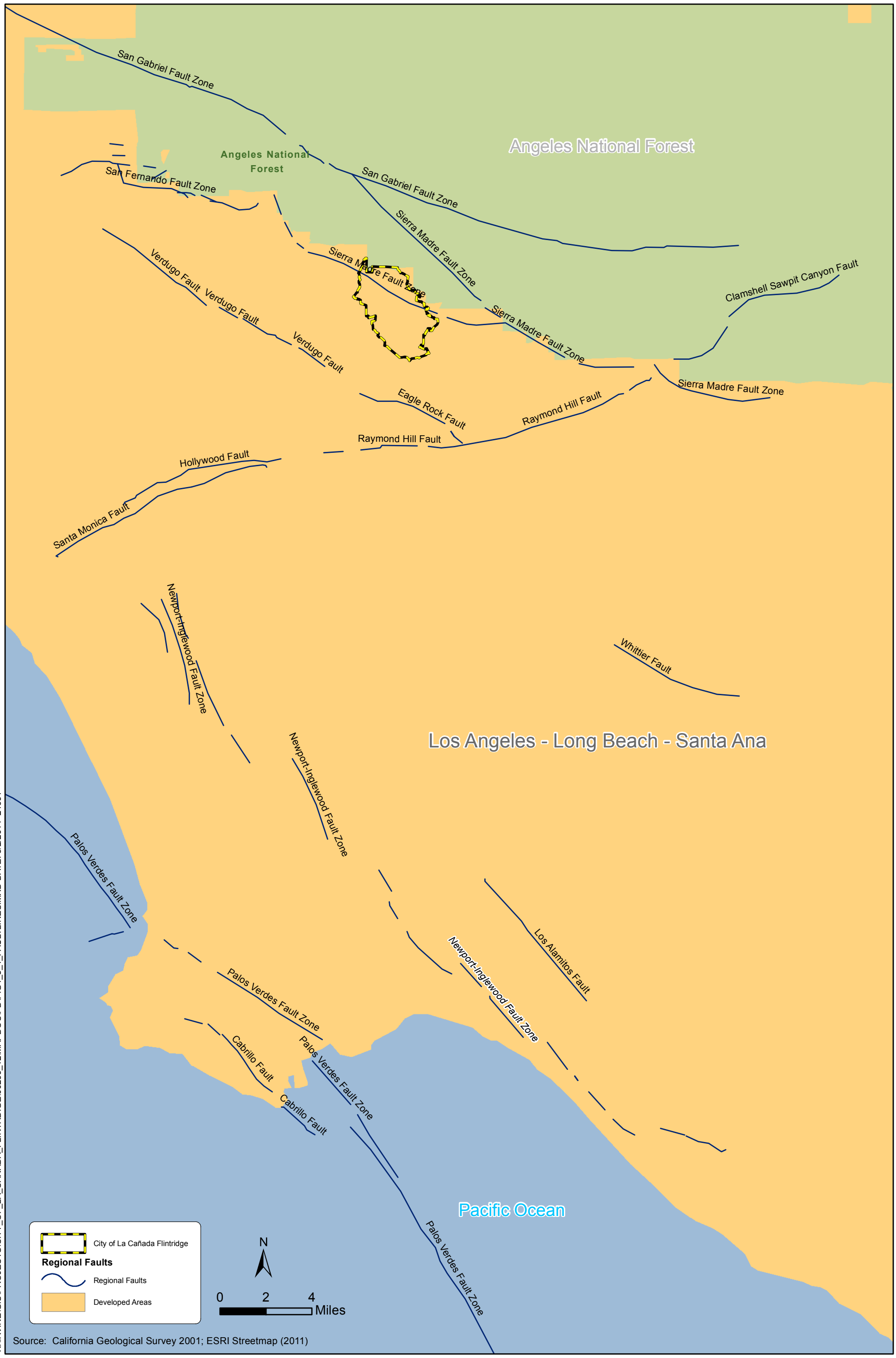

Figure 4.5-1
Principal Faults in the City and Surrounding Area
FSHA Specific Plan EIR

Studies by the Southern California Earthquake Data Center suggest that a large earthquake on the San Andreas fault, to the north, could trigger corollary ruptures on reverse faults along the southern margin of the San Gabriel Mountains (Southern California Earthquake Data Center 2007b). Whether all segments of the Sierra Madre fault zone would or could rupture in such an event is unknown. However, this and other reverse faults of the Transverse Ranges continue to be the subject of ongoing studies. A number of other faults that have been recognized as active by the State of California and/or the California Building Code are present in the surrounding region, and a moderate to major event on any of these faults could result in potentially damaging ground shaking in LCF.

Slopes and Soil Stability

The project site is located on the crest of the San Rafael Hills, at an elevation of approximately 1,650 feet above sea level. According to the U.S. Department of Agriculture, Natural Resource Conservation Center, the soil association[2] on and in the area surrounding the project site is the Vista-Amargosa association. This association is characterized by Vista and Amargosa soils. Vista soils, which are thinner sandy loam soils, are well drained and exhibit moderately rapid subsoil permeability. Amargosa soils are excessively drained, with rapid runoff and moderately rapid subsoil permeability that makes them prone to sheet and rill erosion and gullying. However, hazards due to shrink-swell are minimal; therefore, these soils are not considered expansive soils. The potential for erosion with the Vista-Amargosa association is high (U.S. Soil Conservation Service 1969). Given the hilltop location of the project site, slopes in the area can range from 30% to 50%.

Although the soil type present in the vicinity of the project site has the potential to experience erosion, the project site is not located in or near an area identified by the California Geological Survey as being susceptible to landslides (California Geological Survey 2007b). In addition, the project site is not located in area that is susceptible to liquefaction or subsidence (California Department of Conservation, Division of Mines and Geology 1999).

4.5.3 Environmental Impact Analysis

Methodology

The identification of potential significant impacts associated with the alternatives was based on the proximity of the site to geological features with the potential to result in risks to people or structures. Such geological features include faults, slopes, and unstable soils.

The following discussion identifies the potential impacts of the project and the measures that would be required to mitigate impacts that are found to be significant.

Thresholds of Significance

For the purposes of the analysis in this EIR, which is made in accordance with Appendix G of the State CEQA Guidelines, the project alternatives would have a significant environmental impact under CEQA related to geology and soils if they would:

[2] A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil; the soil association is named for the major soils. The soils in one association may occur in another but in a different pattern.

1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:
    - 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).
    - Strong seismic ground shaking.
    - Seismically related ground failure, including liquefaction.
    - Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable or would become unstable as a result of the project and potentially result in an on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.
4. Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risk to life or property.
5. Be located on soils that are incapable of adequately supporting the use of septic tanks or alternative waste disposal systems where sewers are not available for the disposal of wastewater.

Construction Impacts

Seismic Hazards

The proposed project would involve demolition of existing structures and the construction of new permanent structures, including new sports facilities. In addition, as many as six portable buildings would be placed on the existing soccer field while construction in Plan Areas 2 and 3 would occur. Although there is no realistic way to avoid hazards related to seismic shaking entirely, construction of the project would comply with applicable seismic safety provisions of the 2014 County of Los Angeles Building Code and the 2013 California Building Code. Relative to existing risks associated with seismic hazards, construction of the proposed project would not result in an increased risk of loss, injury, or death. Therefore, impacts occurring as a result of construction of the project would be less than significant.

Slopes and Soil Stability

With the exception of the new parking structure in Plan Area 1 and the Arts and Humanities Building in Plan Area 2, none of the proposed structures would be located near slopes with potential stability issues. The new parking structure would be built on and integrated into an existing slope. The southwestern corner of the proposed Arts and Humanities Building would be located adjacent to a short, steep slope above St. Katherine Drive. Given that the potential for erosion from the Vista-Amargosa association is high, according to the California Geological Survey, efforts would be taken to reduce the amount of runoff from the site during the construction period so as not to destabilize the adjacent slopes. With implementation of Mitigation Measure GEO-1, impacts related to slope stability during construction would be less than significant.

Although the potential exists for erosion to occur at the project site, the Landslide Inventory Map of the Pasadena quadrangle produced by the California Geological Survey (2007) indicates that there is a low probability for landslides to occur. Therefore, impacts related to landslides would be less than significant. No expansive soils or soils that are susceptible to liquefaction have been identified in the area. Therefore, risks associated with such soil types are not present. There would be no construction-related impacts. In addition, no septic tanks would be installed as part of the project. Therefore, no impacts related to soil suitability for septic tank installation would occur.

Southern California Edison Subtransmission Line

Because of the location of the proposed SCE subtransmission line within a seismically active region, there is some risk with respect to ground shaking during the construction period. However, the area in which the subtransmission line would run has not been identified as an area that is subject to liquefaction, ground failure, of fault rupture, and risks at the pole locations would not be substantially higher than elsewhere in the region. Therefore, seismically related impacts during the construction period would be less than significant.

Construction activities for the SCE subtransmission line would include the replacement of as many as 13 existing subtransmission poles along an existing utility right-of-way on the campus and northwest of the campus. The pad locations for the subtransmission poles and the temporary laydown/work areas would first be graded and/or cleared of vegetation, as required, to provide a reasonably level and vegetation-free surface for structure installation. Removal of vegetation has the potential to increase erosion because the vegetation would no longer anchor the surrounding soils. Following grading and clearing, however, areas would be compacted and capable of supporting heavy vehicular traffic. Consequently, the level of erosion is not expected to be substantial, and impacts would be less than significant.

Operational Impacts

Seismic Hazards

Operation of the proposed project would not result in an increased risk of loss, injury, or death due to rupture of a known earthquake fault, strong seismic ground shaking, seismically related ground shaking, or landslides. All structures would comply with applicable provisions of the 2011 County of Los Angeles Building Code and the 2013 California Building Code, including those related to structural stability. The project site is located in a seismically active region, and there is no realistic way to avoid hazards related to seismic shaking entirely. However, risks related to exposure to future ground shaking would be no greater than risks posed on the project site at present or at other sites in the vicinity. Therefore, operational impacts related to primary and secondary seismic hazards would be less than significant.

Slopes and Soil Stability

Although the project site is located along the crest of the San Rafael Hills, and soils that are prone to erosion can be found in the area, operation of the project would not result an increased risk of loss, injury, or death due to landslides because no landslide areas are located adjacent to the project site. In addition, 60% of the slope between the proposed Arts and Humanities Building and St. Katherine Drive would be planted with dwarf native myrtle (*Myoporum parvifolium*), and 40% would be planted with coyote brush (*Baccharis pilularis*). Both of these plants are known for their erosion-control properties (Coachella Valley Water District 2006; Rancho Santa Ana Botanic Garden 2012). Other areas of the project site would also be landscaped, resulting in further resistance to erosion.

All buildings constructed or remodeled in each of the Plan Areas of the proposed project would comply with structural provisions in the 2014 County of Los Angeles Building Code and the 2013 California Building Code.

No septic tanks would be installed as part of the project. Therefore, no impacts related to soil suitability for septic tank installation would occur. As stated above, the project site is not located within an area that has been identified as having expansive soils or soils that are susceptible to liquefaction or subsidence. Therefore, impacts related to slope and soil stability occurring as a result of project operation would be less than significant.

Southern California Edison Subtransmission Line

Because of the location of the proposed SCE subtransmission line within a seismically active region, there is some risk with respect to ground shaking during project operation. However, the subtransmission poles are not used for human occupancy and are designed consistent with California Public Utilities Commission (CPUC) General Order (GO) 95, Rules for Overhead Line Construction, to withstand wind, temperature, and tension load. Accounting for these factors would result in a design that would be adequate to withstand expected seismic loading. Consequently, seismically related risks would be minimized, and impacts would be less than significant.

Operation of the proposed SCE subtransmission line would be nearly identical to that of the existing line. Vegetation removed from the pad areas for the subtransmission poles would be allowed to revegetate naturally, thereby stabilizing the soils and reducing the temporary amount of minor erosion that could occur during the construction period. Operation of the SCE subtransmission line would have less-than-significant impacts related to slopes and soil stability.

4.5.4 Mitigation Measures

GEO-1: To reduce erosion on the slope between the proposed Arts and Humanities Building and St. Katherine Drive, the construction contractor shall implement the following measures, as appropriate, to ensure that runoff from the denuded site of Plan Area 2 does not result in slope instability:

- Plant vegetated buffer strips.
- Install staked hay bales.
- Install soil retention blankets.

4.5.5 Significant Unavoidable Impacts

Following implementation of Mitigation Measure GEO-1, there would be no significant unavoidable impacts.

4.5.6 Cumulative Impacts

All projects within 0.5 mile of the campus and the proposed SCE subtransmission line are site-specific projects, including additions to and remodeling of existing structures. Such projects would not temporarily or permanently increase risks related to seismicity or slope and soil stability. Cumulative impacts would not be considerable, and the project would not contribute to a significant cumulative impact.