4.6 GEOLOGY/SOILS

4.6.1 Introduction

This section of the EIR analyzes the potential physical environmental effects related to seismic hazards, underlying soil characteristics, slope stability, erosion, and existing mineral resources as a result of implementation of the General Plan Update. Data used to prepare this section was taken from the current City of Simi Valley General Plan, the 2007 General Plan Update Technical Background Report, the California Geological Survey (CGS) (formerly known as the Division of Mines and Geology), and seismic studies previously prepared for the City of Simi Valley.

One comment letter addressing geology, seismic hazards, soils, and mineral resources as received in response to the NOP circulated for the General Plan Update. Full bibliographic entries for all reference materials are provided in Section 4.6.6 (References) at the end of this section.

4.6.2 Environmental Setting

Regional Geology

Simi Valley is located within the Transverse Ranges geomorphic province of California. This province is characterized by an east/west-trending sequence of ridges and valleys formed by a combination of folding and faulting during a period of compression and uplift. The province extends offshore to include San Miguel, Santa Rosa, and Santa Cruz islands. Its eastern extension, the San Bernardino Mountains, has been displaced to the south along the San Andreas Fault. Intense north/south compression is squeezing the Transverse Ranges. Rocks in Simi Valley are of Upper Cretaceous through lower Miocene marine and non-marine sedimentary beds. These rocks have been uplifted and folded into a north-dipping sequence that forms a broad arc at the eastern edge of the valley (GeoSoils Consultants, Inc. 1999). Simi Valley is bounded to the north and east by Big Mountain and the Santa Susana Mountains, and to the south by the Simi Hills.

In general, the faulting and seismicity of southern California are dominated by the compressionary regime associated with the "Big Bend" of the San Andreas Fault Zone. The San Andreas Fault Zone separates two of the major tectonic plates that comprise the earth's crust. West of the San Andreas Fault Zone lies the Pacific Plate, which is moving in a northwesterly direction relative to the North American Plate, which lies east of the San Andreas Fault Zone. This relative movement between the two plates is the driving force of fault ruptures (earthquakes) in western California. The San Andreas Fault generally trends northwest/southeast. However, north of the Transverse Ranges Province, the fault trends more in an east/west direction (the Big Bend), causing the fault's right-lateral strike-slip movement to produce north/south compression between the two plates. This compression has produced rapid uplift of many of the mountain ranges in southern California. North/south compression in southern California has been estimated from 5 to 20 millimeters per year (City of Santa Monica 2002). As a result, this is one of the most rapidly rising regions on earth (CGS 2002).

Local Geology

Simi Valley has accumulated over 500 feet of alluvial sediments derived from erosion of the surrounding hills and mountains. Younger alluvium is present on the valley floor as well as in the canyons that drain into the valley. Older alluvium is exposed along the margins of the valley and in the hills near the Oak Park and Canada de la Brea oil fields. Higher elevations are underlain predominantly by bedrock of the Tertiary-age Santa Susana, Llajas, and Sespe formations. Conejo volcanics are exposed in portions of the western Simi Valley, whereas the eastern end of the valley is dominated by the Cretaceous-age Chatsworth formation.

Soil Associations

Pico-Anacapa Series

The Pico series consists of deep, well-drained soils that formed in alluvium from primarily sedimentary rocks. Pico soils are found on floodplains and alluvial fans at elevations of 10 to 1,500 feet, and tend to exhibit slow to medium runoff and moderately rapid permeability (USDA NRCS n.d.). These soils are generally found in the central portion of the City.

Salinas Series

The Salinas series consists of deep, well-drained soils that formed in alluvium weathered from sandstone and shale. Salinas soils are found at elevations of 50 to 2,000 feet on alluvial plains, fans, and terraces, and have slopes of 0 to 9 percent. These soils also tend to exhibit slow to medium runoff and moderately slow permeability (USDA NRCS n.d.), and are generally found in the central portion of the City.

Soper Series

The Soper series consists of moderately deep, well-drained soils that formed in material weathered from conglomerate and sandstone. Soper soils are on hills and uplands and have slopes of 15 to 50 percent. These soils tend to exhibit rapid runoff and moderately slow permeability, and are generally found in the northeast and southwest portions of the City (USDA NRCS n.d.).

Chesterton Series

The Chesterton series are moderately well drained, very slowly permeable soils on uplifted marine sediments and old terraces. They are gently sloping to moderately steep, and are found at elevations of about 50 to 600 feet. These soils are moderately well drained, and tend to exhibit slow to medium runoff and very slow permeability (USDA NRCS n.d.), and are generally found in the northeast and southwest portions of the City.

Rincon Series

The Rincon series consists of deep, well-drained soils that formed in alluvium from sedimentary rocks. Rincon soils are on old alluvial fans and both stream and marine terraces, have slopes of 0 to 30 percent, and are found at elevations of 20 to 2,000 feet. They tend to exhibit slow to rapid runoff and slow permeability, and they are generally found in the northeast and southwest portions of the City (USDA NRCS n.d.).

San Benito Series

The San Benito series is a member of a fine-loamy, mixed, thermic soils family. San Benito soils formed in residuum weathered from shale and sandstone with strongly sloping to very steep slopes at elevations of 25 to 3,500 feet. These soils are well drained, and exhibit medium to very rapid runoff, and moderately slow permeability, and they are generally found in the northern and southern portions of the City (USDA NRCS n.d.).

Castaic Series

The Castaic soils are well drained, moderately slowly permeable and formed in residuum weathered from shale, sandstone, and mudstone. They are strongly sloping to very steep and are found on rounded hills at elevations of 50 to 2,500 feet. These soils tend to exhibit medium to very rapid runoff and moderately slow permeability, and are generally found in the northern and southern portions of the City (USDA NRCS n.d.).

Calleguas Series

Consisting of very shallow and shallow, well-drained soils, the Calleguas series are formed on uplands, hills, and mountains in material weathered from sedimentary rocks. They are found at elevations of 100 to 2,800 feet at slopes of 9 to 75 percent. These soils formed in material weathered from sandstone, shale, and mudstone; and tend to exhibit medium or high runoff, and moderate permeability characteristics, and are generally found in the northern and southern portions of the City (USDA NRCS n.d.).

Sespe Series

The Sespe series consists of moderately deep, well-drained soils that formed in material weathered from reddish sandstone and shale bedrock. Sespe soils are on uplands at elevations of 400 to 2,600 feet, and have slopes of 15 to 75 percent. They tend to exhibit rapid and very rapid runoff, and slow permeability, and are only found in the southern portion of the City (USDA NRCS n.d.).

Lodo Series

Consisting of shallow, somewhat excessively drained soils, the Lodo series was formed in material weathered from hard shale and fine-grained sandstone. Lodo soils are located on mountainous uplands, ranging in slopes of five to 75 percent. Typically found at elevations of 300 to 3,400 feet, these soils exhibit medium to rapid runoff and moderate permeability characteristics, and are only found in the southern portion of the City (USDA NRCS n.d.).

Malibu Series

The Malibu series consists of moderately deep to soft bedrock, moderately well drained soils that formed in residuum and colluvium derived from inter-bedded shale and sandstone. Malibu soils are on hills and mountains at elevations of 10 to 1,570 feet and slopes of 4 to 75 percent. They tend to exhibit high to very high runoff, and very slow permeability, and are only found in the southern portion of the City (USDA NRCS n.d.).

Hambright Series

The Hambright series consists of shallow, well-drained soils formed in material weathered from basic igneous rocks. Hambright soils are on plateaus, basalt flows, and hillslopes and have slopes of 2 to 75 percent. Elevations are 300 to 3,000 feet. Hambright soils are commonly mapped in complex with rock outcrop (i.e., Lithic Xerorthents) and are generally found at elevations between 300 and 3,000 feet. They tend to exhibit medium to very rapid runoff, and moderate permeability, and are only found in the westernmost portion of the City (USDA NRCS n.d.).

Geologic Hazards

Seismic Activity

Earthquake magnitude is a quantitative measure of the strength of an earthquake or the strain energy released by it, as determined by the seismographic methods. It does not vary with distance or the underlying earth material. This differs from earthquake intensity, which is a qualitative measure of the effects a given earthquake has on people, structures, loose objects, and the ground at a specific location. Intensity generally increases with increasing magnitude and in areas underlain by unconsolidated materials, and decreases with distance from the hypocenter.

Several magnitude scales have been developed with the most commonly used scale called the moment magnitude (Mw) scale. Moment magnitude is related to the physical size of fault rupture and the movement or displacement across the fault, and as such is more uniform measure of the strength of an earthquake. Another measure of earthquake size is seismic moment. The seismic moment determines the energy that can be radiated by an earthquake. The moment magnitude of an earthquake is defined relative to the seismic moment for that event.

Earthquake intensity in a given locality is typically measured using the Modified Mercalli intensity (MMI) scale with values of this scale ranging from I to XII. The most commonly used adaptation covers the range of intensities from the conditions of a value of I (defined as not felt except by very few, favorably situated) to XII (defined as damage total, lines of sight disturbed, and objects thrown into the air). While an earthquake has only one magnitude, it can have many intensity levels that typically decrease with distance from the epicenter.

Faults

The Southern California region is seismically active and commonly experiences strong ground shaking resulting from earthquakes along known and previously unknown active faults. Active faults are defined as faults that have caused soil and strata displacement within the Holocene period (the last 11,000 years). Potentially active faults are those that have experienced movement in the Quaternary period (last 2 million years), but not during the Holocene. Faults that have not experienced movement in the last 2 million years are generally considered inactive.

Simi Valley is located in a seismically active region. The City is in proximity to several major regional faults systems, including the San Andreas and Santa Susana Faults, as seen in Figure 4.6-1 (Regional

Faults). Local active and potentially active faults (essentially, the Simi–Santa Susana fault) are identified in Figure 4.6-2 (Local Active and Potentially Active Faults).

San Andreas Fault Zone. The San Andreas Fault Zone is the dominant active fault in California. It is the primary surface boundary between the Pacific and the North American plate. There have been numerous historic earthquakes along the San Andreas Fault. This fault is capable of producing a moment magnitude 8 to 8.5 earthquake. The fault has right lateral strike-slip displacement, which indicates that vertical fractures along rock masses within the fault have shifted horizontally. A 1988 United States Geological Survey (USGS) study suggests that there is a 60 percent chance of a magnitude 8 earthquake on the south central segment of the San Andreas Fault in the next 30 years. The portion of the south central segment of the San Andreas Fault closest to Simi Valley (approximately 31 miles to the north) ruptured during the 1857 earthquake (City of Simi Valley 1999).

Santa Susana Fault. The Santa Susana fault is a north-dipping reverse fault that has had very low historic seismicity, although the 1893 Newhall area earthquake of MMI IX may have been caused by the Santa Susana fault. A magnitude 4.6 earthquake in 1976 also was centered near the Santa Susana fault. Surface rupture was attributed to this fault near the Aliso Canyon Oil Field in response to the 1971 San Fernando earthquake. However, subsequent trenching studies conducted across the fault to the east and north of the City have indicated that the Santa Susana fault has not experienced surface rupture in the last 100,000 years. The most recent movement along the Santa Susana fault is believed to have occurred over 10,000 years ago since fan deposits are not cut along the fault (City of Simi Valley 1999).

Simi–Santa Rosa Fault. The Simi–Santa Rosa fault is a high-angle reverse fault commonly mapped over a distance of about 17 miles from the east end of Simi Valley through the Tierra Rejada Valley to about the central part of the Santa Rosa Valley. Westward, the structure is mapped as the Santa Rosa fault into the Camarillo area. Some studies include the Springville and Camarillo faults as parts of the same fault system with an overall length of about 30 miles. As currently mapped, the Simi–Santa Rosa fault consists of a single strand along the base of the hills in northern Simi Valley. At the east end of Simi Valley and westward from the Tierra Rejada Valley, this single strand branches with multiple strands.

Vertical separation across the fault is estimated to be approximately one mile, with much of this believed to have accumulated during an earlier extensional phase of deformation. Of this total separation, approximately 1,500 feet is believed to have accumulated since about middle Miocene time (approximately the last 15 million years), with only relatively minor displacement over the last two million years. Movement is believed to be almost entirely dipslip. Where the Arroyo Simi drains across the fault at the west end of the valley, bedrock is quite shallow on the north side of the fault, but is covered by almost 500 feet of Quaternary sediments on the south side of the fault. This suggests significant reverse displacement during the Quaternary period (City of Simi Valley 2003).

Historic Seismic Activity

The City of Simi Valley has experienced earthquakes in the past, with a historic record reaching back to the mid-1800s. Prior to that date, the area was very sparsely populated; thus, the historical seismic record is not complete. Table 4.6-1 (Historic Earthquakes Felt in Simi Valley) lists the primary historic earthquakes that have affected the City from 1850 to 2006. Only those earthquakes at a MMI V or greater are listed.

Table 4.6-1 Historic Earthquakes Felt in Simi Valley

Date	*Earthquake Location*	*Earthquake Richter Magnitude*
1812	Santa Barbara Region	Approximately 7.0
1827	East of San Buenaventura Mission	6.0
1857	Fort Tejon	8.0
1893	Newhall Area	IX*
1925	Santa Barbara	6.3
1926	Southwest of Ventura, offshore	5.0
1933	Long Beach	6.3
1941	Santa Barbara, offshore	5.0
1952	Arvin-Tehachapi	7.7
1971	San Fernando	6.4
1973	Point Mugu, offshore	5.9
1987	Whittier Narrows	6.1
1994	Northridge	6.7

SOURCE: City of Simi Valley 1999, California Geological Survey 2006.
* Maximum Modified Mercalli Intensity

One of the greatest earthquakes to have occurred in the Southern California region is the Fort Tejon earthquake that occurred on January 9, 1857. This earthquake had a moment magnitude of approximately 8.0, and resulted in a surface rupture scar of about 220 miles in length along the San Andreas Fault. Effects of the earthquake were reportedly felt from Los Angeles to San Francisco, and resulted in two casualties. The exact location of the epicenter is not known; however, the area of strongest reported groundshaking was Fort Tejon (SCEC n.d.).

Prior to 1994, significant known damage from ground shaking in Simi Valley resulted from the 1971 San Fernando earthquake, which involved the San Fernando fault. The east wall of the 1912 Santa Susana Hotel at Tapo Street and Los Angeles Avenue collapsed during the earthquake. At Tierra Rejada Road and Los Angeles Avenues, the foundation of the relatively new K-Mart Store apparently shifted, breaking a gas line. Rock falls were also reported in the Santa Susana Pass and Tapo Canyon. A bedrock landslide also occurred in Tapo Canyon (City of Simi Valley 1999).

Recent Seismic Activity

The strongest, most recent seismic event near Simi Valley was the January 1994 Northridge earthquake (Richter magnitude 6.7). The epicenter of this event, triggered by the Northridge blind thrust fault, was located approximately 9 miles southeast of Simi Valley in the Northridge community of Los Angeles County at a depth of approximately 11 miles. No fatalities were recorded in Simi Valley due to the earthquake. However, the earthquake reportedly resulted in widespread property damage and personal injury to over 1,400 people in the community (City of Simi Valley 1999). Major damage to buildings, roadways, bridges, water tanks and other utility facilities were reported. These included two main feeder lines distributing water to the City, 10 water tanks, 493 residential buildings, the electric power

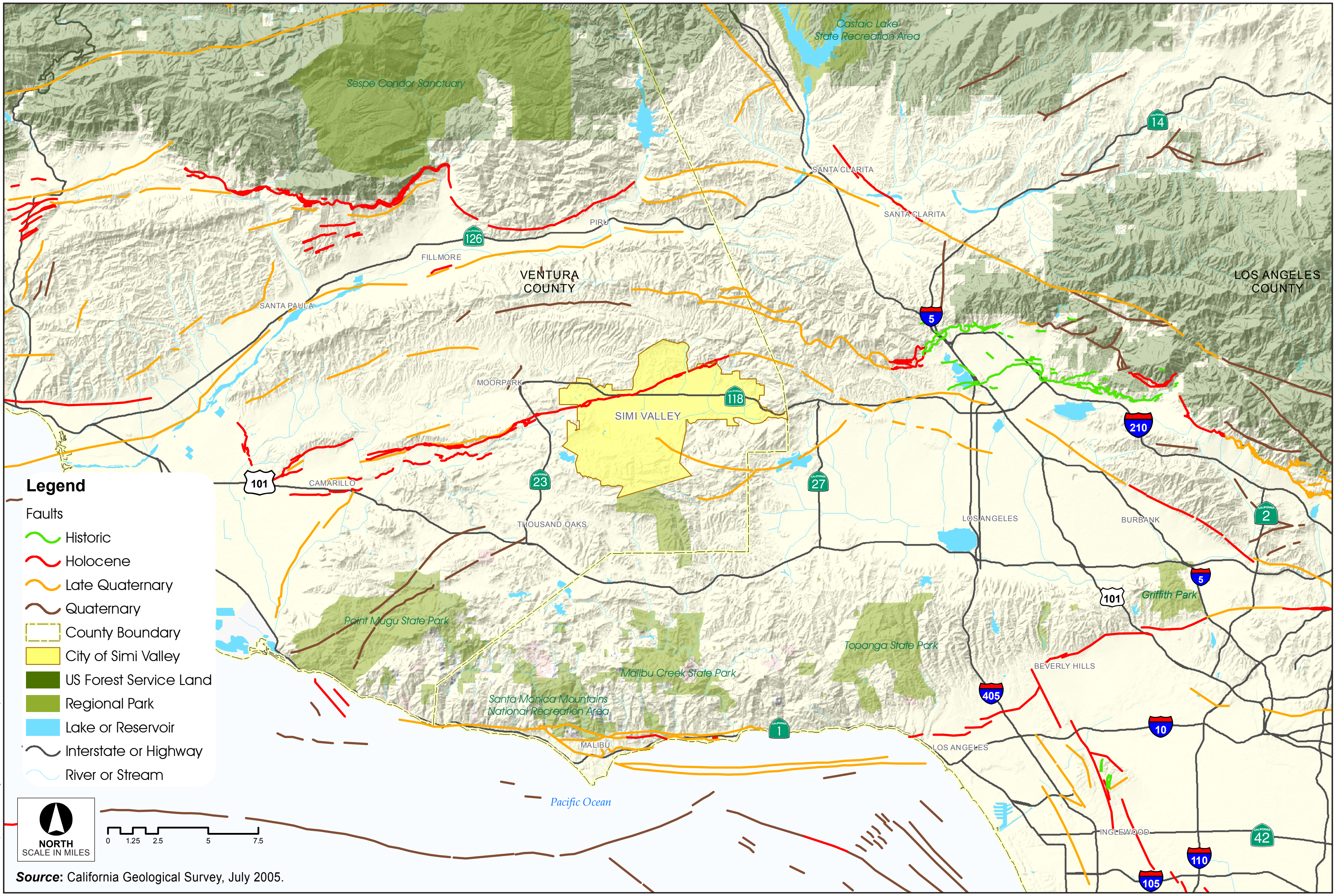

Figure 4.6-1
Regional Faults

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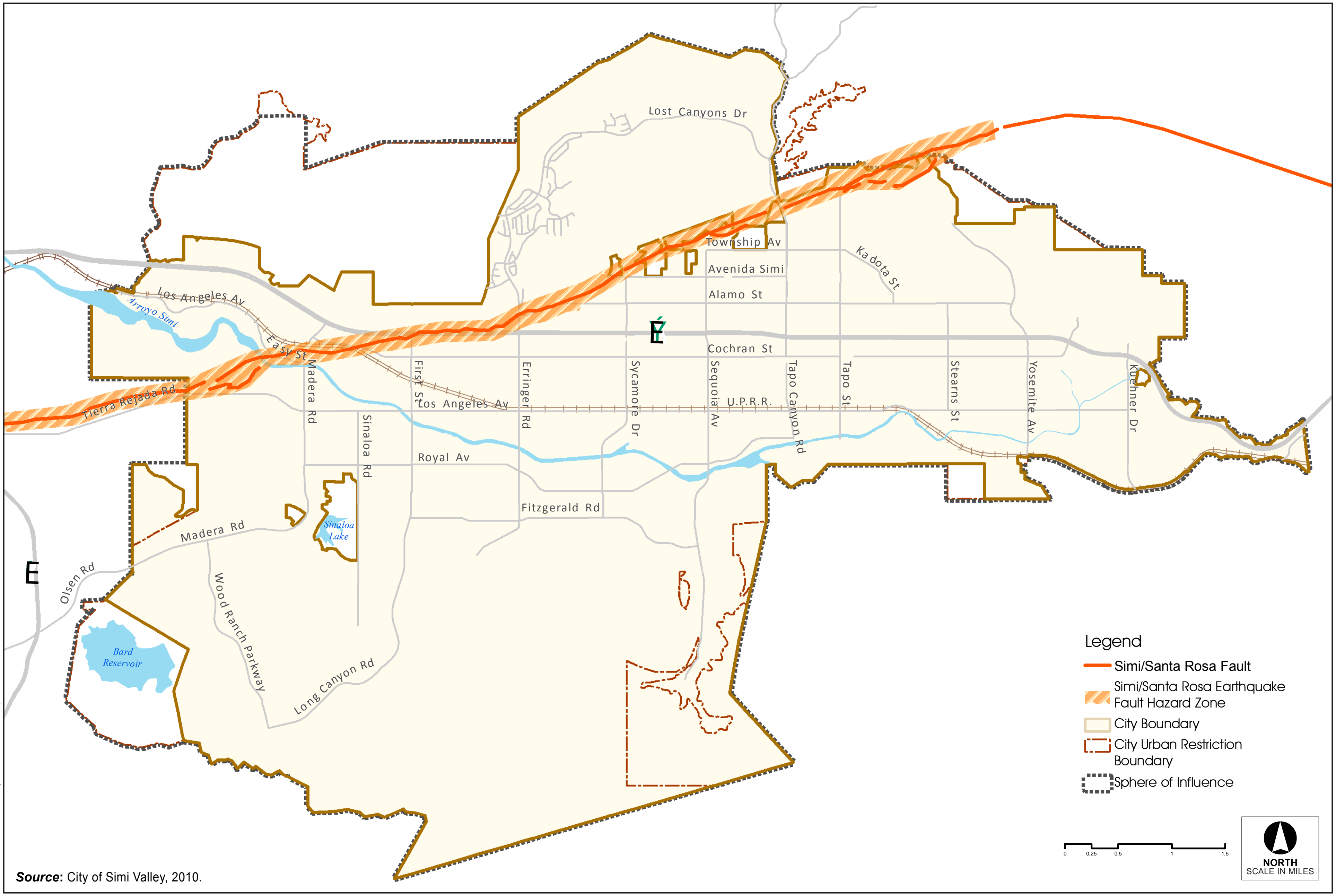

Source: City of Simi Valley, 2010.

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Figure 4.6-2

Local Active and Potentially Active Faults

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distribution system, the Simi Valley Police Department, 12 Simi Valley Unified School District schools buildings, 176 commercial/industrial buildings, and various road closures (City of Simi Valley 2004).

Seismic Hazards

Surface Rupture

Surface rupture or displacement occurs as a fault breaks the ground surface during a seismic event. Generally, this hazard is anticipated to occur along pre-existing faults. Surface rupture cannot be prevented; thus, faults are identified with the purpose of delineating zones over the surface trace of potentially hazardous faults where construction should be avoided. Buildings typically collapse or suffer significant damage as a result of differential movement through a foundation.

The Simi–Santa Rosa fault is the only known active fault within the Simi Valley Planning Area; therefore, it is the only fault that poses a seismic hazard related to surface rupture. The state has designated the Simi–Santa Rosa fault as an Earthquake Fault Zone (Figure 4.6-3 [Geologic Hazards]), thereby prohibiting structures on fault traces per the Alquist-Priolo Special Studies Act of 1972 (refer to Section 4.6.2 [Regulatory Framework]). Structures located on or near this fault zone have the greatest potential to experience future ground displacement. Several critical facilities (which include police and fire stations; hospitals; electrical, water, and communication facilities; schools; and transportation structures) located within a 0.5-mile radius of the Simi–Santa Rosa fault are (City of Simi Valley 1999):

- Simi Valley County Sanitation District Wastewater Treatment Plant
- Simi Valley's Public Services Center
- Simi Valley Unified School District Educational Center
- Atherwood Elementary School
- Adventist Hospital
- Township Elementary School
- Valley View Junior High
- Fire Station #46 (Tapo Street)
- Big Spring Elementary School

Groundshaking

The major cause of structural damage from earthquakes is groundshaking. The amount of ground motion expected at a building site can vary from minimal to forceful depending upon the distance to the fault, the magnitude of the earthquake, and the local geology. Greater movement can be expected at sites located on poorly consolidated material such as alluvium located near the source of the earthquake (epicenter) or in response to an earthquake of great magnitude. Strong groundshaking can damage large freeway overpasses and unreinforced masonry buildings. It can also trigger a variety of secondary hazards such as liquefaction, landslides, fire, and dam failure. Liquefaction and landslides are discussed in the "Soil-Related Geologic Hazards" section below.

The potential for strong groundshaking in Simi Valley is high, as exemplified by the 1994 Northridge earthquake, which had an MMI of X in eastern Simi Valley, and an MMI of VIII to IX through the rest of the valley. Groundshaking within Simi Valley could occur as a result of displacement of regional and/or local faults previously discussed, as well as other fault systems. A probabilistic seismic hazard map for groundshaking that could occur within the City is shown in Figure 4.6-4 (Groundshaking). As indicated on the map, the northern portion of the City is more likely to experience stronger groundshaking than the southern portion.

The Simi Valley Building and Safety Division has conducted a Citywide building survey to locate unreinforced masonry structures. According to the 1999 Safety Element of the City's existing General Plan, only one such structure remains in the City: Bottle Village on Cochran Street. This building, designated as a County of Ventura and State of California Cultural Landmark that is also listed on the National Register of Historic Places, was constructed with bottles, and was damaged extensively during the 1994 Northridge earthquake (GPBV 2005). Bottle Village is not approved for occupancy by the City, is not seismically safe, and cannot be occupied, since it is an unretrofitted, unreinforced masonry building.

Soil-Related Geologic Hazards

Expansive Soils

A soil's potential to shrink and swell depends on the amount and types of clay in the soil. Certain clays are more responsive to changes in water content than other types; they expand when wet and disproportionately shrink when dry. Moreover, the higher the clay content, the more expansive the soil. Highly expansive soils can cause structural damage to foundations and roads without proper structural engineering and are generally less suitable or desirable for development than non-expansive soils because of the necessity for detailed geologic investigations and costlier grading applications.

Generally, the potential for soils to exhibit expansive properties occur in low-lying areas, especially near river channels. Certain bedrock and soils within Simi Valley contain sufficient clay content; thus, the potential for shrink/swell to occur exists. According to the U.S. Soil Conservation Service (1970) soils maps, several zones of highly expansive soils are present in the foothills of Simi Valley. The Santa Susana, Llajas, Sespe, Modelo, Conejo volcanics, and older alluvium may develop or include areas of highly expansive soils. Other remaining areas of the City exhibit moderately expansive soil (City of Simi Valley 1999).

Future development within the foothill areas of Simi Valley is subject to existing building codes and grading criteria that would minimize hazards related to expansive soils (see Regulatory Setting).

Subsidence

Subsidence may also be a potential hazard within Simi Valley. Subsidence can occur as a result of excessive groundwater or petroleum withdrawal where the ground surface sinks. Important examples of subsidence are found in alluvial valleys filled to great depth with alluvial fan and lake-deposited sediments. Subsidence produces cracks in pavements and buildings and may dislocate wells, pipelines, and water drains.

The Simi Valley area is not likely to experience significant amounts of subsidence due to the withdrawal of water, oil, or gas. Currently, no large-scale local subsidence has been reported in the City due to either groundwater or oil extraction (City of Simi Valley 1999). However, removal of oil and gas resources from local bedrock areas such as Sespe, Llajas, and Santa Susana Formations may be susceptible to fluid

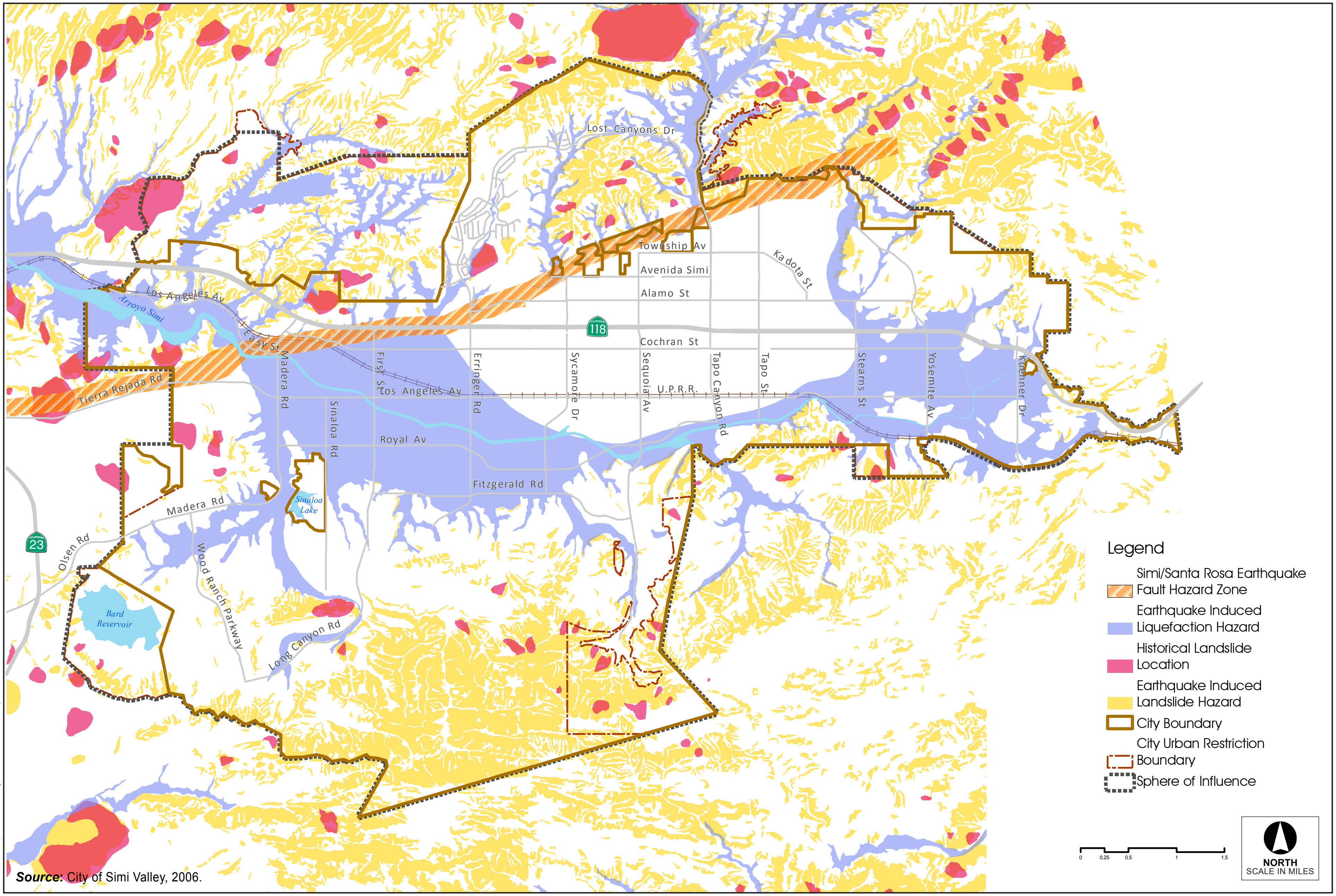

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Figure 4.6-3
Geologic Hazards

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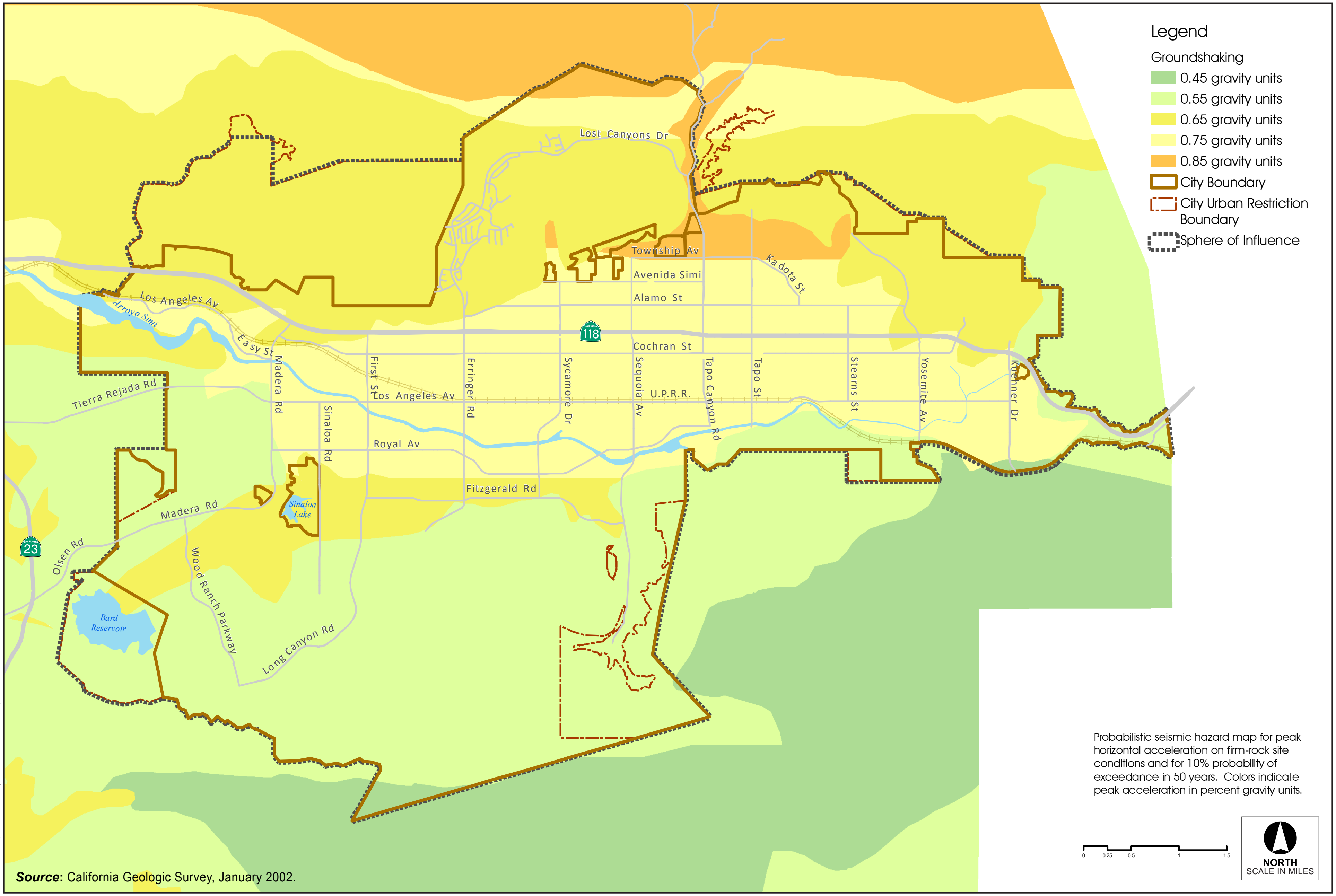

Source: California Geologic Survey, January 2002.

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Figure 4.6-4
Groundshaking

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withdrawal and thus, subsidence. These bedrock areas are primarily open space; therefore, localized subsidence would not adversely affect structures. Drainage courses, wells, and utility lines would be most vulnerable to property damage due to long-term effects of subsidence. Replacing withdrawn fluids with other fluids could mitigate this hazard (City of Simi Valley 1999).

Consolidation Settlement

Consolidation settlement is associated with weak, clay soils near the ground surface, and is generally induced by the weight of buildings. Saturated clays prone to consolidation settlement may be found in the alluvium underlying most of Simi Valley. However, since past groundwater levels are much lower than present levels, the clays are likely to have consolidated to some extent. In the western and eastern portions of the Simi Valley, the high water table would have exposed any collapse-prone soils to wetting and subsequent collapse; however, if more load is added in these areas, they could experience additional collapse. Areas on alluvial fans or debris flow deposits adjacent to the hills (not wetted in the past) could be susceptible to collapse. Collapsible soils have been found in the Tapo Canyon area, and areas underlain by alluvial fan or debris flow deposits where the water table is greater than approximately 40 feet (City of Simi Valley 1999). Site-specific geotechnical investigations that are required for all future development are necessary to identify areas prone to settlement.

Seismically Induced Settlement

Seismically induced settlement results from the compaction of loose, sandy soils during groundshaking. In the western and eastern portions of the Simi Valley Planning Area, the water table is near the surface in those areas, which could make them susceptible to post-liquefaction settlement (see below). Loose, sandy soils may be present in the alluvium underlying the central portion of the valley. Areas of low groundwater, such as those in the northern portion of Simi Valley, could be susceptible to seismic dry sand settlement. Soils testing on individual sites is the only effective measure to specifically identify areas prone to settlement.

Liquefaction

Liquefaction refers to a phenomenon where the surface soils become saturated. Groundshaking packs the sand grains closer together so that there is less pore space available for the water. This increases the water pressure between the sand grains within the alluvium. These soils therefore, become weak and mobile causing foundations of structures to move, leading to varying degrees of structural damage. Generally, liquefaction occurs only below the water table; however, after liquefaction has developed, it can move upward. Liquefaction susceptibility decreases with depth of the water table, and the age, cementation, and compactness of the sediments.

Areas susceptible to liquefaction include those within river channels and flood plain deposits, such as the Arroyo Simi. As shown in Figure 4.6-3, areas that are subject to liquefaction are located throughout the western and eastern portions of Simi Valley, and along the Arroyo Simi. Facilities located in the western and eastern portions of the community that could be susceptible to liquefaction hazard during a seismic event include, but are not limited to, residential areas, several schools, one fire station, the Simi Valley County Sanitation District Wastewater Treatment Plant, the City of Simi Valley's Public Services Center, and the Calleguas Municipal Water District main pump station (City of Simi Valley 1999). Under the terms of the California Seismic Hazard Mapping Act, all development within the State-designated liquefaction hazard zones must perform site-specific geotechnical investigations prior to construction to assess the potential for liquefaction under strong earthquake conditions, and provide mitigation measures as necessary.

Landslides

Landslides are often associated with earthquakes, though there are other factors that may influence the occurrence of landslides. These factors include the slope, the moisture content of the soil, and the composition of the soils and subsurface geology. In addition to an earthquake, heavy rain or the improper grading of a construction site may trigger a landslide. Most of the developed portions of the City are relatively flat and are not subject to landslide hazards. Hillside areas in the northern and southern portions of the City (north of Route 118 in the foothills of the Santa Susana Mountains and south of Royal Avenue) have experienced landslides in the past, and are likely to experience future landslides (City of Simi Valley 1999). Figure 4.6-3 identifies historic landslide locations, as well as earthquake-induced landslide hazard areas. These landslide hazard zones were developed under the terms of the California Seismic Hazard Mapping Act. All development within these areas (as shown in Figure 4.6-3) must perform site-specific geotechnical investigations prior to construction to assess the potential for landslides under strong earthquake conditions, and provide mitigation measures as necessary.

4.6.3 Regulatory Framework

Federal

There are no federal regulations applicable to geologic resources.

State

Alquist-Priolo Special Studies Zone

The Alquist-Priolo Earthquake Fault Zoning Act, administered by the California Geological Survey, was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy, which are defined as any structure used or intended for supporting or sheltering any use of occupancy that is expected to have a human occupancy rate of more 2,000 person-hours per year. The main purpose of the Act is to prevent the construction of buildings used for human occupancy on the surface trace of active state faults. The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones or Special Studies Zones) around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. Single-family wood-frame and steel-frame dwellings up to two stories not part of a development of four units or more are exempt. In compliance with the California Building Code (see below), before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet).

The State of California designated the Simi–Santa Rosa fault as an active fault in 1999 with the establishment of an Earthquake Fault Zone following completion of a Fault Evaluation Report (FER) prepared by the California Geological Survey. Prior to the state designation of an Earthquake Fault Zone along the Simi–Santa Rosa Fault, the City of Simi Valley established a local "Fault Hazard Zone" along the fault (Figure 4.6-3). The Fault Hazard Zone that the City of Simi Valley established along the Simi–Santa Rosa fault follows the same general guidelines regarding prohibiting structures on fault traces as the Alquist-Priolo Special Studies Act (City of Simi Valley 2003).

California Building Code

The state regulations protecting human-occupied structures from geo-seismic hazards are contained in California Code of Regulations (CCR) Title 24, Part 2 (the California Building Code [CBC]). These regulations apply to public buildings and a large percentage of private buildings in the state. Until January 1, 2008, the CBC was based on the then-current UBC and contained Additions, Amendments and Repeals specific to building conditions and structural requirements in the State of California. The 2010 CBC, effective January 1, 2011, is based on the current (2009) International Building Code and contains prominent enhancement of the sections dealing with fire safety, equal access for disabled persons, and environmentally friendly construction. Seismic-resistant construction design is required to meet more stringent technical standards than those set by previous versions of the CBC.

Chapter 16 of the 2010 CBC deal with Structural Design requirements governing seismically resistant construction (Section 1604), including (but not limited to) factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design (Sections 1613.5 through 1613.7). Chapter 18 of the 2010 CBC include (but are not limited to) the requirements for foundation and soil investigations (Sections 1803); excavation, grading, and fill (Section 1804); allowable load-bearing values of soils (Section 1806); and the design of footings, foundations, and slope clearances (Sections 1808 and 1809), retaining walls (Section 1807), and pier, pile, driven, and cast-in-place foundation support systems (Section 1810). Chapter 33 of the 2011 CBC includes (but is not limited to) requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304). Appendix J of the 2010 CBC contains grading specifications for permits, inspections, excavations, fills, setbacks, drainage and terracing, and erosion control (Sections J106, J107, J109 and J110).

Cities and counties are required to enforce the regulations of the 2011 CBC beginning January 2, 2010. The City of Simi Valley adopted the 2010 California Building Code, Volumes 1 and 2, on January 13, 2011 (Ordinance No. 1167).

The Seismology Committee of the Structural Engineers Association of California collaborated with others to delineate Seismic Zones to be used in earlier versions of the CBC for selecting safety factors to be applied in the design of seismic-resistant structures in California. In the 2007 CBC, the concept of Seismic Zones as the basis for seismic-resistant construction has been replaced by the use of Ground Motion maps depicting the acceleration anticipated from the most severe earthquake effects considered in the Building Code, expressed as a percentage of the acceleration of gravity (percent g), for shortperiod (0.2 seconds) and 1.0 second responses. The mapped information is used in a series of formulae to establish the earthquake-resistant design for a particular structure, based on the Site Class (type of underlying geologic materials, i.e., hard rock, stiff soil, etc.), the Site Coefficient (acceleration values), and Occupancy Class (multiple-family residence, hospital, etc.).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act governs the exercise of city, county and state agency responsibilities to identify and map seismic hazard zones and to mitigate seismic hazards to protect public health and safety in accordance with the provisions of Public Resources Code (PRC) Sections 2690 et seq. The intent of this publication is to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, the California Geological Survey's Special Publications 117, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," provides guidance for the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations, including seismic hazard zones within the Simi Valley Planning Area.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) provides an opportunity for states, Tribes and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act) by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of mitigation plan requirements (Section 322). This new section emphasizes the need for state, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts.

The requirement for a state mitigation plan is continued as a condition of disaster assistance, adding incentives for increased coordination and integration of mitigation activities at the State level through the establishment of requirements for two different levels of state plans: "Standard" and "Enhanced." States that demonstrate an increased commitment to comprehensive mitigation planning and implementation through the development of an approved Enhanced State Plan can increase the amount of funding available through the Hazard Mitigation Grant Program (HMGP). DMA 2000 also established a new requirement for local mitigation plans and authorized up to 7 percent of HMGP funds available to a state to be used for development of state, Tribal, and local mitigation plans (FEMA 2006).

■ Local

County of Ventura

Development within unincorporated hillside management areas in the County, including those within the planning area, is regulated by the Ventura County Building Code, and Chapters 6 and 7 of the Ventura County Land Development Manual Division. All building, grading, and excavation must comply with Appendix J of the Ventura County Building Code. Chapter 18 of the Ventura County Building Code also provides development standards associated with expansive soils (Ventura County 2011).

Simi Valley Municipal Code

Development within hillside areas is regulated by the City's Hillside Performance Standards (HPS), as set forth in Chapter 9-32 of the Simi Valley Development Code. These standards serve as a comprehensive planning program established by the City to address special problems associated with long-term planning of hillside and canyon development. The HPS implement the provisions of the General Plan as they relate to the preservation of hillside areas, the maintenance of open space, the retention of scenic and recreational resources of Simi Valley, and enhancement of public health, safety, or welfare by regulating development in hillside areas. Design guidelines related to grading, slope design, and ridgeline development are provided in the HPS, as well as requirements for geologic and soils engineering reports for any area proposed for development within the jurisdiction of the performance standards (City of Simi Valley 2006).

Simi Valley Multi-Hazard Mitigation Plan

Simi Valley and other local districts are required to adopt a state approved Multi-Hazard Mitigation Plan per the Disaster Mitigation Act of 2000 (DMA 2000, Public 106-390-Oct.30, 2000). The Simi Valley Multi-Hazard Mitigation Plan provides a strategy planning tool for the reduction of or prevention of injury and damage from hazards identified within the City. The City's Hazard Mitigation Goals, Objectives, and related potential Actions identify a range of specific actions to achieve respective goals or objectives (City of Simi Valley 2004).

The primary goal related to geologic and seismic hazards as identified in the Simi Valley Multi-Hazard Mitigation Plan is to reduce deaths, injuries, structural damage and losses from earthquakes and other geologic hazards. This can be achieved by developing a comprehensive approach to reducing earthquake-induced structural damage; protecting existing assets with the highest relative vulnerability to earthquakes; acquiring and maintaining information about vulnerability of assets from earthquakes; establishing and maintaining closer working relationships with federal, state, and local governments and districts; and encouraging other organizations to incorporate hazard mitigation activities (FEMA 2006).

4.6.4 Project Impacts and Mitigation

Analytic Method

The analysis that follows is provided within the context of the Planning Area. While most infill or new development would occur within the area of potential change identified in Chapter 3 (Project Description), some infill or redevelopment could occur throughout the City, and these areas would be subject to the same geologic risks as the targeted areas. Information regarding regional geology and seismically induced hazards was taken from various sources from the California Geological Survey and the United States Geological Survey (USGS). Where potential geological hazards are identified, such hazards would be expected to affect any land use changes in the hazard area that would be allowed under the General Plan Update. Adherence to design and construction standards, as required by state and local regulations, would ensure maximum practicable protection for users of the buildings and associated infrastructure. The potential increased geologic hazards resulting from development under the General

Plan Update were evaluated against the 2011 CEQA Thresholds (described below), as well as the potentially mitigating effects of applicable General Plan Update policies on those impacts.

It should be noted that the CBC (adopted by the City) contains strict policies and regulations regarding design and building standards to protect against the risk from seismic and other hazards. Compliance with these provisions is mandatory, not optional, and it is assumed that all development pursuant to the General Plan Update would comply with these provisions.

Thresholds of Significance

The following thresholds of significance are based on Appendix G of the 2011 CEQA Guidelines. For the purposes of this EIR, implementation of the proposed project may result in a potentially significant impact if the proposed project would:

- 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 Earth Faulting Zone Map issued by the State Geologist for the area or based on other substantial evidence of known fault
  - Strong seismic groundshaking
  - Seismic-related groundshaking, including liquefaction
  - Landslides
- Result in a substantial soil erosion or loss of topsoil
- 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
- Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property
- 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 waste water

General Plan Policies that Mitigate Potential Impacts on Geology and Soils

Policies and goals from the Community Development and Safety and Noise Chapters that would mitigate potential impacts on Geology and Soils include the following. All General Plan policies are followed by a set of numbers in parentheses. These numbers reference applicable measures that will be undertaken by the City to implement the policy.

Policy LU-1.3 **Development Priorities**. Prioritize future growth as infill and redevelopment of existing developed areas re-using and, where appropriate, intensifying development of vacant and underutilized properties within the CURB. Allow for growth on the immediate periphery of existing development in limited designated areas, where this is guided by standards to assure seamless integration and connectivity with adjoining areas and open spaces. The Growth Diagram below illustrates the locations in which new development will be permitted. *(Imp A-1, A-2, A-3, LU-6, LU-10, LU-18)*

Policy LU-4.6 **Hillside Development Density.** Maintain land outside the valley floor having a slope of over 20 percent as permanent open space. Commercial and industrial development shall be limited to slopes of 10 percent or less, unless otherwise allowed under the Hillside Performance Standards of the Simi Valley Municipal Code or approved by a specific plan that justifies and provides appropriate design measures for the development of these areas, in which case development shall be limited to slopes of 20 percent or less. *(Imp A-1, A-2, LU-1, LU-2, LU-3, LU-7, LU-8, LU-18, NR-1, NR-2, NR-3)*

Policy S-5.1 **Review Safety Standards.** Regularly review and enforce all seismic and geologic safety standards, including the Building Code, in site design and building construction methods. *(Imp A-1, A-2, LU-18, S-5, S-6)*

Policy S-5.2 **Building Codes.** Adopt building codes that include design and construction features that provide protection for new and renovated structures in hazard areas. *(Imp A-1, A-2, LU-18, S-6)*

Policy S-5.3 **Geotechnical Investigations.** Require geotechnical investigations for applicable improvements to determine the potential for ground rupture, groundshaking, landslides, and liquefaction impacts due to seismic events, as well as expansive soils and subsidence problems, on sites where these hazards are potentially present. *(Imp A-1, A-2, LU-18, S-5)*

Policy S-5.4 **Critical Facilities.** Encourage the upgrade, retrofitting, and/or possible relocation of all existing critical facilities (e.g., schools, police stations, fire stations, and medical facilities) and other public facilities that do not meet current building code standards and are located within geologic hazard areas. *(Imp A-1, A-2, LU-18, S-5)*

Policy S-5.5 **Tilt-Up Structures.** Encourage the upgrade and retrofit of tilt-up structures that do not meet current building code standards and are located within geologic hazard areas. *(Imp A-1, A-2, LU-18, S-5)*

Policy S-5.6 **Damage Prevention and Control.** Develop a comprehensive approach to reducing the possibility of damage and losses due to earthquakes. *(Imp A-1, A-2, LU-18, S-5, S-6)*

Policy S-5.7 **Data and Analysis.** Develop and maintain an up-to-date database of critical City assets and periodically assess their vulnerability to geologic hazards (e.g., data on construction type, occupancy rating, seismic reinforcements, etc.). *(Imp A-1, A-2, LU-18, S-11)*

Policy S-5.8 **Intergovernmental Coordination.** Establish and maintain cooperative relationships with federal, state, and local government agencies and special districts to promote information and resource sharing. *(Imp A-1, A-2, LU-18, S-2)*

Policy S-5.9 **Public Education and Partnerships.** Partner with other agencies and organizations to provide public education programs about potential geologic hazards in Simi Valley, and proper emergency preparation and response strategies before, during, and after geologic occurrences. *(Imp A-1, A-2, LU-18, S-2, S-3)*

Policy S-5.10 **Funding Programs.** Pursue federal and state programs to provide training, education, and mitigation activities for protection against seismic activity. *(Imp A-1, A-2, LU-18, S-2)*

Effects Not Found to Be Significant

The entirety of the City of Simi Valley is served by established wastewater conveyance and treatment services. New land uses allowed under the General Plan Update would connect to existing sewer trunk lines or future expansion of sewer trunk lines. Development under the General Plan Update would not require the use of septic tanks or alternative wastewater systems. Therefore, ***no impact*** related to alternative wastewater disposal systems or septic tanks would result.

Less-Than-Significant Impacts

Impact 4.6-1 **Implementation of the General Plan Update could result in the exposure of people and/or structures potentially substantial adverse effects resulting from strong seismic groundshaking; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.**

The General Plan Update would allow new land uses, redevelopment, or re-use of economically underperforming properties on infill properties within certain areas of the City, generally consistent with existing and proposed land use patterns, intensities, and building types. Further, the General Plan Update conserves the majority of the City's existing patterns and intensities of use, specifically in and around existing residential neighborhoods.

As noted in Section 4.6.1, there are several fault zones within and near the City that have the potential to produce moderate to large earthquakes and corresponding groundshaking within the City limits. However, new land uses permitted under the General Plan Update would be required to comply with the building design standards of the CBC (as adopted by the City pursuant to Section 8-11.01 of the Simi Valley Municipal Code) and would be required to incorporate structural features, foundation modifications, and improved materials and construction methods that reflect current and future updated seismic and geologic safety standards intended to mitigate adverse seismic impacts upon structures.

Further, implementation of the City's building codes and compliance with the policies contained in the General Plan and Municipal Code can be expected to ensure that structures built as a result of implementation of the General Plan Update would perform in a manner equal to or better than the existing structures they would replace due to revisions and improvements to the requirements. Policy S-5.1 through Policy S-5.10 in the General Plan Update will further reduce any potential impacts through the requirement of regular review of seismic safety building standards, the preparation of geotechnical investigations for certain development projects, the seismic retrofitting critical facilities, public seismic safety education, and the procurement of federal and state funds to improve seismic safety. Accordingly, impacts generated by strong seismic groundshaking on structures and/or people as a result of implementation of the General Plan Update are considered ***less than significant***.

Impact 4.6-2 Implementation of the General Plan Update could result in the exposure of people and/or structures to potentially substantial adverse effects resulting from seismic-related ground failure; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.

As noted above in Section 4.6.1, strong groundshaking occurring in areas with high groundwater tables and poorly consolidated soils can result in liquefaction. Areas susceptible to liquefaction include those within river channels and flood plain deposits, such as the Arroyo Simi. As shown in Figure 4.6-3, areas that are subject to liquefaction are located throughout the western and eastern portions of Simi Valley, and along the Arroyo Simi. Facilities located in the western and eastern portions of the community that could be susceptible to liquefaction during a seismic event include, but are not limited to, residential areas, several schools, one fire station, the Simi Valley Sanitation District Wastewater Treatment Plant, the City of Simi Valley's Public Services Center, and the Calleguas Municipal Water District main pump station (City of Simi Valley 1999). A considerable part of the City's mapped liquefiable areas are already developed with residential and commercial structures. In the event of a long duration moderate to strong earthquake, liquefaction could occur, although the actual hazard posed at any given site within the liquefaction zone is dependent upon the type of foundation, the structural design of the building, and the as-graded compaction standards of the soil on which a particular structure was built.

The General Plan Update would allow increased density and/or mixed uses in areas subject to liquefaction. Policy LU-1.3 (Development Priorities) states that future growth as infill of existing uses is the first priority. New construction within the City's liquefaction zone would be built to current and/or improved future building, structural, and seismic codes. Under the terms of the State of California Seismic Hazard Mapping Act, all development within the state-designated liquefaction hazard zones must perform site-specific geotechnical investigations prior to construction to assess the potential for liquefaction under strong earthquake conditions.

California law, local building codes, and the standards contained in the City's Municipal Code require all new construction in the City to first assess the potential for liquefaction at the building site and to provide design recommendations to mitigate the site's liquefaction potential to the satisfaction of the City's building official prior to issuance of building permits. In addition, policies set forth in the General Plan Update, such as Policy S-5.1 (Review Safety Standards) and Policy S-5.3 (Geotechnical Investigations), would further reduce any potential impacts. As such, the potential liquefaction hazards associated with implementation of the General Plan Update would not be significant.

Therefore, with adherence to current building code requirements and the policies of the General Plan Update, implementation of new development under the General Plan Update would not expose people and/or structures to additional hazards associated with liquefaction. This impact is considered ***less than significant***.

Impact 4.6-3 **Implementation of the General Plan Update could result in the exposure of people and/or structures to potentially substantial adverse effects resulting from landslides; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.**

The geologic character of an area determines its potential for landslides. Steep slopes, the extent of erosion, and the rock composition of a hillside can aid in predicting the probability of slope failure. In order to fail, unstable slopes need to be disturbed. Common triggering mechanisms of slope failure include undercutting slopes by erosion or grading; saturation of marginally stable slopes by rainfall or irrigation; and shaking of marginally stable slopes during earthquakes.

Landslides are often associated with earthquakes, although there are other factors that may influence the occurrence of landslides. These factors include the slope, the moisture content of the soil, and the composition of the soils and subsurface geology. In addition to an earthquake, heavy rain or the improper grading of a construction site may trigger a landslide. Most of the developed portions of the City are relatively flat and are not subject to landslide hazards. Hillside areas in the northern and southern portions of the City (north of Route 118 in the foothills of the Santa Susana Mountains and south of Royal Avenue) have experienced landslides in the past, and are likely to experience future landslides (City of Simi Valley 1999). Figure 4.6-3 identifies historic landslide locations, as well as earthquake-induced landslide hazard areas. These landslide hazard zones were developed under the terms of the State of California Seismic Hazard Mapping Act. All development within these areas must perform site-specific geotechnical investigations prior to construction to assess the potential for landslides under strong earthquake conditions.

For the most part, the General Plan Update does not propose any changes to land use in areas susceptible to landslides. However, any development contemplated under the General Plan Update would be required to comply with Title 8 of the City's Municipal Code, which adopts the building requirements of the CBC as the City's Building Code. Any development contemplated under the General Plan Update would be in compliance with Policy S-5.1 through Policy S-5.3 of the proposed Safety and Noise Element of the General Plan Update, which require regular review and revisions to the Building Code, as well as geotechnical and geologic investigations for projects in areas that may be susceptible to landslides. In addition, Policy LU-4.6 (Hillside Development Density) of the Community Development Element requires that all hillsides with a slope greater than 20 percent shall remain as permanent open space where development is prohibited. Furthermore, development within hillside areas is regulated by the City's Hillside Performance Standards, as set forth in Chapter 9-32 of the Simi Valley Development Code. Compliance with the existing regulations, as well as the policies of the General Plan Update would require evaluation and planning to prevent increased risk of landslide hazards. Therefore, this impact would be ***less than significant***.

Impact 4.6-4 **Implementation of the General Plan Update could result in substantial soil erosion and the loss of topsoil; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.**

Topsoil is the uppermost 6 to 8 inches of soil. It has the highest concentration of organic matter and microorganisms, and is where most biological soil activity occurs. Topsoil erosion is of concern when the topsoil layer is blown or washed away, which reduces soil productivity. Since land in the City is largely developed and there are insignificant agricultural uses within the City limits, the potential for large areas of exposed topsoil that could be subject to erosion is considered minimal.

All demolition and construction activities within the City are presently required to comply with CBC Appendix Section J110, Erosion Control standards, which are designed to ensure implementation of appropriate measures during grading and construction to control erosion and storm water pollution. New construction activities carried out under the General Plan Update may slightly increase the potential for construction-related soil erosion. However, every construction project that disturbs one or more acres of land surface or that is part of a common plan of development or sale that disturbs more than one acre of land surface requires coverage under the NPDES Construction General Permit. The Construction General Permit includes specific minimum requirements for construction stormwater quality best management practices, a determination of sediment Risk Level, a Rain Event Action Plan, and monitoring and reporting requirements. Consistent enforcement of CBC code requirements and NPDES permit conditions can be expected to minimize the polluting effects of erosion from construction sites and ensure compliance with the RWQCB Water Quality Control Plan and its regulations. Additionally, Municipal Code Sections 6-12.501-504 of Article 5 (Requirements for the Control of Urban Runoff) also require sediment controls. Therefore, compliance with CBC requirements, RWQCB regulations, and the City's Municipal Code would ensure that new land uses allowed under the General Plan Update do not increase the level of soil erosion and loss of topsoil within the City. As such, the General Plan Update would result in a ***less-than-significant*** impact.

Impact 4.6-5 **Development allowed under the General Plan Update could be located on a geologic unit or soil that is unstable or would become unstable and potentially result in on- or off-site landslides, lateral spreading, subsidence, or collapse; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.**

As previously discussed, there are no significant impacts associated with the General Plan Update as they pertain to landslides and liquefaction; therefore, this analysis addresses impacts related to unstable soils as a result of lateral spreading, subsidence, or collapse.

Lateral spreading occurs as a result of liquefaction. As such, liquefaction-prone areas could also be susceptible to lateral spreading. New land uses allowed under the General Plan Update would be required to comply with the CBC standards for structural design and site development, as well as with Policy S-5.2 (Geotechnical Investigations), proposed in the Safety and Noise Element of the General Plan Update, which require site-specific investigations by a certified geotechnical engineer. In addition, sites located within liquefaction hazard areas shall comply with the State of California Special Publication 117 (SP117), which sets the standards for investigating and mitigating liquefaction potential and related hazards.

The CBC requires that "classification of the soil at each building site shall be determined when required by the building official" and that "the classification shall be based on observation and any necessary test of the materials disclosed by borings or excavations." The CBC also provides standards including, but not limited to: excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soils strength loss. Thus, an acceptable degree of soil stability can be achieved for soil materials by the required incorporation of soil treatment programs (replacement, grouting, compaction, drainage control, etc.) in the excavation and construction plans to address site-specific soil conditions. A site-specific evaluation of soil conditions is required by the City for future construction projects and must contain recommendations for ground preparation and earthwork specific to the site, that become an integral part of the construction design. Such an evaluation would be required for any development contemplated under the General Plan Update.

Adherence to the City's requirements, as well as other state and federal building codes, would ensure that new land uses allowed under the General Plan Update would not be located on unstable soils or geologic units. With these requirements, the General Plan Update would have a ***less-than-significant*** impact associated with the exposure of people or structures to hazards associated with unstable geologic units or soils.

Impact 4.6-6 **Implementation of the General Plan Update could result in development on expansive soils, as defined in Table 18-1-B, or in the creation of substantial risk to people and structures; however, this impact would be reduced to less-than-significant levels through the implementation of General Plan policies and compliance with relevant local, state, and federal regulations. This is a *less-than-significant* impact.**

A soil's potential to shrink and swell depends on the amount and types of clay in the soil. Montmorillonite and bentonite clays are more responsive to changes in water content than other types: they expand when wet and disproportionately shrink when dry. Moreover, the higher the clay content the more the soil will swell when wet and will shrink when dry. Highly expansive soils can cause structural damage to foundations and roads without proper structural engineering and are generally less suitable or desirable for development than non-expansive soils because of the necessity for detailed geologic investigations and costlier grading applications.

As discussed previously, the City's soils are generally one of the following primary soils series; Pico-Anacapa-Salinas, Soper-Chesterton-Rincon, San Benito-Castaic-Calleguas, Sespe-Lodo-Malibu, Badland-Calleguas-Lithic Xerorthents, and Hambright-Lithic Xerorthents-Rock Outcrop associations. General information concerning the shrink-swell potential of the region's soils has been provided in the 1970 Soil Survey by the Soil Conservation Service. This investigation shows a scattering of such soils and indicates the necessity for individual investigations of local soil conditions. Generally, the potential for soils to exhibit expansive properties occur in low-lying areas, especially near river channels. Certain bedrock and soils within Simi Valley contain sufficient clay content; thus, the potential for shrink/swell to occur exists. According to the U.S. Soil Conservation Service (1970) soils maps, several zones of highly expansive soils are present in the foothills of Simi Valley. The Santa Susana, Llajas, Sespe, Modelo, Conejo volcanics, and older alluvium may develop or include areas of highly expansive soils. Other remaining areas of the City exhibit moderately expansive soil (City of Simi Valley 1999).

However, Policy S-5.3 proposed in the General Plan Update would require geological and geotechnical investigations in areas of potential seismic or geologic hazards. The site-specific investigation for each subsequent development project would identify potentially unsuitable soil conditions and recommend appropriate measures and/or design features that conform to the analysis and implementation criteria described in the City's Building Code. Thus, adherence to Building Code requirements, as well as policies identified in the General Plan Update, would reduce impacts related to expansive soils. Therefore, this impact is considered ***less than significant***.

Significant and Unavoidable Impacts

No significant and unavoidable impacts have been identified with respect to geology/soils.

Cumulative Impacts

The geographic context for the analysis of impacts resulting from geologic and seismic hazards is generally site-specific, rather than cumulative in nature, because each development site has unique geologic considerations that would be subject to uniform site development and construction standards. In this way, potential cumulative impacts resulting from geological, seismic, and soil conditions affecting development under the General Plan Update would be minimized on a site-by-site basis to the extent that modern construction methods and code requirements provide.

Therefore, since geologic hazards are site-specific, this project, in combination with other past, present, and reasonably foreseeable future projects, would not create a potentially significant cumulative impact on geologic resources within the City.

Implementation of the General Plan Update policies related to earthquake hazards or geologic disturbances and compliance with updated CBC building standards would reduce any cumulative impacts resulting from fault rupture or groundshaking within the City to a ***less-than-significant*** level.

Impacts from erosion and loss of topsoil from site development and operation can be cumulative in effect within a watershed. This analysis accounts for all future potential growth within this watershed area.

Past cumulative development has involved construction activities that result in increases in runoff and erosion. However, because all development in the watershed is subject to state and local runoff and erosion prevention requirements, including the applicable provisions of the Construction General Permit, BMPs, and Municipal Stormwater NPDES Permit, past development has not resulted in significant violation of water quality standards or waste discharge requirements. Build-out of the General Plan Update, in combination with all other future development that would occur within the watershed, would involve construction activities that could increase erosion. However, future development would be required to comply with existing regulations regarding construction practices that minimize risks of erosion. Among the various regulations are the applicable provisions of Best Management Practices, compliance with appropriate grading permits, and NPDES permits. This would minimize the potential for erosion at individual project construction sites. As such, cumulative impacts would be considered less than significant. As a result, it is anticipated that cumulative impacts due to runoff and erosion from cumulative development activity would be ***less than significant***.

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