3.9 GEOLOGY, SOILS, SEISMICITY

EXECUTIVE SUMMARY

This section describes the types of soils present within the City's Planning Area. Development constraints associated with soil hazards, subsidence, and geologic hazards are discussed along with City development standards. The City's Planning Area consists of its incorporated boundaries and adopted Sphere of Influence (SOI). The County's Planning Area consists of unincorporated land within the One Valley One Vision (OVOV) Planning Area boundaries that is outside the City's boundaries and adopted SOI. Together, the County and City Planning Areas comprise the OVOV Planning Area. With implementation of the proposed General Plan goals, objectives, and policies and mitigation measures defined in this section, potential impacts from geology, soils, and seismicity would be less than significant.

EXISTING CONDITIONS

Soils

Various soil types exist within the City's Planning Area as shown on **Figure 3.9-1, Soil Types within the City's Planning Area**. Saugus loam, 30 to 50 percent slopes, eroded (ScF2) is the most abundant type of soil within the City's Planning Area with approximately 7,689 acres. A detailed description of each soil type found within the City's Planning Area is presented in **Appendix 3.9** of this environmental impact report (EIR) and corresponds with the soil types mapped on **Figure 3.9-1**. Each soil characteristic is identified to determine the Capability Classification of the soil on site, which in turn determines the predicted productivity of the soil if it were under agricultural production; the majority of the soils within the City's Planning Area would be used for wildland/grazing areas, and would not be able to economically or physically sustain agricultural production.

The following text describes the soil associations found within the City's Planning Area. 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, and is named for the major soils. The soils in one association may occur in another association but in a different pattern. A soil series is the lowest category of the national soil classification system. The name of a soil series is the common reference term, used to name soil map units. The soil series are presented in this section by their location (i.e., Upland, Alluvial Fans, Alluvial Fans and Floodplains, Terraces, and Terraces and Foothills). **Appendix 3.9** provides a cross-reference to the soil type and soil association.

Saugus-Castaic-Balcom Association

This association is located on foothills and mountains on gently sloping to very steep, well-drained soils that are loam to silty clay loam throughout; deep to moderately deep over soft sandstone or shale. Some area of this soil association is adjacent to Ventura County, and others are north and south of the Santa Clara River and its tributaries near Saugus. Saugus soils make up about 50 percent of this association. Castaic soils make up about 25 percent of this soil association and Balcom soils about 20 percent. Mocho, Sorrento, and other alluvial fans make up the remaining 5 percent of this soil association.

Saugus Series (Uplands)

Soils of the Saugus series are well drained and are located on uplands. These soils formed on weakly consolidated sediment that contained pebbles and cobblestones in some places. Slopes range from 15 to 50 percent. Elevations range from 1,300 to 2,250 feet. Vegetation consists of dense stands of chamise and candlestick yucca with an understory of annual grasses, forbs, and remnant stands of perennial grasses. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is about 63 degrees Fahrenheit, and the frost-free season ranges from about 275 to 300 days. In a typical profile, the surface layer is grayish-brown loam about 15 inches thick. Below is grayish-brown loam about 15 inches thick. Below is grayish-brown loam underlain by weakly consolidated sediment at a depth of 42 inches. These soils are used for range and for homesites. They also are used for wildlife and watershed purposes.[1]

Castaic Series (Uplands)

The Castaic series consists of well-drained soils that formed in material from soft shale and sandstone. These soils are located on uplands with slopes from 2 to 65 percent. Elevations range from 1,250 to 1,500 feet. Vegetation consists mainly of annual grasses and forbs, but stipa, a perennial grass, grows in small areas and brush grows in some places on north slopes. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. In a typical profile the surface layer is pale-brown silty clay loam underlain by soft shale and sandstone at a depth of about 26 inches. These soils are used for dryland small grains and pasture, for range, for watershed, and as wildlife habitat.[2]

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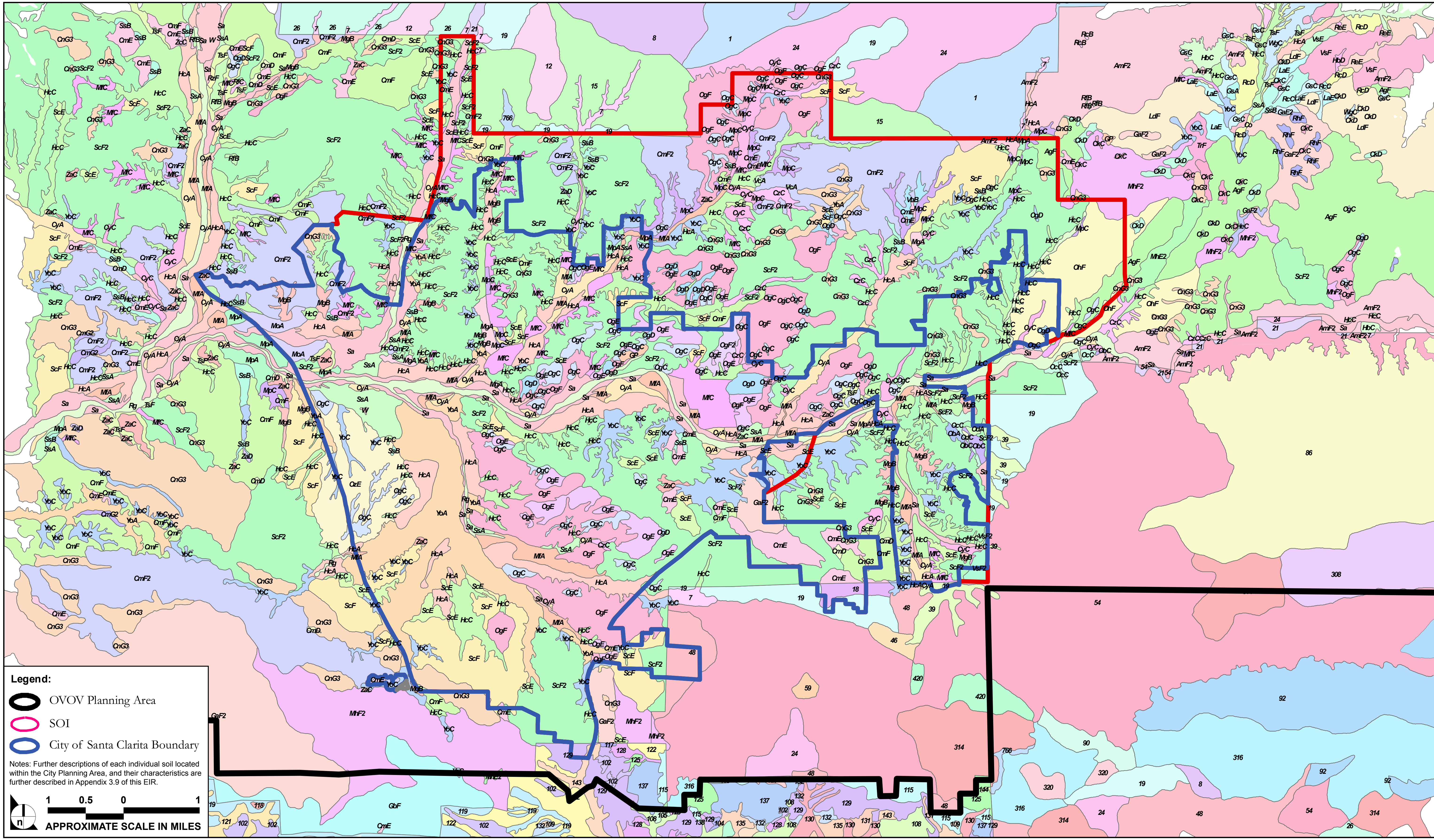
1 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, 1970.

2 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," 1970.



SOURCE: USDA Soil Conservation Service, Soil Survey Antelope Valley Area, January 1970; USDA Soil Conservation Service, Soil Survey Los Angeles, West San Fernando Valley Area, 1980; USDA Soil Conservation Service, Soil Survey Angeles National Forest Area, 1980.

FIGURE **3.9-1**

Soil Types within the City's Planning Area

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Mocho Series (Alluvial Fans)

The Mocho series consists of moderately well-drained soils that formed in sedimentary alluvium. These soils are on alluvial fans along major drainageways with slopes from 0 to 9 percent. Elevations range from 1,175 to 1,225 feet. Vegetation consists of grasses and oaks. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is about 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. Mocho soils are associated with Metz, Sorrento, and Yolo soils. Typically the surface layer is grayish-brown and light brownish-gray calcareous loam to a depth of more than 60 inches. In some places the surface is sandy loam. These soils are used for dryland and irrigated crops.[3]

Sorrento Series (Alluvial Fans)

The Sorrento series consists of well-drained soils that have formed in mixed alluvium. These soils are located on alluvial fans with slopes from 0 to 5 percent. Elevations range from 1,175 to 1,250 feet. Vegetation consists of grasses and oaks. Average annual precipitation ranges from about 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. Sorrento soils are associated with Metz, Mocho, and Yolo soils. In a typical profile the surface layer is brown loam about 7 inches thick. The subsoil is also brown loam about 7 inches thick. Below is yellowish-brown and light yellowish-brown loam to a depth of 72 inches or more. These soils are used for irrigated crops.[4]

Gaviota-Millsholm Association

This soil association is located on foothills on moderately steep or steep, well-drained and somewhat excessively drained soils that have a sandy loam or loam surface layer; shallow over sandstone or shale. This soil association is on foothills and mountains. Gaviota soils make up about 50 percent of this association, and Millsholm soils, about 45 percent. The remaining 5 percent consists of Gazos soils.

Gaviota Series (Uplands)

The Gaviota series is comprised of well-drained to somewhat excessively drained soils that formed in material weathered from hard sandstone. These soils are on uplands with slopes from 15 to 50 percent. Elevations range from 2,000 to 3,500 feet. Annual grasses, forbs, and chamise make up the vegetation.

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3 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," 1970.

4 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," 1970.

Average annual precipitation ranges from about 12 to 16 inches, average annual temperature is 62 degrees Fahrenheit, and the growing season ranges from 250 to 275 days. Typically the surface layer is light brownish-gray sandy loam about 10 inches thick, underlain by 4 inches of similar material. Below is hard sandstone. Outcrops of rock cover 2 to 10 percent of the surface. These soils are used for range, wildlife habitat, and watershed.[5]

Vista-Amargosa Association

This soil association is located on foothills and mountains with strongly sloping to steep, well-drained to excessively drained soils that have a coarse sandy loam surface; and is moderately deep to shallow over granite. Vista soils make up about 55 percent of this association, and Amargosa soils, about 40 percent. The remaining 5 percent consists of the land type Rock land.

Vista Series (Uplands)

Vista series are well-drained soils that formed in material weathered from granitic rock. These soils are located on foothills in the uplands with slopes that range from 9 to 50 percent. Elevation ranges from 2,200 to 3,900 feet. Vegetation is primarily annual grasses and forbs, though clumps of chamise and California juniper are scattered over the areas and Manzanita grows in some places. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is about 62 degrees Fahrenheit, and the frost-free season ranges from 210 to 240 days. Typically the surface layer is brown coarse sandy loam about 16 inches thick. The subsoil is brown sandy loam about 12 inches thick and contains 2 or 3 percent more clay than the surface layer. Below is yellowish-brown coarse sandy loam about 4 inches thick. Hard granitic rock is at a depth of about 32 inches. These soils are used for dryland small grains and range. They also are used for wildlife habitat and for watershed purposes.[6]

Yolo-Metz-Cortina Association

This soil association is nearly level to moderately sloping, well-drained to excessively drained, very deep soils that have a loam to loamy sand surface layer; on alluvial fans and flood plains near Castaic, Saugus and Newhall. Yolo soils make up about 40 percent of this association; Metz soils, about 25 percent; and Cortina soils, about 20 percent. The remaining 15 percent consists of Zamora and other associated soils.

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5 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," 1970.

6 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," 1970.

Yolo Series (Alluvial Fans)

The Yolo series are well-drained soils that have formed in sedimentary alluvium. These soils are on alluvial fans with slopes that range from 0 to 9 percent. Elevations range from 1,175 to 1,200 feet. Grasses and oaks make up the vegetation. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 240 to 300 days. Yolo soils are associated with Metz, Mocho, and Sorrento soils. Typically, the surface layer is grayish-brown loam about 18 inches thick. Below is grayish-brown loam, also about 18 inches thick, underlain by light yellowish-brown loam near silt loam about 36 inches thick. These soils are used mainly for irrigated crops, for range, and for homesites.[7]

Metz Series (Alluvial Fans and Flood Plains)

The Metz series consist of somewhat excessively drained soils that have formed in mixed alluvium. These soils are located on alluvial fans and flood plains with slopes from 0 to 9 percent. Elevations range from 1,175 to 1,250 feet. The vegetation is mainly grass oaks. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. Metz soils are associated with Cortina, Sorrento, and Yolo series. In a typical profile, the surface layer is brown loamy sand about 7 inches thick. Below is brown and light brownish-gray loamy sand and sand that contains some fine gravel and extends to a depth of 60 inches or more. In some areas the surface layer is loam. These soils are used for irrigated crops, dryland farming, and wildlife habitat.[8]

Cortina Series (Alluvial Fans)

The Cortina series consists of excessively drained soils that have formed in alluvium that is predominantly sedimentary. These soils are on alluvial fans with slopes from 0 to 9 percent. Elevations range from 1,200 to 1,400 feet. Vegetation consists of stands of chamise and juniper that have an understory of annual grasses and forbs. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is about 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. Cortina soils are associated with Metz soils. In a typical profile, the surface layer is pale-brown cobbly sandy loam about 6 inches thick. Below, to a depth of 60 inches or more, is a pale-brown and light

7 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

8 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

yellowish-brown very gravelly and cobbly sandy loam. In some areas the surface layer is not cobbly. These soils are used for dryland pasture and small grains, for range, and for irrigated crops.[9]

Zamora Series (Terraces)

The Zamora series consist of well-drained soils that have formed in old alluvium derived from material that was dominantly sedimentary. These soils are located on terraces with slopes that range from 2 to 15 percent. Elevations range from 1,220 to about 1,300 feet. Vegetation consists of grasses and oaks. Average annual precipitation ranges from about 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 240 to 300 days. Zamora soils are associated with Mocho and Yolo soils. In a typical profile, the surface layer is grayish-brown loam about 11 inches thick. Below is brown and dark grayish-brown loam and clay loam underlain at a depth of about 58 inches by pale-brown loam. In some places, the surface layer is clay loam. These soils are used for dryland grains and for range. They also provide habitat for wildlife.[10]

Hanford-Ramona-Greenfield Association

This soil association is located in areas near Fairmont, Acton, Juniper Hills, and Leona Valley on nearly level to moderately steep, well-drained, very deep soils that have a loamy sand to loam surface layer; on alluvial fans and terraces. Hanford soils make up about 45 percent of this association; Ramona soils, about 25 percent; and Greenfield soils, about 20 percent. The remaining 10 percent consists of Oakdale soils and other associated soils.

Hanford Series (Alluvial Fans)

The Hanford series are well-drained or somewhat excessively drained soils that have formed in granitic alluvium. These soils are located on alluvial fans with slopes from 2 to 15 percent. Elevations range from 2,600 feet to 3,500 feet. Vegetation consists mainly of annual grasses and forbs, but California junipers are scattered over the areas. Average annual precipitation ranges from 9 to 12 inches, average annual temperature is about 62 degrees Fahrenheit, and the frost-free season ranges from about 220 to 260 days. The surface layer in a typical profile is pale-brown coarse sandy loam about 8 inches thick. Below is light yellowish-brown coarse sandy loam and gravelly loamy coarse sand that extends to a depth of 70 inches

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9 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

10 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

or more. In some places the surface layer is loamy sand, sandy loam, gravelly loam, or loam. These soils are used for irrigated crops, dryland small grains, range, and for wildlife.[11]

Oakdale Series (Terraces)

The Oakdale series consist of well-drained soils that formed in old granitic alluvium. These soils are on terraces with slopes from 2 to 9 percent. Elevations range from 3,000 to 3,400 feet. The vegetation is chiefly annual grasses and forbs and scattered big sagebrush, rabbit-brush, and California juniper. Average annual precipitation ranges from 9 to 12 inches, average annual temperature is about 60 degrees Fahrenheit, and the frost-free season ranges from 210 to 230 days. Typically, the surface layer is grayish-brown sandy loam about 25 inches thick. Below is brown and reddish-yellow heavy sandy loam and gravelly heavy sandy loam that is about 45 inches thick and contains thin layers of clay that differ in color. Reddish-yellow gravelly coarse sandy loam that generally is stratified is at a depth of about 70 inches. These soils are used for dryland small grains and range and as wildlife habitat.[12]

Oak Glen-Gorman Association

This soil association is located along the southern edge of the Tehachapi Mountains and near Gorman on nearly level to steep, well-drained, very deep soils that have a sandy loam to loam surface layer; on alluvial fans and foothills. The Oak Glen soils and the Gorman soils each occupy about 50 percent each of this soil association.

Oak Glen Series (Alluvial Fans)

The Oak Glen series consists of well-drained soils that have formed in granitic alluvium. These soils are located on alluvial fans with slopes from 0 to 9 percent. Elevations range from 3,400 to 4,000 feet. The vegetation is grasses and oaks. Average annual temperature is 57 degrees Fahrenheit and the frost-free season ranges from about 175 to 200 days. In a typical profile, the surface layer is grayish-brown sandy loam about 32 inches thick. Below is grayish-brown and brown fine sandy loam, loamy coarse sand, and sandy loam that extends to a depth of 70 inches or more. In some places, texture is gravelly sandy loam

11 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

12 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

throughout the profile, and in other places it is loam. These soils are used mostly for dryland small grains, for range, and as wildlife habitat.[13]

Ojai–Agua Dulce Association

The soils of this association are near Newhall, Saugus, and Solemint and are located on gently sloping to steep, well-drained, very deep to moderately deep soils that have a loam or stony loam surface layer; on terraces and foothills.

Ojai Series (Terraces and Foothills)

Soils of the Ojai series are well drained. They have formed in weakly consolidated sedimentary alluvium that contains somewhat weathered pebbles and cobblestones of mixed origin. These soils are located on terraces and foothills and on slopes which range from 2 to 50 percent. Elevations range from 1,300 to 2,200 feet. The vegetation is mainly annual grasses and oaks, but some chamise and Manzanita grow on the foothills. Average annual precipitation ranges from 14 to 16 inches, average annual temperature is 63 degrees Fahrenheit, and the frost-free season ranges from 275 to 300 days. In a typical profile the surface layer is grayish-brown and brown loam, about 25 inches thick. The subsoil is reddish-brown and brown clay loam about 28 inches thick. It is underlain by reddish-yellow sandy loam that has lenses of gravelly sandy loam and is stratified. These soils are used for dryland and irrigated crops. They also are used for range, for homesites, as wildlife habitat, and for watershed purposes.[14]

Soil Hazards

Soil Erosion

Erosion refers to the removal of soil from exposed bedrock surfaces by water or wind. The effects of erosion are intensified with an increase in slope (as water moves faster, it gains momentum to carry more debris), the narrowing of runoff channels (which increases the velocity of water), and by the removal of groundcover, which leaves the soil exposed. Erosion is a concern in the City's Planning Area as some topsoils are sandy and varying topography exist.

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13 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

14 United States Department of Agriculture, "Soil Survey Antelope Valley Area California," Soil Conservation Service in cooperation with University of California Agricultural Experiment Station, Issued January 1970.

Shrink/Swell Potential (Expansive)

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 the soil will swell when wet and 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.

Generally, the potential for soils to exhibit expansive properties occur in low-lying areas, especially near river channels. Certain bedrock and soils within the City's Planning Area contain sufficient clay content; thus, the potential for shrink/swell to occur exists.

Landslides

Landslides occur when the underlying geological support on a hillside can no longer maintain the load of material above it, causing slope failure. The term landslide also commonly refers to a falling, sliding, or flowing mass of soil, rocks, water, and debris which may include mudslides and debris flows. Landslides generated by the El Nino storms of 1992 and 1998 illustrate the hazards to life and property posed by debris flows and landslides. The size of a landslide can vary from minor rock falls to large hillside slumps. Deep-seated landslides are caused by the infiltration of water from rain or other origin into unstable material. Fast-moving debris flows are triggered by intense rains that over saturate pockets of soil on hillsides. Landslides may result from either natural conditions or human activity. They are often associated with earthquakes although there are other factors that may influence their occurrence, including improper grading, soil moisture and composition, and subsurface geology. Soils with high clay content or those that are located on shale are susceptible to landslides, especially when saturated from heavy rains or excessive landscape irrigation. Much of the City's Planning Area consists of mountainous or hilly terrain, in which conditions for unstable soils and landslides may be present.[15]

The California Division of Mines and Geology has prepared Seismic Hazard Zone Maps of the Newhall, Mint Canyon, Oat Mountain, and San Fernando 7.5-minute quadrangles. These four quadrangles include

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15 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-11.

land within the City's Planning Area.[16] The maps identify areas of liquefaction hazard and earthquake-induced landslide hazard, as further shown in **Figure 3.9-2, Liquefaction and Landslide Hazards within the OVOV Planning Area.**

Subsidence

Subsidence is the gradual, local setting or sinking of the earth's surface with little or no horizontal motion. Subsidence usually occurs as a result of the extraction of subsurface gas, oil, or water or from hydro-compaction. It is not the result of landslide or slope failure. Subsidence typically occurs over a long period of time and can result in structural impacts on developed areas, such as cracked pavement and building foundations, and dislocated wells, pipelines, and water drains. No large-scale problems with ground subsidence have been reported in the City's Planning Area.[17]

Top-Soil Loss

The loss of topsoil is the most significant on-site consequence of erosion that occurs during and after construction or other soil disturbance. Topsoil is the soil layer that contains organic matter, plant nutrients, and biological activity. Loss of topsoil reduces the soil's ability to support plant life, regulate water flow, and maintain the biodiversity of soil microbes and insects that control disease and pest outbreaks. Loss of nutrients, soil compaction, and decreased biodiversity of soil inhabitants can severely limit the vitality of landscaping. This can lead to additional site management and environmental concerns, such as increased use of fertilizers, irrigation and pesticides, and increased stormwater runoff that contributes pollution to nearby water bodies.

The off-site consequences of soil erosion from developed sites include a variety of water quality issues. Runoff from developed sites carries pollutants, sediments, and nutrients that disrupt aquatic habitats in the receiving waters. Nitrogen and phosphorus from runoff hasten eutrophication by causing unwanted plant growth in aquatic systems, including algal blooms that alter water quality and habitat conditions. Algal blooms can also result in decreased recreation potential and diminish diversity of indigenous fish, plant, and animal populations.

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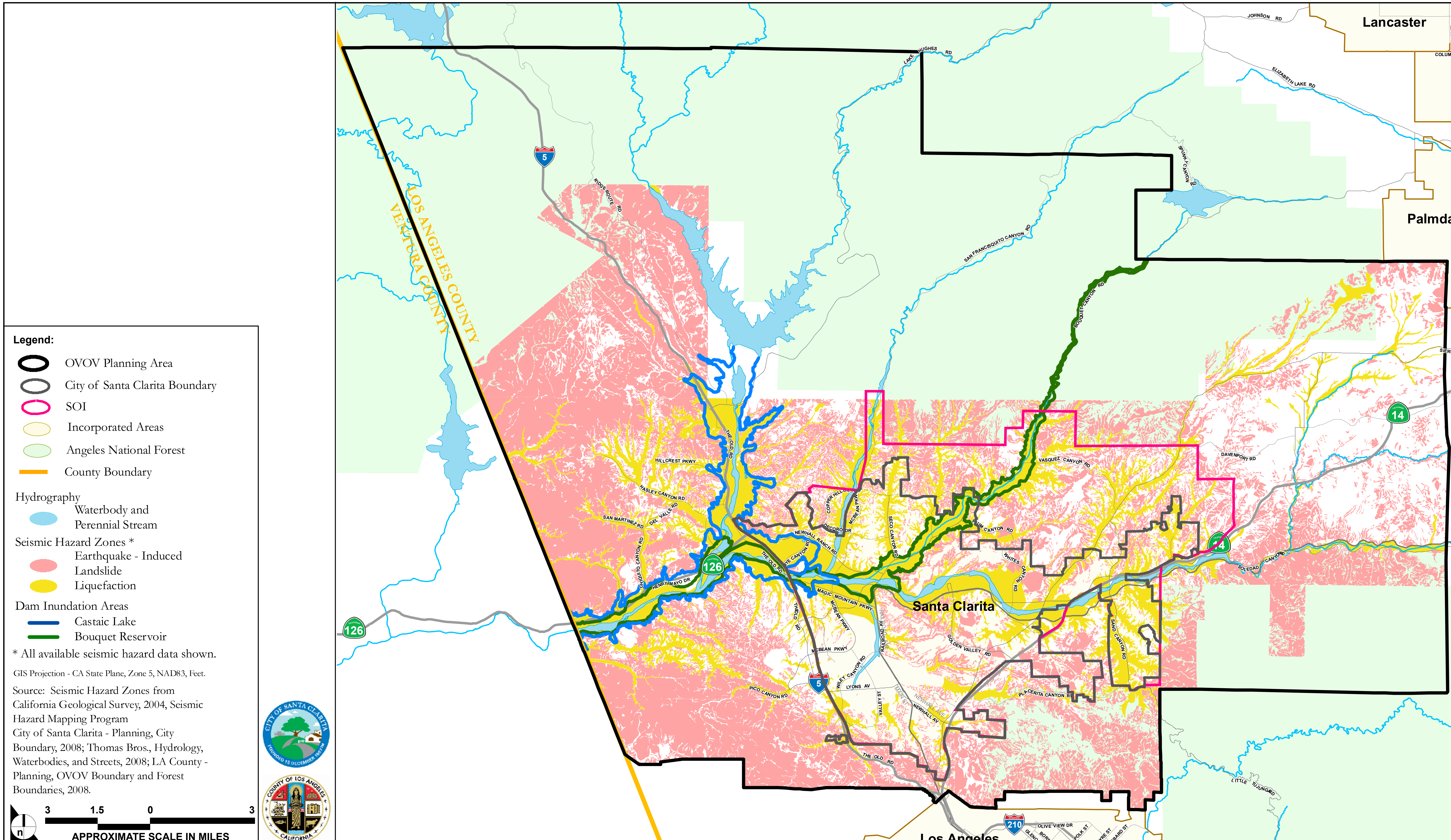
16 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August, 2009, S-11.

17 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August, 2009, S-11.



SOURCE: City of Santa Clarita, County of Los Angeles, Valleywide General Plan - March 2009

FIGURE **3.9-2**

Liquefaction and Landslide Hazards within the OVOV Planning Area

Sedimentation also contributes to the degradation of water bodies. The buildup of sedimentation in stream channels can reduce the stream's flow capacity, potentially leading to increased flooding. Sedimentation also affects aquatic habitat by increasing turbidity levels. Turbidity reduces sunlight penetration into the water and leads to reduced photosynthesis in aquatic vegetation, causing lower oxygen levels that cannot support diverse communities of aquatic life.

Erosion and sedimentation control measures are needed in order to minimize difficult and expensive mitigation measures in receiving waters. The cost of erosion and sedimentation control on construction sites involves minimal expense associated with installing and inspecting control measures and devices, particularly before and after storm events.

Best management practices have been established under the National Pollutant Discharge Elimination System (NPDES) as part of the federal Clean Water Act, to decrease erosion and sedimentation. The topic of post-construction runoff management continues to expand and is addressed in NPDES permits, which require pre-project runoff water balance, sedimentation balance, and channel protection. Policies have been included in the General Plan to assist in acknowledging the importance of soil conservation in the City's Planning Area, as further analyzed below.

Geologic Hazards

Seismicity and Faulting

The City's Planning Area contains, and is in the vicinity of, several known active and potentially active earthquake faults and fault zones. The term *fault* describes a fracture or zone of closely associated fractures, along which rocks on one side have been displaced with respect to those on the other side. A fault zone consists of a zone of related faults which may be braided or branching. New faults within the region continue to be discovered. Scientists have identified almost 100 faults in the Los Angeles area known to be capable of a magnitude 6.0 or greater earthquake. The January 17, 1994, magnitude-6.7 Northridge Earthquake, which produced severe ground motions, caused 57 deaths and 9,253 injuries, and left over 20,000 displaced from their homes. Scientists have indicated that such devastating shaking should be considered the norm near any large thrust fault earthquake in the region. Recent reports from the US Geological Survey and the Southern California Earthquake Center conclude that the Los Angeles area could expect one earthquake every year of magnitude 5.0 or more, for the foreseeable future.

A major earthquake in or near the City's Planning Area may cause deaths and casualties, property damage, fires, hazardous materials spills, and other hazards. The effects could be aggravated by aftershocks and the secondary effects of fire, chemical accidents, water contamination, and possible dam failures. The time of day and season of the year could affect the number of casualties and property damage sustained from a major seismic event. In addition to impacts on human safety and property damage, a major earthquake could cause socio-economic impacts on Valley residents and businesses through loss of employment, interruption of the distribution of goods and services, and reductions in the local tax base. Disruption of transportation, telecommunications, and computer systems could further impact financial services and local government. A catastrophic earthquake could exceed the response capability of the City's Planning Area, requiring disaster relief support from other local governmental and private organizations, and from the state and federal governments.

Earthquakes are classified by their magnitude and by their intensity. The intensity of seismic ground shaking is a function of several factors, including the magnitude of the quake, distance from the epicenter, and local geologic conditions. The largest or maximum credible earthquake a fault is capable of generating is used for community planning purposes. Earthquakes are typically defined by their magnitude as measured on the Richter Scale. Each whole number step in magnitude on the scale represents a tenfold increase in the amplitude of the waves on a seismogram, and about a 31-fold increase in energy released. For example, a 7.5-magnitude earthquake is 31 times more powerful than a 6.5-magnitude quake. The Modified Mercalli Intensity Scale is a measure of the damage potential of earthquakes, and contains 12 levels of intensity from I (tremor not felt) to XII (damage nearly total). For purposes of the discussion in this section, intensity is given using the Richter Scale, which is generally described in **Table 3.9- 1, Richter Scale of Magnitude for Earthquakes**.

Table 3.9-1
Richter Scale of Magnitude for Earthquakes

Richter Magnitude	Earthquake Effects
Less than 3.5	Generally not felt, but recorded
3.5 to 5.4	Often felt, but rarely causes damage
5.5 to 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions
6.1 to 6.9	Can be destructive in areas up to about 100 kilometers across, in areas where people live.
7.0 to 7.9	Major earthquake. Can cause serious damage over large areas.
8.0 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: City of Santa Clarita, City of Santa Clarita General Plan. "Safety Element" Table S-1, page S-3 (2008)

Faults[18]

Active faults are those that have caused soil and strata displacement within the last 11,000 years (the Holocene epoch). Potentially active faults show evidence of surface displacement during the last 2 million years (the Quaternary period). Faults capable of causing major damage within the City's Planning Area are listed below, with estimated potential magnitude indicated on the Richter scale. **Figure 3.9-3, Faults within or adjacent to the OVOV Planning Area,** shows the general location of faults in the vicinity of the County's Planning Area.

- The San Andreas Fault Zone extends approximately 746 miles from the Gulf of California north to the Cape of Mendocino, where it continues northward along the ocean floor. The San Andreas Fault Zone marks the boundary between the Pacific and North American geotechnical plates; it is a right-lateral strike-slip fault that occurs along the line of contact between the two plates. The fault zone is located north of the City of Santa Clarita and extends through the communities of Frazier Park, Palmdale, Wrightwood, and San Bernardino. In 1857, a magnitude 8.0 earthquake occurred along a 255-mile-long segment of this fault, between Cholame and San Bernardino. This seismic event is the most significant historic earthquake in Southern California history. The length of the San Andreas Fault Zone and its active seismic history indicate that it has a high potential for large-scale movement in the near future, with an estimated Richter magnitude of 6.8 to 8.0. Along the Mojave segment, closest to the Santa Clarita Valley, the interval period between major ruptures is estimated to be 140 years.

- The San Fernando Fault Zone is a thrust fault, 11 miles long, generally located approximately 20 miles southeast of Santa Clarita near the communities of San Fernando and Sunland. The fault zone's last major movement occurred on February 9, 1971, producing a quake with a Richter magnitude of 6.6 known as the San Fernando earthquake. The ground surface ruptures during this earthquake occurred on a little-known pre-existing fault in an area of low seismicity and previously unknown historic ground placement. The zone of displacement was approximately 12 miles long and had a maximum of 3 feet of vertical movement. The estimated interval between major ruptures along the San Fernando fault zone is estimated between 100 and 300 years, with a probable earthquake magnitude of 6.0 – 6.8.

- The San Gabriel Fault zone traverses the planning area from northwest to southeast, extending 87 miles from the community of Frazier Park (west of Gorman) to Mount Baldy in San Bernardino County. Within the Santa Clarita Valley, the San Gabriel Fault Zone underlies the northerly portion of the plan area from Castaic and Saugus, extending east through Canyon Country to Sunland. Holocene activity along the fault zone has occurred in the segment between Saugus and Castaic. The length of this fault, and its relationship with the San Andreas Fault system, contribute to its potential for future activity. The interval between major ruptures is unknown, although the western half is thought to be more active than the eastern portion. The fault is a right-lateral strike-slip fault with an estimated earthquake magnitude of 7.2.

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18 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August, 2009, S-3 through S-6.

- The Holser Fault is approximately 12 miles in length extending from just east of former Highway 99, westward to the vicinity of Piru Creek. Nearby communities include Castaic, Val Verde, and Piru. The surface trace of the fault intersects the San Gabriel Fault west of Saugus. The most recent surface rupture has been identified as Quaternary period. Subsurface data in nearby oil fields demonstrate that the Holser Fault is a southward dipping, sharply folded reverse fault. Subsurface exposures of this fault in the Metropolitan Water District's Saugus Tunnel show at least 14 feet of terrace deposits offset by this fault, which suggest that the fault is potentially active. This fault could generate a maximum estimated earthquake magnitude of 6.5.

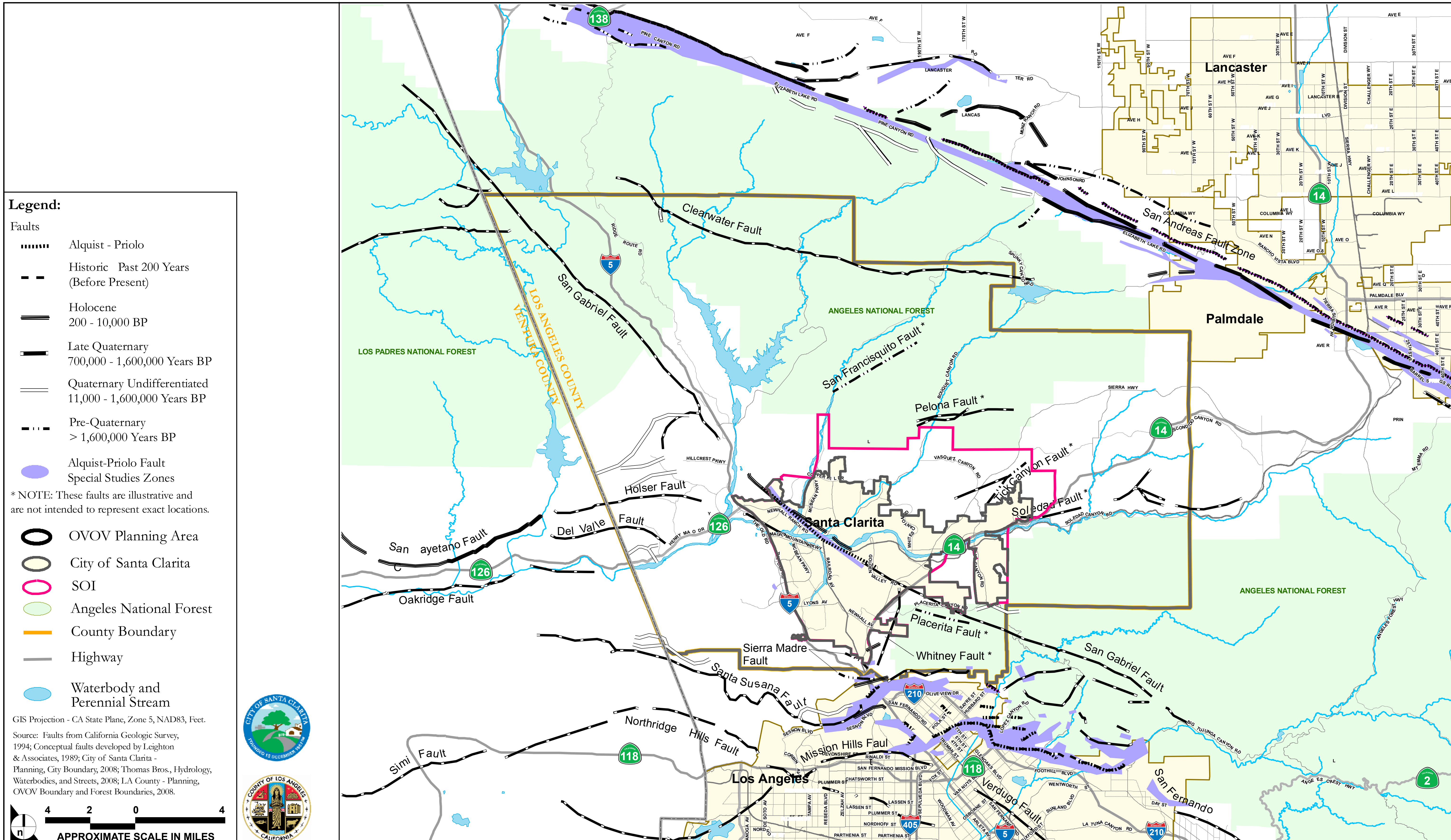
- The Sierra Madre Fault is a 34 miles long fault zone generally located southeast of the planning area along the north side of the San Gabriel Mountains, extending from Sunland to Glendora. The fault is a reverse fault that dips to the north. The zone of faulting is similar to, and may lie within, the same fault system as the San Fernando fault zone (which moved in 1971). Movement along faults in this zone has resulted in the uplift of the San Gabriel Mountains. Geologic evidence indicates that the Sierra Madre Fault Zone has been active in the Holocene epoch. The interval between major ruptures is estimated at several thousand years, and the zone has an estimated earthquake magnitude of 6.0 to 7.0.

- The Santa Susana Fault is a thrust fault, dipping to the north. The fault is located south of the intersection of Interstate 5 and SR-14, and extends 24 miles from Simi Valley to the San Fernando Valley. Nearby communities include Sylmar and San Fernando. This fault has been classified as potentially active by geologists based on evidence suggesting that movement has occurred within the past 2 million years (Quaternary period). In its western portions, there is evidence that the fault plane has been folded and would, therefore, probably not have renewed movement. The interval between major ruptures is unknown. Portions of the fault zone have an estimated earthquake magnitude of 6.5 to 7.3.

- The Oak Ridge Fault is a thrust fault extending 56 miles. The fault is located west of the City and parallels the Santa Clara River and State Route 126 from Piru to the coast. Movement along the portion of the fault between Santa Paula and Ventura has been identified in the Holocene period. At its eastern end, the Oak Ridge thrust becomes more difficult to trace and appears to be overthrust by the Santa Susana fault. The magnitude 6.7 Northridge earthquake in 1994 is thought to have occurred along the eastern edge of the Oak Ridge Fault. The interval between major ruptures is unknown, and the maximum earthquake magnitude is estimated to be 6.5 to 7.5.

- The Clearwater Fault is an east/west trending reverse fault, approximately 20 miles in length. The fault is located approximately 10 miles northeast of the Castaic. Evidence of movement along this fault has been identified in the Late Quaternary period. Although an estimate of the amount and type of displacement on the Clear Water Fault is difficult to determine, the fault is considered to be potentially active.

- The Soledad Fault is a left-lateral normal fault 12 miles in length, located near the communities of Acton and Soledad Canyon. The fault is considered to be active, with surface rupture during the Quaternary period.



SOURCE: City of Santa Clarita, County of Los Angeles, Valleywide General Plan - March 2009

FIGURE 3.9-3

Faults within or adjacent to the OVOV Planning Area

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- The Northridge Hills Fault crosses the San Fernando Valley through Sepulveda, Northridge, and Chatsworth, disappearing under thick alluvium in the east central valley. This fault is believed either to be more than one fault plane or a splinter of faults that align and possibly blend with the fault complex in the Santa Susanna Pass, which extends west into Simi Valley. Near the town of Northridge, the Northridge Hills Fault is buried beneath the alluvium, and the fault's location is interpreted from oil industry data and from topographic patterns. The fault is a reverse fault, 16 miles in length. This portion of the fault has had movement during the late Quaternary period. Despite its name, it is not the fault responsible for the Northridge Earthquake (which occurred along the Oak Ridge Fault).

- The San Francisquito Fault is a subsidiary fault of the San Andreas Fault zone. Although there is no evidence of recent activity, it has experienced up to 23 feet of vertical displacement in the past. Originating just north of the Bouquet Reservoir, it extends under the dam and travels southwest to San Francisquito Canyon.

- The Pelona Fault, 4 miles in length, is located near the community of Sleepy Valley and has ruptured in the Late Quaternary period.

In addition to seismic impacts from these faults, there is a potential for ground shaking from blind thrust faults, which are low angle detachment faults that do not reach the ground surface. Recent examples of blind thrust fault earthquakes include the 1994 Northridge (magnitude 6.7), 1983 Coalinga (magnitude 6.5), and 1987 Whittier Narrows (magnitude 5.9) events. Much of the Los Angeles area is underlain by blind thrust faults, typically at a depth of 6 to 10 miles below ground surface. These faults have the capacity to produce earthquakes of a magnitude up to 7.5. The Holser Fault is an east-west trending fault that dips to the north, and is modeled as being capable of generating a maximum moment magnitude of 6.5.

The Sierra Madre Fault Zone is a series of an echelon moderate angle, north-dipping, reverse faults (thrust faults). The zone of faulting is very similar to, and may be within, the same fault system as the San Fernando Fault Zone. Movement along these frontal faults has resulted in the uplift of the San Gabriel Mountains. Geologic evidence indicates that the Sierra Madre Fault Zone has been active in geologically recent time. Evidence supporting the recent activity of the fault zone is the thrusting of granitic rock over recent alluvial deposits, scarps that offset alluvial surfaces at several locations along the fault, and a general coincidence with a zone of epicenters of historic earthquakes of magnitude of 4.0 to 4.9.

Historic Seismic Activity

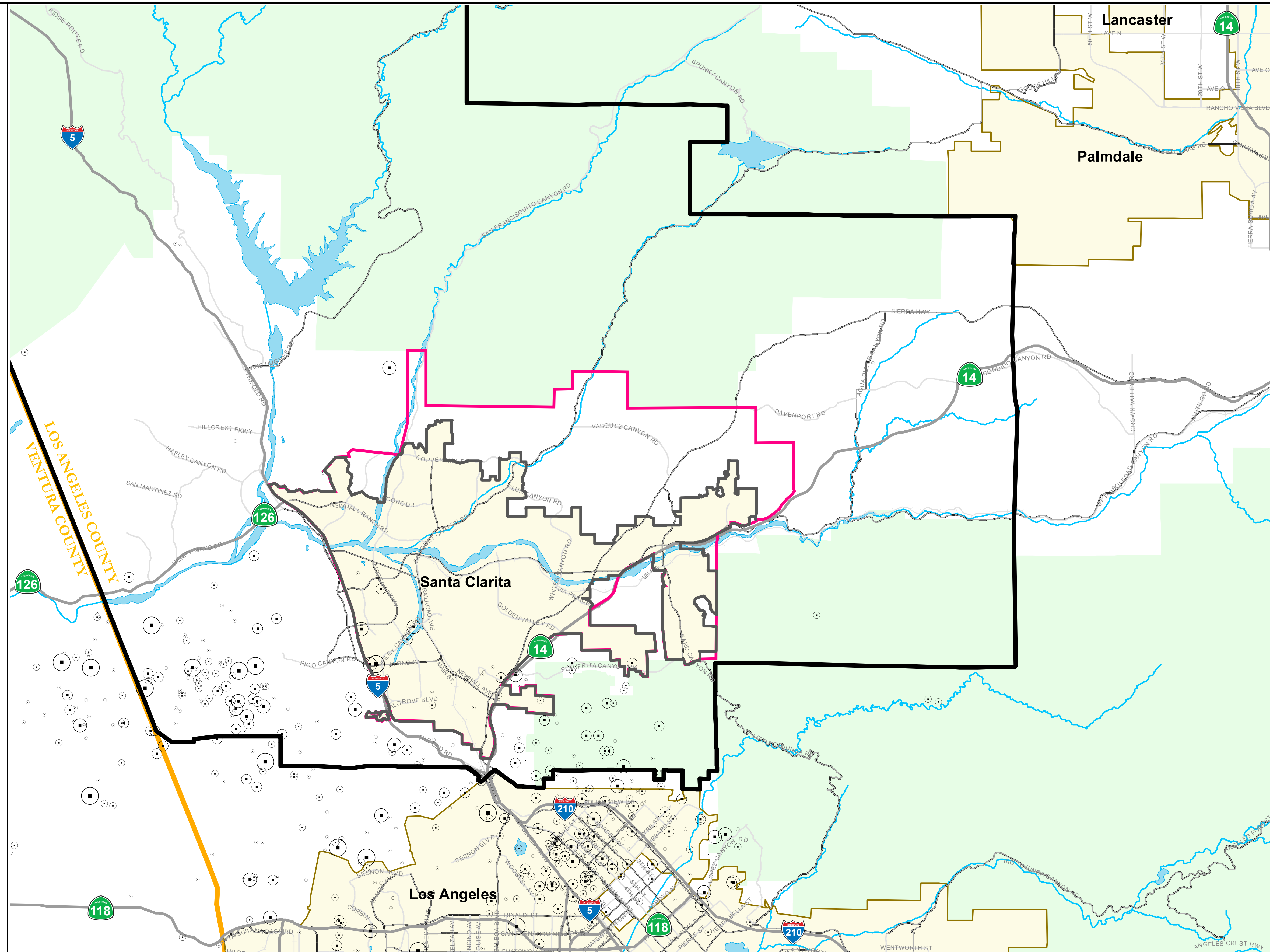
The City's Planning Area has experienced shaking from several earthquakes recorded back to 1855, as shown in **Table 3.9-2, Historic Earthquakes that Have Affected the City's Planning Area**. Prior to that date the historic record is incomplete. Epicenters of historic earthquakes affecting the planning area are shown on **Figure 3.9-4, Epicenters of Major Historic Earthquakes within the OVOV Planning Area.** One of the largest occurred in 1857 in the Fort Tejon area. Estimated at a magnitude of 8.0, this earthquake resulted in a surface structure scar of about 220 miles in length along the San Andreas Fault, and shaking was reported from Los Angeles to San Francisco. [19]

Table 3.9-2
Historic Earthquakes that Have Affected the City's Planning Area

Date	Earthquake Location and County	Earthquake Richter Magnitude
1855	Los Angeles, Los Angeles County	About 6.0
1857	Fort Tejon, Kern County	About 8.0
1883	Ventura-Kern County border	About 6.0
1893	San Fernando Valley, Los Angeles County	5.5–5.9
1916	Near Lebec, Kern County	5.2
1925	Santa Barbara Channel, Santa Barbara County	6.3
1933	Huntington Beach, Orange County	6.3
1941	Santa Barbara Channel, Santa Barbara County	5.9
1946	Northeastern Kern County	6.3
1947	Central San Bernardino County	6.2
1948	Near Desert Hot Springs, Riverside County	6.5
1952	White Wolf Fault, Kern County	7.5
1971	San Fernando (Sylmar), Los Angeles County	6.7
1988	Pasadena, Los Angeles County	5.0
1987	Whittier Narrows, Los Angeles County	5.9
1991	Sierra Madre, Los Angeles County	5.8
1994	Northridge, Los Angeles County	6.7
1999	Hector Mine, San Bernardino County	7.1

Source: City of Santa Clarita, "Draft Safety Element." City of Santa Clarita Draft General Plan, August 2009, Table S-2, S-9.

19 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August, 2009, S-7.



Legend:

- OVOV Planning Area
- City of Santa Clarita
- SOI
- Angeles National Forest
- County Boundary

Hydrography

- Waterbody and Perennial Stream

Epicenters (1990 - 2000)

- 3.00 - 3.21
- 3.22 - 3.57
- 3.58 - 4.02
- 4.03 - 4.70
- 4.72 - 6.60

GIS Projection - CA State Plane, Zone 5, NAD83, Feet.

Source: Northern California Earthquake Center - Epicenters, 2003; City of Santa Clarita - Planning, City Boundary, 2008; Thomas Bros. - Hydrology, Waterbodies, and Streets, 2008; LA County - Planning, OVOV Boundary and Forest Boundaries, 2008.

3 1.5 0 3

APPROXIMATE SCALE IN MILES

SOURCE: City of Santa Clarita, County of Los Angeles, Valleywide General Plan - March 2008

FIGURE **3.9-4**

Epicenters of Major Historic Earthquakes within the OVOV Planning Area

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Recent Seismic Activity

The strongest, most recent seismic event nearest the City's Planning Area was the January 1994 Northridge earthquake (Richter magnitude 6.7). The epicenter of this event was located approximately 13 miles southwest of the City's Planning Area in the Northridge community of the City of Los Angeles. The Northridge earthquake caused over $650 million in damage to residential units, $41 million in damage to businesses and over $20 million in damage to public buildings and roads. No deaths were recorded in the City's Planning Area due to the earthquake. The earthquake damaged the water distribution and filtration systems, natural gas service, electrical service, and roads and bridges in and immediately surrounding the City's Planning Area. Road and bridge damage included the collapse of I-5 and Highway 14 overpass, resulting in isolation of a portion of the City's Planning Area for an extended period of time. Other damage included a crude oil release from a pipeline rupture and other hazardous materials spills.[20]

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 faults. The law requires the state geologist to establish regulatory zones (known as Earthquake Fault Zones or Special Studies Zone) 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. However, local agencies can be more restrictive than state law requires. 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).

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20 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-7.

A few locations within the City's Planning Area are designated as an Alquist-Priolo Special Studies Zone, as shown above in **Figure 3.9-3**. These zones include a long, narrow strip of land extending from the central portion of the City, northwest towards Castaic Creek, a small area in Stevenson Ranch, and areas along the southern boundary of the City's Planning Area.

Seismic Hazards

Seismic Hazards Map Act

The California Geological Survey also provides guidance with regard to seismic hazards. Under the Seismic Hazards Mapping Act, seismic hazard zones are to be identified and mapped to assist local governments in land use planning. 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.

Surface Rupture

Surface rupture or displacement is the break in the ground's surface and associated deformation resulting from the movement of a fault. Surface rupture occurs along the fault trace, where the fault breaks the ground surface during a seismic event. Buildings constructed on or adjacent to a fault trace are typically severely damaged from fault rupture in the event of a major fault displacement during an earthquake. As this hazard cannot be prevented, known faults are identified and mapped so as to prevent or restrict new construction of structures within fault hazard areas.[21]

Ground Shaking

Ground shaking is the most significant earthquake action in terms of potential structural damage and loss of life. Ground shaking is the movement of the earth's surface in response to a seismic event. The intensity of the ground shaking and the resultant damages are determined by the magnitude of the earthquake, distance from the epicenter, and characteristics of surface geology. This hazard is the primary cause of the collapse of buildings and other structures. The significance of an earthquake's ground

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21 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-9.

shaking action is directly related to the density and type of buildings and the number of people exposed to its effect. A landslide, which is also considered a soil hazard, is discussed earlier in this section.[22]

Liquefaction

Liquefaction refers to a process by which water-saturated granular soils transform from a solid to a liquid state during strong ground shaking. Liquefaction usually occurs during or shortly after a large earthquake. The movement of saturated soils during seismic events from ground shaking can result in soil instability and possible structural damage. In effect, the liquefaction soil strata behave as a heavy fluid. Buried tanks may float to the surface, and structures above the liquefaction strata may sink. Pipelines passing through liquefaction materials typically sustain a relatively large number of breaks in an earthquake.

Liquefaction has been observed to occur in soft, poorly graded granular materials (such as loose sands) where the water table is high. Areas in the Valley underlain by unconsolidated alluvium, such as along the Santa Clara River and tributary washes, may be prone to liquefaction **(Figure 3.9-2).**

Dam Inundation

Dam inundation is another potential hazard from seismic shaking. Within the Santa Clarita Valley, dams are located at the Castaic Reservoir and the Bouquet Reservoir. If the Castaic Reservoir Dam were to rupture from a seismic event, potential flooding could occur in Castaic, Val Verde, and Valencia. Failure of the two dams at the Bouquet Reservoir could result in flooding downstream in Saugus and Valencia.[23]

Dam failure can result from natural or man-made causes, including earthquakes, erosion, improper siting or design, rapidly rising flood waters, or structural flaws. Dam failure may cause loss of life, damage to property, and displacement of persons residing in the inundation path. Damage to electric generating facilities and transmission lines could also impact life support systems in communities outside of the immediate inundation area. Within the Santa Clarita Valley, the two major reservoirs which could have a significant impact on the Santa Clarita Valley in the event of a dam failure are located in Bouquet Canyon and Castaic.

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22 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-11.

23 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-12.

Bouquet Canyon Reservoir is located approximately 17 miles northeast of the City's government buildings in Valencia. The reservoir has two earth-filled dams, one on the west side overlooking Cherry Canyon, and one on the south side above Bouquet Canyon. This reservoir is owned and operated by the City of Los Angeles, Department of Water and Power. The Bouquet Reservoir has a maximum capacity of 36,505 acre-feet of water and 7.6 miles of shoreline. Because of its two dams, two potential inundation areas have been identified in the event of a dam failure. On the Cherry Canyon side, the water would flow west for approximately 2 miles through the Canyon into San Francisquito Canyon, and then south for approximately 11 miles into the Santa Clara River. The Bouquet Creek dam would drain south through Bouquet Canyon for 17 miles, into the Santa Clara River.

The Castaic Dam is located on Lake Hughes Road, 1 mile northeast of Interstate 5, just north of the town of Castaic. This dam is operated by the State of California Resources Agency, Department of Water Resources. Castaic Dam is an earth-filled dam located at the confluence of Castaic and Elizabeth Lake Creeks. The dam facing is approximately 1 mile across with a maximum capacity of 350,000 acre-feet of water, covering a surface area of 2,600 acres with 34 miles of shoreline. Should a breach in the dam occur, the water will flow south in Castaic Creek for approximately 5 miles to the Santa Clara River.

Failure of these dams during a catastrophic event, such as a severe earthquake, is considered unlikely, due to their type of construction. However, local safety plans have considered the possibility of dam failure and have outlined a procedure for response and recovery from this type of hazard, including identification of inundation areas and evacuation routes throughout the City's Planning Area.

A historic dam failure event occurred on March 12, 1928. The Saint Francis Dam, a part of the Los Angeles Aqueduct at San Francisquito Canyon, collapsed spilling over 12 billion gallons of water into the Valley. The dam failure resulted in approximately 450 deaths.

Seiches

A seiche is an earthquake-produced wave in a lake or reservoir. Seiches can be triggered by ground motion from distant earthquakes or from ground displacement beneath the water body. In reservoirs, seiches can generate short-term flooding of downstream areas. The closest bodies of water to the City's Planning Area that are subject to seiches during a seismic event include the Bouquet and Castaic Reservoirs.[24]

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24 *City of Santa Clarita General Plan*, "Draft Safety Element," City of Santa Clarita Planning Department, August 2009, S-10.

REGULATORY FRAMEWORK

Local

City's Planning Area

Given that some soils within the City's Planning Area contain sufficient clay content, development could be constrained by soils that exhibit shrink/swell potential. A large portion of the land within the area is mountainous and/or contains hilly terrain. Thus, landslides represent a development constraint, especially within the western portion of the City's Planning Area. Any development within the Alquist-Priolo Special Studies Zone could also be constrained as they are subject to more strict development standards (**Figure 3.9-3**). These zones within the City's Planning Area include a narrow strip of land extending from the central portion of the City, and several areas along the southern boundary of the City's Planning Area. Areas that are subject to liquefaction, which are shown above for the City's Planning Area on **Figure 3.9-2**, could expose people and structures to these hazards. Liquefaction also represents a development constraint. Areas subject to liquefaction are located primarily along the riverbed and canyon bottoms.

All grading and excavation must comply with Chapters 17.20 to 17.80 of the City of Santa Clarita Unified Development Code. Rules and regulations contained within these chapters provide for the control of excavation, grading, and earthwork construction, including fills or embankment activities. During the grading permit application process, the City Engineer may require engineering geological and soil reports, as well as seismic hazard zone studies be prepared for proposed developments. The engineering geological report would require an adequate description of the geology of the site, along with conclusions and recommendations regarding the effect of geologic condition of any proposed development. Soil reports would be required to characterize the existing soil resources on a site, and provide recommendations for grading and design criteria. Development in seismic hazard zone will require studies that evaluate the potential for seismically induced liquefaction, soil instability, and earthquake induced landslides to occur on a site.

In order to limit structural damage from earthquakes, seismic design codes have undergone substantial revision in recent years. Earthquake safety standards for new construction became widely adopted in local building codes in Southern California following the 1933 Long Beach Earthquake, and have been updated in various versions of the California Building Code since that date. The 1994 Northridge Earthquake resulted in significant changes to building codes to ensure that buildings are designed and constructed to resist the lateral force of an earthquake and repeated aftershocks. Required construction techniques to ensure building stability include adequate nailing, anchorage, foundation, shear walls, and welds for steel frame buildings.

The City of Santa Clarita enforces structural requirements of the building code, the Alquist-Priolo Special Studies Zones, and sound engineering and geotechnical practices in evaluating structural stability of proposed new development. The proposed General Plan goals, objectives, and policies ensure that proposals for new development within the City's Planning Area are reviewed for seismic hazards, through analysis of existing conditions and requirements for safe building practices.

Critical, Sensitive, and High Occupancy Facilities

Critical, sensitive, and high occupancy facilities, such as public schools and hospitals, are located throughout the City's Planning Area. The California Division of the State Architect regulates development standards for public schools and other public buildings. The City does not have additional special development standards for critical, sensitive, and high occupancy facilities; however, the building officials will review all projects for additional requirements.

THRESHOLDS OF SIGNIFICANCE

In order to assist in determining whether a project will have a significant effect on the environment, the *California Environmental Quality Act (CEQA) Guidelines*, Appendix G identify criteria for conditions that may be deemed to constitute a substantial or potentially adverse change in physical conditions.

Significant impacts resulting from geology/seismicity/soil impacts would occur if

- There will be a significant impact if the project would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - The 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
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides
- There will be a significant impact if the project were to result in substantial soil erosion or the loss of topsoil
- There will be a significant impact if the proposed project were to 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

The *City of Santa Clarita Local CEQA Guidelines* (Resolution 05-38) adopted on April 26, 2005, also serve as the basis for identifying thresholds to determine the significance of the environmental effects of a project on this resource area and have been included for analysis.

- There will be a significant impact if the project were to include movement or grading of earth exceeding 100,000 cubic yards.

IMPACT ANALYSIS

This impact analysis section evaluates the potential effects of the proposed General Plan goals, objectives and policies within the City's Planning Area using the *State CEQA Guidelines* thresholds of significance criteria.

Impact 3.9-1 **There will be a potentially significant impact if the project were to expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving the 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.**

As shown in **Figure 3.9-3**, an Alquist-Priolo earthquake fault hazard zone (**Objective S 1.1** and **Policy S 1.1.1**) has been established along the traces of the San Gabriel Fault within the City's Planning Area, running in a northwest to southeast direction. Some lands within the existing Alquist-Priolo zone are designated as Industrial (Business Park); Community Commercial (CC); and Specific Plan (SP) on the northern end of the zone; Community Commercial (CC); Specific Plan (SP); Mixed Use – Corridor (MX-C) in the middle of the zone; and Public/Institutional (PI) and Specific Plan (SP) on the southern end of the Alquist-Priolo Zone, in the proposed City's Planning Area Land Use Map. Future development on these lands, may result in the construction and occupation of residential and business structures adjacent to a known Alquist-Priolo Fault Zone (**Objective S 1.2**, **Policy S 1.2.1**, **Policy S 1.2.2**). Such development would increase the number of persons and the amount of developed property exposed to fault rupture hazards (**Goal S 1**).

Implementation of **Policies S 1.2.1 to S 1.2.4** will provide direction in regulating new development in areas that are subject to geological hazards in order to reduce risks to the public from seismic events (**Objective S 1.2**) by implementing and enforcing requirements and guidelines of the Alquist-Priolo Earthquake Fault Zoning Act; restricting new development and land use types in areas that could experience fault rupture, landslides or liquefaction; and by requiring any new development within the

City's Planning Area to conduct soils and geotechnical reports to reduce the possibility of loss, injury or death to a geologic or seismic event.

Proposed General Plan Goals, Objectives, and Policies

Goal S 1: Protection of public safety and property from hazardous geological conditions, including seismic rupture and ground shaking, soil instability, and related hazards.

Objective S 1.1: Identify and map areas in the Santa Clarita Valley that are susceptible to geological hazards, for use by the public and decision makers in considering development plans.

Policy S 1.1.1: Maintain maps of potentially active faults and fault zones, based on information available from the Alquist-Priolo Special Studies Zone maps, United States Geological Survey, State Board of Geologists, State Mining and Geology Board, and other appropriate sources.

Objective S 1.2: Regulate new development in areas subject to geological hazards to reduce risks to the public from seismic events or geological instability.

Policy S 1.2.1: Implement requirements of the Alquist-Priolo Earthquake Fault Zoning Act.

Policy S 1.2.2: Restrict the land use type and intensity of development in areas subject to fault rupture, landslides, or liquefaction, in order to limit exposure of people to seismic hazards.

Policy S 1.2.3: Require soils and geotechnical reports for new construction in areas with potential hazards from faulting, landslides, liquefaction, or subsidence, and incorporate recommendations from these studies into the site design as appropriate.

Policy S 1.2.4: Enforce seismic design and building techniques in local building codes.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

While implementation of the aforementioned goals, objectives, and policies would reduce impacts from fault rupture, they do not address potential impacts related to undiscovered faults or impacts that may be identified through the use of new scientific data, equipment, or procedures. To provide adequate mitigation for potential fault rupture hazards, mitigation measure **MM 3.9-1** has been identified to provide flexibility to the City in requiring site-specific geotechnical investigations in any area falling within identified or yet as unidentified fault zones, including Alquist-Priolo Fault Zones. Adherence to **MM 3.9-1** and the goals, objectives, and policies proposed above would reduce potential impacts from rupture of unidentified fault zones to a less than significant level.

Plan to Plan Analysis

Similar to the proposed General Plan, the existing General Plan does not contain goals and policies that address potential impacts to undiscovered geotechnical resources. The proposed General Plan provides for mitigation to address potential geologic resource occurrence. The proposed General Plan provides for mitigation to undiscovered geotechnical resources, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-2 **There will be a potentially significant impact if the project were to expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.**

Many of the earthquakes that the City's Planning Area has experienced in the past 50 years have involved ground shaking that has damaged residential and commercial buildings, as well as local infrastructure. There have been earthquakes that have had their epicenter within the existing City's boundary and the City's SOI, but the majority of the earthquakes and resulting ground shaking that has occurred has been from earthquakes with their epicenters located outside of the City's Planning Area. Increases in population, and the development of residential and non-residential development that will occur upon implementation of the General Plan, could result in the increased exposure of persons and property to ground-shaking hazards.

Implementation of **Policy S 1.2.4** will allow the City to enforce seismic designs and building techniques in local building codes, thus reducing the potential injury to residents from seismic events. New development will be regulated by seismic design (**Objective S 1.2**) and building techniques to reduce risks to the public from seismic events or geological instability (**Goal S 1**). Implementation of **Policies S 1.3.1** to **S 1.3.4,** will reduce risk of damage in developed areas (**Objective S 1.3**) by identifying buildings within the City's Planning Area that are currently not seismically reinforced to meet seismic safety requirements; bracing cabinets, shelves, equipment in all public facilities; educating residents and persons working in the City's Planning Area on earthquake safety for their homes and places of business; and encouraging cooperation between the City and other agencies to help seismically reinforce public infrastructure such as bridges, dams, and other critical facilities and require repairs to these structures as needed to prevent failure in the event of seismic activity within the City's Planning Area.

Proposed General Plan Goal, Objectives, and Policies

Objective S 1.3: Reduce risk of damage in developed areas from seismic activity.

Policy S 1.3.1: Identify any remaining unreinforced masonry buildings or other unstable structures, and require remediation or seismic retrofitting as needed to meet seismic safety requirements.

Policy S 1.3.2: Increase earthquake safety in all public facilities through bracing of shelves, cabinets, equipment and other measures as deemed appropriate.

Policy S 1.3.3: Provide informational materials to the public on how to make their homes and businesses earthquake safe.

Policy S 1.3.4: Cooperate with other agencies as needed to ensure regular inspections of public infrastructure such as bridges, dams, and other critical facilities, and require repairs to these structures as needed to prevent failure in the event of seismic activity.

Effectiveness of Proposed General Plan Goals, Objectives and Policies

While implementation of the above mentioned proposed goals, objectives and policies would reduce the significance of potential ground-shaking impacts they do not provide specific development standards for development within areas subject to potential ground-shaking impacts nor do they provide adequate mitigation for potential ground-shaking impacts that may be identified through the use of new scientific data, equipment, or procedures. To provide adequate mitigation for potential ground-shaking hazards, mitigation has been identified to provide flexibility to the City in requiring site-specific ground shaking assessment for any development subject to potential ground-shaking impacts and to require adherence to identified design standards. Implementation and adherence to these mitigation measures, **MM 3.9-2** to

3.9-3, and the above mentioned proposed goals, objectives, and policies will reduce potential impacts related to seismically associated ground shaking to a less than significant level.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts of site specific seismic-shaking assessment. The proposed General Plan provides for mitigation to address potential impacts of seismic-shaking. The proposed General Plan provides for mitigation for site-specific seismic shaking, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-3 **There would be a potentially significant impact if the project were to expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction.**

Areas of susceptibility to liquefaction have been identified in the City's Planning Area that are underlain by unconsolidated alluvium, as shown in **Figure 3.9-2**, such as along the Santa Clara River and tributary washes within the City's Planning Area. The City's General Plan would allow the development and occupation of structures within these areas and other areas within the City that are susceptible to liquefaction. To lessen the potential for property loss, injury, or death resulting from liquefaction during earthquake events, goals, objectives and policies are identified in the City's proposed General Plan to reduce these potentially significant impacts.

Although the City has already determined areas of liquefaction and landslides within its Planning Area, implementation of **Policy S 1.1.2** requires that in the event of significant incidents of soil subsidence, the City will compile data and prepare maps showing areas with potential for this hazard. By providing detailed maps of these areas, decision makers will be able to better regulate new development in the areas of these hazards (**Objective S 1.2**) that will provide protection to the public and public's property for these hazardous conditions within the City's Planning Area **(Goal S 1)**.

Proposed General Plan Goals, Objectives, and Policies

Policy S 1.1.2: Maintain maps of areas subject to liquefaction and landslides, based on data provided by the State and other appropriate sources.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

While implementation of the above mentioned goal, objective, and policy would help reduce the significance of potential liquefaction impacts within the City's Planning Area, it does not provide specific development standards for development within areas subject to liquefaction, nor does it provide adequate mitigation for potential liquefaction impacts that may be identified through the use of new scientific data, equipment, or procedures. To ensure that potential impacts associated with this issue of liquefaction are reduced to a less than significant level, the following mitigation measures, **MM 3.9-4** and **MM 3.9-5**, have been identified to provide flexibility to the City in requiring site-specific liquefaction assessments. With the implementation of this mitigation measure and the proposed General Plan goals, objectives, and policies, potential impacts from liquefaction would be less than significant.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts to liquefaction impacts. The proposed General Plan provides for mitigation to address potential liquefaction resource occurrence. The proposed General Plan provides for mitigation to liquefaction impacts, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-4 **There will be a potentially significant impact if the project were to expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.**

Areas susceptible to landslides are identified in **Figure 3.9-2.** Land uses are mapped on the Land Use Map on areas that have been designated as potential hazard areas for landslides. Development within or adjacent to areas susceptible to landslides would increase the potential for injury, death, or loss of property. To lessen the potential for property loss, injury, or death resulting from landslides, the City has implemented an ordinance for Hillside Development. Additionally, goals, objectives, and policies have been identified by the City's General Plan that would help mitigate the potentially significant impacts associated with potential landslide hazards.

Implementation of **Policies CO 2.2.2** and **CO 2.2.5** require that hillside areas be revegetated with native drought tolerant plants if disturbed, thus reducing the possibility of potential landslide hazards, and that promoting the use of adequate erosion control measures for all development in hillside areas, both during and after construction be implemented. These policies fulfill **Objective CO 2.2** and **Goal CO 2** because they will help conserve prominent ridgelines and conserve the Santa Clarita Valley's hillsides and canyons in their natural form.

Proposed General Plan Goals, Objectives, and Policies

Goal CO 2: Conserve the Santa Clarita Valley's hillsides, canyons, ridgelines, soils, and minerals, which provide the physical setting for the natural and built environments.

Objective CO 2.2: Preserve the Santa Clarita Valley's prominent ridgelines and limit hillside development to protect the valuable aesthetic and visual qualities intrinsic to the Santa Clarita Valley landscape.

Policy CO 2.2.2: Ensure that graded slopes in hillside areas are revegetated with native drought tolerant plants or other approved vegetation to blend manufactured slopes with adjacent natural hillsides, in consideration of fire safety and slope stability requirements.

Policy CO 2.2.5: Promote the use of adequate erosion control measures for all development in hillside areas, including single family homes and infrastructure improvements, both during and after construction.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

While implementation of the above mentioned goals, objectives, and policies would help reduce the significance of potential landslide impacts within the City's Planning Area, it does not provide specific development standards for development within areas subject to landslide hazards, nor does it provide adequate mitigation for potential landslide impacts that may be identified through the use of new scientific data, equipment, or procedures. To ensure that potential impacts associated with this issue of landslide hazards are reduced to a less than significant level, the following mitigation measure, **MM 3.9-6**, has been identified below to provide flexibility to the City in requiring site-specific landslide hazard assessments.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts of site specific landslide assessment. The proposed General Plan provides for mitigation to address potential impacts of landslides. The proposed General Plan provides for mitigation for site-specific landslides, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-5 **There would be a potentially significant impact if the project were to result in substantial soil erosion or the loss of topsoil.**

Buildout of the City's proposed General Plan will result in new residential and non-residential structures and facilities that would result in the alteration of existing topography and/or removal of existing vegetation/topsoil. The potential for soil erosion, either by wind or water, is substantially increased upon exposure of underlying soils during grading activities or other landform modifications. Measures are identified below to mitigate the potentially significant erosion impacts associated with implementation of the City's General Plan.

Implementation of **Policy CO 2.2.5** would require developers to use erosion techniques during grading and construction in hillside areas to allow the preservation of soils that are on site, and to minimize the amount of soil erosion and loss of topsoil that could result in development of hillside areas. Implementation of this policy would help preserve the valuable aesthetic and visual qualities of hillsides within the City's Planning Area (**Objective CO 2.2**). **Policies CO 2.1.1** through **CO 2.1.3,** reviewing soil erosion and sedimentation control plans for development-related grading activities where appropriate to ensure mitigation of potential erosion by water and air, provide direction for developers and residents within the City's Planning Area on how to best preserve topsoil by requiring soil erosion and sedimentation control plans, stockpiling soil for later reuse, and promoting soil enhancement through composting. These four policies will help fulfill **Goal CO 2** and **Objective CO 2.1** by reducing sedimentation from development through control of soil erosion and by conserving the visual quality of the Santa Clarita Valley's hillsides, canyons, and ridgelines.

Proposed General Plan Goals, Objectives, and Policies

Goal CO 2: Conserve the Santa Clarita Valley's hillsides, canyons, ridgelines, soils, and minerals, which provide the physical setting for the natural and built environments.

Objective CO 2.1: Control soil erosion, waterway sedimentation, and airborne dust generation, and maintain the fertility of topsoil.

Policy CO 2.1.1: Review soil erosion and sedimentation control plans for development-related grading activities, where appropriate, to ensure mitigation of potential erosion by water and air.

Policy CO 2.1.2: Promote conservation of topsoil on development sites by stockpiling for later reuse, where feasible.

Policy CO 2.1.3: Promote soil enhancement and waste reduction through composting, where appropriate.

Policy CO 2.2.5: Promote the use of adequate erosion control measures for all development in hillside areas, including single family homes and infrastructure improvements, both during and after construction.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

The aforementioned goals, objectives, and policies provide specific requirements to identify, evaluate, and mitigate potential impacts associated with soil erosion and loss of topsoil throughout the City's Planning Area as buildout of the General Plan occurs. Additionally, mitigation measures, **MM 3.9-7** through **3.9-9** will provide more direct methods to reduce impacts from erosion and loss of topsoil. Implementation of the proposed General Plan goals, objectives, and policies and mitigation measures will reduce potential impacts from soil erosion and loss of topsoil to a less than significant level.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts of soil erosion and loss of topsoil. The proposed General Plan provides for mitigation to address potential impacts of soil erosion and loss of topsoil. The proposed General Plan provides for mitigation for soil erosion and loss of topsoil, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-6 **There will be a potentially significant impact if the proposed project were to be located on a geological 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.**

Potential impacts from landslides and liquefaction have been discussed previously. Although the potential for subsidence exists within the City's Planning Area, no large-scale problems with ground subsidence have been reported within its boundaries. However, development within areas that are currently undeveloped could reveal areas of subsidence or areas of soils that are susceptible to subsidence due to seismic activity and human activity. The City has adopted ordinances requiring soil and geotechnical investigations for grading or new construction in areas with a potential for landslide or subsidence activity, in order to mitigate potential hazards from soil instability.

Implementation of **Policy S 1.1.3** requires mapping areas of subsidence and compilation of data in the event of significant incidents of soil subsidence. By providing detailed maps of these areas, decision makers will be able to better regulate new development in the areas subject to soil subsidence (**Objective S 1.2**) and provide protection to the public and public's property **(Goal S 1**).

Proposed General Plan Goals, Objectives, and Policies

Policy S 1.1.3: In the event of significant incidents of soil subsidence, compile data and prepare maps showing areas with potential for this hazard.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

The aforementioned goal, objective, and policy provide specific requirements to identify, evaluate, and mitigate potential impacts associated with subsidence, and collapsible soils. Implementation of the above mentioned policy, with the ordinances adopted by the City, would reduce impacts from subsidence to a less than significant level. No additional mitigation measurements would be required.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts of subsidence. The proposed General Plan provides for mitigation to address potential impacts of subsidence. The proposed General Plan provides for mitigation for subsidence, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

Impact 3.9-7 **There will be a potentially significant impact if the proposed project were to include movement or grading of earth exceeding 100,000 cubic yards.**

The proposed General Plan would allow new developments to occur within the City's Planning Area that could potentially allow the movement or grading of earth exceeding 100,000 cubic yards. New development would be subject to CEQA review and the potential impacts of grading reviewed on a project-by-project basis. The proposed General Plan includes goals, objectives, and policies that would help reduce the amount of grading and earth movement that could occur during new development construction. **Policy CO 2.2.5** would ensure that there are adequate erosion control measures for all development in hillside areas, including single family homes and infrastructure improvements, both during and after construction. **Policy CO 2.1.1** would require the review of soil and sedimentation control plans for new construction where appropriate, to ensure mitigation of potential erosion. **Policy CO 2.1.2** would encourage conservation of topsoil on development sites by stockpiling for later reuse, where feasible.

Proposed General Plan Goals, Objectives, and Policies

Policy CO 2.2.5, and **Policies CO 2.1.1** and **CO 2.1.2** have been cited previously.

Effectiveness of Proposed General Plan Goals, Objectives, and Policies

The implementation of the above goals, objectives, and policies would ensure that future development within the City's Planning Area would minimize the amount of earth movement and grading during construction activities. CEQA review would be required for future development projects and mitigation measures developed on a project-by-project basis. Consequently, potential impacts from movement or grading of earth exceeding 100,000 cubic yards would be less than significant with implementation of the proposed General Plan.

Plan to Plan Analysis

The existing General Plan does not contain goals and policies that address potential impacts of grading. The proposed General Plan provides for mitigation to address potential impacts of grading through policies. The proposed General Plan provides for mitigation for grading, and the existing General Plan does not. Impacts to this resource would be greater under the existing General Plan.

MITIGATION FRAMEWORK

Implementation of the following mitigation measures would reduce soil and seismic impacts to a less than significant level:

MM 3.9-1 Before a project is approved or otherwise permitted within an Alquist-Priolo Zone as identified within the City of Santa Clarita, or within 150 feet of any other active or potentially active fault mapped in a published United State Geologic Survey (USGS) or within other potential earthquake hazard area (as determined by the City Engineer), a site-specific geologic investigation shall be prepared to assess potential seismic hazards resulting from development of an individual project site within the City's Planning Area. Where and when required, the geotechnical investigation shall address the issue(s), hazard(s), and geographic area(s) determined by the City Engineer to be relevant to each individual development project. The site-specific geotechnical investigation shall incorporate up-to-date data from government and non-government sources.

Based on the site-specific geotechnical investigation, no structures intended for human occupancy shall be constructed across active faults. This site-specific evaluation and written report shall be prepared by a licensed geologist and shall be submitted to the City Engineer for review and approval prior to the issuance of grading and/or building permits. If an active fault is discovered, that has not previously been recorded, any structure intended for human occupancy shall be set back at least 50 feet from the fault. A larger or smaller setback may be established if such a setback is supported by adequate evidence as presented to and accepted by the City Engineer.

MM 3.9-2 The design and construction of structures and facilities shall adhere to the standards and requirements detailed in the California Building Code (California Code of Regulations, Title 24), City of Santa Clarita Building Code, and/or professional engineering standards appropriate for the seismic zone in which such construction within the City would occur. Conformance with these design standards shall be enforced through building plan review and approval by the City of Santa Clarita Building and Safety Division prior to the issuance of building permits for any structure or facility.

MM 3.9-3 As determined by the City Engineer, a site-specific assessment shall be prepared to ascertain ground-shaking impacts resulting from development. The site-specific ground shaking assessment shall incorporate up-to-date data from government and non-government sources and may be included as part of any site-specific geotechnical investigation as required in **MM 3.9-1**. The site-specific ground shaking assessment shall include specific measures to reduce the significance of potential ground-shaking hazards to the individual development. The site-specific ground shaking assessment shall be prepared by a licensed geologist and shall be submitted to the City Engineer for review and approval prior to the issuance of building permits.

MM 3.9-4 As determined by the City Engineer, a site-specific assessment shall be prepared to ascertain potential liquefaction impacts resulting from development. The site-specific liquefaction assessment shall incorporate up-to-date data from government and non-government sources and may be included as part of any site-specific geotechnical investigation. This site-specific ground shaking assessment shall be prepared by a licensed geologist and shall be submitted to the City Engineer for review and approval prior to the issuance of grading and/or building permits.

MM 3.9-5 Where development is proposed within an identified or potential liquefaction hazard area or as defined by the City Engineer, adequate and appropriate measures such as design foundations in a manner that limits the effects of liquefaction, the placement of an engineered fill with low liquefaction potential, and the alternative siting of structures in areas with a lower liquefaction risk, shall be implemented to reduce potential liquefaction hazards. Any and all such measures shall be submitted to the City Engineer and the City Building and Safety Division for review prior to the approval of the building permits.

MM 3.9-6 Requirements shall be issued that all engineered slopes be designed to resist seismically induced failure. For lower risk projects, slope design shall be based on pseudo-static stability analysis using soil engineering parameters established on a site-specific basis. For higher risk projects, the stability analyses that will be required shall factor in the intensity of expected ground shaking, prior to the issuance of building occupancy permits for the proposed developments.

MM 3.9-7 The City of Santa Clarita, where required, and in accordance with issuance of a National Pollutant Discharge Elimination System (NPDES) permit, shall require the construction and/or grading contractor for individual developments to establish and implement specific Best Management Practices (BMPs) at the time of project implementation.

MM 3.9-8 Prior to any applicable development within the City of Santa Clarita, a Grading Plan shall be submitted to the City of Santa Clarita, Development Services Division for review and approval. As required by the City, the grading plan shall include erosion- and sediment-control plans. Measures included in individual erosion-control plans shall include, but shall not be limited to, the following:

a. Grading and development plans shall be designed in a manner which minimizes the amount of terrain modification.

b. Surface water shall be controlled and diverted around potential landslide areas to prevent erosion and saturation of slopes.

c. Structures shall not be sited on or below identified landslides unless slides are stabilized.

d. The extent and duration of ground disturbing activities during and immediately following periods of rain shall be limited, to avoid the potential for erosion which may be accelerated by rainfall on exposed soils.

e. To the extent possible, the amount of cut and fill shall be balanced.

f. The amount of water entering and exiting a graded site shall be limited though the placement of interceptor trenches or other erosion-control devices.

g. Erosion and sediment control plans shall be submitted to the City for review and approval prior to the issuance of grading permits.

MM 3.9-9 Where required, drainage design measures shall be incorporated into the final design of individual projects on site. These measures shall include, but will not be limited to:

a. Runoff entering developing areas shall be collected into surface and subsurface drains for removal to nearby drainages.

b. Runoff generated above steep slopes or poorly vegetated areas shall be captured and conveyed to nearby drainages.

c. Runoff generated on paved or covered areas shall be conveyed via swales and drains to natural drainage courses.

d. Disturbed areas that have been identified as highly erosive shall be (re)vegetated.

e. Irrigation systems shall be designed, installed, and maintained in a manner which minimizes runoff.

f. The landscape scheme for projects within the project site shall utilize drought-tolerant plants.

g. Erosion control devices such as rip-rap, gabions, small check dams, etc., may be utilized in gullies and active stream channels to reduce erosion.

SIGNIFICANCE OF IMPACT WITH MITIGATION FRAMEWORK

Implementation of the above mitigation measures along with the implementation of the General Plan's goals, objectives, and policies would reduce soil and seismic impacts to a less than significant level.