4.7 GEOLOGY AND SOILS

This section analyzes the potential seismic and geologic hazards that may result from buildout of the City of Rancho Cucamonga 2010 General Plan Update and is based on a review of existing documents and studies for the project area, as noted throughout this section.

4.7.1 RELEVANT POLICIES AND REGULATIONS

Laws, regulations, and codes have been established to ensure that proper precautions are taken in advance of development to prevent unreasonable levels of damage, injuries, or fatalities from seismic or geologic hazards. The primary regulatory measures include:

- International Building Code
- Alquist-Priolo Special Studies Zones Act/Alquist-Priolo Earthquake Fault Zoning Act
- Unreinforced Masonry Law
- Seismic Hazards Mapping Act
- Natural Hazards Disclosure Act
- California Building Code
- San Bernardino County's Soil Erosion Control Ordinance
- City of Rancho Cucamonga Municipal Code

Federal

International Building Code

The International Building Code (IBC) is the national model building code. The 2006 IBC is the most recent edition of the International Building Code, which was incorporated into the 2007 California Building Code, and currently applies to all structures being constructed in California (ICC 2008). The national model codes are incorporated by reference into the building codes of local municipalities, such as the California Building Code and Rancho Cucamonga's Building Code and are discussed below.

State

Alquist-Priolo Earthquake Fault Zoning Act

The 1971 San Fernando Earthquake in Southern California resulted in the development of the Alquist-Priolo Special Studies Zones Act of 1972. The Act was renamed in 1994 to the Alquist-Priolo Earthquake Fault Zoning (A-P) Act. The *California Department of Mines and Geology (CDMG) Special Publication 42* includes the provisions of the Act and an index to maps of Earthquake Fault-Rupture Zones (formerly Alquist-Priolo Special Study Zones), as well as current revisions to these two documents (including Supplements 1 and 2 added in 1999 and Supplement 3 added in 2003).

Earthquake fault-rupture zones have been delineated to prevent the construction of urban development across the trace of active faults. The boundary of the fault zone is approximately 500 feet from major active faults and 200 to 300 feet from well-defined minor faults. The State Geologist defines an active fault as a fault that has previously had surface displacement within the Holocene Period (the last 11,000 years). A potentially active fault is defined as any fault that has had surface displacement during Quarternary time (last 1,600,000 years) but not within the Holocene period.

Land subdivisions and habitable structures consisting of four units or more that are proposed within A-P zones are required to have detailed fault investigations performed so that engineering geologists can mitigate the hazards associated with active faults.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (*Public Resources Code*, Chapter 7.8, Section 2690–2699.6) directs the State of California Department of Conservation to identify and map areas subject to earthquake hazards (such as liquefaction, earthquake-induced landslides, and amplified ground shaking). Passed by the State legislature after the 1989 Loma Prieta earthquake, the Seismic Hazards Mapping Act was aimed at reducing the threat to public safety and minimizing potential loss of life and property in the event of a damaging earthquake event. A product of the resultant Seismic Hazards Mapping Program, Seismic Zone Hazard Maps identify Zones of Required Investigation, which are those with potential seismic hazards; most developments designed for human occupancy planned within these zones are subject to site-specific geotechnical investigations to identify the hazard and to develop appropriate mitigation measures prior to permitting by local jurisdictions.

Natural Hazards Disclosure Act

The Natural Hazards Disclosure Act (effective June 1, 1998) requires that sellers of real property and their agents provide prospective buyers with a disclosure statement when the property is located within one or more State-mapped hazard areas, including a Seismic Hazard Zone.

California Building Code

The California Building Code (CBC) is promulgated under the *California Code of Regulations* (CCR), Title 24, Parts 1 through 12 (also known as the California Building Standards Code), and is administered by the California Building Standards Commission (CBSC). The CBSC is responsible for administering California's building codes, including adopting, approving, publishing, and implementing codes and standards. The CBC is a compilation of three types of building standards from three different origins:

- Standards adopted by State agencies without change from the national model codes (e.g., the IBC).
- Standards adopted and adapted from the national model code standards to meet California conditions.
- Standards authorized by the California legislature that constitute extensive additions that are not covered by the national model codes and that are adopted to address concerns particular to California (e.g., the specification of Certified Engineering Geologist rather than engineering geologist).

The national model code standards adopted into Title 24 apply to all occupancies in California except for modifications adopted by State agencies and local governing bodies. Facilities and structures such as power plants, freeways, emergency management centers (e.g., traffic management and 911 centers), and dams are regulated under criteria developed by various California and Federal agencies. The current version of the CBC is the 2007 triennial edition (CBSC 2009).

Regional

Santa Ana Region Basin Plan

The City of Rancho Cucamonga is located within the Santa Ana River watershed, where the Santa Ana Regional Water Quality Control Board (RWQCB) imposes minimum lot size requirements for new developments using on-site septic tanks or subsurface leaching/percolation systems. Chapter 5 of the Santa Ana Region Basin Plan outlines the Board's regulations for septic systems, which specifically limit the density of new subsurface systems to lots developed with no more than two dwelling units per acre and prohibits these systems in specific areas with water quality problems and where public sewer systems are in place. Exemptions to the minimum lot size are granted for replacement systems, residential expansion, and where offsets are made (when a number of existing dwelling units on septic systems are connected to the public sewer system in exchange for an equal number of new units to be placed on septic systems).

County

Soil Erosion Control Ordinance

The County's Ordinance for soil erosion and dust control is contained in Chapter 88.02 the San Bernardino County Development Code (Title 8 of the County Code). The County has designated the unincorporated areas near Rancho Cucamonga as soil erosion hazard areas, where individual property owners must make reasonable efforts to prevent dust from blowing off their property. A soil erosion permit is required for any ground disturbance (excavating, leveling, cultivating, disking, plowing, removing residues, or spreading a soil) and for recreational use of off-road vehicles, but exempts activities such as roadway or utility line construction and maintenance, land clearing for fire prevention, soil testing, disturbance of one acre or less, use of a Noble blade within a vineyard, and agricultural practices within an agricultural preserve.

Septic Tank Regulations

Article 4 of Title 3, Division 3, Chapter 1 of the San Bernardino County Code contains regulations for the installation, use and maintenance of sewage holding tanks so as not to affect public health or safety. The County Division of Environmental Health Services (DEHS) is responsible for issuing permits to construct and use septic tanks, as well as to routinely inspect the tanks for proper operation.

If a sewage collection line becomes available near a property utilizing a septic tank, the property owner is required to connect to the sewer line within 90 days and to abandon the septic tank in accordance with County regulations.

Local

Alquist-Priolo Act Modifications

The City of Rancho Cucamonga has adopted more stringent standards than the A-P Act to address seismic hazards in the City. It has expanded the A-P Zone for the Cucamonga Fault to include the area around a splay[1] at the northwestern corner of the City; in this area, geotechnical investigations are required for new developments to determine the presence of a fault trace and to require setbacks from the trace. The City has also extended the A-P Zone for

[1] A secondary fault branching off the main fault.

the Red Hill Fault to include the segments along the scarp at Red Hill and the areas where a buried or uncertain segment is located. This area also requires geotechnical investigations to determine the presence of a fault trace. In addition, the City requires geotechnical investigations for all habitable structures proposed within the expanded Cucamonga Fault Zone and in the northeastern and (extended) southwestern segments of the Red Hill Fault Zone (i.e., not just developments with four units or more, as required under the A-P Act). For the central buried segment of Red Hill, the City-designated zone requires geotechnical investigations for essential and critical facilities (i.e., fire stations, hospitals, emergency operations centers, schools, shelters, communication centers, and other facilities that are needed during an emergency) and the strengthening of foundations of essential and critical facilities in this zone.

Rancho Cucamonga Building Regulations

Building regulations in Rancho Cucamonga are specified in Title 15, Buildings and Construction of the Municipal Code, which includes adoption of the 2007 CBC which, in turn, incorporates the International Building Code. Building construction is governed by the CBC; however, the City has amended and provided exemptions to the CBC that address specific geologic considerations in the City. This title also includes regulations for earthquake hazard reduction in unreinforced masonry (URM) buildings, including historic buildings. This title is enforced by the Building and Safety Division; it requires site-specific investigation, and it establishes construction standards and inspection procedures to ensure that development does not pose a threat to public safety. According to the City of Rancho Cucamonga Building Department, no URMs exist within the Study Area (Thomas 2009).

Blowsand Regulations

The City has adopted specific regulations to address soil/wind erosion and blowsand hazards (which are caused by Santa Ana wind conditions) within the City limits. These regulations are found in Title 8, Health and Safety - Chapter 8.16 of the Rancho Cucamonga Municipal Code. The regulations adopt the County's Soil Erosion Control Ordinance, as contained in Chapter 88.02 the San Bernardino County Development Code.

Grading Ordinance

The City's Grading Ordinance is contained in Title 19, Environmental Protection - Chapter 19.04 of the Rancho Cucamonga Municipal Code. Title 19 discourages mass grading and excessive slopes so as to retain the natural terrain; to preserve significant topographic features; to limit construction on identified seismic or geologic hazard areas; and to encourage variations in housing styles, lot sizes, design densities, and views. The ordinance calls for grading plans to be reviewed by a committee consisting of one representative from the Building and Safety Department, one representative from the Engineering Department, and one representative from the Planning Department. This committee reviews all grading plans for compliance with City standards and guidelines relating to grading practices for topography, drainage structures, slopes, irrigation, planting, building pad differential heights, accessibility, and other features or functions that meet the objectives of this ordinance.

Hillside Development Regulations

The City's Development Code contains hillside development regulations in Chapter 17.24 of Title 17 to prevent the disturbance of natural slopes. Guidelines and development standards for site design, architecture, driveways/roadways, walls and fences, landscaping, grading, drainage, trails and corrals, public safety, and development density are provided in the regulations, for use in the review of developments on sites with slopes of 5 percent or greater.

Grading for development is permitted in areas with slopes of 5 to 7.99 percent, but the natural character of landforms must be retained. Contour grading, combined slopes, limited cut and fill, split-level architectural prototypes, or padding for the structures may be required to reduce grading. Cluster development is encouraged to reduce areas of disturbance.

Development within the Hillside Overlay District (areas generally located north of Hillside Avenue and areas around Red Hill and Beryl Hill) or areas with slopes 8 to 14.9 percent are required to comply with hillside architectural and design techniques that minimize grading. The use of split-level foundations of greater than 18 inches, stem walls, stacking, and clustering is expected for these areas.

Development in areas with slopes of 15 to 29.9 percent is limited to the less visually prominent slopes and where it can be shown that safety, environmental, and aesthetic impacts can be minimized. Large lots, variable setbacks, and variable building structural techniques (i.e., stepped or pole foundations) are expected. Structures should blend with the natural environment in terms of shape, materials, and colors. Roadways should follow natural contours or use grade separations.

Development is prohibited in areas with slopes over 30 percent or greater, unless the site is south of Banyan Street where development is allowed, at least 75 percent of the lots or parcels of the development are surrounded by lots or parcels improved with structures, and where the proposed development appropriately addresses slope stability and other on-site geological factors.

The Development Code also includes a Hillside Residential District (Chapter 17.18), which applies to the northwestern corner of the City and some areas within its SOI. This district permits single-family residential dwellings at a maximum density of two units per acre. Non-residential uses are not allowed. Environmental studies and investigations are required prior to development to address geology, hydrology, seismicity, slope and soil conditions, access/circulation, and biological resources and to determine the buildable area and allowable development density. Compliance with the hillside development regulations in Chapter 17.24 is mandated.

4.7.2 EXISTING CONDITIONS

Regional Geology

The City of Rancho Cucamonga is located at the north-central section of the Chino Valley, just south of the eastern San Gabriel Mountains. The Chino Valley is bound by the San Gabriel Mountains to the north, the San Bernardino Mountains to the northeast, the Puente Hills to the southwest, and the Jurupa Hills to the southeast.

The San Gabriel Mountains extend from the Newhall Pass in Los Angeles County, east to the Cajon Pass in San Bernardino County. This mountain range has the steepest and most rugged topography in the region, with peaks exceeding 9,000 feet above mean sea level (msl), with the highest point at 10,064 feet above msl at Mount Baldy. These mountains are part of the Transverse Ranges and are composed of igneous and metamorphic rocks that were formed over 65 million years ago. Streams from the mountains carried alluvial deposits down into the valley, with deposits consisting of coarse gravels to fine-grained sands deposited more than 10,000 years ago. The alluvial deposits are as thick as 500 to 1,000 feet at the southern edges of the mountains, with deposits southeast of Red Hill nearly 1,400 feet thick. Underneath the alluvial sediments are crystalline rocks, as found exposed in the San Gabriel Mountains north of the City (ECI 2000).

Seismicity

Southern California is a seismically active region, with seismic hazards depending on (1) proximity and earthquake potential of nearby active faults and (2) the local geologic and topographic conditions, which can either amplify or attenuate seismic waves.

The City of Rancho Cucamonga is located in the northern portion of the Peninsular Ranges geomorphic province, just south of the Transverse Ranges province. At the boundary of the provinces are several thrust faults, where large-scale crustal disturbance has occurred as the Peninsular Ranges collide with the Transverse Ranges. The compressional forces of this collision are responsible for the uplift of the San Gabriel Mountains. Exhibit 4.7-1, Fault Locations, depicts the general location of locally known and active faults in the region.

Magnitude and intensity are used to measure earthquakes, where magnitude is a measure of the energy released at the source of the earthquake (as determined from measurements on seismographs), while intensity is a measure of the strength of shaking produced by the earthquake at a given location. Several scales are used to measure magnitude, including (1) local magnitude (ML), also referred to as "Richter magnitude", (2) surface-wave magnitude (Ms), (3) body-wave magnitude (Mb), and (4) moment magnitude (Mw). All magnitude scales yield approximately the same value for any given earthquake, and are based on the size of the seismic wave, its frequency, size and area of displacement, and rigidity of the earth. Table 4.7-1 provides the classes of earthquakes based on magnitude.

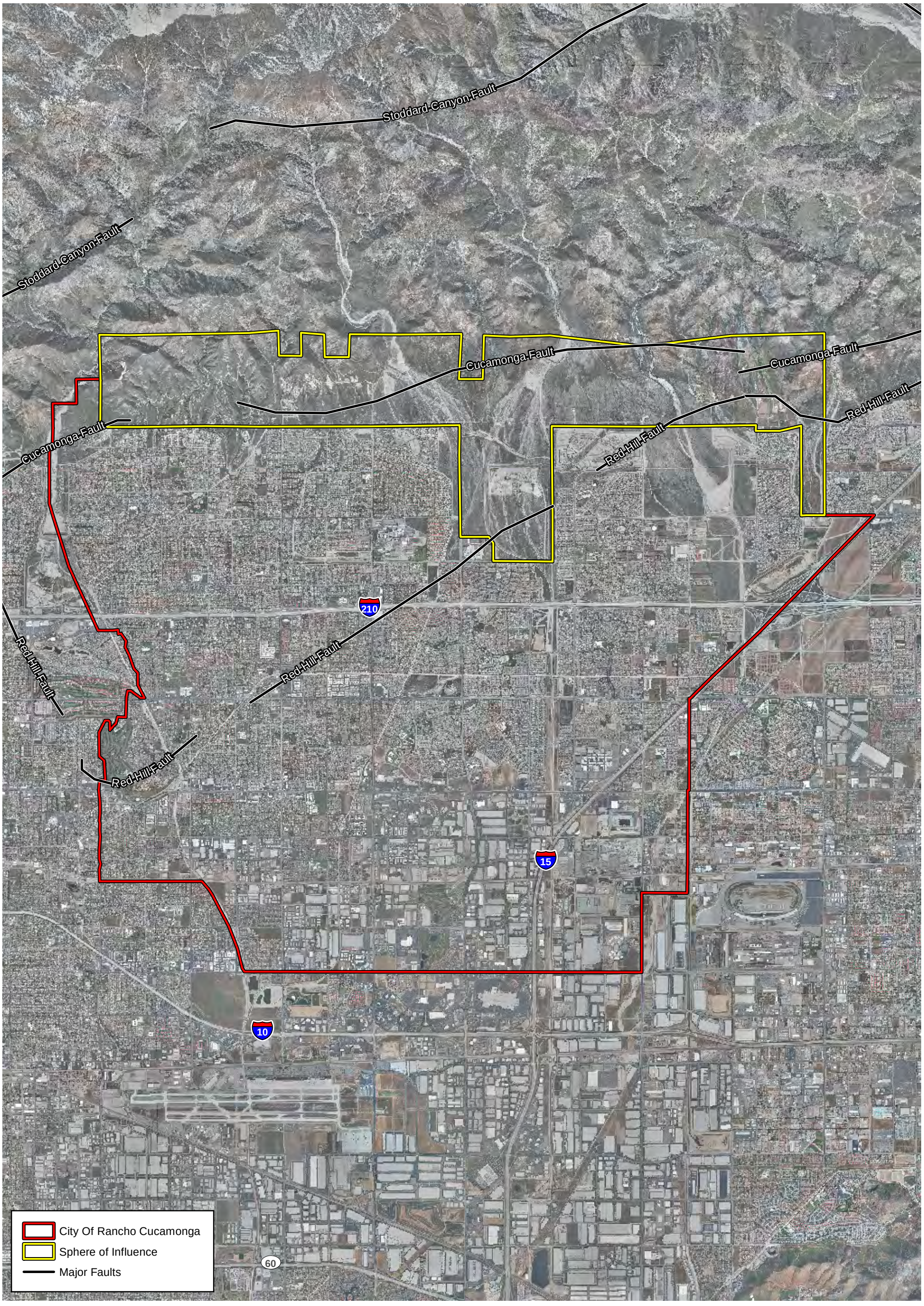
TABLE 4.7-1
EARTHQUAKE MAGNITUDE

Magnitude Class	Magnitude
Great	M > =8
Major	7 < =M < 7.9
Strong	6 < = M < 6.9
Moderate	5 < =M < 5.9
Light	4 < =M < 4.9
Minor	3 < =M < 3.9
Micro	M < 3
Source: USGS 2009.	

The Red Hill Fault is known as the geologic divide between the Cucamonga and Chino groundwater basins, as it curves around the southern portion of Red Hill in the northern section of the City. This fault is defined by a prominent scarp in the alluvial fan south of Day Canyon and at the southern edge of Red Hill. A large number of small earthquakes (magnitudes [M] 1 to 3) have historically occurred beneath the City of Rancho Cucamonga, some which have epicenters on or near the trace of the Red Hill Fault. A maximum credible magnitude of 6.5 is possible on this fault (ECI 2000).

The Red Hill fault consists of three segments:

- ***Etiwanda Avenue Fault Scarp.*** The northeastern segment of the Red Hill Fault (mapped near Etiwanda Avenue) has been shown to be active and may be a splay of the Cucamonga fault. This segment has been included in an Alquist-Priolo Earthquake Hazard Zone. Special studies are required along the Etiwanda segment for any structure proposed for human occupancy (ECI 2000).



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Fault Locations

Exhibit 4.7-1

Rancho Cucamonga General Plan Update

N W E S

1 0.5 0 1 Miles

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- ***Scarp at Red Hill.*** Several studies completed in the area suggest the presence of a fault at the southern base of Red Hill; however, these studies were unable to determine whether or not the fault was active. The scarp is on trend with the Etiwanda Avenue scarp, which is active, as well the San Jose fault, which caused the 1988 and 1990 Upland earthquakes. This segment is not within the State-designated Earthquake Hazard Zone (ECI 2000).

- ***Buried/Uncertain Segment of the Red Hill Fault.*** This central segment is drawn on published maps to connect the Red Hill and Etiwanda Avenue scarps, as well as to account for ground water level differences between several wells in the City. Published locations for this segment of the Red Hill fault vary by as much as 1,000 feet, and subsurface explorations for the fault found no evidence of its existence. Because the data cannot support this segment's existence and/or location, this segment is not within the State-designated Earthquake Hazard Zone (ECI 2000).

The City is located just south of the Cucamonga Fault, which runs along the base of the San Gabriel Mountains near the boundary between the Peninsular and Transverse Ranges. The Cucamonga Fault is considered the eastern extension of the Sierra Madre Fault and dips to the north at about 45 degrees. This fault has scarps that indicate offset in recent alluvial deposits along the northern edge of the City. It has been mapped along the base of the San Gabriel Mountains, from the Lytle Creek area to the San Antonio Canyon, as a single line near Cucamonga Creek to a zone that is ½ mile wide, with a significant offset across the Deer Creek alluvial deposits. This segment is within the State-designated Earthquake Hazard Zone. A maximum credible earthquake of M 7.0 is possible on this fault. A worst-case scenario for an M 7.0 earthquake on the Cucamonga Fault is expected to cause ground displacements of up to 9 feet along the fault scarps, with intense ground shaking lasting more than 30 seconds (ECI 2000).

Exhibit 4.7-2, Earthquake Hazard Zones, shows the State-designated Earthquake Hazard Zone for the Red Hill and Cucamonga Faults within the City and SOI.

Other nearby faults include:

- ***San Andreas Fault.*** The San Andreas Fault is the boundary between the Pacific and North American plates and is widely recognized as the longest and most active fault in California. It has been mapped from Cape Mendocino in Northern California to an area near the Mexican border, with the nearest segment located 14 miles from the City. The San Andreas Fault is known to be active from historic earthquakes, which have caused surface rupture and displacement of recent sediments. A maximum credible earthquake of M 7.8 is possible on this fault. The probability of an earthquake event of M 7.3 along the San Andreas Fault is about 50 percent over the next 50 years. This event would result in extensive ground shaking in the City, resulting in damage to vulnerable structures and localized ground failures (ECI 2000).

- ***San Jacinto Fault.*** The San Jacinto Fault includes several northwest-southeast trending fault segments that extend approximately 130 miles from its intersection with the San Andreas Fault (near in the Lytle Creek area at the San Gabriel Mountains), southward to El Centro in Imperial County near the Mexican border and beyond. This right lateral, strike-slip fault has been active in historic time, with earthquakes of M 6.0 to 7.1 occurring since the 1800s. The branch of the San Jacinto Fault nearest to the City is the Lytle Creek Fault, which forms the western side of Lytle Creek Canyon, northeast of the City. A maximum credible earthquake of M 6.7 to 6.9 is possible on this fault (ECI 2000).

- ***Whittier-Elsinore-Chino Fault.*** The Whittier-Elsinore-Chino Fault is located in the Puente Hills and Chino Hills area, approximately 20 miles southwest of Rancho Cucamonga. The Elsinore Fault branches into the Whittier Fault near Santa Ana Canyon, where it borders the Puente Hills to the southwest and the Chino Fault, which is buried along most of its length, to the northeast. This fault has caused vertical displacements, unlike the horizontal movements associated with the San Andreas and the San Jacinto Faults. A maximum credible earthquake of M 6.8 is possible on this fault (ECI 2000).

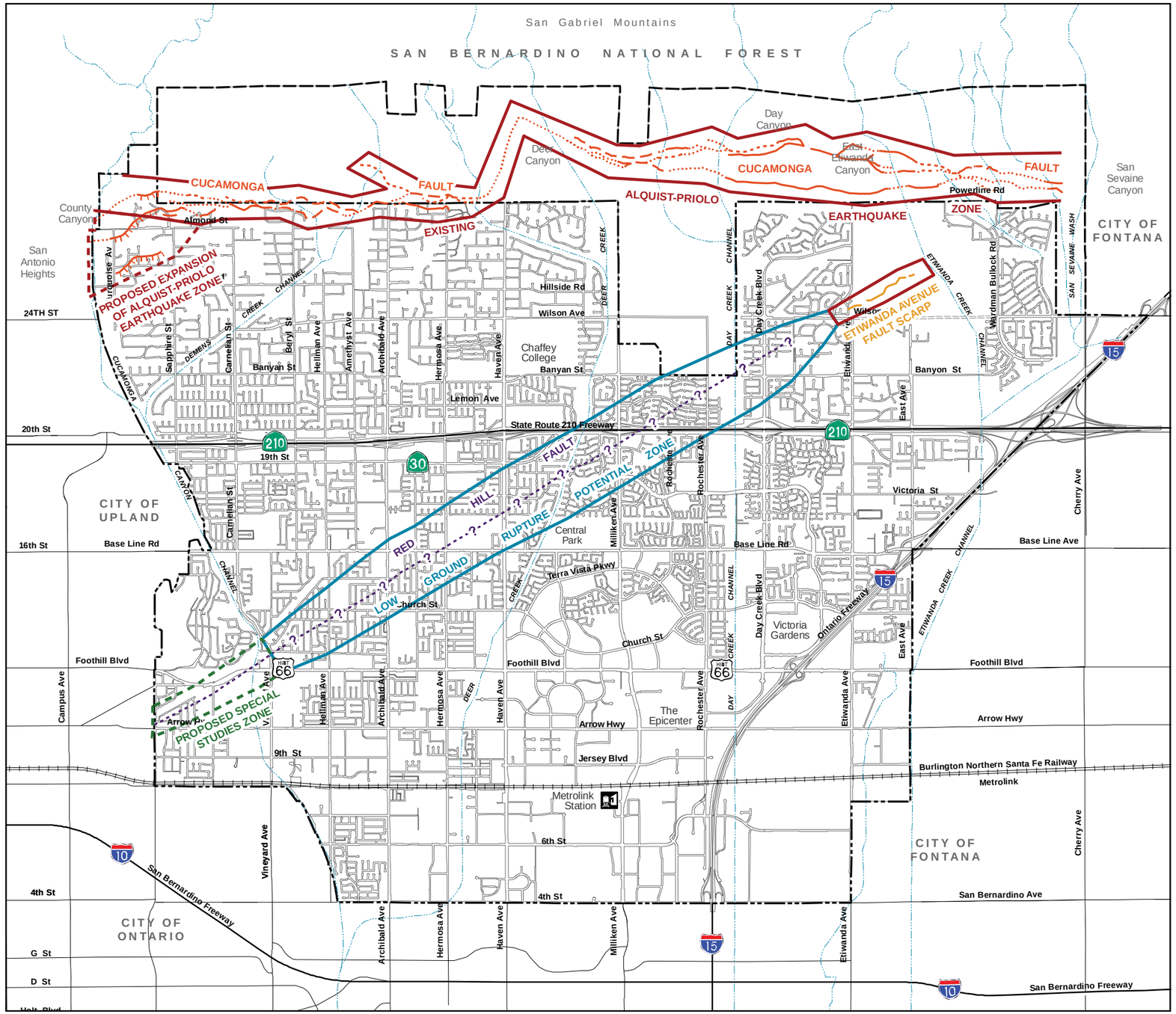
- ***San Jose Fault.*** The San Jose Fault is a potentially active fault extending from south of the San Gabriel Mountains to the San Jose Hills and is associated with the Walnut Creek Fault. It is located 2.5 miles west of the City as it runs southwest from the San Antonio Canyon. It was the source of the Upland earthquakes in 1988 and 1990. This fault is considered a major active fault and is capable of producing an M 6.5 earthquake (ECI 2000).

- ***Sierra Madre Fault.*** The Sierra Madre Fault system is thought to extend over 100 miles from San Fernando to the Cajon Pass, generally running along the base of the San Gabriel Mountains. It extends west from the Cucamonga Fault at San Antonio Canyon. This fault is considered potentially active and is capable of producing an M 7.0 earthquake (ECI 2000).

Seismic Hazards

Ground rupture may occur on any of the faults listed above, with the Red Hill Fault and the Cucamonga Fault presenting ground rupture hazards to the City of Rancho Cucamonga.

Ground shaking is the movement of the earth as a result of an earthquake. An earthquake event on any fault in the Southern California region could cause ground shaking in the City. Peak ground acceleration and seismic intensity from earthquake events decrease with increasing distance from the earthquake epicenter, and local conditions could amplify or weaken seismic waves. The most common seismic intensity scale is the Modified Mercalli Intensity (MMI), which qualifies the seismic ground shaking at a site according to the magnitude of the earthquake, distance to epicenter, type of bedrock or underlying soils, and topographic conditions. Table 4.7-2 presents the MMI scale. Nearby earthquake faults are listed in Table 4.7-3, along with their Maximum Credible Earthquake (MCE) and associated MMI.



Legend

Fault Zones

- Existing Alquist-Priolo Earthquake Zone *
- Proposed Expansion of Alquist-Priolo Earthquake Zone *
- Proposed Special Studies Zone *
- Low Ground Rupture Potential Zone **

* All proposed structures for human occupancy within these zones shall require special fault hazard studies.

** Associated with the uncertain segment of Red Hill Fault, special studies/foundations recommended for essential/critical facilities.

Active Faults

Cucamonga Fault

- Fault Accurately Located
- Fault Approximately Located
- Fault Inferred
- Fault Concealed
- Fault Scarp (ticks indicate downthrown side)

Etiwanda Avenue Fault Scarp

- Fault Accurately Located

Red Hill Fault

- Fault Inferred
- Fault Queried (uncertain)

Base Map

- Rancho Cucamonga City Boundary
- Sphere of Influence

0 0.25 0.5 1 1.5 2 Miles

Earthquake Hazard Zones

Exhibit 4.7-2

Rancho Cucamonga General Plan Update

Source: City of Rancho Cucamonga, 2008, Earth Consultants International, 2000

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TABLE 4.7-2
MODIFIED MERCALLI INTENSITY SCALE

Intensity Value	Description	Average Peak Velocity	Average Peak Acceleration
I	Not felt except by a very few under especially favorable circumstances.		
II	Felt only by a few persons at rest, especially on upper floors of high-rise buildings; delicately suspended objects may swing.		
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake; standing automobiles may rock slightly, vibration like passing of truck; duration estimated.		
IV	During the day, felt indoors by many, outdoors by few; at night, some awakened; dishes, windows, doors disturbed; walls make creaking sound; sensation like a heavy truck striking building; standing automobiles rock noticeably.	1–2 cm/sec	0.015–0.02g
V	Felt by nearly everyone, many awakened; some dishes, windows and so on broken; cracked plaster in a few places; unstable objects overturned; disturbances of trees, poles, and other tall objects sometimes noticed; pendulum clocks may stop.	2–5 cm/sec	0.03–0.04g
VI	Felt by all, many frightened and run outdoors; some heavy furniture moved; a few instances of fallen plaster and damaged chimneys; damage slight.	5–8 cm/sec	0.06–0.07g
VII	Everybody runs outdoors; damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable in poorly built or badly designed structures; some chimneys broken; noticed by persons driving cars.	8–12 cm/sec	0.10–0.15g
VIII	Damage slight in specially designed structures, considerable in ordinary substantial buildings with partial collapse, great in poorly built structures; panel walls thrown out of frame structures; fall of chimneys, factory stacks, columns, monuments, and walls; heavy furniture overturned; sand and mud ejected in small amounts; changes in well water; persons driving cars disturbed.	20–30 cm/sec	0.25–0.30g
IX	Damage considerable in specially designed structures, well designed frame structures thrown out of plumb, great in substantial buildings with partial collapse; buildings shifted off foundations; ground creaked conspicuously; underground pipes broken.	45–55 cm/sec	0.50–0.55g
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations, ground badly cracked; rails bent; landslides considerable from river banks and steep slopes; shifted sand and mud; water splashed, slopped over banks.	More than 60 cm/sec	More than 0.60g
XI	Few, if any, masonry buildings remain standing; bridges destroyed; broad fissures in ground; underground pipelines completely out of service; earth slumps and land slips in soft ground, rails bent greatly.	-	-
XII	Damage total; waves seen on ground surface; lines of sight and level distorted; objects thrown into air.	-	-

cm/sec: centimeters per second; g: gravity (an earthquake measurement equal to 9.8 meters per second^2
-: No data provided in the ECI report.

Source: ECI 2000.

TABLE 4.7-3
NEARBY FAULTS

Fault Name	Distance to City	Maximum Credible Earthquake	Peak Ground Acceleration	Modified Mercalli Intensity*
Cucamonga	0–11 miles	M 7.0	0.24–0.60g	IX–X
San Andreas				
Coachella Segment	14–19 miles	M 7.4	0.14–0.28g	VIII–X
San Bernardino Mtns Segment	14–19 miles	M 7.3	0.13–0.26g	VIII–X
Mojave Segment	15–21 miles	M 7.1	0.11–0.20g	VII–VIII
San Andreas - 1857 Rupture	15–21 miles	M 7.8	0.17–0.31g	VIII–IX
San Jacinto				
San Bernardino Segment	9–15 miles	M 6.7	0.12–0.26g	VII–VIII
San Jacinto Valley	14–23 miles	M 6.9	0.10–0.16g	VII–IX
San Jose	4–14 miles	M 6.5	0.13–0.52g	VIII–X
Sierra Madre	7–17 miles	M 7.0	0.14–0.44g	VIII–X
Whittier-Chino –Elsinore				
Chino- Central Avenue	5–14 miles	M 6.7	0.19–0.42g	VIII–X
Whittier	11–17 miles	M 6.8	0.14–0.18g	VIII
Glen-Ivy	12–17 miles	M 6.8	0.13–0.17g	VIII
Clamshell-Sawpit	16–26 miles	M 6.5	0.05–0.15g	VI–VIII
Elysian Park Thrust	21–28 miles	M 6.7	0.08–0.16g	VII–VIII
Cleghorn	16–21 miles	M 6.5	0.06–0.13g	VI–VIII
North Frontal Fault Zone	21–28 miles	M 7.0	0.07–0.15g	VI–VIII

M: Magnitude in Moment Magnitude Scale (Mw); g: gravity (an earthquake measurement equal to 9.8 meters per second^2
* see Table 4.7-2 for descriptions.

Source: ECI 2000.

Liquefaction is the process by which sediment that is very wet starts to behave like a liquid. Liquefaction typically occurs when loose, sandy soils in areas with groundwater within 50 feet of the surface are subject to strong ground shaking (over 0.2g). The California Geological Survey (CGS) maps for liquefaction hazards have not been completed for the City. While the City has loose sandy soils over large areas, groundwater is generally 350 feet or more below the ground surface. A review of high groundwater depths in the City shows three small areas - south of Base Line Road, west of Hellman Avenue, and north of the Red Hill Fault - where groundwater is within 50 feet of the surface due to impediments to groundwater flow. However, regional mapping indicates that much of the sediment in these areas may be too dense to liquefy (ECI 2000).

Ground accelerations in the City over 0.10g (as expected from a maximum credible earthquake on the Cucamonga, San Andreas, San Jacinto, San Jose, Sierra Madre, and Whittier-Chino-Elsinore Faults) may induce rock falls and landslides from the San Gabriel Mountains. Areas susceptible to rock fall hazards during an earthquake are located below steep, resistant outcrops of relatively well-cemented soil materials. These materials underlie the SOI north of the City. The rock fall hazard is considered high for developments just south of these outcrops, as well as for those located adjacent to steeply ascending slopes (ECI 2000).

The potential for seismic settlement is based on the intensity and duration of ground shaking and the relative density of the subsurface soils. Most of the City is susceptible to seismic settlement, since the alluvial fans underlying the City are of low density. However, as previous earthquakes have shown, seismic settlement is primarily damaging in areas subject to differential settlement, which occurs slowly and can cause significant building damage over

time. In the City, differential settlement is most likely to occur in areas with different soil foundations due to cut and fill and may occur at the base of hillsides (ECI 2000).

Local Geology

The City of Rancho Cucamonga is underlain by the following five geologic deposits (ECI 2000):

- Metamorphic basement rock of the eastern San Gabriel Mountains;
- Older alluvium underlying the Red Hill area;
- Alluvial fan deposits ranging from Pleistocene to recent times;
- Alluvial deposits in modern washes; and
- Windblown sands underlying the south-central portion of the City.

The City has a moderately sloping terrain from north to south, although much of the SOI features steep hillsides and rugged terrain. Ground elevations range from approximately 1,015 feet above msl at the southwestern end of the City to approximately 2,200 feet above msl at the northern end of the City. Within the SOI, the terrain rises to 4,040 feet above mean sea level and features several canyons and bluffs.

The United States Department of Agriculture's (USDA) Soil Survey of San Bernardino County, Southwestern Part (1980) identifies soils in the City as Delhi fine sands, Tujunga soils, Hanford soils, and Soboba soils. Exhibit 4.7-3, Soil Associations, shows soils in the project area.

Delhi fine sands (Db) are found in the southern section of the City and consist of pale brown and light yellowish-brown fine sand. These sands are more than 60 inches thick and are highly permeable so runoff on these soils is very slow. Hazards related to blowing soil for Delhi sands are generally moderate, but can be high in unprotected areas. These soils are used mainly for grapes, pasture plants, alfalfa, and some citrus. Delhi sands have low shrink-swell potential and are considered non-plastic (i.e., they have no clay content). They have slight limitations for dwellings without basements and septic tank absorption fields, with severe limitations for shallow excavations and sanitary landfills due to side wall stability and rapid permeability, respectively. These soils are poor sources of cover material and topsoil, but good sources of sand and road fill.

Tujunga loamy sands (TuB) are found at the central and eastern sections of the City and consist of brown loamy sand and pale-brown coarse sand. These soils are about 60 inches thick, somewhat excessively drained, and found on nearly level to moderately sloping alluvial fans. Tujunga soils are slightly acidic and highly permeable so runoff on these soils is slow to very slow. Hazards from water erosion are slight and hazards from wind erosion are moderate to high on bare soils. These soils are used mainly for irrigated crops such as citrus, grapes, small grains, and pasture plants. Tujunga soils have a low shrink-swell potential and are considered non-plastic. They have slight limitations for dwellings without basements and septic tank absorption fields, with severe limitations for shallow excavations and sanitary landfills due to side wall stability and a high level of permeability, respectively. These soils are poor sources of topsoil, sand, and gravel, but are suitable as road fill.

Some areas with Tujunga gravelly loamy sand (TvC) are also present, which has the same characteristics as TuB soils, except for a higher gravel content (15 to 30 percent by volume). These soils are fair sources of sand and gravel.

Hanford soils (HaC) are found at the western section of the City and consist of light brownish-gray coarse sandy loam on the surface, about 10 inches thick. These soils have slow to medium runoff potential and slight to moderate erosion hazard when left unprotected. They are slightly acid or neutral throughout and moderately permeable. These soils are used for irrigated crops like citrus and alfalfa. Hanford soils have low shrink-swell potential and are considered non-plastic. They have slight limitations for dwellings without basements, septic tank absorption fields, and shallow excavations, with severe limitations for sanitary landfills due to moderate permeability. These soils are poor sources of sand and gravel but good sources of cover material, topsoil, and road fill.

Soboba soils that are stony loamy sand (SpC) are found at the northern section of the City and consist of grayish-brown stony loamy sand on the surface, about 10 inches thick, with underlying material of brown very stony loamy sand and very pale brown stony sand about 60 inches thick. These soils are excessively drained and highly permeable. Runoff on these soils is slow and erosion hazard is slight. They have low shrink-swell potential. Soboba soils are used for dry-farmed seeded pasture and citrus.

Soboba soils that are gravelly loamy sand (SoC) are found on some areas at the northern section and contain more gravel than SpC soils. Gravel makes up 40 to 60 percent of volume of SoC soils. They generally have the same characteristics, except that runoff is very slow for SoC soils.

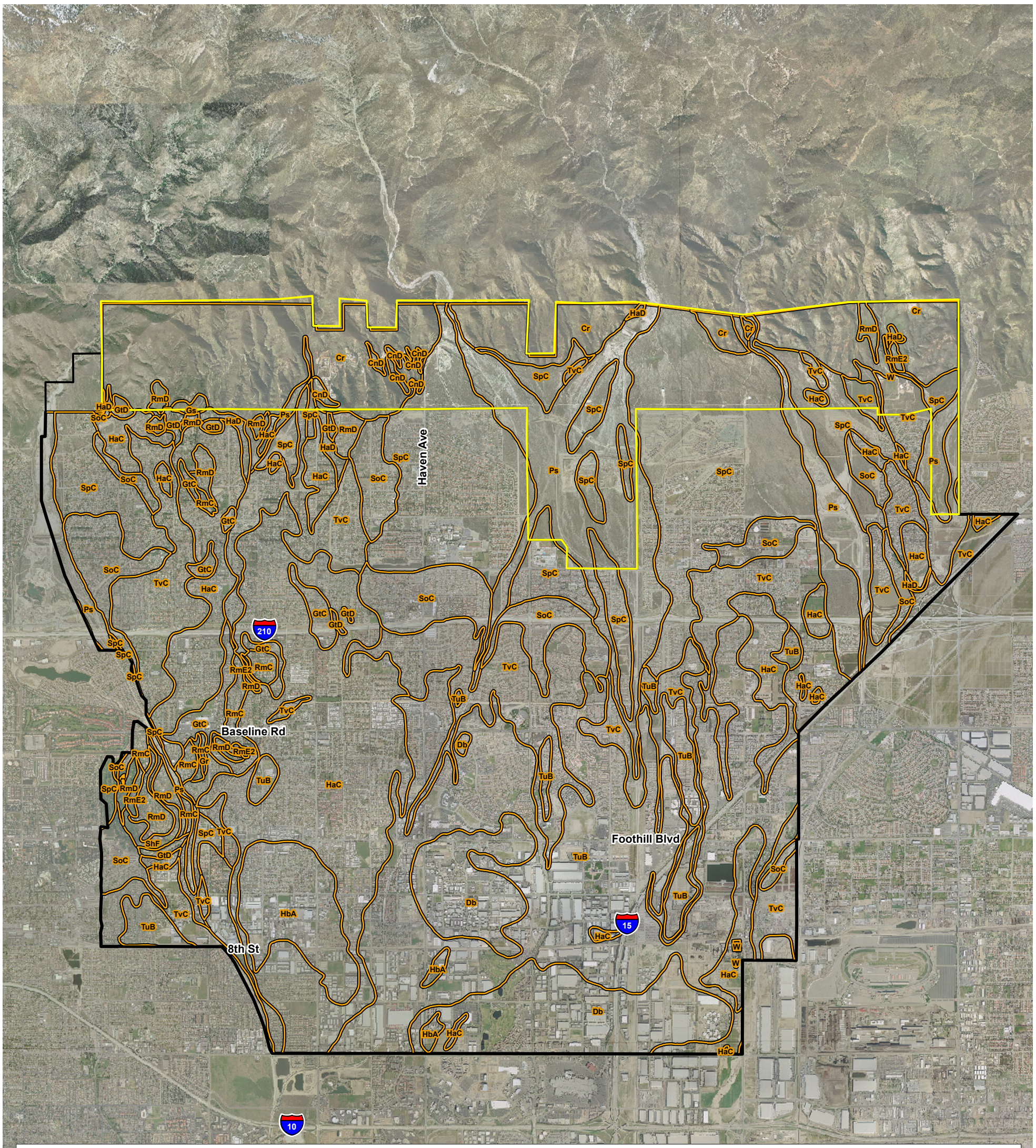
Several other soil types have been mapped in the City and include scattered areas identified as:

- Hanford sandy loam (HbA);
- Hanford coarse sandy loam (HaD);
- Ramona sandy loam, 2 to 9 percent slopes (RmC);
- Ramona sandy loam, 9 to 15 percent slopes (RmD);
- Ramona sandy loam, 15 to 30 percent slopes (RmE2);
- Greenfield sandy loam, 2 to 9 percent slopes (GtC);
- Greenfield sandy loam, 9 to 15 percent slopes (GtD);
- Psamments and Fluvents (Ps) along creeks and drainage courses;
- Cieneba sandy loam (CnD);
- Cieneba Rock outcrop complex (Cr) at the foothills; and
- Grangeville fine sandy loam (Gs).

The soils listed above have low shrink-swell potential. Cieneba and Ramona soils pose severe limitations to septic tank absorption fields (due to the permeability of the soils, depth to water table, and susceptibility to flooding). Cieneba, Hanford, Ramona, and Greenfield soils have a moderate to high erosion hazard.

Geologic Hazards

The geologic hazards in the City of Rancho Cucamonga are directly related to the nearby San Gabriel Mountains. These mountains are considered to be one of the fastest rising, as well as the fastest disintegrating, mountain ranges in the world (ECI 2000). Geologic hazards posed by



City Of Rancho Cucamonga

Sphere of Influence

SOIL TYPES

CnD, CIENEBA SANDY LOAM, 9 TO 15 PERCENT SLOPES
Cr, CIENEBA-ROCK OUTCROP COMPLEX
Db, DELHI FINE SAND
Gr, GRANGEVILLE FINE SANDY LOAM
Gs, GRANGEVILLE FINE SANDY LOAM, SALINE-ALKALI
GtC, GREENFIELD SANDY LOAM, 2 TO 9 PERCENT SLOPES
GtD, GREENFIELD FINE SANDY LOAM, 9 TO 15 PERCENT SLOPES
HaC, HANFORD COARSE SANDY LOAM, 2 TO 9 PERCENT SLOPES
HaD, HANFORD COARSE SANDY LOAM, 9 TO 15 PERCENT SLOPES
HbA, HANFORD SANDY LOAM, 0 TO 2 PERCENT SLOPES
Ps, PSAMMENTS AND FLUVENTS, FREQUENTLY FLOODED
RmC, RAMONA SANDY LOAM, 2 TO 9 PERCENT SLOPES
RmD, RAMONA SANDY LOAM, 9 TO 15 PERCENT SLOPES
RmE2, RAMONA SANDY LOAM, 15 TO 30 PERCENT SLOPES, ERODED
ShF, SAUGUS SANDY LOAM, 30 TO 50 PERCENT SLOPES
SoC, SOBOBA GRAVELLY LOAMY SAND, 0 TO 9 PERCENT SLOPES
SpC, SOBOBA STONY LOAMY SAND, 2 TO 9 PERCENT SLOPES
TuB, TUJUNGA LOAMY SAND, 0 TO 5 PERCENT SLOPES
TvC, TUJUNGA GRAVELLY LOAMY SAND, 0 TO 9 PERCENT SLOPES
W, WATER

D:\Projects\Hogle\J007\Ex_Soils.mxd

Soil Associations

Exhibit 4.7-3

Rancho Cucamonga General Plan Update

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the mountains include debris flows and rock falls due to erosion of steep slopes, heavy rains, soil collapse, soil expansion, earthquake events, and flooding.

Landslides refer to the ground movement of unstable slopes, and include rock falls, deep failure of slopes, and shallow debris flows. Areas with steep slopes, adverse joints or deep weathering have a potential for failure. Potential landslides or slope failure are expected in areas with steep slopes at the northwestern corner of the City and in the SOI. Slopes steeper than 25 percent are found on Red Hill, along Cucamonga Creek at the City's northwest edge, and at the foothills north of the City.

While the metamorphic basement rock at the hillsides of the City is grossly stable, the steep slopes may cause rocks to fall during an earthquake or intense rainfall. Areas with rock fall hazards are confined to the hillsides at the northern edge of the City and the SOI.

The alluvial fans underlying the City were created by several stream systems from the eastern San Gabriel Mountains. These fans and washes represent debris flow events in the recent geologic period. The San Bernardino County Flood Control District maintains debris basins and flood-control facilities in the area to control debris flows and flooding hazards along the canyons, creeks and washes (ECI 2000).

The Santa Ana winds are strong winds that pass through the Cajon Pass from the mountains and the high desert areas north of the Pass. These winds have led to the deposition of loose soils in the south-central portion of the City. The dry, unconsolidated condition of loose soils makes them susceptible to collapse, hydroconsolidation, and erosion. Bare soils are also subject to blowsand hazards, especially during ground disturbance associated with grading, excavation, trenching, agricultural tilling, and other activities on open land. Wind erosion damages land and vegetation by causing soil loss, dryness, and deterioration of soil structure, nutrient and productivity loss, air pollution, and sediment transport and deposition.

Hydroconsolidation or soil collapse is the rearrangement of grains and loss of cementation of water-saturated soils, resulting in sudden and substantial settlement of soils. This often occurs in arid or semi-arid environments with wind laid sands and silts, alluvial fans and mudflow sediments recently deposited by wind erosion or flash floods. Hazards from collapsible soils are expected in Holocene alluvial fans and washes, and in areas overlain by windblown sands in the south-central section of the City.

Expansive soils are soils with a significant amount of clay particles that have the ability to shrink or swell with water. When these soils swell, they exert pressure on building foundations and may cause damage. Soils in the City and its SOI have relatively low amounts of clay and no soil expansion hazards are present.

Ground subsidence is the gradual settling or sinking of the ground, usually associated with the extraction of oil, gas, or ground water from below the ground surface, or the organic decomposition of peat deposits, with a resultant loss in volume. Subsidence has been observed in the cities of Pomona, Chino and Ontario, generally east of San Antonio Creek, but not in Rancho Cucamonga.

While subsidence may occur throughout an over-drafted (when groundwater pumping exceeds recharge of the underlying aquifer) valley, differential displacement and fissures are more readily apparent at and near the valley margin. Thus, damage from regional subsidence may be expected at the valley margins adjacent to the San Gabriel Mountains and Red Hill (ECI 2000).

4.7.3 THRESHOLDS OF SIGNIFICANCE

The following significance criteria are derived from Appendix G of the State CEQA Guidelines. A project would result in a significant adverse impact related to geology and soils if it would:

Threshold 4.7a: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (i) rupture of a known earthquake fault, as delineated on the most recent Earthquake Hazard Fault Map issued by the State Geologist for the area or based on other substantial evidence of a known fault, (ii) strong seismic ground shaking, (iii) seismic-related ground failure, including liquefaction, or (iv) landslides;

Threshold 4.7b: Result in substantial soil erosion or the loss of topsoil;

Threshold 4.7c: 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;

Threshold 4.7d: Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property; and/or

Threshold 4.7e: Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

4.7.4 GENERAL PLAN GOALS AND POLICIES

A number of goals and policies in the proposed 2010 General Plan Update address geology and soil issues, as well as seismicity in the City. Implementation of these goals and policies and their corresponding implementation actions would reduce seismic and geologic hazards to existing and future developments. These include:

Goal PS-5: Minimize the potential damage to structures and loss of life that may result from earthquakes and other seismic hazards.

Policy PS-5.1: Require geological and geotechnical investigations in areas of potential seismic or geologic hazards as part of the environmental and developmental review process for all structures proposed for human occupancy.

Implementation Action: *Continue to require development proposals to comply with City regulations concerning seismic or geologic hazards, and update the City's requirements related to the Red Hill Fault.*

Policy PS-5.2: Establish minimum setbacks for any structure proposed for human occupancy within the Special Studies Zones identified on the Fault Hazard Map, based on minimum standards established under State law and recommendations of the project geologist and City Engineer.

Implementation Action: *Ensure that development proposals adhere to minimum setback requirements required for Special Studies Zones, and as recommended by a project geologist and accepted by the City Engineer.*

Policy PS-5.3: Promote the strengthening of planned utilities through the Cucamonga Valley Water District's Master Plan, the retrofit and rehabilitation of existing weak structures and lifeline utilities, and the relocation or strengthening of certain critical facilities to increase public safety and minimize potential damage from seismic and geologic hazards.

Implementation Action: *Work with CVWD to expedite the upgrade of critical facilities.*

Policy PS-5.4: Continue to encourage the retrofit of unreinforced masonry buildings and identify other potentially hazardous buildings.

Implementation Action: *Continue to implement the requirements of the City's retrofit ordinance.*

Policy PS-5.5: Continue to incorporate the most recent seismic safety practices into City codes and project review processes.

Implementation Action: *Continue to monitor changes in building code requirements relative to seismic safety; update City ordinances as required in response to changes at the State level.*

Policy PS-5.6: During the environmental and developmental review process, promote alternative project designs that incorporate low-intensity land uses in areas determined to have significant seismic or geologic constraints.

Implementation Action: *Continue to require the submittal and review of geotechnical and seismic studies as part of the development review process to guide development proposals.*

Policy PS-5.7: Promote public awareness of seismic and geologic hazards within the City by requiring property transfer notifications.

Implementation Action: *Continue to make information readily available to realtors to assist with property title disclosure and affirmation of geotechnical and seismic hazards in ownership transfers, as required by State law. Establish educational signs along public trails where the trails cross fault zones.*

Goal PS-6: Minimize the potential damage to structures and loss of life that may result from geologic hazards.

Policy PS-6.1: Continue enforcement of the Hillside Development Guidelines to allow for prudent development and redevelopment of all properties located on slopes greater than 10 percent, and continue to preserve as open space properties located on slopes greater than 30 percent.

Implementation Action: *Continue to apply adopted standards to development within the hillsides, and update those standards as needed to reflect current industry standards as they may change.*

Policy PS-6.2: Support mitigation of existing development and private development projects located on unstable hillside areas, especially slopes with recurring failures, where City property or public right-of-way is threatened from slope instability, or where considered appropriate and urgent by the City Engineer, Fire, or Police Departments.

Implementation Action: *Continue to monitor and cause the implementation of mitigation measures incorporated into existing developments in the City designed to reduce impacts resulting from geologic hazards.*

Policy PS-6.3: Enact a geologic disaster recovery ordinance for use following severe winter storms that cause extensive landslide or erosion damage.

Implementation Action: *Adopt an ordinance to address a plan for a geologic disaster recovery.*

Policy PS-6.4: Implement a third-party review or similar system for geotechnical reports related to development or redevelopment to verify and document engineering conditions and properties associated with site materials.

Implementation Action: *Ensure that third-party or peer-review contracts with engineering professionals are maintained annually for consultation with City staff during the development review process and permit issuance.*

Goal PS-8: Minimize the risks associated with wind hazards.

Policy PS-8.3: Require agricultural operations and new construction to comply with City provisions for preventing soil erosion and excessive generation of dust where the property is vulnerable to these conditions.

Implementation Action: *Continue to enforce and routinely inspect that mitigation measures and City regulations related to dust control are being employed.*

Policy PS-8.4: Enforce contemporary dust control provisions in the City's Development Code.

Implementation Action: *Continue to enforce and routinely inspect that mitigation measures and City regulations related to dust control are being employed.*

4.7.5 STANDARD CONDITIONS OF APPROVAL

There are existing regulations that reduce geologic and seismic hazards to structures and infrastructure, as discussed above. Compliance by existing and future development and redevelopment with these standard conditions would reduce the potential for personal injury and property damage associated with geologic and seismic hazards in the City. Existing regulations that promote public safety during major earthquake events or that prevent exposure to local geologic hazards include those standard conditions listed below.

SC 4.7-1 In accordance with the Natural Hazards Disclosure Act, agents and sellers of real property located within a designated Alquist-Priolo Earthquake Hazard Zone shall disclose to any prospective purchaser that the property is within an Earthquake Hazard Zone pursuant to the requirements of the Act.

SC 4.7-2 In accordance with the Alquist-Priolo Earthquake Fault Zone Act, development within the designated Earthquake Fault Zone for the Red Hill Fault and Cucamonga Fault are required to prepare detailed geotechnical investigations for land subdivisions and developments of four units or more. The California Geological Survey (CGS) has developed general guidelines for fault hazard

evaluations, as contained in CGS Note 49. Compliance with the A-P Act would reduce hazards from surface rupture along the Red Hill and Cucamonga Faults.

SC 4.7-3 Development of projects pursuant to the proposed 2010 General Plan Update shall comply with the City's modifications to the Alquist-Priolo Earthquake Fault Zone Act that call for geotechnical investigations for all proposed structures designed for human occupancy within the expanded A-P Zones, including a zone along a splay of the Cucamonga Fault and another zone along the scarp at Red Hill. Also, geotechnical investigations are required for essential and critical facilities along the buried/uncertain segment of the Red Hill Fault, with a setback requirement of at least 50 feet.

SC 4.7-4 In accordance with the City's Building Regulations, as contained in Title 15, Buildings and Construction of the Rancho Cucamonga Municipal Code, which includes adoption of the 2007 California Building Code (CBC), all construction shall comply with the DBC and the amendments and exemptions to the CBC that the City has adopted. This Title requires site-specific investigation and establishes construction standards and inspection procedures to ensure that development does not pose a threat to public safety.

SC 4.7-5 In hillside areas, residential developments shall be graded and constructed consistent with the standards contained in the Hillside Development Regulations Section 17.24.070.

SC 4.7-6 Development projects pursuant to the proposed 2010 General Plan Update shall comply with the City's Grading Ordinance which is contained in Tital 19, Environmental Protection – Chapter 19.04 of the Rancho Cucamonga Municipal Code and requires the submission of grading plans for approval by the grading committee to ensure that grading activities retain the natural terrain; preserve significant topographic features; and limit construction on identified seismic or geologic hazard areas in the hillside areas of the City.

SC 4.7-7 Development of projects pursuant to the proposed 2010 General Plan Update shall comply with Title 8, Health and Safety – Chapter 8.16 of the Rancho Cucamonga Municipal Code which adopts the County's Soil Erosion Control Ordinance, as contained in Chapter 88.02 the San Bernardino County Development Code and requires individual property owners within designated soil erosion hazard areas to make reasonable efforts to prevent dust blowing from their property. Exhibit 4.7-4, Soil Erosion Hazard Area, shows the designated soil erosion hazard area in and near the City of Rancho Cucamonga. Dust-control measures are required for various ground-disturbing activities to prevent dust and debris from affecting adjacent properties during high wind conditions.

SC 4.7-8 All future building pads shall be seeded and irrigated for erosion control. Detailed plans shall be included in the landscape and irrigation plans to be submitted for Planning Department approval prior to the issuance of building permits.

SC 4.7-9 A geological report shall be prepared for an individual project by a qualified engineer or geologist and submitted at the time of application for grading plan check.

SC 4.7-10 The final grading plan, appropriate certifications and compaction reports shall be completed, submitted, and approved by the Building and Safety Official prior to the issuance of building permits.

SC 4.7-11 A separate grading plan check submittal is required for all new construction projects and for existing buildings where improvements being proposed will generate 50 cubic yards or more of combined cut and fill. The grading plan shall be prepared, stamped, and signed by a California registered Civil Engineer.

SC 4.7-12 A soils report shall be prepared by a qualified engineer licensed by the State of California to perform such work.

SC 4.7-13 As required under Article 4 of Title 3, Division 3, Chapter 1 of the San Bernardino County Code, the installation, use and maintenance of sewage holding tanks shall be regulated by the County Division of Environmental Health Services (DEHS) so that tanks do not affect public health or safety. The DEHS is responsible for issuing permits to construct and use septic tanks, as well as to routinely inspect the tanks for proper operation. Under this regulation, if a sewage collection line becomes available to a property served by a septic tank, the property owner shall connect to the sewer line within 90 days and to abandon the septic tank in accordance with County regulations.

SC 4.7-14 Development of projects pursuant to the proposed 2010 General Plan Update shall comply with Chapter 5 of the Santa Ana Region Basin Plan which states that the use of septic systems within the Santa Ana River watershed shall be limited to lots developed with no more than two dwelling units per acre and prohibits these systems in specific areas with water quality problems and where public sewer systems are in place.

SC 4.7-15 For projects using septic tank facilities, written certification of acceptability, including all supportive information, shall be obtained from the San Bernardino County Department of Environmental Health and submitted to the Building Official prior to the issuance of Septic Tank Permits, and prior to issuance of building permits.

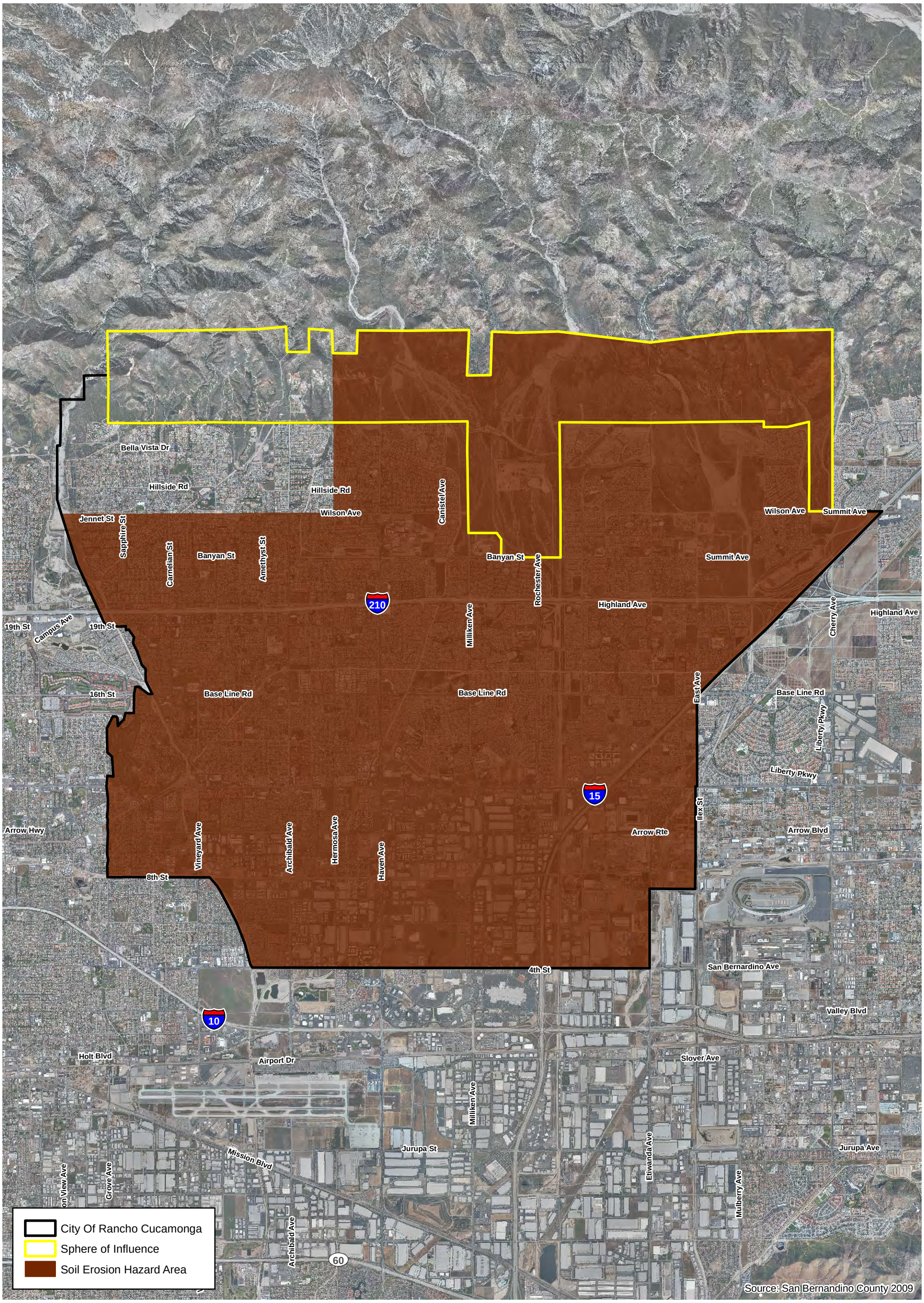
4.7.6 ENVIRONMENTAL IMPACTS

<u>Seismic Hazards</u>

Threshold 4.7a: Would the proposed General Plan Update expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (i) rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault, (ii) strong seismic ground shaking, (iii) seismic related ground failure, including liquefaction, or (iv) landslides?

Ground Rupture

Ground rupture refers to ground surface displacement that can result in structural, roadway, and pipeline damage. The Cucamonga Fault, running east-west along the northern City limits, has the potential for an M 7.0 earthquake that can lead to ground rupture along its fault traces.



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Soil Erosion Hazard Area

Exhibit 4.7-4

Rancho Cucamonga General Plan Update

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Ground displacements are estimated to be up to nine feet along the fault. In addition, the Red Hill Fault runs from the northeast around Etiwanda Avenue to the southwest around Red Hill. The Etiwanda Avenue Fault Scarp has potential for an M 6.5 earthquake and could cause ground rupture hazards to existing and planned developments along its trace. An earthquake on these faults has the potential for ground rupture hazards to future development and redevelopment (ECI 2000).

The Earthquake Fault Zone for the Etiwanda Avenue Fault Scarp is designated as Very Low Density Residential (up to two units per acre), Low Density Residential (two to four units per acre), and Neighborhood Commercial in the proposed Land Use Plan. This area consists of large lot residential uses and vacant land. Future development and redevelopment pursuant to the proposed 2010 General Plan Update that would be located on a fault trace of the Etiwanda Avenue Fault Scarp would be exposed to ground rupture hazards, including cracks on the ground surface, building foundation and structural damage, roadway cracks, and pipeline breaks.

As shown on Exhibit 4.7-2, the Earthquake Fault Zone for the Cucamonga Fault is largely in the SOI and is designated as Open Space, Flood Control/Utility Corridor, Hillside Residential, and Very Low Density Residential in the proposed Land Use Plan. This area consists of drainage channels, canyons, vacant land, water tanks and scattered residences. Again, future residential uses in areas within the Hillside Residential and Very Low Density Residential designations would expose persons and property to ground rupture hazards.

SC 4.7-1 requires disclosure of the presence of nearby faults during real estate transactions. SCs 4.7-2 and 4.7-3 require geotechnical investigations to determine the location of the fault trace and locate structures away from the fault trace. With the low density development allowed in these areas, opportunities to provide adequate setback from the fault trace would avoid ground rupture hazards to future developments. SC 4.7-4 requires the structural design of structures that would be located near the faults to include appropriate seismic design criteria. Compliance with these standard conditions will prevent the construction of buildings for human occupancy across the fault trace and would require setbacks from the trace, reducing ground rupture hazards to future development.

While not designated as an Earthquake Hazard Zone by the State, the inferred alignment of the Red Hill Fault across the City may pose ground-rupture hazards to future development and redevelopment. Similarly, unknown splays of the Cucamonga Fault present surface rupture hazards to future development in the northwestern corner of the City. Future development and redevelopment in these areas may be subject to hazards associated with surface rupture in the event of a major earthquake event on the Red Hill or Cucamonga Fault (ECI 2000).

Goal PS-5 of the Public Health and Safety Chapter seeks to minimize the potential damage to structures and loss of life that may result from earthquakes and other seismic hazards. Under this goal, Policy PS-5.1 considers the recently discovered splays of the Cucamonga Fault in the northwestern portion of the City as part of the Alquist-Priolo Earthquake Fault Zone for the Cucamonga Fault and an area with potential seismic hazards. The area along the southwestern segment of the Red Hill Fault is also considered an Alquist-Priolo Earthquake Fault Zone and an area with potential seismic hazards. These designations require future development and redevelopment planned in these zones to be subject to geotechnical investigations for structures designed for human occupancy to determine the exact location of the fault trace, to provide structural setbacks from the trace, and to recommend design approaches for structures and infrastructure to respond to probable earthquake magnitudes.

Policy PS-5.2 calls for minimum setbacks for active faults in the City to be at least 50 feet on either side, as based on the recommendations of the project geologist and City Engineer.

The buried/uncertain segment of the Red Hill Fault is also considered an area with potential seismic hazards where (1) a Potential Earthquake Fault Zone will be created and (2) special geologic investigations will be required for all essential and critical facilities to demonstrate that the site is not threatened by surface displacements from future earthquakes. Critical facilities include fire stations, schools, hospitals, dams and flood-control structures, bridges, communication centers, and other facilities that are needed during an emergency or that would pose unacceptable safety risks to the community if severely damaged.

Compliance with the following would reduce ground rupture hazards to future development and redevelopment: policies in the Public Health and Safety Chapter, the Natural Hazards Disclosure Act (SC 4.7-1), the A-P Act (SC 4.7-2), and the City's requirements for geotechnical investigations in the City-designated Earthquake Fault Zones (SC 4.7-3).

Impacts related to ground surface rupture would be less than significant; no mitigation is required.

Ground Shaking

Intense ground shaking in the City could occur during an earthquake event on the Cucamonga or Red Hill Fault. Also, the City of Rancho Cucamonga is located near two of California's most active faults: the San Andreas and San Jacinto Faults. Peak ground accelerations and ground shaking intensities are provided in Table 4.7-3. The San Andreas Fault has the probability of generating an M 7.3 earthquake, and the San Jacinto Fault has the probability of generating an M 6.7 earthquake (ECI 2000). Ground-shaking hazards associated with earthquake faults in the City, major faults in the region, and other nearby faults could pose hazards to future development and redevelopment under the proposed 2010 General Plan Update.

Damage to buildings is likely to occur with ground shaking, and would include structural damage to foundations; frames; walls and columns; and non-structural damage to windows, chimneys, and ceilings. Larger earthquakes and those of longer duration cause more damage, with some buildings performing more poorly than others (ECI 2000). Compliance with the CBC and the City's Building Regulations (SC 4.7-4) would allow new development and redevelopment to withstand ground shaking and avoid or reduce structural and non-structural damage.

Older buildings are generally more susceptible to ground shaking due to deterioration of building materials and because they were constructed under less stringent building codes. Redevelopment would allow for older buildings to be replaced with new ones that would be built to current building codes, including more stringent seismic design standards. Thus, beneficial impacts are expected with redevelopment under the proposed 2010 General Plan Update as vulnerable structures are demolished and new structures are more resistant to ground-shaking hazards.

In addition, Policy PS-5.3 of the Public Health and Safety Chapter calls for the strengthening of existing and planned facilities of the Cucamonga Valley Water District to increase public safety and to minimize potential damage from seismic hazards. Policy PS-5.4 calls for the retrofit of unreinforced masonry structures (URMs). Policy PS-5.6 promotes alternative project designs that incorporate low-intensity land uses in areas with seismic constraints. Policy PS-5.7 promotes public awareness of seismic hazards. Implementation of these policies would reduce hazards from ground shaking on existing and future developments in the City.

Impacts associated with ground shaking would be less than significant; no mitigation is required.

Liquefaction

During an earthquake, liquefaction may occur in areas with loose soils and high water tables. While no liquefaction hazards are known in the City, three small areas in the southwestern portion of the City north of Red Hill have perched water conditions and could be subject to liquefaction. Future development and redevelopment under the proposed Land Use Plan in these three areas would be exposed to liquefaction hazards. These hazards include soil settlement, loss of bearing capacity in foundation soils, and the buoyant rise of structures, leading to structural distress or failure. Excess hydrostatic pressure may also lead to sand boils, mud spouts, and seepage of water through ground cracks.

As required under SC 4.7-4, geotechnical investigations for new development and redevelopment would determine on-site geologic conditions and identify appropriate recommendations for earthwork, grading, slopes, foundations, pavements, and other necessary geologic and seismic design considerations. Compliance with SC 4.7-4 would identify potential for liquefaction hazards on individual development sites and the construction of buildings and infrastructure that ensures structural integrity to withstand liquefaction hazards

Impacts associated with liquefaction would be less than significant; no mitigation is required.

Landslides

Earthquake shaking frequently triggers rapid slides on unstable, sloping land. Rock falls and landslides from the San Gabriel Mountains would affect existing and planned developments at the northern end of the City and in the SOI. New development is expected to be limited in these areas per the Hillside Residential and Very Low Density Residential designations of the proposed Land Use Plan (refer to Policy PS-5.6 of the Public Health and Safety Chapter). These low density developments would limit the number of persons who would occupy and structures that would be built in these areas. It would also minimize disturbance of the slopes and decrease the potential for landslides. Compliance with the recommendations of project-specific geotechnical investigations (SC 4.7-4) and the City's Hillside Development Regulations (SC 4.7-5) would also preserve natural slopes and reduce landslide hazards.

Additionally, public awareness efforts under Policy PS-5.7 of the Public Health and Safety Chapter would promote emergency preparedness so that, in the event an earthquake, future residents of the area can take proper precautions to reduce personal injury and property damage.

Impacts associated with landslides would be less than significant; no mitigation is required.

Seismic Settlement

Seismic settlement may also occur, with differential settlement causing building damage over time. Future development and redevelopment on different soil foundations and at the base of hillsides may be subject to seismic settlement. This hazard can be reduced with proper site preparation involving densifying subsurface soils and designing foundations to accommodate a limited degree of differential settlement from seismic shaking.

Again, project-specific geotechnical investigations would identify the potential for soil settlement, including differential settlement, on individual sites and would provide appropriate recommendations for building and infrastructure design and construction to withstand soil

settlement. These include hillside cut and fill transition lots to be over-excavated, with fill depths beneath structures varying by no more than 100 percent. Compliance with the CBC and the City's Building Regulations and with the recommendations of project-specific geotechnical investigations (SCs 4.7-2, 4.7-3, and 4.7-4) would reduce hazards to less than significant levels.

Impacts associated with seismic settlement would be less than significant; no mitigation is required.

Impact 4.7a: Future development and redevelopment under the proposed 2010 General Plan Update would be exposed to seismic hazards, including surface rupture, ground shaking, liquefaction, landslides, and seismic settlement. Compliance with Goal PS-5 and its supporting policies in the Public Health and Safety Chapter of the proposed 2010 General Plan Update and with SCs 4.7-1 through 4.7-5 would reduce impacts to less than significant levels; no mitigation is required.

Soil Erosion

Threshold 4.7b: Would the proposed General Plan Update result in substantial soil erosion or the loss of topsoil?

The County of San Bernardino includes the City of Rancho Cucamonga in designated Soil Erosion Control Areas (shown in Exhibit 4.7-4). The City is also underlain by soils that have moderate to high erosion hazard and soil blowing hazards. Therefore, future development and redevelopment under the proposed 2010 General Plan Update could lead to soil erosion.

Ground Disturbance

Construction of future development and redevelopment would result in ground disturbance and changes in the local topography. Development sites featuring slopes may be altered to include manufactured slopes, berms, or retaining walls to account for slope changes and to create building pads. This would occur on larger sites and at the northern section of the City where the local topography features moderately sloping to steep slopes.

The City's Hillside Development Regulations (SC 4.7-5) and Grading Ordinance (SC 4.7-6) promote the retention of the natural topography and minimal grading to prevent erosion impacts, among other hazards. Compliance with these regulations would minimize ground disturbance and the potential for erosion of slopes by limiting the areas available for development. Conformance with SCs 4.7-5 and 4.7-6 would reduce impacts to less than significant levels; no mitigation is required.

Soil Erosion

The Delhi, Tujunga, Hanford, Cieneba, Ramona and Greenfield soils underlying the City have moderate to high erosion potential (USDA 1980). The location of these soils are shown in Exhibit 4.7-3. Grading and excavation activities for construction may lead to localized erosion, as wind and water carry loose soils off site. In general, erosion would likely occur in a southerly and southwesterly direction to match the general topography. Implementation of erosion-control measures as required by SC 4.7-7 and 4.7-8 would allow for the containment of soils on site and would prevent impacts on adjacent properties.

If ground disturbance activities occur during strong Santa Ana wind episodes, it is likely that wind erosion and fugitive dust would be generated. These would lead to the soiling of exterior

furniture and vehicles, nuisance to persons in outdoor areas, loose soils on roadways and driveways, reduction in visibility for drivers, and loss of topsoil.

Goal PS-8 of the Public Health and Safety Chapter seeks to minimize the risks associated with wind hazards. Policies PS-8.3 and PS-8.4 require agricultural operations and new construction to implement soil erosion and dust-control measures. Dust-control measures required by the County and City in Soil Erosion Control areas (SC 4.7-7) include pre-watering, prompt revegetation, and use of soil binders, which would reduce impacts associated with soil blowing and wind erosion. Compliance with the City's and County's erosion-control regulations would reduce soil erosion from future development and redevelopment.

In addition, future development and redevelopment projects are required to implement erosion-control Best Management Practices (BMPs) outlined in the Storm Water Pollution Prevention Plan (SWPPP) that would be developed and implemented as part of construction activities on sites greater than one acre, in compliance with the National Pollutant Discharge Elimination System (NPDES), as discussed further in Section 4.9, Hydrology and Water Quality. Compliance with SC 4.7-7 would prevent eroded soils from entering adjacent properties and would minimize sediments and loose soils from entering the City's roadways, storm drain systems, and adjacent areas.

Upon completion of development and redevelopment projects under the proposed 2010 General Plan Update, the loss of bare soils through the introduction of development including pavement, roads, buildings, and landscaping are expected to reduce soil erosion from both wind and water.

Assuming compliance with SCs 4.7-7 and 4.7-8, future development and redevelopment would not result in significant adverse impacts associated with substantial soil erosion or loss of topsoil. Impacts relating to erosion would be temporary and less than significant; no mitigation is required.

Impact 4.7b: Soil erosion hazards are present in the City and ground disturbance associated with the construction of new development and redevelopment projects under the proposed 2010 General Plan Update may lead to wind and water erosion. Compliance with Goal PS-5 and Goal PS-8 and their supporting policies in the Public Health and Safety Chapter of the proposed 2010 General Plan Update and SCs 4.7-5 through 4.7-8 would reduce erosion hazards. Impacts would be temporary and less than significant; no mitigation is required.

<u>Geologic Stability</u>

Threshold 4.7c: Would future development or redevelopment under the proposed General Plan Update 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?

Landslides

The hillside areas at the northern end of the City and in the SOI have the potential for slope failure, landslides, and/or erosion. Areas subject to slope instability contain slopes of 30 percent or greater. The City's Hillside Development Regulations prohibit development in areas with slopes over 30 percent (refer to SC 4.7-5). In compliance with SC 4.7-5, future development would not occur in these areas and would not be exposed to slope failure.

Landslides may be induced by seismic activity, heavy rains, or construction activity and may present a risk to human life and property located in or directly below the areas subject to the landslide. While no landslides have been recorded within the City limits, some have historically occurred within the SOI. Potential redevelopment areas on the steep slopes in the Red Hill area may be subject to slope instability, which may result in landslides. The bluffs along the upper Cucamonga Creek have a high potential for failure because of undercutting by flood flow from the stream. Future development in the northwestern section of the City along Cucamonga Creek may also be exposed to landslide hazards. Also, future development in the hillside areas in the SOI would be exposed to landslide hazards posed by slope failure in the San Gabriel Mountains.

Rock falls may also occur in the hillsides at the northern edge of the City and the SOI, while debris flows may occur along the canyons and creeks at the northern end of the City and in the SOI.

A limited amount of new development is expected in the hillside areas in the SOI, as allowed under the Hillside Residential and Very Low Density Residential designations of the proposed Land Use Plan (refer to Exhibit 3-3 in Section 3.0, Project Description). Development in these areas would be limited based on the low development densities allowed by the Hillside Residential and Very Low Density Residential designations; therefore, the number of persons and structures exposed to landslide hazards would also be limited. Additionally, development pursuant to the Hillside Residential and Very Low Density Residential designations would minimize slope disturbance and decrease the potential for landslides, rock falls, and debris flows.

Goal PS-6 of the Public Health and Safety Chapter seeks to minimize the potential damage to structures and loss of life that may result from geologic hazards. Supporting policies call for enforcement of the City's Hillside Development Guidelines (SC 4.7-5); mitigation for unstable hillside areas; a geologic disaster recovery ordinance; and third-party review of geotechnical reports. Implementation of policies PS-5.6 and PS-5.7 of the Public Health and Safety Chapter would minimize hazard exposure and promote emergency preparedness. Also, preparation of project-specific geotechnical investigations (SC 4.7-9), the City's Grading Ordinance (SC 4.7-6), and the City's Hillside Development Guidelines (SC 4.7-5) would preserve natural slopes and reduce landslide hazards. Specifically, the hillside development guidelines would minimize grading of natural slopes and require aesthetic treatments to improve the appearance of the hillsides and preserve the stability of the slopes. These measures include returning slopes to their natural appearance and steepness after grading. Preservation of natural slopes would reduce debris flow potential. SCs 4.7-10 and 4.7-11 also require final grading plans and grading plan checks to ensure adequate stability of on-site soils.

There are several debris basins located upstream of the City of Rancho Cucamonga that reduce storm water flows in canyons and storm drain channels. These basins reduce storm water volume and velocity, as well as debris flows. They include the Cucamonga Creek Debris Basin, the Day Creek Debris Basin, the Deer Creek Debris Basin, Alta Loma Basins 1 and 2, San Sevaine Basin No. 5, and the Etiwanda Debris Basin. These basins are owned and maintained by the San Bernardino County Flood Control District. The County's continued maintenance of debris basins would reduce hazards associated with debris flows from the mountains (Eke 2009). Therefore, compliance with SCs 4.7-5, 4.7-6, 4.7-9, 4.7-10, and 4.7-11 would ensure that there would be less than significant impacts related to landslides; no mitigation is required.

Soil Erosion

Hazards associated with soil erosion and blowing sand are discussed above, under Threshold 4.7b, and impacts are considered less than significant with implementation of applicable SCs. Compliance with the City's and County's soil erosion control regulations (SCs 4.7-7 and 4.7-8) would be required for future development and redevelopment under the proposed 2010 General Plan Update.

Collapsible Soils

Hazards from collapsible soils are present in areas overlain by Holocene alluvial deposits, along washes, and in areas overlain by windblown sands in the City's south-central section. Future development and redevelopment in these areas would be exposed to sudden and substantial soil settlement, potentially resulting in cracks in foundations and walls, along with tilting or sagging floors, cracking or separation in the structure, and non-functioning doors and windows.

Project-specific geotechnical investigations are expected to identify the presence of collapsible soils on individual development sites. Compliance with the City's Building Regulations for the preparation of geotechnical investigations (SC 4.7-4 and SC 4.7-9) would require the design and construction of structures and infrastructure to withstand anticipated levels of soil settlement, thereby reducing potential hazards related to collapsible soils to less than significant levels.

Similarly, differential displacement and fissures due to subsidence at the margins of the Chino Valley adjacent to the San Gabriel Mountains and Red Hill would be identified as part of individual geotechnical investigations, with appropriate recommendations to address these hazards. Compliance with the City's Building Regulations (SC 4.7-4) would reduce hazards to less than significant levels; no mitigation is required.

Impact 4.7c: Future development and redevelopment would be exposed to geologic hazards in the City and the SOI, which include landslides, soil erosion, and collapsible soils. Compliance with Goal PS-6 and its supporting the policies and policies PS-5.6 and PS-5.7 in the Public Health and Safety Chapter of the proposed 2010 General Plan Update and with SCs 4.7-1, 4.7-4, 4.7-5, 4.7-6, 4.7-9, 4.7-10, and 4.7-11 would reduce hazards to less than significant levels; no mitigation is required.

<u>Expansive Soils</u>

Threshold 4.7d: Would future development or redevelopment under the revised General Plan Update be located on expansive soil, as defined in Section 1802.3.2 of the 2007 California Building Code, creating substantial risks to life or property?

According to USDA's Soil Survey of San Bernardino County, Southwestern Part, the soils in the City have low shrink-swell potential (USDA 1980). However, site-specific geologic conditions must be evaluated based on soil borings, and geotechnical investigations shall be required for every development (SC 4.7-4 and 4.7-9). The geotechnical investigations would identify structural design criteria and construction recommendations to ensure the stability and integrity of structures and infrastructure that would be built, including potential for soil expansion and the soil expansion index that needs to be used in the engineering design. Compliance with the City's Building Regulations for the preparation of geotechnical investigation and compliance with appropriate construction standards for individual projects (SC 4.7-4 and 4.7-9) as well as

preparation of a soils report (SC 4.7-12) would ensure that impacts related to expansive soils would be less than significant; no mitigation is required.

Impact 4.7d: No soil expansion hazards are expected in the City and geotechnical and soils investigations for individual projects, as required pursuant to SCs 4.7-1, 4.7-9, and 4.7-12, will identify the soil expansion index of on-site soils that need to be considered in the design of structures and infrastructure. Impacts related to soil expansion would be less than significant; no mitigation is required.

Septic Tanks

Threshold 4.7e: Does the City have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

Where existing sewer lines are available, future development and redevelopment in the City would connect to the public sewer system (SC 4.7-13). However, the foothills in the SOI are largely undeveloped, and no sewer lines are present to serve this area. Future developments in the SOI in areas designated as Hillside Residential are likely to utilize on-site septic tank systems. Upon future annexation into the City, these areas would be required to connect to the public sewer system.

In areas overlain by Cieneba and Ramona soils, severe limitations to septic tank systems could pose hazards to surface and groundwater, and could cause runoff, erosion, and unstable soils. Cieneba soils are found in the foothills within the City's SOI and Ramona soils are found in scattered locations at the western section of the City (USDA 1980). Since the western section is served by the public sewer system, no septic tank limitations are proposed to be located on Ramona soils. Where underlying soils are Cieneba soils, septic tank limitations may occur.

According to the Santa Ana RWQCB's requirements (SC 4.7-14), maximum development densities are established for areas that are served by septic systems, thereby limiting the number of units on septic systems in the SOI. Adherence to these limitations, coupled with the limits on maximum development densities under the proposed Land Use Plan for this area, the SOI would not support a large number of septic tanks in this area. In addition, compliance with the County's septic tank regulations for design, use and maintenance of on-site septic systems (SC 4.7-15) would prevent the potential for surface or groundwater contamination where septic tanks are built. The County guidelines require soil percolation tests to determine suitability of septic tanks at planned locations. Thus, while septic tanks may be located in areas with soil limitations, the number of septic systems would be limited by RWQCB regulations; the density requirements of the proposed Land Use Plan; and the County's design, use and maintenance requirements. Assuming implementation of SCs 4.7-8 and 4.7-9, impacts would be less than significant; no mitigation is required.

Impact 4.7e: Septic tanks in areas with soil limitations area expected on sites overlain by Cieneba and Ramona soils, as found at the foothills in the SOI. Compliance with SCs 4.7-13, 4.7-14, and 4.7-15 would limit the number of septic systems and require them to be designed, used, and maintained properly. Impacts would be less than significant; no mitigation is required.

4.7.7 CUMULATIVE IMPACTS

Future development and redevelopment pursuant to the proposed 2010 General Plan Update and other development projects in the surrounding area would involve grading and excavation activities on individual sites, which would result in changes to the area's existing topography. Development sites that are relatively flat would remain flat, while hillside development would require cut and fill, manufactured slopes, and changes to the natural topography. Compliance with the CBC and the recommendations of individual geotechnical investigations would reduce geologic hazards to new development (SC 4.7-4).

Earthquake faults in the project area include the Cucamonga, San Andreas, San Jacinto, San Jose, Sierra Madre, Whittier-Chino-Elsinore, Elysian Park Thrust, Cleghorn, and North Frontal Faults, which would pose surface rupture hazards to developments proposed over the fault traces. However, compliance with the A-P Act and the City's A-P modifications would minimize surface rupture hazards to new development and redevelopment in and near the City (SCs 4.7-1 through 4.7-3).

Ground shaking hazards due to regional earthquake events could lead to the damage of buildings, parking lots, and utility lines, and the resulting fires, falling objects, and other structural hazards, which could cause property damage and personal injuries. These ground-shaking hazards are not unlike the potential hazards in other areas of the region. Depending on the magnitude of the earthquake, distance to the development site, underlying soil conditions, and strength of structures and infrastructure, ground-shaking hazards may be significant.

Future development and redevelopment in the City and the surrounding area would be designed and built in accordance with applicable standards in the CBC, including pertinent seismic design criteria. Existing buildings to be reused would be rehabilitated in accordance with the CBC and local building regulations (SC 4.7-4). This will allow structures to withstand ground shaking and to maintain hazards at acceptable levels.

Site-specific geologic hazards would be addressed by the geotechnical investigation required by individual cities and the County for each development proposal. This investigation would identify the geologic and seismic characteristics on a site and provide guidelines for engineering design and construction to ensure the structural integrity of proposed development. Compliance of individual projects with the recommendations of the geotechnical investigation would prevent hazards associated with unstable soils, landslide potential, lateral spreading, liquefaction, soil collapse, expansive soil, soil erosion, and other geologic issues. No cumulative adverse impacts are expected.

Future development and redevelopment would connect to a public sewer system where available, but those areas in the SOI which are under County of San Bernardino jurisdiction may utilize septic tanks or alternative wastewater disposal systems in areas without sewer service. Compliance with the RWQCB regulations and the County of San Bernardino's Septic Tank Regulations (SCs 4.7-13 through 4.7-15) would prevent hazards associated with soils incapable of supporting septic systems.

Impacts on geology by new development are not expected to be cumulatively significant, with compliance with geotechnical and engineering practices related to seismic and geologic hazard reduction, structural integrity, and soil management.

4.7.8 MITIGATION MEASURES

With implementation of the relevant goals and policies in the proposed 2010 General Plan Update and compliance with the standard conditions, no significant adverse impacts on geology and soils are expected. Thus, no mitigation measures are required.

4.7.9 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Seismic Hazards

Less Than Significant.

Soil Erosion

Less Than Significant.

Geologic Stability

Less Than Significant.

Expansive Soils

Less Than Significant.

Septic Tanks

Less Than Significant.

Cumulative Impacts

Less Than Significant.