5.6 GEOLOGY AND SOILS

The six components of the project analyzed herein are:

1) Adoption and implementation of the General Plan;
2) Adoption and implementation of the revised Zoning Code;
3) Adoption and implementation of the revised Subdivision Code;
4) Adoption and implementation of amendment to the Noise Code;
5) Adoption and implementation of the Magnolia Avenue Specific Plan (MASP); and
6) Adoption and implementation of the Citywide Design and Sign Guidelines.

Of the six project components, the Zoning Code, Subdivision Code, Noise Code Amendment, and the Citywide Design and Sign Guidelines address site planning, building design and community aesthetics, rather than physical changes to the land, and are thus, not considered to have impacts related to geology and soils and will not be analyzed further in this section. However, in regard to Geology and Soils, the Magnolia Avenue Specific Plan and General Plan address land use designations that could physically impact the land. The MASP land use is included within the General Plan document and thus, will not be analyzed further in this section. Impacts related to the adoption and implementation of the General Plan will be addressed herein.

The Geology and Soils Section of this EIR has been changed from the previously circulated EIR. In addition to the overall changes listed in the Project description Section of this EIR, background information and analysis was added for the Planning Area. Information for all topics within this Section was verified and updated as necessary.

Since an initial study was not prepared with the issuance of the Notice of Preparation, the focus of the following discussion is related to the potential impacts to people or structures due to seismic activity and seismic hazards; soil erosion; and unstable and unsuitable soils.

In addition to other reference documents, the following references were used in the preparation of this section of the EIR:

- Appendix E contains the Geologic and Seismic Technical Background Report performed by Wilson Geosciences, Inc., which includes detailed information regarding the City of Riverside's geologic conditions.
- California Department of Conservation, Division of Mines and Geology, *Fault Rupture Hazard Zones in California,* revised 1997, Supplements 1 and 2 added 1999.
- California Geological Survey, Alquist-Priolo Earthquake Fault Zones. (Available at http://www.consrv.ca.gov/CGS/rghm/ap/)
- County of Riverside, *Riverside County Integrated Project General Plan,* October 2003.
- P&D Environmental, *Public Safety Existing Conditions Report,* September 2003.
- U.S Department of Agriculture Soil Conservation Service, *General Soil Map, Riverside and Western Part of Riverside Counties, California*, compiled 1971.

SETTING

Topography and Geology

The City of Riverside lies within the northern end of the Peninsular Ranges, approximately 12 miles south of the intersection with the Transverse Range. The Santa Ana Mountains are approximately 15 miles south and southwest of the City, while the San Jacinto Mountains are approximately 10 miles east and northeast of the City of Riverside. The San Bernardino Mountains are about 20 miles north of the City.

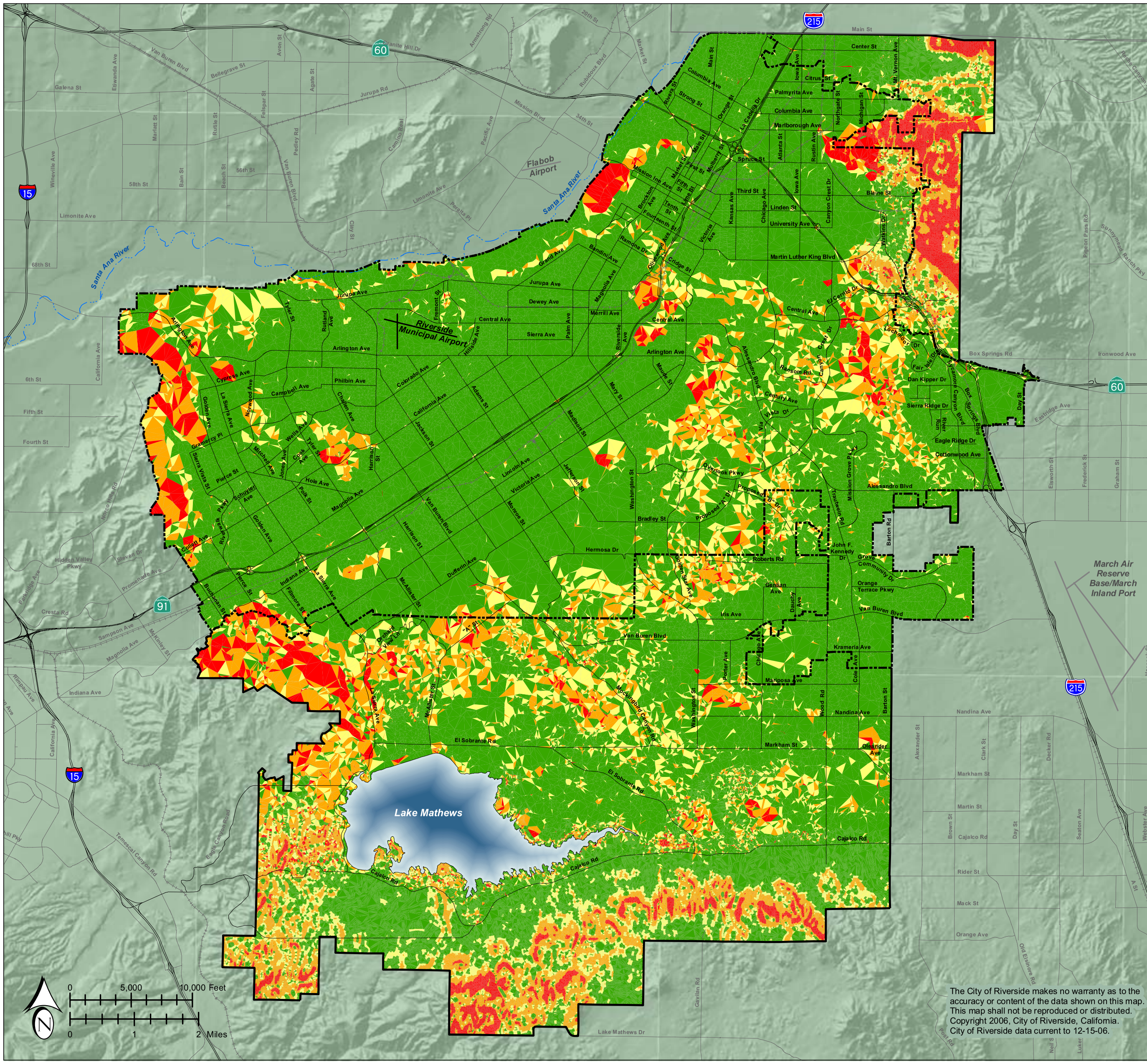
A series of hills and small mountains surround the Planning Area. These hills and mountains are between the two dominant San Jacinto and Santa Ana mountain ranges. They include La Sierra/Norco Hills, Mt. Rubidoux, Box Springs Mountains, Sycamore Canyon and the many smaller ranges south of the City. Within the City, surface elevations range from about 700 feet above mean sea level (amsl) near the Santa Ana River to over 1,400 feet amsl west of La Sierra. The highest point in the southern Sphere of Influence is Arlington Mountain, standing at 1,853 feet amsl approximately 1.5 miles northwest of Lake Mathews. Additionally, portions of Box Springs Mountain Reserve located in the northern Sphere of Influence area extend as high as 2,000 feet.

Mountains and hills typically have slopes of 15 to 50 percent; valley and basin areas usually have slopes of less than 15 percent. Within the City of Riverside, most natural slopes are very flat, generally less than 15 percent, with some slopes ranging from 15 to 25 percent in eastern and western portions of the City of Riverside. Many slopes in the Sphere of Influence are steeper than within the City. Areas around Lake Mathews and the Box Springs Mountain are much steeper. Slopes along a substantial portion of the area west and south of Lake Mathews and along the northeastern line exceed 30 percent and are depicted on **Figure 5.6-1, Areas Underlain by Steep Slope**.

The Planning Area and much of the hills in the Planning Area are made up of granite and adamellite (g_{ra}), mesozoic granitic rock (g_r), granodiorite(g_{rg}), mesozoic basic intrusive rocks (b_i), and alluvium (Q_{al}) (located around the Santa Ana River). Most are dated from the Mesozoic period, except for the alluvium, which dated from the Quaternary.

Seismic Activity

No Fault-Rupture Hazard Zone, as designated by the California Department of Conservation, Alquist-Priolo Earthquake Fault Zone (1999) exists within the Planning Area. However, the City is located in a region with several active fault lines. **Figure 5.6-2, Faults and Fault Zones** shows the most significant faults affecting the Planning Area, including the San Jacinto, and Elsinore faults. The San Andreas fault lies outside of the Planning Area in the County of San Bernardino.



ENVIRONMENTAL IMPACT REPORT

L E G E N D

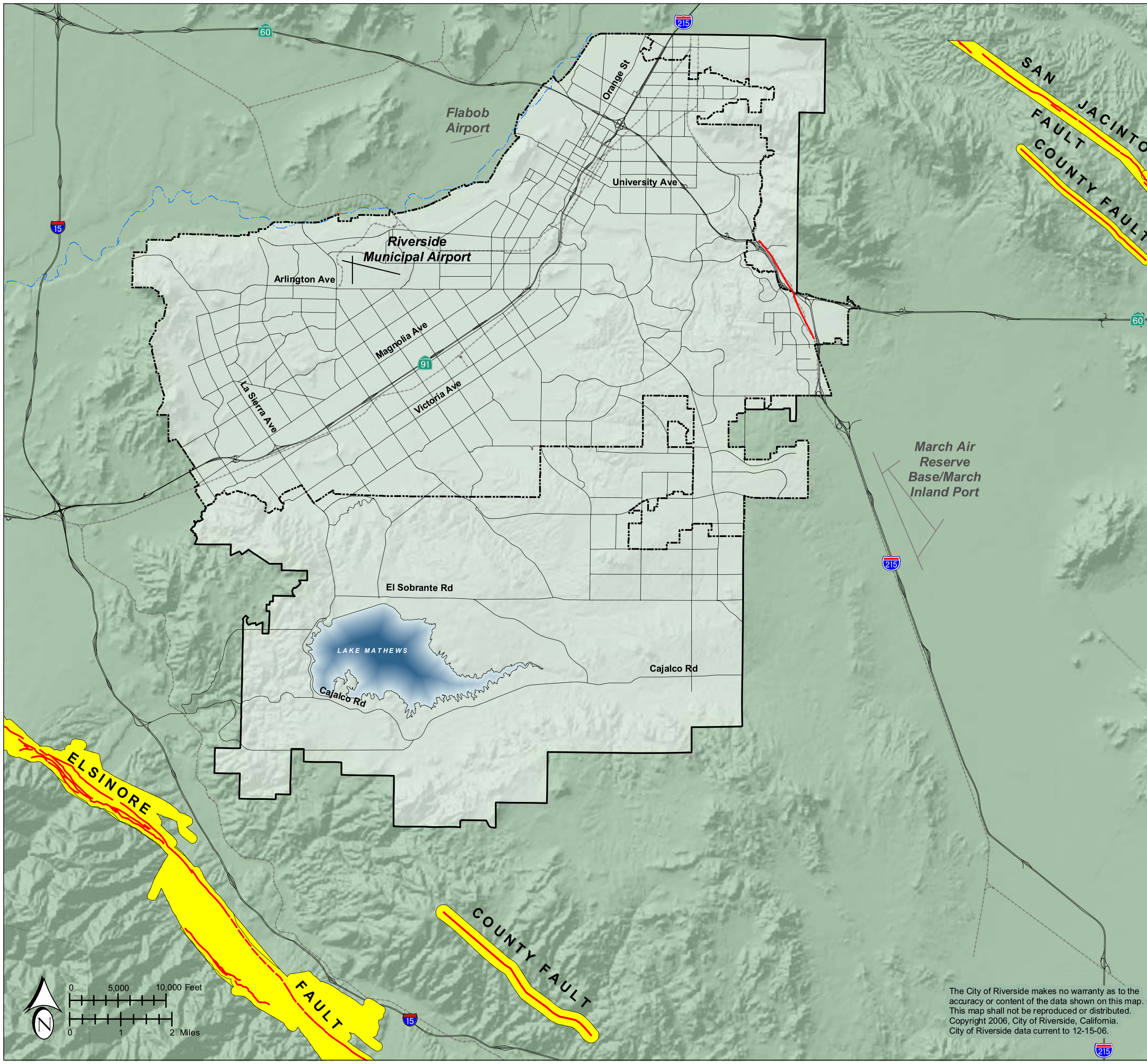
SLOPE

- 0 -10%
- 10-15%
- 15-30%
- 30%+
- RIVERSIDE CITY BOUNDARY
- RIVERSIDE PROPOSED SPHERE OF INFLUENCE

SOURCE: RIVERSIDE COUNTY GIS DATA

Figure 5.6-1

AREAS UNDERLAIN BY STEEP SLOPE



CITY OF RIVERSIDE
ENVIRONMENTAL IMPACT REPORT

LEGEND

- FAULT LINES
- FAULT ZONES
- RIVERSIDE CITY BOUNDARY
- RIVERSIDE PROPOSED SPHERE OF INFLUENCE

SOURCE: RIVERSIDE COUNTY GIS DATA

Figure 5.6-2
FAULTS AND FAULT ZONES

The San Andreas Fault is at its closest point 11 miles from Downtown Riverside, abutting the San Bernardino Mountains. The San Andreas Fault extends 600 miles from Eureka in Northern California's Humboldt County south to the Mexican border. The San Andreas Fault is estimated to have the capability of producing up to an 8.3 magnitude (M) earthquake. The San Jacinto fault runs as close as 7 miles from Downtown. This fault runs more than 125 miles, from northwest of El Centro in Imperial County to northwest of San Bernardino, passing through the intersection of Interstates 10 and 215, the City of Loma Linda and the Box Springs Mountains. This fault is estimated to have the capability of producing up to a 7.0M earthquake. The Elsinore fault passes within 13 miles of Downtown, extending approximately four miles west of Lake Mathews and Corona and south into the City of Lake Elsinore. This northwest-southwest trending fault is estimated to have the capability of producing up to a 6.0M earthquake.

Although no active or potentially active fault has been mapped at the surface within the City, one northwest-southeast trending unnamed fault is projected toward the southwest corner of the Planning Area south of Lake Mathews in the southern Sphere of Influence. Additional faults are predicted to occur south of Lake Mathews, west of Lake Mathews near Mockingbird Canyon, and near the Box Springs Mountains.

Seismic Hazards

People and structures in the Planning Area are subject to risks from the hazards associated with earthquakes. Seismic activity poses two types of hazards: primary and secondary. Primary hazards include ground rupture, ground shaking, ground displacement, and subsidence and uplift from earth movement. Primary hazards can induce secondary hazards such as ground failure (lurch cracking, lateral spreading, and slope failure), liquefaction, water waves (tsunamis and seiches), movement on nearby faults (sympathetic fault movement), dam failure, and fires. Potential seismic hazards affecting the Planning Area include ground shaking, ground failure, and liquefaction.

Seismic shaking is the geological hazard that has the greatest potential to severely impact the Planning Area, given that the area is located near several significant faults that have the potential to cause moderate to large earthquakes. According to Geotechnical Report, prepared by Wilson Geosciences, Inc., the Planning Area could experience ground acceleration greater than 35 to 43 percent. These probabilistic ground motion values for the Planning Area are within the limits for current structural design (CBC/UBC) for non-critical structures, including most residential, commercial, and industrial buildings.

The major geologic hazards associated with ground shaking include liquefaction and ground failure. Liquefaction occurs when ground shaking causes water-saturated soils to become fluid and lose strength. Liquefaction historically has been responsible for significant damage, creating problems with bridges, buildings, buried pipes and underground storage tanks. The City is underlain by areas susceptible to varying degrees of liquefaction, ranging from moderate to very high. Liquefaction hazards are particularly significant along watercourses. The primary liquefaction areas are within the City limits including the area along the Santa Ana River, a broad area south and west of the Riverside Municipal Airport, a portion in western Riverside spanning La Sierra Avenue and a smaller area along the City's southern boundary. Most of the southern Sphere of Influence area is not susceptible to liquefaction, except for alluvial drainages leading into Lake Mathews. **Figure 5.6-3, Generalized Liquefaction Zones** illustrates the areas within the City susceptible to liquefaction hazards. The characteristics of the various liquefaction hazard zones are detailed in Table 5.6-A.

Table 5.6-A
General Liquefaction Zones

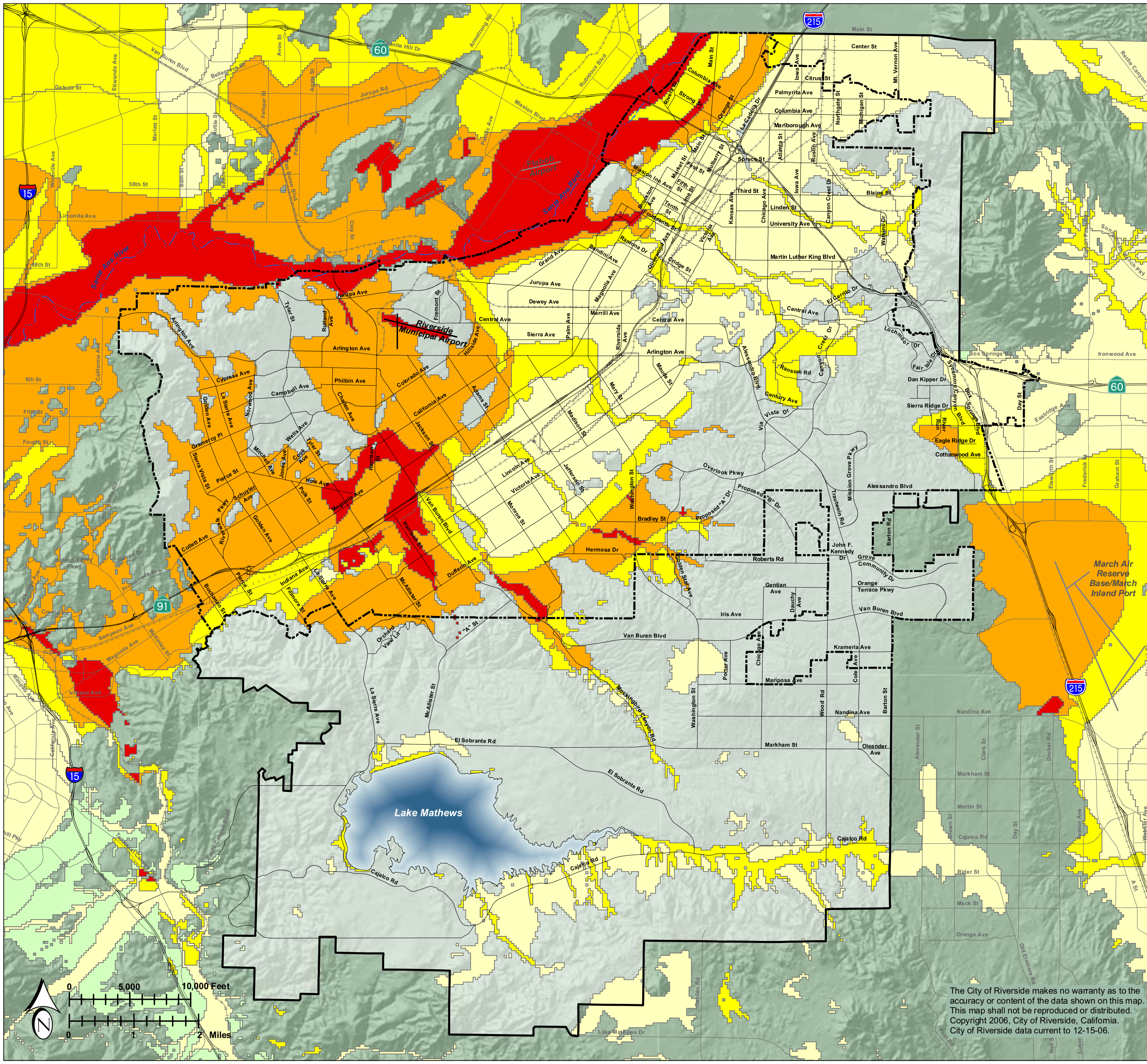
Rank	Groundwater Depth	General Sediment Type
High	Less than 30 feet	Very Susceptible
Moderate	Less than 30 feet 30-50 feet	Susceptible Very Susceptible
Low	Greater than 30 feet	Susceptible
Very Low	30-50 feet 50-100	Susceptible Very Susceptible
Extremely Low	50-100 feet	Susceptible
None	Greater than 100 feet No Data	Susceptible Bedrock

Notes:
1 Groundwater depth is based on the historic high measurement.
2 Very susceptible sediment type includes generally granular Holocene sediments; susceptible includes generally granular Pleistocene sediments.
Source: County of Riverside 2003 RCIP EIR

Strong ground motions can also worsen existing unstable slope conditions, particularly if coupled with saturated ground conditions. Seismically induced landslides and rockfalls would be expected in the northeastern area associated with the Box Springs Mountain, the southern and southwestern areas associated with the Cajalco Ridge and La Sierra Hills, the western area associated with the Norco Hills and at Mt. Rubidoux adjacent to the Santa Ana River in the event of a major earthquake or human activity. Factors contributing to the stability of slopes include slope height and steepness, engineering characteristics of the earth materials comprising the slope, and intensity of ground shaking. It is estimated that a ground acceleration of at least 0.10 g in steep terrain is necessary to induce earthquake-related rockfalls, although exceeding this value does not guarantee that rockfalls will occur. Because there are several faults capable of generating peak ground accelerations of over 0.10 g in Riverside County, there is a high potential for seismically induced rockfalls and landslides to occur. The areas of high susceptibility to seismically induced landslides and rockfalls correspond to steep slopes in excess of 30 percent as depicted on **Figure 5.6-1, Areas Underlain by Steep Slope.**

Soils

The Planning Area contains the following general soil associations: Cajalco-Temescal-Las Posas, Traver-Domino-Willows, Cieneba-Rock Land-Fallbrook, Monserate-Arlington-Exeter and Hanford-Tujunga-Greenfield associations. Soil associations in the Planning Area are generally well-drained sandy loams that are moderately deep. The specific soil types generally found in the Planning Area are listed on **Figure 5.6-4, Soils**. The characteristics of the various soil types are detailed in Table 5.6-B.



CITY OF RIVERSIDE
ENVIRONMENTAL IMPACT REPORT

LEGEND

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH
- RIVERSIDE CITY BOUNDARY
- RIVERSIDE PROPOSED SPHERE OF INFLUENCE

SOURCE: 1976 RIVERSIDE COUNTY SEISMIC SAFETY ELEMENT TECHNICAL REPORT, PREPARED BY ENVICOM CORPORATION FOR THE COUNTY OF RIVERSIDE. THIS DATA WAS DIGITIZED FROM MAPS PROVIDED BY ENVICOM.

Figure 5.6-3

GENERALIZED LIQUEFACTION ZONES

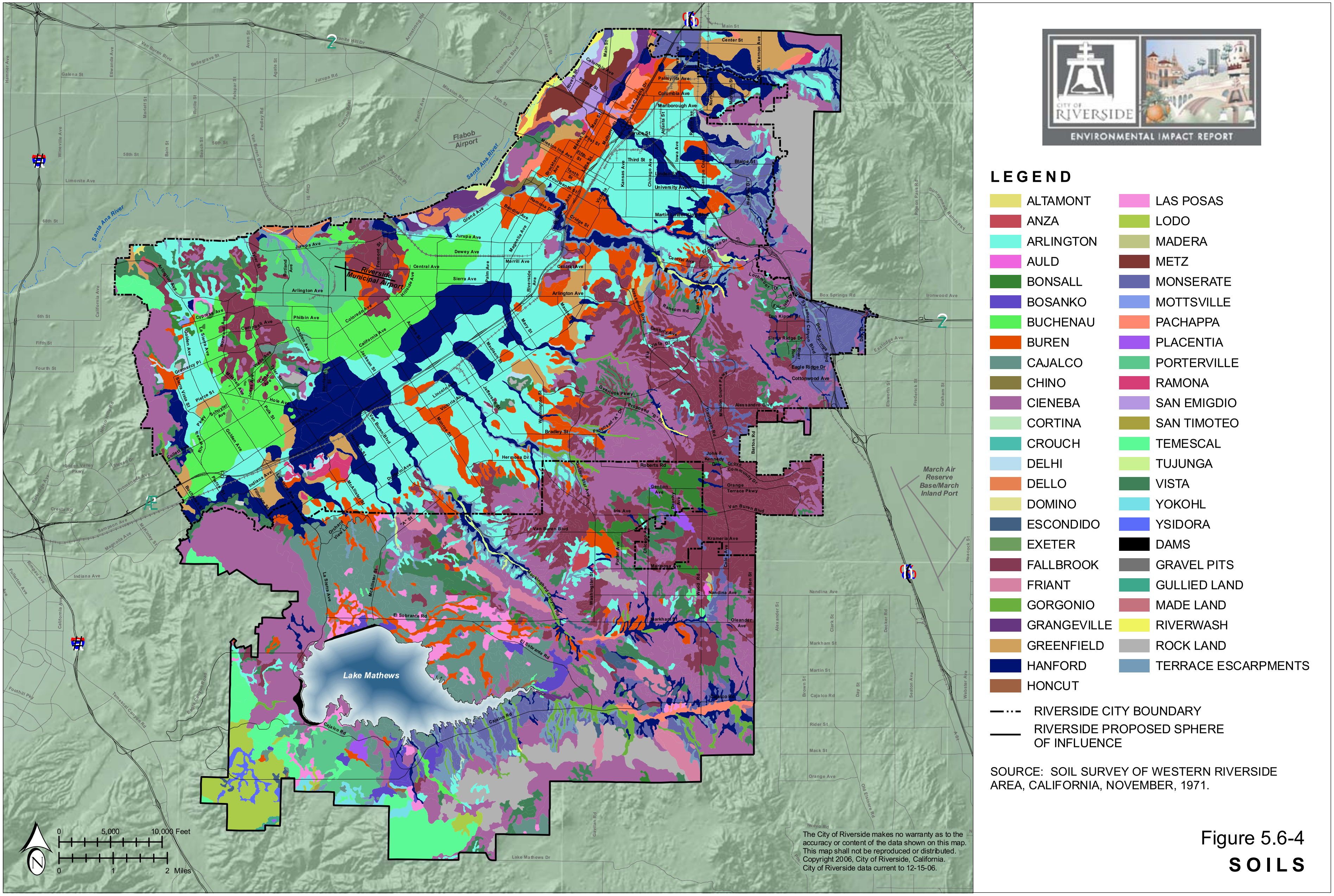


Figure 5.6-4
SOILS

Table 5.6-B
Soil Types

Soil Type	Map Symbol	Erosivity	Permeability	Shrink-Swell Potential	Depth (inches)	Texture
Altamont	AaD	Slight to Moderate	Slow	High	0-23	Clay; cobbly in places
Anza	AdC	Slight to Moderate	Moderately rapid	Low	0-69	Fine sandy loam
Arlington	AnC, AnD, AoA, AoC, AoD, ApB, ArB, ArD	Slight to moderate	Moderately slow	Low to Moderate	0-24	Loam
					24-36	Weakly cemented sandy loam
					36-60	Loamy coarse sand
Auld	AuD	Moderate to High	Moderately slow	Moderate to High	0-28	Clay
					28-44	Loam
Bonsall	BdC, BdD	High	Very slow	Moderate	0-13	Loam
					13-30	Clay
Bosanko	BfC, BfD	Slight to Moderate	Moderately rapid	High	0-32	Clay
Buchenau	BhA, BhC, BkC2	Moderate	Moderately slow over very slow	Moderate	0-52	Loam
Buren	BuC2, BuD2, BvD3, BxC2	Slight to Moderate	Moderately slow over very slow	Moderate	0-37	Clay loam
					37-52	Weakly cemented loam
Cajalco	CaC2, CaD2, CaF2, CbD2, CbF2	High	Moderate	Moderate	0-13	Fine sandy loam
					13-22	Loam
Chino	Cf	Slight	Moderately slow	Moderate	0-60	Silty clay loam
Cieneba	ChC, ChD2, ChF2, CkD2, CkF2, Cr	High	Rapid	Low	0-22	Gravelly coarse sandy loam
Cortina	ClC	High	Rapid	Low	0-60	Cobbly and gravelly loamy sand and sandy loam
Crouch	CyE2	Slight to Moderate	Moderate	Low	0-28	Sandy loam
Delhi	DaD2	Water: Slight Wind: High	Rapid	Low	0-64	Fine sand and loamy fine sand
Dello	DgB, DmA, DoA, DrA	Slight	Moderately rapid to rapid	Low	0-62	Loamy fine sand, loamy sand and sand
Domino	Du	Slight	Moderate over very slow	Moderate	0-27	Silt loam
					27-36	Loam, weakly to strongly cemented with lime
					36-63	Loam
Escondido	EcC2, EcD2, EcE2, EfF2	Moderate	Moderate	Low	0-34	Very fine sandy loam
Exeter	EnC2, EpC2	Slight	Moderate	Moderate	0-16	Sandy loam and very fine sandy loam
					16-37	Loam
					37-50	Indurated hardpan
					50-60	Coarse sandy loam
Fallbrook	FaD2, FkD2, FaE2, FbC2, FbF2, FcD2, FcF2, FfC2	Moderate	Moderate	Moderate	0-14	Sandy loam
					14-24	Sandy clay loam
					24	Weathered granite

Table 5.6-B
Soil Types

Soil Type	Map Symbol	Erosivity	Permeability	Shrink-Swell Potential	Depth (inches)	Texture
Friant	FwE2, FyE2, FyF2	Moderate	Moderate	Low	0-13	Fine sandy loam
Gorgonio	GhC, GhD, GkD, GlC	Slight to Moderate	Rapid	Low	0-20	Loamy sand
					20-60	Gravelly loamy sand
					0-60	Gravelly or cobbly loamy sand
Grangeville	GoB, GtA, GuB, GwA, Gs	Slight	Rapid to moderate	Low	0-60	Loamy fine sand, fine sandy loam, sandy loam, coarse sand and fine sandy loam.
Greenfield	GyA, GyC2, GyD2	Slight to Moderate	Moderate	Low	0-43	Sandy loam
					43-60	Loam
Hanford	HaC, HcA, HcC, HcD2, HfD, HgA	Slight to Moderate	Moderately rapid to rapid	Low	0-40	Coarse sandy loam
					40-60	Loamy sand and gravelly coarse sand
					0-30	Cobbly coarse sandy loam
					30-60	Loamy coarse sand
Honcut	Hnc, HuC2	Moderate	Moderate	Low	0-60	Sandy loam that is cobbly in places
Las Posas	LaC, LaD2, LaE3, LcD2	Moderate	Moderate	High	0-12	Loam, clay loam
					12-32	Clay
					32	Weathered gabbro
Lodo	LoF2, LpF2	High to Very High	Moderate	Low	0-8	Gravelly loam
Madera	MaB2	Slight	Very slow	High	0-19	Fine sandy loam
					19-26	Clay
					26-37	Indurated hardpan
					37-62	Loam
Metz	MfA	Slight	Rapid to very rapid	Low	0-30	Loamy fine sand
Monserate	MmB, MmC2, MmD2, MmE3, MnD2, MnE3	Moderate	Moderately slow over very slow	Moderate	0-10	Sandy loam
					10-28	Sandy clay loam
					28-45	Indurated hardpan
Mottsville	MoC	Moderate	Rapid	Low	24-60	Loamy sand
Pachappa	PaA, PaC2	Slight to Moderate	Slow to Moderate	Low to Moderate	0-20	Fine sandy loam
					20-63	loam
Placentia	PIB, PID	Moderate	Very slow	High	0-18	Fine sandy loam and loam that is cobbly in places
Porterville	PrD, PtB, PvD2	Slight	Slow	High	0-66	Clay that is cobbly in places

Table 5.6-B
Soil Types

Soil Type	Map Symbol	Erosivity	Permeability	Shrink-Swell Potential	Depth (inches)	Texture
					0-36	Clay
					36	Calcareous marl or sandstone
Ramona	RaB2, RaB3, RaD2, RdD2, RdE3, ReC2, RfC2	Moderate	Moderately slow	Low	0-23	Sandy loam
					23-68	Sandy clay loam
					68-74	Fine sandy loam
					0-12	Sandy loam
					12-36	Clay loam
					36	Calcareous consolidated sediment
San Emigdio	SeC2, SfA, SnE2	Moderate	Moderate to moderately rapid	Low	0-60	Fine sandy loam
					0-40	Fine sandy loam
San Timoteo	SmE2	High	Moderate	Low	0-22	Loam
Temescal	TaF2, TbF2	High	Moderate	Moderate	0-17	Loam
					17	Fractured Latiteporphyry
Tujunga	TuB, TvC, TwC	Water: slight, Wind: high	Rapid	Low	0-10	Loamy sand
					10-60	Sand
					0-60	Gravelly loamy sand
Vista	VsC, VsD2, VsF2, VtF2, Vr	Moderate	Moderately rapid	Low	0-24	Coarse sandy loam that is gravelly in places
					24	Weathered granodiorite
Yokohl	YbC, YbD2, YkE2	Moderate	Very slow	High	0-10	Loam that is cobbly in places
					10-26	Clay
					26	Indurated hardpan
Ysidora	YrD2, YsE2	Moderate	Slow to very slow	Moderate	0-12	Very fine sandy loam
					0-12	Gravelly very fine sandy loam

Source: U.S. Department of Agriculture, 1971

Soil Erosion

Soil erosion is the process by which soil particles are removed from a land surface by wind, water, or gravity. Most natural erosion occurs at slow rates; however, the rate of erosion increases when land is cleared or altered and left in a disturbed condition. The primary factors that influence erosion include soil characteristics, vegetative cover, topography, and climate. Soil characteristics that determine the erosivity of a soil are particle size and gradation, organic content, soil structure, and soil permeability. Soils with a high proportion of silt and very fine clays are generally the most erodible. Organic matter creates a favorable soil structure, improving soil stability and permeability, which increases the soil's capacity for the infiltration of water, delays the start of erosion, and reduces the amount of runoff. In addition, the less permeable the soil, the higher the likelihood for erosion. Vegetative cover assists in erosion control by shielding the soil surface from the impact of falling rain or blowing wind. Vegetation slows the velocity of runoff, permits greater infiltration, maintains the soil's capacity to absorb water, and holds soil particles in place.

Topography and the length and steepness of slopes, are crucial to determining the volume and velocity of runoff. As slope length and/or steepness increases, the rate of runoff increases and the potential for erosion is magnified. Climate is a fundamental factor affecting the potential for soil erosion. When and where precipitation is frequent, intense, or prolonged, the potential for soil erosion is increased.

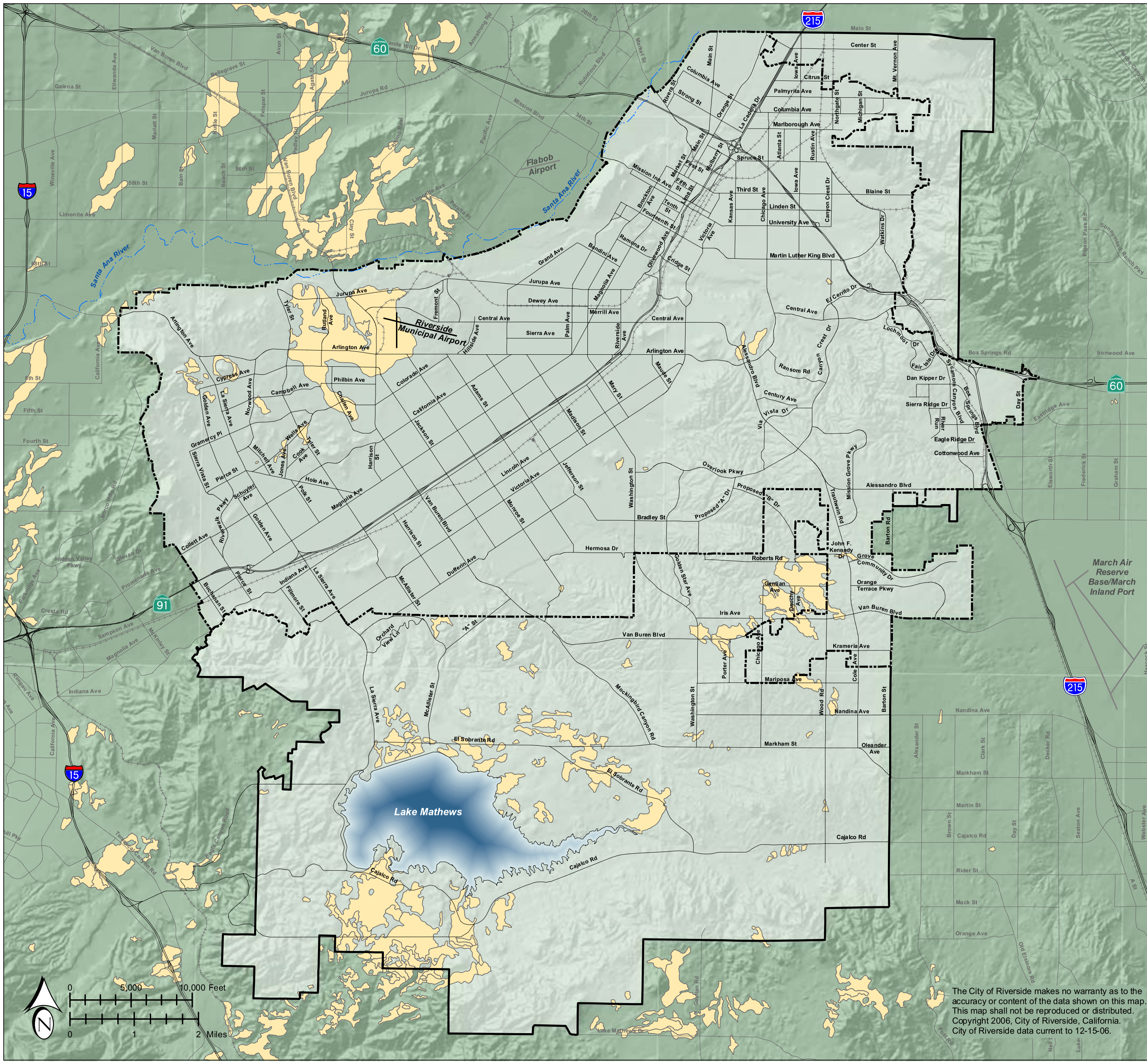
The likelihood of a soil to erode is indicated in under "Erosivity" in Table 5.6-B. The City is underlain by areas susceptible to varying degrees of erosion, ranging from slight to very high. Most soils in the Planning Area are described as being well drained with slow to moderate runoff and slow to moderate permeability. Planning Area slopes greater than 30 percent (see **Figure 5.6-1, Areas Underlain by Steep Slope**) are subject to a higher degree of erosion.

Soil Permeability

Soil permeability is the ability of a soil to transmit air or liquid. The rates given in Table 5.6-B are for soils as they occur in place within the Planning Area. The use a septic tank filter fields is impacted by soil limitations. Within the Planning Area, the limitations range from slight to severe. Criteria for the use of a septic system is generally in areas where the water table is deep and the soil has moderate permeability.

Expansive Soil

Expansive soils are soils with a significant amount of clay particles that have the ability to give up water (shrink) or take on water (swell). Fine-grained soils, such as silts and clays, may contain variable amounts of expansive clay minerals. When these soils swell, the change in volume exerts significant pressures on loads that are placed on them. This shrink/swell movement can adversely affect building foundations, often causing them to crack or shift, with resulting damage to the buildings they support. The shrink-swell potential for soils located in the Planning Area will have to be determined on a site-by-site basis. **Figure 5.6-5, Soils with High Shrink-Swell Potential** shows general areas where the potential for shrink/swell occur. Table 5.6-B identifies the soil types with shrink-swell potential, ranging from low to high.



CITY OF RIVERSIDE
ENVIRONMENTAL IMPACT REPORT

L E G E N D

SOILS WITH HIGH SHRINK SWELL POTENTIAL

SOIL TYPES INCLUDED:

ALTAMONT: AaD, AaE2, AaF

AULD: AuD

BONSALL: BdC, BdD

BOSANKO: BfC, BfD

LAS POSAS: LaC, LaD2, LaE3, LcD2

MADERA: MaB2, MaD2, MbC2

PLACENTIA: PlB, PlD, PmE

PORTERVILLE: PrD, PtB, PvD2

VALLECITOS, THICK SOLUM VARIANT: VeF2

YOKOHL: YbC, YbD2, YkE2

RIVERSIDE CITY BOUNDARY

RIVERSIDE PROPOSED SPHERE OF INFLUENCE

SOURCE: SOIL SURVEY OF WESTERN RIVERSIDE AREA, CALIFORNIA, NOVEMBER, 1971

Figure 5.6-5

SOILS WITH HIGH SHRINK-SWELL POTENTIAL

Thresholds of Significance

The City of Riverside has not established local CEQA significance thresholds as described in Section 15064.7 of the State CEQA Guidelines. Therefore, significance determinations utilized in this Section are from Appendix G of the CEQA Guidelines. A significant impact will occur if implementation of the Project:

- exposes people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: 1) rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist or based on other substantial evidence of a known fault; 2) strong seismic ground shaking; 3) seismic-related ground failure, including liquefaction; or 4) landslides;
- results in substantial soil erosion or the loss of topsoil;
- is 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;
- is located on expansive soil as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property; or
- Has 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.

Related Regulations

Uniform Building Code

The Uniform Building Code (UBC) is published by the International Conference of Building Officials. It forms the basis of about half the State building codes in the United States, including California's, and has been adopted by the State legislature together with Additions, Amendments, and Repeals to address the specific building conditions and structural requirements in California.

California Building Code

California Code of Regulations (CCR), Title 24, Part 2, the California Building Code (CBC), provides minimum standards for building design in the State, consistent with or more stringent than UBC requirements. Local codes are permitted to be more restrictive than Title 24, but are required to be no less restrictive. Chapter 16 of the CBC deals with General Design Requirements, including regulations governing seismically resistant construction (Chapter 16, Division IV) and construction to protect people and property from hazards associated with excavation cave-ins and falling debris or construction materials. Chapter 18 and Appendix Chapter 33 deal with site demolition, excavations, foundations, retaining walls, and grading, including requirements for seismically resistant design, foundation investigations, stable cut and fill slopes, and drainage and erosion control.

Seismic Hazards Mapping Act

California Geological Survey (CGS) provides guidance with regard to seismic hazards. Under CGS *Seismic Hazards Mapping Act*, seismic hazard zones are identified and mapped to assist local governments in land use planning. The intent of this Act is to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, CGS Special Publication 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.

National Pollution Discharge Elimination System (NPDES)

A Stormwater Pollution Prevention Plan (SWPPP) prepared in compliance with a National Pollutant Discharge Elimination System (NPDES) Phase I Permit describes the project area, erosion and sediment controls, runoff water quality monitoring, means of waste disposal, implementation of approved local plans, control of post construction sediment and erosion control measures and maintenance responsibilities, and non-stormwater management controls. Discharges are also required to inspect construction sites before and after storms to identify stormwater discharge from construction activity, and to identify and implement controls where necessary.

The Santa Ana Regional Water Quality Control Board in 2002 issued to the Riverside County Permittees municipal separate storm sewer system (MS4) Permits. It incorporates programs developed since 1993. These are the third MS4 permits issued by each Regional Board and are referred to as the “Third-term” MS4 Permits. In this region, the City of Riverside is a permittee under the Third-term MS4 Permits. Under this permit, the City is required to enforce and comply with storm water discharge requirements. The City has to maintain and control discharges to the MS4’s.

City of Riverside Municipal Code (Public Utilities)

The Riverside Municipal Code Title 14, Section 14.08.030 – Connection to public sewer required, states all homes and any other structures must be properly connected to a public sewer whenever the property abuts upon a right-of-way in which there exists a public sewer to which connection may be made. Additionally if a house or structure is located within an area where the use of a septic tank poses a potential contamination risk to the City’s drinking water wells in the area, as specified by resolution of City Council, all new houses or structures located within such area must be properly connected to the public sewer system. (Ord.6623 1, 2002; Ord. 6172 1, 1994: prior code 27.28).

City of Riverside Municipal Code (Grading)

The Riverside Municipal Code Title 17 – Grading, requires provisions for hillside/arroyo grading (Section 17.28.020). The Municipal Code states where grading is proposed on any parcel having an average natural slope of 10% or greater, or which is zoned Residential Conservation (RC), or which is located within or adjacent to the Mockingbird Canyon, Woodcrest, Prenda, Alessandro, Tequesquite, or Springbrook Arroyos, or a blue line stream identified on USGS Maps, or other significant arroyo, the grading must be confined per this Chapter and limited to the minimum grading necessary to provide for a house, driveway, garage and limited level yard. The ungraded terrain must be left in its natural form for the remainder of the site.

City of Riverside Subdivision Code

A comprehensive update of the City's Subdivision Code (Title 18, RMC) is also part of the Project analyzed in this EIR. The City of Riverside Subdivision Code was last updated comprehensively in 1978. Since then, several changes to the State Subdivision Map Act have occurred. This revision of the City's Subdivision Code has been accomplished to bring the Subdivision Code up to date with current law, to simplify review processes (for example, allowing administrative approval of parcel maps) and to create a more logical organization of the Code. Application and implementation of several sections (Sections 18.090.050, 18.200.020, 18.200.010) of the Subdivision Code will reduce potential geologic impacts.

Proposition R and Measure C

In 1979, City of Riverside voters passed Proposition R: "Taxpayer's Initiative to Reduce Costly Urban Sprawl by Preserving the City of Riverside's Citrus and Agricultural Lands, Its Unique Hills, Arroyos, and Victoria Avenue." The two main features of Proposition R relate to: 1) preservation of agriculture through application of the RA-5-Residential Agricultural Zone to two specific areas of the City: and 2) protection of hillside areas through application of the RC-Residential Conservation Zone to areas of the City based on slopes over 15 percent. City of Riverside also adopted in 1987 Measure C, an amendment to Proposition R, entitled, "Citizen's Rights Initiative to Reduce Costly Urban Sprawl to Reduce Traffic Congestion, to Minimize Utility Rate Increases, and to Facilitate Preservation of Riverside's Citrus and Agriculture Lands, its Scenic Hills, Ridgelines, Arroyos and Wildlife Areas." The purpose of Proposition R and Measure C is to limit development and preserve agriculture and open space in certain areas of the City. These initiatives will thereby minimize ground disturbance and development-related erosion.

The City recognizes that Proposition R and Measure C provide special protections for the City's hillside areas and the City is committed to fulfilling the terms of both Proposition R and Measure C. (See General Plan Land Use Policy LU-4.1.) In fact, it is the City's stated objective to minimize the extent of urban development in the hillsides and mitigate any adverse impacts associated with urbanization. (See General Plan Objective LU-4.) The City will not and legally cannot without a vote of the residents of the City, amend Proposition R and Measure C. It should be noted, that Proposition R and Measure C only apply to limited areas of the City and not to the Sphere Areas. Numerous policies in the General Plan are intended to provide general guidance to the City as a whole. Proposition R and Measure C provide more specific development guidance than the general policies in the General Plan. They implement the General Plan's goals and policies by establishing regulations that describe which goals and policies can be achieved in the hillside areas of the City.

Related General Plan Policies

The General Plan Public Safety Element contains measures to minimize exposure to these hazards.

Seismicity and Faulting

Policy PS-1.1: Ensure that all new development in the City abides by the most recently adopted City and State seismic and geotechnical requirements.

Policy PS-1.2: Locate important public facilities of City importance outside of geologically hazardous areas.

Policy PS-1-3: Provide the public with information on how to be prepared for a seismic event, and minimize any related damage or threat to health and public safety.

Policy PS-1-4: Use open space easements and other regulatory techniques to prohibit development and avoid creating public safety hazards where geologic instability is identified and cannot be mitigated.

Policy PS-1-5: Coordinate efforts between public safety, building officials, communication staff and others to create innovative public awareness programs.

Multi-Hazard Functional Planning and Interagency Response

Policy PS-9.8: Reduce the risk to the community from hazards related to geologic conditions, seismic activity, flooding and structural and wildland fires by requiring feasible mitigation of such impacts on discretionary development projects.

Related Subdivision Code Sections

The project includes a comprehensive update of Riverside's Subdivision Code (Title 18 of the Riverside Municipal Code). Application and implementation of several sections of the Subdivision Code will reduce potential geologic impacts:

- Section 18.090.050 requires that geological/soils studies be prepared for land division proposals to identify and avoid/mitigate geologic and seismic hazards.

- Section 18.200.020 requires all development activity to comply with erosion control standards.
- Section 18.200.010 requires that grading plans be prepared for proposed subdivisions of land.
- Section 18.200.020 sets forth erosion control standards to which all development activity must comply. Also, all development activity is required to comply with erosion control standards in Section 18.200.020.

Environmental Impacts Before Mitigation

Threshold: *Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: 1) rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist or based on other substantial evidence of a known fault; 2) strong seismic ground shaking; 3) seismic-related ground failure, including liquefaction; or 4) landslides.*

Seismic activity is to be expected in Southern California. The Alquist-Priolo Earthquake Fault Zone specifies types of faults and specific faults that are considered sufficiently active and well defined as to constitute a potential hazard to structures from surface faulting or fault creep. Cities are to use the policies and criteria in the exercise of their responsibility to prohibit the location of developments and structures for occupancy across the trace of active faults. In the City of Riverside and in the Sphere of Influence, there are no Alquist-Priolo zones. For this reason, **no impact** will occur with the proposed General Plan related to Alquist-Priolo Earthquake Fault Zone.

The General Plan would continue much of the City's existing pattern of land uses. The fault zones, specifically the San Jacinto fault zone, located in the northeastern portion of the Planning Area and the Elsinore fault zone, which is located in the southern portion of the Planning Area, has the potential to cause moderate to large earthquakes that would cause intense ground shaking in its vicinity. Policies in the General Plan ensure that adverse effects caused by seismic and geologic hazards are minimized by limiting the densities and intensity of uses in this area. Additionally, new development would be required to comply with the building design standards of the CBC Chapter 33 for construction of new buildings and/or structures related to seismicity and specific engineering design and construction measures would be implemented to anticipate and avoid potential impacts from seismic activity. Compliance with CBC regulations and policies included in the General Plan would ensure that impacts related to strong seismic ground shaking are reduced to **less than significant** levels.

Strong ground shaking can result in liquefaction. The City is underlain by areas susceptible to varying degrees of liquefaction, ranging from moderate to very high (areas along the Santa Ana River), while most of the Sphere of Influence is not susceptible to liquefaction (see **Figure 5.6-3**). Liquefaction potential does not necessarily limit development potential, as site-specific geotechnical studies would be required to determine the soil properties and specific potential for liquefaction in specific areas prior to individual development.

Strong ground shaking can also worsen existing unstable slope conditions. Areas in northeastern Riverside are also designated with low to locally moderate susceptibility to landslides and rock falls (see **Figure 5.6-1**). Compliance with the standards in the current CBC would require an assessment of hazards related to landslides and liquefaction and the incorporation of design measures into structures to mitigate this hazard if development were considered feasible. The Municipal Code requires provisions to grading and development on or near hillsides. The City has included policies in its Public Safety Element to achieve the goal of minimizing the risk of injury, loss of life, and property damage caused by earthquake hazards or geologic disturbances (Policies PS-1.1-1.5 & Policy PS-9.8). With compliance of applicable regulations as well as policies identified in the General Plan, impacts are considered **less than significant.**

Threshold: *Result in substantial soil erosion or the loss of topsoil.*

Topsoil is the uppermost layer of soil, usually the top six to eight inches. It has the highest concentration of organic matter and microorganisms, and is where most biological soil activity occurs. Topsoil erosion is of concern when the topsoil layer is blown or washed away, which makes plant life or agricultural production impossible. Substantial amounts of construction project erosion and loss of topsoil could occur during development. All individual construction project activities greater than one acre will be subject to the State's General Permit for Construction Activities that is administered by the California Regional Water Quality Control Board (RWQCB). Employment of Best Management Practices (BMPs) implemented through a Storm Water Pollution Prevention Plan (SWPPP) would be required to limit the extent of eroded materials from a construction site. Development that is one acre or more would be required to comply with the provisions of the NPDES regulations concerning the discharge of eroded materials and pollutants from construction sites and prepare and implement a SWPPP.

Further, the Subdivision Code, as described above, sets forth erosion control standards to which all development activity must comply. The City's Grading Code (Title 17) also requires implementation of BMPs and other measures designed to minimize soil erosion. Compliance with the policies contained in the General Plan, Subdivision Code, and Grading Code would further ensure that new development would not result in substantial soil erosion or loss of topsoil. Also, for operational activities, complying with the Water Quality Management Plan would minimize effects from erosion and ensure consistency with NPDES requirements. Future development projects implemented under the General Plan would have **less than significant** impact to soil erosion or topsoil by implementing the NPDES program as well as following the Subdivision Code and Grading Code.

Threshold: *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.*

Impacts related to landslides and liquefaction is addressed above. This analysis addresses impacts related to unstable soils, or compressible and expansive soils, as a result of lateral spreading, subsidence, or collapse due to the implementation of the General Plan. Dry to partially saturated sediments not susceptible to liquefaction may be susceptible to ground subsidence. The amount of subsidence will not be consistent from location to location because of the heterogeneous nature of the alluvial deposits throughout the Planning Area. There is no specific data in the City that can accurately identify locations that are vulnerable to subsidence; subsidence risk would need to be evaluated on a site-by-site basis.

Land sliding may occur from heavy rainfall, erosion, and removal of vegetation, seismic activity or other factors. Slope stability depends on many factors and their interrelationships. Rock type, pore water pressure are important factors, as well as slope steepness. Where slopes have failed before, they may fail again.

The general topography of the Planning Area ranges from flat to hilly. Most of the Planning Area is generally flat and so is not vulnerable to landslides. Northeastern, southern and western Riverside has areas of slopes greater than 30% (see **Figure 5.6-1**). This would be in areas susceptible to landslides.

As part of the construction permitting process and reflected in the Subdivision Code (Section 18.090.050), the City requires completed reports of soil conditions at specific construction sites to identify potentially unsuitable soil conditions including landslides, liquefaction and subsidence. The reports must be written by a registered soil professional, and measures to eliminate inappropriate soil conditions must be applied. The design foundation support must conform to the analysis and implementation criteria described in CBC Chapter 15. Additionally, if any development is proposed on terrain where slopes are greater than 10%, provisions will have to meet to comply with Title 17, Grading, of the City's Municipal Code.

Compliance to the City's existing codes and policies contained in the General Plan would ensure the maximum practical protection available for users of buildings and infrastructure. With these requirements, the proposed Project would have a **less than significant impact.**

***Threshold**: 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.*

Soils containing high clay content often exhibit a relatively high potential to expand when saturated and to contract when dried out. Within the Planning Area, expansive soils are widely scattered and are found in hillside areas as well as low lying alluvial basing. Implementation of the proposed General Plan may result in the construction and occupation of structures within areas that have expansive soils. Development under the General Plan would be required to comply with applicable provisions of the Subdivision Code as well as the CBC with regard to soil hazards such as expansive soils. Policies included in the General Plan would also help reduce impacts related to expansive soils. Due to these regulatory requirements this impact is considered **less than significant.**

***Threshold**: 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.*

Generally, septic tanks are to be located in areas where the water table is deep and the soil has moderate permeability. Some of the City and Sphere Areas are on septic systems and have soils capable of sustaining septic tanks. The majority of the City of Riverside is served by developed sewer infrastructure and it is anticipated the majority of the new development in the Planning Area would not require the use of septic tanks. To reduce the potential risk of contamination to groundwater in the North Orange Well Field, areas in North Orange are restricted from having any on-site sewage disposal. New development in the North Orange Area are required by Ordinance No. 6623 to connect to a public sewer unless the location of the development does not pose any potential risk to the drinking water wells in the area. For any development, including the North Orange Well Area, proposing to use septic systems, **MM Geo 1** will be implemented in order to reduce project impacts to a **less than significant level.**

Proposed Mitigation Measures

An Environmental Impact Report is required to describe feasible mitigation measures, which could minimize significant adverse impacts (CEQA Guidelines, Section 15126.4). Mitigation measures were evaluated for their ability to eliminate the potential significant adverse impacts upon geology/ soils or to reduce impacts to below the level of significance.

No significant impact with respect to people or structures due to seismic activity, seismic hazards, soils erosion, and unstable and unsuitable soils are anticipated as a result of the General Plan implementation. Thus, no mitigation is required as General Plan policies PS-1.1 through 1.5 & Policy PS-9.8 would require that development not be located on unstable soils or geologically hazardous areas; Subdivision Code Sections 18.090.050, 18.200.010 & 020 requires all developments to have geological studies identify and avoid/mitigate hazards and comply with erosion control standards; California Building Code Chapters, 15, 16, 18, and 33 requires development to comply with the general design requirements; and the National Pollution Discharge Elimination System (NPDES) which requires new development to prepare a Storm Water Pollution Prevention Plan (SWPPP), to help control runoff and erosion.

For impacts related to soils suitable for septic tanks, mitigation is required in order to ensure septic systems are not placed in areas that are not geologically suitable.

The following mitigation measure is needed to reduce the significance of potential geologic impacts.

MM Geo 1: To mitigate any potential adverse effects related to use of septic systems in new development, prior to approval of any discretionary action presented to the City of Riverside, an investigation shall be conducted by a registered hydrologist and geotechnical or soils engineer that addresses the site's suitability for septic systems and its impact to groundwater supplies, if such systems are proposed**.** Also**,** lots must be at least one acre in size. Prior to installation of septic systems, approval must come from the County of Riverside Environmental Health Department and the Regional Water Quality Control Board.

Summary of Environmental Effects After Mitigation Measures Are Implemented

With adherence to and implementation of the above General Plan policies, existing regulations and Codes as well as a mitigation measure related to future septic systems, the Project's potential geologic impacts will be reduced below a level of significance at the programmatic level.

The significance of geologic impacts resulting from specific future development projects will be evaluated on a project-by-project basis and General Plan policies and objective as well as City standards and practices will be applied, individually or jointly, as necessary and appropriate. If project-level impacts are identified, specific mitigation measures will be required per CEQA.