Section 5.7
Geology and Soils

5.7.1 PURPOSE

This section describes the existing geologic, soil, and seismic conditions within the City of Artesia and identifies potential impacts that could result from implementation of the proposed General Plan Update, and recommends mitigation measures to avoid or lessen impacts. Information in this Section is based on the City of Artesia Master Environmental Assessment (May 11, 1993) and the City of Artesia General Plan Update Draft Environmental Impact Report (December 9, 1993).

5.7.2 EXISTING REGULATORY SETTING

Applicable Federal, State, and local regulatory policies and law that apply to geologic, soil, and seismic conditions are discussed below.

FEDERAL SOIL PROTECTION ACT

The purpose of the Federal Soil Protection Act is to protect or restore the functions of the soil on a permanent sustainable basis. Protection and restoration activities include prevention of harmful soil changes, rehabilitation of the soil of contaminated sites and of water contaminated by such sites, and precautions against negative soil impacts. If impacts are made on the soil, disruptions of its natural functions and of its function as an archive of natural and cultural history should be avoided, as far as practicable. In addition, the requirements of the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) through the National Pollution Discharge Elimination System (NPDES) permit provide guidance for protection of geologic and soil resources.

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONING ACT

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This State law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. The Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards.

The Act requires the State Geologist to establish regulatory zones, known as "Earthquake Fault Zones," around the surface traces of active faults and to issue appropriate maps. Earthquake Fault Zones were called "Special Studies Zones" prior to January 1, 1994. Local agencies must regulate most development projects within these zones. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults. An evaluation and written report of a specific site must

be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (typically 50 feet set backs are required). The City of Artesia is not affected by a State-designated Alquist-Priolo Earthquake Fault Zone.[1]

It is noted, effective June 1, 1998, the Natural Hazards Disclosure Act requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property is being sold lies within one or more State-mapped hazard areas, including Earthquake Fault Zones.

SEISMIC HAZARDS MAPPING ACT

The Seismic Hazards Mapping Act (S-H Act) of 1990 provides a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and other seismic hazards caused by earthquakes. Mapping and other information generated pursuant to the S-H Act is to be made available to local governments for planning and development purposes. The State requires: (1) local governments to incorporate site-specific geotechnical hazard investigations and associated hazard mitigation, as part of the local construction permit approval process; and (2) the agent for a property seller or the seller if acting without an agent, must disclose to any prospective buyer if the property is located within a Seismic Hazard Zone. The State Geologist is responsible for compiling seismic hazard zone maps. The S-H Act specifies that the lead agency or a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils.

There are four types of Seismic Hazard Maps: Seismic Zone (Ground Shaking), Fault Rupture, Seismic Hazard Zones for Liquefaction and Landslides, and Tsunami Inundation.

Seismic Zones (Ground Shaking) Map**.** The earthquake hazard potential for the U.S., determined through a national program, has been generalized into four seismic zones, numbered Zone 1 through Zone 4. Zone 1 has the lowest earthquake danger and Zone 4 has the highest earthquake danger. Stronger construction standards for buildings in Zones 3 and 4 have been adopted in the Uniform Building Code. All of California lies within Seismic Zone 3 or 4, while most of the densely populated parts of California are in Zone 4. According to the Seismic Zones Map, the City of Artesia is situated within Zone 4.[2]

Fault Rupture Map. These maps illustrate approximately 1,000 foot wide zones nearest active earthquake faults that have ruptured the earth. As discussed above, the State Geologist establishes regulatory zones, known as "Earthquake Fault Zones," around the surface traces of

[1] State of California Department of Conservation, http://www.conservation.ca.gov/cgs/rghm/ap/Pages/affected.aspx, Accessed May 5, 2010.

[2] Figure 7 of the Homeowner's Guide, *Earthquake Maps of California*, http://www.seismic.ca.gov/pub/CSSC_2005-01_HOG.pdf, Accessed May 6, 2010.

active faults and to issue appropriate maps. The City of Artesia is not affected by a State-designated Alquist-Priolo Earthquake Fault Zone.[3]

Seismic Hazard Zones for Liquefaction and Landslides Map. The Seismic Hazards Zonation Program maps two types of Zones of Required Investigation: Liquefaction; and Earthquake-Induced Landslides. Liquefaction Zones of Required Investigation involve areas where historic occurrence of liquefaction, or local geological, geothechnical, and groundwater conditions indicate a potential for permanent ground displacements such that mitigation, as defined in Public Resources Code Section 2693(c) would be required.[4] Earthquake-Induced Landslides Zones of Required Investigation involve areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation, as defined in Public Resources Code Section 2693(c) would be required. In these areas, site-specific study must be completed before a building permit is approved. According to the Seismic Hazard Zones Map Los Alamitos and Whittier Quadrangles (March 25, 1999), the City of Artesia is located within a mapped Liquefaction Zone of Required Investigation, however, is not located within a mapped Earthquake-Induced Landslides Zone.[5]

Tsunami Inundation Map. The California Geological Survey (CGS) has worked closely with CEMA and the Tsunami Research Center at the University of Southern California to produce statewide tsunami inundation maps for California. These maps are for use by coastal communities to produce emergency evacuation plans. According to the Tsunami Inundation Map Los Alamitos Quadrangle/Seal Beach Quadrangle, the City of Artesia is not located within a mapped Tsunami Inundation Zone.[6]

INTERNATIONAL BUILDING CODE

The International Building Code (IBC) (which replaced the Uniform building Code) was published in 2000 by the International Code Council (ICC). The IBC was intended to promote public safety and provided standardized requirements for safe construction, which would not vary from city to city. The IBC provides comprehensive regulations involving the design and installation of building systems. Additionally, the IBC provides structural, fire-, and life- safety provisions that address means of egress, interior finish requirements, roofs, seismic engineering, innovative construction technology, and occupancy classifications.

[3] State of California Department of Conservation, http://www.conservation.ca.gov/cgs/rghm/ap/Pages/affected.aspx, Accessed May 5, 2010.

[4] Public Resources Code Section 2693(c) defines mitigation as "those measures that are consistent with established practice and that will reduce seismic risk to acceptable levels."

[5] State of California Department of Conservation, http://www.conservation.ca.gov/cgs/shzp/Pages/Index.aspx, Accessed May 6, 2010.

[6] State of California Department of Conservation, http://www.consrv.ca.gov/CGS/GEOLOGIC_HAZARDS/TSUNAMI/INUNDATION_MAPS/Pages/Statewide_Maps.aspx, Accessed May 10, 2010.

CALIFORNIA BUILDING CODE

California building standards are published in the California Code of Regulations, Title 24, known as the California Building Code (2007 CBC). The CBC applies to all applications for residential building permits. The CBC consists of 11 parts that contain administrative regulations for the California Building Standards Commission and for all State agencies that implement or enforce building standards. Local agencies must ensure that development complies with the guidelines contained in the CBC. Cities and counties have the ability to adopt additional building standards beyond the CBC.

CITY OF ARTESIA MUNICIPAL CODE

Title 6 Chapter 7, Storm Water Management and Discharge Control

Artesia Municipal Code (AMC) Title 6 Chapter 7, *Storm Water Management and Discharge Control*, is known as the "City of Artesia Storm Water Management and Discharge Control Ordinance." The purpose of this Chapter is to ensure the future health, safety, and general welfare of the citizens of the City and the water quality of the receiving waters of the County of Los Angeles and surrounding coastal areas by:

(1) Reducing pollutants in storm water discharges to the maximum extent practicable;

(2) Regulating illicit connections and illicit discharges and thereby reducing the level of contamination of storm water and urban runoff in the municipal separate storm sewer system; and

(3) Regulating non-storm water discharges to the municipal separate storm sewer system.

The intent of this chapter is to protect and enhance the quality of watercourses, water bodies, and wetlands within the City in a manner consistent with the Federal Clean Water Act, the California Porter-Cologne Water Quality Control Act, and the Municipal NPDES Permit.

Title 8 Chapter 1, Building Code

The "Building Code of the City of Artesia" (Building Code) was codified in AMC Section 8-1.01, *Adoption of Building Code.* AMC Section 8-1.01 adopts Los Angeles County Code Title 26, *Building Code*, which adopted and amended the California Building Code, 2007 Edition (Part 2 of Title 24 of the California Code of Regulations). The City's Building Code regulates the erection, construction, enlargements, alteration, repair, moving, removal, conversion, demolition, occupancy, use, equipment, height, area, security, abatement, and maintenance of buildings or structures in the City.

5.7.3 EXISTING ENVIRONMENTAL SETTING

GEOLOGY

The City of Artesia is located within the Los Angeles basin, which is a depression several thousand feet deep in the earth's crust. This part of Southern California is characterized by elongated northwest-southeast trending ridges, valleys, and structural features. The City is within the alluvial plan of the San Gabriel River, which is comprised primarily of rocks, sand, and soil from the mountains to the north. Artesia is characterized by level topography with slopes of less than five percent. Ground elevations are approximately 65 feet above sea level to the north and slope south to 45 feet above sea level.

SOILS

The soils underlying the City of Artesia are younger alluvium, consisting predominantly of marine and non-marine sand and silt.

FAULTS AND FAULT ZONES

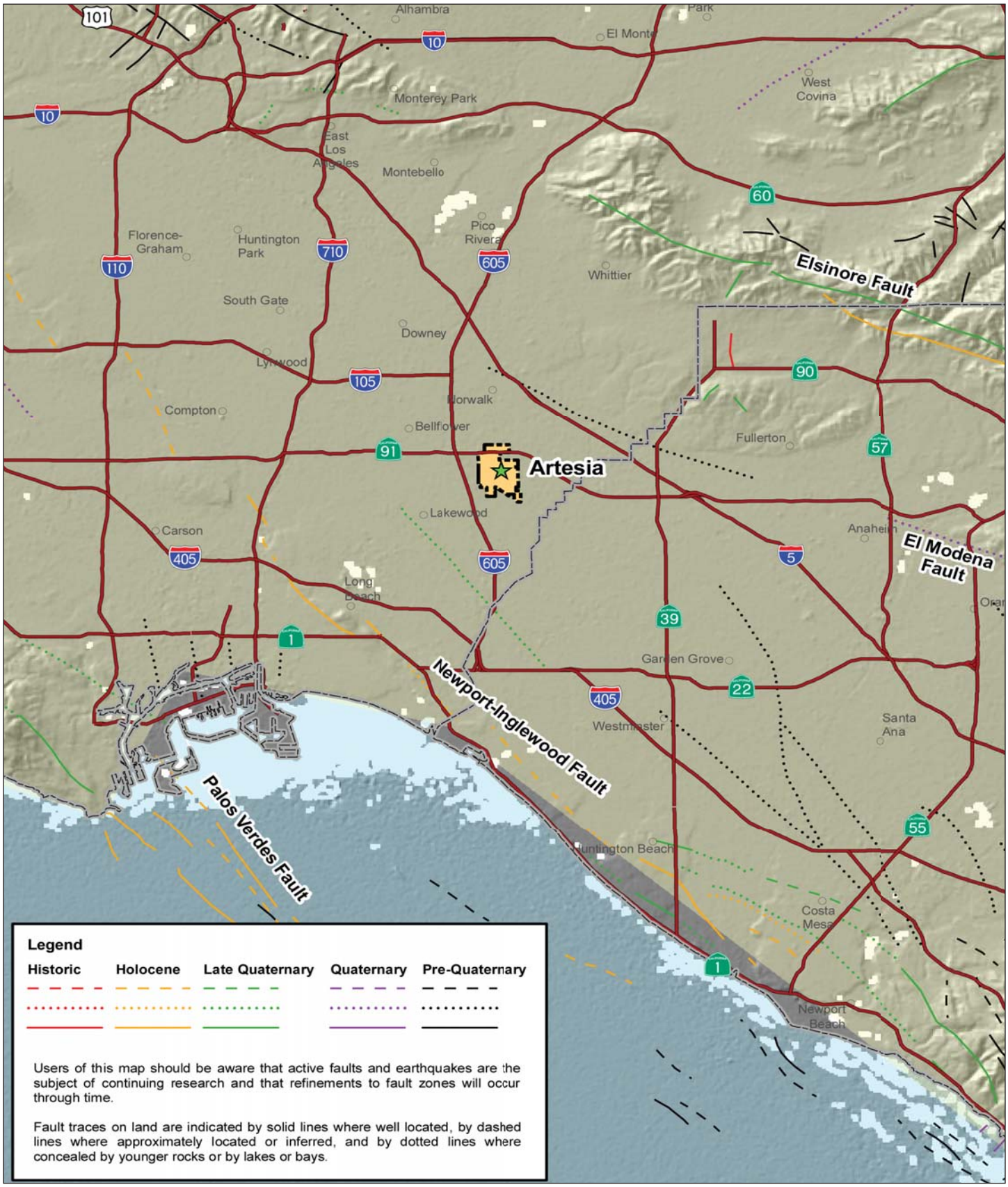
An earthquake fault is a fracture in the crust of the earth along which land on one side has moved relative to land on the other side. Most faults are the result of repeated displacements over a long period of time. A fault trace is the line on the earth's surface defining the fault.

Exhibit 5.7-1, *Fault Location Map*, illustrates the major fault zones and their relationship to the City of Artesia. As indicated in Exhibit 5.7-1, there are no mapped surface or subsurface faults that traverse the City and the City is not listed within a State designated Alquist-Priolo Earthquake Fault Zone, as of May 1999, as discussed above. The faults located nearest the City of Artesia are the Norwalk Fault (located approximately 2.5 miles to the northeast) and Newport-Inglewood Fault (located approximately 5.0 miles to the southwest).

Active Faults

An active fault is defined by the State Mining and Geology Board as a fault that has "had surface displacement within Holocene times (about the last 11,000 years)." This definition does not mean that faults lacking evidence of surface displacement within Holocene times are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity is sometimes difficult to obtain and locally may not exist. A potentially active fault is a fault that shows evidence of surface displacement during Quaternary time (last 1.6 million years).

Active faults and historically destructive earthquakes are generally characteristic of southern California. The City is situated between two active faults, the Norwalk Fault and the Newport-Inglewood Fault; refer to Exhibit 5.7-1. Additionally, several active faults are located within 50 miles of the City. The faults classified as active are described below.



NOT TO SCALE

RBF CONSULTING

07/10 • JN 10-105039

ARTESIA GENERAL PLAN UPDATE
PROGRAM ENVIRONMENTAL IMPACT REPORT

Fault Location Map

Exhibit 5.7-1

NEWPORT-INGLEWOOD FAULT

The Newport-Inglewood Fault zone is a series of discontinuous faults, northwest-trending fault segments that extends approximately 47 miles from the southern edge of the Santa Monica Mountains southeastward to offshore near Newport Beach. From Newport Beach, the fault zone continues offshore southeasterly past Oceanside and is known as the Offshore Zone of Deformation. This fault has right-lateral movement, with a local reverse slip associated with fault steps.

Numerous recent shocks greater than Magnitude 4.0 and also the magnitude 6.3 Long Beach Earthquake (March 11, 193), centered offshore near Newport Beach, suggest an active seismic history. No historic evidence exists for tectonic fault rupture along fault traces included in the Newport-Inglewood fault zone. There may have been subsurface fault rupture of approximately seven inches associated with the Los Angeles Basin Earthquake (October 21, 1941, Magnitude 4.9) and Dominguez Hills Earthquake (June 18, 1944, Magnitude 4.5). The fault zone is considered capable of generating an earthquake of Magnitude 7.4.

NORWALK FAULT

The Norwalk Fault extends at 65 to 85 degrees to the northwest and dips steeply to the northeast. This fault is approximately 16 miles in length and extends from Norwalk to Coyote Hills. The fault is noted as the possible source of a Magnitude 4.7 earthquake occurring on July 8, 1929, which caused significant damage in Whittier and Norwalk. Microseismic activity along the Norwalk Fault is high; the fault may be capable of generating a Magnitude 6.3 earthquake.

RAYMOND FAULT

The Raymond Fault is located approximately 13 miles north of the City. The fault is a north-facing fault, approximately 16 miles in length, approximately 0.25 miles in width, and consists of one to three strands that diverge from the foothills of the San Gabriel Mountains in Sierra Madre to the Adams Hills area of Glendale. Movement on this fault occurs as a left-lateral, with only minor reverse slip. This fault dips at about 75 degrees to the north. There is evidence that at least eight surface-rupturing events have occurred along this fault in the last 36,000 years. The Raymond Fault is considered capable of generating an earthquake of Magnitude 7.0.

SAN ANDREAS FAULT ZONE

The San Andreas Fault, the most dominant active fault in California, is located approximately 41 miles north of Artesia. The San Andreas Fault is considered the main element of the boundary between the Pacific and the North American Plate tectonic plates. The fault extends approximately 625 miles in length from Cape Mendocino to Salton Sea. This fault has a right-lateral strike-slip movement.

This active fault has generated the largest known earthquakes in California. The 1857 Fort Tejon earthquake (Magnitude 7.9) is the most recent earthquake on the San Andreas Fault. This earthquake caused a rupture extending approximately 225 miles, with a maximum surface offset

at 30 feet. The San Andreas Fault is considered capable of generating an earthquake of Magnitude 8.0.

SAN FERNANDO FAULT ZONE

The San Fernando Fault is located approximately 31 miles north of Artesia. Movement on this fault occurs as a thrust. This fault dips toward the north. The slip rate is not well known, but trenching studies indicate recurrence interval as between 100 and 300 years. The San Fernando Fault Zone is considered capable of generating earthquakes with a Magnitude of 6.8.

WHITTIER-ELSINORE FAULT ZONE

The Whittier-Elsinore Fault is located approximately seven miles northeast of Artesia. This fault is a northwest-trending fault, approximately 24 miles in length extending from the Mexican border to the northern edge of the Santa Ana Mountains. This fault dips toward the northeast. Movement on this fault occurs as a right-lateral strike-slip with some reverse slip. The slip rate is between approximately 2.5 and 3.0 millimeters per year (mm/yr). The Whittier-Elsinore Fault Zone is considered capable of generating earthquakes with a Magnitude of 7.2.

Potentially Active Faults

The Association of Engineering Geologists has defined a potentially active fault as "those, based on available data, along which no known historical ground surface ruptures or earthquakes have occurred. These faults, however, show strong indications of geologically recent activity."

MALIBU COAST FAULT

The Malibu Coast Fault is located approximately 24 miles northwest of Artesia. The onshore Malibu Coast Fault consists of several subparallel strands trending east to west, approximately 48 miles in length along the southern margin of the western Santa Monica Mountains. The onshore fault zone is comprised of reverse faults with dips averaging between 45 and 80 degrees to the north, with zones of deformation as wide as 0.03 miles. The slip rate is approximately 0.3 mm/yr and may be higher at the eastern terminus where it meets the Santa Monica Fault. The Malibu Coast Fault is considered capable of generating earthquakes with a Magnitude of 7.0.

The latest movement on this fault was believed to have been more than 11,000 years ago. However, evidence exists that Holocene displacement within colluvial soils were determined to be 5,000 to 6,000 years old at the location of this fault. Based on this evidence, the fault is considered active.

SAN GABRIEL FAULT

The San Gabriel Fault is located approximately 23 miles north of Artesia. It extends from Frazier Park to Mount Baldy Village, approximately 84 miles in length. Due to the length of the San Gabriel Fault and its relationship with the San Andreas Fault System, it is considered potentially active. This fault consists of a zone of echelon strands striking 45 to 65 degrees west of north

with dips between 50 to 80 degrees towards the north. Movement on this fault occurs primarily as a right-lateral strike-slip. The slip rate is approximately 1 to 5 mm/yr and recurrence interval probably varies significantly along the length of the San Gabriel fault zone. The western half of this fault is probably much more active than the eastern half. The San Gabriel Fault is considered capable of generating earthquakes with a Magnitude of 7.8.

SANTA MONICA FAULT

The Santa Monica Fault is located approximately 20 miles southeast of Artesia. It extends approximately 15 miles in length through the communities of Pacific Palisades, Westwood, Beverly Hills, and Santa Monica. This fault is a northwest dipping thrust fault bordering the south flanks of the Santa Monica Mountains. The Santa Monica Fault is a left-reverse fault. The slip rate is between approximately 0.27 and 0.39 mm/yr and may be greater at its western terminus of the fault. The Santa Monica Fault is considered capable of generating earthquakes with a Magnitude of 7.0.

The 1971 San Fernando Earthquake indicates that the Santa Monica Fault could generate a moderate seismic event (Magnitude 6.6). Consequently, this fault is considered potentially active.

SIERRA MADRE FAULT ZONE

The Sierra Madre Fault Zone is located approximately 18 miles north of Artesia. It extends approximately 55 miles in length from San Fernando on the west to San Dimas-Claremount on the east. The Sierra Madre Fault Zone is classified as a "master" fault zone and consists of five primary segments and thousands of feet of vertical and significant left-lateral offsets located along the base of the San Gabriel Mountains and southward up and over the San Gabriel Mountains. The total length of the main fault segments in this zone (the Sierra Madre Fault) is approximately 47 miles, with each segment measuring approximately 10 miles in length.

The Sierra Madre Fault Zone segments consist of north-dipping reverse thrust faults. The slip rate is between approximately 0.36 and 4 mm/yr and may be greater at its western terminus of the fault. The Sierra Madre Fault Zone is considered capable of generating earthquakes with a Magnitude of 7.2.[7]

VERDUGO FAULT

The Verdugo Fault is located approximately 15 miles north of Artesia. This fault bounds the south flank of the Verdugo Mountains and appears to merge with the Eagle Rock-San Rafael Fault System in the vicinity of Verdugo Wash. The Verdugo Fault is a northwest trending and northeast dipping thrust fault. This fault is a low-angle left-reverse fault. The slip rate is approximately 0.5 mm/yr.

[7] Ibid.

Low magnitude earthquakes (less than 3.0) that have been attributed to activity along the Verdugo Fault are occasionally recorded in the Burbank-Glendale area. No direct evidence of ground displacement has been observed associated with these low magnitude earthquakes. The Verdugo Fault is not considered to have had seismic activity during historic time. However, this fault has the potential for future activity and is considered capable of generating earthquakes with a Magnitude of 6.8.

SEISMIC HAZARDS

There are potential primary and secondary seismic hazards associated with earthquakes. The primary seismic hazard associated with earthquakes is strong ground shaking. The secondary seismic hazards are surface fault rupture, ground failure (i.e., earthquake-induced landsliding, fracturing/cracking/fissuring, compaction/subsidence/uplift, and liquefaction), and tsunamis/ seiche. The following discussion addresses the primary and secondary seismic hazards.

Strong Ground Shaking

An earthquake is caused when potential strain energy is suddenly released within the earth's crust. The result is the movement of two adjacent areas of earth material and generation of vibration spreading from the point of origin (epicenter). As expected, an earthquake is most problematic when it occurs in a developed and populated area, resulting in impacts on buildings and people.

The degree of ground shaking that would occur in the City is dependent on the particular fault, fault location, distance from the City, and magnitude of the earthquake. Additionally, the soil and geologic structure underlying the City influences the amount of damage that the City may experience. Alluvium deposits that may become unstable during intense ground shaking underlie the City.

The City is situated in an area of active crustal compression and would likely experience ground shaking due to a seismic event. This may cause buildings within the community to sustain substantial damage. Tilt-up structures, unreinforced masonry buildings, older buildings, buildings over four levels, and mobile homes are particularly susceptible to earthquake damage. Concrete tilt-ups built prior to 1974 may also be particularly susceptible to damage. Other structures are also vulnerable to earthquake damage.

The magnitude scale, originally proposed by Charles F. Richter, is commonly used for describing the size of earthquakes. The scale is related to the total amount of energy released by an earthquake, recording magnitudes ranging from less than 1, up to 9 (the largest assumed earthquake). To evaluate the effect a major earthquake might have on the City, faults have been identified that are capable of causing damage to the City. Table 5.7-1, *Maximum Probable Earthquake Activity*, provides the maximum magnitudes according to the various faults.

Table 5.7-1
Maximum Probable Earthquake Activity

Fault	Distance from City (Miles)	Average Bedrock Acceleration[1] (G)	Predominant Motion Period[1] (Seconds)	Duration[1] (Seconds)	Maximum Magnitude[1] (Richter Scale)
Newport-Inglewood	5	0.30	0.24	21	7.4
Norwalk	2	0.28	0.24	10	6.9
Raymond	13	0.26	0.34	15	7.3
San Andreas	41	0.21	0.50	110	8.5+
San Fernando	31	0.13	0.41	9	6.6
Whittier	7	0.26	0.30	12	7.0
Malibu Coast	24	0.23	0.39	15	7.3
San Gabriel	23	0.25	0.39	24	7.8
Santa Monica	20	0.25	0.38	8	6.6
Sierra Madre	18	0.25	0.38	14	7.2
Verdugo	15	0.28	0.38	9	6.9

[1] The estimated seismic parameters are the maximum probable.

Surface Fault Rupture

Surface fault rupture occurs when movement on a fault deep within the earth breaks through to the surface. A surface fault rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures, because they are accompanied by shaking. Fault creep is the slow rupture of the earth's crust. As indicated in Exhibit 5.7-1, there are no mapped surface or subsurface faults that traverse the City and the City is not listed within a State designated Alquist-Priolo Earthquake Fault zone. Therefore, surface fault rupture is unlikely to occur in the City.

Seismic-Related Ground Failure

Various types of seismic-related ground failures accompany earthquakes, including the following:

- Earthquake-induced landsliding;
- Fracturing, cracking, and fissuring;
- Compaction, subsidence, and uplift; and
- Liquefaction and lateral spreading.

The potential for these types of ground failures to occur within the City are discussed below.

EARTHQUAKE-INDUCED LANDSLIDING

According to the Seismic Hazard Zones Map Los Alamitos and Whittier Quadrangles, the City of Artesia is not located within a mapped Earthquake-Induced Landslide Zone of Required Investigation. Given that Artesia has relatively flat topographic relief and the City is not located within an Earthquake-Induced Landslide Zone, earthquake-induced landsliding is not anticipated to occur within the City.

FRACTURING, CRACKING, AND FISSURING

Ground shaking, settling, compaction, and sliding produce irregular fractures, cracks, and fissures from a few inches to many feet in length. Such fractures may displace soil and earth in a manner similar to faults. Factures of this type are rare in bedrock, but are most significant in weathered rock, alluvium, and alluvial basins up to 75 to 80 miles from the epicenter of a great earthquake surface. Fracturing, cracking, and fissuring within the City are not anticipated due to the depth of the alluvium.

COMPACTION, SUBSIDENCE, AND UPLIFT

Compaction of loose soils and poorly consolidated alluvium occur as a result of strong seismic shaking. The amount of compaction may vary from a few inches to several feet and may be significant in areas of thick soil cover. Due to the soil types underlying the City, tectonic subsidence, uplift tilting, and warping are considered insignificant for Artesia.

LIQUEFACTION, LATERAL SPREADING, AND LURCHING

Liquefaction is a hazard associated with intense ground shaking. During seismic events, the earth accelerates and soils can destabilize, particularly when sufficient water is present in the soil. The destabilized soil and water can mix, resulting in liquefaction. Liquefaction is generally associated with shallow ground water conditions and the presence of loose and sandy soils or alluvial deposits. According to the Seismic Hazard Zones Map Los Alamitos and Whittier Quadrangles (March 25, 1999), the City of Artesia is located within a mapped Liquefaction Zone of Required Investigation.

Lateral spreading results from liquefaction or plastic deformation of soil occurring on gently sloping ground during an earthquake. The conditions occur when blocks of mostly intact surficial soil are displaced down slope along a sheer zone that has formed within liquefied sediment. Due to the City's flat topography and lack of significant slopes, the City is not subject to lateral spreading conditions.

GEOLOGIC HAZARDS

Potential geologic hazards include slope instability, general subsidence, differential settlement, expansive soils, and soil erosion. The City of Artesia is located within the Los Angeles basin, which is a depression several thousand feet deep in the earth's crust. This basin has been filled with rocks, sand, and soil from the surrounding mountains, resulting in vast expanses of flat land.

Artesia is therefore characterized by level topography with slopes of less than 5.0 percent. The City maintains no property subject to apparent threat of slope instability, mudslides, landslides, or subsidence.

Landslides/Slope Instability

Artesia is located on relatively flat topography and is not located adjacent to steep slopes or areas that would otherwise be subject to landslides, debris flow, and/or rockfall. Therefore, damage from landslides and other mass movements, identified above, is not anticipated within the City. Moreover, as previously noted, the City of Artesia is not located within a mapped Earthquake-Induced Landslides Zone, according to the Seismic Hazard Zones Map Los Alamitos and Whittier Quadrangles.

Subsidence or Collapse

Land subsidence is the gradual, local setting, or shrinking of the earth's surface with little or no horizontal motion. Subsidence is normally the result of gas, oil, or water extraction, hydrocompaction, peat oxidation, and not the result of landslide or ground failure. There are no known ongoing or planned large-scale extractions of groundwater, gas, oil, or geothermal energy that would cause subsidence within the City.

Expansion and Contraction

Expansion and contraction of volume can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). During these cycles, the volume of the soil changes markedly, and can cause structural damage to building and infrastructure if the potentially expansive soils were not considered in project site design and construction. The soils present within the City are sand, silt, and clay silt soils, which have a high expansion potential.

Erosion

Soil erosion is defined as the detachment and movement of soil particles by the erosive forces of wind or water. Soil erosion can occur naturally or can be accelerated through the activities of human beings. Wind erosion occurs mostly in: flat, bare areas; dry, sandy soils; or anywhere the soil is loose, dry, and finely granulated. It effects include air pollution, and sediment transport and deposition, among others. Water erosion occurs due to the energy of water as it falls toward the earth and flows over the surface. The main variables affecting water erosion are precipitation and surface runoff. Surface runoff then carries away the detached soil, may detach additional soils, and ultimately deposits sediment elsewhere. The soils present within the City are sand, silt, and clay silt soils, which have a high erodability potential.

5.7.4 SIGNIFICANCE THRESHOLDS AND CRITERIA

Appendix G of the *CEQA Guidelines* contains the Initial *Study Environmental Checklist Form* used during preparation of the Project Initial Study; refer to Appendix 12.1, *Notice of*

Preparation. The Checklist includes questions relating to geology and soils, which have been utilized as thresholds of significance in this Section. Accordingly, a significant environmental impact would occur if the Project would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving;
    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
    - Strong seismic ground shaking;
    - Seismic-related ground failure, including liquefaction;
    - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in landslides, lateral spreading, subsidence, liquefaction or collapse;
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial risk to life or property; and/or
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Based on these significance thresholds and criteria, the Project's effects have been categorized as either "effects found not to be significant" or "potentially significant impact." Feasible mitigation measures, which could avoid or minimize potentially significant impacts, are identified. If a potentially significant impact cannot be reduced to a less than significant level through the application of mitigation, it is categorized as a "significant unavoidable impact."

5.7.5 PROJECT IMPACTS AND MITIGATION MEASURES

❑ GENERAL PLAN UPDATE POLICIES

The following Policies and Policy Actions relevant to geology, soils, and seismicity have been proposed in the General Plan Update:

COMMUNITY RESOURCES AND WELLNESS ELEMENT

Community Safety

Community Policy SAF 2.1: Ensure that new structures and alterations to existing structures minimize seismic hazards through proper design and construction.

Policy Action SAF 2.1.1: Review all development proposals to evaluate the presence of any geologic and/or seismic problems and require mitigation measures if necessary.

Policy Action SAF 2.1.2: Adopt and require compliance with the most current versions of State or County building codes, or other relevant codes.

Policy Action SAF 2.1.3: Continue to contract with the County of Los Angeles Public Works Department for building safety review services.

Community Policy SAF 2.2: Encourage rehabilitation or elimination of structures susceptible to collapse or failure in a seismic event.

Community Policy SAF 7.1: Develop a Citywide Disaster Preparedness Plan

Policy Action SAF 7.1.1: Ensure that adequately trained staff is available to provide essential emergency public services.

Policy Action SAF 7.1.2: Work cooperatively with the Public Safety Commission, community organizations, adjacent jurisdictions and regional agencies to prepare Artesia for emergencies.

Policy Action SAF 7.1.3: Coordinate with regional, State and Federal agencies to prepare for and respond to potential terrorism threats.

Community Policy SAF 7.2: Provide community members with information and education on disaster preparedness.

Policy Action SAF 7.2.1: Promote public education and awareness regarding individual fire prevention and safety, earthquake safety, and other emergency preparedness topics through information resources, programs and seminars in conjunction with the County of Los Angeles and other partners.

SUSTAINABILITY ELEMENT

Environmental and Public Health

Community Policy SUS 6.2: Protect and enhance environmental and public health by reducing or eliminating the use of hazardous and toxic materials; minimizing pollutants entering the air, soil, and water; and lessening the risks which environmental problems pose to human health and prosperity.

Policy Action SUS 6.2.3: Develop protocol to ensure that no one geographic or socioeconomic group in the City is being unfairly affected by environmental pollution.

❑ EFFECTS FOUND NOT TO BE SIGNIFICANT

In accordance with Section 15128, Effects *Not Found To Be Significant, of the CEQA Guidelines,* the following briefly discusses the reasons that various possible significant effects of the Project were determined not to be significant and were therefore not discussed in detail.

Threshold: *Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault?*

As indicated in Exhibit 5.7-1, there are no mapped surface or subsurface faults that traverse the City and the City is not listed within a State designated Alquist-Priolo Earthquake Fault Zone. Therefore, surface fault rupture is unlikely to occur in the City. A less than significant impact is anticipated in this regard.

Threshold: *Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?*

Artesia is located on relatively flat topography and is not located adjacent to steep slopes or areas that would otherwise be subject to landslides, debris flow, and/or rockfall. Therefore, damage from landslides and other mass movements is not anticipated within the City. No impact would occur in this regard.

Threshold: *Would the Project result in substantial soil erosion or the loss of topsoil?*

The soils present within the City are sand, silt, and clay silt soils, which have a high erodability potential. However, the City is approximately 99 percent built-out and has a relatively flat topography. Therefore, conditions that contribute to substantial soil erosion or loss of topsoil are not present within the City. Moreover, all future development projects would be subject to compliance with AMC Title 6 Chapter 7, *Storm Water Management and Discharge Control*, which requires compliance with NPDES standards and implementation of Best Management Practices (BMP), in order to minimize short- and long-term erosion. Impacts would be less than significant in this regard.

Threshold: *Would the Project 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 landslides, lateral spreading, subsidence, liquefaction or collapse?*

Implementation of the General Plan Update would result in less than significant impacts involving projects located on an unstable geologic unit or soil, potentially resulting in landslides or subsidence/collapse. The conditions favorable for these hazards are not present in the City.

Threshold: *Would the Project 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?*

Artesia is 99 percent developed and has an existing wastewater disposal infrastructure. The Sanitation Districts of Los Angeles County own, operate, and maintain trunk sewer lines for the regional conveyance of wastewater. The City owns and is responsible for operation and maintenance of the local sewer lines. Future development within the City would connect to the existing wastewater infrastructure. As Artesia is a fully urbanized City, and sewers are available for the disposal of wastewater, the use of septic tanks or alternative wastewater disposal systems would not be required. As such, no impact would occur in this regard.

❑ POTENTIALLY SIGNIFICANT IMPACTS

Threshold: *Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?*

STRONG SEISMIC GROUND SHAKING

■ **IMPLEMENTATION OF THE PROPOSED GENERAL PLAN UPDATE COULD EXPOSE PEOPLE AND STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS INVOLVING STRONG SEISMIC GROUND SHAKING.**

Impact Analysis: The closest active faults to Artesia are the Newport-Inglewood Fault and the Norwalk Fault, which are within approximately five miles of the City. Additionally, several active faults that can generate ground shaking in Artesia are located within 50 miles of the City, as indicated in Table 5.7-1. The City is situated in an area of active crustal compression and would likely experience ground shaking due to a seismic event. Project implementation could expose people or structures to potential substantial adverse effects strong seismic ground shaking. The possibility of moderate to high ground acceleration or shaking in the City may be considered as approximately similar to the Southern California region as a whole. Therefore, impacts associated with seismically induced ground shaking would be considered significant, unless mitigated.

Development under the proposed General Plan Update would result in the addition of approximately 4,948 dwelling units and the development of approximately 2.9 million square feet of non-residential uses, thereby exposing a greater number of residents, employees, patrons, and structures to the effects of strong seismic ground shaking from locally and regionally generated earthquakes. Potential damage to existing and new structures would be slight to moderate, although severe damage to vulnerable buildings cannot be precluded. Damage to infrastructure, including roadways, bridges, water and wastewater lines, gas lines, power poles, storm drainage, and other public facilities, could occur due to an earthquake event. Additionally, strong seismic ground shaking could result in partial to total collapse of existing unreinforced masonry buildings. Structural vulnerabilities in older buildings that are less earthquake resistant are most likely to contribute to the largest source of injury and economic loss, as a result of an

earthquake. Most of the existing homes in the City were constructed prior to the adoption of modern building codes, which have been established to reduce seismic impacts on structures. However, mitigation, which requires that site-specific Geotechnical Studies be conducted, as part of future developments, has been recommended in order to reduce impacts associated with seismically induced ground shaking, among other impacts addressed below (i.e., liquefaction and expansive soils), to less than significant levels. Additionally, numerous controls would be imposed on future development through the City's permitting process that would lessen impacts associated with strong seismic ground shaking, among other hazards discussed below. The design, construction, and engineering of structures within the City would be subject to compliance with AMC Title 8 Chapter 1, *Building Code*, which adopts the Los Angeles County Building Code (thereby adopting the California Building Code (CBC), 2007 Edition). The effects of strong seismic ground shaking would be minimized for structures designed and constructed in conformance with the CBC and industry-accepted engineering standards. Any future modifications to buildings constructed prior to 1934 would be subject to compliance with the CBC, which would sufficiently mitigate potential impacts from strong seismic ground shaking.

The General Plan Update's Community Safety Element provides for the protection of the City from risk associated with the effects of seismically-induced and other geologic hazards, among other risks. It is a goal of the General Plan Update Community Safety Element that Artesia community members are protected from potential harm caused by seismic activity. Compliance with the Policies and Policy Actions of the proposed Community Safety Element outlined above would further reduce potential impacts related to seismic hazards.

Compliance with the City's Building Code, the General Plan Update Policies and Policy Actions, and recommended mitigation would lessen potential impacts associated with strong seismic ground shaking to less than significant levels.

Mitigation Measures:

GEO-1 Prior to issuance of a Grading Permit for each future development project, a registered geologist or soils engineer shall prepare a site-specific Geologic Study, which shall be submitted to the City Building and Safety Division for approval. The Geologic Study shall specify the measures necessary to mitigate impacts related to seismic and geotechnical hazards, if any. All recommendations in the Geologic Study shall be implemented during site preparation, grading, and construction.

GEO-2 Prior to issuance of any Grading Permit, Applicants of future development projects shall comply with each of the recommendations detailed in the Geotechnical Study, and other such measure(s) as the City deems necessary to adequately mitigate potential seismic and geotechnical hazards.

Level of Significance: Less Than Significant With Mitigation Incorporated.

SEISMIC-RELATED GROUND FAILURE

- **IMPLEMENTATION OF THE GENERAL PLAN UPDATE COULD EXPOSE PEOPLE AND STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS INVOLVING SEISMIC-RELATED GROUND FAILURE (I.E., LIQUEFACTION).**

Impact Analysis: Project implementation would result in less than significant impacts involving the exposure of people or structures to potential substantial adverse effects involving:

- Earthquake-induced landsliding;
- Fracturing, cracking, or fissuring; and
- Compaction, subsidence, or uplift.

These types of ground failures are not anticipated to occur within the City, since the conditions favorable for these hazards are not present.

As noted above, the entire City of Artesia is subject to liquefaction. Therefore, implementation of the General Plan Update could expose people or structures to potential substantial adverse effects involving liquefaction. This impact is considered significant unless mitigated. Mitigation Measure GEO-1 requires site-specific geologic investigation of seismic and geotechnical hazards potential for subsequent new development projects within the City and Mitigation Measure GEO-2 requires compliance with the geologic investigation's recommendations. The Seismic Hazards Mapping Act specifies that the lead agency or a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils. If a geologic report concludes liquefaction impacts cannot be reduced to less than significant, with mitigation as necessary, development would not be permitted. Therefore, following compliance with the recommended mitigation, as well as the Community Safety Element Policies and Policy Actions, impacts would be less than significant in this regard.

Mitigation Measures: Refer to Mitigation Measures GEO-1 and GEO-2.

Level of Significance: Less Than Significant With Mitigation Incorporated.

EXPANSIVE SOILS

- **FUTURE DEVELOPMENT ASSOCIATED WITH IMPLEMENTATION OF THE PROPOSED GENERAL PLAN UPDATE COULD BE LOCATED ON EXPANSIVE SOILS CREATING POTENTIAL RISK TO LIFE OR PROPERTY.**

Impact Analysis: The soils present within the City are sand, silt, and clay silt soils, which have a high expansion potential. Therefore, future development associated with the General Plan Update could be located on expansive soil, creating substantial risk to life or property. This impact is considered significant unless mitigated. Mitigation Measure GEO-1 requires site-

specific geologic investigation of seismic and geotechnical hazards potential for subsequent new development projects within the City and Mitigation Measure GEO-2 requires compliance with the geologic investigation's recommendations. Therefore, following compliance with the recommended mitigation, as well as the Community Safety Element Policies and Policy Actions, impacts involving expansive soils creating risk would be less than significant in this regard.

Mitigation Measures: Refer to Mitigation Measure GEO-1.

Level of Significance: Less Than Significant With Mitigation Incorporated.

5.7.6 CUMULATIVE IMPACTS

- **FUTURE DEVELOPMENT RESULTING FROM IMPLEMENTATION OF THE PROPOSED GENERAL PLAN UPDATE COULD RESULT IN CUMULATIVE IMPACTS RELATED TO GEOLOGIC, SOILS, AND SEISMIC CONDITIONS.**

Impact Analysis: Soils and geological conditions in the City may vary by location and their sustainability for development would not be uniform. Future development sites may exhibit constraints to development that would be addressed at the geotechnical engineering level. Short-term cumulative impacts such as erosion and sedimentation would occur. Development of cumulative Projects would incrementally increase the number of people and structures potentially subject to a seismic event. However, such exposure would be minimized through strict engineering guidelines for development at each respective site. Future development would be subject to compliance with the provisions of AMC Title 6 Chapter 7, *Storm Water Management and Discharge Control*, and AMC Section 8-1.01, *Adoption of Building Code*. Mitigation would be incorporated on a project-by-project basis to reduce cumulative geology and soil impacts to a less than significant level.

Mitigation Measures: Refer to Mitigation Measures GEO-1 and GEO-2.

Level of Significance: Less Than Significant With Mitigation Incorporated.

5.7.7 SIGNIFICANT UNAVOIDABLE IMPACTS

Geology and soils impacts associated with implementation of the proposed General Plan Update would be less than significant following compliance with the existing regulatory framework, recommended mitigation, and Community Safety Element Policies and Policy Actions.

5.7.8 SOURCES CITED

Homeowner's Guide, Figure 7, *Earthquake Maps of California*, http://www.seismic.ca.gov/pub/CSSC_2005-01_HOG.pdf, Accessed May 6, 2010.

RBF Consulting, *City of Artesia General Plan Update*, July 20, 2010.

State of California Department of Conservation, http://www.conservation.ca.gov/cgs/rghm/ap/Pages/affected.aspx, Accessed May 5, 2010.

State of California Department of Conservation, http://www.conservation.ca.gov/cgs/shzp/Pages/Index.aspx, Accessed May 6, 2010.

State of California Department of Conservation, http://www.consrv.ca.gov/CGS/GEOLOGIC_HAZARDS/ TSUNAMI/INUNDATION_MAPS/Pages/Statewide_Maps.aspx, Accessed May 10, 2010.

This page intentionally left blank.