

### 5.7 GEOLOGY AND SOILS

This section of the Draft Environmental Impact Report (DEIR) evaluates the potential for implementation of The Ontario Plan to impact geological and soil resources in the City of Ontario. The analysis in this section is based in part on the following technical reports:

- “Seismic Hazards” and “Geologic Hazards,” chapters 1 and 2 of *Technical Background Report to the Safety Element, City of Ontario, California*, Earth Consultants International, October 11, 2006
- Ontario Sphere of Influence (New Model Colony) General Plan Amendment, Envicom Incorporated, January 7, 1998

Complete copies of these studies are included in the Technical Appendices to this Draft EIR (Volume II, Appendix F)

#### 5.7.1 Environmental Setting

##### Regional Setting

##### Geologic Setting

The City of Ontario is in the Upper Santa Ana River Valley, consisting of a series of coalescing alluvial fans formed by streams flowing out of the San Gabriel Mountains to the north. The Upper Valley has a gentle southerly slope of approximately 1 percent grade, such that elevations within the City of Ontario range from approximately 1,150 feet in the north to 640 feet in the south. The junction of the Upper Valley and the San Gabriel Mountains marks the boundary between two geomorphic provinces. The valley, including the City of Ontario, lies within the Peninsular Ranges geomorphic province, characterized by northwest-trending mountains and valleys and extending south into Mexico. The San Gabriel Mountains are part of the Transverse Ranges province, a set of east-west-trending mountain ranges extending from Santa Barbara County on the west to San Bernardino and Riverside Counties on the east. The San Gabriel Mountains north of Ontario rise as high as 10,064 feet at Mount San Antonio.



##### Geologic Units in the City of Ontario

The geologic units exposed at the surface in Ontario consist of sediments less than 11,000 years old (Holocene) deposited either by water or wind; these units are shown in Figure 5.7-1, *Geologic Map*. In general, the alluvial fan sediments are coarse grained in the northern part of the City, consisting of various mixtures of sand, gravel, and cobbles. Moving southward, away from the mountains, the sediments gradually become finer grained, consisting primarily of silt, silty clay, and silty sand. Generally, soils with faster infiltration rates, higher levels of organic matter, and improved soil structure, such as sand, sandy loam, and loam-textured soils have a greater resistance to erosion than silt, very fine sand, and certain-clay textured soils. (OMAFRA 2009).

**Artificial Fill (Qaf):** The Los Angeles/Ontario Airport and the Milliken Landfill are the largest deposits of artificial fill in the City. Other deposits of man-made fill throughout the City include road and bridge embankments, retention or flood control basins, and man-made fills associated with graded developments. These deposits vary widely in size, age, and composition. Nonengineered fills are not suitable foundation materials and need to be excavated and replaced with compacted, engineered fill before they can support loads such as buildings and roads.

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**Very Young Wash Deposits (Qw):** These Late Holocene sediments consist of unconsolidated sand, gravel, and boulders deposited in active washes or channels on the fan surface. They have essentially no soil developed on the surface, and in terms of engineering characteristics, they are typically compressible, highly permeable, nonexpansive, and very susceptible to erosion. This unit has been mapped only in one small area at the northern edge of the city, in the active channel of Cucamonga Creek.

**Very Young Alluvial Fan Deposits (Qf):** These sediments, also Late Holocene, consist predominantly of sand, gravel, cobbles, and boulders that form the active and recently active portions of the fan. These deposits are generally unconsolidated to slightly consolidated, and where they have not been graded, they have a network of braided channels on the surface. In most areas, these very young deposits have no soil development. This unit is more prevalent north of Ontario, closer to the mountain front; within the city it is present in a narrow band along Cucamonga Creek and in the northeast corner, in the vicinity of Day Creek and East Etiwanda Creek.

**Young Alluvial Fan Deposits (Qyf):** This Holocene to Late Pleistocene<sup>1</sup> unit consists of slightly to moderately consolidated deposits of brown to grayish brown silt, sand, and gravelly sand, locally with cobbles. Where the natural surface has not been disturbed, these deposits are slightly to moderately dissected by streams emanating from the mountains. A moderately to well-developed soil is generally present. This unit is widespread throughout the valley region and is mapped in the western half of Ontario. Within Ontario, this unit varies considerably in grain size, ranging from gravelly to cobbly deposits in the north to silty, clayey deposits in the south.

**Young Alluvial Valley Deposits (Qya):** These Holocene to Late Pleistocene deposits occupy tributary channels of the Santa Ana River, one of which reaches into the eastern corner of Ontario near Etiwanda Avenue and Philadelphia Street. Consisting of slightly to moderately consolidated silt, sand, and gravel, the engineering characteristics of this unit are similar to the alluvial fan deposits described above.

**Young Eolian Deposits (Qye):** Wind-deposited Holocene sediments consisting of silt and fine- to medium-grained sand are present across the eastern half of the city. These are generally about 10 feet thick, and are underlain by the alluvial fan deposits described above.

### Seismic Hazards

#### Faults

The City of Ontario is in one of the more seismically active portions of southern California. Several faults have been identified in and adjacent to the Upper Santa Ana Valley; these faults are shown on Figure 5.7-2, *Regional Faults*, and are described below. An active fault is one that has had surface displacement within the Holocene epoch, that is, within the last 11,700 years.

**Chino-Central Avenue Fault:** The Chino-Central Avenue Fault extends along the eastern flank of the Chino Hills from the Los Serranos area of Chino Hills to Corona, a distance of approximately 13 miles.

**San Jose Fault:** The San Jose Fault extends approximately 11 miles from the base of the San Gabriel Mountains near Upland southwest to the San Jose Hills.

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<sup>1</sup> The Pleistocene Epoch extends from approximately 10,000 to 1.6 million years ago.

**Figure 5.7-1 Geologic Map**



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**Figure 5.7.2 Regional Faults**



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**Sierra Madre Fault:** The Sierra Madre Fault, approximately 47 miles long, extends along the southern base of the San Gabriel Mountains from the San Fernando Valley in the west to San Antonio Canyon in the east, continuing eastward as the Cucamonga Fault. A rupture in the northwestern portion of this fault resulted in the San Fernando Earthquake of 1971.

**Cucamonga Fault:** The Cucamonga Fault extends approximately 16 miles east–west along the southern front of the San Gabriel Mountains, from San Antonio Canyon in the west to the vicinity of Lytle Creek in the east.

**San Andreas Fault –** The San Andreas Fault, the main boundary between the Pacific and North American tectonic plates, extends over 750 miles from near Cape Mendocino in northern California to the Salton Sea region of southern California. The fault is divided into several segments; the closest approach to the City of Ontario is the San Bernardino Segment, approximately 14 miles northeast of the City.

**Whittier Fault:** The Whittier Fault extends along the southern base of the Puente Hills approximately 24 miles, from the Santa Ana River in the east to the Whittier Narrows area in the west.

**Elsinore Fault:** The Elsinore Fault extends along the northeastern front of the Santa Ana Mountains from the Santa Ana River on the northwest, where it merges with the Whittier Fault, southeastward into San Diego County.

**Puente Hills Blind Thrust Fault:** The Puente Hills Blind Thrust Fault, which does not extend to the surface, ranges from northern Orange County to the central Los Angeles area.

**San Jacinto Fault Zone:** The San Jacinto Fault Zone consists of a series of closely spaced faults that form the western margin of the San Jacinto Mountains. The fault zone extends from its junction with the San Andreas Fault in San Bernardino southeastward through the Imperial Valley into Mexico. The fault zone is divided into several segments, with the San Bernardino segment being the closest to Ontario.

All of these faults are active except for the Puente Hills Blind Thrust Fault, which is also thought to have ruptured on several occasions within Holocene time, but is not exposed at the surface.

Table 5.7-1 lists the maximum magnitudes of earthquakes that each fault is capable of, and the peak horizontal ground acceleration that such an earthquake would generate in the Ontario area.



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**Table 5.7-1**  
**Estimated Maximum Earthquake Magnitude and**  
**Associated Peak Ground Acceleration for Faults in and near Ontario**

<b>Fault</b>	<b>Distance to Ontario, miles</b>	<b>Mmax, magnitude</b>	<b>Peak Ground Acceleration, g<sup>1</sup></b>
Chino-Central Avenue	4-12	6.7	0.54-0.23
San Jose	5-12	6.4	0.45-0.20
Sierra Madre	7-15	7.2	0.44-0.25
Cucamonga	7-14	6.9	0.39-0.22
San Andreas, total for five southern segments	14-22	8.0	0.37-0.26
San Andreas, San Bernardino and Coachella segments	14-22	7.7	0.32-0.22
Whittier	8-16	6.8	0.3-0.17
Elsinore	9-16	6.8	0.27-0.16
Puente Hills Blind Thrust	21-32	7.1	0.26-0.17
San Jacinto, San Bernardino segment	10-18	6.7	0.24-0.13

<sup>1</sup> g is the acceleration of gravity

### Surface Rupture of a Fault

Primary ground rupture due to fault movement typically results in a relatively small percentage of the total damage in an earthquake, yet being too close to a rupturing fault can result in extensive damage. It is difficult to safely reduce the effects of this hazard through building and foundation design. Therefore, the primary mitigation measure is to set structures back from the fault zone. Application of this measure is subject to requirements of the Alquist-Priolo Earthquake Fault Zoning Act and guidelines prepared by the California Geological Survey, previously known as the California Division of Mines and Geology. The final approval of a fault setback lies with the local reviewing agency. There are no Alquist-Priolo Earthquake Fault Zones in the City of Ontario. The nearest such zones to the City are along the Chino Fault, approximately 3 miles southwest of the City; and along the Cucamonga Fault, approximately 4.5 miles (CDMG 2000; CGS 2007).

### Strong Earthquakes

Horizontal ground acceleration, which frequently results in widespread damage to structures, is estimated as a percentage of *g*, the acceleration of gravity. The damage that an earthquake will cause to a structure depends on the earthquake's size, location, distance, and depth; the types of rock and soil at the surface of the site; and the type of construction of the structure.

When comparing the sizes of earthquakes, the most meaningful feature is the amount of energy released. Thus scientists most often consider seismic moment, a measure of the energy released when a fault ruptures. We are more familiar, however, with scales of magnitude, which measure amplitude of ground motion. Magnitude scales are logarithmic. Each one-point increase in magnitude represents a 10-fold increase in the size of the waves as measured at a specific location, and a 32-fold increase in energy. That is, a magnitude 7 earthquake produces 100 times (10 x 10) the ground motion of a magnitude 5 earthquake. Similarly, a magnitude 7 earthquake releases approximately 1,000 times more energy (32 x 32) than a magnitude 5 earthquake. Recently, scientists have developed the moment magnitude (*M<sub>w</sub>*) scale to relate energy release to magnitude.

**Historical Earthquakes in the Region**

Selected historic earthquakes in and near the Upper Santa Ana River Valley are listed in Table 5.7-2.

**Table 5.7-2**  
**Selected Historic Earthquakes in and near the Upper Santa Ana River Valley**

<b>Earthquake</b>	<b>Date</b>	<b>Location</b>	<b>Fault</b>	<b>Magnitude</b>	<b>Notable Effects</b>
Wrightwood	1812, December 8	Near Wrightwood, approx. 43 miles northeast of Ontario	Unknown; possibly San Andreas	Approx. 7.5	40 deaths in collapse of chapel at Mission San Juan Capistrano
Cajon Pass	1899, July 22	Near Cajon Pass, approx. 26 miles northeast of Ontario	Unknown; San Andreas or San Jacinto	Approx. 5.7	Extensive structural damage in San Bernardino and Highland
San Bernardino	1907, September 20	Near San Bernardino, approximately 27 miles northeast of Ontario	Unknown	Approx. 5.4	
North San Jacinto	1923, July 22	South of San Bernardino, approx. 15 miles east of Ontario	San Jacinto	6.3	
Ontario	1953, May 12	Ontario, near northern City boundary	Unknown	4.6	
Lytle Creek	1970, September 22	Lytle Creek, approx. 14 miles northeast of Ontario	San Andreas	5.2	
Whittier Narrows	1987, October 1	South El Monte, approx. 26 miles west of Ontario	thrust fault	5.9	8 fatalities; extensive damage to unreinforced masonry buildings in Whittier, Alhambra, and Pasadena
Big Bear	1992, June 28	Southeast of Big Bear Lake, approx. 55 miles east of Ontario	Unknown	6.3	Substantial damage in Big Bear Lake area
Chino Hills	2008, July 29	Chino Hills, 6 miles southwest of Ontario	Unknown	5.4	

Sources: Earth Consultants International 2006; Southern California Earthquake Data Center 2008; US Geological Survey 2008

**Liquefaction and Related Ground Failure**

Liquefaction is a process whereby strong earthquake shaking causes sediment layers that are saturated with groundwater to lose strength and behave as a fluid. This subsurface process can lead to near-surface or surface failure that can damage structures. If surface failure does occur, it is usually expressed as lateral spreading, flow failures, ground oscillation, and/or general loss of bearing strength. Sand boils (injections of fluidized sediment) can commonly accompany these different types of failure.

In order to determine a region's susceptibility to liquefaction, three major factors must be analyzed:

- The intensity and duration of ground shaking.
- The age and textural characteristic of the alluvial sediments. Generally, the younger, less compacted sediments have a higher susceptibility to liquefaction. Textural characteristics also play a dominant role in determining liquefaction susceptibility. Sand and silty sands deposited in river channels and floodplains tend to be more susceptible to liquefaction, and floodplains tend to be more susceptible to liquefaction than coarser or finer grained alluvial materials.

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- The depth to the groundwater. Groundwater saturation of sediments is required for earthquake-induced liquefaction. In general, groundwater depths shallower than 10 feet to the surface can cause the highest liquefaction susceptibility.

Strong earthquakes can be expected in the Ontario area on any of the faults in the region, listed in Table 5.7-1. Young, loose, unconsolidated sediments, the second factor in liquefaction, are present throughout the Ontario area. Fine sand and silty sand, the types of sediments most often associated with liquefaction, occur mainly in the New Model Colony in the southernmost portion of the City. The third factor, water-saturated sediments within about 50 feet of the surface, are not known to occur today in the Ontario area, but have occurred there in the past. Artesian water wells, that is, wells in which groundwater moves upward under pressure, were reported in the southwestern corner of the City in the early 1900s. Groundwater levels in Ontario Water Utility groundwater wells from 1986 to 2008 ranged between roughly 250 to 450 feet below ground surface (ONeill 2009); groundwater at such depths does not contribute to a high susceptibility to liquefaction. Areas of liquefaction susceptibility in the City are shown in Figure 5.7-3.

#### **Seismically Induced Settlement**

Strong ground shaking can cause soils to become more tightly packed and settle due to the collapse of voids and pore spaces. This type of settlement typically occurs in soils that are loose, granular, and cohesionless, and can occur in either wet or dry soils. Unconsolidated young alluvial sediments are especially susceptible to this hazard. Seismically induced settlement can cause damage to structures and buried pipelines. The entire Ontario area is underlain by young, unconsolidated alluvial deposits and artificial fill that may be susceptible to seismically induced settlement.

#### **Hazardous Buildings**

The principal threat in an earthquake is the damage that the earthquake causes to buildings. Continuing advances in engineering design and building code standards over the past decade have greatly reduced the potential for collapse in an earthquake of most of our new buildings. However, many buildings were built before current earthquake design standards were incorporated into the building code. Several specific building types are a particular concern in this regard.

- **Unreinforced Masonry Buildings:** In the late 1800s and early 1900s, unreinforced masonry was the most common type of construction for larger downtown commercial structures and for multi-story apartment and hotel buildings. These were recognized as a collapse hazard following the San Francisco earthquake of 1906, and are generally known to be the most hazardous buildings in an earthquake.

Per Senate Bill 547, local jurisdictions are required to enact structural hazard reduction programs by inventorying pre-1943 unreinforced masonry buildings and developing mitigation programs to correct the structural hazards.

**Precast Concrete Tilt-up Buildings:** This building type was introduced after World War II and gained popularity in light industrial buildings during the late 1950s and 1960s. Extensive damage to concrete tilt-up buildings in the 1971 San Fernando earthquake revealed the need for better anchoring of walls to the roof, floor, and foundation elements of the building and for stronger roof diaphragms.<sup>2</sup> In the typical damage to these buildings, the concrete wall panels would fall outward and the roof would collapse.

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<sup>2</sup> A structural roof deck capable of resisting the stress produced by lateral forces, such as wind or seismic loads.

**Figure 5.7-3 Areas of Liquefaction Susceptibility**



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- **Soft-Story Buildings:** Soft-story buildings are those in which at least one story, commonly the ground floor, has significantly less rigidity and/or strength than the rest of the structure. This can form a weak link in the structure unless special design features are incorporated to give the building adequate structural integrity. Typical examples of soft-story construction are buildings with glass curtain walls on the first floor only, or buildings placed on stilts or columns, leaving the first story open for landscaping, street-friendly building entry, parking, or other purposes. In the early 1950s to early 1970s, soft-story buildings were a popular construction style for low- and midrise concrete frame structures.
- **Nonductile Concrete Frame Buildings:** The brittleness of nonductile concrete frame buildings can result in major damage and even collapse under strong ground shaking. This type of construction, which generally lacks masonry shear walls, was common in the very early days of reinforced concrete buildings, and they continued to be built until the codes were changed to require ductility in the moment-resisting frame in 1973.

There were large numbers of these buildings built for commercial and light industrial use in California's older, densely populated cities. Although many of these buildings have four to eight stories, many are shorter. This category also includes one-story parking garages with heavy concrete roof systems supported by nonductile concrete columns.

The City of Ontario inventoried unreinforced masonry buildings (URM) in the City and reported to the State Seismic Safety Commission in 2003 that there were 55 URMs in the City; 42 of these are considered historically significant. As of 2003, action to reduce URM hazards had been taken at only 4 of the 55 buildings: 2 were in compliance with the 1997 Uniform Code for Building Conservation, 1 was under reconstruction, and 1 had reduced occupancy.



### Other Geologic Hazards

#### Ground Subsidence

Ground subsidence is the gradual settling or sinking of the ground surface with little or no horizontal movement, and most often results from human activities such as the extraction of oil, gas, or groundwater. Effects of subsidence include fissures, sinkholes, depressions, and disruption of surface drainage.

Subsidence resulting from oil and gas extraction is not an issue for Ontario. However, the City is above the Chino Subbasin of the Upper Santa Ana Valley Groundwater Basin, from which groundwater has been extracted for decades. The City currently gets approximately 65 percent of its water from 21 wells that pump water from the Chino Subbasin. The thick alluvial deposits composing the subbasin may be susceptible to compaction, with resulting subsidence at the surface, in the event of rapid groundwater withdrawal. Surface subsidence of up to 2.5 feet and ground fissuring from groundwater production have been reported in the City of Chino to the southwest of Ontario.

#### Collapsible Soils

When collapsible soils become saturated, their grains rearrange and lose cohesion, causing rapid, substantial settlement under relatively light loads. Soils prone to collapse are generally young, deposited by flash floods or wind. Increased surface water infiltration, such as from irrigation or a rise in the groundwater table, combined with the weight of a building can cause rapid settlement and cracking of foundations and walls. Most of the alluvium that underlies the Ontario area is generally not susceptible to collapse due to the granular nature of the soils and the lack of clay needed to form dry bonds between grains.

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#### **Compressible Soils**

Compressible soils are typically unconsolidated, low-density Holocene sediments that may compress under the weight of structures and fill soil. The young sediments underlying the City are generally dry and loose in the upper few feet, and therefore are susceptible to compression. Areas that have been intensely farmed, such as much of the New Model Colony, are especially susceptible to compression.

#### **Expansive Soils**

Soils containing expansive clay minerals can shrink or swell substantially as the moisture content decreases or increases. Structures built on these soils may experience shifting, cracking, and breaking damage as soils shrink and subside or expand. The near-surface sediments in the northern and central parts of the City are composed primarily of granular soils, that is, silty sand, sand, and gravel. Such sediments are usually nonexpansive or have very low expansion potential. Expansive soils are more likely to be present in the southern parts of the City, where there are silts, sandy silts, and silty clays.

#### **Erosion**

Erosion is the movement of rock and soil due to water, wind, and gravity. Soil erosion may be a slow process that continues relatively unnoticed, or it may occur quickly, causing serious loss of topsoil. The rate and magnitude of soil erosion by water is controlled by rainfall intensity and runoff, soil texture and cohesion, slope gradient and length, and vegetation cover. The young alluvial sediment and wind-blown sand underlying the City are generally granular, poorly consolidated, and very susceptible to erosion. Grading increases the potential for erosion by removing protective vegetation, changing natural drainage patterns, and constructing slopes.

#### **Regulatory Framework**

##### **State**

##### *California Alquist-Priolo Earthquake Fault Zoning Act*

The Alquist-Priolo Earthquake Fault Zoning Act was signed into state law in 1972. Its primary purpose is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault. The act requires the State Geologist to delineate "Earthquake Fault Zones" along faults that are "sufficiently active" and "well defined." The act also requires that cities and counties withhold development permits for sites within an Earthquake Fault Zone until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Pursuant to this act, structures for human occupancy are not allowed within 50 feet of the trace of an active fault.

##### *Seismic Hazard Mapping Act*

The Seismic Hazard Mapping Act was adopted by the state in 1990 for the purpose of protecting the public from the effects of nonsurface fault rupture earthquake hazards, including strong ground shaking, liquefaction, seismically induced landslides, or other ground failure caused by earthquakes. The goal of the act is to minimize loss of life and property by identifying and mitigating seismic hazards. The California Geological Survey prepares and provides local governments with seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures.

### *2007 California Building Code*

Current law states that every local agency enforcing building regulations, such as cities and counties, must adopt the provisions of the California Building Code (CBC) within 180 days of its publication. The publication date of the CBC is established by the California Building Standards Commission and the code is also known as Title 24, Part 2 of the California Code of Regulations. The most recent building standard adopted by the legislature and used throughout the state is the 2007 version of the CBC, often with local, more restrictive amendments that are based on local geographic, topographic, or climatic conditions. These codes provide minimum standards to protect property and public safety by regulating the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The CBC contains provisions for earthquake safety based on factors including occupancy type, the types of soil and rock on-site, and the strength of ground.

### *Natural Hazards Disclosure Act*

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 being sold lies within one or more state-mapped hazard areas, including a Seismic Hazard Zone. California law also requires that when houses built before 1960 are sold, the seller must give the buyer a completed earthquake hazards disclosure report and a booklet titled “The Homeowners Guide to Earthquake Safety.” This publication was written and adopted by the California Seismic Safety Commission.

### **City of Ontario**

#### *Ontario Municipal Code*

Ontario Municipal Code Section 8-1.01 adopts the 2007 CBC including CBC Appendix J (Grading) into the Municipal Code, subject to certain amendments.



#### **5.7.2 Thresholds of Significance**

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

- G-1 Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. (Refer to Division of Mines and Geology Special Publication 42.)
  - ii) Strong seismic ground shaking.
  - iii) Seismic-related ground failure, including liquefaction.
  - iv) Landslides.
- G-2 Result in substantial soil erosion or the loss of topsoil.

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- G-3 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.
- G-4 Be located on expansive soil, as defined in Table 18-1B of the Uniform building Code (1994), creating substantial risks to life or property.
- G-5 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.

The Initial Study, included as Appendix A, substantiates that impacts associated with the following thresholds would be less than significant:

- Threshold G-1.iv

This impact will not be addressed in the following analysis.

#### 5.7.3 Environmental Impacts

Buildout of The Ontario Plan is projected to lead to increases of 187,161 residents and 218,004 workers in the City. The following impact analysis addresses thresholds of significance for which the Initial Study disclosed potentially significant impacts. The applicable thresholds are identified in brackets after the impact statement.

**IMPACT 5.7-1: RESIDENTS, WORKERS, AND VISITORS IN THE CITY COULD BE SUBJECTED TO SEISMIC HAZARDS SUCH AS GROUND SHAKING, LIQUEFACTION, AND SEISMICALLY INDUCED SETTLEMENT. [THRESHOLD G-1]**

#### **Impact Analysis:**

##### **Earthquakes**

The Upper Santa Ana River Valley and vicinity contain a number of known earthquake faults, which are described above in Table 5.7-1 and shown in Figure 5.7-2. Of the faults listed, the southern section of the San Andreas Fault is estimated to be capable of generating the greatest magnitude earthquake, 8.0. The most intense peak horizontal ground acceleration that any of these faults is estimated to be capable of generating in the City of Ontario is approximately 0.54 g, by the Chino Fault, which passes approximately four miles from the southwestern City boundary. Projects considered for approval under The Ontario Plan would be required to comply with seismic safety provisions of the CBC (Title 24, Part 2 of the California Code of Regulations). Such compliance would reduce hazards arising from ground shaking to less than significant.

##### **Liquefaction**

Two of the three factors contributing to susceptibility to liquefaction are present or potentially present in the City: potential for strong earthquakes and young, loose, unconsolidated sediments. However, fine sand and silty sand, the sediment types most often associated with liquefaction, occur mainly in the New Model Colony area. The third factor, groundwater within approximately 50 feet of the surface, does not currently exist in the City; however, artesian wells were reported in the southwestern corner of the City in the early 1900s. Areas of liquefaction susceptibility are shown in Figure 5.7-3. Most of the New Model Colony area is considered to have low to moderate liquefaction susceptibility due to sediments that are young, unconsolidated, and

generally fine grained, while a small portion of the southwestern corner of the City is considered to have moderate to high liquefaction susceptibility due to historical artesian well activity in addition to the previously mentioned characteristics. Most of the new development that would occur pursuant to The Ontario Plan would be in the New Model Colony. Projects approved under The Ontario Plan could subject persons or structures to potentially significant hazards arising from liquefaction. Such projects would be mandated to comply with the CBC, thereby reducing such hazards.

#### **Seismically Induced Settlement**

The entire Ontario area is underlain by young, unconsolidated alluvial deposits and artificial fill that may be susceptible to seismically induced settlement (see Figure 5.7-1). Implementation of The Ontario Plan could indirectly increase the numbers of persons and structures in the City that could be subjected to earthquake-related hazards. Projects developed pursuant to The Ontario Plan would be required to meet the most current seismic safety requirements in the CBC. Chapter 16 of the CBC contains requirements for design and construction of structures to resist loads, including earthquake loads. Chapter 18 contains requirements for excavation, grading, and fill; load-bearing values of soils; and foundations, footings, and piles. Compliance with those requirements would ensure that there would not be substantial impacts related to ground shaking, liquefaction, or seismic settlement. The Ontario Plan Policy S1-1 would require that all new habitable structures be designed in accordance with the most recent Building Code adopted by the City, including provisions regarding lateral forces and grading.

**IMPACT 5.7-2: HAZARDS ARISING FROM GROUND SUBSIDENCE, COMPRESSIBLE SOILS, EXPANSIVE SOILS, AND EROSION EXIST OR COULD EXIST IN THE CITY. [THRESHOLDS G-2, G-3, AND G-4]**

**Impact Analysis:** Soils hazards related to earthquakes, such as liquefaction and induced settlement, are addressed above under Impact 5.7-1.

#### **Ground Subsidence**

The thick alluvial deposits comprising the Chino Subbasin may be susceptible to compaction, with resulting subsidence at the surface, in the event of rapid groundwater withdrawal. Surface subsidence of up to 2.5 feet and ground fissuring from groundwater extraction have been reported in the City of Chino. Projects considered for approval under The Ontario Plan could expose structures or persons to potentially significant hazards from ground subsidence. However, compliance with the CBC and review of grading plans for individual projects by the City Engineer would ensure no significant impacts would occur.

#### **Compressible Soils**

The young sediments underlying the City are generally dry and loose in the upper few feet, and therefore are susceptible to compression. Much of the New Model Colony has been intensively farmed, and is therefore especially susceptible to compression. Developments approved pursuant to The Ontario Plan could expose persons or structures to potentially significant hazards from compressible soils. However, compliance with the CBC and review of grading plans for individual projects by the City Engineer would ensure no significant impacts would occur.

#### **Expansive Soils**

Expansive soils are likely in the southern parts of the City, where there are silts, sandy silts, and silty clays. Near-surface soils in the northern and central parts of the City are primarily granular, that is, silty sand, sand,



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and gravel; such sediments are usually nonexpansive or have very low expansion potential. Projects in the southern part of the City considered for approval under The Ontario Plan could expose persons or structures to potentially significant hazards from expansive soils. However, compliance with the CBC and review of grading plans for individual projects by the City Engineer would ensure no significant impacts would occur.

#### **Erosion**

The young alluvial sediment and wind-blown sand underlying the City are generally granular, poorly consolidated, and very susceptible to erosion. Grading increases the potential for erosion by removing protective vegetation, changing natural drainage patterns, and constructing slopes. However, compliance with the CBC and review of grading plans for individual projects by the City Engineer would ensure no significant impacts would occur. In addition, construction activities on project sites larger than one acre are required to prepare a Stormwater Pollution Prevention Plan that details best management practices to reduce the potential for erosion during construction activities. Consequently, impacts would be less than significant.

#### **Conclusion**

Development pursuant to The Ontario Plan could indirectly lead to increases in the numbers of persons and structures that would be exposed to hazards arising from unstable soils conditions. Compliance with CBC requirements would reduce such potentially significant geotechnical hazards. Chapter 18 of the CBC contains requirements for foundation and soils investigations; excavation, grading, and fill; load-bearing values of soils; and foundations, footings, and piles.

**IMPACT 5.7-3      THE CITY OF ONTARIO IS SERVED BY REGIONAL WASTEWATER TREATMENT FACILITIES, AND DEVELOPMENT PURSUANT TO THE PROPOSED ONTARIO PLAN IS NOT EXPECTED TO INVOLVE THE USE OF SEPTIC TANKS. [THRESHOLD G-5]**

**Impact Analysis:** Wastewater from the City of Ontario is treated at wastewater treatment facilities owned and operated by the Inland Empire Utilities Agency. These facilities are Regional Plant No. 1 in the City of Ontario and Regional Plant No. 5 in the City of Chino (see Section 5.17, *Utilities and Service Systems*). The use of septic tanks would not occur in the City.

#### **5.7.4      Relevant Policy Plan Policies and Programs**

##### **Safety Element**

##### **Seismic/Geologic Hazards**

- S1-1      Implementation of Regulations and Standards. We require that all new habitable structures be designed in accordance with the most recent Building Code adopted by the City, including provisions regarding lateral forces and grading.
- S1-2      Entitlement and Permitting Process. We follow state guidelines and the Building Code to determine when development proposals must conduct geotechnical and geological investigations.
- S1-3      Continual Update of Technical Information. We maintain up-to-date California Geological Survey seismic hazard maps.

S1-4 Seismically Vulnerable Structures. We conform to state law regarding unreinforced masonry structures.

### **5.7.5 Existing Regulations and Standard Conditions**

#### **State and Federal Regulations**

- Seismic Hazard Mapping Act: requires the California Geological Survey to prepare and provide local governments with maps of seismic hazard zones.
- 2007 California Building Code (Title 24, California Code of Regulations, Part 2): includes seismic safety standards for the design and construction of buildings

### **5.7.6 Level of Significance Before Mitigation**

Upon implementation of regulatory requirements and standard conditions of approval, the following impacts would be less than significant: 5.7-1, 5.7-2, and 5.7-3.

### **5.7.7 Mitigation Measures**

No mitigation measures are required.

### **5.7.8 Level of Significance After Mitigation**

No significant impacts have been identified, and no significant and unavoidable impacts would occur.



## *5. Environmental Analysis*

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### GEOLOGY AND SOILS

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