5.6 Geology and Soils

This section describes the existing geology, soils, and seismic conditions on the project site and analyzes the potential physical environmental impacts to people and property related to seismic hazards, underlying soil characteristics, slope stability, erosion, and excavation and export of soils. Potential impacts of soil conditions on air and water quality as a result of construction-related activities are discussed in Section 5.3, Air Quality; Section 5.7, Greenhouse Gas Emissions; and Section 5.9, Hydrology and Water Quality. This section is based on data provided by the City of Escondido, the County of San Diego, the U.S. Geologic Service (USGS) and other sources, as cited throughout the section.

General information in this section is taken from the Escondido General Plan Update EIR (City of Escondido 2012) unless otherwise referenced. Project-specific information is from the Third Party Geotechnical Feasibility and Grading Plan Review, Oak Creek Subdivision (66 lots), City of Escondido, San Diego County, California (Appendix D of this EIR) and the Custom Soil Resource Report for San Diego County Area, California, Oak Creek (Appendix E). A summary of the geology and soils impacts identified in Section 5.6.3, Analysis of Project Impacts and Determination of Significance, is provided in Table 5.6-1, Geology and Soils Summary of Impacts.

Table 5.6-1 Geology and Soils Summary of Impacts

Issue Number	Issue Topic	Project Direct Impact	Project Cumulative Impact	Impact After Mitigation
1	Exposure to Seismic-Related Hazards	Less than Significant	Less than Significant	No Mitigation Required
2	Soil Erosion or Topsoil Loss	Less than Significant	Less than Significant	No Mitigation Required
3	Soil Stability	Potentially Significant	Less than Significant	Less than Significant
4	Expansive Soils	Less than Significant	Less than Significant	No Mitigation Required
5	Wastewater Disposal Systems	No Impact	No Impact	No Mitigation Required

5.6.1 Existing Conditions

Natural geologic processes that represent an existing or future hazard to life, health, or property are called geologic hazards. Natural geologic hazards that affect people and property in the Project area include earthquakes (which can cause surface fault rupture, ground shaking, and liquefaction), expansive soils, weathering, and mass wasting phenomena such as landslides or rock falls. The Southern California region contains active faults, steep topography, and other geological characteristics that pose public safety concerns and constrain physical development.

5.6.1.1 Geologic Setting

Regional Geologic Setting

The project site is within western San Diego County. San Diego County is located along the Pacific Rim, an area characterized by island arcs with subduction zones forming mountain ranges and deep oceanic trenches, active volcanoes, and earthquakes. A subduction zone is defined as any area where one lithospheric plate sinks under another (USGS 2008c as cited in City of Escondido 2012). This occurs when plates move toward each other or converge. During the Mesozoic Era subduction of the ancient oceanic plate under the continental plate created an archipelago of volcanic islands in the San Diego area. The heat caused by the subduction produced massive volumes of magma that either erupted at the surface forming volcanic rocks or congealed deep in the Earth's crust to form plutonic rocks (e.g., granite). This resulted in the creation of the plutonic rocks now exposed in the some areas. Subsequent heating also metamorphosed the volcanic and sedimentary rocks of the arc as well as the older Paleozoic rocks, forming the foothills of the western part of the ranges. Continuing subduction of the oceanic plate under the continent caused uplifting and erosion that unroofed the deeply buried plutonic rocks to form a steep and rugged, mountainous coastline. Younger Mesozoic and Cenozoic sedimentary rocks have buried these older rocks west of the mountains, while a thick accumulation of Cenozoic sedimentary rocks including layers of lava and ash has filled the basins east of the mountains.

During the Cenozoic Era, a tectonic spreading center began to separate the southwestern part of North America, including San Diego County, from the rest of the continent. The spreading center formed the Gulf of California and the Salton Trough Region. The slow northwestward movement of San Diego County caused intermittent uplift with subsequent erosion, as well as down warping with subsequent deposition of thick accumulations of sediments. Recorded in these Cenozoic sedimentary rocks are conditions of higher rainfall and subtropical climates that supported coastal rain forests with exotic faunas and floras, periods of extreme aridity and volcanism, sea level fluctuations (oceanic inundations and retreats), a great Eocene river and delta, and the formation of new seaways.

As a result of this geologic history, four general rock types are found within the County of San Diego: 1) Cretaceous Age crystalline and Upper Jurassic metavolcanics; 2) Mesozoic Age metamorphic rocks; 3) Tertiary Age sedimentary rocks; and 4) recent alluvium. Cretaceous Age crystalline rocks, including granites, diorites, and gabbros and Upper Jurassic metavolcanics, underlie most of the mountainous terrain in the central portion of San Diego County. These rocks are associated with the Peninsular Ranges batholith of southern California and Baja California. Mesozoic Age metamorphic rocks include marble, schist, and gneiss outcrops that are found in the western foothills and mountains of the Peninsular Ranges and in the desert east of the mountains. Tertiary Age sedimentary rocks include sandstone, conglomerate, and mudstone and are found in the western portion of the County. Deposits of recent alluvium, including sand, gravel, silt, and clay are found in river and stream valleys, around lagoons, in intermountain valleys, and in the desert basins.

Local Geologic Setting

The project site lies within the Peninsular Range Region of San Diego County. The lower Peninsular Range Region is made up of foothills that range in elevation from 600 to 2,000 feet AMSL and is characterized by rolling to hilly uplands that contain frequent narrow, winding valleys. Specifically, the project site is located in the foothills subprovince of the Peninsular Ranges Geomorphic Province, a region typified by northwest-southeast trending structural blocks separated by major regional fault zones. The project site lies west of the major regional fault and mountain ranges of the Peninsular Ranges Province in an area transitional between the coastal plain to the west and the granitic highlands to the east. Surface exposures in the area include rocks ranging from Mesozoic to Quaternary in ages, and recent soils and alluvial deposits of variable depth and composition (Cotton 2000 as cited in City of Escondido 2012).

The project site primarily contains Mesozoic granitic rocks with some areas of Pre-Cenozoic granitic and metamorphic rocks and Mesozoic plutonic rocks. An Old Alluvial Valley Deposit from the late to middle Pleistocene occurs in the northern portion of the project site. Characteristics of geologic formations found in the project site are described in Table 5.6-2, Geologic Formations within the Project Site.

Table 5.6-2 Geologic Formations within the Project Site

Geologic Formation Symbol	Geologic Formation Characteristic
Qoa	Old alluvial valley deposits from the late to middle Pleistocence era
gf	Granitic and other intrusive crystalline rocks of all ages, from the mid-Cretaceous era

Source: City of Escondido 2011 as cited in Escondido General Plan Update EIR 2012

Soil Associations

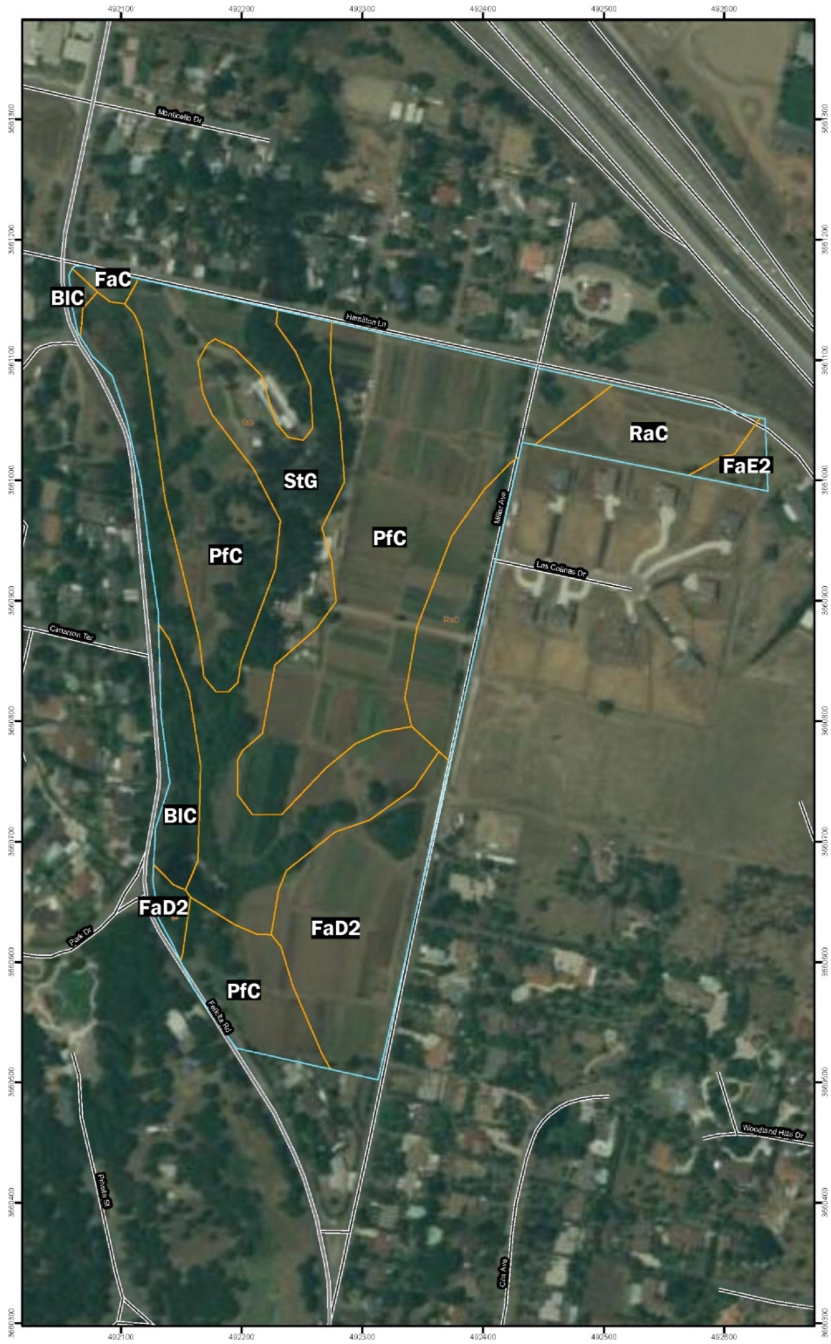
To generally describe soils types, soils are divided into associations (USDA 1973 as cited in City of Escondido 2012). A soil association normally consists of one or more major soils and at least one minor soil, and is named for the major soils. Soils in an association typically differ in slope, depth, stoniness, drainage, and other characteristics that affect management. The San Diego region has been divided into 34 soil associations, each with variable susceptibility to erosive forces, depending on their individual characteristics.

Soils in the Escondido area generally consist of well-drained, medium-to coarse-grained, often rocky sandy loams, commonly with clay loam substrata and underlying igneous and metamorphic bedrock. Most of the soils within the Escondido area have severe erodibility limitations (Cotton 2000 as cited in City of Escondido 2012). Soil types found within the project site are identified in Table 5.6-3, Soil Types within the Project Site, and shown in Figure 5.6-1.

Table 5.6-3 Soil Types within the Project Site

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BlC	Bonsall sandy loam, 2 to 9 percent slopes	1.5	3.5%
FaC	Fallbrook sandy loam, 5 to 9 percent slopes	0.2	0.5%
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	5.3	12.7%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	0.4	1.0%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes	19.2	46.4%
RaC	Ramona sandy loam, 5 to 9 percent slopes	4.2	10.3%
StG	Steep gullied land	10.6	25.5%
Totals for Area of Interest		**41.4**	**100.0%**

Source: NRCS 2013



Map Unit Symbol	Map Unit Name
BlC	Bonsall sandy loam, 2 to 9 % slopes
FaC	Fallbrook sandy loam, 5 to 9 % slopes
FaD2	Fallbrook sandy loam, 9 to 15% slopes, eroded
FaE2	Fallbrook sandy loam, 15 to 30% slopes, eroded
PfC	Placentia sandy loam, thick surface, 2 to 9% slopes
RaC	Ramona sandy loam, 5 to 9% slopes
StG	Steep gullied land

Source: USDA-NRCS 2014

URS

SOIL TYPES

Figure 5.6-1

5.6.1.2 Faults and Seismicity

Regional Seismic Setting

The faulting and seismicity of southern California is dominated by the compressionary regime associated with the "Big Bend" of the San Andreas Fault Zone. The San Andreas Fault Zone separates two of the major tectonic plates that comprise the earth's crust. West of the San Andreas Fault Zone lies the Pacific Plate which is moving in a northwesterly direction relative to the North American Plate, which is located east of the San Andreas Fault Zone. This relative movement between the two plates is the driving force of fault ruptures on the west coast of California. The San Andreas Fault generally trends northwest to southeast and is located to the northeast of the project site, outside of San Diego County. A series of sub-parallel faults are located to the west of the San Andreas Fault Zone including the active San Jacinto, Elsinore, and Rose Canyon Fault Zones which each traverse through San Diego County. North of the Transverse Ranges Province, located generally between Santa Barbara and Joshua Tree, the San Andreas fault trends more in an east to west direction (the Big Bend), causing the fault's right-lateral strike-slip movement to produce north-south compression between the two plates. This compression has produced rapid uplift of many of the mountain ranges in southern California. This crustal shortening is accommodated by faulting (mainly reverse faulting) and causes a large potential for seismicity throughout most of southern California. Faults of the northern Peninsular Ranges Province generally reflect reverse as well as strike-slip faulting patterns, since the province is in a transitionary position between areas dominated by strike-slip movement and by compression.

Local Seismic Setting

Potential faulting within the Project area is limited to a number of inferred fault traces in the southwestern portion of the City. These fault traces have not exhibited any recent activity and are not considered active. Faults showing movement within 1.6 million years (Quaternary) are considered potentially active, and faults showing movement greater than 1.6 million years (Pre-quaternary) are considered inactive. Three active faults, including the San Jacinto Fault, Elsinore Fault and Rose Canyon Fault, have the potential to result in seismic groundshaking within the Project area. The Rose Canyon fault zone is located approximately 15 miles southwest of the project site. The Elsinore fault zone is located approximately 20 miles northeast of the project site. The San Jacinto fault zone is located approximately 40 miles northeast of the project site. These three faults are discussed in greater detail below.

Magnitude Scales

The strength of an earthquake is generally expressed in two ways: magnitude and intensity. The magnitude is a measure that depends on the seismic energy radiated by the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (such as 6.8). The intensity at a specific location is a measure that depends on the effects of the earthquake on people or buildings. Intensity is expressed in Roman Numerals or whole numbers (example: VI or 6). Although there is only one magnitude for a specific earthquake, there may be many values of intensity (damage) for that earthquake at different sites.

Several magnitude scales have been developed by seismologists. The original is the Richter magnitude, developed in 1932 by the late Dr. Charles F. Richter who was a professor at the California Institute of Technology. The Richter scale quantifies the magnitude and intensity of an earthquake through logarithmic equations. The most commonly used scale today is the Moment magnitude scale, jointly developed in 1978 by Dr. Thomas C. Hanks of the USGS and Dr. Hiroo Kanamori, a professor at the California Institute of Technology. Moment magnitude is related to the physical size of fault rupture and the movement (displacement) across the fault, and as such is a more uniform measure of the strength of an earthquake.

Another measure of earthquake size is seismic moment. The seismic moment determines the energy that can be radiated by an earthquake and hence the seismogram recorded by a modern seismograph. The moment magnitude of an earthquake is defined relative to the seismic moment for that event.

It is important to recognize that earthquake magnitude varies logarithmically with the wave amplitude or seismic moment recorded by a seismograph. Each whole number step in magnitude represents an increase of ten times in the amplitude of the recorded seismic waves, and the energy release increases by a factor of about 31 times. The size of the fault rupture and the fault's displacement (movement) also increase logarithmically with magnitude.

Magnitude scales have no fixed maximum or minimum. Observations have placed the largest recorded earthquake (off-shore from Chile in 1960) at moment magnitude 9.6 and the smallest at -3. Earthquakes with magnitudes smaller than about 2 are called microearthquakes.

Magnitudes are not used to directly estimate damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude as an earthquake that occurs in a barren, remote area that does nothing more than frighten wildlife.

Earthquake Intensity

The first scale to reflect earthquake intensities (damage) was developed by de Rossi of Italy and Forel of Switzerland in the 1880s and is known as the Rossi-Forel Intensity scale. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology. In 1902, the Italian seismologist, Mercalli, devised a new scale on an I to XII range. The Mercalli intensity scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neumann to take into account modern structural features. Table 5.6-4, Modified Mercalli Intensity Scale, lists the measurements/values in the Modified Mercalli Intensity (MMI) scale.

Table 5.6-4 Modified Mercalli Intensity Scale

MMI Scale Number	Description of Effect
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only be a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bend greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

Source: City of Escondido 2012

The MMI scale measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layperson because it is based on observations of earthquake effects at specific places. It should be noted that because the data used for assigning intensities are obtained from direct accounts of the earthquake's effects at numerous towns, considerable time (weeks to months) is sometimes needed before an intensity map can be assembled for a particular earthquake.

On the MMI scale, values range from I to XII. The most commonly used adaptation covers the range of intensities from the conditions of I, not felt except by very few, favorably situated, to XII, damage total, lines of sight disturbed, objects thrown into the air. While an earthquake has only one magnitude, it can have much intensity, which typically decreases with distance from the epicenter.

It is difficult to compare magnitude and intensity because intensity is linked with the particular ground and structural conditions of a given area, as well as distance from the earthquake epicenter, while magnitude depends on the energy released by earthquake faulting. However, there is an approximate relation between magnitude and maximum expected intensity close to the epicenter. Table 5.6-5, Comparison of Richter Magnitude and Modified Mercalli Intensity, compares Richter magnitude and MMI values. The areas shaken at or above a given intensity increase logarithmically with earthquake magnitude.

Table 5.6-5 Comparison of Richter Magnitude and Modified Mercalli Intensity

Richter Magnitude	Expected MMI Value	Effect at Site
2	I – II	Usually detected only by instruments
3	III	Felt indoors
4	IV – V	Felt by most people; slight damage
5	VI – VII	Felt by all; many frightened and run outdoors; damage minor to moderate
6	VII – VIII	Everybody runs outdoors; damage moderate to major
7	IX – X	Major damage
8	X – XII	Total and major damage

Source: City of Escondido 2012

Local Faults and Seismicity

Numerous faults have been mapped throughout San Diego County in the vicinity of the project site. Each fault is classified based on its most recent movement as indicated below:

- Historic (movement within the last 200 years)
- Holocene (movement within the past 11,000 years)
- Late-Quaternary (movement within the past 700,000 years)
- Quaternary (age undifferentiated within the past 1.6 million years)
- Pre-Quaternary (movement older than 1.6 million years)

Several major active faults and fault zones are present within the San Diego region, as described below in Table 5.6-6, Active Faults Relevant to the Project. Active fault zones relevant to the project site include San Jacinto Fault Zone, including Coyote Creek Fault; Elsinore Fault Zone and the nearby Earthquake Valley Fault; and the Rose Canyon Fault Zone, including a series of unnamed faults trending from downtown San Diego across San Diego Bay to the City of Coronado. The San Andreas Fault Zone is not located within the Project area, but is included in this discussion because it is a major fault zone with a length of roughly 900-miles in California. A portion of the fault zone traverses through Imperial County, east of the Project area.

Table 5.6-6 Active Faults Relevant to the Project

Fault Name	Approximate Distance from Project Site[1]	Maximum Credible Event[2]	Maximum Probably Event[3]
San Andreas	65 miles northwest	8.2	--
San Jacinto	40 miles northeast	7.2	--
Coyote Creek	40 miles northeast	7.5	7.0
Coronado Banks	28 miles southwest	6.8	6.0
Elsinore	20 miles northeast	7.0	6.8
Rose Canyon	15 miles southwest	7.0	6.5

1 Distance from project site is based on the distance from the Escondido General Plan Update area.

2 The maximum credible earthquake is the maximum earthquake that appears capable of occurring under the presently known tectonic framework, or the earthquake magnitude having a 10 percent probability of being exceeded in a 250-year period.

3 The maximum probable earthquake is the maximum earthquake having a 10-percent probability of being exceeded in 50 years.

Source: Cotton 2000

5.6.1.3 Seismic Hazards

Although no active faults are located within the Project area, earthquake-related geologic hazards from other active faults in the region pose a significant threat to the project site and can impact extensive regions of land. Earthquakes can produce fault rupture and strong ground shaking, and can trigger landslides, rockfalls, soil liquefaction, tsunamis, and seiches. In turn, these geologic hazards can lead to other hazards such as fires, dam failures, and toxic chemical releases.

Primary effects of earthquakes include violent ground motion, and sometimes permanent displacement of land associated with surface rupture. Earthquakes can snap and uproot trees, or knock people to the ground. They can also shear or collapse large buildings, bridges, dams, tunnels, pipelines and other rigid structures, as well as damage transportation systems, such as highways, railroads and airports.

Secondary effects of earthquakes include near-term phenomena such as liquefaction, landslides, fires, tsunamis, seiches, and floods. Long-term effects associated with earthquakes include phenomena such as regional subsidence or emergence of landmasses and regional changes in groundwater levels.

The Project would include construction of 65 new single-family detached residences potentially at risk of being exposed to earthquake hazards.

Fault Rupture

During earthquakes, the ground can rupture at or below the surface. Ground rupture occurs when two lithospheric plates heave past each other, sending waves of motion across the earth. The lithosphere is approximately 75 miles thick and consists of the upper continental and oceanic crusts and the rigid mantle layer that is directly beneath the crust. Earthquakes can cause large vertical and/or horizontal displacement of the ground along the fault. Ground rupture can completely demolish structures by rupturing foundations or by tilting foundation slabs and walls, as well as damage buried and above ground utilities. Drinking water can be lost, and the loss of water lines or water pressure can affect emergency services, including firefighting ability. Research of historical earthquakes has shown that, although only a few structures have been ripped apart by fault rupture, this hazard can produce severe damage to structures built across active fault lines.

Alquist-Priolo Earthquake Fault Zones

In 1972, the state passed the Alquist-Priolo (AP) Earthquake Zoning Act to help identify areas subject to severe ground shaking. It also regulated the siting of buildings with regard to surface fault rupture following the 1971 San Fernando Earthquake. Earthquake faults are categorized as active, potentially active, and inactive. A fault is classified as active if it is included as an Earthquake Fault Hazard Zone, which indicated movement within the past 11,000 years. The purpose of this Act is to prohibit the placement of most structures for human occupancy across the traces of active faults; thereby mitigating the hazard of fault ruptures. Earthquake Fault Hazard Zones identify the probability of ground rupture for future earthquakes. Where such zones are designated, no buildings or structures may be constructed on the trace of the fault. No Earthquake Fault Hazard Zones exist within the project site.

As discussed above, the San Jacinto Fault, Elsinore Fault and Rose Canyon Fault have the potential to result in seismic groundshaking within the project site. These three faults are discussed in greater detail below.

Rose Canyon Fault Zone

The Rose Canyon fault zone is about 19 miles in length and extends through the City of San Diego, La Jolla and Linda Vista communities. The Rose Canyon fault zone is located approximately 15 miles southwest of the project site. It has a slip rate category of approximately 1.1 mm/yr. According to the USGS (2000 as cited in City of Escondido 2012), no historic rupture has occurred on this fault; however, data suggests that there have been a minimum of three surface fault-rupture events in the last approximately 8,100 years. The last large earthquake is estimated to have occurred between 225 and 500 years ago. The faults in this zone typically dip to the east.

Elsinore Fault Zone

The Elsinore fault zone crosses eastern San Diego County on an approximately 124-mile path from the Mexican border to the northern end of the Santa Ana Mountains in Los Angeles County. Near its northwestern end in Riverside County, the fault splits into the Whittier and Chino faults. The Elsinore fault zone is located approximately 20 miles northeast of the project site. The maximum probable earthquake for the Elsinore fault zone is estimated at a magnitude of 6.5 to 7.3 on the Richter scale, with a recurrence interval of 60 years. The largest historical earthquake on record on the Elsinore fault is a magnitude 6.0 event in 1910. No surface rupture was found resulting from this earthquake.

An approximately 12-mile wide zone on the northeast flank of the Elsinore fault is occupied by four major fault zones. These are the Agua Tibia-Earthquake Valley zone, Aguanga-San Felipe zone, Agua Caliente fault zone, and the Hot Springs fault zone. Of these zones, only the Agua Tibia-Earthquake Valley fault has shown surface displacement during the last 11,000 years. Therefore, this fault zone is classified as a state-designated Earthquake Fault Rupture Zone (an area of ground ruptures due to fault activities within the past 11,000 years).

San Jacinto Fault Zone

The San Jacinto fault zone is a complex fault system that is approximately six miles wide and 155 miles long, extending from its junction with the San Andreas zone in the San Gabriel Mountains to the northern edge of the Gulf of California. The San Jacinto fault zone is located approximately 40 miles northeast of the project site. This zone, which is characterized by straightness, continuity, and high seismicity, is the most active of the southern California plate area faults. It has had 10 earthquakes of magnitude 6.0 or greater since 1890. The San Jacinto fault trends from the northwest to the southeast across the northeastern corner of San Diego County, where its zone includes the Coyote Creek, Clark, San Felipe Hills, Borrego Mountain, and many smaller, unnamed Quaternary faults.

Ground Shaking

Ground shaking is the earthquake effect that produces the vast majority of damage. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Earthquakes, or earthquake-induced landslides, can cause damage near and far from fault lines. The potential damage to public and private buildings and infrastructure can threaten public safety and result in significant economic loss. Ground shaking is the most common effect of earthquakes that adversely affects people, animals, and constructed improvements. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Seismic waves propagating through the earth's crust are responsible for the ground vibrations normally felt during an earthquake. Seismic waves can vibrate in any direction, and at different frequencies, depending on the frequency content of the earthquake rupture mechanism and the path and material through which the waves are propagating. The earthquake rupture mechanism is the distance from the earthquake source, or epicenter, to an affected site.

The California Building Code (CBC) defines different Seismic Design Categories based on building occupancy type and the severity of the probable earthquake ground motion at the site. There are six Seismic Design Categories designated A through F, with Category A having the least seismic potential and Category F having the highest seismic potential. All of San Diego County, including the project site, is located within Seismic Design Categories E and F.

Liquefaction

Liquefaction occurs primarily in saturated, loose, fine to medium-grained soils in areas where the groundwater table is generally 50 feet or less below the surface. When these sediments are shaken during an earthquake, a sudden increase in pore water pressure causes the soils to lose strength and behave as a liquid. In general, three types of lateral ground displacement are generated from liquefaction: 1) flow failure, which generally occurs on steeper slopes; 2) lateral spread, which generally occurs on gentle slopes; and 3) ground oscillation, which occurs on relatively flat ground. In addition, surface improvements on liquefiable areas may be prone to settlement and related damage in the event of a large earthquake on a regionally active fault. The primary factors that control the type of failure that is induced by liquefaction (if any) include slope, and the density, continuity, and depth of the liquefiable layer.

Adverse effects of liquefaction include:

- Loss of bearing strength so that the ground loses its ability to support structures. Structures can be left leaning or they can collapse.
- Lateral spreading where the ground can slide on a buried liquefied layer. Buildings, roads, pipelines and other structures can be damaged.

- Sand boils of sand-laden water can be ejected from a buried liquefied layer and erupt at the surface. The surrounding ground often fractures and settles.
- Ground oscillation so that the surface layer, riding on a buried liquefied layer, is thrown back and forth by the shaking and can be severely deformed. Land containing walkways, roads, highways, and structures can all be shaken, broken, damaged and/or destroyed.
- Flotation to the surface of light-weight structures that are buried in the ground (e.g., pipelines, sewers, and nearly empty fuel tanks).
- Settlement when liquefied ground re-consolidates following an earthquake.

During an earthquake, the solid particles in a shallow sedimentary layer tend to decrease in volume due to ground shaking, causing a reduction in soil strength. Liquefaction only occurs if the sediment is sand sized, loosely consolidated, saturated, subject to vibration. Liquefaction occurs primarily in saturated, loosely consolidated, and fine to medium-grained sandy soils in areas where the groundwater table is generally 50 feet or less below the surface and is subject to vibration. Other important factors contributing to liquefaction include the earthquake's magnitude and the duration of the shaking. The Project is not in an area with the potential for liquefaction hazards to occur.

Landslides

A landslide is the down slope movement of soil and/or rock. Landslides can range in speed from very rapid to an imperceptible slow creep. Landslides can be caused by ground shaking from an earthquake or water from rainfall, septic systems, landscaping, or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from ground shaking, blasting or a gradual loosening of their contact with the surface. The likelihood of a landslide depends on an area's geologic formations, topography, ground shaking potential, and influences of man. Improper or excessive grading can increase the probability of a landslide. Land alterations such as excavation, placement of fill, removal of vegetative cover, and introduction of water from drainage, irrigation or septic systems may contribute to the instability of a slope and increase the likelihood of a landslide. Undercutting support at the base of a slope, or adding too much weight to the slope, can also produce a landslide.

An example of a typical adverse effect of landslides is the loss of manmade structures, utilities and roads and/or loss of life by a landslide or rockfall that originated on an unstable area upslope of a home. Adverse effects vary with the size or volume of individual landslides/rockfall events and density of development below. The magnitude of such events can range from movement as small as a single boulder to massive movement of millions of cubic yards of material. The project site contains slopes of greater than 25 percent but no areas where soils are considered subject to landslide.

Subsidence and Settlement

Subsidence, which can be caused by groundwater depletion, seismic activity, and other factors, refers to elevation changes of the land whether slow or sudden. Subsidence can cause a variety of problems including broken utility lines, blocked drainage, or distorted property boundaries and survey lines. According to the Multi-jurisdictional Hazard Mitigation Plan (URS 2004 as cited in City of Escondido 2012), the underlying geologic formations in the project site are mostly granitic and have a very low potential of subsidence.

Expansive Soils

Certain types of clay soils expand when they are saturated and shrink when dried. These are called expansive soils, and can pose a threat to the integrity of structures built on them without proper engineering. Expansive soils are derived primarily from weathering of feldspar minerals and volcanic ash. Expansive soils do not occur in the project site.

Soil Erosion

Erosion of soils can occur from both wind and water sources. Wind erosion physically removes the lighter, less dense soil constituents such as organic matter, clays, and silts, which are often the most fertile part of the soil. Surface water runoff erodes exposed land and undercuts roadbanks, landfills, and riverbanks. Wind moves exposed loose soils off site and can contribute to reduced air quality. Eroded materials fill reservoirs, ponds, and drainage ditches and silt up harbors, streams, and rivers. Soils in the project site have severe erodibility limitations (Cotton 2000 as cited in City of Escondido 2012).

5.6.2 Regulatory Framework

5.6.2.1 Federal

U.S. Geological Survey Landslide Hazard Program

In fulfillment of the requirements of Public Law 106-113, the USGS created the Landslide Hazard Program in the mid-1970s. According to USGS, the primary objective of the National Landslide Hazards Program is to reduce long-term losses from landslide hazards by improving the understanding of the causes of ground failure and suggesting mitigation strategies (USGS 2008a as cited in City of Escondido 2012). The federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility.

5.6.2.2 State

Alquist-Priolo Earthquake Fault Zoning Act

The California Legislature passed this law in 1972 to help identify areas subject to severe ground shaking. This state law requires that proposed developments incorporating tracts of four or more dwelling units investigate the potential for ground rupture within Alquist-Priolo zones. These zones identify the probability of ground rupture during future earthquakes. Where such zones are designated, no buildings or structures may be constructed on the line of the fault, and before any construction is allowed, a geologic study must be conducted to determine the locations of all active fault lines in the zone.

California Building Code

The CBC provides a minimum standard for building design. Chapter 16 of the 2010 CBC contains specific requirements for seismic safety. The CBC includes the addition of more stringent seismic provisions for hospitals, schools, and essential facilities. The CBC contains specific provisions for structures located in seismic zones. Buildings within the project site must conform to Seismic Design Category E or F. Also, California law requires all cities and counties in Seismic Zone 4 (as defined in pre-1997 versions of the code) to identify unreinforced masonry buildings in their jurisdiction, which are not designed to withstand an earthquake.

Seismic Hazards Mapping Act

This Act was passed by the state in 1990, to address non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. No seismic hazard mapping has been completed by the state for the project site. Guidelines for Evaluation and Mitigating Seismic Hazards in California (Special Publication 117) were adopted by the California Mining and Geology Board in 1997 (revised and re-adopted on September 11, 2008 as Special Publication 117a) in accordance with the Seismic Hazards Mapping Act of 1990. The publication contains the guidelines for evaluating seismic hazards other than surface fault rupture (landslides and liquefaction), and for recommending mitigation measures to minimize impacts.

5.6.2.3 Regional/Local

Chapter 22 of the City of Escondido Municipal Code

Chapter 22 of the City of Escondido's Municipal Code establishes regulations related to storm water management and discharge control, harmful waters and wastes, sewer service charges, private sewage disposal systems, sewer connection fees, sewer-connection laterals, and industrial wastewaters. Article 5 of Chapter 22 of the Code requires all subsurface sewage disposal units and systems to be designed, placed and maintained in accordance with the rules and regulations of the County of San Diego. The County Department of Environmental Health (DEH) is the primary agency charged with regulating the design, construction, and maintenance of septic tanks, leach lines, seepage pits, and alternative onsite wastewater treatment systems throughout the County through a delegation from the RWQCB.

City of Escondido Grading and Erosion Control Ordinance

Article 55 of the Escondido Municipal Code establishes the grading and erosion control regulations for the City. The purpose of this article is to assure that development occurs in a manner which protects the natural and topographic character and identity of the environment, visual integrity of hillsides and ridgelines, sensitive species and unique geologic/geographic features, and the health, safety, and welfare of the general public. This Article regulates grading on private and public property and provides standards and design criteria to control stormwater and erosion during construction activities. The ordinance sets forth rules and regulations to control excavation, grading, earthwork construction (including fills and embankments) and development on hillsides and along ridgelines; establishes the administrative procedures for the issuance of permits; and provides for approval of plans and inspection of grading construction in compliance with stormwater management requirements.

County of San Diego Onsite Wastewater System Groundwater Separation Policy

The purpose of the County DEH Onsite Wastewater System Groundwater Separation Policy is three-fold. It serves to: 1) protect groundwater quality by ensuring proper treatment of sewage effluent prior to its entering into groundwater; 2) protect the public health from failing onsite wastewater systems caused by high groundwater; and 3) provide a methodology for the evaluation of potential building sites using onsite wastewater systems.

5.6.3 Analysis of Project Impacts and Determination of Significance

5.6.3.1 Issue 1: Exposure to Seismic-related Hazards

Geology Issue 1 Summary	
Would implementation of the Project expose people or structures to potential substantial adverse effects, including the risk of loss, or 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?	
Impact: Potential exposure of the proposed 65 new residences and their occupants to seismic-related hazards.	**Mitigation:** No mitigation required.
Significance Before Mitigation: Less than significant.	**Significance After Mitigation:** No mitigation required.

Guidelines for Determination of Significance

Based on Appendix G of the CEQA Guidelines and existing City policies and regulations, the Project would result in a significant impact if it would expose people or structures to potential substantial adverse impacts, 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 or based on other substantial evidence of a known fault; strong seismic ground shaking; or seismic-related ground failure, including liquefaction; or landslides. The threshold for each of these seismic-related hazards is discussed below.

Fault Rupture

The Project would result in a significant impact from fault rupture if any building or structure to be used for human occupancy would occur over or within 50 feet of the trace of an Alquist-Priolo Fault.

Seismic Ground Shaking

The Project would result in a significant impact from ground shaking if any building or structure to be used for human occupancy would be located within Seismic Design Category E and F of the CBC and would not conform to the CBC.

Ground Failure

The Project would have the potential to expose people or structures to substantial adverse effects from liquefaction if:

a. Areas proposed for development contain potentially liquefiable soils;
b. Potentially liquefiable soils are saturated or have the potential to become saturated; or
c. In-situ soil densities are not sufficiently high to preclude liquefaction.

Liquefaction occurs when sediments are shaken during an earthquake and a sudden increase in pore water pressure causes the soils to lose strength and behave as a liquid. In general, three types of lateral ground displacement are generated from liquefaction: 1) flow failure, which generally occurs on steeper slopes; 2) lateral spread, which generally occurs on gentle slopes; and 3) ground oscillation, which occurs on relatively flat ground.

Landslides

The Project would result in a significant impact from landslide risk if:

a. It would expose people or structures to substantial adverse effects, including the risk of loss, injury, or death involving landslides;
b. It is located on a geologic unit or soil that is unstable, or would become unstable as a result of the Project, potentially resulting in an on-site or off-site landslide; or
c. It lies directly below or on a known area subject to rockfall that would result in the collapse of structures.

Impact Analysis

Fault Rupture

According to the EGPU 2012, the Alquist-Priolo Earthquake Fault Zoning Act does not identify any active faults or fault zones within Escondido; consequently, the risk of surface rupture is low. The closest known active fault is the Rose Canyon Fault, located offshore approximately 20 miles west of Escondido. Due to the distance of the Project site from the closest known active fault, the potential for the Project to expose people or structures to substantial adverse effects from fault rupture is low. Therefore, impacts associated with rupture of a known fault would be less than significant.

Seismic Ground Shaking

The Southern California region is seismically active. Earthquakes would potentially generate strong seismic ground shaking at the Project site. Pursuant to the Uniform Building Code (UBC) and the California Building Code (CBC), design and construction of the Project would be engineered to withstand the expected ground acceleration that may occur at the Project site from regional active faults. Proper engineering and adherence to the UBC and CBC guidelines would minimize the risk to life and property from potential ground motion at the Project site. Therefore, impacts associated with strong seismic ground shaking would be less than significant.

Liquefaction

Liquefaction is a phenomenon where loose, saturated, and relatively cohesionless soil deposits lose strength during strong ground motions. Primary factors controlling the development of liquefaction include intensity and duration of ground accelerations, characteristics of the subsurface soil, in situ stress conditions, and depth to groundwater. According to the Escondido General Plan, the Project site is not located in a liquefaction hazard area. The geotechnical feasibility review conducted by GeoSoils Incorporated (Appendix D) did not identify any potential liquefaction risks. Therefore, impacts associated with seismic-related ground failure, including liquefaction, would be less than significant.

Landslides

According to the Escondido General Plan Update (2012), the Project site is not located in an area with steep slopes or soils subject to potential landslides. The geotechnical feasibility review conducted by GeoSoils Incorporated (Appendix D) did not identify any potential landslide risks. Therefore, impacts associated with landslides would be less than significant.

Summary

Due to the distance of the Project site from the closest known active fault, the potential for the Project to expose people or structures to substantial adverse effects from fault rupture is low and impacts would be less than significant. Proper engineering and adherence to the UBC and CBC guidelines would minimize the risk to life and property from potential ground motion at the Project site. Therefore, impacts associated with strong seismic ground shaking would be less than significant. The Project site is not located in a liquefaction hazard area. Therefore, impacts associated with seismic-related ground failure, including liquefaction, would be less than significant. The Project site is not located in an area with steep slopes or soils subject to potential landslides. Therefore, impacts associated with landslides would be less than significant. All Project impacts from seismically-related hazards including seismically-induced fault rupture, ground shaking, liquefaction, and landslides would be less than significant.

5.6.3.2 Issue 2: Soil Erosion or Topsoil Loss

Geology Issue 2 Summary	
Would implementation of the Project result in substantial soil erosion or loss of topsoil?	
Impact: The Project would involve site grading and excavations up to 19 feet deep, which would result in disturbed soils and temporary stockpiles of excavated materials that would be exposed to erosion.	**Mitigation:** No mitigation required.
Significance Before Mitigation: Less than significant.	**Significance After Mitigation:** No mitigation required.

Guidelines for Determination of Significance

Based on Appendix G of the CEQA Guidelines and existing City policies and regulations, the Project would result in a significant impact if it would result in substantial soil erosion or loss of topsoil from construction or operational activities.

Impact Analysis

The Project would involve site grading and excavations up to 19 feet deep, which would result in disturbed soils and temporary stockpiles of excavated materials that would be exposed to erosion. However, compliance with the NPDES Construction General Permit, which requires the development of a Storm Water Pollution Prevention Plan (SWPPP) for the project site, would minimize the potential for soil erosion and loss of top soil through the implementation of best management practices (BMPs), such as the following:

- **Minimizing Disturbed Areas.** Clearing of land is limited to that which will be actively under construction in the near term, new land disturbance during the rainy season is minimized, and disturbance to sensitive areas or areas that would not be affected by construction is minimized.
- **Stabilizing Disturbed Areas.** Temporary stabilization of disturbed soils is provided whenever active construction is not occurring on a portion of the Project site, and permanent stabilization is provided by finish grading and permanent landscaping.
- **Protecting Slopes and Channels.** Outside of the approved grading plan area, disturbance of natural channels is avoided, slopes and crossings are stabilized, and increases in

runoff velocity caused by the Project are managed to avoid erosion to slopes and channels.

- **Controlling the Site Perimeter**. Upstream runoff is diverted around or safely conveyed through the Project site and is kept free of excessive sediment and other constituents.
- **Controlling Internal Erosion.** Sediment-laden waters from disturbed, active areas within the Project site are detained.

Once construction is completed, no stockpiles would remain on the Project site. The site would be paved, developed, or vegetated. Therefore, with implementation of construction BMPs, impacts associated with soil erosion and loss of topsoil would be less than significant.

Summary

The Project would involve site grading and excavations which would result in disturbed soils and temporary stockpiles of excavated materials that would be exposed to erosion. With implementation of construction BMPs, impacts associated with soil erosion and loss of topsoil would be less than significant.

5.6.3.3 Issue 3: Soil Stability

Geology Issue 3 Summary	
Would implementation of 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 on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	
Impact: Unstable soil conditions potentially resulting from unsuitable soils and improperly backfilled excavations. Cut and fill heights requiring a grading exemption discretionary permit. Saturated soils resulting from groundwater seepage could potentially become unstable.	**Mitigation:** ***Geo-1*** Incorporation of recommendations from the geotechnical feasibility review.
Significance Before Mitigation: Potentially significant.	**Significance After Mitigation:** Less than significant.

Guidelines for Determination of Significance

Based on Appendix G of the CEQA Guidelines and existing City policies and regulations, the Project would result in a potentially significant impact if it would be located on a geologic unit or soil that is unstable, or that would become unstable as a result of future development, and potentially result in on-site or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. Lateral spreading is a shallow, water-saturated landslide deformation often triggered from seismically-induced liquefaction. Subsidence, which can be caused by groundwater depletion, seismic activity, and other factors, refers to elevation changes of the land whether slow or sudden.

Impact Analysis

The Project site is currently undeveloped. According to the 2013 GeoSoils Incorporated geotechnical feasibility review (Appendix D of this EIR), the subject property is underlain at depth by Cretaceous-age granitic bedrock. Surficial deposits consist of colluvium alluvium. Top soils, colluviums, and alluvium are considered unsuitable for development. The major soil types encountered are classified per the USCS, as listed in Table 5.6-3. The Project would involve site grading and excavations up to 19 feet deep, and creation of slopes up to 35 feet, which would require backfill with on site and/or imported fill materials. Unsuitable soils, including fill material, and improperly backfilled excavations could potentially result in unstable soil conditions. Proper placement and compaction of backfill and adherence to the UBC and CBC guidelines would minimize the risk of unstable soil conditions at the Project site. However, implementation of the measures recommended in the geotechnical investigation, included below as mitigation measure Geo-1, would be required to reduce impacts to a less than significant level.

Moreover, a grading exemption discretionary permit is required for the Project in accordance with the City of Escondido Municipal Code, Article 55, Grading and Erosion Control, Section 33-1066, Design Criteria because the Project proposes cut slopes greater than 20 feet in height and fill slopes greater than 10 feet in height. The Project would include cut slopes over 20 feet in height to establish building pads on Lots 5, 6, 7 and 9. Cut slopes would have a height range of 30 to 35 feet and a slope inclination of 2:1. The purposed Project would also include fill slopes over 10 feet in height to establish a basin on Lot C. Fill slopes would have a height range of 10 to 15 feet and a slope inclination of 2:1. However, implementation of the measures recommended in the geotechnical investigation, included below as mitigation measure Geo-1, would be implemented to reduce potential impacts associated with the grading exemption to a less than significant level.

Soil stability can also be affected by near-surface groundwater. According to the geotechnical investigation, a perched groundwater table occurs at depths between 3 to 15 feet below existing grades. Perched water appears to be generally associated with areas in close proximity to the existing drainage channels on site. However, the potential exists for perched water to occur elsewhere on the site due to the presence of shallow granitic bedrock. Saturated soils resulting from groundwater seepage could potentially become unstable. This represents a potentially significant impact; however, implementation of mitigation measure Geo-1 (detailed below) would reduce this impact to a less than significant level.

Geo-1 All recommendations contained in the geotechnical feasibility review (Appendix D) shall be incorporated into the Project during construction. These recommendations include the following:

1. Transition lots shall be undercut at least 3 feet and at least one-third the maximum fill thickness on any lot, such that the ratio of 3:1 (maximum:minimum) fill thickness, or flatter is attained. Cut lots shall also be undercut to mitigate perched water conditions. All undercuts shall be sloped to drain away from the building area.
2. The fill cap shall extend to at least one foot below the lowest utility invert in street areas to facilitate trenching operations.
3. For fill slopes descending to property lines, removals shall be completed above a 1:1 projection beginning at the property line, or a point located at least 5 feet laterally from any adjacent street, or any nearby utility. Relatively deep removals adjacent to property line at Lots 3, 4, 43, 44, and Open Space Lot C may necessitate the use of structural setbacks within the building area, or possibly deepened foundations.
4. Any planned import soil shall be very low to low expansive.

Summary

The Project would involve site grading, excavations, backfill, and creation of slopes. Unsuitable soils, including fill material, and improperly backfilled excavations could potentially result in unstable soil conditions. Proper placement and compaction of backfill and adherence to the UBC and CBC guidelines would minimize the risk of unstable soil conditions at the Project site. Moreover, a grading exemption discretionary permit is required for the Project in accordance with the City of Escondido Municipal Code, Article 55, Grading and Erosion Control, Section 33-1066, Design Criteria because the Project proposes cut slopes greater than 20 feet in height and fill slopes greater than 10 feet in height. Saturated soils resulting from groundwater seepage could potentially become unstable representing a potentially significant impact. Implementation of mitigation measure Geo-1 is required to reduce these impacts to a less than significant level.

5.6.3.4 Issue 4: Expansive Soils

Geology Issue 4 Summary	
Would implementation of the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1997), creating substantial risks to life or property?	
Impact: The majority of soil at the project site possesses a low to very low expansion potential	**Mitigation:** No mitigation required.
Significance Before Mitigation: Less than significant.	**Significance After Mitigation:** No mitigation required.

Guidelines for Determination of Significance

Based on Appendix G of the CEQA Guidelines and existing City policies and regulations, the Project would result in a significant impact if it would be located on expansive soil, as defined in Section 1802A.3.2 of the CBC, creating substantial risks to life or property.

Impact Analysis

According to the 2013 GeoSoils Incorporated geotechnical feasibility review (Appendix D of this EIR), the majority of soil at the Project site possesses a low to very low expansion potential (expansion index of less than 50). Therefore, impacts associated with expansive soil would be less than significant.

Summary

The majority of soil at the Project site possesses a low to very low expansion potential (expansion index of less than 50). Therefore, impacts associated with expansive soil would be less than significant.

5.6.3.5 Issue 5: Wastewater Disposal Systems

Geology Issue 5 Summary	
Would implementation of the Project have soils incapable of adequately supporting the use of septic tanks or alternative waste disposal systems where sewers are not available for the disposal of wastewater?	
Impact: No impact.	**Mitigation:** No mitigation required.
Significance Before Mitigation: No impact.	**Significance After Mitigation:** No mitigation required.

Guidelines for Determination of Significance

Based on Appendix G of the CEQA Guidelines and existing City policies and regulations, the Project would result in a significant impact if it would 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. Soil types that may be incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems include soils in the Auld, Bonsall, Chino, Fallbrook, Huerhuero, Los Posas, Placentia, Ramona, San Miguel, and Wyman series.

Impact Analysis

The Project site would be provided with sanitary sewer service by the City of Escondido. The Project would connect to the existing sanitary sewer system within the area and would not include the use of septic tanks or alternative waste disposal systems. No impact would occur.

Summary

The Project would not require the use of septic tanks or alternative wastewater disposal systems; therefore, no impact would occur.

5.6.4 Cumulative Impacts

The geographic scope of the cumulative impact analysis for geology is limited to the immediate area of the geologic constraint, with the exception of some geologic impacts that are regional, such as earthquake risk.

Issue 1: Exposure to Seismic Related Hazards

Most of Southern California is located in an area of relatively high seismic activity, including cumulative projects in the San Diego region. Cumulative projects, such as those located in adjacent city and county jurisdictions, would be subject to the CBC, which contains requirements for development in areas subject to Seismic Design Categories E and F. Additionally, cumulative projects would be subject to the Alquist-Priolo Earthquake Fault Zone Act, which restricts development on active fault traces. Compliance with these regulations would result in a less than significant regional cumulative impact. The Project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

Issue 2: Soil Erosion or Topsoil Loss

Cumulative projects would have the potential to result in substantial soil erosion or the loss of topsoil through construction activities such as grading and excavation that would result in topsoil being washed or blown away. Cumulative projects would result in sedimentation to stream courses, which would result in a potentially significant cumulative impact. Most cumulative projects would be subject to state and local runoff and erosion prevention requirements, including the applicable provisions of the CBC and SWRCB general construction permit, which requires the implementation of BMPs to reduce potential impacts associated with the hydromodification of project sites. These measures would be required to be implemented as conditions of approval for future development projects and are subject to continuing enforcement. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The Project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

Issue 3: Soil Stability

Cumulative projects would have the potential to be located on geologic units or soils that are 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. Cumulative projects would be required to undergo analysis of geological and soil conditions applicable to the development site in question during CEQA environmental review and comply with all applicable regulations to reduce risks, including the CBC. Cumulative project compliance with applicable regulations would ensure that a significant regional cumulative impact would not occur. The Project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

Issue 4: Expansive Soils

Cumulative projects would have the potential to be located on expansive soil, as defined in Section 1802A.3.2 of the CBC, which would potentially create substantial risks to life or property. Cumulative projects would be subject to construction standards that have been developed to ensure structures can withstand changes in the integrity of the soil, including those identified in the CBC. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The Project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

Issue 5: Wastewater Disposal Systems

The Project would not require the use of septic tanks or alternative waste water disposal systems and, therefore, would not contribute to a potentially significant cumulative impact.

5.6.5 Significance of Impacts Prior to Mitigation

The Project would not result in potentially significant direct or cumulative impacts associated with the exposure to seismic-related hazards, soil erosion or topsoil loss, soil stability, expansive soils and wastewater disposal systems.

5.6.6 Mitigation

Issue 1: Exposure to Seismic-Related Hazards

The Project would not result in a significant direct or cumulative impact associated with exposure to seismic-related hazards. Therefore, no mitigation is necessary.

Issue 2: Soil Erosion or Topsoil Loss

The Project would not result in a significant direct or cumulative impact associated with soil erosion and topsoil loss. Therefore, no mitigation is necessary.

Issue 3: Soil Stability

The Project has the potential for significant impacts related to soil stability. Implementation of mitigation measure Geo-1, detailed in Section 5.6.3.3, is required to reduce these impacts to a less than significant level.

Issue 4: Expansive Soils

The Project would not result in a significant direct or cumulative impact associated with expansive soils. Therefore, no mitigation is necessary.

Issue 5: Wastewater Disposal Systems

The Project would not result in a significant direct or cumulative impact associated with wastewater disposal systems. Therefore, no mitigation is necessary.

5.6.7 Conclusion

The discussion below provides a synopsis of the conclusion reached in each of the above impact analyses.

Issue 1: Exposure to Seismic-Related Hazards

Due to the distance of the Project site from the closest known active fault, the potential for the Project to expose people or structures to substantial adverse effects from fault rupture is low. Proper engineering and adherence to the UBC and CBC guidelines would minimize the risk to life and property from potential ground motion at the project site. The project site is not in a liquefaction hazard area or in an area with steep slopes or soils subject to potential landslides. Therefore, direct impacts from seismically-induced ground shaking, liquefaction, and landslides would be less than significant. In addition, the Project would not contribute to a significant cumulative impact associated with seismically-related hazards.

Issue 2: Soil Erosion or Topsoil Loss

The Project would involve site grading and excavations that would result in disturbed soils and temporary stockpiles of excavated materials that would be exposed to erosion. However, compliance with existing applicable regulations, including the NPDES program and CBC, and implementation of construction BMPs, would reduce potential direct impacts to below a significant level. Additionally, the Project would not contribute to a potentially significant cumulative impact associated with soil erosion or topsoil loss.

Issue 3: Soil Stability

The Project would involve site grading, excavations, backfill, and creation of slopes. Unsuitable soils, including fill material and improperly backfilled excavations, could potentially result in unstable soil conditions. Proper placement and compaction of backfill and adherence to the UBC and CBC guidelines would minimize the risk of unstable soil conditions at the project site. Moreover, a grading exemption discretionary permit is required for the Project in accordance with the City of Escondido Municipal Code, Article 55, Grading and Erosion Control, Section 33-1066, Design Criteria because the Project proposes cut slopes greater than 20 feet in height and fill slopes greater than 10 feet in height. Saturated soils resulting from groundwater seepage could potentially become unstable representing a potentially significant impact.

Compliance with state and local building standards and regulations, including the CBC and implementation of mitigation measure Geo-1, would reduce direct impacts associated with on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse to a less than significant level. Additionally, the Project would not contribute to a potentially significant cumulative impact associated with soil stability.

Issue 4: Expansive Soils

The majority of soil at the project site has a low to very low expansion potential (expansion index of less than 50). Therefore, direct and cumulative impacts associated with expansive soil would be less than significant.

Issue 5: Wastewater Disposal Systems

The Project would not require the use of septic tanks or alternative wastewater disposal systems. Therefore, no direct or cumulative impact would occur.

5.6.8 References

City of Escondido. 2012. *Escondido General Plan Update, Downtown Specific Plan Update, and Climate Action Plan Environmental Impact Report. SCH#2010071064.* Prepared by Atkins. April 23.