

## 4.5 GEOLOGY/SOILS AND MINERAL RESOURCES

This section of the Draft EIR describes existing geology, soils, and mineral resources conditions for the San Pedro Community Plan Area (CPA) and analyzes how implementation of the proposed San Pedro Community Plan (proposed plan) could affect or be affected by geologic and soils conditions. No comment letters specifically addressing seismic, soils, or mineral resources were received in response to the Notice of Preparation (NOP) circulated for the proposed plan.

Baseline information for the analysis was compiled from a review of geologic maps and reports prepared by the California Geological Survey (CGS) and Division of Oil, Gas, and Geothermal Resources (DOGGR), as well as information compiled and evaluated by the City of Los Angeles in conjunction with its overall planning and hazard mitigation processes to identify geologic conditions and geologic hazards in the CPA. Additional sources of information included the City of Los Angeles General Plan Framework, the City's development ordinances, and environmental documents prepared for projects in the vicinity of the San Pedro CPA. Full reference-list entries for all cited materials are provided in Section 4.5.5 (References). A regulatory framework is also provided in this section describing applicable agencies and regulations related to geology/soils and mineral resources.

### 4.5.1 Environmental Setting

#### ■ Regional Geologic Setting

The San Pedro CPA is located in the Peninsular Ranges Geomorphic Province and within the Los Angeles Basin. The Peninsular Ranges are characterized by northwest-trending blocks of mountain ridges and sediment-floored valleys. The dominant geologic structure features are northwest-trending fault zones that either fade out to the northwest or terminate at east-trending faults that form the southern margin of the Transverse Ranges. The Los Angeles Basin is bounded on two sides by major faults: the Palos Verdes fault to the south, and the San Gabriel-Foothill fault to the north. The basin is bounded to the east and southeast by the Santa Ana Mountains and San Joaquin Hills, and to the northwest by the Santa Monica Mountains.

Three major groups of rocks are represented within the basin: older igneous<sup>46</sup> and metamorphic<sup>47</sup> bedrock (100 million to 75 million years old), older sedimentary rocks (about 65 million to 15 million years old) and younger sedimentary rocks (15 million to 1 million years old). The sedimentary rock layers contain shale, siltstone, sandstone, and conglomerates, as well as some interbedded volcanic rocks. Over 22 million years ago, the Los Angeles Basin was a deep marine basin formed by tectonic forces between the North American and Pacific plates. Since that time, over 5 miles of marine and non-marine sedimentary rock, as well as intrusive and extrusive igneous, rocks have filled the basin. During the last 2 million years, defined by the Pleistocene and Holocene Epochs, the Los Angeles Basin and surrounding mountain ranges have been uplifted to form the present day landscape.

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<sup>46</sup> An igneous rock is a rock formed by the crystallization of molten material such as magma or lava.

<sup>47</sup> A metamorphic rock is a rock that has been altered by heat, pressure, or chemical actions that change the minerals, textures, and composition of the original rock.

Erosion of the surrounding mountains has resulted in deposition of alluvial materials (unconsolidated sediments) in low-lying areas by the Los Angeles River and its major tributaries (Burbank Western Channel, Pacoima Wash, Tujunga Wash, and Verdugo Wash in the San Fernando Valley; and the Arroyo Seco, Compton Creek, and Rio Hondo south of the Glendale Narrows). The non-hilly portions of the CPA are underlain by these alluvial materials.

## ■ Topography and Physiography

The City of Los Angeles contains many landforms that reflect recent geologic folding and faulting. Four major landform types are represented in the Los Angeles area: high mountains (the San Gabriel Mountains and smaller ranges), broad valleys (San Fernando and San Gabriel Valleys, which are separated from the coastal plain by low hills), low hills, and the coastal plain. The CPA is located at the southern edge of the Los Angeles coastal plain, adjacent to the eastern portion of the Palos Verdes Peninsula. Topographically, the eastern portion of the CPA is mostly flat to gently undulating, while the western portion of the CPA is gently to moderately hilly.

Although the majority of the San Pedro CPA is developed urban land, a few areas of natural or undeveloped open space remain. To the south, open space is provided by the beaches along the Pacific Ocean and shoreline recreation areas, and to the east by the harbor. These areas are predominantly located around the borders, including coastal bluffs and hill slopes to the west and north along the border of Rancho Palos Verdes. A handful of unimproved street rights-of-way also exist throughout the CPA. To the north are the Navy Fuel Depot and Harbor Park, which are proposed to be preserved in their present undeveloped state. Larger open space parcels that remain are primarily on land currently or formerly owned by either the Port of Los Angeles or the federal government, including the Upper, Middle, and White Point reservations of Fort MacArthur.

An old landslide area in South Shores, now well known as Sunken City, was once the fully developed 600 block of Paseo Del Mar before beginning to slide into the sea in 1929. Most of the existing homes were successfully moved before toppling into the ocean, but broken remnants of roads and other infrastructure still remain, and the area is considered geologically unsafe and public access prohibited. Geological studies to date indicate that there may be some risk if any substantial fixed structures were to be placed in that area, and the area is designated open space.

## ■ Regional and Local Faults

A fault is a fracture or line of weakness in the earth's crust, along which rocks on one side of the fault are offset relative to the same rocks on the other side of the fault. Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking.<sup>48</sup>

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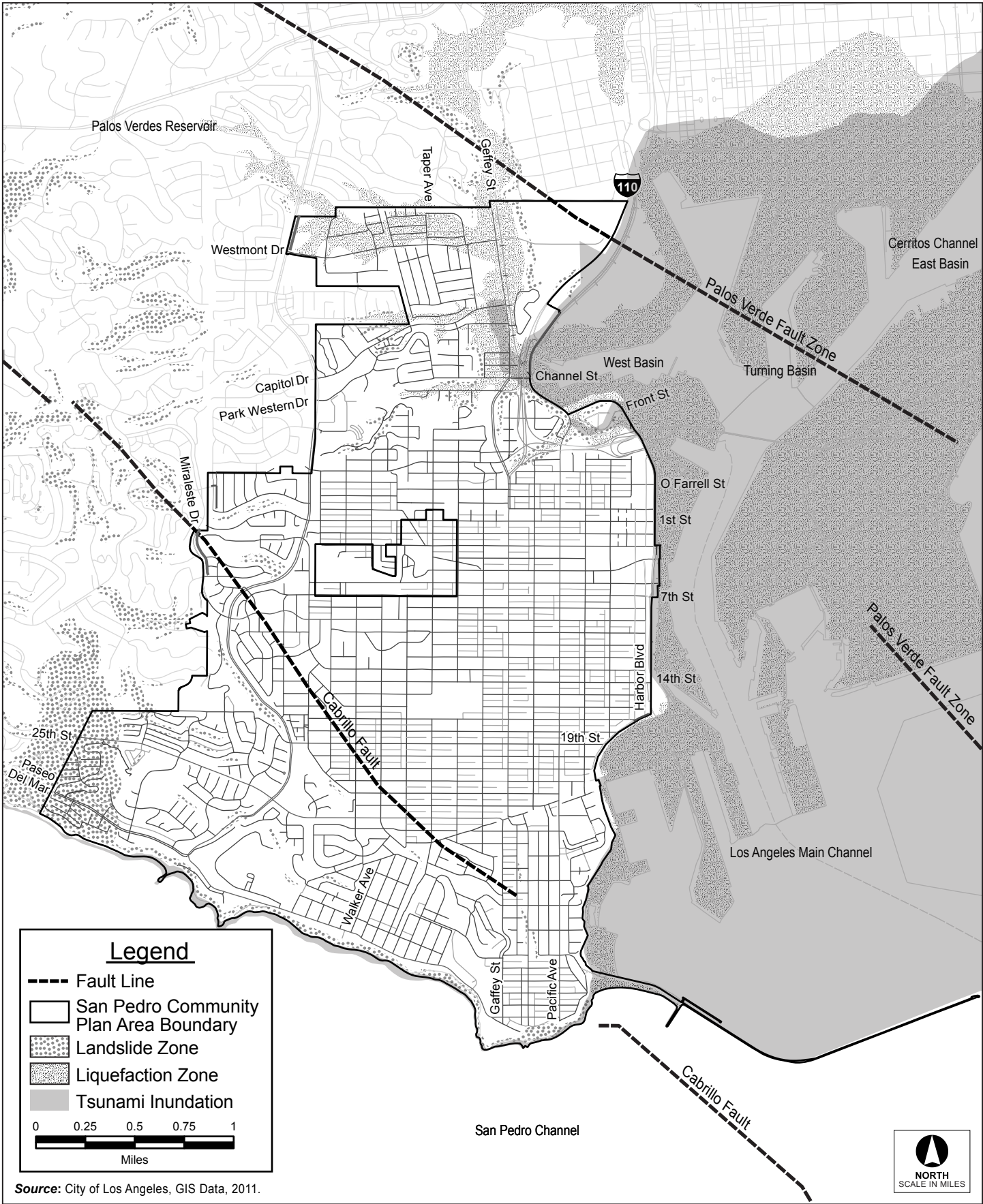
<sup>48</sup> California Geological Survey, Regional Geologic Hazards and Mapping Program, Alquist-Priolo Earthquake Fault Zones (2011), <http://www.consrv.ca.gov/CGS/rghm/ap/Pages/index.aspx>.

Based on criteria established by the CGS, faults may be categorized as active, potentially active, or inactive. Active faults are those that show evidence of surface displacement within the last 11,000 years (Holocene age). Potentially active faults are those that show evidence of the last displacement within the last 1.6 million years (Quaternary age). Faults showing no evidence of displacement within the last 1.6 million years also may be considered inactive for most purposes, except for some critical structures. Table 4.5-1 (Major Named Faults Considered Active in Southern California) provides a summary of major named active faults in Southern California.

<i>Fault</i>	<i>Maximum Magnitude</i>	<i>Slip Rate (mm/yr.)</i>	<i>Type of Fault</i>	<i>Most Recent Seismic Event</i>
Cabrillo	6.0–6.8	Uncertain	Right normal	Holocene
Cucamonga	6.0–7.0	5.0–14.0	Thrust	Holocene
Elsinore (Glen Ivy Segment)	6.8	5.0	Right lateral strike-slip	Late Quaternary
Hollywood	5.8–6.5	0.33–0.75	Left reverse	Holocene
Los Alamitos Thrust	Uncertain	Uncertain	Thrust	Uncertain
Malibu Coast	Uncertain	0.3	Reverse	Late Quaternary
Northridge Thrust	6.5–7.5	3.5–6.0	Thrust	1994
Newport-Inglewood Zone	6.0–7.4	0.6	Right lateral	1933
Oak Ridge	6.5–7.5	3.5–6.0	Thrust	Holocene
Palos Verdes	6.0–7.0	0.1–3.0	Right reverse	Holocene
Raymond	6.0–7.0	0.1–0.22	Left lateral	Holocene
San Andreas (Southern Segment)	6.8–8.0	20.0–35.0	Right lateral strike-slip	1857
San Cayetano	6.5–7.3	1.3–9.0	Thrust	Uncertain
San Fernando	6.0–6.8	5.0	Thrust	1971
San Gabriel	Unknown	1.0–5.0	Right-lateral strike-slip	Late Quaternary
San Jacinto (San Bernardino Segment)	6.5–7.5	7.0–17.0	Right lateral strike-slip	1968
Santa Monica	6.0–7.0	0.27–0.39	Left reverse	Late Quaternary
Sierra Madre	6.0–7.0	0.36–4.0	Reverse	Holocene
Simi-Santa Rosa			Reverse	Holocene
Verdugo	6.0–6.8	0.5	Reverse	Holocene
Whittier	6.0–7.2	2.5–3.0	Right lateral strike-slip	1987

SOURCE: Southern California Earthquake Data Center, [http://www.data.scec.org/fault\\_index/](http://www.data.scec.org/fault_index/)

As shown on Figure 4.5-1 (Seismic Hazards) there are two major active faults in the vicinity of the San Pedro CPA: the Cabrillo fault and the Palos Verdes fault zone. The Cabrillo fault trends northwest/southeast across the southern portion of the CPA, and the Palos Verdes fault zone trends northwest/southeast across the northern tip of the CPA.



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Figure 4.5-1  
Seismic Hazards

Many active earthquake fault zones have been mapped in the Los Angeles area; typically they have visible, aboveground traces, such as the San Andreas fault. However, earthquakes along the unmapped faults, such as the blind thrust fault associated with the Northridge earthquake, are increasingly becoming the focus of study and concern. The concept of blind thrust faults has been recognized only recently by seismologists. The effect of such faults may dominate the geology of the Los Angeles basin in a way not previously understood. In addition, not all earthquakes result in surface rupture. For example, the Loma Prieta Earthquake of 1989 caused major damage in the San Francisco Bay Area, but the movement deep in the earth did not break through to the surface.

### ***Alquist-Priolo Earthquake Fault Zones***

The purpose of the Alquist-Priolo Earthquake Fault Zones Act is to prevent the construction of buildings used for human occupancy across the surface trace of active faults. The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones [EFZs]) around the surface traces of active faults and to issue appropriate maps. The zones vary in width, but average about one-quarter mile wide. For the purposes of the Act, an active fault is one that has ruptured in the last 11,000 years. There are no Alquist-Priolo EFZs within the CPA. Although the Palos Verde fault is classified in the City of Los Angeles Safety Element as a Fault Rupture Study Area, it is not classified as an Alquist-Priolo EFZ.

## **■ Seismicity**

Earthquakes are caused by the violent and abrupt release of strain built up along faults. When a fault ruptures, energy spreads, sometimes unequally, in the form of seismic waves. Seismic waves are categorized into two groups, body waves and surface waves. Body waves travel through the crust and eventually reach the ground interface, creating surface waves. Body waves and surface waves cause the ground to vibrate up and down and side to side at different frequencies depending on the frequency content of the earthquake rupture mechanism, the distance from the earthquake source, and the path and material through which the seismic waves spreads.

### ***Earthquake Magnitude***

Earthquakes are classified based on the amount of energy released, using logarithmic scales known as the Richter scale and the Moment Magnitude scale. Each whole number of Richter magnitude represents a tenfold increase in the wave amplitude (earthquake size) generated by an earthquake, as well as a 3.16-fold increase in energy released. Thus, a magnitude 6.3 earthquake is ten times larger than a magnitude 5.3 earthquake and releases 31.6 times more energy. In contrast, a magnitude 7.3 event is 100 times larger than a magnitude 5.3, and releases 1,000 times more energy. One limitation of the Richter magnitude scale is that it has an upper limit at which large earthquakes appear to have about the same magnitude. As a result, the moment magnitude scale (M), which does not have an upper limit magnitude, was introduced in 1979, and is used to characterize earthquakes greater than magnitude 3.5. Earthquakes of M 6.0 to 6.9 are classified as “moderate,” M 7.0 to 7.9 as “major,” and M 8.0 and larger as “great.”

The entire Southern California area is a seismically active region. With respect to the immediate San Pedro CPA, the Cabrillo fault is considered capable of generating an earthquake with a maximum

magnitude of M 6.0 to 6.8, while the Palos Verdes fault is considered capable of generating an earthquake with a maximum magnitude of M 6.0 to 7.0.

### Earthquake Intensity

The Modified Mercalli Intensity Scale is a scale used for measuring the intensity of an earthquake. The scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII one that causes almost complete destruction. Table 4.5-2 (Modified Mercalli Intensity Scale) provides abbreviated definitions of the scale ratings. Although this scale is useful in describing earthquake effects for the general public, it is not employed by engineers when designing seismic-resistant structures (see the “California Building Code” section in Section 4.5.2 [Regulatory Framework], below).

**Table 4.5-2 Modified Mercalli Intensity Scale**

Scale Rating	Description
I	Not felt
II	Felt by persons at rest, on upper floors, or favorably placed.
III	Felt indoors; hanging objects swing; vibration like passing of light trucks; duration estimated; may not be recognized as an earthquake.
IV	Hanging objects swing; vibration like passing of heavy truck or sensation of a jolt like a heavy ball striking the walls; standing automobiles rock; windows, dishes, doors rattle; wooden walls and frame may creak.
V	Felt outdoors; direction estimated; sleepers wakened; liquids disturbed; some spilled; small unstable objects displaced or upset; doors swing; shutters, pictures move; pendulum clocks stop, start, change rate.
VI	Felt by all; many frightened and run outdoors; persons walk unsteadily; windows, dishes, glassware broken; knickknacks, books, etc., off shelves; pictures off walls; furniture moved or overturned; weak plaster and masonry D cracked.
VII	Difficult to stand; noticed by drivers of automobiles; hanging objects quiver; furniture broken; weak chimneys broken at roof line; damage to masonry D, including cracks, fall of plaster, loose bricks, stones, tiles, and embraced parapets; small slides and caving in along sand or gravel banks; large bells ring.
VIII	Steering of automobiles affected; damage to masonry C, partial collapse; some damage to masonry B; none to masonry A; fall of stucco and some masonry walls; twisting, fall or chimneys, factory stacks, monuments, towers, elevated tanks; frame houses moved on foundations if not bolted down; loose panel walls thrown out; decayed piling broken off. Branches broken from trees; changes in flow or temperature of sprigs and wells; cracks in wet ground and on steep slopes.
IX	General panic; masonry D destroys; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged; general damage to foundations; frame structures, if not bolted, shifted off foundations; frames racked; serious damage to reservoirs; underground pipes broken; conspicuous cracks in ground and liquefaction.
X	Most masonry and frame structures destroyed with their foundations; some well built wooden structures and bridges destroyed; serious damage to dams, dikes, embankments; large landslides; water thrown out of banks of canals, rivers, lakes, etc.; sand and mud shifted horizontally on beaches and flat land; rails bent slightly.
XI	Rails bent greatly; underground pipelines completely out of service.
XII	Damage nearly total; large rock masses displaced; lines of sight and level distorted; objects thrown in the air.

SOURCE: Pre-Earthquake Planning for Post-Earthquake Rebuilding”, Spangle, William E., 1987

Definitions:

Masonry A = Good workmanship and mortar, reinforced designed to resist lateral force

Masonry B = Good workmanship and mortar, reinforced

Masonry C = Good workmanship and mortar, unreinforced

Masonry D = Poor workmanship and mortar and weak materials, like adobe

## Historic Seismicity

Seismic events present the most widespread threat of devastation to life and property. With an earthquake, there is no containment of potential damage. Since 1800 there have been approximately 60 damaging seismic events, or earthquakes, in the Los Angeles region. Since 1933, there have been four moderate-size earthquakes that have caused numerous deaths and substantial property damage in the metropolitan Los Angeles area. These four temblors are identified by their location as the Long Beach (March 11, 1933; M 6.3), San Fernando (February 9, 1971; M 6.4), Whittier Narrows (October 1, 1987; M 5.9), and Northridge (January 17, 1994; M 6.7) earthquakes. The Long Beach earthquake ranks as one of the major disasters in the history of southern California. The majority of the damage was suffered by structures that are now considered substandard in construction and/or were located on filled or saturated ground. The San Fernando earthquake, located in the San Fernando Valley, caused enough damage to lead to adoption of more stringent building codes. The damage caused by the Whittier Narrows earthquake occurred in buildings constructed prior to the adoption of these more stringent building codes.

The Northridge earthquake, the most recent of these seismic episodes, occurred January 17, 1994, with a magnitude of M 6.7, producing strong ground motions over an extensive area. The earthquake affected a densely built-up, primarily low-rise area, with Modified Mercalli Intensities ranging from VII to IX. The Northridge earthquake was listed by seismologists as a moderate quake. Nevertheless, it was the most costly seismic event in the United States since the 1906 San Francisco earthquake, resulting in the loss of life, physical injury, psychological trauma, and property damage estimated in the billions of dollars. The earthquake occurred on a previously unrecognized blind thrust fault, and no surface rupture that can be unequivocally associated with the main shock has been identified. Analysis by the United States Geologic Survey (USGS) and Caltech indicates that the earthquake rupture initiated about 11 miles below the San Fernando Valley, and it is presumed that the rupture stopped about 3 miles below the surface.<sup>49</sup>

The Northridge earthquake was one of the most measured earthquakes in history because of extensive seismic instrumentation in buildings and on the ground throughout the region. The quake provided valuable data for evaluating existing standards and techniques, and improving hazard mitigation. Two weeks after the Northridge quake, a seismic retrofit tilt-up (concrete walls poured and tilted up on the site) ordinance was adopted and made retroactive by the City of Los Angeles. Subsequently, the City adopted a series of ordinances that required retrofitting of certain existing structures (e.g., foundation anchoring of hillside dwellings) and for new construction, as well as an ordinance that required evaluation of structures by a structural engineer during the construction process.

## ■ Seismic Hazards

Besides surface rupture along a fault, the primary seismic hazard associated with earthquakes is groundshaking. Secondary hazards associated with seismic activity include liquefaction, differential settlement, and landsliding/slope stability. Tsunamis and seiches are generally associated with seismic activity. Underwater landslides can also cause these phenomena. Because the primary effect associated with tsunamis and seiches is flooding, this issue is addressed in Section 4.8 (Hydrology/Water Quality).

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<sup>49</sup> City of Los Angeles, *City of Los Angeles Hazard Mitigation Plan* (2005), Chapter 3.

## ***Groundshaking***

The principal seismic hazard occurring as a result of an earthquake produced by local faults is strong groundshaking. The intensity of groundshaking depends on several factors, including the magnitude of the earthquake, distance from the earthquake epicenter, and the underlying soil conditions. In general, the larger the magnitude of an earthquake and the closer a site to the epicenter of the event, the greater will be the effects. However, soil conditions can also amplify the earthquake shock waves. Generally, the shock waves remain unchanged in bedrock, are amplified to a degree in thick alluvium,<sup>50</sup> and are greatly amplified in thin alluvium.

Modern, well-constructed buildings are designed to resist groundshaking through the use of shear walls and reinforcements. The City of Los Angeles Building Code includes regulations and requirements designed to reduce risks to life and property from groundshaking to the maximum extent feasible.

## ***Liquefaction***

Liquefaction involves the sudden loss of strength in saturated, cohesionless soils that are subjected to ground vibration and which results in temporary transformation of the soil into a fluid mass. If the liquefying layer is near the surface, the effects are much like that of quicksand for any structures located on top of it. If the layer is deeper in the subsurface, it may provide a sliding surface for the material above it. The effects of liquefaction include the loss of the soil's ability to support footings and foundations, which may cause buildings and foundations to buckle. These failures were observed in the 1971 San Fernando and the 1994 Northridge earthquakes.

Figure 4.5-1 illustrates areas within the CPA that are susceptible to liquefaction, as delineated by the CGS. As shown, liquefaction-prone areas are primarily limited to the northern portion of the CPA along Gaffey Street north of Miraflores Avenue, north of Westmont Drive, and west of the I-110. Small portions of liquefaction zones also occur along Harbor Boulevard north of 7<sup>th</sup> Street, at Cabrillo Beach, and along the coastline west of White Point Park/Royal Palms State Beach. Those locations are identified by the state as requiring special study for liquefaction hazard. The City of Los Angeles is responsible for ensuring the proper studies are prepared in conjunction with development permitting, and that design and construction of projects include the appropriate features to reduce potential hazards to people and property from liquefaction.

## ***Seismically Induced Settlement***

The thick alluvial deposits that underlie the CPA would be subject to differential settlement caused by the intense shaking associated with seismic events. This type of hazard results primarily in damage to property when an area settles to different degrees over a relatively short distance. The actual potential for settlement is difficult to predict because the conditions under which this hazard can occur are site specific. The City of Los Angeles Building Code includes regulations and requirements for geotechnical studies to identify locations that could be subject to settlement and to design and construct buildings to minimize potential hazards from settlement.

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<sup>50</sup> Alluvium is an accumulation of stream-deposited sediments, including sands, silts, clays, or gravels.



## ***Seismically Induced Landslides***

A landslide is a mass down-slope movement of earth materials under the influence of gravity, and includes a variety of forms including: rockfalls, debris slides, mudflows, block slides, soil slides, slumps, and creeps. These mass movements are triggered or accelerated by earthquake-induced ground motion, increased water content, excessive surface loading, or alteration of existing slopes by man or nature. Earthquake-induced landslides, usually associated with steep canyons and hillsides, can originate on or move down slopes as gentle as one degree in areas underlain by saturated, sandy materials. As shown in Figure 4.5-1, areas identified as landslide zones are mainly the hilly areas in the northern portion of the CPA east of Gaffey Street, near Capitol and Park Western Drives, and open space areas to the south of those streets, and western and southern areas of the CPA, particularly near the coastal cliffs. The central portion of San Pedro, including the business and harbor areas, is not in a landslide hazard area.

## ***Non-Seismic Landslides***

In October 2011, a section of Paseo Del Mar, bounded by Weymouth Avenue on the east and Western Avenue on the west, experienced a landslide event, with approximately 600 square feet of concrete and dirt collapsing into the ocean below. This oceanfront bluff area has been moving as fast as 2.5 feet per day in recent weeks<sup>51</sup> and ground movement has intensified.<sup>52</sup>

## **■ Soil and Groundwater Conditions**

### ***Soil Erosion***

The factors contributing to soil erosion potential include: climate, the physical characteristics of soils, topography, land use, and the amount of soil disturbance. In general, the loss of ground cover caused by construction activities is a primary factor contributing to an increase in soil erosion potential. Erosion potential is also directly related to the steepness of the terrain.

Because the CPA is an urbanized area largely covered by impermeable surfaces, and a large portion of the terrain is relatively flat, potential for erosion is relatively low.

### ***Expansive Soils***

Expansive soils are typically associated with fine-grained clayey soils that have the potential to shrink and swell with repeated changes in the moisture content. The ability of clayey soil to change volume can result in uplift or cracking to foundation elements or other rigid structures such as slabs-on-grade, rigid pavements, sidewalks, or other slabs or hardscape founded on these soils. The Natural Resources Conservation Service (NRCS), which compiles and maps soils data throughout the U.S., does not have any mapping for the San Pedro CPA, so physical and chemical data that would indicate whether expansive soils are present are not readily available. However, the City of Los Angeles Building Code includes regulations and requirements for geotechnical studies to identify locations that could be underlain by expansive soils and to design and construct buildings to minimize potential hazards associated with these types of soils.

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<sup>51</sup> City of Los Angeles, Bureau of Engineering, Update November 17, 2011.

<sup>52</sup> County of Los Angeles, Department of Public Works, Update November 15, 2011.

## Groundwater

The CPA is located within the geographic boundaries of the Los Angeles Coastal Plain Groundwater Basin. The California Department of Water Resources (DWR) and Metropolitan Water District (MWD) monitor groundwater levels in the basin; however, there are no reported data for the San Pedro CPA. In general, groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations. Shallow perched<sup>53</sup> conditions may be present in places.

## Subsidence

Subsidence is a phenomenon where the soils and other earth materials settle or compress, resulting in a lower ground surface elevation. When fill and native materials on a site are water saturated, there is a net decrease in the pore pressure, and contained water will allow the soil grains to pack closer together. This closer grain packing results in less volume and the lowering of the ground surface.

Subsidence in the Los Angeles-Long Beach harbor area was first observed in 1928, and it has affected the majority of the harbor area. Based on extensive studies by the City of Long Beach and the California DOGGR, it has been determined that most of the subsidence was the result of oil and gas production from the Wilmington Oil Field following its discovery in 1936. (Additional information about oil and gas production in the study area is presented under the “Mineral Resources” section, below.) By 1941, subsidence of approximately 1.3 feet was noted in the area of Long Beach. By 1962, subsidence had spread over a wide area and reached approximately 2 feet in the area of Terminal Island. Water injection is used to mitigate subsidence and continues to be maintained at rates greater than the total volume of produced substances, including oil, gas, and water, to prevent further reservoir compaction and subsidence.<sup>54</sup>

## ■ Mineral Resources

### Oil and Gas Production

Drilling for oil in Los Angeles began in 1896, when Edward Doheny discovered oil at Second Street and Glendale Boulevard. Subsequently, oil production became the primary mineral extraction activity in the City. Oil resources have been identified at twenty-three major oil-drilling areas or state-designated oil fields in Los Angeles, which in whole or part underlie the City.<sup>55</sup> A very small area in the CPA adjoins and is partially within the Wilmington Oil Field<sup>56</sup> where it crosses the Los Angeles Harbor to the north of the Vincent Thomas Bridge. The oil field is approximately 11 miles long and 3 miles wide, covering approximately 13,500 acres. In 2009 it produced approximately 13.6 million barrels of oil from over 5,000 wells.<sup>57</sup>

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<sup>53</sup> “Perched” groundwater refers to a water table that is isolated from and higher than the regional water table.

<sup>54</sup> Los Angeles Harbor Department, *San Pedro Waterfront EIS/EIR* (2008), Section 3.5.2.1.6 (Subsidence).

<sup>55</sup> Los Angeles Harbor Department, *San Pedro Waterfront EIS/EIR* (2008), Section 3.5.2.1.9 (Mineral Resources).

<sup>56</sup> California Department of Conservation, Division of Oil, Gas, and Geothermal Resources. *Oil, Gas, and Geothermal Fields in California* (2001).

<sup>57</sup> California Department of Conservation, Division of Oil Gas and Geothermal Resources, *2009 Preliminary Report of California Oil and Gas Production Statistics* (issued January 2010).

According to California DOGGR records, there are six oil and gas wells in the CPA. All are inactive, with the exception of one well that is idle. That well, which is not within the boundary of Wilmington Oil Field as delineated by DOGGR, is located on South Leland Street in the vicinity of 34<sup>th</sup> and 36<sup>th</sup> Streets.<sup>58</sup>

### ***Sand and Gravel***

The other primary mineral resources within the City of Los Angeles are rock, gravel, and sand deposits. Sand and gravel deposits follow the Los Angeles River flood plain, coastal plain, and other water bodies and courses. Significant potential deposit sites have been identified by the State Geologist. These deposits are located along the flood plain from the San Fernando Valley through downtown. The State Geologist is responsible for classifying and/or designating certain deposits based on adopted criteria that address the resource development potential of a particular commodity, without regard to land use or ownership. The areas are categorized into four mineral resource zones (MRZs) based on geologic factors. Of the four categories, lands classified as MRZ-2 are of the greatest importance because they identify significant mineral deposits of a particular commodity. There are no deposits in the CPA that have been classified as MRZ-2 by the State Geologist.<sup>59</sup>

## **4.5.2 Regulatory Framework**

### **■ Federal**

#### ***U.S. Code Title 42***

Federal laws codified in the U.S. Code Title 42, Chapter 86 (Earthquake Hazard Reduction Act of 1977) were enacted to reduce the risks to life and property from earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program. Implementation of these requirements are regulated, monitored, and enforced at the state and local level. Key regulations and standards are summarized below.

#### ***National Pollutant Discharge Elimination System (NPDES) Phase I Permit***

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

The City implements these requirements through its Standard Urban Stormwater Mitigation Plan (SUSMP), which addresses stormwater pollution from new construction and redevelopment projects. The SUSMP requirements contain a list of minimum Best Management Practices (BMPs) that must be

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<sup>58</sup> California Department of Conservation, Division of Oil Gas and Geothermal Resources, DOGGR Online Mapping System (DOMS) (2011).

<sup>59</sup> Los Angeles Department of City Planning, *General Plan Framework*, Areas of Significant Mineral Deposits.

employed to infiltrate or treat stormwater runoff, control peak flow discharge, and reduce the post-project discharge of pollutants from stormwater conveyance systems. Refer to Section 4.8 for additional information.

## ■ State

### **State Building Code**

California Code of Regulations (CCR), Title 24, Part 2, the California Building Code (CBC), provides minimum standards for building design in the state. Until January 1, 2008, the CBC was based on the then current Uniform Building Code and contained Additions, Amendments and Repeals specific to building conditions and structural requirements in California. The 2010 CBC, effective January 1, 2011, is based on the current (2009) International Building Code (IBC).<sup>60</sup> Each jurisdiction in California may adopt its own building code based on the 2010 CBC. Local codes are permitted to be more stringent than the 2010 CBC, but, at a minimum, are required to meet all state standards and enforce the regulations of the 2010 CBC beginning January 1, 2011. Chapter 16 of the CBC deals with structural design requirements governing seismically resistant construction (Section 1604), including (but not limited to) factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design (Sections 1613.5 through 1613.7). Chapter 18 includes (but is not limited to) the requirements for foundation and soil investigations (Section 1803); excavation, grading, and fill (Section 1804); allowable load-bearing values of soils (Section 1806); and the design of footings, foundations, and slope clearances (Sections 1808 and 1809), retaining walls (Section 1807), and pier, pile, driven, and cast-in-place foundation support systems (Section 1810). Chapter 33 includes (but is not limited to) requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304). Appendix J of the CBC includes (but is not limited to) grading requirements for the design of excavations and fills (Sections J106 and J107) and for erosion control (Sections J109 & J110). Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal-OSHA regulations (CCR, Title 8).

The CBC is revised every three years. At the time the NOP for the proposed San Pedro Community Plan was published in 2008, the 2007 CBC was in effect. However, the 2010 CBC is the current code. Effective January 2, 2011, California requires compliance with the 2010 CBC.

### **Seismic Hazards Mapping Act**

The Seismic Hazards Mapping Act became effective in 1991 to identify and map seismic hazard zones for the purpose of assisting cities and counties in preparing the safety elements of their general plans and to encourage land use management policies and regulations that reduce seismic hazards. The intent of this Act is to protect the public from the effects of strong groundshaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, CGS's Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, provides guidance for the evaluation and mitigation of earthquake-related hazards for projects in designated zones of required investigations.

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<sup>60</sup> California Building Standards Commission, 2010 California Building Code, *California Code of Regulations*, Title 24, Part 2, Volumes 1 and 2 (effective January 1, 2011), <http://publicecodes.citation.com/st/ca/st/b200v10/index.htm> (accessed by G.J. Burwasser, PG7151, January 16, 2010).

Under this program, liquefaction and landslide hazards mapping has been prepared for the project area. As noted above, liquefaction and landslide hazard zones have been identified in the San Pedro CPA.

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

In 1972, the Alquist-Priolo Special Studies Zone Act (now known as the Alquist-Priolo Earthquake Fault Zoning Act) was passed into law. The Act defines “active” and “potentially active” faults using the CGS criteria. However, the established policy is to zone active faults and only those potentially active faults that have a relatively high potential for ground rupture. Therefore, not all faults identified as “potentially active” by the CGS are zoned under the Alquist-Priolo Act.

### ***Surface Mining and Reclamation Act***

Sections 2761(a) and (b) and 2790 of the Surface Mining and Reclamation Act (SMARA) provide for a mineral lands inventory process termed classification-designation. The California Division of Mines and Geology and the state Mining and Geology Board are the state agencies responsible for administering this process. The primary objective of the process is to provide local agencies, such as cities and counties, with information on the location, need, and importance of minerals within their respective jurisdictions. It is also the intent of this process, through the adoption of General Plan mineral resource management policies, that this information be considered in future local land use planning decisions. Areas designated by the Mining and Geology Board as “regionally significant” are incorporated by regulation into Title 14, Division 2 of the CCR. Such designations require that a lead agency’s land use decisions involving designated areas are made in accordance with its mineral resource management policies and that they consider the importance of the mineral resource to the region or the state as a whole and not just the lead agency’s jurisdiction.

The City is responsible for implementing the SMARA requirements, as they apply to Los Angeles. It does so primarily through land use controls and permit issuance and monitoring.

## **■ Local**

### ***City of Los Angeles General Plan***

State law since 1975 has required city general plans to include a safety element that addresses the issue of protection of its people from unreasonable risks associated with natural disasters, e.g., fires, floods, and earthquakes. The Safety Element of the General Plan contains policies that emphasize seismic safety issues because seismic events present the most widespread threat of devastation to life and property.

Because erosion can result in the loss of valuable ground surface materials by depositing them into basins and the ocean, and also contributes to potential water quality degradation and reduced air quality, the Conservation Element of the General Plan contains policies to minimize impacts from erosion.

### **Safety Element**

The Safety Element provides a contextual framework for understanding the relationship between hazard mitigation, response to a natural disaster, and initial recovery from a natural disaster. The policies of the

Safety Element reflect the comprehensive scope of the City’s Emergency Operations Organization (EOO), which is tasked with integrating the City’s emergency operations into a single operation.

**Conservation Element**

The intent of the Conservation Element is the conservation and preservation of natural resources. Policies of the Conservation Element address the effect of erosion on such natural resources as beaches, watersheds, and watercourses. Although the Conservation Element cites erosion of hillsides resulting in loss of natural watersheds and features, flooding, and endangerment to structures and people as a continuing issues, it contains limited policies related to erosion and instead refers to the Los Angeles Municipal Code Sections 91.700 et seq. and Specific Plan for Management of Flood Hazards (Ordinance 172.081) for specific guidance.

The Conservation Element of the General Plan contains policies to minimize impacts from mineral resource extraction that can result in the loss of valuable ground surface materials, potential odors, noise, hazardous spills, explosions, and fires.

Policies from the Safety Element and Conservation Element related to geology and soils are listed below In Table 4.5-3 (General Plan Policies Relevant to Geology/Soils and Mineral Resources).

<b>Table 4.5-3 General Plan Policies Relevant to Geology/Soils and Mineral Resources</b>	
<i>No.</i>	<i>Policy</i>
<b>SAFETY ELEMENT</b>	
<b>Hazard Mitigation</b>	
Policy 1.1.2	Disruption reduction. Reduce, to the greatest extent feasible and within the resources available, potential critical facility, governmental functions, infrastructure and information resource disruption due to natural disaster.
Policy 1.1.3	Facility/systems maintenance. Provide redundancy (back-up) systems and strategies for continuation of adequate critical infrastructure systems and services so as to assure adequate circulation, communications, power, transportation, water and other services for emergency response in the event of disaster related systems disruptions.
Policy 1.1.5	Risk reduction. Reduce potential risk hazards due to natural disaster to the greatest extent feasible within the resources available, including provision of information and training.
Policy 1.1.6	State and federal regulations. Assure compliance with applicable state and federal planning and development regulations, e.g., Alquist-Priolo Earthquake Fault Zoning Act, state Mapping Act, and Cobey-Alquist Flood Plain Management Act.
<b>Emergency Response (Multi-Hazard)</b>	
Policy 2.1.2	Health and environmental protection. Develop and implement procedures to protect the environment and public, including animal control and care, to the greatest extent feasible within the resources available, from potential health and safety hazards associated with hazard mitigation and disaster recovery efforts.
Policy 2.1.4	Interim procedures. Develop and implement pre-disaster plans for interim evacuation, sheltering and public aid for disaster victims displaced from homes and for disrupted businesses, within the resources available. Plans should include provisions to assist businesses which provide significant services to the public and plans for reestablishment of the financial viability of the City.
Policy 2.1.5	Response. Develop, implement, and continue to improve the City’s ability to respond to emergency events.
Policy 2.1.7	Volunteers. Develop and implement, within the resources available, strategies for involving volunteers and civic organizations in emergency response activities.

<b>Table 4.5-3 General Plan Policies Relevant to Geology/Soils and Mineral Resources</b>	
<b>No.</b>	<b>Policy</b>
<b>Disaster Recovery (Multi-Hazard)</b>	
Policy 3.1.2	Health/safety/environment. Develop and establish procedures for identification and abatement of physical and health hazards which may result from a disaster. Provisions shall include measures for protecting workers, the public and the environment from contamination or other health and safety hazards associated with abatement, repair and reconstruction programs.
Policy 3.1.3	Historic/cultural. Develop procedures which will encourage the protection and preservation of City-designated historic and cultural resources to the greatest extent feasible within the resources available during disaster recovery.
Policy 3.1.4	Interim services/systems. Develop and establish procedures prior to a disaster for immediate reestablishment and maintenance of damaged or interrupted essential infrastructure systems and services so as to provide communications, circulation, power, transportation, water and other necessities for movement of goods, provision of services and restoration of the economic and social life of the City and its environs pending permanent restoration of the damaged systems.
Policy 3.1.5	Restoration. Develop and establish prior to a disaster short- and long-term procedures for securing financial and other assistance, expediting assistance and permit processing and coordinating inspection and permitting activities so as to facilitate the rapid demolition of hazards and the repair, restoration and rebuilding, to a comparable or a better condition, those parts of the private and public sectors which were damaged or disrupted as a result of the disaster.
<b>CONSERVATION ELEMENT</b>	
Erosion Policy 2	Continue to prevent or reduce erosion that will damage the watershed or beaches or will result in harmful sedimentation that might damage beaches or natural areas.
Resource Management Policy 2	Continue to support state and federal bans on drilling in the Santa Monica Bay and on new drilling along the California coast in order to protect the San Pedro and Santa Monica bays from potential spills associated with drilling, extraction and transport operations.
SOURCE: Los Angeles Department of City Planning, <i>General Plan of the City of Los Angeles</i> , Safety Element (adopted November 26, 1996); Los Angeles Department of City Planning, <i>General Plan of the City of Los Angeles</i> , Conservation Element (adopted September 26, 2001).	

### **City of Los Angeles Municipal Code**

Compliance with the City Building Code (CBC) is mandatory for development in the city. Chapter IX (Building Regulations), Article 1 (Building Code) sets forth the specific requirements. Throughout the permitting, design, and construction phases of a building project, the Department of Building and Safety engineers and inspectors confirm that the requirements of the CBC pertaining specifically to geoseismic and soils conditions are being implemented by project architects, engineers, and contractors.

The principal mechanism for mitigation of geologic hazards is the City Grading Code, the requirements of which are specified in Chapter IX (Building Regulations), Article 1 (Building Code), Division 70. A unique feature of the Grading Code is a requirement that professional geologists supervise hillside grading. Under the Grading Code, the Department of Building and Safety has the authority to withhold building permit issuance if a project cannot mitigate potential hazards to the project or which are associated with the project. The Grading Code periodically is revised to reflect new technology and improve standards and requirements.

Chapter IX (Building Regulations), Article 1 (Building Code), Division 88 (Special Provision for Existing Buildings) of the Municipal Code (Ord. No. 171,939) establishes standards for seismically unreinforced masonry bearing wall buildings constructed before 1934. It identifies which types of buildings are subject

to the requirements, but specifically notes that the provisions of the division are minimum standards for structural seismic resistance established primarily to reduce the risk of loss of life or injury and will not necessarily prevent loss of life or injury or prevent earthquake damage to an existing building that complies with those standards.

The Municipal Code also contains voluntary standards to help reduce earthquake hazard risks. For example, Division 94 of the Building Code seeks to promote public safety and welfare by reducing the risk of death or injury that may result from the effects of earthquakes on existing hillside buildings constructed on or into slopes in excess of one unit vertical in three units horizontal (33.3 percent slope). Such buildings have been recognized as life hazardous as a result of partial or complete collapse that occurred during the Northridge Earthquake. This division provides voluntary retrofit standards under which buildings shall be permitted to be structurally analyzed and retrofitted. When fully followed, these standards strengthen the portion of the structure that is most vulnerable to earthquake damage. Division 91 similarly addresses wood-frame buildings.

### ***City of Los Angeles Local Hazard Mitigation Plan (LHMP)***

The City approved its Local Hazard Mitigation Plan (LHMP) in 2005. The plan identifies potential natural and human-caused hazards, and potential scenarios and estimated losses, addresses existing and proposed mitigation policies, programs and projects, and response programs. With regard to earth resources, the LHMP identifies earthquake as a high-risk hazard, but landslides/mudslides and tsunamis are considered low-risk hazards.

### ***Oil Drilling District Procedures***

The Oil Drilling District procedures adopted in 1948, as amended in 1971 to include offshore oil drilling, set forth provisions for monitoring and imposing mitigation measures to prevent significant subsidence relative to oil and gas extraction and mining activities. The districts are established as overlay zones and are administered by the City Planning Department with the assistance of other City agencies. The City Oil Administrator of the Office of the City Administrative Officer is responsible for monitoring oil extraction activities and has the authority to recommend additional mitigation measures to the Planning Commission after an Oil Drilling District is established. The Planning Department Office of Zoning Administration issues and administers oil drilling permits and may impose additional mitigation measures, as deemed necessary, after a permit has been granted, such as measures to address subsidence.

## **■ Proposed Plan Policies**

Table 4.5-4 (Proposed San Pedro Community Plan Policies) lists policies that are applicable to issues related to geology and soils. There are no mineral resources policies.



<b>Table 4.5-4 Proposed San Pedro Community Plan Policies</b>	
<b>No.</b>	<b>Policy</b>
<b>Community Facilities and Infrastructure</b>	
Policy CF6.2	Protect open space. Protect significant open space resources from environmental hazards.
Policy CF.6.3	Natural terrain. The grading of natural terrain to permit development in hillside areas should be minimized commensurate with densities designated by this Plan, the geological stability of the area, and compatibility with adjoining land uses.
Policy CF.6.4	Natural drainage patterns. The alteration of natural drainage patterns, canyons, and water courses should be minimized except where improvements are necessary to protect life and property.
Policy CF.6.5	Avoid geologic hazards. Development should be restricted on areas of known geologic hazard, unstable soil conditions or landslides.
Policy CF.6.6	Protection from oil spills. Offshore oil drilling should be strictly controlled in the immediate area off San Pedro so as to safeguard against oil spillage, prevent interference with shipping lanes, preserve the scenic value of the coastline, and protect ecologically important areas and designated wildlife refuges.
<b>Land Use</b>	
Policy LU.1.4	Hillside development. Limit the intensity and density in hillside areas to that which can be reasonably accommodated by infrastructure and natural topography. Development should be integrated with and be visually subordinate to natural features and terrain.
Policy LU 19.1	Maintain coastal resources. Protect coastal resources from environmental hazards, such as impacts associated with offshore oil drilling and erosion of coastal bluffs.

### Consistency Analysis

Community facilities and infrastructure are required by law to be constructed in accordance with Los Angeles Building Code design requirements for structures. Minimum requirements for protection from seismic and geologic/soils hazards, including foundation support and structural design, are specified in the Los Angeles Building Code. Minimum grading requirements, including erosion control, excavation stability, and fill material acceptability are specified in the Los Angeles Building Code. Ongoing compliance, which is monitored and enforced by the City of Los Angeles, will continue to ensure consistency with Policies CF.6.2 through CF.6.6. The proposed plan and implementing ordinances do not propose new hillside development or development along coastal bluffs. There would be no inconsistencies with Policies LU.1.4 or LU.19.1.

## 4.5.3 Project Impacts and Mitigation

### ■ Analytic Method

The proposed plan is the adoption of the San Pedro proposed plan and implementing ordinances. Such actions would not have a direct effect related to geologic and soils conditions, but development that is likely to occur as a result of the proposed plan could be subject to geologic or soils hazards. Baseline information for the analysis was compiled from a review of published geologic maps and reports, as well as information compiled and evaluated by the City of Los Angeles in conjunction with its overall planning and hazard mitigation processes to identify geologic conditions and geologic hazards in the CPA. As noted below, site-specific geotechnical evaluations would be prepared as required by the City, which would identify special geotechnical concerns and necessary design and construction specifications.

Independent of the CEQA process, there is a comprehensive regulatory framework implemented at the state and City level to mitigate potential hazards associated with geologic and soils conditions. The design-controllable aspects of building foundation support, protection from seismic ground motion, and soil instability are governed by existing regulations. Compliance with these regulations is required, not optional. Compliance must be demonstrated by the project proponent to have been incorporated in the plan's design before permits for project construction would be issued. The analysis presented herein assumes compliance with all applicable laws, regulations, and standards.

The Los Angeles CEQA Thresholds Guide (2006) sets forth guidance for the determination of significance of geology/soils and mineral resources impacts. This guidance is based on Appendix G of the CEQA Guidelines and provides specific criteria to be considered when making a significance determination. In some cases, the Thresholds Guide includes quantitative thresholds. For purposes of this analysis, Thresholds Guide criteria are used, supplemented by the thresholds identified in Appendix G, where appropriate.

## ■ Thresholds of Significance

Implementation of the proposed plan may have a significant adverse impact on geology/soils or mineral resources if it would:

- Cause or accelerate geologic hazards that would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury involving:
  - > Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
  - > Strong seismic groundshaking;
  - > Seismic-related ground failure, including liquefaction and landslides;
  - > Expansive soils; or
  - > Location on or adjacent to unstable geologic units or soils, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, or collapse
- Cause or accelerate instability from erosion so as to result in a geologic hazard to other properties; or accelerate natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition which would not be contained or controlled on site.
- Destroy, permanently cover or materially and adversely modify one or more distinct and prominent geologic or topographic features would be. Such features may include, but are not limited to, hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands.
- Result in the permanent loss of, or loss of access to, a mineral resource that is located in a MRZ-2 or other known or potential mineral resource area, or result in the permanent loss of, or loss of access to, a mineral resource that is of regional or statewide significance, or is noted in the Conservation Element as being of local importance
- Be located on 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

## ■ Effects Not Found to Be Significant

It is the City's policy that all new development must be connected to a public sewerage system. All portions of the CPA are either currently being served by a public sewerage system and the proposed plan and implementing ordinances do not propose any development in areas not served by sewer service. There is *no impact*, because no new development in the CPA would utilize septic tanks.

A small portion of the Wilmington Oil Field in the vicinity of the Los Angeles Harbor to the north of the Vincent Thomas Bridge extends into the San Pedro Community Plan. However, there are no active oil wells or water injection wells in that area. There are a few wells in the CPA; all but one is inactive, and the remaining one is idle. The proposed plan and implementing ordinances do not propose and land use changes that would increase the likelihood of mineral resource exploration or extraction, nor would the proposed amendments and zoning and build-out of the proposed plan preclude future exploration/extraction. Therefore, implementation of the proposed plan would not affect any oil and gas resources in the CPA. There are *no impacts* to oil and gas resources.

There are no active sand and gravel operations in the CPA the state has not classified any deposits underlying the CPA as having value to the state. There is *no impact* related to MRZ-2 zones.

## ■ Less-Than-Significant Impacts

**Impact 4.5-1**      **The San Pedro Community Plan area is in an area where active faults are present, but the proposed plan would not cause or accelerate geologic hazards that would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury by exposing people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. Compliance with existing CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.**

Because the proposed plan is implementation of a policy document, it would not directly cause or accelerate geologic hazards related to fault rupture. To the extent the proposed plan would facilitate or accommodate future development, such development, in and of itself, would not directly cause fault rupture. However, growth within the San Pedro Community Plan would increase the number of people and structures that could be exposed to seismic hazards such as fault rupture.

There are no CGS-classified Earthquake Fault Zones (EFZs) subject to special study under the Alquist-Priolo Act within the boundary of the San Pedro CPA. However, the Palos Verde fault is identified in the City of Los Angeles Safety Element as a Fault Rupture Study Area. This fault is still being studied by the state and the City, and it has not been classified as an Alquist-Priolo EFZ by the state. A seismic event along a fault zone, regardless of whether it is classified by the state as an EFZ, could have the potential to cause surface ground rupture, thereby exposing people or structures in the CPA to substantial geologic hazards, which could contribute to the risk of loss, injury, or death.

While the proposed plan and implementing ordinances would permit construction of habitable structures in the CPA, if a fault becomes classified by the state as an EFZ, if the results of a study prepared to meet Safety Element fault rupture study areas indicate a hazard, or if a previously unknown fault zone became

apparent, the City's standard regulatory procedures would ensure that no buildings would be approved or constructed across an active fault, thereby reducing the potential risk of loss, injury, or death due to surface fault rupture.

Compliance with the CBC, City's Codes, and applicable regulatory requirements would ensure that the proposed plan and all development therein would not cause or accelerate geologic hazards that would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury as a result of fault rupture. This impact is *less than significant*.

**Impact 4.5-2      Implementation of the proposed plan would not cause or accelerate geologic hazards which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from strong seismic groundshaking. Compliance with existing CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.**

Seismic groundshaking is the direct result of movement along a fault. As explained in Impact 4.5-1, the project would not directly cause or accelerate fault movement or rupture and, similarly, would not directly result in strong seismic groundshaking. However, the CPA (like all communities in the City of Los Angeles) is in a seismically active region, and development under the proposed plan would expose people and property to groundshaking from earthquakes originating on one or more of the active faults in the region (see Table 4.5-1) during the planning horizon of the proposed plan and implementing ordinances.

Statewide, scientists estimate a 99.7 percent probability of an  $M \geq 6.7$  earthquake occurring in California during the next 30 years. When compared to northern California, southern California has a greater chance of an  $M \geq 6.7$  earthquake. For larger events, the 30-year probability of an  $M \geq 7.5$  event is twice that of northern California (37 percent vs. 15 percent). For the principal faults (in southern California this would include the San Andreas, San Jacinto, and Elsinore faults), an earthquake on the southern part of the San Andreas has a 59 percent probability of generating a  $M \geq 6.7$  earthquake in the next 30 years (compared to 21 percent on the northern part of the fault).<sup>61</sup>

The proposed plan and implementing ordinances would facilitate development of new housing, particularly in downtown San Pedro and along commercial corridors and centers. Floor Area Ratio (FAR) would be increased in some areas, allowing for increases in density. Population and the number of dwelling units could increase under the proposed plan and implementing ordinance, thereby increasing the number of people and structures in the CPA exposed to geologic hazards, including strong seismic groundshaking.

Currently accepted design standards for seismically induced groundshaking-resistant construction are addressed in the 2010 CBC and the City of Los Angeles Building and Grading Codes. These guidelines are considered minimum standards for design and construction of buildings and must be incorporated

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<sup>61</sup> 2007 Working Group on California Earthquake Probabilities, The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2): U.S. Geological Survey Open-File Report 2007-1437 and California Geological Survey Special Report 203 (2008), <http://pubs.usgs.gov/of/2007/1091/>.

into any final project designs.<sup>62</sup> Because design and construction of new habitable structures in compliance with the CBC's recommended seismic design criteria would achieve an "acceptable level" of risk, as defined by the State of California, potential hazards associated with strong seismic groundshaking on new development in the CPA would be reduced.

Compliance with the CBC, City Codes, and related applicable regulatory requirements, which would be within the jurisdiction of the City to ensure and monitor, would ensure that the proposed plan and all development therein would not cause or accelerate geologic hazards that would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury as result of strong seismic groundshaking. This impact is *less than significant*.

### Unreinforced Masonry Buildings

Unreinforced masonry buildings or buildings constructed on unreinforced brick foundations, which could have been constructed before building codes were adopted, are particularly susceptible to earthquake damage. Some newer buildings constructed before earthquake-resistant provisions were included in the building codes, could also be damaged during an earthquake. Wood-frame buildings one or two stories high (e.g., single-family dwellings) are generally considered to be structurally resistant to earthquake damage, but older buildings (e.g., built prior to 1960) can also be affected because of the manner in which the frames were attached to the foundations.

Anticipated development under the proposed plan and implementing ordinances is expected to involve some amount of renovation, restoration, and/or reuse of existing buildings. Building occupants, visitors, or workers could be exposed to potential hazards from falling debris or structural failure as a result of an earthquake if the buildings do not meet current seismic safety standards. To address potential hazards associated with older buildings that may present seismic safety hazards, in conjunction with building permit approvals, the City is required to ensure implementation the provisions of its Code for the Seismic Retrofit of Hazardous Unreinforced Masonry Bearing Wall Buildings (Building Code, Division 88) and Tilt-Up Concrete Wall Buildings (Division 91). On a voluntary basis, owner/occupants also can retrofit older structures using standards established in Divisions 92 and 93, and existing structures that may be susceptible to earthquake-induced landslide hazard can also be retrofitted on a voluntary basis (Division 94). The City also provides standards, on a voluntary basis, for existing concrete buildings and tilt-ups (Divisions 95 and 96).

Compliance with adopted Building Code requirements, which would be ensured by the City during application processing and permitting, would reduce the potential hazards associated with existing buildings. Impacts are *less than significant*.

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<sup>62</sup> It should be noted that conformance to the recommended seismic design criteria does not constitute any kind of guarantee or assurance that substantial structural damage or ground failure would not occur if a maximum magnitude earthquake occurred. The primary goal of seismic design is to protect life through prevention of structural collapse and not to avoid all damage. During a major earthquake, a building may be damaged beyond repair yet not collapse. Based on this goal, it is concluded that design and construction of structures in the CPA in accordance with the recommended seismic design criteria (i.e., peak horizontal ground acceleration) would achieve an "acceptable level" of risk as defined by CCR Title 14, Section 3721(a).

**Impact 4.5-3** Implementation of the proposed plan would not cause or accelerate geologic hazards that would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury involving seismic-related ground failure, including liquefaction and/or landslides. Compliance with existing CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.

### **Liquefaction**

As shown in Figure 4.5-1, liquefaction-prone areas are primarily limited to the northern portion of the CPA along Gaffey Street north of Miraflores Avenue, north of Westmont Drive, and west of I-110. Small portions of liquefaction zones also occur along Harbor Boulevard north of 7<sup>th</sup> Street, at Cabrillo Beach, and along the coastline west of White Point Park/Royal Palms State Beach.

The proposed plan would not directly increase liquefaction hazards because it would not affect seismic conditions or alter underlying soil or groundwater characteristics that govern liquefaction potential. It is a state and City requirement for preparation, review, and approval of geotechnical reports for new developments in liquefaction-prone areas. Compliance with the recommendations of the geotechnical report, the City's Building and Grading Codes, as well as with any specific requirements established by the Department of Public Works and/or the City Engineer would reduce liquefaction-related hazards.

Compliance with the CBC, City's Codes, and applicable regulatory requirements described above would ensure that the potential risk of loss, injury, or death due to liquefaction is *less than significant*.

### **Earthquake-Induced Settlement**

Settlement or subsidence of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid rearrangement, compaction, and settling of subsurface materials (particularly loose, uncompacted, and variable sandy sediments). Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Localized differential settlements up to two-thirds of the total settlements anticipated must be assumed until more precise predictions of differential settlements can be made. Implementation of the applicable City's Codes and regulatory requirements pertaining to seismic hazards described above would ensure that the potential risk of loss, injury, or death due to settlement is *less than significant*.

### **Landslides**

As shown in Figure 4.5-1, earthquake-induced landslide hazards zones are mainly located in the hilly areas in the northern portion of the CPA east of Gaffey Street, near Capitol and Park Western Drives and open space areas to the south of those streets, and western and southern areas of the CPA particularly near the coastal cliffs. The central portion of San Pedro, including the business and harbor areas, is not located within a landslide hazard area. Most of the landslide-prone areas are located in areas designated as Single-Family Residential and Open Space, and the proposed plan, and implementing ordinances do not propose significant changes in those areas. The other area of concern is Paseo del Mar along the coastal bluffs, where a recent significant landslide has occurred apparently unrelated to seismic activity. No development under the proposed plan would occur in the coastal bluffs area.

Industrial areas along the east side of North Gaffey Street would be rezoned to allow for increased development in that area. Therefore, some seismically induced landslide-prone areas could be redeveloped or developed with new structures under the proposed plan and implementing ordinances. Landsliding in those areas would have the potential to expose people and structures in the CPA to landsliding and other geologic hazards, resulting in increased risk of loss, injury, or death.

It is the City's standard practice to require the preparation, review, and approval of geotechnical reports for new developments in landslide susceptible areas. Compliance with the recommendations of the geotechnical report, the City's Building and Grading Codes, as well as with any specific requirements established by the Department of Public Works and/or the City Engineer would mitigate landslide-related hazards. This impact is *less than significant*.

**Impact 4.5-4            Implementation of the proposed plan would not cause or accelerate instability from erosion so as to result in a geologic hazard to other properties, or accelerate natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition that would not be contained or controlled on site. Compliance with existing state water quality protection regulations and the CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.**

Soil erosion is a naturally occurring process. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss. The effects of erosion are intensified with an increase in slope (as water moves faster, it gains momentum to carry more debris), the narrowing of runoff channels (which increases the velocity of water), and by the removal of groundcover (which leaves the soil exposed to erosive forces). The potential for soil erosion can be accelerated and increased by human activities such as grading and cut-and-fill methods, particularly on steep slopes. Erosion can result in the loss of valuable ground surface materials, depositing them into basins and the ocean, and can result in the reduction in air quality due to wind-carried dust. Erosion, especially water erosion, can damage the watershed and contribute to hillside instability and flooding. Following brush fires, the threat of erosion is great due to loss of ground cover. When completed, surface improvements, such as buildings and paved roads, decrease the potential for erosion, but can increase the rate and volume of runoff containing sediment that can clog drainages and cause flooding, slope instability, and exacerbate erosion potential by diverting water flow.

Implementation of the proposed plan would facilitate new construction. Grading for most structures that would be a reasonably foreseeable effect of the proposed plan is expected to be minimal, consisting of grading for foundations, building pads, potential underground parking, and utility trenches in areas that are already developed. Excavations for utility trenches and foundations typically involve less than 5 feet of change in ground surface elevations. Most road and pad grading typically would be less than 2 feet deep. Nonetheless, deeper excavations could accompany the emplacement of underground facilities in the flatlands or road cuts in the uplands.

All earthwork and grading activities require grading permits from the Department of Building and Safety that include requirements and standards designed to limit potential impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70 of

the Los Angeles Municipal Code, which addresses grading, excavations, and fills, and the recommendations of a site-specific geotechnical report. Discretionary review may require the preparation of a site-specific geotechnical report to evaluate soils issues.

The proposed plan would also incorporate the City's proposed Baseline Hill Ordinance requirements that, among other controls, would include grading regulations. The regulations establish a new limit that uses a base quantity of grading plus a percentage of the lot size, with a maximum value that would be based on the property's zoning. It would also limit the amount of export/import. An indirect outcome of the Hillside Ordinance is that it could help reduce soil erosion potential in hillside areas, where erosional effects would be most likely to occur.

Because one of the major effects associated with grading is sedimentation in receiving waters, erosion control standards are set by the RWQCB through administration of the National Pollution Discharge Elimination System (NPDES) permit process for storm drainage discharge. The NPDES permit requires implementation of nonpoint source control of stormwater runoff through the application of a number of Best Management Practices (BMPs). These BMPs are meant to reduce the amount of constituents, including eroded sediment, that enter streams and other water bodies. A Storm Water Pollution Prevention Plan (SWPPP), as required by the RWQCB, is required to describe the stormwater BMPs (structural and operational measures) that would control the quality (and quantity) of stormwater runoff. Erosion and sedimentation issues are addressed more fully in Section 4.8.

Compliance with state NPDES permit, City's Codes, and applicable regulatory requirements, in combination with the City's standard grading and building permit requirements and the application of Best Management Practices, would ensure that potential impacts from erosion are *less than significant*.

**Impact 4.5-5      Implementation of the proposed plan could result in development in areas subject to potential geologic hazards or unstable soils and potentially result in on- or off-site landslide, lateral spreading, subsidence, or collapse. Compliance with existing CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.**

The proposed plan and implementing ordinances would primarily result in General Plan Amendments and zone changes to create consistency between GPF land use designations, zone changes to set development standards, design standards and guidelines, and ordinances to protect historic resources and single-family residential uses. It is anticipated this would result in the construction of new buildings in the plan area. These buildings could be constructed on areas that are potentially unstable and could potentially be subject to hazards from landsliding, lateral spreading, subsidence, settlement, or collapse, if not properly sited, designed, and constructed.

A landslide is a mass down slope movement of earth materials under the influence of gravity, and includes a variety of forms including: rockfalls, debris slides, mudflows, block slides, soil slides, slumps, and creeps. It is usually associated with steep canyons and hillsides, but can originate on or move down slopes on gentle slopes in areas underlain by saturated, sandy materials. In addition to being triggered by earthquakes, increased water content, excessive surface loading, or alteration of existing slopes by man or nature can cause landslides.



Lateral spreading is a phenomenon where large blocks of intact, nonliquefied soil move downslope riding on a liquefied substrate of large extent. The mass moves toward an unconfined area, such as a descending slope or stream-cut bluff, and can occur on slope gradients as gentle as one degree.

Settlement is the gradual downward movement of an engineered structure (e.g., a building) caused by the compaction of the unconsolidated material below the foundation. The risk of soils collapse and settlement would be highest in areas containing fill. Lateral spreading and collapse could occur in unsupported walls of pits excavated in the existing fill or loose alluvium.

Subsidence is the phenomenon where the soils and other earth materials settle or compress, resulting in a lower ground surface elevation. Subsidence in the Los Angeles-Long Beach area is historically related to oil and gas production in the Wilmington Oil Field. Water injection is used to mitigate subsidence and continues to be maintained at rates greater than the total volume of produced substances, including oil, gas, and water, to prevent further reservoir compaction and subsidence.

The principal tool for mitigation of geologic hazards is the City Grading Code, the requirements of which are specified in Chapter IX (Building Regulations), Article 1 (Building Code), Division 70. Under the Grading Code, the Department of Building and Safety has the authority to withhold building permit issuance if a project cannot mitigate potential hazards to the project or which are associated with the project. For example, all on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70, of the Los Angeles Municipal Code, which addresses grading, excavations, and fills, and the recommendations of the Geotechnical Report. Compliance with the recommendations of the geotechnical report, the City's Building and Grading Codes, as well as with any specific requirements established by the Department of Public Works and/or the City Engineer are typically sufficient to mitigate soil instability-related hazards.

Implementation of the City's Codes that implement the CBC in combination with the City's standard grading and building permit requirements and the application of Best Management Practices would reduce impacts from unstable soils to *less than significant*.

**Impact 4.5-6            Implementation of the proposed plan would not create substantial risks to life or property as a result of expansive soils. Compliance with existing CBC and City of Los Angeles Building Code regulations would ensure this impact remains *less than significant*.**

The proposed plan and implementing ordinances would primarily result in General Plan Amendments and zone changes to create consistency between GPF land use designations, zone changes to set development standards, design standards and guidelines, and ordinances to protect historic resources and single-family residential uses. Buildings could be constructed in the CPA on areas of expansive soils. The City requires, as a standard practice, the preparation, review, and approval of geotechnical reports for new developments. All earthwork and grading activities require grading permits from the Department of Building and Safety that would include requirements and standards designed to limit potential expansive soil impacts to acceptable levels. All on-site grading and site preparation must comply with applicable provisions of Chapter IX, Division 70, of the Los Angeles Municipal Code, which addresses grading, excavations, and fills, and the recommendations of the Geotechnical Report. Compliance with the recommendations of the geotechnical report, the City's Building and Grading Codes, as well as with any

specific requirements established by the Department of Public Works and/or the City Engineer are typically sufficient to mitigate expansive soil-related hazards.

Therefore, implementation of the City's Codes and regulatory requirements, in combination with the City's standard grading and building permit requirements and the application of Best Management Practices, would reduce impacts from expansive soils to *less than significant*.

**Impact 4.5-7**      **Implementation of the proposed plan would not destroy, permanently cover or materially and adversely modify one or more distinct and prominent geologic or topographic features such as hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds and wetlands. This impact would be *less than significant*.**

The majority of the San Pedro CPA is developed urban land, but a few areas of natural or undeveloped open space remain. To the south, open space is provided by the beaches along the Pacific Ocean and shoreline recreation areas; and to the east by the harbor. These areas are predominantly located around the borders, including coastal bluffs and hill slopes to the west and north along the border of Rancho Palos Verdes. The topographic characteristics of the bluffs and hill slopes contribute substantially to a variety of natural resource values for the CPA and the region.

The proposed plan and implementing ordinances would primarily result in General Plan Amendments and zone changes to create consistency between GPF land use designations, zone changes to set development standards, design standards and guidelines, and ordinances to protect historic resources and single-family residential uses. Development in most of the hilly areas would be minimal because the areas not designated Open Space are designated as Single-Family Residential and Public Facilities, which would not involve extensive land alteration. The San Pedro Coastal Land Use Plan and Specific Plan designate coastal bluff and hill slope areas to be preserved as Open Space. Development, if any, in the Open Space areas would be subject to the provisions of the San Pedro Coastal Land Use Plan. Objective 6 of the Land Use Plan, in particular, and Policies LU1.2 and LU18.1 seek to preserve scenic views and improve the visual environment of the Community through the protection of its natural features, topography, and coastline.

For those reasons, implementation of the proposed plan and implementing ordinances would not destroy, permanently cover, or materially and adversely modify distinct and prominent geologic or topographic features. This impact is *less than significant*, and no mitigation measures are required.

## ■ Mitigation Measures

Development under the proposed plan would comply with all local, State, and federal regulations pertaining to geological hazards. In addition, discretionary projects are subject to environmental review and mitigation measures are applied as part of the conditions of approval for the project. As such, no mitigation is required.

## ■ Level of Significance After Mitigation

Compliance with all local, State and federal regulations would ensure that all impacts related to geology/soils and mineral resources are *less than significant*.

## 4.5.4 Cumulative Impacts

The geographic context for the analysis of cumulative impacts resulting from geologic hazards is generally site-specific, because each project site has a different set of geologic considerations that would be subject to specific site-development and construction standards. Soil and geologic conditions are site-specific. As such, the potential for cumulative impacts to occur is geographically limited for many geology and soils impact analyses; however, variations from a site-specific cumulative context are identified, where they occur.

In common with the rest of California, Los Angeles is in a seismically active area and is subject to risk of damage to persons and property as a result of seismic groundshaking. Given the risk from seismic activity associated with all development in seismically active areas, this impact would be significant if it were not mitigated by building code requirements. Building in California is strictly regulated by the CBC, as adopted and enforces by each jurisdiction, to reduce risks from seismic events to the maximum extent possible. Impacts associated with potential geologic hazards related to fault rupture would occur at individual building sites and would be related to the site's location relative to fault zones, the composition of the site's soil, and the structural strength of a particular building. The CPA is not in an Alquist-Priolo EFZ.

Because the City of Los Angeles uses and enforces the requirements of the CBC as part of its Building Code, new buildings and facilities in the City are required to be sited and designed in accordance with the most current geotechnical and seismic guidelines and recommendations. In addition, development that could occur as a result of the proposed plan would implement all necessary design features recommended by the site-specific geotechnical studies to reduce the risk from seismic activity, unstable slopes, and soil limitations. With adherence to the Building Code and related plans, regulations, and design and engineering guidelines and practices, the project would not make a cumulatively considerable contribution to any potential cumulative impact arising from fault rupture. The proposed plan's cumulative impact is *less than significant*.

Impacts associated with potential geologic hazards related to groundshaking and seismic-related ground failure would occur at individual building sites. These effects are site-specific, and impacts would not be compounded by additional development. New buildings and facilities in the City are required to be sited and designed in accordance with appropriate geotechnical and seismic guidelines and recommendations, consistent with the requirements of the Building Code. Therefore, although there is risk from seismic events inherent in all development in seismically active areas in the state of California, compliance with applicable regulations reduces this risk because those regulations have been formulated to preserve public safety. Because individual projects that could be developed as a result of the proposed plan and implementing ordinances would comply with the provisions of all applicable codes and regulations and because its building plans would conform to the most current seismic safety design guidelines, the proposed plan would not make a cumulatively considerable contribution to any potential cumulative impacts arising out of strong seismic groundshaking, and the cumulative impact is *less than significant*.

The construction phase of individual development projects facilitated by the proposed plan and implementing ordinances could expose soil to erosion by wind or water. Development of other cumulative projects in the vicinity of the project site could similarly expose soil surfaces and further alter

soil conditions. To minimize the potential for cumulative impacts that could cause erosion, the project and cumulative projects in the adjacent area are required to conform to the provisions of applicable federal, state, County, and City laws and ordinances pertaining to erosion and sedimentation control. This includes the City's SUSMP requirements, which implement the federal and state NPDES program regulations (refer to Section 4.8). Because the proposed plan would be in compliance with applicable NPDES permit requirements and would implement and maintain the BMPs required by individual project SWPPPs, it would not make a cumulatively considerable contribution to any potential cumulative impact related to soil erosion, and the cumulative impact is *less than significant*.

As with seismic groundshaking impacts, the geographic context for analysis of impacts on development from unstable soil conditions, including landslides, liquefaction, subsidence, collapse, or expansive, unstable, or corrosive soils generally is site-specific. Development is required to undergo analysis of geological and soil conditions applicable to the specific individual project, and restrictions on development would be applied in the event that geological or soil conditions pose a risk to safety as a result of site-specific geologic or soils instability, subsidence, collapse, and/or expansive soil. Because development facilitated by the proposed plan would also be required to implement appropriate design and construction measures, the proposed plan would not make a cumulatively considerable contribution to any potential cumulative impacts, and the cumulative impact of the proposed plan is *less than significant*.

Cumulative projects, depending on where they are located, could substantially change site topography and/or unique geologic or physical features at their respective sites. In certain situations this could be a potentially significant impact, particularly if a large number of cumulative projects were to change topography or unique geologic features. However, the proposed plan would not substantially change site topography or affect unique geologic features, and would have no impact on such features. Therefore, the proposed plan would not make a cumulatively considerable contribution, and the cumulative impact related to prominent geologic or topographic features is *less than significant*.

### 4.5.5 References

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