6.3 GEOLOGIC HAZARDS AND RESOURCES

This section of the application presents information on the geologic hazards and resources of the area surrounding the Canyon Power Plant (CPP) site. The geologic and tectonic setting of the region incorporating the project area are described, followed by an evaluation of geologic hazards including surface fault-rupture, strong seismic ground shaking, liquefaction, seismic settlement, flooding, slope stability, collapsible and expansive soils, and ground subsidence. Potential environmental impacts of the proposed project on geologic resources at the CPP site are addressed, as are potential mitigation measures.

The final portion of this section describes laws, ordinances, regulations, and standards (LORS) relevant to geologic impacts of the CPP and provides contacts in respective regulatory agencies. Required permits are also discussed.

The Canyon Power Plant (CPP) will consist of a nominal 200-megawatt (MW) simple-cycle plant, using four natural gas-fired General Electric LM 6000PC Sprint combustion turbines and associated infrastructure. The project site is located at 3071 East Miraloma Avenue, in a City of Anaheim (COA)-designated industrial zone.

The CPP and associated construction laydown areas will be located on approximately 10 acres of disturbed land located at 3071 East Miraloma Avenue. Main access to the CPP site will be at the southeast corner of the project site from East Miraloma Avenue. A second gated entrance will be accessible via East Miraloma Avenue with a third gate off the alley to the east of the site. (Total land disturbance will be approximately 10 acres.)

The existing CPP site is predominantly paved (concrete and asphalt). Principal land use for the site was food catering for a fleet of approximately 75 to 100 trucks, formerly operated by Orange County Food Service. Onsite structures include a kitchen/warehouse building, maintenance garage (9 service bays), truck wash facility (5 bays), two ice manufacturing buildings, several storage sheds, and an outdoor truck repair shop which includes storage lockers and petroleum products, all of which will be demolished as a part of the CPP project.

The following activities are not part of the CPP project:

- Three residential houses along East Miraloma Avenue have recently been removed and are not a part of this Application for Certification (AFC). The COA Risk Manager and Fire Department determined that the residential units posed security and fire risks, and therefore they were removed. A letter from the COA Risk Manager to the Public Utilities Department is included in Appendix Q.
- Soil remediation activities associated with Phase I, Phase II, and Supplemental Phase II reports. The COA, now as owner of the property, has determined that it will conduct any

soil remediation activities to limit its environmental liability for future uses of the site. These activities will occur regardless of whether the CPP project obtains a CEC license.

- Installation of a temporary, 8-foot-high security fence around the perimeter of the entire 10-acre site.
- General maintenance activities including site cleanup and trash removal.

The project will include the construction and/or installation of the following components:

- **Proposed CPP site.** In addition to the four natural gas-fired GE LM 6000PC Sprint gas turbines, the plant will include generator step-up transformers (GSUs), a 69 kilovolt (kV) switchyard, onsite fuel gas compressors, a gas pressure control and metering station, a packaged chilled water system for combustion turbine engine (CTG) power augmentation with associated heating ventilation and air conditioning (HVAC)-type four-cell cooling tower, selective catalytic reduction system (SCR) emission control systems, and other associated plant infrastructure.
- **Gas Pipeline.** Natural gas will be provided via a new 3,240-foot-long, 12-inch, and 350 pounds per square inch gauge (psig) gas line owned and maintained by SoCal Gas Company (SCGC), which will be connected to new onsite fuel gas compressors that will be part of the CPP facility. From the CPP site, this new pipeline will run approximately 580 feet east in East Miraloma Avenue to Kraemer Boulevard, then north 2,660 feet in Kraemer Boulevard to East Orangethorpe Avenue to connect into SCGC's transmission line L-1218 in East Orangethorpe Avenue. (Total land disturbance will be 0.219 acre.)
- **Process water.** Process water for the project will be recycled water supplied from the Orange County groundwater replenishment system (GWRS) via a new 2,185-foot-long, 14-inch pipeline utilizing a new offsite booster pump station. The water pipeline will run east of the site on the north side of East Miraloma Avenue for 1,850 feet to the new pumping station located north of the curb in the COA-owned easement of East Miraloma Avenue, then north 210 feet in new easement from the Orange County Water District (OCWD), then 125 feet easterly in new easement to the GWRS line on the western side of the Carbon Canyon Diversion Channel. There, it will connect to the 60-inch-diameter GWRS recycled water line at an existing 36-inch stub up. (Total land disturbance for both line and pumping station will be 0.246 acre.)
- **Electrical interconnection.** Underground 69 kV cables will connect from GSUs to the onsite switchyard, which will use gas-insulated switchgear (GIS). There will be four new underground 69 kV circuits leaving the site. Two will proceed underneath and to the south side of East Miraloma Avenue approximately 100 feet to rise up and connect to the existing 69 kV overhead Vermont-Yorba lines via two new transition structures. The second two 69 kV underground circuits will proceed eastward approximately 4,000 feet in East Miraloma Avenue, turn south on Miller, then proceed approximately 3,000 feet to

connect to the Dowling-Yorba 69 kV line at East La Palma Avenue. (Total land disturbance for both sets of cables will be 0.489 acre.)

- **Communications.** Fiber optic cable will run in a common trench with the approximately 7,000-foot 69 kV electric cables, where it will tie into existing underground fiber optic cable for the supervisory control and data acquisition (SCADA) system.

6.3.1 Affected Environment

6.3.1.1 Regional Geologic Setting

The CPP site is located within the Los Angeles Basin of southern California at the northern terminus of the Peninsular Ranges geomorphic province. The Los Angeles Basin is bounded by the Santa Monica Mountains on the north, Puente Hills and Whittier Fault to the east, Santa Ana Mountains and San Joaquin Hills on the south, and Palos Verde Peninsula and coastline to the west. The tectonic shift from extension during the Miocene epoch to crustal compression to present time has uplifted the peripheral edges of the Los Angeles Basin, exposing stratigraphy in the flanks of surrounding hills and mountains (Norris and Webb, 1990). Refer to Figure 6.3-1, Regional Geology.

The Los Angeles Basin resulted from extensional tectonics along a transform plate boundary. Northwest-trending faults, which divide the basin into blocks, provided a mechanism for basin subsidence. Sedimentary deposition occurred contemporaneously with basin subsidence, faulting and folding during the early Miocence. Pre-basinal rocks range in age from late Cretaceous through Oligocene, and were deposited in a sedimentary cycle unrelated to the formation of the Los Angeles Basin. At the onset of basin development, a transgressive sequence of conglomerates and breccias, with interbedded volcanics and marine sediments were deposited. Principal subsidence and deposition occurred from late Miocene through early Pleistocene. A sequence of deep water turbidite sands with lithified interbedded shales to shallow neritic and lagoonal deposits that accumulated during this period reflect gradual shallowing of the basin with time. Marine deposition terminated in late Pleistocene time and basin disruption resulted not only in reactivation, but changed the direction of movement along intrabasinal faults. Maximum sediment accumulation is on the order of 4.5 miles (Morton, 2004).

Northwest-trending faults divide the Los Angeles Basin into four crustal blocks, each reflecting a different history of deformation and sedimentation. These are informally designated the southwestern, northwestern, central and northeastern blocks. The CPP site is located within the southeast portion of the central block. Main faults involved in this division are the: Newport-Inglewood Fault Zone separating the central and southwestern block; Whittier Fault Zone separating the central and northwestern block; and east-west trending Santa Monica Fault Zone separating the northwestern from all other blocks. Movement along these structural faults is still an integral part of basinal deformation and subsidence. Present

day evidence of major faulting that accompanies the subsidence of the basin includes continued fault displacements and associated earthquakes mainly along the basin margins.

6.3.1.2 Site Geologic Conditions

The CPP site is located on a broad alluvial plane, locally underlain by approximately 2,000 feet of unconsolidated, stratified silt, sand, and gravel deposits based on extrapolated well data interpreted by OCWD (O'Connor-Patel and Woodside, 2004) deposited by the Santa Ana River (Figure 6.3-2). The project area is located within the southeastern portion of the central block of the Los Angeles Basin, on a relatively flat plane sloping about 16 feet per mile (250:1) to the southwest. The central block is structurally characterized as an elongated trough, overlain by at least 32,000 feet of marine and nonmarine Cretaceous to Pleistocene rocks, including Miocene volcanic rocks (Morton, 2004). This stratigraphy is exposed on the western flanks of the Santa Ana Mountains (Norris and Webb, 1990). Geotechnical borings to depths up to 50 feet below ground surface (bgs) indicate the site is underlain by stratified alluvial deposits consisting of medium dense to very dense silty sand and poorly graded sand with intermittent layers of sandy silt. The upper one to 2.5 feet was comprised of artificial fill material (see Appendix F).

6.3.1.3 Groundwater

The project site is located within the lower Santa Ana River watershed and Orange County Water Basin (OCWB). The OCWB is divided into three sub-basins: the Yorba Linda sub-basin to the north (adjacent to the Chino Hills), the Main Basin (incorporating the COA), and the Irvine sub-basin to the south. The OCWB is managed by the OCWD, which manages water recharge systems and groundwater quality in the Orange County region (OCWD, 2004). Numerous abandoned gravel quarry pits along the Santa Ana River, including those adjacent to the CPP site, are part of the OCWD recharge facilities.

The COA receives a portion of its water from a multitude of production wells (several of which border Anaheim Lake, about 0.75 miles east northeast of CPP) and a portion from the Metropolitan Water District of Southern California (MWD). The MWD supplements the COA with water from the Colorado River and northern California.

Water that flows down the Santa Ana River, together with supplies imported from the Colorado River and State Water Project, is channeled into nine recharge basins. These lakes and ponds, with depths ranging from 50 to 150 feet, were formed by sand and gravel mining operations. The soil along this stretch of the Santa Ana River is coarse-grained and sandy. Levees have been constructed along portions of the Santa Ana River to retard the river's flow, increasing groundwater recharge efficiency through the base of the channel (OCWD, 2004).

The CPP is to the immediate west of the Kraemer Basin, located next to Miller Basin, and Anaheim Lake. These basins, which serve as a few of the district's deep recharge basins, require periodic maintenance due to accumulation of fine sediments and biological activity which impedes percolation rates.

Groundwater will not be extracted at the CPP site as part of the project. The impacts of the proposed development to the existing site groundwater conditions are expected to be minimal since numerous recharge basins exist in the vicinity.

6.3.1.4 Seismicity

The project site is located in the seismically active area of southern California where potential for moderate to strong seismic shaking may be generated by active faults. Faults are described as active, potentially active, or inactive. Active faults give evidence of surface displacement within Holocene time (the last 11,000 years) and have the highest potential of generating earthquakes again. In accordance with the Alquist-Priolo Earthquake Fault Zoning Act, special study zones, known as Alquist-Priolo Zones, have been established along faults in California that are known to be active. Active faults are listed on Table 6.3-1. Potentially active faults are listed on Table 6.3-2.

Historic earthquakes that have caused substantial ground shaking in the COA include the 1857 Fort Tejon earthquake (magnitude 7.9) on the San Andreas fault, 1933 Long Beach earthquake (magnitude 6.3) along the Newport-Inglewood Fault Zone, 1987 Whittier Narrows earthquake (magnitude 5.9) on the Elysian thrust fault, 1992 Yucca Valley earthquake (magnitude 7.4), and 1994 Northridge earthquake (magnitude 6.6), which resulted in damage to the Angel Stadium of Anaheim.

6.3.1.5 Significant Seismic Sources

6.3.1.5.1 Whittier Fault. The active Whittier fault is located approximately 5.1 miles north of the site. The main Whittier fault trace is a high-angle reverse fault, with the north side uplifted over the south side at an angle of approximately 70 degrees, although late Quaternary movement has been nearly pure strike-slip and total right separation may be around 8 to 9 kilometers (Yeats, 2004). The northwest-trending Whittier fault extends along the south flank of the Puente Hills from the Santa Ana River on the southeast to Whittier Narrows on the northwest. According to Yeats, at Whittier Narrows the Whittier fault turns more northwesterly becoming the East Montebello fault. In the Brea-Olinda Oil Field, the Whittier fault displaces Pleistocene age alluvium, and Carbon Canyon Creek is offset in a right lateral sense by the Whittier fault.

6.3.1.5.2 Elsinore Fault Zone. The Elsinore fault zone is one of the largest fault zones in southern California and, in historical times, has been one of the quietest. The southeastern

TABLE 6.3-1
MAJOR NAMED FAULTS CONSIDERED TO BE ACTIVE IN SOUTHERN CALIFORNIA

Fault (in increasing distance)	Maximum Magnitude[1]	Fault Type	Slip Rate (mm/yr.)	Distance From Site (miles)	Direction From Site
Puente Hills Blind Thrust	7.1	BT	0.7	2.6	NW
Whittier	6.8	RO	2.5	5.1	N
Elsinore (Glen Ivy Segment)	6.8	SS	5.0	11	E
San Joaquin Hills	6.6	BT	0.5	11	S
Chino-Central Avenue	6.7	RO	1.0	12	NE
San Jose	6.4	RO	0.5	13	NNE
Newport-Inglewood Zone	7.1	SS	1.0	15	SW
Upper Elysian Park	6.4	BT	1.3	19	NW
Sierra Madre	7.2	RO	2.0	19	N
Cucamonga	6.9	RO	5.0	21	NNE
Raymond	6.5	RO	1.5	22	NW
Clamshell-Sawpit	6.5	RO	0.5	23	NNW
Palos Verdes	7.3	SS	3.0	24	SW
Verdugo	6.9	RO	0.5	26	NW
San Gabriel	7.2	SS	1.0	26	N
Hollywood	6.4	RO	1.0	30	NW
Santa Monica	6.6	RO	1.0	33	NW
San Jacinto (San Bernardino Segment)	6.7	SS	12.0	34	NE
San Andreas (Mojave Segment)	7.4	SS	30.0	37	NE
San Andreas (San Bernardino Segment)	7.5	SS	24.0	37	NE
San Fernando	6.7	RO	2.0	39	NW
Northridge Thrust	7.0	BT	1.5	40	NW
Malibu Coast	6.7	RO	0.3	40	NW
Anacapa-Dume	7.5	RO	3.0	49	WNW
Santa Susana	6.7	RO	5.0	49	WNW
Simi-Santa Rosa	7.0	RO	1.0	56	NW

[1] California Geological Survey, 2003.
SS = Strike-slip.
NO = Normal Oblique.
RO = Reverse Oblique.
BT = Blind Thrust.

TABLE 6.3-2
MAJOR FAULTS CONSIDERED TO BE POTENTIALLY ACTIVE IN SOUTHERN CALIFORNIA

Fault (in increasing distance)	Maximum Magnitude	Fault Type	Slip Rate (mm/yr.)	Distance From Site (miles)	Direction From Site
El Modeno	6.5[1]	NO	0.1	1.5	S
Peralta Hills	6.5[1]	RO	0.1	1.9	SW
Norwalk	6.7[2]	RO	0.1	4.8	WNW
Los Alamitos	6.2[1]	SS	0.1	12	WSW
Pelican Hill	6.3[1]	SS	0.1	15	S
Indian Hill	6.6[1]	RO	0.1	17	NNE
Duarte	6.7[2]	RO	0.1	19	NNW
MacArthur Park	5.7[4]	RO	3.0	26	NW
Overland	6.0[2]	SS	0.1	30	NW
Charnock	6.5[2]	SS	0.1	31	NW
Northridge Hills	6.6[3]	SS	1.2	42	NW

[1] Mark, 1977.
[2] Slemmons, 1979.
[3] Wesnousky, 1986.
[4] Hummon et al, 1994.
SS = Strike-slip.
NO = Normal Oblique.
RO = Reverse Oblique.
BT = Blind Thrust.

extension of the Elsinore fault zone, the Laguna Salada fault, ruptured in 1892 in a magnitude 7 quake, but the main trace of the Elsinore fault zone has only seen one historical event greater than magnitude 5.2: the earthquake of 1910, a magnitude 6 shock near Temescal Valley, which produced no known surface rupture and did little damage.

At its northern end, the Elsinore fault zone splays into two segments, the Chino fault and the Whittier fault. At its southern end, the Elsinore fault is cut by the Yuha Wells fault from what amounts to its southern continuation: the Laguna Salada fault. Several of the fault strands which make up the Elsinore fault zone possess their own names. Northwest of Lake Elsinore are the Glen Ivy North and Glen Ivy South faults. Heading southeast from Lake Elsinore, the two parallel fault strands are the Wildomar fault (the more easterly) and the Willard fault.

The Glen Ivy segment of the Elsinore fault zone is located approximately 11 miles east of the site, where it becomes the Whittier fault. An average slip rate of 5.0 millimeters per year and a maximum magnitude of 6.8 are estimated for the Glen Ivy segment by the California Geological Survey (CGS, 2003).

6.3.1.5.3 San Andreas Fault Zone. The San Andreas Fault Zone (SAFZ) is approximately 37 miles northeast of the site. It forms the dextral strike-slip plate boundary between the North American and Pacific plates. The San Andreas fault zone is the most extensively studied fault in California, and perhaps the world.

Two major surface-rupturing earthquakes have occurred on the San Andreas Fault in historic time: the 1857 Fort Tejon and 1906 San Francisco earthquakes. Additional historic surface rupturing earthquakes include the unnamed 1812 earthquake along the Mojave section and the northern part of the San Bernardino Mountains section, and a large earthquake in the San Francisco Bay area that occurred in 1838 that was probably on the Peninsula section. Historic fault creep rates are as high as 32 millimeters per year for the 82-mile long creeping section in Central California with creep rates gradually tapering to zero at the northwestern and southeastern ends of the section. Average slip rates for the San Andreas Fault zone exceed 5.0 millimeters per year (USGS, 2006).

6.3.1.5.4 Puente Hills Blind Thrust. The Puente Hills Blind Thrust (PHBT) is defined based on seismic reflection profiles, petroleum well data, and precisely located seismicity (Shaw et al., 2002). This blind thrust fault system extends eastward from downtown Los Angeles to Brea (in northern Orange County). The PHBT includes three north-dipping segments, named from east to west as the Coyote Hills segment, the Santa Fe Springs segment, and the Los Angeles segment. These segments are overlain by folds expressed at the surface as Coyote Hills, Santa Fe Springs Anticline, and Montebello Hills. The Santa Fe Springs segment of the PHBT is believed to be the causative fault of the October 1, 1987 Whittier Narrows Earthquake (Shaw et al., 2002).

The PHBT underlies the site at depth. Postulated earthquake scenarios for the PHBT include single segment fault ruptures capable of producing an earthquake of magnitude 6.5 to 6.6 and a multiple segment fault rupture capable of producing an earthquake of magnitude 7.1 (Shaw et al., 2002). More recent paleoseismic studies of Holocene uplift include estimated earthquakes of magnitude 7.2 to 7.5 (Dolan et al., 2003).

The PHBT is not exposed at the ground surface and does not present a potential for surface fault rupture. However, the PHBT is considered an active fault capable of generating future earthquakes beneath the Los Angeles Basin. An average slip rate of 0.7 millimeters per year and a maximum magnitude of 7.1 are estimated by the CGS (2003) for the PHBT.

6.3.1.5.5 San Joaquin Hills Blind Thrust. Until recently, the southern Los Angeles Basin has been estimated to have a low seismic hazard relative to the greater Los Angeles region (Working Group on California Earthquake Probabilities, 1995; Dolan et al., 1995). This estimation is generally based on the fewer number of known active faults and the lower rates of historic seismicity for this area. However, several recent studies by Grant et al. (1999, 2002) suggest that an active blind thrust fault system underlies the San Joaquin Hills. This

postulated blind thrust fault is believed to be a faulted anticlinal fold, parallel to the Newport-Inglewood fault zone (NIFZ) but considered a distinctly separate seismic source (Grant et al., 2002). The recency of movement and Holocene slip rate of this fault are not known.

The vertical surface projection of the San Joaquin Hills Thrust is approximately 11 miles south of the site at the closest point. This thrust fault is not exposed at the surface and does not present a potential surface fault rupture hazard. However, the San Joaquin Hills Thrust is considered an active feature that can generate future earthquakes. An average slip rate of 0.5 mm/yr and a maximum magnitude of 6.6 is estimated for the San Joaquin Hills Thrust by the CGS (2003).

6.3.1.5.6 El Modeno Fault. The potentially active El Modeno fault is located about 1.5 miles south of the site. The fault is a steeply-dipping normal fault about 9 miles long and has about 2,000 feet of uplift on its eastern side. Movement on the fault has been inferred during Holocene time, suggesting the fault is active (Ryan et al., 1982). However, Jennings, 1994 shows this fault to be potentially active and the CGS does not include it in its database.

6.3.1.5.7 Peralta Hills Fault. The Peralta Hills fault (PHF) is considered potentially active and is located approximately 1.9 miles southwest of the site (Jennings, 1994). This reverse fault is about 5 miles long and generally trends east-west and dips to the north. Although Pleistocene (between 1.8 million years to 11,550 years) offsets have been recognized along portions of this fault, No evidence currently exists for displacement in the overlying Holocene (11,000 years to present) alluvium to merit re-classification of the PHF as an "active fault" (Ziony and Jones, 1989). The PHF is excluded from the Alquist-Priolo Special Studies Zone Act (SCEDC, 2000).

6.3.1.5.8 Norwalk Fault. The potentially active Norwalk fault is located about 4.8 miles west-northwest of the site. The fault is a known groundwater barrier along the southern edge of the Coyote Hills. The fault trends southeasterly along the front of the Coyote Hills which have been uplifted. This fault offsets lower Pleistocene age and older deposits near the mouth of the Santa Ana Canyon. Evidence for Holocene offsets along its trace remains undiscovered (Ziony and Jones, 1989). Jennings (1994) also considers the Norwalk fault to be potentially active.

6.3.1.6 Geologic and Seismic Hazards

Several types of potential geologic hazards known to be present in parts of California were evaluated for their potential impact on the proposed site structures. These include surface fault rupture, seismic shaking, liquefaction, seismically-induced settlement, flooding, landsliding, expansive soils, and ground subsidence. An evaluation of the potential impacts on the site from these potential geologic hazards is presented in the following sections.

6.3.1.6.1 Surface Faulting Rupture. The site is not within a currently established Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards. The closest active fault to the site with the potential for surface rupture is the Whittier fault, is located approximately 5.1 miles north of the site. Based on the available geologic data, active faults with the potential for surface fault rupture are not known to be located directly beneath or projecting toward the site.

6.3.1.6.2 Earthquake Ground Shaking. The CPP will likely be subjected to moderate to strong earthquake motions during the life of the facility. The California Division of Mines and Geology (CDMG, 1998) estimated peak ground accelerations to range from 0.35 to 0.40 g based on a magnitude 6.8 earthquake. This magnitude was selected based on a 10 percent probability of exceedance in 50 years.

6.3.1.6.3 Flooding. The CPP site is located approximately one mile north of the Santa Ana River which drains the largest region within Orange County, covering approximately 2,700 square miles. The destructive flooding along the Santa Ana River in 1938 spurred the modification of the Santa Ana River channel by the U.S. Army Corps of Engineers (ACOE). Concrete-lined channels in the vicinity of the site have reduced flooding in this zone from a 100-year flood event. Post 1938, this northeastern portion of Anaheim had been categorized as a 500-year flood zone (with flooding below one foot). Site structures and elevations should be designed to minimize impacts of a flood event (Figure 6.3-4).

According to the COA Safety Element (2004), the site is located within a potential inundation area for an earthquake-induced dam failure from Prado and Carbon Canyon dams (Figure 6.3-4). Governmental agencies (such as the State of California Division of Safety of Dams and the ACOE) provide a safeguard to potential dam failure by continual monitoring. Potential for dam failures during an earthquake has been addressed by the CDMG in the earthquake planning scenarios for a magnitude 8.3 earthquake on the San Andreas fault (Davis et al., 1982) and a magnitude 7.0 earthquake on the Newport-Inglewood fault (Toppozada et al., 1988). As stated in the both reports, catastrophic failure of a major dam as a result of a scenario earthquake is regarded as unlikely. Current design and construction practices, and ongoing programs of review, modification, or total reconstruction of existing dams are intended to ensure that all dams are capable of withstanding the maximum credible earthquake (MCE) for the site. Therefore, the potential for inundation at the site as a result of an earthquake-induced dam failure is considered low.

The site is not located down slope of any large bodies of water that would impact the site in the event of earthquake-induced seiches (wave oscillations in an enclosed or semi-enclosed body of water).

6.3.1.6.4 Tsunamis. Tsunamis are defined as a series of waves produced by large-scale sudden displacements of water bodies such as the ocean. Potential for this hazard does exist

along the coastal regions of southern California due to active, offshore faults sub parallel to the coast. The CPP site is located inland, approximately 15 miles from the coastline and 215 feet above mean sea level. Tsunamis are therefore are not considered a significant hazard at the site.

6.3.1.6.5 Slope Stability. The site lies far enough from the nearest significant upland slopes (Figure 6.3-5) to preclude the hazards of induced landsliding. Based on the Seismic Hazard Zones Map, Orange Quadrangle (CDMG, 1998), the proposed project site is not located within an area where previous occurrence of landslide movement, or local topographic, geological, geotechnical, and subsurface conditions indicate a potential for permanent ground displacements such that mitigation would be required. The relatively flat-lying topography at the site and surrounding area precludes unstable slope conditions and the potential for lurching (earth movement at right angles to a cliff or steep slope during ground shaking). There are no known landslides near the site, nor is the site in the path of any known or potential landslides.

6.3.1.6.6 Liquefaction. The CPP site falls within California Division of Mines and Geology (CDMG, 1998) liquefaction zone (Figure 6.3-5). This map is generated by correlating (in a graphical information system model) Quaternary deposits distribution, historically highest (shallow) groundwater levels, quantitative analysis of geotechnical data pertaining to engineering strengths of deposits, and information on potential ground shaking based on probabilistic shaking maps (California Department of Conservation [CDOC], 2000).

Liquefaction is favorable when a site is underlain by loose, cohesionless soils (generally fine-grained sands) which are saturated by shallow groundwater (generally to depths of about 40 feet below ground surface) and are subjected to strong seismic ground motion of significant duration (CDMG, 1997). Structures located on liquefiable soils such as silt or sand may experience significant damage during an earthquake due to the instability of structural foundations and the moving earth. The CPP project site is underlain by poorly graded silty-sands to sandy-silts (Appendix F), geologically designated as young alluvial fan deposits – Qyfa (Morton, 2004). Although historically highest ground-water levels were interpreted to be about 20 feet bgs (based on a series of monitoring points in the area), no groundwater was encountered at a depth of 50.5 feet bgs during the geotechnical investigation (see Appendix F). It is noted, however, that saturated conditions could change rapidly by virtue of the CPP location within the Santa Ana River floodplain and proximity to groundwater recharge basins.

Based on a series of cone penetrometer tests (CPT), soils analysis, and groundwater investigation, the geotechnical report indicates that liquefaction induced settlement would be less than 0.25 inch when subjected to a magnitude 7.5 adjusted peak ground acceleration. The reader is directed to the geotechnical report in Appendix F for further information.

6.3.2 Environmental Consequences

Natural resources occurring within the area include alluvial deposits, and oil and gas resources. The following section discusses these resources in the vicinity of the CPP site.

6.3.2.1 Sand and Gravel Aggregate Resources

The CPP project area falls within MRZ-2. This zone is defined as an area where sufficient information indicates the presence of significant mineral deposits (sands and gravels), or there is a strong likelihood of their presence and development should be controlled. The site is adjacent to three groundwater recharge basins. These depressions, along with numerous other basins along the Santa Ana River, were created from past mining of sands and gravels. They now function as percolation ponds, fed by diverted waters of the Santa Ana River for recharge of the OCWB. Due to the current usage of the land in this area, the proposed project would have negligible impact on these resources.

6.3.2.2 Oil and Gas Resources

The proposed CPP site lies between two oil fields; the Olive and Richmond oil fields. Based on maps published by the California Division of Oil, Gas, and Geothermal Resources (DOGGR), there are no known oil wells at the site. According to the DOGGR map W1-2, the closest production well (Chevron Texaco- 'Bryant Ranch' 2) is approximately 9 miles east-northeast from CPP, in the Chino Hills area. Although there appeared to be no abandoned wells within the site boundaries in the DOGGR records, a slight potential exists for encountering abandoned wells during the CPP constructions phase due to the history of oil exploration in this region.

6.3.2.3 Mineral Resources

The CPP site falls within MRZ-2 (Kohler, 1982; Miller and Corbaley, 1981). An MRZ-2 zone defines an area where adequate information indicates that significant mineral deposits are present, or there is a high likelihood of their presence and development should be controlled. The proposed CPP site is located in an industrial zone, within the COA. Although the site is located on the Santa Ana River alluvial terrace, characterized by sands and gravels, the location within an urban setting makes it an unlikely candidate for exploitation of mineral resources.

6.3.2.4 Consequences to Natural Resources

Natural resources occurring within the region include sand and gravel as aggregate resources, and oil and gas resources. All of these resources have been exploited, at least in a limited manner, in the vicinity of the CPP site. There are currently no significant gravel mining operations or oil fields within a 10-mile radius of the site.

6.3.2.5 Cumulative Impacts

A review of the existing site conditions and the proposed project development indicates that no cumulative impacts from geologic hazards or to geologic resources resulting from the CPP have been identified.

6.3.3 Mitigation Measures

No unavoidable adverse impacts related to geologic hazards and resources have been identified for the CPP. These mitigation measures are more accurately described as project design features. They are presented in this report for clarity.

6.3.3.1 Earthquake Ground Shaking

The CPP will likely be subjected to moderate to strong earthquake motions during the life of the facility. The CDMG (1998) estimated peak ground accelerations to range from 0.35 to 0.40 g based on a magnitude 6.8 earthquake. This magnitude was selected based on a 10 percent probability of exceedance in 50 years. The CPP will be designed and constructed at a minimum to the seismic design requirements for ground shaking specified in the current Uniform Building Code (International Conference of Building Officials, 1997) for Seismic Zone Four and the California Building Code (CBC) (California Building Standards Commision, 1998). Proper design and construction will reduce impacts from ground shaking to less than significant.

6.3.4 Applicable LORS

The proposed project will comply with applicable LORS pertaining to geological hazards and resources during construction and operations. Applicable LORS are discussed below and summarized in Table 6.3-3.

6.3.4.1 Federal

No federal LORS are applicable.

6.3.4.2 State

6.3.4.2.1 California Public Resources Code Section 25523(a): 20 CCR Section 1752(b) and (c). The project site is not within the Alquist-Priolo Special Study Zone (APSSZ). The CPP will not be subject to requirements for construction within the APSSZ.

6.3.4.2.2 California Building Code (CBC), Appendix Chapter 33. This element sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments. It establishes basic policies to safeguard life, limb, property, and public welfare by regulating grading on private property.

TABLE 6.3-3
APPLICABLE LORS

LORS	Applicability	Conformance (Section)
Federal		
No federal LORS are applicable (see also Appendices A1 through A7).		
State		
Cal PRC §25523(a), Alquist Priolo Special Study Zone	NA	6.3.4.2
California Building Code, Chapters 16 and 33	Codes address excavation, grading, and earthwork construction, including construction applicable to earthquake safety and seismic activity hazards.	3.5, 6.3.4.3, Appendix A-7
Local		
1997 Uniform Building Code with Amendments by the COA Community Development Department	Codes address excavation, grading, and earthwork construction, including construction applicable to earthquake safety and seismic activity hazards.	3.5, 6.3.4.3, Appendix A7

The geotechnical engineer and engineering geologist will certify the placement of fills and adequacy of the site for structural improvements in accordance with the CBC, Appendix Chapter 33.

The geotechnical engineer will address Sections 3309 (Grading Permit Requirements), 3312 (Cuts), 3315 (Drainage and Terracing), 3316 (Erosion Control), 3317 (Grading Inspection), and 3318 (Completion of Work) of the CBC, Appendix Chapter 33.

6.3.4.2.3 California Building Code 1998, Volume 2, Chapter 16. This element sets forth rules and regulations that address potential seismic hazards.

6.3.4.3 Local

The CPP site is located in the COA and will be subject to the LORS for the COA. The administering agency for the above authority is the COA Building Division of the Community Development Department.

6.3.4.4 Agencies and Agency Contacts

Agencies with jurisdiction to issue applicable permits and/or enforce LORS related to geologic hazards and resources, and the appropriate contact person are shown in Table 6.3-4.

TABLE 6.3-4
AGENCY CONTACTS

Agency	Contact/Title	Telephone
California Division of Mines and Geology (CDMG)[1]	Jim Davis, State Geologist, Office of the State Geologist	(916) 445-1923
City of Anaheim Community Development Department	Sheri Vander Dussen, Planning Director	(714) 765-5009
City of Anaheim Community Development Department Building Division	Kyle Tonokawa, Plan Check	(714) 765-5153 X 5776
City of Anaheim Fire Department	Joe Kaslowski, Hazardous Waste Specialist	(714) 765-4031

[1] Geological resources and hazards fall under the jurisdiction of the CDMG.

6.3.4.5 Applicable Permits

Grading permits will be issued by the COA based on a review of the grading plan and the Geotechnical Investigation Report.

6.3.5 References

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