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CHAPTER 4 – ENVIRONMENTAL IMPACT ASSESSMENT

4.6 GEOLOGY, SOILS, AND MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less-Than-Significant Impact with Mitigation Measures	Less-Than-Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☑	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault?[1]	☐	☐	☑	☐
ii) Strong seismic ground shaking?	☐	☐	☑	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☑	☐
iv) Landslides?	☐	☐	☑	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☑	☐
c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☑	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☑	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☑

[1] Refers to Divisions of Mines and Geology Special Publication #42

Would the project:	Potentially Significant Impact	Less-Than-Significant Impact with Mitigation Measures	Less-Than-Significant Impact	No Impact
f) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	❐	❐	❐	☑
g) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	❐	❐	❐	☑

4.6.0 Introduction

This section describes existing geologic and pedogenic soil conditions related to the San Diego Gas & Electric Company (SDG&E) East County (ECO) Substation Project (Proposed Project). Topography and mineral resources are also addressed. Potential geologic hazards, including those associated with strong seismic shaking, and the way these conditions and potential hazards could affect the Proposed Project are discussed. The Proposed Project would result in significant impacts associated with the expansive soils; however, these impacts will be less than significant with the implementation of the applicant-proposed measures (APMs).

4.6.1 Methodology

Preparation of this section was primarily based on review of geologic and mineral resource literature and unpublished documents relevant to the Proposed Project area. This material included publications from the United States (U.S.) Geological Survey (USGS), the Natural Resource Conservation Service, and the California Geological Survey (CGS). Planning documents prepared by the County of San Diego were also reviewed and reconnaissance field investigations were performed. The Interim Geotechnical Investigation Report is provided in Attachment 4.6-A: Interim Geotechnical Investigation.

Each component of the Proposed Project, including the ECO Substation, Southwest Powerlink (SWPL) loop-in, 138 kilovolt (kV) transmission line, Boulevard Substation rebuild, and White Star Communication Facility rebuild were considered in this analysis. However, where existing conditions or potential impacts are identical for multiple components, they are described together in the subsections that follow.

4.6.2 Existing Conditions

Geological Setting

The Proposed Project area lies within the Peninsular Ranges region. Mountains of the Peninsular Ranges are predominantly north-south trending and extend approximately 900 miles from Southern California to the southern tip of Mexico’s Baja California peninsula. These mountains are part of the North American Coast Ranges that run along the Pacific coast from Alaska to Mexico. Elevations range from about 500 to 11,500 feet above mean sea level. Mountains of the Peninsular Ranges are mainly composed of extensive Mesozoic (from roughly 251 million years ago to the beginning of the Cenozoic Era 65 million years ago) granitic plutons, overlain in areas by metasedimentary rocks, such as marbles, slates, schist, quartzites, and gneiss (San Diego Natural History Museum, 2008). In the Proposed Project area, the Peninsular Ranges include the In-Ko-Pah and Jacumba mountain ranges. Geologic units and characteristics are identified in Table 4.6-1: Paleontological Sensitivity.

Table 4.6-1: Paleontological Sensitivity

Geologic Rock Unit	Symbol	Geologic Age	Paleontological Sensitivity
ECO Substation & SWPL Loop-In			
Holocene alluvium & fanglomerate	Qya	Holocene	Low
Older alluvium and fanglomerate	Qt	Pleistocene	Moderate
Jacumba Volcanics	Tj	Miocene	Zero
Table Mountain Formation	Ta	Miocene	High
Peninsular Ranges Batholith	Klp	Cretaceous	Zero
138 kV Transmission Line			
Holocene alluvium	Qya	Holocene	Low
Older alluvium and fanglomerate	Qt	Pleistocene	Moderate
Jacumba Volcanics	Tj	Miocene	Zero
Table Mountain Formation	Ta	Miocene	High
Peninsular Ranges Batholith	Klp, Klh	Cretaceous	Zero
Julian Schist	Jsp	Triassic	Zero
Boulevard Substation Rebuild			
Holocene alluvium	Qya	Holocene	Low
Peninsular Ranges Batholith	Klp	Cretaceous	Zero
White Star Communication Facility Rebuild			
Peninsular Ranges Batholith	Klp	Cretaceous	Zero

Source: USGS, 2008

Faults, Seismicity, and Related Hazards

Faults

The seismicity of the Southern California region is dominated by the northwest-trending San Andreas Fault and other active faults, such as the San Jacinto and Elsinore faults that parallel the San Andreas system.

The San Andreas and sympathetic fault systems respond to stress that is induced by the relative motions of the Pacific and North American Tectonic Plates. This stress is relieved by strain, predominantly as right lateral strike-slip faulting on the San Andreas and other related faults. The effects of strain include mountain building, basin development, widespread regional uplift, deformation of Quaternary deposits, and the generation of earthquakes (Wallace, 1990).

Historical faulting in the region is related to faults associated with movement along the Elsinore Fault Zone, located approximately 12 miles northeast of the ECO Substation site. Geological maps of the central portion of the ECO Substation site show two buried faults that are considered inactive.

Geological maps that cover the Boulevard Substation rebuild and the 138 kV transmission line areas do not show any mapped evidence of faulting. Therefore, seismicity in these areas is primarily related to seismic activity of distant regional faults. The most significant faults within the region include the San Andreas, San Jacinto, and the Elsinore faults. The closest and most significant in terms of potential impact to the Proposed Project is the Elsinore fault. Table 4.6-2: Active Faults lists active faults that are within 65 miles of the ECO Substation site, along with the characteristics of each fault.

Fault Rupture

Several extremely complex zones of predominantly right-lateral strike-slip faults occur in the Peninsula Ranges. The Proposed Project site is in a region where distant active faults are capable of surface rupture. Active faults have all been delineated as Alquist-Priolo Earthquake Fault Zones.

The Alquist-Priolo Earthquake Fault Zoning Act of 1972, formerly known as the Special Studies Zoning Act, regulates construction and development of buildings intended for human occupancy to avoid rupture hazards from surface faults. This act does not specifically regulate overhead transmission lines, but it does aid in defining areas where fault rupture is likely to occur.

Earthquakes can occur anywhere along the various strands of the Elsinore Fault zones and other regional faults (including currently unknown faults), although only earthquakes of magnitude 6.0 or greater are likely to produce a noticeable or damaging surface fault rupture and slip (Petersen et al., 1996).

East County Substation and Southwest Powerlink Loop-In

Geological mapping of the area indicates that the central portion of the ECO Substation site is crossed by two buried inactive faults (Brooks and Roberts, 2003). Although these faults are relatively short and are not expected to generate large, significantly damaging earthquakes, fault rupture can occur along their traces as a result of stress or from sympathetic movement related to large earthquakes on the distant Elsinore Fault.

138 kV Transmission Line

No known active faults are mapped within or across the 138 kV transmission line right-of-way (ROW). However, as previously discussed and shown in Table 4.6-2: Active Faults, several faults are located in the region.

Table 4.6-2: Active Faults

Fault	Approximate Closest Distance to the ECO Substation and SWPL Loop-In (miles)	Fault Length (miles)	Maximum Estimated Earthquake Magnitude	Approximate Slip Rate (millimeters/ year)
San Andreas: Coachella Segment	55	60	7.2	25.0
Brawley Seismic Zone	38	42	6.4	25.0
Brawley Fault Zone	43	15	6.5	20.0
Imperial	38	38	7.0	5.0
Superstition Mountain (part of the San Jacinto Fault Zone)	28	14	6.6	3.0
Superstition Hills (part of the San Jacinto Fault Zone)	31	14	6.6	2.0
Elmore Ranch (part of the San Jacinto Fault Zone)	32	18	6.6	1.0
San Jacinto: Borrego Segment	28	18	6.6	4.0
San Jacinto: Coyote Creek Segment	40	25	6.8	4.0
San Jacinto: Anza Segment	44	57	7.2	12.0
Elsinore: Julian Segment	32	47	7.1	5.0
Earthquake Valley (part of the Elsinore Fault Zone – Julian Segment)	35	12	6.5	Not Applicable
Elsinore: Coyote Mountain Segment	12	24	6.8	4.0
Laguna Salada	15	41	7.0	3.5
Rose Canyon	60	43	7.2	1.5
Newport-Inglewood: off-shore section	61	41	7.1	1.5
Coronado Bank	62	115	7.6	3.0

Sources: USGS, 2008

Boulevard Substation Rebuild

No known active faults are mapped within or in close proximity to the Boulevard Substation rebuild area.

White Star Communication Facility Rebuild

No known active faults are mapped within or in close proximity to the White Star Communication Facility rebuild site. The nearest active fault to the White Star Communication Facility is the Coyote Mountain Fault of the Elsinore Fault Zone, which is approximately 16 miles northeast.

Strong Ground Motion

Strong ground motion or intensity of seismic shaking during an earthquake will be dependent on the distance from the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the Proposed Project area. Earthquakes on faults closest to the Proposed Project area or rupturing in the direction of the Proposed Project area will most likely generate the largest ground motion or shaking.

An earthquake is commonly described by the amount of energy released, which has traditionally been quantified using the Richter scale. However, seismologists have recently begun using a Moment Magnitude scale because it provides a more accurate measurement of a major earthquakes size. The Moment Magnitude and Richter Magnitude scales are almost identical for earthquakes of less than magnitude 7.0. Moment Magnitude scale readings are slightly greater than a corresponding Richter Magnitude scale reading for earthquakes with magnitudes greater than 7.0.

Review of historical earthquake activity from 1800 to 2005 indicates that many earthquakes of magnitude 6.0 or greater have occurred within 50 miles of the Proposed Project area. Table 4.6-3: Significant Historical Earthquakes provides a summary of significant (magnitude 6.0 or greater) earthquake events and the relative distances of these events to the Proposed Project area.

The intensity of ground motions induced by earthquakes can be described using peak site accelerations, represented as a fraction of the acceleration of gravity (g). CGS Probabilistic Seismic Hazard Assessment (PSHA) maps were used to estimate peak ground accelerations (PGAs) within the vicinity of the Proposed Project area. Considering the uncertainties regarding the size and location of potential earthquakes and resulting ground motions that can affect a particular site, PSHA maps show peak ground accelerations with 10 percent probability that they will be exceeded in 50 years, which equals an annual probability of one in 475 of being exceeded each year. Estimated PGAs range from 0.24g to 0.32g within the Proposed Project area, with the higher PGAs closer to active faults and in areas underlain by young sediments. A summary of estimated peak ground accelerations for the Proposed Project is presented in Table 4.6-4: Approximate Peak Acceleration Estimates.

Table 4.6-3: Significant Historical Earthquakes

Event Date	Earthquake Name or General Location	Fault Involved (if known)	Magnitude	Approximate Closest Distance to the ECO Substation Site (miles)
November 24, 1987	Superstition Hills Earthquake	Superstition Hills Fault	6.6	31
November 23, 1987	Elmore Ranch Fault	Elmore Ranch Fault Zone	6.2	27
October 15, 1979	1979 Imperial Valley Earthquake	Imperial, Brawley Fault Zone, Rico Faults	6.4	47
April 8, 1968	Borrego Mountain Earthquake	Coyote Creek segment of the San Jacinto Fault Zone	6.6	39
March 19, 1954	1954 San Jacinto Fault Earthquake	Clark Fault, part of the Anza segment of the San Jacinto Fault Zone	6.4	45
October 21, 1942	Fish Creek Mountains Earthquake	Coyote Creek segment of the San Jacinto Fault Zone	6.6	25
May 18, 1940	1940 Imperial Valley Earthquake	Imperial Fault	6.9	37
March 25, 1937	San Jacinto Fault (Terwilliger Valley) Earthquake	San Jacinto Fault	6.0	54
June 22, 1915	1915 Imperial Valley Earthquake (two strong shocks about an hour apart)	Imperial Fault	6.1 and 6.3	38
May 28, 1892	Borrego Mountains, aftershock of the Laguna Salada Earthquake	Coyote Creek, part of the San Jacinto Fault Zone	6.8	39
February 9, 1890	North end of the Borrego Desert	Assumed on the San Jacinto	6.8	54

Sources: Blake, 2000 (using CGS 1800–2008 Earthquake database); Southern California Earthquake Data Center (SCEDC), 2008

Table 4.6-4: Approximate Peak Acceleration Estimates

Site or ID	Average Peak Acceleration Range
ECO Substation/SWPL Loop-In	0.26–0.32 g
Boulevard Substation/138 kV Transmission Line ROW	0.24–0.28 g

Source: USGS, 2008

The Modified Mercalli Scale is another common measure of earthquake intensity, which is a subjective measure of earthquake strength at a particular place as determined by its effects on people, structures, and earth materials. Table 4.6-5: Earthquake Intensity Scale presents the Modified Mercalli Scale for Earthquake Intensity, including a range of approximate average peak accelerations associated with each intensity value. Based on the approximate peak accelerations provided, the Proposed Project area would fall within Intensity Range VII (refer to Table 4.6-5: Earthquake Intensity Scale).

Uniform Building Code Seismic Design Parameters

Seismic design parameter estimation is a subset of structural analysis and is the calculation of the response of a building or other structure to earthquakes. It is part of the process of structural design or structural assessment and retrofit in regions where earthquakes are prevalent. Uniform Building Code (UBC) seismic design parameters applicable for the ECO substation and the SWPL loop-in are presented in Table 4.6-6: UBC Seismic Design Parameters – ECO Substation and SWPL Loop-In. UBC seismic design parameters applicable for the Boulevard Substation rebuild are presented in Table 4.6-7: UBC Seismic Design Parameters – Boulevard Substation.

Liquefaction

Liquefaction is the result of increased pore pressure in saturated granular soils due to strong seismic shaking. Higher pore pressure occurs as the soil attempts to compact in response to the shaking, resulting in less grain-to-grain soil contact and, therefore, loss of strength. Structures supported by a liquefying soil may sustain damage because of loss of foundation support.

East County Substation and Southwest Powerlink Loop-In

Liquefaction is not considered a potential hazard at the ECO Substation or SWPL loop-in sites based on the relatively deep water table and the well-graded alluvial deposits or shallow bedrock.

138 kV Transmission Line

Liquefaction is not considered to be a potential hazard for the majority of the 138 kV transmission line ROW because of the shallow or outcropping granitic bedrock that underlays most of the alignment. Shallow groundwater may be present in low-lying drainages, which can provide a geologic condition susceptible to liquefaction. However, this possibility is considered unlikely due to the general coarse granular nature of the alluvium in the region, which is less susceptible to liquefaction.

Table 4.6-5: Earthquake Intensity Scale

Intensity Value	Intensity Description	Average Peak Acceleration Range
I	Not felt except by very few people under especially favorable circumstances.	<0.0017 g
II	Felt only by a few people at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	0.0017–0.014 g
III	Felt noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly, vibration similar to a passing truck. Duration estimated.	
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation is like a heavy truck striking building. Standing motor cars rock noticeably.	0.014–0.039 g
V	Felt by nearly everyone, many awakened. Some dishes and windows broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles may be noticed. Pendulum clocks may stop.	0.039–0.092 g
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moves and plaster falls or chimneys are damaged. Damage slight.	0.092–0.18 g
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motor cars.	0.18–0.34 g
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. People driving motor cars disturbed.	0.34–0.65 g
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.65–1.24 g

Intensity Value	Intensity Description	Average Peak Acceleration Range
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	>1.24 g
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	

Sources: Bolt, 1988; Wald, 1999

Table 4.6-6: UBC Seismic Design Parameters – ECO Substation and SWPL Loop-In

Abbreviated Fault Name	Approximate Distance to the ECO Substation Site (miles)	Source Type (A, B, C)	Maximum Estimated Earthquake Magnitude	Approximate Slip Rate (millimeters/ year)	Fault Type (SS, DS, BT)
Elsinore-Coyote Mountain	12.3	B	6.8	4	SS
Elsinore-Laguna Salada	15.3	B	7	3.5	SS
Elsinore-Julian	27.2	A	7.1	5	SS
Superstition Mtn. (San Jacinto)	27.5	B	6.6	5	SS
San Jacinto-Borrego	27.7	B	6.6	4	SS
Superstition Hills (San Jacinto)	31.0	B	6.6	4	SS
Elmore Ranch	31.6	B	6.6	1	SS
Earthquake Valley	35.3	B	6.5	2	SS
Imperial	37.6	A	7	20	SS
San Jacinto-Coyote Creek	39.7	B	6.8	4	SS
Brawley Seismic Zone	42.2	B	6.5	25	SS
San Jacinto-Anza	43.8	A	7.2	12	SS
San Andreas-Southern	55.1	A	7.4	24	SS
Rose Canyon	59.1	B	6.9	1.5	SS
Coronado Bank	62.1	B	7.4	3	SS

Source Type:
A – Faults that are capable of producing large-magnitude events and that have of a high rate of seismic activity
B – All faults other than types A and C.
C – Faults that are not capable of producing large-magnitude earthquakes and that have a relatively low rate of seismic activity.
Fault Type:
SS – strike slip, DS – dip slip, BT – blind thrust
Source: California Building Code, 2001

Table 4.6-7: UBC Seismic Design Parameters – Boulevard Substation Rebuild Site

Abbreviated Fault Name	Approximate Closest Distance to the Boulevard Substation Rebuild Site (miles)	Source Type (A, B, C)	Maximum Estimated Earthquake Magnitude	Approximate Slip Rate (millimeters/ year)	Fault Type (SS, DS, BT)
Elsinore – Coyote Mountain	15.1	B	6.8	4	SS
Elsinore- Julian	21.5	A	7.1	5	SS
Elsinore- Laguna Salada	23.1	B	7	3.5	SS
San Jacinto- Borrego	29.6	B	6.6	4	SS
Earthquake Valley	29.6	B	6.5	2	SS
Superstition Mtn. (San Jacinto)	30.6	B	6.6	5	SS
Superstition Hills (San Jacinto)	35.0	B	6.6	4	SS
Elmore Ranch	35.2	B	6.6	1	SS

Source Type:
A – Faults that are capable of producing large-magnitude events and that have of a high rate of seismic activity
B – All faults other than types A and C
C – Faults that are not capable of producing large-magnitude earthquakes and that have a relatively low rate of seismic activity
Fault Type:
SS – strike slip, DS – dip slip, BT – blind thrust
Source: California Building Code, 2001

Boulevard Substation Rebuild

Liquefaction is not considered to be a potential hazard because of the shallow or outcropping granitic bedrock that is exposed at the Boulevard Substation rebuild area.

White Star Communication Facility Rebuild

Liquefaction is not considered to be a potential hazard because of the shallow or outcropping bedrock that underlies the White Star Communication Facility rebuild site.

Slope Instability

Many major historical earthquakes in the Proposed Project region show correlation between the occurrence of damaging landslides and earthquake ground shaking. Strong ground motion can also result in rockfall hazards. The locations susceptible to earthquake-induced failure include highly weathered and unconsolidated materials on moderately steep slopes (especially areas of previously existing landslides).

East County Substation and Southwest Powerlink Loop-In

The western portion of the ECO Substation site and proposed location of the SWPL loop-in have mainly flat to gently sloping terrain. The proposed substation is not likely to experience landslides or other slope failures because of the low topographic relief of this area and relatively minor cut and fill slopes proposed for the site. However, the eastern portion of the site, where no development or disturbance is planned, encompasses relatively steep slopes that have a high potential for rockfalls.

138 kV Transmission Line

The 138 kV transmission line will cross predominantly flat to steeply sloping terrain that may be prone to landslides or other forms of slope failure (e.g., rockfalls, debris flows, or seismic induced failures).

Boulevard Substation Rebuild

The Boulevard Substation rebuild site is located in an area with flat to gently sloping terrain. As such, it is not likely to experience landslides or other forms of slope failure.

White Star Communication Facility Rebuild

The White Star Communication Facility rebuild site is located in an area with flat to gently sloping terrain. As such, it is not likely to experience landslides or other forms of slope failure.

Differential Settlement

If the soil beneath a structure settles non-uniformly, the structure can be damaged. The reasons for differential settlement are usually traced to differences in bearing characteristics of the soils. Alternatively, a portion of the soil beneath a structure may lose strength during an earthquake due to liquefaction. If liquefaction occurs non-uniformly, differential compaction will occur. Unconsolidated or weakened geologic units in the Proposed Project area may be subject to differential settlement. These include areas underlain by alluvium and highly weathered rock.

Subsidence

Subsidence occurs most often when fluids are withdrawn from the ground, removing partial support for previously saturated soils. More rarely, subsidence occurs due to tectonic down-warping during earthquakes. Neither source of subsidence appears to be present in the Proposed Project area, making the probability of damage due to subsidence very low.

Soils

The soils in the vicinity of the Proposed Project area reflect the underlying rock type, the extent of weathering, and the topography, as well as the degree of human modification. A summary of characteristics (description, erosion hazard, expansive potential, and corrosion potential) for soils that are crossed by the Proposed Project are presented in Table 4.6-8: Soil Units and Hazards.

Properties of soil that influence erosion by rainfall and runoff are ones that affect the infiltration capacity of soil, as well as the resistance of a soil to detachment and being carried away by flowing water. Soils with a high percentage of fine sands and silt that are also low in density are generally the most erodible. The potential for erosion decreases as organic matter and clay content increases.

Clay acts as a binder to soil particles and reduces the potential for erosion. Although clays tend to resist erosion, once they are eroded, they can be easily transported by water. Clean, well-drained, and well-graded gravels and sand-gravel mixtures are commonly the least erodible soils. Highly permeable soils and soils with high infiltration rates reduce the amount of runoff.

Soil corrosivity is related to the electrical resistivity of the soil, oxygen content, pH, and presence of chlorides and sulfates. The most corrosive soils typically have the lowest pH and highest concentration of chlorides and sulfates. Soils with high sulfate content are corrosive to concrete and may prevent adequate curing, which can considerably reduce strength. Low pH or low electrical resistivity (or both) soils may corrode buried or partially buried metallic structures.

Expansive or Collapsible Soils

Expansive soils are characterized by the ability to undergo significant volume change (shrink and swell) as a result of variation in soil moisture content. Soil moisture content can change due to many factors, including perched groundwater, landscape irrigation, rainfall, and utility leakage. Expansive soils are commonly very fine-grained with a high to very high percentage of clay.

Although no specific areas of expansive soils have been identified within any of the Proposed Project component sites, some isolated areas may exist. Expansive soils are usually fine-grained soils with high clay content. These types of soils may be present in man-placed fill; however, as shown in Table 4.6-8: Soil Units and Hazards, soils with high clay content are not anticipated to be encountered by the Proposed Project.

Table 4.6-8: Soil Units and Hazards

Unit ID	Soil Association	Description	Off -Road/ Off-Trails Hazard of Erosion	Roads/ Trails Hazard of Erosion	Shrink/Swell (expansive potential)	Uncoated Steel Risk of Erosion	Concrete Risk of Corrosion
s1010	Sesame–Rock Outcrop–Cienba	Very shallow to moderately deep soils formed in material weathered from granitic and metamorphic rocks. Includes areas of bare rock outcrop. Soils types are primarily sandy loam, gravelly loam, and sandy clay loam.	Not Rated Cienba Very Severe	Not Rated Cienba Very Severe	Low to Moderate	Moderate	Low to Moderate
s1013	San Miquel–Friant-Exchequer	Shallow soils formed in material weathered from metamorphic and metavolcanic rocks consisting of silt loam, clay, and fine sandy loam.	Moderate to Very Severe	Moderate to Severe	Low to High	Moderate to High	Moderate to High
s1014	Tollhouse–Rock Outcrop–La Posta	Shallow to moderately deep soils formed on strongly sloping to steep slopes in weathered granitics consisting of coarse sandy loam and loamy coarse sand. Includes areas of bare rock outcrop.	Moderate	Severe	Low to Moderate	Moderate	Moderate
s1015	Hotaw-Crouch-Boomer	Moderately deep to very deep soils formed in material weathered from underlying granitic and metavolcanic rocks. Soil types are gravelly loam, coarse sandy loam, and gravelly and sandy clay loam.	Slight to Very Severe	Slight to Severe	Low to Moderate	Moderate	Moderate

Unit ID	Soil Association	Description	Off -Road/ Off-Trails Hazard of Erosion	Roads/ Trails Hazard of Erosion	Shrink/Swell (expansive potential)	Uncoated Steel Risk of Erosion	Concrete Risk of Corrosion
s1016	Sheephead–Rock Outcrop–Bancas	Shallow to moderately deep soils formed in weathered bedrock material. Soil types include stony loam, loam, and cobbly fine sandy loam. Includes areas of bare rock outcrop.	Slight to Moderate	Slight to Severe	Low to Moderate	Moderate	Low to Moderate

Source: Natural Resource Conservation Service (NRCS), 2008

Mineral Resources

Based on review of published sources and data from the USGS Mineral Resources Data System, no active mining operations will be crossed by the Proposed Project. Two prospective mining areas are located within close proximity of the 138 kV transmission line; however, neither is within the transmission line ROW. The Jacumba Manganese Group—located approximately 550 feet north of the 138 kV transmission line at approximate Milepost 5.2—is a prospective manganese site. The Round Mountain Deposit—located approximately 150 feet north of the 138 kV transmission line at approximate Milepost 8.9—is a prospective silica site.

4.6.3 Impacts

Significance Criteria

Standards of significance were derived from Appendix G of the California Environmental Quality Act Guidelines. These standards are summarized as follows:

Geology and Soils

Impacts to geology and soils will be considered significant if the Proposed Project:

- Exposes people or structures to potential substantial adverse effects involving strong seismic ground shaking, fault rupture, liquefaction, or landslides
- Results in substantial soil erosion or the loss of topsoil
- Is located on a geologic unit or soil that is unstable, or that will become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse
- Is located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property
- Is 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

Mineral Resources

Impacts to mineral resources will be considered significant if the Proposed Project:

- Results in the loss of availability of a known mineral resource that may be of value to the region and the residents of the State
- Results in the loss of availability of a locally important mineral resource recovery site that is delineated on a local general plan, specific plan, or other land use plan

Question 4.6a – Human Safety and Structure Integrity – ***Less-than-Significant Impact***

i. Earthquake Fault Rupture

The Proposed Project will not cross nor be in close proximity of any active faults. The nearest active fault—the Elsinore Fault, Coyote Mountain Segment—is located approximately 12 miles northeast. The nearest active faults to the Boulevard Substation rebuild site and the 138 kV transmission line ROW—the Elsinore Fault, Coyote Mountain Segment, and Brawley Fault Zone—are located 15 miles to the east. Although the ECO Substation site is crossed by two inactive faults, they are relatively short and are not expected to generate large, damaging earthquakes. In addition, the ECO Substation and the equipment to be installed for the Boulevard Substation rebuild will be configured according to the Institute of Electrical and Electronics Engineers (IEEE) 693 “Recommended Practices for Seismic Design of Substations” in order to withstand anticipated ground motion. Therefore, the likelihood of fault rupture is anticipated to be less than significant.

ii. Strong Seismic Shaking

The Proposed Project area may be subject to relatively strong seismic shaking due to earthquakes. However, the 138 kV transmission line and ECO Substation will be engineered to withstand strong ground movement and moderate ground deformation. The IEEE 693 “Recommended Practices for Seismic Design of Substations” has specific requirements to mitigate substation equipment damage. When these requirements are followed, very little structural damage from horizontal ground accelerations approaching 1.0 g is anticipated. Incorporation of these standard engineering practices will ensure that people or structures will not be exposed to hazards associated with strong seismic ground shaking. As a result, impacts will be less than significant.

iii. Ground Failure

Because of the relatively deep water table, presence of granite outcroppings, and well-graded alluvial deposits, ground failure and liquefaction are not considered potential hazards in the Proposed Project area. However, the potential exists for poorly graded soils and shallow water to be present within drainages that cross the 138 kV transmission line ROW. Although these conditions may exist, the possibility of ground failure resulting from them is considered unlikely due to the general coarse granular nature of the alluvium in the region. Therefore, impacts will be less than significant.

iv. Landslides

Hazards related to slope instability and landslides are generally associated with foothill areas and mountain terrain, as well as steep riverbanks and levees. The Proposed Project will predominantly be located in areas that contain flat to gently sloping terrain. However, the 138 kV transmission line may be located in areas with steeply sloping terrain, thereby increasing the potential for landslides. Because the areas that will be potentially impacted by the construction of the 138 kV transmission line are relatively small in scale and the foundation design of the transmission structures will be developed to minimize risks associated with slope failure or instability, impacts associated with geologic unit and soil instability will be less than significant.

Question 4.6b – Soil Erosion or Topsoil Loss

Construction – Less-than-Significant Impact

The fenced area of the ECO Substation will occupy approximately 58 acres, which will be graded during the early phases of construction. Grading will expose soil to erosion by removing the vegetative cover and compromising the soil structure. Rain and wind may potentially further detach soil particles and transport them off site. With the implementation of the Proposed Project's Stormwater Pollution Prevention Plan (SWPPP) and Water Quality Construction Best Management Practices (BMP) Manual, soil erosion will be minimized and impacts will be reduced to a less-than-significant level (refer to Section 4.8 Hydrology and Water Quality for more details regarding the SWPPP and Water Quality Construction BMP Manual). Additionally, during construction, the ECO Substation site will be graded and graveled, which will result in the loss of topsoil over the approximate 58-acre substation footprint. However, topsoil in desert habitats is generally very thin and agriculturally unproductive, and the amount of topsoil removed will be minimal relative to the surrounding area. As a result, impacts will be less than significant.

Construction of the other Proposed Project components will result in minimal loss of topsoil and soil erosion. Grading may be required for the Boulevard Substation rebuild and for pole sites along the 138 kV transmission line ROW. Grading will be limited to approximately 3.2 acres at the Boulevard Substation rebuild site. Along the 138 kV transmission line, grading will be limited to the amount necessary to safely install the poles to a maximum of 50 feet by 50 feet at each pole site. Grading will not be required for installation of the White Star Communication Facility rebuild equipment. As previously mentioned for the ECO Substation, impacts to topsoil will be minor considering the current use and production value. Because impacts to erosion will be temporary and controlled through the use of BMPs, impacts will be less than significant.

Operation and Maintenance – Less-than-Significant Impact

Operation and maintenance of the Proposed Project components will not typically involve ground-disturbing activities or grading. If grading is required, SDG&E will implement the Proposed Project SWPPP and associated BMPs. Additionally, existing access roads will be used for routine operation and maintenance activities. Therefore, impacts to soil erosion or topsoil will be less than significant.

Question 4.6c – Geologic Unit Instability – *Less-than-Significant Impact*

The Proposed Project area is subject to relatively strong seismic shaking due to earthquakes. However, as described previously in the response to Question 4.6a, overhead transmission facilities and substations are engineered to withstand strong ground movement and moderate ground deformation. The Proposed Project component sites are not located in an area with the potential for liquefaction and are not likely to be subject to subsidence because operation and maintenance activities at these sites will not involve the withdrawal of substantial groundwater that can cause subsidence.

The majority of the Proposed Project components will be located on relatively flat to gently sloping terrain; therefore, little potential exists for slope failure. The 138 kV transmission line will cross areas of more steeply sloping terrain; however, areas impacted by the construction of the 138 kV transmission line will typically only be 50 feet by 50 feet in size and, if applicable, the foundation design of the transmission structures will be developed to minimize risks associated with slope failure or instability. As a result, impacts associated with geologic unit and soil instability will be less than significant.

Question 4.6d – Expansive Soils – *Less-than-Significant Impact*

As described in Section 4.6.2 Existing Conditions, four soil associations that have a low to moderate shrink/swell potential and one soil association that has a low to high shrink/swell potential, may occur at the ECO Substation and SWPL loop-in sites. Extremely expansive soils may damage Proposed Project structures and facilities and can result in collapse. Power outages, damage to nearby roads or structures, and injury or death to nearby people may result from collapse of Proposed Project structures and facilities. While the soils in the Proposed Project areas are not anticipated to have enough clay content to result in large expansions, implementation of APM-GEO-01 in Section 4.6.4 Applicant-Proposed Measures, which includes the incorporation of design recommendations in accordance with the final Geotechnical Report to be prepared by URS, will reduce risks associated with expansive soils to a less-than-significant level.

Question 4.6e – Soil Permeability – *No Impact*

Soil permeability is a consideration for projects that require septic system installation. Because the Proposed Project will not involve the installation of a septic tank or alternative wastewater disposal system, no impacts will occur.

Question 4.6f – Loss of Regional- or State-Valued Mineral Resources – *No Impact*

No active mining operations or known areas designated or delineated for mineral resource recovery are within the Proposed Project area. In addition, no known mineral resources that have noted value to the region and to the residents of the state will be impacted by the Proposed Project. Prospective mineral sites, including the Jacumba Manganese Group and the Round Mountain Deposit, will not be impacted by construction or operation and maintenance of the Proposed Project because the 138 kV transmission line will not cross these sites. As a result, the Proposed Project will have no impact on mineral resources.

Question 4.6g – Loss of Locally Important Mineral Resources – *No Impact*

No known mineral resources are locally important within the vicinity of the Proposed Project area; therefore, no impacts will occur.

4.6.4 Applicant-Proposed Measures

The following APM will ensure that impacts associated with expansive soils or other geological hazards will be reduced to a less-than-significant level:

- APM-GEO-01: SDG&E will consider the recommendations and findings of final Geotechnical Reports prepared by URS and the contractor's Geotechnical Engineer in the final design of all Project components to ensure that the potential for expansive soils and differential settling is compensated for in the final design and construction techniques. In addition, SDG&E will comply with all applicable codes and seismic standards. The final design will be reviewed and approved by a Professional Engineer registered in the State of California prior to construction.

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