4.6 Geology, Soils, Seismicity, and Mineral Resources

This section describes existing conditions in the study area and evaluates the potential for the Proposed Project and alternatives to result in significant impacts related to exposing people or structures to unfavorable geologic hazards, soils, seismic conditions or to impact known mineral resources.

4.6.1 Setting

Regional Geology

The study area is located along the southeasterly margin of the Great Valley geomorphic province, with easterly portions of the study area encroaching into the foothills of the Sierra Nevada province. The Great Valley and the Sierra Nevada are two of 11 geomorphic provinces recognized in California. Each province displays unique, defining features based on geology, faults, topographic relief and climate (California Geological Survey [CGS], 2002). The Great Valley is an alluvial plain approximately 50 miles wide and 400 miles long in the central part of California. The Great Valleys’ northern part is the Sacramento Valley, drained by the Sacramento River and its southern part is the San Joaquin Valley, which is drained by the San Joaquin River. The Proposed Project would be located in the San Joaquin Valley. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic (approximately 160 million years ago). The Sierra Nevada is a tilted fault block nearly 400 miles long. Its east face is a high, rugged multiple scarp, contrasting with the gentle western slope that disappears under sediments of the Great Valley. Deep river canyons are cut into the western slope. Their upper courses, especially in massive granites of the higher Sierra, are modified by glacial sculpturing, forming such scenic features as Yosemite Valley. The high crest culminates in Mount Whitney with an elevation of 14,495 feet above mean sea level (MSL) near the eastern scarp (CGS, 2002).

Faults

The nearest active faults, based on the establishment of State of California Earthquake Fault Zones, are the Pond (or Pond Poso Creek), Kern Front, New Hope, and Premier faults, located approximately 40 miles south of the study area. This is a group of aseismic faults with historic ground rupture attributed to fluid (oil and water) withdrawal rather than tectonic activity. The active Independence fault is located approximately 48 miles east of the study area and is capable of generating an earthquake of up to magnitude 7.1 (United States Geological Survey [USGS]/CGS, 2002). The widely known San Andreas Fault is located approximately 70 miles southwest of the study area. A northwest-trending, unnamed, obscured (buried) fault is mapped as crossing the easterly portion of the Proposed Project and Alternatives 2, 3 and 6 northeast of the City of Visalia (Jennings, 1994). There are no indications that this fault is active or a potential seismic source. Table 4.6-1, below, lists active faults and significant seismic sources within approximately 100 kilometers (km) (62 miles) of the Proposed Project.

TABLE 4.6-1
PRINCIPAL ACTIVE FAULTS/SIGNIFICANT SEISMIC SOURCES

Fault	Distance from Fault to the Proposed Project (miles)	Maximum Moment Magnitude (M)
Great Valley Segment 14	45	6.4
Independence	47	7.1
Great Valley Segment 13	52	6.5
Owens Valley	54	7.6
So. Sierra Nevada	58	7.3
Great Valley Segment 12	61	6.3

NOTES: The reported potential magnitudes are Maximum Moment Magnitudes rather than Richter Scale Magnitudes, a scale that is generally no longer used.

SOURCE: Blake, 2001.

Soils

From an agricultural perspective, based on Soil Survey information from the United States Department of Agriculture, soils classified as a loam, sand loam or silt loam primarily underlie the study area (USDA, 2008). A loam is friable soil containing a relatively equal mixture of sand and silt and a somewhat smaller portion of clay. The mixture of sand and finer grained materials in loamy soils generally reduces the erodibility of those soils. Alluvium is the primary parent material of the agricultural soils delineated in the study area.

From a geotechnical engineering perspective, soils can refer to the surficial materials that overlie geologic formational materials or bedrock. Typical designations for these surficial materials include alluvium, topsoil, fill, slope wash or other mass wasted materials such as landslide debris. Soils can be in a relatively loose or unconsolidated condition and as such are susceptible to consolidation and settlement with the addition of structural loads.

Local Geology, Drainage, and Groundwater

A geologic map published by the CGS (formerly the California Division of Mines and Geology [Mathews and Burnett, 1965]) indicates that the westerly part of the Proposed Project is underlain by recent (Holocene-age [less than approximately 10,000 years old]) alluvial fan deposits comprising part of the sediments of the Great Valley. The deposits are sediments laid down from streams flowing from the highlands to the east. The primary constituents of the deposits are sand and silt derived from metamorphic and igneous rocks of the Sierra Nevada. The eastern part of the Proposed Project alignment is mapped primarily as Pleistocene- age (less than approximately 2,000,000 years old) non-marine sedimentary deposits consisting of older alluvium and dissected alluvial fan deposits. The Pleistocene non-marine deposits have a composition and origin similar to the recent alluvial fan deposits underlying the western part of the Proposed Project alignment. In addition, in the easternmost portions of the alignment, granitic rock associated with the Sierra Nevada is mapped. The granitic rock is an intrusive igneous rock that crystallized from molten magma and comprises the bulk of the Sierra Nevada that was emplaced mostly during the Mesozoic Era, some 65 to 230 million years ago.

Alternative 2 is also mapped as being primarily underlain by Holocene and Pleistocene (together the Quaternary period) alluvial deposits. In addition, the eastern part of the alignment, north of Woodlake, would cross areas mapped as metamorphic rock. The westerly north-south trending portion of Alternative 3 is also mapped as being underlain by Quaternary alluvial deposits. In the north, Alternative 3 would turn east and cross Stokes Mountain to its northeasterly terminus. Stokes Mountain and areas to the northeast are mapped primarily as granitic rock, which is generally light colored and basic igneous rock that is generally dark colored. The igneous granitic and basic rocks are relatively resistant and contribute to the relatively steep terrain in the eastern part of Alternative 3. Alternative 6 would cross geologic conditions similar to those of Alternative 2.

Westerly and central portions of the study area are in the valley crossing areas of relatively slight relief at elevations of roughly 350 to 450 feet above MSL. The easterly end of the Proposed Project is at an elevation of approximately 675 feet above MSL as it rises into the foothills. The highest elevations in the study area are near the easterly end of Alternative 3 where there are elevations around 2,000 feet above MSL. Drainage in the study area is primarily by the way of creeks, canals, and the Kaweah River which generally drain to the west-southwest. A review of well data, indicates that groundwater in the valley portions of the study area is generally at depths of less than 100 feet, with some areas with groundwater at depths of less than 50 feet, particularly near areas where surface water is present (California Department of Water Resources, 2008). Deeper groundwater levels can be expected in the easterly foothill sections of the study area.

Geologic Hazards

A geologic hazard is a geologic condition, either natural or man-made, that poses a potential danger to life and property. A discussion of possible geologic hazards in the study area is presented in the following sections.

Seismic Activity

Based on the tectonic setting and the historical record, the study area is in a region that is characterized by a relatively low level of seismicity. According to a probabilistic seismic hazard model for California peak horizontal ground accelerations having a 10 percent probability of exceedance in 50 years can be estimated to be approximately 20 percent of gravity (0.2g) which can be considered low compared to the many more seismically active areas of western California (USGS/CGS, 2002). Historical earthquakes of magnitude 6.0 or greater with epicenters within approximately 100 km (62 miles) of the study area are shown in Table 4.6-2.

TABLE 4.6-2
HISTORICAL EARTHQUAKES THAT AFFECTED THE STUDY AREA

Date	Magnitude (M)
March 26, 1872	7.3
March 26, 1872	6.5
August 4, 1985	6.1

SOURCE: USGS, 2008.

Liquefaction

Soil liquefaction can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by relatively shallow groundwater (generally less than 50 feet) are susceptible to liquefaction. Liquefaction causes soil to lose strength and "liquefy," triggering structural distress or failure due to the dynamic settlement of the ground or a loss of strength in the soils underneath structures.

Lateral spreading of the ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spreading has generally been observed to take place in the direction of a free-face (e.g. a retaining wall or slope).

Liquefiable conditions, should they be present in the study area, have a higher potential of occurring in the westerly portions of the alignments where relatively young, potentially loose alluvial deposits occur and in those areas where groundwater levels are less than 50 feet in depth. The actual presence and extent of liquefiable soils would be evaluated as part of the subsurface exploration program that would be required for the proper geotechnical design of the project.

Subsidence

Land subsidence is a loss in surface elevation due to removal of subsurface support on the soil structure. Subsidence is recognized as one of the most diverse forms of ground failure, ranging from small or local collapses to broad regional lowering of the earth's surface. Land subsidence associated with groundwater-level declines has been recognized in the San Joaquin Valley since the 1930s. Areas with up to 28 feet of ground subsidence in the valley have been recorded. Since the early 1970s land subsidence has continued in some locations, but has generally slowed due to reductions in groundwater pumpage and the accompanying recovery of groundwater level made possible by supplemental use of surface water for irrigation (Galloway and Riley, 2008). To a lesser extent, the extraction of fluids from oil and gas wells in the San Joaquin Valley has also contributed to land subsidence. There are no known areas of subsidence specific to the study area.

Collapsible Soils

Soil collapse, or hydro-consolidation, occurs when soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. This phenomenon typically occurs in recently deposited Holocene soils in a dry or semiarid environment, including eolian (wind blown) sands and alluvial fan and mudflow sediments deposited during flash floods. The combination of weight from a building or other structures, and an increase in surface water infiltration (such as from irrigation or a rise in the groundwater table) can initiate settlement and cause structural foundations and walls to crack. Collapsible soils, should they be present in the study area, have a higher potential of occurring in the westerly portions of the alignments where relatively young, potentially loose alluvial deposits occur. The actual presence and extent of collapsible soils would be evaluated as part of the subsurface exploration program that would be required for the proper geotechnical design of the project.

Expansive Soils

Expansive soils contain significant amounts of clay particles that have the ability to give up water (shrink) or take on water (swell). When these soils swell, the change in volume can exert significant pressures on loads that are placed on them, such as buildings, and can result in structural distress and/or damage. Due to the granular nature of the soils in the study area the potential for significant amounts of expansive soils is low. However, portions of the easterly reach of Alternative 3 cross areas mapped as being underlain by basic intrusive rocks. These rocks have a higher potential for developing expansive soils. Geotechnical subsurface exploration and laboratory testing would need to be performed to evaluate actual presence of expansive soils.

Landslides

Due to slight topographic relief over much of the study area landslides are not a concern except in the easterly portions of the alternative alignments which encroach into the Sierra Nevada. Easterly parts of Alternative 3, which wrap around the upper portions of Stokes Mountain, have a potential for crossing possible landslides (or shallow failures). However, the suggestion that the arcuate, concave to the north, shape of Stokes Mountain is due to landsliding on a very large scale is not supported by the indicated geologic conditions and as noted in the MACTEC report “could be an erosional manifestation of the geologic structure of the underlying granitic and basic intrusive bedrock.” The MACTEC report also concludes that if a large, deep-seated landslide is present downslope to the north of the Stokes Mountain ridgeline that it is anticipated to be stable (MACTEC, 2007).

Existing Mineral Resources

Mineral resources in Tulare County that are considered major producing areas include sand, gravel, and crushed stone, which are used as sources for aggregate (road materials and other construction). The major sources for aggregate in the County are alluvial deposits (river beds and floodplains) and hard rock quarries. Currently, there are approximately 28 active aggregate mines in the County (Tulare County, 2008). In the study area, aggregate resource extraction operations are located predominantly along the Kaweah River, near the community of Lemon Cove, and along the Tule River between the City of Porterville and Lake Success. Both of these areas produce between 0.5 million and two million tons per year. A small aggregate production area, located north of the City of Visalia, is also located within the study area. It produces less than 0.5 million tons per year (Kohler, 2006; Chapman, 2009). The aggregate production areas all are located outside the Proposed Project and alternative project areas.

Geothermal Resources

There are no known or potential geothermal resources identified in the study area. Industrial or geothermal category operations do not exist anywhere near the study area, with the closest resources located southeast of the Proposed Project in the Sierra Foothills (Laney and Brizzee, 2003).

Regulatory Context

State

Alquist-Priolo Earthquake Fault Zoning Act

Surface rupture is the most easily avoided seismic hazard. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the State geologist established regulatory zones, called "earthquake fault zones," around the surface traces of active faults and published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace, because many active faults are complex and consist of more than one branch. There is the potential for ground surface rupture along any of the branches. This Act will not apply to the Proposed Project or its alternatives as there are no Earthquake Fault Zones in the study area.

California Building Code

The California Building Code (CBC) has been codified in the California Code of Regulations (CCR) as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under State law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the CBC is to establish minimum standards to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction. The CBC is based on the International Building Code. The 2007 CBC is based on the 2006 International Building Code (IBC) published by the International Code Conference. In addition, the CBC contains necessary California amendments which are based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion into building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients which are used to determine a Seismic Design Category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site and ranges from SDC A (very small seismic vulnerability) to SDC E/F (very high seismic vulnerability and near a major fault). Design specifications are then determined according to the SDC.

Seismic Hazards Mapping Act

The State Department of Conservation, CGS, provides guidance with regard to seismic hazards. Under the CGS Seismic Hazards Mapping Act, seismic hazard zones are to be identified and mapped to assist local governments for planning and development purposes. The intent of the Act is to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other types of ground failure, and other hazards caused by earthquakes. CGS Special Publication 117 Guidelines for Evaluating and Mitigating Seismic Hazards in California, provides guidance for evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations (CGS, 2008). This Act will not apply to the Proposed Project and alternatives as seismic hazard zones have not yet been established in Tulare County.

Surface Mining and Reclamation Act

The primary State law concerning conservation and development of mineral resources is SMARA, as amended to date. SMARA is found in the California Public Resources Code (PRC), Division 2, Chapter 9, Sections 2710, et seq.

Depending on the region, natural resources can include geologic deposits of valuable minerals used in manufacturing processes and the production of construction materials. SMARA was enacted in 1975 to limit new development in areas with significant mineral deposits. SMARA calls for the State geologist to classify the lands within California based on mineral resource availability. In addition, the California Health and Safety Code requires the covering, filling, or fencing of abandoned shafts, pits and excavations (California Health and Safety Code Sections 24400-03). Furthermore, mining may also be regulated by local government, which has the authority to prohibit mining pursuant to its general plan and local zoning laws.

SMARA states that the extraction of minerals is essential to the continued economic well-being of the State and to the needs of society, and that reclamation of mined lands is necessary to prevent or minimize adverse effects on the environment and to protect the public health and safety. The reclamation of mined lands will permit the continued mining of minerals and will provide for the protection and subsequent beneficial use of the mined and reclaimed land. Surface mining takes place in diverse areas where the geologic, topographic, climatic, biological, and social conditions are significantly different, and reclamation operations and the specifications therefore may vary accordingly (California Public Resources Code Section 2711).

Local

Tulare County General Plan (Proposed Project and Alternatives 2, 3, and 6)

The following goals and policies identified in the Tulare County General Plan Safety Element may be applicable to the Proposed Project and alternatives:

> *Goal 3.A:* To reduce the loss of life, and damage to or loss of personal property due to crime, fire, earthquakes, flooding and other disasters, natural and man-made.
>
> *Policy 3.A.8:* Enforce Chapter 70 of the Uniform Building Code as it relates to grading.
>
> *Goal 3.M:* To prevent serious injury and loss of life due to seismic activity.

> *Policy 3.M.4:* Recommendation for site investigations: a. Landslides; b. Subsidence/ Settlement; c. Flooding; and d. Local soils/geologic conditions.
>
> *Policy 3.M.5:* Chapter 70 of the Uniform Building Code 1973 edition, should be adopted and enforced. To insure this, entities involved should retain on a full or part-time basis, a qualified engineering geologist to review reports and perform other functions related to implementation.
>
> *Policy 3.MI.I:* New construction directly astride or across known faults, or fault zones, should be prohibited. Non-structural land uses however, should not be prohibited.
>
> *Policy 3.N.2:* Consideration of seismic and secondary hazard aspects in the environmental impact assessment process.
>
> *Policy 3.N.3:* Seismic aspects must be addressed in the environmental reporting process.

(Tulare County, 2001).

The following policy identified in the Environmental Resources Management Element of the Tulare County General Plan may be applicable to the Proposed Project and alternatives:

> *Policy 6.E.13:* Protection of known mineral sources should be assured by their designation on Open Space Protection Maps and consideration of their value when conflicting land uses are proposed.

(Tulare County, 2001).

Fresno County General Plan (Proposed Project and Alternatives 2, 3, and 6)

There are not goals or policies identified in the Fresno County General Plan that would be applicable to the Proposed Project and alternatives (Fresno County, 2000).

City of Visalia General Plan (Proposed Project and Alternatives 2, 3, and 6)

The City of Visalia General Plan Safety Element adopted the Tulare County General Plan Safety Element; therefore, the goals and policies applicable to the Proposed Project and alternatives in the City's General Plan are the same goal and policies as listed above under the Tulare County General Plan (City of Visalia, 1975).

City of Farmersville General Plan (Proposed Project)

The City of Farmersville General Plan does not include any goals, objectives, and policies related to Geology, Soils and Mineral Resources that would be applicable to the Proposed Project (City of Farmersville, 2002).

4.6.2 Significance Criteria

The following significance criteria are adapted from and are consistent with the CEQA Guidelines, Appendix G, Environmental Checklist. In accordance with the CEQA guidelines, the Proposed Project would result in a significant impact to geology, soils, seismicity, and mineral resources if it would:

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 (Refer to Division of Mines and Geology Special Publication 42.)

   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 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 wastewater disposal systems where sewers are not available for the disposal of wastewater

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.

4.6.3 Applicant Proposed Measures

No Applicant Proposed Measures have been identified by SCE for reducing impacts on geology, soils or mineral resources.

4.6.4 Impacts and Mitigation Measures

Approach to Analysis

This impact analysis considers the potential geology, soils, seismicity, or mineral resources impacts associated with the construction, operation, and maintenance of Proposed Project including modification of the Rector, Springville, Vestal, and Big Creek 3 Substations. The proposed modifications at the Springville, Vestal, and Big Creek 3 Substations consist solely of electrical system and safety upgrades. All substation work would occur on previously disturbed areas within the existing footprint of the substations, and the associated construction, operation and maintenance activities would have no impact with respect to geology, soils, seismicity, or mineral resources.

a.i) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.

Impact 4.6-1: The Proposed Project could be susceptible to ground surface rupture of an active fault which could damage proposed improvements which, in turn, could pose a hazard to nearby structures or people. *Less than significant* (Class III)

There are no active earthquake faults that are recognized or zoned by the State of California in the immediate project area. The closest active fault to the Proposed Project is more than 40 miles away. Whereas seismic activity is not limited to active faults, ground rupture is typically associated with active faults. Moreover, no Alquist-Priolo Earthquake Fault Zones have been mapped in the vicinity of the Proposed Project. Therefore, based on the location of the project components and the active faults in the region, the potential for surface fault rupture to affect the Proposed Project and pose a hazard to nearby structures or people would be minimal. Potential ground surface rupture impacts would be less than significant.

Mitigation: None required.

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a.ii) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.

Impact 4.6-2: The Proposed Project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. *Less than significant* (Class III)

Ground shaking on the Proposed Project alignment could occur due to earthquakes on regional faults. However, the closest active fault to the Proposed Project is more than 40 miles away. Ground shaking due to seismic events is expected to have low to moderate intensities. According to the Probabilistic Assessment of California, the Proposed Project alignment has a 10 percent probability of exceeding a peak ground acceleration value of 0.2g in 50 years. Given the relatively low calculated peak ground acceleration and the use of current building code standards, the potential for seismic ground shaking to impact the Proposed Project would be less than significant.

Strong ground shaking could cause wires to swing and contact each other causing short-circuiting. However, observations from past earthquakes have shown that overhead transmission lines can accommodate strong ground shaking. In fact, the required separation distance to reduce wires touching in strong winds is also considered sufficient to accommodate movement associated with ground shaking. Therefore, existing design criteria for wind loads are adequate to prevent wire contact during ground shaking and thus, this impact would be less than significant.

Substation improvements and new towers and poles would be designed in accordance with the CBC and the seismic design criteria developed using the site specific seismic design criteria calculated for the substation, tower, and pole locations. Use of standard seismic engineering design criteria, and accepted construction methods would ensure that potential impacts associated with strong ground shaking at the existing substations and new pole and tower locations would be less than significant.

Mitigation: None required.

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a.iii) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction.

Impact 4.6-3: The Proposed Project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction. *Less than significant* (Class III)

Based on background information and the geologic field reconnaissance, the Proposed Project would not be expected to be adversely impacted by seismic-related ground failure, such as liquefaction. Regardless, soils may exist in the project area that could liquefy even at relatively low ground accelerations. Liquefaction hazards are evaluated as a standard practice in design-level geotechnical investigations such as would be conducted for the Proposed Project, and typically mitigated through standard geotechnical measures such as soil treatment or engineered fill replacement. Incorporation of recommended measures, if any, into the Proposed Project design specifications would ensure that the potential impact due to seismic-related ground failure would be reduced to less than significant levels.

Mitigation: None required.

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a.iv) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.

Impact 4.6-4: The Proposed Project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides. *Less than significant* (Class III)

Background data and the geologic field reconnaissance did not indicate the presence of landslides underlying, or adjacent to, the majority of the Proposed Project alignment. Most of the Proposed Project alignment crosses land of slight topographic relief where the presence of landslides is not a design consideration. However, the easterly portion of the alignment climbs into the Sierra Nevada foothills where the stability of slopes, both under static and earthquake conditions, may have a potential impact. Nonetheless, standard engineering construction practices, incorporation of recommendations made in design-level geotechnical investigations, and avoidance of potentially sensitive slopes, if present, would avoid or reduce potential impacts of landslides. Accordingly, the potential impact to the Proposed Project due to landslides would be less than significant.

Mitigation: None required.

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b) Result in substantial soil erosion or the loss of topsoil.

Impact 4.6-5: The Proposed Project could result in substantial soil erosion or the loss of topsoil. ***Less than significant with mitigation*** **(Class II)**

Surface soil erosion and loss of topsoil could occur from soil disturbances associated with grading, work areas, pole and tower installation, and the construction and use of access roads. In cases such as this (i.e., constructed-related impacts), increased runoff or entrainment of sediment in runoff is just as much a concern as soil erosion. It is both processes (surface runoff and disturbed soils) that must be managed, and the principle concern for the Proposed Project for this issue relates more to water quality impacts than to the effect of losing topsoil as discussed in Section 4.8, *Hydrology and Water Quality*. In addition to Best Management Practices (BMPs) that would be incorporated to protect water quality, implementation of Mitigation Measure 4.8-1 would further reduce potential water quality impacts associated with proposed new roads. Moreover, implementation of Mitigation Measure 4.2-1a in Section 4.2, *Agricultural Resources*, which requires implementation of measures to reduce potential loss of topsoil, would reduce the potential for soil loss. Therefore, implementation of Mitigation Measures 4.8-1 and 4.2-1a would reduce the impact to a less-than-significant level

> **Mitigation Measure 4.6-5:** Implement Mitigation Measure 4.8-1 and Mitigation Measure 4.2-1a.

Significance after Mitigation: Less than significant.

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c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

Impact 4.6-6: The Proposed Project could be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. ***Less than significant*** **(Class III)**

Lateral spreading is a phenomenon associated with liquefaction, which is discussed above, under Impact 4.6-3. Considering the relatively deep depth to groundwater in the project area, the potential for liquefaction or related lateral spreading is considered to be very low within the project area.

Subsidence in the San Joaquin Valley has occurred due to groundwater withdrawal. The Proposed Project would not be expected to contribute to subsidence because it would not involve the withdrawal of substantial subsurface groundwater. However, destabilization of natural or constructed slopes could occur as a result of construction activities. Excavation, grading, and fill operations associated with providing access to proposed pole and lattice tower locations could alter existing slope profiles making them unstable as a result of over-excavation of slope material, steepening of the slope, or increased loading. However, the effects of collapsible soils can be neutralized through proper foundation engineering for the structural improvements. Deep foundations that extend through zones of collapsible soils into competent underlying materials are a means to eliminate the effects of collapsible soils. Therefore, incorporation of geotechnical engineering recommendations, as is standard practice for a construction project of this nature, would reduce the potential for collapse or any other unstable soil conditions. The impact of potentially unstable soils would be less than significant.

Mitigation: None required.

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d) Be located on expansive soil, creating substantial risks to life or property.

Impact 4.6-7: The Proposed Project could be located on expansive soil, creating substantial risk to life or property. *Less than significant* (Class III)

Shrink-swell or expansive soil behavior is a condition in which soil reacts to changes in moisture content by expanding or contracting. Expansive soils can cause structural damage particularly when concrete structures are in direct contact with the soils. Due to the granular nature of the on-site soils (primarily sands), substantial amounts of expansive soils in the project area are not likely to exist. Furthermore, the extent and potential affects of expansive soils, if present, can be explored during the geotechnical design evaluations that would be needed to properly design and construct the proposed improvements. Appropriate design features to address expansive soils may include excavation of potentially problematic soils during construction and replacement with engineered backfill, ground-treatment processes, direction of surface water and drainage away from foundation soils, and the use of deep foundations such as piers or piles. Implementation of these standard engineering methods would ensure that impacts associated with expansive soils would remain less than significant.

Mitigation: None required.

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e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

The Proposed Project would not include any components that would include construction of any septic tank or other wastewater disposal system into soils. Accordingly, there would be no potential impact to soils in the project area from wastewater disposal (No Impact).

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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.

Extraction operations exist outside the Proposed Project area. There are no known economically viable sources of rock materials in the immediate project area. In addition, there are no known unique geologic features identified within the project area. Therefore, the potential for the Proposed Project to result in the loss of mineral or unique geologic features is low and there would be no impact (No Impact).

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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.

The activities from the Proposed Project, including lattice tower replacement, new pole/tower installation, and substation upgrades, would affect only a small area. The Proposed Project would not be located in an area currently used to extract known mineral resources. Therefore, the Proposed Project would not result in the loss of availability of locally-important minerals (No Impact).

4.6.5 Cumulative Impacts

Impacts on geology and soils are generally localized and do not result in regionally cumulative impacts. Geologic conditions can vary significantly over short distances creating entirely different effects elsewhere. Other future development would be constructed to the then-current standards, which could potentially exceed those of existing improvements within the region, which reduces the potential impacts to the public.

The impact of the Proposed Project on geology, soils, and mineral resources would be localized and incrementally less than significant. Therefore, the Proposed Project would not affect the immediate vicinity surrounding the project area. As discussed in Section 3.6, *Cumulative Projects*, there are no projects within the immediate vicinity of the Proposed Project. Moreover, the Proposed Project would all be constructed in accordance with the most recent version of the CBC seismic safety requirements and recommendations contained in the Proposed Project's specific geotechnical reports. Therefore, incremental impacts to area geology and soils resulting from construction, operation and maintenance of the Proposed Project would not contribute to a cumulatively considerable impact (Class II).

4.6.6 Alternatives

No Project Alternative

Under the No Project Alternative, the Proposed Project would not be implemented; therefore there would be no impacts related to geology, soils, and mineral resources (No Impact).

Alternative 2

Impacts related to geology, soils, seismicity and mineral resources for Alternative 2 would be similar to the Proposed Project because, like the Proposed Project, the alignment would cross mostly relatively flat terrain underlain by similar earth materials. Due to the longer length of Alternative 2 it would likely result in a greater amount of ground disturbance than the Proposed Project, but the additional disturbance would not be substantial. Therefore, impacts to geology, soils, seismicity and mineral resources under Alternative 2 would be less than significant with mitigation (Class II).

Alternative 3

From a geology, soils, seismicity and mineral resources perspective the north-south trending portion of Alternative 3 would not differ significantly from the Proposed Project alignment because, like the Proposed Project, the alignment would cross mostly relatively flat terrain underlain by similar earth materials. Therefore impacts from construction, operations and maintenance of Alternative 3 would be similar to the Proposed Project. However, the central and easterly portions of Alternative 3 would cross relatively steep terrain in the vicinity of Stokes Mountain where there are slope stability considerations, including suspected landslides. Also, evidence of expansive clayey soils were observed in areas underlain by basic intrusive rocks (e.g., gabbro). While hillside construction could cause slope failure, these issues would be resolved through standard engineering practices (i.e., geotechnical investigation, subsurface exploration, laboratory testing, engineering analyses and design). Moreover, due to the longer length of Alternative 3 and the potential need for remedial earthwork, it would likely result in more ground disturbance than the Proposed Project. However, the greater surface disturbance would not be substantial and impacts to geology, soils, seismicity and mineral resources under Alternative 3 would be less than significant with mitigation (Class II).

Alternative 6

Impacts related to geology, soils, seismicity and mineral resources for Alternative 6 would be similar to the Proposed Project because, like the Proposed Project, the alignment would cross mostly relatively flat terrain underlain by similar earth materials. Due to the longer length of Alternative 6 it would result in more ground disturbance than the Proposed Project. However, the greater surface disturbance would not be substantial and impacts to geology, soils, seismicity and mineral resources under Alternative 6 would be less than significant with mitigation (Class II).

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