Section 4.6
Geology and Soils
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Geology and Soils

4.6.1 Introduction

This section describes effects on geology and soils that would be caused by implementation of the proposed North Sky River Wind Energy Project and Jawbone Wind Energy Project (project). The following discussion addresses existing environmental conditions in the affected area, identifies and analyzes environmental impacts, and recommends measures to reduce or avoid adverse impacts anticipated from project construction, operation, and decommissioning activities. In addition, existing laws and regulations relevant to geology and soils are described. In some cases, compliance with these existing laws and regulations would serve to reduce or avoid certain impacts.

The analysis in this section is largely based on the Draft Geologic Hazard and Limited Geotechnical Review for the Proposed Jawbone Wind Energy Project (Kleinfelder, 2010) and the Preliminary Geotechnical & Geological Evaluation Report for the Proposed Hoffman Summit Wind Farm Project (PSI, 2008) which covers the site of the proposed North Sky River Wind Energy Project. The complete geotechnical reports are provided as Appendix G of this EIR.

4.6.2 Environmental Setting

Regional Setting

The proposed project is located in northeastern Kern County, 16 miles north of the City of Mojave and 40 miles east of City of Bakersfield. The site sits on rugged terrain at the base of the Tehachapi Mountains, just west of the Fremont Valley in the Mojave Desert. The Tehachapi Mountains are an east-west trending mountain range at the southern end of the Sierra Nevada which separates the Great Valley from the Mojave Desert. The mountain range has been sheared into this east-west trend by left-lateral fault movement of the Garlock fault which runs near the southern boundary of the range. The Tehachapi Mountains are primarily composed of Mesozoic Quartz monzonite with local lenses of hornblende diorite and are also characterized by deeply incised valleys, steep hillsides, and mountains that lie on the eastern side of the Pacific Crest line descending towards the Mojave Desert.

The project site is encompassed by the Jawbone Canyon Watershed. The general area in and around the project site is hilly, with mountain ridges, valley areas, and canyons. Ground cover is comprised of woodland and desert scrub, native and non-native grasses, and bare soil (Kleinfelder, 2010; PSI, 2008).

Geologic Setting and Soils

The overall geologic setting is similar for the Jawbone and North Sky project sites. However, the sites are discussed separately, based on specific information from the sites’ respective geotechnical reports.

Jawbone Project Site

The Jawbone tower sites would be located along the narrow ridge tops of an irregularly shaped hill, which is flanked by drainage channels and valleys. The site is primarily composed of Cretaceous
granite bedrock, along with a continuous exposure of marble traversing the ridgeline in its central portions. Alluvial soils (anticipated at less than a few feet thick) form a thin surface veneer where bedrock is not directly exposed. The adjacent hills have northerly oriented exposures of older metamorphic roof pendant rocks. (Kleinfelder, 2010)

**North Sky Project Site**

The site is predominantly made up of granitic rocks that consist chiefly of granodiorite, which is a hard, crystalline, igneous, quartz, feldspar and mica bearing rock that is present in most areas where the proposed wind turbine generators (WTGs) would likely be sited. Also, many of the lower slopes and valley bottoms are primarily underlain by massive, highly weathered rock with a few large outcrops of fresh rock. Portions of the southwestern area of the site (as well as localized areas in the northern and western areas) are occupied by metamorphic rock, consisting primarily of poorly to well-foliated schist, quartzite, and massive limestone. In some cases, the limestone has undergone a higher degree of metamorphism to create coarsely crystalline marble present as small, relatively thin north to northeasterly trending roof pendants within the granitic rocks.

Surficial soils consist of stream alluvium, colluviums, residuum, and topsoil, and are present locally throughout the site. Young alluvium deposits (coarse-grained; made primarily of angular quartz and feldspar grains) occupy the active stream beds, whereas the older alluvial deposits (more consolidated; made up of light brown silty sand with few cobble to boulder sized clasts) underlie stream terraces in the larger drainages. The modern stream channels have often cut into the older stream terraces, leaving vertical or near vertical channel walls between 5 and 10 feet in height.

Colluvium consists of thick accumulations of topsoil-like material, and is located at or near the base of steep slopes, on the lower portions of the hills. This clayey to silty sand with cobble to boulder-sized rocks and rock fragments is subject to significant consolidation with the addition of water.

Residuum is persistently found on or near ridge tops, and is typically composed of sand-sized decomposed granitic particles, and often with some silt or gravel. These soils are typically over-consolidated and very dense except for within 5 to 10 feet of the ground surface, where medium dense soils were observed.

On or near the tops of ridges (where the WTGs would most likely be sited), topsoil is thin to essentially non-existent. Topsoils on the lower slopes are poorly developed, consisting primarily of loose, dry, brown, silty sands with rock fragments. (PSI, 2008)

**Faults and Seismic History**

The proposed sites for the Jawbone and North Sky projects are not located within a State-designated Alquist-Priolo Earthquake Fault Zone, where site-specific studies addressing the potential for surface fault rupture are required. Major or active fault zones near the proposed project site include the Garlock Fault Zone (six miles to the south of North Sky; 12.6 miles to the southeast of Jawbone), San Andreas Fault Zone (43 miles to the southwest), and White Wolf Fault (19 miles to the west of North Sky; 9.5 miles to the southwest of Jawbone) (PSI, 2008; Kleinfelder, 2010).

- **Garlock Fault.** This near-vertical, active fault has primarily left lateral displacements. It trends east-northeast for 170 miles from its intersection with the San Andreas Fault (in the vicinity of Interstate Highway 5) toward Death Valley. The western segment of the Garlock Fault is located along the southern perimeter of the Tehachapi Mountains. In this segment, stream channels have been displaced by left slip movement. The north branch of the Garlock
Fault is considered an active fault, and is a high-angle shear zone with predominant strike slip movement to the west. (Kleinfelder, 2010)

- **San Andreas Fault.** This near-vertical and active fault, with primarily right lateral displacements, generally trends northwest for 320 miles. Many related faults, including the Tylerhorse Fault and the Cottonwood Fault, off-set alluvial deposits and are active or potentially active. Several of the regionally related faults, including the Galway Lake and Homestead Valley Faults, have caused earthquakes and ground ruptures (right slip) in 1975 and 1979, respectively. All of these faults are considered part of the San Andreas Fault system. (Kleinfelder, 2010)

- **White Wolf Fault.** This shorter, left lateral, reverse fault has evidence of historic displacement. It is located at the western edge of Tehachapi Mountains. (Kleinfelder, 2010)

Several smaller, inactive, or potentially active faults are also located relatively close to the site. The southern segment of the inactive Sierra Nevada Fault System extends to within 9.5 miles east of the site. The Jawbone fault (inactive) may be a segment or splay off of this fault system (Kleinfelder, 2010; PSI, 2008). In addition, minor, inactive faults are present in the southern portion of the Jawbone project site (PSI, 2008).

**Slope Stability**

In steep areas, strong ground shaking could activate landslides on hillsides, slope failures on creek banks (lurch cracking), and tension cracking in areas underlain by loose, low-density soils. Also, loose, highly jointed and fractured rock exposures at the edges of the ridge tops may mobilize such that local rock and debris falls may occur. Review of aerial photographs and geologic literature and site reconnaissance indicates the presence of only one suspected landslide in a remote, eastern portion of the North Sky site (PSI, 2008). No landslides were determined present in the Jawbone site (Kleinfelder, 2010).

The North Sky and Jawbone project sites could contain locally steep portions, hillsides, and creek banks, and areas underlain by loose, low-density soil – with the potential for landslides or other slope failures. Site specific slope stability will need to be addressed in the facility’s design level engineering and geotechnical investigations, and in development of grading plans and cut slopes.

**Soil Hazards**

Geologic hazards associated with soil characteristics include erosion, expansion (“shrink-swell” patterns), and settlement, as described below.

**Erosion.** Soil erosion occurs when surface materials are worn away from the earth’s surface due to land disturbance and/or natural factors such as wind and precipitation. The potential for soil erosion is determined by characteristics including texture and content, surface roughness, vegetation cover, and slope grade and length. Wind erosion typically occurs when fine-grained non-cohesive soils are exposed to high velocity winds, while water erosion tends to occur when loose soils on moderate to steep slopes are exposed to high-intensity storm events. At the proposed sites, erosion would primarily occur within existing drainage channels and washes, with periodic sedimentation (transport) during and following periods of intense rainfall. The proposed towers, however, would be located on bedrock ridge tops, where the potential for erosion is considered to be low. There is low potential for erosion at localized shear zones in the bedrock and in areas of decomposing granite exposed at the ground surface (Kleinfelder, 2010). The potential for wind erosion to affect the structural integrity of project features is low, due to these soil characteristics.
Expansion. Soils which expand and contract in volume (“shrink-swell” pattern) are considered to be expansive, and may cause damage to aboveground infrastructure as a result of density changes that shift overlying materials. Expansive soils are characterized by their ability to undergo significant volume change (shrink and swell) due to variation in soil moisture content. Changes in soil moisture could result from a number of factors, including rainfall, landscape irrigation, utility leakage, and/or perched groundwater. Expansive soils are typically very fine grained with a high to very high percentage of clay. During geologic reconnaissance of the site, no expansive soils were observed; however, future subsurface exploration at the specific tower sites may encounter shear zones in the near surface granitic bedrock that may contain clay (Kleinfelder, 2010).

Settlement. The settlement of soils is characterized by sinking or descending soils that occurs as the result of a heavy load being placed on underlying sediments, and may be triggered by seismic events. However, seismically induced settlement is dependent on the relative density of the subsurface soils, and would not occur on surface or near surface bedrock, where the WTGs would most likely be sited.

Faults and Seismicity

The Mojave Desert region, including the proposed project site, is a geologically young and seismically active area. The uplift of the Tehachapi Mountains and the San Gabriel Mountains, as well as associated seismic activity, is the result of movement along the San Andreas and Garlock Fault systems (SEI, 2008). Significant relatively nearby seismic events with a magnitude greater than 6.5 are shown below, in Table 4.6-1.

<table>
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<tr>
<th>Name</th>
<th>Year</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Magnitude</th>
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<tr>
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<td>1812</td>
<td>34.37</td>
<td>-117.65</td>
<td>7</td>
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<tr>
<td>Owens Valley</td>
<td>1872</td>
<td>36.70</td>
<td>-118.10</td>
<td>7.4</td>
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<td>1952</td>
<td>35</td>
<td>-119.0167</td>
<td>7.5</td>
</tr>
<tr>
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<td>1971</td>
<td>34.4112</td>
<td>-118.4007</td>
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<tr>
<td>Northridge</td>
<td>1994</td>
<td>34.213</td>
<td>-118.537</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Source: Kleinfelder, 2010

As described above in Section 4.6.2 (Geologic Setting – Faults and Seismic History), the proposed project is not crossed by an Alquist-Priolo Special Study Zone.

Strong Ground Shaking

Strong ground shaking from an earthquake can result in damage associated with landslides, ground lurching, structural damage, and liquefaction. A major seismic event on the Garlock or San Andreas faults (and possibly other active faults in the region) would likely cause moderate to significant ground shaking at the proposed project site (Kleinfelder, 2010). In-depth geotechnical study of final WTG locations would be conducted prior to implementation of the proposed project, in order to ensure proper design and compliance with applicable building codes and geotechnical requirements associated with the potential for strong ground shaking.

Fault Rupture

Ground surface rupture along an earthquake fault may cause damage to aboveground infrastructure and other features. The State of California has mapped known active faults that may cause surface fault rupture in inhabited areas as part of the Alquist-Priolo Earthquake Fault Zoning Act. As
mentioned, the project site is not located within or adjacent to an Earthquake Fault Zone regulated under the Alquist-Priolo Earthquake Fault Zoning Act. Since no known active or potentially active faults cross or project toward the site, the potential for fault-related surface rupture at the site is very low (PSI, 2008; Kleinfelder, 2010).

**Liquefaction**

Liquefaction is the phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of earthquake-induced strong groundshaking. Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations. To determine the liquefaction susceptibility of a region, factors to analyze include: (1) the density and textural characteristics of the alluvial sediments, (2) the intensity and duration of groundshaking, and (3) the depth to groundwater.

On the North Sky site, depth to groundwater is greater than 50 feet; in accordance with Special Publication 117 (SP 117), published by the California Department of Conservation, Division of Mines and Geology (CGS, 2008), standard geotechnical engineering analyses in California are not required to assess liquefaction where the depth to groundwater is greater than 50 feet. The potential for seismically induced liquefaction to occur on the North Sky site is minimal (PSI, 2008).

On the Jawbone site, the proposed tower sites are located where surface or near surface bedrock is present (Kleinfelder, 2010) and bedrock is a lithified formational material which is not considered liquefiable. Liquefaction potential on the rest of the Jawbone site is considered comparable to that described above for the North Sky site. Therefore, the potential for seismically induced liquefaction to occur on the Jawbone site is minimal.

**Lateral Spreading**

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. With little to no potential for liquefaction, and bedrock sites for the wind towers, lateral spreading would be highly unlikely.

### 4.6.3 Regulatory Setting

Geologic resources and geotechnical hazards are governed primarily by local jurisdictions. The conservation elements and seismic safety elements of city and county general plans contain policies for the protection of geologic features and avoidance of hazards.

The California Environmental Quality Act (CEQA) is the major environmental statute that guides the design and construction of projects on non-federal lands in California. This statute sets forth a specific process of environmental impact analysis and public review. In addition, the project proponent must comply with other applicable State and local applicable statutes, regulations and policies. Relevant and potentially relevant statutes, regulations and policies are discussed below.
Federal

**Clean Water Act (CWA)**

The CWA (33 U.S.C. Section 1251 et seq.), formerly the Federal Water Pollution Control Act of 1972, was enacted with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States. The CWA requires states to set standards to protect, maintain, and restore water quality through the regulation of point source and certain non-point source discharges to surface water. Those discharges are regulated by the National Pollutant Discharge Elimination System (NPDES) permit process (CWA Section 402). Projects that disturb one or more acres of land are required to obtain NPDES coverage under the NPDES General Permit for Storm Water Discharges Associated with Construction Activity (General Permit), Order No. 99-08-DWQ. The General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP), which includes Best Management Practices (BMPs) to protect stormwater runoff.

Requirements of the federal CWA and associated SWPPP requirements are described in further detail in Section 4.9 (Hydrology and Water Quality).

State

**Alquist-Priolo Earthquake Fault Zoning Act of 1972**

Formerly the Special Studies Zoning Act, the Alquist-Priolo Earthquake Fault Zoning Act of 1972 regulates development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. In accordance with this law, the California Geological Survey maps active faults and designates Earthquake Fault Zones along mapped faults. This Act groups faults into categories of active, potentially active, and inactive. Historic and Holocene age faults are considered active, Late Quaternary and Quaternary age faults are considered potentially active, and pre-Quaternary age faults are considered inactive. These classifications are qualified by the conditions that a fault must be shown to be “sufficiently active” and “well defined” by detailed site-specific geologic explorations in order to determine whether building setbacks should be established. Any project that involves the construction of buildings or structures for human occupancy, such as an operation and maintenance building, is subject to review under the Alquist-Priolo Earthquake Fault Zoning Act, and any structures for human occupancy must be located at least 50 feet from any active fault.

**Seismic Hazards Mapping Act (the Act) of 1990**

In accordance with Public Resources Code, Chapter 7.8, Division 2, the California Department of Conservation, Division of Mines and Geology [now the California Geological Survey (CGS)] is directed to delineate Seismic Hazard Zones through the Seismic Hazards Zonation Program. The purpose of the Act is to reduce the threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards, such as those associated with strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. Cities, counties, and State agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. In accordance with the Act, site-specific geotechnical investigations must be performed prior to permitting most urban development projects within seismic hazard zones.
California Building Code (CBC, 2008)

The State of California provides minimum standards for building design through the CBC. The CBC is based on the Uniform Building Code (UBC), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis), and has been modified for conditions within California. In 2008, a revised version of the CBC took effect. In accordance with the CBC, a grading permit is required if more than 50 cubic yards of soil is moved during implementation of a proposed project. Chapter 16 of the CBC contains definitions of seismic sources and the procedure used to calculate seismic forces on structures.

Local

Construction and operation of the proposed project is subject to policies and regulations contained within General and Specific Plans including the Kern County General Plan (KCGP), the Kern County Zoning Ordinance, and the Kern County Code of Building Regulations, which include policies for the avoidance of geologic hazards and/or the protection of unique geologic features, as well as for the preservation of paleontologic resources (please see Section 4.5 (Cultural Resources) for discussion of paleontologic resources relevant to the proposed project). The policies, goals, and implementation measures in the KCGP for geology and soils applicable to the project are provided below. The KCGP contains additional policies, goals, and implementation measures that are more general in nature and are not specific to development such as the proposed project. These measures are not listed below, but, as stated in Chapter 2, (Introduction), all policies, goals, and implementation measures in the KCGP are incorporated by reference.

Kern County General Plan

Chapter 1. Land Use, Open Space, and Conservation Element

1.3 Physical and Environmental Constraints

- **Policy 1.** Kern County will ensure that new developments will not be sited on land that is physically or environmentally constrained (Map Code 2.1 [Seismic Hazard], Map Code 2.2 [Landslide], Map Code 2.3 [Shallow Groundwater], Map Code 2.5 [Flood Hazard], Map Codes from 2.6 – 2.9, Map Code 2.10 [Nearby Waste Facility], and Map Code 2.11 [Burn Dump Hazard]) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.
- **Policy 6.** Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby, minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.
- **Policy 7.** Ensure effective slope stability, wastewater drainage, and sewage treatments in areas with steep slopes are adequate for development.

1.9 Resource (Land Use, Open Space, and Conservation Element)

- **Policy 17.** Lands classified as MRZ-2, as designated by the State of California, should be protected from encroachment of incompatible land uses.
4.3 Seismically Induced Surface Rupture, Ground Shaking, and Ground Failure (Safety Element)

- **Policy 1.** The County shall require development for human occupancy to be placed in a location away from an active earthquake fault in order to minimize safety concerns.

4.5 Landslides, Subsidence, Seiche, and Liquefaction (Safety Element)

- **Policy 1.** Determine the liquefaction potential at sites in areas of shallow groundwater (Map Code 2.3) prior to discretionary development and determine specific mitigation to be incorporated into the foundation design, as necessary, to prevent or reduce damage from liquefaction in an earthquake.

- **Policy 2.** Route major lifeline installations around potential areas of liquefaction or otherwise protect them against significant damage from liquefaction in an earthquake.

- **Policy 3.** Reduce potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion.

5 Energy Element

**Policy 2.** All wind energy development shall be subject to the development standards of Kern County Zoning Ordinance.

**Kern County Zoning Ordinance (Title 19 of the Ordinance Code)**

The Wind Energy (WE) Combining District (Chapter 19.64) contains development standards and conditions (Section 19.64.140) that would be applicable to the siting and operation of WTGs. The following provisions apply to geology and soils issues related to the proposed project.

**Chapter 19.64 WE Combining District**

- **Section 19.64.140(A):** All necessary building and grading permits shall be obtained from the Kern County Planning and Community Development Department. For construction and permit purposes, all WTG towers shall conform to the regulations of the applicable seismic zone of the UBC and the applicable ground shaking zone.

- **Section 19.64.140(K):** Prior to issuance of any grading permit, a plan for the mitigation of potential soil erosion and sedimentation shall be prepared by a California registered civil engineer or other professional and submitted for the approval by the Director of the Engineering, Surveying, and Permit Services Department.

- **Section 19.64.140(L):** A minimum of on-site roadways shall be constructed. Temporary access roads utilized for initial machine installation shall be revegetated to a natural condition after completion of machine installation. The project proponent shall submit a plan of all proposed roads, temporary and permanent, for approval by the Planning Director prior to the issuance of any building permits.

- **Section 19.64.140(M):** Construction of any slopes steeper than four to one (4:1) shall be prohibited unless specifically authorized by the Kern County Planning and Community Development Department and mitigation is provided.

- **Section 19.64.130(N):** Soil erosion and sedimentation control plan, including revegetation plan, as provided in Section 19.64.140 (grading permits only).

**Kern County Code of Building Regulations (Title 17 of the Ordinance Code)**

All construction in Kern County is required to conform to the Kern County Building Code (Chapter 17.08, Building Code, of the Kern County Code of Regulations). Kern County has adopted the
UBC, 2007 Edition, with some modifications and amendments. The entire County is in Seismic Zone 4, a designation previously used in the UBC to denote the areas of highest risk to earthquake ground motion. California has an Unreinforced Masonry program that details seismic safety requirements for Zone 4. Seismic provisions associated with Seismic Zone 4 have been adopted.

Chapter 17.28 Kern County Grading Code.

The purpose of the Kern County Grading Code is to safeguard life, limb, property and the public welfare by regulating grading on private property. All requirements of the Kern County Grading Code will be applied during implementation of the proposed project. All required grading permit(s) shall be obtained prior to commencement of construction activities. Sections of the Grading Code that are particularly relevant to geology and soils are provided below.

Section 17.28.140 Erosion control.

A. Slopes. The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. The protection for the slopes shall be installed as soon as practicable and prior to calling for final approval. Where cut slopes are not subject to erosion due to the erosion-resistant character of the materials, such protection may be omitted.

B. Other Devices. Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

C. Temporary Devices. Temporary drainage and erosion control shall be provided as needed at the end of each work day during grading operations, such that existing drainage channels would not be blocked. Dust control shall be applied to all graded areas and materials and shall consist of applying water or another approved dust palliative for the alleviation or prevention of dust nuisance. Deposition of rocks, earth materials or debris onto adjacent property, public roads or drainage channels shall not be allowed.

Section 17.28.170 Grading inspection.

A. General. All grading operations for which a permit is required shall be subject to inspection by the building official. Professional inspection of grading operations and testing shall be provided by the civil engineer, soils engineer and the engineering geologist retained to provide such services in accordance with Subsection 17.28.170(E) for engineered grading and as required by the building official for regular grading.

B. Civil Engineer. The civil engineer shall provide professional inspection within such engineer’s area of technical specialty, which shall consist of observation and review as to the establishment of line, grade and surface drainage of the development area. If revised plans are required during the course of the work they shall be prepared by the civil engineer.

C. Soils Engineer. The soils engineer shall provide professional inspection within such engineer’s area of technical specialty, which shall include observation during grading and testing for required compaction. The soils engineer shall provide sufficient observation during the preparation of the natural ground and placement and compaction of the fill to verify that such work is being performed in accordance with the conditions of the approved plan and the appropriate requirements of this chapter. Revised recommendations relating to conditions differing from the approved soils engineering and engineering geology reports shall be submitted to the permittee, the building official and the civil engineer.
D. Engineering Geologist. The engineering geologist shall provide professional inspection within such engineer’s area of technical specialty, which shall include professional inspection of the bedrock excavation to determine if conditions encountered are in conformance with the approved report. Revised recommendations relating to conditions differing from the approved engineering geology report shall be submitted to the soils engineer.

E. Permittee. The permittee shall be responsible for the work to be performed in accordance with the approved plans and specifications and in conformance with the provisions of this Code, and the permittee shall engage consultants, if required, to provide professional inspections on a timely basis. The permittee shall act as a coordinator between the consultants, the contractor and the building official. In the event of changed conditions, the permittee shall be responsible for informing the building official of such change and shall provide revised plans for approval.

F. Building Official. The building official may inspect the project at the various stages of the work requiring approval to determine that adequate control is being exercised by the professional consultants.

G. Notification of Noncompliance. If, in the course of fulfilling their responsibility under this chapter, the civil engineer, the soils engineer, or the engineering geologist finds that the work is not being done in conformance with this chapter or the approved grading plans, the discrepancies shall be reported immediately in writing to the permittee and to the building official. Recommendations for corrective measures, if necessary, shall also be submitted.

H. Transfer of Responsibility. If the civil engineer, the soils engineer, or the engineering geologist of record is changed during the course of the work, the work shall be stopped until:

1. The civil engineer, soils engineer, or engineering geologist, has notified the building official in writing that they will no longer be responsible for the work and that a qualified replacement has been found who will assume responsibility.

2. The replacement civil engineer, soils engineer, or engineering geologist notifies the building official in writing that they have agreed to accept responsibility for the work.

4.6.4 Impacts and Mitigation Measures

This section describes the methodology used in conducting the CEQA impact analysis for geology and soils, the thresholds of significance used in assessing impacts to geology and soils, and the assessment of impacts to geology and soils, including relevant mitigation measures.

Methodology

This section describes the potential geology and soils impacts associated with development of the proposed project. This analysis first established baseline conditions for the affected environment relevant to geology and soils, as presented above in Section 4.6.2 (Environmental Setting). These baseline conditions were evaluated based on their potential to be affected by construction activities as well as operation and maintenance activities for the proposed project. As described in Sections 3.7 (Construction), 3.8 (Operation and Maintenance Activities), and 3.9 ( Decommissioning and Repowering), activities that are reasonably expected to occur throughout the life of the proposed project, including construction and installation of WTGs, operation and maintenance, and decommissioning, may extend over a period of 30 years. The predicted interactions between the
affected environment and project activities are evaluated based on the significance criteria identified below (Thresholds of Significance).

Thresholds of Significance

The Kern County CEQA Implementation Document and Kern County Environmental Checklist state that a project would have a significant impact on Geology and Soils if it would:

- 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;
  - Strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction;
  - Landslides;
- Result in substantial soil erosion or loss of topsoil;
- 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;
- Be located on expansive soil, as defined in Section 1802.3.2 of the California Building Code (2007), creating substantial risks to life or property; or
- 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.

Project Impacts

Impact 4.6-1: Expose People or Structures to Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death Involving the Rupture of a Known Earthquake Fault

The proposed project site is not located within a State-designated Alquist-Priolo Earthquake Fault Zone where site-specific studies addressing the potential for surface fault rupture are required (Kleinfelder, 2010). The closest faults mapped within an Alquist-Priolo Earthquake Fault Zone are the Garlock Fault Zone (12.6 miles to the southeast) and the San Andreas Fault Zone (43 miles to the southwest). The White Wolf fault, which has evidence of historic displacement, is 9.5 miles to the southwest (Kleinfelder, 2010). Given the proximity of the project site to the Garlock and White Wolf faults and the overall seismic activity in the region, structures on the project site may be subject to moderate to severe ground shaking, which may result in structural damage. Structural damage to WTGs, overhead transmission lines, or other project facilities could injure workers at the proposed project site. Therefore, impacts from seismic hazards are considered potentially significant and mitigation would be required.

Mitigation Measures

MM 4.6-1 Prior to the issuance of building or grading permits, the project proponents shall conduct a full geotechnical study to evaluate soil conditions and geologic hazards on the project site and submit it to the Kern County Engineering, Surveying, and Permit Services Department for review and approval. The geotechnical study must be
signed by a California-registered professional engineer and must identify the following:

- Location of fault traces and potential for surface rupture;
- Maximum considered earthquake and associated ground accelerations;
- Potential for seismically induced ground shaking, liquefaction, landslides, differential settlement, and mudflows;
- Stability of existing cut-and-fill slopes;
- Collapsible or expansive soils;
- Foundation material type;
- Potential for wind erosion, water erosion, sedimentation, and flooding;
- Location and description of unprotected drainage that could be impacted by the proposed development; and
- Recommendations for placement and design of facilities, foundations, and remediation of unstable ground.

The project proponents shall determine the final siting of project facilities based on the results of the geotechnical study and implement recommended measures to minimize geologic hazards. The project proponents shall not locate project facilities on or immediately adjacent to a fault trace. The Kern County Engineering, Surveying, and Permit Services Department will evaluate any final facility siting design developed prior to the issuance of any building or grading permits to verify that geological constraints have been avoided.

**Level of Significance after Mitigation**

Impact would be less than significant.

**Impact 4.6-2: Expose People or Structures to Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death Involving Strong Seismic Ground Shaking**

As described in Section 4.6.2, the Garlock, White Wolf, and San Andreas faults, are located 6 miles, 9.5 miles, and 43 miles, respectively, from the proposed project site. Due to the proximity of the project to these active faults, the proposed project site would likely experience strong ground shaking resulting from moderate to strong earthquakes during the lifetime of the project. While the shaking would be less severe from an earthquake that originates farther from the project site, the effects could potentially be damaging to project infrastructure. It is likely that the proposed project would be subjected to at least a moderate or larger earthquake occurring close enough to produce strong ground shaking at the project location. Therefore, this impact is considered potentially significant; however, the project proponent is required to design all WTGs and associated infrastructure to withstand substantial ground shaking in accordance with applicable California Building Code seismic design standards, Kern County Building Code, Chapter 17, and as recommended by a California registered professional engineer in the site-specific geotechnical review.

**Mitigation Measures**

The project would comply with the goals, policies, and implementation measures of the KCGP. No additional mitigation measures are proposed.
Level of Significance

Impact would be less than significant.

Impact 4.6-3: Expose People or Structures to Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death Involving Seismic-related Ground Failure, Including Liquefaction

Due to the presence of faults that have displaced recent alluvial deposits in the project area, seismic-related ground failure has the potential to result in surface rupture at or near the proposed project site. Seismic event(s) also have the potential to result in liquefaction, which occurs when saturated granular sediments temporarily lose their shear strength. As described in Section 4.6.2, the potential for seismically induced liquefaction to occur on either the North Sky site or the Jawbone site is considered minimal due to the depth to groundwater and the siting of towers where bedrock is at or near the ground surface. However, because of the potential for seismic-related ground surface rupture to occur at or near the project site, impacts from seismic-related ground failure would be considered potentially significant and mitigation would be required.

Mitigation Measures

Implement Mitigation Measure 4.6-1.

Level of Significance after Mitigation

Impact would be less than significant.

Impact 4.6-4: Expose People or Structures to Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death Involving Landslides

Strong shaking has the potential to activate landslides on hillsides (particularly the steeper bluffs along the ridgelines of the Jawbone study area boundary), slope failures on creek banks, and tension cracking in areas underlain by loose, low-density soil, such as extensive fill. This potential impact would more likely occur immediately following construction activities. During construction of the proposed project, destabilization of natural or constructed slopes could occur as a result of excavation and/or grading activities. Unmapped landslides and areas of localized slope instability may also be encountered, particularly during installation of project facilities. Excavation operations associated with construction of WTG foundations and grading operations for temporary and permanent access roads, as well as construction activities in areas of hilly or sloping terrain could result in slope instability, landslides, soil creep, or debris flows. Geotechnical studies would be required for final siting of project infrastructure in order to identify site-specific geologic conditions. Impacts from hazards associated with landslides would be potentially significant and mitigation would be required.

Mitigation Measures

MM 4.6-2: Prior to the issuance of grading and building permits, the project proponents shall demonstrate compliance with the following:

(a) The project proponents shall design cut/fill slopes for an adequate factor of safety, considering material type and compaction, identified during the site-specific geotechnical study. The slope of cut surfaces shall be no steeper than...
2:1 (horizontal to vertical), unless the project proponents furnish a soils engineering or an engineering geology report, or both, stating that the site has been investigated and given an opinion that a cut at a steeper slope will be stable, if acceptable stabilization methods are employed and it will not create a hazard to public or private property. Other potential considerations would include structures set back from the slopes, and subsequent design recommendations.

(b) The project proponents shall avoid locating roads and structures near landslide and mudflow areas. Where avoidance of landslide areas is not feasible, the project proponents shall construct relatively flat cut-and-fill at slopes not to exceed 2:1 (horizontal to vertical), or 26 percent, or flatter.

(c) The project proponents will not locate turbines, transmission lines, and/or associated structures across faults, lineaments, or unstable areas.

**Level of Significance after Mitigation**

Impact would be less than significant.

**Impact 4.6-5: Result in Substantial Soil Erosion or Loss of Topsoil**

Excavation and grading for WTG foundations, work areas, and access roads could loosen soil or remove stabilizing vegetation and expose areas of loose soil. These areas, if not properly stabilized during construction, could be subject to increased soil loss and erosion by wind and stormwater runoff. As described in Section 4.6.2, ridge tops (where the WTGs would likely be sited) generally consist of bedrock outcrops, whereas increasing thicknesses of alluvium and colluviums sediments are present on the lower flanks and valleys. Due to these soil characteristics, the potential for wind erosion to affect the structural integrity of project features would be low. As described in Section 4.9 (Hydrology and Water Quality), the placement of proposed project infrastructure is not expected to result in substantial erosion related to stormwater runoff.

In compliance with the federal CWA as well as regulations of the State Water Resources Control Board (SWRCB), a SWPPP including site-specific BMPs for erosion and sediment control, would be developed and implemented for the proposed project.

Pursuant to 19.64.140 (Wind Energy Combining District - Development Standards and Conditions) of the Kern County Zoning Ordinance, prior to the issuance of any grading permit, a project proponent is required to submit a plan, prepared by a registered civil engineer or other professional, for the mitigation of potential soil erosion and sedimentation and submit it to the Director of the Engineering, Surveying, and Permit Services Department for review and approval. At a minimum, the plan is required to include: a) provisions for site revegetation, including any necessary re-soiling; b) proposed plant species; c) proposed plant density and percentage of ground coverage; d) the methods and rates of plant seed application; and e) sediment collection facilities as may be required by the Engineering, Surveying, and Permit Services Department. Furthermore, the soil erosion and sedimentation control plan is to be consistent with the applicable requirements of the Regional Water Quality Control Board (RWQCB) pertaining to the project’s SWPPP.

Notwithstanding the foregoing, the revegetation portion of the soil erosion and sedimentation plan will need to be prepared by a professional biologist or other professional approved, prior to review and approval of the soil erosion and sedimentation plan by the Engineering, Surveying, and Permit Services Department. The plan will also need to include a timetable for full implementation,
estimated costs, and a surety bond or other security as approved by the Engineering, Surveying, and Permit Services Department in an amount determined by that department to guarantee plan implementation. The security will remain on file with the Engineering, Surveying, and Permit Services Department until that department has verified that the plan has been successfully implemented.

**Mitigation Measures**

The project would comply with the goals, policies, and implementation measures of the KCGP and Kern County Zoning Ordinance. No additional mitigation measures are proposed.

**Level of Significance**

Impact would be less than significant.

**Impact 4.6-6: 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**

The potential for the site soils to experience liquefaction during a seismic event is considered low due to the high relative density of the soil and the absence of groundwater from the ground surface to a depth of at least 50 feet on the North Sky River site and due to the presence of bedrock at the Jawbone Canyon site, as described above under Impact 4.6-3.

As previously discussed, lateral spreading typically occurs adjacent to free faces such as slopes and creek channels. With the low potential for liquefaction at the project site, on-site lateral spreading would be highly unlikely.

Seismically induced settlement is dependent on the relative density of the subsurface soils, and would not occur on surface or near surface bedrock (where the WTGs would most likely be sited).

A geotechnical assessment for soils at the proposed project site would be conducted prior to final design and approval of the project, and would be used in determining final siting of project infrastructure. Ideal soil conditions should have low to moderate shrink-swell potential and should not include expansive soils. Based on feasibility-level geotechnical investigations conducted at the proposed project site, existing soils at the project site exhibit low probability for shrink-swell patterns, or expansive characteristics (Kleinfelder, 2010).

As described under Impact 4.6-3, portions of the proposed project site are located within 6 miles of the Garlock Fault Alquist-Priolo Special Study Zone, and seismic-related ground failure may result in surface rupture near the proposed project site. Such event(s) could potentially result in damage to project facilities/structures, introducing the potential to subsequently result in on- or off-site landslide, liquefaction, or collapse. In order to avoid such an occurrence, a geotechnical evaluation would be required to avoid locating project infrastructure on unstable or potentially unstable geologic units or soils.

**Mitigation Measures**

Implement Mitigation Measure 4.6-1.
Level of Significance after Mitigation

Impact would be less than significant.

Impact 4.6-7: Be Located on Expansive Soil, as Defined in Section 1802.3.2 of the California Building Code (2007), Creating Substantial Risks to Life or Property

During geologic reconnaissance of the site, no expansive soils were observed; however, future subsurface exploration at the specific tower sites may encounter shear zones in the near surface granitic bedrock that may contain clay. Expansive soils may cause differential and cyclical foundation movements that can cause damage and/or distress to structures and equipment. In addition, potential impacts associated with loose sands or other compressible soils include excessive settlement, low foundation-bearing capacity, and limitation of year-round access to Project facilities. Implementation of MMs 4.6-1 and 4.6-3 is required to ensure that impacts would be less than significant.

Mitigation Measures

Implement Mitigation Measure 4.6-1.

MM 4.6-3: Utility lines shall be designed to withstand vertical and horizontal displacement. If determined necessary by the findings of the site-specific geotechnical study, the project proponents shall remove and replace shrink-swell soils with a non-expansive or non-collapsible soil material.

Level of Significance after Mitigation

Impact would be less than significant.

Impact 4.6-8: Have Soils that are Incapable of Adequately Supporting the Use of Septic Tanks or Alternative Wastewater Systems Where Sewers are Not Available for the Disposal of Wastewater

As described above in Section 3.5 (Proposed Project Characteristics), a septic system and leach line would be used for sewage treatment of the proposed project’s permanent Operation and Maintenance (O&M) Facility. The septic system and leach lines would be located away from surface drainages and protected from potential surface runoff. If located in the older alluvial soils, leach line wastewater infiltration would be slow due to the dense soils, while the younger alluvial, sandy soils would experience moderate to fast wastewater infiltration. Proper siting and design would minimize potential for a health impact from flooding. The septic system and leach field would be constructed to comply with applicable requirements of the Kern County Environmental Health Services Department. If not designed correctly, septic systems could result in health impacts, adversely affect natural habitat, and pollute groundwater. This impact is therefore considered to be potentially significant and mitigation is required.
Mitigation Measures

**MM 4.6-4:** Prior to the issuance of any building permit for the Operation and Maintenance Facility or Facilities, the project proponents shall obtain all required permits and approvals from the Kern County Environmental Health Services Department, and shall implement all required conditions including but not limited to the set-back of project sewage system(s) from area fault traces and drainages.

**Level of Significance after Mitigation**

Impact would be less than significant.

**Cumulative Setting Impacts and Mitigation Measures**

**Cumulative Setting**

The geographic scope for considering cumulative impacts to Geology and Soils includes the extent of the project site because impacts to geology and soils are site-specific. For this project, cumulative impacts to soil erosion and topsoil loss are considered at a larger, watershed level. Impacts of the proposed project would be cumulatively considerable if they would have the potential to combine with similar impacts of other past, present, or reasonably foreseeable projects. As described in Section 3.11, most cumulative projects are characterized as other wind energy projects in the Tehachapi Wind Resource Area.

**Impact 4.6-9: Contribute to Cumulative Geologic and Soils Impacts**

With regard to the project’s potential to expose people or structures to hazards associated with the rupture of a known earthquake fault or from strong seismic groundshaking, damage to WTGs and associated project facilities could occur from direct rupture of a fault in the project area. In the event of such an earthquake, structural damage to WTGs, overhead transmission lines, and other associated facilities from the project could injure workers at the proposed project site. However no fault traces exist within several miles of the project site, and the project would be required to construct project facilities in conformance with relevant building codes, which would minimize placement of structures in active faults zones. As such, when combined with similar impacts of past, present, or reasonably foreseeable projects, proposed project impacts are not expected to result in a significant cumulative impact.

With regard to the proposed project’s potential to expose people or structures to hazards associated with seismic-related ground failure, including liquefaction, it is possible that ground rupture and/or failure could occur in the project area, and that such an event could result in damage to project infrastructure. However, such an impact would be site-specific, and would be reduced to less-than-significant levels with the implementation of MM 4.6-1. Therefore, this potential impact would not be expected to combine with similar impacts of past, present, or reasonably foreseeable projects to result in a cumulative impact.

Regarding the proposed project’s potential to expose people or structures to hazards associated with landslides, destabilization of slopes could occur during construction of project infrastructure. However, implementation of MM 4.6-2 would reduce the potential for structures to be subject to landslides or slope instability. Therefore, this impact of the proposed project impacts would not have the potential to combine with similar impacts of past, present, or reasonably foreseeable projects to result in a cumulative impact.
Regarding the proposed project’s potential to result in substantial soil erosion or loss of topsoil, the characteristics of soil at the proposed project site indicate that the potential for substantial erosion or loss of topsoil would be low. This impact is not expected to combine with similar impacts of other cumulative projects located in the Jawbone Canyon watershed; implementation of measures of the KGCP would reduce this impact of the proposed project to less-than-significant levels. Additionally, the project would be required to implement a SWPPP, which would include site-specific BMPs for erosion and sediment control, reducing this cumulative impact to a less-than-significant level.

With regard to the proposed project’s potential to place infrastructure on soil that is unstable or expansive, geotechnical assessments at the project site would be conducted prior to construction to assure that soils are suitable for the placement of project infrastructure. MM 4.6-3 would further reduce the impacts of expansive soils on project infrastructure. With regard to the proposed project’s potential to have soils incapable of adequately supporting the use of septic tanks, compliance with MM 4.6-4 would reduce this site-specific impact to less than significant. Therefore, these impacts would not have the potential to combine with similar impacts of past, present, or reasonably foreseeable projects to result in a cumulative impact.

The proposed project site is not located in a populated area and, in compliance with WE Combining District requirements, project facilities would be set back from any existing residences, as would other wind energy projects in the cumulative scenario. All projects in the cumulative scenario are subject to the requirements of laws and regulations described in Section 4.6.3, which would mitigate project impacts, including as related to geology and soils.

**Mitigation Measures**

Implement Mitigation Measures 4.6-1 through 4.6-4.

**Level of Significance after Mitigation**

Cumulative impacts would be less than significant.