3.6. GEOLOGY and SOILS

3.6.1. ENVIRONMENTAL SETTING

Regional Geology

The WSP plan area and Westlands transmission corridors are located in the central San Joaquin Valley, which is part of the Great Valley Geomorphic Province, a topographic and structural basin bounded on the east by the Sierra Nevada and on the west by the Coast Ranges, with the Diablo Range flanking the valley directly to the west. The Sierra Nevada are part of a fault block which dips gently to the southwest and forming the bedrock beneath the valley. This basement complex is composed of igneous and metamorphic rocks of pre-Tertiary age. These in turn are overlain by surficial deposits of Quaternary age, including fluvial (stream and river), alluvial (floodplain), and lacustrine (lake) strata (2.6 Million years ago to present)(see Figure GEO-1).

The Great Valley was formed by continued tectonic downwarping, approximately along its axis. In the San Joaquin Valley, this trough-like depression is asymmetrical with the deepest part of the syncline west of the valley center, approximately below the now dry Tulare, Buena Vista, and Kern lake beds. Geologic relationships show that the downwarping continued into late Pleistocene and probably Recent times.

The Quaternary Period includes the Pleistocene Epoch (about 2.6 Million to about 10,000 years ago) and the Holocene (Recent) Epoch, approximately the past 10,000 years. The Pleistocene Epoch is informally termed the Ice Age, although it also includes several warm intervals during which the climate differed little from that of today. Mountain glaciers in the Sierra Range expanded during the intervening colder intervals as did continental glaciers in parts of the Midwest. However, there is no evidence of glaciation in the Coast Ranges.

Cycles of glacial activity in the Sierras triggered cyclic changes in sediment deposition on the San Joaquin Valley floor. With the growth of the mountain glaciers, rocks and finer sediment carved from glacial valleys were carried by abundant meltwater to the margins of the San Joaquin Valley where they were deposited to form broad, low semi-conical features termed alluvial or fluvial fans. River channels shifted laterally across the fans and often split into multiple distributaries, leaving sand and gravel deposits along their former courses. Flood events left finer silts and clays on the overbank areas on the fan surface between channels and in abandoned channels. These fans eventually extended many miles radially from the points where the rivers left the steep mountain slopes, in some cases meeting other fans extending eastward from the Diablo Range. The Kings River, which now runs from the Sierras to the west-southwest, passing north of the towns of Lemoore and Hanford, produced a large fluvial fan which met another fan, generated by Los Gatos Creek, spreading from the base of the Diablo Range north of Coalinga. Together, these fans created a broad natural dam within the southern San Joaquin Valley to the northeast of the project site.

South of the dam, runoff from the surrounding drainage basins ponded to form Tulare Lake, the largest of three lakes which existed southeast of the project area until historic times. The relative height of the fan dam varied through Quaternary time with changes in climate, rates of outlet erosion, and rates of tectonic subsidence. Consequently, the depth and extent of Tulare Lake fluctuated many times.

Topography and Physical Features

Westlands Solar Park

The WSP plan area is characterized by very gradual slopes with ground elevations decreasing from west to east toward the Kings River. Ground elevations within the plan area range from a high of 285 feet above mean sea level at the western edge of the plan area to a low of 200 feet elevation at the eastern boundary, reflecting an average elevation change of 12 feet per mile (0.2 percent). Apart from irrigation and drainage canals, ditches, collection ponds, and their adjoining levees, there are no notable or unique geologic features within the WSP plan area.

The WSP plan area is entirely underlain by Quaternary alluvium, including Quaternary fluvial (stream and river), alluvial (floodplain), and lacustrine (lake) deposits. The eastern margins of the plan area, between Nevada Avenue and Laurel Avenue, are underlain by lake deposits, which comprise an area of approximately 3 square miles along the eastern WSP boundary.

The westernmost parts of the site are mapped as fan deposits and form the outer limits of alluvial fans that spread eastward from the Diablo Range hills to the west. Approximately 3 square miles of the WSP plan area is underlain by these fan deposits.

The large central portion of the WSP plan area falls between areas mapped as lake deposits and those mapped as fan deposits. These areas were occupied by streams with lower gradients than those on the fans, and left both channel deposits, consisting mostly of sand and gravel, and finer overbank deposits during flood events. The channel and overbank deposits are collectively termed basin deposits.

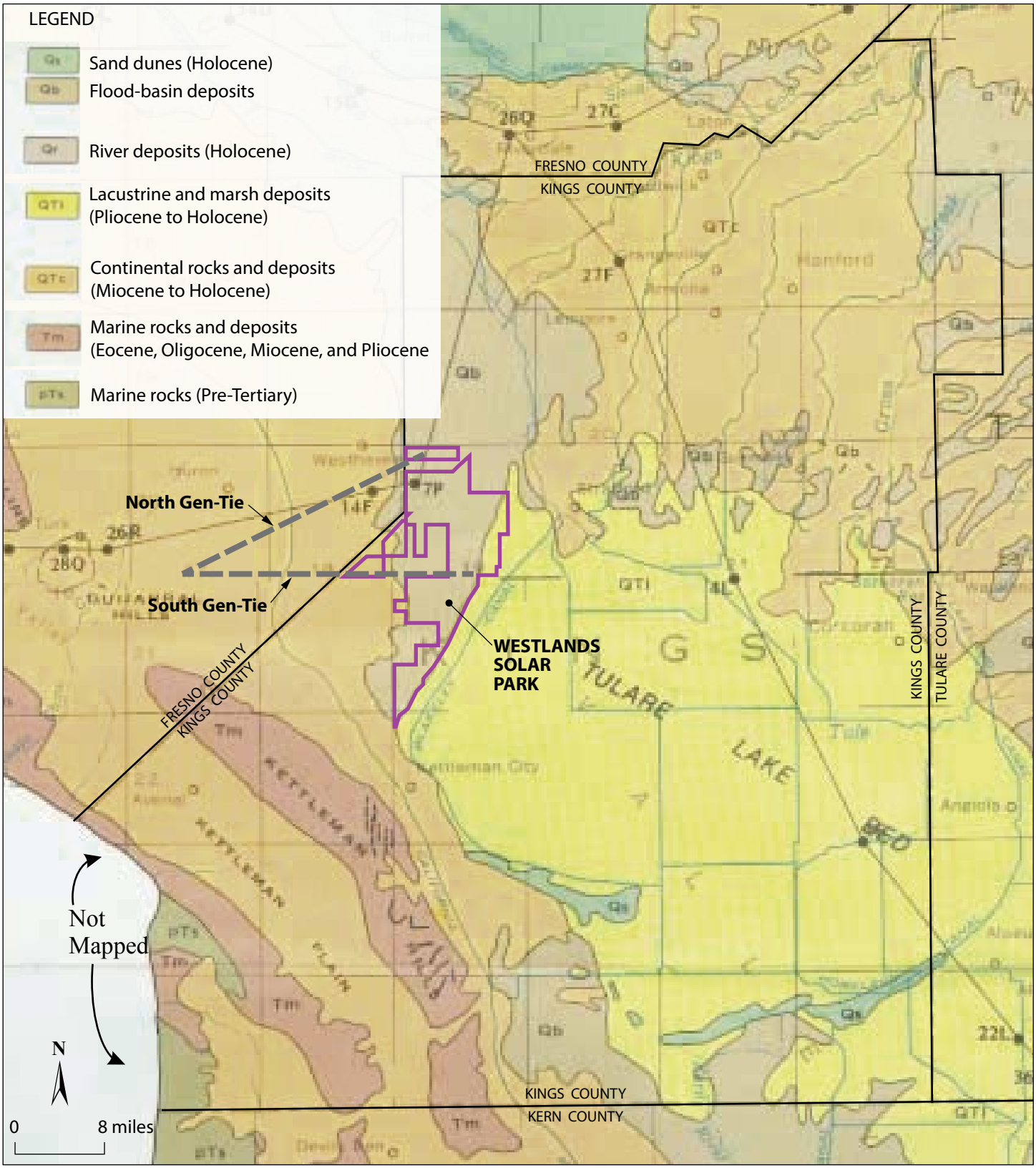
WSP Gen-Tie Corridors

The gen-tie corridors pass over relatively level ground en route to the Gates Substation near west side of the valley. The terrain along corridors rises gradually in elevation between about 215 feet at its lowest point in WSP interior to about 400 feet at the Gates Substation east of I-5.

The Kings County segments of the gen-tie corridors are predominantly underlain by basin and alluvial fan deposits, while the Fresno County segments are almost entirely underlain by alluvial fan deposits.

Tectonics and Seismicity

No portion of the WSP plan area or Westlands transmission corridors are located in an Alquist-Priolo Earthquake Fault Zone and no known active faults traverse the study areas (CGS 2010b). However, there are several active faults in the Coast Ranges to the west, including the San Andreas fault. The San Andreas Fault Zone predominantly accommodates the right-lateral strike-slip displacement across the Pacific and North American tectonic plate junction. The nearest segment of the San Andreas fault is located about 27 miles southwest of the WSP plan area, and 24 miles southwest of the nearest point of the WSP gen-tie



Base map: Kings County, 2002

General Geology

Figure GEO-1

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corridors at the Gates Substation. The San Andreas fault it is estimated to be capable of producing a magnitude 7.7 earthquake along the nearest segments to the WSP plan area and transmission corridors.

The Nunez Fault Zone, a 3-mile long fault zone located 2 miles northwest of Coalinga, was the epicenter of the 6.2 magnitude 1983 Coalinga earthquake. The Nunez fault is a designated Alquist-Priolo Earthquake Fault Zone and is located about 24 miles west of the WSP plan area and 12 miles southwest of the WSP gen-tie corridors at the nearest points.

The western San Joaquin Valley is also traversed by a series of faults known collectively as the Great Valley Fault System, which runs parallel to and east of the San Andreas Fault zone and is believed to be the fundamental tectonic boundary between the Coast Range province and the Sierran block. This fault system is composed of blind thrust faults, which do not intersect the ground surface but can cause significant shaking and ground deformation. Blind thrust faults are not classified as active or potentially active in the same manner as faults that are present on the ground surface. The nearest segment of this fault system is the Kettleman Hills segment which runs approximately 17 miles southwest from the WSP plan area, and 12 miles from the WSP gen-tie corridors at the nearest points. The 6.0 magnitude Kettleman Hills earthquake in 1985 occurred within this fault complex (Kings County 2010a).

Seismic, Geologic, and Soils Hazards

Groundshaking

Based on Peak Ground Acceleration mapping by the California Geological Survey (CSG), the estimated peak horizontal ground acceleration within the WSP plan area during an earthquake ranges from 0.20-0.30g (g = force of gravity). The WSP gen-tie corridors would generally be subject to higher earthquake shaking intensities, given their proximity to causative faults in the Coast Ranges. Peak ground accelerations along the gen-ties would range from 0.25-0.40g. For comparison, lands located near the San Andreas Fault Zone in San Benito County are subject to peak ground accelerations of 0.60-0.80g and greater (USGS 2014).

Ground Rupture

Earthquakes are caused by the sudden displacement of earth along faults with a consequent release of stored strain energy. The fault slippage can often extend to the ground surface where it is manifested by sudden and abrupt relative ground displacement. Damage resulting directly from fault rupture generally occurs only where structures are located immediate to the fault traces that rupture. No portion of the WSP plan area or the gen-tie corridors are located within an Alquist-Priolo Earthquake Fault Zone. The closest known active or potentially active fault is the Nunez fault, which is approximately 24 miles west of the WSP plan area and 12 miles southwest of the WSP gen-tie corridors at the nearest points. There is no evidence indicating the presence of faults or fault traces in the WSP plan area or the gen-tie corridors; therefore, the potential for fault rupture at the site is extremely low.

Liquefaction

Soil liquefaction is the phenomenon in which a saturated, cohesionless soil loses shear strength during an earthquake as a result of induced shearing strains, which essentially transforms the soil to a liquid state resulting in ground failure or surface deformation. Liquefaction can result in total and differential settlement of structures. Conditions required for liquefaction typically include fine, well-sorted, loose sandy soil, high groundwater, higher intensity earthquakes, and particularly long duration of ground

shaking. Ground accelerations of at least 0.10g and ground shaking durations of at least 30 seconds are needed to initiate liquefaction. The occurrence of liquefaction is generally limited to soils located within about 50 feet of the ground surface. Groundwater is an essential factor in liquefaction since the soil loses its shear strength when increased pore pressure of groundwater becomes greater than the contact stresses between the grains of soil that keep them in contact with each other.

Within the WSP plan area and along the gen-tie corridors, most soil series have high clay content, indicating a low susceptibility to liquefaction. Although high groundwater conditions occur within the WSP plan area and in some sections of the gen-tie corridors, these areas are typically associated with clay soils. The sections of the gen-tie corridors which pass through areas of sandy loam soils are well drained and do not have groundwater levels near the ground surface, and therefore have a low susceptibility to liquefaction. Along canals and ditches, where conditions may include saturated soil conditions and unconsolidated sediments, the potential for liquefaction would be greater. However, the overall potential for liquefaction would be reduced due to distance from the nearest causative faults in the Coast Ranges.

Lateral spreading can occur with seismic ground shaking on slopes where saturated soils liquefy and flow toward the open slope face. There is a low potential for lateral spreading within the WSP plan area since it is essentially flat and does not include significant slopes. However, there is some potential for lateral spreading along the open channels of the canals and ditches that would be retained within the WSP plan area. Within the gen-tie corridors, the potential for lateral spreading would also be generally low and confined to levee banks and open faces of canals and ditches.

Seismic Settlement

Seismic settlement may occur as saturated and unsaturated granular soils become rearranged during groundshaking resulting in a volume reduction and surface deformation. The magnitude of seismic settlement is a function of the relative density of the soil and the magnitude of cyclic shear stress caused by seismic ground motion. The potential for the occurrence of an earthquake with the capability of promoting seismic settlement is low throughout most of the WSP plan area and gen-tie corridors where stiff clay soils are the most prevalent. However, some seismic settlement could occur in isolated locations on the valley floor where sandy soils are present above the groundwater table. The general potential for significant surface deformation resulting from seismic settlement is considered low for the WSP plan area and gen-tie corridors.

Landslides

Due to the relatively level terrain of the WSP plan area and the gen-tie corridors, the potential for landslides is very low.

Subsidence

Ground subsidence is typically caused when overdrafts of a groundwater basin reduces the upward hydraulic pressure that supports the overlying land surface, resulting in consolidation/settlement of the underlying soils. Land subsidence occurs when the water bearing zones are compressed due to the removal of groundwater. Under severe conditions, land subsidence can result in damage of structures and utilities on or beneath the ground surface. Additionally, the compression of the water bearing zones results in permanent reduction of the water storage capacity of the aquifer. Mapping of the San

Joaquin Valley indicates that as much as 20 feet of land subsidence may have occurred in the west-central portion of the WSP plan area between 1926 and 1970 (USBR 2011, p. 12-24).

During the droughts of 1976-77, 1987-92, 2007-09, and 2011-16, increased groundwater pumping resulted in periods of renewed compaction. After previous droughts ending in 2009, recovery to pre-drought water levels was rapid and compaction virtually ceased (USGS 2016).

Soils

The WSP plan area is covered by soils of the Lethent-Garces-Panoche soil association, as mapped by the NRCS Soil Survey of Kings County. Soils of this association typically have loam or clay loam surface soils, and clay, clay loam, sandy clay loam subsurface soils. Most of the horizons are alkaline and saline. The permeability is moderate to very slow and runoff is slow or very slow. The NRCS Soil Survey indicates that the WSP plan area includes 10 detailed soil map units. Over half of the site soils consist of Lethant clay loam which is typified by high salinity in the root zone and perched groundwater conditions. The other soil types present on the WSP site, which are listed in Table AG-1 in Section *3.2. Agricultural Resources*, largely have soil limitations similar to those associated with the Lethent clay. Most of the on-site soil types have moderate to high shrink-swell (expansion) potential. All site soils have high potential corrosivity to uncoated steel, and moderate to high corrosivity to concrete (NRCS 1986).

The soils along the WSP gen-tie corridors include several soil series as mapped by the NRCS in the Soil Survey of Western Fresno County. The soils along the gen-tie alignments are alluvial fan soils of the Cerini-Excelsior-Westhaven association. These soils consist of loam, clay loam, and sandy loam; they are well-drained and have restricted permeability (NRCS 2006).

Soil Expansion

As discussed above, the near surface soils throughout the majority of the WSP plan area have a high potential for soils expansion as indicated in NRCS descriptions for most of the soil types, which have a moderate to high shrink-swell potential (NRCS 1996, pp. 202-206). Expansive soils are subject to shrinking and swelling during seasonal wetting and drying cycles. As expansive soils dry, the soil shrinks; when moisture is reintroduced to the soil, the soil swells. Where structures are constructed over expansive clays, moisture can increase below the structure over time, resulting in swell pressures on foundations and concrete slabs which can in turn result in cracking of these structures. The sandy loam soils within most of the WSP gen-tie corridors have low to moderate expansion potential (NRCS 2006). At the eastern end of the northern gen-tie corridor, the soils consist of clay loams which have a moderate to high expansion potential (NRCS 1996).

Erosion Potential

Within the WSP plan area, the combination of clay soils and nearly flat terrain result in negligible potential for erosion by stormwater runoff. On the alluvial fans on the west side of the valley, the localized sloping terrain and looser soil cover result in a somewhat greater, but still low potential for erosion (NRCS 1986, NRCS 2006).

Due to high wind conditions which occur periodically in spring, wind erosion is prevalent on the west side of the San Joaquin Valley where the WSP plan area and gen-tie corridors are located. This results in

the loss of topsoil and crops, adverse public health effects (by airborne dispersal of spores causing Valley Fever), reduced visibility resulting in automobile accidents, and damage to public facilities.

Groundwater Conditions

Based upon the WWD's 2013 Deep Groundwater Mapping, the depth to the unconfined (upper) groundwater table within the WSP plan area ranges from a high of about 250 feet BSG (below surface grade) along Laurel Avenue near the east boundary to about 450 feet BSG at the western end along Avenal Cutoff Road at Nevada Avenue (WWD 2013).

Based upon the WWD's Shallow Groundwater Surface mapping for April 2015, the depth to the shallow groundwater on about 75 percent of the WSP plan area is between 10 and 15 feet, with depths of 5 to 10 feet occurring over approximately 20 percent of the plan area, and depths less than 5 feet occurring over approximately 5 percent at the southern end of the plan area. Along the gen-tie corridors, the depth to shallow groundwater is highly variable, ranging from 10 feet in some places to over 40 feet in others (WWD 2015).

Groundwater table elevations fluctuate with time since they are dependent upon seasonal precipitation, irrigation, groundwater pumping, and climatic conditions as well as other factors. (See Sections *3.2. Agricultural Resources* and *3.14. Utilities and Service Systems,* for additional discussions of groundwater conditions.)

Mineral Resources

Kings County contains few commercial mining and mineral extraction operations. Currently, only limited excavation of soil, sand and some gravel is excavated for commercial use. The County has only one surface mining permit for a non-active gravel operation, and two agricultural reclamation sites that were fully reclaimed. In the past, there was an open pit gypsum mine and a mercury mine in southwestern Kings County, but these mines are now closed (Kings County 2010a). Within Kings County, there are several abandoned oil wells associated with the abandoned Westhaven oil field which is located just west of the WSP plan area in Fresno County (DOGGR 2001, 2003).

Fresno County has an abundance and wide variety of mineral resources that have been extracted for many years. In western Fresno County, present-day production includes aggregates (sand and gravel), fossil fuels (oil and natural gas), metals (chromite), and construction and industrial materials (asbestos, gypsum, and limestone). There are no identified aggregate resource areas or active sand and gravel operations in the vicinity of the gen-tie corridors western Fresno County. Two large sand and gravel quarries located near Coalinga will serve as potential aggregate sources for construction of the WSP generating facilities and transmission lines (Fresno County 2000a).

Oil and natural gas production has long been a major industry in western Fresno County, particularly around Coalinga. There are a number of active and abandoned oil and gas fields in the vicinity of the WSP plan area and gen-tie corridors in Kings County and western Fresno County. The nearest to the WSP plan area is the abandoned Westhaven oil field, located just west of the WSP plan area in Fresno County. Other notable oil and gas fields in the vicinity include the Kettleman North Dome and Coalinga oil fields to the west of I-5, the abandoned gas fields at Dudley Ridge and southeast Kings County, and the several smaller

gas fields and abandoned oil fields in western Fresno County (Fresno County 2000a, DOGGR 2001, DOGGR 2003).

Within the WSP plan area, there are 9 mapped oil and gas wells, all but one of which have been plugged and abandoned. There is one inactive oil and gas well (Mary Bellochi #1) located on the north side of Nevada Avenue, just outside the WSP plan area (south of the tailwater pond), that is mapped as "idle" by DOGGR. In the vicinity of the WSP gen-tie corridors in western Fresno County, there are a number of abandoned and plugged oil and gas wells associated with the abandoned Westhaven oil field (DOGGR 2017).

3.6.2. REGULATORY CONTEXT

State

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act), requires the delineation of zones along active faults in California. The purpose of the Alquist-Priolo Act is to regulate development on or near active fault traces to reduce the hazards associated with fault rupture and to prohibit the location of most structures for human occupancy across these traces. Cities and counties must regulate certain development projects within the zones, including the preparation of geologic investigations in order to demonstrate that development sites are not threatened by future surface displacement. The nearest Alquist-Priolo Earthquake Fault Zone that is mapped in the vicinity is the Nunez Fault Zone located northwest of Coalinga, approximately 24 miles west of the Westlands Solar Park and 12 miles west of the WSP gen-tie corridors at their nearest point.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act is intended to protect the public from the effects of strong groundshaking, liquefaction, landslides, or other ground failure/hazards caused by earthquakes. This act requires the State Geologist to delineate seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site must conducted and appropriate mitigation measures incorporated into the project design. There are no Seismic Hazard Maps that include the WSP plan area or the WSP gen-tie corridors.

California Division of Oil, Gas, and Geothermal Resources

The Department of Conservation's Division of Oil, Gas, and Geothermal Resources (DOGGR) is responsible for supervising the drilling, operation, maintenance, plugging, and abandonment of oil, gas, and geothermal wells. DOGGR's regulatory program promotes responsible development of oil, natural gas, and geothermal resources in California through sound engineering practices, prevention of pollution, and implementation of public safety programs. DOGGR requires the land developments avoid building over or near plugged or abandoned oil and gas wells, or requires the remediation of wells to current DOGGR standards.

California Building Code

The California Building Code (CBC) is Part 2 of the California Building Standards Code (CBSC) which is codified as Title 24 of the California Code of Regulations (CCR). The CBC is based on the 2006 International Building Code and includes additional provisions and modifications specific to California. The CBC pertains to building design and construction and is separate from other parts of the CBSC such as the electrical code, plumbing code, mechanical code, fire code, energy code, etc. In terms of providing seismic safety, the primary objective of the CBC standards is to ensure public safety and minimize property damage in the event of an earthquake. The 2016 version of the California Building Standards Code assigns a seismic design category (SDC) to each structure. The SDC is assigned as a means of capturing both the seismic hazard, in terms of mapped acceleration parameters (spectral values), site class (defining the soil profile), and the occupancy category (based on its importance or hazardous material contents). The SDC affects design and detailing requirements as well as the structural system that may be used and its height.

Kings County

Kings County General Plan

The 2035 Kings County General Plan includes the following goals, objectives and policies related to geology, soils, and minerals that are relevant to the Westlands Solar Park:

Health and Safety Element

A. Natural Hazards

HS GOAL A2 Minimize loss of life and personal property caused by geologic hazards.

HS OBJECTIVE A2.1 Regulate new construction to achieve acceptable levels of risk posed by geologic hazards.

HS Policy A2.1.3: Prohibit new construction along known fault zones, and limit uses to nonstructural land uses.

HS Policy A2.1.4: Review all development proposals to determine whether a geotechnical soils report is required for new construction.

HS Policy A2.1.5: Consider the environmental review process for land use projects' seismic hazards, including subsidence, liquefaction, flooding, local soils, and geologic conditions.

Resource Conservation Element

B. Soil Resources

RC GOAL C1 Encourage the conservation of soil resources that are critical to the long-term protection and sustainability of the County's agricultural productivity and economy.

RC OBJECTIVE C2.2 Ensure that land use decisions are compatible with the control of soil erosion and the maintenance of soil quality.

RC Policy A2.2.1: Require erosion control measures for any development involving construction or grading near waterways, or on land with slopes over ten percent. Require that improvements such as roads and driveways be designed to retain natural vegetation and topography to the extent feasible.

RC Policy A2.2.2: Continue to require the application of construction related erosion control measures, including Stormwater Pollution Protection Plans (SWPPP) for all new construction.

G. Energy Resources

RC GOAL G1 Encourage the development of oil and gas energy sources provided that they do not degrade environmental quality.

RC OBJECTIVE G1.1 Ensure the restoration of oil and gas well sites to a pre-drilling condition after the completed use of a site.

RC Policy G1.1.1: Require the timely reclamation of oil and gas development sites upon termination of such activities to facilitate the conversion of the land to its primary land use as designated by the General Plan. Reclamation costs shall be borne by the well operator.

Kings County Code of Ordinances

Development Code

The Land Subdivisions are regulated by Article 23 of the Kings County Development Code. The Development Code requires that a preliminary soils report be prepared by a registered civil engineer for all subdivisions. If the preliminary soils report indicates the presence of critically expansive soils or other soil problems, a detailed soils investigation is required which recommends corrective action for any soils problems which are likely to result in structural damage. Article 23 of the Development Code provides that one of its objectives is to ensure that land developments incorporate proper grading and erosion control, and that the Public Works Director shall be responsible for evaluating the planned method of erosion and sedimentation control.

Kings County Building Code

The County Code of Ordinances, at Section 5-36, adopts and incorporates by reference the 2013 Edition of the California Building Code (CBC) as the Kings County Building Code, which is applicable to all building construction in Kings County. The CBC is described earlier in this section.

Fresno County

Since no portion of the Westlands Solar Park is located within Fresno County, the County's plans, policies and regulations are not applicable to WSP solar development. Transmission projects that are to be constructed or co-sponsored by an investor-owned utility (IOU) such as PG&E are subject to the sole permitting jurisdiction of the California Public Utilities Commission (CPUC) and are exempt from local jurisdiction. However, CPUC General Order 131-D requires public utilities to coordinate with local jurisdictions regarding consistency of their projects with local plans and policies (CPUC 1994). Transmission lines that may be privately owned (such as gen-ties) are not under CPUC jurisdiction, and thus are subject to Fresno County jurisdiction and may require the issuance of a conditional use permit from the County.

Fresno County General Plan

The Health and Safety Element of the Fresno County General Plan contains a number of policies related to Seismic and Geological Hazards. In general these policies require compliance with Building Code requirements for all structures, and also require preparation of geologic investigations for projects located in areas with potential for geologic hazards, and implementation of recommended engineering design measures. The Health and Safety Element is directly accessible at the following web address: http://www2.co.fresno.ca.us/4510/4360/General_Plan/GP_Final_policy_doc/Health%20Element_rj.pdf

Fresno County Code

The Fresno County Code, at Section 15.08.010, adopts and incorporates by reference the 2013 Edition of the California Building Code (CBC), with certain exceptions and amendments, which is applicable to all building construction in Fresno County. The CBC is described earlier in this section.

3.6.3. Environmental Impact Analysis

Significance Criteria

Based on the State CEQA Guidelines, Appendix G, the WSP solar development and the transmission projects would be considered to result in a significant geology and soils impact if they 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. (Impact GEO-1)

ii) Strong seismic ground shaking. (Impact GEO-2)
iii) Seismic-related ground failure, including liquefaction. (Impact GEO-3)
iv) Landslides. (Impact GEO-4)

b. Result in substantial soil erosion or the loss of topsoil. (Impact GEO-6)

c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse. (Impacts GEO-3 and GEO 4)

d. Be located on expansive soil, creating substantial risks to life or property. (Impact GEO-5)

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. (Impact GEO-9)

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. (Impact GEO-10)

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. (Impact GEO-10)

IMPACTS AND MITIGATION

Impact GEO-1. Rupture of Known Earthquake Fault

***Westlands Solar Park*. There are no known active or potentially active earthquake faults in proximity to the WSP plan area; therefore, the potential for impact from fault rupture is extremely low. (*Less-than-Significant Impact*)**

***WSP Gen-Tie Corridors*. There are no known active or potentially active earthquake faults in proximity to the WSP gen-tie corridors; therefore, the potential for impact from fault rupture is extremely low. (*Less-than-Significant Impact*)**

This impact analysis addresses significance criterion 'a-i' above.

Westlands Solar Park

The WSP plan area is not located within an Alquist-Priolo Earthquake Fault Zone. The closest mapped fault zone is the Nunez Fault Zone, located approximately 24 miles west of the plan area. The Kettleman Hills segment of the Great Valley Fault System, a series of blind thrust faults, is located approximately 17 miles southwest of the plan area. The nearest segment of the San Andreas Fault Zone is located approximately 27 miles southwest of the plan area. There is no evidence indicating the presence of faults or fault traces within the WSP plan area, and as such, the potential for fault rupture within the WSP plan area is

extremely low. Therefore, the potential hazard due to fault rupture in the WSP plan area represents a *less-than-significant* impact.

Westlands Transmission Corridors

Valley Floor Segments

The nearest active faults to the gen-tie corridors are the Nunez Fault Zone, the Great Valley Fault System, and the San Andreas Fault Zone, which are located 12 miles west, 13 miles southwest, and 24 miles southwest, respectively, from the transmission corridors at their nearest points. There are no known faults or fault traces in the vicinity of the gen-tie corridors, and as such the potential for fault rupture within these corridors is extremely low. Therefore, the potential hazard due to fault rupture within the gen-tie corridors represents a *less-than-significant* impact.

Mitigation Measures:

***Westlands Solar Park*. No mitigation is required.**

***WSP Gen-Tie Corridors*. No mitigation is required.**

Impact GEO-2. Seismic Ground Shaking

***Westlands Solar Park*. Moderate ground shaking expected within the WSP plan area during a moderate to severe earthquake could potentially result in damage to solar generating facilities and other structures. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. Strong ground shaking expected within the WSP Gen-Tie Corridors during a moderate to severe earthquake could potentially result in damage to transmission towers and lines. (*Less-than-Significant Impact with Mitigation*)**

This impact analysis addresses significance criterion 'a-ii' above.

Westlands Solar Park

Large or moderate earthquakes centered on faults in the Coast Ranges to the west would result in ground shaking that could cause damage to structures in the WSP plan area. The greatest potential damage to the site would result from an earthquake centered on a nearby segment of the San Andreas System, the Great Valley Fault System, or the Nunez fault, all of which are located within 27 miles of the WSP plan area. A major earthquake centered on a nearby fault would result in moderate ground shaking with peak horizontal ground accelerations of 0.25-0.30g within the WSP plan area during the life of the solar generating projects.

Ground shaking would cause dynamic loading resulting in stress to buildings and structures. However, structures designed and built in accordance with the California Building Code (which is incorporated into the Kings County Building Code) are expected to respond well. The CBC provisions applicable to solar development within the WSP provide for high degree of seismic strength and resistance to lateral forces (strong shaking) in construction in order to minimize risks to public safety and damage to property, corresponding to the magnitude of the seismic events expected in the region.

Moderate ground shaking expected within the WSP plan area during a moderate to severe earthquake could potentially result in damage to solar generating facilities and other structures, which represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-1a below, the impact would be reduced to *less than significant*.

WSP Gen-Tie Corridors

The gen-tie lines would be subject to potential damage from an earthquake centered on the San Andreas or Nunez faults, or the Great Valley Fault System. The severity of shaking would be variable, with the severity of potential ground shaking decreasing with distance east from the Coastal Ranges. The WSP gen-tie corridors would be subject to peak ground accelerations of 0.25 to 0.40g, depending on location.

Moderate ground shaking expected within the WSP Gen-Tie Corridors during a moderate to severe earthquake could potentially result in damage to transmission towers and lines, which represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-1b below, the impact would be reduced to *less than significant*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-1a.**

***WSP Gen-Tie Corridors*. Implement MM GEO-1b.**

MM GEO-1a. **Minimization of Seismic Ground Shaking Hazard within WSP. Prior to the issuance of building permits for solar projects within the WSP plan area, the project applicants for each solar project shall provide documentation to Kings County demonstrating that all project structures are designed in accordance with the seismic design criteria of the California Building Code. The project applicants shall also implement all recommendations contained in the project-specific geotechnical engineering reports with respect to grading, soil preparation, building and equipment foundation design, solar array support specifications, pavement design, excavations, and other construction considerations.**

For each solar project within the WSP plan area, a geotechnical investigation will be conducted prior to engineering design for the project to determine the detailed soil characteristics of the site. This will provide the basis for engineering recommendations and specifications regarding soil preparation, foundation design, solar array support specifications, pavement design, excavations, and other

construction considerations to be followed during site development. The geotechnical report for each SGF project will be reviewed and approved by Kings County prior to issuance of building permits.

MM GEO-1b. **Minimization of Seismic Ground Shaking Hazard for WSP Gen-Tie Projects. Prior to final project design for the transmission lines and related facilities, geotechnical investigations shall be performed to evaluate ground accelerations for design of all planned transmission structures to ensure conformance with applicable design standards for the anticipated seismic forces.**

Based on design parameters established by the geotechnical investigations, the structural elements of the transmission line system can then be designed to resist or accommodate location-specific ground motions and conform to the current seismic design standards.

Impact GEO-3. Liquefaction, Lateral Spreading, and Seismic Settlement

***Westlands Solar Park*. There is a potential for seismically-induced, liquefaction, lateral spreading, and settlement within the WSP plan area which could result in damage to foundations and structures. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. There is a potential for seismically-induced, liquefaction, lateral spreading, and settlement within portions of the WSP Gen-Tie Corridors which could result in damage to foundations and structures. (*Less-than-Significant Impact with Mitigation*)**

This impact analysis addresses significance criterion 'a-iii' above.

Westlands Solar Park

Liquefaction

Liquefaction would typically pose a hazard where liquefaction-prone conditions are present, such as combination of loose granular soils and shallow groundwater. Within the WSP plan area, most soil series have high clay content, indicating a low susceptibility to liquefaction. Although perched groundwater conditions occur within the WSP plan area, these areas are typically associated with stiff clay soils. However, there may be localized instances where liquefaction-prone conditions are present. In the extreme western portion of the WSP plan area, near Nevada Avenue and Avenal Cutoff Road, there is an area of approximately 1,080 acres that consists of loam soils. The nearest groundwater in this area was recently (April 2015) mapped at 20-25 feet below the surface; however, during some years (e.g., 2003) groundwater in this area has been mapped at 5-10 feet below ground surface (WWD 2015, 2003). This indicates a potential for liquefaction in this area when shallow groundwater is near the ground surface. (However, given the installation of drip irrigation systems over most of these lands in the past decade, these high groundwater conditions are not expected to recur in the future.)

In summary, while soil and groundwater conditions over most of the WSP plan area are not generally conducive to liquefaction, there may be localized areas within the clayey soils where less cohesive soils exist with high groundwater conditions, indicating a potential susceptibility to liquefaction in those areas. Also, the loam soils in the western portion of the WSP plan area are potentially susceptible to liquefaction when groundwater levels are high. Therefore, the potential liquefaction hazard in the WSP plan area represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-2a below, the impact would be reduced to *less than significant*.

Lateral Spreading

Lateral spreading can occur with seismic ground shaking on slopes where saturated soils liquefy and flow toward the open slope face. There is a generally low potential for lateral spreading within the WSP plan area since it is essentially flat and does not include significant slopes. However, there is some potential for lateral spreading along the open channels of the canals and ditches that would be retained and within the WSP plan area. Therefore, the potential for lateral spreading within the WSP plan area represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-2a below, the impact would be reduced to *less than significant*.

Seismic Settlement

Seismic settlement may occur as saturated and unsaturated granular soils become rearranged during groundshaking resulting in a volume reduction and surface deformation. The magnitude of seismic settlement is a function of the relative density of the soil and the magnitude of cyclic shear stress caused by seismic ground motion. The potential for the occurrence of an earthquake with the capability of promoting seismic settlement at the project is generally low within the WSP plan area where stiff clay soils comprise the most common soil types. It is anticipated that some seismic settlement could occur in isolated locations where unconsolidated soils are present above the groundwater table. While the probability of seismic settlement within the WSP plan area is low, localized conditions for seismic settlement may be present, and this hazard would represent a *potentially significant impact*. With implementation of Mitigation Measure GEO-2a below, the impact would be reduced to *less than significant*.

It is noted that the phenomenon of seismic settlement is sometimes referred to as "subsidence," although subsidence is more typically considered to be the result of groundwater overpumping and consequent soil compression. Subsidence of this type is a regional occurrence and would not be expected to adversely affect solar developments within the WSP. (See "Environmental Setting" above for a brief description of subsidence.)

WSP Gen-Tie Corridors

Liquefaction

The WSP gen-tie corridors generally pass through areas of alluvial sandy loam soils that are well drained and do not have groundwater levels near the ground surface, and therefore have a low susceptibility to liquefaction. However, there may be localized instances where liquefaction potential may be greater, such as along stream beds and other water bodies, where conditions may include saturated soil conditions and

unconsolidated sediments. Therefore, the potential for localized liquefaction hazard within the gen-tie corridors represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-2b below, the impact would be reduced to *less than significant*.

In the interior areas of the valley, such as at the easterly sections of the gen-tie corridors, soil conditions may include areas of stiff clays, which are generally not susceptible to liquefaction even with high groundwater conditions. However, there may be localized instances where liquefaction-prone conditions are present. Therefore, the potential liquefaction hazard within the gen-tie corridors represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-2b below, the impact would be reduced to *less than significant*.

Lateral Spreading

The potential for lateral spreading is correlated with liquefaction susceptibility, so there may be localized potential for lateral spreading on loam soils with high groundwater conditions. Within the gen-tie corridors, the potential for lateral spreading would be generally low and confined to levee banks and open faces of canal channels and ditches. Thus, while the potential hazard due to lateral spreading would be localized, it would represent a *potentially significant impact*. With implementation of Mitigation Measure GEO-2b below, the impact would be reduced to *less than significant*.

Seismic Settlement

Along the gen-tie corridors, the potential for seismic settlement could occur in isolated locations where unconsolidated soils are present. The presence of sandy loam soils along portions of the gen-tie corridors indicates that localized conditions for seismic settlement may be present, and this hazard would represent a *potentially significant impact*. With implementation of Mitigation Measure GEO-2b below, the impact would be reduced to *less than significant*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-2a.**

***WSP Gen-Tie Corridors*. Implement MM GEO-2b.**

MM GEO-2a. **Minimization of Ground Failure Hazard within WSP. Prior to the issuance of the first building permit for each solar project within WSP, the applicant shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for liquefaction, lateral spreading, and seismic settlement within the project area and to prepare recommendations and foundation design specifications to mitigate potential damage to project structures due to these soil hazards. Any mitigation identified in the geotechnical reports shall be subject to review and approval by the Kings County Building Official and made conditions of building permit approval.**

Measures to minimize potential damage resulting from these ground failure hazards may include removal of soils from below the bottom of footings and replacement of

the soils with engineered fill, surcharging to induce settlement before construction, or supporting posts and piles in dense soil or bedrock below the liquefiable zone. The recommendations of the geotechnical engineer will be implemented as required by Kings County.

MM GEO-2b. **Minimization of Ground Failure Hazards for WSP Gen-Tie Corridors. Prior to final project design for the gen-tie lines and related facilities, the project proponent shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for liquefaction, lateral spreading, and seismic settlement within the gen-tie corridors and to prepare recommendations and foundation design specifications to mitigate potential damage to project structures due to these soil hazards.**

Typical construction techniques for addressing liquefaction include: removal of liquefiable layers and replacement with compacted fill, or support of structures with piles at depths designed specifically for liquefaction, deep dynamic compaction, and other methods.

In locations where the transmission lines would irrigation channels or ditches, foundations for towers and other structures should be located to avoid potential areas of liquefaction and lateral spreading, such as by moving tower locations away from the channel.

Impact GEO-4. Landslides and Slope Failures

***Westlands Solar Park*. The level terrain of the WSP plan area has a very low potential for landslides, although there is a moderate potential for localized slope failures along the channels and levees of irrigation canals, ditches, and ponds. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. The relatively level terrain of the gen-tie corridors has a very low potential for landslides, although there is a moderate potential for localized slope failures along the channels and levees of irrigation canals, ditches, and ponds. (*Less-than-Significant Impact with Mitigation*)**

This impact analysis addresses significance criterion 'a-iv' above.

Westlands Solar Park

The nearly level terrain of WSP plan area has a very low potential for landslides although there is a moderate potential for localized slope failures along the channels and levees of irrigation canals, ditches, and ponds. Although the potential hazard to structures from potential slope failures within the WSP plan area is small, it represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-3a below, the impact would be reduced to *less than significant*.

WSP Gen-Tie Corridors

The nearly level terrain of the gen-tie corridors has a very low potential for landslides, although there is a moderate potential for localized slope failures along the channels and levees of irrigation canals, ditches, and ponds. Although the potential hazard to structures from potential slope failures within the WSP Gen-Tie Corridors is small, it represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-3b below, the impact would be reduced to *less than significant*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-3a.**

***WSP Gen-Tie Corridors*. Implement MM GEO-3b.**

MM GEO-3a. **Minimization of Landslide and Slope Failure Hazard within WSP. Prior to the issuance of the first building permit for each solar project within WSP, the applicant shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for slope failures and to prepare recommendations to mitigate or avoid potential damage to project structures due to potential slope failures. Any mitigation identified in the geotechnical report shall be subject to review and approval by the County Building Official and made conditions of building permit approval.**

The potential for slope failures can be addressed through soil compaction or other grading techniques, as recommended by the project geotechnical engineer. The recommendations of the geotechnical engineer will be implemented as required by Kings County.

MM GEO-3b. **Minimization of Landslide and Slope Failure Hazard for WSP Gen-Tie Corridors. Prior to final project design for the gen-tie lines and related facilities, the project proponent shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for landslides and/or slope failures within the gen-tie corridors and to prepare recommendations to mitigate or avoid potential damage to project structures due to potential slope failures.**

Impact GEO-5. Expansive Soils

***Westlands Solar Park*. Most soil units within the WSP plan area have moderate to high potential for soils expansion which could result in potential damage to foundations and equipment pads. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. Most soil units within the gen-tie corridors consist of sandy loam soils which have a low to moderate potential for soils expansion. The clay loam soils at the eastern end of the northern gen-tie corridor have a moderate to high potential for soils expansion. Areas with moderate to high potential for soils expansion could result in potential damage to foundations and equipment pads. (*Less-than-Significant Impact with Mitigation*)**

This impact analysis addresses significance criterion 'd' above.

Westlands Solar Park

The near surface soils throughout the majority of the WSP plan area have a high potential for soils expansion. These soils have high clay content and are subject to shrinking and swelling during seasonal wetting and drying cycles. Where structures are constructed over expansive clays, moisture can increase below the structure over time, resulting in swell pressures on foundations and concrete slabs which can in turn result in cracking of these structures. The potential hazard to structures from expansive soil conditions represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-4a below, the impact would be reduced to *less than significant*.

WSP Gen-Tie Corridors

The soils of the Valley segments of the transmission corridors consist primarily of well-drained loams formed on alluvial fans. While clay content is generally low for most of the corridor lengths, there is an area of soils with higher clay content at the eastern end of the northern gen-tie corridor, which may be susceptible to expansion. Therefore, the potential hazard to structures from expansive soil conditions represents a *potentially significant impact*. With implementation of Mitigation Measure GEO-4b below, the impact would be reduced to *less than significant*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-4a.**

***WSP Gen-Tie Corridors*. Implement MM GEO-4b.**

MM GEO-4a. **Minimization of Soils Expansion Hazard within WSP. Prior to the issuance of the first building permit for each solar project within WSP, the applicant shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for soils expansion and to prepare recommendations and foundation design specifications to mitigate potential damage to project structures due to potential soils expansion. Any mitigations identified the geotechnical report shall be subject to review and approval by the County Building Official and made conditions of building permit approval.**

All solar projects within WSP will be subject to project-specific geotechnical investigations prior to the submittal of permit applications. These subsurface studies

will involve detailed evaluations of on-site soils conditions and provide construction level- recommendations as to the most appropriate form of special foundation design, based on the nature and extent of expansive soils beneath the planned building foundations and concrete pads. The potential damage from soils expansion would be reduced by several alternative engineering measures (e.g., overexcavation and replacement with non-expansive soils; extending foundations below the zone of shrink and swell; chemically treating the soils with quicklime or cement), as recommended by the project geotechnical engineer. The recommendations of the geotechnical engineer will be implemented as required by Kings County.

MM GEO-4b. **Minimization of Soils Expansion Hazard for WSP Gen-Tie Corridors. Prior to final project design for the gen-tie lines and related facilities, the project proponent shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for soils expansion within the gen-tie corridors and to prepare recommendations and foundation design specifications to mitigate potential damage to project structures due to soils expansion.**

Impact GEO-6. Erosion Potential

***Westlands Solar Park*. The development of the WSP plan area would create the potential for water- and wind-related soil erosion during construction and decommissioning of the WSP solar generating facilities. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. The construction of the gen-tie projects would create the potential for water- and wind-related soil erosion during construction of the gen-tie facilities. (*Less-than-Significant Impact with Mitigation*)**

This impact analysis addresses significance criterion 'b' above.

Westlands Solar Park

The development of the WSP solar facilities would involve site clearing, rough grading, soil compaction, establishment of temporary construction staging areas, excavation of temporary water supply basins, and trenching for solar arrays, and construction of support facilities and internal access driveways. Once vegetation is removed, the exposed and disturbed soil would be susceptible to erosion from wind and rain. During decommissioning of the solar facilities, the soil would again be exposed and susceptible to erosion. The potential for erosion and sedimentation during construction and decommissioning represents a *potentially significant impact*. With the implementation of Mitigation Measure HYD-1, the impact would be reduced to *less-than-significant*.

Erosion potential during operation of the WSP solar facilities would be negligible. Approximately 99 percent of the ground surface within each solar facility would not be covered with impervious materials,

and would be revegetated. The general absence of exposed soils during operations, and the virtually flat topography would not be conducive to erosion. Almost all rainwater would percolate into the ground within a short period, and the relatively minor volumes of runoff that could be generated during more intense storm events would be retained within each SGF site. Therefore, the very low potential for erosion impacts to occur during the operational phase of the solar facilities would represent a *less-than-significant impact.*

WSP Gen-Tie Corridors

The gen-tie projects would involve clearing and grading of tower sites and temporary access driveways, and establishment of temporary construction staging areas. Once vegetation is removed, the exposed and disturbed soil would be susceptible to erosion from wind and rain. The gen-tie corridors pass through virtually flat terrain with soils varying from clayey soils in the east to looser soils on the alluvial fan deposits in the west. The clay soils have generally low natural erosion potential while the looser alluvial fan soils have a somewhat greater erosion potential. The seasonal high wind conditions throughout the gen-tie corridor vicinity would contribute to a high potential for wind erosion in areas of exposed soils. The potential for wind and water erosion during grading and construction for the gen-tie facilities represents a *potentially significant impact*. With the implementation of Mitigation Measure HYD-1, the impact would be reduced to *less-than-significant*.

During operation of the gen-tie lines, the tower pads would be subject to erosion from stormwater runoff. While the alluvial fan soils along most of the length of the gen-tie corridors are somewhat erodible, the virtually flat terrain would minimize the potential for concentrated runoff conditions. Revegetation of the tower sites would further reduce soil exposure to wind and water erosion. Therefore, the low potential for erosion during operation of the gen-tie lines represents a *less-than-significant impact*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM HYD-1 (prepare and implement SWPPPs).**

***WSP Gen-Tie Corridors*. Implement MM HYD-1 (prepare and implement SWPPPs).**

As discussed in Section *3.8. Hydrology and Water Quality*, under subsection *3.8.2. Regulatory Setting*, the solar projects developed within the WSP will be subject to the U.S. EPA's National Pollutant Discharge Elimination System (NPDES) permit requirements for construction activities. These are implemented at the state level through the General Permit for Discharges of Storm Water Associated with Construction Activity, as administered by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB). Prior to construction grading and prior to the decommissioning, the project proponents will be required to file a "Notice of Intent" (NOI) with the SWRCB to comply with the General Permit and prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP for each project phase will be prepared by a licensed engineer and will detail the treatment measures and best management practices (BMPs) to control pollutants that shall be implemented and complied with during the construction and post-construction phases of solar development. The SWPPP(s) required for decommissioning shall specify BMPs to be implemented during

that final project phase. Typical BMPs that may be specified in the SWPPPs include: scheduling construction activities around forecasted rain events; designation of restricted-entry zones; sediment tracking control measures (e.g., crushed stone or riffle metal plate at construction entrances); protective measures for sensitive areas; and provision for revegetation upon completion of construction within a given area. All project SWPPPs would be subject to approval by the Central Valley Regional Water Quality Control Board (CVRWQCB), which would make the final determinations on which BMPs are required for each project. The construction contracts for each construction phase, and for the decommissioning phase, would include the requirement to implement the BMPs in accordance with the SWPPPs. The SWPPPs would identify the responsible entities for both the construction and post-construction periods. The SWPPPs are to be kept on-site during construction, where they would be subject to inspection by Kings County and CVRWQCB staff. The SWPPPs are to be updated each year for each solar project while construction is ongoing.

The gen-tie projects would be subject to the same NPDES requirements for preparation and implementation of SWPPPs, as discussed above for the WSP plan area. Typical BMPs would be the same or similar to those described above for the Westlands Solar Park.

Impact GEO-7. Shallow Groundwater

***Westlands Solar Park*. Shallow groundwater conditions within the WSP plan area could adversely affect below-ground electrical conduits. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. Localized shallow groundwater conditions may occur within the WSP gen-tie corridors; however, since the transmission facilities would not include below-ground elements apart from concrete tower footings, there would be no adverse effect upon the gen-tie facilities. (*Less-than-Significant Impact*)**

Westlands Solar Park

Most of the WSP plan area is subject to perched groundwater conditions. After wet rainy seasons, groundwater levels can be as shallow as five feet below the ground surface in some areas of the WSP plan area (WWD 2001). Excessive subsurface moisture could adversely affect buried electrical cables. However, cable trenches would be typically three feet deep, with electrical conduit laid on a layer of crushed rock approximately one foot thick. Thus the potential for groundwater levels to rise to the level of the buried electrical conduit would be small and limited to isolated situations, if any. Also, with the cessation of agricultural irrigation within each SGF site as it is developed, it is anticipated that any localized high groundwater conditions would recede below the near-surface zone. The solar projects would not include underground utilities such as sewer, water, or natural gas lines. Although the potential for groundwater rising to the planned depth of buried utilities is small, the potential hazard from shallow groundwater conditions within the WSP plan area represents a *potentially significant impact*. With the implementation of Mitigation Measure GEO-5 below, the impact would be reduced to *less-than-significant*.

WSP Gen-Tie Corridors

The gen-tie corridors include some areas of high groundwater, particularly in the eastern segments of the corridors. The shallow groundwater conditions occur only in the areas located east of the California Aqueduct, where most groundwater depths are 10 feet or less, with a few isolated locations where depths are 5 feet or less. It is not expected that the gen-tie lines would include buried electrical cable or other underground elements. Therefore, the hazard posed by localized shallow groundwater conditions within the WSP Gen-Tie Corridors would represent a *less-than-significant impact*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-5.**

***WSP Gen-Tie Corridors*. No mitigation is required.**

MM GEO-5. **Shallow Groundwater Protection within WSP. Prior to the issuance of the first building permit for each solar development within WSP, the applicant shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for adverse groundwater impacts to buried electrical conduit and to prepare recommendations and design specifications to avoid potential damage from groundwater. Any mitigations identified in the geotechnical report shall be subject to review and approval by the County Building Official and made conditions of building permit approval.**

Measures to minimize potential groundwater damage to buried conduit may include waterproofing the electrical trenches and conduits, per applicable standards, as recommended by the project geotechnical engineer.

Impact GEO-8. Soil Corrosivity

***Westlands Solar Park*. Corrosive soils within the WSP plan area could potentially cause damage to on-site structures, foundations, and utilities. (*Less-than-Significant Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. Corrosive soils within the WSP gen-tie corridors could potentially cause damage to on-site structures and foundations. (*Less-than-Significant Impact with Mitigation*)**

Westlands Solar Park

All of the soil units within the WSP plan area have a high potential corrosivity to uncoated steel, and moderate to high potential corrosivity to concrete (NRCS 1986). Unless buried steel and concrete elements are properly treated, the site soil conditions could cause damage to such buried structures under moist environments. This is a *potentially significant impact*. With the implementation of Mitigation Measure GEO-6a below, the impact would be reduced to *less-than-significant*.

WSP Gen-Tie Corridors

The soil units within the WSP gen-tie corridors have a high potential corrosivity to uncoated steel, and low to high potential corrosivity to concrete (NRCS 2006). Unless buried steel and concrete elements are properly treated, the soil conditions could cause damage to such buried structures under moist environments. This is a *potentially significant impact*. With the implementation of Mitigation Measure GEO-6b below, the impact would be reduced to *less-than-significant*.

Mitigation Measures:

***Westlands Solar Park*. Implement MM GEO-6a.**

***WSP Gen-Tie Corridors*. Implement MM GEO-6b.**

MM GEO-6a. **Corrosion Protection for Buried Structures within WSP. Prior to the issuance of the first building permit for each solar development within WSP, the applicant shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for soil corrosivity and to prepare recommendations and design specifications to mitigate potential damage to underground project elements due to potentially corrosive soils. Any mitigation identified in the geotechnical report shall be subject to review and approval by the County Building Official and included as conditions of building permit approval.**

All solar projects within WSP will be subject to project-specific geotechnical investigations prior to the submittal of permit applications. These subsurface studies will involve detailed evaluations of corrosivity characteristics of on-site soils and provide construction-level recommendations as to the most appropriate method of protecting subsurface structures from soil corrosion. Measures to minimize potential damage to underground steel and concrete structures due to corrosive soils may include the use of corrosion resistant materials, coatings, and cathodic protection for buried steel, and selection of the appropriate type of cement and water/cement ratio, as recommended by the project geotechnical engineer. The recommendations of the geotechnical engineer will be implemented as required by Kings County.

MM GEO-6b. **Corrosion Protection for Buried Structures within WSP Gen-Tie Corridors. Prior to final project design for the gen-tie lines and related facilities, the project proponent shall retain a qualified geotechnical engineer to undertake a soils investigation to determine the potential for soil corrosivity and to prepare recommendations and design specifications to mitigate potential damage to underground project elements due to potentially corrosive soils.**

Impact GEO-9. Soil Suitability for Wastewater Disposal

***Westlands Solar Park*. The operational domestic wastewater disposal requirements for each WSP solar facility would be provided either by septic tanks with no leachfields (wastewater would be disposed off-site), or portable chemical toilets, depending on the size of the solar facility, and by portable chemical toilets during construction. Therefore, on-site soils would not be utilized for wastewater disposal. (*No Impact*)**

***WSP Gen-Tie Corridors*. During construction, wastewater disposal requirements would be provided by portable chemical toilets. There would be no need for wastewater disposal during gen-tie line operation. Therefore, on-site soils would not be utilized for wastewater disposal. (*No Impact*)**

This impact analysis addresses significance criterion 'e' above.

Westlands Solar Park

None of the WSP solar facilities are anticipated to use a septic leachfields for on-site wastewater disposal. The WSP solar facilities will have no operations staff stationed at the facilities. Operations workers who visit the sites periodically for inspection, maintenance, repair, and panel washing duties would arrive from off-site locations. For larger SGFs, it is expected that domestic wastewater disposal would be provided a septic tank located within the O&M yard at each SGF. The tanks would have a capacity of approximately 2,000 gallons and would be emptied as needed by a contracted wastewater service vehicle which would haul the wastewater to an approved wastewater treatment facility in the region. For smaller solar facilities, the sanitary needs of workers visiting the solar facilities for maintenance activities may be provided by portable chemical toilets that would be serviced by a private contractor. Construction workers would also utilize portable chemical toilets. Therefore, no WSP solar facility would connect to the sanitary sewer system or utilize on-site septic disposal systems for disposal of wastewater. Thus, although the WSP plan area is located in an area with a perched water table, and engineering would be required by Kings County for any new septic disposal system that is installed; no such systems are expected to be required or proposed for any WSP solar facility. Therefore, WSP solar development would result in *no impact* in terms of capability of the site soils to adequately support septic systems.

WSP Gen-Tie Corridors

During construction of the gen-tie projects, it is expected that portable toilet facilities would provide wastewater service for construction workers. No permanent employees would be present upon completion of the gen-tie lines, so permanent wastewater facilities would not be required once the gen-tie lines are completed. Since there would be no discharge of treated wastewater associated with the construction or operation of the gen-tie lines, there would be a *no impact* to soil and groundwater.

Mitigation Measures:

***Westlands Solar Park*. No mitigation is required.**

***WSP Gen-Tie Corridors*. No mitigation is required.**

Impact GEO-10. Mineral Resources

***Westlands Solar Park*. The construction of the WSP solar facilities would increase the demand for local sand and gravel resources. This increased demand would represent a small portion of the aggregate resources in the area and would not result in a loss of availability of a known mineral resource. While an abandoned oil field is located near the WSP plan area, WSP solar development would not interfere with access to known mineral or oil and gas resources. Therefore, WSP solar development would not result in the loss of availability of an important mineral resource recovery site. (*Less-than-Significant Impact*)**

***WSP Gen-Tie Corridors*. The construction of the gen-tie projects would increase the demand for local sand and gravel resources. This increased demand would represent a small portion of the aggregate resources in the area and would not result in a loss of availability of a known mineral resource. While an abandoned oil field and several abandoned oil wells are located near the gen-tie corridors, the construction of the WSP gen-tie projects would not interfere with access to known mineral or oil and gas resources. No portion of the WSP gen-tie corridors is located in proximity to locally-important recovery sites for mineral resources, or oil and gas resources, and therefore would not result in the loss of availability of an important mineral resource recovery site. (*Less-than-Significant Impact*)**

This impact analysis addresses significance criteria 'f' and 'g' above.

Westlands Solar Park

The WSP solar generating facilities will require sand and gravel for the construction of maintenance driveways, for fill material for utility trenches, as base material for building and equipment pads, and in concrete mix. The total aggregate requirements of the WSP solar facilities would be relatively small and would not represent a significant portion of the available aggregate resources and would not result in a

loss of availability of known mineral resources to the region or State. Therefore, the impact to availability of aggregate resources would represent a *less-than-significant impact*.

As discussed in Section *3.6.1 Environmental Setting*, the WSP plan area is not located in proximity to any known aggregate resource areas or other mineral resource areas. Therefore, the solar development of the WSP plan area would not interfere with access to known aggregate resources, and the impact to access to mineral resources would be *less than significant*.

There are a number of active and abandoned oil and gas fields in Kings County and western Fresno County. Within the WSP plan area, there are 9 abandoned oil wells associated with the abandoned Westhaven oil field. All of the former oil wells within the WSP plan area have been plugged and abandoned. (There is one oil and gas well [Mary Bellochi #1] located on the north side of Nevada Avenue, just outside the WSP plan area (south of the tailwater pond) which is mapped as "idle" (DOGGR 2017). While there is always the possibility that oil and gas extraction within the WSP plan area could become feasible under future economic conditions and new technologies, the Westlands Solar Park would include open areas within and around the solar generating facilities that would be accessible to mineral rights holders if drilling on within the WSP plan area were to become economically feasible in the future. Therefore, the solar development of the WSP plan area would not interfere with access to oil and gas resources, and the impact to access to oil and gas resources within the WSP plan area would be *less than significant*.

In summary, the WSP solar development would not result in the loss of availability of a known mineral resource, or in the loss of availability of an important mineral resource recovery site. Therefore, the impact of WSP solar development upon mineral resources would be *less than significant*.

WSP Gen-Tie Corridors

The gen-tie projects will require sand and gravel primarily for concrete mix for the tower footings. The total aggregate requirements of the gen-tie projects would be relatively small and would not represent a significant portion of the available aggregate resources and would not result in a loss of availability of known mineral resources to the region or State. Therefore, the impact to availability of aggregate resources would be *less than significant*.

As discussed in Section *3.6.1 Environmental Setting*, the WSP gen-tie corridors are not located in proximity to any known aggregate resource areas or other mineral resource areas. Therefore, the construction of the gen-tie lines would not interfere with access to known aggregate resources, and the impact to access to mineral resources would be *less than significant*.

With respect to oil and gas resources, there are a number of abandoned and plugged oil and gas wells associated with several small abandoned oil and gas fields in western Fresno County in the vicinity of WSP gen-tie corridors. However, with one exception there are no active or inactive oil or gas wells in proximity to the transmission corridors. (The one exception is "Mary Bellochi #1" located north of Nevada Avenue outside the WSP-South to Gates Gen-Tie corridor, which is mapped as "idle" by DOGGR.) Given the narrow linear character of the gen-tie corridors, the construction of the gen-tie lines would not interfere with access to any underlying oil and gas resources, and the impact to access to oil and gas resources along the gen-tie corridors would be *less than significant*.

In summary, the construction of the WSP gen-tie projects would not result in the loss of availability of a known mineral resource, or in the loss of availability of an important mineral resource recovery site. Therefore, the impact of the WSP gen-tie projects upon mineral resources would be *less than significant*.

Mitigation Measures:

***Westlands Solar Park*. No mitigation is required.**

***WSP Gen-Tie Corridors*. No mitigation is required.**

Cumulative Impacts

Impact GEO-11. Cumulative Geology and Soils Impacts

***Westlands Solar Park*. The potential cumulative geology and soils impacts resulting from WSP solar development, combined with impacts from related cumulative projects, would be less than cumulatively significant under near-term and far-term conditions, with mitigation. (*Less-than-Significant Cumulative Impact with Mitigation*)**

***WSP Gen-Tie Corridors*. The potential cumulative geology and soils impacts resulting from the WSP gen-tie projects, combined with impacts from related cumulative projects, would be less than cumulatively significant under near-term and far-term conditions with mitigation. (*Less-than-Significant Cumulative Impact with Mitigation*)**

Geographic Scope of Cumulative Impact Analysis

Geologic and soils impacts relate to physical site conditions which may have an impact on a proposed project, instead of the project having an impact on its setting. Therefore, these impacts tend to be highly localized and generally do not extend beyond individual project boundaries (except perhaps in cases where an older building that is not designed to modern seismic standards may collapse into a neighboring property and the like). In addition, the potential geology and soils impacts associated with the WSP solar development, as well as the potential geology and soils impacts associated with other cumulative projects, would be mitigated on a site-specific basis for each project in accordance with local building standards and regulations, and pursuant to the recommendations of soils and geotechnical engineers for each project, as required by Kings County and Fresno County. Thus the geologic and soils conditions affecting individual projects in the same general vicinity would not accumulate to result in a greater level of geologic and soils impact. Given the relatively flat terrain of the site vicinity, and the absence of large-scale geologic hazards, such as large deep-seated landslides, or potential mud slides or debris flows that would extend beyond project boundaries, it is highly unlikely that geologic and soils impacts would extend beyond the WSP plan area. Therefore, the geographic scope for the cumulative analysis of geologic and soils impacts is conservatively defined to extend no more than ¼ mile beyond the boundaries of the WSP plan area. Lands

located at greater distances have no potential to contribute to cumulatively significant geology and soils impacts in combination with the less-than-significant geology and soils impacts associated with the WSP solar developments.

Regarding the WSP gen-tie corridors, the physical footprint of the gen-tie projects would be very small, during both construction and operation, so the area subject to potential geologic and soils impacts from the gen-tie projects is limited. Therefore, the geographic scope of the cumulative analysis for the gen-tie projects extends to lands adjacent to the gen-tie corridors, and includes the cumulative projects on those adjacent lands.

Westlands Solar Park

Near-Term

Under near-term conditions, there are four pending, approved, and completed projects (or groups of projects) within a ¼ mile radius of the WSP's outside boundaries. All four of these projects comprise solar PV developments. (Note: The Westside Solar project and Westlands Aquamarine solar project, shown in Figure PD-9, are located within the WSP plan area. Since the impacts associated with these projects are addressed in the WSP impact analysis, they are not included again in the list of cumulative projects below.) These solar projects are listed below and described in Section *2.5. Completed, Approved and Pending Projects/ Introduction to Cumulative Impact Analysis*. Their locations are shown in Figure PD-9.

- Mustang/Orion/Kent South
- American Kings
- Mustang 2
- Kettleman

Similar to the conditions within the WSP plan area, the other four cumulative project sites are characterized by flat terrain without hillsides or other topographic or geologic features. The dominant soil type on the three northerly cumulative sites is Lethant clay, which also covers the majority of the WSP plan area, and the primary soil type on the Kettleman site is Houser clay. Both soil types are characterized by perched groundwater conditions. Thus all four cumulative sites and the WSP plan area are subject to poor drainage and high groundwater conditions. Given that geologic and soils conditions are across the neighboring cumulative sites are very similar to those within the WSP plan area, development of the cumulative projects is expected to be subject to similar geologic and soils hazards as identified for the WSP plan area. Thus each cumulative site would be subject similar levels of hazard due to for seismic shaking, liquefaction, seismic settlement, localized slope failures, soils expansion, shallow groundwater conditions, soil corrosivity, and soil erosion, although the nature and severity of some of these hazards would be highly localized depending on location-specific soil conditions (i.e., the potential presence of liquefiable soil lenses would vary from site to site).

The vulnerability of each cumulative project to most seismic and soil hazards would be subject to confirmation and detailed characterization through the completion of geotechnical investigations required prior to the development of each site. As with the WSP solar development, it is expected that the potential seismic and geologic hazards and any adverse soil conditions at the cumulative project sites would be mitigated through building code requirements and design recommendations of geotechnical engineers for each project, as required by Kings County. For the WSP solar development

these measures are specified in MMs GEO-1a through GEO-4a, GEO-5, GEO-6a, and MM HYD-1. The specified soil engineering measures would be expected to fully mitigate or avoid all potentially hazardous geologic and soils conditions noted above for the WSP plan area and would also be required for the cumulative project sites. While constructing the facilities to meet the seismic design criteria of the California Building Code would not completely eliminate the potential for building damage during a major earthquake, it would reduce the potential impacts to public safety and property to less-than-significant levels at both the WSP and the cumulative projects. Therefore, the near-term cumulative geologic and soils impacts associated with WSP solar development would be *less than significant with mitigation*.

Far Term

For far-term conditions, the analysis of cumulative geology and soils impacts considers the full buildout of land uses within Kings County adjacent to and near the WSP plan area (generally includes development within ¼ mile from the WSP boundary), as shown on the Kings County 2035 General Plan. The 'Kings County Land Use Map' of the Land Use Element shows that all lands within ¼ mile of the WSP boundaries are designated as either 'General Agriculture 20 ac.' or 'Exclusive Agriculture 40 ac.' Thus it is reasonable to assume that agricultural production will remain the dominant land use on the adjacent and surrounding lands for the life of the General Plan.

It is important to note that, as is the case with the lands within the WSP plan area, the agricultural designations of the Kings County 2035 General Plan allow the installation of utility-scale PV solar generating facilities (Kings County 2010a). Thus it is possible that additional solar development projects could be proposed in the WSP vicinity within the remaining 20-year planning horizon of the General Plan. Since the adjacent lands to the west of the WSP site are located within Fresno County, the corresponding General Plan designations for Fresno County lands would guide permitted uses on adjacent lands to the west. All lands within ¼ mile of the WSP plan area to the west are designated 'Agriculture' under the Fresno County General Plan (FC 2010). While the Fresno County General Plan does not specifically allow PV solar development on agriculturally-designated lands, the County has established a process for considering solar PV development on agriculturally-designated lands, and has approved a number of solar PV projects under this process (Fresno County 2013). Therefore, it is reasonable to assume that Fresno County would consider proposals for PV solar development on agricultural lands within ¼ mile of the WSP site.

As discussed under 'Near-Term' conditions, it is expected that the potential seismic and geologic hazards and any adverse soil conditions that would affect future solar development adjacent to the WSP site would be mitigated through building code requirements and design recommendations of geotechnical engineers for each project, as would be required for projects in the adjacent areas located in either Kings County or Fresno County. For the WSP solar development these measures are specified in MMs GEO-1a through GEO-4a, GEO-5, GEO-6a, and MM HYD-1. The specified geotechnical and structural engineering measures would be expected to fully mitigate or avoid all of the potential geologic and soils hazards for the WSP plan area and would also be required for the cumulative project sites. While constructing the facilities to meet the seismic design criteria of the California Building Code would not completely eliminate the potential for structural damage during a major earthquake, it would reduce the potential impacts to public safety and property to less-than-significant levels at solar development within the WSP and on the adjacent lands. Therefore, the far-term cumulative geologic and soils impacts associated with WSP solar development would be *less than significant with mitigation*.

WSP Gen-Tie Corridors

Near Term

Under near-term conditions, there are 3 approved and pending solar projects and two transmission projects on lands adjacent to the WSP gen-tie corridors. (Note: The Westside Solar project and Westlands Aquamarine solar project, shown in Figure PD-9, are located within the WSP plan area. Since the impacts associated with these projects are addressed in the WSP impact analysis, they are not included again in the list of cumulative projects below.) These projects are listed below and shown in Figure PD-10, and described in Section *2.5. Completed, Approved, and Pending Projects/Introduction to Cumulative Impact Analysis*.

- Mustang/Orion/Kent South solar projects
- Central Valley Power Connect transmission project (Gates to Gregg Substation)
- Westside Transmission Project (Gates to Dos Amigos/Los Banos Substation)

The WSP gen-tie corridors and the other cumulative near-term projects are subject to similarly low levels of geologic and seismic hazards such as ground shaking, liquefaction, and slope failures. In all cases, the potential geologic hazards would be minimized through compliance with applicable building codes and standards, which would ensure that the projects and facilities are designed and constructed to withstand the level of hazard predicted for each project. As such, the level of geologic hazard would be reduced to less-than-significant levels at each cumulative site, and the cumulative impact from geologic hazards would be *less than significant*.

The soils of the cumulative sites are somewhat variable, ranging from sandy loams along the west side of the valley to more clayey soils toward the interior of the valley. The soil characteristics at each cumulative site would determine the potential for soils expansion, shallow groundwater conditions, soil corrosivity, and soil erosion. However, it is expected that the geotechnical engineering studies that would be required for each cumulative project would identify soils engineering specifications that would incorporated into project design and construction to address any localized adverse soil conditions. For the WSP gen-tie projects these measures are specified in MMs GEO-1b through GEO-4b, GEO-6b, and MM HYD-1. It is expected that the same or similar measures would also be required for the cumulative projects. As such, the level of soils hazard would be reduced to less-than-significant levels at each cumulative site, and the near-term cumulative impact from soils hazards associated with the WSP gen-tie projects would be *less than significant with mitigation*.

Far Term

For far-term conditions, the analysis of cumulative geology and soils impacts considers the full buildout of land uses adjacent to and near the WSP gen-tie corridors, as shown in the general plans of Kings County and Fresno County. Under both counties' general plans, the predominant land use planned in the vicinity of the WSP gen-tie corridors is agricultural. Thus it is reasonable to assume that agricultural production will remain the dominant land use on the adjacent and surrounding lands for the life of the general plan. There is the potential for additional solar and transmission projects to be proposed and planned in the vicinity of the gen-tie corridors over the next 20 years, although the precise location and nature of such projects is currently unforeseeable.

As discussed under 'Near-Term' conditions, it is expected that the potential seismic and geologic hazards and any adverse soil conditions that would affect future development adjacent to the WSP gen-tie corridors would be mitigated through compliance with applicable building codes and standards, as well as design recommendations of geotechnical engineers for each project. For the WSP gen-tie projects these measures are specified in MMs GEO-1b through GEO-4b, GEO-6b, and MM HYD-1. It is expected that the same or similar measures would also be required for the cumulative projects. The specified geotechnical and structural engineering measures would be expected to fully mitigate or avoid all of the potential geologic and soils hazards. Therefore, the far-term cumulative geologic and soils impacts associated with the WSP gen-tie projects would be *less than significant with mitigation*.

Mitigation Measures:

***Westlands Solar Park*. Implement MMs GEO-1a, GEO-2a, GEO-3a, GEO-4a, GEO-5, GEO-6a, and HYD-1. No additional mitigation is required.**

***WSP Gen-Tie Corridors*. Implement MMs GEO-1a, GEO-2a, GEO-3a, GEO-4a, GEO-6a, and HYD-1. No additional mitigation is required.**

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