3.1.2 Geology, Soils, and Seismicity

This section discusses potential impacts to geology, soils, and seismicity resulting from the implementation of the Proposed Project. The analysis is based on the review of existing resources, technical data, and applicable laws, regulations, and guidelines.

3.1.2.1 Existing Conditions

3.1.2.1.1 Regional Overview

Geologic Setting

The project is located on the eastern portion of the Peninsular Range geomorphic province which is a series of northwest-oriented mountain ranges separated by northwest trending valleys, subparallel to faults branching from the San Andreas Fault (CGS 2002). Regionally, the trend of topography is similar to the California Coast Ranges, but the geology is more like the Sierra Nevada, with granitic rock intruding older metamorphic rocks. The Peninsular Ranges extend into lower California and are bound on the east by the Colorado Desert. The project area is close to the western boundary of the Colorado Desert Province—a low-lying barren desert basin caused by a depressed tectonic block (about 245 feet below sea level in part, dominated by the Salton Sea) between active branches of the Elsinore, San Jacinto, and San Andreas fault systems (CGS 2002).

As shown in Figure 3.1.2-1, the project area is underlain by Cretaceous plutonic rocks[1] of the composite Peninsular Ranges Batholith,[2] namely consisting of a bedrock unit known as the Tonalite of La Posta (also referred to as the La Posta Quartz Diorite) (USGS 2004). The bedrock unit is topographically expressed by low hills, valleys, and undulating topography atop an elevated highland, which includes the McCain Valley north of Interstate 8 (I-8), the Campo Valley southwest of I-8, and the gently-sloped Tierra del Sol area. The Tecate Divide—a subtle north–northeast-trending ridge within the Tonalite of La Posta—separates the Rugged, LanEast, and LanWest sites to the northeast from the Tierra del Sol site to the southwest. The divide also separates drainages that discharge to the Salton Sea from drainages that discharge to the Pacific Ocean via the Tijuana River.

Generally, the Tonalite of La Posta is weathered near the surface and supports a sandy topsoil, as discussed for each individual site below. At a regional scale, the granitic rock preferentially weathers along fractures/lineaments in the landscape created by near-vertical tubular bodies of rock up to 0.5 mile thick (USGS 2004). This structure has a tendency to create hills and streams

[1] Plutonic rock is a body of intrusive igneous rock that is crystallized from magma slowly cooling below the surface of the Earth.

[2] A batholith is a large emplacement of plutonic rock (usually at least 40 square miles) that forms from cooled magma deep in the Earth's crust.

oriented roughly parallel to the outer boundary of the batholith. Regionally, the Tonalite of La Posta is bounded to the west and north by higher mountainous peaks (e.g., Laguna Mountains) consisting of a mix of uplifted plutonic and ancient metamorphic rock. Further to the east and northeast, canyons lead out of the mountainous highlands, past older metamorphic rocks, into broader alluvial valleys on the western side of the Salton Trough and within the Anza Borrego State Park and Carrizo Plain regions.

The type, aerial extent, and some key physical and hydrological characteristics of soils mapped within each of the project sites were identified based on a review of soil surveys completed by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) (NRCS 2012a-d). Soil units are shown in Figure 3.1.2-2 and are described in Table 3.1.2-1.

Faults and Seismicity

There are no major active faults—including those faults zoned under the Alquist–Priolo Earthquake Fault Zoning Act[3] (AP Act)—within or near the project area (CGS 2010; County of San Diego 2007). The closest mapped faults are pre-Quaternary in age, over 5 miles to the east of the project area, and are considered to have little to no potential to generate an earthquake. The closest active faults in the region are located over 12 miles to the northeast and beyond, and are associated with the Salton Trough. Holocene-active faults considered capable of producing a large earthquake include, from closest to farthest, the Elsinore Fault Zone (about 12 miles northeast), the San Jacinto Zone (about 29 miles northeast), the Imperial Fault (about 45 miles east–northeast), the Brawley Seismic Zone (about 45 miles east–northeast), the Newport-Inglewood-Rose Fault Zone (about 47 miles west), and the San Andreas Fault (about 56 miles northeast) (CGS 2010). Based on a review of geologic maps and stereoscopic aerial photographs, as well as geologic field mapping, Ninyo and Moore (2012a, 2012b) concluded that the project area is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively).

Ground Shaking

The project sites are located in a seismically active area, as is the majority of Southern California, and the potential for strong ground motion is considered substantial during the design life of the projects. The most recent large seismic event to affect the project vicinity was on Sunday, April 4, 2010, when a magnitude 7.2 earthquake struck an area approximately 30 miles south of Mexicali (Sierra El Mayor Earthquake). The epicenter of the earthquake was well south of the international border, but resulted in observable surface slip on several faults,

[3] Refer to Section 3.1.2.2, Regulatory Setting, for a description of the Alquist–Priolo Earthquake Fault Zoning Act.

or portions of faults, in the southwestern part of the Salton Trough, near Ocotillo (approximately 17 miles west–northwest of the project area). Most fault offsets were minor in magnitude—less than 20 millimeters (about 0.8 inches)—but offsets observed on the Yuha, Pinto Wash, and Ocotillo faults were 50–60 millimeters (about 2 inches), 40 millimeters (1.5 inches), and 85 millimeters (3.3 inches), respectively (USGS and CGS 2011). These faults, occurring in a broad area of the Yuha Desert, were not previously zoned under the AP Act because it was the first time that surface fractures had been observed in the southwestern Salton Trough. Consequently, in 2012, the California Geological Survey (CGS, formerly California Division of Mines and Geology) updated its AP maps to identify portions of the Laguna Salada Section of the Elsinore Fault, the Yuha Wells Fault, and other unnamed faults in the vicinity of Ocotillo as active earthquake fault zones under the AP Act.

The Sierra El Mayor Earthquake is estimated to have resulted in a Modified Mercalli Intensity[4] of VI (strong) to VII (very strong) in the project area (USGS 2010). Typically, ground shaking associated with intensity of VII is associated with negligible damage in buildings of good design and construction; slight to moderate damage in well-built ordinary structures; and considerable damage in poorly built or badly designed structures (e.g., brick and unreinforced masonry) (USGS 2012). These are only estimates based on correlations between average peak ground accelerations (PGAs) and the observed level of damage in past earthquakes—the actual level of shaking experienced and the level of damage caused in any one place is highly site- and earthquake-specific.

The primary tool that seismologists use to describe potential for future ground shaking hazards is a probabilistic seismic hazard assessment (PSHA). The PSHA for the State of California takes into consideration the range of possible earthquake sources (including worst-case scenarios) and estimates their characteristic magnitudes to generate a probability map for ground shaking. The PSHA maps depict values of PGA[5] with a 10% probability of being exceeded in 50 years (i.e., a 1 in 475 annual chance). Use of this probability level allows engineers to design structures to withstand ground motions with a 90% chance of *not* occurring in the next 50 years, making buildings safer than if they were merely designed for the most probable events.

The PSHA for the State of California indicates that the project area is unlikely to experience

[4] This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction (I – XII), does not have a mathematical basis; instead it is an arbitrary ranking shaking intensity based on observed effects.

[5] The PGA for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. PGA is expressed as a percentage of the constant value of acceleration due to gravity (g) (approximately 980 centimeters per second squared). Unlike measures of magnitude, which provide a single measure of earthquake energy, PGA resulting from an earthquake varies from place to place, depending on distance from the earthquake epicenter and character of the underlying geology (e.g., hard bedrock, soft sediments, or artificial fills).

severe or highly destructive levels of ground shaking, primarily as a result of its distance from historically active faults. In the project area, there is only a 10% chance of exceeding PGA values of 0.27–0.33g over the next 50 years, with the lower values corresponding to areas over bedrock, and the higher values corresponding to areas over unconsolidated alluvium (CGS 2003). In its review of expected ground motions on the Tierra del Sol and Rugged sites, Ninyo and Moore (2012a, 2012b) estimated that the PGA having a 1 in 2,475 annual chance of occurring (equivalent to a 2% chance in 50 years) is approximately 0.45g and 0.49g, respectively. Such values of PGA are typically associated with an earthquake with a Modified Mercalli Intensity of VIII, which would likely cause substantial damage in buildings not constructed according to modern building standards, with older brick or unreinforced masonry buildings prone to collapse. Structures adequately designed to current standards could also suffer cosmetic or utility damage, but would be unlikely to experience either full or partial structural collapse.

When compared to other areas of California, particularly the urban areas of Southern California and the Bay Area which are close to historically active faults, these levels of PGA are relatively low. This information is consistent with the County's geologic hazard guidelines, which does not identify any of the project sites as being within a near-source shaking zone (County of San Diego 2007, Figure 3).

3.1.2.1.2 Tierra del Sol

Geology, Topography, and Soils

The Tierra del Sol site ranges in elevation from approximately 3,530 feet above mean sea level (amsl) on its southeastern border to about 3,742 feet amsl in the west-central area. Most areas of the project site are moderately sloped, between 3% and 5% at the high point, gradually flattening out towards the project boundaries (see Appendix 3.1.5-1). Localized site areas contain slopes greater than 10%. According to the site reconnaissance and subsurface exploration performed by Ninyo and Moore (2012a), the site is underlain by weathered to fresh granitic rock of the Tonalite of La Posta and localized areas underlain by alluvium and colluvium.[6] Alluvial soils are primarily associated with the Mottsville soil series (unit *Mvc*) shown in Figure 3.1.2-2. Ninyo and Moore (2012a) observed surficial soils such as topsoil and minor fills to be present but generally shallow—less than 2 feet thick.

[6] Colluvium is the name for loose bodies of sediment that have been deposited or built up at the bottom of a slope or against a barrier on that slope, transported by gravity.

Soils on the Tierra del Sol site all have similar characteristics; all are primarily coarse sands with some loam,[7] are well-drained with low-to-moderate runoff potential, have a high wind erosion susceptibility, low shrink/swell potential, and low-to-moderate risk of corrosion (NRCS 2012a). Site-specific testing by Ninyo and Moore (2012a), indicates the soils would not be classified as corrosive based on California Department of Transportation (Caltrans) guidelines. The soils on site tend to have significant fractions of gravel and cobbles. The soils are generally poorly developed, meaning they are young, support fairly thin topsoils, and do not differ greatly in character from the underlying weathered bedrock material (which in this case, is also referred to as decomposed granite, or gruss). None of the soil units identified above are on the County's list of hydric or clay soils (County of San Diego 2007, Table 1 and 2).

Liquefaction

Based on Ninyo and Moore's geotechnical investigation, liquefaction is not considered an issue on the Tierra del Sol site because no shallow groundwater was observed and because unconsolidated soils are shallow (Ninyo and Moore 2012a). This finding is consistent with the County's geologic hazard guidelines, which does not identify the Tierra del Sol site as being within a potential liquefaction area (County of San Diego 2007, Figure 4).

Landslides

Based on Ninyo and Moore's geotechnical investigation, landslides are not considered an issue on the Tierra del Sol site because no evidence of landslides was observed and because slope gradients are low (Ninyo and Moore 2012a). This finding is consistent with the County's geologic hazard guidelines, which does not identify the Tierra del Sol site as being within a landslide susceptibility area (County of San Diego 2007, Figure 5).

Expansive Soils

Based on the soil survey, the potential for expansive soils to be present on the Tierra del Sol site is low. Due to the sandy granular character of the soils and their low organic content, soils are generally non-plastic and therefore not prone to shrink-swell behavior (NRCS 2012a; Ninyo and Moore 2012a). In addition, the Tierra del Sol site is not within an area identified as having expansive soils in the County's geologic hazard guidelines (County of San Diego 2007, Figure 6).

[7] Loam is soil composed of sand, silt, and clay in relatively even concentration (about 40-40-20% concentration respectively). The term is often qualified to indicate a relative abundance of one constituent over others (e.g., a "sandy loam" is a loam, but where sand is more abundant than silt and clay).

3.1.2.1.3 Rugged

Geology, Topography, and Soils

Elevations on the Rugged site range from approximately 3,510 feet amsl in the easternmost portion of the site, east of McCain Valley Road, to approximately 3,680 feet amsl in the northern portion of the site. Due to the rugged and valley terrain of the watershed, some areas are steep with scattered rock outcroppings, and other areas are relatively flat with existing vegetation, including oak trees. Like the Tierra del Sol site, the bedrock underlying the project site is composed of the Tonalite of La Posta, which is mantled in localized areas by alluvium or colluvium. The site encompasses a portion of Tule Creek, which is an intermittent creek that flows southwest in an open area between 500 and 1,000 feet wide and with a slope of 1% (Appendix 3.1.5-2).

Soil units on the project site are described in Table 3.1.2-1. Approximately 16% of the site is underlain by deeper alluvial soils (*Lu*) associated with Tule Creek; these soils, along with the Tollhouse rocky coarse sandy loam (*ToE2*) and rock outcrops (*AcG*) belong to Hydrologic Groups C and D (higher runoff potential), primarily as a result of a higher fraction of silt and clay (for the alluvial soils), or because of the shallow depth to a restrictive layer[8] (for the Tollhouse soil and rock outcrops). These conditions cause a higher portion of precipitation to be conveyed as runoff compared to deep, highly-permeable soils. None of the soil units on the project site are on the County's list of clay soils (County of San Diego 2007, Table 2). However, the alluvial land (soil unit *Lu*, as Shown in Figure 3.1.2-2) is on the County's list of hydric soils, most likely because the soil unit is generally coterminous with creek corridors and floodplains (County of San Diego 2007, Table 1).

Liquefaction

Portions of the Rugged site along Tule Creek are identified in the County guidelines (County of San Diego 2007, Figure 4) as potential liquefaction areas. This is primarily due to the presence of the Tule Creek corridor, where seasonally shallow groundwater may be present, and where the soils are sandy enough to liquefy when saturated. The potential susceptibility to liquefaction is echoed by the geologic reconnaissance of the site conducted by Ninyo and Moore (2012b). The area identified as having the potential for liquefaction is roughly equivalent to the area mapped as alluvial land (*Lu*). All other areas of the site would have a low potential for liquefaction. This issue is further discussed in Section 3.1.2.2.

[8] A "restrictive layer" may be caused by a highly clayey soil horizon, hardpan, or lithic (hard) bedrock.

Landslides

The Rugged site is not within a landslide susceptibility area identified in the County's geologic hazard guidelines (County of San Diego 2007, Figure 5). Portions of the site are sloped, but not steeply. Furthermore, the site is underlain by granitic bedrock which is not typically prone to substantial slope failure in areas that are not steeply sloped. For these reasons, the geologic reconnaissance by Ninyo and Moore (2012b) determined that slope stability and landslides would not be issues of concern. The landslide hazard on the site is therefore considered to be low.

Expansive Soils

Based on the soil survey, the potential for expansive soils to be present on the Rugged site is generally low. Due to the sandy granular character of the soils and their low organic content, soils are generally non-plastic and therefore not prone to shrink-swell behavior (NRCS 2012b). The Rugged site is not within an area identified as having expansive soils in the County's geologic hazard guidelines (County of San Diego 2007, Figure 6). However, areas over alluvial land (*Lu*), due to the potential to contain a higher fraction of clay, are mapped by the NRCS as having a moderate shrink-swell potential (see Table 3.1.2-1).

3.1.2.1.4 LanEast

Geology, Topography, and Soils

The LanEast site is a combination of relatively level land in most areas of the site with slightly higher slopes near the Walker Creek corridor and the site's southern edge. Elevations range from a low point of 3,070 feet amsl on the southeastern end of the site to 3,290 feet amsl in the northwestern corner. Walker Creek passes along the southeastern portion of the site prior to entering Walker Canyon past the site's eastern boundary. Slope gradients range from flat to gently sloped, with most areas of the site between 0 and 5 degrees and local areas on the southeastern side up to 15 degrees. The mapped geologic units underlying the site consist of the Tonalite of La Posta and young alluvium, with the Indian Hill Granodiorite closely bordering the site to the south. Soil units, as shown in Figure 3.1.2-2 and Table 3.1.2-1, include a combination of the La Posta rocky loamy coarse sand, alluvial land, the Mottsville loamy coarse sand, and a small area consisting of the Tollhouse rocky coarse sandy loam. None of the soil units identified above are on the County's list of clay soils (County of San Diego 2007, Table 2). However, the alluvial land is on the County's list of hydric soils, most likely because the soil unit is generally coterminous with creek corridors and floodplains (County of San Diego 2007, Table 1).

Liquefaction

A small portion of the LanEast site along Walker Creek is identified in the County guidelines (County of San Diego 2007, Figure 4) as a potential liquefaction area. This is primarily due to the presence of the Walker Creek corridor, where seasonally shallow groundwater may be present, and where the soils are sandy enough to liquefy when saturated. The area identified as having the potential for liquefaction is roughly equivalent to the area mapped as alluvial land (*Lu*).

Landslides

The LanEast site is not within a landslide susceptibility area identified in the County's geologic hazard guidelines (County of San Diego 2007, Figure 5). Most of the site is gently sloped, and is underlain by granitic bedrock which is not typically prone to substantial slope failure. General soil and slope conditions are not greatly different from the Rugged site, where geologic reconnaissance by Ninyo and Moore (2012b) determined that slope stability and landslides would not be issues of concern. The landslide hazard on the site is therefore considered to be low.

Expansive Soils

Based on the soil survey, the potential for expansive soils to be present on the LanEast site is generally low. Due to the sandy granular character of the soils and their low organic content, soils are generally non-plastic and therefore not prone to shrink-swell behavior (NRCS 2012c). The site is not within an area identified as having expansive soils in the County's geologic hazard guidelines (County of San Diego 2007, Figure 6). However, areas over alluvial land (*Lu*), due to the potential to contain a higher fraction of clay, are mapped by the NRCS as having a moderate shrink-swell potential (see Table 3.1.2-1).

3.1.2.1.5 LanWest

Geology, Topography, and Soils

The LanWest site consists of a combination of relatively level land on the southern and central portions of the site with rolling rock and boulder covered hills on the northwestern portion. Elevations on the site range from a low point of 3,190 feet amsl on the southeastern side of the site to 3,330 feet amsl on the northwestern side. A small intermittent creek corridor passes along the southern portion of the site. Slope gradients range from flat to gently sloped, with most of the site between 0 and 5 degrees and local areas on the northwestern side up to 15 degrees. The mapped geologic unit underlying the LanEast solar farm consists of the Tonalite of La Posta. Soil units, as shown in Table 3.1.2-1, include approximately equal parts of the La Posta rocky

loamy coarse sand and the Mottsville loamy coarse sand. None of the soil units identified above are on the County's list of hydric or clay soils (County of San Diego 2007, Tables 1 and 2).

Liquefaction

The County's geologic hazard guidelines do not identify the LanWest site as being within a potential liquefaction area (County of San Diego 2007, Figure 4). While regional geologic mapping does not indicate the site is underlain by young alluvium (USGS 2004), about half of the site is underlain by the Mottsville loamy coarse sand, which is identified by the NRCS as a soil unit that is derived from alluvium. The soil profile is over 60 inches thick (which is the maximum depth to which pedogenic soils are characterized). This means that depending on site-specific circumstances, the site may or may not contain liquefiable soils depending on the presence, depth and character of unconsolidated alluvium. This issue is further discussed in Section 3.1.2.2.

Landslides

The LanWest site is not within a landslide susceptibility area identified in the County's geologic hazard guidelines (County of San Diego 2007, Figure 5). Most of the site is gently sloped and is underlain by granitic bedrock which is not typically prone to substantial slope failure. General soil and slope conditions are not greatly different from the Rugged site, where geologic reconnaissance by Ninyo and Moore (2012b) determined that slope stability and landslides would not be issues of concern. The landslide hazard on the site is therefore considered to be low.

Expansive Soils

Based on the soil survey, the potential for expansive soils to be present on the LanWest site is low. Due to the sandy granular character of the soils and their low organic content, soils are generally non-plastic and therefore not prone to shrink-swell behavior (NRCS 2012d). In addition, the LanWest site is not within an area identified as having expansive soils in the County's geologic hazard guidelines (County of San Diego 2007, Figure 6).

3.1.2.2 Regulatory Setting

Federal Regulations

The following federal regulations pertaining to geologic hazards would apply to the Proposed Project.

Occupational Safety and Health Administration (OSHA) Regulations

Excavation and trenching are among the most hazardous construction operations. The Occupational Safety and Health Administration's (OSHA) Excavation and Trenching standard, Title 29 of the Code of Federal Regulation (CFR), Part 1926.650, covers requirements for excavation and trenching operations. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. In California, the California Occupational Safety and Health Administration (Cal/OSHA) has responsibility for implementing federal rules relevant to worker safety, including slope protection during construction excavations. Cal/OSHA's requirements are more restrictive and protective than federal OSHA standards.

U.S. Geological Survey Landslide Hazard Program

In fulfillment of the requirements of Public Law 106-113, the USGS created the Landslide Hazard Program in the mid-1970s. According to USGS, the primary objective of the National Landslide Hazards Program is to reduce long-term losses from landslide hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies (County of San Diego 2011a). The federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility. In San Diego County, the Unified Disaster Council (UDC) is the governing body of the Unified San Diego County Emergency Services Organization. The primary purpose of the UDC and the Emergency Services Organization is to provide for the coordination of plans and programs designed for the protection of life and property in the County of San Diego.

State Regulations

The statewide minimum public safety standard for mitigation of earthquake hazards (as established through the California Building Code (CBC), Alquist–Priolo Earthquake Fault Zoning Act, and the Seismic Hazards Mapping Act) is that the minimum level of mitigation for a project should reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy,[9] but in most cases, is not required to prevent or avoid the ground failure itself. It is not feasible to design all structures to completely avoid damage in worst-case earthquake scenarios. Accordingly, regulatory agencies have generally defined an "acceptable level" of risk as that which provides reasonable protection of the public safety; although it does not necessarily ensure continued structural integrity and functionality of a project (14 CCR 3721(a). Nothing in these acts,

[9] A "structure for human occupancy" is any structure used or intended for supporting or sheltering any use or occupancy, which is expected to have a human occupancy rate of more than 2,000 person-hours per year.

however, precludes lead agencies from enacting more stringent requirements, requiring a higher level of performance, or applying these requirements to developments other than those that meet the acts' definitions of "project."

Alquist–Priolo Earthquake Fault Zoning Act

The Alquist–Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the State Geologist established regulatory zones, called "earthquake fault zones," (EFZs) around the surface traces of active faults and has published maps showing these zones. EFZs are designated by the CGS and are delineated along traces of faults where mapping demonstrates surface fault rupture has occurred within the past 11,000 years. Construction within these zones cannot be permitted until a geologic investigation has been conducted to prove that a building planned for human occupancy will not be constructed across an active fault. These types of site evaluations address the precise location and recency of rupture along traces of the faults and are typically based on observations made in trenches excavated across fault traces.

The Proposed Project is not within an Alquist–Priolo Earthquake Fault Zone and therefore is not subject to the requirements of this act.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (PRC, Chapter 7.8, Section 2690 et seq.) directs the CGS to protect the public from earthquake-induced liquefaction and landslide hazards (note that these hazards are distinct from fault surface rupture hazard regulated by the Alquist–Priolo Earthquake Fault Zoning Act of 1972). This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones (i.e., zones of required investigation). Before a development permit may be granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. Evaluation and mitigation of potential risks from seismic hazards within zones of required investigation must be conducted in accordance with the CGS, Special Publication 117A, adopted March 13, 1997, by the State Mining and Geology Board as updated in 2008.

As of 2012, Seismic Hazard Zone Maps have been prepared for portions of populated areas of Southern California and the San Francisco Bay Area; however, no seismic hazard zones have yet been delineated for the project area. As a result, the provisions of the Seismic Hazards Mapping Act would not apply to the project.

California Building Code

The CBC has been codified in the California Code of Regulations (CCR) as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the CBC is to establish minimum standards to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction. The 2010 edition of the CBC is based on the 2009 International Building Code published by the International Code Conference. The 2010 CBC contains California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (such as wind loads) for inclusion into building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

Local Regulations

The following local/regional regulations pertaining to geology, soils, and seismicity would apply to the Proposed Project.

County Special Studies Zones

The Alquist–Priolo (AP) Act provides that a city or county may establish more restrictive policies than those within the AP Act, if desired. The County established Special Study Zones that include late-Quaternary faults mapped by the CGS in the County. Late-Quaternary faults (movement during the past 700,000 years) were mapped based on geomorphic evidence similar to that of Holocene faults except that tectonic features are less distinct. As indicated by the CGS, these faults may be younger, but the lack of younger overlying deposits precludes more accurate age classification. Traces of faults within "Special Study Zones" are treated by the County as active unless a fault investigation can prove otherwise. Before any construction is allowed, a geologic study must be conducted to determine if any active fault lines are located on or within the vicinity of the project site.

San Diego County General Plan

The 2011 County General Plan guides future growth in the unincorporated areas of the County and considers projected growth anticipated to occur within various communities. The following

goals and policies from several General Plan elements were determined to be applicable to the Proposed Project.

Safety Element

The following goals and policies of the Safety Element are applicable to the Proposed Project.

Goal S-7: Reduced Seismic Hazards. Minimized personal injury and property damage resulting from seismic hazards.

- **Policy S-7.1: Development Location**. Locate development in areas where the risk to people or resources is minimized. In accordance with the California Department of Conservation Special Publication 42, require development be located a minimum of 50 feet from active or potentially active faults, unless an alternative setback distance is approved based on geologic analysis and feasible engineering design measures adequate to demonstrate that the fault rupture hazard would be avoided.
- **Policy S-7.2: Engineering Measures to Reduce Risk.** Require all development to include engineering measures to reduce risk in accordance with the CBC, Uniform Building Code, and other seismic and geologic hazard safety standards, including design and construction standards, that regulate land use in areas known to have or potentially have significant seismic and/or other geologic hazards.
- **Policy S-7.3: Land Use Location.** Prohibit high occupancy uses, essential public facilities, and uses that permit significant amounts of hazardous materials within Alquist–Priolo and County special studies zones.

Goal S-8: Reduced Landslide, Mudslide, and Rock Fall Hazards. Minimized personal injury and property damage caused by mudslides, landslides, or rock falls.

- **Policy S-8.1: Landslide Risks.** Direct development away from areas with high landslide, mudslide, or rock fall potential when engineering solutions have been determined by the County to be infeasible.
- **Policy S-8.2: Risk of Slope Instability.** Prohibit development from causing or contributing to slope instability.

San Diego County Code

Grading Ordinance

Division 7 of Title 8 of the San Diego County Code (County of San Diego 2011b), Grading Ordinance, establishes the requirement to obtain a grading permit prior to grading operations.

The grading ordinance requires the submittal of grading plans or improvement plans for review by the County Official (Director of Public Works or his or her authorized representative) prior to issuance of a grading permit. The ordinance contains design standards and performance requirements which must be met to avoid or reduce to an acceptable level the potential for slope instabilities, expansive soils, excessive erosion, and sedimentation to adversely affect the proposed development (Chapter 4). The ordinance sets forth the maximum slope allowed for cut and fill slopes, the requirement for drainage terraces on cut or fill slopes exceeding 40 feet in height, expansive soil requirements for cuts and fills, minimum setback requirements for buildings from cut or fill slopes, and reporting requirements including a soil engineer's report and a final engineering geology report by an engineering geologist, which includes specific approval of the grading as affected by geological factors. The ordinance also contains requirements to reduce effects on air quality (Section 87.428, dust control), native habitat (Section 87.503), cultural and paleontological resources (Sections 87.429 and 87.430), and watercourses (Chapter 6). Upon review of grading plans, the County Official has the authority to approve, attach conditions of approval, or deny the permit application.

The applicant for the Proposed Project would be required to submit a soil investigation report which would include, but would not be limited to, data regarding the nature, distribution, and strength of existing soils and rock on the site; the soil engineer's conclusions and recommendations for grading requirements, including the correction of weak or unstable soil conditions and treatment of any expansive soils that may be present; and his opinions as to the adequacy of building sites to be developed by the proposed grading operations (Section 87.209). The soil engineer shall provide an engineering geology report by an engineering geologist when required by the County Official. Recommendations included in such reports and approved by the County Official shall be incorporated in the grading plan or specifications.

On-Site Wastewater Treatment System Ordinance

Chapter 3, Division 8, of Title 6 of the San Diego County Code (County of San Diego 2011c) establishes the requirements foroOn-site wastewater treatment systems (OWTS) in the County. The purpose of this chapter is to implement state laws and regulations associated with waste discharge requirements (State Water Resources Control Board and the California Regional Water Quality Control Boards (RWQCBs) for San Diego Region) and implement additional standards for septic systems and graywater systems that are necessary to protect the health and safety of the San Diego County community. It also makes it unlawful for any person to cause, suffer, or permit the disposal of sewage, human excrement, or other liquid wastes, in any place or manner except through and by means of an approved plumbing and drainage system and an approved sewage disposal system.

Provided that no public sanitary sewer system is available, the ordinance allows for installation of OWTS provided that the requirements and standards of the ordinance are complied with and a permit issued by the Department of Environmental Health is obtained. Standards and requirements include, but are not limited to soil percolation tests to determine soil suitability, the selection of a treatment system appropriate for the site conditions, and specific setback requirements from lakes, streams, ponds, slopes, and other utilities and structures. Chapter 6, Division 8, of Title 6 of the County Code pertains to Septic Tank and Cesspool Cleaners, which establishes processes, fees, and requirements for the examination, cleaning, and collection of sewage from septic tanks and cesspools.

San Diego County Zoning Ordinance Fault Displacement Area Regulations

The County Zoning Ordinance Sections 5400 through 5406 (County of San Diego 2011d) implement the requirements of the AP Act. The provisions of Sections 5400 through 5406 outline the allowable development, permitting requirements, and construction limitations within Fault Rupture Zones, as designated by the AP Act. For non-discretionary permits (such as building permits), the Department of Planning and Land Use, Building Division requires any above-surface structure to conform to the seismic requirements of the CBC and to incorporate design recommendations contained within the soils and geologic report as required per code. The County prohibits any buildings or structures to be used for human occupancy to be constructed over or within 50 feet of the trace of known fault (Section 5406, Zoning Ordinance). The County generally requires geologic reports for development proposed in AP Zones (Section 5406 b, Zoning Ordinance).

Other specific zoning ordinance sections do the following:

- Prohibit construction of essential facilities and high occupancy structures in special studies zones as defined under the AP Act or in special studies zones defined by the County of San Diego (Section 5404, Zoning Ordinance)
- Require a geologic report for other development proposed in special studies zones as defined under the AP Act or in special studies zones defined by the County of San Diego (Section 5406, Zoning Ordinance)
- Prohibit new construction of structures to be used for hazardous waste storage and/or human or animal occupancy over or within 50-feet of the trace of an active known fault, with the exception of single-family wood-frame dwellings not exceeding two stories in height, built or located as part of a development of less than four dwellings and mobile homes wider than eight feet (Section 5406 c & d, Zoning Ordinance)
- Delineate special studies zones along active faults as new geologic information becomes available. These special study zones shall be administered in the same manner as those delineated by the State of California.

3.1.2.3 Analysis of Project Effects and Determination as to Significance

The Proposed Project consists of four renewable energy solar farms in southeastern San Diego County. The following impact analysis has been separated into discussions for each of the four solar farms: Tierra del Sol, Rugged, LanEast, and LanWest, as well as a combined discussion of the Proposed Project as a whole. For the purposes of this Program EIR, the Tierra del Sol and Rugged solar farms are analyzed at a project-level, whereas the LanEast and LanWest solar farms are analyzed at a programmatic level as sufficient project-level data has not been developed at this time.

Methodology and Assumptions

This section characterizes the geologic and seismic hazards in the Proposed Project area in order to evaluate their potential adverse effects on the project as well as the potential for the project to create or worsen such hazards for the public and/or surrounding properties. For geology and soil conditions, the study area is typically limited to the footprint of the Proposed Project whereas for seismic hazards, the study area is regional, because earthquakes on distant faults can produce ground shaking on the project site.

The scope of the impact analysis reflects the significance thresholds contained in the County's *Guidelines for Determining Significance and Report Format and Content Requirements: Geologic Hazards* (County of San Diego 2007), which addresses fault rupture, ground shaking, liquefaction, landslides, and expansive soils. Baseline information against which potential impacts of the project are compared is derived from a variety of sources, including maps and surveys from the U.S. Geological Survey (USGS), the U.S. Department of Agriculture, the CGS, and the County of San Diego General Plan. The impact analysis is based in large part on, preliminary geologic reports completed by Ninyo and Moore (2012a, 2012b) and the aforementioned County significance guidelines. Groundwater resources investigation reports completed for the Tierra del Sol and Rugged sites were also used for this analysis.

3.1.2.3.1 Fault Rupture

Guidelines for the Determination of Significance

For the purpose of this EIR, the County's *Guidelines for Determining Significance and Report Format and Content Requirements: Geologic Hazards* (July 30, 2007) applies to both the direct impact analysis and the cumulative impact analysis. These significance guidelines have been developed by the County to address question VI a) i) in the CEQA Guidelines, Appendix G, and to ensure compliance with Fault Displacement Area regulations within the County Zoning Ordinance.

A significant impact would result if:

- The project would propose any building or structure to be used for human occupancy over or within 50 feet of the trace of an Alquist–Priolo fault or County Special Study Zone fault
- The project proposes the following uses within an AP Zone which are prohibited by the County: i) uses containing structures with a capacity of 300 people or more; ii) uses with the potential to severely damage the environment or cause major loss of life; iii) specific civic uses including police and fire stations, schools, hospitals, rest homes, nursing homes, and emergency communication facilities.

Analysis

Tierra del Sol

As discussed in the existing conditions section, the Tierra del Sol project would be not be located in a fault rupture hazard zone identified by the Alquist–Priolo Earthquake Fault Zoning Act, nor would it be located within any other area with substantial evidence of an active or potentially active fault. In addition, the project does not include high-occupancy structures (with a capacity of 300 people or more), critical facilities, or specific civic uses. Therefore, the Tierra del Sol project would have **no impact** from the exposure of people or structures to adverse effects from a known fault-rupture hazard zone.

Rugged

As discussed in the existing conditions section, the Rugged site would be not be located in a fault rupture hazard zone identified by the Alquist–Priolo Earthquake Fault Zoning Act, nor would it be located within any other area with substantial evidence of an active or potentially active fault. In addition, the Rugged solar farm does not include high-occupancy structures (with a capacity of 300 people or more), critical facilities, or specific civic uses. Therefore, the Rugged solar farm would have **no impact** from the exposure of people or structures to adverse effects from a known fault-rupture hazard zone.

LanEast and LanWest

As discussed in the existing conditions section, the LanEast and LanWest solar farms would be not be located in a fault rupture hazard zone identified by the Alquist–Priolo Earthquake Fault Zoning Act, nor would they be located within any other area with substantial evidence of an active or potentially active fault. In addition, the solar farms do not include high-occupancy structures (with a capacity of 300 people or more), critical facilities, or specific civic uses. Therefore, the LanEast and the LanWest solar farms would have **no impact** from the exposure of people or structures to adverse effects from a known fault-rupture hazard zone.

Proposed Project

None of the project sites are located within or near a fault rupture hazard zone, and therefore, there would be **no impact** to the project sites with respect to exposure of people or structures to adverse effects from a known fault-rupture hazard zone.

3.1.2.3.2 Ground Shaking

Guidelines for the Determination of Significance

For the purpose of this EIR, the County's *Guidelines for Determining Significance and Report Format and Content Requirements: Geologic Hazards* (July 30, 2007) applies to both the direct impact analysis and the cumulative impact analysis. These significance guidelines have been developed by the County to address question VI a) ii) in the CEQA Guidelines, Appendix G. A significant impact would result if:

- The project would be located within a County Near-Source Shaking Zone or within Seismic Zone 4 and the project does not conform to the Uniform Building Code (UBC).

Analysis

Tierra del Sol

The Tierra del Sol site could be subject to strong ground shaking in the event of a large earthquake on any of the active or potentially active faults in the greater Southern California region. However, as discussed in the existing conditions section, the chances of the project vicinity experiencing severe or highly damaging levels of ground shaking is low. The project site is not within a near-source shaking zone identified on the county hazard maps (County of San Diego 2007, Figure 4), and the peak ground acceleration with a 2% chance of occurring in the next 50 years (i.e., equivalent to a 1 in 2,475 annual chance) is estimated to be approximately 0.45g.[10] Such levels of ground shaking have in the past been associated with MMI VIII (very strong), which can cause substantial damage and possible collapse in old brick and unreinforced-masonry-type structures, but only minor damage to newer buildings constructed in accordance with modern building standards. Building codes currently in effect are intended to prevent substantial damage and structural collapse of buildings in "design earthquakes," which are usually equivalent to earthquakes with a 10% chance of occurring in the next 50 years, or for critical facilities (e.g., hospitals, emergency operations centers, fire stations), a 2% chance.

[10] Peak ground accelerations are expressed as a percentage of the constant value of acceleration due to gravity (g), which is approximately 980 centimeters per second squared.

As the project would consist of arrays of trackers, the public safety implications of damage or collapse of these structures would be negligible. The proposed solar farm site would be off-limits to the public, and none of the surrounding properties are developed or for other reasons highly vulnerable to the structural toppling of the trackers (which would be highly improbable for properly designed, seismically-compliant structures). Adequate seismic design, while important for all structures, would be most important in the Tierra del Sol operations and maintenance (O&M) building, because it would be staffed and thus considered a structure for human occupancy under California law, as well as for areas (if any) containing or storing hazardous materials in any quantity, because incidental release of such materials could pose a threat to the public or the environment.

To ensure the structural integrity of all buildings and structures, the Tierra del Sol solar farm would conform to the seismic design requirements as outlined within the CBC, which contains universal standards for proper site preparation and grading practices, adequate design of foundation, and guidelines for the appropriate selection and use of construction materials. The local agency that enforces the CBC is the County Department of Planning and Development Services (PDS), which reviews applications for building permits for compliance with the CBC, local amendments to the CBC, and County zoning ordinances. Grading plans would also be reviewed for compliance with state and local standards (as discussed in Section 3.1.2.2). As part of the development review process, the County requires a soil investigation report which would include, but would not be limited to, data regarding the nature, distribution, and strength of existing soils and rock on the site; the soil engineer's conclusions and recommendations for grading requirements, including the correction of weak or unstable soil conditions and treatment of any expansive soils that may be present; and his/her opinions as to the adequacy of building sites to be developed by the proposed grading operations. Further, building permits would not be approved unless engineering designs and construction plans incorporated appropriate seismic design parameters, which would be developed in a project-specific geotechnical report.

Because the site would be required to comply with state and local building and grading standards, substantial adverse effects from strong seismic ground shaking would be avoided or reduced to acceptable levels. Potential adverse effects from strong seismic ground shaking would therefore be **less than significant**.

Rugged

Similar to the Tierra del Sol solar farm, while the Rugged solar farm site could be subject to strong ground shaking in the event of a large earthquake on any of the active or potentially active faults in the greater Southern California region, it is not within a near-source shaking zone identified on the county hazard maps (County of San Diego 2007, Figure 4), and there is only a 10% chance of exceeding PGA values of 0.27–0.33g over the next 50 years. As the project

would consist of arrays of trackers, the public safety implications of damage or collapse of these structures would be negligible. The Rugged site would be off-limits to the public, and none of the surrounding properties are developed or for other reasons vulnerable to the structural toppling of trackers (which would be highly improbable for properly designed, seismically-compliant structures).

To ensure the structural integrity of all buildings and structures, the project would conform to the seismic design requirements as outlined within the CBC. The County PDS reviews applications for building permits for compliance with the CBC, local amendments to the CBC, and County zoning ordinances. Grading plans would also be reviewed for compliance with state and local standards (as discussed in Section 3.1.2.2).

Because the site would be required to comply with state and local building and grading standards, substantial adverse effects from strong seismic ground shaking would be avoided or reduced to acceptable levels. Potential adverse effects from strong seismic ground shaking would therefore be **less than significant**.

LanEast and LanWest

Similar to the Tierra del Sol solar farm, while the LanEast and LanWest solar farm sites could be subject to strong ground shaking in the event of a large earthquake on any of the active or potentially active faults in the greater Southern California region, they are not within a near-source shaking zone identified on the county hazard maps (County of San Diego 2007, Figure 4), and there is only a 10% chance of exceeding PGA values of 0.27–0.33g over the next 50 years. As the project would consist of arrays of trackers, the public safety implications of damage or collapse of these structures would be negligible. The LanEast and LanWest sites would be off-limits to the public, and none of the surrounding properties are developed or for other reasons vulnerable to the structural toppling of trackers (which would be highly improbable for properly designed, seismically-compliant structures).

To ensure the structural integrity of all buildings and structures, the project would conform to the seismic design requirements as outlined within the CBC. The County PDS reviews applications for building permits for compliance with the CBC, local amendments to the CBC, and County zoning ordinances. Grading plans would also be reviewed for compliance with state and local standards (as discussed in Section 3.1.2.2).

Because the site would be required to comply with state and local building and grading standards, substantial adverse effects from strong seismic ground shaking would be avoided or reduced to acceptable levels. Potential adverse effects from strong seismic ground shaking would therefore be **less than significant**.

Proposed Project

Because the County PDS would review building permit applications for the Proposed Project for compliance with the seismic design provisions of the CBC, local amendments to the CBC, and County zoning ordinances, on-site structures would be built in a manner that would reduce or avoid the potential for substantial damage or collapse. Given the project sites would be off limits to the public, and that structures would be built according to modern building codes, potential adverse effects from strong seismic ground shaking would be **less than significant.**

3.1.2.3.3 Liquefaction

Guidelines for the Determination of Significance

For the purpose of this EIR, the County's *Guidelines for Determining Significance and Report Format and Content Requirements: Geologic Hazards* (July 30, 2007) applies to both the direct impact analysis and the cumulative impact analysis. The following significance guidelines have been developed by the County to address question a) iii) and the portion of question c) that addresses on-site and off-site lateral spreading or liquefaction in the CEQA Guidelines, Appendix G. A significant impact would result if:

- The project site has potential to expose people or structures to substantial adverse effects because i) the project site has potentially liquefiable soils, ii) the potentially liquefiable soils are saturated or have the potential to become saturated, and iii) in-situ soil densities are not sufficiently high to preclude liquefaction.

Analysis

As discussed above in the analysis of ground shaking, the project vicinity could be subject to strong levels of seismic shaking in the future. Liquefaction is a phenomenon that can occur under a specific set of circumstances that can substantially amplify the normally expected magnitude of shaking and can lead to loss of bearing pressure in normally competent soils. As indicated in the significance criteria, an area that has low in situ soil densities (which typically include loose sandy soils) and a shallow or perched groundwater table has the potential to liquefy if subject to a strong earthquake. The most severe liquefaction effects occur when the thickness of loose sandy soils is high and when those soils are saturated close to the ground surface; however, the potential for liquefaction to occur in any given area is highly dependent on site-specific conditions. Typical effects of liquefaction include sinking foundations, tilting structures, and rupture and/or substantial damage to underground utility lines.

Tierra del Sol

As discussed in the setting, liquefaction is not a concern on the Tierra del Sol site because no shallow groundwater was observed during site-specific subsurface exploration and because loose soils are generally shallow. The site is predominantly composed of shallow soils and decomposed granite over competent bedrock. These findings are based on a site-specific geotechnical evaluation conducted by Ninyo & Moore (2012a) and a groundwater investigation performed by Dudek (see Appendix 3.1.5-5). Therefore, the impact associated with liquefaction is considered **less than significant** on the Tierra del Sol site.

Rugged

As discussed in the setting, portions of the Rugged site along the Tule Creek corridor, as indicated by soils mapped as "alluvial land" (soil unit *Lu*), could be subject to liquefaction under certain conditions. Conditions within shallow soils can become temporarily saturated during and shortly after rain storms, and some amount of throughflow[11] may be sustained along the creek corridors during the wet season (see Section 3.1.5, Hydrology and Water Quality). Groundwater within the Tule Creek corridor has been measured at depths of roughly 15 feet below surface grades and has the potential to experience liquefaction or seismically induced settlement (Ninyo and Moore 2012b) The geologic reconnaissance of the Rugged site consisted of a high-level review of existing information, data, and potential geologic issues. It did not include subsurface exploration, soil testing or project-specific geotechnical design recommendations to address the potential for liquefaction. Without adequate design, the Rugged solar farm would have the potential to be adversely affected by liquefaction of susceptible soils during a large earthquake. Therefore, the following project design feature (PDF), as listed in Table 1-10 of Section 1.0, Project Description, would be implemented in order to reduce potential risks due to liquefaction:

> **PDF-GE-1:** Prior to the approval of any building plan and the issuance of any building permit, a geotechnical study must be prepared by a Registered Civil or Geotechnical Engineer, and submitted for approval by the by the PDS, Building Division. The report must specify foundation designs, which are adequate to preclude substantial damage to the proposed structures due to liquefaction. The applicant must prepare the report and submit it along with the submittal for the building plans. The PDS, Building Division shall review the geotechnical study for compliance with all applicable building codes, engineering standards, and shall ensure that liquefaction evaluation is adequate and that any recommendations to minimize effects of liquefaction, if any, are incorporated into the project design.

[11] Throughflow is the movement diagonally downslope of water through the soil, as opposed to the vertical movement known as percolation.

Building permits would not be approved unless the applicant submits adequate geotechnical studies and incorporates recommendations related to liquefaction into the project design (**PDF-GE-1**). Because this would be a requirement for the project to be approved, the impact of the project with respect to liquefaction would be **less than significant,** and no additional mitigation measures are necessary.

LanEast and LanWest

The LanEast site is not identified by the County as being within a liquefaction zone, but portions of the LanWest site that are underlain by soils mapped as alluvial land are within a liquefaction zone (County of San Diego 2007). The analysis and conclusions regarding liquefaction is the same as described above for the Rugged site; a geotechnical study providing recommendations related to liquefaction would be required for both LanEast and LanWest solar farms prior to the provision of building permits (**PDF-GE-1**). Therefore, the impact of the solar farms with respect to liquefaction would be **less than significant**.

Proposed Project

The Rugged, LanEast, and LanWest sites are located on soils that are potentially liquefiable. Should the required geotechnical investigation reports for these sites confirm the presence of liquefiable soils and a shallow groundwater table, project structures would be designed to withstand the effects of liquefaction by incorporating appropriate foundation designs (**PDF-GE-1**). Building permits would not be approved unless the applicant demonstrates that structures founded within or over potentially liquefiable sediments, if any, have been either relocated or properly designed to account for the hazard. For these reasons, the impact of the project with respect to liquefaction would be **less than significant**.

3.1.2.3.4 Landslides

Guidelines for the Determination of Significance

For the purpose of this EIR, the County's *Guidelines for Determining Significance Report Format and Content Requirements: Geologic Hazards* (July 30, 2007) applies to both the direct impact analysis and the cumulative impact analysis. The following significance guidelines have been developed by the County to address question VI a) iv) and the portion of question c) that relates to on-site or off-site landslide or collapse in the CEQA Guidelines, Appendix G. A significant impact would result if:

- The project would expose people or structures to substantial adverse effects, including the risk of loss, injury, or death involving landslides

- The project is located on a geologic unit or soil that is unstable, or would become unstable as a result of the project, potentially resulting in an on-site or off-site landslide
- The project site lies directly below or on a known area subject to rockfall which could result in collapse of structures.

Analysis

Tierra del Sol

The project site is not within a landslide susceptibility area as identified in the County's *Guidelines for Determining Significance Report Format and Content Requirements: Geologic Hazards*. The topography of the Tierra del Sol site is flat to gently sloped and is underlain by granitic bedrock which is not typically prone to substantial slope failure in areas that are not steeply sloped. Since the project is not located within an identified landslide susceptibility area and the geologic environment has a low probability to become unstable, the project would have a **less-than-significant** impact from the exposure of people or structures to potential adverse effects from landslides.

The Tierra del Sol solar farm involves site grading for installation of trackers that would result in the creation of areas of cut and areas underlain by fill. In order to assure that any proposed buildings (including those proposed on the project site) are adequately supported (whether on native soils, cut, or fill), a soils investigation report is required as part of the building permit process. This report would evaluate the strength of underlying soils and make recommendations on the design of building foundation systems. Grading plans must be compliant with standards in the grading ordinance addressing the stability, incline, and compaction of cuts and fills. The soils investigation report must demonstrate that a proposed building meets the structural stability standards required by the CBC and the local grading ordinance. The report must be approved by the County prior to the issuance of a building permit. With this standard requirement, impacts would be **less than significant**.

Rugged

The project site is not within a landslide susceptibility area as identified in the County's *Guidelines for Determining Significance Report Format and Content Requirements: Geologic Hazards*. The topography of the Rugged site is flat to gently sloped, and is underlain by granitic bedrock which is not typically prone to substantial slope failure in areas that are not steeply sloped. Since the project is not located within an identified landslide susceptibility area and the geologic environment has a low probability to become unstable, the Rugged solar farm would have a low potential to expose people or structures to potential adverse effects from landslides. In addition, because grading plans must be compliant with

standards in the CBC and the grading ordinance which address the stability, incline, and compaction of cuts and fills, the project would not create new areas of slope instability. For these reasons, impacts from landslides and slope instabilities would be **less than significant**.

LanEast and LanWest

The project sites are not within a landslide susceptibility area as identified in the County *Guidelines for Determining Significance Report Format and Content Requirements: Geologic Hazards*. The topography of both the LanEast and LanWest sites is flat to gently sloped, and is underlain by granitic bedrock which is not typically prone to substantial slope failure in areas that are not steeply sloped. Since the solar farms are not located within an identified landslide susceptibility area and the geologic environment has a low probability to become unstable, the LanEast and LanWest solar farms would have a low potential to expose people or structures to potential adverse effects from landslides. In addition, because grading plans must be compliant with standards in the CBC and the grading ordinance which address the stability, incline, and compaction of cuts and fills, the solar farms would not create new areas of slope instability. For these reasons, impacts from landslides and slope instabilities would be **less than significant**.

Proposed Project

None of the project sites are located in an area identified by the County of San Diego as being in a landslide susceptibility area. Furthermore, the geologic and topographic conditions on each of the project sites do not otherwise indicate the potential for landslides or significant slope instabilities. Because the Proposed Project would be required to comply with the CBC and the grading ordinance, grading activities such as cuts and fills would be performed in a manner that avoids the potential for site preparation and grading associated with each project to create unstable slopes. For these reasons, the impact of the Proposed Project with respect to landslides would be **less than significant**.

3.1.2.3.5 Expansive Soils

Guidelines for the Determination of Significance

For the purpose of this EIR, the County's *Guidelines for Determining Significance, Report Format and Content Requirements: Geologic Hazards* (July 30, 2007) applies to both the direct impact analysis and the cumulative impact analysis. The following significance guidelines have been developed by the County to address question d) in the CEQA Guidelines, Appendix G. A significant impact would result if:

- The project would be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), and does not conform with the Uniform Building Code.

Analysis

Tierra del Sol

The Tierra del Sol site does not contain expansive soils as defined by Table 18-I-B of the Uniform Building Code (1994). Due to the sandy granular character of the soils and their low organic content, on-site soils are generally non-plastic and therefore not prone to shrink-swell behavior (NRCS 2012a; Ninyo and Moore 2012a). In addition, the Tierra del Sol site is not within an area identified as having expansive soils in the County's geologic hazard guidelines (San Diego County of San Diego 2007, Figure 6). On-site soils also have a shrink-swell behavior classified by the NRCS as low.

Nevertheless, required compliance with the CBC and the County grading ordinance would ensure that potentially expansive soils, if present, are adequately addressed. Standard practices include removing expansive soils and placing a mat of properly compacted, non-expansive fill prior to placing foundations, structures, utilities, or road beds. In some cases, potentially expansive soils can be treated or mixed with other materials to reduce its expansive potential to acceptable levels. Implementation of these standard practices, as required by the CBC and local ordinances, would ensure that potential impacts on the project due to expansive soils would be **less than significant**.

Rugged

Similar to the Tierra del Sol solar farm, the Rugged solar farm would have a **less-than-significant** impact with respect to expansive soils because such soils, if present, would be adequately addressed with required compliance with the CBC and the County grading ordinance. As discussed in the existing conditions section, the potential for expansive soils to be present on the Rugged site is generally low, with the possible exception of low-lying areas of the site mapped as alluvial land (*Lu*), which has a shrink-swell behavior classified by the NRCS as moderate. Regardless, standard engineering practices would include but would not be limited to removing expansive soils and placing a mat of properly compacted, non-expansive fill prior to placing foundations, structures, utilities, or road beds. In some cases, potentially expansive soils can be treated or mixed with other materials to reduce its expansive potential to acceptable levels. These types of site preparation activities would be specified in the soils investigation report that would be required as part of the process of obtaining grading and development permits for the project.

LanEast and LanWest

Similar to the Tierra del Sol solar farm, the LanEast and LanWest solar farms would have a **less-than-significant** impact with respect to expansive soils because such soils, if present, would be adequately addressed with required compliance with the CBC and the County grading ordinance. As discussed in the existing conditions section, the potential for expansive soils to be present on the LanEast and LanWest sites is generally low, with the possible exception of low-lying areas of the LanEast site mapped as alluvial land (*Lu*), which has a shrink-swell behavior classified by the NRCS as moderate. Regardless, standard engineering practices would include but not be limited to removing expansive soils and placing a mat of properly compacted, non-expansive fill prior to placing foundations, structures, utilities, or road beds. In some cases, potentially expansive soils can be treated or mixed with other materials to reduce its expansive potential to acceptable levels. These types of site preparation activities would be specified in the soils investigation report that would be required as part of the process of obtaining grading and development permits for the project.

Proposed Project

The Tierra del Sol, Rugged, LanEast, and LanWest solar farms would have a **less-than-significant** impact with respect to expansive soils because such soils, if present, would be adequately addressed with required compliance with the CBC and the County grading ordinance.

3.1.2.3.6 Adequate Soils for Septic Systems or other On-Site Wastewater Systems

Guidelines for the Determination of Significance

The County's Guidelines for Determining Significance for geologic hazards and water quality do not contain a significance criterion that addresses adequate soils for septic systems or other on-site wastewater systems. However, the following analysis is provided to address question e) in the CEQA Guidelines, Appendix G, which states that a significant impact would result if:

- The project would have soils incapable of supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Analysis

Tierra del Sol

The O&M building proposed on the Tierra del Sol site would include lavatory facilities served by a private on-site septic system and groundwater well. Such systems are also

referred to as On-Site Wastewater Treatment Systems (OWTS). The system would include a septic field with approximately 300 feet of septic leach line, an equal size reserve area, and a 1,000-gallon septic tank. California Water Code Section 13282 allows RWQCBs to authorize a local public agency to issue permits for OWTS "to ensure that systems are adequately designed, located, sized, spaced, constructed and maintained." The RWQCBs with jurisdiction over San Diego County have authorized the County of San Diego, Department of Environmental Health (DEH) to issue certain OWTS permits throughout the County and within the incorporated cities. DEH will review the OWTS lay-out for the project pursuant to DEH, Land and Water Quality Division's, On-site Wastewater Systems: Permitting Process and Design Criteria. In addition, the project will comply with the Title 6, Division 8, Chapter 3 of the San Diego County Code, which regulates on-site wastewater treatment systems and improper disposal of sewage.

The required permits and County ordinance codes ensure that proposed OWTS would be adequately designed and appropriate for the type of soils found on site. Because an OWTS would not be approved by the County without having demonstrated that the location and design is appropriate for the site, there would be a **less-than-significant** impact with respect to adequate soils for on-site septic systems.

Rugged

Similar to the Tierra del Sol solar farm, the Rugged solar farm would have a **less-than-significant** impact with respect to adequate soils for on-site septic systems because an OWTS would not be approved by the County without an OWTS permit issued by the County of San Diego, DEH. A permit would not be issued unless the applicant can demonstrate that the location and design is appropriate for the site.

LanEast and LanWest

Similar to the Tierra del Sol solar farm, the LanEast and LanWest solar farms would have a **less–than-significant** impact with respect to adequate soils for on-site septic systems because an OWTS would not be approved by the County without an OWTS permit issued by the County of San Diego, DEH. A permit would not be issued unless the applicant can demonstrate that the location and design is appropriate for the site.

Proposed Project

The Proposed Project would have a **less-than-significant** impact with respect to expansive soils because an OWTS would not be approved by the County without an OWTS permit issued by the County of San Diego, DEH.

3.1.2.4 Cumulative Impact Analysis

All of Southern California lies within a seismically-active region with an extremely diverse range of geologic and soil conditions that can vary substantially within short distances. Thus, the cumulative context for potential impacts to people and structures related to geologic and seismic hazards is more localized or site-specific. The temporal scope includes construction, operation, and maintenance phases of the project. As analyzed earlier in Section 3.1.2.3, the project would have no impacts related to exposure of people or facilities to ground displacement/fissure due to fault rupture. This issue is not considered in the cumulative context, because the project would not contribute, even incrementally, to potential cumulative impacts. Potential geologic and soils impacts associated with the project are restricted to potential facility damage from earthquake-related ground shaking, liquefaction, landslides, and expansive soils. In all cases, the impacts were determined to be less than significant (with incorporation of **PDF-GE-1** for Rugged, LanEast and LanWest solar farms) because the existing regulatory framework controlling the design and construction of structures in California, and actions required to obtain a grading and/or development permits at the local level are sufficient to avoid or substantially reduce the potential impacts. All other projects in the cumulative scenario would be required to comply with the same or similar set of laws, regulations, and ordinances.

Other projects, which in combination, could result in a greater severity or extent of liquefaction (during an earthquake) than would have been anticipated in the project-specific analysis would be those that (1) permanently saturate previously dry soils, (2) result in a sustained rise of the local groundwater table, and/or (3) perform grading or earth-moving operations that would use liquefiable soils as fill. For effects to compound, other projects in the cumulative scenario would have to be overlapping or in the immediate vicinity of the Proposed Project. In accordance with the CBC, as well as state and local building and grading regulations, use of liquefiable soil for fill material is prohibited where the material would be saturated. Further, none of the other projects in the cumulative scenario (see Table 1-12 and shown in Figure 1-12 in Chapter 1.0, Project Description) would result in substantial increases in the local or regional groundwater table. Therefore, there would be no cumulative impact to which the Proposed Project could contribute.

Because all projects in the cumulative scenario would be designed in accordance with seismic design criteria as required by the CBC and with other specific design criteria, there would be **no significant cumulative impact** related to geology, soils, and seismicity.

3.1.2.5 Conclusion

Compliance with the CBC, state and local regulations pertaining to geologic and seismic hazards, as well as standard requirements for the approval of building and grading permits, including preparation and submittal of soil investigation reports, is sufficient to reduce to acceptable levels risks from seismic ground shaking, liquefaction, and expansive soils.

Table 3.1.2-1
Soil Units within the Project Sites

Map Unit, Soil Name	Acres (Percent of the Project Site)	Depth to restrictive layer (inches)	Hydrologic Group[a]	Erosion Factor (Kw)[b]	Wind Erodibility[c]	Risk of Corrosion[d]	Shrink-Swell Behavior[e]
Tierra del Sol							
KcC, Kitchen Creek loamy coarse sand	400 (94%)	40–60	B	0.17	2	Low	Low
MvC, Mottsville loamy coarse sand	21 (5%)	> 60	A	0.20–0.24	2	Low to Moderate	Low
LcE2, La Posta rocky loamy coarse sand	4 (1%)	20–40	B	0.15–0.24	2	Low to Moderate	Low
Rugged							
LcE2, La Posta rocky loamy coarse sand	418 (64%)	20–40	B	0.15–0.24	2	Low to Moderate	Low
Le, Loamy alluvial land	103 (16%)	> 60	C	0.37–0.49	5	Low to High	Moderate
MvC, Mottsville loamy coarse sand	96 (15%)	> 60	A	0.20–0.24	2	Low to Moderate	Low
ToE2, Tollhouse rocky coarse sandy loam	13 (2%)	5–20	D	0.15	5	Moderate	Low
KcC, Kitchen Creek loamy coarse sand	15 (2%)	40–60	B	0.17	2	Low	Low
AcG, Acid igneous rock land	4 (1%)	0–4	D	—	8	—	—
LanEast							
LcE2, La Posta rocky loamy coarse sand	51 (22%)	20–40	B	0.15–0.24	2	Low to Moderate	Low
Le, Loamy alluvial land	86 (37%)	> 60	C	0.37–0.49	5	Low to High	Moderate
MvC, Mottsville loamy coarse sand	74 (31%)	> 60	A	0.20–0.24	2	Low to Moderate	Low
ToE2, Tollhouse rocky coarse sandy loam	23 (10%)	5–20	D	0.15	5	Moderate	Low

Table 3.1.2-1
Soil Units within the Project Sites

Map Unit, Soil Name	Acres (Percent of the Project Site)	Depth to restrictive layer (inches)	Hydrologic Group[a]	Erosion Factor (Kw)[b]	Wind Erodibility[c]	Risk of Corrosion[d]	Shrink-Swell Behavior[e]
LanWest							
LcE2, La Posta rocky loamy coarse sand	18 (51%)	20–40	B	0.15–0.24	2	Low to Moderate	Low
MvC, Mottsville loamy coarse sand	17 (49%)	> 60	A	0.20–0.24	2	Low to Moderate	Low

Notes:

[a] Hydrologic soil groups are used for estimating the runoff potential of soils on watersheds at the end of long-duration storms after a prior wetting and opportunity for swelling, and without the protective effect of vegetation. Soils are assigned to groups A through D in order of increasing runoff potential.

[b] Erosion factor Kw indicates the susceptibility of the whole soil to sheet and rill erosion by water (estimates are modified by the presence of rock fragments). The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. A range of values is given because map units are composed of several soil series.

[c] Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

[d] Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. The risk of corrosion also is expressed as low, moderate, or high.

[e] Shrink-swell behavior is the quality of soil that determines its volume change with change in moisture content. The volume-change behavior of soils is influenced by the amount of moisture change and amount and kind of clay in the soil. Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3%; moderate if 3% to 6%; high if 6% to 9%; and very high if more than 9%.

Sources: NRCS 2012a, 2012b, 2012c, 2012d.

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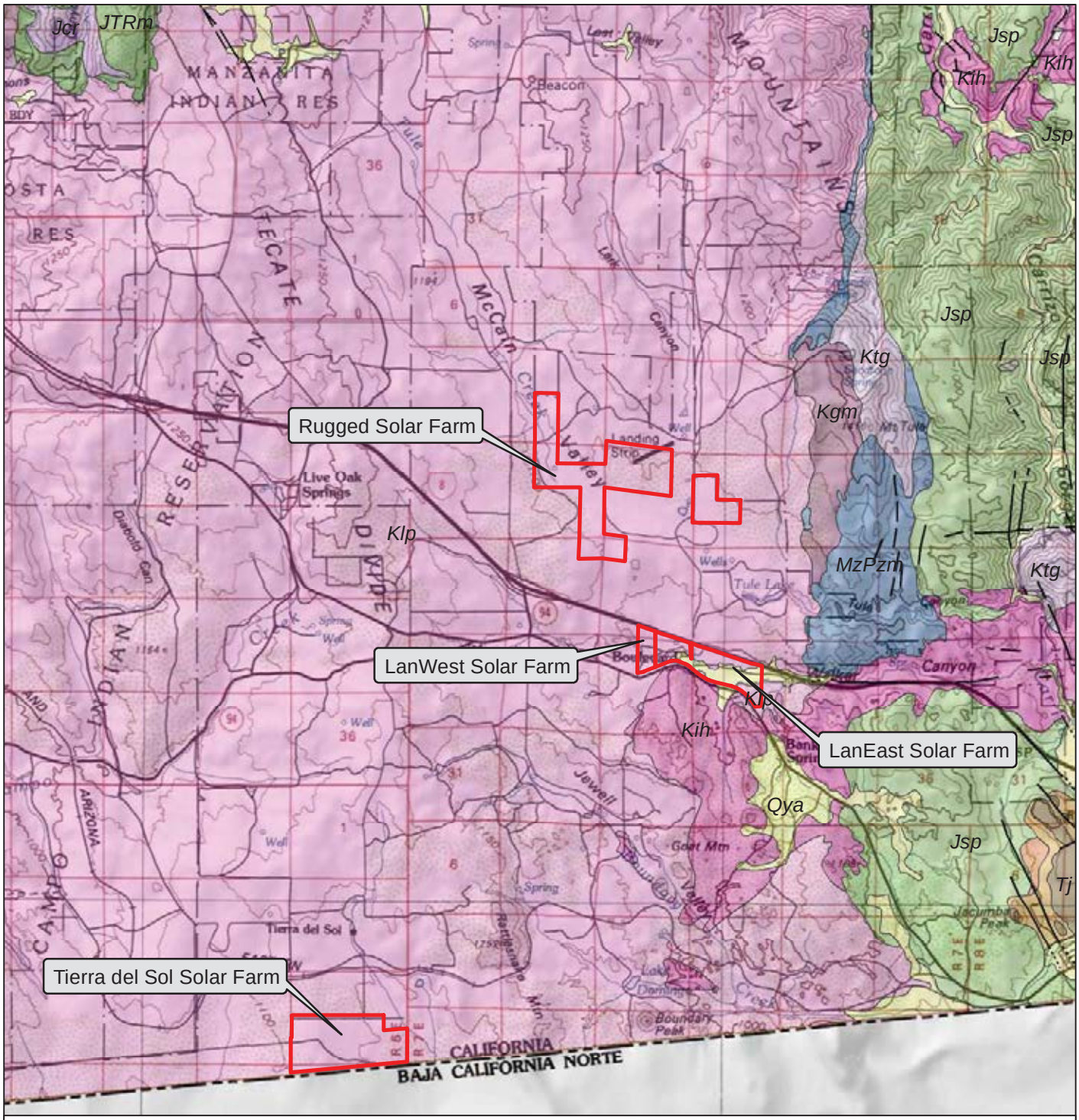

Sedimentary Rocks

- Qya, Young alluvium
- Qt, Terrace deposits
- Ta, Anza Formation

Plutonic Rocks

- Kgm, Tonalite of Granite Mountain
- Kih, Indian Hill granodiorite
- Klp, Tonalite of La Posta
- Ktg, Tonalite and grabbro
- Jcr, Granodiorite of Cuyamaca Reservoir

Metamorphic Rocks

- Jtrm, Metasedimentary and metavolcanic rocks
- Jsp, Migmatitic schist and gneiss of Stephenson Peak
- MzPzm, Rocks of Jacumba Mountains

0 1 2 Miles

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SOURCE: USGS 2004

FIGURE 3.1.2-1

Regional Geologic Map

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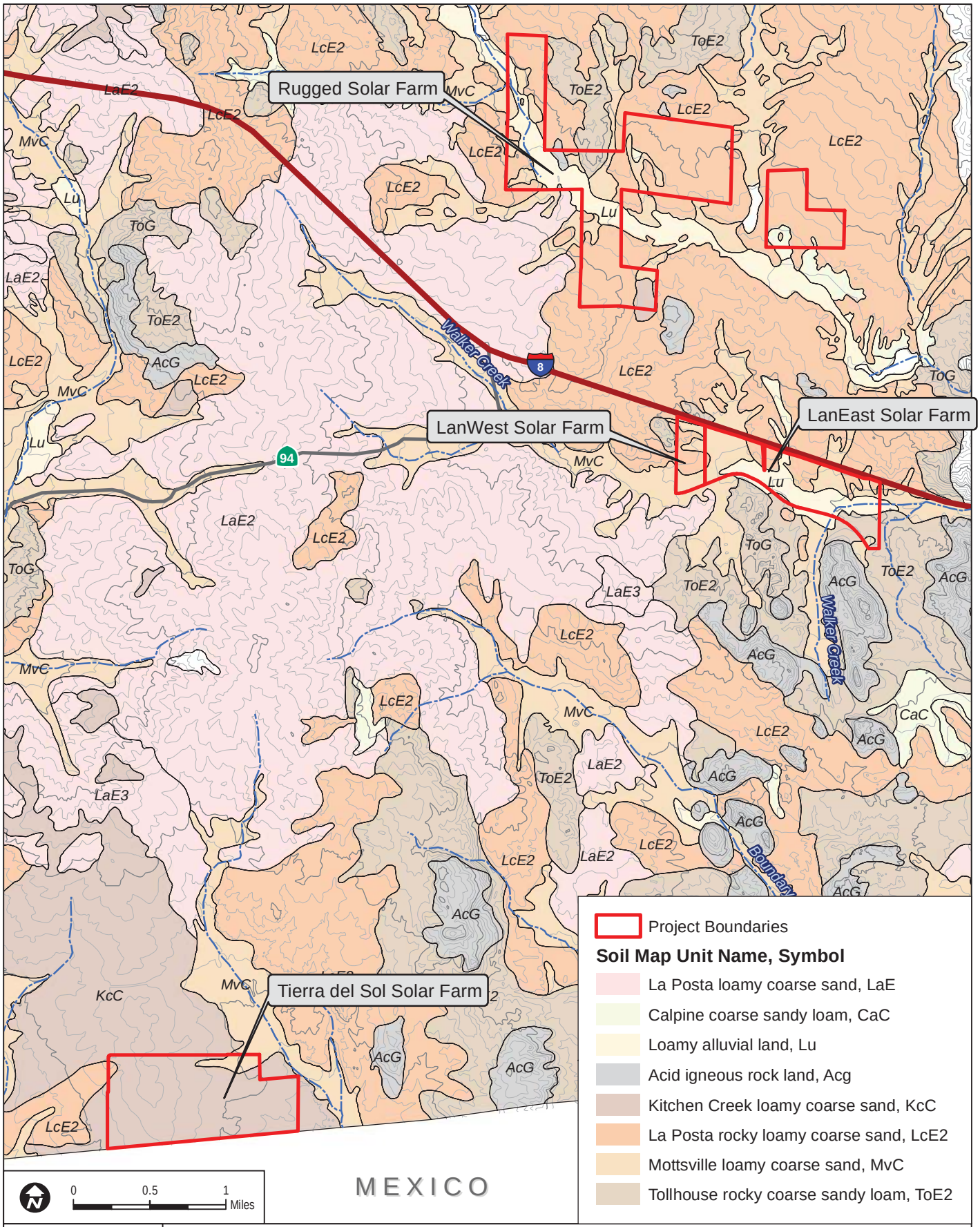

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SOURCE: NRCS 2012a-d

FIGURE 3.1.2-2
Soils Map

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