SECTION 4.6

GEOLOGY AND SOILS

This section describes federal, state and local regulations applicable to geology and soils. It also describes the environmental setting of the Project area with regard to the soils, seismicity and geologic conditions, focusing on the Project site. A discussion of geology and soil impacts is also provided and mitigation measures are identified as appropriate. The analysis in this section is based on the *Soil Survey of Imperial County, California, Imperial Valley Area* (USDA 1981) and the "Geotechnical Report, Titan Solar Facility 1791 Hwy 78, Imperial County, California" (LandMark 2017). This document is included as **Appendix F** of the Technical Appendices of this EIR on the attached CD.

4.6.1 REGULATORY FRAMEWORK

A. STATE

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Zoning Act (Chapter 7.5, Division 2, Public Resources Code, State of California, effective May 4, 1975) provides a statewide mechanism for reducing losses from surface fault rupture. The Act promotes public safety by prohibiting siting of most structures for human occupancy across traces of active faults that constitute a hazard to structures from surface faulting or fault creep. In accordance with the Act, the Office of State Geologist delineated Special Study Zones that encompass potentially and recently active traces of four major faults: San Andreas, Calaveras, Hayward and San Jacinto. The County of Imperial is responsible for enforcing the Act by ensuring that homes, offices, hospitals, public buildings, and other structures for human occupancy that are built on or near active faults or within a special study zone, are designed and constructed in compliance with the County of Imperial Codified Ordinance (Imperial County, n.d.).

The Project area is not located within a Fault Hazard Zone, as defined by the state of California in the Alquist-Priolo Earthquake Fault Zoning Act. Review of the current Alquist-Priolo Earthquake Fault Zone maps indicates that the nearest mapped Earthquake Fault Zone is the Borrego segment of the San Jacinto fault zone located approximately 2 miles southwest of the Project site (refer to Figure 4.6-4) (LandMark 2017, p. 8). In addition, the Project does not include any habitable structures.

California Building Code

Title 24 of the California Code of Regulations (CCR), commonly referred to as the California Building Code (CBC), is published and updated by the California Building Standards Commission. The most recent version (2016) went into effect as of January 1, 2017. Cities and counties are required by state law to enforce CCR Title 24. Title 24 applies to all building occupancies, and related features and equipment throughout the State of California, and contains requirements related to the structural, mechanical, electrical, and plumbing systems, and requires measures for energy conservation, green design, construction and maintenance, fire and life safety, and accessibility. Among other elements, Chapter 16 of this code dictates the design and construction standards applicable to resist seismic shaking on structures. The Project is subject to compliance with the 2016 CBC.

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act (SMARA) of 1975 acknowledges that mineral extraction is essential to California's economy and that the reclamation of mined lands after extraction is necessary to prevent or minimize adverse effects on the environment and to protect the public health and safety. SMARA also classifies mineral resources in the State and provides information to local governments regarding mineral resources. Designating lands that contain regionally significant mineral resources is the responsibility of local governments. Typically, local governments preserve such areas from encroachment or conversion to other uses as part of the General Plan. The law has resulted in the preparation of Mineral Land Classification Maps delineating Mineral Resource Zones (MRZ) for aggregate resources (sand, gravel, and stone). Mining does occur throughout the County of Imperial as shown on the Active Surface Mining Operations Map (Imperial County 2003). However, the Project site is not located in an area in an MRZ.

B. LOCAL

County Land Use Ordinance

Title 9 Division 15 (Geological Hazards) of the County Land Use Ordinance has established procedures and standards for development within earthquake fault zones. Per County regulations, construction of buildings intended for human occupancy are prohibited across the trace of an active fault. An exception exists when such buildings located near the fault or within a designated Special Studies Zone are demonstrated through a geotechnical analysis and report not to expose a person to undue hazard. The proposed Project does not include any residential structures or Operation and Maintenance Buildings. In addition, no faults aligning through the Project site were identified in the Geotechnical Report prepared for the Project (LandMark 2017).

Imperial County General Plan

The Seismic and Public Safety Element (Imperial County n.d.) of the Imperial County General Plan contains goals, objectives, programs and policies to minimize the risks associated with natural and human-made hazards including seismic/geological hazards, flood hazards, and Imperial Irrigation District Lifelines (i.e. electricity). **Table 4.6-1** analyzes the consistency of the Project with the applicable goals and objectives relating to seismic hazards and soil conditions in the Imperial County General Plan. While this EIR analyzes the Project's consistency with the General Plan pursuant to CEQA Guidelines Section 15125(d), the Imperial County Board of Supervisors ultimately determines consistency with the General Plan.

TABLE 4.6-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Goals and Objectives	Consistent with General Plan?	Analysis
SEISMIC AND PUBLIC SAFETY ELEMENT		
Land Use Planning and Public Safety		
Goal 1: Include public health and safety considerations in land use planning.	Yes	The proposed Project is located in west-central Imperial County, a highly rural area characterized by open space and desert. Public health and safety would not be affected in association locating the proposed Project in this area based on its location removed from population centers. Therefore, the proposed Project is consistent with this goal.
Objective 1.4 Require, where possessing the authority, that avoidable seismic risks be avoided; and that measures, commensurate with risks, be taken to reduce injury, loss of life, destruction of property, and disruption of service.	Yes	The proposed Project is sited in an area subject to seismic shaking. However, no faults are known to align through Project site. Two faults are located within 10 miles of the Project site (refer to Table 4.6-2). As a result, the proposed Project could experience strong ground shaking during an earthquake. However, the Project would be designed in accordance

TABLE 4.6-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Goals and Objectives	Consistent with General Plan?	Analysis
		with all applicable federal, State and local building codes. No residential structures or O&M buildings are proposed as part of the Project. Damage to solar panels and ancillary structures can be mitigated through engineering and compliance with the 2016 CBC and ASCE 7-10 Seismic Parameters. (refer to mitigation measure MM 4.6.1). Therefore, the proposed Project is consistent with this objective.
Objective 1.7 Require developers to provide information related to geologic and seismic hazards when siting a proposed Project.	Yes	A Geotechnical Report has been prepared for the Project site by LandMark Consultants, Inc. The investigation was used in the analysis of geology and soils. The Geotechnical Report included recommendations to address potential geologic or seismic hazards that may be associated with the Project site. These recommendations have been included in this EIR as mitigation measures MM 4.6.1, MM 4.6.4a, MM 4.6.4b, MM 4.6.4c and MM 4.6.6. Therefore, the proposed Project is consistent with this objective.
Emergency Preparedness		
Goal 2: Minimize potential hazards to public health, safety, and welfare and prevent the loss of life and damage to health and property resulting from both natural and human-related phenomena.	Yes	The proposed Project is not located within an Alquist-Priolo Earthquake Fault Zone. The Project would be designed in accordance with all applicable federal, CBC and local building requirements. Therefore, the proposed Project is consistent with this goal.
Objective 2.8 Prevent and reduce death, injuries, property damage, and economic and social dislocation resulting from natural hazards including flooding, land subsidence, earthquakes, other geologic phenomena, levee or dam failure, urban and wildland fires and building collapse by appropriate planning and emergency measures.	Yes	The Project is located in the seismically active Imperial Valley of southern California with numerous mapped faults of the San Andreas Fault System traversing the region. The Geotechnical Report prepared for the Project includes recommendations that all structures be designed in accordance with the 2016 CBC and ASCE 7-10 Seismic Parameters. The recommendations of the Geotechnical Report have been included

TABLE 4.6-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Goals and Objectives	Consistent with General Plan?	Analysis
		as mitigation measure MM 4.6.1 to reduce risks associated with seismic hazards. Therefore, the proposed Project is consistent with this objective.
Programs and Policies		
Seismic/Geologic Hazards		
4. Ensure that no structure for human occupancy, other than one-story wood frame structures, shall be permitted within fifty feet of an active fault trace as designated under the Alquist-Priolo Geologic Hazards Zone Act.	Yes	The proposed Project does not include any residential structures or O&M buildings. The San Jancinto-Borrego Fault is approximately 1.8 miles to the southwest of the Project site. The proposed Project will be designed in accordance with the 2016 CBC and ASCE 7-10 Seismic Parameters. Therefore, the proposed Project is consistent with this policy.
RENEWABLE ENERGY AND TRANSMISSION ELEMENT		
Goal 7 Actively minimize the potential for land subsidence to occur as a result of renewable energy operations.	Yes	The proposed Project is not located in an area prone to subsidence. Therefore, the proposed Project is consistent with this Goal.

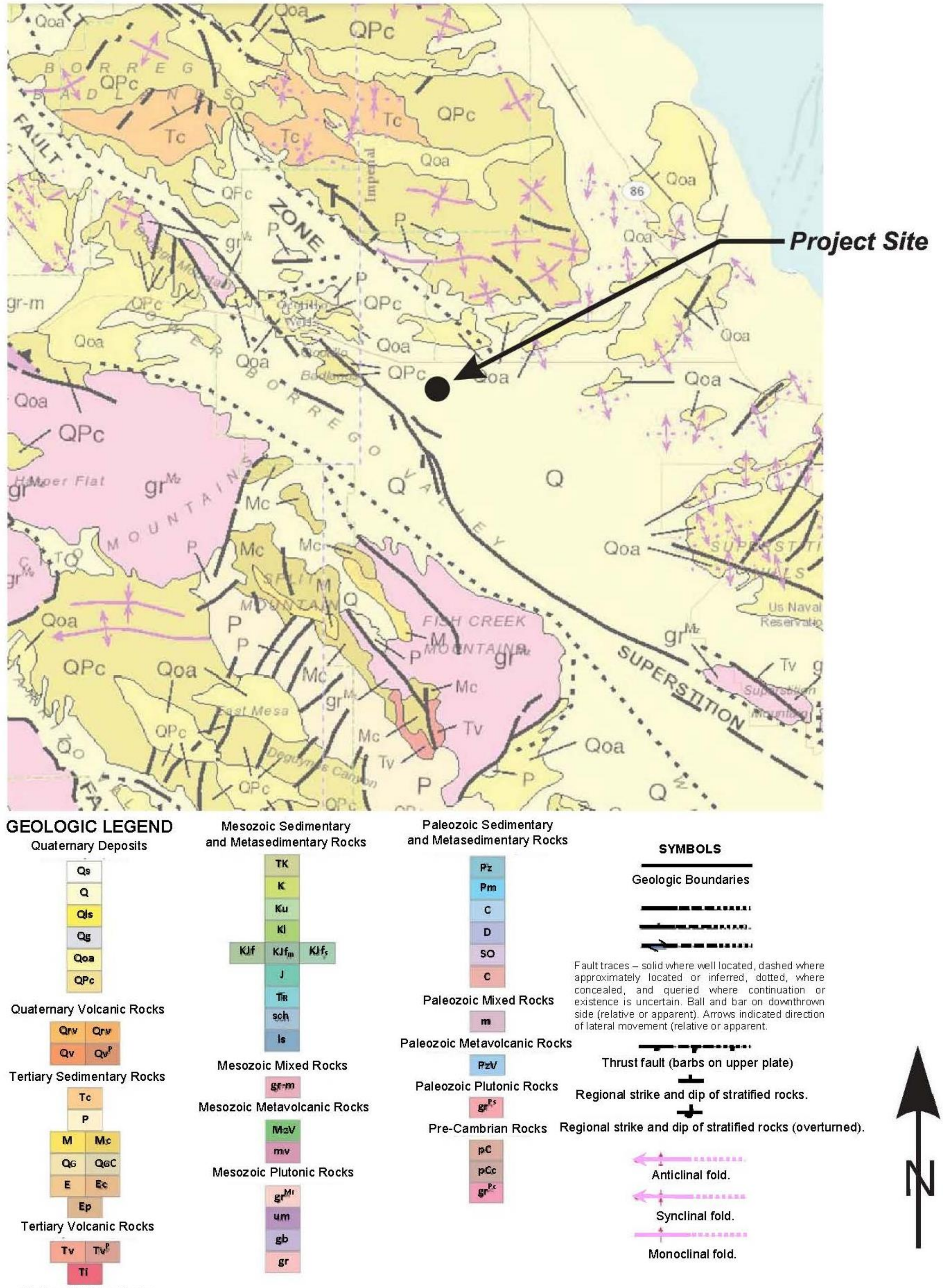
4.6.2 ENVIRONMENTAL SETTING

A. SEVILLE 4 SOLAR PROJECT SITE

Geology

Regional

The Project site is located in the western Imperial Valley portion of the Salton Trough physiographic province. The Salton Trough is a topographic and geologic structural depression resulting from large scale regional faulting. The trough is bounded on the northeast by the San Andreas Fault and the Chocolate Mounts and the southwest by the Peninsular Range and faults of the San Jacinto Fault Zone. The Salton Trough represents the northward extension of the Gulf of California, containing both marine and non-marine sediments deposited since the Miocene Epoch. Tectonic activity that formed the trough continues at a high rate as evidence by deformed young sedimentary deposits and high levels of seismicity. **Figure 4.6-1** shows the location of the Project site relative to regional earthquake faults and physiographic features (LandMark 2017, p. 6). The region is underlain by the Quaternary Lake Cahuilla beds, Pleistocene Borrego Formation, and the Pliocene Palm Springs Formation. The Lake Cahuilla lacustrine deposits consist of



Source: LandMark 2017.

FIGURE 4.6-1
REGIONAL GEOLOGIC MAP

interbedded lenticular (i.e. formation with a lens-shaped cross-section) and tabular sand, silt and clay and alluvial deposits consisting of gravelly sands. The Palm Springs Formation consists of at least 6,000 feet of reddish clay and light gray arkosic (i.e. sedimentary rock/sandstone) sands. The Borrego Formation consists of gray lacustrine clays with interbedded sands. Basement rock consisting of Mesozoic granite and possibly Paleozoic metamorphic rocks are estimated to exist at depths between 15,000 and 20,000 feet below the surface (LandMark 2017, p. 7).

Site-Specific

Subsurface soils encountered during the field exploration conducted on April 3 and 4, 2017 consists of predominantly medium dense to dense silty sands and sandy silts to a depth of 50 feet below ground surface. Thin (2 to 5 feet thick) clay layers were encountered sporadically throughout the Project site below a depth of 5 feet (LandMark 2017, p. 7).

Faulting

The Project site is located in the seismically active Imperial Valley of southern California with numerous mapped faults of the San Andreas Fault System traversing the region. The San Andreas Fault System is comprised of the San Andras, San Jacinto, and Elsinor Fault zones in southern California. LandMark performed a computer-aided search of known faults or seismic zones that lie within a 62-mile (100 kilometer) radius of the Project site (LandMark 2017, p. 8). **Table 4.6-2** summarizes significant historic earthquake events on faults in the vicinity of the Project site. **Figure 4.6-2** is a regional fault map illustrating known active faults relative to the site. **Figure 4.6-3** shows the Project site in relation to local faults. **Figure 4.6-4** shows the Project site relative to the nearest Alquist-Priolo earthquake fault. The criterion for fault classification adopted by the California Geological Survey defines Earthquake Fault Zones along active or potentially active faults. An active fault is one that has ruptured during Holocene time (roughly within the last 11,000 years). A fault that has ruptured during the last 1.8 million years (Quaternary time), but has not been proven by direct evidence to have not moved within Holocene time is considered to be potentially active. A fault that has not moved during Quaternary time is considered to be inactive.

TABLE 4.6-2
SIGNIFICANT HISTORIC EARTHQUAKE EVENTS IN THE VICINITY OF THE PROJECT SITE

Fault Name	Approximate Distance (miles)	Approximate Distance (km)	Maximum Moment Magnitude (Mw)	Fault Length (km)	Slip Rate (mm/yr)
San Jacinto – Borrego	1.8	2.9	6.6	29 ± 3	4 ± 2
Superstition Mountain	8.2	13.1	6.6	24 ± 2	5 ± 3
Elimore Ranch	11.2	17.9	6.6	29 ± 3	1 ± 0.5
Superstition Hills	11.3	18.0	6.6	23 + 2	4 ± 2
San Jacinto – Anza	12.6	20.1	7.2	91 ± 9	12 ± 6
San Jacinto – Coyote Creek	14.3	22.9	6.8	41 ± 4	4 ± 2
Painted Gorge Wash*	16.8	26.8			
Elsinore – Coyote Mountain	18.6	29.7	6.8	39 ± 4	4 ± 2
Earthquake Valley	22.8	36.5	6.5	20 ± 2	2 ± 1
Ocotillo*	23.0	36.8			
Vista de Anza*	24.2	38.8			

TABLE 4.6-2
SIGNIFICANT HISTORIC EARTHQUAKE EVENTS IN THE VICINITY OF THE PROJECT SITE

Fault Name	Approximate Distance (miles)	Approximate Distance (km)	Maximum Moment Magnitude (Mw)	Fault Length (km)	Slip Rate (mm/yr)
Earthquake Valley	22.8	36.5	6.5	20 ± 2	2 ± 1
San Andreas – Coachella	24.5	39.2	7.2	96 ± 10	25 ± 5
Elsinore – Julian	24.8	39.7	7.1	76 ± 8	5 ± 2
Yuha Well*	25.2	40.4			
Laguna Salada	25.8	41.3	7	67 ± 7	3.5 ± 1.5
Shell Beds	26.2	42.0			
Hot Springs*	29.1	46.5			
Imperial	29.5	47.2	7	62 ± 6	20 ± 5
Unnamed 1*	30.0	48.0			
Yuha*	30.6	49.0			
Brawley*	32.8	52.5			
Unnamed 2*	34.9	55.9			

*Source: LandMark 2017. *Faults not included in CGS database.*

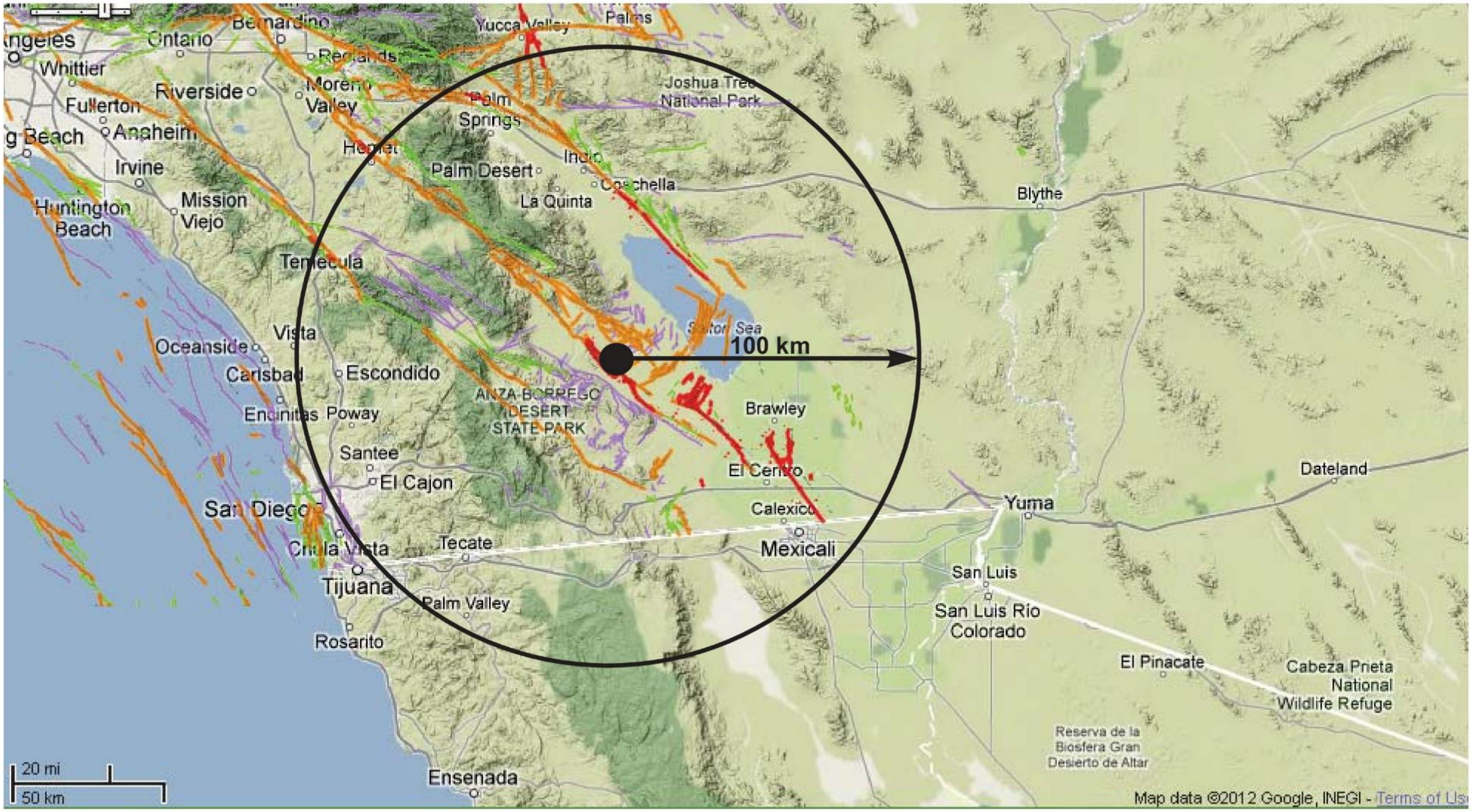
Groundwater

Groundwater was not encountered in the borings during the time of exploration. The groundwater in the area of the Project site was previously used for irrigation purposes. A total of five wells were historically used to irrigate the Allegretti Farms property. A Geotechnical Investigation prepared by PETRA Geotechnical, Inc. in December 2012 for the Seville Solar Farm Complex identified groundwater in one bore hole at a depth of 43 feet below ground surface (LandMark 2017, p. 8). This borehole was located north of the Project site.

Other records have identified groundwater at a depth of 77 to 91 feet below ground surface about one mile to the west of the Project site. Both groundwater sources may be perched (i.e. disconnected from the lower aquifer. The groundwater aquifer is expected to be at depths greater than 200 feet based on groundwater level data from the USGS. Depth to groundwater may fluctuate due to localized geologic conditions, precipitation, irrigation, drainage and construction practices in the region. Based on the regional topography, groundwater is assumed to flow generally towards the southeast (LandMark 2017, p. 8). Flow directions may also vary locally in the vicinity of the Project site. Fish Creek (desert ephemeral stream) borders the south side of the site, Tarantula Wash borders the northeast side and San Felipe Creek (desert ephemeral stream) previously bisected the Allegretti Property. The Seville Solar Farm Complex has flood control berms on the western edge that divert the San Felipe Creek stormwater flows to the south and east (LandMark 2017, p. 8).

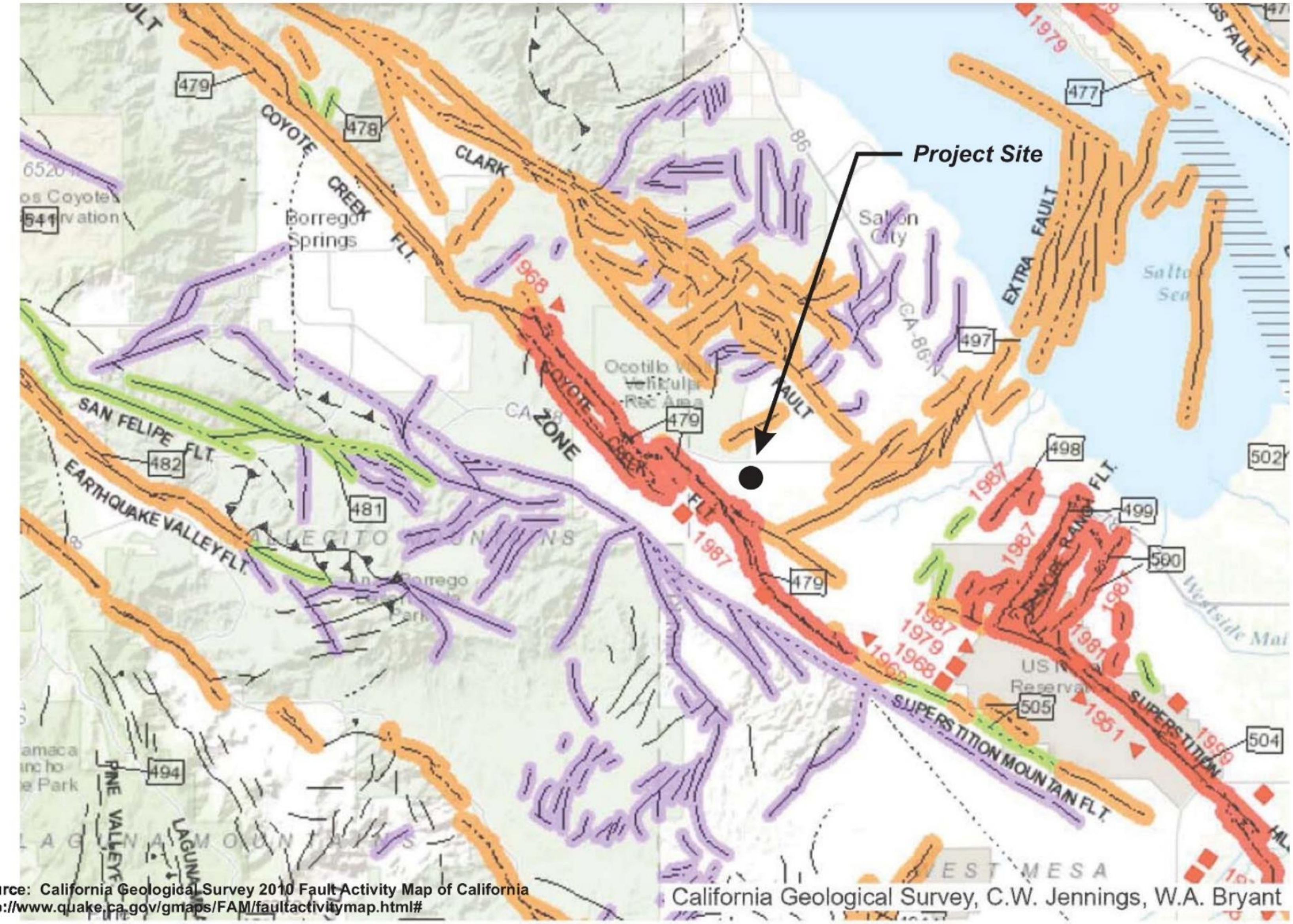
Landslides

The hazard of landsliding is unlikely due to the regional planar topography. No ancient landslides are shown on the geologic maps of the region and no indications of landslides were observed during the site investigation (LandMark 2017, p. 10).



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivity map.html#

FIGURE 4.6-2
REGIONAL FAULT MAP



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#

FIGURE 4.6-3
MAP OF LOCAL FAULTS

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain. Concealed faults in the Great Valley are based on maps of selected subsurface horizons, so locations shown are approximate and may indicate structural trend only. All offshore faults based on seismic reflection profile records are shown as solid lines where well defined, dashed where inferred, queried where uncertain.

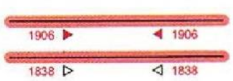
FAULT CLASSIFICATION COLOR CODE
(Indicating Recency of Movement)

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.



A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

FIGURE 4.6-3
MAP OF LOCAL FAULTS - LEGEND

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened. On offshore faults, barbs simply indicate a reverse fault regardless of steepness of dip.

OTHER SYMBOLS

Numbers refer to annotations listed in the appendices of the accompanying report. Annotations include fault name, age of fault displacement, and pertinent references including Earthquake Fault Zone maps where a fault has been zoned by the Alquist-Priolo Earthquake Fault Zoning Act. This Act requires the State Geologist to delineate zones to encompass faults with Holocene displacement.

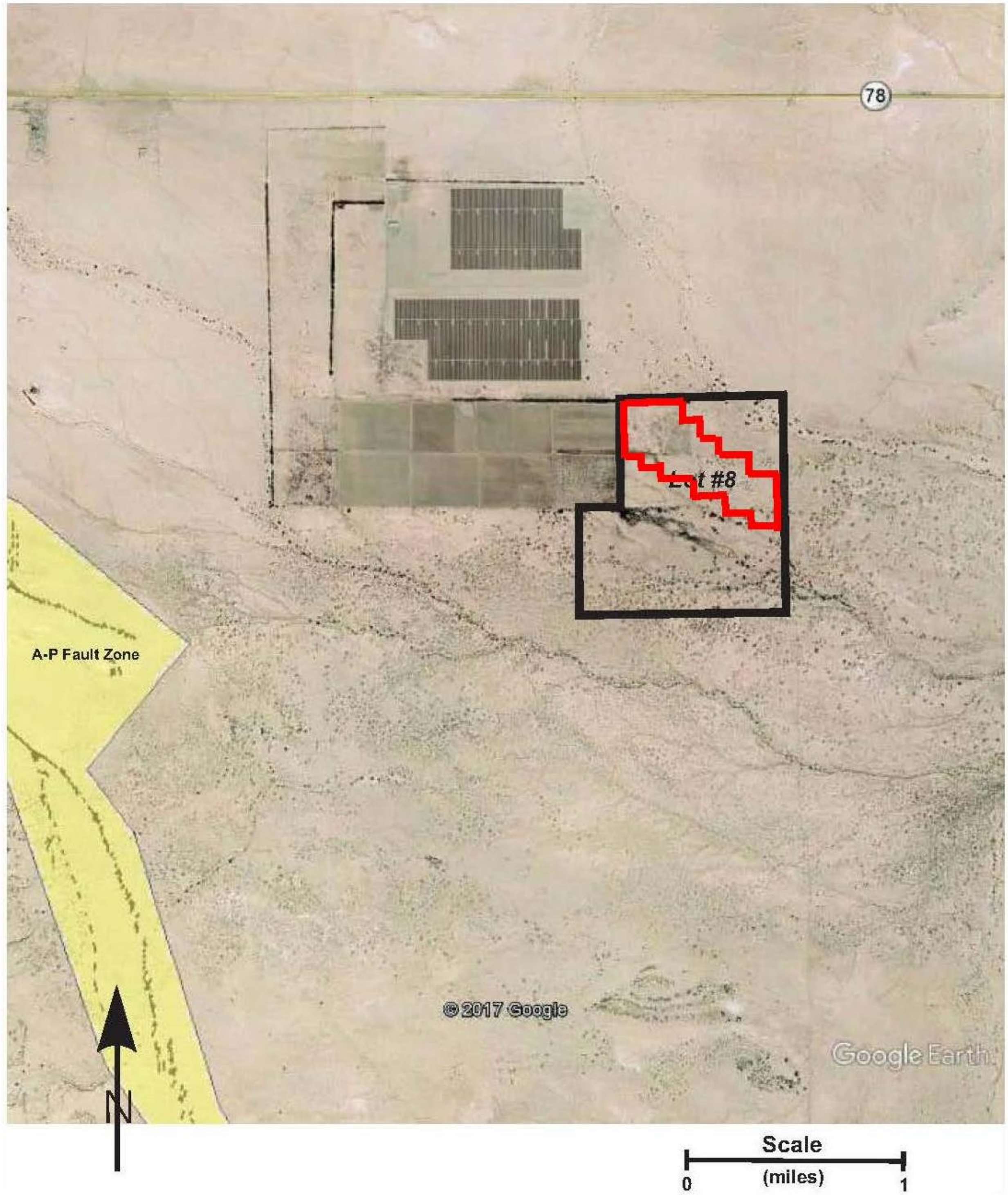
Structural discontinuity (offshore) separating differing Neogene structural domains. May indicate discontinuities between basement rocks.

Brawley Seismic Zone, a linear zone of seismicity locally up to 10 km wide associated with the releasing step between the Imperial and San Andreas faults.

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic	0–200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
Quaternary	Late Quaternary	Holocene	200–11,700			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
Quaternary	Late Quaternary	Pleistocene	11,700–700,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
Quaternary	Early Quaternary	Pleistocene	700,000–1,600,000*			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			1,600,000*–4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

FIGURE 4.6-3
MAP OF LOCAL FAULTS - LEGEND



Source: LandMark 2017.

FIGURE 4.6-4
ALQUIST-PRIOLO FAULT ZONE MAP

Soil Map Units

Surficial deposits at the Project site and surrounding area consist predominantly of silty sand loams of the Indio, Meloland, Rositas, and Vint soil groups. These loams and sands are formed in sediment and alluvium of mixed origin (Colorado River overflows, mountain run-off and fresh-water lake-bed sediments) (LandMark 2017, p. 7).

Table 4.6-3 provides a brief summary of the characteristics of the two soil types within the Project site boundaries, followed by additional details of each soil. **Figure 4.6-5** depicts the soil map units within the boundaries of both of the proposed configurations and the Gen-Tie Line alignment. Soils within the existing boundary of Lot D have been previously analyzed as part of the Seville Solar Farm Complex EIR and engineered during construction of Seville 1 Solar and Seville 2 Solar. Thus, soils within Lot D are not identified in the table below.

TABLE 4.6-3
SUMMARY OF SOIL MAP UNITS WITHIN THE PROJECT SITE

Soil	Texture[1]	Depth of Surface Layer[1]	Wind Erodability Group[2]	Erosion (K) Factor[3]	Permeability Inches Per Hour[3]	Fixed-Frame Acres/Percent of total Acres	HSAT Acres/ Percent of total Acres
105 Glenbar Clay Loam	Loam	0-13	4L	0.37	0.2-0.6	*	*
119 Indio-Vint Complex	Loam	0-12	4L	0.55	0.6-2.0	*	*
121-Meloland fine sand	Very Fine Sandy Loam	12	1	0.28	2.0-6.0	116.6/79.7%	130.8/75%
132 Rositas sand (2 to 5 percent slopes)	Fine Sand	0-9	5	0.20	6.0-20	*	*
143-Vint Fine Sandy Loam	Fine Sandy Loam	0-12	3	0.37	0.9-2.0	29.7/20.3%	43.6/25%
					Total	146.3/100%	174.4/100%

Source: USDA 1981.
**Within Gen-Tie Line Corridor*
[1] Taken from Table 11, Engineering Index Properties.
[2] Wind erodibility groups range from 1 to 8, with 1 being highly erodible and 8 having low erodibility. Taken from Table 12, Physical and Chemical Properties of Soils.
[3] This is an index of erodibility for standard condition and includes susceptibility of soil to erosion and rate of runoff. Low K values (below 0.15) indicate low erosion potential. High K values (above 0.4) are highly erodible. Taken from Table 12, Physical and Chemical Properties of Soils.

105 Glenbar Clay Loam – These very deep, well drained soil is mainly on the floors of alluvial basins in dissected playas on West Mesa. Elevation is 200 feet above sea level to 230 feet below. Permeability is moderately slow, and available water capacity is very high. Surface runoff is slow, and the hazard of erosion is slight, although many areas are channeled by geologic erosion. The hazard of soil blowing is moderate. This soil is suited to water impoundment areas such as reservoirs and fish ponds (USDA 1981 p. 12).

119-Indio-Vint Complex – These nearly level soils are on flood plains and alluvial basin floors and are so intricately mixed that they were not separated on the soil map. Elevation is 200 feet above sea level to 230 feet below. Permeability of the Indio soil is moderate, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. Permeability of the Vint soil is moderately rapid and available water capacity s moderate. Surface runoff is slow, and the hazard of erosion is slight. These soils are too permeable for water impoundment construction, so ponds and reservoirs need an impervious lining to prevent seepage (USDA 1981 p. 22).

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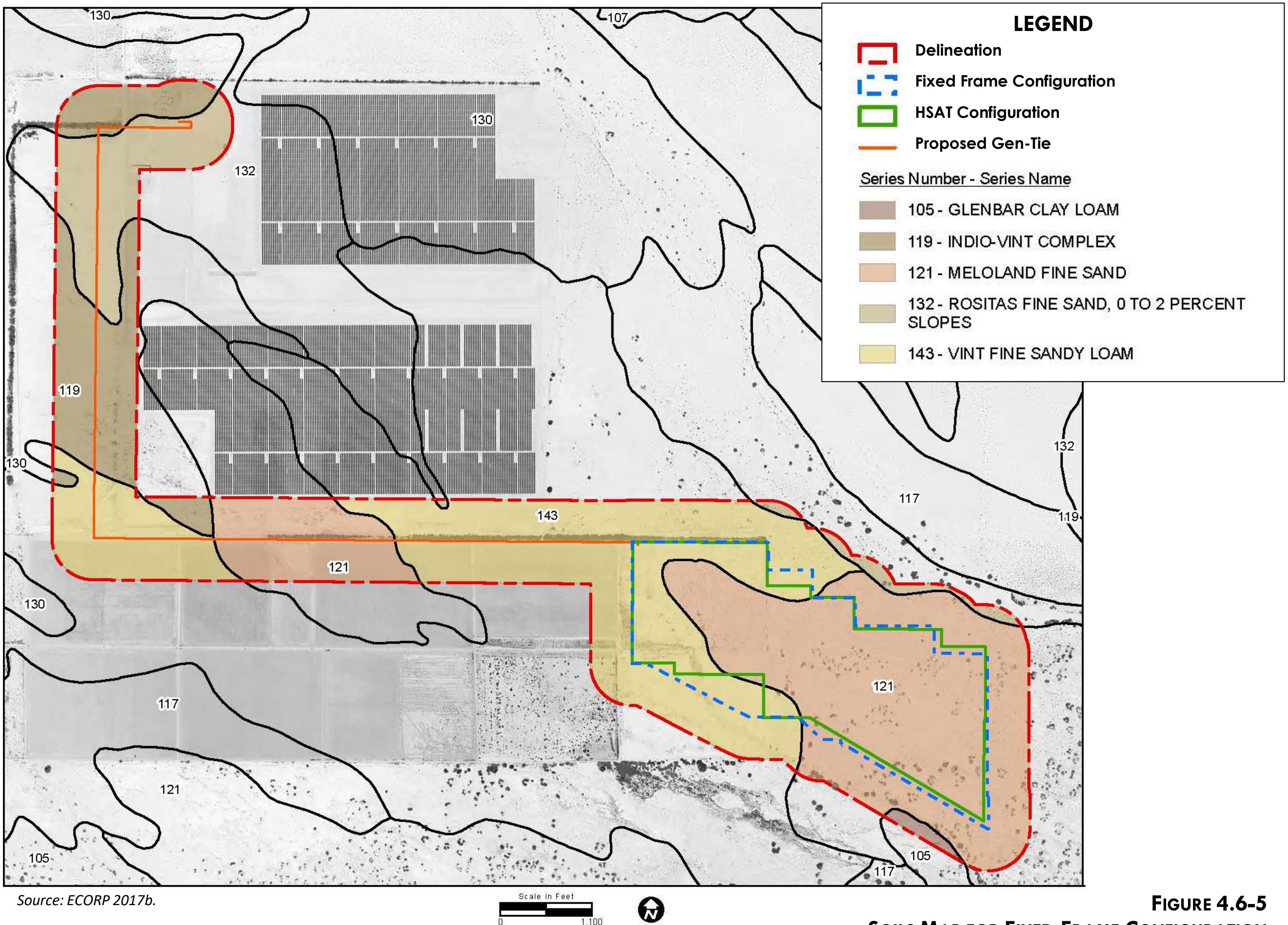

Source: ECORP 2017b.

FIGURE 4.6-5
SOILS MAP FOR FIXED-FRAME CONFIGURATION

121-Meloland Fine Sand – is a very deep, well drained nearly level soil found on flood plains and alluvial basin floors. Permeability is slow, and available water capacity is high to very high. Surface runoff is slow and the hazard of erosion is slight. The hazard of soil blowing is high. Meloland soil is moderately suited to homesites and urbanareas, though sandy surface layers and salinity affect its use (USDA 1981 p. 23). As shown in **Table 4.6-3**, the Fixed-Frame Configuration contains 115.6 acres of Meloland Fine Sand and the HSAT Configuration contains 130.8 acres.

132-Rositas Fine Sand (0 to 2 percent slopes) – this very deep, somewhat excessively drained, nearly level soil is on flood plains, basins, and terraces. Elevation is 300 feet above sea level to 200 feet below. Permeability is rapid, and available water capacity is low. Surface runoff is slow and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. This soil is too permeable to be good material for water impoundments Ponds and reservoirs need an impervious limit of prevent seepage (USDA 1981 p. 31).

143-Vint Fine Sandy Loam – is a very deep, well drained, nearly level soil is found on flood plains, basins, and terraces. This soil is found at an elevation of 35 to 300 feet. Permeability is moderately rapid and available water capacity is moderate. Surface runoff is slow and the hazard of erosion is slight, although geologic erosion has etched most areas with rills and arroyos. The hazard of soil blowing is moderate. Vint soil is well suited to homesites and urban areas, though dustiness and sandy soil materials affect use. Septic tank absorption fields can function well but there is a hazard of ground water contamination from septic tank effluent in the permeable subsurface strata. This soil is too permeable to be good material for water impoundments, thus ponds and reservoirs need impervious lining to prevent seepage (USDA 1981, p. 37). As shown in **Table 4.6-3**, the Fixed-Frame Configuration contains 29.7 acres of Vint Fine Sandy Loam and the HSAT Configuration contains 43.6 acres.

Subsurface Soils

Subsurface soil conditions were previously discussed relative to the Project site. Refer to the discussion under Geology, Site Specific, above.

Liquefaction

Liquefaction of soils can be caused by strong vibratory motion in response to earthquakes. Research and historical data indicate saturated loose, granular soils are susceptible to liquefaction, whereas cohesive soils such as clays, are not adversely affected by vibratory motion. The Project site is characterized by sand and silty sand. A Particle Size Analysis (ASTM D422) was used to evaluate the potential for liquefaction.

Expansive Soils

Expansive soils are primarily comprised of clay particles. Clay increases in volume when water is absorbed and shrinks when dry. Expansive soils can damage building foundations, concrete flatwork, and asphaltic concrete pavements as a result of swelling forces that reduce soil strength. A Plasticity Index (ASTM D4318) was used to for expansive soil design criteria. The near surface soils in the Project site are silty and sandy silts (LandMark 2017, p. 10).

Seismic Settlement

Seismic settlement refers to uneven settlement of a slab-on-ground foundation. When seismic settlement occurs, some portions of the foundation settle more than other portions. The soils beneath the Project site consist primarily of medium dense to very dense silty sands. These soil types (i.e. dry sands) have the potential for seismic settlement (LandMark 2017, p. 11). A non-liquefaction seismic settlement potential was performed for dry sands.

Soil Corrosivity

Project components including concrete foundations and metal would come in contact with on-site soils. Site soils, especially when of elevated moisture content, are potentially corrosive to buried ferrous metals. Soil corrosivity was conducted at select locations on the Project site (LandMark 2017, p. 5).

Mineral Resources

Imperial County contains diverse mineral resources. Those with the highest economic value include gold, gypsum, sand, gravel, lime, clay, and stone. Geologic factors restrict mining operations to the relatively few locations where mineral deposits are feasible for extraction. The majority of the mining areas are in the eastern portion of Imperial County as depicted on Figure 5, Mining Resources, of the Imperial County General Plan Conservation and Open Space Element (Imperial County 1993). The Project area appears to contain no mineral resources, and no mining activities occur in the vicinity of, or on, the Project site.

B. Seville 4 Substation and Gen-Tie Line

As previously noted, soils within the boundary of Lot D have been previously analyzed as part of the Seville Solar Farm Complex EIR. Lot D was graded and engineered during construction of Seville 1 Solar and Seville 2 Solar. Thus, soils within Lot D are not identified in the table below. The same is true for soils in the area of the extension of the access road and IID Switching Station. **Figure 4.6-5** shows the soils within the boundaries of the Project site for both configurations and the proposed Gen-Tie Line alignment.

4.6.3 IMPACTS AND MITIGATION MEASURES

A. Standards of Significance

The impact analysis provided below is based on the following CEQA Guidelines, as listed in Appendix G. The Project would result in a significant impact to geology and soils if it would result in any of the following:

- a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.
  - ii) Strong Seismic ground shaking.
  - iii) Seismic-related ground failure, including liquefaction and seiche/tsunami.
- iv) Landslides.
- b) Result in substantial soil erosion or the loss of topsoil.
- c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse.
- d) Be located on expansive soil, as defined in the latest Uniform Building Code, creating substantial risk to life or property.
- e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Note: One additional issue, corrosive soils, was identified in the Geotechnical Report and is discussed in the analysis of Project Impacts and Mitigation Measures.

B. ISSUES SCOPED OUT AS PART OF THE INITIAL STUDY

Several checklist criteria were eliminated from further evaluation as part of the Initial Study and review of the Geotechnical Report. Criterion "a-i" was scoped out because the Project area is not within a designated State of California Alquist-Priolo Earthquake Fault Zone. The California Geological Survey (2016) has established Earthquake Fault Zones in accordance with the 1972 Alquist-Priolo Earthquake Fault Zone Act. The Earthquake Fault Zones consist of boundary zones surrounding well defined, active faults or fault segments. The Project site does not lie within an Alquist-Priolo Earthquake Fault Zone; therefore, surface fault rupture is considered to be low at the Project site. Review of the current Alquist-Priolo Earthquake Fault Zone map indicates that the nearest mapped Earthquake Fault Zone is the Borrego segment of the San Jacinto fault zone (LandMark 2017, p. 9) located approximately 1.8 miles southwest of the Project site (refer to **Figure 4.6-4**). Therefore, surface fault rupture is considered to be low at the Project site.

Criterion "a-iii" regarding seismic-related ground failure including seiche/tsunami was scoped out based on the Project site's distance from the coast or any large body of water. Thus, the threat of tsunami, seiche, or other seismically-induced flooding is unlikely because the Project area is not located near any large bodies of water (LandMark 2017, p. 5).

Criterion "a-iv**"** was scoped out because the site is generally flat. Due to the regional planar topography, the hazard of landsliding is unlikely. In addition, no ancient landslides are shown on the geologic maps of the region. Lastly, no indications of landslides were observed during the site investigation (LandMark 2017, p. 10).

Criterion "e" was scoped out because the Project does not include an Operations and Maintenance Building or septic system. Therefore, no impact would occur with regard to soil capability to support a septic system and this issue will not be discussed in the EIR.

C. METHODOLOGY

Existing conditions were evaluated based on potential to be affected by construction activities, operation and reclamation of the Project. Details regarding construction, operation, and reclamation were provided by the Applicant. Geology and soils impacts were formulated based on the findings of the "Geotechnical Report, Titan Solar Facility 1791 Hwy 78, Imperial County, California" (LandMark 2017) included in **Appendix F** of the Technical Appendices of this EIR on the attached CD. The Geotechnical Report investigated the upper 50 feet of subsurface soil at selected locations within the Seville 3 Solar Project and the proposed Project site for evaluation of physical/engineering properties, liquefaction potential during seismic events, field testing for steel post capacities and soil electrical/thermal resistivity parameters. Professional opinions were developed from field and laboratory test data and are included as recommendations in the Geotechnical Report. As part of site exploration, four (B-9, B-11, B-12 and B-14) subsurface borings were advanced within the boundaries of the Project site.

The Geotechnical Report employed laboratory testing on of site soils to aid in classification and evaluation of selected engineering properties. The tests were conducted in general conformance with the procedures of the American Society for Testing and Materials (ASTM) or other standardized methods including: the Plasticity Index (ASTM D4318) – used for soil classification and expansive soil design criteria; Particle Size Analyses (ASTM D422) – used for soil classification and liquefaction evaluation; Unit Dry Densities (ASTM D2937) and Moisture contents (ASTM D2216) used for insitu soil parameters; Direct Shear (ASTM D3080) – used for soil strength determination; Unconfined Compression (ASTM D2166) – used for soil strength estimates; and Chemical Analyses (soluble sulfates and chlorides, pH and resistivity) (Caltrans Methods) – used for concrete mix proportions and corrosion protection requirements (LandMark 2017, p. 4).

Field resistivity testing was also conducted at two locations within the Project site in accordance with

ASTM G57 standards. Additionally, a near surface soils sample (upper 5 feet) was obtained for laboratory soil corrosivity testing at select locations (LandMark 2017, p. 5).

D. Project Impacts and Mitigation Measures

Strong Seismic Ground Shaking

Impact 4.6.1 The primary seismic hazard at the Project area has the potential for strong ground shaking during earthquakes along the San Jacinto-Borrego fault. This is considered a **potentially significant impact.**

The Project area is located in the seismically active southern California area making the Project's structures subject to strong ground shaking in the event of movements along the San Jacinto Fault. The Project site will likely be subjected to a moderate to strong ground motion from earthquakes in the region. Ground motions are dependent primarily upon the earthquake magnitude and distance to the seismogenic (rupture) zone. Acceleration magnitude is also dependent upon attenuation by rock and soil deposits, direction of rupture and type of fault. Therefore, ground motions may vary considerably in the same area (LandMark 2017, p. 9).

Engineered design and earthquake-resistant construction are the common solutions to increase safety and development of seismic areas. Designs should comply with the 2016 edition of the CBC for Site Class E using seismic coefficients (LandMark 2017, p. 24).

Construction

Exposure to strong seismic ground shaking during construction could damage work in progress resulting in a **potentially significant impact**. However, impacts associated with strong seismic ground shaking during construction would be addressed through Project design. The Project would be designed based on the 2016 CBC to ensure that all foundations and structures are constructed to withstand a seismic event during operation of the Project as discussed below.

Operation

As previously discussed, the Project area will likely be subjected to moderate to strong ground motion from earthquakes in the region. The Project site has a peak ground acceleration (PGA_M) value (i.e. Ground Acceleration Value) of 0.80 g.

Imperial County is classified as Seismic Zone 4 by the Uniform Building Code (UBC 1997). Developments within in Seismic Zone 4 (highest risk on a scale of 0 to 4) are required to incorporate the most stringent earthquake resistant measures. While the Project does not include habitable structures (such as a home that would be permanently occupied), Project facilities could be damaged by strong seismic shaking. Thus, impacts associated with strong seismic shaking are considered **potentially significant**.

Reclamation

Reclamation of the Project would involve removal of all on-site facilities. No PV panels, transmission lines, inverters, etc. would remain and the Project site would be reclaimed to its end state to approximate the existing desert lands or idle farmland. Following reclamation, no structures would remain that could be damaged. **No impacts** resulting from strong seismic ground shaking are anticipated in association with reclamation of the Project site.

Mitigation Measures

MM 4.6.1 Structures with the Project area shall be designed and constructed in accordance with the 2016 California Building Code (CBC) and ASCE 7-10 Seismic Parameters.

Timing/Implementation: *Prior to approval of final building plans/As part of Project design.*
Enforcement/Monitoring: *Imperial County Planning and Development Services Department and Imperial County Department of Public Works.*

Significance After Mitigation

Implementation of mitigation measure MM 4.6.1 would reduce potential structural damage caused by strong seismic ground shaking by adhering to and enforcing the appropriate provisions of the 2016 CBC and ASCE 7-10 Seismic Parameters. Thus, strong seismic ground shaking impacts can be mitigated to a **less than significant** level through adherence to applicable codes and standards.

Liquefaction

Impact 4.6.2 Sand and silty sand are the predominant soils on the Project site. Based on these soil types, the risk of liquefaction induced settlement on the Project site is very low. Therefore, liquefaction is considered a **less than significant impact**.

The Project site soils have been classified as Site Class D (stiff soil profile) (LandMark 2017, p. 9). These soils have a high runoff potential with very low infiltration rates (Purdue 2017).

The Geotechnical Report investigated the upper 50 feet of subsurface soil at selected locations within the Project site for evaluation of physical/engineering properties, including liquefaction. Particle Size Analysis (ASTM D422) was used for soil classification and liquefaction evaluation. Liquefaction occurs when granular soil below the water table is subjected to vibratory motions such as produced by earthquakes. With strong ground shaking, an increase in pore water pressure develops as the soil tends to reduce in volume. If the increase in pore water pressure is sufficient to reduce the vertical effective stress (suspending the soils particles in water), the soil strength decreases and the soil behaves as a liquid (similar to quicksand). Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations (LandMark 2017, p. 11).

Four conditions are generally required for liquefaction to occur:

1) The soil must be saturated (relatively shallow groundwater)
2) The soil must be loosely packed (low to medium relative density)
3) The soil must be relatively cohesionless (not clayey); and
4) Groundshaking of sufficient intensity must occur to function as a trigger mechanism.

The Project site lacks groundwater in the upper 50 feet of the subsurface soils. The absence of groundwater reduces the potential for liquefaction. Based on these conditions, liquefaction is not a design consideration (LandMark 2017, p. 11). Therefore, liquefaction is considered a **less than significant impact.**

Mitigation Measures

None required.

Significance After Mitigation

Not applicable.

Unstable Soils – Seismic/Differential Settlement

Impact 4.6.3 Potential for seismic settlement across the Project site is 0.35 inch or less. This is considered minimal and would be addressed through design to address differential movement. Therefore, seismic settlement is considered a **less than significant impact**.

As part of the Geotechnical Report, an evaluation of the non-liquefaction seismic settlement potential was performed for dry sands. An empirical approach was used to quantify seismic settlement using Standard Penetration Test (SPT) blow counts and Peak Ground Acceleration (PGA) estimates from the probabilistic seismic hazard analysis (LandMark 2017, p. 11).

The soils beneath the Project site consist primarily of medium dense to very dense silty sands (LandMark 2017, p. 11). Differential (i.e. uneven) settlement may be estimated to be approximately 50 to 67% (one-half to two thirds) of the total induced settlements based on the Southern California Earthquake Center (1999) report "Recommended Procedures for Implementation of Department of Mines and Geology Special Publication 177, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California." Should settlement occur, buried utility lines and the buildings (e.g. inverters) may not settle equally. Based on total estimated settlement of 0.35 inch, differential settlements of approximately one-quarter inch may be expected from seismic settlement at the southeast corner of the Project site. Settlement can be addressed through design to accommodate differential movement at the points of entry to inverters (LandMark 2017, p.12). Therefore, seismic/differential settlement is considered a **less than significant impact**.

Mitigation Measures

None required.

Significance After Mitigation

Not applicable.

Erosion

Impact 4.6.4 Surface soils on the Project site are generally classified as AASHTO Group A1 and A3, which are highly erodible. Construction, operation, and reclamation activities could result in erosion and loss of top soil on the Project site. Therefore, erosion is considered a **potentially significant impact.**

The American Association of State Highway and Transportation Officials (AASHTO) is a system of soil classification that divides soils into seven groups. Groups A-1 thru A-3 are granular materials of which 35% or less of the particles pass through the No. 200 sieve. The classification system is based on the grain size (gravel, sand, silt and clay) and plasticity (silty or clayey). The site soils are classified as silty sands with sand with approximately 75% sand, 20% silt and 5% clay (LandMark 2017, p. 24). The soil compositions are considered highly erodible.

Construction

Disturbance of the Project site ranges from 153 acres for the Fixed-Frame Configuration to 181 acres for the HSAT Configuration inclusive of the Gen-Tie Line, common access roads, IID Switch-station and Seville 4 Substation (refer to Tables 2.0-3 and 2.0-4 in Chapter 2.0, Project Description).

Prior to placing any fills, the surface 12-inches of the soil will be removed as part of mass grading (LandMark 2017, p.13). Site development will also include minimal grading for the PV panel areas, underground utility installation, site paving and all-weather road surfacing (LandMark 2017, p.1). Soil erosion could result during construction of the proposed Project in association with the ground disturbing activities.

During construction, erosion would be controlled by watering and, as necessary, the use of other dust suppression methods and materials accepted by the Imperial County Air Pollution Control District (ICAPCD) (i.e. Rule 801) or the California Air Resources Board (CARB). The Project would also be subject to preparation, review and approval of a grading plan by the County Engineer and compliance with the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (discussed further in Section 4.11, Hydrology and Water Quality). These actions in additions to the recommendations of the

Geotechnical Report (MM 4.6.4a, MM 4.6.4b and MM 4.6.4c) would mitigate the potential soil erosion impacts during construction to **less than significant**.

Operation

Dust would be controlled during operations by the periodic application and maintenance of soil binders to exposed soil surfaces. Daily operations and routine maintenance (such as occasional PV panel washing) are not anticipated to increase erosion. Likewise, during operation soil erosion and sedimentation would be controlled in accordance with the Best Management Practices (BMPs) included as part of the project's Storm Water Pollution Prevention Plan (SWPPP) (discussed further in Section 4.11, Hydrology and Water Quality). Thus, erosion impacts would be reduced to **less than significant** levels during operations.

Reclamation

Activities associated with reclamation include concrete removal; removal and dismantling of underground utilities; excavation and removal of soil; and final site contour. Removal of Project infrastructure presents the potential to expose soils to erosion. During reclamation, soil erosion and sedimentation is anticipated to be controlled in accordance with implementation of a Dust Control Plan (Rule 801) and compliance with NPDES Construction General Permit. These actions would mitigate the potential soil erosion impacts to **less than significant** during reclamation**.** Some natural erosion from wind or rain may occur after the Project site is reclaimed to approximate the existing desert lands or idle farmland.

Mitigation Measures

MM 4.6.4a All permanent slopes shall not be steeper than 3:1 to reduce wind and rain erosion. Protected slopes with ground cover may be as steep as 2:1. Note: Maintenance with motorized equipment may not be possible at this inclination.

Timing/Implementation: *Prior to approval of grading plans/During grading.*
Enforcement/Monitoring: *Imperial County Planning and Development Services Department and Imperial County Department of Public Works.*

MM 4.6.4b Low slope angles (less than 3H:1V) shall be used for unprotected slopes. Where significant exposure is expected, addition of cement to the soil or concrete filled rock facing shall be employed to create a cemented mass that is resistant to water movement.

Timing/Implementation: *Prior to approval of grading plans/During grading.*
Enforcement/Monitoring: *Imperial County Planning and Development Services Department and Imperial County Department of Public Works.*

MM 4.6.4c Dressing (fine grading and compacting) of the slopes shall be implemented periodically to fill small rivulets caused by direct rainfall onto the slopes. Surface soils coagulants shall also be considered for wind erosion control of the sandy ground surface

Timing/Implementation: *As needed following rain events/During Project operation.*
Enforcement/Monitoring: *Imperial County Planning and Development Services Department.*

Significance After Mitigation

Implementation of mitigation measures MM 4.6.4a, MM 4.6.4b and MM 4.6.4c would reduce potential for erosion through slope design, addition of cement, dressing, and use of surface soil coagulants. With these mitigation measures, erosion impacts would be mitigated to **less than significant**.

Expansive Soils

Impact 4.6.5 The near surface soils in the Project site are silty sand and sandy silts. These soils are considered non-expansive. Therefore, impacts associated with expansive soils are considered **less than significant.**

Laboratory tests were conducted on selected bulk (auger cuttings) and relatively undisturbed soil samples obtained from the soil borings to aid in classification and evaluation of selected engineering properties of Project site soils. Plasticity Index (ASTM D4318) was used for soil classification and expansive soil design criteria (LandMark 2017, p. 4). The Plasticity Index (PI) is a measure of the plasticity of a soil. Plasticity is the property of a material to be deformed repeatedly without rupture by the action of a force, and remain deformed after the removal of force (Nagayach 2016). Soils with a high PI tend to be clay, those with a lower PI tend to be silt, and those with a PI of 0 (non-plastic) tend to have little or no silt or clay.

Specifically, sample locations B-9 (5 feet deep) and B-12 (15 feet deep) were advanced on the Project site. B-9 had a PI of 14 and B-12 has a PI of 38. Thus the soils on the site in B-12 are clay while those in B-9 were a bit more silty.

Construction

Near-surface soils consist of fine sand and fine sandy loam. These soils are well drained and considered non-expansive. Therefore, special foundation designs to mitigate expansive soil conditions are not required and impacts associated with expansive soils during construction are considered **less than significant**.

Operation

During operation, the Project is not anticipated to have any issues with regard to expansive soils. The Project site will be designed to allow water to flow across the site and be captured in on-site retention basins. Because near surface soils are non-expansive, impacts associated with expansive soils during operation are considered **less than significant**.

Reclamation

Reclamation of the Project site would involve removal of concrete, removal and dismantling of underground utilities and excavation and removal of soil. The on-site soils would be ripped to the depth necessary to remove all miscellaneous buried solar project equipment. The Project site would be reclaimed to its end state to approximate the existing desert lands or idle farmland. As a result, impacts associated with expansive soils during reclamation would be **less than significant**.

Mitigation Measure

None required.

Significance After Mitigation

Not applicable.

Soil Corrosivity

Impact 4.6.6 Soils within the Project site are corrosive to concrete and metals. This is considered a **potentially significant impact.**

Corrosion is an electrochemical process where the reaction rate is largely dependent upon the conductivity of the surrounding electrolyte. Accordingly, the lower the resistivity, the greater the current flow and the greater the corrosion rate assuming all other factors are equal.

External corrosion of buried ferrous structures is dependent upon many factors. Some of these factors include temperature, pH, soil resisitivity (i.e. a measure of how much the soil resists the flow of electricity), soluble ion concentrations, moisture content, and the amount of free oxygen in the soil to allow for the oxidation reaction to occur. The combination of these factors can lead to extreme variations in corrosion attack. However, some general rules can be assumed. Soils with high moisture content, high electrical conductivity (inversely low resistivity), high acidity (low pH), and high level of soluble ions (dissolved salts) typically will be the most corrosive to buried ferrous metals. Additionally, soils with low pH (below 5.5) and high sulfate concentrations (above 1,000 ppm) may be considered detrimental to concrete in contact with the soil (Yeager 2017, p. 4).

Soil resisitivity (the inverse of conductivity) measures the ability of an electrolyte (soil) to support electrical current flow. The most common method of measuring soil resistivity is the Wenner 4-Pin Method which uses four pins (electrodes) that are driven into the earth and equally spaced apart in a straight line. The Wenner 4-pin Method provides an average resistivity of a hemisphere (essentially) of soil with a diameter approximately equal to the pin spacing (Yeager 2017, p. 4). For example, the resistivity value obtained with the pins spaced at 5 feet apart is the average resistivity of a hemisphere of soil from the surface to a depth of 5 feet. By taking readings at different pin spacings (or depths), average soil resistivity conditions can be obtained within areas at, above, and below trench zones (Yeager 2017, p. 4).

Chemical Analysis (soluble sulfates and chlorides pH and resistivity) (Caltrans Methods) was used for concrete mix proportions and corrosion protection requirements. Electrical Resistivity Testing was conducted within the Project site in accordance with ASTM G57 standards. The resistivity of the soil was determined by using the Wenner 4-pin method (Yeager 2017, p. 4). Six separate readings based on pin spacings of 40, 20, 15, 10, 5 and 2.5 feet were recorded for each of the two test locations.

The saturated resistivities of the soil samples were 700 ohm-cm and 960 ohm-cm for the two samples on the Project site. Resisitivity measures in the range of 0 – 1,000 ohm-cm are considered very corrosive. Thus, the soil within the Project site should be considered corrosive to buried metallic structures. This conclusion is based primarily on the high soil soluble salt concentrations and low soil sample resistivities (Yeager 2017, p. 4).

A near surface soil sample (upper 5 feet) was obtained for laboratory soil corrosivity testing at select locations (LandMark 2017, p. 5). The soil corrosivity was evaluated based on the results of the soil resistivity survey and the chemical analyses of a soil sample from two test sites within the Project site. The soil sample depths were approximately 0 to 3 feet. The samples were tested for chloride concentration, sulfate concentration, pH, and soil box resistivity in the saturated condition (minimum soil box resistivity). Both test sites had resistivity readings well above 2000 ohm-cm for all pin spacings.

Soil tests revealed chloride concentrations of 85 ppm and 200 ppm at the two test sites. Chloride concentrations higher than 300 ppm are considered high. Sulfite concentrations for the two test sites were relatively low at 200 ppm and 210 ppm. Sulfate concentrations below 1,000 ppm are considered to be the level at which sulfates become a major contributor to soil corrosivity. The pH values of 8.4 and 8.5 were indicative of slightly alkaline soil conditions (Yeager 2017, p. 3).

Construction

Impacts associated with soil corrosivity during construction would be addressed through Project design to accommodate long-term operation of the Project. With proper design including supplemental corrosion control measures of any metallic utilities buried within the Project site, as recommended by a structural engineer and implemented in the field by the contractor, soil corrosivity impacts during construction would be reduced to **less than significant**.

Operation

Both slabs-on-grade for structural and non-structural concrete would come in contact with soils during operation of the Project. The native soils have low levels of sulfate ion concentrations (less than 900 ppm) and low to moderate levels of chloride ion concentrations (less than 430 ppm). Resistivity determinations on the soil indicate severe potential for metal loss because of electrochemical corrosion processes. Thus, concrete in contact with on-site soils could subject slabs-on-grade to soil corrosivity. Impacts as a result of corrosivity during operation are considered **potentially significant**.

Reclamation

Reclamation of the proposed Project would involve removal of concrete and underground utilities. Equipment and foundations to support the Project would no longer be in contact with corrosive soils. After the Project site is cleared and contoured, it would be reclaimed to its end state to approximate the existing desert lands or idle farmland. No structures are proposed as part of reclaiming the Project area. As a result, impacts associated with corrosive soils during reclamation would be **less than significant**.

Mitigation Measures

MM 4.6.6 The Project shall implement the recommendations of the Geotechnical Report regarding structural concrete, non-structural concrete, concrete mixes and corrosivity, driven pile design criteria, settlement, excavations, stormwater detention basin berms, lateral earth pressures, seismic design, soil erosion factors for SWPPP, and all-weather access roadways.

Timing/Implementation: *Prior to issuance of building permit/during construction.*
Enforcement/Monitoring: *Imperial County Planning and Development Services Department, Division of Building & Safety.*

Significance After Mitigation

Implementation of mitigation measure MM 4.6.6 would ensure that the Project is designed and constructed to protect concrete against corrosion from contact with on-site soils. With implementation of this mitigation measure, impacts resulting from soil corrosivity would be reduced to **less than significant**.

4.6.4 CUMULATIVE SETTING, IMPACTS AND MITIGATION MEASURES

A. CUMULATIVE SETTING

The geographic scope for the cumulative geology and soils setting is the Imperial Valley portion of the Salton Trough physiographic province of Southern California. A list of large scale proposed, approved and reasonably foreseeable renewable energy projects is identified in Table 3.0-1 of Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. None of these projects are adjacent to or in close proximity to the Project. In general, geology and soils impacts are site-specific and limited to the boundaries of each individual project rather than cumulative in nature.

B. CUMULATIVE IMPACTS AND MITIGATION MEASURES

Cumulative Exposure to Geologic and Seismic Impacts

Impact 4.6.7 Implementation of the proposed Project, in combination with existing, approved, proposed, and reasonably foreseeable development, may result in cumulative exposure to geologic and seismic hazards. This is considered a **less than cumulatively considerable impact**.

Construction

Project exposure to geology and soil impacts such as ground shaking, expansive soils, or corrosive soils would be addressed through constructing the Project in accordance with applicable building codes (i.e. 2016 CBC) and Project design features as recommended in the Geotechnical Report prepared by

LandMark (2017). Construction phase soil erosion would be controlled on site with site specific measures; a grading plan approved by the County Engineer; watering all-weather and private roads at least three times a day and watering actively disturbed areas to reduce fugitive dust (MM 4.4.1a and MM 4.4.1b in Section 4.4, Air Quality); compliance with the NPDES Construction General Permit; and compliance with the required Storm Water Pollution Prevention Plan (SWPPP). Construction-phase geology and soils impacts are primarily considered potentially significant short-term, site-specific impacts under CEQA. Therefore, geology and soils impacts are not expected to combine with similar impacts of large scale proposed, approved and reasonably foreseeable renewable energy projects identified in Table 3.0-1 in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. Therefore, the proposed Project would have a **less than cumulatively considerable contribution** to soil erosion impacts. Likewise, cumulative impacts associated with soil erosion would be **less than cumulatively considerable** during Project construction.

Operation

Ground Shaking

As discussed above, the Project is located in a seismically active area which would make it susceptible to seismic ground shaking in the event of an earthquake during Project operations and maintenance. Mitigation measure MM 4.6.1 requires structures to be designed and constructed in conformance with the 2016 CBC, and ASCE 7-10 Seismic Parameters and the County of Imperial building requirements. Mitigation measure MM 4.6.1 would apply during final Project design, and prior to and during construction of the proposed Project. Implementation of mitigation measure MM 4.6.1 would reduce the Project's exposure to damage from seismic ground shaking to less than significant during operation and maintenance. Furthermore, ground shaking impacts are site-specific and would not combine with similar impacts of large scale proposed, approved and reasonably foreseeable renewable energy projects identified in Table 3.0-1 in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. The proposed Project would have a less than cumulatively considerable contribution to ground shaking impacts and result in a **less than cumulatively considerable impact** during operation and maintenance of the proposed Project.

Soil Erosion

Soil erosion would occur during Project operation and maintenance activities. Operation and maintenance-phase soil erosion would be controlled on-site with site-specific slope design measures (MM 4.6.4a, MM 4.6.4b and MM 4.6.4c) that require watering all-weather and private roads at least three times a day and watering actively disturbed areas to reduce fugitive dust (MM 4.4.1a and MM 4.4.1b in Section 4.4, Air Quality); and compliance with the Project's SWPPP. Furthermore, soil erosion impacts are site-specific and would not combine with similar impacts of large scale proposed, approved and reasonably foreseeable renewable energy projects identified in Table 3.0-1 in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. Therefore, the proposed Project would have a **less than cumulatively considerable contribution** to exposure to soil erosion during operations and maintenance. Likewise, a **less than cumulatively considerable** soil erosion impact would occur during operation and maintenance of the proposed Project.

On-site soils that have high concentrations of chlorides, low sulfate concentrations and saturated resistivities are considered "corrosive" or "very corrosive." Contact of such soils with buried metallic structures can lead to premature failures. Mitigation measure MM 4.6.6 requires that the Project be designed in accordance with the recommendations of the Geotechnical Report. Corrosive soils impacts are site-specific and would not combine with similar impacts of large scale proposed, approved and reasonably foreseeable renewable energy projects identified in Table 3.0-1 in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. Therefore, operation and maintenance of the proposed Project would have a **less than cumulatively considerable contribution** to corrosive soils impacts. Likewise, cumulative impacts associated with corrosive soils would be **less than cumulatively considerable** during operation and maintenance of the proposed Project.

Reclamation

As part of the reclamation process, all solar equipment and other on-site facilities (chain link fence, gates, posts and concrete footings, solar generation facilities, electrical switchyard and substation facilities, water tanks, foundations) would be removed and salvaged if economically feasible. After the Project site is cleared and contoured, it would be reclaimed to its end state to approximate the existing desert lands or idle farmland.

Project exposure to geology and soil impacts such as ground shaking, erosion, or corrosive soils would be addressed through constructing the Project in accordance with applicable building codes and Project design features as recommended in the Geotechnical Report prepared by LandMark (2017). During reclamation, all of these facilities would be removed negating any impact associated with future damage caused by ground shaking or corrosive soils. Therefore, cumulative impacts associated with ground shaking and corrosive soils would be **less than cumulatively considerable** during reclamation.

Soil erosion impacts could occur in association with reclamation activities. Erosion is primarily considered a potentially significant short-term, site-specific impact under CEQA. All reclamation activities would implement appropriate fugitive dust control measures consistent with applicable ICAPCD requirements in effect at the time of Project reclamation. Similarly, all reclamation activities would implement appropriate BMPs and other measures consistent with applicable County and RWQCB requirements in effect at the time of Project reclamation. Thus, reclamation activities would result in a **less than cumulatively considerable contribution** to soil erosion impacts. Likewise, cumulative impacts associated with soil erosion would be **less than cumulatively considerable** during operation and maintenance of the proposed Project. However, if the end reclaimed state of the Project site as desert lands or idle farmland was reestablished as active farmland, dust and soil disturbance may be generated similar to levels historically occurring. Dust would be mitigated through required adherence to ICAPCD Rule 800, and soil erosion would be mitigation through adherence to County and RWQCB requirements.

Mitigation Measures

As discussed throughout this analysis, the proposed Project would be subject to all applicable building codes and standards including the 2016 CBC and ASCE 7-10 Seismic Parameters (MM 4.6.1). Likewise, the Project would be designed to minimize erosion (MM 4.6.4a, MM 4.6.4b and MM 4.6.4c). Incorporation of recommendations of the Geotechnical Report would address impacts resulting from soil corrosivity. Finally, the Project requires watering of all-weather and private roads at least three times a day and watering actively disturbed areas to reduce fugitive dust (MM 4.4.1a and MM 4.4.1b in Section 4.4, Air Quality); complies with the requirements of the SWRCB's Construction General Permit; and preparing and implementing a Project-specific SWPPP to address potential soil erosion impacts. Therefore, following mitigation, cumulative geologic and seismic impacts would be reduced to **less than cumulatively considerable**.

Significance After Mitigation

Project-specific impacts are mitigated on a project-by-project basis. Upon compliance with mandatory regulatory requirements, and following implementation of mitigation measures MM 4.6.1, MM 4.6.4a, MM 4.6.4b, MM 4.6.4c, and MM 4.6.6, as well as MM 4.4.1a and MM 4.4.1b, geology and soils impacts would be reduced to **less than cumulatively considerable** levels.

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