

APPENDIX S
PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

FOR THE

**FIRST SOLAR DEVELOPMENT, INC.
DESERT QUARTZITE SOLAR PROJECT
CACA-049397**

**RIVERSIDE COUNTY, CALIFORNIA
Township 7 South, Range 21 East, San Bernardino
Baseline and Meridian**

Prepared for:

First Solar Development, Inc.
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Prepared by:

URS

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URS Project No. 28907270

August 2011



August 8, 2011

Mr. James Cook
First Solar Development, Inc.
1111 Broadway, Suite 400
Oakland, CA 94607-4165

**Re: Preliminary Geotechnical Investigation Report
Desert Quartzite Solar Project (CACA 04937)
Riverside County, California
Township 7 South, Range 21 East, San Bernardino Baseline and Meridian**

Dear Mr. Cook:

URS Corporation (URS) is pleased to present the results of our preliminary geologic/geotechnical investigation performed for the proposed site development at the Desert Quartzite Solar Project, located in Riverside County, California. The preliminary conclusions and recommendations contained in this report are based on the findings of our literature review and our interpretation of the site geologic and geotechnical conditions based upon this literature review. The purpose of this investigation was to evaluate the geologic/geotechnical constraints to the development of the property. Further site-specific geotechnical investigation, including field investigation, will be required for the final design phase of the project.

Should you have any questions or require additional information, please do not hesitate to contact Robert Urban at 805-361-1109.

Sincerely,
URS Corporation

A handwritten signature in black ink, appearing to read "Robert J. Urban", is positioned above the printed name and title of Robert J. Urban.

Robert J. Urban, P.G. #7842, C.E.G. #2428
Exp. 1/31/13
Senior Engineering Geologist

A handwritten signature in black ink, appearing to read "Natalie J. Evans", is positioned above the printed name and title of Natalie Evans.

Natalie Evans, G.I.T. #286
Geologist

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION.....	1-1
1.1 BACKGROUND	1-1
1.2 SCOPE OF WORK.....	1-1
1.3 SITE LOCATION AND DESCRIPTION	1-1
1.4 PROPOSED DEVELOPMENT	1-2
2.0 GEOLOGIC SETTING	2-1
2.1 REGIONAL GEOLOGIC AND SEISMIC SETTING.....	2-1
2.2 GENERAL SITE GEOLOGY	2-1
2.2.1 Quaternary Non Marine (Qpv).....	2-2
2.2.2 Quaternary Alluvium (Qa ₆).....	2-2
2.2.3 Quaternary Dune Sand (Qs).....	2-2
2.2.4 Quaternary Dune Sand (Q a ₃)	2-2
2.2.5 Quaternary Alluvium (Qs)	2-3
2.3 FAULTS	2-3
2.4 NRCS SURFACE SOILS INFORMATION	2-4
2.5 GROUNDWATER CONDITIONS.....	2-5
3.0 GEOLOGIC AND SEISMIC HAZARDS	3-1
3.1 FLOODING	3-1
3.2 SLOPE INSTABILITY/LANDSLIDES.....	3-1
3.3 SUBSIDENCE.....	3-1
3.4 POOR SOIL CONDITIONS (EXPANSIVE OR COLLAPSIBLE SOILS)	3-2
3.5 EXCESSIVE SETTLEMENT (ARTIFICIAL FILL).....	3-2
3.6 FAULT HAZARDS.....	3-2
3.6.1 Surface Fault Rupture	3-2
3.6.2 Seismic Ground Shaking.....	3-3
3.7 LIQUEFACTION	3-3
3.8 TSUNAMIS AND SEICHES	3-5

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

3.9	GENERAL SOIL EROSION AND STABILITY CONSIDERATIONS.....	3-5
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<u>Section</u>	<u>Page</u>
4.0 SUMMARY	4-1
4.1 CONCLUSIONS AND RECOMMENDATIONS	4-1
4.2 LIMITATIONS.....	4-1
5.0 REFERENCES.....	5-1

<u>List of Tables</u>		<u>Page</u>
Table 1	Summary of Potential Seismic Sources – Faults in Proximity to Site	2-3
Table 2	NRCS Surface Soils Properties and Description	2-3
Table 3	Summary of Potential Seismic Sources – Parameters and Estimated Earthquakes for Regional Faults.....	3-4

List of Figures

Figure 1	Topographic Map of Desert Quartzite Solar Project Site
Figure 2	Aerial Map of Desert Quartzite Solar Project Site
Figure 3	Geologic Map of Desert Quartzite Solar Project Site
Figure 4	Regional Fault and Epicenter Map of Desert Quartzite Solar Project Site
Figure 5	Soils Map of Desert Quartzite Solar Project Site

List of Appendices

Appendix A	EQFAULT Seismic Parameters
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PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

EXECUTIVE SUMMARY

This geotechnical assessment executive summary has been prepared to provide a general overview of the report. The executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the sections discussed herein.

The Desert Quartzite Solar Project (Site) is located in eastern Riverside County approximately 8 miles southwest of the town of Blythe, California. First Solar Development, Inc. (First Solar) proposes to construct and operate a solar photovoltaic energy-generating project at the Site. The proposed project will include the solar facility, an on-site substation, and an interconnection transmission line (gen-tie) to Southern California Edison's (SCE) Colorado River Substation to the west of the site.

The primary objective of this preliminary geotechnical investigation was to identify potential geologic and geotechnical issues for the Project development. The scope of work performed by URS included a review of readily available information and data on the geotechnical and geological conditions of the project area and preparation of this report.

Based on information obtained from the preliminary review, the Site appears to be suitable for development for the proposed project. A comprehensive geotechnical report should be prepared prior to construction with recommendations to be incorporated into the final design.

The most significant geologic hazard to the project identified in this preliminary study is the potential for moderate seismic shaking likely to occur during the design life of the proposed development. The project Site is located in the seismically active Southern California region within the influence of several fault systems considered to be potentially active. Structures should be designed in accordance with the values and parameters provided in the 2007 California Building Code (CBC) and ASCE 7-05. The preliminary seismic design parameters are provided within the report.

A comprehensive design-level geotechnical investigation should be performed prior to construction. Earthwork on the project should be observed and evaluated by a licensed engineer practicing in the field of geotechnical engineering. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction.

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PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

SECTION 1.0 INTRODUCTION

1.1 BACKGROUND

First Solar Development, Inc. (First Solar) is considering development of the Desert Quartzite Solar Project (Site), located in eastern Riverside County approximately 10 miles southwest of the town of Blythe, California. Consequently, First Solar retained URS to conduct a preliminary geotechnical investigation to support planning and permitting activities relative to this project. The primary objective of the preliminary investigation was to identify potential geologic and geotechnical issues for the Project development, and to provide geologic/geotechnical information to support the Bureau of Land Management's permitting process for the project.

1.2 SCOPE OF WORK

This investigation is based on a review of readily available information and data on the geotechnical and geological conditions of the project area. The tasks performed for this investigation included the following:

- Review of First Solar's development plans
- Review of available pertinent literature and reports
- Preparation of this report

The primary information available for this study included published regional geologic maps and reports.

1.3 SITE LOCATION AND DESCRIPTION

The Site is approximately 7.5 square miles in size and is located south of U.S. Interstate 10 (I-10), approximately 10 miles southwest of the town of Blythe, California (Figure 1). The Site comprises approximately 4,769 acres located within Sections 3, 4, 9 through 15, 22, 23, and 24, Township 7 South, Range 21 East, San Bernardino Baseline and Meridian.

The Site is situated on the Palo Verde Mesa located within the Mojave Desert geomorphic province of Southern California. The Site is located on a relatively flat area and ranges in elevation from approximately 330 feet above mean sea level (MSL) at the southeast corner to 475 feet MSL in the northwest (USGS 1983). The Palo Verde Mesa is located south of the McCoy Mountains, west of the Palo Verde Valley, north of the Palo Verde Mountains, and northeast of the Mule Mountains.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

1.4 PROPOSED DEVELOPMENT

First Solar proposes to construct and operate an approximately 300 megawatt (MW) solar photovoltaic energy facility at the Site. The proposed project includes the following key structures: solar field arrays, an on-site operation and maintenance facility, an on-site substation, and an interconnection transmission line (gen-tie) to SCE's Colorado River Substation. The proposed project Site boundary, including the proposed gen-tie corridor, is shown on Figure 1 (topographic map) and Figure 2 (aerial map). URS understands that the development plans are preliminary in nature and subject to refinement.

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

**SECTION 2.0
GEOLOGIC SETTING**

2.1 REGIONAL GEOLOGIC AND SEISMIC SETTING

The project site is located on the Palo Verde Mesa within the Mojave geomorphic province of southern California. The Mojave Desert is a broad interior fault-bounded wedge consisting of pre-Cambrian gneisses, metamorphosed sedimentary rocks, plutonic rocks, scattered Mesozoic-age volcanics and metavolcanics, and sedimentary strata. The Mojave Desert is bounded by the right-lateral San Andreas fault on the south, the left-lateral Garlock fault on the northwest, and the Colorado River on the east (DMG 1954) and is characterized by isolated mountain ranges separated by vast expanses of desert plains. Dominant northwest-southeast trending faults control topography in this region.

The area surrounding the site is characterized by faults and seismicity driven by movement along the boundary between the North American and Pacific crustal plates. These two plates are passing by each other horizontally, in a right lateral sense (i.e., the North American plate is moving southeastward relative to the Pacific plate) at a rate of about 40 to 50 millimeters (mm)/year. Most of this stress is accommodated by movement on the San Andreas fault, which extends from north of San Francisco to the Gulf of California and marks the southern boundary of the Mojave Desert geomorphic province. The San Andreas fault presents significant seismic risk to California with a high potential for large earthquakes.

The remaining portion of the crustal stress is accommodated by the numerous shorter active faults that flank the San Andreas fault. These shorter faults are also considered to be significant seismic sources. The geoseismic characteristics of these seismic sources are summarized in Section 2.3, including an estimate of the maximum earthquake magnitude that might be generated by each fault. A geologic map is depicted on Figure 3. The location of the site with respect to known active or potentially active faults and epicenters of earthquakes with magnitudes of 4 or greater is shown on the Regional Fault and Epicenter Map, Figure 4.

2.2 GENERAL SITE GEOLOGY

The Palo Verde Mesa is characterized by the nearly level morphology of the mesa and gently to moderately sloping alluvial fans. Fluvial erosion and deposition are the major geomorphic processes in the immediate area. According to the regional geologic mapping of Jennings (CGS 1967), the northern portion of the project site is underlain by metamorphosed sedimentary bedrock of Pre-Cretaceous age. The Cretaceous Period is a geologic period extending from approximately 145 to 65.6 million years ago (Ma). Southwest of the Site, the metamorphosed sedimentary bedrock of Pre-Cretaceous age (greater than 145 Ma) abuts Precambrian age (4,600 to 542 Ma) granitic bedrock. Based on the Jennings' fault activity mapping (CGS 1994), this unconformity is a pre-Quaternary age (2.6 Ma to present) thrust

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

fault system trending northwest immediately southwest of the Site. Stone (USGS 2006) identifies the bedrock types as Jurassic age (199 to 145 Ma) volcanics north of the thrust fault and Jurassic age (199 to 145 Ma) plutonic rocks to the south (USGS 2006). Both Jennings (CGS 1994) and Stone (USGS 2006) map a thrust fault in the same place; however, Jennings' map includes additional fault traces. The Jennings 1994 CGS map identifies a Tertiary age (65 to 2.6 Ma) fault southwest of the site; however, a recent map developed by the USGS depicts detailed Quaternary age (2.6 Ma to present) terrace mapping which identifies terraces of varying ages rather than an offset single terrace that has been offset due to faulting (USGS 2006).

Overlying the Precambrian to Mesozoic age bedrock immediately southwest of the Site are Tertiary age (65 to 2.6 Ma) volcanics of rhyolitic composition (CSG 1994; USGS 2006). These volcanics are of Oligocene age (34 to 23 Ma) to Miocene age (23 to 5.3 Ma), indicating the depositional event(s) took place between 5.3 and 34 million years before present, coinciding with a period of intense plate tectonic activity. In the southeastern corner of the Site, the bedrock is overlain by Pleistocene age (2.6 Ma to 11,700 years before present [BP]) non-marine sediments. Holocene age (11,700 BP to present) alluvium overlays the older units across most of the Site; according to Stone (USGS 2006), the alluvium overlying the western portion of the Site is of Pleistocene age (2.6 Ma to 11,700 BP). Deposits of Holocene age dune sand are present in the northwestern portion of the Site (11,700 BP to present), including along the off-site portion of the gen-tie corridor. The distribution of these various units is depicted on the attached Geologic Map (Figure 2). The general characteristics of each of these geologic map units are described below in the relative order of predominance on the Site, including the proposed gen-tie corridor.

2.2.1 Quaternary Non Marine (Qpv)

Pleistocene age (2.6 Ma to 11,700 BP) alluvial deposits of the ancestral Colorado River comprised of moderately indurated, poorly graded sand, gravel, boulders, silt, and clay.

2.2.2 Quaternary Alluvium (Qa₆)

Holocene age (11,700 BP to present) alluvial fan and alluvial valley deposits comprised of unconsolidated sand, gravel, silt, and clay.

2.2.3 Quaternary Dune Sand (Qs)

Holocene Age (11,700 BP to present) dune sand comprised of actively drifting sand.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

2.2.4 Quaternary Alluvium (Qa₃)

Holocene and Pleistocene age (2.6 Ma to present) alluvial fan deposits comprised of unconsolidated sand, gravel, silt, and clay.

2.2.5 Quaternary Alluvium (Qw)

Holocene Age (11,700 BP to present) alluvium of modern washes comprised of unconsolidated sand and gravel derived from local mountain ranges.

2.3 FAULTS

There are no known faults active during the Quaternary located in the Palo Verde Mesa area. The Jennings (CGS 1994) map identifies a Tertiary age (65 to 2.6 Ma) fault southwest of the Site; however, a recent map developed by the USGS depicts detailed quaternary terrace mapping which identifies terraces of varying ages rather than an offset single terrace (CGS 1994; USGS 2006).

The approximate distances of active fault zones from the Site are listed in Table 1.

**TABLE 1
SUMMARY OF POTENTIAL SEISMIC SOURCES –
FAULTS IN PROXIMITY TO SITE**

Fault Name	Approximate Distance from Site (Miles)
Brawley Seismic Zone	58.8
Elmore Ranch	59.2
San Andreas – Southern	59.7
San Andreas – Coachella	59.7
Imperial	66.7
Superstition Hills (San Jacinto)	71.0
Superstition Mountain (San Jacinto)	73.8
Pinto Mountain	81.7
San Jacinto – Borrego	82.3
San Jacinto – Anza	84.1
Pisgah-Bullion Mountain – Mesquite LK	84.6
Laguna Salada	89.0
San Jacinto – Coyote Creek	89.2
Elsinore – Coyote Mountain	92.3
Emerson So. – Copper Mountain	94.3

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

Eureka Peak	97.9
Burnt Mountain	99.7

2.4 NRCS SURFACE SOILS INFORMATION

Based on review of the U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) (previously Soil Conservation Service) soil survey of the Palo Verde Area, the Site is characterized by multiple soil types, generally consisting of silty sands and gravels (USDA 1969). The NRCS mapped soil types at the Site are listed in Table 2. Figure 5 depicts the distribution of soils at the Site.

TABLE 2
NRCS SURFACE SOILS PROPERTIES AND DESCRIPTION

Soil Series	Slope (% Grade)	Depth (Inches)	Classification		Description
			USCS ¹	AASHTO ²	
Aco	0–1	0–60	SM	A-1, A-2	The Aco series comprises deep, well-drained soil formed in mixed alluvium on terraces above the flood plain.
Carrizo	0–2	0–60	SW-SM, GM	A-1	The Carrizo series comprises deep, well-drained soils formed in mixed sandy and gravelly alluvium on arroyos.
Chuckwalla	0–1	0–60	GC-GM	A-1, A-2, A-4	The Chuckwalla series comprises deep, well-drained soils formed in mixed stratified alluvium on alluvial fan terraces.
Orita	0–1	0–80	SM, GM	A-1, A-2, A-4, A-6	The Orita series comprises deep, well drained soils formed in alluvium on alluvial fan remnants and terraces.
Rositas	0–9	0–72	SM, SP-SM	A-1, A-2, A-3	The Rositas series comprises deep, well-drained soils formed in sandy eolian soils from recent alluvium on sand dunes.

¹ USCS: United Soils Classification System.

² AASHTO: American Association of State Highway and Transportation Officials classification.

The Aco series is present throughout the Site and is the predominant soil type on the Site. All of the soils mapped on Site have low potential for expansive soil characteristics, according to the Palo Verde Area soil map (USDA 1969).

As shown on Figure 5, other soil series prevalent on the Site include the Orita and Rositas series as well as the Carrizo series. The mapped soil series on the Site are considered to have high risk of corrosion for uncoated steel and low to moderate risk of corrosion for concrete. Based on the USDA report, there is a low to moderate potential for water- and wind-induced erosion for soil series throughout the Site (USDA 1969).

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

The USDA report provides an interpretation of soil limitations for septic suitability. Using these interpretations, all of the soil series mapped on the Site are classified as somewhat limited with respect to septic suitability with one exception; the Orita series is classified as very limited suitability for septic system disposal fields (USDA 1969).

2.5 GROUNDWATER CONDITIONS

The depth to groundwater in the Site vicinity is believed to be greater than 100 feet below ground surface (bgs) based on relative site elevation difference above the Colorado River and floodplain (Palo Verde Valley) and measured depth to groundwater at adjacent sites (DWR 1978; Metzger et al 1973). Groundwater levels may fluctuate seasonally with precipitation, regional pumping from wells, irrigation, drainage, and site grading.

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

**SECTION 3.0
GEOLOGIC AND SEISMIC HAZARDS**

Geologic and seismic hazards are those hazards that could impact the project due to the surrounding geologic and seismic conditions. Geological hazards include slope instability (landslides), erosion, subsidence, poor soil conditions, excessive settlement, and flooding. Seismic hazards include phenomena that occur during an earthquake such as surface fault rupture, seismic ground shaking, liquefaction, and tsunami waves. The potential impact of these hazards to the Site has been *assessed* and is summarized in the following sections.

3.1 FLOODING

The Site is located in an area designated Zone D within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, indicating an area where there are possible but undetermined flood hazards (FIRM map 06065C Panel *06065C3200G). In areas designated Zone D, no analysis of flood hazards has been conducted.

The project Site is located in an arid environment and on relatively high ground northeast of the Mule Mountains, which drain into and through portions of the Site. Based on the TLA site drainage report (TLA 2011), the potential for flooding on the Site is considered moderate.

3.2 SLOPE INSTABILITY/LANDSLIDES

The potential for slope instability is insignificant based on the relatively flat terrain that characterizes the Site (USGS 1975; 1983). Therefore, the potential for hazards related to slope instability, landslides, or debris flows is considered low; however, considering the potential for flooding on Site, the hazard of episodic debris flows may be present based on Site hydraulic analysis (TLA 2011).

3.3 SUBSIDENCE

Land subsidence can be caused by various natural phenomena, including tectonic movement, hydro compaction, or consolidation. The extraction of water or petroleum from sedimentary source rocks can also cause the permanent collapse of the pore space previously occupied by the removed fluid. Sufficient subsidence resulting from these phenomena may cause damage to nearby engineered structures.

Based on review of available literature, subsidence has not been documented within the vicinity of the project site (USGS 2002; DWR 1978) and available literature does not indicate significant quantities of fluids being extracted in the project area. Subsidence is therefore not anticipated to pose a significant hazard to the proposed project.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

3.4 POOR SOIL CONDITIONS (EXPANSIVE OR COLLAPSIBLE SOILS)

Expansive soils are fine-grained soils (clay) that can undergo a significant increase in volume with an increase in water content. Changes in the water content of an expansive soil can result in severe distress to structures constructed upon the soil. Based on USDA, NRCS soil maps and descriptions, the on Site surface and near-surface soils are expected to exhibit low expansive potentials. As expansive soils may impact a project, testing should be conducted to identify the degree to which onsite soils may expand.

Collapsible soils are those that undergo settlement upon wetting, even without the application of additional load. The process of collapse with the addition of water is known as hydrocompaction. Hydrocompaction occurs when water weakens or destroys the bonds between soil particles and severely reduces the bearing capacity of the soil. Typical collapsible soils are lightly colored, are low in plasticity and have relatively low densities. Collapsible soils are typically associated with alluvial fans, windblown materials, or colluvium. Because the project Site is largely covered in alluvium and windblown materials, the potential for collapsible soils may exist at the project Site. If collapsible soils are found to occur at the Site, as part of the design level geotechnical investigation mitigation measures may be necessary to reduce or eliminate the hazard. Traditional methods of construction grading generally would employ removal of collapsible soils and replacement with engineered fill. Provided that these mitigation methods are incorporated into the design of the project, collapsible soils are not expected to have a significant impact upon the project.

3.5 EXCESSIVE SETTLEMENT (ARTIFICIAL FILL)

A risk of excessive settlement can be associated with improperly placed and substandard artificial fills. With regard to this potential hazard, based on aerial photograph review and available literature there is no evidence at this time of previous site disturbance which would entail artificial fill; therefore, it is unlikely that excessive settlement of artificial fill would have a negative impact on this project.

3.6 FAULT HAZARDS

3.6.1 Surface Fault Rupture

The “Alquist-Priolo Earthquake Fault Zoning Act” is a state law that regulates development projects near active faults to mitigate the hazard of surface fault rupture. The Act requires that development permits for projects within “Earthquake Fault Zones” be withheld until geologic investigations demonstrate that the sites are not threatened by surface displacement from future fault rupture. To be zoned under the Alquist-Priolo Fault Zoning Act, a fault must be considered active or both sufficiently active and well-defined (CGS 1997). CGS defines an active fault as one that has had surface displacement within Holocene time (about the last 11,000 years), and a sufficiently active fault as one that has evidence of Holocene

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

surface displacement along one or more of its segments or branches (CGS 1997). The CGS considers a fault to be well defined if its trace is clearly detectable as a physical feature at or just below the ground surface.

The State of California has not yet completed mapping the region in which the Site is located for Seismic Hazard Zones. No known active, sufficiently active, or well-defined fault traces have been recognized as crossing the proposed project Site, and the CGS does not delineate any part of the proposed project as being within an Earthquake Fault Zone.

3.6.2 Seismic Ground Shaking

As indicated by the numbers and distribution of recorded earthquake epicenters and the proximity of faults in the region (Figure 3), it is anticipated that the site will be subjected to seismic shaking during the lifetime of the development. The degree of shaking that is felt at a given site depends on the distance from the earthquake source, the type of subsurface material on which the project is situated, and topography. Based on the California Geological Survey interactive Seismic Hazard map (CGS 2008), the Peak Ground Acceleration with a 10 percent chance of exceedance in 50 years would be less than 0.1g. The effect of seismic ground motion to the planned development should be mitigated by proper building design, in accordance to 2007 California Building Code (CBC) and its current amendments. Building codes are designed to limit the degree of damage that would otherwise occur to an un-reinforced building. Additional geotechnical studies should be performed to develop final seismic design recommendations.

The Site is located in Southern California, a seismically active area. The magnitude and type of seismic hazard which may potentially affect the Site is dependent on both proximity to causative faults, and magnitude of seismic event. Table 3 presents distance of fault zones from the Site and the maximum credible earthquake (MCE), calculated using the EQFAULT program, which nearby seismic events may produce.

Based on these calculations, the peak ground acceleration at the Site for a 10 percent Probability of Exceedance in 50 years is estimated to be approximately 0.0373g.

3.7 LIQUEFACTION

Liquefaction is defined as significant and relatively sudden reduction in stiffness and shear strength of saturated sandy soils caused by a seismically induced increase in pore water pressures. Potential for seismically induced liquefaction exists whenever relatively loose, sandy soils exist with high groundwater level and/or potential for long duration, high seismic shaking. The susceptibility of a site to liquefaction is relative to water content, depth, and density of granular sediments as well as the frequency and magnitude of earthquakes in the surrounding area. When liquefaction occurs, the site can experience damage induced by permanent ground movements resulting in differential settlement.

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

**TABLE 3
SUMMARY OF POTENTIAL SEISMIC SOURCES – PARAMETERS AND
ESTIMATED EARTHQUAKES FOR REGIONAL FAULTS**

Fault Name	Approximate Distance from Site (Miles)	Estimated Maximum Credible Earthquake Event		
		Maximum Earthquake Magnitude (MM ¹)	Peak Site Acceleration (g ²)	Estimated Site Intensity (Mod. Merc. ³)
Brawley Seismic Zone	58.8	6.4	0.016	IV
Elmore Ranch	59.2	6.6	0.019	IV
San Andreas – Southern	59.7	7.4	0.037	V
San Andreas – Coachella	59.7	7.1	0.029	V
Imperial	66.7	7.0	0.022	IV
Superstition Hills (San Jacinto)	71.0	6.6	0.014	III
Superstition Mountain (San Jacinto)	73.8	6.6	0.013	III
Pinto Mountain	81.7	7.0	0.015	IV
San Jacinto – Borrego	82.3	6.6	0.010	III
San Jacinto – Anza	84.1	7.2	0.018	IV
Pisgah-Bullion Mountain – Mesquite LK	84.6	7.1	0.016	IV
Laguna Salada	89.0	7.0	0.013	III
San Jacinto – Coyote Creek	89.2	6.8	0.011	III
Elsinore – Coyote Mountain	92.3	6.8	0.010	III
Emerson So. – Copper Mountain	94.3	6.9	0.011	III
Eureka Peak	97.9	6.4	0.006	II
Burnt Mountain	99.7	6.4	0.006	II

¹ MM: moment magnitude.

² g: acceleration due to earth's gravity.

³ Mod. Merc.: Modified Mercalli Intensity Scale.

Mitigation methods for liquefaction may include identifying potentially liquefiable soils and then either avoiding placing structures within the limits of liquefiable soils, or applying in-situ soil improvement, and using a deep foundation system. In-situ soil improvement methods for liquefiable soil include vibro-replacement, compaction grouting and deep soil mixing. A deep foundation system may consist of driven pre-cast piles or cast-in-drilled-hole piers or caissons. The results of the forthcoming detailed geotechnical investigation relative to liquefaction potential at the site should be incorporated into the final project design.

Based on the relatively deep water table underlying the Site, which is elevated over 100 feet above the floodplain of the Colorado River, the potential for liquefaction is considered to be low (USGS 1983; Metzger et al 1973).

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

3.8 TSUNAMIS AND SEICHES

A tsunami is a great sea wave (commonly called a tidal wave) produced by a significant undersea disturbance, such as tectonic displacement of the sea floor associated with large, shallow earthquakes. A seiche is a wave generated in an enclosed body of water such as a lake or reservoir. Based on the fact that the Site is situated inland, far from oceans or large, land-locked water bodies, the potential for seismically induced tsunamis or seiches is considered to be low (CGS 1977).

3.9 GENERAL SOIL EROSION AND STABILITY CONSIDERATIONS

The soils present at the Site have a low to moderate susceptibility to wind and water erosion (USDA 1969). Preventative measures to reduce seasonal flooding and erosion should be incorporated into site grading and drainage plans. Dust control should be implemented during construction, and soil stabilization measures should be implemented, where necessary.

The upper soils at the Site are expected to be relatively loose to medium-dense and may be unsuitable in their present condition to support structures in the vicinity of the operations and maintenance facility and the on-site substation. The soils within the building and structural areas may require moisture conditioning, over-excavation, and recompaction to improve bearing capacity and to reduce the potential for differential settlement from static loading. It is expected that these potential issues will be investigated as part of the forthcoming detailed geotechnical investigation and addressed, as applicable, in the final project design.

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

**SECTION 4.0
SUMMARY**

4.1 CONCLUSIONS AND RECOMMENDATIONS

The geology and seismic conditions of the project site have been evaluated in terms of their impact on the proposed project. Based on the findings of the preliminary site investigation, the project Site is generally suitable for the proposed development. Provided that standard geotechnical practices are followed and standard mitigation methods are incorporated into the final design of the development, it is anticipated that geologic hazards will not significantly impact the project. The primary geotechnical consideration for the project is the potential for moderate seismic shaking likely to occur during the design life of the proposed development. The project Site is located in the seismically active Southern California region within the influence of several fault systems considered to be potentially active. Structures should be designed in accordance with the values and parameters provided in the 2007 California Building Code (CBC) and ASCE 7-05. The seismic design parameters are provided within the report.

The published literature clearly indicates that the mapped faults near the Site are not active. Therefore, from a fault rupture hazard standpoint there is no requirement to establish a development setback zone for these faults.

Finally, URS notes that this is a preliminary assessment of engineering geologic/geotechnical conditions of the Site. For any given aspect of the development, final geotechnical conclusions and recommendations should be provided in a separate report after specific, final project plans are developed, and on-site geotechnical explorations and testing are performed.

4.2 LIMITATIONS

This report presents preliminary interpretations and recommendations pertaining to the subject site based on the assumption that surface and subsurface conditions do not deviate appreciably from those indicated by the available literature and reports (as cited in this preliminary report). The scope of this preliminary engineering geology and geotechnical investigation did not include any field investigations. The potential for encountering conditions different from those assumed cannot be discounted. Professional judgments presented in this report are based on evaluations of the available literature gathered, on our understanding of the proposed project construction, and on our general experience in the geotechnical engineering and engineering geology field. The judgments presented meet the standard of care of our profession at this time and location in work performed under similar circumstances.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

SECTION 5.0 REFERENCES

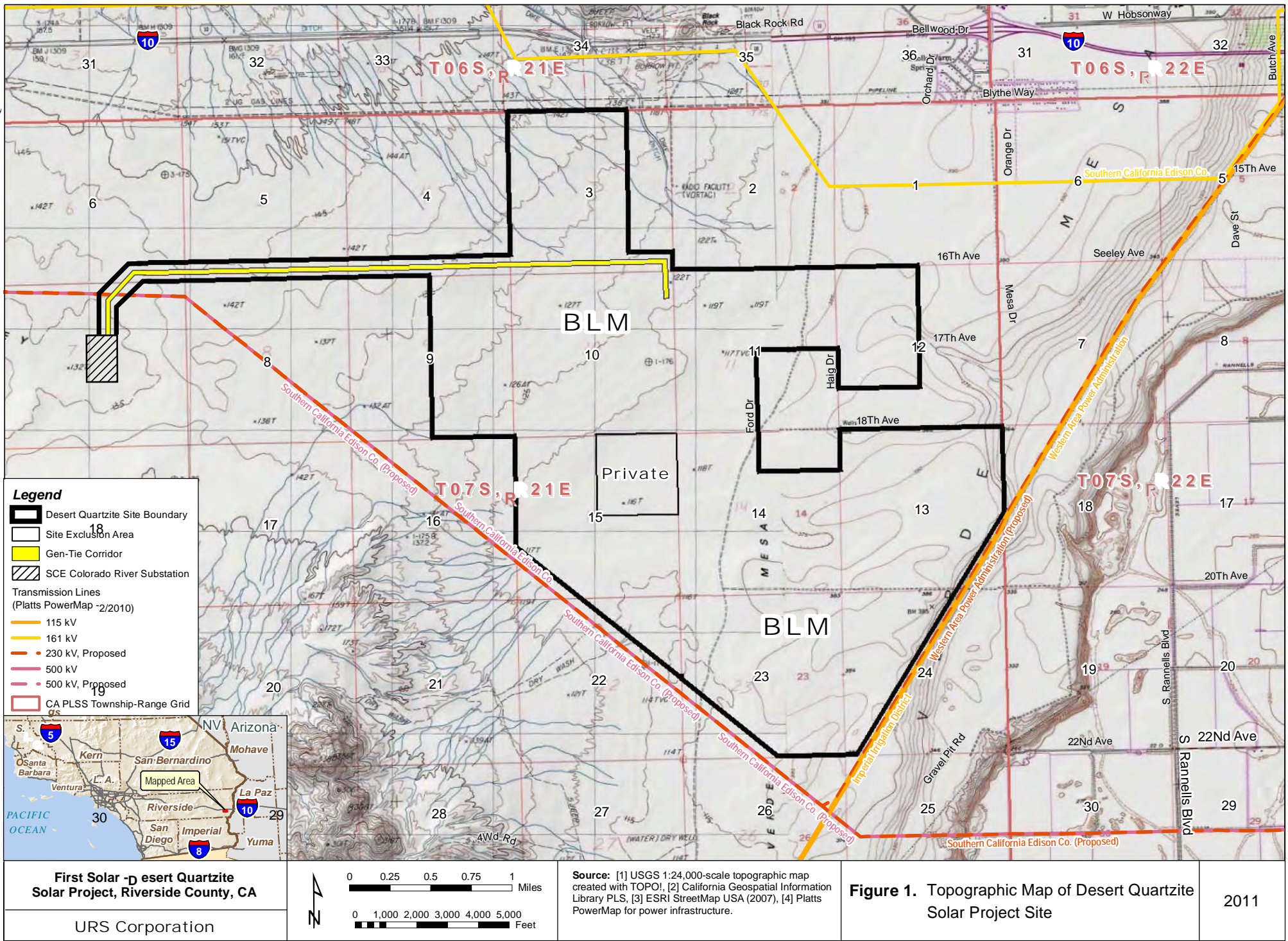
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PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT DESERT QUARTZITE SOLAR PROJECT

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**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

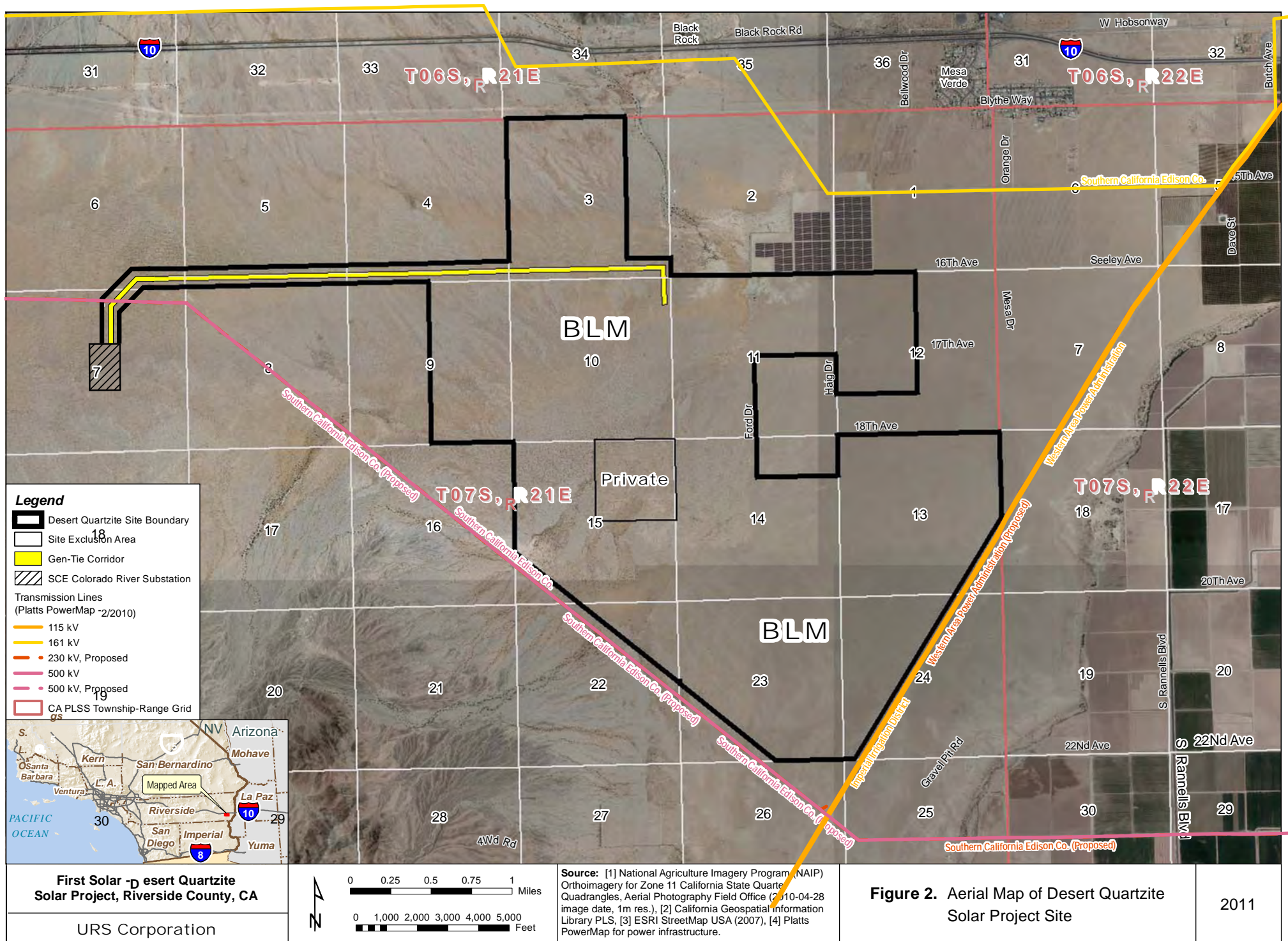
FIGURES

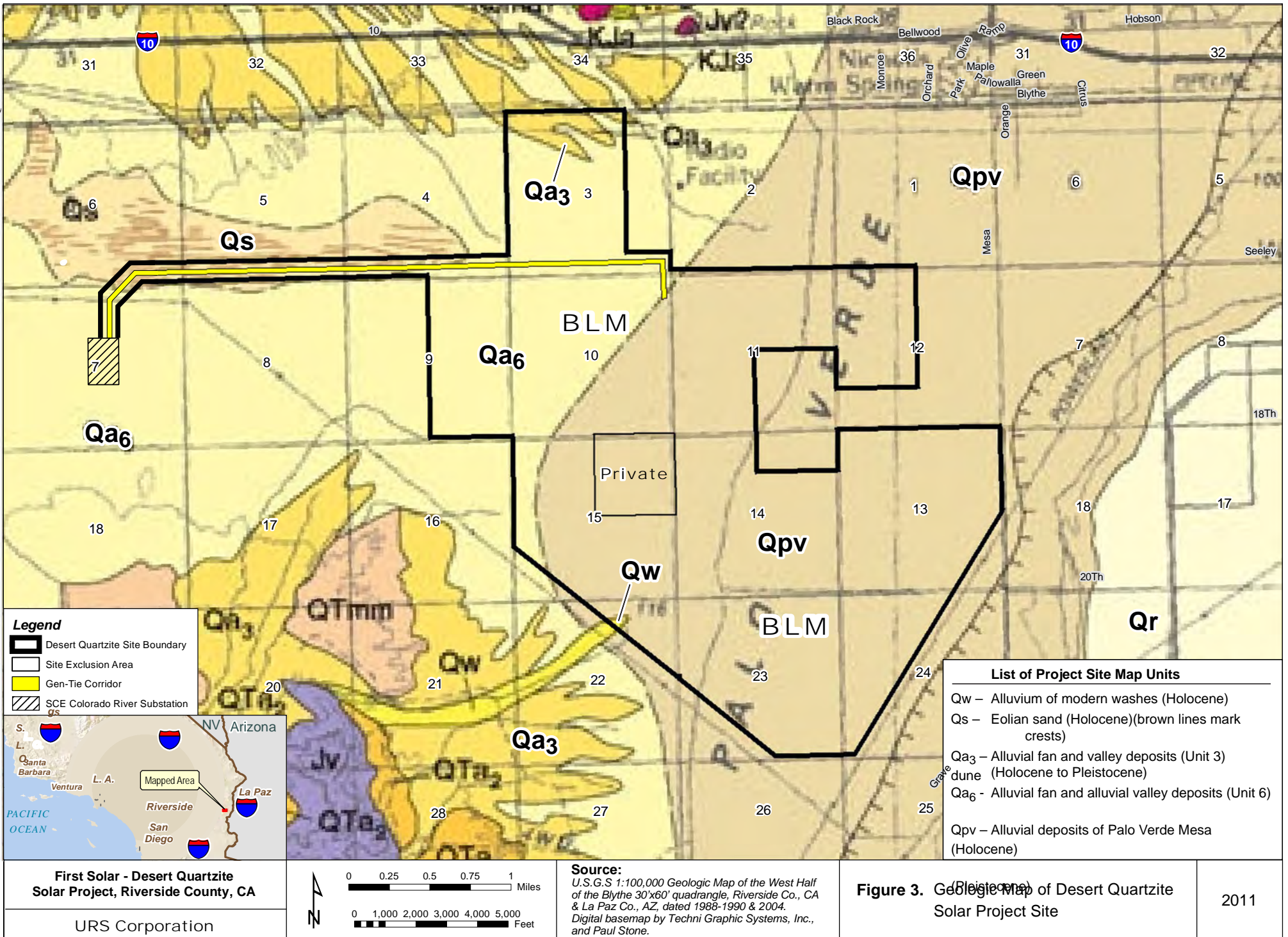


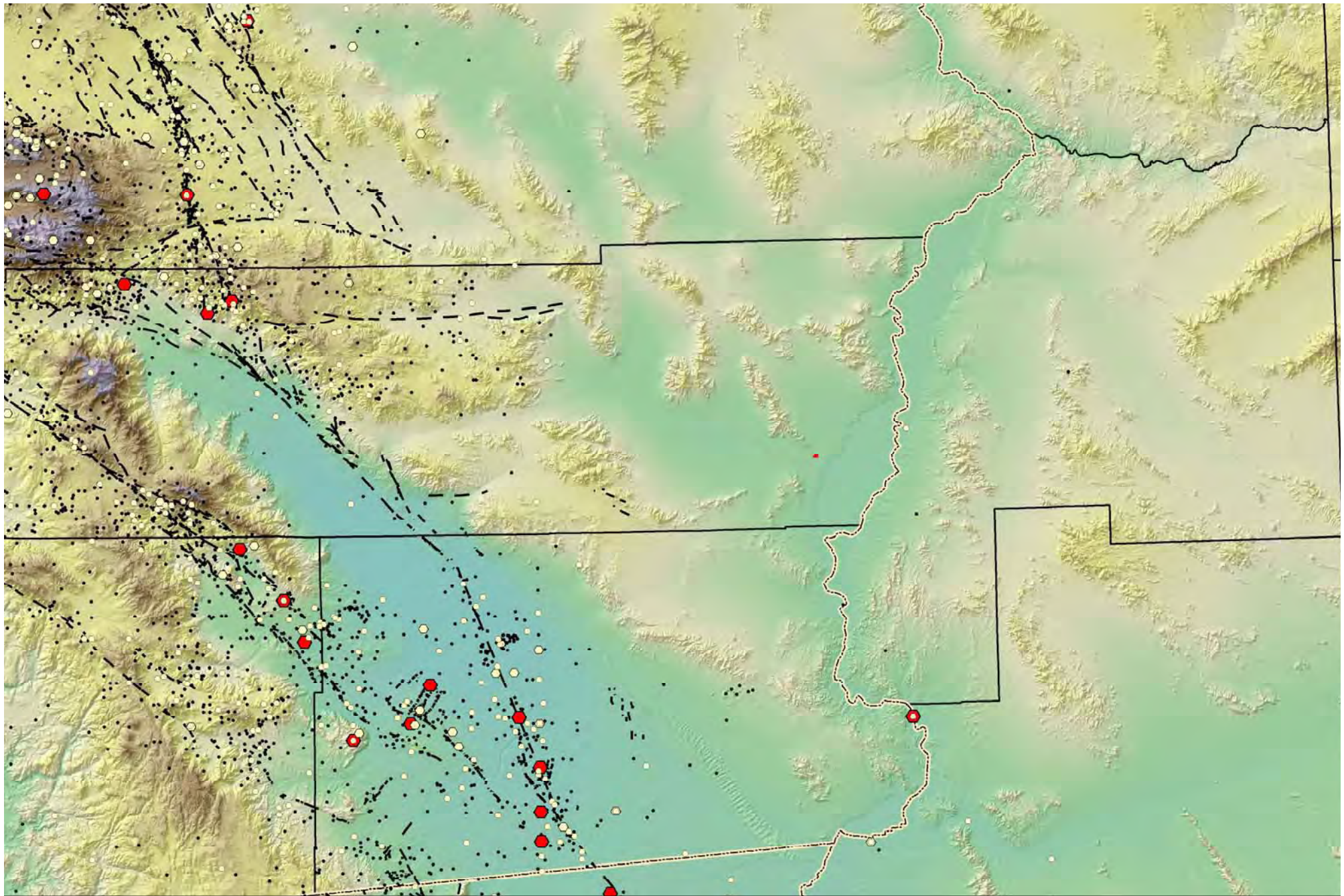
First Solar - Desert Quartzite Solar Project, Riverside County, CA

URS Corporation

Figure 1. Topographic Map of Desert Quartzite Solar Project Site



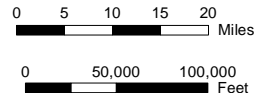




Maricopa County

**First Solar - Desert Quartzite
Solar Project, Riverside County, CA**

URS Corporation

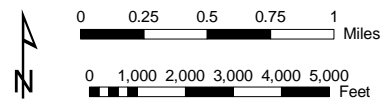


Fault Source: CGS CD 2000-006
Epicenter Source: CGS 1800-2000 Earthquake Catalog
and California Earthquake Data Center (SCEDC)
Source: U.S. Geological NASA Survey Shuttle Radar
Topography Mission (SRTM) 2 Arc Seconds,
Tele Atlas North America, Inc, ESRI.

Figure 4. Regional Fault and Epicenter
Map of Desert Quartzite
Solar Project Site

2011

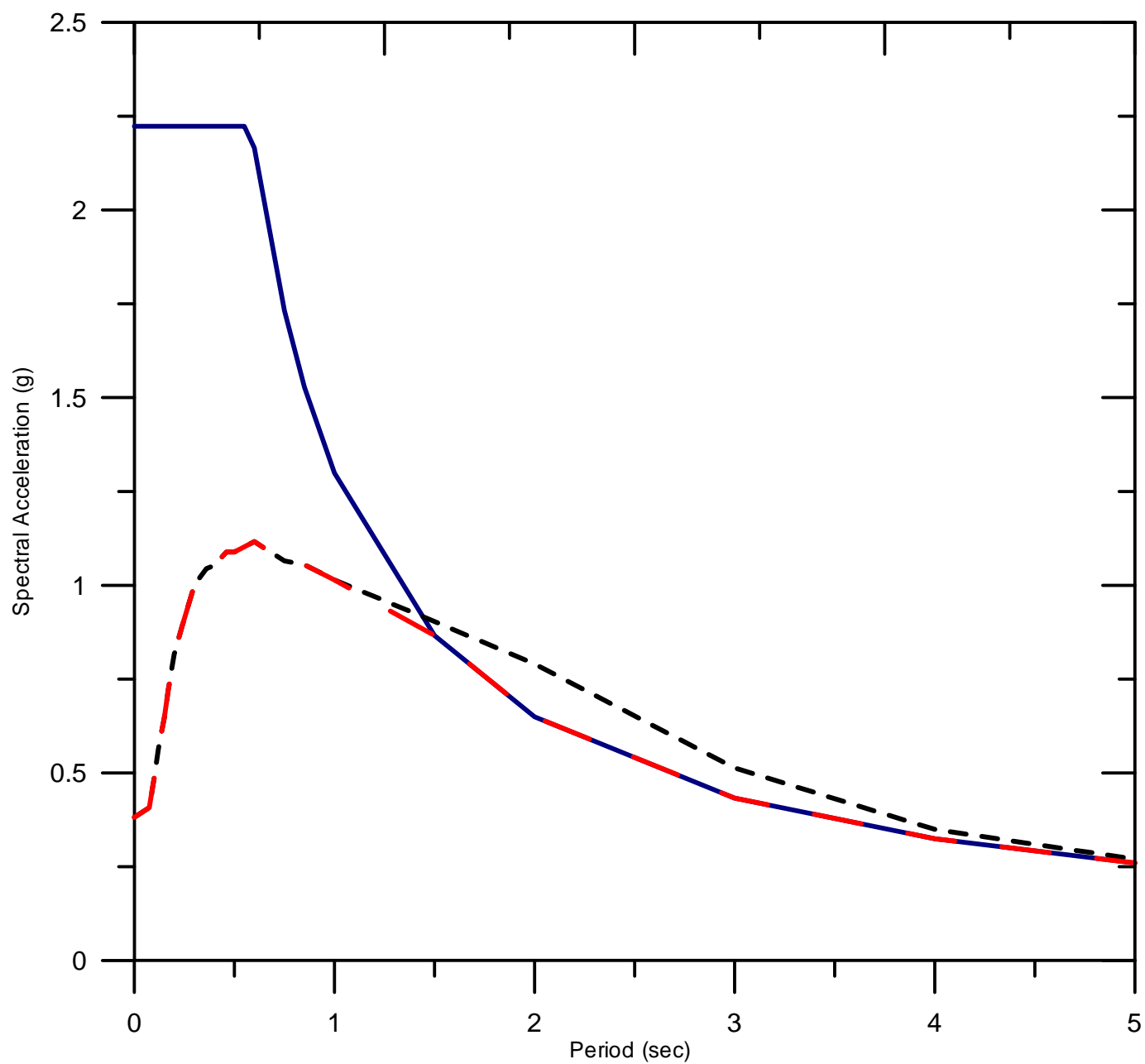
2011



Source: [1] USGS 1:24,000-scale topographic map created with TOPO!, [2] USDA-NRCS Soil Survey of the Palo Verde Area (USDA, 1969).

**PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
DESERT QUARTZITE SOLAR PROJECT**

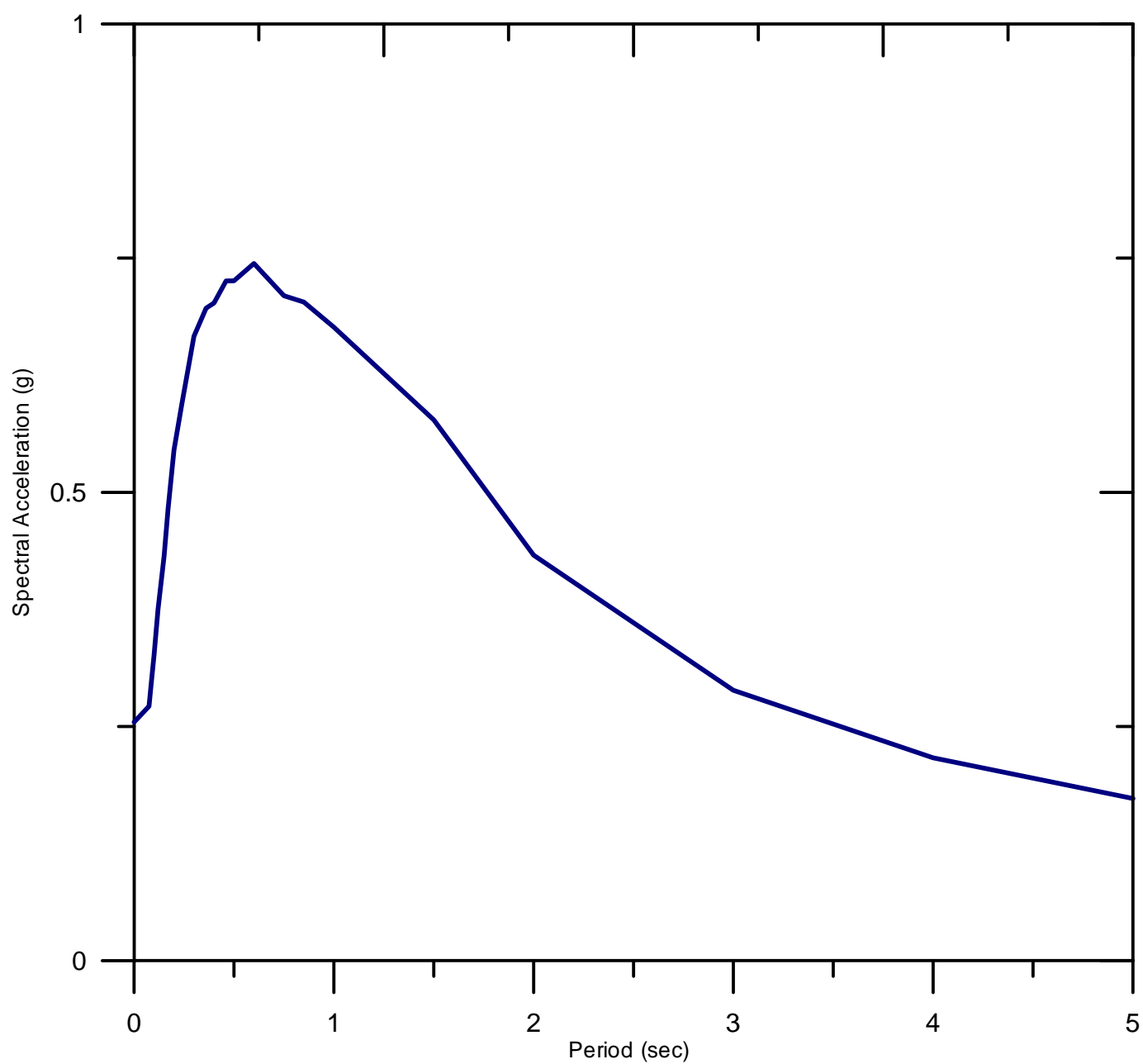
**APPENDIX A
EQFAULT SEISMIC PARAMETERS**



Note:

- Deterministic MCE spectral accelerations
- - - Probabilistic MCE spectral accelerations
- Site-Specific MCE spectral accelerations

**Figure 1 - MAXIMUM CREDIBLE EARTHQUAKE (MCE)
ACCELERATION RESPONSE SPECTRUM
FIRST SOLAR DESERT QUARTZITE**



Note:

— Design spectral accelerations

**Figure 2 - SITE-SPECIFIC DESIGN RESPONSE SPECTRUM -
FIRST SOLAR DESERT QUARTZITE**

First Solar EQFault.txt

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*****
*
*           E Q F A U L T           *
*
*           Version 3.00            *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: DATE: 08-01-2011

JOB NAME: First Solar Desert Quartzite

CALCULATION NAME:

FAULT-DATA-FILE NAME: CDMGFLTE.DAT

SITE COORDINATES:
 SITE LATITUDE: 33.5620
 SITE LONGITUDE: 114.7069

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 21) Sadigh et al. (1997) Horiz. - Rock
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
 DISTANCE MEASURE: clodis
 SCOND: 0
 Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
 COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CDMGFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT	APPROXIMATE NAME	DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT		
			MAXIMUM EARTHQUAKE MAG. (Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD. MERC.
BRAWLEY SEISMIC ZONE		58.8(94.6)	6.4	0.016	IV
ELMORE RANCH		59.2(95.3)	6.6	0.019	IV
SAN ANDREAS - Southern		59.7(96.1)	7.4	0.037	V
SAN ANDREAS - Coachella		59.7(96.1)	7.1	0.029	V
IMPERIAL		66.7(107.4)	7.0	0.022	IV
SUPERSTITION HILLS (San Jacinto)		71.0(114.3)	6.6	0.014	III
SUPERSTITION MTN. (San Jacinto)		73.8(118.8)	6.6	0.013	III
PINTO MOUNTAIN		81.7(131.5)	7.0	0.015	IV
SAN JACINTO - BORREGO		82.3(132.5)	6.6	0.010	III
SAN JACINTO-ANZA		84.1(135.3)	7.2	0.018	IV
PISGAH-BULLION MTN.-MESQUITE LK		84.6(136.2)	7.1	0.016	IV
LAGUNA SALADA		89.0(143.2)	7.0	0.013	III
SAN JACINTO-COYOTE CREEK		89.2(143.5)	6.8	0.011	III
ELSINORE-COYOTE MOUNTAIN		92.3(148.6)	6.8	0.010	III
EMERSON So. - COPPER MTN.		94.3(151.7)	6.9	0.011	III
EUREKA PEAK		97.9(157.5)	6.4	0.006	II
BURNT MTN.		99.7 (160.5)	6.4	0.006	II

-END OF SEARCH- 17 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE BRAWLEY SEISMIC ZONE FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 58.8 MILES (94.6 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.0373 g

Project: First Solar Quartzite Site
 Project No. 28907270
 By: NS

Subject: Site-specific MCE Motion

Solution:

1. Site coefficients F_a and F_v per Table 11.4-1 and Table 11.4.2, respectively:

Site F= No
 F_a = 1.5
 F_v = 2.2

2. Adjusted MCE spectral response acceleration parameters for Site F:

S_{MS} = 0.59 S_{M1} = 0.34
 T_0 = 0.12 sec. T_S = 0.58 sec. T_L = 8 sec.

3. Scaling factor Q = 0.67

T (sec.)	MCE SA (g)		Site-Specific MCE	Design SA per Mapped Method	Design SA (5% Damping)		S_{DS}	S_{D1}
	PSHE	DSHE						
0	0.38	2.22	0.38	0.16	0.25		0.67	0.87
0.075	0.41	2.22	0.41	0.31	0.27			
0.09	0.46	2.22	0.46	0.34	0.30		S_{MS}	S_{M1}
0.1	0.49	2.22	0.49	0.36	0.33		1.00	1.30
0.12	0.56	2.22	0.56	0.39	0.37			
0.15	0.65	2.22	0.65	0.39	0.43			
0.17	0.72	2.22	0.72	0.39	0.48			
0.2	0.82	2.22	0.82	0.39	0.55			
0.24	0.89	2.22	0.89	0.39	0.59			
0.3	1.00	2.22	1.00	0.39	0.67			
0.36	1.04	2.22	1.04	0.39	0.70			
0.4	1.05	2.22	1.05	0.39	0.70			
0.46	1.09	2.22	1.09	0.39	0.73			
0.5	1.09	2.22	1.09	0.39	0.73			
0.6	1.12	2.17	1.12	0.38	0.74			
0.75	1.06	1.73	1.06	0.31	0.71			
0.85	1.05	1.53	1.05	0.27	0.70			
1	1.01	1.30	1.01	0.23	0.68			
1.5	0.90	0.87	0.87	0.15	0.58			
2	0.79	0.65	0.65	0.11	0.43			
3	0.51	0.43	0.43	0.08	0.29			
4	0.35	0.32	0.32	0.06	0.22			
5	0.27	0.26	0.26	0.05	0.17			