Appendix A
Scoping Report

LITTLE BEAR SOLAR PROJECT

Scoping Report

EIR No. 7225
CUP Nos. 3550, 3551, 3552, 3553, & 3577

Prepared for
County of Fresno Department of Public Works and Planning

October 2017

LITTLE BEAR SOLAR PROJECT

Scoping Report

EIR No. 7225
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Prepared for
County of Fresno Department of Public Works and Planning

October 2017

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900
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ESA

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Little Bear Solar Project Scoping Report

SCOPING REPORT

Little Bear Solar Project

1. Introduction

This report provides an overview of the comments received by the County of Fresno Department of Public Works and Planning (County) during the public scoping period for the Environmental Impact Report (EIR) that the County is preparing for the Little Bear Solar Project (Project), EIR No. 7225.[1]

CEQA Guidelines Section 15083 provides that a "Lead Agency may…consult directly with any person…it believes will be concerned with the environmental effects of the project." Scoping is the process of early consultation with affected agencies and the public prior to completion of a Draft EIR. Section 15083(a) states that scoping can be "helpful to agencies in identifying the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth in an EIR and in eliminating from detailed study issues found not to be important." Scoping is an effective way to bring together and consider the concerns of affected State, regional, and local agencies, the Project proponent, and other interested persons (CEQA Guidelines §15083(b)). Scoping is not conducted to resolve differences concerning the merits of a project or to anticipate the ultimate decision on a proposal. Rather, the purpose of scoping is to determine the scope of information and analysis to be included in an EIR and, thereby, to ensure that an appropriately comprehensive and focused EIR will be prepared that provides a firm basis for informed decision-making. Comments not within the scope of CEQA will not be addressed through the CEQA process.

This report is intended for use by the County in preparing the EIR as formal documentation of initial input received from governmental agencies and members of the public regarding the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth in the EIR. It also provides access for other agencies and members of the public to comments received during the scoping period (September 7, 2017 to October 9, 2017).

2. Description of the Project

Project Summary

Little Bear Solar 1, LLC; Little Bear Solar 3, LLC; Little Bear Solar 4, LLC; Little Bear Solar 5, LLC; and Little Bear Solar 6, LLC (collectively, "Applicant") have applied to the County for five Unclassified Conditional Use Permits (UCUPs): one each to construct, operate, maintain, and

[1] The County of Fresno Department of Public Works and Planning is the lead agency pursuant to the California Environmental Quality Act (CEQA) for the preparation of an EIR for the Project.

decommission five photovoltaic (PV) solar electricity generating facilities and associated infrastructure to be known as Little Bear Solar 1, 3, 4, 5, and 6 (CUP Nos. 3550, 3551, 3552, 3553, and 3577). Together, these solar facilities would generate a total of up-to 180-megawatts (MW) on approximately 1,288 acres of Westlands Water District-owned lands in unincorporated Fresno County. It is expected that each solar facility would include PV modules (panels), support structures, electrical inverters, and intermediate voltage transformers. Individual facilities also would include a substation, inverters, and transformers. Each facility also could include an Energy Storage System (ESS) that would provide up to 500 megawatt hours (MWhrs) of electrical storage. Other necessary infrastructure would include a permanent operation and maintenance building, water storage, meteorological data system, telecommunications infrastructure, access roads, and security fencing. The Project would share, where feasible, an existing approximately 2-mile long 115 kilovolt (kV) generation tie-line (gen-tie line) between the adjacent North Star Solar project's on-site substation and Pacific Gas and Electric Company's (PG&E's) Mendota substation and otherwise would construct a new gen-tie line to interconnect the Project at PG&E's Mendota substation.

Project Location

The approximately 1,288-acre Project site is located in unincorporated Fresno County, approximately 13 miles east of Interstate 5 (I-5), approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), in the western portion of the San Joaquin Valley. The Project site is bounded by West California Avenue to the north, SR-33 to the east, West Jensen Avenue to the south, and San Bernardino Avenue to the west. See Figure 1, *Project Location*.

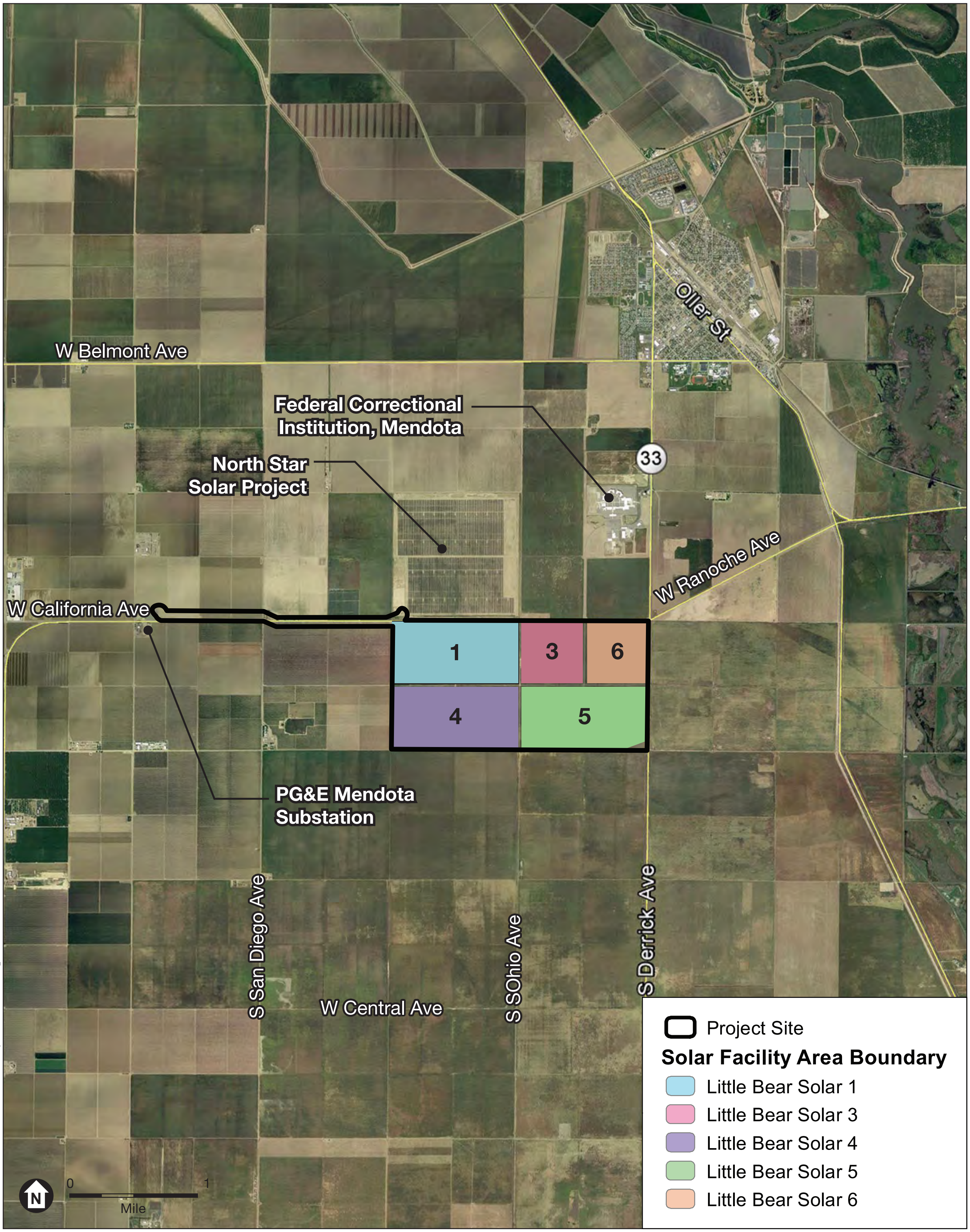
3. Opportunities for Public Comment

Notification

On September 7, 2017, the County published and distributed a Notice of Preparation (NOP) to advise interested local, regional, state, and federal agencies, as well as the public, that an EIR would be prepared for the Project. The NOP was sent to a mailing list that included Tribes; local, state, and federal agencies; 30 property owners within an area that included the properties within 1 mile of the Project site; other interested parties; and the Governor's Office of Planning and Research, State Clearinghouse. The NOP and NOP mailing list are provided in Appendix A. The NOP also was posted with the Mendota City Clerk and Fresno County Clerk. Additionally, an electronic copy of the NOP was posted on the County's website at: http://www.co.fresno.ca.us/DepartmentPage.aspx?id=74235. The NOP solicited comments on the scope, content, and format of the EIR. Agencies and members of the public were encouraged to submit their comments to the County by either U.S. mail or e-mail.

In addition to the NOP, the County notified the public about the public scoping meeting through a newspaper legal advertisement published in the Business Journal on September 11, 2017. The legal notice is provided in Appendix B. Notifications provided basic Project information, the date, time, and location of the scoping meeting, and a brief explanation of the public scoping process.

All scoping comments received on or before end of the scoping period (October 9, 2017), are documented in this Scoping Report and will be considered in the EIR.



D160635.00 - First Solar Little Bear\05 Graphics-GIS-Modeling\Illustrator

SOURCE: ESA, 2017

First Solar Little Bear

Figure 1
Little Bear Solar Project Site Location

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Public Scoping Meeting

The County conducted a public scoping meeting on Thursday, September 14, 2017 from 5:30 p.m. to 7:30 p.m. at the City of Mendota City Council Chambers, located at 643 Quince Street, Mendota, California. The Public Scoping Meeting presentation (Appendix C) included an overview of the environmental review process, Project description, Project overview, potential environmental impacts, and role of the public comments. Meeting attendees included: Christina Monfette and Chris Motta of Fresno County Department of Public Works and Planning; Janna Scott, Jill Feyk-Miney, and Larry Kass of ESA; and representatives from First Solar. No members of the public attended the scoping meeting, and no oral or written comments were received.

4. Summary of Scoping Comments

Four comment letters were received during the scoping period. Table 1 lists the names of commenting parties in the order in which the comments were received. The County has reviewed and relied upon the full text of the comment letters in preparing the EIR; summaries of the environmental issues raised are provided below for ease in review by other agencies and members of the public. The letters are provided in Appendix D.

TABLE 1
PARTIES SUBMITTING COMMENTS DURING THE LITTLE BEAR SOLAR PROJECT EIR SCOPING PROCESS

Name	Organization/Affiliation	Letter ID	Date
Written Comments			
Ensher Alexander & Barsoom	Adjacent property owners	A	September 19, 2017
Robert Pennell, Tribal Cultural Resources Director	Table Mountain Rancheria	B	October 2, 2017
Julie A. Vance, Regional Manager	California Department of Fish and Wildlife (CDFW)	C	October 6, 2017
Brian Clements, Program Manager	San Joaquin Valley Air Pollution Control District	D	October 9, 2017

The comment letters received by the County identify potential impacts in four areas as summarized below:

Air Quality

Concerns regarding the Project's potential impact on air quality were outlined in Letter D by the San Joaquin Valley Air Pollution Control District (SJVAPCD). SJVAPCD requests that details be provided about activities that would result in the emission of pollutants relative to sensitive receptors and, more specifically, that emissions from construction and operation of the Project be identified, quantified, and compared to thresholds for oxides of nitrogen (NOx), reactive organic gases (ROG), and particulate matter of 10 microns or less in size (PM10) to determine the potential significance of Project impacts.

If diesel trucks are to be used for panel cleaning and maintenance, SJVAPCD recommends that the Project be evaluated for potential health impacts to nearby sensitive receptors, as diesel truck emissions are a source of toxic air contaminants (TACs). SJVAPCD recommends conducting a screening analysis that includes all sources of emission to determine if it is necessary to conduct a health risk assessment (HRA).

SJVAPCD recommends that the Draft EIR contain a discussion of mitigation measures, SJVAPCD's attainment status, methodology and model assumptions used in characterizing the Project's impact on air quality, and the components and phases of the Project and the associated emission projections.

Letter D also identifies SJVAPCD rules and regulations applicable to the Project, including: District Rule 9510 (to submit an Air Impact Assessment application), Regulation VIII (Fugitive PM10 Prohibitions), Rule 4102 (Nuisance), Rule 4601 (Architectural Coatings), and Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations).

Biological Resources

Letter A from an adjacent property owner includes questions about the Project's potential impact on biological resources including the pomegranate trees farmed on their property and the bees required to pollinate them. The commenter asks whether solar project construction could disrupt newly planted trees and whether the power lines or solar panels could affect the trees and fruit, and expresses concern that weeds and other invasive plants might migrate onto their farm. The commenter encourages a 0.5-mile buffer between their farm and the Project's solar panels.

The California Department of Fish and Wildlife (CDFW), which is a Trustee Agency and may be a Responsible Agency for this Project, submitted Letter C. CDFW's comments and recommendations relate to: special-status wildlife species and their foraging and denning opportunities; Swainson's hawk nest sites within 2 miles of the Project site; project-specific and cumulative impacts to Swainson's hawk foraging habitat; foraging and denning habitat for San Joaquin kit fox, allowance for the species' unimpeded movement through the Project site, and a recommendation to prohibit rodenticide use so as to prevent the poisoning of Swainson's hawk or San Joaquin kit fox. CDFW's comments and recommendations also relate to the potential presence of blunt-nosed leopard lizard and burrowing owl, as well as denning and foraging opportunities for these species. Bats, birds, and bird nests; listed and other special status plants and related surveys also are discussed. Mitigation measures are recommended. CDFW offers the County its assistance with the identification and mitigation of potential significant impacts of the Project.

Tribal Cultural Resources

Letter B from the Table Mountain Rancheria Tribal Government Office expresses interest in consulting with the County regarding the Project, which is proposed in the Tribe's cultural area of interest. Next steps in consultation are proposed.

Water Supply

Letter A from the adjacent property owner inquires as to the supply source and the amount of water that would be needed to operate and maintain the Project.

APPENDIX A

Notice of Preparation and Mailing List

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NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT AND PUBLIC SCOPING MEETING FOR THE LITTLE BEAR SOLAR PROJECT

TO: Responsible and Trustee Agencies, other interested agencies and members of the public

FROM: County of Fresno, Department of Public Works and Planning
Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, CA 93721

SUBJECT: Notice of Preparation of a Draft Environmental Impact Report for the Little Bear Solar Project

Date: August 31, 2017

Action: The County of Fresno (County) will be the Lead Agency pursuant to the requirements of the California Environmental Quality Act (CEQA), and will be responsible for preparing an Environmental Impact Report (EIR) pursuant to CEQA and the CEQA Guidelines. The EIR will analyze potential impacts of the requested Conditional Use Permits for the Little Bear Solar Project (EIR #7225).

Project Title: Little Bear Solar Project

Project Applicants: Little Bear Solar 1 LLC, Little Bear Solar 3 LLC, Little Bear Solar 4 LLC, Little Bear Solar 5 LLC, and Little Bear Solar 6 LLC

Project Summary:

Little Bear Solar 1 LLC, Little Bear Solar 3 LLC, Little Bear Solar 4 LLC, Little Bear Solar 5 LLC, and Little Bear Solar 6 LLC (collectively, Applicant) have submitted to the County Conditional Use Permit (CUP) applications to construct, operate, and ultimately decommission up-to 180-megawatt (MW) photovoltaic (PV) electricity generating facilities and associated infrastructure, to be known as Little Bear Solar 1, 3, 4, 5, and 6, or the Little Bear Solar Project (Project). The Project would generate and deliver solar-generated power to the California electrical grid via PG&E's Mendota Substation. The approximately 1,288-acre Project site is on Westlands Water District-owned lands in unincorporated Fresno County, immediately west of State Route 33 (SR-33), approximately 2.5 miles southwest of the City of Mendota, and 13 miles east of Interstate 5. The Project site is agricultural: the parcels currently are periodically dry-farmed, typically for grain or forage crops. A more detailed description is provided below.

The Applicant's Project Description and site plan as well as a location map, are available for review at the following locations:

- Fresno County Public Works and Planning Department, 2220 Tulare Street, Fresno, CA 93721
- Fresno County website: http://www.co.fresno.ca.us/viewdocument.aspx?id=74176

Written Comments:

As required by Section 15082 and CEQA Guidelines, this Notice of Preparation ("NOP") has been prepared and distributed to solicit comments from potential Responsible and Trustee Agencies and other public agencies so that Project-related concerns relevant to each agency's statutory responsibilities in connection with the Project can be addressed in the EIR, as well as any related issues from interested parties other than potential Responsible and Trustee Agencies, including other agencies and affected members of the public. The EIR will be the environmental document of reference for Responsible and Trustee Agencies when considering subsequent discretionary approvals.

The County requests that any potential Responsible or Trustee Agencies responding to this NOP reply in a manner consistent with Section 15082(b) of the CEQA Guidelines, which allows for submittal of any comments in response to this notice no later than 30 days after receipt of the NOP. Comments in response to this NOP will be accepted through 5 p.m., Monday, October 9, 2017. Written comments should be addressed to the person noted below.

Please send your written comments to:

Attn: Christina Monfette
Fresno County Department of Public Works and Planning
Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, CA 93721
Phone: (559) 600-4245 Fax: (559) 600-4200
Email: cmonfette@co.fresno.ca.us

Please reference EIR #7225, Little Bear Solar Project. Please include your name, address, and phone number and/or email address so that we may contact you for clarification, if necessary.

Public Scoping Meeting:

The CEQA process encourages comments and questions from the public throughout the planning process. Consistent with the California Public Resources Code and Section 15083(c)(1), (2)(A) to (D) of the CEQA Guidelines, a Public Scoping Meeting will be held to solicit public and agency comments on the scope and content of the Draft EIR (DEIR). Oral and/or written comments also may be presented at the Public Scoping Meeting. The Public Scoping Meeting will be held on:

Date: Thursday, September 14, 2017
Time: 5:30 p.m. to 7:30 p.m.
Place: City of Mendota City Council Chambers, 643 Quince Street, Mendota, CA 93640

Signature: [signature] **Date:** 9/5/17

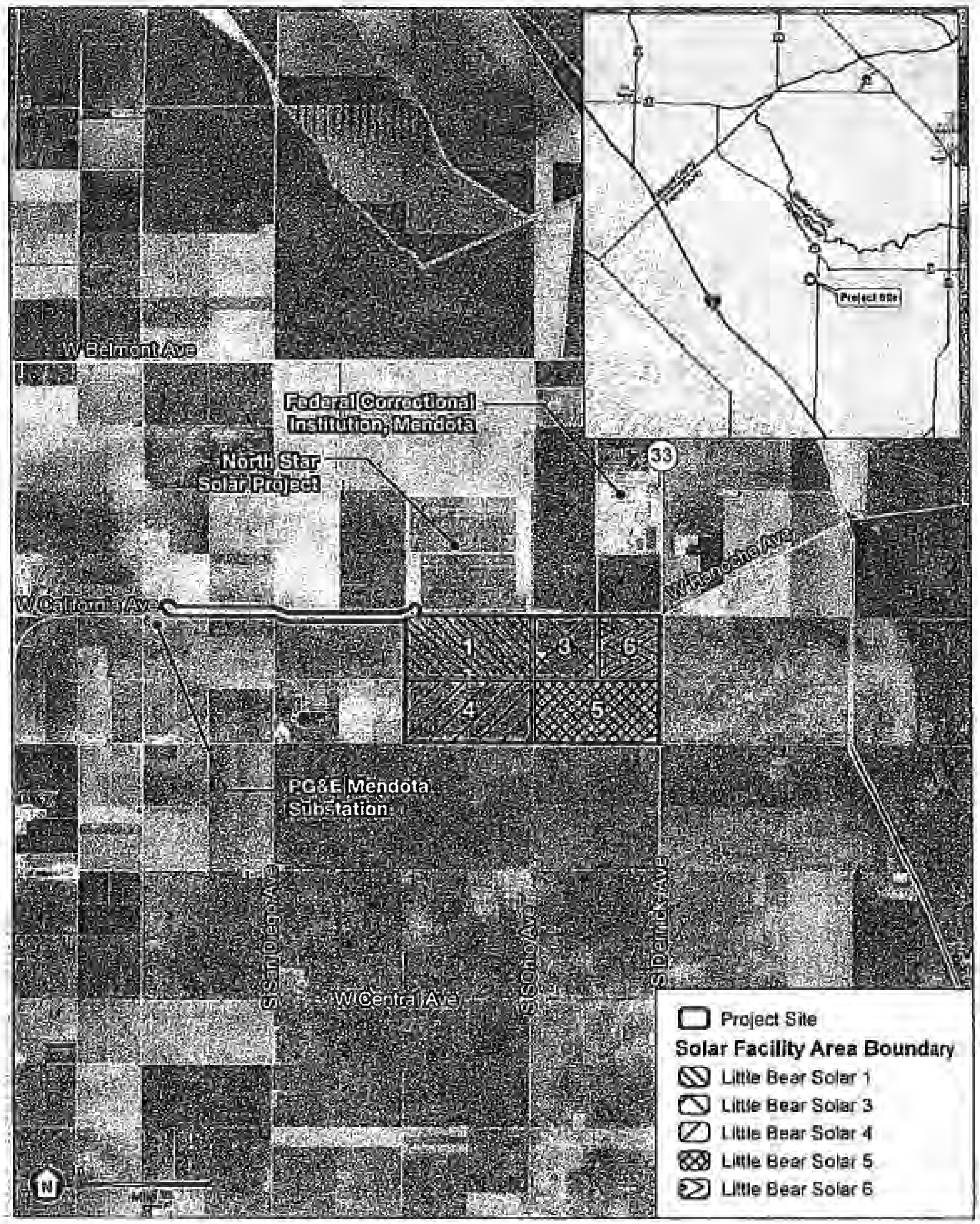
Project Location:
The Project site is located on Westlands Water District-owned lands in unincorporated western Fresno County, immediately west of SR-33, approximately 2.5 miles southwest of the City of Mendota, and 13 miles east of Interstate 5. The Project site would encompass five parcels bounded by West California Avenue to the north, SR-33 to the east, West Jensen Avenue to the south, and San Bernardino Avenue to the west. See Figure 1, *Little Bear Solar Project Site Location*.

Physical Setting:
The Project site encompasses five parcels owned by the Westlands Water District. The Project site consists of disturbed agricultural land that is periodically dry-farmed, typically for grain or forage crops. The site is subject to high levels of selenium and a water table that does not provide for sufficient drainage for commercially irrigated crops. Irrigation is not allowed on any of the land within the Project site. Because the Project site is cultivated without the benefit of irrigation, the productivity of the crop depends entirely on rainfall. There is an approximately 5,000 square-foot metal storage shed and approximately 2,500 square-feet of metal storage silos located the parcel located just east of South Ohio Avenue. No other structures are located on the Project site.

Adjacent land uses include agriculture to the east, south and west of the Little Bear site and an existing solar PV project and related powerline infrastructure (the North Star Solar Project) to the north.

Land Use Designation:
The Project site consists of disturbed agricultural land designated as Agriculture in the Fresno County General Plan, and zoned AE-20 (Exclusive Agricultural, 20-acre minimum parcel size) pursuant to the Ordinance Code of the County of Fresno, Zoning Map. The County Code (Section 816.2) permits electric transmission substations and electric distribution stations on parcels zoned Exclusive Agricultural, subject to Director Review and Approval, and does not discuss solar facilities. The designation protects the general welfare of the agricultural community from encroachments of unrelated agricultural uses that, by their nature, would be injurious to the physical and economic well-being of the agricultural district. Uses in the AE-20 zone district are limited to primarily agricultural uses and other activities compatible with agricultural uses. The Project site consists of approximately 1,288-acres of Farmland of Local Importance as designated by the California Department of Conservation's Farmland Mapping and Monitoring Program. The Project site is not subject to a Williamson Act contract.

Major Components of the Project:
The Project consists of two major components: the Solar Facility and the Generation Tie-Line (gen-tie line). The Solar Facility would consist of five individual facilities with solar PV modules (or panels), support structures, electrical inverters, and intermediate voltage transformers. Each individual facility also would include a substation, inverters, and transformers. Each facility also could include an Energy Storage System (ESS) that would provide up to 500 megawatt hours of electrical storage. Other necessary infrastructure would include a permanent operation and maintenance building, water storage, meteorological data system, telecommunications infrastructure, access roads, and security fencing. The solar modules at the site would operate during daylight 7 days a week, 365 days a year, and would generate up to 180 MW of solar power. The Project would generate electricity during daylight hours when electricity demand is at its peak.



SOURCE: ESA, 2017

First Solar Little Bear

Figure 1
Little Bear Solar Project Site Location

ESA

The Project would, where possible, share the existing two-mile-long 115 kV gen-tie line and underground communication lines between the North Star Solar Project substation and PG&E's existing Mendota Substation. The installation of new gen-tie line transmission poles would be required.

Alternatives to be Analyzed in the EIR:
In accordance with Section 15126.6 of the CEQA Guidelines, the DEIR will assess a range of reasonable alternatives to the Project. The range of alternatives to be addressed will include a No Project Alternative as well as other alternatives that would attain most of the basic objectives of the Project while avoiding or reducing any of its significant environmental effects. Potential alternatives will be identified during the coordinated consultation and scoping process.

Potential Environmental Impacts:
An Initial Study typically is prepared during the preliminary review process to determine whether a project is subject to CEQA. Pursuant to CEQA Guidelines Section 15060(d), the lead agency can determine that an EIR will be clearly required for a project and may skip further initial review and begin work directly on the EIR. The County has determined that this Project could result in significant environmental impacts and/or have a significant impact on the quality of the human environment, thereby necessitating the preparation of an EIR, and so has not prepared an Initial Study.

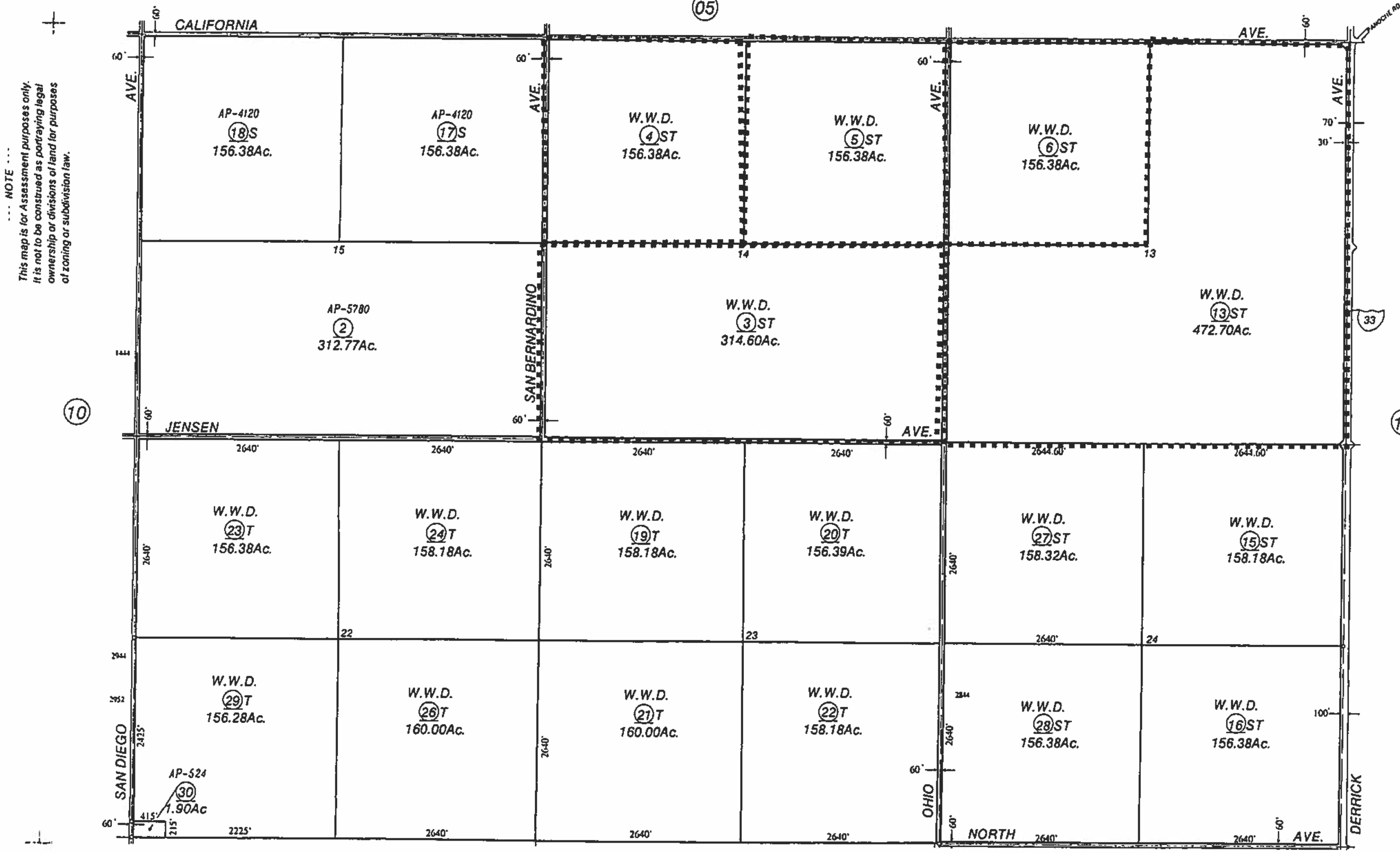
The EIR will analyze energy conservation and all environmental issues identified in the CEQA Environmental Checklist Form (listed below), after having first established the environmental setting, or baseline, for the environmental analysis. The EIR will identify any potential significant direct, indirect, and cumulative effects of the Project and alternatives related to:

- Aesthetic quality and views, particularly in the vicinity of existing communities;
- Agriculture and forestry resources, including the use of property now in non-irrigated agricultural use to a renewable energy generation use for the duration of the permit term;
- Air Quality and noise in the vicinity of sensitive receptors, particularly during construction;
- Biological resources, including species and habitats, based on database queries, field surveys, and agency consultations, if required;
- Cultural resources and paleontological resources that could be disturbed during construction, based on record searches and field surveys;
- Energy conservation, regarding the efficient use of energy;
- Geology and soils, hazards and hazardous materials, hydrology and water quality, and related considerations and constraints;
- Greenhouse gas emissions, including the incremental Project-specific contribution to global climate change;
- The Project's relationship to land use and planning, as well as lands subject to special resources management activities, such as mineral resources and recreation;
- Transportation and traffic, particularly during construction activities;
- Population and housing, public services, and utilities and service systems; and
- Growth inducement, particularly in relation to existing, adopted development plans for Fresno County.

SEC'S. 13,14,15,22,23, & 24, T. 14 S., R. 14 E., M.D.B. & M.

Tax Rate Area
140-006

019-1



NOTICE OF PREPARATION MAILING LIST

Agencies and Organizations	Contact	Address	City, State ZIP
Adams Broadw ell Joseph & Cardozo	Sheila Sannadan	601 Gatew ay Blvd, Suite 1000	South San Francisco, CA 94080
California Energy Commission		1516 Ninth Street, Ms-29	Sacramento, CA 95814-5512
California Native American Heritage Commission		915 Capitol Mall, Room 364	Sacramento, CA 95814
California Public Utilities Commission		505 Van Ness Avenue	San Francisco, CA 94102
Central Valley Flood Protection Board		3310 El Camino, Room Ll40	Sacramento, CA 95821
City Of Kerman, Planning Department		850 S. Madera Avenue	Kerman, CA 93630
City Of Mendota, Planning And Community Development		643 Quince Street	Mendota, CA 93640
City Of San Joaquin		21900 W Colorado Avenue	San Joaquin, CA 93660
Consolidated Mosquito Abatement District		P.O. Box 278	Selma, CA 93662
County Of Fresno Fire Protection District		25101 W Morton Ave	Tranquillity, CA 93668
Department Of Conservation, Division Of Land Resource Protection		801 K Street	Sacramento, CA 95814
Fresno Council Of Governments	Barbara Goodw in	2035 Tulare St Ste 201	Fresno CA 93721
Fresno Metropolitan Flood Control District		5469 E. Olive Avenue	Fresno, CA 93727
Golden Plains Unified School District		22000 Nevada Street	San Joaquin, CA 93660
James Irrigation District		8749 9th Street	San Joaquin, CA 93660
Kings River Conservation District		4886 E. Jensen Avenue	Fresno, CA 93725
Pacific Gas & Electric, Land Services Department		650 "O" Street, Third Floor	Fresno, CA 93760
San Joaquin Unified Valley Air Pollution Control District		1990 E. Gettysburg Avenue	Fresno, CA 93726
Southern San Joaquin Valley Archaeological Info Center	Celeste Thompson	9001 Stockdale Ave.	Bakersfield, CA 93311-1099
State of California Caltrans	Deputy Director Of Planning & Dev. Services	1352 W. Olive Ave.	Fresno, CA 93778-2616
State of California Department of Fish & Wildlife	Lisa Gymer, Environmental Scientist	1130 E. Shaw Avenue	Fresno, CA 93710
State of California Department of Forestry And Fire Protection, Fresno-Kings Unit	Bill Johnson And Norman Cook	210 S. Academy Ave.	Sanger, CA 93657-9306
State of California Department of Conservation		801 "K" Street - M/S 13-71	Sacramento, CA 95814-3514
State of California Environmental Protection Agency, Department of Toxic Substances Control		1515 Tollhouse Road	Clovis, CA 93612
State of California Highw ay Patrol		1382 W. Olive Ave.	Fresno, CA 93728
State of California Reclamation Board		1416 Ninth Street - Room 455-6	Sacramento, CA 95814

NOTICE OF PREPARATION MAILING LIST (Continued)

Agencies and Organizations	Contact	Address	City, State ZIP
State of California Regional Water Quality Control Board, Region 5		1685 E. Street	Fresno, CA 93706-2020
State Office of Historic Preservation, Department of Parks & Recreation	Ms. Lucinda Woodward	P.O. Box 942896	Sacramento, CA 94296-0001
Tranquillity Irrigation District		Box 487	Tranquillity, CA 93668
Tranquillity Resource Conservation District		Po Box 487	Tranquillity, CA 93668-0487
United States Department of Agriculture, Natural Resources Conservation Service		4625 W. Jennifer, Suite 125	Fresno, CA 93722
United States Department of Army Corps of Engineers		650 Capitol Mall	Sacramento, CA 95814
United States Department of The Interior, Fish & Wildlife Services - Endangered Species Div.		2800 Cottage Way, #W-2606	Sacramento, CA 95825-1888
United States Environmental Protection Agency Region 9		75 Hawthorne Street (Wtr-9)	San Francisco, CA 94105
United States Fish And Wildlife Service, San Joaquin Valley Division	Justin Sloan	1130 E. Shaw Avenue, Suite 206	Fresno, CA 93710
Westlands Water District		32650 W Adams Avenue	Tranquillity, CA 93668
Environmental Science Associates	Janna A. Scott, J.D.,	550 Kearny Street, Suite 800	San Francisco, CA 94108
First Solar	James F. Cook	135 Main St, 6th Floor	San Francisco, CA 94105
Irish Hills Environmental	James White	3111 Los Osos Valley Rd.	Los Osos, CA 93402

APPENDIX B
Newspaper Notice

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THE BUSINESS JOURNAL
FRESNO | KINGS | MADERA | TULARE

P.O. Box 126
Fresno, CA 93707
Telephone (559) 490-3400

(Space Below for use of County Clerk only)

IN THE COUNTY OF FRESNO, STATE OF CALIFORNIA

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT AND PUBLIC SCOPING MEETING FOR

THE LITTLE BEAR SOLAR PROJECT

DATE AND TIME OF PUBLIC SCOPING MEETING: SEPTEMBER 14, 2017 5:30 TO 7:30 PM

MISC. NOTICE

DECLARATION OF PUBLICATION
(2015.5 C.C.P.)

STATE OF CALIFORNIA

COUNTY OF FRESNO

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of THE BUSINESS JOURNAL published in the city of Fresno, County of Fresno, State of California, Monday, Wednesday, Friday, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Fresno, State of California, under the date of March 4, 1911, in Action No.14315; that the notice of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

SEPTEMBER 11, 2017

I declare under penalty of perjury that the foregoing is true and correct and that this declaration was executed at Fresno, California,

ON SEPTEMBER 11, 2017

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT AND PUBLIC SCOPING MEETING FOR THE LITTLE BEAR SOLAR PROJECT

TO: Responsible and Trustee Agencies, other interested agencies and members of the public

FROM: County of Fresno, Department of Public Works and Planning
Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, CA 93721

SUBJECT: Notice of Preparation of a Draft Environmental Impact Report for the Little Bear Solar Project

Date: September 7, 2017

Action: The County of Fresno (County) will be the Lead Agency pursuant to the requirements of the California Environmental Quality Act (CEQA), and will be responsible for preparing an Environmental Impact Report (EIR) pursuant to CEQA and the CEQA Guidelines. The EIR will analyze potential impacts of the requested Conditional Use Permits for the Little Bear Solar Project (EIR #7225).

Project Title: Little Bear Solar Project

Project Applicants: Little Bear Solar 1 LLC, Little Bear Solar 3 LLC, Little Bear Solar 4 LLC, Little Bear Solar 5 LLC, and Little Bear Solar 6 LLC

Project Summary:
Little Bear Solar 1 LLC, Little Bear Solar 3 LLC, Little Bear Solar 4 LLC, Little Bear Solar 5 LLC, and Little Bear Solar 6 LLC (collectively, Applicant) have submitted to the County Conditional Use Permit (CUP) applications to construct, operate, and ultimately decommission up-to 180-megawatt (MW) photovoltaic (PV) electricity generating facilities and associated infrastructure, to be known as Little Bear Solar 1, 3, 4, 5, and 6, or the Little Bear Solar Project (Project). The Project would generate and deliver solar-generated power to the California electrical grid via PG&E's Mendota Substation. The approximately 1,288-acre Project site is on Westlands Water District-owned lands in unincorporated Fresno County, immediately west of State Route 33 (SR-33), approximately 2.5 miles southwest of the City of Mendota, and 13 miles east of Interstate 5. The Project site is agricultural: the parcels currently are periodically dry-farmed, typically for grain or forage crops. A more detailed description is provided below.

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Please send your written comments to:
Attn: Christina Monfette
Fresno County Department of Public Works and Planning

Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, CA 93721
Phone: (559) 600-4245 Fax: (559) 600-4200
Email: cmonfette@co.fresno.ca.us
Please reference EIR #7225, Little Bear Solar Project. Please include your name, address, and phone number and/or email address so that we may contact you for clarification, if necessary.

Public Scoping Meeting:

The CEQA process encourages comments and questions from the public throughout the planning process. Consistent with the California Public Resources Code and Section 15083(c)(1), (2)(A) to (D) of the CEQA Guidelines, a Public Scoping Meeting will be held to solicit public and agency comments on the scope and content of the Draft EIR (DEIR). Oral and/or written comments also may be presented at the Public Scoping Meeting. The Public Scoping Meeting will be held on:

Date: Thursday, September 14, 2017
Time: 5:30 p.m. to 7:30 p.m.
Place: City of Mendota City Council Chambers, 643 Quince Street, Mendota, CA 93640

Signature: Date:

Project Location:

The Project site is located on Westlands Water District-owned lands in unincorporated western Fresno County, immediately west of SR-33, approximately 2.5 miles southwest of the City of Mendota, and 13 miles east of Interstate 5. The Project site would encompass five parcels bounded by West California Avenue to the north, SR-33 to the east, West Jensen Avenue to the south, and San Bernardino Avenue to the west.

Physical Setting:

The Project site encompasses five parcels owned by the Westlands Water District. The Project site consists of disturbed agricultural land that is periodically dry-farmed, typically for grain or forage crops. The site is subject to high levels of selenium and a water table that does not provide for sufficient drainage for commercially irrigated crops. Irrigation is not allowed on any of the land within the Project site. Because the Project site is cultivated without the benefit of irrigation, the productivity of the crop depends entirely on rainfall. There is an approximately 5,000 square-foot metal storage shed and approximately 2,500 square-feet of metal storage silos located on the parcel located just east of South Ohio Avenue. No other structures are located on the Project site.

Adjacent land uses include agriculture to the east, south and west of the Little Bear site and an existing solar PV project and related powerline infrastructure (the North Star Solar Project) to the north.

Land Use Designation:

The Project site consists of disturbed agricultural land designated as Agriculture in the Fresno County General Plan, and zoned AE-20 (Exclusive Agricultural, 20-acre minimum parcel size) pursuant to the Ordinance Code of the County of Fresno Zoning Map. The County Code (Section 816.2) permits electric transmission substations and electric distribution stations on parcels zoned Exclusive Agricultural, subject to Director Review and Approval, and does not discuss solar facilities. The designation protects the general welfare of the agricultural community from encroachments of unrelated agricultural uses that, by their nature, would be injurious to the physical and economic well-being of the agricultural district. Uses in the AE-20 zone district are limited to primarily agricultural uses and other activities compatible with agricultural uses. The Project site consists of approximately 1,288-acres of Farmland of Local Importance as designated by the California Department of Conservation's Farmland Mapping and Monitoring Program. The Project site is not subject to a Williamson Act contract.

Major Components of the Project:

The Project consists of two major components: the Solar Facility and the Generation Tie-Line (gen-tie line). The Solar Facility would consist of five individual facilities with solar PV modules (or panels), support structures, electrical inverters, and intermediate voltage transformers. Each individual facility also would include a substation, inverters, and transformers. Each facility also could include an Energy Storage System (ESS) that would provide up to 500 megawatt hours of electrical storage. Other necessary infrastructure would include a permanent operation and maintenance building, water storage, meteorological data system, telecommunications infrastructure, access roads, and security fencing. The solar modules at the site would operate during daylight 7 days a week, 365 days a year, and would generate up to 180 MW of solar power. The Project would generate electricity during daylight hours when electricity demand is at its peak.

The Project would, where possible, share the existing two-mile-long 115 kV gen-tie line and underground communication lines between the North Star Solar Project substation and PG&E's existing Mendota Substation. The installation of new gen-tie line transmission poles would be required.

Alternatives to be Analyzed in the EIR:

In accordance with Section 15126.6 of the CEQA Guidelines, the DEIR will assess a range of reasonable alternatives to the Project. The range of alternatives to be addressed will include a No Project Alternative as well as other alternatives that would attain most of the basic objectives of the Project while avoiding or reducing any of its significant environmental effects. Potential alternatives will be identified during the coordinated consultation and scoping process.

Potential Environmental Impacts:

An Initial Study typically is prepared during the preliminary review process to determine whether a project is subject to CEQA. Pursuant to CEQA Guidelines Section 15060(d), the lead agency can determine that an EIR will be clearly required for a project and may skip further initial review and begin work directly on the EIR. The County has determined that this Project could result in significant environmental impacts and/or have a significant impact on the quality of the human environment, thereby necessitating the preparation of an EIR, and so has not prepared an Initial Study.

The EIR will analyze energy conservation and all environmental issues identified in the CEQA Environmental Checklist Form (listed below), after having first established the environmental setting, or baseline, for the environmental analysis. The EIR will identify any potential significant direct, indirect, and cumulative effects of the Project and alternatives related to:

- Aesthetic quality and views, particularly in the vicinity of existing communities;
- Agriculture and forestry resources, including the use of property now in non-irrigated agricultural use to a renewable energy generation use for the duration of the permit term;
- Air Quality and noise in the vicinity of sensitive receptors, particularly during construction;
- Biological resources, including species and habitats, based on database queries, field surveys, and agency consultations, if required;
- Cultural resources and paleontological resources that could be disturbed during construction, based on record searches and field surveys;
- Energy conservation, regarding the efficient use of energy;
- Geology and soils, hazards and hazardous materials, hydrology and water quality, and related considerations and constraints;
- Greenhouse gas emissions, including the incremental Project-specific contribution to global climate change;
- The Project's relationship to land use and planning, as well as lands subject to special resources management activities, such as mineral resources and recreation;
- Transportation and traffic, particularly during construction activities;
- Population and housing, public services, and utilities and service systems; and
- Growth inducement, particularly in relation to existing, adopted development plans for Fresno County.

09/11/2017

APPENDIX C

Public Scoping Meeting Presentation

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Fresno County

Little Bear Solar Project EIR

SCOPING MEETING

Thursday, September 14, 2017
5:30 pm - 7:30 pm

Agenda

- Introductions
- Purpose of the Meeting
- Project Overview
- The CEQA Process
- Proposed Schedule
- Project Details
- Potential Environmental Effects and Alternatives
- Public Comments
- Next Steps

Introductions

- Participants and Roles
  - Fresno County
    - Department of Public Works and Planning
    - Chrissy Monfette, Planner; Chris Motta, Principal Planner
    - CEQA Lead Agency (responsible for the EIR)
    - Decision-maker for requested Conditional Use Permits
  - Environmental Science Associates (ESA)
    - Janna Scott, Project Manager; Jill Feyk-Miney, Deputy PM
    - Environmental Consultant to the County
  - First Solar, Applicant
  - Other Public Agencies
  - Members of the Public

Purpose of the Meeting

For us to hear from you. Your questions and ideas are welcome and invited!

Project Overview

The Applicant seeks:

- Five Conditional Use Permits
- Construction, operation, maintenance, and decommissioning
- 180 megawatt solar photovoltaic electricity-generating facility
- Approximately 1,288 acres of Westlands Water District land adjacent to an existing solar facility (the North Star Solar Project)

Project Details
Objectives

CEQA Process
Steps for an EIR

Proposed Schedule

Anticipated Environmental Review Milestones

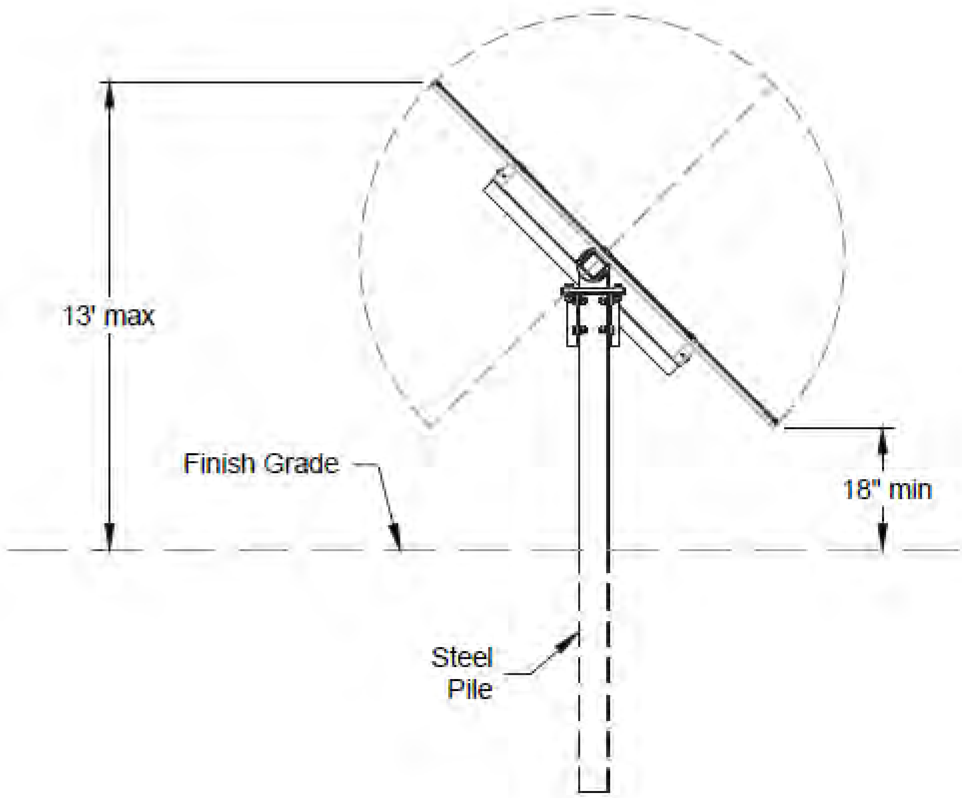
- **Spring 2018: Issue Draft EIR for review & comments**
- **Summer 2018: Complete Final EIR**
- **Fall 2018: County consideration of EIR and CUPs**

Project Details
Major Components

- Solar Facility
  - Solar panels and support structures
  - Electrical substations
- Generation Tie Lines
  - Use of existing
  - Proposed new

Project Details
PV Panels and Supports

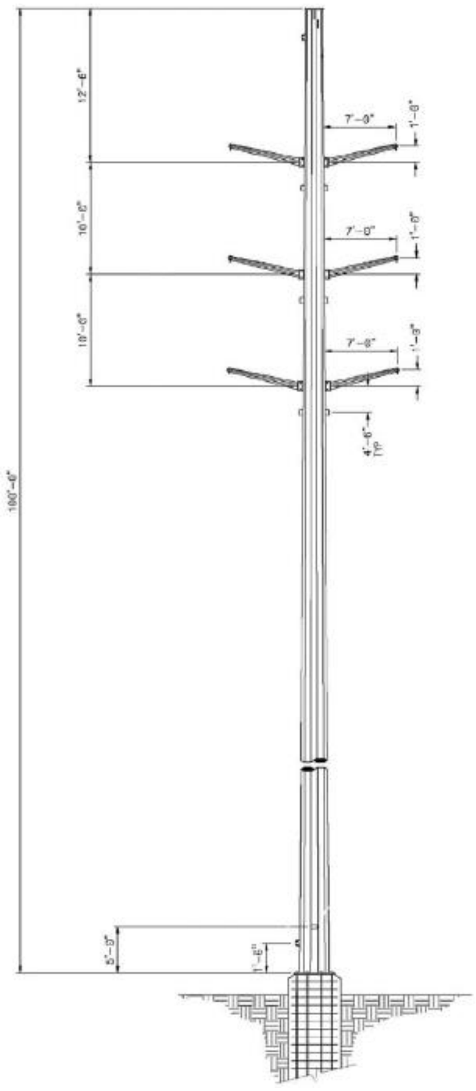
Project Details
PV Panels and Supports



First Solar 2017

Project Details
Electrical Substations

Project Details
Generation Tie Lines



Typical transmission structures

- Either 75-feet tall or 100-feet, depending on location
- Foundation types have not yet been determined

First Solar 2017

Potential Environmental Effects

- Aesthetics
- Agricultural and Forestry
- Air Quality
- Biological Resources
- Cultural Resources
- Energy Conservation
- Geology/Soils
- Greenhouse Gas Emissions
- Hazards & Hazardous Materials
- Hydrology/Water Quality
- Land Use/Planning
- Mineral Resources
- Noise
- Population/Housing
- Public Services
- Recreation
- Transportation/Traffic
- Tribal Cultural Resources
- Utilities/Service Systems

Potential Alternatives

- Threshold Criteria
- No Project Alternative
- Environmentally Superior Alternative




Public Participation Opportunities

- **Speak at today's meeting**
- **Send written comments on or before October 9, 2017**

Chrissy Monfette, Planner

Fresno County Department of Public Works and Planning

Development Services Division

2220 Tulare Street, Sixth Floor

Fresno, CA 93721

Email: cmonfette@co.fresno.ca.us

Phone: (559) 600-4245

Fax: (559) 600-4200

- **Provide comments on the Draft EIR**
- **Participate in public hearings on the Project**

Public Comments

- Speaker Cards and Comment Sheets
- Requests
  - State your name clearly
  - One person to speak at a time
  - Support everyone’s participation
  - Respect others’ opinions
  - Written comments encouraged

What's Next?

- **Next Steps in the CEQA Process:**
  - **Scoping Comment Period Concludes October 9, 2017**
  - **Scoping Report Finalized October 2017**
  - **Draft EIR Published Spring 2018**
  - **Public Comments on Draft EIR Spring 2018**
  - **Final EIR Summer 2018**
  - **County Consideration of the EIR and the Project Fall 2018**

Want more information?

http://www.co.fresno.ca.us/DepartmentPage.aspx?id=74235

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Divisions of Public Works and Planning

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Little Bear Solar Project

Notice of Preparation for EIR No. 7225

Project Site Location Map

Project Description

Public Scoping Meeting:

Thursday, September 14, 2017 – 5:30 p.m. to 7:30 p.m.

City of Mendota City Council Chambers, 643 Quince Street, Mendota, CA 93640

APPENDIX D
Scoping Comment Letters

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Ensher, Alexander & Barsoom

530 Bercut Dr. Suite D

Sacramento, CA 95811-0101

RECEIVED
COUNTY OF FRESNO

SEP 19 2017

DEPARTMENT OF PUBLIC WORKS
AND PLANNING
DEVELOPMENT SERVICES DIVISION

EIR 7225

Fresno County Department of Public Works and Planning

Attn: Christina Monfette

2220 Tulare Street, Sixth Floor

Fresno, CA 93721

September 19, 2017

RE: EIR # 7225, Little Bear Solar Project

Dear Christina Monfette

We farm 960 acres of pomegranates on sections 15, 16 and 21 which borders the west side of your proposed project site. Pomegranates are a heat sensitive crop and we require bees for our pollination.

We have the following concerns regarding how this proposed project will deteriorate the farmability of our land:

1. We are unaware of how the power lines and reflection from the solar panels will affect our sensitive trees and fruit.

2. Construction disruption could damage our newly planted trees in section 15.

3. If the solar farm is not kept clean, it will create weeds and other invasive plants that will migrate into our farm.

4. Our trees need pollination from bees and the introduction of a solar field in close proximity to their natural habitat could create an unnatural environment for natural bee pollination.

5. With all of the idle ground that Westlands Water District has we would encourage a 1/2 mile buffer between our fruit producing farm and the solar farm.

6. How much water will be required (and where will it come from) to cool the stored energy as well as cleaning the dirt and dust on the solar panels. I would think that this water use is contrary to Westlands Water Districts rules that "Irrigation is not allowed on any of the land within the Project site. Because the Project site is cultivated without the benefit of irrigation, the productivity of the crop depends entirely on rainfall."

Very Truly Yours,

S Barsoom

Steve Barsoom, CEO

cc: Day Carter & Murphy, LLP

Comment Letter B

TABLE MOUNTAIN RANCHERIA
TRIBAL GOVERNMENT OFFICE

CERTIFIED 3675 3107

RECEIVED
OCT 05 2017
FRESNO COUNTY
DEPT. OF
PUBLIC WORKS & PLANNING

October 2, 2017

Christina Monfette
Fresno County Department of Public Works and Planning
Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, Ca. 93721

RE: Little Big Bear Solar Project

Dear: Christina Monfette

Table Mountain Rancheria is responding to your letter dated, August 31, 2017, regarding, Little Big Bear Solar Project. Thank you for notifying Table Mountain Rancheria of the potential development and request for consultation. The Rancheria is very interested in this project as it lies within our cultural area of interest.

If you have already conducted a record search, please provide Table Mountain Rancheria with copies of any cultural resource report you may have.

At this time, please contact our office at (559) 325-0351 or rpennell@tmr.org to coordinate a discussion and meeting date regarding your project.

Sincerely,

Robert Pennell
Tribal Cultural Resources Director

Leanne Walker-Grant
Tribal Chairperson

Beverly J. Hunter
Tribal Vice-Chairperson

Craig Martinez
Tribal Secretary/Treasurer

Matthew W. Jones
Tribal Council Member

Richard L. Jones
Tribal Council Member

23736
Sky Harbour Road
Post Office
Box 410
Friant
California
93626
(559) 822-2587
Fax
(559) 822-2693

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

October 6, 2017

Christina Monfette
Fresno County Department of Public Works and Planning
Development Services Division
2220 Tulare Street, 6th Floor
Fresno, California, 93721

Dear Ms. Monfette:

Subject: Little Bear Solar (Project)
Notice of Preparation of a draft Environmental Impact Report
SCH# 2016011008

The California Department of Fish and Wildlife (CDFW) received a Notice of Preparation of a draft Environmental Impact Report (EIR) from the Fresno County Department of Public Works and Planning (County) for the Project pursuant the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1]

Thank you for the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife. Likewise, we appreciate the opportunity to provide comments regarding those aspects of the Project that CDFW, by law, may be required to carry out or approve through the exercise of its own regulatory authority under the Fish and Game Code.

CDFW ROLE

CDFW is California's **Trustee Agency** for fish and wildlife resources, and holds those resources in trust by statute for all the people of the State. (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines § 15386, subd. (a).) CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. (*Id.*, § 1802.) Similarly, for purposes of CEQA, CDFW is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related activities that have the potential to adversely affect fish and wildlife resources.

[1] CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

CDFW is also submitting comments as a **Responsible Agency** under CEQA. (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381.) CDFW expects that it may need to exercise regulatory authority as provided by the Fish and Game Code. As proposed, the Project may be subject to CDFW's lake and streambed alteration regulatory authority. (Fish & G. Code, § 1600 et seq.) Likewise, to the extent implementation of the Project as proposed may result in "take" as defined by State law of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required.

PROJECT DESCRIPTION SUMMARY

Proponent: Little Bear Solar 1, 3, 4, 5, and 6 LLCs

Objective: The objective of the Project is to construct, operate, and ultimately decommission 5 photovoltaic (PV) electricity generating facilities for a total of up to 180-megawatts (MWs) and associated infrastructure on approximately 1,288 acres. Primary Project activities include construction and installation of solar PV modules, support structures, electrical inverters, voltage transformers, and Energy Storage System (ESS), and new generation-tie lines, and use of existing transmission lines to provide power to the electrical grid via the Mendota Substation.

Location: The Project is located west of State Route 33, south of West California Avenue, east of South San Bernardino Avenue, and north of West Jensen Avenue, approximately 2.5 miles southwest of the City of Mendota, in an unincorporated area of western Fresno.

COMMENTS AND RECOMMENDATIONS

CDFW offers the comments and recommendations below to assist the County in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources. Based on the potential for the Project to have a significant impact on biological resources, CDFW agrees that an Environmental Impact Report is appropriate for the Project.

The Project has the potential to impact several special-status wildlife species, including those known to occur in the Project site vicinity identified either through CNDDB or through CDFW staff's personal knowledge, such as Swainson's hawk (*Buteo swainsoni*, SWHA), which is listed as Threatened under CESA; blunt-nosed leopard lizard (*Gambelia sila*, BNLL), which is listed as Endangered under both CESA and the Federal Endangered Species Act (ESA) and listed as a State Fully Protected species; Nelson's antelope squirrel (*Ammospermophilus nelsoni*), which is listed as Threatened under

CESA; San Joaquin kit fox (*Vulpes macrotis mutica*, SJKF), which is listed as Threatened under CESA and Endangered under ESA; tricolored blackbird (*Agelaius tricolor*), which is listed as a Candidate under CESA; burrowing owl (*Athene cunicularia*, BUOW), western mastiff bat (*Eumops perotis californicus*), hoary bat (*Lasiurus cinereus*), which are State Species of Special Concern; San Joaquin woollythreads (*Monolopia congdonii*), which is listed as Endangered under ESA and State Rare Plant Rank 1B species; and recurved larkspur (*Delphinium recurvatum*) and Lost Hills crownscale (*Atricplex coronata* var. *vallicola*), which are both State Rare Plant Rank 1B species.

According to the NOP documentation, the Project site is agricultural land that is periodically dry farmed, typically for grain or forage crops and is reliant solely on precipitation for irrigation. Agricultural lands do not preclude the use of such lands by wildlife species such as those mentioned in the above paragraph and conversion of crop land or fallow land to a solar farm will eliminate or diminish foraging or denning opportunities for those wildlife species.

CDFW recommends the County require preliminary biological assessments be conducted on the entire Project site, including both the solar facility and the associated gen-tie corridors and an appropriate buffer around the Project site to determine the potential for special-status species and lakes or streams to occur on the Project site. These assessments will help inform the County's analyses of potentially significant impacts to biological resources and should include avoidance, minimization, and mitigation measures the County can include in the draft EIR to reduce potentially significant impacts to less than significant levels. Depending on the results of these preliminary biological assessments, CDFW may recommend conducting additional species-specific protocol-level surveys prior to the start of Project activities to determine if take, as defined by Fish and Game Code Section 86, can be avoided or if issuance of an incidental take permit (ITP) is warranted.

SWHA: There are at least 10 known SWHA nest sites within 10 miles of the Project site, two of which are known to be within 2 miles of the Project site (CNDDB). The Project site provides suitable foraging habitat for SWHA, which, when converted, may cause SWHA to forage a greater distance from their nest sites, expending greater energy resources and resulting in a loss of fecundity. CDFW recommends the County include an analysis for both Project specific and cumulative loss of foraging habitat for SWHA in the draft EIR. CDFW considers removal of foraging habitat for SWHA to be a significant impact under CEQA and recommends the County include compensatory mitigation in the draft EIR to reduce this impact to a less than significant level. CDFW recommends the County require compensatory mitigation that follows CDFW's "Staff Report regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California" (CDFG, 1994), which would require the conservation of at least 966 acres of equal or greater quality SWHA foraging habitat. Agricultural lands that continue to provide foraging opportunities for SWHA may satisfy this requirement. CDFW recommends the County require compensatory lands to be placed under a conservation easement and continued management funded through a non-wasting endowment prior to starting Project activities.

Though it appears from a review of aerial photographs that there are limited structures for use by SWHA for nesting purposes, CDFW recommends the County require that a qualified biologist familiar with SWHA conduct a thorough evaluation for potential nest structures on the Project site and within ½ miles of the Project site prior to starting Project activities, as SWHA are known to nest in a variety of less optimal structures when nest options are limited. If an active SWHA nest is found within ½ mile of the Project site, CDFW recommends the County require the nest to be protected with a ½-mile no-disturbance buffer during the breeding season (March 1 through September 15) or until the young have fledged and are no longer dependent on the nest or parents for survival, as determined by the qualified biologist and with written concurrence from CDFW. If the ½-mile no-disturbance buffer cannot be maintained, CDFW recommends the Project applicant consult with CDFW prior to reducing the buffer distance to determine if avoidance is feasible or if, pursuant to Fish and Game Code Section 2081(b), acquisition of an ITP may be warranted.

SJKF: SJKF have been known to occur throughout the Project site vicinity and the Project site may provide suitable foraging and denning habitat. Based on reported sightings of SJKF from numerous other projects during construction activities, it appears SJKF may be attracted to construction sites for the freshly disturbed soils and stored materials. CDFW recommends the County include the survey methodology and avoidance and minimization measures contained in the "U.S. Fish and Wildlife Service Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance" (USFWS, 2011) (Standardized Recommendations) in the draft EIR. If known or potential dens are found, implementation of a no-disturbance buffer should be required and followed by immediate contact with CDFW and United States Fish and Wildlife Service (USFWS). If the buffers established in the USFWS's Standardized Recommendations cannot be maintained, CDFW recommends consulting with CDFW and USFWS to determine alternative avoidance measures or if avoidance is not feasible, acquisition of an ITP prior to initiating vegetation– or ground-disturbing activities.

Fencing Gap: Because of the size of the Project and its location within the valley where SJKF have been known to occur with regularity, CDFW recommends the County require the Project to maintain connectivity with surrounding land and easy movement for SJKF through the Project site. CDFW recommends the County require the Project to install all perimeter fencing such that the fencing material is raised 4-6 inches above the ground for the entire length of the fencing and the bottom of the fencing material be knuckled back to allow for unimpeded movement of SJKF through the Project site. SJKF juveniles have been known to become trapped in chain link fencing material; therefore, if this fencing material is proposed for use inside of the perimeter fencing, CDFW recommends the County require either the interior fencing be installed similarly to that described for the perimeter fencing or that plastic slats be installed from the ground to at least four feet above the ground for the entire length of the fence.

Prohibit Rodenticide Use: To prevent direct poisoning or secondary poisoning (lethal take) of SWHA or SJKF, CDFW recommends the County include a mitigation measure in the draft EIR that prohibits the use of rodenticides on the Project site. If rodenticide use is allowed, an ITP is warranted and CDFW recommends the Project applicant immediately consult with CDFW to obtain an ITP prior to use of rodenticides on the Project site.

BNLL: BNLL are known to occur in the Project site vicinity. The Project site may provide foraging opportunities for BNLL as they have been observed on dirt roads around and between agricultural fields foraging on insects. If small mammal burrows occur on or near the Project site, BNLL denning habitat may also exist on the Project site. Because BNLL is a State Fully Protected species, CDFW cannot authorize their take as a result of Project related activities through issuance of an ITP. Therefore, if biological assessments determines BNLL may use the Project site, CDFW recommends the County require strict avoidance measures in the draft EIR such as avoidance of burrow openings by at least 50 feet, maintaining suitable vegetation throughout the solar facilities, and requiring compensatory mitigation in the form of preservation of BNLL habitat through recordation of a conservation easement and funding of a non-wasting endowment to allow for the continued management of the conserved lands prior to starting Project activities.

BUOW: BUOW is known to occur throughout the Project site vicinity and the Project site has the potential to contain suitable foraging and denning habitat. If biological assessments determines the Project site to be occupied or has the potential to be occupied by BUOW, CDFW recommends the County include the following mitigation measures in the draft EIR.

Conduct BUOW surveys according to the "Staff Report on Burrowing Owl Mitigation" (CDFG 2012), including pre-Project, pre-construction, and immediately prior to starting or resuming ground disturbing activities. The staff report can be found on CDFW's website at www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf.

Avoid BUOW burrows during the breeding and non-breeding seasons by following the "Staff Report on Burrowing Owl Mitigation" with regard to buffer distances found at the above website.

Allow passive relocation of BUOW only during the non-breeding season and only after a Burrowing Owl Exclusion Plan has been submitted and reviewed by CDFW. Include the impact of evicting owls in the analysis of the Project in the draft EIR.

Require habitat compensation and funding for continued management activities for BUOW if BUOW are found to be present on or adjoining the Project site before starting Project activities.

Bats: Several bat species are known to occur in the Project site vicinity and the Project site may provide suitable roosting habitat in the form of buildings and silos and provides foraging habitat. If the biological assessments determine that bats occur on the Project site, CDFW recommends the County require bats be protected during the breeding season (March 1 through September 30) with at least a 200-foot no-disturbance buffer. Outside the breeding season, once a qualified biologist has determined the bats have left to forage, reentry into the structures is blocked and alternative bat roosting habitat is provided, the structures may be removed.

Birds: CDFW recommends surveys for active bird nests be conducted no more than 10 days before starting Project activities if they are to occur between January 1 and September 15. Surveys on the Project site need to be conducted in a sufficient area around the Project site to identify any nests that are present and to determine their status. A sufficient area means any nest within an area that could potentially be affected by the Project. In addition to direct impacts such as nest destruction, nests may be affected by noise, vibration, odors, and movement of workers or equipment. Continuously survey identified nests for the first 24 hours to establish a behavioral baseline prior to starting any construction-related activities. Once work commences, continuously monitor all nests to detect any behavioral changes as a result of the Project. If behavioral changes are observed, cease all work causing the change and consult with CDFW for additional avoidance and minimization measures.

If continuous monitoring of identified nests by a qualified wildlife biologist is not feasible, CDFW recommends implementing a minimum no-disturbance buffer of 250 feet around active nests of non-listed, non-raptor bird species, 500 feet around active nests of non-listed, raptor bird species, and ½ mile around listed bird species until the breeding season has ended or until a qualified biologist has determined that the young have fledged and are no longer dependent upon the nest or parental care for survival. Variance from these no-disturbance buffers may be implemented when there is compelling biological or ecological reason to do so. Any variance from these buffers is advised to be supported by a qualified wildlife biologist and it is recommended CDFW be notified in advance of implementation of a no-disturbance buffer variance.

Additional nesting bird surveys need to be conducted before restarting Project-related activities after a lapse of 10 days or more during the general bird-breeding season.

To prevent bird death and injury, it is advised that all vertical pipes associated with the solar mounts and fencing be capped as they are installed.

Plants: Several listed and other special-status plant species are known to occur throughout the Project site vicinity. If the biological assessments indicate special-status species have the potential to occur on the Project site, CDFW recommends the Project conduct plant surveys following acceptable protocols during the blooming season prior to starting Project activities. If special-status plant species are found, CDFW recommends the County include avoiding plants by at least 50 feet, developing a salvage plan to be submitted and reviewed by CDFW, and preservation of known populations of plants impacted by the Project.

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a database which may be used to make subsequent or supplemental environmental determinations. (Pub. Resources Code, § 21003, subd. (e).) Accordingly, please report any special-status species and natural communities detected during Project surveys to the California Natural Diversity Database (CNDDB). The CNNDB field survey form can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/CNDDB_FieldSurveyForm.pdf. The completed form can be mailed electronically to CNDDB at the following email address: CNDDB@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/plants_and_animals.asp.

FILING FEES

The Project, as proposed, would have an impact on fish and/or wildlife, and assessment of filing fees is necessary. Fees are payable upon filing of the Notice of Determination by the County and serve to help defray the cost of environmental review by CDFW. Payment of the fee is required for the underlying project approval to be operative, vested, and final. (Cal. Code Regs, tit. 14, § 753.5; Fish & G. Code, § 711.4; Pub. Resources Code, § 21089.)

CONCLUSION

CDFW appreciates the opportunity to comment on the Notice of Preparation of a draft Environmental Impact Report to assist the County in identifying and mitigating Project impacts on biological resources.

Questions regarding this letter or further coordination should be directed to Lisa Gymer, Senior Environmental Scientist Specialist at 559-243-4014, extension 238 or Lisa.Gymer@wildlife.ca.gov.

Sincerely,

Julie A. Vance
Regional Manager
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ec: Annee Ferranti, California Department of Fish and Wildlife
Lisa Gymer, California Department of Fish and Wildlife

REFERENCES

California Department of Fish and Game. 2012. Staff report on burrowing owl mitigation. Natural Resources Agency: March 7, 2012

California Department of Fish and Game. 2009. Protocols for surveying and evaluating impacts to special status native plant populations and natural communities. Natural Resources Agency: November 24, 2009.

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U.S. Fish and Wildlife Service. 2011. U.S. Fish and Wildlife Service standardized recommendations for protection of the endangered San Joaquin kit fox prior to or during ground disturbance. Sacramento Fish and Wildlife Office: January 2011.

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Comment Letter D

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

October 9, 2017

Attn: Christina Monfette
Fresno County Department of Public Works and Planning
Development Services Division
2220 Tulare Street, Sixth Floor
Fresno, CA 93721

Project: Notice of Preparation of a Draft Environmental Impact Report for the Little Bear Solar Project

District CEQA Reference No: 20171007

Dear Ms. Monfette:

The San Joaquin Valley Unified Air Pollution Control District (District) has reviewed the Notice of Preparation for the Draft Environmental Impact Report (Draft EIR) for the project referenced above. The project includes the construction, operation, and ultimately decommissioning of up to 180-megawatt (MW) photovoltaic (PV) electricity generating facilities and associated infrastructure, to generate and deliver solar-generated power to the California electrical grid via PG&E's Mendota Substation, to be located on approximately 1,288 acres immediately west of State Route 33 (SR-33), approximately 2.5 miles southwest of the City of Mendota, and 13 miles east of Interstate 5 in Section 13 and 14, Township 14 South, Range 14 East (APN 019-110-03ST, 019-110-04ST, 019-110-05ST, 019-110-06ST, and 019-110-13ST) (Project). The District offers the following comments:

General Comments:

1) The Consultation Notice does not provide sufficient information to allow the District to assess the Project's potential impact on air quality. Referral documents should include a Project summary detailing, at a minimum, the identification of activities that would result in emissions of criteria pollutants and/or hazardous air pollutants and proximity of the Project to sensitive receptors. Specific details regarding assessing Project related impacts on air quality are discussed below.

Seyed Sadredin
Executive Director/Air Pollution Control Officer

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4800 Enterprise Way
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Southern Region
34946 Flyover Court
Bakersfield, CA 93308-9725
Tel: 661-392-5500 FAX: 661-392-5585

www.valleyair.org www.healthyairliving.com

Emissions Analysis

2) The environmental review of the Project's potential impact on air quality should include the identification and quantification of Project related emissions. The review should include a discussion of the components and phases of the Project and the associated emission projections, (including ongoing emissions from each previous phase).

2a) Construction Emissions

Construction activities include: the transport of materials to the construction site; on-site land preparation and panel installation; off-site construction activities necessary for operation of the facility (new power lines, substation, etc.); and construction employee commute.

Equipment exhaust, as well as fugitive dust emissions should be quantified. Project related short-term (construction) impacts should be considered significant if, with the implementation of mitigation measures, emissions exceed 10 tons per year of oxides of nitrogen (NOx), 10 tons per year of reactive organic gases (ROG), or 15 tons per year particulate matter of 10 microns or less in size (PM10).

2b) Operational Emissions

Operational activities include: the transport of water to the site, if applicable; panel cleaning; vehicles and equipment used on-site; deliveries to the site; and employee commute.

Emissions from permitted (stationary) sources and non-permitted (mobile) sources should be analyzed separately. Project related long-term (operational) impacts should be considered significant if, with the implementation of mitigation measures, emissions exceed 10 tons per year of oxides of nitrogen (NOx), 10 tons per year of reactive organic gases (ROG), or 15 tons per year particulate matter of 10 microns or less in size (PM10).

2c) For more information on the quantification of project related air emissions and analysis methodologies, the District's Technical Services Department – CEQA/ISR Division staff can be reached by phone at (559) 230-6000 or by email at CEQA@valleyair.org.

3) Should operational emissions result from the use of diesel trucks for panel cleaning and maintenance, the District recommends the Project be evaluated for potential health impacts to nearby sensitive receptors resulting from Project operations and the maintenance of the PV panels. Diesel truck emissions are a source of toxic air contaminants (TACs). TACs are air pollutants identified by the State of California that may cause or contribute to an increase in risk exposure to the surrounding public, such as residents and worksites that are proposed or actual.

3a) Health Risk Assessment – A health risk assessment is an evaluation to determine the effects of TACs from the Project on the surrounding public. A common source of TACs includes, but is not limited to diesel exhaust fumes that are emitted from both mobile and stationary sources.

The District recommends the Project be evaluated for potential health impacts to sensitive receptors (on-site and off-site) resulting from operational emissions. If this is a multi-year construction Project, include construction emissions in the analysis.

i. The District recommends conducting a screening analysis that includes all sources of emissions to determine if it is necessary to conduct a health risk assessment (HRA). A screening analysis is used to identify projects that may have a significant health impact. A prioritization, using CAPCOA's updated methodology, is a recommended screening method. A prioritization score of 10 or more is considered to be potentially significant and an HRA should be performed. The prioritization calculator can be found at: http://www.valleyair.org/busind/pto/emission_factors/Criteria/Toxics/Utilities/PRIORITIZATION%20RMR%202016.XLS.

ii. If an HRA is to be performed, it is recommended that the Project proponent contact the District to review the proposed modeling protocol. The Project would be considered to have a significant health risk if the HRA demonstrates that Project related health impacts would exceed the District's significance threshold of 20 in a million for carcinogenic risk and 1.0 for Acute and Chronic Hazard Indices.

iii. More information on toxic emission factors, prioritizations and HRAs can be obtained by:

- Calling Technical Services staff at (559) 230-6000.
- E-mailing inquiries to: hramodeler@valleyair.org; or
- Visiting the District's website at (modeling information): http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm.

4) If preliminary review indicates that an Environmental Impact Report (EIR) should be prepared, in addition to the effects identified above, the document should also include the following:

4a) Mitigation Measures – If preliminary review indicates that with mitigation, the Project would have a less than significant adverse impact on air quality, the effectiveness of each mitigation measure incorporated into the Project should be discussed.

4b) District's attainment status – The document should include a discussion of whether the Project would result in a cumulatively considerable net increase of any criteria pollutant or precursor for which the San Joaquin Valley Air Basin is in non-attainment. Information on the District's attainment status can be found online by visiting the District's website at http://valleyair.org/aqinfo/attainment.htm.

4c) A discussion of the methodology, model assumptions, inputs and results used in characterizing the Project's impact on air quality.

4d) A discussion of the components and phases of the Project and the associated emission projections, (including ongoing emissions from each previous phase).

District Rules and Regulations

5) Based on information provided, the proposed Project meets the applicability threshold within District Rule 9510 (Indirect Source Review) of 9,000 square feet of development space (Rule 9510, section 2.1.10). Therefore, per Section 2.1 of the rule the District concludes that the Project is subject to District Rule 9510.

5a) Any applicant subject to District Rule 9510 is required to submit an Air Impact Assessment (AIA) application to the District no later than applying for final discretionary approval, and to pay any applicable off-site mitigation fees before issuance of the first grading/building permit.

5b) If approval of the Project constitutes the last discretionary approval by your agency, the District recommends that demonstration of compliance with District Rule 9510, including payment of all applicable fees before issuance of the first grading/building permit, be made a condition of Project approval. Information about how to comply with District Rule 9510 can be found online at: www.valleyair.org/ISR/ISRHome.htm.

6) The Project may be subject to District rules and regulations including, but not limited to: Regulation VIII (Fugitive PM10 Prohibitions), Rule 4102 (Nuisance), Rule 4601 (Architectural Coatings), and Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations). The Project may also require District permits. The applicant is strongly encouraged to contact the District prior to the start of construction to identify other District regulations that apply to this Project and determine if an Authority to Construct (ATC) is required. District's Small Business Assistance (SBA) staff can be reached by phone at (559) 230-5888. A complete list of current District rules can be found online at: www.valleyair.org/rules/1ruleslist.htm.

7) The District recommends that a copy of the District's comments be provided to the Project proponent.

District staff is available to meet with you and/or the applicant to further discuss the regulatory requirements that are associated with this Project. If you have any questions or require further information, please call Stephanie Pellegrini at (559) 230-5820.

Sincerely,

Arnaud Marjollet
Director of Permit Services

Brian Clements
Program Manager

AM: sp

Appendix B
Project Description

Appendix B1, Draft Closure, Decommissioning, and Reclamation Plan

Appendix B2, Draft Pest Management Plan

Appendix B1

Draft Closure, Decommissioning, and Reclamation Plan

PRELIMINARY CLOSURE, DECOMMISSIONING, AND RECLAMATION PLAN

LITTLE BEAR SOLAR PROJECT

FRESNO COUNTY, CA

[CUP Reference TBD]

SUBMITTED TO:

Fresno County Department of Public Works and Planning

Development Services Division

2220 Tulare Street, 6th Floor
Fresno, California 93721

PREPARED BY:

Little Bear Solar 1, LLC; Little Bear Solar 3, LLC; Little Bear Solar 4, LLC;
Little Bear Solar 5, LLC & Little Bear Solar 6, LLC

February, 2017

Table of Contents

Acronyms and Abbreviations

County	Fresno County Department of Public Works and Planning Development Services Division
CUP	Conditional Use Permit
ESA	Environmental Site Assessment
O&M	Operations and Maintenance
Project	Little Bear Solar Project
PV	Photovoltaic
PPA	Power Purchase Agreement
SFG	Fresno County Solar Facility Guidelines
SPGF	Solar Power Generation Facility
WWD	Westland Water District

1 Introduction

1.1 Purpose of the Reclamation Plan

The purpose of this preliminary Closure, Decommissioning, and Reclamation Plan (Reclamation Plan) is to establish the methodologies that could be employed for decommissioning and reclamation activities associated with the permanent closure of the facilities at the Little Bear Solar Project (Project). The actual actions implemented in the facility closure will be determined based on the expected future use of the site. Therefore, a more detailed reclamation plan will be developed in advance of the start of decommissioning activities.

This Reclamation Plan has been developed in compliance with a requirement in Fresno County Development Services Division's *Solar Facility Guidelines* (SFG) to "provide a Reclamation Plan detailing the lease life, timeline for removal of the improvements and specific measures to return the site to the agricultural capability prior to installation of solar improvements." The SFG provide specific direction on the contents of the Reclamation Plan, which are discussed in further detail starting in Section 2.

The Project is expected to operate at a minimum for the term of its Power Purchase Agreement (PPA) or other energy contracts. Because much of the needed electrical infrastructure will have been developed, it is possible that the Solar Power Generation Facility (SPGF) would continue to be upgraded and used to generate solar energy even beyond the term of the initial energy purchase agreements, remaining in solar energy production for the foreseeable future. Even if the SPGF does not continue to operate, certain facility components such as access roads, electrical transmission lines, Operations and Maintenance (O&M) building, and others could be used to support other future uses on this site, including agricultural production.

For purposes of developing this plan, it is assumed that if and when the Project is decommissioned, all Project structures and electrical equipment would be removed from the site and the disturbed areas would be reclaimed for purposes of restoring the site to its present-day conditions, to the extent feasible.

This preliminary reclamation plan addresses the following:

- Project Description
- Regulatory Criteria
- Decommissioning and Reclamation Activities
    - Pre-Decommissioning
    - Removal of Facilities
    - Hazardous Waste Management
    - Debris Management, Disposal, and Recycling

- Post-Demolition Site Restoration
- Project Reclamation Costs and Bonding

As mentioned above, because this document addresses Project actions that would occur well in the future, it will be updated and finalized in the months prior to the scheduled decommissioning. This will ensure the final plan addresses the proposed future land use of the site and the applicable rules and regulations in place at that time.

1.2 Project Overview

The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5, approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), in unincorporated Fresno County, Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian. Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east. **Figure 1—Project Vicinity** shows the location of the Project site

The Project will interconnect to the PG&E-owned Mendota Substation located approximately 2 miles west of the Project site using an existing 115 kV gen-tie line that interconnects the North Star Solar Project and the Mendota Substation. The location of the Project site and the Mendota Substation is shown in **Figure 2—Project Location**.

The Project contemplates the construction and operation of an approximately 180 megawatt (MW) solar photovoltaic power generation facility. The Project will consist of five individual facilities, ranging from approximately 157 to 322 acres, and generally referred to hereafter as “Facility”, or by individual Facility name (“Little Bear 1,” “Little Bear 3,” “Little Bear 4,” “Little Bear 5” and “Little Bear 6”). Each Facility will consist of solar photovoltaic (PV) modules grouped together in a series of arrays arranged over the site. The electric power generated by the Project will be transmitted to the Mendota Substation by the combination of a new, approximately 1.25-mile-long, onsite gen-tie line and the existing North Star gen-tie line. The proposed solar facility is intended to operate year-round.

The solar PV modules will be mounted on support structures which will be designed to track the sun’s path through the sky along a single axis, oriented north-south in order to maximize the amount of incident solar radiation absorbed over the year and the annual production of electrical power. The direct current (DC) power output from the solar PV modules in each array will be routed to one or more current inverter(s), which will convert the DC power input into an alternating current (AC) power output. The AC current inverter outputs will then be routed to a step-up transformer. An underground network of AC power cables will connect the step-up transformers to a lineup of medium voltage switchgear and then to the Facility’s 115 kV substation.

Each Facility will include internal roads constructed of compacted native soil. Earthen basins will be constructed to contain storm water runoff on the Project site. The Facilities will be secured through a combination of perimeter security fencing, controlled access gates, electronic security systems, and remote monitoring. Security fencing will be six-foot chain link topped with three-strand barbed wire. Telecommunications will be provided by a local provider or a microwave/satellite communications tower that will be approximately 60 feet tall. The Project will have meteorological stations within the solar field, and each Facility may have between two and five 20-foot tall steel lattice meteorological towers mounted on concrete foundations and installed around the perimeter of the solar field.

Each Facility may optionally have an Energy Storage System (ESS) that will provide up to four hours of electrical storage. The ESS will be sited on an approximately one-acre area next to the onsite substation in separate outside rated enclosures and will consist of self-contained battery storage modules placed in racks, converters, switchboards, integrated heating, ventilation, and air conditioning (HVAC) units, inverters, transformers, and controls in prefabricated metal containers or in a building. The battery storage modules would use proven storage technologies such as Lithium Ion, Sodium-Sulphur, or Vanadium-Redox-Flow batteries.

The five Facilities may share a single operations and maintenance (O&M) building, of up to approximately 2,000 square feet, along with a parking area and other associated facilities. The O&M building is depicted on the Little Bear 1 site in Figure 3a – Project Design. If a Facility does not require use of the shared O&M building, storage enclosures may be installed on concrete pads within the Facility site.

Figure 3 – Project Layout shows the location of the components of the proposed Project and associated facilities.

2 Guidance for Reclamation Plan Contents

The County's SFG provides the following guidance on the minimum content for reclamation plans. Where necessary, reference is made to other sections of the Reclamation Plan where more detailed information is provided:

1. Description of present use of the site;

The site is intermittently used for dry-farm agriculture and related activities, such as seasonal livestock grazing. According to information provided by Westlands Water District (WWD), the Project property is non-irrigable and thus only capable of being dry farmed. Consequently, the site has mostly lain fallow during the past ten years.

The corridor of land containing the North Star Solar Project gen-tie line continues to be used for a mixture of agricultural uses, such as field crops and orchards.

2. Describe the proposed alternate use of the land (all equipment to be installed above and underground, structures, fencing, etc.);

The Project will include the following main elements: modular photovoltaic solar panels on single-axis trackers; direct current to alternating current power inverters mounted on concrete pads; three-phase transformers mounted on concrete pads, a medium-voltage (34.5 kV) collection system either overhead or underground, electric substations, a 115 kV gen-tie line, a control/administration building and parking lot, meteorology towers, security fencing and lighting and other on-site facilities as required. Earthen basins will be constructed to contain storm water runoff from the Project site.

3. Duration of the alternate use of the property (specify termination date);

The proposed SPGF is expected to be in commercial operation for approximately 30 years from the commencement of operations, with a potential for continued use in accordance with County permitting requirements.

4. Address ownership of the property (lease or sale);

The Project will own the property in fee title. The Project also holds real estate rights for the land across which the gen-tie line is located, through a shared facilities agreement.

5. Describe how the subject property will be reclaimed to its previous agricultural condition (if applicable), specifically:

a. Timeline for completion of reclamation after solar facility lease has terminated (identify phasing if needed);

b. Handling of any hazardous chemicals/materials to be removed;

c. Removal of all equipment, structures, buildings and improvements at and above grade;

d. Removal of any below-grade foundations;

e. Removal of any below-grade infrastructure (cables/lines, etc.) that are no longer deemed necessary by the local public utility company;

f. Detail any grading necessary to return the site to original grade;

g. Type of crops to be planted; and,

h. Irrigation system details to be used (existing wells, pumps, etc. should remain throughout the solar facility use)

Section 3, Project Decommissioning and Reclamation Procedures (below), provides a discussion of the procedures that will be used to return the proposed Project site back to pre-construction conditions. It should be noted that although the property has been historically used for agricultural production it no longer has rights to water delivery from the Westlands Water District, the present property owner. In consideration of these restrictions, this Reclamation Plan contemplates decommissioning of the project and stabilization of the site, and does not propose additional actions to restore agricultural capacity to the property beyond its present condition.

6. A Site Plan shall be submitted along with the text of the Reclamation Plan showing the location of equipment, structures, above and underground utilities, fencing, buffer area, reclamation phasing, etc.

Figure 3 – Project Layout shows the site plan for the Project.

7. An engineering cost estimate of reclaiming the site to its previous agricultural condition shall be submitted for review and approval;

Information for the engineering cost estimate to implement the Reclamation Plan is provided in Attachment A.

3 Decommissioning and Reclamation Procedures

The procedures described for decommissioning and reclamation are designed to promote public health and safety, environmental protection and compliance with applicable regulations. It is assumed that decommissioning will begin approximately 30 or more years after Project operation is initiated. The Project decommissioning plan may incorporate the sale of some of the facility components via the used equipment market and recycling of components. Decommissioning will be conducted in accordance with a Final Reclamation Plan that will be developed in the months prior to decommissioning being initiated.

This conceptual reclamation plan assumes that all equipment and facilities within and associated with the SPGF will be removed.

3.1 Pre-Decommissioning Activities

Pre-decommissioning activities will be conducted to prepare the Project for demolition. This would include assessing the existing site conditions and development of a Final Reclamation Plan and schedule as described above.

Pre-decommissioning activities would include removing hazardous materials from the site including residues that occur in equipment. All operational liquids and chemicals are expected to be removed and disposed of as discussed in Section 3.4. Hazardous material and petroleum containers, pipelines, and other similar structures shall be rinsed clean, when feasible, and the waste liquid collected for off-site disposal.

Locations for decommissioned structures, non-hazardous waste, and debris will be designated on the Final Reclamation Plan to facilitate the decommissioning process and off-site removal.

3.2 Removal of Facilities

Site decommissioning and equipment removal may take a year or more. Therefore, access roads, fencing, electrical power, and raw/sanitary water facilities will temporarily remain in place for use by the decommissioning and restoration workers until no longer needed. Therefore, these components would be the last to be removed prior to site rehabilitation.

SPGF Above- and Below-Ground Facilities

Structures that need to be dismantled during decommissioning include the onsite substations, onsite O&M area, perimeter fence, solar field, and transformers and inverters. These structures will be dismantled and moved to designated areas for either recycling or disposal at an approved landfill.

Above-ground structures will be removed through mechanical or other approved methods. Below-ground structures will be removed or, upon agency approval, may remain in place to minimize soil disturbance. Below-ground facilities/utilities that potentially may be removed include pipelines, electrical lines and conduits, and concrete slabs.

Stormwater retention basins will be filled and brought to grade level.

Gen-Tie Transmission Lines

If the gen-tie transmission lines will not continue to be utilized for another purpose at the time of Project decommissioning, the lines will be removed. Decommissioning of the gen-tie will consist of removal of all structures associated with the construction of the transmission line(s) to include, but not limited to overhead conductors and the removal of poles. All steel will be recycled and the foundations will be removed to a depth of at least 2 feet below the ground surface or as otherwise obligated by any real estate agreements. Aluminum from overhead conductors will be recycled.

Roads

Access and on-site roads will remain in place to accomplish decommissioning at the end of the facility's life and would be one of the last Project components to be removed. Any graveled roads or areas—if not left in place for future uses—would be removed and the material used to fortify existing perimeter roads. The compacted native soil roads in the solar field would not need to be removed but may be deep-chiseled to alleviate soil compaction.

3.3 Debris Management, Disposal, and Recycling

All removed material and demolition debris will be placed in designated locations within the SPGF. Each stockpile will be transported off-site to either a used equipment market, off-site recycling center, or approved landfill depending on the material type. Debris will be broken down into manageable sizes so that transportation is simplified.

3.4 Hazardous Waste Management

All disposal and transportation of hazardous waste will be conducted under compliance with applicable regulations as required. In areas where no record of hazardous waste exposure occurred, a visual inspection would be conducted. If a concern is identified, further evaluation of the area shall occur and the area or structure will be treated accordingly. A licensed state waste contractor would be used to ensure that all required laws and regulations have been met and to address any remaining requirements needed to successfully close the Project.

3.5 Post-Demolition Site Restoration

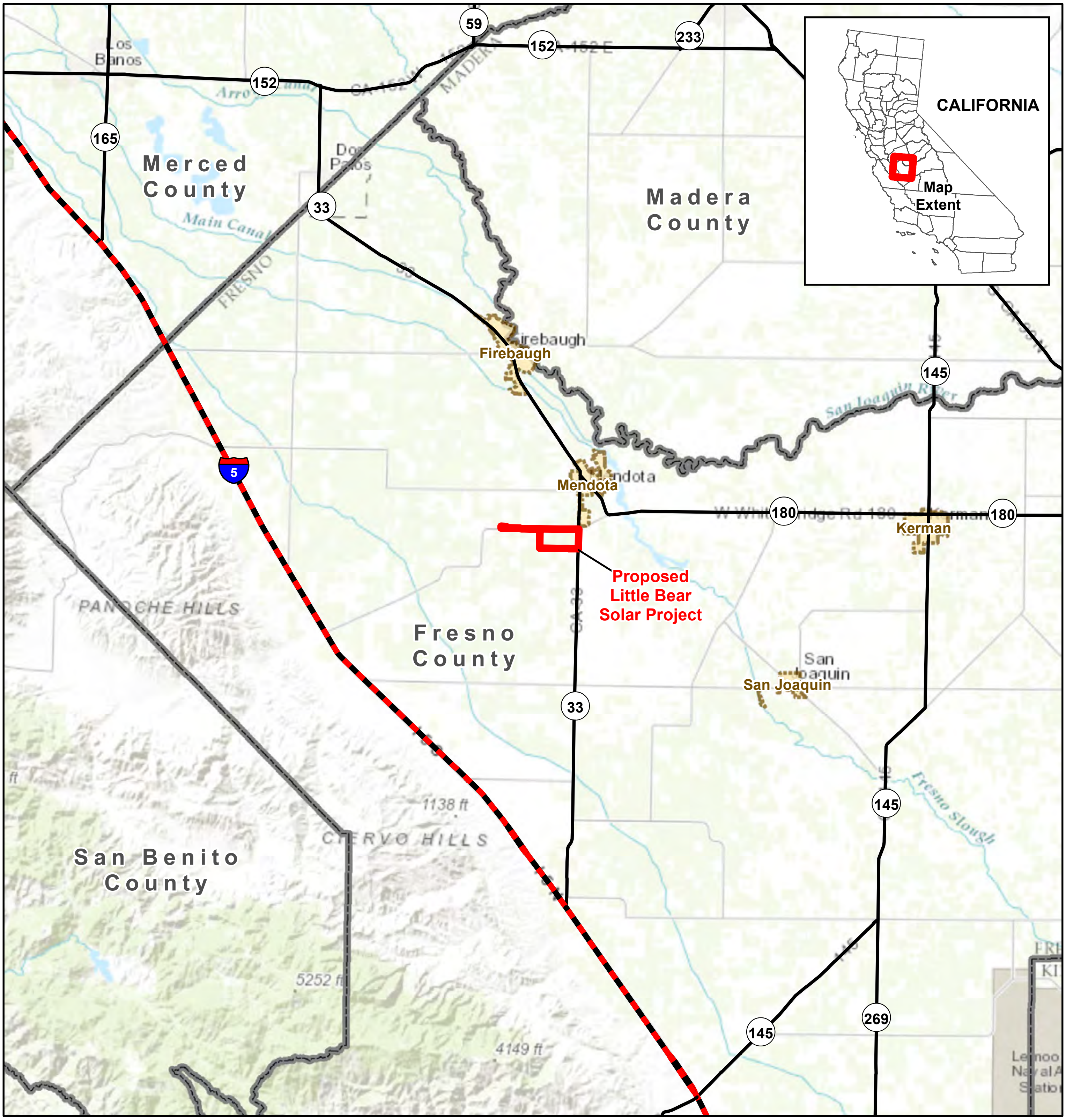
After all removal of existing structures of the SPGF and ancillary facilities, the Project area will be restored to topographic conditions similar to pre-construction. The site will be chisled and disced to loosen compacted soils. A rangeland seed mix of grasses and forage crops will be broadcast on the property to revegetate the site. Revegetation will assist in preventing soil erosion and dust.

4 Project Decommissioning Costs and Bonding

Prior to the issuance of any construction-related permits (e.g., Grading Permit), the Applicant will provide financial assurance in an amount sufficient to ensure restoration the Project land to its previous conditions, to the extent feasible, in accordance with the approved Reclamation Plan. Financial assurances shall be made to the County of Fresno and may take the form of cash, letter of credit or bond that complies with Section 66499 of the California Government Code, et seq.

The bond instrument will be based on a decommissioning cost estimate provided by the Applicant and based on the final, approved design of the Project. This estimate will consider any Project components that are expected to be left in place at the request of and for the benefit to the landowner (e.g., O&M building, electric lines, access road, water pipelines).

FIGURES



Legend

- Interstate
- State Highway
- Proposed Project
- Municipality
- County Boundary

0 5 10
Miles

Universal Transverse Mercator
North American Datum 1983
Zone 11 North, Meters

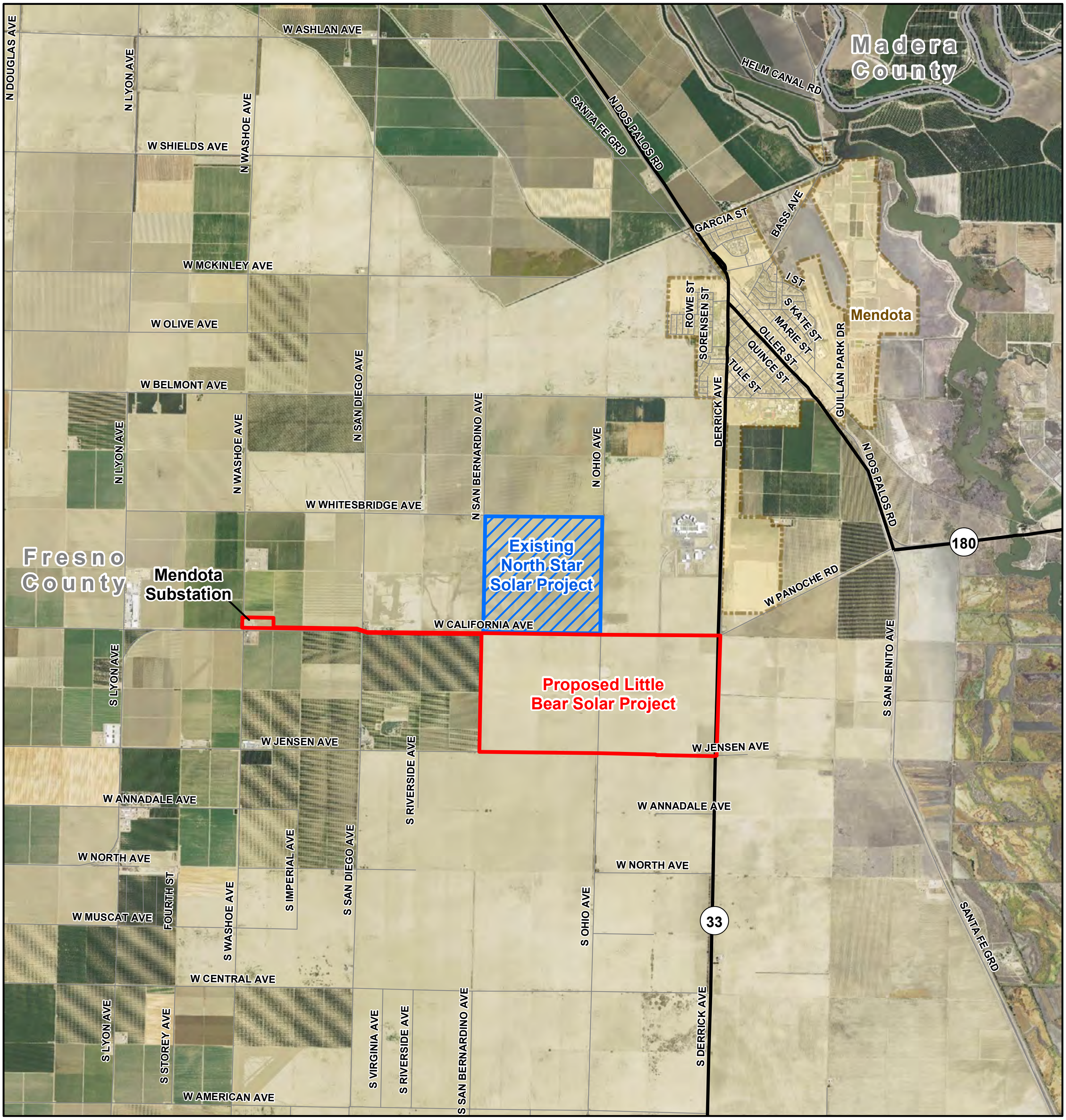
LITTLE BEAR SOLAR PROJECT

Figure 1-- Regional Location

Map Extent: Fresno County, CA

Date: 09-08-16		Author: rnc

G:\Little Bear Solar Project/MXD's/Project Location



Legend

- State Highway
- Road
- Proposed Project
- Existing North Star Solar Project
- Municipality
- County Boundary

0 0.5 1
Miles

Universal Transverse Mercator
North American Datum 1983
Zone 11 North, Meters

LITTLE BEAR SOLAR PROJECT

Figure 2 -- Project Vicinity

Map Extent: Fresno County, CA

Date: 09-08-16 | Author: rnc

G:\Little Bear Solar Project/MXD's/Project Location

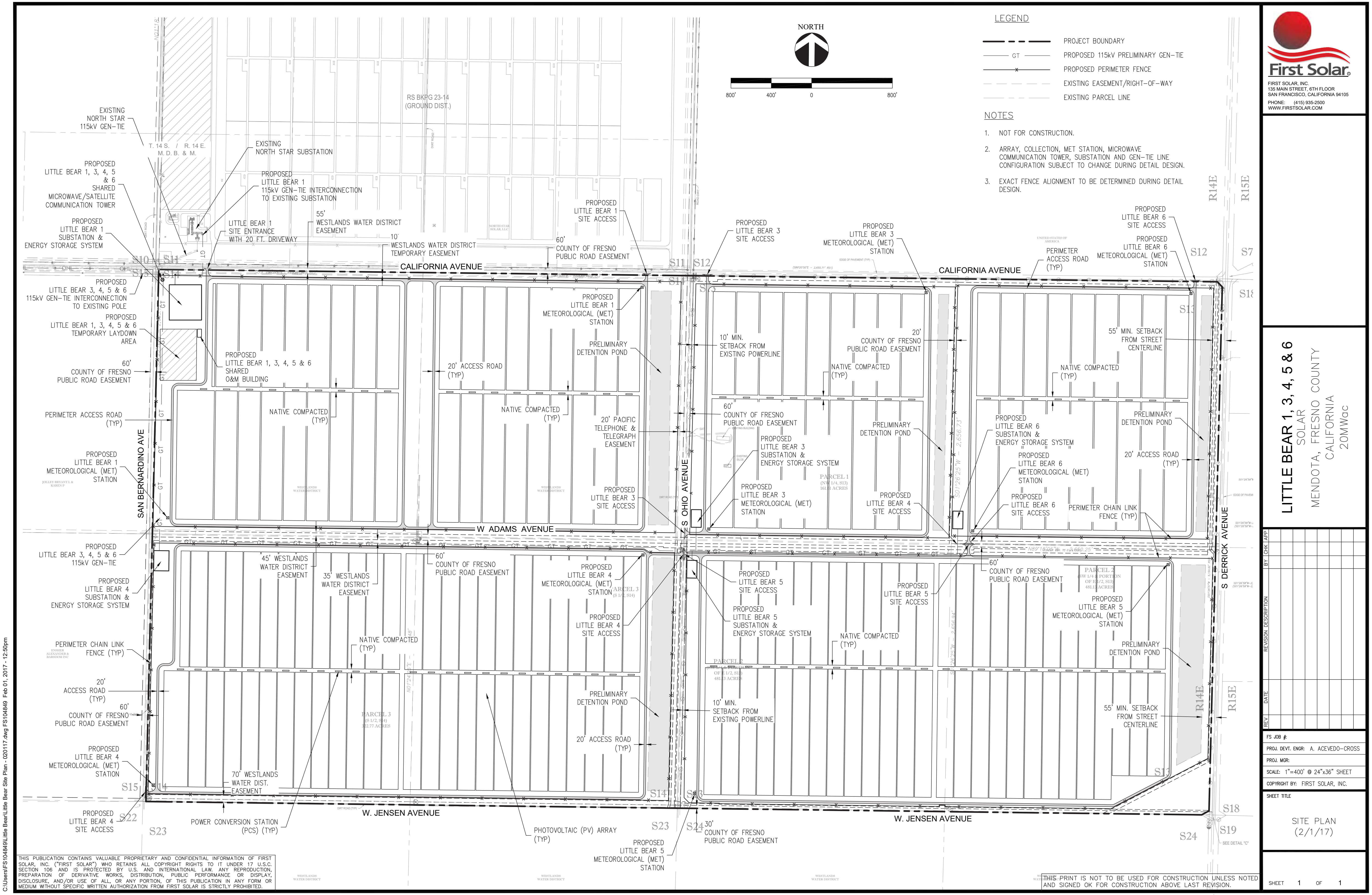


FIGURE 3 -- PROJECT LAYOUT

APPENDIX A

ESTIMATE OF RECLAMATION COSTS

[to be completed at time of final design]

Appendix B2
Draft Pest Management Plan

DRAFT PEST MANAGEMENT PLAN

LITTLE BEAR SOLAR PROJECT

FRESNO COUNTY, CA

[CUP Reference TBD]

PREPARED FOR:

Fresno County Department of Public Works and Planning

Development Services Division

2220 Tulare Street, 6th Floor

Fresno, California 93721

PREPARED BY:

Little Bear Solar 1, LLC; Little Bear Solar 3, LLC; Little Bear Solar 4, LLC;
Little Bear Solar 5, LLC & Little Bear Solar 6, LLC

February, 2017

Table of Contents

Acronyms and Abbreviations

CUP	Conditional Use Permit
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
Gen-tie	generation tie-line
IPM	integrated pest management
IPWMP	Integrated Pest and Weed Management Plan
kV	kilovolt
mph	miles per hour
MW	megawatt
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
Project	Little Bear Solar Project
PV	Photovoltaic
PPA	Power Purchase Agreement
SDS	Safety Data Sheets
WEAP	Worker Environmental Awareness Procedure

1 Introduction

1.1 Purpose of the Plan

This Pest Management Plan (PMP) outlines procedures and strategies for controlling pests at the Little Bear Solar Project (Project). The PMP is designed to satisfy the requirements of the Supplemental Information Guidelines for solar projects, which specifies that the Project operator shall develop and implement an on-site PMP to "identify methods and frequency to manage weeds, insects, disease, and vertebrate pests that may impact adjacent sites."

General requirements for these additional mitigation measures are outlined in Section 3. As required by the CUP, this PMP has been submitted for approval to the Fresno County Department of Public Works and Planning Development Services Division (County).

1.2 Project Location and Overview

The Little Bear Solar Project, proposes to construct, own and operate an approximately 180 megawatt (MW) solar photovoltaic power generation facility (Project) on lands located near Mendota in Fresno County, California. The Project will consist of up to five facilities: two 20 MW facilities, one 40 MW facility and two 50 MW facilities, along with associated infrastructure including a substation and operation and maintenance building. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The proposed solar facility is intended to operate year-round.

The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5 (I-5), approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), in unincorporated Fresno County.

2 Procedures and Methodologies

2.1 Weed Management

Weed management at the proposed Project will include identification of problem areas, implementation of measures intended to prevent the spread and establishment of new weed occurrences, and application of appropriate measures to treat known occurrences of weeds. These steps toward effective weed management are described in the following sections.

2.1.1 Preventative Measures

The prevention of weed establishment is the most effective weed management practice. Preventing or reducing the potential for weed establishment reduces additional efforts, costs, and time invested in subsequent weed control or eradication measures. Several measures have proven to be effective toward preventing the spread and establishment of weeds on projects where surface disturbing activities are proposed. The following preventative measures will be implemented:

- Vehicles and equipment to be used in off-road areas while on site will be inspected at the site entrance prior to entry to site by EHS personnel or individuals under EHS personnel direction. If excessive dirt/mud and/or visible plant materials is observed, the vehicle/equipment will be washed prior to gaining entry to the site. Washing will occur off site at existing car washes with appropriate containment facilities.
- Vehicle cabs may be subject to cleaning in an effort to remove refuse, soil, or other materials susceptible to transporting weed seeds or other plant structures. The use of compressed air is recommended for cleaning vehicle cabs before and immediately prior to departing the site.
- All imported or procured materials used for site reclamation, revegetation, and installation of stormwater/erosion control measures will be certified as weed free by the vendor.
- Disturbance areas will be limited to the smallest area needed for construction.
- The WEAP training will include a section on weed spread and colonization.

2.1.2 Treatment Methods

Treatment methods are necessary to control and eradicate known invasive and noxious weed occurrences. Treatment methods include a variety of approaches such as mechanical, chemical, and biological controls. The most appropriate and effective weed treatment measures will be determined following the assessment of existing weed populations on the Project site. Herbicides may be used for weed control, consistent with labeling requirements and applicable local regulation.

Mechanical treatments include the use of physical means to remove plants, reproductive parts, or propagules. Mechanical treatments include manual methods (pulling weed plants from the soil), use of hand tools and hand-held power tools, mowing, and more aggressive efforts that involve removing above and below ground plant structures. The designation of the appropriate mechanical treatment will depend on variables including season, plant life stage, weed species, size and population of each occurrence, and more.

Chemical treatments involve the use and application of pre- and/or post-emergent herbicides. The use of herbicides is highly regulated and involves a variety of specific protocols, safety measures, and precautions for eliminating, reducing, and mitigating for uncontrolled releases. Pre-emergent herbicides are applied to the soil before the weed seed germinates and usually incorporated into the soil with irrigation or rainfall. Post-emergent herbicides are applied directly to plants. Timing is critical for both pre-emergent and post-emergent herbicide application. In the Project vicinity, pre-emergent herbicides would primarily be applied in early fall, prior to fall/early winter rains. Post-emergent herbicides must be applied while the weed is actively growing, most effectively in the early seedling stage, but always prior to seed set. Therefore, all post-emergent treatments will occur between February and early April. Species-specific herbicides may be used as appropriate and available, along with other mechanical and chemical means for post-emergent elimination. When possible, selective herbicides may be used to target specific weed species, rather than all plant growth. The perimeter between the fence and the panels may be treated to prevent weeds or vegetation from growing and causing a possible risk for wildland fire exposure. The possible use of herbicides as a treatment method is described in additional detail in Section 2.1.3 of this plan.

Biological treatments include the use of plants and animals (particularly insects) that parasitize, ingest, or out-compete weed species. Based on the weed species expected to occur in the Project area and other factors, biological controls are not expected to be a viable or appropriate alternative for treating weed occurrences at the proposed site.

2.1.3 Herbicide Handling and Application

Weed management contractors/personnel that are responsible for applying herbicides will obtain all of the required Federal, State, or local agency permits and will hold all necessary certifications and have received all relevant training. Permits may include terms and conditions that are not included in this weed management plan. A licensed contractor will apply herbicides in accordance with all applicable laws, regulations, and permit stipulation, including EPA label instructions. If faced with any of the following scenarios, herbicide application shall be suspended until such conditions no longer exist:

- Wind velocities in excess of 10 miles per hour (mph) during application of liquid herbicides and 15 mph during application of dry herbicides;
- Snow or ice present on weed foliage; or

- Within 12 hours of forecasted rain, or when plant surfaces are covered with water from recent rainfall or dew.

Herbicides glyphosate (Roundup, Touchdown) and pelargonic acid (Scythe) can be used to control small weed populations. Other herbicides can only be used if they are Federal or State Government-approved and applied by a licensed contractor.

For weed infestations readily accessible and passable by vehicle, vehicle-mounted applicators will be used. Manual application methods will be used in weed occurrences that are relatively small, inaccessible by established road or ROW, or in rough, varied terrain. All herbicide applicators, spreaders and sprayers, will be calibrated before each use to ensure all applications rates and procedures are appropriately implemented.

Herbicide transport and handling will follow these methods:

- No herbicides will be stored on-site.
- Only the quantity of herbicide expected for each day's use will be transported.
- Herbicide concentrate will be transported in approved containers in a controlled manner so as to prevent spills. Concentrate will be positioned in delivery or work vehicles so as to be secured and separated from the driving compartment, food, clothing, and safety equipment.
- The mixing of herbicide materials will be conducted at an off-site location or within a controlled space in the O&M Area that is designated on-site. All mixing will take place over a drip/spill containment device and at a distance more than 200 feet from open or flowing water, wetlands, or other sensitive resources.
- Herbicides will not be applied to areas of open or flowing water, wetlands, or other sensitive resources unless authorized by the appropriate regulatory agency.
- All equipment and containers used for herbicide storage, application, and transport will subject to inspection for leaks or damage.
- Emptied herbicide containers will be disposed in accordance with instructions provided on the label.

2.1.4 Herbicide Spills and Cleanup

All spills and inadvertent releases of herbicides will be addressed immediately upon detection. Spill response kits will be readily available in herbicide contractor vehicles and in daily on-site herbicide storage areas.

Spill response will vary depending on a variety of conditions, including location, amount of spill, area impacted by spill, type of herbicide spilled, and more. For each spill the following procedures should be implemented:

- Disseminate the appropriate on-site and agency notifications of a spill.
- Secure the affected area barring pedestrian and vehicle traffic.
- All spill response personnel shall put on the appropriate Personal Protective Equipment (PPE) prior to entering the spill containment area.
- Personnel, while wearing the appropriate PPE and equipped with the necessary tools and equipment, shall stop the herbicide leak or release.
- All materials associated with spill response, including the released herbicide, affected soils and plants, absorptive material, clothing, and PPE shall be removed and containerized according to appropriate regulations and procedures.

All generated spill response containers shall be transported, following appropriate regulations, and disposed legally at an approved disposal facility.

2.1.5 Worker Safety and Spill Reporting

All contractors responsible for herbicide use, transport, application, and control at the site will hold the appropriate certifications. Such certifications shall be made available. Contractors transporting herbicides to the site shall also have legible Safety Data Sheets (SDS) and labels on-site. All herbicide spills and inadvertent releases shall be reported in accordance with all applicable laws and regulations.

2.2 Pest Management

Because the Project site may potentially support special status wildlife species during Project operations, the Project proposes to meet the goal of pest management while protecting sensitive wildlife species. Due to the joint effort to sustain sensitive wildlife species and reduce the presence of undesirable pest rodents, the Project will preferentially support ecological pest control practices on-site.

2.2.1 Preventive Controls

2.2.1.1 Vegetation Management

Rodent populations flourish in areas with uncontrolled vegetation growth, as tall, dense stands of weeds provide shelter and food resources for rodents.

Establishment of the Project would make the site less attractive to rodents by limiting vegetation from growing there and by not providing cover for them to hide. The UC Davis Integrated Pest Management

(IPM) guidance recommends removing weeds, heavy mulch, and dense vegetative cover to make habit for rodents less suitable. As described in Section 2.1, weed control measures would be implemented supporting the reduction of habitat available to pest rodent species. Mowing and/or spraying with herbicides will manage the growth of uncontrolled and/or invasive vegetation on-site.

2.2.1.2 Facilitate Predation by Natural Predators

To support the potential wildlife habitat value of the site during Project operations, the Project proposes to manage rodent populations through natural predator-prey techniques. The site may provide foraging habitat for several predator species of rats, voles, and other rodents: northern harrier; Swainson's and ferruginous hawks; prairie falcon, and golden eagle. Northern harrier prey on small mammals, especially mice, rats, voles, shrews, rabbits, and song birds, in addition to small reptiles and amphibians. Major prey for hawk species include California voles, valley pocket gophers, rabbits, deer mice, and California ground squirrels (Estep 1989). Prairie falcons prey on small birds, mammals, and reptiles, particularly ground squirrels. Golden eagles prey on small- to medium-sized mammals, including hares, rabbits, jackrabbits, ground squirrels, prairie dogs, and marmots, in addition to some larger prey. Implementation of weed management practices would support optimum hunting habitat for predator species by ensuring vegetation does not grow too tall to limit visual spotting of or access to prey.

2.2.1.3 Avoiding Rodent Attractants

Review of the UC Davis IPM guidance for rat control indicates that solar arrays do not provide significant habitat favored by rats. No potential food sources would be present in the array area, and the solar arrays would not provide cover for their nests. Burrowing rodents such as Norway rats are found along building foundations and in moist areas in and around garden and fields. Areas around building foundations will be monitored for signs of rodents and pest removal options will be used where appropriate (see Section 2.3.2 below). Additionally, water use will be minimal during operations of the facility thereby minimizing attraction to the site by rodents seeking water sources.

The most successful and long-lasting form of rodent control in structures is exclusion, or "building them out." The Project will seal cracks and openings in building foundations and any openings for water pipes, electric wires, sewer pipes, drain spouts, and vents. The Project will ensure that doors, windows, and screens fit tightly. Their edges can be covered with sheet metal if gnawing is a problem. Coarse steel wool, wire screen, and lightweight sheet metal are excellent materials for plugging gaps and holes. Norway and roof rats are likely to gnaw away plastic sheeting, wood, caulking, and other less sturdy materials.

Because rats and house mice are excellent climbers, openings above ground level must also be plugged. Rodent proofing against roof rats, because of their greater climbing ability, usually requires more time to find entry points than for Norway rats. Roof rats often enter buildings at the roofline, so the Project will ensure that access points in the roof are sealed. If roof rats are traveling on overhead utility wires, contact a pest control professional or the utility company for information and assistance with measures that can be taken to prevent this.

Strict trash policies will be enforced at the Project site; workers shall be trained in the requirements of utilizing approved, rodent-proof trash containers which will be emptied regularly. Standing water will also be avoided in dust spraying or other water-use operations.

2.2.2 Pest Removal Options

The construction and operation of the Project would significantly reduce the number of invasive pests on the site; however, preventive controls are not always completely successful. Pest rodent populations may need to be managed through pest removal practices. To support the ecological value of the site, the priority of the Project is to manage rodent populations through the vegetation/natural predator-prey techniques discussed above. While this approach to pest management is preferred, should rodent populations persist and create operational problems or risks to human health (e.g., chewing through electrical wiring or exposing employees to nests and droppings) then more active management measures may be employed.

Trapping would be the preferred active management technique should avoidance and predator/prey techniques fail to provide sufficient management. Trapping would be employed for 3-6 months and evaluated for success before other management options are considered. Trapping would be done in accordance with management methods such as those provided in the University of California, Davis *Integrated Pest Management for Home Gardeners and Landscape Professionals (for Rats and/or Voles)* guidelines (UC Davis IPM).

The use of rodenticides would be restricted and they would only be employed should other management techniques fail. All uses of such compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other state and federal legislation. If rodent control must be conducted, zinc phosphide will be used because of its proven lower risk to San Joaquin Kit Fox. Bait stations shall be enclosed so the opening is accessible for the target rodent (i.e., 2-inch diameter for ground squirrel), but the openings will be at an elevated angle so that bait remains inside the station under all conditions.

3 Training and Recordkeeping

All workers will complete required WEAP training before starting work. WEAP training will include a section on weed spread and colonization and rodent control. Construction management will designate staff that will be trained to identify noxious weeds and will be responsible for operating and maintaining equipment to control weeds and rodents. Weed management contractors/personnel that are responsible for applying herbicides will obtain all of the required training and permits and will hold and provide evidence of all necessary certifications. Site staff will maintain records of any herbicide use on the Project site.

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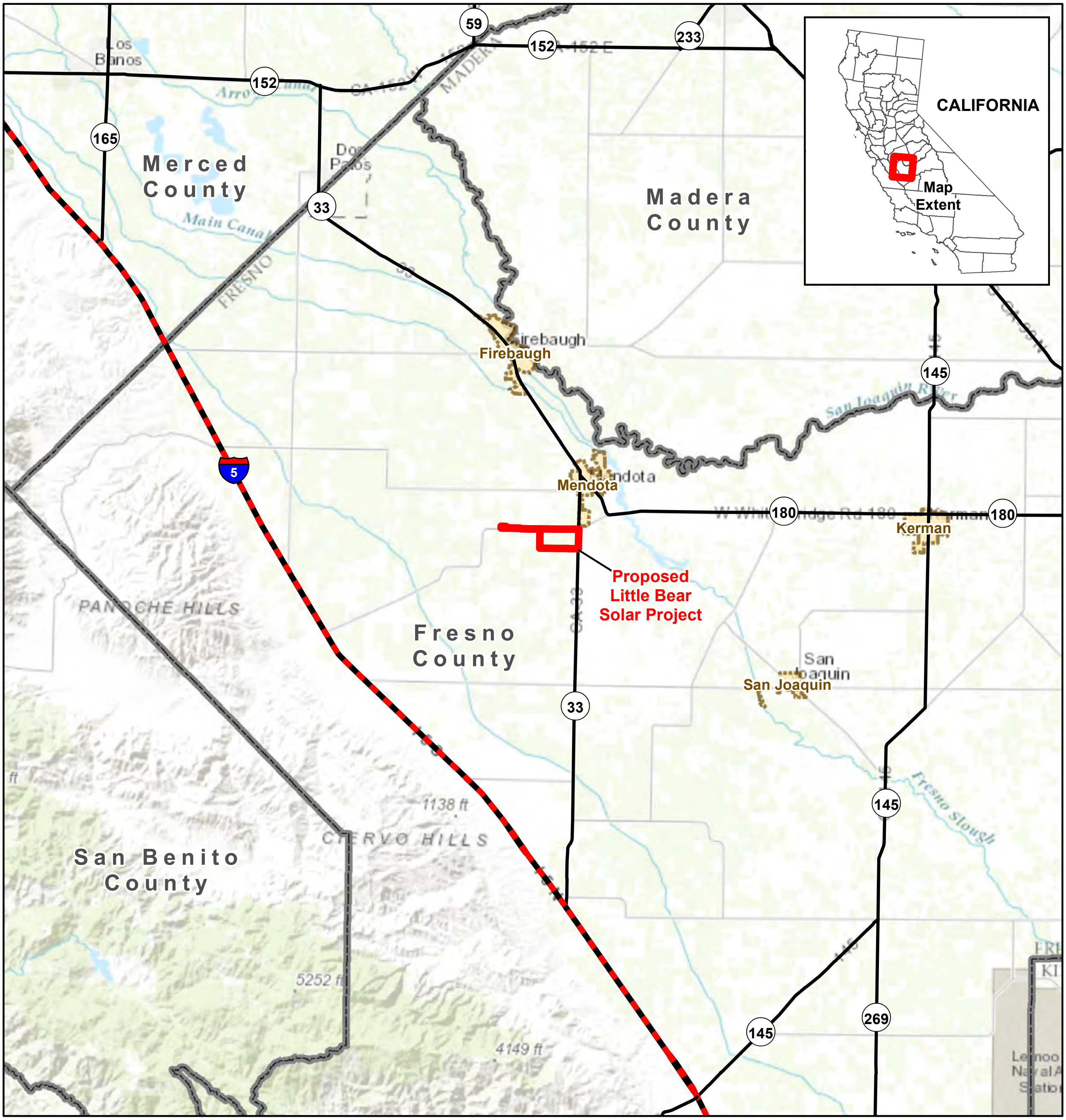
FIGURES



Legend

Interstate	
State Highway	
Proposed Project	
Municipality	
County Boundary	

0 5 10
Miles

Universal Transverse Mercator
North American Datum 1983
Zone 11 North, Meters

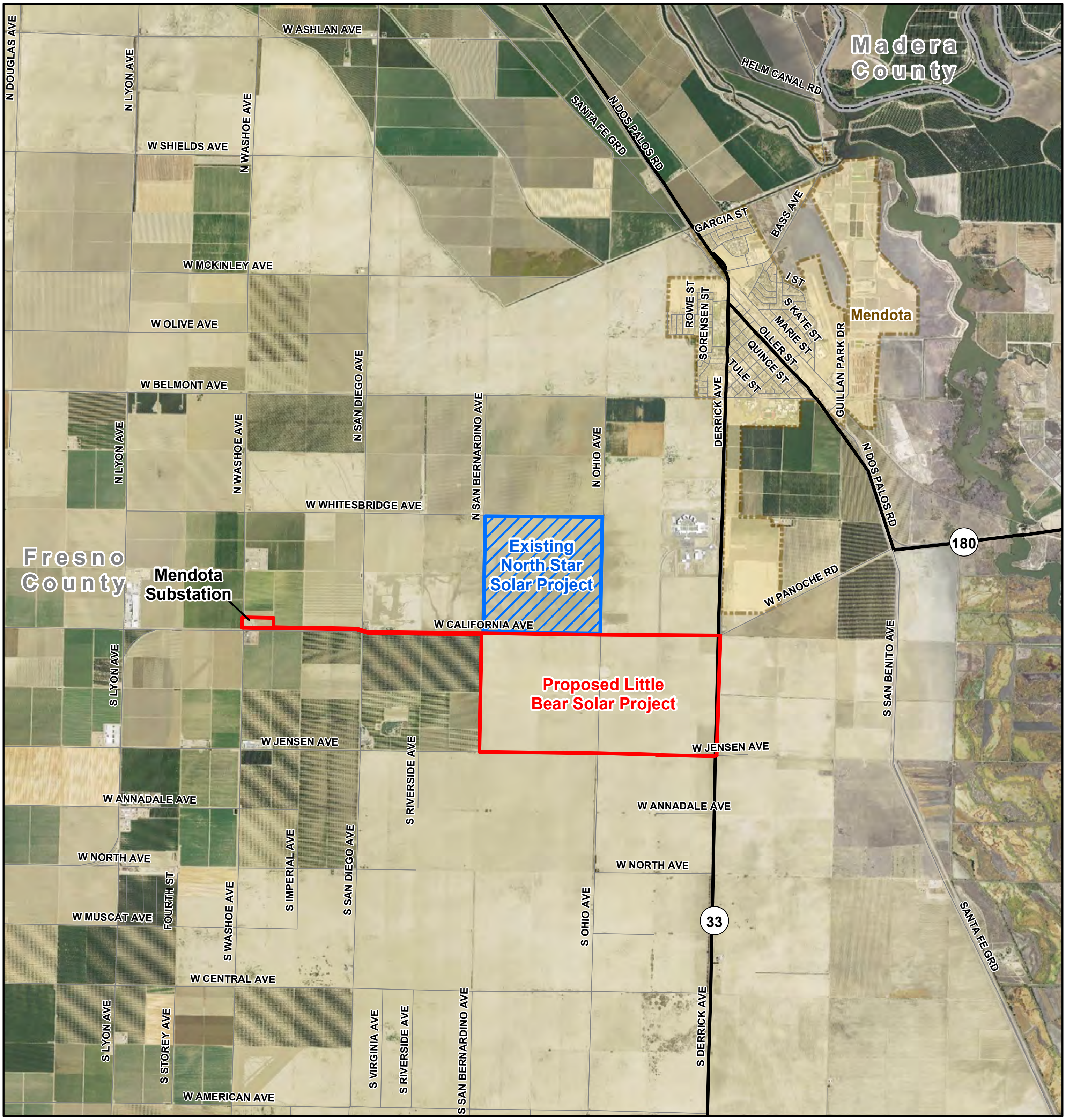
LITTLE BEAR SOLAR PROJECT

Figure 1-- Regional Location

Map Extent: Fresno County, CA

Date: 09-08-16 | Author: rnc

G:\Little Bear Solar Project/MXD's/Project Location



Legend

- State Highway
- Road
- Proposed Project
- Existing North Star Solar Project
- Municipality
- County Boundary

0 0.5 1
Miles

Universal Transverse Mercator
North American Datum 1983
Zone 11 North, Meters

LITTLE BEAR SOLAR PROJECT

Figure 2 -- Project Vicinity

Map Extent: Fresno County, CA

Date: 09-08-16		Author: rnc

G:\Little Bear Solar Project/MXD's/Project Location

Appendix C
California Land Evaluation and Site Assessment (LESA) Little Bear Solar Project in Fresno County, California

California Land Evaluation and Site Assessment (LESA)
Little Bear Solar Project
in
Fresno County, California

Prepared for:

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Little Bear Solar 4, LLC; Little Bear Solar 5, LLC; Little Bear Solar 6, LLC

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Santa Barbara, California 93101

SEPTEMBER 2017

Printed on 30% post-consumer recycled material.

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1.0 PROJECT SETTING

1.1 Purpose of this California Land Evaluation and Site Assessment

The purpose of this California Land Evaluation and Site Assessment (LESA) is to provide agencies and decision makers with a succinct and technically developed optional methodology to use in ensuring that potentially significant impacts or effects on the environment, exclusively related to agricultural land conversions, are quantitatively considered in the environmental review process (Public Resources Code Section 21095), including in the California Environmental Quality Act (CEQA).

The California LESA Model was developed in 1997 after the 1981 Land Evaluation and Site Assessment Guidebook prepared for the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) Model. The California LESA Model evaluates measures of soil resource quality, a given project's size, water resource availability, surrounding agricultural lands, and surrounding protected resource lands. In application to a specific project, the factors are rated, weighted, and combined, resulting in a single numeric score. The project score becomes the basis for making a determination of a project's potential significance.

1.2 Introduction

The proposed Little Bear Solar Project entails the development of a solar photovoltaic (PV) power generation facility on approximately 1,288 acres of agriculturally zoned land in Fresno County, California (See Figure 1- Regional Location, Figure 2 - Project Vicinity, Figure 3 - Project Site). The 1,288 acres comprises five (5) APNs (assessor's parcel numbers) including 019-110-03ST, 019-110-04ST, 019-110-05ST, 019-110-06ST, 019-110-13ST located 13 miles east of U.S. Interstate 5, 2.5 miles southwest of the City of Mendota, and adjacent to State Route 33 (SR-33). The properties are bounded by West California Ave. to the north, SR-33 to the east, West Jensen to the south and San Bernardino Ave. to the west. Land uses adjacent to the site include agricultural land uses to the west, south and east and a solar facility, generation tie line and federal correctional facility to the north.

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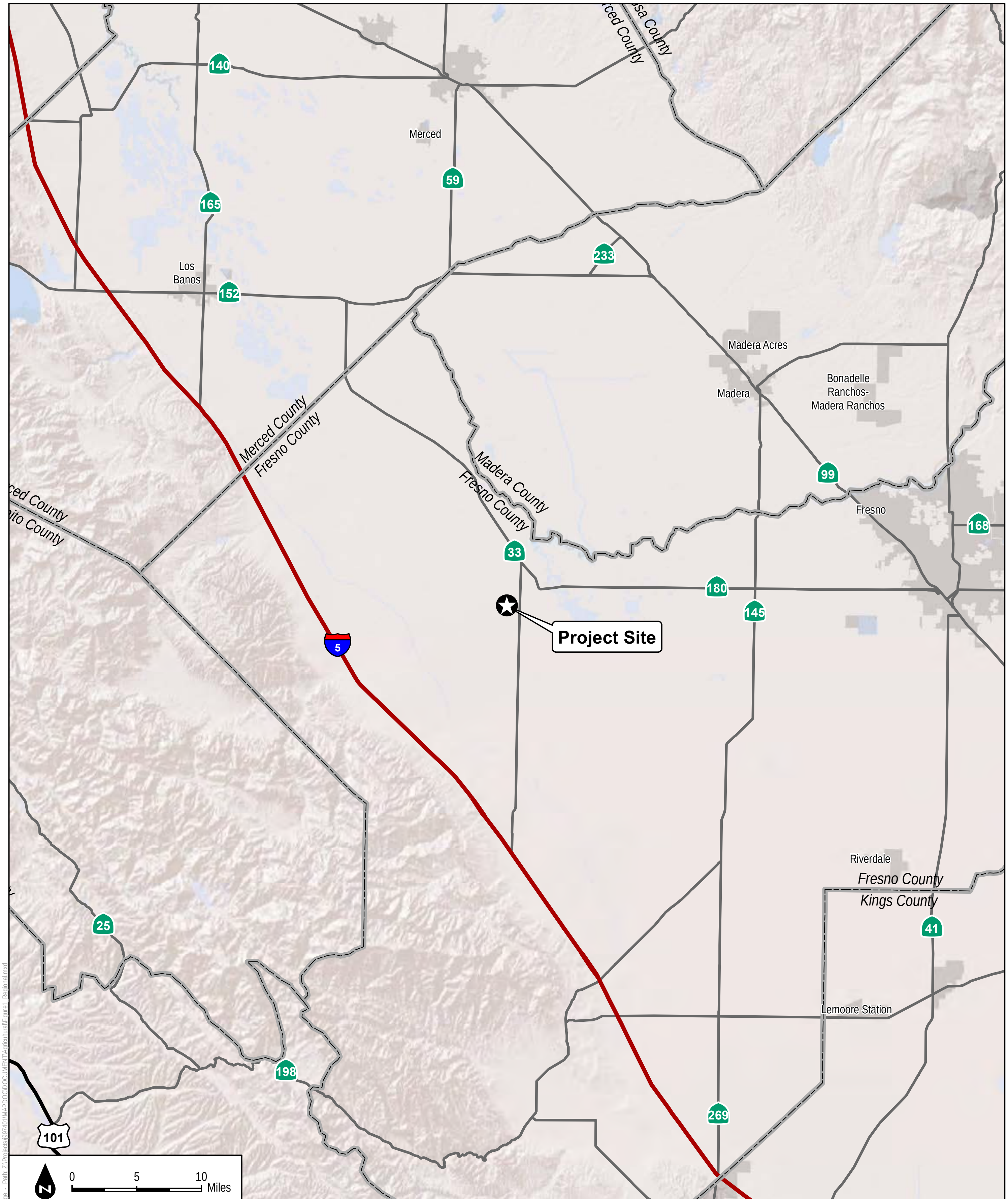

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SOURCE: ESRI Basemaps

FIGURE 1

Regional Location

California LESA for the Little Bear Solar Project

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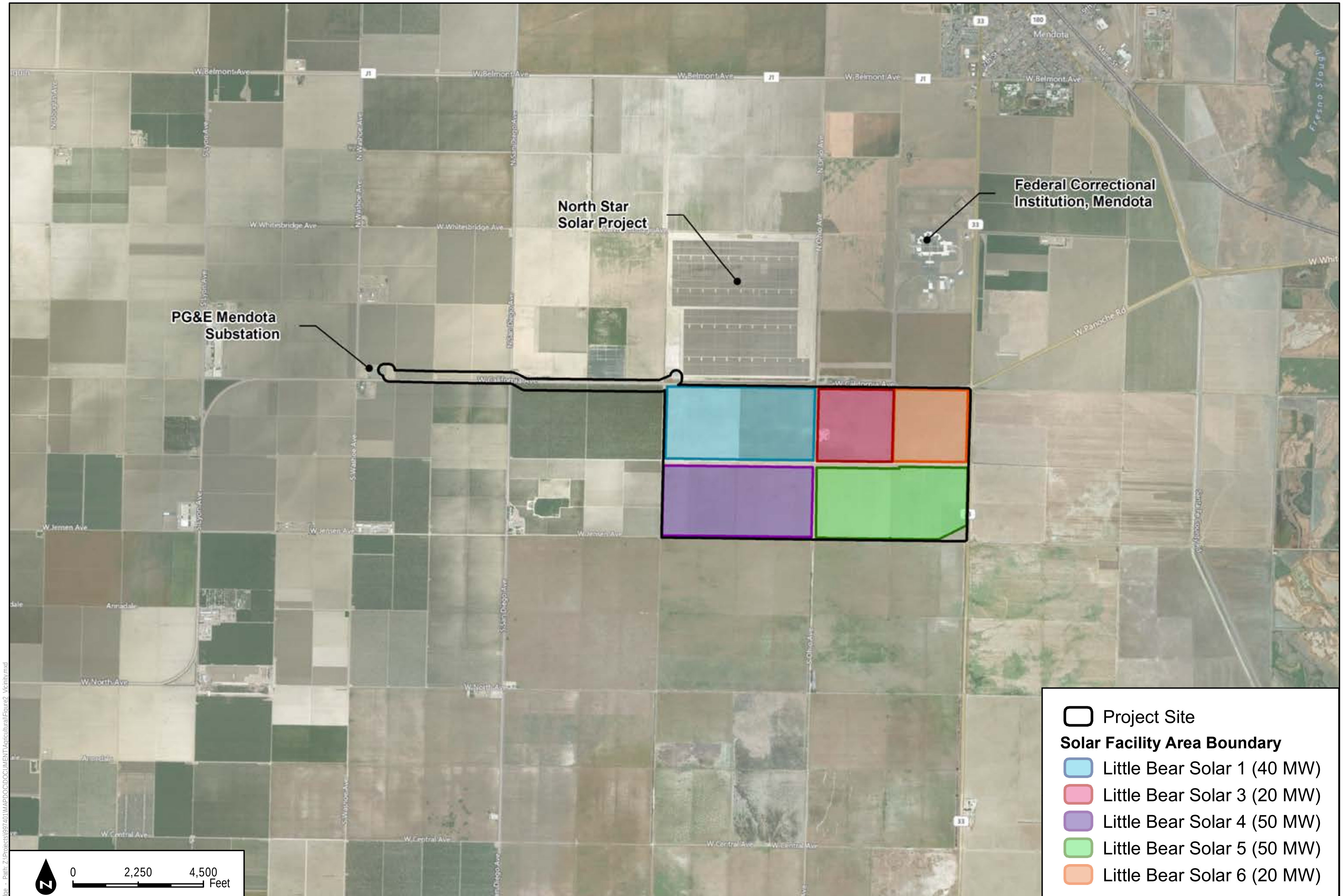

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SOURCE: Bing Maps (Accessed 2017)

FIGURE 2

Project Vicinity

California LESA for the Little Bear Solar Project

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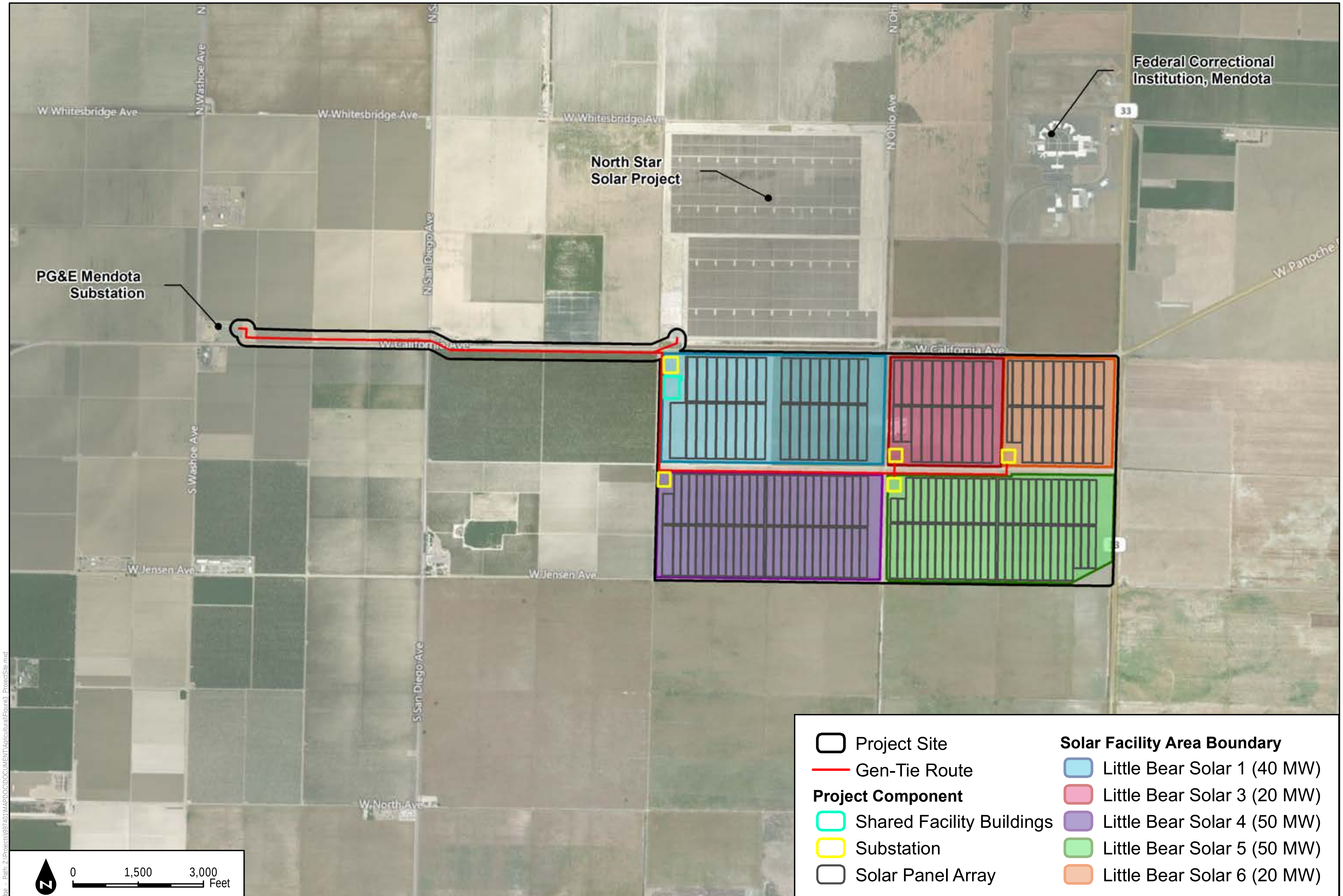

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SOURCE: Bing Maps (Accessed 2017)

FIGURE 3

Site Layout

California LESA for the Little Bear Solar Project

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1.3 Project Description

The Applicant proposes to construct, own and operate an approximately 180 megawatt (MW) solar photovoltaic power generation facility (Project) on lands located near Mendota in unincorporated Fresno County, California. The Project will consist of up to five generation facilities: two 20 MW facilities, one 40 MW facility and two 50 MW facilities. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The Project is expected to require 12-14 months to construct.

The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5 (I-5), approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), within Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian. Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east.

The Project will be located on approximately 1,288 acres of private land. The Project site is zoned AE-20 (Exclusive Agricultural District, 20-acre minimum parcel size) and has been intermittently dry-farmed or lain fallow in recent years. Surrounding land uses include agriculture, the Federal Correctional Institution Mendota and the adjacent North Star Solar Project (60 MW).

Each generation facility within the Project will include the following main elements: modular photovoltaic solar panels (either fixed-tilt or on single-axis trackers); direct current to alternating current power inverters mounted on concrete pads; three-phase transformers mounted on concrete pads that convert the output of each inverter to 34.5 kilovolts (kV), a 34.5 kV collection system either overhead or underground, a 34.5 kV to 115 kV substation, meteorology towers, security fencing and lighting and other on-site facilities as required. Earthen basins will be constructed to contain storm water runoff from the Project site. There will be a common control/administration building and parking lot that will be shared by each generation facility.

Each generation facility may optionally include an Energy Storage System (ESS) that will provide up to 500 MW-hours of electrical storage. The ESS will be sited on an approximately 1.5-acre area next to the onsite substations in a separate, fenced enclosure and will consist of self-contained, rack-mounted battery storage modules, converters, switchboards, integrated heating, ventilation, and air conditioning (HVAC) units, inverters, transformers, and controls in prefabricated metal containers or in a building.

The Project will interconnect to the Mendota Substation using the existing North Star 115 kV gen-tie line that interconnects the North Star Solar Project. One generation facility will interconnect with the North Star gen-tie line by way of the North Star Solar Project switchyard. The remaining generation facilities will each connect to a new, approximately 1.25-mile 115 kV gen-tie line that will lead to the North Star gen-tie line and continue from that point to the Mendota Substation as a second electrical circuit added to the existing towers of the North Star gen-tie line.

Table 1.3
Project Site Acreage and Facility Summary

Assessor's Parcel Number	Approximate Acreage	Facility
019-110-04ST	161 acres	Little Bear 1
019-110-05ST	161 acres	
019-110-06ST	161 acres	Little Bear 3
019-110-03ST	322 acres	Little Bear 4
019-110-13ST	322 acres	Little Bear 5
019-110-13ST	161 acres	Little Bear 6
Totals	1,288 acres	

The majority of the site is currently fallowed or dry farmed with minimal annual grasslands, areas or agricultural development, disturbed soils.

2.0 REGULATORY SETTING

2.1 Federal

2.1.1 Farmland Protection Policy Act (7 U.S.C. Section 4201)

The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. Further, the FPPA directs federal programs to be compatible with State and local policies for the protection of farmlands. The FPPA does not authorize the Federal Government to regulate the use of private or nonfederal land or, in any way, affect the property rights of owners of such land. Information regarding the FPPA is provided for background information in this agricultural technical report.

The FPPA is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that, to the extent possible, federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland. Federal agencies are required to develop and review their policies and procedures to implement the FPPA every two years.

For the purpose of the FPPA, farmland includes prime farmland, unique farmland, and farmland of statewide or local importance, defined as follows in 7 U.S.C. Section 4201: *Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary. Prime farmland includes land that possesses the above characteristics but is being used currently to produce livestock and timber. It does not include land already in or committed to urban development or water storage; unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables; and Farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate State or unit of local government agency or agencies, and that the Secretary determines should be considered as farmland for the purposes of this chapter;*

Projects are subject to the FPPA requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a federal agency or with assistance from a federal agency (NRCS 2008). As the Project does not have federal involvement, the FPPA is not applicable in this situation.

2.2 State

2.2.1 California Department of Conservation (DOC)

The California Department of Conservation is the state agency that administers both the State Farmland Mapping and Monitoring Program (FMMP) and the California Land Conservation Act, or more commonly known as "The Williamson Act". The Important Farmland Mapping Program compiles information of the state's important farmlands, including tracking farmland proposed for development, and provides this information to state and local government agencies for use in planning and for decision makers and decision-making bodies. The FMMP Important Farmland Maps are based on a classification system that combines technical soil ratings and current land use. Important Farmland Categories include Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, Grazing Land, Urban and Built-up Land, and Other Land. FMMP's Important Farmland Maps require that Prime Farmland, meet the following criteria: 1) Prime Farmland must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date, which equates to four years. Therefore, the land must have been used for irrigated agricultural production at some point in time during a four-year period of time prior to the most recent date of the Important Farmland Map date[1]; and 2) The soil must meet the physical and chemical criteria for Prime Farmland or Farmland of Statewide Importance as determined by the USDA Natural Resources Conservation Service (NRCS). NRCS compiles lists of which soils in each survey area meet the quality criteria. Factors considered in qualification of a soil by NRCS include:

- Water moisture regimes, available water capacity, and developed irrigation water supply
- Soil temperature range
- Acid-alkali balance
- Water table
- Soil sodium content
- Flooding (uncontrolled runoff from natural precipitation)
- Erodibility
- Permeability rate
- Rock fragment content
- Soil rooting depth.[2]

[1] http://www.conservation.ca.gov/dlrp/fmmp/overview/Pages/prime_farmland_fmmp.aspx
[2] Ibid.

The soils information presented in this analysis is derived from statewide soils maps that have been prepared by both state and federal government entities. The California Department of Conservation (DOC), Division of Land Resource Protection, and the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), both conduct regular and ongoing assessments of soil types and then prepare detailed soil maps. Once soils are mapped, they are grouped into the following categories that have specific definitions. The categories and definitions are as follows:

Prime Farmland. In California, the DOC Farmland Mapping and Monitoring Program (FMMP) maps all statewide farmlands. The FMMP's soils study area is contiguous with modem soil surveys developed by the USDA. The FMMP requires that any land designated as Prime must meet the following criteria related to land use and soils.

As such, farmland with the optimal combination of physical and chemical features to sustain long-term agriculture is described as Prime. The land has been determined to have the soil quality, growing season, and moisture supply needed to produce sustained high crop yields (DOC 2015b).

Farmland of Statewide Importance. As with Prime Farmland, Farmland of Statewide Importance must also meet both the criteria described above with respect to land use and soils and is similar to the Prime Farmland category. The difference is that Farmland of Statewide Importance tolerates greater shortcomings of the soil, such as greater slopes or less ability to store moisture (DOC 2015b).

Unique Farmland. This category of farmland is categorized as having lesser quality soils, but is still used for the production of leading agricultural crops. This farmland is typically irrigated, but can also include non-irrigated orchards or vineyards found in some climatic zones in the state. These lands must have been used for irrigated agricultural production at some time during the four years prior to the mapping date (DOC 2015b).

Farmland of Local Importance. Lands that have been determined by local jurisdictional authorities such as county boards of supervisors or local advisory committees to have a specific importance to the local agricultural economy are considered Farmland of Local Importance (DOC 2015b).

The FMMP has three other categories of land:

Grazing Land. Land that is particularly suited to the grazing of livestock given existing vegetation. This particular designation was developed in concert with the California Cattlemen's Association, UC Cooperative Extension, and a host of other groups with an interest in grazing and livestock (DOC 2015b).

Urban and Built-Up Land. This category refers to land that is occupied by structures with a building density of at least one unit to 1.5 acres or six structures to a 10-acre parcel. This category includes land uses such as residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures, and other developed purposes (DOC 2015b).

Other Land. All other lands that do not fall into the categories above are subsumed into this category. Examples of these lands include low-density rural developments, brush, timber wetland, riparian areas not suitable for livestock grazing, confined livestock poultry or aquaculture facilities, strip mines, borrow pits, and water bodies smaller than 40 acres. In addition, vacant and non-agricultural land surrounded on all sides by urban development and greater than 40 acres is mapped as Other Land (DOC 2015b).

The California Department of Conservation developed the California LESA Model (Model). Embedded within the Model is the NRCS soils information upon which the FMMP is woven. Hence, since the soils data is already included in the LESA Model and Analysis, no further discussion is presented here except to state that there are no prime soils on the site, therefore not mapped as Prime Farmland. All soils are mapped by the FMMP as non-prime.

The California Land Conservation Act of 1965 or the Williamson Act

The California Land Conservation Act of 1965, better known as the Williamson Act mentioned above, provides for reduced property taxation on agricultural land in exchange for a 10-year continuously rolling agreement. The purpose of the Williamson Act is the long-term conservation of agricultural and open space lands. The Act establishes a program to enroll land in Williamson Act whereby the land is enforceably restricted to agricultural, open space, or recreational uses or uses deemed to be “compatible” with the agricultural land uses or compatible recreational uses as outlined in the Act in exchange for reduced property tax assessments.

The Act requires that each participating local government have a set of uniform rules for administering Williamson Act and Farmland Security Zone contracts within its jurisdiction. The County’s Rules establish the basic requirements of all contracts and are incorporated as a part of each contract. In order to qualify for a Williamson Act contract, parcels must meet certain criteria such as zoning, minimum parcel size, availability of agricultural water, and minimum acreage. None of the project site is under a Williamson Act contract.

Farmland Security Zone Act

The Farmland Security Zone Act is similar to the Williamson Act and was passed by the California State Legislature in 1999 to ensure that long-term farmland preservation is part of public policy.

(Government Code sections 51296-51297.4) Farmland Security Zone Act contracts are sometimes referred to as "Super Williamson Act Contracts." Under the provisions of this act, a landowner already under a Williamson Act contract can apply for Farmland Security Zone status by entering into a contract with the county. Farmland Security Zone contracts must be for an initial term of at least 20 years. As with Williamson Act contracts, each year an additional year is automatically added to the contract term unless a notice of nonrenewal is given. In return for a further 35% reduction in the property tax value of land and growing improvements (in addition to Williamson Act tax benefits), the owner of the property promises not to develop the property into nonagricultural uses during the term of the contract. Farmland Security Zone contracts may also be cancelled, but only upon finding that cancellation would both service the purposes of the Williamson Act, and that cancellation would be in the public interest (Government code section 51297). None of the project site is under a Farmland Security Zone contract.

2.3 County

2.3.1 Fresno County - Local Documents, Policies and Requirements

Fresno County General Plan

The Fresno County General Plan (Fresno County, October 2000[3]) is an overarching, comprehensive framing document that provides for the long-term protection of the County's agricultural, natural and cultural resources as well as for development within the County. In conformance with the State's general plan requirements, the Plan outlines policies, standards and programs to guide day-to-day land use decisions, which directly affect the County's future. Further, the General Plan for Fresno County has the following aims and purposes:

- Establishing within County government a framework for analyzing local and regional conditions and needs in order to respond effectively to the problems and opportunities facing Fresno County;
- Identifying Fresno County's economic, environmental, and social goals;
- Recording the County government's policies and standards for the maintenance and improvement of existing development and the location and characteristics of future development;
- Providing Fresno County's citizens with information about their community and with opportunities to participate in the local planning and decision-making process;

[3] http://www.co.fresno.ca.us/DepartmentPage.aspx?id=68048

- Improving the coordination of community development and environmental protection activities among the County, cities, and regional, State, and Federal agencies; and
- Establishing a basis for subsequent planning efforts, such as preparation and updating of community plans, specific plans, redevelopment plans, and special studies to deal with unique problems or areas in the community.

Further, the General Plan framed the goals, policies and programs for the County within a Vision Statement. "The County sees its primary role to be the protector of prime agricultural lands, open space, recreational opportunities, and environmental quality, and the coordinator of countywide efforts to promote economic development." The Vision Statement is supported by ten (10) major themes. The themes relevant to this report have been excerpted and are included below:

- Economic Development: The plan seeks to promote job growth and reduce unemployment through the enhancement and expansion of its traditional agricultural economic base and through the diversification of its economic base, expanding such business clusters as information technology, industrial machinery, and tourism.
- Agricultural Land Protection: The plan seeks to protect its productive agricultural land as the county's most valuable natural resource and the historical basis of its economy through directing new urban growth to cities and existing unincorporated communities and by limiting the encroachment of incompatible development upon agricultural areas.
- Resource Protection: The plan seeks to protect and promote the careful management of the county's natural resources, such as its soils, water, air quality, minerals, and wildlife and its habitat, to support the county's economic goals and to maintain the county's environmental quality.
- Enhanced Quality of Life: The plan strives throughout all its elements to improve the attractiveness of the county to existing residents, new residents, and visitors through increased prosperity, attractive forms of new development, protection of open space and view corridors, promotion of cultural facilities and activities, efficient delivery of services, and expansion of recreational opportunities.

The County's General Plan has 7 (seven) elements, which are required by State law and the Conservation Element addresses the conservation, development, and use if natural resources including water, forests, soils, rivers and mineral deposits. In addition, the County has an Open Space Element that provides an overlap between the Conservation and Safety Elements and weaves policies together. In specific, the Open Space Element details plans and measures for preserving open space for the following: 1) protection of natural resources such as wildlife habitat; 2) the managed protection of resources such as agriculture and timber land; 3) outdoor recreation such as parks, trails, and scenic vistas; and 4) public health and safety such as areas subject to geologic hazards, flooding, and fires.

In addition, the County has an Agricultural and Land Use Element, which contains goals, policies as well as implementation programs and standards for development and agricultural and non-agricultural uses within agriculturally zoned areas of the County. The Agriculture Element outlines definitions for Agriculture within the context of the Agriculture Element. These are summarized below:

Agricultural Land:

- Productive (Prime) Agricultural Land: Soils which are suitable for the production of most climatically adapted irrigated crops. Such land includes the following soils:
    1. All land which qualifies for rating as Class I or II soils in the Natural Resources Conservation Service land use capability classifications;
    2. Land which qualifies for rating with a Storie index rating of 80 through 100; and
    3. Land which supports livestock used for the production of food and fiber and which has an annual carrying capacity equivalent to at least one (1) animal unit per acre as defined by the USDA.
- Potentially Productive Agricultural Land: Soils, which within the realm of economic possibility can be altered using certain reclamation or modification practices to make them more productive for essential food crops such as grain and vegetables. Included are certain Class III and IV soils and soils with a Storie index of 60-80.

Land Evaluation and Site Assessment (LESA)

The LESA Model is split into two sections, the Land Evaluation Section and Factors and the Site Assessment Factors. Scoring sheets have been included in the LESA for ease of information summary and appraisal.

Part One: Scoring of Land Evaluation Factors

The California LESA Model includes two Land Evaluation factors that are separately rated:

a. The Land Capability Classification Rating - The USDA Land Capability Classification (LCC) - The LCC indicates the suitability of soils for most kinds of crops. Groupings are made according to the limitations of the soils when used to grow crops, and the risk of damage to soils when they are used in agriculture. Soils are rated from Class I to Class VIII, with soils having the fewest limitations receive the highest rating (Class I). Specific subclasses are also utilized to further characterize soils. An expanded explanation of the LCC is included in most soil surveys.

b. The Storie Index Rating - The Storie Index provides a numeric rating (based upon a 100 point scale) of the relative degree of suitability or value of a given soil for intensive agriculture. The rating is based upon soil characteristics only. Four factors that represent the inherent characteristics and qualities of the soil are considered in the index rating. The factors are: profile characteristics, texture of the surface layer, slope, and other factors (e.g., drainage, salinity).

Pursuant to the LESA Model, the tale below summarizes the numeric conversions of Land Capability Classification Units.

Table 2.3.1
Numeric Conversions of Land Capability Classification Units

LCC	LCC Point Rating
I	100
IIe	90
IIs,w	80
IIIe	70
IIIs,w	60
IVe	50
IVs,w	40
V	30
VI	20
VII	10

Table 2.3.1
Numeric Conversions of Land Capability Classification Units

LCC	LCC Point Rating
VIII	0

Table 2.3.1.1
Summary of Soils on the Project Site

Soil Type	NRCS Farmland Classification	Storie Index	Land Capability Class
Tranquility clay, saline sodic	Non-Prime	Not rated	IVs
Posochanet clay loam, saline-sodic	Non-Prime	Not rated	VII
Calfax clay loam, saline-sodic	Non-Prime	Not rated	VII

Figure 4 provides an overview of the soil types on the project site.

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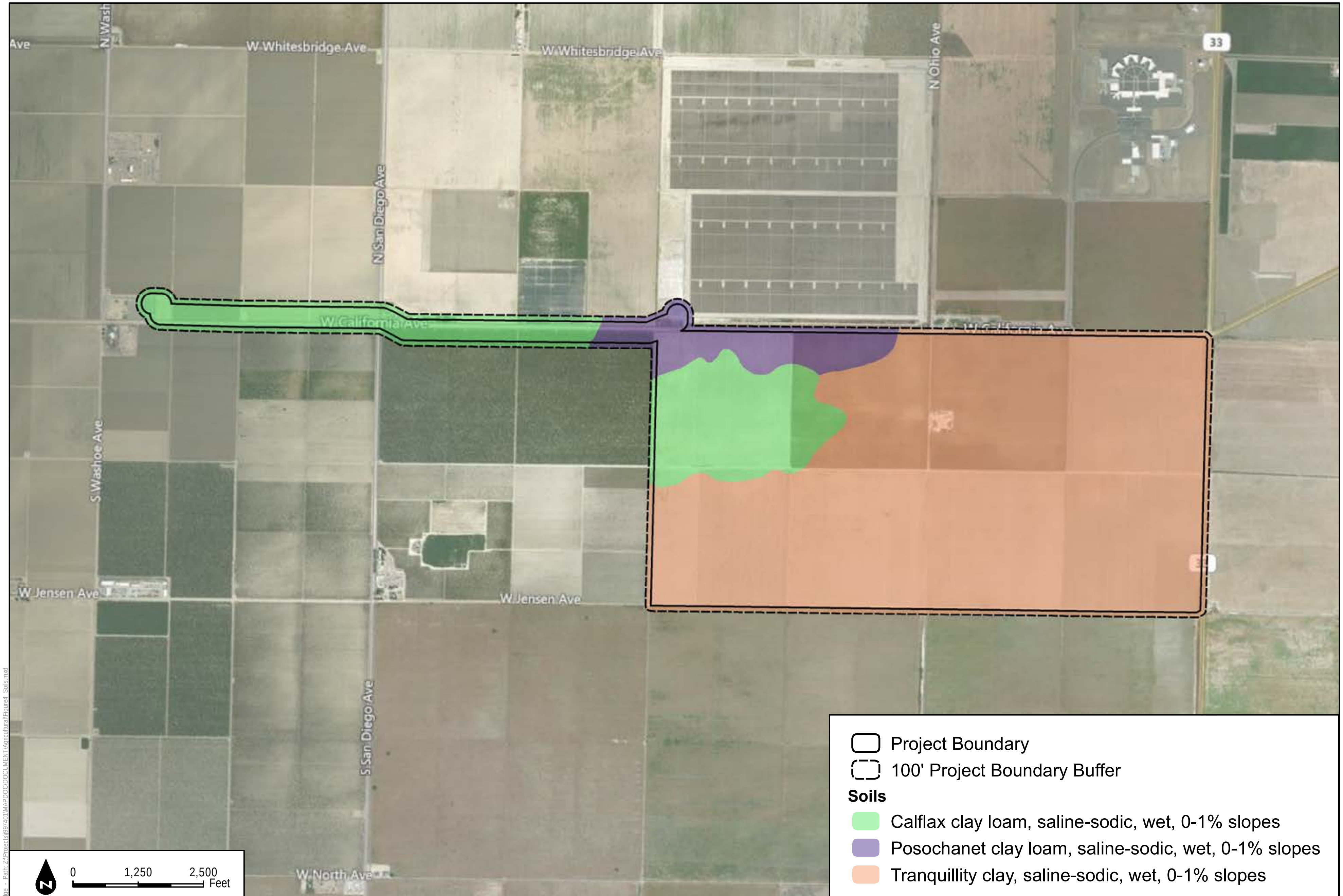

DUDEK

SOURCE: BING (2016)

FIGURE 4

Soils

California LESA for the Little Bear Solar Project

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Table 2.3.1.2 below equates to Table 1A of Land Evaluation Worksheet entitled *Land Capability Classification and Storie Index Scores* in the California Agricultural Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011).

Table 2.3.1.2
Land Capability Classification and Storie Index Scores

A	B	C	D	E	F	G	H
Soil Map Unit	Project Acres	Proportion of Project Area	LCC	LCC Rating	LCC Score	Storie Index	Storie Index Score
Tranquility clay, saline-sodic, wet, 0 to 1 percent slopes	1,053.9	0.82	IVs,w	40	32.8	Not rated 0	Not rated 0
Calflax clay loam, saline-sodic, wet, 0 to 1 percent slopes	160.3	0.125	VII	10	1.25	Not rated 0	Not rated 0
Posochanet clay loam, saline-sodic, wet, 0 to 1 percent slopes	71.0	0.055	VII	10	0.55	Not rated 0	Not rated 0
TOTALS	1,285 (excludes buffer areas)	1.0		LCC Score	34.6	Storie Index Total Score	Not rated 0

Hence, the application of the Land Evaluation Tool results in an LCC score of 34.6 and a Storie Index Score of zero (0). The Storie Index Score results in zero (0) based on the fact the soils are not at all rated.

Part 2: Scoring of Site Assessment Factors

The California LESA Model includes four Site Assessment factors that are separately rated:

1. The Project Size Rating
2. The Water Resources Availability Rating
3. The Surrounding Agricultural Land Use Rating
4. The Surrounding Protected Resource Land Rating

The analysis for the Site Assessment ensues below.

1. The Project Size Rating: The Site Assessment relies upon the following Project Size Scoring rubric and corresponds to Table 2.3.1.3 in the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011).

Table 2.3.1.3
Project Size Scoring

LCC Class I or II Soils		LCC Class III Soils		LCC Class IV or lower	
Acres	**Score**	**Acres**	**Score**	**Acres**	**Score**
80 or above	**100**	**160 or above**	**100**	**320 or above**	**100**
60-79	**90**	**120-159**	**90**	**240-319**	**80**
40-59	**80**	**80-119**	**80**	**160-239**	**60**
20-39	**50**	**60-79**	**70**	**100-159**	**40**
10-19	**30**	**40-59**	**60**	**40-99**	**20**
Fewer than 10	**0**	**20-39**	**30**	**Fewer than 40**	**0**

Table 2.3.1.3
Project Size Scoring

LCC Class I or II Soils		LCC Class III Soils		LCC Class IV or lower	
Acres	**Score**	**Acres**	**Score**	**Acres**	**Score**
		10-19	**10**		
		Fewer than 10	**0**		

According to the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011), *The inclusion of the measure of a project's size in the California Agricultural LESA Models is a recognition of the role that farm size plays in the viability of commercial agricultural operations. In general, larger farming operations can provide greater flexibility in farm management and marketing decisions. Certain economies of scale for equipment and infrastructure can also be more favorable for larger operations. In addition, larger operations tend to have greater impacts upon the local economy through direct employment, as well as impacts upon support industries (e.g., fertilizers, farm equipment, and shipping) and food processing industries.*

As such, the application of this test to the Little Bear Solar Project results in a score of 100 based on the size of the project.

2. The Water Resources Availability Rating: the Water Resources Availability Rating is based upon identifying the various water sources that may supply a given property, and then determining whether different restrictions in supply are likely to take place in years that are characterized as being periods of drought and non-drought. The table below, Table 2.3.1.4 – Water Resources Availability corresponds to Table 4 in the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011),

Table 2.3.1.4
Water Resources Availability

A	B	C	D	E
Project Proportion	**Water Source**	**Proportion of Project Area**	**Water Availability Score**	**Weighted Availability Score (CxD)**
1	Not irrigated	1.00	25	25
	Total		**Total Water Resources Score**	**25**

3. The Surrounding Agricultural Land Use Rating: determination of the surrounding agricultural land use rating is based upon the identification of a project's "Zone of Influence" (ZOI), which is defined as that land near a given project, both directly adjoining and within a defined distance away, that is likely to influence, and be influenced by, the agricultural land use of the subject project site.

4. Site Assessment: The Surrounding Protected Resource Land Rating: The Surrounding Protected Resource Land Rating is essentially an extension of the Surrounding Agricultural Land Rating, and is scored in a similar manner. Protected resource lands are those lands with long-term use restrictions that are compatible with or supportive of agricultural uses of land. Included among them are the following:

The surrounding land uses include agriculture, the federal correctional institution Mendota and the adjacent North Star Solar Project (60 MW). The "Zone of Influence" for this project includes 1,086 acres of which there are 1,045 acres in agricultural use, 12 acres in rural residential uses and 29 acres classified as roads or developed areas. Further, 162 Acres within the 0.25 miles surrounding the project are under Williamson Act contract.

Table 2.3.1.5 below corresponds to Site Assessment Worksheet 3 in the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011) which is a table that combines criteria 3 and 4.

Table 2.3.1.5
Surrounding Agricultural Land Use and Surrounding Protected Resource Land

A	B	C	D	E	F	G
Total acres	**Acres in Agriculture**	**Acres of Protected Resource Land**	**Percent in Agriculture**	**Percent Protected Land**	**Surrounding Agricultural Land Score**	**Surrounding Protected Resource Land Score**
1,086	1,045	162	96%	4%	100	0

Based on the criteria in the preceding table, the score for this portion of the project is 100 points for the surrounding land use score and 0 points for the surrounding protected resource land score.

The Final LESA Scoresheet, Table 2.3.1.6 below corresponds to Table 8, Final LESA Score Sheet in the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011).

Table 2.3.1.6
Final LESA Score Sheet

	Factor Scores	Factor Weight	Weighted Factor Scores
Land Evaluation Factors			
Land Capability Classification	34.6	0.25	8.6
Storie Index	0	0.25	0
Land Evaluation Subtotal		***0.50***	**8.6**
Site Assessment Factors			
Project Size	100	0.15	15.0
Water Resource Availability	25	0.15	3.7

Table 2.3.1.6
Final LESA Score Sheet

	Factor Scores	Factor Weight	Weighted Factor Scores
Surrounding Agricultural Land	100	0.15	15
Protected Resource Land	0	0.05	0
Site Assessment Subtotal		***0.50***	**33.7**
		Final LESA Score	**42.3**

According to the Land Evaluation and Site Assessment Model Instruction Manual prepared by the California Department of Conservation (updated in 2011), the California LESA Model is weighted so that 50 percent of the total LESA score of a given project is derived from the Land Evaluation factors, and 50 percent from the Site Assessment factors. Individual factor weights are listed below, with the sum of the factor weights required to equal 100 percent. A single LESA score is generated for a given project after all of the individual Land Evaluation and Site Assessment factors have been scored and weighted.

Table 2.3.1.7
California LESA Model Scoring Thresholds

Total LESA Score	Scoring Decision
0-39 Points	Not Considered Significant
40-59 Points	Considered Significant only if the LE and the SA subscores are each greater than or equal to 20 points.
60-79 Points	Considered Significant unless either the LE or the SA subscore is less than 20 points.
80-100 Points	Considered Significant

The total LESA score is 42.3. As the LE and SA subscores are not each greater than or equal to 20 points, per the scoring thresholds above, the project's score is not considered significant.

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Appendix D
Aesthetics: Glare Analysis

FORGESOLAR GLARE ANALYSIS

Project: **Little Bear Solar Project**

A 180 MW project on 1,288 acres of land in Western Fresno County with single-axis horizontal tracking system. panels would be arranged in north to south oriented rows and would track the sun east-west. The Project would use thin film or other (monocrystalline or polycrystalline PV modules

Site configuration: **SAT -all OP locations-temp-12**

Analysis conducted by JEssica O'Dell (jodell@esassoc.com) at 15:38 on 17 Jul, 2018.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

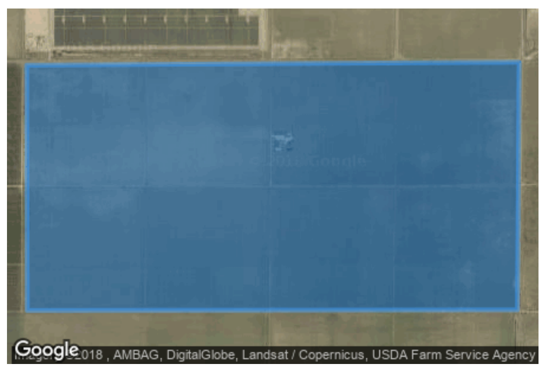
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 19800.2539

PV Array(s)

Name: PV array 1
Description: SAT
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 45.0°
Resting angle: 45.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	36.719807	-120.423188	197.68	13.00	210.68
2	36.719979	-120.387396	171.68	13.00	184.68
3	36.705599	-120.387525	175.81	13.00	188.81
4	36.705564	-120.423145	202.12	13.00	215.12

Flight Path Receptor(s)

Name: FP 1
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.727312	-120.353220	149.75	50.00	199.75
Two-mile	36.753520	-120.368472	156.82	596.39	753.21

Name: FP 2
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.763604	-120.373304	152.91	50.00	202.92
Two-mile	36.791441	-120.383070	148.27	608.10	756.37

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	36.720648	-120.440808	213.58	5.00
OP 2	2	36.720287	-120.439413	212.91	5.00
OP 3	3	36.720278	-120.436504	210.52	5.00
OP 4	4	36.724038	-120.377969	164.88	5.00
OP 5	5	36.731267	-120.392925	177.07	5.00
OP 6	6	36.718922	-120.328717	154.16	5.00
OP 7	7	36.720031	-120.406422	189.87	5.00
OP 8	8	36.698266	-120.387622	177.19	5.00
OP 9	9	36.716505	-120.423560	199.50	12.00
OP 10	10	36.710140	-120.423431	203.07	3.00
OP 11	11	36.716161	-120.432271	205.17	11.00
OP 12	12	36.716539	-120.441455	213.51	11.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 12	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: FP 1

0 minutes of yellow glare
0 minutes of green glare

Flight Path: FP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

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Site Config ID: 19800.2539

PV Array(s)

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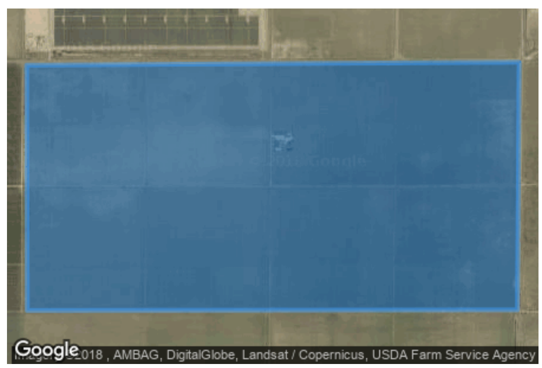
Description: SAT
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 45.0°
Resting angle: 45.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



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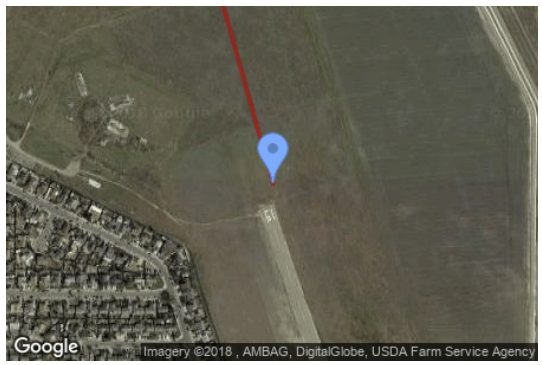
Two-mile	36.753520	-120.368472	156.82	596.39	753.21

Name: FP 2
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.763604	-120.373304	152.91	50.00	202.92
Two-mile	36.791441	-120.383070	148.27	608.10	756.37

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	36.720648	-120.440808	213.58	5.00
OP 2	2	36.720287	-120.439413	212.91	5.00
OP 3	3	36.720278	-120.436504	210.52	5.00
OP 4	4	36.724038	-120.377969	164.88	5.00
OP 5	5	36.731267	-120.392925	177.07	5.00
OP 6	6	36.718922	-120.328717	154.16	5.00
OP 7	7	36.720031	-120.406422	189.87	5.00
OP 8	8	36.698266	-120.387622	177.19	5.00
OP 9	9	36.716505	-120.423560	199.50	12.00
OP 10	10	36.710140	-120.423431	203.07	3.00
OP 11	11	36.716161	-120.432271	205.17	11.00
OP 12	12	36.716539	-120.441455	213.51	11.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 12	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: FP 1

0 minutes of yellow glare
0 minutes of green glare

Flight Path: FP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

FORGESOLAR GLARE ANALYSIS

Project: **Little Bear Solar Project**

A 180 MW project on 1,288 acres of land in Western Fresno County with single-axis horizontal tracking system. panels would be arranged in north to south oriented rows and would track the sun east-west. The Project would use thin film or other (monocrystalline or polycrystalline PV modules

Site configuration: **SAT -all OP locations-temp-12-temp-13**

Analysis conducted by JEssica O'Dell (jodell@esassoc.com) at 15:43 on 17 Jul, 2018.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

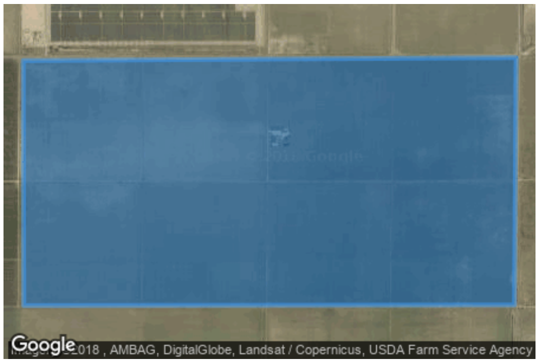
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 19801.2539

PV Array(s)

Name: PV array 1
Description: SAT
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



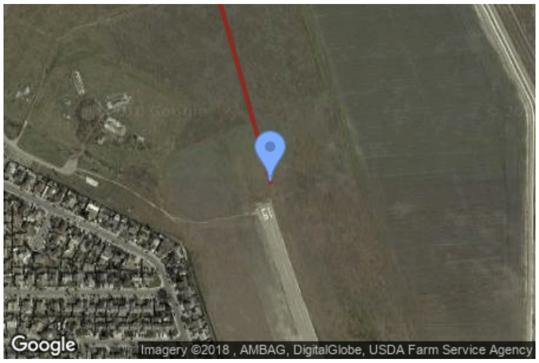
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	36.719807	-120.423188	197.68	13.00	210.68
2	36.719979	-120.387396	171.68	13.00	184.68
3	36.705599	-120.387525	175.81	13.00	188.81
4	36.705564	-120.423145	202.12	13.00	215.12

Flight Path Receptor(s)

Name: FP 1
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.727312	-120.353220	149.75	50.00	199.75
Two-mile	36.753520	-120.368472	156.82	596.39	753.21

Name: FP 2
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.763604	-120.373304	152.91	50.00	202.92
Two-mile	36.791441	-120.383070	148.27	608.10	756.37

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	36.720648	-120.440808	213.58	5.00
OP 2	2	36.720287	-120.439413	212.91	5.00
OP 3	3	36.720278	-120.436504	210.52	5.00
OP 4	4	36.724038	-120.377969	164.88	5.00
OP 5	5	36.731267	-120.392925	177.07	5.00
OP 6	6	36.718922	-120.328717	154.16	5.00
OP 7	7	36.720031	-120.406422	189.87	5.00
OP 8	8	36.698266	-120.387622	177.19	5.00
OP 9	9	36.716505	-120.423560	199.50	12.00
OP 10	10	36.710140	-120.423431	203.07	3.00
OP 11	11	36.716161	-120.432271	205.17	11.00
OP 12	12	36.716539	-120.441455	213.51	11.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	25.0	180.0	1	7,375	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	14
OP 2	0	24
OP 3	0	21
OP 4	0	0
OP 5	0	0
OP 6	1	2
OP 7	0	0
OP 8	0	516
OP 9	0	2333
OP 10	0	3396
OP 11	0	788
OP 12	0	281

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	14
OP 2	0	24
OP 3	0	21
OP 4	0	0
OP 5	0	0
OP 6	1	2
OP 7	0	0
OP 8	0	516
OP 9	0	2333
OP 10	0	3396
OP 11	0	788
OP 12	0	281

Flight Path: FP 1

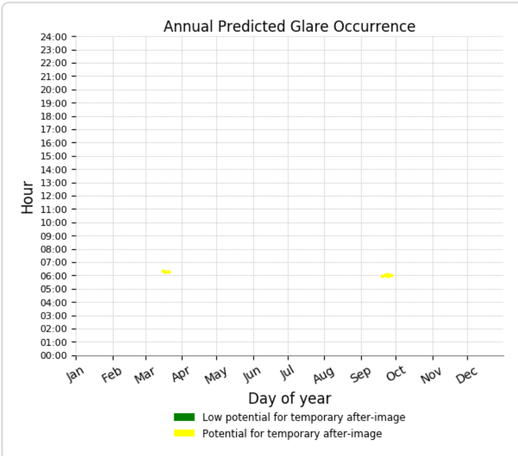
0 minutes of yellow glare
0 minutes of green glare

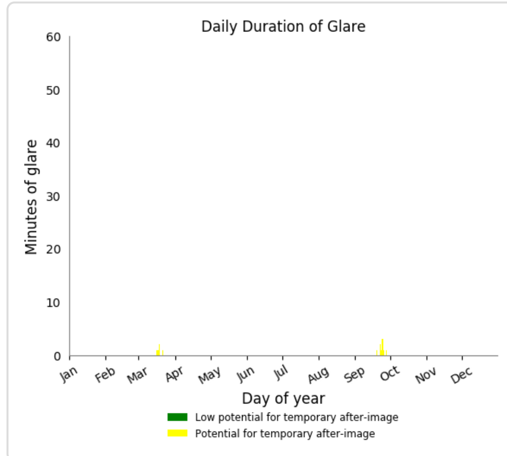
Flight Path: FP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

14 minutes of yellow glare
0 minutes of green glare

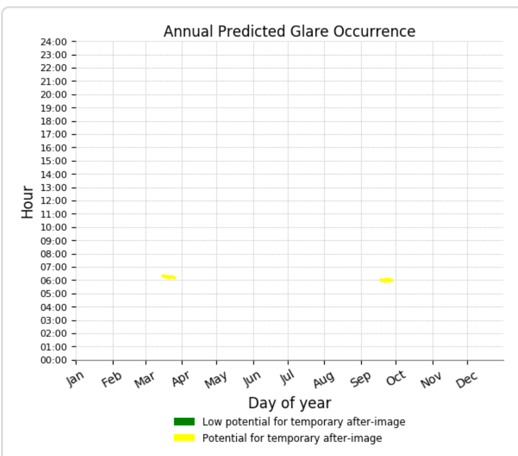


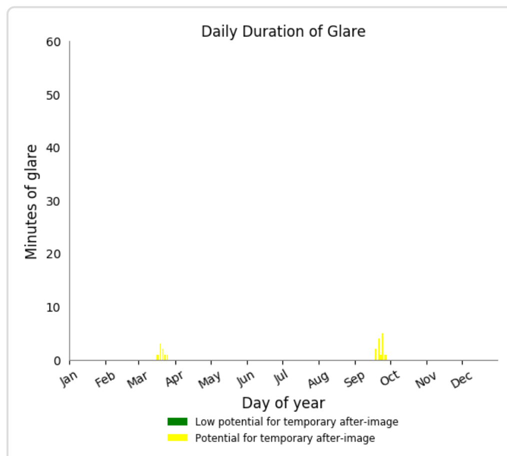


Point Receptor: OP 2

24 minutes of yellow glare

0 minutes of green glare

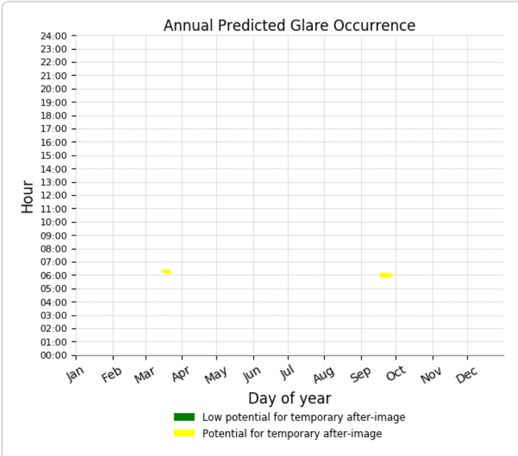


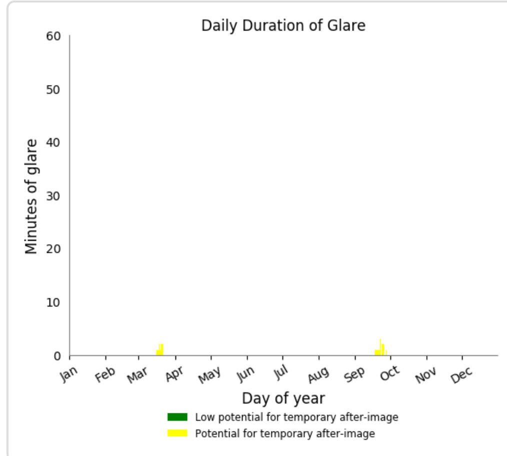


Point Receptor: OP 3

21 minutes of yellow glare

0 minutes of green glare





Point Receptor: OP 4

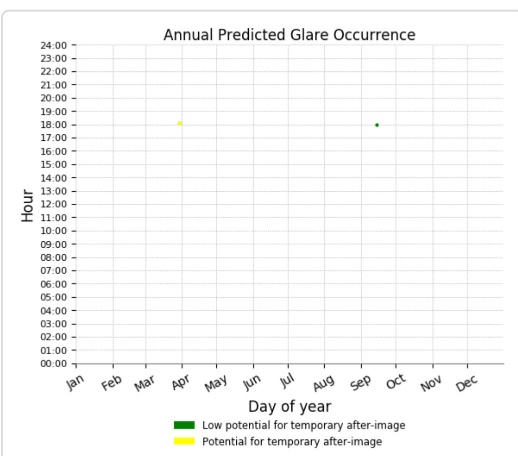
0 minutes of yellow glare
0 minutes of green glare

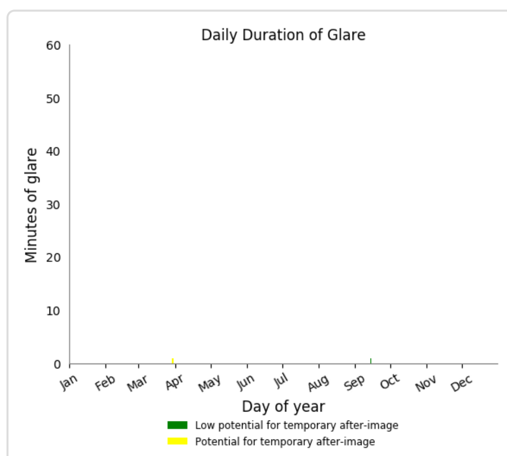
Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

2 minutes of yellow glare
1 minutes of green glare





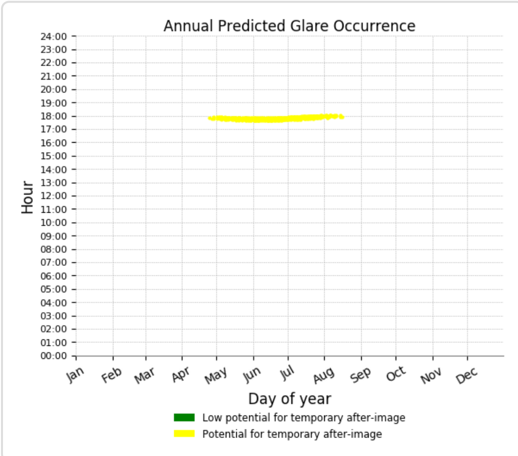
Point Receptor: OP 7

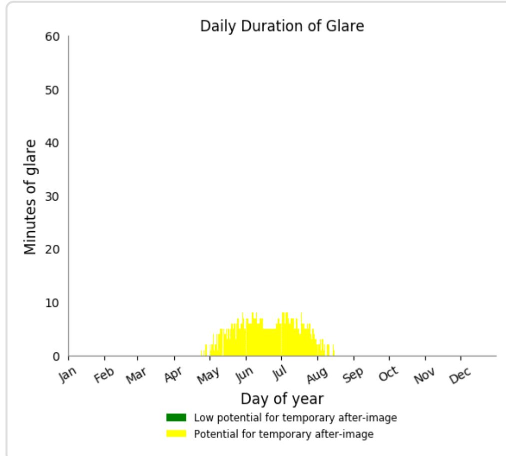
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

516 minutes of yellow glare

0 minutes of green glare

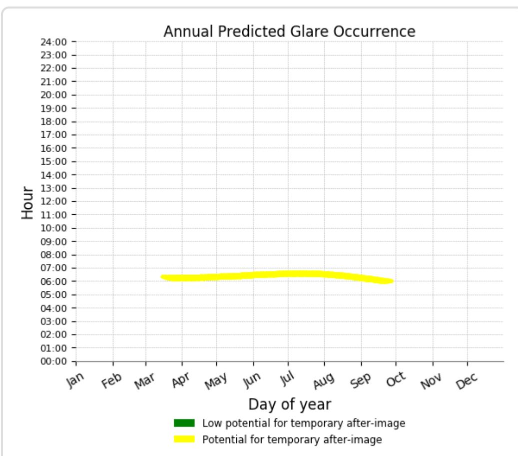


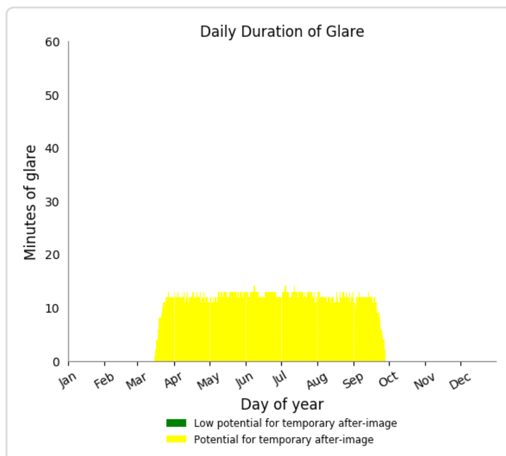


Point Receptor: OP 9

2333 minutes of yellow glare

0 minutes of green glare

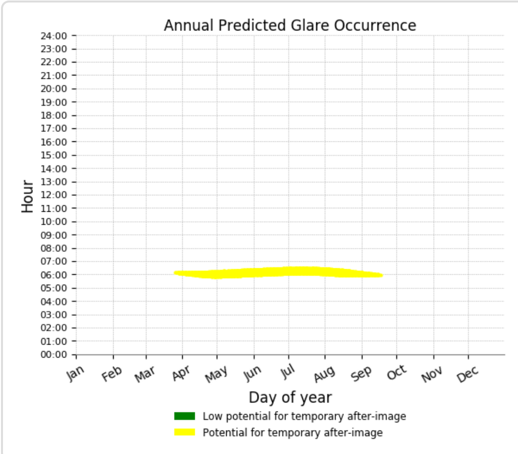


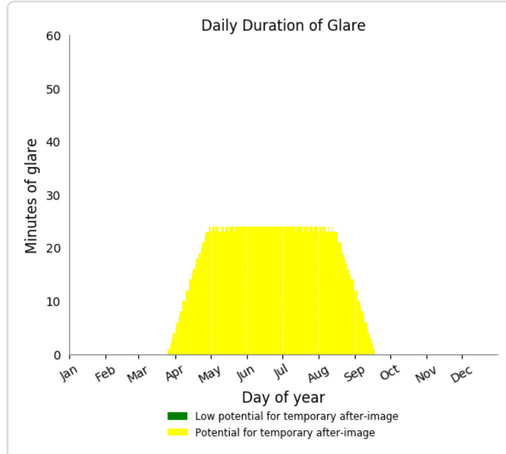


Point Receptor: OP 10

3396 minutes of yellow glare

0 minutes of green glare

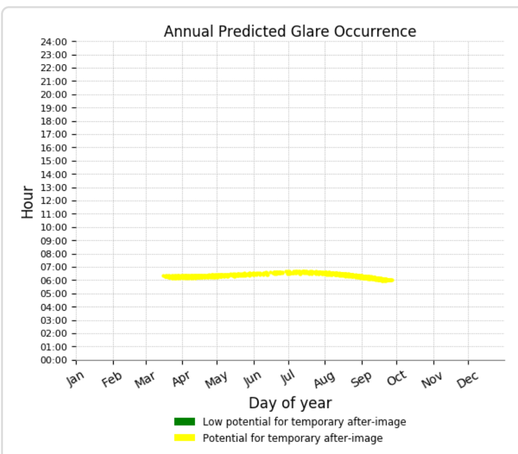


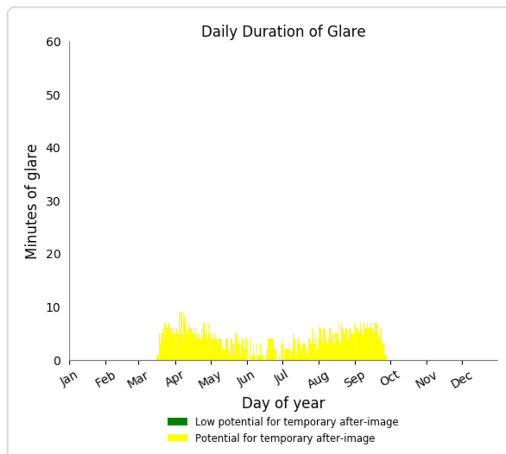


Point Receptor: OP 11

788 minutes of yellow glare

0 minutes of green glare

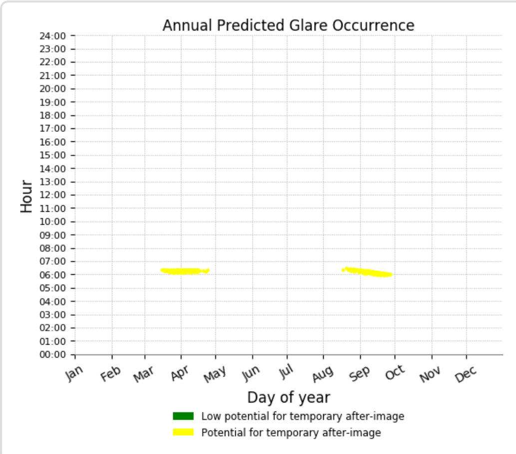


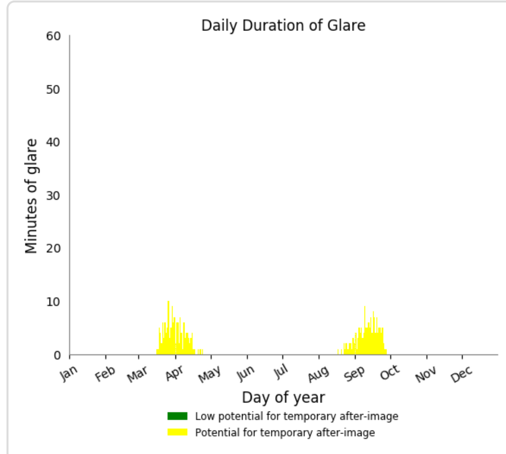


Point Receptor: OP 12

281 minutes of yellow glare

0 minutes of green glare





Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
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FORGESOLAR GLARE ANALYSIS

Project: **Little Bear Solar Project**

A 180 MW project on 1,288 acres of land in Western Fresno County with single-axis horizontal tracking system. panels would be arranged in north to south oriented rows and would track the sun east-west. The Project would use thin film or other (monocrystalline or polycrystalline PV modules

Site configuration: **SAT -all OP locations-temp-12-temp-13**

Analysis conducted by JEssica O'Dell (jodell@esassoc.com) at 15:47 on 17 Jul, 2018.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

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- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

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COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

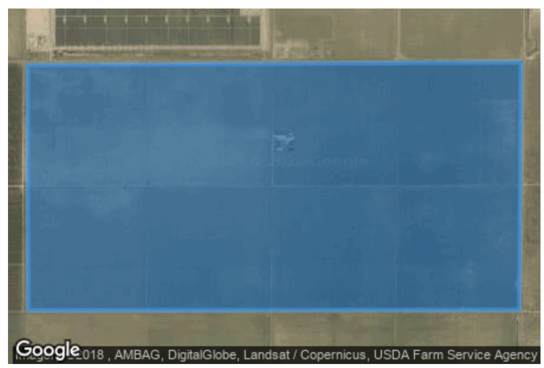
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 19802.2539

PV Array(s)

Name: PV array 1
Description: SAT
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
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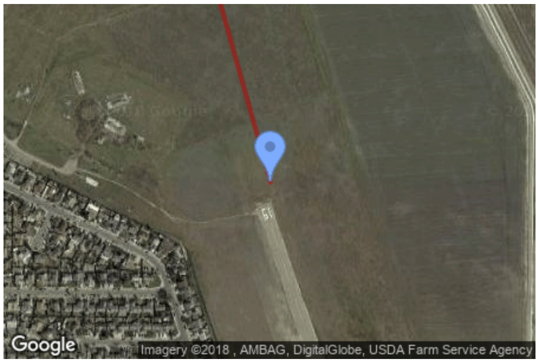
3	36.705599	-120.387525	175.81	13.00	188.81
4	36.705564	-120.423145	202.12	13.00	215.12

Flight Path Receptor(s)

Name: FP 1
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.727312	-120.353220	149.75	50.00	199.75
Two-mile	36.753520	-120.368472	156.82	596.39	753.21

Name: FP 2
Description:
Threshold height: 50 ft
Direction: °
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	36.763604	-120.373304	152.91	50.00	202.92
Two-mile	36.791441	-120.383070	148.27	608.10	756.37

Discrete Observation Receptors

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OP 11	11	36.716161	-120.432271	205.17	11.00
OP 12	12	36.716539	-120.441455	213.51	11.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	25.0	180.0	1	8,148	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	29
OP 2	0	56
OP 3	0	25
OP 4	0	0
OP 5	0	0
OP 6	1	1
OP 7	0	2
OP 8	0	545
OP 9	0	2662
OP 10	0	3664
OP 11	0	830
OP 12	0	334

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
FP 1	0	0
FP 2	0	0
OP 1	0	29
OP 2	0	56
OP 3	0	25
OP 4	0	0
OP 5	0	0
OP 6	1	1
OP 7	0	2
OP 8	0	545
OP 9	0	2662
OP 10	0	3664
OP 11	0	830
OP 12	0	334

Flight Path: FP 1

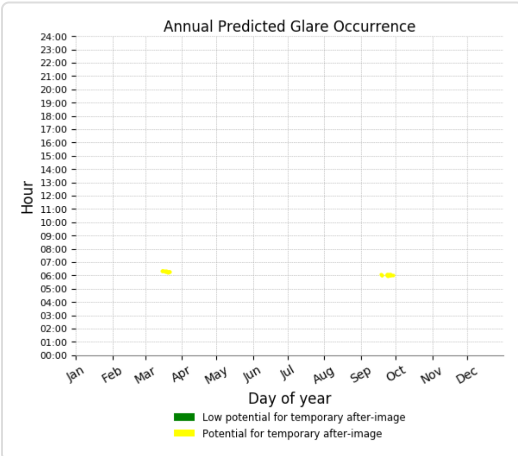
0 minutes of yellow glare
0 minutes of green glare

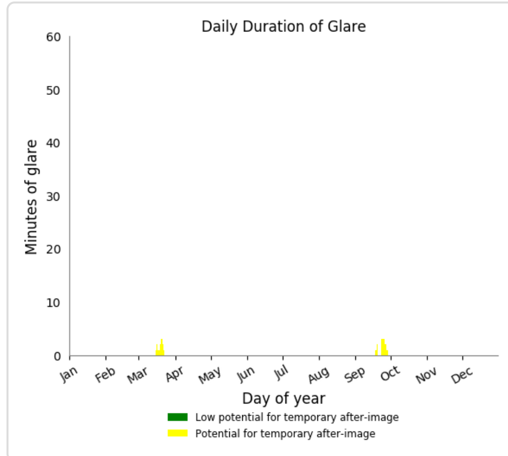
Flight Path: FP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

29 minutes of yellow glare
0 minutes of green glare

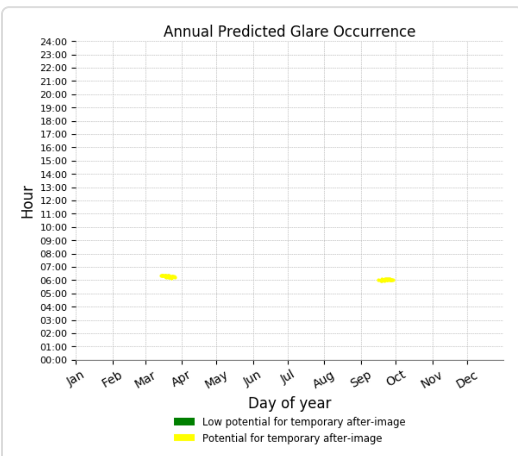


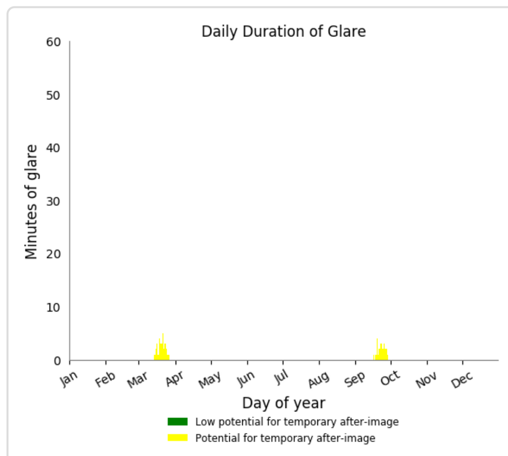


Point Receptor: OP 2

56 minutes of yellow glare

0 minutes of green glare

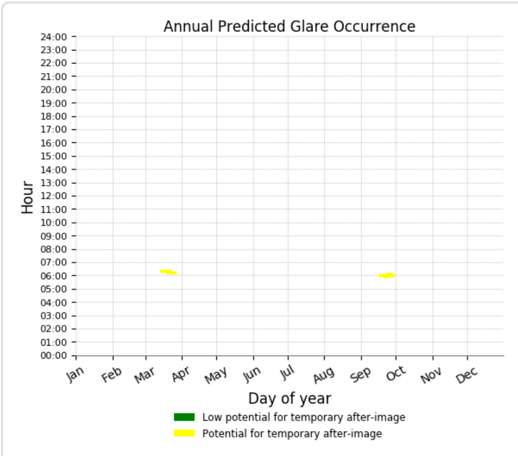


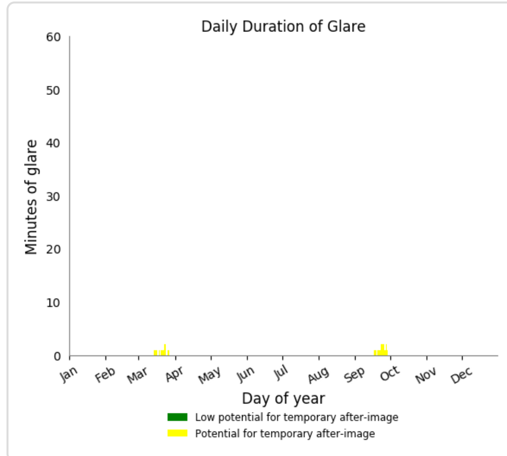


Point Receptor: OP 3

25 minutes of yellow glare

0 minutes of green glare





Point Receptor: OP 4

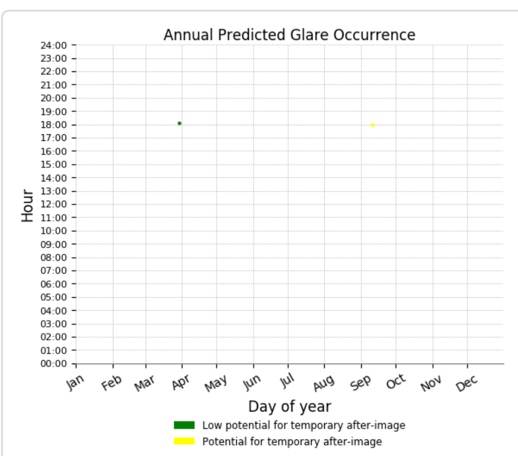
0 minutes of yellow glare
0 minutes of green glare

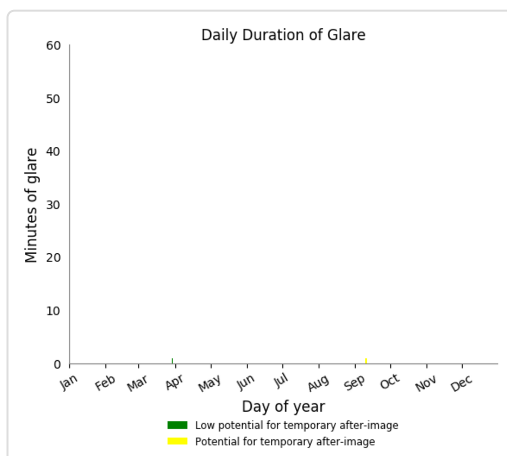
Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

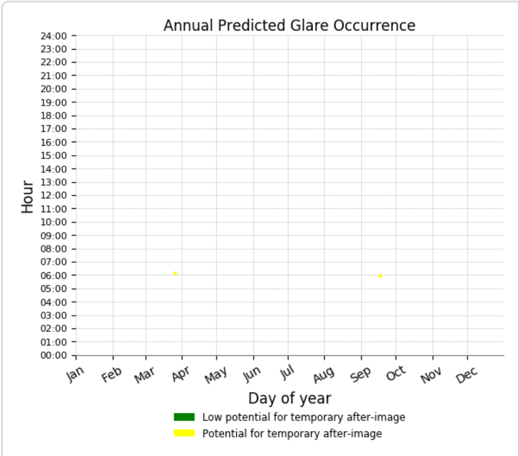
1 minutes of yellow glare
1 minutes of green glare

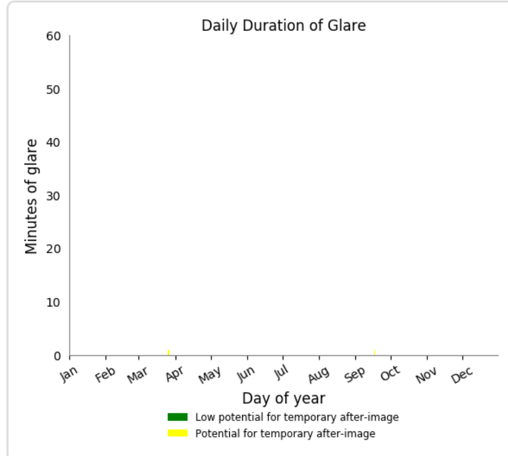




Point Receptor: OP 7

2 minutes of yellow glare
0 minutes of green glare

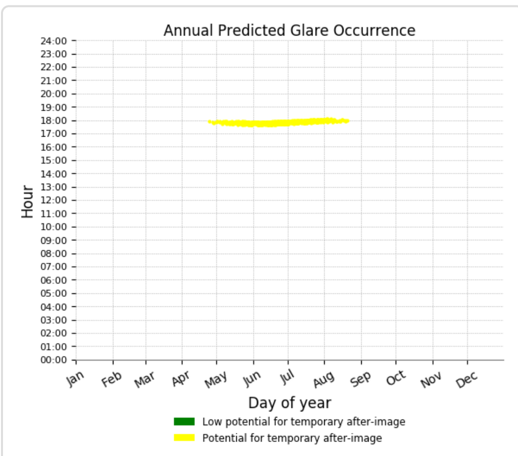


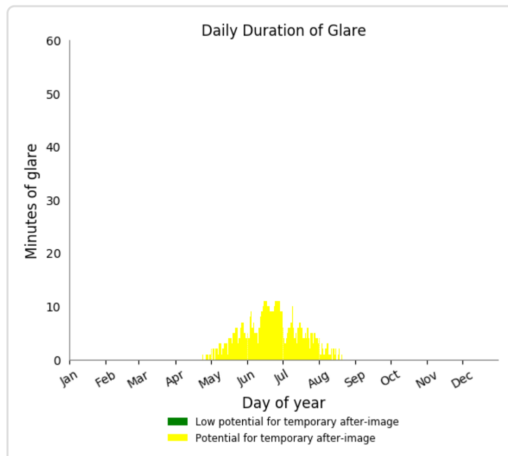


Point Receptor: OP 8

545 minutes of yellow glare

0 minutes of green glare

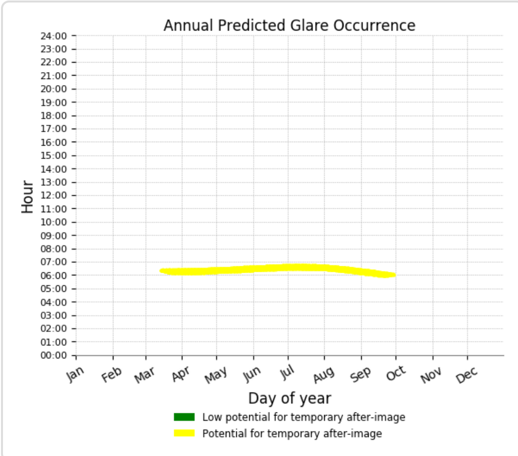


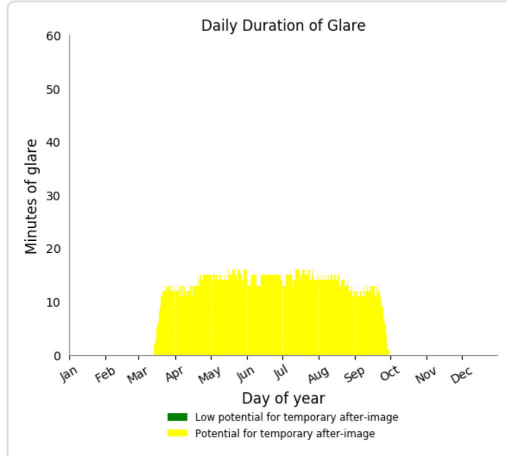


Point Receptor: OP 9

2662 minutes of yellow glare

0 minutes of green glare

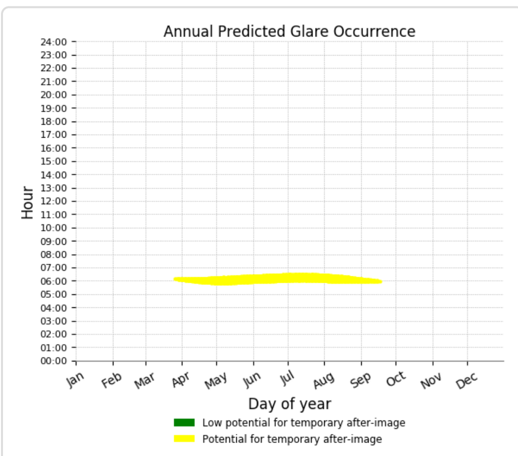


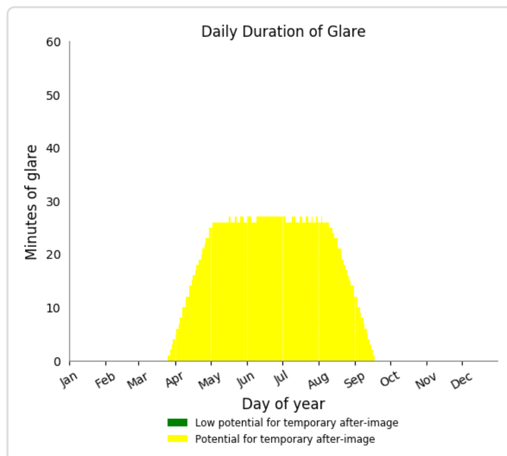


Point Receptor: OP 10

3664 minutes of yellow glare

0 minutes of green glare

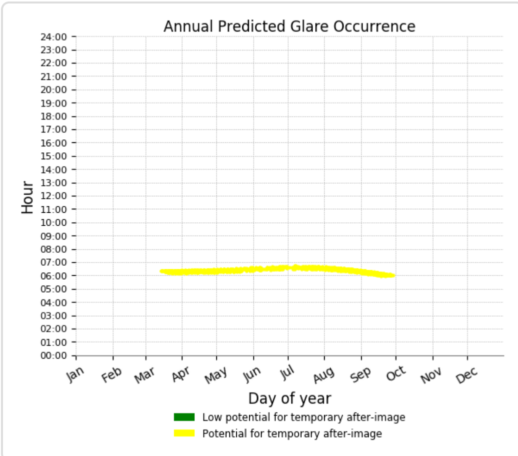


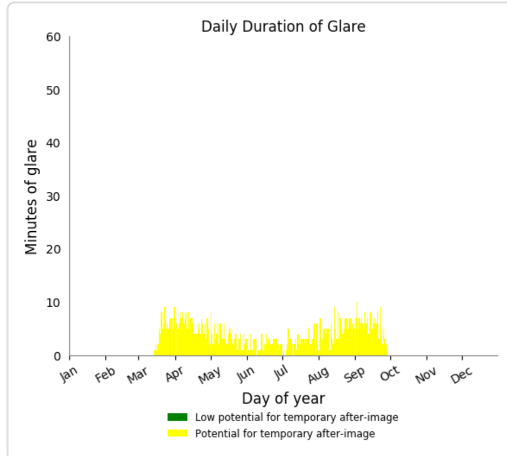


Point Receptor: OP 11

830 minutes of yellow glare

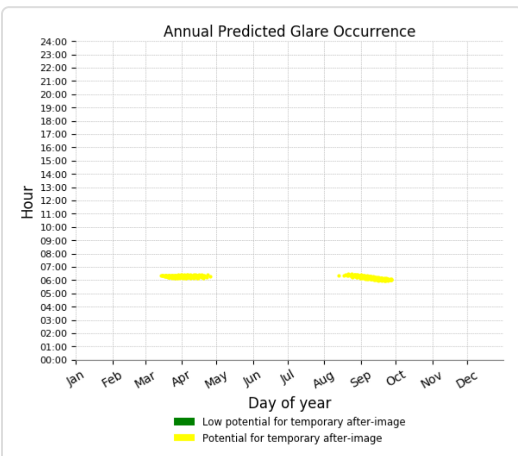
0 minutes of green glare

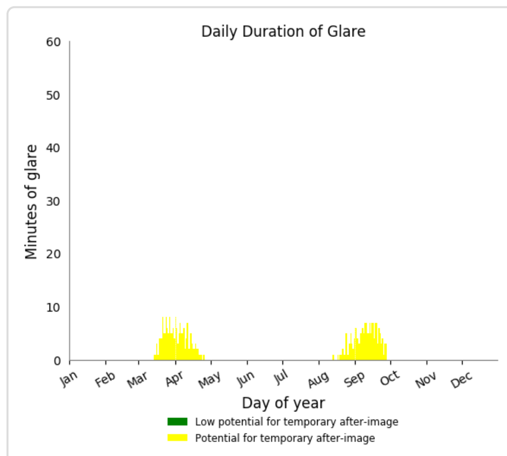




Point Receptor: OP 12

334 minutes of yellow glare
0 minutes of green glare





Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Appendix E
Air Quality and Greenhouse Gas Emissions Analysis Technical Report

Air Quality and Greenhouse Gas Emissions Analysis Technical Report for the Little Bear Solar Project Fresno County, California

Prepared for:

Little Bear Solar 1 LLC,
Little Bear Solar 3 LLC,
Little Bear Solar 4 LLC,
Little Bear Solar 5 LLC, and
Little Bear Solar 6 LLC

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FEBRUARY 2018

Printed on 30% post-consumer recycled material.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
μg	micrograms
2009 RACT SIP	Reasonably Available Control Technology Demonstration for Ozone State Implementation Plan
AB	Assembly Bill
AC	alternating current
Applicant	Little Bear Solar LLC
BAU	business as usual
BPS	best performance standard
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
CALGreen	California Green Building Standards Code
CalRecycle	California Department of Resources Recycling and Recovery
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
County	County of Fresno
CPUC	California Public Utilities Commission
DC	direct current
DPM	diesel particulate matter
EIR	environmental impact report
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESS	Energy Storage System
FCOG	Fresno Council of Governments
First Update	First Update to the Climate Change Scoping Plan: Building on the Framework
GHG	greenhouse gas
GWP	global warming potential
HAP	hazardous air pollutant
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
HIA	acute hazard index
HIC	chronic hazard index
HRA	health risk assessment
IPCC	Intergovernmental Panel on Climate Change

Acronym/Abbreviation	Definition
ISR	Indirect Source Review
kV	kilovolt
lbs	pounds
LOS	level of service
LST	localized significance thresholds
m^3	cubic meter
MPO	metropolitan planning organization
MMT	million metric ton
MT CO_2E	metric tons of carbon dioxide equivalent
MW	megawatt
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NHTSA	National Highway Traffic Safety Administration
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
O&M	operations and maintenance
O_3	ozone
OPR	Office of Planning and Research
Pb	Lead
PCM	Post-Construction Monitoring
PCS	power conservation station
PFC	Perfluorocarbon
PG&E	Pacific Gas and Electric
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PPA	Power Purchase Agreement
ppb	parts per billion
ppm	parts per million
Project	Little Bear Solar Project
PSD	prevention of significant deterioration
PV	Photovoltaic
PVCS	photovoltaic combining switchgear
ROG	reactive organic gases
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan
SB	Senate Bill
Scoping Plan	Climate Change Scoping Plan: A Framework for Change
SCS	Sustainable Communities Strategy
SF_6	sulfur hexafluoride
SIP	State Implementation Plan
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District

Acronym/Abbreviation	Definition
SLCP Strategy	Proposed Short-Lived Climate Pollution Reduction Strategy
SO_2	sulfur dioxide
SO_x	sulfur oxides
SR-	State Route
TAC	toxic air contaminant
VERA	Voluntary Emissions Reduction Agreement
VMT	vehicle miles travelled
WWD	Westlands Water District
ZEV	zero-emissions vehicle
ZNE	zero net energy

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EXECUTIVE SUMMARY

The purpose of this technical report is to assess the potential air quality and greenhouse gas (GHG) emissions impacts associated with implementation of the proposed Little Bear Solar Project (Project). This assessment utilizes the significance thresholds in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.).

Project Overview

The Project applicant (Applicant) proposes to construct and operate an approximately 180 MW solar photovoltaic power generation facility on lands located near Mendota in unincorporated Fresno County, California. The Project will consist of up to five facilities; two 20 MW facilities, one 40 MW facility, and two 50 MW facilities. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The Project is expected to require approximately 12 months to construct.

Each generation facility within the Project will include the following main elements: modular photovoltaic solar panels (either fixed-tilt or on single-axis trackers); direct current to alternating current power inverters mounted on concrete pads; three-phase transformers mounted on concrete pads that convert the output of each inverter to 34.5 kilovolts (kV), a 34.5 kV collection system either overhead or underground, a 34.5 kV to 115 kV substation, meteorology towers, security fencing and lighting and other on-site facilities as required. There will be a common control/administration building and parking lot that will be shared by each generation facility. Each generation facility may also optionally include an Energy Storage Systems (ESS) that will provide up to four hours of electrical storage. The ESS will be sited in a separate outside rated enclosure and will consist of self-contained battery storage modules placed in racks, converters, switchboards, integrated heating, ventilation, and air conditioning (HVAC) units, inverters, transformers, and controls in prefabricated metal containers or in a building.

Air Quality

The air quality impact analysis evaluated the potential for adverse impacts to ambient air quality due to construction and operational emissions resulting from the Project. Impacts were evaluated for their significance based on the San Joaquin Valley Air Pollution Control District (SJVAPCD) environmental thresholds of significance (SJVAPCD 2015b). These thresholds were developed in accordance with the CEQA Guidelines.

Criteria air pollutants are defined as pollutants for which the federal and state governments have established ambient air quality standards, or criteria, for outdoor concentrations to protect public health. Criteria air pollutants include ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and lead (Pb). Pollutants that are evaluated herein also include reactive organic gasses (ROGs) (i.e., volatile organic compounds (VOCs) and reactive organic compounds), oxides of nitrogen (NO_x), CO, sulfur oxides (SO_x), PM_{10}, $PM_{2.5}$. ROGs and NO_x are important because they are precursors to O_3.

Air Quality Plan Consistency

Implementation of the Project would not exceed the demographic growth forecasts in the *San Joaquin Valley Demographic Forecasts 2010 to 2050* (Fresno County Association of Governments 2014) and through compliance with SJVAPCD Rule 9510 and implementation of a VERA with SJVAPCD, would also be consistent with the SJVAPCD Attainment Plans for CO, PM_{10}, $PM_{2.5}$, and O_3. . Based on these considerations, impacts related to the Project's potential to conflict with or obstruct implementation of the applicable air quality plan would be less than significant.

Construction Criteria Air Pollutant Emissions

Construction of the Project would result in the temporary addition of pollutants to the local airshed caused by on-site sources (e.g., off-road construction equipment, soil disturbance, and ROG off-gassing) and off-site sources (e.g., on-road haul trucks, vendor trucks, and worker vehicle trips). With compliance with SJVAPCD Rule 9510 and implementation of a VERA with SJVAPCD, annual construction emissions for ROG, NO_x, CO, SO_x, PM_{10}, or $PM_{2.5}$ would not exceed the SJVAPCD significance thresholds during construction. However, CO and NO_x emissions would exceed 100 pound per day, which under SJVAPCD guidance requires that an ambient air quality assessment be performed for all criteria pollutants. The ambient air quality assessment showed that the Project would not exceed any State or Federal Ambient Air Quality Standards during construction; therefore, the Project would have a less than significant impact.

Operational Criteria Air Pollutant Emissions

Operation of the Project would generate operational criteria air pollutants from mobile sources (i.e., vehicles), area sources (e.g., periodic use of architectural coatings), and energy. Maximum operational emissions would not exceed the SJVAPCD operational significance thresholds for ROG, $NO_{x,}$ CO, SO_x, PM_{10}, or $PM_{2.5}$.

Exposure of Sensitive Receptors

Construction activities would not generate emissions in excess of the site-specific localized significance thresholds; therefore, site-specific impacts during construction of the Project would be less than significant. In addition, diesel equipment would also be subject to the California Air Resources Board (CARB) air toxic control measures for in-use off-road diesel fleets, which would minimize diesel particulate matter (DPM) emissions. A construction health risk assessment was performed and determined that the cancer risk and the chronic hazard index would fall below the SJVAPCD thresholds of significance.

No residual toxic air contaminant (TAC) emissions and corresponding cancer risk are anticipated after construction, and no long-term sources of TAC emissions are anticipated during operation of the Project. Therefore, impacts from the exposure of sensitive receptors to Project-related TAC emissions would be less than significant. The Project would not significantly contribute to a CO hotspot. As such, impacts to sensitive receptors would be less than significant.

Odors

Potential odors produced during construction would be attributable to concentrations of unburned hydrocarbons from tailpipes of construction equipment, architectural coatings (e.g., canned spray paint used for soil and lathe marking), and asphalt pavement application, which would disperse rapidly from the Project site. Impacts associated with odors during construction would be less than significant. The Project is a solar development that would not include land uses that have the potential to generate substantial odors, consequently impacts associated with odors during operation would be less than significant.

Cumulative Impacts

The potential for the Project to result in a cumulatively considerable impact, per the SJVAPCD guidance and thresholds, is based on the Project's impact compared to the SJVAPCD significance criteria. As discussed previously, with compliance with SJVAPCD Rule 9510 and implementation of a VERA with SJVAPCD maximum construction and operational emissions would not exceed the SJVAPCD significance thresholds for ROG, NO_x, CO, SO_x, PM_{10}, or $PM_{2.5}$. Therefore, the Project's cumulative impacts would be less than significant.

Greenhouse Gas Emissions

Global climate change is considered a cumulative impact but must also be evaluated on a project level under CEQA. A project contributes toward this potential impact through its incremental emissions combined with the cumulative increase of other sources of GHG emissions. GHGs are gases that absorb infrared radiation in the atmosphere. The greenhouse effect is a natural process that contributes to regulating the Earth's temperature. Global climate change concerns are focused on whether human activities are leading to an enhancement of the greenhouse effect. Principal GHGs regulated under state and federal law and regulations include carbon dioxide

(CO_2), methane (CH_4), and nitrous oxide (N_2O). GHG emissions are measured in metric tons of CO_2 equivalent (MT CO_2E), which account for weighted global warming potential (GWP) factors for CH_4 and N_2O.

Project-Generated Construction and Operational Greenhouse Gas Emissions

SJVAPCD supports the use of the interim thresholds as recommended by the California Air Pollution Control Officers Association (CAPCOA) when adopted thresholds are not applicable. As such, for the purposes of establishing a quantitative threshold for GHG emissions, the interim threshold for operational emissions of commercial and industrial projects established by CAPCOA of 900 MT CO_2E is used herein. Pursuant to the SJVAPCD *Final Staff Report – Climate Change Action Plan: Addressing GHG Emissions Impacts under CEQA*, construction emissions were amortized over a 30-year project lifetime, so that GHG reduction measures will address construction GHG emissions as part of the operational GHG reduction strategies (SJVAPCD 2009c).

Construction of the Project would result in GHG emissions primarily associated with use of off-road construction equipment, on-road hauling and vendor (material delivery) trucks, and worker vehicles. Total Project-generated GHG emissions during construction were estimated to be 4,013 MT CO_2E over the construction period. Estimated Project-generated construction emissions amortized over 30 years would be approximately 134 MT CO_2E per year.

The Project would generate operational GHG emissions from vehicular sources from routine maintenance of the site. Estimated annual Project-generated operational GHG emissions would be approximately 121 MT CO_2E per year. Estimated annual Project-generated operational emissions beginning in 2021 and amortized Project construction emissions would be approximately 254 MT CO_2E per year, well below the 900 MT threshold. Therefore, the Project's GHG contribution would not be cumulatively considerable and is less than significant.

Greenhouse Gas Emissions Benefits

Renewable energy production potentially offsets GHG emissions generated by fossil-fuel power plants. The Project would provide a potential reduction of 82,544 MT CO_2E per year if the electricity generated by the Project were to be used instead of electricity generated by fossil-fuel sources. After accounting for the annualized construction and annual operational emissions of 254 MT CO_2E per year, and the annualized reduction in GHG from the production of solar energy of 82,544 MT CO_2E, the net reduction in GHG emissions would be 82,290 MT CO_2E per year.

Consistency with Applicable Greenhouse Gas Reduction Plans

The Fresno Council of Governments' (FCOG's) Regional Transportation Plan (RTP) / Sustainable Communities Strategy (SCS) is an applicable plan adopted for the purpose of reducing GHGs from the land use and transportation sectors in Fresno County and was adopted after completion of a Programmatic Environmental Impact Report (EIR). CARB approved the RTP/SCS in 2015. A project could result in a significant impact if it conflicts with an applicable plan, policy, or regulation adopted for the purposes of reducing GHGs, making it inconsistent with the adopted FCOG RTP/SCS. As proposed, the Project would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs, and no mitigation is required. This impact would be less than significant.

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Air Quality and Greenhouse Gas Emissions Analysis Technical Report for the Little Bear Solar Project

1 INTRODUCTION

1.1 Report Purpose and Scope

The purpose of this technical report is to assess the potential air quality and GHG emissions impacts associated with implementation of the proposed Project. This assessment uses the significance thresholds in Appendix G of the CEQA Guidelines (14 CCR 15000 et seq.) and is based on the emissions-based significance thresholds recommended by the SJVAPCD and the County of Fresno (County).

This introductory section provides a description of the Project and the Project location. Section 2, Air Quality, describes the air quality–related environmental setting, regulatory setting, existing air quality conditions, and thresholds of significance and analysis methodology and presents an air quality impact analysis per Appendix G of the CEQA Guidelines. Section 3, Greenhouse Gas Emissions, follows the same format as Section 2 and similarly describes the GHG emissions-related environmental setting, regulatory setting, existing climate changes conditions, and thresholds of significance and analysis methodology and presents a GHG emissions impact analysis per Appendix G of the CEQA Guidelines. Section 4, References Cited, includes a list of the references cited. Section 5, List of Preparers, includes a list of those who prepared this technical report.

1.2 Regional and Local Setting

1.2.1 Regional Location

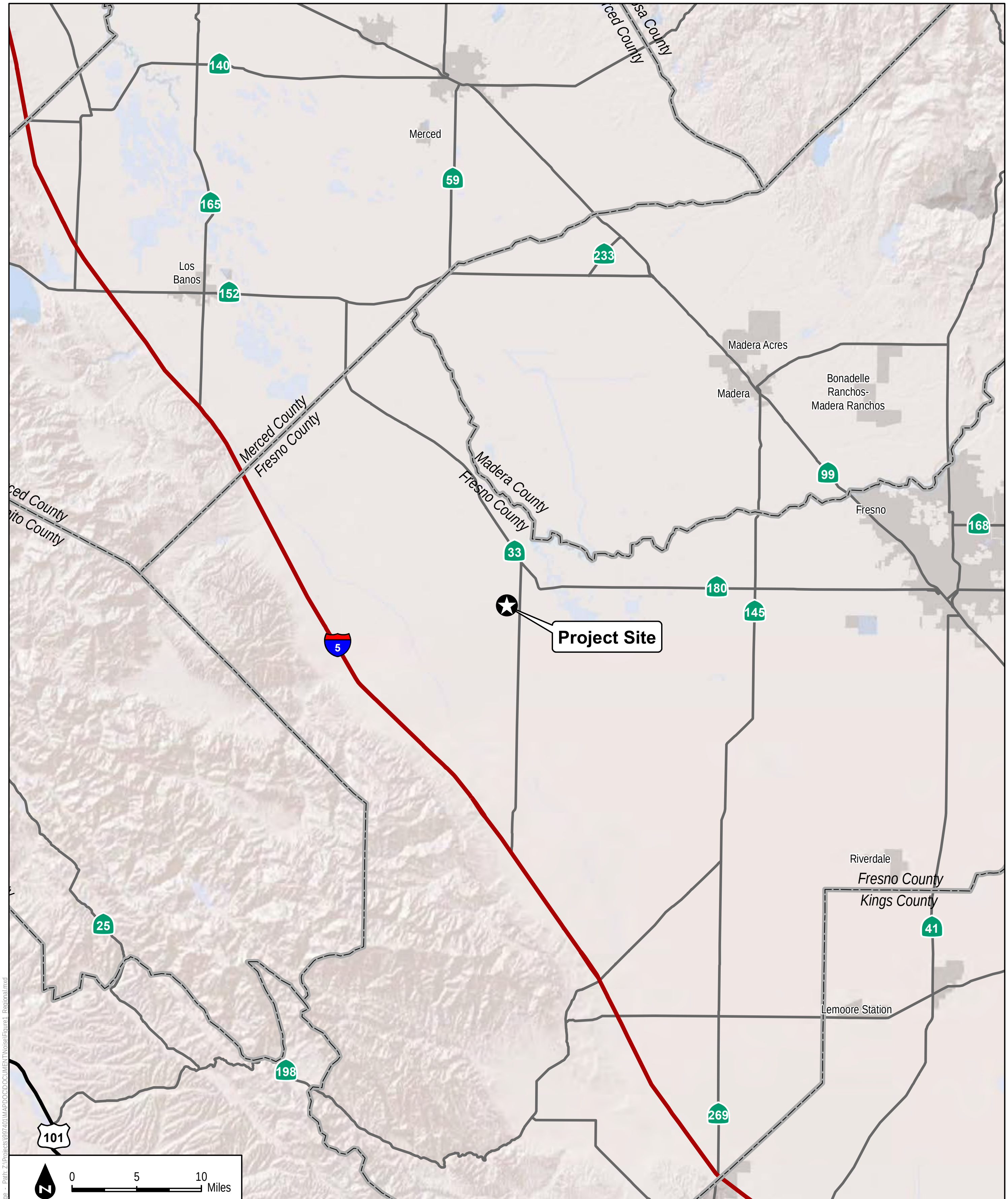
The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5, approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route (SR-) 33, in unincorporated Fresno County, Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian. Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east. Figures 1 and Figure 2 show the location of the proposed Project on a regional and local basis, respectively.

The Project site is currently under agricultural production with winter wheat and barley crops. There is an approximately 5,000 square-foot metal storage shed with neighboring metal storage silos (approximately 2,500 square feet) located on one Project parcel, just east of South Ohio Avenue, which will be removed as part of construction. The Project site is approximately 1,288 acres in total. Land use in the vicinity of the Project is largely agricultural production with a few, scattered residences—the closest of which is approximately 0.75 mile from the Project site. The Project will be immediately adjacent to the North Star Solar Power Project and approximately 0.5 mile south of the Federal Correctional Institution Mendota.

1.2.2 Project Setting

The land use designation for the Project site is agriculture according to the Fresno County 2000 General Plan. The agriculture land use designation provides for the production of crops and livestock, and for location of necessary agriculture commercial centers, agricultural processing facilities, and certain nonagricultural activities.

The Project site is currently zoned AE-20 (Exclusive Agricultural District, 20-acre minimum parcel size). The purpose of the AE-20 zone designation is intended to be an exclusive district for agriculture and for those uses which are necessary and an integral part of the agricultural operation. The designation is also intended to protect the general welfare of the agricultural community from encroachments of non-related agricultural uses which by their nature would be injurious to the physical and economic well-being of the agricultural district. Uses under zone designation AE-20 are limited to primarily agricultural uses and other activities compatible with agricultural uses.



SOURCE: ESRI Basemaps

FIGURE 1

Regional Location

DUDEK

Little Bear Solar Project Air Quality and Greenhouse Gas Emissions Analysis Technical Report

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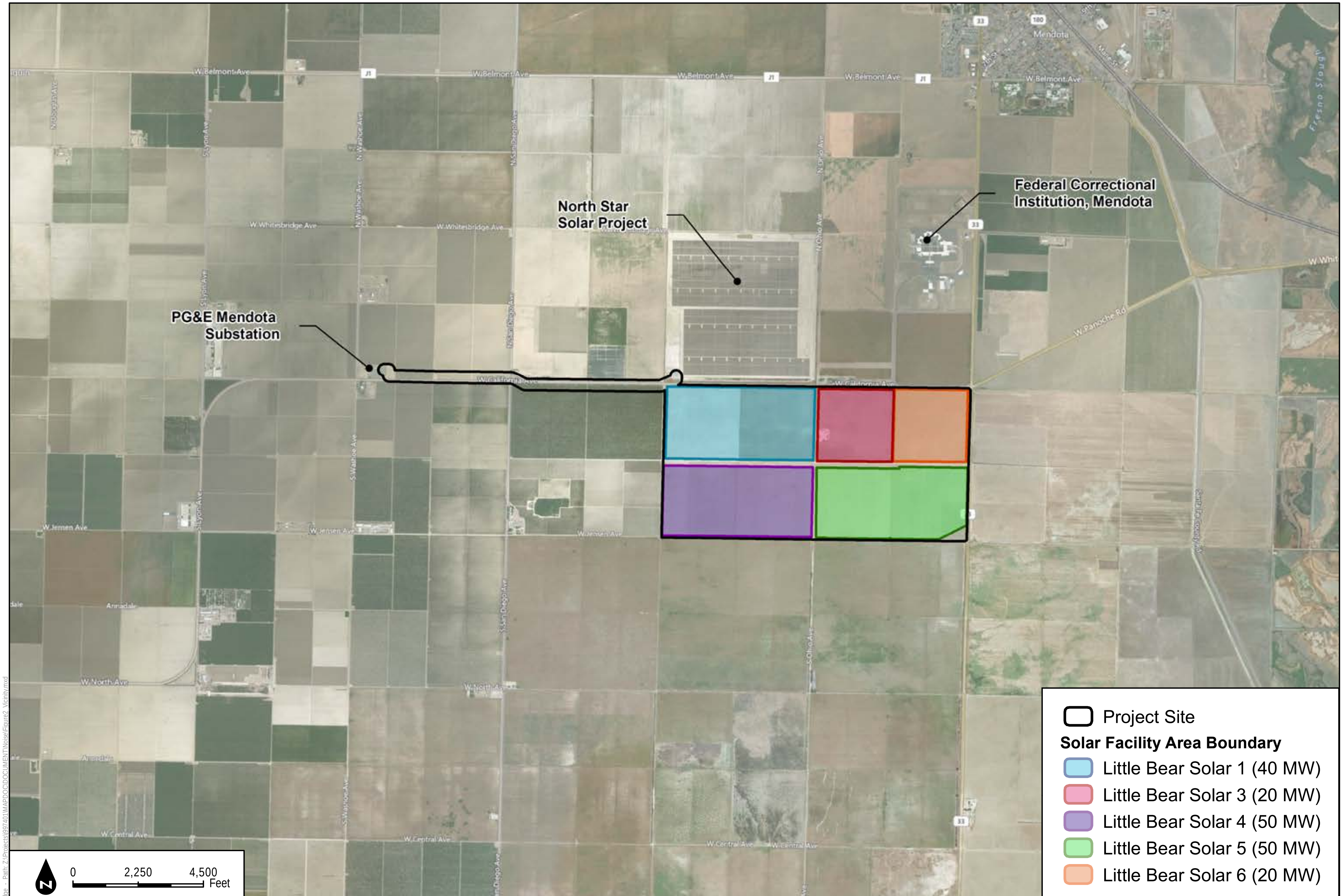

DUDEK

SOURCE: Bing Maps (Accessed 2017)

FIGURE 2
Project Vicinity

Little Bear Solar Project Air Quality and Greenhouse Gas Emissions Analysis Technical Report

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1.3 Proposed Project Description

The Project proposes to construct and operate an approximately 180 MW solar photovoltaic power generation facility on lands located near Mendota in unincorporated Fresno County, California. The Project will consist of up to five facilities; two 20 MW facilities, one 40 MW facility, and two 50 MW facilities. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The Project is expected to require 12 months to construct.

Each generation facility within the Project will include the following main elements: modular photovoltaic solar panels (either fixed-tilt or on single-axis trackers); direct current to alternating current power inverters mounted on concrete pads; three-phase transformers mounted on concrete pads that convert the output of each inverter to 34.5 kilovolts (kV), a 34.5 kV collection system either overhead or underground, a 34.5 kV to 115 kV substation, meteorology towers, security fencing and lighting and other on-site facilities as required. There will be a common control/administration building and parking lot that will be shared by each generation facility. Each generation facility may also optionally include an Energy Storage Systems (ESS) that will provide up to four hours of electrical storage. The ESS will be sited on an approximately one-acre area, in a separate outside rated enclosure and will consist of self-contained battery storage modules placed in racks, converters, switchboards, integrated heating, ventilation, and air conditioning (HVAC) units, inverters, transformers, and controls in prefabricated metal containers or in a building.

The Project will interconnect to the Mendota Substation using the existing 115 kV gen-tie line that interconnects with the North Star Solar Project. One generation facility will interconnect with the North Star gen-tie line by way of the North Star Solar Project switchyard. The remaining generation facilities will each connect to a new, approximately 2.25-mile 115 kV gen-tie line that will lead to the North Star gen-tie line and continue from that point to the Mendota Substation as a second electrical circuit added to the existing towers of the North Star gen-tie line.

The Project will have private perimeter roads and interior access ways for construction and operation. Perimeter roads and interior access ways are proposed to be composed of native compacted soil. The Project will have driveways connecting at up to ten points with local county roads.

Construction will generally occur during daylight hours, Monday through Friday. Non-daylight work hours and work on weekends may be necessary to make up schedule deficiencies, or to complete critical construction activities. For instance, during hot weather, it may be necessary to start work earlier to avoid work during high ambient temperatures. Further, construction requirements will necessitate some nighttime activity for installation, service or electrical connection, inspection and testing activities.

Construction activities may include the use of the neighboring North Star Solar Project for placement of temporary office trailers, parking for construction workers and filling water trucks using an existing water well on the North Star site.

Voluntary Emissions Reduction Agreement

A Voluntary Emissions Reduction Agreement (VERA) is available for projects where design elements and compliance with SJVAPCD rules and regulations may not be sufficient to reduce project-related air quality impacts to a less-than-significant level. A VERA is a contractual agreement between a project applicant and the SJVAPCD that facilitates the development, funding, and implementation of emission reduction projects to provide pound-for-pound mitigation of air emission increases to the extent agreed to by the parties to the agreement. The project applicant is responsible for providing funds for the SJVAPCD's Emission Reduction Incentive Program. Funding in accordance with the fee per ton of pollutant would be provided by the project applicant to the SJVAPCD prior to project implementation (or at appropriate milestones per the VERA) to establish an accounting mechanism for paying for emission reduction projects; however, the applicant is responsible only for the actual cost to execute the reduction and SJVAPCD administrative fees. The SJVAPCD then verifies that the appropriate emission reductions have been achieved to qualify as mitigation for a project's emission increases.

The SJVAPCD has proven experience that implementation of a VERA is a feasible mitigation measure under the California Environmental Quality Act (CEQA), achieving emission reductions to reduce impacts to a less-than-significant level. Furthermore, the SJVAPCD adopted Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs) to obtain credit under the State Implementation Plan (SIP) for its incentive programs to reduce emissions from sources that are not otherwise reduced by federal, state, or SJVAPCD regulatory measures. On April 9, 2015, EPA finalized a limited approval and limited disapproval (for a minor administrative error) of Rule 9610 as a revision to the California SIP. Additional documentation regarding the effectiveness of the SJVAPCD's incentive programs can be found in *2015 Annual Demonstration Report SIP Credit for Emission Reductions Generated Through Incentive Programs* (SJVAPCD 2015a). Accordingly, the SJVAPCD has a strong motivation for the efficacy of its incentive programs funded by Indirect Source Review and VERAs.

The VERA is included herein as a project design feature. The VERA will offset project-generated emissions in excess of the SJVAPCD mass annual thresholds after accounting for compliance with SJVAPCD Rule 9510.

2 AIR QUALITY

2.1 Environmental Setting

2.1.1 Climate and Topography

As discussed in Section 1, the Project is located within the SJVAB,[1] which consists of eight counties and is spread across 25,000 square miles of Central California. The SJVAB is bordered on the east by the Sierra Nevada (8,000–14,491 feet in elevation), on the west by the Coast Ranges (averaging 3,000 feet in elevation), and to the south by the Tehachapi Mountains (6,000–7,981 feet in elevation). The San Joaquin Valley comprises the southern half of California's Central Valley, is approximately 250 miles long, and averages 35 miles wide with a slight downward elevation gradient from Bakersfield in the southeast end (elevation 408 feet) to sea level at the northwest end where the San Joaquin Valley opens to the San Francisco Bay at the Carquinez Strait. Its northern end in the Sacramento Valley comprises the northern half of California's Central Valley. The region's topographic features restrict air movement through and out of the SJVAB. As a result, the SJVAB is highly susceptible to pollutant accumulation over time.

The San Joaquin Valley is in a Mediterranean Climate Zone, influenced by a subtropical high-pressure cell most of the year and characterized by warm, dry summers and cooler winters. Mediterranean climates are characterized by sparse rainfall, which occurs mainly in winter. Summertime maximum temperatures in the San Joaquin Valley often exceed 100 degrees Fahrenheit (°F). The San Joaquin Valley Air Basin (SJVAB) averages 10.6 inches of precipitation per year (WRCC 2017).

The vertical dispersion of air pollutants in the San Joaquin Valley can be limited by the presence of persistent temperature inversions. Air temperatures usually decrease with an increase in altitude. A reversal of this atmospheric state, where the air temperatures increases with height, is termed an inversion. A temperature inversion can act like a lid, restricting vertical mixing of air above and below an inversion because of differences in air density and thereby trapping air pollutants below the inversion. The subtropical high-pressure cell is strongest during spring, summer, and fall and produces subsiding air, which can result in air temperature inversions. Most of the surrounding mountains are above the normal height of summer inversions (1,500–3,000 feet). Wintertime high-pressure events can often last many weeks with surface temperatures lowering into 30°F–40°F. During these events, fog can be present and inversions are extremely strong. These wintertime inversions can inhibit vertical mixing of pollutant to a few hundred feet.

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[1] Descriptions of climate and topography are based on the SJVAPCD's *Guidance for Assessing and Mitigating Air Quality Impacts* (SJVAPCD 2015c).

Wind speed and direction play an important role in dispersion and transport of air pollutants. Winds in the San Joaquin Valley most frequently blow from the northwesterly direction, especially in the summer. The region's topographic features restrict air movement and channel the air mass towards the southeastern end of the San Joaquin Valley. Marine air can flow into the SJVAB from the Sacramento–San Joaquin River Delta and over Altamont Pass and Pacheco Pass. From there, it can flow through the San Joaquin Valley, over the Tehachapi Pass, and into the Mojave Desert Air Basin. The Coastal Range and the Sierra Nevada are barriers to air movement to the west and east, respectively. A secondary but significant summer wind pattern is from the southeasterly direction and can be associated with nighttime drainage winds, prefrontal conditions, and summer monsoons. During winter, winds can be very weak, which minimizes the transport of pollutants and results in stagnation events.

Two significant diurnal wind cycles that occur frequently in the San Joaquin Valley are the sea breeze and mountain-valley upslope and drainage flows. The sea breeze can accentuate the northwest wind flow, especially on summer afternoons. Nighttime drainage flows can accentuate the southeast movement of air down the San Joaquin Valley. In the mountains during periods of weak synoptic scale winds, winds tend to be upslope during the day and downslope at night. Nighttime and drainage flows are pronounced during the winter when flow from the easterly direction is enhanced by nighttime cooling in the Sierra Nevada. Eddies can form in the valley wind flow and can recirculate a polluted air mass for an extended period.

Solar radiation and temperature are particularly important in the chemistry of O_3 formation. The SJVAB averages over 260 sunny days per year. Photochemical air pollution (primarily O_3) results from the atmospheric ROGs and NO_2 under the influence of sunlight. O_3 concentrations are very dependent on the amount of solar radiation, especially during late spring, summer and early fall. O_3 levels typically peak in the afternoon. After the sun goes down, the chemical reaction between N_2O and O_3 begins to dominate. This reaction tends to reduce O_3 concentrations in the metropolitan areas through the early morning hours. At sunrise, NO_x tend to peak, partly due to low levels of O_3 at this time and also due to the morning commuter vehicle emissions of NO_x.

Reaction rates generally increase with temperature, which results in greater O_3 production at higher temperatures. However, extremely hot temperatures can "lift" or "break" the inversion layer. Typically, if the inversion layer remains intact, O_3 levels peak in the late afternoon. If the inversion layer breaks and the resultant afternoon winds occur, O_3 levels peak in the early afternoon and decrease in the late afternoon as the contaminants are dispersed or transported out of the SJVAB. O_3 levels are low during winter periods when there is much less sunlight to drive the photochemical reaction.

2.1.2 Pollutants and Effects

2.1.2.1 Criteria Air Pollutants

Criteria air pollutants are defined as pollutants for which the federal and state governments have established ambient air quality standards, or criteria, for outdoor concentrations to protect public health. The federal and state standards have been set, with an adequate margin of safety, at levels above which concentrations could be harmful to human health and welfare. These standards are designed to protect the most sensitive persons from illness or discomfort. Pollutants of concern include O_3, NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, and Pb. These pollutants, as well as TACs, are discussed in the following text.[2] In California, sulfates, vinyl chloride, hydrogen sulfide, and visibility-reducing particles are also regulated as criteria air pollutants.

Ozone. O_3 is a strong-smelling, pale blue, reactive, toxic chemical gas consisting of three oxygen atoms. It is a secondary pollutant formed in the atmosphere by a photochemical process involving the sun's energy and O_3 precursors, such as hydrocarbons and NO_x[3]. These precursors are mainly NO_x and ROGs. The maximum effects of precursor emissions on O_3 concentrations usually occur several hours after they are emitted and many miles from the source. Meteorology and terrain play major roles in O_3 formation, and ideal conditions occur during summer and early autumn on days with low wind speeds or stagnant air, warm temperatures, and cloudless skies. O_3 exists in the upper atmosphere O_3 layer as well as at the Earth's surface in the troposphere. The O_3 that the U.S. Environmental Protection Agency (EPA) and CARB regulate as a criteria air pollutant is produced close to the ground level, where people live, exercise, and breathe. Ground-level O_3 is a harmful air pollutant that causes numerous adverse health effect and is, thus, considered "bad" O_3. Stratospheric O_3, or "good" O_3, occurs naturally in the upper atmosphere, where it reduces the amount of ultraviolet light (i.e., solar radiation) entering the earth's atmosphere. Without the protection of the beneficial stratospheric O_3 layer, plant and animal life would be seriously harmed.

O_3 in the troposphere causes numerous adverse health effects; short-term exposures (lasting for a few hours) to O_3 at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. These health problems are particularly acute in sensitive receptors such as the sick, the elderly, and young children.

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2 The descriptions of each of the criteria air pollutants and associated health effects are based on the EPA's Criteria Air Pollutants (EPA 2016d) and the CARB Glossary of Air Pollutant Terms (CARB 2016a).

3 NO_x is a general term pertaining to compounds of nitric oxide (NO), NO_2 and other oxides of nitrogen.

Nitrogen Dioxide. NO_2 is a brownish, highly reactive gas that is present in all urban atmospheres. The major mechanism for the formation of NO_2 in the atmosphere is the oxidation of the primary air pollutant nitric oxide, which is a colorless, odorless gas. NO_x plays a major role, together with ROGs, in the atmospheric reactions that produce O_3. NO_x is formed from fuel combustion under high temperature or pressure. In addition, NO_x is an notable precursor to acid rain and may affect both terrestrial and aquatic ecosystems. The two major emissions sources are transportation and stationary fuel combustion such as electric utility and industrial boilers. NO_2 can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Carbon Monoxide. CO is a colorless, odorless gas formed by the incomplete combustion of hydrocarbon, or fossil fuels. CO is emitted almost exclusively from motor vehicles, power plants, refineries, industrial boilers, ships, aircraft, and trains. In urban areas, such as the Project location, automobile exhaust accounts for the majority of CO emissions. CO is a nonreactive air pollutant that dissipates relatively quickly; therefore, ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic. CO concentrations are influenced by local meteorological conditions—primarily wind speed, topography, and atmospheric stability. CO from motor vehicle exhaust can become locally concentrated when surface-based temperature inversions are combined with calm atmospheric conditions, which is a typical situation at dusk in urban areas from November to February. The highest levels of CO typically occur during the colder months of the year, when inversion conditions are more frequent.

In terms of adverse health effects, CO competes with oxygen, often replacing it in the blood, reducing the blood's ability to transport oxygen to vital organs. The results of excess CO exposure can include dizziness, fatigue, and impairment of central nervous system functions.

Sulfur Dioxide. SO_2 is a colorless, pungent gas formed primarily from incomplete combustion of sulfur-containing fossil fuels. The main sources of SO_2 are coal and oil used in power plants and industries; as such, the highest levels of SO_2 are generally found near large industrial complexes. In recent years, SO_2 concentrations have been reduced by the increasingly stringent controls placed on stationary source emissions of SO_2 and limits on the sulfur content of fuels.

SO_2 is an irritant gas that attacks the throat and lungs and can cause acute respiratory symptoms and diminished ventilator function in children. When combined with particulate matter, SO_2 can injure lung tissue and reduce visibility and the level of sunlight. SO_2 can also yellow plant leaves and erode iron and steel.

Particulate Matter. Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter can form when gases emitted from industries and motor vehicles undergo chemical reactions in the atmosphere. $PM_{2.5}$ and PM_{10} represent fractions of particulate matter. Coarse particulate matter (PM_{10}) is about 1/7 the thickness of a human hair. Major sources of PM_{10} include crushing or grinding operations; dust stirred up by vehicles traveling on roads; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Fine particulate matter ($PM_{2.5}$) is roughly 1/28 the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (e.g., from motor vehicles and power generation and industrial facilities), residential fireplaces, and woodstoves. In addition, $PM_{2.5}$ can form in the atmosphere from gases such as SO_x, NO_x, and ROGs.

$PM_{2.5}$ and PM_{10} pose a greater health risk than larger-size particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. $PM_{2.5}$ and PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Very small particles of substances such as Pb, sulfates, and nitrates can cause lung damage directly or be absorbed into the blood stream, causing damage elsewhere in the body. Additionally, these substances can transport adsorbed gases such as chlorides or ammonium into the lungs, also causing injury. PM_{10} tends to collect in the upper portion of the respiratory system, whereas $PM_{2.5}$ is so tiny that it can penetrate deeper into the lungs and damage lung tissue. Suspended particulates also damage and discolor surfaces on which they settle and produce haze and reduce regional visibility.

People with influenza, people with chronic respiratory and cardiovascular diseases, and the elderly may suffer worsening illness and premature death as a result of breathing particulate matter. People with bronchitis can expect aggravated symptoms from breathing particulate matter. Children may experience a decline in lung function due to breathing PM_{10} and $PM_{2.5}$. Other groups considered sensitive are smokers, people who cannot breathe well through their noses, and exercising athletes (because many breathe through their mouths).

Lead. Pb in the atmosphere occurs as particulate matter. Sources of Pb include leaded gasoline; the manufacturing of batteries, paints, ink, ceramics, and ammunition; and secondary lead smelters. Prior to 1978, mobile emissions were the primary source of atmospheric Pb. Between 1978 and 1987, the phaseout of leaded gasoline reduced the overall inventory of airborne lead by nearly 95%. With the phaseout of leaded gasoline, secondary lead smelters, battery recycling, and manufacturing facilities are becoming Pb-emissions sources of greater concern.

Prolonged exposure to atmospheric Pb poses a serious threat to human health. Health effects associated with exposure to Pb include gastrointestinal disturbances, anemia, kidney disease, and in severe cases, neuromuscular and neurological dysfunction. Of particular concern are low-level

Pb exposures during infancy and childhood. Such exposures are associated with decrements in neurobehavioral performance, including intelligence quotient performance, psychomotor performance, reaction time, and growth. Children are highly susceptible to the effects of Pb.

Reactive organic gases. Hydrocarbons are organic gases that are formed from hydrogen and carbon and sometimes other elements. Hydrocarbons that contribute to formation of O_3 are referred to and regulated as ROGs (also referred to as ROGs). Combustion engine exhaust, oil refineries, and fossil-fueled power plants are the sources of hydrocarbons. Other sources of hydrocarbons include evaporation from petroleum fuels, solvents, dry cleaning solutions, and paint.

The primary health effects of ROGs result from the formation of O_3 and its related health effects. High levels of ROGs in the atmosphere can interfere with oxygen intake by reducing the amount of available oxygen through displacement. Carcinogenic forms of hydrocarbons, such as benzene, are considered TACs. There are no separate health standards for ROGs as a group.

2.1.2.2 Non-Criteria Air Pollutants

Toxic Air Contaminants. A substance is considered toxic if it has the potential to cause adverse health effects in humans, including increasing the risk of cancer upon exposure or acute and/or chronic non-cancer health effects. A toxic substance released into the air is considered a TAC. TACs are identified by federal and state agencies based on a review of available scientific evidence. In California, TACs are identified through a two-step process that was established in 1983 under the Toxic Air Contaminant Identification and Control Act. This two-step process of risk identification and risk management and reduction was designed to protect residents from the health effects of toxic substances in the air. In addition, the California Air Toxics "Hot Spots" Information and Assessment Act, Assembly Bill (AB) 2588, was enacted by the legislature in 1987 to address public concern over the release of TACs into the atmosphere. The law requires facilities emitting toxic substances to provide local air pollution control districts with information that will allow an assessment of the air toxics problem, identification of air toxics emissions sources, location of resulting hotspots, notification of the public exposed to significant risk, and development of effective strategies to reduce potential risks to the public over 5 years.

Examples include certain aromatic and chlorinated hydrocarbons, certain metals, and asbestos. TACs are generated by a number of sources, including stationary sources (e.g., dry cleaners, gas stations, combustion sources, and laboratories), mobile sources (e.g., automobiles), and area sources (e.g., landfills). Adverse health effects associated with exposure to TACs may include carcinogenic effects (i.e., cancer-causing) and noncarcinogenic effects. Noncarcinogenic effects typically affect one or more target organ systems and may be experienced on either short-term (acute) or long-term (chronic) exposure to a given TAC.

Diesel Particulate Matter. DPM is part of a complex mixture that makes up diesel exhaust. Diesel exhaust is composed of two phases, gas and particle, both of which contribute to health risks. CARB classified "particulate emissions from diesel-fueled engines" (i.e., DPM; 17 CCR 93000) as a TAC in August 1998. DPM is emitted from a broad range of diesel engines: on-road diesel engines of trucks, buses, and cars and off-road diesel engines, including locomotives, marine vessels, and heavy-duty construction equipment, among others. Approximately 70% of all airborne cancer risk in California is associated with DPM (CARB 2000). To reduce the cancer risk associated with DPM, CARB adopted a diesel risk reduction plan in 2000 (CARB 2000).

Valley Fever. Coccidioidomycosis, more commonly known as "Valley Fever," is an infection caused by inhalation of the spores of the *Coccidioides immitis* fungus, which grows in the soils of the southwestern United States. The spores can be found in some areas naturally occurring in soils, can become airborne when the soil is disturbed, and can subsequently be inhaled into the lungs. Valley Fever symptoms occur within two to three weeks of exposure. Approximately 60 percent of Valley Fever cases are mild and display flu-like symptoms or no symptoms at all. The fungus is very prevalent in the soils of California's San Joaquin Valley, including in Fresno County. Fresno County, with more than 10 cases annually of Valley Fever per 100,000 people based on the incidence rates reported from 2008-2012 (California Department of Public Health, 2016). Coccidioides is thought to grow best in soil after heavy rainfall and then disperse into the air most effectively during hot, dry conditions New residents to the San Joaquin Valley have usually never been exposed to Valley Fever, and as a result are particularly susceptible to the infection. Many longtime residents of the area have at some time been exposed to the fungus, become infected, and have recovered, and are thus immune.

2.1.3 Sensitive Receptors

Some land uses are considered more sensitive to changes in air quality than others, depending on the population groups and the activities involved. People most likely to be affected by air pollution include children, the elderly, athletes, and people with cardiovascular and chronic respiratory diseases. Facilities and structures where these air pollution-sensitive people live or spend considerable amounts of time are known as sensitive receptors. Land uses where air pollution-sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities (sensitive sites or sensitive land uses) (CARB 2005). The SJVAPCD considers hospitals, schools, parks, playgrounds, daycare centers, nursing homes, convalescent facilities, and residential areas as sensitive receptor land uses (SJVAPCD 2015c).

The greatest potential for exposure of sensitive receptors to air contaminants would occur during the temporary construction phase, when soil would be disturbed and equipment would be used for site grading, materials delivery, and PV solar panel installation. Potential exposure to emissions would vary substantially from day to day, depending on the amount of work being conducted, weather conditions, location of receptors, and exposure time. The construction-phase emissions in this analysis are estimated conservatively based on worst-case conditions, with maximum levels of construction activity occurring simultaneously within a short period of time. The nearest sensitive receptors are scattered rural residential land uses. Residential land uses have the highest potential to be affected by the Project, in particular single-family or multiple-family residences located in the surrounding community within 1 mile (5,280 feet) of the Project site. There are several agricultural properties adjacent to the Project site. The closest residential structures to the Project site is approximately 3,850 feet west of the Project site boundary along California Avenue. The next closest sensitive receptor is another residence approximately 4,800 feet west of the Project site at the corner of West Jensen Avenue and South San Diego Avenue.

2.2 Regulatory Setting

2.2.1 Federal Regulations

2.2.1.1 Criteria Air Pollutants

The federal Clean Air Act, passed in 1970 and last amended in 1990, forms the basis for the national air pollution control effort. The EPA is responsible for implementing most aspects of the Clean Air Act, including setting National Ambient Air Quality Standards (NAAQS) for major air pollutants; setting hazardous air pollutant (HAP) standards; approving state attainment plans; setting motor vehicle emission standards; issuing stationary source emission standards and permits; and establishing acid rain control measures, stratospheric O_3 protection measures, and enforcement provisions. Under the Clean Air Act, NAAQS are established for the following criteria pollutants: O_3, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and Pb.

The NAAQS describe acceptable air quality conditions designed to protect the health and welfare of the citizens of the nation. The NAAQS (other than for O_3, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and those based on annual averages or arithmetic mean) are not to be exceeded more than once per year. NAAQS for O_3, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ are based on statistical calculations over 1-year to 3-year periods, depending on the pollutant. The Clean Air Act requires the EPA to reassess the NAAQS at least every 5 years to determine whether adopted standards are adequate to protect public health based on current scientific evidence. States with areas that exceed the NAAQS must prepare a state implementation plan that demonstrates how those areas will attain the standards within mandated time frames.

2.2.1.2 *Hazardous Air Pollutants*

The 1977 federal Clean Air Act amendments required the EPA to identify National Emission Standards for HAPs to protect public health and welfare. HAPs include certain volatile organic chemicals, pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. The 1990 federal Clean Air Act Amendments, which expanded the control program for HAPs, identified 189 substances and chemical families as HAPs.

2.2.2 State Regulations

2.2.2.1 *Criteria Air Pollutants*

The federal Clean Air Act delegates the regulation of air pollution control and the enforcement of the NAAQS to the states. In California, the task of air quality management and regulation has been legislatively granted to CARB, with subsidiary responsibilities assigned to air quality management districts and air pollution control districts at the regional and county levels. CARB, which became part of the EPA in 1991, is responsible for ensuring implementation of the California Clean Air Act of 1988, responding to the federal Clean Air Act, and regulating emissions from motor vehicles and consumer products.

CARB has established California Ambient Air Quality Standards (CAAQS), which are generally more restrictive than the NAAQS. The CAAQS describe adverse conditions; that is, pollution levels must be below these standards before a basin can attain the standard. Air quality is considered "in attainment" if pollutant levels are continuously below the CAAQS and violate the standards no more than once each year. The CAAQS for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and $PM_{2.5}$ and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. The NAAQS and CAAQS are presented in Table 1.

Table 1
Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentration[c]	*Primary*[c,d]	*Secondary*[c,e]
O_3	1 hour	0.09 ppm (180 μg/m³)	—	Same as primary standard[f]
	8 hours	0.070 ppm (137 μg/m³)	0.070 ppm (137 μg/m³)[f]	
NO_2[g]	1 hour	0.18 ppm (339 μg/m³)	0.100 ppm (188 μg/m³)	Same as primary standard
	Annual arithmetic mean	0.030 ppm (57 μg/m³)	0.053 ppm (100 μg/m³)	
CO	1 hour	20 ppm (23 mg/m³)	35 ppm (40 mg/m³)	None
	8 hours	9.0 ppm (10 mg/m³)	9 ppm (10 mg/m³)	

Table 1
Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentration[c]	*Primary*[c,d]	*Secondary*[c,e]
SO_2[h]	1 hour	0.25 ppm (655 μg/m³)	0.075 ppm (196 μg/m³)	—
	3 hours	—	—	0.5 ppm (1,300 μg/m³)
	24 hours	0.04 ppm (105 μg/m³)	0.14 ppm (for certain areas)[g]	—
	Annual	—	0.030 ppm (for certain areas)[g]	—
PM_{10}[i]	24 hours	50 μg/m³	150 μg/m³	Same as primary standard
	Annual arithmetic mean	20 μg/m³	—	
$PM_{2.5}$[i]	24 hours	—	35 μg/m³	Same as primary standard
	Annual arithmetic mean	12 μg/m³	12.0 μg/m³	15.0 μg/m³
Pb[j,k]	30-day average	1.5 μg/m³	—	—
	Calendar quarter	—	1.5 μg/m³ (for certain areas)[k]	Same as primary standard
	Rolling 3-month average	—	0.15 μg/m³	
Hydrogen sulfide	1 hour	0.03 ppm (42 μg/m³)	—	—
Vinyl chloride[j]	24 hours	0.01 ppm (26 μg/m³)	—	—
Sulfates	24 hours	25 μg/m³	—	—
Visibility reducing particles	8 hour (10:00 a.m. to 6:00 p.m. PST)	Insufficient amount to produce an extinction coefficient of 0.23 per kilometer due to the number of particles when the relative humidity is less than 70%	—	—

Source: CARB 2016b.

Notes: μg = micrograms; m³ = cubic meter; mg = milligrams; NO_2 = nitrogen dioxide; O_3 = ozone; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns; ppm = parts per million by volume; SO_2 = sulfur dioxide

[a] California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, suspended particulate matter (PM_{10}, $PM_{2.5}$), and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[b] National standards (other than O_3, NO_2, SO_2, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once per year. The O_3 standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m³ is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standard.

[c] Concentration is expressed first in units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[e] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] On October 1, 2015, the national 8-hour O_3 primary and secondary standards were lowered from 0.075 ppm to 0.070 ppm.

[g] To attain the national 1-hour standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 parts per billion (ppb). Note that the national 1-hour standard is in units of ppb. California standards are in units of ppm. To directly compare the national 1-hour standard to the California standards, the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

[h] On June 2, 2010, a new 1-hour SO_2 standard was established, and the existing 24-hour and annual primary standards were revoked. To attain the national 1-hour standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment of the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

[i] On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM_{10} standards (primary and secondary) of 150 $\mu g/m^3$ were also retained. The form of the annual primary and secondary standards is the annual mean averaged over 3 years.

[j] CARB has identified Pb and vinyl chloride as TACs with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[k] The national standard for Pb was revised on October 15, 2008, to a rolling 3-month average. The 1978 Pb standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

2.2.2.2 Toxic Air Contaminants

The state Air Toxics Program was established in 1983 under AB 1807 (Tanner). The California TAC list identifies more than 700 pollutants, of which carcinogenic and noncarcinogenic toxicity criteria have been established for a subset of these pollutants pursuant to the California Health and Safety Code. In accordance with AB 2728, the state list includes the (federal) HAPs. The Air Toxics “Hot Spots” Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not regulate air toxics emissions. TAC emissions from individual facilities are quantified and prioritized. “High-priority” facilities are required to perform a health risk assessment, and if specific thresholds are exceeded, facilities are required to communicate the results to the public in the form of notices and public meetings.

In 2000, CARB approved a comprehensive Diesel Risk Reduction Plan to reduce diesel emissions from both new and existing diesel-fueled vehicles and engines. The regulation is anticipated to result in an 80% decrease in statewide diesel health risk in 2020 compared with the diesel risk in 2000. Additional regulations apply to new trucks and diesel fuel, including the On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation, On-Road Heavy Duty (New) Vehicle Program, In-Use Off-Road Diesel Vehicle Regulation, and New Off-Road Compression-Ignition (Diesel) Engines and Equipment program. These regulations and programs have timetables by which manufacturers must comply and existing operators must upgrade their diesel powered equipment. Several Airborne Toxic Control Measures reduce diesel emissions, including In-Use Off-Road Diesel-Fueled Fleets (13 CCR 2449 et seq.) and In-Use On-Road Diesel-Fueled Vehicles (13 CCR 2025).

California Health and Safety Code Section 41700

This section of the Health and Safety Code states that a person shall not discharge from any source whatsoever quantities of air contaminants or other material that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public; or that endanger the comfort, repose, health, or safety of any of those persons or the public; or that cause, or have a natural tendency to cause, injury or damage to business or property. This section also applies to sources of objectionable odors.

2.2.3 Local Regulations

2.2.3.1 San Joaquin Valley Air Pollution Control District

The SJVAPCD is the regional agency responsible for the regulation and enforcement of federal, state, and local air pollution control regulations in the SJVAB. The SJVAPCD jurisdiction includes all of Merced, San Joaquin, Stanislaus, Madera, Fresno, Kings, and Tulare Counties, and the San Joaquin Valley portion of Kern County.

The SJVAPCD has prepared several air quality attainment plans to achieve the O_3 and particulate matter standards, the most recent of which include the *2014 Reasonably Available Control Technology Demonstration for the 8-Hour Ozone State Implementation Plan* (SJVAPCD 2014b), *2013 Plan for the Revoked 1-Hour Ozone Standard* (SJVAPCD 2013a), *2007 PM_{10} Maintenance Plan and Request for Redesignation* (SJVAPCD 2007), *2012 $PM_{2.5}$ Plan* (SJVAPCD 2012), and *2015 Plan for the 1997 $PM_{2.5}$ Standard* (SJVAPCD 2015b). The following sections summarize key elements of these and other recent air quality attainment plans.

Ozone Attainment Plans

Extreme 1-Hour Ozone Attainment Demonstration Plan

The *Extreme 1-Hour Ozone Attainment Demonstration Plan*, adopted by the SJVAPCD Governing Board October 8, 2004, sets forth measures and emission-reduction strategies designed to attain the federal 1-hour O_3 standard by November 15, 2010, as well as an emissions inventory, outreach, and rate of progress demonstration. This plan was approved by the EPA on March 8, 2010; however, the EPA's approval was subsequently withdrawn effective November 26, 2012, in response to a decision issued by the U.S. Court of Appeals for the Ninth Circuit (*Sierra Club v. EPA*, 671 F.3d 955) remanding EPA's approval of these State Implementation Plan (SIP) revisions. Concurrent with the EPA's final rule, CARB withdrew the 2004 plan. The SJVAPCD developed a new plan for the 1-hour O_3 standard, the *2013 Plan for the Revoked 1-Hour Ozone Standard*, which it adopted in September 2013.

2007 8-Hour Ozone Plan

The *2007 8-Hour Ozone Plan*, adopted by the Governing Board on April 30, 2007, sets forth measures and a "dual path" strategy to attain the federal 1997 8-hour O_3 standard by 2023 for the SJVAB by reducing emissions of O_3 and particulate matter precursors (SJVAPCD 2007). The plan also includes provisions for improved pollution control technologies for mobile and stationary sources, as well as an increase in state and federal funding for incentive-based measures to reduce emissions. Local measures would have been adopted by the SJVAPCD before 2012. This plan was approved by the EPA on April 30, 2012. On November 26, 2012, however, the EPA withdrew its determination that the plan satisfied the federal Clean Air Act requirements regarding emissions growth caused by growth in vehicle miles traveled. Other determinations in the EPA's March 1, 2012, rule approving the plan remain unchanged and in effect. The SJVAPCD is currently in the process of developing an O_3 plan to address EPA's 2008 8-hour O_3 standard, with attainment required by 2032.

2009 Reasonably Available Control Technology Demonstration for Ozone State Implementation Plans

On April 16, 2009, the Governing Board adopted the *Reasonably Available Control Technology Demonstration for Ozone State Implementation Plans* (2009 RACT SIP) (SJVAPCD 2009a). In part, the 2009 RACT SIP satisfied the commitment by the SJVAPCD for a new reasonably available control technology analysis for the 1-hour O_3 plan (see discussion of the EPA withdrawal of approval in the *Extreme 1-Hour Ozone Attainment Demonstration Plan* summary above) and was intended to prevent all sanctions that could be imposed by EPA for failure to submit a required SIP revision for the 1-hour O_3 standard. With respect to the 8-hour standard, the plan also assesses the SJVAPCD's rules based on the adjusted major source definition of 10 tons per year (due to the SJVAB's designation as an extreme O_3 nonattainment area), evaluates SJVAPCD rules against new Control Techniques Guidelines promulgated since August 2006, and reviews additional rules and rule amendments that had been adopted by the Governing Board since August 17, 2006, for reasonably available control technology consistency.

2013 Plan for the Revoked 1-Hour Ozone Standard

The SJVAPCD developed a plan for EPA's revoked 1-hour O_3 standard after the EPA withdrew its approval of the 2004 *Extreme 1-Hour Ozone Attainment Demonstration Plan* as a result of litigation. As a result of the litigation, the EPA reinstated previously revoked requirements for 1-hour O_3 attainment plans. The 2013 plan addresses those requirements, including a demonstration of implementation of Reasonably Available Control Measures and a demonstration of a rate of progress averaging 3% annual reductions of ROG or NO_x emissions every 3 years. The *2013 Plan for the Revoked 1-Hour Ozone Standard* was approved by the Governing Board on September 19, 2013 (SJVAPCD 2013a). Based on implementation of the ongoing control measures, preliminary modeling indicates that the SJVAB will attain the 1-hour O_3 standard by 2017, before the final attainment year of 2022 and without relying on long-term measures under the federal Clean Air Act Section 182(e)(5) ("black box reductions").

2014 Reasonably Available Control Technology Demonstration for the 8-Hour Ozone State Implementation Plan

On June 19, 2014, the Governing Board adopted the *2014 Reasonably Available Control Technology Demonstration for the 8-Hour Ozone State Implementation Plan* (SJVAPCD 2014b). This RACT SIP includes a demonstration that the SJVAPCD rules implement RACT. The plan reviews each of the NO_x reduction rules and concludes that they satisfy requirements for stringency, applicability, and enforceability, and meet or exceed RACT. The plan's analysis of further ROG reductions through modeling and technical analyses demonstrates that added ROG reductions will not advance SJVAB's O_3 attainment. Each ROG (i.e., ROG) rule evaluated in the 2009 RACT SIP, however, has been subsequently approved by the EPA as meeting RACT within the last 2 years. The O_3 attainment strategy, therefore, focuses on further NO_x reductions.

Particulate Matter Attainment Plans

2007 PM_{10} Maintenance Plan and Request for Redesignation

On September 20, 2007, the Governing Board approved the *2007 PM_{10} Maintenance Plan and Request for Redesignation* (SJVAPCD 2007). After achieving compliance with the annual and 24-hour NAAQS for PM_{10} during the period from 2003 to 2006,[4] the SJVAPCD prepared the *2007 PM_{10} Maintenance Plan and Request for Redesignation*. The plan includes future emission estimates through 2020 and, based on modeling, projects that SJVAB will continue to attain the PM_{10} NAAQS through 2020. The plan does not call for adoption of new control measures. Measures called for in the *2007 8-Hour Ozone Plan* and *2008 $PM_{2.5}$ Plan* (discussed subsequently) will also produce PM_{10} benefits; however, the plan does include a contingency plan if future PM_{10} levels were to exceed the NAAQS. It also includes a request that the EPA redesignate the SJVAB to attainment status for the PM_{10} NAAQS. On October 25, 2007, CARB approved the SJVAPCD's plan with modifications to the transportation conformity budgets. On September 25, 2008, the EPA redesignated the SJVAB to attainment for the PM_{10} NAAQS and approved the PM_{10} maintenance plan.

4 Attainment is achieved if the 3-year annual average PM_{10} concentration is less than or equal to 50 $\mu g/m^3$ and the expected 24-hour exceedance days is less than or equal to 1.0.

2008 $PM_{2.5}$ Plan

The SJVAPCD Governing Board adopted the *2008 $PM_{2.5}$ Plan* on April 30, 2008 (SJVAPCD 2008). This plan is designed to assist the SJVAB in attaining $PM_{2.5}$ standards, including the 1997 federal standards, 2006 federal standards, and state standard, as soon as possible. On July 13, 2011, the EPA issued a proposed rule partially approving and disapproving the *2008 $PM_{2.5}$ Plan*. Subsequently, on November 9, 2011, the EPA issued a final rule approving most of the plan with an effective date of January 9, 2012. However, the EPA disapproved the plan's contingency measures because they would not provide sufficient emission reductions.

2012 $PM_{2.5}$ Plan

Approved by the Governing Board on December 20, 2012, the *2012 $PM_{2.5}$ Plan* addresses attainment of EPA's 24-hour $PM_{2.5}$ standard of 35 micrograms (µg) per cubic meter (m^3), established in 2006. In addition to reducing direct emissions of $PM_{2.5}$, this plan focuses on reducing emissions of NO_x, which is a predominant pollutant in the formation of $PM_{2.5}$ in the SJVAB. The plan relies on a multilevel approach to reducing emissions through SJVAPCD efforts (industry, the general public, employers, and small businesses) and state/federal efforts (passenger vehicles, heavy-duty trucks, and off-road sources), as well as SJVAPCD and state/federal incentive programs to accelerate replacement of on-road and off-road vehicles and equipment. Through compliance with this attainment plan, the SJVAB would achieve attainment of the federal $PM_{2.5}$ standard by the attainment deadline of 2019, with the majority of the SJVAB actually experiencing attainment well before the deadline. The EPA lowered the $PM_{2.5}$ standard again in 2012 and is in the process of completing attainment designations.

2015 Plan for the 1997 $PM_{2.5}$ Standard

The Governing Board adopted the *2015 Plan for the 1997 $PM_{2.5}$ Standard* on April 16, 2015 (SJVAPCD 2015b). This plan addresses the EPA's annual $PM_{2.5}$ standard of 15 micrograms (µg) per m^3 and 24-hour $PM_{2.5}$ standard of 65 $\mu g/m^3$ established in 1997. While nearly achieving the 1997 standards, the SJVAB experienced higher $PM_{2.5}$ levels in winter 2013–2014 due to the extreme drought, stagnation, strong inversions, and historically dry conditions; thus, the SJVAPCD was unable to meet the attainment date of December 31, 2015. Accordingly, this plan also contains a request for a one-time extension of the attainment deadline for the 24-hour standard to 2018 and the annual standard to 2020. The plan builds on past development and implementation of effective control strategies. Consistent with EPA regulations for $PM_{2.5}$ plans to achieve the 1997 standards, the plan contains most stringent measures, best available control measures, and additional enforceable commitments for further reductions in emissions and ensures expeditious attainment of the 1997 standard.

Senate Bill 656 Particulate Matter Control Measure Implementation Schedule

Senate Bill (SB) 656 was enacted in 2003 and codified as California Health and Safety Code Section 39614. SB 656 seeks to reduce exposure to PM_{10} and $PM_{2.5}$ and to make further progress toward attainment of the NAAQS and CAAQS for PM_{10} and $PM_{2.5}$. SB 656 required CARB, in consultation with local air districts, to develop and adopt lists of "the most readily available, feasible, and cost-effective" particulate matter control measures. Subsequently, the air districts were required to adopt implementation schedules for the relevant control measures in their district. In June 2005, the SJVAPCD adopted its SB 656 Particulate Matter Control Measure Implementation Schedule. The SJVAPCD analysis of the CARB list concluded that all but one of the measures that apply to SJVAPCD sources had been implemented or were in one of the SJVAPCD's attainment plans for adoption within the next 2 years. The remaining measure pertains to a future amendment of a rule for gasoline transfer into stationary storage containers, delivery vessels, and bulk plants.

Applicable Rules

Because Project construction and non-vehicular operational activities would be located within SJVAB and fall within the jurisdiction of the SJVAPCD, only SJVAPCD regulations are discussed in this section.

The SJVAPCD's primary means of implementing air quality plans is by adopting and enforcing rules and regulations. Stationary sources within the jurisdiction are regulated by the SJVAPCD's permit authority and through its review and planning activities. Unlike stationary source projects, which encompass very specific types of equipment, process parameters, throughputs, and controls, air emissions sources from land use development projects are mainly mobile sources (traffic) and area sources (small dispersed stationary and other non-mobile sources), including exempt (i.e., no permit required) sources such as consumer products, landscaping equipment, furnaces, and water heaters. Mixed-use land development projects may include nonexempt sources, including devices such as small to large boilers, stationary internal combustion engines, gas stations, or asphalt batch plants.

Notwithstanding nonexempt stationary sources, which would be permitted on a case-by-case basis, SJVAPCD regulations VIII and IX generally apply to land use development projects and are described as follows:

Regulation VIII – Fugitive PM_{10} Prohibition

- Rule 8021 Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities

- Rule 8031 Bulk Materials
- Rule 8041 Carryout and Trackout
- Rule 8051 Open Areas
- Rule 8061 Paved And Unpaved Roads
- Rule 8071 Unpaved Vehicle/Equipment Traffic Areas

Pursuant to Rule 8021 Section 6.3, the Project would be required to develop, prepare, submit, obtain approval of and implement a Dust Control Plan, which would reduce fugitive dust impacts to less than significant for all construction phases of the Project.

Regulation IX – Mobile and Indirect Sources

- Rule 9110 General Conformity
- Rule 9120 Transportation Conformity
- Rule 9410 Employer Based Trip Reduction
- Rule 9510 Indirect Source Review (ISR)

Rule 9510 (Indirect Source Review)

The ISR rule, which was adopted December 15, 2005, and went into effect March 1, 2006, requires developers of new residential, commercial, and some industrial projects to reduce NO_x and PM_{10} emissions generated by their projects. Pursuant to Rule 9510, the purpose of the ISR program is to reduce emissions of NO_x and PM_{10} from new land development projects. In general, development contributes to air pollution in the SJVAB increasing the number of vehicles and vehicle miles traveled. ISR applies to development projects that require discretionary approval from the lead agency. The ISR rule also applies to transportation and transit projects whose construction exhaust emissions would equal or exceed 2 tons per year of NO_x or PM_{10}. The ISR rule requires submittal of an Air Impact Assessment application no later than the date on which application is made for a final discretionary approval from the public agency. The Air Impact Assessment contains the information necessary to calculate both construction and operational emissions of a development Project.

Section 6.0 of the ISR rule outlines general mitigation requirements for developments that include reduction in construction emissions of 20% of the total construction NO_x emissions, and 45% of the total construction PM_{10} exhaust emissions. The rule also requires the Project to reduce operational NO_x emissions by 33.3% and operational PM_{10} emissions by 50%, as compared to the unmitigated baseline. Section 7.0 of the ISR rule includes fee schedules for construction or operational excess emissions of NO_x or PM_{10}—those emissions above the goals identified in Section 6.0 of the rule. Monies collected from this fee are used by the SJVAPCD to fund emission reduction projects in the SJVAB on behalf of the Project.

Rule 9610 State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs

Rule 9610 provides an administrative mechanism for the SJVAPCD to receive credit towards SIP requirements for emission reductions achieved in the SJVAB through incentive programs administered by the SJVAPCD, United States Department of Agriculture Natural Resources Conservation Service, or CARB. On April 9, 2015, EPA finalized a limited approval and limited disapproval (for a minor administrative error) of Rule 9610 as a revision to the California SIP. Additional documentation regarding the effectiveness of the SJVAPCD's incentive programs can be found in *2015 Annual Demonstration Report SIP Credit for Emission Reductions Generated Through Incentive Programs* (SJVAPCD 2015a).

2.2.3.2 Fresno Council of Governments

The FCOG is the regional planning agency for Fresno County and serves as a forum for regional issues relating to transportation, the economy, community development, and the environment. FCOG serves as the federally designated metropolitan planning organization (MPO) for Fresno County. With respect to air quality planning and other regional issues, FCOG has prepared the *2014 Regional Transportation Plan and Sustainable Communities Strategy* (2014 RTP/SCS) for the region (FCOG 2014). The 2014 RTP/SCS is a problem-solving guidance document that directly responds to what FCOG has learned about Fresno County's challenges through the annual State of the Region report card.

In regards to air quality, the 2014 RTP/SCS sets the policy context in which FCOG participates in and responds to the air districts air quality plans and builds off the air districts air quality plans processes that are designed to meet health-based criteria pollutant standards in several ways (FCOG 2014). First, it complements air quality plans by providing guidance and incentives for public agencies to consider best practices that support the technology-based control measures in air quality plans. Second, the 2014 RTP/SCS emphasizes the need for local initiatives that can reduce the region's GHG emissions that contribute to climate change, an issue that is largely outside the focus of local attainment plans, which is assessed in Section 3. Third, the 2014 RTP/SCS emphasizes the need for better coordination of land use and transportation planning, which heavily influences the emissions inventory from the transportation sectors of the economy. This also minimizes land use conflicts, such as residential development near freeways, industrial areas, or other sources of air pollution.

Under the guidance of the RTP Roundtable, FCOG staff developed four scenarios (scenarios A, B, C and D) with combined land use and transportation elements, and performed technical analysis for these four scenarios. Three of the scenarios were taken to the public for review and comment in August and September 2013. In September 2013, the Coalition of Community Based Organizations proposed a fourth scenario (Scenario D) and FCOG staff was directed by our Transportation Technical Committee and Policy Advisory Committee to analyze it and report the resulting data. At their meeting on November 21, 2013, the FCOG Policy Board unanimously selected Scenario B as their Preferred Scenario (FCOG 2014).

2.3 Regional and Local Air Quality Conditions

2.3.1 San Joaquin Valley Air Basin Attainment Status

Pursuant to the 1990 federal Clean Air Act amendments, the EPA classifies air basins (or portions thereof) as "attainment" or "nonattainment" for each criteria air pollutant, based on whether the NAAQS have been achieved. Generally, if the recorded concentrations of a pollutant are lower than the standard, the area is classified as "attainment" for that pollutant. If an area exceeds the standard, the area is classified as "nonattainment" for that pollutant. If there is not enough data available to determine whether the standard is exceeded in an area, the area is designated as "unclassified" or "unclassifiable." The designation of "unclassifiable/attainment" means that the area meets the standard or is expected to be meet the standard despite a lack of monitoring data. Areas that achieve the standards after a nonattainment designation are redesignated as maintenance areas and must have approved Maintenance Plans to ensure continued attainment of the standards. The California Clean Air Act, like its federal counterpart, called for the designation of areas as "attainment" or "nonattainment," but based on CAAQS rather than the NAAQS. Table 2 depicts the current attainment status of the Project site with respect to the NAAQS and CAAQS. The attainment classifications for the criteria pollutants are outlined in Table 2.

Table 2
San Joaquin Valley Air Basin Attainment Status (Fresno County)

Pollutant	Designation/Classification	
	Federal Standards	*State Standards*
Ozone (O_3) – 1-hour	No federal standard[1]	Nonattainment/severe
Ozone (O_3) – 8-hour	Nonattainment/extreme[2]	Nonattainment
Nitrogen dioxide (NO_2)	Unclassifiable/attainment	Attainment
Carbon monoxide (CO)	Unclassifiable/attainment	Attainment
Sulfur dioxide (SO_2)	Unclassifiable/attainment	Attainment
Respirable particulate matter (PM_{10})	Attainment[3]	Nonattainment
Fine particulate matter ($PM_{2.5}$)	Nonattainment[4]	Nonattainment
Lead (Pb)[5]	Unclassifiable/attainment	Attainment

Table 2
San Joaquin Valley Air Basin Attainment Status (Fresno County)

Pollutant	Designation/Classification	
	Federal Standards	*State Standards*
Sulfates (SO_4)	No federal standard	Attainment
Hydrogen sulfide (H_2S)	No federal standard	Unclassified
Vinyl chloride[5]	No federal standard	No designation
Visibility-reducing particles	No federal standard	Unclassified

Sources: SJVAPCD 2015c; EPA 40 Code of Federal Regulations (CFR) Part 81 (EPA 2016b); and CARB CCR Title 17 Sections 60200-60210 (CARB 2016c).
Notes: Attainment = meets the standards; Attainment (maintenance) = achieve the standards after a nonattainment designation; Nonattainment = does not meet the standards; Unclassified or unclassifiable = insufficient data to classify; Unclassifiable/attainment = meets the standard or is expected to be meet the standard despite a lack of monitoring data.

1 Effective June 15, 2005, the EPA revoked the federal 1-hour O_3 standard, including associated designations and classifications. EPA had previously classified the SJVAB as extreme nonattainment for this standard. EPA approved the 2004 Extreme Ozone Attainment Demonstration Plan (SJVAPCD 2004) on March 8, 2010 (effective April 7, 2010). Many applicable requirements for extreme 1-hour O_3 nonattainment areas continue to apply to the SJVAB.

2 Though the San Joaquin Valley was initially classified as serious nonattainment for the 1997 8-hour O_3 standard, EPA approved San Joaquin Valley reclassification to extreme nonattainment in the Federal Register on May 5, 2010 (effective June 4, 2010).

3 On September 25, 2008, EPA re-designated the San Joaquin Valley to attainment for the PM_{10} NAAQS and approved the PM_{10} Maintenance Plan.

4 The San Joaquin Valley is designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. EPA designated the San Joaquin Valley as nonattainment for the 2006 $PM_{2.5}$ NAAQS on November 13, 2009 (effective December 14, 2009).

5 CARB has identified Pb and vinyl chloride as TACs with no threshold level of exposure for adverse health effects determined.

In summary, the EPA has designated the SJVAB as a nonattainment area for the federal 8-hour O_3 standard, and CARB has designated the SJVAB as a nonattainment area for the state 1-hour and 8-hour O_3 standards. The SJVAB has been designated as a nonattainment area for the state 24-hour and annual PM_{10} standards, nonattainment area for the federal 24-hour and annual $PM_{2.5}$ standards, and nonattainment area for the state annual $PM_{2.5}$ standard. The SJVAB is designated as unclassified or attainment for the other criteria air pollutants.

2.3.2 Local Ambient Air Quality

Under authority and oversight from the EPA pursuant to 40 Code of Federal Regulations (CFR) Part 58, the SJVAPCD and CARB maintain ambient air quality monitoring stations throughout the SJVAB, and the SJVAPCD currently operates six monitoring sites[5]. In addition, the SJVAPCD gathers air quality data from a variety of monitoring sites from other contracted agencies (e.g., United States Marine Corps). Air quality monitoring stations usually measure pollutant concentrations 10 feet above ground level; therefore, air quality is often referred to in

5 Tranquility, Fresno-Sierra Skypark #2, Fresno-Garland, Clovis, Fresno-Drummond, and Parlier.

terms of ground-level concentrations. Not all air pollutants are monitored at each station; thus, data are summarized from the closest representative station that monitors a specific pollutant.

The closest ambient air quality monitoring station to the Project site that monitors O_3 and $PM_{2.5}$ is the Tranquility monitoring station, located at 32650 West Adams Avenue, Tranquility, California 93668, approximately 11 miles to the south of the proposed Project. The data collected at this station are considered representative of the air quality experienced in the Project vicinity. The closest monitoring station for NO_2 would be the Fresno-Sierra Skypark #2 monitoring station, 30 miles to the east. The closest monitoring station for PM_{10} and CO would be the Drummond Street monitoring station in Fresno, approximately 37 miles to the east. The closest monitoring station with SO_2 data was 3727 North First St monitoring station, 38 miles to the east. The most recent background ambient air quality data from 2014 to 2016 and the number of days exceeding the ambient air quality standards are presented in Table 3.

Table 3
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2014	2015	2015
Ozone (O_3) Tranquility, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.09 ppm (state)	0.086	0.88	0.093
Number of days exceeding state standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	0.070 ppm (state)	0.078	0.081	0.082
	0.070 ppm (federal)	0.096	0.105	0.081
Number of days exceeding state standard (days)		*11*	*11*	*21*
Number of days exceeding federal standard (days)		*10*	*10*	*19*
Nitrogen Dioxide (NO_2) Fresno-Sierra Skypark #2, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.18 ppm (state)	0.053	0.036	0.035
	0.100 ppm (federal)	0.053	0.036	0.034
Number of days exceeding state standard (days)		*0*	*0*	*0*
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Annual concentration (ppm)	0.030 ppm (state)	0.008	*	0.006
	0.053 ppm (federal)	0.008	0.007	0.006
Carbon Monoxide (CO) Fresno-Drummond Street, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	20 ppm (state)	—	—	—
	35 ppm (federal)	3.5	2.3	0.8
Number of days exceeding state standard (days)		—	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	9.0 ppm (state)	—	—	—
	9 ppm (federal)	2.5	1.8	0.4
Number of days exceeding state standard (days)		—	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*

Table 3
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2014	2015	2015
Sulfur Dioxide (SO_2) Fresno-First Street, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.075 ppm (federal)	0.0067	0.0108	0.008
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Maximum 24-hour concentration (ppm)	0.14 ppm (federal)	0.027	0.024	0.020
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Annual concentration (ppm)	0.030 ppm (federal)	0.0049	0.0051	0.0046
Coarse Particulate Matter (PM_{10}) Fresno-Drummond Street, California Monitoring Station[c]				
Maximum 24-hour concentration (μg/m³)	50 μg/m³ (state)	102.9	120.7	88.3
	150 μg/m³ (federal)	107.3	116.7	86.3
Number of days exceeding state standard (days)[b]		*16*	*13*	*17*
Number of days exceeding federal standard (days)[b]		*0*	*0*	*0*
Annual concentration (state method) (μg/m³)	20 μg/m³ (state)	41.8	39.4	38.0
Fine Particulate Matter ($PM_{2.5}$) Tranquility, California Monitoring Station[c]				
Maximum 24-hour concentration (μg/m³)	35 μg/m³ (federal)	46.0	50.9	39.7
Number of days exceeding federal standard (days)[b]		*3*	*7*	*3*
Annual concentration (μg/m³)	12 μg/m³ (state)	—	10.0	7.8
	12.0 μg/m³ (federal)	7	—	—

Sources: CARB 2016d; EPA 2016c.

Notes: — = not available; μg/m3 = micrograms per cubic meter; ND = insufficient data available to determine the value; ppm = parts per million Data taken from CARB iADAM (http://www.arb.ca.gov/adam) and EPA AirData (http://www.epa.gov/airdata/) represent the highest concentrations experienced over a given year.

Exceedances of federal and state standards are only shown for O_3, particulate matter, and Carbon Monoxide. Daily exceedances for particulate matter are estimated days because PM_{10} and $PM_{2.5}$ are not monitored daily. All other criteria pollutants did not exceed federal or state standards during the years shown. There is no federal standard for 1-hour O_3, annual PM_{10}, or 24-hour SO_2, nor is there a state 24-hour standard for $PM_{2.5}$.

a Mean does not satisfy minimum data completeness criteria.

b Measurements of PM_{10} and $PM_{2.5}$ are usually collected every 6 days and every 1 to 3 days, respectively. Number of days exceeding the standards is a mathematical estimate of the number of days concentrations would have been greater than the level of the standard had each day been monitored. The numbers in parentheses are the measured number of samples that exceeded the standard.

2.4 Significance Criteria and Methodology

2.4.1 Thresholds of Significance

2.4.1.1 California Environmental Quality Act Guidelines

The State of California has developed guidelines to address the significance of air quality impacts based on Appendix G of the CEQA Guidelines, which provides guidance that a project would have a significant environmental impact if it would (14 CCR 15000 et seq.):

1. Conflict with or obstruct implementation of the applicable air quality plan.

2. Violate any air quality standard or contribute substantially to an existing or projected air quality violation.
3. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for O_3 precursors).
4. Expose sensitive receptors to substantial pollutant concentrations.
5. Create objectionable odors affecting a substantial number of people.

Appendix G of the CEQA Guidelines (14 CCR 15000 et seq.) indicates that, where available, the significance criteria established by the applicable air quality management district or pollution control district may be relied upon to determine whether the project would have a significant impact on air quality.

2.4.1.2 San Joaquin Valley Air Pollution Control District

The SJVAPCD *Guidance for Assessing and Mitigating Air Quality Impacts (GAMAQI)* has established emissions-based thresholds of significance for criteria pollutants (SJVAPCD 2015b), which are depicted in Table 4. As shown in Table 4, the SJVAPCD has established significance thresholds for construction emissions and operational permitted and non-permitted equipment and activities, and it recommends evaluating impact significance for these categories separately. These thresholds of significance are based on a calendar-year basis, although construction emissions are assessed on a rolling 12-month period.

Table 4
San Joaquin Valley Air Pollution Control District California Environmental Quality Act Significance Thresholds for Criteria Pollutants

Pollutant	Construction Emissions (tons per year)	Operational Emissions (tons per year)	
		Permitted Equipment and Activities	*Non-Permitted Equipment and Activities*
ROG	10	10	10
NO_x	10	10	10
CO	100	100	100
SO_x	27	27	27
PM_{10}	15	15	15
$PM_{2.5}$	15	15	15

Source: SJVAPCD 2015b

In addition to the annual emissions mass thresholds described in Table 4, the SJVAPCD has also established screening criteria to determine whether a project would result in a CO hotspot at affected roadway intersections (SJVAPCD 2015b). If neither of the following criteria are met at any of the intersections affected by the project, the project would result in no potential to create a violation of the CO standard:

- A traffic study for the project indicates that the LOS on one or more streets or at one or more intersections in the project vicinity will be reduced to LOS E or F.
- A traffic study indicates that the project will substantially worsen an already existing LOS F on one or more streets or at more or more intersections in the project vicinity.

Toxic Air Contaminants

The SJVAPCD has established thresholds of significance for combined TAC emissions from the operations of both permitted and non-permitted sources (SJVAPCD 2015b). Projects that have the potential to expose the public to TACs in excess of the following thresholds would be considered to have a significant air quality impact:

- Probability of contracting cancer for the maximally exposed individual equals or exceeds 20 in 1 million people.[6]
- Hazard Index[7] for acute and chronic noncarcinogenic TACs equals or exceeds 1 for the maximally exposed individual.

Odors

As described in the *Guidance for Assessing and Mitigating Air Quality Impacts*, due to the subjective nature of odor impacts, there are no quantitative thresholds to determine if potential odors would have a significant impact (SJVAPCD 2015b). Projects must be assessed for odor impacts on a case-by-case basis for the following two situations:

- **Generators:** Projects that would potentially generate odorous emissions proposed to locate near existing sensitive receptors or other land uses where people may congregate.
- **Receivers:** Residential or other sensitive receptor projects or other projects built for the intent of attracting people locating near existing odor sources.

6 The cancer risk threshold was increased from 10 to 20 in 1 million with approval of APR 1906 (Framework for Performing Health Risk Assessments) on June 30, 2015.

7 Non-cancer adverse health impact, both for acute (short-term) and chronic (long-term) health effects, is measured against a hazard index, which is defined as the ratio of the predicted incremental exposure concentration from the project to a published reference exposure level that could cause adverse health effects as established by the Office of Environmental Health Hazard Assessment. The ratio (referred to as the hazard quotient) of each noncarcinogenic substance that affects a certain organ system is added together to produce an overall hazard index for that organ system.

The SJVAPCD has identified some common types of facilities that have been known to produce substantial odors, as well as screening distances between these odor sources and receptors. These are depicted in Table 5.

Table 5
Screening Levels for Potential Odor Sources

Type of Facility	Screening Distance (miles)
Wastewater treatment facility	2
Sanitary landfill	1
Transfer station	1
Composting facility	1
Petroleum facility	2
Asphalt batch plant	1
Chemical manufacturing	1
Fiberglass manufacturing	1
Painting/coating (i.e., auto body shop)	1
Food processing facility	1
Feed lot / dairy	1
Rendering plant	1

Source: SJVAPCD 2015b

If the project would result in an odor source and sensitive receptors being located within these screening distances, additional analysis would be required. For projects involving new receptors locating near an existing odor source where there is currently no nearby development and for new odor sources locating near existing receptors, the SJVAPCD recommends the analysis be based on a review of odor complaints for similar facilities, with consideration also given to local meteorological conditions, particularly the intensity and direction of prevailing winds. Regarding the complaint record of the odor source facility (or similar facility), the facility would be considered to result in significant odors if there has been:

- More than one confirmed complaint per year averaged over a 3-year period, or
- Three unconfirmed complaints[8] per year averaged over a 3-year period.

[8] An unconfirmed complaint means that either the odor/air contaminant release could not be detected or the source/facility cannot be determined (SJVAPCD 2015b).

2.4.2 Approach and Methodology

2.4.2.1 Construction

Construction of the Project would result in the temporary addition of pollutants to the local airshed caused by on-site sources (i.e., off-road construction equipment, soil disturbance, and ROG off-gassing) and off-site sources (i.e., on-road haul trucks, vendor trucks, and worker vehicle trips). Emissions from the construction phase of the Project were estimated using a spreadsheet model utilizing project applicant supplied information.

Construction scenario assumptions, including phasing, equipment mix, and vehicle trips, were based on information provided by the Applicant. For purposes of estimating Project emissions, and based on information provided by the Applicant, it is assumed that construction of the Project would commence in September 2019[9] and would last approximately 12 months, ending in September 2020. The analysis contained herein is based on the following assumptions (duration of phases is approximate):

- Move on: 1 month (September 2019)
- Substation construction: 4.5 months (September 2019–January 2020)
- Gen-tie installation: 6.5 months (September 2019–March 2020)
- Site preparation and grading: 6.5 months (September 2019–March 2020)
- Trenching: 8 months (October 2019–May 2020)
- Solar PV system installation: 7 months (December 2019–June 2020)
- Site clean-up and restoration: 7 month (February 2020–September 2020)

As shown above, several of the construction phases will run concurrently. For the analysis, it was generally assumed that heavy construction equipment would be operating at the site for 5 days per week (22 days per month) during Project construction.

As shown in Table 6, in addition to the daily worker trips to the site, there would be up to 38 truck trips per day at peak construction activity (i.e., when substation construction, gen-tie installation, site prep, trenching, system installation, and cleanup phases overlap). A total of up to 1,538 trips per day are

[9] The analysis assumes a construction start date of September 2019, which represents the earliest date construction would initiate. Assuming the earliest start date for construction represents the worst-case scenario for criteria air pollutant and GHG emissions because equipment and vehicle emission factors for later years would be slightly less due to more stringent standards for in-use off-road equipment and heavy-duty trucks, as well as fleet turnover replacing older equipment and vehicles in later years.

anticipated during peak construction activities, which would last approximately 1-2 months. Unless otherwise stated, all references to "trips" mean one-way trips.

Based on the Applicant's prior experience, it is expected that most workers and locally sourced materials and supplies will come from the greater Fresno area. Delivery of material and supplies would reach the site via on-road truck delivery from Fresno via SR-180. The distance between the Project site and Fresno is approximately 40 miles and, for purposes of determining trip-related air quality impacts, it was assumed that this distance represents a reasonable average trip length for vehicle and truck trips. The majority of the truck deliveries would be for the PV system installation, as well as any aggregate material that may be required for road base. It is estimated that a total of up to 123,200 worker trips are required to complete the Project. It is estimated that there would be an average of 487 truck deliveries per month. These truck trips would be intentionally spread out throughout the construction day to optimize construction efficiency as is practical by scheduling deliveries at predetermined times.

The heaviest delivery loads to the site would also consist of the tracker structures, rock truck deliveries, and the delivery of the high-voltage (substation) transformers. These loads would typically be limited to total weight of 80,000 pounds (lbs), with a cargo load of approximately 25 tons or 50,000 lbs of rock or tracker structures. The high-voltage transformers could be up to 160,000 lbs. Typically, the rock is delivered in "bottom dump trucks" or "transfer trucks" with six axles and the tracker structures will be delivered on traditional flatbed trucks with a minimum of five axles. Low-bed transport trucks would transport the construction equipment to the site as needed. The size of the low-bed truck (axles for weight distribution) would depend on the equipment transported.

Grading would occur at approximately 16.5 acres of the 1,288 acre site. This would be accomplished with scrapers, motor graders, water trucks, dozers, and compaction equipment. It is anticipated the site will be balanced and no import or export of soil will be required. The PV modules would be off-loaded and installed using small cranes, boom trucks, forklifts, rubber tired loaders, rubber tired backhoes, and other small to medium-sized construction equipment as needed. Construction equipment would be delivered to the site on low-bed trucks unless the equipment can be driven to the site (for example the boom trucks).

The construction equipment mix and vehicle trips used for estimating the Project-generated construction emissions are shown in Table 6. The construction equipment fleet would meet SJVAPCD Rule 9510 Indirect Source Review general mitigation requirements.

Table 6
Construction Scenario Assumptions

Construction Phase	One-way Vehicle Trips			Equipment		
	Average Daily Worker Vehicles[1]	*Average Daily Vendor Truck Trips*	*Total Haul Truck Trips*	*Equipment Type*	*Quantity*	*Usage Hours*
Move-on	10	10	50	Grader	2	6
				Rubber Tired Dozers	1	6
				Scrapers	2	6
				Rubber Tired Loaders	2	6
				Tractor/Loader/Backhoe	2	6
				Skid Steer Loader	3	6
				Generator Sets	1	24
				Generators sets	1	12
Substation construction	20	2	0	Other General Industrial Equipment	1	4
				Tractor/Loader/Backhoe	1	4
				Crane	1	5
				Rough Terrain Forklift	2	4
				Ariel lift	1	4
				Graders	1	6
				Rubber Tired Dozer	1	3
				Scraper	1	4
				Rubber Tired Loader	1	3
				Excavator	1	4
				Tractor/Loader/Backhoe	1	6
Gen-tie installation	20	2	0	Tractor/Loader/Backhoe	1	4
				Cranes	1	4
				Crawler tractors	1	4
				Bore/Dill Rings	1	2
				Rough Terrain Forklift	1	4
				Other Construction Equipment	1	4
				Generator Sets	1	4
Site preparation and grading	29	10	0	Pump (Water Pull)	2	8
				Grader	2	8
				Rubber Tired Dozers	1	3
				Scraper	3	6
				Rubber Tired Loader	3	6
				Tractor/Loader/Backhoe	2	6
				Tractor/Loader/Backhoe	2	6
				Roller	1	3
				Skid Steer Loader	2	6
				Generator Sets	1	24
				Generator Sets	1	24

Table 6
Construction Scenario Assumptions

Construction Phase	One-way Vehicle Trips			Equipment		
	Average Daily Worker Vehicles[1]	*Average Daily Vendor Truck Trips*	*Total Haul Truck Trips*	*Equipment Type*	*Quantity*	*Usage Hours*
Underground work	38	10	0	Tractors/Loaders/Backhoe	1	6
				Trenchers	1	6
				Plate Compactors	1	4
				Excavator	1	4
				Trenchers	4	6
				Crushing/Processing Equipment	1	6
				Tractors/Loaders/Backhoe	2	4
				Roller	2	2
System installation	317	10	0	Rough Terrain Forklift	5	4
				Aerial Lift	3	4
				Skid Steer Loaders	10	4
				Air Compressors	1	6
				Other Construction Equipment	7	6
				Generator Sets	1	24
				Generator Sets	1	24
Site cleanup and restoration	25	6	0	Tractors/Loaders/Backhoe	1	4
				Grader	1	6
				Scraper	2	6

[1]4 on-site trips were assumed per worker vehicle and 2 off-site trips were assumed per worker vehicle
See Appendix A for details.

Water consumption during construction is estimated to be up to approximately 200 acre-feet for dust suppression and earthwork over an approximately 12-month period. Construction water would be provided by existing water from the North Star Solar Project. Contingent sources of water include deliveries from Westlands Water District (WWD) or trucking water to the Project site from an off-site source located approximately 1.5 miles west of the Project. Water for operations would be supplied by WWD or, alternatively, by pipeline from the well on the North Star site.

2.4.2.2 Operation

Emissions from the operational phase of the Project were estimated using the CalEEMod version 2016.3.2 and include area, energy, and mobile source emissions. The following paragraphs describe these sources in detail.

Area Sources

CalEEMod emission factors were used to estimate operational emissions from area sources, which include architectural coatings. ROG off-gassing emissions result from evaporation of solvents contained in surface coatings such as in paints and primers using during building maintenance. The ROG evaporative emissions from application of residential and nonresidential surface coatings were calculated based on the ROG emission factor, the building square footage, the assumed fraction of surface area, and the reapplication rate. The ROG emission factor is based on the ROG content of the surface coatings. Based on the type of structure for the O&M, it is assumed that the surface area for painting equals two times the floor square footage, with 75% assumed for interior coating and 25% assumed for exterior surface coating (CAPCOA 2017).

Energy Sources

Energy sources include emissions associated with Project electricity usage and on-site power generation. The Project may include a backup emergency diesel generator to provide electrical back-up for critical systems. The generator emits criteria pollutants from the combustion of diesel fuel. The emergency generator would only be run up to 50 hours per year per the CARB Air Toxics Control Measure. It was also assumed that the generator would operate for up to two hours during periodic (e.g., monthly) testing and maintenance.

Electricity use would contribute indirectly to criteria air pollutant emissions; however, the emissions from electricity use were only quantified for GHGs, since criteria pollutant emissions occur at the site of the power plant, which is typically off site. Energy use was provided by the Applicant for security lighting and any ancillary use for the energy storage structure.

Mobile Sources

Mobile sources for the Project would primarily be motor vehicles (automobiles and light-duty trucks) traveling to and from the Project site. Motor vehicles may be fueled with gasoline, diesel, or alternative fuels. Based on conservative estimates for vehicular travel, the Project is anticipated to have up to 4,261 trips per year during operation, accounting for the commutes and performance of regular inspection and maintenance activities by eight full-time-equivalent staff.

2.5 Impact Analysis

The SJVAPCD significance criteria described in Section 2.4, Significance Criteria and Methodology, was used to evaluate air quality impacts associated with the construction and operation of the Project.

2.5.1 Would the project conflict with or obstruct implementation of the applicable air quality plan?

A project is non-conforming with an air quality plan if it conflicts with or delays implementation of any applicable attainment or maintenance plan. A project is conforming if it complies with all applicable SJVAPCD rules and regulations, complies with all proposed control measures that are not yet adopted from the applicable plan(s), and is consistent with the growth forecasts in the applicable plan(s) (or is directly included in the applicable plan). Zoning changes, specific plans, general plan amendments and similar land use plan changes which do not increase dwelling unit density, do not increase vehicle trips, and do not increase vehicle miles traveled are also deemed to comply with the applicable air quality plan (SJVAPCD 2015).

The Project would comply with applicable SJVAPCD rules and regulations, such as Regulation VIII (Fugitive PM_{10} Prohibitions) and IX (Mobile and Indirect Sources) which are discussed in detail in Section 2.2.3.1. The Project would not conflict with existing land uses or result in population growth. In addition, the Project would not result in a long-term increase in the number of trips or increase the overall vehicle miles traveled in the area. Haul truck, vendor truck, and worker vehicle trips would be generated during the proposed construction activities but would cease after construction is completed. Unmitigated NO_x emissions during construction would exceed the SJVAPCD significance threshold; however, as discussed in 2.5.2, compliance with SJVAPCD Rule 9510 and implementation of a VERA with SJVAPCD would offset emissions to less than significant. During the longer-term operational phase, the Project would have routine inspection and maintenance activities that would result in a net increase in emissions although, as discussed in Section 2.5.2, the increase in emissions would not exceed any significance threshold or violate any SJVAPCD rule or regulation.

In summary because the Project would offset NO_x emissions during construction through a VERA, the Project would result in a less than significant impact during construction.

2.5.2 Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation?

Construction Emissions

Construction of the Project would result in the temporary addition of pollutants to the local airshed caused by on-site sources (i.e., off-road construction equipment, soil disturbance, and ROG off-gassing) and off-site sources (i.e., on-road haul trucks, vendor trucks, and worker vehicle trips). Construction emissions can vary substantially from day to day, depending on the level of activity, the specific type of operation, and, for dust, the prevailing weather conditions.

Therefore, such emission levels can only be approximately estimated with a corresponding uncertainty in precise ambient air quality impacts.

As discussed in Section 2.4.2.1, Construction, criteria air pollutant emissions associated with temporary construction activity were quantified using a spreadsheet-based model. Construction emissions were calculated for the estimated worst-case day over the construction period associated with each phase and reported as the maximum daily emissions estimated during each year of construction (2019 and 2020). Construction schedule assumptions, including phase type, duration, and sequencing, were based on information provided by the Applicant and are intended to represent a reasonable scenario based on the best information available.

Implementation of the Project would generate air pollutant emissions from entrained dust, off-road equipment, vehicle emissions, and architectural coatings. Entrained dust results from the exposure of earth surfaces to wind from the direct disturbance and movement of soil, resulting in PM_{10} and $PM_{2.5}$ emissions. The Project would comply with SJVAPCD Rule 8021 to control dust emissions generated during the grading activities, which would be required as a condition of approval. Standard construction practices that would be employed to reduce fugitive dust emissions include watering of the active sites to maintain acceptable levels of dust generation. Internal combustion engines used by construction equipment, vendor trucks (i.e., delivery trucks), and worker vehicles would result in emissions of ROGs, NO_x, CO, PM_{10}, and $PM_{2.5}$.

Table 7 presents the estimated maximum annual construction emissions generated during construction of the Project. Details of the emission calculations are provided in Appendix A. The project would also comply with SJVAPCD Rule 9510, Indirect Source Review, which requires large development projects to reduce exhaust emissions from construction equipment by 20% for NO_x and 45% for PM_{10} compared to the statewide average. This is reflected as well in Table 7. The reductions taken in Table 7 are compared to the statewide average fleet, which is calculated using the Sacramento Metropolitan Air Quality Management District's Construction Mitigation Tool. A copy of the completed tool for the project is included in Appendix A.

Table 7
Estimated Maximum Annual Construction Criteria Air Pollutant Emissions

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Tons per year					
2019	1.05	8.92	6.39	0.09	1.08	0.49
2020	1.80	13.54	13.50	0.15	2.15	0.89
Total Annual Emissions[1]	**2.85**	**22.46**	**19.89**	**0.24**	**3.23**	**1.38**

Table 7
Estimated Maximum Annual Construction Criteria Air Pollutant Emissions

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Tons per year					
SJVAPCD Threshold	*10*	*10*	*100*	*27*	*15*	*15*
Threshold Exceeded?	No	**Yes**	No	No	No	No
Total Annual Emissions with ISR Compliance[2]	**2.85**	**14.11**	**19.89**	**0.24**	**2.93**	**1.38**
Threshold Exceeded?	No	**Yes**	No	No	No	No

Notes: CO = carbon monoxide; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; SJVAPCD = San Joaquin Valley Air Pollution Control District; SO_x = sulfur oxides; ROG = reactive organic gases
[1] Construction of the proposed project is anticipated to last approximately 12 months. Total emissions reflect a rolling twelve month total.
[2]This row reflects minimum required emissions reductions in NO_x and PM_{10} to comply with Rule 9510.
See Appendix A for complete results.

Maximum annual emissions of ROG, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$ emissions would occur during construction in 2019 and 2020 as a result of off-road equipment operation and on-road vendor trucks. As shown in Table 7, annual construction emissions would not exceed the SJVAPCD annual significance thresholds for ROG, CO, SO_x, PM_{10}, or $PM_{2.5}$ during construction in all construction years. However, the project's construction NO_x emissions would exceed the 10 ton per year threshold. To offset the NO_x emissions above the 10 tons per year threshold, the project would enter into a VERA with the SJVAPCD to offset 4.12 tons of NO_x emissions. Therefore, construction emissions for the project would be less than significant.

The Project would comply with SJVAPCD Rule 8021 to control fugitive dust emissions generated during grading activities, which would be required as a condition of approval. Standard construction practices that would be employed to reduce fugitive dust emissions include:

- Develop a dust control plan to outline how the Project will comply with Rule 8021 and minimize fugitive dust during construction,
- Minimize and cleanup trackout onto paved roads,
- Cover haul trucks,
- Rapid cleanup of Project-related trackout or spills on paved roads,
- Minimize grading and soil movement when winds exceed 30 miles per hour, and
- Implement a speed limit of 15 miles per hour during all construction phases for vehicles travelling on un-paved roads.

Construction Ambient Air Quality Impact Assessment

Although the Project would not exceed the annual significance threshold established by the SJVAPCD for CO, the Project would emit more than 100 pounds of CO per day during construction. As recommended by the *Guidance for Assessing and Mitigating Air Quality Impacts* (SJVAPCD 2015b), an ambient air quality impacts assessment should be performed if any pollutants exceed 100 pounds per day during construction or operation. Average annual emissions were used as the basis for determining the Project's potential impact on ambient air quality. Summary tables of annual and daily emissions associated with construction are included in Appendix B.

For the initial assessment (Step 1) of the ambient air quality impact analysis, the maximum background concentration for the Project site for each pollutant and averaging period combination was added to the corresponding maximum ground level concentration (GLC) from Project-related construction. The sum of these values was then compared to the corresponding ambient air quality standard. If the incremental increase in concentration from Project-related sources did not cause an exceedance of an ambient air quality standard, then the analysis was complete for that source/receptor/pollutant combination. If the incremental increase in concentration from Project-related sources caused an exceedance of an ambient air quality standard, then the analysis proceeded to Step 2. Step 2 was similar to Step 1 with one major difference. For this second step, the maximum GLC of each pollutant and averaging period combination were compared to its corresponding Significant Impact Level (SIL). The SIL is used to evaluate whether the Project's construction emissions would *contribute* to a violation of an ambient air quality standard, where the background level is close to or exceeds an ambient air quality standard. If the maximum GLC did not exceed the corresponding SIL, then the analysis was complete for that source/receptor/pollutant combination, and no further analysis was required. Because the project failed 1-hour NO_2 and 24-hour PM_{10} during Step 2 of the Level 1 analysis, a Level 2 analysis was necessary for those pollutant averaging times. The Level 2 analysis was performed in accordance with SJVAPCD APR 1925, *Policy for District Rule 2201 AAQA Modeling* (SJVAPCD 2014a). The Level 2 analysis showed that the 1-hour NO_2 passed both the state and federal AAQS during Step 1; however, the 24-hour PM_{10} failed the Step 1 and thus required moving on to Step 2. During Step 2 of the Level 2 analysis, the 24-hour PM_{10} passed as it did not exceed the SIL. Table 8 presents a summary of the AQIA undertaken to determine whether construction activities associated with the Project would cause or contribute to ambient air quality impacts.

Table 8
Construction Ambient Air Quality Impact Assessment Results

LEVEL 1, STEP 1 – Ambient Air Quality Standard Basis			
	State/Federal AAQS	*Cumulative*	
Impact Parameter	*μg/m³*	*μg/m³*	*Status*
1-hour CO	22,900	4,667	PASS
	40,100	4,667	PASS
8-hour CO	10,300	3,031	PASS
	10,300	3,031	PASS
1-hour NO_2	338	666	Step 2
	188	666	Step 2
Annual NO_2	56	25	PASS
	100	25	PASS
1-hour SO_2	655	40	PASS
	196	40	PASS
24-hour SO_2	105	8	PASS
	367	8	PASS
Annual SO_2	79	1	PASS
24-hour PM_{10}	50	127	Step 2
	150	123	PASS
Annual PM_{10}	20	42	Step 2
24-hour $PM_{2.5}$	35	55	Step 2
Annual $PM_{2.5}$	12	10	PASS
	12	10	PASS
LEVEL 1, STEP 2 – SJVAPCD Significant Impact Level (SIL) Basis			
	Class II SILs	*Project Contribution*	
Impact Parameter	*μg/m³*	*μg/m³*	*Status*
1-hour NO_2	7.5	542.11	FAIL
24-hour PM_{10}	5	6.05	FAIL
Annual PM_{10}	1	0.25	PASS
24-hour $PM_{2.5}$	5	4.55	PASS
LEVEL 2, STEP 1 – Ambient Air Quality Standard Basis			
	State/Federal AAQS	Cumulative Contribution	
Impact Parameter	μg/m³	μg/m³	Status
1-hour NO_2	339	172	PASS
	188	172	PASS
24-hour PM_{10}	50	124	Step 2
LEVEL 2, STEP 2 – SJVAPCD Significant Impact Level (SIL) Basis			
	Class II SILs	Project Contribution	
Impact Parameter	μg/m³	μg/m³	Status
24-hour PM_{10}	5	3.13	PASS

Source: See Appendix B.

As demonstrated in Table 8, the Project would result in construction activities that would generate ambient concentrations of criteria pollutant below the applicable thresholds. This impact would be less than significant.

Operational Emissions

The Project involves development of a 180 MW PV solar energy facility with an ESS and overhead gen-tie line. Operation of the Project would generate ROG, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$ emissions from mobile sources, including vehicle trips from maintenance vehicles. As discussed in Section 2.4.2.2, Operation, pollutant emissions associated with long-term operations were quantified using CalEEMod. Project-generated mobile source emissions were estimated based on Project-specific trip rates.

Table 9 presents the maximum daily mobile source emissions associated with operation (year 2021) of the Project. The values shown are the maximum daily emissions results from the operation of the Project. Details of the emission calculations are provided in Appendix A.

Table 9
Estimated Maximum Annual Operational Criteria Air Pollutant Emissions

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Tons per Year					
Area	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	0.01	0.07	0.07	0.00	0.02	0.01
Off-road	0.00	0.00	0.00	0.00	0.00	0.00
Stationary	0.00	0.01	0.01	0.00	0.00	0.00
Total Annual Emissions	**0.01**	**0.08**	**0.08**	**0.00**	**0.02**	**0.01**
SJVAPCD Threshold	*10*	*10*	*100*	*27*	*15*	*15*
Threshold Exceeded?	No	No	No	No	No	No

Notes: PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; SJVAPCD = San Joaquin Valley Air Pollution Control District; SO_x = sulfur oxides; ROG = reactive organic gases
See Appendix A for complete results.

As shown in Table 9, the combined daily area, energy, mobile, off-road, and stationary source emissions would not exceed the SJVAPCD operational thresholds for ROG, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$. Impacts associated with Project-generated operational criteria air pollutant emissions would be less than significant.

2.5.3 Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for O_3 precursors)?

For purposes of this air quality analysis and consistent with SJVAPCD guidance documents, actions that exceed criteria pollutant NAAQS (i.e., primary standards designed to safeguard the health of people considered to be sensitive receptors while outdoors and secondary standards designed to safeguard human welfare) or the EPA's Prevention of Significant Deterioration (PSD) Significant Impact Levels would result in significant impacts. Additionally, actions that violate CAAQS developed by CARB are considered significant.

Determination of whether project emissions would violate any ambient air quality standard is largely a function of air quality dispersion modeling. The SJVAPCD recommends that an ambient air quality analysis be performed when emissions of any criteria pollutant would equal or exceed any applicable threshold of significance for criteria pollutants or 100 lbs/day of any criteria pollutant. If the impacts resulting from a project's emissions would not exceed the CAAQS and NAAQS at the project's property boundaries, the project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation (SJVAPCD 2015b). The CAAQS and NAAQS are shown in Table 1 of Section 2.2, Regulatory Framework. The Project exceeded 100 lbs/day on site during construction; therefore, the Project required an air quality dispersion modeling assessment. The results of the assessment, as shown in Table 8, demonstrated that no State or Federal AAQS would be exceeded.

Air pollution is largely a cumulative impact. The nonattainment status of regional pollutants is a result of past and present development, and the SJVAPCD develops and implements plans for future attainment of ambient air quality standards. Based on these considerations, project-level thresholds of significance for criteria pollutants are relevant in the determination of whether a project's individual emissions would have a cumulatively significant impact on air quality. As described in Section 2.5.2, the Project would have a potentially significant impact for construction and a less-than-significant impact for operations.

The SJVAB is a nonattainment area for O_3, PM_{10}, and $PM_{2.5}$ under the NAAQS and/or CAAQS. The poor air quality in the SJVAB is the result of cumulative emissions from motor vehicles, off-road equipment, commercial and industrial facilities, and other emission sources. Projects that emit these pollutants or their precursors (i.e., ROG and NO_x for O_3) potentially contribute to poor air quality. After implementation of a VERA, annual construction emissions associated with the Project would not exceed the SJVAPCD significance thresholds for criteria pollutants. Accordingly, the Project would result in a less than significant increase in emissions of nonattainment pollutants. The Project would not generate a long-term increase in operational emissions, as shown in Table 9. Furthermore, the Project would not conflict with the SJVAPCD Ozone Attainment Plans, or the PM_{10} or $PM_{2.5}$ Attainment Plan, which address the cumulative emissions in the SJVAB and account for emissions associated with construction activity in the SJVAB.

As shown in Section 2.5.2, the Project would not exceed any State or Federal AAQS during the construction of the Project. Operation of the Project would include very minimal emission generating activity. Based on these considerations, the Project would not result in a cumulatively considerable increase in emissions of nonattainment pollutants. Impacts would be less than significant.

2.5.4 Would the project expose sensitive receptors to substantial pollutant concentrations?

Air quality varies as a direct function of the amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Air quality problems arise when the rate of pollutant emissions exceeds the rate of dispersion. Reduced visibility, eye irritation, and adverse health impacts upon those persons termed “sensitive receptors” are the most serious hazards of existing air quality conditions in the area. Some land uses are considered more sensitive to changes in air quality than others, depending on the population groups and the activities involved. People most likely to be affected by air pollution, as identified by CARB, include children, the elderly, athletes, and people with cardiovascular and chronic respiratory diseases; however, for the purposes of this analysis, residents are also considered sensitive receptors. As such, sensitive receptors include residences, schools, playgrounds, child-care centers, athletic facilities, long-term health-care facilities, rehabilitation centers, convalescent centers, and retirement homes. The closest off-site sensitive receptors to the Project are residential land uses located approximately 3,850 feet west of the Project site boundary.

Valley Fever Exposure

As previously discussed in Section 2.5.2, the Project would comply with SJVAPCD Rule 8021, which requires applicants to develop, prepare, submit, obtain approval of, and implement a Dust Control Plan. The Dust Control Plan would reduce fugitive dust impacts to less than significant for all construction phases of the Project and also control the release of the *Coccidioides immitis* fungus from construction activities.

In addition, the Project shall implement the following measures to reduce short-term fugitive dust impacts to workers and nearby sensitive receptors:

- Develop a Valley Fever Management Plan that addresses exposure to the *Coccidioides immitis* fungus. The Plan shall be provided to the County and shall include a program to limit the potential for exposure to *C. immitis* from construction activities and to identify appropriate worker training, dust management and safety procedures that shall be implemented, as needed, to minimize personnel and public exposure to *C. immitis*.
- Train workers to recognize the symptoms of Valley Fever, and to promptly report suspected symptoms of work-related Valley Fever to a supervisor.
- Audit and enforce compliance with relevant Cal OSHA health and safety standards on the jobsite – including injury and illness reporting requirements.
- Conduct job hazard assessments (JHAs) as defined under 8 CCR 1509 and/or 3380 for all job classifications employed on site. The hazard assessments will comprehend the potential for exposure to the Coccidioides spore relative to work activity proximity to other forms of work activity, weather conditions and other relevant variables and will identify appropriate personal protective equipment based on current working conditions.
- If determined to be necessary by the JHA performed for the specific work task, affected employees should be provided a National Institute for Occupational Safety and Health (NIOSH) approved respiratory protection to reduce exposure to pollutants and the *C. immitis* fungus.
- Provide all construction personnel and visitors to the Project site with information regarding Valley Fever. This would facilitate recognition of symptoms of Valley Fever and earlier treatment.

Health Impacts of Toxic Air Contaminants

In addition to impacts from criteria pollutants, certain projects may include emissions of pollutants identified by the state and federal government as TACs or HAPs. State law has established the framework for California's TAC identification and control project, which is generally more stringent than the federal project, and is aimed at TACs that are a problem in California. The state has formally identified more than 200 substances as TACs, including the federal HAPs, and is adopting appropriate control measures for sources of these TACs.

Health impacts associated with TACs are generally associated with long-term exposure. There are no meaningful sources of TACs for the operating phase of the Project and therefore no reason to expect health impacts related to TACs. The greatest potential for TAC emissions during construction would be diesel particulate emissions from heavy equipment operations and heavy-duty trucks. However, the construction activity is short-term and therefore unlikely to pose a risk of health impacts to the nearest sensitive receptors (the residents to the west of the project site). In an abundance of caution, a voluntary health risk assessment (HRA) was performed. The following paragraphs describe the HRA, and the detailed assessment is provided in Appendix B.

To implement the Office of Environmental Health Hazard Assessment (OEHHA) *Air Toxics Hot Spots Program Risk Assessment Guidelines – Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015) based on project information, the SJVAPCD has developed a 3-tiered approach where each successive tier is progressively more refined, with fewer conservative assumptions. Health risk is determined using the Hotspots Analysis and Reporting Program (HARP) software distributed by CARB, which requires peak one-hour emission rates and annual-averaged emission rates for all pollutants for each modeling source. Additional information on the HAPs modeling methods and assumptions are presented in Appendix B.

Health effects from carcinogenic air toxics are usually described in terms of cancer risk. The SJVAPCD recommends a carcinogenic (cancer) risk threshold of 20 in a million. The cancer burden is determined for the population located within the zone of impact, defined as the area within the one in one million cancer risk isopleth for a 70-year exposure. The Hotspots Analysis and Reporting Program Version 2 (HARP2) was used to generate an isopleth, which is a line of a constant value, showing the area exposed to a cancer risk above one in one million. The furthest sensitive receptor from the project site was used as the basis for the radius of the zone of impact to determine cancer burden.

Some TACs increase non-cancer health risk due to long-term (chronic) exposures. The Chronic Hazard Index (HIC) is the sum of the individual substance chronic hazard indices for all TACs affecting the same target organ system. The HIC estimates for all receptor types used the 'OEHHA Derived' calculation method, which uses high end exposure parameters for the inhalation and next top two exposure pathways and mean exposure parameters for the remaining pathways for non-cancer risk estimates. The HIC is the sum of the individual substance chronic hazard indices for all TACs affecting the same target organ system.[10] A hazard index less than one (1.0) means that adverse health effects are not expected. Within this analysis, noncarcinogenic exposures of less than 1.0 are considered less than significant. The SJVAPCD recommends a HIC significance threshold of 1.0 (project increment) and an acute hazard index (HIA) of 1.0. The exhaust from diesel engines is a complex mixture of gases, vapors, and particles, many of which are known human carcinogens. DPM has established cancer risk factors and relative exposure

[10] The Chronic Hazard Index estimates for all receptor types used the OEHHA Derived calculation method (OEHHA 2015).

values for long term chronic health hazard impacts. No short term, acute relative exposure values are established and regulated and are therefore not addressed in this assessment.

The dispersion modeling was performed using the American Meteorological Society/EPA Regulatory Model (AERMOD), which is the model SJVAPCD requires for atmospheric dispersion of emissions. AERMOD is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of surface and elevated sources, building downwash, and simple and complex terrain (EPA 2015). Based on estimated construction emissions, Dudek determined the proposed Project's impacts on ambient air quality. The modeled concentrations of criteria air pollutants were added to background concentrations in the vicinity of the Project site, and results were compared to National and California Ambient Air Quality Standards, as well as significant impact levels established by the U.S. Environmental Protection Agency and/or the SJVAPCD. Methodologies used for the dispersion modeling were discussed with SJVAPCD technical staff.

The proposed Project may result in a short-term increase of TAC emissions related to construction. The main contaminant of concern for this project is diesel combustion exhaust particulate matter (DPM), which has been listed as a TAC by the CARB. As DPM is the TAC emitted in the largest quantity, it is used as a surrogate for other TACs within diesel exhaust. Dudek evaluated the Project's potential cancer and non-cancer health impacts using exposure periods appropriate to evaluate short-term emission increases. Emissions dispersion of DPM was modeled using AERMOD, then cancer risk and non-cancer health impacts subsequently using the CARB Hot Spots Analysis and Reporting Program Version 2 (HARP2). HARP2 (ADMRT, version 17320) which implements the March 2015 OEHHA age-weighting methodology for assessing toxics risks. The chemical exposure results were then compared to SJVAPCD thresholds to assess Project significance. Principal parameters of this modeling are presented in Table 10.

Table 10
AERMOD Principal Parameters

Parameter	Details
Meteorological Data	The SJVAPCD requires the use of AERMOD for air dispersion modeling. The latest 5-year meteorological data (2007-2011) for the Mendota station (Station ID 99005) from SJVAPCD were downloaded, then input to AERMOD. For cancer or chronic non-cancer risk assessments, the average cancer risk of all years modeled was used.
Urban versus Rural Option	Urban areas typically have more surface roughness as well as structures and low-albedo surfaces that absorb more sunlight – and thus more heat – relative to rural areas. According to SJVAPCD guidelines, the rural dispersion option was selected due to the planned developed nature of the Project area.

Table 10
AERMOD Principal Parameters

Parameter	Details
On-site Buildings	No buildings were included for this construction scenario as area sources were conservatively assessed.
Terrain Characteristics	The terrain in the vicinity of the modeled industrial site is generally flat. The elevation of the modeled site is about 60 meters above sea level (ASL). Digital elevation model (DEM) files were imported into AERMOD so that complex terrain features were evaluated as appropriate.
Elevation Data	Digital elevation data were imported into AERMOD and elevations were assigned to the emission sources and receptors. Digital elevation data were obtained through AERMOD View in the United States Geological Survey's National Elevation Dataset format with a 7.5 minute resolution.
Emission Sources and Release Parameters	Air dispersion modeling of construction activities was conducted using emissions generated using a spreadsheet model, assuming 5 days per week and 22 days per month. The construction area was modeled as a large raised area source.
Source Release Characterizations	Modeling release parameters were developed for the construction analyses. For modeling construction emissions dispersion using AERMOD, it was assumed that the total site area would have active construction activities for a duration of 1 year. The construction activity was modeled as a raised area source.

Note: See Appendix B.

This HRA evaluated impacts using a bounding grid at 25-meter distance from the facility with 25-meter resolution was evaluated to capture maximum ambient pollutant impacts. Nested receptors were input to capture maximum health risk impacts with high resolution then the extent of the emission plume reaching out 2 kilometers. This telescoping grid of receptors was set up with the following resolutions: 25-meter spacing on the facility boundary; 25-meter spacing from facility boundary to 100 meters; 50-meter spacing from 100 meters to 250 meters; 100-meter spacing from 250 meters to 500 meters; 250-meter spacing from 500 meters to 1 kilometer; and 500-meter spacing from 1 kilometer to 2 kilometers.

Construction of Project components would require use of heavy-duty construction equipment, which is subject to a CARB Airborne Toxics Control Measure for in-use diesel construction equipment to reduce diesel particulate emissions, and would involve use of diesel trucks, which are also subject to an Airborne Toxics Control Measure. Construction of Project components would occur in four phases lasting a total of 12 months and would be periodic and short term within each phase. Following completion of construction activities, Project-related TAC emissions would cease. The results of the HRA during construction and operation are provided in Table 11.

Table 11
Construction Activity Health Risk Assessment Results

Impact Parameter	Units	Project Impact	CEQA Threshold	Level of Significance
MICR—Residential & Worker	Per Million	1.0	20.0	Less than Significant
HIC	Not Applicable	0.001	1.0	Less than Significant

Sources: Appendix B
Notes: MICR – Maximum Individual Cancer Risk; HIC – Chronic Hazard Index

The results of the construction analysis demonstrate that the construction mobile sources exhibit maximum individual cancer risks (MICR) below the 20 in a million threshold and chronic hazard indices (HIC) less than 1. The Project construction TACs impact from DPM emissions would be less than significant.

Health Impacts of Carbon Monoxide

As described previously, exposure to high concentrations of CO can result in dizziness, fatigue, chest pain, headaches, and impairment of central nervous system functions. Mobile-source impacts, including those related to CO, occur essentially on two scales of motion. Regionally, Project-related construction travel would add to regional trip generation and increase the vehicles miles traveled (VMT) within the local airshed and the SJVAB. Locally, construction traffic would be added to the roadway system in the vicinity of the Project site. Although the SJVAB is currently an attainment area for CO, there is a potential for the formation of microscale CO "hotspots" to occur immediately around points of congested traffic. Hotspots can form if such traffic occurs during periods of poor atmospheric ventilation, is composed of a large number of vehicles cold-started and operating at pollution-inefficient speeds, and/or is operating on roadways crowded with non-Project traffic. Because of continued improvement in vehicular emissions at a rate faster than the rate of vehicle growth and/or congestion, the potential for CO hotspots in the SJVAB is steadily decreasing.

The SJVAPCD GAMAQI states that a quantitative CO hotspots analysis be performed if either of the following two conditions exist: a traffic study for the project indicates that the Level of Service (LOS) on one or more streets or at one or more intersections in the project vicinity will be reduced to LOS E or F; or a traffic study indicates that the project will substantially worsen an already existing LOS F on one or more streets or at more or more intersections in the project vicinity. The Traffic Technical Report (VRPA Technologies, Inc. 2017) for the project evaluated the traffic impact from construction of the project. The results with mitigation showed that the LOS would be A during AM and PM peak hours with implementation of a traffic signal. Therefore, a quantitative CO hotspots analysis is not required. The construction-related traffic is not anticipated to create a CO hotspot as emissions would be dispersed rapidly and would not be concentrated. During operation, the Project is expected to generate very few vehicle trips for maintenance personnel and therefore no CO hotspots would be created.

As such, impacts to sensitive receptors with regard to potential CO hotspots resulting from the Project's contribution to cumulative traffic-related air quality impacts would be less than significant.

Health Impacts of Other Criteria Air Pollutants

Construction of the Project would not exceed the SJVAPCD threshold for ROGs. Specific ROGs may be TACs; however, ROGs are not expected to present risk of health impacts even if the specific ROGs associated with Project construction aren't entirely known. Some ROGs would be associated with motor vehicles and construction equipment, while others are associated with architectural coatings, the emissions of which would not result in the exceedances of the SJVAPCD's threshold as shown in Table 4. Generally, the ROGs in architectural coatings are of relatively low toxicity. Additionally, SJVAPCD Rule 4601 restricts the ROG content of coatings for both construction and operational applications.

Operation of the Project would not result in emissions that exceed the SJVAPCD's emission thresholds for any criteria air pollutants, including ROGs, NO_x, CO, SO_x, PM_{10}, or $PM_{2.5}$. Regarding ROGs, some ROGs would be associated with motor vehicles and construction equipment, while others are associated with architectural coatings, the emissions of which would not result in the exceedances of the SJVAPCD's thresholds as shown in Table 4. Generally, the ROGs in architectural coatings are of relatively low toxicity.

In addition, ROGs and NO_x are precursors to O_3, for which the SJVAB is designated as nonattainment with respect to the NAAQS and CAAQS (the SDAB is designated by the EPA as a nonattainment area for the 1-hour O_3 NAAQS standard and 1997 8-hour NAAQS standard). The health effects associated with O_3, as discussed in Section 3.2, State Regulations, are generally associated with reduced lung function. The contribution of ROGs and NO_x to regional ambient O_3 concentrations is the result of complex photochemistry. The increases in O_3 concentrations in the SJVAB due to O_3 precursor emissions tend to be found downwind from the source location to allow time for the photochemical reactions to occur. However, the potential for exacerbating excessive O_3 concentrations would also depend on the time of year that the ROG emissions would occur because exceedances of the O_3 ambient air quality standards tend to occur between April and October, when solar radiation is highest.

The holistic effect of a single project's emissions of O_3 precursors is speculative due to the lack of quantitative methods to assess this impact. Nonetheless, the ROG and NO_x emissions associated with project construction could minimally contribute to regional O_3 concentrations and the associated health impacts. As described in Section 3.1, Federal Regulations, O_3 health impacts are associated with respiratory irritation, which may be experienced by nearby receptors during the periods of heaviest use of off-road construction equipment. The Project would exceed the SJVAPCD threshold for O_3 precursor NO_x during construction thus there would be a potentially significant impact during construction. However, construction would be short-term in duration, lasting only 12 months, and the long-term operational emissions would not exceed any significance thresholds for O_3 precursors.

As discussed in section 2.5.2, construction and operation of the Project would not exceed thresholds for PM_{10} or $PM_{2.5}$ and would not contribute to exceedances of the NAAQS and CAAQS for particulate matter. The Project would also not result in substantial DPM emissions during construction and operation as discussed in section 2.5.4 and therefore, would not result in significant health effects related to DPM exposure. Because the project would not exceed thresholds for PM_{10} or $PM_{2.5}$ during construction and operation, health impacts would be less than significant.

Regarding NO_2, according to the construction emissions analysis, construction of the Project would not contribute to exceedances of the NAAQS and CAAQS for NO_2 during construction. However, emissions from construction of the project would still exceed the SJVAPCD significance thresholds for NO_x, would be short-term in duration, and the long-term operational emissions would not exceed any significance thresholds. As described in Section 2.1.2.1, NO_2 and NO_x health impacts are associated with respiratory irritation, which may be experienced by nearby receptors during the periods of heaviest use of off-road construction equipment. Therefore, the construction related health impacts for NO_2 would be considered potentially significant.

2.5.5 Would the project create objectionable odors affecting a substantial number of people?

Odors are a form of air pollution that is most obvious to the general public and can present problems for both the source and surrounding community. Although offensive odors seldom cause physical harm, they can be annoying and cause concern. Odors would be potentially generated from vehicles and equipment exhaust emissions during construction of the Project. Odors produced during construction would be attributable to concentrations of unburned hydrocarbons from tailpipes of construction equipment. Such odors are temporary and generally occur at low levels that would not result in nuisance. In regards to long-term operations, the Project would not change routine inspection and maintenance activities for the existing transmission lines and the operation of the solar facility would not result in any sources of substantial odors. Therefore, impacts associated with odors would be considered less than significant.

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3 GREENHOUSE GAS EMISSIONS

3.1 Environmental Setting

3.1.1 The Greenhouse Effect

Climate change refers to any significant change in measures of climate such as temperature, precipitation, or wind patterns, lasting for an extended period of time (i.e., decades or longer). A GHG is any gas that absorbs infrared radiation in the atmosphere; in other words, GHGs trap heat in the atmosphere. The greenhouse effect is the trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. The greenhouse effect traps heat in the troposphere through a threefold process as follows:

1. Short-wave radiation emitted by the Sun is absorbed by the Earth,
2. The Earth emits a portion of this energy in the form of long-wave radiation, and
3. GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth.

The greenhouse effect is a natural process that contributes to regulating the Earth's temperature. Without it, the temperature of the Earth would be about 0°F (−18°C) instead of its present 57°F (14°C). If the atmospheric concentrations of GHGs rise, the average temperature of the lower atmosphere will gradually increase. Global climate change concerns are focused on whether human activities are leading to an enhancement of the greenhouse effect.

3.1.2 Greenhouse Gases and Global Warming Potential

GHGs include, but are not limited to, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), O_3, water vapor, hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Some GHGs, such as CO_2, CH_4, and N_2O, occur naturally and are emitted to the atmosphere through natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Manufactured GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as HFCs, HCFCs, PFCs, and SF_6, which are associated with certain industrial products and processes. A summary of the most common GHGs and their sources is included subsequently.[11]

Carbon Dioxide. CO_2 is a naturally occurring gas and a by-product of human activities and is the principal anthropogenic GHG that affects the Earth's radiative balance. Natural sources of CO_2 include respiration of bacteria, plants, animals, and fungus; evaporation from oceans, volcanic out-gassing; and decomposition of dead organic matter. Human activities that generate CO_2 are from the combustion of coal, oil, natural gas, and wood.

Methane. CH_4 is a flammable gas and is the main component of natural gas. CH_4 is produced through anaerobic (i.e., without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Nitrous Oxide. Sources of N_2O include soil cultivation practices (microbial processes in soil and water), especially the use of commercial and organic fertilizers, manure management, industrial processes (e.g., in nitric acid production, nylon production, and fossil-fuel-fired power plants), vehicle emissions, and the use of N_2O as a propellant (e.g., in rockets, racecars, aerosol sprays).

Fluorinated Gases. Fluorinated gases are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Several prevalent fluorinated gases include the following:

- **Hydrofluorocarbons:** HFCs are compounds containing only hydrogen, fluorine, and carbon atoms. HFCs are synthetic chemicals that are used as alternatives to O_3-depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are used in manufacturing.
- **Hydrochlorofluorocarbons:** HCFCs are compounds containing hydrogen, fluorine, chlorine, and carbon atoms. HFCs are synthetic chemicals that are used as alternatives to O_3-depleting substances (chlorofluorocarbons).
- **Perfluorocarbons:** PFCs are a group of human-made chemicals composed of carbon and fluorine only. These chemicals were introduced as alternatives, along with HFCs, to the O_3-depleting substances. The two main sources of PFCs are primarily aluminum production and semiconductor manufacturing. Since PFCs have stable molecular structures and do not break down through the chemical processes in the lower atmosphere, these chemicals have long lifetimes, ranging between 10,000 and 50,000 years.

[11] The descriptions of GHGs are summarized from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (1995), IPCC Fourth Assessment Report (2007), CARB's Glossary of Terms Used in GHG Inventories (2015), and EPA's Glossary of Climate Change Terms (2016d).

- **Sulfur Hexafluoride:** SF_6 is a colorless gas that is soluble in alcohol and ether and slightly soluble in water. SF_6 is used for insulation in electric power transmission and distribution equipment, semiconductor manufacturing, the magnesium industry, and as a tracer gas for leak detection.

Global Warming Potential

Gases in the atmosphere can contribute to climate change both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect radiative forcing occurs when chemical transformations of the substance produce other GHGs, when a gas influences the atmospheric lifetimes of other gases, and/or when a gas affects atmospheric processes that alter the radiative balance of the Earth (e.g., affect cloud formation or albedo) (EPA 2016e). The Intergovernmental Panel on Climate Change (IPCC) developed the global warming potential (GWP concept to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The GWP of a GHG is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram of a trace substance relative to that of 1 kilogram of a reference gas (IPCC 2014). The reference gas used is CO_2; therefore, GWP-weighted emissions are measured in metric tons of CO_2 equivalent (MT CO_2E.

It was assumed that the GWP for CH_4 is 25 (which means that emissions of 1 MT of CH_4 are equivalent to emissions of 25 MT of CO_2), and the GWP for N_2O is 298, based on the IPCC Fourth Assessment Report (IPCC 2007). The GWP used in EPA's 2016 Inventory of U.S Greenhouse Gas Emissions and Sinks and CARB's California 2016 GHG emissions inventory are based on the IPCC Fourth Assessment Report.

3.2 Regulatory Setting

3.2.1 Federal Regulations

Massachusetts v. EPA. In *Massachusetts v. EPA* (April 2007), the U.S. Supreme Court directed the EPA administrator to determine whether GHG emissions from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In December 2009, the administrator signed a final rule with the following two distinct findings regarding GHGs under Section 202(a) of the federal Clean Air Act:

- The administrator found that elevated concentrations of GHGs—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations. This is the "endangerment finding."

- The administrator further found the combined emissions of GHGs—CO_2, CH_4, N_2O, and HFCs—from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare. This is the "cause or contribute finding."

These two findings were necessary to establish the foundation for regulation of GHGs from new motor vehicles as air pollutants under the Clean Air Act.

Energy Independence and Security Act of 2007. The Energy Independence and Security Act of 2007 (December 2007), among other key measures, would do the following, which would aid in the reduction of national GHG emissions (EPA 2007):

- Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.
- Set a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020, and directs National Highway Traffic Safety Administration (NHTSA) to establish a fuel economy program for medium-duty and heavy-duty trucks and create a separate fuel economy standard for work trucks.
- Prescribe or revise standards affecting regional efficiency for heating and cooling products and procedures for new or amended standards, energy conservation, energy-efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Federal Vehicle Standards. In response to the U.S. Supreme Court ruling discussed above, the Bush Administration issued Executive Order 13432 in 2007 directing the EPA, the Department of Transportation, and the Department of Energy to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. In 2009, the NHTSA issued a final rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011, and in 2010, the EPA and NHTSA issued a final rule regulating cars and light-duty trucks for model years 2012–2016.

In 2010, President Barack Obama issued a memorandum directing the Department of Transportation, Department of Energy, EPA, and NHTSA to establish additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure. In response to this directive, EPA and NHTSA proposed stringent, coordinated federal GHG and fuel economy standards for model years 2017–2025 light-duty vehicles. The proposed standards projected to achieve 163 grams per mile of CO_2 in model year 2025, on an average industry fleet-wide basis, which is equivalent to 54.5 miles per gallon if this level were achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017–2021, and NHTSA intends to set standards for model years 2022–2025 in a future rulemaking. On January

12, 2017, the EPA finalized its decision to maintain the current GHG emissions standards for model years 2022–2025 cars and light trucks (EPA 2017).

In addition to the regulations applicable to cars and light-duty trucks described above, in 2011, the EPA and NHTSA announced fuel economy and GHG standards for medium-duty and heavy-duty trucks for model years 2014–2018. The standards for CO_2 emissions and fuel consumption are tailored to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and recreational vehicles. According to the EPA, this regulatory program will reduce GHG emissions and fuel consumption for the affected vehicles by 6–23% over the 2010 baselines.

In August 2016, the EPA and NHTSA announced the adoption of the phase two program related to the fuel economy and GHG standards for medium-duty and heavy-duty trucks. The phase two program will apply to vehicles with model year 2018 through 2027 for certain trailers, and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion MT and reduce oil consumption by up to 2 billion barrels over the lifetime of the vehicles sold under the program (EPA and NHTSA 2016).

Clean Power Plan and New Source Performance Standards for Electric Generating Units. On October 23, 2015, EPA published a final rule (effective December 22, 2015) establishing the *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units* (80 FR 64510–64660), also known as the Clean Power Plan. These guidelines prescribe how states must develop plans to reduce GHG emissions from existing fossil-fuel-fired electric generating units. The guidelines establish CO_2 emission performance rates representing the best system of emission reduction for two subcategories of existing fossil-fuel-fired electric generating units: (1) fossil-fuel-fired electric utility steam-generating units, and (2) stationary combustion turbines. Concurrently, the EPA published a final rule (effective October 23, 2015) establishing *Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units* (80 FR 64661–65120). The rule prescribes CO_2 emission standards for newly constructed, modified, and reconstructed affected fossil-fuel-fired electric utility generating units. Implementation of the Clean Power Plan has been stayed by the U.S. Supreme Court pending resolution of several lawsuits.

3.2.2 State Regulations

The statewide GHG emissions regulatory framework is summarized subsequently by category: state climate change targets, building energy, renewable energy and energy procurement, mobile sources, solid waste, water, and other state regulations and goals. The following text describes EOs, assembly bills (AB), senate bills (SB), and other regulations and plans that would directly or indirectly reduce GHG emissions.

Climate Change

The state has taken a number of actions to address climate change. These include EOs, legislation, and CARB plans and requirements and are summarized below.

EO S-3-05. EO S-3-05 (June 2005) established California's GHG emissions reduction targets and laid out responsibilities among the state agencies for implementing the EO and for reporting on progress toward the targets. This EO established the following targets:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80% below 1990 levels.

EO S-3-05 directed the EPA to report biannually on progress made toward meeting the GHG targets and the impacts to California due to global warming, including impacts to water supply, public health, agriculture, the coastline, and forestry. The Climate Action Team was formed, which subsequently issued reports from 2006 to 2010 (CAT 2010b).

EO B-18-12. EO B-18-12 (April 2012) directed state agencies, departments, and other entities under the governor's executive authority to take action to reduce entity-wide GHG emissions by at least 10% by 2015 and 20% by 2020, as measured against a 2010 baseline. EO B-18-12 also established goals for existing state buildings for reducing grid-based energy purchases and water use.

EO B-30-15. EO B-30-15 (April 2015) identified an interim GHG reduction target in support of targets previously identified under S-3-05 and AB 32. EO B-30-15 set an interim target goal of reducing GHG emissions to 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing GHG emissions to 80% below 1990 levels by 2050 as set forth in S-3-05. To facilitate achieving this goal, EO B-30-15 called for CARB to update the scoping plan to express the 2030 target in terms of millions of metric tons (MMT) of CO_2E. The EO also called for state agencies to continue to develop and implement GHG emission reduction programs in support of the reduction targets.

AB 32. In furtherance of the goals established in EO S-3-05, the legislature enacted AB 32 (Núñez and Pavley), the California Global Warming Solutions Act of 2006 (September 27, 2006). AB 32 provided initial direction on creating a comprehensive multiyear program to limit

California's GHG emissions at 1990 levels by 2020 and initiate the transformations required to achieve the state's long-range climate objectives.

SB 32 and AB 197. SB 32 and AB 197 (enacted in 2016) are companion bills. SB 32 codified the 2030 emissions reduction goal of EO B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030. AB 197 established the Joint Legislative Committee on Climate Change Policies, consisting of at least three members of the Senate and three members of the Assembly, to provide ongoing oversight over implementation of the state's climate policies. AB 197 also added two members of the Legislature to the Board as nonvoting members; requires CARB to make available and update (at least annually via its website) emissions data for GHGs, criteria air pollutants, and TACs from reporting facilities; and, requires CARB to identify specific information for GHG emissions reduction measures when updating the scoping plan.

CARB's 2007 Statewide Limit. In 2007, in accordance with California Health and Safety Code, Section 38550, CARB approved a statewide limit on the GHG emissions level for year 2020 consistent with the determined 1990 baseline (427 MMT CO_2E).

CARB's Climate Change Scoping Plan. One specific requirement of AB 32 is for CARB to prepare a scoping plan for achieving the maximum technologically feasible and cost-effective GHG emission reductions by 2020 (Health and Safety Code, Section 38561(a)) and to update the plan at least once every 5 years. In 2008, CARB approved the first scoping plan. The *Climate Change Scoping Plan: A Framework for Change* (Scoping Plan) included a mix of recommended strategies that combined direct regulations, market-based approaches, voluntary measures, policies, and other emission reduction programs calculated to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the state's long-range climate objectives. The key elements of the Scoping Plan include the following (CARB 2008):

1. Expand and strengthen existing energy efficiency programs as well as building and appliance standards.
2. Achieve a statewide renewable energy mix of 33%.
3. Develop a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions.
4. Establish targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets.

5. Adopt and implement measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard (LCFS 17 Cal. Code Regs., Section 95480 et seq.).
6. Create targeted fees, including a public goods charge on water use, fees on high GWP gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation.

The Scoping Plan also identified local governments as essential partners in achieving California's goals to reduce GHG emissions because they have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Specifically, the Scoping Plan encouraged local governments to adopt a reduction goal for municipal operations and for community emissions to reduce GHGs by approximately 15% from then levels (2008) by 2020. Many local governments developed community-scale local GHG reduction plans based on this Scoping Plan recommendation.

In 2014, CARB approved the first update to the Scoping Plan. The *First Update to the Climate Change Scoping Plan: Building on the Framework* (First Update) defined the state's GHG emission reduction priorities for the next 5 years and laid the groundwork to start the transition to the post-2020 goals set forth in EOs S-3-05 and B-16-2012. The First Update concluded that California is on track to meet the 2020 target but recommended a 2030 mid-term GHG reduction target be established to ensure a continuum of action to reduce emissions. The First Update recommended a mix of technologies in key economic sectors to reduce emissions through 2050, including energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and the rapid market penetration of efficient and clean energy technologies. As part of the First Update, CARB recalculated the state's 1990 emissions level, using more recent GWPs identified by the IPCC, from 427 MMT CO_2E to 431 MMT CO_2E (CARB 2014).

In 2015, as directed by EO B-30-15, CARB began working on an update to the Scoping Plan to incorporate the 2030 target of 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing GHG emissions to 80% below 1990 levels by 2050 as set forth in S-3-05. The Governor called on California to pursue a new and ambitious set of strategies, in line with the five climate change pillars from his inaugural address, to reduce GHG emissions and prepare for the unavoidable impacts of climate change. In the summer of 2016, the Legislature affirmed the importance of addressing climate change through passage of Senate Bill 32 (SB 32 (Pavley, Chapter 249, Statutes of 2016).

In December 2017, CARB adopted the *2017 Climate Change Scoping Plan Update* (2030 Scoping Plan) (CARB 2017). The 2030 Scoping Plan builds on the successful framework established in the initial Scoping Plan and First Update, while identifying new, technologically feasible and cost-effective strategies that will serve as the framework to achieve the 2030 GHG target and define the state's climate change priorities to 2030 and beyond. The strategies' "known commitments" include implementing renewable energy and energy efficiency (including the mandates of SB 350), increased stringency of the Low Carbon Fuel Standard, measures identified in the Mobile Source and Freight Strategies, measures identified in the proposed Short-Lived Climate Pollutant Plan, and increased stringency of SB 375 targets. To fill the gap in additional reductions needed to achieve the 2030 target, it recommends continuing the Cap-and-Trade Program and a measure to reduce GHGs from refineries by 20%.

For local governments, the 2030 Scoping Plan replaced the initial Scoping Plan's 15% reduction goal with a recommendation to aim for a community-wide goal of no more than six MT CO2E per capita by 2030 and no more than two MT CO2E per capita by 2050, which are consistent with the state's long-term goals. These goals are also consistent with the Under 2 MOU (Under 2 2016) and the Paris Agreement (UNFCCC 2016), which are developed around the scientifically based levels necessary to limit global warming below 2°C. The 2030 Scoping Plan recognized the benefits of local government GHG planning (e.g., through climate action plans (CAPs)) and provide more information regarding tools CARB is working on to support those efforts. It also recognizes the CEQA streamlining provisions for project level review where there is a legally adequate CAP.[12]

The Scoping Plan recommends strategies for implementation at the statewide level to meet the goals of AB 32, SB32, and the EO and establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions. A project is considered consistent with the statutes and EOs if it meets the general policies in reducing GHG emissions to facilitate the achievement of the state's goals and does not impede attainment of those goals. As discussed in several cases, a given project need not be in perfect conformity with each and every planning policy or goals to be consistent. A project would be consistent if it will further the objectives and not obstruct their attainment.

CARB's Regulations for the Mandatory Reporting of Greenhouse Gas Emissions. CARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (17 CCR 95100–95157) incorporated by reference certain requirements that EPA promulgated in its

[12] *Sierra Club v. County of Napa* (2004) 121 Cal.App.4th 1490; *San Francisco Tomorrow et al. v. City and County of San Francisco* (2015) 229 Cal.App.4th 498; *San Franciscans Upholding the Downtown Specific Plan v. City & County of San Francisco* (2002) 102 Cal.App.4th 656; *Sequoyah Hills Homeowners Assn. V. City of Oakland* (1993) 23 Cal.App.4th 704, 719.

Final Rule on Mandatory Reporting of Greenhouse Gases (Title 40, Code of Federal Regulations (CFR), Part 98). Specifically, Section 95100(c) of the Mandatory Reporting Regulation incorporated those requirements that EPA promulgated in the Federal Register on October 30, 2009; July 12, 2010; September 22, 2010; October 28, 2010; November 30, 2010; December 17, 2010; and April 25, 2011. In general, entities subject to the Mandatory Reporting Regulation that emit over 10,000 MT CO_2E per year are required to report annual GHGs through the California Electronic GHG Reporting Tool. Certain sectors, such as refineries and cement plants, are required to report regardless of emission levels. Entities that emit more than the 25,000 MT CO_2E per year threshold are required to have their GHG emission report verified by a CARB-accredited third-party verified.

CARB's Short-Lived Climate Pollutant Reduction Strategy – SB 605 and SB 1383. SB 605 (September 2014) required CARB to complete a comprehensive strategy to reduce emissions of short-lived climate pollutants in the state no later than January 1, 2016. As defined in the statute, short-lived climate pollutant means "an agent that has a relatively short lifetime in the atmosphere, from a few days to a few decades, and a warming influence on the climate that is more potent than that of carbon dioxide" (SB 605). SB 605, however, did not prescribe specific compounds as short-lived climate pollutants or add to the list of GHGs regulated under AB 32. In developing the strategy, CARB was to:

- complete an inventory of sources and emissions of short-lived climate pollutants in the state based on available data,
- identify research needs to address any data gaps,
- identify existing and potential new control measures to reduce emissions, and
- prioritize the development of new measures for short-lived climate pollutants that offer co-benefits by improving water quality or reducing other criteria air pollutants that impact community health and benefit disadvantaged communities.

CARB released the *Proposed Short-Lived Climate Pollution Reduction Strategy* (SLCP Strategy) in April 2016 for public review and comment. The SLCP Strategy focused on CH_4, black carbon, and fluorinated gases (particularly HFCs) as important short-lived climate pollutants.

Governor Brown signed SB 1383 (Lara) in September 2016. This bill requires CARB to approve and implement a strategy to decrease emissions of short-lived climate pollutants to achieve a reduction in CH_4 by 40%, HFC by 40%, and anthropogenic black carbon by 50% below 2013 levels by 2030. In response to SB 1383, CARB revised the SLCP Strategy and released the *Revised Proposed Short-Lived Climate Pollution Reduction Strategy* (Revised SLCP Strategy) for public comment from November 28, 2016, to January 17, 2017. CARB is currently scheduled to consider approving the SLCP Strategy at its public hearing in March 2017.

Building Energy

Title 24, Part 6. Title 24 of the California Code of Regulations was established in 1978 and serves to enhance and regulate California's building standards. While not initially promulgated to reduce GHG emissions, Part 6 of Title 24 specifically established Building Energy Efficiency Standards that are designed to ensure new and existing buildings in California achieve energy efficiency and preserve outdoor and indoor environmental quality. These energy efficiency standards are reviewed every few years by the Building Standards Commission and the California Energy Commission (CEC) (and revised if necessary) (California Public Resources Code, Section 25402(b)(1)). The regulations receive input from members of industry, as well as the public, with the goal of "reducing of wasteful, uneconomic, inefficient, or unnecessary consumption of energy" (California Public Resources Code, Section 25402). These regulations are scrutinized and analyzed for technological and economic feasibility (California Public Resources Code, Section 25402(d)) and cost effectiveness (California Public Resources Code, Sections 25402(b)(2) and (b)(3)). As a result, these standards save energy, increase electricity supply reliability, increase indoor comfort, avoid the need to construct new power plants, and help preserve the environment. The current Title 24 standards are the 2016 standards, which became effective on January 1, 2017.

Title 24, Part 11. In addition to the CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24) (is commonly referred to as CALGreen) establishes minimum mandatory standards as well as voluntary standards pertaining to the planning and design of sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and interior air quality. The CALGreen standards took effect in January 2011 and instituted mandatory minimum environmental performance standards for all ground-up, new construction of commercial, low-rise residential and state-owned buildings and schools and hospitals. The CALGreen 2016 standards became effective January 1, 2017. The mandatory standards require the following (24 CCR Part 11):

- Mandatory reduction in indoor water use through compliance with specified flow rates for plumbing fixtures and fittings
- Mandatory reduction in outdoor water use through compliance with a local water efficient landscaping ordinance or the California Department of Water Resources' Model Water Efficient Landscape Ordinance

- 65% of construction and demolition waste must be diverted from landfills;
- Mandatory inspections of energy systems to ensure optimal working efficiency;
- Inclusion of electric vehicle charging stations or designated spaces capable of supporting future charging stations
- Low-pollutant emitting exterior and interior finish materials, such as paints, carpets, vinyl flooring, and particle boards

The CALGreen standards also include voluntary efficiency measures that are provided at two separate tiers and implemented at the discretion of local agencies and applicants. CALGreen's Tier 1 standards call for a 15% improvement in energy requirements, stricter water conservation, 65% diversion of construction and demolition waste, 10% recycled content in building materials, 20% permeable paving, 20% cement reduction, and cool/solar-reflective roofs. CALGreen's more rigorous Tier 2 standards call for a 30% improvement in energy requirements, stricter water conservation, 75% diversion of construction and demolition waste, 15% recycled content in building materials, 30% permeable paving, 25% cement reduction, and cool/solar-reflective roofs.

The California Public Utilities Commission (CPUC), CEC, and CARB also have a shared, established goal of achieving zero net energy (ZNE) for new construction in California. The key policy timelines include (1) all new residential construction in California will be ZNE by 2020 and (2) all new commercial construction in California will be ZNE by 2030.[13]

Title 20. Title 20 of the California Code of Regulations requires manufacturers of appliances to meet state and federal standards for energy and water efficiency. Performance of appliances must be certified through the CEC to demonstrate compliance with standards. New appliances regulated under Title 20 include refrigerators, refrigerator-freezers, and freezers; room air conditioners and room air-conditioning heat pumps; central air conditioners; spot air conditioners; vented gas space heaters; gas pool heaters; plumbing fittings and plumbing fixtures; fluorescent lamp ballasts; lamps; emergency lighting; traffic signal modules; dishwashers; clothes washers and dryers; cooking products; electric motors; low-voltage dry-type distribution transformers; power supplies; televisions and consumer audio and video equipment; and battery charger systems. Title 20 presents protocols for testing for each type of appliance covered under the regulations and appliances must meet the standards for energy performance, energy design, water performance and water design. Title 20 contains three types

[13] See, e.g., CPUC, California's Zero Net Energy Policies and Initiatives, Sept. 18, 2013, accessed at http://annualmeeting.naseo.org/Data/Sites/2/presentations/Fogel-Getting-to-ZNE-CA-Experience.pdf. It is expected that achievement of the ZNE goal will occur via revisions to the Title 24 standards.

of standards for appliances: 1) federal and state standards for federally regulated appliances, 2) state standards for federally regulated appliances, and 3) state standards for non-federally regulated appliances.

Senate Bill 1. SB 1 (Murray) (August 2006) established a $3 billion rebate program to support the goal of the state to install rooftop solar energy systems with a generation capacity of 3,000 MWs through 2016. SB 1 added sections to the Public Resources Code, including Chapter 8.8 (California Solar Initiative), that require building projects applying for ratepayer-funded incentives for photovoltaic systems to meet minimum energy efficiency levels and performance requirements. Section 25780 established that it is a goal of the state to establish a self-sufficient solar industry in which solar energy systems are a viable mainstream option for both homes and businesses within 10 years of adoption, and to place solar energy systems on 50% of new homes within 13 years of adoption. SB 1, also termed "Go Solar California," was previously titled "Million Solar Roofs."

California AB 1470 (Solar Water Heating). This bill established the Solar Water Heating and Efficiency Act of 2007. The bill makes findings and declarations of the Legislature relating to the promotion of solar water heating systems and other technologies that reduce natural gas demand. The bill defines several terms for purposes of the act. The bill requires the commission to evaluate the data available from a specified pilot program and, if it makes a specified determination, to design and implement a program of incentives for the installation of 200,000 solar water heating systems in homes and businesses throughout the state by 2017.

Renewable Energy and Energy Procurement

SB 1078. SB 1078 (Sher) (September 2002) established the Renewable Portfolio Standard (RPS) program, which required an annual increase in renewable generation by the utilities equivalent to at least 1% of sales, with an aggregate goal of 20% by 2017. This goal was subsequently accelerated, requiring utilities to obtain 20% of their power from renewable sources by 2010 (SB 107, EO S-14-08, and S-21-09).

SB 1368. SB 1368 (September 2006), required the CEC to develop and adopt regulations for GHG emission performance standards for the long-term procurement of electricity by local publicly owned utilities. These standards must be consistent with the standards adopted by the CPUC.

AB 1109. Enacted in 2007, AB 1109 required the CEC to adopt minimum energy efficiency standards for general-purpose lighting, to reduce electricity consumption 50% for indoor residential lighting and 25% for indoor commercial lighting.

EO S-14-08. EO S-14-08 (November 2008) focused on the contribution of renewable energy sources to meet the electrical needs of California while reducing the GHG emissions from the electrical sector. This EO required that all retail suppliers of electricity in California serve 33% of their load with renewable energy by 2020. Furthermore, the EO directed state agencies to take appropriate actions to facilitate reaching this target. The CNRA, through collaboration with the CEC and California Department of Fish and Wildlife (formerly the California Department of Fish and Game), was directed to lead this effort.

EO S-21-09 and SBX1-2. EO S-21-09 (September 2009) directed CARB to adopt a regulation consistent with the goal of EO S-14-08 by July 31, 2010. CARB was further directed to work with the CPUC and CEC to ensure that the regulation builds upon the RPS program and was applicable to investor-owned utilities, publicly owned utilities, direct access providers, and community choice providers. Under this order, CARB was to give the highest priority to those renewable resources that provide the greatest environmental benefits with the least environmental costs and impacts on public health and can be developed the most quickly in support of reliable, efficient, cost-effective electricity system operations. On September 23, 2010, CARB initially approved regulations to implement a Renewable Electricity Standard. However, this regulation was not finalized because of subsequent legislation (SB X1-2, Simitian, statutes of 2011) signed by Governor Brown in April 2011.

SB X1 2 expanded the Renewables Portfolio Standard by establishing a renewable energy target of 20% of the total electricity sold to retail customers in California per year by December 31, 2013, and 33% by December 31, 2020, and in subsequent years. Under the bill, a renewable electrical generation facility is one that uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation (30 MW or less), digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and that meets other specified requirements with respect to its location.

SB X1-2 applies to all electricity retailers in the state, including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities must meet the renewable energy goals listed above.

SB 350. SB 350 (October 2015) further expanded the RPS by establishing a goal of 50% of the total electricity sold to retail customers in California per year by December 31, 2030. In addition, SB 350 included the goal to double the energy efficiency savings in electricity and natural gas final end uses (e.g., heating, cooling, lighting, or class of energy uses on which an energy-efficiency program is focused) of retail customers through energy conservation and efficiency. The bill also requires the CPUC, in consultation with the CEC, to establish efficiency targets for electrical and gas corporations consistent with this goal.

Mobile Sources

AB 1493. AB 1493 (Pavley) (July 2002) was enacted in a response to the transportation sector accounting for more than half of California's CO_2 emissions. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles that are primarily used for noncommercial personal transportation in the state. The bill required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004. When fully phased in, the near-term (2009–2012) standards will result in a reduction of about 22% in GHG emissions compared to the emissions from the 2002 fleet, while the mid-term (2013–2016) standards will result in a reduction of about 30%.

Heavy-Duty Diesel. CARB adopted the final Heavy-Duty Truck and Bus Regulation, Title 13, Division 3, Chapter 1, Section 2025, on December 31, 2014 to reduce (particulate matter and NO_x emissions from heavy-duty diesel vehicles. The rule requires PM filters be applied to newer heavier trucks and buses by January 1, 2012, with older vehicles required to comply by January 1, 2015. The rule will require nearly all diesel trucks and buses to be compliant with the 2010 model year engine requirement by January 1, 2023. CARB also adopted an Airborne Toxic Control Measure to limit idling of diesel-fueled commercial vehicles on December 12, 2013. This rule requires diesel-fueled vehicles with gross vehicle weights greater than 10,000 lbs to idle no more than 5 minutes at any location (13 CCR 2485).

EO S-1-07. EO S-1-07 (January 2007, implementing regulation adopted in April 2009) sets a declining LCFS for GHG emissions measured in CO_2E grams per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10% by 2020 (17 CCR 95480 et seq.). The carbon intensity measures the amount of GHG emissions in the lifecycle of a fuel, including extraction/feedstock production, processing, transportation, and final consumption, per unit of energy delivered.

SB 375. SB 375 (Steinberg) (September 2008) addresses GHG emissions associated with the transportation sector through regional transportation and sustainability plans. SB 375 requires CARB to adopt regional GHG reduction targets for the automobile and light-truck sector for 2020 and 2035 and to update those targets every 8 years. SB 375 requires the state's 18 regional metropolitan planning organizations (MPOs) to prepare a Sustainable Communities Strategy (SCS) as part of their RTP that will achieve the GHG reduction targets set by CARB. If an MPO is unable to devise an SCS to achieve the GHG reduction target, the MPO must prepare an Alternative Planning Strategy demonstrating how the GHG reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

Pursuant to Government Code, Section 65080(b)(2)(K), a SCS does not: (i) regulate the use of land; (ii) supersede the land use authority of cities and counties; or (iii) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it. Nonetheless, SB 375 makes regional and local planning agencies responsible for developing those strategies as part of the federally required metropolitan transportation planning process and the state-mandated housing element process.

In September 2010, CARB adopted the first SB 375 targets for the regional MPOs. The targets for the FCOG are a 5% reduction in emissions per capita by 2020 and a 10% reduction by 2035. Achieving these goals through adoption of a SCS is the responsibility of the MPOs. FCOG adopted its latest RTP/SCS in 2015. The plan quantified a 9% reduction by 2020 and an 11% reduction by 2035 (FCOG 2014). In 2015, CARB accepted FCOG's quantification of GHG reductions and its determination the SCS, if implemented, would achieve FCOG targets.

Advanced Clean Cars Program and Zero-Emissions Vehicle Program. The Advanced Clean Cars program (January 2012) is a new emissions-control program for model years 2015 through 2025. The program combines the control of smog-causing and soot-causing pollutants and GHG emissions into a single coordinated package. The package includes elements to reduce smog-forming pollution, reduce GHG emissions, promote clean cars, and provide the fuels for clean cars (CARB 2011). To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that in 2025, cars will emit 75% less smog-forming pollution than the average new car sold today. To reduce GHG emissions, CARB, in conjunction with the EPA and the NHTSA, adopted new GHG standards for model year 2017 to 2025 vehicles; the new standards are estimated to reduce GHG emissions by 34% in 2025. The zero-emissions vehicle (ZEV) program will act as the focused technology of the Advanced Clean Cars program by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles in the 2018 to 2025 model years.

EO B-16-12. EO B-16-12 (March 2012) required that state entities under the governor's direction and control support and facilitate the rapid commercialization of ZEVs. It ordered CARB, CEC, CPUC, and other relevant agencies to work with the Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to help achieve benchmark goals by 2015, 2020, and 2025. On a statewide basis, EO B-16-12 established a target reduction of GHG emissions from the transportation sector equaling 80% less than 1990 levels by 2050. This directive did not apply to vehicles that have special performance requirements necessary for the protection of the public safety and welfare.

AB 1236. AB 1236 (October 2015) (Chiu) required a city, county, or city and county to approve an application for the installation of electric vehicle charging stations, as defined, through the issuance of specified permits unless the city or county makes specified written findings based upon substantial evidence in the record that the proposed installation would have a specific, adverse impact upon the public health or safety, and there is no feasible method to satisfactorily mitigate or avoid the specific, adverse impact. The bill provided for appeal of that decision to the planning commission, as specified. The bill provided that the implementation of consistent statewide standards to achieve the timely and cost-effective installation of electric vehicle charging stations is a matter of statewide concern. The bill required electric vehicle charging stations to meet specified standards. The bill required a city, county, or city and county with a population of 200,000 or more residents to adopt an ordinance, by September 30, 2016, that created an expedited and streamlined permitting process for electric vehicle charging stations, as specified. The bill also required a city, county, or city and county with a population of less than 200,000 residents to adopt this ordinance by September 30, 2017.

Water

EO B-29-15. In response to the ongoing drought in California, EO B-29-15 (April 2015) set a goal of achieving a statewide reduction in potable urban water usage of 25% relative to water use in 2013. The term of the EO extended through February 28, 2016, although many of the directives have become permanent water-efficiency standards and requirements. The EO includes specific directives that set strict limits on water usage in the state. In response to EO B-29-15, the California Department of Water Resources has modified and adopted a revised version of the Model Water Efficient Landscape Ordinance that, among other changes, significantly increases the requirements for landscape water use efficiency and broadens its applicability to include new development projects with smaller landscape areas.

Solid Waste

AB 939 and AB 341. In 1989, AB 939, known as the Integrated Waste Management Act (California Public Resources Code, Sections 40000 et seq.), was passed because of the increase in waste stream and the decrease in landfill capacity. The statute established the California Integrated Waste Management Board, which oversees a disposal reporting system. AB 939 mandated a reduction of waste being disposed where jurisdictions were required to meet diversion goals of all solid waste through source reduction, recycling, and composting activities of 25% by 1995 and 50% by the year 2000.

AB 341 (Chapter 476, Statutes of 2011 (Chesbro)) amended the California Integrated Waste Management Act of 1989 to include a provision declaring that it is the policy goal of the state that not less than 75% of solid waste generated be source-reduced, recycled, or composted by the year 2020, and annually thereafter. In addition, AB 341 required the California Department of Resources Recycling and Recovery (CalRecycle) to develop strategies to achieve the state's policy goal. CalRecycle conducted several general stakeholder workshops and several focused workshops and in August 2015 published a discussion document titled AB 341 Report to the Legislature, which identifies five priority strategies that CalRecycle believes would assist the state in reaching the 75% goal by 2020, legislative and regulatory recommendations and an evaluation of program effectiveness (CalRecycle 2012).

Other State Actions

Senate Bill 97. SB 97 (Dutton) (August 2007) directed the Governor's Office of Planning and Research (OPR) to develop guidelines under CEQA for the mitigation of GHG emissions. In 2008, OPR issued a technical advisory as interim guidance regarding the analysis of GHG emissions in CEQA documents, which indicated that a project's GHG emissions, including those associated with vehicular traffic, energy consumption, water usage, and construction activities, should be identified and estimated (OPR 2008). The advisory further recommended that the Lead Agency determine significance of the impacts and impose all mitigation measures necessary to reduce GHG emissions to a level that is less than significant. The CNRA adopted the CEQA Guidelines amendments in December 2009, which became effective in March 2010.

Under the amended guidelines, a lead agency has the discretion to determine whether to use a quantitative or qualitative analysis or apply performance standards to determine the significance of GHG emissions resulting from a particular project (14 CCR 15064.4(a)). The guidelines require a lead agency to consider the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4(b)). The guidelines also allow lead agencies to consider feasible means of mitigating the significant effects of GHG emissions, including reductions in emissions through the implementation of project features or off-site measures. The adopted amendments do not establish a GHG emission threshold, instead allowing a lead agency to develop, adopt, and apply its own thresholds of significance or those developed by other agencies or experts. The CNRA also acknowledges that a lead agency may consider compliance with regulations or requirements implementing AB 32 in determining the significance of a project's GHG emissions (CNRA 2009a).

With respect to GHG emissions, the CEQA Guidelines state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines note that an agency may identify emissions by either selecting a "model or methodology" to quantify the emissions or by relying on "qualitative analysis or other performance based standards" (14 CCR 15064.4(a)). Section 15064.4(b) states that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment: (1) the extent a project may increase or reduce GHG emissions as compared to the existing environmental setting; (2) whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and (3) the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4(b)).

EO S-13-08. EO S-13-08 (November 2008) was intended to hasten California's response to the impacts of global climate change, particularly sea-level rise. It directed state agencies to take specified actions to assess and plan for such impacts. It directed the CNRA, in cooperation with the California Department of Water Resources, CEC, California's coastal management agencies, and the Ocean Protection Council, to request that the National Academy of Sciences prepare a *Sea Level Rise Assessment Report* by December 1, 2010. The Ocean Protection Council, California Department of Water Resources, and CEC, in cooperation with other state agencies, were required to conduct a public workshop to gather information relevant to the *Sea Level Rise Assessment Report*. The Business, Transportation, and Housing Agency was ordered to assess, within 90 days of issuance of the EO, the vulnerability of the state's transportation systems to sea-level rise. The Governor's OPR and the CNRA are required to provide land use planning guidance related to sea-level rise and other climate change impacts. The EO also required the other state agencies to develop adaptation strategies by June 9, 2009, to respond to the impacts of global climate change that are predicted to occur over the next 50 to 100 years. A discussion draft adaptation strategies report was released in August 2009, and the final *2009 California Climate Adaptation Strategy* report was issued in December 2009 (CNRA 2009a). An update to the 2009 report, *Safeguarding California: Reducing Climate Risk*, was issued in July 2014 (CNRA 2014). To assess the state's vulnerability, the report summarized key climate change impacts to the state for the following areas: agriculture, biodiversity and habitat, emergency management, energy, forestry, ocean and coastal ecosystems and resources, public health, transportation, and water.

2015 State of the State Address. In January 2015, Governor Brown, in his inaugural address and annual report to the Legislature, established supplementary goals to further reduce GHG emissions over the next 15 years. These goals include an increase in California's renewable energy portfolio from 33% to 50%, a reduction in vehicle petroleum use for cars and trucks by up to 50%, measures to double the efficiency of existing buildings, and decreasing emissions associated with heating fuels.

2016 State of the State Address. In his January 2016 address, Governor Brown established a statewide goal to bring per capita GHG emission down to two tons per person, which reflects the goal of the *Global Climate Leadership Memorandum of Understanding* (Under 2 MOU) to limit global warming to less than 2°C by 2050. The Under 2 MOU agreement pursues emission reductions of 80% to 95% below 1990 levels by 2050 and/or reaching a per capita annual emissions goal of less than 2 metric tons by 2050. A total of 135 jurisdictions representing 32 countries and 6 continents, including California, have signed or endorsed the Under 2 MOU (Under 2 2016).

3.2.3 Local Regulations

3.2.3.1 San Joaquin Valley Air Pollution Control District

The SJVAPCD does not regulate GHG emissions directly through its permitting responsibilities for stationary sources. The SJVAPCD, however, can have an impact on GHGs from new and modified stationary sources when acting as a lead agency for CEQA. The SJVAPCD implements its GHG policies and reviews whether new or modified stationary sources will implement best performance standards (BPSs).

In 2009, the SJVAPCD developed an internal policy and guidance for local land use agencies to use in evaluating GHG impacts under CEQA. In the Final Staff Report – *Addressing GHG Emissions Impacts under the California Environmental Quality Act* (SJVAPCD 2009c), the SJVAPCD reviewed potential GHG significance thresholds and approaches suggested by or adopted by the following entities, ranging from quantification of a project's GHG impacts without a recommended significance threshold to a zero threshold to specific significance thresholds for different kinds of projects (e.g., residential, mixed use, industrial, plans).[14]

- CARB – "Preliminary Draft Staff Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act"
- OPR – "Technical Advisory – CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review" and "*Preliminary Draft*

[14] These documents encompassed the primary approaches for establishing significance thresholds in the period prior to the March 18, 2010 effective date of revisions of the CEQA Guidelines in accordance with SB 97. Additional guidance regarding assessment of GHG impacts were provided in the revised CEQA Guidelines and accompanying *Final Statement of Reasons for Regulatory Action - Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB97* (CNRA 2009a). In addition, the California appellate courts and the Supreme Court have more recently considered CEQA cases and, in some cases, issued published decisions that provide additional direction regarding the appropriateness of certain GHG assessment methodologies and significance thresholds.

CEQA Guideline Amendments for Greenhouse Gas Emissions and Public Workshop Announcement"

- California Air Pollution Control Officers Association (CAPCOA) – *CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act*
- Association of Environmental Professionals – "Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents"
- South Coast Air Quality Management District – "Draft Guidance Document – *Interim CEQA GHG Significance Threshold*"
- Bay Area Air Quality Management District – Draft revisions to *California Environmental Quality Act Air Quality Guidelines*
- Sacramento Metropolitan Air Quality Management District – "*Addressing Climate Change in CEQA Documents*"

The following discussion summarizes the SJVAPCD's conclusions about various categories of GHG significance thresholds.

Zero Threshold – The SJVAPCD concluded that "Although a zero threshold is appealing in its simplicity; execution of a zero threshold would be difficult or impossible" (SJVAPCD 2009c). Furthermore, the SJVAPCD found that projects that could not reduce their emissions to zero would require preparation of an EIR and adoption of a statement of overriding consideration by the lead agency. Potentially, projects could choose to relocate to a region with a less stringent threshold, so-called "leakage" that would still result in GHG emissions outside the SJVAPCD. Finally, the SJVAPCD noted that CARB concluded that zero thresholds are not mandated because some level of GHG emissions is still consistent with climate stabilization and other regulatory programs will result in GHG reductions. For these reasons, the SJVAPCD did not support a zero threshold. Accordingly, a zero threshold was not selected as an appropriate GHG/climate change threshold for this assessment.

Non-Zero Quantitative Thresholds – As indicated previously, the SJVAPCD reviewed numerous quantitative thresholds adopted or proposed by other air districts and organizations, including "mass of GHG emissions generate per unit of activity, GHG emissions per capita per unit basis, and percent reduction compared to Business-as-Usual" (SJVAPCD 2009c). While a tiered approach was evaluated, with the final tier incorporating a quantitative threshold, the SJVAPCD concluded that "… without supporting scientific information, establishment of tier trigger levels could be argued to be arbitrary, and district staff does not believe the available science supports establishing a bright-line threshold, above which emissions are significant and below which they are not (SJVAPCD 2009c).

More specifically, the SJVAPCD concluded that inadequate evidence exists to support a specific quantitative level (e.g., a number of MT CO_2E per year that would be emitted due to a project) representing a significant impact. Specifically, the *Final Staff Report* states:

> District staff has reviewed the relevant scientific information and concludes that the existing science is inadequate to support quantification of the extent to which project specific GHG emissions would impact global climatic features such as average air temperature, average annual rainfall, or average annual snow pack. Thus, District staff concludes that it is not feasible to scientifically establish a numerical threshold that supports a determination that GHG emissions from a specific project, of any size, would or would have a significant impact on global climate change. In other words, the District was not able to determine a specific quantitative level of GHG emission increase, above which the project would have a significant impact on the environment, and below which would have an insignificant impact. District staff further concludes that impacts of project specific emissions on global climatic change are cumulative in nature, and the significance thereof should be examined in that context. This is readily understood when one considers that global climatic change is the result of the sum total of GHG emissions, both man made [sic] and natural that occurred in the past; that is occurring now; and will occur in the future (SJVAPCD 2009c).

Accordingly, a bright-line numerical threshold was not selected as an appropriate GHG / climate change threshold for this assessment.

Best Performance Standards – The SJVAPCD evaluated performance-based standards, which would state "in quantifiable terms the level and extent of the attribute necessary to reach a goal or objective." (SJVAPCD). The SJVAPCD considered a project achieving the performance-based standard or mitigating GHG emissions to an equivalent emission reduction level would be considered to have a less-than-significant cumulative impact on climate change. In conclusion, the SJVAPCD found that the state's GHG emission reduction target would be accomplished by achieving a 29% reduction from business as usual (BAU) and that achieving this reduction would be a "de facto" performance-based standard for GHG emission reductions.

On December 17, 2009, the SJVAPCD Governing Board adopted *Guidance for Valley Land-Use Agencies in Addressing GHG Emission Impacts for New Projects under CEQA* (SJVAPCD

2009b). The guidance recommends the following hierarchy for evaluating a project's impact with respect to its GHG emissions:

- Projects complying with an approved GHG emission reduction plan or GHG mitigation program, which avoids or substantially reduces GHG emissions within the geographic area in which the project is located would be determined to have a less than significant individual and cumulative impact for GHG emissions. Such plans or programs must be specified in law or approved by the lead agency with jurisdiction over the affected resource and supported by a CEQA compliant environmental review document adopted by the lead agency. Projects complying with an approved GHG emission reduction plan or GHG mitigation program would not be required to implement Best Performance Standards (BPS).
- Projects implementing BPS would not require quantification of project specific GHG emissions.[15] Consistent with the state CEQA Guidelines, such projects would be determined to have a less than significant individual and cumulative impact for GHG emissions.
- Projects not implementing BPS would require quantification of project specific GHG emissions and demonstration that project specific GHG emissions would be reduced or mitigated by at least 29%, compared to BAU, including GHG emission reductions achieved since the 2002–2004 baseline period. Projects achieving at least a 29% GHG emission reduction compared to BAU would be determined to have a less than significant individual and cumulative impact for GHG (SJVAPCD 2009b).
- For development projects, BPS would include project design elements, land use decisions, and technologies that reduce GHG emissions. While the SJVAPCD has adopted BPS for several types of stationary sources (e.g., boilers), it has not developed BPS for land development projects. Projects implementing any combination of BPS, and/or demonstrating a total 29% reduction in GHG emissions from BAU, would be determined to have a less than significant individual and cumulative impact on global climate change (SJVAPCD 2015b).

3.2.3.2 Fresno Council of Governments

SB 375 requires MPOs to prepare an SCS in their RTP. As discussed in Section 2.2.3.2, the FCOG developed the 2014 RTP/SCS as the region's strategy to fulfill the requirements of SB 375. The 2014 RTP/SCS establishes a development pattern for the region that, when integrated with the transportation network and other policies and measures, would reduce GHG emissions

[15] The guidance recommends, "Projects requiring preparation of an Environmental Impact Report for any other reason would require quantification of project specific GHG emissions." This assessment for the project does include quantification of the project's construction and operational GHG emissions.

from transportation (excluding goods movement). Specifically, the 2014 RTP/SCS links the goals of sustaining mobility with the goals of fostering economic development; enhancing the environment; reducing energy consumption; promoting transportation-friendly development patterns; and encouraging all residents affected by socioeconomic, geographic, and commercial limitations to be provided with fair access. The 2014 RTP/SCS does not require that local general plans, specific plans, or zoning be consistent with it but provide incentives for consistency for governments and developers.

3.3 Climate Change Conditions and Inventories

3.3.1 Contributions to Greenhouse Gas Emissions

Per the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014* (EPA 2016e), total United States GHG emissions were approximately 6,870.5 MMT CO_2E in 2014. The primary GHG emitted by human activities in the United States was CO_2, which represented approximately 80.9% of total GHG emissions (5,556.0 MMT CO_2E). The largest source of CO_2, and of overall GHG emissions, was fossil-fuel combustion, which accounted for approximately 93.7% of CO_2 emissions in 2014 (5,208.2 MMT CO_2E). Total United States GHG emissions have increased by 7.4% from 1990 to 2014, and emissions increased from 2013 to 2014 by 1.0% (70.5 MMT CO_2E). Since 1990, United States GHG emissions have increased at an average annual rate of 0.3%; however, overall, net emissions in 2014 were 8.6% below 2005 levels (EPA 2016e).

According to California's 2000–2014 GHG emissions inventory (2016 edition), California emitted 441.5 MMT CO_2E in 2014, including emissions resulting from out-of-state electrical generation (CARB 2016e). The sources of GHG emissions in California include transportation, industry, electric power production from both in-state and out-of-state sources, residential and commercial activities, agriculture, high global-warming potential substances, and recycling and waste. The California GHG emission source categories and their relative contributions in 2014 are presented in Table 12.

Table 12
Greenhouse Gas Emissions Sources in California

Source Category	Annual GHG Emissions (MMT CO_2E)	Percent of Total[a]
Transportation	159.53	36%
Industrial uses	93.32	21%
Electricity generation[b]	88.24	20%
Residential and commercial uses	38.34	9%
Agriculture	36.11	8%

Table 12
Greenhouse Gas Emissions Sources in California

Source Category	Annual GHG Emissions (MMT CO_2E)	Percent of Total[a]
High global-warming potential substances	17.15	4%
Recycling and waste	8.85	2%
Totals	**441.54**	**100%**

Source: CARB 2016e.
Notes: Emissions reflect the 2014 California GHG inventory.
MMT CO_2E = million metric tons of carbon dioxide equivalent per year
a Percentage of total has been rounded, and total may not sum due to rounding.
b Includes emissions associated with imported electricity, which account for 36.51 MMT CO_2E annually.

During the 2000 to 2014 period, per capita GHG emissions in California have continued to drop from a peak in 2001 of 13.9 MT per person to 11.4 MT per person in 2014, representing an 18% decrease. In addition, total GHG emissions in 2014 were 2.8 MMT CO_2E less than 2013 emissions. The declining trend in GHG emissions, coupled with programs that will continue to provide additional GHG reductions going forward, demonstrates that California is on track to meet the 2020 target of 431 MMT CO_2E (CARB 2016e).

3.3.2 Potential Effects of Human Activity on Climate Change

Globally, climate change has the potential to affect numerous environmental resources through uncertain impacts related to future air temperatures and precipitation patterns. The 2014 *Intergovernmental Panel on Climate Change Synthesis Report* (IPCC 2014) indicated that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Signs that global climate change has occurred include warming of the atmosphere and ocean, diminished amounts of snow and ice, and rising sea levels (IPCC 2014).

In California, climate change impacts have the potential to affect sea-level rise, agriculture, snowpack and water supply, forestry, wildfire risk, public health, and electricity demand and supply (CCCC 2006). The primary effect of global climate change has been a 0.2°C rise in average global tropospheric temperature per decade, determined from meteorological measurements worldwide between 1990 and 2005. Scientific modeling predicts that continued emissions of GHGs at or above current rates would induce more extreme climate changes during the twenty-first century than were observed during the twentieth century. A warming of about 0.2°C (0.36°F) per decade is projected, and there are identifiable signs that global warming could be taking place.

Although climate change is driven by global atmospheric conditions, climate change impacts are felt locally. A scientific consensus confirms that climate change is already affecting California.

The average temperatures in California have increased, leading to more extreme hot days and fewer cold nights. Shifts in the water cycle have been observed, with less winter precipitation falling as snow, and both snowmelt and rainwater running off earlier in the year. Sea levels have risen, and wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later (CAT 2010a).

An increase in annual average temperature is a reasonably foreseeable effect of climate change. Observed changes over the last several decades across the western United States reveal clear signals of climate change. Statewide average temperatures increased by about 1.7°F from 1895 to 2011, and warming has been greatest in the Sierra Nevada (CCCC 2012). By 2050, California is projected to warm by approximately 2.7°F above 2000 averages, a threefold increase in the rate of warming over the last century. By 2100, average temperatures could increase by 4.1°F to 8.6°F, depending on emissions levels. Springtime warming—a critical influence on snowmelt—will be particularly pronounced. Summer temperatures will rise more than winter temperatures, and the increases will be greater in inland California, compared to the coast. Heat waves will be more frequent, hotter, and longer. There will be fewer extremely cold nights (CCCC 2012). A decline of Sierra Nevada snowpack, which accounts for approximately half of the surface water storage in California, by 30% to as much as 90% is predicted over the next 100 years (CAT 2006).

Model projections for precipitation over California continue to show the Mediterranean pattern of wet winters and dry summers with seasonal, year-to-year, and decade-to-decade variability. For the first time, however, several of the improved climate models shift toward drier conditions by the mid-to-late twenty-first century in central, and most notably, Southern California. By the late century, all projections show drying, and half of them suggest 30-year average precipitation will decline by more than 10% below the historical average (CCCC 2012).

Wildfire risk in California will increase as a result of climate change. Earlier snowmelt, higher temperatures, and longer dry periods over a longer fire season will directly increase wildfire risk. Indirectly, wildfire risk will also be influenced by potential climate-related changes in vegetation and ignition potential from lightning. However, human activities will continue to be the biggest factor in ignition risk. It is estimated that the long-term increase in fire occurrence associated with a higher emissions scenario is substantial, with increases in the number of large fires statewide ranging from 58% to 128% above historical levels by 2085. Under the same emissions scenario, estimated burned area will increase by 57% to 169%, depending on the location (CCCC 2012).

Reduction in the suitability of agricultural lands for traditional crop types may occur. While effects may occur, adaptation could allow farmers and ranchers to minimize potential negative effects on agricultural outcomes by adjusting timing of plantings or harvesting and changing crop types.

Public health-related effects of increased temperatures and prolonged temperature extremes, including heat stroke, heat exhaustion, and exacerbation of existing medical conditions, could be particular problems for the elderly, infants, and those who lack access to air conditioning or cooled spaces (CNRA 2009a).

3.4 Significance Criteria and Methodology

3.4.1 Thresholds of Significance

3.4.1.1 Office of Planning and Research's Guidance

The OPR's Technical Advisory titled *CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review* (2008) states that "public agencies are encouraged but not required to adopt thresholds of significance for environmental impacts. Even in the absence of clearly defined thresholds for GHG emissions, the law requires that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to "a significant, cumulative climate change impact." Furthermore, the advisory document indicates that "in the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a 'significant impact,' individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice" (OPR 2008).

Global climate change is a cumulative impact; a project participates in this potential impact through its incremental contribution combined with the cumulative increase of all other sources of GHGs.

While the Project would result in emissions of GHGs during construction and operation, no guidance exists to indicate what level of GHG emissions would be considered substantial enough to result in a significant adverse impact on global climate. However, it is generally believed that an individual project is of insufficient magnitude by itself to influence climate change or result in a substantial contribution to the global GHG inventory since scientific uncertainty regarding the significance of a project's individual and cumulative effects on global climate change remains.

Thus, GHG impacts are recognized exclusively as cumulative impacts; there are no noncumulative GHG emission impacts from a climate change perspective (CAPCOA 2008). This approach is consistent with that recommended by the CNRA, which noted in its public notice for the proposed CEQA amendments that the evidence before it indicates that, in most cases, the impact of GHG emissions should be considered in the context of a cumulative impact rather than a project-level impact (CNRA 2009b). Similarly, the *Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB 97* (CNRA 2009c) confirms that an EIR or other environmental document must analyze the incremental contribution of a project to GHG levels and determine whether those emissions are cumulatively considerable. Accordingly, further discussion of the Project's GHG emissions and their impact on global climate are addressed in the following text.

3.4.1.2 California Environmental Quality Act Guidelines

The California Natural Resources Agency adopted amendments to the CEQA Guidelines on December 30, 2009, which became effective on March 18, 2010. With respect to GHG emissions, the amended CEQA Guidelines state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines note that an agency may identify emissions by either selecting a "model or methodology" to quantify the emissions or by relying on "qualitative analysis or other performance based standards" (14 CCR 15064.4(a)). Section 15064.4(b) states that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment:

- The extent a project may increase or reduce GHG emissions as compared to the existing environmental setting.
- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4(b)).

In addition, Section 15064.7(c) of the CEQA Guidelines specifies that "[w]hen adopting thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies, or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence." Similarly, the revisions to Appendix G, Environmental Checklist Form, which is often used as a basis for lead agencies' selection of significance thresholds, do not prescribe specific thresholds.

Rather, the CEQA Guidelines establish two new CEQA thresholds related to GHGs, and these will be used to discuss the significance of project impacts (14 CCR 15000 et seq.):

1. Would the project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?

2. Would the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs?

Accordingly, the CEQA Guidelines do not prescribe specific methodologies for performing an assessment, establish specific thresholds of significance, or mandate specific mitigation measures. Rather, the CEQA Guidelines emphasize the lead agency's discretion to determine the appropriate methodologies and thresholds of significance that are consistent with the manner in which other impact areas are handled in CEQA (CNRA 2009c).

3.4.1.3 San Joaquin Valley Air Pollution Control District

In August 2008, the SJVAPCD adopted a Climate Change Action Plan (CCAP). The CCAP directed the Air Pollution Control Officer to develop guidance documents to assist land–use and other permitting agencies in addressing GHG emissions as part of the CEQA process. The SJVAPCD has adopted the guidance in *Guidance for Valley Land-Use Agencies in Addressing GHG Emission Impacts for New Projects Under CEQA* and the policy, *Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency*. The guidance and policy rely on the use of performance based standards, otherwise known as Best Performance Standards (BPS) to assess significance of project specific GHG emissions on global climate change during the environmental review process. However, SJVAPCD's adopted BPS are specifically directed at reducing GHG emissions from stationary sources; therefore, the adopted BPS would not generally be applicable to the Project as the Project would not be a stationary source of emissions. The SJVAPCD guidance does not limit a lead agency's authority in establishing its own process and guidance for determining significance of project related impacts on global climate change. SJVAPCD supports the use of the interim thresholds as established by the California Air Pollution Control Officers Association (CAPCOA) when adopted thresholds are not applicable. As such, for the purposes of establishing a quantitative threshold for GHG emissions, the interim threshold for operational emissions of industrial projects established by CAPCOA is used herein. This threshold is consistent with California's climate-stabilization target (identified in AB 32). As a conservative estimate, GHG emissions include construction emissions annualized over the 30-year life of the Project, as well as operational emissions.

CAPCOA recommended an interim 900 MT CO_2E screening level as a theoretical approach to identify projects that require further analysis and potential mitigation (CAPCOA 2008). The 900 MT CO_2E per year screening threshold was developed by CAPCOA based on data collection on various development applications submitted among four diverse cities, including the cities of Los Angeles, Pleasanton, Dublin, and Livermore. Following the review of numerous pending applications within these four cities, an analysis was conducted to determine the threshold that would capture 90% or more of applications that would be required to conduct a full GHG analysis and implement GHG emission reduction measures as part of final project design. Following CAPCOA's analysis of development applications in various cities, it was determined that the threshold of 900 MT CO_2E per year would achieve the objective of 90% capture and ensure that new development projects would keep the State of California on track to meet the goals of AB 32. The 900 MT CO_2E threshold is applied to evaluate whether the project would generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

3.4.2 Approach and Methodology

As discussed in Section 3.1.2, Greenhouse Gases and Global Warming Potential, this analysis assumes that the GWP for CH_4 is 25 and the GWP for N_2O is 298, based on the IPCC Fourth Assessment Report (IPCC 2007).

3.4.2.1 Construction

Project generated construction emissions of GHGs were quantified using a spreadsheet based emissions model and applicant supplied information. Mobile-source emissions were modeled based on the estimated daily vehicle trips and vehicle miles traveled that would result from construction activities from worker, vendor, and hauling trips.

The combustion of diesel and gasoline in construction equipment generates GHGs. The spreadsheet model was used to calculate the GHG emissions from construction equipment for the Project. The construction equipment type and engine size were provided by the Applicant for each Project phase. The spreadsheet model uses emission factors from the CARB OFFROAD 2011 model, EMFAC 2014, model and CalEEMod default load factors for each type of equipment to calculate emissions.

3.4.2.2 Operation

Long-term (i.e., operational) regional emissions of GHGs were quantified using the CalEEMod. Mobile-source emissions were modeled based on the increase in daily vehicle trips and the vehicle miles traveled that would result from maintenance activities.

Energy Sources

The estimation of operational energy emissions was based on electricity consumption for the on-site weather station, site control center, HVAC units, O&M building, and ESS. This consumption was provided by the Project applicant. CalEEMod default energy intensity factors (CO_2, CH_4, and N_2O mass emissions per kilowatt-hour) for PG&E are based on the value for PG&E's

energy mix in 2008, the latest year provided in the model. As explained in Section 3.2.2, State Regulations, SB X1 2 established a target of 33% from renewable energy sources for all electricity providers in California by 2020 and SB 350 calls for further development of renewable energy, with a target of 50% by 2030. The estimated energy usage and GHG emission factors for PG&E were used to calculate GHG emissions from this source category.

Mobile Sources

All details for criteria air pollutants emissions estimates methodology discussed in Section 2.4.2.2 are also applicable for the estimation of operational mobile source GHG emissions. Regulatory measures related to mobile sources include AB 1493 (Pavley) and related federal standards. AB 1493 required that CARB establish GHG emission standards for automobiles, light-duty trucks, and other vehicles determined by CARB to be vehicles that are primarily used for noncommercial personal transportation in the state. In addition, the NHTSA and EPA have established corporate fuel economy standards and GHG emission standards, respectively, for automobiles and light-duty, medium-duty, and heavy-duty vehicles. Implementation of these standards and fleet turnover (i.e., replacement of older vehicles with newer ones) will gradually reduce emissions from the Project's motor vehicles. In addition, the Low Carbon Fuel Standard calls for a 10% reduction in the "carbon intensity" of motor vehicle fuels by 2020. The Project would have mobile source emissions generated from the maintenance vehicles travelling to and from the site. Estimated activity data from the Applicant and the CalEEMod were used to calculate emissions from this source category.

Solid Waste

The Project would generate solid waste, and therefore, result in CO_2E emissions associated with landfill off-gassing. CalEEMod default values for solid waste generation were used to estimate GHG emissions associated with solid waste. Solid waste would be generated through maintenance activities and the on-site control building.

Water and Wastewater

Supply, conveyance, treatment, and distribution of water for the Project require the use of electricity, which would result in associated indirect GHG emissions. Similarly, wastewater generated by the proposed Project requires the use of electricity for conveyance and treatment, along with GHG emissions generated during wastewater treatment. The Project applicant provided water consumption estimates for both indoor and outdoor water use and associated electricity consumption from water use and wastewater generation and emissions were estimated using CalEEMod.

Area Sources

Gas-Insulated Switchgear

During O&M, one of the main sources of GHG emissions would be fugitive emissions from equipment containing SF_6 gas installed at the proposed on-site substations. SF_6 has a GWP of 23,900 using CO_2 at a reference value of 1 (UNFCCC 2012). The only piece of equipment within a substation that will have SF_6 gas would be the 115 kV breakers. It is estimated that the Project will have a total of up to seven 115 kV breakers, for a total of 540 lbs of SF_6 gas. The proposed Project's circuit breakers would have a maximum annual leak rate of 0.5%, based on the manufacturer's guaranteed specifications.

3.5 Impact Analysis

The SJVAPCD's significance criteria described in Section 3.4, Significance Criteria and Methodology, were used to evaluate GHG emissions impacts associated with the construction and operation of the Project.

3.5.1 Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Construction Emissions

Construction of the Project would result in GHG emissions, which are primarily associated with use of off-road construction equipment, on-road vendor trucks, and worker vehicles. The SJVAPCD recommends that construction emissions be amortized over a 30-year project lifetime, so that GHG reduction measures will address construction GHG emissions as part of the operational GHG reduction strategies. Thus, the total construction GHG emissions were calculated, amortized over 30 years, and added to the total operational emissions for comparison with the GHG significance threshold of 900 MT CO_2E per year. The determination of significance, therefore, is addressed in the operational emissions discussion following the estimated construction emissions.

A spreadsheet model was used to calculate the annual GHG emissions based on the construction scenario described in Section 2.4.2.1. Construction of the Project is anticipated to commence in September 2019 and reach completion at the end of September 2020, lasting a total of 12 months. On-site sources of GHG emissions include off-road equipment and off-site sources include on-road vehicles (e.g., haul trucks, vendor trucks, and worker vehicles). Table 13 presents construction emissions for the Project in 2019 and 2020 from on-site and off-site emission sources.

Table 13
Estimated Annual Construction Greenhouse Gas Emissions

Year	CO_2	CH_4	N_2O	CO_2E
	Metric Tons per Year			
2019	1,236.21	0.14	0.00	1,239.67
2020	2,767.14	0.22	0.00	2,772.69
Total	**4,003.35**	**0.61**	**0.00**	**4,012.36**
Amortized Emissions over 30 Years				***133.75***

Notes: CH_4 = methane; CO_2 = carbon dioxide; CO_2E = carbon dioxide equivalent; N_2O = nitrous oxide
See Appendix A for complete results.

As shown in Table 13, the estimated total GHG emissions during construction of would be approximately 1,239.67 MT CO_2E in 2019 and 2,772.69 MT CO_2E in 2020, for a total of 4,012.36 MT CO_2E over the construction period. Estimated Project-generated construction emissions amortized over 30 years would be approximately 133.75 MT CO_2E per year. As with Project-generated construction air quality pollutant emissions, GHG emissions generated during construction of the Project would be short-term in nature, lasting only for the duration of the construction period, and would not represent a long-term source of GHG emissions. Because there is no separate GHG threshold for construction, the evaluation of significance is discussed in the operational emissions analysis in the following text.

Operational Emissions

Operation of the Project would generate GHG emissions through motor vehicle trips to and from the Project site; energy use (natural gas or electricity consumed by the Project, as required when the Project is not powered by on-site energy generation); solid waste disposal; and generation of electricity associated with water supply, treatment, and distribution and wastewater treatment. The CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Section 3.4.2.2.

The estimated operational (year 2021) Project-generated GHG emissions from area sources, energy usage, motor vehicles, solid waste generation, and water usage and wastewater generation are shown in Table 14.

Table 14
Estimated Annual Operational Greenhouse Gas Emissions

Emission Source	CO_2	CH_4	N_2O	CO_2E
	Metric Tons per Year			
Energy	55.22	0.01	0.00	55.43

Table 14
Estimated Annual Operational Greenhouse Gas Emissions

Emission Source	CO_2	CH_4	N_2O	CO_2E
	Metric Tons per Year			
Area	0.00	0.00	0.00	29.27[a]
Mobile	29.26	0.01	0.00	29.31
Off-road	0.78	0.00	0.00	0.78
Stationary	1.43	0.00	0.00	1.43
Waste	0.19	0.01	0.00	0.47
Water	2.47	0.04	0.00	3.83
Total	**89.35**	**0.06**	**0.00**	**120.52**
Amortized Construction Emissions over 30 Years				***133.75***
Operation + Amortized Construction Total				***254.27***

Notes: CH_4 = methane; CO_2 = carbon dioxide; CO_2E = carbon dioxide equivalent; N_2O = nitrous oxide
See Appendix A for complete results.
[a] Emissions from SF_6 are considered an area source.

As shown in Table 14, estimated annual Project-generated GHG emissions would be approximately 121 MT CO_2E per year as a result of Project operation. Estimated annual Project-generated operational emissions in 2021 and amortized Project construction emissions would be approximately 254 MT CO_2E per year. As shown, the total annual emissions would not exceed the GHG significance threshold of 900 MT CO_2E per year. Because the Project's GHG emissions would not result in a cumulatively considerable contribution, the Project would result in a less-than-significant cumulative impact in terms of climate change.

Greenhouse Gas Emissions Benefits

In keeping with the renewable energy target under the Scoping Plan and as required by SB 350, the proposed Project would provide a source of renewable energy to achieve the RPS of 50% by 2030. Renewable energy, in turn, potentially offsets GHG emissions generated by fossil-fuel power plants. Using the installed tracker capacity of 180 MW (180,000 kW) AC, the solar farm is anticipated to generate approximately 447,538,272 kWh per year (NREL 2017). This factor reflects the available daylight hours, conversion of DC to AC, and various system losses using the National Renewable Energy Laboratory's PVWatts online solar calculator. A GHG factor for fossil-fuel-generated electricity was developed based on reported CO_2 emissions and total fossil fuel generated electricity delivered for PG&E in 2014 (EPA 2014). The CO_2 factor for fossil-fuel-generated electricity would be 0.41 lbs CO_2E per kilowatt-hour. The detailed calculation is provided in Appendix A.

The contributions of CH_4 and N_2O are included in the CO_2E emission factor, including their respective GWPs. Thus, the Project would provide a potential reduction of 82,544 MT CO_2E per year if the electricity generated by the Project were to be used instead of electricity generated by fossil-fuel sources. After accounting for the annualized construction and annual operational emissions of 254 MT CO_2E per year, and the annualized reduction in GHG from the production of solar energy of 82,544 MT CO_2E, the net reduction in GHG emissions would be 82,290 MT CO_2E per year. This reduction is not considered in the significance determination of the Project's GHG emissions but is provided for disclosure purposes.

Carbon Sequestration

Carbon sequestration is the process by which CO_2 is removed from the atmosphere and deposited into a carbon reservoir (e.g., vegetation). Trees and vegetation take in CO_2 from the atmosphere during photosynthesis, break down the CO_2, store the carbon within plant parts, and release the oxygen back into the atmosphere. According to the Draft Biological Technical Report for the Project, the existing site consists of 1,254 acres of disked agricultural land, 27 acres of disturbed land, and 3.8 acres of developed land (Dudek 2017). As there would not be a significant change in land use from a vegetation and thus carbon sequestration standpoint for the Project, it is not anticipated that there would be a net gain or loss of carbon from the implementation of the Project.

3.5.2 Would the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Under the SJVAPCD's CEQA thresholds for GHG, a project would not have a significant GHG impact if it is consistent with an applicable plan to reduce GHG emissions, and a CEQA-compliant analysis was completed for the GHG reduction plan. The FCOG's RTP/SCS is an applicable plan adopted for the purpose of reducing GHGs from the land use and transportation sectors in Fresno County and was adopted after completion of a Program EIR. CARB approved the RTP/SCS in 2015. A project could result in a significant impact due to a conflict with an applicable plan, policy, or regulation if it would be inconsistent with the adopted FCOG RTP/SCS. Therefore, the Project could have a potential conflict with the RTP/SCS if it were to be found inconsistent based on a qualitative assessment of the Project's consistency with FCOG's SCS policies.

SB 375 requires FCOG to demonstrate in its SCS that it will reduce car and light truck GHG emissions 5% per capita by 2020, and 10% by 2035. The FCOG SCS has projected to exceed the goal by committing to a 9% reduction by 2020 and 11% reduction by 2035. The GHG emission goals in the FCOG RTP/SCS are based on demographic data trends and projections that include household, employment, and total population statistics. The FCOG RTP/SCS projects that the total employment in Fresno County will be 1,378,000 in 2020 and 1,466,000 in 2025, or 17,600 additional jobs per year in that timeframe (FCOG 2014). The Project is anticipated to have up to eight full-time equivalent personnel consisting of plant operators and maintenance technicians starting in 2021. Therefore, the additional jobs estimated by the Project would be well within the annual growth projection for the FCOG 2014 RTP/SCS. Therefore, the Project would be consistent with the FCOG 2014 RTP/SCS and would not conflict with an applicable plan and the Project would have a less than significant impact.

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APPENDIX A

Detailed Calculation Tables

Phase		Start Date	End Date	Work Days per Week	Work Days	Avg. # of Worker Vehicles (roundtrip)	Avg. Daily Vendor Trucks (roundtrip)	Total Haul Deliveries (roundtrip)	Avg. Haul Deliveries (roundtrip)	Avg. Daily Offsite Water Truck Trips (roundtrip)	#On-Road Pickups	2019 Work Days	2020 Work Days
Move-on (Laydown, construction trailers, and parking area)		9/1/2019	9/15/2019	5	**9**	10	5	25	3	10	5	9	0
Substation Construction		9/15/2019	1/31/2020	5	**94**	20	1	10	1	5	4	73	21
Gen-tie Line Installation		9/15/2019	3/31/2020	5	**136**	20	1	5	1	5	4	73	63
Site Preparation and Grading		9/15/2019	3/31/2020	5	**136**	29	5	0	0	50	5	73	63
Underground work (Trenching)		10/15/2019	5/15/2020	5	**148**	38	5	0	0	20	0	52	96
System Installation		12/1/2019	6/30/2020	5	**146**	317	5	0	0	20	10	19	127
Cleanup/Testing/Restoration		2/28/2020	9/1/2020	5	**132**	25	3	0	0	5	3	0	132
Overall		9/1/2019	9/1/2020		**254**							82	172
		Distance to Offsite Water (miles):	1.5										
		Avg. Worker Housing Distance:	40										
		Avg. Vendor Distance:	40										
		Avg. Haul Delivery Distance:	40										

ID	Phase Type (Select a drop down list item in Column B; if "Other", please specify in Column C)	Phase Start Date	Phase End Date	Equipment Operating Hours Per Day[1]	Equipment Type (Select a drop down list item in Column H; if "Other" please specify in Column I)		Phase	Number of Equipment	Horsepower	Load Factor	Engine Mfg Year	Engine Tier Rating (Tier 2, Tier 4i)[4]	Diesel Particulate Filter (Level)[5]		Engine Hours	Days (Calculated)	2019 Days	2020 Days
1	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Graders		Move-on (Laydown, construction tra	2	185	0.41		2				9	9	0
2	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Dozers		Move-on (Laydown, construction tra	1	158	0.4		2				9	9	0
3	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Scrapers		Move-on (Laydown, construction tra	2	365	0.4		2				9	9	0
4	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Loaders		Move-on (Laydown, construction tra	2	190	0.36		2				9	9	0
5	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Tractors/Loaders/Backhoes		Move-on (Laydown, construction tra	2	120	0.42		2				9	9	0
6	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Skid Steer Loaders		Move-on (Laydown, construction tra	3	83	0.37		2				9	9	0
7	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	24	Generator Sets	30kW Generator (security)	Move-on (Laydown, construction tra	1	40	0.74		3				9	9	0
8	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	12	Generator Sets	45kW Generator (offices)	Move-on (Laydown, construction tra	1	60	0.74		3				9	9	0
9	Substation Construction	9/15/2019	1/31/2020	4	Other General Industrial Equipment		Substation Construction	1	238	0.5		2				94	73	21
10	Substation Construction	9/15/2019	1/31/2020	4	Tractors/Loaders/Backhoes		Substation Construction	1	90	0.37		2				94	73	21
11	Substation Construction	9/15/2019	1/31/2020	5	Cranes		Substation Construction	1	400	0.29		2				94	73	21
12	Substation Construction	9/15/2019	1/31/2020	4	Rough Terrain Forklifts		Substation Construction	2	90	0.2		2				94	73	21
13	Substation Construction	9/15/2019	1/31/2020	4	Aerial Lifts		Substation Construction	1	60	0.31		2				94	73	21
14	Substation Construction	9/15/2019	1/31/2020	6	Graders		Substation Construction	1	185	0.41		2				94	73	21
15	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Dozers		Substation Construction	1	158	0.4		2				94	73	21
16	Substation Construction	9/15/2019	1/31/2020	4	Scrapers		Substation Construction	1	365	0.4		2				94	73	21
17	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Loaders		Substation Construction	1	190	0.36		2				94	73	21
18	Substation Construction	9/15/2019	1/31/2020	4	Excavators		Substation Construction	1	42	0.5		2				94	73	21
19	Substation Construction	9/15/2019	1/31/2020	6	Tractors/Loaders/Backhoes		Substation Construction	1	190	0.36		2				94	73	21
20	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Tractors/Loaders/Backhoes		Gen-tie Line Installation	1	90	0.37		2				136	73	63
21	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Cranes		Gen-tie Line Installation	1	400	0.29		2				136	73	63
22	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Crawler Tractors		Gen-tie Line Installation	1	147	0.44		2				136	73	63
23	Gen-tie Line Installation	9/15/2019	3/31/2020	2	Bore/Drill Rigs		Gen-tie Line Installation	1	190	0.42		2				136	73	63
24	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Rough Terrain Forklifts		Gen-tie Line Installation	1	90	0.2		2				136	73	63
25	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Other Construction Equipment		Gen-tie Line Installation	1	238	0.42		2				136	73	63
26	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Generator Sets		Gen-tie Line Installation	1	45	0.74		3				136	73	63
27	Site Preparation and Grading	9/15/2019	3/31/2020	8	Pumps	Water Pull	Site Preparation and Grading	2	185	0.41		2				136	73	63
28	Site Preparation and Grading	9/15/2019	3/31/2020	8	Graders		Site Preparation and Grading	2	185	0.41		2				136	73	63
29	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rubber Tired Dozers		Site Preparation and Grading	1	158	0.4		2				136	73	63
30	Site Preparation and Grading	9/15/2019	3/31/2020	6	Scrapers		Site Preparation and Grading	3	365	0.4		2				136	73	63
31	Site Preparation and Grading	9/15/2019	3/31/2020	6	Rubber Tired Loaders		Site Preparation and Grading	3	190	0.36		2				136	73	63
32	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Buster	Site Preparation and Grading	2	120	0.42		2				136	73	63
33	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Disk	Site Preparation and Grading	2	300	0.42		2				136	73	63
34	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rollers		Site Preparation and Grading	1	160	0.38		2				136	73	63
35	Site Preparation and Grading	9/15/2019	3/31/2020	6	Skid Steer Loaders		Site Preparation and Grading	2	83	0.37		2				136	73	63
36	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	30kW Generator (security)	Site Preparation and Grading	1	40	0.74		3				136	73	63
37	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	45kW Generator (offices)	Site Preparation and Grading	1	60	0.74		3				136	73	63
38	Underground work (Trenching)	10/15/2019	5/15/2020	6	Tractors/Loaders/Backhoes	Cable plow	Underground work (Trenching)	1	120	0.42		2				148	52	96
39	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers	Cable Trenchers	Underground work (Trenching)	1	42	0.5		2				148	52	96
40	Underground work (Trenching)	10/15/2019	5/15/2020	4	Plate Compactors		Underground work (Trenching)	1	180	0.43		2				148	52	96
41	Underground work (Trenching)	10/15/2019	5/15/2020	4	Excavators		Underground work (Trenching)	1	90	0.37		2				148	52	96
42	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers		Underground work (Trenching)	4	40	0.5		2				148	52	96
43	Underground work (Trenching)	10/15/2019	5/15/2020	6	Crushing/Processing Equipment	Padder	Underground work (Trenching)	1	180	0.43		2				148	52	96
44	Underground work (Trenching)	10/15/2019	5/15/2020	4	Tractors/Loaders/Backhoes		Underground work (Trenching)	2	90	0.37		2				148	52	96
45	Underground work (Trenching)	10/15/2019	5/15/2020	2	Rollers		Underground work (Trenching)	2	95	0.38		2				148	52	96
46	System Installation	12/1/2019	6/30/2020	4	Rough Terrain Forklifts		System Installation	5	90	0.2		2				146	19	127
47	System Installation	12/1/2019	6/30/2020	4	Aerial Lifts		System Installation	3	110	0.31		2				146	19	127
48	System Installation	12/1/2019	6/30/2020	4	Skid Steer Loaders		System Installation	10	80	0.4		2				146	19	127
49	System Installation	12/1/2019	6/30/2020	6	Air Compressors		System Installation	1	49	0.48		2				146	19	127
50	System Installation	12/1/2019	6/30/2020	6	Other Construction Equipment	Post Machines	System Installation	7	149	0.42		4i				146	19	127
51	System Installation	12/1/2019	6/30/2020	24	Generator Sets	30kW Generator (security)	System Installation	1	40	0.74		3				146	19	127
52	System Installation	12/1/2019	6/30/2020	24	Generator Sets	45kW Generator (offices)	System Installation	1	60	0.74		3				146	19	127
53	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	4	Tractors/Loaders/Backhoes		Cleanup/Testing/Restoration	1	90	0.37		2				132	0	132
54	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Graders		Cleanup/Testing/Restoration	1	185	0.41		2				132	0	132
55	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Scrapers		Cleanup/Testing/Restoration	2	365	0.4		2				132	0	132

Off-Site Vehicle Emissions Estimation

2019 Water Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**9**	**10**	**3**	90	30	270
Substation	**73**	**5**	**3**	365	15	1,095
Gen-Tie	**73**	**5**	**3**	365	15	1,095
Site Prep and Grading	**73**	**50**	**3**	3650	150	10,950
Underground/Trench	**52**	**20**	**3**	1040	60	3,120
System Installation	**19**	**20**	**3**	380	60	1,140
Cleanup/Testing/Commissioning	**0**	**5**	**3**	0	15	-
Total	**299**			5890		**17,670**
Overall Work Days	**82**					

2019 Hauling

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**9**	**3**	**80**	27	240	2,160
Substation	**73**	**1**	**80**	73	80	5,840
Gen-Tie	**73**	**1**	**80**	73	80	5,840
Site Prep and Grading	**73**	**0**	**80**	0	0	-
Underground/Trench	**52**	**0**	**80**	0	0	-
System Installation	**19**	**0**	**80**	0	0	-
Cleanup/Testing/Comissioning	**0**	**0**	**80**	0	0	-
Total	**299**			173		**13,840**
Overall Work Days	**82**					

2019 Vendor Trucks

Phase - Equipment Type: LHDT1	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**9**	**5**	**80**	45	400	3,600
Substation	**73**	**1**	**80**	73	80	5,840
Gen-Tie	**73**	**1**	**80**	73	80	5,840
Site Prep and Grading	**73**	**5**	**80**	365	400	29,200
Underground/Trench	**52**	**5**	**80**	260	400	20,800
System Installation	**19**	**5**	**80**	95	400	7,600
Cleanup/Testing/Comissioning	**0**	**3**	**80**	0	240	-
Total	**299**			911		**72,880**
Overall Work Days	**82**					

Pollutants	**ROG**		**TOG**		**CO**		**NOX**		**CO2**		**CO2 (Pavley I + LCFS)**		**PM10**		**PM2.5**		**SOX**	
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**				**0.10**		**0.10**		**0.01**	
Units	**Avg. Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Water Trucks	0.11	0.00	0.12	0.01	0.31	0.01	1.72	0.07	0.26	21.50	0.00	0.00	0.05	0.00	0.05	0.00	0.01	0.00
Hauling	0.09	0.00	0.10	0.00	0.24	0.01	1.34	0.06	0.00	0.00	0.00	0.00	0.04	0.00	0.04	0.00	0.00	0.00
G/Mi	**0.22**		**0.25**		**1.07**		**4.19**		**585.44**				**0.04**		**0.04**		**0.01**	
Vendor Trucks	0.43	0.02	0.49	0.02	2.10	0.09	8.20	0.34	0.52	42.67	0.00	0.00	0.09	0.00	0.08	0.00	0.01	0.00
Sum	0.63	0.03	0.72	0.03	2.65	0.11	11.27	0.46	0.78	64.17	0.00	0.00	0.17	0.01	0.16	0.01	0.02	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

2019 Worker Vehicle

Equipment Type: Passenger Cars + Trucks	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**9**	**10**	**80**	90	800	7,200
Substation	**73**	**20**	**80**	1460	1600	116,800
Gen-Tie	**73**	**20**	**80**	1460	1600	116,800
Site Prep and Grading	**73**	**29**	**80**	2117	2320	169,360
Underground/Trench	**52**	**38**	**80**	1976	3040	158,080
System Installation	**19**	**317**	**80**	6023	25360	481,840
Cleanup/Testing/Commissioning	**0**	**25**	**80**	0	2000	-
Total	**299**			13126		**1,050,080**
Overall Work Days	**82**					

Pollutants	**ROG**		**TOG**		**CO**		**NOX**		**CO2**		**CO2 (Pavley I + LCFS)**		**PM10**		**PM2.5**		**SOX**	
G/Mi	**0.03**		**0.05**		**1.19**		**0.17**		**348.37**				**0.01**		**0.01**		**0.00**	
Units	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Worker Vehicle	0.93	0.04	1.27	0.05	33.61	1.38	4.73	0.19	4.46	365.81	0.00	0.00	0.21	0.01	0.20	0.01	0.10	0.00
Sum	0.93	0.04	1.27	0.05	33.61	1.38	4.73	0.19	4.46	365.81	0.00	0.00	0.21	0.01	0.20	0.01	0.10	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

Off-Site Vehicle Emissions Estimation

2020
Water Truck

Equipment Type: HHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**0**	**10**	**3**	0	30	-
Substation	**21**	**5**	**3**	105	15	315
Gen-Tie	**63**	**5**	**3**	315	15	945
Site Prep and Grading	**63**	**50**	**3**	3150	150	9,450
Underground/Trench	**96**	**20**	**3**	1920	60	5,760
System Installation	**127**	**20**	**3**	2540	60	7,620
Cleanup/Testing/Commissioning	**132**	**5**	**3**	660	15	1,980
Total	**502**			8690		**26,070**
Overall Work Days	**172**					

2020
Hauling

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**0**	**3**	**80**	0	240	-
Substation	**21**	**1**	**80**	21	80	1,680
Gen-Tie	**63**	**1**	**80**	63	80	5,040
Site Prep and Grading	**63**	**0**	**80**	0	0	-
Underground/Trench	**96**	**0**	**80**	0	0	-
System Installation	**127**	**0**	**80**	0	0	-
Cleanup/Testing/Comissioning	**132**	**0**	**80**	0	0	-
Total	**502**			84		**6,720**
Overall Work Days	**172**					

2020
Vendor Trucks

Phase - Equipment Type: LHDT1	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**0**	**5**	**80**	0	400	-
Substation	**21**	**1**	**80**	21	80	1,680
Gen-Tie	**63**	**1**	**80**	63	80	5,040
Site Prep and Grading	**63**	**5**	**80**	315	400	25,200
Underground/Trench	**96**	**5**	**80**	480	400	38,400
System Installation	**127**	**5**	**80**	635	400	50,800
Cleanup/Testing/Comissioning	**132**	**3**	**80**	396	240	31,680
Total	**502**			1910		**152,800**
Overall Work Days	**172**					

Pollutants	**ROG**		**TOG**		**CO**		**NOX**		**CO2**		**CO2 (Pavley I + LCFS)**		**PM10**		**PM2.5**		**SOX**	
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**				**0.10**		**0.10**		**0.01**	
Units	**Avg. Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Water Trucks	0.08	0.01	0.09	0.01	0.22	0.02	1.21	0.10	0.18	31.72	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00
Hauling	0.02	0.00	0.02	0.00	0.06	0.00	0.31	0.03	0.05	8.18	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
G/Mi	**0.22**		**0.25**		**1.07**		**4.19**		**585.44**				**0.04**		**0.04**		**0.01**	
Vendor Trucks	0.43	0.04	0.49	0.04	2.10	0.18	8.20	0.71	0.52	89.45	0.00	0.00	0.09	0.01	0.08	0.01	0.01	0.00
Sum	0.53	0.05	0.60	0.05	2.38	0.20	9.72	0.84	0.75	129.35	0.00	0.00	0.13	0.01	0.12	0.01	0.02	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

2020
Worker Vehicle

Equipment Type: Passenger Cars + Trucks	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles / Day	Total Miles
Move-on	**0**	**10**	**80**	0	800	-
Substation	**21**	**20**	**80**	420	1600	33,600
Gen-Tie	**63**	**20**	**80**	1260	1600	100,800
Site Prep and Grading	**63**	**29**	**80**	1827	2320	146,160
Underground/Trench	**96**	**38**	**80**	3648	3040	291,840
System Installation	**127**	**317**	**80**	40259	25360	3,220,720
Cleanup/Testing/Commissioning	**132**	**25**	**80**	3300	2000	264,000
Total	**502**			50714		**4,057,120**
Overall Work Days	**172**					

Pollutants	**ROG**		**TOG**		**CO**		**NOX**		**CO2**		**CO2 (Pavley I + LCFS)**		**PM10**		**PM2.5**		**SOX**	
G/Mi	**0.03**		**0.05**		**1.19**		**0.17**		**348.37**				**0.01**		**0.01**		**0.00**	
Units	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Worker Vehicle	1.70	0.15	2.34	0.20	61.91	5.32	8.72	0.75	8.22	1413.34	0.00	0.00	0.39	0.03	0.37	0.03	0.18	0.02
Sum	1.70	0.15	2.34	0.20	61.91	5.32	8.72	0.75	8.22	1413.34	0.00	0.00	0.39	0.03	0.37	0.03	0.18	0.02

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

On-Site Vehicle Emissions Estimation

2019

Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	3.0	0.1	27	0.38	3.38
Substation	73	1.0	0.1	73.00	0.06	4.56
Gen-Tie	73	1.0	0.1	73.00	0.10	7.30
Site Prep and Grading	73	0.0	0.1	0.00	0.00	0.00
Underground/Trench	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Commissioning	0	0.0	0.1	0.00	0.00	0.00
Total	299			173.00		15.24
Overall Work Days	**82**					

Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	6.0	0.1	54	0.60	5.40
Substation	73	2.0	0.1	146.00	0.20	14.60
Gen-Tie	73	2.0	0.1	146.00	0.20	14.60
Site Prep and Grading	73	0.0	0.1	0.00	0.00	0.00
Underground/Trench	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Comissi	0	0.0	0.1	0.00	0.00	0.00
Total	299			346.00		34.60
Overall Work Days	**82**					

Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	10.0	0.5	90	5.00	45
Substation	73	5.0	0.5	365.00	2.50	183
Gen-Tie	73	5.0	0.5	365.00	2.50	183
Site Prep and Grading	73	50.0	0.5	3650.00	25.00	1825
Underground/Trench	52	20.0	0.5	1040.00	10.00	520
System Installation	19	20.0	0.5	380.00	10.00	190
Cleanup/Testing/Comissi	0	5.0	0.5	0.00	2.50	0
Total	299			5890.00		2945
Overall Work Days	**82**					

On-Road Pickup

Phase - Equipment Type:	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	20.0	0.25	180	5.00	45
Substation	73	16.0	0.25	1168.00	4.00	292
Gen-Tie	73	16.0	0.25	1168.00	4.00	292
Site Prep and Grading	73	20.0	0.25	1460.00	5.00	365
Underground/Trench	52	0.0	0.25	0.00	0.00	0
System Installation	19	40.0	0.25	760.00	10.00	190
Cleanup/Testing/Comissio	0	12.0	0.25	0.00	3.00	0
Total	299			4736.00		1184
Overall Work Days	**82**					

Idling Assumptions

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	299	3.0	5.00	4.00	1	37
Dump Truck	299	3.0	5.00	4.00	1	37
Water Truck	299	3.0	5.00	10.00	3	93
On-Road Pickup	299	3.0	5.00	8.00	2	75
Total	1196				7	243
Overall Work Days	**82**					

On Site Driving

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	0.23		0.26		0.65		3.61		1216.78				0.10		0.10		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.05		0.07		2.05		0.22		351.52				0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.23		0.26		0.65		3.61		1216.78		0.00		0.10		0.10		0.01	
Water Truck	0.02	0.00	0.02	0.00	0.05	0.00	0.29	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.02	0.00	0.02	0.00	0.12	0.00	0.30	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

On Site Idling

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2020

Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	3.0	0.1	0	0.38	0.00
Substation	21	1.0	0.1	21.00	0.06	1.31
Gen-Tie	63	1.0	0.1	63.00	0.10	6.30
Site Prep and Grading	63	0.0	0.1	0.00	0.00	0.00
Underground/Trench	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Commissioning	132	0.0	0.1	0.00	0.00	0.00
Total	502			84.00		7.61
Overall Work Days	**172**					

Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	6.0	0.1	0	0.60	0.00
Substation	21	2.0	0.1	42.00	0.20	4.20
Gen-Tie	63	2.0	0.1	126.00	0.20	12.60
Site Prep and Grading	63	0.0	0.1	0.00	0.00	0.00
Underground/Trench	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Comissi	132	0.0	0.1	0.00	0.00	0.00
Total	502			168.00		16.80
Overall Work	**172**					

Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	10.0	0.5	0	5.00	0
Substation	21	5.0	0.5	105.00	2.50	53
Gen-Tie	63	5.0	0.5	315.00	2.50	158
Site Prep and Grading	63	50.0	0.5	3150.00	25.00	1575
Underground/Trench	96	20.0	0.5	1920.00	10.00	960
System Installation	127	20.0	0.5	2540.00	10.00	1270
Cleanup/Testing/Comissi	132	5.0	0.5	660.00	2.50	330
Total	502			8690.00		4345
Overall Work	**172**					

On-Road Pickup

Phase - Equipment Type:	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	20.0	0.25	0	5.00	0
Substation	21	16.0	0.25	336.00	4.00	84
Gen-Tie	63	16.0	0.25	1008.00	4.00	252
Site Prep and Grading	63	20.0	0.25	1260.00	5.00	315
Underground/Trench	96	0.0	0.25	0.00	0.00	0
System Installation	127	40.0	0.25	5080.00	10.00	1270
Cleanup/Testing/Comissio	132	12.0	0.25	1584.00	3.00	396
Total	502			9268.00		2317
Overall Work Days	**172**					

Idling Assumptions

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	502	3.0	5.00	4.00	1	63
Dump Truck	502	3.0	5.00	4.00	1	63
Water Truck	502	3.0	5.00	10.00	3	157
On-Road Pickup	502	3.0	5.00	8.00	2	126
Total	2008				7	408
Overall Work Days	**172**					

On Site Driving

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	0.23		0.26		0.65		3.61		1216.78				0.10		0.10		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.05		0.07		2.05		0.22		351.52				0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.23		0.26		0.65		3.61		1216.78		0.00		0.10		0.10		0.01	
Water Truck	0.01	0.00	0.01	0.00	0.04	0.00	0.20	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.01	0.00	0.02	0.00	0.10	0.01	0.21	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

On Site Idling

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Break and Tire Wear and Road Dust

Emissions Factors (g/mi) (EMFAC2014)

		Vehicle Class			
		Hauling (MHDT, T6)	Hauling (HHDT, T7)	Vendor (LHD2 DSL)	Worker Vehicles (Light Duty)
Tire Wear (EMFAC2014)	**PM_{10}**	0.012	0.0358849	0.012	0.008
	$PM_{2.5}$	0.003	0.0089712	0.003	0.002
Break Wear (EMFAC2014)	**PM_{10}**	0.13034	0.0615426	0.08918	0.03675001
	$PM_{2.5}$	0.05586	0.0263754	0.03822	0.01575
Re-entrained Road Dust (AP-42)	**PM_{10}**	0.6751599	0.6751599	0.2905389	0.10995002
	$PM_{2.5}$	0.1657211	0.1657211	0.0713141	0.02698773
On-Site Unpaved Travel (AP-42)	**PM_{10}**	117.686	117.686	122.488	79.7835
	$PM_{2.5}$	17.7686	17.7686	12.2488	14.09756

Emissions Summary (g)

		PM_{10}				$PM_{2.5}$			
		BW	**TW**	**RE**	**UP**	**BW**	**TW**	**RE**	**UP**
2018	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0
2019	Offsite	49,197	9,653	157,905		21,084	2,413	38,759	
	Onsite	434	45		446,914				69,906
2020	Offsite	167,000	34,684	512,613		71,571	8,671	125,823	
	Onsite	655	71		699,077	281	18		110,302
2021	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0
2022	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0

Emissions Summary (tons)

		PM_{10}				$PM_{2.5}$			
		BW	**TW**	**RE**	**UP**	**BW**	**TW**	**RE**	**UP**
2018	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0
2019	Offsite	0.0542303	0.010641	0.1740605	0	0.0232416	0.0026602	0.0427239	0
	Onsite	0.0004782	5.006E-05	0	0.4926383	0	0	0	0.0770577
2020	Offsite	0.1840857	0.0382326	0.5650592	0	0.0788939	0.0095582	0.1386964	0
	Onsite	0.0007216	7.823E-05	0	0.7706003	0.0003093	1.956E-05	0	0.1215875
2021	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0
2022	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0

Offsite

Phase	Total Miles - 2019				Total Miles - 2020			
	Water Trucks	**Hauling**	**Vendor Trucks**	**Worker Vehicles**	**Water Trucks**	**Hauling**	**Vendor Trucks**	**Worker Vehicles**
Move-on	270	2,160	3,600	7,200	0	0	0	0
Substation	1,095	5,840	5,840	116,800	315	1,680	1,680	33,600
Gen-Tie	1,095	5,840	5,840	116,800	945	5,040	5,040	100,800
Site Prep and Grading	10,950	0	29,200	169,360	9,450	0	25,200	146,160
Underground/Trench	3,120	0	20,800	158,080	5,760	0	38,400	291,840
System Installation	1,140	0	7,600	481,840	7,620	0	50,800	3,220,720
Cleanup/Testing/Commissioning	0	0	0	0	1,980	0	31,680	264,000
Total	**17,670**	**13,840**	**72,880**	**1,050,080**	**26,070**	**6,720**	**152,800**	**4,057,120**

Offsite Emissions

		2019				2020			
Tire Wear	**PM_{10}**	212	166	875	8,401	313	81	1,834	32,457
	$PM_{2.5}$	53	42	219	2,100	78	20	458	8,114
Break Wear	**PM_{10}**	2,303	1,804	6,499	38,590	3,398	876	13,627	149,099
	$PM_{2.5}$	987	773	2,785	16,539	1,456	375	5,840	63,900
Re-entrained Road Dust	**PM_{10}**	11930.076	9344.2135	21174.475	115456.319	17601.42	4537.0748	44394.343	446080.43
	$PM_{2.5}$	2928.2914	2293.5797	5197.3711	28339.2783	4320.3484	1113.6456	10896.793	109492.47

Onsite

Phase	Total Miles - 2019				Total Miles - 2020			
	Haul Trucks	**Dump Truck**	**Water Trucks**	**On-Road Pickup**	**Haul Trucks**	**Dump Truck**	**Water Trucks**	**On-Road Pickup**
Move-on	3	5	45	45	0	0	0	0
Substation	5	15	183	292	1	4	53	84
Gen-Tie	7	15	183	292	6	13	158	252
Site Prep and Grading	0	0	1,825	365	0	0	1,575	315
Underground/Trench	0	0	520	0	0	0	960	0
System Installation	0	0	190	190	0	0	1,270	1,270
Cleanup/Testing/Commissioning	0	0	0	0	0	0	330	396
Total	**15**	**35**	**2,945**	**1,184**	**8**	**17**	**4,345**	**2,317**

Onsite Emissions

		2019				2020			
Tire Wear	**PM_{10}**	0	0	35	9	0	0	52	19
	$PM_{2.5}$	0	0	9	2	0	0	13	5
Break Wear	**PM_{10}**	2	5	384	44	1	2	566	85
	$PM_{2.5}$	1	2	165	19	0	1	243	36
Unpaved Travel	**PM_{10}**	1,793	4,072	346,585	94,464	896	1,977	511,346	184,858
	$PM_{2.5}$	271	615	52,329	16,692	135	299	77,205	32,664

Dust From Material Movement

Grading Equipment Passes

AP-42, 11.9

EF_{PM10} = 1.542546 lb/VMT
$EF_{PM2.5}$ = 0.16655879 lb/VMT

E = EF x VMT
VMT = As / Wb x 43,560 (sf/ac) / 5,280 (ft/mi)

	Acres Graded	Grader		Work Days		
Phase	Acres Graded	Passes	Trenching (CY)	2019	2020	Total
Move-on (Laydown, construction trailers, and park	10	10	0	0	19	19
Substation Construction	1.5	10	0	0	77	77
Gen-tie Line Installation	0	0	0	0	232	232
Site Preparation and Grading	0	25	0	0	94	94
Underground work (Trenching)	5	0	7363	0	77	77
System Installation	0	0	0	0	130	130
Cleanup/Testing/Restoration	0	0	0	0	172	172

Where:

E =		emissions (lb)
PM_{10} EF =	1.542546	emission factor (lb/VMT)
$PM_{2.5}$ EF =	0.16655879	emission factor (lb/VMT)
VMT =	664.125	vehicle miles traveled
As =	966	acreage of the grading site (acre)
Wb =	12	blade width of the grading equipment (CalEEMod default is 12 ft based on Caterpillar's 140 motor grader)

Pounds

		2019		2020	
Phase	VMT	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
EF (lb/VMT)		1.542546	0.16655879	1.542546	0.16655879
Move-on (Laydown, construction trailers, a	6.875	0	0	106.0500375	11.45091681
Substation Construction	1.03125	0	0	15.90750563	1.717637521
Gen-tie Line Installation	0	0	0	0	0
Site Preparation and Grading	0	0	0	0	0
Underground work (Trenching)	3.4375	0	0	0	0
System Installation	0	0	0	0	0
Cleanup/Testing/Restoration	0	0	0	0	0
Total	--	**0**	**0**	**121.9575431**	**13.16855433**

Tons

2019		2020	
PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
0	0	0.053025019	0.005725458
0	0	0.007953753	0.000858819
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	**0**	**0.060978772**	**0.006584277**

Trenching

AP-42, 13.2

EF = emission factor (lb/ton)
EF = K*(0.0032)*((U/5)^1.3)/((M/2)^1.4)

K_{PM10} =	0.35	PM_{10} particle size multiplier (AP-42 default)
$K_{PM2.5}$ =	0.053	$PM_{2.5}$ particle size multiplier (AP-42 default)
U =	2.2	mean wind speed (meters/second) (CalEEMod default is 7.1 mph [2.2 m/s])
M =	12	material moisture content (%) (The moisture contents of different materials are listed in AP-42 Table 13.2.4-1. CalEEMod uses the moisture content of cover (12%) as default).

EF_{PM10} = 3.13541E-05
$EF_{PM2.5}$ = 4.74791E-06

Pounds per Day

		2019		2020	
Phase	Tons	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
EF (lb/ton)		3.13541E-05	4.74791E-06	3.13541E-05	4.74791E-06
Move-on (Laydown, construction trailers, a	0	0	0	0	0
Substation Construction	0	0	0	0	0
Gen-tie Line Installation	0	0	0	0	0
Site Preparation and Grading	0	0	0	0	0
Underground work (Trenching)	9308.0557	0	0	0.003790208	0.000573946
System Installation	0	0	0	0	0
Cleanup/Testing/Restoration	0	0	0	0	0
Total	**9308.0557**	**0**	**0**	**0.003790208**	**0.000573946**

Tons per Year

2019		2020	
PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	1.8951E-06	2.86973E-07
0	0	0	0
0	0	0	0
0	**0**	**1.8951E-06**	**2.86973E-07**

Notes:
Assumes 1.2641662 tons per CY based on a bulk density of 1.5 grams/cubic centimeter (per CalEEMod).

E = EF x TP
EF = emissions factor (lb/ton)
TP = throughput of loaded and unloaded materials (ton)

Grading+Trenching

Pounds

	PM_{10}	$PM_{2.5}$
2020	121.9613333	13.169128

Tons

PM_{10}	$PM_{2.5}$
0.060980667	0.006584564

Project Summary By Year

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	*PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2019	1.05	6.39	8.92	1.08	0.49	1,236.21	0.14	1,239.67	0.09
2020	1.80	13.50	13.54	2.15	0.89	2,767.14	0.22	2,772.69	0.15
2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	2.85	19.89	22.46	3.23	1.38	4,003.34	0.36	4,012.36	0.24
SJVAPCD Thresholds	10	100	10	15	15				
Exceeded?	No	No	**Yes**	No	No				

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2019									
Const. Equip	0.98	4.90	8.25	0.33	0.33	806.22	0.14	809.69	0.09
Const. Mobile Offsite	0.06	1.49	0.66	0.02	0.02	429.97	0.00	429.97	0.00
Const. Mobile Onsite	0.001	0.005	0.013	0.0003	0.00	0.010	0.000	0.010	0.0000
Const. BWTW- Road Dust				0.7321	0.1457				
Const. Fugitive Dust				0.0000000	0.0000000				
Total	1.05	6.39	8.92	1.08	0.49	1,236.21	0.14	1,239.67	0.09

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2020									
Const. Equip	1.61	7.96	11.94	0.49	0.49	1,219.15	0.22	1,224.70	0.13
Const. Mobile Offsite	0.192	5.528	1.586	0.044	0.04	1,542.695	0.000	1,542.695	0.02
Const. Mobile Onsite	0.001	0.009	0.020	0.0005	0.00	5.290	0.000	5.290	0.0001
Const. BWTW- Road Dust				1.5588	0.3491				
Const. Fugitive Dust				0.0609807	0.0065846				
Total	1.80	13.50	13.54	2.15	0.89	2,767.14	0.22	2,772.69	0.15

Paved Road Dust Calculations (EPA AP-42 13.2.1, equation 2)

$E = (k*(sL)^{0.91}*(W)^{1.02})*(1-P/4N)$

E = (k*(sL)^0.91*(W)^1.02)*(1-P/4N)

	PM_{10}	$PM_{2.5}$	
E =			emission factor
k =	0.0022	0.00054	particle size multiplier (lb/vmt)
sL =	0.03	0.03	surface silt loading
W HHD =	16	16	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W Vendor =	7	7	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W worker =	2.7	2.7	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
P =	40	40	Number of days per year with >0.01 inches of rain (Source: WRCC data for Handford, wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3747)
N =	365	365	Days per period

	lb/vmt		g/vmt	
	Emission Factor	Emissions Factor	PM_{10} Emission Factor	Emissions Factor
Vehicle Type				
HHD	0.00149	0.00037	0.675159935	0.165721075
Vendor	0.00064	0.00016	0.290538896	0.071314093
Worker	0.00024	0.00006	0.109950022	0.026987733

Unpaved Road Calculations (EPA AP-42 13.2.2, equation 1a)

$E = k\,(s/12)^a(W/3)^b$

1 lb/VMT = 281.9 g/VKT

E=		size specific emission factor (lb/VMT)
s=	8.5	surface material silt content (%) (AP-42 mean value for construction sites, Table 13.2.2-1)
W HHD =	16	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W Vendor =	7	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W worker =	2.7	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
M=	12	surface material misture content (%) (The moisture contents of different materials arelisted in AP-42 Table 13.2.4-1. CalEEMod uses the moisture content of cover(12%) as default.
S=	15	mean vehicle speed (mph)
K (PM10)=	1.5	lb/vmt, AP-42 Table 13.2.2-2
K (PM2.5)=	0.15	lb/vmt, AP-42 Table 13.2.2-2
a =	0.9	constant from AP-42 Table 13.2.2-2
b =	0.45	constant from AP-42 Table 13.2.2-2

	lb/vmt		g/vmt	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
HHD	2.335901891	0.233590189	1059.547345	105.9547345
Vendor	1.610255251	0.161025525	730.3995441	73.03995441
Worker	1.048852216	0.185329798	475.7513938	84.06418765

	lb/vmt		g/vmt	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
HHD	0.391730747	0.039173075	177.6860898	17.76860898
Vendor	0.270039806	0.027003981	122.4880035	12.24880035
Worker	0.175892517	0.031079807	79.78350874	14.09756427

Notes: Watering 3 times daily and 15 mph speed limit in accordance with SJVAPCD Rule 8021.
15 mph speed limit results in a 57% reduction, WRAP Fugitive Dust Handbook, 2006.
3 times daily watering results in 61% reduction, WRAP Fugitive Dust Handbook, 2006.

LINE	Contractor (Company)	Equipment Mfgt. (Example: CAT)	Equipment Model No. (Example: 320L)	Type of Equipment (Example: Excavators)	CARB Equipment ID#	Contractor Equipment ID#	Engine Model Year	Engine HP	Estimated Total Hours of Operation for the Project	Engine Type or Fuel Use	Input Status & Notes
1	FS	Cat	X	Graders	X	X	2005	185	108	ULSD	Input completed
2	FS	Cat	X	Rubber Tired Dozers	X	X	2005	158	54	ULSD	Input completed
3	FS	Cat	X	Scrapers	X	X	2005	365	108	ULSD	Input completed
4	FS	Cat	X	Rubber Tired Loaders	X	X	2005	190	108	ULSD	Input completed
5	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	120	108	ULSD	Input completed
6	FS	Cat	X	Skid Steer Loaders	X	X	2005	83	162	ULSD	Input completed
7	FS	Cat	X	Other Construction Equipment	X	X	2008	40	216	ULSD	Input completed
8	FS	Cat	X	Other Construction Equipment	X	X	2008	60	108	ULSD	Input completed
9	FS	Cat	X	Other Construction Equipment	X	X	2005	238	376	ULSD	Input completed
10	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	90	376	ULSD	Input completed
11	FS	Cat	X	Cranes	X	X	2005	400	470	ULSD	Input completed
12	FS	Cat	X	Rough Terrain Forklifts	X	X	2005	90	752	ULSD	Input completed
13	FS	Cat	X	Other Construction Equipment	X	X	2005	60	376	ULSD	Input completed
14	FS	Cat	X	Graders	X	X	2005	185	564	ULSD	Input completed
15	FS	Cat	X	Rubber Tired Dozers	X	X	2005	158	282	ULSD	Input completed
16	FS	Cat	X	Scrapers	X	X	2005	365	376	ULSD	Input completed
17	FS	Cat	X	Rubber Tired Loaders	X	X	2005	190	282	ULSD	Input completed
18	FS	Cat	X	Excavators	X	X	2005	42	376	ULSD	Input completed
19	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	190	564	ULSD	Input completed
20	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	90	544	ULSD	Input completed
21	FS	Cat	X	Cranes	X	X	2005	400	544	ULSD	Input completed
22	FS	Cat	X	Crawler Tractors	X	X	2005	147	544	ULSD	Input completed
23	FS	Cat	X	Bore/Drill Rigs	X	X	2005	190	272	ULSD	Input completed
24	FS	Cat	X	Rough Terrain Forklifts	X	X	2005	90	544	ULSD	Input completed
25	FS	Cat	X	Other Construction Equipment	X	X	2005	238	544	ULSD	Input completed
26	FS	Cat	X	Other Construction Equipment	X	X	2008	45	544	ULSD	Input completed
27	FS	Cat	X	Other Construction Equipment	X	X	2005	185	2,176	ULSD	Input completed
28	FS	Cat	X	Graders	X	X	2005	185	2,176	ULSD	Input completed
29	FS	Cat	X	Rubber Tired Dozers	X	X	2005	158	408	ULSD	Input completed
30	FS	Cat	X	Scrapers	X	X	2005	365	2,448	ULSD	Input completed
31	FS	Cat	X	Rubber Tired Loaders	X	X	2005	190	2,448	ULSD	Input completed
32	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	120	1,632	ULSD	Input completed
33	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	300	1,632	ULSD	Input completed
34	FS	Cat	X	Rollers	X	X	2005	160	816	ULSD	Input completed
35	FS	Cat	X	Skid Steer Loaders	X	X	2005	83	1,632	ULSD	Input completed
36	FS	Cat	X	Other Construction Equipment	X	X	2008	40	3,264	ULSD	Input completed
37	FS	Cat	X	Other Construction Equipment	X	X	2008	60	3,264	ULSD	Input completed
38	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	120	888	ULSD	Input completed
39	FS	Cat	X	Trenchers	X	X	2005	42	888	ULSD	Input completed
40	FS	Cat	X	Plate Compactors	X	X	2005	180	592	ULSD	Input completed
41	FS	Cat	X	Excavators	X	X	2005	90	592	ULSD	Input completed
42	FS	Cat	X	Trenchers	X	X	2005	40	3,552	ULSD	Input completed
43	FS	Cat	X	Crushing/Proc. Equipment	X	X	2005	180	888	ULSD	Input completed
44	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	90	1,184	ULSD	Input completed
45	FS	Cat	X	Rollers	X	X	2005	95	592	ULSD	Input completed
46	FS	Cat	X	Rough Terrain Forklifts	X	X	2005	90	2,920	ULSD	Input completed
47	FS	Cat	X	Other Construction Equipment	X	X	2005	110	1,752	ULSD	Input completed
48	FS	Cat	X	Skid Steer Loaders	X	X	2005	80	5,840	ULSD	Input completed
49	FS	Cat	X	Other Construction Equipment	X	X	2005	49	876	ULSD	Input completed
50	FS	Cat	X	Other Construction Equipment	X	X	2013	149	6,132	ULSD	Input completed
51	FS	Cat	X	Other Construction Equipment	X	X	2008	40	3,504	ULSD	Input completed
52	FS	Cat	X	Other Construction Equipment	X	X	2008	60	3,504	ULSD	Input completed
53	FS	Cat	X	Tractors/Loaders/Backhoes	X	X	2005	90	528	ULSD	Input completed
54	FS	Cat	X	Graders	X	X	2005	185	792	ULSD	Input completed

55	FS	Cat	X	Scrapers	X	X	2005	365	1,584	ULSD	Input completed

SMAQMD Construction Mitigation Program - Results

Version 7.0

12/29/2017 16:27

Project Name:

Overall Life-Of-Project (LOP) Emissions

Project Start Date: 09/01/2019

Comparison of your project fleet's emissions with the statewide average for construction equipment

		NOx	ROG	PM10	PM2.5
	Project fleet and statewide average construction equipment emission rates (g/bhp-hr)				
Your fleet's emission factors based on data entered >>	Project Fleet	4.41	0.32	0.19	0.17
Calculator estimated statewide average emission factors >>	Statewide Average	3.62	0.45	0.22	0.21
	Absolute Reduction	-0.80	0.13	0.04	0.03
	Percent Reduction	**-22%**	**29%**	**16%**	**16%**
	Project fleet construction equipment average daily emissions (lbs/day)				
	Project Fleet	98.12	7.07	4.11	3.88

Project haul truck(s) daily emissions

		NOx	ROG	PM10	PM2.5
	Project haul truck(s) average daily emissions (lbs/day)				
	Project Fleet	**0.98**	**0.03**	**0.02**	**0.01**

Project construction equipment and haul truck total emissions

		NOx	ROG	PM10	PM2.5
	Project total construction equipment and haul truck average daily emissions (lbs/day)				
Days Equipment will be Used on the Project: 365	Construction Equipment	98.12	7.07	4.11	3.88
Days of Hauling: 239	Haul Truck(s)	0.98	0.03	0.02	0.01
	Total	**99.11**	**7.10**	**4.14**	**3.90**

NOTE:

Little Bear Solar Operational Emissions
San Joaquin Valley Unified APCD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Unrefrigerated Warehouse-No Rail	1.00	1000sqft	0.02	1,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	3			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Operational Year 2021.

Land Use - 1,000 square foot Operation and Maintenance building.

Construction Phase - construction emissions not used in analysis. See Spreadsheet model for construction emissions.

Vehicle Trips - Eight full time staff were assumed based on information provided by First Solar. All trips were assumed to be primary trips.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Water And Wastewater - Operational water use information provided by First Solar.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Stationary Sources - Emergency Generators and Fire Pumps - One 75 horsepower emergency generator.

Table Name	Column Name	Default Value	New Value

tblEnergyUse	LightingElect	3.22	0.00
tblEnergyUse	NT24E	5.13	0.00
tblEnergyUse	NT24NG	1.05	0.00
tblEnergyUse	T24E	1.04	189.80
tblEnergyUse	T24NG	17.03	0.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperLoadFactor	0.29	0.29
tblOperationalOffRoadEquipment	OperLoadFactor	0.37	0.37
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblStationaryGeneratorsPumpsEF	CH4_EF	0.07	0.07
tblStationaryGeneratorsPumpsEF	ROG_EF	2.2480e-003	2.2477e-003
tblStationaryGeneratorsPumpsUse	HorsePowerValue	0.00	75.00
tblStationaryGeneratorsPumpsUse	HoursPerDay	0.00	2.00
tblStationaryGeneratorsPumpsUse	HoursPerYear	0.00	50.00
tblStationaryGeneratorsPumpsUse	NumberOfEquipment	0.00	1.00
tblVehicleTrips	DV_TP	5.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PR_TP	92.00	100.00
tblVehicleTrips	ST_TR	1.68	16.00
tblVehicleTrips	SU_TR	1.68	16.00
tblVehicleTrips	WD_TR	1.68	16.00
tblWater	IndoorWaterUseRate	231,250.00	1,303,406.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	6.3000e-004	5.2700e-003	4.1700e-003	1.0000e-005	4.0000e-005	3.7000e-004	4.1000e-004	1.0000e-005	3.5000e-004	3.6000e-004	0.0000	0.5741	0.5741	1.1000e-004	0.0000	0.5768
2018	0.0710	0.6356	0.4590	6.8000e-004	1.8400e-003	0.0407	0.0426	6.6000e-004	0.0376	0.0383	0.0000	62.1339	62.1339	0.0182	0.0000	62.5895
Maximum	**0.0710**	**0.6356**	**0.4590**	**6.8000e-004**	**1.8400e-003**	**0.0407**	**0.0426**	**6.6000e-004**	**0.0376**	**0.0383**	**0.0000**	**62.1339**	**62.1339**	**0.0182**	**0.0000**	**62.5895**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	6.3000e-004	5.2700e-003	4.1700e-003	1.0000e-005	4.0000e-005	3.7000e-004	4.1000e-004	1.0000e-005	3.5000e-004	3.6000e-004	0.0000	0.5741	0.5741	1.1000e-004	0.0000	0.5768
2018	0.0710	0.6356	0.4590	6.8000e-004	1.8400e-003	0.0407	0.0426	6.6000e-004	0.0376	0.0383	0.0000	62.1338	62.1338	0.0182	0.0000	62.5895
Maximum	**0.0710**	**0.6356**	**0.4590**	**6.8000e-004**	**1.8400e-003**	**0.0407**	**0.0426**	**6.6000e-004**	**0.0376**	**0.0383**	**0.0000**	**62.1338**	**62.1338**	**0.0182**	**0.0000**	**62.5895**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	**Start Date**	**End Date**	**Maximum Unmitigated ROG + NOX (tons/quarter)**	**Maximum Mitigated ROG + NOX (tons/quarter)**
1	**12-29-2017**	**3-28-2018**	0.3804	0.3804
2	**3-29-2018**	**6-28-2018**	0.3359	0.3359
		Highest	0.3804	0.3804

2.2 Overall Operational

Unmitigated Operational

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Area	4.6000e-003	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	55.2150	55.2150	2.5000e-003	5.2000e-004	55.4314
Mobile	6.2300e-003	0.0675	0.0665	3.2000e-004	0.0191	2.9000e-004	0.0194	5.1400e-003	2.7000e-004	5.4100e-003	0.0000	29.2586	29.2586	1.8600e-003	0.0000	29.3051
Offroad	6.0000e-004	6.7100e-003	4.2200e-003	1.0000e-005		3.1000e-004	3.1000e-004		2.8000e-004	2.8000e-004	0.0000	0.7754	0.7754	2.5000e-004	0.0000	0.7817
Stationary	3.0800e-003	0.0100	0.0112	1.0000e-005		4.5000e-004	4.5000e-004		4.5000e-004	4.5000e-004	0.0000	1.4280	1.4280	2.0000e-004	0.0000	1.4330
Waste						0.0000	0.0000		0.0000	0.0000	0.1908	0.0000	0.1908	0.0113	0.0000	0.4727
Water						0.0000	0.0000		0.0000	0.0000	0.4135	2.0517	2.4652	0.0426	1.0200e-003	3.8339
Total	**0.0145**	**0.0843**	**0.0819**	**3.4000e-004**	**0.0191**	**1.0500e-003**	**0.0202**	**5.1400e-003**	**1.0000e-003**	**6.1400e-003**	**0.6043**	**88.7287**	**89.3331**	**0.0587**	**1.5400e-003**	**91.2578**

Mitigated Operational

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Area	4.6000e-003	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	55.2150	55.2150	2.5000e-003	5.2000e-004	55.4314
Mobile	6.2300e-003	0.0675	0.0665	3.2000e-004	0.0191	2.9000e-004	0.0194	5.1400e-003	2.7000e-004	5.4100e-003	0.0000	29.2586	29.2586	1.8600e-003	0.0000	29.3051
Offroad	6.0000e-004	6.7100e-003	4.2200e-003	1.0000e-005		3.1000e-004	3.1000e-004		2.8000e-004	2.8000e-004	0.0000	0.7754	0.7754	2.5000e-004	0.0000	0.7817
Stationary	3.0800e-003	0.0100	0.0112	1.0000e-005		4.5000e-004	4.5000e-004		4.5000e-004	4.5000e-004	0.0000	1.4280	1.4280	2.0000e-004	0.0000	1.4330

Waste						0.0000	0.0000		0.0000	0.0000	0.1908	0.0000	0.1908	0.0113	0.0000	0.4727
Water						0.0000	0.0000		0.0000	0.0000	0.4135	2.0517	2.4652	0.0426	1.0200e-003	3.8339
Total	**0.0145**	**0.0843**	**0.0819**	**3.4000e-004**	**0.0191**	**1.0500e-003**	**0.0202**	**5.1400e-003**	**1.0000e-003**	**6.1400e-003**	**0.6043**	**88.7287**	**89.3331**	**0.0587**	**1.5400e-003**	**91.2578**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	12/29/2017	1/11/2018	5	10	
2	Site Preparation	Site Preparation	1/12/2018	1/12/2018	5	1	
3	Grading	Grading	1/13/2018	1/16/2018	5	2	
4	Building Construction	Building Construction	1/17/2018	6/5/2018	5	100	
5	Paving	Paving	6/6/2018	6/12/2018	5	5	
6	Architectural Coating	Architectural Coating	6/13/2018	6/19/2018	5	5	

Acres of Grading (Site Preparation Phase): 0.5

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 1,500; Non-Residential Outdoor: 500; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73

Building Construction	Cranes	1	4.00	231	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	187	0.41
Paving	Pavers	1	7.00	130	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	247	0.40
Grading	Rubber Tired Dozers	1	1.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	6.0000e-004	5.2500e-003	3.9600e-003	1.0000e-005		3.7000e-004	3.7000e-004		3.5000e-004	3.5000e-004	0.0000	0.5349	0.5349	1.1000e-004	0.0000	0.5376
Total	**6.0000e-004**	**5.2500e-003**	**3.9600e-003**	**1.0000e-005**		**3.7000e-004**	**3.7000e-004**		**3.5000e-004**	**3.5000e-004**	**0.0000**	**0.5349**	**0.5349**	**1.1000e-004**	**0.0000**	**0.5376**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.2000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0392	0.0392	0.0000	0.0000	0.0392
Total	**3.0000e-005**	**2.0000e-005**	**2.2000e-004**	**0.0000**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0392**	**0.0392**	**0.0000**	**0.0000**	**0.0392**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.0000e-004	5.2500e-003	3.9600e-003	1.0000e-005		3.7000e-004	3.7000e-004		3.5000e-004	3.5000e-004	0.0000	0.5349	0.5349	1.1000e-004	0.0000	0.5376
Total	**6.0000e-004**	**5.2500e-003**	**3.9600e-003**	**1.0000e-005**		**3.7000e-004**	**3.7000e-004**		**3.5000e-004**	**3.5000e-004**	**0.0000**	**0.5349**	**0.5349**	**1.1000e-004**	**0.0000**	**0.5376**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.2000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0392	0.0392	0.0000	0.0000	0.0392
Total	**3.0000e-005**	**2.0000e-005**	**2.2000e-004**	**0.0000**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0392**	**0.0392**	**0.0000**	**0.0000**	**0.0392**

3.2 Demolition - 2018

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Off-Road	4.7900e-003	0.0424	0.0350	5.0000e-005		2.8000e-003	2.8000e-003		2.6700e-003	2.6700e-003	0.0000	4.7737	4.7737	9.2000e-004	0.0000	4.7967
Total	**4.7900e-003**	**0.0424**	**0.0350**	**5.0000e-005**		**2.8000e-003**	**2.8000e-003**		**2.6700e-003**	**2.6700e-003**	**0.0000**	**4.7737**	**4.7737**	**9.2000e-004**	**0.0000**	**4.7967**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.7000e-004	1.6800e-003	0.0000	3.6000e-004	0.0000	3.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3435	0.3435	1.0000e-005	0.0000	0.3438
Total	**2.3000e-004**	**1.7000e-004**	**1.6800e-003**	**0.0000**	**3.6000e-004**	**0.0000**	**3.6000e-004**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3435**	**0.3435**	**1.0000e-005**	**0.0000**	**0.3438**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.7900e-003	0.0424	0.0350	5.0000e-005		2.8000e-003	2.8000e-003		2.6700e-003	2.6700e-003	0.0000	4.7737	4.7737	9.2000e-004	0.0000	4.7967
Total	**4.7900e-003**	**0.0424**	**0.0350**	**5.0000e-005**		**2.8000e-003**	**2.8000e-003**		**2.6700e-003**	**2.6700e-003**	**0.0000**	**4.7737**	**4.7737**	**9.2000e-004**	**0.0000**	**4.7967**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.7000e-004	1.6800e-003	0.0000	3.6000e-004	0.0000	3.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3435	0.3435	1.0000e-005	0.0000	0.3438
Total	**2.3000e-004**	**1.7000e-004**	**1.6800e-003**	**0.0000**	**3.6000e-004**	**0.0000**	**3.6000e-004**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3435**	**0.3435**	**1.0000e-005**	**0.0000**	**0.3438**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.7000e-004	0.0000	2.7000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.9000e-004	4.8800e-003	2.1300e-003	0.0000		2.1000e-004	2.1000e-004		1.9000e-004	1.9000e-004	0.0000	0.4458	0.4458	1.4000e-004	0.0000	0.4492
Total	**3.9000e-004**	**4.8800e-003**	**2.1300e-003**	**0.0000**	**2.7000e-004**	**2.1000e-004**	**4.8000e-004**	**3.0000e-005**	**1.9000e-004**	**2.2000e-004**	**0.0000**	**0.4458**	**0.4458**	**1.4000e-004**	**0.0000**	**0.4492**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-005	1.0000e-005	9.0000e-005	0.0000	2.0000e-005	0.0000	2.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0191	0.0191	0.0000	0.0000	0.0191
Total	**1.0000e-005**	**1.0000e-005**	**9.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0191**	**0.0191**	**0.0000**	**0.0000**	**0.0191**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.7000e-004	0.0000	2.7000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.9000e-004	4.8800e-003	2.1300e-003	0.0000		2.1000e-004	2.1000e-004		1.9000e-004	1.9000e-004	0.0000	0.4458	0.4458	1.4000e-004	0.0000	0.4492
Total	**3.9000e-004**	**4.8800e-003**	**2.1300e-003**	**0.0000**	**2.7000e-004**	**2.1000e-004**	**4.8000e-004**	**3.0000e-005**	**1.9000e-004**	**2.2000e-004**	**0.0000**	**0.4458**	**0.4458**	**1.4000e-004**	**0.0000**	**0.4492**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-005	1.0000e-005	9.0000e-005	0.0000	2.0000e-005	0.0000	2.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0191	0.0191	0.0000	0.0000	0.0191
Total	**1.0000e-005**	**1.0000e-005**	**9.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0191**	**0.0191**	**0.0000**	**0.0000**	**0.0191**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.5000e-004	0.0000	7.5000e-004	4.1000e-004	0.0000	4.1000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.0600e-003	9.4300e-003	7.7800e-003	1.0000e-005		6.2000e-004	6.2000e-004		5.9000e-004	5.9000e-004	0.0000	1.0608	1.0608	2.0000e-004	0.0000	1.0659
Total	**1.0600e-003**	**9.4300e-003**	**7.7800e-003**	**1.0000e-005**	**7.5000e-004**	**6.2000e-004**	**1.3700e-003**	**4.1000e-004**	**5.9000e-004**	**1.0000e-003**	**0.0000**	**1.0608**	**1.0608**	**2.0000e-004**	**0.0000**	**1.0659**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	4.0000e-005	3.7000e-004	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0763	0.0763	0.0000	0.0000	0.0764
Total	**5.0000e-005**	**4.0000e-005**	**3.7000e-004**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0763**	**0.0763**	**0.0000**	**0.0000**	**0.0764**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.5000e-004	0.0000	7.5000e-004	4.1000e-004	0.0000	4.1000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Off-Road	1.0600e-003	9.4300e-003	7.7800e-003	1.0000e-005		6.2000e-004	6.2000e-004		5.9000e-004	5.9000e-004	0.0000	1.0608	1.0608	2.0000e-004	0.0000	1.0659
Total	**1.0600e-003**	**9.4300e-003**	**7.7800e-003**	**1.0000e-005**	**7.5000e-004**	**6.2000e-004**	**1.3700e-003**	**4.1000e-004**	**5.9000e-004**	**1.0000e-003**	**0.0000**	**1.0608**	**1.0608**	**2.0000e-004**	**0.0000**	**1.0659**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	4.0000e-005	3.7000e-004	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0763	0.0763	0.0000	0.0000	0.0764
Total	**5.0000e-005**	**4.0000e-005**	**3.7000e-004**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0763**	**0.0763**	**0.0000**	**0.0000**	**0.0764**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0542	0.5516	0.3876	5.7000e-004		0.0354	0.0354		0.0326	0.0326	0.0000	52.0058	52.0058	0.0162	0.0000	52.4106
Total	**0.0542**	**0.5516**	**0.3876**	**5.7000e-004**		**0.0354**	**0.0354**		**0.0326**	**0.0326**	**0.0000**	**52.0058**	**52.0058**	**0.0162**	**0.0000**	**52.4106**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0542	0.5516	0.3876	5.7000e-004		0.0354	0.0354		0.0326	0.0326	0.0000	52.0058	52.0058	0.0162	0.0000	52.4105
Total	**0.0542**	**0.5516**	**0.3876**	**5.7000e-004**		**0.0354**	**0.0354**		**0.0326**	**0.0326**	**0.0000**	**52.0058**	**52.0058**	**0.0162**	**0.0000**	**52.4105**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0219	0.0181	3.0000e-005		1.2800e-003	1.2800e-003		1.1800e-003	1.1800e-003	0.0000	2.4270	2.4270	6.8000e-004	0.0000	2.4441
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**2.3000e-003**	**0.0219**	**0.0181**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**2.4270**	**2.4270**	**6.8000e-004**	**0.0000**	**2.4441**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.7000e-004	1.6800e-003	0.0000	3.6000e-004	0.0000	3.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3435	0.3435	1.0000e-005	0.0000	0.3438
Total	**2.3000e-004**	**1.7000e-004**	**1.6800e-003**	**0.0000**	**3.6000e-004**	**0.0000**	**3.6000e-004**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3435**	**0.3435**	**1.0000e-005**	**0.0000**	**0.3438**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0219	0.0181	3.0000e-005		1.2800e-003	1.2800e-003		1.1800e-003	1.1800e-003	0.0000	2.4270	2.4270	6.8000e-004	0.0000	2.4441
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**2.3000e-003**	**0.0219**	**0.0181**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**2.4270**	**2.4270**	**6.8000e-004**	**0.0000**	**2.4441**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.7000e-004	1.6800e-003	0.0000	3.6000e-004	0.0000	3.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3435	0.3435	1.0000e-005	0.0000	0.3438
Total	**2.3000e-004**	**1.7000e-004**	**1.6800e-003**	**0.0000**	**3.6000e-004**	**0.0000**	**3.6000e-004**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3435**	**0.3435**	**1.0000e-005**	**0.0000**	**0.3438**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Archit. Coating	6.9500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.5000e-004	5.0100e-003	4.6400e-003	1.0000e-005		3.8000e-004	3.8000e-004		3.8000e-004	3.8000e-004	0.0000	0.6383	0.6383	6.0000e-005	0.0000	0.6398
Total	**7.7000e-003**	**5.0100e-003**	**4.6400e-003**	**1.0000e-005**		**3.8000e-004**	**3.8000e-004**		**3.8000e-004**	**3.8000e-004**	**0.0000**	**0.6383**	**0.6383**	**6.0000e-005**	**0.0000**	**0.6398**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Archit. Coating	6.9500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Off-Road	7.5000e-004	5.0100e-003	4.6400e-003	1.0000e-005		3.8000e-004	3.8000e-004		3.8000e-004	3.8000e-004	0.0000	0.6383	0.6383	6.0000e-005	0.0000	0.6398
Total	**7.7000e-003**	**5.0100e-003**	**4.6400e-003**	**1.0000e-005**		**3.8000e-004**	**3.8000e-004**		**3.8000e-004**	**3.8000e-004**	**0.0000**	**0.6383**	**0.6383**	**6.0000e-005**	**0.0000**	**0.6398**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	6.2300e-003	0.0675	0.0665	3.2000e-004	0.0191	2.9000e-004	0.0194	5.1400e-003	2.7000e-004	5.4100e-003	0.0000	29.2586	29.2586	1.8600e-003	0.0000	29.3051
Unmitigated	6.2300e-003	0.0675	0.0665	3.2000e-004	0.0191	2.9000e-004	0.0194	5.1400e-003	2.7000e-004	5.4100e-003	0.0000	29.2586	29.2586	1.8600e-003	0.0000	29.3051

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Unrefrigerated Warehouse-No Rail	16.00	16.00	16.00	50,075	50,075
Total	16.00	16.00	16.00	50,075	50,075

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Unrefrigerated Warehouse-No Rail	9.50	7.30	7.30	59.00	0.00	41.00	100	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Unrefrigerated Warehouse-No Rail	0.506092	0.032602	0.169295	0.124521	0.019914	0.005374	0.021664	0.110051	0.001797	0.001623	0.005307	0.000969	0.000792

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	55.2150	55.2150	2.5000e-003	5.2000e-004	55.4314
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	55.2150	55.2150	2.5000e-003	5.2000e-004	55.4314

NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Unrefrigerated Warehouse-No Rail	189800	55.2150	2.5000e-003	5.2000e-004	55.4314
Total		**55.2150**	**2.5000e-003**	**5.2000e-004**	**55.4314**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Unrefrigerated Warehouse-No Rail	189800	55.2150	2.5000e-003	5.2000e-004	55.4314
Total		**55.2150**	**2.5000e-003**	**5.2000e-004**	**55.4314**

6.0 Area Detail

6.1 Mitigation Measures Area

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Mitigated	4.6000e-003	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	4.6000e-003	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Architectural Coating	7.0000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	3.9100e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**4.6100e-003**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Architectural Coating	7.0000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	3.9100e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**4.6100e-003**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	2.4652	0.0426	1.0200e-003	3.8339
Unmitigated	2.4652	0.0426	1.0200e-003	3.8339

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Unrefrigerated Warehouse-No Rail	1.30341 / 0	2.4652	0.0426	1.0200e-003	3.8339
Total		**2.4652**	**0.0426**	**1.0200e-003**	**3.8339**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Unrefrigerated Warehouse-No Rail	1.30341 / 0	2.4652	0.0426	1.0200e-003	3.8339
Total		**2.4652**	**0.0426**	**1.0200e-003**	**3.8339**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.1908	0.0113	0.0000	0.4727
Unmitigated	0.1908	0.0113	0.0000	0.4727

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Unrefrigerated Warehouse-No Rail	0.94	0.1908	0.0113	0.0000	0.4727
Total		**0.1908**	**0.0113**	**0.0000**	**0.4727**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Unrefrigerated Warehouse-No Rail	0.94	0.1908	0.0113	0.0000	0.4727
Total		**0.1908**	**0.0113**	**0.0000**	**0.4727**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Cranes	1	8.00	2	231	0.29	Diesel
Tractors/Loaders/Backhoes	1	8.00	2	97	0.37	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	tons/yr										MT/yr					
Cranes	4.1000e-004	4.8200e-003	1.9700e-003	1.0000e-005		2.0000e-004	2.0000e-004		1.8000e-004	1.8000e-004	0.0000	0.5036	0.5036	1.6000e-004	0.0000	0.5076
Tractors/Loaders/ Backhoes	1.9000e-004	1.8900e-003	2.2500e-003	0.0000		1.1000e-004	1.1000e-004		1.0000e-004	1.0000e-004	0.0000	0.2719	0.2719	9.0000e-005	0.0000	0.2741
Total	**6.0000e-004**	**6.7100e-003**	**4.2200e-003**	**1.0000e-005**		**3.1000e-004**	**3.1000e-004**		**2.8000e-004**	**2.8000e-004**	**0.0000**	**0.7754**	**0.7754**	**2.5000e-004**	**0.0000**	**0.7817**

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type
Emergency Generator	1	2	50	75	0.73	Diesel

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

10.1 Stationary Sources

Unmitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	tons/yr										MT/yr					
Emergency Generator - Diesel (75 - 100 HP)	3.0800e-003	0.0100	0.0112	1.0000e-005		4.5000e-004	4.5000e-004		4.5000e-004	4.5000e-004	0.0000	1.4280	1.4280	2.0000e-004	0.0000	1.4330

Total	3.0800e-003	0.0100	0.0112	1.0000e-005		4.5000e-004	4.5000e-004		4.5000e-004	4.5000e-004	0.0000	1.4280	1.4280	2.0000e-004	0.0000	1.4330

11.0 Vegetation

Little Bear Solar Operational Emissions
San Joaquin Valley Unified APCD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Unrefrigerated Warehouse-No Rail	1.00	1000sqft	0.02	1,000.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.7 **Precipitation Freq (Days)** 45

Climate Zone 3 **Operational Year** 2021

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 641.35 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Operational Year 2021.

Land Use - 1,000 square foot Operation and Maintenance building.

Construction Phase - Construction emissions not used in analysis. See spreadsheet model for construction emissions.

Vehicle Trips - Eight full time staff were assumed based on information provided by First Solar. All trips were assumed to be primary trips.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Water And Wastewater - Operational water use information provided by First Solar.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Stationary Sources - Emergency Generators and Fire Pumps - One 75 horsepower emergency generator.

Table Name	Column Name	Default Value	New Value

tblEnergyUse	LightingElect	3.22	0.00
tblEnergyUse	NT24E	5.13	0.00
tblEnergyUse	NT24NG	1.05	0.00
tblEnergyUse	T24E	1.04	189.80
tblEnergyUse	T24NG	17.03	0.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperLoadFactor	0.29	0.29
tblOperationalOffRoadEquipment	OperLoadFactor	0.37	0.37
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblStationaryGeneratorsPumpsEF	CH4_EF	0.07	0.07
tblStationaryGeneratorsPumpsEF	ROG_EF	2.2480e-003	2.2477e-003
tblStationaryGeneratorsPumpsUse	HorsePowerValue	0.00	75.00
tblStationaryGeneratorsPumpsUse	HoursPerDay	0.00	2.00
tblStationaryGeneratorsPumpsUse	HoursPerYear	0.00	50.00
tblStationaryGeneratorsPumpsUse	NumberOfEquipment	0.00	1.00
tblVehicleTrips	DV_TP	5.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PR_TP	92.00	100.00
tblVehicleTrips	ST_TR	1.68	16.00
tblVehicleTrips	SU_TR	1.68	16.00
tblVehicleTrips	WD_TR	1.68	16.00
tblWater	IndoorWaterUseRate	231,250.00	1,303,406.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2761	10.5378	8.4117	0.0129	0.0822	0.7324	0.8146	0.0218	0.6983	0.7201	0.0000	1,273.9895	1,273.9895	0.2356	0.0000	1,279.8804
2018	3.0796	11.0316	8.2052	0.0129	0.8349	0.7087	1.4583	0.4356	0.6520	1.0304	0.0000	1,261.5749	1,261.5749	0.3569	0.0000	1,267.2925
Maximum	**3.0796**	**11.0316**	**8.4117**	**0.0129**	**0.8349**	**0.7324**	**1.4583**	**0.4356**	**0.6983**	**1.0304**	**0.0000**	**1,273.9895**	**1,273.9895**	**0.3569**	**0.0000**	**1,279.8804**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2761	10.5378	8.4117	0.0129	0.0822	0.7324	0.8146	0.0218	0.6983	0.7201	0.0000	1,273.9895	1,273.9895	0.2356	0.0000	1,279.8804
2018	3.0796	11.0316	8.2052	0.0129	0.8349	0.7087	1.4583	0.4356	0.6520	1.0304	0.0000	1,261.5749	1,261.5749	0.3569	0.0000	1,267.2925
Maximum	**3.0796**	**11.0316**	**8.4117**	**0.0129**	**0.8349**	**0.7324**	**1.4583**	**0.4356**	**0.6983**	**1.0304**	**0.0000**	**1,273.9895**	**1,273.9895**	**0.3569**	**0.0000**	**1,279.8804**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Area	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0402	0.3646	0.4012	1.8300e-003	0.1077	1.5800e-003	0.1093	0.0289	1.5000e-003	0.0304		187.0049	187.0049	0.0111		187.2819
Offroad	0.5967	6.7057	4.2209	8.8200e-003		0.3069	0.3069		0.2824	0.2824		854.7583	854.7583	0.2765		861.6694
Stationary	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.9083**	**7.8730**	**5.5154**	**0.0118**	**0.1077**	**0.3447**	**0.4524**	**0.0289**	**0.3201**	**0.3490**		**1,167.6905**	**1,167.6905**	**0.3052**	**0.0000**	**1,175.3200**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0402	0.3646	0.4012	1.8300e-003	0.1077	1.5800e-003	0.1093	0.0289	1.5000e-003	0.0304		187.0049	187.0049	0.0111		187.2819
Offroad	0.5967	6.7057	4.2209	8.8200e-003		0.3069	0.3069		0.2824	0.2824		854.7583	854.7583	0.2765		861.6694
Stationary	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.9083**	**7.8730**	**5.5154**	**0.0118**	**0.1077**	**0.3447**	**0.4524**	**0.0289**	**0.3201**	**0.3490**		**1,167.6905**	**1,167.6905**	**0.3052**	**0.0000**	**1,175.3200**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	12/29/2017	1/11/2018	5	10	
2	Site Preparation	Site Preparation	1/12/2018	1/12/2018	5	1	
3	Grading	Grading	1/13/2018	1/16/2018	5	2	
4	Building Construction	Building Construction	1/17/2018	6/5/2018	5	100	
5	Paving	Paving	6/6/2018	6/12/2018	5	5	
6	Architectural Coating	Architectural Coating	6/13/2018	6/19/2018	5	5	

Acres of Grading (Site Preparation Phase): 0.5

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 1,500; Non-Residential Outdoor: 500; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	231	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	187	0.41
Paving	Pavers	1	7.00	130	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	247	0.40
Grading	Rubber Tired Dozers	1	1.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37

Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2100	10.4978	7.9182	0.0120		0.7318	0.7318		0.6978	0.6978		1,179.3075	1,179.3075	0.2319		1,185.1047
Total	**1.2100**	**10.4978**	**7.9182**	**0.0120**		**0.7318**	**0.7318**		**0.6978**	**0.6978**		**1,179.3075**	**1,179.3075**	**0.2319**		**1,185.1047**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0662	0.0400	0.4934	9.5000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		94.6820	94.6820	3.7500e-003		94.7757
Total	**0.0662**	**0.0400**	**0.4934**	**9.5000e-004**	**0.0822**	**6.4000e-004**	**0.0828**	**0.0218**	**5.9000e-004**	**0.0224**		**94.6820**	**94.6820**	**3.7500e-003**		**94.7757**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	1.2100	10.4978	7.9182	0.0120		0.7318	0.7318		0.6978	0.6978	0.0000	1,179.3075	1,179.3075	0.2319		1,185.1047
Total	**1.2100**	**10.4978**	**7.9182**	**0.0120**		**0.7318**	**0.7318**		**0.6978**	**0.6978**	**0.0000**	**1,179.3075**	**1,179.3075**	**0.2319**		**1,185.1047**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0662	0.0400	0.4934	9.5000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		94.6820	94.6820	3.7500e-003		94.7757
Total	**0.0662**	**0.0400**	**0.4934**	**9.5000e-004**	**0.0822**	**6.4000e-004**	**0.0828**	**0.0218**	**5.9000e-004**	**0.0224**		**94.6820**	**94.6820**	**3.7500e-003**		**94.7757**

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943		1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**		**0.6228**	**0.6228**		**0.5943**	**0.5943**		**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0586	0.0346	0.4289	9.3000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		92.2247	92.2247	3.2900e-003		92.3069
Total	**0.0586**	**0.0346**	**0.4289**	**9.3000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**92.2247**	**92.2247**	**3.2900e-003**		**92.3069**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943	0.0000	1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**		**0.6228**	**0.6228**		**0.5943**	**0.5943**	**0.0000**	**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0586	0.0346	0.4289	9.3000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		92.2247	92.2247	3.2900e-003		92.3069
Total	**0.0586**	**0.0346**	**0.4289**	**9.3000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**92.2247**	**92.2247**	**3.2900e-003**		**92.3069**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Fugitive Dust					0.5303	0.0000	0.5303	0.0573	0.0000	0.0573			0.0000			0.0000
Off-Road	0.7858	9.7572	4.2514	9.7600e-003		0.4180	0.4180		0.3846	0.3846		982.7113	982.7113	0.3059		990.3596
Total	**0.7858**	**9.7572**	**4.2514**	**9.7600e-003**	**0.5303**	**0.4180**	**0.9483**	**0.0573**	**0.3846**	**0.4418**		**982.7113**	**982.7113**	**0.3059**		**990.3596**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0293	0.0173	0.2145	4.6000e-004	0.0411	3.0000e-004	0.0414	0.0109	2.8000e-004	0.0112		46.1124	46.1124	1.6400e-003		46.1534
Total	**0.0293**	**0.0173**	**0.2145**	**4.6000e-004**	**0.0411**	**3.0000e-004**	**0.0414**	**0.0109**	**2.8000e-004**	**0.0112**		**46.1124**	**46.1124**	**1.6400e-003**		**46.1534**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.5303	0.0000	0.5303	0.0573	0.0000	0.0573			0.0000			0.0000
Off-Road	0.7858	9.7572	4.2514	9.7600e-003		0.4180	0.4180		0.3846	0.3846	0.0000	982.7113	982.7113	0.3059		990.3596

Total	0.7858	9.7572	4.2514	9.7600e-003	0.5303	0.4180	0.9483	0.0573	0.3846	0.4418	0.0000	982.7113	982.7113	0.3059		990.3596

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0293	0.0173	0.2145	4.6000e-004	0.0411	3.0000e-004	0.0414	0.0109	2.8000e-004	0.0112		46.1124	46.1124	1.6400e-003		46.1534
Total	**0.0293**	**0.0173**	**0.2145**	**4.6000e-004**	**0.0411**	**3.0000e-004**	**0.0414**	**0.0109**	**2.8000e-004**	**0.0112**		**46.1124**	**46.1124**	**1.6400e-003**		**46.1534**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7528	0.0000	0.7528	0.4138	0.0000	0.4138			0.0000			0.0000
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943		1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**	**0.7528**	**0.6228**	**1.3755**	**0.4138**	**0.5943**	**1.0081**		**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0586	0.0346	0.4289	9.3000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		92.2247	92.2247	3.2900e-003		92.3069
Total	**0.0586**	**0.0346**	**0.4289**	**9.3000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**92.2247**	**92.2247**	**3.2900e-003**		**92.3069**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7528	0.0000	0.7528	0.4138	0.0000	0.4138			0.0000			0.0000
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943	0.0000	1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**	**0.7528**	**0.6228**	**1.3755**	**0.4138**	**0.5943**	**1.0081**	**0.0000**	**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0586	0.0346	0.4289	9.3000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		92.2247	92.2247	3.2900e-003		92.3069
Total	**0.0586**	**0.0346**	**0.4289**	**9.3000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**92.2247**	**92.2247**	**3.2900e-003**		**92.3069**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0848	11.0316	7.7512	0.0114		0.7087	0.7087		0.6520	0.6520		1,146.5323	1,146.5323	0.3569		1,155.4555
Total	**1.0848**	**11.0316**	**7.7512**	**0.0114**		**0.7087**	**0.7087**		**0.6520**	**0.6520**		**1,146.5323**	**1,146.5323**	**0.3569**		**1,155.4555**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0848	11.0316	7.7512	0.0114		0.7087	0.7087		0.6520	0.6520	0.0000	1,146.5323	1,146.5323	0.3569		1,155.4555
Total	**1.0848**	**11.0316**	**7.7512**	**0.0114**		**0.7087**	**0.7087**		**0.6520**	**0.6520**	**0.0000**	**1,146.5323**	**1,146.5323**	**0.3569**		**1,155.4555**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9202	8.7447	7.2240	0.0113		0.5109	0.5109		0.4735	0.4735		1,070.1372	1,070.1372	0.3017		1,077.6798
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9202**	**8.7447**	**7.2240**	**0.0113**		**0.5109**	**0.5109**		**0.4735**	**0.4735**		**1,070.1372**	**1,070.1372**	**0.3017**		**1,077.6798**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1055	0.0622	0.7721	1.6700e-003	0.1479	1.0900e-003	0.1490	0.0392	1.0100e-003	0.0402		166.0045	166.0045	5.9200e-003		166.1524
Total	**0.1055**	**0.0622**	**0.7721**	**1.6700e-003**	**0.1479**	**1.0900e-003**	**0.1490**	**0.0392**	**1.0100e-003**	**0.0402**		**166.0045**	**166.0045**	**5.9200e-003**		**166.1524**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9202	8.7447	7.2240	0.0113		0.5109	0.5109		0.4735	0.4735	0.0000	1,070.1372	1,070.1372	0.3017		1,077.6798

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9202**	**8.7447**	**7.2240**	**0.0113**		**0.5109**	**0.5109**		**0.4735**	**0.4735**	**0.0000**	**1,070.1372**	**1,070.1372**	**0.3017**		**1,077.6798**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1055	0.0622	0.7721	1.6700e-003	0.1479	1.0900e-003	0.1490	0.0392	1.0100e-003	0.0402		166.0045	166.0045	5.9200e-003		166.1524
Total	**0.1055**	**0.0622**	**0.7721**	**1.6700e-003**	**0.1479**	**1.0900e-003**	**0.1490**	**0.0392**	**1.0100e-003**	**0.0402**		**166.0045**	**166.0045**	**5.9200e-003**		**166.1524**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2.7810					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506		281.4485	281.4485	0.0267		282.1171
Total	**3.0796**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**		**281.4485**	**281.4485**	**0.0267**		**282.1171**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2.7810					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506	0.0000	281.4485	281.4485	0.0267		282.1171
Total	**3.0796**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**	**0.0000**	**281.4485**	**281.4485**	**0.0267**		**282.1171**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0402	0.3646	0.4012	1.8300e-003	0.1077	1.5800e-003	0.1093	0.0289	1.5000e-003	0.0304		187.0049	187.0049	0.0111		187.2819
Unmitigated	0.0402	0.3646	0.4012	1.8300e-003	0.1077	1.5800e-003	0.1093	0.0289	1.5000e-003	0.0304		187.0049	187.0049	0.0111		187.2819

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Unrefrigerated Warehouse-No Rail	16.00	16.00	16.00	50,075	50,075
Total	16.00	16.00	16.00	50,075	50,075

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

Unrefrigerated Warehouse-No Rail	9.50	7.30	7.30	59.00	0.00	41.00	100	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Unrefrigerated Warehouse-No Rail	0.506092	0.032602	0.169295	0.124521	0.019914	0.005374	0.021664	0.110051	0.001797	0.001623	0.005307	0.000969	0.000792

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Total		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Unmitigated	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	3.8100e-003					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0214					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Total	**0.0252**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	3.8100e-003					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0214					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Total	**0.0252**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Cranes	1	8.00	2	231	0.29	Diesel
Tractors/Loaders/Backhoes	1	8.00	2	97	0.37	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	lb/day										lb/day					
Cranes	0.4102	4.8176	1.9699	5.7300e-003		0.1956	0.1956		0.1800	0.1800		555.0781	555.0781	0.1795		559.5662
Tractors/Loaders/ Backhoes	0.1865	1.8881	2.2511	3.0900e-003		0.1113	0.1113		0.1024	0.1024		299.6802	299.6802	0.0969		302.1033
Total	**0.5967**	**6.7057**	**4.2209**	**8.8200e-003**		**0.3069**	**0.3069**		**0.2824**	**0.2824**		**854.7583**	**854.7583**	**0.2764**		**861.6694**

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type
Emergency Generator	1	2	50	75	0.73	Diesel

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

10.1 Stationary Sources

Unmitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	lb/day										lb/day					
Emergency Generator - Diesel (75 - 100 HP)	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.2461**	**0.8027**	**0.8932**	**1.1800e-003**		**0.0362**	**0.0362**		**0.0362**	**0.0362**		**125.9271**	**125.9271**	**0.0177**		**126.3685**

11.0 Vegetation

Little Bear Solar Operational Emissions

San Joaquin Valley Unified APCD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Unrefrigerated Warehouse-No Rail	1.00	1000sqft	0.02	1,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	3			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Operational Year 2021.

Land Use - 1,000 square foot Operation and Maintenance building.

Construction Phase - Construction emissions not used in analysis. See spreadsheet model for construction emissions.

Vehicle Trips - Eight full time staff were assumed based on information provided by First Solar. All trips were assumed to be primary trips.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Water And Wastewater - Operational water use information provided by First Solar.

Operational Off-Road Equipment - Operational Off-Road Equipment provided by First Solar.

Stationary Sources - Emergency Generators and Fire Pumps - One 75 horsepower emergency generator.

Table Name	Column Name	Default Value	New Value

tblEnergyUse	LightingElect	3.22	0.00
tblEnergyUse	NT24E	5.13	0.00
tblEnergyUse	NT24NG	1.05	0.00
tblEnergyUse	T24E	1.04	189.80
tblEnergyUse	T24NG	17.03	0.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperDaysPerYear	260.00	2.00
tblOperationalOffRoadEquipment	OperLoadFactor	0.29	0.29
tblOperationalOffRoadEquipment	OperLoadFactor	0.37	0.37
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	1.00
tblStationaryGeneratorsPumpsEF	CH4_EF	0.07	0.07
tblStationaryGeneratorsPumpsEF	ROG_EF	2.2480e-003	2.2477e-003
tblStationaryGeneratorsPumpsUse	HorsePowerValue	0.00	75.00
tblStationaryGeneratorsPumpsUse	HoursPerDay	0.00	2.00
tblStationaryGeneratorsPumpsUse	HoursPerYear	0.00	50.00
tblStationaryGeneratorsPumpsUse	NumberOfEquipment	0.00	1.00
tblVehicleTrips	DV_TP	5.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PR_TP	92.00	100.00
tblVehicleTrips	ST_TR	1.68	16.00
tblVehicleTrips	SU_TR	1.68	16.00
tblVehicleTrips	WD_TR	1.68	16.00
tblWater	IndoorWaterUseRate	231,250.00	1,303,406.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2726	10.5454	8.3488	0.0128	0.0822	0.7324	0.8146	0.0218	0.6983	0.7201	0.0000	1,262.6541	1,262.6541	0.2353	0.0000	1,268.5355
2018	3.0796	11.0316	8.1471	0.0128	0.8349	0.7087	1.4583	0.4356	0.6520	1.0304	0.0000	1,250.5034	1,250.5034	0.3569	0.0000	1,256.2119
Maximum	**3.0796**	**11.0316**	**8.3488**	**0.0128**	**0.8349**	**0.7324**	**1.4583**	**0.4356**	**0.6983**	**1.0304**	**0.0000**	**1,262.6541**	**1,262.6541**	**0.3569**	**0.0000**	**1,268.5355**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2726	10.5454	8.3488	0.0128	0.0822	0.7324	0.8146	0.0218	0.6983	0.7201	0.0000	1,262.6541	1,262.6541	0.2353	0.0000	1,268.5355
2018	3.0796	11.0316	8.1471	0.0128	0.8349	0.7087	1.4583	0.4356	0.6520	1.0304	0.0000	1,250.5034	1,250.5034	0.3569	0.0000	1,256.2119
Maximum	**3.0796**	**11.0316**	**8.3488**	**0.0128**	**0.8349**	**0.7324**	**1.4583**	**0.4356**	**0.6983**	**1.0304**	**0.0000**	**1,262.6541**	**1,262.6541**	**0.3569**	**0.0000**	**1,268.5355**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Area	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0329	0.3732	0.3729	1.6900e-003	0.1077	1.6200e-003	0.1094	0.0289	1.5300e-003	0.0304		172.4825	172.4825	0.0118		172.7784
Offroad	0.5967	6.7057	4.2209	8.8200e-003		0.3069	0.3069		0.2824	0.2824		854.7583	854.7583	0.2765		861.6694
Stationary	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.9010**	**7.8815**	**5.4871**	**0.0117**	**0.1077**	**0.3447**	**0.4525**	**0.0289**	**0.3201**	**0.3490**		**1,153.1681**	**1,153.1681**	**0.3060**	**0.0000**	**1,160.8166**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0329	0.3732	0.3729	1.6900e-003	0.1077	1.6200e-003	0.1094	0.0289	1.5300e-003	0.0304		172.4825	172.4825	0.0118		172.7784
Offroad	0.5967	6.7057	4.2209	8.8200e-003		0.3069	0.3069		0.2824	0.2824		854.7583	854.7583	0.2765		861.6694
Stationary	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.9010**	**7.8815**	**5.4871**	**0.0117**	**0.1077**	**0.3447**	**0.4525**	**0.0289**	**0.3201**	**0.3490**		**1,153.1681**	**1,153.1681**	**0.3060**	**0.0000**	**1,160.8166**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	12/29/2017	1/11/2018	5	10	
2	Site Preparation	Site Preparation	1/12/2018	1/12/2018	5	1	
3	Grading	Grading	1/13/2018	1/16/2018	5	2	
4	Building Construction	Building Construction	1/17/2018	6/5/2018	5	100	
5	Paving	Paving	6/6/2018	6/12/2018	5	5	
6	Architectural Coating	Architectural Coating	6/13/2018	6/19/2018	5	5	

Acres of Grading (Site Preparation Phase): 0.5

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 1,500; Non-Residential Outdoor: 500; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	231	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	187	0.41
Paving	Pavers	1	7.00	130	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	247	0.40
Grading	Rubber Tired Dozers	1	1.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37

Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2100	10.4978	7.9182	0.0120		0.7318	0.7318		0.6978	0.6978		1,179.3075	1,179.3075	0.2319		1,185.1047
Total	**1.2100**	**10.4978**	**7.9182**	**0.0120**		**0.7318**	**0.7318**		**0.6978**	**0.6978**		**1,179.3075**	**1,179.3075**	**0.2319**		**1,185.1047**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0626	0.0476	0.4306	8.4000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		83.3466	83.3466	3.3600e-003		83.4307
Total	**0.0626**	**0.0476**	**0.4306**	**8.4000e-004**	**0.0822**	**6.4000e-004**	**0.0828**	**0.0218**	**5.9000e-004**	**0.0224**		**83.3466**	**83.3466**	**3.3600e-003**		**83.4307**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	1.2100	10.4978	7.9182	0.0120		0.7318	0.7318		0.6978	0.6978	0.0000	1,179.3075	1,179.3075	0.2319		1,185.1047
Total	**1.2100**	**10.4978**	**7.9182**	**0.0120**		**0.7318**	**0.7318**		**0.6978**	**0.6978**	**0.0000**	**1,179.3075**	**1,179.3075**	**0.2319**		**1,185.1047**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0626	0.0476	0.4306	8.4000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		83.3466	83.3466	3.3600e-003		83.4307
Total	**0.0626**	**0.0476**	**0.4306**	**8.4000e-004**	**0.0822**	**6.4000e-004**	**0.0828**	**0.0218**	**5.9000e-004**	**0.0224**		**83.3466**	**83.3466**	**3.3600e-003**		**83.4307**

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943		1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**		**0.6228**	**0.6228**		**0.5943**	**0.5943**		**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0551	0.0411	0.3708	8.2000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		81.1531	81.1531	2.9200e-003		81.2263
Total	**0.0551**	**0.0411**	**0.3708**	**8.2000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**81.1531**	**81.1531**	**2.9200e-003**		**81.2263**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943	0.0000	1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**		**0.6228**	**0.6228**		**0.5943**	**0.5943**	**0.0000**	**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0551	0.0411	0.3708	8.2000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		81.1531	81.1531	2.9200e-003		81.2263
Total	**0.0551**	**0.0411**	**0.3708**	**8.2000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**81.1531**	**81.1531**	**2.9200e-003**		**81.2263**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Fugitive Dust					0.5303	0.0000	0.5303	0.0573	0.0000	0.0573			0.0000			0.0000
Off-Road	0.7858	9.7572	4.2514	9.7600e-003		0.4180	0.4180		0.3846	0.3846		982.7113	982.7113	0.3059		990.3596
Total	**0.7858**	**9.7572**	**4.2514**	**9.7600e-003**	**0.5303**	**0.4180**	**0.9483**	**0.0573**	**0.3846**	**0.4418**		**982.7113**	**982.7113**	**0.3059**		**990.3596**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0276	0.0206	0.1854	4.1000e-004	0.0411	3.0000e-004	0.0414	0.0109	2.8000e-004	0.0112		40.5766	40.5766	1.4600e-003		40.6131
Total	**0.0276**	**0.0206**	**0.1854**	**4.1000e-004**	**0.0411**	**3.0000e-004**	**0.0414**	**0.0109**	**2.8000e-004**	**0.0112**		**40.5766**	**40.5766**	**1.4600e-003**		**40.6131**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.5303	0.0000	0.5303	0.0573	0.0000	0.0573			0.0000			0.0000
Off-Road	0.7858	9.7572	4.2514	9.7600e-003		0.4180	0.4180		0.3846	0.3846	0.0000	982.7113	982.7113	0.3059		990.3596

Total	0.7858	9.7572	4.2514	9.7600e-003	0.5303	0.4180	0.9483	0.0573	0.3846	0.4418	0.0000	982.7113	982.7113	0.3059		990.3596

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0276	0.0206	0.1854	4.1000e-004	0.0411	3.0000e-004	0.0414	0.0109	2.8000e-004	0.0112		40.5766	40.5766	1.4600e-003		40.6131
Total	**0.0276**	**0.0206**	**0.1854**	**4.1000e-004**	**0.0411**	**3.0000e-004**	**0.0414**	**0.0109**	**2.8000e-004**	**0.0112**		**40.5766**	**40.5766**	**1.4600e-003**		**40.6131**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7528	0.0000	0.7528	0.4138	0.0000	0.4138			0.0000			0.0000
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943		1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**	**0.7528**	**0.6228**	**1.3755**	**0.4138**	**0.5943**	**1.0081**		**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0551	0.0411	0.3708	8.2000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		81.1531	81.1531	2.9200e-003		81.2263
Total	**0.0551**	**0.0411**	**0.3708**	**8.2000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**81.1531**	**81.1531**	**2.9200e-003**		**81.2263**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7528	0.0000	0.7528	0.4138	0.0000	0.4138			0.0000			0.0000
Off-Road	1.0643	9.4295	7.7762	0.0120		0.6228	0.6228		0.5943	0.5943	0.0000	1,169.3502	1,169.3502	0.2254		1,174.9857
Total	**1.0643**	**9.4295**	**7.7762**	**0.0120**	**0.7528**	**0.6228**	**1.3755**	**0.4138**	**0.5943**	**1.0081**	**0.0000**	**1,169.3502**	**1,169.3502**	**0.2254**		**1,174.9857**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0551	0.0411	0.3708	8.2000e-004	0.0822	6.1000e-004	0.0828	0.0218	5.6000e-004	0.0224		81.1531	81.1531	2.9200e-003		81.2263
Total	**0.0551**	**0.0411**	**0.3708**	**8.2000e-004**	**0.0822**	**6.1000e-004**	**0.0828**	**0.0218**	**5.6000e-004**	**0.0224**		**81.1531**	**81.1531**	**2.9200e-003**		**81.2263**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0848	11.0316	7.7512	0.0114		0.7087	0.7087		0.6520	0.6520		1,146.5323	1,146.5323	0.3569		1,155.4555
Total	**1.0848**	**11.0316**	**7.7512**	**0.0114**		**0.7087**	**0.7087**		**0.6520**	**0.6520**		**1,146.5323**	**1,146.5323**	**0.3569**		**1,155.4555**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0848	11.0316	7.7512	0.0114		0.7087	0.7087		0.6520	0.6520	0.0000	1,146.5323	1,146.5323	0.3569		1,155.4555
Total	**1.0848**	**11.0316**	**7.7512**	**0.0114**		**0.7087**	**0.7087**		**0.6520**	**0.6520**	**0.0000**	**1,146.5323**	**1,146.5323**	**0.3569**		**1,155.4555**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9202	8.7447	7.2240	0.0113		0.5109	0.5109		0.4735	0.4735		1,070.1372	1,070.1372	0.3017		1,077.6798
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9202**	**8.7447**	**7.2240**	**0.0113**		**0.5109**	**0.5109**		**0.4735**	**0.4735**		**1,070.1372**	**1,070.1372**	**0.3017**		**1,077.6798**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0992	0.0740	0.6675	1.4700e-003	0.1479	1.0900e-003	0.1490	0.0392	1.0100e-003	0.0402		146.0757	146.0757	5.2600e-003		146.2073
Total	**0.0992**	**0.0740**	**0.6675**	**1.4700e-003**	**0.1479**	**1.0900e-003**	**0.1490**	**0.0392**	**1.0100e-003**	**0.0402**		**146.0757**	**146.0757**	**5.2600e-003**		**146.2073**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9202	8.7447	7.2240	0.0113		0.5109	0.5109		0.4735	0.4735	0.0000	1,070.1372	1,070.1372	0.3017		1,077.6798

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9202**	**8.7447**	**7.2240**	**0.0113**		**0.5109**	**0.5109**		**0.4735**	**0.4735**	**0.0000**	**1,070.1372**	**1,070.1372**	**0.3017**		**1,077.6798**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0992	0.0740	0.6675	1.4700e-003	0.1479	1.0900e-003	0.1490	0.0392	1.0100e-003	0.0402		146.0757	146.0757	5.2600e-003		146.2073
Total	**0.0992**	**0.0740**	**0.6675**	**1.4700e-003**	**0.1479**	**1.0900e-003**	**0.1490**	**0.0392**	**1.0100e-003**	**0.0402**		**146.0757**	**146.0757**	**5.2600e-003**		**146.2073**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2.7810					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506		281.4485	281.4485	0.0267		282.1171
Total	**3.0796**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**		**281.4485**	**281.4485**	**0.0267**		**282.1171**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2.7810					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506	0.0000	281.4485	281.4485	0.0267		282.1171
Total	**3.0796**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**	**0.0000**	**281.4485**	**281.4485**	**0.0267**		**282.1171**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0329	0.3732	0.3729	1.6900e-003	0.1077	1.6200e-003	0.1094	0.0289	1.5300e-003	0.0304		172.4825	172.4825	0.0118		172.7784
Unmitigated	0.0329	0.3732	0.3729	1.6900e-003	0.1077	1.6200e-003	0.1094	0.0289	1.5300e-003	0.0304		172.4825	172.4825	0.0118		172.7784

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Unrefrigerated Warehouse-No Rail	16.00	16.00	16.00	50,075	50,075
Total	16.00	16.00	16.00	50,075	50,075

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

Unrefrigerated Warehouse-No Rail	9.50	7.30	7.30	59.00	0.00	41.00	100	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Unrefrigerated Warehouse-No Rail	0.506092	0.032602	0.169295	0.124521	0.019914	0.005374	0.021664	0.110051	0.001797	0.001623	0.005307	0.000969	0.000792

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Unmitigated	0.0252	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	3.8100e-003					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0214					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Total	**0.0252**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	3.8100e-003					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0214					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Total	**0.0252**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Cranes	1	8.00	2	231	0.29	Diesel
Tractors/Loaders/Backhoes	1	8.00	2	97	0.37	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	lb/day										lb/day					
Cranes	0.4102	4.8176	1.9699	5.7300e-003		0.1956	0.1956		0.1800	0.1800		555.0781	555.0781	0.1795		559.5662
Tractors/Loaders/ Backhoes	0.1865	1.8881	2.2511	3.0900e-003		0.1113	0.1113		0.1024	0.1024		299.6802	299.6802	0.0969		302.1033
Total	**0.5967**	**6.7057**	**4.2209**	**8.8200e-003**		**0.3069**	**0.3069**		**0.2824**	**0.2824**		**854.7583**	**854.7583**	**0.2764**		**861.6694**

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type
Emergency Generator	1	2	50	75	0.73	Diesel

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

10.1 Stationary Sources

Unmitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	lb/day										lb/day					
Emergency Generator - Diesel (75 - 100 HP)	0.2461	0.8027	0.8932	1.1800e-003		0.0362	0.0362		0.0362	0.0362		125.9271	125.9271	0.0177		126.3685
Total	**0.2461**	**0.8027**	**0.8932**	**1.1800e-003**		**0.0362**	**0.0362**		**0.0362**	**0.0362**		**125.9271**	**125.9271**	**0.0177**		**126.3685**

11.0 Vegetation

APPENDIX B

Air Quality Impact Assessment and Health Risk Assessment

AIR QUALITY IMPACT ASSESSMENT
And HEALTH RISK ASSESSMENT
for the
Little Bear Solar Project
Fresno County, California

Prepared for:

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JANUARY 2018

Printed on 30% post-consumer recycled material.

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Air Quality Impact Assessment and Health Risk Assessment for the Little Bear Solar Project

SUMMARY

The Little Bear Solar Project (Project or Applicant) is a 180 megawatt (MW) solar photovoltaic power generation facility and associated gen-tie line proposed to be constructed on lands located near Mendota in unincorporated Fresno County, California. The proposed Project would be a 180-megawatt (MW) alternating current (AC) photovoltaic (PV) solar energy facility with associated on-site substations, inverters, fencing, roads, and supervisory control and data acquisition system. The Project will consist of up to five facilities: two 20 MW facilities, one 40 MW facility, and two 50 MW facilities. The Project will interconnect to the Mendota Substation using the existing North Star 115 kV gen-tie line that interconnects the North Star Solar Project.

The purpose of this air quality impact assessment (AQIA) is to determine whether the Project exceeds any State or Federal ambient air quality standards (AAQS) during construction. The San Joaquin Valley Air Pollution Control District (SJVAPCD) Guidance for Assessing and Mitigating Air Quality Impacts (GAMAQI) recommends performing ambient air dispersion modeling if a project generates criteria air pollutant emissions that exceed 100 pounds per day. Project construction is estimated to generate maximum daily carbon monoxide (CO) emissions that would exceed the SJVAPCD 100 pounds per day guidance, which requires dispersion modeling for CO. The purpose of the health risk assessment (HRA) is to determine the potential cancer risk to the closest sensitive receptors of the proposed Project due to diesel particulate matter (DPM) emissions resulting from diesel construction equipment and onsite diesel trucks.

Dispersion modeling was conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). The SJVAPCD Air Dispersion Modeling Guidance was used to prepare the dispersion modeling assessment. The SJVAPCD HRA guidance in addition to the Office of Environmental Health Hazard Assessment's (OEHHA) 2015 Risk Assessment guidelines were used to prepare the construction HRA for the Project. The analysis considers a 1-year exposure scenario consistent with guidance from the San Joaquin Valley Air Pollution Control District (SJVAPCD).

The HRA finds that maximally exposed receptor of the proposed Project would be exposed to a cancer risk of approximately 1.00 in 1 million under a 1-year exposure scenario, which is less than SJVAPCD's evaluation criterion. Also, the chronic hazard index of less than 1 indicates a less than significant impact. For the dispersion modeling, the Project would not exceed the State or Federal AAQS during construction and thus would result in a less than significant impact.

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Air Quality Impact Assessment and Health Risk Assessment for the Little Bear Solar Project

1 INTRODUCTION

1.1 Purpose

In support of the air quality technical report preparation, Dudek has prepared an air quality impact analysis (AQIA) and health risk assessment (HRA) modeling analysis to estimate ambient air quality and health risk impacts from the construction of the Project.

The analysis presented in this report uses air dispersion modeling methodology to evaluate potential ambient air quality impacts and public health risks associated with construction of the proposed Project. Results of the modeling analysis are compared with the most recent California Environmental Quality Act (CEQA) significance thresholds established by the SJVAPCD.

Per CEQA Guidelines Appendix G, the AQIA directly addresses air quality questions (b) and (c), while the HRA directly addresses question (d). Would the project: (b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation; (c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors); or (d) Expose sensitive receptors to substantial pollutant concentrations?

Although the Project's construction activity is short-term and therefore unlikely to pose a risk of health impacts to the nearest sensitive receptors (the residents to the west of the project site), in an abundance of caution, a voluntary health risk assessment (HRA) was performed.

1.2 Project Description

The Little Bear Solar Project (Project or Applicant) is a 180 megawatt (MW) solar photovoltaic power generation facility and associated gen-tie line proposed to be constructed on lands located near Mendota in unincorporated Fresno County, California. The proposed Project would be a 180-megawatt (MW) alternating current (AC) photovoltaic (PV) solar energy facility with associated on-site substations, inverters, fencing, roads, and supervisory control and data acquisition system. The Project will consist of up to five facilities: two 20 MW facilities, one 40 MW facility, and two 50 MW facilities. The Project will interconnect to the Mendota Substation using the existing North Star 115 kV gen-tie line that interconnects the North Star Solar Project. The Project location is provided in Figures 1 and 2.

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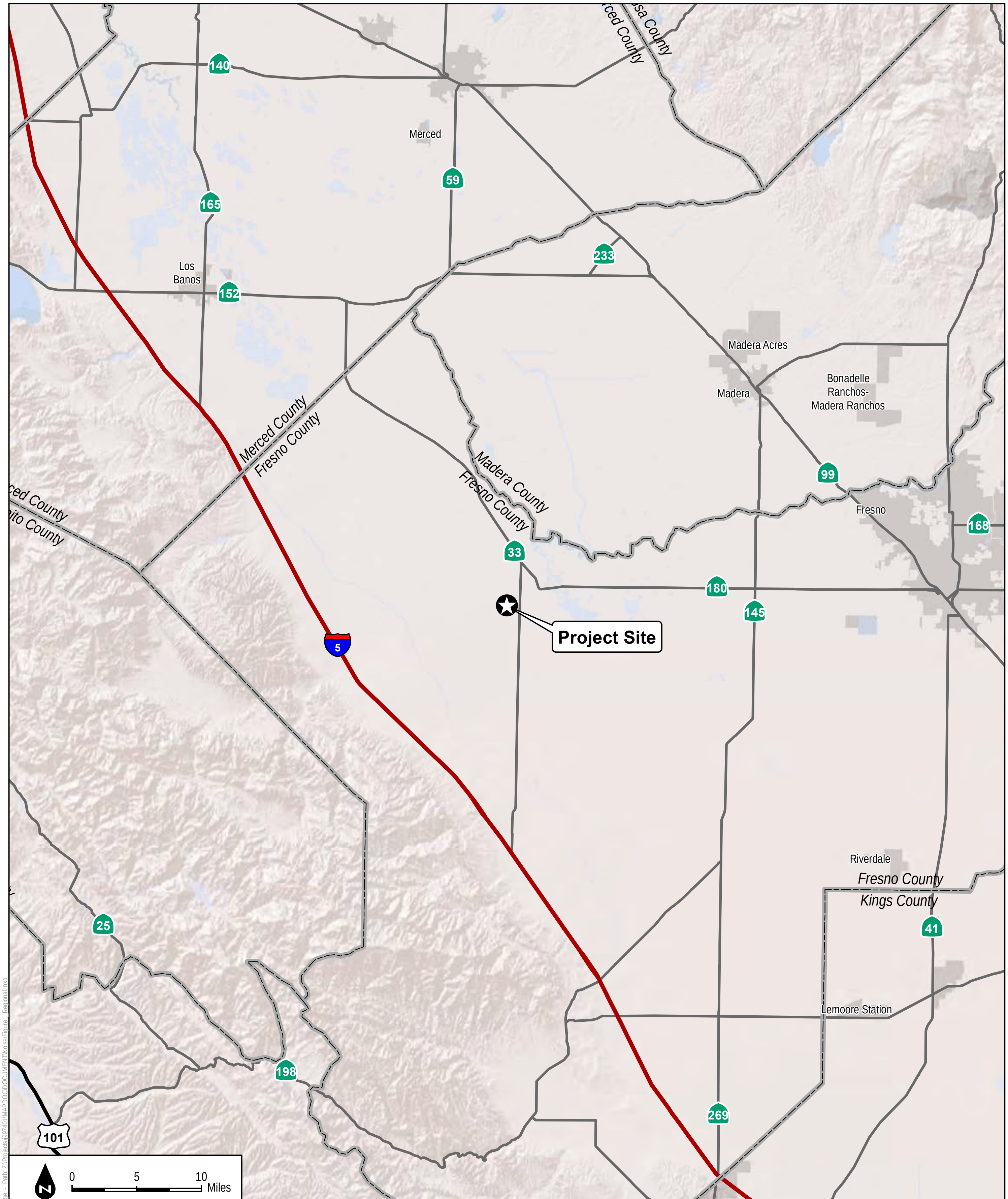

DUDEK

SOURCE: ESRI Basemaps

FIGURE 1

Regional Location

Little Bear Solar Project Air Quality Impact Assessment and Health Risk Assessment

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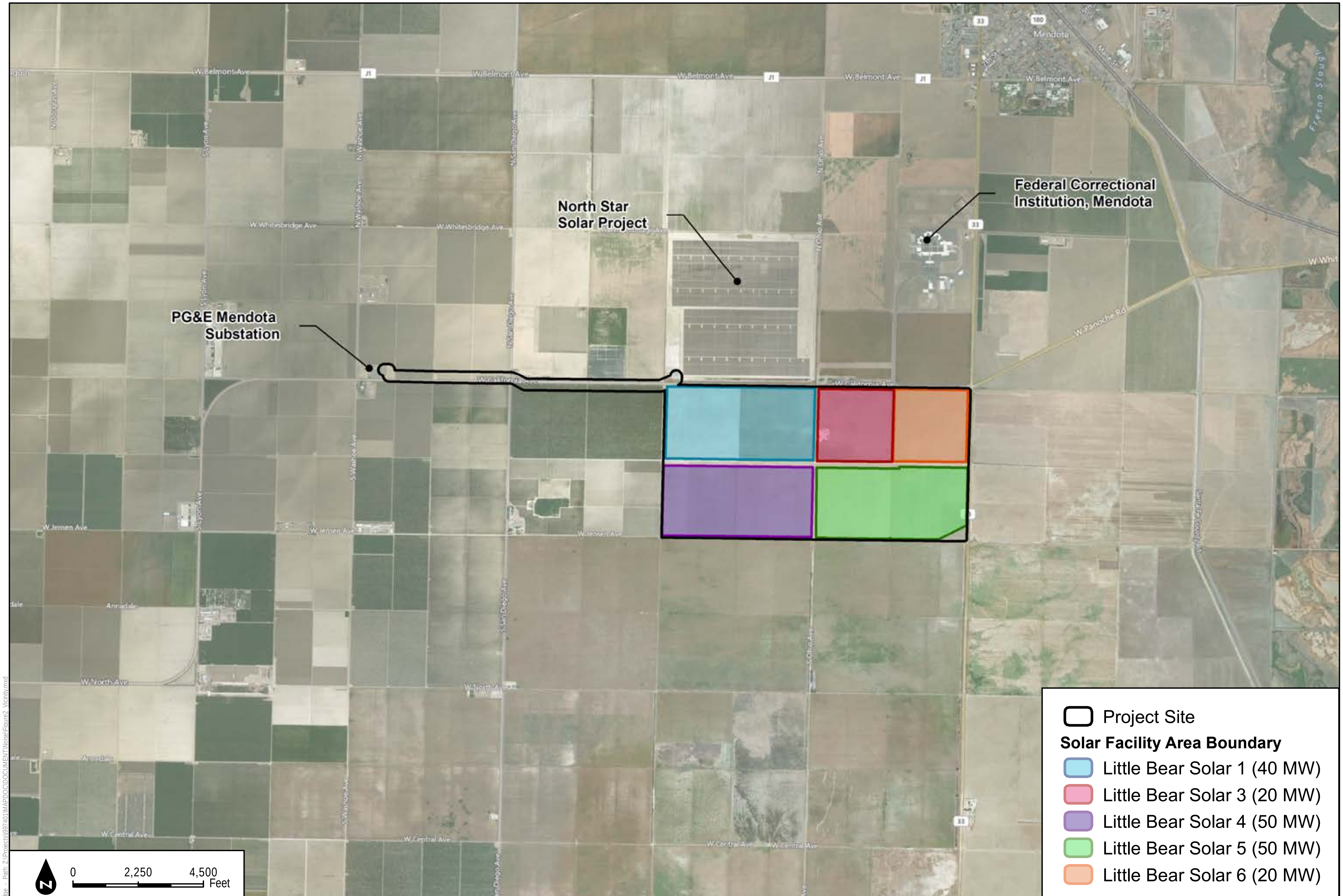

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SOURCE: Bing Maps (Accessed 2017)

FIGURE 2

Project Vicinity

Little Bear Solar Project Air Quality Impact Assessment and Health Risk Assessment

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1.3 Criteria Air Pollutants

Criteria air pollutants are defined as pollutants for which the federal and state governments have established ambient air quality standards, or criteria, for outdoor concentrations to protect public health. The federal and state standards have been set, with an adequate margin of safety, at levels above which concentrations could be harmful to human health and welfare. These standards are designed to protect the most sensitive persons from illness or discomfort. Pollutants of concern include O_3, NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, and Pb. These pollutants, as well as TACs, are discussed in the following text.[1] In California, sulfates, vinyl chloride, hydrogen sulfide, and visibility-reducing particles are also regulated as criteria air pollutants.

Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter can form when gases emitted from industries and motor vehicles undergo chemical reactions in the atmosphere. $PM_{2.5}$ and PM_{10} represent fractions of particulate matter. Coarse particulate matter (PM_{10}) is about 1/7 the thickness of a human hair. Major sources of PM_{10} include crushing or grinding operations; dust stirred up by vehicles traveling on roads; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Fine particulate matter ($PM_{2.5}$) is roughly 1/28 the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (e.g., from motor vehicles and power generation and industrial facilities), residential fireplaces, and woodstoves. In addition, $PM_{2.5}$ can form in the atmosphere from gases such as SO_x, NO_x, and ROGs.

$PM_{2.5}$ and PM_{10} pose a greater health risk than larger-size particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. $PM_{2.5}$ and PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Very small particles of substances such as Pb, sulfates, and nitrates can cause lung damage directly or be absorbed into the blood stream, causing damage elsewhere in the body. Additionally, these substances can transport adsorbed gases such as chlorides or ammonium into the lungs, also causing injury. PM_{10} tends to collect in the upper portion of the respiratory system, whereas $PM_{2.5}$ is so tiny that it can penetrate deeper into the lungs and damage lung

[1] The descriptions of each of the criteria air pollutants and associated health effects are based on the EPA's Criteria Air Pollutants (EPA 2016) and the California Air Resources Board (CARB) Glossary of Air Pollutant Terms (CARB 2016).

tissue. Suspended particulates also damage and discolor surfaces on which they settle and produce haze and reduce regional visibility.

People with influenza, people with chronic respiratory and cardiovascular diseases, and the elderly may suffer worsening illness and premature death as a result of breathing particulate matter. People with bronchitis can expect aggravated symptoms from breathing particulate matter. Children may experience a decline in lung function due to breathing PM_{10} and $PM_{2.5}$. Other groups considered sensitive are smokers, people who cannot breathe well through their noses, and exercising athletes (because many breathe through their mouths).

1.4 Toxic Air Contaminants

A substance is considered toxic if it has the potential to cause adverse health effects in humans, including increasing the risk of cancer upon exposure, or acute (short term) and/or chronic (long term) noncancer health effects. A toxic substance released into the air is considered a toxic air contaminant (TAC). Examples include certain aromatic and chlorinated hydrocarbons, DPM, certain metals, and asbestos. TACs are generated by a number of sources, including stationary sources such as dry cleaners, gas stations, combustion sources, and laboratories; mobile sources such as automobiles; and area sources such as landfills. Adverse health effects associated with exposure to TACs may include carcinogenic (i.e., cancer-causing) and noncarcinogenic effects. Noncarcinogenic effects typically affect one or more target organ system and may be experienced either on acute or chronic exposure to a given TAC.

California's air toxics control program began in 1983 with the passage of the Toxic Air Contaminant Identification and Control Act, Assembly Bill (AB) 1807, better known as the Tanner Bill. The Tanner Bill established a regulatory process for the scientific and public review of individual toxic compounds. When a compound becomes listed as a TAC under the Tanner process, the CARB normally establishes minimum statewide emission-control measures to be adopted by air quality management districts and air pollution control districts. By 1992, 18 of the 189 federal hazardous air pollutants had been listed by the CARB as state TACs. In April 1993, the CARB added 171 substances to the state program to make the state TAC list equivalent to the federal list of hazardous air pollutants. In 1998, CARB designated diesel engine exhaust particulate matter (DPM) as a TAC (CARB 1998). The exhaust from diesel engines is a complex mixture of gases, vapors, and particles, many of which are known human carcinogens. DPM has established cancer risk factors and relative exposure values for long term chronic health hazard impacts. No short term, acute relative exposure values are established and regulated and are therefore not addressed in this assessment.

The second major component of California's air toxics program, supplementing the Tanner process, was provided by the passage of Assembly Bill (AB) 2588, the Air Toxics "Hot Spots" Information and Assessment Act of 1987. AB 2588 currently regulates over 600 compounds, including all of the Tanner-designated TACs.

Additionally, Proposition 65, passed by California voters in 1986, required that a list of carcinogenic and reproductive toxicants found in the environment be compiled, the discharge of these toxicants into drinking water be prohibited, and warnings of public exposure by air, land, or water be posted if a significant adverse public health risk is posed. The emission of any of listed substances by a facility would require a public warning unless health risks could be demonstrated to be less than significant. For carcinogens, Proposition 65 defines the "no significant risk level" as the level of exposure that would result in an increased cancer risk of greater than 10 in 1 million over a 70-year lifetime. The "no significant risk level" is 1/1000 of the No Observable Effect Level for reproductive toxicants.

In 2000, CARB approved a comprehensive Diesel Risk Reduction Plan to reduce diesel emissions from both new and existing diesel-fueled vehicles and engines. The regulation is anticipated to result in an 80% decrease in statewide diesel health risk in 2020 compared with the diesel risk in 2000. Additional regulations apply to new trucks and diesel fuel, including the On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation, On-Road Heavy Duty (New) Vehicle Program, In-Use Off-Road Diesel Vehicle Regulation, and New Off-Road Compression-Ignition (Diesel) Engines and Equipment program. These regulations and programs have timetables by which manufacturers must comply and existing operators must upgrade their diesel powered equipment. Several Airborne Toxic Control Measures reduce diesel emissions, including In-Use Off-Road Diesel-Fueled Fleets (13 CCR 2449 et seq.) and In-Use On-Road Diesel-Fueled Vehicles (13 CCR 2025).

1.5 Cancer Risk

Cancer risk is defined as the increase in lifetime probability (chance) of an individual developing cancer due to exposure to a carcinogenic compound, typically expressed as the increased probability in 1 million. The cancer risk from inhalation of a TAC is estimated by calculating the inhalation (and if applicable, ingestion) dose in units of milligrams/kilogram body weight per day based on an ambient concentration in units of micrograms per cubic meter ($\mu g/m^3$), breathing rate, and exposure period, and multiplying the dose by the inhalation cancer potency factor, expressed as (milligrams/kilogram body weight per day)$^{-1}$. Cancer risks for residential receptors and similar sensitive receptors are typically estimated based on a lifetime (70 years) of continuous exposure.

Cancer risks are typically calculated for all carcinogenic TACs and summed to calculate the overall increase in cancer risk to an individual. The calculation procedure assumes that cancer risk is proportional to concentrations at any level of exposure and that risks due to different carcinogens are additive. This approach is generally considered a conservative assumption at low doses and is consistent with the current Office of Environmental Health Hazard Assessment (OEHHA) regulatory approach. Exposure to carcinogenic TACs does not imply that the exposed individual would contract cancer; rather, the cancer risk is a probability of developing cancer if other factors (e.g., heredity, exposure to environmental or workplace exposures that comprise the immune system, overall health) would result in an increased susceptibility to developing cancer.

1.6 Noncancer Health Impacts

The noncancer health impact of an inhaled TAC is measured by the hazard quotient, which is the ratio of the ambient concentration of a TAC in units of $\mu g/m^3$ divided by the reference exposure level (REL), also in units of $\mu g/m^3$. The REL is the concentration at or below which no adverse health effects are anticipated. The REL is typically based on health effects to a particular target organ system, such as the respiratory system, liver, or central nervous system. Hazard quotients of individual TACs are then summed for each target organ system to obtain a hazard index.

1.7 Local Conditions

The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5, approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route (SR-) 33, in unincorporated Fresno County, Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian. Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east. Figure 1 and Figure 2 show the location of the proposed Project on a regional and local basis, respectively.

The Project site is currently under agricultural production with winter wheat and barley crops. The Project site is approximately 1,288 acres in total. Land use in the vicinity of the Project is largely agricultural production with a few, scattered residences—the closest of which is approximately 0.75 mile from the Project site. The Project will be immediately adjacent to the North Star Solar Power Project and approximately 0.5 mile south of the Federal Correctional Institution Mendota.

The San Joaquin Valley is in a Mediterranean Climate Zone, influenced by a subtropical high-pressure cell most of the year and characterized by warm, dry summers and cooler winters. Mediterranean climates are characterized by sparse rainfall, which occurs mainly in winter. Summertime maximum temperatures in the San Joaquin Valley often exceed 100 degrees

Fahrenheit (°F). The San Joaquin Valley Air Basin (SJVAB) averages 10.6 inches of precipitation per year (WRCC 2017).

The vertical dispersion of air pollutants in the San Joaquin Valley can be limited by the presence of persistent temperature inversions. Air temperatures usually decrease with an increase in altitude. A reversal of this atmospheric state, where the air temperatures increases with height, is termed an inversion. A temperature inversion can act like a lid, restricting vertical mixing of air above and below an inversion because of differences in air density and thereby trapping air pollutants below the inversion. The subtropical high-pressure cell is strongest during spring, summer, and fall and produces subsiding air, which can result in air temperature inversions. Most of the surrounding mountains are above the normal height of summer inversions (1,500–3,000 feet). Wintertime high-pressure events can often last many weeks with surface temperatures lowering into 30°F–40°F. During these events, fog can be present and inversions are extremely strong. These wintertime inversions can inhibit vertical mixing of pollutant to a few hundred feet.

Wind speed and direction play an important role in dispersion and transport of air pollutants. Winds in the San Joaquin Valley most frequently blow from the northwesterly direction, especially in the summer. The region's topographic features restrict air movement and channel the air mass towards the southeastern end of the San Joaquin Valley. Marine air can flow into the SJVAB from the Sacramento–San Joaquin River Delta and over Altamont Pass and Pacheco Pass. From there, it can flow through the San Joaquin Valley, over the Tehachapi Pass, and into the Mojave Desert Air Basin. The Coastal Range and the Sierra Nevada are barriers to air movement to the west and east, respectively. A secondary but significant summer wind pattern is from the southeasterly direction and can be associated with nighttime drainage winds, prefrontal conditions, and summer monsoons. During winter, winds can be very weak, which minimizes the transport of pollutants and results in stagnation events.

2 GUIDANCE AND THRESHOLDS

2.1 OEHHA Guidance

This report includes health risk assessments associated with construction emissions and emissions from diesel vehicles. All these risk assessments followed the methodologies prescribed in the California Environmental Protection Agency/OEHHA's *Air Toxics Hot Spots Program Risk Assessment Guidelines – Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015), which was adopted in 2015 replacing the previous 2003 guidance manual.

The Children's Environmental Health Protection Act of 1999 (Senate Bill 25), which requires explicit consideration of infants and children in assessing risks from air toxics, required revisions of the methods for both noncancer and cancer risk assessment and of the exposure assumptions in the 2003 OEHHA health risk assessment guidance manual. In response to SB 25, OEHHA released three technical support documents (TSDs) addressing RELs (OEHHA 2008), cancer potency (OEHHA 2009), and exposure assessment and stochastic analysis (OEHHA 2012) and adopted the revised health risk assessment guidance manual (OEHHA 2015). The TSD for RELs and continuing work to reevaluate TACs to ensure adequate protection for infants and children has led to revisions of RELs for approximately 10 chemicals and chemical families. The basic methodology for evaluating acute and chronic health effects using the RELs otherwise remained the same as in the previous guidance manual. Moreover, RELs are designed to protect the most sensitive individuals in the population, including infants and children, by selecting appropriate toxicological data and including margins of safety. Accordingly, the evaluation methods are assumed to protect children as well as other sensitive subpopulations (groups of more highly susceptible individuals) from adverse health effects in the event of exposure (OEHHA 2008).

The cancer risk methodology described in exposure assessment and stochastic analysis TSD and the OEHHA guidance manual accounts for the higher sensitivity of infants and children by applying age-specific breathing rates and age-sensitivity factors. According to the TSD, "Accounting for effects of early-in life exposure requires accounting for both the increased potency of early in life exposure to carcinogens and the greater exposure on a per [kilogram] body weight that occurs early in life due to behavioral and physiological differences between infants and children, and adults" (OEHHA 2012). As compared to the previous guidance, which relied on a single breathing rate for all ages, the revised guidance also includes age-specific breathing rates that reflect the differences between those for infants, children, and adults. The health risk assessments in this report use the Hotspots Analysis and Reporting Program, Version 2 (HARP 2), which incorporates RELs and cancer potency factors, which are periodically updated, and health effects calculations based on the 2015 OEHHA guidance manual. Accordingly, these risk assessments evaluate and reflect conservative, health-protective methodologies to assess health impacts to adults as well as infants, children, and other sensitive subpopulations.

2.2 SJVAPCD Guidance

Several guidance documents and regulations shape and define the scope of the modeling analysis. Methods and supplemental information regarding criteria pollutants—reactive organic gases (ROG), oxides of nitrogen (NO_x), sulfur oxides (SO_x), carbon monoxide (CO), particulate matter (PM)—can be found in the SJVAPCD Guidance for Assessing and Mitigating Air Quality Impacts (GAMAQI, SJVAPCD 2015a). The GAMAQI includes pertinent background information, definitions, significance thresholds, and other relevant materials. These significance thresholds are detailed in Table 1 below.

Table 1
SJVAPCD CEQA Air Quality Significance Thresholds

Pollutant/Precursor	Construction Emissions (tons/year)
ROG	10
NO_x	10
CO	100
SO_x	27
PM_{10}	15
$PM_{2.5}$	15

Notes: ROG = reactive organic gases; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter.

Toxic Air Contaminants (TACs) are listed in the AB2588 Air Toxic "Hot Spots" and Assessment Act's "Emissions Inventory Criteria and Guideline Regulation." A subset of these TACs has been listed by the OEHHA as having acute, chronic, and/or carcinogenic effects on public health. The GAMAQI also recommends that an ambient air quality analysis be performed when any on-site emission increase from construction or operation activities exceed 100 pounds per day after implementation of all enforceable mitigation measures.

The SJVAPCD current thresholds of significance for TAC emissions from the operations of both permitted and non-permitted sources are combined and presented in Table 2.

Table 2
SJVAPCD CEQA Toxic Air Contaminants Thresholds

Carcinogens	Non-Carcinogens	
	Acute	*Chronic*
Maximally Exposed Individual risk equals or exceeds 20 in one million	Hazard Index equals or exceeds 1 for the Maximally Exposed Individual	Hazard Index equals or exceeds 1 for the Maximally Exposed Individual

2.3 CAPCOA Guidance

The GAMAQI also refers to the California Air Pollution Control Officers Association (CAPCOA) guidance document *Health Risk Assessments for Proposed Land Use Projects* (CAPCOA 2009). CAPCOA prepared the guidance to assist lead agencies in complying with CEQA requirements. This document is also referenced in the impact analysis. This guidance was developed to help agencies comply with CEQA. This CAPCOA guidance document focuses on the acute, chronic, and cancer impacts of sources subject to review under CEQA. It also outlines the recommended procedures to identify when a project should undergo further risk evaluation, how to conduct the HRA, how to engage the public, what to do with the results from the HRA, and what mitigation measures may be appropriate for various land use projects. However, this guidance does not address risk assessments for construction projects. Therefore, this guidance was not relied upon for the HRA.

3 EMISSION CALCULATIONS

3.1 Methodology and Assumptions

Construction of the Project would result in the temporary addition of pollutants to the local airshed caused by on-site sources (i.e., off-road construction equipment, soil disturbance, and ROG off-gassing) and off-site sources (i.e., on-road haul trucks, vendor trucks, and worker vehicle trips). Emissions from the construction phase of the Project were estimated using a spreadsheet based calculation model incorporating emission factors from CARB's EMFAC 2014, OFFROAD2011, CalEEMod, and EPA AP-42.

Construction scenario assumptions, including phasing, equipment mix, and vehicle trips, were based on information provided by the Applicant. For purposes of estimating Project emissions, and based on information provided by the Applicant, it is assumed that construction of the Project would commence in September 2019 and would last approximately 12 months, ending in August 2020. The analysis contained herein is based on the following assumptions (duration of phases is approximate):

- Move on: 1 month (September 2019)
- Substation construction: 5 months (September 2019–January 2020)
- Gen-tie installation: 7 months (September 2019–March 2020)
- Site preparation and grading: 7 months (September 2019–March 2020)
- Trenching: 8 months (October 2019–May 2020)
- Solar PV system installation: 7 months (December 2019–June 2020)
- Site clean-up and restoration: 7 months (February 2020–August 2020)

As shown above, several of the construction phases will run concurrently. For the analysis, it was generally assumed that heavy construction equipment would be operating at the site for approximately 8 hours per day, 5 days per week (22 days per month), during Project construction.

Delivery of material and supplies would reach the site via on-road truck delivery from Fresno via SR-180. The distance between the Project site and Fresno is approximately 40 miles. For the HRA and dispersion modeling, only onsite emissions were accounted for from haul and vendor diesel trucks. The majority of the truck deliveries would be for the PV system installation, as well as any aggregate material that may be required for road base.

The heaviest delivery loads to the site would also consist of the tracker structures, rock truck deliveries, and the delivery of the generator step up. These loads would typically be limited to total weight of 80,000 pounds (lbs), with a cargo load of approximately 25 tons or 50,000 lbs of rock or tracker structures. Typically, the rock is delivered in "bottom dump trucks" or "transfer trucks" with six axles and the tracker structures will be delivered on traditional flatbed trucks with a minimum of five axles. Low-bed transport trucks would transport the construction equipment to the site as needed. The size of the low-bed truck (axles for weight distribution) would depend on the equipment transported.

Grading would occur throughout the site. This would be accomplished with scrapers, motor graders, water trucks, dozers, and compaction equipment. It is anticipated the site will be balanced and no import or export of soil material will be required. The PV modules would be off-loaded and installed using small cranes, boom trucks, forklifts, rubber tired loaders, rubber tired backhoes, and other small to medium-sized construction equipment as needed. Construction equipment would be delivered to the site on low-bed trucks unless the equipment can be driven to the site (for example the boom trucks).

3.2 Estimated Emissions

Construction emissions can vary substantially from day to day, depending on the level of activity, the specific type of operation, and for dust, the prevailing weather conditions. Therefore, such emission levels can only be approximately estimated with a corresponding uncertainty in precise ambient air quality impacts.

Criteria air pollutant emissions associated with temporary construction activity were quantified using a spreadsheet-based model. Construction emissions were calculated for the estimated worst-case day over the construction period associated with each phase and reported as the maximum daily emissions estimated during each year of construction (2019 and 2020). Construction schedule assumptions, including phase type, duration, and sequencing, were based on information provided by the Applicant and are intended to represent a reasonable scenario based on the best information available.

Construction of the Project would generate air pollutant emissions from entrained dust, off-road equipment, and vehicle emissions. Entrained dust results from the exposure of earth surfaces to wind from the direct disturbance and movement of soil, resulting in PM_{10} and $PM_{2.5}$ emissions. As a condition of approval, the Project would be required to comply with SJVAPCD Rule 8021 to control dust emissions generated during the grading activities. Standard construction practices that would be employed to reduce fugitive dust emissions include watering of the active sites to maintain acceptable levels of dust generation. Internal combustion engines used by construction equipment, vendor trucks (i.e., delivery trucks), and worker vehicles would result in emissions of ROG, NO_x, CO, PM_{10}, and $PM_{2.5}$.

Table 3 presents the estimated annual construction emissions generated during construction of the Project. Details of the emission calculations are provided in Appendix A.

Table 3
Estimated Annual Onsite Construction Emissions

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Tons per year					
2019	0.98	8.26	4.90	0.09	0.83	0.41
2020	1.61	11.96	7.97	0.13	1.32	0.62
Total	2.59	20.22	12.87	0.22	2.15	1.03

Notes: CO = carbon monoxide; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; SO_x = sulfur oxides; ROG = reactive organic compound
See Appendix A for complete results.

Maximum annual emissions of ROG, NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$ emissions would occur during construction in 2019 and 2020 as a result of off-road equipment operation and on-road vendor trucks and haul trucks. Table 4 shows the maximum daily construction emissions from the Project.

Table 4
Estimated Maximum Daily Construction Emissions

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Pounds per day					
2019	24.02	201.51	119.55	2.16	20.15	10.00
2020	18.72	139.05	92.72	1.55	15.36	7.17
Maximum	24.02	201.51	119.55	2.16	20.15	10.00

Notes: CO = carbon monoxide; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; SO_x = sulfur oxides; ROG = reactive organic compound
See Appendix A for complete results.

As shown in Table 4, the Project would exceed 100 pounds per day for NO_x and CO during construction and thus an AQIA is recommended. Tables 3 and 4 were used to complete the AQIA. Table 5 presents estimated annual onsite emissions from construction equipment and vehicles from exhaust only. This does not include fugitive dust emissions or other non-exhaust related sources. The emissions in Table 5 were used in preparation of the HRA.

Table 5
Estimated Annual Onsite Construction Emissions – Exhaust Only

Year	ROG	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
	Tons per year					
2019	0.99	8.26	4.90	0.09	0.33	0.33
2020	1.61	11.96	7.97	0.13	0.49	0.49
Total	2.60	20.22	12.87	0.22	0.82	0.82

Notes: CO = carbon monoxide; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; SO_x = sulfur oxides; ROG = reactive organic compound
See Appendix A for complete results.

The Project would be required to comply with SJVAPCD Rule 8021 to control fugitive dust emissions generated during grading activities. Standard construction practices that would be employed to reduce fugitive dust emissions include:

- Short-term dust control by a water truck and/or available water source on or near the drilling rig,
- Minimize and cleanup trackout onto paved roads,
- Cover haul trucks,
- Stabilize (chemical or vegetation) site upon completion of grading when subsequent development is delayed,
- Rapid cleanup of project-related trackout or spills on paved roads,
- Minimize grading and soil movement when winds exceed 30 miles per hour, and
- Implement a speed limit of 15 miles per hour during all construction phases for vehicles travelling on un-paved roads.

4 MODELING METHODOLOGY

4.1 Dispersion Model

Dudek conducted a dispersion modeling analysis of PM_{10} and $PM_{2.5}$ emitted from diesel combustion sources and earth moving activity at the ambient air regulatory distance of 25 meters offsite for the purpose of an ambient air quality assessment. In addition, dispersion modeling was performed for the following criteria air pollutants: nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2). Dispersion modeling for reactive organic gases (also known as volatile organic compounds) was not performed because there are no ambient air quality standards for that pollutant. Reactive organic gases and oxides of nitrogen are ozone precursors, therefore no regulatory models are available to evaluate effects on ozone concentrations due to a single project.

The dispersion modeling was performed using the American Meteorological Society/EPA Regulatory Model (AERMOD), which is the model SJVAPCD requires for atmospheric dispersion of emissions. AERMOD is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of surface and elevated sources, building downwash, and simple and complex terrain (EPA 2015). Based on estimated construction emissions, Dudek determined the proposed Project's impacts on ambient air quality. The modeled concentrations of criteria air pollutants were added to background concentrations in the vicinity of the Project site, and results were compared to National and California Ambient Air Quality Standards, as well as significant impact levels established by the U.S. Environmental Protection Agency and/or the SJVAPCD. Methodologies used for the dispersion modeling were discussed with SJVAPCD technical staff after prior client approval.

The proposed Project may result in a short-term increase of toxic air contaminant (TAC) emissions related to construction. The main contaminant of concern is diesel combustion exhaust particulate matter (DPM), which has been listed as a TAC by the CARB. Dudek evaluated the Project's potential cancer and non-cancer health impacts using exposure periods appropriate to evaluate short-term emission increases. Emissions dispersion of DPM was modeled using AERMOD, then cancer risk and non-cancer health impacts subsequently using the CARB Hot Spots Analysis and Reporting Program Version 2 (HARP2). HARP2 (ADMRT, version 17320) which implements the March 2015 OEHHA age-weighting methodology for assessing toxics risks. The chemical exposure results were then compared to SJVAPCD thresholds to assess Project significance.

Since the proposed Project emitted more than 100 pounds per day of NO_x, CO, and PM_{10} during construction, air dispersion modeling was performed to assess AQIA impacts of emissions estimated for construction activity. The HRA was performed as a precautionary measure to evaluate any risk to nearby sensitive receptors. Principal parameters of AERMOD for the proposed Project construction and operations include:

- Meteorological Data: The SJVAPCD requires the use of AERMOD for air dispersion modeling. The latest 5-year meteorological data (2007-2011) for the Mendota station (Station ID 99005) from SJVAPCD were downloaded, then input to AERMOD. For cancer or chronic non-cancer risk assessments, the average cancer risk of all years modeled was used.

- Urban and Rural Options: Urban areas typically have more surface roughness as well as structures and low-albedo surfaces that absorb more sunlight – and thus more heat – relative to rural areas. According to SJVAPCD guidelines, the rural dispersion option was selected due to the planned developed nature of the Project area.

- Modeling Options: The modeling included the use of standard regulatory default options including selection of the adjust friction velocity option.

- Terrain Characteristics: The terrain in the vicinity of the modeled industrial site is generally flat. The elevation of the modeled site is about 60 meters above sea level (ASL). Digital elevation model (DEM) files were imported into AERMOD so that complex terrain features were evaluated as appropriate.

- Modeling Grid: A bounding grid at 25-meter distance from the facility with 25-meter resolution was evaluated to capture maximum ambient pollutant impacts. Nested receptors were input to capture maximum health risk impacts with high resolution then the extent of the emission plume reaching out 2 kilometers. This telescoping grid of receptors was set up with the following resolutions:

    - 25-meter spacing on the facility boundary,
    - 25-meter spacing from facility boundary to 100 meters,
    - 50-meter spacing from 100 meters to 250 meters,
    - 100-meter spacing from 250 meters to 500 meters,
    - 250-meter spacing from 500 meters to 1 kilometer, and

  - 500-meter spacing from 1 kilometer to 2 kilometers.

- Discrete Receptors: Since the Project is in the preliminary planning phase, the air quality modeling evaluated the points of maximum impact for the AQIA and HRA. The point of maximum impact is a location within the modeling grid where the model calculates the highest (worst-case) pollutant concentrations. The point of maximum impact was determined for the closest sensitive receptor (residence, hospital, childcare, etc.) and worker receptor.

- Source Equipment Operating Scenarios: Air dispersion modeling of construction activities was conducted using emissions generated using a spreadsheet based model, conservatively assuming work days of 8 hours per day, 5 days per week, and 22 days per month. The construction area was modeled as a large raised area source.

- Source Release Characterizations: Modeling release parameters were developed for the construction analyses. For modeling construction emissions dispersion using AERMOD, it was assumed that the total site area would have active construction activities for a duration of 1 year. The construction activity was modeled as a raised area source.

Table 6 shows the construction release characteristics used in the AERMOD model.

Table 6
Construction AREA Source Parameters for AQIA and HRA

Parameter	Units	Value
Emission Rate	grams per second (g/s)	1
Release Height	meters	5
Initial Vertical Dimension	meters	1.2

4.2 AQIA Methodology

Per SJVAPCD guidance (SJVAPCD 2014b), a Level 1 analysis was performed using AERMOD for each averaging period where the maximum concentration for each source and receptor combination was generated to produce worst-case concentrations for each directly emitted criteria pollutant of concern (CO, NO_2, PM_{10}, $PM_{2.5}$) without respect to time of occurrence.

In the Level 1 analysis, all criteria pollutants were modeled together, with a normalized (i.e., unit) emission rate of 1 gram per second for each source. The use of a normalized emission rate enabled the modeling run outputs to be used for multiple pollutant analyses, similar to an HRA.

The main differences are in the pollutant-specific averaging periods. The Level 1 procedure is described below:

- Normalization: For each source, the modeled dispersion factor, X/Q, in units of micrograms per cubic meter per grams per second ($\mu g/m^3$)/(g/s) was multiplied by the calculated emission rate of each subject pollutant in units of grams per second (g/s) to obtain ambient pollutant GLC in units of micrograms per cubic meter ($\mu g/m^3$).

- Averaging Periods: For all AQIA analyses, the appropriate averaging periods were selected for compatibility with criteria pollutant ambient air quality standards, i.e., 1-hour, 8-hour, 24-hour, and annual averaging periods shown in the Ambient Air Quality Standards table in Appendix B.

- Process: Using estimated release parameters AERMOD output files were generated for each averaging period and source combination.
  - For Step 1 of the AQIA analysis, the maximum background concentration for the Project Area (see Appendix B) for each pollutant and averaging period combination was added to the corresponding maximum GLC (Project impact). The sum of these values was then compared to the corresponding ambient air quality standard. If the Project impact did not cause an exceedance of an ambient air quality standard, then the analysis was complete for that source/receptor/pollutant combination because no exceedance of an ambient air quality standard was determined. If the Project impact caused an exceedance of an ambient air quality standard, then the analysis proceeded to Step 2.
  - Step 2 was similar to a Step 1 with one major difference. For this step, the maximum GLC of each pollutant and averaging period combination was compared to its corresponding Significant Impact Level (SIL, see Appendix B). If the maximum GLC did not exceed the corresponding SIL, then the analysis was complete for that source/receptor/pollutant combination because the emissions would not be considered to *contribute* to an exceedance of an ambient air quality standard, and no further action was required.

The SJVAPCD has a progressive three level approach to performing AAQAs, where you start with a Level 1 and you only need to perform a Level 2 analysis if the Level 1 analysis fails. In contrast to a Level 1 analysis, a Level 2 analysis the pollutants are not modelled together. Also, the modelled concentrations for each pollutant/averaging period at each receptor are the sum of the contributions from each source calculated using the source group all option in AERMOD.

The modelling of some pollutants have additional requirements compared to a Level 1 analysis. A Level 3 analysis is only performed for NO_2 and the approach is similar to a Level 2.

4.3 HRA Methodology

The Children's Environmental Health Protection Act of 1999 (Senate Bill 25), which requires explicit consideration of infants and children in assessing risks from air toxics, required revisions of the methods for both non-cancer and cancer risk assessment and of the exposure assumptions in the 2003 OEHHA health risk assessment guidance manual. In response to SB 25, OEHHA released three technical support documents (TSDs) addressing RELs (OEHHA 2008), cancer potency (OEHHA 2009), and exposure assessment and stochastic analysis (OEHHA 2012) and adopted a revised health risk assessment guidance manual (OEHHA 2015). The TSD for RELs and continuing work to reevaluate TACs to ensure adequate protection for infants and children has led to revisions of RELs for approximately 10 chemicals and chemical families.

The basic methodology for evaluating non-cancer health effects using the RELs otherwise remained the same as in the previous guidance manual. Moreover, RELs are designed to protect the most sensitive individuals in the population including infants and children by the selection of appropriate toxicological data and by including margins of safety. Accordingly, the evaluation methods are assumed to protect children as well as other sensitive subpopulations (groups of more highly susceptible individuals) from adverse health effects in the event of exposure (OEHHA 2008). The cancer risk methodology described in exposure assessment and stochastic analysis TSD and the OEHHA guidance manual accounts for the higher sensitivity of infants and children by applying age-specific breathing rates and age-sensitivity factors.

According to the TSD, "Accounting for effects of early-in life exposure requires accounting for both the increased potency of early in life exposure to carcinogens and the greater exposure on a per [kilogram] body weight that occurs early in life due to behavioral and physiological differences between infants and children, and adults" (OEHHA 2012). As compared to the previous guidance, which relied on a single breathing rate for all ages, the revised guidance also includes age-specific breathing rates that reflect the differences between those for infants, children, and adults. The health risk assessment in this report uses HARP 2, which incorporates RELs, cancer potency factors, and health effects calculations based on the 2015 OEHHA guidance manual. Accordingly, this assessment evaluates and reflects conservative, health-protective methodologies to assess health impacts to adults as well as infants, children, and other sensitive subpopulations.

As chronicled above, in March 2015 the OEHHA approved the new *Air Toxics Hot Spots Program Risk Guidance Manual for Preparation of Health Risk Assessments*. The SJVAPCD requires that all HRAs prepared for CEQA documents follow District policies in conjunction with the OEHHA guidance document. In order to implement the OEHHA guidance based on project information, the District has developed a 3-tiered approach where each successive tier is progressively more refined with each progressive level being less conservative.

In July 2015, the CARB, in cooperation with the CAPCOA, published a set of Risk Management Guidance for Stationary Source of Air Toxics. This document is intended to help Districts with their reevaluation process and to communicate ARB and Districts' plans, priorities, and policies regarding implementation of the new OEHHA risk assessment methodology.

SJVAPCD's HRA Tier 1 approach is a screening assessment methodology that incorporates very conservative assumption methodologies when specific information about a project and its impact locations to actual or assumed receptor locations are unknown. The Tier 2 option implements the AERMOD dispersion model and the Hotspots Analysis and Reporting Program Version 2 (HARP2) Air Dispersion Modeling and Risk Assessment Tool (ADMRT, version 17320). The Tier 2 approach provides a more accurate analysis. Tier 2 requires specific information modeling input for sources and receptors that refine the Tier 1, screening assessment approach. Tier 3 (refined project specific exposure parameters) is used when specific exposure parameters information about the project and effected receptors is known.

SJVAPCD guidance (SJVAPCD 2015b), Tier 3 cancer and non-cancer health risk calculations were performed using ground-level unity emission concentration (X/Q) input from AERMOD. This modeling established the emissions dispersion field to surrounding receptors from atmospheric influence of the Project emissions. The ground level concentrations (GLC) were then determined by multiplication of annual average emission rates and annually averaged X/Q values determined by AERMOD for the raised area source of emissions from construction activity. HARP2 then assessed resulting chemical exposures from construction emissions.

Based on its review of RELs and cancer potency factors to provide consideration of infants and children, OEHHA did not propose any revisions of the values for DPM, the primary TAC associated with construction equipment and diesel trucks. As noted, the cancer risk calculations in the revised OEHHA guidance manual include age-specific adjustments for infant and children. Therefore, the HRA results presented in Section 6.2 reflect the latest OEHHA guidance.

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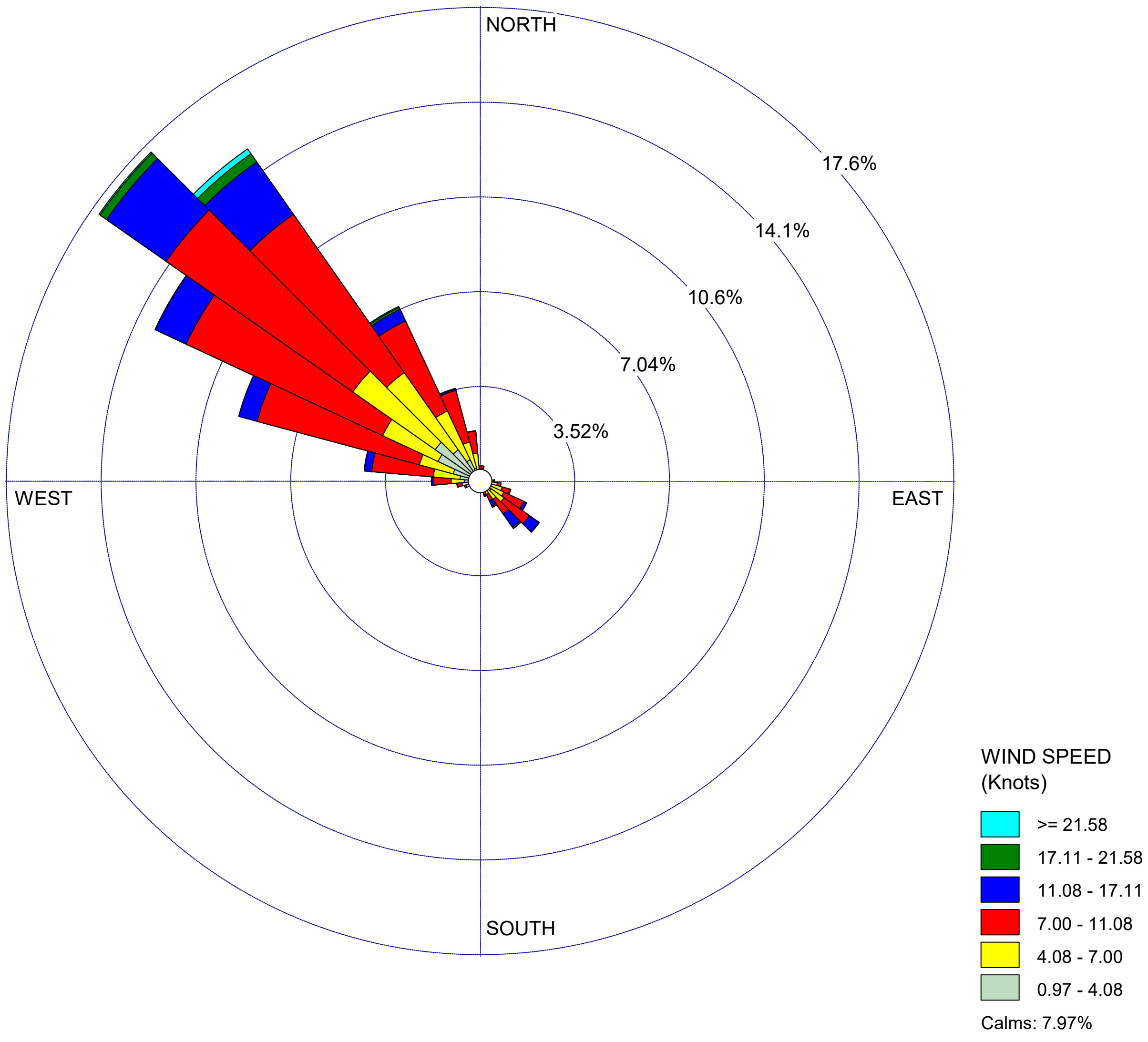
WIND ROSE PLOT:

Station #99005

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2007 - 00:00** **End Date: 12/31/2011 - 23:59**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **7.97%**	TOTAL COUNT: **43824 hrs.**	
	AVG. WIND SPEED: **6.46 Knots**	DATE: **12/13/2017**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

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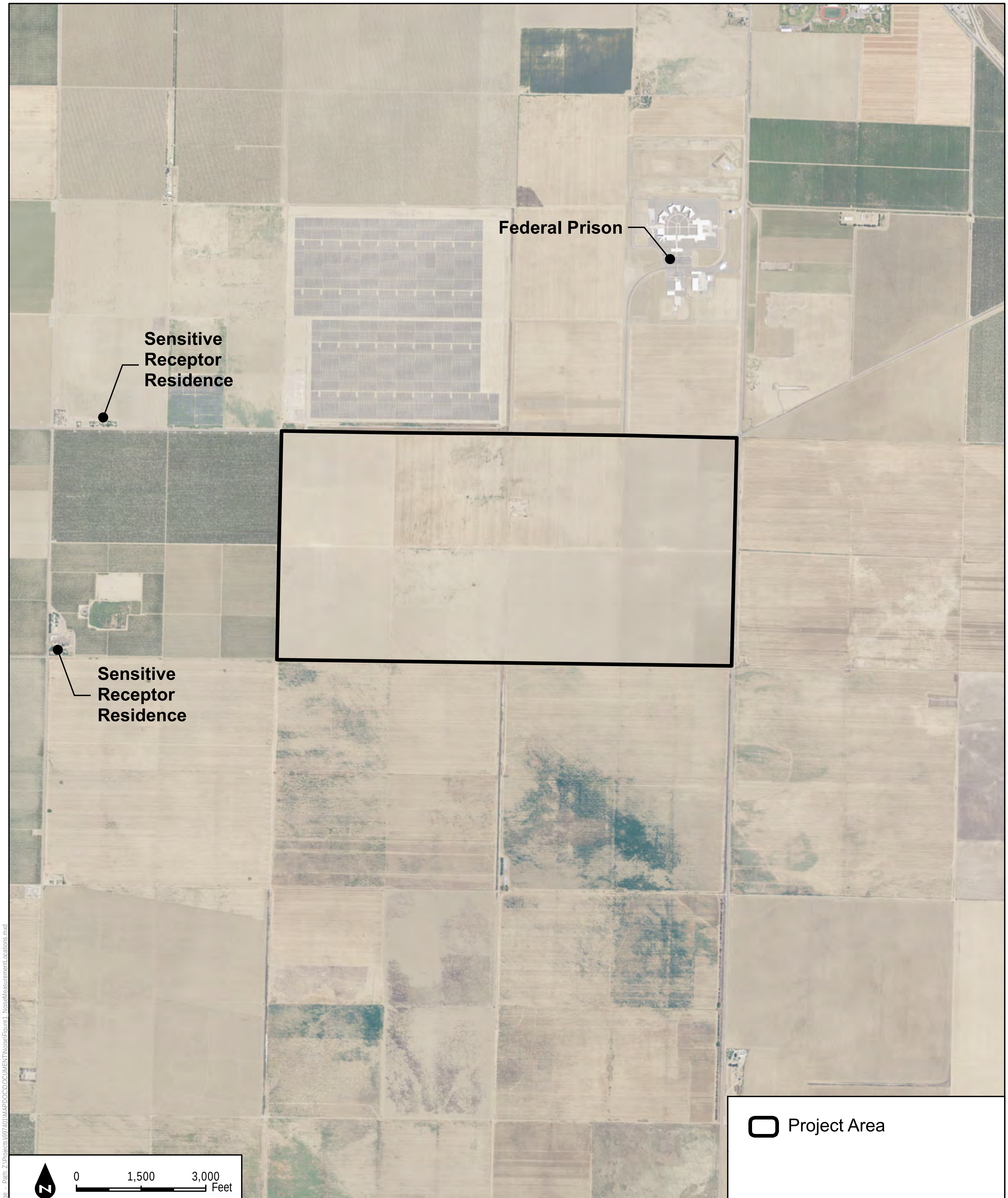
5 RECEPTORS USED FOR EVALUATING MODELED IMPACTS

Some land uses are considered more sensitive to changes in air quality than others, depending on the population groups and the activities involved. People most likely to be affected by air pollution include children, the elderly, athletes, and people with cardiovascular and chronic respiratory diseases. Facilities and structures where these air pollution-sensitive people live or spend considerable amounts of time are known as sensitive receptors. Land uses where air pollution-sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities (sensitive sites or sensitive land uses) (CARB 2005). The SJVAPCD considers hospitals, schools, parks, playgrounds, daycare centers, nursing homes, convalescent facilities, and residential areas as sensitive receptor land uses (SJVAPCD 2015a).

The greatest potential for exposure of sensitive receptors to air contaminants would occur during the temporary construction phase, when soil would be disturbed and equipment would be used for site grading, materials delivery, and PV solar panel installation. Potential exposure to emissions would vary substantially from day to day, depending on the amount of work being conducted, weather conditions, location of receptors, and exposure time. The construction-phase emissions in this analysis are estimated conservatively based on worst-case conditions, with maximum levels of construction activity occurring simultaneously within a short period of time. The nearest sensitive receptors are scattered rural residential land uses. Residential land uses have the highest potential to be affected by the Project, in particular single-family or multiple-family residences. There are several agricultural properties adjacent to the Project site. Table 7 shows a list of sensitive receptors close to the site and Figure 4 displays them in relation to the Project site.

Table 7
Sensitive Receptors Close to the Project Site

Type of Receptor	Direction
Residential	West of the Northern Project Boundary
Residential	West of the Southern Project Boundary
Federal Prison	North of the Project Area



DUDEK

SOURCE: USDA NAIP (2016)

FIGURE 4

Sensitive Receptor Locations

Air Quality Impact Assessment and Health Risk Assessment for the Little Bear Solar Project

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6 AIR DISPERSION MODELING AQIA AND HRA RESULTS

6.1 AQIA Results

Modeled emission rates for criteria pollutants were determined for construction of the proposed Project. Ozone is a photochemical oxidation product of NO_x and ROG emissions that is not evaluated in a source impact AQIA because it is not quantifiably present in combustion exhaust gases, i.e., not directly emitted.

Fugitive dust was included in the construction AQIA. Under SJVAPCD Regulation VIII, a Dust Control Plan would be required for the Project. All applicable control measures would be required to be fully implemented which would reduce fugitive dust impacts to less than significant for the Project.

Table 8 below summarizes the results of the Level 1 construction AQIA methodology described above and contained in Appendix C. Background ambient air quality data is contained in Appendix B, and the AERMOD outputs are contained in Appendix C.

Specifically, Table 8 shows the Step 1 results:

- For all CO and SO_2 impacts, the Step 1 analysis yields passing results (i.e., no exceedance of an ambient air quality standard).
- The project exceeded the AAQS threshold for the 1-hour NO_2, 24-hour PM_{10}, annual PM_{10}, and 24-hour $PM_{2.5}$ in the Step 1 analysis thereby requiring evaluation at Step 2.
- During the Step 2 analysis of 1-hour NO_2, 24-hour PM_{10}, annual PM_{10}, and 24-hour $PM_{2.5}$, the annual PM_{10}, and 24-hour $PM_{2.5}$ passed and the 1-hour NO_2, 24-hour PM_{10} failed.

Because the project failed 1-hour NO_2 and 24-hour PM_{10} during Step 2 of the Level 1 analysis, a Level 2 analysis was necessary for those pollutant averaging times. The Level 2 analysis was performed in accordance with SJVAPCD APR 1925. The Level 2 analysis showed that the 1-hour NO_2 passed both the state and federal AAQS during Step 1; however, the 24-hour PM_{10} failed the Step 1 and thus required moving on to Step 2. During Step 2 of the Level 2 analysis, the 24-hour PM_{10} passed as it did not exceed the SIL.

Table 8
Construction Ambient Air Quality Impact Assessment Results

LEVEL 1, STEP 1 – Ambient Air Quality Standard Basis			
	State/Federal AAQS	*Cumulative*	
Impact Parameter	*μg/m³*	*μg/m³*	*Status*
1-hour CO	22,900	4,667	PASS
	40,100	4,667	PASS
8-hour CO	10,300	3,031	PASS
	10,300	3,031	PASS
1-hour NO_2	338	642	Step 2
	188	642	Step 2
Annual NO_2	56	25	PASS
	100	25	PASS
1-hour SO_2	655	40	PASS
	196	40	PASS
24-hour SO_2	105	8	PASS
	367	8	PASS
Annual SO_2	79	1	PASS
24-hour PM_{10}	50	127	Step 2
	150	123	PASS
Annual PM_{10}	20	42	Step 2
24-hour $PM_{2.5}$	35	55	Step 2
Annual $PM_{2.5}$	12	10	PASS
	12	10	PASS
LEVEL 1, STEP 2 – SJVAPCD Significant Impact Level (SIL) Basis			
	Class II SILs	*Project Contribution*	
Impact Parameter	*μg/m³*	*μg/m³*	*Status*
1-hour NO_2	7.5	542.11	FAIL
24-hour PM_{10}	5	6.05	FAIL
Annual PM_{10}	1	0.25	PASS
24-hour $PM_{2.5}$	5	4.55	PASS
LEVEL 2, STEP 1 – Ambient Air Quality Standard Basis			
	State/Federal AAQS	Cumulative Contribution	
Impact Parameter	μg/m³	μg/m³	Status
1-hour NO_2	339	172	PASS
	188	172	PASS
24-hour PM_{10}	50	124	Step 2
LEVEL 2, STEP 2 – SJVAPCD Significant Impact Level (SIL) Basis			
	Class II SILs	Project Contribution	
Impact Parameter	μg/m³	μg/m³	Status
24-hour PM_{10}	5	3.13	PASS

Source: See Appendix C.

The results of the AQIA showed concentrations of each pollutant below the respective AAQS. Therefore, with respect to CEQA Appendix G, Air Quality question (b), the AQIA shows that criteria pollutant emissions from construction of the Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation.

6.2 HRA Results

The cancer risk calculations were performed by multiplying the AERMOD-predicted DPM concentrations in $\mu g/m^3$ due to DPM emissions from trucks and construction equipment by the appropriate risk values. The exposure and risk equations that were used to calculate the cancer risk at residential receptors are taken from the OEHHA manual for health risk assessments prepared under the Air Toxics "Hot Spots" program (OEHHA 2003).

The potential exposure pathway for DPM includes inhalation only. The potential exposure through other pathways (e.g., ingestion) requires substance and site-specific data, and the specific parameters for DPM are not known for these pathways (CARB 1998). Cancer risks were evaluated using the inhalation cancer potency factor published by the OEHHA and CARB (CARB 2013). The cancer potency factor for DPM is 1.1 per milligram per kilogram of body weight per day (mg/kg-day). In accordance with CARB policy (CARB 2015d), the breathing rate equal to the 80^{th} percentile, or 302 liters per kilogram of body weight per day, was used for the cancer risk calculations. Table 9 below summarizes the construction HRA results of the HRA methodology described above and contained in Appendix C.

Table 9
Construction Activity Health Risk Assessment Results

Impact Parameter	Units	Project Impact	CEQA Threshold	Level of Significance
MICR—Residential & Worker	Per Million	1.00	20.0	Less than Significant
HIC	Not Applicable	0.001	1.0	Less than Significant

Sources: Appendix C
Notes: MICR – Maximum Individual Cancer Risk; HIC – Chronic Hazard Index

The results of the construction analysis demonstrate that the construction mobile sources exhibit maximum individual cancer risks (MICR) below the 20 in a million threshold and chronic hazard indices (HIC) less than 1. AERMOD and HARP2 outputs are contained in Appendix C.

Therefore, with respect to CEQA Appendix G, Air Quality question (d), TAC emissions from construction of the Project would not expose sensitive receptors to substantial pollutant concentrations.

6.0 CONCLUSIONS

Based on this analysis, the closest sensitive receptors to the Project would not be exposed to TACs at levels above significance thresholds established by the SJVAPCD. Similarly, the AQIA showed that the generation of pollutants from Project construction would not exceed State or Federal AAQS.

The results determined in this analysis reflect reasonable estimates of source emissions and exhaust characteristics, available meteorological data near the Project site, and the use of currently approved air quality models. Given the limits of available tools for such an analysis, the actual impacts may vary from the estimates in this assessment. However, the combined use of the AERMOD dispersion model and the health impact calculations required by the OEHHA and the SJVAPCD tend to overpredict impacts, such that they produce conservative (i.e., health-protective) results. Accordingly, the health impacts are not expected to be higher than those estimated in this assessment.

7.0 REFERENCES

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ATTACHMENT A

Emissions Outputs

HRA Calculation Assumptions

Phase		Start Date	End Date	Work Days per Week	Work Days	Avg. # of Worker Vehicles (roundtrip)	Avg. Daily Vendor Trucks (roundtrip)	Total Haul Deliveries (roundtrip)	Avg. Haul Deliveries (roundtrip)	Avg. Daily Offsite Water Truck Trips (roundtrip)	#On-Road Pickups	2019 Work Days	2020 Work Days
Move-on (Laydown, construction trailers, and parking area)		9/1/2019	9/15/2019	5	**9**	10	5	25	3	10	5	9	0
Substation Construction		9/15/2019	1/31/2020	5	**94**	20	1	10	1	5	4	73	21
Gen-tie Line Installation		9/15/2019	3/31/2020	5	**136**	20	1	5	1	5	4	73	63
Site Preparation and Grading		9/15/2019	3/31/2020	5	**136**	29	5	0	0	50	5	73	63
Underground work (Trenching)		10/15/2019	5/15/2020	5	**148**	38	5	0	0	20	0	52	96
System Installation		12/1/2019	6/30/2020	5	**146**	317	5	0	0	20	10	19	127
Cleanup/Testing/Restoration		2/28/2020	9/1/2020	5	**132**	25	3	0	0	5	3	0	132
Overall		9/1/2019	9/1/2020		**254**							82	172

Distance to Offsite Water (miles):	1.5
Avg. Worker Housing Distance:	40
Avg. Vendor Distance:	40
Avg. Haul Delivery Distance:	40

ID	Phase Type (Select a drop down list item in Column B; if "Other", please specify in Column C)	Phase Start Date	Phase End Date	Equipment Operating Hours Per Day[1]	Equipment Type (Select a drop down list item in Column H; if "Other" please specify in Column I)		Phase	Number of Equipment	Horsepower	Load Factor	Engine Mfg Year	Engine Tier Rating (Tier 2, Tier 4i)[4]	Diesel Particulate Filter (Level)[5]		Engine Hours	Days (Calculated)	2019 Days	2020 Days
1	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Graders		Move-on (Laydown, construction tra	2	185	0.41		2				9	9	0
2	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Dozers		Move-on (Laydown, construction tra	1	158	0.4		2				9	9	0
3	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Scrapers		Move-on (Laydown, construction tra	2	365	0.4		2				9	9	0
4	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Loaders		Move-on (Laydown, construction tra	2	190	0.36		2				9	9	0
5	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Tractors/Loaders/Backhoes		Move-on (Laydown, construction tra	2	120	0.42		2				9	9	0
6	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Skid Steer Loaders		Move-on (Laydown, construction tra	3	83	0.37		2				9	9	0
7	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	24	Generator Sets	30kW Generator (security)	Move-on (Laydown, construction tra	1	40	0.74		3				9	9	0
8	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	12	Generator Sets	45kW Generator (offices)	Move-on (Laydown, construction tra	1	60	0.74		3				9	9	0
9	Substation Construction	9/15/2019	1/31/2020	4	Other General Industrial Equipment		Substation Construction	1	238	0.5		2				94	73	21
10	Substation Construction	9/15/2019	1/31/2020	4	Tractors/Loaders/Backhoes		Substation Construction	1	90	0.37		2				94	73	21
11	Substation Construction	9/15/2019	1/31/2020	5	Cranes		Substation Construction	1	400	0.29		2				94	73	21
12	Substation Construction	9/15/2019	1/31/2020	4	Rough Terrain Forklifts		Substation Construction	2	90	0.2		2				94	73	21
13	Substation Construction	9/15/2019	1/31/2020	4	Aerial Lifts		Substation Construction	1	60	0.31		2				94	73	21
14	Substation Construction	9/15/2019	1/31/2020	6	Graders		Substation Construction	1	185	0.41		2				94	73	21
15	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Dozers		Substation Construction	1	158	0.4		2				94	73	21
16	Substation Construction	9/15/2019	1/31/2020	4	Scrapers		Substation Construction	1	365	0.4		2				94	73	21
17	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Loaders		Substation Construction	1	190	0.36		2				94	73	21
18	Substation Construction	9/15/2019	1/31/2020	4	Excavators		Substation Construction	1	42	0.5		2				94	73	21
19	Substation Construction	9/15/2019	1/31/2020	6	Tractors/Loaders/Backhoes		Substation Construction	1	190	0.36		2				94	73	21
20	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Tractors/Loaders/Backhoes		Gen-tie Line Installation	1	90	0.37		2				136	73	63
21	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Cranes		Gen-tie Line Installation	1	400	0.29		2				136	73	63
22	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Crawler Tractors		Gen-tie Line Installation	1	147	0.44		2				136	73	63
23	Gen-tie Line Installation	9/15/2019	3/31/2020	2	Bore/Drill Rigs		Gen-tie Line Installation	1	190	0.42		2				136	73	63
24	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Rough Terrain Forklifts		Gen-tie Line Installation	1	90	0.2		2				136	73	63
25	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Other Construction Equipment		Gen-tie Line Installation	1	238	0.42		2				136	73	63
26	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Generator Sets		Gen-tie Line Installation	1	45	0.74		3				136	73	63
27	Site Preparation and Grading	9/15/2019	3/31/2020	8	Pumps	Water Pull	Site Preparation and Grading	2	185	0.41		2				136	73	63
28	Site Preparation and Grading	9/15/2019	3/31/2020	8	Graders		Site Preparation and Grading	2	185	0.41		2				136	73	63
29	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rubber Tired Dozers		Site Preparation and Grading	1	158	0.4		2				136	73	63
30	Site Preparation and Grading	9/15/2019	3/31/2020	6	Scrapers		Site Preparation and Grading	3	365	0.4		2				136	73	63
31	Site Preparation and Grading	9/15/2019	3/31/2020	6	Rubber Tired Loaders		Site Preparation and Grading	3	190	0.36		2				136	73	63
32	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Buster	Site Preparation and Grading	2	120	0.42		2				136	73	63
33	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Disk	Site Preparation and Grading	2	300	0.42		2				136	73	63
34	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rollers		Site Preparation and Grading	1	160	0.38		2				136	73	63
35	Site Preparation and Grading	9/15/2019	3/31/2020	6	Skid Steer Loaders		Site Preparation and Grading	2	83	0.37		2				136	73	63
36	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	30kW Generator (security)	Site Preparation and Grading	1	40	0.74		3				136	73	63
37	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	45kW Generator (offices)	Site Preparation and Grading	1	60	0.74		3				136	73	63
38	Underground work (Trenching)	10/15/2019	5/15/2020	6	Tractors/Loaders/Backhoes	Cable plow	Underground work (Trenching)	1	120	0.42		2				148	52	96
39	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers	Cable Trenchers	Underground work (Trenching)	1	42	0.5		2				148	52	96
40	Underground work (Trenching)	10/15/2019	5/15/2020	4	Plate Compactors		Underground work (Trenching)	1	180	0.43		2				148	52	96
41	Underground work (Trenching)	10/15/2019	5/15/2020	4	Excavators		Underground work (Trenching)	1	90	0.37		2				148	52	96
42	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers		Underground work (Trenching)	4	40	0.5		2				148	52	96
43	Underground work (Trenching)	10/15/2019	5/15/2020	6	Crushing/Processing Equipment	Padder	Underground work (Trenching)	1	180	0.43		2				148	52	96
44	Underground work (Trenching)	10/15/2019	5/15/2020	4	Tractors/Loaders/Backhoes		Underground work (Trenching)	2	90	0.37		2				148	52	96
45	Underground work (Trenching)	10/15/2019	5/15/2020	2	Rollers		Underground work (Trenching)	2	95	0.38		2				148	52	96
46	System Installation	12/1/2019	6/30/2020	4	Rough Terrain Forklifts		System Installation	5	90	0.2		2				146	19	127
47	System Installation	12/1/2019	6/30/2020	4	Aerial Lifts		System Installation	3	110	0.31		2				146	19	127
48	System Installation	12/1/2019	6/30/2020	4	Skid Steer Loaders		System Installation	10	80	0.4		2				146	19	127
49	System Installation	12/1/2019	6/30/2020	6	Air Compressors		System Installation	1	49	0.48		2				146	19	127
50	System Installation	12/1/2019	6/30/2020	6	Other Construction Equipment	Post Machines	System Installation	7	149	0.42		4i				146	19	127
51	System Installation	12/1/2019	6/30/2020	24	Generator Sets	30kW Generator (security)	System Installation	1	40	0.74		3				146	19	127
52	System Installation	12/1/2019	6/30/2020	24	Generator Sets	45kW Generator (offices)	System Installation	1	60	0.74		3				146	19	127
53	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	4	Tractors/Loaders/Backhoes		Cleanup/Testing/Restoration	1	90	0.37		2				132	0	132
54	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Graders		Cleanup/Testing/Restoration	1	185	0.41		2				132	0	132
55	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Scrapers		Cleanup/Testing/Restoration	2	365	0.4		2				132	0	132

On-Site Vehicle Emissions Estimation HRA Calculation Assumptions

2019 Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	3.0	0.1	27	0.38	3.38
Substation	73	1.0	0.1	73.00	0.06	4.56
Gen-Tie	73	1.0	0.1	73.00	0.10	7.30
Site Prep and Grading	73	0.0	0.1	0.00	0.00	0.00
Underground/Trench	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
leanup/Testing/Commissionin	0	0.0	0.1	0.00	0.00	0.00
Total	299			173.00		15.24
Overall Work Days	**82**					

2019 Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	6.0	0.1	54	0.60	5.40
Substation	73	2.0	0.1	146.00	0.20	14.60
Gen-Tie	73	2.0	0.1	146.00	0.20	14.60
ite Prep and Gradin	73	0.0	0.1	0.00	0.00	0.00
Underground/Trencl	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
up/Testing/Comissi	0	0.0	0.1	0.00	0.00	0.00
Total	299			346.00		34.60
Overall Work Days	**82**					

2019 Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	10.0	0.5	90	5.00	45
Substation	73	5.0	0.5	365.00	2.50	183
Gen-Tie	73	5.0	0.5	365.00	2.50	183
ite Prep and Gradin	73	50.0	0.5	3650.00	25.00	1825
Underground/Trencl	52	20.0	0.5	1040.00	10.00	520
System Installation	19	20.0	0.5	380.00	10.00	190
up/Testing/Comissi	0	5.0	0.5	0.00	2.50	0
Total	299			5890.00		2945
Overall Work Days	**82**					

On Site Driving

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	0.23		0.26		0.65		3.61		1216.78				0.10		0.10		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.05		0.07		2.05		0.22		351.52				0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	0.23		0.26		0.65		3.61		1216.78		0.00		0.10		0.10		0.01	
Water Truck	0.02	0.00	0.02	0.00	0.05	0.00	0.29	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.02	0.00	0.02	0.00	0.12	0.00	0.30	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

2019 On-Road Pickup

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	20.0	0.25	180	5.00	45
Substation	73	16.0	0.25	1168.00	4.00	292
Gen-Tie	73	16.0	0.25	1168.00	4.00	292
ite Prep and Gradin	73	20.0	0.25	1460.00	5.00	365
Underground/Trencl	52	0.0	0.25	0.00	0.00	0
System Installation	19	40.0	0.25	760.00	10.00	190
up/Testing/Comissi	0	12.0	0.25	0.00	3.00	0
Total	299			4736.00		1184
Overall Work	**82**					

On Site Idling

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	0.16		0.18		1.17		6.19		687.33		0.00		0.05		0.05		0.01	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Idling Assumptions

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	299	3.0	5.00	4.00	1	37
Dump Truck	299	3.0	5.00	4.00	1	37
Water Truck	299	3.0	5.00	10.00	3	93
On-Road Pickup	299	3.0	5.00	8.00	2	75
Total	1196				7	243
Overall Work	**82**					

On-Site Vehicle Emissions Estimation HRA Calculation Assumptions

2020 Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	3.0	0.1	0	0.38	0.00
Substation	21	1.0	0.1	21.00	0.06	1.31
Gen-Tie	63	1.0	0.1	63.00	0.10	6.30
Site Prep and Grading	63	0.0	0.1	0.00	0.00	0.00
Underground/Trench	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Commissioning	132	0.0	0.1	0.00	0.00	0.00
Total	502			84.00		7.61
Overall Work Days	**172**					

2020 Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	6.0	0.1	0	0.60	0.00
Substation	21	2.0	0.1	42.00	0.20	4.20
Gen-Tie	63	2.0	0.1	126.00	0.20	12.60
ite Prep and Gradin	63	0.0	0.1	0.00	0.00	0.00
Underground/Trencl	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
up/Testing/Comissi	132	0.0	0.1	0.00	0.00	0.00
Total	502			168.00		16.80
Overall Work	**172**					

2020 Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	10.0	0.5	0	5.00	0
Substation	21	5.0	0.5	105.00	2.50	53
Gen-Tie	63	5.0	0.5	315.00	2.50	158
ite Prep and Gradin	63	50.0	0.5	3150.00	25.00	1575
Underground/Trencl	96	20.0	0.5	1920.00	10.00	960
System Installation	127	20.0	0.5	2540.00	10.00	1270
up/Testing/Comissi	132	5.0	0.5	660.00	2.50	330
Total	502			8690.00		4345
Overall Work	**172**					

On Site Driving

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**				**0.10**		**0.10**		**0.01**	
Units	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.05**		**0.07**		**2.05**		**0.22**		**351.52**				**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**		**0.00**		**0.10**		**0.10**		**0.01**	
Water Truck	0.01	0.00	0.01	0.00	0.04	0.00	0.20	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.01	0.00	0.02	0.00	0.10	0.01	0.21	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

2020 On-Road Pickup

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	20.0	0.25	0	5.00	0
Substation	21	16.0	0.25	336.00	4.00	84
Gen-Tie	63	16.0	0.25	1008.00	4.00	252
ite Prep and Gradin	63	20.0	0.25	1260.00	5.00	315
Underground/Trencl	96	0.0	0.25	0.00	0.00	0
System Installation	127	40.0	0.25	5080.00	10.00	1270
up/Testing/Comissi	132	12.0	0.25	1584.00	3.00	396
Total	502			9268.00		2317
Overall Work	**172**					

On Site Idling

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Units	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**MT/ Day**	**MT/ Yr**	**MT/ Day**	**MT/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**	**Lb/ Day**	**Tons/ Yr**
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Idling Assumptions

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	502	3.0	5.00	4.00	1	63
Dump Truck	502	3.0	5.00	4.00	1	63
Water Truck	502	3.0	5.00	10.00	3	157
On-Road Pickup	502	3.0	5.00	8.00	2	126
Total	2008				7	408
Overall Work	**172**					

HRA Calculation Assumptions

Project Summary By Year

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	*PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2019	0.99	4.90	8.26	0.33	0.33	806.23	0.14	809.70	0.09
2020	1.61	7.97	11.96	0.49	0.49	1,224.44	0.22	1,229.99	0.13
Totals	2.60	12.87	20.22	0.82	0.82	2,030.67	0.36	2,039.69	0.22
SJVAPCD Thresholds	10	100	10	15	15				
Exceeded?	No	No	Yes	No	No				

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2019									
Const. Equip	0.98	4.90	8.25	0.33	0.33	806.22	0.14	809.69	0.09
Const. Mobile Onsite	0.001	0.005	0.013	0.0003	0.00	0.010	0.000	0.010	0.0000
Total	0.99	4.90	8.26	0.33	0.33	806.23	0.14	809.70	0.09

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2020									
Const. Equip	1.61	7.96	11.94	0.49	0.49	1,219.15	0.22	1,224.70	0.13
Const. Mobile Onsite	0.001	0.009	0.020	0.0005	0.00	5.290	0.000	5.290	0.0001
Total	1.61	7.97	11.96	0.49	0.49	1,224.44	0.22	1,229.99	0.13

AQIA Emission Estimate Assumptions

Phase		Start Date	End Date	Work Days per Week	Work Days	Avg. # of Worker Vehicles (roundtrip)	Avg. Daily Vendor Trucks (roundtrip)	Total Haul Deliveries (roundtrip)	Avg. Haul Deliveries (roundtrip)	Avg. Daily Offsite Water Truck Trips (roundtrip)	#On-Road Pickups	2018 Work Days	2019 Work Days	2020 Work Days	2021 Work Days	2022 Work Days
Move-on (Laydown, construction trailers, and parking area)		9/1/2019	9/15/2019	5	**9**	10	5	25	3	10	5	0	9	0	0	0
Substation Construction		9/15/2019	1/31/2020	5	**94**	20	1	10	1	5	4	0	73	21	0	0
Gen-tie Line Installation		9/15/2019	3/31/2020	5	**136**	20	1	5	1	5	4	0	73	63	0	0
Site Preparation and Grading		9/15/2019	3/31/2020	5	**136**	29	5	0	0	50	5	0	73	63	0	0
Underground work (Trenching)		10/15/2019	5/15/2020	5	**148**	38	5	0	0	20	0	0	52	96	0	0
System Installation		12/1/2019	6/30/2020	5	**146**	317	5	0	0	20	10	0	19	127	0	0
Cleanup/Testing/Restoration		2/28/2020	9/1/2020	5	**132**	25	3	0	0	5	3	0	0	132	0	0
Overall		9/1/2019	9/1/2020		**254**							0	82	172	0	0

Distance to Offsite Water (miles):	1.5
Avg. Worker Housing Distance:	40
Avg. Vendor Distance:	40
Avg. Haul Delivery Distance:	40

ID	Phase Type (Select a drop down list item in Column B; if "Other", please specify in Column C)	Phase Start Date	Phase End Date	Equipment Operating Hours Per Day[1]	Equipment Type (Select a drop down list item in Column H; if "Other" please specify in Column I)		Phase	Number of Equipment	Horsepower	Load Factor	Engine Mfg Year	Engine Tier Rating (Tier 2, Tier 4i)[4]	Diesel Particulate Filter (Level)[5]		Engine Hours	Days (Calculated)	2018 Days	2019 Days	2020 Days	2021 Days	2022 Days
1	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Graders		Move-on (Laydown, construction tra	2	185	0.41		2		12		9	0	9	0	0	0
2	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Dozers		Move-on (Laydown, construction tra	1	158	0.4		2		6		9	0	9	0	0	0
3	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Scrapers		Move-on (Laydown, construction tra	2	365	0.4		2		12		9	0	9	0	0	0
4	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Rubber Tired Loaders		Move-on (Laydown, construction tra	2	190	0.36		2		12		9	0	9	0	0	0
5	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Tractors/Loaders/Backhoes		Move-on (Laydown, construction tra	2	120	0.42		2		12		9	0	9	0	0	0
6	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	6	Skid Steer Loaders		Move-on (Laydown, construction tra	3	83	0.37		2		18		9	0	9	0	0	0
7	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	24	Generator Sets	30kW Generator (security)	Move-on (Laydown, construction tra	1	40	0.74		3		24		9	0	9	0	0	0
8	Move-on (Laydown, construction trailers, and parking area)	9/1/2019	9/15/2019	12	Generator Sets	45kW Generator (offices)	Move-on (Laydown, construction tra	1	60	0.74		3		12		9	0	9	0	0	0
9	Substation Construction	9/15/2019	1/31/2020	4	Other General Industrial Equipment		Substation Construction	1	238	0.5		2		4		94	0	73	21	0	0
10	Substation Construction	9/15/2019	1/31/2020	4	Tractors/Loaders/Backhoes		Substation Construction	1	90	0.37		2		4		94	0	73	21	0	0
11	Substation Construction	9/15/2019	1/31/2020	5	Cranes		Substation Construction	1	400	0.29		2		5		94	0	73	21	0	0
12	Substation Construction	9/15/2019	1/31/2020	4	Rough Terrain Forklifts		Substation Construction	2	90	0.2		2		8		94	0	73	21	0	0
13	Substation Construction	9/15/2019	1/31/2020	4	Aerial Lifts		Substation Construction	1	60	0.31		2		4		94	0	73	21	0	0
14	Substation Construction	9/15/2019	1/31/2020	6	Graders		Substation Construction	1	185	0.41		2		6		94	0	73	21	0	0
15	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Dozers		Substation Construction	1	158	0.4		2		3		94	0	73	21	0	0
16	Substation Construction	9/15/2019	1/31/2020	4	Scrapers		Substation Construction	1	365	0.4		2		4		94	0	73	21	0	0
17	Substation Construction	9/15/2019	1/31/2020	3	Rubber Tired Loaders		Substation Construction	1	190	0.36		2		3		94	0	73	21	0	0
18	Substation Construction	9/15/2019	1/31/2020	4	Excavators		Substation Construction	1	42	0.5		2		4		94	0	73	21	0	0
19	Substation Construction	9/15/2019	1/31/2020	6	Tractors/Loaders/Backhoes		Substation Construction	1	190	0.36		2		6		94	0	73	21	0	0
20	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Tractors/Loaders/Backhoes		Gen-tie Line Installation	1	90	0.37		2		4		136	0	73	63	0	0
21	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Cranes		Gen-tie Line Installation	1	400	0.29		2		4		136	0	73	63	0	0
22	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Crawler Tractors		Gen-tie Line Installation	1	147	0.44		2		4		136	0	73	63	0	0
23	Gen-tie Line Installation	9/15/2019	3/31/2020	2	Bore/Drill Rigs		Gen-tie Line Installation	1	190	0.42		2		2		136	0	73	63	0	0
24	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Rough Terrain Forklifts		Gen-tie Line Installation	1	90	0.2		2		4		136	0	73	63	0	0
25	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Other Construction Equipment		Gen-tie Line Installation	1	238	0.42		2		4		136	0	73	63	0	0
26	Gen-tie Line Installation	9/15/2019	3/31/2020	4	Generator Sets		Gen-tie Line Installation	1	45	0.74		3		4		136	0	73	63	0	0
27	Site Preparation and Grading	9/15/2019	3/31/2020	8	Pumps	Water Pull	Site Preparation and Grading	2	185	0.41		2		16		136	0	73	63	0	0
28	Site Preparation and Grading	9/15/2019	3/31/2020	8	Graders		Site Preparation and Grading	2	185	0.41		2		16		136	0	73	63	0	0
29	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rubber Tired Dozers		Site Preparation and Grading	1	158	0.4		2		3		136	0	73	63	0	0
30	Site Preparation and Grading	9/15/2019	3/31/2020	6	Scrapers		Site Preparation and Grading	3	365	0.4		2		18		136	0	73	63	0	0
31	Site Preparation and Grading	9/15/2019	3/31/2020	6	Rubber Tired Loaders		Site Preparation and Grading	3	190	0.36		2		18		136	0	73	63	0	0
32	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Buster	Site Preparation and Grading	2	120	0.42		2		12		136	0	73	63	0	0
33	Site Preparation and Grading	9/15/2019	3/31/2020	6	Tractors/Loaders/Backhoes	Tractor Disk	Site Preparation and Grading	2	300	0.42		2		12		136	0	73	63	0	0
34	Site Preparation and Grading	9/15/2019	3/31/2020	3	Rollers		Site Preparation and Grading	1	160	0.38		2		3		136	0	73	63	0	0
35	Site Preparation and Grading	9/15/2019	3/31/2020	6	Skid Steer Loaders		Site Preparation and Grading	2	83	0.37		2		12		136	0	73	63	0	0
36	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	30kW Generator (security)	Site Preparation and Grading	1	40	0.74		3		24		136	0	73	63	0	0
37	Site Preparation and Grading	9/15/2019	3/31/2020	24	Generator Sets	45kW Generator (offices)	Site Preparation and Grading	1	60	0.74		3		24		136	0	73	63	0	0
38	Underground work (Trenching)	10/15/2019	5/15/2020	6	Tractors/Loaders/Backhoes	Cable plow	Underground work (Trenching)	1	120	0.42		2		6		148	0	52	96	0	0
39	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers	Cable Trenchers	Underground work (Trenching)	1	42	0.5		2		6		148	0	52	96	0	0
40	Underground work (Trenching)	10/15/2019	5/15/2020	4	Plate Compactors		Underground work (Trenching)	1	180	0.43		2		4		148	0	52	96	0	0
41	Underground work (Trenching)	10/15/2019	5/15/2020	4	Excavators		Underground work (Trenching)	1	90	0.37		2		4		148	0	52	96	0	0
42	Underground work (Trenching)	10/15/2019	5/15/2020	6	Trenchers		Underground work (Trenching)	4	40	0.5		2		24		148	0	52	96	0	0
43	Underground work (Trenching)	10/15/2019	5/15/2020	6	Crushing/Processing Equipment	Padder	Underground work (Trenching)	1	180	0.43		2		6		148	0	52	96	0	0
44	Underground work (Trenching)	10/15/2019	5/15/2020	4	Tractors/Loaders/Backhoes		Underground work (Trenching)	2	90	0.37		2		8		148	0	52	96	0	0
45	Underground work (Trenching)	10/15/2019	5/15/2020	2	Rollers		Underground work (Trenching)	2	95	0.38		2		4		148	0	52	96	0	0
46	System Installation	12/1/2019	6/30/2020	4	Rough Terrain Forklifts		System Installation	5	90	0.2		2		20		146	0	19	127	0	0
47	System Installation	12/1/2019	6/30/2020	4	Aerial Lifts		System Installation	3	110	0.31		2		12		146	0	19	127	0	0
48	System Installation	12/1/2019	6/30/2020	4	Skid Steer Loaders		System Installation	10	80	0.4		2		40		146	0	19	127	0	0
49	System Installation	12/1/2019	6/30/2020	6	Air Compressors		System Installation	1	49	0.48		2		6		146	0	19	127	0	0
50	System Installation	12/1/2019	6/30/2020	6	Other Construction Equipment	Post Machines	System Installation	7	149	0.42		4i		42		146	0	19	127	0	0
51	System Installation	12/1/2019	6/30/2020	24	Generator Sets	30kW Generator (security)	System Installation	1	40	0.74		3		24		146	0	19	127	0	0
52	System Installation	12/1/2019	6/30/2020	24	Generator Sets	45kW Generator (offices)	System Installation	1	60	0.74		3		24		146	0	19	127	0	0
53	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	4	Tractors/Loaders/Backhoes		Cleanup/Testing/Restoration	1	90	0.37		2		4		132	0	0	132	0	0
54	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Graders		Cleanup/Testing/Restoration	1	185	0.41		2		6		132	0	0	132	0	0
55	Cleanup/Testing/Restoration	2/28/2020	9/1/2020	6	Scrapers		Cleanup/Testing/Restoration	2	365	0.4		2		12		132	0	0	132	0	0

On-Site Vehicle Emissions Estimation

AQIA Emission Estimate Assumptions

2019 Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	3.0	0.1	27	0.38	3.38
Substation	73	1.0	0.1	73.00	0.06	4.56
Gen-Tie	73	1.0	0.1	73.00	0.10	7.30
Site Prep and Grading	73	0.0	0.1	0.00	0.00	0.00
Underground/Trench	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Commissioning	0	0.0	0.1	0.00	0.00	0.00
Total	299			173.00		15.24
Overall Work Days	**82**					

2019 Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	6.0	0.1	54	0.60	5.40
Substation	73	2.0	0.1	146.00	0.20	14.60
Gen-Tie	73	2.0	0.1	146.00	0.20	14.60
Site Prep and Grading	73	0.0	0.1	0.00	0.00	0.00
Underground/Trench	52	0.0	0.1	0.00	0.00	0.00
System Installation	19	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Comissioning	0	0.0	0.1	0.00	0.00	0.00
Total	299			346.00		34.60
Overall Work Days	**82**					

2019 Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	10.0	0.5	90	5.00	45
Substation	73	5.0	0.5	365.00	2.50	183
Gen-Tie	73	5.0	0.5	365.00	2.50	183
Site Prep and Grading	73	50.0	0.5	3650.00	25.00	1825
Underground/Trench	52	20.0	0.5	1040.00	10.00	520
System Installation	19	20.0	0.5	380.00	10.00	190
Cleanup/Testing/Comissioning	0	5.0	0.5	0.00	2.50	0
Total	299			5890.00		2945
Overall Work Days	**82**					

2019 On-Road Pickup

Phase - Equipment Type:	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	9	20.0	0.25	180	5.00	45
Substation	73	16.0	0.25	1168.00	4.00	292
Gen-Tie	73	16.0	0.25	1168.00	4.00	292
Site Prep and Grading	73	20.0	0.25	1460.00	5.00	365
Underground/Trench	52	0.0	0.25	0.00	0.00	0
System Installation	19	40.0	0.25	760.00	10.00	190
Cleanup/Testing/Comissioning	0	12.0	0.25	0.00	3.00	0
Total	299			4736.00		1184
Overall Work Days	**82**					

Idling Assumptions (2019)

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	299	3.0	5.00	4.00	1	37
Dump Truck	299	3.0	5.00	4.00	1	37
Water Truck	299	3.0	5.00	10.00	3	93
On-Road Pickup	299	3.0	5.00	8.00	2	75
Total	1196				7	243
Overall Work Days	**82**					

On Site Driving (2019)

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**				**0.10**		**0.10**		**0.01**	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.05**		**0.07**		**2.05**		**0.22**		**351.52**				**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**		**0.00**		**0.10**		**0.10**		**0.01**	
Water Truck	0.02	0.00	0.02	0.00	0.05	0.00	0.29	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.02	0.00	0.02	0.00	0.12	0.00	0.30	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

On Site Idling (2019)

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2020 Haul Truck

Phase - Equipment Type: MHDT	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	3.0	0.1	0	0.38	0.00
Substation	21	1.0	0.1	21.00	0.06	1.31
Gen-Tie	63	1.0	0.1	63.00	0.10	6.30
Site Prep and Grading	63	0.0	0.1	0.00	0.00	0.00
Underground/Trench	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Commissioning	132	0.0	0.1	0.00	0.00	0.00
Total	502			84.00		7.61
Overall Work Days	**172**					

2020 Dump Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	6.0	0.1	0	0.60	0.00
Substation	21	2.0	0.1	42.00	0.20	4.20
Gen-Tie	63	2.0	0.1	126.00	0.20	12.60
Site Prep and Grading	63	0.0	0.1	0.00	0.00	0.00
Underground/Trench	96	0.0	0.1	0.00	0.00	0.00
System Installation	127	0.0	0.1	0.00	0.00	0.00
Cleanup/Testing/Comissioning	132	0.0	0.1	0.00	0.00	0.00
Total	502			168.00		16.80
Overall Work	**172**					

2020 Water Truck

Phase - Equipment	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	10.0	0.5	0	5.00	0
Substation	21	5.0	0.5	105.00	2.50	53
Gen-Tie	63	5.0	0.5	315.00	2.50	158
Site Prep and Grading	63	50.0	0.5	3150.00	25.00	1575
Underground/Trench	96	20.0	0.5	1920.00	10.00	960
System Installation	127	20.0	0.5	2540.00	10.00	1270
Cleanup/Testing/Comissioning	132	5.0	0.5	660.00	2.50	330
Total	502			8690.00		4345
Overall Work	**172**					

2020 On-Road Pickup

Phase - Equipment Type:	Days	Trips /Day	Round Trip Length (mi)	Total Trips	Miles /Day	Total Miles
Move-on	0	20.0	0.25	0	5.00	0
Substation	21	16.0	0.25	336.00	4.00	84
Gen-Tie	63	16.0	0.25	1008.00	4.00	252
Site Prep and Grading	63	20.0	0.25	1260.00	5.00	315
Underground/Trench	96	0.0	0.25	0.00	0.00	0
System Installation	127	40.0	0.25	5080.00	10.00	1270
Cleanup/Testing/Comissioning	132	12.0	0.25	1584.00	3.00	396
Total	502			9268.00		2317
Overall Work Days	**172**					

Idling Assumptions (2020)

Equipment Type	Op Days	# Times / Hr	Min/ Time	# Hours /Day	Idle Time / Day (Hours)	Total Idle Time (Days)
Haul Truck	502	3.0	5.00	4.00	1	63
Dump Truck	502	3.0	5.00	4.00	1	63
Water Truck	502	3.0	5.00	10.00	3	157
On-Road Pickup	502	3.0	5.00	8.00	2	126
Total	2008				7	408
Overall Work Days	**172**					

On Site Driving (2020)

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**				**0.10**		**0.10**		**0.01**	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.05**		**0.07**		**2.05**		**0.22**		**351.52**				**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Mi	**0.23**		**0.26**		**0.65**		**3.61**		**1216.78**		**0.00**		**0.10**		**0.10**		**0.01**	
Water Truck	0.01	0.00	0.01	0.00	0.04	0.00	0.20	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Sum	0.01	0.00	0.02	0.00	0.10	0.01	0.21	0.02	0.03	5.29	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00

Table Notes: G/Mile = Grams per Mile, ROG = Reactive Organic Gases, TOG = Total Organic Gases, CO= Carbon Monoxide, NOx = Oxides of Nitrogen, CO2 = Carbon Dioxide, LCFS = Low Carbon Fuel Standard, PM10 = Particulate Matter 10 Microns or Smaller, PM2.5 Particulate Matter 2.5 Microns or smaller, SOX = Oxides of Sulfur, MI = Mile, LB= Pound, YR= Year. Emission factors from the California Air Resources Board EMFAC2014

On Site Idling (2020)

Pollutants	ROG		TOG		CO		NOX		CO2		CO2 (Pavley I + LCFS)		PM10		PM2.5		SOX	
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Units	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	MT/ Day	MT/ Yr	MT/ Day	MT/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr	Lb/ Day	Tons/ Yr
Haul Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
On-Road Pickup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G/Day	**0.16**		**0.18**		**1.17**		**6.19**		**687.33**		**0.00**		**0.05**		**0.05**		**0.01**	
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Break and Tire Wear and Road Dust

Emissions Summary (g)

		PM_{10}				$PM_{2.5}$			
		BW	**TW**	**RE**	**UP**	**BW**	**TW**	**RE**	**UP**
2018	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0
2019	Offsite								
	Onsite	434	45		446,914				69,906
2020	Offsite								
	Onsite	655	71		699,077	281	18		110,302
2021	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0
2022	Offsite	0	0	0		0	0	0	
	Onsite	0	0		0	0	0		0

Emissions Summary (tons)

		PM_{10}				$PM_{2.5}$			
		BW	**TW**	**RE**	**UP**	**BW**	**TW**	**RE**	**UP**
2018	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0
2019	Offsite	0	0	0	0	0	0	0	0
	Onsite	0.0004782	5.006E-05	0	0.4926383	0	0	0	0.0770577
2020	Offsite	0	0	0	0	0	0	0	0
	Onsite	0.0007216	7.823E-05	0	0.7706003	0.0003093	1.956E-05	0	0.1215875
2021	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0
2022	Offsite	0	0	0	0	0	0	0	0
	Onsite	0	0	0	0	0	0	0	0

Offsite

Phase	Total Miles - 2019				Total Miles - 2020			
	Water Trucks	**Hauling**	**Vendor Trucks**	**Worker Vehicles**	**Water Trucks**	**Hauling**	**Vendor Trucks**	**Worker Vehicles**
Move-on	270	2,160	3,600	7,200	0	0	0	0
Substation	1,095	5,840	5,840	116,800	315	1,680	1,680	33,600
Gen-Tie	1,095	5,840	5,840	116,800	945	5,040	5,040	100,800
Site Prep and Grading	10,950	0	29,200	169,360	9,450	0	25,200	146,160
Underground/Trench	3,120	0	20,800	158,080	5,760	0	38,400	291,840
System Installation	1,140	0	7,600	481,840	7,620	0	50,800	3,220,720
Cleanup/Testing/Commissioning	0	0	0	0	1,980	0	31,680	264,000
Total	**17,670**	**13,840**	**72,880**	**1,050,080**	**26,070**	**6,720**	**152,800**	**4,057,120**

Emissions Factors (g/mi) (EMFAC2014)

		Vehicle Class			
		Hauling (MHDT, T6)	Hauling (HHDT, T7)	Vendor (LHD2 DSL)	Worker Vehicles (Light Duty)
ear (EMFA	PM_{10}	0.012	0.0358849	0.012	0.008
	$PM_{2.5}$	0.003	0.0089712	0.003	0.002
Vear (EMF	PM_{10}	0.13034	0.0615426	0.08918	0.03675
	$PM_{2.5}$	0.05586	0.0263754	0.03822	0.01575
Re-entrained Road Dust	PM_{10}	0.6751599	0.6751599	0.2905389	0.10995
	$PM_{2.5}$	0.1657211	0.1657211	0.0713141	0.0269877
On-Site Unpaved Travel	PM_{10}	117.686	117.686	122.488	79.7835
	$PM_{2.5}$	17.7686	17.7686	12.2488	14.09756

Offsite Emissions

		2019				2020			
Tire Wear	PM_{10}	212	166	875	8,401	313	81	1,834	32,457
	$PM_{2.5}$	53	42	219	2,100	78	20	458	8,114
Break Wear	PM_{10}	2,303	1,804	6,499	38,590	3,398	876	13,627	149,099
	$PM_{2.5}$	987	773	2,785	16,539	1,456	375	5,840	63,900
Re-entrained Road Dust	PM_{10}	11930.076	9344.2135	21174.475	115456.32	17601.42	4537.0748	44394.343	446080.43
	$PM_{2.5}$	2928.2914	2293.5797	5197.3711	28339.278	4320.3484	1113.6456	10896.793	109492.47

Onsite

Phase	Total Miles - 2019				Total Miles - 2020			
	Haul Trucks	**Dump Truck**	**Water Trucks**	**On-Road Pickup**	**Haul Trucks**	**Dump Truck**	**Water Trucks**	**On-Road Pickup**
Move-on	3	5	45	45	0	0	0	0
Substation	5	15	183	292	1	4	53	84
Gen-Tie	7	15	183	292	6	13	158	252
Site Prep and Grading	0	0	1,825	365	0	0	1,575	315
Underground/Trench	0	0	520	0	0	0	960	0
System Installation	0	0	190	190	0	0	1,270	1,270
Cleanup/Testing/Commissioning	0	0	0	0	0	0	330	396
Total	**15**	**35**	**2,945**	**1,184**	**8**	**17**	**4,345**	**2,317**

Onsite Emissions

		2019				2020			
Tire Wear	PM_{10}	0	0	35	9	0	0	52	19
	$PM_{2.5}$	0	0	9	2	0	0	13	5
Break Wear	PM_{10}	2	5	384	44	1	2	566	85
	$PM_{2.5}$	1	2	165	19	0	1	243	36
Unpaved Travel	PM_{10}	1,793	4,072	346,585	94,464	896	1,977	511,346	184,858
	$PM_{2.5}$	271	615	52,329	16,692	135	299	77,205	32,664

AQIA Emission Estimate Assumptions

Dust From Material Movement

Acres Graded		Grader Passes	Trenching (CY)	Work Days		
Phase	Graded			2019	2020	Total
Move-on (Laydown, construction trailers, a	10	10	0	0	19	19
Substation Construction	1.5	10	0	0	77	77
Gen-tie Line Installation	0	0	0	0	232	232
Site Preparation and Grading	0	25	0	0	94	94
Underground work (Trenching)	5	0	7363	0	77	77
System Installation	0	0	0	0	130	130
Cleanup/Testing/Restoration	0	0	0	0	172	172

Grading Equipment Passes

AP-42, 11.9

EF_{PM10} = 1.542546 lb/VMT
$EF_{PM2.5}$ = 0.16655879 lb/VMT

E = EF x VMT
VMT = As / Wb x 43,560 (sf/ac) / 5,280 (ft/mi)

Where:

E =		emissions (lb)
PM_{10} EF =	1.542546	emission factor (lb/VMT)
$PM_{2.5}$ EF =	0.16655879	emission factor (lb/VMT)
VMT =	664.125	vehicle miles traveled
As =	966	acreage of the grading site (acre)
Wb =	12	blade width of the grading equipment (CalEEMod default is 12 ft based on Caterpillar's 140 motor grader)

Pounds

Phase	VMT	2019		2020	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
EF (lb/VMT)		1.542546	0.16655879	1.542546	0.16655879
Move-on (Laydown, construction trailers, a	6.875	0	0	106.0500375	11.45091681
Substation Construction	1.03125	0	0	15.90750563	1.717637521
Gen-tie Line Installation	0	0	0	0	0
Site Preparation and Grading	0	0	0	0	0
Underground work (Trenching)	3.4375	0	0	0	0
System Installation	0	0	0	0	0
Cleanup/Testing/Restoration	0	0	0	0	0
Total	--	**0**	**0**	**121.9575431**	**13.16855433**

2019		2020	
PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
0	0	0.053025019	0.005725458
0	0	0.007953753	0.000858819
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	**0**	**0.060978772**	**0.006584277**

Trenching

AP-42, 13.2

EF = emission factor (lb/ton)
EF = K*(0.0032)*((U/5)^1.3)/((M/2)^1.4)

K_{PM10} =	0.35	PM_{10} particle size multiplier (AP-42 default)
$K_{PM2.5}$ =	0.053	$PM_{2.5}$ particle size multiplier (AP-42 default)
U =	2.2	mean wind speed (meters/second) (CalEEMod default is 7.1 mph [2.2 m/s])
M =	12	material moisture content (%) (The moisture contents of different materials are listed in AP-42 Table 13.2.4-1. CalEEMod uses the moisture content of cover

EF_{PM10} = 3.13541E-05
$EF_{PM2.5}$ = 4.74791E-06

Pounds per Day

Phase	Tons	2019		2020	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
EF (lb/ton)		3.13541E-05	4.74791E-06	3.13541E-05	4.74791E-06
Move-on (Laydown, construction trailers, a	0	0	0	0	0
Substation Construction	0	0	0	0	0
Gen-tie Line Installation	0	0	0	0	0
Site Preparation and Grading	0	0	0	0	0
Underground work (Trenching)	9308.0557	0	0	0.003790208	0.000573946
System Installation	0	0	0	0	0
Cleanup/Testing/Restoration	0	0	0	0	0
Total	**9308.0557**	**0**	**0**	**0.003790208**	**0.000573946**

2019		2020	
PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$

AQIA Emission Estimate Assumptions

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	1.8951E-06	2.86973E-07
0	0	0	0
0	0	0	0
0	**0**	**1.8951E-06**	**2.86973E-07**

Notes:
Assumes 1.2641662 tons per CY based on a bulk density of 1.5 grams/cubic centimeter (per CalEEMod).

E = EF x TP
EF = emissions factor (lb/ton)
TP = throughput of loaded and unloaded materials (ton)

Grading+Trenching

Pounds

	PM_{10}	**$PM_{2.5}$**
2018	0	0
2019	0	0
2020	121.9613333	13.1691283
2021	0	0
2022	0	0

Tons

PM_{10}	**$PM_{2.5}$**
0	0
0	0
0.060980667	0.006584564
0	0
0	0

AQIA Emission Estimate Assumptions

Project Summary By Year

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	*PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2019	0.98	4.90	8.26	0.83	0.41	806.23	0.14	809.70	0.09
2020	1.61	7.97	11.96	1.32	0.62	1,224.44	0.22	1,229.99	0.13
Totals	2.59	12.87	20.22	2.15	1.03	2,030.67	0.36	2,039.69	0.22
SJVAPCD Thresholds	10	100	10	15	15				
Exceeded?	No	No	Yes	No	No				

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2019									
Const. Equip	0.98	4.90	8.25	0.33	0.33	806.22	0.14	809.69	0.09
Const. Mobile Offsite									
Const. Mobile Onsite	0.001	0.005	0.013	0.0003	0.00	0.010	0.000	0.010	0.0000
Const. BWTW- Road Dust				0.4932	0.0771				
Const. Fugitive Dust				0.0000000	0.0000000				
Total	0.98	4.90	8.26	0.83	0.41	806.23	0.14	809.70	0.09

Year	ROG Tons/Yr	CO Tons/Yr	NOx Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	CO2 MT/Yr	CH4 MT/Yr	CO2e MT/Yr	SOx Tons/yr
2020									
Const. Equip	1.61	7.96	11.94	0.49	0.49	1,219.15	0.22	1,224.70	0.13
Const. Mobile Offsite									
Const. Mobile Onsite	0.001	0.009	0.020	0.0005	0.00	5.290	0.000	5.290	0.0001
Const. BWTW- Road Dust				0.7714	0.1219				
Const. Fugitive Dust				0.0609807	0.0065846				
Total	1.61	7.97	11.96	1.32	0.62	1,224.44	0.22	1,229.99	0.13

AQIA Emission Estimate Assumptions

Paved Road Dust Calculations (EPA AP-42 13.2.1, equation 2)

E = (k*(sL)^0.91*(W)^1.02)*(1-P/4N)

	PM_{10}	$PM_{2.5}$	
E =			emission factor
k =	0.0022	0.00054	particle size multiplier (lb/vmt)
sL =	0.03	0.03	surface silt loading
W HHD =	16	16	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W Vendor =	7	7	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W worker =	2.7	2.7	average vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
P =	40	40	Number of days per year with >0.01 inches of rain (Source: WRCC data for Handford, wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3747)
N =	365	365	Days per period

	lb/vmt		g/vmt	
	Emission Factor	Emissions Factor	PM_{10} Emission Factor	Emissions Factor
Vehicle Type				
HHD	0.00149	0.00037	0.675159935	0.165721075
Vendor	0.00064	0.00016	0.290538896	0.071314093
Worker	0.00024	0.00006	0.109950022	0.026987733

Unpaved Road Calculations (EPA AP-42 13.2.2, equation 1a)

$E = k\,(s/12)^a (W/3)^b$

1 lb/VMT = 281.9 g/VKT

E=		size specific emission factor (lb/VMT)
s=	8.5	surface material silt content (%) (AP-42 mean value for construction sites, Table 13.2.2-1)
W HHD =	16	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W Vendor =	7	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
W worker =	2.7	mean vehicle weight (tons) (based on EMFAC2014 User's Guide Appendix 4: Vehicle Categories)
M=	12	surface material misture content (%) (The moisture contents of different materials arelisted in AP-42 Table 13.2.4-1. CalEEMod uses the moisture content of cover(12%) as default.
S=	15	mean vehicle speed (mph)
K (PM10)=	1.5	lb/vmt, AP-42 Table 13.2.2-2
K (PM2.5)=	0.15	lb/vmt, AP-42 Table 13.2.2-2
a =	0.9	constant from AP-42 Table 13.2.2-2
b =	0.45	constant from AP-42 Table 13.2.2-2

	lb/vmt		g/vmt	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
HHD	2.335901891	0.233590189	1059.547345	105.9547345
Vendor	1.610255251	0.161025525	730.3995441	73.03995441
Worker	1.048852216	0.185329798	475.7513938	84.06418765

	lb/vmt		g/vmt	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
HHD	0.391730747	0.039173075	177.6860898	17.76860898
Vendor	0.270039806	0.027003981	122.4880035	12.24880035
Worker	0.175892517	0.031079807	79.78350874	14.09756427

Notes: Watering 3 times daily and 15 mph speed limit in accordance with SJVAPCD Rule 8021.
15 mph speed limit results in a 57% reduction, WRAP Fugitive Dust Handbook, 2006.
3 times daily watering results in 61% reduction, WRAP Fugitive Dust Handbook, 2006.

Ambient Air Quality Analysis - Little Bear Solar Project

Table 1. Max Emission Rates (lbs/day) for Project						
Max Rates	ROG	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$
Offroad Equipment	20.43	104.55	101.37	1.75	10.77	8.09
Fugitive Dust						
Total OnSite, lbs/day	20.43	104.55	101.37	1.75	10.77	8.09
Daily Max, g/s	0.32	1.65	1.60	0.03	0.17	0.13
Hourly Max lbs/hr	2.55	13.07	12.67	0.22	1.35	1.01

Note: Conversion assumes 8 hr workday

Table 2. AERMOD Maximum Impact X/Q, $(ug/m^3)/(g/s)$				
Max 1-Hour	Max 3-Hour	Max 8-Hour	Max 24-Hour	Max Annual
411.53	219.92	104.53	35.68	1.49

Note: These concentrations are based on the AERMOD Results Summary Report

Table 3. Project Contribution Concentrations (ug/m3)						
Pollutant	CAS No.	Hr. Max (g/s) (from Table 1)	X/Q (ug/m3)/(g/s) (from Table 2)	NO_X to NO_2 Conversion	Project Concentration (ug/m3)	Scaled Rate (lbs/hr)
1-hour CO	630080	1.60	411.53	–	657.03	12.671
8-hour CO	630080	1.60	104.53	–	166.89	11.404
1-hour NO_2	10102440	1.65	411.53	80%	542.11	13.069
Annual NO_2	10102440	1.65	1.49	100%	2.45	1.307
24-hour PM_{10}	85101	0.17	35.68	–	6.05	0.808
Annual PM_{10}	85101	0.17	1.49	–	0.25	0.135
24-hour $PM_{2.5}$	88101	0.13	35.68	–	4.55	0.607
Annual $PM_{2.5}$	88101	0.13	1.49	–	0.19	0.101
1-hour SO_2	7449095	0.03	411.53	–	11.34	0.219
24-hour SO_2	7449095	0.03	35.68	–	0.98	0.131
Annual SO_2	7449095	0.03	1.49	–	0.04	0.022

Table 4. Level 1 AAQA for Little Bear Solar Project

Impact Parameter	Applicable Standard	Project Area Maximum Background Concentration (Years 2014-2016)		Project Contribution (ug/m3)	Cumulative Concentration (ug/m3)	AAQS Threshold (ug/m3)	Step 1 Significance	SIL (ug/m3)	Step 2 Significance
		ppmv	ug/m^3						
1-hour CO	State	3.5	4,010	657.03	4,667	22,900	PASS	2000	Step 1
	Federal	3.5	4,010	657.03	4,667	40,100	PASS	2000	Step 1
8-hour CO	State	2.5	2,864	166.89	3,031	10,300	PASS	500	Step 1
	Federal	2.5	2,864	166.89	3,031	10,300	PASS	500	Step 1
1-hour NO_2	State	0.053	100	542.11	642	339	Step 2	7.5	FAIL
	Federal	0.053	100	542.11	642	188	Step 2	7.5	FAIL
Annual NO_2	State	0.012	23	2.45	25	57	PASS	1	Step 1
	Federal	0.012	23	2.45	25	100	PASS	1	Step 1
1-hour SO_2	State	0.011	28	11.34	40	655	PASS	7.5	Step 1
	Federal	0.011	28	11.34	40	196	PASS	7.8	Step 1
24-Hour SO_2	State	0.003	7	0.98	8	105	PASS	5	Step 1
	Federal	0.003	7	0.98	8	367	PASS	5	Step 1
Annual SO_2	Federal	0.001	1	0.04	1	79	PASS	1	Step 1
24-hour PM_{10}	State	--	121	6.05	127	50	Step 2	5	FAIL
	Federal	--	117	6.05	123	150	PASS	5	Step 1
Annual PM_{10}	State	--	42	0.25	42	20	Step 2	1	PASS
24-hour $PM_{2.5}$	Federal	--	51	4.55	55	35	Step 2	5	PASS
Annual $PM_{2.5}$	State	--	10	0.19	10	12	PASS	1	Step 1
	Federal*	--	10	0.19	10	12	PASS	1	Step 1

Sources:

CARB. 2016. "Ambient Air Quality Standards." May 4, 2016. Accessed August 2017. http://www.arb.ca.gov/research/aaqs/aaqs2.pdf.

CARB. 2017. "iADAM: Air Quality Data Statistics." Accessed August 2017. http://www.arb.ca.gov/adam/topfour/topfour1.php.

SJVAPCD. 2014. APR 1925 (Policy for District Rule 2201 AAQA Modeling). April 2014.

Notes:

Annual PM2.5 federal monitoring data not available, therefore used state monitoring data. State SO2 data not available so federal data used

Table 5. Level 2 AAQA for Little Bear Solar Project

Impact Parameter	Applicable Standard	Project Area Background Concentration		Project Contribution (ug/m3)	Cumulative Concentration (ug/m3)	AAQS Threshold (ug/m3)	Step 1 Significance	SIL (ug/m3)	Step 2 Significance
		ppmv	ug/m^3						
1-hour NO_2	State	0.046	86	85.92	172	339	PASS	7.5	Step 1
	Federal	0.046	86	85.92	172	188	PASS	7.5	Step 1
24-hour PM_{10}	State	--	121	3.13	124	50	Step 2	5	PASS

Notes:

The 1-hour NO_2 project background concentration is based on the 3yr average of the 98th percentile of the Fresno-Sierra Skypark #2 monitoring station as provided by the SJVAPCD document title Procedure for Determining NO_2 Monitor Background Values (Design Values) for Use in Calculating NAAQS Compliance

ATTACHMENT B

Ambient Air Quality Standards and Significant Impact Levels

Appendix B

Table B-1
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2014	2015	2015
Ozone (O_3) Tranquility, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.09 ppm (state)	0.086	0.88	0.093
Number of days exceeding state standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	0.070 ppm (state)	0.078	0.081	0.082
	0.070 ppm (federal)	0.096	0.105	0.081
Number of days exceeding state standard (days)		*11*	*11*	*21*
Number of days exceeding federal standard (days)		*10*	*10*	*19*
Nitrogen Dioxide (NO_2) Fresno- Sierra Skypark #2, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.18 ppm (state)	0.053	0.036	0.035
	0.100 ppm (federal)	0.053	0.036	0.034
Number of days exceeding state standard (days)		*0*	*0*	*0*
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Annual concentration (ppm)	0.030 ppm (state)	0.008	*	0.006
	0.053 ppm (federal)	0.008	0.007	0.006
Carbon Monoxide (CO) Drummond Street, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	20 ppm (state)	—	—	—
	35 ppm (federal)	3.5	2.3	0.8
Number of days exceeding state standard (days)		*0*	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	9.0 ppm (state)	—	—	—
	9 ppm (federal)	2.5	1.8	0.4
Number of days exceeding state standard (days)		*0*	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Sulfur Dioxide (SO_2) Fresno-First Street, California Monitoring Station[c]				
Maximum 1-hour concentration (ppm)	0.075 ppm (federal)	0.0067	0.0108	0.008
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Maximum 24-hour concentration (ppm)	0.14 ppm (federal)	0.027	0.024	0.020
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Annual concentration (ppm)	0.030 ppm (federal)	0.0049	0.0051	0.0046
Coarse Particulate Matter (PM_{10}) Fresno-Drummond Street, California Monitoring Station[c]				
Maximum 24-hour concentration ($\mu g/m^3$)	50 $\mu g/m^3$ (state)	102.9	120.7	88.3
	150 $\mu g/m^3$ (federal)	107.3	116.7	86.3
Number of days exceeding state standard (days)[b]		*16*	*13*	*17*
Number of days exceeding federal standard (days)[b]		*0*	*0*	*0*
Annual concentration (state method) ($\mu g/m^3$)	20 $\mu g/m^3$ (state)	41.8	39.4	38.0
Fine Particulate Matter ($PM_{2.5}$) Tranquility, California Monitoring Station[c]				
Maximum 24-hour concentration ($\mu g/m^3$)	35 $\mu g/m^3$ (federal)	46.0	50.9	39.7
Number of days exceeding federal standard (days)[b]		*3*	*7*	*3*
	12 $\mu g/m^3$ (state)	—	10.0	7.8

Table B-1
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2014	2015	2015
Annual concentration (μg/m^3)	12.0 μg/m^3 (federal)	7	—	—

Sources: CARB 2016d; EPA 2016c.

Notes: — = not available; μg/m3 = micrograms per cubic meter; ND = insufficient data available to determine the value; ppm = parts per million Data taken from CARB iADAM (http://www.arb.ca.gov/adam) and EPA AirData (http://www.epa.gov/airdata/) represent the highest concentrations experienced over a given year.

Exceedances of federal and state standards are only shown for O_3, particulate matter, and Carbon Monoxide. Daily exceedances for particulate matter are estimated days because PM_{10} and $PM_{2.5}$ are not monitored daily. All other criteria pollutants did not exceed federal or state standards during the years shown. There is no federal standard for 1-hour O_3, annual PM_{10}, or 24-hour SO_2, nor is there a state 24-hour standard for $PM_{2.5}$.

[a] Mean does not satisfy minimum data completeness criteria.

[b] Measurements of PM_{10} and $PM_{2.5}$ are usually collected every 6 days and every 1 to 3 days, respectively. Number of days exceeding the standards is a mathematical estimate of the number of days concentrations would have been greater than the level of the standard had each day been monitored. The numbers in parentheses are the measured number of samples that exceeded the standard.

Table B-2
SJVAPCD Significant Impact Levels

Pollutant	Averaging Period	SILs (μg/m^3)		
		Class I	Class II*	Class III
$PM_{2.5}$	24-hour	**	**	**
	Annual	**	**	**
Fugitive $PM_{2.5}$	24-hour	-	**	-
	Annual	-	**	-
PM_{10}	24-hour	0.2	5	-
	Annual	0.32	1	-
Fugitive PM_{10}	24-hour	-	10.4	-
	Annual	-	2.08	-
CO	1-hour	-	2,000	-
	8-hour	-	500	-
NO_2	1-hour	-	7.5	-
	Annual	0.1	1	-
SO_2	1-hour	-	7.8	-
	3-hour	1	25	-
	24-hour	0.2	5	-
	Annual	0.08	1	-

Source: SJVAPCD APR 1925

Notes: * Only Class II SILs applicable for District use.

** $PM_{2.5}$ SILs vacated by court order, use PM_{10} SILs as surrogate $PM_{2.5}$ SILs.

ATTACHMENT C

AERMOD Input and HARP 2 Output Files

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** MODEL SETUP OPTIONS SUMMARY ***

- -

**Model Is Setup For Calculation of Average CONCentration Values.

-- DEPOSITION LOGIC --
**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION. DRYDPLT = F
**Model Uses NO WET DEPLETION. WETDPLT = F

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:
1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay.

**Other Options Specified:
CCVR_Sub - Meteorological data includes CCVR substitutions
TEMP_Sub - Meteorological data includes TEMP substitutions

**Model Assumes No FLAGPOLE Receptor Heights.

**The User Specified a Pollutant Type of: CO

**Model Calculates 1 Short Term Average(s) of: 1-HR
and Calculates PERIOD Averages

**This Run Includes: 1 Source(s);   1 Source Group(s); and 3589 Receptor(s)

```
                with:      0 POINT(s), including
                           0 POINTCAP(s) and      0 POINTHOR(s)
                 and:      0 VOLUME source(s)
                 and:      1 AREA type source(s)
                 and:      0 LINE source(s)
                 and:      0 OPENPIT source(s)
                 and:      0 BUOYANT LINE source(s) with      0 line(s)
```

**Model Set To Continue RUNning After the Setup Testing.

```
 **The AERMET Input Meteorological Data Version Date:  16216

 **Output Options Selected:
          Model Outputs Tables of PERIOD Averages by Receptor
          Model Outputs Tables of Highest Short Term Values by Receptor
(RECTABLE Keyword)
          Model Outputs External File(s) of High Values for Plotting
(PLOTFILE Keyword)
          Model Outputs Separate Summary File of High Ranked Values
(SUMMFILE Keyword)

 **NOTE:  The Following Flags May Appear Following CONC Values:  c for
Calm Hours
                                                                 m for
Missing Hours
                                                                 b for
Both Calm and Missing Hours

 **Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    45.00 ;
Decay Coef. =    0.000     ;  Rot. Angle =     0.0
                  Emission Units = GRAMS/SEC
;  Emission Rate Unit Factor =   0.10000E+07
                  Output Units   = MICROGRAMS/M**3

 **Approximate Storage Requirements of Model =      3.9 MB of RAM.

 **Detailed Error/Message File:   Little Bear Solar.err
 **File for Summary of Results:   Little Bear Solar.sum
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

```
 *** AERMOD - VERSION 16216r ***   *** C:\Lakes\AERMOD View\Little Bear
Solar\Little Bear Solar.isc         ***        12/13/17
 *** AERMET - VERSION  16216 ***   ***
***        09:51:44

PAGE   3
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                    *** UP TO THE FIRST 24 HOURS OF
METEOROLOGICAL DATA ***

   Surface file:   Met Data\Mendota_07-11.SFC
Met Version:  16216
   Profile file:   Met Data\Mendota_07-11.PFL
   Surface format: FREE
   Profile format: FREE
   Surface station no.:    99005                 Upper air station no.:
66666
                  Name: UNKNOWN                                   Name:
UNKNOWN
                  Year:   2007                                    Year:
2007

 First 24 hours of scalar data
 YR MO DY JDY HR     H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0
BOWEN ALBEDO  REF WS   WD     HT  REF TA     HT
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - - - - - -
 07 01 01   1 01  -47.5  0.433 -9.000 -9.000 -999.  684.    155.4  0.22
0.67   1.00    5.10  291.   15.0  279.2    2.0
 07 01 01   1 02  -47.5  0.433 -9.000 -9.000 -999.  684.    155.2  0.22
0.67   1.00    5.10  288.   15.0  278.9    2.0
 07 01 01   1 03  -47.5  0.433 -9.000 -9.000 -999.  684.    155.1  0.22
0.67   1.00    5.10  294.   15.0  278.8    2.0
 07 01 01   1 04  -47.6  0.433 -9.000 -9.000 -999.  684.    154.9  0.22
0.67   1.00    5.10  293.   15.0  278.5    2.0
 07 01 01   1 05  -42.5  0.377 -9.000 -9.000 -999.  557.    114.2  0.22
0.67   1.00    4.60  293.   15.0  278.2    2.0
 07 01 01   1 06  -42.5  0.377 -9.000 -9.000 -999.  555.    114.1  0.22
0.67   1.00    4.60  292.   15.0  278.1    2.0
 07 01 01   1 07  -42.5  0.377 -9.000 -9.000 -999.  555.    114.1  0.22
0.67   1.00    4.60  295.   15.0  278.0    2.0
 07 01 01   1 08  -41.4  0.379 -9.000 -9.000 -999.  560.    119.4  0.22
0.67   0.67    4.60  293.   15.0  277.9    2.0
 07 01 01   1 09    7.9  0.437  0.218  0.008   47.  693.   -963.2  0.13
0.67   0.37    5.10  307.   15.0  279.5    2.0
 07 01 01   1 10   46.2  0.503  0.622  0.007  189.  854.   -249.5  0.13
0.67   0.26    5.70  321.   15.0  281.8    2.0
 07 01 01   1 11   74.5  0.511  0.922  0.007  381.  877.   -162.5  0.13
0.67   0.22    5.70  324.   15.0  283.5    2.0
 07 01 01   1 12   89.8  0.515  1.034  0.007  447.  887.   -138.0  0.13
0.67   0.21    5.70  316.   15.0  285.0    2.0
 07 01 01   1 13   91.2  0.434  1.080  0.008  501.  693.    -81.4  0.09
0.67   0.21    5.10  333.   15.0  286.2    2.0
```

```
 07 01 01   1 14   78.7  0.465  1.057  0.008  543.  761.   -115.8  0.13
0.67   0.22    5.10  329.   15.0  287.1    2.0
 07 01 01   1 15   52.9  0.418  0.940  0.009  570.  650.   -125.0  0.13
0.67   0.25    4.60  312.   15.0  287.4    2.0
 07 01 01   1 16   15.9  0.401  0.632  0.009  577.  609.   -367.5  0.22
0.67   0.34    4.10  284.   15.0  286.6    2.0
 07 01 01   1 17  -41.9  0.440 -9.000 -9.000 -999.  700.    184.1  0.22
0.67   0.60    5.10  271.   15.0  285.0    2.0
 07 01 01   1 18  -47.8  0.433 -9.000 -9.000 -999.  683.    153.1  0.22
0.67   1.00    5.10  277.   15.0  283.1    2.0
 07 01 01   1 19  -48.0  0.432 -9.000 -9.000 -999.  682.    152.5  0.22
0.67   1.00    5.10  284.   15.0  282.2    2.0
 07 01 01   1 20  -48.0  0.432 -9.000 -9.000 -999.  682.    152.1  0.22
0.67   1.00    5.10  287.   15.0  281.8    2.0
 07 01 01   1 21  -48.1  0.432 -9.000 -9.000 -999.  682.    151.8  0.22
0.67   1.00    5.10  290.   15.0  281.2    2.0
 07 01 01   1 22  -48.2  0.432 -9.000 -9.000 -999.  682.    151.5  0.22
0.67   1.00    5.10  292.   15.0  280.8    2.0
 07 01 01   1 23  -42.2  0.377 -9.000 -9.000 -999.  559.    115.5  0.22
0.67   1.00    4.60  290.   15.0  280.5    2.0
 07 01 01   1 24  -42.2  0.377 -9.000 -9.000 -999.  556.    115.2  0.22
0.67   1.00    4.60  290.   15.0  280.1    2.0


 First hour of profile data
 YR MO DY HR HEIGHT F  WDIR    WSPD AMB_TMP sigmaA  sigmaW  sigmaV
 07 01 01 01   15.0 1  291.    5.10   279.3   99.0  -99.00  -99.00

 F indicates top of profile (=1) or below (=0)
```

```
 *** AERMOD - VERSION 16216r ***   *** C:\Lakes\AERMOD View\Little Bear
Solar\Little Bear Solar.isc         ***        12/13/17
 *** AERMET - VERSION  16216 ***   ***
***        09:51:44

PAGE   4
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                             *** THE SUMMARY OF MAXIMUM PERIOD
( 43824 HRS) RESULTS ***


                                         ** CONC OF CO       IN
MICROGRAMS/M**3                              **


NETWORK
GROUP ID                        AVERAGE CONC                RECEPTOR  (XR,
YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - - - - - -

ALL       1ST HIGHEST VALUE IS       1.61225 AT (  733360.08,
4065757.53,    55.02,    55.02,    0.00)  DC
          2ND HIGHEST VALUE IS       1.61191 AT (  733359.71,
4065782.17,    54.93,    54.93,    0.00)  DC
          3RD HIGHEST VALUE IS       1.61109 AT (  733359.35,
4065806.80,    54.86,    54.86,    0.00)  DC
          4TH HIGHEST VALUE IS       1.61072 AT (  733360.44,
4065732.89,    55.01,    55.01,    0.00)  DC
          5TH HIGHEST VALUE IS       1.61071 AT (  733358.98,
4065831.44,    54.86,    54.86,    0.00)  DC
          6TH HIGHEST VALUE IS       1.60948 AT (  733358.62,
4065856.07,    54.86,    54.86,    0.00)  DC
          7TH HIGHEST VALUE IS       1.60863 AT (  733360.81,
4065708.26,    55.01,    55.01,    0.00)  DC
          8TH HIGHEST VALUE IS       1.60799 AT (  733358.25,
4065880.71,    54.86,    54.86,    0.00)  DC
          9TH HIGHEST VALUE IS       1.60704 AT (  733361.17,
4065683.62,    55.12,    55.12,    0.00)  DC
         10TH HIGHEST VALUE IS       1.60590 AT (  733357.89,
4065905.34,    54.86,    54.86,    0.00)  DC


 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```

```
 *** AERMOD - VERSION 16216r ***   *** C:\Lakes\AERMOD View\Little Bear
Solar\Little Bear Solar.isc         ***        12/13/17
 *** AERMET - VERSION  16216 ***   ***
***        09:51:44

PAGE   5
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                                *** THE SUMMARY OF
HIGHEST  1-HR RESULTS ***


                                    ** CONC OF CO       IN
MICROGRAMS/M**3                          **

                                                      DATE
NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)
RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     187.58548  ON 08022208: AT (
729999.34,  4065331.49,    64.62,    64.62,    0.00)  DC


 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** Message Summary : AERMOD Model Execution ***

--------- Summary of Total Messages --------

A Total of   0 Fatal Error Message(s)
A Total of   0 Warning Message(s)
A Total of   3492 Informational Message(s)

A Total of   43824 Hours Were Processed

A Total of   3492 Calm Hours Identified

A Total of   0 Missing Hours Identified (0.00 Percent)

******** FATAL ERROR MESSAGES ********
*** NONE ***

********   WARNING MESSAGES   ********
*** NONE ***

HARP2 - HRACalc (dated 17023) 12/21/2017 9:03:46 AM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
****
RISK SCENARIO SETTINGS

Receptor Type: Resident
Scenario: All
Calculation Method: Derived

****
EXPOSURE DURATION PARAMETERS FOR CANCER

Start Age: -0.25
Total Exposure Duration: 1

Exposure Duration Bin Distribution
3rd Trimester Bin: 0.25
0<2 Years Bin: 1
2<9 Years Bin: 0
2<16 Years Bin: 0
16<30 Years Bin: 0
16 to 70 Years Bin: 0

****
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments. The remaining pathways are only used for cancer and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: True
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

****
INHALATION

Daily breathing rate: LongTerm24HR

Worker Adjustment Factors
Worker adjustment factors enabled: NO

Fraction at time at home
3rd Trimester to 16 years: OFF
16 years to 70 years: ON

****
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.05
Soil mixing depth (m): 0.01
Dermal climate: Mixed

****
TIER 2 SETTINGS

Tier2 adjustments were used in this assessment. Please see the input file for details.
Tier2 - What was changed: ED or start age changed|
Calculating cancer risk
Cancer risk breakdown by pollutant and receptor saved to:
C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5CancerRisk.csv
Cancer risk total by receptor saved to:
C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5CancerRiskSumByRec.csv
Calculating chronic risk
Chronic risk breakdown by pollutant and receptor saved to:
C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5NCChronicRisk.csv
Chronic risk total by receptor saved to:
C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5NCChronicRiskSumByRec.csv
Calculating acute risk
Acute risk breakdown by pollutant and receptor saved to:
C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5NCAcuteRisk.csv
Acute risk total by receptor saved to: C:\Users\apoll\Desktop\HARP2\LB\LB NEW\hra\CONST-5NCAcuteRiskSumByRec.csv
HRA ran successfully

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** MODEL SETUP OPTIONS SUMMARY ***

- -

**Model Is Setup For Calculation of Average CONCentration Values.

-- DEPOSITION LOGIC --
**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION. DRYDPLT = F
**Model Uses NO WET DEPLETION. WETDPLT = F

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:
1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay.

**Other Options Specified:
CCVR_Sub - Meteorological data includes CCVR substitutions
TEMP_Sub - Meteorological data includes TEMP substitutions

**Model Assumes No FLAGPOLE Receptor Heights.

**The User Specified a Pollutant Type of: AQIA_ALL

**Model Calculates 4 Short Term Average(s) of: 1-HR   3-HR   8-HR   24-HR
and Calculates PERIOD Averages

**This Run Includes: 1 Source(s);   1 Source Group(s); and   7553 Receptor(s)

with: 0 POINT(s), including
0 POINTCAP(s) and   0 POINTHOR(s)
and: 0 VOLUME source(s)
and: 1 AREA type source(s)
and: 0 LINE source(s)
and: 0 OPENPIT source(s)
and: 0 BUOYANT LINE source(s) with   0 line(s)

```
 **Model Set To Continue RUNning After the Setup Testing.

 **The AERMET Input Meteorological Data Version Date:  16216

 **Output Options Selected:
          Model Outputs Tables of PERIOD Averages by Receptor
          Model Outputs Tables of Highest Short Term Values by Receptor
(RECTABLE Keyword)
          Model Outputs External File(s) of High Values for Plotting
(PLOTFILE Keyword)
          Model Outputs Separate Summary File of High Ranked Values
(SUMMFILE Keyword)

 **NOTE:  The Following Flags May Appear Following CONC Values:  c for
Calm Hours
                                                                 m for
Missing Hours
                                                                 b for
Both Calm and Missing Hours

 **Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    48.16 ;
Decay Coef. =    0.000     ;  Rot. Angle =     0.0
                  Emission Units = GRAMS/SEC
;  Emission Rate Unit Factor =   0.10000E+07
                  Output Units   = MICROGRAMS/M**3

 **Approximate Storage Requirements of Model =      7.7 MB of RAM.

 **Detailed Error/Message File:   061317_LBear_AQIA.err
 **File for Summary of Results:   061317_LBear_AQIA.sum
```

```
 *** AERMOD - VERSION 16216r ***   *** C:\Lakes\AERMOD
View\061317_LBear_AQIA\061317_LBear_AQIA.isc         ***        12/21/17
 *** AERMET - VERSION  16216 ***   ***
***        16:32:36

PAGE   2
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                            *** METEOROLOGICAL DAYS
SELECTED FOR PROCESSING ***
                                                               (1=YES;
0=NO)

            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1
1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1

                NOTE:  METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO
DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.



                                  *** UPPER BOUND OF FIRST THROUGH FIFTH
WIND SPEED CATEGORIES ***
                                                            (METERS/SEC)

                                                   1.54,   3.09,   5.14,
8.23,  10.80,
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** UP TO THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

Surface file: Met Data\Mendota_07-11.SFC
Met Version: 16216
Profile file: Met Data\Mendota_07-11.PFL
Surface format: FREE
Profile format: FREE
Surface station no.: 99005 Upper air station no.: 66666
Name: UNKNOWN Name: UNKNOWN
Year: 2007 Year: 2007

First 24 hours of scalar data

YR	MO	DY	JDY	HR	H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS	WD	HT	REF TA	HT
07	01	01	1	01	-47.5	0.433	-9.000	-9.000	-999.	684.	155.4	0.22	0.67	1.00	5.10	291.	15.0	279.2	2.0
07	01	01	1	02	-47.5	0.433	-9.000	-9.000	-999.	684.	155.2	0.22	0.67	1.00	5.10	288.	15.0	278.9	2.0
07	01	01	1	03	-47.5	0.433	-9.000	-9.000	-999.	684.	155.1	0.22	0.67	1.00	5.10	294.	15.0	278.8	2.0
07	01	01	1	04	-47.6	0.433	-9.000	-9.000	-999.	684.	154.9	0.22	0.67	1.00	5.10	293.	15.0	278.5	2.0
07	01	01	1	05	-42.5	0.377	-9.000	-9.000	-999.	557.	114.2	0.22	0.67	1.00	4.60	293.	15.0	278.2	2.0
07	01	01	1	06	-42.5	0.377	-9.000	-9.000	-999.	555.	114.1	0.22	0.67	1.00	4.60	292.	15.0	278.1	2.0
07	01	01	1	07	-42.5	0.377	-9.000	-9.000	-999.	555.	114.1	0.22	0.67	1.00	4.60	295.	15.0	278.0	2.0
07	01	01	1	08	-41.4	0.379	-9.000	-9.000	-999.	560.	119.4	0.22	0.67	0.67	4.60	293.	15.0	277.9	2.0
07	01	01	1	09	7.9	0.437	0.218	0.008	47.	693.	-963.2	0.13	0.67	0.37	5.10	307.	15.0	279.5	2.0
07	01	01	1	10	46.2	0.503	0.622	0.007	189.	854.	-249.5	0.13	0.67	0.26	5.70	321.	15.0	281.8	2.0
07	01	01	1	11	74.5	0.511	0.922	0.007	381.	877.	-162.5	0.13	0.67	0.22	5.70	324.	15.0	283.5	2.0
07	01	01	1	12	89.8	0.515	1.034	0.007	447.	887.	-138.0	0.13	0.67	0.21	5.70	316.	15.0	285.0	2.0
07	01	01	1	13	91.2	0.434	1.080	0.008	501.	693.	-81.4	0.09	0.67	0.21	5.10	333.	15.0	286.2	2.0

```
 07 01 01   1 14   78.7  0.465  1.057  0.008  543.  761.   -115.8  0.13
0.67   0.22    5.10  329.   15.0  287.1    2.0
 07 01 01   1 15   52.9  0.418  0.940  0.009  570.  650.   -125.0  0.13
0.67   0.25    4.60  312.   15.0  287.4    2.0
 07 01 01   1 16   15.9  0.401  0.632  0.009  577.  609.   -367.5  0.22
0.67   0.34    4.10  284.   15.0  286.6    2.0
 07 01 01   1 17  -41.9  0.440 -9.000 -9.000 -999.  700.    184.1  0.22
0.67   0.60    5.10  271.   15.0  285.0    2.0
 07 01 01   1 18  -47.8  0.433 -9.000 -9.000 -999.  683.    153.1  0.22
0.67   1.00    5.10  277.   15.0  283.1    2.0
 07 01 01   1 19  -48.0  0.432 -9.000 -9.000 -999.  682.    152.5  0.22
0.67   1.00    5.10  284.   15.0  282.2    2.0
 07 01 01   1 20  -48.0  0.432 -9.000 -9.000 -999.  682.    152.1  0.22
0.67   1.00    5.10  287.   15.0  281.8    2.0
 07 01 01   1 21  -48.1  0.432 -9.000 -9.000 -999.  682.    151.8  0.22
0.67   1.00    5.10  290.   15.0  281.2    2.0
 07 01 01   1 22  -48.2  0.432 -9.000 -9.000 -999.  682.    151.5  0.22
0.67   1.00    5.10  292.   15.0  280.8    2.0
 07 01 01   1 23  -42.2  0.377 -9.000 -9.000 -999.  559.    115.5  0.22
0.67   1.00    4.60  290.   15.0  280.5    2.0
 07 01 01   1 24  -42.2  0.377 -9.000 -9.000 -999.  556.    115.2  0.22
0.67   1.00    4.60  290.   15.0  280.1    2.0


 First hour of profile data
 YR MO DY HR HEIGHT F  WDIR    WSPD AMB_TMP sigmaA  sigmaW  sigmaV
 07 01 01 01   15.0 1  291.    5.10   279.3   99.0  -99.00  -99.00

 F indicates top of profile (=1) or below (=0)
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF MAXIMUM PERIOD (43824 HRS) RESULTS ***

** CONC OF AQIA_ALL IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	NETWORK RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG) OF TYPE	GRID-ID
ALL	1ST HIGHEST VALUE IS	1.48716	AT (732769.79, 4065374.43, 57.56, 57.56, 0.00) DC	
	2ND HIGHEST VALUE IS	1.48607	AT (732819.69, 4065375.88, 57.41, 57.41, 0.00) DC	
	3RD HIGHEST VALUE IS	1.48604	AT (732744.83, 4065373.71, 57.60, 57.60, 0.00) DC	
	4TH HIGHEST VALUE IS	1.48598	AT (732794.74, 4065375.16, 57.46, 57.46, 0.00) DC	
	5TH HIGHEST VALUE IS	1.48591	AT (732844.65, 4065376.61, 57.36, 57.36, 0.00) DC	
	6TH HIGHEST VALUE IS	1.48581	AT (732694.93, 4065372.25, 57.76, 57.76, 0.00) DC	
	7TH HIGHEST VALUE IS	1.48535	AT (732719.88, 4065372.98, 57.66, 57.66, 0.00) DC	
	8TH HIGHEST VALUE IS	1.48408	AT (732669.97, 4065371.53, 57.81, 57.81, 0.00) DC	
	9TH HIGHEST VALUE IS	1.48380	AT (732894.55, 4065378.06, 57.24, 57.24, 0.00) DC	
	10TH HIGHEST VALUE IS	1.48364	AT (732869.60, 4065377.33, 57.26, 57.26, 0.00) DC	

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF AQIA_ALL IN MICROGRAMS/M**3   **

```
                                                          DATE
NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)
RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     411.52896  ON 08022208: AT (
731572.02,  4065339.59,    61.06,    61.06,    0.00)  DC
         HIGH   8TH HIGH VALUE IS     286.64384  ON 10113007: AT (
731278.40,  4065130.97,    62.16,    62.16,    0.00)  DC
```

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF HIGHEST 3-HR RESULTS ***

** CONC OF AQIA_ALL IN MICROGRAMS/M**3   **

```
                                                   DATE
NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)
RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     219.91616  ON 07120409: AT ( 731003.91,  4065122.99,    63.04,    63.04,    0.00)  DC
```

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF HIGHEST 8-HR RESULTS ***

** CONC OF AQIA_ALL IN MICROGRAMS/M**3 **

```
                                                                  DATE                                    NETWORK
GROUP ID                                 AVERAGE CONC     (YYMMDDHH)
RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     104.53214c ON 10113008: AT ( 731549.98,  4065238.91,    61.26,    61.26,    0.00)  DC
```

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF AQIA_ALL IN MICROGRAMS/M**3 **

```
                                                           DATE                                 NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)
RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS      35.67818c ON 10113024: AT ( 731574.20,  4065264.63,    61.16,    61.16,    0.00)  DC
```

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** Message Summary : AERMOD Model Execution ***

--------- Summary of Total Messages --------

```
 A Total of            0 Fatal Error Message(s)
 A Total of            0 Warning Message(s)
 A Total of         3492 Informational Message(s)

 A Total of        43824 Hours Were Processed

 A Total of         3492 Calm Hours Identified

 A Total of            0 Missing Hours Identified (  0.00 Percent)
```

******** FATAL ERROR MESSAGES ********
*** NONE ***

********   WARNING MESSAGES   ********
*** NONE ***

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** MODEL SETUP OPTIONS SUMMARY ***

- -

**Model Is Setup For Calculation of Average CONCentration Values.

-- DEPOSITION LOGIC --
**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION. DRYDPLT = F
**Model Uses NO WET DEPLETION. WETDPLT = F

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:
1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay.
6. Ambient Ratio Method (ARM) Used for NO2 Conversion
with a 1-hour NO2/NOx Ratio of 0.800
with an Annual NO2/NOx Ratio of 0.750

**Other Options Specified:
CCVR_Sub - Meteorological data includes CCVR substitutions
TEMP_Sub - Meteorological data includes TEMP substitutions

**Model Assumes No FLAGPOLE Receptor Heights.

**The User Specified a Pollutant Type of: NO2

**Note that special processing requirements apply for the 1-hour NO2 NAAQS - check available guidance.
Model will process user-specified ranks of daily maximum 1-hour values averaged across the number of years modeled.
For annual NO2 NAAQS modeling, the multi-year maximum of PERIOD values can be simulated using the MULTYEAR keyword.
Multi-year PERIOD and 1-hour values should only be done in a single model run using the MULTYEAR option with a
single multi-year meteorological data file using STARTEND keyword.

**Model Calculates 1 Short Term Average(s) of: 1-HR
and Calculates ANNUAL Averages

```
 **This Run Includes:      1 Source(s);       1 Source Group(s); and
7553 Receptor(s)

                with:      0 POINT(s), including
                           0 POINTCAP(s) and      0 POINTHOR(s)
                 and:      0 VOLUME source(s)
                 and:      1 AREA type source(s)
                 and:      0 LINE source(s)
                 and:      0 OPENPIT source(s)
                 and:      0 BUOYANT LINE source(s) with      0 line(s)


 **Model Set To Continue RUNning After the Setup Testing.

 **The AERMET Input Meteorological Data Version Date:  16216

 **Output Options Selected:
          Model Outputs Tables of ANNUAL Averages by Receptor
          Model Outputs Tables of Highest Short Term Values by Receptor
(RECTABLE Keyword)
          Model Outputs External File(s) of Concurrent Values for
Postprocessing (POSTFILE Keyword)
          Model Outputs External File(s) of High Values for Plotting
(PLOTFILE Keyword)
          Model Outputs Separate Summary File of High Ranked Values
(SUMMFILE Keyword)
          Model Outputs External File(s) of Maximum Daily 1-hr Values by
Day (MAXDAILY Keyword)
          Model Outputs External File(s) of Maximum Daily 1-hr Values by
Year (MXDYBYYR Keyword)
          Model Outputs External File(s) of Contributions to Maximum
Daily Values Paired in Time & Space (MAXDCONT Keyword)

 **NOTE:  The Following Flags May Appear Following CONC Values:  c for
Calm Hours
                                                                 m for
Missing Hours
                                                                 b for
Both Calm and Missing Hours

 **Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    48.16 ;
Decay Coef. =    0.000     ;  Rot. Angle =     0.0
                  Emission Units = GRAMS/SEC
;  Emission Rate Unit Factor =   0.10000E+07
                  Output Units   = MICROGRAMS/M**3

 **Approximate Storage Requirements of Model =    218.9 MB of RAM.

 **Debug Options Selected:         ARMDEBUG

 **Detailed Error/Message File:   061317_LBear_AQIA.err
 **File for Summary of Results:   061317_LBear_AQIA.sum
```

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

```
 *** AERMOD - VERSION 16216r ***   *** C:\Lakes\AERMOD
View\061317_LBear_AQIA\061317_LBear_AQIA.isc         ***        12/27/17
 *** AERMET - VERSION  16216 ***   ***
***        09:20:43

PAGE   3
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  ARM  RURAL

                                    *** UP TO THE FIRST 24 HOURS OF
METEOROLOGICAL DATA ***

   Surface file:   Met Data\Mendota_07-11.SFC
Met Version:  16216
   Profile file:   Met Data\Mendota_07-11.PFL
   Surface format: FREE
   Profile format: FREE
   Surface station no.:    99005                  Upper air station no.:
66666
                  Name: UNKNOWN                                      Name:
UNKNOWN
                  Year:   2007                                       Year:
2007

 First 24 hours of scalar data
 YR MO DY JDY HR     H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0
BOWEN ALBEDO  REF WS   WD     HT  REF TA     HT
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - - - - - - -
 07 01 01   1 01  -47.5  0.433 -9.000 -9.000 -999.  684.    155.4  0.22
0.67   1.00    5.10  291.   15.0  279.2    2.0
 07 01 01   1 02  -47.5  0.433 -9.000 -9.000 -999.  684.    155.2  0.22
0.67   1.00    5.10  288.   15.0  278.9    2.0
 07 01 01   1 03  -47.5  0.433 -9.000 -9.000 -999.  684.    155.1  0.22
0.67   1.00    5.10  294.   15.0  278.8    2.0
 07 01 01   1 04  -47.6  0.433 -9.000 -9.000 -999.  684.    154.9  0.22
0.67   1.00    5.10  293.   15.0  278.5    2.0
 07 01 01   1 05  -42.5  0.377 -9.000 -9.000 -999.  557.    114.2  0.22
0.67   1.00    4.60  293.   15.0  278.2    2.0
 07 01 01   1 06  -42.5  0.377 -9.000 -9.000 -999.  555.    114.1  0.22
0.67   1.00    4.60  292.   15.0  278.1    2.0
 07 01 01   1 07  -42.5  0.377 -9.000 -9.000 -999.  555.    114.1  0.22
0.67   1.00    4.60  295.   15.0  278.0    2.0
 07 01 01   1 08  -41.4  0.379 -9.000 -9.000 -999.  560.    119.4  0.22
0.67   0.67    4.60  293.   15.0  277.9    2.0
 07 01 01   1 09    7.9  0.437  0.218  0.008   47.  693.   -963.2  0.13
0.67   0.37    5.10  307.   15.0  279.5    2.0
 07 01 01   1 10   46.2  0.503  0.622  0.007  189.  854.   -249.5  0.13
0.67   0.26    5.70  321.   15.0  281.8    2.0
 07 01 01   1 11   74.5  0.511  0.922  0.007  381.  877.   -162.5  0.13
0.67   0.22    5.70  324.   15.0  283.5    2.0
 07 01 01   1 12   89.8  0.515  1.034  0.007  447.  887.   -138.0  0.13
0.67   0.21    5.70  316.   15.0  285.0    2.0
 07 01 01   1 13   91.2  0.434  1.080  0.008  501.  693.    -81.4  0.09
0.67   0.21    5.10  333.   15.0  286.2    2.0
```

```
 07 01 01   1 14   78.7  0.465  1.057  0.008  543.  761.   -115.8  0.13
0.67   0.22    5.10  329.   15.0  287.1    2.0
 07 01 01   1 15   52.9  0.418  0.940  0.009  570.  650.   -125.0  0.13
0.67   0.25    4.60  312.   15.0  287.4    2.0
 07 01 01   1 16   15.9  0.401  0.632  0.009  577.  609.   -367.5  0.22
0.67   0.34    4.10  284.   15.0  286.6    2.0
 07 01 01   1 17  -41.9  0.440 -9.000 -9.000 -999.  700.    184.1  0.22
0.67   0.60    5.10  271.   15.0  285.0    2.0
 07 01 01   1 18  -47.8  0.433 -9.000 -9.000 -999.  683.    153.1  0.22
0.67   1.00    5.10  277.   15.0  283.1    2.0
 07 01 01   1 19  -48.0  0.432 -9.000 -9.000 -999.  682.    152.5  0.22
0.67   1.00    5.10  284.   15.0  282.2    2.0
 07 01 01   1 20  -48.0  0.432 -9.000 -9.000 -999.  682.    152.1  0.22
0.67   1.00    5.10  287.   15.0  281.8    2.0
 07 01 01   1 21  -48.1  0.432 -9.000 -9.000 -999.  682.    151.8  0.22
0.67   1.00    5.10  290.   15.0  281.2    2.0
 07 01 01   1 22  -48.2  0.432 -9.000 -9.000 -999.  682.    151.5  0.22
0.67   1.00    5.10  292.   15.0  280.8    2.0
 07 01 01   1 23  -42.2  0.377 -9.000 -9.000 -999.  559.    115.5  0.22
0.67   1.00    4.60  290.   15.0  280.5    2.0
 07 01 01   1 24  -42.2  0.377 -9.000 -9.000 -999.  556.    115.2  0.22
0.67   1.00    4.60  290.   15.0  280.1    2.0


 First hour of profile data
 YR MO DY HR HEIGHT F  WDIR    WSPD AMB_TMP sigmaA  sigmaW  sigmaV
 07 01 01 01   15.0 1  291.    5.10   279.3   99.0  -99.00  -99.00

 F indicates top of profile (=1) or below (=0)
```

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER 5 YEARS ***

** CONC OF NO2 IN MICROGRAMS/M**3 **

NETWORK GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG) OF TYPE	GRID-ID
ALL	1ST HIGHEST VALUE IS	0.50475 AT	(732096.04, 4065354.84, 59.46, 59.46, 0.00)	DC
	2ND HIGHEST VALUE IS	0.50474 AT	(731971.28, 4065351.21, 59.86, 59.86, 0.00)	DC
	3RD HIGHEST VALUE IS	0.50469 AT	(731996.23, 4065351.93, 59.76, 59.76, 0.00)	DC
	4TH HIGHEST VALUE IS	0.50467 AT	(732046.14, 4065353.38, 59.59, 59.59, 0.00)	DC
	5TH HIGHEST VALUE IS	0.50465 AT	(732071.09, 4065354.11, 59.51, 59.51, 0.00)	DC
	6TH HIGHEST VALUE IS	0.50462 AT	(732021.18, 4065352.66, 59.66, 59.66, 0.00)	DC
	7TH HIGHEST VALUE IS	0.50460 AT	(731946.32, 4065350.48, 59.94, 59.94, 0.00)	DC
	8TH HIGHEST VALUE IS	0.50450 AT	(732121.00, 4065355.56, 59.36, 59.36, 0.00)	DC
	9TH HIGHEST VALUE IS	0.50423 AT	(732145.95, 4065356.29, 59.26, 59.26, 0.00)	DC
	10TH HIGHEST VALUE IS	0.50420 AT	(731921.37, 4065349.75, 59.99, 59.99, 0.00)	DC

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** THE SUMMARY OF MAXIMUM 1ST-HIGHEST MAX DAILY 1-HR RESULTS AVERAGED OVER 5 YEARS ***

** CONC OF NO2 IN MICROGRAMS/M**3 **

NETWORK GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)	OF TYPE	GRID-ID
ALL	1ST HIGHEST VALUE IS	227.71873 AT	(729788.20, 4065220.26, 66.14, 66.14, 0.00)	DC	
	2ND HIGHEST VALUE IS	227.56839 AT	(729778.17, 4065242.68, 66.13, 66.13, 0.00)	DC	
	3RD HIGHEST VALUE IS	227.55154 AT	(729860.38, 4065247.41, 65.91, 65.91, 0.00)	DC	
	4TH HIGHEST VALUE IS	227.50055 AT	(729850.90, 4065268.60, 65.91, 65.91, 0.00)	DC	
	5TH HIGHEST VALUE IS	227.21650 AT	(729713.92, 4065197.80, 66.36, 66.36, 0.00)	DC	
	6TH HIGHEST VALUE IS	226.95163 AT	(729798.22, 4065197.85, 66.15, 66.15, 0.00)	DC	
	7TH HIGHEST VALUE IS	226.88882 AT	(729704.14, 4065219.65, 66.35, 66.35, 0.00)	DC	
	8TH HIGHEST VALUE IS	226.79651 AT	(729841.42, 4065289.80, 65.92, 65.92, 0.00)	DC	
	9TH HIGHEST VALUE IS	226.78458 AT	(729768.15, 4065265.09, 66.15, 66.15, 0.00)	DC	
	10TH HIGHEST VALUE IS	226.76941 AT	(729869.86, 4065226.22, 65.92, 65.92, 0.00)	DC	

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** THE SUMMARY OF MAXIMUM 8TH-HIGHEST MAX DAILY 1-HR RESULTS AVERAGED OVER 5 YEARS ***

** CONC OF NO2 IN MICROGRAMS/M**3 **

NETWORK GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)	OF TYPE	GRID-ID
ALL	1ST HIGHEST VALUE IS	85.92447 AT	(730748.56, 4065315.64, 63.56, 63.56, 0.00)	DC	
	2ND HIGHEST VALUE IS	85.82622 AT	(730773.51, 4065316.37, 63.46, 63.46, 0.00)	DC	
	3RD HIGHEST VALUE IS	85.70388 AT	(730798.47, 4065317.09, 63.41, 63.41, 0.00)	DC	
	4TH HIGHEST VALUE IS	85.60647 AT	(730723.61, 4065314.92, 63.58, 63.58, 0.00)	DC	
	5TH HIGHEST VALUE IS	85.43829 AT	(730823.42, 4065317.82, 63.35, 63.35, 0.00)	DC	
	6TH HIGHEST VALUE IS	85.22719 AT	(730698.65, 4065314.19, 63.66, 63.66, 0.00)	DC	
	7TH HIGHEST VALUE IS	85.10215 AT	(730848.37, 4065318.55, 63.26, 63.26, 0.00)	DC	
	8TH HIGHEST VALUE IS	84.87809 AT	(730749.29, 4065290.65, 63.56, 63.56, 0.00)	DC	
	9TH HIGHEST VALUE IS	84.87192 AT	(730774.24, 4065291.38, 63.46, 63.46, 0.00)	DC	
	10TH HIGHEST VALUE IS	84.72919 AT	(730724.33, 4065289.93, 63.66, 63.66, 0.00)	DC	

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV ARM RURAL

*** Message Summary : AERMOD Model Execution ***

--------- Summary of Total Messages --------

A Total of   0 Fatal Error Message(s)
A Total of   1 Warning Message(s)
A Total of   3492 Informational Message(s)

A Total of   43824 Hours Were Processed

A Total of   3492 Calm Hours Identified

A Total of   0 Missing Hours Identified (0.00 Percent)

******** FATAL ERROR MESSAGES ********
*** NONE ***

******** WARNING MESSAGES ********
CO W361   28   COCARD: Multiyear PERIOD/ANNUAL values for NO2/SO2 require MULTYEAR Opt

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** MODEL SETUP OPTIONS SUMMARY ***

- -

**Model Is Setup For Calculation of Average CONCentration Values.

-- DEPOSITION LOGIC --

**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION. DRYDPLT = F
**Model Uses NO WET DEPLETION. WETDPLT = F

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:

1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay.

**Other Options Specified:

CCVR_Sub - Meteorological data includes CCVR substitutions
TEMP_Sub - Meteorological data includes TEMP substitutions

**Model Assumes No FLAGPOLE Receptor Heights.

**The User Specified a Pollutant Type of: PM_10

**Model Calculates 1 Short Term Average(s) of: 24-HR

**This Run Includes: 1 Source(s);   1 Source Group(s); and 7553 Receptor(s)

with: 0 POINT(s), including
           0 POINTCAP(s) and   0 POINTHOR(s)
and: 0 VOLUME source(s)
and: 1 AREA type source(s)
and: 0 LINE source(s)
and: 0 OPENPIT source(s)
and: 0 BUOYANT LINE source(s) with   0 line(s)

**Model Set To Continue RUNning After the Setup Testing.

```
 **The AERMET Input Meteorological Data Version Date:  16216

 **Output Options Selected:
          Model Outputs Tables of Highest Short Term Values by Receptor
(RECTABLE Keyword)
          Model Outputs External File(s) of High Values for Plotting
(PLOTFILE Keyword)
          Model Outputs Separate Summary File of High Ranked Values
(SUMMFILE Keyword)

 **NOTE:  The Following Flags May Appear Following CONC Values:  c for
Calm Hours
                                                                 m for
Missing Hours
                                                                 b for
Both Calm and Missing Hours

 **Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    48.16 ;
Decay Coef. =    0.000     ;  Rot. Angle =     0.0
                  Emission Units = GRAMS/SEC
;  Emission Rate Unit Factor =   0.10000E+07
                  Output Units   = MICROGRAMS/M**3

 **Approximate Storage Requirements of Model =      4.4 MB of RAM.

 **Detailed Error/Message File:   061317_LBear_AQIA.err
 **File for Summary of Results:   061317_LBear_AQIA.sum
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
            1 1 1 1 1 1 1 1 1 1   1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54,   3.09,   5.14,   8.23, 10.80,

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** UP TO THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

Surface file: Met Data\Mendota_07-11.SFC
Met Version: 16216
Profile file: Met Data\Mendota_07-11.PFL
Surface format: FREE
Profile format: FREE
Surface station no.: 99005 Upper air station no.: 66666
Name: UNKNOWN Name: UNKNOWN
Year: 2007 Year: 2007

First 24 hours of scalar data

YR	MO	DY	JDY	HR	H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS	WD	HT	REF TA	HT
07	01	01	1	01	-47.5	0.433	-9.000	-9.000	-999.	684.	155.4	0.22	0.67	1.00	5.10	291.	15.0	279.2	2.0
07	01	01	1	02	-47.5	0.433	-9.000	-9.000	-999.	684.	155.2	0.22	0.67	1.00	5.10	288.	15.0	278.9	2.0
07	01	01	1	03	-47.5	0.433	-9.000	-9.000	-999.	684.	155.1	0.22	0.67	1.00	5.10	294.	15.0	278.8	2.0
07	01	01	1	04	-47.6	0.433	-9.000	-9.000	-999.	684.	154.9	0.22	0.67	1.00	5.10	293.	15.0	278.5	2.0
07	01	01	1	05	-42.5	0.377	-9.000	-9.000	-999.	557.	114.2	0.22	0.67	1.00	4.60	293.	15.0	278.2	2.0
07	01	01	1	06	-42.5	0.377	-9.000	-9.000	-999.	555.	114.1	0.22	0.67	1.00	4.60	292.	15.0	278.1	2.0
07	01	01	1	07	-42.5	0.377	-9.000	-9.000	-999.	555.	114.1	0.22	0.67	1.00	4.60	295.	15.0	278.0	2.0
07	01	01	1	08	-41.4	0.379	-9.000	-9.000	-999.	560.	119.4	0.22	0.67	0.67	4.60	293.	15.0	277.9	2.0
07	01	01	1	09	7.9	0.437	0.218	0.008	47.	693.	-963.2	0.13	0.67	0.37	5.10	307.	15.0	279.5	2.0
07	01	01	1	10	46.2	0.503	0.622	0.007	189.	854.	-249.5	0.13	0.67	0.26	5.70	321.	15.0	281.8	2.0
07	01	01	1	11	74.5	0.511	0.922	0.007	381.	877.	-162.5	0.13	0.67	0.22	5.70	324.	15.0	283.5	2.0
07	01	01	1	12	89.8	0.515	1.034	0.007	447.	887.	-138.0	0.13	0.67	0.21	5.70	316.	15.0	285.0	2.0
07	01	01	1	13	91.2	0.434	1.080	0.008	501.	693.	-81.4	0.09	0.67	0.21	5.10	333.	15.0	286.2	2.0

```
 07 01 01   1 14   78.7  0.465  1.057  0.008  543.  761.   -115.8  0.13
0.67   0.22    5.10  329.   15.0  287.1    2.0
 07 01 01   1 15   52.9  0.418  0.940  0.009  570.  650.   -125.0  0.13
0.67   0.25    4.60  312.   15.0  287.4    2.0
 07 01 01   1 16   15.9  0.401  0.632  0.009  577.  609.   -367.5  0.22
0.67   0.34    4.10  284.   15.0  286.6    2.0
 07 01 01   1 17  -41.9  0.440 -9.000 -9.000 -999.  700.    184.1  0.22
0.67   0.60    5.10  271.   15.0  285.0    2.0
 07 01 01   1 18  -47.8  0.433 -9.000 -9.000 -999.  683.    153.1  0.22
0.67   1.00    5.10  277.   15.0  283.1    2.0
 07 01 01   1 19  -48.0  0.432 -9.000 -9.000 -999.  682.    152.5  0.22
0.67   1.00    5.10  284.   15.0  282.2    2.0
 07 01 01   1 20  -48.0  0.432 -9.000 -9.000 -999.  682.    152.1  0.22
0.67   1.00    5.10  287.   15.0  281.8    2.0
 07 01 01   1 21  -48.1  0.432 -9.000 -9.000 -999.  682.    151.8  0.22
0.67   1.00    5.10  290.   15.0  281.2    2.0
 07 01 01   1 22  -48.2  0.432 -9.000 -9.000 -999.  682.    151.5  0.22
0.67   1.00    5.10  292.   15.0  280.8    2.0
 07 01 01   1 23  -42.2  0.377 -9.000 -9.000 -999.  559.    115.5  0.22
0.67   1.00    4.60  290.   15.0  280.5    2.0
 07 01 01   1 24  -42.2  0.377 -9.000 -9.000 -999.  556.    115.2  0.22
0.67   1.00    4.60  290.   15.0  280.1    2.0


 First hour of profile data
 YR MO DY HR HEIGHT F  WDIR    WSPD AMB_TMP sigmaA  sigmaW  sigmaV
 07 01 01 01   15.0 1  291.    5.10   279.3   99.0  -99.00  -99.00

 F indicates top of profile (=1) or below (=0)
```

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF PM_10 IN MICROGRAMS/M**3 **

```
                                                  DATE                            NETWORK
GROUP ID                         AVERAGE CONC     (YYMMDDHH)      RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS       3.13038c ON 09121024: AT ( 729532.43,  4065037.95,    67.08,    67.08,    0.00)  DC
```

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR

*** MODELOPTs: RegDFAULT CONC ELEV RURAL

*** Message Summary : AERMOD Model Execution ***

--------- Summary of Total Messages --------

```
A Total of            0 Fatal Error Message(s)
A Total of            0 Warning Message(s)
A Total of         3492 Informational Message(s)

A Total of        43824 Hours Were Processed

A Total of         3492 Calm Hours Identified

A Total of            0 Missing Hours Identified (  0.00 Percent)
```

******** FATAL ERROR MESSAGES ********
*** NONE ***

********   WARNING MESSAGES   ********
*** NONE ***

Appendix F
Biological Resources

Appendix F1, Biological Technical Report for the Little Bear Solar Project

Appendix F2, Habitat Assessment and Protocol Surveys for Burrowing Owl at the Little Bear Solar Project Site

Appendix F3, Results of Protocol-Level Nesting Swainson's Hawk Surveys for the Little Bear Solar Project

Appendix F1

Biological Technical Report for the Little Bear Solar Project

BIOLOGICAL TECHNICAL REPORT
for the
Little Bear Solar Project
Fresno County, California

Prepared for:

Little Bear Solar 1, LLC
Little Bear Solar 3, LLC
Little Bear Solar 4, LLC
Little Bear Solar 5, LLC, and
Little Bear Solar 6, LLC
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NOVEMBER 2017

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TABLES

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ACRONYM LIST

Acronym/ Abbreviation	Definition
AB	Assembly Bill
AC	Alternating Current
AMSL	Above mean sea level
AOU	American Ornithologists' Union
APN	Assessor's Parcel Number
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
County	County of Fresno
CRPR	California Rare Plant Rank
SSC	California Species of Concern
CUP	Conditional Use Permit
CWA	Clean Water Act
CVRWQCB	Central Valley Regional Water Quality Control Board
DC	Direct Current
EIR	Environmental Impact Report
ESA	Federal Endangered Species Act
ESS	Energy Storage Systems
GHG	Greenhouse Gas
HA	Hydrologic Area
HAS	Huron Hydrologic Subarea
HU	Hydrologic Unit
HVAC	Heating, Ventilation, and Air Conditioning
MBTA	Migratory Bird Treaty Act
MCV	Manual of California Vegetation, 1st ed.
MDBM	Mount Diablo Base and Meridian
MMRP	Mitigation and Monitoring Program
MW	Megawatt
NASS	National Agricultural Statistics Service
NHD	National Hydrography Dataset
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PCS	Power Conversion Station
PG&E	Pacific Gas and Electric
PV	Photovoltaic
RPS	Renewable Portfolio Standard

Acronym/ Abbreviation	Definition
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SR	State Route
SWRCB	State Water Resources Control Board
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDR	Water Discharge Requirements
WOUS	Waters of the United States
WQC	Water Quality Certification
WWD	Westlands Water District

1 INTRODUCTION

Dudek has prepared this Biological Technical Report in support of the proposed 180-megawatt (MW) Little Bear Solar Project (Project), located in unincorporated Fresno County, California. This report addresses current site conditions, provides a habitat assessment for special-status species with the potential to occur in the Project and surrounding areas, survey methodology, and results of survey efforts. The report analyzes the potential effects of the Project as it relates to sensitive biological resources within the federal Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), California Endangered Species Act (CESA), and California Fish and Game Code (e.g., protected species), and it recommends mitigation measures to reduce these impacts. In addition to proper documentation of biological resources, the intention of this report is to assist the County of Fresno (County) during California Environmental Quality Act (CEQA) project review process and environmental review by applicable regulatory resource agencies, specifically U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW). Judgments regarding likelihood of occurrence and effects are based on an evaluation of available biological resource information dealing with regional and local conditions, species biology, evaluations of the Project and surrounding areas, and professional field investigation experience.

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2 PROJECT DESCRIPTION

Little Bear Solar 1, LLC, Little Bear Solar 3, LLC, Little Bear Solar 4, LLC, Little Bear Solar 5, LLC, and Little Bear Solar 6, LLC[1] collectively propose to construct, own, and operate the Little Bear Solar Project, an approximately 180 MW solar photovoltaic power generation facility on lands located near Mendota in Fresno County, California. The Project will consist of up to five facilities: two 20 MW facilities, one 40 MW facility, and two 50 MW facilities. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The Project is expected to require 12-14 months to construct.

Each generation facility within the Project will include the following main elements: modular photovoltaic solar panels (either fixed-tilt or on single-axis trackers); direct current to alternating current power inverters mounted on concrete pads; three-phase transformers mounted on concrete pads that convert the output of each inverter to 34.5 kilovolts (kV), a 34.5 kV collection system either overhead or underground, a 34.5 kV to 115 kV substation, meteorology towers, security fencing and lighting, and other on-site facilities as required. Earthen basins will be constructed to contain storm water runoff from the Project site. There will be a common control/administration building and parking lot that will be shared by each generation facility.

Each generation facility may also optionally include an Energy Storage Systems (ESS) that will provide up to four hours of electrical storage. The ESS will be sited on an approximately one-acre area, in a separate outside rated enclosure and will consist of self-contained battery storage modules placed in racks, converters, switchboards, integrated heating, ventilation and air conditioning (HVAC) units, inverters, transformers, and controls in prefabricated metal containers or in a building.

The Project will interconnect to the Mendota Substation using the existing North Star 115 kV gen-tie line that interconnects the North Star Solar Project. One generation facility will interconnect with the North Star gen-tie line by way of the North Star Solar Project switchyard. The remaining generation facilities will each connect to a new, approximately 1.25-mile 115 kV gen-tie line that will lead to the North Star gen-tie line and continue from that point to the Mendota Substation as a second electrical circuit added to the existing towers of the North Star gen-tie line.

The Project will have private perimeter roads and interior access ways for construction and operation. Perimeter roads and interior access ways are proposed to be composed of native compacted soil. The Project will have driveways at up to ten points off of local county roads.

---

[1] There is no Little Bear Solar 2.

2.1 Project Location

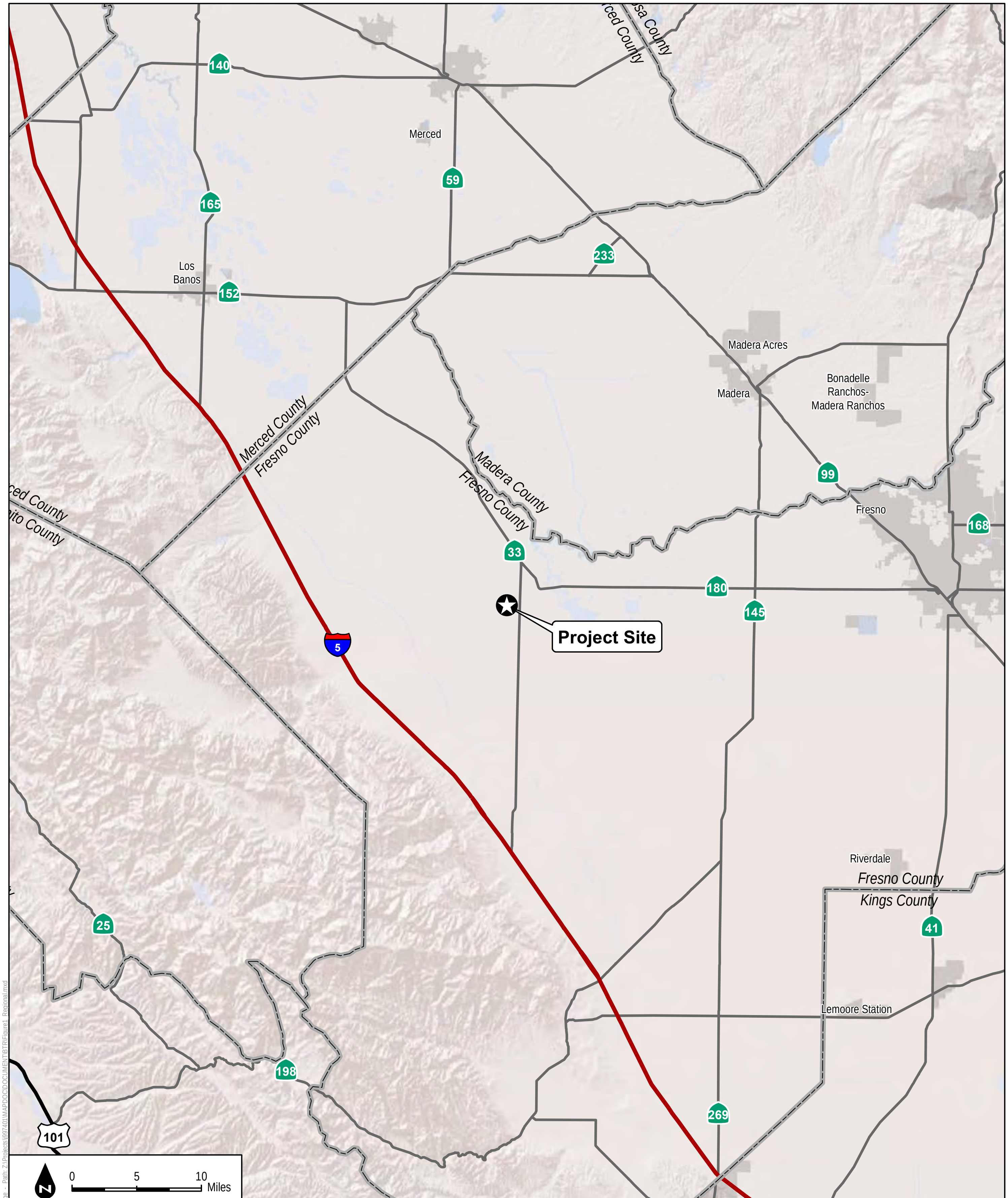
The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5 (I-5), approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), in the western portion of the San Joaquin Valley, in unincorporated Fresno County, Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian (MDBM). Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east. Figure 1 – Regional Map and Figure 2 – Vicinity Map show the location of the proposed Project on a regional and local basis, respectively.

The Project will be located on approximately 1,288 acres of private land (Table 1). The Project site is zoned AE-20 (Exclusive Agricultural District, 20-acre minimum parcel size) and has been intermittently dry-farmed and/or laid fallow in recent years (County of Fresno 2015). Surrounding land uses include agriculture, the federal correctional institution Mendota, and the adjacent North Star Solar Project (60 MW).

Table 1
Little Bear Project Site Parcel Numbers, Acreages, and Generating Capacity

Facility[1]	Assessor's Parcel Number (APN)	Approximate Acreage	Approximate Generating Capacity (MWac)
Little Bear 1	019-110-04ST	161	40
	019-110-05ST	161	
Little Bear 3	019-110-06ST	161	20
Little Bear 4	019-110-03ST	322	50
Little Bear 5	019-110-13ST	322	50
Little Bear 6	019-110-13ST	161	20
TOTAL		**1,288**	**180**

1 There is no Little Bear 2 facility.



SOURCE: ESRI Basemaps

FIGURE 1

Regional Location

DUDEK

Biological Technical Report for the Little Bear Solar Project

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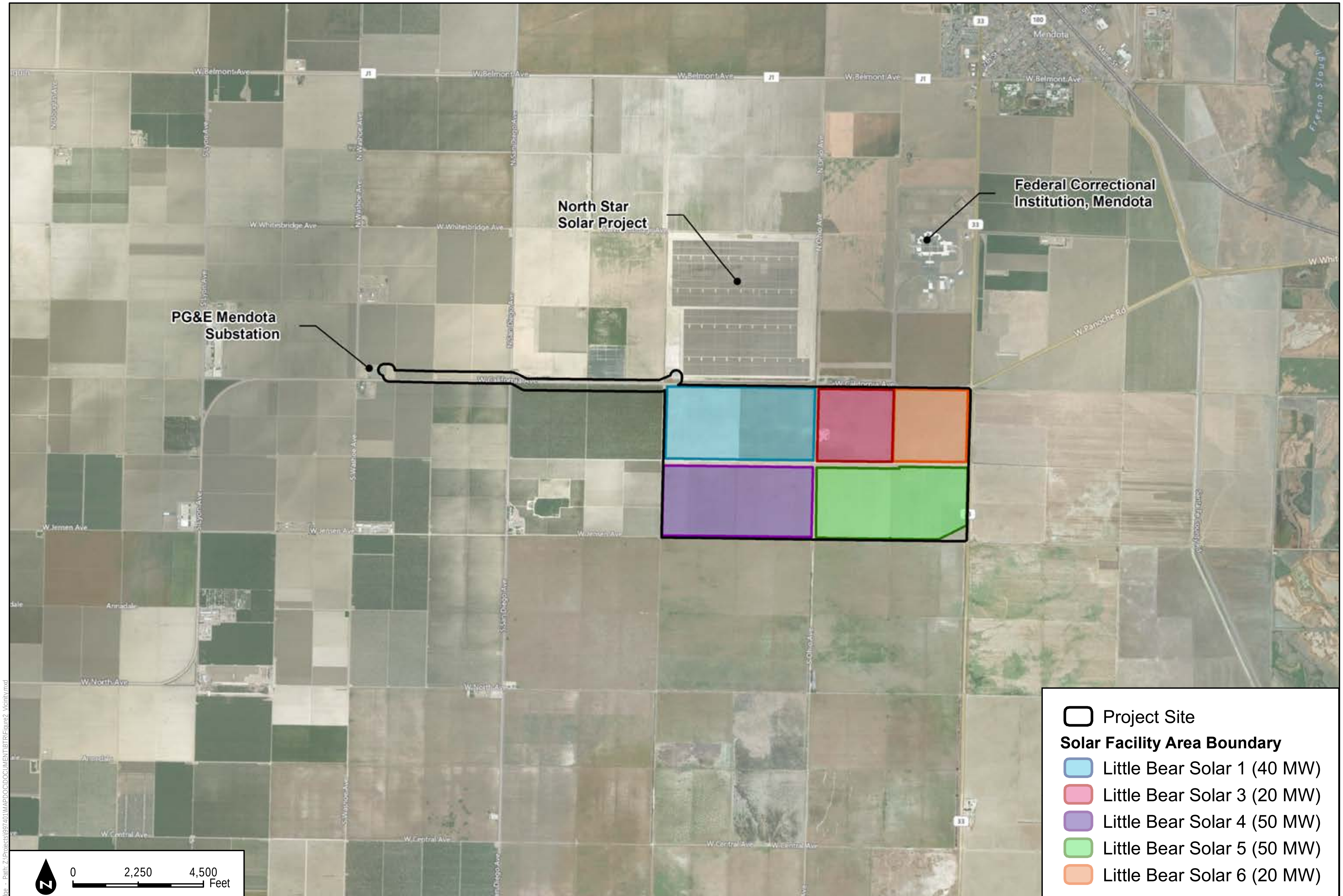

FIGURE 2

Project Vicinity

SOURCE: Bing Maps (Accessed 2017)

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Biological Technical Report for the Little Bear Solar Project

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3 REGULATORY SETTING

3.1 Federal

The following federal regulations pertaining to biological resources would apply to the proposed Project.

Federal Endangered Species Act

The federal Endangered Species Act (FESA) (16 U.S.C. 1533) gives authority to list a species as threatened or endangered to the Secretary of the Interior, represented by the U.S. Fish and Wildlife Service (USFWS). Under FESA, the "take" of endangered or threatened wildlife or plants species, or adverse modifications to critical habitat in areas under federal jurisdiction, is prohibited. Under FESA, "take" is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The USFWS have interpreted the definition of "harm" to include significant habitat modification that could result in the take of a species.

Either an incidental take permit under Section 10(a) or an incidental take statement under Section 7 is required if an activity would result in the take of a federally listed species. Section 7 requires the reviewing agency to determine whether any federally listed species, or species proposed for listing, may be present on a project site and if a project is likely to affect the species. Additionally, the reviewing agency must determine if a proposed project is likely to jeopardize the existence of a listed species or a proposed listed species, or result in destruction or adverse modification of proposed or designated critical habitat for such species. FESA requires the federal government to designate "critical habitat" for any listed species; "critical habitat" is defined as specific areas within the geographical area occupied by the species at the time of listing if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection. Additionally, it includes specific areas outside the geographical area occupied by the species if the regulatory agency determines that the area itself is essential for conservation.

USFWS must authorize projects where a federally listed species is present and likely to be affected by an existing or proposed project. Project authorization may involve a letter of concurrence that the project will not result in the take of a listed species, or a Biological Opinion that describes what measures must be undertaken to minimize the likelihood of an incidental take. Projects determined by USFWS to jeopardize the continued existence of a species cannot be approved under a Biological Opinion. Take that is incidental to the lawful operation of a project is permitted under Section 10(a) through approval of a habitat conservation plan, where a federal agency is not authorizing, funding, or carrying out the project.

Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.) regulates and prohibits taking, killing, possessing, harming, or trading in migratory birds. The MBTA addresses whole birds, parts of birds, and bird nests and eggs. This international treaty for the conservation and management of bird species that migrate through one or more countries is enforced in the United States by USFWS. Currently, USFWS defines an "active nest" as one that includes viable eggs, chicks, or juveniles—not nests that are under construction (USFWS 2003).

Clean Water Act

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical and biological integrity of waters of the United States (as defined 33 CFR 328.3[a]). Section 401 of the CWA (33 U.S.C. 1341) prohibits the discharge of any pollutant into waters of the United States. Project applicants for a federal license or permit to conduct activities including, but not limited to, the creation or operation of facilities, which may result in discharge into waters of the United States, must obtain certification that the project would not violate applicable effluent limitations and water quality standards. Section 404 of the CWA (33 U.S.C. 1344) requires a federal license or permit from the U.S. Army Corps of Engineers (USACE) prior to the discharge of dredge or fill material into waters of the United States, unless activity is exempt from Section 404 permit requirements. Permit applicants must demonstrate that they have attempted to avoid or minimize impacts on the resource; however, if no further minimization of impacts is possible, the applicant is required to mitigate remaining impacts on all federally regulated waters of the United States. In California, the State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs) are responsible for the protection of water quality under Section 401 of the CWA.

3.2 State

The following state regulations pertaining to biological resources would apply to the proposed Project.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) (California Public Resources Code, Section 21000 et seq.) was established by the state legislature to inform both state and local governmental decision-makers and the public about significant environmental effects of proposed activities (including impacts on biological resources), to identify ways to avoid or reduce significant adverse effects on the environment, and to disclose the reasons why a project is approved if significant environmental impacts would result.

California Endangered Species Act

The California Endangered Species Act (CESA) and Section 2081 of the California Department of Fish and Game Code identify measures to ensure state-listed species and their habitats are conserved, protected, restored, and enhanced. CESA requires permits from the California Department of Fish and Wildlife (CDFW) for activities that could result in the take of a state-listed threatened or endangered species. "Take" is defined as to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture or kill (Fish and Game Code Section 86). Section 2080 of the Fish and Game Code prohibits the take of state-listed plants and animals unless otherwise permitted under Sections 2080.1, 2081, and 2835. Section 2081(b) affords CDFW the authority to issue permits for incidental take for otherwise lawful activities. To authorize an incidental take, the impacts of the take must be minimized and fully mitigated. Issuance of incidental take permits may not jeopardize the continued existence of a state-listed species. For species listed as threatened or endangered under FESA, CDFW may rely on a federal incidental take statement or permit to authorize an incidental take under CESA.

The California Fish and Game Commission maintains a list of threatened and endangered species (Fish and Game Code Section 2070). The California Fish and Game Commission maintains two additional lists: (1) a candidate species list, which identifies species under review for addition to either the endangered or threatened species list; and (2) a species of special concern list, which serves as a watch list based on limited distribution, declining populations, diminishing habitat, or unusual scientific, recreational, or educational value.

California Fully Protected Species and Species of Special Concern

The classification of "fully protected" was CDFW's initial effort to identify and provide additional protection to those animals that were rare or faced possible extinction. California Fish and Game Code sections (fish at Section 5515, amphibians and reptiles at Section 5050, birds at Section 3511, and mammals at Section 4700) addressing "fully protected" species state that these species may not be taken or possessed at any time, and no provisions in this code or any other State law shall be construed to authorize permits for the take of fully protected species. Species of special concern are broadly defined as animals not listed under FESA or CESA, but which are nonetheless of concern to the CDFW because they are declining at a rate that could result in listing, or they historically occurred in low numbers and known threats to their persistence currently exist. This designation is intended to elicit special consideration for these animals by the CDFW, land managers, consulting biology, and others. Additionally, this is intended to stimulate collection of additional information on the biology, distribution, and status of poorly known at-risk species, and focus research and management attention on them.

California Department of Fish and Game Code Section 3503

Nesting birds and birds of prey are protected in California under the Fish and Game Code (Sections 3503 and 3503.5, respectively). Section 3503.5 stipulates it is "unlawful to take, possess, or destroy any birds in the order Falconiformes (diurnal birds of prey) or Strigiformes (owls) or to take, possess, or destroy any nest or egg of any bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Disturbance during breeding season that results in the incidental loss of fertile eggs or nestlings or otherwise leads to nest abandonment is considered "taking" by the CDFW.

Nests of all other birds (except house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and select other species) are also protected under Sections 3503 and 3513 of the Fish and Game Code. CDFW currently defines "active nest" as any structure that is under construction or under modification or in use for the purposes of breeding.

California Fish and Game Code Sections 1600–1616

Under Sections 1600–1616 of the California Fish and Game Code, CDFW regulates activities that would substantially alter the flow, bed, channel, or bank of streams and lakes. Such activities require a 1602 Lake and Streambed Alteration Agreement from CDFW. The California Code of Regulations (CCR) defines a stream as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). The term "stream" includes rivers, creeks, ephemeral streams, dry washes, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife. Removal of riparian vegetation also requires a Section 1602 Lake and Stream Alteration Agreement from CDFW.

State Water Resources Control Board

The SWRCB administers Section 401 of the CWA, which requires that an applicant for a Section 404 permit first obtain a water quality certification (WQC), or waiver thereof, that the project will not violate applicable state water quality standards. The authority to either grant certification or waive the requirement for certification has been delegated by the SWRCB to nine regional boards, including the Central Valley Regional Water Quality Control Board (CVRWQCB) – Region 5 – in Fresno County. The SWRCB protects all waters of the state (Water Code, Section 13260(a)), but has special responsibility for isolated wetlands and headwaters, pursuant to provisions of the Porter-Cologne Water Quality Control Act. Waters of the State are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state" (Water Code, Section 13050(e)). These waterbodies have high resource value but are vulnerable to filling and may lack regulation by other programs. Projects that require a USACE permit, or fall under other federal jurisdiction, and have the potential to impact waters of the state are required to comply with the terms of the WQC Program. If a proposed project does not require a federal license or permit, but involves activities that may result in a discharge of fill or other substances to waters of the state, the RWQCBs have the option to regulate such activities under its state authority in the form of Waste Discharge Requirements (WDR) or Certification of Waste Discharge Requirements.

California Native Plant Protection Act

The California Native Plant Protection Act (California Fish and Game Code Sections 1900–1913) and the Natural Communities Conservation Planning Act provide guidance on the preservation of plant resources. Vascular plants which have no designated status or protection under state or federal endangered species legislation, but are listed as rare or endangered by the California Native Plant Society (CNPS), are defined as follows:

1. Rank 1A: Plants presumed extirpated in California and either rare or extinct elsewhere
2. Rank 1B: Plants rare, threatened, or endangered in California and elsewhere
3. Rank 2A: Plants presumed extirpated in California, but common elsewhere
4. Rank 2B: Plants rare, threatened, or endangered in California, but more common elsewhere
5. Rank 3: Plants about which more information is needed – a review list
6. Rank 4: Plants of limited distribution – a watch list

Generally, plants with CNPS Ranks 1A, 1B, 2A, 2B, or 3 are considered to meet the criteria for endangered, threatened, or rare species as outlined by Section 15380 of the CEQA Guidelines. Additionally, plants with CNPS Ranks 1A, 1B, 2A, 2B, or 3 also meet the definition of Section 1901, Chapter 10 (Native Plant Protection Act) and Sections 2062 and 2067 (CESA) of the California Fish and Game Code.

3.3 Regional

The Open Space and Conservation Elements within the Fresno County General Plan provides protection and preservation of natural resources, open spaces, protection of cultural resources while providing recreational opportunities and managing production of commodity resources (General Plan 2002). These goals and policies provide guidance for decision makers regarding the future affects to these resources within the Fresno County planning area. Goals and policies that are applicable to the proposed Project, and the Projects consistency according to these goals, were reviewed as part of the Project literature review. More specifically, those goals and policies within the Natural Resources Section, Section E - Fish and Wildlife Habitat, and Section F - Vegetation.

The goal for Section E is to "help protect, restore, and enhance habitats of Fresno County that support fish and wildlife species so that populations are maintained at viable levels"; whereas the goal for Section F is "to preserve and protect the valuable vegetation resources of Fresno County" (General Plan 2002).

Fresno County is responsible to ensure that each project within the County follows those goals and policies outlined within the General Plan and adhere to the Implementation Programs set forth within the General Plan.

4 BIOLOGICAL SETTING

4.1 Climate

The climate of the Project area is typical of inland valleys in California, with hot dry summers and cool, mild winters. Daytime temperatures in the summer often exceed 100 degrees Fahrenheit, with lows in the 60's. In winter, daytime temperatures are usually in the 50's, with lows around 35 degrees Fahrenheit. Radiation (Tule) fog is common in the winter, and may persist for days.

4.2 Soils

Review of the Natural Resources Conservation Service resulted in three types of soil mapped on the proposed Project area: Calflax clay loam, saline-sodic, wet, 0 to 1% slopes; Posochanet clay loam, saline-sodic, wet, 0 to 1% slopes; and Tranquility clay loam, saline-sodic, wet, 0 to 1% slopes (USDA 2016a). Soils descriptions are provided in Appendix C.

4.3 Terrain

Topography of the approximately 1,288-acre Project site is generally flat overall. The site slopes slightly from 215 feet above mean sea level (amsl) in the southwest to 180 feet amsl in the northeast.

4.4 Land Uses

As stated above in Section 2.1, the entire site, excluding farm service roadways and the area surrounding an existing metal storage shed and silo structure, is typically registered as fallow/idle cropland but is periodically dry farmed (County of Fresno 2015). In addition, the Project site may still be disked during periods of being "fallow" for a number of reasons such as to keep invasive weed encroachment, and/or limit rodents use. During the time of the site visit, the Project site was recently disked and was likely under agricultural production with winter wheat and barley crops. There is an approximately 5,000 square-foot metal storage shed with neighboring metal storage silos (approx. 2,500 sq. ft.), just east of S. Ohio Avenue, which will be removed as part of Project construction.

4.5 Hydrologic Features

The Project site is located within the Huron hydrologic subarea (HAS) of the Westlands hydrologic area (HA), within the South Valley Floor hydrologic unit (HU) in the Tulare Lake Basin. The Project site is located within the Westlands Water District (WWD), which provides water allocations to the regional agricultural operations within the service area. However, the Project site is no longer eligible to receive agricultural water deliveries from WWD. In general, surface water within the Project site and surrounding area flows from southwest to northeast based on the local topography. The San Luis Drain located approximately 1.5 miles east of the Project site is the first major hydrologic conveyance feature east of the Project site. Approximately 2.5 miles east of the Project site, Fresno Slough is the main hydrologic feature supporting substantial wildlife habitat, specifically the CDFW managed Mendota Wildlife Area, in the vicinity. Other natural waterways in the region include the San Joaquin River to the north, Big Panoche Creek to the west, and the Kings River to the south.

5 METHODS

5.1 Literature Review

Prior to conducting fieldwork, the following available resources were reviewed to assess the potential for biological and wetland resources within the study area and vicinity:

- records search of the California Natural Diversity Database (CNDDB) (CDFW 2016a),
- list of potentially occurring special-status plants generated by a query of the CNPS's *Inventory of Rare and Endangered Plants* (CNPS 2016),
- list of potentially occurring listed species generated from a review of the U.S. Fish and Wildlife Service's IPaC Trust Resources Report (USFWS 2016a) list of federal endangered and threatened species (Appendix D),
- U.S. Department of Agriculture, Natural Resources Conservation Service Web Soil Survey (NRCS 2016)
- National Wetland Inventory (USFWS 2016c) and National Hydrography Dataset (USGS 2016b).

Dudek also reviewed additional literature previously prepared for a smaller designed Little Bear Solar Project. An Initial Study had been prepared for the Little Bear Solar Project for 630 acres of land, currently the west half (1 square mile) of the present Project site. However, the Project was withdrawn before Fresno County held any public hearings on the application for a Conditional Use Permit, and it was redesigned to include the adjacent 640 acres. Additional documents reviewed were:

- Initial Study Application No. 6962, Unclassified Conditional Use Permit Application Nos. 3492, 3493, 3494 and 3495 (County of Fresno 2015)
- *Biological Resources Evaluation for the Little Bear Solar Project, Fresno County, California* prepared for the Project site in 2015 by LSA Environmental Consultants (LSA 2015).

5.2 Field Reconnaissance

Dudek biologists completed a biological resources habitat suitability survey at the site to gain a clear understanding of natural resources present; these surveys included vegetation mapping, analysis of potential special-status plant and wildlife species to occur, as well as a jurisdictional resources evaluation. Burrowing owl (*Athene cunicularia*) and Swainson's hawk (*Buteo swainsoni*) surveys for the Project were conducted by another consulting firm. Although these species were not part of Dudek's scope of work and were not formally surveyed for, Dudek biologists considered potential presence of burrowing owl during the survey effort. Swainson's hawks do not winter within the Central Valley, and were not expected during the survey effort. The survey results in this report are limited to the Project area and the gen-tie line. The individuals who conducted the surveys, the date and time of the surveys, and survey conditions are presented in Table 2. Photo documentation collected during the survey is provided in Appendix E.

Table 2
Field Reconnaissance Surveys

Date	Hours	Personnel	Focus	Conditions
Jurisdictional Resource Evaluation, Vegetation Mapping, Rare Plant Survey				
11/29/2016	0850-1300	Russell Sweet, Randall McInvale	Habitat assessment for special-status plant and animal species, jurisdictional resource evaluation, and vegetation mapping	46ºF, 40% cc, 1-2 mph wind

Notes: cc = cloud cover; mph = miles per hour; °F = ° Fahrenheit

5.2.1 Vegetation Community and Land Cover Mapping

Dudek conducted vegetation mapping to serve as the basis of the description of current conditions of the Project site. Vegetation mapping was conducted to be consistent with *Vegetation Alliances and Associations: Natural Communities List Arranged Alphabetically by Life Form* (Natural Communities List; CDFG 2010) based on the *Manual of California Vegetation*, second edition (Sawyer et al. 2009), which is the California expression of the National Vegetation Classification Standard, Version 2 (FGDC 2008). These classification systems focus on a quantified, hierarchical approach that includes both floristic (plant species) and physiognomic (community structure and form) factors as currently observed (as opposed to predicting climax or successional stages).

At the time of the site visit, the Project site appeared to be actively farmed because the site was recently disked, thus vegetation mapping was conducted via windshield surveys, which covered 100% of the Project site. A 300-scale (i.e., 300 feet = 1 inch) aerial photograph map (Bing Maps 2016) with an overlay of the Project boundary was used to map vegetation communities. Following completion of the fieldwork, Dudek geographic information system (GIS) analysts digitized the vegetation boundaries as delineated by the field biologists and created GIS coverage for vegetation communities.

Vegetation communities were classified based on site factors, descriptions, distribution, and characteristic species present within an area. Where the vegetation communities observed in the field did not match those described in Sawyer et al. (2009), the *Manual of California Vegetation*, first edition (MCV) (Sawyer and Keeler-Wolf 1995), was utilized. Where land covers did not conform to these standards, Dudek generated additional site-specific vegetation community or land cover classifications, where necessary.

5.2.2 Flora

All plant species encountered during the field surveys were identified to subspecies or variety, if possible, to determine sensitivity status. Latin and common names for plant species with a California Rare Plant Rank (formerly CNPS Lists) follow the CNPS *Inventory of Rare, Threatened, and Endangered Plants of California* (CNPS 2016). For plant species without a California Rare Plant Rank, Latin names follow the Jepson Interchange List of Currently Accepted Names of Native and Naturalized Plants of California (Jepson Flora Project 2016) and common names follow the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Plants Database (USDA 2016). A provides a list of all plant species observed on the Project site.

For the purposes of this report, special-status plant species are those plants listed, proposed for listing, or candidates for listing as threatened or endangered by the USFWS under the Endangered Species Act (ESA); those listed or proposed for listing as rare, threatened, or endangered by the CDFW under the California Endangered Species Act (CESA); plants that are California Rare Plant Rank (CRPR) 1 and 2 in the CNPS's online Inventory of Rare and Endangered Plants (CNPS 2016).

5.2.3 Fauna

All wildlife species, as detected during field surveys by sight, calls, tracks, scat, or other signs, were identified and recorded. In addition to species actually observed, expected wildlife usage of the site was determined according to known habitat preferences of regional wildlife species and knowledge of their relative distributions in the area. No trapping or focused surveys for special-status or nocturnal species was conducted. Latin and common names for vertebrate species referred to in this report follow Crother (2012) for amphibians and reptiles, Wilson and Reeder (2005) for mammals, and the American Ornithologists' Union (AOU) Checklist of North and Middle American Birds (AOU 2016) for birds. Appendix B provides a complete list of wildlife species observed during the survey effort.

For the purposes of this report, special-status wildlife species are those that are designated as either rare, threatened, or endangered (or candidate) by CDFW or the USFWS and are protected under either the California Endangered Species Act (CESA) (Fish & Game Code, § 2050 et seq.) or federal Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.), meet the CEQA definition for endangered, rare, or threatened (Cal. Code Regs., tit. 14, § 15380(b),(d)), or are considered fully protected (FP) under Fish & Game Code, § 3511, 4700, 5050, and 5515. Special-status wildlife species also include those that are of expressed concern to resource/regulatory agencies or local jurisdictions. This includes wildlife on the CDFW *Special Animals List* (CDFW 2016b) that are determined by CDFW to be a Species of Special Concern (SSC).

5.2.4 Special-Status And Regulated Resources

5.2.4.1 Special-Status Plants

Focused plant surveys were not conducted following the CNPS's "Botanical Survey Guidelines" (CNPS 2001), CDFW's "Protocols for Surveying and Evaluating Impacts to Special Status Native Populations and Natural Communities" (CDFG 2009); and USFWS's "General Rare Plant Survey Guidelines" (Cypher 2002). However, habitat characteristics present with the Project site were evaluated to determine the potential to support special-status plant species. All plant species encountered during the field surveys were identified to subspecies or variety, if applicable, to determine sensitivity status.

There are a number of special-status plant species with the potential to occur within the Project vicinity. The priority special-status plant species were gathered during the database review, see 4.1 above. Habitat suitability was evaluated for special-status species based on their potential to occur on site based on the presence of "preferred" habitat, elevation, and soils present on the Project site.

5.2.4.2 Aquatic Jurisdictional Resource Evaluation

An evaluation of the potential for jurisdictional waters of the United States (WOUS) and waters of the State, including wetlands, was conducted to determine the potential for presence of water resources under the jurisdiction of the U.S. Army Corps of Engineers (USACE), the Regional Water Quality Control Board (RWQCB), and the California Department of Fish and Wildlife (CDFW). The evaluation included the identification of vegetation communities dominated by hydrophytic vegetation and stream channels or other evidence of an ordinary high water mark within the Project site. Connectivity to local water conveyance features was also evaluated to determine the discharge points and their connection to regional waterways. A formal jurisdictional wetlands delineation was not conducted.

5.3 Survey Limitations

Limitations of the surveys include a diurnal bias for wintering and migratory birds and recognizable sign of mammal species. The habitat suitability survey was conducted during the daytime to maximize the detection of most animals. Wintering and migratory birds represent the largest component of the vertebrate fauna during the time of the survey, and because most birds are active in the daytime, diurnal surveys maximize the number of bird observations. Conversely, diurnal surveys usually result in few observations of mammals, many of which may only be active at night. In addition, many species of reptiles and amphibians are secretive in their habits and are difficult to observe using standard transects. However, observations of many common species known to occur within the region were limited due to the habitat suitability survey being conducted in the later part of the year and in colder wintering months when temperatures are below optimal activity levels. No protocol or focused surveys were conducted during the survey effort.

Burrowing Owl and Swainson's Hawk

Swainson's hawks conduct seasonal migrations and do not overwinter in the Central Valley; therefore, they would not occur at the Project site during the time of the survey effort. Burrowing owl can occur as resident or overwintering species within the Project site; however, they are not breeding during the time of the survey. Species-specific surveys for burrowing owl and Swainson's hawks are being conducted separately from the Dudek survey by another consulting firm. However, these species were recorded if observations were made and/or if suitable habitat occurred on the Project site during the survey. In addition, these species' potential to occur on the Project site and potential impacts to those species are discussed within this report; however, recommended mitigation measures are not provided on the assumption that a separate report with results and mitigation measures (if warranted) will be prepared.

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6 RESULTS

6.1 Vegetation Communities, Land Covers, and Floral Diversity

Surveys were conducted for natural vegetative communities and land covers which may occur on the Project site. CDFW state rankings of 1, 2, or 3 or lower are considered high priority for inventory or sensitivity, and impacts to these communities typically require mitigation. Dudek mapped the Project site vegetation on November 29, 2016. Three land covers (disked agricultural, disturbed land, and developed land) were mapped within the Project site and are discussed below. Three additional land cover types, 1. California annual grassland, 2. agricultural (orchard), and 3. ornamental were identified within the gen-tie alignment. While minor impacts may occur to agriculture and ornamental land covers near San Diego Avenue and near the Mendota Substation, no impacts are anticipated within California annual grassland, as the electrical transmission infrastructure where this community occurs will be built on the existing transmission poles associated with the North Star Solar Project site. During the 2016 survey, no native vegetation communities, including any sensitive vegetation communities, were identified within the Project site. The land cover types and their acreages within the Project site are presented in Table 3. Note that the land cover type acreage provided in Table 3 was calculated in GIS based on field mapping results within the entirety of all parcels included in the Project. The total acreage differs from Table 1 in the project description, likely due to slight variation in aerial imagery and parcel map boundaries. The spatial distribution of the vegetation communities and land covers are presented on Figures 3a and 3b.

Table 3
Existing Land Cover Types on the Little Bear Solar Project Site

Land Cover Type	Acreage
Disked Agricultural	1,257.1
Disturbed Land	27.1
Developed Land	3.8
TOTAL	**1,288.0**

6.1.1 Disked Agricultural

At the time of the field survey, one principal biotic habitat was present on site. The entire site, excluding farm service roadways and the area surrounding an existing metal storage shed and silo structure, appeared to be actively farmed and was completely disked. It was evident that this area had been recently disked and at the time of the survey, the Project site supported essentially no standing vegetation. The Project site was likely under agricultural production with winter wheat and barley crops according to the National Agricultural Statistics Service

(NRCS) CropScape website. A five year database review of CropScape reported the site to have been actively farmed and/or fallow/idle cropland (USDA 2016). Crop rotations during this period were registered as winter wheat, barley, and oats (USDA 2016).

6.1.2 Disturbed Land

Although not recognized by the Natural Communities List (CDFG 2010), disturbed lands are areas that have been physically disturbed and no longer recognizable as native or naturalized vegetation association. These areas may continue to retail soil substrate. If vegetation is present, it is almost entirely composed of non-native vegetation, such as ornamentals or ruderal exotic species. Disturbed land is not considered a sensitive biological resource by CDFW under CEQA (CDFG 2010). Disturbed land includes dirt roads occurring along the perimeter and throughout the Project site.

6.1.3 Developed Land

Although not recognized by the Natural Communities List (CDFG 2010), developed land refers to areas that have been constructed upon or disturbed so severely that native vegetation is no longer supported. Developed land includes areas with permanent or semi-permanent structures, pavement or hardscape, landscaped areas, and areas with a large amount of debris or other materials. Developed land is not considered a sensitive biological resource by CDFW under CEQA (CDFG 2010). On site, developed land occurs centrally as an abandoned building.

6.2 Common Wildlife

A total of 13 birds and 2 mammals were audibly or visually detected or observed by presence of sign (i.e., scat, burrows/dens, prey remains, whitewash, etc.) during surveys. As noted above, the Project site largely consisted of disked agricultural field. Common species detected or observed during the survey are noted below.

The open habitat of the Project is well suited for predatory bird species. Power line towers adjacent to the Project provide suitable nesting habitat for raptors, and the site provides suitable foraging habitat. Bird species observed were Brewer's blackbird (*Euphagus cyanocephalus*), common raven (*Corvus corax*), mourning dove (*Zenaida macroura*), Bell's sparrow (*Atremisiospiza belli*), house finch (*Haemorhous mexicanus*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), red-winged blackbird (*Agelaius phoeniceus*), western meadowlark (*Sturnella neglecta*), and red-tailed hawk (*Buteo jamaicensis*).

SOURCE: Bing Maps (Accessed 2017)

FIGURE 3a

Vegetation Communities and Land Cover Types

DUDEK

Biological Technical Report for the Little Bear Solar Project

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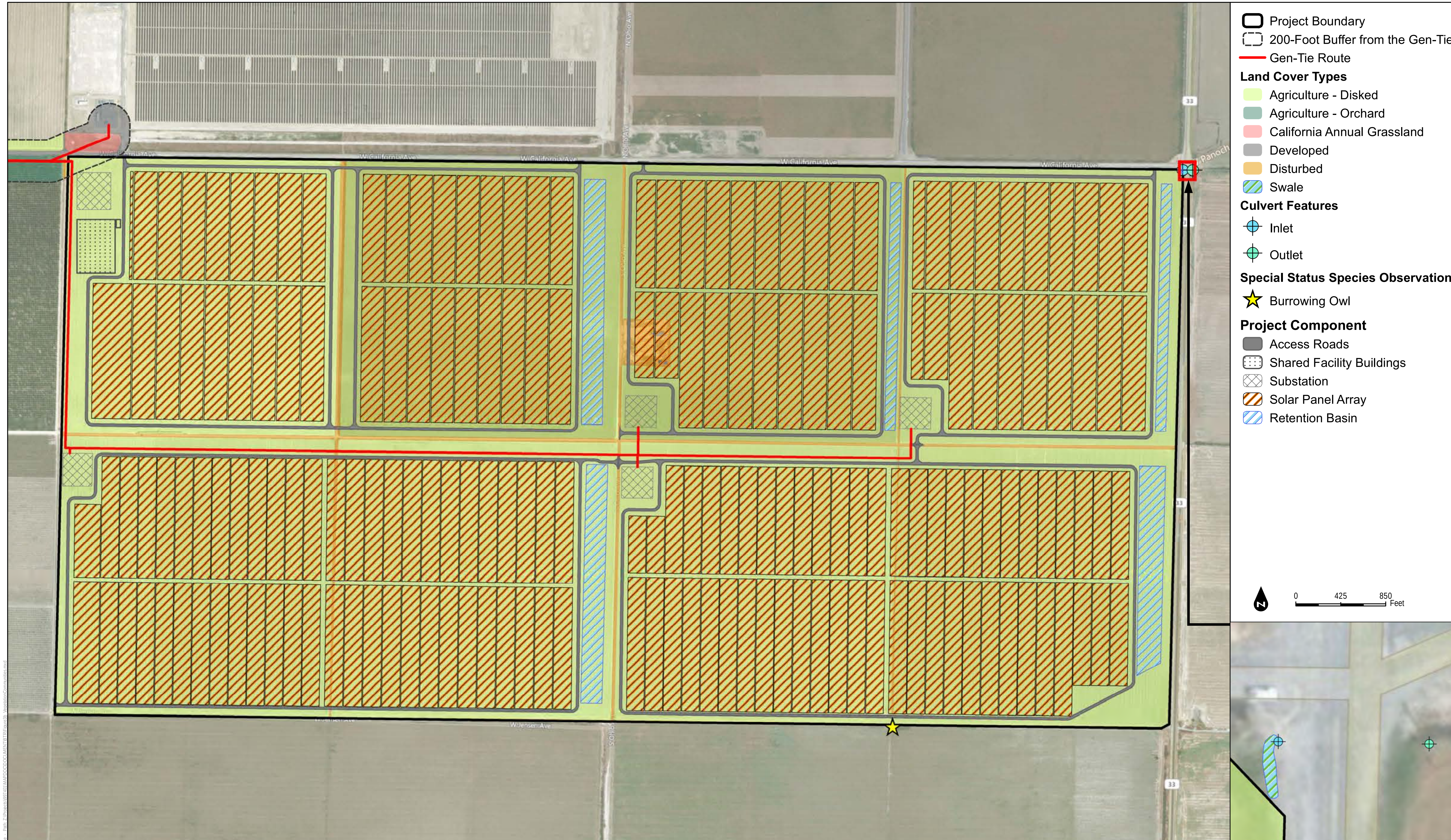

DUDEK

SOURCE: Bing Maps (Accessed 2017)

FIGURE 3b

Vegetation Communities and Land Cover Types

Biological Technical Report for the Little Bear Solar Project

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Amphibians require standing or flowing water for part or all of their life cycle. Ponds, seasonal pools, and drainages provide suitable habitat for common amphibian species. The hydrologic feature, an irrigation ditch located in the northwest corner of the Project site, did not contain water at the time of the survey and is presumed to only contain water during the winter rainy season. No amphibian species were observed during the field survey.

Vegetation characteristics contribute to the possible diversity of reptiles in an area. Most reptiles prefer a variety of habitats in which to forage; they live in small burrows, which they also use as a refuge from differing ambient temperatures and predator avoidance. The agricultural practices on the proposed Project site provide no suitable habitat for reptile species. No reptiles were observed during the field survey.

Agricultural fields can be utilized to a limited extent by mammalian predators such as coyote (*Canis latrans*) and foxes (*Vulpes* ssp.). However, the value is dependent on the availability of suitable prey species. Several small mammal species such as house mice, deer mice, voles, and harvest mouse may occur in such fields as the Project. Mammal species observed were coyote (tracks), and gopher (*Thomomys bottae*).

6.3 Special-Status/Regulated Resources

6.3.1 Special-Status Plant Species

No special-status plants were observed on the Project site during the survey in November 2016, although the survey was not conducted within the blooming or phenological period for several special-status plant species. Due to the high level of disturbance from disking and crop rotations and lack of native species, it was concluded that the Project site does not contain suitable habitat for special-status plant species. All special-status plant species found in the CNPS (CNPS 2016) and CNDDB (CDFW 2016a) occurrence records for the Coit Ranch and surrounding eight 7.5-minute USGS quadrangles (USGS 2016a) were evaluated for their potential to occur on site based on the presence of suitable habitat, elevation, and soils, and are listed in Table 4 (Figure 4). Based on the literature review and field surveys, no special-status plant species were identified as having potential to occur within the Project site. Therefore, special-status plants are not discussed further in this document as no impacts are anticipated. Additionally, there is no USFWS critical habitat for special-status plants mapped within or adjacent to the Project site (USFWS 2016b).

6.3.2 Special-Status Wildlife Species

Based on the literature review and field surveys, eight special-status wildlife species were either observed or identified as having low to high potential to occur within the Project site. Table 5 shows special-status wildlife species that were observed during field surveys or have low to high potential to occur at the Project site based on observed habitat. Should the Project site remain in an uncultivated condition for several years, and vegetation is allowed to accumulate, the site is still considered to provide low quality habitat for the majority of species. Therefore, the potential for special-status wildlife species to occur would not be anticipated to change during uncultivated periods. Species that have no potential to occur due to various factors such as lack of suitable habitat, the site is outside the known elevation or geographic range, or the species has been extirpated from the region, are not discussed further in this report.

Table 4
Potentially Occurring Special-Status Plant Species

Scientific Name/ Common Name	Status (Federal/State/ CRPR)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Amsinckia furcata forked fiddleneck	None/None/4.2	Cismontane woodland, valley and foothill grassland/annual herb/Feb–May/164–3281	**Not expected to occur.** Although the closest occurrence is approximately 3.7 miles northwest of the Project site along Panoche Creek and bordering agricultural lands (Jepson eFlora 2016), the Project site lacks suitable woodland or grassland habitat for this species. However, there is a potential the species may occur along the gen-tie line if precipitation and soil conditions provide patches of suitable habitat.
Atriplex cordulata var. *cordulata* heartscale	None/None/1B.2	Chenopod scrub, meadows and seeps, valley and foothill grassland (sandy); saline or alkaline/annual herb/Apr–Oct/0–1837	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence is approximately 2.3 miles east of the Project site in alkali playas (CDFW 2016a).
Atriplex coronata var. *vallicola* Lost Hills crownscale	None/None/1B.2	Chenopod scrub, valley and foothill grassland, vernal pools; alkaline/annual herb/Apr–Aug/164–2083	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence, approximately 2.2 miles northeast of the Project site, was collected in 1937 and 1938. An additional CNDDB occurrence is approximately 5 miles northeast and located in alkali sink habitat (CDFW 2016a).
Atriplex depressa Brittlescale	None/None/1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools; alkaline, clay/annual herb/Apr–Oct/3–1050	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence is approximately 5.4 miles east of the Project site within alkaline scalds in a cattle pasture (CDFW 2016a).
Atriplex minuscula lesser saltscale	None/None/1B.1	Chenopod scrub, playas, valley and foothill grassland; alkaline, sandy/annual herb/May–Oct/49–656	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence is approximately 5.1 miles east of the Project site in the Alkali Sink Ecological Reserve (CDFW 2016a).
Atriplex subtilis subtle orache	None/None/1B.2	Valley and foothill grassland; alkaline/annual herb/June–Sep (Oct)/131–328	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, there are no occurrences within approximately 10 miles of the Project site (CDFW 2016a, Jepson eFlora 2016).
Chloropyron palmatum palmate-bracted bird's-beak	FE/CE/1B.1	Chenopod scrub, valley and foothill grassland; alkaline/annual herb (hemiparasitic)/May–Oct/16–509	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence is approximately 4.8 miles east of the Project site in saline-alkali soil (CDFW 2016a).

Table 4
Potentially Occurring Special-Status Plant Species

Scientific Name/ Common Name	Status (Federal/State/ CRPR)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Delphinium recurvatum recurved larkspur	None/None/1B.2	Chenopod scrub, cismontane woodland, valley and foothill grassland; alkaline/perennial herb/Mar–June/10–2592	**Not expected to occur.** Although the Project site may contain alkaline soils along the gen-tie and/or northern facilities (Soilweb 2016), suitable habitat is absent from the Project site. In addition, the nearest CNDDB occurrence is approximately 3.9 miles northeast of the Project site in alkali plains (CDFW 2016a).
Eriastrum hooveri Hoover's eriastrum	None/None/4.2	Chenopod scrub, pinyon and juniper woodland, valley and foothill grassland; sometimes gravelly/annual herb/Mar–July/164–3002	**Not expected to occur.** The Project site lacks suitable habitat, including gravelly soils (SoilWeb 2016). Although the nearest CNDDB occurrence is approximately 4.9 miles east of the Project site, the species is in alkali sink scrub (CDFW 2016a).
Eriogonum gossypinum cottony buckwheat	None/None/4.2	Chenopod scrub, valley and foothill grassland; clay/annual herb/Mar–Sep/328–1804	**Not expected to occur.** Although clay soils are present throughout the Project facilities (SoilWeb 2016), the Project site lacks suitable habitat. In addition, there are no occurrences within approximately 10 miles of the Project site (CDFW 2016a, Jepson eFlora 2016).
Eriogonum nudum var. *indictum* protruding buckwheat	None/None/4.2	Chaparral, chenopod scrub, cismontane woodland; clay, serpentinite/perennial herb/(Apr) May–Oct (Dec)/492–4800	**Not expected to occur.** The Project site is outside of the species' known elevation range. In addition, there are no occurrences within approximately 10 miles of the Project site (CDFW 2016a, Jepson eFlora 2016).
Eriogonum vestitum Idria buckwheat	None/None/4.3	Valley and foothill grassland/annual herb/Apr–Aug/771–2953	**Not expected to occur.** The Project site is outside of the species' known elevation range. In addition, there are no occurrences within approximately 10 miles of the Project site (CDFW 2016a, Jepson eFlora 2016).
Goodmania luteola golden goodmania	None/None/4.2	Mojavean desert scrub, meadows and seeps, playas, valley and foothill grassland; alkaline or clay/annual herb/Apr–Aug/66–7218	**Not expected to occur.** Although the Project site may contain alkaline or clay soils (SoilWeb 2016), suitable habitat is absent from the Project site. In addition, there are no occurrences within approximately 10 miles of the Project site (CDFW 2016a, Jepson eFlora 2016).
Layia munzii Munz's tidy-tips	None/None/1B.2	Chenopod scrub, valley and foothill grassland (alkaline clay)/annual herb/Mar–Apr/492–2297	**Not expected to occur.** Although the Project site may contain alkaline/clay soils (SoilWeb 2016), suitable habitat is absent from the Project site. In addition, the site is outside of the species' known elevation range and the nearest CNDDB occurrence is approximately 4.1 miles northeast of the Project site from collections in 1938 and 1940 (CDFW 2016a).

Table 4
Potentially Occurring Special-Status Plant Species

Scientific Name/ Common Name	Status (Federal/State/ CRPR)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Lepidium jaredii ssp. *album* Panoche pepper-grass	None/None/1B.2	Valley and foothill grassland (steep slopes, clay)/annual herb/Feb–June/607–902	**Not expected to occur.** Although the Project site may contain clay soils (SoilWeb 2016), suitable habitat is absent from the Project site. In addition, the site is outside of the species' known elevation range and the nearest CNDDB occurrence is approximately 8 miles southwest of the Project site (CDFW 2016a).
Monolopia congdonii San Joaquin woollythreads	FE/None/1B.2	Chenopod scrub, valley and foothill grassland (sandy)/annual herb/Feb–May/197–2625	**Not expected to occur.** The Project site lacks suitable habitat, which may include sandy soils (SoilWeb 2016). In addition, the nearest CNDDB occurrence is approximately 2.8 miles south of the Project site and collected in 1935 (CDFW 2016a).
Sagittaria sanfordii Sanford's arrowhead	None/None/1B.2	Marshes and swamps (assorted shallow freshwater)/perennial rhizomatous herb/May–Oct (Nov)/0–2133	**Not expected to occur.** Although the Project site lacks suitable aquatic habitat required by this species, there is a potential for the species to occur in ditches, if precipitation provides suitable conditions (Jepson eFlora 2016). In addition, the nearest CNDDB occurrence is approximately 4.4 miles northeast of the Project site in aquatic habitat (CDFW 2016a).
Trichostema ovatum San Joaquin bluecurls	None/None/4.2	Chenopod scrub, valley and foothill grassland/annual herb/July–Oct/213–1050	**Not expected to occur.** Although the Project site lacks suitable habitat, this species is known to occur in disturbed sites (Jepson eFlora 2016), which may occur along the gen-tie line. However, continual disturbance associated with the active agricultural land would likely preclude the growth of this species. In addition, the nearest occurrence is approximately 2.3 miles northeast of the Project site in a residential neighborhood (Jepson eFlora 2016).

Status Legend
FE: Federally listed as endangered.
CE: State listed as endangered
CRPR
1B: Plants rare, threatened, or endangered in California and elsewhere
2B: Plants rare, threatened, or endangered in California, but more common elsewhere
4: Plants of limited distribution – a watch list
Threat Rank
1 – Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat).
2 – Fairly threatened in California (20%–80% occurrences threatened/moderate degree and immediacy of threat)

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
		Amphibians	
Rana draytonii California red-legged frog	FT/SSC	Lowland streams, wetlands, riparian woodlands, livestock ponds; dense, shrubby or emergent vegetation associated with deep, still or slow-moving water; uses adjacent uplands	**Not expected to occur.** The Project site lacks suitable ponds, marshes, streams, lagoons and other waterways (Thomson et al. 2016) required for this species. Suitable habitat is located approximately 2 miles east of the Project site. No CNDDB occurrences are located within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Spea hammondii western spadefoot	None/SSC	Primarily grassland and vernal pools, but also in ephemeral wetlands that persist at least 3 weeks in chaparral, coastal scrub, valley–foothill woodlands, pastures, and other agriculture.	**Not expected to occur.** The Project site lacks suitable aquatic, such as washes, floodplains, alluvial fans, playas and alkali flats suitable for this species (Thomson et al. 2016). The nearest CNDDB occurrence is approximately 4.9 miles east of the Project site in the Fresno Slough (CDFW 2016a).
		Reptiles	
Actinemys marmorata western pond turtle	None/SSC	Slow-moving permanent or intermittent streams, ponds, small lakes, and reservoirs with emergent basking sites; adjacent uplands used for nesting and during winter	**Not expected to occur.** The Project site lacks suitable aquatic habitat for this species. Western pond turtles require a broad range of aquatic water bodies, require upland habitat for nesting/overwintering, the soil needs to be loose enough for excavation and disturbance needs to be infrequent (Thomson et al. 2016). The nearest CNDDB occurrence is approximately 3.1 miles east of the Project site (CDFW 2016a).
Anniella pulchra Northern California legless lizard	None/SSC	Coastal dunes, stabilized dunes, beaches, dry washes, valley–foothill, chaparral, and scrubs; pine, oak, and riparian woodlands; associated with sparse vegetation and sandy or loose, loamy soils	**Not expected to occur.** The Project site lacks suitable shrubs for cover, soil moisture, or sandy/loose soils for burrowing. Soils at the Project site are composed of clay loam (between 20-50% clay content, Soilweb 2016), which is unsuitable for burrowing. This species will not use gravel sized substrate or those with greater than 10% clay content (Thomson et al. 2016). The nearest CNDDB occurrence is approximately 6.7 miles northeast of the Project site (CDFW 2016a).
Gambelia sila blunt-nosed leopard lizard	FE/SE, FP	Sparsely vegetated alkali and desert scrubs, including semi-arid grasslands, alkali flats, and washes	**Not expected to occur.** The Project site lacks suitable habitat for this species and is regularly tilled as part of continuous crop rotation. The nearest CNDDB occurrence is approximately 2.4 miles northeast of the Project site (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Masticophis flagellum ruddocki San Joaquin whipsnake	None/SSC	Open, dry, treeless areas including grassland and saltbush scrub. This species needs mammal burrows for refuge.	**Not expected to occur.** The Project site lacks suitable habitat for this species and is regularly tilled as part of continuous crop rotation. The nearest CNDDB occurrence is approximately 4.8 miles east of the Project site (CDFW 2016a).
Phrynosoma blainvillii Blainville's horned lizard	None/SSC	Open areas of sandy soil in valleys, foothills, and semi-arid mountains including coastal scrub, chaparral, valley–foothill hardwood, conifer, riparian, pine–cypress, juniper, and annual grassland habitats	**Not expected to occur.** The Project site lacks suitable soils and shrub cover required for this species. In addition, this species needs loose fine soils for burrowing and the Project site is mostly composed of clay loam (Soilweb 2016). The nearest CNDDB occurrence is approximately 5.1 miles northeast of the Project site (CDFW 2016a).
Thamnophis gigas giant garter snake	FT/ST	Freshwater marsh habitat and low-gradient streams; also uses canals and irrigation ditches	**Not expected to occur.** The Project site lacks the aquatic habitat required by this species. This species is highly aquatic and remains close to water sources (CDFW 2014b). In addition, the nearest CNDDB occurrence is approximately 3.4 miles east of the Project site (CDFW 2016a).
Thamnophis hammondii two-striped gartersnake	None/SSC	Streams, creeks, pools, streams with rocky beds, ponds, lakes, vernal pools	**Not expected to occur.** The Project site lacks the aquatic habitat required by this species. This species is highly aquatic and is found near permanent or intermittent freshwater streams, creeks and pools (Thomson et al. 2016). The nearest CNDDB occurrence is approximately 2.6 miles northeast of the Project site (CDFW 2016a).
		Birds	
Agelaius tricolor (nesting colony) tricolored blackbird	None/SSC	Nests near freshwater, emergent wetland with cattails or tules, but also in Himalayan blackberry; forages in grasslands, woodland, and agriculture	**Not expected to nest.** Moderate potential to winter. The Project site lacks suitable nesting habitat, but provides foraging areas within cultivated agricultural lands (Meese et al. 2014). This species nests in marshes and up to 3 meters in willows (Shuford and Gardali 2008) and needs open accessible water which is not present on site but there are wetlands and waterways approximately 2.5 miles northeast of the Project site. The nearest CNDDB occurrence is approximately 2.2 miles east of the Project site (CDFW 2016a) and this species is known to have established colonies in the Mendota Wildlife Area (UCDavis 2016).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Asio flammeus (nesting) short-eared owl	None/SSC	Grassland, prairies, dunes, meadows, irrigated lands, and saline and freshwater emergent wetlands	**Not expected to occur.** Not expected to nest. The Project site lacks suitable ground vegetation, herbaceous cover, or rolling topography that would be used by this species for ground nesting (Wiggins et al. 2006). Nesting pairs inhabit salt or freshwater marshes, irrigated grain or alfalfa fields, and ungrazed grasslands and old pastures (Holt and Leasure 1993). In San Joaquin Valley, will inhabit short, weedy vegetation with native atriplex. Given the prevalence of agricultural fields and the waterways approximately 2.5 miles northeast of the Project site, there is a possibility this species will forage within the Project site. The nearest CNDDB occurrence is approximately 9.8 miles southwest of the Project site (CDFW 2016a).
Athene cunicularia (burrow sites and some wintering sites) Western burrowing owl	None/SSC	Nests and forages in grassland, open scrub, and agriculture, particularly with ground squirrel burrows	**High potential to burrow and winter.** The Project site contains suitable habitat features (and possibly ground squirrel burrows) to support this species. This species requires short vegetation with sparse shrubs and burrows for roosting and nesting. Owls in agricultural areas nest along roadsides and water conveyance structures which are in close proximity to the site. Burrowing owls thrive in some landscapes highly altered by human activity. One burrowing owl was observed approximately 10-feet south of the Project area. Suitable burrows were observed; however, none appeared as though the owl was using the site as a residence.
Baeolophus inornatus (year-round) Oak titmouse	BCC/None	Lives in warm, open, dry oak or oak-pine woodlands. Will use other brush as long as woodlands are nearby. Nests in tree cavities, stumps, fence posts, pipes, eaves or holes in riverbanks.	**Not expected to nest or winter.** No suitable woodland habitats present within or near the Project site. In addition, there are no CNDDB occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Buteo swainsoni (nesting) Swainson's hawk	None/ST	Nests in open woodland and savanna, riparian, and in isolated large trees; forages in nearby grasslands and agricultural areas such as wheat and alfalfa fields and pasture	**High potential to forage.** Suitable agricultural foraging habitat occurs on the Project site. Although the Project site lacks tall nesting trees, this species has been known to nest on power poles or transmission towers directly north of the Project facilities and along the gen-tie line. In addition, the nearest CNDDB occurrence is located approximately 0.1 miles west of the gen-tie line (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Charadrius montanus (wintering) mountain plover	None/SSC	Winters in shortgrass prairies, plowed fields, open sagebrush, and sandy deserts	**Low potential to winter.** Although this species prefers prairie habitats, grazed grasslands, or burned fields, they are known to forage on tilled fields (Knopf and Wunder 2006). In addition, the nearest CNDDB occurrence is approximately 5.0 miles southeast of the Project site (CDFW 2016a).
Coccyzus americanus occidentalis (nesting) western yellow-billed cuckoo	FT, BCC/SE	Nests in dense, wide riparian woodlands and forest with well-developed understories	**Not expected to winter or nest.** The Project site lacks riparian woodland habitat required by this species. The nearest CNDDB occurrence is approximately 4.5 miles northeast of the Project site (CDFW 2016a).
Eremophila alpestris actia California horned lark	None/WL	Nests and forages in grasslands, disturbed lands, agriculture, and beaches; nests in alpine fell fields of the Sierra Nevada	**High potential to nest and winter.** The Project site contains suitable nesting habitat within the plowed agricultural fields as well as bare ground along the gen-tie line. This species may forage in recently plowed fields or agricultural areas, which surround the Project site. The CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range and the occurrence of this species is not well represented in CNDDB (CDFW 2016a). One California horned lark was observed foraging on the site during the November survey effort.
Falco columbarius (wintering) merlin	None/WL	Forages in semi-open areas, including coastline, grassland, agriculture, savanna, woodland, lakes, and wetlands	**Moderate potential to winter.** This species frequents coastlines, open grasslands, savannahs, woodlands, lakes, wetlands, edges, and early successional stages (CDFW 1999). The nearest CNDDB occurrence is approximately 2.1 miles northeast of the Project site (CDFW 2016a).
Falco peregrinus anatum (nesting) American peregrine falcon	FDL, BCC/SDL, FP	Nests on cliffs, buildings, and bridges; forages in wetlands, riparian, meadows, croplands, especially where waterfowl are present	**Low potential to winter and nest.** The Project site contains marginally suitable foraging agricultural habitat for this species, which may contain prey rodents or birds frequenting the adjacent croplands. Although this species typically nests along cliffs, lattice towers north of the Project facilities and along the gen-tie line may serve as suitable nesting structures. In addition, the CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Haliaeetus leucocephalus (nesting & wintering) bald eagle	FDL, BCC/SE, FP	Nests in forested areas adjacent to large bodies of water, including seacoasts, rivers, swamps, large lakes; winters near large bodies of water in lowlands and mountains	**Not expected to nest or winter.** The Project site lacks large bodies of water for foraging, forested areas for nesting sites, or suitable nesting structures. In addition, there are no forested areas in close proximity to the Project site. The CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Lanius ludovicianus (nesting) loggerhead shrike	None/SSC	Nests and forages in open habitats with scattered shrubs, trees, or other perches	**Moderate potential to nest and winter.** Suitable nesting trees may occur in the agricultural lands/orchards along the gen-tie line. This species may utilize the idle agricultural lands for foraging. Orchards and manmade structures on and adjacent to the Project site may serve as hunting perches. The Project site is within the species' range (CDFW 2016a). One loggerhead shrike was observed foraging in the orchards adjacent to the west of the Project site.
Picoides nuttallii (year-round) Nuttall's woodpecker	BCC/None	Found primarily in oak woodlands but also found in riparian woodlands.	**Not expected to occur.** The Project site lacks the required woodland habitats utilized by this species for foraging and nesting. CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Plegadis chihi (nesting colony) white-faced ibis	None/WL	Nests in shallow marshes with areas of emergent vegetation; winter foraging in shallow lacustrine waters, flooded agricultural fields, muddy ground of wet meadows, marshes, ponds, lakes, rivers, flooded fields, and estuaries	**Not expected to nest.** Low potential to winter. The Project site lacks suitable aquatic habitat or vegetation required for nesting. This species has the potential to utilize the Fresno Slough (east of the Project site) and the Project site during periods of excessive precipitation (e.g., flooded agricultural fields). The nearest CNDDB occurrence is approximately 5.1 miles southeast of the Project site (CDFW 2016a).
Melanerpes lewis (wintering) Lewis's woodpecker	BCC/None	This species requires ponderosa pine forest, open riparian woodland dominated by cottonwood, and logged or burned pine forest.	**Not expected to occur.** The Project site lacks suitable woodland or forested habitat for foraging or nesting. CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Numenius americanus (wintering) Long-billed curlew	None/WL	In winter, this species requires tidal estuaries, wet pasture habitats and sandy beaches.	**Not expected to occur.** The Project site lacks suitable aquatic habitat or vegetation required for nesting. This species has the potential to utilize the Fresno Slough (east of the Project site) and the Project site during periods of excessive precipitation (e.g., flooded agricultural fields). CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Riparia riparia (nesting) bank swallow	None/ST	Nests in riparian, lacustrian, and coastal areas with vertical banks, bluffs, and cliffs with sandy soils; open country and water during migration	**Not expected to nest.** Low potential to winter. The Project site lacks features suitable for nesting colonies, such as vertical rocky substrates or vertical banks along rivers, streams, lakes and ocean coasts. Riparian areas east of the Project site may serve nesting colonies and the species may forage in open agricultural areas on the Project site. The nearest CNDDB occurrence is approximately 4.5 miles northeast of the Project site (CDFW 2016a).
Fishes			
Hypomesus transpacificus Delta smelt	FT/SE	Sacramento–San Joaquin Delta; seasonally in Suisun Bay, Carquinez Strait, and San Pablo Bay	**Not expected to occur.** There are no waterways running directly through or immediately adjacent to the Project site. CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).
Mammals			
Ammospermophilus nelson Nelson's antelope squirrel	None/ST	Arid annual grassland and shrubland with saltbushes *(Atriplex spp.*), California jointfir (*Ephedra californica*), bladderpod (*Physaria* spp.*)*, goldenbushes (*Astereae*), snakeweed (*Gutierrezia* spp.*)* Prefers fine textured soils.	**Not expected to occur.** Habitat is open deserts with rolling hills or sandy washes, with or without shrub cover. Their range is San Joaquin and adjacent valleys of S. California. However, the regular tilling of soils at the Project site makes this unsuitable habitat. The nearest record in CNDDB is 2.7 miles northeast of the Project site (CDFW 2016a).
Dipodomys ingens giant kangaroo rat	FE/SE	On fine sandy loam soils with sparse forb vegetation and low-density alkali desert scrub	**Not expected to occur.** The Project site lacks the required open desert with scattered shrubs and grasses on sandy loam soils required this species. CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Dipodomys nitratoides exilis Fresno kangaroo rat	FE/SE	Alkali sink/open grassland habitats; sands and saline sandy soils in chenopod scrub	**Not expected to occur.** This species required dry grasslands and desert valleys, often on alkali soils. However, the clay loam soils as well as the regular tilling of soils at the Project site makes this unsuitable habitat. The nearest record in CNDDB is 5.5 miles east of the Project site (CDFW 2016a).
Eumops perotis californicus western mastiff bat	None/SSC	Chaparral, coastal and desert scrub, coniferous and deciduous forest and woodland; roosts in crevices in rocky canyons and cliffs where the canyon or cliff is vertical or nearly vertical, trees, and tunnels	**Not expected to roost.** Low potential to forage. Although the Project site lacks suitable tall substrates for this crevice-roosting species, there are structures on-site that may support roosting (e.g., large barn/shed, grain silos). Suitable habitat consists of extensive open areas with abundant roost locations provided by crevices in rock outcrops and buildings (CDFW 1990a). The Project site provides suitable foraging habitat over agricultural fields. The nearest CNDDB occurrence is approximately 2.3 miles northeast of the Project site (CDFW 2016a).
Lasiurus blossevillii western red bat	None/SSC	Forest, woodland, riparian, mesquite bosque, and orchards, including fig, apricot, peach, pear, almond, walnut, and orange; roosts in tree canopy	**Not expected to roost.** Low potential to forage. The Project site along the gen-tie line contains orchards, which may be used for roosting. However, this species prefers riparian habitats, which are located east of the Project site. The nearest CNDDB occurrence is approximately 2.6 miles northeast of the Project site (CDFW 2016a).
Onychomys torridus tularensis Tulare grasshopper mouse	None/SSC	Low, open scrub, and semi-scrub habitats in arid Lower Sonoran associations	**Not expected to occur.** The Project site lacks the shrubland communities typically associated with this species. The nearest record in CNDDB is 9.1 miles southwest of the Project site near the Panoche Hills (CDFW 2016a).
Perognathus inornatus San Joaquin pocket mouse	None/SSC	Open grassland and scrub areas on fine-textured soils	**Not expected to occur.** The Project site lacks the dry grassland and desert scrub preferred by this species. However, the regular tilling of soils at the Project site makes this unsuitable habitat. The nearest CNDDB occurrence is approximately 2.4 miles northeast of the Project site (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Taxidea taxus American badger	None/SSC	Dry, open, treeless areas; grasslands, coastal scrub, agriculture, and pastures, especially with friable soils	**Not expected to occur.** Although badgers will utilize a variety of habitats (including agriculture) the majority of the Project site is regularly tilled which makes most of the site unsuitable. However, there is a potential for this species to pass through the Project site. The nearest CNDDB occurrence is approximately 5.9 miles east of the Project site (CDFW 2016a).
Vulpes macrotis mutica San Joaquin kit fox	FE/ST	Grasslands and scrublands, including those that have been modified; oak woodland, alkali sink scrubland, vernal pool, and alkali meadow	**Moderate potential to occur.** The Project site contains suitable agricultural habitats where the species may forage within or burrow in adjacent areas. Suitable denning habitat may occur along the gen-tie line and foraging habitat may occur in the tilled agricultural fields and adjacent orchards. Additionally, this species occurs in the vicinity and may pass through the Project site. The nearest CNDDB occurrence is approximately 2.3 miles northeast of the Project site (CDFW 2016a).
Invertebrates			
Aegialia concinna Ciervo aegilian scarab beetle	None/None	Known only from Fresno County in sandy substrates	**Not expected to occur.** The Project site is not located within the four known localities where this species is currently distributed. In addition, this species is associated with Delta/inland dune systems and sandy substrates, which are not located in the Project site. CNDDB includes no occurrences within 10 miles of the Project site (CDFW 2016a).
Branchinecta longiantenna longhorn fairy shrimp	FE/None	Sandstone outcrop pools, alkaline grassland vernal pools, and pools within alkali sink and alkali scrub communities	**Not expected to occur.** The Project site is not located within the four known locations where the species is currently distributed (USFWS 2016b). In addition, the Project site lacks vernal pools (on grasslands or sandstone substrates) suitable for this species. In addition, the nearest CNDDB occurrence is approximately 4.3 miles southeast of the Project site (CDFW 2016a).
Branchinecta lynchi vernal pool fairy shrimp	FT/None	Vernal pools, seasonally ponded areas within vernal swales, and ephemeral freshwater habitats	**Not expected to occur.** Suitable vernal pool habitat is not present on the Project site. The nearest CNDDB occurrence is approximately 4.9 miles northeast of the Project site (CDFW 2016a).
Coelus gracilis San Joaquin dune beetle	None/None	Inhabits fossil dunes along the western edge of San Joaquin Valley; extirpated from Antioch Dunes (type locality)	**Not expected to occur.** Inhabits sites with sandy substrates in sand dunes along the western edge of the San Joaquin Valley. Soil type at the Project site is mostly clay loam (Soilweb 2016) and is not suitable habitat. CNDDB includes no occurrences within 10 miles of the Project site (CDFW 2016a).

Table 5
Potentially Occurring Special-Status Wildlife Species

Scientific Name/ Common Name	Status (Federal/State/ County/Other)[1]	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Metapogon hurdi Hurd's metapogon robberfly	None/SSC	Known only from Antioch and Fresno	**Not expected to occur.** Species likely inhabits inland sand dune habitats. CNDDB includes no occurrences within 10 miles of the Project site, although the Project site is within the species' range (CDFW 2016a).

Status Legend
FE = Federally Endangered.
FT = Federally Threatened.
FP = State Fully Protected.
FDL=Federally Delisted.
SE = State Endangered.
ST = State Threatened.
SSC = California Species of Concern.
SDL=State Delisted.
BCC=Bird of Conservation Concern
WL = CDFG Watch List.
FP: CDFW Fully Protected Species

Project Boundary

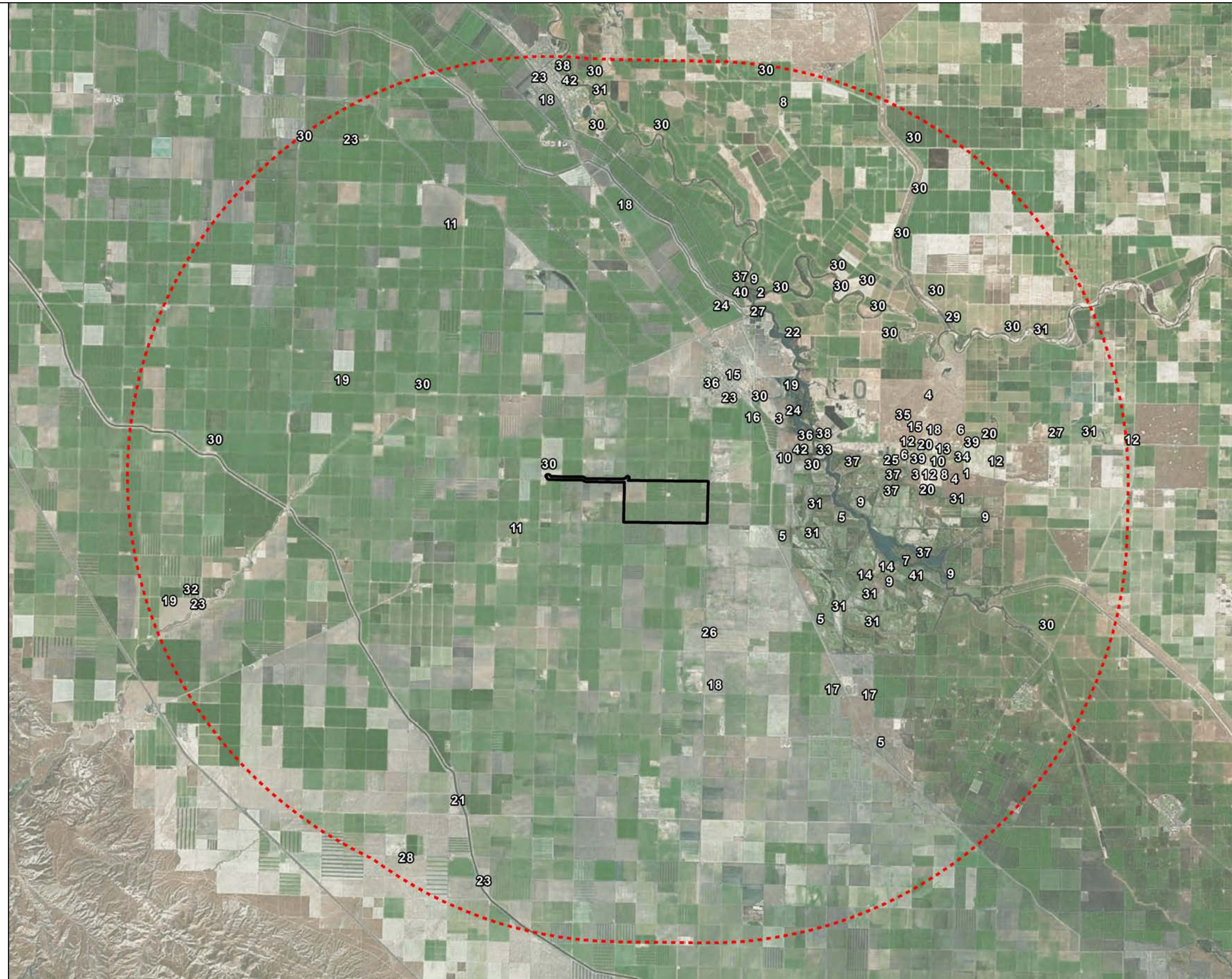
10-Mile Buffer

CNDDB Special-Status Species Occurrence Records

1 - American badger, *Taxidea*
2 - bank swallow, *Riparia riparia*
3 - blunt-nosed leopard lizard, *Gambelia sila*
4 - brittlescale, *Atriplex depressa*
5 - burrowing owl, *Athene cunicularia*
6 - coast horned lizard, *Phrynosoma blainvillii*
7 - Coastal and Valley Freshwater Marsh, *Coastal and Valley Freshwater Marsh*
8 - Fresno kangaroo rat, *Dipodomys nitratoides exilis*
9 - giant gartersnake, *Thamnophis gigas*
10 - heartscale, *Atriplex cordulata var. cordulata*
11 - hoary bat, *Lasiurus cinereus*
12 - Hoover's eriastrum, *Eriastrum hooveri*
13 - lesser saltscale, *Atriplex minuscula*
14 - longhorn fairy shrimp, *Branchinecta longiantenna*
15 - Lost Hills crownscale, *Atriplex coronata var. vallicola*
16 - merlin, *Falco columbarius*
17 - mountain plover, *Charadrius montanus*
18 - Munz's tidy-tips, *Layia munzii*
19 - Nelson's antelope squirrel, *Ammospermophilus nelsoni*
20 - palmate-bracted salty bird's-beak, *Chloropyron palmatum*
21 - Panoche pepper-grass, *Lepidium jaredii ssp. album*
22 - recurved larkspur, *Delphinium recurvatum*
23 - San Joaquin kit fox, *Vulpes macrotis mutica*
24 - San Joaquin Pocket Mouse, *Perognathus inornatus*
25 - San Joaquin whipsnake, *Masticophis flagellum ruddocki*
26 - San Joaquin woollythreads, *Monolopia congdonii*
27 - Sanford's arrowhead, *Sagittaria sanfordii*
28 - short-eared owl, *Asio flammeus*
29 - silvery legless lizard, *Anniella pulchra pulchra*
30 - Swainson's hawk, *Buteo swainsoni*
31 - tricolored blackbird, *Agelaius tricolor*
32 - Tulare grasshopper mouse, *Onychomys torridus tularensis*
33 - two-striped gartersnake, *Thamnophis hammondii*
34 - Valley Sink Scrub, *Valley Sink Scrub*
35 - vernal pool fairy shrimp, *Branchinecta lynchi*
36 - western mastiff bat, *Eumops perotis californicus*
37 - western pond turtle, *Emys marmorata*
38 - western red bat, *Lasiurus blossevillii*
39 - western spadefoot, *Spea hammondii*
40 - western yellow-billed cuckoo, *Coccyzus americanus occidentalis*
41 - white-faced ibis, *Plegadis chihi*
42 - Yuma myotis, *Myotis yumanensis*

N

0 1.25 2.5 5 Miles



DUDEK

SOURCE: Bing Aerial Imagery 2016, CDFW CNDDB Database 2016

FIGURE 4

Special-Status Species Occurence Records

Biological Technical Report for the Little Bear Solar Project

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6.3.2.1 Reptiles and Amphibians

Nine special-status reptiles and amphibians were identified during the USGS nine-quadrangle database review in CNDDB. Based on the highly disturbed nature of the Project site, and continued intensive agricultural activity, no special-status reptiles and/or amphibians are expected to occur on the Project site.

6.3.2.2 Birds

Ten special-status bird species were identified as occurring in the site vicinity, including nine that are either listed as endangered or threatened under ESA or CESA or designated as SSC or WL by CDFW. Of these, three were observed on, flying over, or near the site during biological surveys in 2015: loggerhead shrike, California horned lark, and western burrowing owl. Another SSC species, the mountain plover (*Charadrius montanus*) has the potential to occur on the site in winter.

Western Burrowing Owl (*Athene cunicularia*)

Burrowing owl is a USFWS bird of conservation concern and a California Species of Special Concern (SSC). With a relatively wide-ranging distribution throughout the west, burrowing owls are considered to be habitat generalists (Lantz et al. 2004). In California, burrowing owls are yearlong residents of open, dry grassland and desert habitats, and in grass, forb and open shrub stages of pinyon-juniper and ponderosa pine habitats (Zeiner et al. 1990). Preferred habitat is generally typified by short, sparse vegetation with few shrubs, level to gentle topography, and well-drained soils (Haug et al. 1993).

The presence of burrows is the most essential component of burrowing owl habitat as they are required for nesting, roosting, cover, and caching prey (Coulombe 1971; Martin 1973; Green and Anthony 1989; Haug et al. 1993). In California, western burrowing owls most commonly live in burrows created by California ground squirrels (*Spermophilus beecheyi*). Burrowing owls may occur in human-altered landscapes such as agricultural areas, ruderal grassy fields, vacant lots, and pastures if the vegetation structure is suitable (i.e., open and sparse); useable burrows are available; and foraging habitat occurs in close proximity (Gervais et al. 2008). Debris piles, rip rap, culverts, and pipes can be used for nesting and roosting.

Protocol-level surveys for the burrowing owl were not conducted during this survey effort. As noted above, burrowing owl surveys will be the subject of a separate report prepared for the Project. However, biologists detected a single burrowing owl in the disked field immediately south of the southern east/west access road during field surveys. There is potential for this species to be present in the Project site.

Loggerhead Shrike *(Lanius ludovicianus)*

The loggerhead shrike is a USFWS Bird of Conservation Concern and a California Species of Special Concern. It is widespread throughout the United States, Mexico, and portions of Canada (Humple 2008). The species is a yearlong resident in most of the United States, including from California east to Virginia and south to Florida, and in Mexico. In California, while shrikes are widespread at the lower elevations in the state, the largest breeding populations are located in portions of the Central Valley, the Coast Ranges, and the southeastern deserts (Humple 2008).

Preferred habitats for loggerhead shrikes are open areas that include scattered shrubs, trees, posts, fences, utility lines, or other structures that provide hunting perches with views of open ground, as well as nearby spiny vegetation or man-made structures (such as the top of chain-link fences or barbed wire) that provide a location to impale prey items for storage or manipulation (Humple 2008). Loggerhead shrikes occur most frequently in riparian areas along the woodland edge, grasslands with sufficient perch and butcher sites, scrublands, and open canopied woodlands, although they can be quite common in agricultural and grazing areas, and can sometimes be found in mowed roadsides, cemeteries, and golf courses. Loggerhead shrikes occur only rarely in heavily urbanized areas. For nesting, the height of shrubs and presence of canopy cover are most important (Yosef 1996). The Project site provides suitable foraging habitat for loggerhead shrikes. One loggerhead shrike was observed during the field survey.

California Horned Lark (*Eremophila alpestris actia*)

The California horned lark (*Eremophila alpestris actia*) is a WL species that lives in open habitats such as are present on the site. This species may forage in the recently plowed fields or agricultural areas, which surround the Project site. This species was recorded on the Project site on and in the vicinity on November 29, 2016. California horned larks may nest on the Project site during periods when the ground remains undisturbed by plowing, tilling, or grading. In addition, this species was observed by LSA and during the 2015 survey effort.

Mountain Plover (*Charadrius montanus*)

The mountain plover is a California Species of Concern during its wintering period in California from September through March, when it can be found on short grasslands and plowed fields of the Central Valley from Sutter and Yuba Counties southward. Mountain plovers are also found in foothill valleys west of San Joaquin Valley, the Imperial Valley, plowed fields of Los Angeles and western San Bernardino counties, and along the central Colorado River valley. They are found in areas with little or no vegetation, including short grasslands, freshly plowed fields, newly sprouting grain fields, and sod farms. The CNDDB query produced two occurrences within 10.0 miles of the Project site. The nearest occurrence was 5 miles southwest of the Project site (CNDDB 2016). Biological surveys were not conducted to detect mountain plovers. Conditions vary from winter to winter in the agricultural lands and pastures where this species often is found. Therefore, occurrence may be sporadic, and mountain plovers may occur on the site on occasion during winter or migration, depending on crop rotation and other factors influencing habitat conditions.

Swainson's Hawk (*Buteo swainsoni*)

The Swainson's hawk is a State Threatened species. In California, it nests in the Central Valley, Klamath Basin, Northeastern Plateau, Lassen County, and Mojave Desert. It breeds in stands with few trees in riparian areas, agricultural environments, oak savannah, and juniper-sage flats. Swainson's hawks forage in adjacent grasslands or livestock pastures. In the Central Valley, they nest in riparian areas and in isolated tree clusters, often near rural residences or other areas with human disturbance. However, disturbance level may regulate the occurrence of this species in otherwise suitable nesting habitat. Biological surveys were not conducted to detect Swainson's hawk nesting site. As noted above, Swainson's hawk surveys will be the subject of a separate report prepared for the Project. However, per the CNDDB review, one Swainson's hawk nest has been documented approximately 0.1 mile west of the gen-tie line.

6.3.2.2.1 Other Birds of Prey

Two uncommon birds of prey, the merlin (*Falco columbarius*), a WL species, and peregrine falcon (*Falco peregrinus anatum*) a FDL but FP species, has the potential to occur on the Project site foraging. The merlin does not nest in California; however, it forages in open habitats that are present on the Project site. The Project site does not contain suitable nesting habitat for peregrine falcons. Both species occur in a variety of habitats across California, including grasslands, agriculture, open brushlands, and open forest. No merlins or peregrine falcons were observed during the biological survey. The biological survey was not conducted during the appropriate season to detect this species.

6.3.2.2.2 Additional Special-status Bird Species Occurring in the Region

Three additional special-status bird species occur or may occur in the region: The tricolored blackbird (*Agelaius tricolor*; SSC for nesting), white-faced ibis (*Plegadis chihi*; SSC for nesting), and bank swallow (*Riparia riparia;* ST). The tricolored blackbird breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, and tall herbs. These habitats are absent on the Project site; however, the Fresno Slough and Mendota Wildlife Area support suitable habitat. No tricolored blackbirds were observed during biological surveys in 2016. CNDDB occurrences for this species were recorded within 2.2 miles east of the site of the Project site at the Mendota Wildlife Area.

The white-faced ibis is an SSC species that nests in dense emergent wetlands and feeds in emergent wetlands, lacustrine waters, muddy ground in wet meadows, and irrigated pastures or croplands. None were seen on the ground at the Project site or within 1.0 mile of the site. No nesting habitat is present in the immediate Project site vicinity.

The bank swallow is a state threatened species which almost always nests near water. Bank swallow require fine-textured or sandy banks or cliffs to dig horizontal nesting tunnel and burrow (Zeiner et al. 1990). These habitats are absent on the Project site; however, the Fresno Slough and Mendota Wildlife Area support suitable habitat. No bank swallows were observed during biological surveys in 2016. CNDDB occurrences for this species were recorded within 4.5 miles northeast of the site of the Project site.

6.3.2.3 Mammals

As explained in Table 5, five special-status mammal species were identified to have potential of occurring on the Project site. Of these five species, only the San Joaquin kit fox is listed as endangered or threatened under ESA or CESA. Four species of bats are considered to have potential to occur in a foraging or roosting capacity. These five species are discussed further below.

San Joaquin Kit Fox (*Vulpes macrotis mutica*)

The SJKF is a Federally Endangered and State Threatened species that was once common in the San Joaquin Valley. It lives in annual grasslands or grassy open stages with scattered shrubby vegetation. It requires loose-textured sandy soils for burrowing, and a suitable prey base. A habitat assessment and early evaluation of impacts to SJKF following the SJKF Early Evaluation Requirements outline in the 1999 USFWS SJKF Survey Protocol for the Northern Range was conducted (Appendix F). Information gathered for the habitat assessment includes a description of the proposed Project, sighting records with a 10-miles radius of the Project boundary, including the associated gen-tie, an analysis for adverse effects of the Project on SJKF (if any), and recommendations for mitigating adverse effects of the Project on kit foxes (if applicable). The closest occurrence of the SJKF was recorded in 1947, approximately 2.7 miles northeast of the Project site within the City limits of the City of Mendota, CA. Although this species is known to occur in western Fresno County, the CNDDB query resulted in only five occurrences for the SJKF within 10.0 miles of the Project site.

Western Mastiff Bat *(Eumops perotis californicus)*

Western mastiff bat is a California Species of Special Concern. It is widespread in the southwestern United States; the northern portion of Baja California, Mexico; and south into central mainland Mexico (Hall 1981; Wilson and Reeder 2005). In California, recent surveys have documented western mastiff bat virtually spanning the state, including numerous sites along the western foothills of the Sierra Nevada (Pierson and Rainey 1998). Western mastiff bat uses a wide variety of vegetation communities, including chaparral, coastal and desert scrub, and coniferous and deciduous forest (Best et al. 1996; Krutzsch 1955; Pierson and Rainey 1998). Day roosts are established in crevices in rocky canyons and cliffs where the canyon or cliff is vertical or nearly vertical (Best et al. 1996; Krutzsch 1955) as well as in trees and tunnels (Zeiner et al. 1990). Western mastiff bat has also adapted to roosting in various kinds of man-made structures (Best et al. 1996; Krutzsch 1955). Although western mastiff bats are yearlong residents in California and are known to shift day roosts throughout the year, whether they are seasonally migratory is unknown (Pierson and Rainey 1998). The closest occurrence of western mastiff bat is approximately 2.3 miles northeast of the Project site (CDFW 2016a).

Western Red Bat *(Lasiurus blossevillii)*

Western red bat is a California Species of Special Concern. It occurs in the western United States, Mexico, Central Mexico, and possibly South America (Cryan 2003; Pierson et al. 2006). Based on a lack of records for Oregon and Washington, its range in the Pacific region of the United States is thought to be no farther north than California (Szewczak, pers. comm. 2012). In California, most of the records are from the Central Valley, which is the breeding center for the western red bat in the state. About 83% of the breeding records for western red bat in California are from the Sacramento and San Joaquin rivers, with other breeding records from the San Diego, Santa Ana, and Los Angeles rivers (Pierson et al. 2006). Although the Central Valley is the center of activity during the reproductive season (May through August), western red bats occur throughout low elevations of California. Individuals appear to stay in California year-round, because there are occurrence records for every month of the year (Pierson et al. 2006) (Figure 4). There is evidence for seasonal movements in California but little evidence for mass migrations characteristic of the eastern red bat (*Lasiurus borealis*) and other tree bats (Cryan 2003; Pierson et al. 2006). In the Central Valley, foraging western red bats are closely associated with well-developed riparian zones that provide suitable roosting sites (Pierson et al. 2006). However, western red bats have also been observed in orchard trees and other non-native trees. The closest occurrence of red bat is approximately 2.6 miles northeast of the Project (CNDDB 2016). The orchards located alone the gen-tie line have low potential for occurrence of roosting red bats due to the regular occurring maintenance to the orchards.

6.3.3 Hydrologic Feature Assessment

Evidence of hydrology and hydrophytic vegetation were examined throughout the Project site. Hydrophytic vegetation was not found to occur within the Project site and evidence of hydrology was used as the primary indicator for the presence of jurisdictional resources. Because no potential wetland sites were identified, no data station pits were dug, and no formal wetland determination data forms were recorded. No jurisdictional wetlands or non-wetland waters were identified during previous surveys within the Project site conducted by LSA Environmental Consultants in 2015 (LSA 2015). USGS National Hydrography Dataset (NHD) flow lines were found to occur on site and are defined as canal/ ditch (USGS 2016b). USFWS National Wetlands Inventory (NWI) data within the Project site includes the presence of R5UBFx features, which are defined as: riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded, excavated (USFWS 2016c). The majority of the NHD and NWI features were not apparent during the field survey, likely due to the dynamic surface conditions associated with agricultural cultivation (disking); however, one irrigation ditch and culvert was identified in the northeastern portion of the Project site. This feature is shown on Figure 3b. Within the irrigation ditch identified on the Project site, a culvert discharges into a water conveyance ditch immediately east of SR-33, which may ultimately discharge into the Fresno Slough located approximately three miles east of the Project site.

The Hydrology and Water Quality Technical Report (Dudek 2017) prepared for the Project identified the Project's Concentration Point as a culvert just south of the northeast corner of the Project (Dudek 2017). The Project's Concentration Point is located just south of the irrigation ditch/ culvert described above, also in the northeastern portion of the Project. This second culvert traverses under SR-33 and discharges into an open field to the east of the Project with no apparent water conveyance ditch/ channel connection to the Fresno Slough.

The San Luis Drain is a manmade drainage feature designed to convey subsurface water from irrigated agricultural land. The drain, which runs between the Project site and the Fresno Slough was closed in 1985 following a USFWS study at the drain discharge point, Kesterson Reservoir, which found that selenium-laden water in the drain was negatively impacting waterfowl (BOR 2012). The portion of the San Luis Drain adjacent to the Project site is concrete lined and appears designed to exclude surface flows, which are conveyed over top of the drain.

The Fresno slough is hydrologically connected to the Kings River to the south and the San Joaquin River to the north and therefore, if water flows from the Project reached the Fresno Slough, they would discharge into a WOUS and waters of the State. As such, water flows from the Project site entering the Fresno Slough may be regulated under the jurisdiction of the CVRWQCB.

6.4 Wildlife Corridors and Habitat Linkages

Wildlife corridors are linear features that connect large patches of natural open space and provide avenues for the migration and dispersal of animals. Wildlife corridors contribute to population viability by assuring continual exchange of genes between populations, providing access to adjacent habitat areas for foraging and mating, and providing routes for recolonization of habitat after local extirpation or ecological catastrophes (e.g., fires).

Habitat linkages are small patches that join larger blocks of habitat and help reduce the adverse effects of habitat fragmentation. Habitat linkages provide a potential route for gene flow and long-term dispersal of plants and animals and may also serve as primary habitat for smaller animals, such as reptiles and amphibians. Habitat linkages may be continuous habitat or discrete habitat islands that function as stepping stones for dispersal.

Although formal wildlife movement studies were not conducted on the Project, and based on the fact that the surrounding areas adjacent to the Project site are similar and intensively farmed, it is not considered likely that any portion of the Project site serves as an important linkage between habitats. In addition, there are no regional migratory wildlife corridors that have been identified by the County or state resources agencies.

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7 PROJECT IMPACTS

The purpose of this section is to describe the direct and indirect impacts of the proposed Project on special-status or regulated biological resources. The significance determinations for potential impacts are described in Section 7.1.

7.1 Definition of Impacts

As described in Section 1.2, the proposed Project includes the construction of a 1,288-acre solar facility. The facility will be connected through a gen-tie line to the PG&E's Mendota Substation. The entire proposed solar facility, inclusive of the gen-tie line, will be analyzed for impacts.

7.1.1 Direct Impacts

Direct impacts are impacts that result from direct ground-disturbing activities. These impacts can result in either permanent or temporary impacts. For the proposed Project, this includes the footprint of the solar facility. Direct impacts were quantified by using GIS software to overlay the proposed construction limits on biological resources.

7.1.1.1 Permanent Direct Impacts

Permanent direct impacts consist of possible effects associated with construction of the approximately 1,288-acre solar facility footprint. Permanent direct impacts could result from the construction of structures such as solar panels, tracking/support structures, inverters, and interconnection facilities. These structures would be enclosed within a perimeter security fence approximately 6 feet high.

7.1.1.2 Temporary Direct Impacts

Temporary direct impacts consist of ground disturbance associated with construction activities that would not result in a permanent structure and that would be restored to substantially similar conditions after construction is complete. Temporary impacts may result from equipment staging, equipment turnaround areas, and construction access. Additionally, temporary direct impacts could occur from removal or trampling of vegetation outside designated work zones in the absence of avoidance and minimization measures.

7.1.2 Indirect Impacts

Indirect impacts are reasonably foreseeable effects to biological resources that could be caused by the proposed Project on remaining or adjacent biological resources. Indirect impacts may be short-term construction-related impacts due to noise and dust or long-term impacts due to degradation of habitat. Indirect impacts were considered within 500 feet of the construction limits of the Project.

7.1.3 Cumulative Impacts

Cumulative impacts refer to the combined environmental effects of the proposed Project and other relevant projects. In some cases, the impact from a single project may not be significant, but when combined with other projects, the cumulative impact may be significant. Analysis of cumulative impacts is based on past, present, and reasonably foreseeable future projects that may be constructed or commence operation during the time frame of activity associated with the proposed Project.

7.2 Impacts to Vegetation Communities and Land Covers

Development of the Project will require disturbance of nearly the entire 1,288-acre site. As stated in Section 6.1, above, agricultural fields, disturbed and developed lands are not considered sensitive vegetative communities. Therefore, there will be no impacts to sensitive vegetation communities or land cover types on the Project and these resources will not be discussed further.

No riparian or wetland vegetation or communities were identified on the Project site; therefore, no impacts will occur and will not be discussed further.

7.3 Impacts to Special-Status Plant Species

There is no potential for direct and indirect impacts to special-status plant species within the Project site. As described in Section 4.4 the Project site is typically registered as fallow/idle cropland but is periodically dry farmed (County of Fresno 2015). In years when the site is farmed, it's cultivated/seeded in the fall (Sept/Oct) and harvested by late May or early June. Following harvest, the next vegetative growth wouldn't occur until after the next cool-season rains (i.e., fall). If the site is fallowed during that subsequent rainy season, which growth would likely be a combination of grains and weedy roadside species encroachment. As previously noted, the Project site may still be disked during periods of being "fallow" for a number of reasons such as to limit invasive weed encroachment, and/or limit rodents use. As described in Section 6.3.1, no special-status plant species have potential to occur on site and will not be discussed further.

7.4 Impacts to Special-Status Wildlife Species

As described in Section 4.4 the Project site is typically registered as fallow/idle cropland but is periodically dry farmed (County of Fresno 2015). In years when the site is farmed, it's cultivated/seeded in the fall (Sept/Oct) and harvested by late May or early June. Following harvest, the next vegetative growth wouldn't occur until after the next cool-season rains (i.e., fall). If the site is fallowed during that subsequent rainy season, which growth would likely be a combination of grains and weedy roadside species encroachment. In addition, the Project site may still be disked during periods of being "fallow" for a number of reasons such as to limit invasive weed encroachment, and/or limit rodent use. As noted above, development of the Project will require disturbance of nearly the entire 1288-acre site. All of these impacts are direct permanent impacts. The Project will result in no temporary impacts to habitat for any wildlife species.

7.4.1 Direct Permanent Impacts

This section addresses the potential for direct permanent impacts to special-status wildlife species. Because the entire Project site will be utilized and converted from its existing conditions, no potential for direct temporary impacts was identified and they are therefore not discussed.

San Joaquin Kit Fox

No San Joaquin kit fox or its sign (e.g., tracks, scat, or prey remains, etc.) were detected throughout the 1,288 acres of agricultural and disked fields of the Project site, and few small mammal burrows were observed on the Project site. The California Natural Diversity Database also does not indicate San Joaquin kit fox presence on the Project site. San Joaquin kit fox is unlikely to occur given the relative scarcity of suitable prey on this managed agricultural property, and because much higher quality habitats are available elsewhere in the region. While it is not possible to conclude that kit fox would never visit the site, the species is unlikely to occur there on a regular basis. Therefore, impacts to San Joaquin kit fox habitat would be less than significant. In an unlikely event that an individual kit fox could move onto the site temporarily prior to construction, Project activities could result in harm or injury to kit fox that would constitute a significant impact. Potential impacts to this species are addressed further in Sections 8 and 9, below.

Burrowing Owl

One burrowing owl was observed directly south, approximately 10-feet of the Project site, during the survey. The owl was flushed from the area as biologists were driving through the area. Further inspection of the site identified several burrows consistent in size of potential burrows. Suitable foraging habitat is present throughout the Project site. However, similar suitable foraging habitat is abundant in the area, and would remain after Project development. Under current conditions, conditions suitable to support nests and burrows are absent from the site. Therefore, impacts to be burrowing owl habitat would be less than significant. However, prior to Project implementation, should habitat change from existing conditions, some potential exists for burrowing owls to occupy the site. In the unlikely event that this occurs, the Project could result in impacts to individual owls occurring on the site. Therefore, direct individual burrowing owls is potentially significant. Potential impacts to this species will be addressed in a subsequent report prepared for the Project.

Swainson's Hawk

This species was not observed nesting on the site during the survey. However, the survey was conducted during the time when Swainson's hawk are not inhabiting the Central Valley. Given the presence of suitable foraging habitat within the Project site and the immediate vicinity, Swainson's hawks could potentially use the Project for foraging. Potential impacts to this species will be addressed in a subsequent report prepared for the Project.

Other Special-Status Birds

Other special-status bird species, such as those mentioned in Section 6.3.2.2 above, could be affected by removing foraging habitat. The open space on the Project site could be used for ground nesting birds. However, prior to Project implementation, should habitat change from existing conditions, some potential exists for burrowing owls to occupy the site. In the unlikely event that this occurs, the Project could result in impacts to nesting birds occurring on the site. Direct impacts to habitat for nesting or migratory birds that could result from the proposed Project is considered a less than significant impact due to abundant habitat occurring within the Project vicinity. However, disturbing nesting birds could cause nest abandonment or mortality of young which could be a violation of the Migratory Bird Treaty Act and/or Fish and Game Code 3503. There is the potential for direct impacts to special-status bird nests. Potential impacts to these species are addressed further in Sections 8 and 9, below.

Bat Species

Species-specific surveys (i.e., acoustic analysis or mist netting) were not conducted at the time. However, visual inspections were conducted in and around the silos and metal barn during the time of the survey. No sign of bats (i.e., urine staining or guano piles) were observed on and around the structures on site. The orchards along the gen-tie do provide suitable, however low, roosting potential for western red bat. It is unlikely bats will roost in the orchards due to the constant maintenance (i.e., herbicide, rodenticide, and insecticide application by vehicles, tree trimming, harvesting, etc.), conducted by the orchard owners, within the orchard. Therefore, impacts to special-status bats would be less than significant and are not discussed further.

7.4.2 Short-term Indirect Impacts

Short-term or temporary indirect impacts to special-status wildlife species would primarily result from vegetation removal activities during grading/filling activities associated with the construction of the solar facility. Potential temporary indirect impacts could occur as a result of generation of fugitive dust, noise, chemical pollutants, increased human activity, and non-native animal species. All special-status wildlife species observed or with a moderate to high potential to occur on site could be impacted by potential temporary indirect impacts such as those listed below.

Generation of Fugitive Dust. Dust can impact vegetation surrounding the Project site, resulting in indirect impacts to special-status wildlife species, such as birds nesting in adjacent areas.

Noise. Project-related noise could occur from equipment used during construction activities. Noise impacts can have a variety of indirect impacts on wildlife species within the area, including increased stress, weakened immune systems, altered foraging behavior, displacement due to startle, degraded communication with conspecifics (e.g., masking), damaged hearing from extremely loud noises, and increased vulnerability to predators (Lovich and Ennen 2011). The use of mechanized hand tools could cause temporary disruption of behaviors for the period the tool is in use, including causing wildlife to temporarily vacate the area and suppressing important activities, such as foraging, and nesting.

Increased Human Activity. Construction activities can deter wildlife from using habitat areas near or adjacent to the proposed activities while activities are in progress. Although the surrounding vicinity is used for agricultural production, the presence of human activity within the area could potentially alter the foraging and movement of wildlife species from using the areas adjacent to the Project.

7.4.2.1 Long-term Indirect Impacts

Potential long-term or permanent indirect impacts to special-status wildlife species include the invasion of non-native invasive plant and animal species.

7.5 Impacts to Wildlife Corridors and Habitat Connectivity

There are no wildlife corridors within the Project area and no habitat connectivity within the Project site. Therefore, no impacts to wildlife corridors or habitat connectivity are anticipated and will not be discussed further

7.6 Impacts to Hydrologic Features

As detailed in Section 6.3.3, hydrologic features within the Project site are currently limited to one irrigation ditch and one culvert, which conveys water in an easterly direction away from the site. Receiving waters of stormwater flows generated from the Project site are not currently known, though the Fresno Slough is the main hydrologic features east of the Project site within the natural flow path. A formal wetland delineation/ jurisdictional determination would need to be completed to define the jurisdictional limits of hydrologic features within the Project site as well as their potential connectivity to jurisdictional waters in the vicinity. However, as currently designed, the Project is not anticipated to directly impact the existing irrigation ditch or the culverts. Indirect impacts to hydrologic features may occur as a result of changes to water quality related to construction and operational stormwater discharges. To minimize the potential for indirect impacts, the Hydrology and Water Quality Technical Report recommends Best Management Practices (BMPs), including sizing the detention basins to permanently retain the 100-year 48-hour duration storm (Dudek 2017). The Stormwater Pollution Prevention Plan (SWPPP) to be developed for the Project will include the final detention basin sizing parameters as well as additional BMPs and design features to minimize impacts to water quality, as determined to be necessary.

7.7 Impacts to Regional Resource Planning

The Natural Resources section within the Open Space and Conservation Element of the Fresno County General Plan outlines goals and policies to protect fish and wildlife habitat. Because the Project will occur on an active agricultural field, there is marginally suitable habitat for species-status species, although some species have potential to occur. Through implementation of appropriate species mitigation (see Section 8, below) the proposed Project will not conflict with any adopted local plan such as the *Fresno County General Plan* (County of Fresno 2002). Thus, there will be no impact to regional resource planning.

7.8 Cumulative Impacts

Development of the approximately 1,288-acre Project site would have a less than significant impact on the diversity and abundance of native flora and fauna in the region. The Project site supports only marginal habitat suitable for foraging special-status animal species. The Project site does not support a high diversity of native plants, and most wildlife species that could be expected to regularly use the Project area are species that are adapted to disturbances that are caused by agricultural practices. Because of the present condition of the proposed Project site and the surrounding vicinity is of a similar nature, it is not likely that development of the site would contribute significantly to cumulative adverse impacts to reginal flora and fauna.

8 SIGNIFICANT IMPACTS

The purpose of this section is to identify the significant direct, indirect, and cumulative impacts of the Project.

8.1 Explanation of Findings of Significance

Impacts to special-status vegetation communities, plants, wildlife species, and jurisdictional waters, including wetlands, must be quantified and analyzed to determine whether such impacts are significant under CEQA. CEQA Guidelines Section 15064(b) states that an ironclad definition of "significant" effect is not possible because the significance of an activity may vary with the setting. Appendix G of the CEQA Guidelines, however, provides "examples of consequences which may be deemed to be a significant effect on the environment" (CEQA Guidelines, Section 15064[e]). These effects include substantial effects on rare or endangered species of animal or plant or the habitat of the species. CEQA Guidelines Section 15065(a) is also helpful in defining whether a project may have "a significant effect on the environment." Under that section, a proposed project may have a significant effect on the environment if the project has the potential to: (1) substantially degrade the quality of the environment, (2) substantially reduce the habitat of a fish or wildlife species, (3) cause a fish or wildlife population to drop below self-sustaining levels, (4) threaten to eliminate a plant or animal community, (5) reduce the number or restrict the range of a rare or endangered plant or animal, or (6) eliminate important examples of a major period of California history or prehistory.

The following are the significance thresholds for biological resources provided in the CEQA Guidelines Appendix G Environmental Checklist, which states that a project could potentially have a significant affect if it:

- **Impact BIO-1.** Has a substantial adverse effect, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW.
- **Impact BIO-2.** Has a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by CDFW or USFWS.
- **Impact BIO-3.** Has a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- **Impact BIO-4.** Interferes substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impedes the use of native wildlife nursery sites.

- **Impact BIO-5.** Conflicts with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- **Impact BIO-6.** Conflicts with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

8.2 Impact BIO-1.1 Special-Status Wildlife Species

Direct impacts to special-status wildlife species and their habitat are considered a significant impact, absent mitigation. Specifically, direct impacts to foraging individuals. Overall, this project will have negligible impacts to special-status wildlife species due to the disturbed and developed lands and agricultural land use in the Project vicinity, which allows for continued foraging habitat for San Joaquin kit fox and special-status avian species with the potential to occur in the area, including burrowing owl, Swainson's hawk, and loggerhead shrike. The loss of foraging habitat due to the Project could potentially be significant without mitigation. One burrowing owl was observed directly south of the Project site during the survey effort. Depending on the timing of construction-related activities, the proposed Project could result in the direct loss of an active nest, the abandonment of a nest by adult birds during that year's nesting season, or the direct loss of individual burrowing owls occurring within burrows. Therefore, the potential loss of an active nest or individual burrows would be significant.

Potential short-term indirect impacts to special-status wildlife, including fugitive dust, chemical pollutants (including herbicides), increased human activity, and non-native animal species would be significant, absent mitigation. Potential long-term indirect impacts to special-status wildlife, including the invasion of non-native, invasive plant species, would be significant, absent mitigation.

Mitigation measures described in Section 9.1, MM-BIO 1.1, would reduce potential impacts to special-status San Joaquin kit fox to less than significant. Mitigation measures for burrowing owl and Swainson's hawk are not provided within this report; however, they will be provided, as appropriate, in the separate survey report provided by the consulting firm tasked with burrowing owl and Swainson's hawk surveys.

8.3 Impact BIO-1.2 Nesting and Migratory Birds

The Project site is void of all trees and shrubs, which can be used for nesting birds. However, the adjacent orchard could potentially be used for nesting birds. In addition, the open space on the Project site and adjacent fields could be used for ground nesting birds. Impacts could result from Project activities if nesting birds are present in the Project site at the time of construction and activities cause nest abandonment or mortality of young. Mitigation measures described in

Section 9.1, MM-BIO 1.2 would reduce potential impacts to nesting and migratory birds to less than significant.

8.4 Impact BIO-3 State and Federally Protected Wetlands and Waters

Although a formal wetland delineation/ jurisdictional determination would need to be completed to define the jurisdictional limits of hydrologic features within the Project site, as well as their potential connectivity to jurisdictional waters in the vicinity, based on the current Project design, no direct impacts to state and federally protected wetlands and waters are anticipated. Indirect impacts to these resources and downstream receiving waters may occur as a result of construction related activities in the short-term as well as operation activities in the long-term. Following implementation of MM-BIO-3.1, which includes employing standard BMPs in accordance with the National Pollutant Discharge Elimination System (NPDES) permit program implemented by the Regional Water Quality Control Board (RWQCB), no indirect impacts to state and federally protected wetlands and waters are expected to result from Project-related activities.

8.5 Impact BIO-5 Local Policies or Ordinances Protecting Biological Resources

With implementation of mitigation measures BIO-1.1, 1.2, and 1.3, the proposed Project will not conflict with any adopted local plan such as the *Fresno County General Plan* (County of Fresno 2002) as they relate to resources found on the Project site. Thus, no conflicts with local policies or ordinances are anticipated.

8.6 Impact BIO-6 Conflicts with Habitat Conservation Plans

There are no adopted Habitat Conservation Plans, Natural Community Conservation Plans, or other approved local, regional, or state habitat conservation plans that cover the Project area. Therefore, the Project does not conflict with any provisions from an adopted local, regional, or state habitat conservation plan.

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9 RECOMMENDATIONS AND MITIGATION MEASURES

Recommendation and mitigation measures are included below for sensitive-status species. Significant direct and indirect impacts to special-status species will be mitigated to below a level of significance with implementation of the following measures.

9.1 Impact BIO-1 – Special Status Wildlife Species

Potentially significant impacts to special-status wildlife species discussed in Section 7.2, including San Joaquin kit fox, and nesting birds, will be less than significant with the incorporation of the following mitigation measures.

MM-BIO-1.1 **San Joaquin Kit Fox.** The applicant shall have a qualified biologist conduct a pre-construction survey for San Joaquin kit fox no less than 14 days and no more than 30 days prior to any construction related activities. Surveys will be conducted on the Project site and within a 200-foot buffer zone within areas where legal access is available in order to evaluate and ascertain if kit fox is using the Project site. If an active kit fox den is observed within the work area or 200-foot buffer zone, the CDFW and USFWS shall be contacted prior to disturbance within 200 feet of the den to determine the best course of action. If no kit fox activity is detected, work shall continue as planned and a brief memo shall be submitted to the CDFW and USFWS after the completion of the pre-construction survey.

While San Joaquin kit foxes are not anticipated to access the site during construction, the applicant shall implement precautionary measures following the *Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance* developed by the USFWS (1999) as follows:

1. Project-related vehicles shall observe a 20 mph speed limit in all Project areas, except on county roads and state and federal highways; this is particularly important at night when kit foxes are most active. Nighttime construction shall be minimized. Off-road traffic outside of designated Project areas shall be prohibited.
2. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe, becoming trapped or injured. If a San Joaquin kit fox is discovered inside a pipe, that section of pipe shall not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

3. All food-related trash items such as wrappers, cans, bottles, and food scraps shall be disposed of in closed containers and removed regularly from a construction or Project site.
4. Use of rodenticides and herbicides in Project areas shall be restricted as follows. All uses of such compounds shall observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other state and federal legislation, as well as additional Project-related restrictions deemed necessary by the USFWS. If rodent control must be conducted, zinc phosphide shall be used because of proven lower risk to kit fox.
5. Escape ramps shall be provided for all open trenches or ditches deeper than 2 feet to allow animals to escape.
6. Any contractor or employee who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to their representative. The representative shall contact the USFWS & CDFW immediately in the case of a dead, injured, or entrapped kit fox.
7. The USFWS and CDFW shall be notified in writing within 3 working days of the accidental death or injury to a San Joaquin kit fox during Project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information.

MM-BIO-1.2 **Nesting Birds.** If ground-disturbing activities cannot be completed outside the nesting bird season (February 1 through August 31), the following measures shall be implemented:

1. Surveys shall be conducted within 200 feet for passerines and 500 feet for raptors of disturbance areas no earlier than 5 days prior to the commencement of disturbance. If ground-disturbance activities are delayed, then additional pre-disturbance surveys shall be conducted such that no more than 5 days will have elapsed between the survey and ground-disturbance activities.
2. If active nests are found, clearing and construction shall be postponed or halted within a buffer area, established by the qualified biologist, that is suitable to the particular bird species and location of the nest, until the nest is vacated and juveniles have fledged, as determined by the biologist. The construction avoidance area shall be clearly demarcated in the field with

highly visible construction fencing or flagging, and construction personnel shall be instructed on the sensitivity of nest areas. The results of the surveys, showing the locations of any active nests detected, and documentation of any avoidance measures taken, shall be submitted to the Project owners to document compliance with applicable state and federal laws.

MM-BIO-1.3 **Indirect Impacts to Special-Status Species.** The following best management practices shall be implemented to minimize indirect impacts to special-status species:

1. **Minimize construction impacts.** The construction limits shall be flagged prior to ground-disturbance activities, and all construction activities, including equipment staging and maintenance, shall be conducted within the flagged disturbance limits.
2. **Avoid Toxic Substances on Road Surfaces.** Soil binding and weighting agents used on unpaved surfaces shall be non-toxic to wildlife and plants.
3. **Minimize Spills of Hazardous Materials.** All vehicles and equipment shall be maintained in proper condition to minimize the potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials. Hazardous spills shall be immediately cleaned up and the contaminated soil shall be properly handled or disposed of at a licensed facility.
4. **Worker Guidelines.** All trash and food-related waste shall be placed in self-closing containers and removed regularly from the site to prevent overflow. Workers shall not feed wildlife or bring pets to the Project site.
5. **Workers Education.** All construction workers on site will attend an environmental training prior to beginning work on the Project. The training will detail the measures to be implemented to protect special-status species.

9.2 Impact BIO-3 – State and Federally Protected Wetlands and Waters

Potentially significant impacts to state and federally protected wetlands and waters discussed in Section 7.6, specifically the irrigation ditch and culverts and receiving waters of stormwater flows, may occur as a result of Project implementation. As currently designed, the Project is not anticipated to impact these hydrologic features. Potential indirect impacts to receiving waters will be mitigated through implementation of MM-BIO-3.1.

MM-BIO-3.1 **Water Resource Protection.** Potential jurisdictional waters outside of the proposed Project boundaries, including potential receiving waters shall be protected to the greatest extent possible. Specifically, these protection measures should include the following:

Establish temporary and/or permanent flagging or barriers between the Project site and the potential jurisdictional areas using highly visible materials during construction to ensure that these areas are not disturbed during construction. Long-term fencing will accommodate wildlife passage, where appropriate.

Develop and implement a SWPPP with specific protections for water quality related to flows entering potential jurisdictional waters. Components of the SWPPP should include the installation of BMPs to divert or filter stormwater prior to exiting the Project site.

When sizeable construction equipment is working near potential jurisdictional areas, it is highly encouraged that flaggers are utilized to assist in equipment positioning to avoid impacts during construction activities.

Excavated fill material shall not be placed in potential jurisdictional areas.

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APPENDIX A

Plant Species Observed During the Survey

APPENDIX A
Plant Species Observed on the Little Bear Solar Project Site

ARECACEAE

** *Washingtonia robusta* – Washington fan palm

ASTERACEAE

** *Acroptilon repens* – Russian knapweed
* *Lactuca serriola* – Prickly lettuce

BRASSICACEAE

** *Bassia hyssopifolia* – Fivehorn smotherweed

CONVOLVULACEAE

* *Convolvulus arvensis* – Field bindweed

POACEAE

* *Avena* sp. – Oat
* *Bromus* sp. – Brome
** *Cynodon dactylon* – Bermudagrass
* *Phalaris* sp. – Canarygrass

MALVACEAE

N *Malvella leprosa* – Alkali mallow
* *Malva parviflora* – Cheeseweed

N *Native Plant*
* *Non-native*
** *Invasive Non-native Plant*

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APPENDIX B

Wildlife Species Observed During the Survey

APPENDIX B
Wildlife Species Observed on the Little Bear Solar Project Site

BIRDS *

ACCIPITRIDAE (HAWKS)
Buteo jamaicensis –Red-tailed hawk

ALAUDIDAE (LARKS)
Eremophila alpestris – Horned lark

COLUMBIDAE (PIGEONS AND DOVES)
Zenaida macroura – Mourning dove

CORVIDAE (CROWS)
Corvus corax – Common raven

EMBERIZIDAE (SPARROWS AND ALLIES)
Artemisiospiza belli –Bell's sparrow

FRINGILLIDAE (FINCHES)
Carpodacus mexicanus – House finch

ICTERIDAE (BLACKBIRDS AND ORIOLES)
Agelaius phoeniceus – Red-winged blackbird
Euphagus cyanocephalus – Brewer's blackbird
Sturnella neglecta –Western meadowlark

LANIIDAE (SHRIKES)
Lanius ludovicianus – Loggerhead shrike

PASSERIDAE (OLD WORLD SPARROWS)
Passer domesticus – House sparrow

STRIGIDAE (TRUE OWL)
Athene cunicularia hypugaea – Western burrowing owl

STURNIDAE (STARLINGS AND ALLIES)
Sturnus vulgaris –European starling

MAMMALS

CANIDAE (DOGS)
Canus latrans –Coyote (Observed sign: tracks)

SCIUIRIDAE (SQUIRRELS)

Otospermophilus beecheyi –California ground squirrel

* Includes birds observed actively foraging/hunting over the site or perched on the ground on in vegetation. No nesting surveys were conducted.

APPENDIX C

Descriptions of Soils Occurring on the Project

APPENDIX C
Soil Descriptions

Based on review of the U.S. Department of Agriculture-Natural Resource Conservation Service web soil survey (USDA NCRS 2016a), the soils on the Project site and gen-tie alignment include Tranquility clay, Calfax clay loam, and Posochanet clay. A brief summary of the soils located on the project site is provided herein based on the series descriptions provided by the USDA NRCS because biological resources can often be associated with various substrates; this is particularly true of some special-status plant species and wetland resources. These soils vary widely in depth, fertility, and permeability.

A brief description of the surface soils present within the Project site based on the USDA NRCS Official Soil Series Descriptions (OSDs) (USDA NRCS 2016b) is provided below.

Tranquility Clay, Saline-Sodic, Wet, 0 to 1 Percent Slopes

The Tranquility series consists of very deep, somewhat poorly drained soils on fan skirts which formed in alluvium derived dominantly from calcareous sedimentary rock. In areas where this soil occurs, the mean annual precipitation is 8 inches and the mean annual air temperature is 63°F. These soils are used for irrigated crops such as cotton and wheat. They are also used for wildlife habitat on the west edge of Mendota Wildifle Management Area. Vegetation on wildlife management areas consists primarily of timothy, watergrass, and saltbush. This soil type is the most common throughout the project site.

Taxonomic class. Tranquility: Fine, smectitic, thermic Sodic Haploxererts

Typical Pedon

Ap1--0 to 6 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; strong coarse subangular blocky structure, extremely hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; violently effervescent, carbonates disseminated; calcium carbonate equivalent is 3 percent; electrical conductivity is 2.6 decisiemens per meter; sodium adsorption ratio is 14; moderately alkaline (pH 8.2); abrupt smooth boundary. (2 to 8 inches thick).

Ap2--6 to 16 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure, very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; violently effervescent, carbonates disseminated and segregated as few fine irregularly shaped concentrations; calcium carbonate equivalent is 4 percent; common fine irregularly shaped gypsum crystals; gypsum content is less than 1 percent; electrical conductivity is 8.7 decisiemens per meter; sodium adsorption ratio is 24; moderately alkaline (pH 8.3); abrupt smooth boundary. (8 to 18 inches thick).

Calfax Clay Loam, Saline-Sodic, Wet, 0 to 1 Percent Slopes

The Calfax series consists of very deep, moderately well drained soils on fan skirt formed in alluvium from calcareous sedimentary rock. In areas where this soil occurs, the mean annual precipitation is about 7 inches, and the mean annual air temperature is 63°F. These soils are used principally for crops such as cotton, seed alfalfa, sugar beets, wheat, and safflower. Native vegetation is annual grasses, forbs, and saltbrush. This soil type is present in the northwestern portion of the Project site and along the majority of the gen-tie alignment.

Taxonomic class. Calflax: Fine-loamy, mixed, superactive, thermic Sodic Haplocambids

Typical Pedon

Ap--0 to 8 inches; light yellowish brown (2.5Y 6/4) clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse subangular blocky structure parting to strong medium subangular blocky; hard, very friable, moderately sticky and moderately plastic; few fine and common medium and fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; electrical conductivity is 3.6 decisiemens per meter; sodium adsorption ratio is 4; slightly alkaline (pH 7.4); abrupt smooth boundary. (6 to 10 inches thick).

Bw--8 to 26 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate coarse prismatic and moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; electrical conductivity is 2.8 decisiemens per meter; sodium adsorption ratio is 5; slightly alkaline (pH 7.4); clear smooth boundary. (16 to 20 inches thick).

Posochanet Clay Loam, Saline-Sodic, Wet, 0 to 1 Percent Slopes

The Posochanet series consists of very deep, moderately well drained soils on fan skirt formed in stratified alluvium dominantly from calcareous sedimentary rock with influence from granitic rock sources in some areas. In areas where this soil occurs, the mean annual precipitation is about 7 inches, and the mean annual air temperature is 64°F. These soils are used for irrigated crops, mainly cotton, wheat, and seed alfalfa. Native vegetation is annual grasses and forbs. This soil type is present in the northwestern portion of the Project site and along the far eastern portion of the gen-tie alignment.

Taxonomic classes. Posochanet: Fine-silty, mixed, superactive, thermic Sodic Haplocambids

Typical Pedon

Ap1--0 to 7 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; coarse strong subangular blocky structure parting to moderate subangular blocky; very hard, friable, moderately sticky and moderately plastic; common very fine and few fine roots; common very fine and fine tubular pores; slightly effervescent, carbonates disseminated; electrical conductivity is 1.6 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 7.9); abrupt smooth boundary. (6 to 10 inches thick).

Ap2--7 to 15 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, friable, moderately sticky and moderately plastic; few very fine, fine and medium roots; common very fine and fine tubular pores; slightly effervescent, carbonates disseminated; electrical conductivity is 3.6 decisiemens per meter; sodium adsorption ratio is 9; moderately alkaline (pH 8.0); clear smooth boundary. (7 to 10 inches thick).

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APPENDIX D

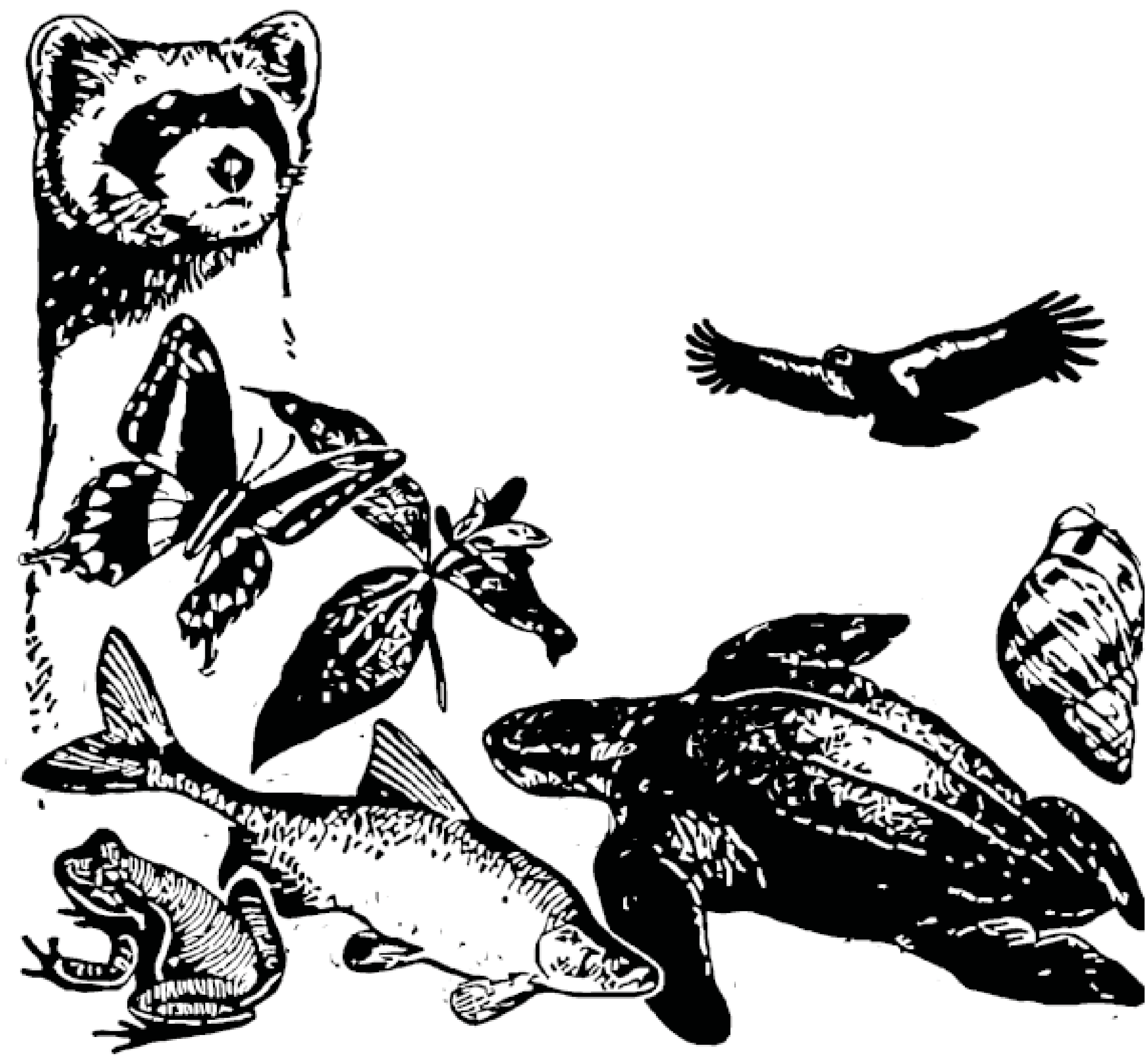
Results of 2016 United States Fish and Wildlife IPac Trust Resources Report

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

Generated November 22, 2016 06:29 PM MST, IPaC v3.0.10

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

Table of Contents

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

LOCATION

Fresno County, California

IPAC LINK

https://ecos.fws.gov/ipac/project/PQOVW-J4IVV-ED5EK-2HEHB-Y5XGCI

U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Amphibians

California Red-legged Frog Rana draytonii — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D02D

Crustaceans

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K03G

Fishes

Delta Smelt Hypomesus transpacificus — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E070

Flowering Plants

San Joaquin Wooly-threads Monolopia (=Lembertia) congdonii — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q34W

Mammals

Fresno Kangaroo Rat Dipodomys nitratoides exilis — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08O

Giant Kangaroo Rat Dipodomys ingens — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A08P

San Joaquin Kit Fox Vulpes macrotis mutica — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A006

Reptiles

Blunt-nosed Leopard Lizard Gambelia silus — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C001

Giant Garter Snake Thamnophis gigas — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C057

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

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1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The following species of migratory birds could potentially be affected by activities in this location:

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Burrowing Owl Athene cunicularia — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0NC

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Wintering

Lewis's Woodpecker Melanerpes lewis — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HQ

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern

Season: Year-round

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FY

Long-billed Curlew Numenius americanus — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06S

Marbled Godwit Limosa fedoa — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JL

Mountain Plover Charadrius montanus — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B078

Nuttall's Woodpecker Picoides nuttallii — Bird of conservation concern

Season: Year-round

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HT

Oak Titmouse Baeolophus inornatus — Bird of conservation concern

Season: Year-round

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MJ

Peregrine Falcon Falco peregrinus — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FU

Short-eared Owl Asio flammeus — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Swainson's Hawk Buteo swainsoni — Bird of conservation concern

Season: Breeding

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B070

Tricolored Blackbird Agelaius tricolor — Bird of conservation concern

Season: Year-round

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06P

Western Grebe aechmophorus occidentalis — Bird of conservation concern

Season: Wintering

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0EA

Wildlife refuges and fish hatcheries

There are no refuges or fish hatcheries in this location

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Wetland data is unavailable at this time.

APPENDIX E

Photo Documentation

APPENDIX E
Photo Documentation

	
Photo 1.Looking east from northeast corner.	Photo 2. Looking south form the northeast corner.
	
Photo 3. Looking north from the southeast corner.	Photo 4. Looking east from the southeast corner.

	
Photo 5. Looking west from the southwest corner.	Photo 6. Looking north from the southwest corner.
	
Photo 7. Looking east from the northwest corner.	Photo 8. Looking south from the northwest corner.

	
Photo 9. Looking northeast from the southwest corner.	Photo 10. Looking southeast from the northwest corner.
	
Photo 11. Looking north at the farm shed.	Photo 12. Looking northeast at the silos on the Project.

	
Photo 13. Looking east from the west along transmission line.	Photo 14. Looking east at terminus of transmission line.

APPENDIX F

Early San Joaquin Kit Fox (Vulpes macrotis mutica) Potential of Occurrence and Impacts for the Little Bear Solar Project

DUDEK
1801 OAK STREET, SUITE 165
BAKERSFIELD, CALIFORNIA 93301
T 661.369.5741

TECHNICAL MEMORANDUM

To:	First Solar, LLC
From:	Russell Sweet, Dudek
Subject:	Early San Joaquin Kit Fox (*Vulpes macrotis mutica*) Potential of Occurrence and Impacts for the Little Bear Solar Project
Date:	February 3, 2017
Attachment(s):	Figure 1 - Regional Map Figure 2 - Vicinity Map Figure 3 - San Joaquin Kit Fox Occurrences Appendix A - Photo Documentation

INTRODUCTION

This memo outlines the results for an early evaluation for potential of occurrence and impacts to San Joaquin kit fox (*Vulpes macrotis mutica*) for the Little Bear Solar Project (referred to hereafter as the "Project"). The Project will consist of the development of a solar photovoltaic (PV) power generating project on approximately 1,288 acres of private agricultural lands in western Fresno County.

PROJECT DESCRIPTION

The Little Bear Solar Project proposes to construct, own and operate an approximately 180 megawatt (MW) solar photovoltaic power generation facility (Project) on lands located near Mendota in Fresno County, California. The Project will consist of up to five facilities; two 20 MW facilities, one 40 MW facility and two 50 MW facilities. The Project will interconnect to the electrical grid at Pacific Gas and Electric's (PG&E) Mendota Substation, located approximately two miles west of the Project site. The Project is expected to require 12-14 months to construct.

The Project site is located in the San Joaquin Valley, approximately 13 miles east of Interstate 5 (I-5), approximately 2.5 miles southwest of the City of Mendota, and immediately west of State Route 33 (SR-33), in the western portion of the San Joaquin Valley, in unincorporated Fresno County, Sections 13 and 14, Township 14 South, Range 14 East, Mount Diablo Base and Meridian (MDBM). Specifically, the Project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, San Bernardino Avenue to the west, and SR-33 to the east. *Figures 1* and *2* show the location of the proposed Project on a regional and local perspective, respectively.

Methodology

A literature review was conducted to evaluate the environmental setting of the project and 10-mile radius surrounding the project, to identify special-status biological resources that may be found on the site. The review included the Initial Study, and a search of the California Natural Diversity Database (CNDDB) (California Department of Fish and Game, now California Department of Fish and Wildlife [CDFW] 2016) for the Broadway Farms, Cantua Creek, Chaney Ranch, Coit Ranch, Firebaugh, Levis, Mendota Dam, Monocline Ridge, and Tranquility 7.5-minute USGS quadrangles.

FIELD INVESTIGATION

A site visit was conducted by Dudek biologists Russell Sweet and Randall McInvale on November 29, 2016. Weather conditions during the site visit consisted of temperatures of 46 degrees Fahrenheit, winds ranging from 1-2 miles per hour. Visibility was fair due to 40% overcast skies throughout the survey effort. The site visit focused on SJKF habitat evaluation for the Project.

The entire site was evaluated for the presence, absence, or likelihood of occurrence of San Joaquin kit fox (SJKF). Focused surveys for SJKF were not conducted during the site visit as part of the habitat evaluation. However, parameters for potential suitable habitat were used referencing the *Kit Fox Habitat Evaluation Form* for San Luis Obispo County. Parameters included recovery importance, habitat condition, isolation, mortality, quantity of habitat impacted, recent observations, results of habitat impacts, and project shape.

RESULTS

Vegetation Communities/ Land Cover Types

At the time of the SJKF evaluation, one principal biotic habitat was present on site. The entire site, excluding farm service roadways and the area surrounding an existing metal storage shed and silo structure, was actively farmed and was completely disked. The Project site was likely under agricultural production with winter wheat and barley crops according to the National Agricultural Statistics Service (NRCS) CropScape website. There is an approximately 5000 square-foot metal storage shed with neighboring metal storage silos (approx. 2500 sq. ft.) located on parcel 019-110-06ST, just east of S. Ohio Avenue, which will be removed as part of Project construction. *Table 1* provides the parcel numbers which comprise the 1,288 acre Project site.

Table 1
Little Bear Project Site Parcel Numbers, Acreages, and Generating Capacity

Facility	Assessor's Parcel Number (APN)	Approximate Acreage	Approximate Generating Capacity (MWac)
Little Bear 1	019-110-04ST	161	40
	019-110-05ST	161	
Little Bear 3	019-110-06ST	161	20
Little Bear 4	019-110-03ST	322	50
Little Bear 5	019-110-13ST	322	50
Little Bear 6	019-110-13ST	161	20
	TOTAL	**1,288**	**180**

Known San Joaquin Kit Fox Occurrences within 10-miles

Based on database review, there are five documented occurrences of SJKF to occur within a 10-mile radius of the project site. Four of the five occurrences were recorded between 9 and 10 miles of the Project. One documented record was within 3 miles of the site and documented in February of 1947. GPS location for this recorded within the urban setting of the City of Mendota. More specifically, one male was observed on what is now 8th Street between Pucheu Street and Quince Street. *Figure 3* shows the location of SJKF within 10 miles of the Project.

Table 2
San Joaquin Kit Fox CNDDB Documented Occurrences within
10-Miles of the Proposed Project Site

Year Observed	CNDDB Occurrence Number	Location	General Notes and Updates
1997	82	California Aqueduct mile post 119.4, about 1.75 miles south of Manning Ave., 2.5 miles northeast of I-5, just north of Floral Ave., west of Lyon Ave.	One adult observed foraging in a small irrigation ditch, during a DWR spotlight survey.
1920	370	Approximately 5 miles west of Firebaugh	One male collected by Joseph Dixon and A. Oliver on Dec. 3, 1920.
1937	371	Panoche Creek, about 1.75 miles northeast of I-5 and 2 miles northwest of Chaney Road.	Observation made by Ward Russell and Sam Wells on Sept. 15, 1937.

Table 2
San Joaquin Kit Fox CNDDB Documented Occurrences within 10-Miles of the Proposed Project Site

Year Observed	CNDDB Occurrence Number	Location	General Notes and Updates
1947	373	Vicinity of Mendota. Review of GPS coordinates puts the observation within the urban setting of Mendota, on 8th St., between Pucheu St. and Quince St.	One male was observed by Carl Koford on Feb. 1, 1947.
1990	1117	Location was reported as Firebaugh. GPS coordinates place the record south of the intersection of W. Nees Ave. and Main St., Firebaugh, California.	Two foxes sighted by Gail Presley (DFG) in 1990.

* **Source:** CDFW. 2016. California Natural Diversity Database.

Potential for San Joaquin Kit Fox Occurrence

The entire area of the project site is proposed to be constructed and operated on highly disturbed agricultural land, and because agricultural operations have taken place on the project site for many years, this portion of the project site provides limited opportunities for special-status animal species to utilize the property including SJKF.

In addition, because the natural habitats that may have previously existed in the region have since been converted to agriculture, and ongoing farming practices such as disking, rodent and lagomorph control measures, and other activities required by farming that result in essentially continual disturbance to the land, no habitat for special-status plant species exists. However, the Kings Slough at the Mendota Wildlife Area is located approximately 2 miles east of the Project. The slough provides a variety of habitats for water fowl as well as threatened and endangered wildlife and plant species. Database searches provided no recorded observations of SJKF within the Mendota Wildlife Area.

No evidence of SJKF exists on site, and due to the low occurrence of dens on cultivated cropland in the geographic area, there is no evidence to conclude that project activities will result in a "take" of SJKF. In carrying out the project, the applicant will have the responsibility of complying with all applicable laws pertaining to the protection of threatened and endangered species including, but not limited to, the California Endangered Species Act (CESA) and the Federal Endangered Species Act (FESA). Protocols for determination of the existence of SJKF dens as determined by the CDFW are provided to the biologist as guidelines for determining the presence of threatened and endangered species. They are to be applied by the biologist using his or her best professional judgment. Further, protocol survey methodologies were designed to determine the presence of the species, not the absence. Because of the baseline and pre-baseline conditions of the project site (active agriculture), the biologist determined that conducting protocol surveys on the project site and surrounding flood-irrigated agriculture was not necessary. However, minimization measures have been drafted for preconstruction surveys to be implemented prior to construction; see below.

RECOMMENDATIONS FOR MITIGATION

For purposes of environmental review under the California Environmental Quality Act (CEQA), based on the scope of the Project and the Applicant's understanding of the environmental resources and potential impacts to those resources, it is anticipated that the County will prepare and certify an Environmental Impact Report (EIR) and Mitigation Monitoring and Reporting Program (MMRP). Mitigation Measures will be designed and reported within the EIR for the protection of SJKF. At a minimum, measures outlined within the 2011 *USFWS Standardized Recommendation for the Endangered San Joaquin Kit Fox prior to or During Ground Disturbance* will be adhered to for the Project. In addition, a cumulative impact analysis will be addressed with the EIR for SJKF as well as an analysis for other special-status plant and wildlife species with potential to occur on the proposed Project.

If you have any questions regarding the surveys or information found in this letter, please contact Mr. Russell Sweet at 661.936.5741. You may also reach Mr. Sweet at rsweet@dudek.com.

Sincerely,

Russell Sweet
Senior Biologist

LITERATURE CITED

California Department of Fish and Wildlife. 2016. California natural diversity database. The Resources Agency, Sacramento, CA. *accessed November 2016.*

USFWS (U.S. Fish and Wildlife Service). 2011. *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance.* Sacramento, California.

APPENDIX A

Photo Documentation

Appendix A
Photo Documentation

Photo 1. Looking east from northeast corner.

Photo 2. Looking south form the northeast corner.

Photo 3. Looking north from the southeast corner.

Photo 4. Looking east from the southeast corner.

Photo 5. Looking west from the southwest corner.

Photo 6. Looking north from the southwest corner.

Appendix A
Photo Documentation

Photo 7. Looking east from the northwest corner.

Photo 8. Looking south from the northwest corner.

Photo 9. Looking northeast from the southwest corner.

Photo 10. Looking southeast from the northwest corner.

Photo 11. Looking north at the farm shed.

Photo 12. Looking northeast at the silos on the Project.

Appendix A
Photo Documentation

	
Photo 13. Looking east from the west along transmission line.	Photo 14. Looking east at terminus of transmission line.

Appendix F2

Habitat Assessment and Protocol Surveys for Burrowing Owl at the Little Bear Solar Project Site

LSA

BERKELEY
CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

November 21, 2017

Dave Sterner
Manager of Siting and Permitting First Solar, Inc.
135 Main Street, 6th Floor
San Francisco, CA 94105

Subject: Habitat Assessment and Protocol Surveys for Burrowing Owl at the Little Bear Solar Project Site, Mendota, Fresno County, California

Dear Mr. Sterner:

LSA has prepared this burrowing owl (Athene cunicularia) habitat assessment and results of the protocol surveys for burrowing owl for the above-referenced project. The habitat assessment is used to determine the suitability of the habitat to support burrowing owls and whether or not occupancy surveys for burrowing owl are warranted. The habitat assessment and surveys were conducted in accordance with the guidelines of the 2012 California Department of Fish and Wildlife (formerly California Department of Fish and Game) Staff Report on Burrowing Owl Mitigation (the "Staff Report").[1]

DESCRIPTION OF PROJECT SITE

The Little Bear Solar Project is an approximately 180-megawatt solar photovoltaic project proposed to be constructed on agricultural land near the city of Mendota in unincorporated Fresno County. The approximately 1,288- acre project site is located in the western portion of the San Joaquin Valley, approximately 13 miles (mi) east of Interstate 5 (I-5), approximately 1.9 mi southwest of Mendota (Figure 1). Specifically, the project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, South San Bernardino Avenue to the west, and South Derrick Avenue (State Route 33) to the east (Figure 2).

The project site has flat topography at an average elevation of 200 feet above mean sea level. With the exception of the North Star Solar Project located on the north side of West California Avenue, the adjacent land uses are comprised of agricultural land uses. The agricultural lands located west of South San Bernardino Avenue are comprised of highly managed pistachio and pomegranate orchards. On site, and to the south, northeast and east, winter wheat crops are the dominant vegetation type. Though historically irrigated, the project site no longer has rights to water from the local irrigation district. Consequently, winter wheat crops do not receive supplemental water, and are dependent on the rain events during the rainy season. The wheat crops are typically planted in late fall or early winter, and by early spring reach heights of over 3 feet; crops are harvested in the late spring, typically in May or June. The harvesting process results in vegetative stubble that averages up to 1 foot in height. In anticipation of planting in the fall, during the summer, sheep are

[1] California Department of Fish and Game. 2012. Staff Report On Burrowing Owl Mitigation. Sacramento, CA. 34 pp.

used to graze the stubble to ground level. Russian thistle (*Salsola tragus*), saltbush (*Atriplex* sp.), and field bindweed (*Convolvulus arvensis*) also occur intermittently throughout the row crops in the eastern portion of the project site. Unmanaged crop vegetation also occurs along the edges of the row crops and paved roadways, including the dirt access roads and other areas on the project site that are not actively farmed (e.g., near water pumps and farm supplies).

Ohio Avenue, South Ohio Avenue, and an unnamed dirt road bisects the project site north to south at 0.5-mi intervals, connecting the adjacent developed roadways. West Adams Avenue bisects the project site east to west (Figure 2).

HABITAT ASSESSMENT

Per the Staff Report, suitable burrow habitat includes, but is not limited to, short or sparse vegetation, the presence of burrows, burrow surrogates or presence of fossorial mammal dens (e.g., California ground squirrel burrows (*Otospermophilus beecheyi*), well-drained soils, and abundant and available prey. Burrow surrogates include culverts, piles of concrete rubble, piles of soil, burrows created along soft banks of ditches and canals, pipes, and similar structures. Suitable foraging habitat for burrowing owls is defined as habitat that supports short or sparse vegetation. The height of the vegetation is also important in determining the suitability of burrows and foraging habitat. Burrowing owls must be able to observe potential predators from the burrow entrance and during foraging for food. The height of vegetation in the vicinity of the burrow entrance or during foraging cannot obscure the owl's view of potential predators. Per the Staff Report, suitable foraging habitat is vegetation that measures less than 2.5 feet in height.

Methods

The habitat assessment consisted of performing a records search, reviewing aerial photos of the project site and surrounding lands, and conducting a field survey.

Prior to conducting the field survey component of the habitat assessment, LSA performed a query of the California Natural Diversity Database (CNDDB)[1] for burrowing owl records within the vicinity of the project site.

LSA biologists Laura Belt, David Muth, Stefan de Barros, and Julie McNamara conducted a protocol burrowing owl field habitat assessment survey on Monday, June 20, 2016. The survey included the limits of the project site, and all suitable burrow habitat on and within 500 feet of the project site.

Adjacent habitat that was inaccessible was surveyed by scanning with high-powered binoculars. The surveys consisted of walking parallel transects spaced up to 60 feet apart, on average depending on the height of the vegetation, to ensure complete visual coverage. At the start of each transect and every 300 feet, the entire visible project area was scanned for burrowing owls using binoculars. The biologists also listened for burrowing owls that may be vocalizing. All suitable burrows or burrow

[1] California Department of Fish and Wildlife. 2016. Query of the California Natural Diversity Database for burrowing owl occurrences within 10 miles of the project site. Biogeographic Data Branch, California Department of Fish and Game, Sacramento.

surrogates within the survey area were mapped in the field, and sign suggesting the presence of burrowing owls, was recorded. Sign of the presence of burrowing owls includes its tracks, molted feathers, cast pellets (defined as 1-2 inch long brown to black regurgitated pellets consisting of non-digestible portions of the owls' diet, such as fur, bones, claws, beetle fragments, or feathers), prey remains, egg shell fragments, owl white wash, nest burrow decoration materials (e.g., paper, foil, plastic items, livestock or other animal manure), and possible owl perch sites (e.g. wooden or metal posts, well head and water pump structures). Representative photos were also taken to record the results of the habitat assessment survey and are included Figure 5., attached.

Known Occurrences in the Project Area

During protocol breeding season (February 1 through August 31) and non-breeding season (September 1 through January 31) surveys conducted by LSA on the western half of the project site (Section 14) in 2014-2015, a single burrowing owl was observed along South San Bernardino Avenue on December 10, 2014, December 30, 2014 and January 15, 2015 (Figure 3). (The 2014-2015 surveys were conducted for an earlier, smaller (640-acre) iteration of the Little Bear Solar Project. That proposal was rescinded by the applicant and the expanded project on 1,288 acres was proposed in its place.)

During the second of two protocol breeding season surveys conducted on the 1,288-acre site in 2016, a single burrowing owl was observed along the south side of West Jensen Avenue, at the intersection of Ohio Avenue on July 12, 2016 (Figure 3). Based on these observations of a single burrowing owl during the winter of 2014/2015 and the summer of 2016, it was determined that individual burrowing owls were likely dispersing from nesting locations off the project site and using the project site for foraging. No other burrowing owls were observed during the course of these surveys.

There are two CNDDB documented occurrence of burrowing owls within 5 mi of the project site. The closest occurrence is located approximately 3 mi southeast of the project site, along the canal bank of Sante Fe Grade. The occurrence cites that two burrowing owls were observed at an active burrow in May 1991. The other occurrence is approximately 4 mi south-southeast of the project site, along the east bank of the San Luis Drain. The occurrence cites the observation of suitable burrows, and adult and juvenile burrowing owls observed on July 12, 1989.

Results

The majority of the western section (Section 14) of the project site appeared to have been grazed by sheep and active sheep grazing was observed on the southwestern section of the project site. The remaining harvested winter wheat crop stubble was grazed to ground level, and there was sheep scat observed throughout the western project limits. During the summer and early fall, these grazed areas provide marginally suitable foraging habitat for burrowing owls. No burrowing owls were observed during the habitat assessment survey, however, white wash was observed at the previously identified concrete structure that provides suitable surrogate burrow habitat. The concrete structure is located along South San Bernardino Avenue, approximately 0.75 mi south of West California Avenue. California ground squirrel burrows and sign of the presence of ground squirrels were also present (Figure 3 and Figure 5a).

A total of 15 California ground squirrel burrows, were observed along the perimeter of the project on West Jenson Avenue, in the vicinity of Ohio Avenue located approximately 0.5 mi east of South Ohio Avenue. Five suitable burrows were observed around a concrete wellhead located on the south west side of the intersection, three burrows were observed at a culvert outfall pipe on the south side of the West Jenson Avenue, east of South Ohio Avenue, and seven burrows were observed at an above ground abandoned water pipe structure, located on the north side of the road, directly north of the culvert outfall pipe. One burrowing owl sized pellet casting and white wash was observed at the burrow complex located near the culvert outfall pipe (see Figure 5b, attached). No other suitable burrowing owl habitat was observed at the project site.

Since the results of the habitat assessment survey revealed that suitable burrow habitat occurs on the project site, and during previous protocol surveys conducted during the non-breeding season a single burrowing was observed at a burrow site on Section 14 of the project site along South San Bernardino Avenue on December 10, 2014, protocol surveys (non-breeding season and breeding season) were conducted to determine if burrowing owl were present on the 1,288 acre project site.

PROTOCOL SURVEYS

Methods

LSA biologists conducted four protocol-level non-breeding burrowing owl surveys between September 2016 and January 2017, and four protocol-level breeding season burrowing owl surveys between February 2017 and July 2017, all in accordance with guidelines in the Staff Report. The surveys generally consisted of both a daytime (sunrise) survey and late afternoon (sunset) survey in order to increase the potential of observing burrowing owls. The survey included the extent of the project site and included the identification of all suitable burrow habitat (e.g., California ground squirrel burrows, manmade culverts and pipes) on and within 500 feet of the project site. Adjacent habitat that was inaccessible was surveyed by scanning with high-powered binoculars. The surveys consisted of walking parallel transects spaced up to 60 feet apart, on average depending on the height of the vegetation, to ensure complete visual coverage. At the start of each transect and every 300 feet, the entire visible project area was scanned for burrowing owls using binoculars. The biologists also listened for burrowing owls that may be vocalizing. All suitable burrows or burrow surrogates (e.g., manmade culverts and pipes) within the survey area were mapped in the field, and the presence of burrowing owls, including pellet castings, prey remains, whitewash, feathers or decoration, if any, was recorded. Representative photos were also taken to record the results of the non-breeding and breeding season surveys and are included Figure 6. and Figure 7., attached.

Results

Table A summarizes the results of each non-breeding season and breeding season survey.

Table A: Table A: Burrowing Owl Protocol Surveys Descriptions and Summary Results

	Date	Time	Survey Conditions Site Conditions	Observations	Surveyors
Non-Breeding Season					
Survey 1	September 19, 2016	1700 - 2115	90°F, no cloud cover; no wind Vegetation grazed to ground level and the site disked	One burrowing owl was observed along West Jensen Avenue. Suitable burrows occur along the perimeter of the project limits.	Laura Belt, Stefan de Barros and Julie McNamara
	September 20, 2016	0545 - 1315	60°F, no cloud cover; wind up to 10 mph Vegetation grazed to ground level and ground disked	One burrowing owl was observed along West Jensen Avenue. Suitable burrows occur along the perimeter of the project limits.	Laura Belt, Stefan de Barros and Julie McNamara
Survey 2	October 19, 2016	1650 - 1915	65°F, no cloud cover; wind up to 5 mph Vegetation grazed to ground level and ground disked	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, David Muth and Julie McNamara
	October 20, 2016	0615 - 1415	60°F, no cloud cover; wind up to 10 mph Vegetation grazed to ground level and ground disked	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, David Muth and Julie McNamara
Survey 3	December 13, 2016	1600 - 1730	66°F, high, thin cloud cover; wind up to 5 mph Site disked and planted with winter wheat	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, Julie McNamara and Nicole Clement
	December 14, 2016	0630 -1230	46°F, with low, thick cloud cover; wind up to 5 mph Site disked and planted with winter wheat	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, Julie McNamara and Nicole Clement
Survey 4	January 26, 2017,	1630 -1800	54°F, with high, thin cloud cover; wind up to 5 mph Vegetation averaged 1 to 3 inches height	One burrowing owl was observed along South San Bernardino Avenue. Suitable burrows occur along the perimeter of the project limits.	Laura Belt, Julie McNamara and Joey Bena
	January 27, 2017,	0830-1230	50°F, intermittent cloud cover; wind up to 5 mph Vegetation averaged 1 to 3 inches height	One burrowing owl was observed along South San Bernardino Avenue. Suitable burrows occur along the perimeter of the project limits.	Laura Belt, Julie McNamara and Joey Bena
Breeding Season					
Survey 1	February 23, 2017	1030- 1430	50°F, no cloud cover; wind up to 5 mph Vegetation averaged 1 to 2.5 feet in height	No burrowing owls were observed. No burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits.	Laura Belt, Julie McNamara, and Nicole Clement
	February 23, 2017,	1720 - 1850	55°F, no cloud cover; wind up to 5 mph Vegetation averaged 1 to 2.5 feet in height	No burrowing owls were observed. No burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits. Multiple vehicles and workers at location where a burrowing owl was observed In January 2017. Signs of presence of large raptors (foraging) on site.	Laura Belt, Julie McNamara, and Nicole Clement
	February 24, 2017	0735 - 0945	49°F, no cloud cover; wind up to 5mph. Vegetation averaged 1 to 2.5 feet in height	No burrowing owls were observed. No new burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits. Multiple vehicles and workers at the location where a burrowing owl was observed In January 2017. Signs of presence of large raptors (foraging) on site.	Laura Belt, Julie McNamara and Nicole Clement
Survey 2	April 19, 2017	0800 - 1430	50°F, no cloud cover; wind up to 5 mph. Vegetation averaged 3 feet in height	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, Dan Williams and Joey Bena
	April 19, 2017	1830 -2130	68°F, no cloud cover; wind up to 5 mph. Vegetation averaged 3 feet in height	No burrowing owls were observed. Burrowing owl sign was observed outside of the project limits. Suitable burrows occur along the perimeter of the project limits. Signs of presence of large raptors (foraging) on site.	Laura Belt, Dan Williams and Joey Bena
Survey 3	May 24, 2017	0700-1000	64°F, partly cloudy; wind up to 5 mph Vegetation averaged 3 feet in height	No burrowing owls were observed. No new burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits. Signs of target practice were observed at the location where a burrowing owl was observed in January 2017.	Dan Williams, Anna Van Zuuk and Joey Bena
	May 24, 2017	1900-2100	84°F, partly cloudy; wind up to 10 mph Vegetation averaged 3 feet in height	No burrowing owls were observed. No new burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits.	Dan Williams, Anna Van Zuuk and Joey Bena David Muth
Survey 4	July 12, 2017	1930-2100	93°F , partly cloudy; wind up to 5 mph Vegetation mowed to 1 foot in height.	No burrowing owls were observed. No new burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits.	Dan Williams, Anna Van Zuuk and David Muth
	July 13, 2017	0700-0900	68 °F, partly cloudy winds calm Vegetation mowed to 1 foot in height.	No burrowing owls were observed. No new burrowing owl sign was observed. Suitable burrows occur along the perimeter of the project limits.	Dan Williams, Anna Van Zuuk and David Muth

Non-Breeding Season Surveys

During the first non-breeding season surveys conducted in the fall of 2016 on September 19 and 20, 2016, a single burrowing owl was observed in a burrow located on the north side of West Jensen Avenue, and the east side of Ohio Avenue (Figure 6a and 6b). Six additional suitable burrows were observed immediately adjacent to the burrowing owl, and 8 suitable burrows were observed on the south side of W. Jensen Avenue within 25 feet of the observed owl. Maintenance activities associated with the pomegranate and pistachio orchards located along the west side of the South San Bernardino Avenue roadway were ongoing, and are depicted in Figure 6c, attached. Suitable burrows were also observed along the perimeter of the project limits on South San Bernardino Avenue, on the project site and within 25 feet of the project site and are depicted in Figure 4 and Figure 6d.

No burrowing owls were observed during the second and third non-breeding season surveys conducted on October 19 and 20, 2016 and December 13 and 14, 2016. During the October 2016 survey a total of 8 suitable burrows were observed on the project site, and a single burrowing owl pellet casting was observed on a concrete structure locate on the project site on South San Bernardino Avenue as depicted in Figure 6e, attached. During the December 2016 survey, a total of 10 suitable burrows were observed on the north side of West Jensen Avenue and Ohio Avenue as depicted in Figure 6f, attached. LSA observed that the majority of the vegetation on the project site had been grazed, and the site had been disked. During the third survey LSA observed that the site was re-disked and planted with winter wheat. No suitable burrows were observed at the concrete culvert structure on South San Bernardino Avenue as depicted in Figure 6g, attached.

During the fourth and final non-breeding season survey conducted in the winter of 2016 on January 26 and 27, 2017, a single burrowing owl was observed perched on top of a concrete culvert located on east side of South San Bernardino Avenue (Figure 6h, attached); white wash was also observed on top of the culvert, as depicted in Figure 6i attached. One suitable burrow was observed approximately 10 feet from the burrowing owl and 14 suitable burrows were observed on the project site and along the perimeter of the project limits and are depicted in Figure 4 and Figure 6j, attached.

On the project site, American kestrels were observed foraging during the sunrise survey. During the sunset survey, barn owls were observed foraging on site. Signs of the presence of barn owls and other large hawks (foraging) on site in the form of pellet castings, feathers and large whitewash on top of concrete structures were observed on the project site along South San Bernardino Avenue and West Jensen Avenue were also observed. At the West Jensen Avenue at Ohio Avenue burrow site, the presence of mammal scat at the burrows, likely coyote, and larger mammal prey remains were also observed at the burrow complex.

During all four surveys, signs of the presence of burrowing owls (i.e., white wash, pellet castings, prey remains) were observed at manmade structures located in the vicinity of burrows located on the project site, and within 25 feet of the project site, however no burrowing owl sign was observed at the burrow entrances.

Breeding Season Surveys

The breeding season surveys began in the early spring on February 23 and 24, and continued on April 19, 2017, May 24 and into the summer on July 12 and 13, 2017; no burrowing owls were observed at the project or vicinity and no new burrowing owl sign was observed at the project. Suitable burrows were observed in the same locations as during the non-breeding season, along South San Bernardino Avenue in the west on West Jensen Avenue in the southern limits of the project site.

During the course of the first and second surveys, LSA observed that the majority of the wheat crop on the project averaged 1 to 2.5 feet in height. During the third survey, the height of the wheat crop averaged 3 feet. During the fourth and final survey, the wheat had been mowed to 1 foot in height.

During the first survey conducted on February 23 and 24, 2017, no burrowing owls were observed. The maintenance activities in the neighboring pomegranate and pistachio orchards (first observed during the January 2017 non-breeding season survey) were ongoing throughout the course of the breeding season surveys and are depicted in Figure 7a, attached. Observations of signs of the presence of large owls (foraging) on site also persisted. A total of 16 suitable burrows were observed on the project site (Figure 4 and Figure 7b).

During the second survey conducted on April 19, 2017, no burrowing owls were observed (Representative Photo M, attached). Burrowing owl sign was observed on top of concrete well structures and water pumps located approximately 25 feet outside of the project limits South San Bernardino Avenue and South Jensen Avenue. A total of 4 suitable burrows were observed at West Jensen Avenue and Ohio Avenue on the project site (Figure 7c, attached), and a total of 2 suitable burrows were observed at West Jensen Avenue and South San Bernardino Avenue. Several suitable burrows were observed within 25 feet of the project site along the perimeter of the project limits.

During the third survey conducted on May 24, 2017, no suitable burrows were observed at the concrete culvert structure on South San Bernardino Avenue as depicted in Figure 7d, attached. A total of 6 suitable burrows were observed on the project site at West Jensen Avenue and Ohio Avenue as depicted in Figure 7e, attached. No burrowing owls were observed.

During the fourth and final breeding season survey conducted on July 12 and 13, 2017, no burrowing owls were observed. No new burrowing owl sign was observed on the project site. A total of 6 suitable burrows occurred on the project site, and a total of 8 suitable burrows occurred with 25 feet of the project area, along the perimeter of the project limits as depicted in the views of the West Jensen Avenue and Ohio Avenue site (Figure 7f and g).

Similar to the non-breeding season surveys, during all four surveys, signs of the presence of burrowing owls (i.e., white wash, pellet castings, prey remains) were observed at manmade structures located in the vicinity of burrows located on the project site, and within 25 feet of the project site. However no burrowing owl sign was observed at the burrow entrances.

CONCLUSION

LSA identified numerous suitable burrows and burrow surrogates during the habitat assessment and protocol non-breeding and breeding season surveys along the exterior roadways of the project site and in the vicinity of manmade structures where the soil was compacted. These areas may provide limited and periodic opportunistic use of the site by individual burrowing owls during the non-breeding and breeding season. Management activities associated with the wheat crop resulted in limited availability of foraging habitat for burrowing owls. Human presence at the burrow sites, coupled with pressure from natural predators at the burrow sites likely precludes owls from using the project site for nesting. Although a single burrowing owl was observed on the project site during the non-breeding season surveys, the lack of sign at any of the suitable burrow sites indicates that the burrowing owl is not using the project site for nesting and is likely only utilizing the perimeter of the project site for foraging and as potential shelter from predators.

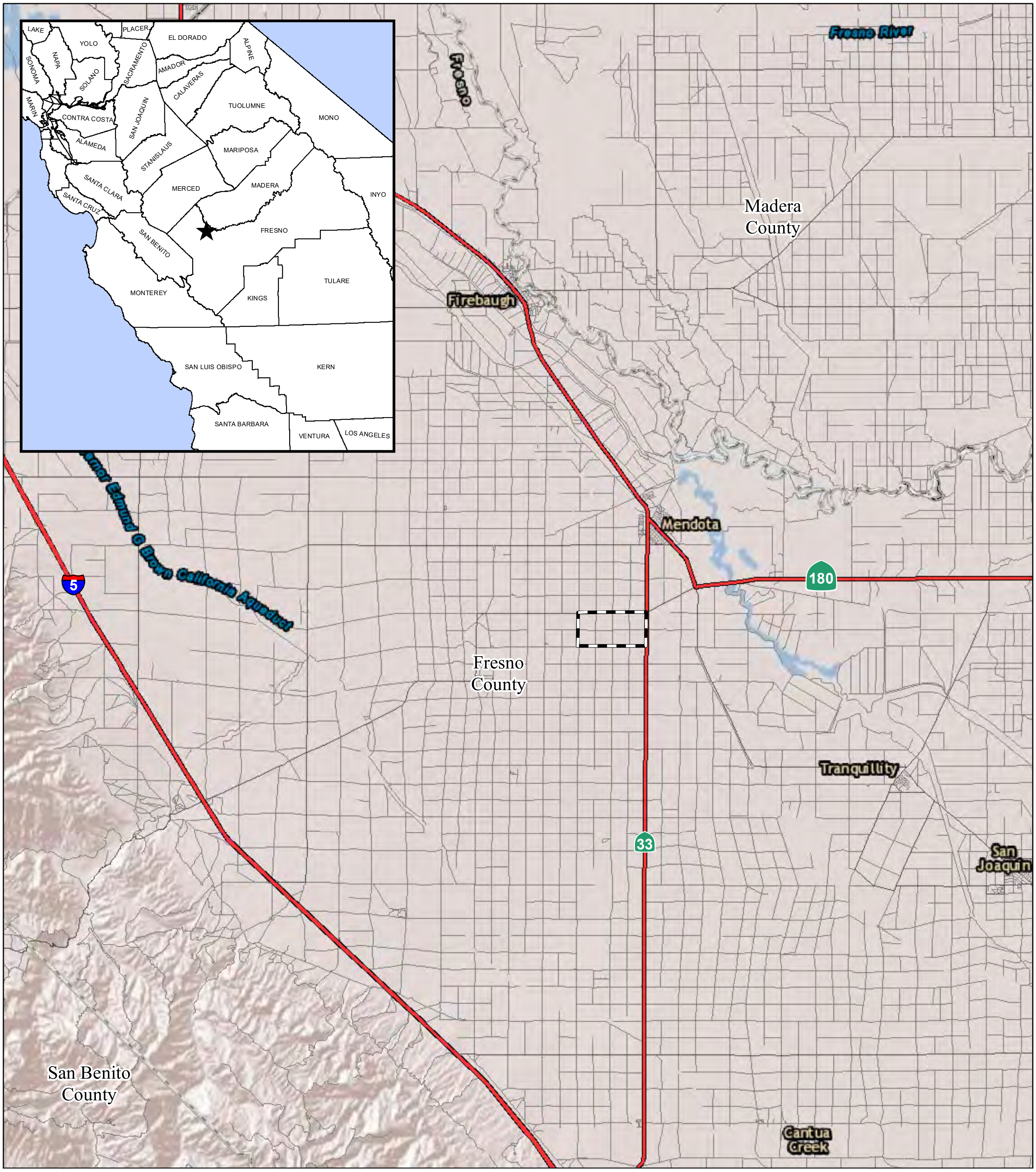
Please contact me if you have any questions or require additional information.

Sincerely,

LSA Associates, Inc.

Laura Belt
Senior Biologist/Project Manager

Attachments:
Figure 1: Regional and Project Location
Figure 2: Suitable Burrowing Owl Burrows/Burrow Surrogates within 500 Feet of the Project Site
Figure 3: 2014/2015 Little Bear West (Section 14) Burrowing Owl Observations
Figure 4: 2016/2017 Little Bear Burrowing Owl Non-Breeding and Breeding Season Observations
Figure 5: Habitat Assessment Survey Representative Photos
Figure 6: Non-Breeding Season Survey Representative Photos
Figure 7: Breeding Season Survey Representative Photos



LSA

LEGEND

Little Bear Solar Project

FIGURE 1

N

0 2 4

MILES

SOURCE: ESRI Imagery (4/2008)

Little Bear Solar Project
Little Bear Solar 1, LLC, Little Bear Solar 2, LLC
Little Bear Solar 3, LLC, and Little Bear Solar 4, LLC
Fresno County, California

Regional Location

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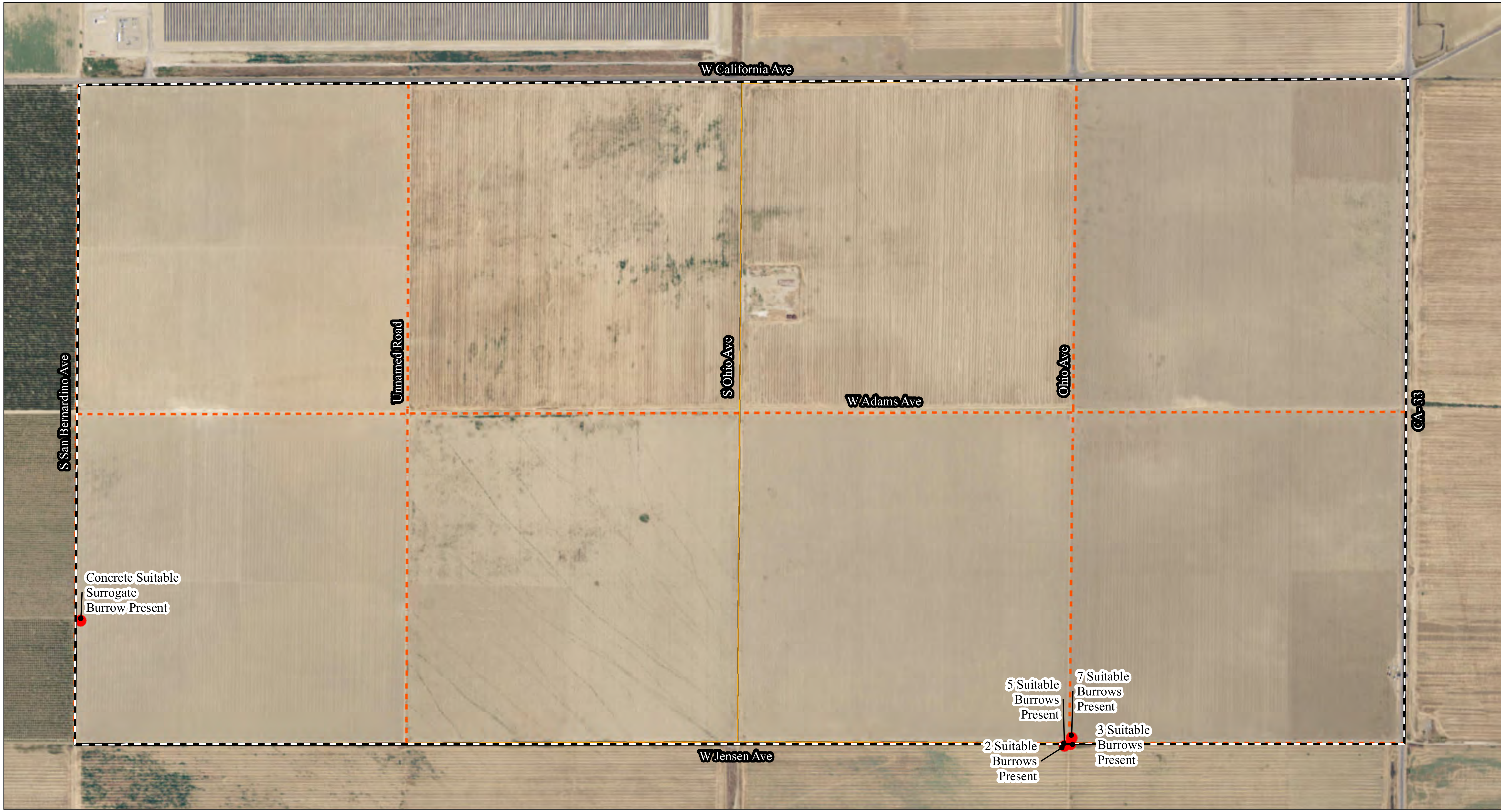

LSA

LEGEND

- Little Bear Solar Project
- Survey Sections
- Dirt Roads
- Suitable Burrows/ Burrow Surrogates

N

0 375 750
FEET

FIGURE 2

Little Bear Solar Project
Fresno County, California

Suitable Burrowing Owl Burrows/Burrow Surrogates
within 500 Feet of the Project Site

SOURCE: Basemap - NAIP Aerial Imagery (2016); Mapping - LSA (2016)

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FIGURE 3

Little Bear Solar Project
Fresno County, California

Known Occurences of Burrowing Owls in the Project Area

SOURCE: Basemap - NAIP Aerial Imagery (2016); Mapping - LSA (2016)

I:\Fts1408\GIS\HA_Fig3_BuOw_Occ.mxd (11/20/2017)

LSA

LEGEND

- Little Bear Solar Project
- Survey Sections
- Dirt Roads
- 2016 Suitable Burrows/ Burrow Surrogates
- 2017 Suitable Burrows/ Burrow Surrogates
- Burrowing Owl Observations

0 375 750
FEET

SOURCE: Basemap - NAIP Aerial Imagery (2016); Mapping - LSA (2017)

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FIGURE 4

Little Bear Solar Project
Fresno County, California

Non-Breeding and Breeding Season 2016/2017: Suitable Burrowing Owl Burrows/Burrow Surrogates within 500 Feet of the Project Area

Figure 5: Habitat Assessment REPRESENTATIVE PHOTOS

Figure 5a: View of concrete structure that provides suitable surrogate burrowing owl habitat located along South San Bernardino Avenue, 0.75 mile south of West California Avenue, looking south. Suitable California ground squirrel burrows located along the perimeter of the structure (June 20, 2016). (Location where a single burrowing owl was observed in December 2014).

View of abandoned water pump and pipe, and California ground squirrel burrows that provide suitable habitat for burrowing owls, located 20 feet north of West Jensen Avenue 0.50 mile east of South Ohio Avenue, looking north (June 20, 2016).

Figure 6: Non-Breeding Season REPRESENTATIVE PHOTOS

Photo 6a: View of a single juvenile burrowing owl observed in the project limits during sunset survey on September 19, 2016. The owl was perched in a burrow located on the north side of West Jensen Avenue and the east side of Ohio Avenue. View of abandoned water pump pipe in background.

Photo 6b: Close-up view of the single juvenile burrowing owl observed on the project site, just before sunset on September 19, 2016.

Photo 6c: View of pistachio orchard and harvesting activities, on the west side of the project site on South San Bernardino Avenue (September 20, 2016).

Photo 6d: View of abandoned well head structure located on the east side of South San Bernardino Avenue, 0.75 mile south of West California Avenue, with suitable burrows (October 20, 2016). One burrowing owl sized pellet casting was observed on top of structure. No burrowing owls were observed.


Photo 6e: Close-up view of single burrowing owl sized pellet casting on top of concrete structure on October 20, 2016.

Photo 6f: View of abandoned water pump pipe during sunset survey conducted on December 13, 2016, with no burrowing owl or sign of the recent presence of burrowing owls. The suitable burrow complex is located on the north side of West Jensen Avenue and the east side of Ohio Avenue.

Photo 6g: View of abandoned well head structure located on the east side of South San Bernardino Avenue, 0.75 mile south of West California Avenue, with suitable burrows (December 14, 2016). No suitable burrows   and no new burrowing owl sign were observed.

Photo 6h: View of single adult burrowing owl observed in the project limits during the daytime survey on January 27, 2017. The owl was perched on the concrete structure located along South San Bernardino Avenue, 0.75 mile south of West California Avenue. Additionally, the owl was seen at this location during the sunset survey on January 26, 2017.

Photo 6i: View of burrowing owl size sign (whitewash) on top pf the concrete structure where the burrowing owl was observed on January 26 & 27, 2017.

Photo 6j: View of the abandoned water pump and pipe during sunset survey, on the north side of West Jensen Avenue on the east side of Ohio Avenue, which shows continued predator use (large prey remains and large scat) on January 26, 2017. There were no burrowing owls observed or signs of the recent presence of burrowing owls.

Figure 7: Breeding Season Representative Photos

Photo 7a: View from South San Bernardino Avenue abandoned concrete well structure, looking west. Ongoing management activities associated with the pomegranate orchard were observed on February 23 & 24, 2017.

Photo 7b: View of the abandoned water pump pipe located on the north side of West Jensen Avenue and the east side of Ohio Avenue. No burrowing owls or sign of the presence of burrowing owls was observed (February 23, 2017). View of the height of the winter wheat crop ranging from 1 foot to over 2.5 feet throughout the project area (February 23, 2017).

Photo 7c: View looking northeast View of the abandoned water pump pipe located on the north side of West Jensen Avenue and the east side of Ohio Avenue. No burrowing owls or sign of the presence of burrowing owls was observed. The average height of the crop throughout the project area was 3 feet (April 19, 2017).

Photo 7d: View of the abandoned concrete structure located along San Bernardino Avenue, 0.75 mi south of West California Avenue, where a burrowing owl was observed during the final non-breeding season surveys conducted on January 26 & 27, 2017. No burrowing owls, sign of the presence of burrowing owls, or suitable surrogate burrows were observed at this location (May 24, 2017).

Photo 7e: View looking northwest of the abandoned water pump pipe located on the north side of West Jensen Avenue and the east side of Ohio Avenue. No burrowing owls or sign of the presence of burrowing owls was observed (May 24, 2017).

Photo 7f: View northeast at concrete culvert and abandoned water pump pipe just north of West Jensen Avenue and just east of Ohio Avenue. No burrowing owls or sign of the presence of burrowing owls were observed at this location (July 12, 2017).

Photo 7g: View northeast at pipe with ground squirrel burrows along the south side of West Jensen Avenue just east of Ohio Avenue. No burrowing owls or sign of the presence of burrowing owls was observed (July 12, 2017).

Appendix F3

Results of Protocol-Level Nesting Swainson's Hawk Surveys for the Little Bear Solar Project

LSA

BERKELEY
CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

MEMORANDUM

DATE: October 18, 2017

TO: Dave Sterner, Manager of Siting and Permitting, First Solar

FROM: Dan Williams, LSA

SUBJECT: Results of Protocol-Level Nesting Swainson's Hawk Surveys for the Little Bear Solar Project, Mendota, Fresno County

Below is a summary of the results of the 2017 focused surveys for nesting Swainson's hawks conducted for the Little Bear Solar Project, near Mendota in Fresno County.

DESCRIPTION OF PROJECT SITE

The Little Bear Solar Project is an approximately 180-megawatt solar photovoltaic project proposed to be constructed on agricultural land near the city of Mendota in unincorporated Fresno County. The approximately 1,288- acre project site is located in the western portion of the San Joaquin Valley, approximately 13 miles (mi) east of Interstate 5 (I-5), approximately 1.9 mi southwest of Mendota (Figure 1). Specifically, the project site is bounded by West California Avenue to the north, West Jensen Avenue to the south, South San Bernardino Avenue to the west, and South Derrick Avenue (State Route 33) to the east (Figure 2).

The project site has flat topography at an average elevation of 200 feet above mean sea level. With the exception of the North Star Solar Project located on the north side of West California Avenue, the adjacent land uses are comprised of rural residences and agricultural lands. No trees occur on the project site. The agricultural lands located west of South San Bernardino Avenue are comprised of highly managed pistachio and pomegranate orchards. On site, and to the south and east, winter wheat crops are the dominant vegetation type. Though historically irrigated, the project site no longer has rights to water from the local irrigation district. Consequently, the success of the crops is dependent on natural precipitation during the rainy season. The wheat crops are typically planted in late fall or early winter, and by early spring reach heights of over 3 feet; crops are harvested in the late spring or early summer, typically in May or June. The harvesting process results in vegetative stubble that averages up to 1 foot in height (see Representative Photos A and B, attached). In anticipation of fall planting, sheep are used to graze the stubble to ground level during summer months. Russian thistle (*Salsola tragus*), saltbush (*Atriplex* sp.), and field bindweed (*Convolvulus arvensis*) also occur intermittently throughout the crops in the eastern portion of the project site. Unmanaged crop vegetation also occurs along the edges of the fields and paved roadways, including the dirt access roads and other areas on the project site that are not actively farmed (e.g., near water pumps and farm supplies) (Figure 3).

Dirt roads bisect the project site north to south and east to west at 0.5-mi intervals, connecting to the adjacent developed roadways. South Ohio Avenue bisects the project site north to south at 1 mi

201 Creekside Ridge Court, Suite 250, Roseville, California 95678 916.772.7450 www.lsa.net

east of San Bernardino Avenue, and West Adams Avenue bisects the project site east to west, at 0.5 mi south of West California Avenue (Figure 3).

PROXIMITY OF SUITABLE NESTING HABITAT FOR SWAINSON'S HAWKS TO THE PROJECT SITE

Swainson's hawks generally nest in trees in annual grasslands and riparian corridors. Common nest trees include conifers, cottonwoods, oaks and willows. Swainson's hawks will also nest in non-native trees, and when trees are scarce Swainson's hawks may occasionally build nests on top of utility poles.

As previously mentioned, no trees occur on the project site. Land uses in within a 1-mi and 5-mi radius are primarily croplands and orchards. The pistachio and pomegranate orchards located on the west of the project site do not provide suitable nesting habitat for Swainson's hawks, since the trees are highly managed and maintained year round to ensure a successful fall harvest. The closest locations of potentially suitable nest trees within 1-mi of the project site are a group of non-native casuarina trees located 0.85 mi south of the project site on South Ohio Avenue and a group of casuarina trees located 1.0 mi west of the project site on South San Diego Avenue.

METHODS

On February 24, 2017, April 17, 2017, May 23-25, 2017 and July 12-13, 2017, LSA biologists conducted focused surveys for nesting Swainson's hawks at the project site, and within a 5-mi radius. The survey for Swainson's hawks was conducted in accordance with the California Department of Fish and Wildlife Staff Report on Swainson's Hawk Mitigation (CDFW 1994) and Recommended Timing and Methodology for Swainson's Hawks Nesting Surveys in California's Central Valley (Swainson's Hawk Technical Advisory Committee [SHTAC] 2000), attached.

All trees and other structures that would provide suitable nesting sites for Swainson's hawk within a 5-mi radius of the project site were visually surveyed; any observations of Swainson's hawks were noted and their behavior documented. The project site and surrounding area was surveyed on foot and via windshield surveys from access roads. Properties located outside of the project limits that were not accessible were surveyed from adjacent public roads using high powered binoculars and a spotting scope.

No suitable nesting habitat for Swainson's hawk occurs within the project limits, however suitable nesting habitat was identified within a 5-mi radius of the project site. The project site also provides suitable foraging habitat for Swainson's hawks. There are eight occurrences of nesting Swainson's hawks within this 5-mi radius. These include current occurrences, observations of active nests with the last 10 years, and historic observations of active nests more than 10 years old. Of these eight occurrences, four are current records in the California Department of Fish and Wildlife Natural Diversity Data Base (CNDDB) and four are recent documented observations by LSA. All eight occurrences and descriptions of the Swainson's hawk nesting sites are provided in Table A below. The locations of the documented nest sites in proximity to the project site are depicted in Figure 2, attached.

Table A: CNDDB and LSA Documented Swainson's Hawk Nesting Occurrences Within a 5-Mile Radius of the Project Site

CNDDB Occurrence Number	Distance from the Project Site	Date of Observation(s)	Description and Location of the Nesting Habitat	Specific Information
NA/ Swainson's hawk nest 2014	1.02 mi. W	April 2014 & April 2015	Incense cedar tree adjacent to a residence along N. San Diego Avenue, just north of W. California Avenue.	LSA: Adult nesting; two nestlings observed in 2014 and 2015. Trees later cropped likely as a result of overhead utility line maintenance activities. LSA: No nest present in 2017.
NA/ Swainson's hawk nest #3	1.46 mi. S	May through July 2017	Casuarina tree located 1.46 miles south of the project site, and 100 feet west of State Route (SR) 33.	LSA: 2 adults and 2 nestlings, 1 observed branching 7/13/17.
#1103	2.02 mi. W	April 2000	Pine tree adjacent to a residence along N. Washoe Avenue, just north of W. California Avenue.	CNDDB: Two adults were observed roosting; potential nesting. LSA: In the spring of 2013, LSA observed that the residence and all of the trees were removed from the site.
#1730	2.15 mi. NNE	May 2008 & April through July 2017	Eucalyptus tree within Caltrans Maintenance Station, located 2.15 miles northwest of the project site, northwest of Belmont Avenue and SR-180.	CNDDB: An adult was observed nesting. In June 2008, the observer stated that the nest had failed. LSA: 2 adults and 1 large nestling present in July 2017.
#1729	2.53 mi. ENE	June 2008	Cottonwood tree located 800 feet south of SR-180, along Fresno Slough at the Mendota Wildlife Area.	CNDDB: Adult and nestling in nest. LSA: Family of red-tailed hawks present in this tree in 2017.
NA/ Swainson's hawk nest #1	2.78 mi. E	June and July 2016	Cottonwood tree located 0.69 mile south of SR-180, next to Fresno Slough at Mendota Wildlife Area.	LSA: Adults with 2 branching nestlings. No nest activity observed in 2017.
NA/ Swainson's hawk nest #2	3.24 mi. ENE	June and July 2016	Cottonwood tree located 0.28 mile south of SR-180, at Mendota Wildlife Area.	LSA: 2 adults with 2 branching nestlings. Family of red-tailed hawks present in this tree in 2017.
#784	4.78 mi. NNE	April 1999	Willow tree at the Mendota Pool Park located on the north side of the San Joaquin River, 2 miles northeast of Mendota.	CNDDB: One adult was observed nesting. LSA: Not observed in 2017.

RESULTS

Swainson's Hawk Observations

As previously noted, no trees occur on the project site. The closest location of suitable nest trees within 1.0 mile of the project site that may provide suitable nest sites for Swainson's hawks is a group of non-native casuarina trees located 0.85 mi south of the project site on South Ohio Avenue, and a group of casuarina trees located 1.0 mile west of the project site on South San Diego Avenue. No Swainson's hawks or nesting activities were observed at these locations.

LSA observed two active Swainson's hawk nests within 5 miles of the project site during the 2017 surveys: Nest #3 (located 1.46 miles south of the project site along SR-33), and CNDDB Occurrence

#1730 (located at the Caltrans Maintenance Station 2.15 miles north northeast of the project site along SR-180).

Nest #3 along SR-33: On the afternoon of July 12, 2017, LSA observed an adult Swainson's hawk and two large nestlings in the nest (see Representative Photos C, D, and E, attached), while another adult, Swainson's hawk (presumably the other parent) was observed soaring overhead. The nestlings were fully feathered and appeared to be very close to fledging. On the morning of July 13, 2017, one of the nestlings was observed perched in a different casuarina tree located about 30 feet north of the nest, while the other young bird was observed still in the nest. Both parents were observed soaring low overhead and occasionally vocalizing.

CNDDB #1730 at Caltrans Maintenance Station: On the afternoon of July 12, 2017, LSA observed one adult Swainson's hawk and one large nestling in the nest (see Representative Photo F, attached) while another adult Swainson's hawk (presumably the other parent) soared overhead and at one point appeared to drive an approaching red-tailed hawk (*Buteo jamaicensis*) away from the area.

Other Large Stick Nests and Raptor Activity

During surveys conducted by LSA in the spring of 2014 and 2015 for the North Star Solar Project, the closest occurrence of an active Swainson's hawk nest (e.g., presence of young or other nesting behaviors), was located approximately 1.02 mile west of the Little Bear Solar Project site in an incense cedar tree on North San Diego Avenue near the corner of West California Avenue (see Figure 1). During the 2016 survey, LSA documented that the tops of all of the trees in the vicinity of the overhead utility lines were removed, likely as a result of utility line maintenance activities. The nest was also likely removed as a result of these activities and no suitable nesting habitat was observed in the 2016 survey. During all four surveys conducted by LSA in 2017, the lack of suitable nesting habitat at that location persisted.

In June 2016 LSA observed a large stick nest located on top of a metal platform situated above 4 abandoned grain silos, on the east side of South Ohio Avenue and approximately 0.36 mi south of West California Avenue (Figure 3 and Representative Photos G, H and I, attached). The nest was identified as an active common raven (*Corvus corax*) nest, but no nesting activities were observed there during the 2017 surveys. LSA observed an active barn owl (*Tyto alba*) nest within this silo complex during the 2017 season (see Representative Photos of owl nestlings). Based on subsequent surveys of the silo area, it is likely that at least one nestling fledged.

In June 2016, LSA observed a third large stick nest on top of a utility pole, outside the eastern project limits, in the SR-33 right-of-way, approximately 435 feet south of West California Avenue. No birds were observed in the nest at that time. However, several large black feathers, pellet castings, whitewash, and prey remains were observed on the ground directly below the nest, indicating that the nest had been active and was likely a common raven nest (see Representative Photos J and K, attached). During the April 2017 survey, an adult red-tailed hawk was observed sitting in the nest, but during the May and July 2017 surveys, there was no activity observed at the nest site.

During the April 2017 survey, LSA observed a fourth stick nest on top of a utility pole on West California Avenue, approximately 30 feet north of the project limits. The utility pole is located approximately 710 feet east of the intersection of West California Avenue and South San Bernardino Avenue (see Representative Photos L and M, attached). The nest was identified as an active common raven nest. During the May 2017 survey, the nest remained active with large juveniles present which appeared nearly flight ready. During the July survey, the nest was observed empty multiple times and was thus determined to be inactive.

During the May 2017 survey, a male and female northern harrier (*Circus cyaneus*) were observed foraging low over the wheat fields on the project site, specifically in the northwest quadrant of the project site just southeast of the intersection of West California Avenue and South San Bernardino Avenue. Based on the behavior of the harriers, they may have nested in the tall wheat. The northern harriers were not observed at the project site during the July 2017 surveys after the wheat fields had been mowed.

CONCLUSION

As a result of the 2017 focused surveys for nesting Swainson's hawks at the Little Bear Solar project site and vicinity, no active Swainson's hawk nests were observed on the project site. No Swainson's hawks or nesting activities were observed in the two groups of casuarina trees that are the closest potentially suitable nesting habitat, located 0.85 mi and 1.0 mi from the project site. Two active Swainson's hawk nests were observed within 5 miles of the project site: 1.46 mile south of the site along SR-33, and 2.15 miles north northeast of the site at the Caltrans Maintenance Station in Mendota. Both of these nests were observed to be very near fledging as of July 13, 2017.

REPRESENTATIVE PHOTOS

Photo A: View looking north from West Jensen Avenue showing the southeast portion of the Project Site after mowing of the winter wheat (July 13, 2017).

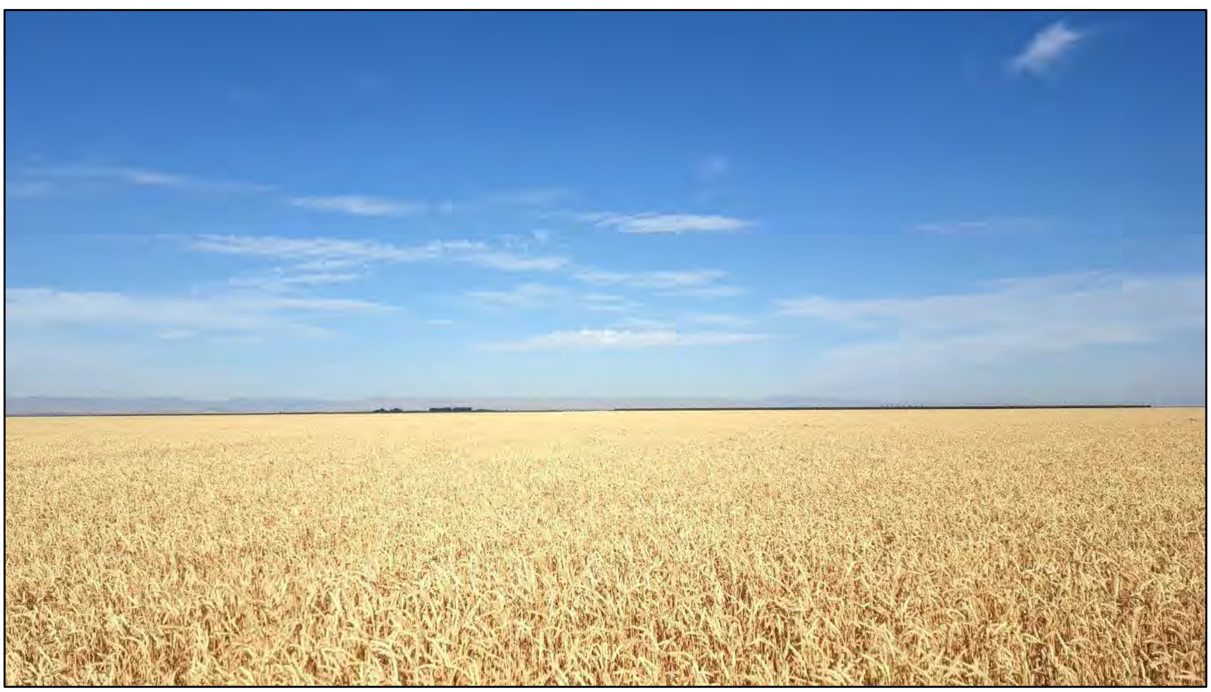


Photo B: View looing west from near the center of the Project Site prior to mowing of the winter wheat (May 24, 2017).

Photo C: View of Swainson's hawk nest #3 in casuarina tree along SR-33, 1.46 mile south of the Project Site (July 12, 2017).

Photo D: Closer view of Swainson's hawk nest #3 showing adult (left) and two juvenile Swainson's hawks (July 12, 2017).

Photo E: View of juvenile Swainson's hawk observed the following day in the next casuarina tree north from Swainson's hawk nest #3, (July 13, 2017).

Photo F: View of Swainson's hawk nest in eucalyptus tree with adult (on branch above) and one juvenile, CNDDB occurrence #1730, located 2.15 miles north northeast of the project site, (July 12, 2017).

Photo G: View at sunset looking north at silo complex along South Ohio Avenue near the center of the project site (July 12, 2017).

Photo H: View of large stick nest located on top of silo (July 12, 2017). Common raven were observed nesting here in June 2016. No nesting activities were observed during 2017 surveys.

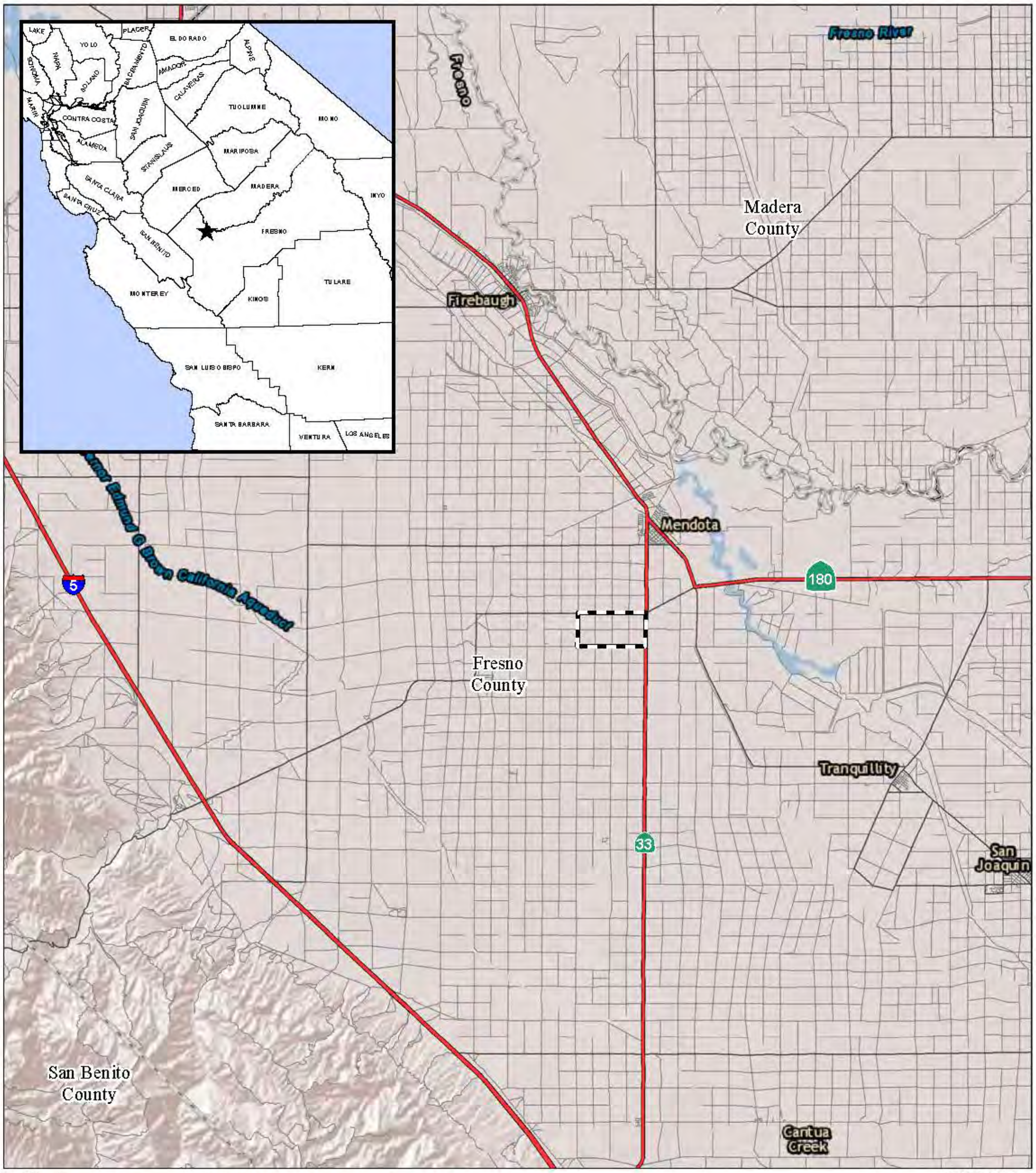
Photo I: Digiscoped view of barn owls perched on platform between silos, on the east side of South Ohio Avenue near center of project site (July 12, 2017).

Photo J: Large stick nest located on top of a utility pole, outside the eastern project limits, in the SR-33 right-of-way, approximately 435 feet south of West California Avenue. Based on large black feathers, pellet castings, whitewash, and prey remains observed on the ground directly below the nest, the nest had been active and was likely a common raven nest (June 20, 2016).

Photo K: Close-up view of large stick nest on top of a utility pole, outside the eastern project limits, in the SR-33 right-of-way, approximately 435 feet south of West California Avenue (June 20, 2016).

Photo L: View looking northwest from the project site of the utility pole along the north side of California Avenue. LSA observed an active common raven nest during the survey conducted on April 18, 2017. The nest is located on top of the third utility pole, 710 feet east of West California Avenue and South San Bernardino Avenue.

Photo M: Close-up view of common raven on nest on April 18, 2017. The nest is located on top of the third utility pole, 710 feet east of West California Avenue and South San Bernardino Avenue.



LEGEND

Little Bear Solar Project

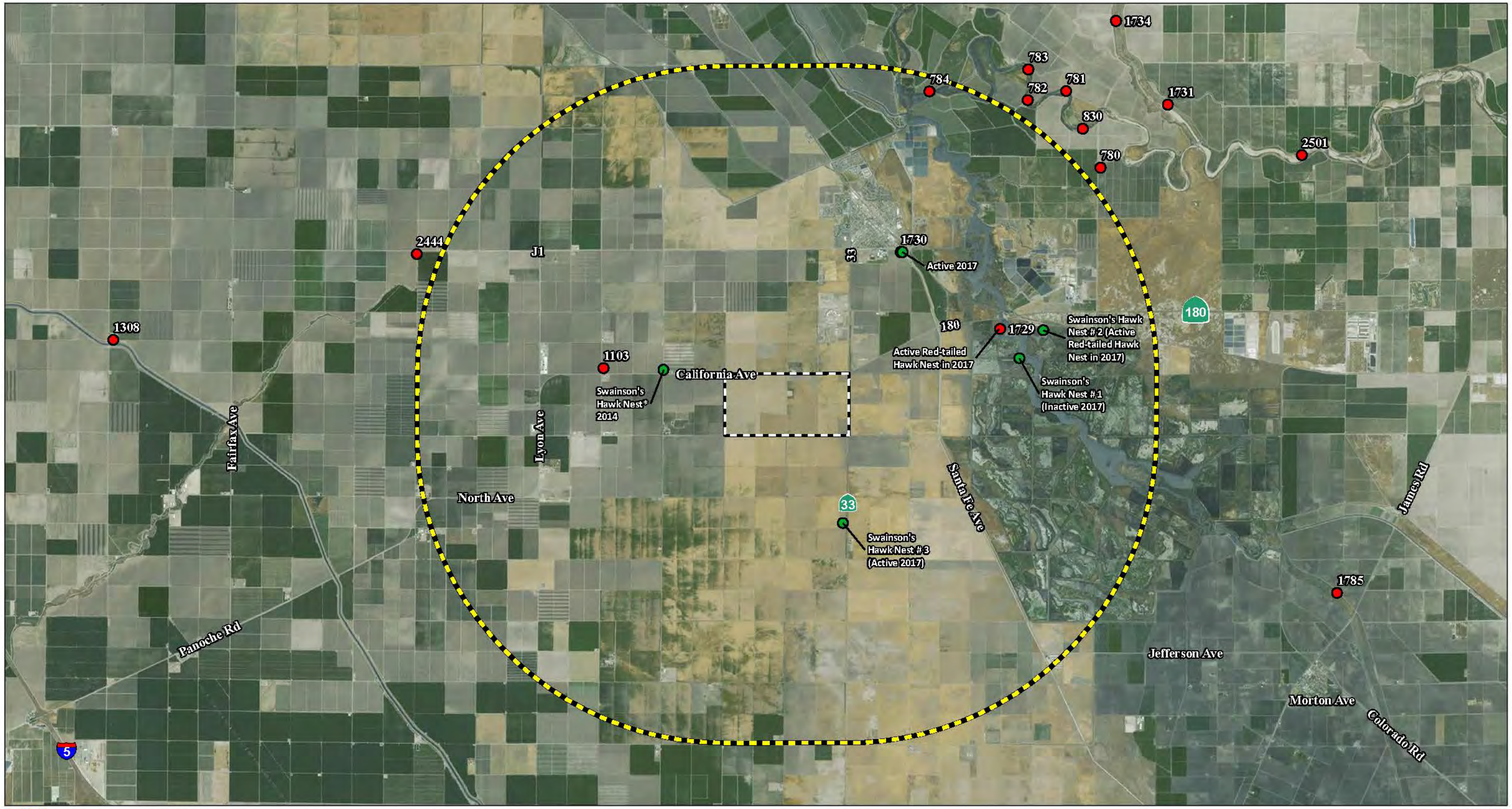
FIGURE 1

SOURCE: ESRI Imagery (2014)

Little Bear Solar Project
Fresno County, California

Regional Location

I:\Fts1408\GIS\HA_Figure_1.mxd (10/4/2017)



LSA

LEGEND

Little Bear Solar Project

5-Mile Radius

Swainson's Hawk CNDDB Occurrence

LSA Swainson's Hawk Observation

*Swainson's Hawk Active Nest in 2014 and 2015.

N

0 4000 8000

FEET

SOURCE: NAIP Aerial Imagery (2016)

I:\Fts1408\GIS\Swainsons_JulySurvey_Figure2.mxd (10/4/2017)

FIGURE 2

Little Bear Solar Project
Fresno County, California

Swainson's Hawk Survey Area

LSA

LEGEND

Little Bear Solar Project

Survey Sections

Unnamed Dirt Roads

Large Stick Nests

0 375 750
FEET

SOURCE: Basemap - NAIP Aerial Imagery (2016); Mapping - LSA (2017)

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FIGURE 3

Little Bear Solar Project
Fresno County, California

Large Stick Nests within
500 Feet of the Project Site

State of California

Nongame Bird and Mammal Section Report # 94.18

Memorandum

To : Div. Chiefs - IFD, BDD, NHD, WMD
Reg. Mgrs. - Regions 1, 2, 3, 4

Date : November 8, 1994

From : Department of Fish and Game

Subject: Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California

I am hereby transmitting the Staff Report Regarding Mitigation for Impacts to Swainson's Hawks in the Central Valley of California for your use in reviewing projects (California Environmental Quality Act [CEQA] and others) and in developing 2081 Management Authorizations and 2090 Biological Opinions which may affect Swainson's hawk habitat in the Central Valley. The staff report has been developed during the last 18 months by the Environmental Services Division (ESD) in cooperation with the Wildlife Management Division (WMD) and Regions 1, 2, and 4. It has been sent out for public review on several occasions and redrafted as appropriate.

Either the mitigation measures in the staff report may be used or project specific measures may be developed. Alternative project specific mitigation measures proposed by the Department Divisions/Regions or by project sponsors will also be considered. However, such mitigation measures must be submitted to ESD for review. The review process will focus on the consistency of the proposed measure with Department, Fish and Game Commission, and legislative policy and with laws regarding raptors and listed species. ESD will coordinate project specific mitigation measure review with WMD.

If you have any questions regarding the report, please contact Mr. Ron Rempel, Program Supervisor, Habitat Conservation Planning and Endangered Species Permitting, Environmental Services Division at (916) 654-9980.

COPY Original signed by
A. Petrovich, Jr.
For
Boyd Gibbons
Direction

Enclosure

cc: Mr. Ron Rempel
Department of Fish and Game
Sacramento

file; d, exfile, esd, chron
Vouchilas/seh/pdl SRPBUTEO.DS1

Staff Report regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California

INTRODUCTION

The Legislature and the Fish and Game Commission have developed the policies, standards and regulatory mandates which, if implemented, are intended to help stabilize and reverse dramatic population declines of threatened and endangered species. In order to determine how the Department of Fish and Game (Department) could judge the adequacy of mitigation measures designed to offset impacts to Swainson's hawks in the Central Valley, Staff (WMD, ESD and Regions) has prepared this report. To ensure compliance with legislative and Commission policy, mitigation requirements which are consistent with this report should be incorporated into: (1) Department comments to Lead Agencies and project sponsors pursuant to the California Environmental Quality Act (CEQA); (2) Fish and Game Code Section 2081 Management Authorizations (Management Authorizations); and (3) Fish and Game Code Section 2090 Consultations with State CEQA Lead Agencies.

The report is designed to provide the Department (including regional offices and divisions), CEQA Lead Agencies and project proponents the context in which the Environmental Services Division (ESD) will review proposed project specific mitigation measures. This report also includes "model" mitigation measures which have been judged to be consistent with policies, standards and legal mandates of the Legislature and Fish and Game Commission. Alternative mitigation measures, tailored to specific projects, may be developed if consistent with this report. Implementation of mitigation measures consistent with this report are intended to help achieve the conservation goals for the Swainson's hawk and should complement multi-species habitat conservation planning efforts currently underway.

The Department is preparing a recovery plan for the species and it is anticipated that this report will be revised to incorporate recovery plan goals. It is anticipated that the recovery plan will be completed by the end of 1995. The Swainson's hawk recovery plan will establish criteria for species recovery through preservation of existing habitat, population expansion into former habitat, recruitment of young into the population, and other specific recovery efforts.

During project review the Department should consider whether a proposed project will adversely affect suitable foraging habitat within a ten (10) mile radius of an active (used during one or more of the last 5 years) Swainson's hawk nest(s). Suitable Swainson's hawk foraging habitat will be those habitats and crops identified in Bechard (1983), Bloom (1980), and Estep (1989). The following vegetation types/agricultural crops are considered small mammal and insect foraging habitat for Swainson's hawks:

- alfalfa
- fallow fields
- beet, tomato, and other low-growing row or field crops
- dry-land and irrigated pasture

- rice land (when not flooded)
- cereal grain crops (including corn after harvest)

The ten mile radius standard is the flight distance between active (and successful) nest sites and suitable foraging habitats, as documented in telemetry studies (Estep 1989, Babcock 1993). Based on the ten mile radius, new development projects which adversely modify nesting and/or foraging habitat should mitigate the project's impacts to the species. The ten mile foraging radius recognizes a need to strike a balance between the biological needs of reproducing pairs (including eggs and nestlings) and the economic benefit of developments) consistent with Fish and Game Code Section 2053.

Since over 95% of Swainson's hawk nests occur on private land, the Department's mitigation program should include incentives that preserve agricultural lands used for the production of crops, which are compatible with Swainson's hawk foraging needs, while providing an opportunity for urban development and other changes in land use adjacent to existing urban areas.

LEGAL STATUS

Federal

The Swainson's hawk is a migratory bird species protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in Section 50 of the Code of Federal Regulations (C.F.R.) Part 10, including feathers or other parts, nests, eggs or products, except as allowed by implementing regulations (50 C.F.R. 21).

State

The Swainson's hawk has been listed as a threatened species by the California Fish and Game Commission pursuant to the California Endangered Species Act (CESA), see Title 14, California Code of Regulations, Section 670.5(b)(5)(A).

LEGISLATIVE AND COMMISSION POLICIES, LEGAL MANDATES AND STANDARDS

The FGC policy for threatened species is, in part, to: "Protect and preserve all native species ... and their habitats...." This policy also directs the Department to work with all interested persons to protect and preserve sensitive resources and their habitats. Consistent with this policy and direction, the Department is enjoined to implement measures that assure protection for the Swainson's hawk.

The California State Legislature, when enacting the provisions of CESA, made the following findings and declarations in Fish and Game Code Section 2051:

> a) "Certain species of fish, wildlife, and plants have been rendered extinct as a consequence of man's activities, untempered by adequate concern and conservation";
>
> b) "Other species of fish, wildlife, and plants are in danger of, or threatened with, extinction because their habitats are threatened with destruction, adverse modification, or severe curtailment because of overexploitation, disease, predation, or other factors (emphasis added)";and
>
> c) "These species of fish, wildlife, and plants are of ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state, and the conservation, protection, and enhancement of these species and their habitat is of statewide concern" (emphasis added).

The Legislature also proclaimed that it "is the policy of the state to conserve, protect, restore, and enhance any endangered or threatened species and its habitat and that it is the intent of the Legislature, consistent with conserving the species, to acquire lands for habitat for these species" (emphasis added).

Section 2053 of the Fish and Game Code states, in part, "it is the policy of the state that state agencies should not approve projects as proposed which would jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species, if there are reasonable and prudent alternatives available consistent with conserving the species and or its habitat which would prevent jeopardy" (emphasis added).

Section 2054 states "The Legislature further finds and declares that, in the event specific economic, social, and or other conditions make infeasible such alternatives, individual projects may be approved if appropriate mitigation and enhancement measures are provided" (emphasis added).

Loss or alteration of foraging habitat or nest site disturbance which results in:

(1) nest abandonment; (2) loss of young; (3) reduced health and vigor of eggs and/or nestlings (resulting in reduced survival rates), may ultimately result in the take (killing) of nestling or fledgling Swainson's hawks incidental to otherwise lawful activities. The taking of Swainson's hawks in this manner can be, a violation of Section 2080 of the Fish and Game Code. This interpretation of take has been judicially affirmed by the landmark appellate court decision pertaining to CESA (DFG v. ACID, 8 CA App.4, 41554). The essence of the decision emphasized that the intent and purpose of CESA applies to all activities that take or kill endangered or threatened species, even when the taking is incidental to otherwise legal activities. To avoid potential violations of Fish and Game Code Section 2080, the Department recommends and encourages project sponsors to obtain 2081 Management Authorizations for their projects.

Although this report has been prepared to assist the Department in working with the development community, the prohibition against take (Fish and Game Code Section 2080) applies to all persons, including those engaged in agricultural activities and routine maintenance of facilities. In addition, sections 3503, 3503.5, and 3800 of the Fish and Game Code prohibit the take, possession, or destruction of birds, their nests or eggs.

To avoid potential violation of Fish and Game Code Section 2080 (i.e. killing of a listed species), project-related disturbance at active Swainson's hawk nesting sites should be reduced or eliminated during critical phases of the nesting cycle (March 1 - September 15 annually). Delineation of specific activities which could cause nest abandonment (take) of Swainson's hawk during the nesting period should be done on a case-by-case basis.

CEQA requires a mandatory findings of significance if a project's impacts to threatened or endangered species are likely to occur (Sections 21001 (c), 21083, Guidelines Sections 15380, 15064, 15065). Impacts must be avoided or mitigated to less than significant levels unless the CEQA Lead Agency makes and supports findings of Overriding Consideration. The CEQA Lead Agency's Findings of Overriding Consideration does not eliminate the project sponsor's obligation to comply with Fish and Game Code Section 2080.

NATURAL HISTORY

The Swainson's hawk (Buteo swainsoni) is a large, broad winged buteo which frequents open country. They are about the same size as a red-tailed hawk (Buteo jatnaicensis), but trimmer, weighing approximately 800-1100 grams (1.75 - 2 lbs). They have about a 125 cm. (4+foot) wingspan. The basic body plumage may be highly variable and is characterized by several color morphs - light, dark, and rufous. In dark phase birds, the entire body of the bird may be sooty black. Adult birds generally have dark backs. The ventral or underneath sections may be light with a characteristic dark, wide "bib" from the lower throat down to the upper breast, light colored wing linings and pointed wing tips. The tail is gray ventrally with a subterminal dusky band, and narrow, less conspicuous barring proximally. The sexes are similar in appearance; females however, are slightly larger and heavier than males, as is the case in most sexually dimorphic raptors. There are no recognized subspecies (Palmer 1988).

The Swainson's hawk is a long distance migrator. The nesting grounds occur in northwestern Canada, the western U.S., and Mexico and most populations migrate to wintering grounds in the open pampas and agricultural areas of South America (Argentina, Uruguay, southern Brazil). The species is included among the group of birds known as "neotropical migrants". Some individuals or small groups (20-30 birds) may winter in the U.S., including California (Delta Islands). This round trip journey may exceed 14,000 miles. The birds return to the nesting grounds and establish nesting territories in early March.

Swainson's hawks are monogamous and remain so until the loss of a mate (Palmer 1988). Nest construction and courtship continues through April. The clutch (commonly 3-4 eggs) is generally laid in early April to early May, but may occur later. Incubation lasts 34-35 days, with both parents participating in the brooding of eggs and young. The young fledge (leave the nest) approximately 42-44 days after hatching and remain with their parents until they depart in the fall. Large groups (up to 100+ birds) may congregate in holding areas in the fall and may exhibit a delayed migration depending upon forage availability. The specific purpose of these congregation areas is as yet unknown, but is likely related to: increasing energy reserves for migration; the timing of migration; aggregation into larger migratory groups (including assisting the young in learning migration routes); and providing a pairing and courtship opportunity for unattached adults.

Foraging Requirements

Swainson's hawk nests in the Central Valley of California are generally found in scattered trees or along riparian systems adjacent to agricultural fields or pastures. These open fields and pastures are the primary foraging areas. Major prey items for Central Valley birds include: California voles (*Microtus californicus*), valley pocket gophers (*Thomomys bottae*), deer mice (*Peromyscus maniculatus*), California ground squirrels (*Spermophilus beecheyi*), mourning doves (*Zenaida macroura*), ring-necked pheasants (*Phasianus colchicus*), meadowlarks (*Sturnella neglecta*), other passerines, grasshoppers (*Conocephalinae sp*.), crickets (*Gryllidae sp*.), and beetles (Estep 1989). Swainson's hawks generally search for prey by soaring in open country and agricultural fields similar to northern hariers (*Circus cyaneus*) and ferruginous hawks (*Buteo regalis*). Often several hawks may be seen foraging together following tractors or other farm equipment capturing prey escaping from farming operations. During the breeding season, Swainson's hawks eat mainly vertebrates (small rodents and reptiles), whereas during migration vast numbers of insects are consumed (Palmer 1988).

Department funded research has documented the importance of suitable foraging habitats (e.g., annual grasslands, pasture lands, alfalfa and other hay crops, and combinations of hay, grain and row crops) within an energetically efficient flight distance from active Swainson's hawk nests (Estep pers. comm.). Recent telemetry studies to determine foraging requirements have shown that birds may use in excess of 15,000 acres of habitat or range up to 18.0 miles from the nest in search of prey (Estep 1989, Babcock 1993). The prey base (availability and abundance) for the species is highly variable from year to year, with major prey population (small mammals and insects) fluctuations occurring based on rainfall patterns, natural cycles and agricultural cropping and harvesting patterns. Based on these variables, significant acreages of potential foraging habitat (primarily agricultural lands) should be preserved per nesting pair (or aggregation of nesting pairs) to avoid jeopardizing existing populations. Preserved foraging areas should be adequate to allow additional Swainson's hawk nesting pairs to successfully breed and use the foraging habitat during good prey production years.

Suitable foraging habitat is necessary to provide an adequate energy source for breeding adults, including support of nestlings and fledglings. Adults must achieve an energy balance between the needs of themselves and the demands of nestlings and fledglings, or the health and survival of both may be jeopardized. If prey resources are not sufficient, or if adults must hunt long distances from the nest site, the energetics of the foraging effort may result in reduced nestling vigor with an increased likelihood of disease and/or starvation. In more extreme cases, the breeding pair, in an effort to assure their own existence, may even abandon the nest and young (Woodbridge 1985).

Prey abundance and availability is determined by land and farming patterns including crop types, agricultural practices and harvesting regimes. Estep (1989) found that 73.4% of observed prey captures were in fields being harvested, disced, mowed, or irrigated. Preferred foraging habitats for Swainson's hawks include:

- alfalfa;
- fallow fields;
- beet, tomato, and other low-growing row or field crops;
- dry-land and irrigated pasture;
- rice land (during the non-flooded period); and
- cereal grain crops (including corn after harvest).

Unsuitable foraging habitat types include crops where prey species (even if present) are not available due to vegetation characteristics (e.g. vineyards, mature orchards, and cotton fields, dense vegetation).

Nesting Requirements

Although the Swainson's hawk's current nesting habitat is fragmented and unevenly distributed, Swainson's hawks nest throughout most of the Central Valley floor. More than 85% of the known nests in the Central Valley are within riparian systems in Sacramento, Sutter, Yolo, and San Joaquin counties. Much of the potential nesting habitat remaining in this area is in riparian forests, although isolated and roadside trees are also used. Nest sites are generally adjacent to or within easy flying distance to alfalfa or hay fields or other habitats or agricultural crops which provide an abundant and available prey source. Department research has shown that valley oaks (Quercus lobata), Fremont's cottonwood (Populus fremontii), willows (Salix spp.), sycamores (Platanus spp.), and walnuts (juglans spp.) are the preferred nest trees for Swainson's hawks (Bloom 1980, Schlorff and Bloom 1983, Estep 1989).

Fall and Winter Migration Habitats

During their annual fall and winter migration periods, Swainson's hawks may congregate in large groups (up to 100+ birds). Some of these sites may be used during delayed migration periods lasting up to three months. Such sites have been identified in Yolo, Tulare, Kern and San Joaquin counties and protection is needed for these critical foraging areas which support birds during their long migration.

Historical and Current Population Status

The Swainson's hawk was historically regarded as one of the most common and numerous raptor species in the state, so much so that they were often not given special mention in field notes. The breeding population has declined by an estimated 91% in California since the turn of the century (Bloom 1980). The historical Swainson's hawk population estimates are based on current densities and extrapolated based on the historical amount of available habitat. The historical population estimate is 4,284-17,136 pairs (Bloom 1980). In 1979, approximately 375 (± 50) breeding pairs of Swainson's hawks were estimated in California, and 280 (75%) of those pairs were estimated to be in the Central Valley (Bloom 1980). In 1988, 241 active breeding pairs were found in the Central Valley, with an additional 78 active pairs known in northeastern California. The 1989 population estimate was 430 pairs for the Central Valley and 550 pairs statewide (Estep, 1989). This difference in population estimates is probably a result of increased survey effort rather than an actual population increase.

Reasons for decline

The dramatic Swainson's hawk population decline has been attributed to loss of native nesting and foraging habitat, and more recently to the loss of suitable nesting trees and the conversion of agricultural lands. Agricultural lands have been converted to urban land uses and incompatible crops. In addition, pesticides, shooting, disturbance at the nest site, and impacts on wintering areas may have contributed to their decline. Although losses on the wintering areas in South America may occur, they are not considered significant since breeding populations outside of California are stable. The loss of nesting habitat within riparian areas has been accelerated by flood control practices and bank stabilization programs. Smith (1977) estimated that in 1850 over 770,000 acres of riparian habitat were present in the Sacramento Valley. By the mid-1980s, Warner and Hendrix (1984) estimated that there was only 120,000 acres of riparian habitat remaining in the Central Valley (Sacramento and San Joaquin Valleys combined). Based on Warner and Hendrix's estimates approximately 93% of the San Joaquin Valley and 73% of the Sacramento Valley riparian habitat has been eliminated since 1850.

MANAGEMENT STRATEGIES

Management and mitigation strategies for the Central Valley population of the Swainson's hawk should ensure that:

- suitable nesting habitat continues to be available (this can be accomplished by protecting existing nesting habitat from destruction or disturbance and by increasing the number of suitable nest trees); and

- foraging habitat is available during the period of the year when Swainson's hawks are present in the Central Valley (this should be accomplished by maintaining or creating adequate and suitable foraging habitat in areas of existing and potential nest sites and along migratory routes within the state).

A key to the ultimate success in meeting the Legislature's goal of maintaining habitat sufficient to preserve this species is the implementation of these management strategies in cooperation with project sponsors and local, state and federal agencies.

DEPARTMENT'S ROLES AND RESPONSIBILITIES IN PROJECT CONSULTATION AND ADMINISTRATION OF CEQA AND THE FISH AND GAME CODE

The Department, through its administration of the Fish and Game Code and its trust responsibilities, should continue its efforts to minimize further habitat destruction and should seek mitigation to offset unavoidable losses by (1) including the mitigation measures in this document in CEQA comment letters and/or as management conditions in Department issued Management Authorizations or (2) by developing project specific mitigation measures (consistent with the Commission's and the Legislature's mandates) and including them in CEQA comment letters and/or as management conditions in Fish and Game Code Section 2081 Management Authorizations issued by the Department and/or in Fish and Game Code Section 2090 Biological Opinions.

The Department should submit comments to CEQA Lead Agencies on all projects which adversely affect Swainson's hawks. CEQA requires a mandatory findings of significance if a project's impacts to threatened or endangered species are likely to occur (Sections 21001 fc), 21083. Guidelines 15380, 15064, 15065). Impacts must be: (1) avoided; or (2) appropriate mitigation must be provided to reduce impacts to less than significant levels; or (3) the lead agency must make and support findings of overriding consideration. If the CEQA Lead Agency makes a Finding of Overriding Consideration, it does not eliminate the project sponsor's obligation to comply with the take prohibitions of Fish and Game Code Section 2080. Activities which result in (1) nest abandonment; (2) starvation of young; and/or (3) reduced health and vigor of eggs and nestlings may result in the take (killing) of Swainson's hawks incidental to otherwise lawful activities (urban development, recreational activities, agricultural practices, levee maintenance and similar activities. The taking of Swainson's hawk in this manner may be a violation of Section 2080 of the Fish and Game Code. To avoid potential violations of Fish and Game Code Section 2080, the Department should recommend and encourage project sponsors to obtain 2081 Management Authorizations.

In aggregate, the mitigation measures incorporated into CEQA comment letters and/or 2081 Management Authorizations for a project should be consistent with Section 2053 and 2054 of the Fish and Game Code. Section 2053 states, in part, "it is the policy of the state that state agencies should not approve projects as proposed which would jeopardize the continued existence of'any endangered or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species, if there are reasonable and prudent alternatives available consistent with conserving the species and or its habitat which would prevent jeopardy" - Section 2054 states: "The Legislature further finds and declares that, in the event specific economic, social, and or other conditions make infeasible such alternatives, individual projects may be approved if appropriate mitigation and enhancement measures are provided."

State lead agencies are required to consult with the Department pursuant to Fish and Game Code Section 2090 to ensure that any action authorized, funded, or carried out by that state agency will not jeopardize the continued existence of any threatened or endangered species. Comment letters to State Lead Agencies should also include a reminder that the State Lead Agency has the responsibility to consult with the Department pursuant to Fish and Game Code Section 2090 and obtain a written findings (Biological Opinion). Mitigation measures included in Biological Opinions issued to State Lead Agencies must be consistent with Fish and Game Code Sections 2051-2054 and 2091-2092.

NEST SITE AND HABITAT LOCATION INFORMATION SOURCES

The Department's Natural Diversity Data Base (NDDB) is a continually updated, computerized inventory of location information on the State's rarest plants, animals, and natural communities. Department personnel should encourage project proponents and CEQA Lead Agencies, either directly or through CEQA comment letters, to purchase NDDB products for information on the locations of Swainson's hawk nesting areas as well as other sensitive species. The Department's Nongame Bird and Mammal Program also maintains information on Swainson's hawk nesting areas and may be contacted for additional information on the species.

Project applicants and CEQA Lead Agencies may also need to conduct site specific surveys (conducted by qualified biologists at the appropriate time of the year using approved protocols) to determine the status (location of nest sites, foraging areas, etc.) of listed species as part of the CEQA and 2081 Management Authorization process. Since these studies may require multiple years to complete, the Department shall identify any needed studies at the earliest possible time in the project review process. To facilitate project review and reduce the potential for costly project delays, the Department should make it a standard practice to advise developers or others planning projects that may impact one or more Swainson's hawk nesting or foraging areas to initiate communication with the Department as early as possible .

MANAGEMENT CONDITIONS

Staff believes the following mitigation measures (nos. 1-4) are adequate to meet the Commission's and Legislature's policy regarding listed species and are considered as preapproved for incorporation into any Management Authorizations for the Swainson's hawk issued by the Department. The incorporation of measures 1-4 into a CEQA document should reduce a project's impact to a Swainson's hawk(s) to less than significant levels. Since these measures are Staff recommendations, a project sponsor or CEQA Lead agency may choose to negotiate project specific mitigation measures which differ. In such cases, the negotiated Management Conditions must be consistent with Commission and Legislative policy and be submitted to the ESD for review and approval prior to reaching agreement with the project sponsor or CEQA Lead Agency.

Staff recommended Management Conditions are:

1. No intensive new disturbances (e.g. heavy equipment operation associated with construction, use of cranes or draglines, new rock crushing activities) or other project related activities which may cause nest abandonment or forced fledging, should be initiated within 1/4 mile (buffer zone) of an active nest between March 1 - September 15 or until August 15 if a Management Authorization or Biological Opinion is obtained for the project. The buffer zone should be increased to ½ mile in nesting areas away from urban development (i.e. in areas where disturbance [e.g. heavy equipment operation associated with construction, use of cranes or draglines, new rock crushing activities] is not a normal occurrence during the nesting season). Nest trees should not be removed unless there is no feasible way of avoiding it. If a nest tree must be removed, a Management Authorization (including conditions to off-set the loss of the nest tree) must be obtained with the tree removal period specified in the Management Authorization, generally between October 1- February 1. If construction or other project related activities which may cause nest abandonment or forced fledging are necessary within the buffer zone, monitoring of the nest site (funded by the project sponsor) by a qualified biologist (to determine if the nest is abandoned) should be required . If it is abandoned and if the nestlings are still alive, the project sponsor shall fund the recovery and hacking (controlled release of captive reared young) of the nestling(s). Routine disturbances such as agricultural activities, commuter traffic, and routine facility maintenance activities within 1/4 mile of an active nest should not be prohibited.

2. Hacking as a substitute for avoidance of impacts during the nesting period may be used in unusual circumstances after review and approval of a hacking plan by ESD and WMD. Proponents who propose using hacking will be required to fund the full costs of the effort, including any telemetry work specified by the

Department.

3. To mitigate for the loss of foraging habitat (as specified in this document), the Management Authorization holder/project sponsor shall provide Habitat Management (HM) lands to the Department based on the following ratios:

(a) Projects within I mile of an active nest tree shall provide:

- one acre of HM land (at least 10% of the HM land requirements shall be met by fee title acquisition or a conservation easement allowing for the active management of the habitat, with the remaining 90% of the HM lands protected by a conservation easement [acceptable to the Department] on agricultural lands or other suitable habitats which provide foraging habitat for Swainson's hawk) for each acre of development authorized (1:1 ratio); or

- One-half acre of HM land (all of the HM land requirements shall be met by fee title acquisition or a conservation easement [acceptable to the Department) which allows for the active management of the habitat for prey production on-the HM lands) for each acre of development authorized (0.5:1 ratio).

(b) Projects within 5 miles of an active nest tree but greater than 1 mile from the nest tree shall plovide 0.75 acres of HM land for each acre of urban development authorized (0-75:1 ratio). All HM lands protected under this requirement may be protected through fee title acquisition or conservation easement (acceptable to the Department) on agricultural lands or other suitable habitats which provide foraging habitat for Swainson's hawk.

(c) Projects within 10 miles of an active nest tree but gleater than 5 miles from an active nest tree shall provide 0.5 acres of HM land for each acre of urban development authorized (0.5:1 ratio). All HM lands- protected under this requirement may be protected through fee title acquisition or a conservation easement (acceptable to the Department) on agricultural lands or other suitable habitats which provide foraging habitat for Swainson's hawk.

4. Management Authorization holders/project sponsors shall provide for the long-term management of the HM lands by funding a management endowment (the interest on which shall be used for managing the HM lands) at the rate of $400 per HM land acre (adjusted annually for inflation and varying interest rates).

Some project sponsors may desire to provide funds to the Department for HM land protection. This option is acceptable to the extent the proposal is consistent with Department policy regarding acceptance of funds for land acquisition. All HM lands should be located in areas which are consistent with a multi-species habitat conservation focus. Management

Authorization holders/project sponsors who are willing to establish a significant mitigation bank (> 900 acres) should be given special consideration such as 1.1 acres of mitigation credit for each acre preserved.

PROJECT SPECIFIC MITIGATION MEASURES

Although this report includes recommended Management Measures, the Department should encourage project proponents to propose alternative mitigation strategies that provide equal or greater protection of the species and which also expedite project environmental review or issuance of a CESA Management Authorization. The Department and sponsor may choose to conduct cooperative, multi-year field studies to assess the site's habitat value and determine its use by nesting and foraging Swainson's hawk. Study plans should include clearly defined criteria for judging the project's impacts on Swainson's hawks and the methodologies (days of monitoring, foraging effort/efficiency, etc.) that will be used.

The study plans should be submitted to the Wildlife Management Division and ESD for review. Mitigation measures developed as a result of the study.must be reviewed by ESD (for consistency with the policies of the Legislature and Fish and Game Commission) and approved by the Director.

EXCEPTIONS

Cities, counties and project sponsors should be encouraged to focus development on open lands within already urbanized areas. Since small disjunct parcels of habitat seldom provide foraging habitat needed to sustain the reproductive effort of a Swainson's hawk pair, Staff does not recommend requiring mitigation pursuant to CEQA nor a Management Authorization by the Department for infill (within an already urbanized area) projects in areas which have less than 5 acres of foraging habitat and are surrounded by existing urban development, unless the project area is within 1/4 mile of an active nest tree.

REVIEW

Staff should revise this report at least annually to determine if the proposed mitigation strategies should be retained, modified or if additional mitigation strategies should be included as a result of new scientific information.

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RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRAL VALLEY

Swainson's Hawk Technical Advisory Committee
May 31, 2000

This set of survey recommendations was developed by the Swainson's Hawk Technical Advisory Committee (TAC) to maximize the potential for locating nesting Swainson's hawks, and thus reducing the potential for nest failures as a result of project activities/disturbances. The combination of appropriate surveys, risk analysis, and monitoring has been determined to be very effective in reducing the potential for project-induced nest failures. As with most species, when the surveyor is in the right place at the right time, Swainson's hawks may be easy to observe; but some nest sites may be very difficult to locate, and even the most experienced surveyors have missed nests, nesting pairs, mis-identified a hawk in a nest, or believed incorrectly that a nest had failed. There is no substitute for specific Swainson's hawk survey experience and acquiring the correct search image.

METHODOLOGY

Surveys should be conducted in a manner that maximizes the potential to observe the adult Swainson's hawks, as well as the nest/chicks second. To meet the California Department of Fish and Game's (CDFG) recommendations for mitigation and protection of Swainson's hawks, surveys should be conducted for a ½ mile radius around all project activities, and if active nesting is identified within the ½ mile radius, consultation is required. In general, the TAC recommends this approach as well.

Minimum Equipment

Minimum survey equipment includes a high-quality pair of binoculars and a high quality spotting scope. Surveying even the smallest project area will take hours, and poor optics often result in eye-strain and difficulty distinguishing details in vegetation and subject birds. Other equipment includes good maps, GPS units, flagging, and notebooks.

Walking vs Driving

Driving (car or boat) or "windshield surveys" are usually preferred to walking if an adequate roadway is available through or around the project site. While driving, the observer can typically approach much closer to a hawk without causing it to fly. Although it might appear that a flying bird is more visible, they often fly away from the observer using trees as screens; and it is difficult to determine from where a flying bird came. Walking surveys are useful in locating a nest after a nest territory is identified, or when driving is not an option.

Angle and Distance to the Tree

Surveying subject trees from multiple angles will greatly increase the observer's chance of detecting a nest or hawk, especially after trees are fully leafed and when surveying multiple trees in close proximity. When surveying from an access road, survey in both directions. Maintaining a distance of 50 meters to 200 meters from subject trees is optimal for observing perched and flying hawks without greatly reducing the chance of detecting a nest/young: Once a nesting territory is identified, a closer inspection may be required to locate the nest.

Speed

Travel at a speed that allows for a thorough inspection of a potential nest site. Survey speeds should not exceed 5 miles per hour to the greatest extent possible. If the surveyor must travel faster than 5 miles per hour, stop frequently to scan subject trees.

Visual and Aural Ques

Surveys will be focused on both observations and vocalizations. Observations of nests, perched adults, displaying adults, and chicks during the nesting season are all indicators of nesting Swainson's hawks. In addition, vocalizations are extremely helpful in locating nesting territories. Vocal communication between. hawks is frequent during territorial displays; during courtship and mating; through the nesting period as mates notify each other that food is available or that a threat exists; and as older chicks and fledglings beg for food.

Distractions

Minimize distractions while surveying. Although two pairs of eyes may be better than one pair at times, conversation may limit focus. Radios should be off, not only are they distracting, they may cover a hawk's call.

Notes and Species Observed

Take thorough field notes. Detailed notes and maps of the location of observed Swainson's hawk nests are essential for filling gaps in the Natural Diversity Data Base; please report all observed nest sites. Also document the occurrence of nesting great homed owls, red-tailed hawks, red-shouldered hawks and other potentially competitive species. These species will infrequently nest within 100 yards of each other, so the presence of one species will not necessarily exclude another.

TIMING

To meet **the minimum level** of protection for the species, surveys should be completed for **at least** the two survey periods immediately prior to a project's initiation. For example, if a project is scheduled to begin on June 20, you should complete 3 surveys in Period III and 3 surveys in Period V. However, it is always recommended that surveys be completed in Periods II, III and V. **Surveys should not be conducted in Period IV.**

The survey periods are defined by the timing of migration, courtship, and nesting in a "typical" year for the majority of Swainson's hawks from San Joaquin County to Northern Yolo County. Dates should be adjusted in consideration of early and late nesting seasons, and geographic differences (northern nesters tend to nest slightly later, etc). If you are not sure, contact a TAC member or CDFG biologist.

Survey dates Justification and search image	Survey time	Number of Surveys
I. *January-March 20 (recommended optional)*	*All day*	*1*

Prior to Swainson's hawks returning, it may be helpful to survey the project site to determine potential nest locations. Most nests are easily observed from relatively long distances, giving the surveyor the opportunity to identify potential nest sites, as well as becoming familiar with the project area. It also gives the surveyor the opportunity to locate and map competing species nest sites such as great homed owls from February on, and red-tailed hawks from March on. After March 1, surveyors are likely to observe Swainson's hawks staging in traditional nest territories.

II. *March 20 to April 5*	*Sunrise to 1000* *1600 to sunset*	*3*

Most Central Valley Swainson's hawks return by April 1, and immediately begin occupying their traditional nest territories. For those few that do not return by April 1, there are often hawks ("floaters") that act as place-holders in traditional nest sites; they are birds that do not have mates, but temporarily attach themselves to traditional territories and/or one of the site's "owners." Floaters are usually displaced by the territories' owner(s) if the owner returns.

Most trees are leafless and are relatively transparent; it is easy to observe old nests, staging birds, and competing species. The hawks are usually in their territories during the survey hours, but typically soaring and foraging in the mid-day hours. Swainson's hawks may often be observed involved in territorial and courtship displays, and circling the nest territory. Potential nest sites identified by the observation of staging Swainson's hawks will usually be active territories during that season, although the pair may not successfully nest/reproduce that year.

III. *April 5 to April 20*	*Sunrise to 1200* *1630 to Sunset*	***3***

Although trees are much less transparent at this time, 'activity at the nest site increases significantly. Both males and females are actively nest building, visiting their selected site frequently. Territorial and courtship displays are increased, as is copulation. The birds tend to vocalize often, and nest locations are most easily identified. This period may require a great deal of "sit and watch" surveying.

IV. *April 21 to June 10*	*Monitoring known nest sites only* ***Initiating Surveys is not recommended***	

Nests are extremely difficult to locate this time of year, and even the most experienced surveyor will miss them, especially if the previous surveys have not been done. During this phase of nesting, the female Swainson's hawk is in brood position, very low in the nest, laying eggs, incubating, or protecting the newly hatched and vulnerable chicks; her head may or may not be visible. Nests are often well-hidden, built into heavily vegetated sections of trees or in clumps of mistletoe, making them all but invisible. Trees are usually not viewable from all angles, which may make nest observation impossible.

Following the male to the nest may be the only method to locate it, and the male will spend hours away from the nest foraging, soaring, and will generally avoid drawing attention to the nest site. Even if the observer is fortunate enough to see a male returning with food for the female, if the female determines it is not safe she will not call the male in, and he will not approach the nest; this may happen if the observer, or others, are too close to the nest or if other threats, such as rival hawks, are apparent to the female or male.

V. *June 10 to JuIy 30 (post-fledging)*	***Sunrise to 1200*** ***1600 to sunset***	***3***

Young are active and visible, and relatively safe without parental protection. Both adults make numerous trips to the nest and are often soaring above, or perched near or on the nest tree. The location and construction of the nest may still limit visibility of the nest, young, ‘and adults.

DETERMINING A PROJECT'S POTENTIAL
FOR IMPACTING SWAINSON'S HAWKS

LEVEL OF RISK	REPRODUCTIVE SUCCESS (Individuals)	LONGTERM SURVIVABILITY (Population)	NORMAL SITE CHARACTERISTICS (Daily Average)	NEST MONI-TORING
HIGH	Direct physical contact with the nest tree while the birds are on eggs or protecting young. (Helicopters in close proximity)	Loss of available foraging area. Loss of nest trees.	Little human-created noise, little human use: nest is well away from dwellings, equipment yards, human access areas, etc. *Do not include general cultivation practices in evaluation.*	MORE
	Loss of nest tree after nest building is begun prior to laying eggs.	Loss of potential nest trees.		
	Personnel within 50 yards of nest tree (out of vehicles) for extended periods while birds are on eggs or protecting young that are < 10 days old.	Cumulative: Multi-year, multi-site projects with substantial noise/personnel disturbance.		
	Initiating construction activities (machinery and personnel) within 200 yards of the nest after eggs are laid and before young are > 10 days old.	Cumulative: Single-season projects with substantial noise/personnel disturbance that is greater than or significantly different from the daily norm.		
	Heavy machinery only working within 50 yards of nest.			
	Initiating construction activities within 200 yards of nest before nest building begins or after young > 10 days old.		Substantial human-created noise and occurrence: nest is near roadways, well-used waterways, active airstrips, areas that have high human use. *Do not include general cultivation practices in evaluation.*	
LOW	All project activities (personnel and machinery) greater than 200 yards from nest.	Cumulative: Single-season projects with activities that "blend" well with site's "normal' activities.		LESS

Appendix G

Energy Conservation: Little Bear Solar Project Fuel Use Calculations

Little Bear Solar Project Fuel Use 2/22/2018

CO_2 emissions from GHG Calculations:

Construction Diesel Sources		
	CO2 Emissions	
Construction equipment CO2 Emissions (from CalEEMod)	2025.37	MT
Vendor/Hauling/Water Trucks (from CalEEMod)	198.82	
TOTAL Diesel Sources =	**2224.19**	**MT**
Convert to kilograms	2.22E+06	kg

Per CCAR GRP (2009):

Diesel fuel combustion =	10.15	kg CO2/gallon
Construction Diesel Combustion =	219132.02	gallons

Construction Gasoline sources		
Construction workers (from CalEEMod)	1779.15	MT
Convert to kilograms	1.78E+06	kg

Per CCAR GRP (2009):

Gasoline fuel combustion =	8.81	kg CO2/gallon
Construction Gasoline combustion=	201946.65	gallons

Operation and Maintenance Gasoline sources		
Mobile Sources (from CalEEMod)	29.3	MT
Convert to kilograms	2.93E+04	kg

Per CCAR GRP (2009):

Gasoline fuel combustion =	8.81	kg CO2/gallon
Operation Gasoline combustion=	3325.77	gallons

Appendix H
Geotechnical Reports

Appendix H1, Geotechnical Engineering Report, Little Bear Solar Facility

Appendix H2, Geologic Reconnaissance Report, Little Bear Solar Project

Appendix H1

Geotechnical Engineering Report, Little Bear Solar Facility

Geotechnical Engineering Report

Little Bear Solar Project

Southwest Corner of W California Avenue and S Ohio Avenue

Mendota, California

August 7, 2015

Terracon Project No. 60155057

Prepared for:
First Solar, Inc.
Tempe, Arizona

Prepared by:
Terracon Consultants, Inc.
Irvine, California

Terracon

August 7, 2015

First Solar, Inc.
350 West Washington, Suite 600
Tempe, Arizona 85281

Attn: Mr. Eric Thornbrew, P.E.
P: 602-427-1275
E: eric.thornbrew@firstsolar.com

Re: Geotechnical Engineering Report
Little Bear Solar Facility
Southwest Corner of W California Avenue and S Ohio Avenue
Mendota, Fresno County, California
Terracon Project No. 60155057

Dear Mr. Thornbrew:

Terracon Consultants, Inc. (Terracon) has completed geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number P60150223, dated June 2, 2015 and authorized on July 1, 2015. This report provides a description of project scope and site conditions, the details of our pile load test program, the results of pile load testing, subsurface exploration, in-situ electrical resistivity testing, in-situ and laboratory thermal resistivity testing, and percolation testing. Additionally, this report provides geotechnical engineering recommendations concerning earthwork and the design and construction of the proposed structures and site development elements for the project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

REGISTERED PROFESSIONAL ENGINEER
FOUAD ABUHAMDAN
C 77455
CIVIL
STATE OF CALIFORNIA

for Joshua R. Morgan, E.I.T.
Senior Staff Engineer

Fouad (Fred) Abuhamdan, P.E.,PMP
Senior Associate

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GEOTECHNICAL ENGINEERING REPORT
LITTLE BEAR SOLAR PROJECT
SOUTHWEST CORNER OF W CALIFORNIA AVE AND S OHIO AVE
MENDOTA, FRESNO COUNTY, CALIFORNIA
Terracon Project No. 60155057
August 7, 2015

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed 40 MegaWatt (MW) Little Bear Solar Project to be located at the southwest corner of W California Avenue and S Ohio Avenue, south of Mendota, in Fresno County, California. The "Site Location Plan" (Exhibit A-1) is included in Appendix A of this report. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- earthwork
- driven pile design and construction
- groundwater conditions
- pavement/roadway design and construction
- foundation design and construction

Terracon's geotechnical engineering scope of work for this project included the following field exploration activities:

SUMMARY OF THE SUBSURFACE EXPLORATION		
Exploration Type	**Quantity**	**Approximate Depth Below Ground Surface (bgs)**
Pile Load Tests	10	5 and 6 feet
Test Pits	10	4½ to 5 feet
Test Borings	6	5 to 41½ feet
Percolation Tests	4	5 feet

Logs of the borings and test pits along with a "Boring and Test Location Diagram" (Exhibit A-2) are included in Appendix A of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

In addition to the subsurface exploration, ten (10) in-situ electrical resistivity tests, six (6) in-situ thermal resistivity tests, twelve (12) laboratory thermal resistivity tests, ground potential rise (GPR) analysis, and in-situ corrosion testing at three (3) locations were performed during our course of work on the project.

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	Refer to the “Boring and Test Location Diagram” (Exhibit A-2 in Appendix A).
Proposed Structures	The site will be developed with solar PV modules mounted on horizontal single-axis tracker (HSAT) systems. The solar tracker systems are anticipated to be supported on driven steel W-section piles. The facility will also include one substation with end towers and self-contained structures.
Maximum loads (assumed)	Driven Pile Foundation Loads: ■ Shear: 2,000 lbs ■ Uplift: 2,000 lbs Substation Transformers: 12 to 15 tons
Proposed grading	Based on the topography, the project site is relatively flat. Minor cuts and fills are anticipated to bring the site to design grades.
Pavements	It is our understanding that aggregate surface roadways will be used for fire access roads, delivery roads and parking areas on the site. In addition, compacted native subgrade roadways will be utilized for maintenance and operation roads within the solar arrays.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	The proposed solar project occupies multiple blocks of land located corner of W California Avenue and S Ohio Avenue, south of Mendota, in Fresno County, California. The project site will encompass an approximate area of 200 acres.
Current ground cover	The majority of the surface appears to be covered by native soils with sparse vegetation and appear to have been cultivated as agricultural land.
Existing topography	Based on the topography, the site is relatively flat.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The site is situated within the southeastern Great Valley Geomorphic Province in Central California, and is specifically part of the Cenozoic Fill of the Great Valley. Which overlies the Great Valley sequence of sedimentary rocks, most of which are marine in origin and many of which are oil bearing. To the east is the Sierra Nevada Geomorphic Province and the west is bounded by the Diablo Range of the Coast Ranges Geomorphic Province.[1] The surface geology at the site is characterized as an alluvial plain, which is comprised of Recent Quaternary fan deposits[2]. The principal faults responsible for tectonic movement and most seismic hazards at the site are the two aforementioned faults that will be discussed in more detail in the Faulting and Estimated Ground Motions section of this report.

3.2 Typical Subsurface Profile

Specific conditions encountered at each boring location are indicated on the individual boring and test pits logs. Stratification boundaries on the boring and test pit logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings and test pits can be found on the boring and test pit logs included in Appendix A of this report. Based on the results of the borings and test pits, subsurface conditions within the depth of exploration on the project site can be generalized as lean/fat clay with variable amounts of sand extending to depths of 35 to 40 feet below existing ground surface, overlying poorly graded sand with variable amounts of silt and clay. Borings were terminated in the poorly graded sand layer due to sands flowing into the auger.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B. Atterberg Limit test results indicate the plasticity of on-site soils ranges from medium to high plasticity. A direct shear test was performed on clay materials encountered at a depth of approximately 5 feet bgs and indicated an ultimate friction angle of 21-degrees with an approximate corresponding cohesion of 340 psf. Laboratory test results indicate that the clayey materials encountered in the substation areas at approximate depths of 2½ and 5 feet bgs exhibit a negligible swell potential in response to wetting under a confining pressure of 2,000 psf. Laboratory Moisture-Density Test (Modified Proctor) results indicate that the surface materials have a maximum dry density ranging between 103.9 and 120.6 pcf, with corresponding optimum moisture contents ranging between 10.8% to 19.0%.

3.3 Groundwater

Groundwater was observed in test borings at the time of field exploration at depths of approximately 17 to 18 feet below existing ground surface. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

In clayey soils with low permeability, the accurate determination of groundwater level may not be possible without long term observation and delayed depth measurements in the test borings.

---

[1] Norris, R. M. and Webb, R. W., *"Geology of California, Second Edition,"* John Wiley & Sons, Inc., 1990.

[2] Geologic Map of California – Olaf P. Jenkins Edition – Santa Cruz Sheet, Compilation by Charles W. Jennings 1958.

Long term observation after drilling could not be performed as borings were backfilled immediately upon completion due to safety concerns. Groundwater levels can best be determined by implementation of a groundwater monitoring plan. Such a plan would include installation of groundwater monitoring wells, and periodic measurement of groundwater levels over a sufficient period of time.

State Department of Water Resources identified the groundwater depth in multiple wells on and adjacent to the project site. Groundwater was found to be between 3 and 7 feet bgs.[3]

The possibility of groundwater fluctuations should be considered when developing design and construction plans for the project.

3.4 Percolation Test Results

Four (4) borings were advanced to approximate depths of 5 feet bgs and were utilized for percolation testing (falling head borehole permeability). An approximately 2-inch thick layer of gravel was placed in the bottom of each boring, and a 3-inch diameter perforated pipe was installed on top of the gravel layer in the three borings. Gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period. At the beginning of each test, the pipes were refilled with water and readings were taken at 30-minute time intervals. Percolation rates are provided in the following table:

PERCOLATION TEST RESULTS				
Test Location (depth)	**Soil Classification**	**Slowest Measured Percolation Rate, in/hr**	**Correlated Infiltration Rate*, in/hr**	**Water Head, in**
P-1 (5 ft)	Lean Clay	0.75	<0.1	55.6
P-3 (5 ft)	Lean Clay	1.00	<0.1	57.3
P-8 (5 ft)	Lean Clay	1.50	<0.1	49.4
P-10 (ft)	Lean Clay	0.25	<0.1	49.5

*If the proposed infiltration systems will mainly rely on vertical downward seepage, the correlated infiltration rates should be used. The correlated infiltration rates were calculated using the Porchet Method.

The field test results are not intended to be design rates. They represent the result of our tests, at the depths and locations indicated, as described above. The design rate should be determined by the designer by applying an appropriate factor of safety. With time, the bottom of infiltration systems tend to plug with organics, sediments, and other debris. Long term

[3] Wells Nos. 14S14E14M001M & 14S14E15A001M located at the center of and north side of project site (http://www.water.ca.gov/waterdatalibrary/)

maintenance will likely be required to remove these deleterious materials to help reduce decreases in actual percolation rates. In addition, the percolation rate may be affected by the following factors, which should be considered when selecting the factor of safety:

Test Procedures: Percolation during the test likely included seepage out of the boring both vertically and laterally, whereas seepage from storm water infiltration systems may primarily flow vertically downward, depending on the geometry and details of the systems.

Water Quality: The percolation test was performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Soil Variability: Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines content. The design elevation and size of the proposed infiltration system should account for this expected variability in percolation rates.

Percolation testing should be performed after construction of the infiltration system to verify the design percolation rates. It should be noted that siltation and vegetation growth along with other factors may affect the percolation rates of the percolation areas. The actual percolation rate may vary from the values reported here. Infiltration systems should be located at least 10 feet from any existing or proposed foundation system.

3.5 Field Soil Resistivity Test Results

Field measurements of soil resistivity were performed on July 8 and July 9, 2015 in general accordance with ASTM Test Method G57, and IEEE Standard 81, using the Wenner Four-Electrode Method. The soil resistivity testing was performed near the center of the test locations identified on Exhibit A-2. The Wenner arrangement (equal electrode spacing) was used with the "a" spacing incrementally increasing. The "a" spacing is generally considered to be the depth of influence of the test.

A total of ten (10) in-situ electrical resistivity tests were performed at the project site. In-situ electrical resistivity tests were performed with "a" spacings of 2, 4, 6, 8, 12, 20, 30, 50, 100, and 200 feet at six (6) locations and four (4) tests were performed using "a" spacings of 2, 4, 6, and 8 feet.. The in-situ electrical resistivity test report is included in Appendix D.

3.6 Thermal Resistivity Test Results

Terracon retained the services of GeothermUSA to perform the field and laboratory testing for thermal resistivity. GeothermUSA obtained the coordinates and conducted in-situ thermal resistivity and ambient temperature measurements at three depths (2, 3, and 4 feet bgs) in a total of six (6) test pits. In-situ thermal resistivity and ambient temperature measurements were made at these depths using thermal probes and the Geotherm TPA-2000 run off a portable power source. All thermal testing was performed in accordance with the IEEE Standard (IEEE-442).

Laboratory testing included two (2) tests on samples obtained from the six (6) test pits from the upper 36 inches bgs (a total of twelve (12) tests). The samples were tested for laboratory thermal resistivity at compaction values of 85% and 95% of the maximum dry density as required by the provided First Solar specifications.

We recommend that the thermal resistivity results be discussed with an electrical design team to determine the influence on cable type and backfill materials. The test results are presented in the GeothermUSA report attached in Appendix J.

3.7 Seismic Considerations

3.7.1 Seismic Site Classification

Based on the USGS U.S. Seismic Design Maps application utilizing the 2010 ASCE 7 Standard with a Risk Category of I, II, or II, the following seismic values have been determined for the site:

DESCRIPTION	VALUE
2013 California Building Code Site Classification (CBC) [1]	E
Site Latitude	N 36.71708°
Site Longitude	W 120.42196°
S_s Spectral Acceleration for a Short Period	1.143g
S_1 Spectral Acceleration for a 1-Second Period	0.385g
F_a Site Coefficient for a Short Period	0.900g
F_v Site Coefficient for a 1-Second Period	2.458g

[1] Note: The 2013 California Building Code (CBC) Site Classification requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the required 100 foot soil profile determination. Borings extended to a maximum depth of 41½ feet, and this seismic site class definition considers that similar soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

3.7.2 Faulting and Estimated Ground Motions

The project site is located in Southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. The following table indicates the distance of the fault zones and the associated maximum credible earthquake that can be produced by nearby seismic events, as calculated using the USGS Earthquake Hazard Program 2002 Interactive Deaggregations. The Great Valley-11 Fault, which is located approximately 21.1 kilometers from the site, is considered to have the most significant effect at the site from a design standpoint.

CHARACTERISTICS AND ESTIMATED EARTHQUAKES FOR REGIONAL FAULTS		
Fault Name	**Approximate Distance to Site (km)***	**Maximum Credible Earthquake (MCE) Magnitude**
Great Valley 11	21.1	6.4
Great Valley 10	23.2	6.4
Great Valley 12	27.3	6.3

Based on the USGS using the 2010 ASCE 7 Standard, the mean peak ground acceleration (PGA) for the project site is anticipated to be approximately 0.598g[4]. Based on the USGS Earthquake Hazard Program 2002 interactive deaggregations the modal magnitude is estimated to be 6.4.

The site is not located within an Alquist-Priolo Earthquake Fault Zone based on our review of the State Fault Hazard Maps.[5]

3.7.3 Liquefaction Potential

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils exist below groundwater. The project site may be considered at a risk of liquefaction-related ground failure during a seismic event, based upon the subsurface conditions encountered in the test borings.

Materials encountered within the outline of the proposed substation included clayey soils overlying granular soils. Groundwater was encountered at approximate depths of 17 to 18 feet bgs.

The consequences of one-dimensional settlement may be largely mitigated by the presence of a thick non-liquefiable layer located above liquefied soils (Ishihara 1985, Naesgaard et al. 1998, Bouckovalas and Dakoulas 2007). It is our opinion that the presence of 35 to 40 foot thick non-liquefiable layer may act as a bridging layer that redistributes stresses and therefore results in

[4] USGS, data collected in reference to the project site coordinates provided in Section 3.7.1 of this report (http://earthquake.usgs.gov/designmaps/us/application.php)
[5] California Department of Conservation Division of Mines and Geology (CDMG), *"Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region"*, CDMG Compact Disc 2000-003, 2000.

more uniform ground surface settlement. Therefore, the soils below a depth of 40 feet bgs in boring B-1 may be considered non-liquefiable. Therefore, the impact of liquefaction on the proposed structures may be considered low.

3.8 Corrosion Potential

Results of soluble sulfate testing indicate that ASTM Type V portland cement should be used in all concrete on and below grade. Foundation concrete should be designed for severe sulfate exposure in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

Laboratory test results indicate that on-site soils have resistivity ranging from 126 to 1,038 ohm-centimeters, chloride content ranging from 175 to 2,425 ppm, Redox Potential ranging from 655mV to 681mV, pH values ranging from 7.71 to 8.36, water soluble sulfate contents less than or equal to 0.01%, salt contents ranging between 1,299 ppm and 24,696 ppm and negligible concentrations of sulfides. These test results are provided to assist in determining the type and degree of corrosion protection that may be required for the design and construction at the site. Refer to Summary of Laboratory Results contained in Appendix B for the complete results of the various corrosivity testing conducted on the samples obtained from the site.

Terracon retained the services of Corrpro to perform the following in-situ tests at three (3) locations on the site:

- Linear Polarized Resistance (LPR) rates for "as received" and "wetted" soil samples for galvanized steel and bare steel;
- Current densities & corrosion rates using E-LogI test method for galvanized steel and bare steel; and,
- Pile Potential Measurement for galvanized steel & bare steel; connected and not connected to copper.

The test locations were chosen based on the lowest measured electrical resistivity and are shown on the "Boring and Test Location Diagram", Exhibit A-2 in Appendix A. The results of the testing are included in the Corrpro report included in Appendix I. The report also contains the results of the galvanic corrosion analysis based on grounding system design provided by First Solar.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings and test pits provided that the findings and recommendations presented in this report are incorporated into project design and construction.

The proposed end transmission towers may be supported on drilled shafts. Substation transformers and facilities may be supported on mat foundations bearing on engineered fill. It is our understanding that the PV solar panels will be supported by W6x7 galvanized steel piles.

Surface and near surface soils consisted of clayey materials with high expansion potential. These soils should not be used as engineered fill. Engineered fill should comprise of imported low-volume change materials.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (which are presented in Appendices A and B), engineering analyses, and our current understanding of the proposed project.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation, and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations and roadways are contingent upon following the recommendations outlined in this section. All grading within the substation should incorporate the limits of the proposed structures plus a minimum lateral distance as specified in this report.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Grading plans were not reviewed as part of the scope of work for this report. Terracon should be retained to evaluate the grading plans as they are developed, and to provide updated geotechnical engineering recommendations based on review of those plans.

4.2.1 Site Preparation

Strip and remove existing vegetation, debris, and other deleterious materials from proposed development areas. Exposed surfaces within the substation area should be free of mounds and depressions which could prevent uniform compaction.

Stripped materials consisting of vegetation and organic materials should be wasted from the site, or used to revegetate landscaped areas or exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

4.2.2 Subgrade Preparation

Due to the low bearing capacity of the near surface soils, shallow mat and spread footing foundations should be supported on engineered fill. The minimum depth of fill and over-excavation should be 5 feet below existing grades or 3 feet below the bottom of the deepest foundations, whichever is greater.

The over-excavation should then be backfilled up to the footing or mat base elevation with engineered fill placed in lifts of 8 inches or less in loose thickness and should be moisture conditioned and compacted following the recommendations in section 4.2.4 of this report. The limits of required over-excavation and engineered fill are shown in the figure to the right.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Wet, dry, or loose/disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open for an extended period of time.

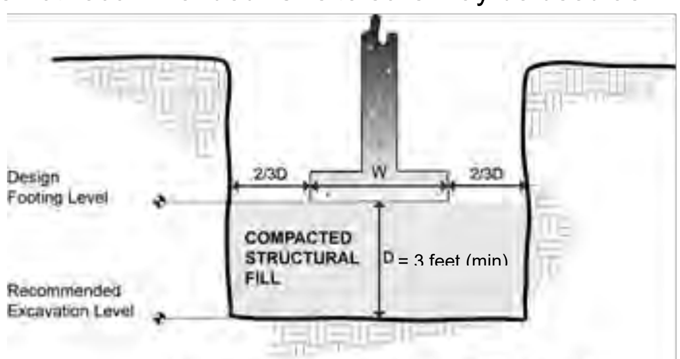
Subsequent to the surface clearing and grubbing efforts, the exposed subgrade soils which will support engineered fill, interior slabs, exterior slabs, or pavement areas constructed at grade, should be prepared to a minimum depth of 10 inches. Subgrade preparation should generally include scarification, moisture conditioning, and compaction. The moisture content and compaction of subgrade soils should be maintained until construction.

4.2.3 Fill Materials and Placement

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than three inches in size. Pea gravel or other open-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Surface and near surface soils consisted of clayey materials with high expansion potential. These soils should are not considered suitable for use as engineered fill, and their use as engineered fill beneath foundation or slabs is not recommended. Onsite soils may be used as fill material for general site grading and pavement areas.

Imported soils (if required for the project) for use as fill material within proposed structural areas should conform to low volume change materials as indicated in the following specifications:



Overexcavation / Backfill

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

Gradation	**(ASTM C 136)**
3”	100
No. 4 Sieve	50-100
No. 200 Sieve	20 - 50

- Liquid Limit .... 30 (max)
- Plasticity Index .... 15 (max)
- Maximum Expansion Index* .... 20 (max)

*ASTM D4829

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed ten inches loose thickness.

4.2.4 Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

Material Type and Location	Per the Modified Maximum Density Test (ASTM D1557)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction (% over optimum)	
		Minimum	Maximum
On-site native soils:			
Bottom of excavation to receive fill:	90	0%	+4%
Beneath asphalt pavements:	95	0%	+4%
Beneath aggregate base roadways:	95	0%	+4%
Miscellaneous backfill:	90	0%	+4%
Compacted native soils for roadways:	90	0%	+4%
Utility trench subgrade and backfill*:	90	0%	+4%
Approved import engineered fill:			
Beneath foundations:	95	0%	+4%
Aggregate base (pavements):	95	0%	+4%

* Minimum compaction of 95% is required in the top 12 inches beneath roadways and structural areas. Compaction requirements may be modified by the electrical engineer based on thermal resistivity.

4.2.5 Vault Pit Excavations

Vaults can be supported on undisturbed native soils encountered at the bottom of the vault pit excavations. The bottom of the vault pit excavation should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Depending upon depth of excavation and seasonal conditions, groundwater or perched groundwater may be encountered in excavations. Pumping from sumps may be utilized to control water within excavations. Well points may be required for significant groundwater flow, or where excavations penetrate groundwater to a significant depth. The design of the proposed vault should account for the potential of uplift buoyant forces if these structures are constructed below the level of groundwater.

If the exposed soils at the bottom of the excavations have elevated water contents and are pumping or yielding during attempts to compact the bottom of the excavation, the bottom of the pits should be over-excavated to a minimum depth of 12 inches, and replaced with well sorted crushed aggregate materials. The aggregate materials should be wrapped (top, bottom and sides) with a non-woven geotextile such as Mirafi 140N, or an approved equivalent. The crushed aggregate could have a nominal particle size of ¾ to 1 inch. The aggregate layer and the geotextile layer are anticipated to create a stable platform beneath the proposed vault and overlying backfill materials.

We recommend that the plan dimensions of the pits be over-excavated by about 2 feet laterally to provide adequate access around the excavation for vault placement. The walls of the proposed vault pit excavation should be shored or sloped in conformance with OSHA excavation and trench safety standards. If any excavation is extended to a depth of more than 20 feet, it will be necessary to have the side slopes designed by a professional engineer.

Soils from the pit excavations should not be stockpiled higher than six 6 feet or within ten 10 feet of the edge of an open trench. Construction of open cuts adjacent to existing structures, including underground pipes is not recommended within a 1½ H:1V plane extending beyond and down from the perimeter of the structure. Cuts that are proposed within five 5 feet of light standards, other utilities, underground structures, and pavement should be provided with temporary shoring.

It may be necessary for the Contractor to retain a geotechnical engineer to monitor the soils exposed in all excavations and provide engineering services for slopes. This will provide an opportunity to monitor the soils encountered and to modify the excavation slopes as necessary. It also offers an opportunity to verify the stability of the excavation slopes during construction.

4.2.6 Construction Considerations

At the time of our geotechnical exploration of the site, moisture contents of the surface and near-surface native soils ranged from about 17 to 27 percent. Based on these moisture contents, some moisture conditioning of the soils will likely be needed during construction of the project.

Although the exposed subgrades are anticipated to be relatively stable upon initial exposure, on-site soils may pump and unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance. Should unstable subgrade conditions develop stabilization measures will need to be employed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to pavement construction.

Based upon the subsurface conditions determined from the geotechnical explorations, subgrade soils exposed during construction are anticipated to be relatively workable. We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season, it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork may require additional mitigative measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

If unstable subgrade conditions develop during construction, suitable methods of stabilization will be dependent upon factors such as schedule, weather, size of area to be stabilized, and the nature of the instability. If soil stabilization is needed, Terracon should be consulted to evaluate the situation as needed.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

4.3 Pile Load Test Procedures

4.3.1 Test Pile Installation

Terracon subcontracted Sunstall, Inc. to install the test piles for the pile load tests. GAYK HRE equipment with a hydraulic attachment was utilized for installation. A total of twenty (20) piles were installed on July 10, 2015 under Terracon supervision at the 10 test locations (2 per location) selected by the client. The test locations are indicated on Exhibit A-2 in Appendix A. At each test location, two bare steel W6x9 sections were installed.

The test locations were plotted in Google Earth at the approximate positions requested to obtain the latitude and longitude of each location. The test pile locations were laid out at the estimated latitude and longitude coordinates using a hand-held GPS unit.

Each test pile was stood on the ground at the test location and the pile driver was positioned vertically on top of the pile. The pile verticality was checked with a magnetic spirit level and the pile driver would then push the pile into the ground (without actuating the hammer) to the depth possible, typically to about a foot or foot and a half. The pile verticality was then checked again and the pile re-straightened, if needed. The operator would then actuate the hammer and the pile was driven to the specified depth of penetration. The piles were driven to an embedment depth of approximately 5 feet and six locations, and 6 feet at four locations. All piles were driven within an approximate period of time ranging between 18 and 42 seconds.

4.3.2 Test Pile Details

Terracon provided the W6x9 posts to the job site. The piles were driven to approximate depths of 5 and 6 feet bgs to facilitate performing tension (pull-out) tests, with 12 to 24-inches of the pile being above the ground surface. The bare steel W6x9 sections have the following properties[6]:

Parameter	Property
Depth	5.900 in
Flange Width, b_f	3.940 in
Flange Thickness, t_f	0.215 in
Web Thickness, t_w	0.170 in
Moment of Inertia, I_x	16.40 in^4
Section Area, A	2.68 in^2
Young's Modulus, E_s	29,000 ksi
Yield Stress, F_y	50 ksi
Hot Dip Galvanization	None

[6] American Institute of Steel Construction (AISC), *"Steel Construction Manual – Fourteenth Edition"* February, 2012.

The performance criteria for the piles at this project includes an acceptable upward deflection of less than ¼-inch, and an allowable lateral deflection of less than ½-inch under the design loading conditions.

4.3.3 Pile Load Testing

The pile load testing was performed with reference made to ASTM D3689 Test Methods for Deep Foundations under Static Axial Tensile Load and D3966 Test Methods for Deep Foundations under Lateral Load. The technical data outlined in Appendices B and C of the Statement of Work from First Solar was also used as a reference for testing procedures.

An Enerpac 10-ton hydraulic pull jack and an Enerpac manual hydraulic pump was used to apply the test loads using chains and clevises all rated for at least a 10-ton safe working capacity. The loads were measured with an Omegadyne LC-101, 10-ton electronic load cell. The calibration certificate for the electronic load cell is attached in Appendix H.

Both the vertical and lateral tests were performed in tension. Terracon's proprietary steel tri-pod system was used to develop the vertical tension reaction. A locking "E"- plate clamp was used to grip the top of the web for the tension tests. Deflections and loads were measured using a pair of calibrated Mitutoyo ID-C150EXB digital deflection gauges and from the electronic readout device from the load cell. These readings were recorded manually on test data sheets by a field engineer. Terracon set up a steel reference beam to attach the deflection gauges with magnetic bases. The ends of the reference beam were supported on standard 3 x 6-inch bricks, seated firmly into the ground surface. For the vertical test, magnetic bases were also attached to the sides of the test pile to provide a suitable surface for the defection gauges to rest against.

For lateral loading, Terracon connected the test pile to the reaction pile to provide a lateral tension reaction point. The piles were spaced at an approximate horizontal distance of 10 feet from each other. A chain was used to connect the reaction members and a flange clamp was set on the pile to apply horizontal loading approximately 6 inches above the ground surface. One reference beam was positioned near the outside edge of the test pile flange. Two digital dial gauges were positioned horizontally on the reference beams to bear near the outside edges of the test pile flange at about 6 inches above ground surface as well as the approximate point of lateral load.

The test loads were applied and the deflections were measured in general accordance with the loading schedule provided in Exhibit A of the RFP. The Enerpac jack was rated to have a 20,000 pound capacity. All components used in the tests were rated for load capacities within the range of applied test loads.

4.3.4 Pile Load Test Results

All measurements recorded during the pile load tests are presented on the data reports included in Appendix E. The allowable downward capacity of the pile may be assumed to be equal to the allowable tension capacity of the pile derived from uplift pile load testing.

An increase of 1/3 for allowable downward forces and lateral loads for combined wind and seismic loads may be applied. Additionally, an increase of ¼ for allowable uplift forces for the same loading conditions may be applied.

4.3.5 L-PILE Analyses

The L-PILE analyses considered the test piles with their top at the field gauge height of 6 inches and the embedded pile lengths of 5.0 and 6.0 feet based on field installation. Subsurface conditions were modeled as “Stiff Clay without Free Water”. Unit weight values were based on the subsurface conditions encountered in the test borings and test pits within the solar arrays. The following table summarizes the soil and pile parameters used in the analysis of each pile.

Pile Number	Embedment Length (ft)	L-Pile Soil Type	Effective Unit Weight (pcf)	Cohesion (psf)	ε_{50}
TP-01	5	Stiff Clay W/out Free Water	115	1,170	.007
TP-02	6	Stiff Clay W/out Free Water	115	1,420	.007
TP-03	5	Stiff Clay W/out Free Water	115	1,940	.007
TP-04	5	Stiff Clay W/out Free Water	115	2,880	.007
TP-05	5	Stiff Clay W/out Free Water	115	1,540	.007
TP-06	6	Stiff Clay W/out Free Water	115	1,780	.007
TP-07	6	Stiff Clay W/out Free Water	115	1,680	.007
TP-08	6	Stiff Clay W/out Free Water	115	1,480	.007
TP-09	5	Stiff Clay W/out Free Water	115	1,590	.007
TP-10	5	Stiff Clay W/out Free Water	115	560	.01

L-PILE analyses were performed by applying the field test load that resulted in approximately ½-inch top deflection at the point of load application of 6-inches above the ground surface. The actual test loads and measured deflections were utilized in our analyses as opposed to the interpolated load at ½-inch deflection as reported elsewhere in this report. The coefficient of subgrade reaction (k-value), friction angle, strain factor and cohesion were then adjusted (by trial and error method) such that the applied load resulted with a deflection value that matched the in-situ test results. Please note that this procedure was based on only one discrete set of data determined at 6 inches from the ground surface during the field load testing. Since no lateral deflections were measured below the ground surface during the testing, we have assumed in our analyses that the soil-structure interaction is simulated by a long slender pile and that the pile behaves in a flexural manner as depicted on the L-PILE Lateral Deflection versus Depth curves generated for each test pile. Actual lateral deflections of the test and production piles below the ground surface may vary from the results depicted from our analyses. The results of the L-PILE analyses are included in Appendix G of this report.

4.4 Foundations

Transmission line end towers can be supported on drilled shafts. Electrical substation elements can be supported by mat foundations bearing on compacted engineered fill. Supporting the proposed solar tracker systems on driven steel W-section piles is considered suitable for this project provided the measured deflections associated with the structural test loads are acceptable during the design life of the proposed solar tracker systems.

Design recommendations for foundations for the proposed structures and related structural elements are presented in the following paragraphs.

4.4.1 Drilled Shaft Design Recommendations (Substation End Towers)

The proposed transmission end towers can be supported on drilled shafts with a minimum embedment depth of 10 feet bgs. Total required embedment of the drilled shafts should be determined by the structural engineer based on structural loading and parameters provided in this report.

The allowable end bearing and side friction components of resistance were evaluated and are presented in the table below. The allowable axial and uplift parameters are based on a minimum factor of safety of 2.5.

Recommended geotechnical parameters for lateral load analyses of drilled shaft foundations have been developed for use in the L-PILE computer program. Based on our review of the subsurface conditions within the outline of the substation and the Standard Penetration Test (SPT) results, engineering properties have been estimated for the soils conditions as shown in the following table. We recommend that Terracon review the final drilled shaft design to verify that sufficient embedment is achieved.

Axial & Lateral Load Analyses
Estimated Engineering Properties of Soils

Top Depth / Bottom Depth	Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Cohesion (psf)	Coeff. of Static Subgrade Reaction K_s (pci)	ε_{50}	End Bearing Capacity (psf)	Skin Friction (psf)
2 / 6	60	Stiff Clay With Free Water	750	300*	0.01	--	160
6 / 10	60	Stiff Clay With Free Water	250	100	0.02	--	50

Axial & Lateral Load Analyses Estimated Engineering Properties of Soils							
Top Depth Bottom Depth	Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Cohesion (psf)	Coeff. of Static Subgrade Reaction K_s (pci)	ε_{50}	End Bearing Capacity (psf)	Skin Friction (psf)
10 34	60	Stiff Clay With Free Water	750	300*	0.01	2,700	160
34 38	60		1000	500*	0.008	3,600	220

* A maximum of 200 pci should be used for cyclic loading.

The depth below ground surface indicated in the table above is referenced from the existing ground surface at the site at the time of the field exploration. If fill is placed to raise the site grades, the depths shown in the table above must be increased by the thickness of fill placed. The required depths of shaft embedment should also be determined for design lateral loads and overturning moments to determine the most critical design condition.

Lateral load design parameters are valid within the elastic range of the soil. The coefficients of subgrade reaction are ultimate values; therefore, appropriate factors of safety should be applied in the shaft design or deflection limits should be applied to the design.

It should be noted that the load capacities provided herein are based on the stresses induced in the supporting soils. The structural capacity of the shafts should be checked to assure that they can safely accommodate the combined stresses induced by axial and lateral forces. Furthermore, the response of the drilled shaft foundations to lateral loads is dependent upon the soil/structure interaction as well as the shaft's actual diameter, length, stiffness and "fixity" (fixed or free-head condition).

4.4.2 Drilled Shaft Construction Considerations

Drilling to design depths should be possible with conventional single flight power augers. For drilled shaft depths above the depth of groundwater, temporary steel casing will likely be required to properly drill and clean shafts prior to concrete placement. For drilled shaft depths below groundwater level, we recommend the use of slurry drilling methods with polymers to keep the solids in suspension during the drilling.

Drilled shaft foundation concrete should be placed immediately after completion of drilling and cleaning. If foundation concrete cannot be placed in dry conditions, a tremie should be used for concrete placement. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes

If casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent infiltration of water or the creation of voids in shaft concrete. Shaft concrete should have a relatively high fluidity when placed in cased shaft holes or through a tremie. Shaft concrete with slump in the range of 6 to 8 inches is recommended.

We recommend that all drilled shaft installations be observed on a full-time basis by an experienced geotechnical engineer in order to evaluate that the soils encountered are consistent with the recommended design parameters. If the subsurface soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

The contractor should check for gas and/or oxygen deficiency prior to any workers entering the excavation for observation and manual cleanup. All necessary monitoring and safety precautions as required by OSHA, State or local codes should be strictly enforced.

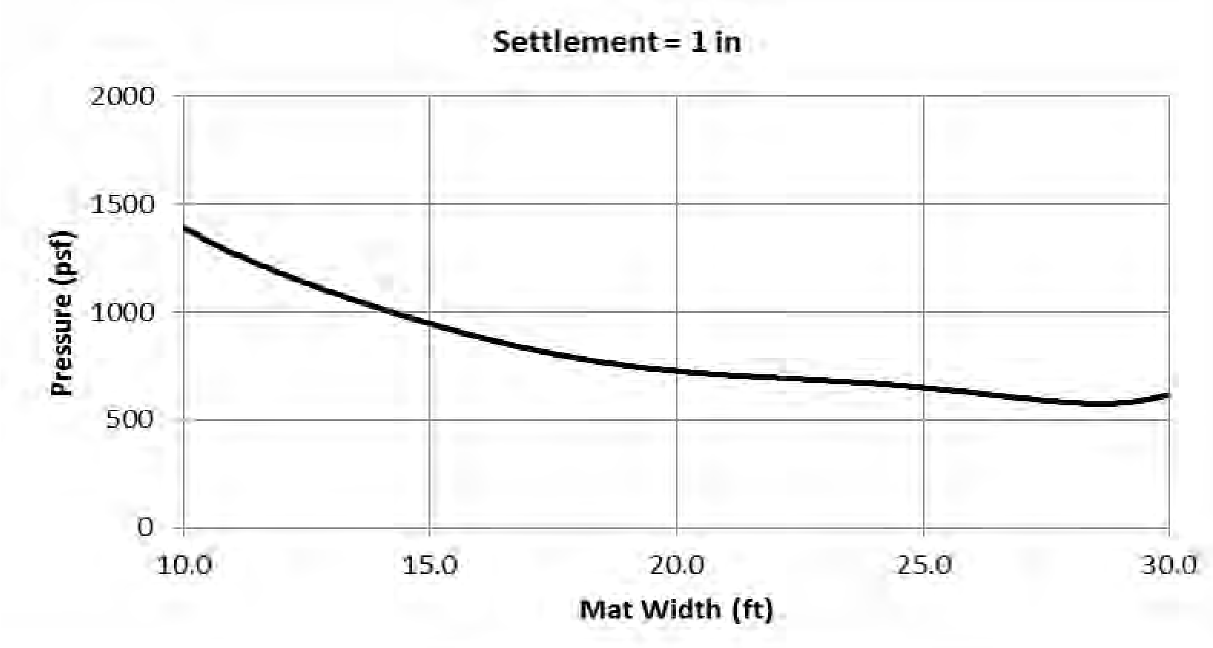
The contractor should check for gas and/or oxygen deficiency prior to any workers entering the excavation for observation and manual cleanup. All necessary monitoring and safety precautions as required by OSHA, State or local codes should be strictly enforced by the owner and the EPC.

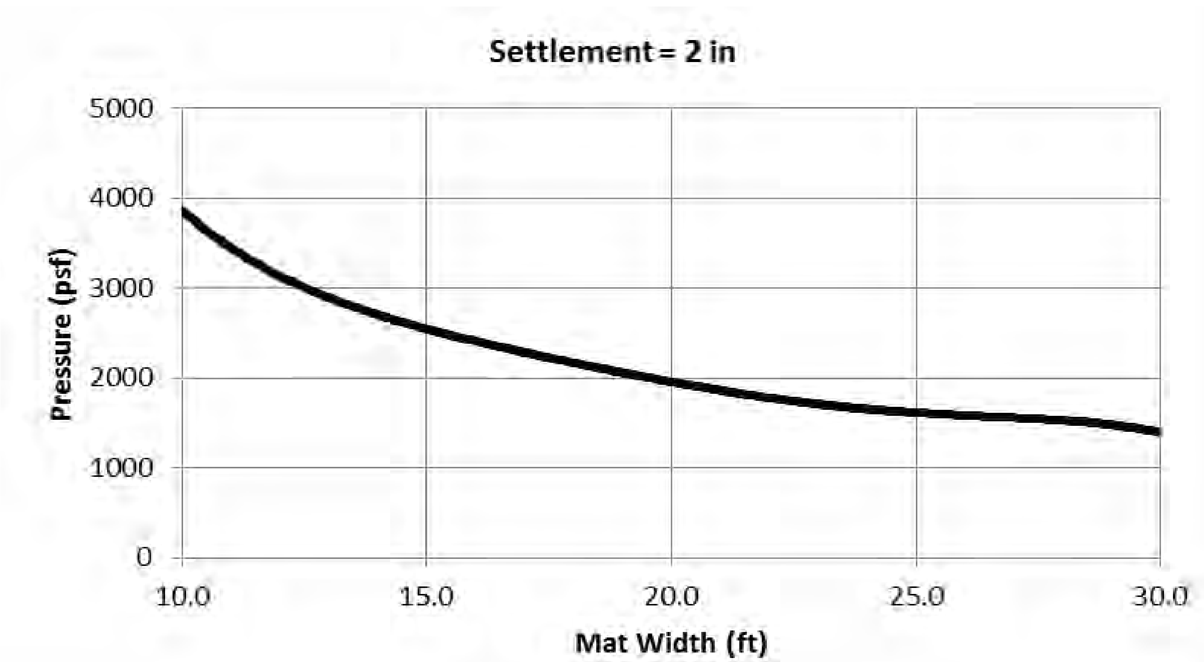
4.4.3 Mat Foundation Design Recommendations

DESCRIPTION	RECOMENDATION
Foundation Type	Mat foundations
Bearing Material	A minimum of 3 feet of compacted engineered fill consisting of imported low volume change materials
Allowable Bearing Pressure	1,500 psf for footing widths less than 9 feet. For footing widths > 9 feet, allowable bearing capacities should be determined by the charts below.
Minimum Dimensions	24 inches
Minimum Embedment Depth Below Finished Grade	18 inches
Total Estimated Static Settlement	1 inch to 2 inches
Estimated Differential Settlement	¾ to 1 inch.

Settlement calculations were performed utilizing Westergaard and Hough's methods[5] to estimate the static settlement for various foundation widths with an allowable settlement of 1 inch and 2 inch respectively.

[5] FHWA Geotechnical Engineering Circular No. 6 – Shallow Foundations, FHWA-SA-02-054.





Since there are several factors that will control the design of mat foundations besides vertical load, Terracon should be consulted when the final foundation depth and width are determined to assist the structural designer in the evaluation of anticipated settlement.

For structural design of mat foundations, a modulus of subgrade reaction (Kv_1) of 150 pounds per cubic inch (pci) may be used. Other details including treatment of loose foundation soils, superstructure reinforcement and observation of foundation excavations as outlined in the

Earthwork section of this report are applicable for the design and construction of a mat foundation at the site.

The subgrade modulus (K_v) for the mat is affected by the size of the mat foundation and would vary according the following equation:

$$K_v = K_{v1}/B$$

Where: K_v is the modulus for the size footing being analyzed
B is the width of the mat foundation.

4.4.4 Spread Footing Design Recommendations

DESCRIPTION	DESIGN RECOMMENDATION
Foundation Type	Conventional Shallow Spread Footing
Structure	Substation equipment/operation buildings and minor structures
Bearing Material	A minimum of 3 feet of compacted engineered fill, consisting of low volume change materials
Allowable Bearing Pressure	1,500 psf for footing widths up to 9 feet
Minimum Width for Continuous and Column Footings	16 inches and 24 inches, respectively
Minimum Embedment Depth Below Finished Grade	18 inches
Total Estimated Settlement	1-inch
Estimated Differential Settlement	½ to ¾ inch over 40 feet

4.4.5 Vault Foundation Design Recommendations

DESCRIPTION	DESIGN RECOMMENDATION
Foundation Type	Conventional Shallow Strip Footings
Structure	Vaults
Bearing Material	10 inches of scarified, moisture conditioned and compacted native soils.
Allowable Bearing Pressure	1,500 psf
Minimum Width for Footings	12 inches
Minimum Embedment Depth Below Finished Grade	36 inches
Total Estimated Settlement	1-inch
Estimated Differential Settlement	½ to ¾ inch over 40 feet

4.4.6 Foundations Design Considerations

Finished grade is defined as the lowest adjacent grade within five feet of the foundation for perimeter (or exterior) footings.

The allowable foundation bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

4.5 Floor Slab Design Recommendations

DESCRIPTION	VALUE
Interior floor system	Slab-on-grade concrete for buildings
Floor slab support	Engineered fill comprised of low volume change materials extending to a minimum depth of 3 feet below the bottom of the foundations
Subbase	4-inches of Class II Aggregate Base materials
Modulus of subgrade reaction	150 pounds per square inch per inch (psi/in) (The modulus was obtained based on our experience with similar subgrade conditions, and estimates obtained from NAVFAC 7.1 design charts)

In areas of exposed concrete, control joints should be saw cut into the slab after concrete placement in accordance with ACI Design Manual, Section 302.1R-37 8.3.12 (tooled control joints are not recommended). Additionally, dowels should be placed at the location of proposed construction joints. To control the width of cracking (should it occur) continuous slab reinforcement should be considered in exposed concrete slabs.

The use of a vapor retarder or barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

4.6 Lateral Earth Pressures

For native soils above any free water surface, recommended equivalent fluid pressures for design of foundation elements are:

DESIGN CASE	VALUE (On-site Soils)	VALUE (Granular Imported
Active Case	45 psf/ft	40 psf/ft
Passive Case[a]	320 psf/ft[a]	360 psf/ft[a]
At-Rest Case	65 psf/ft	60 psf/ft
Coefficient of friction	0.25	0.40[b]

[a] Note: Ignore passive pressure in the upper 18 inches bgs because of soil disturbance.

[b]Note: Reduce to 0.30 when used in conjunction with passive pressure.

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

4.7 Pavement and Roadway Design and Construction Recommendations

4.7.1 Asphalt and Concrete Pavement Design Recommendations

Assuming the pavement subgrades will be prepared as recommended within this report, the following pavement sections should be considered minimums for this project for the traffic indices assumed in the table below. As more specific traffic information becomes available, we should be contacted to reevaluate the pavement calculations.

	Recommended Pavement Section Thickness (inches)*	
	Traffic Index (TI) = 4.5 ~3,000 ESAL's	**Traffic Index (TI) = 6.0 ~33,000 ESAL's**
Flexible Pavement	3" Asphaltic Concrete over 9" Class II Aggregate Base	4" Asphaltic Concrete over 12" Class II Aggregate Base

* All materials should meet the CALTRANS Standard Specifications for Highway Construction.

All pavements should be supported on a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils. These pavement sections are considered minimal sections based upon the expected traffic and the existing subgrade conditions. However, they are expected to function with periodic maintenance and overlays if good drainage is provided and maintained.

4.7.2 Aggregate Surface Roadway Design Recommendations

Aggregate surface roadway design was conducted in general accordance with the Army Corps of Engineers (ACOE), Technical Manual TM-5-822, Design of Aggregate Surface Roads and

Airfields (1990). The design of pavement thickness was based on traffic containing less than 70 vehicles per day with 15 percent trucks, and about 1 percent of the total traffic composed of trucks having three or more axles, and no tracked vehicles. Terracon should be contacted if significant changes in traffic loads or characteristics are anticipated.

As a minimum, the aggregate surface course should have a minimum thickness of 8 inches. The recommended thickness should be measured after full compaction and should be constructed on a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils. This aggregate road section should be considered suitable for variable weather conditions anticipated at the location of the project with periodic maintenance.

It is our understanding that aggregate surfaced roads and parking areas will be utilized during the construction of this project. Based on our previous experience with First Solar projects, it is the client's desire to use a section of 3 inches of aggregate base over 12 inches of compacted native soils for temporary parking areas and low traffic drives. This section is anticipated to perform under the anticipated light and temporary traffic loading provided the subgrade is prepared and compacted to a minimum depth of 12 inches, and with periodic maintenance.

Aggregate materials should conform to the specifications of Class II aggregate base in accordance with the requirements and specifications of the State of California Department of Transportation (CalTrans), or other approved local governing specifications.

Positive drainage should be provided during construction and maintained throughout the life of the roadways. Proposed roadway design should maintain the integrity of the road and eliminate ponding.

4.7.3 Compacted Native Soils Access Road Design Recommendations

It is our understanding that First Solar is planning to use compacted native soils for the surface of interior roadways on the project. Based on the client's experience, such roads have performed in other facilities in the vicinity of the project site during the construction phase.

Due to the infrequent rain and minimal traffic in the vicinity of the project, it is our opinion that such unsurfaced roadways are anticipated to perform with periodic maintenance under the anticipated light and temporary traffic loading provided the roadways are compacted and prepared in conformance with Section 4.2.4 to a minimum depth of 12 inches.

Compacted native soils roads are expected to pump and yield, and unstable conditions could develop during construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Periodic maintenance and reshaping of these roadways should be anticipated.

4.7.4 Pavement and Roadway Design and Construction Considerations

Regardless of the design, aggregate surfaced roadways will display varying levels of wear and deterioration. We recommend an implementation of a site inspection program at a frequency of at least once per year to verify the adequacy of the roadways. Preventative measures should be applied as needed for erosion control and regrading. An initial site inspection should be completed approximately three months following construction.

Shoulder build-up on both sides of proposed roadways should match the aggregate surface elevation and slope outwards at a minimum grade of 10% for five feet.

Preventative maintenance should be planned and provided for through an on-going pavement management program in order to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment.

Materials and construction of pavements for the project should be in accordance with the requirements and specifications of the Caltrans, or other approved local governing specifications.

Base course or pavement materials should not be placed when the surface is wet. Surface drainage should be provided away from the edge of paved areas to minimize lateral moisture transmission into the subgrade.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analyses and recommendations presented in this report are based upon the data obtained from the pile load test program, the borings and test pits performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between pile tests, borings and test pits, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: COIT RANCH, CA (1/1/1984) and TRANQUILLITY, CA (1/1/1984).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

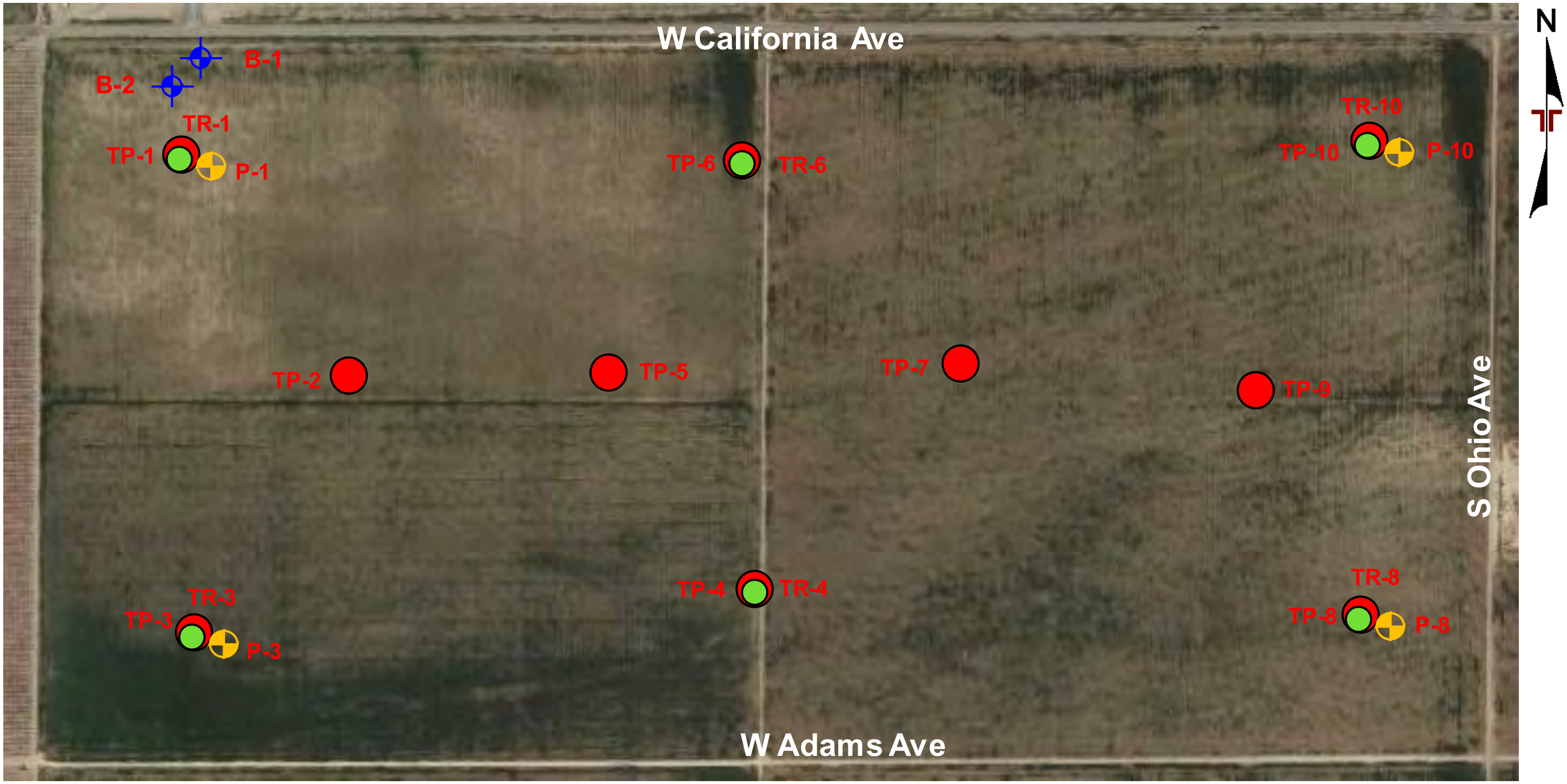
Project Manager: FH	Project No. 60155057
Drawn by: SZ	Scale: 1"=2,100 SF
Checked by: JM	File Name: A-1
Approved by: FH	Date: 07/30/2015

Terracon
2817 McGaw Ave.
Irvine, CA 92614

SITE LOCATION

Little Bear Solar Project
SW & SE of Intersection of W California Ave & San Bernardino
Mendota, CA

Exhibit
A-1



LEGEND

TP-1 APPROXIMATE TEST PIT, PILE TEST, ELECTRICAL RESISTIVITY LOCATION

TR-1 APPROXIMATE THERMAL RESISTIVITY TEST LOCATION

P-1 SOIL PERCOLATION TESTING APPROXIMATE LOCATION

B-1 APPROXIMATE BORING LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: FH	Project No. 60155057
Drawn by: SZ	Scale: 1 in. ~ 600 ft.
Checked by: JM	File Name: A-2
Approved by: FH	Date: 07/30/2015

Terracon
Consulting Engineers & Scientists

2817 McGaw Avenue Irvine, CA 92614
PH. (949) 261-0051 FAX. (949) 261-6110

BORING LOCATION DIAGRAM

Little Bear Solar Project

SW & SE of Intersection of W California Ave & San Bernardino
Mendota, CA

Exhibit

A-2

Field Exploration Description

A total of six (6) borings were drilled and ten (10) test pits were excavated at the site between the dates of July 11, 2015 and July 28, 2015. The borings were drilled to approximate depths ranging between 5 and 41½ feet (bgs) and the test pits were excavated to approximate depths ranging between 4 and 5 feet bgs. The test borings were advanced with a truck-mounted Mobil B-53 drill rig utilizing 8-inch diameter hollow-stem augers. The test pits were excavated with a rubber tire backhoe. Groundwater conditions were evaluated in each boring and test pit at the time of site exploration.

Approximate locations for borings and test pits are shown on the attached "Boring and Test Location Diagram", Exhibit A-2. The borings and test pits were located in the field using the proposed site plan, an aerial photograph of the site, and a handheld GPS unit. The accuracy of field exploration locations should only be assumed to the level implied by the method used.

Continuous lithologic logs of each boring and test pit were recorded by the field engineer during the drilling and exploration operations. At selected intervals, samples of the subsurface materials were taken at boring locations by driving split-spoon or ring-barrel samplers. Bulk samples of subsurface materials were also obtained from the borings and test pits.

Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials with a 140-pound automatic hammer falling 30 inches. The penetration resistance value is a useful index in estimating the consistency or relative density of materials encountered.

An automatic hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analyses of the subsurface information for this report.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site. The excavations were backfilled with excavated soils prior to the backhoe crew leaving the site.

BORING LOG NO. B-1

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc. Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.7197803° Longitude: -120.4216948° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY WITH SAND (CL), light brown, medium stiff										46-17-29	84
					5-4-5				17			
		5			3-3-6				27	91		
	soft				WOH-2-2						44-15-29	
	medium stiff	10			4-4-4				19	106		
		15			3-3-4 N=7							
			▽									
	stiff	20			4-7-6				25	99		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater encountered @ 18.5*

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-4

BORING LOG NO. B-1

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc. Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave Mendota, CA

LOCATION See Exhibit A-2

Latitude: 36.7197803° Longitude: -120.4216948°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
25.0	**LEAN CLAY WITH SAND (CL)**, light brown, medium stiff *(continued)*											
	FAT CLAY (CH), trace sand, light brown, medium stiff	25		X	2-2-3 N=5							
		30		X	1-2-3 N=5						50-19-31	90
38.0	stiff	35		X	5-5-5 N=10							
40.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown											
	Boring Terminated at 40 Feet	40										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater encountered @ 18.5

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-4

BORING LOG NO. B-2

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

LOCATION See Exhibit A-2

Latitude: 36.7195516° Longitude: -120.4219591°

GRAPHIC LOG / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
LEAN CLAY (CL), trace sand, light brown, medium stiff											
				2-3-4				17	94		
	5			2-3-5				25	94		
	10			4-5-4				19	104		
stiff	15			3-4-6				27	88		
		▽									
medium stiff	20			4-4-3 N=7							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater encountered @ 17.5*

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-5

BORING LOG NO. B-2

PROJECT: Little Bear Solar Project

**CLIENT: First Solar Inc.
Tempe, AZ**

**SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA**

LOCATION See Exhibit A-2

Latitude: 36.7195516° Longitude: -120.4219591°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), trace sand, light brown, medium stiff *(continued)*											
	brown, soft	25		X	2-3-1 N=4						36-18-18	88
	medium stiff	30		X	3-3-4 N=7							
	very stiff	35		X	4-7-10 N=17							
38.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, loose	40		X	2-2-4 N=6							
41.5	***Boring Terminated at 41.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater encountered @ 17.5

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-5

BORING LOG NO. P-1

PROJECT: Little Bear Solar Project

**CLIENT: First Solar Inc.
Tempe, AZ**

**SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.718598° Longitude: -120.421793° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	5.0	5										
	Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-6

BORING LOG NO. P-3

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

LOCATION See Exhibit A-2

Latitude: 36.714359° Longitude: -120.421902°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	5.0	5										
	Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL BORING LOG.GPJ TERRACON2015.GDT 8/6/15

BORING LOG NO. P-8

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.714341° Longitude: -120.407332° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	5.0	5										
	Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-8

BORING LOG NO. P-10

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.718549° Longitude: -120.406974° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown 5.0	5										
	Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Boring Started: 7/21/2015	Boring Completed: 7/21/2015
Drill Rig: DR009	Driller: Technicon Drilling
Project No.: 60155057	Exhibit: A-9

TEST PIT LOG NO. TP-1

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

LOCATION See Exhibit A-2

Latitude: 36.718598° Longitude: -120.421793°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown										45-16-29	78
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-10

TEST PIT LOG NO. TP-2

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.716416° Longitude: -120.420187° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-11

TEST PIT LOG NO. TP-3

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.714359° Longitude: -120.421902° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown 4.0			(hand)								
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-12

TEST PIT LOG NO. TP-4

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.714395° Longitude: -120.414542° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown 4.0			(hand sample)								
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-13

TEST PIT LOG NO. TP-5

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.716434° Longitude: -120.416485° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-14

TEST PIT LOG NO. TP-6

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

LOCATION See Exhibit A-2

Latitude: 36.7186° Longitude: -120.414499°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-15

TEST PIT LOG NO. TP-7

PROJECT: Little Bear Solar Project

**CLIENT: First Solar Inc.
Tempe, AZ**

**SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.716363° Longitude: -120.412133° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-16

TEST PIT LOG NO. TP-8

PROJECT: Little Bear Solar Project

**CLIENT: First Solar Inc.
Tempe, AZ**

**SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA**

LOCATION See Exhibit A-2

Latitude: 36.714341° Longitude: -120.407332°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown			(hand)							41-15-26	65
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-17

TEST PIT LOG NO. TP-9

PROJECT: Little Bear Solar Project

CLIENT: First Solar Inc.
Tempe, AZ

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.716328° Longitude: -120.408582° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown											
	4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Abandonment Method: Test Pit backfilled with soil cuttings upon completion.	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.	Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-18

TEST PIT LOG NO. TP-10

PROJECT: Little Bear Solar Project

**CLIENT: First Solar Inc.
Tempe, AZ**

**SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 36.718549° Longitude: -120.406974° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), light brown 4.0											
	Test Pit Terminated at 4 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Test Pit backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2817 McGaw Avenue
Irvine, California

Test Pit Started: 7/21/2015	Test Pit Completed: 7/21/2015
Excavator: Backhoe	Operator: Sounder Backhoe Drilling
Project No.: 60155057	Exhibit: A-19

APPENDIX B

LABORATORY TESTING

Laboratory Testing Description

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix C. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

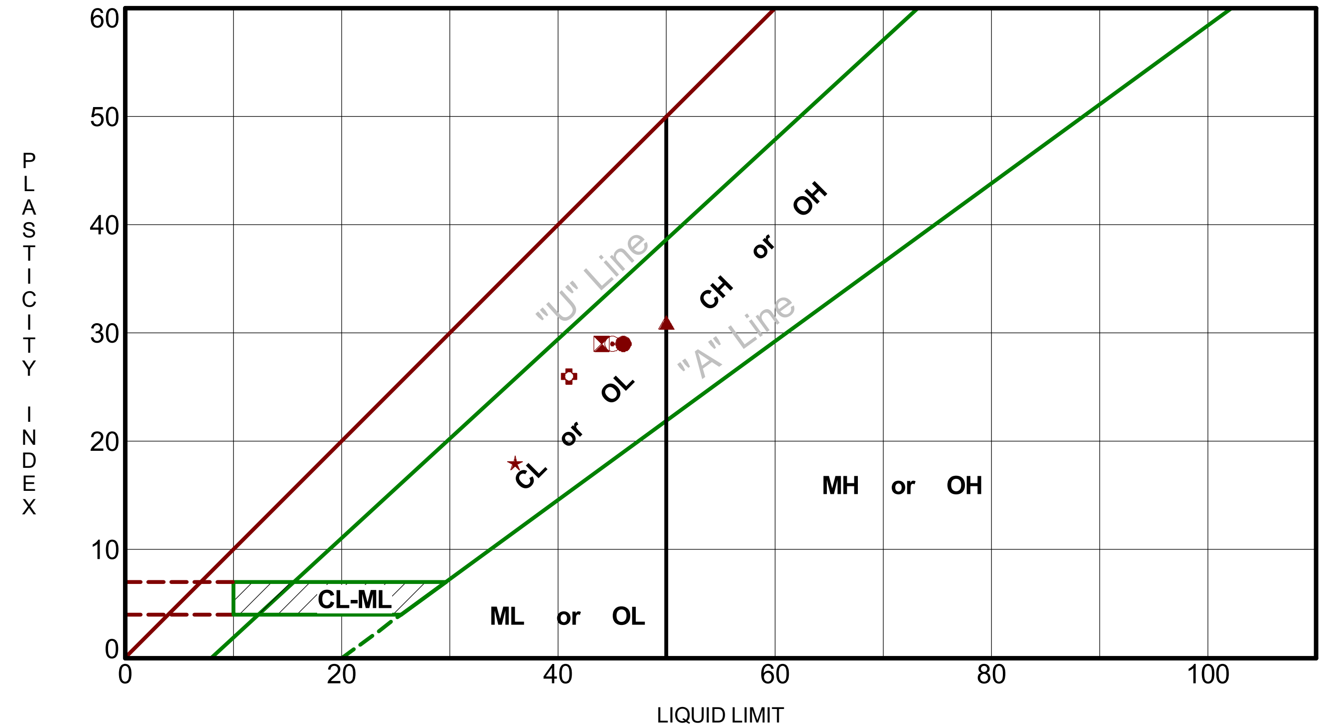
- Atterberg Limits
- Percent passing #200 Sieve
- Thermal Resistivity
- Direct Shear
- Consolidation/Collapse Potential
- In-situ Water Content
- In-situ Dry Density
- Moisture Density Relationship
- Sieve Analysis
- California Bearing Ratio

In addition, selected soil samples within the solar field and the proposed substation were tested for the following chemical tests:

- Soluble Chlorides
- pH
- Redox Potential
- Soluble Sulfates
- Minimum Electrical Resistivity
- Soluble Sulfides

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-1	0 - 2.5	46	17	29	84	CL	LEAN CLAY WITH SAND
B-1	7.5 - 9	44	15	29		CL	LEAN CLAY WITH SAND
▲ B-1	30 - 31.5	50	19	31	90	CH	FAT CLAY
★ B-2	25 - 26.5	36	18	18	88	CL	LEAN CLAY
⊙ TP-1	0 - 4	45	16	29	78	CL	SANDY LEAN CLAY
TP-8	0 - 4	41	15	26	65	CL	SANDY LEAN CLAY

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

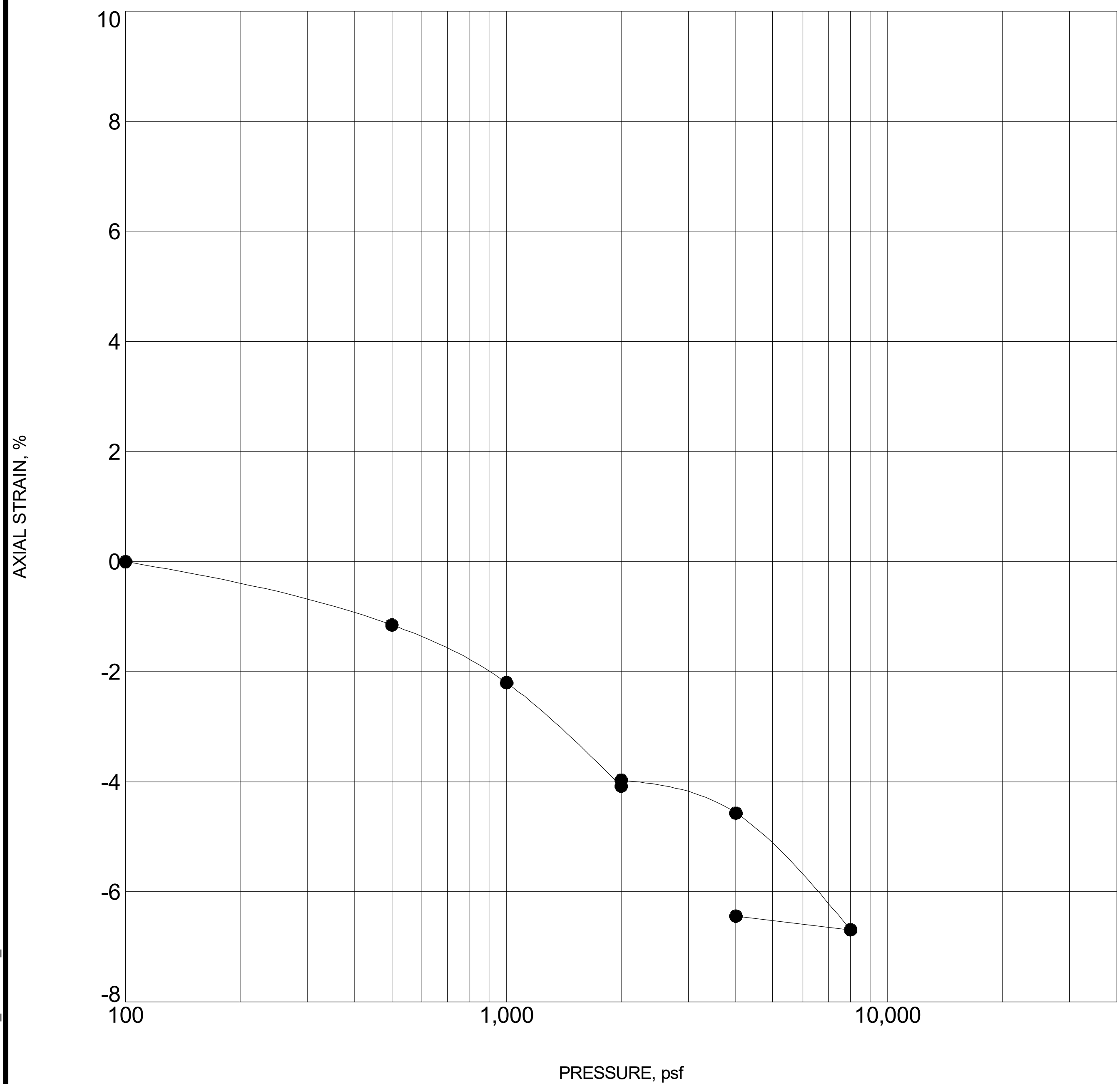
Terracon
2817 McGaw Avenue
Irvine, California

PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-2

SWELL CONSOLIDATION TEST
ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
●	B-1 5.0 ft	LEAN CLAY WITH SAND	91	27

NOTES: Water added @ 2000psf

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

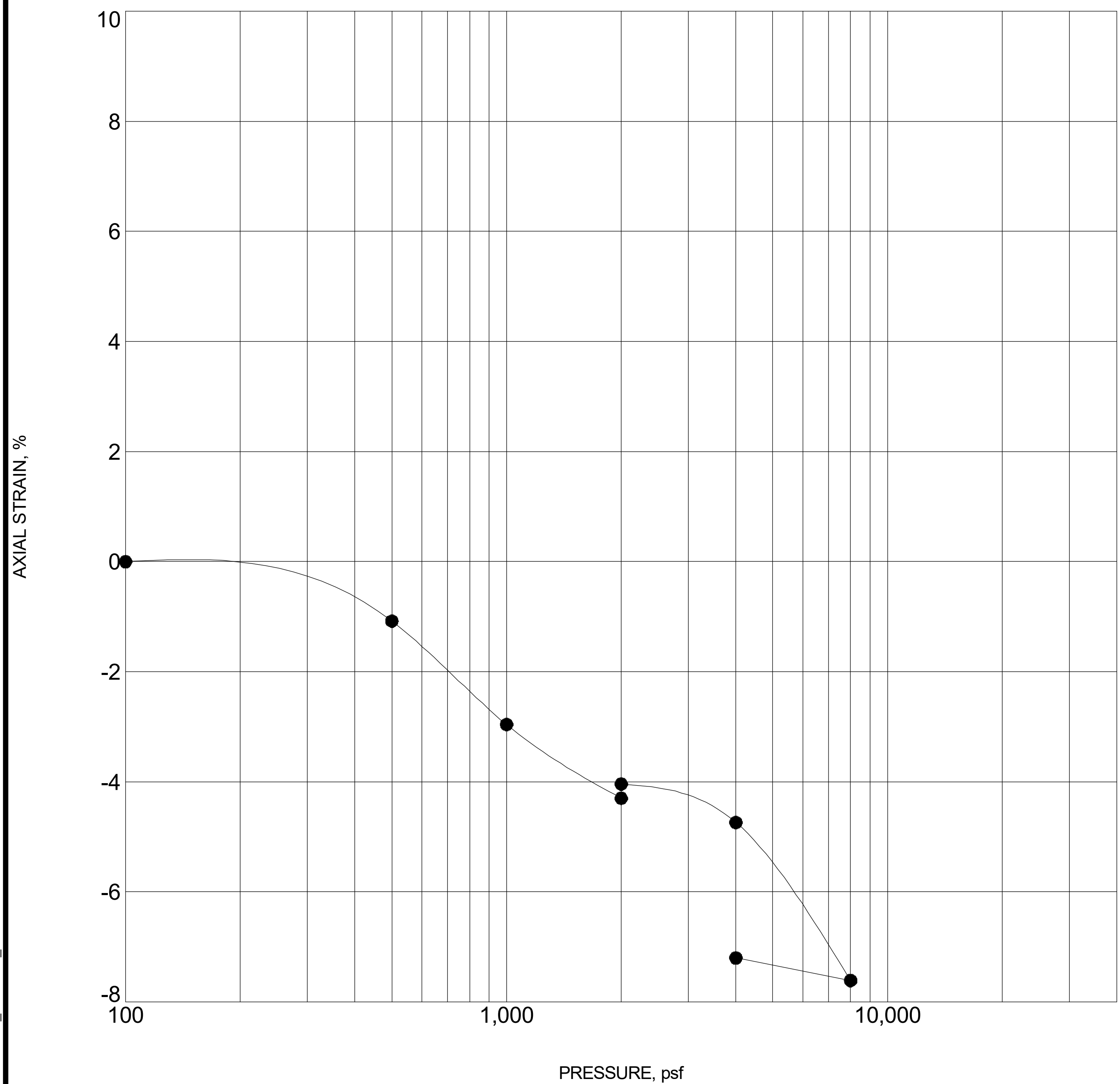
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc. Tempe, AZ

EXHIBIT: B-3

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
●	B-2 2.5 ft	LEAN CLAY	94	17

NOTES: Water added @ 2000psf

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

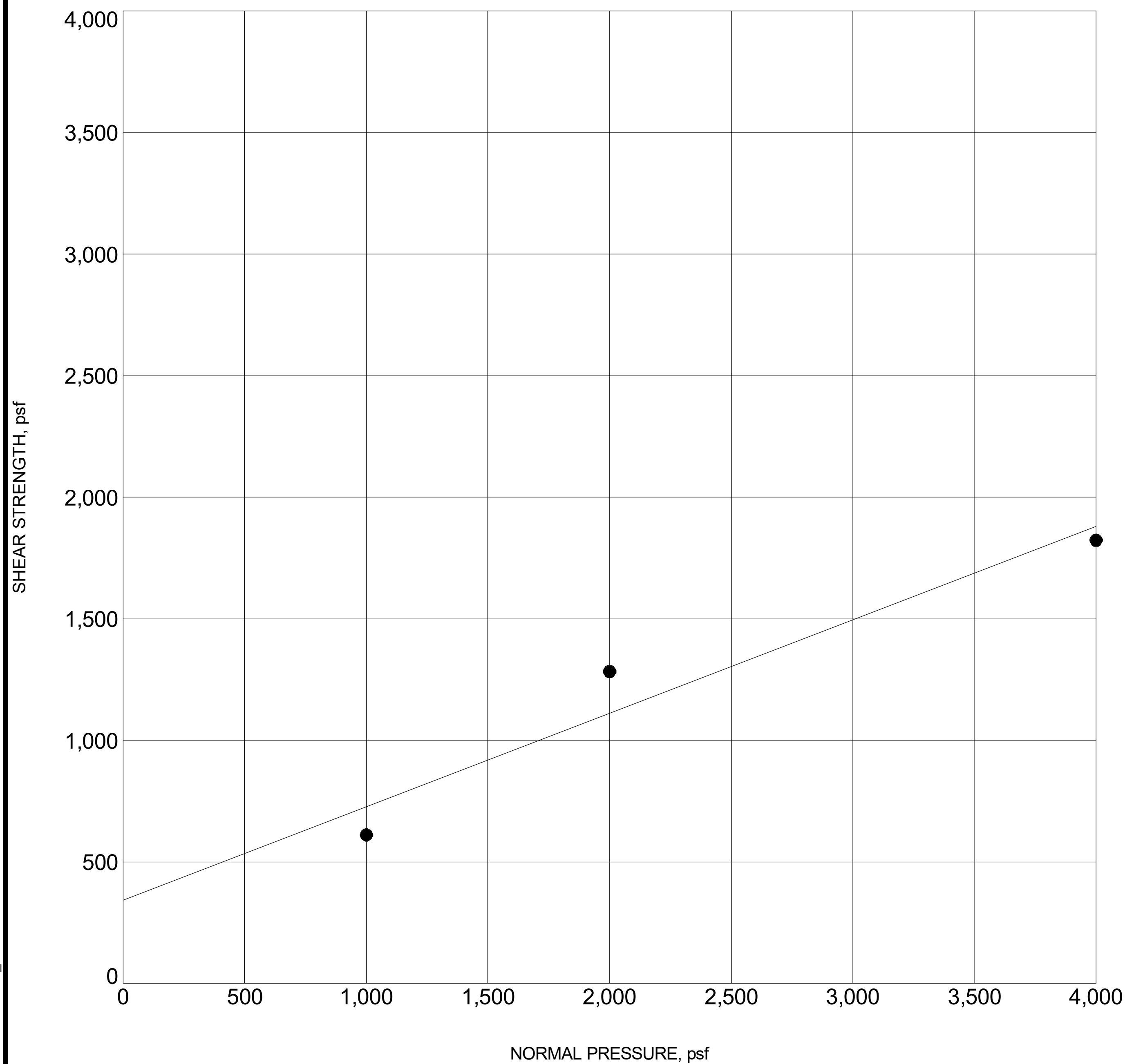
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-4

DIRECT SHEAR TEST

ASTM D3080



	Specimen Identification		Classification	γ_d, pcf	WC,%	c, psf	ϕ°
●	**B-2**	**5.0ft**	**LEAN CLAY**	**94**	**25**	**342**	**21**

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

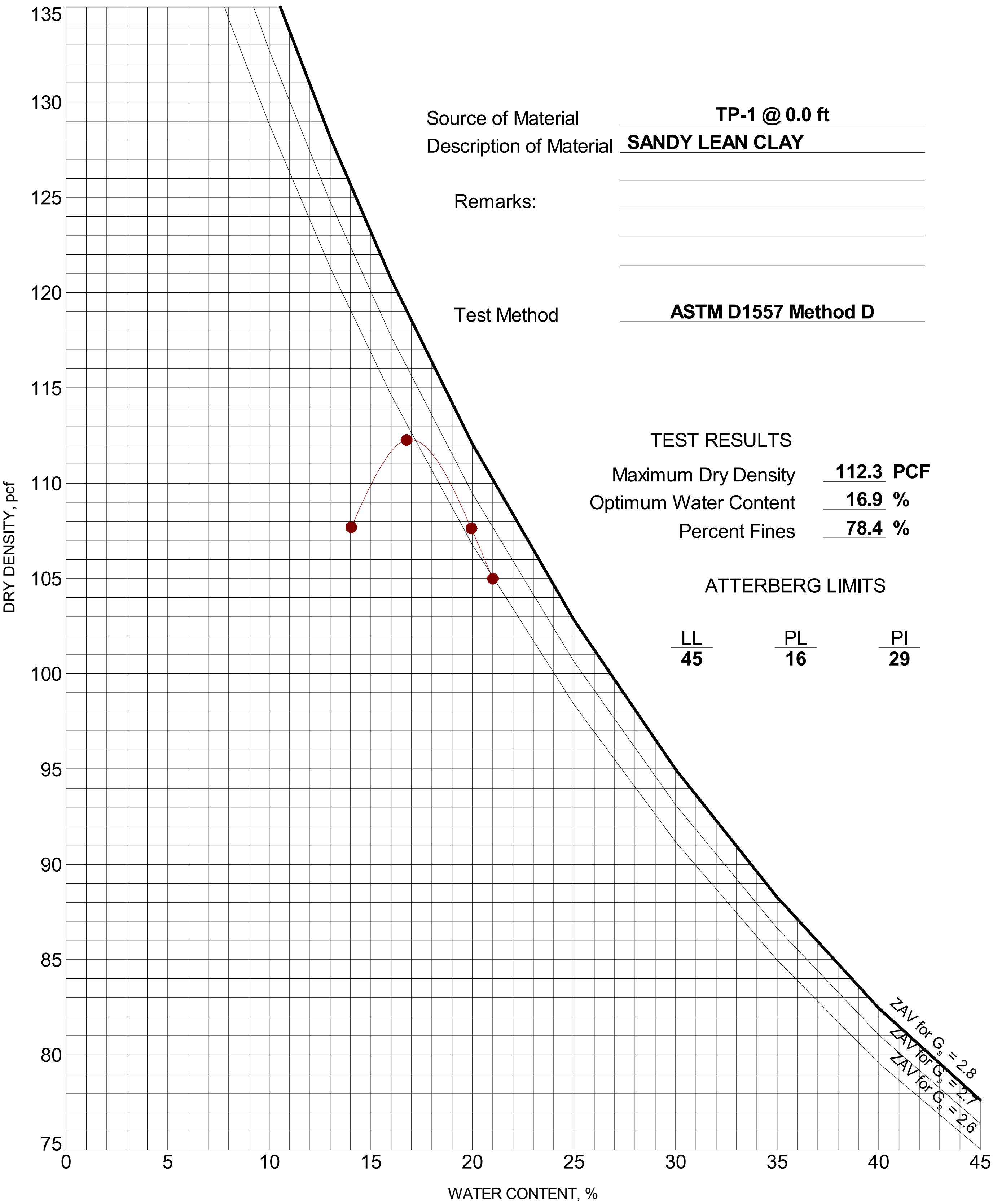
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-5

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **TP-1 @ 0.0 ft**

Description of Material: **SANDY LEAN CLAY**

Remarks:

Test Method: **ASTM D1557 Method D**

TEST RESULTS

Maximum Dry Density **112.3 PCF**

Optimum Water Content **16.9 %**

Percent Fines **78.4 %**

ATTERBERG LIMITS

LL	PL	PI
45	**16**	**29**

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 BORING LOG.GPJ TERRACON2012.GDT 8/6/15

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

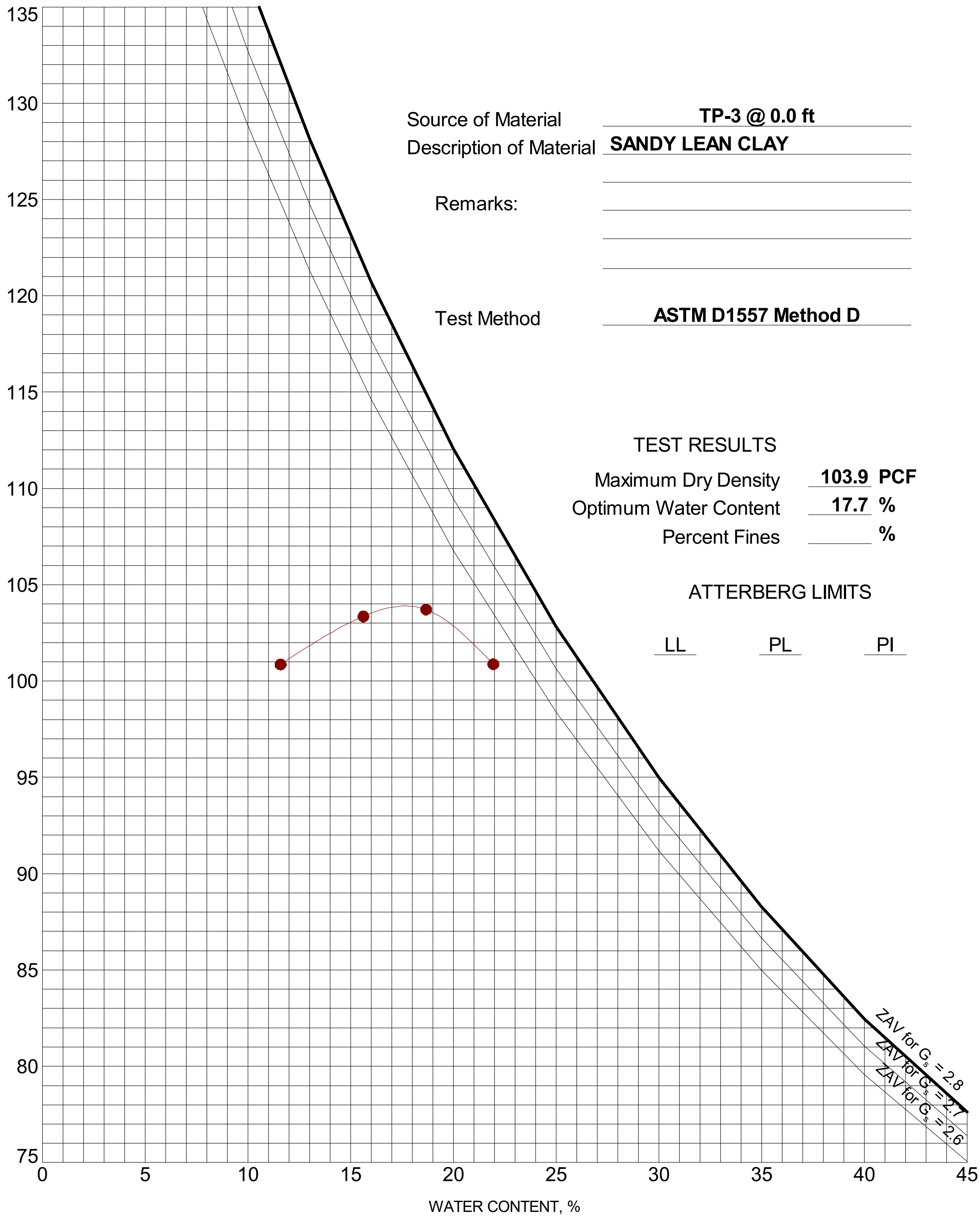
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-6

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **TP-3 @ 0.0 ft**

Description of Material: **SANDY LEAN CLAY**

Remarks:

Test Method: **ASTM D1557 Method D**

TEST RESULTS

Maximum Dry Density **103.9 PCF**

Optimum Water Content **17.7 %**

Percent Fines **%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

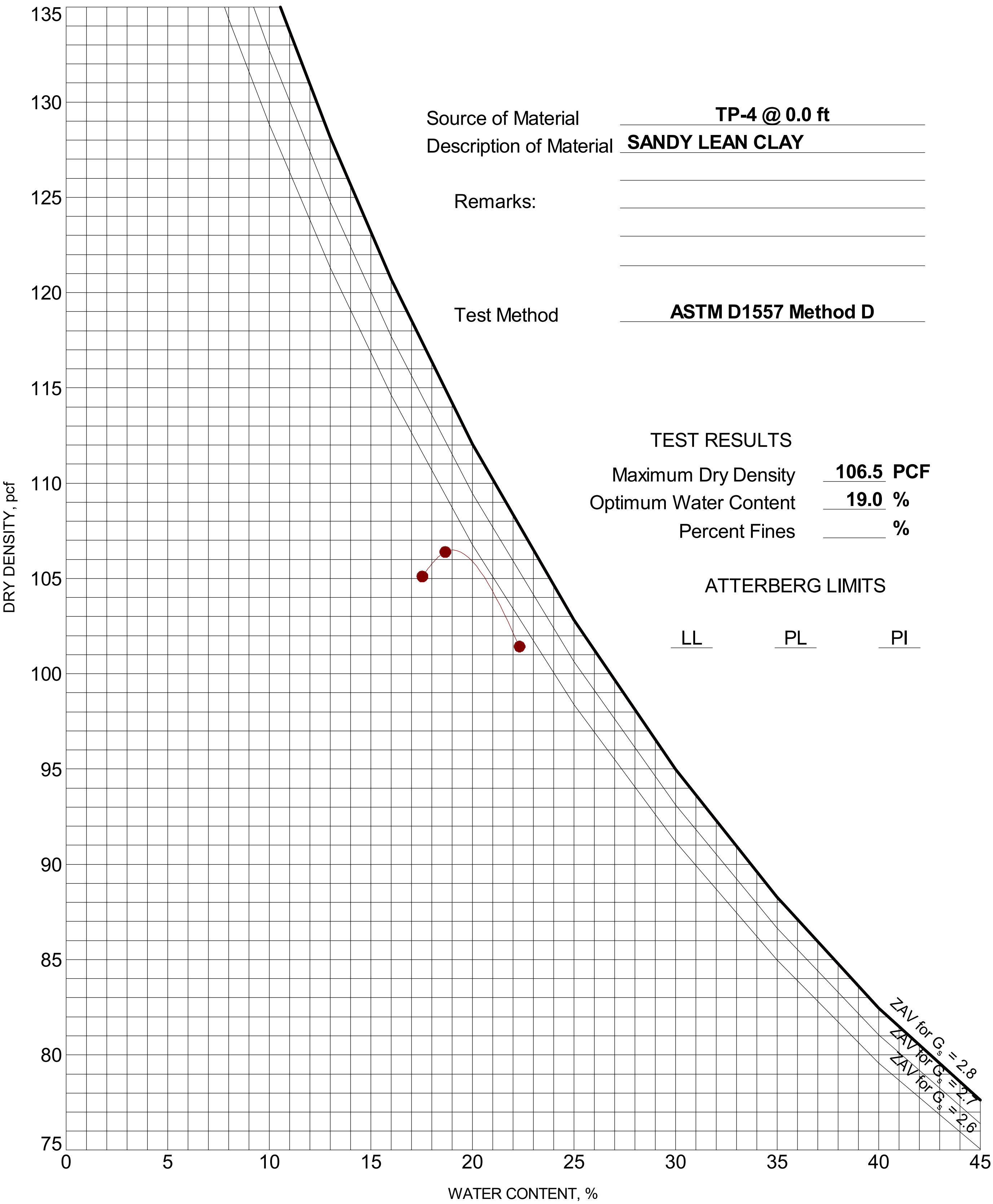
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-7

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **TP-4 @ 0.0 ft**

Description of Material: **SANDY LEAN CLAY**

Remarks:

Test Method: **ASTM D1557 Method D**

TEST RESULTS

Maximum Dry Density	**106.5**	**PCF**
Optimum Water Content	**19.0**	**%**
Percent Fines		**%**

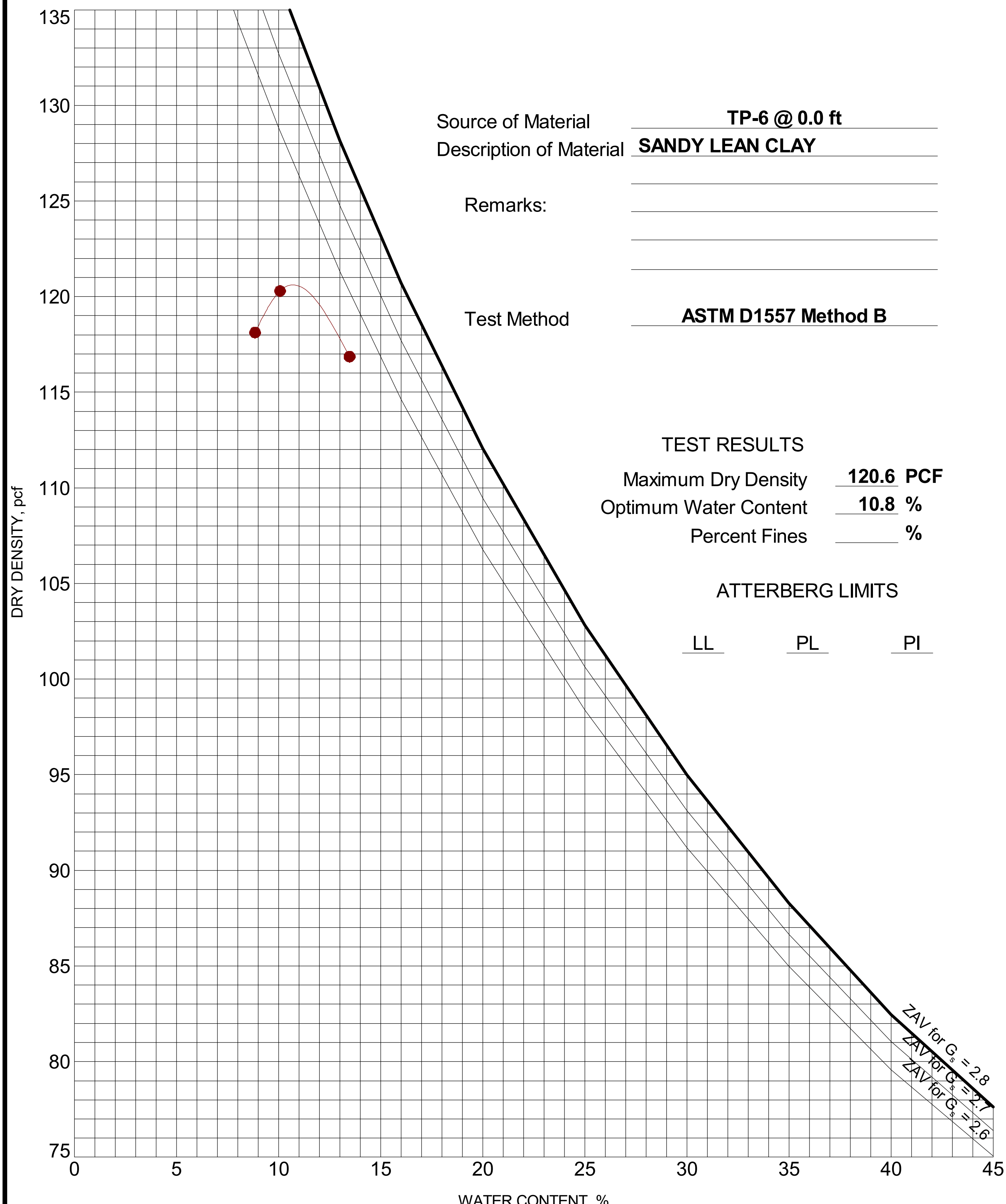
ATTERBERG LIMITS

LL	PL	PI

PROJECT: Little Bear Solar Project	Terracon 2817 McGaw Avenue Irvine, California	PROJECT NUMBER: 60155057
SITE: SWC of W California Ave & S Ohio Ave Mendota, CA		CLIENT: First Solar Inc. Tempe, AZ
		EXHIBIT: B-8

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **TP-6 @ 0.0 ft**

Description of Material **SANDY LEAN CLAY**

Remarks:

Test Method **ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density **120.6 PCF**

Optimum Water Content **10.8 %**

Percent Fines **%**

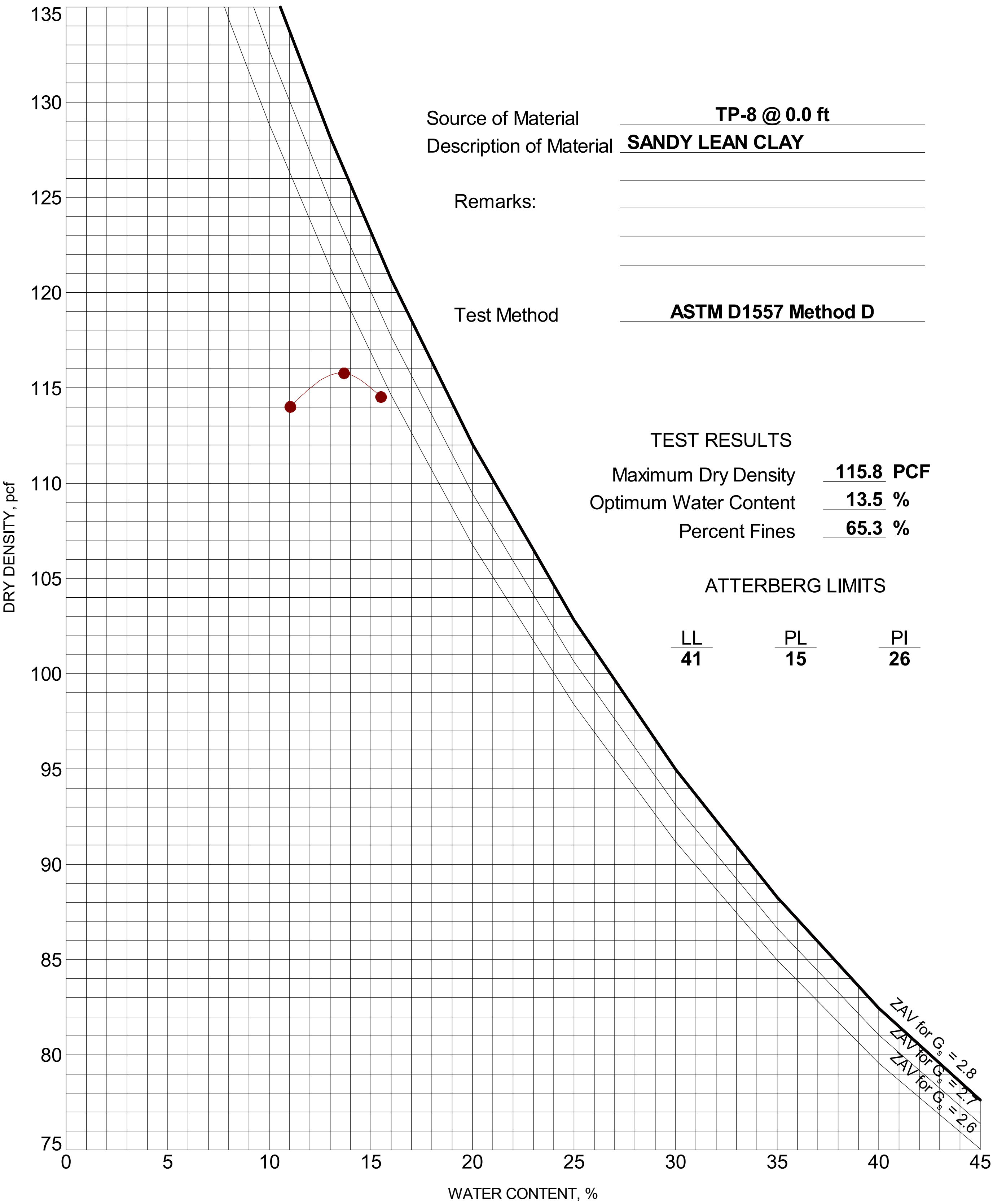
ATTERBERG LIMITS

LL	PL	PI

PROJECT: Little Bear Solar Project	Terracon	PROJECT NUMBER: 60155057
SITE: SWC of W California Ave & S Ohio Ave Mendota, CA	2817 McGaw Avenue Irvine, California	CLIENT: First Solar Inc. Tempe, AZ
		EXHIBIT: B-9

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **TP-8 @ 0.0 ft**

Description of Material **SANDY LEAN CLAY**

Remarks:

Test Method **ASTM D1557 Method D**

TEST RESULTS

Maximum Dry Density **115.8 PCF**

Optimum Water Content **13.5 %**

Percent Fines **65.3 %**

ATTERBERG LIMITS

LL	PL	PI
41	**15**	**26**

PROJECT: Little Bear Solar Project

SITE: SWC of W California Ave & S Ohio Ave
Mendota, CA

Terracon
2817 McGaw Avenue
Irvine, California

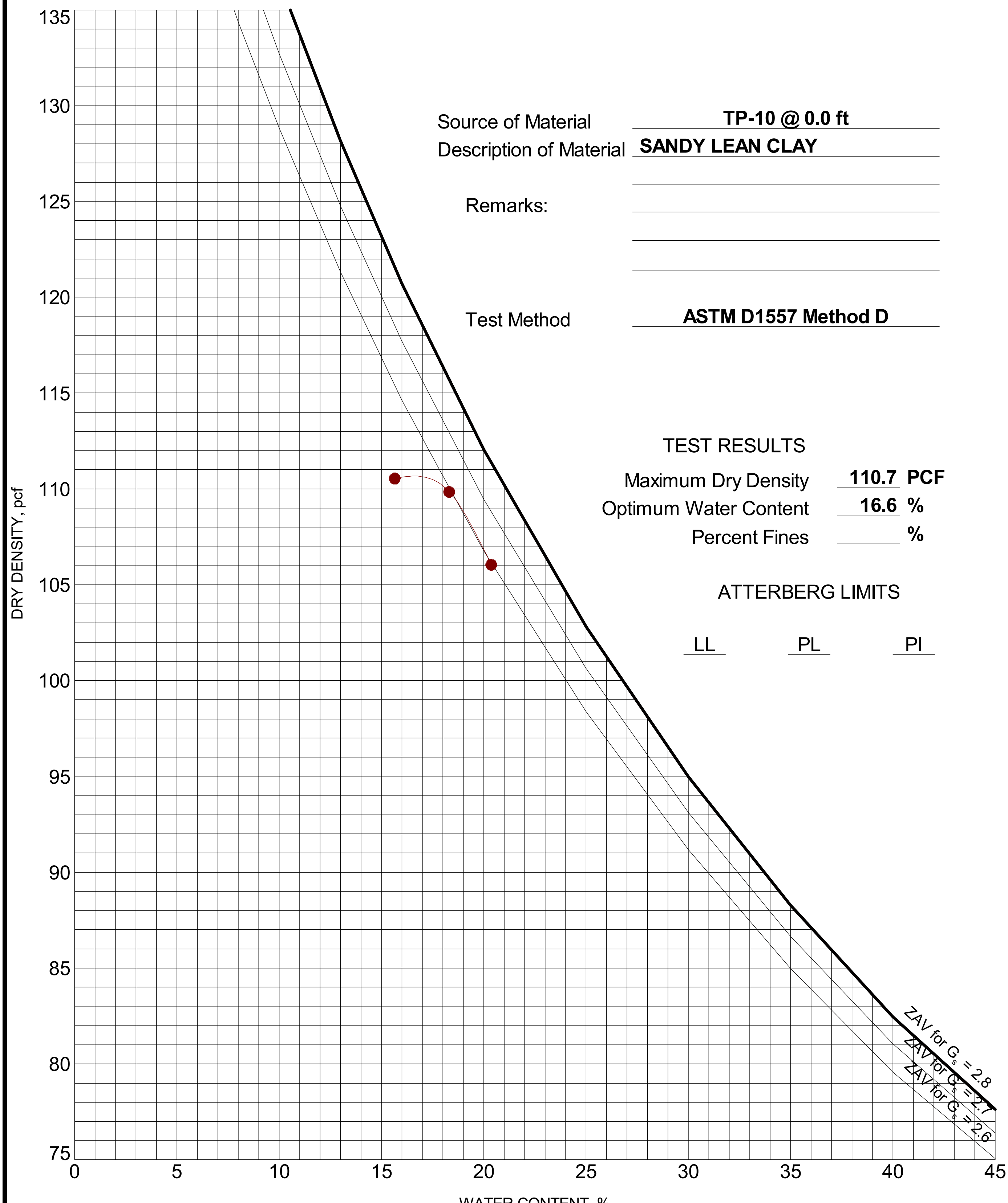
PROJECT NUMBER: 60155057

CLIENT: First Solar Inc.
Tempe, AZ

EXHIBIT: B-10

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**TP-10 @ 0.0 ft**
Description of Material	**SANDY LEAN CLAY**
Remarks:	
Test Method	**ASTM D1557 Method D**

TEST RESULTS

Maximum Dry Density	**110.7**	**PCF**
Optimum Water Content	**16.6**	**%**
Percent Fines		**%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Little Bear Solar Project	Terracon 2817 McGaw Avenue Irvine, California	PROJECT NUMBER: 60155057
SITE: SWC of W California Ave & S Ohio Ave Mendota, CA		CLIENT: First Solar Inc. Tempe, AZ
		EXHIBIT: B-11

CHEMICAL LABORATORY TEST REPORT

Project Number: 60155057
Service Date: 08/07/15
Report Date: 08/07/15
Task:

Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Project

FS: Little Bear Solar

Sample Submitted By: Terracon (60) **Date Received:** 8/6/2015 **Lab No.: 15-0587**

Results of Corrosivity Analysis

Sample Number				
Sample Location	TP-1	TP-3	TP-4	TP-5
Sample Depth (ft.)				
pH Analysis, AWWA 4500 H	7.71	8.30	8.36	8.03
Water Soluble Sulfate (SO4), AWWA 4500 E (percent %)	0.15	0.49	0.02	1.14
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil	Nil
Red-Ox, AWWA 2580, (mV)	+666	+658	+674	+668
Total Salts, AWWA 2510, (mg/kg)	12656	11536	1299	24696
Chlorides, AWWA 4500 Cl B, (mg/kg)	2425	600	175	2100
Resistivity, ASTM G-57, (ohm-cm)	150	204	1038	126

Analyzed By: Kurt D. Ergun

Kurt D. Ergun
Chemist

CHEMICAL LABORATORY TEST REPORT

Project Number: 60155057
Service Date: 08/07/15
Report Date: 08/07/15
Task:

Terracon

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Project

FS: Little Bear Solar

Sample Submitted By: Terracon (60) **Date Received:** 8/6/2015 **Lab No.: 15-0587**

Results of Corrosivity Analysis

Sample Number				
Sample Location	TP-7	TP-8	TP-9	TP-10
Sample Depth (ft.)				
pH Analysis, AWWA 4500 H	8.18	7.92	8.21	8.27
Water Soluble Sulfate (SO4), AWWA 4500 E (percent %)	0.16	0.73	1.61	0.53
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil	Nil
Red-Ox, AWWA 2580, (mV)	+660	+656	+681	+655
Total Salts, AWWA 2510, (mg/kg)	4693	14056	24304	13384
Chlorides, AWWA 4500 Cl B, (mg/kg)	225	650	475	875
Resistivity, ASTM G-57, (ohm-cm)	446	233	160	209

Analyzed By:

Kurt D. Ergun
Chemist

CHEMICAL LABORATORY TEST REPORT

Project Number: 60155057
Service Date: 08/07/15
Report Date: 08/07/15
Task:

Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Project

FS: Little Bear Solar

Sample Submitted By: Terracon (60) **Date Received:** 8/6/2015 **Lab No.: 15-0587**

Results of Corrosivity Analysis

Sample Number	
Sample Location	B-1
Sample Depth (ft.)	0.0-2.0
pH Analysis, AWWA 4500 H	8.36
Water Soluble Sulfate (SO4), AWWA 4500 E (percent %)	0.02
Sulfides, AWWA 4500-S D, (mg/kg)	Nil
Red-Ox, AWWA 2580, (mV)	+680
Total Salts, AWWA 2510, (mg/kg)	2918
Chlorides, AWWA 4500 Cl B, (mg/kg)	350
Resistivity, ASTM G-57, (ohm-cm)	475

Analyzed By: Kurt D. Ergun
Kurt D. Ergun
Chemist

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	Shelby Tube	Split Spoon
Rock Core	Macro Core	Modified California Ring Sampler
Grab Sample	No Recovery	Modified Dames & Moore Ring Sampler

WATER LEVEL

- **Water Initially Encountered**
- **Water Level After a Specified Period of Time**
- **Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(b/f)	**Standard Penetration Test (blows per foot)**
N	**N value**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**
(WOH)	Weight of Hammer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G,H,I]
			Fines classify as CL or CH	SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]	ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K,L,M,N]
					Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K,L,M]
			PI plots below "A" line	MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K,L,M,P]
					Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

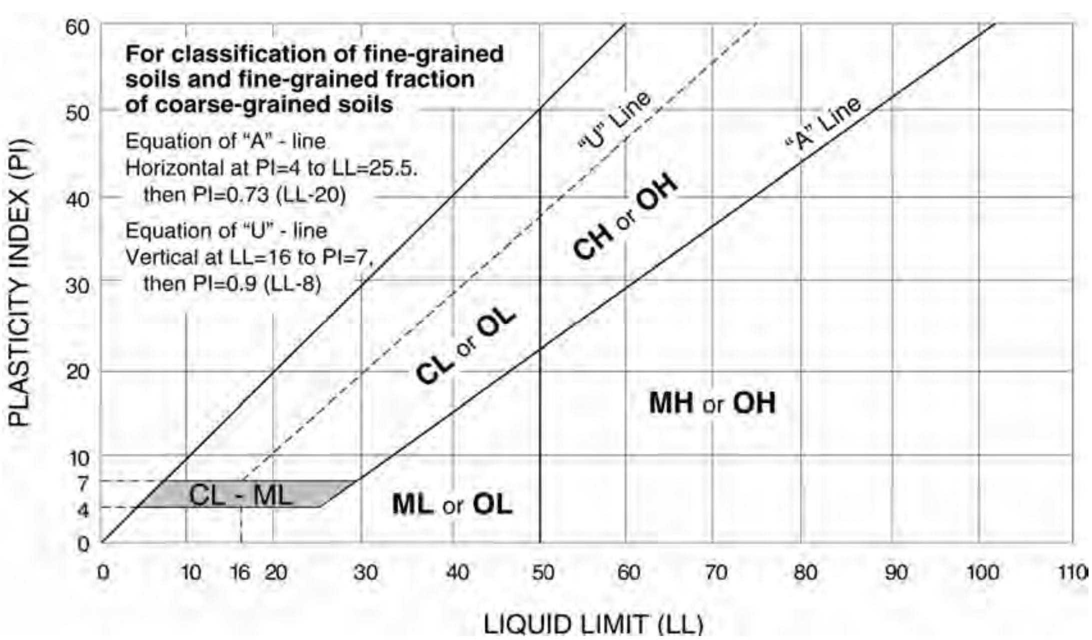


Exhibit C-2

Design Maps Detailed Report

ASCE 7-10 Standard (36.71708°N, 120.42196°W)

Site Class E – "Soft Clay Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 1.143 g
From Figure 22-2 [2]	S_1 = 0.385 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class E, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_S$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = E and S_S = 1.143 g, F_a = 0.900

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = E and S_1 = 0.385 g, F_v = 2.458

Equation (11.4–1):	$S_{MS} = F_aS_S = 0.900 \times 1.143 = 1.029$ g
Equation (11.4–2):	$S_{M1} = F_vS_1 = 2.458 \times 0.385 = 0.947$ g

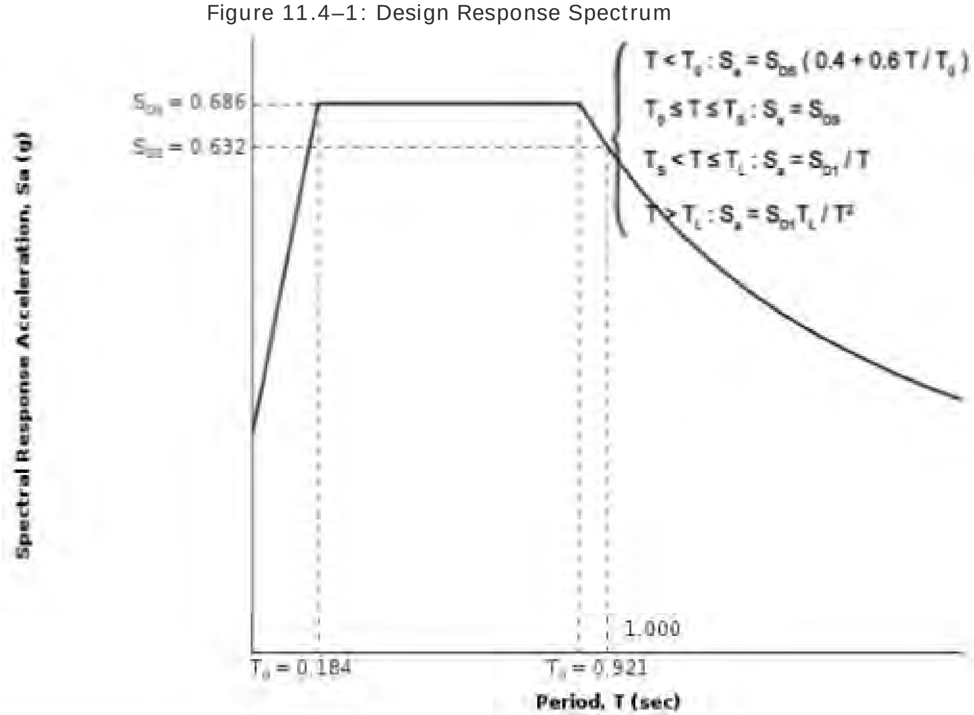
Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4–3):	$S_{DS} = ⅔ S_{MS} = ⅔ \times 1.029 = 0.686$ g
Equation (11.4–4):	$S_{D1} = ⅔ S_{M1} = ⅔ \times 0.947 = 0.632$ g

Section 11.4.5 — Design Response Spectrum

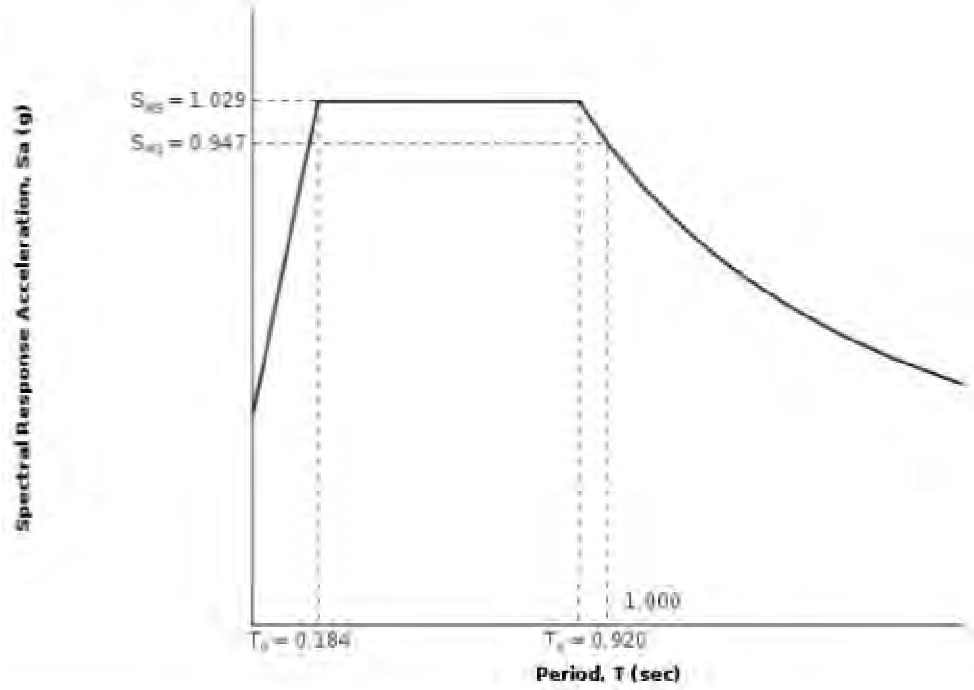
From Figure 22-12 [3]	$T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.413

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 0.900 \times 0.413 = 0.372$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = E and PGA = 0.413 g, F_{PGA} = 0.900

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 1.024

From Figure 22-18 [6] C_{R1} = 1.076

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.686 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.632 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is E for buildings in Risk Categories I, II, and III, and F for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

APPENDIX D

FIELD ELECTRICAL RESISTIVITY TESTING

Location	Temp. F°	Bearing	Latitude	Longitude
TP1	82			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	0.607	7.6	2.3
N/S	4	0.291	7.3	2.2
N/S	6	0.185	7.0	2.1
N/S	8	0.146	7.3	2.2
N/S	12	0.106	8.0	2.4
N/S	20	0.071	8.9	2.7
N/S	30	0.052	9.8	3.0
N/S	50	0.034	10.7	3.3
N/S	100	0.020	12.6	3.8
N/S	200	0.011	13.8	4.2
E/W	2	0.560	7.0	2.1
E/W	4	0.227	5.7	1.7
E/W	6	0.167	6.3	1.9
E/W	8	0.133	6.7	2.0
E/W	12	0.101	7.6	2.3
E/W	20	0.070	8.8	2.7
E/W	30	0.049	9.2	2.8
E/W	50	0.032	10.1	3.1
E/W	100	0.017	10.7	3.3
E/W	200	0.010	12.6	3.8

Location	Temp. F°	Bearing	Latitude	Longitude
TP2	70			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	1.214	15.3	4.6
N/S	4	0.474	11.9	3.6
N/S	6	0.268	10.1	3.1
N/S	8	0.219	11.0	3.4
E/W	2	1.340	16.8	5.1
E/W	4	0.499	12.5	3.8
E/W	6	0.323	12.2	3.7
E/W	8	0.207	10.4	3.2

Location	Temp. F°	Bearing	Latitude	Longitude
TP3	80			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	1.071	13.5	4.1
N/S	4	0.420	10.6	3.2
N/S	6	0.284	10.7	3.3
N/S	8	0.257	12.9	3.9
N/S	12	0.197	14.9	4.5
N/S	20	0.137	17.2	5.2
N/S	30	0.097	18.3	5.6
N/S	50	0.058	18.2	5.6
N/S	100	0.030	18.8	5.7
N/S	200	0.013	16.3	5.0
E/W	2	1.053	13.2	4.0
E/W	4	0.413	10.4	3.2
E/W	6	0.325	12.3	3.7
E/W	8	0.266	13.4	4.1
E/W	12	0.187	14.1	4.3
E/W	20	0.130	16.3	5.0
E/W	30	0.098	18.5	5.6
E/W	50	0.059	18.5	5.6
E/W	100	0.027	17.0	5.2
E/W	200	0.015	18.8	5.7

Location	Temp. F°	Bearing	Latitude	Longitude
TP4	80			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	11.556	145.2	44.3
N/S	4	4.076	102.4	31.2
N/S	6	2.147	80.9	24.7
N/S	8	1.334	67.1	20.4
N/S	12	0.456	34.4	10.5
N/S	20	0.165	20.7	6.3
N/S	30	0.092	17.3	5.3
N/S	50	0.052	16.3	5.0
N/S	100	0.028	17.6	5.4
N/S	200	0.015	18.8	5.7
E/W	2	14.351	180.3	55.0
E/W	4	4.895	123.0	37.5
E/W	6	2.060	77.7	23.7
E/W	8	0.807	40.6	12.4
E/W	12	0.353	26.6	8.1
E/W	20	0.165	20.7	6.3
E/W	30	0.092	17.3	5.3
E/W	50	0.046	14.5	4.4
E/W	100	0.022	13.8	4.2
E/W	200	0.007	8.8	2.7

Location	Temp. F°	Bearing	Latitude	Longitude
TP5	70			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	0.608	7.6	2.3
N/S	4	0.422	10.6	3.2
N/S	6	0.213	8.0	2.4
N/S	8	0.145	7.3	2.2
E/W	2	0.777	9.8	3.0
E/W	4	0.280	7.0	2.1
E/W	6	0.222	8.4	2.6
E/W	8	0.161	8.1	2.5

Location	Temp. F°	Bearing	Latitude	Longitude
TP6	82			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	3.410	42.9	13.1
N/S	4	0.750	18.8	5.7
N/S	6	0.385	14.5	4.4
N/S	8	0.270	13.6	4.1
N/S	12	0.155	11.7	3.6
N/S	20	0.083	10.4	3.2
N/S	30	0.053	10.0	3.0
N/S	50	0.032	10.1	3.1
N/S	100	0.017	10.7	3.3
N/S	200	0.008	10.1	3.1
E/W	2	3.150	39.6	12.1
E/W	4	0.834	21.0	6.4
E/W	6	0.424	16.0	4.9
E/W	8	0.259	13.0	4.0
E/W	12	0.145	10.9	3.3
E/W	20	0.089	11.2	3.4
E/W	30	0.055	10.4	3.2
E/W	50	0.032	10.1	3.1
E/W	100	0.015	9.4	2.9
E/W	200	0.006	7.5	2.3

Location	Temp. F°	Bearing	Latitude	Longitude
TP7	65			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	9.721	122.2	37.2
N/S	4	7.401	186.0	56.7
N/S	6	1.320	49.8	15.2
N/S	8	0.657	33.0	10.1
E/W	2	6.850	86.1	26.2
E/W	4	2.025	50.9	15.5
E/W	6	1.215	45.8	14.0
E/W	8	0.639	32.1	9.8

Location	Temp. F°	Bearing	Latitude	Longitude
TP8	70			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	1.033	13.0	4.0
N/S	4	0.402	10.1	3.1
N/S	6	0.290	10.9	3.3
N/S	8	0.256	12.9	3.9
N/S	12	0.152	11.5	3.5
N/S	20	0.096	12.1	3.7
N/S	30	0.066	12.4	3.8
N/S	50	0.042	13.2	4.0
N/S	100	0.020	12.6	3.8
N/S	200	0.008	10.1	3.1
E/W	2	1.313	16.5	5.0
E/W	4	0.420	10.6	3.2
E/W	6	0.281	10.6	3.2
E/W	8	0.223	11.2	3.4
E/W	12	0.160	12.1	3.7
E/W	20	0.094	11.8	3.6
E/W	30	0.065	12.3	3.7
E/W	50	0.038	11.9	3.6
E/W	100	0.017	10.7	3.3
E/W	200	0.006	7.5	2.3

Location	Temp. F°	Bearing	Latitude	Longitude
TP9	63			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	9.702	121.9	37.2
N/S	4	6.379	160.3	48.9
N/S	6	1.259	47.5	14.5
N/S	8	0.399	20.1	6.1
E/W	2	9.020	113.3	34.5
E/W	4	3.620	91.0	27.7
E/W	6	0.742	28.0	8.5
E/W	8	0.407	20.5	6.2

Location	Temp. F°	Bearing	Latitude	Longitude
TP10	64°			
Orientation	A-Spacing (ft)	Measurement (ohms)	Apparent Res (ohm-ft)	Apparent Res (ohm-m)
N/S	2	0.804	10.1	3.1
N/S	4	0.390	9.8	3.0
N/S	6	0.254	9.6	2.9
N/S	8	0.190	9.6	2.9
N/S	12	0.123	9.3	2.8
N/S	20	0.079	9.9	3.0
N/S	30	0.052	9.8	3.0
N/S	50	0.033	10.4	3.2
N/S	100	0.018	11.3	3.4
N/S	200	0.008	10.1	3.1
E/W	2	0.868	10.9	3.3
E/W	4	0.384	9.7	2.9
E/W	6	0.273	10.3	3.1
E/W	8	0.208	10.5	3.2
E/W	12	0.131	9.9	3.0
E/W	20	0.079	9.9	3.0
E/W	30	0.054	10.2	3.1
E/W	50	0.035	11.0	3.4
E/W	100	0.020	12.6	3.8
E/W	200	0.011	13.8	4.2

APPENDIX E

PILE LOAD TESTING

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SUMMARY OF PILE LOAD TESTING

Project Name: Little Bear
Project Number: 60155057

Lateral Load						
Pile No.	Embedment Depth, in	Pile Drive Time, sec	Deflection near 0.5", in	Load, lb	Deflection near 1", in	Load near 1"
TP-1	60	25	0.49	2,280	1.03	3,120
TP-2	72	30	0.52	3,520	1.06	5,900
TP-3	60	21	0.52	3,720	1.04	4,820
TP-4	60	18	0.55	5,500	1.07	7,200
TP-5	60	31	0.53	3,020	1.06	3,940
TP-6	72	36	0.51	4,300	1.05	7,120
TP-7	72	42	0.52	4,100	1.05	6,720
TP-8	72	28	0.52	3,680	1.03	5,340
TP-9	60	22	0.54	3,120	1.07	5,140
TP-10	60	25	0.55	1,060	1.05	1,300

Project Name: Little Bear
Project Number: 60155057

Uplift						
Pile No.	Embedment Depth, in	Pile Drive Time, sec	Deflection near 0.25", in	Load, lb	Deflection near 1", in	Load near 1"
TP-1	60	25	0.26	2,520	0.99	2,960
TP-2	72	30	0.29	3,400	1.02	4,500
TP-3	60	21	0.27	2,380	1.03	2,500
TP-4	60	18	0.27	3,140	1.00	3,660
TP-5	60	31	0.30	4,130	1.17	4,500
TP-6	72	36	0.27	4,280	1.10	4,860
TP-7	72	42	0.26	5,600	1.11	7,020
TP-8	72	28	0.27	3,620	1.07	3,940
TP-9	60	22	0.26	4,420	1.07	4,380
TP-10	60	25	0.29	2,240	1.08	2,800

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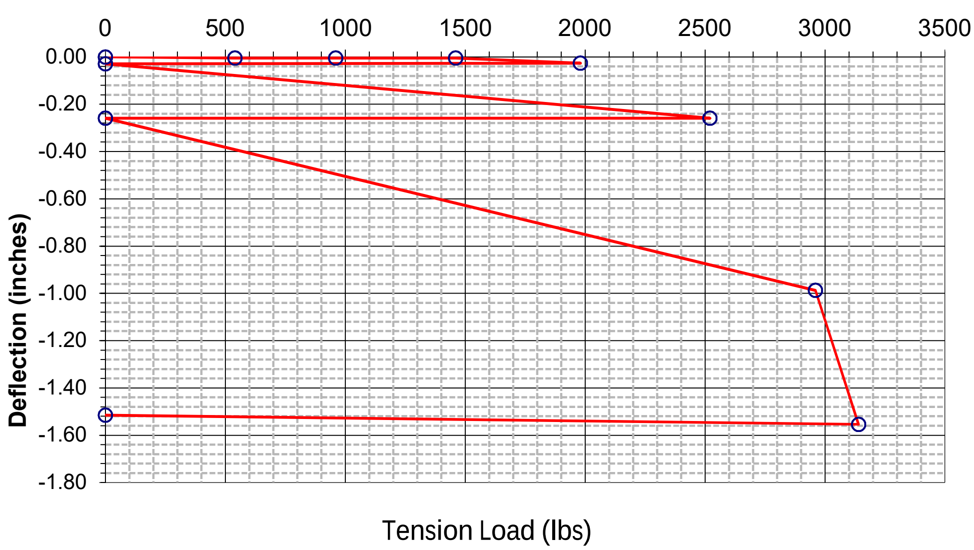
Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Time to Drive :	25	[seconds]
Date Tested:	07/13/15	Latitude:	36.7186	[° N]
Pile Size:	W6X9	Longitude:	120.42179	[° W]
Pile Location :	TP-1			

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	540	-0.005
2	960	-0.004
3	1460	-0.005
4	1980	-0.026
5	0	-0.028
6	2520	-0.259
7	0	-0.259
8	2960	-0.988
9	3140	-1.554
10	0	-1.515

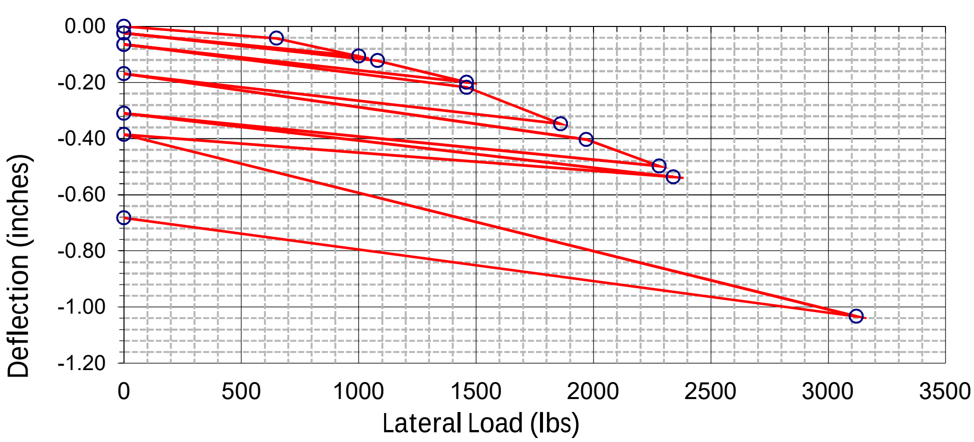


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	25	[seconds]
Pile Location:	TP-1	Latitude:	36.7186	[° N]
		Longitude:	120.42179	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	650	-0.0424
2	1000	-0.1062
3	0	-0.0249
4	1080	-0.1225
5	1460	-0.2000
6	0	-0.0649
7	1460	-0.2174
8	1860	-0.3478
9	0	-0.1687
10	1970	-0.4032
11	2280	-0.4978
12	0	-0.3099
13	2340	-0.5367
14	0	-0.3855
15	3120	-1.0330
16	0	-0.6822



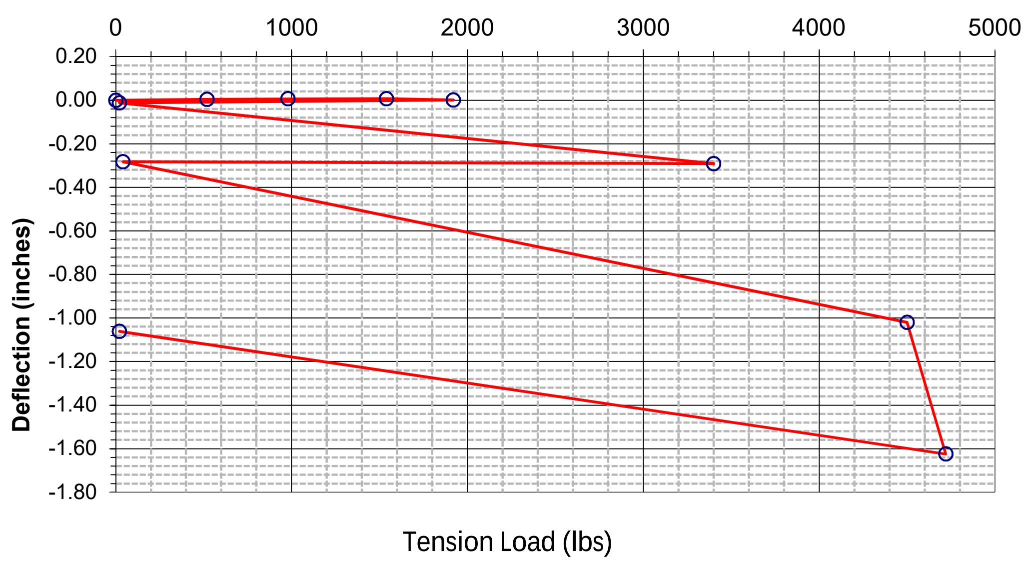
Pile Load Test Results

Project Name:	Little Bear Solar
Project Number:	60155057
Date Tested:	07/13/15
Pile Size:	W6X9
Pile Location :	TP-2

Pile Embedment Depth:	6.0	[feet]
Time to Drive :	30	[seconds]
Latitude:	36.71642	[° N]
Longitude:	120.42019	[° W]

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	520	0.004
2	980	0.006
3	1540	0.006
4	1920	0.000
5	20	-0.013
6	3400	-0.291
7	40	-0.282
8	4500	-1.020
9	4720	-1.624
10	20	-1.062

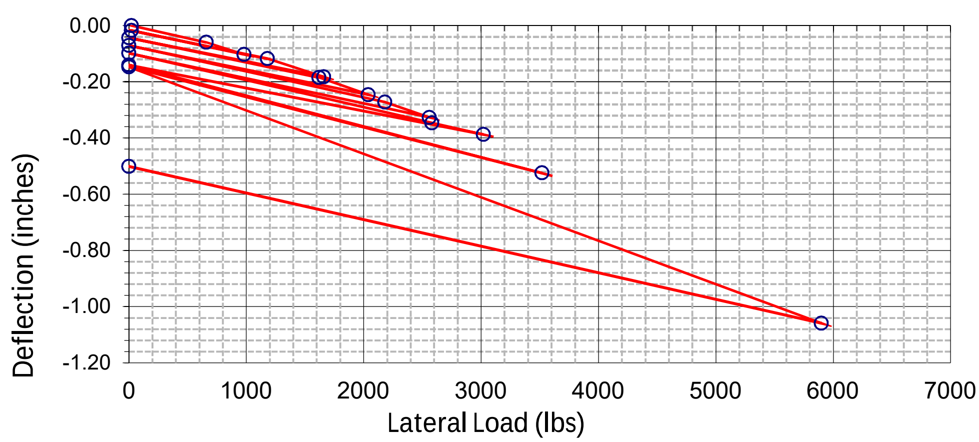


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	6.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	30	[seconds]
Pile Location:	TP-2	Latitude:	36.71642	[° N]
		Longitude:	120.42019	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	20	0.0000
1	660	-0.0602
2	980	-0.1032
3	20	-0.0179
4	1180	-0.1176
5	1660	-0.1827
6	0	-0.0443
7	1620	-0.1849
8	2040	-0.2458
9	0	-0.0711
10	2180	-0.2721
11	2560	-0.3275
12	0	-0.0980
13	2580	-0.3469
14	3020	-0.3875
15	0	-0.1408
16	3520	-0.5246
17	0	-0.1475
18	5900	-1.0589
19	0	-0.5008



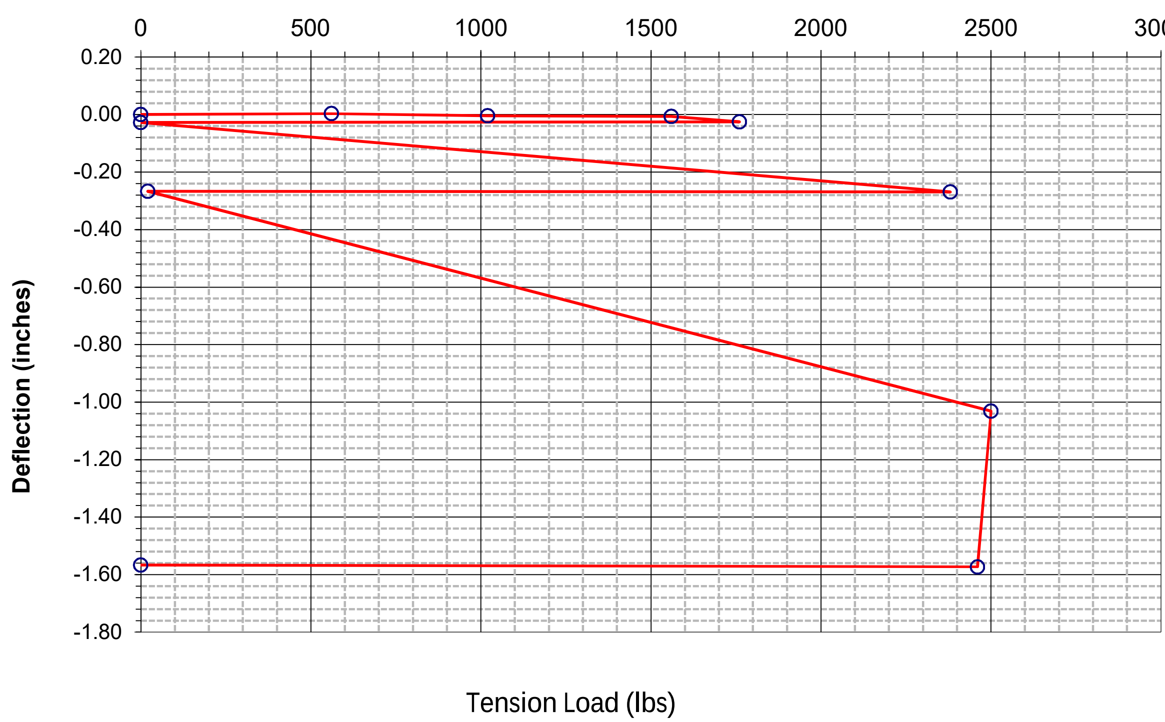
Pile Load Test Results

Project Name:	Little Bear Solar
Project Number:	60155057
Date Tested:	07/13/15
Pile Size:	W6X9
Pile Location :	TP-3

Pile Embedment Depth:	5.0	[feet]
Time to Drive :	21	[seconds]
Latitude:	36.71436	[° N]
Longitude:	120.4219	[° W]

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	560	0.003
2	1020	-0.004
3	1560	-0.006
4	1760	-0.025
5	0	-0.027
6	2380	-0.269
7	20	-0.267
8	2500	-1.032
9	2460	-1.573
10	0	-1.566

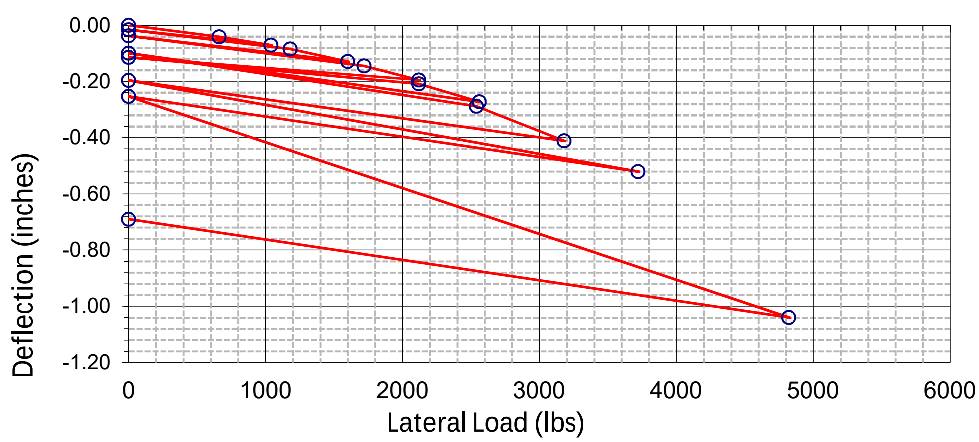


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	21	[seconds]
Pile Location:	TP-3	Latitude:	36.71436	[° N]
		Longitude:	120.4219	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	660	-0.0418
2	1040	-0.0710
3	0	-0.0166
4	1180	-0.0847
5	1600	-0.1297
6	0	-0.0382
7	1720	-0.1455
8	2120	-0.1949
9	0	-0.1142
10	2120	-0.2093
11	2560	-0.2721
12	0	-0.0997
13	2540	-0.2881
14	3180	-0.4109
15	0	-0.1959
16	3720	-0.5208
17	0	-0.2527
18	4820	-1.0392
19	0	-0.6900



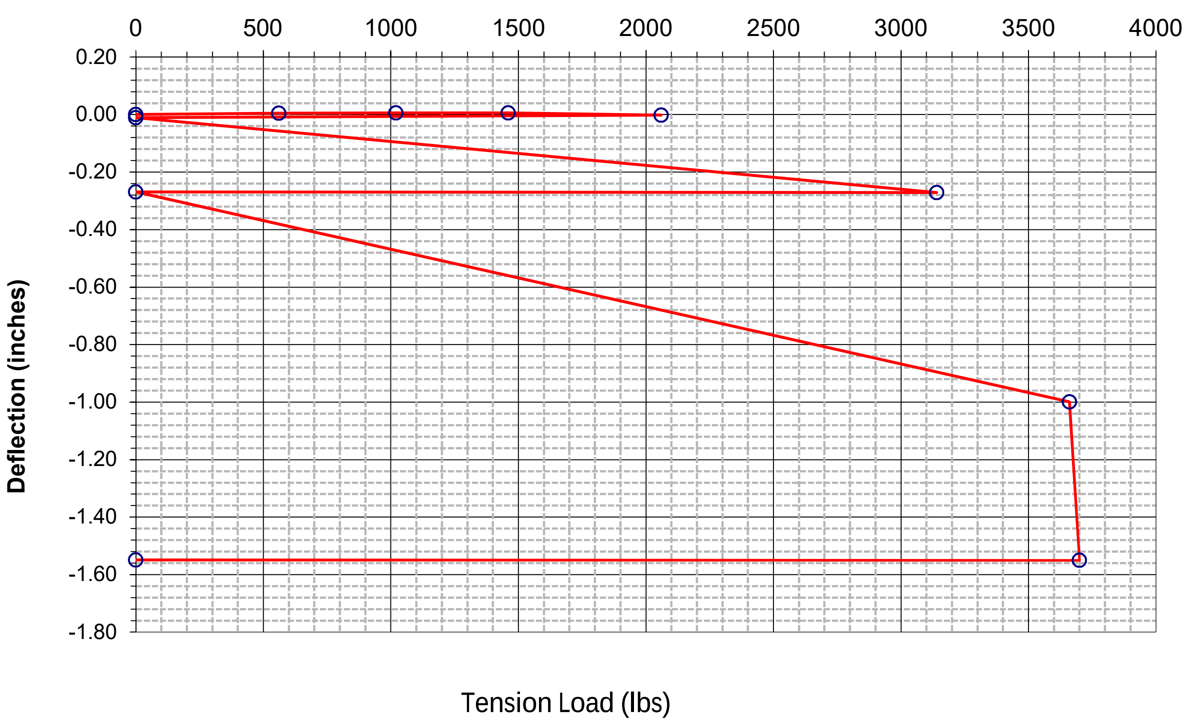
Pile Load Test Results

Project Name: Little Bear Solar
Project Number: 60155057
Date Tested: 07/13/15
Pile Size: W6X9
Pile Location : TP-4

Pile Embedment Depth: 5.0 [feet]
Time to Drive : 18 [seconds]
Latitude: 36.7144 [° N]
Longitude: 120.41454 [° W]

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	560	0.005
2	1020	0.006
3	1460	0.006
4	2060	-0.001
5	0	-0.010
6	3140	-0.271
7	0	-0.269
8	3660	-0.998
9	3700	-1.550
10	0	-1.549

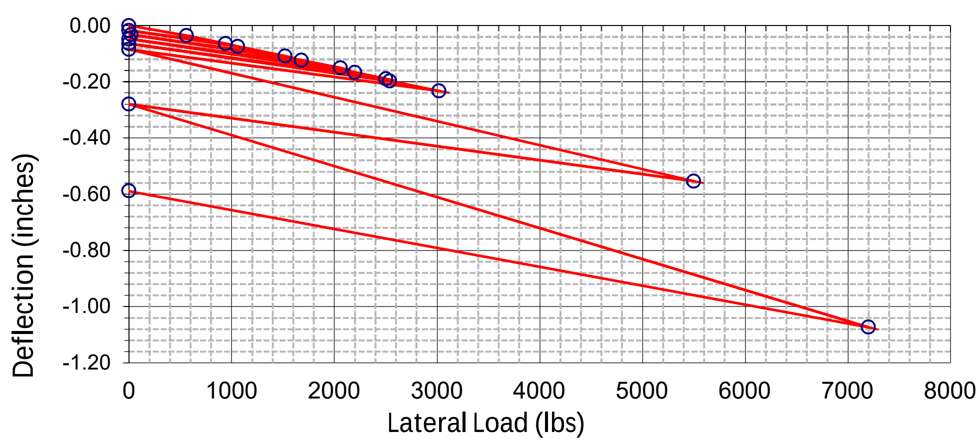


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	18	[seconds]
Pile Location:	TP-4	Latitude:	36.7144	[° N]
		Longitude:	120.41454	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	560	-0.0360
2	940	-0.0643
3	0	-0.0171
4	1060	-0.0750
5	1520	-0.1091
6	20	-0.0322
7	1680	-0.1232
8	2060	-0.1511
9	0	-0.0478
10	2200	-0.1671
11	2500	-0.1891
12	0	-0.0643
13	2540	-0.1976
14	3020	-0.2329
15	0	-0.0849
16	5500	-0.5539
17	0	-0.2796
18	7200	-1.0730
19	0	-0.5883

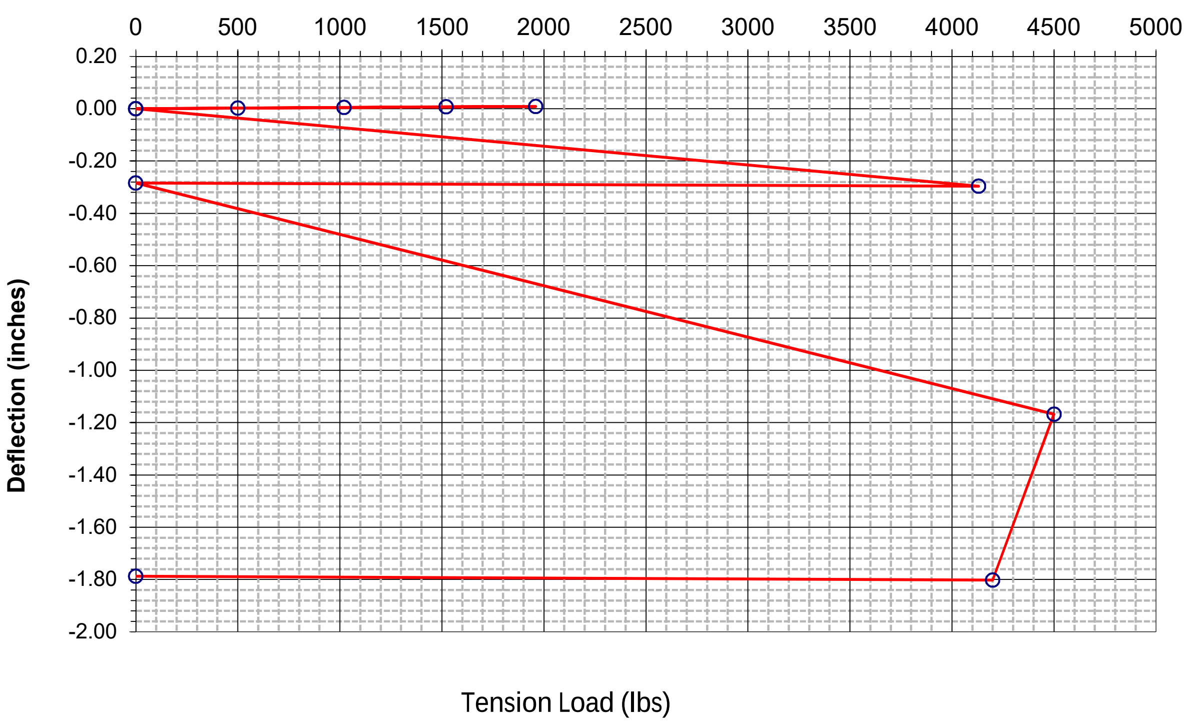


Pile Load Test Results

Project Name:	Little Bear Solar		Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057		Time to Drive :	31	[seconds]
Date Tested:	07/13/15		Latitude:	36.71643	[° N]
Pile Size:	W6X9		Longitude:	120.41649	[° W]
Pile Location :	TP-5				

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	500	0.003
2	1020	0.006
3	1520	0.008
4	1960	0.009
5	0	0.000
6	4130	-0.296
7	0	-0.284
8	4500	-1.168
9	4200	-1.802
10	0	-1.787

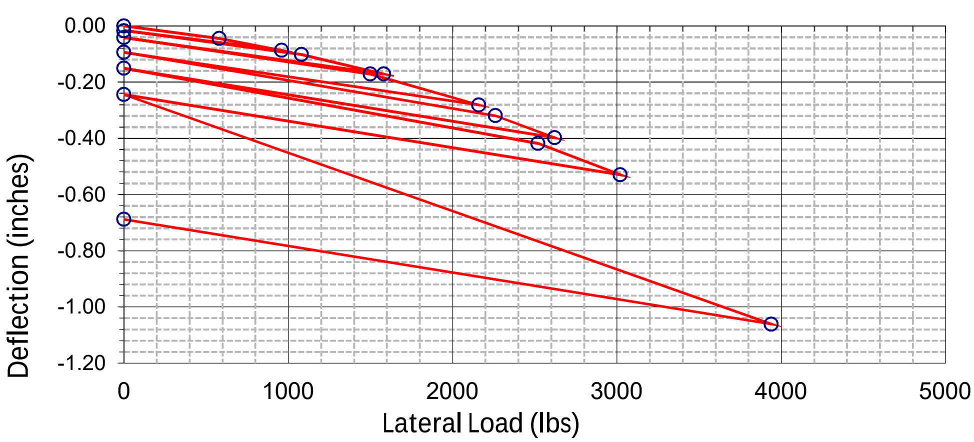


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	31	[seconds]
Pile Location:	TP-5	Latitude:	36.71643	[° N]
		Longitude:	120.41649	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	580	-0.0446
2	960	-0.0871
3	0	-0.0171
4	1080	-0.1021
5	1580	-0.1717
6	0	-0.0411
7	1500	-0.1714
8	2160	-0.2819
9	0	-0.0941
10	2260	-0.3189
11	2620	-0.3983
12	0	-0.1510
13	2520	-0.4187
14	3020	-0.5299
15	0	-0.2442
16	3940	-1.0608
17	0	-0.6876

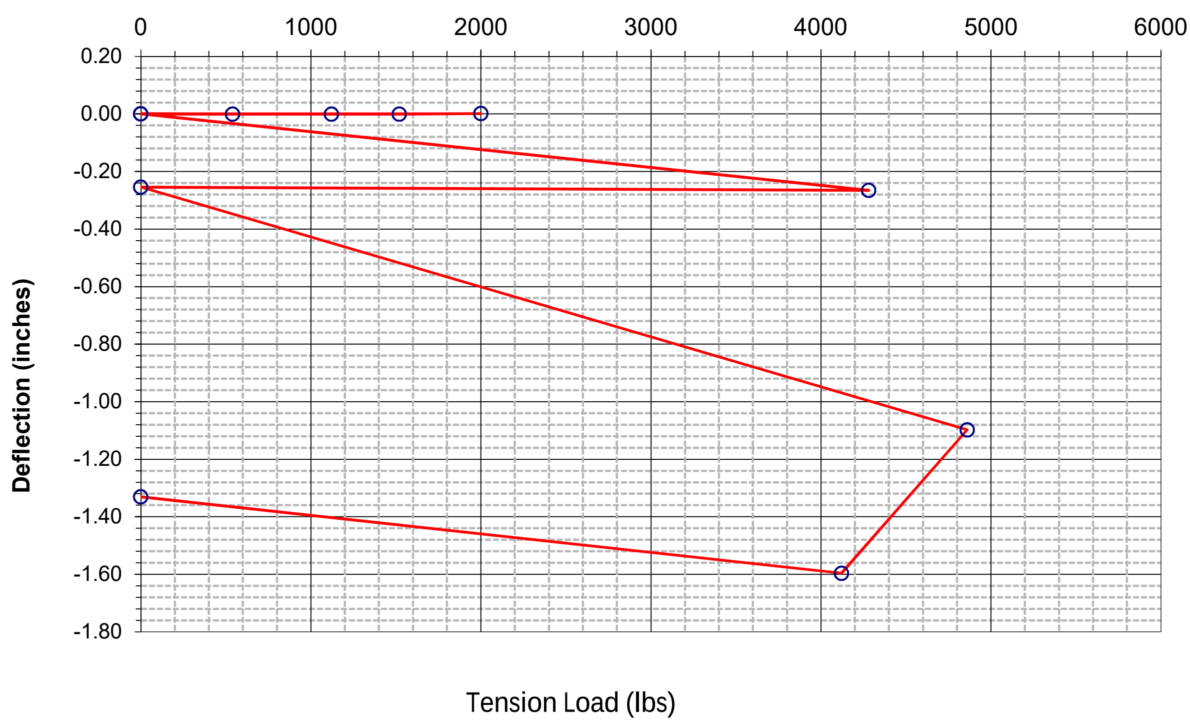


Pile Load Test Results

Project Name: Little Bear Solar
Project Number: 60155057
Date Tested: 07/13/15
Pile Size: W6X9
Pile Location : TP-6

Pile Embedment Depth: 6.0 [feet]
Time to Drive : 36 [seconds]
Latitude: 36.7186 [° N]
Longitude: 120.4145 [° W]

Tension Test Results		
Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	540	-0.001
2	1120	-0.001
3	1520	0.000
4	2000	0.001
5	0	0.000
6	4280	-0.266
7	0	-0.255
8	4860	-1.098
9	4120	-1.596
10	0	-1.331

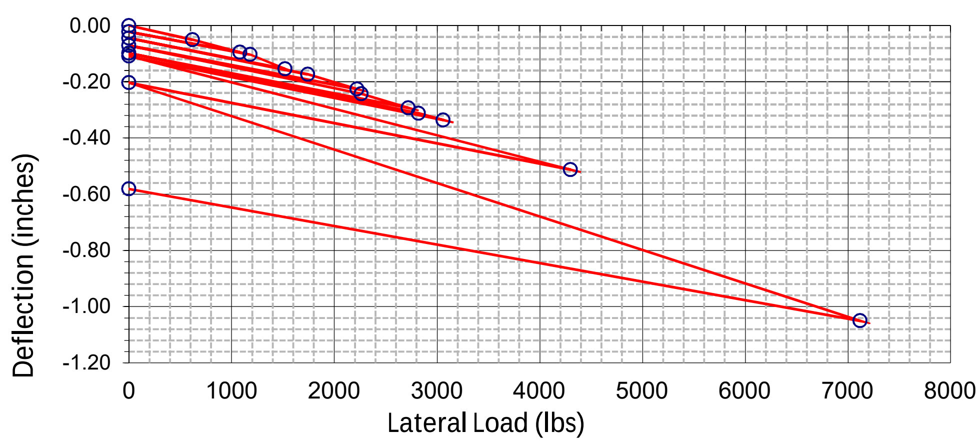


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	6.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	36	[seconds]
Pile Location:	TP-6	Latitude:	36.7186	[° N]
		Longitude:	120.4145	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	620	-0.0506
2	1080	-0.0949
3	0	-0.0226
4	1180	-0.1031
5	1520	-0.1547
6	0	-0.0447
7	1740	-0.1735
8	2220	-0.2259
9	0	-0.0712
10	2260	-0.2431
11	2720	-0.2932
12	0	-0.0983
13	2820	-0.3118
14	3060	-0.3359
15	0	-0.1088
16	4300	-0.5125
17	0	-0.2028
18	7120	-1.0505
19	0	-0.5811

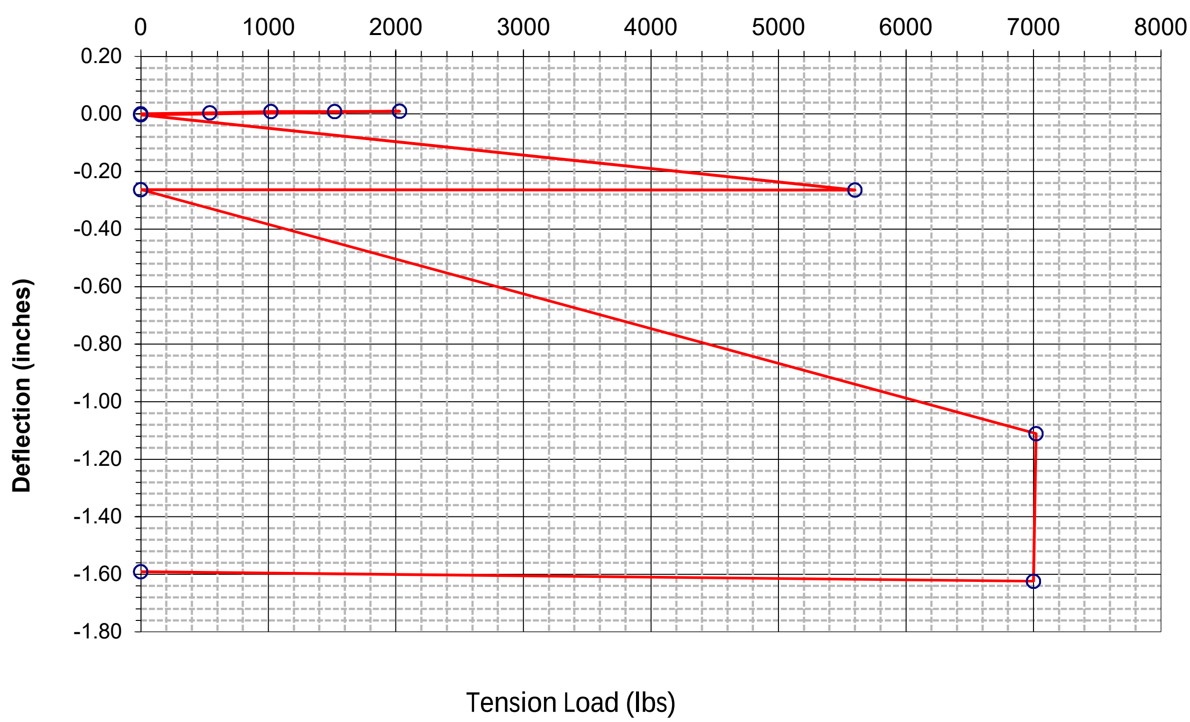


Pile Load Test Results

Project Name: Little Bear Solar
Project Number: 60155057
Date Tested: 07/13/15
Pile Size: W6X9
Pile Location : TP-7

Pile Embedment Depth: 6.0 [feet]
Time to Drive : 42 [seconds]
Latitude: 36.71636 [° N]
Longitude: 120.41213 [° W]

Tension Test Results		
Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	540	0.004
2	1020	0.008
3	1520	0.008
4	2030	0.009
5	0	-0.003
6	5600	-0.264
7	0	-0.263
8	7020	-1.111
9	7000	-1.624
10	0	-1.591



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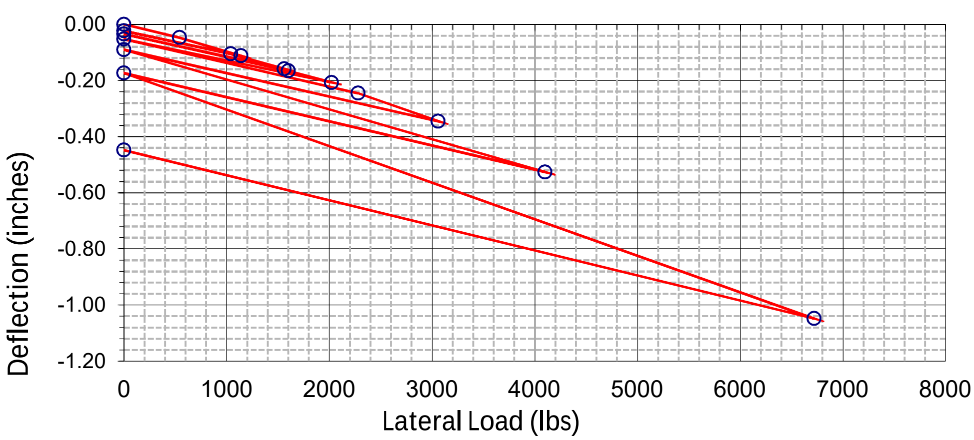
Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	6.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/13/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	42	[seconds]
Pile Location:	TP-7	Latitude:	36.71636	[° N]
		Longitude:	120.41213	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	540	-0.0477
2	1140	-0.1125
3	0	-0.0229
4	1040	-0.1056
5	1560	-0.1587
6	0	-0.0351
7	1600	-0.1658
8	2020	-0.2071
9	0	-0.0526
10	2280	-0.2450
11	3060	-0.3459
12	0	-0.0910
13	4100	-0.5263
14	0	-0.1732
15	6720	-1.0478
16	0	-0.4481

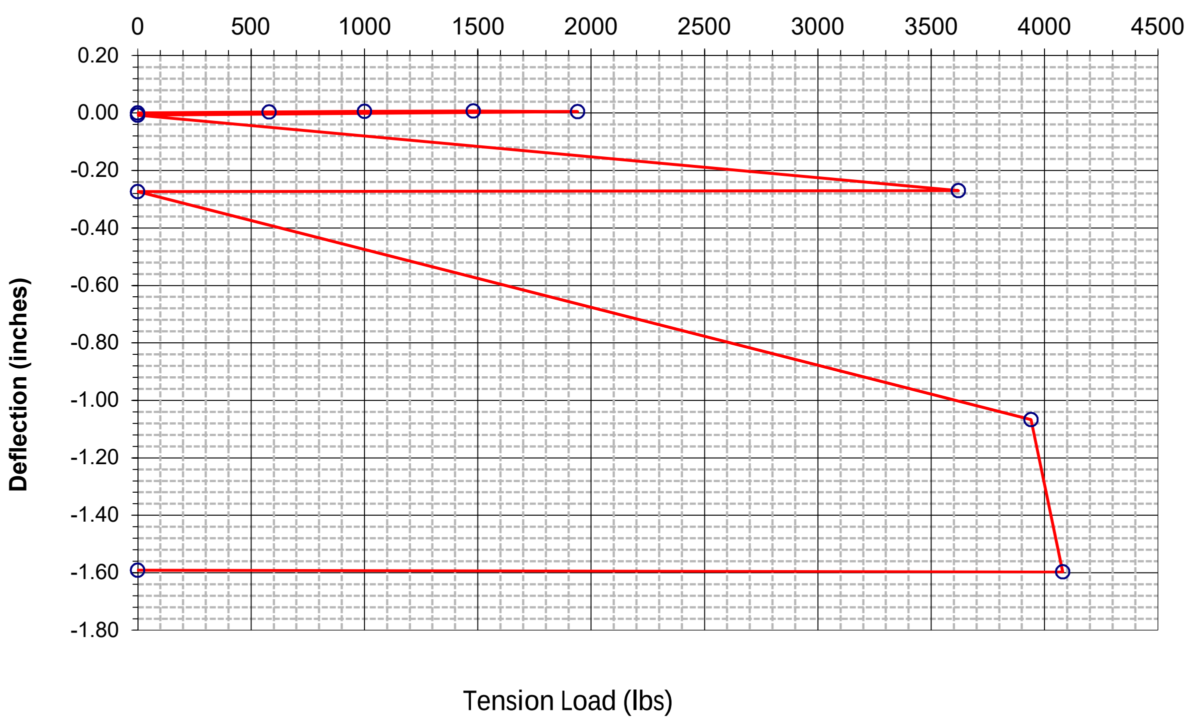


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	6.0	[feet]
Project Number:	60155057	Time to Drive :	28	[seconds]
Date Tested:	07/14/15	Latitude:	36.71434	[° N]
Pile Size:	W6X9	Longitude:	120.40733	[° W]
Pile Location :	TP-8			

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	580	0.004
2	1000	0.007
3	1480	0.008
4	1940	0.005
5	0	-0.007
6	3620	-0.270
7	0	-0.273
8	3940	-1.067
9	4080	-1.597
10	0	-1.591



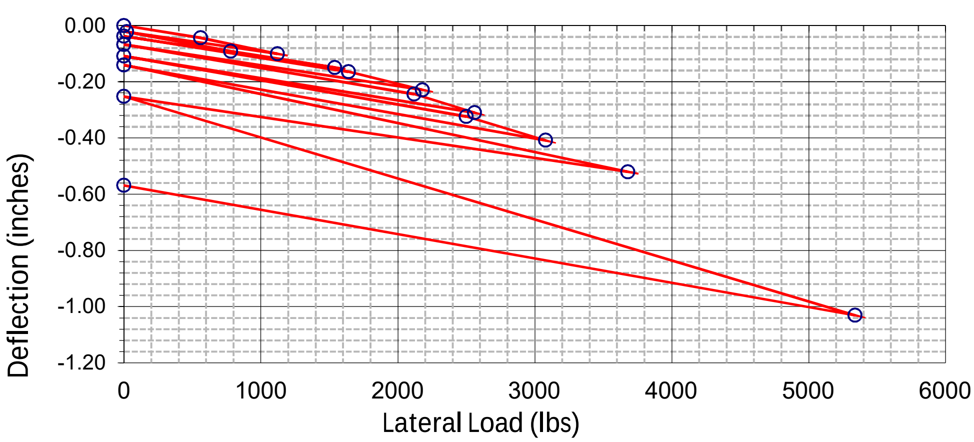
Pile Load Test Results

Project Name: Little Bear Solar
Project Number: 60155057
Date Tested: 07/14/15
Pile Size: W6X9
Pile Location: TP-8

Pile Embedment Depth: 6.0 [feet]
Lat Gauge 1 Position(above grade): 6 [inches]
Lat Gauge 2 Position(above grade): 6 [inches]
Time to Drive: 28 [seconds]
Latitude: 36.71434 [° N]
Longitude: 120.40733 [° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	560	-0.0435
2	1120	-0.1003
3	20	-0.0225
4	780	-0.0920
5	1540	-0.1496
6	0	-0.0379
7	1640	-0.1649
8	2180	-0.2298
9	0	-0.0682
10	2120	-0.2446
11	2560	-0.3097
12	0	-0.1089
13	2500	-0.3239
14	3080	-0.4085
15	0	-0.1407
16	3680	-0.5206
17	0	-0.2522
18	5340	-1.0307
19	0	-0.5682

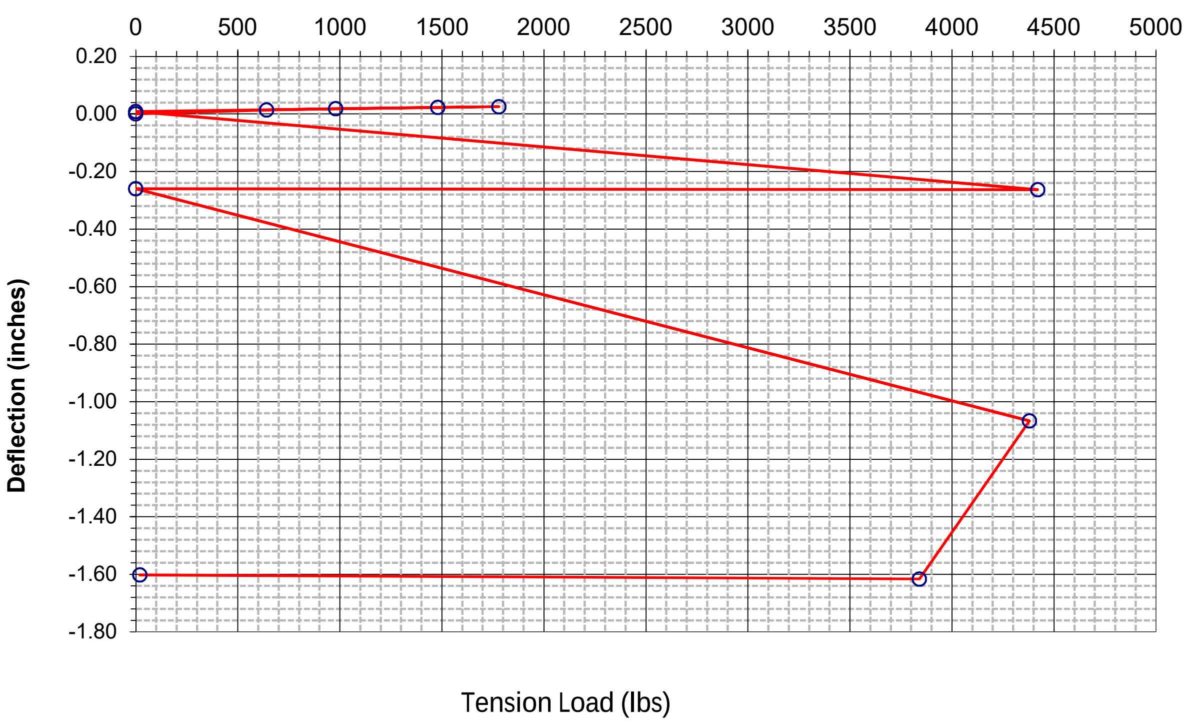


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Time to Drive :	22	[seconds]
Date Tested:	07/14/15	Latitude:	36.71633	[° N]
Pile Size:	W6X9	Longitude:	120.40858	[° W]
Pile Location :	TP-9			

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	640	0.014
2	980	0.019
3	1480	0.023
4	1780	0.026
5	0	0.009
6	4420	-0.263
7	0	-0.260
8	4380	-1.067
9	3840	-1.616
10	20	-1.602



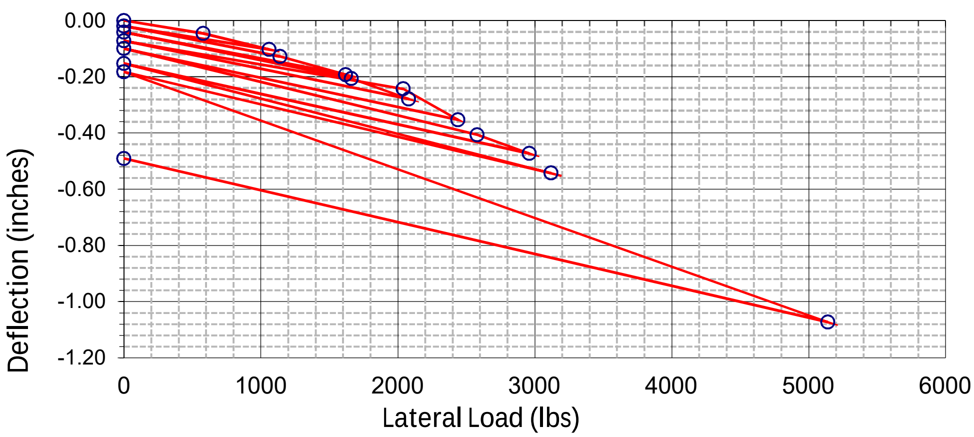
Pile Load Test Results

Project Name:	Little Bear Solar
Project Number:	60155057
Date Tested:	07/14/15
Pile Size:	W6X9
Pile Location:	TP-9

Pile Embedment Depth:	5.0	[feet]
Lat Gauge 1 Position(above grade):	6	[inches]
Lat Gauge 2 Position(above grade):	6	[inches]
Time to Drive:	22	[seconds]
Latitude:	36.71633	[° N]
Longitude:	120.40858	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	580	-0.0465
2	1060	-0.1027
3	0	-0.0198
4	1140	-0.1276
5	1620	-0.1925
6	0	-0.0420
7	1660	-0.2070
8	2080	-0.2794
9	0	-0.0720
10	2040	-0.2426
11	2440	-0.3530
12	0	-0.0992
13	2580	-0.4066
14	2960	-0.4723
15	0	-0.1529
16	3120	-0.5428
17	0	-0.1822
18	5140	-1.0726
19	0	-0.4907

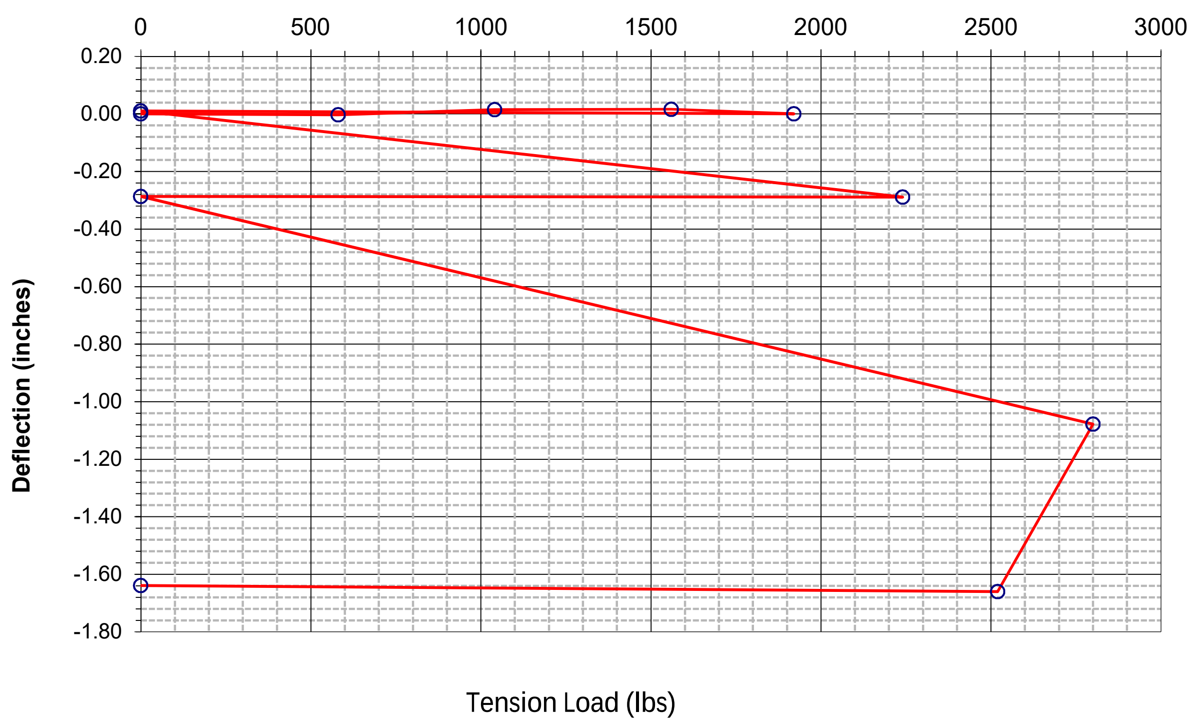


Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Time to Drive :	25	[seconds]
Date Tested:	07/14/15	Latitude:	36.71855	[° N]
Pile Size:	W6X9	Longitude:	120.40697	[° W]
Pile Location :	TP-10			

Tension Test Results

Reading	Axial Load (lbs)	Corrected Deflection Δ Average
0	0	0.000
1	580	-0.003
2	1040	0.014
3	1560	0.016
4	1920	0.000
5	0	0.010
6	2240	-0.289
7	0	-0.286
8	2800	-1.078
9	2520	-1.660
10	0	-1.639



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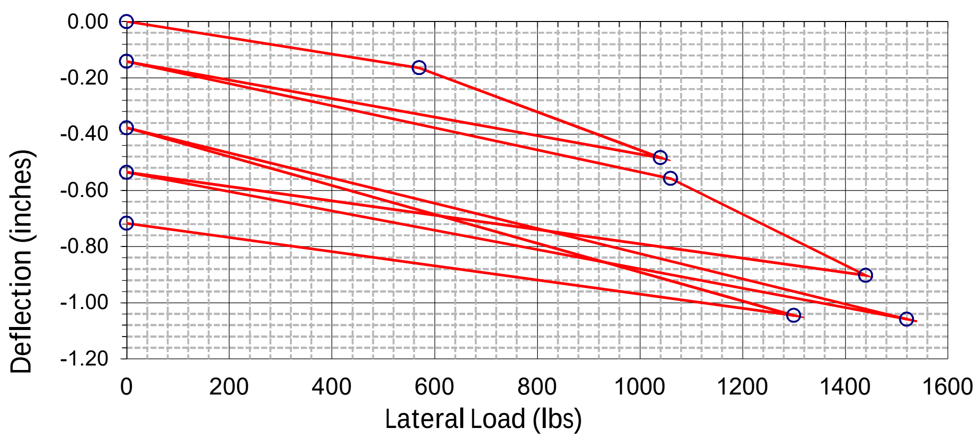
Pile Load Test Results

Project Name:	Little Bear Solar	Pile Embedment Depth:	5.0	[feet]
Project Number:	60155057	Lat Gauge 1 Position(above grade):	6	[inches]
Date Tested:	07/14/15	Lat Gauge 2 Position(above grade):	6	[inches]
Pile Size:	W6X9	Time to Drive:	25	[seconds]
Pile Location:	TP-10	Latitude:	36.71855	[° N]
		Longitude:	120.40697	[° W]

Lateral Test Results

Reading	Lateral Load (lbs)	Corrected Deflection Δ Average
0	0	0.0000
1	570	-0.1644
2	1040	-0.4846
3	0	-0.1418
4	1060	-0.5586
5	1440	-0.9027
6	0	-0.5361
7	1520	-1.0588
8	0	-0.3779
9	1300	-1.0453
10	0	-0.7178



APPENDIX F

TEST PIT PHOTO LOGS

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-1	Date: 7/28/2015
Approximate Depth: 4 feet bgs	Project Geologist: Trevor Lillis

Terracon

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-2	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-3	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-4	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-5	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-6	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-7	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-8	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

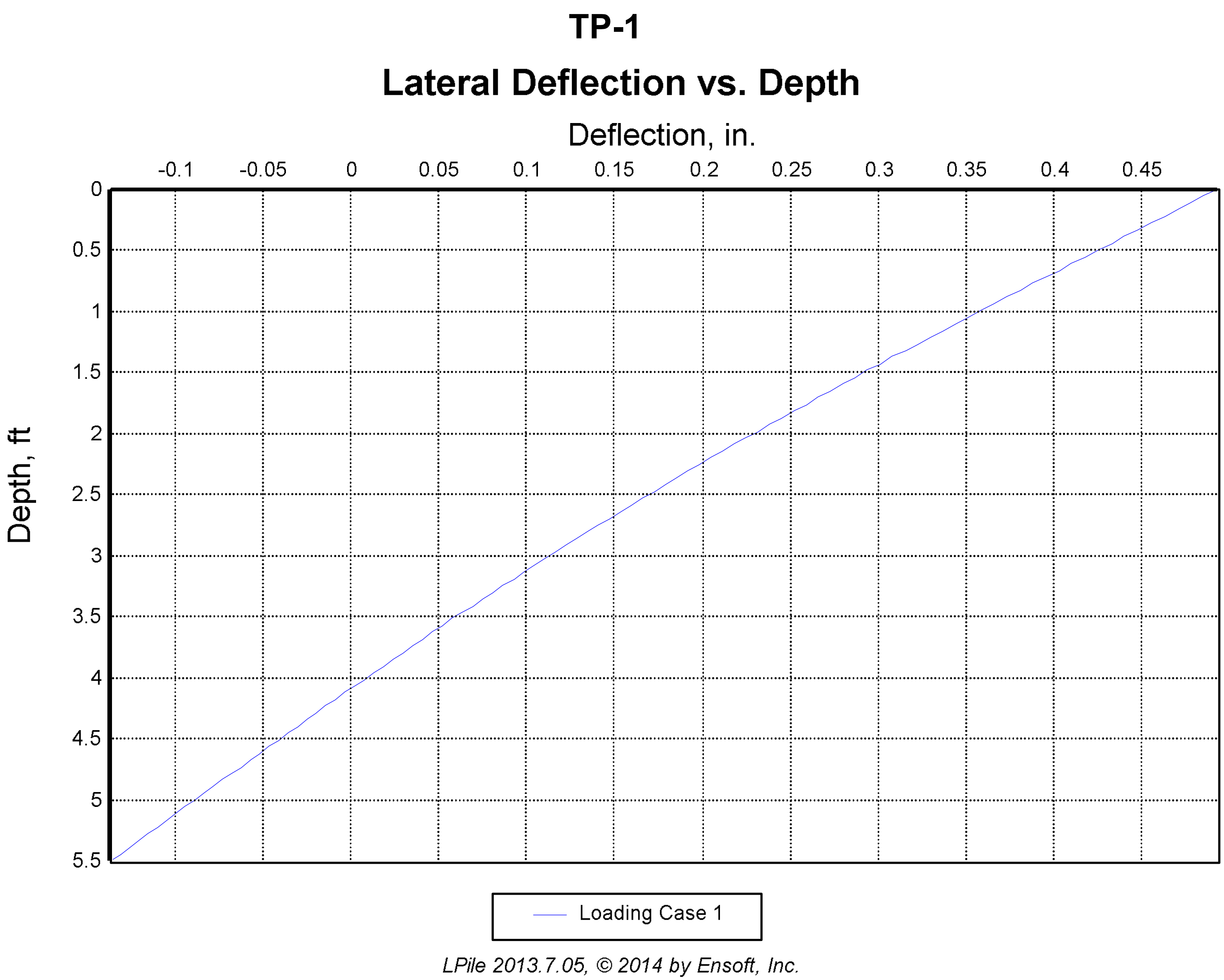
TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-9	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

TEST PIT PHOTO LOG

Project: Little Bear Solar Project	Project No.: 60155057
Test Pit No.: TP-10	Date: 7/28/2015
Approximate Depth: 4 feet	Project Geologist: Trevor Lillis

APPENDIX G
L-PILE ANALYSES


TP-1
Lateral Deflection vs. Depth
Deflection, in.
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Depth, ft
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Loading Case 1
LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

This copy of LPile is used by:

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Terracon Inc.

Serial Number of Security Device: 138584418
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is forbidden by the software license agreement.

Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-1.lp7d
Name of output report file: TP-1.lp7o
Name of plot output file: TP-1.lp7p
Name of runtime messeage file: TP-1.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 17:07:35

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

```
--------------------------------------------------------------------------------

Ground Slope Angle                                        =       0.000 degrees
                                                          =       0.000 radians

Pile Batter Angle                                         =       0.000 degrees
                                                          =       0.000 radians


--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer              =     0.50000 ft
   Distance from top of pile to bottom of layer           =     7.00000 ft
   Effective unit weight at top of layer                  =   115.00000 pcf
   Effective unit weight at bottom of layer               =   115.00000 pcf
   Undrained cohesion at top of layer                     =  1170.00000 psf
   Undrained cohesion at bottom of layer                  =  1170.00000 psf
   Epsilon-50 at top of layer                             =     0.00700
   Epsilon-50 at bottom of layer                          =     0.00700


   (Depth of lowest soil layer extends    1.50 ft below pile tip)



--------------------------------------------------------------------------------
                          Summary of Soil Properties
--------------------------------------------------------------------------------
```

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1170.000	0.00700
		7.000	115.000	1170.000	0.00700

```
--------------------------------------------------------------------------------
                                  Loading Type
--------------------------------------------------------------------------------

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3



--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load    Load         Condition               Condition           Axial Thrust
     Compute
 No.    Type             1                       2                Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   ----------------------   ----------------
---------------------
   1     1     V =   2280.00000 lbs   M =       0.0000 in-lbs        0.0000000
       No

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.


--------------------------------------------------------------------------------
    Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 2280.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.4971	-2.424E-06	2280.0000	-0.0115	2.912E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.4895	1504.8000	2280.0000	-0.0115	180.7595	4.756E+08	0.000	0.000	0.000
0.110	0.4820	3009.6000	2280.0000	-0.0115	361.5190	4.756E+08	0.000	0.000	0.000
0.165	0.4744	4514.4000	2280.0000	-0.0115	542.2785	4.756E+08	0.000	0.000	0.000
0.220	0.4668	6019.2000	2280.0000	-0.0115	723.0380	4.756E+08	0.000	0.000	0.000
0.275	0.4592	7524.0000	2280.0000	-0.0115	903.7976	4.756E+08	0.000	0.000	0.000
0.330	0.4517	9028.8000	2280.0000	-0.0115	1084.5571	4.756E+08	0.000	0.000	0.000
0.385	0.4441	10534.	2280.0000	-0.0114	1265.3166	4.756E+08	0.000	0.000	0.000
0.440	0.4365	12038.	2280.0000	-0.0114	1446.0761	4.756E+08	0.000	0.000	0.000
0.495	0.4290	13543.	2280.0000	-0.0114	1626.8356	4.756E+08	0.000	0.000	0.000
0.550	0.4215	15048.	2255.9710	-0.0114	1807.5951	4.756E+08	-72.8152	114.0230	0.000
0.605	0.4140	16521.	2207.3285	-0.0114	1984.5446	4.756E+08	-74.5862	118.9160	0.000
0.660	0.4065	17962.	2157.5248	-0.0113	2157.5913	4.756E+08	-76.3343	123.9481	0.000
0.715	0.3990	19369.	2106.5749	-0.0113	2326.6438	4.756E+08	-78.0591	129.1255	0.000
0.770	0.3915	20742.	2054.4946	-0.0113	2491.6119	4.756E+08	-79.7602	134.4546	0.000

0.825	0.3841	22081.	2001.2995	-0.0113	2652.4065	4.756E+08
-81.4371	139.9424	0.000				
0.880	0.3767	23384.	1947.0057	-0.0112	2808.9399	4.756E+08
-83.0894	145.5963	0.000				
0.935	0.3692	24651.	1891.6297	-0.0112	2961.1256	4.756E+08
-84.7167	151.4240	0.000				
0.990	0.3619	25881.	1835.1880	-0.0112	3108.8785	4.756E+08
-86.3186	157.4340	0.000				
1.045	0.3545	27073.	1777.6977	-0.0111	3252.1148	4.756E+08
-87.8945	163.6349	0.000				
1.100	0.3472	28228.	1719.1760	-0.0111	3390.7520	4.756E+08
-89.4439	170.0362	0.000				
1.155	0.3399	29343.	1659.6406	-0.0110	3524.7090	4.756E+08
-90.9664	176.6480	0.000				
1.210	0.3326	30418.	1599.1094	-0.0110	3653.9062	4.756E+08
-92.4614	183.4809	0.000				
1.265	0.3253	31454.	1537.6008	-0.0110	3778.2654	4.756E+08
-93.9284	190.5464	0.000				
1.320	0.3181	32448.	1475.1334	-0.0109	3897.7097	4.756E+08
-95.3668	197.8567	0.000				
1.375	0.3109	33401.	1411.7263	-0.0109	4012.1640	4.756E+08
-96.7760	205.4251	0.000				
1.430	0.3038	34311.	1347.3990	-0.0108	4121.5544	4.756E+08
-98.1553	213.2657	0.000				
1.485	0.2966	35179.	1282.1714	-0.0108	4225.8089	4.756E+08
-99.5041	221.3936	0.000				
1.540	0.2895	36004.	1216.0638	-0.0107	4324.8567	4.756E+08
-100.8218	229.8252	0.000				
1.595	0.2825	36785.	1149.0971	-0.0107	4418.6291	4.756E+08
-102.1076	238.5783	0.000				
1.650	0.2754	37521.	1081.2926	-0.0106	4507.0587	4.756E+08
-103.3607	247.6719	0.000				
1.705	0.2684	38212.	1012.6721	-0.0106	4590.0799	4.756E+08
-104.5803	257.1268	0.000				
1.760	0.2615	38857.	943.2580	-0.0105	4667.6290	4.756E+08
-105.7656	266.9654	0.000				
1.815	0.2545	39457.	873.0732	-0.0105	4739.6438	4.756E+08
-106.9156	277.2121	0.000				
1.870	0.2477	40010.	802.1413	-0.0104	4806.0643	4.756E+08
-108.0295	287.8937	0.000				
1.925	0.2408	40516.	730.4865	-0.0104	4866.8321	4.756E+08
-109.1062	299.0392	0.000				
1.980	0.2340	40974.	658.1338	-0.0103	4921.8910	4.756E+08
-110.1445	310.6805	0.000				
2.035	0.2272	41384.	585.1087	-0.0102	4971.1865	4.756E+08
-111.1435	322.8526	0.000				
2.090	0.2205	41746.	511.4378	-0.0102	5014.6664	4.756E+08
-112.1017	335.5938	0.000				
2.145	0.2138	42060.	437.1483	-0.0101	5052.2805	4.756E+08

-113.0179	348.9467	0.000				
2.200	0.2071	42323.	362.2685	-0.0101	5083.9810	4.756E+08
-113.8907	362.9582	0.000				
2.255	0.2005	42538.	286.8274	-0.0100	5109.7222	4.756E+08
-114.7185	377.6804	0.000				
2.310	0.1939	42702.	210.8554	-0.009951	5129.4607	4.756E+08
-115.4997	393.1713	0.000				
2.365	0.1873	42816.	134.3838	-0.009892	5143.1556	4.756E+08
-116.2325	409.4956	0.000				
2.420	0.1808	42879.	57.4452	-0.009832	5150.7687	4.756E+08
-116.9148	426.7260	0.000				
2.475	0.1744	42892.	-19.9265	-0.009773	5152.2642	4.756E+08
-117.5447	444.9441	0.000				
2.530	0.1679	42853.	-97.6957	-0.009713	5147.6091	4.756E+08
-118.1198	464.2422	0.000				
2.585	0.1615	42763.	-175.8256	-0.009654	5136.7735	4.756E+08
-118.6375	484.7249	0.000				
2.640	0.1552	42621.	-254.2773	-0.009595	5119.7301	4.756E+08
-119.0950	506.5114	0.000				
2.695	0.1489	42427.	-333.0102	-0.009536	5096.4550	4.756E+08
-119.4894	529.7383	0.000				
2.750	0.1426	42182.	-411.9813	-0.009477	5066.9276	4.756E+08
-119.8171	554.5628	0.000				
2.805	0.1364	41884.	-491.1456	-0.009419	5031.1308	4.756E+08
-120.0745	581.1667	0.000				
2.860	0.1302	41533.	-570.4551	-0.009361	4989.0511	4.756E+08
-120.2573	609.7622	0.000				
2.915	0.1240	41131.	-649.8590	-0.009303	4940.6789	4.756E+08
-120.3607	640.5975	0.000				
2.970	0.1179	40675.	-729.3032	-0.009247	4886.0088	4.756E+08
-120.3794	673.9664	0.000				
3.025	0.1118	40168.	-808.7299	-0.009190	4825.0399	4.756E+08
-120.3075	710.2180	0.000				
3.080	0.1058	39608.	-888.0769	-0.009135	4757.7758	4.756E+08
-120.1379	749.7720	0.000				
3.135	0.0997	38996.	-967.2771	-0.009081	4684.2256	4.756E+08
-119.8628	793.1369	0.000				
3.190	0.0938	38331.	-1046.2580	-0.009027	4604.4034	4.756E+08
-119.4731	840.9358	0.000				
3.245	0.0878	37615.	-1124.9402	-0.008974	4518.3299	4.756E+08
-118.9579	893.9411	0.000				
3.300	0.0819	36846.	-1203.2369	-0.008923	4426.0318	4.756E+08
-118.3048	953.1236	0.000				
3.355	0.0760	36026.	-1281.0520	-0.008872	4327.5435	4.756E+08
-117.4987	1019.7210	0.000				
3.410	0.0702	35155.	-1358.2787	-0.008823	4222.9070	4.756E+08
-116.5215	1095.3396	0.000				
3.465	0.0644	34233.	-1434.7966	-0.008774	4112.1735	4.756E+08
-115.3512	1182.1046	0.000				

```
     3.520     0.0586     33261. -1510.4694  -0.008728  3995.4042  4.756E+08
-113.9602  1282.8942      0.000
     3.575     0.0529     32240. -1585.1398  -0.008682  3872.6720  4.756E+08
-112.3137  1401.7125      0.000
     3.630     0.0472     31169. -1658.6242  -0.008638  3744.0629  4.756E+08
-110.3664  1544.3147      0.000
     3.685     0.0415     30050. -1730.7043  -0.008596  3609.6789  4.756E+08
-108.0581  1719.3067      0.000
     3.740     0.0358     28884. -1801.1141  -0.008555  3469.6407  4.756E+08
-105.3050  1940.2115      0.000
     3.795     0.0302     27673. -1869.5201  -0.008516  3324.0925  4.756E+08
-101.9860  2229.6759      0.000
     3.850     0.0246     26417. -1935.4872  -0.008478  3173.2078  4.756E+08
-97.9145  2629.0032      0.000
     3.905     0.0190     25118. -1998.4154  -0.008442  3017.1998  4.756E+08
-92.7770  3223.1807      0.000
     3.960     0.0134     23779. -2057.4030  -0.008408  2856.3371  4.756E+08
-85.9733  4222.7617      0.000
     4.015   0.007899     22402. -2110.8735  -0.008376  2690.9759  4.756E+08
-76.0584  6355.3087      0.000
     4.070   0.002381     20992. -2154.7600  -0.008346  2521.6350  4.756E+08
-56.9310     15784.      0.000
     4.125  -0.003118     19558. -2153.2433  -0.008318  2349.3151  4.756E+08
61.5271     13023.      0.000
     4.180  -0.008599     18150. -2106.5122  -0.008292  2180.2146  4.756E+08
80.0822  6146.4429      0.000
     4.235    -0.0141     16777. -2050.0857  -0.008268  2015.3044  4.756E+08
90.9072  4266.2844      0.000
     4.290    -0.0195     15444. -1987.5277  -0.008245  1855.1510  4.756E+08
98.6625  3337.2229      0.000
     4.345    -0.0249     14154. -1920.3478  -0.008225  1700.1601  4.756E+08
104.9131  2775.5660      0.000
     4.400    -0.0304     12909. -1849.3605  -0.008206  1550.6588  4.756E+08
110.2000  2394.9389      0.000
     4.455    -0.0358     11712. -1775.1071  -0.008189  1406.9237  4.756E+08
114.8103  2117.8537      0.000
     4.510    -0.0412     10566. -1697.9773  -0.008173  1269.1961  4.756E+08
118.9161  1905.9692      0.000
     4.565    -0.0466  9471.1312 -1618.2673  -0.008159  1137.6908  4.756E+08
122.6296  1738.0093      0.000
     4.620    -0.0519  8429.7836 -1536.2103  -0.008147  1012.6020  4.756E+08
126.0281  1601.1617      0.000
     4.675    -0.0573  7443.3337 -1451.9957  -0.008136   894.1078  4.756E+08
129.1676  1487.2218      0.000
     4.730    -0.0627  6513.1493 -1365.7806  -0.008126   782.3722  4.756E+08
132.0901  1390.6774      0.000
     4.785    -0.0680  5640.5033 -1277.6978  -0.008118   677.5483  4.756E+08
134.8275  1307.6794      0.000
     4.840    -0.0734  4826.5881 -1187.8610  -0.008111   579.7792  4.756E+08
```

```
137.4052  1235.4540      0.000
     4.895    -0.0788  4072.5267 -1096.3689  -0.008105   489.1999  4.756E+08
139.8436  1171.9483      0.000
     4.950    -0.0841  3379.3812 -1003.3080  -0.008099   405.9379  4.756E+08
142.1591  1115.6086      0.000
     5.005    -0.0894  2748.1602  -908.7549  -0.008095   330.1144  4.756E+08
144.3655  1065.2360      0.000
     5.060    -0.0948  2179.8248  -812.7778  -0.008092   261.8448  4.756E+08
146.4741  1019.8898      0.000
     5.115    -0.1001  1675.2935  -715.4381  -0.008089   201.2395  4.756E+08
148.4947   978.8207      0.000
     5.170    -0.1055  1235.4465  -616.7911  -0.008087   148.4042  4.756E+08
150.4354   941.4243      0.000
     5.225    -0.1108   861.1292  -516.8873  -0.008086   103.4405  4.756E+08
152.3035   907.2071      0.000
     5.280    -0.1161   553.1553  -415.7725  -0.008085    66.4461  4.756E+08
154.1049   875.7623      0.000
     5.335    -0.1215   312.3095  -313.4890  -0.008084    37.5152  4.756E+08
155.8452   846.7510      0.000
     5.390    -0.1268   139.3499  -210.0755  -0.008084    16.7390  4.756E+08
157.5289   819.8888      0.000
     5.445    -0.1321    35.0098  -105.5681  -0.008084     4.2054  4.756E+08
159.1603   794.9349      0.000
     5.500    -0.1375      0.000      0.000  -0.008083      0.000  4.756E+08
160.7430   385.8421      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.4971376 inches
Computed slope at pile head      =     -0.0114982 radians
Maximum bending moment           =         42892. inch-lbs
Maximum shear force              =   2280.0000008 lbs
Depth of maximum bending moment  =      2.4750000 feet below pile head
Depth of maximum shear force     =      0.0550000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
```

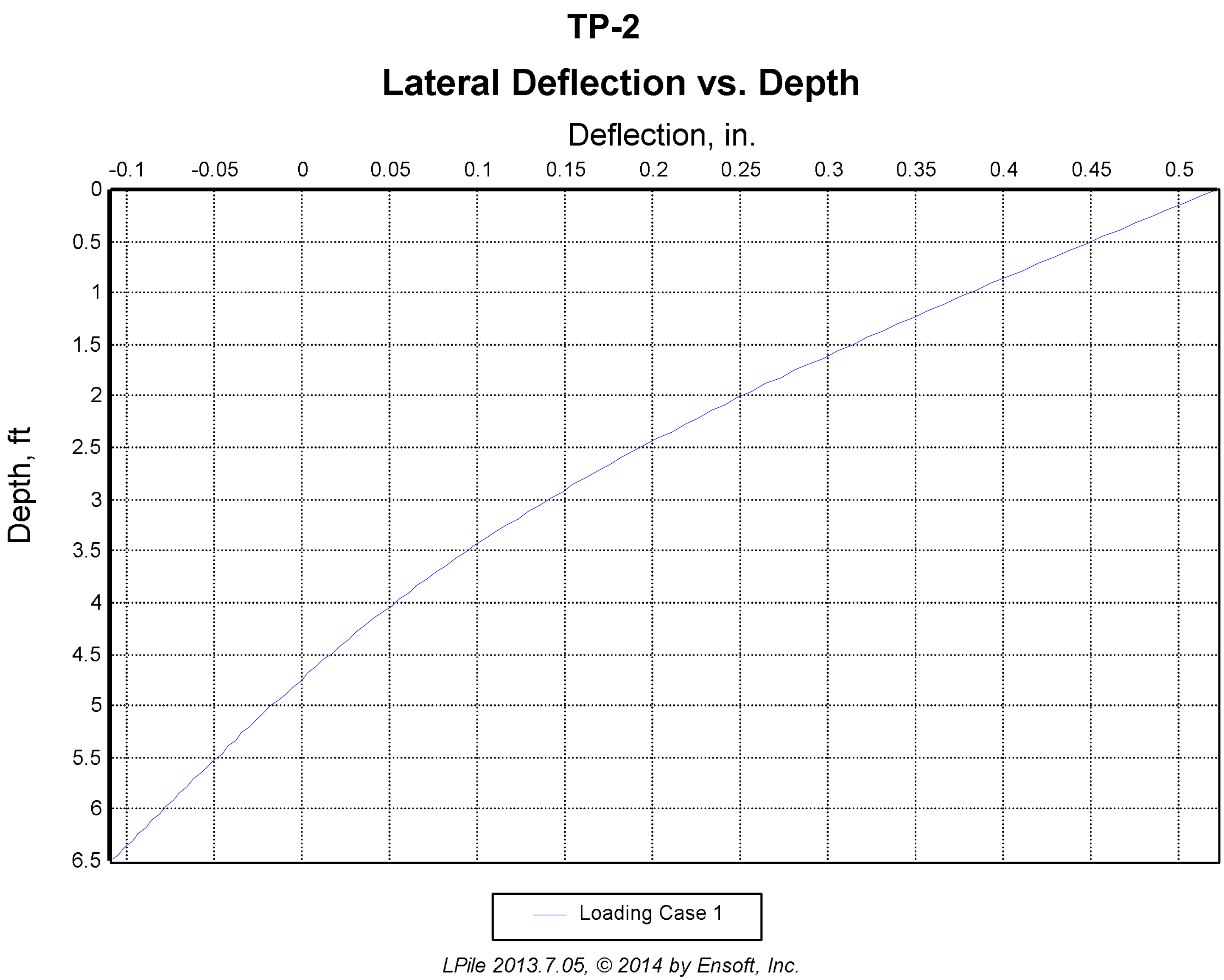
Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 2280.0000	M = 0.000	0.0000000	0.49713760	42892.	2280.0000	-0.01149825

The analysis ended normally.


TP-2
Lateral Deflection vs. Depth
Deflection, in.
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth, ft
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
Loading Case 1
LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-2.lp7d
Name of output report file: TP-2.lp7o
Name of plot output file: TP-2.lp7p
Name of runtime messeage file: TP-2.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 17:01:00

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 6.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	6.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	6.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1420.00000 psf
Undrained cohesion at bottom of layer	=	1420.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 0.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1420.000	0.00700
		7.000	115.000	1420.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition               Condition            Axial Thrust
     Compute
 No.    Type             1                       2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   3520.00000 lbs   M =       0.0000 in-lbs         0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3520.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5142	8.679E-07	3520.0000	-0.0118	1.043E-07	4.756E+08	0.000	0.000	0.000
0.06500	0.5050	2745.6000	3520.0000	-0.0118	329.8068	4.756E+08	0.000	0.000	0.000
0.130	0.4957	5491.2000	3520.0000	-0.0118	659.6137	4.756E+08	0.000	0.000	0.000
0.195	0.4865	8236.8000	3520.0000	-0.0118	989.4205	4.756E+08	0.000	0.000	0.000
0.260	0.4773	10982.	3520.0000	-0.0118	1319.2273	4.756E+08	0.000	0.000	0.000
0.325	0.4681	13728.	3520.0000	-0.0118	1649.0341	4.756E+08	0.000	0.000	0.000
0.390	0.4589	16474.	3520.0000	-0.0118	1978.8410	4.756E+08	0.000	0.000	0.000
0.455	0.4497	19219.	3520.0000	-0.0117	2308.6478	4.756E+08	0.000	0.000	0.000
0.520	0.4406	21965.	3485.7040	-0.0117	2638.4546	4.756E+08	-87.9386	155.6826	0.000
0.585	0.4315	24657.	3416.1176	-0.0117	2961.8347	4.756E+08	-90.4879	163.5800	0.000
0.650	0.4224	27294.	3344.5574	-0.0116	3278.6017	4.756E+08	-92.9997	171.7359	0.000
0.715	0.4133	29874.	3271.0530	-0.0116	3588.5722	4.756E+08	-95.4732	180.1630	0.000
0.780	0.4043	32397.	3195.6343	-0.0115	3891.5652	4.756E+08	-97.9079	188.8745	0.000
0.845	0.3954	34860.	3118.3320	-0.0115	4187.4029	4.756E+08	-100.3032	197.8845	0.000
0.910	0.3864	37261.	3039.1770	-0.0114	4475.9102	4.756E+08	-102.6583	207.2079	0.000

0.975	0.3776	39601.	2958.2009	-0.0113	4756.9150	4.756E+08	
-104.9727	216.8605	0.000					
1.040	0.3687	41876.	2875.4357	-0.0113	5030.2481	4.756E+08	
-107.2457	226.8591	0.000					
1.105	0.3600	44086.	2790.9139	-0.0112	5295.7436	4.756E+08	
-109.4767	237.2217	0.000					
1.170	0.3513	46230.	2704.6687	-0.0111	5553.2382	4.756E+08	
-111.6649	247.9671	0.000					
1.235	0.3426	48306.	2616.7336	-0.0111	5802.5721	4.756E+08	
-113.8097	259.1158	0.000					
1.300	0.3340	50312.	2527.1429	-0.0110	6043.5885	4.756E+08	
-115.9103	270.6893	0.000					
1.365	0.3255	52248.	2435.9311	-0.0109	6276.1340	4.756E+08	
-117.9661	282.7107	0.000					
1.430	0.3170	54112.	2343.1336	-0.0108	6500.0583	4.756E+08	
-119.9762	295.2047	0.000					
1.495	0.3086	55903.	2248.7863	-0.0107	6715.2144	4.756E+08	
-121.9400	308.1977	0.000					
1.560	0.3003	57620.	2152.9256	-0.0106	6921.4589	4.756E+08	
-123.8566	321.7181	0.000					
1.625	0.2920	59262.	2055.5887	-0.0105	7118.6516	4.756E+08	
-125.7252	335.7965	0.000					
1.690	0.2839	60827.	1956.8134	-0.0104	7306.6561	4.756E+08	
-127.5450	350.4654	0.000					
1.755	0.2758	62315.	1856.6379	-0.0103	7485.3394	4.756E+08	
-129.3150	365.7602	0.000					
1.820	0.2678	63723.	1755.1016	-0.0102	7654.5720	4.756E+08	
-131.0345	381.7189	0.000					
1.885	0.2598	65052.	1652.2443	-0.0101	7814.2283	4.756E+08	
-132.7023	398.3827	0.000					
1.950	0.2520	66301.	1548.1065	-0.0100	7964.1864	4.756E+08	
-134.3176	415.7961	0.000					
2.015	0.2442	67468.	1442.7297	-0.009901	8104.3283	4.756E+08	
-135.8792	434.0074	0.000					
2.080	0.2365	68551.	1336.1562	-0.009790	8234.5399	4.756E+08	
-137.3861	453.0692	0.000					
2.145	0.2289	69552.	1228.4291	-0.009677	8354.7110	4.756E+08	
-138.8372	473.0385	0.000					
2.210	0.2214	70468.	1119.5925	-0.009562	8464.7355	4.756E+08	
-140.2310	493.9780	0.000					
2.275	0.2140	71298.	1009.6915	-0.009446	8564.5117	4.756E+08	
-141.5665	515.9558	0.000					
2.340	0.2067	72043.	898.7722	-0.009328	8653.9419	4.756E+08	
-142.8421	539.0469	0.000					
2.405	0.1995	72701.	786.8818	-0.009209	8732.9328	4.756E+08	
-144.0563	563.3338	0.000					
2.470	0.1923	73271.	674.0688	-0.009090	8801.3959	4.756E+08	
-145.2077	588.9074	0.000					
2.535	0.1853	73752.	560.3830	-0.008969	8859.2468	4.756E+08	

-146.2945	615.8682	0.000				
2.600	0.1783	74145.	445.8753	-0.008848	8906.4062	4.756E+08
-147.3148	644.3278	0.000				
2.665	0.1715	74448.	330.5986	-0.008726	8942.7995	4.756E+08
-148.2666	674.4104	0.000				
2.730	0.1647	74660.	214.6069	-0.008604	8968.3571	4.756E+08
-149.1479	706.2547	0.000				
2.795	0.1581	74782.	97.9564	-0.008481	8983.0147	4.756E+08
-149.9561	740.0162	0.000				
2.860	0.1515	74813.	-19.2952	-0.008358	8986.7132	4.756E+08
-150.6888	775.8699	0.000				
2.925	0.1450	74752.	-137.0877	-0.008236	8979.3990	4.756E+08
-151.3432	814.0139	0.000				
2.990	0.1386	74599.	-255.3587	-0.008113	8961.0243	4.756E+08
-151.9160	854.6727	0.000				
3.055	0.1324	74354.	-374.0435	-0.007991	8931.5472	4.756E+08
-152.4040	898.1029	0.000				
3.120	0.1262	74016.	-493.0743	-0.007870	8890.9322	4.756E+08
-152.8032	944.5984	0.000				
3.185	0.1201	73585.	-612.3802	-0.007748	8839.1499	4.756E+08
-153.1094	994.4985	0.000				
3.250	0.1141	73061.	-731.8869	-0.007628	8776.1781	4.756E+08
-153.3179	1048.1967	0.000				
3.315	0.1082	72443.	-851.5160	-0.007509	8702.0014	4.756E+08
-153.4234	1106.1528	0.000				
3.380	0.1024	71732.	-971.1848	-0.007391	8616.6123	4.756E+08
-153.4196	1168.9076	0.000				
3.445	0.0967	70928.	-1090.8054	-0.007274	8520.0109	4.756E+08
-153.2999	1237.1021	0.000				
3.510	0.0910	70031.	-1210.2844	-0.007158	8412.2060	4.756E+08
-153.0564	1311.5026	0.000				
3.575	0.0855	69040.	-1329.5215	-0.007044	8293.2154	4.756E+08
-152.6798	1393.0343	0.000				
3.640	0.0800	67956.	-1448.4090	-0.006932	8163.0666	4.756E+08
-152.1599	1482.8246	0.000				
3.705	0.0747	66780.	-1566.8302	-0.006821	8021.7977	4.756E+08
-151.4842	1582.2645	0.000				
3.770	0.0694	65512.	-1684.6580	-0.006713	7869.4580	4.756E+08
-150.6384	1693.0915	0.000				
3.835	0.0642	64152.	-1801.7530	-0.006606	7706.1092	4.756E+08
-149.6052	1817.5078	0.000				
3.900	0.0591	62702.	-1917.9609	-0.006502	7531.8270	4.756E+08
-148.3637	1958.3506	0.000				
3.965	0.0541	61160.	-2033.1093	-0.006401	7346.7021	4.756E+08
-146.8887	2119.3452	0.000				
4.030	0.0491	59530.	-2147.0038	-0.006302	7150.8422	4.756E+08
-145.1486	2305.4899	0.000				
4.095	0.0442	57811.	-2259.4223	-0.006206	6944.3745	4.756E+08
-143.1038	2523.6653	0.000				

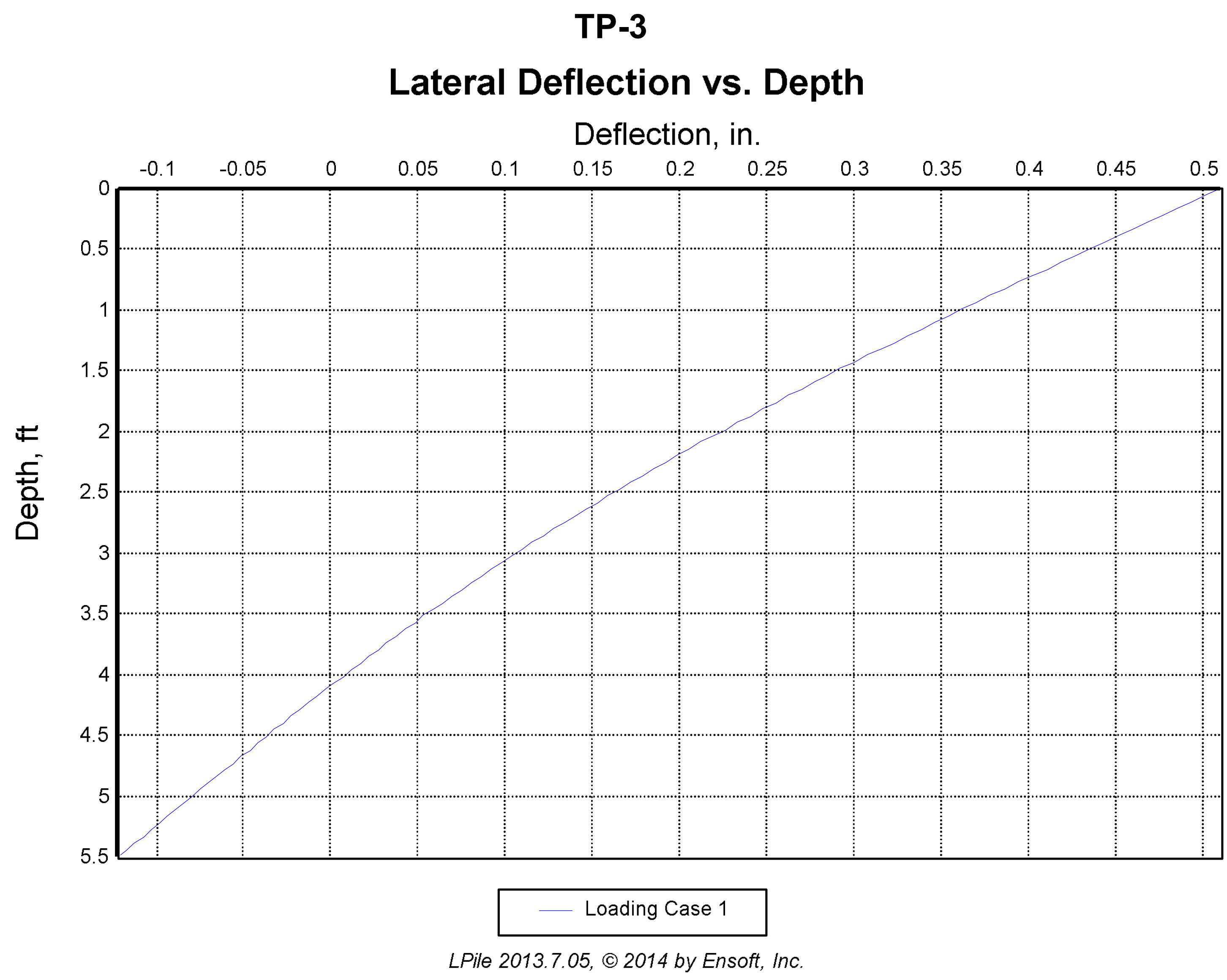
```
     4.160     0.0394     56005. -2370.1069  -0.006112  6727.4485  4.756E+08
-140.7031  2783.6363      0.000
     4.225     0.0347     54114. -2478.7538  -0.006022  6500.2396  4.756E+08
-137.8785  3099.7806      0.000
     4.290     0.0300     52138. -2584.5422  -0.005935  6262.9542  4.756E+08
-133.3740  3464.0388      0.000
     4.355     0.0254     50082. -2686.4583  -0.005851  6015.9216  4.756E+08
-127.9492  3923.5823      0.000
     4.420     0.0209     47947. -2783.8699  -0.005771  5759.5381  4.756E+08
-121.8242  4545.6295      0.000
     4.485     0.0164     45739. -2876.1190  -0.005694  5494.2515  4.756E+08
-114.7120  5444.6088      0.000
     4.550     0.0120     43461. -2962.2310  -0.005621  5220.5815  4.756E+08
-106.0880  6883.2212      0.000
     4.615   0.007665     41118. -3040.5771  -0.005551  4939.1583  4.756E+08
-94.7996  9646.3943      0.000
     4.680   0.003362     38717. -3107.6354  -0.005486  4650.8070  4.756E+08
-77.1446     17900.      0.000
     4.745  -0.000893     36270. -3116.1225  -0.005424  4356.8178  4.756E+08
55.3827     48397.      0.000
     4.810  -0.005100     33856. -3061.1307  -0.005367  4066.8761  4.756E+08
85.6218     13094.      0.000
     4.875  -0.009265     31495. -2988.9718  -0.005313  3783.1918  4.756E+08
99.4011  8368.3993      0.000
     4.940    -0.0134     29193. -2907.7011  -0.005264  3506.7719  4.756E+08
108.9853  6349.0384      0.000
     5.005    -0.0175     26959. -2819.7656  -0.005218  3238.3169  4.756E+08
116.4903  5199.2422      0.000
     5.070    -0.0215     24795. -2726.4718  -0.005175  2978.3753  4.756E+08
122.7247  4446.4419      0.000
     5.135    -0.0255     22705. -2628.6532  -0.005136  2727.4027  4.756E+08
128.0922  3910.5683      0.000
     5.200    -0.0295     20694. -2526.8950  -0.005101  2485.7914  4.756E+08
132.8262  3507.1594      0.000
     5.265    -0.0335     18763. -2421.6335  -0.005068  2253.8873  4.756E+08
137.0752  3191.0269      0.000
     5.330    -0.0374     16916. -2313.2078  -0.005039  2032.0009  4.756E+08
140.9395  2935.6757      0.000
     5.395    -0.0414     15155. -2201.8899  -0.005013  1820.4147  4.756E+08
144.4910  2724.4831      0.000
     5.460    -0.0453     13481. -2087.9032  -0.004989  1619.3882  4.756E+08
147.7825  2546.4612      0.000
     5.525    -0.0491     11898. -1971.4348  -0.004968  1429.1620  4.756E+08
150.8545  2394.0392      0.000
     5.590    -0.0530     10406. -1852.6435  -0.004950  1249.9606  4.756E+08
153.7385  2261.8210      0.000
     5.655    -0.0569  9007.4684 -1731.6663  -0.004934  1081.9947  4.756E+08
156.4596  2145.8507      0.000
     5.720    -0.0607  7704.3637 -1608.6222  -0.004920   925.4632  4.756E+08
```

```
159.0381  2043.1588      0.000
     5.785    -0.0645  6498.0179 -1483.6159  -0.004909   780.5546  4.756E+08
161.4909  1951.4703      0.000
     5.850    -0.0684  5389.9230 -1356.7401  -0.004899   647.4481  4.756E+08
163.8317  1869.0116      0.000
     5.915    -0.0722  4381.5033 -1228.0775  -0.004891   526.3147  4.756E+08
166.0723  1794.3782      0.000
     5.980    -0.0760  3474.1221 -1097.7024  -0.004885   417.3183  4.756E+08
168.2227  1726.4430      0.000
     6.045    -0.0798  2669.0875  -965.6820  -0.004880   320.6160  4.756E+08
170.2912  1664.2906      0.000
     6.110    -0.0836  1967.6581  -832.0772  -0.004876   236.3589  4.756E+08
172.2852  1607.1694      0.000
     6.175    -0.0874  1371.0470  -696.9437  -0.004873   164.6928  4.756E+08
174.2111  1554.4562      0.000
     6.240    -0.0912   880.4260  -560.3324  -0.004871   105.7585  4.756E+08
176.0742  1505.6300      0.000
     6.305    -0.0950   496.9285  -422.2904  -0.004870    59.6920  4.756E+08
177.8795  1460.2516      0.000
     6.370    -0.0988   221.6529  -282.8612  -0.004869    26.6254  4.756E+08
179.6312  1417.9481      0.000
     6.435    -0.1026    55.6650  -142.0852  -0.004869     6.6866  4.756E+08
181.3330  1378.4007      0.000
     6.500    -0.1064      0.000      0.000  -0.004869      0.000  4.756E+08
182.9881   670.6677      0.000

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection             =      0.5142233 inches
Computed slope at pile head      =     -0.0118476 radians
Maximum bending moment           =         74813. inch-lbs
Maximum shear force              =   3520.0000011 lbs
Depth of maximum bending moment  =      2.8600000 feet below pile head
Depth of maximum shear force     =      0.0650000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1




--------------------------------------------------------------------------------
                           Summary of Pile Response(s)
--------------------------------------------------------------------------------


Definitions of Pile-head Loading Conditions:
```

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 3520.0000	M = 0.000	0.0000000	0.51422331	74813.	3520.0000	-0.01184762

The analysis ended normally.


TP-3
Lateral Deflection vs. Depth
Deflection, in.
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth, ft
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Loading Case 1
LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-3.lp7d
Name of output report file: TP-3.lp7o
Name of plot output file: TP-3.lp7p
Name of runtime messeage file: TP-3.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:50:45

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1940.00000 psf
Undrained cohesion at bottom of layer	=	1940.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 1.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1940.000	0.00700
		7.000	115.000	1940.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition               Condition           Axial Thrust
     Compute
 No.    Type             1                       2                Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   3720.00000 lbs   M =       0.0000 in-lbs         0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3720.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5145	-1.818E-06	3720.0000	-0.0127	2.184E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.5061	2455.2000	3720.0000	-0.0127	294.9234	4.756E+08	0.000	0.000	0.000
0.110	0.4977	4910.4000	3720.0000	-0.0127	589.8468	4.756E+08	0.000	0.000	0.000
0.165	0.4893	7365.6000	3720.0000	-0.0127	884.7702	4.756E+08	0.000	0.000	0.000
0.220	0.4809	9820.8000	3720.0000	-0.0127	1179.6937	4.756E+08	0.000	0.000	0.000
0.275	0.4726	12276.	3720.0000	-0.0127	1474.6171	4.756E+08	0.000	0.000	0.000
0.330	0.4642	14731.	3720.0000	-0.0127	1769.5405	4.756E+08	0.000	0.000	0.000
0.385	0.4559	17186.	3720.0000	-0.0126	2064.4639	4.756E+08	0.000	0.000	0.000
0.440	0.4475	19642.	3720.0000	-0.0126	2359.3873	4.756E+08	0.000	0.000	0.000
0.495	0.4392	22097.	3720.0000	-0.0126	2654.3107	4.756E+08	0.000	0.000	0.000
0.550	0.4309	24552.	3679.9608	-0.0125	2949.2341	4.756E+08	-121.3310	185.8257	0.000
0.605	0.4227	26954.	3598.9498	-0.0125	3237.8089	4.756E+08	-124.1569	193.8744	0.000
0.660	0.4144	29303.	3516.0870	-0.0125	3519.8871	4.756E+08	-126.9424	202.1679	0.000
0.715	0.4062	31596.	3431.3993	-0.0124	3795.3231	4.756E+08	-129.6869	210.7175	0.000
0.770	0.3980	33832.	3344.9140	-0.0124	4063.9732	4.756E+08	-132.3897	219.5350	0.000

0.825	0.3899	36011.	3256.6589	-0.0123	4325.6959	4.756E+08
-135.0500	228.6331	0.000				
0.880	0.3817	38131.	3166.6622	-0.0123	4580.3522	4.756E+08
-137.6673	238.0249	0.000				
0.935	0.3736	40191.	3074.9526	-0.0122	4827.8050	4.756E+08
-140.2407	247.7247	0.000				
0.990	0.3656	42190.	2981.5593	-0.0122	5067.9197	4.756E+08
-142.7695	257.7474	0.000				
1.045	0.3576	44127.	2886.5118	-0.0121	5300.5639	4.756E+08
-145.2530	268.1090	0.000				
1.100	0.3496	46000.	2789.8405	-0.0121	5525.6078	4.756E+08
-147.6904	278.8266	0.000				
1.155	0.3417	47809.	2691.5759	-0.0120	5742.9237	4.756E+08
-150.0810	289.9181	0.000				
1.210	0.3338	49553.	2591.7494	-0.0119	5952.3867	4.756E+08
-152.4237	301.4030	0.000				
1.265	0.3259	51230.	2490.3926	-0.0118	6153.8741	4.756E+08
-154.7179	313.3018	0.000				
1.320	0.3181	52840.	2387.5381	-0.0118	6347.2658	4.756E+08
-156.9626	325.6367	0.000				
1.375	0.3104	54382.	2283.2186	-0.0117	6532.4444	4.756E+08
-159.1569	338.4313	0.000				
1.430	0.3027	55854.	2177.4680	-0.0116	6709.2952	4.756E+08
-161.2997	351.7111	0.000				
1.485	0.2950	57256.	2070.3203	-0.0115	6877.7059	4.756E+08
-163.3902	365.5034	0.000				
1.540	0.2874	58587.	1961.8106	-0.0115	7037.5672	4.756E+08
-165.4272	379.8376	0.000				
1.595	0.2799	59846.	1851.9745	-0.0114	7188.7725	4.756E+08
-167.4096	394.7454	0.000				
1.650	0.2724	61031.	1740.8483	-0.0113	7331.2180	4.756E+08
-169.3362	410.2610	0.000				
1.705	0.2650	62144.	1628.4694	-0.0112	7464.8031	4.756E+08
-171.2059	426.4216	0.000				
1.760	0.2576	63181.	1514.8757	-0.0111	7589.4297	4.756E+08
-173.0174	443.2673	0.000				
1.815	0.2503	64143.	1400.1062	-0.0110	7705.0033	4.756E+08
-174.7692	460.8420	0.000				
1.870	0.2430	65029.	1284.2006	-0.0109	7811.4319	4.756E+08
-176.4599	479.1930	0.000				
1.925	0.2358	65838.	1167.1998	-0.0109	7908.6274	4.756E+08
-178.0879	498.3724	0.000				
1.980	0.2287	66570.	1049.1458	-0.0108	7996.5043	4.756E+08
-179.6517	518.4370	0.000				
2.035	0.2216	67223.	930.0813	-0.0107	8074.9809	4.756E+08
-181.1495	539.4491	0.000				
2.090	0.2146	67798.	810.0508	-0.0106	8143.9789	4.756E+08
-182.5794	561.4771	0.000				
2.145	0.2077	68292.	689.0996	-0.0105	8203.4234	4.756E+08

-183.9393	584.5965	0.000				
2.200	0.2008	68707.	567.2747	-0.0104	8253.2432	4.756E+08
-185.2272	608.8907	0.000				
2.255	0.1939	69041.	444.6243	-0.0103	8293.3710	4.756E+08
-186.4407	634.4523	0.000				
2.310	0.1872	69294.	321.1983	-0.0102	8323.7433	4.756E+08
-187.5772	661.3842	0.000				
2.365	0.1805	69465.	197.0486	-0.0101	8344.3005	4.756E+08
-188.6341	689.8012	0.000				
2.420	0.1738	69554.	72.2286	-0.0100	8354.9875	4.756E+08
-189.6084	719.8320	0.000				
2.475	0.1673	69561.	-53.2061	-0.009910	8355.7532	4.756E+08
-190.4967	751.6213	0.000				
2.530	0.1608	69484.	-179.1976	-0.009814	8346.5511	4.756E+08
-191.2957	785.3324	0.000				
2.585	0.1543	69324.	-305.6857	-0.009718	8327.3394	4.756E+08
-192.0014	821.1504	0.000				
2.640	0.1479	69080.	-432.6072	-0.009622	8298.0812	4.756E+08
-192.6094	859.2863	0.000				
2.695	0.1416	68753.	-559.8964	-0.009526	8258.7448	4.756E+08
-193.1152	899.9814	0.000				
2.750	0.1354	68341.	-687.4838	-0.009431	8209.3035	4.756E+08
-193.5134	943.5136	0.000				
2.805	0.1292	67846.	-815.2966	-0.009336	8149.7367	4.756E+08
-193.7982	990.2044	0.000				
2.860	0.1230	67265.	-943.2578	-0.009243	8080.0293	4.756E+08
-193.9630	1040.4283	0.000				
2.915	0.1170	66600.	-1071.2857	-0.009150	8000.1728	4.756E+08
-194.0005	1094.6241	0.000				
2.970	0.1110	65851.	-1199.2936	-0.009058	7910.1652	4.756E+08
-193.9023	1153.3103	0.000				
3.025	0.1050	65017.	-1327.1889	-0.008967	7810.0116	4.756E+08
-193.6591	1217.1039	0.000				
3.080	0.0991	64099.	-1454.8723	-0.008877	7699.7248	4.756E+08
-193.2600	1286.7458	0.000				
3.135	0.0933	63097.	-1582.2366	-0.008789	7579.3257	4.756E+08
-192.6926	1363.1344	0.000				
3.190	0.0875	62011.	-1709.1662	-0.008702	7448.8438	4.756E+08
-191.9425	1447.3704	0.000				
3.245	0.0818	60841.	-1835.5349	-0.008617	7308.3186	4.756E+08
-190.9928	1540.8189	0.000				
3.300	0.0762	59588.	-1961.2043	-0.008533	7157.7996	4.756E+08
-189.8235	1645.1955	0.000				
3.355	0.0705	58252.	-2086.0217	-0.008452	6997.3481	4.756E+08
-188.4110	1762.6894	0.000				
3.410	0.0650	56834.	-2209.8170	-0.008372	6827.0380	4.756E+08
-186.7265	1896.1421	0.000				
3.465	0.0595	55335.	-2332.3993	-0.008294	6646.9574	4.756E+08
-184.7348	2049.3162	0.000				

3.520 0.0540 53755. -2453.5512 -0.008218 6457.2105 4.756E+08
-182.3922 2227.3109 0.000
3.575 0.0486 52096. -2573.0227 -0.008145 6257.9199 4.756E+08
-179.6429 2437.2270 0.000
3.630 0.0433 50359. -2690.5217 -0.008074 6049.2295 4.756E+08
-176.4146 2689.2823 0.000
3.685 0.0380 48545. -2805.7000 -0.008005 5831.3082 4.756E+08
-172.6105 2998.7784 0.000
3.740 0.0327 46656. -2918.1332 -0.007939 5604.3550 4.756E+08
-168.0961 3389.8041 0.000
3.795 0.0275 44693. -3027.2881 -0.007876 5368.6061 4.756E+08
-162.6765 3902.8005 0.000
3.850 0.0223 42660. -3132.4678 -0.007815 5124.3452 4.756E+08
-156.0498 4611.7766 0.000
3.905 0.0172 40558. -3232.7076 -0.007757 4871.9190 4.756E+08
-147.7074 5669.7822 0.000
3.960 0.0121 38392. -3326.5519 -0.007703 4611.7640 4.756E+08
-136.6692 7459.1230 0.000
4.015 0.007027 36167. -3411.4337 -0.007651 4344.4577 4.756E+08
-120.5482 11323. 0.000
4.070 0.001994 33889. -3480.5422 -0.007602 4070.8437 4.756E+08
-88.8717 29421. 0.000
4.125 -0.003008 31573. -3477.0356 -0.007557 3792.5795 4.756E+08
99.4978 21829. 0.000
4.180 -0.007981 29300. -3401.8797 -0.007515 3519.5215 4.756E+08
128.2474 10605. 0.000
4.235 -0.0129 27082. -3311.3429 -0.007476 3253.1741 4.756E+08
146.1064 7459.2187 0.000
4.290 -0.0178 24929. -3210.3529 -0.007439 2994.4718 4.756E+08
159.9240 5913.4599 0.000
4.345 -0.0227 22845. -3101.4810 -0.007406 2744.1375 4.756E+08
169.9907 4932.1003 0.000
4.400 -0.0276 20835. -2986.4954 -0.007376 2502.6979 4.756E+08
178.4504 4263.3756 0.000
4.455 -0.0325 18902. -2866.2840 -0.007348 2270.5958 4.756E+08
185.8265 3775.5718 0.000
4.510 -0.0373 17051. -2741.4714 -0.007323 2048.2171 4.756E+08
192.3937 3401.9848 0.000
4.565 -0.0422 15284. -2612.5320 -0.007301 1835.9055 4.756E+08
198.3316 3105.4824 0.000
4.620 -0.0470 13603. -2479.8404 -0.007281 1633.9715 4.756E+08
203.7643 2863.6523 0.000
4.675 -0.0518 12010. -2343.7003 -0.007263 1442.6995 4.756E+08
208.7816 2662.1176 0.000
4.730 -0.0565 10509. -2204.3635 -0.007248 1262.3521 4.756E+08
213.4509 2491.2064 0.000
4.785 -0.0613 9100.5308 -2062.0428 -0.007234 1093.1735 4.756E+08
217.8239 2344.1583 0.000
4.840 -0.0661 7787.0246 -1916.9202 -0.007222 935.3926 4.756E+08

```
221.9414  2216.0970      0.000
     4.895    -0.0709  6570.1960 -1769.1537  -0.007212   789.2248  4.756E+08
225.8360  2103.4116      0.000
     4.950    -0.0756  5451.7416 -1618.8815  -0.007204   654.8738  4.756E+08
229.5343  2003.3677      0.000
     5.005    -0.0804  4433.2724 -1466.2259  -0.007197   532.5333  4.756E+08
233.0584  1913.8545      0.000
     5.060    -0.0851  3516.3234 -1311.2958  -0.007192   422.3876  4.756E+08
236.4268  1833.2150      0.000
     5.115    -0.0899  2702.3619 -1154.1889  -0.007187   324.6130  4.756E+08
239.6548  1760.1296      0.000
     5.170    -0.0946  1992.7941  -994.9934  -0.007184   239.3783  4.756E+08
242.7559  1693.5332      0.000
     5.225    -0.0993  1388.9707  -833.7892  -0.007182   166.8459  4.756E+08
245.7414  1632.5567      0.000
     5.280    -0.1041   892.1923  -670.6496  -0.007180   107.1719  4.756E+08
248.6211  1576.4830      0.000
     5.335    -0.1088   503.7132  -505.6415  -0.007179    60.5070  4.756E+08
251.4036  1524.7152      0.000
     5.390    -0.1136   224.7455  -338.8265  -0.007179    26.9969  4.756E+08
254.0964  1476.7522      0.000
     5.445    -0.1183    56.4621  -170.2617  -0.007178     6.7823  4.756E+08
256.7061  1432.1699      0.000
     5.500    -0.1230      0.000      0.000  -0.007178      0.000  4.756E+08
259.2385   695.3035      0.000

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection             =      0.5144973 inches
Computed slope at pile head      =     -0.0127175 radians
Maximum bending moment           =         69561. inch-lbs
Maximum shear force              =   3720.0000021 lbs
Depth of maximum bending moment  =      2.4750000 feet below pile head
Depth of maximum shear force     =      0.0550000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1



--------------------------------------------------------------------------------
                           Summary of Pile Response(s)
--------------------------------------------------------------------------------


Definitions of Pile-head Loading Conditions:
```

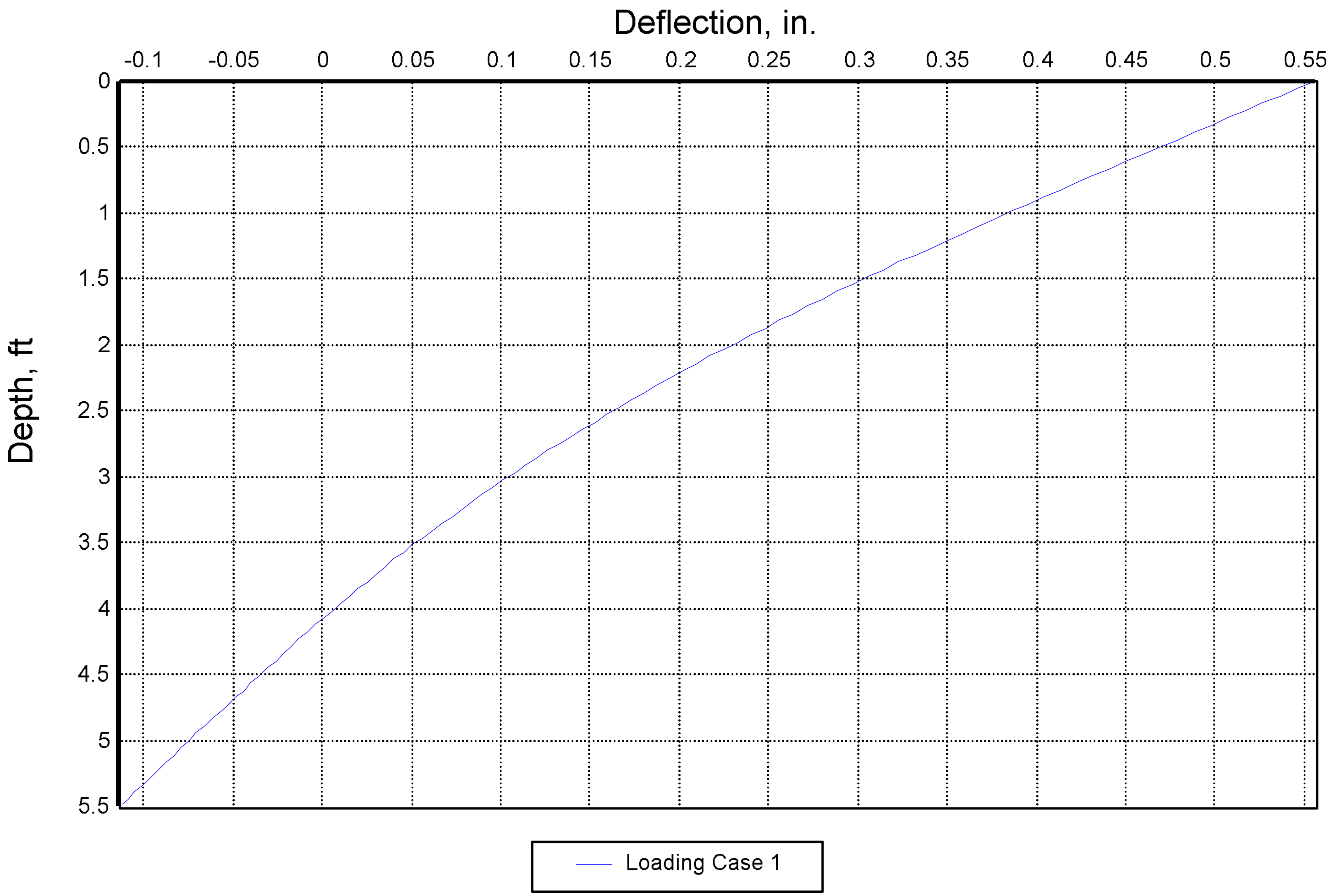
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```
               Pile-head      Pile-head                                      Maximum
       Maximum
Load  Load    Condition 1    Condition 2       Axial       Pile-head       Moment
        Shear        Pile-head
Case  Type    V(lbs) or     in-lb, rad.,      Loading     Deflection       in Pile
       in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.       lbs         inches         in-lbs
         lbs          radians
----  ----  -------------  -------------  ------------  ------------
-------------  ------------  ------------
  1     1   V =  3720.0000  M =      0.000      0.0000000     0.51449733
69561.      3720.0000    -0.01271748
```

The analysis ended normally.

TP-4

Lateral Deflection vs. Depth



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LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

===

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-4.lp7d
Name of output report file: TP-4.lp7o
Name of plot output file: TP-4.lp7p
Name of runtime messeage file: TP-4.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:47:30

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	2880.00000 psf
Undrained cohesion at bottom of layer	=	2880.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 1.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	2880.000	0.00700
		7.000	115.000	2880.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition               Condition           Axial Thrust
     Compute
 No.    Type             1                       2                Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   5500.00000 lbs   M =       0.0000 in-lbs        0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 5500.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5543	-1.939E-06	5500.0000	-0.0146	2.330E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.5447	3630.0000	5500.0000	-0.0146	436.0427	4.756E+08	0.000	0.000	0.000
0.110	0.5350	7260.0000	5500.0000	-0.0146	872.0854	4.756E+08	0.000	0.000	0.000
0.165	0.5254	10890.	5500.0000	-0.0146	1308.1280	4.756E+08	0.000	0.000	0.000
0.220	0.5158	14520.	5500.0000	-0.0146	1744.1707	4.756E+08	0.000	0.000	0.000
0.275	0.5062	18150.	5500.0000	-0.0145	2180.2134	4.756E+08	0.000	0.000	0.000
0.330	0.4966	21780.	5500.0000	-0.0145	2616.2561	4.756E+08	0.000	0.000	0.000
0.385	0.4870	25410.	5500.0000	-0.0145	3052.2988	4.756E+08	0.000	0.000	0.000
0.440	0.4775	29040.	5500.0000	-0.0144	3488.3415	4.756E+08	0.000	0.000	0.000
0.495	0.4680	32670.	5500.0000	-0.0144	3924.3841	4.756E+08	0.000	0.000	0.000
0.550	0.4585	36300.	5439.6517	-0.0144	4360.4268	4.756E+08	-182.8736	263.2590	0.000
0.605	0.4490	39850.	5317.5924	-0.0143	4786.9006	4.756E+08	-187.0032	274.8733	0.000
0.660	0.4396	43319.	5192.8290	-0.0142	5203.5895	4.756E+08	-191.0677	286.8658	0.000
0.715	0.4302	46705.	5065.4048	-0.0142	5610.2807	4.756E+08	-195.0661	299.2544	0.000
0.770	0.4209	50006.	4935.3639	-0.0141	6006.7650	4.756E+08	-198.9974	312.0583	0.000

0.825	0.4116	53220.	4802.7508	-0.0140	6392.8368	4.756E+08
-202.8605	325.2977	0.000				
0.880	0.4023	56345.	4667.6109	-0.0140	6768.2938	4.756E+08
-206.6544	338.9940	0.000				
0.935	0.3932	59381.	4529.9902	-0.0139	7132.9377	4.756E+08
-210.3779	353.1699	0.000				
0.990	0.3840	62325.	4389.9356	-0.0138	7486.5735	4.756E+08
-214.0300	367.8497	0.000				
1.045	0.3749	65176.	4247.4945	-0.0137	7829.0102	4.756E+08
-217.6096	383.0588	0.000				
1.100	0.3659	67931.	4102.7153	-0.0136	8160.0604	4.756E+08
-221.1154	398.8249	0.000				
1.155	0.3570	70591.	3955.6469	-0.0135	8479.5407	4.756E+08
-224.5463	415.1770	0.000				
1.210	0.3481	73153.	3806.3392	-0.0134	8787.2716	4.756E+08
-227.9011	432.1462	0.000				
1.265	0.3392	75615.	3654.8430	-0.0133	9083.0776	4.756E+08
-231.1785	449.7658	0.000				
1.320	0.3305	77977.	3501.2095	-0.0132	9366.7871	4.756E+08
-234.3772	468.0715	0.000				
1.375	0.3218	80237.	3345.4914	-0.0131	9638.2328	4.756E+08
-237.4959	487.1014	0.000				
1.430	0.3132	82393.	3187.7418	-0.0130	9897.2515	4.756E+08
-240.5332	506.8965	0.000				
1.485	0.3046	84445.	3028.0149	-0.0129	10144.	4.756E+08
-243.4876	527.5006	0.000				
1.540	0.2962	86390.	2866.3661	-0.0128	10377.	4.756E+08
-246.3576	548.9614	0.000				
1.595	0.2878	88228.	2702.8513	-0.0126	10598.	4.756E+08
-249.1416	571.3297	0.000				
1.650	0.2795	89958.	2537.5280	-0.0125	10806.	4.756E+08
-251.8381	594.6608	0.000				
1.705	0.2713	91578.	2370.4545	-0.0124	11001.	4.756E+08
-254.4452	619.0144	0.000				
1.760	0.2632	93087.	2201.6904	-0.0123	11182.	4.756E+08
-256.9612	644.4551	0.000				
1.815	0.2551	94484.	2031.2964	-0.0121	11350.	4.756E+08
-259.3842	671.0534	0.000				
1.870	0.2472	95768.	1859.3346	-0.0120	11504.	4.756E+08
-261.7120	698.8856	0.000				
1.925	0.2393	96939.	1685.8686	-0.0119	11644.	4.756E+08
-263.9426	728.0352	0.000				
1.980	0.2315	97994.	1510.9632	-0.0117	11771.	4.756E+08
-266.0737	758.5936	0.000				
2.035	0.2238	98933.	1334.6849	-0.0116	11884.	4.756E+08
-268.1029	790.6608	0.000				
2.090	0.2162	99756.	1157.1019	-0.0115	11983.	4.756E+08
-270.0275	824.3466	0.000				
2.145	0.2087	100460.	978.2841	-0.0113	12068.	4.756E+08

-271.8447	859.7723	0.000				
2.200	0.2013	101047.	798.3033	-0.0112	12138.	4.756E+08
-273.5516	897.0717	0.000				
2.255	0.1939	101514.	617.2334	-0.0110	12194.	4.756E+08
-275.1449	936.3931	0.000				
2.310	0.1867	101862.	435.1506	-0.0109	12236.	4.756E+08
-276.6211	977.9017	0.000				
2.365	0.1796	102089.	252.1335	-0.0108	12263.	4.756E+08
-277.9764	1021.7814	0.000				
2.420	0.1725	102194.	68.2630	-0.0106	12276.	4.756E+08
-279.2067	1068.2386	0.000				
2.475	0.1655	102179.	-116.3766	-0.0105	12274.	4.756E+08
-280.3073	1117.5050	0.000				
2.530	0.1587	102041.	-301.6982	-0.0103	12257.	4.756E+08
-281.2735	1169.8423	0.000				
2.585	0.1519	101780.	-487.6114	-0.0102	12226.	4.756E+08
-282.0996	1225.5471	0.000				
2.640	0.1452	101397.	-674.0216	-0.0100	12180.	4.756E+08
-282.7798	1284.9574	0.000				
2.695	0.1387	100891.	-860.8303	-0.009903	12119.	4.756E+08
-283.3072	1348.4601	0.000				
2.750	0.1322	100261.	-1047.9343	-0.009763	12044.	4.756E+08
-283.6746	1416.5006	0.000				
2.805	0.1258	99507.	-1235.2251	-0.009624	11953.	4.756E+08
-283.8735	1489.5946	0.000				
2.860	0.1195	98630.	-1422.5886	-0.009487	11848.	4.756E+08
-283.8947	1568.3430	0.000				
2.915	0.1133	97630.	-1609.9040	-0.009351	11727.	4.756E+08
-283.7276	1653.4507	0.000				
2.970	0.1071	96505.	-1797.0430	-0.009216	11592.	4.756E+08
-283.3604	1745.7509	0.000				
3.025	0.1011	95258.	-1983.8691	-0.009083	11443.	4.756E+08
-282.7793	1846.2363	0.000				
3.080	0.0951	93887.	-2170.2361	-0.008952	11278.	4.756E+08
-281.9690	1956.1008	0.000				
3.135	0.0893	92393.	-2355.9865	-0.008822	11098.	4.756E+08
-280.9112	2076.7937	0.000				
3.190	0.0835	90777.	-2540.9502	-0.008695	10904.	4.756E+08
-279.5849	2210.0943	0.000				
3.245	0.0778	89039.	-2724.9419	-0.008571	10696.	4.756E+08
-277.9657	2358.2138	0.000				
3.300	0.0722	87180.	-2907.7585	-0.008448	10472.	4.756E+08
-276.0241	2523.9376	0.000				
3.355	0.0666	85201.	-3089.1758	-0.008329	10234.	4.756E+08
-273.7252	2710.8300	0.000				
3.410	0.0612	83102.	-3268.9439	-0.008212	9982.3830	4.756E+08
-271.0265	2923.5331	0.000				
3.465	0.0558	80886.	-3446.7815	-0.008098	9716.1288	4.756E+08
-267.8756	3168.2178	0.000				

```
     3.520     0.0505     78552. -3622.3688  -0.007987  9435.8580  4.756E+08
-264.2069  3453.2854      0.000
     3.575     0.0453     76104. -3795.3362  -0.007880  9141.7625  4.756E+08
-259.9369  3790.5014      0.000
     3.630     0.0401     73542. -3965.2509  -0.007776  8834.0657  4.756E+08
-254.9560  4196.9107      0.000
     3.685     0.0350     70870. -4131.5948  -0.007676  8513.0284  4.756E+08
-249.1164  4698.2568      0.000
     3.740     0.0300     68089. -4293.7331  -0.007580  8178.9560  4.756E+08
-242.2116  5335.5064      0.000
     3.795     0.0250     65202. -4450.8625  -0.007487  7832.2099  4.756E+08
-233.9380  6178.4240      0.000
     3.850     0.0201     62214. -4601.9223  -0.007399  7473.2229  4.756E+08
-223.8191  7357.2221      0.000
     3.905     0.0152     59128. -4745.4240  -0.007315  7102.5246  4.756E+08
-211.0345  9149.1520      0.000
     3.960     0.0104     55950. -4879.0681  -0.007235  6720.7839  4.756E+08
-193.9477     12281.      0.000
     4.015   0.005674     52687. -4998.6077  -0.007159  6328.8948  4.756E+08
-168.2936     19577.      0.000
     4.070   0.000973     49352. -5090.2395  -0.007089  5928.1998  4.756E+08
-109.3785     74227.      0.000
     4.125  -0.003683     45968. -5075.4728  -0.007022  5521.7815  4.756E+08
154.1261     27617.      0.000
     4.180  -0.008297     42652. -4961.6831  -0.006961  5123.4278  4.756E+08
190.6913     15169.      0.000
     4.235    -0.0129     39419. -4827.8353  -0.006904  4735.0522  4.756E+08
214.9082     11019.      0.000
     4.290    -0.0174     36279. -4679.6898  -0.006852  4357.9216  4.756E+08
234.0176  8871.1955      0.000
     4.345    -0.0219     33242. -4519.9580  -0.006803  3993.0360  4.756E+08
250.0180  7529.3387      0.000
     4.400    -0.0264     30313. -4351.0232  -0.006759  3641.2326  4.756E+08
261.9055  6549.9213      0.000
     4.455    -0.0308     27498. -4174.7343  -0.006719  3303.1335  4.756E+08
272.3033  5827.8845      0.000
     4.510    -0.0353     24802. -3991.9528  -0.006683  2979.2827  4.756E+08
281.5800  5270.6455      0.000
     4.565    -0.0397     22229. -3803.3381  -0.006650  2670.1656  4.756E+08
289.9796  4825.7725      0.000
     4.620    -0.0440     19782. -3609.4130  -0.006621  2376.2217  4.756E+08
297.6724  4461.2159      0.000
     4.675    -0.0484     17464. -3410.6028  -0.006595  2097.8535  4.756E+08
304.7827  4156.2155      0.000
     4.730    -0.0527     15280. -3207.2612  -0.006572  1835.4332  4.756E+08
311.4039  3896.6977      0.000
     4.785    -0.0571     13231. -2999.6872  -0.006553  1589.3071  4.756E+08
317.6084  3672.7641      0.000
     4.840    -0.0614     11320. -2788.1369  -0.006536  1359.7998  4.756E+08
```

```
323.4532  3477.2385      0.000
     4.895    -0.0657  9550.4389 -2572.8325  -0.006521  1147.2174  4.756E+08
328.9843  3304.7843      0.000
     4.950    -0.0700  7924.0222 -2353.9687  -0.006509   951.8490  4.756E+08
334.2393  3151.3458      0.000
     5.005    -0.0743  6443.2003 -2131.7174  -0.006499   773.9698  4.756E+08
339.2493  3013.7829      0.000
     5.060    -0.0786  5110.1552 -1906.2319  -0.006491   613.8418  4.756E+08
344.0401  2889.6244      0.000
     5.115    -0.0829  3926.9741 -1677.6495  -0.006485   471.7158  4.756E+08
348.6339  2776.8976      0.000
     5.170    -0.0871  2895.6579 -1446.0940  -0.006480   347.8321  4.756E+08
353.0493  2674.0077      0.000
     5.225    -0.0914  2018.1300 -1211.6780  -0.006477   242.4217  4.756E+08
357.3024  2579.6510      0.000
     5.280    -0.0957  1296.2430  -974.5039  -0.006474   155.7072  4.756E+08
361.4071  2492.7504      0.000
     5.335    -0.1000   731.7849  -734.6657  -0.006473    87.9034  4.756E+08
365.3754  2412.4087      0.000
     5.390    -0.1042   326.4843  -492.2499  -0.006472    39.2179  4.756E+08
369.2179  2337.8714      0.000
     5.445    -0.1085    82.0150  -247.3366  -0.006472     9.8518  4.756E+08
372.9437  2268.5001      0.000
     5.500    -0.1128      0.000      0.000  -0.006472      0.000  4.756E+08
376.5611  1101.8751      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.5543134 inches
Computed slope at pile head      =     -0.0146047 radians
Maximum bending moment           =        102194. inch-lbs
Maximum shear force              =   5500.0000001 lbs
Depth of maximum bending moment  =      2.4200000 feet below pile head
Depth of maximum shear force     =      0.0550000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

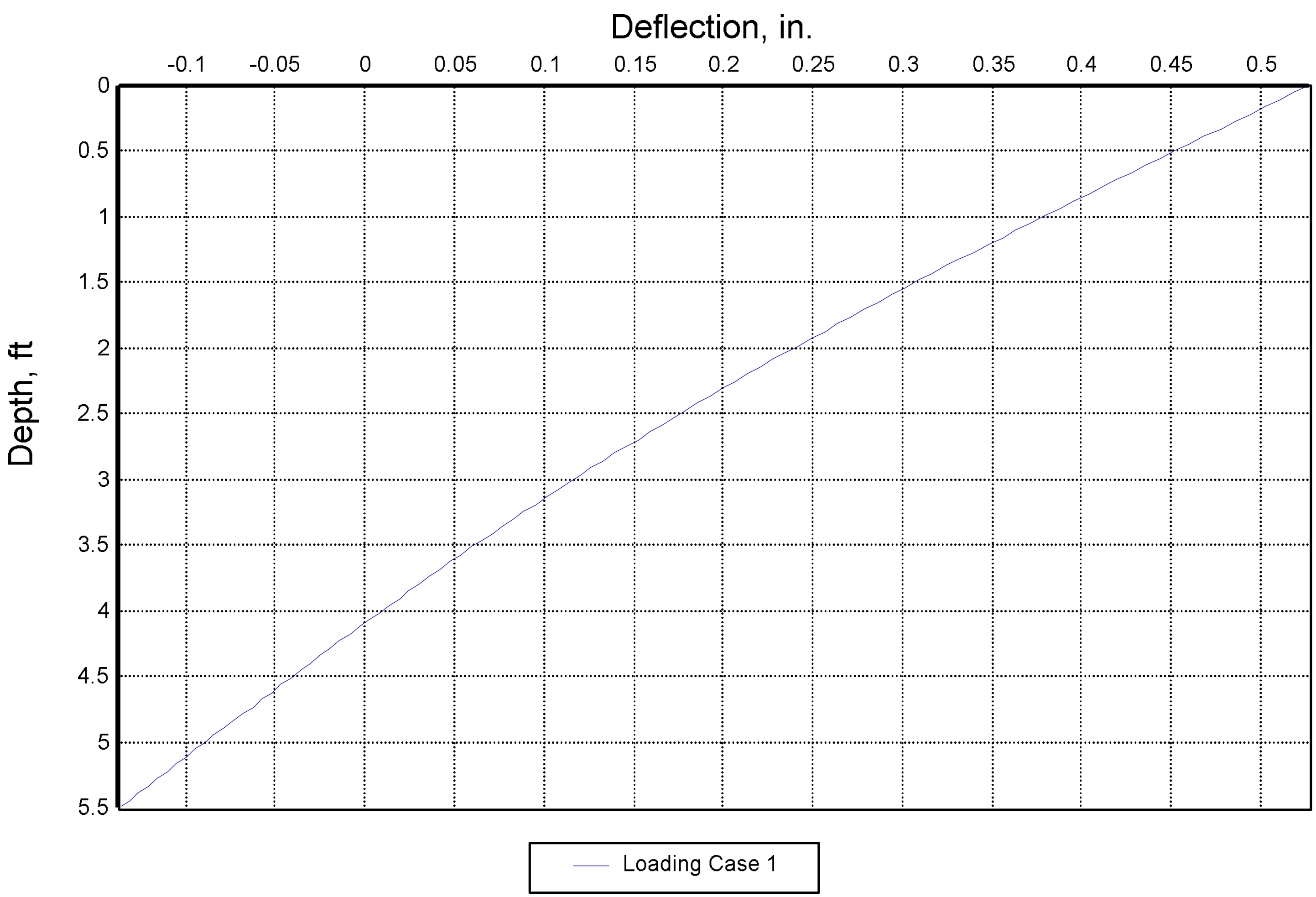
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 5500.0000	M = 0.000	0.0000000	0.55431341	102194.	5500.0000	-0.01460473

The analysis ended normally.

TP-5

Lateral Deflection vs. Depth



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==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-5.lp7d
Name of output report file: TP-5.lp7o
Name of plot output file: TP-5.lp7p
Name of runtime messeage file: TP-5.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:43:27

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

```
--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Engineering Units of Input Data and Computations:
 - Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed                =          500
- Deflection tolerance for convergence                =   1.0000E-05 in
- Maximum allowable deflection                        =     100.0000 in
- Number of pile increments                           =          100

Loading Type and Number of Cycles of Loading:
 - Cyclic loading specified
 - Number of cycles of loading = 4613937818241073152

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
 - Compute pile response under loading and nonlinear bending properties of pile
   (only if nonlinear pile properties are input)
 - Use of p-y modification factors for p-y curves not selected
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected
```

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1540.00000 psf
Undrained cohesion at bottom of layer	=	1540.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 1.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1540.000	0.00700
		7.000	115.000	1540.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition               Condition           Axial Thrust
     Compute
 No.    Type             1                       2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   3020.00000 lbs   M =       0.0000 in-lbs         0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3020.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5336	-9.697E-07	3020.0000	-0.0127	1.165E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.5252	1993.2000	3020.0000	-0.0127	239.4271	4.756E+08	0.000	0.000	0.000
0.110	0.5168	3986.4000	3020.0000	-0.0127	478.8541	4.756E+08	0.000	0.000	0.000
0.165	0.5085	5979.6000	3020.0000	-0.0127	718.2812	4.756E+08	0.000	0.000	0.000
0.220	0.5001	7972.8000	3020.0000	-0.0127	957.7083	4.756E+08	0.000	0.000	0.000
0.275	0.4917	9966.0000	3020.0000	-0.0126	1197.1354	4.756E+08	0.000	0.000	0.000
0.330	0.4834	11959.	3020.0000	-0.0126	1436.5624	4.756E+08	0.000	0.000	0.000
0.385	0.4751	13952.	3020.0000	-0.0126	1675.9895	4.756E+08	0.000	0.000	0.000
0.440	0.4668	15946.	3020.0000	-0.0126	1915.4166	4.756E+08	0.000	0.000	0.000
0.495	0.4584	17939.	3020.0000	-0.0126	2154.8437	4.756E+08	0.000	0.000	0.000
0.550	0.4502	19932.	2987.8595	-0.0125	2394.2707	4.756E+08	-97.3954	142.7958	0.000
0.605	0.4419	21883.	2922.8145	-0.0125	2628.6016	4.756E+08	-99.7107	148.9260	0.000
0.660	0.4336	23790.	2856.2517	-0.0125	2857.7151	4.756E+08	-101.9948	155.2351	0.000
0.715	0.4254	25653.	2788.1919	-0.0124	3081.4916	4.756E+08	-104.2471	161.7314	0.000
0.770	0.4172	27471.	2718.6562	-0.0124	3299.8135	4.756E+08	-106.4671	168.4233	0.000

0.825	0.4090	29242.	2647.6662	-0.0124	3512.5644	4.756E+08
-108.6542	175.3199	0.000				
0.880	0.4009	30965.	2575.2437	-0.0123	3719.6300	4.756E+08
-110.8079	182.4307	0.000				
0.935	0.3928	32641.	2501.4110	-0.0123	3920.8976	4.756E+08
-112.9276	189.7658	0.000				
0.990	0.3847	34267.	2426.1907	-0.0122	4116.2562	4.756E+08
-115.0128	197.3360	0.000				
1.045	0.3766	35844.	2349.6057	-0.0122	4305.5967	4.756E+08
-117.0627	205.1528	0.000				
1.100	0.3686	37369.	2271.6797	-0.0121	4488.8120	4.756E+08
-119.0768	213.2283	0.000				
1.155	0.3606	38842.	2192.4365	-0.0121	4665.7965	4.756E+08
-121.0543	221.5757	0.000				
1.210	0.3526	40263.	2111.9003	-0.0120	4836.4468	4.756E+08
-122.9947	230.2088	0.000				
1.265	0.3447	41630.	2030.0961	-0.0120	5000.6615	4.756E+08
-124.8971	239.1423	0.000				
1.320	0.3368	42943.	1947.0489	-0.0119	5158.3408	4.756E+08
-126.7609	248.3924	0.000				
1.375	0.3290	44200.	1862.7847	-0.0119	5309.3874	4.756E+08
-128.5852	257.9758	0.000				
1.430	0.3212	45401.	1777.3297	-0.0118	5453.7058	4.756E+08
-130.3693	267.9111	0.000				
1.485	0.3134	46546.	1690.7108	-0.0117	5591.2026	4.756E+08
-132.1123	278.2177	0.000				
1.540	0.3057	47633.	1602.9553	-0.0117	5721.7866	4.756E+08
-133.8134	288.9170	0.000				
1.595	0.2980	48662.	1514.0913	-0.0116	5845.3687	4.756E+08
-135.4715	300.0318	0.000				
1.650	0.2904	49632.	1424.1474	-0.0115	5961.8624	4.756E+08
-137.0858	311.5867	0.000				
1.705	0.2828	50542.	1333.1529	-0.0115	6071.1829	4.756E+08
-138.6551	323.6086	0.000				
1.760	0.2752	51392.	1241.1378	-0.0114	6173.2484	4.756E+08
-140.1784	336.1263	0.000				
1.815	0.2678	52180.	1148.1329	-0.0113	6267.9790	4.756E+08
-141.6546	349.1716	0.000				
1.870	0.2603	52907.	1054.1697	-0.0112	6355.2975	4.756E+08
-143.0824	362.7787	0.000				
1.925	0.2529	53572.	959.2806	-0.0112	6435.1292	4.756E+08
-144.4605	376.9852	0.000				
1.980	0.2456	54173.	863.4988	-0.0111	6507.4019	4.756E+08
-145.7875	391.8321	0.000				
2.035	0.2383	54711.	766.8585	-0.0110	6572.0464	4.756E+08
-147.0619	407.3644	0.000				
2.090	0.2310	55186.	669.3949	-0.0109	6628.9958	4.756E+08
-148.2822	423.6317	0.000				
2.145	0.2238	55595.	571.1443	-0.0109	6678.1863	4.756E+08

-149.4467	440.6886	0.000				
2.200	0.2167	55939.	472.1443	-0.0108	6719.5570	4.756E+08
-150.5535	458.5955	0.000				
2.255	0.2096	56218.	372.4334	-0.0107	6753.0499	4.756E+08
-151.6007	477.4194	0.000				
2.310	0.2025	56431.	272.0518	-0.0106	6778.6104	4.756E+08
-152.5861	497.2347	0.000				
2.365	0.1955	56577.	171.0409	-0.0106	6796.1867	4.756E+08
-153.5074	518.1248	0.000				
2.420	0.1886	56657.	69.4439	-0.0105	6805.7308	4.756E+08
-154.3622	540.1828	0.000				
2.475	0.1817	56669.	-32.6943	-0.0104	6807.1978	4.756E+08
-155.1477	563.5137	0.000				
2.530	0.1749	56614.	-135.3272	-0.0103	6800.5467	4.756E+08
-155.8610	588.2357	0.000				
2.585	0.1681	56490.	-238.4059	-0.0102	6785.7402	4.756E+08
-156.4987	614.4831	0.000				
2.640	0.1614	56299.	-341.8794	-0.0102	6762.7449	4.756E+08
-157.0573	642.4088	0.000				
2.695	0.1547	56039.	-445.6941	-0.0101	6731.5315	4.756E+08
-157.5329	672.1879	0.000				
2.750	0.1480	55711.	-549.7939	-0.0100	6692.0752	4.756E+08
-157.9211	704.0218	0.000				
2.805	0.1415	55313.	-654.1195	-0.009930	6644.3556	4.756E+08
-158.2169	738.1435	0.000				
2.860	0.1349	54847.	-758.6080	-0.009854	6588.3573	4.756E+08
-158.4150	774.8245	0.000				
2.915	0.1285	54312.	-863.1930	-0.009778	6524.0700	4.756E+08
-158.5093	814.3830	0.000				
2.970	0.1220	53708.	-967.8037	-0.009703	6451.4886	4.756E+08
-158.4928	857.1944	0.000				
3.025	0.1157	53035.	-1072.3643	-0.009629	6370.6141	4.756E+08
-158.3577	903.7058	0.000				
3.080	0.1093	52292.	-1176.7938	-0.009556	6281.4535	4.756E+08
-158.0952	954.4535	0.000				
3.135	0.1030	51481.	-1281.0045	-0.009484	6184.0205	4.756E+08
-157.6949	1010.0876	0.000				
3.190	0.0968	50601.	-1384.9017	-0.009413	6078.3362	4.756E+08
-157.1451	1071.4044	0.000				
3.245	0.0906	49653.	-1488.3821	-0.009343	5964.4292	4.756E+08
-156.4318	1139.3903	0.000				
3.300	0.0845	48637.	-1591.3323	-0.009275	5842.3368	4.756E+08
-155.5387	1215.2844	0.000				
3.355	0.0784	47553.	-1693.6273	-0.009208	5712.1060	4.756E+08
-154.4463	1300.6661	0.000				
3.410	0.0723	46401.	-1795.1279	-0.009143	5573.7936	4.756E+08
-153.1313	1397.5833	0.000				
3.465	0.0663	45183.	-1895.6776	-0.009080	5427.4687	4.756E+08
-151.5648	1508.7440	0.000				

3.520 0.0603 43899. -1995.0988 -0.009018 5273.2132 4.756E+08
-149.7113 1637.8127 0.000
3.575 0.0544 42549. -2093.1870 -0.008958 5111.1239 4.756E+08
-147.5256 1789.8827 0.000
3.630 0.0485 41136. -2189.7036 -0.008900 4941.3154 4.756E+08
-144.9490 1972.2662 0.000
3.685 0.0427 39659. -2284.3648 -0.008844 4763.9224 4.756E+08
-141.9032 2195.8831 0.000
3.740 0.0368 38120. -2376.8252 -0.008790 4579.1043 4.756E+08
-138.2799 2477.8620 0.000
3.795 0.0310 36522. -2466.6521 -0.008738 4387.0507 4.756E+08
-133.9227 2846.8242 0.000
3.850 0.0253 34864. -2553.2814 -0.008688 4187.9895 4.756E+08
-128.5906 3354.8093 0.000
3.905 0.0196 33151. -2635.9368 -0.008641 3982.1999 4.756E+08
-121.8802 4108.4182 0.000
3.960 0.0139 31385. -2713.4549 -0.008596 3770.0328 4.756E+08
-113.0231 5369.8485 0.000
4.015 0.008232 29570. -2783.8141 -0.008554 3551.9518 4.756E+08
-100.1865 8032.2477 0.000
4.070 0.002600 27710. -2841.9128 -0.008514 3328.6285 4.756E+08
-75.8703 19259. 0.000
4.125 -0.003007 25818. -2840.7226 -0.008477 3101.3353 4.756E+08
79.4770 17445. 0.000
4.180 -0.008590 23961. -2780.0571 -0.008443 2878.2008 4.756E+08
104.3578 8018.1553 0.000
4.235 -0.0142 22149. -2706.2174 -0.008411 2660.5268 4.756E+08
119.3989 5568.6374 0.000
4.290 -0.0197 20388. -2623.8624 -0.008381 2449.1003 4.756E+08
130.1616 4362.4674 0.000
4.345 -0.0252 18685. -2535.2176 -0.008354 2244.4846 4.756E+08
138.4591 3624.2244 0.000
4.400 -0.0307 17042. -2441.5222 -0.008329 2047.1138 4.756E+08
145.4664 3125.2895 0.000
4.455 -0.0362 15462. -2343.5002 -0.008307 1857.3545 4.756E+08
151.5700 2762.7276 0.000
4.510 -0.0417 13949. -2241.6717 -0.008286 1675.5261 4.756E+08
157.0010 2485.8246 0.000
4.565 -0.0471 12503. -2136.4313 -0.008268 1501.9128 4.756E+08
161.9095 2266.5227 0.000
4.620 -0.0526 11128. -2028.0894 -0.008252 1336.7715 4.756E+08
166.3993 2087.9628 0.000
4.675 -0.0580 9826.1555 -1916.8978 -0.008237 1180.3370 4.756E+08
170.5450 1939.3673 0.000
4.730 -0.0635 8598.1476 -1803.0651 -0.008224 1032.8263 4.756E+08
174.4025 1813.5050 0.000
4.785 -0.0689 7446.1095 -1686.7675 -0.008213 894.4412 4.756E+08
178.0147 1705.3327 0.000
4.840 -0.0743 6371.6146 -1568.1556 -0.008204 765.3708 4.756E+08

```
181.4153  1611.2191      0.000
     4.895    -0.0797  5376.1442 -1447.3601  -0.008195   645.7929  4.756E+08
184.6314  1528.4789      0.000
     4.950    -0.0851  4461.0992 -1324.4957  -0.008189   535.8759  4.756E+08
187.6850  1455.0815      0.000
     5.005    -0.0905  3627.8098 -1199.6635  -0.008183   435.7796  4.756E+08
190.5943  1389.4608      0.000
     5.060    -0.0959  2877.5433 -1072.9538  -0.008178   345.6561  4.756E+08
193.3745  1330.3885      0.000
     5.115    -0.1013  2211.5108  -944.4475  -0.008175   265.6510  4.756E+08
196.0384  1276.8871      0.000
     5.170    -0.1067  1630.8726  -814.2179  -0.008172   195.9036  4.756E+08
198.5970  1228.1682      0.000
     5.225    -0.1121  1136.7432  -682.3311  -0.008170   136.5478  4.756E+08
201.0597  1183.5887      0.000
     5.280    -0.1175   730.1955  -548.8480  -0.008169    87.7125  4.756E+08
203.4346  1142.6183      0.000
     5.335    -0.1229   412.2639  -413.8240  -0.008168    49.5219  4.756E+08
205.7289  1104.8157      0.000
     5.390    -0.1283   183.9478  -277.3104  -0.008168    22.0962  4.756E+08
207.9488  1069.8105      0.000
     5.445    -0.1337    46.2142  -139.3544  -0.008168     5.5513  4.756E+08
210.0996  1037.2894      0.000
     5.500    -0.1391      0.000      0.000  -0.008168      0.000  4.756E+08
212.1864   503.4927      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection            =      0.5335503 inches
Computed slope at pile head     =     -0.0126805 radians
Maximum bending moment          =         56669. inch-lbs
Maximum shear force             =   3020.0000000 lbs
Depth of maximum bending moment  =      2.4750000 feet below pile head
Depth of maximum shear force    =       0.000000 feet below pile head
Number of iterations            =             42
Number of zero deflection points =             1
```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

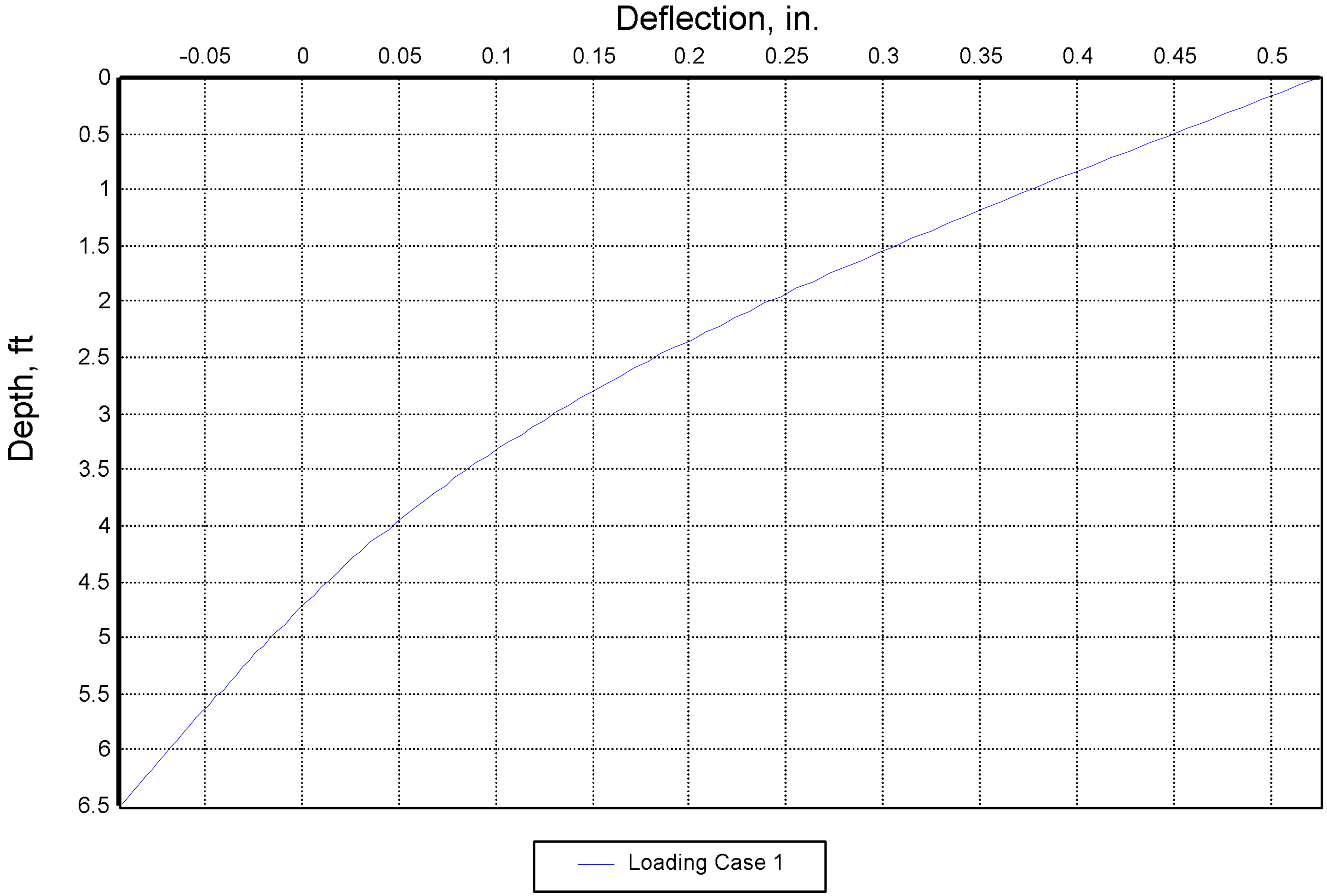
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 3020.0000	M = 0.000	0.0000000	0.53355029	56669.	3020.0000	-0.01268055

The analysis ended normally.

TP-6

Lateral Deflection vs. Depth



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```
================================================================================

              LPile Plus for Windows, Version 2013-07.005

             Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:        N:\Projects\2015\60155057\Working Files\Pile
Testing\LPILE\
Name of input data file:       TP-6.lp7d
Name of output report file:    TP-6.lp7o
Name of plot output file:      TP-6.lp7p
Name of runtime messeage file: TP-6.lp7r


--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  August 7, 2015     Time:  16:38:04


--------------------------------------------------------------------------------
                                Problem Title
--------------------------------------------------------------------------------

Project Name: Little Bear Solar Project
```

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 6.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	6.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	6.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

```
--------------------------------------------------------------------------------

Ground Slope Angle                                    =        0.000 degrees
                                                      =        0.000 radians

Pile Batter Angle                                     =        0.000 degrees
                                                      =        0.000 radians


--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer          =      0.50000 ft
   Distance from top of pile to bottom of layer       =      7.00000 ft
   Effective unit weight at top of layer              =    115.00000 pcf
   Effective unit weight at bottom of layer           =    115.00000 pcf
   Undrained cohesion at top of layer                 =   1780.00000 psf
   Undrained cohesion at bottom of layer              =   1780.00000 psf
   Epsilon-50 at top of layer                         =      0.00700
   Epsilon-50 at bottom of layer                      =      0.00700


   (Depth of lowest soil layer extends    0.50 ft below pile tip)



--------------------------------------------------------------------------------
                           Summary of Soil Properties
--------------------------------------------------------------------------------
```

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1780.000	0.00700
		7.000	115.000	1780.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition               Condition           Axial Thrust
     Compute
 No.    Type             1                       2                Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   4300.00000 lbs   M =       0.0000 in-lbs        0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 4300.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5082	-2.083E-06	4300.0000	-0.0124	2.502E-07	4.756E+08	0.000	0.000	0.000
0.06500	0.4985	3354.0000	4300.0000	-0.0124	402.8890	4.756E+08	0.000	0.000	0.000
0.130	0.4889	6708.0000	4300.0000	-0.0124	805.7780	4.756E+08	0.000	0.000	0.000
0.195	0.4793	10062.	4300.0000	-0.0123	1208.6671	4.756E+08	0.000	0.000	0.000
0.260	0.4697	13416.	4300.0000	-0.0123	1611.5561	4.756E+08	0.000	0.000	0.000
0.325	0.4601	16770.	4300.0000	-0.0123	2014.4451	4.756E+08	0.000	0.000	0.000
0.390	0.4505	20124.	4300.0000	-0.0123	2417.3341	4.756E+08	0.000	0.000	0.000
0.455	0.4409	23478.	4300.0000	-0.0122	2820.2232	4.756E+08	0.000	0.000	0.000
0.520	0.4314	26832.	4257.2394	-0.0122	3223.1122	4.756E+08	-109.6426	198.2364	0.000
0.585	0.4219	30119.	4170.5079	-0.0121	3617.9883	4.756E+08	-112.7457	208.4310	0.000
0.650	0.4125	33338.	4081.3755	-0.0121	4004.6247	4.756E+08	-115.7991	218.9800	0.000
0.715	0.4031	36486.	3989.8811	-0.0120	4382.7982	4.756E+08	-118.8019	229.9017	0.000
0.780	0.3937	39562.	3896.0645	-0.0120	4752.2895	4.756E+08	-121.7534	241.2150	0.000
0.845	0.3844	42564.	3799.9662	-0.0119	5112.8827	4.756E+08	-124.6527	252.9402	0.000
0.910	0.3751	45490.	3701.6270	-0.0118	5464.3661	4.756E+08	-127.4990	265.0987	0.000

0.975	0.3659	48339.	3601.0887	-0.0118	5806.5315	4.756E+08
-130.2915	277.7134	0.000				
1.040	0.3568	51108.	3498.3936	-0.0117	6139.1750	4.756E+08
-133.0293	290.8086	0.000				
1.105	0.3477	53796.	3393.5846	-0.0116	6462.0963	4.756E+08
-135.7116	304.4101	0.000				
1.170	0.3387	56402.	3286.7055	-0.0115	6775.0996	4.756E+08
-138.3375	318.5454	0.000				
1.235	0.3298	58923.	3177.8005	-0.0114	7077.9929	4.756E+08
-140.9061	333.2441	0.000				
1.300	0.3210	61359.	3066.9147	-0.0113	7370.5884	4.756E+08
-143.4165	348.5375	0.000				
1.365	0.3122	63708.	2954.0939	-0.0112	7652.7028	4.756E+08
-145.8677	364.4591	0.000				
1.430	0.3035	65968.	2839.3844	-0.0111	7924.1568	4.756E+08
-148.2590	381.0450	0.000				
1.495	0.2949	68137.	2722.8336	-0.0110	8184.7757	4.756E+08
-150.5892	398.3337	0.000				
1.560	0.2864	70215.	2604.4894	-0.0109	8434.3892	4.756E+08
-152.8575	416.3667	0.000				
1.625	0.2779	72200.	2484.4005	-0.0108	8672.8316	4.756E+08
-155.0628	435.1883	0.000				
1.690	0.2696	74091.	2362.6164	-0.0106	8899.9417	4.756E+08
-157.2040	454.8466	0.000				
1.755	0.2613	75886.	2239.1875	-0.0105	9115.5629	4.756E+08
-159.2802	475.3931	0.000				
1.820	0.2532	77584.	2114.1651	-0.0104	9319.5435	4.756E+08
-161.2901	496.8836	0.000				
1.885	0.2451	79184.	1987.6012	-0.0103	9511.7368	4.756E+08
-163.2327	519.3785	0.000				
1.950	0.2372	80685.	1859.5489	-0.0101	9692.0006	4.756E+08
-165.1066	542.9431	0.000				
2.015	0.2294	82085.	1730.0621	-0.009989	9860.1981	4.756E+08
-166.9108	567.6483	0.000				
2.080	0.2216	83384.	1599.1958	-0.009854	10016.	4.756E+08
-168.6438	593.5715	0.000				
2.145	0.2140	84580.	1467.0061	-0.009716	10160.	4.756E+08
-170.3043	620.7965	0.000				
2.210	0.2065	85672.	1333.5500	-0.009576	10291.	4.756E+08
-171.8907	649.4154	0.000				
2.275	0.1990	86660.	1198.8860	-0.009435	10410.	4.756E+08
-173.4017	679.5287	0.000				
2.340	0.1917	87542.	1063.0735	-0.009292	10516.	4.756E+08
-174.8355	711.2469	0.000				
2.405	0.1845	88318.	926.1735	-0.009148	10609.	4.756E+08
-176.1903	744.6913	0.000				
2.470	0.1775	88987.	788.2481	-0.009003	10689.	4.756E+08
-177.4644	779.9961	0.000				
2.535	0.1705	89548.	649.3613	-0.008856	10757.	4.756E+08

-178.6557	817.3094	0.000				
2.600	0.1636	90000.	509.5783	-0.008709	10811.	4.756E+08
-179.7621	856.7958	0.000				
2.665	0.1569	90343.	368.9664	-0.008561	10852.	4.756E+08
-180.7813	898.6387	0.000				
2.730	0.1503	90576.	227.5945	-0.008413	10880.	4.756E+08
-181.7106	943.0427	0.000				
2.795	0.1438	90698.	85.5339	-0.008264	10895.	4.756E+08
-182.5475	990.2377	0.000				
2.860	0.1374	90709.	-57.1422	-0.008115	10896.	4.756E+08
-183.2888	1040.4823	0.000				
2.925	0.1311	90609.	-200.3580	-0.007967	10884.	4.756E+08
-183.9312	1094.0690	0.000				
2.990	0.1250	90397.	-344.0350	-0.007818	10859.	4.756E+08
-184.4712	1151.3302	0.000				
3.055	0.1189	90072.	-488.0916	-0.007670	10820.	4.756E+08
-184.9047	1212.6454	0.000				
3.120	0.1130	89635.	-632.4431	-0.007523	10767.	4.756E+08
-185.2272	1278.4503	0.000				
3.185	0.1072	89086.	-777.0008	-0.007376	10701.	4.756E+08
-185.4337	1349.2475	0.000				
3.250	0.1015	88423.	-921.6723	-0.007231	10622.	4.756E+08
-185.5186	1425.6213	0.000				
3.315	0.0959	87648.	-1066.3600	-0.007086	10528.	4.756E+08
-185.4755	1508.2545	0.000				
3.380	0.0904	86760.	-1210.9614	-0.006943	10422.	4.756E+08
-185.2973	1597.9518	0.000				
3.445	0.0851	85759.	-1355.3678	-0.006802	10301.	4.756E+08
-184.9756	1695.6685	0.000				
3.510	0.0798	84645.	-1499.4638	-0.006662	10168.	4.756E+08
-184.5011	1802.5489	0.000				
3.575	0.0747	83420.	-1643.1257	-0.006524	10021.	4.756E+08
-183.8628	1919.9770	0.000				
3.640	0.0697	82082.	-1786.2210	-0.006389	9859.8433	4.756E+08
-183.0481	2049.6447	0.000				
3.705	0.0647	80633.	-1928.6060	-0.006255	9685.7943	4.756E+08
-182.0418	2193.6448	0.000				
3.770	0.0599	79073.	-2070.1247	-0.006124	9498.4413	4.756E+08
-180.8264	2354.6013	0.000				
3.835	0.0552	77404.	-2210.6054	-0.005996	9297.8731	4.756E+08
-179.3806	2535.8533	0.000				
3.900	0.0505	75625.	-2349.8585	-0.005870	9084.1954	4.756E+08
-177.6786	2741.7240	0.000				
3.965	0.0460	73738.	-2487.6718	-0.005748	8857.5326	4.756E+08
-175.6888	2977.9213	0.000				
4.030	0.0416	71744.	-2623.8053	-0.005629	8618.0300	4.756E+08
-173.3716	3252.1565	0.000				
4.095	0.0372	69645.	-2757.9842	-0.005513	8365.8571	4.756E+08
-170.6768	3575.1309	0.000				

```
     4.160     0.0330     67442. -2889.8884  -0.005400  8101.2107  4.756E+08
-167.5389  3962.1813      0.000
     4.225     0.0288     65136. -3019.1380  -0.005291  7824.3202  4.756E+08
-163.8704  4436.1674      0.000
     4.290     0.0247     62732. -3145.1585  -0.005187  7535.4537  4.756E+08
-159.2590  5023.6945      0.000
     4.355     0.0207     60230. -3266.6961  -0.005086  7234.9482  4.756E+08
-152.3761  5735.6721      0.000
     4.420     0.0168     57636. -3382.5072  -0.004989  6923.3067  4.756E+08
-144.5754  6715.0725      0.000
     4.485     0.0129     54953. -3491.7175  -0.004897  6601.0993  4.756E+08
-135.4510  8165.5514      0.000
     4.550   0.009154     52189. -3592.9919  -0.004809  6268.9929  4.756E+08
-124.2269     10585.      0.000
     4.615   0.005437     49348. -3683.9714  -0.004726  5927.8077  4.756E+08
-109.0539     15646.      0.000
     4.680   0.001782     46442. -3758.6838  -0.004647  5578.6526  4.756E+08
-82.5162     36113.      0.000
     4.745  -0.001813     43485. -3758.5445  -0.004573  5223.4670  4.756E+08
82.8734     35658.      0.000
     4.810  -0.005352     40578. -3683.8580  -0.004504  4874.3380  4.756E+08
108.6304     15831.      0.000
     4.875  -0.008840     37738. -3593.4646  -0.004440  4533.1480  4.756E+08
123.1475     10866.      0.000
     4.940    -0.0123     34972. -3493.2971  -0.004381  4200.9578  4.756E+08
133.6921  8492.5071      0.000
     5.005    -0.0157     32288. -3385.7367  -0.004325  3878.5382  4.756E+08
142.1039  7071.8501      0.000
     5.070    -0.0190     29691. -3272.1433  -0.004275  3566.5038  4.756E+08
149.1610  6114.8334      0.000
     5.135    -0.0223     27184. -3153.4143  -0.004228  3265.3704  4.756E+08
155.2725  5420.8412      0.000
     5.200    -0.0256     24771. -3030.1918  -0.004185  2975.5847  4.756E+08
160.6827  4891.5052      0.000
     5.265    -0.0289     22457. -2902.9609  -0.004147  2697.5421  4.756E+08
165.5503  4472.5902      0.000
     5.330    -0.0321     20243. -2772.1022  -0.004112  2431.5982  4.756E+08
169.9850  4131.5958      0.000
     5.395    -0.0353     18132. -2637.9225  -0.004080  2178.0772  4.756E+08
174.0654  3847.7915      0.000
     5.460    -0.0385     16128. -2500.6752  -0.004052  1937.2772  4.756E+08
177.8508  3607.2958      0.000
     5.525    -0.0416     14231. -2360.5727  -0.004027  1709.4750  4.756E+08
181.3863  3400.4436      0.000
     5.590    -0.0447     12445. -2217.7960  -0.004005  1494.9289  4.756E+08
184.7076  3220.2876      0.000
     5.655    -0.0479     10771. -2072.5012  -0.003986  1293.8817  4.756E+08
187.8433  3061.6987      0.000
     5.720    -0.0510  9211.9919 -1924.8239  -0.003970  1106.5624  4.756E+08
```

```
190.8164  2920.8039      0.000
     5.785    -0.0540  7768.6756 -1774.8835  -0.003956   933.1885  4.756E+08
193.6461  2794.6212      0.000
     5.850    -0.0571  6443.1736 -1622.7856  -0.003944   773.9666  4.756E+08
196.3485  2680.8158      0.000
     5.915    -0.0602  5237.1301 -1468.6243  -0.003935   629.0943  4.756E+08
198.9368  2577.5325      0.000
     5.980    -0.0633  4152.1197 -1312.4842  -0.003927   498.7607  4.756E+08
201.4226  2483.2779      0.000
     6.045    -0.0663  3189.6547 -1154.4413  -0.003921   383.1476  4.756E+08
203.8155  2396.8360      0.000
     6.110    -0.0694  2351.1912  -994.5650  -0.003916   282.4297  4.756E+08
206.1239  2317.2062      0.000
     6.175    -0.0724  1638.1334  -832.9181  -0.003913   196.7758  4.756E+08
208.3551  2243.5576      0.000
     6.240    -0.0755  1051.8388  -669.5586  -0.003911   126.3489  4.756E+08
210.5155  2175.1942      0.000
     6.305    -0.0785   593.6219  -504.5396  -0.003910    71.3070  4.756E+08
212.6103  2111.5289      0.000
     6.370    -0.0816   264.7571  -337.9102  -0.003909    31.8031  4.756E+08
214.6445  2052.0627      0.000
     6.435    -0.0846    66.4821  -169.7161  -0.003909     7.9860  4.756E+08
216.6223  1996.3689      0.000
     6.500    -0.0877      0.000      0.000  -0.003909      0.000  4.756E+08
218.5472   972.0402      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.5081908 inches
Computed slope at pile head      =     -0.0123623 radians
Maximum bending moment           =         90709. inch-lbs
Maximum shear force              =   4300.0000017 lbs
Depth of maximum bending moment  =      2.8600000 feet below pile head
Depth of maximum shear force     =      0.0650000 feet below pile head
Number of iterations             =             41
Number of zero deflection points =              1
```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

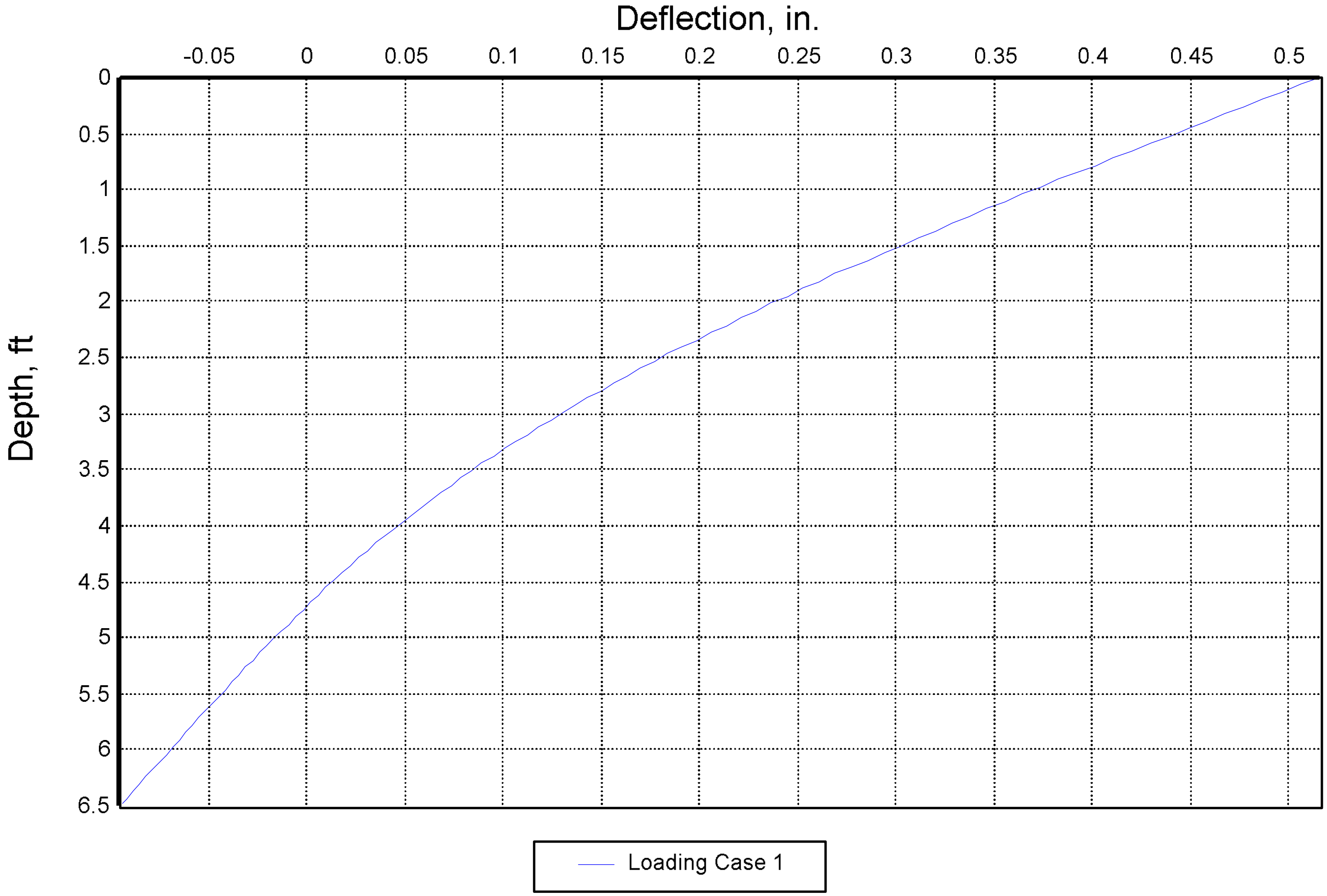
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 4300.0000	M = 0.000	0.0000000	0.50819080	90709.	4300.0000	-0.01236231

The analysis ended normally.

TP-7

Lateral Deflection vs. Depth



LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-7.lp7d
Name of output report file: TP-7.lp7o
Name of plot output file: TP-7.lp7p
Name of runtime messeage file: TP-7.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:34:38

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 6.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	6.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	6.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1680.00000 psf
Undrained cohesion at bottom of layer	=	1680.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 0.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1680.000	0.00700
		7.000	115.000	1680.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition                Condition            Axial Thrust
     Compute
 No.    Type             1                        2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   4100.00000 lbs   M =       0.0000 in-lbs         0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 4100.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5148	1.736E-06	4100.0000	-0.0123	2.085E-07	4.756E+08	0.000	0.000	0.000
0.06500	0.5052	3198.0000	4100.0000	-0.0123	384.1500	4.756E+08	0.000	0.000	0.000
0.130	0.4956	6396.0000	4100.0000	-0.0123	768.3000	4.756E+08	0.000	0.000	0.000
0.195	0.4860	9594.0000	4100.0000	-0.0123	1152.4500	4.756E+08	0.000	0.000	0.000
0.260	0.4764	12792.	4100.0000	-0.0123	1536.6000	4.756E+08	0.000	0.000	0.000
0.325	0.4668	15990.	4100.0000	-0.0123	1920.7500	4.756E+08	0.000	0.000	0.000
0.390	0.4573	19188.	4100.0000	-0.0122	2304.9000	4.756E+08	0.000	0.000	0.000
0.455	0.4478	22386.	4100.0000	-0.0122	2689.0500	4.756E+08	0.000	0.000	0.000
0.520	0.4383	25584.	4059.4814	-0.0122	3073.2000	4.756E+08	-103.8940	184.9036	0.000
0.585	0.4288	28719.	3977.2897	-0.0121	3449.7572	4.756E+08	-106.8538	194.3677	0.000
0.650	0.4194	31789.	3892.8075	-0.0121	3818.5053	4.756E+08	-109.7674	204.1549	0.000
0.715	0.4100	34792.	3806.0710	-0.0120	4179.2313	4.756E+08	-112.6339	214.2815	0.000
0.780	0.4007	37726.	3717.1172	-0.0119	4531.7259	4.756E+08	-115.4527	224.7646	0.000
0.845	0.3914	40590.	3625.9837	-0.0119	4875.7828	4.756E+08	-118.2230	235.6223	0.000
0.910	0.3821	43383.	3532.7085	-0.0118	5211.1998	4.756E+08	-120.9440	246.8739	0.000

0.975	0.3729	46101.	3437.3306	-0.0117	5537.7780	4.756E+08
-123.6149	258.5400	0.000				
1.040	0.3638	48745.	3339.8891	-0.0117	5855.3220	4.756E+08
-126.2349	270.6422	0.000				
1.105	0.3548	51312.	3240.4242	-0.0116	6163.6406	4.756E+08
-128.8033	283.2038	0.000				
1.170	0.3458	53800.	3138.9765	-0.0115	6462.5459	4.756E+08
-131.3192	296.2493	0.000				
1.235	0.3368	56208.	3035.5871	-0.0114	6751.8542	4.756E+08
-133.7817	309.8051	0.000				
1.300	0.3280	58535.	2930.2981	-0.0113	7031.3853	4.756E+08
-136.1901	323.8994	0.000				
1.365	0.3192	60780.	2823.1520	-0.0112	7300.9634	4.756E+08
-138.5435	338.5621	0.000				
1.430	0.3105	62940.	2714.1920	-0.0111	7560.4165	4.756E+08
-140.8410	353.8253	0.000				
1.495	0.3019	65014.	2603.4621	-0.0110	7809.5765	4.756E+08
-143.0817	369.7236	0.000				
1.560	0.2933	67001.	2491.0071	-0.0109	8048.2799	4.756E+08
-145.2646	386.2938	0.000				
1.625	0.2849	68900.	2376.8722	-0.0108	8276.3670	4.756E+08
-147.3889	403.5757	0.000				
1.690	0.2765	70709.	2261.1038	-0.0107	8493.6825	4.756E+08
-149.4534	421.6119	0.000				
1.755	0.2682	72427.	2143.7486	-0.0106	8700.0757	4.756E+08
-151.4573	440.4487	0.000				
1.820	0.2600	74053.	2024.8545	-0.0104	8895.4001	4.756E+08
-153.3994	460.1355	0.000				
1.885	0.2519	75586.	1904.4701	-0.0103	9079.5137	4.756E+08
-155.2786	480.7263	0.000				
1.950	0.2440	77024.	1782.6448	-0.0102	9252.2792	4.756E+08
-157.0939	502.2792	0.000				
2.015	0.2361	78367.	1659.4291	-0.0101	9413.5640	4.756E+08
-158.8439	524.8573	0.000				
2.080	0.2283	79613.	1534.8743	-0.009926	9563.2401	4.756E+08
-160.5274	548.5294	0.000				
2.145	0.2206	80761.	1409.0327	-0.009795	9701.1844	4.756E+08
-162.1432	573.3704	0.000				
2.210	0.2130	81811.	1281.9579	-0.009661	9827.2790	4.756E+08
-163.6897	599.4619	0.000				
2.275	0.2055	82761.	1153.7043	-0.009526	9941.4108	4.756E+08
-165.1656	626.8935	0.000				
2.340	0.1981	83611.	1024.3277	-0.009390	10043.	4.756E+08
-166.5693	655.7632	0.000				
2.405	0.1909	84359.	893.8851	-0.009252	10133.	4.756E+08
-167.8990	686.1791	0.000				
2.470	0.1837	85005.	762.4348	-0.009113	10211.	4.756E+08
-169.1529	718.2602	0.000				
2.535	0.1766	85548.	630.0368	-0.008974	10276.	4.756E+08

-170.3293	752.1384	0.000				
2.600	0.1697	85988.	496.7523	-0.008833	10329.	4.756E+08
-171.4258	787.9597	0.000				
2.665	0.1629	86323.	362.6444	-0.008692	10369.	4.756E+08
-172.4405	825.8870	0.000				
2.730	0.1561	86554.	227.7781	-0.008550	10397.	4.756E+08
-173.3707	866.1021	0.000				
2.795	0.1495	86679.	92.2201	-0.008408	10412.	4.756E+08
-174.2138	908.8089	0.000				
2.860	0.1430	86698.	-43.9603	-0.008266	10414.	4.756E+08
-174.9670	954.2371	0.000				
2.925	0.1366	86610.	-180.6920	-0.008123	10404.	4.756E+08
-175.6270	1002.6462	0.000				
2.990	0.1303	86416.	-317.9007	-0.007982	10380.	4.756E+08
-176.1903	1054.3310	0.000				
3.055	0.1242	86114.	-455.5097	-0.007840	10344.	4.756E+08
-176.6531	1109.6283	0.000				
3.120	0.1181	85705.	-593.4387	-0.007699	10295.	4.756E+08
-177.0111	1168.9240	0.000				
3.185	0.1122	85188.	-731.6042	-0.007559	10233.	4.756E+08
-177.2593	1232.6638	0.000				
3.250	0.1063	84564.	-869.9184	-0.007420	10158.	4.756E+08
-177.3925	1301.3652	0.000				
3.315	0.1006	83831.	-1008.2892	-0.007282	10070.	4.756E+08
-177.4045	1375.6329	0.000				
3.380	0.0950	82991.	-1146.6194	-0.007145	9969.0202	4.756E+08
-177.2884	1456.1789	0.000				
3.445	0.0894	82043.	-1284.8060	-0.007010	9855.1093	4.756E+08
-177.0363	1543.8480	0.000				
3.510	0.0840	80987.	-1422.7394	-0.006876	9728.2601	4.756E+08
-176.6392	1639.6515	0.000				
3.575	0.0787	79823.	-1560.3025	-0.006744	9588.5018	4.756E+08
-176.0866	1744.8115	0.000				
3.640	0.0735	78552.	-1697.3692	-0.006614	9435.8746	4.756E+08
-175.3664	1860.8203	0.000				
3.705	0.0684	77175.	-1833.8032	-0.006487	9270.4313	4.756E+08
-174.4645	1989.5223	0.000				
3.770	0.0634	75692.	-1969.4562	-0.006361	9092.2378	4.756E+08
-173.3638	2133.2261	0.000				
3.835	0.0585	74103.	-2104.1654	-0.006238	8901.3745	4.756E+08
-172.0444	2294.8656	0.000				
3.900	0.0537	72409.	-2237.7506	-0.006118	8697.9377	4.756E+08
-170.4817	2478.2324	0.000				
3.965	0.0489	70612.	-2370.0104	-0.006001	8482.0418	4.756E+08
-168.6460	2688.3220	0.000				
4.030	0.0443	68712.	-2500.7174	-0.005887	8253.8209	4.756E+08
-166.5000	2931.8660	0.000				
4.095	0.0397	66711.	-2629.6110	-0.005776	8013.4318	4.756E+08
-163.9966	3218.1782	0.000				

4.160 0.0353 64610. -2756.3887 -0.005668 7761.0575 4.756E+08
-161.0743 3560.5579 0.000
4.225 0.0309 62411. -2880.6918 -0.005564 7496.9115 4.756E+08
-157.6516 3978.7376 0.000
4.290 0.0266 60116. -3001.8804 -0.005463 7221.2439 4.756E+08
-153.0885 4487.9605 0.000
4.355 0.0224 57728. -3118.7647 -0.005367 6934.3883 4.756E+08
-146.6147 5109.0793 0.000
4.420 0.0182 55251. -3230.2673 -0.005274 6636.8178 4.756E+08
-139.2894 5958.2567 0.000
4.485 0.0142 52689. -3335.5812 -0.005186 6329.0678 4.756E+08
-130.7464 7204.1307 0.000
4.550 0.0101 50047. -3433.4883 -0.005101 6011.7625 4.756E+08
-120.2974 9249.0353 0.000
4.615 0.006198 47332. -3521.8824 -0.005021 5685.6656 4.756E+08
-106.3540 13384. 0.000
4.680 0.002312 44553. -3595.7735 -0.004946 5351.7961 4.756E+08
-83.1104 28044. 0.000
4.745 -0.001518 41723. -3599.0056 -0.004875 5011.8527 4.756E+08
74.8231 38451. 0.000
4.810 -0.005294 38939. -3529.9482 -0.004809 4677.3775 4.756E+08
102.2471 15065. 0.000
4.875 -0.009020 36216. -3444.5130 -0.004748 4350.3748 4.756E+08
116.8173 10102. 0.000
4.940 -0.0127 33565. -3349.3273 -0.004690 4031.9094 4.756E+08
127.2488 7815.2163 0.000
5.005 -0.0163 30991. -3246.8485 -0.004637 3722.7436 4.756E+08
135.5173 6470.1503 0.000
5.070 -0.0199 28500. -3138.4490 -0.004589 3423.4817 4.756E+08
142.4301 5573.0362 0.000
5.135 -0.0235 26095. -3025.0237 -0.004544 3134.6289 4.756E+08
148.4040 4926.7255 0.000
5.200 -0.0270 23781. -2907.2088 -0.004503 2856.6217 4.756E+08
153.6855 4436.0462 0.000
5.265 -0.0305 21560. -2785.4826 -0.004466 2589.8463 4.756E+08
158.4331 4049.0813 0.000
5.330 -0.0340 19436. -2660.2190 -0.004432 2334.6495 4.756E+08
162.7556 3734.9607 0.000
5.395 -0.0374 17410. -2531.7192 -0.004402 2091.3472 4.756E+08
166.7311 3474.1096 0.000
5.460 -0.0409 15486. -2400.2312 -0.004375 1860.2300 4.756E+08
170.4178 3253.4813 0.000
5.525 -0.0443 13666. -2265.9628 -0.004351 1641.5673 4.756E+08
173.8602 3064.0259 0.000
5.590 -0.0476 11951. -2129.0910 -0.004330 1435.6107 4.756E+08
177.0932 2899.2581 0.000
5.655 -0.0510 10344. -1989.7682 -0.004312 1242.5964 4.756E+08
180.1448 2754.4021 0.000
5.720 -0.0544 8847.2382 -1848.1271 -0.004296 1062.7475 4.756E+08

```
183.0376  2625.8592      0.000
     5.785    -0.0577  7461.3791 -1704.2842  -0.004283   896.2754  4.756E+08
185.7903  2510.8639      0.000
     5.850    -0.0611  6188.5549 -1558.3428  -0.004271   743.3813  4.756E+08
188.4184  2407.2540      0.000
     5.915    -0.0644  5030.3644 -1410.3949  -0.004262   604.2572  4.756E+08
190.9351  2313.3137      0.000
     5.980    -0.0677  3988.3388 -1260.5231  -0.004255   479.0870  4.756E+08
193.3515  2227.6634      0.000
     6.045    -0.0710  3063.9483 -1108.8021  -0.004249   368.0474  4.756E+08
195.6770  2149.1805      0.000
     6.110    -0.0743  2258.6076  -955.2993  -0.004245   271.3083  4.756E+08
197.9198  2076.9423      0.000
     6.175    -0.0776  1573.6813  -800.0767  -0.004242   189.0337  4.756E+08
200.0870  2010.1829      0.000
     6.240    -0.0809  1010.4879  -643.1908  -0.004239   121.3818  4.756E+08
202.1847  1948.2613      0.000
     6.305    -0.0843   570.3037  -484.6936  -0.004238    68.5060  4.756E+08
204.2183  1890.6366      0.000
     6.370    -0.0876   254.3658  -324.6335  -0.004237    30.5549  4.756E+08
206.1924  1836.8495      0.000
     6.435    -0.0909    63.8754  -163.0550  -0.004237     7.6728  4.756E+08
208.1113  1786.5074      0.000
     6.500    -0.0942      0.000      0.000  -0.004237      0.000  4.756E+08
209.9785   869.6361      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.5147992 inches
Computed slope at pile head      =     -0.0123197 radians
Maximum bending moment           =         86698. inch-lbs
Maximum shear force              =   4100.0000001 lbs
Depth of maximum bending moment  =      2.8600000 feet below pile head
Depth of maximum shear force     =      0.2600000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
```

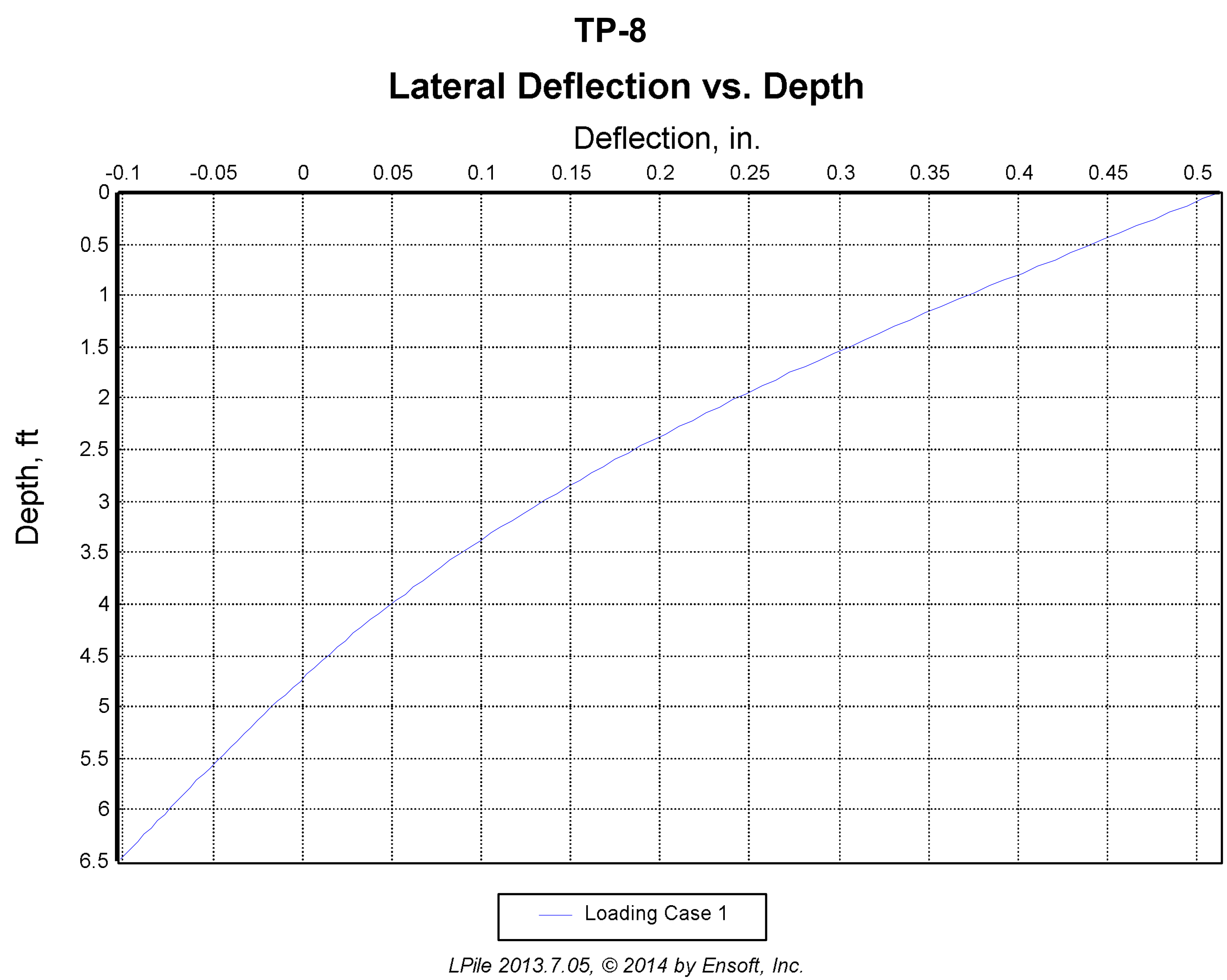
Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```
               Pile-head      Pile-head                                       Maximum
       Maximum
Load  Load    Condition 1    Condition 2       Axial       Pile-head       Moment
        Shear        Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
       in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
         lbs          radians
----  ----  -------------  -------------  ------------  ------------
-------------  ------------  ------------
  1     1   V =  4100.0000  M =      0.000      0.0000000     0.51479925
86698.      4100.0000    -0.01231973
```

The analysis ended normally.


TP-8
Lateral Deflection vs. Depth
Deflection, in.
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth, ft
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
Loading Case 1
LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-8.lp7d
Name of output report file: TP-8.lp7o
Name of plot output file: TP-8.lp7p
Name of runtime messeage file: TP-8.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:31:02

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 6.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	6.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	6.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1480.00000 psf
Undrained cohesion at bottom of layer	=	1480.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 0.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1480.000	0.00700
		7.000	115.000	1480.000	0.00700

```
--------------------------------------------------------------------------------
                                  Loading Type
--------------------------------------------------------------------------------

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3



--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load    Load         Condition               Condition            Axial Thrust
     Compute
 No.    Type             1                        2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   3680.00000 lbs   M =       0.0000 in-lbs        0.0000000
       No

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.


--------------------------------------------------------------------------------
    Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3680.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5257	9.547E-07	3680.0000	-0.0122	1.147E-07	4.756E+08	0.000	0.000	0.000
0.06500	0.5162	2870.4000	3680.0000	-0.0122	344.7980	4.756E+08	0.000	0.000	0.000
0.130	0.5067	5740.8000	3680.0000	-0.0122	689.5961	4.756E+08	0.000	0.000	0.000
0.195	0.4973	8611.2000	3680.0000	-0.0122	1034.3941	4.756E+08	0.000	0.000	0.000
0.260	0.4878	11482.	3680.0000	-0.0121	1379.1922	4.756E+08	0.000	0.000	0.000
0.325	0.4783	14352.	3680.0000	-0.0121	1723.9902	4.756E+08	0.000	0.000	0.000
0.390	0.4689	17222.	3680.0000	-0.0121	2068.7883	4.756E+08	0.000	0.000	0.000
0.455	0.4594	20093.	3680.0000	-0.0121	2413.5863	4.756E+08	0.000	0.000	0.000
0.520	0.4501	22963.	3644.0652	-0.0120	2758.3844	4.756E+08	-92.1406	159.6911	0.000
0.585	0.4407	25778.	3571.1574	-0.0120	3096.4486	4.756E+08	-94.8025	167.7963	0.000
0.650	0.4314	28534.	3496.1888	-0.0119	3427.5844	4.756E+08	-97.4247	176.1684	0.000
0.715	0.4221	31232.	3419.1905	-0.0119	3751.6003	4.756E+08	-100.0067	184.8205	0.000
0.780	0.4128	33868.	3340.1943	-0.0118	4068.3074	4.756E+08	-102.5478	193.7664	0.000
0.845	0.4036	36442.	3259.2322	-0.0118	4377.5201	4.756E+08	-105.0474	203.0205	0.000
0.910	0.3944	38953.	3176.3368	-0.0117	4679.0557	4.756E+08	-107.5047	212.5984	0.000

0.975	0.3853	41397.	3091.5415	-0.0117	4972.7346	4.756E+08
-109.9192	222.5164	0.000				
1.040	0.3762	43775.	3004.8798	-0.0116	5258.3804	4.756E+08
-112.2901	232.7921	0.000				
1.105	0.3672	46085.	2916.3861	-0.0115	5535.8198	4.756E+08
-114.6168	243.4439	0.000				
1.170	0.3583	48325.	2826.0952	-0.0114	5804.8827	4.756E+08
-116.8984	254.4915	0.000				
1.235	0.3494	50494.	2734.0424	-0.0114	6065.4025	4.756E+08
-119.1344	265.9561	0.000				
1.300	0.3406	52590.	2640.2637	-0.0113	6317.2156	4.756E+08
-121.3239	277.8599	0.000				
1.365	0.3318	54613.	2544.7956	-0.0112	6560.1621	4.756E+08
-123.4662	290.2271	0.000				
1.430	0.3231	56560.	2447.6752	-0.0111	6794.0855	4.756E+08
-125.5605	303.0831	0.000				
1.495	0.3145	58431.	2348.9402	-0.0110	7018.8326	4.756E+08
-127.6060	316.4555	0.000				
1.560	0.3060	60224.	2248.6291	-0.0109	7234.2539	4.756E+08
-129.6019	330.3736	0.000				
1.625	0.2975	61939.	2146.7809	-0.0108	7440.2037	4.756E+08
-131.5473	344.8691	0.000				
1.690	0.2891	63573.	2043.4353	-0.0107	7636.5397	4.756E+08
-133.4414	359.9759	0.000				
1.755	0.2808	65127.	1938.6327	-0.0106	7823.1236	4.756E+08
-135.2832	375.7307	0.000				
1.820	0.2726	66597.	1832.4143	-0.0105	7999.8206	4.756E+08
-137.0718	392.1730	0.000				
1.885	0.2645	67985.	1724.8219	-0.0104	8166.5001	4.756E+08
-138.8062	409.3454	0.000				
1.950	0.2564	69288.	1615.8982	-0.0103	8323.0354	4.756E+08
-140.4853	427.2941	0.000				
2.015	0.2485	70506.	1505.6868	-0.0101	8469.3037	4.756E+08
-142.1080	446.0693	0.000				
2.080	0.2406	71637.	1394.2322	-0.0100	8605.1864	4.756E+08
-143.6732	465.7256	0.000				
2.145	0.2329	72681.	1281.5795	-0.009908	8730.5692	4.756E+08
-145.1798	486.3221	0.000				
2.210	0.2252	73636.	1167.7752	-0.009788	8845.3419	4.756E+08
-146.6263	507.9239	0.000				
2.275	0.2176	74503.	1052.8664	-0.009666	8949.3989	4.756E+08
-148.0115	530.6018	0.000				
2.340	0.2101	75279.	936.9018	-0.009544	9042.6388	4.756E+08
-149.3338	554.4335	0.000				
2.405	0.2027	75964.	819.9308	-0.009420	9124.9651	4.756E+08
-150.5918	579.5046	0.000				
2.470	0.1954	76558.	702.0043	-0.009294	9196.2858	4.756E+08
-151.7839	605.9096	0.000				
2.535	0.1882	77059.	583.1744	-0.009169	9256.5139	4.756E+08

-152.9081	633.7526	0.000				
2.600	0.1811	77468.	463.4948	-0.009042	9305.5670	4.756E+08
-153.9626	663.1496	0.000				
2.665	0.1741	77782.	343.0206	-0.008914	9343.3683	4.756E+08
-154.9454	694.2293	0.000				
2.730	0.1672	78003.	221.8088	-0.008787	9369.8457	4.756E+08
-155.8542	727.1358	0.000				
2.795	0.1604	78128.	99.9179	-0.008659	9384.9331	4.756E+08
-156.6865	762.0305	0.000				
2.860	0.1537	78159.	-22.5912	-0.008531	9388.5694	4.756E+08
-157.4396	799.0950	0.000				
2.925	0.1471	78093.	-145.6559	-0.008402	9380.6997	4.756E+08
-158.1107	838.5346	0.000				
2.990	0.1406	77931.	-269.2107	-0.008274	9361.2749	4.756E+08
-158.6965	880.5827	0.000				
3.055	0.1342	77673.	-393.1878	-0.008147	9330.2522	4.756E+08
-159.1934	925.5051	0.000				
3.120	0.1279	77318.	-517.5162	-0.008020	9287.5953	4.756E+08
-159.5975	973.6072	0.000				
3.185	0.1217	76866.	-642.1219	-0.007893	9233.2747	4.756E+08
-159.9043	1025.2410	0.000				
3.250	0.1155	76316.	-766.9270	-0.007768	9167.2680	4.756E+08
-160.1089	1080.8148	0.000				
3.315	0.1095	75669.	-891.8497	-0.007643	9089.5601	4.756E+08
-160.2057	1140.8057	0.000				
3.380	0.1036	74925.	-1016.8034	-0.007520	9000.1440	4.756E+08
-160.1884	1205.7750	0.000				
3.445	0.0978	74083.	-1141.6963	-0.007397	8899.0211	4.756E+08
-160.0499	1276.3880	0.000				
3.510	0.0921	73144.	-1266.4307	-0.007277	8786.2013	4.756E+08
-159.7819	1353.4403	0.000				
3.575	0.0865	72108.	-1390.9019	-0.007158	8661.7043	4.756E+08
-159.3751	1437.8920	0.000				
3.640	0.0809	70974.	-1514.9974	-0.007040	8525.5598	4.756E+08
-158.8185	1530.9138	0.000				
3.705	0.0755	69744.	-1638.5953	-0.006925	8377.8086	4.756E+08
-158.0992	1633.9499	0.000				
3.770	0.0701	68418.	-1761.5629	-0.006812	8218.5031	4.756E+08
-157.2022	1748.8048	0.000				
3.835	0.0648	66996.	-1883.7545	-0.006701	8047.7089	4.756E+08
-156.1095	1877.7658	0.000				
3.900	0.0597	65479.	-2005.0090	-0.006592	7865.5059	4.756E+08
-154.7994	2023.7810	0.000				
3.965	0.0546	63868.	-2125.1464	-0.006486	7671.9898	4.756E+08
-153.2453	2190.7217	0.000				
4.030	0.0495	62164.	-2243.9637	-0.006382	7467.2742	4.756E+08
-151.4145	2383.7844	0.000				
4.095	0.0446	60368.	-2361.2289	-0.006282	7251.4928	4.756E+08
-149.2653	2610.1254	0.000				

```
     4.160     0.0397     58481. -2476.6726  -0.006185  7024.8029  4.756E+08
-146.7443  2879.9058      0.000
     4.225     0.0350     56504. -2589.9772  -0.006090  6787.3886  4.756E+08
-143.7803  3208.0961      0.000
     4.290     0.0302     54440. -2700.3605  -0.005999  6539.4665  4.756E+08
-139.2539  3591.4233      0.000
     4.355     0.0256     52292. -2806.7613  -0.005912  6281.3674  4.756E+08
-133.5687  4069.8108      0.000
     4.420     0.0210     50062. -2908.4413  -0.005828  6013.5068  4.756E+08
-127.1492  4717.8762      0.000
     4.485     0.0165     47754. -3004.7099  -0.005748  5736.3538  4.756E+08
-119.6932  5655.5789      0.000
     4.550     0.0121     45374. -3094.5426  -0.005671  5450.4534  4.756E+08
-110.6471  7159.1720      0.000
     4.615   0.007661     42927. -3176.2229  -0.005599  5156.4667  4.756E+08
-98.7895     10059.      0.000
     4.680   0.003321     40419. -3246.0129  -0.005530  4855.2603  4.756E+08
-80.1594     18827.      0.000
     4.745  -0.000967     37863. -3254.3080  -0.005466  4548.1956  4.756E+08
58.8902     47502.      0.000
     4.810  -0.005206     35343. -3196.3577  -0.005406  4245.4347  4.756E+08
89.7002     13438.      0.000
     4.875  -0.009401     32877. -3120.8229  -0.005350  3949.2293  4.756E+08
103.9788  8627.3273      0.000
     4.940    -0.0136     30474. -3035.8360  -0.005298  3660.6229  4.756E+08
113.9362  6557.2416      0.000
     5.005    -0.0177     28141. -2943.9217  -0.005250  3380.3433  4.756E+08
121.7414  5375.1304      0.000
     5.070    -0.0217     25882. -2846.4335  -0.005206  3108.9607  4.756E+08
128.2284  4599.9158      0.000
     5.135    -0.0258     23700. -2744.2365  -0.005165  2846.9494  4.756E+08
133.8150  4047.5112      0.000
     5.200    -0.0298     21601. -2637.9389  -0.005128  2594.7176  4.756E+08
138.7430  3631.3528      0.000
     5.265    -0.0338     19585. -2527.9943  -0.005094  2352.6254  4.756E+08
143.1664  3305.0499      0.000
     5.330    -0.0377     17657. -2414.7554  -0.005064  2120.9961  4.756E+08
147.1896  3041.3696      0.000
     5.395    -0.0417     15818. -2298.5055  -0.005036  1900.1238  4.756E+08
150.8872  2823.2107      0.000
     5.460    -0.0456     14071. -2179.4769  -0.005012  1690.2786  4.756E+08
154.3142  2639.2613      0.000
     5.525    -0.0495     12418. -2057.8644  -0.004990  1491.7111  4.756E+08
157.5127  2481.7224      0.000
     5.590    -0.0534     10861. -1933.8333  -0.004971  1304.6549  4.756E+08
160.5155  2345.0332      0.000
     5.655    -0.0573  9401.5254 -1807.5262  -0.004955  1129.3296  4.756E+08
163.3488  2225.1154      0.000
     5.720    -0.0611  8041.3457 -1679.0671  -0.004940   965.9421  4.756E+08
```

```
166.0336  2118.9067      0.000
     5.785    -0.0650  6782.1807 -1548.5648  -0.004928   814.6888  4.756E+08
168.5876  2024.0602      0.000
     5.850    -0.0688  5625.5845 -1416.1159  -0.004918   675.7562  4.756E+08
171.0250  1938.7459      0.000
     5.915    -0.0726  4573.0399 -1281.8064  -0.004910   549.3225  4.756E+08
173.3583  1861.5146      0.000
     5.980    -0.0765  3625.9665 -1145.7137  -0.004903   435.5582  4.756E+08
175.5975  1791.2031      0.000
     6.045    -0.0803  2785.7266 -1007.9075  -0.004898   334.6269  4.756E+08
177.7517  1726.8663      0.000
     6.110    -0.0841  2053.6308  -868.4512  -0.004894   246.6861  4.756E+08
179.8284  1667.7282      0.000
     6.175    -0.0879  1430.9427  -727.4029  -0.004891   171.8876  4.756E+08
181.8342  1613.1458      0.000
     6.240    -0.0917   918.8824  -584.8154  -0.004889   110.3779  4.756E+08
183.7747  1562.5808      0.000
     6.305    -0.0955   518.6307  -440.7377  -0.004888    62.2989  4.756E+08
185.6552  1515.5799      0.000
     6.370    -0.0994   231.3315  -295.2151  -0.004887    27.7880  4.756E+08
187.4798  1471.7580      0.000
     6.435    -0.1032    58.0951  -148.2895  -0.004887     6.9785  4.756E+08
189.2526  1430.7860      0.000
     6.500    -0.1070      0.000      0.000  -0.004887      0.000  4.756E+08
190.9768   696.1905      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.5257308 inches
Computed slope at pile head      =     -0.0121770 radians
Maximum bending moment           =         78159. inch-lbs
Maximum shear force              =   3680.0000000 lbs
Depth of maximum bending moment  =      2.8600000 feet below pile head
Depth of maximum shear force     =      0.4550000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

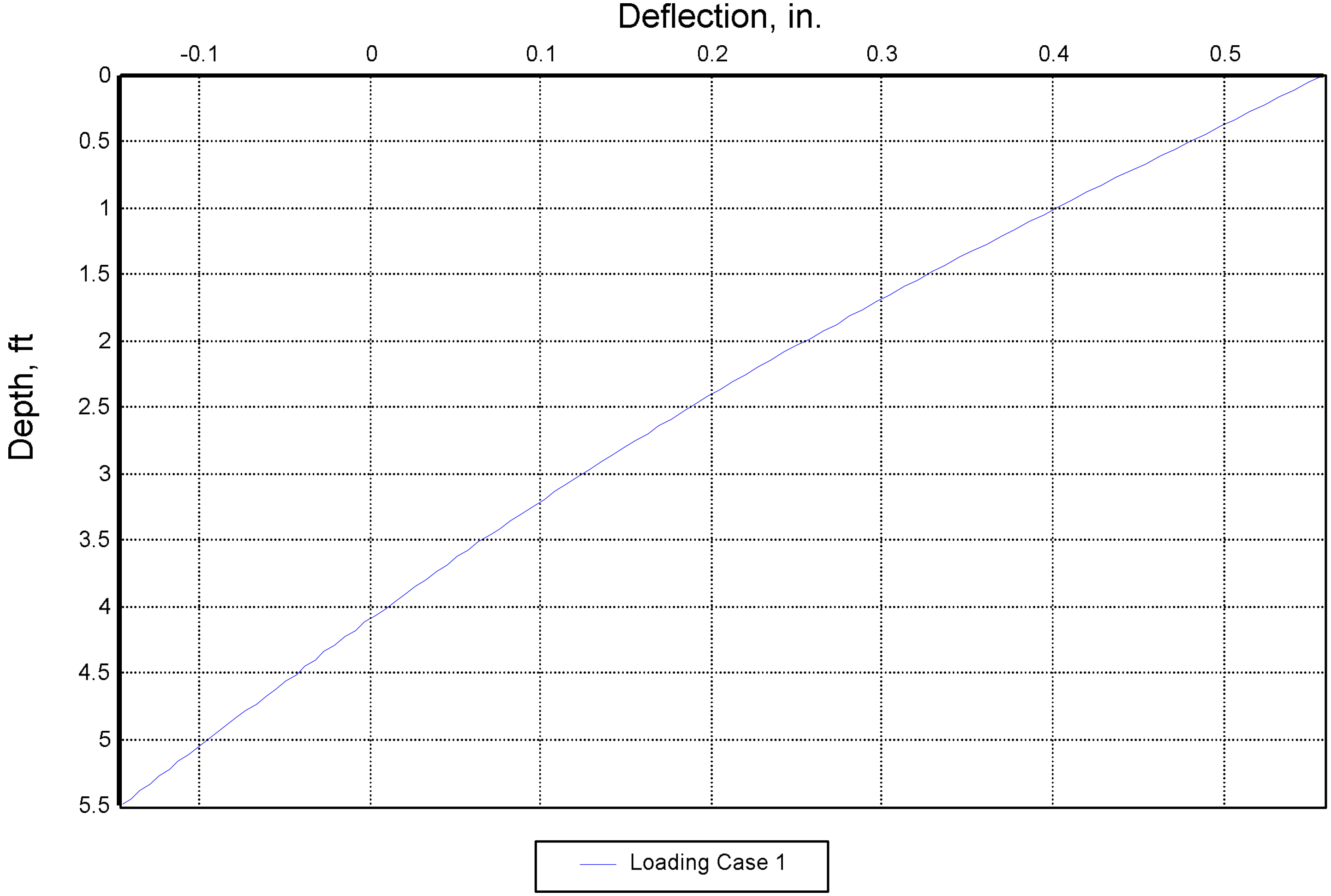
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 3680.0000	M = 0.000	0.0000000	0.52573079	78159.	3680.0000	-0.01217704

The analysis ended normally.

TP-9

Lateral Deflection vs. Depth



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LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

===

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-9.lp7d
Name of output report file: TP-9.lp7o
Name of plot output file: TP-9.lp7p
Name of runtime messeage file: TP-9.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 16:28:55

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	1590.00000 psf
Undrained cohesion at bottom of layer	=	1590.00000 psf
Epsilon-50 at top of layer	=	0.00700
Epsilon-50 at bottom of layer	=	0.00700

(Depth of lowest soil layer extends 1.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	1590.000	0.00700
		7.000	115.000	1590.000	0.00700

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load         Condition              Condition           Axial Thrust
     Compute
 No.    Type             1                       2                Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   -----------------------   ----------------
---------------------
   1     1     V =   3120.00000 lbs   M =       0.0000 in-lbs         0.0000000
       No
```

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5378	-1.091E-06	3120.0000	-0.0128	1.310E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.5293	2059.2000	3120.0000	-0.0128	247.3551	4.756E+08	0.000	0.000	0.000
0.110	0.5209	4118.4000	3120.0000	-0.0128	494.7102	4.756E+08	0.000	0.000	0.000
0.165	0.5124	6177.6000	3120.0000	-0.0128	742.0654	4.756E+08	0.000	0.000	0.000
0.220	0.5040	8236.8000	3120.0000	-0.0128	989.4205	4.756E+08	0.000	0.000	0.000
0.275	0.4955	10296.	3120.0000	-0.0128	1236.7756	4.756E+08	0.000	0.000	0.000
0.330	0.4871	12355.	3120.0000	-0.0128	1484.1307	4.756E+08	0.000	0.000	0.000
0.385	0.4787	14414.	3120.0000	-0.0128	1731.4859	4.756E+08	0.000	0.000	0.000
0.440	0.4702	16474.	3120.0000	-0.0127	1978.8410	4.756E+08	0.000	0.000	0.000
0.495	0.4618	18533.	3120.0000	-0.0127	2226.1961	4.756E+08	0.000	0.000	0.000
0.550	0.4535	20592.	3086.7565	-0.0127	2473.5512	4.756E+08	-100.7378	146.6197	0.000
0.605	0.4451	22607.	3019.4812	-0.0127	2715.6352	4.756E+08	-103.1266	152.9164	0.000
0.660	0.4368	24578.	2950.6401	-0.0126	2952.3231	4.756E+08	-105.4830	159.3977	0.000
0.715	0.4284	26502.	2880.2546	-0.0126	3183.4916	4.756E+08	-107.8064	166.0719	0.000
0.770	0.4201	28380.	2808.3467	-0.0125	3409.0191	4.756E+08	-110.0963	172.9477	0.000

0.825	0.4119	30209.	2734.9387	-0.0125	3628.7858	4.756E+08
-112.3521	180.0346	0.000				
0.880	0.4036	31990.	2660.0533	-0.0125	3842.6736	4.756E+08
-114.5733	187.3424	0.000				
0.935	0.3954	33720.	2583.7136	-0.0124	4050.5664	4.756E+08
-116.7592	194.8815	0.000				
0.990	0.3872	35400.	2505.9430	-0.0124	4252.3498	4.756E+08
-118.9093	202.6630	0.000				
1.045	0.3791	37028.	2426.7654	-0.0123	4447.9112	4.756E+08
-121.0228	210.6989	0.000				
1.100	0.3710	38604.	2346.2051	-0.0123	4637.1401	4.756E+08
-123.0992	219.0017	0.000				
1.155	0.3629	40125.	2264.2869	-0.0122	4819.9278	4.756E+08
-125.1378	227.5847	0.000				
1.210	0.3549	41592.	2181.0360	-0.0122	4996.1676	4.756E+08
-127.1377	236.4625	0.000				
1.265	0.3469	43004.	2096.4780	-0.0121	5165.7550	4.756E+08
-129.0984	245.6502	0.000				
1.320	0.3389	44360.	2010.6393	-0.0120	5328.5872	4.756E+08
-131.0191	255.1644	0.000				
1.375	0.3310	45658.	1923.5464	-0.0120	5484.5639	4.756E+08
-132.8988	265.0225	0.000				
1.430	0.3231	46899.	1835.2266	-0.0119	5633.5866	4.756E+08
-134.7369	275.2434	0.000				
1.485	0.3152	48081.	1745.7077	-0.0118	5775.5592	4.756E+08
-136.5324	285.8475	0.000				
1.540	0.3074	49203.	1655.0181	-0.0118	5910.3877	4.756E+08
-138.2845	296.8567	0.000				
1.595	0.2997	50265.	1563.1868	-0.0117	6037.9805	4.756E+08
-139.9921	308.2944	0.000				
1.650	0.2920	51267.	1470.2435	-0.0116	6158.2482	4.756E+08
-141.6543	320.1862	0.000				
1.705	0.2843	52206.	1376.2185	-0.0116	6271.1037	4.756E+08
-143.2700	332.5597	0.000				
1.760	0.2767	53083.	1281.1429	-0.0115	6376.4627	4.756E+08
-144.8380	345.4448	0.000				
1.815	0.2692	53897.	1185.0484	-0.0114	6474.2430	4.756E+08
-146.3573	358.8740	0.000				
1.870	0.2617	54648.	1087.9678	-0.0113	6564.3651	4.756E+08
-147.8265	372.8829	0.000				
1.925	0.2542	55333.	989.9345	-0.0113	6646.7522	4.756E+08
-149.2442	387.5100	0.000				
1.980	0.2468	55954.	890.9829	-0.0112	6721.3301	4.756E+08
-150.6091	402.7978	0.000				
2.035	0.2394	56509.	791.1484	-0.0111	6788.0274	4.756E+08
-151.9197	418.7927	0.000				
2.090	0.2321	56999.	690.4674	-0.0110	6846.7754	4.756E+08
-153.1742	435.5457	0.000				
2.145	0.2249	57421.	588.9775	-0.0110	6897.5085	4.756E+08

-154.3710	453.1132	0.000				
2.200	0.2177	57776.	486.7173	-0.0109	6940.1642	4.756E+08
-155.5082	471.5576	0.000				
2.255	0.2105	58063.	383.7270	-0.0108	6974.6829	4.756E+08
-156.5838	490.9477	0.000				
2.310	0.2034	58283.	280.0478	-0.0107	7001.0083	4.756E+08
-157.5955	511.3606	0.000				
2.365	0.1964	58433.	175.7228	-0.0106	7019.0876	4.756E+08
-158.5410	532.8820	0.000				
2.420	0.1894	58514.	70.7964	-0.0106	7028.8711	4.756E+08
-159.4177	555.6080	0.000				
2.475	0.1824	58526.	-34.6850	-0.0105	7030.3131	4.756E+08
-160.2229	579.6468	0.000				
2.530	0.1756	58469.	-140.6732	-0.0104	7023.3714	4.756E+08
-160.9534	605.1204	0.000				
2.585	0.1687	58341.	-247.1178	-0.0103	7008.0078	4.756E+08
-161.6060	632.1671	0.000				
2.640	0.1619	58142.	-353.9661	-0.0102	6984.1882	4.756E+08
-162.1768	660.9447	0.000				
2.695	0.1552	57874.	-461.1629	-0.0101	6951.8826	4.756E+08
-162.6619	691.6336	0.000				
2.750	0.1486	57534.	-568.6500	-0.0101	6911.0658	4.756E+08
-163.0568	724.4414	0.000				
2.805	0.1419	57123.	-676.3664	-0.009986	6861.7169	4.756E+08
-163.3563	759.6084	0.000				
2.860	0.1354	56641.	-784.2471	-0.009907	6803.8205	4.756E+08
-163.5550	797.4145	0.000				
2.915	0.1289	56088.	-892.2236	-0.009829	6737.3659	4.756E+08
-163.6465	838.1874	0.000				
2.970	0.1224	55463.	-1000.2228	-0.009752	6662.3486	4.756E+08
-163.6238	882.3145	0.000				
3.025	0.1160	54767.	-1108.1666	-0.009675	6578.7696	4.756E+08
-163.4787	930.2564	0.000				
3.080	0.1096	54000.	-1215.9712	-0.009600	6486.6366	4.756E+08
-163.2020	982.5660	0.000				
3.135	0.1033	53162.	-1323.5464	-0.009525	6385.9641	4.756E+08
-162.7833	1039.9135	0.000				
3.190	0.0971	52253.	-1430.7943	-0.009452	6276.7738	4.756E+08
-162.2102	1103.1195	0.000				
3.245	0.0908	51274.	-1537.6083	-0.009380	6159.0959	4.756E+08
-161.4686	1173.2010	0.000				
3.300	0.0847	50224.	-1643.8716	-0.009310	6032.9692	4.756E+08
-160.5415	1251.4351	0.000				
3.355	0.0785	49104.	-1749.4552	-0.009241	5898.4420	4.756E+08
-159.4088	1339.4498	0.000				
3.410	0.0725	47914.	-1854.2154	-0.009174	5755.5738	4.756E+08
-158.0465	1439.3561	0.000				
3.465	0.0664	46656.	-1957.9910	-0.009108	5604.4358	4.756E+08
-156.4249	1553.9454	0.000				

```
     3.520     0.0604     45330. -2060.5986  -0.009044  5445.1129  4.756E+08
-154.5071  1686.9948      0.000
     3.575     0.0545     43936. -2161.8273  -0.008982  5277.7053  4.756E+08
-152.2467  1843.7547      0.000
     3.630     0.0486     42476. -2261.4312  -0.008922  5102.3314  4.756E+08
-149.5831  2031.7625      0.000
     3.685     0.0427     40951. -2359.1173  -0.008865  4919.1306  4.756E+08
-146.4355  2262.2747      0.000
     3.740     0.0369     39362. -2454.5295  -0.008809  4728.2675  4.756E+08
-142.6923  2552.9484      0.000
     3.795     0.0311     37711. -2547.2213  -0.008755  4529.9380  4.756E+08
-138.1919  2933.2885      0.000
     3.850     0.0253     36000. -2636.6109  -0.008704  4324.3776  4.756E+08
-132.6857  3456.9439      0.000
     3.905     0.0196     34231. -2721.8972  -0.008656  4111.8744  4.756E+08
-125.7575  4233.8180      0.000
     3.960     0.0139     32407. -2801.8799  -0.008609  3892.7909  4.756E+08
-116.6143  5534.2594      0.000
     4.015   0.008240     30532. -2874.4728  -0.008566  3667.6056  4.756E+08
-103.3642  8279.3672      0.000
     4.070   0.002600     28613. -2934.4095  -0.008525  3437.0117  4.756E+08
-78.2622     19863.      0.000
     4.125  -0.003013     26659. -2933.1703  -0.008486  3202.3228  4.756E+08
82.0172     17968.      0.000
     4.180  -0.008601     24741. -2870.5714  -0.008451  2971.9254  4.756E+08
107.6764  8262.2778      0.000
     4.235    -0.0142     22870. -2794.3856  -0.008418  2747.1621  4.756E+08
123.1898  5738.9199      0.000
     4.290    -0.0197     21052. -2709.3737  -0.008387  2528.8449  4.756E+08
134.4221  4500.6400      0.000
     4.345    -0.0252     19293. -2617.8283  -0.008359  2317.5612  4.756E+08
142.9881  3739.2532      0.000
     4.400    -0.0307     17597. -2521.0690  -0.008333  2113.7594  4.756E+08
150.2220  3224.6572      0.000
     4.455    -0.0362     15966. -2419.8432  -0.008310  1917.8181  4.756E+08
156.5226  2850.7043      0.000
     4.510    -0.0417     14403. -2314.6883  -0.008289  1730.0667  4.756E+08
162.1287  2565.0949      0.000
     4.565    -0.0472     12910. -2206.0113  -0.008270  1550.7988  4.756E+08
167.1954  2338.8928      0.000
     4.620    -0.0526     11491. -2094.1331  -0.008253  1380.2794  4.756E+08
171.8296  2154.7106      0.000
     4.675    -0.0581     10146. -1979.3135  -0.008238  1218.7510  4.756E+08
176.1086  2001.4329      0.000
     4.730    -0.0635  8877.9573 -1861.7680  -0.008225  1066.4376  4.756E+08
180.0900  1871.6019      0.000
     4.785    -0.0689  7688.4140 -1741.6782  -0.008214   923.5473  4.756E+08
183.8182  1760.0159      0.000
     4.840    -0.0743  6578.9420 -1619.2000  -0.008204   790.2754  4.756E+08
```

```
187.3280  1662.9297      0.000
     4.895    -0.0798  5551.0701 -1494.4681  -0.008195   666.8054  4.756E+08
190.6474  1577.5741      0.000
     4.950    -0.0852  4606.2442 -1367.6008  -0.008188   553.3110  4.756E+08
193.7990  1501.8544      0.000
     5.005    -0.0906  3745.8371 -1238.7026  -0.008182   449.9573  4.756E+08
196.8016  1434.1556      0.000
     5.060    -0.0960  2971.1567 -1107.8666  -0.008178   356.9011  4.756E+08
199.6710  1373.2109      0.000
     5.115    -0.1014  2283.4531  -975.1765  -0.008174   274.2928  4.756E+08
202.4204  1318.0120      0.000
     5.170    -0.1068  1683.9238  -840.7076  -0.008171   202.2762  4.756E+08
205.0611  1267.7458      0.000
     5.225    -0.1121  1173.7191  -704.5285  -0.008169   140.9894  4.756E+08
207.6028  1221.7492      0.000
     5.280    -0.1175   753.9461  -566.7017  -0.008168    90.5655  4.756E+08
210.0540  1179.4751      0.000
     5.335    -0.1229   425.6728  -427.2846  -0.008167    51.1326  4.756E+08
212.4220  1140.4685      0.000
     5.390    -0.1283   189.9304  -286.3300  -0.008167    22.8148  4.756E+08
214.7132  1104.3474      0.000
     5.445    -0.1337    47.7172  -143.8867  -0.008167     5.7319  4.756E+08
216.9332  1070.7886      0.000
     5.500    -0.1391      0.000      0.000  -0.008167      0.000  4.756E+08
219.0871   519.7585      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.5378151 inches
Computed slope at pile head      =     -0.0128274 radians
Maximum bending moment           =         58526. inch-lbs
Maximum shear force              =   3120.0000020 lbs
Depth of maximum bending moment  =      2.4750000 feet below pile head
Depth of maximum shear force     =      0.0550000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
```

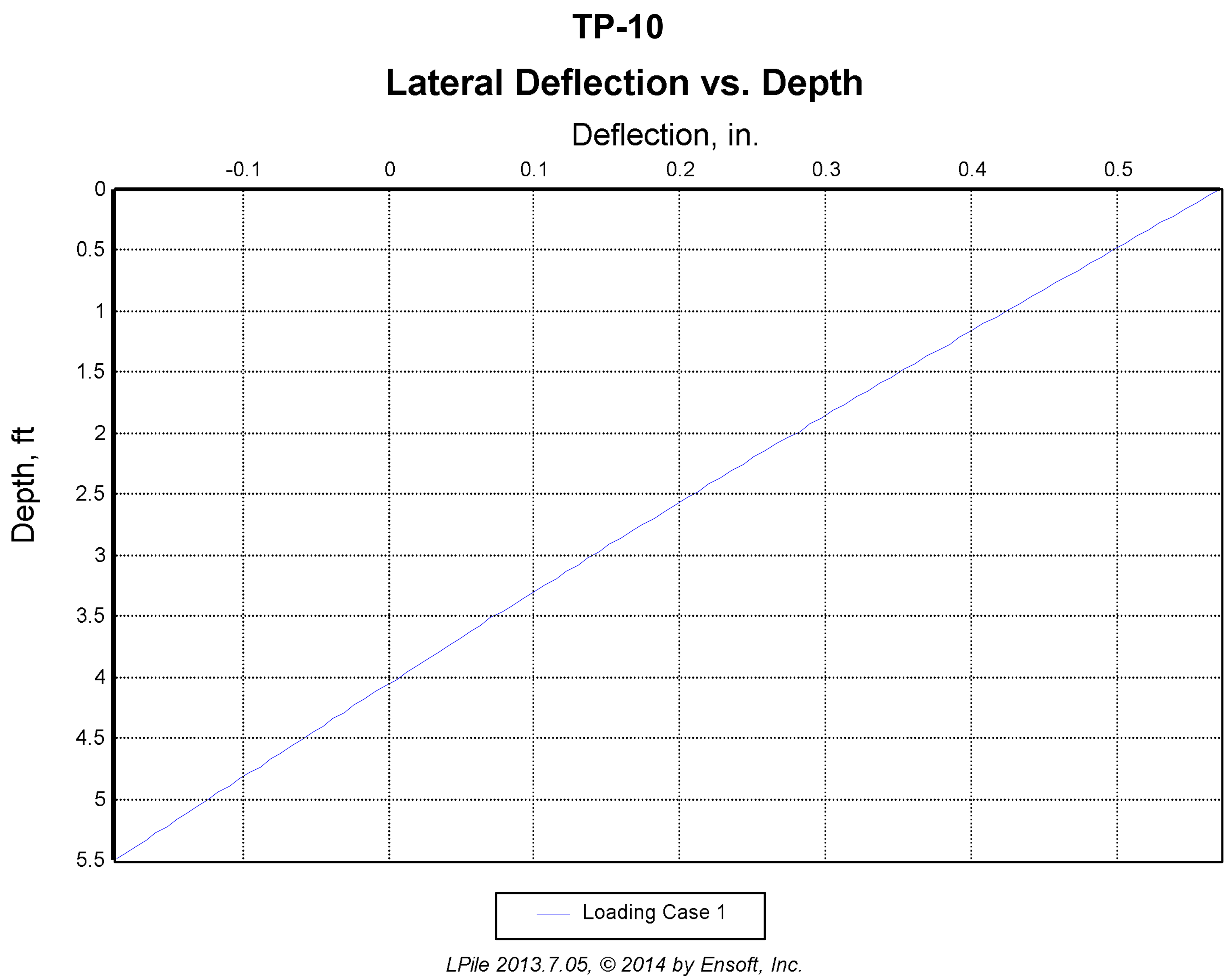
Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```
               Pile-head      Pile-head                                      Maximum
       Maximum
Load  Load    Condition 1    Condition 2        Axial       Pile-head       Moment
        Shear        Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
       in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
         lbs          radians
----  ----  -------------  -------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  3120.0000  M =      0.000      0.0000000     0.53781509
58526.      3120.0000    -0.01282740
```

The analysis ended normally.


TP-10
Lateral Deflection vs. Depth
Deflection, in.
-0.1
0
0.1
0.2
0.3
0.4
0.5
Depth, ft
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
Loading Case 1
LPile 2013.7.05, © 2014 by Ensoft, Inc.

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==

This copy of LPile is used by:

Terracon Inc.
Terracon Inc.

Serial Number of Security Device: 138584418
This copy of LPile is licensed for exclusive use by: Terracon, Global License,

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Files Used for Analysis

Path to file locations: N:\Projects\2015\60155057\Working Files\Pile Testing\LPILE\
Name of input data file: TP-10.lp7d
Name of output report file: TP-10.lp7o
Name of plot output file: TP-10.lp7p
Name of runtime messeage file: TP-10.lp7r

Date and Time of Analysis

Date: August 7, 2015 Time: 15:50:44

Problem Title

Project Name: Little Bear Solar Project

Job Number: 60155057

Client: First Solar, Inc.

Engineer: JRM

Description: W6x9

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
- Cyclic loading specified
- Number of cycles of loading = 4613937818241073152

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 5.50 ft

Depth of ground surface below top of pile = 0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	3.9400000
2	5.500000	3.9400000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	5.50000 ft
Flange Width	=	3.94000 in
Section Depth	=	5.90000 in
Flange Thickness	=	0.21500 in
Web Thickness	=	0.17000 in
Section Area	=	2.68000 Sq. in
Moment of Inertia	=	16.40000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.50000 ft
Distance from top of pile to bottom of layer	=	7.00000 ft
Effective unit weight at top of layer	=	115.00000 pcf
Effective unit weight at bottom of layer	=	115.00000 pcf
Undrained cohesion at top of layer	=	560.00000 psf
Undrained cohesion at bottom of layer	=	560.00000 psf
Epsilon-50 at top of layer	=	0.01000
Epsilon-50 at bottom of layer	=	0.01000

(Depth of lowest soil layer extends 1.50 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Stiff Clay w/o Free Water	0.500	115.000	560.000	0.01000
		7.000	115.000	560.000	0.01000

Loading Type

Cyclic loading criteria were used for computation of p-y curves for all analyses.

Number of cycles of loading = 3

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 1060.00000 lbs	M = 0.0000 in-lbs	0.0000000	No

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1060.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5471	-2.182E-06	1060.0000	-0.0118	2.621E-07	4.756E+08	0.000	0.000	0.000
0.05500	0.5393	699.6000	1060.0000	-0.0118	84.0373	4.756E+08	0.000	0.000	0.000
0.110	0.5315	1399.2000	1060.0000	-0.0118	168.0746	4.756E+08	0.000	0.000	0.000
0.165	0.5237	2098.8000	1060.0000	-0.0118	252.1120	4.756E+08	0.000	0.000	0.000
0.220	0.5159	2798.4000	1060.0000	-0.0118	336.1493	4.756E+08	0.000	0.000	0.000
0.275	0.5081	3498.0000	1060.0000	-0.0118	420.1866	4.756E+08	0.000	0.000	0.000
0.330	0.5003	4197.6000	1060.0000	-0.0118	504.2239	4.756E+08	0.000	0.000	0.000
0.385	0.4925	4897.2000	1060.0000	-0.0118	588.2612	4.756E+08	0.000	0.000	0.000
0.440	0.4847	5596.8000	1060.0000	-0.0118	672.2985	4.756E+08	0.000	0.000	0.000
0.495	0.4770	6296.4000	1060.0000	-0.0118	756.3359	4.756E+08	0.000	0.000	0.000
0.550	0.4692	6996.0000	1049.1755	-0.0118	840.3732	4.756E+08	-32.8016	46.1414	0.000
0.605	0.4614	7681.3116	1027.2396	-0.0118	922.6941	4.756E+08	-33.6709	48.1619	0.000
0.660	0.4537	8351.9563	1004.7333	-0.0118	1003.2533	4.756E+08	-34.5300	50.2361	0.000
0.715	0.4459	9007.5596	981.6634	-0.0117	1082.0056	4.756E+08	-35.3789	52.3664	0.000
0.770	0.4381	9647.7519	958.0367	-0.0117	1158.9068	4.756E+08	-36.2172	54.5552	0.000

0.825	0.4304	10272.	933.8602	-0.0117	1233.9129	4.756E+08
-37.0448	56.8053	0.000				
0.880	0.4227	10880.	909.1411	-0.0117	1306.9806	4.756E+08
-37.8616	59.1193	0.000				
0.935	0.4150	11472.	883.8866	-0.0117	1378.0672	4.756E+08
-38.6671	61.5004	0.000				
0.990	0.4073	12047.	858.1042	-0.0117	1447.1305	4.756E+08
-39.4613	63.9517	0.000				
1.045	0.3996	12605.	831.8015	-0.0117	1514.1290	4.756E+08
-40.2439	66.4765	0.000				
1.100	0.3919	13145.	804.9862	-0.0116	1579.0217	4.756E+08
-41.0146	69.0786	0.000				
1.155	0.3842	13668.	777.6662	-0.0116	1641.7684	4.756E+08
-41.7733	71.7618	0.000				
1.210	0.3765	14172.	749.8495	-0.0116	1702.3292	4.756E+08
-42.5196	74.5301	0.000				
1.265	0.3689	14657.	721.5445	-0.0116	1760.6653	4.756E+08
-43.2532	77.3882	0.000				
1.320	0.3612	15124.	692.7596	-0.0116	1816.7380	4.756E+08
-43.9738	80.3406	0.000				
1.375	0.3536	15572.	663.5034	-0.0115	1870.5099	4.756E+08
-44.6813	83.3925	0.000				
1.430	0.3460	16000.	633.7848	-0.0115	1921.9438	4.756E+08
-45.3751	86.5495	0.000				
1.485	0.3384	16408.	603.6128	-0.0115	1971.0034	4.756E+08
-46.0551	89.8173	0.000				
1.540	0.3308	16797.	572.9968	-0.0115	2017.6532	4.756E+08
-46.7208	93.2025	0.000				
1.595	0.3233	17165.	541.9462	-0.0114	2061.8584	4.756E+08
-47.3718	96.7119	0.000				
1.650	0.3157	17512.	510.4709	-0.0114	2103.5848	4.756E+08
-48.0079	100.3530	0.000				
1.705	0.3082	17839.	478.5810	-0.0114	2142.7991	4.756E+08
-48.6284	104.1340	0.000				
1.760	0.3007	18144.	446.2867	-0.0114	2179.4690	4.756E+08
-49.2331	108.0635	0.000				
1.815	0.2932	18428.	413.5987	-0.0113	2213.5628	4.756E+08
-49.8215	112.1514	0.000				
1.870	0.2857	18690.	380.5279	-0.0113	2245.0496	4.756E+08
-50.3929	116.4080	0.000				
1.925	0.2782	18930.	347.0857	-0.0113	2273.8997	4.756E+08
-50.9470	120.8448	0.000				
1.980	0.2708	19148.	313.2837	-0.0113	2300.0839	4.756E+08
-51.4832	125.4745	0.000				
2.035	0.2634	19343.	279.1340	-0.0112	2323.5742	4.756E+08
-52.0008	130.3108	0.000				
2.090	0.2560	19516.	244.6490	-0.0112	2344.3436	4.756E+08
-52.4992	135.3690	0.000				
2.145	0.2486	19666.	209.8416	-0.0112	2362.3660	4.756E+08

-52.9778	140.6659	0.000				
2.200	0.2412	19793.	174.7251	-0.0112	2377.6163	4.756E+08
-53.4357	146.2203	0.000				
2.255	0.2338	19897.	139.3135	-0.0111	2390.0706	4.756E+08
-53.8723	152.0529	0.000				
2.310	0.2265	19977.	103.6210	-0.0111	2399.7060	4.756E+08
-54.2866	158.1868	0.000				
2.365	0.2192	20034.	67.6629	-0.0111	2406.5009	4.756E+08
-54.6776	164.6479	0.000				
2.420	0.2119	20067.	31.4545	-0.0111	2410.4347	4.756E+08
-55.0445	171.4653	0.000				
2.475	0.2046	20075.	-4.9876	-0.0110	2411.4883	4.756E+08
-55.3861	178.6717	0.000				
2.530	0.1973	20060.	-41.6464	-0.0110	2409.6439	4.756E+08
-55.7012	186.3042	0.000				
2.585	0.1901	20020.	-78.5039	-0.0110	2404.8848	4.756E+08
-55.9885	194.4050	0.000				
2.640	0.1829	19956.	-115.5415	-0.0109	2397.1962	4.756E+08
-56.2466	203.0221	0.000				
2.695	0.1756	19868.	-152.7392	-0.0109	2386.5645	4.756E+08
-56.4738	212.2107	0.000				
2.750	0.1684	19755.	-190.0762	-0.0109	2372.9777	4.756E+08
-56.6685	222.0345	0.000				
2.805	0.1613	19617.	-227.5303	-0.0109	2356.4258	4.756E+08
-56.8288	232.5673	0.000				
2.860	0.1541	19454.	-265.0781	-0.0108	2336.9003	4.756E+08
-56.9523	243.8954	0.000				
2.915	0.1470	19267.	-302.6945	-0.0108	2314.3948	4.756E+08
-57.0368	256.1203	0.000				
2.970	0.1399	19055.	-340.3529	-0.0108	2288.9048	4.756E+08
-57.0795	269.3619	0.000				
3.025	0.1328	18818.	-378.0246	-0.0107	2260.4281	4.756E+08
-57.0773	283.7635	0.000				
3.080	0.1257	18556.	-415.6789	-0.0107	2228.9648	4.756E+08
-57.0266	299.4980	0.000				
3.135	0.1186	18269.	-453.2823	-0.0107	2194.5176	4.756E+08
-56.9234	316.7753	0.000				
3.190	0.1115	17958.	-490.7989	-0.0107	2157.0919	4.756E+08
-56.7630	335.8539	0.000				
3.245	0.1045	17621.	-528.1888	-0.0106	2116.6961	4.756E+08
-56.5399	357.0554	0.000				
3.300	0.0975	17260.	-565.4087	-0.0106	2073.3418	4.756E+08
-56.2476	380.7861	0.000				
3.355	0.0905	16875.	-602.4103	-0.0106	2027.0443	4.756E+08
-55.8784	407.5669	0.000				
3.410	0.0835	16465.	-639.1398	-0.0106	1977.8230	4.756E+08
-55.4229	438.0780	0.000				
3.465	0.0765	16031.	-675.5363	-0.0106	1925.7017	4.756E+08
-54.8696	473.2260	0.000				

```
     3.520     0.0696     15573.  -711.5306    -0.0105  1870.7093  4.756E+08
-54.2041   514.2492      0.000
     3.575     0.0626     15092.  -747.0427    -0.0105  1812.8807  4.756E+08
-53.4082   562.8878      0.000
     3.630     0.0557     14587.  -781.9784    -0.0105  1752.2575  4.756E+08
-52.4578   621.6743      0.000
     3.685     0.0488     14060.  -816.2253    -0.0105  1688.8894  4.756E+08
-51.3206   694.4535      0.000
     3.740     0.0419     13510.  -849.6450    -0.0105  1622.8360  4.756E+08
-49.9512   787.3850      0.000
     3.795     0.0350     12938.  -882.0622    -0.0104  1554.1689  4.756E+08
-48.2829   911.0509      0.000
     3.850     0.0281     12346.  -913.2448    -0.0104  1482.9754  4.756E+08
-46.2098  1085.4426      0.000
     3.905     0.0212     11733.  -942.8649    -0.0104  1409.3639  4.756E+08
-43.5481  1353.9010      0.000
     3.960     0.0144     11101.  -970.4105    -0.0104  1333.4738  4.756E+08
-39.9235  1833.5587      0.000
     4.015   0.007523     10452.  -994.8172    -0.0104  1255.4947  4.756E+08
-34.0360  2986.1304      0.000
     4.070   0.000684  9787.8415 -1012.2171    -0.0104  1175.7346  4.756E+08
-18.6911     18028.      0.000
     4.125  -0.006145  9115.7073 -1007.7070    -0.0103  1094.9965  4.756E+08
32.3581  3475.3036      0.000
     4.180    -0.0130  8457.6683  -984.1592    -0.0103  1015.9516  4.756E+08
38.9988  1985.0919      0.000
     4.235    -0.0198  7816.6171  -956.9869    -0.0103   938.9473  4.756E+08
43.3413  1446.1988      0.000
     4.290    -0.0266  7194.4455  -927.2842    -0.0103   864.2108  4.756E+08
46.6670  1158.5207      0.000
     4.345    -0.0334  6592.6020  -895.5817    -0.0103   791.9162  4.756E+08
49.4011   976.6153      0.000
     4.400    -0.0402  6012.2776  -862.2044    -0.0103   722.2065  4.756E+08
51.7424   849.9470      0.000
     4.455    -0.0470  5454.4922  -827.3748    -0.0103   655.2042  4.756E+08
53.8016   756.0423      0.000
     4.510    -0.0538  4920.1428  -791.2568    -0.0103   591.0172  4.756E+08
55.6470   683.2923      0.000
     4.565    -0.0605  4410.0333  -753.9763    -0.0103   529.7418  4.756E+08
57.3241   625.0578      0.000
     4.620    -0.0673  3924.8941  -715.6339    -0.0103   471.4659  4.756E+08
58.8648   577.2504      0.000
     4.675    -0.0741  3465.3965  -676.3120    -0.0103   416.2702  4.756E+08
60.2926   537.2063      0.000
     4.730    -0.0808  3032.1623  -636.0792    -0.0103   364.2293  4.756E+08
61.6249   503.1109      0.000
     4.785    -0.0876  2625.7719  -594.9941    -0.0102   315.4128  4.756E+08
62.8755   473.6826      0.000
     4.840    -0.0944  2246.7701  -553.1070    -0.0102   269.8864  4.756E+08
```

```
64.0553   447.9892      0.000
     4.895    -0.1011  1895.6707  -510.4617    -0.0102   227.7117  4.756E+08
65.1729   425.3351      0.000
     4.950    -0.1079  1572.9607  -467.0969    -0.0102   188.9471  4.756E+08
66.2355   405.1902      0.000
     5.005    -0.1146  1279.1028  -423.0470    -0.0102   153.6483  4.756E+08
67.2491   387.1432      0.000
     5.060    -0.1214  1014.5387  -378.3426    -0.0102   121.8684  4.756E+08
68.2187   370.8694      0.000
     5.115    -0.1282   779.6907  -333.0114    -0.0102    93.6580  4.756E+08
69.1485   356.1091      0.000
     5.170    -0.1349   574.9637  -287.0784    -0.0102    69.0658  4.756E+08
70.0422   342.6519      0.000
     5.225    -0.1417   400.7471  -240.5666    -0.0102    48.1385  4.756E+08
70.9028   330.3253      0.000
     5.280    -0.1484   257.4158  -193.4967    -0.0102    30.9213  4.756E+08
71.7331   318.9867      0.000
     5.335    -0.1552   145.3314  -145.8881    -0.0102    17.4575  4.756E+08
72.5356   308.5168      0.000
     5.390    -0.1619    64.8435   -97.7583    -0.0102     7.7891  4.756E+08
73.3122   298.8154      0.000
     5.445    -0.1687    16.2904   -49.1239    -0.0102     1.9568  4.756E+08
74.0649   289.7973      0.000
     5.500    -0.1754      0.000      0.000    -0.0102      0.000  4.756E+08
74.7953   140.6948      0.000
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.5471434 inches
Computed slope at pile head       =     -0.0118274 radians
Maximum bending moment            =         20075. inch-lbs
Maximum shear force               =   1060.0000025 lbs
Depth of maximum bending moment   =      2.4750000 feet below pile head
Depth of maximum shear force      =      0.0550000 feet below pile head
Number of iterations              =             43
Number of zero deflection points =              1
```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 1060.0000	M = 0.000	0.0000000	0.54714343	20075.	1060.0000	-0.01182737

The analysis ended normally.

APPENDIX H
CALIBRATION CERTIFICATE

Certificate of Calibration 148270

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Force Measurement Products & Systems

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Product Information

Serial Number: DEDR2601550
Part Number: AWT05-506320
Description: EDJR-10T/25000 LB, W/SHACKLES
Calibration Date: 3Nov14
***Calibration In Service Date** 07/01/15
Calibrated By: Dave Wright
Notes: H05-03
Unit Condition: New

Capacity: 25,000.000 LB
Temperature/Humidity: 71.60 °F/36.50%
Guaranteed Accuracy:± 0.20 %of Capacity

Signature: David R. Wright
Authorized Dillon Representative

Calibration Data

Standard (units LB)	Tolerance Maximum	Tolerance Minimum	Final From Three Run Average (units LB)	Error (units LB)
5,000.000	5,050.000	4,950.000	5,000.000	0.00
10,000.000	10,050.000	9,950.000	10,000.000	0.00
15,000.000	15,050.000	14,950.000	15,000.000	0.00
20,000.000	20,050.000	19,950.000	20,000.000	0.00
25,000.000	25,050.000	24,950.000	25,000.000	0.00

*** After In Service Calibration Date, normal calibration cycle should begin**

Standards Used

Equipment Description: Instron-0175/50k(Manual
Equipment Serial Number: 0175A
Load Range: 50,000LB

Calibration Source: G583940J
Calibration Date: 08/12/13
Calibration Due Date: 02/12/15
Calibration Procedure: 36242-0010

Weigh-Tronix is an ISO 9001 Registered Company

The instruments used in the calibration of this equipment have been calibrated by certified standards traceable to the National Institute of Standards and Technology (N.I.S.T.). Calibration services were performed under a controlled Quality Assurance Program which complies to ISO-9001. These results relate only to the items calibrated or tested referenced in this document. This certificate shall not be reproduced except in full, without the written approval of Avery Weigh-Tronix. Avery Weigh-Tronix guarantees the product to be in calibration at the time of shipment. No degradation of calibration occurs before shipping while the product remains in our controlled stock environment.

APPENDIX I
CORROSION EVALUATION REPORT

	CORROSION RATE ANALYSIS LITTLE BEAR SOLAR PROJECT MENDOTA, CA	

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CORROSION RATE ANALYSIS
FOR THE
LITTLE BEAR SOLAR PROJECT
MENDOTA, CALIFORNIA

CORRPRO PROJECT NO. : 340161383

REV. 1

1	11/03/2015	Issued for Approval	E. van Roggen	S. Singh
0	07/31/2015	Issued for Approval	A. Johnson	S. Singh
REV	**DATE DD/MM/YY**	**REMARKS**	**PREPARED BY**	**REVIEWED BY**

Designation/Project	Corrosion Rate Analysis Little Bear Solar Project Mendota, CA

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Scope

Corrpro (*An Aegion Company*), a specialized company in cathodic protection, alternating current (AC) interference mitigation, coating inspection, electrical grounding and lightning protection systems is retained by Terracon Consultants, Inc. to perform a corrosion rate analysis for the Little Bear Solar Project in Mendota, California.

The scope of work includes the evaluation of soil resistivity data for the determination of test pile placement and testing in the field. The field work included testing, which was performed at the selected driven pile locations. Testing of soil chemistry, LPR, E-Log I, and galvanic data were performed to produce the corrosion rate analysis. The corrosion rate analysis includes a summary of all testing, data, analysis, and recommendations.

These corrosion rate calculations may be used to determine the suitability of the materials used for steel or galvanized piles which are to be installed at the solar power station.

1.2 Objective

The objective of this evaluation is to estimate the service life of the below grade portion of the galvanized steel piles due to site specific conditions, and to provide recommendations for ensuring the service life meets the 25 year design life criteria.

1.3 Site-Specific Description

The Little Bear project is located on a 300 acre site in Mendota, CA. Little Bear is located on the South side of California Avenue directly across from the North Star solar project, located on the North side of the road. A site plan map is located in the appendix.

The Little Bear project design is comprised of an estimated 10 arrays with 18 tracker tables and 44 columns. This equates to approximately 31,680 steel piles. The piles are driven to a depth between 5 and 6 feet. Corrpro tested both steel and galvanized piles driven to these depths. There are ten (10) inverter skids with a copper grounding grid. The details of the grid are included in the calculations and appendix.

View of terrain typical to Little Bear project in Mendota, California.

1.4 Site-Testing HSE

Corrpro made site visits in July, 2015 to conduct testing on pre-driven piles at designated locations. During field site testing, Corrpro health, safety, and environmental (HSE) procedures were followed which included the use of proper personal protective equipment (PPE), completion of daily job safety analysis (JSA), and disposal of any waste products off-site.

1.5 Equipment

Corrpro is an ISO9001 registered company and all equipment used for testing has been certified, calibrated, and kept in good working order. The equipment used for this project included generator, portable rectifier, digital multi-meters, LPR, Cu/CuSO4, Ag/AgCl, and Platinum reference cells, along with various test leads and wires.

2.0 REFERENCES

This report has been developed in accordance with the following applicable project documents, specifications and relevant standards:

[1] First Solar, LLC. (May 15, 2015). Little Bear Site Development Plan; BD-100-T

[2] Barboian, E. (2002). *NACE Corrosion Engineer's Reference Book.* (3rd Ed.). Houston, TX: NACE International.

[3] NACE International. (2004). *NACE CP 4 - Cathodic Protection Specialist Course Manual*. Houston, TX.

[4] NACE International. (2011). *NACE CP 3 - Cathodic Protection Technologist Course Manual.* Houston, TX.

[5] Peabody, A.W. (2001). *Peabody's Control of Pipeline Corrosion*. Houston, TX: NACE International.

[6] Federal Highway Administration. (2000). *Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes (FHWA-NHI-00-044).* Washington, DC.

[7] Substation Committee of the IEEE Power Engineering Society (January 2000). IEEE Guide for Safety in AC Substation Grounding, IEEE Std 80-2000, Page 65. The Institute of Electrical And Electronics Engineers, Inc. 3 Park Avenue, New York, NY 10016-5997, USA

[8] ANSI/NACE SP0502 (2010) Standard Practice Pipeline External Corrosion Direct Assessment Methodology

3.0 SOIL CORROSIVITY TESTING

3.1 Sulfate and Chloride Content Testing

The chemical content of soil may change due to the minerals in the soil itself, or those imported by human activity (i.e. landfill, irrigation, fertilizers, industrial wastes, and pollution). Chlorides and sulfates tend to prevent formation of protective types of corrosion products. Chlorides also contribute to pitting corrosion and lower soil resistivity. Chloride ions, when in sufficient concentration at the embedded metal depth and in presence of oxygen, can cause de-passivation of metal embedded in concrete or mortar.

Sulfates also contribute to lowering the soil resistivity and deterioration of buried concrete (commonly referred to as sulfate attack) when in excess of 2000 ppm in soil (considerably lower in water); they also support the growth of sulfate-reducing bacteria (only for bare steel in contact with the soil, not for mortar coated steel due to the high pH of the mortar or concrete).

Testing for sulfate and chloride content was carried out in a laboratory setting. The effects of sulfates and chlorides can be determined based on the values provided in the following tables:

Table-1

Sulfate Concentration (ppm)	Degree of Corrosivity
>10,000	Severely corrosive
1,500 – 10,000	Considerable corrosive
150 – 1,500	Positive corrosive
0 - 150	Negligible corrosive

Table-2

Chloride Concentration (ppm)	Degree of Corrosivity
>5,000	Severe
1,500 – 5,000	Considerable
500 – 1,500	Corrosive
<500	Threshold

Samples at three (3) testing locations resulted in Chloride content values ranging from 689 ppm to 3,141 ppm. The Sulfate content values ranged from 470 ppm to 4,990 ppm.

3.2 pH Testing

The soil pH provides a general guide to the nature of possible corrosion. Acidic soils are corrosive, neutral soils are optimum for the development of sulfate-reducing bacteria, and alkaline soils are generally nonthreatening; however, exceedingly high pH values can lead to a low soil resistivity. The degree of acidity or alkalinity of a soil is expressed as the pH, a value that represents the logarithm of the reciprocal of the hydrogen ion concentration. A pH value of 7 indicates neutrality; lower values, acidity; and higher values, alkalinity.

Soil pH testing was carried out in a laboratory setting. The effects of pH can be determined based on the values provided in the following table:

Table-3

pH Concentration (Units)	Degree of Corrosivity
<5.5	Severe
5.5 – 6.5	Moderate
6.5 – 7.5	Neutral
>7.5	None

Soil samples at test locations resulted in pH values ranging from 7.79 to 8.13.

3.3 Redox Potentials

Soil oxidation-reduction potential (ORP), also known as “redox” potential, is a measure of the degree of aeration in a soil, with a high (positive) redox potential indicating a large oxygen concentration. Low (negative) redox potentials indicate that a soil is anaerobic, and can possibly support sulfate-reducing bacteria.

Table-4

Redox Potential (mV)	Degree of Corrosivity
> +100	Negligible
+50 to +100	Positive
0 to +50	Considerable
< 0	Severe

Redox potentials were measured using platinum and silver/silver chloride half cells. Testing was done at TP-1, TP-6, and TP-9 sites. The soil tested ranged in depth from two to three feet. The values for redox potential measurements performed in the soil test sites was found to be 9.3mV (TP-1), 26.5mV (TP-6), and 28.7mV (TP-9). The degree of corrosivity for buried steel structures due to soil redox potential is considered to range between “Considerable” and “Severe” due to the possibility of supporting anaerobic, sulfate-reducing bacteria.

3.4 Field Soil Resistivity

Soil resistivity is a principal soil chemistry parameter when evaluating the corrosiveness of a soil environment towards buried steel structures, with corrosivity being inversely related to soil resistivity. Soil resistivity is a measure of the capability of the soil to conduct electrical current (through the diffusion of ions) and is related to the concentration of salts within the soil, with a low resistivity indicating high-level salt concentration. Resistivity is the inverse of conductivity and is typically measured in units of ohm-centimeters.

Soil Resistivity vs. Degree of Corrosivity

Soil resistivity (ohm-cm)	Degree of corrosivity
0–500	Very corrosive
500–1,000	Corrosive
1,000–2,000	Moderately corrosive
2,000–10,000	Mildly corrosive
Above 10,000	Negligible

Figure 1 - Degree of Corrosivity to Buried Metallic Structures due to Soil Resistivity [5]

Analysis of data from soil resistivity measurements made using the Wenner 4-pin method at four (4) foot spacing shows the soil to be very corrosive. Soil samples obtained at a depth of two to three feet and tested in a lab show similar results.

Method of Analysis	TP-1 (Ω-cm)	TP6 (Ω-cm)	TP-9 (Ω-cm)
Wenner 4-pin method, 4 ft. interval N/S	222.9	574.5	2818.3
Wenner 4-pin method, 4 ft. interval E/W	173.9	638.9	2773.1
Geocon Lab Testing, CT643	190	350	360
Corrpro Miller 400 Soil Box (SN: 4-8820)	190 wet	320 wet	490 wet
Corrpro Miller 400 Soil Box (SN: 4-8820)	540 dry	1100 dry	3900 dry

There is a difference in soil resistivity obtained at TP-9. During the time of testing and collection the soils where TP-1 and TP-6 are located had been recently plowed. The soil at these locations was loose and wet, whereas TP-9 was dense and dry. The dry and wet testing Corrpro performed suggests that soils near the surface at TP-9, when tested by Wenner 4-pin in the field, were very dry. Soil resistivity at TP-9 drops dramatically to 611 ohm-cm when tested by Wenner 4-pin at eight foot spacing. Wenner 4-pin data from TP-9 at a two foot interval shows soil resistivity to be 3,716 ohm-cm which is in line with the samples collected by Corrpro at 3,900 ohm-cm

	
Soil at TP-6 and TP-1 (in background)	Soil at TP-9, note soil is not plowed

3.5 Linear Polarization Resistance

Linear Polarization Resistance (LPR) is an electrochemical method which can be used to measure instantaneous corrosion rates and monitor for changes in corrosion rates. The LPR method is commonly used for corrosion monitoring of fluid side corrosion of pipelines, tanks and vessels in the power generation, water/wastewater and refining industries.

The LPR device functions by applying a small potential, in the range of +/- 20 mV, between two (2) electrodes exposed to the electrolyte environment being tested and measuring the resulting current flow between the electrodes. The polarization resistance of the material in the environment is defined as the ratio between the applied potential (ΔE) and the resulting current density (i) as follows:

$$R_p = \left(\frac{\partial \Delta E}{\partial i}\right)_{i=0,\ dE/dt \to 0}$$

Figure 2 – Polarization Resistance Formula

At small values of ΔE where activation polarization dominates, the polarization resistance of the material is inversely related to the corrosion current (i_{corr}) by the Stern-Geary equation:

$$i_{cor} = \frac{B}{R_p}$$

Figure 3 - Stern-Geary Equation Relating Polarization Resistance to Corrosion Rate

$$B = \frac{ba\ bc}{2.303\ (ba + bc)}$$

Figure 4 - Stern-Geary Coefficient

Where B is the Stern-Geary Coefficient, and ba and bc are the anodic and cathodic Tafel slopes, respectively. The Stern-Geary Coefficient can be evaluated experimentally by extracting the Tafel slopes (in Volts per decade) from the Tafel (E-Log I) polarization plots. Commercial LPR instruments typically do not calculate the Stern-Geary Coefficient, and instead use set values for each type of material (as the Tafel slopes do not vary significantly in different environments) to provide direct corrosion rate measurements.

The empirical corrosion rate is calculated using the measured I_{corr}, which is normalized to a per unit surface area basis by dividing the measured current by the specimen's surface area (i.e. i_{corr}), through the following formula:

$$CR = K_1 \frac{i_{cor}}{\rho} EW$$

Figure 5 - Calculation of Corrosion Rate using i_{corr}

where CR is corrosion rate, K_1 is a constant, ρ is the specimen's density, and EW is the specimen's equivalent weight (i.e. the amount mass of metal which will be oxidized by the passage of one Faraday of electric charge).

Linear Polarization Resistance measurement equipment consists of a 2-electrode or 3-electrode LPR probe and a LPR meter. 3-electrode probes have a third, reference electrode which is dedicated for measuring the potential between the electrodes, which greatly reduces the errors associated with a high IR drop (i.e voltage drop across the electrolyte stemming from current flow through a resistive electrolyte). This IR error can be significant with 2-electrode LPR probes, leading to overestimates of especially in situations of high electrolyte resistivity (e.g. electrolyte is soil).

In addition to general or uniform corrosion, localized corrosion called pitting may occur. This can result in a more rapid failure of the structure than what a corrosion rate measurement would indicate. A pit on the metal surface is a result of a localized, high anodic current density where positive ions flow away from the pit into solution and electrons flow from the pit to surrounding metal.

Increased pitting raises the electrical instability or noise on the electrode surfaces which can be detected by an increase in the magnitude and variability of the current flow between the two nominally identical electrodes in the Corrater probe under short-circuit conditions. The imbalance reading is a qualitative reading. If the imbalance reading is low and stable compared to the corrosion reading, then pitting will likely be minimal. However, if the imbalance reading is high and erratic when compared to the corrosion reading then pitting may be the primary form of corrosive attack.

An Aquamate LPR meter manufactured by Rohrback Cosasco Systems and 2-electrode probe, were used to measure instantaneous corrosion rates in the Little Bear Project testing area.

LPR driven into soil at TP-1

The LPR probe was inserted into the soil in an excavation of 2 to 3 feet at each testing location. Three readings in dry, as-found soil, were collected for duration of at least three minutes each at all locations. After each reading the soil was wetted around the probe with deionized water and retested for a duration of at least three minutes. The data collected during site testing is shown below in Table 5.

Table-5

Test Site	Test Depth	Corrosion Rate	Imbalance	Corrosion Type	Dry/Wet
TP-1	2.5 feet	14.1 MPY	5.16	Pitting	Dry
TP-1	2.5 feet	14.9 MPY	17.8	Uniform/Pitting	Wet
TP-6	2.5 feet	11.0 MPY	28.0	Pitting	Dry
TP-6	2.5 feet	10.9 MPY	19.4	Pitting	Wet
TP-9	2.5 feet	15.1 MPY	1.50	Pitting	Dry
TP-9	2.5 feet	12.9 MPY	0.57	Pitting	Wet

3.6 E – Log I

E – Log I testing is an electrochemical test method which can be used to empirically measure a specific metal's corrosion rate in a particular environment. The E – Log I test method consists of measuring the change in potential of a metal specimen due to the stepwise change in current applied to the specimen.

In deaerated environments, such as the surfaces along buried or driven steel structures, the collected data, when plotted as E vs Log I, (i.e. change in potential versus the natural log of current applied) should exhibit a section of linear (Tafel) behavior with increased current.

Analysis of the E vs Log I plot can yield useful information such as the corrosion current, $I_{CORR,}$ which can be used with the equivalent metal weight (related atomic weight), density, and surface area of the tested specimen to calculate the actual instantaneous corrosion rate, and the amount of cathodic protection current, $I_{CP,}$ that would be required to provide corrosion protection to the structure. The corrosion current is the current level at which the Tafel Slope intersects with the Free Corrosion Potential (E_{CORR}), while the cathodic protection current requirement is the current level at which the E- Log I curve breaks away from the linear Tafel Slope.

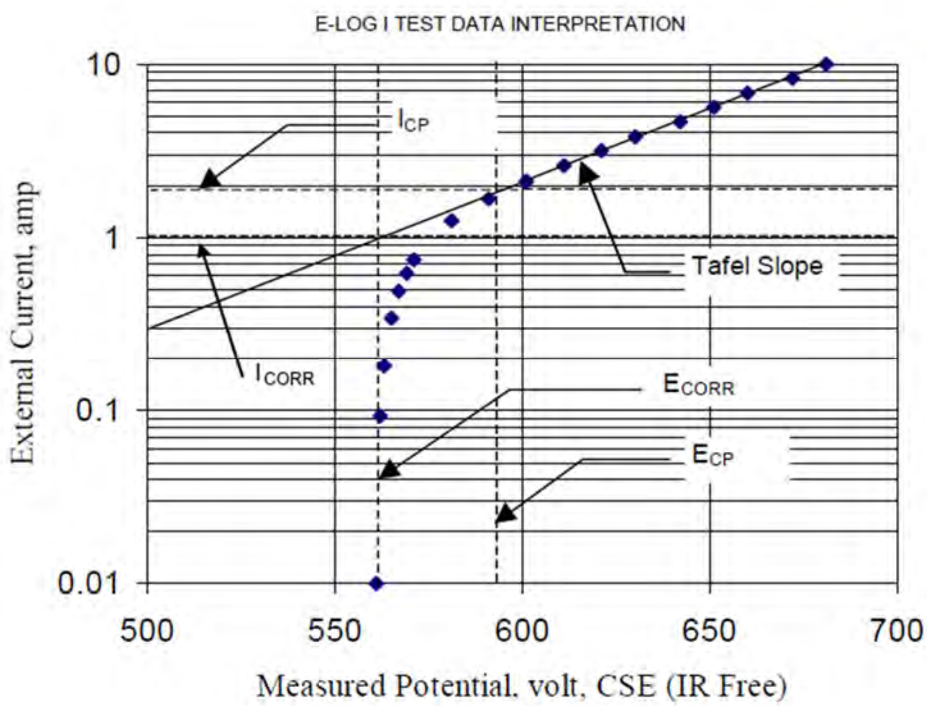


Figure 6 - E-Log I Plot Depicting Calculation of Corrosion Current and Cathodic Protection Current Requirement

The empirical corrosion rate is calculated using the measured Icorr, which is normalized to a per unit surface area basis by dividing the Icorr determined from the E vs Log I plot by the specimen's surface area (i.e. icorr), through the following formula:

$$CR = K_1 \frac{i_{cor}}{\rho} EW$$

Figure 7 - Calculation of Corrosion Rate using i_{corr}

where CR is corrosion rate, K1 is a constant, ρ is the specimen's density, and EW is the specimen's equivalent weight (i.e. the amount mass of metal which will be oxidized by the passage of one Faraday of electric charge).

For E – Log I testing at the Little Bear project site was performed 48 hours after the test piles had been driven. A temporary impressed current cathodic protection system was setup at each testing site as shown in Figure 8. A model CS-10 calibrated portable current supply manufactured by Tinker Rasor was connected between a copper ground rod and the pile being tested. To supply the required current a heavy duty 12V DC battery was connected to the CS-10. The positive terminal of the current supply was connected to the copper ground rod and the negative terminal of the current supply was connected to the pile. A calibrated digital multimeter was used to obtain voltage readings. The CS-10 has a built-in ammeter with digital display and a current interrupter with timer.

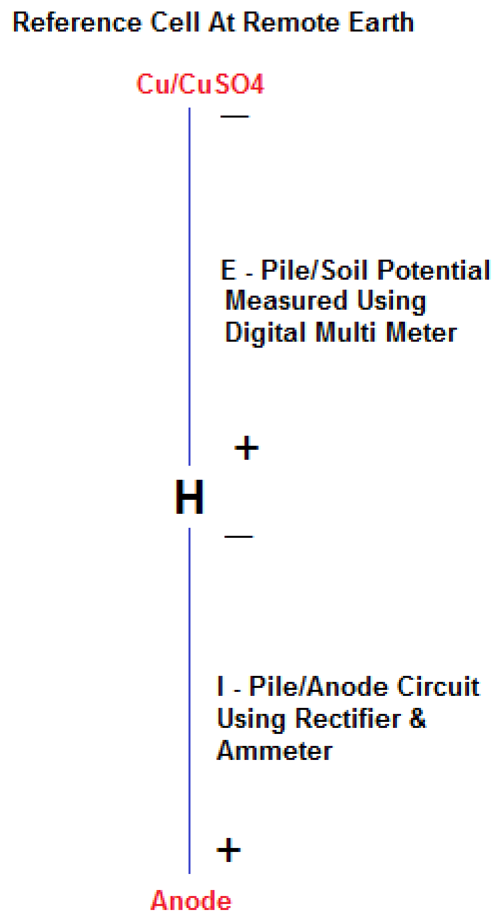


Figure 8 - Arrangement for E-Log-I field test

A portable Copper/Copper Sulfate reference electrode was located 110 feet away from the pile at remote earth. This enables the measurement of the pile's remote to earth electrochemical potentials at various incremental CP current levels. The power supply was energized and the current was increased every 3 minutes (with an approximate 5 second off period between the adjustments). The Instant OFF potentials (potentials recorded immediately after the interruption of current) were recorded along with the ON potentials. The current interval was logged using the CS-10's built in ammeter.

E-Log I field testing at TP-6

The current flow and pile to soil potential at each current interval were used for plotting the graph found in Appendix A. Based on the breakdown of the E-Log I curve; the average corrosion current for steel and galvanized piles was found to be 110mA.

4.0 CORROSION RATE ANALYSIS

4.1 Galvanic Corrosion Cell

Corrosion is an electrochemical process which involves both oxidation and reduction reactions and can be characterized as a simple corrosion cell. In order for a corrosion cell to occur, there must exist four (4) basic components: an anode, a cathode, a common electrolyte and a metallic (electronic) path. The anode in a corrosion cell is the more electrochemically active (more negative) metal relative to the cathode, which is more electrochemically passive (more positive).

The electrochemical potential difference, or electromotive force, between the anode and the cathode forces corrosion current to flow from the anode through the electrolyte to the cathode and back through the electronic path as illustrated below in Figure 9.

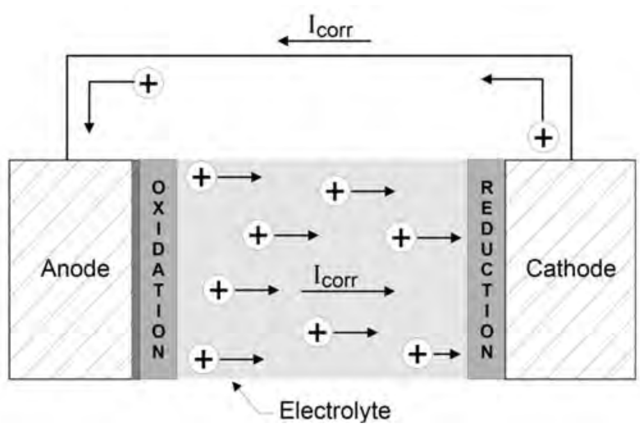


Figure 9 - Typical Corrosion Cell showing Conventional Current Flow [4]

The anode, which supplies the corrosion current, undergoes an oxidation reaction which results in metal loss at the electrolyte interface, while the cathode undergoes reduction reactions, which do not consume the cathode. These are the same principles that are employed in cathodic protection (CP), where by utilizing an electromotive force, either by selecting metals with sufficiently different electrochemical potentials (galvanic CP) or by applying a voltage (impressed current CP) between an anode and cathode, corrosion can be isolated to the anode while the cathode is “cathodically protected” from corrosion.

Since there is a large electrochemical potential difference between zinc and copper, approximately -0.9 Volts, there is sufficient driving voltage to promote galvanic corrosion if the galvanized zinc piles and copper grounding system are made electrically continuous and are located in the same electrolyte (native soil, in this case), creating a corrosion cell.

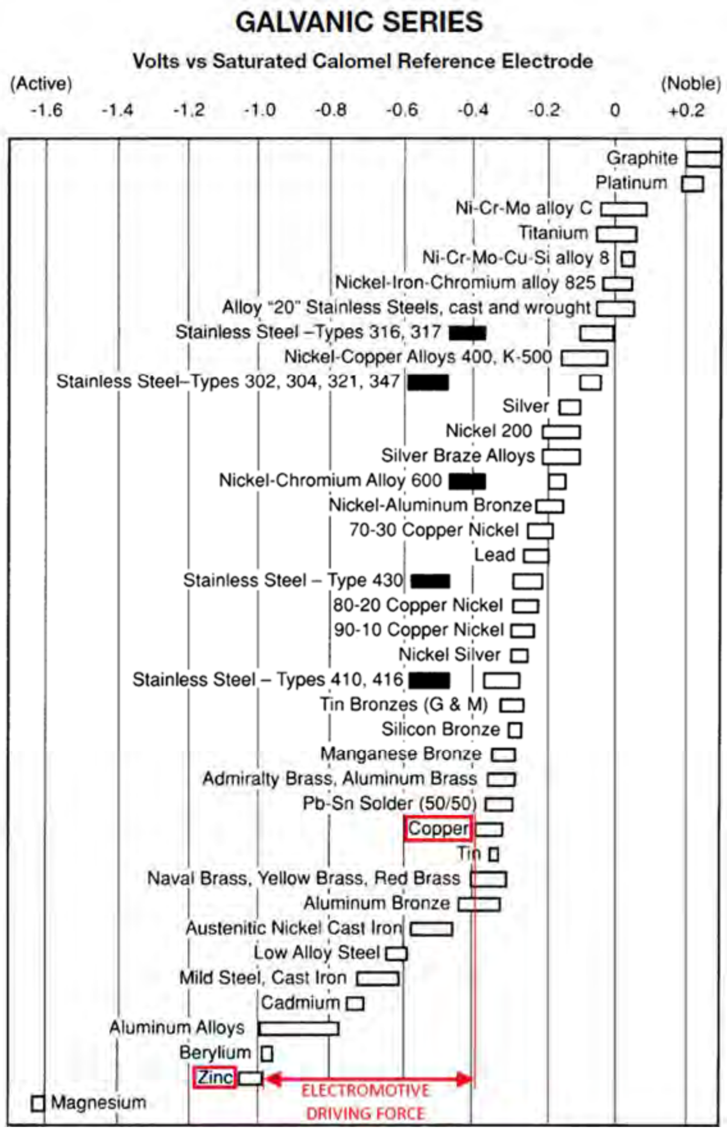


Figure 10 - Galvanic Series of Various Metals with Respect to Saturated Calomel Electrode (SCE) [1]

As a result, the buried galvanized zinc piles which are made electrically continuous with the copper grounding system will preferentially corrode, while copper will act as a cathode and be cathodically protected by the cathodic protection current provided by the zinc. In addition, once the zinc galvanization is consumed by corrosion, the steel substrate will form a galvanic couple with the copper grounding grid, and it too will preferentially corrode while supplying cathodic protection to the copper.

The magnitude of the galvanic corrosion expected is dependent on the electromotive forces (EMF) between steel and copper and the resistance of the corrosion cell circuit, which is largely dependent on the resistances-to-earth of the pile supports and the copper grounding systems.

The magnitude of the galvanic corrosion expected is dependent on the electromotive forces (EMF) between zinc and copper, between steel and copper, and the resistance of the corrosion cell circuit, which is largely dependent on the resistances-to-earth of the piles and the copper grounding systems.

4.2 Resistance-to-Earth Calculations

The theoretical resistances-to-earth of the galvanized steel piles and copper grounding systems in the Little Bear Project have been calculated using the soil resistivity's measured in the field, and theoretical resistance-to-earth equations. The formulas used in these calculations are displayed below while the detailed resistance-to-earth calculations can be found in Appendix B of this report.

The theoretical resistance-to-earth of the steel piles was calculated using the average soil resistivity measured at a five foot, five inch depth. These tests yielded a resistance-to-earth of the galvanized steel piles in the project area of 4.63 milliohms.

Calculations were also performed to determine the theoretical resistance-to-earth of the various copper grounding systems in the Little Bear Project, including the copper-clad grounding rods and 4/0 AWG and 2/0 AWG bare copper loop at each inverter skid. These resistances-to-earth were calculated using the average soil resistivity, Modified Sunde's Equation for ground resistance of a horizontally buried cable, shown below in Figure 11, and the Modified Dwight's Equation for ground resistance of a vertical rod, shown below in Figure 12.

$$R = \frac{1}{2\pi L}(\rho \ln \frac{L^2}{td})$$

where:

- L = Length of the Buried Copper Cable
- ρ = Resistivity of Native Soil
- t = Depth of Burial of the Copper Cable
- d = Diameter of the Copper Cable

Figure 11 – Modified Sunde's Equation for Resistance-to-Earth of a Buried Cable

$$R_{v,re} = \frac{\rho}{2\pi L}\left\{\left(\ln\frac{8L}{d}\right) - 1\right\}$$

where:

$R_{v,re}$ = resistance of vertical anode to remote earth (ohms)
ρ = resistivity of soil
L = length of anode
d = diameter of anode

Figure 12 - Dwight's Equation for a Resistance-to-Earth for a Vertical Groundbed

The total resistance-to-earth for all of the copper ground systems in the Little Bear Project was calculated to be 0.64 milliohm. The total resistance of the corrosion cell, which is equal to the sum of the resistances-to-earth for the steel piles and the copper grounding systems, is equal to 5.27 milliohm.

4.3 Corrosion Current Calculations

Since the typical electrochemical potentials of zinc and copper are -1100 mV and -200 mV with respect to Copper/Copper Sulfate Reference Electrode (CSE), the electromotive force between the zinc galvanization and the copper grounding system is approximately -900 mV. Since some of the electromotive force in the corrosion cell is required to transfer charge across the polarization layer of both the anode (zinc) and the cathode (copper), the actual driving voltage available to drive corrosion current in the corrosion cell is estimated to be 800 mV.

The total corrosion current due to galvanic corrosion between the zinc and copper couple expected to flow from all of the galvanized piles to the copper grounding system is equal to the driving voltage of the zinc/copper couple, 0.800 volts, divided by the total resistance of the corrosion cell, 5.27 milliohms, which yields a corrosion current of 151.8 amperes. Once the zinc is consumed, the steel will be the predominant anode in the galvanic couple and will have a driving voltage of approximately 450 mV, which will yield a corrosion current of 75.9 amperes.

4.4 Metal Weight Loss Due to Galvanic Corrosion

Using Faraday's Law, which determines the amount of metal weight lost to produce a corrosion current over a certain amount of time, the weight loss of zinc and steel per year can be calculated.

$$W_t = \frac{M}{nF} t I_{corr}$$

where:

W_t = total weight loss at anode or weight of material produced at the cathode (g)

n = number of charges transferred in the oxidation or reduction reaction

I_{corr} = the corrosion current (A)

F = Faraday's constant of approximately 96,500 coulombs per equivalent weight of material (where equivalent weight = $\frac{M}{n}$)

M = the atomic weight of the metal which is corroding or the substance being produced at the cathode (g)

t = the total time in which the corrosion cell has operated (s)

Figure 13 - Faraday's Law

Reduced Species	Oxidized Species	Molecular Weight, M (g)	Electrons Transferred (n)	Equivalent Weight, M/n (g)	Theoretical Consumption Rate (Kg/A-y)
Al	Al^{+++}	26.98	3	8.99	2.94
Cd	Cd^{++}	112.4	2	56.2	18.4
Be	Be^{++}	9.01	2	4.51	1.47
Ca	Ca^{++}	40.08	2	20.04	6.55
Cr	Cr^{+++}	52.00	3	17.3	5.65
Cu	Cu^{++}	63.54	2	31.77	10.38
H_2	H^{+}	2.00	2	1.00	0.33
Fe	Fe^{++}	55.85	2	27.93	9.13
Pb	Pb^{++}	207.19	2	103.6	33.9
Mg	Mg^{++}	24.31	2	12.16	3.97
Ni	Ni^{++}	58.71	2	29.36	9.59
OH^{-}	O_2	32.00	4	8.00	2.61
Zn	Zn^{++}	65.37	2	32.69	10.7

Figure 14 - Theoretical Consumption Rates of Various Metals

Based on the corrosion currents, as discussed above in Section 4.3 of this Corrosion Analysis, and the overall buried surface area of the galvanized steel piles of 392,708 square feet, a corrosion rate of the zinc galvanization due to galvanic and general corrosion was calculated to be 3.73 mils/year. Once the zinc galvanization has been consumed from the driven piles, the bare steel will act anodically with a corrosion rate due to galvanic corrosion of approximately 0.129 mils/year (due to corrosion on both sides of the pile).

4.5 Corrosion Rate Due to Soil Corrosivity

By using the average corrosion current found during the E – Log I field testing, corrosion rates of both buried zinc and steel structures in the Little Bear Project area can be estimated. Corrosion Rate can be calculated using the formula in Figure 7 (Section 3.6).

The general, soil-side corrosion rate of carbon steel is approximately 4.37 mils/year (8.74 mils/year considering both sides of the pile) in the short term, and 2.18 mils/year (4.37 mils/year considering both sides of the pile) in the long term.

4.6 Overall Corrosion Rates and Lifetime Expectancies

In order to approximate the lifetime of the buried galvanized steel piles, if no additional corrosion mitigation measures are put into place, an average zinc galvanization thickness of 3.0 mils and a steel corrosion allowance of 50% of the W6x7 pile web thickness, equal to 82.5 mils, was used in this lifetime analysis. Using the corrosion rates calculated due to galvanic corrosion and general corrosion, the estimated lifetime until the corrosion allowance of the piles is exceeded, can be calculated.

The galvanized zinc coating for the structural pile supports is estimated to corrode from galvanic and soil-side corrosion at a total of 3.73 mils/year and last approximately 0.8 years until it is completely consumed. Once the zinc coating is depleted, the bare steel piles will begin to corrode at a rate of approximately 2.86 mils/year (on each side of the pile, ultimately consuming 5.72 mils of steel thickness per year). Based on a corrosion allowance of 82.5 mils, the bare steel W6x7 piles are estimated to have an approximate lifetime of 15.22 years.

Overall, the galvanized W6x7 pile supports are calculated to have total lifetimes of approximately **15.22 years**, until general and galvanic corrosion have consumed 50% of their original thickness.

Detailed calculations involved in the corrosion rate analysis including corrosion rate and lifetime approximations are included in Appendix B of this report.

5.0 CONCLUSIONS

1. The corrosive soil environment is not suitable for corrosion protection by hot dip galvanizing. The corrosive soil environment will cause rapid failure of the hot dip galvanizing through consumption of sacrificial zinc. Utilize an alternative corrosion control method such as increasing the pile thickness or installing a cathodic protection system.

2. Corrosion of the steel piles in the project area is expected to be severe due to the low soil resistivity, high chloride, and high sulfate ion concentrations.

3. Corrosion at the site will consume the 3 mils zinc galvanization in less than one year. After this point, corrosion will begin on the steel, consuming the 50% corrosion allowance in approximately 15 years. Therefore, additional corrosion strategies are required for the piles to achieve the 25 year design life.

APPENDIX A: TESTING DATA

GEOCON

INCORPORATED

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

PROJECT NAME Corr Pro

PROJECT NUMBER T2646-22-01

DATE 7/24

TECHNICIAN JW

SAMPLE NUMBER TP-1

CORROSIVITY TEST DATA

CAL 634

VOLUME FACTOR

SMALL BOX = 1.0
LARGE BOX = 6.76

1

MOISTURE ADDED	RESISTIVITY OHMS MULT BY	OHMS	RESISTIVITY
20	1K	2.1	2100
10	1K	1.3	1300
10	100	6.1	610
10	100	2.4	240
10	100	2.3	230
10	100	2.0	200
10	100	1.9	190
10	100	1.9	190
10	100	1.9	190

MINIMUM RESISTIVITY (OHM CM) : 190

PH: 7.84

GEOCON

INCORPORATED

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

CORROSIVITY TEST DATA

CAL 634

PROJECT NAME: Corr Pro

PROJECT NUMBER: T2642-22-01

DATE: 7/24

TECHNICIAN: W

SAMPLE NUMBER: TP-6

VOLUME FACTOR
SMALL BOX = 1.0
LARGE BOX = 6.76

1

MOISTURE ADDED	RESISTIVITY OHMS MULT BY	OHMS	RESISTIVITY
20	1k	2.2	2200
10	100	9.1	910
10	100	5.8	580
10	100	4.0	400
10	100	3.6	360
10	100	3.6	360
10	100	3.5	350
10	100	3.5	350
10	100	3.5	350

MINIMUM RESISTIVITY (OHM CM): 350

PH: 7.79

GEOCON

INCORPORATED

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

CORROSIVITY TEST DATA

CAL 634

PROJECT NAME: Corr Pro

PROJECT NUMBER: T2642-22-01

DATE: 7/24

TECHNICIAN: W

SAMPLE NUMBER: TP-9

VOLUME FACTOR
SMALL BOX = 1.0
LARGE BOX = 6.76

1

MOISTURE ADDED	RESISTIVITY OHMS MULT BY	OHMS	RESISTIVITY
20	1k	4.7	4700
10	1k	2.4	2400
10	100	8.0	800
10	100	5.4	540
10	100	3.9	390
10	100	4.1	410
10	100	3.8	380
10	100	3.8	380
10	100	3.6	360
10	100	3.8	380
10	100	4.0	400

MINIMUM RESISTIVITY (OHM CM): 360

PH: 8.13

GEOCON WEST

6960 Flanders DR San Diego CA92121

CHLORIDE CONTENT

AASHTO T291-94

(METHOD 'A')

Project:	Corr Pro
Number:	T2646-22-01
Date	7-23-15
Tech:	PJ

SILVER NITRATE SOLUTION 1ml = 0.5 mg Cl

SAMPLE NUMBER	TP-1	TP-6	TP-9			
BLANK	0.3	0.3	0.3			
WET MASS	50.0	50.0	50.0			
DRY MASS	48.3	48.7	48.0			
MOISTURE CONTENT	3.5	2.7	4.2			
PH (6.0 TO 8.0)	ok	ok	ok			
SAMPLE ML	30.00	30.00	30.00	30.00	30.00	30.00
TITRATION						
ml water in final dilution	25	25	25			
ml of sample in final dilution	5	5	5			
start	4.2	14.0	17.3			
end	14.6	17.3	19.8			
AgNO4	10.4	3.3	2.5			
PPM	3141	925	689			
% CHLORIDE	0.314	0.092	0.069	✓		

Remarks:

GEOCON

GEOCON INC 6960 FLANDERS DRIVE SAN DIEGO CA 92121

SULFATE CONTENT ASTM C1580

Project Name: Corv Pio

Project Number: T2646-22-01

Date: 7-23-15

Technician: TPJ

Sample No.	TP-1		
Wet Weight		Moisture Content	
Dry Weight			
Dilution	1		
Time (minutes)	Blank	Reading	
0:30	5.39	2373	2367.61
1:00	5.12	2350	2344.88
1:30	5.12	2344	2338.88
2:00	4.81	2338	2333.19
		Percent %	retest

Sample No.	TP-1		
Wet Weight		Moisture Content	
Dry Weight			
Dilution	10		
Time (minutes)	Blank	Reading	
0:30	1.13	236	234.87
1:00	1.32	238	236.68
1:30	1.30	239	237.7
2:00	1.34	239	237.66
		Percent %	0.499

Sample No.	TP-6		
Wet Weight		Moisture Content	
Dry Weight			
Dilution	1		
Time (minutes)	Blank	Reading	
0:30	4.81	226	221.19
1:00	3.10	226	222.9
1:30	3.28	226	222.72
2:00	3.14	226	222.86
		Percent %	0.047

Sample No.	TP-9		
Wet Weight		Moisture Content	
Dry Weight			
Dilution	1		
Time (minutes)	Blank	Reading	
0:30	10.4	457	446.6
1:00	7.33	457	449.67
1:30	7.19	458	450.81
2:00	6.60	458	451.4
		Percent %	retest

Sample No.	TP9		
Wet Weight		Moisture Content	
Dry Weight			
Dilution	6		
Time (minutes)	Blank	Reading	
0:30	3.06	68.6	65.54
1:00	3.29	70.7	67.41
1:30	3.30	72.1	68.8
2:00	3.47	72.8	69.33
		Percent %	0.087

Sample No.			
Wet Weight		Moisture Content	
Dry Weight			
Dilution			
Time (minutes)	Blank	Reading	
0:30			
1:00			
1:30			
2:00			
		Percent %	

Location	Temp. F°	Bearing	Latitude	Longitude	
TP10	64°				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	0.804	10.1	3.1	308.0
N/S	4	0.390	9.8	3.0	298.7
N/S	6	0.254	9.6	2.9	291.4
N/S	8	0.190	9.6	2.9	291.1
N/S	12	0.123	9.3	2.8	282.7
N/S	20	0.079	9.9	3.0	302.6
N/S	30	0.052	9.8	3.0	298.8
N/S	50	0.033	10.4	3.2	316.0
N/S	100	0.018	11.3	3.4	344.7
N/S	200	0.008	10.1	3.1	306.4
E/W	2	0.868	10.9	3.3	332.5
E/W	4	0.384	9.7	2.9	294.2
E/W	6	0.273	10.3	3.1	313.7
E/W	8	0.208	10.5	3.2	318.7
E/W	12	0.131	9.9	3.0	301.1
E/W	20	0.079	9.9	3.0	302.6
E/W	30	0.054	10.2	3.1	310.2
E/W	50	0.035	11.0	3.4	335.1
E/W	100	0.020	12.6	3.8	383.0
E/W	200	0.011	13.8	4.2	421.3

Location	Temp. F°	Bearing	Latitude	Longitude	
TP8	70				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	1.033	13.0	4.0	395.7
N/S	4	0.402	10.1	3.1	308.0
N/S	6	0.290	10.9	3.3	333.2
N/S	8	0.256	12.9	3.9	392.2
N/S	12	0.152	11.5	3.5	349.3
N/S	20	0.096	12.1	3.7	367.7
N/S	30	0.066	12.4	3.8	379.2
N/S	50	0.042	13.2	4.0	402.2
N/S	100	0.020	12.6	3.8	383.0
N/S	200	0.008	10.1	3.1	306.4
E/W	2	1.313	16.5	5.0	502.9
E/W	4	0.420	10.6	3.2	321.7
E/W	6	0.281	10.6	3.2	322.9
E/W	8	0.223	11.2	3.4	341.7
E/W	12	0.160	12.1	3.7	367.7
E/W	20	0.094	11.8	3.6	360.0
E/W	30	0.065	12.3	3.7	373.4
E/W	50	0.038	11.9	3.6	363.9
E/W	100	0.017	10.7	3.3	325.6
E/W	200	0.006	7.5	2.3	229.8

Location	Temp. F°	Bearing	Latitude	Longitude	
TP3	80				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	1.071	13.5	4.1	410.2
N/S	4	0.420	10.6	3.2	321.7
N/S	6	0.284	10.7	3.3	326.3
N/S	8	0.257	12.9	3.9	393.7
N/S	12	0.197	14.9	4.5	452.7
N/S	20	0.137	17.2	5.2	524.7
N/S	30	0.097	18.3	5.6	557.3
N/S	50	0.058	18.2	5.6	555.4
N/S	100	0.030	18.8	5.7	574.5
N/S	200	0.013	16.3	5.0	497.9
E/W	2	1.053	13.2	4.0	403.3
E/W	4	0.413	10.4	3.2	316.4
E/W	6	0.325	12.3	3.7	373.4
E/W	8	0.266	13.4	4.1	407.5
E/W	12	0.187	14.1	4.3	429.8
E/W	20	0.130	16.3	5.0	497.9
E/W	30	0.098	18.5	5.6	563.0
E/W	50	0.059	18.5	5.6	565.0
E/W	100	0.027	17.0	5.2	517.1
E/W	200	0.015	18.8	5.7	574.5

Location	Temp. F°	Bearing	Latitude	Longitude	
TP1	82				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	0.607	7.6	2.3	232.5
N/S	4	0.291	7.3	2.2	222.9
N/S	6	0.185	7.0	2.1	212.6
N/S	8	0.146	7.3	2.2	223.7
N/S	12	0.106	8.0	2.4	243.6
N/S	20	0.071	8.9	2.7	271.9
N/S	30	0.052	9.8	3.0	298.8
N/S	50	0.034	10.7	3.3	325.6
N/S	100	0.020	12.6	3.8	383.0
N/S	200	0.011	13.8	4.2	421.3
E/W	2	0.560	7.0	2.1	214.5
E/W	4	0.227	5.7	1.7	173.9
E/W	6	0.167	6.3	1.9	191.9
E/W	8	0.133	6.7	2.0	203.8
E/W	12	0.101	7.6	2.3	232.1
E/W	20	0.070	8.8	2.7	268.1
E/W	30	0.049	9.2	2.8	281.5
E/W	50	0.032	10.1	3.1	306.4
E/W	100	0.017	10.7	3.3	325.6
E/W	200	0.010	12.6	3.8	383.0

Location	Temp. F°	Bearing	Latitude	Longitude	
TP6	82				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	3.410	42.9	13.1	1306.1
N/S	4	0.750	18.8	5.7	574.5
N/S	6	0.385	14.5	4.4	442.4
N/S	8	0.270	13.6	4.1	413.7
N/S	12	0.155	11.7	3.6	356.2
N/S	20	0.083	10.4	3.2	317.9
N/S	30	0.053	10.0	3.0	304.5
N/S	50	0.032	10.1	3.1	306.4
N/S	100	0.017	10.7	3.3	325.6
N/S	200	0.008	10.1	3.1	306.4
E/W	2	3.150	39.6	12.1	1206.5
E/W	4	0.834	21.0	6.4	638.9
E/W	6	0.424	16.0	4.9	487.2
E/W	8	0.259	13.0	4.0	396.8
E/W	12	0.145	10.9	3.3	333.2
E/W	20	0.089	11.2	3.4	340.9
E/W	30	0.055	10.4	3.2	316.0
E/W	50	0.032	10.1	3.1	306.4
E/W	100	0.015	9.4	2.9	287.3
E/W	200	0.006	7.5	2.3	229.8

Location	Temp. F°	Bearing	Latitude	Longitude	
TP-9	82				
Orientation	**A-Spacing (ft)**	**Measurement (ohms)**	**Apparent Res (ohm-ft)**	**Apparent Res (ohm-m)**	**Apparent Res (ohm-cm)**
N/S	2	9.702	121.9	37.2	3716.1
N/S	4	3.679	92.5	28.2	2818.3
N/S	6	1.259	47.5	14.5	1446.7
N/S	8	0.399	20.1	6.1	611.3
E/W	2	9.020	113.3	34.5	3454.9
E/W	4	3.620	91.0	27.7	2773.1
E/W	6	0.742	28.0	8.5	852.6
E/W	8	0.407	20.5	6.2	623.6

APPENDIX B: CORROSION RATE CALCULATIONS

LITTLE BEAR SOLAR PROJECT
RESISTANCE-TO-EARTH GALVANIC CORROSION
CURRENT CALCULATIONS FOR W6x7 PILES

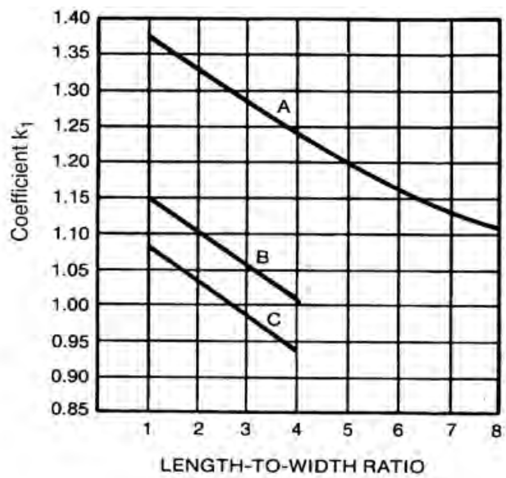
1.0 RESISTANCE-TO-EARTH CALCULATIONS FOR GALVANIZED PILES

Schwarz Equation For Ground Resistance of Rods Placed Vertically in an Area

$$R_2 = \frac{\rho}{2\pi n_R L_R}\left[\ln\left(\frac{4L_R}{b}\right) - 1 + \frac{2k_1 \cdot L_r}{\sqrt{A}}(\sqrt{n_R} - 1)^2\right]$$

where

L_r	is the length of each rod in m
$2b$	is the diameter of rod in m
n_R	number of rods placed in area A
A	is the area covered by conductors in m^2
k_1, k_2	are the coefficients



CURVE A — FOR DEPTH h = 0
$y_A = -0.04x + 1.41$
CURVE B — FOR DEPTH h = 1/10 $\sqrt{AREA}$
$y_B = -0.05x + 1.20$
CURVE C — FOR DEPTH h = 1/6 $\sqrt{AREA}$
$y_C = -0.05x + 1.13$

Soil Resistivity from Geotech Report (ρ) =	3.00	ohm-m
Buried Length of Each Pile (L_r) =	1.7	m
Equivalent Diameter of Each Pile (2b) =	0.2	m
Number of Piles in Area A (n_R) =	31680	Piles
Area Covered By Piles (A) =	36,483	m^2
Coefficient k_1 =	0.930	
Calculated Resistance-to-Earth of the Galvanized Piles (R_P) =	**0.00463**	**ohms**

LITTLE BEAR SOLAR PROJECT
RESISTANCE-TO-EARTH GALVANIC CORROSION
CURRENT CALCULATIONS FOR W6x7 PILES

2.0 RESISTANCE-TO-EARTH CALCULATIONS FOR COPPER GROUNDING SYSTEM

$$R = \frac{1}{2\pi L}\left(\rho \ln \frac{L^2}{td}\right)$$

Soil Resistivity from Geotech Report (ρ) =	3.00	ohm-m
Total Buried Length of 4/0 AWG Bare Copper Cable (L) =	385.3	m
Diameter of 4/0 AWG Bare Copper Cable (d) =	0.0117	m
Burial Depth of Copper Cable (t) =	0.61	m
Calculated Resistance-to-Earth of the 4/0 AWG Copper Cable (R_L) =	0.0209	ohms

Modified Dwight's Equation - Vertical Copper Clad Ground Rods

$$R_{v,re} = \frac{\rho}{2\pi L}\left\{\left(\ln \frac{8L}{d}\right) - 1\right\}$$

where:

$R_{v,re}$ = resistance of vertical anode to remote earth (ohms)
ρ = resistivity of soil
L = length of anode
d = diameter of anode

Soil Resistivity from Geotech Report (ρ) =	3.00	ohm-m
Length of Copper-Clad Ground Rod (L) =	3.05	m
Diameter of Copper-Clad Ground Rod (d) =	0.0191	m
Calculated Resistance-to-Earth for One Copper Clad Ground Rod (R_R) =	0.964	ohms
Number of Ground Rods Per Inverter Skid (N_G)=	2	Rods

$$R = \frac{1}{2\pi L}\left(\rho \ln \frac{L^2}{td}\right)$$

Soil Resistivity from Geotech Report (ρ) =	3.00	ohm-m
Total Buried Length of 2/0 AWG Bare Copper Cable in the Site Grounding System (L) =	969	m
Diameter of 2/0 AWG Bare Copper Cable (d) =	0.0065	m
Burial Depth of Copper Cable (t) =	0.61	m
Calculated Resistance-to-Earth of the 2/0 AWG Copper Cable (R_S) =	0.0095	ohms

$$R_I = \frac{1}{\frac{N_G}{R_R} + \frac{1}{R_S} + \frac{1}{R_L}}$$

Equivalent Resistance-to-Earth for One (1) Inverter Skid (R_I) = 0.0064 ohms

3.0 TOTAL RESISTANCE-TO-EARTH CALCULATIONS

Resistance-to-Earth of Ground System at Each Inverter Skid (R_I) =	0.0064	ohms
Number of Inverter Skids (N_S) =	10	

Calculation of Parallel Resistances-to-Earth of Copper Ground Systems

$$R_G = \frac{1}{\frac{N_S}{R_I}}$$

Total Resistance-to-Earth of the Copper Ground Systems (R_G) =	**0.00064**	**ohms**
Resistance-to-Earth of the Galvanized Piles (R_P) =	0.00463	ohms
Total Resistance of Corrosion Cell ($R_C = R_G + R_P$) =	**0.00527**	**ohms**

4.0 GALVANIC CORROSION CURRENT - ZINC TO COPPER CORROSION CELL

Electrochemical Potential of Zinc (to CSE) =	-1110.0	mV
Electrochemical Potential of Copper (to CSE) =	-200.0	mV
Electromotive Force (emf) between a Zinc and Copper Galvanic Couple =	910.0	mV
Driving Voltage (emf less anode and cathode polarization potentials) =	800.0	mV
Total Resistance of Corrosion Cell (R_C) =	0.00527	ohms
Total Corrosion Current (Zinc and Copper Corrosion Cell) =	**151.8**	**amps**

5.0 GALVANIC CORROSION CURRENT - STEEL TO COPPER CORROSION CELL (ONCE ZINC IS CONSUMED)

Electrochemical Potential of Steel (to CSE) =	-650.0	mV
Electrochemical Potential of Copper (to CSE) =	-200.0	mV
Electromotive Force (emf) between a Zinc and Copper Galvanic Couple =	450.0	mV
Driving Voltage (emf less anode and cathode polarization potentials) =	400.0	mV
Total Resistance of Corrosion Cell (R_C) =	0.00527	ohms
Total Corrosion Current (Steel and Copper Corrosion Cell) =	**75.9**	**amps**

1.0 CONSUMPTION RATE OF ZINC

$$W_t = \frac{M}{nF} t I_{corr}$$

where:

W_t = total weight loss at anode or weight of material produced at the cathode (g)

n = number of charges transferred in the oxidation or reduction reaction

I_{corr} = the corrosion current (A)

F = Faraday's constant of approximately 96,500 coulombs per equivalent weight of material (where equivalent weight = $\frac{M}{n}$)

M = the atomic weight of the metal which is corroding or the substance being produced at the cathode (g)

t = the total time in which the corrosion cell has operated (s)

Number of Electrons Lost by Zinc in Oxidation Reaction =	2	electrons
Corrosion Current due to Galvanic Coupling with Copper (I) =	151.8	amps
Faraday's Constant (F) =	96,500	coulombs
Atomic Weight of Zinc (M) =	65.37	g/mol
Atomic Weight of Zinc (M) =	0.14	lb/mol
Zinc Weight Loss Per Year due to Galvanic Coupling with Copper (W) =	3,575	lb/year
Density of Zinc =	449.3	lb/cu. ft
Volume loss of Zinc Per Year Due to Galvanic Corrosion =	7.957	cu. ft/year

2.0 CORROSION RATE OF ZINC GALVANIZED COATING ON DRIVING PILES BASED ON GALVANIC CORROSION

Average Thickness of Zinc Galvanization on Piles =	3.00	mils
Buried Surface Area of a Single W6X7 Pile =	12.4	sq. ft
Buried Surface Area of all W6X7 Piles =	392,708	sq. ft
Volume of Zinc Galvanization on all Piles =	98.2	cu. ft
Corrosion Rate of Zinc Due to Galvanic Corrosion =	0.243	mil/year

3.0 TOTAL CORROSION RATE OF ZINC ON DRIVING PILES BASED ON GENERAL AND GALVANIC CORROSION

$$CR = \frac{I_{corr} \cdot K \cdot EW}{dA}$$

Corrosion Constant (K_1) =	128800	mil/amp-cm-yr
Corrosion Current (from E Log I tests) (Icorr) =	0.11	amps
Density of Zinc (d) =	7.13	g/cm3
Equivalent Weight of Zinc (EW) =	32.68	g
Buried Surface Area of a Single W6X7 Pile (A) =	11516.34	cm2
Corrosion Rate of Zinc Due to General Corrosion (Short Exposure) =	5.639	mil/year
Corrosion Rate of Zinc Due to General Corrosion (Long Exposure) =	2.650	mil/year
Total Expected Corrosion Rate of a Zinc Galvanized Coating =	**3.730**	**mil/year**
Total Lifetime of a Galvanized Zinc Coating =	**0.80**	**years**

LITTLE BEAR SOLAR PROJECT
CORROSION RATE ANALYSIS OF BARE STEEL
TOTAL LIFETIME ANALYSIS OF GALVANIZED W6x7 PILES

1.0 CONSUMPTION RATE OF STEEL

$$W_t = \frac{M}{nF} t I_{corr}$$

where:

- W_t = total weight loss at anode or weight of material produced at the cathode (g)
- n = number of charges transferred in the oxidation or reduction reaction
- I_{corr} = the corrosion current (A)
- F = Faraday's constant of approximately 96,500 coulombs per equivalent weight of material (where equivalent weight = $\frac{M}{n}$)
- M = the atomic weight of the metal which is corroding or the substance being produced at the cathode (g)
- t = the total time in which the corrosion cell has operated (s)

Number of Electrons Lost by Steel in Oxidation Reaction =	3	electrons
Corrosion Current due to Galvanic Coupling with Copper (I) =	75.91	amps
Faraday's Constant (F) =	96,500	coulombs
Atomic Weight of Steel (M) =	55.85	g/mol
Atomic Weight of Steel (M) =	0.12	lb/mol
Steel Weight Loss Per Year due to Galvanic Coupling with Copper (W) =	1,018	lb/year
Density of Steel =	483.8	lb/cu. ft
Volume loss of Steel Per Year Due to Galvanic Corrosion =	2.104	cu. ft/year

2.0 CORROSION RATE OF STEEL DRIVING PILES BASED ON GALVANIC CORROSION

Buried Surface Area of a Single W6X7 Pile =	12.4	sq. ft
Buried Surface Area of all W6X7 Piles =	392,708	sq. ft
Corrosion Rate of Steel Due to Galvanic Corrosion =	0.064	mil/year
Ultimate Galvanic Corrosion Rate (Due to Corrosion on Both Sides of Pile) =	0.129	mil/year

3.0 TOTAL CORROSION RATE OF STEEL DRIVING PILES BASED ON GENERAL AND GALVANIC CORROSION

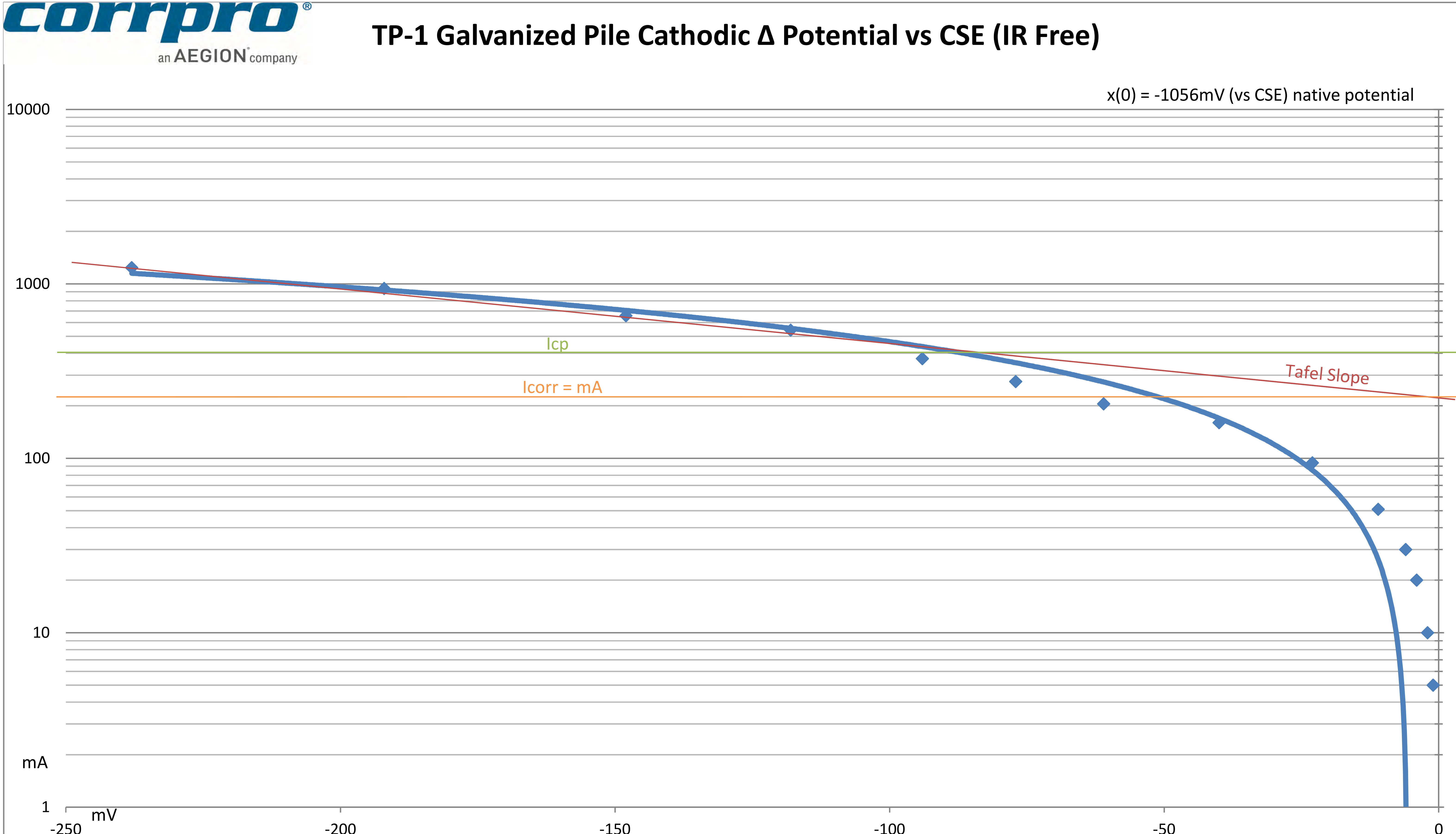
$$CR = \frac{I_{corr} \cdot K \cdot EW}{dA}$$

Corrosion Constant (K_1) =	128800	mil/amp-cm-yr
Corrosion Current (from E Log I tests) (Icorr) =	0.11	amps
Density of Steel (d) =	7.86	g/cm3
Equivalent Weight of Steel (EW) =	27.92	g
Buried Surface Area of a Single W6X7 Pile (A) =	11516.34	cm2
Corrosion Rate of Steel Due to General Corrosion (Short Exposure) =	4.370	mil/year
Corrosion Rate of Steel Due to General Corrosion (Long Exposure) =	2.185	mil/year
Ultimate General Corrosion Rate (Short Exposure, due to Corrosion on Both Sides of Pile) =	8.740	mil/year
Ultimate General Corrosion Rate (Long Exposure, due to Corrosion on Both Sides of Pile) =	4.370	mil/year
Total Corrosion Rate of Steel (Galvanic & General Corrosion) =	2.861	mil/year
Ultimate Corrosion Rate of Steel (Galvanic & General Corrosion on Both Sides of Pile) =	5.722	mil/year

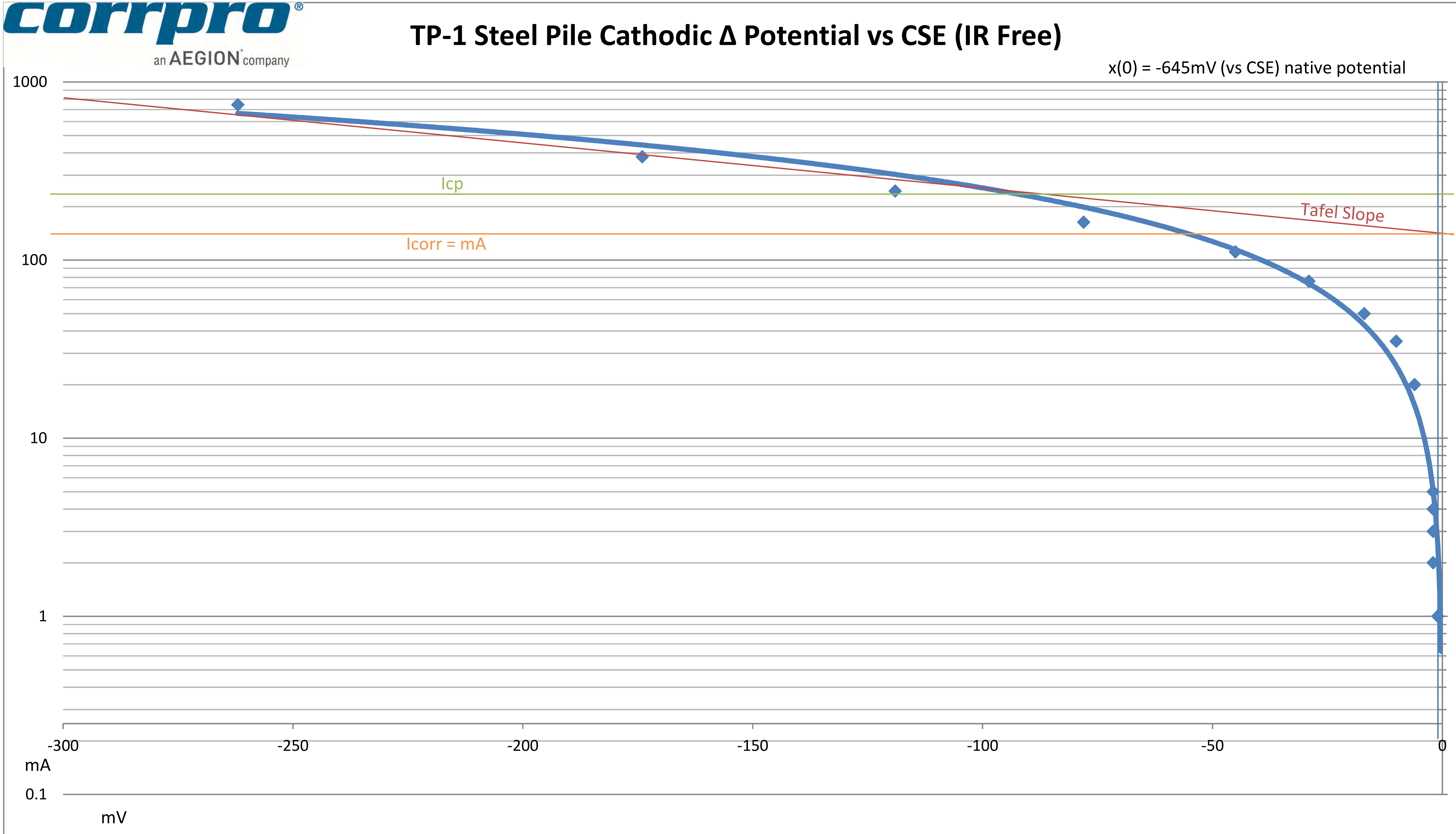
4.0 TOTAL LIFETIME OF GALVANIZED STEEL DRIVING PILES BASED ON GENERAL AND GALVANIC CORROSION

Total Lifetime of a Galvanized Zinc Coating =	0.80	years
W6X7 Pile Flange Thickness =	0.165	in
50% Corrosion Allowance (Basis of Lifetime Calculations) =	82.5	mils
Total Lifetime of a Bare Steel W6x7 Pile =	14.42	years
Lifetime of a Galvanized Steel W6x7 Pile (Based on General & Galvanic Corrosion) =	**15.22**	**years**

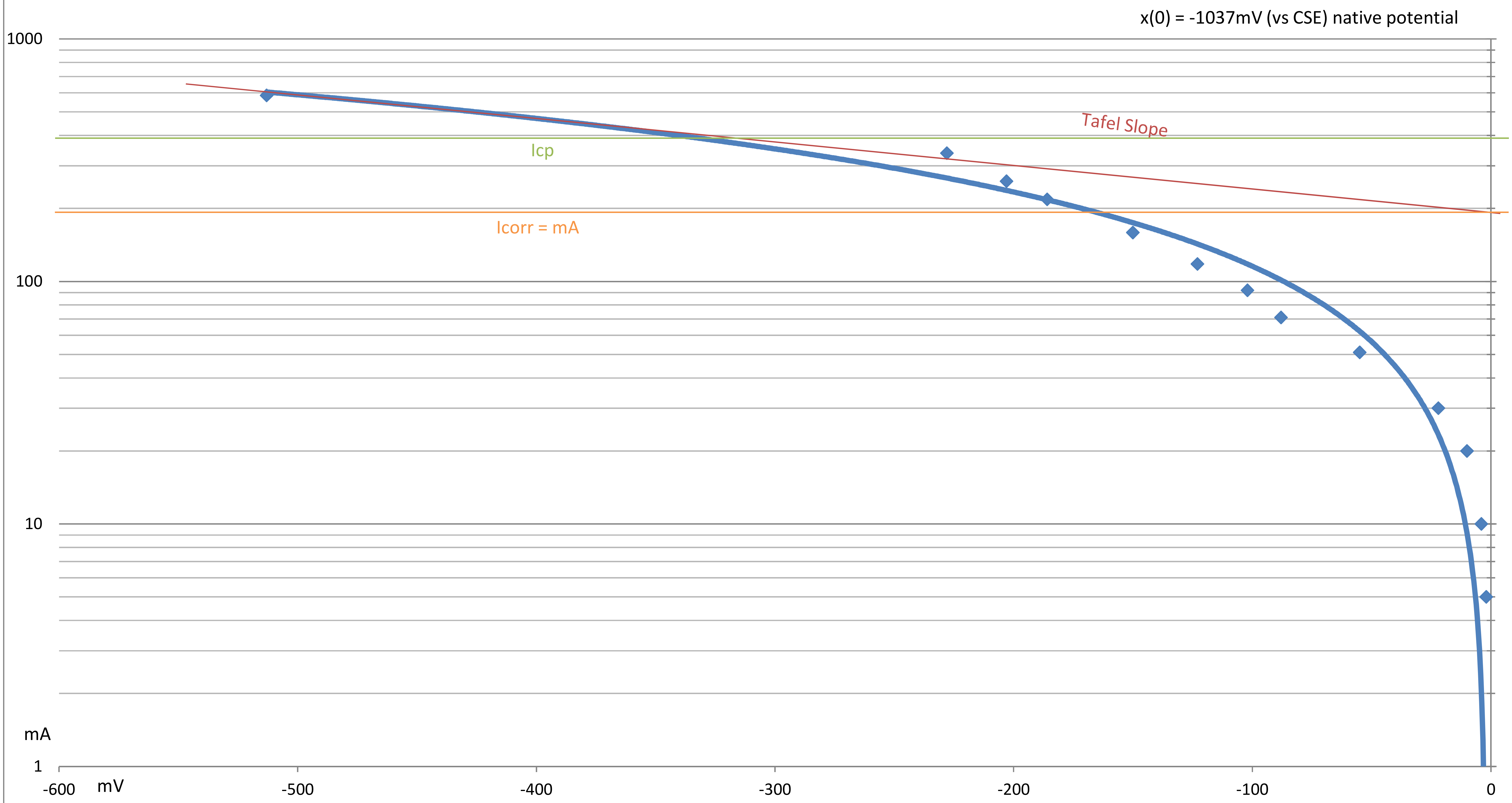
Conclusion: The 3 mils HDG coating and a corrosion allowance of 50% is not sufficient to provide service beyond 15 years. Alternate or additional methods of corrosion protection should be considered.

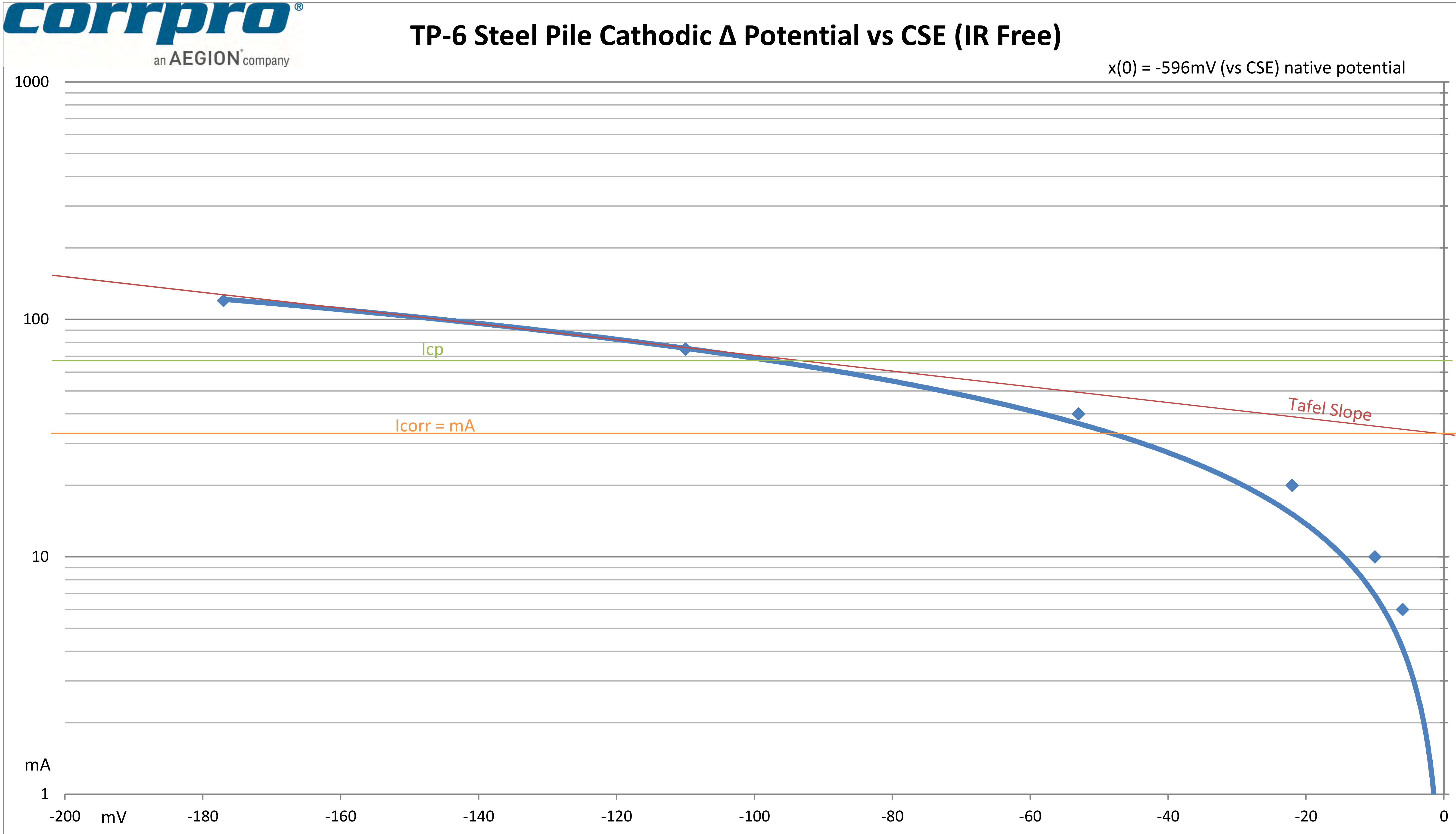


corrpro
an AEGION company
TP-1 Galvanized Pile Cathodic Δ Potential vs CSE (IR Free)
x(0) = -1056mV (vs CSE) native potential
10000
1000
100
10
1
mA
mV
Icp
Icorr = mA
Tafel Slope
-250
-200
-150
-100
-50
0

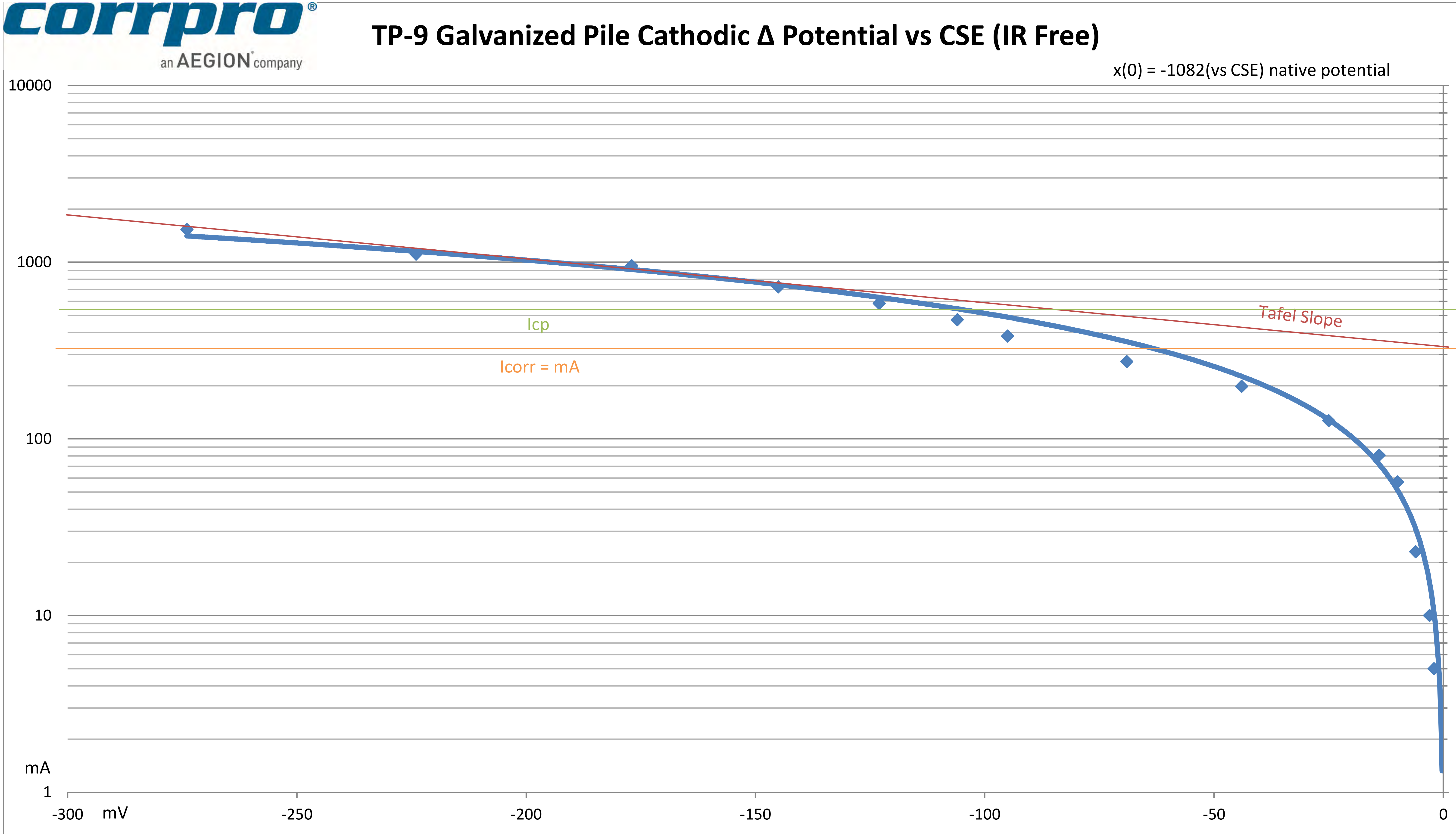

TP-1 Steel Pile Cathodic Δ Potential vs CSE (IR Free)
x(0) = -645mV (vs CSE) native potential
1000
100
10
1
0.1
mA
Icp
Icorr = mA
Tafel Slope
-300
-250
-200
-150
-100
-50
0
mV

TP-6 Galvanized Pile Cathodic Δ Potential vs CSE (IR Free)

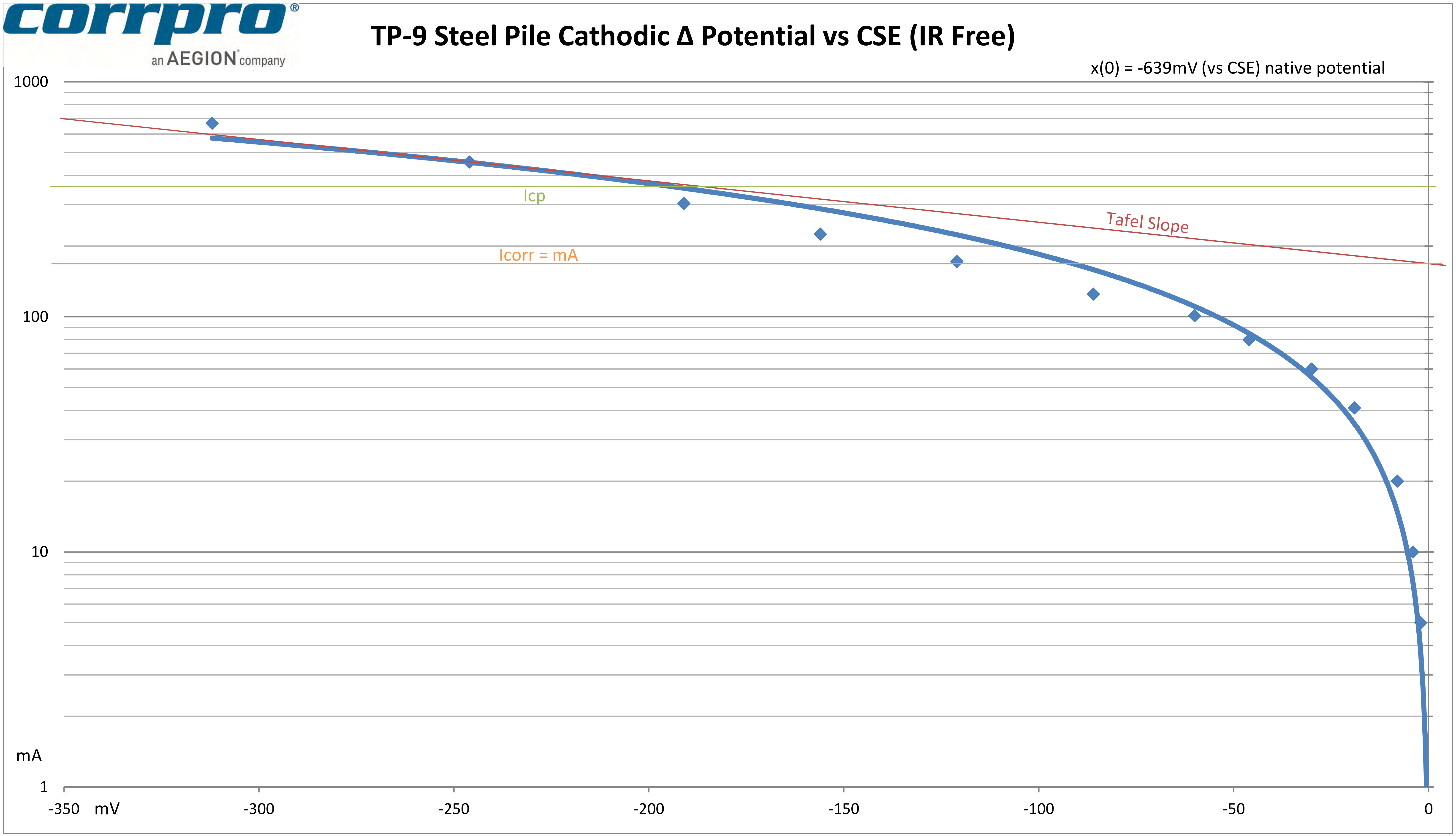




TP-6 Steel Pile Cathodic Δ Potential vs CSE (IR Free)
x(0) = -596mV (vs CSE) native potential
1000
100
10
1
mA
Icp
Icorr = mA
Tafel Slope
-200
mV
-180
-160
-140
-120
-100
-80
-60
-40
-20
0



corrpro
an AEGION company
TP-9 Galvanized Pile Cathodic Δ Potential vs CSE (IR Free)
x(0) = -1082(vs CSE) native potential
10000
1000
100
10
1
mA
Icp
Icorr = mA
Tafel Slope
-300
mV
-250
-200
-150
-100
-50
0



TP-9 Steel Pile Cathodic Δ Potential vs CSE (IR Free)
x(0) = -639mV (vs CSE) native potential
1000
100
10
1
mA
Icp
Icorr = mA
Tafel Slope
-350 mV
-300
-250
-200
-150
-100
-50
0

APPENDIX J
THERMAL RESISTIVITY TEST REPORT

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Tel: 925-999-9232
Fax: 925-999-8837
info@geothermusa.com

SOIL THERMAL SURVEY
FIRST SOLAR LITTLE BEAR PROJECT
MENDOTA, CALIFORNIA

August 2015

Prepared for:

Terracon Consultants, Inc.
2817 McGaw Avenue
Irvine, CA 92614

Submitted by:

GEOTHERM USA, LLC

COOL SOLUTIONS FOR UNDERGROUND POWER CABLES
THERMAL SURVEYS, CORRECTIVE BACKFILLS & INSTRUMENTATION

Serving the electric power industry since 1978

SOIL THERMAL SURVEY
FIRST SOLAR LITTLE BEAR PROJECT
MENDOTA, CALIFORNIA

AUGUST 2015

INTRODUCTION

A field thermal resistivity survey of the native soils was performed for the proposed underground power cables at the *First Solar Little Bear Project in Mendota, California*. In-situ thermal resistivity and ambient temperature measurements were conducted to a maximum depth of 4-ft at 6 locations along the cable routes. The fieldwork was carried out on the 28th of July, 2015. ***TERRACON*** marked the test locations, obtained permits, cleared services and provided a backhoe with an operator.

Field Testing and Soil Sampling:

In-situ thermal testing was carried out at 6 test pit locations **(Table 1)**. A backhoe was used to dig 4-foot deep test pits, and ambient temperature and thermal tests (TR) were performed at depths of 2, 3 and 4 feet. In addition, samples for laboratory testing - moisture content, density and thermal dryout characterization were also taken.

In-situ thermal tests were conducted in accordance with the IEEE Standard (**IEEE-442**); using thermal probes and the *Geotherm* **TPA-2000** run off a portable power source. All laboratory geotechnical testing was conducted in accordance with **ASTM**. Soil descriptions are made by visual examination of samples, and test locations are referenced by the number given by ***TERRACON***.

The field thermal resistivity values were measured at the given soil moisture on that particular day. Depending on weather and environmental conditions; i.e. drying due to cable heat or other heat source, seasonal drying (drought), artificial draining, water demand of crops, drying due to frost (ice lenses), etc., the soil may be drier at certain times of the year. Therefore, the design thermal resistivity for the native soils should be based on the driest expected conditions.

The test report contains factual information on the subsurface conditions at the specific test pit locations; no warrantee is expressed or implied that materials or conditions other than those described may not be encountered along the cable route.

Field Coordinates:

Test Pit	Longitude	Latitude
TR-1	-120.421793°	36.718598°
TR-3	-120.421902°	36.714359°
TR-4	-120.414542°	36.714395°
TR-6	-120.414499°	36.718600°
TR-8	-120.407332°	36.714341°
TR-10	-120.406974°	36.718549°

Laboratory Testing:

The tests included the measurement of moisture content, density and thermal dryout characterization (thermal resistivity as a function of moisture content). Samples from 2'-4' depth were re-compacted at the 'field' moisture content and at 85% and 95% of the single point standard Proctor density. A series of thermal resistivity measurements were made in stages with moisture content ranging from 'natural' to totally dry condition. The tests were conducted in accordance with IEEE standard-442. The test results are given in **Table 1** and the thermal dryout curves are presented in **Figures 1 and 2.**

Comments:

Ambient Temperature: In-situ testing was conducted at the time of the year when the earth ambient temperature was not the highest. At the end of a warm summer, the ambient temperatures may be somewhat higher; especially at shallow depths. This should be taken into consideration for the cable rating. At the proposed cable burial depth of 3-4 ft., temperature of about 32 ºC is suggested.

Geotherm believes a maximum ambient soil temperature of approximately 32 °C shall be adequate; however, the Engineer of Record will ultimately be responsible for the determination of appropriate soil temperature assumptions.

Soil thermal resistivity for cable rating:
Thermal resistivity of about 70°C-cm/W may apply for the native soil in-situ. This does not take into consideration any soil drying as a result of the heat generated by the cables.

Native soil as cable trench backfill:
If the native soil is installed at its natural moisture content and at **85% relative density**, a thermal resistivity of ~ 160 °C-cm/W may apply for the rating.

If the native soil is installed at its natural moisture content and at **95% relative density**, a thermal resistivity of ~ 125°C-cm/W may apply for the rating.

Geotherm suggests these values based on lab test data; however, the Engineer of Record will ultimately be responsible for the determination of appropriate soil thermal parameter assumptions.

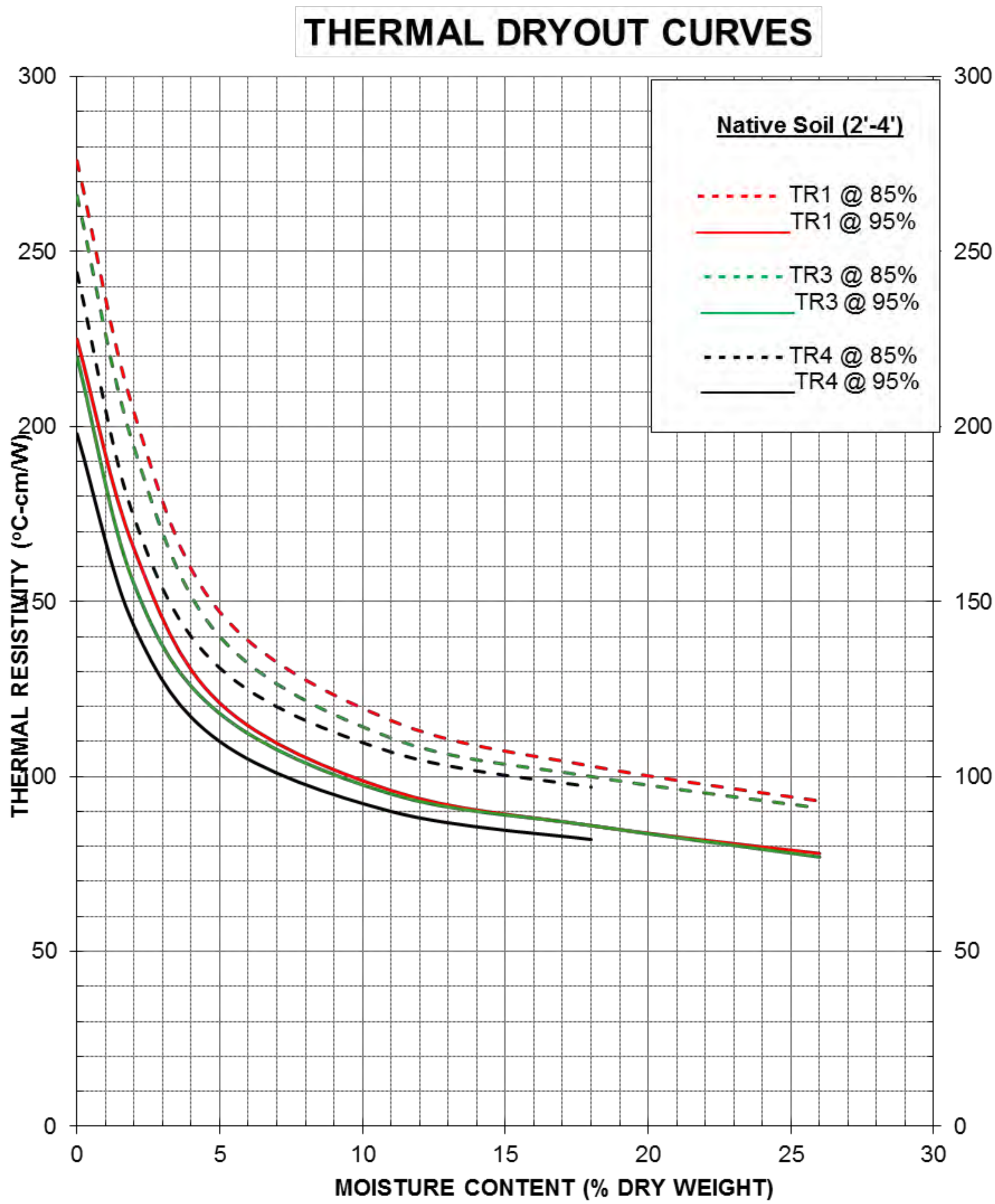
Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA

Deepak Parmar

TABLE 1

Test Pit	Depth (ft.)	Temp. (°C)	In-situ TR (°C-cm/W)	Laboratory TR @ 95% & 85% density (°C-cm/W)		Dry Density (lb/ft^3)	In-situ M/C (%)	Visual Description
				Wet	Dry			
TR1	2	30.0	51	78 (95%) 93 (85%)	225 (95%) 276 (85%)	90 81	25	Sandy lean clay
	3	28.3	56					
	4	27.2	57					
TR3	2	30.7	54	77 (95%) 91 (85%)	220 (95%) 266 (85%)	79 89	27	Sandy lean clay
	3	29.1	58					
	4	28.1	63					
TR4	2	30.4	78	97 (95%) 82 (85%)	198 (95%) 244 (85%)	90 81	18	Sandy lean clay
	3	28.3	70					
	4	27.5	63					
TR6	2	29.7	57	68 (95%) 76 (85%)	160 (95%) 205 (85%)	106 95	15	Sandy lean clay
	3	28.1	55					
	4	27.5	53					
TR8	2	30.5	66	75 (95%) 86 (85%)	195 (95%) 238 (85%)	91 81	24	Sandy lean clay
	3	29.1	68					
	4	27.9	69					
TR10	2	29.9	66	83 (95%) 106 (85%)	218 (95%) 284 (85%)	87 78	28	Sandy lean clay
	3	28.3	64					
	4	27.2	61					

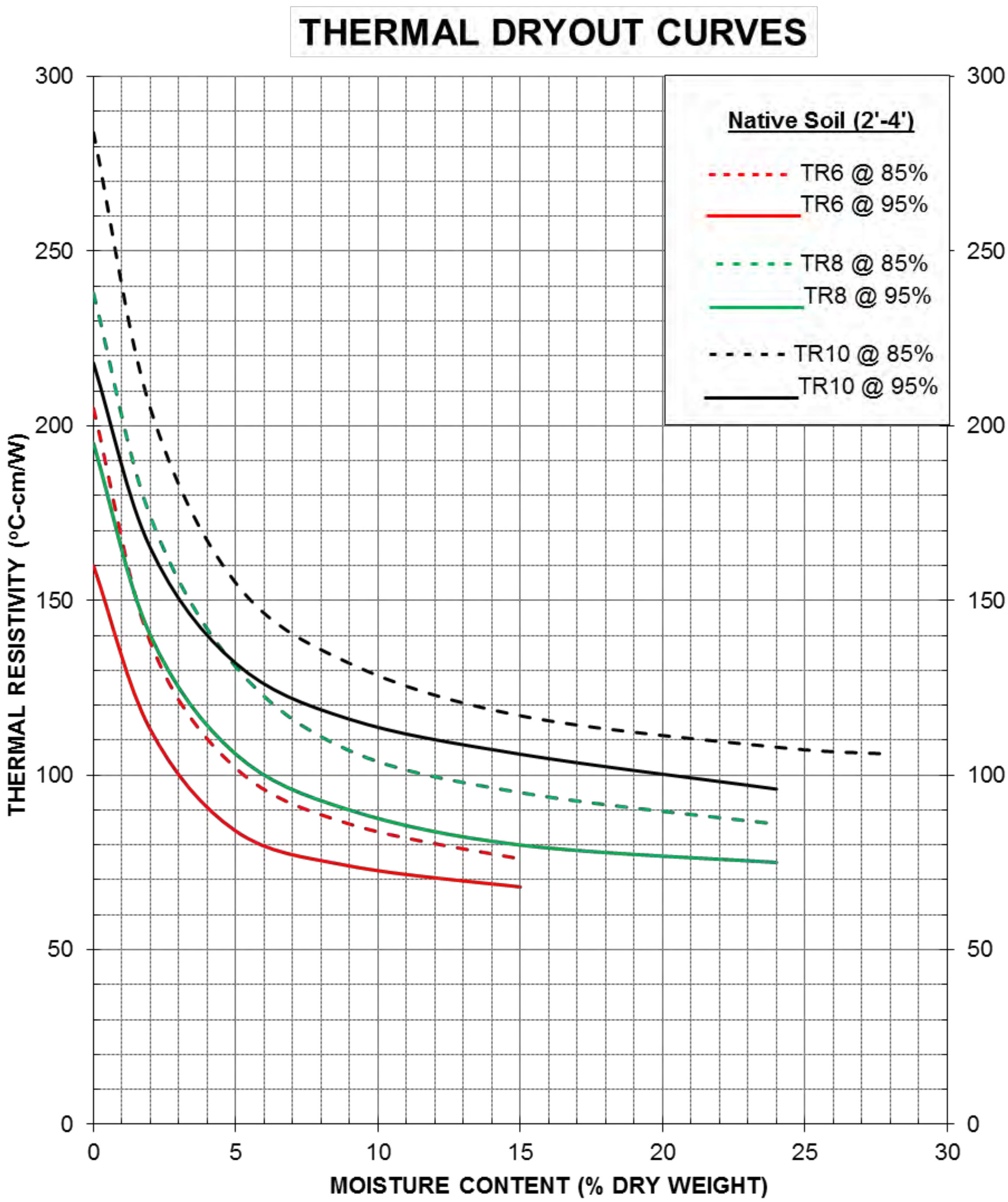


Terracon Consultants, Inc.

Thermal Analysis of Native Soil

First Solar Little Bear Project- Mendota, California

August 2015 **Figure 1**



Terracon Consultants, Inc.

Thermal Analysis of Native Soil

First Solar Little Bear Project- Mendota, California

August 2015 **Figure 2**

Appendix H2
Geologic Reconnaissance Report, Little Bear Solar Project

GEOLOGIC RECONNAISSANCE REPORT
LITTLE BEAR SOLAR PROJECT
FRESNO COUNTY, CALIFORNIA

PREPARED FOR:
Dudek
1102 R Street
Sacramento, California 95811

PREPARED BY
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
5710 Ruffin Road
San Diego, California 92123

March 22, 2017
Project No. 108256001

March 22, 2017
Project No. 108256001

Mr. Steve Peterson, AICP, LEED AP
Dudek
1102 R Street
Sacramento, California 95811

Subject: Geologic Reconnaissance Report
Little Bear Solar Project
Fresno County, California

Dear Mr. Peterson:

In accordance with your request and authorization, we have performed a geologic reconnaissance for the Little Bear Solar project in Fresno County, California. The attached report presents our methodology, findings, opinions, and preliminary recommendations regarding the geology and soils conditions at the site.

We appreciate the opportunity to be of service on this project.

Sincerely,
NINYO & MOORE

PROFESSIONAL GEOLOGIST
CHRISTINA A. TRETINJAK
No. 8470
Exp. 11-30-17
STATE OF CALIFORNIA

Christina Tretinjak, PG, CEG
Project Geologist

Gregory T. Farrand, PG, CEG
Principal Geologist

REGISTERED GEOLOGIST
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CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

CAT/WRM/GTF/gg

Distribution: (1) Addressee

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EXECUTIVE SUMMARY

The proposed Little Bear Solar project is located approximately 2.5 miles southwest of the City of Mendota in unincorporated Fresno County in the San Joaquin Valley in central California. The solar generation site (project site) is bounded by West California Avenue to the north, South Derrick Avenue (SR-33) to the east, West Jensen Avenue to the south, and San Bernardino Avenue to the west. Specifically, the project site consists of a rectangular area approximately 1,288-acres in size, and a proposed underground circuit line extending parallel to West California Avenue to the existing Mendota Substation approximately 2 miles to the west.

As shown on Figure 2, the project area is generally undeveloped, with the exception of a few farm-related structures located near the central portion of the project area. The site is currently privately-owned and is being used for agricultural purposes. Elevations across the site range from approximately 215 feet above mean sea level (MSL) in the southwest portion of the site to approximately 180 feet above MSL in the northeast portion of the site.

Geologic and geotechnical constraints evaluated for the project include:

- Surface and near-surface soils at the project site are mapped as fan deposits (Jennings and Strand, 1958). Fill materials associated with the construction of the existing roadways utilities as well as agricultural topsoil are also anticipated at the project. Geotechnical constraints related to soils at the project are:
  - *Soft Ground* – Areas with soft ground or loose soils can be found throughout the project.
  - *Expansive Soils* – The project soils are expected to have a moderate potential for expansion.
  - *Fill Soils* – Man-made fill soils placed without engineering supervision may be loosely or inadequately compacted, may contain oversize materials unsuitable for reuse in engineered fills, and may contain unsuitable organic or expansive materials and debris that may preclude their use in engineered fills.
- The closest known major active fault is the Great Valley 11 Fault, which is located approximately 13 miles west of the project. Geotechnical constraints related to faulting and seismic events at the project are:
  - *Ground Shaking* – The project has a moderate potential for strong ground motions due to earthquakes on nearby active faults.
  - *Liquefaction* – Fan deposits (where shallow groundwater is present) may be subject to seismic settlement or liquefaction during a nearby seismic event.

- Shallow groundwater or perched water may occur beneath portions of the project site.
- The potential for landsliding at the project site is considered low.
- Dam inundation and significant flooding of the site are not considered to be significant hazards to the project site.
- Based on previous work in the general vicinity of the project area, the soils at the project site may be corrosive.

1. INTRODUCTION

In accordance with your request, Ninyo & Moore has completed a geologic reconnaissance for the proposed Little Bear Solar project located in unincorporated Fresno County, California (Figure 1). Our evaluation is based on a geologic reconnaissance, published and non-published reports, aerial photographs, in-house data, and the assessment of the potential geologic hazards in the project area. The purpose of this geologic reconnaissance was to evaluate the potential for existing environmental impacts related to geologic or soils conditions to affect the project site and adjoining areas, and to discuss measures that can be implemented to reduce or mitigate the potential impacts with respect to the design and construction of the proposed project.

2. SCOPE OF SERVICES

Ninyo & Moore's scope of services for this geologic reconnaissance have included the activities listed below:

- Review of readily available regional, local, and site-specific geologic and geotechnical reports.
- Review of readily available background information including topographic, soils, mineral resources, geologic, and seismic and geologic hazard maps, and stereoscopic aerial photographs.
- Performance of a geologic reconnaissance of the site vicinity.
- Compilation and analysis of the data obtained from our background reviews and site reconnaissance.
- Preparation of this report presenting our findings, conclusions, and preliminary recommendations regarding potential geologic and soil impacts at the site. The findings were evaluated with respect to questions A through E listed in Section 6, "Geology and Soils" within Appendix G, "Environmental Checklist Form" of the "Guidelines for Implementation of the California Environmental Quality Act (CEQA)."

3. REGULATORY FRAMEWORK

Geologic resources and geotechnical hazards within the proposed project area are governed by the County of Fresno. The site is also governed by the regulations of the California Code of Regulations (CCR), 2016 California Building Code (CBC).

The CBC is promulgated under CCR, Title 24, Parts 1 through 12 (also known as the California Building Standards Code), and is administered by the California Building Standards Commission (CBSC). The CBSC is responsible for administering California's building codes.

4. SITE AND PROJECT DESCRIPTION

The site of the proposed Little Bear Solar project is located approximately 2.5 miles southwest of the City of Mendota in unincorporated Fresno County in the San Joaquin Valley in central California. The project site is bounded by West California Avenue to the north, South Derrick Avenue (SR-33) to the east, West Jensen Avenue to the south, and San Bernardino Avenue to the west (Figure 1). Specifically, the project site consists of a rectangular area approximately 1,288-acres in size, and a gen-tie line corridor extending parallel to West California Avenue to the existing Mendota Substation approximately 2 miles to the west (Figure 2). Site elevations range from approximately 215 feet above mean sea level (MSL) in the southwest portion of the site to approximately 180 feet above MSL in the northeast portion of the site. The site is currently privately-owned and we understand it has been intermittently dry-farmed or lain fallow in recent years.

Based on our review of the project description (Little Bear Solar, 2016), we understand that the project will consist of the development of a solar photovoltaic (PV) power generating project. Specifically, the project will consist of five individual facilities: two 20 MW facilities; one 40 MW facility and two 50 MW facilities.

5. GEOLOGY

The following sections present our findings relative to regional and site geology, geologic hazards (e.g., landslides or expansive soils), groundwater, faulting, and seismicity.

5.1. Regional Geologic Setting

The project area is situated in the southern portion of the Great Valley Geomorphic Province. This geomorphic province encompasses an area between the Sierra Nevada and Coastal Ranges that extends approximately 500 miles from the Transverse Ranges in the south to the Klamath Mountains and Cascades in the north (Norris and Webb, 1990). The province varies in width from approximately 30 to 70 miles. In general, the province consists of a relatively flat-floored valley consisting of alluvial materials overlying relatively undeformed Cenozoic sedimentary rocks, which in turn are underlain at depth by Sierran basement rocks.

Structurally, the Great Valley is an asymmetrical synclinal trough, bounded by the generally northwest-southeast trending Sierra Nevada Mountains on the east, and the Coast Ranges on the west. The trough is bisected by the Stockton Fault in the Stockton arch, and the White Wolf Fault, south of the Bakersfield arch. Other prominent structural features include the Kern Front Fault, north of Bakersfield, the Buena Vista thrust, on the east margin of the Coast Range, and Sutter Buttes, north of Sacramento. In addition, several valley fold structures, which are notable for their oil and gas reserves, are evident near the Great Valley and Coast Range boundary, including Elk Hills, Lost Hills, Buena Vista Hills, Kettleman Hills, McKittrick, and Wheeler Ridge. Significant fold structures have also been mapped near Sutter Buttes, Dunnigan, Lodi, Willows, and Rio Vista. Much of the structural deformation is thought to be the result of compression due to the bend in the active San Andreas Fault. North of the bend, major tectonic activity associated with this fault consists of primarily right-lateral, strike-slip movement. Further discussion of faulting relative to the site is provided in the Faulting and Seismicity section of this report.

5.2. Site Geology

Based on our review of published geologic maps and our site reconnaissance, surficial soils at the project site consist of fill, agricultural topsoil, and fan deposits. A brief description of these units, as described in the cited literature or as observed on the site, is presented below.

5.2.1. Fill

Fill soils are anticipated to underlie portions of the site area due to previous land use, roadway construction, and burial of utility lines. As observed at the surface, the fill soils are generally composed of brown clay, silt, sand, and gravel.

5.2.2. Agricultural Topsoil

Agricultural topsoil mantles the site and is anticipated to be on the order of 1 to 2 feet in thickness. Where observed, these soils generally consist of brown and dark brown, silty fine to medium sand.

5.2.3. Fan Deposits

Quaternary-age fan deposits of the Great Valley (Jennings and Strand, 1958) underlie the fill and agricultural topsoil at the site. Where observed these soils generally consist of light brown to dark brown, silty fine sand with clay. Based on two borings included in a preliminary-level geotechnical report (Terracon, 2015), the upper approximately 40 feet of the site is underlain by lean clay with sand, fat clay and sand.

5.3. Groundwater

Sources provided by the California Water Data Library Resources (DWR) and the California State Water Resources Control Board (SWRCB) were reviewed for information pertaining to groundwater quality and occurrence in the vicinity of the project. According to the SWRCB Water Quality Control Plan for the San Joaquin Hydrologic Basin, the project is located within the Westlands Hydrologic Area in the South Valley Floor Hydrologic Unit.

We researched information on the SWRCB GeoTracker website for groundwater monitoring well data in the vicinity of the project site. Numerous irrigation and observation wells are located around the project site. An irrigation well is located in the western portion of the project site. Depth to groundwater was measured in the irrigation well in May 2016 at a depth of 294 feet. Numerous other irrigation wells located in the site vicinity have reported groundwater measurements at depths on the order of 200 to 400 feet. However, measurements taken in observation wells located approximately 1 mile north of the project site indicate groundwater depths as shallow as 5 feet. Based on the preliminary-level geotechnical report for the site (Terracon, 2015), groundwater was encountered in two borings at approximately 17 to 18 feet in depth at the time of drilling. Potential beneficial uses of groundwater have been designated for agricultural purposes.

5.4. Faulting and Seismicity

As shown on Figure 4, there are several active faults in the region. Therefore, like most of southern California, the project area is considered to be seismically active. The closest known active fault is the Great Valley 11 Fault, which is capable of generating an earthquake magnitude of 6.6 (California Geological Survey [CGS], 2016c). The Great Valley 11 Fault is located approximately 13 miles west of the site.

In general, hazards associated with seismic activity include ground surface rupture, strong ground motion, liquefaction, and tsunamis. These hazards are discussed in the following sections.

5.4.1. Ground Surface Rupture

Ground surface rupture due to active faulting is not considered likely in the project area due to the absence of known active faults underlying the site. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

5.4.2. Strong Ground Motion

The 2016 California Building Code (CBC) specifies that the Risk-Targeted, Maximum Considered Earthquake (MCE_R) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCE_R ground motion response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal peak ground acceleration (PGA) that corresponds to the MCE_R for the site was calculated as 0.47g using the United States Geological Survey (USGS, 2017) seismic design tool (web-based). Spectral response acceleration parameters, consistent with the 2016 CBC, are also provided in the recommendations section of this report for the evaluation of seismic loads on buildings and other structures.

The 2016 CBC specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration with adjustment for site class effects in accordance with the American Society of Civil Engineers (ASCE) 7-10 Standard. The MCE_G peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. The MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) was calculated as 0.45g using the USGS (USGS, 2016) seismic design tool that yielded a mapped MCE_G peak ground acceleration of 0.41g for the site and a site coefficient (F_{PGA}) of 1.092 for Site Class D.

As noted, the nearest known active fault is the Great Valley Fault 11, located approximately 13 miles west of the project site. Table 1 below lists principal known active faults that may affect the subject site, the maximum moment magnitude (M_{max}) and the fault types. The approximate fault-to-site distances were calculated using the USGS website (USGS, 2016).

Table 1 – Principal Active Faults

Fault	Approximate Distance miles (km)[1]	Maximum Moment Magnitude (M_{max})[1]
Great Valley 11	13 (21)	6.6
Great Valley 10	15 (23)	6.5
Great Valley 12	16 (26)	6.4
Great Valley 9	20 (33)	6.8
Great Valley 13	25 (40)	7.1
Ortigalita	27 (44)	7.1
Great Valley 8	42 (67)	6.8
Great Valley 14 (Kettleman Hills)	43 (69)	7.2
Quien Sabe	45 (73)	6.6
San Andreas (Parkfield/Cholame)	50 (80)	8.2
Calaveras (southern)	56 (89)	7.0
Rinconada	58 (94)	7.5
San Andreas (Santa Cruz Mtn)	60 (97)	8.1
Calaveras (central)	62 (100)	7.0

Note:
[1] United States Geological Survey, 2016

5.4.3. Liquefaction and Seismically Induced Settlement

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by a relatively shallow groundwater table are susceptible to liquefaction. Based on the preliminary-level geotechnical report's encountered shallow water table and presence of a thick overlying layer of lean clay with sand and fat clay above a depth of 38 feet and presence of silty sand at a depth of below 38 feet in two borings approximately 40 feet in depth (Terracon, 2015), the potential for liquefaction may be low or may be fairly uniform. Therefore, liquefaction still may be a design consideration. It is the responsibility of the geotechnical engineer of record to verify the potential for liquefaction and dynamic settlement and to provide appropriate design recommendations.

5.4.4. Tsunamis and Seiches

Tsunamis are long wavelength seismic sea waves (long compared to the ocean depth) generated by sudden movements of the ocean bottom during submarine earthquakes, landslides, or volcanic activity. Based on the inland location and elevation of the project, the potential for a tsunami to impact the site is not a design consideration.

Seiches are oscillations of enclosed or partially enclosed bodies of water often generated by seismic activity. Based on the elevation of the site and the absence of nearby bodies of water, the potential for seiches to impact the site is considered low.

5.5. Landsliding

Based on our review of published geologic literature, aerial photographs, site reconnaissance, and on our subsurface evaluations, no landslides or related features are known to underlie or be adjacent to the project site. Therefore, the potential for landslides at the project site is considered low.

5.6. Regional Land Subsidence

Land subsidence is characterized as a shrinking of the ground surface relative to surrounding areas, and can generally occur where deep alluvial deposits are present in valley areas. Subsidence in alluvial valley areas is typically associated with groundwater withdrawal or other fluid withdrawal from the subsurface such as oil and/or natural gas. Extraction of these geologic fluids can cause subsidence, which can result in the development of surface ground cracks and fissures, particularly near valley margins. Cracks and earth fissures can cause damage to improvements including roads, transmission lines, foundations, structures, and pipelines. Review of the USGS report "Land Subsidence along the Delta-Mendota Canal in the Northern Part of the San Joaquin Valley" prepared in 2013, indicates that widespread land subsidence occurred in the region from 1926 to 1970 as a result of groundwater withdrawal. Measurements within the Mendota area indicate that 2.4 to 4.9 meters of land subsidence has occurred between 1926 and 1970. Current monitoring indicates that 25 millimeters of land subsidence occurred in the region between 2008 and 2010 (USGS, 2016).

During our site reconnaissance, we did not observe ground cracks or earth fissures. We note however, that the site generally consists of plowed agricultural fields that may conceal underlying cracks or fissures.

5.7. Flood Hazards

Based on review of Federal Emergency Management Agency (FEMA) Mapping Information Platform website (2016), the project site is not located within mapped 100 or 500-year floodways. Portions of the Panoche Creek, located north of the site, are mapped as within an active floodway. Based on review of the flood maps and the elevation of the site, the potential for significant flooding to impact the project is not a project constraint. In addition, the potential for dam inundation is not considered a project constraint for the same reasons.

5.8. Expansive Soils

Expansive soils generally result from specific clay minerals that have the capacity to shrink or swell in response to changes in moisture content. Shrinking or swelling of foundation soils can lead to damage to slabs, foundations, and other engineered structures, including tilting and cracking. Clayey fill and agricultural soils may be expansive. Additionally, the fan deposits may contain lenses of clay, which can be expansive. In general, the soils and earth materials at the project may be expected to have a moderate potential for expansion.

5.9. Corrosive Soils

Caltrans corrosion (2015) criteria define as soils with more than 500 parts per million (ppm) chlorides, more than 0.2 percent sulfates, or a pH less than 5.5. Based on the preliminary-level geotechnical report for the site (Terracon, 2015), site soils can be classified as corrosive. Additionally, based on laboratory testing performed on soil samples from Ninyo & Moore projects near the project area and Caltrans corrosion (2015) criteria, soils in the general vicinity of the project site have been classified as corrosive. The potential for similar soils to occur at the project is considered high.

5.10. Soils

Based on the interactive map using the Web Soil Survey website (USDA, 2016), three different soil units have been noted on the project site. These soils types include: Tranquility Clay, Posochanet Clay Loam, and Calflax Clay Loam. Based on the previous agricultural site use and the surrounding paved and unpaved roadways, preexisting native soils are anticipated to have been removed and/or disturbed on the project site.

5.11. Mineral Resources

According to the Fresno County General Plan Background Report (2000) the project area is not located within a mineral resource location.

6. CONCLUSIONS

Based on our review of the referenced background data and our geologic field reconnaissance it is our opinion that geologic and geotechnical considerations at the project site include the following:

- Surface and near-surface soils at the project are mapped as fan deposits. Fill materials associated with the construction of the existing roadways and utilities and agricultural topsoil associated with the site's previous use as farmland are also anticipated to be present at the project site. Geotechnical constraints related to soils at the project are:
    - *Soft Ground* – Areas with soft ground or loose soils can be found in areas underlain by existing fill and agricultural topsoil.
    - *Expansive Soils* – The project soils are expected to have a moderate potential for expansion.
    - *Fill Soils* – Man-made fill soils placed without engineering supervision may be loosely or inadequately compacted, may contain oversize materials unsuitable for reuse in engineered fills, and may contain unsuitable organic or expansive materials and debris that may preclude their use in engineered fills.
- Shallow groundwater or perched water may occur beneath portions of the project.
- The closest known major active fault is the Great Valley 11 Fault, which is located approximately 13 miles west of the project. Geotechnical constraints related to faulting and seismic events at the project are:
    - *Ground Shaking* – The project has a moderate potential for strong ground motions due to earthquakes on nearby active faults.
    - *Liquefaction* – Fan deposits may be subject to seismic settlement and/or liquefaction during a nearby seismic event.
- The potential for landsliding in the project area is considered low.
- Significant flooding or dam inundation are not considered design constraints.
- Based on previous work in the project area, some soils at the project site may be expansive and corrosive.

The conditions described above would increase the cost and duration of grading and construction of the project, but would not preclude development of the project.

7. RECOMMENDATIONS

Based on the geologic and geotechnical considerations at the project site presented in the previous section, our general recommendations are presented below. These recommendations assume that further geotechnical evaluation, including subsurface evaluation and laboratory testing, will be conducted prior to finalization of project plans and that specific recommendations will be provided at that time.

- Soft Ground – Soils in areas with soft ground or loose soils in the area of the proposed project may be subject to settlement. Recommendations to mitigate this condition can typically include removal and/or replacement of soils as engineered compacted fill. The extent of soft soils and recommended removals may be evaluated by subsurface exploration and laboratory testing.

- Land subsidence – Land subsidence may cause ground cracks or earth fissures which may lead to damage to foundations and engineered structures. The proposed structures should be designed to accommodate vertical movement associated with long-term ground subsidence. The PV structures can also be provided with mechanisms so they can be readily realigned in response to subsidence as needed.

- Expansive Soils – Expansive soils may lead to damage to foundations and engineered structures. If expansive soils exist on site, the following recommendations may be implemented during construction: the soils may be removed from sensitive areas and placed in deeper fill areas; the soils may be excavated and removed from the site; or the expansive soils may be treated (i.e., lime treatment) to mitigate their potential for expansion. The extent of expansive soils and recommended mitigation measures may be evaluated by subsurface exploration and laboratory testing.

- Ground Shaking – Proposed structures should be designed appropriately to mitigate strong ground shaking in the event of an earthquake on a nearby fault.

- Liquefaction – The site may be considered susceptible to liquefaction and dynamic settlement based on the measured shallow groundwater in a nearby groundwater monitoring well and groundwater depths encountered in borings. Prior to development, a geotechnical evaluation involving subsurface exploration and laboratory testing should be performed to specifically evaluate the potential for liquefaction on the project site. If such an evaluation finds that a potential for liquefaction to exist, the following recommendations may be implemented during construction: removal and replacement of soils susceptible to seismic settlement and/or liquefaction; densification of these soils; or utilization of special foundations to mitigate liquefaction and seismic settlement.

- Shallow groundwater – Shoring and dewatering may be required if construction is proposed in areas of shallow groundwater.

- Landsliding – Landslides have not been mapped on the site or reported in the available literature. Further, no landslides were observed on or adjacent to the site during our field reconnaissance.

- Corrosive Soils – If corrosive soils exist on the site, a corrosion engineer may be required to assist in the design of improvements in contact with the soil. A preliminary evaluation of soil corrosivity tests were reported in a geotechnical report and classified the site soils as corrosive (Terracon, 2015). The extent of corrosive soils and recommended mitigation measures may be further evaluated by subsurface exploration and laboratory testing.

8. IMPACT ANALYSIS

Based upon the results of our geologic reconnaissance, our findings, conclusions, and recommendations regarding potential geological impacts to the Little Bear Solar Project are summarized in the following sections.

8.1. Significance Thresholds

In evaluating the significance of potential environmental concerns in a particular study area, the criteria to consider, as they relate to geologic and soil conditions, are presented in the CEQA Guidelines. In accordance with the scope of work, the findings of this study were evaluated with respect to Questions A through E of Section 6 "Geology and Soils" with in Appendix G of the CEQA Guidelines (2009).

8.2. Project Impacts and Significance

Based on the above criteria and the results of the evaluation, the potential impact by geologic and soil conditions at the project have been identified, and are discussed below.

A. Would the project 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 known fault?

The potential for ground surface rupture due to active faulting is considered low in the project area due to the absence of known active faults underlying the site (less than significant impact). However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

ii. Strong seismic ground shaking?

The project has a moderate potential for strong ground motions due to earthquakes on nearby active faults (less than significant impact with mitigation incorporated).

iii. Seismic related ground failure, including liquefaction?

Based on the shallow groundwater measured in a nearby well, it is our opinion that the potential for liquefaction over the majority of the project site is a design consideration and should be evaluated further. However, we consider this impact to be less than significant with mitigation incorporated.

iv. Landslides?

Geologic mapping does not indicate the presence of mapped landslides on the project site. Additionally, landslides were not observed on or adjacent to the project. Therefore, the potential for existing landslides is considered low (less than significant impact).

B. Would the project result in substantial soil erosion or the loss of topsoil?

If the site is developed in accordance with current building codes and industry standards, the potential for substantial soil erosion is considered to be low (less than significant impact). The potential for substantial loss of topsoil due to the proposed development is considered low due to the previous agricultural use of the site.

C. Would the project be located on geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

The fan deposits underlying the site may be subject to seismic settlement or liquefaction during a nearby seismic event. The site is not considered prone to landsliding or slope instability issues. Based on these items, we consider this impact to be less than significant with mitigation incorporated. Land subsidence may cause ground cracks or earth fissures which may lead to damage to foundations and engineered structures. The proposed structures should be designed to accommodate vertical movement associated with long-term ground subsidence.

D. Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

The soils on the project site are expected to have a moderate to high potential for expansion based on classification in a report (Terracon, 2015). However, we consider this impact to be less than significant with mitigation incorporated.

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?

The soils on the project site are expected to be able to support adequately designed septic tanks or alternative waste water disposal systems. We consider this impact to be less than significant with mitigation incorporated.

9. LIMITATIONS

The field evaluation and geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No warranty, implied or expressed, is made regarding the conclusions, recommendations, and professional opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered. Our preliminary conclusions and recommendations area based on an analysis of the observed conditions and the referenced background information.

The purpose of this study was to evaluate geologic and geotechnical conditions within the project site and to provide a preliminary geotechnical evaluation report to assist in the preparation of environmental impact documents for the project. A comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing, should be performed prior to design and construction of structural improvements.

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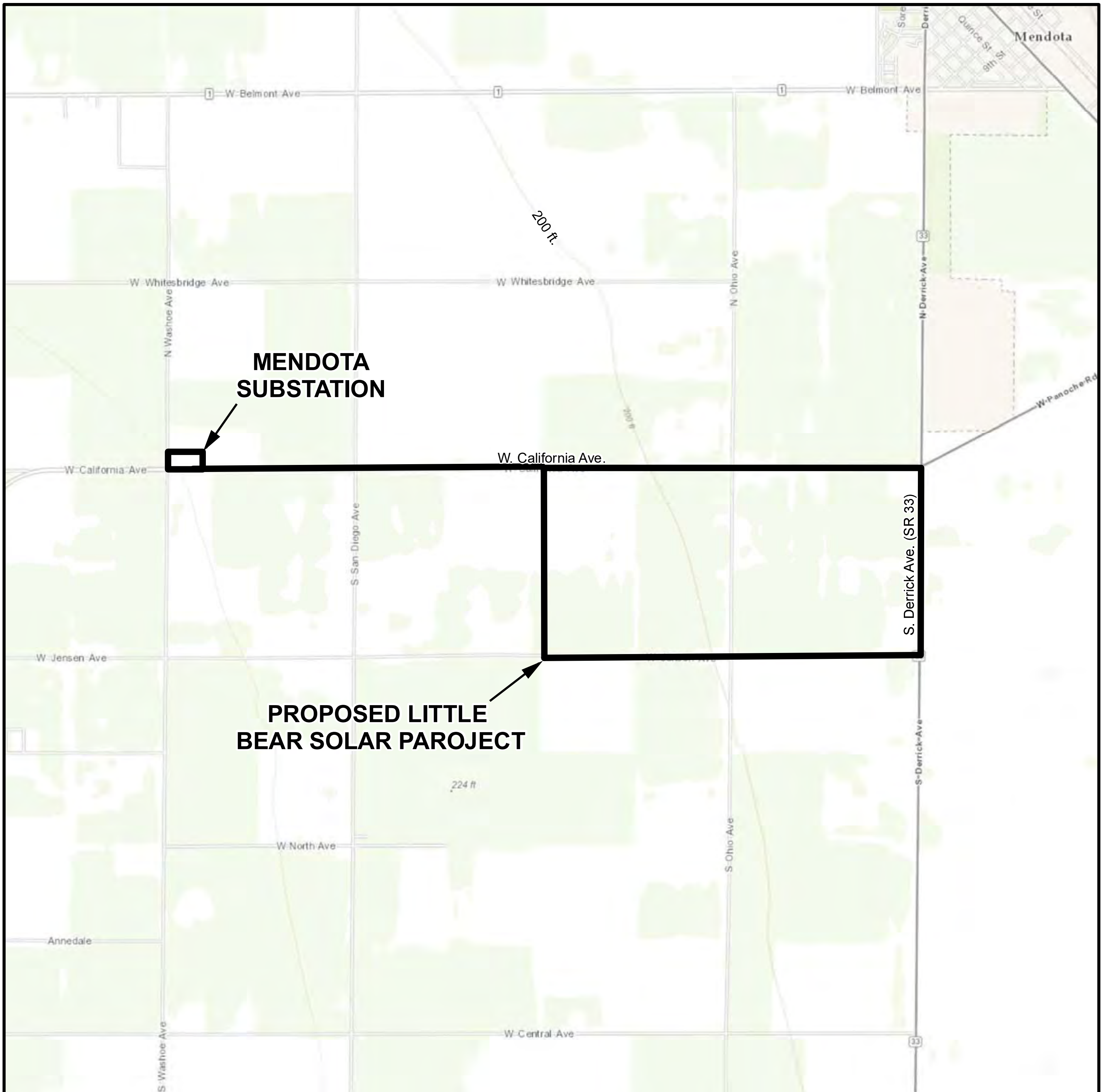
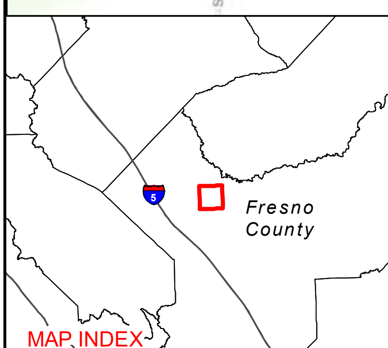


SOURCE: ESRI WORLD TOPO, 2016



N

SCALE IN FEET

0 4,000 8,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

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Ninyo & Moore

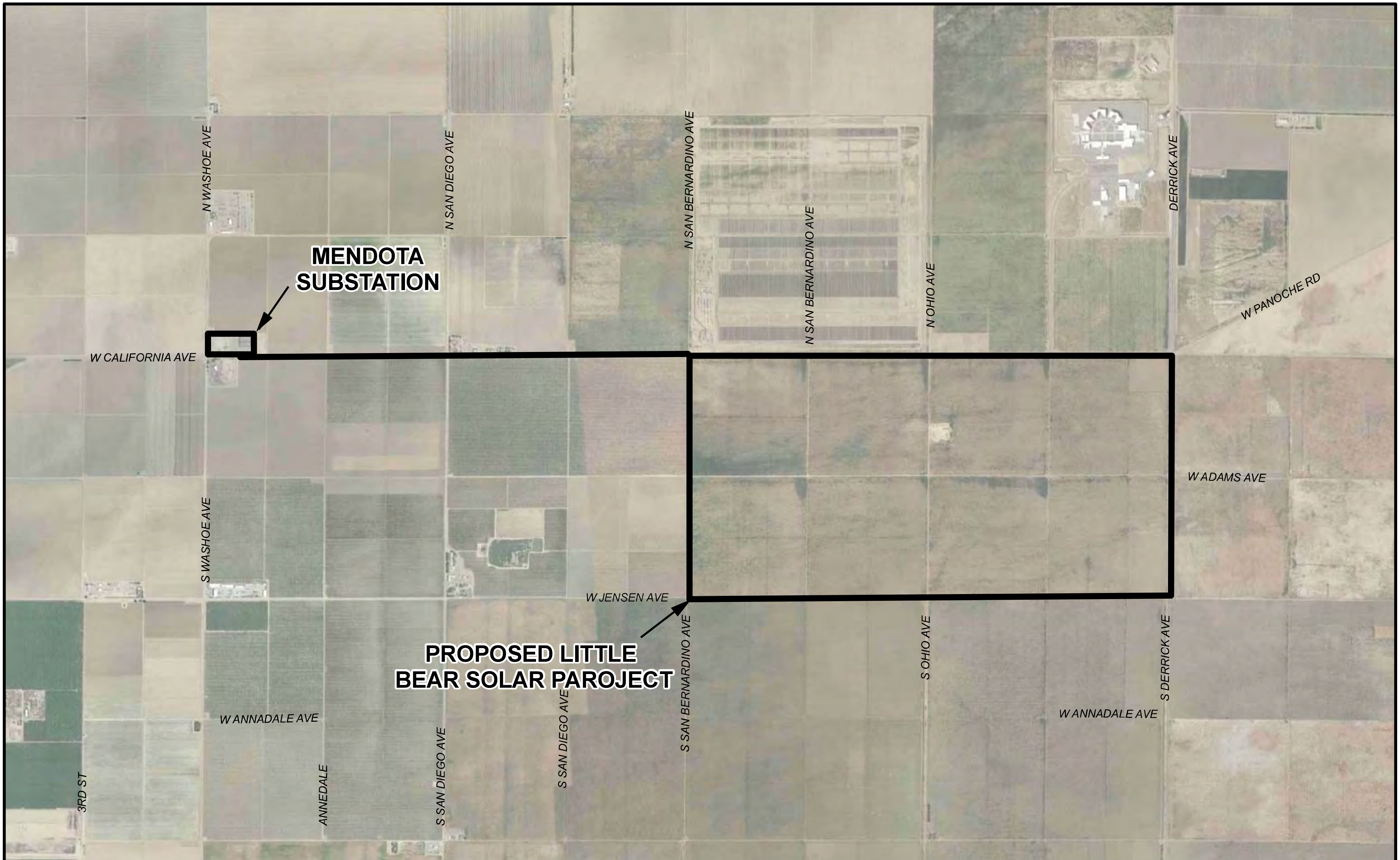
PROJECT AREA LOCATION

PROJECT NO.	DATE
108256001	1/17

LITTLE BEAR SOLAR PROJECT
FRESNO COUNTY, CALIFORNIA

FIGURE

1



SOURCE: GOOGLE EARTH, 2016.

N

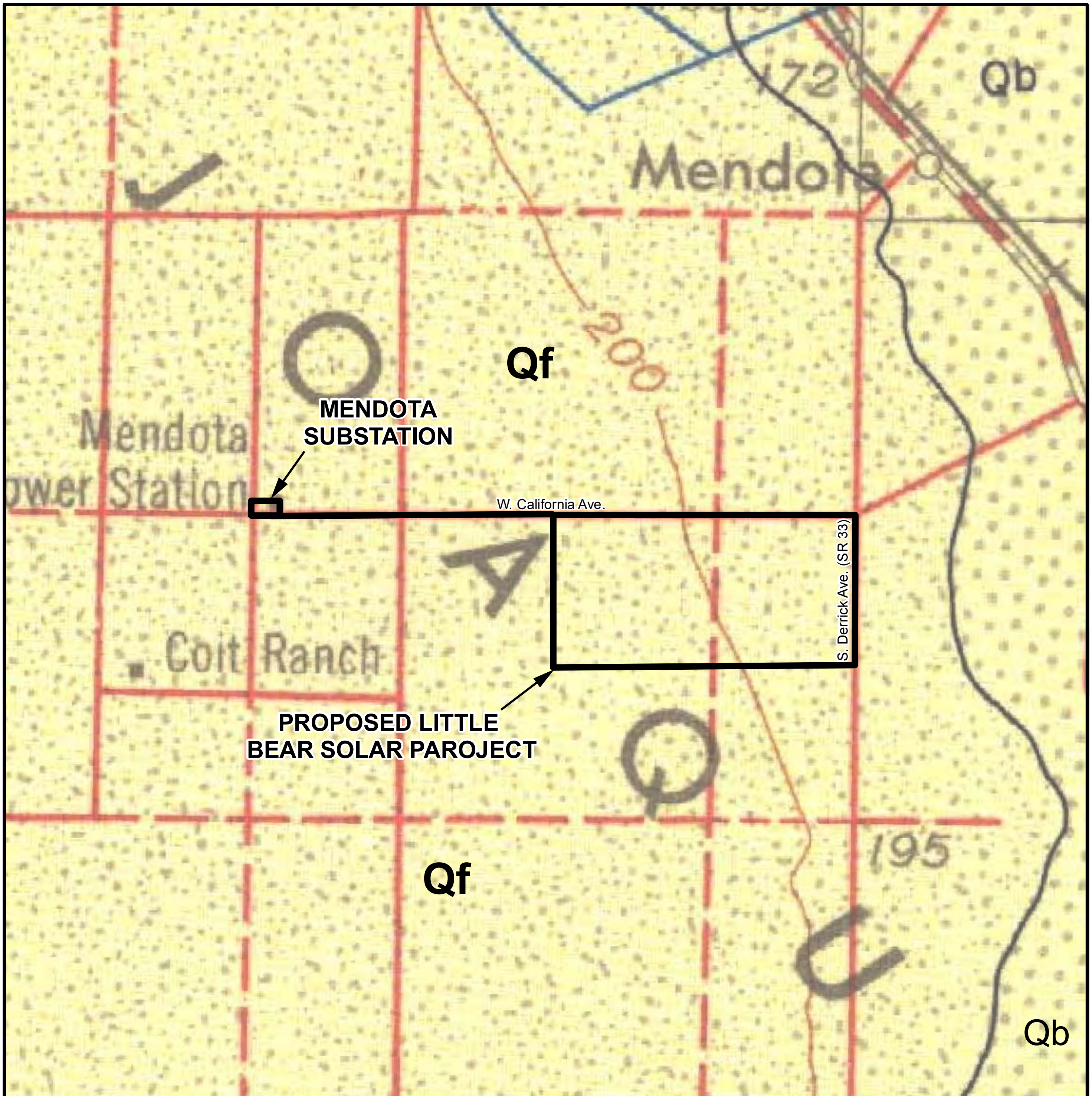
SCALE IN FEET

0 1,500 3,000 6,000

NOTE: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore		PROJECT AREA AND VICINITY	FIGURE
PROJECT NO.	DATE	LITTLE BEAR SOLAR PROJECT FRESNO COUNTY, CALIFORNIA	2
108256001	1/17		

2_108256001_PAV.mxd 1/9/2017 AOB



SOURCE: JENNINGS, C.W., AND STRAND, R.G., 1958, GEOLOGIC MAP OF CALIFORNIA, SANTA CRUZ SHEET.

LEGEND

- Qf FAN DEPOSITS
- Qb BASIN DEPOSITS

N

SCALE IN FEET

0 5,000 10,000

NOTES: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

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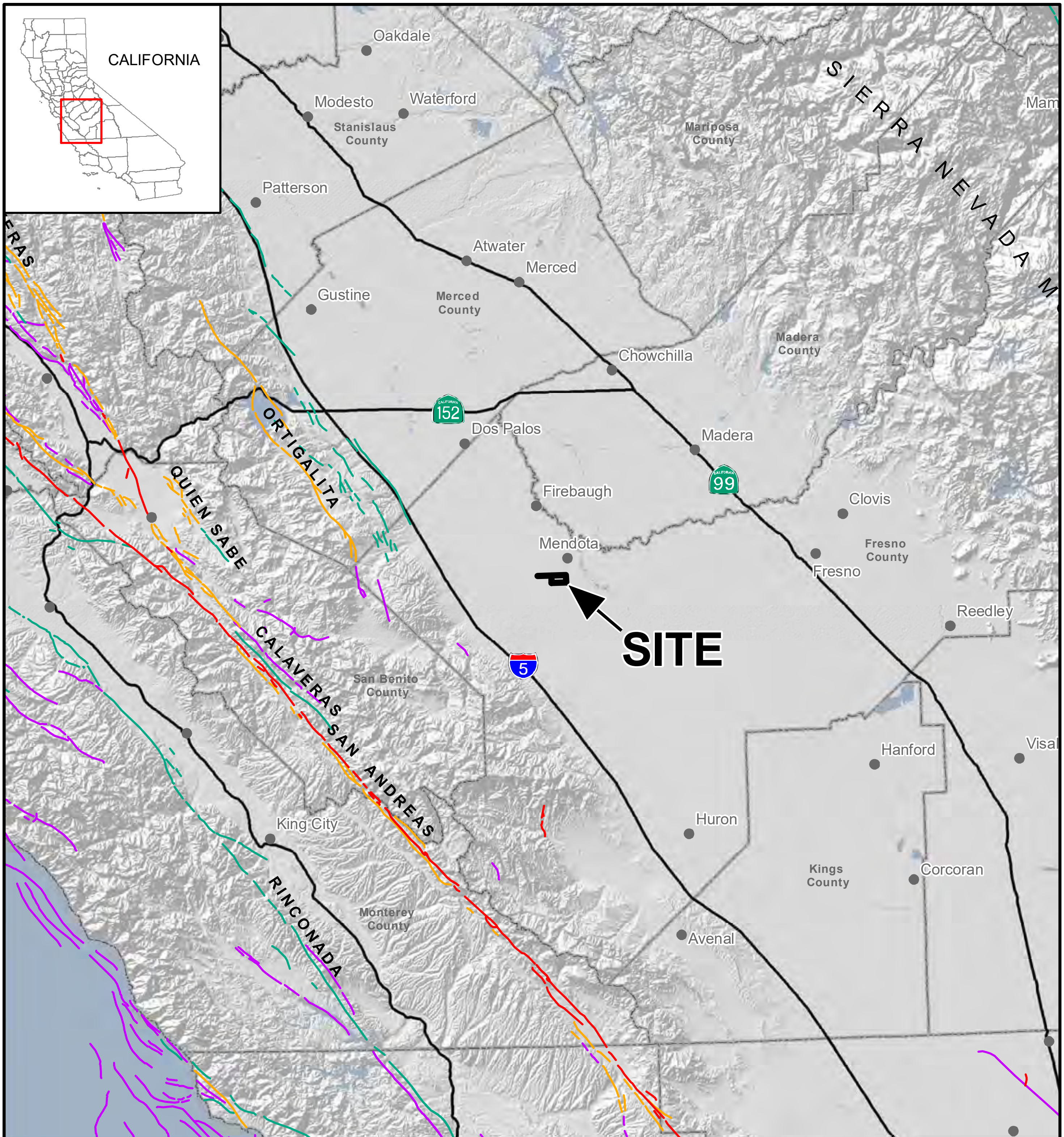
Ninyo & Moore	GEOLOGY	FIGURE
PROJECT NO. / DATE	LITTLE BEAR SOLAR PROJECT FRESNO COUNTY, CALIFORNIA	3
108256001 / 1/17		



SOURCE: FAULTS - California Department of Conservation, 2000; BASE - California Spatial Information Library (CaSIL), 2009; HILLSHADE - ESRI, 2008

LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

N

SCALE IN MILES

0 20 40

NOTES: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

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Ninyo & Moore

FAULT LOCATION MAP

PROJECT NO.	DATE
108256001	1/17

LITTLE BEAR SOLAR PROJECT
FRESNO COUNTY, CALIFORNIA

FIGURE

4