

# **TRIP GENERATION ANALYSIS**

## **Joshua Tree Solar Farm San Bernardino County**

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## **1.0 INTRODUCTION**

This Trip Generation Analysis has been prepared for the proposed Joshua Tree Solar Farm (Project) to evaluate the potential transportation impacts resulting from the construction and operation of the Project. The Project is located on a recently deactivated private airport in a rural area of unincorporated San Bernardino County.

## **2.0 PROJECT DESCRIPTION**

The Project is a 20 megawatt solar photovoltaic (PV) generating facility located on approximately 115 acres of previously developed land, 3.5 miles east of the city of Joshua Tree. Project facilities will include solar panels, inverters, switchgear, and local distribution power lines, see Figure 3 for a detailed site plan. The existing paved surfaces of the recently deactivated private airport will remain in place and the existing building structures will be demolished or repurposed. The Project will connect to the existing Southern California Edison (SCE) distribution system via a 33 kilovolt generation line extension. The new utility line will be retrofitted to the existing poles on the west side of Sunfair Road by augmenting existing poles or by replacing poles. Construction of the generation line extension will be within the existing SCE right-of-way and have no negative effect/impact on traffic flow or safety. Construction of the Project is expected to start in the second half of 2013 and be completed over a 6 month period.

Major roadways in the Project vicinity include State Route 62 (SR-62, also known as Twenty-nine Palms Highway) in the east-west direction and Sunfair Road (also known as Coyote Valley Road) in the north-south direction. The Project is located on Sunfair Road 1.3 miles north of SR-62. The nearest urbanized areas are Joshua Tree, 3.5 miles to the west, and Twenty-nine Palms, 11 miles to the east. The Project site location can be found on Figure 1 Vicinity Map.

## **3.0 CONSTRUCTION ROUTES**

All construction traffic will access the site via a gate located on Sunfair Road as shown in Figure 3 - Detailed Site Plan. It is assumed that 80 percent of the construction traffic will travel east on SR-62 from the Joshua Tree/Yucca Valley area and turn left onto Sunfair Road. The remaining 20 percent of construction traffic are assumed to travel west on SR-62 from the Twenty-nine Palms area. SR-62 is a 4-lane road located in a rural area of San Bernardino County and has a separate left turn lane for construction traffic traveling from the Joshua Tree/Yucca Valley area. See Figure 2 Project Construction Traffic Routes for worker and delivery routes.

## **4.0 TRIP GENERATION**

### **4.1 Construction**

The trip generation analysis for this Project is based on the number of workers and the associated construction and delivery truck trips expected for the Project. Construction workers will consist of laborers, equipment operators, electricians, supervisory personnel, support personnel, and construction management personnel. Truck traffic will include haul trucks during demolition and material/equipment delivery trucks. Water truck trips have not been included in

the analysis for this Project because water will be available on-site as discussed below. Construction work will generally be done during daylight hours, Monday through Saturday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. For this analysis it is assumed that construction traffic will travel to and from the site during the AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak hours to provide a worst case scenario.

Construction workers are expected to average about 35 to 40 workers during the 6 month construction period, with a peak number of workers ranging between 60 and 65 workers during the second half of the construction period. Assuming an average of 1.25 workers per vehicle (carpooling factor), the anticipated worker vehicle trips generated by the Project will be a peak of 52 one-way trips during both the AM and PM peak hours.

During the first 2 weeks of construction, dump trucks will be needed on-site for removal of debris and demolished structures. An average of 4 trips per day and a peak of 6 trips per day will occur as needed during demolition. Approximately 5 deliveries per day will be required for material and equipment during the 6-month construction period with an expected peak of approximately 24 deliveries per day during the delivery of the modules, trackers, and cabling.

Water trucks will be active on-site, but are not included in this analysis because water required during construction is expected to be obtained from Joshua Basin Water District via a nearby existing waterline co-located within the western bounds of Sunfair Road. Water truck reloading stations will be established on site and will be fed by this existing waterline.

Large trucks use more roadway capacity than passenger vehicles due to their larger size and reduced maneuverability. To account for their increased demands on roadways, passenger car equivalent (PCE) factors are used. A PCE of 2.5 is applied to all large trucks accessing the site. Using this PCE, a total of 75 delivery truck trips will be used for this analysis during a worst case scenario when demolition haul trucks overlap delivery trucks.

Table 1 below shows the Trip Generation Summary of total one-way trips during peak that will be used for this analysis.

**Table 1. Trip Generation Summary**

<b>Vehicle Type</b>	<b>Peak Daily Trips One-way</b>
Construction Worker <sup>1</sup>	52
Delivery Truck <sup>2</sup>	75

<sup>1</sup> Assumed workers commute to the Project site with 1.25 persons per vehicle.

<sup>2</sup> Passenger car equivalent of 2.5 is applied to all large trucks accessing the site

## 4.2 Operation

The Project facility will be primarily managed, monitored, and controlled remotely. Therefore it is assumed that the Project will have 1 to 2 employees 1 to 2 times per month on site for system inspections and 2 to 6 employees on site 1 to 2 times per month for troubleshooting and maintenance requirements. In addition, 1 employee may be on-site during the night for security

and will have no impact on peak traffic. An additional 14 workers will be needed to perform routine cleaning on the PV modules. Cleaning of the PV modules is anticipated to take up to 1.5 weeks and will be conducted up to 4 times per year. No off-site delivery of water for cleaning will be necessary because a water source is located on site. With the exception of the security employee, operations workers are expected to commute to and from the Project site individually during the peak AM and PM hours, generating a peak of 22 one-way trips if panel washing was being performed during routine maintenance and inspections. This additional volume of daily traffic is considered negligible and the operational phase of the Project will have no impact on the traffic and/or transportation infrastructure.

## 5.0 ROADWAY OPERATING CHARACTERISTICS

Existing and future roadway operations have been characterized using a peak hour Level of Service (LOS) analysis; LOS provides a standardized means of describing a roadway's or an intersection's operation by relating traffic volumes to facility capacity. As shown in Table 2, LOS ranges from A to F with LOS A representing the best conditions (free flow) and LOS F representing the worst conditions (most congested).

Table 2. 2013 Level of Service Descriptions for Basic Freeway Segments @ 65 mi/hr

Level of Service	Description	V/C
A	Low volumes, primarily free-flow operations. Density is low and vehicles can freely maneuver within the traffic stream. Drivers can maintain their desired speeds with little or no delay.	0.00 to 0.30
B	Stable flow with potential for some restrictions of operating speeds due to traffic conditions. Maneuvering is only slightly restricted. The stopped delays are not bothersome, and drivers are not subject to appreciable tension.	0.31 to 0.50
C	Stable operations, however the ability to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signed coordination or longer queues cause delays.	0.51 to .71
D	Approaching unstable traffic flow, where small increases in volumes could cause substantial delays. Most drivers are restricted in their ability to maneuver and in their selection of travel speeds. Comfort and convenience are low but tolerable.	0.72 to 0.89
E	Operations characterized by significant approach delays and average travel speeds of one-half to one-third free flow speed.	0.90 to 1.00
F	Forced flow operations with high approach delays at critical signalized intersections. Speeds are reduced substantially, and stoppages may occur for short or long periods of time because of downstream congestion.	Greater than 1.00

<sup>1</sup>Table 2 taken from CALTRANS Guide for the Preparation of Traffic Impact Studies, December 2002, Basic Freeway Segments @ 65 mi/hr

Based on assumptions in Section 4.1 Construction, it is estimated that a maximum of 127 one-way trips during both the peak morning and evening hours would occur. The impacts of projected construction-period traffic on local roadways are described below:

Sunfair Road is a two-lane undivided highway. Based on a capacity of 1,600 vehicles per hour per lane (vphpl), the addition of peak-hour construction traffic of 127 vehicles would represent less than 4 percent of the 3,200 vphpl capacity of Sunfair road. Due to the rural nature of the community, Sunfair Road carries little traffic and will not see significant impacts as a result of the Project construction traffic.

SR-62 is a four-lane undivided highway. Based on a capacity of 2,200 vphpl, this highway has a total capacity of 8,800 vehicles per hour. Table 3 below shows the 2013 (year of construction) projected existing traffic on SR-62. Projected existing traffic volume was calculated using a “best fit” line based on historical traffic volumes obtained from Caltrans 2001 to 2011 and then projected to 2013 the year of construction. As shown in Table 3 below SR-62 currently has a volume to capacity ratio of 0.22 equating to a LOS A. When construction traffic is added to the 2013 existing peak hour traffic the volume to capacity ratio increases to a maximum of 0.23 equating to a LOS A. It is expected that SR-62 will continue to operate with a primarily free-flowing traffic condition and a LOS A. In addition, SR-62 has a separate left turn lane with adequate capacity for the east bound construction traffic to turn onto Sunfair Road, so it is expected that existing traffic will not be adversely affected by the turning movements of construction traffic on this roadway. SR-62 will not see a significant impact as a result of the Project construction traffic.

**Table 3. 2013 Projected Traffic Conditions**

Road Segment	2013 Existing Peak Hour Traffic without Project	2013 Existing Volume to Capacity Ratio without Project	2013 Existing LOS	Total Construction Trips During Peak	2013 Conditions with Construction Traffic	2013 Volume to Capacity Ratio with Project	2013 LOS with Project
Traffic on SR-62 west of Sunfair Road	1894	0.22	A	102	1,996	0.23	A
Traffic on SR-62 east of Sunfair Road	1536	0.17	A	25	1,561	0.18	A

## 6.0 CONCLUSION

As shown in the analysis above, the construction period trip generation of workers and trucks will not generate a significant number of trips on local roadways. SR-62 will continue to operate at a LOS A during worst case scenario construction peak traffic. Although no significant, adverse traffic impacts are expected during Project construction or operation, the following mitigation measures could be implemented to minimize any potential for delays during the AM and PM peak hours:

- Use of appropriate traffic controls (i.e. flagmen, signage, barriers, etc.) during generation line extension installation along Sunfair Road, if deemed necessary;



- Stagger construction work shifts;
- Encourage increased carpooling between construction workers;
- Encourage potential use of vanpool or commuter bus for construction workers to access the Project site;
- Establish flexible working hours outside of peak hours; and
- Schedule truck deliveries during off peak hours.

## **7.0 REFERENCES**

Caltrans, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011. Traffic Volumes on California State Highways.

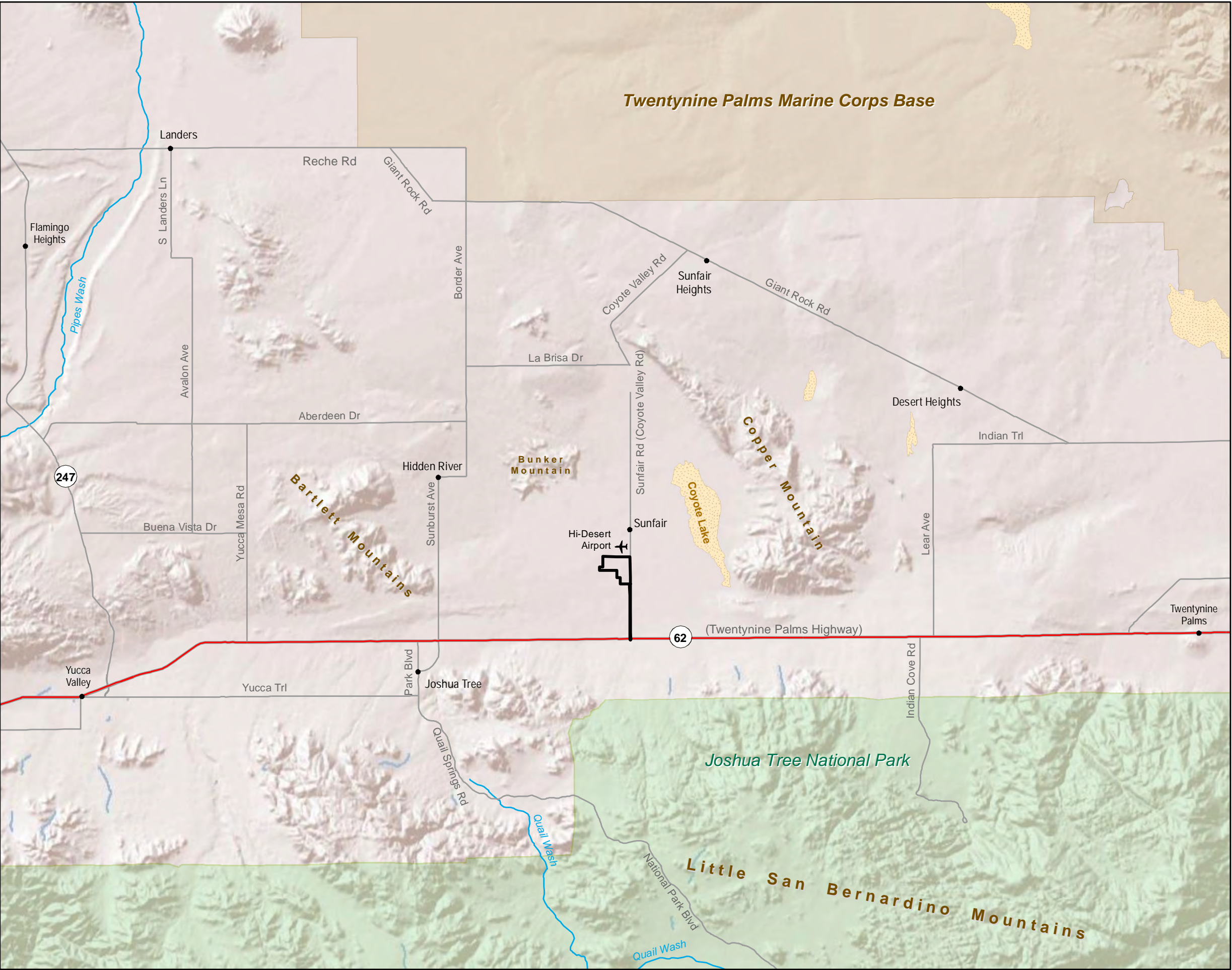
Caltrans, December 2002, Guide for the Preparation of Traffic Impact Studies.

San Bernardino Associated Governments, December 2007, Congestion Management Program for San Bernardino County

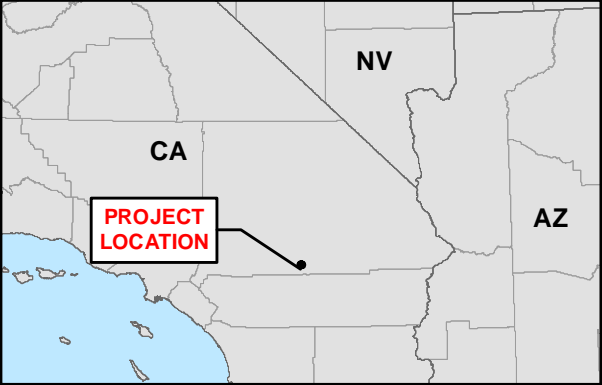
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## FIGURES

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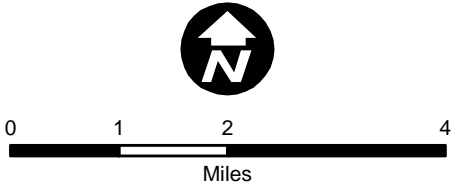


JOSHUA TREE  
SOLAR FARM  
SAN BERNARDINO COUNTY, CA



Legend

- Joshua Tree Solar Farm
- City/Town
- State Highway
- County Highway/Major Road
- Watercourse
- Dry Lake
- National Park
- Military Installation

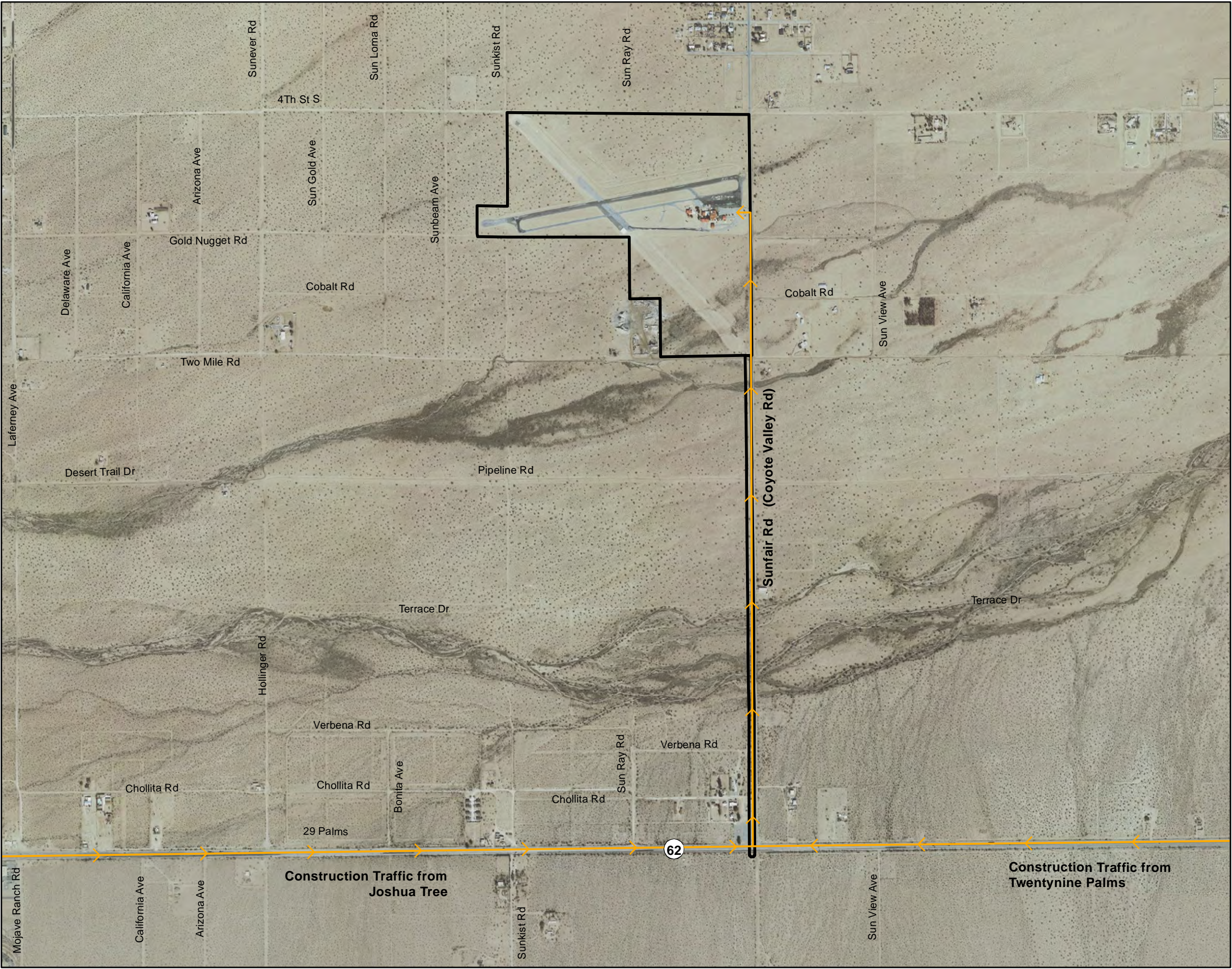


Notes:  
(a) UTM Zone 11, NAD 1983 Projection.  
(b) Source data: ESRI, CASIL

FIGURE 1  
PROJECT VICINITY MAP



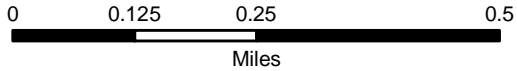




JOSHUA TREE  
SOLAR FARM  
SAN BERNARDINO COUNTY, CA



- Legend
- Joshua Tree Solar Farm
  - Construction Traffic Route

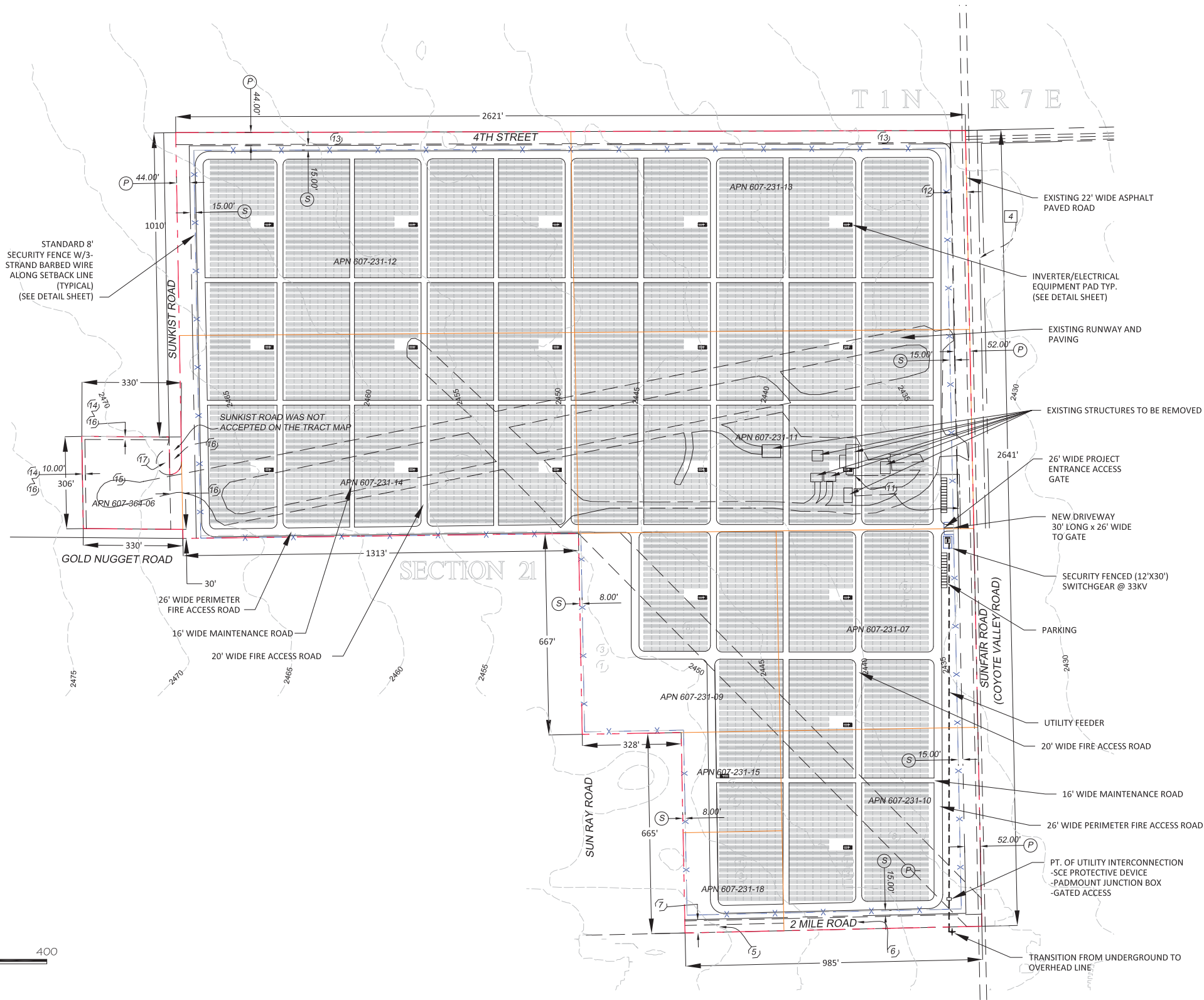


Notes:  
(a) UTM Zone 11, NAD 1983 Projection.  
(b) Source data: ESRI,Tt

FIGURE 2  
PROJECT CONSTRUCTION TRAFFIC ROUTE







LEGEND

- (P) PROPOSED OFFER OF DEDICATION FOR PUBLIC ROAD  
(S) PROPOSED FENCE SETBACK PER COUNTY ORDINANCE 84.29.50 (a) & (b)  
--- EXISTING EASEMENT LINE  
--- PROPOSED OFFER OF DEDICATION LINE  
--- FENCE SETBACK LINE PER COUNTY ORDINANCE 84.29.50 (a) & (b)  
--- PROPOSED FENCE  
--- PROPERTY LINE  
--- PARCEL LINE

EASEMENT LEGEND & NOTES

- EASEMENTS ITEMS PER P.T.R. 126743694-X49  
(1) RESERVATIONS IN PATENT- WAITING FOR CORRECT DOC.  
(2) CENTERLINE CALIFORNIA ELECTRIC POWER EASEMENT PER 2306/OR/302 (NO WIDTH GIVEN)  
(3) CENTERLINE CALIFORNIA ELECTRIC POWER EASEMENT PER 2389/OR/242 (NO WIDTH GIVEN)  
(4) CENTERLINE CALIFORNIA WATER & TELEPHONE EASEMENT PER 5157/OR/421 (NO WIDTH GIVEN)  
(5) 10' WIDE GENERAL TELEPHONE EASEMENT PER 8787/OR/1086  
(6-7) 40' WIDE PUBLIC ROAD PER 91-295474 O.R. ( OFFERED PER 9516/OR/1325) AND PRIVATE ROAD EASEMENT PER 9516/OR/1323  
(8) 10' SO. CAL. EDISON EASEMENT PER 90-243568 O.R.  
EASEMENTS ITEMS PER P.T.R. 126743693-X49  
(1) RIGHTS OF PUBLIC IN ANY PORTION LYING WITHIN ROAD, STREET, OR HIGHWAY  
(2) RESERVATIONS IN PATENT- UNPLOTTABLE  
(3) OPERATION & MAINTENANCE OF RR; RIGHT OF WAY FOR COUNTY ROADS; RIGHT TO USE WATER RISING UPON LAND. RESERVED ON PAGE 357 OF 498/Dd/299  
(4) 17' INGRESS/EGRESS & ROAD EASEMENT PER 6492/OR/732  
(5) 25' GENERAL TELEPHONE EASEMENT PER 7663/OR/411  
(6) 40' PUBLIC ROAD EASEMENT PER 92-251092 O.R. (OFFERED PER 82-029702 O.R.)  
(7) 40' PUBLIC ROAD EASEMENT PER 92-113701 O.R. (OFFERED PER 72/PM/40-41)  
(8) AIRPORT RUNWAY EXPANSION EASEMENT PER 93-094839 O.R.  
(9) RIGHTS OF THE PUBLIC OVER ANY PORTION LYING WITHIN A ROAD/HIGHWAY  
(10) CENTERLINE CALIFORNIA ELECTRIC POWER EASEMENT PER 2389/OR/268 (NO WIDTH GIVEN)  
(11) APPRX. CENTERLINE 6' WIDE SO. CA. EDISON EASEMENT PER 8026/OR/962 (DOC. HAS HAND WRITTEN NOTES)  
(12) 50' PUBLIC ROAD EASEMENT PER 8061/OR/921  
(13) 50' PUBLIC ROAD EASEMENT PER 2003-0555328  
(14) PUE PER 78/MB/71-72  
(15) CC&R'S PER 5236/OR/439: BUILDING RESTRICTIONS ( DOCUMENT STATES THAT THE PLANNING COMMISSION CAN RE-ZONE)  
(16) ELECTRIC POWER EASEMENT PER 5271/OR/415  
(17) PUBLIC ROAD EASEMENT PER 1998-0283419  
OTHER ITEMS LISTED: WATER RIGHTS, CLAIMS TO WATER; RIGHTS OF PARTIES IN POSSESSION, IF ANY

C-01

P:\490-PP-JOSHUA TREE PROJECT\CAD\DESIGN SET\C-01 SITE-JT-AJWG  
PLOT/UPDATE: Jul 13, 2012 2:42:10 PM

EXHIBIT PREPARER:



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IRVINE, CALIFORNIA 92614-6213  
TEL: 949.809.5000

APPLICANT:

JOSHUA TREE SOLAR FARM, LLC  
700 LOUISIANA ST. #33  
HOUSTON, TX 77002  
(925) 285-2510

SOLAR PV SYSTEM SUMMARY:

20MW AC SOLAR  
PHOTOVOLTAIC GENERATION  
SYSTEM

PROJECT NAME:

JOSHUA TREE SOLAR FARM

PROJECT ADDRESS:

5500 SUNFAIR ROAD.  
JOSHUA TREE, CA 92252

SITE PLAN  
JOSHUA TREE SOLAR FARM  
JOSHUA TREE  
SAN BERNARDINO COUNTY, CALIFORNIA

A	7/6/12	INITIAL SUBMITTAL	JD	WG	
DATE		REVISION	SUBMIT BY	APPROVED BY	
NOT ISSUED FOR CONSTRUCTION					