United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
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Carlsbad, California 92011

In Reply Refer To:
FWS-IMP-09B0351-10F0271

SEP 23 2010

Memorandum

To: Field Manager, El Centro Office, Bureau of Land Management
El Centro, California
(Attn: Andrew Trouette)

From: Field Supervisor, Carlsbad Fish and Wildlife Office
Carlsbad, California

Subject: Section 7 Biological/Conference Opinion on the Imperial Valley Solar (Solar Two) Power Plant (3031 (P) CAD000.06)

This memorandum transmits the U.S. Fish and Wildlife Service's (Service) biological and conference opinion on the proposed Imperial Valley Solar Power Plant (Project), located in Imperial County, California and its effects on the endangered Peninsular bighorn sheep (*Ovis canadensis nelsoni*; PBS) and flat-tailed horned lizard (*Phrynosoma mcallii*; FTHL), proposed for Federal listing, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your request for formal consultation, dated December 24, 2009, was received December 28, 2009.

This biological/conference opinion is based on information provided in the following documents and communications: (1) *Staff Assessment and Draft California Desert Conservation Area Plan Amendment SES Solar Two Commission Application For Certification (08-AFC-5) Imperial County*, dated February 2010; (2) *Imperial Valley Solar Project (Formerly SES Solar Two) Supplemental Staff Assessment*, dated July 2010; (3) the Biological Assessment (BA) for the Project prepared by URS, dated December 23, 2009; (4) the *404B-1 Alternatives Analysis For the Imperial Valley Solar Project* prepared by Ecosphere, dated June 3, 2010; and (5) supplemental materials provided during the consultation process. The project file for this consultation is located at the Carlsbad Fish and Wildlife Office (CFWO).

YUMA CLAPPER RAIL, LEAST BELL'S VIREO AND SOUTHWESTERN WILLOW FLYCATCHER

The primary water source for the operations and maintenance of the proposed Project would be supplied by the Seeley Wastewater Reclamation Facility (WWRF) and the Project applicant would finance upgrades to the existing WWRF so the effluent can be treated to a tertiary level.

TAKE PRIDE IN AMERICA

Once the upgrade is complete, it is anticipated the proposed Project would take all of the treated effluent produced by the Seeley WWRF, which is between 567,812 (150,000) and 757,082 liters-per-day (lpd) (200,000 gallons-per-day (gpd)).

The Seeley WWRF currently discharges the effluent into the New River via an unlined earthen channel approximately 244-meter (m) [800-feet (ft)] long and 15-m (50-ft) wide. Once the discharge is rerouted to the proposed Project, a decline in vegetation along the channel may occur. The approximately 0.37-hectare (ha) (0.92-acres (ac)) unlined channel now supports fresh-brackish water marsh dominated by narrow-leaved cattail (*Typha latifolia*), and tamarisk scrub dominated by salt cedar (*Tamarix sp*.) with less than 15 percent cover of arrow weed (*Pluchea sericea*) and Emory's baccharis (*Baccharis emoryi*). General reconnaissance surveys were conducted on the Seeley WWRF site in May 2002 and July 2009, and no special-status species were detected (Dudek 2009).

Although the tamarisk scrub is unlikely to support habitat for the Yuma clapper rail (*Rallus longirostris yumamensis*; YCR), freshwater brackish marsh may support the species and the entire area is generally considered suitable for this species given the number of nearby occurrences in the New River (Dudek 2010a). However, focused protocol surveys for Yuma clapper rail were conducted by John Konecny, a Service-permitted biologist, and were found to be negative (J. Konecny, pers. comm. 2010). Therefore, we conclude the proposed Project is not likely to adversely affect YCR and is not addressed in this biological opinion.

The tamarisk scrub also has the potential to support least Bell's vireo (*Vireo bellii pusillus*; LBV) and southwestern willow flycatcher (*Empidonax traillii extimus*; SWWF). Mr. Konecny determined the habitat within the channel was unsuitable for LBV because of the lack of understory and narrow configuration of the tamarisk habitat (Dudek 2010a). Based on input from biologists conducting the 2010 habitat assessment (A. Hayworth, pers. comm. 2010), the habitat within the channel likely does not support the SWWF for similar reasons. However, focused protocol surveys were conducted for LBV and SWWF in the areas described above in May 2010 with negative results (Dudek 2010b). Therefore, we conclude the proposed Project is not likely to adversely affect LBV and SWWF, and these species are not addressed in this biological opinion.

CONSULTATION HISTORY

On December 28, 2009, the Bureau of Land Management (BLM) initiated consultation for construction, operation, maintenance, and decommissioning of the Imperial Valley Solar facility (formerly known as Solar Two). Following several discussions with Tessera Solar (applicant) that involved the BLM, U.S. Army Corps of Engineers (Corps), California Department of Fish and Game (CDFG), the California Energy Commission (CEC), and the Service, Tessera Solar modified its project to reduce adverse effects to waters of the U.S., biological resources, and cultural resources. The Corps' *404B-1 Alternatives Analysis for the Imperial Valley Solar*

Project incorporates these project modifications. This biological opinion analyzes the effects associated with the reduced project footprint as described in alternative #3 in the 404B-1 analysis.

On December 14, 2009, we received a letter from the BLM requesting our concurrence that the proposed Project may affect, but is not likely to adversely affect PBS. After further review of project impacts and information received on April 2, 2010, from Dr. Vern Bleich, we concluded the project is likely to adversely affect PBS.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the issuance of a right-of-way (ROW) grant by the BLM to the applicant that would authorize construction, operation, and decommissioning of the 2,659 ha (6,571 ac) Imperial Valley Solar plant (formerly known as Solar Two), a solar dish stirling engine project, and its ancillary facilities. Two related federal actions are necessary for ultimate approval of this Project. The first is an individual permit from the Corps in compliance with Section 404 of the Clean Water Act. The second is a loan guarantee from the Department of Energy for construction of alternative energy projects. The BLM is acting as the Federal lead agency for the Project and has prepared the aforementioned BA on behalf of those two federal agencies.

The Project is located in Imperial County, California, approximately 161 kilometers (km) (100 miles (mi)) east of San Diego, 22.5 km (14 mi) west of El Centro, and 6.4 km (4 mi) east of Ocotillo (Figure 1). The proposed Project site is bordered by Interstate 8 (I-8) to the south; County Highway S80 (also known as Evan Hewes Highway) and a railroad to the west, north and northeast; and agricultural lands to the east. Plaster City, a gypsum plant run by United States Gypsum (USG), is also on the northern boundary of the site. The proposed Project would occupy approximately 2,523 ha (6,235 ac) of land managed by the BLM and approximately 136 ha (336 ac) of privately owned land, use approximately 4 hectare-meter (33 acre-feet) of water per year, produce 709 megawatts (MW) of electricity, and operate for a term of 40 years.

The Project would occupy an area that is regulated by the BLM's California Desert Conservation Area (CDCA) Plan of 1980, as amended. In the CDCA Plan, the location of the proposed Project includes land that is classified as Multiple-Use Class L (Limited Use), which allows for development of solar power facilities after National Environmental Protection Act (NEPA) requirements are met. The proposed Project is not identified within the CDCA Plan; therefore BLM is also processing a Plan Amendment to include the proposed Project as a recognized element within the Plan.

Project Components

Construction

The primary equipment for the power plant would include the approximately 28,360 SunCatchers and their support infrastructure, which includes: a 600-volt underground power

collection system; overhead collection circuits; a 19-km (11.8-mi) water supply pipeline[1]; a 16.6-km (10.3-mi), 230 kilovolt (kV) electrical transmission line (approximately 12.2 km (7.56 mi) of the new line would be constructed offsite); 75 km (46.7 mi) of arterial and perimeter roads; 275.6 km (171.24 mi) of unpaved (but acrylic polymer treated) maintenance roads; a 15-ha (37-ac) main services complex, which includes a water treatment facility and evaporation ponds; and a 3.6-ha (9-ac) substation. The SunCatcher is a 12-m (38-ft) high by 12-m (40-ft) wide solar concentrator in a dish structure that supports an array of curved glass mirror facets. The SunCatcher dish is mounted on a 0.6-m (2-ft) diameter, round steel pipe that is hydraulically vibrated into the ground to a depth of approximately 5 m (17 ft). No mass site grading is required to install the solar field, though grading is required for the buildings and substation, transmission line, portions of the water supply line, evaporation ponds, and access and maintenance roads. Site access roads would generally follow existing BLM roads. Vegetation under SunCatcher fields would be trimmed or mowed for the life of the Project. Refer to Table 1 for a summary of habitat impacts, both temporary and permanent, for each project component.

Table 1: Imperial Valley Solar – Project Impacts

Project Feature	**Phase I**	**Phase II**	**Total**
Permanent Impacts			
Water Pipeline (onsite portion)	2.4 ha 6 ac	0	2.4 ha 6 ac
230 kV Transmission Line	44.5 ha 110 ac	0	44.5 ha 110 ac
Substation	1.6 ha 4 ac	2 ha 5 ac	3.6 ha 9 ac
Main Services Complex, Including the SunCatcher Assembly Area	15 ha 37 ac	0	15 ha 37 ac
Perimeter and Arterial Roads	25 ha 64 ac	32.4 ha 80 ac	58.3 ha 144 ac
Maintenance Roads	35.6 ha 88ac	48.2 ha 119 ac	83.8 ha 207 ac
SunCatcher Field (excluding Maintenance Roads and Utility Trenching)	291 ha 719 ac	384.5 ha 950 ac	675.4 ha 1,669 ac
Subtotal	416 ha 1,028 ac	467 ha 1,154 ac	833 ha 2,182 ac
Temporary Impacts			
Laydown Areas	53 ha 131 ac	0	53 ha 131 ac
Utility Trenching	214 ha 529 ac	289.4 ha 715 ac	503.4 ha 1,244 ac
Subtotal	267 ha 660 ac	289.4 ha 715 ac	556.4 ha 1,375 ac
GRAND TOTAL	683 ha 1,688 ac	756.4 ha 1,869 ac	1,439.5 ha 3,557 ac

*38 ha (93 ac) are located in the Yuha Desert MA

[1] The water supply pipeline would be routed primarily within the Evan Hewes Highway Right-of-Way

The Project would be constructed in two phases for a total output of 709 MW. Phase I of the Project would consist of up to 12,000 SunCatchers built on approximately 40 percent of the Project site. Acreage impacts for Phase I construction would include 683 ha (1,688 ac) as listed in Table 1. The renewable energy from Phase I would be transmitted via the existing 500 kV, SDG&E Southwest Powerlink transmission line. Phase I construction is scheduled to begin fall 2010, and last for approximately 24 months.

Phase II would expand the Project by adding 16,360 SunCatchers, for a total of 28,360. Acreage cleared for Phase II construction would impact 756 ha (1,869 ac) as listed in Table 1. Phase II would require a new transmission capacity within the grid. The construction and operation of Phase II is contingent on the development of either the Sunrise Powerlink transmission line or additional transmission capacity in the SDG&E transmission system. Phase II of the project would be connected to the grid at the SDG&E Imperial Valley Substation via the new double circuit 230 kV transmission line. Phase II construction is scheduled to begin in the summer of 2012, and last for approximately 24 months.

Water would be needed for dust control and soil preparation during construction. Approximately 170,344 lpd (45,000 gpd) would be needed for the construction of Phase I. Phase II would require approximately 234,696 lpd (62,000 gpd). Construction water would be provided by the Dan Boyer Water Company. Water would be transported to the site via 26,498 liter (7,000 gallon) water trucks.

The site layout generally would consist of 46-m (150-ft) wide linear strips (rows) containing SunCatchers, their support infrastructure, and 3-m (10-ft) wide maintenance roads (the length of the 46 m (150 ft) wide rows would vary depending on location within the site). The primary building block for these rows consists of 1.5 MW solar generator groups, which contain 60 SunCatchers. Between each of these 46-m (150-ft) wide strips would be 23 m (75 ft) of avoided ground cover. Approximately 57 ha (141 ac) of primary drainages would also be avoided. The entire project would be fenced for security purposes, however the design of the fencing would be determined in coordination with the regulatory and resource agencies to protect sensitive ecological areas and address storm flows in washes (Figure 2).

Brush trimming would be conducted within the 46-m (150-ft) linear strips, which would consist of cutting the top of the existing brush while leaving the native plant root system in place to minimize soil erosion. To minimize shading on SunCatchers and prevent potential brush fire hazards, natural vegetation trimmings would be cleared in the area of each SunCatcher, as well as on either side of paved roadways. After brush has been trimmed, blading for roadways and foundations would be conducted between SunCatcher rows to provide access to individual SunCatchers. Blading would consist of limited removal of terrain undulations. Although ground disturbance would be minimized wherever possible, the Project applicant proposes that localized rises or depressions within the individual 1.5 MW solar groups would be removed to provide for proper alignment and operation of the individual SunCatchers. Paved roadways would be constructed as close to the existing topography as possible, with limited cut-and-fill operations to maintain roadway design slope to within a maximum of 10 percent.

Operations and Maintenance

Operations and maintenance (O&M) activities would occur 7 days a week, 24 hours a day to ensure SunCatcher availability when solar energy is available. O&M activities would include: brush trimming, SunCatcher maintenance, and SunCatcher mirror washing; each SunCatcher would require washing approximately once every month. Individual washings per SunCatcher would use approximately 53 liters (14 gallons) of water, with another "seasonal scrubbing" wash of approximately 159 liters (42 gallons) once every 3 months. Seasonal scrubbing would occur prior to peak electricity demand season, which is June through September. Mirror washing and dust control watering would comprise the primary water use for O&M activities, which is estimated at127,001 lpd (33,550 gpd), with total annual use of approximately 5 hectare-meter (38 acre-feet). Additionally, it is anticipated that heavy equipment would be used for scour repair and removal of sediment from the impacted washes for the life of the project.

The water for O&M needs would be supplied by the Seeley WWTF. The water would be treated to a tertiary level and pumped to the site via a 19 km (11.8 mi) force main pipeline constructed in Evans Hewes Highway. The water would be treated by reverse osmosis and stored on site.

Decommission

The planned life of the proposed Project is 40 years; however, if the Project is still economically viable, it could be operated longer. The Project may become economically noncompetitive before 40 years have passed, forcing early decommissioning. Whenever the Project is permanently closed, the closure procedure would follow a plan that would be developed as described below.

The removal of the proposed Project from service, or decommissioning, may range from "mothballing" to the removal of equipment and appurtenant facilities, depending on conditions at the time. Because the conditions and effects of the decommissioning are largely unknown at this time, these conditions would be presented to the CEC, BLM, and other applicable agencies. Once the impacts from the conditions are assessed, if effects exceed those analyzed herein, or if take of FTHL or PBS exceeds what is authorized, reinitiation of this biological opinion would be required.

Action area

Under the implementing regulations for section 7(a)(2) of the Act, the action area is defined as the reach of direct and indirect effects, as well as the analysis area for this opinion. The action area is also the area in which baseline conditions and cumulative effects are analyzed.

To define the action area for this project, we note that bighorn sheep are wide-ranging, large mammals living in a harsh desert environment that must cover relatively large areas to meet their resource needs. Because bighorn sheep conservation and management must be considered on a large, landscape scale, the proposed project may negatively affect the ability of PBS to utilize the

greater landscape that is now available to them. As a result, the action area needs to include the 2,630 ha (6,500 ac) solar plant site; the surrounding Coyote, In-Ko-Pah, and Jacumba Mountains; and the valley floor area stretching from the eastern boundary of the project west to the base of the mountains and south to the international boundary (Figure 3). For FTHL, the action area not only needs to include the Project site, but the offsite access roads, proposed 19-km (11.8-mi) water line, proposed 16.6-km (10.3-mi) transmission line, 45-ha (110-ac) construction laydown area east of Dunaway road, and 450-m (1,476-ft) buffer around the project site and all new project components to account for indirect effects of the development on FTHL (Young and Young 2005). Finally, the action area also includes the West Mesa Management Area where acquisition and management of land for the benefit of FTHL will be focused.

Conservation Measures

The proposed Project includes the following conservation measures (CM) and/or design features that will be implemented to avoid, minimize, and offset potential adverse effects to the FTHL and PBS. These measures were developed and coordinated with the BLM, CEC, and Project applicant and based on information in the Project BA, Draft SA/EIS, and supplemental material provided during the consultation process. The CM will be implemented during the project construction phase and during long-term O&M of the project. The Final SA/EIS includes additional measures to offset proposed Project impacts on rare and sensitive species, which will be implemented to further reduce impacts to biological resources on the proposed Project site.

1. Prior to ground disturbing activities, an individual will be identified as the Designated Biologist[2] (i.e., field contact representative); the Project applicant will ensure that the Designated Biologist position is always filled with a qualified Designated Biologist for the life of the project. Over the course of the Project, each successive Designated Biologist will be approved by the BLM's Authorized Officer (i.e., BLM field manager, El Centro) and the Energy Commission Compliance Project Manager (CPM). The Designated Biologist will have the authority to ensure compliance with the CM for the FTHL and will be the primary agency contact for the implementation of these measures. The Designated Biologist will have the authority and responsibility to halt activities that are in violation of the CM. A detailed list of responsibilities for the Designated Biologist is listed in measures BIO-2 and BIO-11 of the draft SA/EIS and is summarized below. To avoid and minimize impacts to biological resources, the Designated Biologist and/or biological monitor(s) (see number 2 below) will:

    - Notify BLM's Authorized Officer, CPM, and the CFWO at least 14 calendar days before initiating ground-disturbing activities.

[2] A qualified Designated Biologist must have (1) a bachelor's degree with an emphasis in ecology, natural resource management, or related science; (2) three years of experience in field biology or current certification of a nationally recognized biological society, such as The Ecological Society of America or The Wildlife Society (3) previous experience with applying the terms and conditions of a biological opinion; and, (4) the appropriate permit and/or training if conducting focused or protocol surveys for listed or proposed species.

- Immediately notify BLM's Authorized Officer, CPM, and the CFWO in writing if the Project applicant is not in compliance with any CM, including but not limited to any actual or anticipated failure to implement CM within the time periods specified.
- Be present during construction (e.g., grubbing, grading, SunCatcher installation) and O&M activities that take place in FTHL habitat to avoid or minimize take of FTHL. Activities include, but are not limited to, ensuring compliance with all impact avoidance and minimization measures, monitoring for FTHLs and removing lizards from harm's way, and checking avoidance areas (e.g., washes) to ensure that signs, stakes, and fencing are intact and that human activities are restricted in these avoidance zones.
- At the end of each work day, inspect all potential wildlife pitfalls (trenches, bores and other excavations) for wildlife and then backfill. If backfilling is not feasible, all trenches, bores, and other excavations will be contoured at a 3:1 slope at the ends to provide wildlife escape ramps, or completely and securely covered to prevent wildlife access.
- Conduct compliance inspections at a minimum of once per month after clearing, grubbing, and grading are completed and submit a monthly compliance report to BLM's Authorized Officer and CPM.
- During construction, examine areas of active surface disturbance periodically, at least hourly, when surface temperatures exceed 29°C (85°F) for the presence of FTHL.
- No later than January 31 of every year the Project remains in operation, provide the CPM, BLM's Authorized Officer, CFWO, CDFG, and the FTHL Interagency Coordinating Committee (ICC) an annual FTHL Status Report, which will include, at a minimum: 1) a general description of the status of the project site and construction activities, including actual or projected completion dates, if known; 2) a copy of the table in the Project biological monitoring report (see SA/EIS measure BIO-7) with notes showing the current implementation status of each conservation measure; 3) an assessment of the effectiveness of each completed or partially completed measure in avoiding and minimizing project impacts; 4) completed Horned Lizard Observation Data Sheets and a Project Reporting Form from the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS) (FTHL ICC 2003); 5) a summary of information regarding the numbers of captured, relocated, and dead FTHLs; and 6) recommendations on how CM might be changed to more effectively avoid, minimize, and offset future project impacts on the FTHL.

2. Biological monitor(s) will assist the Designated Biologist in conducting surveys and in monitoring of mobilization, ground disturbance, grading, construction, operation, closure, and restoration activities. The biological monitor(s) will have experience conducting FTHL field monitoring, have sufficient education and field experience to understand FTHL biology, be able to identify FTHL scat, and be able to identify and follow FTHL tracks. The Designated Biologist will submit the resume, at least three references, and

contact information of the proposed biological monitors to the BLM, CEC, CDFG, and CFWO for approval.

3. Prior to Project initiation, a worker environmental awareness program (WEAP) will be developed and implemented, and will be available in both English and Spanish. Wallet-sized cards summarizing this information will be provided to all construction, operation, and maintenance personnel. The education program will include the following aspects:

   - Biology and status of the FTHL;
   - Protection measures designed to reduce potential impacts to the species;
   - Reporting procedures to be used if a FTHL is encountered in the field;
   - Driving procedures and techniques, for commuting to, and driving on, the Project site, to reduce mortality of FTHL on roads.

4. Temporary FTHL barrier fencing will be installed along the main construction access road, east of the Project site. FTHL barrier fencing will be built per specifications listed in Appendix 7 of the RMS to prevent FTHLs from entering these areas during construction. Barrier fencing will be inspected daily by the Designated Biologist or biological monitor(s) to ensure the fence sustains its effectiveness as a lizard-proof barrier. If FTHLs are encountered within the fence, the Designated Biologist or biological monitor(s) will remove the lizards per CM #7 below. Fencing will be removed upon completion of project construction and/or the access road is no longer used as a primary road.

5. FTHLs will be removed from harm's way during all construction, operations, and maintenance activities per CM #7. FTHL removal will be conducted by two or more biological monitors when construction activities are being conducted in suitable FTHL habitat. To the extent feasible, methods to find FTHLs will be designed to achieve a maximal capture rate and will include, but not be limited to using strip transects, tracking, and raking around shrubs. During construction, the minimum survey effort will be 30 minutes per 0.40 ha (30 minutes per 1 ac). Persons that handle FTHLs will first obtain all necessary permits and authorization from the CDFG. If the species is federally listed, only persons authorized by both CDFG and the Service under the auspices of this biological opinion will handle FTHLs. FTHL removal surveys will also include:

   - Accurate records maintained by biological monitors for each relocated FTHL, including sex, snout-vent length, weight, air temperature, location, date, and time of capture and release, a close-up photo of the lizard, and a photo of the habitat where the lizard was first encountered. To the extent feasible, a sample of the lizard scat will be collected. A Horned Lizard Observation Data Sheet and a Project Reporting Form, per Appendix 8 of the RMS, will be completed. During construction, quarterly reports describing FTHL removal activity, per the reporting requirements described in

CM #1, will be submitted to the Service, BLM, CEC, and CDFG. During O&M, FTHL removal reports will be included in the annual FTHL Status Report, per CM #1.

6. During O&M, the Designated Biologist or biological monitor(s) will evaluate and implement the best measures to reduce FTHL mortality along access and maintenance roads, particularly during the FTHL active season (March 1 through September 30). These measures may include reduced driving speeds, biological monitor escorts, or temporary fencing at designated locations. Implementation of these measures would be based on FTHL activity levels, the best professional judgment of the Designated Biologist, and site specific road utilization. FTHL found on access/maintenance roads will be relocated per CM #7.

7. The removal of FTHLs out of harm's way will include relocation to nearby suitable habitat in low-impact (e.g., away from roads and SunCatchers) areas of the Project site. Relocated FTHLs will be placed in the shade of a large shrub in undisturbed habitat. If surface temperatures in the sun are less than 24° Celsius (C) 75° Fahrenheit (F) or exceed 38°C (100° F), the Designated Biologist or biological monitor, if authorized, will hold the FTHL for later release. Initially, captured FTHLs will be held in a cloth bag, cooler, or other appropriate clean, dry container from which the lizard cannot escape. Lizards will be held at temperatures between 75° F and 90° F and will not be exposed to direct sunlight. Release will occur as soon as possible after capture and during daylight hours. The Designated Biologist or biological monitor will be allowed some judgment and discretion when relocating lizards to maximize survival of FTHLs found in the Project area.

8. To the maximum extent practicable, grading in FTHL habitat will be conducted during the active season, which is defined as March 1 through September 30, or if ground temperatures are between 24°C (75° F) and 38 °C (100° F). If grading cannot be conducted during this time, any FTHLs found will be removed to low-impact areas (see above) where suitable burrowing habitat exists, (e.g., sandy substrates and shrub cover).

9. The Project applicant will fund and implement, a Before-and-After Impact Study, to determine if FTHLs remain on the project site after construction. The study design will be reviewed and approved by the BLM, CDFG, ICC and the Service prior to ground-disturbing activities. At a minimum, the Study will include: parameters to be measured; sample size; level of effort per plot; assessment approach; data management; verification of scat source and extirpation of habitat; and reporting requirements.

10. To compensate for loss of FTHL habitat, the Project applicant will purchase and provide long-term management funding for 2,679 ha (6,619.9 ac) of suitable FTHL habitat within a FTHL MA. Long-term management funding will be determined through a Property Assessment Report (PAR) tailored to the specific acquisition. The land will be deeded and transferred to the BLM and managed consistent with the management activities

outlined in the FTHL RMS. Alternatively, the Project applicant may satisfy the requirements of this measure by depositing a sufficient amount of funds to cover acquisition and management of 2,679 ha (6,619.9 ac) of FTHL habitat in a MA into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), as described in the CEC's supplemental Staff Assessment, Condition of Certification BIO-10.

11. Transmission lines and all electrical components will be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee's (APLIC's) Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Mitigating Bird Collisions with Power Lines (APLIC 2004) to reduce the likelihood of large bird electrocutions and collisions.

12. The boundaries of all areas to be disturbed (including staging areas, access roads, and sites for temporary placement of spoils) will be delineated with stakes and flagging prior to construction activities. Spoils will be stockpiled in disturbed areas lacking native vegetation or where habitat quality is poor. To the extent possible, disturbance of shrubs and surface soils due to stockpiling will be minimized. All disturbances, vehicles, and equipment will be confined to the flagged areas. To the extent possible, surface disturbance will be timed to minimize mortality to FTHL (see CM #8).

13. Temporarily disturbed areas associated with water pipeline and transmission line construction and staging areas, will be revegetated according to a Habitat Restoration Plan (HRP) approved by the BLM, CEC, CDFG, and Service. The HRP must be approved in writing by the aforementioned agencies prior to the initiation of any vegetation disturbing activities. Restoration involves recontouring the land, replacing the topsoil (if it was collected), planting seed and/or container stock, and maintaining (i.e., weeding, replacement planting, supplemental watering, etc.), and monitoring the restored area for a period of 5 years (or less if the restoration meets all success criteria). Components of the HRP will include:

    - The incorporation of Desert Bioregion Revegetation/Restoration Guidance measures. These measures generally include alleviating soil compaction, returning the surface to its original contour, pitting or imprinting the surface to allow small areas where seeds and rain water can be captured, planting seedlings that have acquired the necessary root mass to survive without watering, planting seedlings in the spring with herbivory cages, broadcasting locally collected seed immediately prior to the rainy season, and covering the seeds with mulch.

14. The Project applicant will install exclusionary fencing around the evaporation ponds and cover the evaporation ponds with 3.8-centimeter (cm) (1.5-in) mesh netting designed to exclude birds and other wildlife from drinking or landing on the water of the ponds. The netted ponds will be monitored regularly to verify that the netting remains intact, is fulfilling its function in excluding birds and other wildlife from the ponds, and does not

pose an entanglement threat to birds and other wildlife. The ponds will include a visual deterrent in addition to the netting, and the ponds will be designed such that the netting will never contact the water.

15. The Project applicant will use water for construction, operation, and maintenance (e.g., truck washing, dust suppression, SunCatcher washing, landscaping, etc.) in a manner that does not result in water ponding. During construction, the biological monitor(s) will patrol these areas to ensure water does not puddle and attract common ravens, and other wildlife to the site, and will make recommendations for reduced water application rates where necessary.

16. The Project applicant will prepare and implement a Raven Control Plan, approved by the BLM, CEC, CDFG, and Service, for the entire project site. The raven control plan will identify the purpose of conducting raven control and include, at a minimum, training on how to identify raven nests and how to determine whether a nest belongs to a raven or a raptor species; describe the seasonal limitations on disturbing nesting raptors; describe raven control methods to be employed (e.g. perching and nesting deterrents); and describe procedures for documenting the activities on an annual basis.

17. Debris (e.g., glass, metal) associated with SunCatcher fields will not be allowed to accumulate under SunCatchers. Any debris found will be immediately removed and appropriately recycled.

18. The Project applicant will implement a Weed Management Plan that will be subject to review and approval by the BLM, Service, CDFG, and the Energy Commission staff. In addition to describing weed eradication and control methods, and a reporting plan for weed management during and after construction, the final Noxious Weed Management Plan will include at a minimum:

    - A pre-construction weed inventory that includes a survey of the entire project site, for weed populations that: (1) are considered by the Imperial County Agriculture Commissioner as being a priority for control and (2) aid and promote the spread of wildfires (such as cheatgrass [*Bromus tectorum*], Saharan mustard [*Brassica tournefortii*] and medusa head [*Taeniatherum caput-medusae*]). These populations will be mapped and described according to density and area covered. These plant species will be treated prior to construction or at a time when treatments will be most effective based on phenology according to control methods and practices for invasive weed populations designed in consultation with the Imperial County Agriculture Commissioner's Office and California Invasive Plants Council (Cal-IPC), as appropriate.

    - For areas directly impacted by the Project, a pre-construction weed inventory will be conducted for those weed populations rated "High" or "Moderate" for negative ecological impact in the California Invasive Plant Inventory Database (Cal-IPC 2006). These weed species will be treated prior to construction or at a time when

treatments will be most effective based on phenology according to control methods and practices for invasive weed populations designed in consultation with Cal-IPC.

- Weed control treatments will include all legally permitted chemical, manual, and mechanical methods applied with the authorization of the Imperial County Agriculture Commissioner. The application of herbicides will be in compliance with all State and Federal laws and regulations under the prescription of a Pest Control Advisor (PCA) and implemented by a Licensed Qualified Applicator. Where manual and/or mechanical methods are used, disposal of the plant debris will follow the regulations set by the Imperial County Agriculture Commissioner. The timing of the weed control treatment will be determined for each plant species in consultation with the PCA, Imperial County Agriculture Commissioner, and Cal-IPC with the goal of controlling populations before they start producing seeds.
- For the lifespan of the project (i.e., as long as the project is physically present), long-term measures to control the introduction and spread of noxious weeds in the project area will be taken as follows:
    - The survey areas described above would be surveyed annually to monitor previously-identified and treated populations and to identify new invasive weed populations. The treatment of weeds will occur on a minimum annual basis, unless otherwise approved by the PCA, Imperial County Agriculture Commissioner, and Cal-IPC.
    - During project construction, all seeds and straw materials will be certified weed free, and all gravel and fill material will be certified weed free by the Imperial County Agriculture Commissioner's Office.
    - During project construction, vehicles and all equipment will be washed (including wheels, undercarriages, and bumpers) at an offsite washing facility (e.g., a car wash or truck wash) immediately before project construction begins and prior to returning to project construction should equipment be used in a different construction area. In addition, tools such as chainsaws, hand clippers, pruners, etc., will be washed at an offsite washing facility immediately before project construction begins and prior to returning to project construction should tools be used in a different construction area. Vehicles, tools, and equipment will be washed at an offsite washing facility should these vehicles, tools, and equipment have been used in an area where invasive plants have been mapped during the pre-construction weed control inventory and as directed by the Designated Biologist, prior to entering a project area free of populations of invasive plants (as determined by the pre-construction weed control inventory). All washing will take place where rinse water is collected and disposed of in either a sanitary sewer or landfill; an effort will be made to use wash facilities that use recycled water. A written daily log will be kept for all vehicle/equipment/tool washing that states the date, time, location, type of equipment washed, methods used, and staff

present. The log will include the signature of a responsible staff member. Logs will be available to the CEC, BLM, CDFG, the Service, and Designated Biologist for inspection at any time.

19. The applicant will purchase or restore wash foraging habitat at a 1:1 ratio, which will be permanently available for bighorn sheep. "Available" will be defined as wash habitat located in or immediately adjacent to the essential habitat line, as delineated in the Recovery Plan for Bighorn Sheep in the Peninsular Ranges, California (Service 2000). The number of acres of wash habitat lost to bighorn sheep will be defined as the average percent cover of vegetation supported by the primary and secondary drainages mapped and considered jurisdictional by the Corps located within the perimeter fence of the project, which equals 100 ha (247 ac). It is anticipated the acreage requirement to offset impacts to bighorn sheep will be met through enhancement along Carrizo Creek and marsh on lands managed by California State Parks. The acreage needed for bighorn sheep will overlap with the acreage proposed to replace the functional losses to waters of the U.S., as required through the Corps section 404 permit.

SPECIES ACCOUNTS

Peninsular bighorn sheep (*Ovis canadensis nelsoni*)

Legal/Listing Status

Desert bighorn sheep within the Peninsular Mountain Ranges of the U.S. were federally listed as an endangered distinct population segment on March 18, 1998, (63 Federal Register [FR] 13134). A recovery plan was approved in October 2000, and 152,542 ha (376,938 ac) of revised critical habitat were designated on April 14, 2009, (74 FR 17288). The decision to list the PBS at the time was made because of declining population numbers and the continuing loss, degradation, and fragmentation of habitat throughout a significant portion of the range of the population. Due to human developments, the population segment had become isolated from other populations of desert bighorn sheep. In addition, periods of depressed recruitment, likely associated with disease and high predation, coincided with low population numbers endangering the continued existence of these animals in southern California. The California Fish and Game Commission listed bighorn sheep inhabiting the Peninsular Ranges as "rare" in 1971. In 1984, the designation was changed to "threatened" by the CDFG to conform to the terminology in the amended California Endangered Species Act. In addition, bighorn sheep in the Peninsular Ranges are "fully protected" under State law, per California Department of Fish and Game Code 4700, which does not allow "incidental take" of fully protected species.

Species Description

Bighorn sheep inhabiting the Peninsular Ranges were once considered a separate subspecies (*Ovis canadensis cremnobates*) and were one of the 4 desert subspecies (*O. c. nelsoni, O. c. mexicana, O. c. cremnobates,* and *O. c. weemsi*) recognized by Cowan (1940). The distinctiveness of these subspecies was questioned and reassessed when modern techniques

became available. Based on morphometric and genetic results, Wehausen and Ramey (1993) and Ramey (1995) placed the bighorn sheep in the Peninsular Ranges within the subspecies *O. c. nelsoni*, which is the currently accepted taxonomy. While the range of *O. c. nelsoni* or Nelson's bighorn sheep covers much of Nevada, Utah, southern California, and northwest Arizona (Monson and Sumner 1980), only the bighorn sheep from the Peninsular Ranges of the U.S. are listed under the ESA. Moreover, the Peninsular Mountain Ranges bighorn sheep, which are commonly referred to as PBS, were listed as a distinct population segment and not as a subspecies under the Act.

Habitat Affinities

Bighorn sheep in the Peninsular Ranges and throughout the desert southwest have important habitat requirements that relate to topography, visibility, water availability, and forage quality and quantity. Bighorn sheep evolved predator evasion behaviors that use escape terrain, which is generally defined as steep, rugged slopes (Hansen 1980a, Cunningham 1989). Escape terrain is critical because bighorn sheep typically do not depend upon speed alone to outrun their predators, but use their exceptional climbing abilities to out maneuver predators on steep, rocky outcrops and talus slopes (Geist 1971, McQuivey 1978). When ewes are ready to give birth they will typically seek out the most precipitous terrain, where they and their lambs will be safest (Geist 1971). The presence of such steep terrain for predator evasion and lambing is, therefore, a crucial component of bighorn sheep habitat.

The predator evasion behavior of bighorn sheep also depends on the ability to visually detect danger at a distance. Bighorn sheep will avoid habitat in which dense vegetation reduces visibility (Risenhoover and Bailey 1985, Etchberger *et al.* 1989). This appears to be the case in the Peninsular Ranges, where bighorn sheep usually remain below the elevation of chaparral and other dense vegetation associations. In the Peninsular Ranges, bighorn sheep habitat occurs along the east-facing desert slopes, typically below approximately 1,402 m (4,600 ft) elevations (Jorgensen and Turner 1975, DeForge *et al.* 1997). The patterns of vegetation associations in the Peninsular Ranges, in combination with bighorn sheep predator avoidance behavior, result in habitat use patterns that are more restricted to lower elevations than in most other bighorn populations. The available habitat of PBS can, therefore, be visualized as a long, narrow band that runs north-south along the lower elevations of the Peninsular Ranges.

Variations in slope and aspect also help bighorn sheep to survive in a harsh environment. During hot weather, desert bighorn seek shade under boulders, over hanging rocks, and cliffs, or they may move to north facing slopes (Merritt 1974, Andrew 1994) where temperatures are moderated. During inclement weather bighorns may again seek protected caves, overhangs, or slopes that are protected from strong winds, and on cold winter days bighorns may move to sunny, south facing slopes (Andrew 1994).

In addition to mountainous terrain, other types of habitat are crucial to bighorn sheep populations. Areas of gentle terrain, such as valley floors, serve as important linkages between neighboring mountainous regions, thereby providing bighorn sheep temporary access to

resources (e.g., forage, water, or lambing habitat) in neighboring areas, and allowing gene flow to occur between subpopulations (Krausman and Leopold 1986, Schwartz *et al.* 1986, Bleich *et al.* 1990, Bleich *et al.* 1996). Alluvial fans and washes contain a greater diversity of browse species than steeper terrain, and this diverse vegetation furnishes important sources of high quality forage (Leslie and Douglas 1979). In summer and times of drought, wash vegetation remains green longer than forages found on mountainsides under these conditions, thus providing forage higher in nutrients and digestibility (Andrew 1994, Crawley 1983, Laycock and Price 1970). Leslie and Douglas (1979) noted that these areas became increasingly important to bighorn sheep not only in summer, but during any period of limited forage availability. Bighorn sheep in the Peninsular Ranges have been observed foraging on alluvial fans for extended periods of time in Coyote Canyon and other undeveloped washes and alluvial fans within Anza-Borrego Desert State Park (Service 2000). In the northern Santa Rosa and San Jacinto Mountains, much of the alluvial fan and wash habitat has been lost to residential and golf course development (Service 2000).

In hot, arid deserts, water is an important resource for bighorn sheep (Jones *et al.* 1957, Blong and Pollard 1968, Leslie and Douglas 1979, Turner and Weaver 1980, Elenowitz 1984, Cunningham and Ohmart 1986). A number of studies have shown that desert bighorn sheep will concentrate around water sources in the summer, with most animals found within a 3-to-5-km (2-to-3-mi) radius of water (Jones *et al.* 1957, Leslie and Douglas 1979, Cunningham and Ohmart 1986). During periods of more abundant rainfall and cooler temperatures, sheep distribution is less coincident with permanent water sources (Leslie and Douglas 1979). Apparently, bighorn sheep obtain enough water from forage to meet their requirements during cooler, wetter portions of the year. Lactating ewes and lambs may be more dependent on free-standing water and are often found closer to water sources (Blong and Pollard 1968, Leslie and Douglas 1979, Bleich *et al.* 1997). Water sources are most valuable to bighorn sheep if they occur in proximity to adequate escape terrain with good visibility. Therefore, the juxtaposition of open escape terrain to water sources is an important factor in their utilization (Cunningham 1989, Andrew 1994). The critical importance of free-standing water to bighorn sheep has been questioned (Krausman and Leopold 1986, Broyles 1995), and some small populations apparently exist without free-standing water (Krausman *et al.* 1985, Krausman and Leopold 1986, Broyles 1995). However, in most populations, bighorn sheep will drink regularly when water is available, and they concentrate near water sources during the warmer months. In the Peninsular Ranges, bighorns migrate seasonally during the hot season, leaving mountain ranges where no standing water is known to exist, such as the Coyote Mountains, and moving to adjacent mountain ranges where standing water is available year-round. They then center their activity on standing water for the hot season, and this behavior may indicate that vegetation alone does not provide sufficient water during the hot season, and at least in some mountain ranges, standing water is a requirement.

In the Peninsular Ranges, bighorn sheep use a wide variety of plant species as their food source (Weaver *et al.* 1968, Jorgensen and Turner 1973). Turner (1973) recorded the use of at least 43 species, with browse being the food category most frequently consumed. Cunningham and Ohmart (1986) determined that the bighorn sheep diet in Carrizo Canyon (at the south end of the U.S. Peninsular Ranges) consisted of 57 percent shrubs, 32 percent forbs, 8 percent cacti, and 2

percent grasses. Scott (1986) and Turner (1976) reported similar diet compositions at the north end of the range. Diet composition varied among seasons (Cunningham and Ohmart 1986, Scott 1986), presumably because of variations in forage availability, selection of specific plant species during different times of the year (Scott 1986), and seasonal movements of bighorn sheep.

The time period surrounding late gestation, lambing, and nursing is very demanding in terms of the energy and protein required by bighorn ewes. Failure to acquire sufficient nutrients during late gestation and during nursing adversely affects the survival of newborn ungulates (Thorne *et al.* 1976, Julander *et al.* 1961, Holl *et al.* 1979). Crude protein and digestible energy values of early green-up species are usually much higher than those of dormant forages during the critical late gestation, lambing, and rearing seasons (Crawley 1983, White 1983). With their high nutrient content, even minor volumes of these forages within the overall diet composition may contribute important nutritional value at critical life stages (Wagner 2000). However, during the reproductive season, due to the varied topography of bighorn sheep habitat, these forages typically are concentrated on specific sites, such as alluvial fans and washes, where more productive soils support greater herbaceous growth than steeper, rockier soils. Furthermore, forage green-up follows an elevational gradient with lower elevations beginning spring growth earlier than higher elevations (Wehausen 1980, Berger 1991). Access to a range of elevations provides bighorn sheep enhanced opportunities to acquire nutrients during critical seasons (Hebert 1973, Wehausen 1980, Berger 1991).

Life History

The movement patterns and habits of ewes are learned by their offspring (Geist 1971). By following older animals, young bighorn sheep gather knowledge about escape terrain, water sources, foraging areas, and lambing habitat (Geist 1971). As young rams reach 2 to 4 years of age, they begin to follow older rams away from their natal group (Geist 1971, Festa-Bianchet 1991). Because bighorn sheep rely on vigilance to detect predators, they benefit from gregariousness and group alertness (Geist 1971, Berger 1978).

The adult sexes tend to loosely segregate during much of the year, coming together primarily during the rut (Geist 1971, Bleich *et al.* 1997), which typically peaks from August through October in the Peninsular Ranges (Rubin *et al.* 2000). During the rut, rams join the ewe groups and compete to breed with receptive ewes. The largest rams presumably are the most successful breeders, but smaller rams have been reported to breed as well (Hogg 1984). During the period of sexual segregation, ewes and their lambs are typically found in steeper, more secure habitat, while rams may be found in less steep or rugged terrain (Geist 1971, Bleich *et al.* 1997).

Desert bighorn sheep are primarily diurnal (Krausman *et al.* 1985), but they may be active at any time of day or night (Miller *et al.* 1984). Their daily activity pattern includes alternating feeding and resting/ruminating periods. Forage quality influences activity patterns because when forages are low in digestibility, bighorn sheep must spend more time ruminating and digesting forage. Consequently, bighorn sheep may establish a cycle of feeding and ruminating that reflects forage quality and optimizes nutrient intake (Wagner and Peek 1999, Wagner 2000).

In general, bighorn sheep are a wide-ranging species that requires large swaths of relatively pristine land. For example, in the San Jacinto Mountains, fixed-kernel home range sizes averaged 25 km^2 (9.65 mi^2) for rams and 20 km^2 (7.72 mi^2) for ewes (DeForge *et al.* 1997). Large home ranges allow for animals to move in response to variation in predation pressure and changes in resource availability. The size of individual or group home ranges depends on the juxtaposition of required resources (water, forage, escape, or lambing habitat) and, therefore, varies geographically. Home range size also is affected by forage quantity and quality, season, sex, and age of the animal (Leslie 1977, McQuivey 1978). Although most desert bighorn sheep do not seasonally migrate along elevational gradients like many populations in higher latitude mountain ranges, they do exhibit seasonal differences in habitat use patterns. In many populations, animals will have a smaller home range in summer (McQuivey 1978, Leslie and Douglas 1979, Elenowitz 1983), presumably due to their limited movement away from permanent water sources. During the cooler or wetter months of the year, bighorn sheep often exhibit an expanded range as animals move farther from water sources (Simmons 1980). Ewes generally display a higher degree of philopatry to their seasonal home ranges than do rams. Rams tend to range more widely, often moving among ewe groups (Boyce *et al.* 1997, DeForge *et al.* 1997, Rubin *et al.* 1998). In most populations of desert bighorn sheep, ram home ranges have been found to be larger than those of ewes (Simmons 1980, DeForge *et al.* 1997).

The gregarious and philopatric behavior of ewes limits their dispersal and exploratory ability relative to those of rams (Geist 1967, 1971). Geist (1971) theorized, however, that a young ewe might switch to a new ewe group if she encountered neighboring sheep and followed them away from her natal ewe group. In the Peninsular Ranges, movement of radio-collared ewes between ewe groups is rare; however, inter-group movement does occasionally occur. During a 3-year study, one ewe moved over 30 km (18.6 mi) and temporarily joined another ewe group (Rubin *et al.* 1998). No emigration of ewes has been observed even though radio-collared animals have been regularly monitored in the northern Santa Rosa Mountains since 1981 (Ostermann *et al.* 2001) and throughout the range since 1993 (E. Rubin *et al*. 1998; DeForge *et al.* 1997). Bighorn sheep evolved movement patterns that were adapted to exploiting stable patches of habitat, consequently compared to other North American ungulates they are regarded as poor dispersers (Geist 1971). Nevertheless, dispersal and exploratory movements do occur, and genetic analyses reflect a low rate of ewe dispersal across the Peninsular Ranges in the evolutionary past (Boyce *et al.* 1999). In 2005, two yearling ewes crossed Chino Canyon, and temporarily occupied the area north of the canyon in an exploratory movement documented by the Bighorn Institute.

The breeding period, or rut, occurs in the late summer and fall months. In the Peninsular Ranges, ewes estimated to be between 2 and 16 years of age have been documented to produce lambs (Rubin *et al*. 2000, Ostermann *et al.* 2001). As parturition approaches, ewes seek secluded sites with shelter, escape terrain, and unobstructed views (Turner and Hansen 1980). They isolate themselves from other females while bearing their lambs (Etchberger and Krausman 1999). Lambs are born after a gestation of approximately 6 months-171 to 185 days (Turner and Hansen 1980, Shackleton *et al.* 1984, Hass 1995). During a 4-year (1993 to 1996) study conducted in the Peninsular Ranges, south of the San Jacinto Mountains, the lambing season extended from February through August; however, 87 percent of the lambs were born from

February to April, and 55 percent of the lambs were born in March (Rubin *et al.* 2000). DeForge *et al.* (1997) and Cunningham (1982) reported a similar onset of the lambing season in the San Jacinto Mountains and in Carrizo Canyon, respectively. However, in the San Jacinto and Northern Santa Rosa Mountains ewe groups, the lambing season has started in January during some years (Bighorn Institute 1997). Lambs usually are weaned by 6 months of age (Hansen and Deming 1980, Wehausen 1980).

From 1993 to 1996, the reproductive patterns of five ewe groups [Carrizo Canyon, south San Ysidro Mountains, north San Ysidro Mountains, Santa Rosa Mountains (Deep Canyon), and northern Santa Rosa Mountains] were monitored and annual lamb production averaged 77 percent (0.77 lambs born per "ewe-year") for the 4-year period (Rubin *et al*. 1998). Using a fecal-based enzyme immunoassay, Borjesson *et al.* (1996) determined that in the fall of 1992, at least 85 percent of sampled adult ewes were pregnant. Both of these observations suggest that conception rates are not limiting population growth in the Peninsular Ranges.

Lamb survival (to 6 months of age) was variable among groups and across years. A year of high lamb survival in one group was not necessarily a high survival year in another group (Rubin *et al.* 2000). Of the four groups studied, the northern Santa Rosa Mountains group typically had the lowest lamb survival, while the neighboring Deep Canyon group, located less than 8 km (5 mi) away, had the highest lamb survival. Lamb recruitment in the northern Santa Rosa Mountains was found to be very low between the years of 1977 and 1997 (DeForge *et al.* 1982, DeForge and Scott 1982, Turner and Payson 1982; Ostermann *et al.* 2001). Shorter periods of low lamb to ewe ratios, as well as clinical signs of pneumonia among lambs, have occasionally been observed in Anza-Borrego Desert State Park (Jorgensen and Turner 1973, Jorgensen and Turner 1975, Hicks 1978), but years of high lamb to ewe ratios (Cunningham 1982; M. Jorgensen, *in litt* 2000) have been observed in these areas as well (Rubin *et al.* 2000).

Wehausen (1992) suggested that periods of low recruitment may not warrant alarm because long-lived animals such as bighorn sheep can exist in viable populations if periods of low offspring recruitment are interrupted by periodic pulses of high offspring recruitment. Most ewe groups in the Peninsular Ranges appear to have exhibited such recruitment pulses, but declining population trends suggest that at times they have not been sufficient to balance adult mortality.

In ruminants, reproductive success is related to the mother's body weight, access to resources, quality of home range, and age (Etchberger and Krausman 1999). Survival of offspring also depends on birth weight and parturition date. Festa-Bianchet and Jorgenson (1996) found that female sheep reduce the care of lambs when resources are scarce to favor their own nutritional requirements over their lamb's development. Ewes that fail to acquire a minimum level of energy reserves (i.e., body weight) may not conceive (Wehausen 1984) or will produce smaller offspring with a poorer chance of survival (Price and White 1985). Several studies have documented a positive relationship between winter precipitation and lamb recruitment in the following year (Douglas and Leslie 1986, Wehausen *et al.* 1987). However, the relationships between climate, lamb recruitment, and population trends likely differ among different bighorn sheep populations, and are not fully understood (Rubin *et al.* 2000).

Lamb and yearling age classes experience high mortality rates relative to adult bighorns. After reaching adulthood at 2 years of age, bighorn sheep survival is high until 10 years of age (Hansen 1980b), or until shortly before the age of ecological longevity (Cowan and Geist 1971). However, observed values of annual adult survivorship in the PBS appear low relative to other reported desert populations. During November 1992 to May 1998, survivorship of 113 adult radio-collared bighorn sheep (97 ewes and 16 rams) was monitored between State Route (SR) 74 in the Santa Rosa Mountains and the U.S.-Mexico border. During this period, overall annual adult survival was 0.79, with no significant difference among three age classes of adults (Hayes *et al.* 2000). Annual survivorship of individual ewe groups ranged from 0.70 to 0.87, and a year of high survivorship in one group was not necessarily a year of high survivorship in other groups (Rubin *et al.* 1998). In the northern Santa Rosa Mountains ewe group, adult survivorship was monitored during a 14-year period (1985 to 1998), and was found to range between 0.50 and 1.00 annually (Ostermann *et al*. 2001). In the San Jacinto Mountains, DeForge *et al.* (1997) monitored the survival of adult (2 or more years of age) radio-collared bighorn sheep during 1993 to 1996 and estimated annual adult survival to be 0.75.

Survival of desert bighorn sheep in greater southeastern California averaged 0.91 (Andrew 1994), 0.86 or greater in northwest Arizona (when highway mortalities were excluded (Cunningham and deVos 1992), 0.82 in New Mexico (Logan *et al.* 1996), and 0.85 or greater for four populations studied in the Mojave Desert (Wehausen 1992).

Distribution

Within the U.S., the range of PBS extends along the Peninsular Ranges from the San Jacinto Mountains in Riverside County south to the U.S.-Mexico border. Bighorn sheep habitat in the Peninsular Ranges of California is restricted to the east facing, lower elevation slopes that are typically below 1,402 m (4,600 ft) and located along the northwestern edge of the Colorado Division of the Sonoran Desert.

An examination of past records and current data suggests that the distribution of PBS in California has been altered during the past 25 years. Ewe groups along the Mexican border and in the northern San Jacinto Mountains (north of Chino Canyon) were apparently extirpated in the late1980s (DeForge *et al.* 1997; Rubin *et al.* 1998). DeForge *et al.* (1997) suggested disturbance and habitat fragmentation were the primary factors driving the changes in bighorn distribution in the northern San Jacinto Mountains. Blong (1967) reported that construction of the Tramway Road through Chino Canyon severely reduced bighorn movement in this area. Ewes ceased regularly occupying the northern San Jacinto Mountains about 20 years after construction of the Palm Springs Aerial Tramway in Chino Canyon, though rams continued to cross Chino Canyon and use the area formerly occupied by the ewe group (DeForge *et al.* 1997). However, ewes were recently documented crossing Chino Canyon in route to Blaisdell Canyon in 2005, where they remained for several days before re-crossing and returning to Tachevah Canyon (Bighorn Institute 2005). The group, consisting of adult ewes, female lambs and yearlings, and male yearlings; has been regularly located within Chino Canyon since 2005 (Bighorn Institute 2005, 2007).

The possible extirpation of the bighorn subpopulation between I-8 and the U.S.-Mexico border was poorly documented, but the construction of the Interstate in the mid-1960s, railroad activity, livestock grazing, poaching, and fire suppression appear the most likely factors contributing to the isolation and decline of bighorn sheep in the area (Rubin *et al.* 1998). Recently, bighorn sheep sightings and their sign have become common around the Mountain Spring area of I-8 (Service and CDFG, unpublished aerial census data, 2006, 2008). Bighorn sheep have been observed crossing this wide highway (J. Collins, Naval Air Facility El Centro, *in litt*. 2007, 2008), and bighorn sheep have been observed further south in the Jacumba Mountains by the U.S. Border Patrol (D. Kim, pers. *in litt*., 2007).

Rubin *et al.* (1998) suggested that in portions of the range, roads or increased traffic have contributed to habitat fragmentation by restricting ewe movement, as evidenced by four ewe groups whose home ranges were delineated by roadways. In the 1970s, ewes were observed crossing SR 74 in the Santa Rosa Mountains (D. Jessup, *in litt.* 1999). However, no radio-collared ewes were observed crossing this road from 1993 to 2001 (Service 2000). California Department of Transportation records indicated SR 74 traffic approximately tripled from 1970 onward. However, in recent years ewes have begun crossing SR 74 in at least two locations documented by the Bighorn Institute. Additionally, the number of crossings by rams near Vista Point has also increased, and several have been struck by automobiles. As a result, Caltrans has installed wildlife crossing signs in the area.

Population Trends

Bighorn sheep have been documented in the Peninsular Ranges since early explorers, such as Anza, observed them in the 1700s (Bolton 1930). Grinnell and Swarth (1913) described the area of Deep Canyon in the southern Santa Rosa Mountains, "...well worn trails, footprints, and feces were plentiful. In places it looked as though a herd of domestic sheep had been over the region." Rangewide population estimates were not made until the 1970s. Published estimates were as high as 971 in 1972, (Weaver 1972), and 1,171 in 1974 (Weaver 1975).

Range-wide population estimates in the U.S were 570 in 1988 (Weaver 1989), 400 in 1992 (Service 2000), and between 327 and 524 in 1993 (Torres *et al.* 1994). Starting in 1994, a biennial helicopter census has been conducted throughout the Peninsular Ranges using radio-collared animals to estimate sighting probabilities. The range-wide population estimates were 347, 276, 334, 400, 667, 708, 793, and 876 for the years 1994-2008, respectively. From the historic highs of the 1970s, population estimates declined to a low of 276 adults in 1996 (Service 2000); since 1996, the population has steadily increased. Currently, at least eight ewe groups (or subpopulations) exist in the overall U.S. range, however, the population trajectory of each ewe group appears to be determined independently (Rubin *et al.* 1998). Climatic patterns are correlated across the Peninsular Ranges, suggesting that other local factors specific to each ewe group play important roles in determining long-term abundance trends (Rubin *et al.* 1998). Independent population trends also were observed among ewe groups in the Mojave Desert (Wehausen 1992). Bighorn sheep are relatively long-lived animals that have the potential to reproduce over an extended period of time (2-16 years). Therefore, periods of above average

recruitment may compensate for periods of low recruitment (Wehausen 1992). Forage quality and quantity vary with environmental conditions; therefore, female condition, and conception, parturition and lamb survival rates reflect this natural variation. However, if mortality agents begin impacting adult survival, then subpopulation levels may drop dramatically, endangering the existence of a ewe group. Consequently, persistence of a ewe group is always vulnerable to disease outbreaks, high levels of predation, mortality caused by urbanization, and habitat loss from development and human disturbance.

An important influence on bighorn sheep population trends are their behavioral responses to human activity. Bighorn sheep were classified as a wilderness species by Aldo Leopold (1933) because they usually declined when confronted with expanding human developments and activities. Over the past 75 years, numerous other scientists and land managers have expressed concerns regarding the impact of human activities on bighorn sheep populations (Horesji 1976, Hicks and Elder 1979, Graham 1980, Leslie and Douglas 1980, Hamilton *et al.* 1982, Stemp 1983, Miller and Smith 1985, Gionfriddo and Krausman 1986, Krausman and Leopold 1986, Smith and Krausman 1988, Etchberger *et al.* 1989, Krausman *et al.* 2001, Papouchis *et al*. 2001). These concerns have been echoed in the Peninsular Ranges where bighorn sheep have altered their movement and habitat use patterns in response to human activity (Jorgensen and Turner 1973, Hicks 1978, Olech 1979, Cunningham 1982, DeForge and Scott 1982, Gross 1987, Sanchez *et al.* 1988). The impacts of human development extend beyond the urban edge into bighorn sheep habitat. Growing human populations and their increased activities adjacent to and within bighorn sheep habitat have the potential to adversely affect bighorn sheep by directly converting habitat to human uses and fragmenting remaining use areas. Additionally, the behavioral responses of bighorn sheep to human activities may alter how they utilize resources occurring in their environment. These altered behavior patterns may be less than optimal and could eventually negatively affect population trajectories.

Threat

Threats to bighorn sheep in the Peninsular Ranges include habitat loss and fragmentation, urban sources of mortality, human disturbance, disease, and mountain lion predation (Service 2000). As discussed above, the population dynamics of ewe groups operate independently, and threats to the various ewe groups vary spatially and temporally.

<u>Habitat Loss and Fragmentation:</u> Habitat loss is a leading cause of current species extinctions and endangerment worldwide (Burgman *et al.* 1993). It represents a particularly serious threat to PBS, because they live in a narrow band of lower elevation habitat that represents some of the most desirable real estate in the California desert, and it is being developed at a rapid pace. At least 7,490 ha (18,500 ac) or about 77.7 km^2 (30 mi^2) of suitable habitat has been lost to urbanization and agriculture within the range of the three ewe groups that occur along the urban interface between Palm Springs and La Quinta (Service 2000), and development is spreading southward towards Anza-Borrego Desert State Park. Within the narrow band of habitat, bighorn sheep make use of sparse and sometimes sporadically available resources found within their home ranges. As humans encroach into this habitat, these resources are eliminated or reduced in

value, and the survival of ewe groups is threatened. Bighorn sheep are also sensitive to habitat loss or modification because they are relatively poor dispersers (Geist 1967, 1971), largely learning their ranging patterns from older animals. When habitat is lost or modified, the affected group may remain within their familiar surroundings where they will experience a reduced likelihood of population persistence, due to the reduced quantity and/or quality of resources.

Encroaching urban development and anthropogenic disturbances have the dual effect of restricting animals to a smaller area and severing connections between ewe groups. Fragmentation poses a particularly severe threat to species with a metapopulation structure, such as PBS, because overall survival depends on interaction among subpopulations. Isolated, small groups of animals are subject to greater risks of extinction, while inter-connected, small groups acquire much of the resilience of larger populations. The movement of rams and occasional ewes between ewe groups maintains genetic diversity and augments populations of individual ewe groups (Brown and Kodric-Brown 1977, Soulé 1980, Krausman and Leopold 1986, Schwartz *et al.* 1986, Burgman *et al.* 1993). Temporary moves by females between neighboring ewe groups could also provide new habitat knowledge facilitating future range expansion (Geist 1971). Increased fragmentation reduces such possibilities and increases the risk of ewe group extinction.

Beyond physical barriers to movement, fragmentation also can result from less obvious forms of habitat modification. Increased traffic on roads apparently make bighorn sheep, especially ewes, hesitant to cross roads (Rubin *et al.* 1998; Epps *et al.* 2004). Animals that do cross suffer an additional risk of mortality from automobile collisions (Turner 1976, McQuivey 1978, Cunningham and deVos 1992, DeForge and Ostermann 1998, Bighorn Institute 1999), with the result that a group whose range is bisected by a road can have reduced viability in the long-term (Cunningham and deVos 1992).

Bighorn sheep evolved in the presence of predators, and developed effective physical and behavioral mechanisms for dealing with them. Similar to other desert bighorn populations, sheep in the Peninsular Ranges have likely experienced varying levels of lion predation for thousands of years. However, when other factors, such as drought, habitat loss and fragmentation due to urbanization, diseases, and other mortality factors reduce populations to low levels and/or alter the abundance and distribution of alternate prey species, such as mule deer, then the influence of predation on population dynamics may increase (Logan and Sweanor 2001). For example, prey populations frequently respond to the presence of mountain lions by changing their distribution at a landscape scale (Hornocker 1970). Where habitats have become fragmented by human developments, bighorns may not be able to move away from areas of high predation risk. In the Peninsular Ranges, coyotes (*Canis latrans*), golden eagles (*Aquila chrysaetos*) and bobcats (*Lynx rufus*) are also potential predators of bighorn sheep (Weaver and Mensch 1970, Jorgensen and Turner 1975, DeForge and Scott 1982).

<u>Disease:</u> The westward spread of Europeans and their domestic livestock across North America was thought to play a significant role in reducing the distribution and abundance of bighorn sheep due to the introduction of new infectious diseases (Spraker 1977, Onderka and Wishart

1984). In particular, domestic sheep have been repeatedly implicated in *Pasteurella* pneumonia die-offs of bighorn sheep. It has been hypothesized that disease has played an important role in the population dynamics of bighorn sheep in the Peninsular Ranges (DeForge *et al.* 1982, DeForge and Scott 1982, Turner and Payson 1982, Wehausen *et al.* 1987). Numerous pathogens have been isolated or detected by serologic assay from bighorn sheep in these ranges. These pathogens include bluetongue virus, contagious ecthyma virus, parainfluenza-3 virus, bovine respiratory syncytial virus (BRSV), *Anaplasma*, *Chlamydia*, *Leptospira*, *Pasteurella*, *Psoroptes,* and *Dermacentor* (DeForge *et al.*, 1982; Clark *et al.* 1985, 1993; Mazet *et al*. 1992; Elliott *et al.* 1994; Boyce 1995; Crosbie *et al.*, 1997, DeForge *et al.* 1997).

Response to Human Disturbance: Numerous bighorn sheep biologists and land managers have written about their experiences and observations concerning the impacts of human activity on bighorn sheep. These scientists and mangers developed their opinions by and large independently over a lengthy period of time (approximately 75 years). The overwhelming majority expressed concern, recounted increases in human activity with accompanying changes in bighorn sheep behavior, and at times decreased population levels. They almost universally recommended management of human activity in bighorn sheep habitat.

The strength of inference varies within the literature, ranging from simple opinion to reporting expensive and difficult to conduct field studies in peer-reviewed scientific publications. The most compelling evidence available is the local extinctions of bighorn sheep populations living next to expanding urban areas where bighorns experienced high levels of human activity within their home ranges (Krausman *et al.* 2001). Occasional encounters with humans that result in flight or other behavioral and physiological reactions are probably well within the abilities of bighorn sheep to tolerate. Bighorn sheep have evolved to deal with occasional disruptions of their usual behavioral patterns, such as the presence of a predator. However, it appears beyond a certain threshold of human activity, bighorns can simply be overwhelmed, and a number of factors interact to determine the effects of human activity on bighorn sheep.

Bighorn response to human activity is variable and depends on many factors, including but not limited to: the type and predictability of the activity, presence of domestic dogs, previous experience with humans, size or composition of the bighorn sheep group, location of bighorn sheep relative to the elevation of the activity, distance to escape terrain, and distance to the activity (Weaver 1973; McQuivey 1978; Hicks 1977, 1978; Hicks and Elder 1979; MacArthur *et al.* 1979, 1982; Wehausen 1980; Hamilton *et al*. 1982; Whittaker and Knight 1998; Papouchis *et al.* 1999).

The history of sheep and human interactions has shown that not all bighorn sheep react in the same way to human disturbance. As in humans, there are individual differences in behavior and different groups of sheep have had different experiences with humans (King and Workman 1986). A portion of individuals in some populations may not react as strongly to disturbance as others (Hicks and Elder 1979, Leslie and Douglas 1980, Papouchis *et al.* 2001). Different groups of bighorns may possess different “cultures” in terms of their reactions to human activities. Ewes with lambs typically are more sensitive to disturbance (Light and Weaver 1973,

Wehausen 1980) than groups without young. Attraction, habituation, and avoidance are behavioral events that should be placed in careful context with descriptions of the conditions under which the animal displayed a particular response. Individual animals or populations should not be labeled based on the limited responses of a few animals (Whittaker and Knight 1998).

Although the reactions of bighorn sheep to human activity are complex, for communication purposes it is useful to divide them into habitat effects and physiological effects. Habitat effects refer to the relocation of bighorn sheep away from human activity, and this can also be considered spatial displacement. The end result of moving away from humans reduces the options bighorns have for meeting their resource needs. Physiological effects refer to changes that occur within bighorn sheep when they perceive and react to danger or disturbance, such as elevated heart rate or the additional energy expended in moving away from sources of concern. In reality, habitat and physiological effects are not mutually exclusive, and both usually occur when sheep act to avoid danger or disturbance.

A variety of recreational activities such as hiking, mountain biking, hang gliding, horseback riding, camping, hunting, dog-walking, and use of aircraft and off-road vehicles have the potential to disrupt normal bighorn sheep social behaviors and use of essential resources, and cause bighorn sheep to abandon traditional habitat (Graham 1971, Jorgensen 1973 and 1974, McQuivey 1978, MacArthur *et al*. 1979, Olech 1979, Wehausen 1979, Graham 1980, Leslie and Douglas 1980, Monson and Sumner 1980, Wilson *et al.* 1980, MacArthur *et al*. 1982, Bates and Workman 1983, Wehausen 1983, Miller and Smith 1985, Cunningham and Ohmart 1986, Krausman and Leopold 1986, Armentrout and Brigham 1988, Krausman *et al.* 1989, Goodson *et al*. 1999, Papouchis *et al*. 1999, 2001). For example, Graham (1971) found that areas with more than 500 visitor-days of use per year resulted in a decline of use by bighorn sheep. Jorgensen (1974) reported that PBS use of an area of Anza-Borrego Desert State Park was reduced by about 50 percent on days when more recreational vehicle traffic occurred, versus periods of low or no vehicle use. Etchberger *et al.* (1989) found that habitat abandoned by bighorn sheep in the Pusch Ridge Wilderness had greater human disturbance and differences in vegetation and visibility as a result of fire suppression when compared to currently occupied habitat. In addition to recreation, construction, industrial, and agricultural activities may also disturb bighorn sheep (Krausman *et al*. 1989, Leslie and Douglas 1980).

Cases have been cited in which bighorn sheep populations did not appear to be greatly affected by human activity. However, even when bighorn sheep appear to be tolerant, continued and frequent human use of an area can cause them to eventually avoid the area, interfering with use of resources, such as water, mineral licks, lambing or feeding areas, or traditional movement routes (Jorgensen and Turner 1973, McQuivey 1978, Graham 1980, Leslie and Douglas 1980, DeForge and Scott 1982, Hamilton *et al.* 1982, Krausman and Leopold 1986, Rubin *et al.* 1998).

In addition to spatial displacement, human activity can result in physiological responses, such as elevated heart rate, even when no behavioral response is discernable, and the cumulative energetic cost of such responses may potentially affect the nutritional status of individuals and

potentially populations (Stemp 1983, MacArthur *et al.* 1979, 1982). Responses can range from cautious curiosity to immediate flight. Cardiac and behavioral responses of bighorn sheep to an approaching human were determined to be greatest when a person was accompanied by a dog or approached from over a ridge (MacArthur *et al.* 1979, 1982). When individuals perceive danger, changes can occur within the endocrine system along with increased heart rates. These changes are actually adaptive and evolved to deal with imminent danger, such as a mountain lion attack. However, long-term chronic activation of this "flight or fight" mechanism may cause physiological reactions that impair immune function, endocrine regulation, and growth and development (Desert Bighorn Council 1992). Additionally, bighorn sheep prevented from using preferred foraging areas or following normal activity patterns by frequent human disturbance may experience less than adequate nutrition, which can also adversely affect the immune system (Festa-Bianchet 1988, Wagner and Peek 1999).

Drought: Similar to predation, prolonged drought is a natural factor that can have negative impacts on desert bighorn sheep populations, either by limiting water sources or by affecting forage quality and quantity (Rosenzweig 1968, Hansen 1980a, Douglas and Leslie 1986, Wehausen *et al.* 1987). During drought years, the concentration of bighorn sheep near remaining water sources may increase competition for forage as well as water, thereby limiting population growth through density dependent regulation (Caughley 1977). In addition, increased density potentially renders animals more susceptible to diseases or parasites (Anderson and May 1979, May and Anderson 1979). Climate-change research indicates that warmer temperatures during the past 30 years have affected the function, composition and distribution of many ecological communities (Walther et al. 2002), and that future changes in climate are expected to affect the population dynamics of many species (McCarty 2001). Recent regional trends in warming and drying (Lane et al. 1994, Weiss and Overpeck 2005) have caused concern among scientists and managers for the persistence of desert bighorn sheep, especially in the drier mountain ranges of the southwest (Epps et al. 2004). A warmer and dryer climate may result in fewer sources of water and nutritious forage for PBS.

Exotic Vegetation and Fire Suppression: In the Peninsular Ranges, the presence of tamarisk (*Tamarix* sp.), also known as saltcedar, represents a serious threat to bighorn sheep. This exotic plant has rapid reproductive and dispersal rates (Sanchez 1975, Lovich *et al.* 1994), enabling it to out compete native plant species in canyon bottoms and washes. It has the following negative effects on bighorn sheep: 1) it reduces or eliminates the standing water on which bighorn sheep depend, 2) it out competes plant species on which bighorn sheep feed, and 3) it occurs in thick, often impenetrable stands that block access to water sources and it provides cover for predators.

Fire suppression can influence the distribution and habitat use patterns of bighorn sheep by causing avoidance of areas with low visibility (Risenhoover and Bailey 1985, Etchberger *et al.* 1989, Etchberger *et al*. 1990, Krausman *et al*. 1996). Long-term fire suppression results in taller, denser stands of vegetation, thereby reducing openness and visibility and making bighorn sheep more susceptible to predation (Sierra Nevada Bighorn Sheep Interagency Advisory Group 1997). In addition, Graf (1980) suggested that fire suppression reduces forage conditions on some bighorn sheep ranges. In the Peninsular Mountains, changes in vegetation succession are evident

in some portions of bighorn sheep habitat, primarily in higher elevation chaparral and pinyon-juniper, and this change has apparently decreased bighorn sheep use of certain canyons and springs (M. Jorgensen, Anza-Borrego Desert State Park, *in litt* 2000).

Border Crossing from Mexico: The number of individuals entering the U.S. from Mexico on foot continues to increase. Some of these individuals travel through the Peninsular Ranges and camp at water sources where they may occasionally kill and consume bighorn sheep, or displace them. Because in response the U.S. Border Patrol is increasing its enforcement activity along the border and in the southern Peninsular Ranges, the overall level of human activity in the area is increasing. This scenario may cause bighorn sheep to avoid areas they once used and may compromise bighorn sheep population connectivity between the U.S. and Mexico. In addition, the Federal government has constructed an intermittent fence along the border, which may prevent the movement of large mammals, as well as targeted humans, along some sections of the border. The locations of the constructed portions will likely funnel border crossing individuals into the Jacumba Mountains, where no fence has been constructed. The number of individuals traversing this portion of the Peninsular Ranges may increase as a result of the border fence design, causing the Border Patrol to also increase their activities in this portion of PBS habitat.

Flat-tailed horned lizard (*Phrynosoma mcallii*)

Legal/Listing Status

The FTHL is designated as a State Species of Special Concern by the CDFG and is listed as a threatened species in Mexico. The FTHL was initially proposed as a threatened species under the Act in 1993 (58 FR 62624). Since that time, the Service withdrew the species from listing three times (62 FR 37853, 68 FR 331, 71 FR 36745), while the courts subsequently reinstated proposed threatened status three times (66 FR 66384, 70 FR 72776, 75 FR 9377). While currently proposed for threatened status, a more detailed account of our previous Federal actions for FTHL can be found in our **Federal Register** notice published on March 2, 2010, (75 FR 9377).

In June 1997, seven Federal and State agencies signed a Flat-Tailed Horned Lizard Conservation Agreement to implement a Flat-tailed Horned Lizard RMS. The purpose of the RMS is to provide a framework for conserving and managing sufficient habitat to maintain several viable populations of the FTHL throughout the U.S. range of the species. The RMS was developed by FTHL ICC working group over a 2-year period. As part of the Conservation Agreement, agencies delineated specific areas under their jurisdiction as Management Areas (MAs). The MAs comprise 196,273 ha (485,000 ac), including 15,216 ha (37,600 ac) of private inholdings, of FTHL habitat managed by signatories of the Conservation Agreement within five MAs. The five MAs are the Borrego Badlands, West Mesa, Yuha Desert, East Mesa, and the Yuma Desert. These managed areas represent a habitat-based conservation strategy and are believed to represent approximately 40 percent of FTHL habitat remaining in the U.S.

The five MAs include large areas of public land where FTHLs have been found and include most

FTHL habitat identified as key areas in previous studies (Turner *et al.* 1980, Turner and Medica 1982, Rorabaugh *et al.* 1987, Foreman 1997). MAs were proposed based on accepted principles of preserve design, utilizing the best information available at the time (FTHL ICC 2003). Furthermore, the MAs were delineated to include areas as large as possible, while avoiding extensive, existing and predicted management conflicts (e.g., off-highway vehicle (OHV) open areas). The MAs are meant to function as core areas for maintaining self-sustaining populations of FTHLs in the U.S. (FTHL ICC 2003). Lands within the MAs have a development cap of 1 percent relative disturbance. Ocotillo Wells State Vehicle Recreation Area (SVRA) was designated as a Research Area under the Conservation Agreement. Research on FTHLs is funded and encouraged in this area.

Species Description

The FTHL was first described by Hallowell in 1852 as *Anota mcallii* after U.S. Army Colonel George A. M'Call (Funk 1981). The FTHL is a small phrynosomatid lizard that reaches a maximum adult body length of 8.4 cm [3.3 inches (in)] (Muth and Fisher 1992). The FTHL has a dorso-ventrally flattened body; long, broad flattened tail; and dagger-like head spines common to horned lizards of the genus *Phrynosoma.* The species is cryptic in color, ranging from pale gray to light rust brown dorsally, and white or cream ventrally. Males have enlarged postanal scales; females do not. The FTHL can be distinguished from the only other horned lizard known to occur within its range, the desert horned lizard (*Phrynosoma platyrhinos*), by its dark vertebral stripe, two rows of fringed scales on each side of the body, lack of external ear openings, and white or cream (unspotted) ventral surface with a prominent umbilical scar in most individuals (Foreman 1997). Apparent hybrids between the two species, exhibiting a mix of morphological characteristics, have been observed in the vicinity of Ocotillo, California (Stebbins 1985), and southeast of Yuma, Arizona (K. Young, Utah State University, pers. comm. 2002). Genetic analysis has confirmed hybridization in Arizona (Mendelson *et al.* 2004, Mulcahy *et al.* 2006).

Genetics

Because current FTHL populations are separated by significant barriers to movement (Colorado River, Salton Sea), genetic differences between populations may exist. To measure the genetic diversity of FTHL populations in relationship to current patterns of fragmentation, a genetic analysis of the FTHL and the desert horned lizard was conducted (Mendelson *et al.* 2004, Mulcahy *et al.* 2006). Populations were sampled in Coachella Valley, East Mesa, West Mesa, Ocotillo Wells SVRA, the Yuha Desert, the Yuma Desert, and Gran Desierto in Mexico. Sequences were also obtained from individual lizards from the southwest side of Laguna Salada valley in Mexico, north of Borrego Springs, and the southeast part of the range in Mexico. Mitochondrial DNA sequences were obtained of the ND4 gene from a total of 84 FTHLs.

Thirty unique haplotypes of FTHLs were recovered. Unique haplotypes were identified in Coachella Valley (3 unique haplotypes), Yuha Desert (4 unique haplotypes), Ocotillo Wells SVRA (6 unique haplotypes), East Mesa (1 unique haplotype), Gran Desierto Mexico (3 unique haplotypes), and Yuma (7 unique haplotypes). One shared haplotype was recovered from every

location where more than one sample was taken. Uncorrected pair-wise sequence divergence within FTHL ranged from 0-2.2 percent. Most individual sequences could be divided into two clades corresponding to each side of the Colorado River. The analysis indicates that the species expanded into its current range in past millennia and then developed unique haplotypes in each area it populated. The data are indicative of a relatively deep but incomplete divergence within an otherwise moderate-level range of variation among populations of FTHL. Low levels of population-endemic haplotypes exist.

The FTHL was found to be hybridizing with a subspecies of the desert horned lizard (*Phrynosoma platyrhinos goodei)* in the Yuma Desert. Mendelson *et al.* (2004) suggest that *P. p. goodei* is a full species and treat the matter further in Mulcahy *et al.* (2006).

Habitat Affinities

The FTHL is most commonly found in sandy flats and valleys dominated by creosote bush (*Larrea tridentata*) and white burr sage (*Ambrosia dumosa*) (Turner *et al*. 1980, Muth and Fisher 1992, Foreman 1997), which Sawyer *et al.* (2009) refer to as the *Larrea tridentata-Ambrosia dumosa* shrubland alliance or creosote bush-white burr sage scrub. Turner *et al.* (1980) stated the best habitats are generally low-relief areas with surface soils of fine packed sand or pavement, overlain with loose, fine sand. Flat-tailed horned lizards are also known to occur at the edges of vegetated sand dunes, on barren clay soils, and sparse saltbush communities, but Turner *et al.* (1980) suspected that these recorded occurrences were actually individuals that had dispersed from more suitable habitats. Within a creosote plant community in West Mesa, California, Muth and Fisher (1992) found that FTHLs preferred sandy substrates with white burr sage and Emory dalea (*Psorothamnus emoryi*), and avoided creosote and *Tiquilia plicata*. In Arizona, Rorabaugh *et al.* (1987) found FTHL abundance correlated with big galleta grass (*Hilaria rigida*) and sandy substrates, but suggested that the presence of sandy substrates were more important than that of big galleta grass. Beauchamp *et al.* (1998) described FTHLs occupying mud hills and gravelly flats. Altman *et al.* (1980) also reported finding FTHLs in desert pavement areas. Grant (2005) found the percent cover of sand and the number of black harvester ant (*Messor pergandei*) nests to be positively correlated with FTHL abundance.

Life History

Greater than 95 percent of the diet by prey item of FTHLs consists of ants of the genera *Messor*, *Pogonomyrmex*, *Conomyrma*, and *Myrmecocystus* (Turner and Medica 1982, Pianka and Parker 1975). *Messor pergandei* and *Pogonomyrmex* spp. are harvester ants that collect seeds of plants for food. Harvester ants are much larger than *Conomyrma* and *Myrmecocystus* and hence are probably more important prey sources. FTHLs are oviparous (egg-laying), early maturing, and may produce multiple clutches within a breeding season (Howard 1974). FTHLs produce relatively small egg clutches (Howard 1974), compared to most other horned lizards (Pianka and Parker 1975). The first cohort hatches in July to August (Muth and Fisher 1992; Young and Young 2000) in years of adequate rainfall. Approximately 50 millimeters (mm) (2 in) of rainfall in the previous September to May is enough to cause the first cohort to appear in July or August

(Grant 2005). Generally a second cohort then appears in the fall (Muth and Fisher 1992). In drier years, only one cohort is produced that emerges in the fall (e.g. Setser 2004, Muth and Fisher 1992). Hatchlings from the first cohort may reach sexual maturity after their first winter season, whereas hatchlings born later may require an additional growing season to mature (Howard 1974, Young and Young 2000). FTHLs can live up to at least 6 years in the wild (FTHL ICC 2003), and up to 9 years in captivity (Baur 1986). In the Yuma Desert, few lizards were found to live longer than 4 years (FTHL ICC 2003).

Based on studies of their daily movements, FTHLs are very active and have large home ranges compared to other sympatric lizard species of similar size (Miller 1999; Wone and Beauchamp 2003). Large variation in home range size was noted among individuals and between years (Miller 1999; Young and Young 2000); this variation may depend on gender and precipitation. However, FTHLs may not maintain distinct home ranges, but instead shift their area of use through time, thereby increasing the home range estimate with each additional location (Miller 1999). Mean home range size for FTHLs has been estimated between 0.56 ha (1.4 ac) and 10.3 ha (25.5 ac) (Muth and Fisher 1992; Miller 1999; Young and Young 2000; Setser 2004).

Adult FTHLs are reported to be obligatory hibernators (Mayhew 1965), although individuals have been noted on the surface during January and February (Wone and Beauchamp 2003). While most adults apparently hibernate during winter months, some juveniles may remain active (Muth and Fisher 1992, Grant 2005). Hibernation may begin as early as October and end as late as March (Muth and Fisher 1992). Individual lizards may hibernate for many months, or as short as one week (Muth and Fisher 1992, Grant 2005), or not at all (Wone and Beauchamp 2003). The date at which FTHLs enter hibernation in the fall depends on the size and weight of the lizard. Larger, heavier lizards begin hibernation sooner (Grant 2005, Grant and Doherty 2006). Hibernation burrows are constructed by the lizards themselves rather than using burrows constructed by other animals and are within 10 cm (3.9 in) of the surface (Muth and Fisher 1992). Mayhew (1965) found that the majority of lizards hibernated within 5 cm (2.0 in) of the surface. The greatest depth recorded was 20 cm (7.9 in) below the surface. Grant (2005) found the median depth of hibernating lizards (N = 31) to be 5 cm to the center of the dorsum.

FTHLs generally lie close to the ground and remain motionless when approached (Wone 1995). Individuals may also bury themselves in loose sand if it is available (Norris 1949). More rarely they may flee. Their propensity to remain motionless and bury themselves in the sand, along with their cryptic coloration and flattened body, make individual lizards difficult to find in the field (Foreman 1997) and increase their susceptibility to vehicle strikes. During the summer, FTHLs escape extreme surface temperatures by retreating to burrows (Rorabaugh 1994; Young and Young 2000; Wone and Beauchamp 2003).

Distribution

The FTHL, the most restricted range of any species of horned lizard in the U.S. (Stebbins 2003), is endemic to the Sonoran Desert in southern California, southwestern Arizona, and adjacent portions of Baja California and Sonora, Mexico (Turner and Medica 1982). Within California, the FTHL ranges from the Coachella Valley, the northernmost extent of its range, south along both sides of the Salton Sea and Imperial Valley. On the west side of the Salton Sea and Imperial Valley, the species ranges into the Borrego Valley, Ocotillo Wells area, West Mesa, and the Yuha Desert. On the east side of Imperial Valley, the species occurs in the vicinity of the Dos Palmas Area of Critical Environmental Concern, but predominantly occurs in East Mesa and in areas adjoining the Algodones Dunes (aka, Imperial Sand Dunes, Glamis Sand Dunes). In Arizona, the FTHL is found in the Yuma Desert south of the Gila River and west of the Gila and Butler Mountains (Rorabaugh *et al*. 1987). The FTHL is patchily distributed throughout its range, and was once recorded at 520 m (1,706 ft) above sea level, but is more commonly found below 250 m (820 ft) in areas with flat-to-modest slopes (Turner *et al*. 1980).

The range of the FTHL extends into Mexico from the international border in the Yuha Desert in California, south to Laguna Salada in Baja California, and from the international border in the Yuma Desert in Arizona, south and east through the Pinacate Region to the sandy plains around Puerto Penasco and Bahia de San Jorge, Sonora (Johnson and Spicer 1985, Gonzales-Romero and Alvarez-Cardenas 1989).

Historically, a portion of the range of the FTHL was periodically flooded by water from the meandering Colorado River that filled the Salton Trough (Basin) to varying depths (and areal extents), depositing sediments in the process. The lake that periodically formed is known as Lake Cahuilla. At its fullest extent to 12 m (39 ft) in elevation, Lake Cahuilla covered half of the Coachella Valley, the agricultural areas of the Imperial Valley, and a relatively smaller area in adjacent Mexico. The lake filled and evaporated 4 times from 700 to 1580 AD (Waters 1983). Before agriculture, the vegetation of the lakebed when it was dry was predominantly saltbush (Parish 1914).

The current distribution of the FTHL is not contiguous across its range. Large-scale agricultural and urban development, primarily in the Imperial and Coachella Valleys in the United States, and Mexicali and San Luis Valleys in Mexico, has increased fragmentation beyond current natural barriers. In addition, the Salton Sea, Colorado River, East Highline Canal, New Coachella Canal, and All American Canal are barriers to movement of FTHLs. Due to this habitat fragmentation and existing natural geographic barriers, the distribution of FTHLs is now divided on a broad scale into at least four geographically discrete U.S. populations, three in California and one in Arizona. The three in California include; Coachella Valley population, including those individuals northwest of the Salton Sea; Western Population, including those individuals in the areas west of the Salton Sea and Imperial Valley; and the Eastern Population, including those individuals in the areas east of the Salton Sea and Imperial Valley but west of the Colorado River. Additionally, populations occur in southwestern Arizona and Baja California and Sonora, Mexico.

A portion of the historical range of the FTHL has been modified by agricultural, urban, and industrial development and no longer supports the species but an indeterminable amount of this area was likely not suitable for FTHL prior to the aforementioned human related modifications upon the landscape. FTHL populations remain on public lands in several desert areas that receive limited protection under the RMS, as well as protected reserve land in Coachella Valley and unprotected private desert land.

The historical range of the FTHL has been estimated by Hodges (1997), and by the ICC in the RMS (FTHL ICC 2003). Within the Coachella Valley, the Scientific Advisory Group has provided estimates of the current range of the species. However, these estimates of historical range are based on assumptions of occupied FTHL habitat. Because most of the area was developed in the early twentieth century, we do not know how much of this now-developed area was suitable FTHL habitat.

Hodges (1997) estimated that the FTHL historically occupied up to 979,037 ha (2,419,200 ac) of habitat in Arizona and California prior to agricultural or urban development of either the Coachella or Imperial Valleys. Approximately 51 percent (503,173 ha [1,243,339 ac]) of this historical habitat remains in the U.S., with about 56,770 ha (140,300 ac) in Arizona and 446,390 ha (1,103,040 ac) in California (Hodges 1997). The Salton Sea trough could arguably be considered ephemeral historical habitat, present at some points and absent at others, as the area changed through time and was periodically inundated with water (historic Lake Cahuilla). Hodges (1997) included the Salton Sea as historical habitat. Additionally, Lake Cahuilla was periodically filled by flooding of the Colorado River through a network of temporary and semi-permanent drainages, all of which did not provide habitat for the FTHL when filled with water.

Table 2: Estimates of Flat-tailed Horned Lizard Range

	U.S.		**Coachella (subset of U.S figure)**		**Rangewide Total**	
	Historic	Current	Historic	Current	Historic	Current
Hodges (1997)	979,016 ha 2,419,200 ac	503,162 ha 1,243,341 ac	N/A	N/A	N/A	N/A
ICC (2003)	1,054,800 ha 2,606,468 ac	485,358 ha 1,199,345 ac	167,499 ha 413,900 ac	16,200 ha 40,030 ac	2,502,433 ha 6,183,647 ac	1,603,584 ha 3,962,543 ac
CVAG (2005)	N/A	N/A	179,745 ha 444,160 ac	162,200 ha 40,030 ac	N/A	N/A

The current range for the FTHL was estimated by using GIS information to eliminate areas from the historical range now converted to agriculture, urban areas and other anthropogenic disturbances (FTHL ICC 2003). For the Coachella Valley specifically, the habitat model for the FTHL was obtained from CVAG in 2002 and used to delineate the current range in the Coachella Valley. The habitat model for the Coachella Valley contains many small parcels of land in which FTHLs may already be extirpated or in which they cannot be expected to maintain viable

populations. These pieces were, however, included in the current range of the FTHL, which was estimated to be 1,603,584 ha (3,962,543 ac) in the U.S. and Mexico.

Johnson and Spicer (1985) estimated that in 1981 approximately 59 percent of the species range occurred in Mexico, with the majority of the range in Mexico occurring in the state of Sonora. However, the distribution of the species in Mexico is poorly understood because few surveys have been conducted to determine areas where the species occurs (CEDO 2002). In Sonora, about 14 percent of the habitat was estimated to be threatened by urban, agricultural or recreational use, and habitat degradation in 1981 (Johnson and Spicer 1985). In Baja California, considerable habitat loss has occurred in the Mexicali Valley, where urban and agricultural development extends from the Mexicali San Luis Valleys to the Colorado River (Johnson and Spicer 1985, Foreman 1997).

Approximately 60 percent of the species' range in Mexico is located within two areas provided with protection by the Mexican government: (1) the Upper Gulf of California and Colorado Delta Biosphere Reserve, and (2) the Pinacate and Gran Desierto de Altar Biosphere Reserve (CEDO 2002). The National Park of Pinacate is an area administered by the Mexican government with use restrictions similar to those in a national park in the U.S.. The Pinacate area is primarily a volcanic zone within which FTHL habitat is probably limited to the sandy perimeters of Volcan Pinacate. The Upper Gulf of California Biosphere Reserve includes FTHL habitat in the vicinity of the Colorado River Delta in Sonora, Mexico.

Population Trends

Information concerning size and dynamics of FTHL populations has increased greatly in recent years. From 1979 to 2001, population trends were monitored using scat counts and lizards observed along transects (Wright 2002). Different methods of transect selection, numbers and experience of observers, numbers of repetitions, and lengths and shapes of transects have been used from year to year (Wright 2002).

Methodologies that rely on scat counts to assess the relative abundance of FTHLs are confounded by several potential limitations (Wright 2002). Wright (2002) states that while differences in scat abundance could indicate differences in lizard abundance, the observed decline in the rate at which scat is found could also be a result of an increase in OHV activity resulting in crushed or buried scat, lower deposition rates, greater wind eradication, different observers, or additional factors. Furthermore, the use of scat counts does not account for variations in lizard activity, misidentification of scat from other species, variability in scat production due to fluctuating food resources, weather conditions that affect scat production or longevity in the field, observer differences, and small sample sizes (Muth and Fisher 1992, Rorabaugh 1994). Consequently, scat abundance may not be closely correlated with lizard abundance under varying conditions (Rorabaugh 1994, Beauchamp *et al*. 1998). In addition, the use of a relative index, such as scat counts, to indicate population trends are not reliable due to uncorrected bias that exists (discussed further below). Relative index techniques assume that any changes or differences in survey results are proportional to true changes or differences in the

populations of interest (Thompson *et al*. 1998). Thus, due to the significant limitations of scat count data, we consider the use of scat count information useful primarily in determining the presence and distribution of FTHLs in areas where desert horned lizards do not occur.

Two measures of abundance trends (i.e., lizards detected per 10 hours, and lizards per transect) used between 1979 and 2001 for the East Mesa, West Mesa, and Yuha Desert, did not include scat data (Wright 2002). No statistically significant trends were found in the rate at which lizards were detected or the number of lizards per transect on any of the areas from 1979 to 2001 (Wright 2002). The measure of lizards per transect has inherent error due to differences in transect lengths surveyed among years. More importantly, the methodologies used between 1979 and 2001 have varied and the data have not incorporated detection probabilities (Thompson *et al*. 1998). Because FTHLs are difficult to find in the field due to their cryptic coloration and behavioral characteristics, incorporating the probability of detecting them should be included in survey results.

Detectability is a common source of bias that is ignored for relative index techniques, such as the techniques used to collect the data between 1979 and 2001. Numerous factors may affect the detectability of animals within selected sampling plots. These include physical structure and cover, weather, individual behavior, and survey methodology. However, it is possible that differences in relative abundance found using uncorrected data may result from only a difference in detectability of animals between areas or within the same area across time (Thompson *et al*. 1998). Uncorrected bias could seriously affect the validity and usefulness of data in indicating abundance trends (Thompson *et al*. 1998).

The BLM recently estimated the population size on three MAs by using capture-mark-recapture (CMR) techniques incorporating detection probabilities (see Thompson *et al.* 1998, Williams *et al.* 2002). Grant (2005) analyzed the BLM FTHL mark-recapture data from four summer monitoring surveys of three Management Areas: the Yuha Desert MA in 2002, the East Mesa MA in 2003, the West Mesa MA in 2003, and the Yuha Desert MA again in 2004. The East Mesa MA was estimated to have 42,619 (95 percent CI = 19,704 to 67,639) adult lizards (over 65 mm snout-to-vent length) in 2003 and the Yuha Desert MA in 2002 was estimated to have 25,514 adult lizards (95 percent confidence interval = 12,761 to 38,970). The West Mesa MA was estimated to have 10,849 adult lizards (95 percent confidence interval = 3,213 to 23,486). The Yuha Desert in 2004 was estimated to have 73,017 adult lizards (95 percent confidence interval = 4,837 to 163,635). The West Mesa MA survey and the Yuha Desert MA survey of 2004 were based on sparse data, hence the large confidence intervals. No trend can be inferred from the 2 years of data in the Yuha Desert MA because the confidence intervals overlap. Young *et al.* (2004) surveyed the Yuma Desert MA using CMR and estimated a population of 25,855 (95 percent confidence interval = 16,390 to 43,951). A concurrent survey using distance sampling with a trapping web estimated a population of 16,328 adult lizards (95 percent CI 8,378 to 31,794); however, the data were ill-conditioned. The trapping web methodology is probably unsuitable because daily movements of FTHLs are too large relative to practical trapping web sizes.

Hollenbeck (2004) surveyed the Ocotillo Wells Research Area in 2003. The Ocotillo Wells Research Area is the Ocotillo Wells SVRA, an area open to OHV recreation. He estimated 19,222 lizards (95 percent confidence interval 18,870 to 26,752) in 2003. A similar survey completed in 2005 (Eric Hollenbeck, pers. comm.) estimated 24,345 adult lizards (95 percent confidence interval 14,328 – 69,922) and 37,085 young-of-the-year (95 percent confidence interval 22,165 to 74,811).

The Flat-tailed Horned Lizard RMS was revised in 2003 and CMR methodology was adopted as the standard for abundance and trend monitoring (FTHL ICC 2003). Presence/absence surveys in the framework of occupancy estimation (Mackenzie *et al.* 2003) were adopted for distribution monitoring (FTHL ICC 2003). A new monitoring plan using CMR and occupancy has been circulated for comments and is meant to form the basis of future FTHL monitoring.

Based on track monitoring in the Coachella Valley from 2002 to 2005 (CCB 2005), which may not be reliable due to an uncorrected bias that exists (Service 2008), it appears that Coachella Valley FTHL numbers declined for several years but mostly recovered in 2006. The abundance index for FTHLs is the mean number of trackways (a set of tracks laid down by one lizard) per transect. This index has dropped each year from nearly 1 in 2002 to approximately 0.1 in 2005 (CCB 2005). Anecdotally, while Dr. Cameron Barrows could find 10 FTHLs on the Coachella Valley Preserve in an hour in 2002, he was fortunate to find one in an hour in 2005 (Cam Barrows, pers. comm. 2006). In 2006, the index had returned to nearly 0.7. Such wide fluctuations make it difficult to determine the status of the species. The critical time period is at the low ebb of population size, when the population could fluctuate too low to recover. It is unknown how close the Coachella Valley population came to reaching this point in 2005.

The proposed Project site occurs within the geographically discrete FTHL Western Population, which includes areas west of the Salton Sea and the Imperial Valley. The Western Population includes approximately 252,999 ha[3] (625,175 ac) within the current mapped range of the FTHL, not including Mexico. There is no direct estimate of the FTHL population size for this population segment. Several FTHL MAs and one research area (RA) occur within this population segment, including the Yuha Desert MA, West Mesa MA, Borrego Badlands MA, and Ocotillo Wells SVRA RA (Figure 5). Recent data indicate that relatively large FTHL populations remain in the Yuha Desert and Ocotillo Wells SVRA RA (see above). The West Mesa MA also supports a lesser population of approximately 10,000 lizards (see above). Current population estimations for the Borrego Badlands MA do not exist. To date, impacts to FTHL habitat within the MAs that overlap the action area are below the 1 percent cap (Table 3) (Daniel Steward, BLM pers. comm. 2010).

[3] Acreage for the Western Population was calculated using GIS and the "current distribution" FTHL layer as defined in the Rangewide Management Strategy (FTHL ICC 2003).

Table 3 Acres Impacted To Date In the West Mesa and Yuha Desert Management Areas			
Management Area	**FTHL Suitable Habitat**	**Acres Impacted**	**Percent Impacted**
West Mesa	55,078 ha 136,100 ac	50 ha 123.11 ac	0.09
Yuha Desert	24,362 ha 60,200ac	*73 ha *180.01ac	0.30ac

*Includes acreage impacts from the proposed Sunrise Powerlink project.

Threats

Rangewide potential threats to the FTHL include: urban development (including renewable energy), OHV activity, military activities, introduction of exotic plants, pesticide use, and habitat degradation due to Border Patrol activities along the U.S.–Mexico border.

Numerous renewable energy developments have recently been proposed for construction within the California desert, primarily on BLM lands. Energy developments can result in surface disturbance that would modify FTHL habitat, likely making the area no longer suitable for FTHL. Several aspects of FTHL ecology and behavior contribute to the species' sensitivity to habitat loss and degradation. Among these are the following: 1) the FTHL is distributed over a relatively small area; 2) relatively low clutch size may limit the ability of FTHL populations to recover from declines; 3) FTHLs often freeze in response to danger, which makes them susceptible to mortality on roads and in other areas of activity; 4) FTHLs are found in valleys and flats where the majority of residential, agricultural, and energy development typically occurs; 5) FTHLs are susceptible to a variety of predators, many of which occur at elevated levels near agriculture or urban areas; and 6) FTHLs inhabit the most arid portions of the Sonoran Desert, in which drought is likely an important factor in population dynamics, which may be exacerbated by accelerated climate change.

Changes in weather patterns associated with global climate change, particularly the timing and amount of rainfall in the Sonoran Desert, are a potential threat to the FTHL. Assessments for the Sonoran Desert are few, but since the 1970s, the region appears to have experienced widespread warming trends in winter and spring, increased minimum winter temperatures, and more variable precipitation (Weiss and Overpeck 2005). Additionally, models developed to assess extinction risk to lizards due to climate change suggest that Phrynosomatid lizards are susceptible to increased risk of extinction because of intolerance to an increase in environmental temperatures (Sinervo *et al*. 2010). Therefore, the effects associated with global climate change may adversely affect the FTHL, but at this time, the level of uncertainty in climate predictions is high. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate local information to make accurate predictions regarding the magnitude of potential effects to the FTHL.

OHV activity occurs at varying intensities throughout most remaining areas supporting FTHL habitat. Use guidelines within all of the FTHL MAs recognized in the RMS allow OHV use on existing or designated routes; however legal use is restricted to such routes in these areas. Four areas open to unrestricted OHV use in California are within the range of the FTHL: Plaster City Open Area, Superstition Hills Open Area, Imperial Sand Dunes Recreation Area; and Ocotillo Wells SVRA. Together, the four Open Areas comprise approximately 99,998 ha (247,100 ac) which is 21 percent of the approximately 485,358 ha (1,199,345 ac) of habitat remaining in U.S. Illegal OHV recreation is difficult to quantify, but occurs to some degree in many areas inside the MAs. Recreational use of OHV vehicle open areas has increased substantially since the 1980s, and is expected to continue to increase in the future. Visitation at California SVRAs, of which Ocotillo Wells SVRA is the largest, increased by 52 percent between 1982 and 2000 (CDPR 2002). The number of registered OHVs in California has increased by 108 percent since 1980 (CDPR 2002). While some research has demonstrated FTHL fatalities associated with vehicle use (Muth and Fisher 1992), the degree of impact to FTHL populations is not known. Grant (2005) found that hibernating FTHLs suffer low levels of mortality due to OHVs, but quantification of direct effects of OHVs on active (non-hibernating) lizards has yet to be undertaken. OHVs likely degrade habitat by destroying native plants which produce seeds which are the main food for the harvester ants *Messor pergandei* and *Pogonomyrmex* spp. These ants are the primary food for the FTHL.

The Department of the Navy administers land in FTHL habitat in Arizona and California. In California, the Navy has several bombing practice targets for Navy jets. The bombs used are generally dummy bombs with only a small charge that releases smoke to verify the strike. The impact of low-flying, loud aircraft has not been studied. The operations and maintenance of these targets likely has some level of effect. However, the military lands are off-limits to the public; thus, other sources of ground disturbance are limited.

Sonoran Desert vegetation, like vegetation in other deserts, rarely experiences fire "due to low primary productivity and limited production of fuels" (Brooks and Matchett 2006). However, invasive exotic plants, especially annual species (e.g., Mediterranean grass (*Schismus barbatus*)) increase the fine fuel load thereby increasing the frequency of fire (Brooks 1999). Invasive plants generally quickly recolonize sites following fire, which in turn encourages more frequent fires (Brooks and Esque 2002). As a result, increased fire frequency may result in the local extirpation of desirable woody shrubs and their replacement by more fire-tolerant herbaceous species, such as aforementioned invasive annual grasses (Paysen *et al.* 2000).

Invasive exotic plants pose a threat to the FTHL because FTHLs are found in areas with a high percentage of bare ground. Thick herbage is difficult for them to move through because of their wide bodies (Newbold 2005), perhaps making them more susceptible to predators. Additionally, dense stands of exotic plants shrink their field of view, making it more difficult to find prey. Exotic plant seeds may not be the ideal food resource for the ants that FTHLs prey on. Saharan mustard was estimated to cover 39.5 percent of sampled sand fields in the Coachella Valley Preserve in 2005 (Barrows 2005). The extent of invasive plant coverage in FTHL habitat throughout their range has not been measured, but may be increasing.

Pesticides used in agriculture are known to kill individual surface-foraging harvester ants, though colonies seem to recover quickly from a single treatment (FTHL ICC 2003). The chronic effects of pesticide drift are unknown and difficult to quantify. Foreman (1997) stated that the effects of applying broad-spectrum insecticide to desert scrub communities over many years are potentially many and complex. Pesticide/herbicide drift from croplands also has the potential to affect plant communities adjacent to agricultural areas. Although some pesticide drift is likely leaving agricultural areas and entering adjacent desert lands, the magnitude and effects of this drift have not been measured. Moreover, such effects are limited to areas in the immediate vicinity of agriculture, which is a small proportion of the FTHL range.

In Imperial and Yuma County, Border Patrol is highly active in patrolling the international border to intercept individuals crossing the border from Mexico. The Border Patrol has no restrictions on desert access and can drive off-road. The border area is enduring impacts from Border Patrol traffic, as well as, the associated driving through the desert by individuals attempting to pick up border crossers from Mexico.

Some of these threats have been reduced since the development and implementation of the RMS and we anticipate a further reduction of threats with continued implementation of the RMS. A more detailed analysis of these threats can be found in the RMS (FTHL ICC 2003), which is hereby incorporated by reference.

Synopsis of Status

Recent data indicate that relatively large FTHL populations remain in the East Mesa, Yuha Desert, and Yuma Desert MAs and the Ocotillo Wells SVRA. The West Mesa MA also supports a lesser population of approximately 10,000 lizards. Based on recent CMR surveys in these MAs, the species consistently can be found in all of the MAs, which include 40 percent of the remaining range in the U.S. Additionally, based on a recent report (Service 2010) analyzing several years of occupancy and demographic data on four of the MAs (East Mesa, West Mesa, Yuha Basin, and Yuma Desert) and the Ocotillo Wells State Vehicular Recreation Area, it was concluded that FTHL populations in these four locations are not low and have not declined since 2007 and probably not declined since 1997. Currently the lizard is afforded protection under a Conservation Agreement that entails implementation of the RMS. This strategy established the five MAs (West Mesa, East Mesa, Yuha Desert, Yuma Desert, and Borrego Badlands) with the goal of maintaining viable populations of FTHLs. If this voluntary management strategy continues to be implemented over the long term, the FTHL likely will remain in designated FTHL MAs.

ENVIRONMENTAL BASELINE

Project Site

The proposed Project site is located within the Lower Colorado River Valley Subdivision of the Sonoran Desert (Shreve and Wiggins 1964), in gently rolling open terrain predominantly

consisting of creosote bush-white burr sage scrub. This region is characterized as a hot and dry climate with summer high temperatures up to 48.8^{o} C (120° F) and less than 7.6 cm (3 in) of annual rainfall (ASDM 2010). The majority of the precipitation falls in the winter and spring months with occasional monsoonal thunderstorms (CDWR 2009).

Habitats in this region vary with the topography and precipitation levels. The area to the east of the Project site supports irrigated agricultural lands. Areas to the south, west, and north are dominated by creosote bush, white burr sage, brittle bush (*Encelia farinosa*), and several species of cactus. Other plant species observed on the project site include tamarisk (*Tamarix* sp.), ocotillo (*Fouquieria splendens*), silver cholla (*Opuntia echinocarpa*), and mesquite (*Prosopis* sp.). Shrub density ranges from moderate to low. Substrates on the proposed Project site include desert pavement, coarse sand, and sandy wash. Compared to the washes, the upland areas of the project site furnish less forage in terms of quantity and quality for bighorn sheep. Sparse stands of tamarisk and mesquite mixed with creosote scrub are primarily concentrated within several dry washes that transect the property. Disturbed areas are mostly limited to dirt roads and OHV trails that traverse the Project site.

An existing SDG&E transmission line traverses the site from the northwest to the southeast. North of the site is the USG wallboard manufacturing facility (known as Plaster City), which is located on Evan Hewes Highway approximately 3 miles west of the intersection of Dunaway Road and Evan Hewes Highway. The southern border of the proposed Project is adjacent to I-8, where currently no fence exists. However, the interstate may still inhibit bighorn sheep inter-mountain movements due to the almost continual traffic.

The western portion of the proposed Project site (west of the SDG&E transmission line) is characterized by rolling terrain with well-defined washes. East of the SDG&E transmission line, the terrain has uniform and gentle slopes. The area adjoining the proposed Project is primarily undeveloped recreational desert land. Other land uses in the area surrounding the Project site include BLM-administered public land zoned for multiple use, including an OHV Open Area (Plaster City Open Area), and private land containing agricultural, residential, and industrial uses. The Yuha Desert Area of Critical Environmental Concern (ACEC), is just south of I-8, this ACEC overlaps the Yuha Desert FTHL MA.

Status of the Species in the Action Area

Peninsular Bighorn Sheep

<u>Past Peninsular Bighorn Sheep Consultations in the Area</u>

Formal Section 7 Conference Opinion on the effects of the Proposed Jimenez Pit Sand and Gravel Mine, Imperial County, California (Reference no. 1-6-98-F07) February 1998.

> The Jimenez Pit project is located on 41 ha (100 ac) within the boundaries of two, 65 ha (160 ac) unpatented claims, and it involves mining 5,896,701metric tons (6.5 million

tons) (an average of 226,796 metric tons (250,000 tons) per year) of aggregate over an estimated 30-year period. The action impacted waters of the U.S. and required a section 404 Clean Water Act permit from the Army Corps of Engineers. The project is located in Peninsular bighorn sheep habitat, and on an alluvial fan at the base of the Coyote Mountains.

Formal Biological Opinion on the effects of California Desert Conservation Area Plan, Bureau of Land Management, Riverside and Imperial Counties, California (Reference no. FWS-ERIV/IMP-2810.2), December 2002.

To provide for management of recreational use, and to resolve other resource and public land use conflicts, section 602(d) of FLPMA directed the Secretary of the Interior to "prepare and implement a comprehensive, long-range plan for management use, development, and protection of the public lands within the California Desert Conservation Area." As such the CDCA Plan is an over-arching or programmatic plan from which activity-level or more site-specific plans are tiered.

Formal Biological Opinion on the effects of Western Colorado Amendment to the CDCA Plan, Bureau of Land Management route designation, Imperial County, California (Reference no. (FWS-IMP-3327.1) December 2002.

To improve the conservation and management of biological resources, especially threatened and endangered species, five bioregional planning areas were designated within the CDCA Plan area, including the Western Colorado Amendment area. The WECO amendment consisted entirely of route designations on BLM lands within Imperial County, California.

Formal Consultation on the effects of Sand and Gravel Mining Along the Slopes of the Coyote and Jacumba Mountains, Imperial County, California, Bureau of Land Management permits for sand and gravel extraction from public lands (Reference no. FWS-ERIV-3371.1) July 2003.

Sand and gravel mines have operated along the southwestern edge of the Coyote Mountains and eastern edge of the Jacumba Mountains for decades, and the Bureau of Land Management (BLM) has routinely issued permits and contracts authorizing the extraction of sand and gravel (aggregate). Bighorn sheep in the Peninsular Ranges were listed as endangered by the Service on March 8, 1998, and critical habitat was designated on February 1, 2001. Consequently, the mines operating on BLM lands in the Coyote and Jacumba Mountains were included within the boundaries of designated critical habitat; and actions taken by the BLM regarding these mines required consultation with the Service under section 7 of the ESA.

Formal Consultation on the effects of Sunrise Powerlink Transmission Line, Imperial and San Diego Counties, California, Bureau of Land Management Right-of -Way permit (Reference no. FWS-2008BO423-2009F0097) January 2009 (currently reinitiated).

> The entire project spans 193 km (120 miles) between El Centro and southwestern San Diego County. The proposed ROW bisects bighorn sheep habitat and critical habitat within the I-8 Island, where approximately 30 to 50 bighorn sheep live year-round. The construction phase of the project is likely to cause temporary displacement of bighorn sheep due to the numerous low-elevation helicopter flights and the elevated levels of human activity necessary to construct the project. The applicant is currently reinitiating section 7 consultation on Peninsular bighorn sheep, and no ground disturbance or construction has occurred to date.

The incidental take resulting from the above past consultations has not been exceeded. All of the ewe groups in the action area, as defined in the Recovery Plan (Service 2000), appear to be stable or increasing in abundance.

Species Abundance within the Action Area

Carrizo Canyon (also referred to as Carrizo Gorge) is a large north-south drainage bordered on the west by the In-Ko-Pah Mountains and on the east by the Jacumba Mountains. The southernmost recovery region identified in the Recovery Plan was designated the Carrizo Canyon/Tierra Blanca Mountains/Coyote Mountains Recovery Region (Service 2000). Available evidence indicates that Carrizo Canyon serves as the core use area for bighorn sheep in the greater area; however, different subsets of the Carrizo Canyon population migrate seasonally to the Tierra Blanca and Coyote Mountain ranges, during the cooler, wetter months of the year. Approximately, 50 bighorn move across County Highway S2 in the fall to the Coyote Mountains, where they generally remain for 6 to 8 months. Although recent observations indicate that some animals are remaining in the Coyote Mountains for longer periods of time, including year-round (R. Botta, CDFG, pers. comm., 2010). There are no known water sources in the Coyote Mountains, and the group eventually returns to Carrizo Canyon where there are permanent water sources available during the hot season. Bighorn sheep moving from Carrizo Canyon to the Coyote Mountains temporarily reduces the density of animals living near the permanent water sources in Carrizo Canyon. This reduction in density provides an opportunity for forage resources to recover from the higher levels of browsing experienced during the summer months. Bighorns migrating to the Coyote Mountains may acquire lower levels of intra-specific competition for quality forage during the cooler, wetter months, and the Coyote Mountains may also provide parturition and lamb rearing areas where predation risk from mountain lions is lower than Carrizo Canyon.

On March 25, 2009, a group of four female and one yearling bighorn sheep were observed on the western portion of the project site by a biological consultant (J. Platt, *in litt* 2009). At least one of the adult ewes appeared to be pregnant, none of the animals observed appeared to be radio-collared, and the group was following a wash in a northwest to southeast direction (Figure 3). The proximity of the group to the Coyote Mountains supports the assumption that the group originated in the Coyote Mountains.

The Jacumba Mountains form the east side of Carrizo Canyon, and extend southward into Mexico. Bighorn sheep populations inhabiting this area were poorly known prior to 1968 (Weaver *et al.* 1968). Starting at that time, CDFG initiated a state-wide inventory of desert bighorn sheep. Methods included ground and aerial surveys, waterhole counts, and interviews with local residents. Due to funding and time constraints, information for the Jacumba Mountains was obtained mainly by interviewing local residents, with some having lived and worked in the area as far back as 1919. For example, Lloyd Lovell was raised in the area by the McCain family, early ranchers and namesakes for nearby McCain Valley. Lovell related that the area north and including Devil's Canyon had been good sheep habitat in his youth and he frequently observed them in the area. At the time of the Weaver *et al*. survey, the number of sheep in the area appeared reduced compared to earlier years. Based upon interviews and limited ground surveys, Weaver *et al.* (1968) estimated the number of bighorn sheep using Devil's Canyon at 12 animals, the number south of the I-8 corridor at 20 individuals, and the number inhabiting Carrizo Gorge to the north at 20. The Jacumba Mountains south of the I-8 corridor were mapped as containing a permanent population of bighorn sheep. The surveys were continued for 3 years and the final population estimate for the Jacumba Mountains was 83 total animals (Weaver 1972).

Hicks (1978) reported a study of the status and distribution of bighorn sheep in the In-Ko-Pah Mountains, which mentioned a sighting of bighorn sheep attempting to cross I-8 near Myer Creek during spring 1978. When questioned, highway maintenance crews said they had not observed sheep in the area since 1971. Additionally, the area around Mountain Springs and I-8 was mentioned as an area containing bighorn sheep by border crossing individuals from Mexico (Hicks 1978). The number of sheep inhabiting the In-Ko-Pah and Jacumba Mountains was estimated at 80 to 100 animals. Cunningham (1982) studied bighorn sheep in the area soon after Hicks (1978), and observed that I-8 acted as a barrier to sheep movement. He reported that > 30 bighorn sheep were believed to inhabit the area south of the Interstate. Cunningham (1982) speculated that the area around the I-8 Island was once important bighorn sheep habitat because six water sources existed relatively close to the highway from In-Ko-Pah to Ocotillo. Local residents also reported that three of these springs had been used by bighorn sheep, and highway department personnel stated that bighorn sheep were common when construction of I-8 began. The Interstate most likely bisected a once continuous distribution of bighorn sheep (Cunningham 1982). In summary, bighorn sheep populations in the Jacumba Mountains north of I-8 to Carrizo Gorge were well studied and documented by field biologists (see also Olech 1979 and Sanchez 1988). However, population estimates for the area from I-8 to the Mexican border were largely derived from interviewing local residents and highway department personnel.

Helicopter surveys became the favored method for surveying bighorn sheep populations inhabiting remote, roadless areas in the 1980s. A limited number of flights occurred south of I-8, because few animals were regularly observed (Rubin *et al.* 1998). However, a small population of < 25 animals was assumed to exist south of the Interstate as reported in 1994 (Torres *et al.* 1994), when regular biennial, range-wide helicopter surveys of the Peninsular Ranges were started by CDFG. A subsequent aerial survey of the area failed to find any bighorn sheep south of the Interstate or around the I-8 Island, and this subpopulation of bighorn was

assumed to be extirpated by 1996 (Torres *et al.* 1996, Rubin *et al.* 1998, Service 2000). Therefore, subsequent aerial surveys spent minimal time south of Carrizo Gorge (Rubin *et al.* 1998). The construction of I-8 in the mid-1960s, railroad activity in Carrizo Gorge, livestock grazing, poaching, and fire suppression were suggested as the likely causes of the decline and disappearance of bighorn sheep in the I-8 area south to the Mexican border (Rubin *et al.* 1998).

Helicopter surveys conducted in the mid-1990s, in Baja Norte, Mexico, documented bighorn sheep south of the border in the Sierra Cucapa Mountains, although the number of bighorn sheep recorded was low and numbers of domestic livestock were considered high compared to neighboring mountain ranges in northern Baja (DeForge *et al.* 1993). Bighorn sheep are also known to inhabit the Sierra Juarez, which is located immediately south of the Jacumba Mountains in Mexico. Portions of the Sierra Cucapa and Sierra Jurarez are visible from the Coyote and Jacumba Mountains, and the Imperial Solar project site (Figure 3). The distance from the Coyote Mountains to the northern extent of the Sierra Cucapa Mountains is approximately 26 km (16 mi), and the distance from the Coyote Mountains to the Sierra Juarez is 32 km (20 mi).

For approximately 10 years, bighorn sheep were regarded as absent from the I-8 corridor and southern Jacumba Mountains. Starting in January 2006, bighorn sheep sightings began occurring on a regular basis in the Jacumba Mountains. The first sightings were from the U.S. Border Patrol, and they were centered on the Mountain Springs area, including the I-8 Island. The November 2006 CDFG aerial survey detected two ewes in Devil's Canyon and six ewes, four lambs, and four rams overlooking the east-bound lanes of I-8. Follow-up hikes through the area by Dr. Esther Rubin and Service personnel revealed bighorn sheep tracks and fecal piles. Automatic cameras were set up at the permanent water source at Mountain Springs, and several groups of bighorn sheep were photographed and observed. The BLM also supplied photographs and point locations of bighorn sheep observed in the area. During 2007, several visits to the I-8 Island area were made by Service biologists and Caltrans personnel and each observed sheep tracks and fecal pellets. The November 17, 2008, CDFG aerial survey detected five groups of bighorn sheep totaling 30 individuals, which were located within the I-8 Island and just north of the west bound lane. Due to insufficient funds, the aerial survey did not cover the entire area south of I-8 to the international border. Bighorn sheep were subsequently reported south of I-8 by the U.S. Border Patrol and by Art Davenport, a biological consultant. A field-trip to the border area on April 24, 2008, detected fecal pellets in lower Pinto Wash, which based upon the elevation, topography, and micro-site, have a probability of being of bighorn sheep origin. Funding was obtained from the Department of Homeland Security for capture operations to occur south of I-8 during October 2009, and nine sheep were successfully captured in the I-8 Island area.

Based upon the plentiful tracks leading under the two bridges that span Devil's Canyon, it is apparent bighorn sheep are using these bridges as underpasses to access the approximately 1,214 ha (3,000 ac) island of habitat between the east and west bound lanes. On the east bound side there are no similar bridges, only large culverts and smaller, lower bridges. Questions remain as to whether the east bound lanes pose a significant obstacle to sheep movement. It is unknown if

bighorns use the culverts at times. However, there have been several sightings of bighorn sheep crossing I-8 on the highway surface (J. Collins, Naval Air Facility El Centro, *in litt.* 2007, 2008) and the California Highway Patrol confirmed that an adult ram was killed on the east bound lanes on August 12, 2008.

In summary, bighorn sheep appear to have re-colonized the I-8 Island area and at least occasionally use areas south of the interstate. The bighorn being observed may have either moved to the area as the population in Carrizo Gorge expanded in numbers and geographic distribution, represent an increasing remnant of an original population, or be animals that moved northward from areas further south, including Mexico. Occasional movements by the bighorn sheep regularly found in the I-8 Island area towards Carrizo Canyon indicate that a range expansion, originating from Carrizo Canyon, may be the most likely explanation for the recent increase in bighorn sheep in the I-8 corridor (R. Botta, CDFG, pers. comm. 2010).

The above description includes bighorn sheep in the Coyote Mountains because the sheep observed on the project site in March 2009, most likely originated from that location. Descriptions of bighorn sheep populations in the Jacumba Mountains and Mexico were included because the project may adversely affect the ability of bighorn sheep to move between mountain ranges using the valley floor. The bighorn sheep observed on site may have been observed while attempting an inter-mountain movement. However, there is no conclusive evidence to confirm or refute this possibility. Additionally, bighorn sheep in the Coyote and Jacumba Mountains are both considered part of the Carrizo Canyon/Tierra Blanca Mountains/Coyote Mountains Recovery Region (Service 2000). Likewise, while designated critical habitat for bighorn sheep occurs within the action area, the proposed Project will not affect bighorn sheep critical habitat, because the project site is not located in critical habitat. However, bighorn sheep occupying critical habitat within the greater action area may be indirectly affected by the potential effect of the Project to impede movement of bighorn sheep at a landscape scale (see Effects of the Action below).

Flat-tailed Horned Lizard

<u>Species Abundance within the Action Area</u>

Suitable habitat for the FTHL is present throughout the 2,659 ha (6,571 ac) proposed Project site, which includes the solar plant, the offsite transmission line, and the laydown area. The solar plant includes: the onsite portions of the transmission line and waterline, SunCatcher fields and associated infrastructure, the main service complex, and the substation. Based on focused surveys conducted between May 1 and July 11, 2007, and May 5 and May 7, 2008, two FTHLs were detected along the eastern boundary of the solar plant, one within the proposed Project site and one just outside. One additional FTHL was detected within the solar plant site during the 2008 focused surveys. Two deceased FTHLs were observed along the offsite transmission line corridor in 2007 (Figure 6).

These surveys used a modified occupancy protocol approach based on the FTHL 2008 monitoring plan developed by Grant (2008). Occupancy protocols were designed to develop an estimate for the percentage of a site that is occupied by FTHL, not how many lizards occur on the site or the density of lizards occurring on the site. For better accuracy, occupancy surveys should include a FTHL detection probability. The 2007/08 surveys did not incorporate a detection probability, which can result in estimates that are biased low and may provide misleading results (Grant 2005). Furthermore, research suggests that FTHL population densities can exhibit local boom and bust dynamics driven primarily by temporally varying factors such as rainfall (Grant 2005). Because these surveys were conducted in consecutive below average rainfall years, FTHL population densities on the proposed Project site may have been lower, resulting in even lower detection rates. An estimate of FTHL abundance on the proposed Project site is likely more accurately portrayed by using density estimates derived from mark-recapture surveys conducted in 2002 in the adjacent Yuha Desert MA (T. Grant pers. comm. 2010). Using density estimates from that study (Grant and Doherty 2007), the proposed Project site could support an average of 1.05 lizards per ha, for a total population estimate of 2,792 individuals occurring on the proposed Project site. If we assume the site supports lower FTHL population densities due to adverse edge effects from I-8 and Evans Hewes Highway (Barrows *et al.* 2006; and Young and Young 2005) and we use the lower confidence interval number derived by Grant and Doherty (2007), the site may support lizard densities of 0.52 lizards per ha, for a total population estimate of 1,383 individuals occurring on the proposed Project site. Therefore, depending on yearly precipitation values and other temporally varying factors that could affect FTHL densities, the proposed Project site could support between 1,383 and 2,792 individuals.

Habitat Connectivity

The RMS identified potential habitat corridors in the action area between the West Mesa and Yuha Desert MAs. However, existing obstacles to movement between the Yuha Desert and West Mesa MAs through the area include I-8, the Evans Hewes Highway, the railroad, and the Plaster City OHV Open Area. There are several culverts or openings under these obstacles that may allow some movement between the MAs through the proposed Project area but most of the culverts that are adjacent to the proposed Project boundary along I-8 were inaccessible to FTHL (URS 2010). FTHL movement over the highways could occur, but is not likely due to adverse road effects, e.g. increased mortality and predation (FTHL ICC 2003). Movement of lizards under I-8 west of the proposed Project boundary likely occurs via a large bridge that spans the South Fork Coyote Wash under I-8. To the east of the Project site, similar limitations to those that exist along the south side of the proposed Project, e.g. impassible culverts, likely occur.

Factors Affecting the Species' Environment within the Action Area

A number of factors such as fragmentation, OHV activity, edge effects associated with roads, and climate change may adversely affect the FTHL in the action area. Roads may be especially deadly as FTHLs are inclined to stop motionless rather than run when confronted with a threat and are difficult to see and avoid. Lizard densities are likely reduced along I-8 and Evans Hewes Highway.

The Plaster City OHV Open Area is directly north of the proposed Project site. OHV traffic may not kill hibernating FTHLs, but lizards on the surface can be killed. The indirect effects of OHVs are poorly understood (Grant 2005).

As mentioned above, changes in weather patterns associated with global climate change, particularly the timing and amount of rainfall in the Sonoran Desert, are a potential threat to the FTHL, affecting suitable habitat in the action area. Existing habitat may become unable to support FTHLs, and habitat that does not currently support FTHLs may become available in the future. Rainfall patterns could change, rendering habitat too dry or wet to continue to support FTHLs and/or temperatures may rise to levels that adversely affects FTHL survival. The sum effect is difficult to predict because the extent that climate will change is unknown.

EFFECTS OF THE ACTION

Peninsular Bighorn Sheep

Effects to the Species in the Action Area

The proposed project would be constructed on approximately 2,659 ha (6,571 ac) of the Colorado Division of the Sonoran Desert in Imperial County, California. Approximately 2,616 ha (6,465 ac) of the site would be permanently fenced to prevent unauthorized human access to the facility. The design elements of the fence, which are necessary to prevent humans from breaching the barrier, would preclude bighorn sheep from using the site for the foreseeable future. The project may adversely affect bighorn sheep by: 1) reducing the ability of bighorn sheep to travel between mountain ranges, 2) eliminating access to forage resources, 3) incrementally adding to the permanent conversion of natural desert plant communities to human industrial uses, and 4) creating hazards associated with fencing the proposed Project site.

<u>Habitat Connectivity</u>

Intermountain movements by desert bighorn sheep have been well documented in the past, and continue to occur in areas where human activities and developments do not physically block bighorns or elicit behavioral reactions from bighorn sheep resulting in their avoidance of intermountain movements. For example, on the Cabeza Prieta National Wildlife Refuge in Arizona, bighorns are occasionally observed crossing the wide flat valley between the Sierra Pinta and Sierra Cabeza Prieta, a distance of 13 km (8 mi). Bighorns crossing the flat, open terrain usually take the shortest possible route, and seldom pause to feed (Simmons 1969). Additional intermountain movements of bighorn sheep were reported by Davis and Taylor (1939), Russo (1956), Monson (1964), Hansen (1965), Whitam and Smith (1979), and Ough and deVos (1984). In Nevada, annual migrations between mountain ranges have ranged between 32 km (20 mi) for the Muddy and Black Mountains to over 64 km (40 mi) for the Meadow Valley Range and the Arrow Canyon Mountains (McQuivey 1978). In more recent years, colonizations of isolated mountain ranges by desert bighorn sheep, which required intermountain movements, have been reported in California (Epps *et al*. 2010).

The shortest distance between the Jacumba Mountains and the Coyote Mountains is approximately 5 km (3 mi). Under pristine conditions bighorn sheep may have crossed directly between the mountain ranges using the valley floor, compared to taking a more circuitous, mountain route through Carrizo Gorge. However, I-8 and the town of Ocotillo occur on the valley floor area that offers the most direct route for bighorn sheep movement between the two mountain ranges (Figure 3). The proposed Project site offers an alternative, less direct route to the Jacumba Mountains or Sierra Juarez, which avoids the town of Ocotillo, but still requires sheep to cross an OHV open area and I-8. The proposed Project site also offers a direct route to the Sierra Cucapa in Mexico, which is approximately 32 km (20 mi) from the Coyote Mountains. However, bighorn sheep would need to cross the OHV open area, I-8, navigate the recently constructed vehicle barriers along the international border, and cross several two-lane highways in Mexico and the U.S. to reach the Sierra Cucapa.

A number of the bighorn sheep, which migrate seasonally to the Coyote Mountains, have been radio-collared and monitored monthly by CDFG using fixed-wing aircraft. The point locations obtained thus far indicate that bighorn sheep move seasonally between Carrizo Gorge and the Coyote Mountains using Sweeney Pass (R. Botta, CDFG, pers. comm. 2010), which is located on County Highway S2 northwest of the main portion of the Coyote Mountains (Figure 7) and 23 km (14 mi) from the proposed Project site. No intermountain movements by bighorn sheep from the Coyote Mountains south to the Jacumba Mountains, Sierra Cucapa, or Sierra Juarez have been documented. The bighorn sheep observed on the proposed Project site in March 2009, may have been undertaking an intermountain movement, but no conclusive evidence exists to confirm such an event. The group was moving in a southeasterly direction, but they may have been responding to the presence of the vehicle and its occupants.

Although relatively rare for bighorn ewes when compared to rams, dispersal (one-way movements) across open, flat desert to colonize or re-colonize distant mountain ranges does occasionally occur (Simmons 1969, Boyce *et al*. 1999, and Epps *et al.* 2010). These movements are important for maintaining functional metapopulations of desert bighorn sheep in the California desert (Schwartz *et al.* 1986, Bleich *et al.* 1990, 1996), and may be evidence of an increasing and expanding population. When bighorn sheep population persistence is viewed from a large-scale, landscape perspective; human developments, such as towns, highways, and more recently, renewable energy projects, may eliminate the possibility of intermountain movements by desert bighorn sheep.

The proposed Project contributes to the overall, long-term loss of habitat connectivity occurring in the Peninsular Ranges. The proposed Project site represents a location where PBS would not be able to travel in the future. However, the current relative value of the area as a travel corridor is uncertain at best due to the location of an OHV open area located between the Coyote Mountains and the proposed Project site, the additional barriers presented by I-8 and other human structures, and the lack of telemetry data or other information indicating that bighorn sheep use the proposed Project site for intermountain movements. Human structures present in the vicinity of the town of Ocotillo may not completely, physically block bighorn sheep movements, but from a behavioral standpoint, such human-dominated areas may reduce the

likelihood bighorn sheep would use the area. The proposed Project site is less developed and possesses more natural characteristics of terrain and vegetation, and therefore is more likely to be used by bighorn sheep.

Forage Resources.

Desert bighorn sheep rely on steep, rugged terrain to evade predators. Consequently, their distribution is tied to mountainous topography. However, desert bighorn also utilize less precipitous portions of the landscape, such as washes, to access the quality forage resources characteristic of desert washes. The greater available soil moisture present in washes results in a greater variety and quantity of vegetation with higher nutritional content (Leslie and Douglas 1979). In arid regions, small changes in plant moisture content can result in marked changes in plant nutritional content and diet quality (Epps *et al.* 2004). The forage species found in washes generally have higher moisture content and greater nutritional value throughout much of the year compared to mountainside plants, which "cure out" quite rapidly once warmer weather arrives.

The time period surrounding late gestation, lambing, and nursing is very demanding in terms of the energy and protein required by bighorn ewes. Failure to acquire sufficient nutrients during late gestation and during nursing adversely affects the survival of newborn ungulates (Holl *et al.* 1979, Douglas 2001). Lower elevations may green-up earlier in spring (Wehausen 1980, Berger 1991), providing important nutrients for bighorn ewes. Crude protein and digestible energy values of early green-up species are usually much higher than those of dormant forages during the critical late gestation, lambing, and rearing seasons (Crawley 1983, White 1983). With their higher nutrient content, even minor volumes of these forages, within the overall diet composition, may contribute important nutritional value.

Bighorn sheep in the area have been observed to follow ravines and breaks in the topography down onto alluvial fans, and at times out onto the valley floor (M. Jorgensen, Anza-Borrego Desert State Park, pers. comm. 2010). Tracking and direct observations indicate that bighorns are focused upon accessing the quality forage found in these areas. Essentially, bighorn sheep weigh the predation risk of being caught away from escape terrain with the opportunity to acquire more plentiful and nutritious forage. The portion of the Coyote Mountains adjacent to the proposed Project site does not end abruptly at a flat valley floor. A series of benches, ravines, and areas of broken topography extend from the mountains to the proposed Project site. Therefore, the presence of bighorn sheep unexpectedly distant from designated essential or critical habitat is understandable given these terrain features. The bighorn sheep observed on the site in March 2009, most likely followed the irregular topography down from the Coyote Mountains while foraging, eventually arriving in the wash habitat where they were observed. The fencing of the proposed Project site would permanently exclude bighorn sheep from accessing these sources of forage, even though some vegetation associated with washes may persist on site after construction. The area of primary and secondary drainages mapped and considered jurisdictional by the Corps located on the proposed Project site is 357 ha (881 ac.) Based on a California Rapid Assessment method (CRAM) analysis, these drainages support approximately 28 percent overall plant cover. Therefore, the proposed Project site supports

approximately100 ha (247 ac) of wash vegetation habitat. This value approximates the amount of wash foraging habitat that would be lost to bighorn sheep.

The higher elevations of the proposed Project site are characterized by extensive areas of desert pavement interspersed with mainly creosote bush, burr sage, and exotic grasses, such as red brome (*Bromus madritensis* ssp. *rubens*) and Mediterranean grass. These exotic grasses can furnish nutritious forage during early green-up. However, they reach senescence quickly and rapidly lose much of their nutritive value. Similarly, creosote bush contains numerous secondary plant compounds, and although occasionally sampled by bighorn sheep, the species is not considered a valuable forage species. Therefore, the loss of foraging opportunities associated with the upland areas of the proposed Project site is considered less important than the loss of forage resources found in the washes.

Incremental Loss and Alteration of Desert Landscapes

Natural desert plant communities begin abruptly at the terminus of the irrigated agricultural area west of El Centro, California. If the proposed Project is constructed, a brief swath of natural desert would remain between intensive agriculture and the eastern boundary of the proposed Project located near Plaster City. Moving westward, the proposed Project in combination with the existing town of Ocotillo, would permanently change the character of the valley floor in this area.

Interpretations of present day bighorn sheep behavioral ecology should consider the vast changes that have occurred in the desert southwest following European settlement (McCutchen 1981). In many areas, bighorn sheep most likely use the landscape much differently than earlier generations of mountain sheep. McCutchen (1981) argues that large areas, which do not exist today, were suitable for bighorn sheep prior to the arrival of Europeans, and dispersal, colonization, and gene exchange were common place. The widespread distribution of desert bighorn sheep is a result of these processes. Therefore, the small, isolated groups of extant desert bighorn are remnants of former larger interconnected populations, which utilized a much greater spatial area. Likewise, many of the characteristic behaviors we currently attribute to desert bighorn sheep, such as slow dispersal, have been profoundly shaped by the human-caused changes to their environment. The proposed Project represents an additional such alteration to the desert, which would require PBS to at least partially alter where they obtain forage and how they move across the desert landscape.

Fencing

Wire fences or even a single strand of wire may kill or harm bighorn sheep. Bighorn rams may easily become entangled, when wire becomes trapped within the curl of their horns. If this happens, the animals frequently panic, fight the strange object, and eventually strangle themselves. Additionally, bighorn sheep have been killed while attempting to crawl under wire fences. Bighorns have crawled through amazingly small gaps along the bottom of wire fences constructed in the Rancho Mirage area of the Coachella Valley of California (Aimee Byard,

Bighorn Institute, pers. comm. 2010). Following correct fence specifications should minimize the chances that accidents or entrapments would occur.

Should an animal become trapped within the enclosure, attempts to return the animal to open sheep habitat may result in injury or death to the animal, if proper methods of removal are not followed. Given the numerous mirrors and other structures, pursuit and/or capture with helicopters and net-guns is most likely not a viable approach. Therefore, measures for removing bighorn sheep from the enclosure should be planned ahead of time to reduce the probability of accidents occurring, and personnel should be trained beforehand in case an animal becomes trapped.

Effects on Recovery of Peninsular Bighorn Sheep

Section 2(b) of the ESA states the primary purposes of the Act are to provide a means whereby the ecosystems upon which listed species depend may be conserved, and to provide a program for the recovery of listed species. In section 2(c), Congress establishes a policy requiring all Federal agencies to use their authorities to recover listed species and further the purposes of the Act. Consistent with these purposes and Congressional policy, sections 3(5), 4(f), 7(a)(1), implementing regulations (50 CFR 402.02) to section 7(a)(2), and related preamble at 51 *Federal Register* 19926-57 require Federal agencies to further the survival and recovery of listed species in the use of their authorities. Pursuant to these mandates, our analysis below assesses (1) whether the proposed project adequately offsets its adverse effects to the environmental baseline, and (2) the extent to which the proposed project would cause "significant impairment of recovery efforts" or adversely affect the "species' chances for survival to the point that recovery is not attainable" (51 *Federal Register* 19934).

The recovery strategy, as outlined in the Recovery Plan (Service 2000), is founded upon four biological principals that generally apply to desert bighorn sheep throughout their range, including the Peninsular Ranges of California.

1. Bighorn sheep are wide-ranging animals that are spatially dependent on large, intact tracts of habitat that provide a diversity of resources needed to offset seasonal, annual, and longer term cycles of environmental variability and scarcity.

2. Metapopulation structure requires habitat contiguity between/among constituent demes (ewe groups) to allow for long-term shifts in distribution and genetic interchange.

3. Bighorn sheep appear to lack natural or acquired resistance to some diseases and remain highly vulnerable to diseases introduced by domestic sheep.

4. Behavioral responses to human-related activities, which can adversely affect habitat use patterns and population persistence, can be variable among individuals and populations.

The proposed project would permanently remove from the overall resource base an area that currently provides forage to PBS. As mentioned previously, the forage associated with the washes on the project site is likely more valuable than the sparse forage present on the upland portions. Thus, the proposed project may negatively influence recovery by contributing to the overall loss of resources needed by PBS to adjust to the variability of their desert environment. However, the amount of loss is relatively small, and other foraging opportunities are available to bighorn sheep in the area. Furthermore, the applicant has proposed to restore an equal amount of wash habitat in the Carrizo Creek drainage that is currently infested with exotic vegetation and not providing bighorn sheep with water or forage resources. Therefore, completion of the project (including restoration of Carrizo Creek) should not significantly impede recovery of PBS in regard to principle number 1.

The recovery strategy for PBS focuses on maintaining a functioning metapopulation structure, which requires that bighorns retain the ability to move between subpopulations. These movements maintain genetic integrity and make it possible for sheep to re-colonize suitable habitat should a local extinction event occur. The proposed project will add to the number and spatial extent of human-made obstacles, which impede the ability of bighorn sheep to move across the landscape. Therefore, the proposed project will negatively affect the recovery of PBS by making it more difficult for the distinct population segment to maintain a functioning metapopulation structure.

The proposed project does not directly introduce or increase disease threats to PBS. Therefore, the proposed project has no effect on recovery in regard to principle 3 above.

The behavioral characteristics of individual and groups of bighorn sheep vary, with some being much less likely to use areas where humans and their structures are present compared to others. Therefore, this variation in behavior can have a profound influence on the magnitude of the effects associated with a project or other human use, such as recreation. For example, the proposed project will not extend westward entirely to the town of Ocotillo; a gap will exist where Carrizo Wash runs under I-8. It is unknown whether bighorn sheep in the area will exhibit the boldness to use this area for inter-mountain movement. Additionally, anthropogenic structures south of I-8 near this area, including the interstate, present a potential barrier. As a result, it is difficult to assess the effects on recovery in regards to principle 4 until more information is available concerning the behavioral characteristics of bighorn sheep in the area.

Effects to Critical Habitat in the Action Area

The proposed Project site is not located within designated critical habitat for bighorn sheep; consequently, impacts to critical habitat are not anticipated. However, bighorn sheep existing in and using critical habitat may be indirectly affected by the project effects on habitat connectivity.

Flat-tailed Horned Lizard

Direct Effects

Direct effects to the FTHL include impacts to suitable habitat, mortality, and degradation of habitat connectivity between management areas.

Loss of Habitat

Approximately 883 ha (2,182 ac) of suitable FTHL habitat would be permanently destroyed, 38 ha (93 ac) of which occur within the Yuha Desert MA. An additional 556 ha (1,375 ac) would be temporarily impacted (Table 1), for a total of 1,439 ha (3,557 ac). Temporary impacts are likely to result in FTHL habitat loss that would persist for various periods of time. Following extensive disturbance and compaction, desert soils can take between 92 and 124 years to recover in the absence of active restoration (Webb 2002). In addition, recovery of plant cover and biomass in the desert can require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). Although active restoration can reduce the time required to restore desert ecosystems, success is varied and dependent on numerous variables (Bainbridge 2007). Based on this information, the amount of habitat currently characterized as a temporary disturbance is likely to be unsuitable as habitat for the life of the proposed Project (40 years).

Construction, maintenance, and operations of the solar plant can cause physical disturbances that may change soil structure; runoff and soil erosion patterns; moisture holding capabilities of the soil; and energy flux patterns due to surface reflectivity changes. Changes in plant and animal density, diversity, growth, reproduction, and behavior can be expected as a result of these activities (Patten 1978). Therefore, even though approximately 1,214 ha (3,000 ac) of the proposed solar plant site would not be directly impacted by grading or other mechanical surface disturbances, the entire solar plant site likely will experience the aforementioned habitat quality changes. For example, native plant populations, adapted to more xeric conditions, could be replaced with more mesic non-native varieties, which could lead to artificial increases in rodent populations (Patten 1978) and, consequently, a reduction in native ant populations (Brown *et al.* 1979). Additionally, significant shifts in dominance may occur within the creosote bush-white burr sage scrub, possibly increasing the patchiness and diversity of native plant communities in short periods of time (3 years), which could lead to changes in the faunal diversity and abundance (Smith *et al*. 1987) within the proposed Project area.

Based on the effects described above, we are assuming 2,659 ha (6,571 ac) of suitable FTHL habitat will be destroyed or adversely impacted. This represents approximately a 1 percent loss of mapped suitable habitat in the Western Population segment.

To offset this impact, the Project applicant proposes to fund the acquisition and management of suitable FTHL habitat within the West Mesa MA (CM #10). Although the purchase and protection of suitable FTHL habitat would not create new habitat within the range of the lizard, it would result in a net increase in the amount of FTHL habitat managed for the conservation of

this species. In addition, habitat enhancements the BLM performs with acquisition and management funds would restore habitat values to lands that have been degraded by human activities.

Mortality

A majority of the lizards occurring within construction areas on the proposed Project site at the time of construction would likely be killed during the course of construction. FTHLs typically freeze and bury themselves in the sand in response to predators and this behavior is likely to occur in response to construction activity (FTHL ICC 2003). Alternatively, FTHLs may be underground and inactive if construction occurs during cold weather conditions, which could lead to individual FTHLs being crushed or entombed in their burrows. Any remaining lizards not killed during construction activities may be killed or injured by O&M activities through increased vehicle traffic and maintenance activities (e.g., mirror washing). FTHL mortality in conjunction with plant construction, operations, and maintenance is likely. Moreover, because of a lack of FTHL exclusionary fencing and the ongoing O&M activities, the Project site may contribute to ongoing FTHL mortality for the life of the Project resulting in lower reproduction rates, probability of survival, and probability of emigration to a source site (Runge *et al*. 2006).

To minimize mortality of FTHLs, individuals found would be removed from harm's way when encountered during construction, operation, and maintenance. Also, a worker education program would be implemented to inform personnel working on the proposed Project site about FTHL ecology and measures to avoid and minimize impacts. Finally, a biological monitor position would be filled for the life of the Project to ensure compliance with avoidance and minimization measures (CMs 1 through 7).

Because of several uncertainties, for the purposes of this analysis, we assume all lizards (approximately 1,383 to 2,792 individuals as previously discussed in the FTHL status section) occurring on the proposed Project site at the time of construction will be killed. However, based on previous experiments and surveys involving handling and moving lizards (Grant 2005, Painter and Ingraldi 2007, Painter *et al.* 2008), we expect some survival of relocated lizards to occur and anticipate that a population of lizards, albeit at lower densities, will remain onsite.

Effect on Habitat Connectivity between Management Areas

According to the RMS, some FTHL movement between the Yuha Desert MA and the West Mesa MA likely occurs under existing conditions. Recent genetic analysis supports this assumption indicating there is current genetic interchange between the Yuha Desert MA and the Mesa MA populations (pers. comm. D. Mulcahy 2010).

No Project related alterations to the existing potential movement corridors (e.g. culverts, trestles) are proposed and approximately 57 ha (141 ac) of primary drainages leading up to the railroad trestles and culverts under I-8 on the proposed Project site would be avoided. However, if FTHL use the proposed Project site to move between the Yuha Desert MA and West Mesa MA, and

physical disturbances and O&M activities render the proposed Project site unsuitable for FTHLs and/or increase FTHL mortality, this would reduce the effectiveness of an already constrained habitat corridor (Simberloff and Cox 1987). The South Fork Coyote Wash and any FTHL movement currently occurring under I-8 at this location west of the proposed Project boundary, however, will not be directly affected by the proposed Project.

It is important for future FTHL management, and stability of the species, to better understand how well FTHLs persist on the proposed Project site. To gain this understanding, the Project applicant will fund and implement a FTHL occupation study (CM #9) to help provide this information. Biological monitoring activities designed to minimize FTHL mortality would be adaptively implemented through the Designated Biologist position proposed to be funded for the life of the Project, which may help sustain populations of FTHLs on the proposed Project site (CM #1).

Effect on FTHL Management Areas

Approximately 40 percent of the current range of FTHL, in areas considered especially important to the species (Rado 1981, Turner *et al.* 1980), is being managed and conserved in MAs, through implementation of the FTHL RMS. Based on the best scientific information currently available, we anticipate this level of conservation and management will maintain persistent populations of FTHLs in perpetuity. FTHL habitat impacts from the proposed Project within the Yuha Desert MA are 38 ha (93 ac). The Yuha Desert MA contains approximately 24,362 ha (60,200 ac) of suitable FTHL habitat, 23,148 ha (57,200 ac) of which is managed by the BLM; therefore, overall loss of habitat in this MA would be relatively small (0.15 percent). Additionally, the loss of 38 ha (93 ac) would increase the cumulative impact in the Yuha Desert MA to 110.5 ha (273.01 ac), or 0.45 percent of the available suitable FTHL habitat, which would not exceed the 1 percent development cap for that MA.

Indirect Effects

Possible indirect effects to FTHLs caused by proposed Project construction, operation, and maintenance include increases in FTHL predators and introduction of invasive weeds.

Construction and operation of the Project could provide new sources of food, water, and nesting and perching sites that might attract unnaturally high numbers of FTHL predators such as the common raven, loggerhead shrikes, and American kestrel. These predators habituate to human activities and are subsidized by food and water, as well as roosting, perching, and nesting resources that are introduced or augmented by human developments (FTHL ICC 2003). The Project applicant has proposed to fund and implement a Raven Control Plan and implement other project design features to reduce nesting. This includes installing physical deterrents to nesting, removing nests, and conducting monitoring to make sure these measures are working as intended (CM #11 and CM #17). Additionally, exclusionary fencing would be installed around the evaporation ponds and netting would be installed over the ponds to exclude wildlife.

Round-tailed ground squirrels (*Spermophilus tereticaudus*) may be the primary predator of FTHL in the proposed Project vicinity (FTHL ICC 2003). While the species was not directly observed on the proposed Project site, they are known to occur in the proposed Project area (Hoefler and Harris 1995). A potential effect of O&M of the solar plant is increased shade and water application from the periodic washing beneath the SunCatcher structures. The increase in water may lead to more dense vegetation on the proposed Project site (Smith *et al*. 1987). The higher density of vegetation, specifically perennials, could attract higher densities of round-tailed ground squirrels to the proposed Project vicinity that may not have previously been sustained under the current arid conditions (Grant 2005), elevating predation on FTHLs. Elevated predation levels may contribute population declines in some areas of the proposed Project vicinity (FTHL ICC 2003). Valid measures to minimize this potential threat to FTHL have not been proposed.

The permanent and temporary earth disturbance associated with construction activities could introduce new non-native invasive weeds to lands adjacent to the solar plant site and its linear facilities, which could further spread weeds already present in the project vicinity, including Sahara mustard, red brome, and Mediterranean grass. Invasive weeds can colonize areas of disturbance and out-compete and exclude native species, potentially altering the structure of the vegetation, degrading or eliminating upland habitat used by the FTHL, and providing food and cover for undesirable non-native animals (Randall and Hoshovsky 2000). We anticipate implementation of the Weed Control Plan (CM #18) would minimize adverse effects associated with increased introduction of non-native plant species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, private, or certain tribal actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Bighorns may react strongly to low-flying aircraft, especially helicopters (Bleich *et al.* 1990). Military and private aircraft frequently fly over the Peninsular Ranges and low elevation flights have the potential to disturb bighorn sheep. Such aerial sources of disturbance are not covered in BLM Land Management Plans. However, at this time, we do not have any specific project information to analyze potential direct and indirect impacts of this activity on PBS.

Routine maintenance of highways and other structures do not routinely require Federal permits or funding, though some of these activities will be covered under future section 7 consultations. These activities can temporarily disturb bighorn sheep and potentially cause them to avoid an area during maintenance activities. However, at this time, we do not have any specific project information to analyze potential direct and indirect impacts of this activity on PBS.

Imperial County has released a draft EIR for the Wind Zero project. The 382 ha (944 ac) project proposes to build a training facility for law enforcement and a road course and racetrack country

club near Ocotillo (south of I-8 and north of SR 98) and adjacent to the Yuha Desert ACEC in Imperial County. This project is located approximately 3.3 km (2 mi) southwest of the proposed Project. Approximately 295 ha (729 ac) of suitable FTHL habitat within the current range of the species, but outside of a MA, may be lost with implementation of this project. Some measures to avoid and minimize impacts to individual FTHL are proposed but replacement of habitat losses apparently will not occur. The proposed project site also would eliminate a large vacant parcel of land that otherwise could be used by sheep if they attempted to cross I-8 immediately west of the Project site. Thus, the Project may further reduce north-south movement opportunities for sheep in this portion of their range, though neither the Project nor Coyote Wells/Wind Zero projects would adversely affect the location where sheep are now known to cross I-8 in the vicinity of Mountain Springs.

Overall, known cumulative effects would reduce the extent of suitable FTHL habitat available on private lands in the action area but the amount of habitat loss at issue is relatively small compared to the large amount of BLM lands that are being conserved in the State-Federal management area reserve system for the species. Though cumulative effects would reduce potential opportunities for bighorn sheep movement across the I-8 corridor in the desert flats where bighorn sheep spend relatively little time, north-south movements by sheep in the action area are known to occur more frequently in mountainous terrain, which would not be affected by the proposed project or cumulative effects. Therefore, cumulative effects would not preclude sheep population connectivity between/among the Coyote, In-Ko-Pah, and Jacumba mountain ranges in the action area.

CONCLUSION

Peninsular Bighorn Sheep

After reviewing the current status and environmental baseline of bighorn sheep in the Peninsular Ranges, effects of the proposed action, and cumulative effects, it is our biological opinion that the implementation of the proposed action is not likely to jeopardize the continued existence of the distinct population segment of bighorn sheep in the Peninsular Ranges. We reached these conclusions based upon the following reasons:

1. Available telemetry data indicate that seasonal intermountain movements of bighorn sheep found in the Coyote Mountains occur across County Highway S2 in the Sweeney Pass area, which is located in the northwestern portion of the mountain range. No telemetry data indicate that intermountain movements to mountain ranges through the project site occur.

2. Dispersal (one-way movements) to mountain ranges through the project site may already be impeded by human structures and land uses. Opportunities to facilitate future habitat connectivity exist along I-8 much further west in the Jacumba Mountains.
3. Construction of the proposed project would eliminate approximately 100 ha (247 ac) of plant communities associated with desert washes from the available forage base. The

conservation and/or restoration of wash habitat available to bighorn sheep would offset the loss of foraging opportunities resulting from construction and fencing of the project.

4. Wash habitat is available to bighorn sheep at other locations in the Coyote Mountains.

5. The proposed project contributes to the transformation of the desert to industrial and other human uses, but the effects of the project do not appreciably decrease the probability of population persistence for bighorn sheep in the action area.

Flat-tailed Horned Lizard

After reviewing the current status of the FTHL, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the Service's biological opinion that the death of up to approximately 2,792 individuals from impacts and the destruction of approximately 2,659 ha (6,571 ac) of suitable habitat is not likely to appreciably reduce the likelihood of survival and recovery of the FTHL by reducing the reproduction, numbers, or distribution of the species. We reached these conclusions based upon the following reasons:

6. The proposed Project would impact only a small fraction (much less than 1 percent) of the overall range of the FTHL in the U.S. Similarly, the FTHL population estimates for the Western Population Segment and suitable habitat areas east of the Imperial Valley suggest that the loss of FTHL individuals on the proposed Project site would be relatively small.
7. The proposed Project would result in a relatively small loss of FTHL habitat, 38 ha (93 ac) out of 24,362 ha (60,200 ac), in the Yuha Desert MA.
8. Connectivity between the Yuha Desert MA and the West Mesa MA through the Project site, though likely less functional than under baseline conditions, would remain a possibility because of the avoidance of the major washes, the lack of FTHL exclusionary fencing around the Project site, and the maintenance of existing culverts under I-8 and the railroad tracks. Further, the Coyote Wash undercrossing and other possible connectivity areas outside of the Project boundary will not be directly affected by the proposed Project.
9. The acquisition and management funds contributed by the applicant through the FTHL RMS would result in an increase in the amount of existing habitat that is conserved and managed for the FTHL and would likely lead to restoration of degraded habitat within these areas.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, and Federal regulation pursuant to section 4(d) of the Act, prohibit the take of endangered and threatened species, respectively, without special exemption. 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. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below for PBS are non-discretionary, and must be undertaken by the BLM so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The BLM has a continuing duty to regulate the activity covered by this incidental take statement. If the BLM fails to adopt and implement the terms and conditions or fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the BLM must report the progress of the action and its impact on the species to the Service as specified herein [50 CFR §402.14(i)(3)].

The prohibitions against taking FTHL found in section 9 of the Act do not apply until the species is listed. However, the Service advises the BLM to consider implementing the following reasonable and prudent measures. If the FTHL is listed and this conference opinion is adopted as a biological opinion, the measures described below for the FTHL, with their implementing terms and conditions, will be non-discretionary.

Amount or Extent of Take Anticipated

Peninsular Bighorn Sheep

Although the probability is low, the Service realizes that one (1) PBS may breach the exclusionary fence surrounding the project site over the life of the project. Such an event could result in the injury or death of the animal during the removal process. Alternatively, one (1) PBS may become entangled in fencing material over the life of the project leading to injury or death of the animal. The specified level of incidental take due to complications with fencing as just described over the life of the project is one (1) PBS.

Flat-tailed horned lizard

The FTHL is a rare, difficult to detect species, with a limited distribution. Detection of FTHLs in the field is difficult because of their propensity to remain motionless and/or bury themselves in the sand when threatened and their cryptic coloration and flattened body (Foreman 1997). More appropriate detection probabilities for FTHL were first investigated and incorporated into

abundance estimates by Grant (2005). We do not have survey data to derive a detection probability estimate for the proposed Project site, but data from 2006-2009 FTHL occupancy monitoring surveys within FTHL MAs estimated an average detection probability of 18 percent. Given that the level of survey effort (i.e., amount of area searched per period of time) to find FTHLs on the proposed Project site will incorporate a level of effort similar to occupancy monitoring, we assume detection probabilities will also be similar. Therefore, we will assume a detection probability of 18 percent on the proposed project site.

The Service anticipates up to 2,792 individual FTHLs may be incidentally taken as a result of the proposed Project, but predict that only 18 percent or 503 individuals (18 percent of 2,792) would be detected over the life of the project. Thus, the detection of 503 individuals either dead or alive will indicate that the anticipated incidental take level of 2,792 individuals has been met. Incidental take is expected to be in the form of accidental injury or death due to construction, operation, and maintenance of the proposed Project and in the form of capture or collect when the biological monitors move live FTHLs out of harm's way. If more than 503 FTHLs are found (alive or dead) on the project site during construction, operations, or maintenance over the life of the project, the amount of incidental take would be exceeded and reinitiation of this biological/conference opinion would be required.

Reasonable and Prudent Measures

The reasonable and prudent measures outlined below are nondiscretionary. Failure to comply may cause the protective coverage of section 7(o)(2) to lapse. The following reasonable and prudent measures are necessary and appropriate to minimize incidental take.

Flat-tailed Horned Lizard

> We have not identified any additional reasonable and prudent measures beyond those identified in the Conservation Measures above that would further minimize incidental take of FTHL.

Peninsular Bighorn Sheep

> The BLM, Corps, and applicant will minimize the probability of bighorn sheep being killed or injured by the construction and maintenance of the perimeter fence.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the BLM, Corps, applicant, and all agents/contractors must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The following terms and conditions implement the reasonable and prudent measure for PBS:

1.1 In conjunction with the BLM, CDFG, and Service, the applicant shall devise a plan for safely removing bighorn sheep from the interior of the facility if bighorns breach the Project perimeter fence.

1.2 Onsite personnel shall be trained on proper techniques and protocols for dealing with entrapped or entangled animals. These proper techniques and protocols shall be articulated in a bighorn removal plan. Prior to fence construction, the bighorn removal plan shall be submitted to CDFG and the Service for approval.

1.3 The Project perimeter fence shall be designed, constructed, and maintained to minimize the risk of injury or death occurring to PBS. The fence design shall include the following:

- Fences shall be a minimum of 2.44-m (8-ft) high, chain link, with spaces no larger than 11-cm (4.3-in).
- Spaces along the bottom of the fence shall be less than 5 cm (2 in) to discourage bighorn sheep from attempting to crawl under the fence. In low spots, it may be necessary to manually pile rocks or other substrate along the bottom of the fence.
- No razor-wire shall be used in the construction of the fence.
- Three (3) gates at least 3-m (10-ft) wide shall be installed along the northern project boundary at the major washes (identified as wash I, K, and C on Figure 2) to provide for safe escape routes and enable bighorn sheep to be herded out of the interior of the facility.

Disposition of Sick, Injured, or Dead Specimens

The Service's Carlsbad Fish and Wildlife Office (760) 431-9440 must be notified should any bighorn sheep or FTHL (should it be listed) are found injured or dead in the action area. Any dead, injured, or sick PBS should be immediately reported to: our Division of Law Enforcement at (619) 557-2997, (310) 328-1516, the Carlsbad Fish and Wildlife Office at (760) 431-9440, CDFG entities: (909) 659-6464, (760) 771-0375, or (916) 358-1464, and the Bighorn Institute at (760) 346-7334. Written notification should be submitted within 5 calendar days to the Carlsbad Fish and Wildlife Office, 6010 Hidden Valley Road, Suite 101, Carlsbad, California 92011. To the extent known, written or verbal notification should include the date, time, and location of the incident; number of discovered specimens; cause of injury or death; and any other pertinent information. Injured animals, if deemed treatable, should be transported under humane conditions to a qualified veterinarian or certified wildlife care facility, with the Service apprised of the final disposition. Any dead specimens may be: (1) reposited with the closest Service field office or with an educational/research institution possessing the appropriate State and Federal

permits; or (2) marked, photographed, and left in the field. In either case, the finding and relevant details should be immediately reported to the Service.

Reporting Requirements

Please refer to CM #1 in the Conservation Measures section of this biological/conference opinion above for details on reporting procedures for FTHL.

Any sightings of bighorn sheep on or near the Project site by Project employees or contractors shall be reported immediately to the Designated Biologist and/or Biological Monitor, whoever is available first. The Designated Biologist and/or Biological Monitor shall forward the information to CFWO immediately via e-mail and phone.

REINITIATION NOTICE

This concludes formal consultation on the proposed Project for the PBS. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this conference opinion; or (4) a new species is listed or critical habitat designated that may be affected by the proposed action.

This concludes the formal conference on the proposed project for the flat-tailed horned lizard (FTHL). You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the FTHL is listed. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

If the FTHL is listed under the Act and this conference opinion is adopted as the biological opinion, the BLM shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this conference opinion; or (4) a new species is listed or critical habitat designated that may be affected by the proposed action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the proposed Project will be reviewed to determine whether any take of the FTHL has occurred. Modifications of the opinion and incidental take

statement may be appropriate to reflect that take. No take of the FTHL may occur between the listing of the FTHL and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

If you have any questions regarding this document, please contact the Carlsbad Fish and Wildlife Office at (760) 431-9440.

Attachments (6)

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Figure 1: Project Overview Map

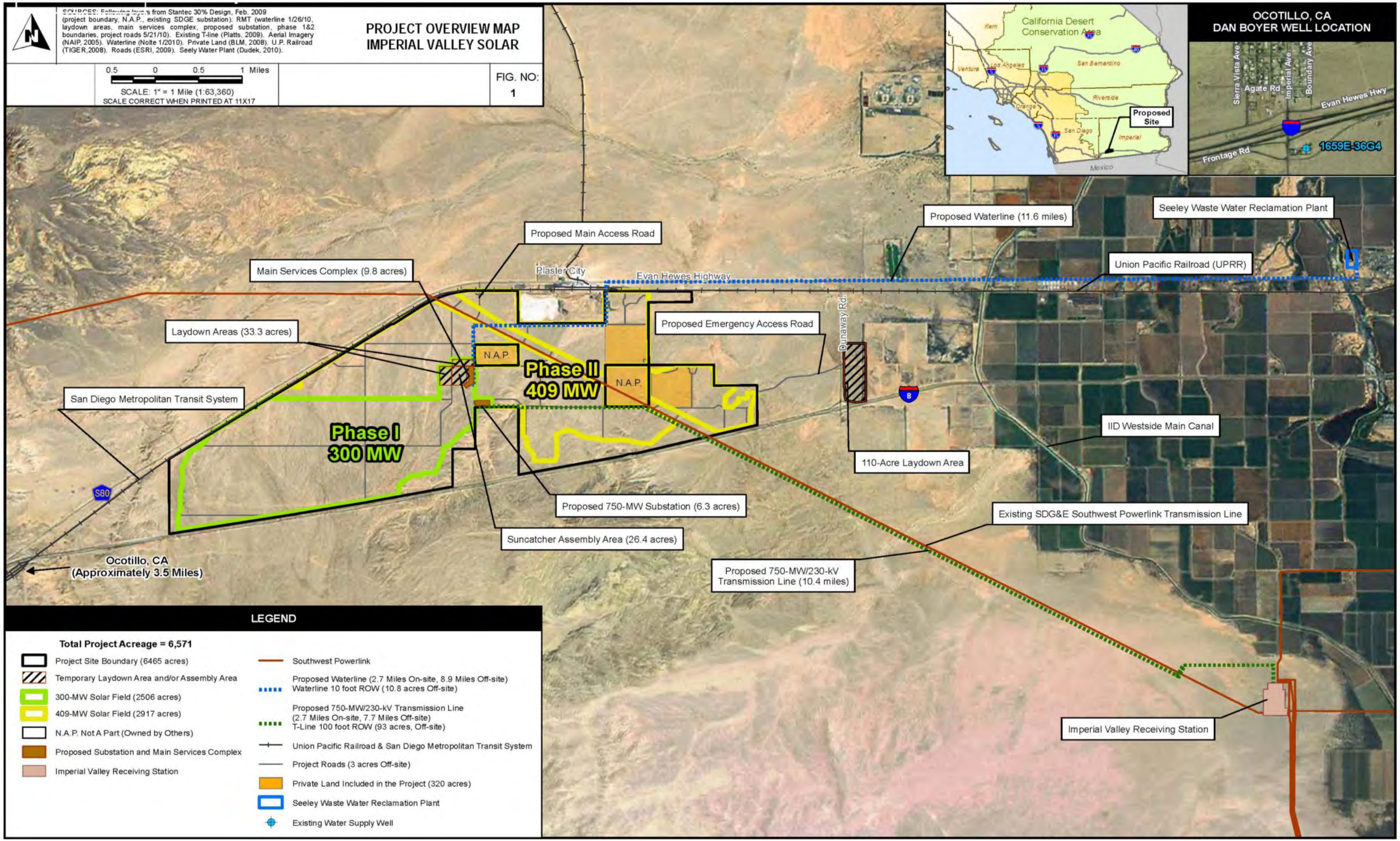
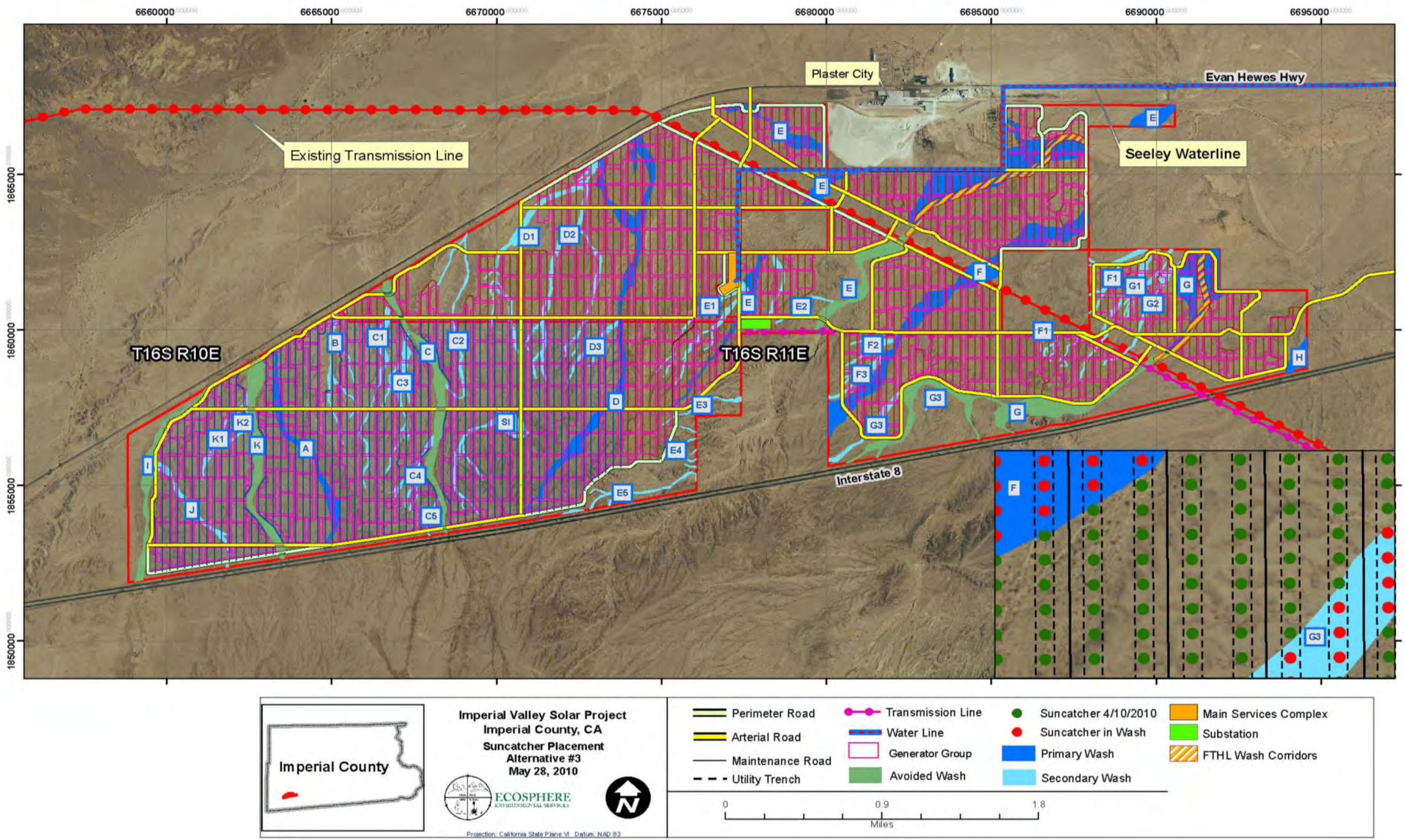


Figure 2: Project Design Layout



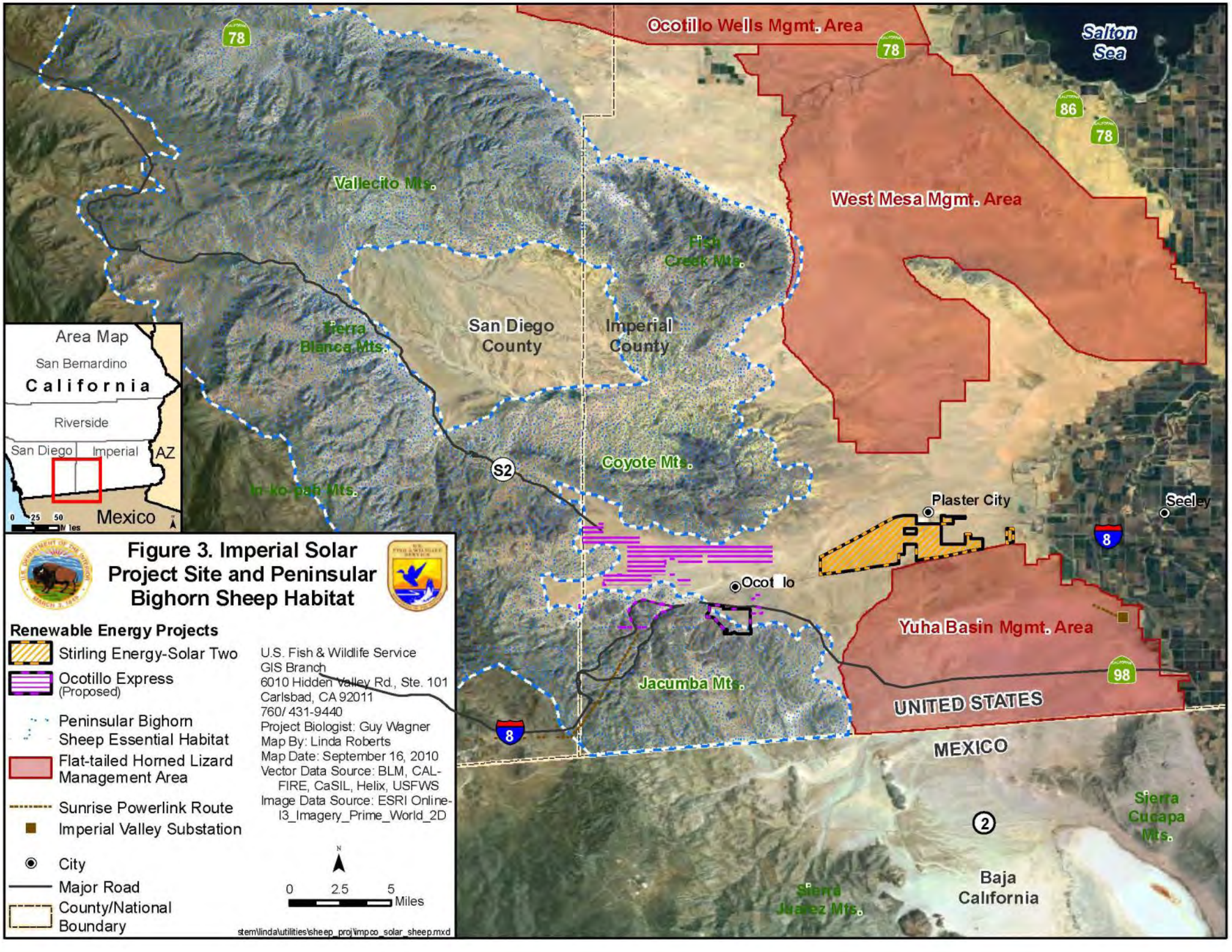

Ocotillo Wells Mgmt. Area
Salton Sea
78
86
Vallecito Mts.
West Mesa Mgmt. Area
Fish Creek Mts.
San Diego County
Imperial County
Tierra Blanca Mts.
Coyote Mts.
S2
In-ko-pah Mts.
Plaster City
Seeley
8
Ocotillo
Yuha Basin Mgmt. Area
98
Jacumba Mts.
UNITED STATES
MEXICO
2
Sierra Cucapa Mts.
Baja California
Sierra Juarez Mts.
Area Map
San Bernardino
California
Riverside
San Diego
Imperial
AZ
Mexico
0 25 50 Miles
Figure 3. Imperial Solar Project Site and Peninsular Bighorn Sheep Habitat
Renewable Energy Projects
Stirling Energy-Solar Two
Ocotillo Express (Proposed)
Peninsular Bighorn Sheep Essential Habitat
Flat-tailed Horned Lizard Management Area
Sunrise Powerlink Route
Imperial Valley Substation
City
Major Road
County/National Boundary
U.S. Fish & Wildlife Service
GIS Branch
6010 Hidden Valley Rd., Ste. 101
Carlsbad, CA 92011
760/ 431-9440
Project Biologist: Guy Wagner
Map By: Linda Roberts
Map Date: September 16, 2010
Vector Data Source: BLM, CAL-FIRE, CaSIL, Helix, USFWS
Image Data Source: ESRI Online-I3_Imagery_Prime_World_2D
N
0 2.5 5 Miles
stem\linda\utilities\sheep_proj\impco_solar_sheep.mxd

Figure 4. FTHL Western Population in California

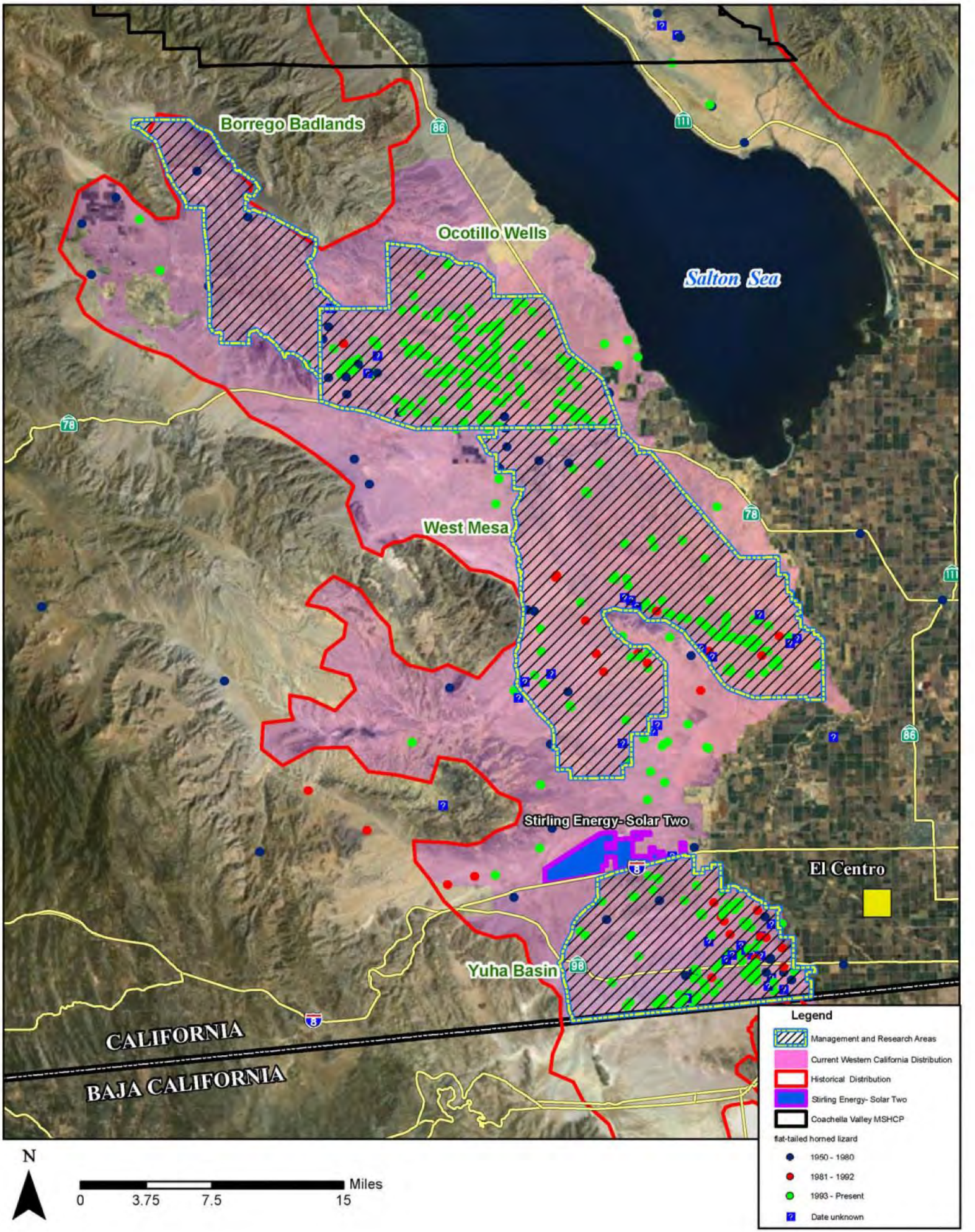


Figure 5: Peninsular Bighorn Sheep Locations

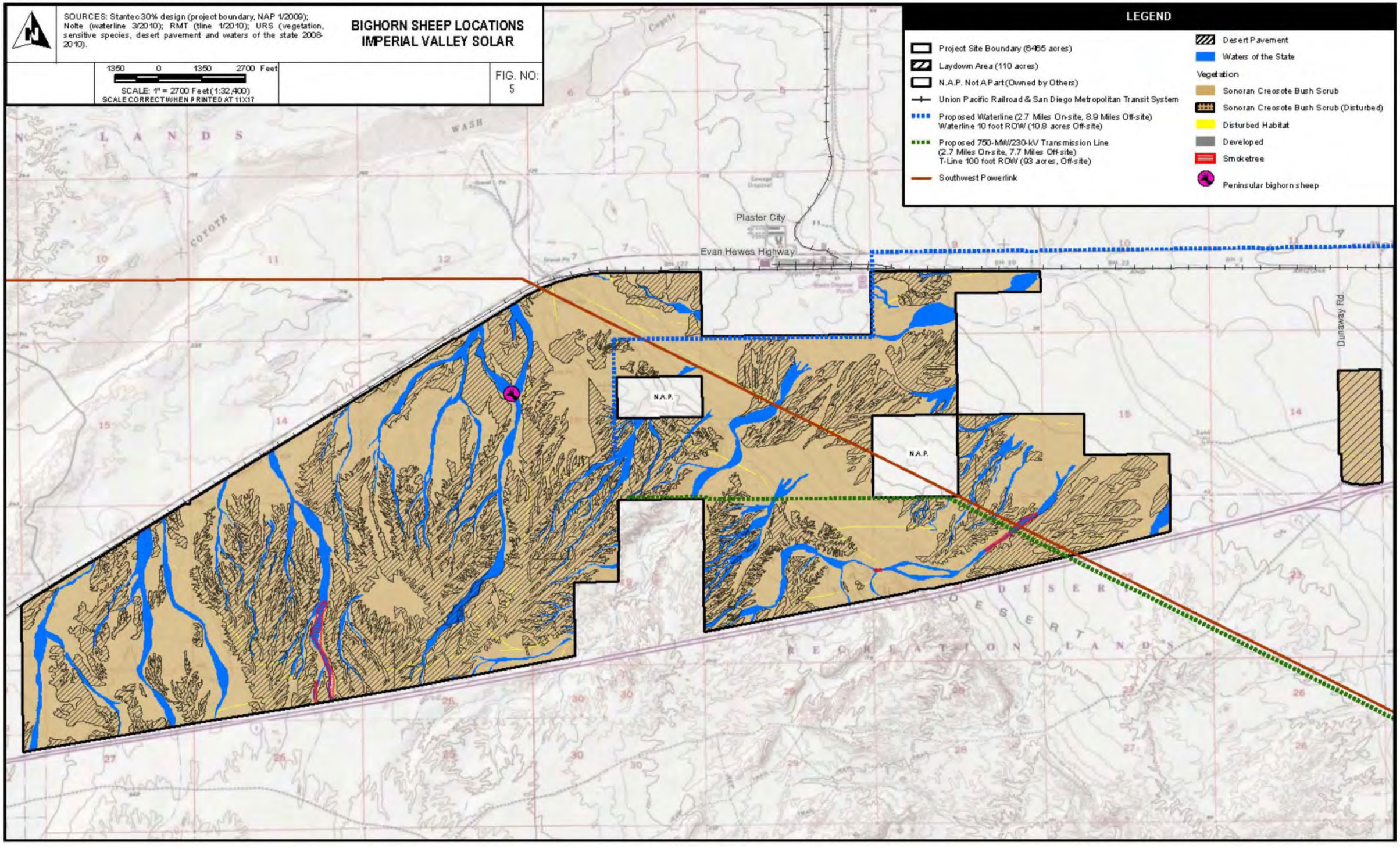
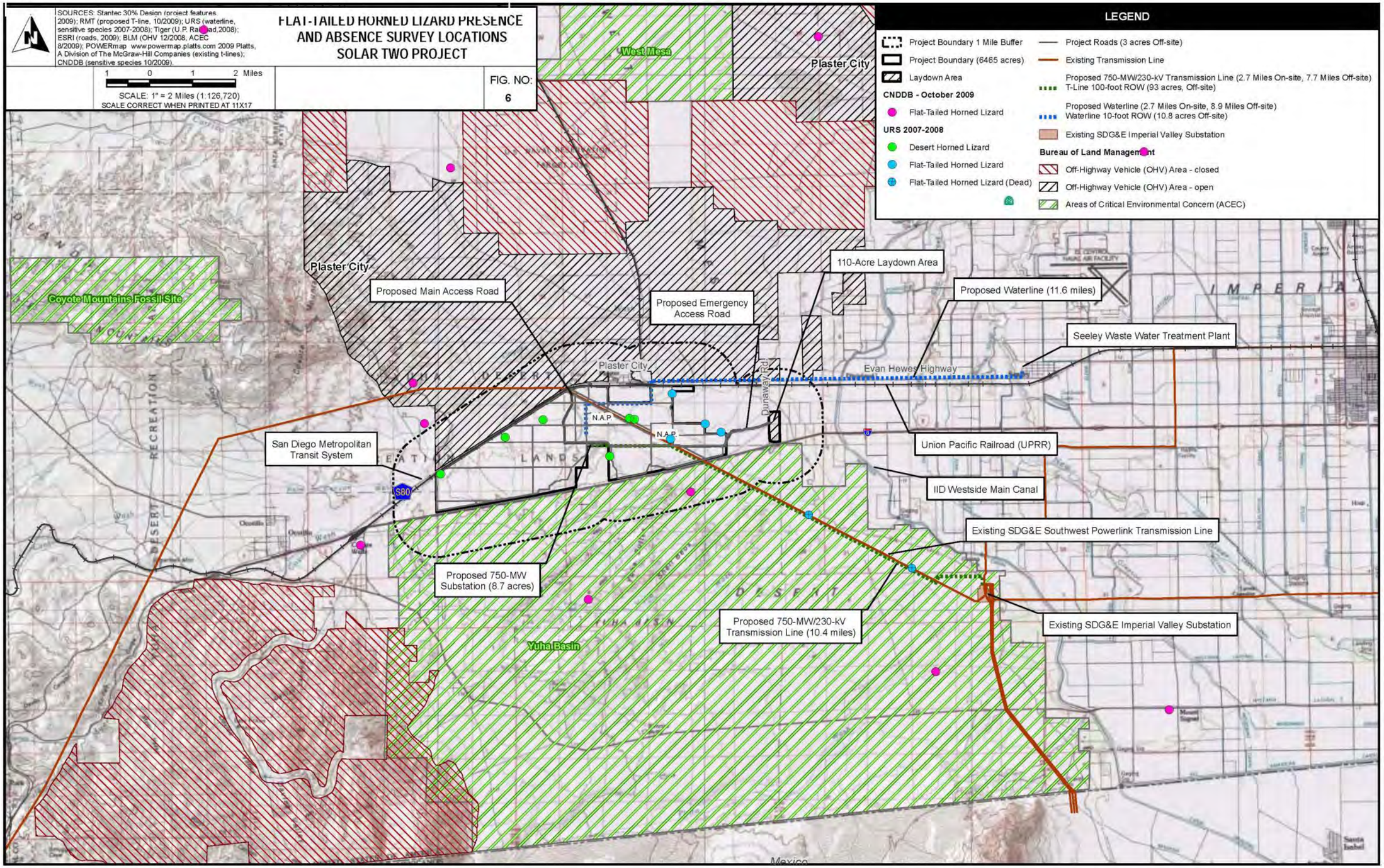



Figure 6: Flat-tailed Horned Lizard Presence/Absence Survey Locations