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Appendix A: Biological Opinion for the Soda Mountain Solar Project, San Bernardino County, California [2831.03(CP), CACA-49584, CAD000.06/CAD080]

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
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Carlsbad, California 92008

In Reply Refer To:
FWS-SB-15B0081-14F0616

JAN 13 2016

Memorandum

To: District Manager, Bureau of Land Management
California Desert District, Moreno Valley, California

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

Subject: Biological Opinion for the Soda Mountain Solar Project, San Bernardino County, California [2831.03(CP), CACA-49584, CADOOO.06/CAD080]

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the Bureau of Land Management's (Bureau) proposed issuance of a right-of-way grant for the Soda Mountain Solar Project and its effects on the federally threatened desert tortoise (*Gopherus agassizii*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). The proposed Soda Mountain Solar Project involves the construction, operation, maintenance, and decommissioning of a 287-megawatt photovoltaic solar power plant and associated infrastructure and facilities. We received your request for formal consultation on December 13, 2013.

This biological opinion is based on information that accompanied your request for consultation, including the biological assessment (Bureau 2013a) and draft environmental impact statement (Bureau 2013b), information that the Bureau and Soda Mountain Solar, LLC, (applicant or Soda Mountain Solar) provided during consultation, correspondence with National Park Service and Bureau staff, and information contained in our files. The Service can make a complete record of this consultation available at the Palm Springs Fish and Wildlife Office.

CONSULTATION HISTORY

On December 10, 2013, the Bureau (2013c) requested initiation of formal consultation for the issuance of a right-of-way grant for the construction, operation, maintenance, and decommissioning of the Soda Mountain Solar Project. In the request for initiation, the Bureau concluded that the proposed project may affect, but is unlikely to adversely affect, the federally endangered Mohave tui chub (*Gila bicolor mohavensis*). The Mohave tui chub occurs in Lake Tuendae and MC Springs, which are located approximately 4 miles east of the project site at

Zzyzx. The applicant provided a hydrogeological conditions and groundwater modeling report (Appendix C in Bureau 2013a) that served as a basis for the Bureau's determination.

By memorandum dated April 16, 2014, the Service (2014a) notified the Bureau that given the uncertainties surrounding the behavior of groundwater in the area, the lack of clarity and precision in the groundwater monitoring plan, and the importance of surrounding areas to the continued existence of the Mohave tui chub, we could not agree with the Bureau's conclusion that the proposed project may affect, but is not likely to adversely affect, the Mohave tui chub. Consequently, the Bureau and the county of San Bernardino requested that Soda Mountain Solar install and test a groundwater well to assess potential effects of pumping groundwater from the Soda Mountain basin on Mohave tui chub occurring in the surrounding areas. Panorama Environmental (Panorama), Burns and McDonnell conducted a groundwater well test to characterize the groundwater resources within the Soda Mountain Solar project area.

On October 20, 2014, the Bureau provided the Service with the results of Panorama's (2014a) groundwater well test. Staff of the U.S. Geological Survey (2014) used the results to assess the potential effects of pumping groundwater from the Soda Mountain basin and found that the proposed pumping for the Soda Mountain Solar Project is unlikely to measurably affect discharge from nearby areas that support Mohave tui chub. The Bureau revised the groundwater monitoring and mitigation plan to reflect the results of the groundwater well test and identified thresholds that would trigger corrective measures to avoid effects to Mohave tui chub (Panorama 2014a).

Based on the revisions to the groundwater monitoring and mitigation plan (Panorama 2014a), we concur with the Bureau's determination that the proposed Soda Mountain Solar Project may affect, but is not likely to adversely affect, the Mohave tui chub. If the proposed action changes in any manner that could result in adverse effects that were not anticipated, the Bureau must contact us immediately to ensure the appropriate level of consultation is completed.

We provided a draft biological opinion to the Bureau on December 19, 2014 (Service 2014c). The Bureau shared the draft biological opinion with the applicant and the National Park Service and provided comments to the Service on January 20, 2015 (Bureau 2015a). We have incorporated those comments where appropriate.

We also received a memo from the Bureau on October 2, 2015. (Bureau 2015b). The Bureau detailed a change in the proposed action that reduced the solar energy capacity, project foot print acres, and water use. We have incorporated these changes in the project description and throughout our biological opinion as necessary.

We provided another draft biological opinion to the Bureau on October 23, 2015 (Service 2015). The Bureau shared the draft biological opinion with the applicant. We received additional comments and clarification on the project description on December 2, 2015 (Bureau 2015b). We have revised the biological opinion to include those comments.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Introduction

The Bureau proposes to issue a right-of-way grant to Soda Mountain Solar to construct, operate, maintain, and decommission a 287-megawatt photovoltaic solar power plant and associated infrastructure and facilities near Baker, California. The proposed project is located approximately 6 miles southwest of the unincorporated community of Baker and approximately 50 miles northeast of Barstow. The project is situated on both the northwest and southeast sides of Interstate 15 (I-15) near the western boundary of the Mojave National Preserve. The proposed facility would occupy 1,726 acres (Bureau 2015) within a 2,942-acre right-of-way.

Construction

Prior to commencement of construction, the applicant would install construction fencing, security perimeter fencing, and desert tortoise exclusion fencing (Figure 1). The construction fence would be a temporary fence, coupled with a desert tortoise exclusion fence, erected around the disturbance areas within the right-of-way, areas used for access to the site, and project well locations northwest of I-15. The perimeter fence would be a combination of permanent security fencing, desert tortoise exclusion fencing, and desert tortoise guards, around each individual block of the South Arrays, the entire East Array, and the substation and switchyard. The applicant would also install temporary desert tortoise exclusion fencing around all areas of temporary disturbance (e.g. underground collector lines, temporary construction roads). Installation of desert tortoise guards would occur where desert tortoise exclusion fencing intersects with roads on the project site.

Construction would occur over an 18-month to 5-year period. It would commence with site clearing and grading of laydown areas and the substation location, followed by survey, clearance, and grading of road corridors to provide site access. During construction of solar arrays and associated facilities, the applicant would maintain existing vegetation to the extent possible. Project construction would require grading and clearing of vegetation for the staging areas, roads, operations and maintenance facilities, and project substation. Within the solar array blocks, construction contractors would cut back vegetation but leave the plant root structure and about 6 inches of aboveground vegetation to be trimmed during operation as necessary.

In the following paragraphs, we provide a description of the key components of the project. Table 1 provides approximate disturbance acreages for the project components. Figure 1 shows the Soda Mountain Solar Project footprint and components.

Solar Panel Arrays

The project would consist of four solar arrays blocks. The East Array would be located on the southeast side of Interstate 15 on approximately 428 acres. South Array 1, 2, and 3 would be located immediately south of the East Array, on approximately 1,128 acres. The project would utilize approximately 1.3 million flat-plate polycrystalline silicon solar panels. The panels would mount on 6-foot to 12-foot-tall linear trackers that would rotate throughout the day to increase total solar exposure.

Temporary Construction Areas

The construction laydown area would consist of one 30-acre area within the right-of-way. The applicant would install construction fencing around portions of the laydown area not otherwise located within the project's perimeter fence. The applicant would remove the construction fences around the laydown area and restore the area to pre-project conditions following construction.

Access Road

The applicant would construct a 2,600-foot primary access route to the southwest corner of solar site. This construction would not modify Rasor Road and would not restrict public use of the road. The applicant would also construct an approximately 1,000-foot-long access road from the Los Angeles Department of Water and Power transmission line access road to the substation and switchyard and an access road from the Blue Bell Mine Road to the substation and switchyard. The applicant would use an existing California Department of Transportation access road to the Opah Ditch pit mine for construction of the collection line. Within the project footprint, the applicant would construct approximately 14.5 miles of internal roads for panel access during site operation and maintenance. Access road construction activities would also include improvements to existing roads; areas damaged by erosion or requiring widening for turns may require reinforcement with rip-rap or crushed aggregate during construction and operation.

Collection Lines

Within the project site, underground collection cables would connect the solar panel arrays to the substation. Collection lines would originate from the arrays southeast of I-15, cross under the interstate at a single location through a directional boring, and continue along Opah Ditch Mine Road to the substation location.

Substation, Switchyard, and Interconnection

The project would have a 15-acre substation and switchyard for central collection and transfer of solar-generated power to the regional electrical grid. These facilities would be constructed west of the project site and deliver power to the adjacent Los Angeles Department of Water and Power's Marketplace-Adelanto 500-kilovolt transmission line through an interconnection. A permanent gated, chain-link fence combined with desert tortoise exclusion fencing would be constructed around the substation and switchyard.

Operation and Maintenance Facility

The operations and maintenance facilities would be located at the southwestern corner of the site, adjacent to the southernmost array. The operation and maintenance facilities would consist of an operation and maintenance building, a maintenance facility, and a warehouse facility.

Fencing and Security

As described above, the applicant would install permanent security fencing, integrated with desert tortoise exclusion around various portions of the project. Fencing would be approximately 6-feet high with 1 foot of barbed wire at the top and integrated with desert tortoise exclusion fencing. The applicant would not install permanent security fencing in major drainage washes to minimize adverse effects on wildlife corridors and storm water flow. However, the applicant may install breakaway fencing along larger drainages. Breakaway fencing would consist of a driven post with detachable connections just above ground level, which would allow the fencing to yield to the force of a storm event; the fence would be reattached to the post following such events. Desert tortoise guards would be installed as appropriate where desert tortoise exclusion fencing intersects with roads on the project site and cleaned after major flood events.

Lighting

During construction, the applicant would strategically locate lighting in the construction staging area, parking area, and around site security facilities. Lighting would serve safety and security purposes, incorporate shielding, and focus downward and toward the interior of the site to minimize light exposure to areas outside the construction area. The purpose of the lighting is not to facilitate construction at night; however, lighting is needed for construction activities at night, the applicant would limit it to the locations and amounts needed to ensure safety.

During operation and maintenance, the project would incorporate lighting at the site entrance, operation and maintenance building, substation, and switchyard. These lights would provide for safe access to project facilities and visual surveillance; lighting would be the minimum required for safety and security. All lights would incorporate shields and focus downward and toward the interior of the site to minimize the effects of lighting on neighboring areas.

Water Supply, Use, and Storage

The applicant would install up to five groundwater production wells, a water pipeline between the wells and the maintenance building, and five monitoring wells within the project perimeter fence to provide non-potable water for project construction. The applicant would also install three permanent water storage tanks - one 5,000-gallon potable water supply tank, one 22,500-gallon tank for fire suppression near the operation and maintenance building, and one 42,000-

gallon tank located near the southern entrance to the project for use during panel washing. The applicant estimates that construction would require approximately 192 acre-feet of water per year (approximately 283 to 354 acre-feet over the construction period). The applicant would truck 4 to 5, 20,000-gallon, temporary water tanks to the site in anticipation of construction water needs. The applicant would truck potable water to the site due to the expected high boron and fluoride content in groundwater pumped from the water supply wells.

Drainage and Erosion Control

Design of the four individual array blocks would preserve existing site runoff patterns to the extent feasible. The solar facility would not detain runoff or substantially interfere with existing drainage patterns on or off the project site and would preserve existing sediment transport throughout the site. The project's design would allow runoff from the alluvial fan on the north side of I-15 to flow through the project area through the existing channels. The applicant would construct berms along the edges of flow corridors through the south arrays to prevent side channel flows from affecting the solar arrays. Berms would be outside perimeter fences, but during construction would be located within the temporary construction fence.

The applicant would avoid placing solar panels of the south arrays within the flow corridors downstream of the three existing culverts under I-15 to allow flows from the culverts to follow existing braided flow channels. Development within existing washes would only consist of access road crossings and potential subsurface collector lines.

Table 1. Surface Disturbance of Project Components.

Project Component	**Temporary Area of Disturbance (acres)[1]**	**Permanent Area of Disturbance (acres)**	**Total Area of Disturbance (acres)**
Solar Arrays[2,3]	59	1,726	1,785
Substation, Switchyard, and Interconnection	25	15	40
Access Roads	61	16	77
Berms	49	10	59
Collector Routes	33	0	33
Laydown Area	30	0	30
Construction Fence	35	0	35
Total	**292**	**1,767**	**2,059**

[1] The applicant would restore areas of temporary disturbance to pre-project conditions following construction.

[2] Permanent disturbance is calculated as all areas within the perimeter fence. Temporary disturbance associated with the solar array includes areas within the construction fence and a work area 30 feet from the construction fence, excluding other project components.

[3] This disturbance area includes disturbances for operation and maintenance buildings, warehouses, water tank, project wells.

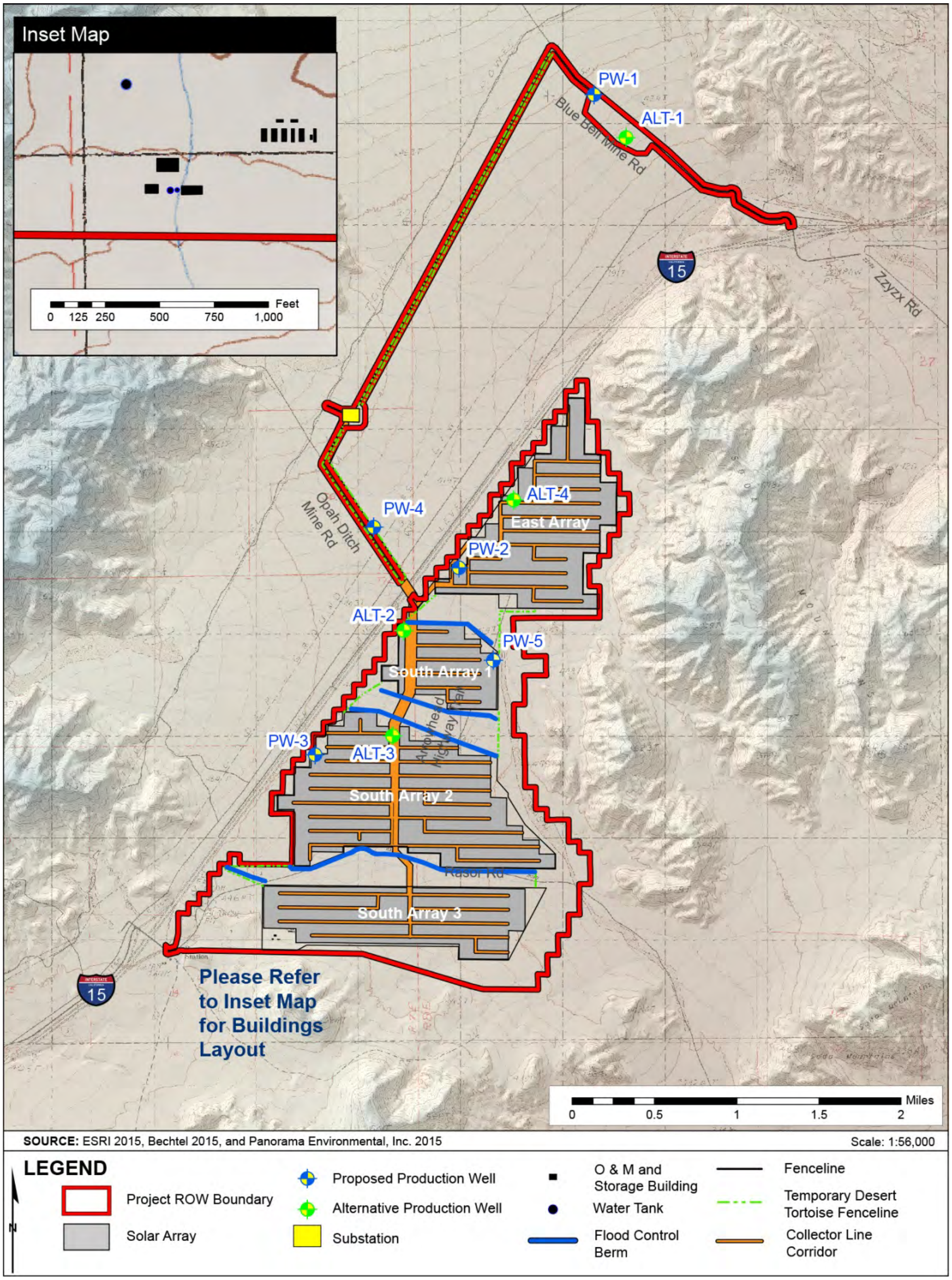

Figure 1. Soda Mountain Solar Project footprint and components.

Operation and Maintenance

Operational activities would include monitoring power generated by the solar arrays, monitoring interconnection to the Los Angeles Department of Water and Power transmission lines, operating the solar array tracking system, and conducting panel washing activities periodically throughout the year.

Maintenance activities would include inspecting, repairing, and maintaining the arrays, tracking systems, and the centralized monitoring and control system; maintaining and repairing the collector lines, which may require trenching. Administrative buildings, fencing and signage, roadways, and other ancillary facilities at the site would also require maintenance.

With the exception of linear facilities, operation and maintenance activities associated with the solar facility would occur within the fenced perimeter of the project site. Activities that would occur outside the perimeter fence could include road maintenance and servicing the gen-tie interconnection. The biological assessment (Bureau 2013a) for the Soda Mountain Solar Project provides additional details on these activities.

Operation and maintenance of the proposed project would require water for potable use, dust control, panel washing, and fire protection. The applicant anticipates requiring approximately 24 acre-feet of water per year for general operation and maintenance.

Decommissioning and Site Reclamation

The project would have an anticipated economic lifespan of 30 to 40 years. Because site conditions and agency requirements may change over the course of the project lifespan, the draft decommissioning plan would be finalized prior to termination of the right-of-way authorization and be approved by the Bureau, dependent on the future use of the site. The project is planned to be operated over the full term of the right-of-way grant and beyond, pending renewal. At the end of the project's economic lifespan, structures and equipment would be removed and the land surface would be reclaimed. The draft decommissioning and closure plan (Bureau 2013b) describes the activities that would occur during decommissioning and site reclamation.

In this biological opinion, we are consulting on the issuance of the Bureau's right-of-way grant for the project, which the environmental impact statement describes as 30 years for the solar facility. We based our analysis on this assumption. If the Bureau determines that it is appropriate to extend the right-of-way grant beyond this time frame, this extension would constitute a modification of the agency action that may affect the listed species in a manner that we did not consider in this biological opinion and may necessitate re-initiation of consultation with the Service, pursuant to section 7(a)(2) of the Act (50 Code of Federal Regulations 402.16).

As previously stated, the decommissioning plan would not be finalized until closer to the time of facility closure. As proposed in the draft decommissioning and closure plan, decommissioning and site reclamation would occur in phases, allowing for minimal amounts of disturbance and requiring minimal dust control and water usage. The applicant anticipates approximately 192 acre-feet of water per year for decommissioning and site reclamation; decommissioning and site reclamation activities would take place over a 2-year period.

Minimization Measures

General Protective Measures

To minimize adverse effects to the desert tortoise, the Bureau will ensure the applicant implements the following protective measures during construction, operation, maintenance, and decommissioning activities. These measures differ to some degree from those described in the original biological assessment (Bureau 2013a) because of discussions among the Bureau, Service, and Soda Mountain Solar that occurred during the consultation process. The biological assessment (Bureau 2013a) contains more detailed descriptions of the proposed protective measures.

1. The applicant will employ authorized biologists, approved by the Service, and desert tortoise monitors to ensure compliance with protective measures for the desert tortoise. Use of authorized biologists and desert tortoise monitors will be in accordance with the most up-to-date Service guidance (currently Service 2010a) and will be required for monitoring of any construction, operation, maintenance, or decommissioning activities that may injure or kill desert tortoises. The phrases "authorized biologist" and "desert tortoise monitor," as used in this section are taken from the Service's (2010a) guidance and are defined as follows:

   a. Authorized biologists must have thorough and current knowledge of desert tortoise behavior, natural history, ecology, and physiology, and demonstrate substantial field experience and training to safely and successfully conduct their required duties. Authorized biologists are approved to monitor project activities within desert tortoise habitat and are responsible for locating desert tortoises and their sign (i.e., conduct clearance surveys). Authorized biologists must ensure proper implementation of protective measures, and make certain that the effects of the project on the desert tortoise and its habitat are minimized in accordance with the biological opinion. All incidents of noncompliance in accordance with the biological opinion must be recorded and reported.

   b. Desert tortoise monitors will be approved by the authorized biologist to monitor project activities within desert tortoise habitat, ensure proper implementation of protective measures, and record and report desert tortoises and sign observations in accordance with approved protocol. They will report incidents of noncompliance in accordance with the biological opinion, move desert tortoises from harm's way when they enter project sites and place these animals in "safe areas" pre-selected by authorized biologists or maintain the desert tortoises in their immediate possession until an authorized biologist assumes care of the animal. Desert tortoise monitors assist authorized biologists during surveys to acquire experience. Monitors should not conduct clearance surveys or other specialized duties of the authorized biologist unless the authorized biologist has determined that the monitor has demonstrated that he or she is completely capable of performing that task independently.

c. None of the proposed measures will prohibit any individual from handling a desert tortoise when necessary to ensure the safety of the animal.

2. The applicant will provide the credentials of all individuals seeking approval as authorized biologists to the Bureau. The Bureau will review these and provide the credentials of appropriate individuals to the Service for approval at least 30 days prior to the time they must be in the field.

3. The applicant will designate a field contact representative who will oversee compliance with protective measures during construction, operation, maintenance, and decommissioning activities that may result in injury or mortality of desert tortoises. If the field contact representative, authorized biologist, or desert tortoise monitor identifies a violation of the desert tortoise protective measures, they will halt work in the immediate area until the violation is corrected.

4. Authorized biologists and desert tortoise monitors will capture and handle desert tortoises in compliance with the most up-to-date Desert Tortoise Field Manual (currently Service 2009a).

5. The applicant will develop and implement an environmental awareness program for all workers (construction, operation, maintenance, and decommissioning) that will address the following: a) types of construction activities that may affect the desert tortoise, b) the required desert tortoise protective measures, c) life history of and threats to the desert tortoise, d) legal protections and penalties, and e) reporting requirements.

6. The applicant will install fencing to exclude desert tortoises from the construction right-of-way as described by the Bureau in its record of decision (the construction fence) and clear this area of all desert tortoises prior to the onset of construction. The site may be partitioned with temporary construction fencing to conduct clearance surveys in an efficient manner. Any work outside fenced areas will have clearance surveys conducted by authorized biologists.

7. Following installation of fencing, the applicant will inspect the fence line and all desert tortoise guards on a weekly basis and within 24 hours following all major rainfall events. A major rainfall event is defined as one for which flow is detectable within the fenced drainage. Any damage to the fencing will be temporarily repaired within 24 hours to keep desert tortoises out of the site. During operation of the facility, fencing and desert tortoise guards will be inspected bi-weekly and following all major rainfall events. Any damage to

the fencing will be repaired within 24 hours. The applicant will keep all desert tortoise guards free of sediment and in appropriate working order (e.g., suitable escape ramps).

8. The applicant will install shade structures at regular intervals (no greater than 100 meters apart) on the outside of the outer most fence line, whether permanent or temporary. The precise fence locations will be determined during final design and will enclose areas of project activity. Design of the shade structures will be approved by the Bureau. All permanent shade structures will be installed prior to energizing of any of the solar arrays.

9. The applicant will employ an appropriate number of authorized biologists and desert tortoise monitors to provide full coverage monitoring of construction, operation, maintenance, and decommissioning activities that occur in any unfenced work areas. Authorized biologists or desert tortoise monitors will flag all desert tortoise burrows for avoidance in areas adjacent to construction work areas.

10. The applicant will confine all construction activities, project vehicles, and equipment within the delineated boundaries of construction areas that authorized biologists or desert tortoise monitors have identified as cleared of desert tortoises. The applicant will confine all work areas to the smallest practical area, considering topography, placement of facilities, location of burrows, public health and safety, and other limiting factors. The applicant will use previously disturbed areas to the extent feasible.

11. Any non-emergency expansion of activities into areas outside of the areas considered in this biological opinion will require the Bureau's approval and desert tortoise clearance surveys. These expanded activities may require re-initiation of consultation with the Service.

12. The applicant will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas during construction, operation, maintenance, or decommissioning.

13. During operation and maintenance activities at the completed project site, the applicant will confine all vehicle parking, material stockpiles, and construction-related materials to the permanently fenced project sites and construction logistics area.

14. The applicant will confine project access to two roads for construction. Following construction, one of the roads will be revegetated and the other road will be maintained for use during operation, maintenance, and decommissioning of the facilities. The applicant will temporarily fence these roads with construction fencing prior to the onset of construction; following construction, the fencing will be removed. To reduce the potential for vehicle strikes of desert tortoises on unfenced access roads, the applicant will enforce a 15-mile-per-hour speed limit for project related travel (i.e., construction, operation, maintenance, and decommissioning) in these areas. The applicant will post speed limit signs along all access routes.

15. Project personnel who are working outside fenced areas will be required to check under vehicles or equipment before moving them. If project personnel encounter a desert tortoise, they will contact an authorized biologist. The desert tortoise will be allowed to move a safe distance away prior to moving the vehicle. Alternatively, an authorized biologist or desert tortoise monitor may move the desert tortoise to a safe location to allow for movement of the vehicle.

16. An authorized biologist or desert tortoise monitor will inspect all ground-disturbing activities (i.e., excavations and grading) that are not within construction fencing on a regular basis (several times per day) and immediately prior to filling of the excavation. If project personnel discover a desert tortoise in an open trench, an authorized biologist or desert tortoise monitor will move it to a safe location. The applicant will cover or erect construction fence around the excavations that are outside of the perimeter fence at the end of each day to prevent entrapment of desert tortoises during non-work hours.

17. Project personnel working outside the fenced areas will not move construction pipes greater than 3 inches in diameter if they are stored less than 8 inches above the ground until they have inspected the pipes to determine the presence of desert tortoises. As an alternative, the applicant may cap all such pipes before storing them outside of fenced area.

18. No pets will be allowed on site prior to or during construction, except working dogs, if used for surveys. All working dogs will remain under the control of their handlers at all times.

Management of Common Ravens

1. The applicant will contain all trash associated with the project that could serve as an attractant to predators in secure, self-closing receptacles to prevent the introduction of anthropogenic food resources for common ravens.

2. The applicant will promptly remove and dispose of (bury or disposal at a landfill) all road-killed animals on the project site or its access roads. Migratory bird carcasses will be removed from the site in accordance with the bird and bat conservation strategy (Panorama 2014c).

3. The applicant will use water for construction, operation, maintenance, and decommissioning (e.g., truck washing, dust suppression, panel washing, landscaping, etc.) in a manner that does not result in puddling or ponding of standing water for more than 4 hours.

4. The applicant will use closed tanks to store water for all project site water needs to eliminate an open water source for common ravens.

5. The applicant will monitor all potential structures on which common ravens may nest

within the right-of-way and remove nests that it identifies following authorization by the Bureau and the Service. The applicant will implement adaptive management if the proposed measures are unsuccessful.

6. The applicant will monitor facility structures to identify frequently used perching locations for common ravens. If it identifies such locations, the applicant will install bird barrier spikes or other functional equivalent following specific discussion with the Bureau and, if necessary, with the Service.

7. The applicant will provide $105 per acre of the project right-of-way area (2,942 acre BLM right-of-way) to the regional common raven management program.

8. The applicant will monitor the effectiveness of these measures during all phases of construction and for 2 years following completion of construction activities. Monitoring will include: 1) an initial raven count for the project area, 2) a quarterly inventory of ravens, during construction and biannually after construction, found on the site with an analysis of the increase, decrease or level of the population, and 3) a final report at the end of construction with a review of the raven inventory. The applicant will continue to implement the measures to reduce the attractiveness of the project to common ravens described herein throughout the life of the project; the applicant will implement adaptive management measures if management of the project is not effective in controlling common raven use of the project site. The applicant will consult with the Bureau and the Service prior to implementing adaptive management changes.

Weed Management

1. The applicant will designate an environmental compliance manager to provide oversight of construction practices and ensure compliance with weed management provisions.

2. The applicant will provide training to all personnel charged with environmental management responsibilities that will include the following: a) weed plant identification; b) effect of noxious and invasive weeds on native vegetation, wildlife, and fire activity; and c) required measures to prevent the spread of noxious and invasive weeds on the site.

3. The applicant will implement an integrated weed management plan (Bureau 2013d) to control weed infestations and the spread of noxious and invasive weeds on the project site. We have summarized the integrated weed management plan herein.

4. During construction, the applicant will perform weekly inspections during the growing season of all construction areas, access routes, and equipment cleaning facilities for the presence of noxious and invasive weeds and weed seed. Following the completion of construction activities, the applicant will continue monitoring according to the following schedule: 1) once a month during the first 2 years of the re-vegetation, 2) quarterly for the third and fourth years, 3) semi-annually for year 5 through 10, and 4) every other year and

following major rainfall events (as defined in General Protective Measure #7) for years 11 through 30, and 5) once a month for 3 years following decommissioning.

5. During operation of completed facilities, the applicant will monitor the site according to the schedule described above in Weed Management measure #4. If noxious and invasive species are found during any of the monitoring periods, the affected areas will be treated by performing weed control at least every other week during the growing season and once a month during the remainder of that year. Weed control will consist of physical or mechanical control methods (e.g., hand pulling, hoeing, etc.) or herbicide application as specified in the integrated weed management plan (Bureau 2013d). If they do not detect noxious or invasive species, the monitoring will continue per Weed Management measure #4 above.

6. The applicant will apply all herbicides used in weed treatments according to a plan approved by the Bureau, which will only be used within the permanent perimeter fence, and in accordance with the herbicide labels. The applicant will only use qualified individuals for herbicide application and will suspend herbicide use when any of the following conditions are met: a) wind velocity has the potential to carry granular or liquid herbicides off-site, b) snow or ice covers the foliage of weeds, c) precipitation is occurring or is imminent, or d) air temperatures exceed 90 degrees Fahrenheit.

7. The applicant will monitor all locations of weed treatment to ensure that treatments are effective.

8. The applicant will limit disturbance areas during construction to the minimal required to perform work and will only use defined routes when accessing work areas.

9. The applicant will use vehicle wash and inspection stations (one on each side of I-15) to wash off-road construction vehicles and delivery vehicles reaching the active construction area and will closely monitor all material brought onto the site to minimize the potential for weed introductions.

10. The applicant will identify and flag all areas of noxious and invasive weed infestation and minimize use of these areas by project personnel until weed treatment of the area has occurred.

11. After project construction, the applicant will restore areas of temporary disturbance as described in the vegetation resource management plan.

12. The applicant will preferentially perform native seed collection for restoration work from areas adjacent to the project site. When it is necessary (i.e., native seed from the surrounding area is not available for collection) to use native seeds from commercial vendors, the applicant will only accept seed that is free of non-native weed seeds.

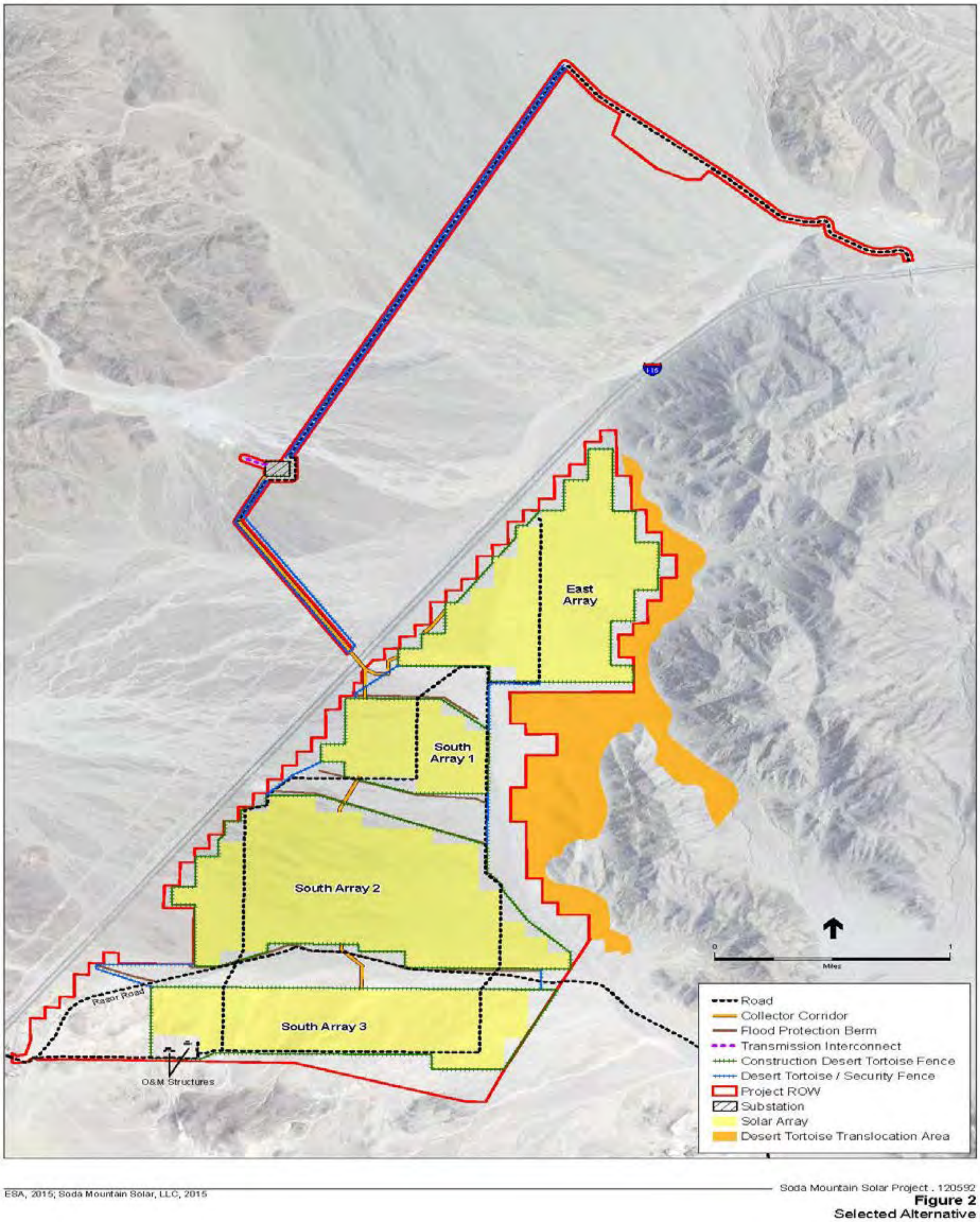

Figure 2. Translocation areas for desert tortoises.

Translocation Strategy

To minimize adverse effects associated with the project, the applicant has proposed to translocate desert tortoises from within the proposed solar facility and any other fenced areas. The Bureau would move desert tortoises to recipient sites east of the project site, as shown in Figure 2. The desert tortoise translocation plan follows the Service's (2011a) guidance. We have summarized the following description of the translocation strategy for the project from the translocation plan (Appendix D in Bureau 2013a), the Service's (2011a) translocation guidance, and modifications made to address changes in the project (i.e., removal of the North Array from the project description and elimination of the need for translocation areas north of Interstate 15). These documents contain additional details of the procedures described below.

Translocation Methods

The applicant will implement a final desert tortoise translocation plan or other documentation related to translocation that may be based on the draft plan (Appendix D in Bureau 2013a) that is consistent with Service's (2011a) guidance, or disposition plans as requested by the Service. The final plan will include all revisions deemed necessary by the Bureau and the Service that result from this consultation.

The applicant will follow the Service's (2009a) procedures to conduct clearance surveys and translocate desert tortoises; clearance surveys will occur during the desert tortoise active season. The biological assessment (Bureau 2013a) describes the data that the authorized biologist will collect during clearance surveys. Desert tortoises that appear healthy will have blood drawn to determine disease status, and will remain on site (i.e., within the fenced project site, pending results of the disease test). The applicant will regularly confirm the desert tortoise's location using radio transmitters or by visually locating them until they are removed from the project site. The applicant will monitor desert tortoises on the project site at least once per month until translocation; desert tortoises will not be held on site for longer than 18 months. If a desert tortoise is too small to carry a transmitter, the applicant will place it in an interim holding pen. At a minimum, the authorized biologist(s) will mark all desert tortoises they handle animals with unique identification numbers and collect data on the same parameters collected during the clearance surveys.

The applicant will quarantine desert tortoises showing signs of illness or injury to prevent interactions with other desert tortoises and transport them to a suitable care facility to undergo assessment, treatment, and/or necropsy; rehabilitated desert tortoises would be potentially eligible for subsequent release. Coordination with the approved care facility will occur when clearance surveys commence to facilitate prompt transport of unhealthy desert tortoises. Quarantine areas will be away from work areas and protected by exclusion fencing so desert tortoises.

Following preconstruction surveys and health evaluations, the authorized biologist will determine the number of desert tortoises to be translocated from the site and will prepare a disposition plan for each desert tortoise. Desert tortoises will be moved to the recipient area and hydrated in accordance with the most recent agency guidelines (Service 2011a). The applicant does not propose long-term monitoring of desert tortoises following translocation, but will monitor translocated individuals until the moved animals have settled and are not moving into harm's way. Authorized biologist(s) will excavate all desert tortoise burrows within the cleared area to find viable nests. If the applicant locates a viable nest, they will move it as described in the Desert Tortoise Field Manual (Service 2009a).

The applicant will conduct clearance surveys for the linear facilities at any time throughout the year. Linear facilities for this project will include the buried collector lines between arrays, and connection to the substation. The applicant will not move desert tortoises located during these surveys unless necessary to reduce the potential for injury or mortality of the individual; in most cases project personnel will allow desert tortoises to clear the site without assistance or interference. If desert tortoises are moved, they will be moved to the closest adjacent habitat.

The applicant will survey fence lines and a 30-foot-wide buffer to locate desert tortoises prior to construction of the fence according to the Service's (2009a) protocol. Desert tortoises found in the fence line survey area or spotted within 50 meters of the fence line survey area will be given a unique identifier, a visual health assessment, and be fitted with a transmitter. Desert tortoises will be moved into habitat adjacent to and outside the fence line if the individual is inside the fence line or the authorized biologist determines the individual is within harm's way. The desert tortoise will be moved into an empty burrow if clearance of the fence area takes place during winter months, outside the active season (i.e., from November to March and from June to August); desert tortoises will not be blocked in empty burrows. During the remainder of the year, the applicant will follow temperature guidelines according to the Service's (2011a) translocation guidance. Desert tortoises that are too small to accept a transmitter (i.e., if no transmitter is available that is 10 percent or less of the desert tortoise's body weight) will be marked and translocated into habitat adjacent to and outside the fence line. Unhealthy desert tortoises will be transported to a suitable care facility as described above.

If a desert tortoise that was moved out of the fence alignment moves back into the project site prior to the completion of the fence, the individual will be translocated as identified in the translocation plan and considered a translocatee. If the individual remains outside of the fence, it will be considered a resident of the area, the transmitter will be removed, and no further action will be taken.

Measures to Offset Adverse Effects to the Desert Tortoise

The Bureau will require the applicant to offset the loss of desert tortoise habitat resulting from construction, operation, and maintenance of the proposed project in accordance with the West Mojave Plan (Bureau *et al*. 2005). Compensation will include acquisition of private lands containing desert tortoise habitat and their transfer to the Bureau, implementation of habitat enhancement and rehabilitation projects on public land, or some combination of these actions. The Bureau estimates that 2,059 acres of suitable desert tortoise habitat would be required to offset the loss of desert tortoise habitat caused by the project (Childers 2015). The compensation lands will be located within the Western or Eastern Mojave recovery units, as defined in the recovery plan for the desert tortoise (Service 2011b); however, the specific locations of these lands are currently unknown.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02).

The jeopardy analysis in this biological opinion relies on four components: 1) the Status of the Species, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; 2) the Environmental Baseline, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the desert tortoise; 3) the Effects of the Action, which determine the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the desert tortoise; and 4) the Cumulative Effects, which evaluate the effects of future, non-federal activities in the action area on the desert tortoise.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the current status of the desert tortoise, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the desert tortoise in the wild.

STATUS OF THE DESERT TORTOISE

Section 4(c)(2) of the Endangered Species Act requires the Service to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether the species' status has changed since it was listed or since the most recent 5-year review; these reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species (Service 2010a). We are incorporating the 5-year review by reference to provide most of the information for this section of the biological opinion. The 5-year review is available at
http://ecos.fws.gov/docs/five_year_review/doc3572.DT%205Year%20Review_FINAL.pdf

The following paragraphs provide a summary of the relevant information in the 5-year review and information updated since publication of the 5-year review:

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the five-factor analysis required by section 4(a)(1) of the Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994 and 2011b, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 Federal Register 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

In the 5-year review, the Service summarizes information with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long lived, require up to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings.

In the 5-year review, the Service also discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. Due to differences in area covered and especially to the non-representative nature of earlier sample sites, data gathered by the Service's current rangewide monitoring program cannot be reliably compared to information gathered through other means at this time.

The rangewide monitoring that the Service initiated in 2001 is the first comprehensive attempt to determine the densities of desert tortoises across their range. The Desert Tortoise Recovery Office (Service 2014b) used annual density estimates obtained from this sampling effort to evaluate rangewide trends in the density of desert tortoises over time. This analysis indicates that densities in the Northeastern Mojave Recovery Unit have increased by approximately 13.6 percent per year since 2004, with the rate of increase apparently resulting from increased survival of adults and subadults moving into the adult size class. The analysis also indicates that the populations in the other 4 recovery units are declining: Upper Virgin River (-5.1 percent), Eastern Mojave (-6.0 percent), Western Mojave (-8.6 percent), and Colorado Desert (-3.4 percent; however, densities in the Joshua Tree and Piute Valley conservation areas within this unit seem to be increasing). Figure 3 shows linear trends in the log-transformed densities in each desert tortoise conservation area by recovery unit. Data for the Upper Virgin River Recovery Unit are from 1999 to the present; data for all other recovery units are from 2004 to the present.

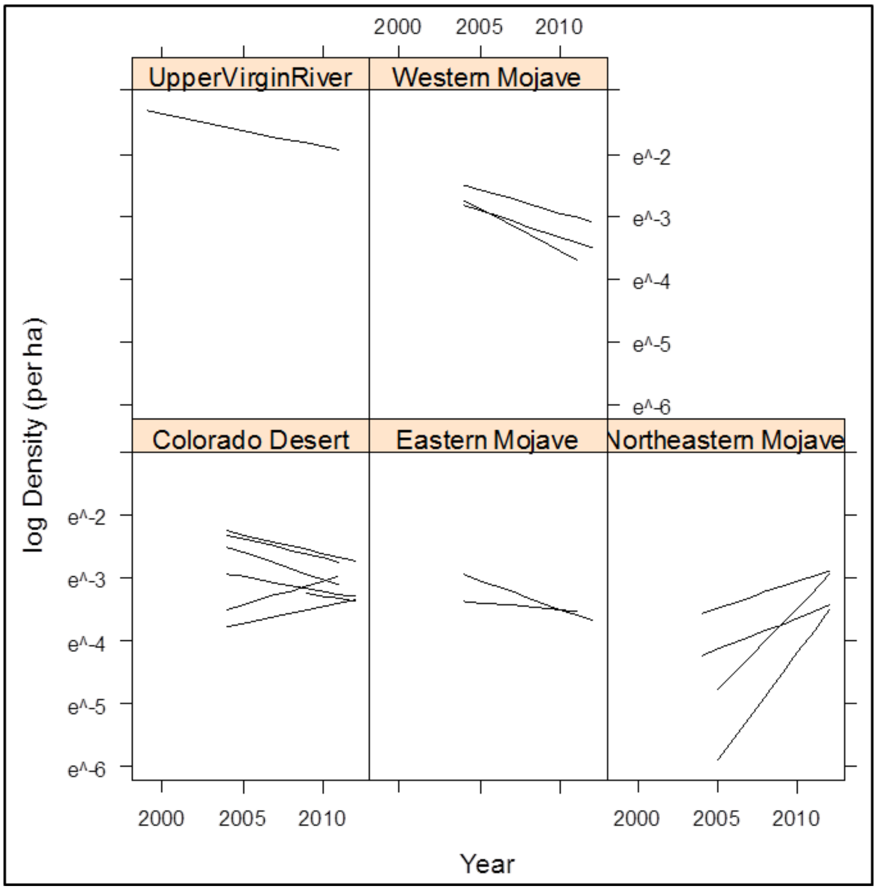

Figure 3. Rangewide trends in the density of desert tortoises.

Allison (2013) also evaluated changes in size distribution of desert tortoises since 2001. In the Western Mojave and Colorado Desert recovery units, the relative number of juveniles to adults indicates that juvenile numbers are declining faster than adults. In the Eastern Mojave, the number of juvenile desert tortoises is also declining, but not as rapidly as the number of adults. In the Upper Virgin River Recovery Unit, trends in juvenile numbers are similar to those of adults; in the Northeastern Mojave Recovery Unit, the number of juveniles is increasing, but not as rapidly as are adult numbers in that recovery unit. Juvenile numbers, like adult densities, are responding in a directional way, with increasing, stable, or decreasing trends, depending on the recovery unit where they area found.

In this context, we consider "juvenile" desert tortoises to be animals smaller than 180 millimeters in length. The Service does not include juveniles detected during rangewide sampling in density estimations because they are more difficult to detect and surveyors frequently do not observe them during sampling. However, this systematic rangewide sampling provides us with an opportunity to compare the proportions of juveniles to adults observed between years.

In the 5-year review, the Service provides a brief summary of habitat use by desert tortoises; the revised recovery plan contains more detailed information (Service 2011b). In the absence of specific and recent information on the location of habitable areas of the Mojave Desert, especially at the outer edges of this area, the 5-year review also describes and relies heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2005 rangewide monitoring surveys (Nussear *et al.* 2009). The model predicts the probability that desert tortoises will be present in any given location; calculations of the amount of desert tortoise habitat in the 5-year review and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

To begin integrating anthropogenic activities and the variable risk levels they bring to different parts of the Mojave and Colorado deserts, the Service completed an extensive review of the threats known to affect desert tortoises at the time of their listing and updated that information with more current findings in the 5-year review. The review follows the format of the five-factor analysis required by section 4(a)(1) of the Act. The Service described these threats as part of the process of its listing (55 Federal Register 12178; April 2, 1990), further discussed them in the original recovery plan (Service 1994), and reviewed them again in the revised recovery plan (Service 2011b).

To understand better the relationship of threats to populations of desert tortoises and the most effective manner to implement recovery actions, the Desert Tortoise Recovery Office is developing a spatial decision support system that models the interrelationships of threats to desert tortoises and how those threats affect population change. The spatial decision support system describes the numerous threats that desert tortoises face, explains how these threats interact to affect individual animals and habitat, and how these effects in turn bring about changes in populations. For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens, known predators of desert tortoises, use the transmission line's pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011b). Changes in the abundance of native plants because of invasive weeds can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation. The spatial decision support system allows us to map threats across the range of the desert tortoise and model the intensity of stresses that these multiple and combined threats place on desert tortoise populations.

The threats described in the listing rule and both recovery plans continue to affect the species. Indirect effects to desert tortoise populations and habitat occur in accessible areas that interface with human activity. Most threats to the desert tortoise or its habitat are associated with human land uses; research since 1994 has clarified many mechanisms by which these threats act on desert tortoises. As stated earlier, increases in human access can accelerate illegal collection and release of desert tortoises and deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive weeds.

Some of the most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects, and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, and habitat invasion by non-native invasive plant species. However, we remain unable to quantify how threats affect desert tortoise populations. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy *et al.* 2004).

The following map depicts the 12 critical habitat units of the desert tortoise, linkages between conservation areas for the desert tortoise, and the aggregate stress that multiple, synergistic threats place on desert tortoise populations (Figure 4). Conservation areas include designated critical habitat and other lands managed for the long-term conservation of the desert tortoise (e.g., the Desert Tortoise Natural Area, Joshua Tree National Park, and the Desert National Wildlife Refuge). The revised recovery plan (Service 2011b) recommends connecting blocks of desert tortoise habitat, such critical habitat units and other important areas to maintain gene flow between populations. Linkages defined using least-cost path analysis (Averill-Murray *et al.* 2013) illustrate a minimum connection of habitat for desert tortoises between blocks of habitat and represent priority areas for conservation of population connectivity. This map illustrates that, across the range, desert tortoises in areas under the highest level of conservation management remain subject to numerous threats, stresses, and mortality sources.

Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and desert wildlife management areas that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoise during the construction of the projects, such as translocation of affected individuals. In aggregate, these projects would result in an overall loss of approximately 37,503 acres of habitat of the desert tortoise. We also predicted that the project areas supported up to 3,483 desert tortoises; we concluded that most of these individuals were small desert tortoises, that most large individuals would likely be translocated from project sites, and that most mortalities would be small desert tortoises that were not detected during clearance surveys. To date, 560 desert tortoises have been observed during construction of projects; most of these individuals were translocated from work areas, although some desert tortoises have been killed (see Appendix 1). The mitigation required by the Bureau and California Energy Commission, the agencies permitting these facilities, will result in the acquisition of private land and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. Although most of these mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise and the Service continues to support their implementation, we cannot assess how desert tortoise populations will respond because of the long generation time of the species.

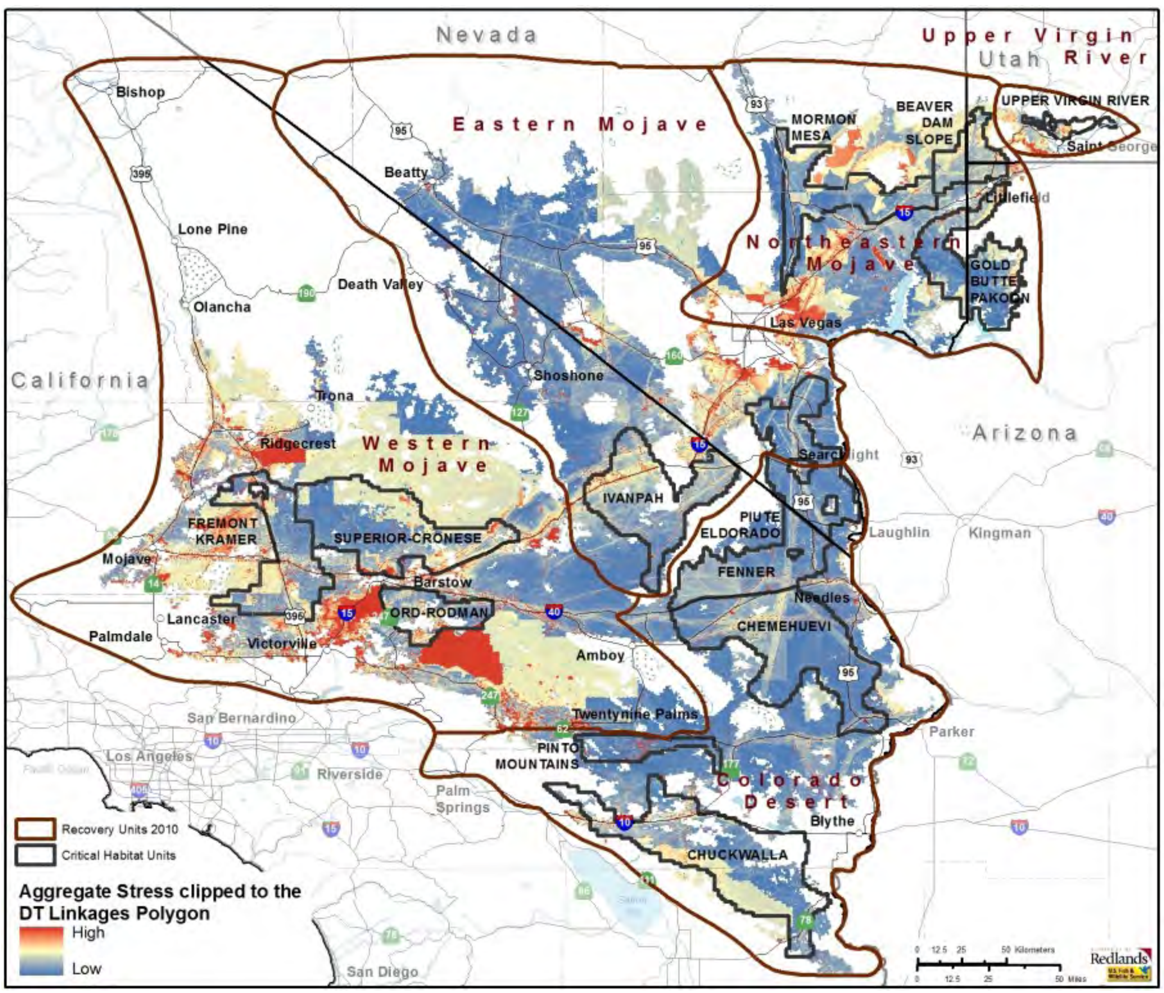

Figure 4. Critical habitat units of the desert tortoise, linkages between conservation areas for the desert tortoise, and the aggregate stress that multiple, synergistic threats place on desert tortoise populations.

In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012a) also issued a biological opinion to the Department of the Army for the use of additional training lands at Fort Irwin. As part of this proposed action, the Department of the Army removed approximately 650 desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training. The Department of the Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises.

The Service also issued a biological opinion to the U.S Marine Corps that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2012b). We concluded that the Marine Corps' proposed action, the use of approximately 167,971 acres for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-highway Vehicle Management Area.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin, and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and Federal, State, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Although land managers have been implementing measures to manage these threats, we have been unable, to date, to determine whether the measures have been successful, at least in part because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010a), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses." Oftedal's work (2002 in Service 2010a) suggests that invasive weeds may adversely affect the physiological health of desert tortoises. Current information indicates that invasive species likely affect a large portion of the desert tortoise's range (Figure 5). Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

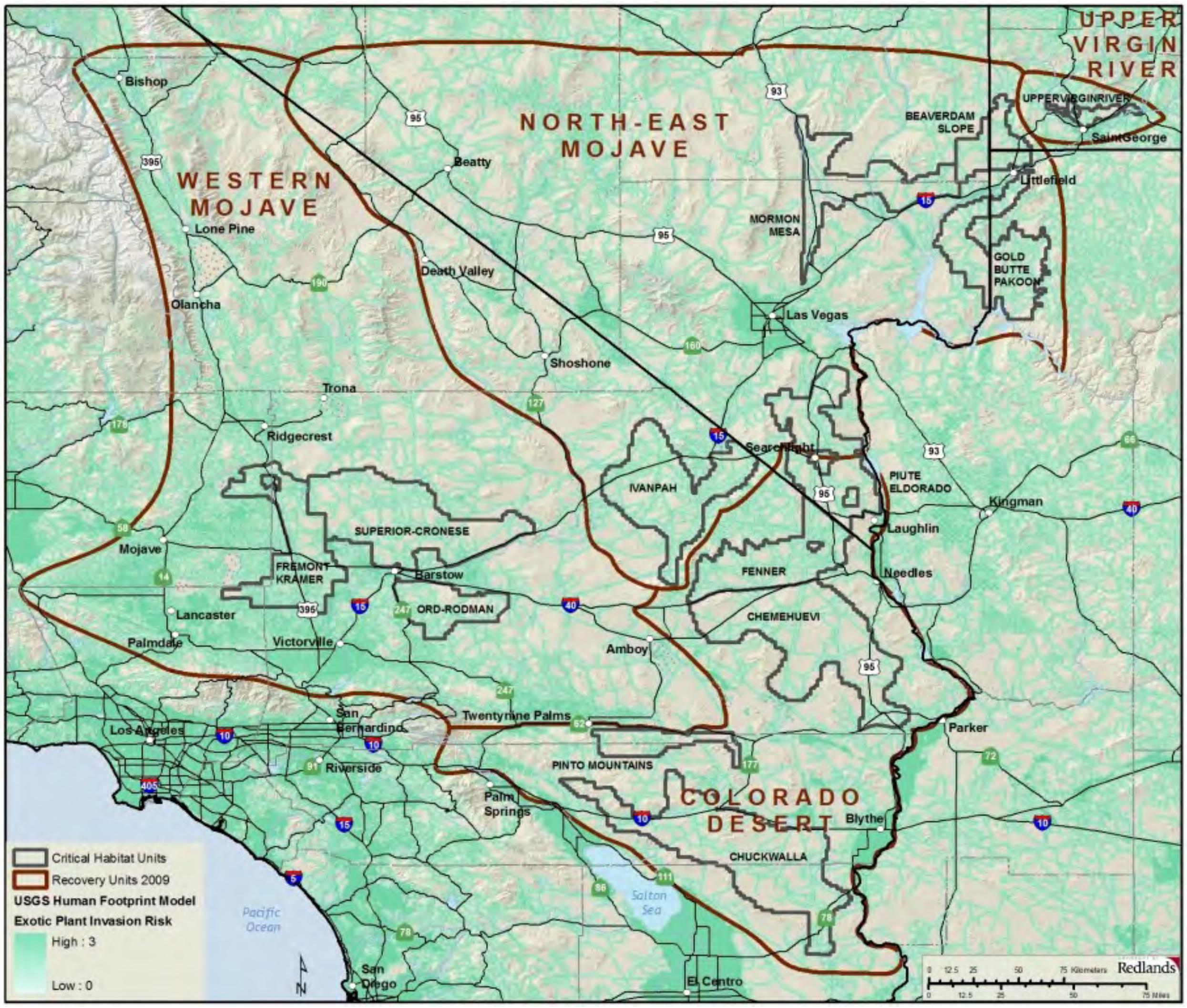

Figure 5. Invasion risk of non-native invasive plant species within the range of the desert tortoise.

Global climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen *et al.* 2007 in Service 2010a]). Precipitation will likely decrease by 5 to 15 percent annually in the region with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by up to 5 percent. Because germination of the desert tortoise's food plants is highly dependent on cool-season rains, the forage base could be reduced due to increasing temperatures and decreasing precipitation in winter. Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore *et al.* (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises. Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible.

The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to achieve recovery. When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 Code of Federal Regulations 402.02). Although the Service does not explicitly address these metrics in the 5-year review, we have used the information in that document to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal 2002 in Service 2010a), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal *et al.* 2002; Tracy *et al.* 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

Data from small-scale study plots (e.g., 1 square mile) established as early as 1976 and surveyed primarily through the mid-1990s indicate that localized population declines occurred at many sites across the desert tortoise's range, especially in the western Mojave Desert; spatial analyses of more widespread surveys also found evidence of relatively high mortality in some parts of the range (Tracy *et al.* 2004). Although population densities from the local study plots cannot be extrapolated to provide an estimate of the number of desert tortoises on a range wide basis, historical densities in some parts of the desert exceeded 100 adults in a square mile (Tracy *et al.* 2004). The Service (2010a) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly."

The Desert Tortoise Recovery Office (Service 2014b) applied estimated densities within desert tortoise conservation areas surveyed during rangewide monitoring since 2004 to the estimated acreages of remaining habitat (see Table 3) within each recovery unit to estimate the change in numbers of individuals greater than 180 millimeters in carapace length (Table 2). This calculation assumes that densities inside the surveyed conservation areas are similar to densities in habitat outside these areas, but any bias will be less than would have resulted from applying densities from much smaller study plots to the entire range. Although we presume densities are generally higher within conservation areas, we consider this a reasonable way to describe overall changes in the population given the lack of broad-scale data outside the conservation areas.

Table 2. Estimated number of desert tortoises greater than 180 millimeters in length in each recovery unit.

Recovery Units	**2004**	**2012**	**Change**	**Percentage of Change**
Western Mojave	152,967	76,644	-76,323	-50
Colorado Desert	111,749	85,306	-26,443	-24
Northeastern Mojave	13,709	40,838	+27,129	+198
Eastern Mojave	68,138	42,055	-26,083	-38
Upper Virgin River	12,678	8,399	-4,280	-34
Total	359,242	253,242	-106,000	-30

Table 3. Acreages of habitat (as modeled by Nussear *et al.* 2009, using only areas with a probability of occupancy by desert tortoises greater than 0.5 as potential habitat) within various regions of the desert tortoise's range and of impervious surfaces as of 2006 (Fry *et al.* 2011); calculations are by Darst (2014). All units are in acres.

Recovery Units	**Modeled Habitat**	**Impervious Surfaces* (percentage in parentheses)**	**Remaining Modeled Habitat**
Western Mojave	7,585,312	1,989,843 (26)	5,595,469
Colorado Desert	4,950,225	510,862 (10)	4,439,363
Northeastern Mojave	3,012,293	386,182 (13)	2,626,111
Eastern Mojave	4,763,123	825,274 (17)	3,937,849
Upper Virgin River	231,460	84,404 (36)	147,056
Total	20,542,413	3,796,565 (18)	16,745,848

* Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises.

The distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 (Service 2010a) in terms of the overall extent of its range. Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow and Lancaster, California; Las Vegas, Nevada; and St. George, Utah; etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g., portions of off-road management areas managed by the Bureau and unauthorized use in areas such as east of California City, California). Since 1994, urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range. Desert tortoises have been essentially removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012a).

In conclusion, we have used the 5-year review (Service 2010a), revised recovery plan (Service 2011b), and additional information that has become available since these publications to review the reproduction, numbers, and distribution of the desert tortoise. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species. Prior to its listing, the number of desert tortoises likely declined range wide, although we cannot quantify the extent of the decline; since the time of listing, data suggest that declines continue to occur throughout most of the range, although recent information suggests that densities may have increased in the Northeastern Mojave Recovery Unit. The continued increase in human access across the desert continues to expose more desert tortoises to the potential of being killed by human activities. The distributional limits of the desert tortoise's range have not changed substantially since the issuance of the original recovery plan in 1994; however, desert tortoises have been extirpated from large areas within their range (e.g., Las Vegas, other desert cities). The species' low reproductive rate, the extended time required for young animals to reach breeding age, and the multitude of threats that continue to confront desert tortoises combine to render its recovery a substantial challenge.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "environmental baseline" as the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The action area is the basis of subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take.

For the purposes of this biological opinion, we consider the action area to be the 2,942-acre project right-of-way, the Los Angeles Department of Water and Power switchyard, access routes from I-15, and the recipient sites for translocated desert tortoises. The total size of the action area with all features included is approximately 7,500 acres.

The Bureau (2013a) has determined that the proposed action would have no effect on critical habitat of the desert tortoise.

Habitat Characteristics of the Action Area

The following information provides a summary of the discussion of habitat characteristics from the biological assessment (Bureau 2013a) for the Soda Mountain Solar Project. The proposed solar site is located in a desert valley that is generally bounded in all directions by the Soda Mountains. The proposed project area consists of large, alluvial fans with cobble substrate that extend from upper elevations within the Soda Mountains. Sandy areas with little or no cobble occur within the eastern and southern portions of the area. Desert pavement is also common within the southern portion of the project area. Friable soils are generally present within the eastern portion of the project site, adjacent to the South Soda Mountains. Elevations within the project area range from approximately 1,200 feet above mean sea level to 1,600 feet above mean sea level.

The project site comprises three primary plant communities. Most of the project site shows sparse coverage with creosote bush-white bursage scrub, with creosote bush scrub and cheesebush scrub as other prominent communities. The creosote bush-white bursage scrub community covers approximately 97 percent of the study area. Creosote bush scrub comprises less than 1 percent of the project area. A large wash that runs southwest to northeast through the project area in the South and East arrays supports cheesebush scrub; this habitat is confined to the wash. Areas of development and existing unpaved roads occur in the eastern portion of the project area.

All portions of the action area contain habitat features that the U.S. Geological Survey has mapped as conducive to desert tortoise occupancy (Nussear *et al*. 2009).

Existing Conditions in the Action Area

In this section, we discuss the anthropogenic and natural conditions in the action area as they relate to the desert tortoise and its habitat. Unless we have noted otherwise by citing a biological opinion, the anthropogenic conditions present in the action area were constructed or instituted prior to the listing of the desert tortoise.

Land Use

The project site is located primarily within a Federal utility corridor that consists of public lands managed by the Bureau. The lands in the vicinity of the site are primarily undeveloped with the exception of utility corridors that are described below. Portions of the action area occupy areas designated multiple-use Class L (“Limited”), Class M (“Moderate”), and Class I (“Intensive”) in the California Desert Conservation Area Plan. No wilderness areas, areas of critical environmental concern, desert wildlife management areas, or wildlife habitat management areas occur within or adjacent to the action area.

The Service (2006) issued a biological opinion to the Bureau regarding the effects of its amendment to the California Desert Conservation Area Plan for the western Mojave Desert on the desert tortoise and its critical habitat. The Bureau's proposed action was a substantial revision of the California Desert Conservation Area Plan, with the fundamental goal of adopting numerous management prescriptions that were intended to promote the recovery of the desert tortoise. The Service concluded that the Bureau's amendment of the plan was not likely to jeopardize the continued existence of the desert tortoise or adversely modify its critical habitat because the vast majority of changes addressed in the amendment reduced the intensity of use and were protective of the desert tortoise.

Paved and Unpaved Roads

The action area is south and east of I-15; however, the interstate is not part of the action area. I-15 has likely caused some reduction in the number of desert tortoises in the action area, both as a result of its construction and ongoing traffic. The construction of I-15 resulted in the loss of hundreds of acres of habitat and the likely degradation of additional areas as sheet flow across the valley's alluvial fans was disrupted. We also expect that desert tortoise densities adjacent to the freeway are depressed, as discussed by Hoff and Marlow (2002), but we are not aware of surveys that quantify the effect of interrupted sheet flow.

The action area south of I-15 includes the unpaved Rasor Road and Arrowhead Trail. Rasor Road provides access to the Rasor Off-Highway Vehicle Management Area to the south and east of the proposed project site; access via Rasor Road would still be open to the public. The Arrowhead Trail extends north from Rasor Road in the eastern portion of the action area.

Non-native Species

Within the action area, the overall prevalence of invasive species is low, with the exception of Sahara mustard (*Brassica tournefortii*), which was documented at near-infestation levels on loose sandy soils within the southern portion of the proposed project area. Other invasive plant species identified in the action area include Mediterranean splitgrass (*Schismus* sp.), red brome (*Bromus madritensis* ssp. *rubens*), cheatgrass (*B. tectorum*), redstem filaree (*Erodium cicutarium*), Mediterranean barley (*Hordeum murinum*), crystalline iceplant (*Mesembryanthemum crystallinum*), five-stamen tamarisk (*Tamarix chinensis*), and rattail fescue (*Vulpia myuros*).

Utilities

Several utilities are located within the action area including a fiber optic line, two transmission lines, a distribution line, telephone line, fuel pipeline, and a cellular tower. Portions of the project site are located within a designated utility corridor adjacent to I-15. A distribution line and telephone line run parallel and adjacent to the western edge of I-15. A 115-kilovolt transmission line and a 500 kilovolt-transmission line run parallel to and adjacent to the western perimeter of the action area; these lines are operated by Southern California Edison and the Los Angeles Department of Water and Power, respectively.

The construction of the numerous tower sites for the transmission lines disturbed or destroyed habitat. An unpaved road runs parallel to the power lines and provides access to utility company workers and the public; spur roads extend from this road to each tower. The main and spur roads have likely caused more habitat loss than the tower sites. The use of these roads, by workers and the public, likely results in ongoing injury and death of desert tortoises; the deaths of desert tortoises related to use of access roads within utility corridors have been documented. For example, on April 13, 2013, a desert tortoise that had been struck by a utility vehicle was found along the El Dorado to Ivanpah transmission line route in Nevada. In one case in the western Mojave Desert near Daggett, a desert tortoise bearing a radio transmitter was buried alive by a utility company maintaining the access road. In the spring of 2011, at least two desert tortoises were crushed by vehicles using utility line access roads; based on the use patterns of the utility company at the time, these desert tortoises seem to have been killed by casual users of the access roads. Most of deaths that result from use of the access roads for utility lines are likely not detected; however, these instances demonstrate that access roads within utility corridors pose an ongoing threat to desert tortoises.

As described above, the Los Angeles Department of Water and Power's transmission line traverses the western boundary of the proposed solar facility; the Service issued a biological opinion to the Bureau for this line in 1991 (Service 1991). The Service (1993) amended this biological opinion to eliminate the limit for the number of desert tortoises that could be moved from harm's way during construction, operations, and maintenance of the transmission line. The Service concluded in the 1991 biological opinion and subsequent amendment that the project was not likely to jeopardize the continued existence of the desert tortoise or adversely modify its critical habitat.

A substantial ongoing effect of electrical power lines is their use by common ravens for perching and nesting. The presence of this additional nesting substrate, which allows common ravens to nest far above the reach of ground-dwelling predators, likely contributes substantially to the increase in the number of common ravens in the desert. As previously discussed, common ravens prey on desert tortoises and are likely detrimental to their recovery.

The Calnev pipeline corridor supports two existing pipelines that run parallel and adjacent to the eastern perimeter of the proposed north array and land to the southwest within the project site. The installation of the existing pipelines resulted in the disturbance of habitat within the right-of-way. Ongoing maintenance contributes to periodic disturbance in the right-of-way; ongoing use of the access road likely contributes to continuing mortality of desert tortoises, as we discussed previously in this section.

Rail Lines

The Service and Federal Railroad Administration have completed formal consultation on the Desert Xpress High-Speed Train Project from Victorville, California to Las Vegas, Nevada (2011c). The rail line would be located west of and adjacent to Interstate 15. The components of the rail alignment would include a 75-foot-wide permanent right-of-way, concrete barriers, overhead electrical distribution and transmission lines, fencing, and access and maintenance areas. This rail line would cross washes in the action area with bridges; the design plan includes numerous culverts and overcrossing structures to allow washes to pass under the rail line. The Service concluded that the DesertXpress project is not likely to jeopardize the continued existence of the desert tortoise or adversely modify its critical habitat.

Status of the Desert Tortoise in the Action Area

The Service's (2010c) protocol is effective at detecting desert tortoises larger than 180 millimeters in length. We have determined, through work conducted during range-wide sampling, that field workers detect desert tortoises that are 180 millimeters in length or longer more readily than they do small individuals. For the purposes of the analysis in this biological opinion, we will refer to desert tortoises 180 millimeters and greater in length as large animals and desert tortoises less than 180 millimeters in length as small animals.

Desert tortoises reach reproductive age (i.e., become adults) at different sizes in different parts of their range. The likelihood of being detected during surveys is a function of size and not reproductive capacity; therefore, we will not use the terms "adult" and "subadult" in this biological opinion unless we are discussing reproduction.

Estimates for Desert Tortoises Larger than 180 Millimeters

We summarized the following information from the biological assessment (Bureau 2013a). In 2009, URS conducted desert tortoise surveys within the action area based on the Service's (1992, 2009b) field survey protocol. Kiva Biological Consulting conducted subsequent surveys in 2013 using the Service's updated field survey protocol (Service 2010c). The following table summarizes the results of the desert tortoise surveys conducted in 2009 and 2013 (Appendix A and B in Bureau 2013a, respectively).

Table 4. Results of desert tortoise surveys conducted in the action area.

Survey	Live Desert Tortoises	Scat	Burrows	Carcasses
2009	0	0	0	0
2013	1	6	23	5

These results indicate desert tortoises occur at low densities in the action area. Survey results indicate desert tortoises occur intermittently and in low densities in the East Array areas. Desert tortoise sign was moderately widespread in the East Array, particularly at the foot of the mountains to the east. Surveyors found two carcasses south of the desert tortoise recipient area. Desert tortoise sign was not detected within the South Array. No sign has been located near the freeway.

Kiva Biological Consulting used the equation contained in the Service's (2010c) protocol to derive estimates of the number of large desert tortoises within the project site and the lower and upper 95 percent confidence intervals for the Soda Mountain Solar facility. The equation derived an estimate of 2 desert tortoises occurring in the action area with a lower and upper 95 percent confidence interval of 0.39 to 10.28, respectively (Bureau 2013a). Use of the upper 95 percent confidence interval for the number of desert tortoises within the project area provides for a conservative estimate of the number of large individuals predicted within the actual project area. We will use the upper 95 percent confidence interval as a basis upon which to conduct the analysis of effects in this biological opinion because it is the maximum number of desert tortoises likely to be present.

This estimate described above was based on the project design analyzed in our December 19, 2014 (Service 2014c), which included a solar array west of Interstate 15 that is no longer part of the proposed project. We do not anticipate that elimination of this array requires a reassessment of the population estimate for the solar site because no desert tortoises, burrows, or scat were located within the project right-of-way west of Interstate 15 and virtually all live desert tortoises and desert tortoise sign located during surveys were found on or immediately adjacent areas of the East Array that are part of the currently proposed project site. Therefore, we will use the estimates provided in the previous paragraph in the analysis that follows.

Estimates for Desert Tortoises Smaller than 180 Millimeters

Desert tortoises less than 180 millimeters in length (including hatchlings) are difficult to detect because of their small size and their cryptic nature. Hatchlings may also have emerged from a nest on the site since the time of the survey; this scenario could also increase the overall number of individuals on the site. We did not attempt to estimate the numbers of eggs that may be present because viable eggs are not present during a portion of the year and we would need to use several other assumptions to reach such an estimate.

Table 5. Estimated number of desert tortoises in the action area.

Size Class of Desert Tortoise (millimeters)	Estimated Number of Desert Tortoises (individuals)	Rationale for the Number
>180	10	We used the upper 95 percent confidence limit based on the number of desert tortoises found during protocol surveys.
<180	68	We used a life table to calculate the total number of animals based on the number of larger desert tortoises and then the number smaller than 180 millimeters.
Total	78	

We used the Service's general methodology for estimating the number of small desert tortoises in the project area. Table 5 summarizes the upper 95 percent confidence intervals for the estimates of the number of desert tortoises in the project area. As a basis upon which to conduct the analysis of effects in this biological opinion, we will use the numbers in the following table. The table also contains the reason that we chose the numbers; details of our calculations are in Appendix 2.

The methodology is based on the assumption that the life table developed by Turner *et al*. (1987) is applicable. (Turner *et al*. developed a life table based on work they conducted near Goffs, California, which is located approximately 66 miles southeast of the action area.) We emphasize that, although the estimate of the number of desert tortoises on the project site is based on the best available information, the overall number of animals may be different. The demographic structure of the desert tortoise population on the Goffs study site may have been different in the early 1980s than that currently on the project site because of the declines that have occurred since that time; consequently, use of the Goffs data may overestimate the actual number of smaller desert tortoises within the project area. Furthermore, we recognize that the survey data used for these estimates represent a single point in time and the number of individuals in these areas may change by the onset of project activities, environmental conditions, and other anthropogenic and natural processes.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. In the following analysis, we considered the general manner in which the proposed action may affect desert tortoises and then evaluated the specific components of the proposed action. We conducted the analysis based on the current conditions in the action area as we described in the Environmental Baseline section of this biological opinion. In the Conclusion section of the biological opinion, we considered the overall effects of the proposed action on the reproduction, numbers, and distribution of the desert tortoise.

Effects Associated with Capture and Translocation of Desert Tortoises

The first step in the translocation of desert tortoises involves their capture. In some cases, the authorized biologists may find the animals above ground or near the mouth of their burrow. In such cases, authorized biologists can easily pick up the desert tortoise and transfer it to a container for transport. If desert tortoises are deeper in their burrows, the authorized biologists would excavate the burrow; we expect that excavating desert tortoises from deep in their burrows is likely more stressful for them than being captured on the surface of the ground.

The capture and holding of desert tortoises can subject them to stress; stressed desert tortoises occasionally void their bladders. Desert tortoises store water in their bladders; this water is important to desert tortoises, particularly during times of low rainfall, in maintaining their life functions. Consequently, desert tortoises that void their bladders are at an increased risk of dying after their release; Averill-Murray (2002) found that desert tortoises that urinated during handling had lower survival rates than those that did not. To offset this effect, the Bureau and the applicant have proposed to hydrate desert tortoises prior to their release according to the Service's protocol. Because the Bureau and the applicant would employ qualified biologist, we expect that the capture and transport of desert tortoises is unlikely to kill or injure any individuals.

We acknowledge that, in every phase of implementation of the proposed action, desert tortoises are at risk of being killed or injured when workers (including authorized biologists and biological monitors) drive outside of areas that have been fenced and cleared of desert tortoises. As in many cases, small desert tortoises are at greater risk than larger animals. We are aware of desert tortoises that have been crushed by the vehicles of biologists working on translocations; both resident and translocated animals are vulnerable.

Boarman (2002), in a review of literature on threats to the desert tortoise, stated that the adverse effects of translocation include increased risk of mortality, spread of disease, and reduced reproductive success. The tendency for translocated desert tortoises to spend more time above ground, moving through their environment, than animals within their home ranges exacerbates at least some of these threats. Recent research, using comparisons among resident desert tortoises (animals within their home ranges with translocated individuals nearby) and control desert tortoises (animals within their home ranges with no translocated individuals nearby), has provided substantial information on this issue. We will evaluate the potential effects of translocation on desert tortoises in the following paragraphs.

Field *et al*. (2007), Nussear (2004), and Nussear *et al*. (2012) have found that translocated animals seem to reduce movement distances following their first post-translocation hibernation to a level that is not significantly different from resident populations. As time increases from the date of translocation, most desert tortoises change their movement patterns from dispersed, random patterns to more constrained patterns, which indicate an adoption of a new home range (Nussear 2004). Walde *et al*. (2011) found that movement patterns of desert tortoises translocated from Fort Irwin differed from those of animals studied elsewhere but describe their results as "apparent trends" because they have not completed analyses to determine if these trends were statistically significant. Translocated animals moved greater distances than residents and controls through the 4 years of their study. Desert tortoises that were translocated short distances moved much shorter distances than those that were translocated long distances. The movements of resident desert tortoises were similar to those of controls.

After translocation, we expect that translocated animals would spend more time moving, at least during the first year, which means they would be more vulnerable to predators, adverse interactions with other desert tortoises, and weather conditions than resident animals. For example, in spring 2013, biologists translocated 108 large and 49 small desert tortoises from approximately 2,000 acres of the KRoad Moapa Solar Project on the Moapa River Indian Reservation northeast of Las Vegas; they also monitored 18 large desert tortoises as controls or residents. Extremely high temperatures during the summer may have killed two or more large translocated desert tortoises. Predators likely killed eight small translocated desert tortoises. No resident or control desert tortoises have died during monitoring (Burroughs 2013). During the first year of increased movement, desert tortoises would also be more likely to engage in fence-pacing behavior, which can lead to hyperthermia and death.

As we previously discussed, we expect that translocated desert tortoises would spend more time moving around. Because translocated desert tortoises spend more time moving, individuals that are moved during the summer months outside of their active season (i.e., from June to August) could be overexposed to heat and die from hyperthermia. Cook *et al*. 1978 (in Nussear *et al*. 2012) stated summer releases have previously been reported to be potentially lethal to translocated desert tortoises, often with high mortality within days of release. We expect desert tortoises translocated during the summer months are more likely to die.

Hinderle *et al*. (2015) found that almost half of desert tortoises translocated 2 kilometers returned to their capture site; only one desert tortoise moved 5 kilometers returned to the capture site and no desert tortoises returned home from 8 kilometers away. The propensity for desert tortoises to attempt to return to their capture site would increase the likelihood that they would encounter an exclusion fence and pace it until they are attacked by predators or exposed to extreme weather.

As with other translocations (Nussear 2004, Field *et al*. 2007), we anticipate that predation is likely to be the primary source of post-translocation mortality. The level of winter rainfall may dictate the amount of predation observed in desert tortoises (Drake *et al*. 2010, Esque *et al*. 2010). Drake *et al*. (2010) documented a statistically significant relationship between decreased precipitation and increased predation of translocated desert tortoises at Fort Irwin. We are aware of two instances where monitoring of large numbers of control and resident desert tortoises accompanied the translocation of desert tortoises (Fort Irwin and Ivanpah Solar Electric Generating System). At Fort Irwin, Esque *et al*. (2010) found that “translocation did not affect the probability of predation: translocated, resident, and control tortoises all had similar levels of predation.” At the Ivanpah Solar Electric Generating System, the numbers of translocated, resident, and control desert tortoises that have died since the onset of work at the Ivanpah Solar Electric Generating System are roughly equal (Davis 2014), which seems to indicate that translocation is not a factor in these mortalities; among translocated, resident, and control animals, predation by canids is the greatest source of mortality.

Drought conditions seem to affect translocated and resident desert tortoises similarly. Field *et al*. (2007) noted that studies from various sites “suggest that all (desert) tortoises at the (Large-scale Translocation Site) site, regardless of translocated or resident status, likely were adversely affected by drought conditions at the site in 1997. Field *et al*. (2007) noted that most of the translocated desert tortoises “quickly became adept at life in the wild,” despite the harsh conditions. Consequently, we have concluded that the amount of rainfall preceding translocation is not likely to decrease the survival rate of desert tortoises that would be moved from within the area of the proposed solar facility.

Nussear *et al*. (2012) investigated the effects of translocation on reproduction in 120 desert tortoises. They found that, in the first year since translocation, the mean reproductive effort for translocated desert tortoises was slightly less than that of residents. Nussear *et al*. (2012) noted that the translocated animals may have benefited from being fed while in the pre-translocation holding facility; the food provided in the facility may have increased their production of eggs in the first year after translocation. In the second and third years after translocation, the mean number of eggs was not different between resident and translocated desert tortoises.

Translocating desert tortoises may also adversely affect resident desert tortoises within the action area due to local increases in density. Increased densities may result in increased incidence of aggressive interactions between individuals, increased competition for available resources, increased incidence of predation that may not have occurred in the absence of translocation, and increased spread of upper respiratory tract disease or other diseases.

We anticipate that density-dependent effects on resident populations are likely to be minor for the following reasons. First, the action area contains few desert tortoises; therefore, few animals are likely to be moved during construction. Second, the applicant will restrict the number of large desert tortoises released in translocation areas to 2.15 individuals per square mile (Bureau 2013a), which is the maximum recipient and translocated density for the Western Mojave Recovery Unit (Service 2011a). Third, the recipient sites are not a confined space, so released individuals would be able to disperse into other areas. Finally, during the translocation work at Fort Irwin, researchers tested over 200 desert tortoises for differences in the levels of corticosterone, which is a hormone commonly associated with stress responses in reptiles; Drake *et al*. (2012) "did not observe a measurable physiological stress response (as measured by [corticosterone]) within the first two years after translocation." The researchers found no difference in stress hormone levels among resident, control, and translocated desert tortoises. For these reasons, we conclude that the addition of translocated desert tortoises to the recipient areas would not result in detrimental effects to translocated or resident animals.

The Service based its guidance for the upper limit of the number of desert tortoises translocated into an area on the density of large animals. We did not develop guidance regarding limiting the density of small desert tortoises during translocation for several reasons. Natural mortality rates of smaller desert tortoises are greater than those of larger tortoises. In general, we expect that healthy populations have a large number of desert tortoises smaller than 180 millimeters (Turner *et al*. 1987), but have limited information on how many that might be. Additionally, small desert tortoises use resources differently than do large ones (Wilson *et al*. 1999) and we expect that juveniles (small animals) and adults (large animals) interact much less frequently than do adults. Due to differences in habitat use, caused by both physical and physiological differences in large and small desert tortoises, we expect overlapping of ranges while the small desert tortoises are growing and dispersing. Consequently, we do not expect translocating small desert tortoises at higher densities than large animals would result in any density-dependent adverse effects.

Upper respiratory tract disease and other pathogens are spread by direct contact between desert tortoises. Consequently, increasing the density of desert tortoises in the recipient areas has the potential to exacerbate the spread of diseases because, presumably, animals that occur in higher densities would have more opportunity to contact one another. Several circumstances are likely to reduce the magnitude of the threat of disease prevalence being exacerbated by translocation. First, the applicant will use experienced biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels in translocated animals; animals are less likely to succumb to disease when they are not stressed. Second, desert tortoises on the project site are currently part of a continuous population with the resident populations of the recipient sites and are likely to share similar pathogens and immunities. Third, Drake *et al*. (2012) indicated that translocation does not seem to increase stress in desert tortoises. Fourth, density-dependent stress is unlikely to occur for the reasons discussed previously in this section. Finally, Service-trained biologists will perform health assessments using Service-approved protocols (Service 2013) and will not translocate any desert tortoise showing severe clinical signs of disease, but rather will transport the animal to an agency-approved quarantine, as described in the project's translocation plan.

Based on this information, we anticipate that post-translocation survival rates will not significantly differ from that of animals that have not been translocated. We expect that translocated desert tortoises would be at greatest risk during the time they are spending more time above ground than resident animals. We cannot precisely predict the level of post-translocation mortality because regional factors that we cannot control or predict (e.g., drought, predation related to a decreased prey base during drought, etc.) would likely exert the strongest influence on the rate of mortality and affect translocated and resident desert tortoises similarly.

Effects Associated with the Construction of the Soda Mountain Solar Project

The applicant will install construction and perimeter fencing, equipped with desert tortoise exclusion fencing and desert tortoise guards, around the project and remove all desert tortoises that it can locate on the proposed project site prior to ground disturbance. During construction of the perimeter fencing and during other ground-disturbing activities that are outside of the fenced facility (i.e., access roads and the interconnection to the Marketplace-Adelanto transmission line), the applicant will perform pre-activity clearance surveys and employ monitors to move desert tortoises out of harm's way if they re-enter work areas. For these reasons, we anticipate that construction is likely to kill few, if any, large individuals. Some potential always exists that surveyors may miss desert tortoises during clearance surveys and construction monitoring. We cannot predict how many of these large desert tortoises that clearance surveys and construction monitoring would miss. However, because the applicant will use qualified biologists, authorized by the Service for clearance surveys, we anticipate the number is likely to be small. Weather conditions can also affect the number of animals detected during surveys; warm weather after average or above-average rainfall would lead to more activity in desert tortoises, which would facilitate their detection.

In some cases, desert tortoises that have been fenced out of their home territories make repeated efforts to return and follow fence lines for long periods. Desert tortoises would die when exposed to harsh conditions (i.e., cold or hot temperatures) while pacing fences. We expect that desert tortoises whose home territories have been reduced by the project would be the animals most likely to pace fences.

The installation of fencing may also reduce the home range size of some individuals that inhabit areas immediately adjacent to the fence alignments, or that overlap the project footprint. This reduction could result in future injury or mortality of these individuals as they expand their home range into adjacent areas where unknown threats may occur or where adverse social or competitive interactions may occur with neighboring desert tortoises.

The applicant has proposed to survey the perimeter fence line areas to identify any desert tortoises within 50 meters of the area. Desert tortoises located inside the fence line or determined to be in harm's way by the authorized biologist would be fitted with a transmitter and moved into habitat adjacent to and outside the fence line. Desert tortoises can overheat quickly when pacing fences. Even fitting desert tortoises with a transmitter and implementing frequent monitoring of the individuals could be inadequate in preventing mortalities of desert tortoises exhibiting this behavior. Any desert tortoises attempting to return to the project site before completion of fence construction will be held in situ if they appear healthy until blood is drawn, test results are received, and a translocation review package is prepared and approved by the Service as described under Description of the Proposed Action – Translocation Methods section of this biological opinion.

Desert tortoises remaining outside the fence line that do not attempt to return to the project site will be deemed residents and the transmitter will be removed; no further action will be taken for the resident desert tortoise. The Bureau did not specify the duration of monitoring required for these desert tortoises. If the monitoring is for a short period of time, the desert tortoise could attempt to return to a portion of its range inside the fence. If a desert tortoise that has had its transmitter removed begins to pace the fence, it could overheat and die. The applicant has proposed to install shade structures of a design approved by the Bureau and the Service at regular intervals on the outside of the fence line; these structures should reduce the likelihood that desert tortoises would die as a result of hyperthermia.

Desert tortoises often construct their nests at the entrance to their burrows (Ennen *et al*. 2012). Because the applicant will excavate all desert tortoise burrows that are found within the construction footprint prior to the onset of ground disturbance (Bureau 2013a), the biologists may detect at least some of the nests and eggs. Overall, we anticipate that detection of eggs is unlikely because the buried nests are difficult to find. Because hatchlings can take shelter in burrows of all sizes and are difficult to see due to their cryptic nature and their small size, surveyors are less likely to detect them than they are larger desert tortoises. Consequently, we expect that most of the hatchling and eggs are likely to remain in the work areas during construction. The applicant is likely to kill these desert tortoises during construction. Because construction activities would occur year round, we cannot predict whether these activities would affect the hatchling or egg stage. Consequently, we have combined these stages in our estimation of effects.

We cannot predict precisely how many desert tortoises may be injured or killed because of the numerous variables involved. For example, we do not know the precise number of desert tortoises onsite, the size of those individuals, whether eggs will be present at the time of construction, the time of year that construction occurs, and the weather before or during construction. Regardless of these factors, we expect that few large desert tortoises are likely to be killed or injured during construction because the action area does not support many individuals; also, the applicant has proposed to implement measures that have proven effective in the past in reducing mortality and injury.

Effects Associated with the Construction of Linear Facilities

Linear facilities have different effects on desert tortoises relative to construction on large blocks of habitat. Construction of linear facilities (e.g., access roads, collector routes, water pipelines, and installation of the fence along the primary access road) would take place outside of the permanent perimeter fencing. We have analyzed these effects here rather than grouping them with our analysis of the overall effects of construction of the solar arrays.

During construction of linear components, the applicant would move desert tortoises out of harm's way into adjacent habitat. An approved recipient site will not be required for desert tortoises encountered within linear components. Based on the amount of surface disturbance that we expect from the construction of linear facilities, we anticipate that the applicant would move few desert tortoises. Because of the relatively limited amount of activity associated with the construction of linear facilities and numerous protective measures that the applicant has proposed, we expect the number of desert tortoises that would be injured or killed to be small.

Installation of the temporary construction fence along the primary access road would prevent most desert tortoises from being killed or injured on the road during construction. It would also affect desert tortoises in regard to fence pacing behavior during construction of the solar facility. As we discussed previously, desert tortoises that pace fences may become overheated and die. We cannot assess how many animals are likely to engage in this behavior because that number is a function of how many desert tortoises are active and encounter the fence and their behavioral response to it.

The temporary construction fence would be in place for the duration of construction, which the Bureau expects to last between 24 to 30 months. During this time, the temporary fence would fragment habitat in the area because desert tortoises would be unable to cross the road and access the existing culverts under Intestate 15. Results from the desert tortoise surveys (Appendix A and B in Bureau 2013a) indicate that desert tortoises seem to be absent from the areas near the primary access roads; no desert tortoises were found in these areas during surveys. Because desert tortoises seem to be scarce in these areas, we expect that fence pacing behavior would be infrequent. We anticipate that the applicant proposed measures, which we described in the previous section of this biological opinion related to desert tortoises exhibiting this behavior, would be adequate in minimizing mortality.

Construction of the solar facility also includes the installation of collector lines to connect the solar panel arrays to the project substation. These collection lines would be located outside the perimeter fence and be installed underground by way of multiple trenches along Opah Ditch Mine Road. Desert tortoises could be crushed by trenching equipment being used to install the collector lines; workers could also trample desert tortoises. Small desert tortoises would be at greatest risk because they are more difficult to see. If trenches or holes are left uncovered, desert tortoises could become entrapped and die of exposure or be killed by predators. The applicant has proposed several measures to protect desert tortoises during activities that would occur outside the fenced solar facility. These measures include installing temporary fencing around work areas, checking excavations, and assigning monitors to project sites. With these measures, we expect that few desert tortoises are likely to be injured or killed. We cannot quantify the number of desert tortoises the collector lines may affect because we do not know how many animals will cross this linear work area during construction; however, we expect the number to be small because the action area does not support many individuals. Also, we expect that monitors would be able to detect and protect most desert tortoises. The trench for the collector lines would result in the temporary loss of a small amount of habitat and be restored following the completion of construction.

Effects Associated with Operations and Maintenance

We are aware of occasions where desert tortoises have been able to enter fenced facilities, such as a pump station for a gas pipeline and an operating solar plant; they entered through gaps under the fencing or open gates. Floods can damage fences to the point where desert tortoises may be able to enter the facilities. Once inside the fencing, desert tortoises would be at risk of being killed or injured by operations or maintenance. Fencing will be inspected bi-weekly and following all major rainfall events and any damage to the fencing will be repaired within 24 hours. Therefore, we expect that few, if any, desert tortoises will be able to enter the fenced facilities, and, in general, operation and maintenance within the perimeter fence are likely to injure or kill few desert tortoises.

Over the 30-year life of the project, the applicant may conduct some ground-disturbing maintenance activities outside of fenced areas. These activities have the potential to injure or kill desert tortoises primarily by vehicle strikes, as workers travel to and from work sites outside of fenced areas; a limited possibility exists that desert tortoises could be injured or killed by equipment or workers moving around a work site. Because typical maintenance activities would not result in surface disturbance or loss of habitat and the applicant proposes to implement protective measures to reduce the potential effects, maintenance activities would kill or injure few, if any, desert tortoises.

Maintenance activities associated with repair of desert tortoise exclusion fencing would likely kill or injure few, if any, desert tortoises for the following reasons. First, fence repairs are likely to result in minimal ground disturbance in localized areas. Second, at least a portion of the work area would be on disturbed areas within the fenced project site. Third, the permanent perimeter roads, located outside the perimeter fencing, would allow access to most repair locations with minimal off-road travel. Finally, the applicant would implement numerous protective measures to reduce the potential for injury or mortality of desert tortoises.

Operation and maintenance of the collector lines may affect desert tortoises. As previously mentioned, the collector lines would be installed underground; the collector line corridor would not be permanently fenced. Therefore, desert tortoises may use the habitat and be present during maintenance activities. Vehicles and workers conducting this work could kill or injure desert tortoises in the same manner as during construction. The applicant would implement numerous protective measures to reduce the potential for injury or mortality of desert tortoises during this work.

Use of the unfenced primary access road poses some risk of vehicle strikes to desert tortoises. The applicant's proposal to maintain a 15-mile-per-hour speed limit should be protective of larger animals; small animals would be at greater risk because they are more difficult to see. We expect few desert tortoises to be killed or injured along the primary access road because of the low density of desert tortoises in the area and protective measures proposed by the applicant.

Effects Associated with Decommissioning the Solar Facility

Work associated with decommissioning of the site within the perimeter fence is unlikely to result in injury to or mortality of desert tortoises because desert tortoises would not be present. The effects associated with use of the primary access roads would be similar to those associated with construction and described previously in this biological opinion. If the sites are restored to pre-project conditions, they would likely be available for use by desert tortoises at some point after removal of the facilities. We cannot predict how soon desert tortoises would reoccupy the site after decommissioning because of the many variables involved. These variables would include the amount of degree to which substrates and shrubs have been disturbed, weather conditions, and the restoration methodologies; additionally, different portions of the site may return to functional habitat at different rates. We anticipate that the Bureau will informally consult with the Service as the time for decommissioning approaches, if some aspect of decommissioning and restoration may affect desert tortoises differently than we have anticipated in this biological opinion, the Bureau would need to re-initiate formal consultation, pursuant to section 7(a)(2) of the Act.

The biological assessment notes that some potential exists for continued use of the solar facility (Bureau 2013a). In such a case, re-initiation of consultation, pursuant to section 7(a)(2) of the Act, may be necessary.

Effects of Loss of Habitat

Development of the proposed Soda Mountain Solar Project would result in 292 and 1,767 acres of temporary and permanent disturbance, respectively, as presented in the biological assessment (Bureau 2013a). Construction of the proposed project would result in the direct, long-term loss of 1,767 acres of habitat that will not be available to desert tortoises for foraging, breeding, or sheltering for the life of the project. Following extensive disturbance and compaction, Mojave Desert substrates 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 Mojave Desert can require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). Active restoration, including decompaction, seeding, and planting, can reduce the time required to restore desert ecosystems, success is varied and dependent on numerous variables. Based on this information, the 1,767 acres currently characterized as permanent disturbance are likely to remain unsuitable as habitat for several decades following decommissioning of the facility and commencement of restoration work. The potential exists that habitat within the solar arrays may be permanently lost if restoration efforts are not successful.

The Bureau and applicant have proposed to mow vegetation in the solar array field (Bureau 2013a). Areas to be mowed are likely to return to pre-disturbance conditions quicker than graded areas because the roots of most shrubs would be retained for the life of the project and the surface of the ground would be less disturbed. If cryptogamic crust is present, mowing may cause fewer disturbances. (Cryptogamic crusts are a mixture of algae and soil fungi that occur in the upper millimeters of the substrate. They assist in retaining soil moisture and some can incorporate atmospheric nitrogen into substrates; these attributes are beneficial for the establishment and growth of native annual plant species.) Retaining cryptogamic crusts may inhibit the invasion of non-native plant species to some degree and allow for the persistence of native annual plants. We expect mowing will allow these areas to return to a suitable state for desert tortoises more quickly than the areas proposed to be graded.

Up to 1,155 acres may be graded for construction of access roads, installation of collector lines, and to smooth out isolated surface irregularities and to remove oversized rocks; these areas may require the longest time to recover. Some potential exists that the root crowns of shrubs may persist after grading, if the grading removes only a small amount of substrate. Grading of the entire surface area would also remove most of the cryptogamic crusts, which is likely to delay the re-establishment of native annual plants and increase the potential for the establishment of weeds.

Effects Associated with Climate Change

Increases in atmospheric carbon are responsible for changes in climate. As we discussed in the Status of the Desert Tortoise section of this biological opinion, climate change is likely to cause frequent and/or prolonged droughts with an increase of the annual mean temperature. Increased temperatures would likely adversely affect desert tortoises by decreasing the range of temperatures at which desert tortoises would be active; decreased rainfall would likely result in fewer annual plants on which desert tortoises feed.

Plant communities in arid lands sequester carbon by incorporating it into their tissues. Plants also respire carbon into the substrate, where it combines with calcium to form calcium carbonate; calcium carbonate also sequesters carbon (Allen and McHughen 2011). The removal or permanent disturbance of plant life from approximately 1,767 acres within the action area is likely to reduce the amount of carbon that natural processes can sequester. We acknowledge that a portion of the project would be mowed and that regrowth of shrubs in that area may lessen, to some degree, the loss of carbon-sequestering plants; we do not have the ability to quantify the difference the mowing would cause.

The proposed action is unlikely to affect desert tortoises in a measurable manner with regard to carbon sequestration for several reasons. First, the amount of carbon sequestration that would be lost would be minor because the proposed action would affect a small portion of the desert. Second, some researchers have questioned the amount of carbon sequestration that occurs in arid areas; Schlesinger *et al*. (2009) contend that previous high estimates of carbon sequestration in the Mojave Desert bear re-examination. Finally, the reduction in the use of fossil fuels because of the solar facility would prevent more carbon from entering the atmosphere than would occur by the vegetation that is currently present within the area to be disturbed by construction. For example, Fernandes *et al*. (2010) report that thin film photovoltaic technology reduces overall atmospheric carbon by 4 million grams of carbon per acre per year and that, by contrast, the amount of annual carbon uptake by desert land is approximately 429,000 grams of carbon per acre per year. Additionally, any changes in the level of carbon production or sequestration would be dispersed far beyond the boundaries of the action area of this biological opinion; consequently, we could not link any such changes to any specific effects to desert tortoises within or outside the action area of this consultation.

The proposed action is also unlikely to alter the surface albedo of the action area to the degree that it affects local climatic conditions. (Albedo is the amount of light reflected by an object. An object that reflects more light is heated less. The opposite is also true; an object that reflects less light is heated more.) Millstein and Menon (2011) found that large-scale photovoltaic plants in the desert could lead to significant local temperature increases (0.4˚C) and regional changes in wind patterns because the solar plants are less reflective than many substrates in the desert. As we discussed above, increases in temperatures would likely impair the activity patterns of desert tortoises.

The proposed action is unlikely to affect desert tortoises in a measurable manner with regard to changes in the albedo of the action area because Millstein and Menon's (2011) prediction was based on a model that analyzed the effects of a 1-terawatt solar facility. (A terawatt is 1,000,000,000,000 watts; by comparison, the proposed solar facility would produce a maximum of 287,000,000 watts (i.e., 287 megawatts).) Although Millstein and Menon's model raises an important issue to consider, it is based on numerous assumptions that would affect how a solar plant may actually affect the local environment. Millstein and Menon acknowledge that their assumptions regarding the density of solar panels within the plant and the effectiveness of the panels would influence predictions of the amount of heat generated by the facility. Specifically, they assumed that solar panels would completely cover the ground's surface (they do not, which could alter the reflectivity they predicted) and a specific efficiency of the panels (they acknowledge that more efficient panels are being developed that generate less heat). Additionally, the model assumes specific reflectivity of the desert's surface in two places (near Harper Dry Lake in western Mojave Desert and near Blythe in the Colorado Desert) that may be substantially different than that of the proposed project area. All of these factors would likely render the model's predictions somewhat different than real-world conditions and outcomes.

Millstein and Menon's model may be inappropriate for the scale of this biological opinion. The two modeled solar plants in Millstein and Menon's model covered 18,750 square kilometers or 4,633,207 acres. We defined the action area of this biological opinion as the 2,942-acre project right-of-way, the Los Angeles Department of Water and Power switchyard, and the recipient sites for translocated desert tortoises; this total area is approximately 7,500 acres. Consequently the modeled solar plants that generated a local temperature increase of 0.4˚C were approximately 618 times larger than the entire action area; considered in another light, the modeled solar plants were approximately 2,600 times larger than the proposed 1,767 acre Soda Mountain Solar Project. Consequently, the proposed action is unlikely to change local temperatures or regional wind patterns.

Miscellaneous Effects

Indirect effects associated with construction, operation, maintenance, and decommissioning of the Soda Mountain Solar Project may injure or kill desert tortoises. These effects include increased predation by common ravens that are attracted to the area because of increased human activity and modification of the habitat and diet of desert tortoises due to the spread of non-native plant species.

Construction and operation of the proposed facility have the potential to attract common ravens and increase desert tortoise predation in the action area. The applicant has proposed numerous measures in the management plan for the project to address predation by common ravens associated with the project site (Bureau 2013a). These measures include control of attractants, monitoring and reporting programs, and implementing adaptive management techniques such as devices to discourage roosting or nesting on project-related structures. To address the indirect and net effects of the proposed project with regard to common ravens, the applicant will participate in the regional management and monitoring program for common ravens. The Service developed this program in coordination with the Desert Managers Group, which is a consortium of land management agencies and other stake holders in California, and the Renewable Energy Action Team, which is composed of the Service, Bureau, California Energy Commission, and California Department of Fish and Wildlife.

We cannot reasonably predict the amount of predation by common ravens that construction and operation of the project is likely to add to baseline levels within the action area, but we anticipate that measures proposed by the applicant are likely to be effective in eliminating some, but not all, common raven use of the project site. Implementation of the management program for common ravens, to which the applicant would contribute, is likely to reduce predation on desert tortoises throughout the desert. Depending on the location of specific control actions, funding of regional management of common ravens may also aid in reducing the amount of common raven predation on desert tortoises within the action area; given the low density of desert tortoises in the action area, any changes to the rate of predation by common ravens locally would likely not be measurable.

Non-native species can occur in densities that can increase the risk of fires, which may result in future habitat loss. Non-native plant species currently occur on the proposed project site and are likely to occur in other portions of the action area at varying densities. Within the local area, numerous features serve as vectors for infestation of the action area by non-native plant species (e.g., highways, unpaved roads, the Rasor Road Off-highway Vehicle Management Area). Construction and operation of the Soda Mountain facility has the potential to increase the distribution and abundance of non-native species within the action area due to ground-disturbing activities that favor the establishment of non-native species. In addition, access to the project site and other project features by construction and operation personnel could increase the volume and distribution of non-native seed carried into the action area.

The applicant has proposed numerous measures to address control of non-native plant species within the project site. We cannot predict the degree to which non-native species would proliferate within or spread beyond the boundaries of the solar facility for several reasons. For example, above-average rainfall immediately after construction may encourage the spread of weeds whereas drought may have the opposite effect. We cannot predict whether project equipment would introduce new species or whether such new species would be able to germinate, grow, and reproduce onsite. Because the objective of the applicant's weed management plan is to ensure that the presence of weed populations on and adjacent to the project does not increase due to the project and because available technology, consistently and persistently applied, can achieve this objective, we predict that the proposed project would not lead to an increase in the number or amount of non-native species within or outside the boundaries of the solar facilities. If the applicant's objective is not met, we would consider this new information regarding the effects of the action that may affect desert tortoise and its habitat in a manner or to an extent not considered in this biological opinion. Consequently, the Bureau would be required to re-initiate formal consultation, pursuant to 50 Code of Federal Regulations 402.16.

Effects of Compensation

The Bureau has required compensation for loss of habitat associated with this project at a ratio of 1:1, per the provisions of the West Mojave Plan amendment to the California Desert Conservation Area Plan (Service 2006). Compensation will include acquisition of private lands containing desert tortoise habitat and their transfer to the Bureau, implementation of habitat enhancement and rehabilitation projects on public land, or some combination of these actions. The compensation lands will be located within the Western or Eastern Mojave recovery units, as defined in the recovery plan for the desert tortoise (Service 2011b). The Bureau estimates that 2,059 acres of suitable habitat would be required to offset the loss of desert tortoise habitat caused by the project (Childers 2015).

Because habitat enhancement actions and land acquisition would occur in desert wildlife management areas or other locations that are important to desert tortoise conservation, the proposed compensation requirements would provide a positive recovery benefit to the desert tortoise and at least partially offset loss of habitat associated with the project. The funding of management actions is likely to result in restoration and rehabilitation of degraded habitat, protection of existing habitat from future sources of degradation, and a reduction in the direct mortality of desert tortoises. In general, the original and revised recovery plans (Service 1994, 2011b) identify the actions proposed for compensation as being necessary for the recovery of the desert tortoise. We cannot quantify the level of effects that these actions will have because we do not know the specific actions that will be implemented at this time.

Implementation of some of the habitat enhancement actions has the potential to result in adverse effects to the desert tortoise. Because we do not have specific information regarding future habitat enhancement and rehabilitation projects, we cannot perform a detailed analysis of these actions. The Bureau has indicated that these actions would require future project-specific authorizations prior to implementation. Consequently, we would address any adverse effects to the desert tortoise in future project-specific section 7 consultations.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private 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. The Bureau manages most of the land in the action area; because all future actions on lands managed by the Bureau would require consultation, pursuant to section 7(a)(2) of the Endangered Species Act, we do not anticipate any cumulative effects associated with future activities on public lands. We are not aware of any actions that are reasonably certain to occur on non-federal lands within the action area.

CONCLUSION

As we stated previously in the biological opinion, “jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02). This regulatory definition focuses on how the proposed action would affect the reproduction, numbers, or distribution of the species under consideration in the biological opinion. For that reason, we have used those aspects of the desert tortoise’s status as the basis to assess the overall effect of the proposed action on the species.

Additionally, we determine whether a proposed action is likely “to jeopardize the continued existence of the species” through an analysis of how a proposed action affects the listed taxon within the action area in relation to the range of the entire listed taxon. For the desert tortoise, this process involves considering the effects at the level of the action area, then at the level of the recovery unit (in this case, the Western Mojave Recovery Unit), and then finally for the range of the listed taxon. Logically, if a proposed action is unlikely to cause a measurable effect on the listed taxon within the action area, it will not affect the species throughout the recovery unit or the remainder of its range. Conversely, an action with measurable effects on the listed entity in the action area may degrade the status of the species to the extent that it is affected at the level of the recovery unit or range-wide.

In the following sections, we will synthesize the analyses contained in the Effects of the Action section of this biological opinion to determine how the proposed action affects the reproduction, number, and distribution of the desert tortoise. We will then assess the effects of the proposed action on the recovery of the species and whether they are likely to appreciably reduce the likelihood of both the survival and recovery of the desert tortoise.

Reproduction

Construction of the solar facility would not have a measurable long-term effect on reproduction of individual desert tortoises that live adjacent to the solar facility because intense construction activity would occur over a relatively brief time relative to the reproductive life of female desert tortoises. Furthermore, desert tortoises are well adapted to highly variable and harsh environments and their longevity helps compensate for their variable annual reproductive success (Service 1994).

We expect that translocated desert tortoises may exhibit decreased reproduction in the first year following translocation. However, research conducted by Nussear *et al*. (2012) suggests the reproductive rates of translocated desert tortoises are likely to be the same as those of resident animals in subsequent years. Based on work conducted by Saethre *et al*. (2003), we do not expect the increased density of desert tortoises that would result from translocation to affect the reproduction of resident animals.

For these reasons and also because few desert tortoises would be affected by the proposed action, we expect that the proposed Soda Mountain Solar Project is not likely to affect reproduction of the desert tortoise in the action area.

Numbers

We expect that many of the small desert tortoises and eggs within the boundaries of the solar facility are likely to be killed or injured during construction because of their small size and cryptic nature. We also expect that the applicant would likely find some small animals and translocate them. Small desert tortoises are likely to die during work along linear facilities and in the course of operations and maintenance; however, protective measures are likely to be more effective in preventing mortality or injury during these activities because of the smaller area involved with work along the linear facilities and few desert tortoises are likely to enter the fenced solar facility.

We estimated that the site of the solar facility might support up to 68 small desert tortoises. We did not attempt to compare this estimate with one of the same size classes for the Western Mojave Recovery Unit for two reasons. First, the large number of assumptions involved, particularly in the context of the entire recovery unit, decreases the value of this analysis; that is, the number of small animals that we might estimate as residing in the Western Mojave Recovery Unit would be based on so many assumptions that our analysis would have little predictive value. Second, the natural high rate of mortality among hatchlings reduces the analytic value of the exercise; in short, many of these smaller animals would die even if the project is not constructed. Although we are not comparing the overall estimate of the numbers of small desert tortoises likely to be killed or injured to the overall numbers within the recovery unit, we can reasonably conclude that the number of small desert tortoises affected by the proposed action is a small percentage of the population in the Western Mojave Recovery Unit.

We expect that the proposed action is likely to result in the injury or mortality of few large desert tortoises because most construction activities (the aspect of the proposed actions that would be most likely to kill or injure desert tortoises) would occur within areas that have been fenced and cleared of desert tortoises. For activities outside of fenced areas, the applicant would implement measures to reduce the level of mortality during all work activities. During operations and maintenance, the same factors that we discussed previously for small desert tortoises would hold true for large animals. Consequently, densities of large desert tortoises serve as the basis for our following analysis.

Few desert tortoises occur within the action area. We expect the majority of large desert tortoises within the solar arrays blocks will be captured and released in the recipient areas. Based on the results of studies conducted at Fort Irwin and the Ivanpah Solar Electric Generating System, we expect that the majority of these animals will survive the translocation. Nussear *et al*. (2012) also found that survivorship is not significantly different between translocated and resident animals. In its report on the desert tortoise population trends, the Desert Tortoise Recovery Office (Service 2014b) estimated that 76,644 large desert tortoises (i.e., those greater than 180 millimeters in length) occupy modeled habitat within the Western Mojave Recovery Unit. The overall number of desert tortoises would increase if we included individuals smaller than 180 millimeters. Consequently, even the loss of all 10 large desert tortoises estimated to occur within the action area would comprise a barely measurable portion (approximately 0.013 percent) of the overall population within the Western Mojave Recovery Unit.

Distribution

The long-term loss of 1,767 acres of desert tortoise habitat that would result from implementation of the solar project would not appreciably reduce the distribution of the desert tortoise. Based on the information in Table 3 of this biological opinion, the Western Mojave Recovery Unit contains approximately 5,595,469 acres of desert tortoise habitat; rangewide, we estimate that approximately 16,745,848 acres of modeled desert tortoise habitat remain. Consequently, the proposed action would result in the loss of approximately 0.03 percent of the remaining habitat in the Western Mojave Recovery Unit and 0.01 percent of the remaining habitat rangewide.

Effects on Recovery

Given the small number of large desert tortoises that we expect the Soda Mountain Solar Project to kill, the proposed action is unlikely to appreciably diminish the ability of the desert tortoise to reach stable or increasing population trends in the future. The project site does not contain high-quality desert tortoise habitat and is not located in an area that is considered crucial to the recovery of the desert tortoise (i.e., critical habitat unit, desert wildlife management area, or other conservation areas for the desert tortoise).

The proposed project site is located between the Superior-Cronese and Ivanpah Critical Habitat Units, which connect through the Newberry Springs area and the Mojave National Preserve to the southwest and east of project site, respectively. Consequently, the project configuration will not affect desert tortoise connectivity because it is not located within a preferred linkage (Averill-Murray *et al*. 2013; see Figure 6).

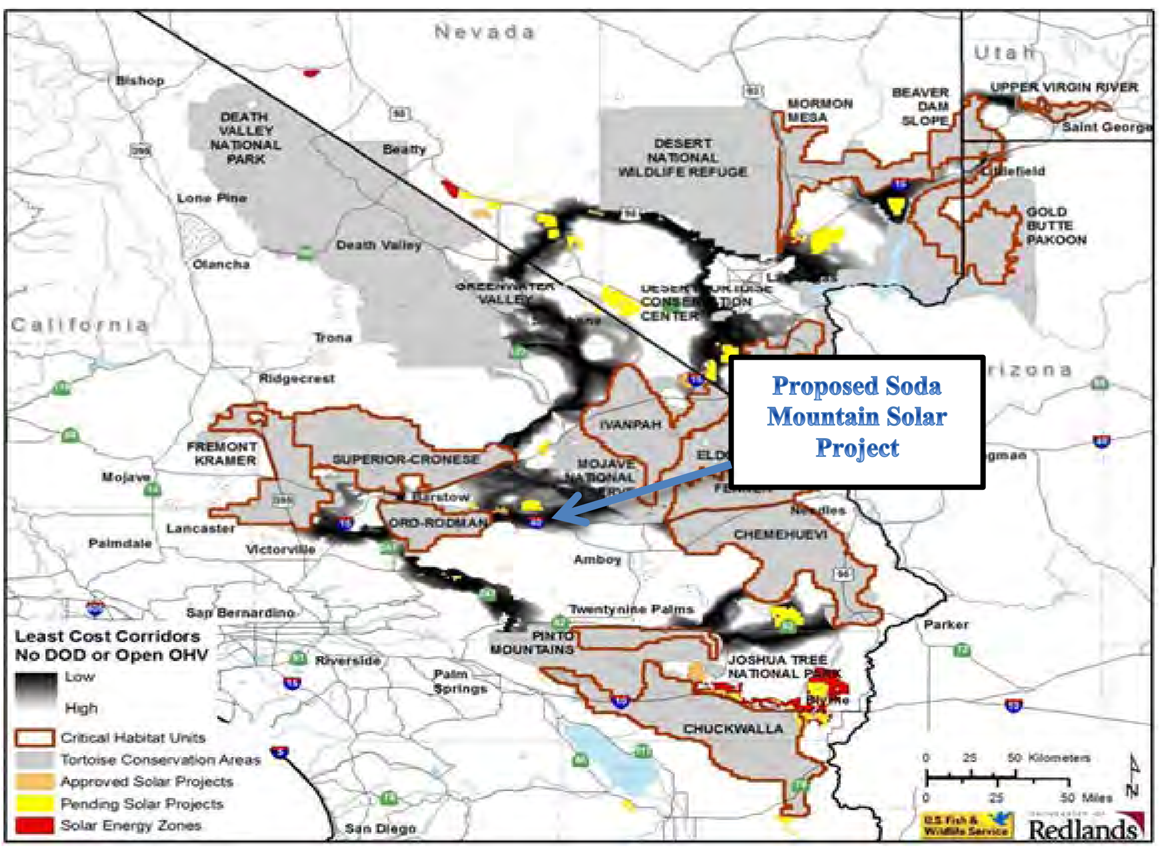

Figure 6. Map of corridors between desert tortoise conservation areas (from Averill-Murray *et al*. 2013).

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Bureau's proposed issuance of a right-of-way grant for the Soda Mountain Solar

Project is not likely to jeopardize the continued existence of the desert tortoise. We reached this conclusion for the project because:

1. The issuance of a right-of-way grant for the Soda Mountain Solar Project would not affect the reproductive capacity of desert tortoises in the action area.

2. The Bureau and applicant have proposed numerous measures, including translocation of desert tortoises from the project site, to minimize their injury and mortality. Information from previous large-scale translocations has demonstrated that it can be an effective tool for reducing mortality at project sites. Consequently, the proposed action is not likely to appreciably reduce the number of desert tortoises in the Western Mojave Recovery Unit.

3. The proposed action will not appreciably reduce the distribution of the desert tortoise because it would result in the loss of approximately 0.03 percent of suitable habitat in the Western Mojave Recovery Unit.

4. The proposed action is not located in an area that the Service considers important for the long-term conservation of the desert tortoise, either as a conservation area itself or as connecting habitat between other conservation areas. Consequently, the proposed action would not adversely affect recovery of the desert tortoise.

As we noted previously in this biological opinion, we conduct our analysis under section 7(a)(2) of the Act in relation to the status of the entire listed taxon. Because we have reached the determination that the proposed action is not likely to appreciably diminish reproduction, numbers, or distribution of the desert tortoise in the Western Mojave Recovery Unit or affect its recovery there, the proposed action is also not likely to reduce appreciably the likelihood of both the survival and recovery of the Mojave population of the desert tortoise throughout its range.

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 wildlife 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 by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it 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 the purpose 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 and the avoidance and minimization measures proposed by the Bureau.

The measures described below are non-discretionary; the Bureau must include these measures as binding conditions of its right-of-way grant to Soda Mountain Solar for the exemption in section 7(o)(2) to apply. The Bureau has a continuing duty to regulate the activity covered by this incidental take statement. If the Bureau fails to require Soda Mountain Solar to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the right-of-way grant, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Bureau must report the progress of the actions and its impact on the species to the Service as specified in the incidental take statement (50 Code of Federal Regulations 402.14(i)(3)).

Construction of the Solar Facility

We anticipate that all desert tortoises within the Soda Mountain project site are likely to be taken. We anticipate that most of the large individuals (i.e., those greater than 180 millimeters in length) within the area will be captured and moved from harm's way to adjacent habitat. Desert tortoises that are not detected during clearance surveys prior to construction may be killed or injured; because of the difficulty in finding small desert tortoises, we expect that most of these individuals are likely to be killed or injured during construction.

We estimate that, at most, approximately 10 large desert tortoises and 68 small desert tortoises may be present within the boundaries of the solar facility. We are unable to state precisely how many desert tortoises are present within the area where the proposed solar facility would be built for several reasons. Desert tortoises are cryptic (i.e., individuals spend much of their lives underground or concealed under shrubs), they are inactive in years of low rainfall, and their numbers and distribution within the action area may have changed since the surveys were completed because of hatchlings, deaths, immigration, and emigration. The numbers of hatchlings and eggs are even more difficult to quantify because of their small size, the location of eggs underground, and the fact that their numbers vary depending on the season; that is, at one time of the year, eggs are present but they become hatchlings later in the year.

Determining the amount or extent of the forms in which the take is likely to occur (killed, injured, or captured) is also difficult. As we noted previously, most of the large individuals within this area will likely be captured and moved from harm's way to adjacent habitat. Few larger desert tortoises are likely to be killed or injured because our prior experience is that the proposed avoidance and minimization measures will be effective. However, occasionally even large animals remain undetected during clearance surveys and are likely to be killed or injured during construction. The applicant is also likely to find and translocate some of the small desert tortoises; eggs are unlikely to be detected.

Using the total number of individuals within the site of the solar facility as the anticipated level of incidental take in the form of desert tortoises that are killed or injured as a result of the proposed action would be inappropriate because we fully expect that the applicant will capture and move numerous individuals into adjacent habitat. Therefore, we anticipate that the number of individuals killed or injured resulting from the proposed action will be a subset of the number of desert tortoises estimated to be within the action area. Because the applicant is not likely to find every dead or injured desert tortoise within the area of the solar facility, the number of dead or injured individuals that are found likely will be a subset of the number that are killed or injured.

To summarize, we do not know the precise number of desert tortoises within the area of the solar facility and cannot predict the numbers of animals that the applicant will capture and move from harm's way prior to and during construction, the number of individuals that are likely to be killed or injured, or the number of dead or injured individuals that will be found. Therefore, we cannot precisely quantify the number of individuals that are likely to be killed or injured during construction of the proposed solar facility. Because the applicant is unlikely to find every individual that is killed or injured and we know that this number will be a fraction of the total number of desert tortoises present, we will consider the amount or extent of take to be exceeded if two large desert tortoises are killed or injured within the construction fence of the solar facility during construction of the proposed project. We used large desert tortoises to establish this amount or extent of take because small desert tortoises are difficult to find and the method by which we calculate their abundance contains more assumptions and therefore more potential for variation than does our method for predicting the number of large desert tortoises. If the amount or extent of take for large desert tortoises is exceeded, the re-initiation of formal consultation would also require re-evaluation of the effects of the action on small desert tortoises.

In the previous paragraphs, we described the difficulties involved with quantifying the numbers of desert tortoises that are likely present in the solar facility and of desert tortoises that are likely to be moved from harm's way. However, we based our overall section 7(a)(2) analysis in this biological opinion on the premise that at most approximately 10 large and 68 small desert tortoises are likely to occur within the boundaries of the proposed solar facility. If the surveys were inaccurate and more desert tortoises actually reside on site, the applicant would exceed the amount or extent of incidental take that we have anticipated; additionally, this increased number of individuals would constitute new information revealing effects of the agency action that may affect the desert tortoise to an extent that the Service did not consider in this biological opinion. Consequently, we will consider the amount or extent of take to be exceeded if more than ten large desert tortoises are captured and translocated from within the solar facility during construction of the proposed project. Additionally, we will consider the amount or extent of take to be exceeded if any combination of killed and captured and translocated desert tortoises exceeds ten large desert tortoises (e.g., two desert tortoises die and nine are captured and relocated). We used these two scenarios because we encourage the applicant to capture and translocate all large desert tortoises we anticipate to be on site; however, the total number of desert tortoises taken in the form of mortality and/or capture and translocation should not exceed the ten large desert tortoises upon which we based our analysis.

More uncertainty exists in the numbers of small desert tortoises and eggs that are likely to be present because of the assumptions that we make to derive an estimate; additionally, circumstances could lead to the authorized biologists and monitors finding more small desert tortoises than we predicted (e.g., an unusually high survival rate in the previous year, long periods of good weather leading to greater activity levels, biologists with better search images for small animals, etc.). Because our estimate of the number of large desert tortoises within the project area forms the basis for the estimate of the number of small desert tortoises, finding more large animals than we predicted would likely mean that our estimate of the number of small animals is too low. Therefore, we are not establishing an independent re-initiation criterion for the number of small desert tortoises or eggs that would be moved out of harm's way during construction of the proposed project.

We expect that most of the eggs present within boundaries of the solar facility will be destroyed. We cannot predict how many eggs desert tortoises will produce prior to the onset of construction and the number of eggs present would vary depending upon the time of the year clearance surveys are conducted. Biologists are unlikely to find many eggs because they are difficult to detect. For these reasons, predicting the number of eggs that may be taken is not possible and we are not establishing a re-initiation criterion for the loss of eggs. As we noted in the previous paragraph regarding small desert tortoises, the amount or extent of take of large desert tortoises we established previously in this section serve as a surrogate for the number of eggs; if the amount or extent of take for large desert tortoises is exceeded, the re-initiation of formal consultation would also require re-evaluation of the effects of the action on eggs.

Translocation of Desert Tortoises from the Solar Facility

Because the applicant will employ experienced biologists, approved by the Service and the Bureau, and sanctioned handling techniques, we do not expect that the take, in the form of capture or collection, required to move desert tortoises out of harm's way during construction of the proposed project will result in mortality or injury of any individuals. Consequently, we do not anticipate that the activities involved with capturing and transporting desert tortoises from the solar facility to the recipient site is likely to kill or injure any desert tortoises.

The work required to translocate desert tortoises would necessitate increased use of vehicles in suitable habitat when desert tortoises are active. We cannot predict how many desert tortoises are likely to be killed or injured in this manner because of the numerous variables involved (the density of desert tortoises in the area, how many animals are active when biologists are working in the area, the conditions of the road, etc.). Additionally some desert tortoises (particularly small individuals) may be killed or injured but never detected. Because the applicant will employ experienced biologists, approved by the Service and the Bureau, we expect that few desert tortoises are likely to be killed or injured by vehicle strikes during translocation. For these reasons, we will consider the amount or extent of take to be exceeded if more than one large desert tortoise is killed or injured as a result of vehicle strikes during translocation activities.

We anticipate that moving eggs from harm's way may result in the destruction of a portion of the eggs. Because some are likely to survive, we consider moving them from harm's way to be better for desert tortoises than leaving them in place in work areas, where they would most likely be destroyed. Therefore, we are not establishing a re-initiation criterion for the number of eggs that would be moved out of harm's way during construction of the proposed project.

Operation and Maintenance of the Solar Facility

Operations and maintenance activities would occur primarily within the perimeter fence; however, desert tortoises may occasionally breach the fence and would then likely be taken, either by being captured and moved outside the fence into suitable habitat or by being killed or injured. We cannot reasonably anticipate the number of desert tortoises that may breach the fence during the life of the project or predict the numbers of those individuals that would be killed, injured, or captured because of the numerous variables involved. For example, we cannot predict the future numbers of desert tortoises that may reside near the project site or when an animal would then find a hole in the fence and enter the facility. We also cannot predict whether the animal would be killed, injured, or captured.

Because we cannot precisely quantify the number of individuals that are likely to be killed, injured, or captured during operations and maintenance of the proposed solar facility, we will consider the amount or extent of take to be exceeded if more than one large desert tortoise is killed or injured within the solar facility in any calendar year or if more than five are killed or injured cumulatively.

Construction, Operation, and Maintenance of Linear Facilities

Determining the number of desert tortoises that are likely to be taken along linear facilities is extremely difficult. In addition to the reasons we have already discussed regarding why the take of desert tortoises is difficult to quantify; narrow linear facilities pose additional difficulty in that they most likely cross only a small portion of a desert tortoise’s home territory. Consequently, desert tortoises that are detected during a survey may be absent during construction or vice versa. Additionally, the likelihood of encountering a desert tortoise varies with the time of day, season, and long- and short-term weather conditions.

Consequently, we have not tried to quantify the number of desert tortoises that likely to be encountered during the construction, operations, and maintenance of the linear facilities. Rather, because the proposed protective measures have been effective in minimizing the injury and mortality of desert tortoises in similar linear projects and the applicant is unlikely to find every desert tortoise it kills during construction, we will consider the amount or extent of take to be exceeded if more than one large desert tortoise is killed or injured during construction of the linear facilities. We will consider the amount or extent of take to be exceeded if more than one desert tortoise is killed or injured during operations and maintenance of the linear facilities in any calendar year or if more than five are killed or injured cumulatively. We are not establishing a limit for moving desert tortoises from harm’s way if they are encountered during construction, operations, or maintenance of linear facilities. As we discussed previously, we cannot reasonably assess how many individuals are likely to be encountered during work activities and moving these desert tortoises a short distance from harm’s way will not adversely affect them in a measurable manner.

General Considerations

The exemption provided by section 7(o)(2) to the take prohibitions contained in section 9 of the Endangered Species Act extends only to the action area as described in the Environmental Baseline section of this biological opinion.

Incidental take that may be associated with decommissioning of the project is not covered by this incidental take statement because most activities would occur within fenced facilities where desert tortoises are absent. When more information becomes available at the end of the right-of-way grant, the Bureau will determine how it wants to proceed in light of the information that is available at that time. Re- authorization of industrial use of the site may require re-initiation of formal consultation.

We did not have enough information to analyze the potential effects of the measures to offset the adverse effects of the proposed project on the desert tortoise. Consequently, this biological opinion does not cover the incidental take that may occur as a result of those future actions. The Bureau is required to follow the consultation procedures of section 7(a)(2) of the Act with regard to those future actions.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize take of desert tortoises during the construction, operation, and maintenance of the proposed facility:

> The Bureau must condition the right-of-way grant to reduce adverse effects associated with moving desert tortoises.

Our evaluation of the proposed action includes consideration of the protective measures proposed by the Bureau in the biological assessment and re-iterated in the Description of the Proposed Action section of this biological opinion. Consequently, any changes in these protective measures may constitute a modification of the proposed action that causes an effect to the desert tortoise that was not considered in the biological opinion and require re-initiation of consultation, pursuant to the implementing regulations of the section 7(a)(2) of the Act (50 Code of Federal Regulations 402.16).

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Bureau must ensure that applicant complies with the following terms and conditions, which implement the reasonable and prudent measure, and the following reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions implement the reasonable and prudent measure described above:

1. The Bureau must require the applicant to monitor desert tortoises that are moved during fence line and clearance surveys until an authorized biologist determines the animals are exhibiting behavioral signs of adjusting to the translocation area (e.g., returning to burrows during inactive periods, not walking the fence line, not attempting to cross Interstate 15 for desert tortoises in the east of desert tortoise recipient site, etc.). Once the authorized biologist makes this determination, he or she may remove the transmitter and cease monitoring.

2. The Bureau must prohibit the applicant from translocating desert tortoises during summer months (i.e., once animals have generally become inactive).

REPORTING REQUIREMENTS

The Bureau must provide an annual report to the Service by January 31 of each year that the facility is being constructed or operated that provides details on the effects of the action on the desert tortoise. Specifically, the reports must include information on any instances when desert tortoises were killed, injured, or handled, the circumstances of such incidents, and any actions undertaken to prevent similar mortalities or injuries from re-occurring. If animals are moved from harm's way during the reporting period, the Bureau must include that information in these reports. The reports must also include a description of any monitoring efforts that the applicant implements. In addition, within 60 days of the completion of the proposed action (i.e., at the conclusion of all activities related to decommissioning), the Bureau must provide final report to the Service with this information.

We also request that the Bureau provide us with the names of any monitors who assisted the authorized biologists and an evaluation of the experience they gained on the project; the qualifications form on our website (http://www.fws.gov/carlsbad/PalmSprings/DesertTortoise/DT%20authorized%20biologist%20request%20form.pdf), filled out for the project, along with any appropriate narrative would provide an appropriate level of information. This information would provide us with additional reference material in the event these individuals are submitted as potential authorized biologists for future projects.

DISPOSITION OF DEAD OR INJURED DESERT TORTOISES

Within 3 days of locating any dead or injured desert tortoises, you must notify the Palm Springs Fish and Wildlife Office by telephone (760 322-2070) and by facsimile or electronic mail. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

Injured desert tortoises must be taken to a qualified veterinarian for treatment. If any injured desert tortoises survive, the Bureau must contact the Service regarding their final disposition.

The Bureau must ensure that the applicant takes care in handling dead specimens to preserve biological material in the best possible state for later analysis, if such analysis is needed. The Service will make this determination when the Bureau provides notice that a desert tortoise has been killed by project activities.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to use their authorities to further its purposes by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the Bureau and applicant develop a disposition plan for any nests of desert tortoises that are relocated from the project site. We recommend that the nests be monitored periodically to ascertain whether the eggs hatched. This information may prove useful in determining whether our current guidance (Service 2009a) needs revision.

2. We recommend that the Bureau require the applicant to conduct specific searches for small desert tortoises in portions of the project areas where densities of these individuals may be greater. Biologists at the Ivanpah Solar Electric Generating System removed numerous small individuals by using search techniques specific to small desert tortoises.

RE-INITIATION NOTICE

This concludes formal consultation on the Bureau's proposal to issue a right-of-way grant to construct and operate the Soda Mountain Solar Project. As provided in 50 Code of Federal Regulations 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take specified in the incidental take statement is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may lapse and any further take may be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation.

If you have any questions, please contact Vincent James at (760) 322-2070, extension 215 or Ray Bransfield at (805) 644-1766, extension 317.

Appendices

Appendix 1. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

Appendix 2. Methodology used to estimate the number of desert tortoises and eggs present in the action area.

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Appendix 1. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

The following table summarizes information regarding the solar projects that have undergone formal consultation with regard to the desert tortoise. In the Citations column, a single reference indicates that the acres of desert tortoise habitat and number of desert tortoises are estimates from the biological opinion; when the column includes two citations, the first is for the acreage of habitat and the estimated number of desert tortoises from the biological opinion and the second is for number of desert tortoises that were found onsite prior to or during construction.

Project and Recovery Unit	Acres of Desert Tortoise Habitat	Desert Tortoises Estimated[1]	Desert Tortoises Observed[2]	Citations[3]
Eastern Mojave				
Ivanpah Solar Electric Generating System	3,582	1,136	175[7]	Service 2011a, Davis 2014
Stateline Solar	1,685	947	34	Service 2013a, LaPre 2014
Silver State North – NV	685	14[6]	4	Service 2010a, Cota 2013
Silver State South – NV	2,427[4]	1,020[4]	152	Service 2013a, Cota 2014
Amargosa Farm Road – NV	4,350	4[6]	-	Service 2010e
Western Mojave				
Abengoa Harper Lake	Primarily in abandoned agricultural fields	4[6]	-	Service 2011b
Chevron Lucerne Valley	516	10	-	Service 2010b
Northeastern Mojave				
Nevada Solar One - NV	400	[5]	[5]	Burroughs 2012, 2014
Copper Mountain North - NV	1,400	30[5]	30[5]	Burroughs 2012, 2014
Copper Mountain - NV	380	[5]	[5]	Burroughs 2012, 2014
Moapa K Road Solar - NV	2,141	186	157	Service 2012, Burroughs 2013

Colorado				
Genesis	1,774	8	0	Service 2010c, Fraser 2014a
Blythe	6,958	30	0	Service 2010d, Fraser 2014b
Desert Sunlight	4,004	56	7	Service 2011c, Fraser 2014a
McCoy	4,533	15	0	Service 2013b, Fraser 2014b
Desert Harvest	1,300	5	-	Service 2013c
Rice	1,368	18	1	Service 2011d, Fraser 2014a
Total	**37,503**	**3,483**	**560**	

1. The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects. When available, we included an estimate of the numbers of small desert tortoises.
2. This column reflects the numbers of desert tortoises observed within project areas. It includes translocated animals and those that were killed by project activities. Project activities may result in the deaths of more desert tortoises than are found.
3. The first citation in this column is for the biological opinion or incidental take permit and is the source of the information for both acreage and the estimate of the number of desert tortoises. The second is for the number of desert tortoises observed during construction of the project; where only one citation is present, construction has not begun or data are unavailable at this time.
4. These numbers include Southern California Edison's Primm Substation and its ancillary facilities.
5. These projects occurred under the Clark County Multi-species Habitat Conservation Plan; the provisions of the habitat conservation plan do not require the removal of desert tortoises. We estimate that all three projects combined will affect fewer than 30 desert tortoises.
6. These estimates do not include smaller desert tortoises.
7. In the table attached to the electronic mail, the number of desert tortoises translocated from the project site is represented by the total number of translocated animals minus the number of animals born in the holding pens.

The Service completed biological opinions for the Calico and Palen projects. The applicant for the Calico project, which was located in the Western Mojave Recovery Unit, has abandoned the project and the Bureau of Land Management has withdrawn the request for consultation (Bureau of Land Management 2013). The Palen project, which is located in the Colorado Desert

Recovery Unit, has had several owners; most recently, the project proponent (Palen Solar Holdings, LLC) submitted a letter to the California Energy Commission in which it withdrew its application (California Energy Commission 2014). Another company may pursue a solar project at this location, although it has not filed applications with the Bureau and California Energy Commission to date (Fraser 2014c).

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Appendix 2. Methodology used to estimate the number of desert tortoises and eggs present in the action area.

We used the life table contained in Turner *et al*. (1987) to estimate the number of smaller desert tortoises that may be present in the action area based on the upper confidence limit of the number of desert tortoises predicted by the U.S. Fish and Wildlife Service's (Service 2010) protocol. We predicted the numbers of animals that would likely occur in each size class using the expected percentages in each size class and the total number of animals that were actually found. The following table depicts these values.

Mean Carapace Length (mm) [1]	**Life-table Distribution (percentage)** [2]	**Number of Desert Tortoises Likely to Be Present in the Action Area**[3]
<60	39.7	30.92
60 – 99	32.0	24.92
100 – 139	10.8	8.41
140 – 179	4.5	3.51
180+	13.2	10.28
Total		77.88

[1] Modified from Turner *et al*. (1987). One live female desert tortoise approximately 220 millimeters in size was detected in the action area (Woodman 2014). We combined the size classes used by Turner *et al*. above this size because it did not affect our calculation of the number of small animals.

[2] In this column, we used the life-table distribution percentage from Turner *et al*. (1987) but combined the percentages for the size classes above 180 millimeters.

[3] We used the upper confidence limit derived from the Service's (2010) protocol as the number of desert tortoises in the greater-than-180-millimeter class. We then used the equation $10.28/x = 13.2/100$ to derive the total number of desert tortoises based on 10.28 animals being in the 180+ size class. Finally, we used the equation (% in size class)/100 = $x/77.88$ to derive the number of desert tortoises likely to occur in the remaining size classes.

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Appendix B: Soda Mountain Solar Project Complete Project Description

CHAPTER 2. PROJECT DESCRIPTION

2.1 Introduction

Soda Mountain Solar, LLC (applicant), proposes to construct, operate, and maintain a utility-scale solar photovoltaic (PV) electrical generating and storage facility and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. The project also includes future decommissioning, which is anticipated to occur after 40 years of operation. This project is known as the Soda Mountain Solar Project (proposed project or project).

The project is located on approximately 2,670 acres of land administered by the U.S. Department of Interior, Bureau of Land Management (BLM), California Desert District, within the jurisdiction of the Barstow Field Office in San Bernardino County. As described in Section 2.1, the BLM performed a separate review of the project under the National Environmental Policy Act (NEPA).

The project would disturb approximately 2,059 acres overall. The project would generate up to 300 megawatts (MW) of renewable energy and include up to 300 MW/1,200 MW-hours (MWh) of battery storage. The power produced by the project would be conveyed to the regional electrical grid through an interconnection with the existing Mead-Adelanto 500-kilovolt (kV) transmission line operated by the Los Angeles Department of Water and Power (LADWP).

2.2 Description of the Proposed Project

2.3 Project Location

The project is located entirely on federally owned land managed by the BLM. The 2,670-acre project site is located approximately 7 miles southwest of the community of Baker in unincorporated San Bernardino County, California (Figure 2-1, 2-2, and 2-3), approximately 50 miles northeast of Barstow. The project site is in portions of Sections 1 and 11–14, Township 12 North, Range 7 East; Sections 25, Township 13 North, Range 7 East; Sections 6, 7, and 18, Township 12 North, Range 8 East; Sections 17 – 21, 29-32, Township 13 North, Range 8 East, San Bernardino Meridian, California.

The project is bounded directly to the east by the Mojave National Preserve (administered by the National Park Service) and BLM lands, including the Rasor Off-Highway Vehicle (OHV) Recreation Area at the southeast corner. Interstate 15 (I-15), the former Arrowhead Trail Highway, runs along the western boundary of the project site. The Rasor Road Services Shell Oil gas station is located off I-15 southwest of the project site, along the access road to the project site. A residence is next to the gas station, roughly 260 feet southwest of the proposed boundary. There are no other sensitive receptors within 1,500 feet of the project site. Approximately four storm drain culverts run under I-15 adjacent to the project site. Primary access to the project site is from the Rasor Road northbound exit off I-15.

Figure 2-1. Project site vicinity.

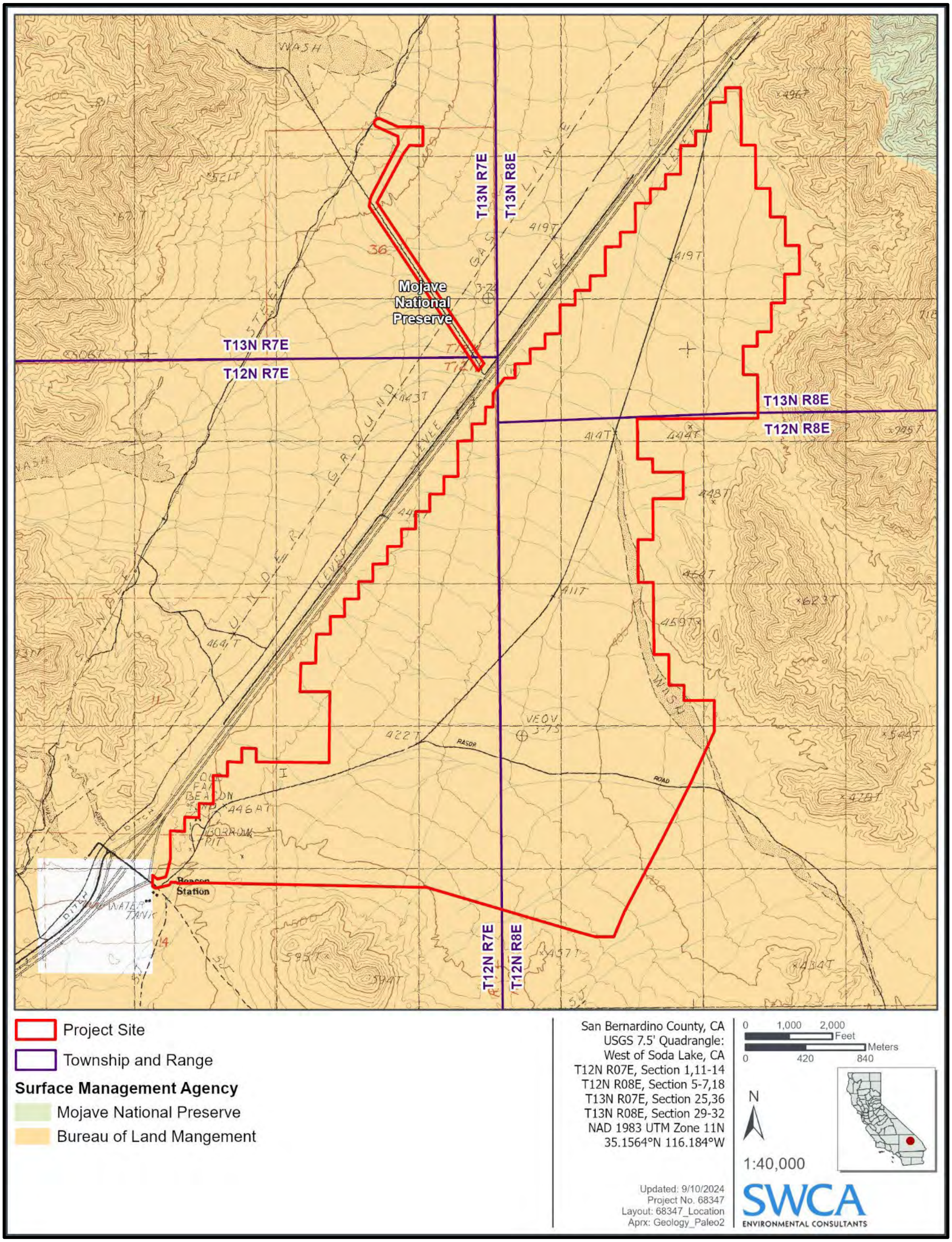

Figure 2-2. Public Land Survey location.

2.3.1.1 EXISTING CONDITIONS

The project would occupy the alluvial valley dividing the northern and southern portions of the Soda Mountains in the Mojave Desert. The project site is composed of rural desert land and is almost entirely undeveloped (Figure 2-4). Rasor Road, an unimproved BLM public access road, runs from the site's southwest corner and splits into two forks after approximately 1.4 miles. The Rasor Road fork continues from west to east, to the Rasor OHV recreation area. Arrowhead Trail, the other fork, continues northward through the project site. Figure 2-4. Project site location and existing conditions. show the current existing conditions of the project site.

Based on a review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, unnamed tributaries are located east of the project site and flow from west to east (FEMA 2023). On-site runoff primarily drains to the southeast side of the project site. FEMA Zone D floodplains, which represent areas of undetermined flood hazards, are located within the project site. Additionally, the project is not located within the California Department of Water Resources (DWR) 100-year DWR Awareness floodplain. The project site is located in the Mojave Desert Air Basin and within a Soda Lake Valley Groundwater Basin sub-basin.

There are no existing overhead or underground transmission lines on the project site that would be affected by the proposed project. The infrastructure surrounding the site includes the four-lane I-15, two high-voltage electric transmission lines, an electrical distribution line, wireless cellular telephone towers, two fiber-optic cables, and two fuel pipelines. The location of the fiber-optic cables is not publicly available. The two high-voltage electrical transmission lines to the west of I-15 are the Kramer 115-kV sub-transmission line operated by Southern California Edison (SCE) and the Mead-Adelanto 500-kV transmission line operated by the LADWP, as shown in Figure 2-3. The project would utilize one of the existing culverts under I-15 to connect the gen-tie to the Mead-Adelanto transmission line. The Mead-Adelanto Transmission Project is a 202-mile-long, 500-kV alternating current (AC) transmission line that extends between a southwest terminus at the Adelanto substation in Southern California and a northeast terminus at Marketplace Substation approximately 17 miles southwest of Boulder City, Nevada.

2.3.1.2 LAND USE AND ZONING

As shown in Figure 2-3, the project site is located within the BLM's California Desert District, within the jurisdiction of the Barstow Field Office, and the planning boundary of the California Desert Conservation Area (CDCA) Plan and the Desert Renewable Energy Conservation Plan (DRECP). The BLM signed its Record of Decision (ROD) approving the DRECP Land Use Plan Amendment (LUPA) to the CDCA Plan in September 2016 (BLM 2016). The DRECP is a landscape-level plan established by the California Energy Commission, the BLM, the California Department of Fish and Wildlife (CDFW), and the U.S. Fish and Wildlife Service (USFWS) which plan covers 22.5 million acres of public land in seven California counties. The DRECP LUPA includes land use allocations to replace the multiple-use classes established in the CDCA Plan. The project is within lands classified as General Public Land for management. However, given the BLM signed the ROD for the project in March 2016, before the BLM approved the DRECP LUPA, neither the BLM process for project review and approval nor the Conservation and Management Actions (CMAs) outlined in the DRECP are applicable to this project.

The generation-tie line (gen-tie line) west of I-15 would be located within an Area of Critical Environmental Concern and a designated federal Section 368 Energy Corridor adjacent to I-15 (corridor number 27-225).

2.3.1.3 SITE SELECTION

The project site was selected given the BLM's issuance of a ROD and associated amendment to the CDCA Plan in March 2016. The site is located within a designated federal Section 368 Energy Corridor adjacent to I-15 (Corridor number 27-225). Additionally, an existing SCE-owned 115-kV sub-transmission line and an LADWP-operated 500-kV transmission line run parallel to and adjacent to the western perimeter of the project site. The project site is located immediately adjacent to existing roadways that provide readily available access for construction and operations. The project site was selected based on consideration of the project objectives, engineering constraints, site geology, environmental impacts, water, waste and fuel constraints, and electric transmission constraints, among other factors.

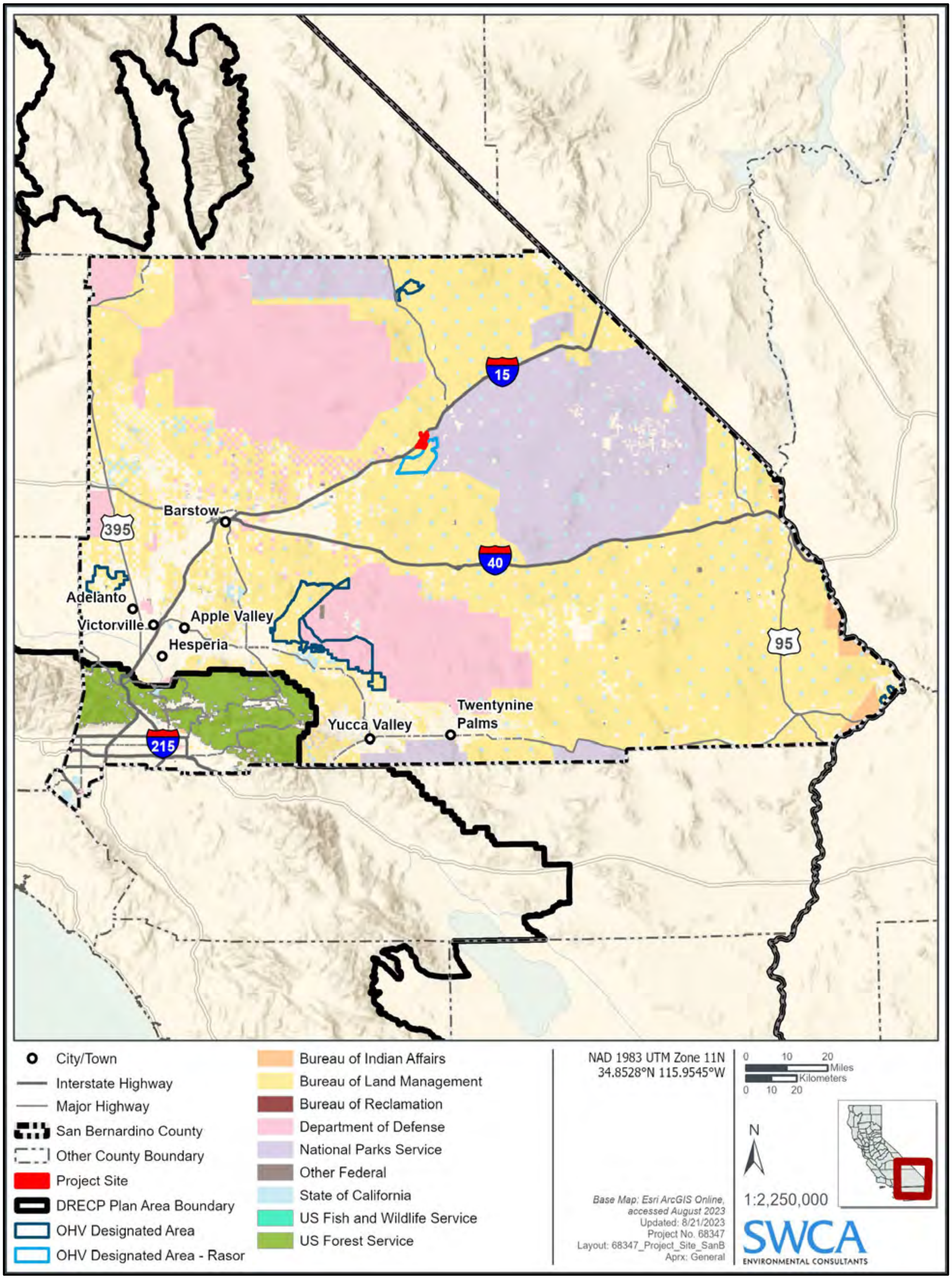

Figure 2-3. Land use management in San Bernardino County.

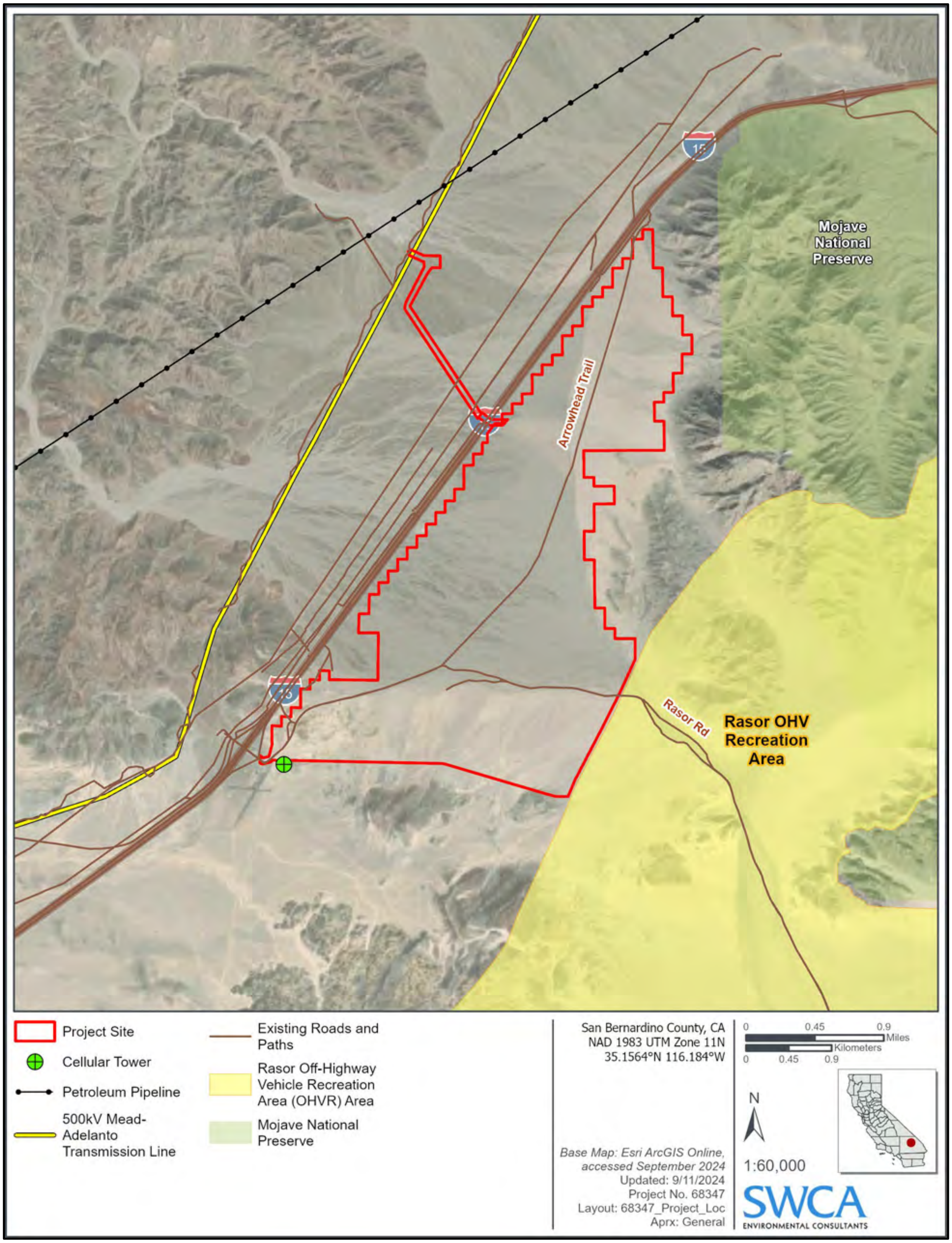

Figure 2-4. Project site location and existing conditions.

Figure 2-5. Existing view from west, facing east toward I-15 and project site.

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Figure 2-6. Existing view from northwest, facing east across I-15 to project site.

2.4 Generating Facility Description and Design

The project proposes to construct, operate, maintain, and decommission a proposed 300-MW PV solar facility located on approximately 2,670 acres. The approximate disturbance acreage for the project would be 2,059 acres. As shown in Figure 2-7 through Figure 2-10, the project components are as follows:

1. The solar plant site (i.e., all facilities that create a footprint in and around the field of solar panels, including the solar field consisting of solar power arrays identified as the East Array and South Arrays 1, 2, and 3), operation and maintenance (O&M) buildings and structures, stormwater infrastructure, and related infrastructure and improvements.
2. A substation and switchyard for interconnection to the existing transmission system.
3. Gen-tie line connecting project substation, switchyard, and 500-kV Mead-Adelanto line.
4. Approximately 300 MW/1,200 MWh of battery energy storage system (BESS) across 18 acres.

The project would operate 24 hours per day year-round and would generate electricity during daylight hours when the sun is shining. The project would generate and deliver solar-generated power to the regional electrical grid through an interconnection with the existing Mead-Adelanto 500-kV transmission line operated by LADWP.

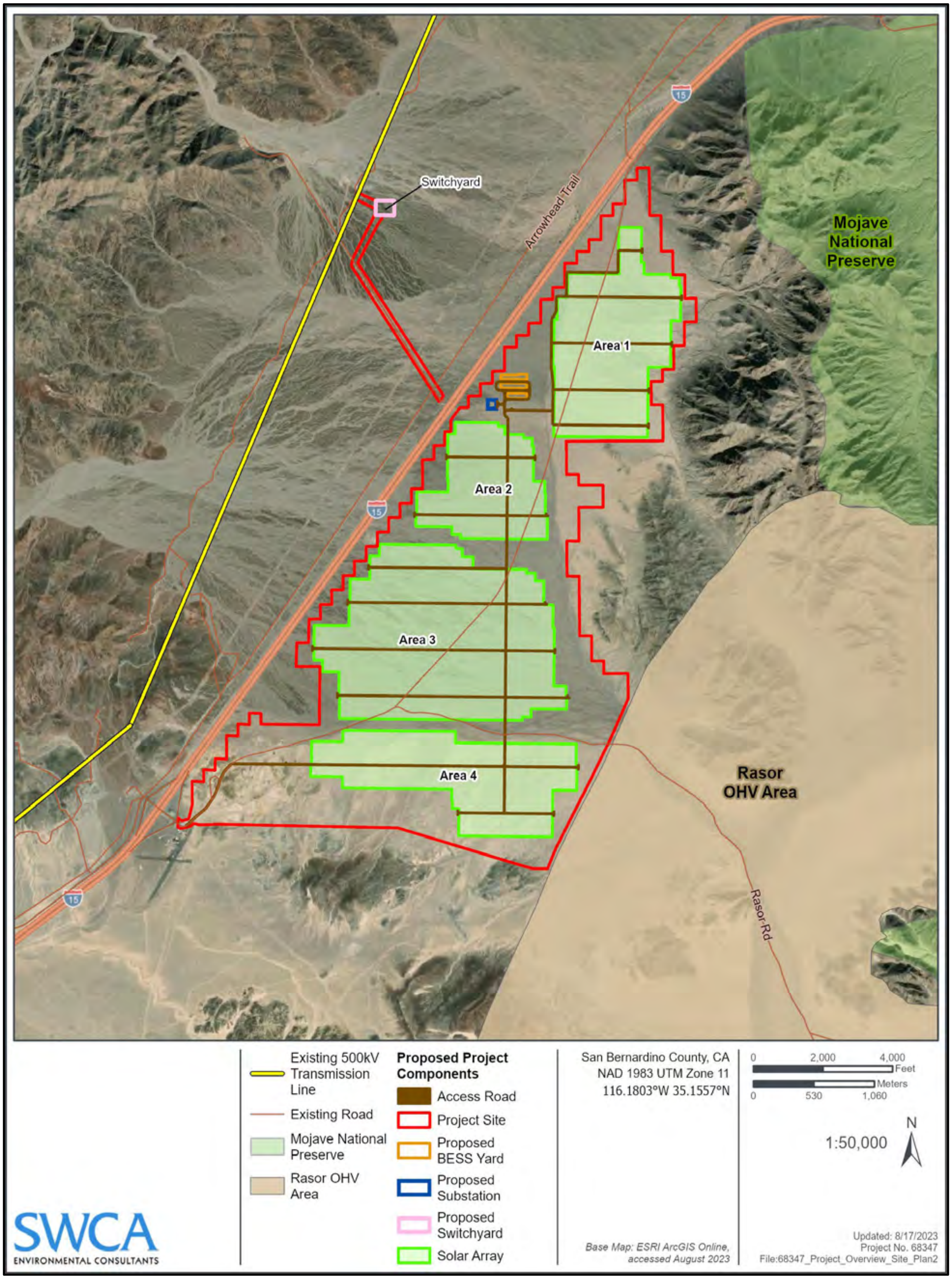

Figure 2-7. Project overview site plan.

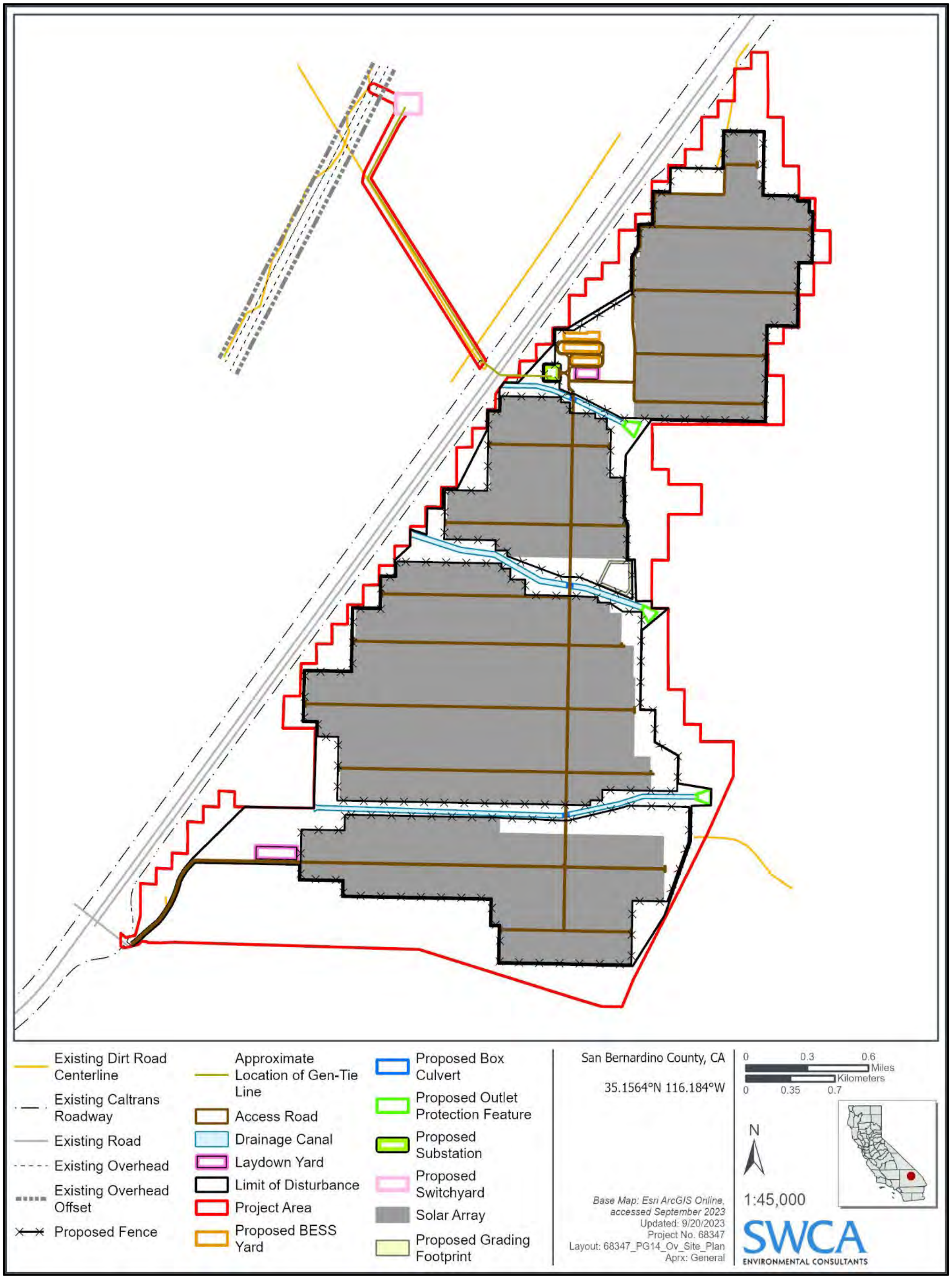

Figure 2-8. Existing and proposed conditions.

Figure 2-9. Simulated view from west looking east at I-15 and constructed project.

Figure 2-10. Simulated view from northwest, facing east across I-15 to project site.

2.4.1 *Solar Panel Arrays and Support Structures*

2.4.1.1 SOLAR PANEL ARRAYS

Solar cells, also called photovoltaic (PV) cells, convert sunlight directly into electricity (voltage), which is called the "PV effect." PV cells are located on panels; rows of solar panels form an array. The PV modules are uniformly dark in color, non-reflective, and designed to be highly absorptive of all light that strikes their glass surfaces. Arrays controlled by a single motor create a system called a single-axis solar tracker, which rotates throughout the day to increase total solar exposure. For the project, hundreds of solar trackers would be interconnected to form a utility-scale PV system. The solar panel arrays would be organized into Area 1, Area 2, Area 3, and Area 4 on the southeast side of I-15, as shown in Figure 2-7.

2.4.1.2 SUPPORT AND MOUNTING STRUCTURES

The single-axis solar tracker would be mounted on structures supported by steel piles (e.g., cylindrical pipes, H-beams, or similar), which would be driven into the soil using pile/vibratory/rotary driving technique. Driven pier foundations are a "concrete-free" foundation solution that would result in minimal site disturbance and facilitate site reclamation during decommissioning. Most pier foundations would be driven to approximate depths of 6 to 12 feet deep depending upon the required embedment depth. The piles would be spaced 10 to 15 feet apart. The support structure would be elevated at least 1 foot above the base flood elevation and approximately 6 to 12 feet tall, depending on site topography.

2.4.1.3 ELECTRICAL CONNECTION SYSTEM

Solar panels would be electrically connected using string wiring secured to the panel support system. String wiring terminates at PV array combiner boxes or load break disconnect boxes, which are lockable electrical boxes mounted on or near an array's support structure. Output wires from combiner boxes would be routed along an underground trench system approximately 3 to 6 feet deep and 1 to 6 feet wide, including trench and disturbed area, to the central inverter pads. Inverters are a key component of solar PV power-generating facilities because they convert the solar panel's direct current (DC) power into AC power and step up the voltage for use with the transmission network. The output voltage of the inverters would be stepped up from 600 to 1,200 V to 34.5 kV AC power and transmitted by underground collection lines to the project substation.

2.4.2 *Substation*

The 140,000-square-foot high-voltage substation would be located adjacent to Area 1 and Area 2 on a raised gravel pad and would have a maximum height of 35 feet (see Figure 2-7 and Figure 2-8). The substation would include the main Generation Step Up (GSU) transformer, high-voltage circuit breakers, switches, meters, instrumentation transformers, relay equipment, a control enclosure, and related equipment. The substation equipment would be mounted on concrete foundations and structures (hot dip galvanized or weathering steel).

All the underground 34.5-kV collection lines would be combined at the substation, and the voltage would be stepped up to 500 kV via the GSU transformer. All interconnection equipment, including the control room, would be installed aboveground on concrete foundations and steel structures within the substation footprint.

Power to the project substation control enclosure would be provided primarily by a station service transformer (roughly 50 kilovolt amps [kVA]) located within the substation yard. The control enclosure would be equipped with a backup battery and an energy management system capable of powering the control enclosure for 48 hours in the event of an outage. In the event of a prolonged outage, a secondary power source will be provided via an underground connection to Kramer 115-kV sub-transmission line owned by SCE, which runs parallel to I-15.

2.4.3 *Switchyard*

The switchyard would be set on an approximately 234,300-square-foot raised gravel pad and would have a maximum height of 100 feet. The switchyard would be located 0.8-mile northwest of I-15, adjacent to the LADWP Mead-Adelanto 500-kV transmission line ROW. The switchyard would include the High Voltage Bus Structure, high-voltage circuit breakers, switches, instrumentation transformers, relay equipment, a control enclosure, and related equipment. Like the substation, the switchyard equipment would be mounted on concrete foundations and steel structures (hot dip galvanized or weathering steel).

Power to the switching station control enclosure would be provided primarily by a station service transformer (roughly 50 kVA) located within the substation yard. The control enclosure would be equipped with a backup battery and an energy management system capable of powering the control enclosure for 48 hours in the event of an outage. In the event of a prolonged outage, a secondary power source will be provided via an underground connection to Kramer 115-kV sub-transmission line owned by SCE, which runs parallel to I-15.

2.4.4 *Gen-tie Line*

The approximately 1-mile 500-kV gen-tie line would be designed in accordance with LADWP design standards including required right-of-way (ROW) width. The gen-tie would also use eleven tubular steel pole support structures and six lattice towers, all of which would be approximately 160 feet high. A small segment of the gen-tie line, approximately 450 feet, would go under I-15 near an existing Caltrans culvert. On either end of this underground section there would be riser towers and transition to overhead tower structures. Both the underground section of the gen-tie line and the riser towers would be designed in accordance with General Order 128.

2.4.5 *Battery Energy Storage System*

A BESS absorbs, holds, and then reinjects energy from the PV system into the electrical grid. The project is anticipated to include up to 300 MW/1,200 MWh of energy for dispatch into the local electrical grid via the same point of interconnection as the solar arrays. The BESS would be located adjacent to the substation and Area 1. Up to 18 acres may be utilized for the BESS throughout the project site at full buildout.

2.4.5.1 BATTERIES

Individual lithium-ion cells typically form the core of the BESS and are assembled in sealed battery modules. The battery modules would be installed in self-supporting racks electrically connected either in series or parallel to each other. The operating rack-level DC voltage currently ranges between 700 and 1,500 volts (V). The individual battery racks are connected in series or a parallel configuration to deliver the BESS energy and power rating.

2.4.5.2 BATTERY ENERGY STORAGE SYSTEM ENCLOSURE AND CONTROLLER

The BESS containers would house the batteries described above, as well as the BESS unit controllers. There would also be a site controller, located in a pad mount enclosure within the BESS yard. The BESS site controller is a multilevel control system for the battery modules, power conversion system, medium-voltage system, and up to the point of connection with the electrical grid. The controllers ensure that the BESS effectively mimics conventional turbine generators when responding to grid emergency conditions. The BESS enclosure would also house required heating, ventilation, and air conditioning (HVAC) and fire protection systems. The battery storage containers would be built using standard International Organization for Standardization (ISO) shipping containers, and each would measure approximately 20 feet in length, 6 feet in width, and 8 feet in height, although other smaller form-factor structures exist that may be used. The containers would be painted Sudan Brown.

The safety system would include a fire detection, alarm, and suppression control system that would be triggered automatically when the system senses imminent fire danger. A fire suppression control system would be provided within each on-site battery enclosure. The safety system would use either a waterless evaporating fluid, a sustainable clean agent (not a hydrofluorocarbon clean agent), or an alternative suppression agent, such as an inert gas. The control system would also notify the project operators and could be configured to notify local first responders as well.

2.4.6 *Operation and Maintenance Area Facilities*

2.4.6.1 BUILDINGS

Three buildings related to operations, maintenance, and storage would be constructed as part of the project. One building would be 2,400 square feet, and the other two buildings would each be 5,000 square feet in area. Similar to the BESS, each building would be painted Sudan Brown. These buildings would be in the northwest portion of the site next to the BESS facilities. All of these facilities would be monitored by on-site O&M personnel and/or remotely.

The project would power the O&M buildings via a 480-V circuit from the BESS Auxiliary Power distribution system. This circuit will be fed from the collector substation and transformed to 480 volts via an auxiliary transformer mounted at the BESS yard. Power will be distributed via 480-V switchgear at the BESS yard. Power distribution will be via underground cables. Backup power to the O&M facilities would be via a local microgrid. This system would consist of solar PV panels mounted to the roof of the O&M buildings, a backup battery providing 24 hours of standby power, and an automatic transfer switch. This connection removes the need to have an emergency generator as part of the proposed project.

2.4.6.2 PARKING AREAS

A 13,200-square-foot parking area would be located adjacent to the buildings described above, in the southwest corner of the site. They would be composed of compacted soil covered with filter fabric and 4-12” of compacted Class II aggregate base. The parking areas are not expected to exceed approximately 0.33 acre, or 13,200 square feet. Parking would be provided for the anticipated employees during project operation, for visitors, and for other equipment anticipated to be on-site at any time.

2.4.6.3 ACCESS ROADS

Primary operational access to the project site would be provided via the existing Rasor Road, that runs from I-15 eastward to the Rasor OHV recreation area (Figure 2-11). No public road improvements are proposed within the San Bernardino County maintained road ROW on Rasor Road. The portion of Rasor Road on BLM land would serve as the entrance and primary access road within the site is approximately 0.4-mile in length. The project would maintain and improve this portion of Rasor Road up to 26 feet wide and include a gated entrance to the project site which can be accessed approximately 250 feet southeast from the I-15 northbound off-ramp. Although it would be closed to the public during project construction, Rasor Road would reopen during project operation and serve as the main access to Rasor OHV recreation area.

Currently, Arrowhead Trail splits off of Rasor Road and runs north-south. Arrowhead Trail would be closed; the project would construct internal access road(s) which lead to the substation and between the solar arrays. These internal access roads would be up to 26 feet wide and include a 50-foot turning radius at the project boundary.

Northwest of I-15, the project would construct an access road up to 26 feet wide underneath the gen-tie line to access the switchyard.

These roads would consist of compacted native material and would be graded as necessary but would generally follow the existing terrain covered with filter fabric and 4 to 12 inches of compacted Class II aggregate or amended with Class II aggregate only where native soils are not suitable for heavy traffic. Larger boulders that could impede vehicle access would be removed. These permanent access roads would be compacted to meet load requirements for vehicle traffic over the life of the project.

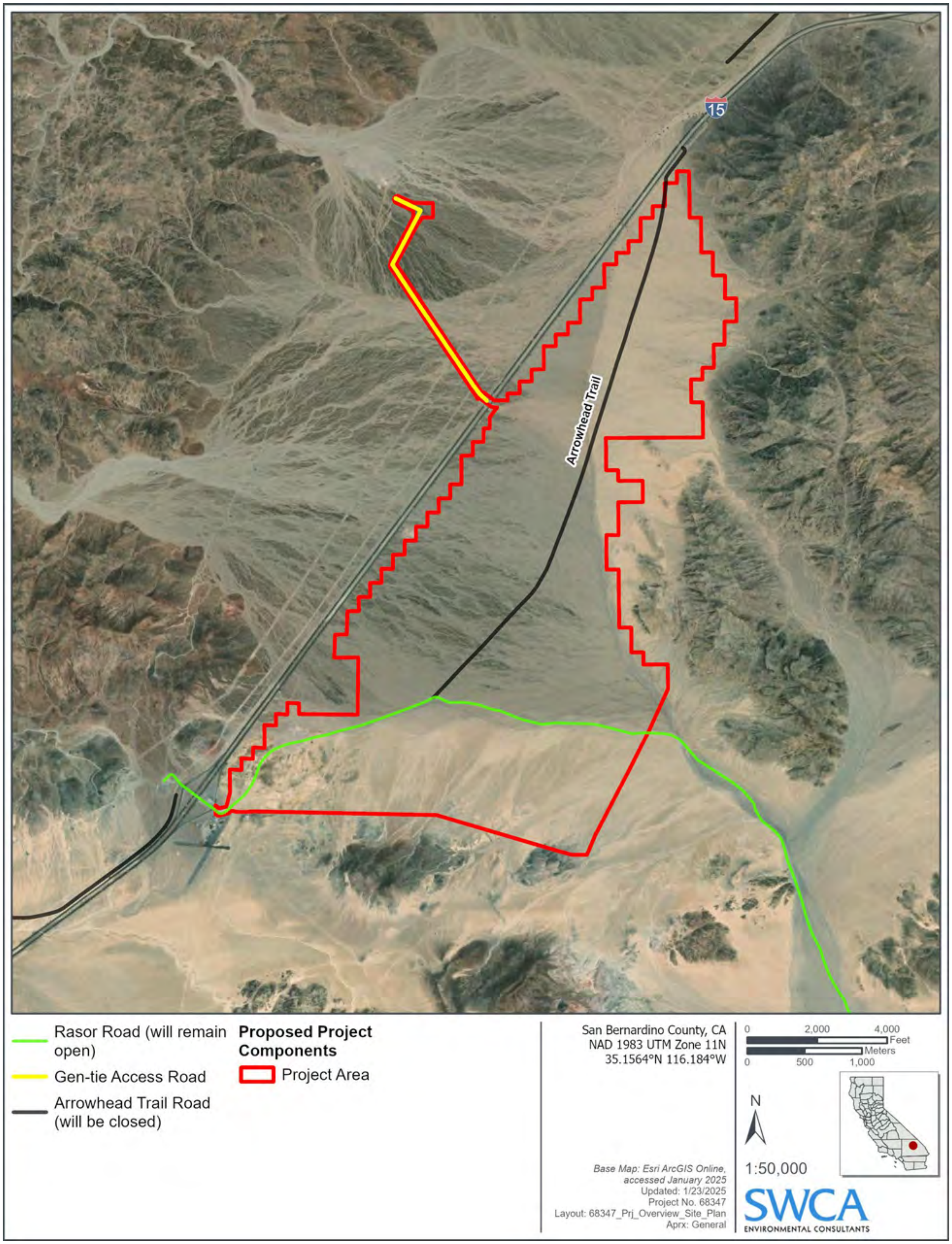

Figure 2-11. Existing and proposed roadways.

2.4.6.4 SITE SECURITY AND FENCING

All project components would be surrounded by warning signage, perimeter security fencing, desert tortoise exclusionary fencing, and perimeter security cameras. Combined security and desert tortoise fencing would be installed surrounding each individual array field and extend to include the substation and BESS area. A permanently gated, 8-foot-high chain-link fence with three-strand barbed wire meeting National Electric Safety Code requirements would be constructed around the substation and the switchyard. The line posts and terminal posts of the fence would be buried up to 3.5 feet deep, and the distance between posts would be approximately 10 feet. All permanent tortoise exclusionary fencing would be constructed in accordance with Chapter 8, Desert Tortoise Exclusion Fence, of the USFWS's 2009 Desert Tortoise Field Manual (USFWS 2009).

2.4.6.5 LIGHTING

Lighting would be provided at the Rasor Road site entrance, O&M buildings, substation, and switchyard. Exterior security lighting would be installed to provide safe access to project facilities as well as visual surveillance. Some portable lighting also could be required for essential nighttime maintenance activities. All lighting would be kept to the minimum required for safety and security; sensors, motion detectors, and switches would be used to keep lighting turned off when not required. All lighting would be compliant with San Bernardino County Dark Sky Ordinance.

2.4.7 *Landscaping*

The project would plant a variety of native and drought tolerant trees and shrubs along the western boundary of the project site. There would be approximately 30 acres of landscaped areas on-site, including up to 5 acres of irrigated landscaped areas as needed.

2.4.8 *Drainage and Erosion Control*

Grading of up to 2,059 acres and other types of ground treatment would be conducted outside of existing major drainage channels and would not involve substantial changes to site topography. Once construction is complete, the topography beneath the solar panels would generally be the same as the baseline condition except in areas where soil has been compacted or rocks and isolated surface undulations have been removed by grading. Native vegetation would be allowed to reestablish naturally and would be trimmed during operation as necessary.

Security fencing would not be used in the major drainage channels in between the array fields to minimize impacts to wildlife corridors and stormwater flow. If needed along larger drainages, breakaway fencing would consist of a driven post with detachable connections just above ground level, which allow the fencing to yield to the force of a storm event without damage to the embedded portion of the post. Following such an event, the fence would be reattached to the post. The entrance to each access road along the perimeter would include a security gate.

The design of the array fields would avoid placing solar panels within the stormwater flow corridors downstream of the existing culverts under I-15 so that flows from the culverts would continue to follow existing braided flow channels. Three drainage channels would be constructed between the array fields. Each channel would be approximately 3 feet below grade and vary in width and length. Approximately ten temporary sediment basins of varying sizes and depths would be constructed adjacent to the drainage channels and throughout the site and removed at the conclusion of construction.

Development within the channels would be limited to access road crossings and potential subsurface collector lines. Approximately twelve box culverts and eight low-water crossings would be installed at the intersection of access roads and drainage channels, and permanent protection berms would be constructed along the edges of the arrays near these flow corridors to prevent occasional side channel flows from entering the array fields. Temporary and permanent fiber rolls would also be installed on slopes before they transition into steeper slopes to control runoff.

2.4.9 *Solid Waste and Hazardous Materials Management*

Construction would generate solid waste. All waste generated during construction would be stored in wind-proof and wildlife-proof containers that periodically would be transported to an off-site disposal facility authorized to accept the waste. During construction, portable sanitary facilities would be located in the project area and maintained by a local contractor.

During operations and maintenance, some PV panels would require replacement due to breakage or other damage or to take advantage of new technologies. Removed PV panels would be recycled or disposed of in accordance with applicable local, state, and federal standards and regulations.

Hazardous materials that may be used and stored during construction and/or operations and maintenance could include gasoline and diesel fuel, paints, thinners, solvents, sealants, lubricants, hydraulic fluids, herbicides. Facility transformers would contain non-polychlorinated biphenyl (PCB)-rated dielectric fluid. Due to the non-hazardous nature of these transformer fluids, secondary containment is not required. Facility breakers may contain SF6 gas insulating fluid depending on final design.

Hazardous materials would be stored within secondary containment to control any potential leaks of oils, grease, fuels, and other hazardous materials stored at the project site. All potential contaminants would be stored and used at least 50 feet from any defined or constructed channels or basins at all times. If quantities exceed regulatory thresholds, a spill prevention control and countermeasure (SPCC) plan would be developed prior to project construction in accordance with applicable regulations and would include a facility diagram that would identify the location and contents of hazardous materials containers; potential equipment failures; containment and diversionary structures; facility drainage; personnel, training, and spill prevention procedures; and emergency contact information. Diversionary structures meeting the requirements of the SPCC plan would be provided for oil-containing equipment, including transformers, at the project site. Transformers would be inspected on a regular basis to detect and respond to any leakage.

All use, storage, transport, and disposal of hazardous materials associated with the project would be done in strict accordance with federal, state, and local regulations and guidelines. Employees would be trained in the appropriate protocol for notification and cleanup of hazardous materials. Additionally, the site would be supplied with adequate spill containment kits and personal protective equipment in case of a release.

2.5 Construction

The following sections provide details about the timeline and process for construction of the project. Once construction is complete, the project would operate for approximately 40 years. Construction would begin in the second quarter of 2026, and initial operation would begin in the fourth quarter of 2027. Full-scale commercial operation is anticipated to begin by the second quarter of 2028.

2.5.1 *Construction Schedule and Workforce*

Construction of the project is anticipated to begin in the second quarter of 2026 and occur over an approximately 18-month period and consist of overlapping construction stages. Stage 1 would include mobilization, site preparation, grading, fencing, preparation of roads and laydown areas, and installation of measures in the Stormwater Pollution Prevention Plan (SWPPP) as well as erosion control features. Stage 2 would include installation of solar array structural components including piles, racking systems, and foundations. Stage 3 would include installation of the solar and BESS inverters, solar panels, battery storage systems, and ancillary equipment, and would also include trenching activities to install cables and other electrical equipment. Stage 4 would include inspections, testing, and commissioning. Stage 1 would be from months 1 to 8, Stage 2 would be from months 4 to 12, Stage 3 would occur during months 10 to 116, and Stage 4 would occur during months 15 to 18. An average of 200 construction workers would operate daily on-site, with an anticipated 300 construction workers during peak construction activities.

The typical construction work schedule is expected to be from 6:00 a.m. to 6:00 p.m., Monday through Friday. However, to meet schedule demands or to reduce impacts, it may be necessary to work early mornings, evenings, or on weekends during certain construction phases. The work schedule may be modified throughout the year to account for changing weather conditions (e.g., starting the workday earlier in the summer months to avoid work during the hottest part of the day for health and safety reasons). If construction work takes place outside these typical hours, activities would comply with San Bernardino County standards for construction noise levels. For safety reasons, certain construction tasks, including final electrical terminations, must be performed after dark when no energy is being produced. The project would use restricted nighttime task lighting during construction. Lighting would include only what is needed to provide a safe workplace, and lights would be focused downward, shielded, and directed toward the interior of the site to minimize light exposure outside the construction area.

2.5.2 *Preconstruction Activities (Stage 1)*

Prior to construction, all contractors, subcontractors, and other on-site personnel would receive Worker Environmental Awareness Program (WEAP) training regarding the appropriate work practices necessary to effectively understand and implement the biological commitments in the project description, implement the mitigation measures, comply with applicable environmental laws and regulations, avoid and minimize impacts, and understand the importance of these resources and the purpose and necessity of protecting them.

Qualified biologists would conduct preconstruction surveys for sensitive species. Sensitive resource areas would be flagged so they are avoided or appropriately managed during construction. Preconstruction field survey work would include identifying precise locations of the project site boundary and desert tortoise and security fencing. Construction staging areas would be established for storing materials, construction equipment, and vehicles. These features would be subsequently staked in the field. No paint or permanent discoloring agents would be applied to rocks or vegetation to indicate survey or construction limits. All off-road vehicle travel, fence installation, and staging area establishment would be surveyed and/or monitored by qualified biologists, archaeologists, and tribal monitors, as appropriate. The preconstruction field surveys would be conducted during daylight hours, and vary in length and timing, depending on the species found on-site. The proposed WEAP training would be required before a worker would be allowed to work on the site. These trainings would also occur on a continuous basis during construction.

2.5.3 *Site Preparation (Stage 1)*

As shown in Figure 2-12, approximately 2,059 acres throughout the site would be disturbed. Grubbing and grading would be required across a majority of the site to level rough or undulating areas, including around roads and laydown areas, as well as the BESS yard, substation yard, and switchyard. Grubbing and grading would also be required to prepare soils for concrete foundations for substation equipment, inverters, energy storage systems, and the operations and maintenance buildings. Grubbing would involve the removal of vegetation from the construction site, while grading would include earthwork to achieve a certain base or slope. Mowing, minimal grubbing, and grading may also be required in the array areas to prepare the site to receive pile foundations. There would be approximately 630,000 cubic yards of cut and 180,100 cubic yards of fill, thus requiring approximately 449,900 cubic yards of cut on-site. The 449,900 cubic yards of net cut would be balanced throughout the disturbed area within the project site.

Per Mojave Desert Air Quality Management District Rule 403, as part of project construction, the applicant would develop a Dust Control Plan that describes all applicable dust control measures to address construction-related dust (Mojave Desert Air Quality Management District 2020). Further, a SWPPP or SWPPP-equivalent document required by the Lahontan Regional Water Quality Control Board (RWQCB) would be prepared by a qualified engineer or erosion control specialist and would be implemented before construction. The SWPPP would be designed to reduce potential impacts related to erosion and surface water quality during construction activities and throughout the life of the project. It would include project information and best management practices (BMPs). The BMPs would include dewatering procedures, stormwater runoff quality control measures, concrete waste management, stormwater detention, watering for dust control, and construction of perimeter silt fences, as needed.

2.5.4 *Solar Array Assembly and Construction (Stage 2)*

Construction of the solar arrays would begin with the installation of array support posts, which would be driven into the soil using a pile/vibratory/rotary driving technique to a depth of approximately 6 to 12 feet. Single-axis solar tracking structures would be fastened to the support piles. Once the support structures are in place, solar panels would be attached to the support frame. The assembled groups of solar panels would be wired together into strings through connectors on the back of the modules. Assembled panel sections would then be connected to combiner boxes located throughout the arrays that would deliver power to the inverter. Output wires from combiner boxes would be routed along an underground trench system approximately 3 to 6 feet deep and 1 to 6 feet wide, to the central inverter. Central inverters would be mounted on concrete pads or driven piles. Central inverters would be brought in by tractor-trailers through the Rasor Road site entrance and delivered directly to the mounting pad sites where they are placed by mobile crane.

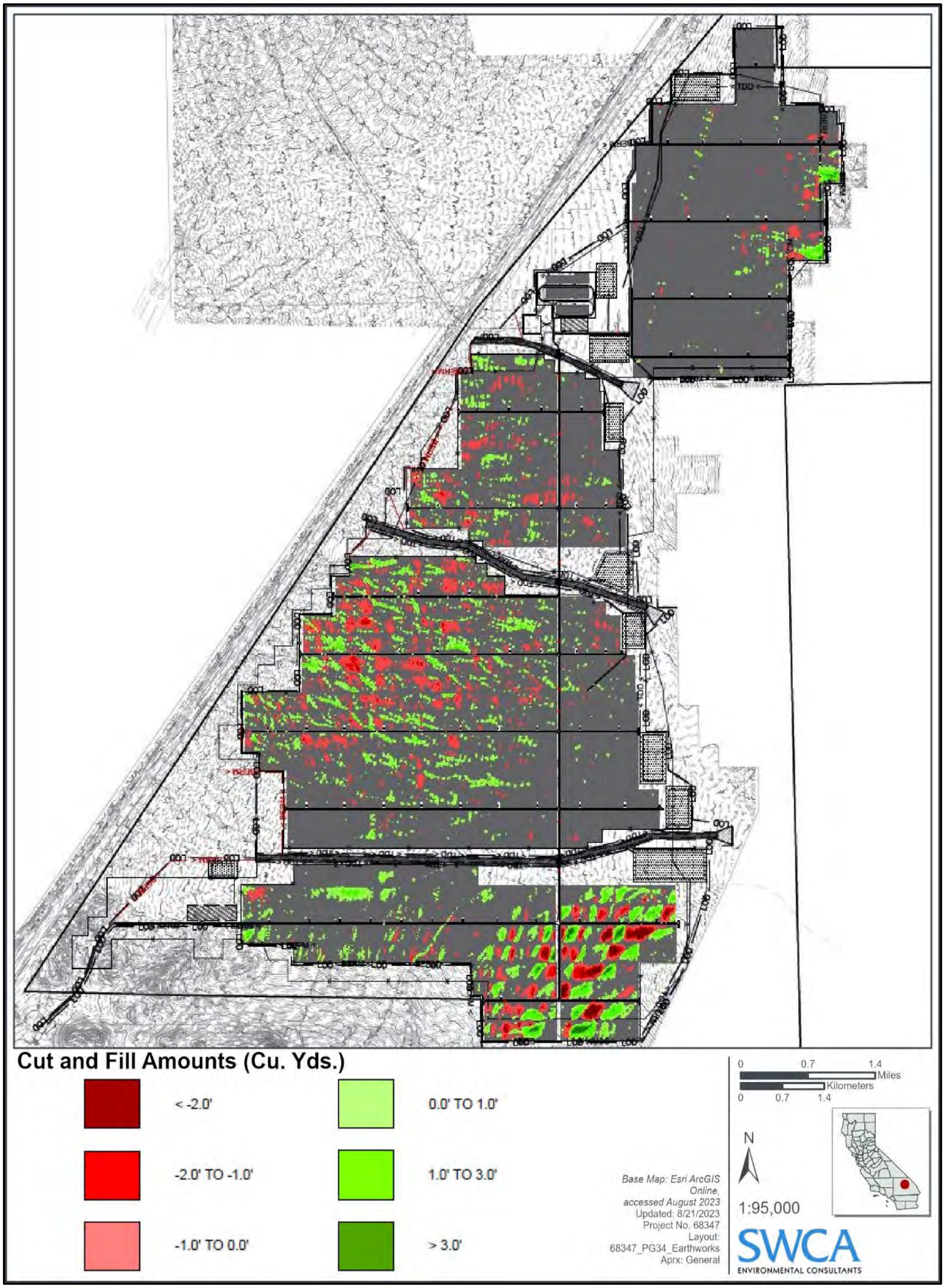

Figure 2-12. Proposed earthwork.

2.5.5 *Substation, Switchyard, and Gen-tie Construction (Stage 3)*

Construction of the project substation, switchyard, and interconnection to the Mead-Adelanto 500-kV transmission line would occur concurrently with the construction of the solar arrays. In order to construct the transmission line, one tower would be removed from the existing line, and multiple new tower structures would be constructed adjacent to location of the removed tower. The new towers would carry the 500-kV transmission line into and out of the new switchyard. The sequence of construction would be to install the new towers and equipment, string the new line, then request and outage to cut in the new line to the existing Mead-Adelanto line.

The proposed gen-tie line which would connect the new switching station to the project substation would be installed using concrete caisson foundations or driven poles. Upon installation of all poles, the line insulators and switches would be installed. Upon installation of all line equipment, the conductors would be strung along the poles.

The substation and switchyard areas would be graded and compacted to an approximately level grade and raised at least one foot above the adjacent grade to prevent flooding. Upon completion of the raised pad, concrete foundations, underground cabling, and a grounding grid would be installed. Upon completion of the underground work, steel structures would be installed to mount equipment. Once the steel structures are constructed, the substation equipment would be installed including transformers, switches, breakers, and control enclosures. Then, wiring and terminations will be performed at all equipment, after which equipment testing will be performed.

The gen-tie line would be routed to the project switchyard by boring under I-15. The boring operation would be accomplished by constructing a boring pit on each side of I-15 to initiate and terminate the bore. The gen-tie line would cross I-15 through bores in a 200-foot-wide corridor at a 90-degree angle and would be installed per Caltrans requirements. Alternative design concepts for boring design, including through an existing culvert, may be considered based on project requirements. No overhead generation-tie lines crossing I-15 are proposed.

2.5.6 *Electrical Construction Activities (Stage 3)*

Buried electrical lines for DC array wiring and AC wiring between inverters and transformers would then be installed using trenching machines. The trenches would be approximately 3 to 6 feet deep and 1 to 6 feet wide. The trenched areas would be backfilled and compacted after the cables are laid into place It is anticipated that the solar panels would require one washing during the construction phase prior to energizing and performance testing of the arrays in order to remove the dust that has accumulated on the panels during construction.

The medium-voltage collection cables would be trenched at depths up to 4 to 8 feet using a trenching machine. The trenches would be approximately 12 to 36 inches wide. Multiple trenches may be placed adjacent to each other, depending on the number of collector circuits in a particular location. The cables would be placed within the trenches in layers (as necessary) followed by backfill and compaction operation. Alternatively, a single pass trenching and cable installation machine could be used to automate the cable placement and backfill process. The main trenching operations would be for installation of DC cables from the combiner boxes to the inverters and installation of AC collector circuits between inverters and the substation. The collector cable would be installed by circuit in conduits, with each circuit contained in a single 6-inch-diameter conduit (typical) spaced approximately 10 feet on center. The exact locations would be determined during detailed design.

2.5.7 *Construction Equipment and Materials*

Standard construction equipment would be used during construction, including earth-moving equipment (e.g., bulldozers, excavators, backhoes) and road-building equipment (e.g., compactors, scrapers, graders). Construction equipment would include air compressors, all-terrain passenger vehicles, backhoes, cranes, a drill rig, tractor-trailers, flat-bed trucks, telehandlers, pick-up trucks, pile drivers, trenchers, portable generators, and water trucks. Construction equipment and maintenance trucks would be maintained to minimize leaks of motor oils, hydraulic fluids, and fuels. No extremely hazardous materials are currently anticipated to be produced, used, stored, or disposed of as a result of the project.

Most of the fuel required by construction and operation staff vehicles and engines would be procured at commercial gas stations in the local area, such as at the service station at Rasor Road or in Baker. A limited amount of #2 diesel and gasoline petroleum fuels (approximately 500 gallons each) would be stored in the staging areas in above-grade steel tanks with secondary containment.

Concrete would be required for building or structure footings and foundations and pads for inverters, transformers, water tank footings, and substation equipment. In areas where driven support posts are not practical for the solar arrays, pre-drilling and installation of posts with sand slurry may be used.

2.5.8 *Construction Vehicle Access and Traffic*

All construction materials would be delivered by truck. Most truck traffic would occur on designated truck routes and major streets. Construction traffic would include periodic truck deliveries of materials and supplies, equipment, recyclables, trash, and other truck shipments, as well as construction worker commuting vehicles. Most construction equipment and vehicles would be brought to the site at the beginning of each construction phase during construction mobilization and remain on-site throughout the duration of the construction phase for which they were needed. Generally, the equipment and vehicles would not be driven on public roads while in use for the project. Equipment will be brought to site on trailers with permitted load as required by Caltrans and would not drive on public roads.

Over the approximately 18-month construction period, the project would require approximately 1,000 truckloads of construction materials per month for delivery of components and construction materials, including concrete. Up to 90,000 truckloads would result over the total construction period, excluding travel by construction workers. As water is obtained from an off-site source during construction, an estimated 17 water transport truck trips per day would also be required. Average truck traffic would be approximately 80 trucks per day, 25 days per month. The project would use a just-in-time delivery system with supplies and components delivered on a schedule to minimize on-site storage needs.

The project would prepare a Construction Traffic Management Plan, to provide construction vehicle information, facilitate traffic control methods, and provide a designated contact for addressing complaints.

2.5.9 *Construction Water Supply and Use*

Project construction would take place over approximately 18 months. Water would be needed primarily for dust control and soil compaction during the first 90 days of grading activities, with small amounts used for sanitary and other purposes. During Stage 1 and Stage 2 of construction, which includes the 90-day grading period, the project would require approximately 200,000 gpd, or approximately 336 acre-feet per year (af/yr). Water requirements in the second year of construction are expected to be less than 110 af/yr, or half of the requirement of the first year of construction.

Five temporary water tanks of 100,000 gallons would be brought on-site by truck to store water in anticipation of construction water needs. The tanks would be housed on trailers located along access roads or within areas that have been cleared for installation of project components. The tanks may be moved around the site as construction progresses and would be used to fill on-site water trucks. The temporary water storage tanks would be removed after construction. Water used for construction would be supplied by a private groundwater well in Baker, San Bernardino County.

2.6 Operation and Maintenance

The project would begin operation in 2027 and operate 7 days a week, 365 days a year, with an approximately 40-year anticipated lifespan. Operational needs at the site include monitoring and optimizing the power generated by the solar arrays and interconnection with the transmission lines, operating the Supervisory Control and Data Acquisition (SCADA) system, troubleshooting the collector lines and repairing damaged cables, connections, or equipment, performing preventative maintenance per manufacturer recommendations, and conducting panel-washing activities periodically through the year. Additional maintenance would be required to maintain the administrative buildings, fencing and signage, roadways, and other ancillary facilities at the site. Project would hire local workforce as available to perform operations and maintenance.

2.6.1 *Operation and Maintenance Workforce*

The project substation would be uncrewed during operation; however, a workforce of approximately 2 to 4 personnel would visit the substation on an as needed basis for maintenance, equipment operation, and/or security. The project would be remotely controlled, eliminating the need for permanent on-site employees. Final staffing levels and configuration would be based on the final site configuration and early operating and maintenance experience. The facility would not be accessible to the public, and access will be infrequent and limited to authorized personnel.

2.6.2 *Automated Facility Control and Monitoring System*

The project would be operated and monitored by means of a SCADA system located in the control building. Sensors located at each inverter, BESS, project switches, and breakers would report operational parameters. Data access, as well as the operation of the project PV and BESS systems would be controlled, either on-site or remotely, through a high-security system. The non-conductive fiber-optic communications cable would be co-located with the low-voltage DC and AC wiring to reduce environmental impacts. Personnel communication would use two-way radio/receptor stations, which would require a Federal Communications Commission (FCC) license.

2.6.3 *Operational Water Supply and Use*

Project operation would require water for dust control, panel washing, and fire protection. The non-potable water for the project would be supplied by an existing private groundwater well located in Baker, San Bernardino County. This water would be trucked in from these wells and installed in three permanent water storage tanks to support project operations.

Three 10,000-gallon water tanks would be located throughout the site near the operation and maintenance building, BESS, and adjacent to the solar arrays. Water would be used to clean the PV panels; dust and dirt build-up reduces the amount of incoming solar radiation striking the active PV layer within the panel. To reduce this effect, panel washing would be conducted three times per year over a 3-week period during operations, or additionally as necessitated. The water would drain by gravity to panel-washing trucks for use. Panel washing would require approximately 2.8 af (912,384 gallons) of water per year. In total, an estimated 5.6 af/yr of water would be used for panel washing, dust control and suppression during operation.

The water tanks would also provide storage of water used for fire suppression. The tank would not require a regular supply of water because the water would be withdrawn only in the event of a fire. The tank would be monitored periodically and refilled as needed to replace evaporative losses. For fire suppression water supply, the project would conform to County requirements, which incorporate National Fire Protection Association (NFPA) Standards 1142 and 13 by reference and provide minimum requirements for fire suppression water supply where no public water supply is available (Standard 1142) and sprinkler systems (Standard 13).

2.7 Decommissioning and Site Reclamation

The solar ROW grant is authorized for a 30-year term and would be subject to renewal at that time. When the project reaches the end of its useful life, structures and equipment would be removed for reuse or sold as scrap, and the land surface would be reclaimed. A Decommissioning and Site Reclamation Plan has been prepared for the project. Because site conditions are likely to change over the life of the project, and to ensure that the decommissioning and site reclamation plan addresses all necessary conditions, the draft will be finalized and approved by the BLM before decommissioning and reclamation activities begin.

Upon decommissioning, aboveground structures would be dismantled and removed from the site. Where required by the BLM, concrete pads or foundations would be demolished, and rubble would be removed to an off-site disposal facility authorized to accept the waste. Belowground facilities may be disconnected at the surface and left in place in conformance with guidance and approval from the BLM. New project access roads and corridors would be closed, with the exception of Rasor Road, which would remain accessible.

Decommissioning of the substation and switchyard would involve deconstruction of structures. Salvaged materials would be recycled to the extent possible. Material that cannot be recycled would be transported for disposal in authorized landfills. Underground cabling and conduit may be left in place. The substation and office/storage areas would be graded to approximate the natural contour.

The applicant would prepare and implement a final closure and reclamation plan addressing removal of structures and site restoration in conformance with BLM requirements at the time of decommissioning. Construction hours and site cleanliness practices would be approximately the same during decommissioning as during construction.

Appendix C: Soda Mountain Solar Project Preliminary Site Plan August 2023