Appendix 2
Biological Opinion

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2010-F-0246

October 15, 2010

Memorandum

To: Field Manager, Barstow Field Office, Bureau of Land Management, Barstow, California

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

Subject: Biological Opinion on Tessera Solar's Calico Solar Power Generating Facility, San Bernardino County, California [(3031) P CA-680.33] (8-8-10-F-34)

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 to Tessera Solar (Tessera) for the Calico Solar Power Generating Facility (Calico) and its effects on the federally threatened desert tortoise (*Gopherus agassizii*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). The proposed project involves construction, operation, maintenance, and decommissioning of a 4,613-acre solar power generating facility and the establishment of a 3,617-acre solar development exclusion zone on an 8,230-acre Bureau right-of-way. Your April 1, 2010 request for formal consultation was received by our office on April 7, 2010.

This biological opinion is based on information that accompanied your April 1, 2010, request for consultation (Bureau 2010a, URS 2010a) and additional information regarding changes in the project description obtained from Bureau staff during the formal consultation process. This additional information includes the revised biological assessment (URS 2010b), supplemental biological assessment (URS 2010c), supplemental biological assessment supplement: phased development of the Phase 1 component of the Calico Solar Project (URS 2010d), supplement #5 to the biological assessment (URS 2010e), final desert tortoise translocation plan (URS 2010g), draft staff assessment/environmental impact statement (Bureau and California Energy Commission [CEC] 2010), supplemental staff assessment (CEC 2010a), and final environmental impact statement and proposed amendment to the California Desert Conservation Area Plan (Bureau 2010b). A complete record of this consultation is on file at the Ventura Fish and Wildlife Office.

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Consultation History

On April 1, 2010, the Bureau initiated consultation for construction, operation, maintenance, and decommissioning of the Calico facility (Bureau 2010a). On April 22, 2010, we responded to your request with a memorandum that identified specific insufficiencies in the biological assessment (Service 2010a). On May 17, 2010, the Bureau submitted a revised biological assessment for the proposed project (URS 2010b), which we determined to contain sufficient information to initiate formal consultation (Service 2010b). Following release of the draft staff assessment/environmental impact statement (Bureau and CEC 2010), Tessera modified its project to reduce adverse effects to desert tortoises and rare plant species. The Bureau developed a supplemental biological assessment to describe the changes in the project description and the addition of critical habitat, and submitted it on July 19, 2010 (URS 2010c). The Service shared a draft biological opinion with the Bureau on the proposed project on August 18, 2010 (Service 2010c). Subsequent to the development of the supplemental biological assessment and the issuance of the draft biological opinion, Tessera further refined the project description to include phasing of the Phase 1 component of the proposed project construction, dividing Phase 1 into Phase1a and Phase 1b; the Bureau provided a description of the new project in a supplement on August 30, 2010 (URS 2010d). On September 3, 2010, the CEC directed Tessera to explore alternatives to the proposed project with a further reduced project footprint (CEC 2010b). The Bureau submitted a final project description with a project footprint of 4,613 acres on September 27, 2010 (URS 2010e). This biological opinion analyzes the effects associated with the reduced project footprint, phasing of the proposed project construction, and establishment of the solar development exclusion zone.

In addition, by electronic mail dated July 17, 2010 (Otahal 2010), you requested our concurrence with your determination that translocation of desert tortoises from the project site is not likely to adversely affect the critical habitat of the desert tortoise; the information to support your determination is contained in the supplemental biological assessment (URS 2010c). Tessera proposes to translocate a portion of the desert tortoises from the project site into the Ord-Rodman Critical Habitat Unit and monitor them for a period of no less than 5 years. In addition, Tessera would monitor resident desert tortoises in the critical habitat unit for the same period. Translocation and monitoring activities would consist of driving on Bureau- designated open routes, parking in small areas immediately adjacent to roads, and foot traffic within habitat to translocate and monitor desert tortoises. We concur with your determination that the proposed action is not likely to adversely affect critical habitat of the desert tortoise. We have reached this conclusion because most activities would occur on existing roads designated as open routes by the Bureau, which do not support the primary constituent elements of desert tortoise critical habitat. Activities associated with translocation could temporarily disturb a small amount of critical habitat adjacent to roads as a result of parking adjacent to the open routes and walking through areas to release and monitor desert tortoises; however, we expect the size of this disturbance to be minimal and its effect on the function of critical habitat to be insignificant. Construction, operation, maintenance, and decommissioning of the Calico facility would not occur within or indirectly affect critical habitat in any manner. Accordingly, we will not address critical habitat in this biological opinion. If the proposed action changes in a manner that may

affect critical habitat, the Bureau should contact us as soon as possible to determine whether further consultation would be appropriate.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Introduction

The proposed site is approximately 37 miles east of Barstow, south of the Cady Mountain Wilderness Study Area and directly adjacent to the southeastern boundary of the Pisgah Crater Area of Critical Environmental Concern (ACEC). The Ord-Rodman Desert Wildlife Management Area (DWMA) is located southwest of the project and south of Interstate 40. Tessera would construct the solar facility in three phases (Phase 1a, Phase 1b and Phase 2; URS 2010d). Phase 1 would be 275 MW covering approximately 1,876 acres and sub-divided into 2 phases, Phase 1a and Phase 1b. Construction of Phase 1a would consist of 250 acres of ground disturbance and would include the construction of the main access road, a 990-foot underground water pipeline, a main services area, a substation area, a temporary at-grade crossing, a permanent bridge spanning the Burlington Northern Santa Fe (BNSF) railroad tracks and the installation of 60 solar dish Stirling systems (SunCatchers) pedestals. Prior to completion of the at-grade railroad crossing, the existing BNSF crossing and right-of-way (ROW) would be used to access Phase 1a. Phase 1b would cover the remainder of Phase 1, approximately 1,626 acres. The third phase, Phase 2, would cover approximately 2,737 acres and bring the total number of installed SunCatchers to 26,390. In addition, Tessera would construct an approximately 2-mile transmission line to connect the on-site Calico substation to the Pisgah substation located just east of the project site. The Bureau will also establish a 3,617-acre solar development exclusion zone through amendment of the California Desert Conservation Area Plan to prevent future solar development in portions of the right-of-way not disturbed by project activities. We summarized the description of the proposed action from your request for consultation (Bureau 2010a), the revised biological assessment (URS 2010b), the supplemental biological assessment (URS 2010b), the supplemental biological assessment supplement (URS 2010d), supplement #5 to the biological supplement (URS 2010e), the supplemental staff assessment (CEC 2010a), and the Calico Solar Power Project presiding member's proposed decision (CEC 2010b).

Construction

Construction of the Calico facility would occur over approximately 44 months (CEC 2010b) and require a workforce of 400 to 750 people. Heavy construction would typically occur from 7:00 a.m. to 7:00 p.m., Monday through Friday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. The temporary fencing for Phase 1a may be installed throughout the night to expedite project construction (URS 2010e). Access to the facility during construction and operation would be via the Hector Road exit at an existing interchange from Interstate 40.

All project site construction would occur within desert tortoise exclusion fencing. Tessera would install this fencing in conjunction with the construction phases. Within the project site, Tessera proposes to build surface-treated roadways, north-south access routes and east-west access routes, including a combination of roadway dips and elevated sections across drainage features. The Calico facility includes an on-site substation (approximately 15 acres), a main services complex (37.6 acres), water supply and treatment system, a buried septic tank system with a dual sanitary leach field, two hydrogen generating and distribution systems, an electrical collection system (both underground and overhead), railroad overpass to cross the existing BNSF railroad tracks, a temporary at-grade railroad crossing, two 3,000,000-gallon evaporation ponds, and security perimeter fencing. Localized channel grading would be used on a limited basis to improve channel hydraulics and to control the direction of storm water flow. If retention basins are necessary, they would be designed to be empty within 72 hours. The main services complex would contain three SunCatcher assembly buildings, administrative offices, operations control room, maintenance facility, demineralized water storage tank, and a potable water tank. The Calico facility solar field includes 26,450 38-foot-tall SunCatchers. Tessera would vibrate the base of each SunCatcher unit into place. Paired rows of SunCatchers would have access roads on either side, allowing for 40 to 80 feet of vegetation to remain between each alternate row of SunCatchers. The construction and operation of most of these facilities would not affect the desert tortoise in any manner; consequently, we will not discuss them further in this document.

The proposed project would transmit electricity to the existing Pisgah substation via an approximately 2-mile-long, 220-kilovolt transmission line, requiring the installation of 12 to 15 structures, 90 to 110 feet high. The transmission line would extend outside of the project site fencing by 2,800 feet. Construction of the portion of the line outside of the project site would occur within temporary desert tortoise exclusion fence.

An underground pipeline would deliver water to the Calico facility from a production well on private lands north of the facility, identified as "Not a Part Area 1" (NAP 1) (URS 2010c). This pipeline would extend outside of the project boundary fence; construction would occur within temporary desert tortoise exclusion fence.

Operation and Maintenance

The Calico facility would have an operating life of 40 years; however, the Bureau would issue the right-of-way grant for 20 years and has considered the life of the project to be 30 years. The Calico facility would likely operate 7 days a week with a staff of approximately 180 full-time employees. Including maintenance, the proposed facility would operate 24 hours a day. Workers would access the Calico facility by way of the Hector Road exit, which would connect to new and existing access roads, which Tessera would fence with desert tortoise exclusion fencing. All maintenance activities would occur within fenced areas.

On a monthly basis, Tessera would wash each SunCatcher mirror surface with 14 gallons of demineralized water. During a 3-month period each year, every SunCatcher would receive a "scrub" wash that could require up to 42 gallons of water per SunCatcher (SES 2008). In total, Tessera would use approximately 36.2 acre-feet of well water per year for washing SunCatchers,

dust control, and water treatment system discharge. (Water consumption may actually be less than 36.2 acre-feet per year, which was the estimated use associated with the original, larger project; Tessera did not provide an updated estimate on water consumption in association with the reduction of the number of SunCatchers for the proposed project.) Tessera would mow or trim vegetation between the rows of SunCatchers to allow for proper operation, maintenance, and fire safety.

Decommissioning and Restoration

If the Calico facility were permanently closed, all the project equipment, facilities, structures and associated facilities would be removed from the site. Prior to decommissioning, Tessera would coordinate with the appropriate agencies to develop a decommissioning plan acceptable to the Bureau (Bureau and CEC 2010). At that time, the Bureau would determine if decommissioning requires additional consultation, pursuant to section 7(a)(2) of the Endangered Species Act. Consequently, we will not analyze the potential effects of decommissioning and associated restoration on the desert tortoise at this time.

Minimization Measures

General Protective Measures

To minimize adverse effects to the desert tortoise, Tessera will implement the following protective measures during construction, operation and maintenance activities. We have changed the wording of some measures identified in the biological assessment and incorporated some of the conditions of certification from the CEC supplemental staff assessment (CEC 2010a), but we have not changed the substance of the measures that Tessera has proposed.

1. Tessera will employ authorized biologists, approved by the Bureau, Service, CEC and California Department of Fish and Game (CDFG) 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 and will be required for monitoring of any construction, operation, or maintenance activities that may result in adverse effects to the desert tortoise. The current guidance is entitled *Desert Tortoise – Authorized Biologist and Monitor Responsibilities and Qualifications* (Service 2008a).

2. Tessera 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, CEC and CDFG for approval at least 30 days prior to the time they must be in the field for construction-related ground disturbance.

3. Tessera will designate a field contact representative who will oversee compliance with protective measures during construction, operation, and maintenance 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 until the violation is corrected.

4. Individuals approved to handle desert tortoises (i.e., authorized biologists and desert tortoise monitors approved by the authorized biologist) will do so in compliance with the most up-to-date guidance from the Service. The Service is currently using the *Desert Tortoise Field Manual* (Service 2009a).

5. Tessera will develop and implement a worker environmental awareness program approved by the Bureau, Service, CEC and CDFG. The worker environmental awareness program will be administered to all onsite personnel including surveyors, construction engineers, employees, contractors, contractor's employees, supervisors, inspectors, subcontractors, and delivery personnel. The worker environmental awareness program will be implemented during site preconstruction, construction, and operation and will include, but is not limited to, the following:

   (a) a presentation in which supporting written material and electronic media, including photographs of protected species, is made available to all participants.
   (b) special emphasis on desert tortoises, including information on physical characteristics, distribution, behavior, ecology, sensitivity to human activities, legal protection, penalties for violations, reporting requirements, and protection measures.
   (c) identification of a contact if workers have further comments and questions about the material discussed in the program.

6. Prior to any ground-disturbing activities, Tessera will fence the area with desert tortoise exclusion fence, either temporary or permanent, and conduct desert tortoise clearance surveys. Desert tortoise exclusion fencing will follow the specifications provided in the *Desert Tortoise Field Manual* (Service 2009a). We have provided a description of the procedures for clearance, translocation, and monitoring of these animals below. Workers will perform all ground-disturbing activities in areas fenced with desert tortoise exclusion fence. Only activities related to desert tortoise translocation and translocation monitoring will occur outside of these areas.

   Following installation of the desert tortoise exclusion fencing for both the permanent site fencing and temporary and permanent exclusionary fencing, the fencing shall be regularly inspected. Permanent and temporary fencing will be inspected at least two times a day for the first 7 days to ensure a recently moved tortoise has not been trapped within the fence. Thereafter, permanent and temporary fencing will be inspected monthly 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 immediately to keep tortoises out of the site, and permanently repaired within 48 hours of observing damage. Inspections of permanent site fencing will occur for the life of the Project. If the fence may have permitted tortoise entry while damaged, the DETO monitors will inspect the area for tortoise. If fencing is not repaired within 48 hours, the BLM, USFWS, and CDFG Wildlife Biologists will be

notified immediately to determine if additional remedial action is required, such as the need for conducting additional clearance surveys within the Project footprint.

7. Tessera will confine all construction activities (including staging and material storage), project vehicles, and equipment within the delineated boundaries of construction areas that authorized biologists or designated desert tortoise monitors have identified and cleared of desert tortoises.

8. Tessera will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas during construction, operation, and maintenance except to deal with emergencies.

9. During operation and maintenance activities at the completed project site, Tessera will confine all vehicle parking, material stockpiles, and construction related materials to the permanently fenced project site. Vehicular traffic will be confined to existing routes of travel to and from the project site; cross country vehicle and equipment use outside designated work areas will be prohibited except to deal with emergency situations.

10. To reduce the potential for vehicle strikes of desert tortoises, Tessera will enforce a 25-mile-per-hour speed limit for project-related travel (i.e., construction, operation, and maintenance) within the site and on non-public access roads in areas surrounding the site. All project personnel will maintain this speed limit when traveling outside of a fenced area; this measure does not apply to public roads that have been posted with speed limits.

11. With the exception of security personnel, Tessera will prohibit firearms on the project site.

12. Project personnel working outside of fenced areas will 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 may move the desert tortoise to a safe location to allow for movement of the vehicle.

Management of Common Ravens

Tessera will implement the following project design features and protective measures to reduce the adverse effects associated with predation of desert tortoises by common ravens (*Corvus corax*). The draft management plan for common ravens (URS 2010g) contains more detailed information on the following actions. The Bureau, Service, CEC, and CDFG must approve this plan prior to the initiation of any ground-disturbing activity.

1. Tessera will dispose of all trash- and food-related waste associated with the project in secure, self-closing receptacles to prevent the introduction of subsidized food resources for common ravens.

2. Tessera will promptly remove and dispose of all road-killed animals on the project site or its access roads.

3. Tessera will use water for construction, operation, and maintenance (e.g., truck washing, dust suppression, SunCatcher washing, landscaping, etc.) in a manner that does not result in puddling. Because mirror cleaning will be conducted at night, Tessera anticipates that water will either evaporate or sink into the ground by morning and therefore be unavailable to wildlife.

4. Tessera will monitor the evaporation ponds on site for common raven use according to the approved Calico Solar Evaporation Pond Design Monitoring and Management Plan.

5. Tessera will install generation tie-lines on utility poles designed to be incompatible with nesting of common ravens in accordance with Avian Power Line Interaction Committee guidelines (2006) and will monitor the effectiveness of these deterrence measures. Tessera will implement alternative measures if the current effort is unsuccessful.

6. All transmission lines associated with the Calico facility will be designed in a manner that will reduce the likelihood of nesting by common ravens. Tessera will monitor all of these utility lines and other potential nesting structures and remove common raven nests that it identifies, following authorization by the Bureau and the Service.

7. Tessera will monitor the Calico facility to identify frequently used perching locations for common ravens. If it identifies such locations, Tessera will install bird barrier spikes or other functional equivalents.

8. Tessera will fund lethal removal of problem common ravens if deemed appropriate by the Bureau and the Service. Problem common ravens are individuals that have been shown, through monitoring, to prey on desert tortoises.

9. Tessera will monitor the effectiveness of its management plan for common ravens during construction and for 5 years following completion of the project. After this initial period, Tessera will monitor once every 5 years, unless results indicate more or less frequent monitoring is necessary.

Tessera will develop and implement adaptive management measures if monitoring shows that the management plan is not effective in controlling common raven use of the project site. Tessera will consult with the Bureau, the Service, CEC and CDFG prior to implementing adaptive management changes.

To address indirect and cumulative effects that it cannot fully eliminate through implementation of an onsite common raven management plan CEC is requiring Tessera to contribute funds to the regional common raven management program. The fee will contribute to an account established with the National Fish and Wildlife Foundation, discussed later under the Compensation section

of this biological opinion, to implement recommendations in the Service's *Environmental Assessment to Implement a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise* (Service 2008b). This environmental assessment identifies several activities to reduce common raven predation on desert tortoises, including reduction of human-provided subsidies (e.g., food, water, sheltering and nesting sites), education and outreach, the removal of common ravens and their nests, evaluation of effectiveness, and adaptive management. In addition to the fees described in the Compensation section, Tessera will contribute $105 per acre of disturbance for the 4,613 acres of desert tortoise habitat affected by this project. The Bureau has informed the Service that this CEC condition is also part of its action and thus has been considered in this analysis (Pogacnik 2010).

Weed Management

Tessera has submitted a draft plan to the Bureau that provides monitoring, preventative, and management strategies for weed control during construction activities and a long-term strategy for weed control and management during the operation of the project. The Bureau, Service, CEC and CDFG must approve the plan prior to the initiation of any ground-disturbing activity.

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

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

3. Tessera will survey for new invasive weed populations and monitor identified and treated populations at the Calico facility as well as within a 250-foot buffer area surrounding the site on Bureau-managed lands and accessible private lands. Tessera will quantify the baseline weed abundance in the portion of the Pisgah Crater ACEC adjacent to and within 500 meters of the eastern project boundary, north of the BNSF railroad tracks.

4. Tessera will maintain vehicle wash and inspection stations and closely monitor materials brought onto the site to minimize the potential for weed introduction.

5. Vehicles traveling into the areas used for desert tortoise translocation (i.e., recipient and control sites) will follow the requirements of the Calico Weed Management Plan to minimize the potential for the introduction of non-native species to these areas.

6. Tessera will apply all herbicides used in weed treatments according to a plan approved by the Bureau and in accordance with the herbicide labels. Tessera will only use licensed individuals for herbicide application and will suspend herbicide use when any of the following conditions are met: a) wind velocity exceeds 6 miles-per-hour during application of liquids or 15 miles-per-hour during application of granular herbicides, 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. Tessera will only use herbicides that have shown empirically-proven low toxicity to test animals. Tessera will request and receive approval of herbicides from the Bureau and Service prior to use.

8. Mulch or green waste from mown weed infestations on site will be removed from the Calico facility in a covered vehicle and transported to a licensed landfill or composting facility.

Desert Tortoise Translocation

Fencing and Clearance Surveys

Tessera will fence the Calico facility with a standard security fence and construct a boundary road around the project site to maintain public access to Bureau and private lands. To minimize adverse effects to desert tortoises from the project and the boundary road, Tessera will install desert tortoise exclusion fencing on the edge of the boundary road furthest from the site to prevent desert tortoises from accessing the road or the Calico facility. Where the fenced project boundary road intersects any other designated route or open road, Tessera will install cattle guards to prevent desert tortoises from gaining entry to the project site and associated roads. For the construction of each phase of the Calico facility, Tessera will install any additional temporary or permanent exclusion fence around the planned construction area to prevent desert tortoises from gaining access. Tessera will install temporary exclusion fencing around the construction area for the 2,800-foot interconnect line, the 990-foot underground pipeline, and the groundwater well, all of which extend outside the project site fence. Tessera will remove this temporary fence following completion of construction.

Within 24 hours prior to construction of the desert tortoise exclusion fence, authorized biologists will survey the staked fence alignment for desert tortoises. Tessera will conduct desert tortoise clearance surveys with transects 5 meters apart, covering a 30-meter-wide band centered on the fence alignment. During these surveys, an authorized biologist will inspect all burrows to determine occupancy and collapse unoccupied burrows. To the extent feasible, Tessera will modify the fence alignment to fence occupied burrows out of the Calico site and associated boundary road. If the fence cannot avoid a desert tortoise burrow, an authorized biologist will remove the individual and process it as detailed in the desert tortoise translocation plan.

For Phase 1a, Tessera will construct the 15.5 miles desert tortoise exclusion fence in 2 shifts, one during the day and one at night (night defined as: 1 hour before sunset until one hour after sunrise). To minimize the potential adverse effects to desert tortoises specific to night construction, Tessera will implement the following measures during the fencing of Phase 1a of the Calico project:

1. Tessera will delineate the 30-meter survey area centered on the fence line during daylight hours so that all workers can identify the authorized construction area. No work, during the day or night, will occur outside of the delineated area.

2. Tessera will inspect all the desert tortoise burrows in the 30-meter survey area during the day before night activities are to occur to determine occupancy, using an optical scope if necessary. If a burrow is determined to be occupied, a temporary desert tortoise exclusion fence will be built around the burrow and the Phase 1a exclusion fence will be built around the burrow. If the fence re-alignment excludes the desert tortoise from Phase 1a, Tessera will remove the temporary fencing around the burrow after construction in the area is complete. If the fence re-alignment encompasses the burrow within Phase 1a, the fencing will remain in place and Tessera will begin monitoring this burrow according to the translocation plan. The fencing around the burrow should encompass the entire burrow including the front apron and allow room for the desert tortoise to exit the burrow; approximately 3 square feet of open area extending from the outer edge of the burrow apron edge should remain at the mouth of the burrow.

3. Tessera will collapse burrows that are determined to be empty in accordance with the Service's guidelines. The Service is currently using guidance provided in the *Desert Tortoise Field Manual* (Service 2009a).

4. Tessera will collect any desert tortoises found on the surface during nighttime construction activity and hold them in a sanitized tub. In the morning, Tessera will move the desert tortoise to a previously constructed quarantine pen outside of Phase 1a. Quarantine pens will be constructed as described in the project's desert tortoise translocation plan.

5. Tessera will not clear any vegetation during the night shift of Phase 1a; any vegetation removal will take place during daytime hours.

6. Tessera will stage all fencing material within the previously delineated construction area the day before night fencing activities will occur.

7. Tessera will ensure that work areas have adequate lighting to minimize potential shadow effects, to ensure authorized biologists can detect desert tortoises without added difficulty, and to ensure that work crews stay within the allowed work area.

8. Tessera will ensure that all vehicles observe a 5-mile-per-hour speed limit during nighttime construction activities including access to construction areas.

Following construction of the desert tortoise exclusion fence around any given portion of the Calico project (i.e., Phase 1a, Phase 1b, Phase 2, transmission line, underground water pipeline, fences which may be constructed to allow for small areas of phased development), Tessera will perform a full clearance survey of the fenced area during the spring (i.e., April to May) or fall

(i.e., late August to mid-October). Authorized biologists and supervised desert tortoise monitors will conduct a minimum of 2 complete clearance sweeps over the entire project site with transects no wider than 5 meters. Surveyors will conduct transects for each sweep in different directions to allow for opposing angles of observation. Tessera will consider the site clear after no new desert tortoises have been discovered during two complete passes. Authorized biologists will excavate all potential desert tortoise burrows by hand to confirm occupancy status. Tessera will collect data on all desert tortoises handled as outlined in the project translocation plan.

Because construction of Phase 1a will not begin until after the end of the fall clearance window in mid-October, Tessera will conduct special clearance surveys for this phase of the project. Tessera will follow all clearance survey methodology with the exception of clearance windows provided above; however, any desert tortoises found in burrows will be left undisturbed and a desert tortoise exclusion fence will be built around the burrow. Tessera will check the desert tortoises enclosed in the pen weekly to ensure that they remain in hibernation. If a desert tortoise is found above ground during a weekly check, Tessera will move the desert tortoise to a quarantine pen outside of Phase 1a. Any desert tortoise detected above ground during surveys will be collected and placed in a quarantine pen. Tessera will translocate all of the desert tortoises found in Phase 1a in the spring as provided in the project translocation plan.

Translocation

Tessera will follow the procedures outlined in the translocation plan for the proposed project (URS 2010f). An authorized biologist will move all desert tortoises found during clearance surveys to pre-selected recipient sites. Recipient sites for the translocated desert tortoises include portions of the Pisgah Crater ACEC to the east of the project (Pisgah ACEC translocation site), the area north of the project site between the Cady Mountains and the desert tortoise exclusion fence (Linkage translocation site), and the northeastern portion of the Ord-Rodman DWMA (Ord-Rodman DWMA translocation site; URS 2010c).

All desert tortoises determined to be appropriate for translocation (i.e., having good body condition and showing no sign of diseases such as upper respiratory tract disease, herpes virus, shell disease, or other diseases) will be marked with a unique identifier determined by the Desert Tortoise Recovery Office and released in a safe location underneath a shrub. If desert tortoises show signs of disease, they will not be released until Tessera has coordinated with the Service. Prior to translocation, Tessera will ensure that all desert tortoises receive a visual health assessment to verify that each individual does not show signs of disease. Desert tortoises translocated a distance greater than 500 meters will be tested for disease [i.e., Enzyme-linked immunosorbent assay, (ELISA) test] via blood sampling. Any desert tortoises that are moved a distance less than 500 meters will not require a blood sample as part of the health assessment. Tessera will quarantine desert tortoises that show signs of disease at a location agreed upon by the Bureau, CDFG, CEC, and Service. Tessera will not translocate desert tortoises outside of the recommended temperature guidelines or outside of the desert tortoise active season (generally between April 1 and May 31), with the exception of the desert tortoises in Phase 1a, which will be moved to quarantine pens within the project site if they are detected above ground during

clearance surveys. Tessera will maintain a record of all desert tortoises encountered and translocated during project surveys and monitoring.

For Phases 1b and 2, Tessera will quarantine desert tortoises requiring blood samples for disease testing (individual translocated greater than 500 meters) within the desert tortoise exclusion fence constructed for the particular construction phase. During clearance surveys, Tessera will fit each desert tortoise with a transmitter and give it a unique identifier when blood samples are collected. These desert tortoises will move freely within the project fence boundary until disease test results are received (i.e., *in situ* quarantine). Tessera will hold juvenile desert tortoises, which are too small to receive transmitters, in a quarantine pen within the project site until disease results are available. In some instances, Tessera may move subadult and adult desert tortoises (i.e., those greater than 180 millimeters in length) located during clearance surveys into a quarantine pen on another portion or the project site rather than proceeding with *in situ* quarantine. (By "subadult and adult desert tortoises," we mean any combination of individuals of these age classes.) Desert tortoises with negative disease test results that are found within 500 meters of a desert tortoise with positive test results (either on day of blood collection or translocation) will be retested for infections prior to translocation. Tessera will not translocate any desert tortoises prior to the Service's concurrence with the health assessment and disposition plan for that individual. (Each disposition plan will describe the conditions regarding a specific desert tortoise; staff from the Service's Desert Tortoise Recovery Office will review each plan and approve it before any desert tortoise is translocated. Based on the specific conditions of the desert tortoise, the capture area, the translocation area, and possibly other factors, the Desert Tortoise Recovery Office may allow for minor modifications of the guidance in the translocation plan as a result of the information in the disposition plan. For example, if the Desert Tortoise Recovery Office deems the conditions to be appropriate, a desert tortoise found slightly more than 500 meters from the project's boundary may be moved under the prescriptions for a short-distance translocation (i.e., less than 500 meters from the fence).)

To reduce the potential that translocated desert tortoises could become infected by disease from contact with individuals within the recipient area, Tessera will conduct surveys within the Ord-Rodman DWMA translocation area to demonstrate the prevalence of disease. The disease rate in the Ord-Rodman DWMA translocation area must be less than 5 percent (95 percent confidence level) to be considered a valid recipient area for translocated desert tortoises. To further decrease the potential for disease spread associated with translocation, Tessera will establish a 6-kilometer buffer around any resident desert tortoise that is determined to be diseased or seropositive (i.e., a seropositive animal is one that has a positive result from blood testing) based on the health assessment and blood testing.

Monitoring

Tessera will attach transmitters to and monitor all desert tortoises cleared from the Calico project site which are of sufficient size to accommodate transmitters. Smaller animals will be blood tested (when being moved greater than 500 meters) and translocated without transmitters if found to be in good health. Tessera will also attach transmitters to and monitor desert tortoises

that are resident to the recipient and control areas. Tessera will attempt to locate and attach transmitters to equal numbers of recipient, control, and translocated desert tortoises. In the event that too few resident desert tortoises can be located, Tessera will confer with the Service, Bureau, CEC, and CDFG to determine if additional searches to located more desert tortoises are needed. The location of the control population will be in habitat similar to but at least 6.2 miles distant from the recipient area or in an area separated from the recipient area by a physical barrier that prevents desert tortoise movement. The area selected for the Calico facility is north of the project site on the western edge of the Cady Mountain Wilderness Study area (URS 2010c). Tessera will use qualified biologists, authorized by the Service, Bureau, CEC, and CDFG to monitor these populations.

In addition to attaching transmitters to desert tortoises in the recipient and control areas, Tessera will collect blood samples on the resident subadults and adults located in the recipient areas receiving desert tortoises from more than 500 meters away and all subadult and adult desert tortoises receiving transmitters in the control site. Tessera will not translocate any desert tortoises from the project site to a location within 6 kilometers of a resident desert tortoise showing either clinical signs of disease or with a blood test result indicating that the individual is seropositive.

During monitoring, Tessera will collect information on survivorship, mortality rates, health status, body condition, movement of individuals, and predation to inform adaptive management. Tessera will monitor the translocated, resident, and control desert tortoises for a minimum of 5 years. Tessera has provided a more detailed description of the monitoring program in its translocation plan (URS 2010f). Following more intensive monitoring immediately after translocation, locations for individuals will be collected at a minimum of once per week from March to November and once every other week from November to February.

To minimize adverse effects to the desert tortoises, Tessera will implement the following protective measures when implementing clearance surveys, desert tortoise translocation and monitoring:

1. Tessera will design all desert tortoise exclusion fencing in accordance with the Service guidelines. The Service is currently using guidance provided in the *Desert Tortoise Field Manual* (Service 2009a).

2. Tessera will comply with the most up-to-date guidance for performing clearance surveys and handling desert tortoises. The Service is currently using the *Desert Tortoise Field Manual* (Service 2009a).

3. Tessera will use authorized biologists for the performance of clearance surveys and for any other activities that require the handling of desert tortoises. If Tessera uses desert tortoise monitors during clearance surveys or for other activities that require identification of sign or handling of desert tortoises, they will do so under the direct supervision of an authorized biologist.

4. Tessera will use authorized biologists with additional qualifications approved by the Service for attaching transmitters and collecting blood samples.

5. Following clearance of the fenced project phases, an authorized biologist will be onsite during initial clearing and grading to move any desert tortoises missed during the clearance surveys. Following initial clearing and grading, an authorized biologist will be on-call during construction, should a desert tortoise be located inside the project construction site.

6. An authorized biologist will hydrate all desert tortoises scheduled for translocation within 12 hours prior to release in accordance with the translocation plan.

7. Tessera will only use Service-authorized individuals that have experience identifying the clinical signs of upper respiratory tract disease, herpes virus, and cutaneous dyskeratosis for the performance of health assessments. Tessera will provide the Service with the qualifications of any authorized biologists that it will use to perform health assessments on desert tortoises during clearance and translocation activities.

8. The number of desert tortoises translocated into each translocation area will not exceed the Service (2010g) recommended percentage over the estimated population density (i.e., 30 percent above 5.0 subadult and adult desert tortoises per square kilometer for the Pisgah ACEC translocation area and 30 percent above 8.2 subadult and adult desert tortoises per square kilometer for the Ord-Rodman DWMA translocation area). Because desert tortoises translocated into the Linkage translocation area will be moved less than 500 meters, no density threshold has been applied for this translocation area.

Compensation

We summarized the following information from the Bureau's final environmental impact statement for the proposed action (Bureau 2010b). The Bureau will require Tessera to compensate for the loss of desert tortoise habitat at a compensation ratio of 1:1 per the provisions of the West Mojave Plan (Bureau et al. 2005). Tessera will pay the Bureau's compensation as a fee based on the July 23, 2010 Renewable Energy Action Team (REAT) fee schedule (total $16,196,623.95) or as modified by the REAT at the time of compensation payment. Furthermore, Tessera may pay this fee in a phased manner, pending discussions with the REAT, rather than as a lump sum. The memorandum of agreement between the REAT agencies and National Fish and Wildlife Foundation allows the REAT agencies to require additional funding to be deposited into the project-specific account if the agencies find the money is not adequate to implement the required biological mitigation (REAT 2010). The funds will be used for enhancement of desert tortoise habitat within the Ord-Rodman DWMA. The enhancement funds may be used to cover environmental review and implementation of the activities listed below, including the hiring of contractors to carry out the activities. The following is a list of potential habitat enhancement and rehabilitation actions, identified by the Bureau that could be implemented to fulfill the Bureau's compensation requirements:

1. Construction of 40 miles of desert tortoise exclusion fence along State Route 247 from Barstow to Lucerne Valley to prevent desert tortoises from entering the roadway, with the primary focus area being between Barstow and Stoddard Ridge.

2. Installation of 60 miles of barrier fencing (post and cable) along Camp Rock road to prevent unauthorized vehicular use of desert tortoise habitat within the DWMA.

3. Addressing road needs within the Ord-Rodman DWMA including signing of 280 miles of open routes, signing and closure of 172 miles of undesignated routes, and rehabilitation of at least 100 miles of these routes.

4. Habitat enhancement via exotic weed control.

5. Installation of desert tortoise exclusion fence along Interstate 40.

6. Securing mines in which desert tortoises may become trapped.

7. Funding a headstart program for desert tortoises developed in coordination with the Service's Desert Tortoise Recovery Office.

In addition to the required compensation described above, the CDFG and CEC will require compensation for loss of desert tortoise habitat at a ratio of 2:1 for the lands north of the BNSF railroad. The State agencies will require compensation at a ratio of 4:1 for 369 acres of this area, because of their high value to desert tortoises. The portion of compensation required by these agencies will be used to acquire desert tortoise habitat in the Ord-Rodman, Superior-Cronese, or Fremont-Kramer DWMAs. The Bureau informed the Service that this compensation requirement is part of the project description for its action, and thus has been considered in this analysis (Pogacnik 2010).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of desert tortoises, 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 determines 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 evaluates 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.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the desert tortoise and the role of the action area in the survival and recovery of the desert tortoise as the context for evaluation of the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

STATUS OF THE SPECIES

Basic Ecology of the Desert Tortoise

The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. In California, the desert tortoise occurs primarily within the Creosote, Shadscale, and Joshua Tree Series of Mojave Desert Scrub, and the Lower Colorado River Valley subdivision of Sonoran Desert Scrub. Optimal habitat has been characterized as creosote bush scrub in areas where precipitation ranges from 2 to 8 inches, diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner and Brown 1982, Schamberger and Turner 1986). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. In California, desert tortoises are typically associated with gravelly flats or sandy soils with some clay, but occasionally occur in windblown sand or in rocky terrain (Luckenbach 1982). Desert tortoises occur in the California desert from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982, Schamberger and Turner 1986). Recent range-wide monitoring efforts have consistently documented desert tortoises above 3,000 feet (Service 2006a).

Desert tortoises may spend more time in washes than in flat areas outside of washes; Jennings (1997) notes that, between March 1 and April 30, desert tortoises "spent a disproportionately longer time within hill and washlet strata" and, from May 1 through May 31, hills, washlets, and washes "continued to be important." Jennings' paper does not differentiate between the time desert tortoises spent in hilly areas versus washes and washlets; however, he notes that, although washes and washlets comprised only 10.3 percent of the study area, more than 25 percent of the plant species on which desert tortoises fed were located in these areas. Luckenbach (1982) states that the "banks and berms of washes are preferred places for burrows;" he also recounts an incident in which 15 desert tortoises along 0.12 mile of wash were killed by a flash flood. Desert tortoises are most active in California during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rain storms. Desert tortoises spend most of their time during the remainder of the year in burrows, escaping the extreme conditions of the desert; however, recent work has demonstrated that they can be active at any time of the year. Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley

(1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Weinstein et al. (1987), and Service (1994).

Food resources for desert tortoises are dependent on the availability and nutritional quality of annual and perennial vegetation, which is greatly influenced by climatic factors, such as the timing and amount of rainfall, temperatures, and wind (Beatley 1969, 1974, Congdon 1989, Karasov 1989, Polis 1991; all in Avery 1998). In the Mojave Desert, these climatic factors are typically highly variable; this variability can limit the desert tortoise's food resources.

Desert tortoises will eat many species of plants. However, at any time, most of their diet consists of a few species (Nagy and Medica 1986 and Jennings 1993 in Avery 1998). Additionally, their preferences can change during the course of a season (Avery 1998) and over several seasons (Esque 1994 in Avery 1998). Possible reasons for desert tortoises to alter their preferences may include changes in nutrient concentrations in plant species, the availability of plants, and the nutrient requirements of individual animals (Avery 1998). In Avery's (1998) study in the Ivanpah Valley, desert tortoises consumed primarily green annual plants in spring; they ate cacti and herbaceous perennials once the winter annuals began to disappear. Medica et al. (1982 in Avery 1998) found that desert tortoises ate increased amounts of green perennial grass when winter annuals were sparse or unavailable; Avery (1998) found that desert tortoises rarely ate perennial grasses.

Desert tortoise females typically produce one to two clutches of 1 to 7 eggs per year (Turner et al. 1986 *in* Service 1994). On rare occasions, clutches can contain up to 15 eggs; most clutches contain 3 to 7 eggs. Multi-decade studies of the Blanding's turtle (*Emydoidea blandingii*), which, like the desert tortoise, is long lived and matures late, indicate that approximately 70 percent of the young animals must survive each year until they reach adult size; after this time, annual survivorship exceeds 90 percent (Congdon et al. 1993). Research has indicated that 50 to 60 percent of young desert tortoises typically survive from year to year, even in the first and most vulnerable year of life. We do not have sufficient information on the demography of the desert tortoise to determine whether this rate is sufficient to maintain viable populations; however, it does indicate that maintaining favorable habitat conditions for small desert tortoises is crucial for the continued viability of the species.

Desert tortoises typically hatch from late August through early October. At the time of hatching, the desert tortoise has a substantial yolk sac; the yolk can sustain them through the fall and winter months until forage is available in the late winter or early spring. However, neonates will eat if food is available to them at the time of hatching; when food is available, they can reduce their reliance on the yolk sac to conserve this source of nutrition. Neonate desert tortoises use abandoned rodent burrows for daily and winter shelter; these burrows are often shallowly excavated and run parallel to the surface of the ground.

Neonate desert tortoises emerge from their winter burrows as early as late January to take advantage of freshly germinating annual plants; if appropriate temperatures and rainfall are present, at least some plants will continue to germinate later in the spring. Freshly germinating

plants and plant species that remain small throughout their phenological development are important to neonate desert tortoises because their size prohibits access to taller plants. As plants grow taller during the spring, some species become inaccessible to small desert tortoises.

Neonate and juvenile desert tortoises require approximately 12 to 16 percent protein content in their diet for proper growth. Desert tortoises, both juveniles and adults, seem to selectively forage for particular species of plants with favorable ratios of water, nitrogen (protein), and potassium. The potassium excretion potential model (Oftedal 2001) predicts that, at favorable ratios, the water and nitrogen allow desert tortoises to excrete high concentrations of potentially toxic potassium, which is abundant in many desert plants. Oftedal (2001) also reports that variation in rainfall and temperatures cause the potassium excretion potential index to change annually and during the course of a plant's growing season. Therefore, the changing nutritive quality of plants, combined with their increase in size, further limits the forage available to small desert tortoises to sustain their survival and growth.

In summary, the ecological requirements and behavior of neonate and juvenile desert tortoises are substantially different from those of subadults and adults. Smaller desert tortoises use abandoned rodent burrows, which are typically more fragile than the larger ones constructed by adults. They are active earlier in the season. Finally, small desert tortoises rely on smaller annual plants with greater protein content; the smaller plant size allows them to gain access to food and the higher protein content promotes growth.

Status of the Desert Tortoise

The Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California. On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 *Federal Register* 32326). In its final rule, dated April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 *Federal Register* 12178).

The Service listed the desert tortoise in response to loss and degradation of habitat caused by numerous human activities including urbanization, agricultural development, military training, recreational use, mining, and livestock grazing. The loss of individual desert tortoises to increased predation by common ravens, collection by humans for pets or consumption, collisions with vehicles on paved and unpaved roads, and mortality resulting from diseases also contributed to the Service's listing of this species.

Recovery Plan for the Desert Tortoise

The recovery plan for the desert tortoise is the basis and key strategy for recovery and delisting of the desert tortoise. The recovery plan divides the range of the desert tortoise into 6 distinct population segments or recovery units and recommends the establishment of 14 DWMAs throughout the recovery units. Within each DWMA, the recovery plan recommends

implementation of reserve-level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. The recovery plan also recommends that DWMAs be designed to follow the accepted concepts of reserve design and be managed to restrict human activities that negatively affect desert tortoises (Service 1994). The delisting criteria established by the recovery plan are:

1. The population within a recovery unit must exhibit a statistically significant upward trend or remain stationary for at least 25 years;

2. Enough habitat must be protected within a recovery unit or the habitat and desert tortoises must be managed intensively enough to ensure long-term viability;

3. Populations of desert tortoises within each recovery unit must be managed so discrete population growth rates (lambdas) are maintained at or above 1.0;

4. Regulatory mechanisms or land management commitments that provide for long-term protection of desert tortoises and their habitat must be implemented; and

5. The population of the recovery unit is unlikely to need protection under the Endangered Species Act in the foreseeable future.

The recovery plan based its descriptions of the six recovery units on differences in genetics, morphology, behavior, ecology, and habitat use over the range of the Mojave population of the desert tortoise. The recovery plan contains generalized descriptions of the variations in habitat parameters of the recovery units and the behavior and ecology of the desert tortoises that reside in these areas (pages 20 to 22 in Service 1994). The recovery plan (pages 24 to 26 from Service 1994) describes the characteristics of desert tortoises and variances in their habitat, foods, burrow sites, and phenotypes across the range of the listed taxon. Consequently, to capture the full range of phenotypes, use of habitat, and range of behavior of the desert tortoise as a species, conservation of the species across its entire range is essential.

The Service has released a revised recovery plan for public review (Service 2008c). The revised recovery plan includes a discussion of reducing the number of recovery units to four, based on information that has been generated since the release of the original document.

Relationship of Recovery Units, Distinct Population Segments, Desert Wildlife Management Areas, and Critical Habitat Units

The recovery plan (Service 1994) recognized six recovery units or evolutionarily significant units across the range of the listed taxon, based on differences in genetics, morphology, behavior, ecology, and habitat use of the desert tortoises found in these areas. The boundaries between these areas are vaguely defined. In some cases, such as where the Western Mojave Recovery Unit borders the Eastern Mojave Recovery Unit, a long, low-lying, arid valley provides a fairly substantial separation of recovery units. In other areas, such as where the Eastern Mojave

Recovery Unit borders the Northern Colorado Recovery Unit, little natural separation exists. Because of the vague boundaries, the acreage of these areas has not been quantified. Over the years, the Service has commonly referred to the areas as "recovery units;" the term "distinct population segment" has not been in common use.

The recovery plan recommended that land management agencies establish one or more DWMAs within each recovery unit. As mentioned previously in the Recovery Plan for the Desert Tortoise section of this biological opinion, the recovery plan recommended that these areas receive reserve-level management to remove or mitigate the effects of the human activities responsible for declines in the number of desert tortoises. As was the case for the recovery units, the recovery plan did not determine precise boundaries for the DWMAs; the recovery team intended for land management agencies to establish these boundaries, based on the site-specific needs of the desert tortoise. At this time, DWMAs have been established throughout the range of the desert tortoise.

Based on the recommendations contained in the draft recovery plan for the desert tortoise, the Service designated critical habitat throughout the range of the desert tortoise (59 *Federal Register* 5820). The 14 critical habitat units have defined boundaries and cover specific areas throughout the 6 recovery units.

The Bureau used the boundaries of the critical habitat units and other considerations, such as conflicts in management objectives and more current information, to propose and designate DWMAs through its land use planning processes. In California, the Bureau also classified these DWMAs as areas of critical environmental concern, which allows the Bureau to establish management goals for specific resources in defined areas. Through the land use planning process, the Bureau established firm boundaries for the DWMAs.

The Department of Defense installations and National Park Service units in the California desert did not establish DWMAs on their lands. Where the military mission is compatible with management of desert tortoises and their habitat, the Department of Defense has worked with the Service to conserve desert tortoises and their habitat. Examples of such overlap include the bombing ranges on the Navy's Mojave B and the Chocolate Mountains Aerial Gunnery Ranges; although the target areas are heavily disturbed, most of the surrounding land remains undisturbed. Additionally, the U.S. Army has established several areas along the boundaries of Fort Irwin where training with vehicles is prohibited; desert tortoises persist in these areas, which are contiguous with lands off-base. The National Park Service did not establish DWMAs within the Mojave National Preserve, because the entire preserve is managed at a level that is generally consistent with the spirit and intent of the recovery plan for the desert tortoise.

The following table depicts the relationship among recovery units, DWMAs, and critical habitat units through the range of the desert tortoise.

Critical Habitat Unit	Desert Wildlife Management Area	Recovery Unit	State	Size of Critical Habitat Unit (acres)
Chemehuevi	Chemehuevi	Northern Colorado	CA	937,400
Chuckwalla	Chuckwalla	Eastern Colorado	CA	1,020,600
Fremont-Kramer	Fremont-Kramer	Western Mojave	CA	518,000
Ivanpah Valley	Ivanpah Valley	Eastern Mojave/Northeastern Mojave	CA	632,400
Pinto Mountain	Joshua Tree	Western Mojave/ Eastern Colorado	CA	171,700
Ord-Rodman	Ord-Rodman	Western Mojave	CA	253,200
Piute-Eldorado- CA Piute-Eldorado- NV	Fenner Piute-Eldorado	Eastern Mojave Northeastern Mojave/ Eastern Mojave	CA NV	453,800 516,800
Superior-Cronese	Superior-Cronese Lakes	Western Mojave	CA	766,900
Beaver Dam: NV UT AZ	 Beaver Dam Beaver Dam Beaver Dam	Northeastern Mojave (all)	 NV UT AZ	 87,400 74,500 42,700
Gold Butte-Pakoon NV AZ	 Gold Butte-Pakoon Gold Butte-Pakoon	Northeastern Mojave (all)	 NV AZ	 192,300 296,000
Mormon Mesa	Mormon Mesa Coyote Spring	Northeastern Mojave	NV	427,900
Upper Virgin River	Upper Virgin River	Upper Virgin River	UT	54,600

Methods of Estimating the Number of Desert Tortoises

Before entering into a discussion of the status and trends of the desert tortoise in the Western Mojave Recovery Unit where the proposed action is located, a brief discussion of the methods of estimating the numbers of desert tortoises would be useful. Three primary methods have been widely used: permanent study plots, triangular transects, and line distance sampling.

Generally, permanent study plots are defined areas that are visited at roughly 4-year intervals to determine the numbers of desert tortoises present. Desert tortoises found on these plots during the spring surveys were registered; that is, they were marked so they could be identified individually during subsequent surveys. Between 1971 and 1980, 27 plots were established in California to study the desert tortoise; 15 of these plots were used by the Bureau to monitor desert tortoises on a long-term basis (Berry 1999). Range-wide, 49 plots have been used at one time or another to attempt to monitor desert tortoises (Tracy et al. 2004).

Triangular transects are used to detect sign (i.e., scat, burrows, footprints, etc.) of desert tortoises. The number of sign is then correlated with standard reference sites, such as permanent study plots, to allow the determination of density estimates.

Finally, line distance sampling involves walking transects while trying to detect live desert tortoises. Based on the distance of the desert tortoise from the centerline of the transect, the length of the transect, and a calculation of what percentage of the animals in the area were likely to have been above ground and visible to surveyors during the time the transect was walked, an estimation of the density can be made. This density only represents an estimation of the number of desert tortoises that are greater than 180 millimeters in size. Desert tortoises that are larger than this size are typically classified as subadult or adult desert tortoises.

Each of these methods has various strengths and weaknesses. In general, permanent study plots have been used to estimate the status of desert tortoises across large areas over time. Triangular transects were used to assess the density of desert tortoises on specific sites at a point in time; this method was commonly used to determine how many desert tortoises may be affected by a specific proposed action. In 2001, the Service initiated line-distance sampling to estimate the density of desert tortoises in desert wildlife management areas and critical habitat throughout the range.

Note that, when reviewing the information presented in the following sections, determining the number of desert tortoises over large areas is extremely difficult. The report prepared by the Desert Tortoise Recovery Plan Assessment Committee (Tracy et al. 2004) acknowledges as much. Desert tortoises spend much of their lives underground or concealed under shrubs, are not very active in years of low rainfall, and are distributed over a wide area in several different types of habitat. Other factors, such as the inability to sample on private lands and rugged terrain, further complicate sampling efforts. Consequently, the topic of determining the best way to estimate the abundance of desert tortoises has generated many discussions over the years. As a result of this difficulty, we cannot provide concise estimations of the density of desert tortoises in each recovery unit or DWMA that have been made in a consistent manner.

Given the difficulty in determining the density of desert tortoises over large areas, the reader needs to understand fully that the differences in density estimates in the recovery plan and those derived from subsequent sampling efforts may not accurately reflect on-the-ground conditions. Despite this statement, the reader should also be aware that the absence of live desert tortoises and the presence of carcasses over large areas of some desert wildlife management areas provide at least some evidence that desert tortoise populations seem to be in a downward trend in some regions.

Status and Trends of Desert Tortoise Populations

The following paragraphs provide general information on the status and trends of the desert tortoise population in the Western Mojave Recovery Unit, where the proposed action is located. We have not included detailed information on the status of the desert tortoise in the other

recovery units throughout the range of the species in this biological opinion. This omission will not compromise the analysis in the biological opinion because our determination regarding whether a proposed action is likely to jeopardize the continued existence of a species must be conducted at the level of the listed taxon. When the range of the listed taxon is divided into recovery units, our level of analysis begins with the recovery unit; if the effects of the proposed action have the potential to compromise the ability of the species to survive and recover within the recovery unit, the next level of analysis considers how the compromised recovery unit would affect the listed taxon throughout its range (Service 2005). Our analysis can therefore be conducted in a comprehensive manner through an iterative process. The Western Mojave Recovery Unit comprises one of six recovery units for the desert tortoise; consequently, our level of analysis in this biological opinion will begin at this level.

In the Western Mojave Recovery Unit, desert tortoises generally occur from Olancha and the northern Panamint Valley in the north to Joshua Tree National Park in the south and from the lower foothills of the southern Sierra Nevada and Tehachapi Mountains in the west east to Death Valley and the eastern side of Joshua Tree National Park. Although desert tortoises were historically widespread in the western Mojave Desert, their distribution within this region was not uniform. For example, desert tortoises likely occurred at low densities in the juniper woodlands of the western Antelope Valley and in the sandier habitats in the Mojave River valley. They were also likely largely absent from the higher elevations of the area's mountains and from playas and the areas immediately surrounding dry lakes.

In the following paragraphs, we present information regarding the status of the desert tortoise in areas of the Western Mojave Recovery Unit that are outside of critical habitat and desert wildlife management areas. Most of these areas are at the range limits of the species or are near areas that have undergone extensive habitat disturbance as a result of human activities. Much of this area is privately owned.

We do not have extensive data on the density or status of desert tortoises in the areas of the Western Mojave Recovery Unit that lie outside of critical habitat and desert wildlife management areas. The lack of data may be because at least some of this area had been extensively disturbed prior to the listing of the desert tortoise and includes large amounts of private land; consequently, researchers have not conducted large-scale surveys in most of these areas. Where data do exist (e.g., a Bureau study of desert tortoise density west of Highway 14 between Red Rock Canyon State Park and Highway 178 (Keith et al. 2005); various surveys of the eastern Antelope Valley, Victor Valley, and near the town of Rosamond), they were collected using methods other than line distance sampling and are not comparable to the numbers obtained through the line distance sampling. Much of the information in the following paragraphs was gathered from these sources; additionally, we used anecdotal information as a partial basis for the following discussion and conclusions reached by the Service (e.g., "I saw desert tortoises all the time here when I was young but have not seen one in the last 15 years").

Desert tortoises occur over large areas of Fort Irwin where the U.S. Army conducts realistic, large-scale exercises with large numbers of wheeled and tracked vehicles. The distribution and

abundance of the desert tortoise within the boundary of Fort Irwin have been greatly affected by military exercises. They have been essentially eliminated from most of the valleys and bajadas where vehicles frequently travel off road. They persist in small numbers on the steep, rugged slopes of the mountain ranges and in incised washes that occur throughout Fort Irwin where they are protected from vehicles by the terrain.

We do not have specific information on the numbers of desert tortoises in these areas. We expect that desert tortoises that reside away from the most active training areas will persist long into the future as small aggregations of animals that are likely isolated from desert tortoises in the remainder of the Western Mojave Recovery Unit; some exchange may occur with desert tortoises in the South Range portion of the Naval Air Weapons Station to the west of Fort Irwin and a narrow strip of Bureau lands and Death Valley National Park to the north.

Because of the U.S. Army's proposal to expand the area that is available for training at Fort Irwin, the Service and U.S. Army concluded formal consultation (Service 2004) that resulted in an agreement to remove all desert tortoises from the areas of the base south of the UTM 90 line (i.e., the southern expansion area) and in the Superior Valley (i.e., the western expansion area). To date, 569 desert tortoises of all class sizes have been translocated from the southern expansion area (U.S. Army 2009). Eighty-nine desert tortoises of all class sizes remain to be translocated. Therefore, 658 desert tortoises of all class sizes have been detected in the southern expansion area. Walde et al. (2009 in U.S. Army 2009) estimate between 583 and 895 (95 percent confidence interval) desert tortoises occupy the western expansion area; this estimate is based on transects conducted in 2009. This estimate reflects the number of adult desert tortoises; consequently, the total number of animals within the southern and western expansion areas is likely somewhat greater.

The Naval Air Weapons Station, China Lake, is divided into two large units. The southern unit lies to the west of Fort Irwin and north of the western expansion area; the northern portion of the Naval Air Weapons Station lies to the northwest of the southern unit. The Department of the Navy (Navy) has designated approximately 200,000 acres of the South Range at the Naval Air Weapons Station, China Lake as a management area for the desert tortoise (Service 1995a). Through a consultation with the Service (1992a), the Navy agreed to try to direct most ground-disturbing activities outside of this area, to use previously disturbed areas for these activities when possible, and to implement measures to reduce the effects of any action on desert tortoises. This area also encompasses the Superior Valley Tactical Bombing Range located in the southernmost portion of the Mojave B South land management unit of the Naval Air Weapons Station; it continues to be used as an active bombing range for military test and training operations by the Navy and Department of Defense. In the 9 years for which we had annual reports, activities conducted by the Navy did not kill or injure any desert tortoises (see Navy 1995); one carcass was found at a bombing site but the cause of mortality could not be determined. In general, desert tortoises occur in low densities on the North Range of the Naval Air Weapons Station; Kiva Biological Consulting and McClenahan and Hopkins Associates (in Service 1992a) reported that approximately 136 square miles of the North Range supported densities of 20 or fewer desert tortoises per square mile. The South Range supported densities of

20 or fewer desert tortoises per square mile over an area of approximately 189 square miles and densities of greater than 20 per square mile on approximately 30 square miles. The higher elevations and latitude in this area may be responsible for these generally low densities (Weinstein 1989 in Bureau et al. 2005).

The Indian Wells Valley, which is located to the southwest of the northern portion of the Naval Air Weapons Station, likely supported desert tortoises at higher densities in the past. Urban, suburban, and agricultural development is the likely cause of the lower densities that are currently found in this area; the city of Ridgecrest and town of Inyokern are located in this valley. Rose Valley, which lies generally to the north of the Indian Wells Valley and west of the northern portion of the Naval Air Weapons Station seems to support few desert tortoises and is likely the northern extent of the species' range in this portion of the Western Mojave Recovery Unit.

Edwards Air Force Base, which lies in the eastern portion of the Antelope Valley, is used primarily to test aircraft and weapons systems used by the Department of Defense. Desert tortoises occur over approximately 220,800 acres of the installation. Approximately 80,640 acres of the base have been developed for military uses or are naturally unsuitable for use by desert tortoises, such as Rogers and Rosamond dry lakes. Based on surveys conducted between 1991 and 1994, approximately 160,640 acres of the base supported 20 or fewer desert tortoises per square mile. Approximately 55,040 acres supported densities between 21 and 50 desert tortoises per square mile; from 51 to 69 desert tortoises per square mile occurred on several smaller areas that totaled 5,120 acres (U.S. Air Force 2004). We expect that current densities are somewhat lower, given the regional declines in desert tortoise numbers elsewhere in the Western Mojave Recovery Unit.

Four townships of private land east of the city of California City, north of Edwards Air Force Base, and south of the Rand Mountains supported large numbers of desert tortoises as late as the 1970s. High levels of off-road vehicle use, extensive grazing of sheep, scattered development, and possibly poaching have greatly reduced the density of desert tortoises in this area.

South of Edwards Air Force Base, the direct and indirect effects of urban and suburban development have largely eliminated desert tortoises from this area of primarily private lands that extends from Lancaster in the west to Lucerne Valley in the east. A few desert tortoises remain on the northern slopes of the San Bernardino Mountains, south of Lucerne Valley; however, they seem to be largely absent from the portion of this area in Los Angeles County (Bureau et al. 2005). The Bureau manages the 24,000-acre El Mirage Off-highway Vehicle Management Area, which lies south of the eastern portion of Edwards Air Force Base; the Bureau has designated this and three other off-highway vehicle management areas in the western Mojave Desert for use by off-road vehicles. Low numbers of desert tortoises persist in the area that generally lies between the off-highway vehicle management area and Edwards Air Force Base.

Continuing to the east, the northern portion of Joshua Tree National Park is within the Western Mojave Recovery Unit. Given the general patterns of visitor use at Joshua Tree National Park (i.e., most visitors remain close to established roads and trails), we expect that most of this area receives little visitor use. Private lands between the northern boundary of Joshua Tree National Park and the southern boundary of the Marine Corps Air Ground Combat Center continue to support desert tortoises; the primary threat to desert tortoises in this area is urbanization. The cities of Twentynine Palms, Yucca Valley, Joshua Tree, and Morongo Valley are located in this area.

The Marine Corps Air Ground Combat Center is located north of the cities mentioned in the previous sentence and southeast of Barstow; the center generally supports a wide variety of training exercises that include the use of tracked and wheeled vehicles and live fire. The Marine Corps' integrated natural resource management plan for the center notes that the number of desert tortoises may have declined in its more heavily disturbed areas and that vehicles, common ravens, and dogs are responsible for mortalities (Natural Resources and Environmental Affairs Division 2001). Desert tortoises occur within the Marine Corps Air Ground Combat Center in densities of greater than 50 per square mile in limited areas; most of the installation, however, supports from 0 to 5 animals per square mile (Jones and Stokes Associates 1998 in Natural Resources and Environmental Affairs Division 2001).

The 189,000-acre Johnson Valley Off-highway Vehicle Management Area lies to the west of the Marine Corps Air Ground Combat Center (Service 1991b). The Stoddard Valley Off-highway Vehicle Management Area lies to the west of the Johnson Valley Off-highway Vehicle Management Area. Desert tortoises remain in suitable habitat in these areas, primarily in the portions that are less heavily used for recreation.

The Mojave River valley lies to the northwest of the Marine Corps Air Ground Combat Center. It is generally a low-lying area with current and fallow agricultural use; private lands dominate this area. We are aware of a few records of desert tortoises in this area, primarily in creosote scrub habitat near the Marine Corps Logistics Base, Nebo, and around Elephant Mountain, which lie at the western end of the valley.

The city of Barstow lies at the western end of the Mojave River valley. A large expanse of primarily private land lies between Barstow and the city of Victorville. This area, which is subjected to heavy unauthorized use by off-road vehicles, likely supported high densities of desert tortoises prior to the development of surrounding areas. The cities of Adelanto, Apple Valley, and Hesperia and the Southern California Logistics Airport generally surround Victorville.

Death Valley National Park lies to the north of Fort Irwin. Desert tortoises are uncommon in the national park, primarily because much of the habitat lies either lower or higher than optimal elevations for the species; Greenwater Valley, to the east of Death Valley, seems to support a moderate number of desert tortoises. Panamint Valley lies to the west of Death Valley and east

of the northern section of the Naval Air Weapons Station. It supports low densities of desert tortoises, likely because of unsuitable habitat over large areas of the valley.

The Spangler Hills Off-highway Vehicle Management Area lies to the southwest of the Panamint Valley and southeast of Ridgecrest. We do not have recent information on the number of desert tortoises in this area; we expect that the area supports low densities as a result of extensive recreational use.

Major roads in the Western Mojave Recovery Unit include Interstates 15 and 40, U.S. Route 395, and State Routes 14, 18, 58, 62, 127, 138, 178, and 247. These roads fragment habitat; vehicles using these roads strike and kill numerous desert tortoises every year. Portions of Interstate 15 and Routes 58 and 395 are fenced to prevent entry by desert tortoises. Smaller paved roads and unpaved roads probably do not fragment habitat to a substantial degree but are responsible for additional mortalities of desert tortoises.

The following paragraphs describe efforts to define the density of desert tortoises in and near critical habitat and desert wildlife management areas in the Western Mojave Recovery Unit. The Pinto Mountains DWMA is located in the southeastern portion of the Western Mojave Recovery Unit, generally to the southeast of the Marine Corps Air Ground Combat Center and abutting the northeastern portion of Joshua Tree National Park. No permanent study plots are located in this desert wildlife management area. Tracy et al. (2004) noted that the distribution of carcasses and live desert tortoises appeared to be what one would expect in a "normal" population of desert tortoises; that is, carcasses occurred in the same areas as live animals and were not found in extensive areas in the absence of live desert tortoises. Through line distance sampling, the Service estimated the density of desert tortoises in this DWMA to be approximately 6.2 subadults and adults per square mile in 2007 (Service 2009b).

The Ord-Rodman DWMA is located to the southeast of the city of Barstow, north of the Johnson Valley Off-highway Vehicle Management Area, and west of the Marine Corps Air Ground Combat Center. The recovery plan notes that the estimated density of desert tortoises in this area is 5 to 150 animals per square mile (Service 1994). Three permanent study plots are located within and near this DWMA. The following table contains the density estimates for these plots; the data are from Berry (1996); all data are in the approximate number of desert tortoises of all sizes per square mile.

	Stoddard Valley	**Lucerne Valley**	**Johnson Valley**
1980		176	114
1981	146		
1986		150	80
1987	178		
1990		82	18
1991	225		
1994		73	73

Berry (1996) notes that, for various reasons, surveys at the Stoddard Valley plot encountered various difficulties; some desert tortoises from this plot were taken by poachers and at least one animal became ill with upper respiratory tract disease and contained environmental contaminants. Common ravens and feral dogs have killed desert tortoises at the Lucerne Valley plot; Berry (1996) notes that little recruitment into adult size classes was occurring. Berry also notes that at least two desert tortoises from the Johnson Valley plot were killed by off-road vehicle use or cattle; at least one ill and salvaged animal contained environmental contaminants. Through line distance sampling, the Service estimated the density of desert tortoises in this DWMA to be approximately 21.3 subadults and adults per square mile in 2007 (Service 2009b). Note that, for all desert wildlife management areas, the densities estimated by different methods are not directly comparable; i.e., the differences in numbers depicted in Berry (1996) and Service (2009b) do not necessarily represent a specific change in the density of desert tortoises in the area. For example, the information from study plots may reflect changes in the density of desert tortoises in those specific areas over time, while line distance sampling provides information regarding the density of the entire DWMA.

The Superior-Cronese DWMA is located north of the Ord-Rodman DWMA; two interstate freeways and rural, urban, and agricultural development separate them. This DWMA is located south of Fort Irwin and the southern portion of the Naval Air Weapons Station, China Lake. No permanent study plots have been established in this area; the density of desert tortoises has been estimated through numerous triangular transects and line distance sampling efforts. The recovery plan notes that this DWMA supports densities of approximately 20 to 250 desert tortoises per square mile (Service 1994). Through line distance sampling, the Service estimated the density of desert tortoises in this DWMA to be approximately 16.4 subadults and adults per square mile in 2007 (Service 2009b).

The Fremont-Kramer DWMA is located west of the Superior-Cronese DWMA; the two DWMAs are contiguous. The recovery plan notes that the estimated density of desert tortoises in this area was 5 to 100 animals per square mile (Service 1994). Five permanent study plots are located within this DWMA; one plot, the Interpretive Center plot at the Desert Tortoise Natural Area, is split into two subplots. The following table contains the density estimates for these plots; the data are from Berry (1996); all data are in the approximate number of desert tortoises of all sizes per square mile.

	Fremont Valley	**Desert Tortoise Natural Area, Interior**	**Desert Tortoise Natural Area, Interpretive Center**		**Fremont Peak**	**Kramer Hills**
			Inside Fence	**Outside Fence**		
1979		387	339	296		
1980					99	223
1981	278					
1982		332				314
1985			229	134	45	

1987	179					130
1988		195				
1989			106	80	32	
1991	101					60
1992		47				
1993			61	42	8	
1995						139
1996		18				
1997		8*	34#	23#		
2001	19*					
2002			28#	10#		

* These values represent the actual numbers of desert tortoises found on the plot and do not represent a density estimate; the data are from Berry (2005).
# These data are from Connor (2003).

Berry (1996) noted that the overall trend in this DWMA is "a steep, downward decline" and lists predation by common ravens and domestic dogs, off-road vehicle activity, illegal collecting, upper respiratory tract disease, and environmental contaminants as contributing factors. Through line distance sampling, the Service estimated the density of desert tortoises in this DWMA to be approximately 7.0 subadults and adults per square mile in 2007 (Service 2009b).

We estimate that the overall density of desert tortoises in critical habitat and desert wildlife management areas in the Western Mojave Recovery Unit is approximately 12.2 subadults and adults per square mile (Service 2009b). The 95 percent confidence intervals for this estimate range from approximately 7.8 to 22.1 subadults and adults per square mile (Service 2009b).

By multiplying the approximate area of desert tortoise habitat in the Western Mojave Recovery Unit by the average density of 12.2 subadult and adult desert tortoises per square mile, we estimate that approximately 125,855 subadult and adult desert tortoises may reside within the recovery unit. To estimate the area of desert tortoise habitat within the Western Mojave Recovery Unit, we used a model developed by Nussear et al. (2009), which is based on desert tortoise habitat across the range of the species. This model does not consider habitat loss, fragmentation, or degradation associated with human-caused effects; however, it provides a reference point relative to the amount of desert tortoise habitat. We then used urbanized area cartographic boundary files (Census Bureau 2000) to estimate the portion of modeled habitat that has been lost as a result of human activities; this model depicts areas where human activity has caused substantial ground disturbance (i.e., urbanization, agriculture, and military training). By subtracting the amount of area no longer considered suitable habitat [i.e., the census data] from the area of potential habitat (i.e., from the Nussear et al. model), we estimate that the Western Mojave Recovery Unit contains approximately 10,316 square miles of potential desert tortoise habitat (Waln 2010). The Nussear et al. model does not account for habitat disturbance and variations caused by other factors that affect the density of desert tortoises (e.g., highways). Additionally, the data from line distance sampling were collected in DWMAs, where,

presumably, the density of desert tortoises is greater than in other portions of the Western Mojave Recovery Unit; however, we applied this density for the entire Western Mojave Recovery Unit. Consequently, we recognize that the number of subadult and adult desert tortoises in the Western Mojave Recovery Unit we provide here may be an overestimate.

We estimate that approximately 56,544 to 130,992 juvenile desert tortoises (i.e., smaller than 180 millimeters) reside within the Western Mojave Recovery Unit. This estimate is based on the assumption that 125,855 subadults and adults occur in the Western Mojave Recovery Unit and that 31 to 51 percent of the total population of desert tortoises in the recovery unit are juveniles (Turner et al. 1987). Reproductive success and neonate survival is likely to vary significantly across the range of the desert tortoise. The Turner et al. (1987) study was conducted in the eastern Mojave Desert where we would expect to detect lower mortality for juvenile desert tortoises because of fewer threats. In addition, juvenile desert tortoises are extremely difficult to detect because of their small size and cryptic nature. Consequently, the result of the Turner et al. (1987) study may not adequately represent demography throughout the Western Mojave Recovery unit and the number of juvenile desert tortoises could be greater than or less than our estimates.

The biological opinion for the Bureau's amendment to the California Desert Conservation Area Plan for the western Mojave Desert (Service 2006b) contains a description of the results of studies done on permanent plots in the Western Mojave Recovery Unit. Based on this work, the Desert Tortoise Recovery Plan Assessment Committee (Tracy et al. 2004) concluded that the population densities of adult desert tortoises in the Western Mojave Recovery Unit exhibited a significant downward trend ($P < 0.0001$) from approximately 1975 through 2000. Some of the permanent study plots are located outside of the DWMAs; therefore, the trends within and outside of DWMAs may not be precisely the same. However, data from the permanent study plots provide the only long-term assessment of the status of the desert tortoise in this area.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the purposes of this biological opinion, we consider the action area to include all areas of the 4,613-acre project site and its necessary components as described in the Description of the Proposed Action section of this biological opinion, the privately owned parcels adjacent to and protruding into the project area (NAP areas; see URS 2010a), the 3,617-acre solar development exclusion area, a 2,617-foot buffer from the project boundary, the proposed desert tortoise translocation control site (control site), the proposed translocation areas, all contiguous desert tortoise habitat within 1.5 kilometers of the translocation areas receiving desert tortoises from less than 500 meters and all contiguous desert tortoise habitat within 12.6 kilometers of translocation areas receiving desert tortoises from greater than 500 meters away.

We included the 2,617-foot buffer from the project boundary to address adverse effects to desert tortoises whose home ranges overlap the proposed solar facility; the buffer is based on the assumption that the home range of a male desert tortoise is approximately 2 square kilometers (O'Conner et al. 1994, Duda et al. 1999, Harless et al. 2009). We included habitat within 1.5 and 12.6 kilometers of the translocation areas to address the area in which desert tortoises may disperse following translocation. For situations where desert tortoises are translocated less than 500 meters, the buffer is based on the maximum straight-line distance that a male desert tortoise traveled in the first year following translocation (Walde et al. 2008). For situations where desert tortoises are translocated more than 500 meters, the buffer is based on the maximum straight-line distance the majority of male desert tortoises were observed to disperse during the first year after release (Field et al. 2007, Walde et al. 2008). This distance does not include one male that traveled 14 miles after release; we consider this behavior to be anomalous when compared with that of the majority of translocated desert tortoises.

The action area defined for this biological opinion covers approximately 87,767.6 acres and includes 84,626.1 acres of desert tortoise habitat modeled as 0.5 or greater by U.S. Geological Survey (Nussear et al. 2009); 22,702 acres of this total is desert tortoise critical habitat. The northeast corner of the Ord-Rodman DWMA comprises 25,893.84 acres of the action area and contains 9,402 acres identified as the Ord-Rodman DWMA translocation area. The Pisgah ACEC translocation area is adjacent to the east side of the project site, and includes 604 acres of the Pisgah Crater ACEC. The linkage translocation area includes 576 acres and is located directly north of the project boundary and does not include the area north of NAP 1. All of the identified translocation areas are composed entirely of desert tortoise habitat modeled as 0.5 or greater by U.S. Geological Survey. The control site covers 6,929 acres located northwest of the project site and adjacent to the west edge of the Cady Mountain Wilderness Study Area.

Past Consultations in the Action Area

On December 21, 1990, the Service issued a biological opinion for the Kern River and Mojave Pipeline projects (1-5-87-F-36R, Service 1990). The biological opinion anticipated that pipeline installation would kill or injure 15 desert tortoises along the Mojave River portion of the line in addition to harassing 120 desert tortoises and eliminating 16 nests. For the operation and maintenance of the pipeline, the biological opinion anticipated the harm or mortality of five desert tortoises and the harassment of ten desert tortoises. A portion of the Mojave Pipeline crosses the Calico facility action area. In total, 38 desert tortoises were killed during the construction of these 2 pipelines (Circle Mountain Biological Consultants 1996).

On August 12, 1991, the Service issued a biological opinion to the Bureau for expansion of the existing Hector Mine (1-6-91-F-40, Service 1991a). This biological opinion anticipated the harassment, as a result of moving them from harm's way, of 10 desert tortoises during construction and operation, the mortality of 1 desert tortoise from expansion and operation of the facility, and the loss of 174 acres of desert tortoise habitat.

On October 8, 1992, the Service issued a biological opinion to the Bureau for construction and operation of a disposal and storage facility for dry, treated, and stabilized hazardous waste materials (1-6-92-F-57, Service 1992b). This biological opinion anticipated the harassment, as a result of moving them from harm's way, of 15 desert tortoises during construction and operation, the mortality of 2 desert tortoises during construction, and the mortality of 1 desert tortoise every 2 years as a result of operation of the project facility. Although this proposed project was authorized, the facility was never constructed.

On October 29, 1992, the Service issued a biological opinion to the Bureau for the construction and operation of a boron mine and processing plant (1-6-92-F-54, Service 1992c). This biological opinion anticipated the harassment, as a result of moving them from harm's way, of 30 desert tortoises during construction and operation, the mortality of 3 desert tortoises during the construction of the facility, and the mortality of 1 desert tortoise every 2 years as a result of operation of the project.

On November 28, 1995, the Service issued a biological opinion to the Bureau for the maintenance and repair of Southern California Gas Company's pipeline system in the California deserts (1-8-95-F-28, Service 1995b). This biological opinion anticipated the mortality of two desert tortoises per year as a result of maintenance activities including travel on all associated access roads. A portion of the pipeline system passes through the action area considered in this biological opinion.

On August 15, 1997, the Service issued a biological opinion to the Bureau for the issuance of a temporary use permit to the County of San Bernardino to construct and operate a waste disposal transfer station in Newberry Springs (1-8-97-F-35, Service 1997). This biological opinion anticipated the harassment, as a result of moving them from harm's way of all the desert tortoises found within the 5-acre parcel, and the mortality of 2 desert tortoises as a result of construction and operation of the facility.

On March 7, 2002, the Service issued a biological opinion to the U.S. Marine Corps for base wide operations and training on the Air Ground Combat Center in Twentynine Palms (1-8-99-F-41, Service 2002). Since the issuance of this biological opinion, the Marine Corps generally reports the mortality of two or three desert tortoises per year. Given the nature of training activities, some desert tortoises that are killed are likely not observed. Only the northwestern corner of the installation is within the action area for this biological opinion; this area of the Air Ground Combat Center includes extensive lava flows. We do not have specific information about desert tortoises in this area or whether the Marine Corps' activities have resulted in mortalities there.

On June 30, 2003, the Service issued a biological opinion to the Bureau regarding the effects of the designation of routes of travel in the western Mojave Desert on the desert tortoise and its critical habitat (1-8-03-F-21, Service 2003). As a result of the proposed action, the Bureau designated routes of travel on public lands as open, closed, or limited to vehicular use. The proposed action resulted in a reduction in the mileage of open routes on public lands;

additionally, any route that was not designated as open was considered to be an unauthorized route. The Service concluded that the Bureau's designation of routes of travel was not likely to jeopardize the continued existence of the desert tortoise or adversely modify its critical habitat. Although the Service did not estimate the number of desert tortoises that could be killed or injured by the project because of the large size of the action area and the patchy distribution of desert tortoises, it required the Bureau to contact the Service to determine if re-initiation was necessary if more than five desert tortoises were found dead or injured in a 12-month period.

On January 9, 2006, the Service issued a biological opinion to the Bureau regarding the effects of a proposed amendment to the California Desert Conservation Area Plan for the western Mojave Desert on the desert tortoise and its critical habitat (1-8-03-F-08, Service 2006b). In this case, 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. These prescriptions addressed grazing, land use classification, recreation, and numerous other elements of the Bureau's management of the western Mojave Desert, including a minor revision of the route network considered in the consultation discussed in the previous paragraph. The Service concluded that the Bureau's amendment of the California Desert Conservation Area Plan for the western Mojave Desert 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.

The Service also issued a biological opinion to the Federal Highway Administration for the development of a materials site near the transfer station mentioned previously in this section. The Service concluded that the development of the approximately 88-acre site was not likely to jeopardize the continued existence of the desert tortoise and was likely to result in the injury or mortality of few, if, any, desert tortoises.

In aggregate, the number of desert tortoises that we anticipated would likely be killed or injured by the actions proposed in the aforementioned biological opinions comprises a relatively small portion of the desert tortoises in the action area. Furthermore, several of the biological opinions analyzed the effects of actions that extended over action areas many times the size of the action area being considered in this consultation. Therefore, the mortality associated with these larger actions would not occur or has not occurred entirely within the action area for the Calico project. Consequently, we conclude that the mortality associated with these biological opinions has not substantially affected the environmental baseline of the desert tortoise within the current action area.

Habitat Characteristics of the Action Area

The proposed Calico project site, control site, and translocation sites are located entirely on land managed by the Bureau. The NAP areas (URS 2010b) adjacent to and protruding into the project site are privately owned by multiple landowners, but contain the same habitat characteristics as the project site. We summarized the information in the remainder of the

Environmental Baseline section from the revised biological assessment, supplemental biological assessment, supplement #5 to the biological assessment, and the California Energy Commission's supplemental staff assessment (URS 2010a, URS 2010b, URS 2010d, CEC 2010a).

Habitat within the project site consists primarily of Mojave creosote bush scrub (4,372 acres) and desert saltbush scrub (242 acres). Additional plant communities detected on the project site include catclaw acacia thorn scrub, smoke tree woodland, and big galleta shrub-steppe. The Cady Mountains provide a source of sediments that are transported by fluvial processes onto the project site and redistributed by wind, particularly on the southeastern part of the project site (CEC 2010a). Based on graphic information system (GIS) analysis, Tessera estimated vegetation coverage on the remainder of the action area to be 95 percent Mojave creosote bush scrub with 5 percent saltbush scrub and 5 percent big galleta dune habitat (Miller 2010a).

Both the proposed control area and the Ord-Rodman DWMA have historically supported cattle grazing. The vegetation in the control area, northwest of the project site, shows effects of varying levels of grazing. However, the Bureau does not anticipate authorizing any future grazing in this area (URS 2010b, Chavez 2010). A portion of the Ord-Rodman DWMA still supports grazing within the Ord Mountain Cattle Allotment. This allotment includes approximately 154,948 acres, of which 117,363 acres are within the DWMA (Fesnock 2010b). In addition to cattle grazing, other factors that have affected the habitat within the action area include off-road vehicle use, non-native species, the indirect effects of Interstate 40, a utility corridor, and the BNSF railroad (URS 2010a, URS 2010b).

Status of the Desert Tortoise in the Action Area

From March 29 to April 15, 2010, URS Corporation conducted desert tortoise surveys over an 8,230-acre area, which included the 4,613-acre project site (URS 2010a). URS performed additional surveys in the proposed translocation and control areas to determine suitability, collecting habitat data during desert tortoise surveys. All of these surveys followed the Service's pre-project survey protocol (Service 2010d). During the 2010 surveys on the 4,613-acre project site, URS located 6 subadult and adult desert tortoises, 4 juvenile desert tortoises, and 122 burrows, with the greatest density of sign in the northern portion of the project site. URS detected 12 subadult and adult desert tortoises in the Pisgah ACEC translocation area, and 79 subadult and adult desert tortoises within a 3,616-acre area surveyed north of the project site, which contains the Linkage translocation area (URS 2010e).

The following table depicts the estimated numbers of desert tortoises in the action area. Because of the wide confidence interval in this estimate and the inherent difficulties in developing an accurate estimate, we will assume that the actual project site population may be as high as 29 subadult and adult desert tortoises. We have selected this more conservative approach because it will provide a more robust analysis and identify any potential issues associated with the proposed translocation strategy.

Location	Estimated Density and Number of Desert Tortoises (subadults and adults)	Source of Information
Project site	- 29	2010 survey results (URS 2010d)
Linkage translocation area and its dispersal buffer	8.4 per square kilometer 115	(Miller 2010b, 2010d)
Pisgah ACEC translocation area and its dispersal buffer	7.4 per square kilometer 130	2010 survey results (Miller 2010b, 2010d)
Ord-Rodman DWMA within the action area	8.2 per square kilometer 859	range wide monitoring in conducted in 2007; the density of desert tortoises in the Ord-Rodman DWMA (Service 2009b)
Action area outside of the project boundary, Linkage and Pisgah ACEC translocation areas and their 1.5-kilometer dispersal buffers, and the Ord-Rodman DWMA	4.7 per square kilometer 945	range wide monitoring in conducted in 2007; the density of desert tortoises in the Western Mojave Recovery Unit (Service 2009b)
Total Number of Desert Tortoises in the Action Area	2,078	

Juvenile desert tortoises are extremely difficult to detect because of their small size and cryptic nature. Based on a 4-year study, Turner et al. (1987) determined that juveniles accounted for 31.1 to 51.1 percent of the overall population. Reproductive success and neonate survival is likely to vary substantially across the range of the desert tortoise. Consequently, the demography of desert tortoises on Calico project site may differ from the results of the Turner study. Therefore, as we estimated with the subadults and adults, we have used the upper end of the range to will provide a more robust analysis and identify any potential problems associated with the proposed translocation strategy. Therefore, using estimated numbers for subadult and adult desert tortoises, we estimate the action area may support 2,172 juveniles and the 4,613-acre project site may support 30 juvenile desert tortoises.

Using the average number of eggs that a reproductive female produces in a given year (5.8 eggs; Turner et al. 1986 in Service 1994), we estimate that each reproductive female on the project site could produce 5.8 eggs in a given year. Using our population estimates and assuming a 1:1 sex ratio, we estimate that the project site and action area may contain as many as 15 and 1,039 reproductive females, respectively. These individuals could produce approximately 87 and 6,026

eggs in a given year in the project site and action area, respectively. For the project site, fewer eggs are likely to be present at any given time because the territories of some of the female desert tortoises likely extend outside of the Calico project boundary and individuals may establish nests in these areas. In addition, at the time the project site is cleared, not all of the reproductive females may have deposited their eggs for the season, because not all females will lay their eggs at the same time.

Tessera performed additional protocol surveys on the control and translocation sites. In spring 2010, URS surveyed the Pisagah ACEC translocation area, the Linkage translocation area, the control area and 3,170 acres of the Ord-Rodman DWMA translocation area. URS will conduct surveys for the remainder of the Ord-Rodman DWMA translocation area in spring 2011. The following table includes our estimates of the number of desert tortoises that likely occur in the translocation sites. We used the densities discussed above and the area of the translocation sites and control sites to derive this estimate. We did not anticipate that the proposed action will adversely affect desert tortoise nests in the translocation and control areas; therefore we will not provide estimates for eggs for these areas.

Translocation Area	Subadults and Adults	Juveniles	Total
Pisgah ACEC	18	19	37
Linkage	20	21	41
Ord-Rodman	300	314	614
Control Site	132	138	270

Two additional construction areas outside of the project footprint include the underground water pipeline and transmission line to the Pisgah substation. The associated ground disturbance with each component is 4.5 and 12.9 acres, respectively. Because of the small size of the work sites and the uncertainty associated with estimating the numbers of desert tortoises and their eggs, we have not included estimates for these areas. If desert tortoises or eggs are present in these areas, the numbers would be so low that the overall estimate for the project site would easily encompass any animals or eggs likely to occur on these two sites.

We emphasize that, although our estimate of the number of subadult and adult desert tortoises, juveniles, and eggs on the project site and within action area is based on the best scientific and commercial data, as required by the implementing regulations for section 7(a)(2) (50 Code of Federal Regulations 402.14(g)(8), these numbers represent only an estimate; the overall number of animals and eggs on site may be different. We recognize that the survey data used for these estimates represents a single point in time and the number of individuals in these areas may change by the onset of construction. For example, some desert tortoises may leave or die. Alternatively, the number of desert tortoises present on the site may increase by the time construction commences. For example, one or more desert tortoises may not have been detected during the initial survey; other desert tortoises may have moved on to the site since the time of the surveys. Finally, desert tortoises may have emerged from a nest on the site; this scenario could increase the overall number of individuals; for example, if a clutch of seven eggs (i.e., the number of eggs in a clutch that would be considered large) hatched, this increase would be much

more than we would expect from individuals moving on to the site. However, because we have selected to consider the high range for our estimates for the population sizes, we expect that we have a reasonably accurate baseline for analysis.

EFFECTS OF THE ACTION

In the previous section of this biological opinion, we derived our estimates of the numbers of juvenile, subadult, and adult desert tortoises and eggs that are likely present in the action area from the pre-project survey data and published literature. These sources constitute the best available information. Consequently, we have used the estimates of the numbers of juvenile, subadult, and adult desert tortoises and eggs from the Environmental Baseline in the following analysis. Because of the desert tortoise's cryptic coloration, fossorial habits, and relatively small size, we recognize that not all individuals that are injured or killed during construction, operations, and maintenance will be detected by monitors and workers and reported to us. Juvenile desert tortoises and eggs will be even more difficult to detect, because they are even smaller and, in the case of eggs, always hidden from sight. Lastly, scavengers may find the carcass before monitors or workers and remove it or dismember it to the extent that the cause of death may not be determinable.

Effects of the Translocation Strategy

The primary effects of the proposed action on desert tortoises will result from the capture and translocation of desert tortoises prior to ground disturbance associated with the proposed construction activities. We anticipate that Tessera will capture and translocate all subadult and adult desert tortoises from the fenced project areas, and any other portion of the action area, that are in harm's way due to project-related activities. Because of the difficulty in locating juvenile desert tortoises, Tessera may not find all juveniles on site and thus may move some but not all juvenile desert tortoises from the project site. Tessera will move all desert tortoises to the translocation area nearest its point of capture.

Based on the current survey estimates that cover the Calico Solar project site, we estimate that Tessera will translocate 29 subadult and adult desert tortoises into the identified translocation areas. Tessera will move all desert tortoises located within 500 meters of the northern portion of the project boundary into the Linkage translocation area. Tessera proposed to move 2 desert tortoises located within 500 meters of the Pisgah ACEC translocation area into this receptor site. Based on the estimated density of this area, we anticipate that this receptor site cannot accommodate any additional desert tortoises without exceeding the 30 percent increase in density established as a minimization measure. Therefore, we base our analysis on the assumption that Tessera will translocate the remainder of the desert tortoises found on the project site to the Ord-Rodman DWMA translocation area. Based on the results of the project site surveys in 2010, we do not anticipate that clearance surveys will find desert tortoises in the southern portion of Phase 2; however, if clearance surveys locate any individuals, Tessera will move them to the Ord-Rodman DWMA.

Tessera has proposed numerous measures to minimize injury or mortality of desert tortoises and ensure success of the translocation effort. Although Tessera will install desert tortoise exclusion fencing around the project prior to commencement of construction, we cannot predict exactly how many desert tortoises it will remove from the project site and other related work areas. This is because prior to the fencing and clearance of the project site, desert tortoise numbers may increase or decrease as individuals move throughout the landscape, are born and die. However, based on current surveys, we estimate that Tessera will capture and translocate no more than 29 subadult and adult desert tortoises from the Calico Solar site. Project site surveys from spring 2010 indicate that highest density of subadult and adult desert tortoises were located in the northern portion of the project site and action area. Therefore, we anticipate that Tessera will move most desert tortoises less than 500 meters into the Linkage translocation area. We estimate that the project site contains approximately 30 juvenile desert tortoises and reproductive females on the project site collectively produce approximately 87 eggs per year. However, because of the difficulty in finding desert tortoise eggs and juvenile desert tortoises, we anticipate that Tessera will translocate few, if any, eggs or juveniles from the project site. Effects to juvenile desert tortoises and eggs that are missed on the project site are discussed later in this section.

To measure the effectiveness of translocation, Tessera will monitor desert tortoises in the recipient sites and a control site. The number of desert tortoises that Tessera monitored in a given recipient site will be equal to the number of desert tortoises translocated to that site. The number of desert tortoises that Tessera monitors in the control site will equal the total number of desert tortoises translocated. Monitoring will require the capture, handling, and attachment of transmitters to all monitored individuals. Based on the population estimate for the Calico project site, we anticipate that Tessera will capture, handle, and transmitter 29 resident subadult and adult desert tortoises in the recipient sites and 29 subadult and adult desert tortoises in the control site. We have addressed the effects of capturing, handling, and attaching transmitters to these animals later in our analysis. To minimize the potential adverse effects of disease, Tessera will perform visual health assessments and ELISA testing for all desert tortoises that it locates during protocol level surveys of the recipient and control sites regardless of whether these individuals are included in the population to be monitored. Because Tessera will use experienced biologists, authorized by the Service, to perform health assessments and blood collection, we do not anticipate that these activities will result in injury or mortality of individuals.

Translocation has the potential to increase the prevalence of diseases, such as upper respiratory tract disease, in a resident population. Tessera will conduct visual health assessments on all the desert tortoises that will be translocated. For desert tortoises moved greater than 500 meters, Tessera will also collect blood to test for antibodies to the pathogens that cause upper respiratory tract disease. Tessera will not release desert tortoises in the recipient sites prior to the receipt of the disease test results and Service approval of the desert tortoise disposition plan. While waiting for disease test results, Tessera will quarantine desert tortoises on the project site within their associated construction phase (i.e., *in situ* quarantine) within temporary or permanent desert tortoise exclusion fencing. Tessera will hold juvenile desert tortoises in quarantine pens while awaiting disease test results. For Phase 1a, Tessera will quarantine any desert tortoises found above ground during clearance surveys in quarantine pens outside of Phase 1a and within the

project site until they can be tested for disease and permanently translocated. We address the effects of the quarantine and blood collection on desert tortoises below.

Tessera will conduct health assessments on all resident and control desert tortoises that are handled and fitted with transmitters. This will include the collection of a blood sample for all the desert tortoises in the Ord-Rodman translocation area and the control site. The Linkage translocation area will only receive visual health assessment for resident and translocated individuals.

The prevalence and distribution of disease in the translocation areas will affect the number of desert tortoises that the recipient sites can accommodate. To assess the prevalence of disease, Tessera will handle, conduct visual health assessments, and collect blood samples for ELISA testing on desert tortoises within the Ord-Rodman DWMA translocation. To determine whether the translocation area is below the 5 percent disease prevalence threshold, established in the description of the proposed action, with a sufficient level of confidence (i.e., 95 percent), we estimate that Tessera may have to handle and draw blood from as many as 105 desert tortoises (Averill-Murray 2010). To further reduce the potential for disease transmission, Tessera will not translocate desert tortoises within 6 kilometers of any resident desert tortoises showing signs of disease or with a blood test result indicating that the individual is seropositive.

Tessera will collect blood, for disease testing, from all desert tortoises that it will move greater than 500 meters from their point of collection to their point of release. All desert tortoises fitted with transmitters in the control site, and a sample of desert tortoises in the Ord-Rodman DWMA translocation. Some potential exists that handling and drawing blood from desert tortoises for disease tests may cause elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluids. Because Tessera will use experienced biologists, approved by the Service, Bureau, CEC, and CDFG, and approved handling techniques, collected desert tortoises are unlikely to experience substantially elevated stress levels during handling and blood collection and, we do not expect any injury or mortality to result from handling or blood collection. Furthermore, the use of disease testing and quarantine procedures will reduce the potential for disease spread due to translocation.

In addition, stress associated with handling and movement or due to density dependent effects could exacerbate the threat of increased diseased prevalence if translocated individuals with subclinical upper respiratory tract disease or other diseases begin to exhibit clinical signs of disease. This conversion of translocated desert tortoises from a non-contagious to a contagious state may increase the potential for infection in the resident population above pre-translocation levels.

We cannot reasonably predict the increase in disease prevalence within the resident population that may occur due to translocation. However, the following mitigating circumstances are likely to reduce the magnitude of this threat: 1) Tessera will use experienced biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels that can make translocated animals more susceptible to disease or make them convert from a non-

contagious to contagious state; 2) Tessera will conduct thorough health assessments using qualified biologists to identify any visual signs of disease for desert tortoises being moved less than 500 meters to reduce the potential of introducing disease into the resident population; 3) Tessera will collect blood and perform additional disease tests (i.e., ELISA testing) for all desert tortoises that it moves greater than 500 meters per the recommendation of the Desert Tortoise Recovery Office (Service 2010e) to reduce the potential of introducing disease into the resident population; 4) The desert tortoises on the project site are currently part of a continuous population with the resident populations in the Linkage translocation area where the majority of desert tortoise will be moved and are likely to share similar pathogens and immunities; 5) Tessera will not translocate any animal that either has clinical signs of disease or tests ELISA-positive to reduce the potential of introducing disease into the resident population; 6) Tessera will buffer any resident individual showing signs of disease in the Ord-Rodman DWMA translocation area by 6 kilometers; and 4) density-dependent stress is unlikely to occur for the reasons discussed later in our analysis.

Although the measures proposed by the Bureau and the other mitigating circumstances described above are substantial barriers to disease spread, the potential for post-translocation disease transmission remains. Specifically, the Bureau is not proposing to perform pre-translocation surveys to determine disease prevalence in areas into which translocated animals may move following release in the translocation areas. Additionally, the Bureau is not proposing to establish sufficiently large buffers around diseased resident animals to account for the movement of translocated desert tortoises that is likely to occur after their release (see discussion of post-translocation movement distance later in this section). Without consideration of post-translocation dispersal in analysis of resident disease prevalence at translocation sites, some potential exists that dispersing desert tortoises may move into areas where they may contract diseases from resident animals. In addition, the buffer proposed by the Bureau to reduce the potential of placing translocated animals in close proximity to diseased resident animals is not sufficient to account for some long-range movements that we are likely to see after release of translocated individuals.

Because ELISA testing can result in false positive results (i.e., an animal may test positive even though it is not a carrier of the disease), the potential exists for removal of healthy individuals from the translocated population due to concern over disease. These individuals would not be released into the wild and would no longer contribute to the population. In addition, removal of these animals may reduce the resistance of the population to disease outbreaks because they may carry immunities that could buffer the population against an outbreak that results in high mortality of animals that are not immune. Because Tessera would coordinate with the Service and perform follow-up testing of ELISA-positive individuals, the potential for removing false-positive individuals from the translocated population is low. We expect that, of the 29 subadults and adults and any juveniles to be translocated more than 500 meters, only a small subset are likely to test positive for upper respiratory tract disease. Of these positive desert tortoises, an even smaller subset would test positive on a second ELISA screening. Consequently, we conclude that few desert tortoises will be incorrectly removed from the population due to false positive results.

Translocating desert tortoises may also adversely affect resident desert tortoises within the translocation area due to local increases in population density. The density of resident desert tortoises observed in translocation sites during surveys will determine the number of desert tortoises translocated into the Pisgah ACEC and Ord-Rodman translocation areas. The 2010 survey data indicated that the density of the Pisgah ACEC translocation area was 19.16 sub adult and adult desert tortoises per square mile (Miller 2010c), already greater than 30 percent above 5.0 subadult and adult desert tortoises per square kilometer (12.95 per square mile); therefore, no desert tortoises will be translocated into this area. For the Ord-Rodman DWMA translocation area, Tessera will ensure that the post-translocation density is not more than 30 percent above 8.2 subadult and adult desert tortoises per square kilometer (21.2 per square mile). The number of desert tortoises translocated into the Linkage translocation area will not be restricted based on the density of desert tortoises in this area this area will only be used for desert tortoises moved less than 500 meters. We anticipate that the biological benefits (e.g., remaining within the individual's anticipated home range where burrow locations, resources, and other neighboring desert tortoises are familiar) of moving these individual desert tortoises less than 500 meters is greater than any negative effects that could result from a slight increase in the density in the Linkage translocation area.

Increased densities may result in an increased spread of upper respiratory tract disease, an increased incidence of aggressive interactions between individuals, and an increased incidence of predation that may not have occurred in the absence of translocation. Saethre et al. (2003) evaluated the effects of density on desert tortoises in nine semi-natural enclosures at the Desert Tortoise Conservation Center in Nevada. The enclosures housed from approximately 289 to 2,890 desert tortoises per square mile. Saethre et al. (2003) observed a greater incidence of fighting during the first year of the experiment but did not detect any trends in body condition index, reproduction, or presence of the symptoms of upper respiratory tract disease among the enclosures. Body condition index and reproduction are important indicators of how translocation may affect resident desert tortoises; generally, stress suppresses body condition index and reproduction in desert tortoises. This study did not draw any conclusions regarding density-dependent effects on predation of desert tortoises. Additionally, as discussed previously in this section, desert tortoises tend to move substantial distances from the release sites; this behavior reduces the likelihood of overcrowding in smaller areas.

We anticipate that density-dependent effects on resident populations are likely to be minor for the following reasons: 1) Tessera will perform health assessments on all desert tortoises prior to translocation thus decreasing the potential of moving an individual with poor health into the area; 2) a threshold for density for the Ord-Rodman translocation site has been set so as not to exceed 30 percent of the current estimated densities for each area; 3) translocation will result in a dispersed release of individuals; 4) the translocation areas are not a confined space, so released individuals would be able to disperse into other areas; and 5) density limits at which adverse effects were observed in previous studies are significantly greater than the post-translocation densities that are likely to be in the action area. In addition, Tessera will perform health assessments on the translocated and recipient desert tortoises wearing transmitters during monitoring, which could provide the opportunity for adaptive management, should an

unanticipated effect be observed. Adaptive management could include actions like predator control, removal of desert tortoises showing clinical signs of disease, removal of some translocated animals to new translocation areas to reduce densities, or other measures. However, specific adaptive management measures have not been identified for our evaluation, so we cannot predict their effectiveness in this biological opinion.

Based on these density requirements and the resident population sizes that were estimated for the translocation areas in the Environmental Baseline Section of this biological opinion and the density estimates determined from surveys in 2010, the Ord-Rodman DWMA translocation area should accommodate 90 translocated desert tortoises in total (subadult, adult, and juvenile desert tortoises combined). The Linkage translocation area will accommodate the limited number of individual desert tortoises moved less than 500 meters into the 3,617-acre translocation area. Although this is sufficient to facilitate translocation of the upper end of the 95 percent confidence interval for the project site population estimate (i.e., 29 subadult and adult desert tortoises) and all of juvenile desert tortoises estimated, the proposed areas may not be sufficient to support all project site desert tortoises if the level of disease determined to be present in the translocation areas is above 5 percent or if the establishment of buffers around diseased individuals restricts the number of desert tortoises that the translocation area can accommodate. Consequently, we anticipate that Tessera could have to expand the boundaries of its translocation areas in some locations. Because we cannot predict if or how these expansions would occur, we are not analyzing this contingency in our biological opinion. Expansion of the translocation areas would necessitate re-initiation of consultation.

The proposed translocation strategy and the best available information regarding translocation site densities and project site population size indicate that Tessera's translocation strategy will accommodate more than 90 desert tortoises in the Ord-Rodman DWMA and Linkage translocation areas. Consequently, we anticipate that these areas will accommodate all of the desert tortoises that Tessera will clear from the project site. However, disease prevalence in the Ord-Rodman DWMA translocation area may prevent the translocation of desert tortoises to this recipient area. If project site clearance surveys locate a number of desert tortoises greater than the translocation areas can accommodate due to density or disease constraints, Tessera will need to identify additional areas for translocation, and this would constitute a change in the project description requiring re-initiation of consultation.

For Phase 1a, Tessera will use quarantine pens to hold desert tortoises located above ground during clearance surveys and other desert tortoises that emerge from hibernation during the winter. In addition, Tessera may use quarantine pens in other phases of project construction to hold individual desert tortoises while waiting for disease test results. Tessera will construct all quarantine pens following the specifications of the desert tortoise translocation plan (URS 2010f). The quarantine pens will be 20 by 20 meters, and a veterinarian-approved plan will guide care of the desert tortoises during quarantine. Maintaining the desert tortoises within quarantine pens could affect desert tortoises by increasing their vulnerability to exposure, stress, dehydration, inadequate food resources, and increased predation. Because Tessera will regularly monitor the desert tortoises and provide care based on a veterinarian approved plan, and the

desert tortoises will be held for a limited amount of time, we anticipate that the quarantined individuals are unlikely to experience from exposure, stress, dehydration, or inadequate nutrition. However, the potential exist that predators or poachers could target desert tortoises in the quarantine pens. Tessera will monitor and reduce these threats through regular observations of the quarantined individuals as identified in the proposed construction of Phase 1a and the desert tortoise translocation plan.

Once it receives test results, Tessera will translocate all desert tortoises identified as healthy to the nearest available translocation site. Restricting the desert tortoises to within the phased project elements could affect desert tortoises by increasing their vulnerability to exposure, stress, dehydration, and inadequate food resources. Because Tessera will allow the desert tortoise to wander freely within the area, we anticipate that desert tortoises will be within their individual home ranges where the potential for stress would be relatively low and animals could find adequate shelter and nutrition.

Following release, we cannot predict the movement patterns that all translocated animals are likely to exhibit. Desert tortoises translocated shorter distances (i.e., less than 500 meters) are not likely to move as far following release as desert tortoises moved longer distances. Walde et al. (2008) found that maximum straight-line dispersal distance for male desert tortoises was approximately 1.5 kilometers in the first year following translocation. For desert tortoises translocated greater than 500 meters, mean straight-line dispersal distances of adult translocated desert tortoises (males and females) reported by Nussear (2004, Figures 2 and 4) were approximately 1, 1.5, 1.8, 3.5, and 6 kilometers. Walde et al. (2008) reported mean straight-line dispersal distances of adult translocated desert tortoises using 2 experimental treatments as 2.6 and 4.2 kilometers for males and 1.5 and 2.3 kilometers for females. Maximum straight-line dispersal distances for translocated male desert tortoises ranged from 6.2 to 23 kilometers in the first year following translocation (Field et al. 2007, Walde et al. 2008). Maximum straight-line dispersal distances for translocated males at each site reported in these studies varied from 6.2 kilometers (Field et al. 2007) to 7.3, 7.4, 11.3, 11.6, and 12.6 kilometers (Walde et al. 2008).

Translocated populations can also expand the area they occupy in the first year following translocation (e.g., from 3.9 to 6.9 square miles at a Nevada site; from 0.2 to 10.3 square miles at a Utah site). The degree to which these animals expand the area they use depends on whether the translocated animals are released into typical or atypical habitat; that is, if the translocation area supports habitat that is similar to that of the source area, desert tortoises are likely to move less (Nussear 2004). Translocated animals appear to reduce movement distances following their first post-translocation hibernation to a level that is not significantly different from resident populations (Field et al. 2007, Nussear 2004). 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).

We cannot predict the direction that translocated animals are likely to move. In some studies, translocated desert tortoises have exhibited a tendency to orient toward the location of their capture and attempt to move in that direction (Berry 1986), but in other instances, no discernible

homing tendency has been observed in translocated animals (Field et al. 2007). Information specific to short-distance translocations indicates that at least some individuals will attempt to return to their former home ranges after release (Stitt et al. 2003, Rakestraw 1997).

Based on this information, at least a portion of the translocated animals are likely to make extensive, long-distance movements during the first year following translocation, and the area that the translocated population occupies is likely to increase. We anticipate that the desert tortoises moved greater than 500 meters will likely make the largest movements since they have been moved the greatest distance. Based on the maximum straight-line dispersal distances discussed above, which constitute the best available scientific and commercial data at this time, we anticipate that some of the desert tortoises translocated long distances (greater than 500 meters) may disperse up to approximately 12.6 kilometers from the point of release in first year following translocation. We consider the 23-kilometer dispersal distance identified above to represent an outlier since only one male desert tortoise moved this far. Because female desert tortoises were found to move shorter distances than males following translocation (Field et al. 2007, Walde et al. 2008), the 12.6-kilometer distance captures the maximum straight-line dispersal distance of translocated females as well. We anticipate that most of the translocated individuals moved into the Ord-Rodman DWMA translocation area are likely to make long distance movements that are not typical of normal desert tortoise movement patterns.

Based on the distribution of desert tortoises in the Pisgah Valley portion of the action area, we anticipate that Tessera will translocate the majority of the animals found on the Calico facility site less than 500 meters into the Linkage translocation site. We anticipate that these individuals are likely to move much shorter distances and remain within the maximum straight-line dispersal distance observed for male desert tortoises (1.5 kilometers) discussed above for short-distance translocations. Some of the translocated desert tortoises, especially those moved into the Linkage translocation area, are likely to attempt to return to the project site, where they would encounter the project site fence and either turn around or walk the fence line. Because the action area for this project includes buffers that encompass all the contiguous desert tortoise habitat extending outside the translocation areas based on the maximum straight-line dispersal distances predicted for desert tortoises to move following translocation, we anticipate that all translocated animals, including those that make long-distance movements, will remain in the action area. Following the first hibernation period after translocation, individuals are likely to reduce movement distances and establish new home ranges.

In one study, the majority of the dispersal movement away from the release site occurred during the first 2 weeks after translocation (Field et al. 2007). During this time and over the period prior to home range establishment, desert tortoises may experience higher potential for mortality because they are moving great distances through unfamiliar territory and are less likely to have established cover sites for protection. Desert tortoises that make long-distance movements following translocation can travel for 5 to 10 days and average 671.5 yards per day (Berry 1986). Studies have documented various sources of mortality for translocated individuals, including predation, exposure, fire, disease, crushing by cattle, and flooding (Nussear 2004, Field et al. 2007, Berry 1986, U.S. Army 2009, 2010). Of these, predation appears to be the primary source

of mortality in most translocation studies (Nussear 2004, Field et al. 2007, U.S. Army 2009, 2010). Based on the description of the action area in the Environmental Baseline section of this biological opinion, the potential exists for all six sources of mortality within the action area. However, fire is likely to be localized and highly dependent on the abundance of non-native grasses and other weeds. In addition to these threats, the potential exists for desert tortoises to be killed on roads during the period when translocated individuals are seeking new home range locations.

Tessera has selected translocation areas in desert tortoise habitat that should serve as suitable recipient sites for these animals based on habitat suitability, proximity to home ranges of the translocated animals, and density of the resident population. It has proposed numerous protective measures in its translocation plan that are likely to reduce the potential for mortality of translocated individuals. Tessera will fence the perimeter road around the project site, and require all project associated personnel to follow a 25-mile-per-hour speed limit, reducing the likelihood of mortality along the road. Tessera has selected translocation areas within the Ord-Rodman DWMA that are a great distance from heavily traveled roads, and outside of the active grazing allotment, further reducing the likelihood for mortality. The length of monitoring will provide for some form of adaptive management to occur in association with the translocation. However, adaptive management measures are not available for our evaluation, so we cannot predict their effectiveness in this biological opinion.

Studies have documented mortality rates of 0, 15, 21, and 21.4 percent of translocated animals in other areas (Nussear 2004, Cook et al. 1978 in Nussear 2004, Field et al 2007). Nussear (2004) found that mortality among translocated animals was not statistically different from mortality observed in resident populations. This study did not compare mortality rates in resident populations to those in control groups; therefore, we cannot determine if the translocation caused increased mortality rates in the resident population. In addition, Esque et al. (2010) found that mortality rates in resident (29 of 140 desert tortoises; 20.7 percent mortality), control (28 of 149 desert tortoises; 18.8 percent mortality), and translocated populations did not differ statistically and concluded that the translocation was not the cause of the observed mortality. With the exception of the Esque et al. (2010) study, none of the studies cited in this paragraph used controls to compare mortality rates in resident and translocated populations to the mortality rate experienced in populations not affected by translocation.

Based on the information that we have gathered and considering the uncertainty of site-specific applicability, we estimate that translocated, resident, and control desert tortoises are likely to experience mortality rates of approximately equal proportions due to predation, exposure, fire, disease, crushing by vehicles, and flooding. We conclude that mortality rates in the resident and translocated populations are unlikely to be elevated above levels that these populations would experience in the absence of translocation, based on the information provided in Esque et al. (2010). Therefore, we do not anticipate this mortality will be the result of translocation and, consequently, we anticipate that few, if any, eggs, juveniles, subadults, or adults will die or be injured as a result of translocation. The monitoring of a nearby control population will assist us in determining whether this prediction is realized.

Based largely on one study (Esque et al. 2010), we anticipate that the mortality of translocated and resident desert tortoises is not likely to differ significantly from that of control animals. Such a finding indicates that we do not anticipate desert tortoises are likely to die after being translocated or having translocated animals released within their home ranges specifically because of the translocation. Because the best available data indicate that mortality is unlikely, we are not anticipating any take associated with post-translocation effects to resident or translocated animals; because we are not anticipating any incidental mortality of that nature, this biological opinion cannot contain any reasonable and prudent measures or terms and conditions that address such post-translocation mortality. However, because the survival of the translocated and resident animals (with regard to any effects of translocation) is key to the success of the Bureau's and Tessera's efforts to minimize the effects of the proposed action on the desert tortoise, being able to address any unforeseen effects of translocation is a key component of ensuring that unforeseen effects of the proposed action are not likely to jeopardize the continued existence of the desert tortoise. Consequently, we have added language to the Re-initiation Notice section of this biological opinion to specifically identify when new information reveals effects of the action that may affect the desert tortoise in a manner or to an extent that was not previously considered (i.e., 50 Code of Federal Regulations 402.16(b)).

We have estimated that few, if any, desert tortoises may be moved during installation of the water pipeline and the portion of the transmission line outside the project site. Because disturbance areas on these projects are small, movement of desert tortoises immediately outside of the work areas is not likely to remove them from their current home ranges. Consequently, any desert tortoise moved from the water pipeline and transmission line will likely continue to occupy familiar territory and use known shelter sites and is unlikely to experience post-translocation mortality associated with displacement from the work areas. Furthermore, following completion of construction, desert tortoises occupying these areas will be able to move through and return to the area.

Juvenile desert tortoises will comprise a portion of the overall mortality predicted above for resident and translocated populations. We anticipate that translocated juveniles are likely to experience a higher mortality rate than translocated subadult and adult desert tortoises, simply because smaller and younger desert tortoises in general have higher mortality rates than larger individuals. Because we anticipate that Tessera will move few, if any, juvenile desert tortoises, we do not anticipate large numbers of juveniles will die as a result of translocation because surveyors will miss most of these individuals during clearance surveys of the project site. We have discussed juvenile mortality during construction below. Because juvenile desert tortoises experience high mortality rates under natural circumstances, many of these individuals would likely not survive to reproductive age in the absence of project-related effects.

Effects of Post-translocation Monitoring

Based on the description of the post-translocation monitoring program and our estimate of the number of desert tortoises on the project site, we anticipate that Tessera will transmitter no more than 87 subadult and adult desert tortoises to facilitate monitoring of the translocated, resident,

and control populations. This will require desert tortoises to carry transmitters and will require periodic monitoring and handling of individuals to perform visual health assessments and assess body condition. Some potential exists that handling of desert tortoises may cause elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluids. Because Tessera will use experienced biologists, approved by the Service, Bureau, CEC and CDFG, and approved handling techniques, these desert tortoises are unlikely to experience substantially elevated stress levels resulting from handling and monitoring activities. Any effects would be limited to Subadult and adult desert tortoises because Tessera has not proposed to monitor juveniles.

Effects of Construction of Calico Facility

Prior to construction, Tessera will permanently fence the entire Calico project facility with desert tortoise exclusion fence. On the portions of the project where Tessera must maintain a perimeter road to allow for public access, it will install the desert tortoise exclusion fence on the outside of the road to prevent desert tortoises from accessing the road or project site. Tessera will install cattle guards at every location where the perimeter road intersects a Bureau open route or county road. Tessera will clear all desert tortoises from the 4,613-acre site prior to ground disturbance. During construction of the permanent and temporary exclusion fencing, Tessera 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, including construction access, is unlikely to kill subadult and adult desert tortoises. Some potential always exists that surveyors may miss an individual during clearance surveys and construction monitoring. We cannot predict how many subadult and adult desert tortoises that clearance surveys and construction monitoring would miss. However, because Tessera will use qualified biologists, authorized by the Service for clearance surveys, we anticipate the number is likely to be small.

In addition, construction of the transmission line and water pipeline has the potential to result in injury or mortality of individuals on work sites. We have estimated that work areas associated with these activities would have few if any desert tortoises. However, Tessera would conduct clearance surveys and move desert tortoises out of harm's way if they are found on work sites. In addition, Tessera would use experienced biologists to monitor work activities on these project sites and move any desert tortoises out of harm's way that they may have missed during clearance surveys. For these reasons, we anticipate that construction activities associated with the water pipeline and transmission line are unlikely to kill subadult and adult desert tortoises. Some potential always exists that surveyors may miss an individual during clearance surveys and construction monitoring. We cannot predict how many subadult and adult desert tortoises that clearance surveys and construction monitoring would miss. However, because Tessera will use qualified biologists, authorized by the Service for clearance surveys, we anticipate the number is likely to be small.

In addition, juvenile desert tortoises and eggs are difficult to detect during clearance surveys and construction monitoring; therefore, the potential exists that surveyors may miss most of them and

they are likely to remain in the work areas during construction. Construction activities are likely to kill juvenile desert tortoises and eggs that surveyors miss during clearance surveys or project monitoring. Because Tessera will not be grading the entire project site and vegetation will remain between SunCatcher rows, some small portion of juveniles and nests may survive through construction in the remaining habitat. Based on the estimates in the Environmental Baseline section of this biological opinion, we estimate that up to 30 juvenile desert tortoises may reside on site. We anticipate that construction may kill or injure these individuals, if they are not translocated from the site. Because juvenile desert tortoises experience high mortality rates under natural circumstances, many of these individuals would be unlikely to survive to reproductive age in the absence of project-related effects.

We have estimated that the reproductive females on the project site collectively produce as many as 87 eggs per year. However, we cannot estimate how many of these eggs that construction activities would destroy because this number covers the entire year's production and we do not know what portion of this total will be present on site when construction activities are occurring on a given phase. We anticipate that construction may kill or injure up to 87 desert tortoise eggs on the project site, if they are not translocated; the eggs are unlikely to be translocated, given their small size and the fact that they are underground and, therefore, difficult to detect.

Because clearance surveys are likely to miss juvenile desert tortoises, we anticipate that many, if not all desert tortoises associated with work areas on the water pipeline and transmission line would be injured or killed. However, we have estimated that few, if any, juvenile desert tortoises would occupy these work areas because the areas would be small and are unlikely to support more than a few juveniles. Because juvenile desert tortoises experience high mortality rates under natural circumstances, many of these individuals would be unlikely survive to reproductive age in the absence of project-related effects.

Effects of Operations and Maintenance Activities

As discussed above, rows of vegetation may provide for the survival of a small portion of juvenile desert tortoises and nests through construction. Therefore, some potential exists that regular operations and maintenance activities could kill or injure juvenile and newly hatched desert tortoises during the early years of operations. Because Tessera will collapse desert tortoise burrows during clearance surveys, only small areas of vegetation will remain, vegetation is likely to be mowed, and maintenance activities will be fairly continuous; we do not expect that a population of desert tortoises will subsist within the Calico project site. We cannot predict the number of juvenile desert tortoises that will survive through construction and will be killed during operations and maintenance; however, based on our estimate of the numbers of juveniles and eggs on the site, we anticipate that up to 30 juveniles and 87 eggs may be killed or injured due to operation and maintenance, if they are not captured and translocated. We have discussed additional indirect effects associated with operation and maintenance of this facility in the Miscellaneous Effects section of this biological opinion.

Tessera plans to conduct most operation and maintenance activities inside the desert tortoise exclusion fence over the 30-year life of this project anticipated by the Bureau; however, Tessera may perform some ground-disturbing maintenance activities outside of fenced areas while conducting perimeter fence repair. Activities associated with fence repair have the potential to injure or kill desert tortoises primarily as a result of vehicle strikes, as workers travel to and from work sites outside of the fenced areas, by workers walking the perimeter of the fence during inspections, and during repair of the perimeter fence. Additionally, if the perimeter fence is damaged, desert tortoises that enter the facility could be killed or injured during routine activities. Because Tessera plans to conduct all maintenance activities inside the desert tortoise exclusion fence and has proposed several protective measures such as limiting speed limits to 25 miles per hour, and regular inspections of the perimeter fence, we anticipate few desert tortoises will be affected.

Effects of Restoration/Reclamation Activities for Construction and Operation

Restoration activities within the permanently fenced project area are unlikely to result in injury or mortality of desert tortoises because few if any desert tortoises are likely to occupy the project site after clearance surveys and construction activities. Tessera will restore temporarily disturbed areas associated with the water pipeline and the portion of the transmission line extending outside of the project boundary. Tessera will implement restoration as identified in the restoration plan. The restoration plan will include measures to insure that no activities injure or kill desert tortoises (e.g., pre-activity clearance surveys, use of desert tortoise monitors, and use of tortoise exclusion fencing). Consequently, restoration activities will injure or kill few, if any, desert tortoises.

Effects of Accessing Worksites

The primary access road to the Calico facility will be almost entirely within the fenced project facility. Tessera will install desert tortoise exclusion fencing on the short segment of the main access road that is outside the project facility. Tessera will fence any temporary access roads that it uses while the main access road is constructed and the project facility is fenced. Tessera will also install desert tortoise exclusion fencing on the outside edge of the project perimeter boundary fence. Because Tessera will fence all of the roads associated with worksite access, it is unlikely that access to the Calico facility will result in injury or mortality of desert tortoises. In the event that the fence is damaged, a small number of desert tortoises could enter the roadway and be injured or killed. Because all workers will undergo an education program about desert tortoises and will be limiting travel speeds to 25 miles per hour, workers may be less likely to strike desert tortoises than a casual user. We cannot predict how many individuals will be killed or injured because of the variables involved, such as weather conditions, the nature and condition of the road, and activity patterns of desert tortoises at the time the roads are being used; however we expect this number to be small.

Effects of Partial Loss of Desert Tortoise Home Ranges

Construction of the Calico facility and the surrounding desert tortoise exclusion fence will result in the partial loss of desert tortoise home ranges. Construction of the Calico facility could exclude desert tortoises that occupy the area adjacent to the proposed site from a portion of their home range. There are approximately 6,100 acres of land within a 797-meter buffer of the proposed project. We used the 797-meter buffer as an index for the home range of desert tortoises based on a male desert tortoise home range of approximately 2 square kilometers (O'Conner et al. 1994; Duda et al. 1999; Harless et al. 2009). Using the same desert tortoise density used for the action area outside of the project boundary, 4.7 subadult and adult desert tortoises per square kilometer (12.2 per square mile), determined by the 2007 range wide monitoring to represent the density of desert tortoises in the Western Mojave Recovery Unit (Service 2009b), we estimate that approximately 116 subadult and adult desert tortoises may have home ranges within the area surrounding the project site and an additional 121 juvenile desert tortoises may occupy this area. Displacement of these desert tortoises from a portion of their home range could have similar effects to those described for translocation such as elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluid, increase density of animals and associated effects, and increased exposure to disease. Because desert tortoise home ranges vary greatly in size, we cannot determine how many desert tortoises will actually lose part of their home range as a result of the construction of the Calico facility; however, we expect that the number of desert tortoises that will be injured or killed due to the partial loss of home range to be low because we expect these individuals will all maintain some portion of their home range, be in familiar surroundings, and will be able to expand their territory into contiguous habitat.

Effects of Loss of Habitat

Construction of the Calico facility would cause the long-term loss of a maximum of 4,613 acres of desert tortoise habitat. Tessera estimates that 30 percent of the solar field would be undisturbed, as the SunCatcher solar arrays will allow for approximately 40 to 80 feet of vegetation to be left generally undisturbed between alternate rows of SunCatchers. However, Tessera may trim vegetation to approximately 3 inches throughout the disturbed portions of the project site (i.e., portions of the project site not included in the alternating rows of undisturbed vegetation) to provide for reduced shading and fire hazards.

The Calico facility will remove approximately 4,613 acres of desert tortoise habitat for a period of more than 30 years. Tessera will restore the habitat in the fenced project area when the project is decommissioned, but it is unlikely to function as suitable desert tortoise habitat for many years following facility closure. We cannot predict the amount of time required to return areas of long-term disturbance to suitable desert tortoise habitat because of numerous variables associated with restoration success. The following table provides details on the habitat loss associated with the Calico Solar facility.

Permanent Disturbance[1]	**Acres**
Calico facility - Solar Field	3,175.9
Calico facility – rows between SunCatchers	1,361.1[2]
Temporary Disturbance	
Water pipeline	4.5
Transmission line (between Calico and Pisgah substation)	12.9
Temporary Functional Loss (through isolation)	
N.A.P. 2	429
Lands adjacent to N.A.P. 2	245
Total	5,228.4

[1]Bellows 2010; [2]Potential temporary loss of habitat depending on the extent of mowing activities

Outside the project site, the groundwater pipeline and transmission line will result in the temporary loss of desert tortoise habitat that Tessera will restore following completion of construction of these linear features. The underwater pipeline will result in 4.5 acres of disturbance, while the transmission line will affect 12.9 acres.

In the southern portion of the project, the NAP 2 and the adjacent project exclusion areas include 674 acres of desert tortoise habitat (Miller 2010c). This area will have a severely restricted connection to other desert tortoise habitat in the surrounding area due to development of the project facilities. Although project activities would not disturb this portion of desert tortoise habitat, it will have little, if any, future value to desert tortoises.

These disturbances are likely to result in desert tortoise habitat loss that will persist for various periods. Following extensive disturbance and compaction, Mojave Desert soils can take between 92 and 124 years to recover in the absence of active restoration (Webb 2002). In addition, recovery of plant cover and biomass in the Mojave Desert can require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). Although 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, 3,175.9 acres, currently characterized as desert tortoise habitat are likely to be permanently lost or unsuitable as habitat for several decades following decommissioning of the facilities and commencement of restoration work. However, we anticipate that the mowed and un-mowed areas within the project facility will respond more quickly to restoration efforts and may provide desert tortoise habitat value more rapidly than the rest of the project site. Because active restoration will occur on the linear components, we estimate that Tessera will restore 17.4 acres of desert tortoise habitat prior to decommissioning of the facility. If additional development

does not occur within NAP 2, we anticipate that following the decommissioning of the facility, the 674 acres that were functionally lost to desert tortoise will be again be available for their use.

We estimate that the Western Mojave Recovery Unit contains approximately 10,316 square miles of potential desert tortoise habitat (Waln 2010, see Status of the Desert Tortoise - Status and Trends of Desert Tortoise Populations section of this biological opinion). The habitat that would be disturbed on a long-term basis (i.e., approximately 7.21 square miles) constitutes approximately 0.07 percent of the remaining modeled habitat in the Western Mojave Recovery Unit. Although this percentage does not constitute a numerically substantial portion of the recovery unit, we do not have the ability to place a numerical value on edge effects that the proposed action may cause or that occurs in the recovery unit as a whole. Given that, this low percentage of the recovery unit that would be lost likely underestimates the biological value of the area.

Miscellaneous Effects

The noise produced by the Calico facility during operation has the potential to affect desert tortoises in the areas surrounding the project site. Operation of the Calico facility will generate noise of 63 to 74 adjusted decibel, equivalent sound level (dBA Leq), primarily from the operation of the SunCatchers. This increase of constant noise within the valley could disturb desert tortoises or discourage them from using the area near the project site. Tessera will install all of the SunCatchers greater than 100 feet from the project boundary, thereby reducing the amount of noise extending outside of the project to below 74 dBA Leq. Rabin et al. (2006) illustrated that some species can successfully adapt to ambient sound levels of 90-118 dB decibel sound pressure level (SPL). Limited data exists on the effect of noise on desert tortoises, Bowels et al. (1999 in Service 2008c) demonstrated that desert tortoises hearing is relatively sensitive (mean = 34 dB SPL) and that few physiological effects were observed with short-term exposures to jet air craft noise and sonic booms. However, we cannot extrapolate this result to determine the effects of chronic noise exposure over a desert tortoise's life-time (Service 2008c). Chronic elevated noise levels could lead to elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluid, decreased reproduction, or shifts in home ranges leading to increased density-dependent effects. We cannot reasonably predict the magnitude of the effect that noise will have on desert tortoises in the surrounding area; however, we expect the number of desert tortoises that will be injured or killed will be low based on the ability of other species to adapt to noise disturbance, the level of noise and any effects will attenuate as distance from the project site increases, and the fact that desert tortoises do not appear to rely on auditory cues for their survival. In addition, some portions of the population of desert tortoises occupying this site are likely affected to some extent already by noise generated by Interstate 40 and the railroad that runs through the project site.

Indirect effects associated with construction, operation and maintenance of the Calico facility may injure or kill desert tortoises. These effects include increased predation by common ravens and modification of the habitat and diet of desert tortoises due to the spread of non-native plant species.

Common ravens are attracted to human activity in the desert. Securing trash and reducing other subsidies will likely reduce the attractiveness of the area to predators. We expect that common ravens are still likely to frequent the site because it would offer perching, roosting, and nesting sites within the solar field. Consequently, the proposed facility has the potential to attract common ravens to some degree and lead to further predation on desert tortoises in the vicinity; the proposed measures to monitor use of the site by common ravens and to attempt to remove any subsidies are likely to reduce the attractiveness of the facility to these birds to some degree.

Tessera will contribute funds to the regional common raven management program to address the indirect and cumulative impacts associated with project development that facilitate the expansion of common raven populations into desert tortoise habitat. The one-time fee of $105 per acre of disturbance to 4,613 acres of desert tortoise habitat impacted by this project will fund the project's portion of the regional raven management plan for the 30-year life of the project anticipated by the Bureau. Tessera's funding of the regional management plan for common ravens will contribute to a large-scale management action that the Service and other agencies are undertaking to control and manage common ravens on a regional basis. We expect that implementation of this plan will promote the recovery of the desert tortoise by reducing the number of common ravens that prey on desert tortoises and by implementing actions that are likely to reduce subsidies for common ravens on a regional basis.

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 action area, numerous features serve as vectors for infestation by non-native plant species (e.g., BNSF railroad, Interstate 40). However, construction and operation of the Calico 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 operations personnel is likely to increase the volume and distribution of non-native seed carried into the action area. The increased abundance in non-native species associated with this project may result in an increased fire risk, which may result in future habitat loss. Tessera has proposed numerous measures to address control of non-native plant species within the project site and a surrounding 250-meter (820-foot) buffer and to minimize the potential for fire in and around the facility, including an onsite fire response team. We cannot reasonably predict the increase in non-native species abundance that this project will create within the action area, but we anticipate that the program proposed by Tessera will be reasonably effective in reducing the increase in some species. However, we anticipate that the amount of disturbance created by the 4,613-acre solar field and the activities in the action area will result in an increase in the abundance of non-native species and thereby elevate the risk of fire, which, in turn, heightens the risk of future habitat loss. This could reduce the number and distribution of desert tortoises within the action area.

The loss of habitat associated with this project has the potential to reduce the connectivity between desert tortoise populations. Maintaining a functional corridor through the Pisgah Valley is critical for the long term recovery of the desert tortoise. Specifically, Pisgah Valley is an important part of the desert tortoise habitat which connects desert wildlife management areas in

the West Mojave Recovery Unit (e.g., Ord-Rodman) with the Mojave National Preserve. The valley serves as an important corridor connecting not only the critical habitat units (Ord-Rodman, Superior-Cronese, and Ivanpah), but it also provides one of the few pathways connecting the Western Mojave and Eastern Mojave recovery units, as well as the Western Mojave and Colorado Desert recovery units, as described in the draft revised desert tortoise recovery plan (Service 2008c). However, based on the currently reduced size of the project site, the establishment of the solar development exclusion area, and the amount of remaining desert tortoise habitat in this area, we conclude that the reduced project design will not eliminate connectivity in this area.

Effects of Compensation

The Bureau is proposing to require compensation for loss of habitat associated with this project at a ratio of 1 to 1 per the provisions of the West Mojave Plan (Bureau et al. 2005). The Bureau will use compensation funds for enhancement of desert tortoise habitat within the Ord-Rodman DWMA. Specific habitat enhancement and rehabilitation actions will include all or some of the following: construction of a fence along State Route 247 from Barstow to Lucerne Valley to prevent desert tortoises from entering the roadway, with the primary focus area being Barstow to Stoddard Ridge; installation of barrier fencing along Camp Rock road to prevent unauthorized vehicular use; signing open routes within Ord-Rodman DWMA and visually obscuring routes that have been administratively closed but continue to be used by vehicles; and installation of desert tortoise fencing along Interstate 40. The Bureau may also use these funds to support head start programs for desert tortoises developed in coordination with the Service's Desert Tortoise Recovery Office.

In addition to the Bureau's compensation strategy, the CEC and CDFG will collect additional compensation for loss of desert tortoise habitat north of the BNSF railroad at a ratio of 2 to 1 with an additional ratio of 4 to 1 compensation collected for 369 acres of this habitat. CDFG will use these compensation funds to acquire mitigation lands with potential to contribute to desert tortoise habitat connectivity and linkages between critical habitat, known populations of desert tortoise, and other preserve lands inside the Western Mojave Recovery Unit. To satisfy this mitigation condition, Tessera will acquire, protect, and transfer to a management entity no fewer than 10,302 acres of desert tortoise habitat and provide funding for the initial improvement and long-term maintenance and management of the acquired lands (CEC 2010b). All acquisition and habitat enhancements or rehabilitation actions associated with the Bureau's and the State of California's compensation requirements will be performed within the Western Mojave Recovery Unit.

Although the purchase, protection, and enhancement of suitable desert tortoise habitat through these compensation requirements will not create new habitat within the recovery unit, it will result in an increase in the amount of desert tortoise habitat managed for the conservation of this species in protected areas. These actions will increase the quality of habitat for desert tortoises and reduce the number of existing threats and mortality sources in the areas where they occur. Because habitat enhancement actions and land acquisition would occur in DWMAs or other

locations that are important to desert tortoise conservation, the proposed compensation requirements would provide a positive recovery benefit to desert tortoises.

Implementation of some 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 likely require future project-specific authorizations prior to implementation. Consequently, we will address their potential adverse effects to the desert tortoise in future project-specific, section 7 consultations.

Summary

Prior to construction of the Calico facility, we estimate that Tessera will capture and translocate no more than 29 subadult and adult desert tortoises from the project worksite. We anticipate the size and configuration of the current recipient sites will accommodate all of these animals. However, Tessera may have to identify new translocation areas if it cannot demonstrate compliance with the density and disease thresholds in its translocation plan. Because we cannot predict if or how the translocation strategy might change, these changes would require further analysis and consultation. We anticipate that they will translocate few if any juvenile desert tortoises or desert tortoise eggs. Because they will implement a variety of measures to reduce stress to translocated desert tortoises, we do not anticipate that injury or mortality will result from handling of these animals. Following release of translocated animals, we anticipate that mortality rates in the resident and translocated populations are unlikely to be elevated above normal levels, and that mortality rates will be approximately equal among the translocated, resident, and control desert tortoises.

In addition to the 29 translocated subadult and adult desert tortoises that Tessera will monitor following release, we estimate that it will capture and monitor an additional 29 subadult or adult desert tortoises in the resident and control populations. Furthermore, based on our current estimates, Tessera will collect blood samples from 105 resident desert tortoises located in the Ord-Rodman DWMA translocation area, 29 desert tortoises in the control site, and 29 desert tortoises on the project site. We do not anticipate that placing transmitters on these animals and periodic handling for the purposes of monitoring or collection of blood samples will result in substantial adverse effects because Tessera will use experienced biologists, approved by the Service, and approved handling techniques.

Because Tessera will surround all of its work areas with desert tortoise exclusion fencing, perform clearance surveys on all work areas, and implement numerous measures to prevent injury and mortality of desert tortoises, we anticipate that construction of the Calico project site, including use of access routes, is likely to kill or injure few, if any, subadult and adult desert tortoises. Because of the difficulty detecting and removing them, we estimate that project construction may kill or injure a portion of the 30 juvenile desert tortoises we anticipate to be on site. We also anticipate that project construction will destroy some portion of the 87 desert

tortoise eggs. Given the numerous variables discussed in this section, we cannot predict the precise number of eggs with any certainty.

Following construction, we anticipate that operations and maintenance within the permanently fenced portions of the Calico facility would kill or injure few, if any, subadult and adult desert tortoises and this is only likely to occur in the event that a portion of the exclusion fencing is washed out and a desert tortoise gains access to the site. We anticipate that this occurrence would be rare. Because Tessera will not grade the entire project site, some potential exists for juvenile desert tortoises to survive through construction and for some nests to hatch eggs within the remaining vegetation. Because of the difficulty in detecting juveniles, we estimate that project operations and maintenance will kill or injure all juvenile desert tortoises that survive through construction, and thus will kill or injure a portion of the 30 juveniles we anticipate to be on site. We expect that restoration activities outside of the project site are unlikely to injure or kill desert tortoises because of the numerous protective measures that Tessera will implement. With the exception of activities associated with fence repair, all maintenance activities for the project site will occur within the permanent desert tortoise fencing. Because of the protective measures that Tessera will implement and the nature of the fence repair activities, we anticipate fence maintenance activities will kill or injure few, if any, desert tortoises. Tessera has not identified any specific maintenance activities, other than fence repair after storm events, which will be conducted outside of the desert tortoise fencing; any activities identified in the future are not covered by this biological opinion and may require additional consultation.

Project development will result in 4,613 acres of long-term/permanent disturbance to desert tortoise habitat and a large reduction in the functionality of an additional 674 acres of desert tortoise habitat. Although all disturbed areas will undergo restoration/reclamation work upon decommissioning, it is unlikely to serve as suitable desert tortoise habitat for many years following facility closure. We cannot predict the amount of time required to return areas of long-term disturbance to suitable desert tortoise habitat because of numerous variables associated with restoration success, including the timing and amount of rainfall. We estimate that Tessera will return an additional 17.4 acres of short-term disturbance to suitable desert tortoise habitat by the end of the 40-year project lifespan, and re-open the 674 acres isolated for desert tortoise occupancy following decommissioning.

Construction, operation, and maintenance of the Calico facility have the potential to increase common raven predation on desert tortoises within the action area. In addition, this project is likely to result in an increased abundance of non-native plant species and a subsequent increase in fire frequency within the action area. The measures proposed by Tessera to address these threats will reduce the magnitude of these effects, but some level of adverse effect will likely persist. We cannot reasonably predict the number of desert tortoises that these threats will adversely affect.

The compensation required by the Bureau and the State of California would, to some degree, offset the adverse effects of the proposed solar power facility. All of the actions that would be undertaken as compensation will be consistent with recommendations for recovery of the desert

tortoise. However, the lack of specificity with regard to which actions will be implemented, the uncertainty of success of the actions, and the time lag between implementation of the conservation actions and a substantive effect on recovery of the desert tortoise prohibit us from concluding that the compensation measures would completely offset the adverse effects of the solar facility. Because of the long-term or permanent loss of approximately 4,613 acres of desert tortoise habitat, the project will likely result in a net decrease in desert tortoise habitat.

Areas permanently disturbed by the proposed solar facility and its ancillary features would no longer support reproduction of desert tortoises unless the site closes and habitat restoration is successful. Most of the desert tortoises that currently reside within these areas will likely continue to reproduce after translocation. Consequently, we anticipate that the proposed action will not appreciably diminish the reproductive capacity of the species.

Implementation of the proposed action would not appreciably reduce the number of desert tortoises in the Western Mojave Recovery Unit. Based on the amount of modeled desert tortoise habitat (10,316 square miles) and the average density (12.2 desert tortoises per square mile) that the Service has estimated for this recovery unit, we could estimate that approximately 125,855 subadult and adult desert tortoises occur in the Western Mojave Recovery Unit. Using this estimate and the information and methods described above for estimating the number of juvenile desert tortoises and eggs on the project site, action area, and translocation area, we estimate that the Western Mojave Recovery Unit may contain between 56,544 to 130,992 juvenile desert tortoises at any given time and reproductive females within the Western Mojave Recovery Unit may produce as many as 583,972 desert tortoise eggs over the course of a year. Consequently, we conclude that the number of desert tortoises and eggs that are likely to be lost as a result of the Calico project comprises a relatively small portion of the overall population in the Western Mojave Recovery Unit.

In previous consultations, we estimated the number of desert tortoises found in the desert wildlife management areas and critical habitat by multiplying the average density of animals found in these areas by their total size. For the numbers of desert tortoises outside of those areas, we used a density value of one-tenth of that estimated within desert wildlife management areas and critical habitat, which we multiplied by the estimated area of available desert tortoise habitat. We did not correct for areas that were unsuitable habitat in either case in these past consultation estimates. Because the method of estimating the number of desert tortoises we use in this biological opinion takes into account a conservative estimate of modeled desert tortoise habitat, we used the same average density across all areas of desert tortoise habitat for our estimate. The distribution of the desert tortoise would be reduced by approximately 7.21 square miles, based on the amount of long-term and permanent disturbance associated with the proposed action. This loss comprises approximately 0.07 percent of the modeled habitat in the Western Mojave Recovery Unit. Although this percentage does not constitute a numerically substantial portion of the Western Mojave Recovery Unit, we do not have the ability to place a numerical value on edge effects and fragmentation that the proposed action may cause or that occurs in the recovery unit as a whole. Therefore, even though the percentage of habitat lost is low, the biological effect of the loss could be greater if the actual biological value of the area is greater and has been

underestimated. The Bureau's designation of the area north of the project site and south of the Cady Mountains as a solar exclusion zone is important in reducing habitat fragmentation caused by the proposed action.

Although the effects of this project on desert tortoises are substantial, we do not anticipate that it will result in effects that appreciably reduce the current distribution, numbers, or reproduction of the overall population within the Western Mojave Recovery Unit or range wide. We anticipate that the compensation programs (i.e., one proposed by the Bureau and the other approved by the California Energy Commission) will result in an increase in the amount of habitat that is managed for the conservation of this species and will result in many advances in the implementation of recovery actions. We anticipate that this compensation will offset many adverse effects associated with this project. Taking into consideration the compensation that is proposed and considering the relative scale of the adverse effects in context with our current estimates of the species' status in the Western Mojave Recovery Unit and range wide, we do not anticipate that construction of this project would appreciably reduce our ability to recover the desert tortoise.

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. Most of the land within the action area is managed by the Bureau. According to the County of San Bernardino, no future projects are reasonably certain to occur on the small amount of private land occurring in the action area. (URS 2010b).

CONCLUSION

After reviewing its status, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion because:

1. Project activities are likely to kill or injure few subadult or adult desert tortoises because Tessera will implement numerous measures to reduce the potential that desert tortoises will occupy project work sites (i.e., clearance surveys, exclusion fencing, translocation, qualified biologists, desert tortoise monitors).

2. The number of desert tortoises injured or killed as a direct result of translocation activities (e.g., blood tests, handling, quarantine, etc.) will likely be small because only highly skilled biologists will perform this work in accordance with techniques approved by the Service.

3. Post-translocation mortality in the translocated or resident populations is unlikely to be elevated above that experienced by desert tortoises not affected by translocation.

4. Tessera will implement numerous measures to reduce the potential for increased predation by common ravens and spread of non-native plant species.

5. Regional management actions are likely to aid in reducing common raven predation of desert tortoises in a portion of the desert tortoise's range.

6. This project would not result in loss of desert tortoise habitat in areas that the Bureau or other agencies have designated for intensive management to achieve conservation of desert tortoises (e.g., desert wildlife management areas, critical habitat, etc.).

7. Compensation requirements through the Bureau and CDFG will result in an increase in the amount of existing habitat that is managed for the conservation of the desert tortoise and will likely lead to restoration of lost or degraded habitat within these areas.

We recognize the loss of individual desert tortoises as a result of this project will contribute to a decrease in the population; however, we anticipate that the proposed compensation will offset this effect to at least some degree, maintain a linkage in the Pisgah Valley, and reduce the overall impact of the Calico project. Furthermore, the land acquisition within the DWMAs and participation in the regional raven management plan support actions identified for the recovery of the species in the recovery plan (Service 1994).

As we noted previously in this biological opinion, the analysis we conduct under section 7(a)(2) of the Endangered Species Act must be conducted in relation to the status of the entire listed taxon. We based the analysis in this biological opinion within the context of the Western Mojave Recovery Unit because of the wide range of the desert tortoise. Because we have determined that the effects of this action would not compromise the integrity of the Western Mojave Recovery Unit or impede the survival or recovery of the desert tortoise in a measurable manner in this portion of its range, we have not extended the analysis of the effects of this proposed action to the remainder of the range of the Mojave population of the desert tortoise.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined

as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The measures described in this document are non-discretionary. The Bureau has a continuing duty to regulate the activities covered by the incidental take statement in the biological opinion. If the Bureau fails to include the terms and conditions of this incidental take statement as enforceable conditions of its 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 its action and its impact on the desert tortoise to the Service as specified in the incidental take statement [50 Code of Federal Regulations 402.14(i)(3)].

Translocation of Desert Tortoises

We anticipate that the translocation of approximately 29 subadult and adult desert tortoises from the Calico facility would take, in the form of capture, of all of these individuals. We emphasize that this number is an estimate, based on the best available information. The number of individuals requiring translocation may be somewhat lower; our estimate of the number of desert tortoises that Tessera would translocate from the project site is based on use of the upper limit of the 95 percent confidence range for the project sites population estimate. Consequently, we do not anticipate that Tessera would capture more than 29 subadult and adult desert tortoises for translocation during construction of the project. We do not anticipate that the act of translocating desert tortoises is likely to kill or injure any subadults and adults.

Due to the difficulty in locating juveniles and eggs, we anticipate the capture of few, if any, juvenile desert tortoises and eggs. However, the potential exists that up to 30 juveniles and 87 eggs may be taken through capture if they are found and translocated. We do not anticipate that the act of translocating these individuals will kill or injure any juveniles or eggs.

Because of the small work areas associated with the underground water pipeline and transmission line, we anticipate the translocation of few, if any, desert tortoises or eggs from construction areas for these linear features. Because desert tortoises can move through narrow, linear features quickly, past survey results do not provide a precise estimate of the number of individuals likely to be encountered along these portions of the proposed action. Consequently, we cannot provide an estimate of the number of individuals that may be translocated. We do not anticipate that the act of translocating these individuals will result in injury or mortality.

Disease Testing

We anticipate that as many as 163 subadult and adult desert tortoises (i.e., 29, 29, and 105 in the project site, control, and Ord-Rodman translocation areas, respectively) will be taken, in the form of capture and harassment, when Tessera handles desert tortoises and collects blood to assess

disease prevalence. Although such an invasive procedure presents some likelihood that individuals could be injured or killed, we do not anticipate that blood collection will result in the injury or mortality of any individuals because Tessera would use experienced biologists, authorized by the Service, and approved handling techniques.

Post-translocation Monitoring

We anticipate the take, in the form of capture, of approximately 58 desert tortoises for monitoring of the resident and control populations. Although these animals and the 29 desert tortoises from the translocated population would be captured multiple times over the course of the post-translocation monitoring effort, we do not anticipate injury or mortality of these individuals as a result of the post-translocation monitoring.

Construction of Calico Solar Facility

Because Tessera will fence all of its work areas with desert tortoise exclusion fencing, perform clearance surveys on all work areas, and implement numerous measures to prevent adverse effects to desert tortoises, we anticipate that construction of the Calico project site, including use of access routes, is likely to take few, if any, subadult and adult desert tortoises in the form of mortality or injury.

If juvenile desert tortoises and eggs are not detected and translocated from the project site prior to construction, we anticipate that construction of the Calico facility is likely to take, in the form of mortality or injury, up to 30 juvenile desert tortoises and 87 eggs. Locating juvenile desert tortoises and eggs is difficult because of their small size; consequently, we anticipate that many of these individuals are likely to be injured or killed during construction. We anticipate that construction of the water pipeline and transmission line will injure or kill few, if any, desert tortoises.

Operation and Maintenance of Calico Solar Facility

We anticipate that operation and maintenance activities, including site access, within permanently fenced areas are likely to take few desert tortoises. A small portion of the 30 juveniles and 87 eggs estimated to be on the project site could survive construction in the rows of vegetation between the SunCatchers. Because of the difficulty in locating juvenile desert tortoises, we anticipate that all of the remaining juveniles on the project site and any eggs that hatch will be killed or injured at some point during operations and maintenance. Based on the estimated numbers of juvenile desert tortoises and eggs on site, we anticipate that operation and maintenance may injure or kill up to 30 juveniles and 87 eggs.

A limited potential exists that a very small number of desert tortoises may find their way into a fenced area. Most of these individuals are likely to be taken in the form of capture as they are removed to offsite habitat; a small fraction of these individuals may be taken, in the form of

injury or mortality, if they are exposed to adverse weather conditions or crushed by vehicles before they are detected.

All operations and maintenance for the proposed project, except fence repair, will be within the permanent desert tortoise exclusion fence. Any maintenance activities associated with repair of the desert tortoise exclusion fence would kill or injure few, if any, desert tortoises because the need for this action would be localized and infrequent, access to repair sites would require little, if any, off-road travel, and Tessera would implement numerous protective measures to reduce the potential for take. Tessera has not identified any other maintenance activities that it will conduct outside of the desert tortoise fencing; any activities identified in the future are not covered by this biological opinion and will require additional consultation.

Restoration of Temporary Disturbance for the Calico Solar Facility

Restoration of temporary disturbance areas within fenced construction areas is unlikely to result in take of desert tortoises because Tessera will clear all fenced areas of desert tortoises prior to construction of the facilities. Restoration of temporary disturbances that occurs outside of fenced work areas has the potential to kill or injure desert tortoises because the desert tortoises have not been excluded from the restoration area. However, we estimate that Tessera will kill or injure few, if any, desert tortoises during restoration outside of fenced areas because Tessera will implement restoration as identified in its restoration plan and the plan will include measures to insure that all activities do not injure or kill desert tortoises (e.g., pre-activity clearance surveys and use of desert tortoise monitors).

Compensation

All actions associated with the Bureau's compensation requirements will likely require future Bureau authorizations. Consequently, we have provided no incidental take exemptions for these actions in this biological opinion. These actions will require future project-specific consultation if they may affect the desert tortoise or other listed species.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of desert tortoises during the implementation of the Calico Solar project:

1. The Bureau must ensure that desert tortoises do not enter fenced project facilities.

2. The Bureau must ensure that the level of incidental take anticipated in this biological opinion is commensurate with the analysis contained herein.

3. The Bureau must ensure desert tortoises held in quarantine pens while awaiting results from disease testing are not poached by humans or killed by natural predators.

4. The Bureau must ensure that injury and mortality of desert tortoises, missed during construction clearance and monitoring, is minimized during operation of the Calico facility.

5. The Bureau must ensure that the potential for disease transmission with the recipient translocation populations is minimized.

6. The Bureau must ensure that Tessera safeguards that the maximum number of desert tortoises are found during clearance surveys.

7. The Bureau must ensure that translocation does not result in density-dependent effects or disease related effects to the resident or translocated populations.

Because of the complex nature of this incidental take statement, we have attached a summary of the levels of incidental take that would necessitate re-initiation of formal consultation.

Our evaluation of the proposed action includes consideration of the protective measures described 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 comply with the following terms and conditions, which implement the reasonable and prudent measures described in the previous section or make them enforceable conditions of its right-of-way grant and the reporting and monitoring requirements. These conditions are non-discretionary.

1. The following term and condition implements reasonable and prudent measure 1:

   The Bureau must ensure that Tessera monitors the integrity of all desert tortoise exclusion fencing and the effectiveness of the cattle guards at keeping desert tortoises out of the project site. The Bureau must ensure that Tessera implements adaptive measures if the cattle guards are found to be ineffective in preventing desert tortoise from accessing the road or if smaller desert tortoises become entrapped in them.

2. The following terms and conditions implement reasonable and prudent measure 2:

   a. To ensure that the measures proposed by the Bureau and Tessera are effective and are being properly implemented, the Bureau must contact the Service immediately if it becomes aware that a desert tortoise has been killed or injured by project activities. At that time, the Bureau must review the circumstances surrounding the incident with the

Service to determine whether additional protective measures are required. Project activities may continue during the review, provided that the proposed protective measures in the project description and any appropriate terms and conditions of this biological opinion have been and continue to be fully implemented. Because we do not expect that capturing and removing desert tortoises from work areas outside of the project site is likely to result in injury or mortality of desert tortoises, we are not establishing a re-initiation criterion or notification requirement for that activity.

b. If 6 desert tortoises are directly killed or injured as a result of any construction, operation, maintenance, or restoration activities covered by this biological opinion over the life of the Calico project, the Bureau must re-initiate consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16, on the proposed action. This term and condition also applies to direct mortality and injury of desert tortoises during translocation and post-translocation monitoring on the resident, control, and translocated populations (i.e., due to handling, road kills, or other effects caused by personnel working on the project). However, it does not apply to post-translocation mortality within these populations that is not connected directly to an action required to carry out the translocation and monitoring effort (e.g. predation).

c. If 2 desert tortoises are directly killed or injured in any 1 year as a result of any construction, operation, maintenance, or restoration activities covered by this biological opinion, the Bureau must re-initiate consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16, on the proposed action. This term and condition also applies to direct mortality associated handling of desert tortoises during translocation and post-translocation monitoring on the resident, control, and translocated populations (i.e., due to handling, road kills, or other effects caused by personnel working on the project). However, it does not apply to post-translocation mortality within these populations that is not connected directly to an action required to carry out the translocation and monitoring effort (e.g., predation).

3. The following term and condition implements reasonable and prudent measure 4:

   If 1 desert tortoise is depredated or poached from a quarantine pen, the Bureau must ensure that Tessera implements additional protective measures in consultation with the Bureau and Service to prevent any additional loss of individuals.

4. The following terms and conditions implement reasonable and prudent measure 5:

   a. The Bureau must ensure that Tessera has an authorized biologist available to handle desert tortoises that may be located on the project site during operations and maintenance. If more than 3 desert tortoises are located within the project area during operation,

Tessera must perform additional full coverage surveys of available habitat within the project area to ensure that all desert tortoises are removed.

b. If Tessera locates desert tortoises within the rows of vegetation between the SunCatchers during operations, the Bureau must ensure that Tessera consults with the Service as to the appropriate translocation and disposition of the individual.

c. If Tessera locates desert tortoise burrows within the rows of vegetation between the SunCatchers during operations, the Bureau must ensure that an authorized biologist visits the project site and conducts surveys to locate any desert tortoises in proximity to the burrow. Once a desert tortoise is located, the Bureau must ensure that Tessera consults with the Service as to the appropriate translocation and disposition of the individual, and the burrow is collapsed in a manner consistent with current Service guidance.

5. The following terms and conditions implement reasonable and prudent measure 6:

a. The Bureau must ensure that the disease prevalence within the Linkage and Pisgah ACEC translocation areas is less than 5 percent within a 95 percent confidence interval. The disease prevalence must be determined through visual health assessments of the resident population and the desert tortoises in the associated dispersal buffer (those animals within 1.5 kilometers of the translocation area), consistent with dispersal distances for translocations less than 500 meters.

b. The Bureau must ensure that Tessera conducts disease sampling of all areas that desert tortoises may move to following translocation to the Ord-Rodman DWMA translocation area (i.e., 12.6-kilometer dispersal buffer).

c. The Bureau must ensure that translocated desert tortoises are not placed within 1.5 kilometers of any desert tortoises within the Linkage and Pisgah ACEC translocation areas determined to be positive for disease based on the visual health assessment.

6. The following term and condition implements reasonable and prudent measure 7:

The Bureau must ensure that two consecutive clearance surveys do not detect any desert tortoises for Tessera to consider the area clear of desert tortoises.

7. The following terms and conditions implement reasonable and prudent measure 8:

a. If pre-translocation surveys of any translocation area indicate that it cannot accommodate the projected number of desert tortoises from the Calico project under the threshold established in the Description of the Proposed Action section of this biological opinion, the Bureau must re-initiate consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16 to address modifications to the translocation plan.

b. If pre-translocation surveys of the translocation areas indicate a disease prevalence of more than 5 percent or indicate that additional translocation areas will be required to accommodate the disease buffering requirements identified in the Description of the Proposed Action section of this biological opinion, the Bureau must re-initiate consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16 to address modifications to the translocation plan.

Because of the complex nature of this incidental take statement, we have attached a summary of the levels of incidental take that would necessitate re-initiation of formal consultation.

REPORTING REQUIREMENTS

Within 60 days of the completion of the proposed action, the Bureau must provide a report to the Service that provides details on the effects of the action on the desert tortoise. The Bureau must also provide an annual report by December 31of each year during construction of each phase and during the subsequent translocation monitoring. Specifically, these 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 instances from re-occurring. In addition, these reports should provide detailed information on the results of translocation monitoring to include the following: 1) location of all transmittered desert tortoises, 2) mortality rate from each population, 3) statistical analysis of differences in the mortality rates among all three populations, and 4) health status and body condition of all transmittered desert tortoises.

We recommend that the Bureau provide us with any recommendations that would facilitate the implementation of the protective measures while maintaining protection of the desert tortoise. We also request that the Bureau provide us with the names of any monitors who assisted the authorized biologist and an evaluation of the experience they gained on the project; the qualifications form on our website (http://www.fws.gov/ventura/sppinfo/protocols/deserttortoise_monitor-qualifications-statement.pdf), filled out for this 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 Ventura Fish and Wildlife Office by telephone (805 644-1766) and by facsimile (805 644-3958) or electronic mail. The report must include the date, time, location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

We will advise you on the appropriate means of disposing of the carcass when you contact us.

We may advise you to provide it to a laboratory for analysis. Until we provide information on the disposition of the carcass, you must handle it such that the biological material is preserved in the best possible state for later analysis. If possible, the carcass should be kept on ice or refrigerated (not frozen) until we provide further direction.

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

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act 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 work with Tessera and the Service to determine if the transmittered desert tortoises associated with the resident, control, and translocated populations can be used to answer additional research questions related to translocation or desert tortoise biology.

2. We recommend that the Bureau amend the California Desert Conservation Area Plan to prohibit further large-scale development (e.g., solar energy facilities, wind development, etc.) within the Pisgah Valley. We offer this recommendation because the Service has determined that maintaining a functional corridor through the Pisgah Valley is critical for the long term recovery of the desert tortoise. The importance of this corridor is heightened given the need to allow for the shifting distribution of the desert tortoise and the potential adverse effects of climate change (Service 2010f). While re-design of this project has reduced adverse effects to connectivity, given the uncertainty surrounding this issue, and the critical nature of this connection, we believe a conservative approach is warranted.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the Bureau's proposal to issue a right-of-way grant to Tessera for construction of the Calico Solar facility in San Bernardino County, California. Re-initiation of formal consultation is required where discretionary federal involvement or control over the action has been retained or is authorized by law and: (a) if the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent

not previously considered; (c) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat designated that may be affected by the identified action (50 Code of Federal Regulations 402.16).

In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) will have lapsed and any further take would be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation. If monitoring of translocated and resident desert tortoises indicates a statistically significant elevation in mortality rates above that observed in control populations, this information would constitute new information regarding the effects of the action that may affect desert tortoise in a manner or to an extent not previously considered.

If you have any questions regarding this biological opinion, please contact Ashleigh Blackford of my staff at (805) 644-1766, extension 234.

Attachment

LITERATURE CITED

Averill-Murray, R. 2010. Electronic mail: disease sample numbers. Dated October 1. Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service. Reno, Nevada.

Avery, H.W. 1998. Nutritional ecology of the desert tortoise (*Gopherus agassizii*) in relation to cattle grazing in the Mojave Desert. Ph.D. Dissertation, Department of Biology, University of California. Los Angeles, California.

Avian Power Line Interaction Committee. 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, Avian Power Line Interaction Committee, and California Energy Commission. Washington, D.C., and Sacramento, California.

Bellows, F. 2010. Electronic mail: information on habitat disturbance acreage based on the 4,613-acre project site. Dated October 5. Tessera Solar. Scottsdale, Arizona.

Berry, K.H. 1986. Desert tortoise (*Gopherus agassizii*) relocation: implications of social behavior and movements. Herpetologica 42(1):113-125.

Berry, K.H. 1996. Summary of the results of long-term study plots for the desert tortoise in California. Letter to Molly Brady, Bureau of Land Management, Riverside, California. Dated October 1. Riverside Field Station, U.S. Geological Survey. Riverside, California.

Berry, K.H. 1999. Preliminary report from the 1999 spring survey of the desert tortoise long-term study plot in Chemehuevi Valley and Wash, California. Box Springs Field Station, Western Ecological Research Center, U.S. Geological Survey. Riverside, California.

Berry, K.H. 2005. Electronic mail: information on the number of desert tortoises detected on select permanent study plots in California. Dated February 28. Box Springs Field Station, Western Ecological Research Center, U.S. Geological Survey. Moreno Valley, California.

Bureau of Land Management. 2005. Final environmental impact report and statement for the West Mojave Plan; a habitat conservation plan and California Desert Conservation Area Plan amendment. Moreno Valley, San Bernardino, and Barstow, California.

Bureau of Land Management. 2010a. Formal consultation on the Calico Solar Power Generating Facility, San Bernardino County, California. Barstow Field Office. Barstow, California.

Bureau of Land Management. 2010b. Final environmental impact statement and proposed amendment to the California Desert Conservation Area Plan for the Calico Solar (formally SES Solar One) Project. San Bernardino County, California. Barstow Field Office. Barstow, California.

Bureau of Land Management and California Energy Commission. 2010. Staff assessment and draft environmental impact statement for Calico Solar Project. Application for Certification (08-AFC-13). San Bernardino, California. CEC-700-2010-009-SA-DES-10-13. Dated March. Sacramento, California.

Burge, B.L. 1978. Physical characteristics and patterns of utilization of cover sites by *Gopherus agassizii* in southern Nevada. Proceedings of the 1978 Symposium, Desert Tortoise Council.

Burge, B.L., and W.G. Bradley. 1976. Population density, structure and feeding habits of the desert tortoise, *Gopherus agassizii*, in a low desert study area in southern Nevada. Proceedings of the 1976 Symposium, Desert Tortoise Council.

California Energy Commission. 2010a. Supplemental staff assessment for Calico Solar Power Project. CEC-700-2010-009-SSA. Docket Number 08-AFC-13. Dated July 2010.

California Energy Commission. 2010b. Calico Solar Power Project Presiding Member's Proposed Decision. CEC-800-2010-012-PMPD. Docket Number 08-AFC-13. Dated September. Sacramento, California.

Census Bureau. 2000. Urbanized areas cartographic boundary files [computer file, ArcView Shapefile (.shp) format]. Geography Division, Department of Commerce. (geo_2000_d_dec_00000_400_py_z1). Available at http://www.census.gov/geo/www/ua/ua2kdetshape.zip

Chavez, R. 2010. Electronic mail: information on the cattle grazing in relation to the proposed Calico Solar facility. Dated July 6. Barstow Field Office, Bureau of Land Management. Barstow, California.

Circle Mountain Biological Consultants. 1996. Federal biological opinion analysis for the proposed Eagle Mountain landfill Project. Job #95-001. Prepared for CH2MHill, Santa Ana, California. Wrightwood, California.

Congdon, J.D., A.E. Dunham, and R.C. Van Loben Sels. 1993. Delayed sexual maturity and demographics of Blanding's turtles (*Emydoidea blandingii*): implications for conservation and management of long-lived organisms. Conservation Biology 7:826-833.

Connor, M.J. 2003. Desert tortoise conservation project #2001-0123-000. Final report. Desert Tortoise Preserve Committee. Riverside, California.

Duda, J.J., A.J. Krzysik, and J.E. Freilich. 1999. Effects of drought on desert tortoise movement and activity. The Journal of Wildlife Management 63:1181-1192.

Fesnock, A. 2010a. Electronic mail: information on compensation for Calico Solar. Dated October 7. Bureau of Land Management. Sacramento, California.

Fesnock, A. 2010b. Electronic mail: acreage of the Ord Mountain Cattle Allotment. Dated October 8. Bureau of Land Management. Sacramento, California.

Field, K.J., C.R. Tracy, P.A. Medica, R.W. Marlow, and P.S. Corn. 2007. Return to the wild: translocation as a tool in conservation of the desert tortoise (*Gopherus agassizii*). Biological Conservation 136:232-245.

Harless, M.L., A.D. Walde, D.K. Delaney, L.L. Pater, W.K. Hayes. 2009. Home range, spatial overlap, and burrow use of the desert tortoise in the West Mojave Desert. Copeia 2009:378-389.

Hovik, D.C., and D.B. Hardenbrook. 1989. Summer and fall activity and movements of desert tortoises in Pahrump Valley, Nevada. Abstract of paper presented at Fourteenth Annual Meeting and Symposium of the Desert Tortoise Council.

Jennings, W.B. 1997. Habitat use and food preferences of the desert tortoise, *Gopherus agassizii*, in the western Mojave Desert and impacts of off-road vehicles. In Van Abbema, J., (Ed.). Proceedings: Conservation, restoration, and management of tortoises and turtles – an international conference. New York Turtle and Tortoise Society. Purchase, New York.

Keith, K., K. Berry, and J. Weigand. 2005. Surveys for desert tortoises in the Jawbone-Butterbredt Area of Critical Environmental Concern, Eastern Kern County, California. U.S. Geological Survey and Bureau of Land Management. Moreno Valley and Sacramento, California.

Lovich, J.E., and D. Bainbridge. 1999. Anthropogenic degradation of the Southern California Desert ecosystem and prospects for natural recovery and restoration. Environmental Management 25(3):309-326.

Luckenbach, R.A. 1982. Ecology and management of the desert tortoise (*Gopherus agassizii*) in California. In: R.B. Bury (ed.). North American Tortoises: Conservation and Ecology. U.S. Fish and Wildlife Service, Wildlife Research Report 12. Washington, D.C.

Miller, T. 2010a. Electronic mail: information on the number habitat in the Calico Solar proposed translocation sites. Dated July 6. URS Corporation. San Diego, California.

Miller, T. 2010b. Electronic mail: information on the density of desert tortoises in the Pisah ACEC and Linkage area proposed translocation areas based on 2010 survey data. Dated August 11. URS Corporation. San Diego, California.

Miller, T. 2010c. Electronic mail: information on the acres of desert tortoise habitat in the "Not a Part" areas in the southern portion of the proposed Calico Solar facility. Dated July 13. URS Corporation. San Diego, California.

Miller, T. 2010d. Electronic mail: information on the density of desert tortoises in the Pisgah ACEC translocation area, revised. Dated October 5. URS Corporation. San Diego, California.

Natural Resources and Environmental Affairs Division. 2001. Integrated natural resources management plan and environmental assessment. Marine Air Ground Task Force Training Command, Marine Corps Air Ground Combat Center. Twentynine Palms, California.

Nussear, K.E. 2004. Mechanistic investigation of the distributional limits of the desert tortoise *Gopherus agassizii* . Dissertation. University of Nevada. Reno, Nevada.

Nussear, K.E., T.C. Esque, R.D. Inman, L. Gass, K.A. Thomas, C.S.A. Wallace, J.B. Blainey, D.M. Miller, and R.H.Webb. 2009. Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona. U.S. Geological Survey Open-File Report 2009-1102.

O'Connor, M.P., L.C. Zimmerman, D.E. Ruby, S.J. Bulova, and J.R. Spotila. 1994. Home range size and movement by desert tortoises, *Gopherus agassizii*, in the eastern Mojave Desert. Herpetological Monographs 8:60-71.

Oftedal, O.T. 2001. Low rainfall affects the nutritive quality as well as the total quantity of food available to the desert tortoise. Abstract of paper presented at the Twenty-sixth Annual Meeting and Symposium of the Desert Tortoise Council.

Otahal, C. 2010. Electronic mail: request for Calico Solar consultation to include consultation on desert tortoise critical habitat. Dated July, 17. Barstow Field Office, Bureau of Land Management. Barstow, California.

Pogacnik, T. 2010. Electronic mail regarding inclusion of the California Energy Commission's requirements in the Bureau of Land Management's description of the proposed project for the Calico Solar Power Generating Facility. Dated October 14. From Deputy State Director, Natural Resources, Bureau of Land Management. Sacramento, California.

Rabin, L.A., R.G. Coss, and D.H. Owings. 2006. The effects of wind turbines on antipredator behavior in California ground squirrels (*Spermophilus beecheyi*). Biological Conservation 131:410-420.

Rakestraw, D.L. 1997. Desert tortoise relocation at Yucca Mountain, Nevada. Abstract of paper presented at the 1997 Annual Meeting and Symposium of the Desert Tortoise Council.

Renewable Energy Action Team. 2010. Mitigation Account Memorandum of Agreement between the Renewable Energy Action Team Agencies and the National Fish and Wildlife Foundation.

Saethre, M.B., T.C. Esque, P.A. Medica, R. Marlow, and C.R. Tracy. 2003. Determining carrying capacity of desert tortoises. Abstract of a paper present at the 28th Annual Meeting and Symposium of the Desert Tortoise Council.

Schamberger, M., and F.B. Turner. 1986. The application of habitat modeling to the desert tortoise (*Gopherus agassizii*). Herpetologica 42(1):134-138.

SES. 2008. Stirling Energy Systems/R. Liden (tn 49181). Application for Certification. Submitted to CEC/Docket Unit on December 1.

Stitt, E.W., C.R. Schwalbe, D.E. Swann, R.C. Averill-Murray, and A.K. Blythe. 2003. Sonoran desert tortoise ecology and management: effects of land use change and urbanization on desert tortoises. Final report to Suaguaro National Park.

Tracy, C.R., R. Averill-Murray, W.I. Boarman, D. Delehanty, J. Heaton, E. McCoy, D. Morafka, K. Nussear, B. Hagerty, and P. Medica. 2004. Desert tortoise recovery plan assessment. Prepared for the U.S. Fish and Wildlife Service. Reno, Nevada.

Turner, F.B., and D.E. Brown. 1982. Sonoran desertscrub. In: D.E. Brown (editor). Biotic communities of the American Southwest - United States and Mexico. Desert Plants 4(1-4):181-222.

Turner, F.B., P.A. Medica, and C. Lyons. 1984. Reproduction and survival of the desert tortoise (*Scaptochelys agassizii*) in Ivanpah Valley, California. Copeia (4):811-820.

Turner, F.B., K.H. Berry, D.C. Randall, and G.C. White. 1987. Population ecology of the desert tortoise at Goffs, California, 1983-1986. Report prepared for the Southern California Edison Company.

URS. 2010a. Biological assessment for the Calico Solar Project, San Bernardino County, California. Prepared for U.S. Fish and Wildlife Service and Bureau of Land Management, Barstow Field Office, Barstow, California. San Diego, California.

URS. 2010b. Biological assessment for the Calico Solar Project (Revised May 17), San Bernardino County, California. Prepared for U.S. Fish and Wildlife Service and Bureau of Land Management, Barstow Field Office, Barstow, California. San Diego, California.

URS. 2010c. Supplemental biological assessment for the Calico Solar Project, San Bernardino County, California. Prepared for U.S. Fish and Wildlife Service and Bureau of Land Management, Barstow Field Office, Barstow, California. San Diego, California.

URS. 2010d. Supplemental biological assessment supplement: phased development of the phase 1 component of the Calico Solar Project, San Bernardino County, California. Prepared for U.S. Fish and Wildlife Service and Bureau of Land Management, Barstow Field Office, Barstow, California. San Diego, California.

URS. 2010e. Supplement # 5 to the biological assessment for the Calico Solar Project, San Bernardino County, California. Prepared for U.S. Fish and Wildlife Service and Bureau of Land Management, Barstow Field Office, Barstow, California. San Diego, California.

URS. 2010f. Revised draft plan, desert tortoise translocation plan Calico Solar Project. Prepared for Tessera Solar North America. Scottsdale, Arizona. San Diego, California.

URS. 2010g. Draft raven monitoring management and control plan for Calico Solar Project, San Bernardino County, California. Prepared for Tessera Solar North America. Scottsdale, Arizona. San Diego, California.

U.S. Air Force. 2004. Integrated natural resources management plan for Edwards Air Force Base, California. Edwards Air Force Base 32-7064. September update. Edwards Air Force Base, California.

U.S. Department of the Army. 2009a. Biological assessment. Reinitiation of consultation, Service biological opinion 1-8-03-F-48, proposed addition of maneuver training lands at Fort Irwin, California. Dated May 21. Directorate of Public Works. Fort Irwin, California

U.S. Army. 2009. Fort Irwin annual permit report for 2008. Submitted to the Desert Tortoise Recovery Office, Reno, Nevada. Fort Irwin, California.

U.S. Army. 2010. 2009 Annual reports for Fort Irwin biological opinions and desert tortoise permit for the Fort Irwin translocation project. Submitted to the Desert Tortoise Recovery Office, Reno, Nevada. Fort Irwin, California.

U.S. Department of the Navy. 1995. Annual reports for desert tortoise management issues at the Naval Air Weapons Station, China Lake for 1995, 1996, 1997, 2000, 2001, 2002, 2003, 2004, 2007. China Lake, California.

U.S. Fish and Wildlife Service. 1990. Biological opinion for the Kern River Gas Transmission Company, Mojave Pipeline Company for interstate natural gas pipelines.] (1-1-87-F-36R). Dated December 21. Letter to Environmental Compliance and Projects Analysis Branch, Federal Energy Regulatory Commission, Washington, D.C. Portland, Oregon.

U.S. Fish and Wildlife Service. 1991a. Biological opinion for the proposed expansion of existing mining activities at Hector Mine, San Bernardino County, California. (6840 CAMC-42050 CA-068-0-30 3809(CA-068.28)) (1-6-91-F-40). Dated August 12. Memorandum to State Director, Bureau of Land Management, Sacramento, California. Southern California Field Station. Laguna Niguel, California.

U.S. Fish and Wildlife Service. 1991b. Biological opinion for the Johnson Valley Off-highway Vehicle Area management plan, San Bernardino County, California. (6840 CA-932.5) (1-6-90-F-39). Dated November 14. Memorandum to State Director, Bureau of Land Management, Sacramento, California. Laguna Niguel, California.

U.S. Fish and Wildlife Service. 1992a. Biological opinion for the proposed desert tortoise habitat management plan for the Naval Air Weapons Station, China Lake, California (5090 Ser 008/C0808/1309) (1-6-92-F-60). Dated December 3. From Acting Field Supervisor, Ventura Field Office to Thomas McGill, U.S. Navy, China Lake, California. Ventura, California.

U.S. Fish and Wildlife Service. 1992b. Biological opinion for the proposed Hidden Valley resources residual repository proposal, San Bernardino County, California. (CA-24320 2800(CA0068.06)) (1-6-92-F-57). Dated October 8. Memorandum to State Director, Bureau of Land Management, Sacramento, California. Carlsbad, California.

U.S. Fish and Wildlife Service. 1992c. Biological opinion for the Fort Cady project mining plan proposal, San Bernardino County, California. (3809 CAMC 20175 (CA-068.28)) (1-6-92-F-54). Dated October 29. Memorandum to State Director, Bureau of Land Management, Sacramento, California. Carlsbad, California.

U.S. Fish and Wildlife Service. 1994. Desert tortoise (Mojave population) recovery plan. Portland, Oregon.

U.S. Fish and Wildlife Service. 1995a. Reinitiation of formal consultation for the desert tortoise habitat management plan for the Naval Air Weapons Station, China Lake, California (5090 Ser 823EOOD C8305) (1-8-95-F-30R). Dated June 27. From Field Supervisor, Ventura Field Office to Carolyn Shepherd, U.S. Navy, China Lake, California. Ventura, California.

U.S. Fish and Wildlife Service. 1995b. Biological opinion for the ongoing maintenance activities on Southern California Gas Company's pipeline system in Southern California deserts. (6840 CA-063.50 CA-930.6) (1-8-95-F-28). Dated November 28. Memorandum to State Director, Bureau of Land Management, Sacramento, California. Ventura, California.

U.S. Fish and Wildlife Service. 1997. Biological opinion for the issuance of a temporary use permit for the County of San Bernardino's proposed community transfer station, Newberry Springs, California. (2800, CA-068.33) (1-8-97-F-35). Dated August 17. Memorandum to District Manager, California Desert District, Bureau of Land Management, Riverside, California. Ventura, California.

U.S. Fish and Wildlife Service. 2002. Biological opinion for the base-wide operations and routine maintenance program at U.S. Marine Corps Air Ground Combat Center, Twentynine Palms, California (1-8-99-F-41). Dated March 7. Letter to Commanding General J.F. Weber, Marine Corps Air Ground Combat Center ,Twentynine Palms, California. Ventura, California.

U.S. Fish and Wildlife Service. 2003. Biological opinion for the designation of routes of travel in the Western Mojave Desert, California (6842 CA-063.50) (1-8-03-F-21). Dated June 30. Memorandum to District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California. Ventura, California.

U.S. Fish and Wildlife Service. 2004. Biological opinion for the proposed addition of maneuver training lands at Fort Irwin, California (1-8-03-F-48). Letter to Colonel Edward Flynn, Fort Irwin, California. Dated March 15. Ventura, California.

U.S. Fish and Wildlife Service. 2005. Guidance on conducting Endangered Species Act (ESA) section 7 consultations on the desert tortoise and other species. Ecological Services, California Nevada Operations Office. Sacramento, California.

U.S. Fish and Wildlife Service. 2006a. Range-wide monitoring of the Mojave population of the desert tortoise: 2001-2005 summary report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2006b. Biological opinion for the California Desert Conservation Area Plan [West Mojave Plan] (6840(P) CA-063.50) (1-8-03-F-58). Dated January 9. Memorandum to District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California. Ventura, California.

U.S. Fish and Wildlife Service. 2007. Biological opinion for the Newberry Materials Site Reopening, San Bernardino County, California (HDA-CA, File #08-SBD-I-40, PM 22.5, Document # P55480) (1-8-06-F-51). Dated June 7. Letter to Division Administrator, California Division Federal Highway Administration, Sacramento, California. Ventura, California.

U.S. Fish and Wildlife Service. 2008a. Desert tortoise – authorized biologist and monitor responsibilities and qualifications. http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/dt/DT%20Auth%20Bio%20qualifications%20statement%2010_20_08.pdf

U.S. Fish and Wildlife Service. 2008b. Environmental assessment to implement a desert tortoise recovery plan task: reduce common raven predation on the desert tortoise. Ventura, California.

U.S. Fish and Wildlife Service. 2008c. Draft revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). Sacramento, California.

U.S. Fish and Wildlife Service. 2009a. Desert tortoise field manual. http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/

U.S. Fish and Wildlife Service. 2009b. Range-wide monitoring of the Mojave population of the desert tortoise: 2007 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010a. Acknowledgement of request to initiate formal consultation for Calico Solar Power Generating Facility, San Bernardino County, California, (3030 P CA-680.33). Dated April 22. Ventura, California.

U.S. Fish and Wildlife Service. 2010b. Acknowledgement of request to initiate formal consultation for Calico Solar Power Generating Facility, San Bernardino County, California, ((3030 P CA-680.33)). Dated June 21. Ventura, California.

U.S. Fish and Wildlife Service. 2010c. Draft biological opinion on Tessera Solar's Calico Solar Power Generating Facility, San Bernardino County, California, [(30300 P CA-680.33](8-8-10-F-34). Dated August 18. Ventura, California.

U.S. Fish and Wildlife Service. 2010d. Revised pre-project survey protocols for the desert tortoise (*Gopherus agassizii*). http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/dt/DT%20Pre-project%20Survey%20Protocol_2010%20Field%20Season.pdf

U.S. Fish and Wildlife Service. 2010e. Revision of disease testing requirements based on translocation distance. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010f. Connectivity of desert tortoise populations. Importance of Pisgah Valley for recovery of desert tortoises. Dated June 3. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010g. Translocation of desert tortoises (Mojave population) from project sites: plan development guidance. http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/

Walde, A.D., A.P. Woodman, and W.I. Boarman. 2008. Desert tortoises surveys and research in the southern and western expansion areas of Fort Irwin. 2008 summary report. ITS Corporation. Prepared for the Department of the Army. Fort Irwin, California.

Waln, K. 2010. GIS calculation of U.S. Geological Survey values from 0.5 to 1.0 for the Western Mojave Recovery Unit. Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service. Ventura, California.

Webb, R.H. 2002. Recovery of severely compacted soils in the Mojave Desert, California, USA. Arid Land Research and Management 16:291-305.

Weinstein, M., K.H. Berry, and F.B. Turner. 1987. An analysis of habitat relationships of the desert tortoise in California. A report to Southern California Edison Company. Rosemead, California.