United States Department of the Interior

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In Reply Refer To:
FWS-SB-15B0102-15F0159

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Memorandum

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

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

Subject: Biological Opinion on the Lynx Cat Mountain Mine, San Bernardino County, California

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) issuance of right-of-way grants to allow reactivation of the Lynx Cat Mountain Mine and its effects on the federally threatened Mojave desert tortoise (*Gopherus agassizii*). This document was prepared in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). The proposed action involves expansion of a non-operating quarry onto public and private lands, operation of the expanded quarry, and expansion and use of an existing mine access road. Your December 15, 2014 request for consultation was received in our office on December 17, 2014. We based this biological opinion on information that accompanied your request for consultation and additional information in our files or in published literature. A record of this consultation will be made available at the Carlsbad Fish and Wildlife Office.

The "Mojave desert tortoise" denotes individuals listed as threatened under the Act (55 Federal Register 12178; April 2, 1990). Use of "Mojave" in the common name distinguishes these animals from the Sonoran desert tortoise (*Gopherus morafkai*), which is a candidate for listing and not addressed in this biological opinion. Throughout the remainder of this document, we use only the common name of "desert tortoise" in referring to the "Mojave desert tortoise".

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Matcon Corporation, Inc. (Matcon) is proposing to open an aggregate mine by expanding an existing 5.5-acre quarry onto 51.2 acres of adjacent land near Hinkley, California. The proposed action would also involve widening of an existing access road and operation of the mine in two phases. The proposed mine is located at Lynx Cat Mountain, approximately 4.5 miles north of Hinkley. We have summarized the following description of the proposed action from the biological assessment (Circle Mountain Biological Consultants 2014) and modifications agreed to by the Service, Bureau, and Matcon during a site visit on April 16, 2015.

Mine Operations

Phase 1 of mining would last for 16 to 36 months to provide aggregate for realignment and widening of Highway 58. During this phase, the mine would operate continuously within the existing 5.5 acre quarry and on 42.7 acres of land adjacent to and surrounding the existing quarry. Mining activities would begin with removal of 6 to 12 inches of overburden topsoil and vegetation from this area and placement of this material along the perimeter of the parcel. Following topsoil removal, Matcon would use drilling, blasting, and ripping to extract rock that it would stockpile and convert into aggregate using an on-site crushing, screening, and processing plant.

Phase 2 of mining would begin following the completion of the Highway 58 realignment and would last for approximately 17 to 18 years. During this period, the mine would operate on an intermittent basis depending on market demand for its materials. In general, Matcon would bring processing equipment to the site when needed to fill orders and would not leave equipment at the site during periods of non-operation. During Phase 2, Matcon would also extend mining operations onto an 8.5-acre parcel of Bureau-managed land adjacent to the northeast corner of the existing quarry. Matcon would use the same mining techniques in Phase 2 as those described above, but the use of drilling and blasting would predominate during mining of the 8.5-acre parcel. During both phases of mining, Matcon may occasionally install and operate a portable asphalt batch plant at the site.

Mine Access

Access to the mine site would begin at Hinkley Road and proceed along approximately 2 miles of Santa Fe Avenue[1] and a 3.4-mile dirt access road, which connects Santa Fe Avenue to the mine site. Matcon would widen the 3.4-mile access road from its current width, which averages 17 feet to a new width of 40 feet. For the first 16 to 36 months of mine operation, the access road would accommodate between 750 and 1,000 haul truck trips per day. Following this initial phase, traffic would be intermittent over a period of approximately 17 to 18 years due to reduced mining activity. Over this period, access road use would likely not exceed 65 haul truck trips per day during operation. Matcon would not use the access road during extended periods when the mine is not operating.

Reclamation

Matcon would reclaim and revegetate the mine site and perform five years of reclamation monitoring. To reclaim the mine site, Matcon would rip the surface of the site and place soil islands on all accessible areas using the collected overburden soil that was placed around the site's perimeter during Phase 1 of mining. Soil islands would average 6 to 12 inches in depth and Matcon would seed these islands with a commercial high desert seed mixture of plant species during the fall season. Placement of soil islands and revegetation would occur over time as portions of the mine are closed and made available for reclamation work.

[1] Santa Fe Avenue is paved for the first mile west of Hinkley Road, after which, it is a dirt road.

Minimization Measures

To minimize adverse effects to the desert tortoise, the Bureau will ensure that Matcon implements the following protective measures. We have collated protective measures from throughout the biological assessment and changed the wording of some measures to improve clarity, but we have not changed the substance of the measures that the Bureau proposed. We have also updated some measures based on modifications agreed to by the Service, Bureau, and Matcon during a site visit on April 16, 2015.

1. Matcon will employ authorized biologists, approved by the Service, and desert tortoise monitors to ensure compliance with protective measures for the desert tortoise. Use of authorized biologists and desert tortoise monitors will be in accordance with the most up-to-date Service guidance and will be required for monitoring of any activities that may wound or kill desert tortoises.

2. Matcon will designate a field contact representative who will oversee compliance with protective measures. The field contact representative may be the resident engineer, mine foreman, or a contracted biologist. 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.

3. Matcon will provide the credentials of all individuals seeking approval as authorized biologists to the Bureau. The Bureau will review these and provide the credentials of appropriate individuals to the Service for approval at least 30 days prior to the time they are needed in the field.

4. Individuals approved to capture and handle desert tortoises, perform pre-project clearance surveys, move desert tortoises out of harm's way, excavate burrows, handle nests and eggs, construct artificial burrows, and temporarily confine desert tortoises will do so in compliance with the Desert Tortoise Field Manual (Service 2009). The Desert Tortoise Field Manual can be found at http://www.fws.gov/carlsbad/PalmSprings/DesertTortoise.html. Individuals approved to perform these tasks include authorized biologists and biological monitors who are under the direct supervision of an authorized biologist.

5. Matcon will develop and implement an environmental awareness program for all workers (i.e., mining crews, foremen, and other personnel potentially working on site) that will address the following: a) types of activities that may affect the desert tortoise, b) the required desert tortoise protective measures, c) desert tortoise life history and threats, d) legal protections and penalties, and e) reporting requirements.

6. Prior to the onset of mining and road widening activities, Matcon will install permanent desert tortoise exclusion fencing along the length of the 3.4-mile access road and around the 48.2-acre parcel that it would mine in Phase 1. During Phase 2, Matcon will, where possible[2], extend desert tortoise exclusion fencing around the 8.5-acre parcel of Bureau-managed land that it will incorporate into mining activities.

[2] Portions of the 8.5-acre parcel may be too rocky to allow for installation of permanent desert tortoise exclusion fencing.

7. Matcon will install all desert tortoise exclusion fencing in accordance with the Desert Tortoise Field Manual (Service 2009).

8. To the maximum extent practicable, Matcon will place fence alignments and the features that they are enclosing (i.e., road alignment and mine site) in a manner that reduces the number of desert tortoises that must be moved off of the project sites.

9. Matcon will install desert tortoise exclusion guards across the access road where there are breaks in exclusion fencing. Matcon will coordinate with the Service on placement and design of exclusion guards and their connection with fencing to ensure that the guards provide a functional barrier to desert tortoises.

10. Matcon will install at least one culvert under the access road that is 36 inches in diameter or larger to reduce fragmentation associated with the exclusion fence.

11. Matcon will install shade structures at regular intervals along desert tortoise exclusion fencing to provide shade for desert tortoises that exhibit fence-pacing behavior.

12. Matcon will install all desert tortoise exclusion fencing, culverts, and exclusion guards under the direction of an authorized biologist. The authorized biologist will perform clearance surveys of all fence alignments prior to installation. If desert tortoises are encountered along fence alignments and installation cannot avoid them, the authorized biologist will move the individual the shortest distance possible to an area outside of the fence.

13. The authorized biologist will use their judgment regarding the best measures to use to ensure the desert tortoise does not immediately return to the area inside of the fence. Matcon may use temporary penning of individuals in accordance with the Desert Tortoise Field Manual (Service 2009) if it is necessary to prevent desert tortoises from re-entering the fence alignment or the area that is being enclosed with fencing.

14. Following installation of desert tortoise exclusion fencing, exclusion guards, and culvert(s), and no more than 30 days prior to the initiation of ground disturbance, a survey team supervised by the authorized biologist(s) will perform clearance surveys of the areas to be disturbed along the 3.4-mile access road and within the mine site and move all desert tortoises within the fenced areas to adjacent suitable habitat. Desert tortoises on the mine site will be moved to the north, south, and east of the site. Movement of desert tortoises from this area can occur during any time of year, but the authorized biologist(s) will perform clearance and release in compliance with the Desert Tortoise Field Manual (Service 2009).

15. Matcon will have an authorized biologist on-site throughout initial ground-disturbing activities to move any desert tortoises out of harm's way that may have been missed during clearance surveys.

16. Matcon will maintain all exclusion fencing, culvert(s), and exclusion guards for the life of the mining operation. Maintenance of all desert tortoise exclusion fencing will follow the Desert Tortoise Field Manual (Service 2009). Matcon will inspect and repair fences, exclusion guards,

and culvert(s) on a monthly basis and after major rain events for the first 2 years. Following this initial period, Matcon will inspect the entire fence twice per year and after major rain events, and it will perform monthly spot checks of specific fence locations identified as consistently requiring repair.

17. Matcon will remove all desert tortoise exclusion fences and guards from the access road and mine site perimeter following closure and reclamation of the mine. Removal of desert tortoise exclusion fences will occur under the supervision and direction of an authorized biologist.

18. To reduce the potential for vehicle strikes of desert tortoises on unfenced access roads (i.e., unfenced portions of Santa Fe Avenue), Matcon will enforce a 20-mile-per-hour speed limit for haul trucks and other project-related traffic between March 15 and June 15 and between August 15 and October 30. Matcon will post speed limit signs along the portion of Santa Fe Avenue that it uses for mine access along with a desert tortoise awareness sign.

19. Matcon will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas (i.e., fenced areas that have been cleared of desert tortoises) unless specifically approved to do so by an authorized biologist.

20. When working outside of fenced areas, Matcon will ensure that all project personnel check underneath vehicles or equipment prior to moving them. If project personnel encounter a desert tortoise, they will contact an authorized biologist. The desert tortoise will either be allowed to move a safe distance away prior to moving the vehicle, or the authorized biologist may move the desert tortoise to a safe location to allow for movement of the vehicle.

21. Matcon will ensure that workers do not bring firearms or pets into the mine area.

22. Matcon will contain all trash associated with the mine that could serve as an attractant to predators in secure, self-closing receptacles to prevent the introduction of resources for common ravens.

23. Matcon will promptly remove and dispose of all road-killed animals on the project or its access roads.

24. Matcon will use water for mining activities (e.g., dust suppression, etc.) in a manner that does not result in puddling, and it will use closed tanks to store water for all project site water needs to eliminate open water sources.

Compensation

Matcon will offset the loss of desert tortoise habitat by paying compensation according to the provisions of the West Mojave Plan (Bureau and San Bernardino County 2005) and any additional compensation requirements imposed under permits issued by the California Department of Fish and Wildlife. Compensation required for loss of desert tortoise habitat on federal lands within Desert Wildlife Management Areas is assessed at 5 to 1 under the provisions of the West Mojave Plan.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

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

The jeopardy analysis in this biological opinion relies on four components: (1) the status of the species, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; (2) the environmental baseline, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the desert tortoise; (3) the effects of the action, which 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

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

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing

(i.e., the five-factor analysis required by section 4(a)(1) of the Endangered Species Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

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

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

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

The rangewide monitoring that the Service initiated in 2001 is the first comprehensive attempt to determine the densities of desert tortoises across their range. The Desert Tortoise Recovery Office (Service 2014) used annual density estimates obtained from this sampling effort to evaluate range-wide trends in the density of desert tortoises over time. This analysis indicates that densities in the Northeastern Mojave Recovery Unit have increased by approximately 13.6 percent per year since 2004, with the rate of increase apparently resulting from increased survival of adults and sub adults moving into the adult size class. The analysis also indicates that the populations in the other 4 recovery units are declining: Upper Virgin River (-5.1 percent), Eastern Mojave (-6.0 percent), Western Mojave (-8.6 percent), and Colorado Desert (-3.4 percent; however, densities in the Joshua Tree and Piute Valley conservation areas within this unit seem to be increasing). The following figure (1) shows linear trends in the log-transformed densities in each desert tortoise conservation area by recovery unit. Data for the Upper Virgin River Recovery Unit are from 1999 to the present; data for all other recovery units are from 2004 to the present.

Allison (2014) also evaluated changes in size distribution of desert tortoises since 2001. In the Western Mojave and Colorado Desert recovery units, the relative number of juveniles to adults indicates that juvenile numbers are declining faster than adults. In the Eastern Mojave, the number of juvenile desert tortoises is also declining, but not as rapidly as the number of adults. In the Upper

Virgin River Recovery Unit, trends in juvenile numbers are similar to those of adults; in the Northeastern Mojave Recovery Unit, the number of juveniles is increasing, but not as rapidly as are adult numbers in that recovery unit. Juvenile numbers, like adult densities, are responding in a directional way, with increasing, stable, or decreasing trends, depending on the recovery unit where they area found.

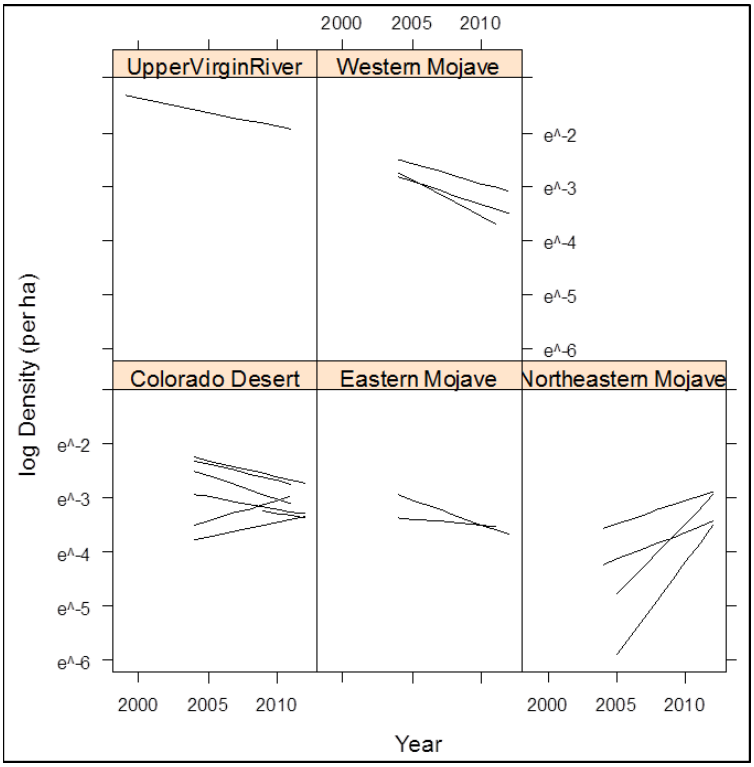

Figure 1. Linear trends in the log-transformed densities in each desert tortoise conservation area by recovery unit

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

In the 5-year review, the Service provides a brief summary of habitat use by desert tortoises; the revised recovery plan contains more detailed information (Service 2011). In the absence of specific and recent information on the location of habitable areas of the Mojave Desert, especially at the outer edges of this area, the 5-year review also describes and relies heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2005 rangewide monitoring surveys (Nussear *et al.* 2009). The model provides information on the relative potential for habitat to support desert tortoises based on habitat variables. The potential is ranked on a scale of 0 to 1 with 1 representing areas with all the habitat variables necessary to support desert

tortoises. The estimates for the amount of desert tortoise habitat in the 5-year review and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

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

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

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

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

threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy *et al.* 2004).

The following map depicts the 12 critical habitat units of the desert tortoise; linkages between conservation areas for the desert tortoise; and the aggregate stress that multiple, synergistic threats place on desert tortoise populations (see figure 2). Conservation areas include designated critical habitat and other lands managed for the long-term conservation of the desert tortoise (e.g., the Desert Tortoise Natural Area, Joshua Tree National Park, and the Desert National Wildlife Refuge). The revised recovery plan (Service 2011) recommends connecting blocks of desert tortoise habitat, such as critical habitat units and other important areas to maintain gene flow between populations. Linkages defined using least-cost path analysis (Averill-Murray *et al.* 2013) illustrate a minimum connection of habitat for desert tortoises between blocks of habitat and represent priority areas for conservation of population connectivity. This map illustrates that, across the range, desert tortoises in areas under the highest level of conservation management remain subject to numerous threats, stresses, and mortality sources.

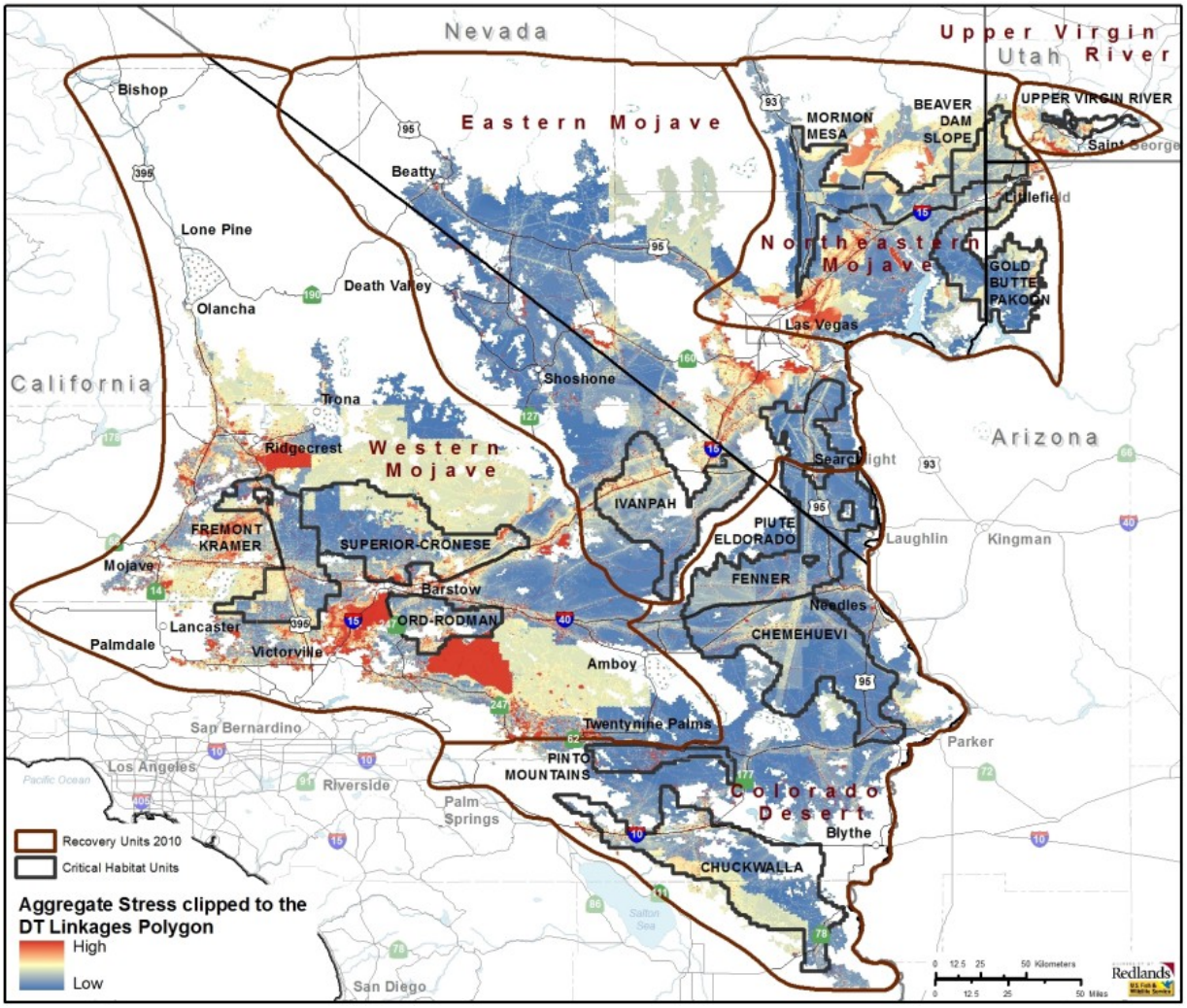

Figure 2. Critical habitat units of the desert tortoise, linkages between conservation areas for the desert tortoise, and the aggregate stress that multiple, synergistic threats place on desert tortoise populations

Since the completion of the 5-year review, the Service has issued several biological opinions that effect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and desert wildlife management areas that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoises during the construction of the projects, such as translocation of affected individuals.

In aggregate, these projects would result in an overall loss of approximately 37,503 acres of habitat of the desert tortoise. We also predicted that the project areas supported up to 3,483 desert tortoises; we concluded that most of these individuals were small desert tortoises, that most large individuals would likely be translocated from project sites, and that most mortalities would be small desert tortoises that were not detected during clearance surveys. To date, 560 desert tortoises have been observed during construction of projects; most of these individuals were translocated from work areas, although some desert tortoises have been killed (see Appendix 2). The mitigation required by the Bureau and California Energy Commission, the agencies permitting these facilities, will result in the acquisition of private land and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. Although most of these mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise and the Service continues to support their implementation, we cannot assess how desert tortoise populations will respond because of the long generation time of the species.

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

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

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

conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010a), “threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses.” Oftedal (2002 in Service 2010a) suggests that invasive weeds may adversely affect the physiological health of desert tortoises. Current information indicates that invasive species likely affect a large portion of the desert tortoise’s range (see figure 3). High densities of weedy species also increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

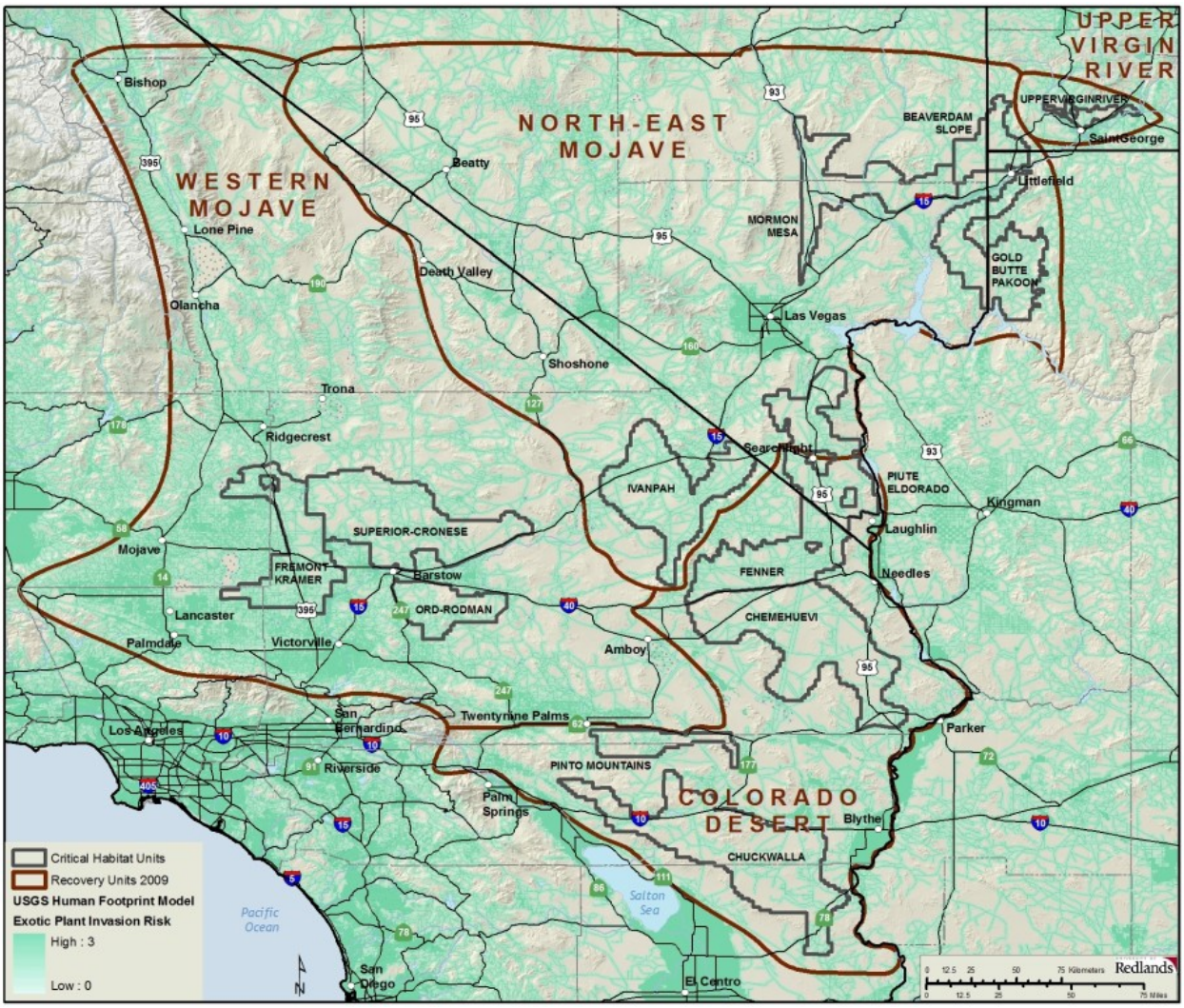

Figure 3. Invasion risk of non-native invasive plant species within the range of the desert tortoise.

Global climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest

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

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

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

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

(2010a) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly."

The Desert Tortoise Recovery Office (Service 2014) applied estimated densities within desert tortoise conservation areas surveyed during range-wide monitoring since 2004 to the estimated acreages of remaining habitat within each recovery unit to estimate the change in numbers of individuals greater than 180 millimeters in carapace length (see table 1). This calculation assumes that densities inside the surveyed conservation areas are similar to densities in habitat outside these areas, but any bias will be less than would have resulted from applying densities from much smaller study plots to the entire range. Although we presume densities are generally higher within conservation areas, we consider this a reasonable way to describe overall changes in the population given the lack of broad-scale data outside the conservation areas.

Table 1. Estimated densities within desert tortoise conservation areas.

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

The following table (2) depicts acreages of habitat (as modeled by Nussear *et al.* 2009, using only areas with a probability of occupancy by desert tortoises greater than 0.5 as potential habitat) within various regions of the desert tortoise's range and of impervious surfaces as of 2006 (Fry *et al.* 2011); calculations are by Darst (2014). All units are in acres.

Table 2. Habitat acreage with probable occupancy by the desert tortoise within the various recovery units

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

The distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 (Service 2010a) in terms of the overall extent of its range. Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow and Lancaster, California; Las Vegas, Nevada; and St. George, Utah; etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g.,

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

portions of off-road management areas managed by the Bureau and unauthorized use in areas such as east of California City, California). Since 1994, urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range. Desert tortoises have been essentially removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012a).

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

ENVIRONMENTAL BASELINE

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

For the purposes of this biological opinion, we consider the action area to include the 17-foot-wide access road and the proposed 62.2-acre mine site, which contains the 5.5-acre existing quarry, 48.2-acre privately owned expansion parcel, and the 8.5-acre, Bureau-managed expansion parcel. The action area also includes a 1,650-foot buffer of the mine site boundary and existing access road to account for exclusion fence installation, access road expansion, and translocation of desert tortoises.

With the exception of information we have provided a separate citation for, all of the following information about the action area is summarized from the biological assessment or environmental assessment (Circle Mountain 2014, Bureau 2014).

Previous Consultations within the Action Area

We have completed previous consultations with the Bureau that analyze effects to the desert tortoise within the action area. In March 1994, we issued a biological opinion that analyzed the effects of cattle grazing on 25 grazing allotments managed by the Bureau in the Mojave Desert (Service

1994b). This biological opinion included the 26,782-acre Harper Lake Grazing Allotment, which overlaps the action area for this consultation. That biological opinion concluded that the Bureau's cattle grazing program in the California Desert Conservation Area was not likely to jeopardize the continued existence of the desert tortoise. This allotment was retired after it was bought out by the Department of the Army and cattle grazing has not occurred there in over a decade (Service 2006).

On June 30, 2003, we 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 (Service 2003). Through this route designation, the Bureau designated routes of travel on public lands as open, closed, or limited to vehicular use. The route designation identified the proposed Lynx Cat Mine access road as a route that was open to public vehicular use. We 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.

On January 9, 2006, we 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 (Service 2006). 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. In addition to confirming the designation of the Lynx Cat Mine access road as an open route of travel, the proposed action considered in this 2006 consultation designated the Superior-Cronese Desert Wildlife Management Area, which overlaps the action area considered in this consultation. This designation is intended to benefit desert tortoise conservation on Bureau land through establishment of specific management prescriptions. We 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.

Habitat Characteristics within the Action Area

The proposed mine site ranges from 2,125 feet to 2,415 feet in elevation and is comprised of gently to moderately sloping alluvial fans except for cliffs and steep, rocky areas that constitute the existing quarry and Lynx Cat Mountain in the eastern and northeastern portions of the site. The proposed access road ranges from 2,125 feet to 2,217 feet in elevation and crosses relatively flat, sandy terrain.

Vegetation on the mine site and along the access road consists of white bursage series, allscale series, and creosote bush series based on the classification system in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). The dominant shrub species on the site include burro bush (*Ambrosia dumosa*), creosote bush (*Larrea tridentata*), allscale (*Atriplex polycarpa*), peach thorn (*Lycium cooperi*), and desert goldenhead (*Acamptopappus sphaerocephalus*). Native, annual plant species on the site include coreopsis (*Coreopsis* sp.), desert dandelion (*Malacothrix glabrata*), little blazing star (*Mentzelia albicaulis*), sunbonnets (*Loeseliastrum matthewsii*), loeseliastrum (*Loeseliastrum schottii*), desert five-spot (*Eremalche rotundifolia*), broad-flowered gilia (*Gilia*

latiflora), dotted-throat gilia (*Gilia stellate*), yellow cups (*Camissonia brevipes*), Mojave sun-cups (*Camissonia campestris*), and brown-eyed primrose (*Camissonia claviformis*). Invasive, non-native species occur on the site, including cheat grass (*Bromus tectorum*), red brome (*B. madritensis* var. *rubens*), Russian thistle (*Salsola tragus*), split-grass (*Schismus* sp.), and Saharan mustard (*Brassica tournefortii*). These species are especially prevalent along roads and at the edges of the existing 5.5-acre quarry.

Existing Disturbances within the Action Area

Mining has occurred periodically on private land within the action area since 1963 and removed all vegetation from a 5.5-acre quarry at the north end of the action area. The action area is the focal point of several roads that lead to the existing quarry, which is used extensively for recreational shooting and target practice. In 2014, surveyors documented 302 off-highway vehicle tracks, numerous roads, and extensive debris associated with recreational shooting (e.g. expended ammunition, targets, etc.). The action area is also located within the boundaries of the former Harper Lake Grazing Allotment, which was previously grazed by cattle. Recent surveys identified evidence that cattle used portions of the action area when the allotment was active.

Status of the Desert Tortoise in the Action Area

Circle Mountain Biological Consultants surveyed the action area over the course of four site visits in May, September, and October 2014. Surveys generally followed U.S. Fish and Wildlife Service protocols (Service 1992, Service 2010b) with 100 percent coverage of the mine site and an adjacent 3.5-acre area to the north. Surveyors used transects spaced at 30-foot intervals, but deviation in survey intensity and transect spacing was necessary in steep rocky areas of Lynx Cat Mountain. The existing quarry site was not surveyed due to extensive disturbance and lack of habitat. Surveys also occurred at 100-foot intervals in a buffer surrounding the proposed mine site and along the existing access road using transects spaced at 16 feet, 655 feet, 1,310 feet, and 1,970 feet from the road shoulder.

Of the four desert tortoise surveys that Circle Mountain Biological Consultants performed, only the May 2014 survey, which included the northeastern half of the privately-owned parcel and the 3.5 acres of adjacent land north of the proposed mine site located adult desert tortoises. Using the Service's 2010 desert tortoise survey protocol (Service 2010b), Circle Mountain Biological Consultants concluded that this portion of the action area contained five adult desert tortoises (i.e., individuals larger than 160 millimeters midline carapace length).

Subsequent surveys of the remainder of the privately-owned mine site (i.e., southwestern half) did not locate desert tortoises, so estimates were not derived using the Service's protocol for these areas. To estimate adult desert tortoise numbers for the southwestern half of the privately-owned portion of the mine site, Circle Mountain Biological Consultants determined the ratio of burrows to adult desert tortoises observed in the northeastern half of the parcel. It then applied this ratio to the number of burrows it observed in the southwestern half of the privately-owned portion of the mine site to derive an estimate. Based on this methodology, Circle Mountain Biological Consultants estimated that the southwestern half of the private parcel contained between eight and nine adult desert tortoises.

Although the location of carcasses and scat verified the presence of desert tortoises on the 8.5-acre mine expansion parcel on Bureau-managed land, it's extremely steep and rocky topography prevented the location of adult desert tortoises and verification of cover site use was not possible. Circle Mountain Biological Consultants estimated that between three and seven adult desert tortoises may occupy this parcel based on the distribution of desert tortoise sign, but it did not provide methodology for how it derived this estimate.

Circle Mountain Biological Consultants did not estimate population size for the buffer surrounding the proposed mine site or the buffer along the access road. However, based on the total estimate derived from the 3 surveys described above (i.e., between 16 and 21 adult desert tortoises) and the size of the surveyed area (i.e., 60.2 acres), density is likely to be approximately 1 adult per every 3 to 4 acres in the vicinity of the mine site and access road. This would equate to approximately 2 to 5 desert tortoises within the access road work areas.

Circle Mountain Biological Consultants did not estimate the number of juvenile desert tortoises or eggs within the action area. Desert tortoise eggs and individuals less than 160 millimeters in length (including hatchlings) are difficult to detect because of their small size and their cryptic nature. Consequently, it is not possible to accurately estimate their population size based on direct observation of juvenile individuals and eggs. In addition, hatchlings may emerge from a nest on the site after surveys occur, which introduces an additional variable that precludes accurate estimation of the number of subadults and juveniles that project activities would affect.

To provide an estimate of juvenile desert tortoises and eggs we have used an indirect method for deriving a population estimate based on the adult population size and a life table produced for the desert tortoise on a study plot near Goffs, California (Turner *et al*. 1987). This method derives estimates based on the number of individuals larger than 180 millimeters midline carapace length rather than 160 millimeters as was used in the surveys for this project. Because desert tortoises between 160 millimeters and 180 millimeters are estimated to typically make up less than 5 percent of a given desert tortoise population (Turner *et al*. 1987, Karl 1998), this should not substantially affect the overall population estimate. Appendix 1 provides the methods and assumptions used to derive our estimate of juvenile desert tortoises and eggs. The table (3) below summarizes the population size information for all size classes based on Appendix 1 and the information discussed above. This table provides estimates for different seasons to address the potential for the timing of the project to affect varying numbers of individuals.

Table 3. Population estimates for the portion of the action area likely to be disturbed by project activities

	January-April	May, June, July	August-December
Eggs	0	60 to 86	0
Hatchlings	0	0	23 to 34
Non-hatchlings smaller than 180 millimeters	94 to 135	94 to 135	94 to 135
Adults (larger than 180 millimeters)	18 to 26[4]		

As stated in Turner *et al*. (1987), the life table has limited predictive ability because it assumes invariant schedules of reproduction and death and constant annual rates of increase or decrease in

[4] From 16 to 21 adults in the mine site and 2 to 5 adults in the access road work areas.

size. In addition, our use of the life table for estimating population size for individuals smaller than 180 millimeters (see Appendix 1) assumes that current egg production and survival rates on the Lynx Cat Mine site are similar to that on the Goffs study site in the early 1980s. However, differences in resource availability, threats, and a variety of other variables can result in differences in the overall mortality rate of individuals at different sites and times and thereby create differences in the proportion of the population composed of individuals in these smaller classes. When we consider this estimate in combination with the other information discussed in this section on threats and the existing condition of the action area, it is likely that the actual size of the population for these smaller size classes is much lower than that reflected in the table above.

EFFECTS OF THE ACTION

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

Capture and Translocation of Desert Tortoises

Matcon will capture and translocate between 16 and 21 adult desert tortoises (i.e., larger than 180 millimeters in length) from the proposed mine site. Given the area affected by access road widening and the desert tortoise density in the action area, we anticipate that Matcon will capture and translocate an additional 2 to 5 adult desert tortoises during widening of the access road. It will also capture and translocate an unknown number of desert tortoises smaller than 180 millimeters in length from the mine site and access road work areas. Following translocation, desert tortoise exclusion fencing will preclude individuals from returning to work areas where project activities could kill or injure them. Based on the dimensions of the proposed mine site and access road work area, Matcon would translocate all desert tortoises a distance of less than 500 meters.

Capturing desert tortoises may cause elevated levels of stress that may render these animals more susceptible to disease or directly result in injury or mortality. Handling desert tortoises sometimes causes them to void the contents of their bladder, which may represent loss of important fluids that could be fatal (Averill-Murray 1999 in Boarman 2002). Averill-Murray 1999 (in Boarman 2002) provided some evidence that handling-induced voiding may adversely affect survivability, although the amount of fluid discharged is usually small. However, because Matcon will use only experienced biologists (i.e., authorized biologists) approved by the Service and approved handling techniques, collected desert tortoises are unlikely to experience substantially elevated stress levels, or be killed or injured.

Biologists previously considered translocation to be an ineffective tool in reducing the impacts of projects on desert tortoises and raised concerns regarding its numerous potential adverse effects (e.g., overcrowding, increased disease transmission, increased mortality, elevation of stress hormones, vulnerability to drought, etc.). Over the past approximately 10 years, several researchers have

undertaken studies to more carefully evaluate the effects of translocation on desert tortoises; some of these studies have included the monitoring of control and resident animals[5]. These studies have indicated that translocated, resident, and control animals do not have significant differences in mortality rates or in levels of stress hormones. The reproductive output of translocated individuals is slightly lower than that of resident or control individuals for the first year after release and translocated animals tend to move more but settle down after a period of time.

The Service's (2013) biological opinion for the Stateline and Silver State South solar projects contains an extensive discussion of the potential effects of translocation on desert tortoises; we incorporate that analysis herein by reference. Because the action area for the action under consideration in this biological opinion likely supports few desert tortoises, we anticipate that any effects of translocation on either resident or translocated animals are likely to be negligible. The potential exists that a translocated or resident desert tortoise may die or be injured during the translocation because of the specific circumstances; however, we consider this likelihood to be extremely low.

Matcon has not proposed long-term monitoring of desert tortoises that are moved from the mine site or access road or to move desert tortoises only during times of the year when individuals are more active. Despite the overall success of well-planned efforts to translocate desert tortoises, moving desert tortoises is not without risk. The successful translocation of desert tortoises depends greatly on the techniques used. Research on translocated desert tortoises indicates that they tend to spend more time above ground and move more than resident or control animals. The extended time above ground can increase the exposure of desert tortoises to predators and weather extremes; we are aware that desert tortoises will occasionally walk along newly installed fences within their territories until they become overheated and die. For these reasons, the Service's (2009) guidance recommends that workers translocate desert tortoises when weather conditions are the most conducive to the desert tortoise's activity patterns (generally April, May, September, and October, although translocation slightly before or after these months may be appropriate, depending on the weather in any given year). Translocation during the summer likely places desert tortoises are at a greater degree of risk than during the winter because animals are more likely to become active during the cooler portions of summer days and then become overheated if they cannot find shelter as the temperature increases. Desert tortoises that are moved during the winter may emerge from the burrows into which they are placed on a warm day and then be unable to find suitable shelter when the temperature drops again; these individuals are likely more vulnerable to predators and exposure to lower temperatures.

These potential risks are mitigated to a degree by the specific situation involved with the proposed action; because of the small size of the project area, any desert tortoise that is moved from a work area will have been moved a short distance within its home range. Desert tortoises that are moved short distances (particularly within their home ranges) will be familiar with the resources in that area and generally spend less time out of their burrows. Matcon will also place translocated desert tortoises within existing burrows or construct artificial burrows to protect them from temperature extremes. Matcon will also place shade structures along exclusion fencing to provide shelter to animals that may exhibit fence-pacing behavior following translocation.

[5] Desert tortoises used as controls inhabit areas that are disjunctive from those occupied by translocated animals; resident animals occupy areas into which desert tortoises have been translocated.

Effects of Mine Operation and Access Road Use

Desert tortoises not translocated during clearance surveys prior to the onset of ground-disturbing activities are likely to be injured or killed by heavy equipment during mine operations or access road widening. Because they are more difficult to detect, desert tortoises smaller than 180 millimeters are more likely to be missed during surveys. We have estimated that the area affected by the project could contain between 94 and 135 non-hatchling desert tortoises that are smaller than 180 millimeters in size. We anticipate that clearance surveys will find and translocate a portion of these individuals. We cannot accurately predict the proportion of the population within this size class that surveys would miss. Consequently, we anticipate that this project would kill fewer than 135 non-hatchling desert tortoises smaller than 180 millimeters in size, but the level of mortality will be primarily determined by the effectiveness of clearance surveys.

If the project commences in late spring or early summer, we have estimated that between 60 and 86 eggs and no hatchlings would occur on the site, but if it commences in late summer or early fall between 23 and 24 hatchlings would occur on site and no eggs. Desert tortoises bury their eggs at the mouths of burrows; if any are present at the time construction occurs, they would likely be missed during surveys and destroyed. Hatchling desert tortoises are extremely difficult to find during clearance surveys and will use rodent burrow and other cover sites that are not easily examined or excavated for purposes of translocation. Because of these factors, we anticipate that mine and access road development will kill between 23 and 24 hatchlings, between 60 and 86 eggs, or some unquantified combination of eggs and hatchlings within the same range of magnitude.

Matcon will fence the proposed mine site and the access road to prevent re-entry by desert tortoises; the small size of the mine site should ensure that clearance surveys are thorough except within the rocky areas that occur on the 8.5-acre parcel managed by the Bureau. Although we have stated that project activities could kill up to 135 non-hatchling desert tortoises smaller than 180 millimeters, given the degraded nature of the site, we anticipate that the number of smaller desert tortoises within the mine site or access road work areas is likely to be lower than what we have quantified. Considering this in combination with the ability to perform thorough clearance surveys, we anticipate that project activities will kill or injure few non-hatchling adult desert tortoises smaller than 180 millimeters in size. We anticipate project activities will result in the loss of all hatchlings and eggs from the project site. Given the degraded nature of the site, we anticipate that the magnitude of this loss is smaller than what we have quantified in the two previous paragraphs.

During mine operations, some potential exists in which desert tortoises could enter the mine site through breaches in the exclusion fencing and be killed or injured. In addition, desert tortoises may be killed or injured along the unfenced portion of the access road (i.e., Santa Fe Avenue). However, given the frequency that Matcon will inspect fences, the worker education program, and the speed limits that workers will use along the unfenced section of the access road, we anticipate that the level of injury and mortality will be low.

Common Ravens

We cannot predict the amount of predation by common ravens that the proposed action is likely to add to baseline levels within the action area, but we anticipate that measures proposed by Matcon are likely to be effective in reducing the attractiveness of the project area to common ravens.

The proposal by the Bureau and Matcon contain all trash associated with the mine in secure, self-closing receptacles should greatly reduce the amount of food that common ravens can acquire at the site. The machinery used by Matcon could provide nesting substrates for common ravens when not in use. Although Matcon would remove most machinery from the site when mining activities are not occurring some potential would remain for common ravens to periodically establish nests within the action area. In Phase 2 of mine operation, mining at the site would occur much less frequently and the degree to which it provided subsidies to common ravens would also be reduced.

Vehicle traffic on the access road is likely to kill wildlife. If this mortality becomes a regular occurrence, common ravens would likely frequent the area to feed on the carcasses. The scavenging would increase the number of common ravens, first by drawing in the initial birds and then by providing a food subsidy that would lead to an overall increase in abundance of common ravens as they are able to raise more young. We cannot predict the degree to which vehicular use on the access road would result in these adverse effects. The Bureau and Matcon have not proposed any measures to respond to such an occurrence.

Habitat Loss and Fragmentation

Mine operations and access road widening would result in the direct, long-term loss of 64.2 acres of habitat that will not be available to desert tortoises for foraging, breeding, or sheltering for the life of the projects (Circle Mountain 2014). Following extensive disturbance and compaction, Mojave Desert substrates can take between 92 and 124 years to recover in the absence of active restoration (Webb 2002). In addition, recovery of plant cover and biomass in the Mojave Desert can require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). 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, the 64.2 acres of lost habitat is likely to remain unsuitable as habitat for several decades following closure of the mine and commencement of reclamation and restoration work. The potential exists that they may be permanently lost if restoration and reclamation efforts are not successful.

Loss of habitat and installation of desert tortoise exclusion fencing will fragment habitat and obstruct movement of desert tortoises. However, the 3.4-mile access road and mine site are currently used by members of the public. Although Matcon would increase the volume of traffic on this road and obstruct desert tortoise movements through installation of exclusion fencing, their proposed installation of culverts under the mine access road would reduce the magnitude of this effect. Given that the mine access road is short and surrounded by extensive areas of contiguous habitat to support population connectivity, we anticipate that this project will have minimal effects on habitat fragmentation.

Introduction of Non-native Plant Species

Project vehicles that travel from offsite have the potential to introduce invasive nonnative plant species. Some nonnative species can cover the ground with dense growth and persist in a dried condition for months after the growing season. These conditions increase the risk that a wildfire caused by a lightning strike or human activity would spread farther and burn hotter than under natural conditions. Fires have killed desert tortoises that were outside of their burrows.

We cannot predict the degree to which non-native species would proliferate within or spread beyond the boundaries of the action area for several reasons. For example, above-average rainfall immediately after disturbances may encourage the spread of weeds whereas drought may have the opposite effect. We cannot predict whether project equipment would introduce new species or whether such new species would be able to germinate, grow, and reproduce onsite.

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.

We do not anticipate any additional non-federal activity in the action area. The action area is predominately comprised of public lands or private lands that are part of the mining operation analyzed in this consultation. The Bureau would be required to consult with the Service on any activity that it authorizes, funds, or implements on its lands under section 7(a)(2) of the Endangered Species Act. Therefore, we do not anticipate any cumulative effects associated with the proposed action.

CONCLUSION

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

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

Reproduction

The proposed action has the potential to kill female desert tortoises; we will discuss the effect of the loss of desert tortoises in the following section. No other aspect of the proposed action would affect the reproductive capacity of desert tortoises. Consequently, the proposed action will not have any effect on the reproductive capacity of desert tortoises that live in the action area or the habitat that surrounds it.

Numbers

The biological assessment predicts that between 18 and 26 adult desert tortoises may occur on the mine site areas that project activities would disturb. We used this information and the Turner *et al*. (1987) life table to estimate that up to 135 non-hatchling adults smaller than 180 millimeters in size may be present. We also estimated that between 23 and 24 hatchlings, between 60 and 86 eggs, or some unquantified combination of eggs and hatchlings within the same range of magnitude may also occur within these areas depending on the timing of project commencement.

Considering these estimates in combination with our knowledge about the degraded condition of the action area, identified sources of error associated with using a life table to estimate population size, the ability to perform thorough clearance surveys, and the suite of protective measures proposed by the Bureau, we conclude that the number of individuals likely to be killed or injured as a result of this project would be low. Injury and mortality that does occur is likely to more heavily affect smaller desert tortoises and eggs that are not near reproductive age; because of their small size and cryptic nature, biologists and workers are more likely to miss them during surveys and when monitoring, which would expose them to project activities.

Because desert tortoises are long-lived creatures and females can produce large numbers of offspring each year, the magnitude of the population level effects associated with desert tortoise mortality depends largely on the size class in which the mortality occurs and the local mortality rate for reproductive females. Several demographic models indicate that desert tortoises require high levels of survivorship and recruitment (i.e., survival to reproductive age) to recover mortality of reproductive adults in a declining population (Congdon *et al*. 1993, Doak *et al*. 1994, and Service 1994a). Desert tortoises do not typically reach reproductive age until they are 12 to 25 years old (Turner *et al*. 1984). Once adults reach reproductive age, they can live for more than 80 years and produce offspring for their entire reproductive lifespan (approximately 50 to 60 years) (Service 1994a). To maintain stable populations, the number of individuals reaching reproductive age (i.e., surviving from hatchling stage for 12 to 25 years) must regularly replace the number of reproductive adults that die in the population. If mortality of adult females is high, then the population requires a higher survival of smaller size classes or the population will decline in size over time.

Data clearly show that populations within the Western Mojave Recovery Unit are in a state of decline. However, we anticipate that mortality of smaller size classes as a result of the proposed action, even those that are close to reproductive age, will have no measureable effect on population stability within the recovery unit because it will not affect a large enough portion of the population to affect substantially the overall population trend within the recovery unit or range wide.

The number of adult desert tortoises on the project site (i.e. up to 26) comprises 0.027 percent of the estimated 76,644 adults present in the recovery unit, and we have concluded that project activities will not result in injury or mortality of these individual. The 169 juvenile desert tortoises (i.e., 135 non-hatchlings smaller than 180 millimeters + 34 hatchlings) that could occur on the project site would also comprise a small fraction of the recovery unit's juvenile population size, and we anticipate that project activities would actually kill or injure far fewer than 136 juveniles. The same analysis of proportionality applies for eggs even though we anticipate that all eggs within the project site will be lost. Because we anticipate that implementation of the proposed action would injure or

kill a small fraction of the number of desert tortoises in the Western Mojave Recovery Unit, we conclude that it would have a negligible effect on the number of desert tortoises in the recovery unit.

Distribution

The disturbance of approximately 64 acres of desert tortoise habitat that would result from implementation of the proposed action would have a negligible effect on the distribution of the desert tortoise. The Western Mojave Recovery Unit may support as much as 5,595,469 acres of desert tortoise habitat (Darst 2014; see table in the Status of the Desert Tortoise section of this biological opinion). Consequently, the proposed action would result in the disturbance for many years of approximately 0.0001 percent of the habitat in the Western Mojave Recovery Unit (64/5,595,469 x 100) and an even smaller effect on the amount of habitat available range-wide.

Effects on Recovery

Matcon would reclaim and restore the mine site after mining operations have been completed. The amount and timing of rainfall are likely to be important to the success of the restoration and the time required for habitat useable by desert tortoises to return. Matcon will offset the loss of desert tortoise habitat by paying compensation under the provisions of the West Mojave Plan and /or permits issued by the California Department of Fish and Wildlife. The compensation would assist to a degree in furthering the recovery of the desert tortoise. In aggregate and over the long term, the restoration of the mine and mill sites and the provision of compensation for the disturbance have the potential for the proposed action to result in a net positive effect on the recovery of the desert tortoise.

After reviewing the current status of the desert tortoise, the environmental baseline for the action area, the effects of the proposed mining operation, and the cumulative effects, it is the Service's biological opinion that the Lynx Cat Mine Project, as proposed, is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion for the following reasons:

1. The proposed action will not affect the reproductive capacity of desert tortoises.

2. The number of desert tortoises likely to be killed or injured over the life of the project is low, comprises a small fraction of the total population with the recovery unit and range-wide, and will not have a measurable effect on population trends.

3. The area of proposed disturbance is small when compared to the amount of habitat available in the Western Mojave Recovery Unit.

4. The restoration of the mine and mill sites and the provision of compensation for the disturbance have the potential for the proposed action to result in a net positive effect on the recovery of the desert tortoise.

INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and Federal regulation pursuant to section 4(d) of the Endangered Species 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 attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal 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 7(o)(2) of the Endangered Species Act, taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Endangered Species Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary. The Bureau must include these measures in its authorization of the Lynx Cat Mine for the exemption in section 7(o)(2) to apply. Failure to comply may cause the protective coverage of section 7(o)(2) to lapse. To monitor the impact of the incidental take, the Bureau must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 Code of Federal Regulations 402.14(i)(3)).

Mine Development and Access Road Widening

We estimated that up to 26 adult desert tortoises and 135 non-hatching juveniles may occur in the project site, but the existing condition of the site other factors we have discussed above may indicate that this is an overestimate. Determining the precise number present at this time is not possible because desert tortoises are cryptic (i.e., individuals spend much of their lives underground or concealed under shrubs), they are inactive in years of low rainfall, and their numbers and distribution within the action area may have changed since the surveys were completed because of hatchings, deaths, immigration, and emigration. The numbers of hatchlings and eggs are even more difficult to quantify because of their small size, the location of eggs underground, and the fact that their numbers vary depending on the season; that is, at one time of the year, eggs are present but they become hatchlings later in the year.

Determining the amount or extent of the forms in which the take is likely to occur (killed, injured, or captured) is also difficult. As we noted previously, Matcon would capture and move the adult individuals (i.e., those greater than 180 millimeters in length) within the project area to adjacent habitat. Furthermore, the Bureau proposes to implement measures that will minimize the mortality or injury of desert tortoises. However, occasionally even large animals remain undetected during monitoring; any undetected animals are likely to be killed or injured during construction. Some carcasses may be inadvertently buried by heavy equipment and others may be scavenged; therefore, not all animals that are killed or injured during construction are likely to be detected.

We anticipate that all desert tortoises within the proposed mine site and access road work areas are likely to be taken during construction (i.e., widening of the access road and initial removal of topsoil and overburden from the mine site). We anticipate that clearance surveys will result in the capture and translocation of most desert tortoises within this area; however, the potential exists that implementation of this portion of the proposed action may kill or injure desert tortoises. Because we cannot precisely quantify the number of individuals that are likely to be killed, injured, or captured during construction of the proposed project, we will consider the amount or extent of take to be

exceeded if two desert tortoises are killed or injured within the project area. We are not establishing a re-initiation criterion for the number of large or small desert tortoises that would be moved out of harm's way during construction. Furthermore, we are not establishing a re-initiation criterion for the loss of eggs.

Ongoing Mine Operations, Access Road Use, and Reclamation

We cannot predict the number of desert tortoises that will attempt to cross the unfenced portions of the access road (i.e., Santa Fe Avenue) or enter work areas through breaches in exclusion fencing over the life of the mining operations or during reclamation work. We acknowledge that Matcon will not find every animal killed or injured by project activities. We also acknowledge that the access roads used for the mine are open for public use and injury or mortality of desert tortoises may occur within the action area that is not related to mine operations or mine access. For these reasons, we will consider the amount or extent of take to be exceeded if two desert tortoises are killed or injured within the mine sites or along the access road in a calendar year. We are not establishing a re-initiation criterion for the number of desert tortoises that would be moved out of harm's way during operation and reclamation.

The exemption provided by this incidental take statement to the prohibitions against take contained in section 9 of the Endangered Species Act extends only to the action area as described in the Environmental Baseline section of this biological opinion.

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 (i.e., construction, operation, and reclamation) of the Lynx Cat Mine project:

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

2. The Bureau must minimize adverse effects associated with handling and movement of desert tortoises.

3. The Bureau must ensure that Matcon reduces the potential for translocation to result in injury or mortality of desert tortoises due to overheating or predation.

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 section 7(a)(2) of the Act (50 Code of Federal Regulations 402.16).

TERMS AND CONDITIONS

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

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

   To ensure that the proposed protective measures 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 and Matcon must review the circumstances surrounding the incident with the Service to determine whether the proposed protective measures and terms and conditions are effective and properly implemented or whether additional protective measures are required. Project activities may continue pending the outcome of the review, provided that the proposed protective measures and any appropriate terms and conditions of this biological opinion have been and continue to be fully implemented.

2. The following term and condition implements reasonable and prudent measure 2:

   The Bureau must ensure that only biologists authorized by the Service under the auspices of this biological opinion conduct clearance surveys for and handle desert tortoises. We request that you provide us with the credentials of authorized biologists you wish to conduct these duties at least 30 days prior to the time they must be in the field.

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

   a. All translocated desert tortoises must be monitored for at least 2 days to ensure their safety. Monitoring must include inspecting the exclusion fence regularly to ensure that desert tortoises translocated nearby are not pacing the fence. If desert tortoises are moved after the spring active period, the Bureau must require Matcon to monitor these individuals for 7 days to ensure their safety. If a desert tortoises activity level seems to be causing it physiological stress (e.g., foaming from the mouth), the authorized biologist must immediately place the animal in the shade to reduce its body temperature. After temperature falls below 95°F (and is unlikely to rise again before dawn), the desert tortoise must again be placed in the shade of a shrub or burrow; monitoring must resume the following day before the desert tortoise becomes active. If the desert tortoise again begins to experience hyperthermia, the authorized biologist must place it in a clean holding container, bring it to a location with controlled temperature, and contact the Service for further guidance.

   b. The Bureau must require Matcon to inspect any machinery that has been idle for more than a day during the nesting season (generally February through May) to ensure that common ravens have not begun to construct a nest. The Bureau must require Matcon to remove any common raven nest before they lay eggs. If the birds lay eggs before the nest is removed, the Bureau must require Matcon to examine the

area under the nest on a daily basis for as long as it is active to determine if the occupants are eating desert tortoises; if desert tortoise carcasses are observed, Matcon must contact the Service within 24 hours. The Bureau must require Matcon to remove the nest after the young have fledged.

REPORTING REQUIREMENTS

Within 60 days of the completion of access road widening and removal of habitat from the mine site, the Bureau must provide a report to the Service that provides details on the effects of the action on the desert tortoise. Because the Lynx Cat Mine will operate for approximately 20 years, the Bureau must also provide an annual report by December 31 of each year. Specifically, these reports must include information on any instances when individuals of listed species were killed, injured, or handled; the circumstances of such incidents; and any actions undertaken to prevent similar instances from re-occurring. As part of these reports, the Bureau must describe the monitoring efforts that occurred during the reporting period.

We request 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 for the desert tortoise and an evaluation of the experience they gained on the project. 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 INDIVIDUALS OF LISTED SPECIES

Within 3 days of locating any dead or injured desert tortoises, you must notify the Palm Springs Fish and Wildlife Office by telephone (760-322-2070) and by facsimile (760-322-4648) 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.

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

The Bureau must require Matcon to take any injured desert tortoises to a qualified veterinarian for treatment. If any injured desert tortoises survive, the Bureau must contact the Service 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, help implement recovery plans, or to develop information.

We recommend that the Bureau require Matcon to refrain from translocating desert tortoises during their period of summer inactivity by avoiding occupied burrows until desert tortoises become active again in the fall.

REINITIATION NOTICE

This concludes formal consultation on the proposed Lynx Cat Mine in San Bernardino County. As provided in 50 Code of Federal Regulations 402.16, 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 if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may 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 you have any questions regarding this biological opinion, please contact Brian Croft of the Palm Springs Fish and Wildlife Office at 760-322-2070, extension 210.

Appendices

1. Estimation of the Number of Desert Tortoises Smaller than 180 millimeters, Midline Carapace Length

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

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Appendix 1. Estimation of the Number of Desert Tortoises Smaller than 180 millimeters, Midline Carapace Length

The methodology provided below is from the Service's draft, revised pre-project survey protocol for the desert tortoise (Service 2014). We expect 13.2 percent of desert tortoises alive in a population over the course of 1 year to be larger than 180 millimeters, with the remainder smaller than 180 millimeters (Table 32 in Turner *et al*. 1987). When they emerge, hatchlings make up 17.7 percent of the population (Table 30 in Turner *et al*. 1987), or 1.3 times as many hatchlings as adults. Based on this information, the table below estimates the number of eggs and smaller desert tortoises in the population based on the estimated number of desert tortoises larger than 180 millimeters. The multiplier for the number of eggs in the action area is from Averill-Murray *et al*. (2014) based on the average across all published studies for the Mojave desert tortoise.

The last three columns of the table indicate the composition of the population at different times of the year to account for potential changes in project effects caused by timing of project activities (i.e. eggs are laid in late spring and early summer; eggs disappear from the landscape as a portion of them are converted to hatchlings in late summer[6]).

Table 1. Desert tortoise population composition throughout the calendar year

	Annual population multipliers	January-April	May, June, July	August-December
Eggs = 1/2 estimated # Adults X multiplier	60 to 86	0	60 to 86	0
Hatchlings = estimated # Adults X multiplier	23 to 34	0	0	23 to 34
Non-hatchlings smaller than 180 mm = estimated # Adults X multiplier	94 to 135	94 to 135	94 to 135	94 to 135
Adults (larger than 180 millimeters)	18 to 26[7]			

[6] Hatchlings may emerge while other eggs are still in the nests; however, because we do not have a good estimate of the rate of conversion of eggs to hatchlings over the summer, we assume that eggs are present in nests from May through July, and are instantaneously converted to hatchlings in August.

[7] This method derives estimates based on the number of individuals larger than 180 millimeters midline carapace length rather than 160 millimeters as was used in the surveys for this project. Because desert tortoises between 160 millimeters and 180 millimeters are estimated to typically make up less than 5 percent of a given desert tortoise population (Turner *et al.* 1987, Karl 1998), this should not substantially affect the overall population estimate.

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Appendix 2. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

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

Table 1. Solar projects which have undergone formal consultation in desert tortoise recovery units

Project and Recovery Unit	Acres of Desert Tortoise Habitat	Desert Tortoises Estimated[1]	Desert Tortoises Observed[2]	Citations[3]
Eastern Mojave				
Ivanpah Solar Electric Generating System	3,582	1,136	175[7]	Service 2011a, Davis 2014
Stateline Solar	1,685	947	34	Service 2013a, LaPre 2014
Silver State North – NV	685	14[6]	4	Service 2010a, Cota 2013
Silver State South – NV	2,427[4]	1,020[4]	152	Service 2013a, Cota 2014
Amargosa Farm Road – NV	4,350	4[6]	-	Service 2010e
Western Mojave				
Abengoa Harper Lake	Primarily in abandoned agricultural fields	4[6]	-	Service 2011b
Chevron Lucerne Valley	516	10	-	Service 2010b
Northeastern Mojave				
Nevada Solar One - NV	400	[5]	[5]	Burroughs 2012, 2014
Copper Mountain North - NV	1,400	30[5]	30[5]	Burroughs 2012, 2014
Copper Mountain - NV	380	[5]	[5]	Burroughs 2012, 2014
Moapa K Road Solar - NV	2,141	186	157	Service 2012, Burroughs 2013
Colorado				
Genesis	1,774	8	0	Service 2010c, Fraser 2014a
Blythe	6,958	30	0	Service 2010d, Fraser 2014b
Desert Sunlight	4,004	56	7	Service 2011c, Fraser 2014a
McCoy	4,533	15	0	Service 2013b, Fraser 2014b

Project and Recovery Unit	Acres of Desert Tortoise Habitat	Desert Tortoises Estimated[1]	Desert Tortoises Observed[2]	Citations[3]
Desert Harvest	1,300	5	-	Service 2013c
Rice	1,368	18	1	Service 2011d, Fraser 2014a
Total	**37,503**	**3,483**	**560**	

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

The Service completed biological opinions for the Calico and Palen projects. The applicant for the Calico project, which was located in the Western Mojave Recovery Unit, has abandoned the project and the Bureau of Land Management has withdrawn the request for consultation (Bureau 2013). The Palen project, which is located in the Colorado Desert Recovery Unit, has had several owners; most recently, the project proponent (Palen Solar Holdings, LLC) submitted a letter to the California Energy Commission in which it withdrew its application (California Energy Commission 2014). Another company may pursue a solar project at this location, although it has not filed applications with the Bureau and California Energy Commission to date (Fraser 2014c).

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