DESERT TORTOISE COUNCIL
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Via email only

Date: February 12, 2024

Attn: Jon Braginton, Planner
County of San Bernardino, Land Use Services Department
385 North Arrowhead Avenue, First Floor
San Bernardino, CA 92415
Jon.Braginton@lus.sbcounty.gov

RE: Overnight Solar Project Scoping Comments

Dear Mr. Braginton,

The Desert Tortoise Council (Council) is a non-profit organization comprised of hundreds of professionals and laypersons who share a common concern for wild desert tortoises and a commitment to advancing the public's understanding of desert tortoise species. Established in 1975 to promote conservation of tortoises in the deserts of the southwestern United States and Mexico, the Council routinely provides information and other forms of assistance to individuals, organizations, and regulatory agencies on matters potentially affecting desert tortoises within their geographic ranges.

Both our physical and email addresses are provided above in our letterhead for your use when providing future correspondence to us. When given a choice, we prefer to receive emails for future correspondence, as mail delivered via the U.S. Postal Service may take several days to be delivered. Email is an "environmentally friendlier way" of receiving correspondence and documents rather than "snail mail."

We appreciate this opportunity to provide comments on the above-referenced project, and that the San Bernardino County Planning Department (County) contacted the Council directly via email on 1/18/2024, which facilitated Ed LaRue's attendance at the project specific webinar on 1/31/2024. Given the location of the proposed project in habitats likely occupied by the Mojave desert tortoise (*Gopherus agassizii*) (synonymous with Agassiz's desert tortoise), our comments include recommendations intended to enhance protection of this species and its habitat during activities authorized by the County, which we recommend be added to project terms and conditions in the authorizing document (e.g., conditional use permit, right of way grant, etc.) as appropriate. Please accept, carefully review, and include in the relevant project file the Council's following comments and attachments for the proposed project.

The Mojave desert tortoise is among the top 50 species on the list of the world's most endangered tortoises and freshwater turtles. The International Union for Conservation of Nature's (IUCN) Species Survival Commission, Tortoise and Freshwater Turtle Specialist Group, now considers the Mojave desert tortoise to be Critically Endangered (Berry et al. 2021), "… based on population reduction (decreasing density), habitat loss of over 80% over three generations (90 years), including past reductions and predicted future declines, as well as the effects of disease (upper respiratory tract disease/mycoplasmosis). *Gopherus agassizii* (sensu stricto) comprises tortoises in the most well-studied 30% of the larger range; this portion of the original range has seen the most human impacts and is where the largest past population losses have been documented. A recent rigorous rangewide population reassessment of *G. agassizii* (sensu stricto) has demonstrated continued adult population and density declines of about 90% over three generations (two in the past and one ongoing) in four of the five *G. agassizii* recovery units and inadequate recruitment with decreasing percentages of juveniles in all five recovery units."

This status, in part, prompted the Council to join Defenders of Wildlife and Desert Tortoise Preserve Committee (Defenders of Wildlife et al. 2020) to petition the California Fish and Game Commission in March 2020 to elevate the listing of the Mojave desert tortoise from Threatened to Endangered in California. In its status review, California Department of Fish and Wildlife (CDFW) (2024a) stated: "At its public meeting on October 14, 2020, the Commission considered the petition, and based in part on the Department's [CDFW] petition evaluation and recommendation, found sufficient information exists to indicate the petitioned action may be warranted and accepted the petition for consideration. The Commission's decision initiated this status review to inform the Commission's decision on whether the change in status is warranted."

Importantly, in their February 2024 status review, CDFW concluded: **"The Department's recommendation is that uplisting the Mojave Desert Tortoise is warranted."** Receipt of this [status review] report is to be placed on the agenda for the next available meeting [expected in April 2024] of the Commission after delivery [at the February meeting]. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the petition."

Before providing our specific comments below, we would like to express our serious concern with the intended timing of the planning process. During the 1/31/2024 webinar when LaRue asked about the results of requisite surveys for plant and animal species of special concern (CDFW 2024) [this includes the tortoise], the Tetra Tech consultants indicated that some surveys had been performed without revealing which ones. We were told that scoping comments are due by 2/19/2024 and the draft environmental impact report (Draft EIR) would be released within a month, in March 2024. We find this scheduling to be problematic, that it may even be dismissive of public input.

It is absolutely essential that requisite surveys be performed before the Draft EIR is written so that survey results can be published in the environmental document. The County must ensure quality control in this matter, even if it means that the consultants perform the surveys this spring and the Draft EIR is published on a realistic schedule in the summer or fall of 2024. For example, Mohave ground squirrel surveys (CDFW 2023) must be performed from March through July of a given year. If these surveys have not already been performed, they must be performed and the results documented in the Draft EIR, which means it would need to be published sometime after July 2024. Other requisite surveys for rare plant communities, plants, and animals are listed herein, and must be performed *before* writing the Draft EIR for the analysis to be complete.

Comments Specific to the Notice of Preparation

In addition to the webinar presentation on 1/31/2024, the Council's sole source of project information is in the County's Notice of Preparation of a Draft Environmental Impact Report and Scoping Meeting, dated 1/18/2024 (herein "Notice;" all page numbers reference the Notice). Page 1 indicates: "The project includes development of a utility scale, solar photovoltaic (PV) electricity generation and energy storage facility that would produce up to 150 megawatts (MW) of solar power and include a 150 MW battery energy storage system (BESS) on approximately 822 acres, plus a generation interconnect (gen-tie) corridor approximately 1.1 miles in length and approximately 80 feet in width, connecting the proposed facility to another existing gen-tie line associated with the Mojave Solar Facility and just south of the existing Alba Substation…The project site is bordered to the north by the existing Lockhart Solar Facility, to the east by the existing Mojave Solar Facility, and to the west and south by undeveloped land."

The project description on page 1 indicates "The project would provide San Bernardino County and the State of California with additional renewable energy sources that would assist the state in complying with the Renewables Portfolio Standard (RPS) under Senate Bill 100, which requires that by December 31, 2030, 60 percent of all electricity sold in the state shall be generated from renewable energy sources." Unlike most solar projects that have been developed on leased public lands from the Bureau of Land Management (BLM), this project would be developed on private lands. When asked to analyze rooftop solar as an alternative to developing public lands, the BLM routinely says that it has no jurisdiction over private lands and that such an alternative is infeasible. For this project, we believe that considering a rooftop solar alternative is prudent, and ask that such an alternative be included in the Draft EIR. To be clear, we define "rooftop solar" as installing solar panels over areas that are already developed – commercial and industrial buildings, parking lots, farm fields used for growing shaded or partially shaded crops, etc.

Page 1 indicates, "…panel washing would occur at least once per year and potentially up to 4 times per year. Panel washing would require up to 12 employees with water trucks and would take approximately 20 days to complete." On page 6, we also read, "Approximately 200 acre-feet of water would be used during the first year of construction." Further, "Components of the plan are likely to include water trucks to spread water, as well as road stabilization with chemicals, gravel, or asphaltic pavement to mitigate visible fugitive dust from vehicular travel and wind erosion."

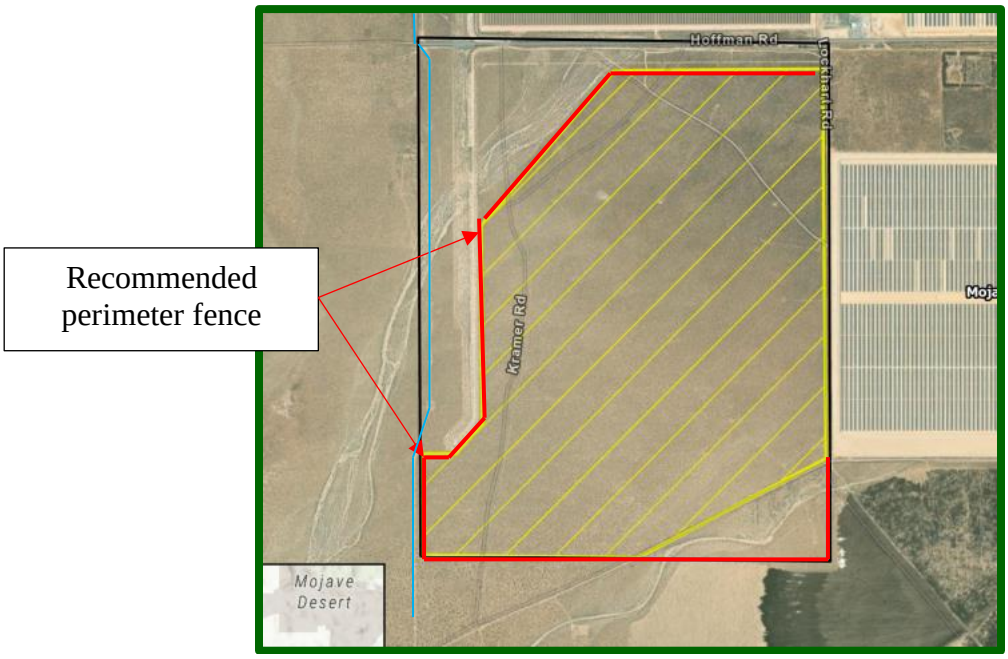
Please be sure the Draft EIR addresses current aquifer characteristics and how this project, combined with the other existing and proposed solar projects, including the Desert Breeze solar project, may affect the aquifer. Our relatively more pertinent concern with the use of so much water is the attraction of known predators, including common ravens and coyotes, into the project area, potentially increasing depredation of tortoises in adjacent areas. Panel washing and dust suppression if not applied in a conscientious manner will result in water puddling onsite and runoff into adjacent areas, which are both human-subsidized water sources for these predators.

The Draft EIR must analyze if this new use would result in an increase of common ravens and other predators of the desert tortoise in the region. Future operations must include provisions for monitoring and managing raven predation on tortoises as a result of the proposed action. A raven monitoring and management plan must include reducing human subsidies for food, water, and sites for nesting, roosting, and perching to address local impacts. The proponent must contribute to the National Fish and Wildlife Foundation's Raven Management Fund for regional and cumulative impacts. It is very important that for any of the gen-tie options the proponent should use transmission towers that prevent raven nesting. For example, the tubular monopole design with insulators on horizontal cross arms is preferable to lattice towers, which should not be used.

Please ensure that all standard measures to mitigate the local, regional, and cumulative impacts of raven predation on the tortoise are included in the Draft EIR, including developing a raven management plan for this specific project. USFWS (2010) provides a template for a project-specific management plan for common ravens. This template includes sections on construction, operation, maintenance, and decommissioning (including restoration) with monitoring and adaptive management during each project phase.

Page 6 indicates, "After grading, temporary fences would be placed around the project site, which would allow materials and equipment to be securely stored on-site and prevent theft and vandalism." We then read on page 6, under *Construction Activities and Equipment*, that "1. The first stage would include fencing, site preparation, grading, and preparation of staging areas and on-site access routes." These two statements seem to contradict one another, stating that fences would be installed after grading versus the "…first stage would include fencing."

Please clarify in the Draft EIR the timing of installation and the type of fence(s) that will be installed. We strongly recommend that the entire "solar array" be fenced as depicted by the yellow lines in the following aerial - as opposed to the "project site" depicted as a black line in the aerial - by a 1 x 2-inch mesh galvanized fence *before* any ground disturbance occurs.



For this project, the site itself and areas to the south and west are undeveloped, apparently intact habitats that likely support desert tortoises. We note that 10 tortoises were found on the nearby proposed Desert Breeze facility (see footnote above). Installing the tortoise exclusion fence before the vegetation is brushed will help accomplish two important things: (1) allow authorized biologists to perform clearance surveys (USFWS 2009) within the fenced area, and (2) prevent tortoises from entering the area before it is cleared and during construction. Since adjacent areas to the west and south will hopefully continue to support tortoises, it is important that the perimeter fence be installed before there is any ground disturbance to prevent tortoise immigration into the development footprint. If strategically planned, the proponent would be able to attach the tortoise exclusion fence, that is, the same 1 x 2-inch mesh that encloses the site to the bottom of the permanent perimeter fence before any grading occurs, which we assume would be chain-link or similar material to ensure it is visible to the public. Please be sure to consult Chapter 8 of the Desert Tortoise Field Manual (USFWS 2009) for the proper materials, specifications, and installation of tortoise exclusion fences.

Page 7 indicates, "An average of 150 workers would be on-site during each phase of construction, depending on the activities. The peak number of workers on the project site at any one time is anticipated to be 300. The workforce would consist of laborers, craftspeople, supervisory personnel, and support personnel. On average, it is anticipated that each worker would generate one round trip to the project site per workday. Most workers would commute to the project site from nearby communities, such as Boron and Barstow, with some traveling from more distant areas, such as Victorville, Hesperia, and San Bernardino. Construction would generally occur during daylight hours, though exceptions may arise because of the need for nighttime work. Workers would reach the project site using Harper Lake Road to Lockhart Ranch Road."

Harper Lake Road was fitted with a tortoise exclusion fence decades ago, but we have found that its maintenance has been problematic, that there are gaps, and that tortoises may still enter onto the asphalt surface. Even if no tortoises are found onsite and incidental take permits are not required (see discussion below), we recommend that tortoise awareness programs be administered to all construction and maintenance workers prior to and during construction and on an annual basis for maintenance workers. This recommendation is intended, in part, to be sure project-related personnel are aware of tortoises occurring along Harper Lake Road north of Highway 58 and particularly along the unfenced Helendale Road located south of Highway 58 with the objective of eliminating road mortality injury, and/or collection of tortoises by personnel associated with this project.

We superimposed a red line on the aerial photograph on the previous page to signify our recommendation for fence placement. We have intentionally placed the fence line along the "solar array" footprint rather than the "project site" denoted by the rectangular black line for several important reasons. That being said, if the areas to the west and northwest of the solar array are to be developed with ancillary features that need to be enclosed within the perimeter fence, we understand that a perimeter fence aligned with the "project site" would be required. And, if so, please consider the following.

We are concerned that a named road, "Kramer Road," would be blocked as the result of project development. There is also an unnamed road denoted by a light blue line in the aerial on the previous page that coincides with another existing, unimproved road. If the project site rather than the solar array is fenced, this road would also be blocked. In our experience, when existing roads are closed, if an alternative route is not provided, "social trails" will be created outside the perimeter fence. In many cases, these roads have a greater impact to air quality, soils, vegetation, wildlife than a well-defined graded road. So, please be sure the Draft EIR addresses the issue of vehicle access after the site is fenced. Please be sure that the perimeter fence right-of-way accommodates a public-use roadway immediately outside the fence to minimize the creation and impacts of social trails.

Additional Comments for Issues Not Given in the Notice of Preparation

Surveys

The Mojave desert tortoise is listed as threatened under the Federal Endangered Species Act (FESA) and California Endangered Species Act (CESA). These legal designations prohibit the "take" of the tortoise by anyone without prior authorization (e.g., incidental take permit), and for this project, require mitigation for the "impacts of the taking." Note than "take" includes capture, harm, or harassment of tortoises.

To determine whether take would occur, the USFWS has two types of surveys for the Mojave desert tortoise, 100% coverage surveys (USFWS 2019) and tortoise clearance surveys (USFWS 2009). One-hundred-percent surveys specify transect width, approval of the biologist conducting the surveys, area to be surveyed (i.e., actions area), and in some cases, the time of year. One-hundred-percent surveys are conducted to determine whether tortoises/tortoise sign are present in the "action area" for the proposed project (USFWS 2019). The "action area" is defined in 50 Code of Federal Regulations 402.2 and the USFWS Desert Tortoise Field Manual (USFWS 2009) as "all areas to be affected directly or indirectly by proposed development and not merely the immediate area involved in the action" (50 Code of Federal Regulations §402.02). Thus, the 100% coverage survey area is larger than the project footprint/project site. CDFW has adopted the USFWS's 100% coverage survey as the methodology to use (https://wildlife.ca.gov/Conservation/Survey-Protocols#377281283-reptiles) to determine tortoise presence/use of the action area and whether take would occur. Please be sure that the proponent's consultants speak with the USFWS and CDFW to determine an appropriate action area for this project, the surveys are conducted following the protocols for each survey type, the biologist(s) conducting the surveys are approved by the USFWS and CDFW prior to conducting the surveys, and the survey results of the entire action area be documented in the Draft EIR.

The methodology and results of the 100% coverage survey are documented and submitted to USFWS and CDFW. If any tortoise sign is found, the project proponent should coordinate with USFWS and CDFW to determine whether "take" under the FESA and CESA is likely to occur from implementation of the proposed project. If USFWS or CDFW determines that the construction, operation/use, maintenance, or decommissioning of the proposed project is likely to result in take of the tortoise, the project proponent must obtain a Section 10(a)(1)(B) incidental take permit from the USFWS and a Section 2081 incidental take permit from the CDFW prior to conducting any ground disturbance.

The incidental take permit will require that the project proponent conduct clearance surveys (USFWS 2009). If any tortoises are found, the incidental take permit(s) will include instructions on moving tortoises, which is a type of take, from the area to be impacted as well as other measures to minimize and mitigate the impacts of the taking.

We remind the County that this and any other actions funded, carried out, or authorized by the County such as issuance of a permit, must comply with FESA and CESA. Therefore, the County should require the project proponent to comply with the USFWS (2019) and CDFW 100% coverage survey protocol for the tortoise, and if the agencies determine an incidental take permit is required, the project proponent must obtain these incidental permits prior to initiating any clearance surveys (USFWS 2009) or ground disturbing activities. The County should require the applicant to obtain incidental take permits if USFWS and/or CDFW determine that a permit is needed.

Prior to performing surveys, the proponent's consultant should access the California Natural Diversity Data Base (CNDDB; CDFW 2024c) to determine the special status species reported from the region, the results of which need to be published in the Draft EIR. The project proponent should implement focused surveys for **all** special status species that may use the project area (including gen-tie lines and other ancillary facilities) using the appropriate methodologies for each taxa as specified by the USFW and CDFW, as follows: Mojave desert tortoise (USFWS 2009, 2019); Mohave ground squirrel (CDFW 2023); Swainson's hawk (CDFW 2010); American badger (Wearn and Glover-Kapfer 2017); kit fox (USFWS 2011); burrowing owl (CDFG 2012); Mojave fringe-toed lizards (*Uma scoparia*) (University of California Riverside, Center for Conservation Biology 2005); and special status native plant populations and natural communities (e.g., Spine scale Scrub, Winterfat Scrubland, and Joshua Tree Woodland) (CDFG 2009, CDFW 2018).

A jurisdictional waters analysis should be performed for all potential impacts to washes, streams, and drainages. This analysis should be reviewed by the CDFW as part of the permitting process and a Streambed Alteration Agreement acquired, if deemed necessary by CDFW.

<u>Impacts Analysis to Tortoise Conservation Areas and Linkage Habitats</u>

To assist the County and proponent with their cumulative effects analysis in the Draft EIR of the direct, indirect, synergistic, and cumulative impacts of the Proposed Project on the Mojave desert tortoise, we provide Appendix A with current information on its status and trends.

The West Mojave Plan (BLM 2005, 2006) created an exclusion area within the surrounding Fremont-Kramer and Superior-Cronese Critical Habitat Units, which completely surrounded the single existing solar development at the time, referred to as the "LUZ facility." Since then, several thousand acres of new solar facilities have been developed (Mojave and Lockhart solar facilities) and proposed (Desert Breeze and this one). It is important that the Draft EIR analyze the direct, indirect, synergistic, and cumulative effects of this and other solar developments that are surrounded by the two critical habitat units, Areas of Critical Environmental Concern (ACEC), National Conservation Lands (NCL), and nearby Wilderness Areas to the north. We ask specifically that the Draft EIR analyze the potential heat sink effects (Sinervo et al. 2013) that this and adjacent solar projects may be having on the tortoise populations in critical habitat.

Wildlife corridors are areas that are used periodically, and may not be continuously occupied by wildlife species. Consequently, a one-day visit to a project site would not provide sufficient information that the project site or nearby areas would not interfere substantially with the movement of any native resident wildlife species or established native resident wildlife corridors.

An online search of scientific literature (e.g., Google Scholar) would reveal the existence of scientific papers on areas important for connectivity for species such as the Mojave desert tortoise. For example, for the tortoise, Averill-Murray et al. (2021) published a paper on connectivity of Mojave desert tortoise populations and linkage habitat. The authors emphasized that "[m]aintaining an ecological network for the Mojave desert tortoise, with a system of core habitats (TCAs = Tortoise Conservation Areas) connected by linkages, is necessary to support demographically viable populations and long-term gene flow within and between TCAs."

"Ignoring minor or temporary disturbance on the landscape could result in a cumulatively large impact that is not explicitly acknowledged (Goble, 2009); therefore, understanding and quantifying all surface disturbance on a given landscape is prudent." Furthermore, "habitat linkages among TCAs must be **wide enough** [emphasis added] to sustain multiple home ranges or local clusters of resident tortoises (Beier, et al., 2008; Morafka, 1994), while accounting for edge effects, in order to sustain regional tortoise populations." Consequently, effective linkage habitats are not long narrow corridors. Any development within them has an edge effect (i.e., indirect impact) that extends from all sides into the linkage habitat further narrowing or impeding the use of the linkage habitat, depending on the extent of the edge effect.

Averill-Murray et al. (2021) further notes that "To help maintain tortoise inhabitance and permeability across all other non-conservation-designated tortoise habitat, all surface disturbance could be limited to less than 5-percent development per square kilometer because the 5-percent threshold for development is the point at which tortoise occupation drops precipitously (Carter, et al., 2020a)." They caution that the upper threshold of 5-percent development per square kilometer may not maintain population sizes needed for demographic or functional connectivity; therefore, development thresholds should be lower than 5-percent.

The lifetime home range for the Mojave desert tortoise is more than 1.5 square miles (3.9 square kilometers) of habitat (Berry 1986) and, as previously mentioned, may make periodic forays of more than 7 miles (11 kilometers) at a time (Berry 1986).

For the Mohave ground squirrel, CDFW published "A Conservation Strategy for the Mohave Ground Squirrel, *Xerospermophilus mohavensis*" in CDFW (2019). This document contains a map with linkage areas among the identified populations of the Mohave ground squirrel. Information from documents like these should be used to support the existence or absence of wildlife linkages in the project area and nearby.

We add that the fundamentals of conservation biology include the need for gene flow between populations to maintain genetic diversity; this enables a species to more likely survive, especially during climate change, which enables biodiversity. Thus, linkage habitats are important as they provide connectivity among wildlife populations to maintain viability and biodiversity.

Indirect impacts

We request that the Draft EIR address the effects of the proposed action on global warming and the effects that global warming may have on the proposed action. For the latter, we recommend including: an analysis of habitats within the project that may provide refugia for tortoise populations; an analysis of how the proposed action would contribute to the spread and proliferation of nonnative invasive plant species; how this spread/proliferation would affect the desert tortoise and its habitats (including the frequency and size of human-caused fires); and how the proposed action may affect the likelihood of human-caused fires. We strongly urge the Proponent to develop and implement a management and monitoring plan using this analysis and other relevant data that would reduce the transport to and spread of nonnative seeds and other plant propagules within the project area and eliminate/reduce the likelihood of human-caused fires. The plan should integrate vegetation management with fire management and fire response.

Mitigation and Monitoring Plans

The Draft EIR should include appropriate mitigation and monitoring plans for all direct, indirect, and cumulative effects to the tortoise and its habitats; the mitigation and monitoring plans should use the best available science with a commitment to implement the mitigation commensurate to impacts to the tortoise and its habitats. Mitigation and monitoring should include a fully-developed desert tortoise translocation plan; tortoise predator management plan; non-native plants species management plan; fire prevention and management plan; compensation plan for the degradation and loss of tortoise habitat that includes protection of the acquired, improved, and restored habitat in perpetuity for the tortoise from future development and human use; a plan to protect tortoise translocation area(s) from future development and human use in perpetuity; and habitat restoration plan for the project site when the lease is terminated and the proposed project is decommissioned.

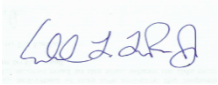
These mitigation and monitoring plans should include implementation schedules that are tied to key actions of the construction, operation, maintenance, decommissioning, and restoration phases of the project so that mitigation occurs concurrently with or in advance of the impacts. The plans should specify success criteria, include a monitoring plan to collect data to determine whether success criteria have been met, and identify actions that would be required if the mitigation measures do not meet the success criteria.

The Draft EIR, based on the results of the tortoise protocol surveys, must discuss the displacement of tortoises from the impact area. Will these tortoises be relocated into adjacent areas or are they to be translocated into distant areas? The Draft EIR should present the intended approach to relocating/translocating displaced tortoises. Additionally, there should be a discussion of previous translocation efforts, such as at Fort Irwin National Training Center and more recently at Twentynine Palms Marine Corps Base, to ensure that translocation standards are up-to-date and acceptable to both USFWS and CDFW.

We appreciate this opportunity to provide the above comments and trust they will help protect tortoises during any resulting authorized activities. Herein, we reiterate that the Council wants to be identified as an Affected Interest for this and all other projects funded, authorized, or carried out by San Bernardino County that may affect desert tortoises, and that any subsequent environmental documentation for this project is provided to us at the contact information listed above.

Please respond in an email that you have received this comment letter so we can be sure our concerns have been registered with the appropriate personnel and office for this Project.

Respectfully,



Edward L. LaRue, Jr., M.S.
Desert Tortoise Council, Ecosystems Advisory Committee, Chairperson

cc. Heidi Calvert, Regional Manager, Region 6 – Inland and Desert Region, California Department of Fish and Wildlife, Heidi.Calvert@wildlife.ca.gov
Brandy Wood, Region 6 – Desert Inland Region, California Department of Fish and Wildlife, Brandy.Wood@wildlife.ca.gov
Rollie White, Assistant Field Supervisor, Palm Spring Fish and Wildlife Office, U.S. Fish and Wildlife Office, rollie_white@fws.gov

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Appendix A. Demographic Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*)

We provide the following information on the status and trend of the listed population of the desert tortoise to assist the County with its analysis of the direct, indirect, and cumulative impacts of the proposed project on the Mojave desert tortoise.

BLM's implementation of a conservation strategy for the Mojave desert tortoise in its resource management plans through 2020 has resulted in the following changes in the status for the tortoise throughout its range and in Nevada from 2004 to 2014 (Table 1; USFWS 2015) and 2004 to 2020 (Table 2). There are 17 populations of Mojave desert tortoise described below that occur in the Critical Habitat Units (CHUs) and Tortoise Conservation Areas (TCAs); 14 are on lands managed by the BLM.

The Desert Tortoise Council (Council) has serious concerns about direct, indirect, and cumulative sources of human mortality for the Mojave desert tortoise given the status and trend of the species range-wide, within each of the five recovery units, and within the TCAs that comprise each recovery unit.

Densities of Adult Mojave Desert Tortoises: A few years after listing the Mojave desert tortoise under the Federal Endangered Species Act (FESA), the U.S. Fish and Wildlife Service (USFWS) published a Recovery Plan for the Mojave desert tortoise (USFWS 1994a). It contained a detailed population viability analysis. In this analysis, the minimum viable density of a Mojave desert tortoise population is 10 adult tortoises per mile^2 (3.9 adult tortoises per km^2). This assumed a male-female ratio of 1:1 (USFWS 1994a, page C25) and certain areas of habitat with most of these areas geographically linked by adjacent borders or corridors of suitable tortoise habitat. Populations of Mojave desert tortoises with densities below this density are in danger of extinction (USFWS 1994a, page 32). The revised recovery plan (USFWS 2011) designated five recovery units for the Mojave desert tortoise that are intended to conserve the genetic, behavioral, and morphological diversity necessary for the recovery of the entire listed species (Allison and McLuckie 2018).

Range-wide, densities of adult Mojave desert tortoises declined more than 32% between 2004 and 2014 (Table 1) (USFWS 2015). At the recovery unit level, between 2004 and 2014, densities of adult desert tortoises declined, on average, in every recovery unit except the Northeastern Mojave (Table 1). Adult densities in the Northeastern Mojave Recovery Unit increased 3.1% per year (SE = 4.3%), while the other four recovery units declined at different annual rates: Colorado Desert (–4.5%, SE = 2.8%), Upper Virgin River (–3.2%, SE = 2.0%), Eastern Mojave (–11.2%, SE = 5.0%), and Western Mojave (–7.1%, SE = 3.3%)(Allison and McLuckie 2018). However, the small area and low starting density of the tortoises in the Northeastern Mojave Recovery Unit (lowest density of all Recovery Units) resulted in a small overall increase in the number of adult tortoises by 2014 (Allison and McLuckie 2018). In contrast, the much larger areas of the Eastern Mojave, Western Mojave, and Colorado Desert recovery units, plus the higher estimated initial densities in these areas, explained much of the estimated total loss of adult tortoises since 2004 (Allison and McLuckie 2018).

At the population level, represented by tortoises in the TCAs, densities of 10 of 17 monitored populations of the Mojave desert tortoise declined from 26% to 64% and 11 have densities less than 3.9 adult tortoises per km^2 (USFWS 2015).

Population Data on Mojave Desert Tortoise: The Mojave desert tortoise was listed as threatened under the FESA in 1990. The listing was warranted because of ongoing population declines throughout the range of the tortoise from multiple human-caused activities. Since the listing, the status of the species has changed. Population numbers (abundance) and densities continue to decline substantially (please see Tables 1 and 2).

Table 1. Summary of 10-year trend data for 5 Recovery Units and 17 CHUs/TCAs for the Mojave desert tortoise, *Gopherus agassizii* (=Agassiz's desert tortoise). The table includes the area of each Recovery Unit and CHU/TCA, percent of total habitat for each Recovery Unit and CHU/TCA, density (number of breeding adults/km^2 and standard errors = SE), and the percent change in population density between 2004-2014. Populations below the viable level of 3.9 adults/km^2 (10 adults per mi^2) (assumes a 1:1 sex ratio) and showing a decline from 2004 to 2014 are in red (Allison and McLuckie 2018, USFWS 2015).

Recovery Unit Designated CHU/TCA	Surveyed area (km^2)	% of total habitat area in Recovery Unit & CHU/TCA	2014 density/km^2 (SE)	% 10-year change (2004–2014)
Western Mojave, CA	**6,294**	**24.51**	**2.8 (1.0)**	**–50.7 decline**
Fremont-Kramer	2,347	9.14	2.6 (1.0)	–50.6 decline
Ord-Rodman	852	3.32	3.6 (1.4)	–56.5 decline
Superior-Cronese	3,094	12.05	2.4 (0.9)	–61.5 decline
Colorado Desert, CA	**11,663**	**45.42**	**4.0 (1.4)**	**–36.25 decline**
Chocolate Mtn AGR, CA	713	2.78	7.2 (2.8)	–29.77 decline
Chuckwalla, CA	2,818	10.97	3.3 (1.3)	–37.43 decline
Chemehuevi, CA	3,763	14.65	2.8 (1.1)	–64.70 decline
Fenner, CA	1,782	6.94	4.8 (1.9)	–52.86 decline
Joshua Tree, CA	1,152	4.49	3.7 (1.5)	+178.62 increase
Pinto Mtn, CA	508	1.98	2.4 (1.0)	–60.30 decline
Piute Valley, NV	927	3.61	5.3 (2.1)	+162.36 increase
Northeastern Mojave	**4,160**	**16.2**	**4.5 (1.9)**	**+325.62 increase**
Beaver Dam Slope, NV, UT, AZ	750	2.92	6.2 (2.4)	+370.33 increase
Coyote Spring, NV	960	3.74	4.0 (1.6)	+ 265.06 increase
Gold Butte, NV & AZ	1,607	6.26	2.7 (1.0)	+ 384.37 increase
Mormon Mesa, NV	844	3.29	6.4 (2.5)	+ 217.80 increase
Eastern Mojave, NV & CA	**3,446**	**13.42**	**1.9 (0.7)**	**–67.26 decline**
El Dorado Valley, NV	999	3.89	1.5 (0.6)	–61.14 decline
Ivanpah Valley, CA	2,447	9.53	2.3 (0.9)	–56.05 decline
Upper Virgin River	**115**	**0.45**	**15.3 (6.0)**	**–26.57 decline**
Red Cliffs Desert	115	0.45	15.3 (6.0)	–26.57 decline
Total amount of land	**25,678**	**100.00**		**–32.18 decline**

Density of Juvenile Mojave Desert Tortoises: Survey results indicate that the proportion of juvenile desert tortoises has been decreasing in all five recovery units since 2007 (Allison and McLuckie 2018). The probability of encountering a juvenile tortoise was consistently lowest in the Western Mojave Recovery Unit. Allison and McLuckie (2018) provided reasons for the decline in juvenile desert tortoises in all recovery units. These included decreased food availability for adult female tortoises resulting in reduced clutch size, decreased food availability resulting in increased mortality of juvenile tortoises, prey switching by coyotes from mammals to tortoises, and increased abundance of common ravens that typically prey on smaller desert tortoises.

Declining adult tortoise densities through 2014 have left the Eastern Mojave adult numbers at 33% (a 67% decline of their 2004 levels) (Allison and McLuckie 2018, USFWS 2015). Such steep declines in the density of adults are only sustainable if there are suitably large improvements in reproduction and juvenile growth and survival. However, the proportion of juveniles has not increased anywhere in the range of the Mojave desert tortoise since 2007, and in the Eastern Mojave Recovery Unit the proportion of juveniles in 2014 declined from 14 to 11 percent (a 21% decline) of their representation since 2007 (Allison and McLuckie 2018).

The USFWS and Utah Division of Wildlife Resources have continued to collect density data on the Mojave desert tortoise since 2014. The results are provided in Table 2 along with the analysis USFWS (2015) conducted for tortoise density data from 2004 through 2014. These data show that adult tortoise densities in most Recovery Units continued to decline in density since the data collection methodology was initiated in 2004. In addition, in the Northeastern Mojave Recovery Unit that had shown an overall increase in tortoise density between 2004 and 2014, subsequent data indicate a decline in density since 2014 (USFWS 2016, 2018, 2019, 2020, 2022a, 2022b).

Table 2. Summary of data for Agassiz's desert tortoise, *Gopherus agassizii* (=Mojave desert tortoise) from 2004 to 2021 for the 5 Recovery Units and 17 CHUs/TCAs. The table includes the area of each Recovery Unit and CHU/TCA, percent of total habitat for each Recovery Unit and CHU/TCA, density (number of breeding adults/km^2 and standard errors = SE), and percent change in population density between 2004-2014 (USFWS 2015). Populations below the viable level of 3.9 breeding individuals/km^2 (10 breeding individuals per mi^2) (assumes a 1:1 sex ratio) (USFWS 1994a, 2015) or showing a decline from 2004 to 2014 are in **red.**

Recovery Unit: Designated CHU/TCA &	% of total habitat area in Recovery Unit & CHU/TCA	2014 density/ km^2 (SE)	% 10-year change (2004–2014)	2015 density/ km^2	2016 density/ km^2	2017 density/ km^2	2018 density/ km^2	2019 density/ km^2	2020 density/ km^2	2021 density/ km^2
Western Mojave, CA	**24.51**	**2.8 (1.0)**	**–50.7 decline**							
Fremont-Kramer	9.14	2.6 (1.0)	–50.6 decline	4.5	No data	4.1	No data	2.7	1.7	No data
Ord-Rodman	3.32	3.6 (1.4)	–56.5 decline	No data	No data	3.9	2.5/3.4*	2.1/2.5*	No data	1.9/2.5*
Superior-Cronese	12.05	2.4 (0.9)	–61.5 decline	2.6	3.6	1.7	No data	1.9	No data	No data
Colorado Desert, CA	**45.42**	**4.0 (1.4)**	**–36.25 decline**							
Chocolate Mtn AGR, CA	2.78	7.2 (2.8)	–29.77 decline	10.3	8.5	9.4	7.6	7.0	7.1	3.9
Chuckwalla, CA	10.97	3.3 (1.3)	–37.43 decline	No data	No data	4.3	No data	1.8	4.6	2.6
Chemehuevi, CA	14.65	2.8 (1.1)	–64.70 decline	No data	1.7	No data	2.9	No data	4.0	No data
Fenner, CA	6.94	4.8 (1.9)	–52.86 decline	No data	5.5	No data	6.0	2.8	No data	5.3
Joshua Tree, CA	4.49	3.7 (1.5)	+178.62 increase	No data	2.6	3.6	No data	3.1	3.9	No data

Recovery Unit: Designated CHU/TCA	% of total habitat area in Recovery Unit & CHU/TCA	2014 density/km^2 (SE)	% 10-year change (2004–2014)	2015	2016	2017	2018	2019	2020	2021
Pinto Mtn, CA	1.98	2.4 (1.0)	–60.30 decline	No data	2.1	2.3	No data	1.7	2.9	No data
Piute Valley, NV	3.61	5.3 (2.1)	+162.36 increase	No data	4.0	5.9	No data	No data	No data	3.9
Northeastern Mojave AZ, NV, & UT	**16.2**	**4.5 (1.9)**	**+325.62 increase**							
Beaver Dam Slope, NV, UT, & AZ	2.92	6.2 (2.4)	+370.33 increase	No data	5.6	1.3	5.1	2.0	No data	No data
Coyote Spring, NV	3.74	4.0 (1.6)	+ 265.06 increase	No data	4.2	No data	No data	3.2	No data	No data
Gold Butte, NV & AZ	6.26	2.7 (1.0)	+ 384.37 increase	No data	No data	1.9	2.3	No data	No data	2.4
Mormon Mesa, NV	3.29	6.4 (2.5)	+ 217.80 increase	No data	2.1	No data	3.6	No data	5.2	5.2
Eastern Mojave, NV & CA	**13.42**	**1.9 (0.7)**	**–67.26 decline**							
El Dorado Valley, NV	3.89	1.5 (0.6)	–61.14 decline	No data	2.7	5.6	No data	2.3	No data	No data
Ivanpah Valley, CA	9.53	2.3 (0.9)	–56.05 decline	1.9	No data	No data	3.7	2.6	No data	1.8

Recovery Unit: Designated CHU/TCA	% of total habitat area in Recovery Unit & CHU/TCA	2004 density/ km^2	2014 density/km^2 (SE)	% 10-year change (2004–2014)	2015	2016	2017	2018	2019	2020	2021
Upper Virgin River, UT & AZ	**0.45**		**15.3 (6.0)**	**–26.57 decline**							
Red Cliffs Desert**	0.45	29.1 (21.4-39.6)**	15.3 (6.0)	–26.57 decline	15.0	No data	19.1	No data	17.2	No data	
Range-wide Area of CHUs - TCAs/Range-wide Change in Population Status	**100.00**			**–32.18 decline**							

*This density includes the adult tortoises translocated from the expansion of the MCAGCC, that is resident adult tortoises and translocated adult tortoises.

**Methodology for collecting density data initiated in 1999.

Abundance of Mojave Desert Tortoises: Allison and McLuckie (2018) noted that because the area available to tortoises (i.e., tortoise habitat and linkage areas between habitats) is decreasing, trends in tortoise density no longer capture the magnitude of decreases in abundance. Hence, they reported on the change in abundance or numbers of the Mojave desert tortoise in each recovery unit (Table 2). They noted that these estimates in abundance are likely higher than actual numbers of tortoises, and the changes in abundance (i.e., decrease in numbers) are likely lower than actual numbers because of their habitat calculation method. They used area estimates that removed only impervious surfaces created by development as cities in the desert expanded. They did not consider degradation and loss of habitat from other sources, such as the recent expansion of military operations (753.4 km^2 so far on Fort Irwin and the Marine Corps Air Ground Combat Center), intense or large scale fires (e.g., 576.2 km^2 of critical habitat that burned in 2005), development of utility-scale solar facilities (as of 2015, 194 km^2 have been permitted) (USFWS 2016), or other sources of degradation or loss of habitat (e.g., recreation, mining, grazing, infrastructure, etc.). Thus, the declines in abundance of Mojave desert tortoise are likely greater than those reported in Table 3.

Table 3. Estimated change in abundance of adult Mojave desert tortoises in each recovery unit between 2004 and 2014 (Allison and McLuckie 2018). Decreases in abundance are in red.

Recovery Unit	Modeled Habitat (km^2)	2004 Abundance	2014 Abundance	Change in Abundance	Percent Change in Abundance
Western Mojave	23,139	131,540	64,871	-66,668	-51%
Colorado Desert	18,024	103,675	66,097	-37,578	-36%
Northeastern Mojave	10,664	12,610	46,701	34,091	270%
Eastern Mojave	16,061	75,342	24,664	-50,679	-67%
Upper Virgin River	613	13,226	10,010	-3,216	-24%
Total	**68,501**	**336,393**	**212,343**	**-124,050**	**-37%**

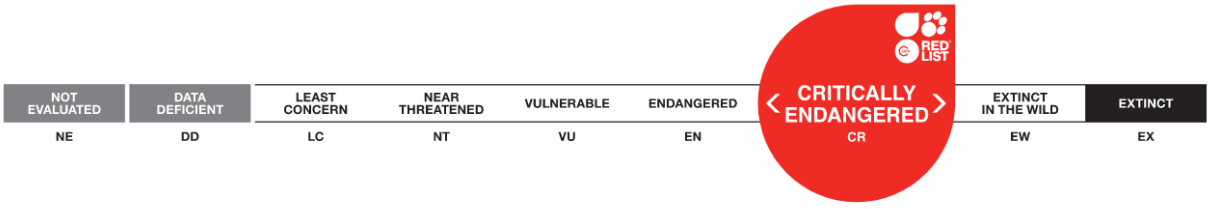
Habitat Availability: Data on population density or abundance does not indicate population viability. The area of protected habitat or reserves for the subject species is a crucial part of the viability analysis along with data on density, abundance, and other population parameters. In the Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994a), the analysis of population viability included population density and size of reserves (i.e., areas managed for the desert tortoise) and population numbers (abundance) and size of reserves. The USFWS Recovery Plan reported that as population densities for the Mojave desert tortoise decline, reserve sizes must increase, and as population numbers (abundance) for the Mojave desert tortoise decline, reserve sizes must increase (USFWS 1994a). In 1994, reserve design (USFWS 1994a) and designation of critical habitat (USFWS 1994b) were based on the population viability analysis from numbers (abundance) and densities of populations of the Mojave desert tortoise in the early 1990s. Inherent in this analysis is that the lands be managed with reserve level protection (USFWS 1994a, page 36) or ecosystem protection as described in section 2(b) of the FESA, and that sources of mortality be reduced so recruitment exceeds mortality (that is, lambda > 1)(USFWS 1994a, page C46).

Habitat loss would also disrupt the prevailing population structure of this widely distributed species with geographically limited dispersal (isolation by resistance Dutcher et al. 2020). Allison and McLuckie (2018) anticipate an additional impact of this habitat loss/degradation is decreasing resilience of local tortoise populations by reducing demographic connections to neighboring populations (Fahrig 2007). Military and commercial operations and infrastructure projects that reduce tortoise habitat in the desert are anticipated to continue (Allison and McLuckie 2018) as are other sources of habitat loss/degradation.

Allison and McLuckie (2018) reported that the life history of the Mojave desert tortoise puts it at greater risk from even slightly elevated adult mortality (Congdon et al. 1993; Doak et al. 1994), and recovery from population declines will require more than enhancing adult survivorship (Spencer et al. 2017). The negative population trends in most of the TCAs for the Mojave desert tortoise indicate that this species is on the path to extinction under current conditions (Allison and McLuckie 2018). They state that their results are a call to action to remove ongoing threats to tortoises from TCAs, and possibly to contemplate the role of human activities outside TCAs and their impact on tortoise populations inside them.

Densities, numbers, and habitat for the Mojave desert tortoise declined between 2004 and 2014 and densities continue to decline in most Recovery Units since 2014. As reported in the population viability analysis, to improve the status of the Mojave desert tortoise, reserves (area of protected habitat) must be established and managed. When densities of tortoises decline, the area of protected habitat must increase. When the abundance of tortoises declines, the area of protected habitat must increase. We note that the Desert Tortoise (Mojave Population) Recovery Plan was released in 1994 and its report on population viability and reserve design was reiterated in the 2011 Revised Recovery Plan as needing to be updated with current population data (USFWS 2011, p. 83). With lower population densities and abundance, a revised population viability analysis would show the need for greater areas of habitat to receive reserve level of management for the Mojave desert tortoise. In addition, we note that none of the recovery actions that are fundamental tenets of conservation biology has been implemented throughout most or all of the range of the Mojave desert tortoise.

IUCN Species Survival Commission: The Mojave desert tortoise is now on the list of the world's most endangered tortoises and freshwater turtles. It is in the top 50 species. The International Union for Conservation of Nature's (IUCN) Species Survival Commission, Tortoise and Freshwater Turtle Specialist Group, now considers Mojave desert tortoise to be Critically Endangered (Berry et al. 2021). As such, it is a "species that possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), a current population size of fewer than 50 individuals, or other factors." It is one of three turtle and tortoise species in the United States to be critically endangered. This designation is more grave than endangered.



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