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Via email and BLM NEPA ePlanning webpage

11 April 2024

Whitney Wirthlin and Matthew Klein
Bureau of Land Management, Southern Nevada District Office,
Attn: Rough Hat Clark Solar Project
4701 N Torrey Pines Drive
Las Vegas, NV 89130
BLM_NV_SND_EnergyProjects@blm.gov

RE: Draft Resource Management Plan Amendment and Environmental Impact Statement for the Rough Hat Clark Solar Project in Clark County, NV (DOI-BLM-NV-S010-2022-0063-EIS)

Dear Ms. Wirthlin and Mr. Klein,

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 northern 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. Given the location of the proposed project in habitats 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 that may be authorized by the Bureau of Land Management (BLM), which we recommend be added to project terms and conditions in the authorizing document (e.g., 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, the California Department of Fish and Wildlife (CDFW) (2024) 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 has been placed on the agenda for the next meeting [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."

Description of the Proposed Project and Alternatives

Candela Renewables, LLC (applicant) applied to the BLM's Las Vegas Field Office for a right-of-way (ROW) grant to provide the necessary land and access for the construction, operation, maintenance, and eventual decommissioning of the proposed Rough Hat Clark Solar Project (project). BLM has prepared this Draft Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (DEIS). The amendment to the 1998 Las Vegas Resource Management Plan (RMP) is to reclassify the Visual Resource Management (VRM) designation of the area.

BLM analyzed the No Action Alternative and two action alternatives.

> No Action Alternative – "BLM would not issue a ROW grant or amend the 1998 Las Vegas RMP. The Project would not be constructed, and existing land uses on the Project site would continue. The BLM would continue to manage the land consistent with the 1998 Las Vegas RMP."

Traditional or Proposed Action Alternative – The applicant would be approved to construct, operate and decommission a 400-megawatt photovoltaic power generating facility on 2,400 acres. This project includes a photovoltaic solar power generating facility with battery storage and interconnection to the regional transmission system. The electricity generated from the project would be collected at the onsite substation and conveyed to the authorized Trout Canyon substation located south of the project site via a generation gen-tie transmission line. Traditional construction methods would be used including clear and cut/drive and crush (estimated 1,215 acres) , and clear and cut with soil removal including grading (estimated 470 acres). Vegetation that regrows after construction would be maintained at a height of up to 18 inches during operation. Scraping, grading, and leveling would be limited to the extent possible and only for necessary components, such as roads, substation, operations and maintenance facilities, temporary construction office complex, temporary laydown areas, and some equipment pads (e.g., battery enclosures). Limited grading would also be necessary for on-site stormwater management features.

Alternative Action 1 – Resources Integration Alternative: This alternative would implement non-traditional development methods (overland travel). Avoidance of vegetation includes about 560 acres, overland travel on about 890 acres, clear and cut/drive and crush on about 590 acres, and clear and cut with soil removal including grading on about 400 acres.

Wildlife access holes (12 inches x 12 inches) would be installed in the security fencing to allow for use by small mammals. They are not intended for tortoises but tortoise may use them.

The action alternatives would include facilities to produce up to a 400-megawatt (MW) alternating current (AC) solar photovoltaic (PV) power generating facility with up to 700 MW of battery energy storage and associated interconnection to the regional transmission system gen-tie line and access road facilities on approximately 2,433 acres of BLM-managed public land located in the Pahrump Valley in Clark County, Nevada, southeast of the town of Pahrump, and approximately 38 miles west of the city of Las Vegas.

The project is one of six currently identified utility scale solar projects and transmission lines built or proposed in habitat for the Mojave desert tortoise south of Pahrump, Nevada in the Pahrump Valley.

Comments on the DEIS/RMPA

Proposed Action Alternatives

BLM describes two action alternatives in addition to the no action alternative. Both action alternatives would impact the same location and have the same footprint.

The Council's persisting concern is that proponents of solar projects continue to identify a single site for development without any attempt to identify alternative sites. As such, when focused studies reveal significant accumulations of tortoises on the proponent's selected site, and indicative of intact habitat for the tortoise, because there is only one site identified for the project, there is no opportunity to select an alternative site where impacts to tortoises/tortoise habitat would be minimized. As such, we request that more than one site, preferably three, be identified and analyzed in the FEIS. The Council believes that sites considered for utility-scale solar projects should not include suitable tortoise habitat. Our reasons for this statement are explained throughout this comment letter.

If that is infeasible, we ask that the "action area" be several times larger than the project footprint so that those portions of the site with fewer tortoises could be selected. Proponents of the Gemini Solar Site in southern Nevada ignored these same recommendations, and displaced more than 100 tortoises, when based on their presence-absence tortoise surveys moving the site to the east would have avoided many of those animals. This is because tortoise habitat and tortoise distribution is not uniform (Krzysik 2002); it is patchy.

To comply with section 102(2)(E) of the National Environmental Policy Act (NEPA), there should be one or more additional action alternatives presented in the EIS. This requirement is supported by BLM's NEPA Handbook (2008). The BLM NEPA Handbook directs BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources…". These alternatives should be sufficiently broad and meet the purpose and need of the Proposed Action. BLM should not make the Proposed Action or Purpose and Need so narrow as to eliminate alternatives that have substantially fewer impacts to the human environment. However, BLM has developed a narrow Proposed Action and Purpose by accepting the specific location for the project that the applicant identified. Now that BLM has data on the abundance of tortoises on the project site, the Council requests that BLM develop other alternatives that avoid this population of tortoises.

Alternatives Considered but Eliminated from Further Analysis

BLM described seven alternatives that were considered but eliminated from further analysis in the EIS. One alternative considered but dismissed was the Area of Critical Environmental Concern Alternative. This alternative was not analyzed in detail because "it is inconsistent with the BLM policy objectives related to the identification, evaluation, and designation of ACECs." "BLM determined that desert tortoise habitat in the Project area had "relevance" based on presence throughout the Project area (43 CFR § 1610.7-2(a)(1), MS-1613.11(A)), but did not meet the "important" criterion (43 CFR § 1610.7-2(a)(1), MS-1613.11(B)). The desert tortoise habitat in the Project area did not meet the "Important" criterion because the habitat within the project area is not geographically unique or uncommon across the range of the Mojave Desert, and habitat connectivity would not be severed if the area is developed because sustainable connectivity would remain throughout a significant geographical area in the Pahrump Valley, including the Stump Springs Regional Augmentation site and the Trout Canyon Translocation area that serve as protection areas for desert tortoise genetic connectivity and habitat."

The Council requests that BLM provide data and citations that support these conclusions as required by NEPA implementing regulations. Further, the Council requests that BLM provide documentation that it coordinated with USFWS's Desert Tortoise Recovery Office (DTRO) on this alternative and USFWS concurred with BLM's reasons for the Pahrump Valley not meeting the "Important" criterion. The connectivity issue for the tortoise and other wildlife is that areas are important if they serve as connectivity area for species to adjust geographically to the impacts of climate change. This adjustment will likely include range shifts to the north. The north-south oriented Pahrump Valley would connect tortoises to habitats to the north. Thus, connectivity is important for both current demographic, ecological, and genetic needs as well as future needs to deal with climate change.

BLM should explain in the FEIS why the apparent "high" density of tortoises in the project area and nearby at the Yellow Pine Solar Project are not indications of important tortoise populations or an indicator of important tortoise habitat. Referring to Attachment A, the data on the status and trend of tortoise populations at Tortoise Conservation Areas (TCAs) managed by BLM show a long term declining trend in the Eastern Mojave Recovery Unit – 67 percent between 2004 and 2014 (Allison and McLuckie 2018). Densities of adult tortoises are not improving but are remaining well below the viability threshold of 3.9 breeding tortoise per $km^{2.}$ The Eldorado TCA has an estimated adult tortoise density of 2.3 per km^2 (USFWS 2020) and the Ivanpah Valley TCA has an estimated density of 1.8 per km^2 (USFWS 2022). Rangewide, most population densities on BLM land are below the threshold for population viability. With the Rough Hat Solar Project, BLM proposes to develop land in one of the few locations on BLM land, the Pahrump Valley, where tortoise densities are above the threshold for population viability in the Eastern Mojave Recovery Unit.

The Council requests that BLM implement the NEPA regulations discussed below under "Using Current Scientific Data and Recommendations for Management and Decisionmaking" and coordination with the USFWS when developing its decision on whether the tortoise population and habitat in the project area/Pahrump Valley is /is not important.

Connectivity

We are very concerned that the placement of this solar project and the existing and numerous proposed solar projects adjacent to this project will fragment regional connectivity between tortoises in adjacent areas. In addition, we are concerned the proposed solar project/other solar projects in the Pahrump Valley will impact the tortoise's ability to move in response to the impacts of climate change. The placement of the facility would contribute to fragmenting this corridor and may substantially reduce or destroy its function in the future as a wildlife corridor. Please see our comments under "Cumulative Impacts" as the Pahrump Valley is experiencing more development and use.

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 and others 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. (2013) cautioned that in areas proposed for essentially permanent habitat conversion, such as by large-scale development, there is the risk that critical linkages will be severed before they are protected. For species with long generation times like the Mojave desert tortoise, this risk is compounded by the fact that we are not likely to detect a problem with a population until well after we have reduced the habitat below its extinction threshold.

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 and others, 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, tortoises may make periodic forays of more than 7 miles (11 kilometers) at a time (Berry 1986).

Information from scientific publications and reports like these should be used to support the existence or absence of effective wildlife linkages in the project area and nearby for the tortoise and other special status species.

The fundamentals of conservation biology include the need for gene flow between populations to maintain genetic diversity and access nearby areas; this enables a species to more likely survive, especially during climate change, which enables biodiversity. Thus, linkage habitats are **important** habitats (please see the discussion above on ACEC designation) as they provide connectivity among wildlife populations to maintain viability and biodiversity in their current distributions as well as future ones when adapting to climate change.

The Council on Environmental Quality (CEQ) (2023) recently issued Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors. The purpose of this document is for Federal agencies to consider "how their actions can **support** [emphasis added] the management, long-term conservation, enhancement, protection, and restoration of year-round habitat, seasonal habitat, stopover habitat, wildlife corridors, watersheds, and other landscape/waterscape/seascape features and processes that promote connectivity." "The objective is to build consideration of connectivity and corridors into the early steps of these [planning] processes to facilitate easy implementation."
CEQ applies this guidance to the following areas:

- Agency planning and decision-making
- Science and data
- Collaboration and coordination.

For the first bullet, agency planning and decision-making, CEQ specifically identifies the following focal areas where connectivity and corridors should be considered early in planning, funding, and decision-making:

- Energy development planning and permitting
- Rangeland planning and management

- Hard rock mining and mineral exploration and development planning and permitting
- Public land planning and management
- Recreation planning
- Telecommunications infrastructure and management
- Transportation planning and use management

In addition, CEQ identifies best practices that should be incorporated into planning and decision-making, gathering baseline information to assess public lands for connectivity and corridor values, using science and data to develop performance measures and metrics to assess whether and how Federal agencies collectively are promoting greater connectivity across terrestrial habitats.

For the second bullet, science and data, CEQ says, "Federal agencies should address how the best available science and data will inform planning and decision-making, and consider approaches to identify and address gaps in available science and data." CEQ describes the types of science and data to be used and the sharing of science and data.

For the third bullet, collaboration and coordination, Federal agencies "should support strategic collaborations and partnerships to advance work on connectivity and corridors," and "should promote both intra- and interagency coordination and collaboration, to ensure that planning and information regarding connectivity and corridor efforts are not siloed within individual agencies or within distinct programs within a single agency." In the DEIS, BLM shows a narrow corridor as priority 1 desert tortoise connectivity habitat running along part of the California-Nevada border and terminating on the south side of Pahrump. Similarly, the priority 2 desert tortoise connectivity habitat stops on the southeast side of Pahrump just north of Trout Canyon but starts on the northeast side of Pahrump. Because the connectivity habitat is not connected/continuous, BLM should reach out to the Town of Pahrump and landowners in California including the BLM California Desert District to explore collaborative opportunities to enhance connectivity across jurisdictional boundaries as part of the process in developing and managing the Pahrump Valley and Eastern Mojave Recovery Unit. This collaborative effort and its results should be described in the FEIS and RMPA.

Because CEQ has identified energy development planning and permitting as a focal area where connectivity and corridors should be considered early in planning, funding, and decision-making, and because BLM is undertaking solar energy development in its planning, funding, and decision-making for the Rough Hat Clark Solar Project DEIS, we request that BLM explain in the FEIS how BLM is complying with this CEQ guidance. Please explain how the all the action alternatives would comply with the purpose and objective of this guidance including enabling "wildlife to adapt to fluctuating environmental conditions, including those caused by climate change" including the tortoise. In addition, the FEIS should demonstrate how BLM is implementing "consistent Federal action on connectivity and corridors" with other Federal agencies in agency planning and decision-making, science and data, and collaboration and coordination."

In addition, BLM should ensure that it has included the latest information on what is needed for effective connectivity among tortoise populations, including location, size, allowable uses, arrangement, and facilitation for adapting to the impacts of climate change.

Relying on an Outdated Resource Management Plan

BLM describes the applicable objective, policy, goal, or requirement of the 1998 Las Vegas RMP that apply to the tortoise as "[m]anage desert tortoise habitat to achieve the recovery criteria defined in the Tortoise Recovery Plan (USFWS 1994)" and "Areas of Critical Environmental Concern (ACECs), "[p]rotect areas with significant cultural, natural, or geological values by establishing areas of critical environmental concern."

The recovery or delisting criteria from the 1994 Recovery Plan (USFWS 1994) include:

(1) As determined by a scientifically credible monitoring plan, the population within a recovery unit must exhibit a statistically significant upward trend or remain stationary for at least 25 years (one desert tortoise generation);
(2) enough habitat must be protected within a recovery unit, or the habitat and desert tortoise populations must be managed intensively enough to ensure long-term viability;
(3) provisions must be made for population management within each recovery unit so that discrete population growth rates (lambdas) are maintained at or above 1.0;
(4) regulatory mechanisms or land management commitments must be implemented that provide for long-term protection of desert tortoises and their habitat.

The Recovery Plan also stated, "[t]o insure population persistence the Plan proposes multiple DWMAs [Desert Wildlife Management Areas, now called TCAs] connected by protected functional habitat…" and "maintaining linkages among habitat patches within DWMAs and among the DWMAs themselves is considered here to be important."

The project and the Pahrump Valley are located in the Eastern Mojave Recovery Unit. The demographic data for the tortoise in the Eastern Mojave Recovery Plan show a downward trend and overall densities lower than the viability threshold (please see Attachment A). The Council concludes that since the 1998 RMP was adopted, BLM management has failed to reverse this ongoing demographic decline and is not making progress in meeting the objective, policy, goal, or requirement of the 1998 Las Vegas RMP that apply to the tortoise.

The Council argues that the DEIS and RMPA should be revised beginning with saying "manage desert tortoise habitat to achieve the recovery criteria defined in the Tortoise Recovery Plan (USFWS 1994) and the Revised Recovery Plan (USFWS 2011). This is necessary because the 1994 Recovery Plan did not include the impacts of climate change on the tortoise when recommending recovery tasks, including the need of the species to move with changing climatic factors.

The Council has submitted numerous comment letters to BLM that they should revise the 1998 RMP (1) to reflect the abundance of data on the declining status and trend of the tortoise and increasing number and intensity of threats to the species in southern Nevada, and (2) implement effective management to improve the demographic condition of the tortoise in the area covered by the RMP. However, BLM has not implemented these requested actions.

BLM should take this opportunity to update the RMP for what is needed for the survival and recovery of the tortoise in the planning area.

Using Scientific Data for Management and Decisionmaking

BLM's failure to include and analyze the best available science with respect to tortoise survival and recovery in an amended RMP means that BLM is ignoring the last 24 years of data on the tortoise with an out-of-date RMP and applying this out-of-date RMP when assessing compliance of the project

By relying on compliance with the 1998 RMP, BLM appears to be saying it is ignoring scientific data on the tortoise that have been analyzed and published during the 24 years since the RMP was adopted. This does not demonstrate compliance with CEQ regulations. We refer BLM to 40 Code of Federal Regulations (CFR) 1507(2)(a) that directs federal agencies to "insure the integrated use of the natural and social sciences and the environmental design arts in planning and in **decisionmaking** [emphasis added] which may have an impact on the human environment;" 40 CFR 1500.1(b) "The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA;" 40 CFR 1502.22(b) "(3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and 40 CFR 1502.24 Methodology and scientific accuracy – "Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements." Relying on a 24-year old RMP rather than using the most recent scientific data is not acceptable.

In addition, the 1998 RMP is carefully worded to say "protect areas with significant cultural, natural, or geological values by establishing areas of critical environmental concern." Establishing an ACEC is an administrative action. What is crucial is that the ACEC is effectively managed so it protects these areas. The RMP should be revised to include requirements to implement effective management of the ACECs established for the tortoise in the 1998 RMP. What is missing from the 1998 RMP is the need for maintaining linkages among habitat patches within DWMAs, among the DWMAs, to facilitate movement of the tortoise's habitat/range because of climate change.

The Council reiterates that BLM should revise the Las Vegas RMP with respect to the tortoise so BLM's management of the tortoise/tortoise habitat in the Las Vegas planning area reflects the increased management needs of the tortoise for its survival and recovery.

Compliance with the Federal Endangered Species Act (FESA)

BLM seems to be confused with respect to its responsibilities. For example, on page 1-4 under "Applicable objective, policy, goal, or requirement summary," BLM says, "SS-3 – Manage desert tortoise habitat to achieve the recovery criteria defined in the Tortoise Recovery Plan (USFWS 1994)." Next to it under "Summary of conformance" to this objective, policy, goal or requirement is "The Project would require a Biological Opinion from the USFWS to ensure it does not result in substantial effects to desert tortoise. The Applicant would incorporate Solar PEIS Programmatic Design Features ER-2-1, SNDO Project Design Feature Gen-1 and Wild-1, and mitigation measures to reduce effects to desert tortoise and their habitat."

Minimizing impacts to the tortoise does not result in achieving recovery criteria. Rather, it results in additional losses to tortoises numbers; tortoise recruitment; habitat quality, quantity, and configuration; and habitat needed for connectivity of tortoise populations to maintain genetic and demographic viability and adapt to the impacts of climate change. Unfortunately, the demographic data from the Tortoise Conservation Areas (TCAs) in the five recovery units (please see Attachment A) demonstrate that BLM's practice of reducing effects from authorized uses on BLM lands is driving the tortoise toward extirpation, not recovery.

Under section 7(a)(1) of the Endangered Species Act, Congress states that all federal agencies "…shall… utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act." In Section 3 of the FESA, "conserve," "conserving," and "conservation" mean "to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition…" "[A]t which the measures provided pursuant to this Act are no longer necessary" means recovery of the species.

The Council believes that the data in the attachment ("Attachment A. Demographic Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*) including the Eastern Mojave Recovery Unit") demonstrate that BLM's management of the Mojave desert tortoise and its habitat under the 1998 RMP has not been effective in meeting Congress's mandate to BLM's in Section 7(a)(1) to carrying out programs for its conservation.

We are unsure whether BLM will consider/propose additional utility scale solar projects in the area or other development/use projects that are not compatible with tortoise management, survival and recovery. The project area and adjacent areas appear to support a small viable population of Mojave desert tortoise. This conclusion is supported by the number of tortoises that were found on the adjacent Yellow Pine Solar Project. During tortoise clearance surveys at the Yellow Pine Solar Project site, almost three times as many tortoises were found than predicted. The Council is concerned that this situation may also occur at Rough Hat Solar Project site.

Unfortunately, most of the tortoise populations located in Tortoise Conservation Areas (e.g., critical habitat, Areas of Environmental Concern, etc.) have tortoise densities that are below the density needed for population viability (USFWS 1994). Because the demographic trend for the tortoise has been one of ongoing declines in population density and numbers since listing (see Attachment A Demographic Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*) including the Eastern Mojave Recovery Unit"), and a trajectory of extirpation for populations in some TCAs in the near future has been calculated (Allison and McLuckie 2018, USFWS 2015), it is imperative that BLM do more than it has to ensure that the tortoise will survive and persist in the future. This is the BLM's responsibility under section 7(a)(1) of the FESA.

To meet its Section 7(a)(1) responsibilities, the BLM needs to adopt and implement effective management actions that will provide for the short-term and long-term conservation of the tortoise in each and all recovery units. This includes managing for population/habitat connectivity and managing habitats to facilitate the movement of listed species in response to climate change. BLM is proposing to approve the construction of utility-scale solar projects in locations with tortoise populations with some of the highest known densities in southern Nevada. When most other populations are below the threshold for population viability, approval of this project does not demonstrate compliance with this section of the FESA.

BLM should demonstrate in the FEIS and the RMP how it is complying with section 7(a)(1), that is, how it is effectively managing desert tortoise habitat to achieve the recovery criteria defined in the Tortoise Recovery Plan.

Compliance with Federal Land Policy and Management Act (FLPMA)

FLPMA directs the Secretary of the Interior (and therefore BLM) to manage the public lands under principles of multiple use and sustained yield. The term "sustained yield" means the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use.

Further, FLPMA defines "principal or major uses" to include and "be limited to, domestic livestock grazing, fish and wildlife development and utilization, mineral exploration and production, rights-of-way, outdoor recreation, and timber production." Consequently, BLM regulations and implementation of resource management plans should include fish and wildlife development and utilization as a principal or major use. This principal use would include the tortoise.

Referring to Attachment A, the data on the status and trend of tortoise populations at TCAs managed by BLM show a long term declining trend with most population densities below the threshold for population viability. With the Rough Hat Clark Solar Project, BLM proposes to develop land in one of the few locations on BLM land where tortoise densities are above the threshold for population viability. Consequently, the Council has serious concerns about BLM's commitment to manage effectively for the sustained yield of the tortoise. In the FEIS, BLM should demonstrate how it is complying with FLPMA and providing for the sustained yield of tortoises on BLM land that hosts the majority of populations of the Mojave desert tortoise.

Further, FLPMA says, "In the development and revision of land use plans, the Secretary [of the Interior] shall … use a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic, and other sciences." The Council requests that BLM amend the RMP to reflect the new data and recommendations published by the scientific community on the tortoise and its habitat needs for survival and recovery during the last 24 years since the plan was adopted.

Impacts to Tortoises/Tortoise Habitat from the Proposed Project

Devitt et al (2022) studied "the impact of utility scale PV [photovoltaic] systems on adjacent desert ecosystems, where the soil–plant–water–atmospheric system was assessed." According to Devitt er al. (2022), utility scale solar energy projects result in significant unintended impacts on desert ecosystems by altering surface hydrology, energy balances and surface air temperatures, biodiversity and ecosystem services, and causing habitat fragmentation.

Heat Island Effect: Devitt et al. (2022) reported that large photo voltaic facilities similar to the proposed Rough Hat Clark Solar Project raised the air and soil temperatures not only on the project site but significant heat was moving from the solar facility into the plant community, especially in the first 200–400 m (656 to 1,312 feet) off the project site. This rise in temperature also impacts the availability of soil moisture and the ability of burrowing animals such as the tortoise in nearby areas to reduce their body temperatures at night to conserve energy and moisture. The impacts of elevated soil and air temperatures to areas adjacent to the proposed project should be analyzed in the FEIS including impacts to the survival, growth, and recruitment of native vegetation if this area is to be managed for wildlife use including use by tortoises.

Photovoltaic facilities can also alter the energy balance by generating heat (Broadbent et al. 2019). Nighttime temperatures over photovoltaic plants are regularly 3–4 degrees C warmer than over wildlands, representing a heat island effect (Devitt et al 2022). In addition, significant heat was moving from the solar facility into the plant community, especially in the first 200–400 meters (656 to 1,312 feet) off the project site. As the warmer air was displaced down gradient, the temperature front advanced into the creosote—bursage plant community with values 5 to 8 degrees C warmer at the 1 m height.

With implementation of either action alternative, a majority of the volume of above-ground biomass of perennial vegetation would be removed at the project site. All vegetation under the PV panels would be no taller than 12 inches. This mowing would result in a substantial reduction in plant biomass that provides shade and evapotranspiration that cools air and ground temperatures, and would likely result in a substantially reduced ability of the surviving vegetation to reduce air and ground temperatures at the project site. Ongoing maintenance activities to prune the vegetation under and adjacent to the PV panels would keep this ability to reduce air and soil temperatures at a reduced level from the pre-project level.

Soil Moisture and Surface Hydrology: Devitt et al. (2022) reported that "Construction of roads, transmission lines and utility scale solar photovoltaic facilities can decouple up-gradient washes from down-gradient locations." They reported that the decoupling of the wash system at the solar site "led to a significant decline in soil moisture, canopy level NDVI [normalized difference vegetation index] values and mid-day leaf xylem water potentials." Over time especially combined with climate change, this impact may result in reduced plant reproduction, growth, and survival for plants downgradient of the decoupling sites including plants not on the project site.

According to the DEIS, one action alternative would use a methodology for the PV solar panels to be installed and maintained with little or no grading of the surface area. Implementation of this methodology would ensure that the existing surface flows are not decoupled or disrupted and the existing surface flows that convey surface water downgradient from the southwest portion of the project to the northeast portion are maintained. Disruption of existing surface hydrology would likely impede the already slow growth rate of perennial vegetation or may result in plant mortality both on the project site and downgradient. When plants die, they release carbon from their roots, stems, and leaves into the atmosphere and contribute to climate change. Given the current climate change conditions, there is an increasing need for carbon sequestration, not carbon release, therefore, an increasing need to, as a minimum, maintain native plants and not disrupt the surface hydrology of the project site.

Fragmentation: Fragmentation of desert ecosystems can be expected with large scale solar energy especially from the high-density placement of these facilities, which can be anticipated based on the investment in grid infrastructure in a given area (Devitt et al. 2022). BLM's proposed high density placement of solar projects would likely have indirect impacts to the suitability/effectiveness of the priority 1 desert tortoise connectivity habitat and priority 2 priority 1 desert tortoise connectivity habitat adjacent to these solar projects. BLM should analyze this in the FEIS using information provided above under "Connectivity" and other available data.

Deserts are fragile ecosystems with recovery from disturbances predicted to take from decades to centuries (Abella 2010), if ever. It is far more expensive to maintain unviable habitats for threatened species than to simply leave viable areas undisturbed when such options are still available. (Devitt et al. 2022).

Cumulative Impacts

In the cumulative impacts analysis of the FEIS, please revise it to ensure that the CEQ's "Considering Cumulative Effects under the National Environmental Policy Act" (1997) is followed, including the eight principles, when analyzing cumulative effects of the proposed action to the affected resource issues. This CEQ document is referred to in BLM's National Environmental Policy Act Handbook (BLM 2008).

CEQ states, "Determining the cumulative environmental consequences of an action requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern. The range of actions that must be considered includes not only the project proposal but all connected and similar actions that could contribute to cumulative effects." The analysis "must describe the response of the resource to this environmental change." Cumulative impact analysis should "address the sustainability of resources, ecosystems, and human communities."

CEQ's guidance on how to analyze cumulative environmental consequences, which contains eight principles listed below:

1. Cumulative effects are caused by the aggregate of past, present, and reasonable future actions.
The effects of a proposed action on a given resource, ecosystem, and human community, include the present and future effects added to the effects that have taken place in the past. Such cumulative effects must also be added to the effects (past, present, and future) caused by all other actions that affect the same resource.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, non-federal, or private) has taken the actions.
Individual effects from disparate activities may add up or interact to cause additional effects not apparent when looking at the individual effect at one time. The additional effects contributed by actions unrelated to the proposed action must be included in the analysis of cumulative effects.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.
Environmental effects are often evaluated from the perspective of the proposed action. Analyzing cumulative effects requires focusing on the resources, ecosystem, and human community that may be affected and developing an adequate understanding of how the resources are susceptible to effects.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.

For cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly or the effects are no longer of interest to the affected parties.

5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
Resources are typically demarcated according to agency responsibilities, county lines, grazing allotments, or other administrative boundaries. Because natural and sociocultural resources are not usually so aligned, each political entity actually manages only a piece of the affected resource or ecosystem. Cumulative effects analysis on natural systems must use natural ecological boundaries and analysis of human communities must use actual sociocultural boundaries to ensure including all effects.

6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects.

7. Cumulative effects may last for many years beyond the life of the action that caused the effects.
Some actions cause damage lasting far longer than the life of the action itself (e.g., acid mine damage, radioactive waste contamination, species extinctions). Cumulative effects analysis needs to apply the best science and forecasting techniques to assess potential catastrophic consequences in the future.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.
Analysts tend to think in terms of how the resource, ecosystem, and human community will be modified given the action's development needs. The most effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource.

Note that CEQ recognizes that synergistic and interactive impacts as well as cumulative impacts should be analyzed in the NEPA document for the resource issues.

We request that the FEIS (1) include these eight principles in its analysis of cumulative impacts to the Mojave desert tortoise; (2) address the sustainability of the tortoise in/near the project area, the Eastern Mojave Recovery Unit, and rangewide (e.g., #3, 5, and 8); and (3) analyze, using the best available science, the sustainability of the Pahrump Valley as a north-south corridor for connectivity for the tortoise especially with the impacts of climate change evaluated. Once this has been completed, then BLM is in a position to determine whether the cumulative impacts can be effectively mitigated to ensure the survival and recovery of the tortoise in the Eastern Mojave Recovery Unit or whether the project cannot be approved. If BLM determines the cumulative impacts can be effectively mitigated to ensure the long-term survival and recovery of the tortoise in the Eastern Mojave Recovery Unit, then BLM should include in the FEIS effective science-based mitigation, monitoring, and adaptive management that protect desert tortoises and their habitats in the Pahrump Valley during the construction, operations and maintenance, and decommissioning of the proposed project.

In addition, we request that BLM add this project and its impacts to a BLM database and geospatial tracking system for special status species, including Mojave desert tortoises, that track cumulative impacts (e.g., surface disturbance, paved and unpaved routes, linear projects, non-natives species occurrence, herbicide /pesticide use, wildfires, etc.), management decisions, and effectiveness of mitigation for each project. Without such a tracking system, BLM is unable to analyze cumulative impacts to special status species (e.g., desert tortoises) with any degree of confidence.

We request that the environmental consequences section of the FEIS include a thorough analysis of these indirect and cumulative effects mentioned in this letter (40 Code of Federal Regulations 1502.16) and implement appropriate mitigation to maintain the function of population connectivity for the Mojave desert tortoise and other wildlife species throughout the Pahrump Valley

Techno-ecological synergies (TES)

When BLM is considering locations for solar projects, the Council recommends using a wholistic method. Currently, BLM appears to be focused only on increasing renewable energy production by a quantifiable amount with the assumption this will reduce GHG emissions by that amount. It does not appear to be considering the actual reduction in GHG emissions from the construction and operation of each solar project or impacts to other resources in its accounting process.

The Council suggest that BLM use a system that emphasizes calculating GHG emissions by life-cycle analysis and related methods. One such system is TES (Hernandez et al. 2019), a systems-based approach to sustainable development. For example, if solar energy development leads to diminished extent of perennial plant communities, then hazardous GHG emissions, dust emissions and soil-borne pathogens may increase and the benefits from the solar energy development are diminished. TES measures the quantity of resources withdrawn from (for example, water withdrawal and habitat loss) or materials released into (for example, CO2 emissions and nutrient runoff) the environment.

Is Translocation Effective Mitigation

BLM is proposing to translocate tortoises as a mitigation measure to minimize the loss of tortoises. We found no effective mitigation proposed in the DEIS for the loss of tortoise habitat.

Unfortunately, translocation of tortoises has not been successful. Mack and Berry (2023) monitored translocated tortoise for 10 years. They reported that 17.7 percent of the tortoises survived, 65.8 percent died, 15.2 percent were missing, and 1.3 percent were removed from the study because they returned to the original site. Mortality was high during the first three years – more than 50 percent of the tortoises died primarily from predation. Thereafter, mortality declined but remained high. Although the translocation efforts by the Maine Corps at Twentynine Palms considered many of these factors, tortoise mortality from predation was high (Henen 2024). To minimize mortality to small tortoises, these animals were brought into headstart facilities. The Marine Corps continues to monitor the translocated tortoises.

In addition, Mulder (2017) studied translocated tortoises during the first four years and learned that male translocated tortoises did not produce offspring with resident or translocated female tortoises. This absence of successful mating at the translocation site is concerning, because it means the genes of these translocated male tortoises were not added to the population at the translocation site. Thus, the hypothesized benefits of genetic diversity from translocation were not fully realized.

The "success" of translocation depends on a myriad of factors including the absence of drought, the ability of the translocation area to support additional tortoises (e.g., availability of native nutritious forage, etc.), social interactions between resident and translocated tortoises, the distance translocated tortoises are moved, effective management of translocation lands to eliminate human-caused threats, and elevated predation.

These and other factors should be addressed in a translocation plan. Using current information, a translocation plan should address the following questions:

- Where is the translocation site and what are the current and adjacent land ownership and uses (please include a map)?
- How far is the translocation site from the project area (translocation sites located close to the site from which tortoises are removed appear to contribute to higher tortoise survival (Mack and Berry 2023) ?
- Who will manage the translocation site?
- How will it be managed in the future because it is a mitigation site; if on BLM land, it is no longer a multiple use site?
- Tortoises should not be released at the translocation site in a year/years with less than average rainfall.
- What are the results of tortoise surveys at the translocation site and of native vegetation surveys including annual native and non-native vegetation?
- What other activities will be allowed at the translocation site and adjacent areas (e.g., mining, grazing, OHV access, utility access, other activities that result in surface disturbance) ?
- How will management be implemented and effectively enforced?
- How and when will monitoring occur (monitoring schedule) and what environmental parameters besides tortoises will be monitored?
- How long will tortoises and environmental parameters be monitored – monitoring should occur for multiple years?
- When monitoring indicates a change in management is needed, when will this change occur (adaptive management) ?
- Who will fund the translocation plan and for how long?
- Will the translocation plan include management of tortoise predators?
- How will small tortoises be managed and monitored?

The Council contends that a translocation site is a mitigation site, and when located on BLM land, BLM is obligated to remove it from multiple use management (i.e., no activities that result in surface disturbance, removal of non-native species, etc.), and allow only uses that are documented to be compatible with tortoise conservation (i.e., survival **and** recovery).

The results of these translocation studies indicate that translocation of Mojave desert tortoises to date has not been shown to be an effective or successful mitigation method. Thus, avoidance of impacts to tortoises/tortoise habitat should be the preferred solution when projects that may result in the loss of tortoises are proposed. Translocation should be the last mitigation choice, not the first one. Rather than approving projects in tortoise habitat, especially lands with tortoise densities above the viability threshold, BLM should approve projects located outside of occupied tortoise habitat, critical habitat, and habitat identified for connectivity/movement in response to climate change. FLPMA identifies wildlife as a use and BLM should be managing it as a use. BLM should revisit the statute and Congress's intent, and ensure that its regulations for implementing FLPMA comply with the statute.

Mitigation Plans

The DEIS mentions that a Translocation Plan will be developed but one is not provide in the DEIS for the public to review. The Translocation Plan and all other mitigation plans should have been provided in the DEIS so the public can review them and determine the effectiveness of the proposed mitigation. Stating that a mitigation plan will be developed even if this statement includes "using the best available science" is not adequate or appropriate, as the preparers are not always experts on the best available science for that specific subject. When mitigation plans are included in the public review process, this provides the public with the opportunity to provide comments based on their diverse knowledge and experience regarding the adequacy and soundness of the proposed mitigation plans. This public review process increases the likelihood that the mitigation plans when reviewed and finalized will be effective when implemented.

The Council requests that all mitigation plans be included in the FEIS so the public may comment on them and the decisionmaker will be able to review them and the public's comments to determine the effectiveness before making a decision. Mitigation plans mentioned but not included in Appendix B, PDFs, Mitigation, and Plans of the DEIS that are relevant to the tortoise/tortoise habitat include: Dust Control and Air Quality Plan, Dust Abatement Plan, Site Restoration-Revegetation & Decommissioning-Reclamation Plan, Integrated Weed Management Plan, Fencing Plan (Desert Tortoise Exclusion and Security), Drainage Plan, SNDO Raven Management Plan, Worker Environmental Awareness Plan, Spill Prevention, Control, and Countermeasures Plan, Fire Management Plan, Hazardous Materials and Waste Management Plan, Trash Abatement Plan, Stormwater Pollution Prevention Plan, Traffic Management Plan, and Grading Plan. While the Council appreciates that BLM will require the development of these plans, we did not see the Tortoise Translocation Plan in this list. BLM should add this mitigation plan to this list and includes these plans in the FEIS.

Project Site May Be a Mitigation Area

The Council recently learned that the project site may be part of a mitigation area. In the Clark County Multispecies Habitat Conservation Plan (HCP), mitigation for the development of lands occupied/used by the tortoise included purchasing and retiring grazing allotments. More than 1.9 million acres of grazing allotments on federal lands in Clark County, including BLM land, were retired[1]. We understand this included allotments in the Pahrump Valley. If the project or other proposed solar projects are located on these purchased and retired grazing allotments, then the development of these mitigation lands as solar projects may violate the terms of the Incidental Take Permit (ITP) issued to Clark County.

[1] https://webfiles.clarkcountynv.gov/Environmental%20Sustainability/Desert%20Conservation/Mitigation%20under%20the%20Current%20MSHCP.pdf

In addition, we understand that the HCP is comprised of Multiple Use Management Areas (MUMAs) that provide conservation value as corridors, connections, and buffers for the Intensively Managed Areas (IMAs) and Less Intensively Managed Areas (LIMAs) where management preserves the quality of habitat sufficiently to allow for unimpeded use and migration of the resident species in the IMAs and LIMAs. The project is located in a MUMA. This means that before this or any other project in a MUMA can be approved, there must be sufficient certainty that the project either individually or cumulatively will continue to allow for unimpeded use and migration of the resident species in the IMAs and LIMAs. This would include the tortoises.

Regarding use and migration, we refer BLM to the section above on "Connectivity."

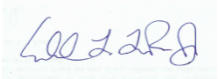
BLM should discuss this issue in the FEIS including the mitigation the ITP and HCP required on BLM lands in the Pahrump Valley and adjacent areas, what has been implemented and where, and what needs to be implemented and where. Maps with the footprint of the projects would be helpful.

In addition, if the project is located in one of these allotments used as mitigation for the issuance of the ITP, this demonstrates BLM's inability to secure mitigation lands for the long-term conservation of the tortoise. This supports the Council concerns expressed in comment letters to BLM that BLM does not have a mechanism to place a legal designation on BLM lands used as mitigation so they are removed from future development/incompatible uses. For example, the Council's position is that translocation sites for the tortoise on BLM land are mitigation and should be managed in perpetuity for the tortoise.
For the numerous issues provided above including impacts to the survival and recovery of the tortoise and the uncertainty of the effectiveness of proposed mitigation, the Council supports the No Action alternative.

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 the BLM that may affect desert tortoises, and that any subsequent environmental documentation for this project is provided to us at the contact information listed above. Additionally, we ask that you notify the Desert Tortoise Council at eac@deserttortoise.org of any proposed projects that BLM may authorize, fund, or carry out in the range of any species of desert tortoise in the southwestern United States (i.e., *Gopherus agassizii*, *G. morafkai*, *G. berlandieri*, *G. flavomarginatus*) so we may comment on it to ensure BLM fully considers actions to conserve these tortoises as part of its directive to conserve biodiversity on public lands managed by BLM.

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,



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Attachment: Attachment A. Demographic Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*) including the Eastern Mojave Recovery Unit

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Attachment A. Demographic Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*) including the Eastern Mojave Recovery Unit

To assist the Agencies with their analysis of the direct, indirect, and cumulative impacts of the Proposed Project on the Mojave desert tortoise, we provide the following information on its status and trend. In reviewing the data presented below, note that the location of the proposed project is within the Colorado Desert Recovery Unit, which has experienced a decline in tortoise density and abundance of –36%, since 2004.

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 Tortoise Conservation Areas (TCAs) that comprise each recovery unit.

Below are tables with data on changes to Mojave desert tortoise densities and abundance since 2004. Important points from these tables include the following:

Change in Status for the Mojave Desert Tortoise Range-wide
● Ten of 17 populations of the Mojave desert tortoise declined from 2004 to 2014.

● Eleven of 17 populations of the Mojave desert tortoise are below the population viability threshold trough 2021. These 11 populations represent 89.7 percent of the range-wide habitat in CHUs/TCAs.

Change is Status for the Eastern Mojave Recovery Unit – Nevada and California
● This recovery unit had a 67 percent decline in tortoise density from 2004 to 2014, the highest rate of decline of the five recovery units.

● All tortoise populations in this recovery unit have densities that are below the viability level established by the USFWS (1994a).

● The Eastern Mojave Recovery Unit provides population and habitat connectivity between the Western Mojave and Colorado Desert recovery units and the Northeastern and Upper Virgin River recovery units. Continued development that fragments tortoise populations and habitats eventually severs the genetic connection between the two recovery units to the west and two to the east.

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 Critical Habitat Units (CHU)/Tortoise Conservation Areas (TCA) for the Mojave desert tortoise, *Gopherus agassizii* (=Agassiz's desert tortoise). The table includes the area of each Recovery Unit and Critical Habitat Unit (CHU)/Tortoise Conservation Area (TCA), percent of total habitat for each Recovery Unit and Critical Habitat Unit/Tortoise Conservation Areas, 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 Critical Habitat Unit/Tortoise Conservation Area	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, 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 Desert adult numbers at 64% (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 (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).

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 km2 so far on Fort Irwin and the Marine Corps Air Ground Combat Center), intense or large scale fires (e.g., 576.2 km2 of critical habitat that burned in 2005), development of utility-scale solar facilities (as of 2015, 194 km2 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.

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).

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 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.

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 Critical Habitat Units (CHUs)/Tortoise Conservation Areas (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**	**2004 density/ km^2**	**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
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

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
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
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**							

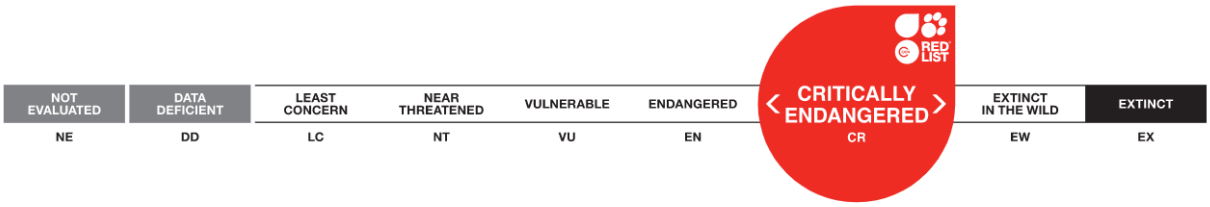
* This density includes the adult tortoises translocated from the expansion of the MCAGCC, that is resident adult tortoises and translocated adult tortoises.

**Methodology for collecting density data initiated in 1999.

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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