United States Department of the Interior

FISH AND WILDLIFE SERVICE
Southern Nevada Fish and Wildlife Office
4701 North Torrey Pines Drive
Las Vegas, Nevada 89130

IN REPLY REFER TO:
File Nos. 08ENVS00-2019-F-0125
and 08ENVS00-2019-I-0126

November 7, 2019

Memorandum

To: Assistant Field Manager
Division of Renewable Resources,
Southern Nevada District Office,
Bureau of Land Management,
Las Vegas, Nevada

From: Field Supervisor GLEN KNOWLES Digitally signed by GLEN KNOWLES Date: 2019.11.07 11:22:35 -08'00'
Southern Nevada Fish and Wildlife Office,
Las Vegas, Nevada

Subject: Formal and Informal Consultation under Section 7 of the Endangered Species Act for the Gemini Solar Project, Clark County, Nevada

This transmits the U.S. Fish and Wildlife Service's (Service) biological opinion in response to your memorandum received June 17, 2019, requesting formal consultation for the Gemini Solar Project in Clark County, Nevada. This biological opinion addresses potential effects to the federally threatened Mojave desert tortoise (*Gopherus agassizii*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 et seq.) and 50 CFR § 402 of our interagency regulations governing section 7 of the Act.

The BLM also requests concurrence from the Service through informal consultation that the proposed project *may affect, but is not likely to adversely affect* the endangered Yuma clapper rail (*Rallus obsoletus yumanensis*), endangered southwestern willow flycatcher (*Empidonax traillii extimus*), or threatened yellow-billed cuckoo (*Coccyzus americanus*).

This biological opinion and concurrence are based on information provided in your memorandum; the biological assessment; correspondence between the Service and BLM; interagency section 7 consultation regulations in 50 CFR Part 402; scientific publications, articles, and reports; and our files. A complete project file of this consultation is available in the Service's Southern Nevada Fish and Wildlife Office in Las Vegas.

Biological Opinion for The Gemini Solar Project

File Nos. 08ENVS00-2019-F-0125
and 08ENVS00-2019-I-0126

Issued to:

Bureau of Land Management
Las Vegas Field Office
4701 North Torrey Pine Drive
Las Vegas, Nevada

by:

U.S. Fish and Wildlife Service
Southern Nevada Fish and Wildlife Office
4701 North Torrey Pine Drive
Las Vegas, Nevada

November 7, 2019

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INFORMAL CONSULTATION (FILE NO. 08ENVS00-2019-I-0126)

The proposed project *may affect, but is not likely to adversely affect* the endangered Yuma clapper rail (*Rallus obsoletus yumanensis*), endangered southwestern willow flycatcher (*Empidonax traillii extimus*), or threatened yellow-billed cuckoo (*Coccyzus americanus*). Direct effects to the listed birds include injury or mortality to individual birds from contact with project vehicles, solar panels, fencing, buildings, towers, and transmission lines. Birds may also be affected by lighting and noise.

Suitable habitat for Yuma clapper rail, southwestern willow flycatcher, and yellow-billed cuckoo does not occur within or near the action area for the proposed project. However, there are documented records of all three species in suitable habitat within 15 to 20 miles of the project. These listed birds occur in areas such as Ash Meadows National Wildlife Refuge, Overton Wildlife Management Area, Las Vegas Wash, Warm Springs Natural Area, and Pahranagat National Wildlife Refuge. We do not have information and cannot predict the paths dispersing and migrating individuals may take, and there is no evidence to indicate that dispersal of these species would occur within the action area. Two mortalities of Yuma clapper rails and one yellow-billed cuckoo at solar facilities in California have been documented, although the circumstances and causes of death have not been confirmed.

The low number of known recorded mortalities, the lack of habitat within the action area, and the long distance from any known occurrence suggests low potential for direct mortality to listed birds related to the Project. Based on the best available science, the potential direct and indirect effects posed by the Project to the three listed bird species are expected to be negligible.

The applicants will prepare a Bird and Bat Conservation Strategy to include a robust analysis of effects with measures to avoid or minimize effects to birds and systematic monitoring and adaptive management components approved by BLM and the Service.

In consideration of the above, we concur with BLM's determination that the proposed project *may affect, but is not likely to adversely affect* the Yuma clapper rail, southwestern willow flycatcher, or yellow-billed cuckoo.

BIOLOGICAL OPINION (FILE NO. 08ENVS00-2019-F-0125)

CONSULTATION HISTORY

May 2017 - Early coordination began between the Service and project biological consultants regarding information about tortoise surveys and translocation.

February 28, 2018 - The BLM, Nevada Department of Wildlife (NDOW), Service, and biological consultants performed a site visit of the Gemini solar site. The primary purpose of the visit was to observe habitat and project layout and discuss translocation timing and options.

April 13, 2018 - The BLM, NDOW, Service, and biological consultants met to discuss translocation options.

February 6, 2019 - The BLM, NDOW, and Service biologists met to further discuss translocation options after tortoise surveys were completed in fall of 2018.

June 17, 2019 - The Service received BLM's biological assessment and request to initiate formal consultation for the Gemini Solar Project to address potential adverse effects to the desert tortoise. BLM also requested concurrence through informal consultation that the proposed action *may affect, but is not likely to adversely affect* the endangered Yuma clapper rail (*Rallus obsoletus yumanensis*), endangered southwestern willow flycatcher (*Empidonax traillii extimus*), or threatened yellow-billed cuckoo (*Coccyzus americanus*).

June 20, 2019 - The Service provided comments on the biological assessment to BLM.

June 25, 2019 - The final draft of the biological assessment was received from BLM. Comments from the Service were addressed, and the consultation package was considered completed. The request for formal consultation was initiated.

July 24, 2019 - The BLM provided the desert tortoise translocation plan to the Service.

August 29, 2019 - The Service provided a draft biological opinion to the BLM for review.

October 10, 2019 - The BLM provided the final desert tortoise translocation plan to the Service.

October 21, 2019 - BLM provided comments on the draft biological opinion to the Service and on October 22, 2019, the Service provided BLM responses to their comments.

DESCRIPTION OF THE PROPOSED ACTION

Definition of the Action Area

Solar Partners XI, LLC (Applicant), a wholly owned subsidiary of Valley of Fire, LLC, submitted a right-of-way (ROW) application under Title V of the Federal Land Policy and Management Act of 1976 (FLPMA) (43 United States Code [USC] § 1761) to construct, operate, maintain, and decommission the Gemini Solar Project (Project). The Project would include development of a photovoltaic (PV) solar generation power plant and ancillary facilities. The Project would be located on 7,113 acres of Bureau of Land Management (BLM) land in Clark County, Nevada within a 44,000-acre ROW application area in the northeastern portion of the Mojave Desert; approximately 33 miles northeast of Las Vegas, in an unincorporated area of Clark County, Nevada (Figure 1). The Project would be immediately south of the Moapa River Indian Reservation (Reservation) and less than 0.5 miles southeast of Interstate 15 (I-15) within the *Piute Point* and *Dry Lake* United States Geographical Survey (USGS) 7.5-minute topographic quadrangles.

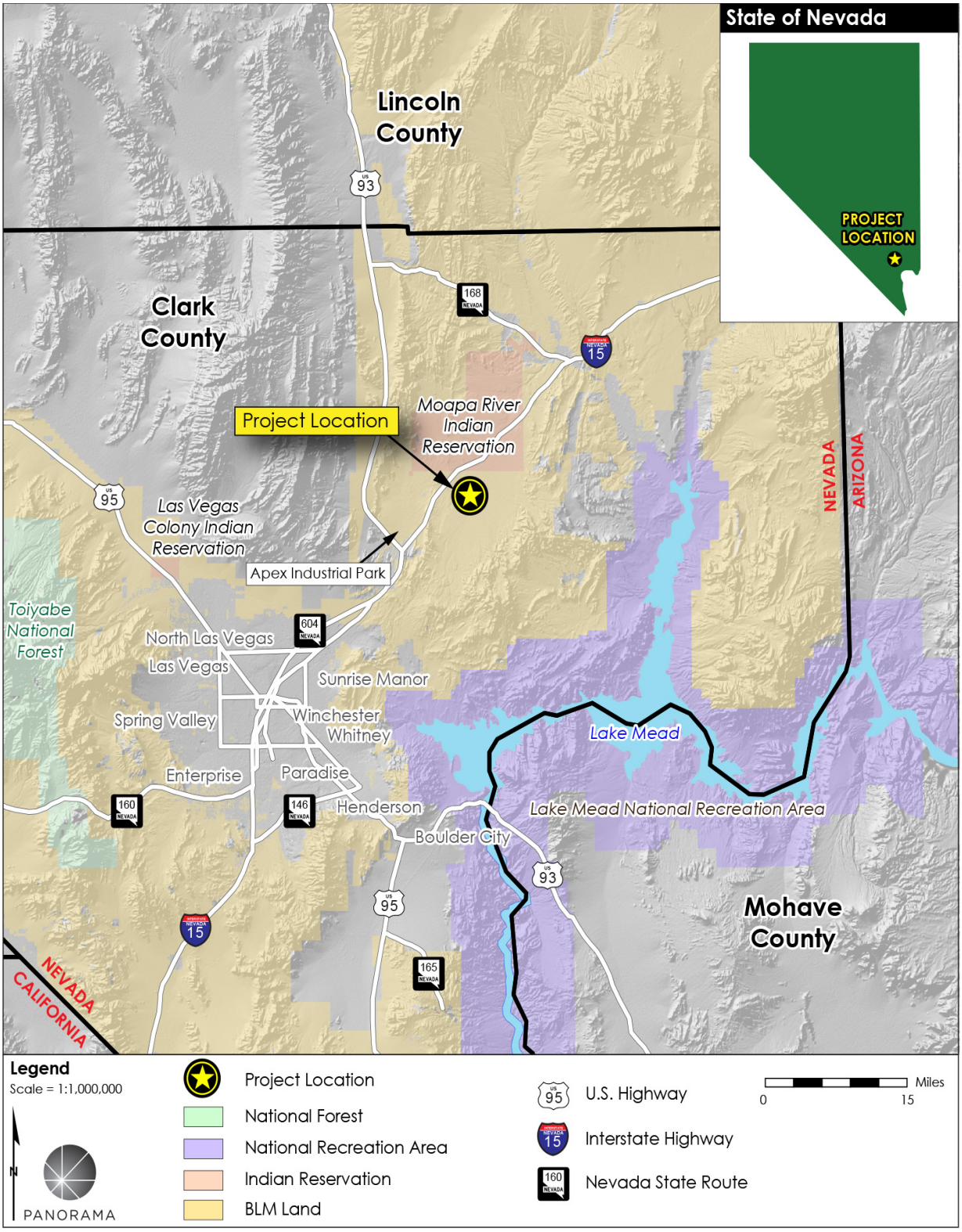

Figure 1. Location of Proposed Project.

Table 1 presents the legal description for the Project, including the solar field, generation tie-in (gen-tie) routes, ancillary facilities, and the BLM segment of Valley of Fire Road that would be used by the Project as primary access. The Project is within the Mount Diablo Meridian.

Table 1. Project legal description.

Township	Range	Sections
T.16.S	R.65.E	sec. 31, W1/2 and SE 1/4.
T.17.S	R.64.E	sec. 10, S1/2; sec. 11, S1/2; sec. 12; sec. 13; sec. 14, N1/2 and SE1/4; sec. 15, N1/2; sec. 25, E1/2; sec. 36, E1/2 and SW1/4
	R.65.E	sec. 7; sec. 8; sec. 9, W1/2; sec. 16, W1/2; secs. 17 thru 20; sec. 21, SW1/4; sec. 28, W1/2; secs. 29 thru 32; sec. 33, W1/2
T.18.S	R.64.E	sec. 1; sec. 2, E1/2;
	R.65.E	sec. 4, W1/4; sec. 5; sec. 6, NE1/4

The Project site would be divided into several different solar array areas, or development areas, labeled A through E (Figure 2).

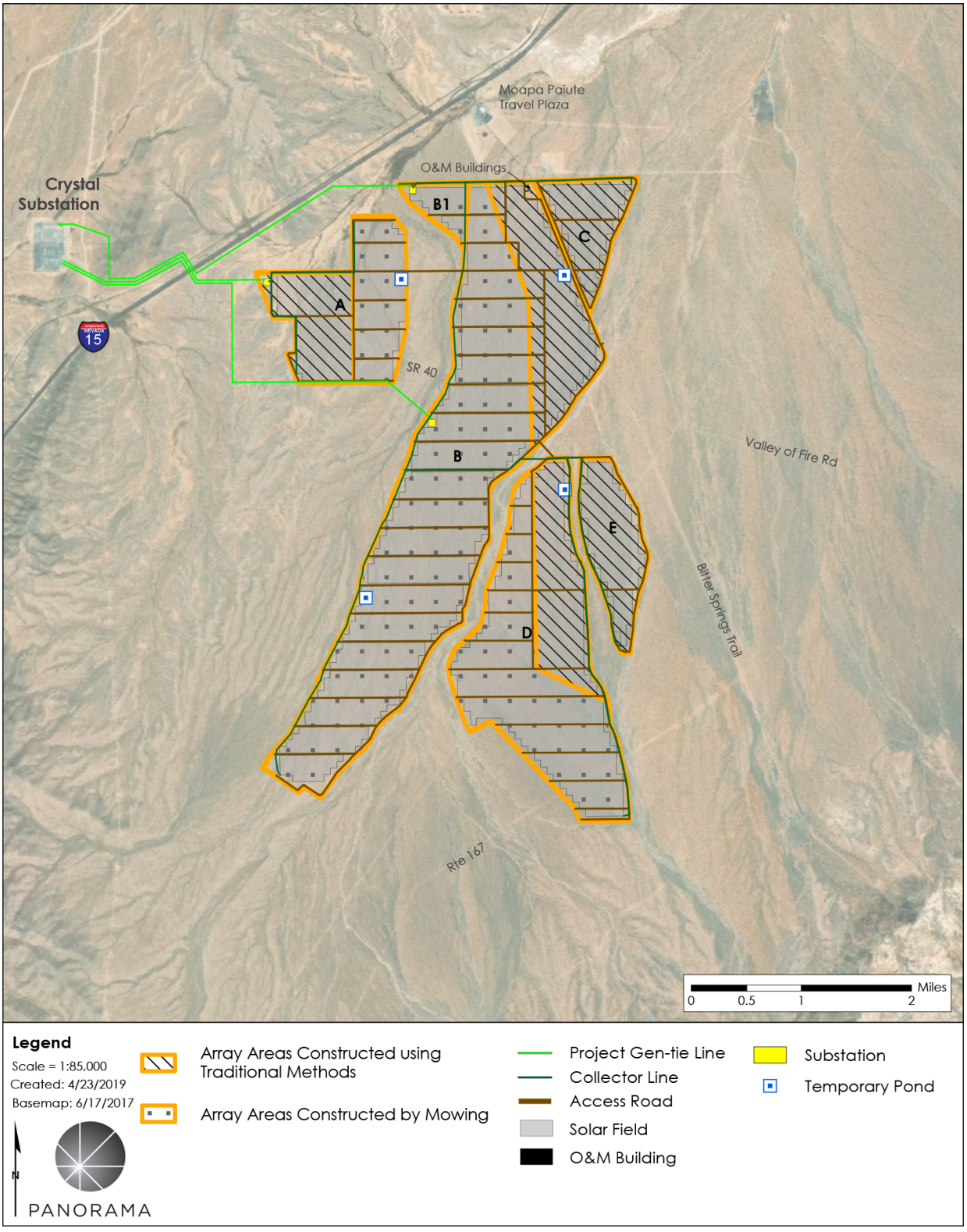

Figure 2. Construction areas using traditional techniques and mowing.

Proposed Action

The Project would include the construction, operation and maintenance (O&M), and decommissioning of a nominal 690-MWac solar PV power generating facility on 7,113 acres. Sixty-five percent of the solar array areas would have the natural ground contours, washes, and vegetation left in place. The vegetation would be mowed during construction, operation, and maintenance to a height of 24 inches, although vegetation may be trimmed to between 18 inches and 24 inches tall under justifiable circumstances. The permanent fencing surrounding the mowed areas would leave approximately 8 inches between the ground and the fence bottom to allow desert tortoises to travel through and occupy the solar field throughout the lifetime of the Project. The remaining 35 percent of the solar array areas would be constructed and maintained through complete vegetation removal (through disking to cut vegetation and rolling to bury it and to compact soils), which is the traditional method of developing utility-scale solar facilities in the desert. Areas developed through these traditional methods would be fenced with desert tortoise exclusion fencing integrated into the perimeter security fencing to permanently exclude desert tortoises. Table 2 summarizes the Project disturbance.

Table 2. Permanent and temporary project disturbance.

Disturbance Type	Disturbance Acres[1]	Notes
Permanent Disturbance – Vegetation Removed		
Entire Solar Facility	2,578.8	690-MWac PV solar facility
Solar Arrays (Traditional Development)	2,351.0	Includes the solar PV panels, steel table frames, trackers, and posts
Operation and Maintenance Building	2.1	Includes the building, parking, and water tank storage, all within solar facility footprint
Substations	7.1	Each of the three substations occupies approximately 2.4 acres within the solar facility footprint
Internal Access Roads for Solar Field and Utility Corridor	170.5[2]	Roads would be graded and covered with gravel base or compacted soil. Includes temporary and permanent disturbance related to water infrastructure
Water Ponds	4.0	Four temporary [3] water ponds would be constructed in development areas A, B, and D

Disturbance Type	Disturbance Acres[1]	Notes
Equipment Areas	14.7	425 equipment areas, which include batteries (53,550 individual batteries), inverters, and medium voltage transformers within the solar facility footprint
Gen-tie Lies and Access Roads to Gen-tie Lines	24.4	Gen-tie foundations assumed to fall within acreage for access roads
Permanent Total	**2,602.4**	
Temporary Disturbance - Significantly Modified Vegetation		
Solar Arrays (Mowing) [4]	4,459.8	690-MWac PV solar facility
Temporary Total	**4,460**	
Temporary Disturbance (granted through a short-term ROW, if outside the project ROW area) [5]		
Gen-tie structure laydown, staging, and installation	36.1	Gen-tie structure laydown, staging, and installation, 200 feet by 200 feet at up to 48 poles, outside the solar facility fence
Gen-tie line conductor stringing	14.8	Multiple pulling sites for each gen-tie line where direction changes sharply; 100 feet by 500 feet
Temporary Total	**51**	
GRAND TOTAL	**7,113**	

1. All values presented are approximate and subject to change per final engineering.
2. North-south access roads closest to the boundary of mowing and traditional development areas were assumed to be constructed within the traditional development.
3. Although the water ponds are temporary and would be removed following construction, the impact would be permanent. The areas where ponds are located may either be restored, or filled, reclaimed and developed with solar panels.
4. Mowed areas would be maintained throughout the life of the Project through vegetation trimming.
5. The solar field staging area is assumed to overlap the access roads, which are considered permanent impacts.

Project Components

Solar Panel Arrays

The Project would utilize high-efficiency commercially available solar PV modules. The solar panels are typically 6.4 feet long by 3.25 feet wide but could be as long as 8 feet. The Project would use solar PV modules mounted on single-axis, horizontal tracker mounting systems. The type of PV modules would be either traditional panels, which capture sunlight from one side of the panel or bifacial panels, which can absorb light from both sides of the panels, including energy reflected back up from the ground surface. Bifacial panels passively absorb light on both

sides. Absorption of reflected light would not interfere with vegetation growth under panels. No heat or light would radiate back from the panels. Mounted PV modules, inverters, and transformers would be combined to form array blocks.

The panel arrays would be arranged in north-south oriented rows, and the drive motors would rotate the horizontally-mounted solar panels from east to west to follow the sun (on a single axis) throughout the day. A diagram of a horizontal tracker is shown in Figure 3. The highest point for a horizontal tracker would be achieved during the morning and evening hours when the trackers are tilted at their maximum angle. The top edge of the panel would be a maximum of 12 feet above the ground surface in areas constructed using traditional methods and 15 feet for areas constructed using mowing. When solar modules are roughly parallel to the ground, the overall height of the tracker unit would be up to six feet above the ground surface in areas of traditional development and up to eight feet above the ground surface in mowed areas. At the most perpendicular to the ground surface, 1 to 1.5 feet of space would generally remain between the bottom of the panel and the ground. In mowed areas, at least 2 to 2.5 feet of space would remain between the bottom of the panel and the ground. Factors such as flow depth are also accounted for when determining height of the panels. The vertical support legs for the tracker mounting system would consist of foundations that may include concrete posts approximately 18 to 24 inches in diameter and 6 to 8 feet deep or driven posts (wide flange I-beam) approximately 6 to 8 inches across and 6 to 12 feet deep. The preferred mounting configuration would use directly embedded driven posts; concrete posts would be used only if subsurface conditions do not support driven posts. Posts in some areas of the solar array may need to be up to 2 feet deeper in areas constructed using mowing and under certain hydrologic conditions, for total depths up to 14 feet.

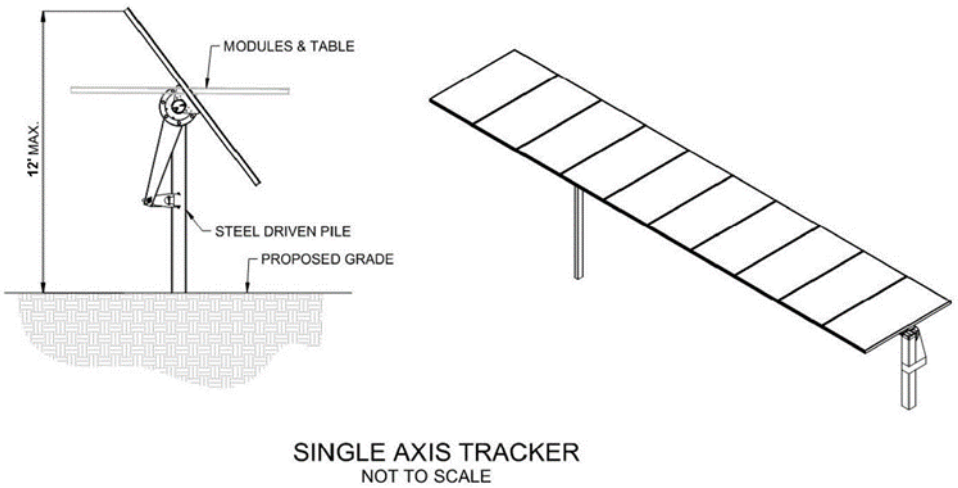

Figure 3. Diagram of single-axis tracking panel.

In this type of system, each tracker panel row could range from approximately 140 feet to 285 feet long and powered by a low-voltage solar-powered drive motor. The motors and actuator are mounted to one of the driven posts and do not require separate foundations for mounting.

Hydraulic drive systems would not be used. The motors would only be operated for a few seconds every five to ten minutes during daylight conditions to move the panels in approximately one-degree increments.

A typical array block is made up of 20 tracker panel rows. Four array blocks are combined and connected to a power conversion station (PCS) and battery energy storage system (BESS) as shown in Figure 4.

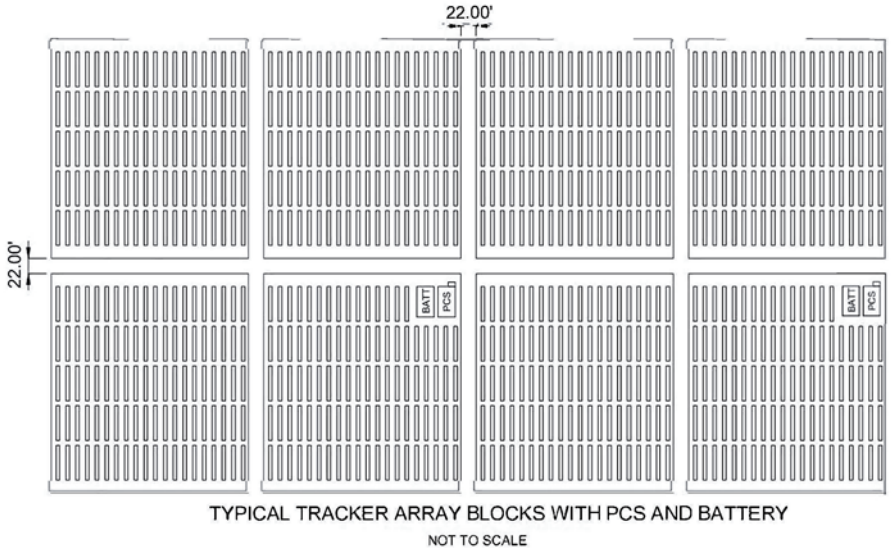

Figure 4. Solar panels in array block with power conversion station and battery.

Meteorological Tower

A meteorological station would be installed at the northern boundary of the solar development area near the O&M facilities to monitor wind speed and communicate with the tracker units. Monitoring would allow the trackers to rotate to a flat position to reduce the potential for damage during high wind activity[1]. The meteorological station tower would be monopole or lattice design and would not exceed 30 feet tall. The tower would require a small concrete foundation approximately three feet by three feet that would extend approximately four feet into the ground.

Emergency Backup Power

If horizontal trackers are used, the PCSs would be equipped with emergency backup power required to rotate the tracker units to a stow position in the unlikely event of high winds and a loss of the primary 230 kilovolt (kV) electrical connection from the Project to NV Energy's transmission system. The emergency back-up power system would consist of a 15 kilovolt-ampere (kVA) battery-based uninterruptible power supply (UPS) at each PCS.

[1] High wind activity is defined as sustained winds of 30 miles-per-hour (mph) for one hour and/or frequent gusts of at least 45 mph are occurring or expected within the next 36 hours.

Electrical Collection System

DC Collection System to AC Transformers

PV modules convert sunlight into direct current (DC) electricity. One or more combiner boxes would be located in the array block to collect the DC electricity from PV modules**.** Figure 5 shows how power would be transferred from the solar array blocks to the grid. A PCS containing inverters and medium voltage transformers, as well as other electrical equipment, would serve approximately every four array blocks. The inverter converts DC generated by the solar arrays and collected at the combiner box into the AC. Each inverter would also be coupled to a battery with the capacity to store energy produced. From the inverter or battery, power is then passed through transformers to convert the low voltage output from the inverters to high voltage (34.5 kV AC) that is suitable for exporting onto the electricity distribution network. Each PCS also would contain communication equipment to wirelessly communicate with the tracker units to control operation and detect anomalous conditions. All electrical equipment would be housed in protective containers typically 10 feet wide by 20 feet long on concrete pads. A photograph of a typical PCS is shown in Figure 6.

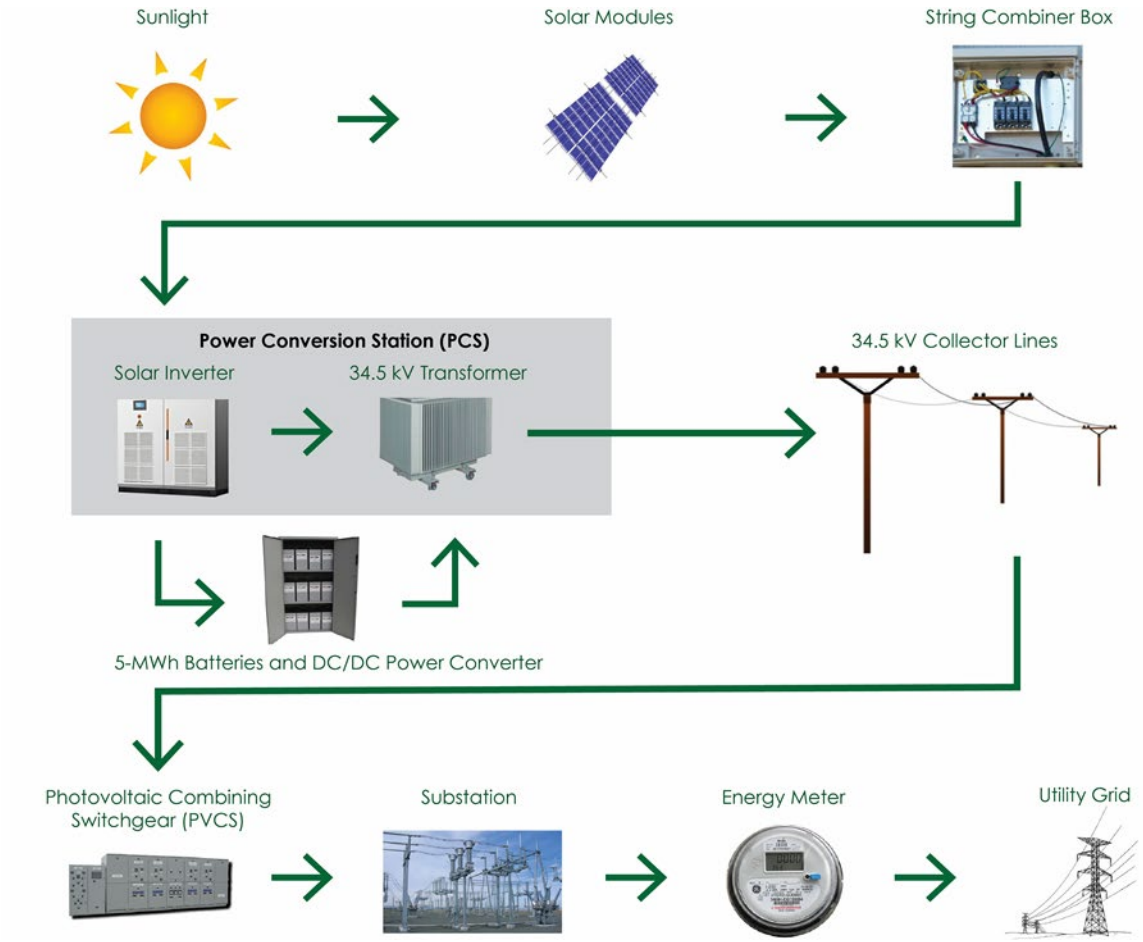

Figure 5. Flow diagram of power generation.

Figure 6. Power conversion station.

34.5 kV AC Collection System

A 34.5 kV AC collection system would convey electricity from the PCSs to on-site substations where electricity would be stepped up to 230 kV and 525 kV transmission levels. The 34.5 kV AC collection system would comprise both underground and overhead cabling. The Photovoltaic Combining Switchgears (PVCSs) aggregate AC power from multiple transformers and PCSs for transmission to the Project substation. The PVCS would be located along the 34.5 kV collector line. Each 34.5 kV circuit would feed electricity from approximately four array blocks to a PCS, which would then be aggregated at the PVCS and flow into the substations. The cables from the medium-voltage transformers to the PVCSs would be installed underground using 35 kV-rated medium voltage cables listed for direct buried applications, except that overhead cabling would be installed where necessary to avoid existing underground facilities. Underground 34.5 kV cables would be installed either directly in the ground or within a prefabricated duct bank system. Prefabricated duct banks are usually comprised of polyvinyl chloride (PVC) conduits and spacers encased in concrete. The 34.5 kV cables would be threaded through the PVC conduits. From the PVCSs to the on-site substation, the 34.5 kV system would be installed overhead along the internal roads between solar array blocks. The overhead lines would cross between development areas (including over the California Wash). Overhead 34.5 kV collector lines would be installed as double circuit lines on wood or steel poles with cross-arms and post insulators. Poles would have a diameter of approximately 18 inches and a height of up to 75 feet above grade (Figure 7). The collector system cables would be installed in a linear arrangement generally following the array blocks and connecting to the closest on-site substation. Alternatively, the 34.5 kV circuit could be installed underground in a utility corridor conduit adjacent to the established 20-foot wide roads. Utility corridors would include 20 feet on one side of the road and ten feet on the other in traditional development areas. Corridors for utilities would be adjacent to every fourth road in mowed areas and would be 15 feet wide.

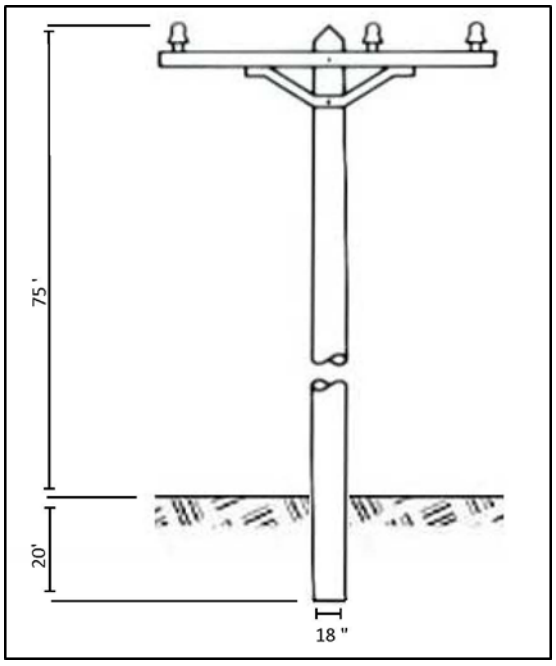

Figure 7. Example of a 34.5 kV distribution pole.

Substations

Up to three substations would be developed within the Project site: two 2.4-acre 230 kV substations and one 2.4-acre 525 kV substation. The substations would be separately fenced to provide increased security around the medium and high voltage electrical equipment. The substation areas would include a transformer containment area, a microwave tower, a control house, and one or more transformers. The transformer containment area would be lined with an impermeable membrane covered with gravel and would include a drain with a drain valve that is usually closed. Transformers would be provided with secondary oil containment equal to 110 percent of the volume of oil present in the transformer in addition to the volume of rainwater for a 25-year, 24-hour rainfall event. All other equipment in the substation would be placed on concrete foundations. The remaining area within the substation fence would be covered in aggregate. The substation layout is shown in Figure 8.

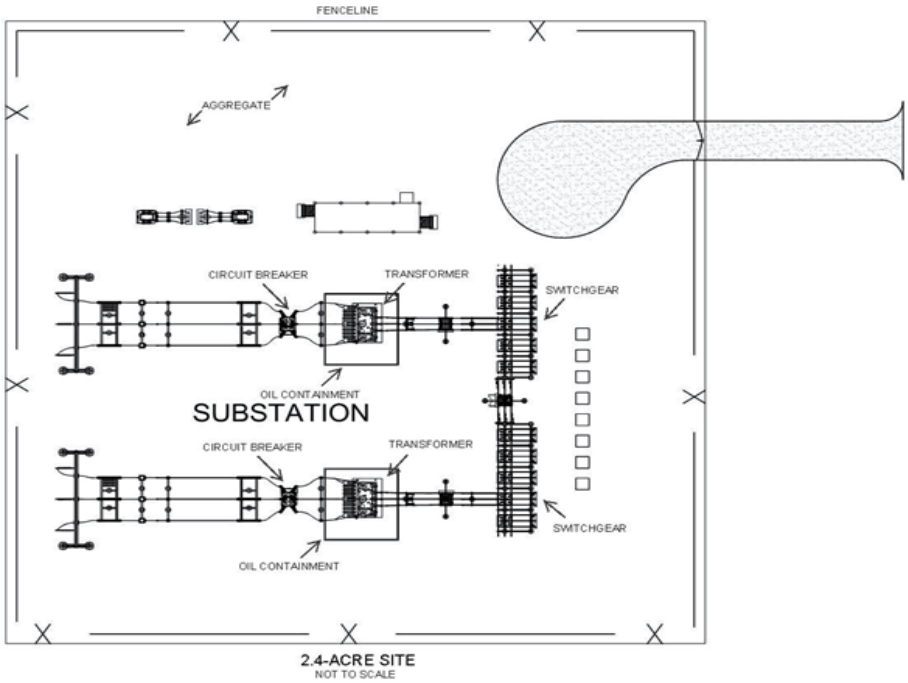

Figure 8. Example of a substation layout.

Energy Storage

A BESS would be located within the Project site. Battery storage would be used during periods of excess generation to store power until the customer or the system determines release of the power to be more valuable. Approximately 425 5-megawatt-hour 4-hour battery systems, comprised of a total of approximately 53,550 individual batteries (126 batteries per system), would be installed on the Project site, with each battery system installed at one inverter/PCS. The batteries may be lithium ion, but the technology for battery storage is changing rapidly and the appropriate technology at the time of construction would be utilized. The units would be installed adjacent to the DC/DC power converter and PCS, on a foundation or piles, as needed to protect the unit from stormwater. The battery systems would be enclosed in a container typically 40 feet long by 9.5 feet wide by 8 feet tall and are configured as a climate-controlled enclosure for batteries (Figure 9). The climate control system would be powered by the solar panels. A DC/DC power converter would be housed in a container typically 10-foot long, 9.5-foot wide, and 8-foot long adjacent to the battery container. Each unit would have a fire suppression system, which involves use of clean fire suppression gas. Alternatively, battery storage may also be located adjacent to the Project substations within the footprint of the substations.

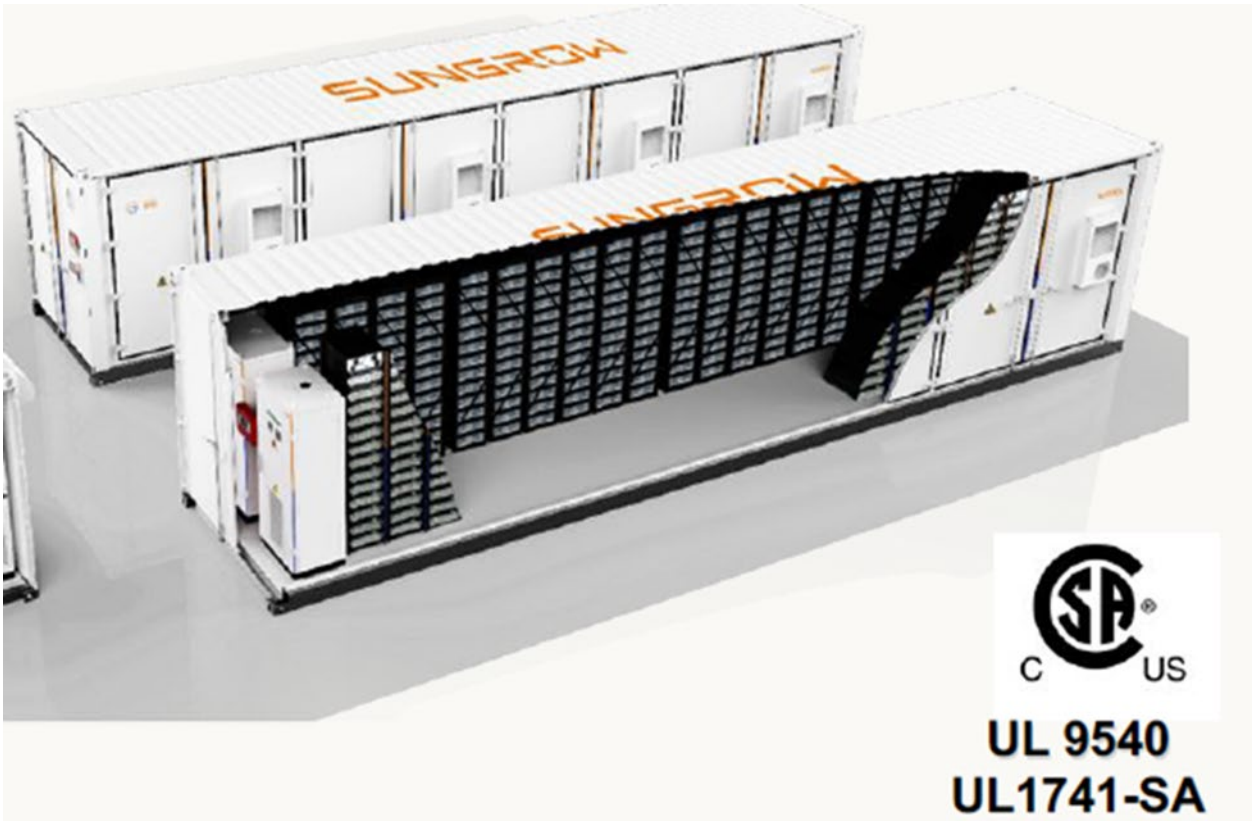

Figure 9. Battery energy storage system.

Operations and Maintenance Facilities

An approximately two-acre O&M area would be located within the site (Figure 10). The O&M area would accommodate a permanent O&M building, parking area, and other associated facilities such as a warehouse, aboveground water storage tank, septic system, security gate, signage, and flagpoles. Structures in the O&M area would be a maximum height of approximately 34 feet. The permanent O&M building would house administrative, operation, maintenance equipment, and personnel. The building would be up to 3,000 square feet in size, would have an adjacent parking area, and would be 16 to 20 feet tall. The O&M building may include communication equipment, a storage and equipment area, offices, restrooms, and other features necessary for daily use.

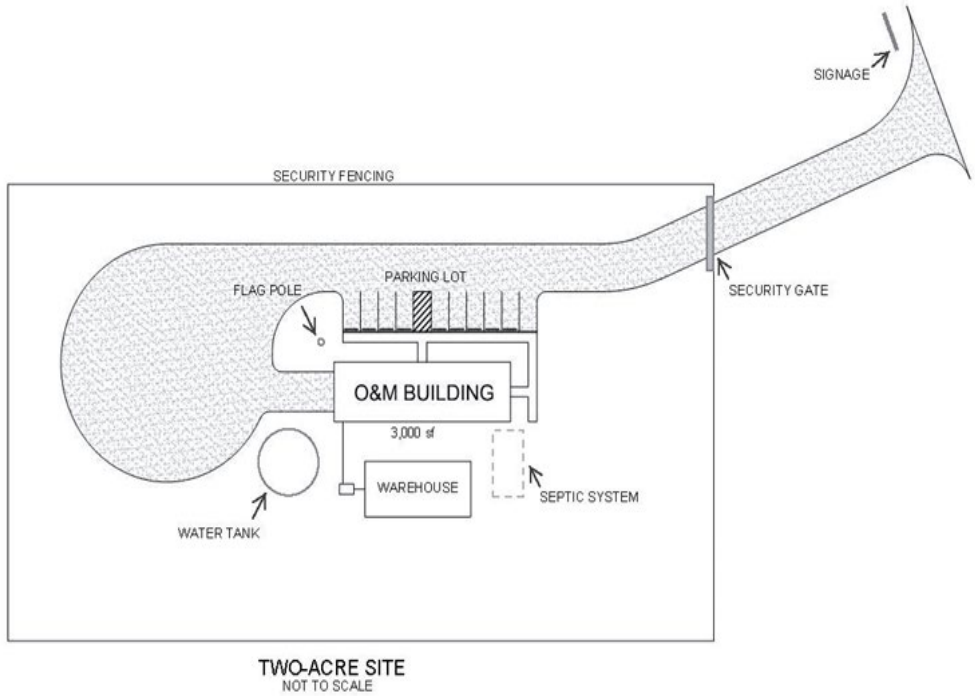

Figure 10. Operation and maintenance building layout.

The on-site buildings are proposed to be pre-engineered metal buildings that would be fabricated off site. Sections would be transported to the Project site for erection and assembly. The buildings would be anchored to concrete foundations on site. The interior details and other finish work would be completed on site after anchoring. Water storage tanks for potable water and fire protection would either be delivered as modular components and assembled on site or constructed on site on a concrete pad.

The Project would be operated and monitored through a supervisory control and data acquisition (SCADA) system located in the O&M building. Sensors located at each inverter/tracker combiner would report operational parameters. Data access and inverters would be controlled, either on site or remotely, through a high-security system. The non-conductive fiber optic communications cable would be co-located with the low-voltage DC and AC wiring.

Site Security and Fencing

Security at the Project site would be through fencing, lighting, security patrols, and electronic security systems. The Project site would be monitored 24 hours per day, 7 days per week during all phases of construction and operation. Lighting would be provided at the O&M building and Project entrance gate. The solar field and support facilities perimeter would be secured with chain link metal-fabric security fencing. Controlled access gates would be located at the site entrance. The perimeter fence would be an approximately six- to seven-foot-high chain link fence, installed on posts, with one-foot-high three-strand barbed-wire at the top. The fence would be treated with a chemical dulling agent at the factory, which reduces the galvanized steel's

potential for glare and reduces contrast. The perimeter security fencing would have an eight-inch opening between the bottom of the fence and the ground around mowed areas to allow desert tortoises to reenter and exit the area after construction. For the 35 percent of the facility developed using traditional methods where permanent tortoise exclusion is needed, tortoise exclusion fencing would be installed on the external perimeter security fence (Figure 11). Along internal fencelines, permanent desert tortoise fencing would be installed on T-posts. A tortoise barrier guard would be required across every access road traveling between areas constructed via mowing and traditional methods. Tortoise exclusion fencing would also be maintained around the substations.

Figure 11. Example tortoise and security fencing.

Site Access and Internal Project-Related Roads

The Valley of Fire Road would be the access road for the Project during construction and O&M. It is a paved, public roadway that crosses through the Project and connects to I-15 less than 0.5 miles west of the Project site.

Project-related roads within the solar facility would include the perimeter road around all traditional development areas and solar field internal access roads. Around mowed areas, a north-south access road would be along one side of the Project site to connect east-west internal access roads. The roads would be constructed to allow access by maintenance and security personnel. The access road would be 20 feet wide and would be composed of native graded and compacted dirt. Alternatively, the north-south connecting access road may use a BLM-approved aggregate base in some or all areas.

Within the solar fields, new internal access roads would be built to provide vehicle access to the solar equipment (PV modules, inverters, transformers) for O&M activities. These internal access roads would be 15 feet wide every 0.25 miles (mowed areas) to 1 mile apart (traditional development). Roads are more closely spaced in mowed areas, since access is restricted to roads. The existing surface area would be cleared and compacted using on-site materials and may be

covered in aggregate. Some internal access roads may be constructed with aggregate; however, most internal roads would be constructed using only recompacted native materials. Where aggregate would be needed (either due to high usage or based on the need to facilitate drainage and minimize dust or erosion) approximately four to six inches of BLM-approved aggregate would be applied over compacted native soils. Concrete cut-off walls may also be installed at the edges of the road crossing within the drainages. The cut-off walls would be installed in the edge of the road and would not require vegetation removal beyond what is already needed to construct the access road. The purpose of the cut-off walls would be to prevent the access road materials from eroding during storm events. Without the cutoff walls, material could erode down the washes and additional heavy equipment would be needed to regrade the washes after major storms. The cut off walls would reduce the need for continued maintenance of the road using heavy equipment. Cut off walls would be installed by hand or using small equipment, accessed from the internal road only, with the concrete flush with the ground surface. Internal access roads would cross drainages in 82 locations in mowed areas. Three drainages would be crossed along the connector access roads (north-south roads). The maximum cumulative acreage from cutoff wall installation would be approximately 0.01 acres, assuming a cutoff wall installation on the downstream side of every internal access road and on both sides of the connector access roads. Cross sections of cutoff walls for internal access roads and connector access roads are shown in Figure 12. Access roads would include a 10-foot buffer on one side of the road and a 20-foot buffer on the other side to allow for the installation of utility conduit for the 34.5 kV AC distribution system in traditional development areas. A 15-foot utility corridor would be adjacent to every fourth access road in the mowed areas for underground utility conduits.

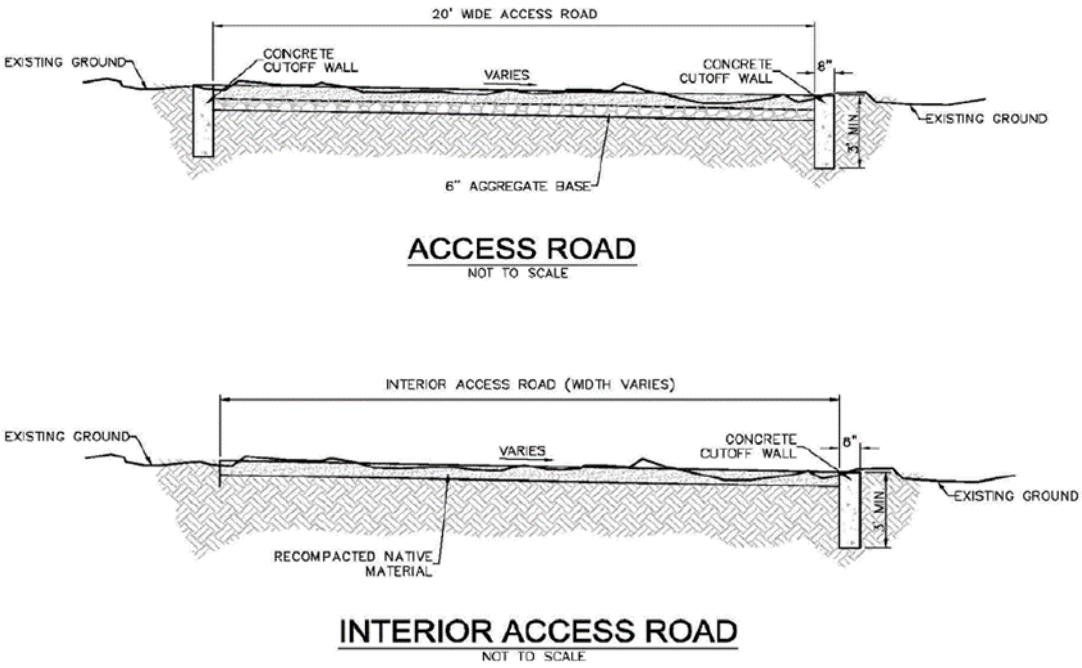

Figure 12. Cross sections of cutoff walls.

Two concrete causeways (Figure 13) would be needed for the crossings of the California Wash between development areas B and D and the west fork of the California Wash between development areas A and B. The causeway between development areas B and D would be 20 feet wide and approximately 74 feet long, and the causeway between development areas A and B would be 20 feet wide and approximately 60 feet long.

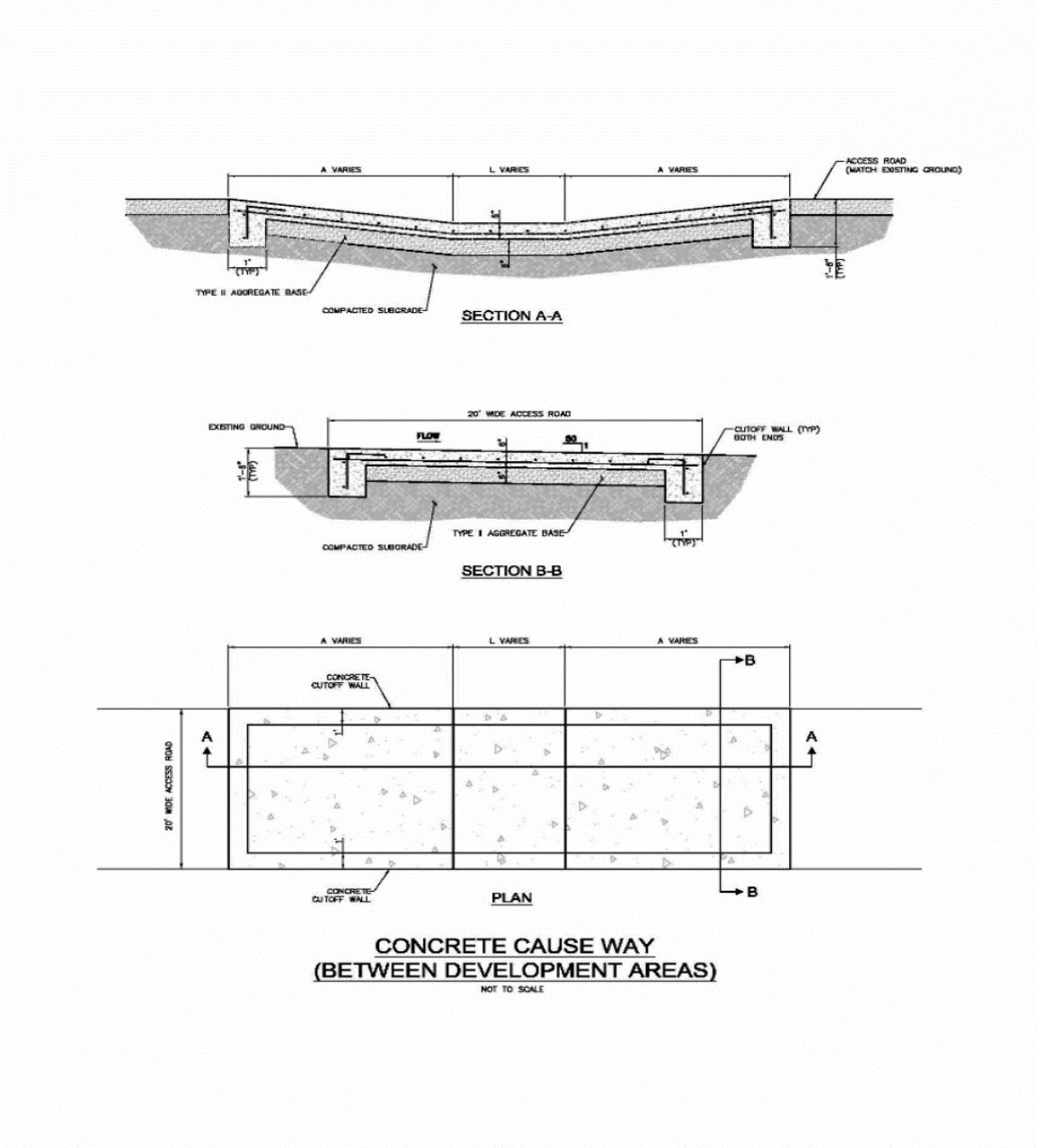

Figure 13.Cross sections of causeways between development areas.

230 kV and 500 kV Gen-Tie Transmission Lines

The Project would require the construction of two 230 kV circuits and one 500 kV circuit for interconnection to the utility transmission grid system. Conductor for the gen-tie lines would be installed on support structures (e.g., dull gray galvanized steel monopoles or lattice towers [Figure 14] with cross-arm supports and insulators). Gen-tie support structures are not anticipated to be taller than 200 feet and spaced approximately 1,500 feet apart, depending on topography and clearance requirements. The structures would be installed on concrete pier foundations up to 20 feet belowground, but final depths would depend on tower heights and type

of foundation (i.e., drilled piles, micro piles with pile caps, or piers). Given the Project site location and distance to the Crystal Substation, the gen-tie lines would be approximately 2 to 4.75 miles long, with a combined length of approximately 11.5 miles. An estimated 48 transmission structures would be required. A permanent 20-foot-wide gen-tie road would run the length of the gen-tie line. The ROW width needed for the gen-tie lines would be 100 feet for an individual 230 kV ROW, 200 feet for an individual 500 kV ROW, and 300 feet where the corridors are together.

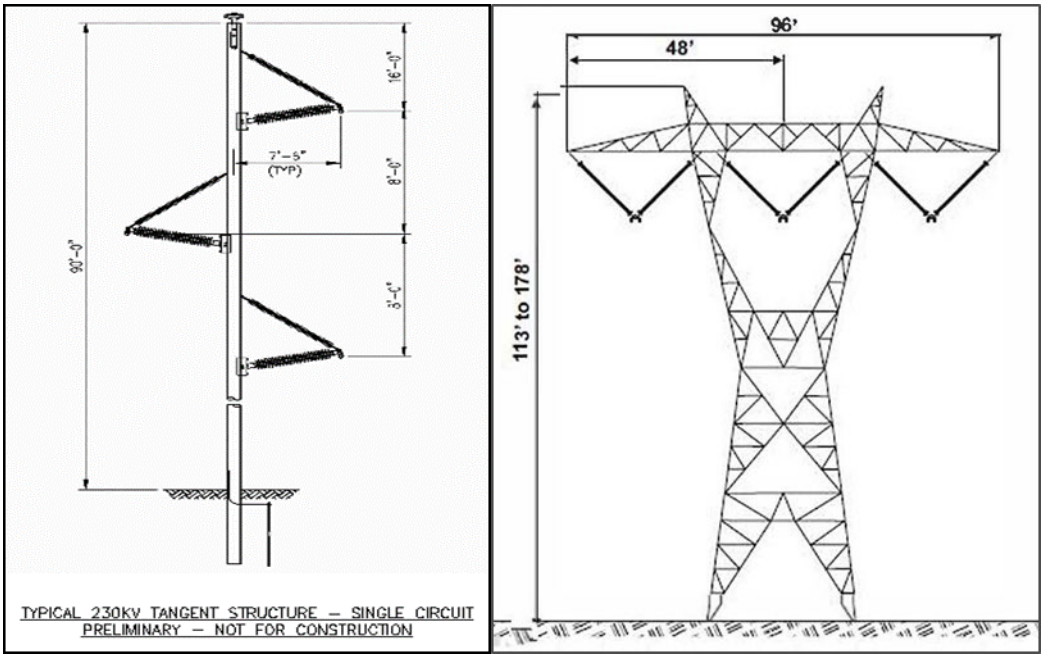

Figure 14. Typical gen-tie support structures for 230 kV and 500 kV lines.

All overhead electrical lines would be designed and installed in accordance with the Avian Power Line Interaction Committee's (APLIC) Suggested Practices for Avian Protection on Power Lines (APLIC 2006). The Applicant also would prepare a Bird and Bat Conservation Strategy to address potential impacts to birds and bats during the construction and O&M phases of the Project.

Interconnection Facilities

The following improvements to NV Energy facilities are expected to be required to support interconnection for the Project:

- Interconnection with NV Energy for delivery of 440 megawatt (MW) to NV Energy Balancing Authority via 230 KV generation tie-line to NV Energy Crystal Substation
  - Interconnection Facilities
    - Two 230 kV circuit breakers, protection and associated facilities at Crystal 230 kV substation

    - 230 kV dead end structure, isolation switch, telecommunications (fiber optic-system data), and vertical transition structure into Crystal 230 kV Substation
    - Metering/Communications equipment owned by NV Energy at the Project site.
  - Network Upgrades
    - New Crystal – Harry Allen 230 kV circuit line on existing transmission towers
- Interconnection with NV Energy for delivery of 250-MW to Los Angeles Department of Water and Power (LADWP) Balancing Authority via 500 kV generation tie-line to NV Energy Crystal Substation
  - Interconnection Facilities
    - New 500 kV bay at Crystal North
    - Two 500 kV circuit breakers and associated disconnects
    - Substation switch
    - Bundled 1590 aluminum conductor steel-reinforced cable (ACSR) (at least from H-frame to point of change of ownership)
    - 230 kV dead end structure, isolation switch, telecommunications (fiber optic-system data), and vertical transition structure into Crystal 525 kV Substation
  - Network Upgrades
    - A new 230 kV circuit line on existing transmission towers connecting Crystal Substation to Harry Allen Substation, approximately 5.5 miles to the southwest, with facility improvements at both stations (previously permitted)
- Access roads to service the above-referenced interconnection routes and facilities

Water

Water would be purchased from a commercial source or a user with an existing appropriation and trucked to the Project site where it would be stored in an on-site storage tank for operation of the Project. Water would not be used for panel washing but would be used in conjunction with dust palliatives during operation where needed (in traditional development areas only).

Wastewater Management

Wastewater generated during construction would include sanitary waste from portable toilets and the O&M septic system (or portable toilets) once completed. The waste from portable toilets would be collected by a contracted sanitary disposal service and transported to a licensed disposal facility.

Facility Lighting

Permanent lighting would be provided within the substation and at the Project entry gate. Small domestic fixtures would also be placed at other electrical equipment as required by applicable codes. Lighting for facilities and associated infrastructure would be shielded to keep light downward and within the boundaries of the Project site and the minimum amount and intensity

necessary for the intended use. Night lighting would be controlled or reduced using directed lighting, shielding, or reduced lumen intensity. The Applicant would prepare a Lighting Plan for construction and operation of the Project.

Facility Power

The O&M facility, monitoring systems, and lighting would likely be powered by solar power, with a minimum 12-hour battery storage unit, and a 250 to 300 kVA diesel generator as backup if a permanent drop of power from existing distribution lines occurs.

Waste and Hazardous Materials Management

The primary wastes generated at the Project during construction and O&M would be nonhazardous solid and liquid wastes. The Applicant would prepare a Hazardous Materials and Waste Management Plan, as well as a Spill Prevention and Emergency Response Plan, which would address waste and hazardous materials management, including Best Management Practices (BMPs) related to storage, spill response, transportation, and handling of materials and wastes. The Project would produce wastes typically associated with O&M activities. These would include defective or broken electrical materials, empty containers, refuse generated by workers and small office operations, and other miscellaneous solid wastes. Batteries would be used during construction in vehicles and equipment and during O&M in the BESS and the battery-based UPS at each PCS. Spent lithium-ion batteries would be sent off-site to be recycled. If a battery cannot be recycled, such as due to damage, the battery would be disposed of at an appropriate facility. Limited quantities of hazardous materials would be used and stored on-site for construction and O&M activities. Safety Data Sheets for each of these materials would be provided in the Spill Prevention and Emergency Response Plan.

Fire Protection

The Applicant would prepare and implement a Fire Management Plan. The Project's fire protection water system used during construction and operation would be supplied from a water storage tank. During construction, one electric and one diesel-fueled backup firewater pump would deliver water to the fire protection water-piping network. The electrical equipment enclosures that house the inverters and transformers would be either metal or concrete. Any fire that could occur would be contained within the structures. A fire protection water system would be installed at the O&M area to support emergency fire response. The fire protection water system would be supplied by either an off-site water supply line or a water tank, holding a minimum of two hours of full flow run time. A piping network would be configured to supply potable and fire supply water to the O&M building. If a water tank were used, one electric and one diesel-fueled backup firewater pump would deliver water to the fire protection piping network. A smaller electric, motor-driven jockey pump would maintain pressure in the piping network. A jockey pump is a small pump designed to maintain a certain pressure in the sprinkler system. If the jockey pump were unable to maintain a set operating pressure in the piping network, the diesel fire pump would start automatically. Sprinkler systems, if required, would be installed in the O&M building and fire pump enclosure.

Health and Safety Program

The Applicant would require that all employees and contractors adhere to appropriate health and safety plans and emergency response plans. All construction and operations contractors would be required to operate under a Health and Safety Program (HASP) that meets industry standards. All site personnel would be required to go through a new hire orientation and follow a Worker Education and Awareness Plan (WEAP), which would address Project-specific safety, health, and environmental concerns.

Stormwater Management

Major existing Federal Emergency Management Agency (FEMA)-designated floodplains on the Project site would be avoided where feasible, with the exception of roadway crossings, and the Project would be designed and engineered to maintain the existing hydrology. Off-site flows to the Project site come from the south. Runoff generated on-site would be conveyed as sheet flow across the site in level areas of the site, similar to existing conditions and in incised drainages through other parts of the site. On-site, incised ephemeral drainages (jurisdictional drainages) would not be filled or altered to an extent that flow patterns would be changed. Post-construction flows would follow the same drainage patterns as existing conditions. The soil is very permeable, so following the natural terrain would allow for maximum infiltration, thereby reducing runoff.

Vegetation Management

Native vegetation (i.e., creosote and bursage) is not anticipated to regrow in the solar development areas constructed using traditional methods. The Applicant would address operational and post construction vegetation management including management of native species, and control of non-native and noxious weeds as part of a BLM-approved Site Restoration Plan and Integrated Weed Management Plan for the Project. Mowed areas would require periodic hand-trimming of vegetation to keep vegetation height to 18 to 24 inches.

Herbicides would be one of the methods employed to control weeds throughout the site. A Pesticide Use Proposal (PUP) would be prepared and approved by the BLM prior to receiving a Notice to Proceed and would provide the exact specifications involved with herbicide application including the type of herbicide(s) proposed for use, method of application, and quantities of herbicide. Herbicide use would be conducted in accordance with BLM requirements and as covered under the RODs for the BLM's Programmatic EIS (PEIS) for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Managed Lands in 17 Western States (BLM 2016), which is tiered from the PEIS for Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States (BLM 2007). The allowed herbicides in mowed areas are identified in the Southern Nevada District Office Programmatic Biological Opinion (84320-2010-F-0365.R038) and include aminopyralid, clopyralid, imazapyr, imazapic, glyphosate, metasulfuron methyl, and rimsulfuron. Herbicides that are believed to have deleterious effects on reptiles, such as 2,4-D, would not be allowed in mowed areas. Aminopyralid would not be used within areas of Nye milkvetch or threecorner milkvetch habitat.

Four weed species were found to be widespread throughout the Project site red brome (*Bromus madritensis* ssp. *rubens*), cheatgrass (*Bromus tectorum*), Mediterranean grass (*Schismus sp.*), and red stem stork's bill (*Erodium cicutarium*). Three additional species of weeds were recorded in large numbers during surveys: Sahara mustard (*Brassica tournefortii*), halogeton (*Halogeton glomeratus*), and African mustard (*Strigosella africana*). Surveys for and control of noxious and non-native weeds would be carried out during seasonally appropriate times and as needed to prevent the increase of non-native and noxious weeds within the Project area and to prevent spread of these weeds through Project-related activities.

Construction

Construction is expected to occur over approximately 28 months in (Figure 15). Construction would primarily occur in two phases, with the fencing for Phase I installed in early 2020, and the fencing for Phase II installed in the fall of 2020 before tortoise translocation from the Phase I fenced areas. The two phases would overlap. The first phase of power could come on-line in 2021 with final completion as early as 2022 but no later than December 2023. Construction would include the major activities of mobilization, construction grading and site preparation, installation of drainage and erosion controls, PV panel and tracker assembly, and solar field construction. The Applicant would commence construction in the fourth quarter of 2019, after issuance of the ROD and a Notice to Proceed.

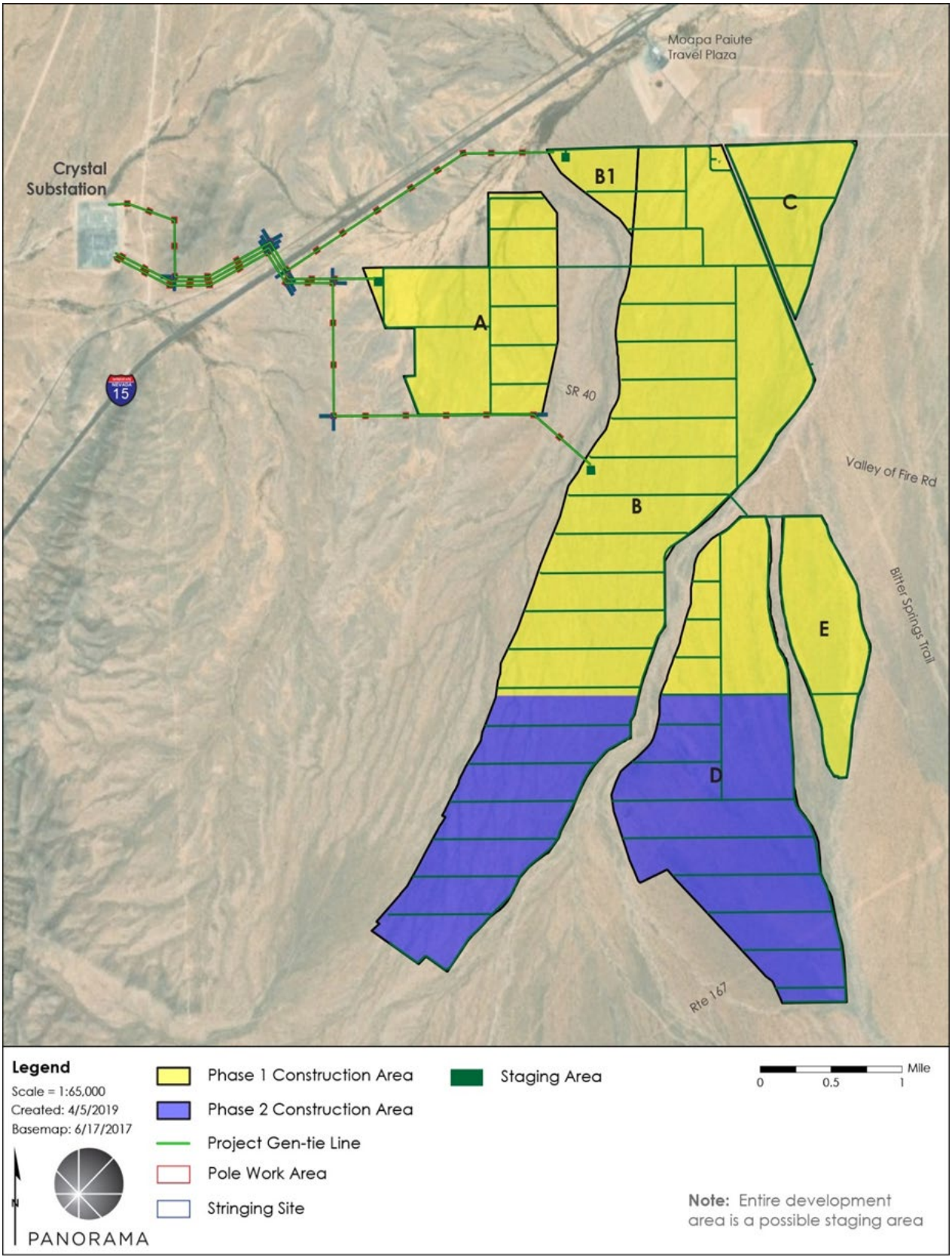
Moapa Paiute
Travel Plaza
Crystal
Substation
B1
C
A
SR 40
15
Valley of Fire Rd
B
Bitter Springs Trail
E
D
Rte 167
Legend
Scale = 1:65,000
Created: 4/5/2019
Basemap: 6/17/2017
Phase 1 Construction Area
Phase 2 Construction Area
Project Gen-tie Line
Pole Work Area
Stringing Site
Staging Area
Mile
0
0.5
1
Note: Entire development area is a possible staging area
N
PANORAMA

Figure 15. Construction phasing and staging areas.

BMPs Used During Construction

Several BMPs would be employed during construction of the Project to minimize environmental degradation. These BMPs include:

- Minimizing vegetation removal by limiting it only to areas of active construction
- Recontouring and revegetating Project roads that are no longer needed in order to increase infiltration and reduce soil compaction
- Utilizing excavated materials for backfill
- Controlling Project vehicle and equipment speeds to reduce dust erosion and to protect tortoises
- Retaining sediment-laden waters from disturbed active construction areas within the Project site through the use of barriers and sedimentation devices (e.g., straw bales, sandbags, jute netting, or silt fences). Conducting periodic surveys of these areas and removing sediment from barriers and sedimentation devices to restore sediment-control capacity (removed sediment would likely be spread back onsite)
- Placing barriers and sedimentation devices around drainages and jurisdictional waters
- Replanting Project areas with native vegetation at spaced intervals to break up areas of exposed soil and reduce soil loss through wind erosion, where possible
- Minimizing land disturbance (including crossings) in natural drainage systems and groundwater recharge zones (i.e., ephemeral washes)
- Locating and constructing drainage crossings for internal access roads so as not to decrease channel stability or increase water volume or velocity
- Avoiding clearing and disturbing areas outside the construction zone
- Conducting construction grading in compliance with industry practice (e.g., the American Society for Testing and Materials [ASTM] international standard methods) and other requirements (e.g., BLM and/or local grading and construction permits)
- Using temporary stabilization devices (i.e., erosion matting blankets or soil stabilizing agents) for areas that are not actively under construction
- Minimize topsoil removal and disturbance to minimize weed invasions and to keep the soil seed bank in place. Where soils would otherwise be disturbed, salvage topsoil and store for restoration
- Restoring native plant communities as quickly as possible in areas temporarily disturbed during construction through natural revegetation or by seeding and transplanting (using weed-free native grasses, forbs, and shrubs) on the basis of BLM recommendations
- Inventory for non-native and noxious weeds throughout construction, treat weeds when they are found, and follow weed plan to minimize the spread of weeds during construction
- Minimizing soil-disturbing activities on wet soils

Temporary Construction Workspace, Laydown, and Mobilization Areas

Temporary construction workspace, laydown, and mobilization areas would be established after tortoise clearance. The Project construction contractor would develop a temporary construction

mobilization and laydown area at the location of the O&M building or adjacent to it (within the traditional development area that is cleared of vegetation). The area would include temporary construction trailers with administrative offices, construction worker parking, temporary water service and fire water supply holding tanks, temporary construction power services, tool sheds, and containers, as well as a laydown area for construction equipment and material delivery and storage and parking. This area would be up to five acres in addition to the O&M area and adjacent to it within the traditional development areas. Permanent access roads would also be used for temporary laydown and parking as the solar field is developed, allowing for the O&M building and facilities to be constructed.

Temporary construction areas would be located at the transmission structure locations and at locations required for conductor stringing and pulling operations to accommodate construction of the gen-tie lines, covering an area not to exceed 200 feet by 200 feet. These areas would be required for staging equipment and materials for foundation construction and tower installation.

Site Preparation Common to Both Methods of Construction

Geotechnical investigation and environmental clearance surveys would be performed at the Project site prior to commencement of construction activities. A design-level geotechnical investigation would be performed including additional subsurface evaluation and laboratory testing prior to construction. During the environmental clearance phase, the boundaries of the construction area would be delineated, marked, and prepared for use. Existing vegetation removal and grading in traditional development areas would be minimized to the extent practicable. Mowed areas would be prepared by mowing vegetation.

Prior to construction, the limits of construction disturbance areas would be determined by surveying, flagging, and staking. Where necessary, the limits of the gen-tie ROW would also be flagged. All construction activities would be confined to these areas to prevent unnecessary impacts on sensitive areas. These areas, which would include buffers established to protect biological resources, would also be staked and flagged. The locations of underground utilities would be located, staked, and flagged in order to guide construction activities.

Prior to major vegetation removal and grading (in traditional development areas), or mowing, approved desert tortoise fencing and permanent Project fencing would be installed around the perimeter of the construction areas to prevent tortoises from moving onto the site from adjacent areas. Agency-approved authorized biologists and biological monitors would be retained to survey for and move desert tortoises in accordance with an approved desert tortoise translocation plan.

Vegetation would be permanently cleared from roadways, access ways, and where concrete foundations would be used for the equipment areas, substations, and O&M facilities. All earthwork required to install construction facilities, access roads, and foundations for Project-related buildings would be balanced on site. Trenching would be required for placement of the 34.5 kV AC collector system.

Concrete would be poured in place for equipment and building foundations, fence footing, and miscellaneous small pads. BLM-approved aggregate material would be used for the trench backfill, surface of the O&M parking lot, and substation area (and if determined necessary, for the north-south connecting road and internal access roads). Riprap material may be required for temporary erosion control during construction. The Applicant would determine a source for these materials and present to BLM for review and approval. Commercially obtained or on-site materials would be used.

Traditional Methods of Construction

Traditional construction methods would occur on 35 percent of the site. These methods include the disk and roll technique, where the vegetation is crushed and mixed into the soil using deep disking, and the soil is then compacted so that construction equipment can safely traverse the site to construct the solar arrays and infrastructure. The disk and roll technique would be used to prepare the surface of the solar field for post and PV panel installation. This technique utilizes conventional farming equipment to prepare the site for construction, including rubber-tired tractors with disking equipment and drum rollers with limited use of scrapers to perform micrograding. The disk and roll method would result in deep tilling of the soil, which would bury all cut surface vegetation. Root crowns of the typical dominant desert vegetation (creosote and white bursage) are typically destroyed using this method.

Permanent security fencing would be installed flush with the ground. Tortoise exclusion fencing would be attached to the permanent security fencing. Desert tortoise would be permanently excluded with the desert tortoise fencing from areas constructed using traditional methods and installation of tortoise gates at all facility entrances to the mowed areas.

In areas where the terrain is not suitable for disk and roll, conventional cut and fill grading would be used. Within the solar field, some grading would be required for roads and access ways between the solar arrays and for equipment pads. The substations would require a graded site to create a relatively flat surface for proper operation, with an approximately one percent maximum slope in either direction. The substation interior would be covered with a BLM-approved aggregate surfacing for safe operation.

Mowed Areas

The permanent security fencing would be installed with a gap between the fence bottom and the ground of approximately eight inches. Approved desert tortoise exclusion fencing would be temporarily installed immediately outside the permanent security fencing around mowed areas, and tortoise gates would be used at entrances to exclude tortoises during construction. The tortoise exclusion fencing and tortoise gates would be removed once construction was completed to allow desert tortoises the opportunity to reoccupy the site. In all areas within the mowed configuration, vegetation would only be mowed or clipped to a height of 24 inches to allow for panel construction. Vegetation may be trimmed to no less than 18 inches tall under justifiable circumstances.

Mowing would occur at a height that would not kill the dominant shrub and bunch grass species so that desert tortoises can re-occupy the mowed areas. Mowing would only occur in the solar array areas where vegetation can affect the panels, equipment, or access. Utilizing skid steer vehicles or other tracked vehicles and minimizing the construction passes during installation would encourage continued viability of the native plant community. Construction would be accomplished through use of equipment selected to minimize width of footprint, minimize weight of equipment and ground pressure, and allow extended reach across multiple solar array rows. A flail-type mower mounted on skids that are mounted on a low-ground pressure tractor is an example of this type of equipment. A rubber tracked skid steer or a steel tracked excavator could also be used.

Some vegetation would need to be crushed to construct the facility; however, passes taken by tracked equipment to construct each solar array would be minimized to reduce the amount of crushed vegetation. A rough estimate of 20 to 25 percent of the vegetation is expected to be crushed in mowed areas by tracked vehicles to bring equipment to the array areas, to mow the facility, and to construct the tracker systems. This number is an estimate and the actual amount would depend on the equipment used and feasibility in the field. All efforts and planning would be made to crush the minimum amount of vegetation possible while safely constructing the facility. Typical types of equipment needed could include loaders or skid steers to carry materials to the array rows, pile drivers to pound in steel posts, small cranes to install the solar panels, and some graders to even out small areas to place equipment such as the PCSs and battery containers. These vehicles typically have a footprint of approximately 4 to 5 feet per track. One vehicle can likely access two solar array rows at a time, so approximately 8 to 10 feet of vegetation would be crushed every approximately 40 feet (depending on the distance between rows) in the mowed areas. From three to ten passes are needed to install each set of solar array rows. Passes are typically needed to install pile posts, to install racking and tracker system, to install the panels, to wire the panels, and then to restore any surface along the route. Where vegetation is crushed, root balls would be left in place, tracked vehicles would distribute weight and minimize soil disturbance, and turns would be wide and confined to graded roads to minimize soil disturbance. Given the distance between panel rows and that one tracked vehicle can access two rows, turns would be made over a 40-foot distance. Native vegetation that is crushed during construction is expected to rebound and regrow after construction is complete.

The mowing method of construction would also minimize the areas of grading and leveling, except potentially for some roads and for some equipment pads (e.g., PCSs, battery containers). Approximately seven acres in the southwestern corner of the mowed area in development area A would need to be graded to accomplish the slope needed for the panel operation. This area would become part of the “traditional development areas” and removed from the mowed areas. Surface drainage channels would remain largely unchanged in mowed areas.

Gravel, Aggregate, and Concrete Needs and Sources

Concrete would be poured in place for equipment and building foundations, fence footing, and miscellaneous small pads. BLM-approved aggregate material would be used for the trench

backfill, surface of the O&M parking lot, and substation area (and if determined necessary, for the north-south connecting road and internal access roads).

PV Solar Array Assembly and Construction

Prior to any construction in PV equipment areas, the clearance and site preparation would be completed. Within each area designated for PV equipment, the construction sequence would follow a generally consecutive order:

1. The construction of the solar field would proceed by arrays. Within each array, materials for each row of PV modules would be staged next to that row. Prepare trenches for underground cable; install underground cable;
2. backfill trenches;
3. install steel posts and table frames;
4. install PV modules;
5. install concrete footings for inverters, transformers, and substation equipment;
6. install inverter and transformer equipment;
7. perform electrical terminations; and
8. inspect, test, and commission equipment.

Cable trenches would be used to provide underground connection of Project equipment. Trenches would contain electrical conductors for power generation and fiber optic cables for equipment communication. Trenches would vary between two to three feet wide and two to three feet deep depending on the number of conductors and voltage of equipment to comply with applicable electrical codes.

The assembled solar equipment would be installed on steel posts to which steel table frames would be attached. Trucks would be used to transport the PV modules to the solar field. A small mobile crane may be used to assist construction workers in setting the solar modules on the driven steel posts. Final solar field assembly would require small cranes, tractors, and forklifts.

Electrical Collection and Transmission System Construction

Electrical construction would consist primarily of the following elements:

1. Equipment - Installation of all electrical equipment including BESS containers, DC/DC converter containers, PCS containers (including inverters and transformers), PVCS containers, circuit breakers, disconnect switches, switchgear and distribution panels, lighting, communication, control, and SCADA equipment.
2. Cables - Installation of all cables necessary to energize the Project equipment including instrument control wiring. High, medium, and low voltage cables would be routed via cable trays, above-grade conduits, below-grade conduit in duct bank, and overhead structures.
3. Grounding - All equipment and structures would be grounded as necessary. Within the solar field, an appropriate grounding system would be engineered and constructed in order to maintain personnel safety and equipment protection.

4. Telecommunications - Multiple communication systems would be required for the Project, including T-1 internet cables, fiber optic, microwave, and telephone. All communications would be installed during electrical construction.

Standard Electrical Collection and Transmission Line

The Project would include an overhead 230 kV and 500 kV gen-tie lines and some of the 34.5 kV collection system may also be installed on overhead lines. Standard transmission line construction techniques would be used to construct the collector and gen-tie lines. Primary stages in transmission line construction are foundation installation (e.g., concrete footings, pier foundations, or micropiles), tower installation with attached cross-arms and insulators, and conductor stringing onto the structures. Up to a 200-foot by 200-foot temporary laydown or staging area would be required at each 230 kV and 500 kV tower location for equipment, towers, and hardware. Grading of laydown areas would be minimized. Temporary staging for gen-tie lines would require up to 36 acres. In general, little to no grading would be expected for these areas. Typical equipment to be used for transmission line construction includes backhoe, truck-mounted tower hole auger, forklift, crane, line truck with air compressor, various pickup and flatbed trucks, conductor reel and tower trailers, bucket trucks, and truck-mounted tensioner and puller.

The steel towers used for the gen-tie lines would be supported by steel-reinforced poured pier concrete foundations suitable for the sandy soil conditions at the site. These foundations are constructed by auguring a cylindrical hole using a truck-mounted drilling rig. Reinforcing steel and anchor bolt cages would be installed in the hole and then the hole would be backfilled with concrete. Steel tower foundations would range in size from approximately 4 to 7 feet in diameter, and from 12 to 30 feet in depth.

Smaller wood or steel poles used for the overhead 34.5 kV collector line would be embedded into the ground to a depth of at least ten percent of the pole height plus two feet. Installation of wood poles is anticipated to require auguring holes approximately two feet in diameter and eight feet deep. Aggregate or high-strength backfill would be used to stabilize the installed poles. Angle points on the 34.5 kV collection line would require steel poles supported by steel-reinforced poured pier concrete foundations.

Poles would be placed onto their foundations (for wood, placed into their holes) using backhoes or heavy lifter vehicles for the smaller, lighter poles or a crane for longer poles. The poles would be supported during backfilling or bolting to the foundation to ensure correct pole seating. Conductor stringing would likely be conducted one phase at a time, with all equipment in the same operational place until all phases of that operation are strung. Ground rods would be hammered into the earth with a jackhammer device attached to a small excavator (such as a Bobcat). Typically, the rods are 8 to 12 feet long and can be longer if needed by joining multiple rods. For the 34.5 kV wood poles, a 3-foot square by 2-foot deep area would be excavated to expose the ground rod for connection to the plant’s grounding grid.

Substation Construction

The Project's three substations would be constructed in compliance with applicable electrical safety codes. Substation construction would consist of site grading, concrete equipment foundation forming and pouring, crane-placed electrical and structural equipment, underground and overhead cabling and cable termination, ground grid trenching and termination, control building erection, and installation of all associated systems including, such as heating, ventilating, and air conditioning (HVAC) system components; distribution panels; lighting; communication and control equipment; and lightning protection.

The substation area would be excavated to a depth of 10 feet. A copper grounding grid would be installed and the foundations for transformers and metal structures would be prepared. After installation of the grounding grid, the area would be backfilled, compacted, and leveled followed by the application of six inches of aggregate rock base. Equipment installation of the transformers, breakers, buswork, and metal dead-end structures would follow. A pre-fabricated control house would be installed to house the electronic components required of the substation equipment.

Site Stabilization, Protection, and Reclamation

Appropriate water erosion and dust-control measures would be implemented to prevent an increased dust and sediment load to ephemeral washes around the construction site and to comply with Clark County dust control requirements. Dust during construction would be controlled and minimized by applying water or BLM-approved palliatives.

The Applicant would employ BMPs to protect the soil surface by covering or binding soil particles (in areas of traditional development). The Project would incorporate erosion-control measures required by regulatory agency permits and contract documents as well as other measures selected by the contractor. Project-specific BMPs would be designed by the contractor and included in the Project Stormwater Pollution Prevention Plan (SWPPP). Weed management guidance would be followed to prevent the additional establishment, increase, or spread of non-native or noxious weeds within and outside of the Project area as a result of Project activities.

The Site Restoration Plan, which also addresses site rehabilitation and restoration, would be implemented immediately after construction for the areas that are temporarily disturbed, such as portions of the transmission line route that involve disturbance for staging.

Water Sources and Storage for Construction

A total of 2,000 acre-feet (AF) of water is estimated to be needed for Project construction, primarily for dust control. The construction water use estimate is based on the median water use of other solar power plant installations in the desert areas of Nevada and neighboring states. Actual water use varies widely at different facilities depending on weather, soil, and vegetation conditions encountered during construction. Water would be trucked to the Project site where it would then be pumped to up to four one-acre storage ponds across the construction site. The

storage ponds would be encircled by an earthen berm comprised of on-site material fill with a liner and would be approximately three feet deep. Each pond would hold approximately one million gallons of water. The water would be pumped from the O&M building via a diesel generator pump or an existing distribution drop, through temporary eight-inch diameter high-density polyethylene (HDPE) pipe laid on the ground surface to each pond. Approximately 223 one-way truck trips per day of 4,000-gallon capacity trucks would be needed to deliver water to the Project site at the O&M building, assuming a two-year construction schedule. Following construction, the ponds would be removed, and solar panels installed in the graded areas.

The BLM has allowed the use of several dust palliatives on other projects within the Southern Nevada District. If dust palliatives are used in place of water in traditional development areas of the Project, the total amount of water needed during construction would be reduced. The Applicant may opt to use such palliatives, as authorized by the BLM for the Project. The soil binder/dust palliatives that are proposed for the Project and which BLM previously has allowed:

- Road Bond 1000
- For roads and heavy traffic areas: Soil Cement
- For non-traffic areas on finer soils: Formulated Soil Binder (FSB) 1000
- For non-traffic areas on sandier/rockier soils: Plas-Tex
- Alternatives as approved by the BLM

Workforce, Schedule, Equipment, and Materials

The on-site construction workforce would consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. The on-site construction workforce is anticipated to be an average of 500 to 700 construction workers with a peak of up to 900 workers at any time. Most construction staff and workers would commute daily to the jobsite from within Clark County, primarily from the Las Vegas area.

Construction generally would occur between 5:00 a.m. and 5:00 p.m. and may occur seven days a week. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. For instance, during hot weather, it may be necessary to start work earlier (e.g., at 3:00 am) to avoid work during high ambient temperatures. Further, construction requirements would require some nighttime activity for installation, service or electrical connection, inspection, and testing activities.

A preliminary construction schedule for the Project is in Table 3. The table shows how construction would be phased by development area.

Table 3. Preliminary construction schedule.

Activity	Development Area	Duration	Timeframe
Install Fencing	A	12 weeks	Jan 1 – March 31, 2020

Activity	Development Area	Duration	Timeframe
	B and B1, Phase I	12 weeks	Jan 1 – Mar 31, 2020
	C	11 weeks	Jan 15 – Mar 31, 2020
	D, Phase I	11 weeks	Jan 15 – Mar 31, 2020
	E	11 weeks	Jan 15 – Mar 31, 2020
	B, Phase II	8 weeks	July 1 – Aug 31, 2020
	D, Phase II	8 weeks	July 1 – Aug 31, 2020
Desert Tortoise Clearance Surveys, Additional Health Assessments and Disposition Plan	A	8 weeks	Apr 1 – May 31, 2020
	B and B1, Phase I	8 weeks	Apr 1 – May 31, 2020
	C	8 weeks	Apr 1 – May 31, 2020
	D	8 weeks	Apr 1 – May 31, 2020
	E	8 weeks	Apr 1 – May 31, 2020
	B, Phase II	6 weeks	Sep 15 – Oct 31, 2020
	D, Phase II	6 weeks	Sep 15 – Oct 31, 2020
Translocate Tortoises	A	3 wees	Sept 15 – Oct 5, 2020
	B and B1, Phase I	3 weeks	Sept 15 – Oct 5, 2020
	C	3 weeks	Sep 15 – Oct 5, 2020
	D, Phase I	3 weeks	Sep 15 – Oct 5, 2020
	E	3 weeks	Sep 15 – Oct 51, 2020
	B, Phase II	2 weeks	Apr 1 – Apr 10, 2021
	D, Phase II	2 weeks	Apr 1 – Apr 10, 2021
Install BMP Erosion Control Measures	A	3 weeks	Nov 1 – Nov 21, 2020
	B and B1, Phase I	3 weeks	Nov 1 – Nov 21, 2020
	C	2 weeks	Nov 1 – Nov 15, 2020
	D, Phase I	2 weeks	Nov 7 – Nov 21, 2020
	E	2 weeks	Nov 1 – Nov 15, 2020

Activity	Development Area	Duration	Timeframe
	Gen-Tie, Phase I	2 weeks	Nov 7 – Nov 21, 2020
	B, Phase II	2 weeks	Jun 1 – Jun 15, 2021
	D, Phase II	2 weeks	Jun 1 – Jun 15, 2021
	Gen-Tie, Phase II	2 weeks	Jun 1 – Jun 15, 2021
Site Preparation including constructing roads (including gen-tie) and laydown areas; berms; pads for O&M building, water tanks; substation grading, and detention basin development	A	4 weeks	Nov 21 – Dec 21, 2020
	Substations, B and B1, Phase I	4 weeks	Nov 21 – Dec 21, 2020
	C	2 weeks	Nov 15 – Nov 30, 2020
	D, Phase I	2 weeks	Nov 21 – Dec 7, 2020
	E	2 weeks	Nov 15 – Dec 1 - 2020
	Gen-Tie, Phase I	4 weeks	Nov 15 – Dec 15, 2020
	B, Phase II	4 weeks	Jun 15 – July 15, 2021
	D, Phase II	4 weeks	Jun 15 – July 15, 2021
	Gen-tie, Phase II	4 weeks	Jun 15 – July 15, 2021
Blading/grading/mowing for Solar Block Arrays; Dig trenches and install underground cable in array; For substation install underground cabling, aggregate base, concrete foundations for equipment; Install foundations for towers for Gen-Tie lines	A	7 weeks	Dec 21, 2020 – Feb 1, 2021
	Substations, B and B1, Phase I	7 weeks	Dec 21, 2020 – Feb 1, 2021
	C	2 weeks	Dec 7 – Dec 21, 2020
	D, Phase I	2 weeks	Dec 7 – Dec 21, 2020
	E	2 weeks	Dec 1 – Dec 15, 2020
	Gen-Tie Phase I	4 weeks	Dec 1 – Dec 31, 2020
	B, Phase II	4 weeks	July 15 – August 15, 2021
	D, Phase II	4 weeks	July 15 – Aug 15, 2021
	Gen-Tie Phase II	4 weeks	July 15 – Aug 15, 2021
Install Tracking System Posts and table frames	A	4 weeks	Feb 1 – Mar 15 2020
	B and B1, Phase I	6 weeks	Feb 1 – Mar 15, 2021
	C	4 weeks	Feb 1 – Feb 28, 2021
	D, Phase I	4 weeks	Feb 1 – Feb 28, 2021
	E	4 weeks	Feb 1 – Feb 28, 2021

Activity	Development Area	Duration	Timeframe
	B, Phase II	4 weeks	Aug 15 – Sept 15, 2021
	D, Phase II	4 weeks	Aug 7 – Sept 7, 2021
Install above-grade DC and AC Cable and poles, PCS equipment, SCADA equipment, communications system; install towers and cable for gen-tie; install O&M building; install substation equipment; install water tanks	A	8 weeks	Mar 1 – Nov 15, 2021
	Substations	34 weeks	Mar 1 – Nov 15, 2021
	B and B1, Phase I	8 weeks	Mar 15 – May 15, 2021
	C	4 weeks	Mar 15 – Apr 15, 2021
	D, Phase I	4 weeks	Mar 1 – Apr 1, 2021
	E	4 weeks	Mar 1 – Apr 1, 2021
	Gen-Tie Phase I	17 weeks	Mar 1 – July 7, 2021
	B, Phase II	8 weeks	Sep 15 – Nov 15, 2021
	D, Phase II	8 weeks	Sep 15 – Nov 15, 2021
	Gen-Tie, Phase II	17 weeks	Jul 8 – Nov 15, 2021
Install Modules	A	10 weeks	May 1 – July 15, 2021
	B and B1, Phase I	10 weeks	May 1 – Jul 15, 2021
	C	8 weeks	May 1 – Jul 1, 2021
	D, Phase I	8 weeks	May 1 – Jul 1, 2021
	E	2 weeks	May 15 – Jun 1, 2021
	B, Phase II	4 weeks	Sep 15 - Oct 15, 2021
	D, Phase II	4 weeks	Sep 15 – Oct 15, 2021
Testing and Commissioning	A*, B, B1 (Phase I), C, D (Phase I), E	4 weeks	Jul 1 – Jul 31, 2021
	B (Phase II) and D/E (Phase II)	4 weeks	Jan 15 – Feb 15, 2022

* Development area A could be connected online in Q2 of 2020, if an off-taker is available at that time. Development area A would comprise approximately 60 to 80 MW of power. The substation in that area would be constructed with the solar array, if the power is to be sold in Q2 2020.

Construction activities would follow a consecutive order; however, most construction activities associated with each construction component would overlap to some degree and would include the following:

1. Installation of tortoise fencing and security fencing;
2. Clearing of tortoises;
3. Installation of BMPs and erosion control measures:
4. Site preparation activities and construction of the access road, laydown areas, substation and equipment concrete pads, and distribution line;
5. Construction of any temporary drainage control features;
6. Installation of posts and table frames;
7. Installation of electrical collection system and substation; and
8. PV module assembly, testing, and commissioning.

Construction Traffic

Typical construction traffic would consist of trucks transporting construction equipment and materials to and from the site and vehicles of management and construction employees during the construction period. Most construction staff and workers would commute daily to the jobsite from within Clark County, primarily from the Las Vegas area. Traffic would use I-15 and Valley of Fire Road to access the Project site. Prior to the start of construction, the Applicant would prepare a Traffic and Transportation Plan to address Project-related traffic.

Construction Power

A temporary overhead line would be installed during construction to provide power to the laydown areas. The nearest existing distribution lines are located west of I-15. Alternatively, diesel generators may be used to provide construction power.

Desert Tortoise Translocation

Presence/absence surveys for desert tortoise were conducted on the Project site in the fall of 2017 and spring of 2018. A translocation plan that details all activities associated with clearance and translocation is in the Appendix. Below is a brief summary of the process.

In spring of 2020, clearance surveys would be conducted in all areas fenced with tortoise exclusion fencing. All tortoises would receive health assessments according to the guidelines in the *Health Assessment Procedures for the Mojave Desert Tortoise (Gopherus agassizii): A Handbook Pertinent to Translocation* (Service 2019b). Tissue samples (blood and oral mucosa) would be collected and submitted for disease analysis. Radio transmitters would be affixed to a subset of tortoises over approximately 90 millimeters in length, so that the animals could be easily relocated for future translocation. Juvenile tortoises, which are difficult to see, will be temporarily transferred to the BLM Research Facility (formerly the Desert Tortoise Conservation Center). At the close of construction, juveniles temporarily housed at the BLM Research Facility and originating from the internal 500 m mowed area will be replaced at their capture sites (or as directed by the Service and BLM if they are at least 140 mm). However, tortoises smaller than 140 mm are less visible and would be more vulnerable during operations. Accordingly, all juveniles from the holding facility that are under 140 mm will be translocated outside the

development area, opposite their capture point. None will be translocated east of area B, except in the south. Because small juvenile tortoises are highly vulnerable to predation, they will be released in the morning to avoid inadvertently attracting nocturnal predators to a release site. Juveniles under 60 mm will be released near inactive rodent burrows or other protective cavities.

All animals with transmitters would be tracked within 24 hours of affixing transmitters, once each week for the first 2 weeks, and monthly thereafter until translocation. Tortoises would then be translocated as summarized below. Fencing for Phase II of Project construction would be installed prior to translocation of tortoises from Phase I areas. Only authorized biologists and biological monitors would conduct these activities. Table 4 shows the timeline for tortoise clearance for the Project.

Table 4. Tortoise clearance timeline for 2020 construction.

Task Name	Duration	Start	Finish
Phase I			
Service Issues BO	140 days	5/29/2019	11/7/2019
Tortoise Fencing (Phase I)	90 days	1/1/2020	3/31/2020
Tortoise Clearance Surveys (Phase I)	60 days	4/1/2020	6/1/2020
Pre-Translocation Health Assessments (Phase I)	20 days	5/15/2020	6/5/2020
Laboratory Tests on Tissue Samples	30-45 days	6/1/2020	7/15/2020
Disposition Plan for Phase I Construction Area prepared and submitted to the BLM	30 days	7/15/2020	8/15/2020
Service Review of Phase I Disposition Plan	30 days	8/15/2020	9/15/2020
Translocation of Tortoises in Disposition Plan (Phase I)	2 weeks	9/25/2020	10/10/2020
Solar field construction in Phase I Area commences	--	11/1/2020	--
Testing and Commissioning Phase I	4 weeks	7/1/2021	7/31/2021
Phase II			
Tortoise Fencing (Phase II)	60 days	7/1/2020	8/31/2020
Tortoise Clearance Surveys (Phase II)	60 days	9/1/2020	10/31/2020
Pre-Translocation Health Assessments (Phase I)	3 weeks	9/15/2020	10/20/2020

Task Name	Duration	Start	Finish
Laboratory Tests on Tissue Samples	30-45 days	11/1/2020	12/15/2020
Disposition Plan for Phase II Construction Area prepared and submitted to the BLM	30 days	1/15/2021	2/15/2021
Service Review of Phase II Disposition Plan	30 days	2/15/2021	3/15/2021
Translocation of Tortoises in Disposition Plan (Phase II)	10 days	4/1/2021	4/12/2021
Solar field construction in Phase II Area commences	--	6/1/2021	--
Testing and Commissioning Phase II	4 weeks	1/15/2022	2/15/2022
Passive and Active Tortoise Reintroduction	--	4/1/2022	--

Clearance and translocation methods in this plan only apply to the solar fields, not the linear facilities outside the solar field (e.g. gen-tie, access roads). Tortoises on these external linear facilities would simply be moved out of harm's way, well within their home range, rather than translocated. The process of clearance and translocation would be:

- Install tortoise exclusion fencing around areas to be cleared.
- Install internal cross fencing in areas to be cleared.
- Conduct clearance surveys in the tortoise-active season preceding the active season in which tortoises will be translocated. Attach transmitters and conduct health assessments, with tissue sampling.
- Monitor transmittered tortoises in situ until the next translocation season. Collect pre-translocation data per the long-term monitoring plan (LTMP).
- Submit a disposition plan for the tortoises to be translocated
- Translocate tortoises.
- Monitor per the LTMP.

The BLM determined that tortoises within 500 m of the development area borders inside mowed areas of the Project site generally would be moved a short distance to a location outside the border, within approximately 500 m of their capture site. For tortoises translocated distantly from their capture site, the release area would be south and southeast of solar development areas D and E. For purposes of the translocation plan, these two release areas are called the "short-distance release area" and "distant release area", respectively. BLM policy is to only allow translocation of desert tortoises in the wild once, so translocated tortoises in the "short-distance release area" and "distant release area" would be afforded some protection in that no future projects would be approved that would displace or destroy desert tortoise habitat in these areas.

Per the Service's translocation guidance, "Data from recent translocations indicate that desert tortoises moved up to 500 m from their capture location are expected to settle within 1.5 km of their release point; most tortoises (>97.5%) moved >500 m are expected to settle within 6.5 km of their release point." Accordingly, the short-distance recipient area immediately outside the Project includes the release band (500 m wide) plus all suitable tortoise habitat within 1.5 km. The distant recipient area includes the distant release area, plus all suitable tortoise habitat within 6.5 km.

The number of tortoises to be translocated cannot be exactly known until clearance surveys are completed. Hence, the number of translocatees and their translocation destinations are based on the number of adult tortoises found and their locations during 2017 and 2018 surveys. The total number of adult tortoises estimated to be moved based on surveys is 219.

The translocation plan includes procedures and activities to ensure that translocated tortoises survive and establish in the recipient area while minimizing impacts to resident tortoises. The health of all tortoises to be translocated and sample of resident tortoises will be assessed by trained and well-qualified biologists. Release locations would be identified in the disposition plan in consideration of current distribution and health status of resident tortoises.

Monitoring of Translocated Desert Tortoises

BLM would ensure that translocated desert tortoises would be monitored in accordance with this biological opinion (BO), the translocation plan and the long-term monitoring plan. Newly translocated tortoises display increased activity, often moving extreme distances in erratic directions; neither distance nor direction can be accurately predicted. While movements for tortoises translocated immediately outside the site are expected to be much less than the distantly released tortoises, tortoises with transmitters affixed at both release sites would be tracked within 24 hours of release, twice weekly for the first two weeks, weekly from March through early November, and then according to the LTMP schedule. Tortoises actively reintroduced to mowed areas following construction would be tracked similarly at release and then according to the LTMP. Tortoises allowed to reintroduce passively would be tracked per the LTMP. Recipient and control tortoises would be identically tracked to compare movements and behaviors. The final LTMP will be provided and approved by the BLM and the Service, prior to the Record of Decision being signed.

Operation and Maintenance

The facility would operate seven days a week using automated facility controls and monitoring systems with SCADA control systems. Nineteen people would be employed on the Project site. Operations staff would be located off site, with site visits occurring daily for security, maintenance, and repairs. To maintain generation performance, PV array cleaning may occur up to 24 hours per day (including nighttime panel cleaning), with approximately two panel cleanings anticipated per year. A solar PV project uses no process water, gas, or fuels for the

power generation process. Cleaning would occur by manual methods using brushes and air or using robotic systems (often built into the panel systems but otherwise placed on the panels).

A plant O&M program would be implemented to control the quality of O&M (Table 5). During the first year of operation, the frequency of inspections would be increased to address settling and electrical termination torque (e.g., for year one, inspections shown as semi-annually are performed quarterly, inspections shown as annual are performed semi-annually). At designated intervals, approximately every 10 to 15 years, major equipment maintenance would be performed. Operations and maintenance procedures would be consistent with industry standard practices maintaining useful life of plant components.

Table 5. Routine maintenance protocol.

Equipment	Maintenance Interval	Task
PV Modules	Quarterly	• Visually inspect panels for breakage and secure mounting • Visually inspect modules for discoloration • Visually inspect wiring for connections and secure mounting • Visually inspect mounting structure for rust and erosion around foundations • Manually clean localized debris from bird droppings, etc.
	Semi-annually	• Clean modules if determined necessary
Inverters	Semi-annually	• Perform temperature checks on breakers and electrical terminations • Visual inspection of all major components and wiring harnesses for discoloration or damage • Measure all low voltage power supply levels • Inspect/remove any dust/debris inside cabinet • Inspect door seals • Check proper fan operation • Inspect and clean (replace if necessary) filters • Check electrical termination torque • Check the operation of all safety devices (e-stop, door switches, ground fault detection)
	Annually	• Check all nuts, bolts and connections for torque and heat discoloration • Calibrate control board and sensors • Inspect air conditioning units for proper operation

Equipment	Maintenance Interval	Task
Medium voltage transformers	Semi-annually	• Perform temperature check • Inspect door seals • Record all gauge readings • Clean any dirt/debris from low voltage compartment • Visual inspection of batteries for corrosion or discoloration (replace if necessary)
Substation transformers	Semi-annually	• Inspect access doors/seals • Inspect electronics enclosure and sensor wiring • Record all gauge readings
	Annually	• Inspect fans for proper operation • Calibrate temperature and pressure sensors • Pull oil sample for oil screening and dissolved gas analysis
Breakers and switchgear	Semi-annually	• Inspect for discoloration of equipment and terminations • Inspect door seals
	Annually	• Check open/close operation
Overhead transmission lines	Annually (and after heavy rains)	• Inspect guy wires and tower angle • Visual inspection of supports/insulators • Visual inspection for discoloration at terminations
Roadways	Annually (and after heavy rain)	• Inspect access ways and roads that cross drainage paths for erosion
Vegetation	Semi-annually in all areas but would likely be an on-going activity	• Non-native and noxious weed inspections would be conducted in accordance with BLM-approved Integrated Weed Management Plan • Inspect for localized vegetation control to restrict height to 24 inches to address faster growth vegetation • Apply herbicides as necessary to control noxious weeds
	Every 3-5 years	• Mowing and hand trimming as needed to reduce vegetation height to 24 inches. Mowing would be staggered and continuous with any one area being mowed around once every 3 to 5 years
Water Wells	Annually	• Visual inspection • Pressure test

Equipment	Maintenance Interval	Task
O&M Building	Semi-annually	• Check smoke detectors • Apply pesticides as necessary to control rodents and insects
	Annually	• Check weather stripping and door/window operation • Check emergency lighting • Inspect electrical service panel
Backup Power	Annually	• Visually inspect backup power system • Perform functional test of backup power system
Fencing	Quarterly (and after heavy rain)	• Inspect fence for vandalism and erosion at base • Desert tortoise fence inspections would be conducted in accordance with the Project-specific Service BO

Approximately 20 acre-feet of water per year (afy) is estimated for Project O&M. The operational water use estimate is based on the median water use of other solar power plant installations in the desert areas of Nevada and neighboring states. Actual water use varies widely at different facilities depending on weather, soil, and vegetation conditions. The Project would not require process water or water for panel washings. Approximately four trucks with a 4,000-gallon capacity would provide water to the facility per day.

Operation and maintenance would require the use of vehicles and equipment, including crane trucks for minor equipment maintenance. Pick-up trucks would be in periodic use on the site. No heavy equipment would be used during normal plant operation. Vehicle traffic during operations and maintenance to the Project site would be minimal at less than 20 round-trips per day under normal operational conditions.

The facility would be operated in one of the following modes:

1. Maximum continuous output operation would occur for as many hours per year as sunlight is available. During times of excess generation, the battery storage system receives solar power and stores the power until the customer, or the system determines release of the power to be more valuable.
2. Small portions of the facility may be temporarily shut down for maintenance and repairs.
3. Only in the case of a transmission system disconnect would the facility encounter a full shutdown.

Dust during O&M would be controlled and minimized by applying water or BLM-approved palliatives (in traditional development areas). Vegetation, including weeds, would be managed in accordance with the Site Restoration Plan and Integrated Weed Management Plan, as previously described. Hazardous wastes and other wastes would be disposed of in accordance with a Waste

and Hazardous Materials Management Plan.

Solar array areas constructed using mowing would need to have vegetation periodically trimmed to a height of 18 to 24 inches. Vegetation under the solar arrays would be cut or trimmed by hand during panel cleaning to a height that allows the vegetation to maintain its habitat function for desert tortoise and to maintain hydrology patterns on the site while not impacting the functionality of the solar panels. Trimming would occur every few years but not annually. Signage on roads and WEAP training would be required to minimize risks of take to desert tortoise during Project operation and maintenance. Desert tortoises would be captured and moved out of harm's way as needed.

Decommissioning

The objective of decommissioning and reclamation would be to remove the installed power generation equipment and to restore the site, in accordance with the Site Restoration Plan and Decommissioning Plan.

The Decommissioning Plan and Site Restoration Plan would describe the Applicant's decommissioning and site reclamation strategy for the Project area after the solar generating facility permanently ceases operation. Permanent closure would occur as a result of facility age, damage beyond repair to the facility, economic conditions, or other reasons. The Decommissioning Plan would be reviewed at least five years prior to planned permanent closure, and a Final Closure Plan would be prepared. The ROW requested from BLM is at least 30 years in duration. The ROW may be extended, subject to the discretion of the BLM. The extension of the ROW may be subject to additional review under the NEPA.

This biological opinion includes decommissioning activities that may affect desert tortoise. This includes capturing and moving tortoises out of harm's way. When these activities occur over 30 years from today, laws regarding desert tortoise may have changed. The Decommissioning Plan would address how desert tortoises would be moved according to the most recent guidance. As needed, this biological opinion may be reinitiated to incorporate such changes.

The Decommissioning Plan addresses dismantling and removal of Project components and reclamation of areas disturbed over the life of the Project. Reclamation would be accomplished through revegetation where needed on the 35 percent of the solar facility areas where vegetation was removed. Invasive weeds in the Project area would also be controlled throughout the life of the Project and beyond, in accordance with the Site Restoration Plan. The Decommissioning Plan supplements the Site Restoration Plan. Together, the plans describe the overall approach to vegetation management, weed management, and site closure and reclamation implemented over the life of the Project.

Management Plans

The following plans would be implemented during construction:

- Health and Safety Plan
  - Emergency Action Plan
  - Waste and Hazardous Materials Management Plan
  - Fire Protection and Prevention Plan
  - Structure and Hazardous Material Fire
  - Wildland Fire
  - Fuels Management
  - Wildfire history in the Vicinity of the Project
- Lighting Plan
- Cultural Resources Mitigation and Monitoring Plan and Human Remains Discovery Plan
- Paleontological Discover and Mitigation and Monitoring Plan
- Traffic and Transportation Plan
- Dust Control and Air Quality Plan
- Stormwater Pollution Prevention Plan (prepared prior to construction)
- Spill Prevention Control and Countermeasure Plan (prepared prior to construction)
- Flagging, Fencing and Signage Plan (prepared prior to construction)
- Site Restoration Plan
  - Cacti and Yucca Salvage Plan
  - Desert Pavement and Biocrust Protection Plan
  - Restoration and Revegetation Plan
  - Integrated Restoration Plan
    - Restoration standards
    - Habitat restoration standards
- Integrated Weed Management Plan
- Integrated Pest Management Plan
  - Note: All pesticide use must be authorized through a Pesticide Use Plan
- Bird and Bat Conservation Strategy, including Raven Management Plan
- Environmental Construction Compliance Monitoring Program
  - Compliance monitoring and mitigation personnel
  - Communication workflows
  - Reporting and documentation
  - Variance process
  - WEAP
- Decommissioning Plan

Proposed Minimization Measures

The following proposed minimization measures would be implemented as part of the Project proposed by the Applicant to avoid or reduce environmental impacts to federally protected species. Minimization measures and actions are designed to comply with the Service guidelines and Nevada Department of Wildlife (NDOW) standards. Minimization would include the general conservation strategies, as well as adhere to the specific desert tortoise conservation measures.

Construction Minimization Measures

Design Measures

1. In order to reduce effects, the Project footprint will be refined in the final engineering design. The final design will be reviewed and approved by the BLM prior to issuance of a Notice to Proceed for construction. All disturbance areas within the mowed areas of the facility will be refined and designed to the minimum size needed to safely and legally operate the facility, including access roads. Justifications for disturbances, such as access road widths, substrates, locations, and frequency will be provided.

Authorized Biologists, Biological Monitors, and Worker Training

2. **Authorized Desert Tortoise Biologists**
   The Applicant will employ Authorized Desert Tortoise Biologists and desert tortoise monitors to ensure compliance with protective measures for the desert tortoise. Authorized Desert Tortoise Biologists shall be onsite during all construction activities to ensure compliance with the BO. Use of authorized biologists and desert tortoise monitors will be in accordance with the most up-to-date Service guidance and will be required for monitoring of any pre-construction, construction, operation, or maintenance activities that may result in take of the desert tortoise, except those operational activities authorized to exclude monitoring. All authorized desert tortoise biologists (and monitors) are agents of the BLM and will report directly to the BLM and the proponent concurrently regarding all compliance issues and take of desert tortoises, including all draft and final reports of non-compliance or take.

3. **Approval of Authorized Biologists**
   The Applicant will provide the credentials of all individuals as Authorized Desert Tortoise Biologists to the Service for approval at least 30 days prior to the time they must be in the field.

   Potential authorized desert tortoise biologists must submit their statement of qualifications to the Service's Southern Nevada Fish and Wildlife Office in Las Vegas for approval, allowing a minimum of 30 days for Service response. The statement form is available in Chapter 3 of the Desert Tortoise Field Manual on the internet at: *https://www.fws.gov/nevada/desert_tortoise/dt/dt_manuals_forms.html*

   Authorized desert tortoise biologist requests in southern Nevada should be e-mailed to: ADTB_request@fws.gov

4. **Field Contact Representative**
   The BLM and the Applicant will designate a Field Contact Representative (FCR) who will be responsible for overseeing compliance of the minimization measures of the BO. The FCR will be on site during all active construction activities that could result in the "take" of a desert tortoise. The FCR will have the authority to halt activities that are in violation of the desert tortoise protective measures until the situation is remedied.

5. **Biological Monitors**
   Biological monitors or authorized biologists will be present at all active construction locations. Biological monitors will work under direct supervision of authorized biologists. Biological monitors will use the most up-to-date guidance from the Service. Desert tortoise monitors will provide oversight to ensure proper implementation of protective measures; record and report desert tortoise and tortoise sign observations in accordance with approved protocol; and report incidents of noncompliance in accordance with the biological opinion and other relevant permits. A biological monitor will escort all survey crews on site prior to construction. The biological monitor(s) will continually survey the construction area before and during construction to ensure that no tortoises are in harm's way. If a tortoise is observed entering the construction zone, work in the immediate vicinity will cease until the monitor moves the tortoise to an area designated by an authorized biologist or the tortoise moves out of the area of its own accord.

6. **Worker Environmental Awareness Program**
   A WEAP will be presented to all Project personnel prior to their working on the Project. This program will contain information concerning the biology and distribution of the desert tortoise, desert tortoise activity patterns, and its legal status and occurrence in the proposed Project area. The program will also discuss the definition of "take" and its associated penalties, measures designed to minimize the effects of construction activities, the roles and responsibilities of desert tortoise monitors, the means by which employees limit impacts, and reporting requirements to be implemented when tortoises are encountered.

   All project personnel shall be instructed to check under vehicles before moving them as tortoises often seek shelter under parked vehicles. Vehicle door magnets or stickers that remind vehicle operators to look beneath tires before driving shall be prepared and distributed by the Authorized Biologist.

   If project personnel encounter a desert tortoise, they will contact an authorized desert tortoise biologist. The desert tortoise will be allowed to move a safe distance away prior to moving the vehicle. Alternatively, an authorized desert tortoise biologist or Biological Monitor may move the desert tortoise to a safe location to allow for movement of the vehicle.

WEAP training will be mandatory, as such, workers will be required to sign in and wear a sticker on their hardhat to signify that they have received the training and agree to comply.

Reporting

7. **Construction Reporting Requirements**
Depending on the scale of the project, agencies may require reports either at project close or quarterly during the duration of construction and annual updates after that. The federal lead agency may delegate this responsibility to the applicants. In addition, a final construction report will be submitted to the Service within 60 days of completion of construction of the project. All quarterly reports are due by the 10th of each of the following months (January, April, July, October), and annual reports are due February 1 of each year. If required, annual status updates shall be provided to the Service following completion of construction.

Specifically, all reports must include information on any instances when desert tortoises were killed, injured, or handled; the circumstances of such incidents; and any actions undertaken to prevent similar incidents from reoccurring. Additionally, the reports should provide detailed information regarding each desert tortoise handled or observed, with the names of all authorized desert tortoise biologists or biological monitors (and the authorized desert tortoise who supervised their actions) involved in the project. Information will include the following: location (UTM), date and time of observation, whether desert tortoise was handled, general health, and whether it voided its bladder, re-hydration method and duration if applicable, location the desert tortoise was moved from and location moved to, unique physical characteristics of each tortoise, and effectiveness and compliance with the desert tortoise protection measures.

Any incident occurring during project activities that was considered by the authorized desert tortoise biologist or biological monitor to be in non-compliance with this biological opinion will be documented immediately and reported to the FCR by the authorized desert tortoise biologist.

Flagging, Fencing, and Clearing

8. **Construction Area Flagging**
The ROW boundaries will be staked prior to beginning construction activities and disturbance will be confined to the ROW. Pre-construction activities such as geotechnical work or meteorological tower installation may occur before desert tortoise fence construction, under supervision of an authorized biologist or desert tortoise monitor. Restricted areas may be identified and shall be monitored to ensure desert tortoises are protected during construction. In cases where construction vehicles are required to go off existing roads, an authorized desert tortoise biologist or Biological monitor (on foot) would precede the vehicles and clear the area.

An authorized desert tortoise biologist or biological monitor will be at each of the geotechnical test sites for all necessary activities. Appropriate desert tortoise clearance

will be conducted, and the authorized desert tortoise biologist or biological monitor will have the authority to micro-site the geotechnical test locations and stop work, if necessary, to avoid sensitive resources.

9. **Desert Tortoise Fencing Requirements**
The exclusion fence will follow current fence specifications established by the Service. Tortoise guards to exclude desert tortoises will be installed at the entry points to the facility and at any entry point into the mowed areas of the Project. The applicant will inspect the exclusion fence and tortoise guards monthly during construction, quarterly for the life of the project, and immediately following all major rainfall events. Any damage to the fence will be repaired within two days of observing the damage and be reported to the Service to determine whether additional measures are necessary.

10. **Desert Tortoise Fencing**
The Applicant will fence the boundaries and install tortoise gates at all entrances of the areas within which surface preparation will follow traditional blading methods ("traditional") with permanent desert tortoise fencing. Mowed areas ("mowed") will be fenced with temporary desert tortoise fencing. All desert tortoise exclusion fencing will be consistent with Service requirements and will be constructed prior to desert tortoise clearance in those areas. Temporary fencing along mowed areas will be bent out at the bottom and tacked down. Temporary fencing will avoid active tortoise burrows. Temporary cross-fencing, which may include standard tortoise fence materials or more expedient materials such as silt fencing, may be implemented on solar fields to optimize clearance. Biological monitors or authorized biologists will be present during all fence installation to move all tortoises in harm's way to outside the permitted Project ROW. All moved tortoises will be monitored to ensure that they remain safe (see Clearance below).

Project access will likely be confined to one primary new access road leading to the Valley of Fire Road and I-15 near the O&M facility. The road is very short given the proximity of the site to Valley of Fire Road. A few other access points could also be used off Valley of Fire onto the traditional development areas in development areas B and C. Access roads will be fenced temporarily with desert tortoise exclusion fencing for the construction period, if not within an area already fenced area for construction. Temporary laydown and pulling areas for the gen-tie lines will also be enclosed with temporary desert tortoise exclusion fencing.

Construction access would be limited to the project (ROW and established access roads as defined in pertinent permitting documents or as identified with the construction supervisor. The Applicants will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas during construction, operation, maintenance, or decommissioning.

Shade structures (PVC or equivalent half pipe) will be placed every 820 feet (250 meters) along the fence perimeter to provide shade for any tortoises pacing or walking along the fence. The shelters will be designed and installed to provide shelter for both small and

large tortoises. The shelters will be installed with one smaller sized shelter placed in between each larger shelter in order to provide additional locations for subadults and juveniles. Shelters will be made from either PVC tubes or similar material with a diameter of 14 inches or greater for the larger shelters and 6 to 8 inches for the smaller ones. Each shade structure will have three to four inches of soil piled on top to keep them from being blown away and to assist with thermoregulation within the shelter. Shade structures should follow Service guidelines.

11. **Fence Monitoring**
    During the tortoise activity seasons, all new fences will be checked twice a day for the first two weeks after construction, or the first two weeks after tortoises become active if fence construction occurs in the winter, including once each day immediately before temperatures reach lethal thresholds. Tortoise guards will be placed at all road access points where desert tortoise-proof fencing is interrupted to exclude desert tortoises from the Project footprint. Gates or tortoise exclusion guards will be installed with minimal ground clearance and shall deter ingress by desert tortoises.

    After the first two weeks, all tortoise exclusion fencing will be inspected monthly during construction, quarterly for the life of the Project, and immediately following all major rainfall events. Any damage to the fence will be repaired within two days of observing the damage and be reported to the Service to determine whether additional measures are necessary. During all fence monitoring, shade structures will be inspected for their effectiveness and adjusted as needed to increase their effectiveness.

12. **Desert Tortoise Clearance Surveys within Fenced Areas and Translocation**
    After installation of tortoise fencing around the perimeter of the solar facility and prior to surface-disturbing activities, authorized biologists and biological monitors supervised by an authorized biologist will conduct a clearance survey to locate and remove all desert tortoises from harm's way including those areas to be disturbed. Clearance surveys must be conducted during the more active tortoise seasons – April, May, September, and October. All handling of desert tortoises and their eggs will be conducted solely by authorized biologists in accordance with the most current Service-approved guidance and the Desert Tortoise Translocation Plan. All clearance and removal/ translocation techniques are detailed in the Service- and BLM-approved Desert Tortoise Translocation Plan.

    If Project personnel encounter a desert tortoise inside the fence, after clearance, they will contact an authorized biologist. The desert tortoise will be allowed to move a safe distance away prior to moving the vehicle.

13. **Desert Tortoise Translocation Monitoring**
    If unforeseen circumstances prevent translocation from occurring immediately following the issuance of this BO, the Applicant will be responsible for monitoring all transmitted

tortoises on the Project site until the time of translocation. This effort will include monitoring tortoises twice a month during the more active season and monthly monitoring during the less active season, as defined in the Translocation Plan. Transmitters will be repaired and replaced as needed. This monitoring will continue until all tortoises are translocated or, in the event they are not translocated, until their transmitters are removed. Quarterly reporting (email) of the pre-translocation monitoring shall be provided to the BLM. All other protocols and guidance during this monitoring will adhere to the Translocation Plan (Appendix).

14. **Desert Tortoise Clearance along Linear Facilities and Outside Work Areas**
For all linear facilities, pre-construction surveys will include a survey belt 90 feet wide centered on the construction ROW and surveyed using 33-foot (10 meter-wide) transects. Biologists will map and flag all desert tortoise burrows for avoidance (unless flagging will increase possible vandalism or predation). Desert tortoises will be monitored during all work activities outside of fenced areas. On the linear facilities (including fencing), tortoises can be moved at any time of year within the temperature constraints identified in the Service's translocation guidance. Temporary fencing may be used in place of or with monitors to keep tortoises safe.

Tortoises may also be penned as necessary. Penning of desert tortoises shall be accomplished by installing a circular fence, approximately 20 feet in diameter, to enclose and surround the occupied tortoise burrow (Service 2009). The pen should be constructed with 1-inch horizontal by 2- inch vertical, galvanized welded 16-gauge wire. Steel T-posts or rebar should be placed every 5 to 6 feet to support the pen material. Pen material will extend 18 to 24-inches above ground. The bottom of the enclosure will be buried 6 to 12 inches or bent towards the burrow, have soils mounded along the base, and other measures implemented to ensure zero ground clearance. Care shall be taken to minimize visibility of the pen by the public. An authorized desert tortoise biologist or biological monitor shall check the pen at least daily to ensure the desert tortoise is secure and not stressed. No desert tortoise shall be penned for more than 48 hours without written approval by the Service.

Because this is a relatively new technique, all instances of penning or issues associated with penning shall be reported to the Service by phone and email within 24 hours by an authorized desert tortoise biologist. Desert tortoises shall not be penned when conditions are favorable for desert tortoise activity unless approved in advance by the Service. Pens for juvenile and hatchling-sized desert tortoises will consist of ½-inch by ¼-inch fencing with a cover to prevent predators, including smaller predators from gaining access to the tortoise (Service 2011).

All pens will be approved by the Service and appropriate agencies, and the authorized desert tortoise biologist shall check pens daily to ensure all desert tortoises within the pens are present and no damage to the pens has occurred. Any impacts to penning or desert tortoises shall be reported to the Service within one day. The Service shall be contacted within one day of observation of desert tortoise injury or mortality.

Outside construction work areas along linear facilities, all potential desert tortoise burrows and pallets within 50 feet of the edge of the construction work area will be flagged. If a desert tortoise occupies a burrow during the less-active season, the tortoise will be temporarily penned (for up to 28 hours per BLM). No stakes, flagging, or fencing will be placed on the apron or in the opening of an active desert tortoise burrow. Desert tortoise burrows will not be marked in a manner that facilitates poaching. Avoidance flagging will be designed to be easily distinguished from access route or other flagging and will be designed in consultation with experienced construction personnel and authorized biologists. This flagging will be removed following construction completion.

If blasting is required in desert tortoise habitat, detonation will only occur after the area has been surveyed and cleared by an authorized desert tortoise biologist no more than 24 hours prior. A minimum 200-foot buffered area around the blasting site will be surveyed. A larger area will be surveyed depending on the anticipated size of the explosion as determined by the authorized desert tortoise biologist. All desert tortoises aboveground within the surveyed area will be moved 500 feet from the blasting site to a shaded location or placed in an unoccupied burrow. Desert tortoises that are moved will be monitored or penned to prevent returning to the buffered survey area. Tortoises located outside of the immediate blast zone and that are within burrows will be left in their burrows. All potential desert tortoise burrows, regardless of occupied status, will be stuffed with newspapers, flagged, and location recorded using a global positioning system (GPS) unit. Immediately after blasting, newspaper and flagging will be removed. If a burrow or cover site has collapsed that could be occupied, it will be excavated to ensure that no tortoises have been buried and are in danger of suffocation. Tortoises removed from the blast zone will be returned to their burrow if it is intact or placed in a similar unoccupied or constructed burrow.

Vegetation Trimming in Mowed Areas

15. **Vegetation Mowing**

In areas of the facility to be constructed using mowing, the vegetation will be cut between 18 and 24 inches in height. Mowing will only occur in the solar array areas where vegetation can affect the panels, equipment, or access. A flail-type mower mounted on skids that are mounted on a low-ground pressure tractor (approximately 5 to 6 psi), is an example of this type of equipment. A rubber tracked skid steer, or a steel tracked excavator could also be used for mowing.

Mowing with vehicles will only occur after tortoises have been translocated out of the facility and before they are allowed to return back into the facility. Any vegetation trimming while desert tortoises are present will occur with hand-held tools.

Protection Measures during Construction

16. **Confinement of Project Activities to Designated Areas**

All Project activities, Project vehicles, and equipment will be confined within designated areas or delineated boundaries of work areas that authorized biologists or biological

monitors have identified and cleared of desert tortoises. In mowed areas, only low-impact vehicles (that will have minimal impact on vegetation) will be permitted in the mowed portions. All other vehicles will remain on bladed roads.

Outside fenced areas, including linear facility ROWs, all survey crew vehicles will remain on existing roads and stay within the ROW.

17. **Speed Limits and Signage**
The Applicant will enforce a 20 mile per hour (mph) speed limit for Project-related travel (i.e., construction, O&M, and decommissioning) on all new and existing roads, except the Valley of Fire Road. The speed limit will be 15 mph in mowed areas. This speed restriction will reduce dust and allow for observation of small tortoises in the road. Speed-limit and caution signs will be installed along access roads and service roads. After the tortoise-proof fence is installed and the tortoise clearance surveys are complete, speed limits within the fenced and cleared areas will be established by the construction contractor and based on surface conditions and safety considerations and remain with limits established by the Service in the BO.

18. **Trash and Litter Control, and other Predator Deterrents**
Trash and food items will be disposed of properly in predator proof containers with resealing lids. Trash will be emptied and removed from the Project site on a periodic basis as they become full. Trash removal reduces the attractiveness of the area to opportunistic predators such as ravens, coyotes, and foxes. To reduce attractants for birds, open containers that may collect rainwater will be removed or stored in a secure or covered location. Long-term ponding of water will not be permitted, to avoid attracting ravens and canids. Structures will be designed to discourage potential nest sites.

19. **Work Outside Fenced Areas**
Biological monitoring will occur for any work conducted outside fenced areas (such as for the gen-tie construction). Biological monitors will also monitor ingress and egress of construction personnel on unfenced roads. Project personnel who are working outside fenced areas will check under vehicles or equipment before moving them. If Project personnel encounter a desert tortoise on an access road to the Project or a fenced access road, they will contact an authorized biologist. The desert tortoise will be allowed to move a safe distance away prior to moving the vehicle.

An authorized biologist or desert tortoise monitor will inspect any Project-related excavations (such as for a gen-tie pole foundations or a trench for the water line option) that are not within desert tortoise exclusion fencing on a regular basis (2 to 3 times per day and at least once prior to lethal temperature thresholds) and immediately prior to filling of the excavation. If Project personnel discover a desert tortoise in an excavation, an authorized biologist or desert tortoise monitor will move it to a safe location. To prevent entrapment of desert tortoises during non-work hours, the Applicant will cover or temporarily fence excavations that are outside of the permanently fenced Project areas at the end of each day (e.g., transmission pole or tower foundation holes).

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

20. **Tortoise Encounters During Construction**
If a tortoise is injured as a direct or indirect result of Project construction activities, it shall be immediately transported to a veterinarian or wildlife rehabilitation facility and reported within 24 hours or the next workday to the BLM and the Service. Any Project construction-related activity that may endanger a desert tortoise shall cease if a desert tortoise is encountered on the Project site. Project construction activities may resume after an authorized biologist removes the desert tortoise from danger or after the desert tortoise has moved to a safe area.

21. **Water Storage**
Water needed for construction will be stored in tanks. If evaporation ponds are used, they will be fenced to prevent use by wildlife and treated in a manner approved by the BLM and Service to prevent drowning. Wildlife escape ramps will be installed, and the liner will be textured sufficiently to ensure that all wildlife can escape if they enter the pond. The ponds and fence will be inspected at least daily.

Minimization of Indirect Impacts

22. **Noise Reduction**
Noise reduction devices (e.g., mufflers) will be employed to minimize the impacts on listed species. Operators will ensure that all equipment is adequately muffled and maintained in order to minimize disturbance to wildlife.

23. **Weed Management**
An Integrated Weed Management Plan will be approved by the BLM. This plan will include the removal of noxious weeds along fencelines, in mowed areas, and downwind/downstream from the Project. Controls at entry locations (e.g., vibrators) will be implemented to minimize infestation within the Project area from an outside source. Vehicles and trailers entering the site will be cleaned prior to accessing the site if coming from an infested area (e.g., other construction sites or agricultural areas). Trucks and other large equipment will be randomly checked before entering the site for any invasive species debris or seed.

Only herbicides with low toxicity to wildlife and non-target native plant species will be used in accordance with a BLM-approved PUP, as determined in consultation with the Service. The typical herbicide application rate rather than the maximum application rate will be used where this rate is effective.

24. **Predator Management**

The project will be required to follow the BLM Raven Management Plan. This plan will prescribe measures that limit the impacts of common ravens and other avian scavengers on desert tortoise, including but not limited to:

- Monitoring for the presence of ravens and other potential human-subsidized predators of special status wildlife;
- BMPs for hazing ravens to discourage their presence; and
- If ravens are seen building nests, removal of nest material prior to an egg being laid.

Domestic dogs shall be prohibited on the project site at all times.

25. **Spill Prevention**
A Spill Prevention and Emergency Response Plan will be developed that considers sensitive ecological resources. Spills of any toxic substances will be promptly addressed and cleaned up before they can enter aquatic or other sensitive habitats as a result of runoff or leaching.

26. **Fire Management**
A Fire Management Plan will be developed to implement measures that minimize the potential for a human-caused fire to affect ecological resources and that respond to natural fire situations.

27. **Dust Control**
Dust is anticipated during construction due to soil disturbance. Dust levels are expected to be higher in areas of traditional development where vegetation will be removed. Construction BMPs will be in place to monitor and decrease dust pollution if required by use of polymeric stabilizers, soil compaction, or watering with water trucks or other means. Where mowing will be implemented, the retention of plant bases, reduced soil disturbance, and less disturbance to soil crusts/desert pavement will reduce the potential for dust. No dust minimization measures are anticipated in mowed areas except on the internal access roads. There, water or other methods that will preclude damage to the adjacent mowed vegetation will be used. Polymeric stabilizers will not be allowed to be used in the mowed areas of the project. In the event that dust is problematic in mowed areas, an adaptive management approach will be used to minimize impacts from fugitive dust.

Operation and Maintenance Minimization Measures

Desert tortoise will be present during O&M of the Project in mowed areas, which comprise approximately 65 percent of the facility. The following minimization measures will be implemented during O&M (i.e., inspection and repair) of the Project to reduce effects on the desert tortoise and other species.

<u>Biological Monitoring and Training</u>

28. **WEAP Training**

WEAP training will be required for all maintenance and operation staff for the duration of the Project. In addition to an overview of minimization measures, the training will include specific BMPs designed to reduce effects to the desert tortoise. The program will also discuss the definition of "take" and its associated penalties, measures designed to minimize the effects of maintenance activities, the means by which employees limit impacts, and reporting requirements to be implemented when tortoises are encountered. WEAP training will be mandatory.

The WEAP shall be presented by an authorized desert tortoise biologist to all project personnel prior to them starting work on the project site. This program will contain information concerning the biology and distribution of the desert tortoise, desert tortoise activity patterns, its legal status, and occurrence in the proposed project area. Personnel shall be instructed to check under vehicles before moving them as tortoises often seek shelter under parked vehicles. WEAP training shall be mandatory, and as such, workers shall be required to sign in and wear a sticker on their hard hat to signify that they have received the training and agree to comply.

29. **Desert Tortoise Fence Inspections**
Permanent desert tortoise exclusion fencing along the boundaries of traditionally developed areas will be inspected quarterly and after storm events to ensure that the fence is intact, and that desert tortoises cannot enter the solar facility site in those areas or other areas where desert tortoises are excluded (e.g., substations).

30. **Biological Monitoring**
A biological monitor(s) will be present during ground-disturbing and off-road vehicle or equipment O&M activities outside of the fenced solar facility, within traditional construction areas, and within mowed areas to ensure that no tortoises are in harm's way.

Tortoises found aboveground during O&M activities will be avoided or moved by an authorized biologist, if necessary. Pre-maintenance clearance surveys followed by temporary exclusionary fencing also may be required if the maintenance action requires ground or vegetation disturbance. A biological monitor will flag the boundaries of areas where activities will need to be restricted to protect tortoises and their habitat. Restricted areas will be monitored to ensure their protection during construction.

Routine maintenance and inspection activities performed by vehicle travel along designated roads within mowed areas of the solar facility and that are performed on foot within the solar arrays can occur without a biological monitor. All material stockpiling for maintenance activities must be confined to desert tortoise fenced areas. If stockpiling is needed in mowed areas, the areas must be first inspected and cleared of tortoise and temporary fencing installed.

31. **Annual Reporting Submission Requirements**
Reports are required annually during O&M for the life of the facilities. The BLM may delegate this responsibility to the applicants. All annual reports are due February 1 of

each year. The Service anticipates the first O&M annual report by February 1, 2023, if construction is completed in 2022. Annual status updates shall be provided to the Service during O&M activities for the life of the facility.

32. **Monitoring of Translocated Tortoises**. Post-translocation tortoise monitoring will occur in accordance with the Translocation Plan and LTMP.

Protection Measures During Operations

33. **Speed Limits and Access**
Speed limits within the mowed Project areas, along transmission line routes, and access roads will be restricted to 15 mph during the periods of highest tortoise activity (March 1 through November 1) and a limit of 20 mph (during periods of lower tortoise activity). Vehicles in mowed areas of the development will remain only on designated roads.

34. **Trash and Litter Control, and other Predator Deterrents**
Trash and food items will be disposed properly in predator proof containers with resealing lids. Trash will be emptied and removed from the Project site on a periodic basis as they become full. Trash removal reduces the attractiveness of the area to opportunistic predators such as ravens, coyotes, and foxes. To reduce attractants for birds, open containers that may collect rainwater will be removed or stored in a secure or covered location. Structures will be designed to discourage potential nest sites.

35. **Maintenance Work within Mowed Areas Occupied by Desert Tortoise**
Project personnel who are working in mowed areas where desert tortoise will be present, will check under vehicles or equipment before moving them. If Project personnel encounter a desert tortoise, they will avoid the tortoise. The desert tortoise will be allowed to move a safe distance away prior to moving the vehicle.

    For any maintenance work that requires off-road travel, an authorized biologist must be on site to clear the areas where off-site access is needed. If necessary, temporary desert tortoise fencing may need to be installed to allow for access to conduct repairs (such as to underground conduit). A biological monitor or authorized biologist must be on site during all work involving ground disturbance within mowed areas of the facility.

36. **Vegetation Trimming**
Vegetation in the mowed areas of the solar arrays will be periodically trimmed to maintain a minimum height of 18 to 24 inches. Trimming will be conducted from existing roads with workers parking and traveling on-foot, using hand-held trimmers. Trimming will only occur in the solar array areas where vegetation can affect the panels, equipment, or access.

37. **Tortoise Encounters During Operation**. Any Project-related activity that may endanger a desert tortoise shall cease if a desert tortoise is encountered on the Project site. Project activities may resume after an authorized desert tortoise biologist removes the desert tortoise from danger or after the desert tortoise has moved to a safe area. If a tortoise is

injured as a direct or indirect result of Project activities, it shall be immediately transported to a veterinarian or wildlife rehabilitation facility and reported within 24 hours or the next workday to the BLM and the Service.

Decommissioning Minimization Measures

A Decommissioning and Site Reclamation Plan specific to the Project will be developed in coordination with appropriate federal and state agencies, approved by the BLM, and implemented by the applicants.

Compensatory Mitigation

In order to further offset adverse effects from the proposed Project to the threatened desert tortoise, the Applicant proposed to pay a desert tortoise remuneration fee of $902 per acre to the BLM (subject to increase on March 1, 2020). The Applicant will pay a 50% reduced fee for the 4,460 acres where the vegetation is being mowed, for a total of $2,011,460 (4,460 X 451). The reduction is based on the applicant preserving the soils, reducing potential invasive weeds, mowing vegetation to 24 inches and raising the tortoise fence 8 inches from the bottom thus allowing the potential that some tortoises might reoccupy the solar facility after construction is complete. These fees will be used to support desert tortoise recovery action that may include the following:

1. Habitat restoration;
2. Monitor habitat, tortoise populations, and effectiveness of recovery actions;
3. Applied research to promote recovery/conservation;
4. Public outreach;
5. Predator management;
6. Other actions recommended by the Desert Tortoise Recovery Office.

For the traditional construction methods and gen-tie line disturbance, totaling approximately 2,654 acres, the Applicant will pay a total of $2,393,908. Because of the need for substantial monitoring from the project's effects on the translocated desert tortoise, BLM further proposes the entire amount be applied to the cost of the habitat use study, monitoring, and other activities. The final LTMP will be provided and approved by the BLM and the Service, prior to the Record of Decision being signed.

BLM will monitor the construction to ensure that all proposed minimization measures are followed. If it is determined that the applicant is not adhering to the minimization measures, and the habitat is being impacted beyond what was approved, the BLM will reinitiate consultation with the Service to implement additional measures to reduce those adverse effects, including adjustments to the discounted remuneration.

ANALYTICAL FRAMEWORK FOR THE SERVICE'S DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.) requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the Status of the Species, which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities that are reasonably certain to occur in the action area on the species.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on October 28, 2019 [84 FR 44976]. This consultation was pending at that time, and we are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the opinion is fully consistent with the updated regulations.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the species, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES RANGEWIDE

Desert Tortoise

Listing History

The Service listed the Mojave population of desert tortoise (all tortoises north and west of the Colorado River in Arizona, Utah, Nevada, and California) as threatened on April 2, 1990 [55 Federal Register (FR) 12178]. The Service issued an initial recovery plan (Service 1994) and a revised recovery plan (Service 2011a) for the desert tortoise. A five-year review was completed in 2010 (Service 2010a).

Species Biology and Life History (verbatim from Service 2010a. All references are in the 2010 document)

"The desert tortoise is a large, herbivorous reptile that reaches 20 to 38 centimeters (8 to 15 inches) in carapace (upper shell) length and 10 to 15 centimeters (4 to 6 inches) in shell height. Hatchlings emerge from eggs at about 5 centimeters (2 inches) in length. Adults have a domed carapace and relatively flat, unhinged plastrons (lower shell). Their shells are greenish-tan to dark brown in color with tan scute (horny plate on the shell) centers. Adult desert tortoises weigh 3.6 to 6.8 kilograms (8 to 15 pounds). The forelimbs have heavy, claw-like scales and are flattened for digging. Hind limbs are more elephantine (Ernst et al. 1994).

Desert tortoises are well adapted to living in a highly variable and often harsh desert environment. They spend much of their lives in burrows, even during their seasons of activity. In late winter or early spring, they emerge from overwintering burrows and typically remain active through fall. Activity does decrease in summer, but tortoises often emerge after summer rain storms to drink (Henen et al. 1998). Mating occurs both during spring and fall (Black 1976; Rostal et al. 1994). During activity periods, desert tortoises eat a wide variety of herbaceous vegetation, particularly grasses and the flowers of annual plants (Berry 1974; Luckenbach 1982; Esque 1994). During periods of inactivity, they reduce their metabolism and water loss and consume very little food. Adult desert tortoises lose water at such a slow rate that they can survive for more than a year without access to free water of any kind and can apparently tolerate large imbalances in their water and energy budgets (Nagy and Medica 1986; Peterson 1996a, b; Henen et al. 1998).

In drought years, the availability of surface water following rains may be crucial for desert tortoise survival (Nagy and Medica 1986). During these unfavorable periods, desert tortoises decrease surface activity and remain mostly inactive or dormant underground (Duda et al. 1999), which reduces water loss and minimizes energy expenditures (Nagy and Medica 1986). Duda et al. (1999) showed that home range size, number of different burrows used, average distances traveled per day, and levels of surface activity were significantly reduced during drought years.

The size of desert tortoise home ranges varies with respect to location and year (Berry 1986a) and also serves as an indicator of resource availability and opportunity for reproduction and social interactions (O'Connor et al. 1994). Females have long-term home ranges that may be as little or less than half that of the average male, which can range to 200 or more acres (Burge 1977; Berry 1986a; Duda et al. 1999; Harless et al. 2009). Core areas used within tortoises' larger home ranges depend on the number of burrows used within those areas (Harless et al. 2009). Over its lifetime, each desert tortoise may use more than 3.9 square kilometers (1.5 square miles) of habitat and may make periodic forays of more than 11 kilometers (7 miles) at a time (Berry 1986a).

Tortoises are long-lived and grow slowly, requiring 13 to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential (Turner et al. 1984; Bury 1987; Germano 1994). Growth rates are greater in wet years with higher annual plant production (e.g., desert tortoises grew an average of 12.3 millimeters [0.5 inch] in an El Niño year compared to 1.8 millimeters [0.07 inches] in a drought year in Rock Valley, Nevada; Medica et al. 1975). The number of eggs as well as the number of clutches that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition (Turner et al. 1986, 1987; Henen 1997; McLuckie and Fridell 2002). The success rate of clutches has proven difficult to measure, but predation, while highly variable (Bjurlin and Bissonette 2004), appears to play an important role in clutch failure (Germano 1994)."

Recovery Plan

The Service issued an initial recovery plan (Service 1994) and a revised recovery plan (Service 2011a) for the desert tortoise. The 1994 recovery plan recommended that a scientifically credible monitoring plan be developed to determine that the population exhibit a statistically significant upward trend or remain stationary for at least 25 years and that enough habitat would be protected within a recovery unit or the habitat and populations be managed intensively enough to ensure long-term viability. Because both minimum population densities and minimum population numbers need to be considered to ensure recovery, the Service further recommended that reserves be at least 1,000 square miles. Smaller reserves that provide high-quality, secure habitat for 10,000 to 20,000 adult desert tortoises should provide comfortable persistence probabilities for the species well into the future when populations are well above minimum viable density (e.g., 30 or more adults per square mile) and population growth rates (lambda, λ) can be maintained (see page C54 of Service 1994). Conversely, populations with densities below approximately 10 adults per square mile (3.9 per square kilometer) are in danger of extinction (see page 32 of Service 1994).

"Adult" desert tortoise connotes reproductive maturity. Desert tortoises may become reproductive at various sizes. The Service based its 2010 survey protocol on the methodology used in rangewide sampling but erred in citing 160 millimeters as the size below which surveyors' ability to detect desert tortoises decreases. In rangewide sampling, the Service uses 180 millimeters as its cut-off length for counting desert tortoises, at least in part because the Styrofoam models used for training are 180 millimeters in length. The Service changed the

survey protocol to use 180 millimeters in the revised version. We have used the term “adult” to indicate reproductive status and those animals larger than 180 millimeters to conform to the Service’s protocols for rangewide sampling and pre-project surveys.

The revised recovery plan for the desert tortoise (Service 2011a) lists three objectives and associated criteria to achieve delisting. The first objective is to maintain self-sustaining populations of desert tortoises within each recovery unit into the future; the criterion is that the rates of population change for desert tortoises are increasing (i.e., $\lambda > 1$) over at least 25 years (i.e., a single generation), as measured by extensive, rangewide monitoring across conservation areas within each recovery unit and by direct monitoring and estimation of vital rates (recruitment, survival) from demographic study areas within each recovery unit.

The second objective addresses the distribution of desert tortoises. The goal is to maintain well-distributed populations of desert tortoises throughout each recovery unit; the criterion is that the distribution of desert tortoises throughout each conservation area increase over at least 25 years.

The final objective is to ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations. The criterion is that the quantity of desert tortoise habitat within each conservation area be maintained with no net loss until population viability is ensured.

The revised recovery plan (Service 2011a) also recommends connecting blocks of desert tortoise habitat, such as critical habitat units and other important areas to maintain gene flow between populations. Linkages defined using least-cost path analysis (Averill-Murray et al. 2013) illustrate a minimum connection of habitat for desert tortoises between blocks of habitat and represent priority areas for conservation of population connectivity. Figure 16 illustrates that, across the range, desert tortoises in areas under the highest level of conservation and management remain subject to numerous threats, stresses, and mortality sources.

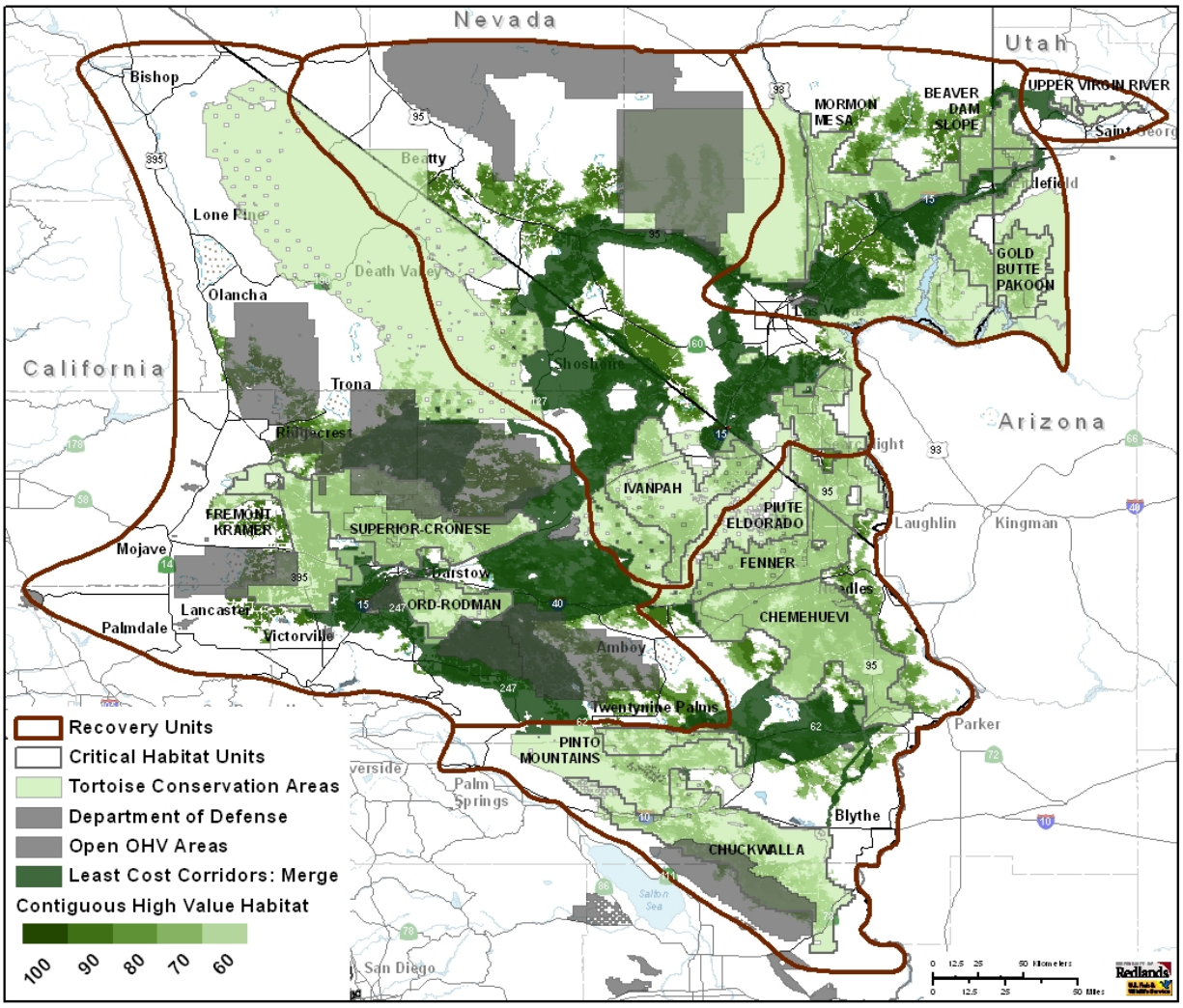

Figure 16. Recovery units, critical habitat units, conservation areas, and contiguous high value habitat.

Threats

The threats described in the listing rule and both recovery plans (Service 1994, 2011a) continue to affect the species. The most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle (OHV) activity, wildfire, and habitat invasion by non-native invasive plant species.

We remain unable to quantify how threats affect desert tortoise populations. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy et al. 2004).

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

The following map (Figure 17) depicts the 12 critical habitat units of the desert tortoise, linkages between conservation areas for the desert tortoise and the aggregate stress that multiple, synergistic threats place on desert tortoise populations, as modeled by the spatial decision support system. Conservation areas include designated critical habitat and other lands managed for the long-term conservation of the desert tortoise (e.g., the Desert Tortoise Natural Area, Joshua Tree National Park, and the Desert National Wildlife Refuge).

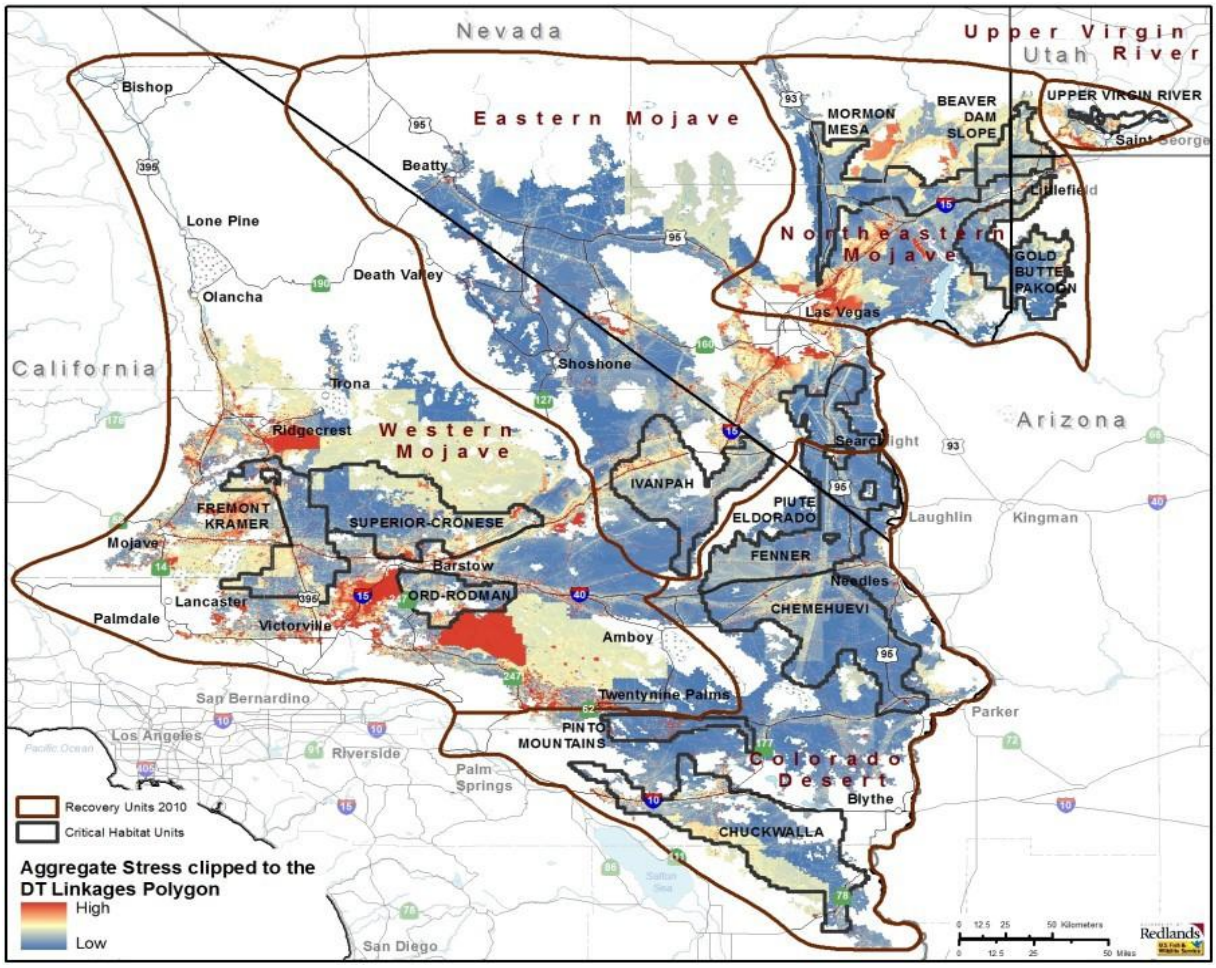

Figure 17. Critical habitat units, recovery units, and linkages.

Five-Year Review

Section 4(c)(2) of the Endangered Species Act requires the Service to conduct a status review of each listed species once every 5 years. The purpose of a 5-year review is to evaluate whether the species' status has changed since it was listed (or since the most recent 5-year review); these reviews, at the time of their completion, provide the most up-to-date information on the rangewide status of the species. For this reason, we are appending the 5-year review of the status of the desert tortoise (Service 2010a) to this biological opinion and are incorporating it by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review.

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

threatened species be maintained.

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

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

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

The vast majority of threats to the desert tortoise or its habitat are associated with human land uses. Using captive neonate and yearling desert tortoises, Drake et al. (2015) found that individuals "eating native forbs had better body condition and immune functions, grew more, and had higher survival rates (>95%) than (desert) tortoises consuming any other diet"; health and body condition declined in individuals fed only grasses (native or non-native). Current information indicates that invasive species likely affect a large portion of the desert tortoise's

range. Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

Drake et al. (2015) "compared movement patterns, home-range size, behavior, microhabitat use, reproduction, and survival for adult desert tortoises located in, and adjacent to, burned habitat" in Nevada. They noted that the fires killed many desert tortoises but found that, in the first five years post-fire, individuals moved deeper into burned habitat on a seasonal basis and foraged more frequently in burned areas (corresponding with greater production of annual plants and herbaceous perennials in these areas). Production of annual plants upon which desert tortoises feed was 10 times greater in burned versus unburned areas but was dominated by non-native species (e.g., red brome [*Bromus rubens*]) that frequently have lower digestibility than native vegetation. During years six and seven, the movements of desert tortoises into burned areas contracted with a decline in the live cover of a perennial forage plant that rapidly colonizes burned areas. Drake et al. (2015) did not find any differences in health or survivorship for desert tortoises occupying either habitat (burned or unburned) during this study or in reproduction during the seventh year after the fire.

Various human activities have introduced numerous species of non-native invasive plants into the California desert. Routes that humans use to travel through the desert (paved and unpaved roads, railroads, motorcycle trails, etc.) serve as pathways for new species to enter habitat of the desert tortoise and for species that currently occur there to spread. Other disturbances of the desert substrate also provide invasive species with entry points into the desert. Figure 18 depicts the potential for these species to invade habitat of the desert tortoise. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species.

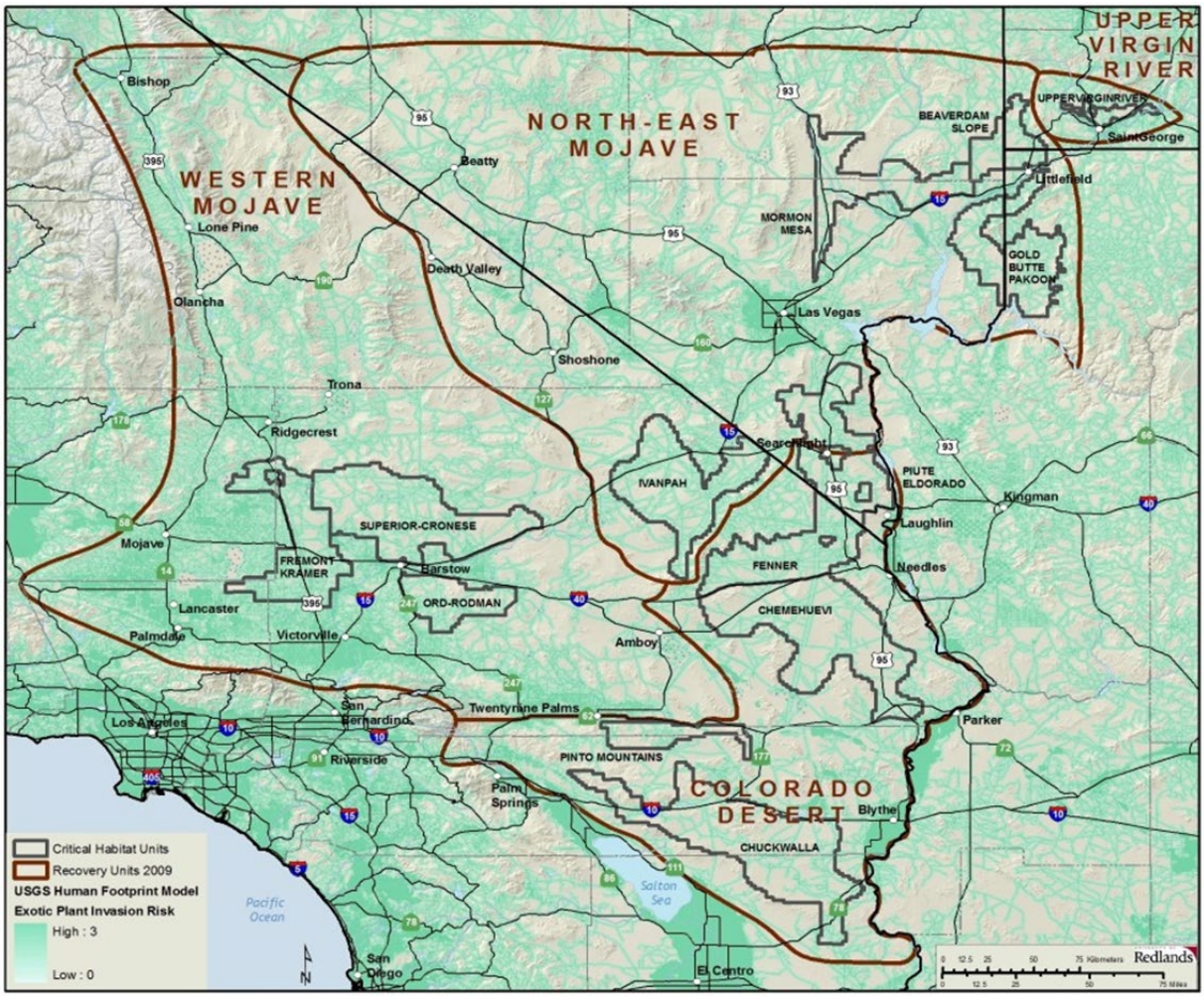

Figure 18. Potential for exotic plant invasion in desert tortoise habitat.

Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and desert wildlife management areas that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoise during the construction of the projects, such as translocation of affected individuals. In aggregate, these projects would result in an overall loss of approximately 48,041 acres of habitat of the desert tortoise. We also predicted that the project areas supported up to 4,363 desert tortoises; we concluded that most of these individuals were small desert tortoises, that most adults would likely be translocated from project sites, and that most mortalities would be small desert tortoises (< 180 mm) that were not detected during clearance surveys. To date, 660 desert tortoises have been observed during construction of solar projects (Table 6); most of these individuals were translocated from work areas, although some desert tortoises have been killed. The mitigation required by the BLM and California Energy Commission (the agencies permitting some of these facilities) resulted in the acquisition of

private land and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. These mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise; many of the measures have been derived directly from the recovery plans and the Service supports their implementation. We expect that, based on the best available scientific information, they will result in conservation benefits to the desert tortoise; however, it is difficult to assess how desert tortoise populations will respond because of the long generation time of the species. Table 6 summarizes information regarding the solar projects that have undergone formal consultation with regard to the desert tortoise.

Table 6. Solar projects for which the Service has issued biological opinions or incidental take permits. References are in Literature Cited.

Project and Recovery Unit	Acres of Desert Tortoise Habitat	Desert Tortoises Estimated[1]	Desert Tortoises Observed[2]	Citations[3]
Eastern Mojave				
Ivanpah Solar Electric Generating System	3,582	1,136	175[7]	Service 2011b, Davis 2014
Stateline	1,685	947	55	Service 2013a, Ironwood 2014
Silver State North – NV	685	14[6]	7	Service 2010b, NewFields 2011
Silver State South – NV	2,427[4]	1,020[4]	152	Service 2013a, Cota 2014
Amargosa Farm Road – NV	4,350	4[6]	-	Service 2010f
Nevada Solar One - NV	400	[5]	[5]	Burroughs 2012, 2014
Copper Mountain North - NV	1,504	10[5]	3[5]	Service 2011c, 2013b; NewFields 2014
Copper Mountain - NV	380	[5]	[5]	Burroughs 2012, 2014
Townsite - NV	905	4[8]	-[5]	Service 2014a
Techren Boulder City - NV	2,291	15[9]	-[5]	Service 2012a
Valley Electric Association - NV	80	4	4[10]	Service 2015a
Western Mojave				
Mojave Solar, Abengoa Harper Lake	Primarily in abandoned agricultural fields	4[6]	-	Service 2011d
Chevron Lucerne Valley	516	10	-	Service 2010c
Cinco	500	53	2	Service 2015b, Daitch 2015
Soda Mountain	1,726	78	-	Service 2015c

Northeastern Mojave				
Res Americas Moapa Solar Energy Center - NV	951	95	-	Service 2014b
Moapa K Road Solar	2,141	186	177	Service 2012b, Cardno, Inc 2018
Playa Solar	1,538	258	77	Service 2015d, Ironwood Consulting 2016
Invenergy Harry Allen Solar	594	242	-	Service 2015d
NV Energy Dry Lake Solar Energy Center	751	45	-	Service 2015d
NV Energy Dry Lake Solar Energy Center at Harry Allen	55	15	-	Service 2015d
Aiya Solar	672	91	-	Service 2015e
Mountainview	146	[5]	[5]	Wise 2018
Colorado				
Genesis	1,774	8	0	Service 2010d, Fraser 2014a
Blythe	6,958	30	0	Service 2010e, Fraser 2014b
Desert Sunlight	4,004	56	7	Service 2011e, Fraser 2014a
McCoy	4,533	15	0	Service 2013c, Fraser 2014b
Desert Harvest	1,300	5	-	Service 2013d
Rice	1,368	18	1	Service 2011f, Fraser 2014a
Total	47,816	4,363	660	

[1]The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects. When available, we included an estimate of the numbers of small desert tortoises.
[2]This column reflects the numbers of desert tortoises observed within project areas. It includes translocated animals and those that were killed by project activities. Project activities may result in the deaths of more desert tortoises than are found. Dashes represent projects for which we have no information at this point; some projects have not broken ground at the time of this biological opinion.
[3]The first citation in this column is for both the acreage and the estimate of the number of desert tortoises. The second is for the number of desert tortoises observed during construction of the project; where only one citation is present, construction has not begun or data are unavailable at this time.
[4]These numbers include Southern California Edison's Primm Substation and its ancillary facilities.
[5]These projects occurred under the Clark County Multi-species Habitat Conservation Plan; the provisions of the habitat conservation plan do not require the removal of desert tortoises. We estimate that all six projects combined will affect fewer than 50 desert tortoises.
[6]These estimates do not include smaller desert tortoises.
[7]In the table attached to the electronic mail, the number of desert tortoises translocated from the project site is represented by the total number of translocated animals minus the number of animals born in the holding pens.
[8]The estimate of the number of desert tortoises is from the portion of the project on BLM land (20.39 acres). The remaining lands are covered by the Clark County Multi-species Habitat Conservation Plan; see footnote 5.
[9]The estimate of the number of desert tortoises is from both BLM (104 acres) and private (2,200 acres) land. The remaining lands are covered by the Clark County Multi-species Habitat Conservation Plan; see footnote 5.

[10]Of the 80-acre project site, 76.4 acres were left intact (there was crushing and mowing of vegetation but no blading) with openings along the bottom of the fence for tortoise. After project completion, four tortoises were released back into the solar facility on September 25, 2017. Two adults have remained in the area and continued to enter the facility since it was completed.

In August 2016, the Service (2016) issued a biological opinion to the BLM for a land use plan amendment under the Desert Renewable Energy Conservation Plan. The land use plan amendment addressed all aspects of the BLM's management of the California Desert Conservation Area; however, the Service and BLM agreed that only those aspects related to the construction, operation, maintenance, and decommissioning of renewable energy facilities were likely to adversely affect the desert tortoise. The land use plan amendment resulted in the designation of approximately 388,000 acres of development focus areas where the BLM would apply a streamlined review process to applications for projects that generate renewable energy; the BLM estimated that approximately 11,290 acres of modeled desert tortoise habitat within the development focus areas would eventually be developed for renewable energy. The BLM also adopted numerous conservation and management actions as part of the land use plan amendment to further reduce the adverse effects of renewable energy development on the desert tortoise.

The land use plan amendment also increased the amount of land that the BLM manages for conservation in California (e.g., areas of critical environmental concern, National Conservation Lands, etc.) from 6,118,135 to 8,689,669 acres (BLM 2015); not all of the areas subject to increased protection are within desert tortoise habitat. The BLM will also manage lands outside of development focus areas according to numerous conservation and management actions; these conservation and management actions are more protective of desert tortoises than direction contained in the previous land use plan. The Service (2016) concluded that the land use plan amendment was not likely to jeopardize the continued existence of the desert tortoise and would benefit its recovery.

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

The Service also issued a biological opinion to the Department of the Navy (Navy) that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2017a). We concluded that the Navy's proposed action, the use of approximately 167,982 acres of public and private land for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-highway Vehicle Management Area. As part of this proposed action, the Navy translocated 997 adult desert tortoises from the expansion area to four recipient sites to the north and east of the expansion area (Henen 2019). The Lucerne-Ord and Siberia sites are entirely within BLM-managed lands, and the Rodman-Sunshine Peak North and Cleghorn sites overlap

BLM-managed lands and lands managed by the Navy. The Lucerne-Ord site lies within the Ord-Rodman desert tortoise critical habitat unit. The tortoises that were translocated by the Navy from the Johnson Valley Off-highway Vehicle Management Area were moved into populations that were below the Service's established minimum viable density, to attempt to augment these populations and make them more viable in the long-term.

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

As the Service notes in the 5-year review (Service 2010a), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses."

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

Core Criteria for the Jeopardy Determination

When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Although the Service does not explicitly address these metrics in the 5-year review, we have used the information in that document and more recent information to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

Reproduction

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal 2002 in Service 2010a), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal et al. 2002; Tracy et al. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood; see previous information from Drake et al. (2015). Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

Various human activities have introduced numerous species of non-native invasive plants into the California desert. Routes that humans use to travel through the desert (paved and unpaved roads, railroads, motorcycle trails, etc.) serve as pathways for new species to enter habitat of the desert tortoise and for species that currently occur there to spread. Other disturbances of the desert substrate also provide invasive species with entry points into the desert. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species.

Numbers

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

Data from small-scale study plots (e.g., one square mile) established as early as 1976 and surveyed primarily through the mid-1990s indicate that localized population declines occurred at many sites across the desert tortoise's range, especially in the western Mojave Desert; spatial analyses of more widespread surveys also found evidence of relatively high mortality in some parts of the range (Tracy et al. 2004). Although population densities from the local study plots cannot be extrapolated to provide an estimate of the number of desert tortoises on a rangewide basis, historical densities in some parts of the desert exceeded 100 adults in a square mile (38 per square kilometer; Tracy et al. 2004). The Service (2010a) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly."

The rangewide monitoring that the Service initiated in 2001 is the first comprehensive attempt to determine the densities of desert tortoises in conservation areas across their range. The Desert Tortoise Recovery Office (Allison and McLuckie 2018) used annual density estimates obtained from this sampling effort to evaluate rangewide trends in the density of desert tortoises over time. (All references to the density of desert tortoises are averages. Some areas support higher densities and some lower; desert tortoises are not distributed in uniform densities across large areas.) This analysis indicates that densities in the Northeastern Mojave Recovery Unit have increased since 2004, with the increase apparently resulting from increased survival of adults and sub-adults moving into the adult size class. The analysis also indicates that the populations in the other four recovery units are declining; Table 7 depicts the estimated abundance of desert tortoises within the recovery units and the change in abundance. Surveys did not include the steepest slopes in these desert tortoise conservation areas; however, the model developed by Nussear et al. (2009) generally rates steep slopes as less likely to support desert tortoises.

Table 7. Tortoise estimates within recovery units and change in abundance (Allison and McLuckie 2018).

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

In the previous summary of the results of rangewide sampling (Service 2015f), we extrapolated the densities obtained within conservation areas (e.g., desert wildlife management area, Desert Tortoise Research Natural Area, Joshua Tree National Park) to all modeled habitat of the desert tortoise. This extrapolation may have exaggerated the number of desert tortoises because we applied the values for areas where densities are generally highest (i.e., the conservation areas) to areas where desert tortoises exist in very low densities (e.g., the Antelope Valley). We are also aware of a few areas where the density of desert tortoises outside of conservation areas is higher than inside.

To examine the status of desert tortoise populations over time, we compared the densities of desert tortoises in the Western Mojave Recovery Unit between 2004 and 2014 (see Service 2015f). In 2004, desert tortoise conservation areas surveyed in the Western Mojave Recovery Unit supported an average density of approximately 5.7 adults per km^2 (14.8 per mi^2). In contrast, surveys in the same areas in 2014 indicated that densities had decreased to 2.8 adults per km^2 (7.3 per mi^2). This decline in densities is consistent with decreases in density of populations in all recovery units over the same time period, with the exception of the Northeastern Mojave Recovery Unit. In fact, historical survey data from numerous plots in the Western Mojave Recovery Unit during the late 1970s and early 1980s suggest that adult desert tortoise densities ranged from 50 to 150 per mi^2 (19 to 58 per km^2; Tracy et al. 2004).

To further assess the status of the desert tortoise, the Desert Tortoise Recovery Office (Service 2015f) used multi-year trends from the best-fitting model describing loge-transformed density of adult animals per square kilometer. In 2014, 3 of the 5 recovery units supported densities below 3.9 adult animals per km^2 [Western Mojave (2.8), Eastern Mojave (1.5), and Colorado Desert (3.7); see table 10 in Service 2015f], which is the minimum density recommended to avoid extinction in the 1994 recovery plan. The Northeastern Mojave Recovery Unit supported 4.4 adult desert tortoises per km^2 and the Upper Virgin River Recovery Unit, which is by far the smallest recovery unit, supported 15.3 adults per km^2.

Allison (2014) evaluated changes in size distribution of desert tortoises since 2001. In the Western Mojave and Colorado Desert recovery units, the relative number of juveniles to adults indicates that juvenile numbers are declining faster than adults. In the Eastern Mojave, the number of juvenile desert tortoises is also declining, but not as rapidly as the number of adults. In the Upper Virgin River Recovery Unit, trends in juvenile numbers are similar to those of adults; in the Northeastern Mojave Recovery Unit, the number of juveniles is increasing, but not as rapidly as are adult numbers in that recovery unit. Juvenile numbers, like adult densities, are responding in a directional way, with increasing, stable, or decreasing trends, depending on the recovery unit where they are found.

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

Distribution

Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow and Lancaster, California; Las Vegas, Nevada; and St. George, Utah; etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g., portions of off-road management areas managed by the BLM and unauthorized use in areas such as east of California City, California).

Urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range since 1994, but there are other large areas of habitat loss. Desert tortoises have essentially been removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012c). The development of large solar facilities has also reduced the amount of habitat available to desert tortoises. No solar facilities have been developed within desert tortoise conservation areas, such as desert wildlife management areas, although such projects have occurred in areas that the Service considers important linkages between conservation areas (e.g., Silver State South Project in Nevada).

In recognition of the absence of specific and recent information on the location of habitable areas within the Mojave Desert, especially at the outer edges, Nussear et al. (2009) developed a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River (Figure 19). The model incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2008 rangewide monitoring surveys. The model predicts the relative potential for desert tortoises to be present in any given location, given the combination of habitat variables at that location in relation to areas of known occupancy throughout the range; calculations of the amount of desert tortoise habitat in the 5-year review (Service 2010a); and the use of a threshold of 0.5 or greater predicted value for potential desert tortoise habitat in this biological opinion. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

Table 8 and Figure 19 depicts acreages of habitat (as modeled by Nussear et al. 2009, using only areas with a probability of occupancy by desert tortoises greater than 0.5 as potential habitat) within the recovery units of the desert tortoise and of impervious surfaces as of 2006 (Fry et al. 2011); calculations are by Darst (2014). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises. All units are in acres.

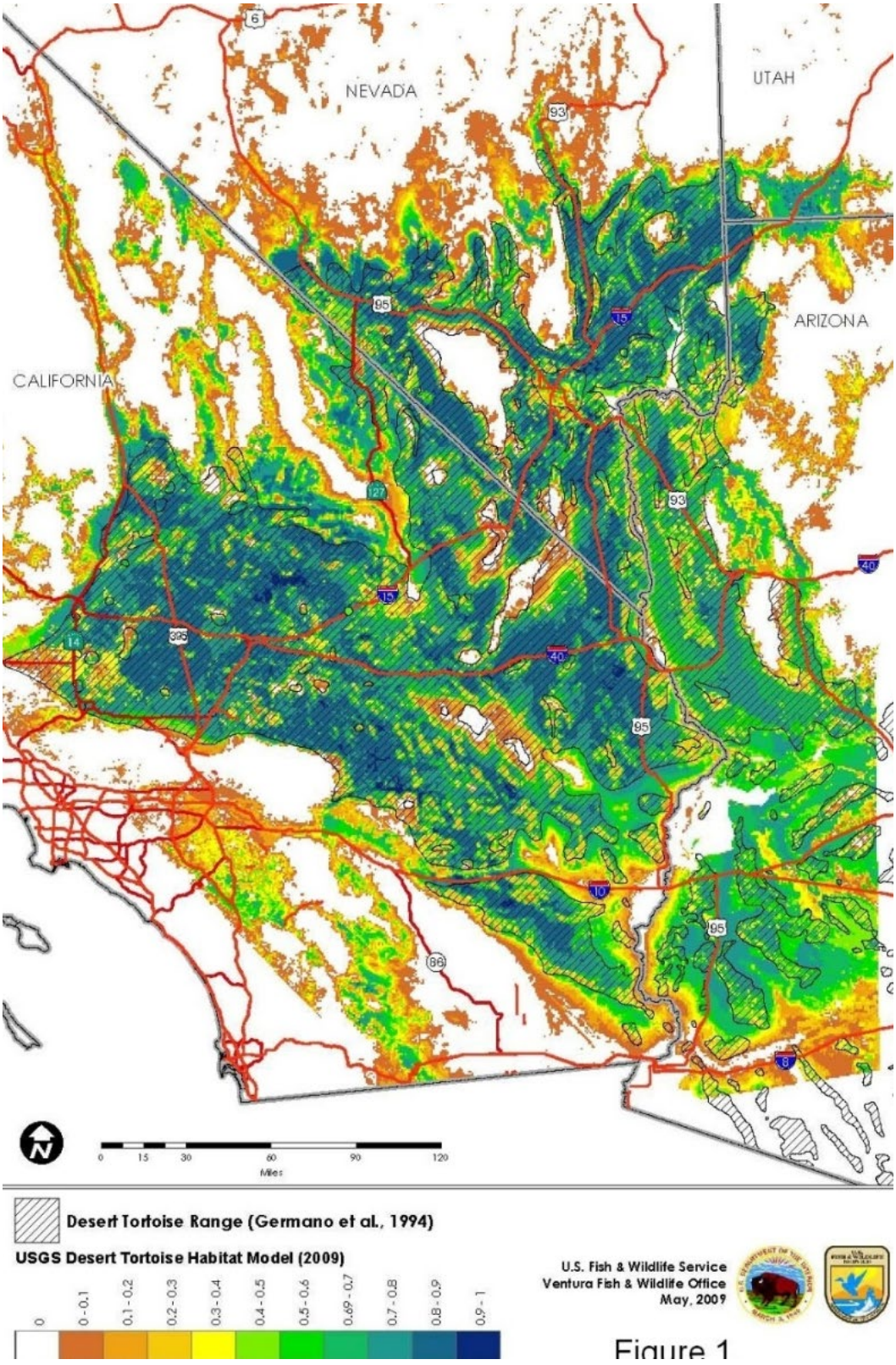

Figure 19. Modeled tortoise habitat within recovery units.

Table 8. Acres of desert tortoise habitat within recovery units.

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

The Service (2010a) concluded in its 5-year review that the distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 in terms of the overall extent of its range. Since 2010, we again conclude that the species' distribution has not changed substantially in terms of the overall extent of its range, although desert tortoises have been removed from several thousand acres because of solar development, military activities, and other project development.

ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action, including interrelated and interdependent actions, and not merely the immediate area involved in the action (50 CFR § 402.02). While the definition of the action area includes direct and indirect effects, the updated Endangered Species Act regulations (84 FR 44976) combine these into "all effects." Even though we discuss separate categories of effects, this biological opinion complies with the new regulations. Subsequent analyses of the environmental baseline, effects of the action, cumulative effects, and levels of incidental take are based upon the action area as determined by the Service. Regulations implementing the Act define the environmental baseline as the past and present effects of all Federal, State, or private actions and other human activities in the action area (50 CFR § 402.02). Also included in the environmental baseline are the anticipated effects of all

proposed Federal projects in the action area that have undergone section 7 consultation, and the effects of state and private actions that are contemporaneous with the consultation in progress.

The action area for the Project includes:

- The area of direct impacts (entire Project site and gen-tie lines):
  - The entirety of the solar facility, including internal access roads and all associated ancillary facilities
  - The gen-tie line routes and gen-tie access roads
  - Temporary staging and pulling areas for the gen-tie construction
  - Surrounding buffer areas (270 acres)
- The area of indirect impacts where federally protected species would be impacted falls into the following categories, the greatest extent of which comprises the action area. The components of and the overall action area is shown in Figure 20.
  - Desert tortoises outside the Project site whose home ranges intersect with the fenced area, the gen-tie line construction areas, and Valley of Fire Road from I-15 to the Project entrance. A distance of 1,969 feet (600 meters) around the fenced areas of the solar field, the gen-tie lines and Crystal substation, and Valley of Fire Road from the I-15 exit, which is based on the average home ranges of desert tortoise and would include most tortoises whose home ranges would intersect the fenced solar field, the gen-tie lines, and Valley of Fire Road from I-15 to the Project site entrances.
  - Recipient area for short distance release. Many tortoises would be moved from the solar field into the 1,640-foot (500 meter) band outside the solar field during construction. Service (2018b) has determined that tortoises moved within 1,640 feet (500 meters) of their capture location may move an average of 0.9 miles. The Project's action area would therefore extend to 1.2 miles, where tortoise habitat is present, beyond the mowed areas of the solar field. This area is shown in blue in Figure 20.
  - Recipient area for distant release. The areas where desert tortoise would be distantly translocated is south of development areas B and D (shown in pink in Figure 20); the average maximum extent that these tortoise would move from the distant translocation site has been determined by the Service (2018b) be 4.0 miles within suitable habitat, shown in green in Figure 20.
  - Areas of tortoise connectivity. The areas of tortoise connectivity between the Arrow Canyon Mountain Range to the west and the Muddy Mountain Range to the east.

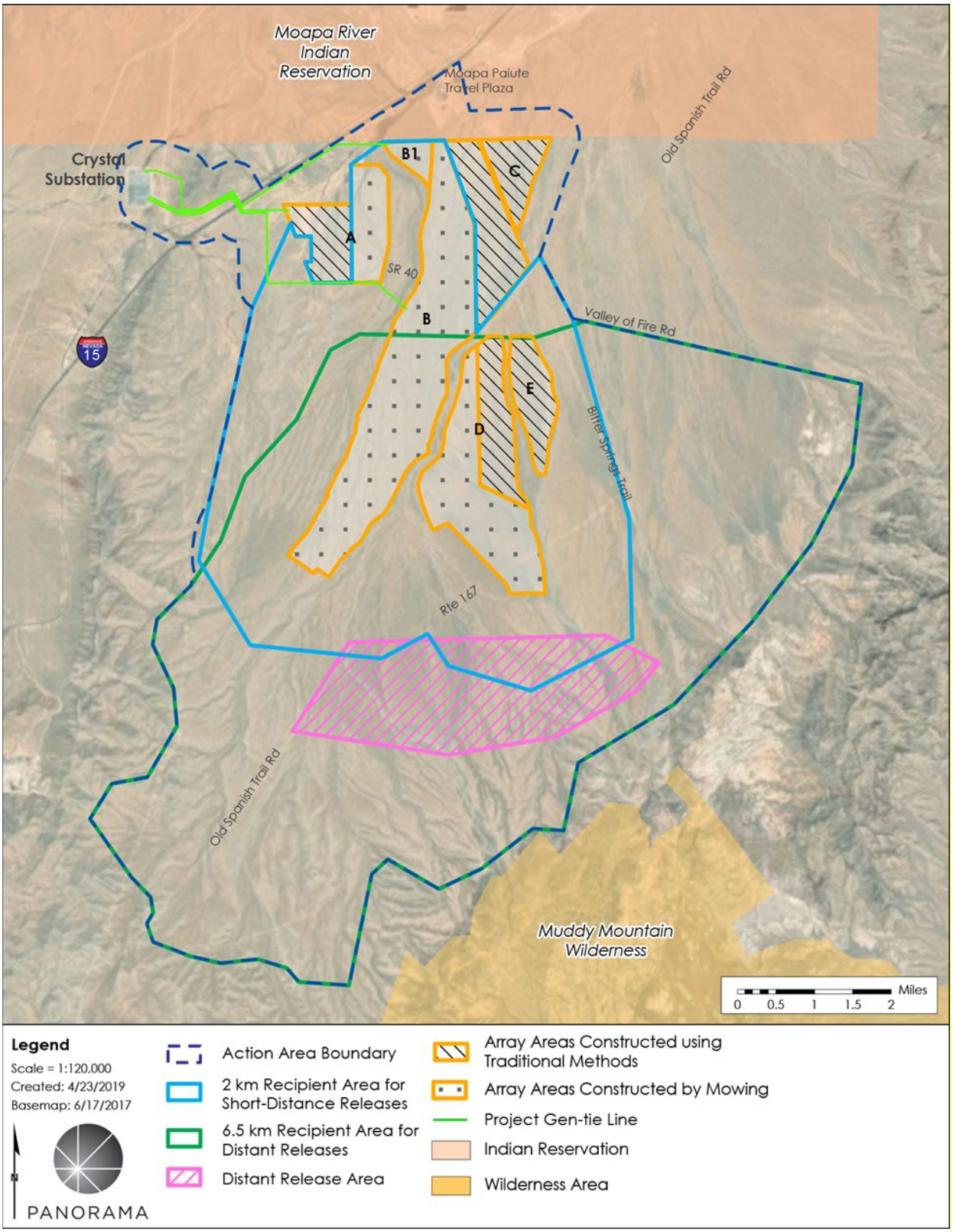

Figure 20. Action Area.

Status of Desert Tortoise in the Action Area

Recovery Unit

The action area occurs within the Northeastern Mojave Recovery Unit as described in the revised desert tortoise recovery plan (Service 2011a). This recovery unit is similar to the 1994 designation, extending into extreme southwestern Utah and northwestern Arizona, but excluding portions south of Las Vegas. The east end of the unit extends south from the Beaver Dam Mountains, across the north end of the Virgin Mountains, down to the Colorado River. From the Colorado River at Las Vegas Bay, the southern boundary extends west generally along Las Vegas Wash through the city of Las Vegas to the Spring Mountains. From here, the western boundary extends north up the Sheep Mountains.

Recent DNA microsatellite data indicate that this unit is genetically similar to the Upper Virgin River Recovery Unit, but the Northeastern Mojave Recovery Unit does contain distinct microsatellite differences compared to the remainder of the range (Hagerty and Tracy 2010). The Sheep Mountains down to the Spring Mountains act as a near barrier for the western portion of this unit. Some variation may occur to the south and west from the Mormon Mesa, but genetic breaks appear to be ambiguous relative to at least semi-permeable topographic barriers to gene flow, such as the Muddy Mountains. An allozyme cluster at one locus from populations in the Mormon Mesa CHU overlaps another cluster identified from populations in Piute Valley in the Eastern Mojave Recovery Unit (Britten et al. 1997). A distinct shell phenotype also occurs in the Beaver Dam Slope region, but these tortoises are not genetically isolated from adjacent populations within the same recovery unit (Service 2011a).

Desert tortoises in this recovery unit are generally found in creosote bush scrub communities of flats, valley bottoms, alluvial fans, and bajadas, but they occasionally use other habitats such as rocky slopes and blackbrush scrub. Desert tortoises are often active in late summer and early fall, in addition to spring, reflecting the fact that this region receives up to about 40 percent of its annual rainfall in summer and supports two distinct annual floras on which tortoises can feed. Average daily winter temperatures usually fluctuate above freezing, and summer temperatures are typically a few degrees cooler than in the western Mojave and Colorado deserts. Two or more desert tortoises often den together in caliche caves in bajadas and washes or caves in sandstone rock outcrops, and they typically eat summer and winter annuals, cacti, and perennial grasses.

This recovery unit includes the Beaver Dam Slope, Gold Butte-Pakoon, and Mormon Mesa critical habitat units (CHUs). It also includes Lake Mead National Recreation Area south to Las Vegas Bay, Grand Canyon-Parashant National Monument on the Arizona Strip, and the eastern edge of Desert National Wildlife Refuge.

Habitat

The action area is regionally characterized by a typical Nevada landscape of broad basins and numerous, parallel mountains that are aligned in a north-south configuration referred to as the Basin and Range Province. Locally, the action area is situated along a gently sloping (2 to 6 percent) bajada (lower bajada), except for a portion of the gen-tie lines into Crystal Substation that is on gently rolling badlands that continue outside the western Project footprint. Outside of the action area, the surrounding hills and mountains include the Dry Lake Range to the west, the Muddy Mountains to the south, and North Muddy Mountains to the east. The upper bajada, sloping upward to the south of the action area and into the Muddy Mountains, is punctuated with limestone outcrops, larger rocks, and an increase in cacti, especially barrel cactus (*Ferocactus cylindraceus*). Multiple braided, intermittent washes connect into the California Wash, which flows northeast into the Muddy River. The topography to the north is relatively flat, with elevations ranging from approximately 2,025 to 2,450 feet above mean sea level, as the California Wash Basin levels and meanders to the northeast, combining with multiple intermittent washes prior to connecting with the Muddy River, approximately 13 miles away. The area has an annual rainfall average of 4 to 8 inches and a mean annual temperature between 60 to 70 degrees Fahrenheit.

The vegetation community on the Project site consists predominantly of Creosote (*Larrea tridentata*)-White Bursage (*Ambrosia dumosa*) Shrubland, with Catclaw Acacia (*Senegalia greggii*) Shrubland in some of the larger washes (Table 9). Along the western boundary of the action area, the vegetation community transitions from Creosote-White Bursage to predominantly Shadscale (*Atriplex confertifolia*) Shrubland with pockets of Big Galleta (*Hilaria rigida*) Herbaceous.

Table 9. Vegetation types in solar facility and gen-tie line areas.

Vegetation Type	Acres	Percentage of Total
Shadscale Shrubland	419.4	5.9%
Big Galleta Herbaceous	73.1	1.0%
Creosote-White Bursage Shrubland	6,534.7	91.9%
Catclaw Acacia Shrubland	77.6	1.1%
Badlands	8.3	0.1%
TOTAL	**7,113**	**100%**

Population Monitoring Data in the Action Area

In 1999, the Desert Tortoise Management Oversight Group endorsed the use of line distance sampling as the most appropriate method for estimating rangewide desert tortoise density.

Fifteen monitoring strata were established which approximate the boundaries of the CHUs. Desert tortoise population monitoring began rangewide in 2001. Long-term monitoring of desert tortoise population growth and distribution, habitat quality and quantity, and the presence and intensity of threats to the desert tortoise are recovery actions identified in the revised recovery plan (Service 2011a).

Desert tortoise density estimates are generated separately for each monitoring stratum and then weighted by stratum area to arrive at average density in the monitored area of each recovery unit. When the annual estimates are imprecise, it should not be expected that there will be a close match from one year to the next. Over a period of many years, however, any underlying trend in the number of tortoises should be obvious.

Service (2016b, 2018a) desert tortoise monitoring data included the five strata in the action area, Beaver Dam Slope, Coyote Spring Valley, Gold Butte-Pakoon, Mormon Mesa, and Piute-Eldorado. The monitoring strata approximate the CHUs and desert tortoise Areas of Critical Environmental Concern (ACECs) and represent the 1994 delineation of recovery units, which would not include the Colorado Desert Recovery Unit. The most recent results for each stratum are provided in Table 10. For additional or updated information on desert tortoise population monitoring, visit the Desert Tortoise Recovery Office website at: https://www.fws.gov/nevada/desert_tortoise/dtro/dtro_monitor.html

Table 10. Desert tortoise density estimates for strata in the action area (Service 2016b, 2018a).

Recovery Unit	**Stratum**	**Area Sampled (mi^2/km^2)**	**Number Transects**	**Total Transect Length (mi/km)**	**No. Tortoises Observed**	**Density Estimate (mi^2/km^2)**
NE Mojave	Beaver Dam Slope	320/828	33	227/365	3	3.4/1.3
	Coyote Springs Valley*	396/1,025	54	368/593	26	10.9/4.2
	Gold Butte-Pakoon	763/1,977	72	439/706	8	4.9/1.9
	Mormon Mesa*	374/968	42	285/458	7	5.5/2.1

*Data is from Service 2016b. The remaining data is from Service 2018a.

Desert Tortoises in the Action Area

Desert tortoise surveys for the Project area and the gen-tie lines were conducted between September 4 and October 19, 2017 (development areas A, B, C, D, and E), April 3 and April 12, 2018 (development area F), and May 7 and May 27, 2018 (development areas B1, B2, and G). The survey area included the solar facility and related infrastructure, the proposed gen-ties, and

the collection line. The survey methodology, data, and maps showing the detailed survey areas are in the Appendix. All surveys followed pre-project Service guidance (Service 2017b). Table 11 summarizes the results of the surveys in the direct effects action area.

Table 11. Survey areas and tortoise density estimates.

Survey Area	Acres (km^2)	Desert Tortoise Observed	Number of Desert Tortoise[1]	Acres (km^2) per Tortoise[1]	Estimated Number of Tortoises	Estimated Density of Tortoises per mi^2 (km^2)
Development Area A	862 (3.5)	14	14	62 (0.3)	28	20.8 (8.0)
Development Area B	3,460 (14.0)	94	74	47 (0.2)	149	27.6 (10.6)
Development Area C	471 (1.9)	6	6	79 (0.3)	12	16.4 (6.3)
Development Area D	1,913 (7.7)	11	10	191 (0.8)	20	6.8 (2.6)
Development Area E	402 (1.6)	1	1	402 (1.6)	2	3.4 (1.3)
Gen-tie and Collector Lines	103 (0.4)	2	2	52 (0.2)	4	26.0 (10.0)
Buffer Areas	270 (1.1)	0	0	-	0	0 (0)
Development Area B1	141 (0.6)	2	2	71 (0.3)	4	17.4 (6.7)
TOTAL	**7,622 (30.8)**	**130**	**109**	**-**	**219**	**18.5 (7.1)**

1. ≥ 180 mm

The total number of adult desert tortoises estimated to occur in the Project area based on tortoise survey data is 219 or 18.5 adult desert tortoises per mi^2 (7.1 per km^2). To estimate the number of tortoises that live within the Project Survey Area, the formula (equation in Figure 21) divides the number of adult tortoises observed during the survey by the product of the probability that a tortoise is aboveground during the survey (Pa), and the probability that a surveyor would see the tortoise if it is aboveground (the searcher efficiency, Pd). Pa is relative to the previous winter's rainfall recorded between October and March by the Western Regional Climate Center. Per the protocol, Pa for this Project is equal to 0.85 because the previous year's rainfall in the region was

greater than 1.5 inches, and Pd is equal to 0.63, which is the standard searcher efficiency for presence/ absence surveys.

$$\left(\begin{array}{c}\text{Estimated number of tortoises}\\ \text{within action area}\end{array}\right) = \frac{\left(\begin{array}{c}\text{Number of tortoises}\\ \text{observed above ground}\end{array}\right)}{\left(\begin{array}{c}\text{Probability that}\\ \text{a tortoise is}\\ \text{above ground } (P_a)\end{array}\right)\left(\begin{array}{c}\text{Probability of}\\ \text{detecting a tortoise,}\\ \text{if above ground } (P_d)\end{array}\right)}\left(\frac{\text{Size of action area}}{\text{Size of area surveyed}}\right)$$

Figure 21. Equation used for tortoise estimates

Previous solar projects have found more tortoises during clearance surveys than were originally estimated. Because tortoises are mobile, there may be more within the action area than were originally estimated based on tortoise survey data. The K Road solar project found 13.6 percent more tortoises during clearance surveys than estimated, and the Silver State South solar project found 23.6 percent more tortoises than estimated in their biological opinion. Because such higher percentages have been found compared to the estimated numbers, we allow for a 25 percent buffer for additional tortoises to be captured and moved. Adding 25 percent to the estimated 219 tortoises puts the total estimate of tortoises within the project site at 274. Since the estimated number of tortoises within the gen-tie line is 4, and those tortoises will only be captured and moved, we estimate that 270 tortoises may be captured and moved via translocation from the solar sites.

Turner et al. (1987) developed a life table for female desert tortoises based on studies conducted at Goffs, California, in 1983. They estimated that 13.2 percent of the desert tortoises in that population were larger than 180 millimeters in length. The methodology and calculations in Table 12 were used to estimate the number of all desert tortoises within the solar facility.

Table 12. Number of tortoises estimated to occur within the solar site and/or gen-tie lines.

Tortoise Calculation	**Tortoise Estimate**
Estimated number (point estimate) of desert tortoises larger than 180 mm (95% confidence interval)	219 (109-400)
Translocation and move and capture of adults (estimate + 25 %)	274 (136-500)
Translocation of adults ([estimate + 25 %] - 4 for gen-tie lines)	270 (132-496)
Percentage of desert tortoises in size classes larger than 180 millimeters (from Turner et al. 1987, table 32)	13.2
The total number of desert tortoises; calculated by 274/0.132	2,076 (1,030-3,788)
The number of juvenile desert tortoises; calculated by 2,076 – 274	1,802 (756-3,514)

Two caveats apply to this estimate. The table in Turner et al. (1987) is based only on females, and we assume that the size classes also apply to males. The demography of the population at the solar facility may be different from Goffs at the time of the work conducted by Turner et al., but we do not have complete information on the demography of the population at the solar facility. Although the estimate of the number of desert tortoises on the project site is based on the best

available information, the overall number of animals may be different.

In addition, we expect the project area to support desert tortoise eggs if cleared during the desert tortoise nesting period, approximately May and June (Turner et al. 1984; Wallis et al. 1999). Estimating the number of tortoise eggs is extremely difficult given that the eggs are buried beneath the soil surface. Applying any assumptions has an unknown and high level of uncertainty. Therefore, we cannot calculate a precise estimate for the number of eggs that may be impacted by the proposed project.

Health assessments and disease levels were assessed in fall 2018 in the Project area, short-distance and distant recipient areas, and control site according to the guidelines in Service's *Health Assessment Procedures for the Mojave Desert Tortoise (Gopherus agassizii): A Handbook Pertinent to Translocation* (Service 2019b). Assessments included a visual inspection of the animal's condition, measurements of body size and weight, and collection of a blood sample and oral swab for disease analysis.

Habitat and Population Connectivity

Quantifying the degree to which a landscape promotes or hinders movements among patches of habitat for a given species, hereafter referred to as "habitat connectivity" (Fischer and Lindenmayer 2007), has become increasingly important relative to desert tortoise recovery. As we evaluate utility-scale solar development and other land uses within the range of the species, it is essential that habitat linkages between and among populations are conserved. For gene flow to occur across the range, populations of desert tortoises need to be connected by areas of occupied habitat that support sustainable numbers of reproductive individuals. Recent research provides evidence that genetic differentiation within the Mojave desert tortoise is consistent with isolation by distance in a continuous-distribution model of gene flow. Populations at the farthest extremes of the distribution are therefore the most differentiated, and a gradient of genetic differentiation occurs between those populations across the range of the species (Britten et al. 1997, Edwards et al. 2004a, Murphy et al. 2007, Hagerty and Tracy 2010). Genetic analyses also suggest that levels of gene flow among subpopulations of desert tortoises likely were high, corresponding to high levels of habitat connectivity (Murphy et al. 2007, Hagerty 2008).

Demographic connectivity describes a pattern of habitat or vegetation that is connected with other areas of similar habitat or vegetation. It refers to the degree to which population growth and vital rates are affected by dispersal (BLM and DOE 2012). The concept of demographic connectivity differs subtly from genetic connectivity as it refers to a more geographic concept of how habitat, vegetation, and dispersal (immigration and emigration) affect survival of a species through birth and growth rates. Demographic connectivity would assume a greater geographic connectedness of habitat and vegetation than genetic connectivity, but both rely on suitable habitat that can be occupied by desert tortoises. The Mojave desert tortoise historically represents a series of continuous, overlapping home ranges within suitable habitats whose boundaries between divergent units may be validated by ecological or major topographic features, such as steep mountainous terrain or, even more significantly, the Colorado River (Germano et al. 1994, Nussear et al. 2009).

Individual desert tortoises can make long-distance movements through restricted habitats, which may contribute to gene flow (Berry 1986, Edwards et al. 2004b), though we do not know the extent to which individuals utilize narrow corridors of relatively intact habitat. The underpinning of the continuous-distribution model of gene flow described above, and the evidence from desert tortoise population genetic studies and distribution, is that individual desert tortoises breed with their neighbors, those desert tortoises breed with other neighbors, and so on. The movements that maintain the genetic diversity across populations occur over generations and not necessarily during the life span of a single desert tortoise. Therefore, for gene flow to happen reliably, populations need to be connected across the range by occupied areas of habitat linkages that support sustainable numbers of desert tortoises.

To define the area required to maintain resident populations within the linkages, we considered desert tortoise home range size and the magnitude of edge effects. The size of desert tortoise home ranges varies with respect to location and year (Berry 1986) and may serve as an indicator of resource availability and opportunity for reproduction and social interactions (O'Connor et al. 1994). Females have long-term home ranges that may be as little as or less than half that of the average male, which can range to 200 acres (Burge 1977, Berry 1986, Duda et al. 1999, Harless et al. 2009). Core areas used within the lifetime home range of desert tortoises depend on the number of burrows used within those areas (Harless et al. 2009). Over its lifetime, a desert tortoise may use more than 1.5 mi^2 of habitat and may make periodic forays of more than 7 miles at a time (Berry 1986). We therefore assess the viability of the linkages based on the ability of those linkages to maintain the lifetime home range of a desert tortoise or the ability of home ranges of this size to connect to one another absent any barriers. Because we expect lifetime home ranges to expand and contract over time, we can consider whether the linkage could remain viable in a year where decreased resource availability results in a smaller population of individuals that respond by expanding their home ranges.

In assessing lifetime home ranges, the Service (1994) assumed a circular configuration of this area when using it in the population viability assessment. We based this assumption on the fidelity that desert tortoises exhibit towards an overwintering burrow year after year. Consequently, the overwintering burrow serves as an anchor point from which the lifetime utilization area radiates out. Using a circular lifetime home range of 1.5 mi^2 for a desert tortoise, we estimate that a linkage would need to be at least 1.4 miles wide to accommodate the width of a single home range. Although these figures provide a means for characterizing the potential minimum width of a linkage, we do not know the exact area or land configuration required to support a sustainable population of resident desert tortoises within any particular linkage, which would be dependent upon several factors.

Based on the best available information, occupancy likely depends on many site-specific factors, including: (1) desert tortoise densities in the vicinity (i.e., lower density sites require larger areas to reliably support sustainable numbers of desert tortoises); (2) length-to-width ratio of the linkage (i.e., longer linkages may need to be wider to preserve the dynamic home ranges and interactions required for gene flow); and (3) potential edge effects and integrity of the ecosystem within and adjacent to the linkage. Another consideration is the extent to which slope and

ruggedness of the terrain allows desert tortoise occupancy or passage. In addition, maintaining connectivity of desert tortoise habitats and populations should reflect results from the landscape genetic analyses of Hagerty (2008) and Hagerty et al. (2011). These analyses showed that desert tortoise gene flow generally occurred historically in a diffuse pattern across the landscape unless otherwise constrained to more narrow, concentrated pathways created by topographic barriers (e.g., around the Spring Mountains in western Nevada). As a result, it is evolutionarily imperative that conservation is focused on maintaining a series of redundant linkages between core populations and critical habitats.

The desert tortoise population in the action area is likely connected to other tortoises in Dry Lake Valley to the north and northwest (e.g., Moapa River Indian Reservation land) by contiguous tortoise occupation or suitable habitat and minimal barriers. Desert tortoises need to have overlapping home ranges and at least semi-permeable barriers for tortoises to be assumed to be connected across the landscape.

Connectivity likely extends into Valley of Fire State Park, through the North Muddy Mountains to the east, and through the Gale Hills and into Rainbow Gardens ACEC to the south. The Muddy Mountains and Lake Mead form impermeable barriers to the southeast. The Project area may have limited connectivity to the Mormon Mesa CHU and the associated Critical Habitat area. West of the action area, the Dry Lake Range, the railroad west of I-15, and I-15 are all barriers. I-15 is fenced with tortoise exclusion fencing but has culverts, which allow for some restricted movement. Other impermeable barriers (i.e., the Muddy River) far north and northwest would preclude connection to the north.

The Revised Desert Tortoise Recovery Plan (Service 2011a) recommends connecting blocks of desert tortoise habitat, such as CHUs and other important areas, to maintain gene flow between populations. Desert tortoise connectivity in the region is addressed in the Solar PEIS (BLM and DOE 2012) and the Supplement to the Solar PEIS. The Desert Tortoise Recovery Office performed a landscape-scale modeling exercise to identify priority habitat linkages between and among desert tortoise conservation areas (as defined in Service 2011a) and to define other large blocks of habitat with important value to recovery of the desert tortoise. Based on Service current understanding, the combination of linkages and existing desert tortoise conservation areas represents the basis for a conservation network for the desert tortoise. Priority 1 areas are designated where least-cost corridor modeling identified potential habitat linkages between existing conservation areas that have the best chance of sustaining connectivity for desert tortoise populations. To identify these linkages, the Service began with USGS desert tortoise habitat potential model (Nussear et al. 2009) and developed a cost surface where higher habitat potential equaled a lower cost to the desert tortoise. The linkages of least-cost to the desert tortoise between pairs of conservation areas (Beier et al. 2008) represent priority areas for conservation of desert tortoise population connectivity. Priority 2 areas are other blocks of habitat with the greatest potential to support populations of desert tortoises, outside least cost corridors, may also have important value to recovery. Based on the USGS model, the Service identified areas of contiguous, high-value desert tortoise habitat as “Priority 2” lands for conservation of desert tortoise within the context of the Final Solar PEIS. While the Solar PEIS does not apply to the Gemini Solar Project, the PEIS identifies the action area as a desert tortoise connectivity corridor

(Figure 22) including predominantly Priority 2 habitat, but some Priority 1 habitat in the southern part of the Project site and south of the site.

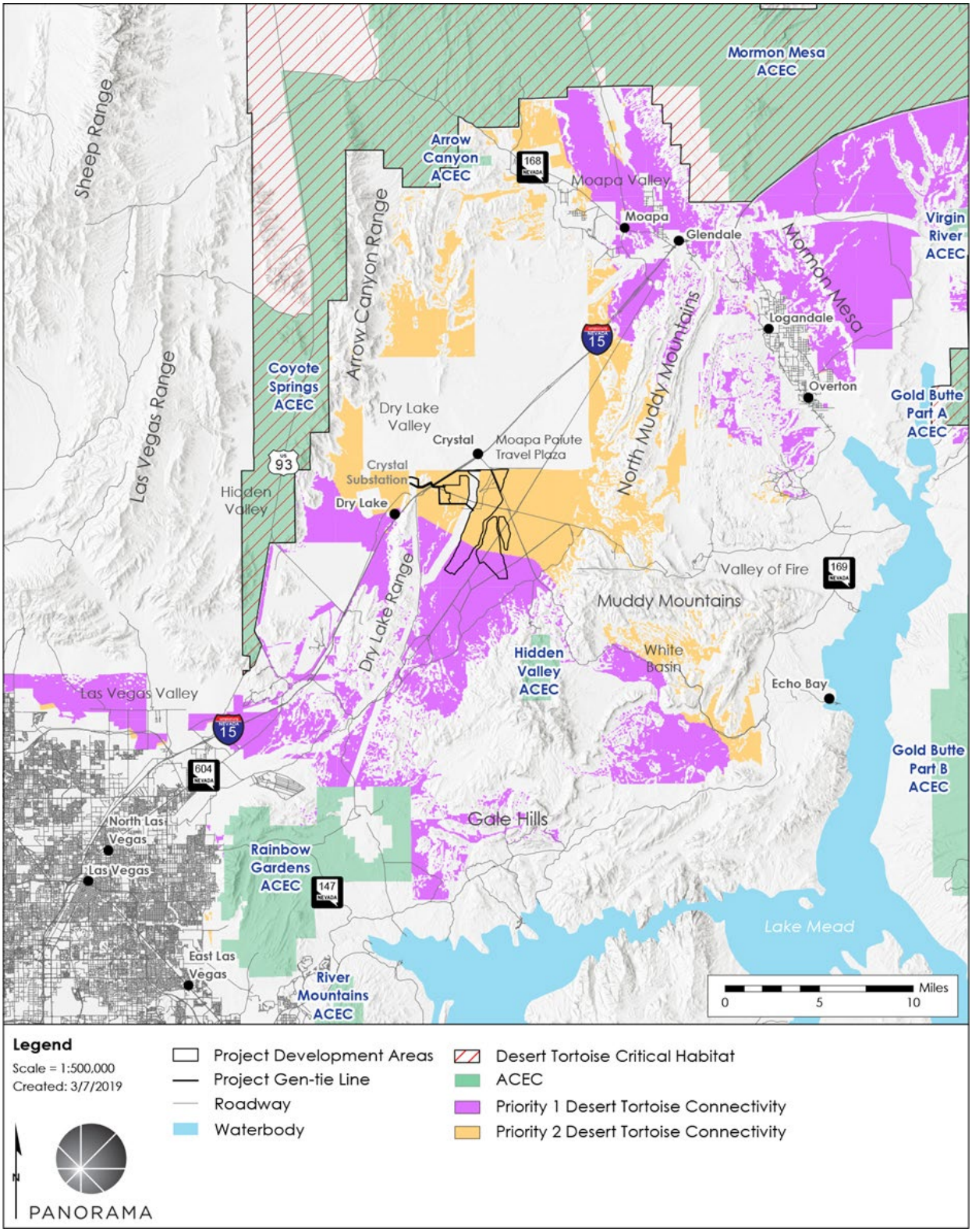

Figure 22. Desert tortoise connectivity areas on BLM land.

Desert Tortoise Translocation Areas

Desert tortoise translocation areas include sites and areas where displaced tortoises will be released (short-distance and distant release areas); area(s) that are established as recipient areas (areas where most tortoises establish following release), maximum dispersal area (the area that encompasses the maximum distances tortoises are anticipated to move following translocation and release), and a control area where resident tortoises will be monitored to compare with translocated tortoises. The short-distance recipient site is 66 km^2 (25.5 mi^2) and the distant recipient area is 125.9 km^2 (48.6 mi^2), and there is some overlap of the two. The short-distance recipient area includes all of the solar project areas that will mowed and all of the tortoises in those areas prior to construction. Desert tortoise recipient sites were selected following Service guidelines (2018b), habitat models, size requirements, and recommendations by BLM and the Service. Figure 23 shows the short-distance and distant recipient area locations.

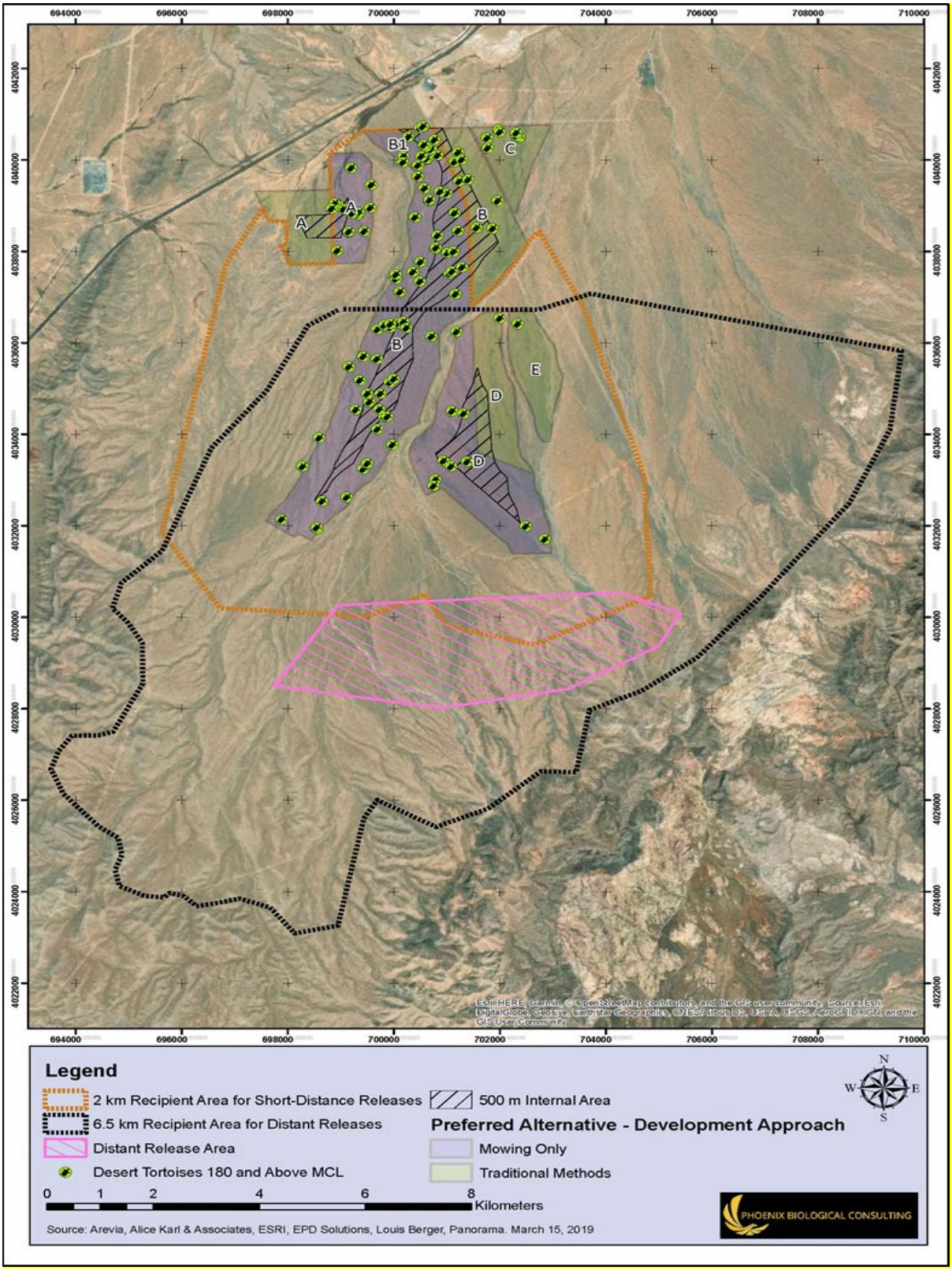

Figure 23. Short-distance (receiving tortoises moved < 500 m) and distant (receiving tortoises moved > 500 m) recipient areas.

Vegetation in the recipient areas is generally dominated by a 12-18% cover of predominantly creosote-white bursage scrub with pockets of big galleta grass along the washes and low-lying areas. Many larger washes are lined with mature stands of cat's claw (*Senegalia greggii)*.

Once data are collected on the tortoises affected by the project, the Applicant will prepare a desert tortoise disposition plan for each tortoise to the Service (see Appendix H in Service 2018b). The plan must be completed within the spring or fall season in which translocation occurs. Based on the health status of those tortoises, the Service will approve or make recommendations on the disposition of the tortoises to be translocated.

Based on the number of tortoises found within the action area during surveys, an estimated 219 tortoises will need to be translocated or captured and moved for the Project to be built. An additional 25 percent was added to that number to account for more tortoises that may move into the area than were found during surveys, making the total estimate 274. Subtracting the four tortoises estimated to be captured and moved along the gen-tie lines, we estimate that 270 tortoises may be translocated from the solar site. Table 13 shows the number of tortoises that are likely to be translocated according to method and location.

Table 13. Tortoises that will be translocated by method and location.

Translocation Approach	**Desert Tortoise Translocation Destination**			**Total Desert Tortoises**
	Distant Translocation	**Moved Outside the Site: ~500 m from the Capture Location**	**Moved to Holding Facility until the End of Construction then Replaced at Capture Location**	
Basic Translocation Approach	36	112	71	219
Adjustments for mowed areas in A, B1 and northwestern B:				
Tortoises within 500 m of development area border		*-33*	*+33*	
Tortoises farther than 500 m from development area border	*+23*		*-23*	
Total	**59**	**79**	**81**	**219***

* Plus a possible 25% (total of 270 tortoises ≥ 180mm minus 4 on gen-tie lines) as calculated in Table 12.

The Service guidance includes establishing a control area to be used in the translocation program to monitor natural effects on resident populations relative to translocated tortoises and tortoises that are resident in the recipient area. The control area should be similar in habitat type and quality, desert tortoise population size and structure, and disease status to the recipient areas (Service 2018b). The control site for the LTMP is the Coyote Springs Valley (CSV) site, 23 km

(14 mi) northwest of the Project. This site is a long, narrow valley between the Arrow Canyon and Las Vegas Ranges. It averages 6 to 8 km (4 to 5 mi) wide east to west and is 35 km (22 mi) long, with elevations of 680 to 990 m (2230 to 3248 ft).

The health of translocated tortoises and resident tortoises at the recipient area and the control area will be assessed and a radio transmitter attached to each tortoise (Service 2018b). The translocation process includes gathering data on sex, age, and health conditions of resident tortoises. This information will be used in conjunction with the same information collected from desert tortoises in the project area during clearance surveys to develop desert tortoise disposition plans and determine placement of translocated tortoises.

Factors Affecting the Desert Tortoise in the Action Area (and Connectivity Areas)

BLM Programmatic Biological Opinions (PBOs) for Projects in the Action Area

Several PBOs have been issued to the BLM that include land in the action area. The first one was issued on November 25, 1997 (1-5-97-F-251; Service 1997), for implementation of various land management programs within the Las Vegas District planning area excluding desert tortoise critical habitat, ACECs, and the Las Vegas Valley. Activities proposed that may affect the desert tortoise in the action area include issuance of ROWs, Recreation and Public Purposes Act leases, mineral material sales and leases, and mining plans of operation. The programmatic consultation was limited to activities that could affect up to 240 acres per project and a cumulative total of 10,000 acres, excluding land exchanges and sales. Only land disposals by sale or exchange in Clark County, but outside the Las Vegas Valley, were covered under the consultation up to a total of 14,637 acres.

On June 18, 1998, the Service issued a PBO (1-5-98-F-053; Service 1998) to BLM for implementation of various land management programs within desert tortoise habitat and the Las Vegas planning area, including desert tortoise critical habitat and ACECs. Activities that were proposed that may have affected the desert tortoise in the action area included recreation, designation of utility corridors and mineral material extraction areas, and designation of the desert tortoise ACECs.

On June 17, 2010, the BLM submitted a programmatic biological assessment to the Service to request consultation for program-level and project level actions that may affect and are likely to adversely affect 19 threatened and endangered species, including the desert tortoise, of which 13 have designated critical habitat within the action area for the consultation. On January 2, 2013, the Service issued a non-jeopardy PBO to the BLM based on review of these activities (84320-2010-F-0365; Service 2013e). While the BLM's 1998 resource management plan remains in effect, the 2013 PBO replaces the Service's 1998 document, which covered a 10-year period. The PBO has been reinitiated six times to include additional acres or activity changes. The PBO

is currently undergoing reinitiation, and the new PBO will replace the 2013 document.

Other Biological Opinions for Projects in the Action Area

Federal Highway Administration PBO

On September 27, 2010, the Service issued a PBO (84320-2010-F-0285; Service 2010g) to the Federal Highway Administration (FHWA) for funding road and highway projects and use of mineral material sites for these projects over a 10-year period. The Nevada Department of Transportation is the primary non-Federal proponent of projects and activities under the PBO. The FHWA and the Service anticipate that up to 4,468 acres of non-critical and 1,170 acres of critical desert tortoise habitat may be disturbed as a result of programmatic activities. This PBO is currently undergoing reinitiation.

Harry Allen Power Plant

On December 3, 1993, the service issued a biological opinion (1-5-93-F-381) to the BLM for proposed ROW amendments to include activities associated with the existing Harry Allen Power Plant. The amended ROWs authorized construction of an access road, overhead power lines, an administrative building, a maintenance building, water treatment facilities, a storm runoff pond, fuel oil tanks, and evaporation ponds. Further, the amended proposal was to include gas turbines in place of the previously proposed coal-slurry and an area approximately 1,300 feet wide and 11,000 feet long for future transmission lines. The project resulted in 523 acres of habitat disturbance. The Service exempted incidental take of 40 tortoises captured and moved from harm's way and 2 tortoises killed or injured. Because two tortoises were killed by project-related activities, BLM requested reinitiation of consultation on April 17, 2006. The Service completed reinitiation on December 20, 2006, and increased incidental take (mortality) to a total of four.

Kern River Natural Gas Transmission Pipeline (KRGT) Project

Two parallel natural gas pipelines operated by Kern River traverse west of the I-15 from the proposed Project. The pipeline projects required a license from the Federal Energy Regulatory Commission (FERC), ROWs from BLM, and permit from the Army Corps of Engineers. The biological opinion for the first KRGT pipeline was issued to FERC on December 21, 1990 (1-5-87-F-36R; Service 1990). The Service concluded that 45 desert tortoises may be killed or injured; 424 desert tortoises captured and moved; and 93 desert tortoise nests destroyed. As of June 24, 1991, approximately 23 deaths and 253 captures of desert tortoise were recorded by Kern River along the pipeline ROW. Problems associated with vehicular traffic on the ROW and access roads may have contributed to the mortalities in combination with high desert tortoise activity levels that were not anticipated. Consequently, on June 24, 1991, FERC requested reinitiation of formal consultation for the project based on a high incidence of desert tortoise mortality and captures on the pipeline project, which exceeded those limits established in the incidental take statement. The Service responded by letter dated June 28, 1991, and under reinitiation of consultation, imposed additional minimization measures and increased the capture limits for desert tortoise from 294 to an unlimited number and increased injury and mortality

limits from 25 to 35.

On July 9, 2002, the Service issued a biological opinion (1-5-02-F-476; Service 2002) to FERC for construction, operation, and maintenance of the second KRGT pipeline, adjacent to the first pipeline. The second pipeline project approximates the previous pipelines constructed under the 1990-1991 biological opinions. The pipeline ROW crosses approximately 318.8 miles of desert tortoise habitat, of which about 102.9 miles traverse desert tortoise critical habitat. Pipeline construction resulted in disturbance of 4,182 acres of desert tortoise habitat including 1,333 acres of desert tortoise critical habitat. Approximately 50 feet of the construction ROW overlapped the previously disturbed land that was affected by construction of the first KRGT pipeline. During construction of the second KRGT pipeline project, over 840 desert tortoises were encountered and one was killed as a direct result of project activities, which includes one desert tortoise in Utah and approximately 380 tortoises in Nevada. One tortoise was killed on June 8, 2011, as a result of maintenance operations. Consequently, BLM and the Service agreed that the requirement for reinitiation of consultation had been triggered for O&M activities due to a desert tortoise mortality and additional effects to the desert tortoise due to a large-scale translocation project in the pipeline action area. On September 28, 2011, the Service issued a biological opinion to BLM for O&M of the KRGT pipelines (84320-2011-F-0337; Service 2011g).

Sampling and Geotechnical Investigation for Proposed Cement Plant

In 2005, Ash Grove Cement Company, in cooperation with the Tribe, proposed to conduct preliminary studies in support of a proposed cement plant and limestone quarry on the Moapa River Indian Reservation. On August 24, 2005, the Service issued a biological opinion (1-5-05-F-497) to the BIA for their approval of the cement project. The project would locate suitable materials to develop the cement plant. The proposed project involved 23.7 acres of disturbance within a 298-acre area.

Surveys of Siting Area 1 occurred March 24 through 31, 2005. Desert tortoise sign observed during the survey included 63 burrows, 11 carcasses, 26 scats, and 12 live tortoises. In addition to the 63 typical desert tortoise burrows that were excavated in soil, there were numerous areas where outcroppings of cap rock with caliche caves and other naturally occurring cavities are present. The abundance of these naturally occurring caves would increase the number of useable tortoise dens from 63 to between 100 and 120.

Desert tortoise surveys and tortoise removal from haul and construction road areas began in March 2006, but the cement plant project did not move forward and did not get built.

UNEV Pipeline

On November 13, 2009, the Service issued a biological opinion to the BLM for ROW grants to construct, operate, and maintain the UNEV petroleum pipeline (6-UT-09-F-023; Service 2009b). The UNEV gas pipeline project aligns with the previous KRGT pipeline ROWs and occurs within the action area for the Playa Solar Project and Dry Lake Solar Energy Center Project. On April 8, 2011, a desert tortoise was killed after being buried under a spoil pile. A second tortoise

was crushed by a project vehicle and killed on May 9, 2011. A third tortoise died on June 29, 2011, when it fell into an open project trench, exceeding the incidental take exempted in the biological opinion. Consultation was reinitiated, and the Service issued a second biological opinion on July 1, 2011, exempting three additional desert tortoise mortalities or injuries (five in total). On July 18, 2011, BLM reported a fourth desert tortoise mortality when a project vehicle ran over and crushed a juvenile tortoise in the road. On August 20, 2011, UNEV reported the fifth tortoise mortality, a crushed desert tortoise on their ROW. The mortality report concluded that the mortality was caused by an unauthorized private vehicle that illegally accessed the ROW.

On August 31, 2011, BLM requested a second reinitiation of consultation in response to the additional desert tortoise mortalities. On September 29, 2011, the Service issued a biological opinion for the UNEV pipeline project. The Service exempted incidental take of 12 desert tortoises through injury or mortality, including the 5 previously killed and 237 desert tortoises captured and moved from harm's way.

On March 21, 2012, the BLM submitted a memorandum to the Service describing a newly discovered Sahara mustard (*Brassica tournefortii*) infestation in the ROW of the UNEV pipeline; a plan to treat the infestation; minimization measures to protect the desert tortoise during the treatment; and a post-application monitoring plan. The infestation occurred approximately from Meadow Valley Wash in Clark County (milepost 371) to the Beaver Dam Slope (milepost 325) at the Nevada and Utah state line. This situation constituted emergency consultation; thus, consultation was reinitiated for the third time and resulted in the Service issuing a biological opinion for this emergency consultation on July 19, 2012.

Coyote Springs Investment (CSI)

On March 2, 2006, the Service issued a biological opinion (1-5-05-FW-536 Tier 1; Service 2006) to the Army Corps of Engineers for the CSI residential development project in Coyote Spring Valley, Clark County, Nevada. The entire project area comprises approximately 13,100 acres, of which 6,881 acres are planned for residential and commercial development and 6,219 acres are planned as a natural reserve that will ultimately be named the Coyote Springs Resource Management Area. The development will impact approximately 4.75 acres of the 61.26 acres of delineated Waters of the U.S. within the project area, thus necessitating compliance with section 404 of the Clean Water Act. Incidental take for desert tortoise will be covered under the Clark County Multiple Species Habitat Conservation Plan (1-5-00-FW-575).

Incidental take for desert tortoise will be covered under the Clark County Multiple Species Habitat Conservation Plan (1-5-00-FW-575). Moapa dace is not included as a covered species in Clark County's MSHCP, and thus, incidental take for the dace is not authorized through Clark County's section l0(a)(l)(B) permit. Additionally, activities associated with surface and groundwater withdrawal are outside of the scope of the MSHCP and the l0(a)(l)(B) incidental take permit for the MSHCP. For the CSI biological opinion, the Moapa dace effects analysis is based off of and tiered to the January 30, 2006, *Intra-Service Programmatic Biological Opinion for the Proposed Muddy River Memorandum of Agreement Regarding the Groundwater*

Withdrawal of 16, 100 Acre-Feet per Year from the Regional Carbonate Aquifer in Coyote Spring Valley and California Wash Basins and Establish Conservation Measures for the Moapa Dace, Clark County, Nevada. This intra-Service biological opinion took a programmatic (landscape-level) approach to evaluating potential effects to the endangered Moapa dace from groundwater pumping by multiple parties in the Coyote Spring Valley and California Wash hydrographic basins, considered in light of conservation measures proposed in the Muddy River Memorandum of Agreement (MOA). Included in this evaluation was the pumping of CSI's State-appropriated water right of 4,600 afy from Coyote Spring Valley to serve the proposed CSI residential development.

The Service anticipates that all desert tortoises that occur on the 6,881 acres of Mojave desert scrub on the project area (approximately 645 adult tortoises) will be taken through capture or injury and mortality as a result of the proposed action. The CSI project will result in the permanent loss of 6,881 acres of desert tortoise habitat. The Service's biological opinion for the Clark County MSHCP stated that covered activities may result in the loss of up to 145,000 acres of Mojave desert scrub habitat (4 percent of total desert tortoise habitat within Clark County) and take of all desert tortoises therein.

CSI has constructed the golf course on the property and plans for additional development. The CSI property is generally bounded on the south by SR 168, on the north by the Clark-Lincoln county line, on the east by Pahranagat Wash, and on the west by US 93. As partial mitigation, CSI will pay $750,000 to fund research and conservation measures for the desert tortoise in the Mormon Mesa CHU.

Calpine Corporation Natural Gas-Fired Power Plant

On December 20, 2001, the Service issued a biological opinion (1-5-01-F-463; Service 2001) to the Bureau of Indian Affairs (BIA) for their proposed approval of a lease of Reservation land to Calpine Corporation for construction, operation, and maintenance of a natural gas-fired power plant. The lease would involve approximately 65 acres for the proposed 760 MW baseload natural gas-fired combined cycle power plant. An additional 33 acres of Reservation land may be used as borrow sites for construction activities, which would require BIA approval. Peaking capacity of the plant may reach 1,100 MW. The project would be constructed, operated, and maintained under a long-term lease (25 years with a 20-year option) with Calpine Corporation for Reservation land and water use.

The project would include 500 kV electrical transmission lines and access roads on Tribal and BLM lands. The U.S. Environmental Protection Agency proposed to issue an authority to construct permit to Calpine Corporation under the Prevention of Significant Deterioration program at 40 CFR 52.21. The U.S. Army Corps of Engineers proposed to permit Calpine Corporation under section 404 of the Clean Water Act. BIA was the lead Federal agency for the consultation. No construction occurred and this project has not moved forward.

K Road Moapa Solar Energy Project

In 2012, the Service issued a biological opinion (84320-2011-F-0430; Service 2012b) to the BIA for the K Road Moapa solar energy project under the intra-Service PBO for the Proposed Muddy River MOA (1-5-05-FW-536, Tier 5). The project involved the Moapa Band of Paiutes (Band) leasing land to a private applicant for the construction of a PV solar generating station 30 miles northeast of Las Vegas in Clark County. The BIA approvals included the lease of Reservation land and grant of easement for ROW for the access road, 12-kV transmission line, and water pipeline. The BLM issued ROW grants for an up to 500-kV transmission line and improvement of an existing access road. The BLM ROW occurs within an existing utility corridor, of which 5.0 miles is located on the Reservation and 0.5 mile on BLM land just south of the Reservation boundary. The project area is located on approximately 2,241 acres of land within the Reservation and 12 acres on BLM land within the utility corridor. All components, with the exception of power transmission lines, access roads, firebreak, and water pipeline, will be developed within the fenced 2,000-ac solar facility. Power and water transmission lines include an approximate 5.5-mile electric transmission line corridor (200 feet wide), an approximate 1-mile water pipeline corridor (25 feet wide), and an approximate 3-mile 12-kV transmission line (25 feet wide) to the Moapa Travel Plaza. The project also includes creating a 6,000-ac Conservation Area to receive displaced tortoises and two additional evaluation areas for short-term use (i.e., five years or less) associated with translocation of the tortoises.

Desert tortoise pre-project surveys estimated that 25 to 103 adult and sub-adult desert tortosies and 20 to 83 hatchling and juvenile tortoises would occur in the 2,000-acre K Road solar facility boundary; thus, the biological opinion identified a threshold of 103 adult and subadult and 83 hatchling and juvenile desert tortoises could be taken by capture within this area of the project. On April 13, 2013, the BIA reinitiated consultation for the project because 98 of the 103 subadult and adult desert tortoises had been captured in the solar facility boundary, and the final capture number was anticipated to exceed the identified 103 threshold. Based on the information in the reinitiation request, the Service revised the incidental take threshold and identified that no more than 120 adult and subadult tortoises would be captured and translocated from the solar facility boundary (84320-2011-F-0430.R001). As was reported on June 1, 2018, final project incidental take resulted in the capture of 117 adults and subadults and 60 hatchlings and juveniles.

Res Americas Moapa Solar Energy Center

In January of 2014, the Service issued a biological opinion (84320-2013-F-0301; Service 2014b) to the BIA for the Res Americas Moapa Solar Energy Center project tiered to the intra-Service PBO for the Proposed Muddy River MOA (1-5-05-FW-536, Tier 6). The project involved the Band leasing land to a private applicant for the construction of a 200 MW PV solar generating station 30 miles northeast of Las Vegas in Clark County. The BIA approvals included the lease of Reservation land and grant of easement for ROW for the access road, two gen-tie transmission lines, and water pipeline. The BLM issued ROW grants for 230-kV and 500-kV transmission lines and an access road. The project area is located on approximately 885.4 acres of land within the Reservation and 66.1 acres on BLM land (total of 951.5 acres). All components, with the

exception of power transmission lines, access roads, and water pipeline, will be developed within the fenced solar facility.

Desert tortoise pre-project surveys documented five adult and sub-adult desert tortoises and one hatchling and juvenile tortoise within the solar field, pipeline ROW, transmission lines corridors, and access road. The biological opinion identified a threshold of 29 adult and subadult and 66 juvenile desert tortoises could be taken by capture within this area of the project. Incidental take for mortality or injury was identified as three for adults and subadults and six for juveniles over the lifetime of the project.

On October 21, 2014, the BIA reinitiated consultation for the project (84320-2015-F-0016) because of changes in the locations of several project features, including the gen-tie line and access road located on BLM land and the water pipeline located on tribal lands. Additionally, the BIA proposed to increase the amount of water used for the project from 75 afy to 375 afy during the expected 2-year construction of the project. The incidental take threshold for desert tortoise did not change. This solar project has not yet been built. Future plans include expanding this project into surrounding Reservation and BLM lands for a new solar facility called Arrow Canyon Solar. On July 30, 2019, the Service issued concurrence (08ENVS00-2019-I-0144; Service 2019a) for effects to Mojave desert tortoise to the BIA for Arrow Canyon geotechnical activities.

Playa Solar Project

On May 1, 2015, the Service issued a biological opinion (84320-2015-F-0139; Service 2015d) to the BLM for the Playa Solar Project tiered to the intra-Service PBO for the Proposed Muddy River MOA (1-5-05-FW-536, Tier 7). The project involves the construction, O&M, and decommissioning of a 200 MW PV solar project on 1,521 acres of BLM lands within the Dry Lake Solar Energy Zone (SEZ) and 3.67 acres of private land. Other facilities include access roads, a 230-kV gen-tie line, a distribution power line, a fiber-optic communications cable, a well, and a pipeline. The project would require up to 1,350 AF of water for construction and operations.

Desert tortoise pre-project surveys documented 18 adult and sub-adult desert tortoises on 2,150 acres. The biological opinion identified a threshold of 34 adult and subadult and 224 juvenile desert tortoises could be taken by capture. Incidental take for mortality or injury was identified as three for adults and subadults during construction and no more than two adults per year or six over the lifetime of the project.

On March 16, 2016, the Service reinitiated consultation (84320-2015-F-0139.R001) and included amendments to the project because of changes in several project features: issuing two ROW grants to establish a Playa 1 (625 acres) and Playa 2 (959 acres), adding a temporary aboveground waterline from the well site on Moapa River Indian Reservation land to the Playa Solar construction site, increasing disturbance from 1,521 acres to 1,538 acres, and expanding the translocation site by 2,867 acres. The groundwater required for the projects was reduced from 1,350 to 675 AF. New site access from US Highway 93 was also requested.

The incidental take threshold for desert tortoise injury and mortality increased from 34 to 44 adult tortoises for construction. Incidental take for O&M was split between Playa 1 and Playa 2. Playa 1 injury and mortality take was identified as no more than one adult tortoise per year or two adults over the lifetime of the project, and Playa 2 take was identified as no more than one adult tortoise per year or three adults over the lifetime of the project.

On April 27, 2016, the Service amended the reinitiation of consultation for the project (84320-2015-F-0139.R001.AMD1) due to the expansion of the translocation recipient area to 2,867 acres. The amendment modified and replaced the language in the reinitiation to specify and confirm health assessments of resident tortoises in the expansion area. The Service estimated that 60 adult tortoises may occur in the expanded area based on the estimate of 13.5 tortoises per mi^2.

The Playa Solar Project has been constructed and a final project report was submitted on October 15, 2016. There were 77 tortoises translocated (42 adults and 35 juveniles). Two mortalities were documented outside of the project area and were not project related.

NV Energy Dry Lake Solar Energy Center

On May 1, 2015, the Service issued a biological opinion (84320-2015-F-0161; Service 2015d) to the BLM for the NV Energy Dry Lake Solar Energy Center Project. The project involves the construction, O&M, and decommissioning of a 130 MW PV solar project on 751 acres of BLM lands within the SEZ. Other facilities include an access road and gen-tie line pads, construction areas, and pull sites.

Desert tortoise pre-project surveys documented four adult and sub-adult desert tortoises on 945 acres and the 55 acres for the Dry Lake Solar Energy Center at Harry Allen Project. The biological opinion identified a threshold of six adult and subadult and 39 hatchling and juvenile desert tortoises could be taken by capture within this area of the project. Incidental take for mortality or injury was identified as no more than one adult during construction and no more than one adult per year or three adults over the lifetime of the project.

On October 18, 2018, the Service amended consultation (84320-2015-F-0161.AMD1) to reduce the acres of project disturbance from 751 acres to 660 acres. This project has not yet been constructed.

NV Energy Dry Lake Solar Energy Center at Harry Allen

On May 1, 2015, the Service issued a biological opinion (84320-2015-F-0162; Service 2015d) to the BLM for the NV Energy Dry Lake Solar Energy Center at Harry Allen Project. The project involves the construction, O&M, and decommissioning of a 20 MW PV solar project on 155 acres of BLM lands within the SEZ. One hundred acres are previously disturbed and fenced, leaving 55 acres of new disturbance for the project.

Desert tortoise pre-project surveys completed for the Project documented one adult tortoise on the 55 acres. The biological opinion identified a threshold of two adult and subadult and 13 hatchling and juvenile desert tortoises could be taken by capture within this area of the project. Incidental take for mortality or injury was identified as no more than one adult during construction and no more than one adult per year or two adults over the lifetime of the project.

On June 28, 2018, the BLM informed the Service that the project will be reducing the acres of disturbance from 55 to zero, as no disturbance will occur on lands that are not previously disturbed. Based on this information, the Service considered the project to be completed.

Invenergy Harry Allen Solar Energy

On May 1, 2015, the Service issued a biological opinion (84320-2015-F-0163; Service 2015d) to the BLM for the Invenergy Harry Allen Solar Energy Project. The project involves the construction, O&M, and decommissioning of a 112 MW PV solar project on 594 acres of BLM lands within the SEZ. Other facilities include an access road and gen-tie line pads, construction areas, and pull sites.

Desert tortoise pre-project surveys documented 17 adult and sub-adult desert tortoises on 725 acres. The biological opinion identified a threshold of 32 adult and subadult and 210 juvenile desert tortoises could be taken by capture within this area of the project. Incidental take for mortality or injury was identified as no more than one adult during construction and no more than one adult per year or three adults over the lifetime of the project.

On July 5, 2018, the Service amended consultation (84320-2015-F-0161.AMD1) to increase the project size from 594 to 640 acres. All 640 acres were surveyed during pre-project surveys, so incidental take was not changed from the original. This project has not yet been constructed.

Tribal Travel Plaza Water Pipeline

On August 6, 2007, the Service issued a biological opinion (Service 2007; 1-5-05-FW-536, Tier 3) to the U.S. Department of Housing and Urban Development for their proposed funding to construct a water pipeline from an existing well to the existing Tribal Travel Plaza. Construction of the water pipeline resulted in 17.57 acres of desert tortoise habitat disturbance. No desert tortoises were reported taken as a result of the project.

Habitat Conservation Plans (HCPs)

Approximately 89 percent of Clark County consists of public lands administered by the Federal government, thereby providing little opportunity for mitigation for the loss of desert tortoise habitat under an HCP on non-Federal lands. Alternatively, funds are collected under HCPs and spent to implement conservation and recovery actions on Federal lands as mitigation for impacts that occur on non-Federal lands. Lands managed by BLM are included in these areas where mitigation funds are used to promote recovery of the desert tortoise.

The Southeastern Lincoln County Multiple Species Habitat Conservation Plan (MSHCP) was developed by three applicants (Lincoln County, City of Caliente, and Union Pacific Railroad), BLM, and the Service. This MSHCP and associated incidental take permit exempts incidental take for desert tortoise and southwestern willow flycatcher (*Empidonax traillii extimus*) within the 30,000-acre permit area while contributing to the conservation for these two listed species. The MSHCP will benefit the tortoise by (1) restoring habitat impacted by wildfires, (2) assisting with development and implementation of a head starting program, (3) providing funding for much needed research, (4) translocating tortoises out of harm's way, (5) fencing development areas, and (6) prohibiting the possession of pet tortoises.

On November 22, 2000, the Service issued an incidental take permit (TE-034927) to Clark County, Nevada, including cities within the County and NDOT for actions proposed in their MSHCP. The incidental take permit allows incidental take of desert tortoise for a period of 30 years on 145,000 acres of non-Federal land in Clark County, and within NDOT ROW, south of the 38th parallel in Nevada.

As partial mitigation under the MSHCP, the County purchased a conservation easement from the City of Boulder City in 1994. The term of the easement is 50 years and it will be retained in a natural condition for recovery of the desert tortoise and conservation of other species in the area. Certain uses shall be prohibited within the easement including motor vehicle activity off designated roads, livestock grazing, and any activity that is inconsistent with tortoise conservation. Much of the easement is also designated desert tortoise critical habitat. Within the boundary of the easement, Boulder City reserved a Solar Energy Zone for energy development projects including Nevada Solar One, Copper Mountain, and Copper Mountain North.

Other Existing Linear Disturbances and Anthropogenic Features

The Union Pacific Railroad crosses through the Moapa River Indian Reservation just west of the I-15. The railroad presents a barrier to tortoise movement, but tortoises are likely capable of crossing the railroad at certain locations. Several large culverts exist that allow tortoise passage underneath the levee for the railroad.

Interstate 15 (I-15) occurs west of the solar project and runs southwest-northeast. I-15 has been fenced to exclude tortoises and thus restricts east-west movement of tortoises in the area. Several large culverts exist that allow tortoise passage underneath the interstate. Unpaved roads and the access road that extends beyond the paved portion of Valley of Fire Road provide public and project access to the action area. A transmission line runs north-south west of the project area.

Other anthropogenic features include collection of desert tortoises for pets, food, and commercial trade; collision with vehicles on roads and highways; mortality from gunshots; predation; and OHV travel cross-country or on trails. In the action area, there is previous disturbance from OHV travel, weeds, and ground disturbance from multiple linear facilities such as pipelines and transmission lines.

Connectivity- All Projects

Genetic and demographic connectivity occurs throughout the Dry Lake Valley. The Project is located near the modeled least cost corridor for the desert tortoise. Least-cost path models identify potential linkages within which an animal would have the best chance of survival according to a specified "cost surface." High-probability, high-quality habitat corresponds to "low cost" for tortoise occupancy (Averill-Murray et al. 2013). This type of evaluation provides an estimation of relative potential for animal passage across the entire landscape, including the identification of potential barriers to movement. East-west least-cost corridors of habitat exist northeast and immediately south of the action area. Predictors of habitat quality for tortoise movement include intermediate distances from minor roads, increasing density of desert washes, and increasing amounts of vegetation cover (Gray et al. 2019).

It is likely that the desert tortoise population within the action area is genetically connected to the populations within the Mormon Mesa CHU due to the short, relatively unencumbered distance between the two. Home ranges of the desert tortoises within the action area likely overlap with the ranges of tortoises found in the connectivity corridor allowing for reproduction and exchange of genes between the two populations. The home ranges of the tortoises found within the corridor also likely overlap with the ranges of tortoises within the Mormon Mesa CHU allowing for a genetic link between the tortoise population in the action area with the populations found within the CHU.

Demographic connectivity describes a pattern of habitat or vegetation that is connected with other areas of similar habitat or vegetation. Demographic connectivity also refers to the degree to which population growth and vital rates are affected by dispersal. Demographic connectivity exists between the desert tortoise population in the action area and the populations in the surrounding areas because some of the existing barriers are permeable. Desert tortoise fencing on I-15 and existing culverts should substantially be reducing road mortality and actually increase tortoise survival and connectivity.

Recreation

Recreational use on roads and trails and large-volume, high-speed travel on major roads and highways has contributed to desert tortoise mortality, habitat loss, habitat degradation, and habitat fragmentation. Many highways have been fenced to exclude tortoises including U.S. Highway 95 south of Las Vegas; U.S. Highway 93 north of Las Vegas; State Routes 161, 163, 164, and 165; and Interstate 15 northeast of Las Vegas.

Upper Respiratory Tract Disease

Upper respiratory track disease (URTD) was discovered in 1990 and is currently a major cause of mortality in portions of their range. Habitat degradation, poor nutrition, and drought have increased the desert tortoises' susceptibility to this disease (Service 1994). It is thought that URTD is transmitted between desert tortoise populations when desert tortoises are captured as pets and subsequently released.

EFFECTS OF THE PROPOSED ACTION

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

The updated Endangered Species Act regulations (84 FR 44976) combine effects into "all effects." Even though we discuss separate categories of effects, direct and indirect effects, this biological opinion complies with the new regulations.

Desert Tortoise Direct Effects

Direct effects are the immediate effects of the action and are not dependent on the occurrence of any additional intervening actions for the impacts to species or critical habitat to occur. The proposed Project will permanently and temporarily impact approximately 4,511 acres of desert tortoise habitat and contribute towards the combined effects to the 47,420-acre recipient areas (short-distance and distant) as a result of translocation of all project tortoises as discussed in the translocation effects section. The project will directly impact approximately 0.17 percent of the total 2,626,111 million acres available within the Northeastern Mojave Recovery Unit (Darst 2014). The habitat that will be permanently disturbed (2602 acres) constitutes only approximately 0.1 percent of the habitat in the Northeastern Mojave Recovery Unit.

The direct and indirect impacts of the Project were determined based on Project-specific characteristics, such as area of proposed land disturbance, technology to be used, and amount of earth-moving or surface alteration required.

Construction and O&M Effects on Desert Tortoises

Injury and Mortality

Death and injury of desert tortoises could result from excavation activities such as clearing and grubbing of vegetation; trenching activities and entrapment in open trenches and pipes; and collisions with or crushing by vehicles or heavy equipment, including individuals that take shelter under parked vehicles and are killed or injured when vehicles are moved. Desert tortoises that enter or attempt to cross project access roads may be struck resulting in death or injury. Mortality mechanisms also include individual desert tortoises or their eggs being crushed or buried in burrows during construction and O&M activities. Because of increased human presence in the area, desert tortoises may be killed or injured due to collection or vandalism associated with increased encounters with workers, visitors, or unauthorized pets. Desert tortoises also may be attracted to the construction area by application of water to control dust, placing them at higher risk of death or injury.

Because 65 percent of the solar site will be enclosed with permeable fencing and most vegetation would be maintained on site during operations, it is likely that tortoises would pass through these portions of the solar site and reoccupy it so some extent, though the extent to which tortoise would reoccupy these areas is unknown at this time. The presence of desert tortoises on the solar site may result in injuries or death during routine maintenance of facilities. Tortoises outside of the fenced solar site may also be injured or killed due to truck traffic along the gen-tie line and associated access roads.

We estimate that all life stages of desert tortoise that occur within the direct effects action area may be adversely affected by the proposed action. Our estimate of the numbers of desert tortoises that are likely to occur within the action area is mostly from pre-project survey data. We acknowledge, however, that not all individuals killed or injured during construction and O&M activities will be detected by biologists, biological monitors, or project staff and subsequently reported to the Service. The inability to detect all tortoises is largely due to the cryptic nature of desert tortoises, fossorial habits, and limited abundance. In the case of juveniles and eggs, their small size and location underground reduce detection probabilities of these life stages. Another confounding factor is that scavengers may locate, consume, or remove carcasses before monitors can locate them.

Overall, we expect death and injury of most subadult and adult tortoises to be avoided during construction and O&M activities through the implementation and compliance of Minimization Measures, including the use of authorized desert tortoise biologists and biological monitors who will be onsite during pre-construction and construction activities. A Worker Environmental Awareness Program will inform all personnel about the desert tortoise, including checking under vehicles prior to moving them and what to do should they encounter a tortoise. Tortoise injury and mortality will also be minimized through flagging and fencing the construction boundaries, installing and monitoring desert tortoise fencing around construction areas, and clearing and translocating tortoises within the project areas prior to beginning work. Enforced speed limits and signs will also aid in preventing injury or mortality to desert tortoise.

Vibration

Heavy equipment (e.g., bulldozers and backhoes) that would cause surface disturbance and otherwise operate during construction would be needed to construct access roads, the O&M building, and the proposed electric substation; to install solar arrays and poles; and to trench for installation of cable and wiring. A few areas that are just outside of the action area may experience short-term or temporary vibrations that could potentially disturb desert tortoises. Vibration from typical construction equipment is barely perceptible farther than 40 to 50 feet beyond the source. Only burrows within 50 feet of the fence at the time of activity could be impacted by vibration. Blasting during construction would also produce vibration. Ground vibrations could cause stress to tortoises, which may result in avoidance of the area, thereby increasing the risk of mortality from increased temperatures or predators. The number of tortoises that could be impacted by vibration is expected to be minimal, if any.

Adverse effects from blasting would be avoided through implementation and compliance of proposed Minimization Measure 14. If blasting is required in desert tortoise habitat, detonation will only occur after the area has been surveyed and cleared by an authorized desert tortoise biologist no more than 24 hours prior. A minimum 200-foot buffered area around the blasting site will be surveyed. A larger area will be surveyed depending on the anticipated size of the explosion as determined by the authorized desert tortoise biologist. All desert tortoises aboveground within the surveyed area will be moved 500 feet from the blasting site to a shaded location or placed in an unoccupied burrow. Desert tortoises that are moved will be monitored or penned to prevent returning to the buffered survey area. Tortoises located outside of the immediate blast zone and that are within burrows will be left in their burrows. All potential desert tortoise burrows, regardless of occupied status, will be stuffed with newspapers, flagged, and location recorded using a global positioning system (GPS) unit. Immediately after blasting, newspaper and flagging will be removed. If a burrow or cover site has collapsed that could be occupied, it will be excavated to ensure that no tortoises have been buried and are in danger of suffocation. Tortoises removed from the blast zone will be returned to their burrow if it is intact or placed in a similar unoccupied or constructed burrow.

Ground-disturbing activities during O&M will be substantially less than during construction of the Project, such that no adverse effects from ground vibration on desert tortoises are expected to occur during O&M.

Dust

Construction activities and operational vehicle traffic on the roads within the action area could generate dust that could affect vegetation adjacent to and within the action area during construction. Long-term adverse effects from dust on vegetation are not expected to occur. The buildup of dust on plant leaves could affect photosynthetic productivity and nutrient and water uptake, resulting in loss of potential foraging plants for desert tortoise. It is assumed that this low-level dusting effect during construction would be minimal and most likely washed away during rainstorms. Dust levels are expected to be reduced in areas slated for mowing as compared to areas developed using traditional methods, due to retention of plants and less disturbance to soil crusts and desert pavement.

Construction BMPs from a Dust Control Plan (Minimization Measure 27) would be in place to monitor and decrease dust pollution by use of polymeric stabilizers in the soil or with frequent watering with water trucks or other means. Where mowing will be implemented, the retention of plant bases, reduced soil disturbance, and less disturbance to soil crusts/desert pavement will reduce the potential for dust.

Noise

Existing noise sources around the action area include road traffic from I-15 and the Valley of Fire Road, railroad traffic (Union Pacific Railroad), aircraft flyover (primarily from Nellis Air Force Base in North Las Vegas), and OHV usage. Noise generated during construction would be temporary in nature and is expected to last approximately 28 months. Construction activities

would require the use of several to over a hundred pieces of equipment. Noise levels at 50 feet from the two loudest equipment types for each construction activity, representing a conservative noise level, are expected to be between 68 and 85 decibels. Desert tortoises outside of the proposed solar facility boundary may experience intermittent exposure to increased noise levels but the impacts would be temporary, and desert tortoise are not expected to be substantially affected given their range of movement.

Noise levels during the O&M phase of the Project are expected to be insignificant. The amount of noise during O&M would not represent a significant change from the current ambient levels.

Increased noise levels may affect desert tortoise foraging and sheltering behavior, leading to poor health and increased risk of mortality, during construction and operations of the facility over a 30-year period. While limited data exist on the effect of noise on desert tortoises, Bowles et al. (1999) demonstrated that the species has relatively sensitive hearing (i.e., mean = 34 dB SPL), but few physiological effects were observed with short-term exposures to jet aircraft noise and sonic booms. These results cannot be extrapolated to chronic exposures over the lifetime of an individual or a population. Based on the ability of other species to adapt to noise disturbance, noise attenuation as distance from the project increases, and the fact that desert tortoises do not rely on auditory cues for their survival, we do not expect any desert tortoises to be injured or killed as a result of project-related noise impacts. In addition, the Applicant has included a measure as part of the proposed action to minimize noise-related impacts to the species. Minimization Measure 22 for noise reduction includes using noise reduction devices (e.g., mufflers) to minimize the impacts on listed species. Operators will ensure that all equipment is adequately muffled and maintained in order to minimize disturbance to desert tortoise.

Project Access Effects (Roads and Fencing)

Primary access to the proposed solar site would be via I-15, Valley of Fire Road, and a paved, public roadway that crosses through the site. Project-related roads within the solar facility would include the perimeter road around all traditional development areas and solar field internal access roads. No other roads would be constructed outside of the perimeter security fence and permanent desert tortoise exclusion fencing. Access to project work areas outside of the fenced facilities may kill or injure desert tortoises due to increased use of existing routes.

When fencing is installed, tortoises that are released back into the area can find their access to previously used burrows cut off. This can lead to exposure to high temperatures that can raise carapace temperature to lethal limits (Peaden et al. 2017). The same study documented increasing carapace temperatures due to pacing along the fence. There is no published literature on how long a tortoise can withstand prolonged extreme temperatures before succumbing to death. Installing shade structures or leaving shrubs along fences would help in preventing such mortality.

The primary effect of project access on desert tortoises is the risk of vehicle strikes. Unless tortoise movement is restricted, implementation of Minimization Measures 2, 5, 9, 10, 11, 14, and 30 are expected to minimize impacts to desert tortoises from access effects. Because all

workers will participate in the WEAP (Minimization Measures 6 and 28) and speed limits will be limited to 15 to 20 mph (Minimization Measures 17 and 33), workers may be less likely to strike desert tortoises than a casual user. In addition, clearance surveys (Minimization Measure 12) and the use of authorized desert tortoise biologists and monitors during construction of the access roads (Minimization Measures 2, 5, and 19) will minimize Project access effects.

We cannot predict how many individuals will be killed or injured due to project-related access because of variables such as weather conditions, the nature and condition of roads, public use that may be confused with project use, and activity patterns of desert tortoises at the time the roads are in use; however, we expect this number to be small.

Effects of Loss of Habitat

Gen-Tie Lines

During the construction phase of the gen-tie lines between the Project site and Crystal Substation, direct desert tortoise encounters with construction equipment could occur, which could result in displacement, injury, or death of tortoises. Biological monitors or authorized biologists will be present at all active construction locations (not including the solar field after it has been fenced with desert tortoise fencing and clearance surveys have been completed). Workers will be required to undergo WEAP training to understand requirements related to desert tortoise impact minimization.

Construction would also result in the temporary loss of desert tortoise habitat for laydown areas and multiple pulling sites. Temporary laydown areas for gen-tie line construction would be 200 feet by 200 feet for up to 48 poles outside the solar facility fence, totaling 36 acres. Pulling sites would total 15 acres of temporary impacts to desert tortoise habitat, at 100 feet by 500 feet per site. Desert tortoises would be displaced from these areas during construction.

Permanent loss of habitat would occur in the footprint of the tubular steel monopoles or lattice towers and in the access roads. The roads would be constructed at a minimum 20 feet wide with an all-weather (aggregate) surface. The permanent habitat loss associated with the pole or tower locations and access roads total approximately 24 acres. Desert tortoise burrows could also be crushed, and therefore, lost by construction of access roads, installation of poles or towers, and by vehicles traveling along access roads.

Solar Field

Construction would result in both permanent and temporary loss of habitat in the solar field as the areas are being constructed. The entire 7,062 acres of solar development sites would not be fenced and constructed all at once. Areas would be fenced and constructed in phases with the first phase likely including development area A. Temporary (for mowed areas) or permanent (for areas constructed using traditional methods) desert tortoise exclusion fencing would be used during construction. As mowed areas are completed and it is safe to do so, desert tortoises would be allowed back into the solar field, limiting the acreage of desert tortoise habitat unavailable at

any one time. Mowing would substantially modify the habitat, due to the mowed and crushed vegetation and the presence of solar arrays and roads. Burrows would be maintained in the mowed area where possible. The areas constructed using traditional methods would represent a permanent loss.

Total long-term disturbance from traditional methods of construction within occupied desert tortoise habitat from the Project would be approximately 2,602 acres. This acreage would be permanently fenced to exclude desert tortoise and would be considered a permanent loss of habitat for the species.

The remaining 4,460 acres of mowed vegetation could be considered semi-permanently disturbed, as this acreage is permanently altered due to the installation and operation of the solar facility; however, vegetation would recover to some extent (and will be monitored), and it is anticipated that an unknown number of desert tortoises would re-occupy the site. Vegetation would generally be mowed to 24 inches and, in justifiable circumstances, no less than 18 inches. Mowing would only occur in the solar array areas where vegetation can affect the panels, equipment, or access. Mowing allows vegetation to remain in place, thereby allowing tortoises to reinhabit the solar field after construction and continue using the burrows within their home ranges.

Other disturbance in the mowed areas would be limited to roads, which would be 15 feet wide with every 4th road 30 feet wide to include a utility corridor. Approximately 110 acres of vegetation within the mowed areas would be removed for access roads. Impacts from cutoff walls would be approximately 0.01 acres of habitat loss.

Project-related vehicles and equipment would operate only within the fenced boundary and access road within the utility corridor. Roads that are not designated as open by BLM would not be used by project personnel unless accompanied by an authorized biologist.

Because recovery of vegetation in the desert can take decades or longer, we consider all ground-disturbing impacts associated with the proposed project to be long-term. Vasek et al. (1975) found that the Mojave Desert transmission line construction and O&M activities resulted in an unvegetated maintenance road, enhanced vegetation along the road edge and between tower sites (often dominated by nonnative species), and reduced vegetation cover under the towers, which recovered significantly but not completely in about 33 years. Webb (2002) determined that absent active restoration following extensive disturbance and compaction in the Mojave Desert, soils in this environment could take between 92 and 124 years to recover. Other studies have shown that recovery of plant cover and biomass in the Mojave Desert could require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). Based on a quantitative review of studies evaluating post-disturbance plant recovery and success in the Mojave and Sonoran deserts, Abella (2010) found that reestablishment of perennial shrub cover (to amounts found on undisturbed areas) generally occurs within 100 years but no fewer than 40 years in some situations. He also found that a number of variables likely affect vegetation recovery times, including but not limited to climate (e.g., precipitation and temperature), invasion by nonnative plant species, and the magnitude and extent of ongoing disturbance. Since 65 percent of the

Project will employ drive-and-crush temporary disturbance on vegetation cut to a minimum of 24 inches, the likelihood of vegetation recovery is much faster than if the vegetation had been cut to the ground. When the facility is decommissioned at the end of the lease, BLM will implement restoration activities following such as decompacting soils, seeding, and nonnative species control.

The proposed Project will permanently and temporarily impact approximately 4,511 acres of desert tortoise habitat and contribute towards the combined effects to the 47,420-acre recipient areas (short-distance and distant) as a result of translocation of project tortoises as discussed in the translocation effects section. The 4,511 acres of Project direct impacts accounts for approximately 0.17 percent of the total 2,626,111 million acres available within the Northeastern Mojave Recovery Unit (Darst 2014). The habitat that would be permanently disturbed (2,602 acres) constitutes approximately 0.1 percent of the habitat in the Northeastern Mojave Recovery Unit. While the model does not take into account anthropomorphic disturbances that have historically or are currently affecting the species, it is unlikely that consideration of these would result in a substantial change in this estimate.

While this percentage (0.1) does not constitute a numerically significant portion of the Northeastern Mojave Recovery Unit, we do not have the ability to place a numerical value on edge effects, habitat degradation, and overall fragmentation that the proposed action may cause or that occurs in the recovery unit as a whole. As a result, the low percentage of habitat within the recovery unit that would be lost underestimates impact of the proposed project on the desert tortoise, especially in light of existing land uses, changes in species composition and fire regimes due to establishment of nonnative plant species, existing and increasing disease and predation rates, and the expansion of human occupancy in what were once remote desert landscapes. The revised recovery plan (Service 2011a) and 5-year review (Service 2010a) provide detailed discussions of these and other past, present, and future threats facing the desert tortoise.

Handling and Translocation Effects

All desert tortoises found on the project site will be captured and removed according to the Translocation Plan (Appendix). Effects would occur both to the translocated tortoises and to the resident tortoises where translocatees are moved. An estimated 79 adult tortoises would be moved to a 500-meter-wide band bordering the Project site (short-distance release area) and another 59 adult tortoises would be distantly translocated to a recipient site south of the Project site (distant release area). Another 81 adult tortoises would be temporarily moved to a holding facility until construction is complete, at which time they would be re-placed back into mowed areas in the site. These numbers could be higher depending upon the actual number of tortoises in the area during clearance. We estimate that the totals could be 25 percent higher (270 translocated tortoises). Translocated tortoises would be handled, have transmitters affixed, given health assessments with tissue sampling, and moved. Tortoises could incur injury or death. Some adult tortoises would be passively or actively reintroduced to mowed areas of the Project site after construction as detailed in the Disposition Plan. Smaller juvenile tortoises would be moved under the same geographic criteria as adults. Very small juveniles would be temporarily moved

to the holding facility and then moved to safe locations immediately outside the facility or to the recipient area.

Capture and translocation of desert tortoises may result in accidental death and injury from stress or disease transmission associated with handling tortoises, stress associated with moving individuals outside of their established home range, stress associated with artificially increasing the density of tortoises in an area and thereby increasing competition for resources, and disease transmission between and among translocated and resident desert tortoises. Capture and handling of translocated and resident desert tortoises for the purposes of conducting health assessments, which include visual inspection relative to body condition, clinical signs of disease, and collection of biological samples for disease screening (i.e., blood samples to test for antibodies to pathogens), could result in accidental death or injury.

Capturing, handling, and moving tortoises for the purposes of translocating them out of the project areas or out of harm's way (during all phases of the project) may result in accidental death or injury if these methods are performed improperly, such as during extreme temperatures or if individuals void their bladders and are not rehydrated. Averill-Murray (2002) determined desert tortoises that voided their bladders during handling had lower overall survival rates (0.81 to 0.88) than those that did not void (0.96). If multiple desert tortoises are handled by biologists without the use of appropriate protective measures and procedures, such as reusing latex gloves, pathogens may be spread among individuals. The Applicant's translocation plan will include protocols to minimize translocation effects and would continue to be adaptively managed over time to facilitate successful translocation. Because the Applicant would employ authorized desert tortoise biologists approved by the Service and adhere to the most recent Service guidance in addition to implementing the conservation measures outlined in the proposed action, we anticipate any mortality or injury to desert tortoises from activities associated with removing individuals from the proposed project sites is unlikely.

Translocation has the potential to increase the prevalence of diseases, such as URDT, in translocated and resident desert tortoises. Physiological stresses associated with handling and movement or from density-dependent effects could exacerbate this risk in translocated individuals with subclinical URTD or other diseases that present symptoms subsequent to translocation. This potential conversion of translocated desert tortoises from a non-contagious to contagious state may increase the potential for infection in the resident population above pre-translocation levels. To minimize this risk, health assessments (physical and biological) would be conducted on all desert tortoises to be translocated prior to being released in accordance with the most recent Service guidance (Service 2019b).

Translocated desert tortoises will not be released into the recipient areas until results of the disease tests have been received and the Service approves the disposition plan for each individual. While awaiting test results, desert tortoises will be monitored *in-situ* or penned (i.e., quarantined) on site no longer than 18 months. Handling and blood collection may result in elevated stress levels that render individuals more susceptible to disease or dehydration from loss of fluids. Because the Applicant will employ authorized biologists approved by the Service and trained to perform health assessments and collection of biological samples, we do not expect

these activities to result in death or injury of any individuals. Furthermore, disease screening and quarantine procedures will reduce the potential for introduction and spread of disease due to translocation.

Desert tortoises in quarantine pens could increase their exposure and vulnerability to stress, dehydration, and inadequate food resources. However, because desert tortoises will be monitored regularly, care will be administered following specific procedures, and the quarantine period should not exceed one year, we anticipate that quarantined individuals are unlikely to experience death or injury from the vulnerabilities identified above. The potential exists, however, for predators or poachers to target quarantined desert tortoises. This risk also is expected to be minimized through regularly scheduled monitoring in accordance with the desert tortoise translocation plan. Desert tortoises monitored *in-situ* may be subject to similar effects as those in quarantine pens; however, because these individuals will be confined to large areas within their existing home ranges, we anticipate that the potential for increased stressors would be relatively low and adequate shelter and food resources would be accessible until translocation.

While we cannot reasonably predict if an increase in disease prevalence within the resident population may occur due to translocation, we believe the following measures will reduce the magnitude of this risk:

- The Applicant would use experienced authorized biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels in translocated animals;
- desert tortoises in the project footprint are currently part of a continuous population with the resident populations of the recipient site and are likely to share similar pathogens and immunities;
- density-dependent stresses are unlikely to occur for reasons stated below;
- any animal that has clinical signs of disease or ELISA-positive blood test would not be translocated; and
- long-term monitoring of translocated individuals would be implemented to determine the prevalence of disease transmission.

Because ELISA testing can yield false-positive results (i.e., an animal may test positive even though it is not a carrier of the disease), the removal of healthy individuals from the translocated population may occur due to concern over disease. These individuals would be removed from the wild and, thereby, no longer contribute to the environmental baseline for the action area. Removing these individuals may inadvertently reduce the resistance of the population to disease outbreaks. Because the Applicant would coordinate with the Service and follow-up testing of ELISA-positive individuals would be performed, the potential for removing false-positive individuals from the translocated population is low. Consequently, we conclude that few, if any, desert tortoises would be removed from the population due to false-positive results. Similarly, some of the animals that test positive may have survived past disease infections and remain healthy. Despite gaps in our knowledge relative to disease pathology and recognition that removal of seropositive desert tortoises may eliminate individuals with superior fitness and genetic adaptations for surviving disease from the gene pool, the low number of individuals

expected to be removed would not be large enough to affect population genetics in the wild.

Boarman (2002), in a review of literature on threats to the desert tortoise, stated that the adverse effects of translocating desert tortoises include increased risk of mortality, spread of disease, and reduced reproductive success. Translocated desert tortoises have a tendency, at least initially, to spend more time aboveground moving through their environment than animals within their home ranges; this tendency exacerbates at least some of these threats.

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

Desert tortoises that were translocated short distances moved much shorter distances than those that were translocated long distances. Moving desert tortoises shorter distances can result in the animals attempting to return to their original capture site. Attempts to return to the capture site would cause individuals to spend relatively greater amounts of time aboveground; if they encounter and follow fence lines during this movement, it may further increase the amount of time they spend aboveground. These behaviors may expose them to elevated risks of predation and exposure to temperature extremes that they would otherwise avoid. The applicants propose to locate desert tortoises translocated from the solar facility via telemetry as outlined in the LTMP to ensure that they not exhibiting behaviors that may endanger their well-being such as walking along the exclusion fence. Overall, because we expect desert tortoises would be moved and monitored by authorized biologists, few, if any, tortoises are likely to be killed or injured as a result of being translocated from the solar site.

Hinderle et al. (2015) found that almost half of desert tortoises translocated 2 km returned to their capture site; only one desert tortoise moved 5 km returned to the capture site; and no desert tortoises returned home from 8 km away. The propensity for desert tortoises to attempt to return to their capture site would increase the likelihood that they would encounter an exclusion fence and pace it; while pacing the fence, they may be attacked by predators or exposed to extreme weather. Despite the fact that Hinderle et al. (2015) found that almost half of the animals in their study returned to their capture sites, more than half did not. The potential exists that these animals remained within their home ranges after translocation and made no effort to return to the capture site, at least immediately.

Desert tortoises that spend less time aboveground are less vulnerable to predation and environmental extremes. Regardless of the distance desert tortoises would be moved, we expect that animals that are moved from the project sites would spend more time aboveground and

moving, at least during the first year, which means they would be more vulnerable to predators, adverse interactions with other desert tortoises, and weather conditions than resident or control animals. During this first year of increased movement, desert tortoises would also be more likely to engage in fence pacing behavior, which can lead to hyperthermia and death. The use of shade structures along fences will minimize this effect. In spring 2013, biologists translocated 108 adult and 49 juvenile desert tortoises from approximately 2,000 acres of the K Road Moapa Solar Project on the Moapa River Indian Reservation northeast of Las Vegas; they also monitored 18 adult desert tortoises as controls or residents. Extremely high temperatures during the summer may have killed two or more adult translocated desert tortoises. Predators likely killed eight juvenile translocated desert tortoises. No resident or control desert tortoises died during monitoring.

As with prior translocations (Nussear 2004, Field et al. 2007), we anticipate that predation is likely to be the primary source of post-translocation mortality particularly for small tortoises. The level of winter rainfall may dictate the amount of predation observed in desert tortoises (Drake et al. 2009, Esque et al. 2010). We are aware of two instances where monitoring of large numbers of control and resident desert tortoises accompanied the translocation of desert tortoises (Fort Irwin and Ivanpah Solar Electric Generating System). At Fort Irwin, Esque et al. (2010) found that "translocation did not affect the probability of predation: translocated, resident, and control tortoises all had similar levels of predation." At the Ivanpah Solar Electric Generating System, the numbers of translocated, resident, and control desert tortoises that have died since the onset of work at the Ivanpah Solar Electric Generating System are roughly equal (Davis 2014), which seems to indicate that translocation is not a factor in these mortalities; among translocated, resident, and control animals, predation by canids was the greatest source of mortality. To minimize the risk of predation, the Disposition Plan will include release sites preferentially located away from known areas of concentrated predator sign if any are identified.

Drought conditions seem to affect translocated and resident desert tortoises similarly. Field et al. (2007) monitored translocated and resident desert tortoises during drought conditions and found no significant difference between resident and translocated animals. Field et al. (2007) noted that most of the translocated desert tortoises "quickly became adept at life in the wild," despite the harsh conditions. Consequently, we have concluded that the amount of rainfall preceding translocation is not likely to decrease the survival rate of desert tortoises that would be moved from within the project areas.

Nussear et al. (2012) investigated the effects of translocation on reproduction in 120 desert tortoises. They found that in the first year since translocation, the mean reproductive effort for translocated desert tortoises was slightly less than that of residents. Nussear et al. (2012) noted that the translocated animals may have benefited from being fed while in the pre-translocation holding facility. If the food provided in the facility increased their production of eggs in the first year after translocation, translocated desert tortoises that were not held in captivity and fed prior to release may have produced fewer eggs than he observed in his experiment. In the second and third year after translocation, the mean number of eggs was not different between resident and translocated desert tortoises. Given the long reproductive life of desert tortoises and the fact that translocated animals produced the same number of eggs as residents the first year after

translocation, the decrease in the output of eggs from translocation desert tortoises for a year will not have a measurable effect on the overall health of the population, either locally or on a broader scale.

In spring 2009, 570 tortoises were translocated from the United States Army National Training Center at Fort Irwin in California south of the project boundary. Genotypes were determined for the translocated male tortoises and an additional 190 resident male tortoises (Mulder et al. 2017). In 2012, 96 female tortoises (50 resident and 46 translocated) were tracked, and nests were visited until blood samples were taken from all live hatchlings (97 hatchlings from 36 nests) and genotyped. The paternity was determined for 35 hatchlings, and all 35 hatchlings were found to be offspring of resident males, with translocated males producing no offspring (Mulder et al. 2017). Translocated males could have reduced fitness due to stress or expended energy in a new environment. Since this is only one study, it is not known if this occurs for all translocated males and, if so, how long it takes before translocated males start breeding.

Translocation also affects resident desert tortoises within the maximum dispersal area due to local increases in population densities. Desert tortoises from the solar facility site would be moved to areas now supporting a resident population, which may result in increased inter-specific encounters and, thereby, an increased potential for spread of disease, potentially reducing the health of the overall population; increased competition for shelter sites and other limited resources; increased competition for forage, especially during drought years; and increased incidence of aggressive interactions between individuals (Saethre et al. 2003). To minimize potential density-dependent effects, recipient areas must be sufficiently large to accommodate and maintain the resident and translocated desert tortoises (Service 2019b).

There are two recipient areas for the Project: a short-distance recipient area (66 km^2; 16,309 acres) for moving tortoises ≤ 500 meters from the capture location (or placing tortoises back into it after being penned during construction) and a distant recipient area (125.9 km^2; 31,111 acres) for moving tortoises > 500 meters from the capture location (and there is some overlap of the two). The short-distance recipient area includes all of the solar project areas that will mowed and all of the tortoises in those areas prior to construction. All tortoises within traditionally developed areas and > 500 meters from the fence will be moved to the distant release area within the distant recipient area.

The 47,420-acre recipient sites (short-distance and distance) represents 1.8 percent of the 2,626,111 acres of remaining desert tortoise habitat in the Northeastern Mojave Recovery Unit. Translocation guidance states that the translocation of tortoises cannot exceed one standard deviation above the mean regional density in which the project occurs (4.4 tortoises per km^2 + 1 SD). This Project is unique in that the tortoise density is already above this level.

Based on survey data, an estimated 219 adult tortoises may be translocated. By translocating tortoises south of the Project into the distant release (and recipient site), the increase in density is expected to increase from 6.2 to 6.9 tortoises per km^2, which is not appreciably increasing what the habitat can support. We anticipate that density-dependent effects on resident populations are likely to be minor. The distant recipient area is not a confined space, so released individuals

would be able to disperse into other areas. Density in the short-distance release and recipient area is expected to decrease from 7.7 to 7.3 tortoises per km^2 because tortoises would get moved from the project areas within the short-distance recipient area into the distant release area. Table 14 shows the post-translocation tortoise estimates.

Table 14. Post-translocation adult tortoise densities in the short-distance and long-distance recipient areas following final translocation and reintroduction.

Recipient Area	Final Recipient Area Size (Minus Traditionally Developed Areas) (km^2)	Current Estimated Density (# tortoises/km^2)	Current # of Tortoises (including Graded Areas)	# of Tortoises Post Translocation (resident and translocated)	Post-Translocation Density (# tortoises/km^2)[1]
Short-Distance Recipient Area	66.0	7.7	539	480	7.3
Distant Recipient Area	125.9	6.2	805	864	6.9

[1] These numbers may be higher if more than the estimated 79 tortoises are translocated.

We anticipate that density-dependent effects on resident desert tortoise populations are likely to be minor for the following reasons:

- Health assessments will be performed on all desert tortoises prior to translocation, thus decreasing the potential for introduction of infectious diseases to the recipient areas;
- tortoise density should only increase from 6.2 to 6.9 tortoises per km^2 in the distant recipient area;
- translocation will be implemented such that individuals are distributed throughout the areas;
- the recipient areas are contiguous with suitable desert tortoise habitats, which will facilitate dispersal into other areas;
- 65 percent of the solar site will have vegetation remaining and allow tortoises back into the site to use, which may lower density estimates; and
- long-term monitoring will provide opportunities to implement adaptive management to address any observed unanticipated effects.

During the translocation work at Fort Irwin, researchers tested over 200 desert tortoises for differences in the levels of corticosterone, which is a hormone commonly associated with stress responses in reptiles; Drake et al. (2012) “did not observe a measureable physiological stress response (as measured by [corticosterone]) within the first two years after translocation”. The researchers found no difference in stress hormone levels among resident, control, and translocated desert tortoises. For these reasons, we conclude that the addition of translocated desert tortoises to the recipient areas would not result in detrimental effects to translocated or

resident animals.

Various studies have documented mortality rates of 0, 15, 21, and 21.4 percent of translocated desert tortoises in other areas (Nussear 2004, Field et al. 2007). Nussear (2004) found that mortality rates among translocated desert tortoises were not statistically different from that observed in resident populations. However, this study did not compare mortality rates in resident populations to those in control groups; therefore, we cannot determine if the translocation caused increased mortality rates in the resident population. Recent studies in support of the Fort Irwin expansion compared mortality rates associated with resident and translocated desert tortoise populations with that of control populations; preliminary results indicated translocation did not increase mortality above natural levels (Esque et al. 2010). This and other fieldwork indicate that desert tortoise mortality is most likely to occur during the first year after release. After the first year, translocated individuals are likely to establish new home ranges and mortality is likely to decrease.

The probability for survival for tortoises over 160 mm was studied in the vicinity of the Ivanpah solar facility during a 5-year study (58 translocated tortoises, 112 resident tortoises, and 149 control tortoises; Dickson et al. 2019). Translocated tortoises were found to have 89% to 99% the survival rates of resident or control tortoises. This may be because tortoises were released within 500 meters of their home range or because tortoises were translocated in early spring, giving them time to dig burrows and become familiar with the environment before the heat of the summer. Another study of four translocation sites (Nafus et al. 2017) tested the relationship of habitat features to translocation dispersal and survival of juvenile desert tortoises in southern Nevada. Findings indicated that the presence of rodent burrows, substrate texture, and wash presence provided refugia, allowing tortoises to avoid predator detection and reduce overall mortality.

Natural mortality rates of juvenile desert tortoises are greater than those of adult tortoises. In general, we expect that healthy populations have a large number of desert tortoises smaller than 180 mm (Turner et al. 1987), but only limited information exists on the actual numbers of small tortoises in a given area. Additionally, juvenile desert tortoises use resources differently than adults (Wilson et al. 1999) and we expect that juveniles and adults interact much less frequently than do adults. Due to differences in habitat use influenced by both physical and physiological differences between adult and juvenile desert tortoises, we expect overlapping of ranges during growth and dispersal of the juvenile desert tortoise. Consequently, we do not expect translocating juvenile desert tortoises at higher densities than adult animals would result in any density-dependent adverse effects.

Tortoises that move over large areas can result in greater overlap with conspecifics (individuals of the same species). If translocated animals have disproportionately higher contact opportunities and increase the connectivity of animals across the landscape, they could rapidly facilitate disease spread if infected. Translocated animals, though often healthy at the time of selection, may be at high risk of acquiring infection from residents and facilitating spread. High mobility after release may increase contact opportunity, and stress associated with translocation may increase susceptibility or make a virulent infection more virulent (Aiello et al. 2014). Several

circumstances are likely to reduce the magnitude of the threat of disease prevalence being exacerbated by translocation, including: (1) the applicants will use experienced authorized biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels in translocated animals; animals are less likely to succumb to disease when they are not stressed; (2) desert tortoises on the project site are currently part of a continuous population with the resident populations of the recipient sites and are likely to share similar pathogens and immunities; (3) Drake et al. (2012) indicated that translocation does not seem to increase stress in desert tortoise; (4) density-dependent stress is unlikely to occur for the reasons discussed previously in this section; and (5) Service-trained biologists will perform health assessments using Service-approved protocols (Service 2019b) and will not translocate any desert tortoise showing severe clinical sings of disease, but rather will transport the animal to an agency-approved quarantine, as described in the translocation plan (Appendix).

Based on the information described above, we anticipate that survival rates of adult desert tortoises moved from the project sites will not significantly differ from that of animals that have not been moved. We expect that desert tortoises would be at greatest risk during the time they are spending more time aboveground than resident animals. We cannot precisely predict the level of risk that will occur after moving desert tortoises because regional factors that we cannot control or predict (e.g., drought, predation related to a decreased prey base during drought, etc.) would likely exert the strongest influence on the mortality rates.

While we have data to help explain the effects to tortoises translocated into the short-distance and distant release areas, we have much less information regarding effects to tortoises that will get placed into holding facilities and moved back into 65 percent of the solar facility after construction. While this portion of the project will contain native vegetation that desert tortoises rely on for forage and shelter, this vegetation will have been mowed and crushed in order to install the solar panels. The site will also contain new access roads that were not previously within the site that will fragment the landscape to some extent. There is currently one ongoing study of a solar site that left vegetation within the facility and allowed tortoises access to the site. The Valley Electric Association constructed a solar project on 80 acres in Pahrump, Nevada. Vegetation onsite was mowed and crushed while solar panels were installed. Four tortoises were held in pens during construction, affixed with transmitters, and released back into the solar site in October 2017. Monitoring reports to the Service have documented that two of these tortoises, a female and male, have been found within and around the solar site since construction. In 2019, the female was found within the facility nine times and the male was located within the facility once. The vegetation in the facility has rebounded from being crushed, and the tortoises appear to be using the site as habitat. While this project is small in scale in comparison to the 65 percent of the proposed Project, we believe it is likely that tortoises placed back into the solar site will utilize the site to some extent. We are uncertain whether tortoises will use the site immediately upon release or after the vegetation has rebounded. There is also a chance that tortoises placed back into the mowed site will move out of the site after release. Identifying how tortoises respond to being placed back into site, how and if they use the site, and how many stay within the site is the main focus of the habitat use study that will be funded by the Applicant. BLM and the Applicant will also adaptively manage tortoises post construction, and will work with the Service to remedy any unforeseen adverse effects to desert tortoises from being released in, and

having access to the site.

In conclusion, we do not anticipate that moving desert tortoises out of harm's way would result in death or injury because these individuals would remain near or within their existing home range, which is not likely to result in significant social or competitive impacts to resident desert tortoises in the area. Following release of desert tortoises translocated outside of their home range, a small number may die due to exposure, stress, dehydration, inadequate food resources, and increased predation. We anticipate most of this mortality is likely to occur in the first year after release, during the period that translocated animals are attempting to establish new home ranges. In addition, we anticipate that a small number of resident desert tortoises at the recipient area may die from natural causes due to these same vulnerabilities. However, we cannot determine if mortality rates in the translocated or resident populations would be above natural mortality levels for the recipient area. In addition, the potential impacts of capturing, handling, and moving tortoises for the purposes of translocation would be avoided or reduced through implementation of the actions specified in the implementation of the Service-approved translocation plan (Appendix). Lastly, as described in the translocation plan, translocated desert tortoises will be allowed back into 65 percent of the solar project site, monitored, findings reported to the Service, and adaptive management strategies implemented, as needed.

Post-Translocation Monitoring

Based on the description of post-translocation monitoring in the translocation plan and our estimate of the number of desert tortoises that require translocation, we anticipate that the Applicant will attach transmitters to approximately 156 subadult and/or adult desert tortoises (i.e., 52 translocated, 52 resident, and 52 control animals) to facilitate monitoring. Thus, desert tortoises will have transmitters attached and be monitored and handled periodically for visual health assessments throughout the monitoring period. Some potential exists that handling of desert tortoises may cause elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluids. However, because the Applicant will employ experienced authorized biologists approved by the Service, we do not expect handling and monitoring activities to result in death or injury of any individuals. The final LTMP will be provided and approved by the BLM and the Service, prior to the Record of Decision being signed.

Post-translocation monitoring provides for adaptive management. Action can be taken if unpredicted scenarios occur. For instance, if short-distance and distant translocated tortoises do not end up using the mowed areas of the solar facility, densities within the recipient areas may increase to high levels. If the monitoring documents that tortoises have rapidly declining body condition scores or other factors of concern, tortoises would be moved to the holding facility until a location is determined for translocation.

Desert Tortoise Indirect Effects

Indirect effects are those for which the proposed action is an essential cause, and that are later in

time, but still reasonably certain to occur. If an effect will occur whether or not the action takes place, the action is not an essential cause of the indirect effect. In contrast to direct effects, indirect effects are more subtle, and may affect tortoise populations and habitat quality over an extended period of time, long after surface-disturbing activities have been completed. Indirect effects are of particular concern for long-lived species such as the desert tortoise because project-related effects may not become evident in individuals or populations until years later.

The area of indirect effects is defined as the area within 0.5 miles of the project area including the proposed translocation area. We have expanded this area in order to capture connectivity effects between the Arrow Mountain Range to the west and the Muddy Mountain Range to the east. Indirect effects do not involve ground-disturbing activities but instead consider effects from habitat fragmentation, decreased connectivity, fugitive dust, noise, lighting, herbicide use, and accidental spills of hazardous materials associated with the project that have the potential to impact desert tortoise and their habitat in the surrounding area. The magnitude of indirect effects is expected to decrease as distance from the action area increases. Potential indirect effects from the proposed action would be addressed through implementation of project design features that control impacts such as soil erosion, dust, stormwater runoff, and water quality during all phases of the project. In addition, the applicants would prepare and implement a Worker Education and Awareness Plan, Raven Management Plan, Integrated Weed Management Plan, Pesticide Use Proposal, Spill Prevention and Emergency Response Plan, Hazardous Materials and Waste Management Plan, and Lighting Management Plan.

Lighting

Temporary lighting would be present in areas of active construction during the construction phase. Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives and would be downward facing and shielded to focus illumination on the desired areas only. However, this lighting would only be installed during construction. Nighttime construction would be rare, but artificial lighting could cause behavioral changes in tortoises, causing them to come out of their burrows. This could expose them to possible mortality from predators or stress-induced fence pacing.

During O&M, the Project's lighting system would provide personnel with illumination for both normal and emergency conditions near the main entrance and the Project substations. Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives and would be downward facing and shielded to focus illumination on the desired areas only. There would be no lighting in the solar field. Therefore, light trespass on surrounding properties would be minimal. If lighting at individual solar panels or other equipment is needed for night maintenance, portable lighting would be used. Project lighting is not expected to have a more than negligible effect on desert tortoise near and adjacent to the Project.

Predator Subsidies

Avian predators, such as the common raven (*Corvus corax*), and scavengers (e.g., coyotes) benefit from a myriad of resource subsidies provided by human activities as a result of

substantial development within the desert because food and water subsidies and roosting and nesting substrates would otherwise be unavailable; these animals prey on eggs, juvenile, and adult desert tortoises. These subsidies can include food (e.g., garbage), water (e.g., detention ponds), nesting substrates (e.g., transmission lines and fencing), cover, and safety from inclement weather or predators (e.g., office buildings). Human activities also facilitate expansion of raven and coyote populations into areas where they were previously absent or in low abundance. Ravens likely will frequent the project areas because of the potential availability of such subsidies. Road-kill of wildlife along I-15 provides additional attractants and subsidies for opportunistic predators and scavengers but is not likely to increase appreciably as a result of the project. Carcasses of any type (bird, mammal, etc.) may attract predators to the project site. Removal of carcasses when found would eliminate the odor and further attraction to the site by predators.

Facility infrastructure, such as gen-tie and transmission poles, fences, buildings, and other structures on the project site may provide perching, roosting, and nesting opportunities for ravens and other avian predators. Natural predation rates may be altered or increased when natural habitats are disturbed or modified. Common raven populations in some areas of the Mojave Desert have increased 1,500 percent from 1968 to 1988 in response to expanding human use of the desert (Boarman 2002). Since ravens were scarce in the Mojave Desert prior to 1940, the existing level of raven predation on juvenile desert tortoises is considered an unnatural occurrence (BLM 1990). In addition to ravens, feral dogs have emerged as significant predators of desert tortoises adjacent to residential areas. Though feral dogs may range several miles into the desert and have been found digging up and killing tortoises (Evans 2001), there have not been any reports of feral dogs in the Project area.

To avoid and minimize the availability of project sources for predators, subsidies will be minimized by Minimization Measures 18, 24, and 34, which propose trash and litter control and monitoring for the presence of ravens and other predators. A Bird and Bat Conservation Strategy and Raven Management Plan would be developed and approved prior to the initiation of construction activities, which would reduce potential raven- (or other avian predator) related impacts to desert tortoise. For example, perch deterrents would be installed, and the project would be required to follow Avian Power Line Interaction Committee standards. Education regarding control of food and trash sources and minimization of ‘perching’ areas is the main focus of the Raven Management Plan. All construction personnel would be required to complete a WEAP training to ensure trash and food-related items are placed in sealed containers and removed from the premises. Specific minimization actions to be implemented include onsite trash management, elimination of available water sources, designing structures to discourage potential nest sites, use of hazing to discourage raven presence, and active monitoring of the site for presence of ravens.

Exposure to Chemicals

Spills of fuels, lubricants, and other petroleum products could impact desert tortoise through poisoning causing decreased health or mortality. The spilled materials could contaminate

stormwater runoff. The SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plan would minimize the risk of stormwater contamination (Minimization Measure 25).

Herbicides may be used for the treatment of non-native plant species if necessary, which could cause decreased health or mortality to tortoises. Herbicide use would follow those approved in BLM's Programmatic EIS (PEIS) for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Managed Lands in 17 Western States (BLM 2016). The applicant would implement an Integrated Weed Management Plan that specifies procedures for managing vegetation and minimizing the spread of non-native and noxious weeds, including integrated pest management and use of herbicides. Standard Operating Procedures would be incorporated into the Weed Management Plan and implemented. The herbicides that may be used in mowed areas include aminopyralid, clopyralid, imazapyr, imazapic, glyphosate, metasulfuron methyl, and rimsulfuron. These herbicides are considered to have very low toxicity to mammals, birds, and fish when applied in accordance with all product label requirements and restrictions. There is limited literature on toxicity trials involving reptiles, but exposure to such chemicals may cause changes in behavior, eating habitat, or even mortality with repeated exposure. Herbicides that are believed to have deleterious effects on reptiles, such as 2,4-D, would not be allowed. Any herbicide would only be used during the less active tortoise season.

Desert tortoise may be indirectly impacted by palliatives (which could cause decreased health or mortality to tortoises) that may be used on traditionally constructed portions of the Project for dust suppression through exposure to or ingestion of treated materials if they were to mobilize in stormwater runoff and flow off site. The BLM has allowed the use of several dust palliatives on other projects within the Southern Nevada District. If approved, experimental palliatives used in place of water for the Project would reduce the total amount of water needed during construction. The Applicant may opt to use such palliatives, as authorized by the BLM, for the Project. The soil binder/dust palliatives that are proposed for the Project, and which BLM previously has allowed, are:

- Road Bond 1000
- For roads and heavy traffic areas: Soil Cement
- For non-traffic areas on finer soils: Formulated Soil Binder FSB 1000
- For non-traffic areas on sandier/rockier soils: Plas-Tex

No palliatives would be used off-site, on access roads, or in mowed areas.

Nonnative Plant Species

Another indirect effect from the development of the proposed project is the potential introduction and spread of nonnative, potentially invasive plant species into habitats adjacent to or within the project sites; invasive plant species reduce habitat quality for desert tortoise, in particular, foraging habitat (Tracy et al. 2004), leading to reduced tortoise health and potentially mortality. Construction and O&M activities of the proposed project components may increase distribution and abundance of nonnative species within the action area due to ground-disturbing activities that favor these species. Project equipment may transport nonnative propagules into the project area where they may become established and proliferate. In addition, the introduction of

nonnative plant species may lead to increased wildfire risk, which ultimately may result in future habitat losses (Brooks and Esque 2002) and changes in forage opportunities for desert tortoises.

Implementation of the Weed Management Plan would reduce the spread and colonization of weeds on site and off site in both disturbed areas and downwind/downstream of the Project. The goal of the Weed Management Plan would be to minimize potential effects from weeds and invasive species within the action area and adjacent lands, as well as to avoid adverse effects on desert tortoise foraging habitat on and off site. The Weed Management Plan would identify specific management and monitoring practices to avoid the introduction or spread of existing invasive species within the action area during construction and operation. Any plan that includes the use of herbicides would require review and approval by the BLM, which includes Pesticide Use Proposal (PUP) information. If approved, herbicides would be limited to within roads and other areas of disturbance within the Project site. Desert tortoises may also be directly impacted by herbicide application. The Weed Management Plan and PUP would include measures to minimize impacts of herbicide application to desert tortoises. Only certain herbicides are allowed for use in desert tortoise habitat, as described earlier in this biological opinion.

While we cannot reasonably predict the increase in nonnative species abundance that this project may cause within the action area, the degradation of habitat due to spread of nonnative plants would be minimized through the measures outlined in the Weed Management Plan. The Service has determined that successful implementation of the Weed Management Plan (proposed minimization measure 23) will sufficiently minimize potential effects of weeds in the action area.

Edge Effects

The edge effect is a term commonly used in conjunction with the boundary between natural habitats and disturbed or developed land. Typical edge effects that can degrade the surrounding habitat include increased human foot traffic, vehicle use, trash, predation, and invasive species. The Project includes placement of a permanent security fence along the solar array boundary. The fence may create roosting sites for ravens or birds of prey; however, these effects would be reduced through implementation of anti-perching devices and other control measures detailed in the approved Raven Management Plan. In the 65 percent of the Project that leaves vegetation within the solar array, there will be no definitive disturbance boundary between the habitat outside the perimeter fence and inside the project, so edge effects from solar development in these areas are minimal. Introduction of weeds from construction or soil disturbance has been addressed.

Because few data exist relative to edge effects from noise, light, vibration, and increased dust from construction and O&M activities, we cannot determine how these potential impacts may affect desert tortoise populations adjacent to the development sites. The lack of information is especially relevant when evaluating effects to individuals within the habitat linkage that would be impacted by the proposed project. Thus, the magnitude and extent of these edge effects cannot be articulated at this time but could conceivably disturb individual desert tortoises to the extent that they abandon all or a portion of their established home ranges and move elsewhere.

Effects on Population Connectivity

The Project site is located within a 44,000-acre ROW application area. Based on recent biological review and analysis with agency personnel, the following design considerations were used to reduce effects of the Project. The design considerations listed below address the effects of habitat fragmentation on desert tortoise in the area:

- Avoidance of intermittent desert washes
- Project siting within an existing BLM variance area
- PV technology options that allow for heterogeneous array layout that provides reduced impacts on biological resources
- Limiting constriction of movement by allowing desert tortoises to reoccupy 65 percent of solar areas constructed via mowing

The division of the Project into six development areas alters forage habitat and movement corridors, and the traditional development areas completely removes forage habitat and excludes movement. Implementation of the mowing regime on 65 percent of the solar facility and installation of desert tortoise permeable fencing allows desert tortoise to reoccupy the eastern half of development area A and western half of development area D, development area B1, and most of development area B (Figure 24). The greater concern for connectivity, though, is the movement of tortoises from the west side to the east side of the Project site and from the north side of the Project site to the North Muddy Mountains due to the long barrier fence along development areas B, C, and D along the traditional development areas. From the Muddy Mountains to the southern end of development area D is 2.4 miles. This area is a pinch-point of unaltered habitat for tortoise migration in the east-west directions. This area must be protected to preserve desert tortoise movement. Tortoise would have some additional space to move through the mowed areas of development area D. The distance from the southern end of the fenced area for traditional development in development area D and the Muddy Mountains is approximately 3.5 miles, as shown in Figure 24. Some reduced gene flow could occur based on tortoise movement restrictions, as could localized increases in densities and stressors.

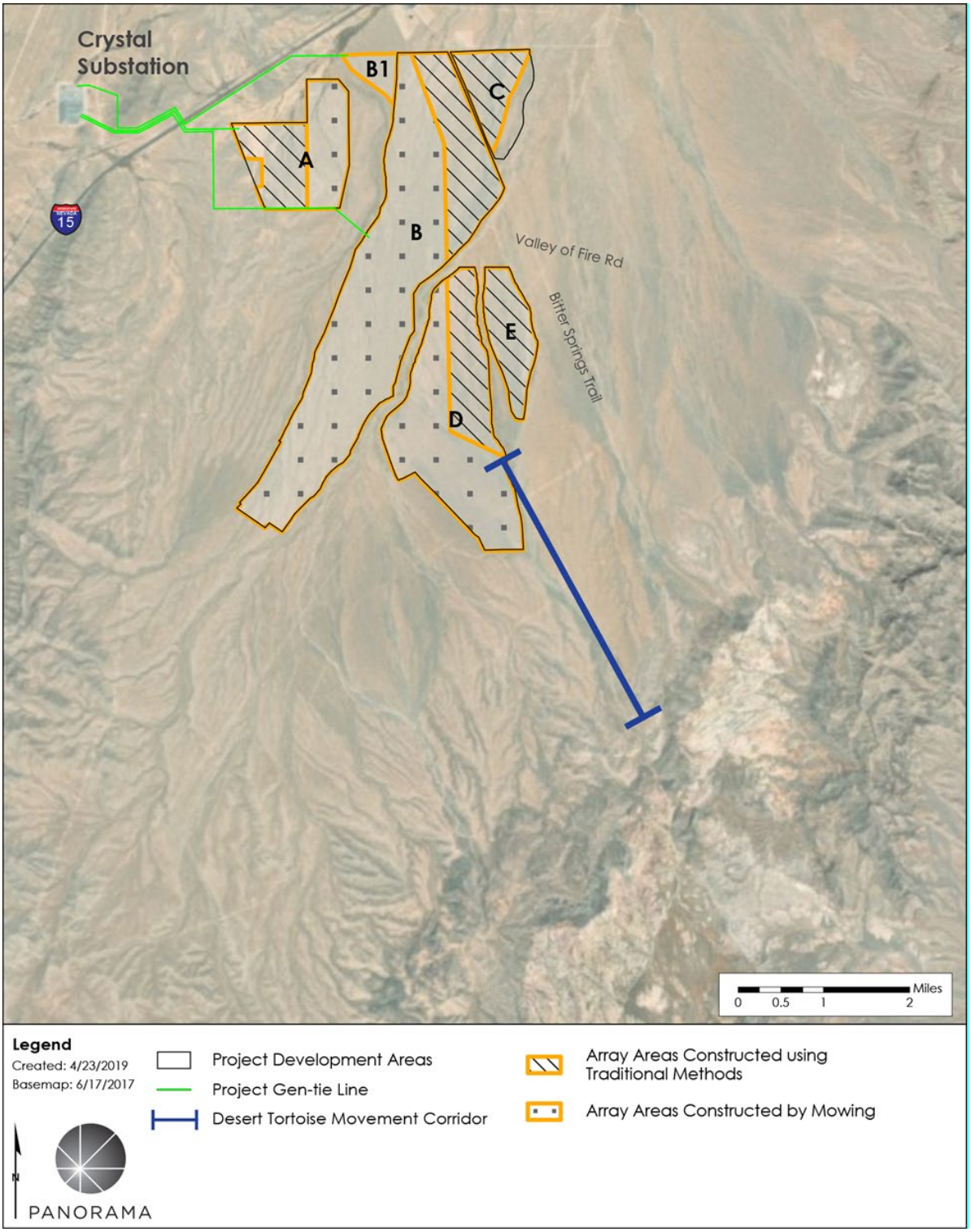

Figure 24. Desert tortoise movement corridor around project.

Landscape genetic analysis performed by Latch et al. (2011) identified both natural (slope) and anthropogenic (roads) landscape variables that significantly influenced desert tortoise gene flow

of a local population. Although they found a higher correlation of genetic distance with slope compared to roads, desert tortoise pairs from the same side of a road exhibited significantly less genetic differentiation than tortoise pairs from opposite sides of a road. Project access roads are not anticipated to decrease population connectivity substantially beyond the existing conditions.

As discussed in the revised recovery plan (Service 2011a) and elsewhere, habitat linkages are essential to maintaining rangewide genetic variation (Edwards et al. 2004b, Segelbacher et al. 2010) and the ability to shift distribution in response to environmental stochasticity such as climate change (Ricketts 2000, Fischer and Lindenmayer 2007). Natural and anthropomorphic constrictions (e.g., I-15) can limit gene flow and the ability of desert tortoises to move between larger blocks of suitable habitat and populations. In the action area, existing anthropomorphic constrictions compound effects of natural barriers on desert tortoise population connectivity.

The proposed solar facility would be constructed at the north end of Dry Lake Valley with existing natural barriers to tortoise movement resulting in a somewhat isolated population. The western boundary of Dry Lake Valley is defined by the Arrow Canyon Range and the North Muddy Mountain Range is the eastern boundary. Potential movement of desert tortoises south of the action area is restricted by I-15 and the Arrow Canyon range to the west, and the Muddy Mountain Range to the east. The area north of the action area is characterized as major east-west drainages, steep and rugged slopes, and mesas. Tortoise movement north of the action area would be hindered by steep topography. We do not anticipate that the proposed action would affect potential movement of tortoises north of the action area, within either the Mormon Mesa or Beaver Dam CHUs.

Because the Project will leave habitat within 65 percent of the solar array and allow tortoises to reoccupy the site following construction, the majority of the action area will continue to be used as part of the connectivity corridor. Due to this, we anticipate that opportunities for desert tortoise connectivity would be modified by the construction of the Project but not significantly.

Effects Associated with Climate Change

Increases in atmospheric carbon are responsible for changes in climate. As we discussed in the *Rangewide Status of the Desert Tortoise* section of this biological opinion, climate change is likely to cause frequent or prolonged droughts with an increase of the annual mean temperature in the range of the desert tortoise. Increased temperatures would likely adversely affect desert tortoises by limiting their ability to be aboveground. A decrease in rainfall would likely result in fewer annual plants that are important for the nutritional well-being of desert tortoises.

Plant communities in arid lands sequester carbon by incorporating it into their tissues. Plants also respire carbon into the substrate, where it combines with calcium to form calcium carbonate; calcium carbonate also sequesters carbon (Allen and McHughen 2011). The permanent removal of plant life from approximately 2,602 acres within the action area is likely to reduce the amount of carbon that natural processes can sequester in this localized area. Because 65 percent of the Project would be mowed and regrowth of shrubs would occur, this effect would be reduced to some degree (compared to using traditional methods on the entire project), though we do not

have the ability to quantify the difference that mowing will cause.

The Project is unlikely to affect desert tortoises in a measureable manner with regard to carbon sequestration. The amount of carbon sequestration that would be lost would be minor because the Project would affect a small portion of the entire Mojave desert. Some researchers have questioned the amount of carbon sequestration that occurs in arid areas. Schlesinger et al. (2009) contend that previous high estimates of carbon sequestration in the Mojave Desert bear re-examination. The reduction in the use of fossil fuels, due to the use of the proposed solar facility, would prevent more carbon from entering the atmosphere than would occur by the vegetation that is currently present within the areas being disturbed by construction.

The Project is also unlikely to alter the surface albedo[2] of the action area to the degree that it affects local climatic conditions. Millstein and Menon (2011) found that large-scale PV plants in the desert could lead to significant localized temperature increases (0.4 ˚C) and regional changes in wind patterns because the solar panels are less reflective than many substrates in the desert. As discussed above, increases in temperatures would likely impair the activity patterns of desert tortoises.

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

Millstein and Menon's model may be inappropriate for the scale of this biological opinion. The two modeled solar plants in Millstein and Menon's model covered 4,633,207 acres. The area covered by solar panels under consideration in the proposed action for this biological opinion would be 7,062 acres. Consequently, the modeled solar plants that generated a local temperature increase of 0.4 degree Celsius were approximately 656 times larger than the area within the proposed solar facility. Therefore, the proposed action is unlikely to change local temperatures or

[2] Albedo is the amount of light reflected by an object. An object that reflects more light is heated less. The opposite is also true; an object that reflects less light is heated more.

regional wind patterns.

Effects of Compensation and Land Conservation (Recipient Areas)

To offset the loss and modification of tortoise habitat, the Applicant will provide compensation to the BLM as described in the Proposed Minimization Measures section. All of the funds will go toward a habitat use study in order to monitor metrics of habitat change under the solar panels and how tortoises use the vegetation onsite for forage and cover.

Although the compensation and protection of vegetation would not create new habitat within the recovery unit, it will provide a funding source to study if leaving vegetation in the solar array provides the forage and cover that tortoises need long term. Costs associated with project construction monitoring and survey and removal of tortoises and their disposition (e.g., translocation, care at an onsite facility) are in addition to the remuneration fees and the responsibility of the Applicant.

Desert Tortoise Conclusions

Reproduction

Disturbance associated with solar facility construction would not have a measurable long-term effect on reproduction of individual desert tortoises that live within or adjacent to the solar facility because intense construction activity would occur over a relatively brief period of time (approximately 28 months) relative to the reproductive life of female desert tortoises. Furthermore, desert tortoises are well adapted to highly variable and harsh environments and their longevity helps compensate for their variable annual reproductive success (Service 1994).

Because the desert tortoises will be translocated from the site prior to construction and all the adult individuals found will be moved, we expect that few, if any, adult animals will die as a result of construction. Juvenile desert tortoises may be killed because they are more difficult to find; however, the reproductive ecology of the desert tortoise is such that reproductive individuals (i.e., adult animals) play a more important role in maintaining populations than those that are not able to reproduce (i.e., juvenile animals), in large part because of the higher mortality rates of eggs and juvenile desert tortoises and the long-lived relatively low mortality rates of adults. Consequently, the loss of juvenile animals and eggs should not have a measurable effect on the reproductive capacity of desert tortoises in the area.

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

Because translocated tortoises may reinhabit 65 percent the solar facility or be placed back into the solar site after construction, we anticipate that the proposed solar facility is not likely to have a measurable effect on reproduction of the desert tortoise in the action area. These tortoises may not undergo the effects of translocation on reproduction because they will remain within their same immediate home range. Because the effect on reproduction would be minimal, the proposed action would not affect reproduction in the remainder of the recovery unit or throughout the range of the species.

We cannot provide an estimate on the number of eggs that would be lost as a result of surface disturbance. In areas where eggs would be lost, we anticipate that the loss of eggs would not be significant at a population level because areas where eggs would be lost comprises a small proportion of the reproductive capacity of the action area. In addition, most of the eggs that may be lost are unlikely to produce individuals that would reach reproductive age due to high rates of natural mortality.

For these reasons, we expect that the proposed action is likely to have a minimal negative effect on the reproductive capacity of desert tortoises in the action area.

Numbers

We expect that the construction of the Project (solar facility and gen-tie lines) is likely to injure or kill few adult desert tortoises. Many more tortoises are likely to be captured and moved prior to project activities. Based on tortoise surveys and a 25 percent buffer, we estimate that 274 adult tortoises and 1,802 juvenile tortoises may experience some type of take. Although we expect most to be captured and moved, some may be injured or killed.

The proposed minimization measures, including the installation of exclusion fencing around the perimeter of the project and surveys by qualified biologists, will detect and remove tortoises from areas within the perimeter fence during construction. The perimeter fence will reduce the likelihood of injury or mortality to tortoises that may try to enter project areas from adjacent habitat. With the exception of vehicular travel on access roads, project activities would be conducted inside the exclusion fence. Based on the results of studies of translocated tortoises conducted at Fort Irwin and the Ivanpah Solar Electric Generating System, we expect that the majority of these animals will survive the translocation and potentially reinhabit 65 percent of the project site after construction. We expect that the greatest risk to adult desert tortoises would occur during construction when numerous workers and heavy equipment will be present.

Desert tortoises may also be killed or injured during O&M, since 65 percent of the site will be open for tortoises to reoccupy after construction. We assume that most of the mortalities during O&M will be juvenile tortoise that are difficult to see. Adult tortoises should be visible to workers during O&M and will be avoided or moved as needed.

The 2014 abundance estimate for the Northeastern Mojave Recovery Unit is 46,701 adult desert tortoises (Allison and McLuckie 2018). The overall number of desert tortoises would greatly increase if we included juveniles smaller than 180 mm. Consequently, even the loss of all 274

adult desert tortoises estimated to be translocated or moved from the project would comprise a very small portion (approximately 0.59 percent) of the overall population within the Northeastern Mojave Recovery Unit and an even smaller portion (0.13 percent) of desert tortoises rangewide (212,343 tortoises).

We expect that many of the juvenile desert tortoises and eggs within the boundaries of the solar facilities are likely to be killed or injured during construction because of their small size and cryptic nature. We also expect that the applicants would likely find some juvenile animals and translocate or move them out of harm's way.

Although we are not comparing the overall estimate of the numbers of juvenile desert tortoises likely to be killed or injured to the overall numbers within the recovery unit, we can reasonably conclude that the number of juvenile desert tortoises affected by the proposed projects is a small percentage of the population in the Northeastern Mojave Recovery Unit. Since juvenile tortoises have naturally higher mortality rates than adult tortoises, the loss of these juveniles is not likely to appreciably diminish the overall tortoise population. The key to recovery is to ensure that reproducing adult tortoises have high survival rates and are reproducing.

For these reasons, we expect that the proposed action is likely to have a minimal negative effect on the numbers of desert tortoises in the action area.

Distribution

The permanent loss of 2,602 acres of desert tortoise habitat that would result from construction of the Project would not appreciably reduce the distribution of the desert tortoise. Based on the Nussear et al. (2009) model and our calculations (Darst 2014), 2,626,111 acres of desert tortoise habitat remain in the Northeastern Mojave Recovery Unit. Consequently, the proposed action would result in the loss of approximately 0.1 percent of the total amount of desert tortoise habitat in the Northeastern Mojave Recovery Unit and only 0.02 percent loss of habitat rangewide.

Because the Project will be leaving vegetation within 65 percent of the solar array and allowing tortoises to reinhabit these areas after construction, the connectivity of the Dry Lake Valley and Coyote Springs Valley will continue to function, albeit slightly reduced due to the permanent fencing of 2,602 acres. The existing connectivity in the action area is discussed in the *Factors Affecting the Desert Tortoise in the Action Area* section.

For these reasons, we expect that the proposed action is likely to have a minimal negative effect on the distribution of desert tortoises in the action area.

Effects on Recovery

To achieve recovery, each recovery unit must contain well distributed, self-sustaining populations across a sufficient amount of protected habitat to maintain long-term population viability and persistence (Service 2011a).

We do not have the ability to place a numerical value on edge effects, habitat degradation, impacts to habitat connectivity, and overall fragmentation that the proposed action may cause. As a result, the percentage of habitat within the recovery unit that would be affected may be greater than the area physically disturbed; however, we still expect the direct and indirect disturbance would not constitute a numerically significant portion of the affected recovery unit. Therefore, we anticipate adequate intact habitat will remain in which desert tortoises will be able to forage, breed, and shelter.

The construction, O&M, and decommissioning of the Project is unlikely to negatively affect the ability of the desert tortoise to reach stable or increasing population trends in the future, since the proposed action will only have an overall minimal negative effect on reproduction, numbers, and distribution of desert tortoises in the action area. The Project will allow vegetation to remain on 65 percent of the site, and tortoises will be allowed back into the solar array to utilize these areas. The site does not contain desert tortoise designated critical habitat and is not located in an area that is considered imperative for the recovery of the desert tortoise (e.g., critical habitat, ACEC, or linkage for the desert tortoise).

CUMULATIVE EFFECTS

Cumulative effects are those effects of future State, private, or Tribal activities, not involving Federal activities that are reasonably certain to occur within the action area of the particular Federal action subject to consultation pursuant to section 7 of the Act. Cumulative effects do not include future Federal activities that are physically located within the action area of the particular Federal action under consultation. Past and present impacts of non-federal actions are considered part of environmental baseline conditions. Most of the action area is federally owned, and any future projects on these lands would be subject to separate section 7 consultation. Projects that may result in adverse effects to the desert tortoise on private and non-Federal land are anticipated to fall under purview of existing HCPs and associated incidental take permits.

Increased development would cause continued habitat loss, degradation, and fragmentation for the local desert tortoise population, as well as increased harm of individual desert tortoises, contributing to the cumulative degradation of the area. Planned future actions such as future transmission line and road corridors, electrical power substations, and industrial solar power plants would likely continue this trend. Most other future actions in the action area would likely require section 7 consultation.

The Arrow Canyon Solar Project (200 MW PV project) and the Southern Bighorn Solar and Storage Center (300 MW and 135 MW storage system) have recently been proposed and would be located on the Moapa River Indian Reservation. Since the action areas are managed by the BIA and BLM, section 7 consultation would be required.

CONCLUSION

Jeopardy Conclusion

When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

After reviewing the rangewide status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. The Service has reached this conclusion based on the following:

1. Project impacts to desert tortoise will be minimized or avoided through implementation of measures described in the proposed action. The BLM, the applicant, and their contractors will implement numerous measures (e.g., clearance surveys, authorized desert tortoise biologists, desert tortoise monitors) to ensure that most tortoises are located and moved out of harm's way and potential desert tortoise injury and mortality is minimized on project work sites.
2. Most adult desert tortoises on the project site will be found and translocated; most or all of these tortoises will survive the translocation.
3. Mitigation and remuneration fees, based on acres disturbed, will fund an important habitat use study for this newly innovative solar design.
4. Genetic and demographic connectivity will be slightly reduced and continue to function.
5. Long-term monitoring will likely identify significant adverse population effects, if they occur, which can be addressed through adaptive management.
6. The project would not significantly affect the rangewide number, distribution, population connectivity, or reproduction of the desert tortoise. Desert tortoises that are moved out of harm's way and placed within their home range will remain in the wild with no long-term adverse effects to survival and reproduction.
7. The number of desert tortoises anticipated to be killed or injured is low relative to the estimated number of tortoises occurring within the action area and impacted recovery unit. Even if all 274 estimated adult tortoises were lost due to Project activities, the loss would account for 0.59 percent of all adult tortoises within the Northeastern Recovery Unit and an even lower percent (0.13) of all adult tortoises rangewide. Biologists should find most adult desert tortoises during clearance surveys, so killing all 274 adult tortoises is unlikely.
8. The amount of desert tortoise habitat proposed to be permanently disturbed is small relative to the amount available within the Northeastern Mojave recovery unit. The proposed action would result in a loss of approximately 0.1 percent of the habitat in Northeastern Mojave recovery unit, and only 0.02 percent loss of habitat rangewide (2,602 acres of 16,745,848 total acres).
9. There will be no impacts to desert tortoise designated critical habitat.

10. The magnitude of the effects to desert tortoise is not capable of delaying or precluding recovery of this species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(0)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

In June 2015, the Service finalized new regulations implementing the incidental take provisions of section 7(a)(2) of the Act. The new regulations also clarify the standard regarding when the Service formulates an incidental take statement [50 CFR 402.14(g)(7)], from "…if such take may occur" to "…if such take is reasonably certain to occur." This is not a new standard, but merely a clarification and codification of the applicable standard that the Service has been using and is consistent with case law. The standard does not require a guarantee that take will result; only that the Service establishes a rational basis for a finding of take. The Service continues to rely on the best available scientific and commercial data, as well as professional judgment, in reaching these determinations and resolving uncertainties or information gaps.

The measures proposed by BLM as part of this incidental take statement are nondiscretionary and must be implemented by BLM, or other jurisdictional Federal agencies as appropriate, so that they become binding conditions of any project, contract, grant, or permit issued by BLM, or other jurisdictional Federal agencies as appropriate, in order for the exemption in section 7(o)(2) to apply. The Service's evaluation of the effects of the proposed actions includes consideration of the measures developed by BLM, to minimize the adverse effects of the proposed action on the desert tortoise. Any subsequent changes in the minimization measures proposed by BLM, or other jurisdictional Federal agencies as appropriate, may constitute a modification of the proposed action and may warrant reinitiation of formal consultation, as specified at 50 CFR § 402.16.

The BLM, or other jurisdictional Federal agency, has a continuing duty to regulate the activity that is covered by this incidental take statement as long as the affected area is retained in Federal ownership or control. If BLM, or other jurisdictional Federal agency, (1) fails to require the project proponent to adhere to the action-specific terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document or (2) fails to retain oversight to ensure compliance with action-specific terms and conditions, the protective coverage of section 7(o)(2) may lapse.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The proposed action will result in take (primarily by capture) of desert tortoises that occur within the fenced perimeter of the proposed solar facility and in harm's way within the development areas of the gen-tie lines and access road; and areas where tortoise exclusion fencing would be installed. Table 15 identifies the incidental take threshold for all age classes of desert tortoises during construction activities. Additional desert tortoises in the action area, including buffer areas, may be affected by the project to the extent that incidental take may occur; however, such effects are anticipated to be minor and involve mostly alteration in feeding, sheltering, and reproduction behavior due to reduction or fragmentation of their home ranges.

We acknowledge that we cannot precisely quantify the amount of take that will occur during all project activities. Some of the constraints that make it difficult to determine desert tortoise densities and abundance include the cryptic nature of the species (i.e., individuals spend much of their lives underground or concealed under shrubs), inactivity in years of low rainfall, and low abundance across a broad distribution within several different habitat types. In addition, population numbers and distribution of individuals fluctuate in response to weather patterns and other biotic and abiotic factors over time. The number of juvenile desert tortoises is even more difficult to quantify because of their small size, location underground, and low detection probabilities during surveys. The following paragraphs define the form of take and the number of individuals we anticipate will be taken by project activities.

Areas Associated with Construction, O&M, and Decommissioning Activities

All desert tortoises and most nests with eggs within the proposed fence perimeter for the solar facility will be taken as a result of the project. Some nests with eggs may survive within the 65 percent of the Project that is mowed. The actual number of individuals that will be missed during clearance surveys and killed during construction is unknown. We expect most tortoises missed would be hatchlings and juveniles. Locating the carcasses of small tortoises or egg fragments is unlikely. To address this issue, we used the total threshold for capture of subadult and adult individuals (up to 274 tortoises) on the proposed project sites as a surrogate measure of mortality of the smaller size classes. Using this threshold as a surrogate assumes that our method used to calculate the estimated abundance of subadult and adult desert tortoises also allows us to calculate the number of juveniles that may be affected. Detecting more than 274 subadult and adult desert tortoises on the Project site, however, would indicate that a larger number of juveniles may be killed or destroyed during construction and would require reinitiation.

Based on the measures proposed by BLM, desert tortoise survey data, and the proposed action, we anticipate that up to 270 adult and sub-adult tortoises (274 minus 4 estimated along gen-tie lines) will be captured within the fenced perimeter for the solar facility and translocated; and up to 3 adult or sub-adult desert tortoises may be killed or injured.

We do not know exactly how many desert tortoises will be encountered in harm's way outside the fenced solar site; however, take in the form of capture and moving of desert tortoises

resulting from these incidental detections is estimated and exempted to ensure mortality and injury of desert tortoises is minimized. Based on the survey data, we estimated that 4 adult or sub-adult tortoises may be within the project area of the gen-tie lines. Because additional tortoises may wander into the linear project site, we estimate that 30 desert tortoises may occur in harm's way outside the fenced solar facility during construction and will be captured and moved. We estimate that no more than one subadult or adult desert tortoise may be injured or killed during construction outside of the fenced solar site.

For all construction activities (both inside and outside of fenced areas), we estimate that up to 180 juvenile tortoises (that will be detected) may be captured and translocated or moved and 1,622 juveniles may be incidentally killed or injured (although only up to 162 of those may actually be detected) during construction. We do not believe that any adults or subadults will be killed due to construction and not detected because of their size. An unknown number of tortoise eggs will be destroyed as a result of the project.

Any take in either form in addition to what is described above would require reinitiation.

O&M activities may result in incidental take, in the form of mortality or injury, of no more than three subadult or adult desert tortoise per year or a total of 12 for the life of the project within the solar array open to desert tortoise and no more than one subadult or adult desert tortoise per year or a total of 7 for the life of the project outside of the fenced areas. O&M activities may also result in mortality or injury of 7 juvenile desert tortoises in a single year, not to exceed 180 for the life of the project (includes both within and outside of fenced areas). It is difficult to know how many tortoises may be within the solar site when decommissioning activities occur over 30 years in the future. Because we cannot estimate, we have combined take for O&M and decommissioning activities. It is also not possible to estimate the number of juveniles that may be injured or killed during O&M and decommissioning activities that will not be detected.

Estimating the number of adult and juvenile tortoises captured and moved during O&M and decommissioning is also difficult. The majority of the tortoises that will get captured and moved during O&M and decommissioning will be within 65 percent of the solar site that is open for desert tortoises to inhabit. If we use the average tortoise density from the surveyed project areas (7.1 tortoises per km^2), and apply it to the 4,460 acres of the mowed areas, we estimate the number of adult tortoises within the mowed areas to be 128 (assuming densities remain the same as before construction). The estimated number of juveniles would be 842. Capturing and moving adults and juveniles could occur often during O&M due to daily driving within the site and performing needed maintenance. We estimate that 10 percent of the estimated adults and juveniles could get moved on an annual basis (13 adults and 84 juveniles). The total take for capturing and moving for adults and juveniles over the 30-year project life would be 390 adults and 2,520 juveniles. All incidental take is outlined in Table 15.

Table 15. Desert tortoise incidental take thresholds.

Type of take	Construction (detected)	Construction (not detected)	O&M and decommissioning activities	Total Incidental Take
Death or injury-subadults & adults (≥180 mm) inside solar fields	3	0	12[1]	15
Death or injury-subadults & adults (≥180 mm) outside solar fields	1	0	7[2]	8
Death or injury-hatchlings & juveniles (<180 mm) inside and outside solar fields	162	1,460[3]	180[4]	1,802
Capture-subadults & adults (≥180 mm)	We estimate that 270 adults & subadults may be moved within the solar fields and 30 may be moved outside the solar fields and 104 resident tortoises in control and translocation areas	N/A[5]	390[6]	794
Capture-hatchling & juveniles (<180 mm)	We estimate that 180 juveniles may be moved during all construction activities	N/A[5]	2,520[7]	2,700

[1] Not to exceed 3 per calendar year or 12 during the life of the project within fenced areas open to desert tortoise.
[2] Not to exceed one per calendar year or 7 during the life of the project.
[3] Not detected due to their small size and location underground.
[4] Not to exceed 7 per calendar year or 180 during the life of the project.

[5] Not applicable - It is not possible to not detect a tortoise that has been captured and moved.
[6] Not to exceed 13 per calendar year or 390 during the life of the project (30 years).
[7] Not to exceed 84 per calendar year or 2,520 during the life of the project (30 years).

The temporary and permanent disturbance of up to 7,113 acres of habitat from construction of the proposed solar project, gen-tie line, and access roads may result in harm to desert tortoises that use this area as part of their home range. If the proposed project-related activities result in impacts to desert tortoise habitat beyond this acreage, the amount or extent of take will be exceeded.

Our estimate of the numbers of desert tortoises that are likely to occur within the action area is derived from the pre-project survey data, estimates based on recent tortoise density, and other solar project clearance data. We acknowledge that more individuals may be killed or injured during construction and O&M activities than is in the incidental take statement because they will not be detected. The inability to detect all tortoises is largely due to the cryptic nature of desert tortoises, their fossorial habits, and their limited abundance; and in the case of juveniles and eggs, their small size and location underground that reduce detection probabilities of these life stages. Another confounding factor is that scavengers may locate, consume, or remove carcasses before biologists or monitors can locate them. If detected injury and mortality numbers exceed those in the incidental take statement, we will assume that the take for non-detected injury and mortality has also been exceeded. Reinitiation will then occur for both detected and non-detected injury and mortality take.

The number of desert tortoise eggs taken as a result of the proposed action is unknown, but we exempt the incidental take of all eggs. In the effects analysis, we explained that we cannot estimate the number of eggs that may be present if surface disturbance occurs during the tortoise nesting season (approximately May through September). So while we cannot estimate the number of eggs, should more than 300 adult and sub-adult tortoises be moved, reinitiation would occur. Reinitiation could indicate that more eggs may be destroyed during construction due to higher numbers of tortoises in the action area.

Should the extent of incidental take exceed the level identified, reinitiation of consultation would be required (see Reinitiation Requirement).

Areas Associated with Translocation

Take in the form of capture would occur affecting up to 300 desert tortoises in harm's way (270 within fenced areas and 30 along the gen-tie line) and 104 resident desert tortoises in support of translocation activities at recipient and control areas (52 in each area). We anticipate that health assessments, including collection of biological samples, and attaching transmitters would be performed on all individuals moved from the solar fields. Although the release of up to 270 translocated adult and subadult tortoises may disrupt normal behaviors of resident tortoises in the recipient areas, we do not believe this level of disruption will result in incidental take . We do not anticipate that the collection of blood samples of those animals that will be translocated out of the Project will result in the death or injury of any individuals because Service-approved authorized desert tortoise biologists will perform health assessments in accordance with the most recent Service guidance (Service 2019b).

The post-translocation monitoring program will include attaching transmitters and conducting periodic health assessments. Although transmittered desert tortoises may be captured multiple times over the course of the post-translocation monitoring period, we do not anticipate that any tortoises will be directly killed or injured due to post-translocation monitoring activities.

An unknown number of translocated desert tortoises may be preyed upon by predators. If monitoring determines that predation of translocated tortoises exceeds 10 percent of the tortoises translocated, the BLM, Service, and applicants will meet and consider additional measures to minimize this effect.

EFFECT OF TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take associated with this project alone is not likely to jeopardize the continued existence or adversely affect the recovery of Mojave desert tortoise. This determination is based in part on the implementation of minimization measures detailed in this biological opinion and BA provided by BLM with their request for consultation and subsequent discussions during the consultation period.

REASONABLE AND PRUDENT MEASURES WITH TERMS AND CONDITIONS

The BLM and applicant will implement numerous minimization measures included as part of the proposed action to minimize the incidental take of Mojave desert tortoise. Our evaluation of the proposed action is based on the assumption that the actions as set forth in the "Proposed Minimization Measures" section of this biological opinion will be implemented. The Service believes these measures are adequate and appropriate to minimize the incidental take of desert tortoise. Therefore, we are not including any reasonable and prudent measures with terms and conditions in this incidental take statement.

Any proposed changes to the minimization measures or in the conditions under which project activities were evaluated may constitute a modification of the proposed action. If this modification causes an effect to Mojave desert tortoise not considered in this biological opinion, reinitiation of formal consultation pursuant to the implementing regulations of section 7(a)(2) of the Act (50 CFR § 402.16) may be warranted.

To be exempt from the prohibitions of section 9 of the Act, the BLM and applicant, including all agents, consultants, and contractors, must comply with the proposed measures in the Description of the Proposed Action incorporated into this incidental take statement by reference. Collectively, these measures are intended to minimize the impact of incidental take of Mojave desert tortoise. These measures are non-discretionary.

REPORTING REQUIREMENTS

The BLM must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement. The BLM will ensure that a report documenting desert tortoise encounters, incidental take (including capture and moving), and effectiveness and compliance with the desert tortoise protection measures is prepared and submitted to the Service's Southern Nevada Fish and Wildlife Office in Las Vegas.

Reports are required quarterly during the duration of construction and annually during O&M for the life of the facilities. The BLM may delegate this responsibility to the applicants. In addition, a final construction report will be submitted to the Service within 60 days of completion of construction of the project. All quarterly reports are due by the 10th of each of the following months (January, April, July, October), and annual reports are due February 1 of each year. The Service anticipates the first annual report by February 1, 2021, if construction or project activities occur in 2020. Annual status updates shall be provided to the Service during O&M activities for the life of the facility.

Specifically, all reports must include information on any instances when desert tortoises were killed, injured, or handled; the circumstances of such incidents; and any actions undertaken to prevent similar incidents from reoccurring. Additionally, the reports should provide detailed information regarding each desert tortoise handled or observed and the names of all monitors involved in the project and the authorized desert tortoise who supervised their actions. Information will include the following: location (GPS), date and time of observation, whether desert tortoise was handled, general health, and whether it voided its bladder, location desert tortoise was moved from and location moved to, unique physical characteristics of each tortoise, and effectiveness and compliance with the desert tortoise protection measures. Any incident occurring during project activities that was considered by the FCR, authorized desert tortoise biologist, or biological monitor to be in non-compliance with this biological opinion will be documented immediately by the authorized desert tortoise biologist.

Additional reporting requirements for translocation and monitoring are within the Translocation Plan and Long Term Monitoring Plan.

DISPOSITION OR CARE FOR DEAD OR INJURED DESERT TORTOISES

To ensure that the protective measures are effective and are being properly implemented, BLM shall contact the Service immediately if a desert tortoise is killed or injured as a result of any activity covered under this biological opinion. Upon locating a dead or injured desert tortoise within the action area, notification must be made by phone to the Southern Nevada Fish and Wildlife Office at (702) 515-5230. At that time, the Service and BLM shall review the circumstances surrounding the incident to determine whether additional protective measures are required. Care should be taken in handling sick or injured animals to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death.

In conjunction with the care of sick or injured desert tortoises or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by the Service to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Injured desert tortoises shall be delivered to any qualified veterinarian for appropriate treatment or disposal. Dead desert tortoises suitable for preparation as museum specimens shall be frozen immediately and provided to an institution holding appropriate Federal and State permits per their instructions. Should no institutions want the desert tortoise specimens, or if it is determined that they are too damaged (crushed, spoiled, etc.) for preparation as a museum specimen, then they may be buried away from the project area or cremated, upon authorization by the Service. BLM or the Applicant shall bear the cost of any required treatment of injured desert tortoises, euthanasia of sick desert tortoises, or cremation of dead desert tortoises. Should sick or injured desert tortoises be treated by a veterinarian and survive, they may be transferred as directed by the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations. The Service hereby makes the following conservation recommendations:

1. We recommend the BLM work with solar energy project applicants to design and construct solar projects in desert tortoise habitat to allow all vegetation to remain underneath the solar panels and allow tortoise to repatriate these areas following construction.
2. We recommend that the BLM salvage plants on the solar project site for use in habitat enhancement or restoration. If the BLM chooses to salvage plants from the 2,602 acres of permanent disturbance on the project site, these plants may be held in a nursery or other temporary holding location until needed; no monitoring or other requirements would be required for these plants.
3. We recommend the removal of all carcasses (any species) found within the project site to prevent attraction to the site by predators by eliminating such subsidies.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in your request received June 17, 2019. As required by 50 CFR § 402.16, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or

control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions about this biological opinion, please contact Carla Wise in the Southern Nevada Fish and Wildlife Office at 702-515-5102, or by e-mail at Carla_Wise @fws.gov. Please reference File Nos. 08ENVS00-2019-F-0125 and 08ENVS00-2019-I-0126 in future correspondence concerning this consultation.

Appendix

cc: Supervisory Biologist - Habitat, Nevada Department of Wildlife, Las Vegas, Nevada

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Appendix. Translocation Plan

GEMINI SOLAR PROJECT
DESERT TORTOISE TRANSLOCATION PLAN

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September 2019

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AB	Authorized Biologist
BA	Biological Assessment
BLM	Bureau of Land Management
BO	Biological Opinion
°C	degrees Centigrade
cm	centimeter
DEIS	Draft Environmental Impact Statement
DTRO	U.S. Fish and Wildlife Service Desert Tortoise Recovery Office
ELISA	Enzyme-linked Immunosorbent Assay
°F	degrees Fahrenheit
ft	foot
g	gram
gen-tie	generation-tie
GPS	Global Positioning System
GPX	GPS data saved in the GPS Exchange format
I-15	Interstate 15
in	inches
ISEGS	Ivanpah Solar Generation System
km	kilometer
km^2	square kilometer
LTMP	long-term monitoring plan
LVFO	BLM Las Vegas Field Office
m	meter
mi	mile
mm	millimeter
MCL	median carapace length
MW	megawatt
NAD	North American Datum
NDOW	Nevada Department of Wildlife
OHV	Off-Highway-Vehicle

qPCR	quantitative Polymerase Chain Reaction
Project	Gemini Solar Project
PV	photovoltaic
ROW	Right-of-Way
Service	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator

GEMINI SOLAR PROJECT
DESERT TORTOISE TRANSLOCATION PLAN

1.0 INTRODUCTION

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct, operate, maintain, and decommission the Gemini Solar Project (Project), a solar photovoltaic (PV) power-generating facility producing 690 megawatt (MW) alternating current of renewable electrical energy. Project details can be found in the Project revised Plan of Development (POD; Solar Partners XI, LLC, 2018), Biological Assessment (BA; Bureau of Land Management [BLM] 2019a) and Draft Environmental Impact Statement (DEIS; BLM 2019b).

This translocation plan addresses clearance and translocation of tortoises from harm's way on the Project site. The translocation methods presented herein are consistent with recommendations in the Service's most recent translocation guidance (2018), direct guidance from the Service's Desert Tortoise Recovery Office (DTRO), and BLM recommendations, and reflect the author's extensive experience with desert tortoise clearance and translocation from many projects. The translocation also will incorporate formal Terms and Conditions from the Project Biological Opinion (BO), once written. A Long Term Monitoring Program (LTMP) to examine and evaluate the short- and long-term effects of translocation is currently under development, in collaboration with the BLM, U.S. Fish and Wildlife Service (Service), and Nevada Department of Wildlife (NDOW). It will be submitted under different cover at a later date, but prior to the issuance of the BO.

1.0 PROJECT AREA, RECIPIENT AREAS, AND CONTROL SITE DESCRIPTION

Project Area

The Project site is entirely on BLM-administered lands in Clark County, Nevada (Figure 1). It comprises multiple, separated solar fields, hereafter called "solar development areas." Climate, topography, soils, and vegetation have been previously described (Phoenix 2018a, b). In brief, the Project lies at 615 to 750 meters (approximately 2025 to 2450 feet) along the lower bajada of a narrow basin surrounded on three sides by mountains: the Dry Lake Range to the west and the Muddy Mountains to the south and east. Topography, hydrology, vegetation (species, size, density), soils and substrates are similar throughout, with minor variations. The topography is mostly flat to gently undulating with a braided wash system of multiple intermittent washes connecting into California Wash, a broad (200 m wide), dry wash system between solar development areas B and D (Figure 2). Vegetation is generally dominated by a 12-18% cover of predominantly creosote-white bursage (*Larrea tridentata-Ambrosia dumosa*) scrub with pockets of big galleta grass (*Hilaria rigida*) along the washes and low-lying areas. Many larger washes are lined with mature stands of cat's claw (*Senegalia greggii)*. A low lying saline area with associated halophytes (*Atriplex hymenelytra, Sueda nigra*) and galleta grass-lined washes lies along the western Project edge. Most washes are gravelly, coarse-sandy and shallow; the more incised washes (generally <1 m deep) have exposed "caliche" on the wash banks and often the wash floors. Outside the washes, soils are soft loamy sands and sandy loams, with the fine-sandier soils immediately east of the Project footprint, including some stabilized aeolian areas. Cryptobiotic crusts are abundant in many locations. Substrates range from scattered fine gravel up to 90% mixed gravels.

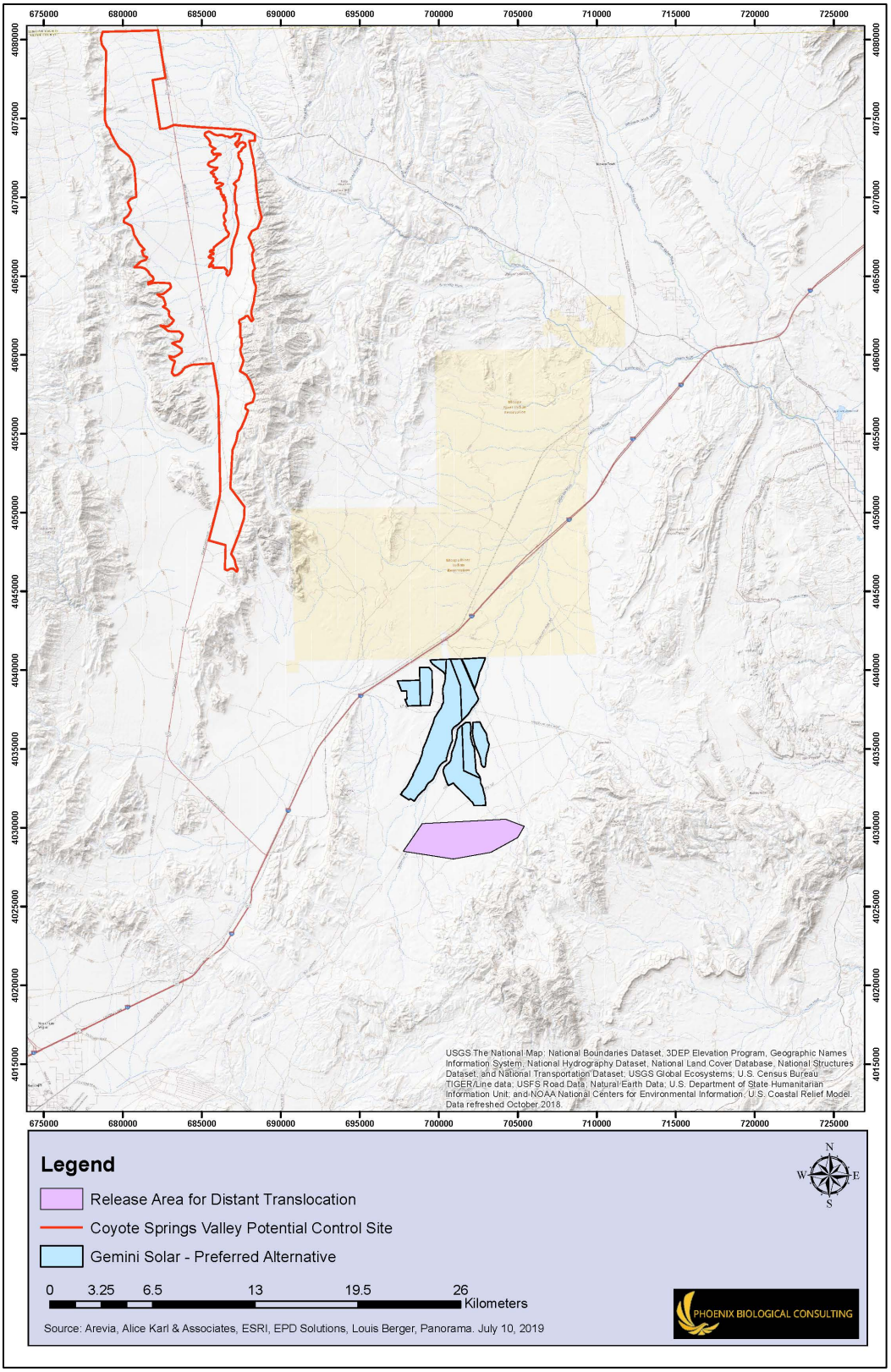

FIGURE 1. Gemini Solar Project, distant release area, and control site.

A few two-track, unimproved dirt roads traverse the Project and surrounding area, among which are the Old Spanish Trail Road and the Bitter Springs Back Country Off-Highway-Vehicle (OHV) trail. OHV use is limited to existing roads, trails, and dry washes (Southern Nevada Agency Partnership 2010). Valley of Fire Highway, a two-lane paved road from Interstate-15 (I-15) to Valley of Fire State Park and Lake Mead, runs through the northern portion of the site. The Moapa Paiute Travel Plaza at I-15 lies 0.25 km (0.16 mi) from the northwestern edge of the Project boundary. I-15 is less than 0.5 km (0.3 mi) northwest of the Project site at its closest point. The Moapa River Indian Reservation borders the site to the north.

BLM Preferred Alternative

The BLM Preferred Alternative (called the Hybrid Alternative in the DEIS) for the Project is the Project area discussed in this translocation plan (Figure 2). . This alternative totals 2848 hectares (7038 acres) and comprises a 65:35 mixture of mowed areas and traditionally developed areas, respectively (BLM 2019b). Mowed areas are those where the vegetation and soils/substrates will be maintained, albeit somewhat altered, during Project construction and operation by using methods such as mowing shrubs to 18 to 24 inches in height and using low-impact vehicles to minimize vegetation crushing. Narrow (4.6-meter-wide [15-foot-wide]), bladed roads to transport supplies and equipment and support maintenance will be constructed in a grid every 0.4 km (0.25 mi) between blocks of solar panels. A 9-meter-wide (15-foot-wide) utility corridor will lie adjacent to every fourth road (i.e., every 1.6 km [1.0 mi]) for underground utilities. By contrast, in traditionally developed areas, all vegetation will be removed and all surfaces will be bladed and compacted, with applications of dust suppressants.

Each solar development area or combination (e.g., B1 and B combination) ultimately will be fenced with a perimeter security fence. Prior to clearing tortoises from each solar development area in advance of construction, tortoise exclusion fencing will be constructed along the boundaries of the areas that will be mowed and along the boundaries of those areas to be traditionally developed (see Section 5.0, below). Following all construction of the solar arrays and associated elements in the mowed areas, the tortoise exclusion fencing will be removed to passively permit tortoises to re-enter mowed portions of the site under the security fence. All traditionally developed areas will be permanently fenced to exclude tortoises.

Release Areas and Recipient Areas

The BLM determined that tortoises within 500 m of the development area borders inside mowed areas of the Project site generally will be moved a short distance to a location outside the border, within approximately 500 m of their capture site (BLM 2019c). By contrast, tortoises in traditionally developed areas and those further than 500 m inside the site in mowed areas will be translocated distantly to a release area south and southeast of solar development areas D and E (Figure 3; BLM 2019c and M. Slaughter, Natural Resource Supervisor, BLM Las Vegas Field Office [LVFO], pers. comm. to A. Karl 28 February 2019). For purposes of this translocation plan, these two release areas will be called the "short-distance release area" and "distant release area", respectively.

The recipient areas are the larger areas into which tortoises will disperse from the release sites. Per the Service's translocation guidance, "Data from recent translocations indicate that desert tortoises moved up to 500 m from their capture location are expected to settle within 1.5 km of their release point; most tortoises (>97.5%) moved >500 m are expected to settle within 6.5 km of their release point." (Service 2018:7). Accordingly, the short-distance recipient area immediately outside the Project includes the release band (500 m wide) plus all suitable tortoise habitat within 1.5 km (Figure 3). The distant recipient area includes the distant release area, plus all suitable tortoise habitat within 6.5 km.

Habitat and anthropogenic uses for the short-distance recipient area are those described above for the Project area. The vegetation, soils, substrates, hydrology, topography and recreational activity in the distant recipient area are similar to the Project site, but with the terrain becoming gently undulating near

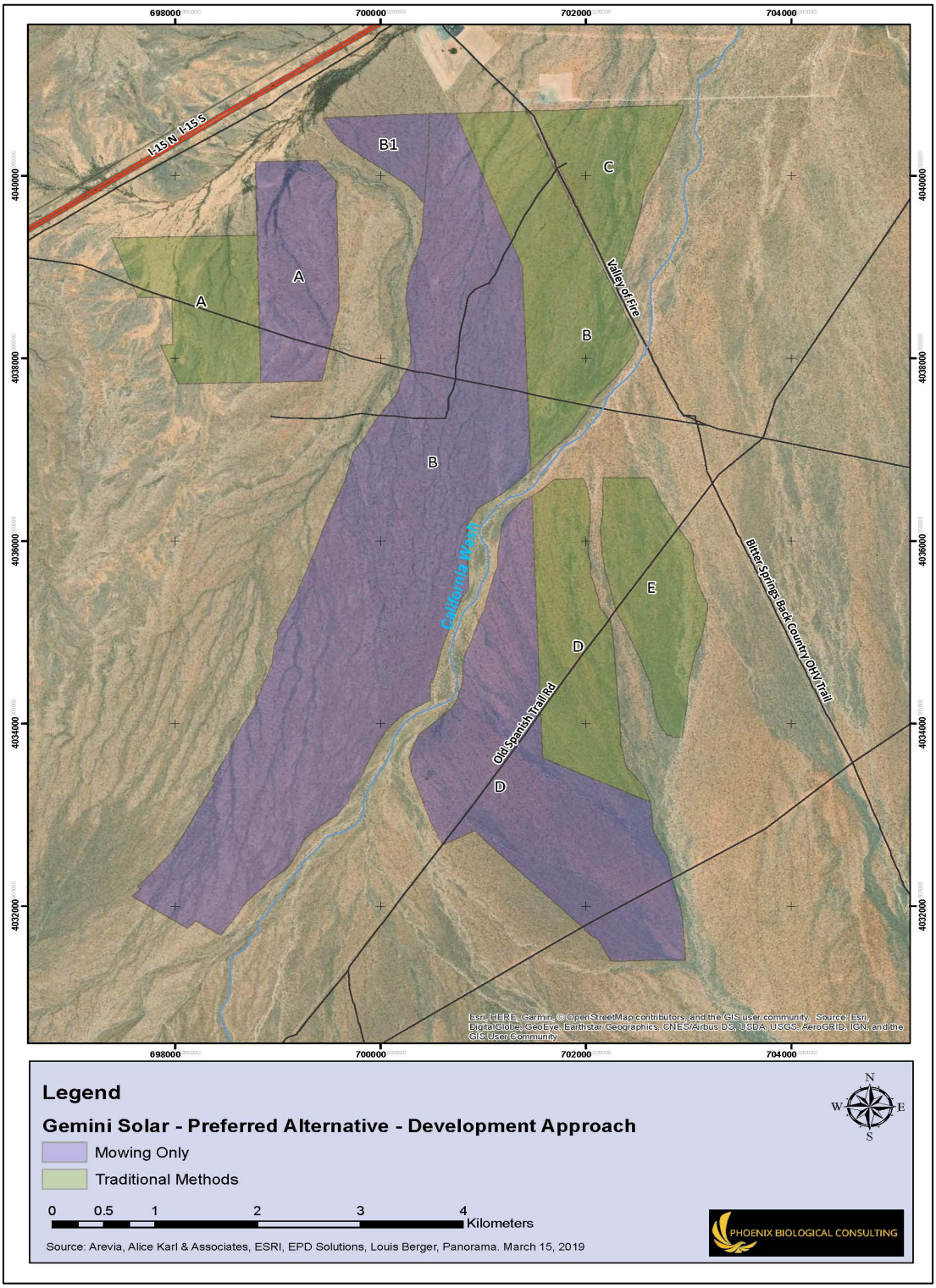

FIGURE 2. BLM Preferred, Hybrid Development Alternative.

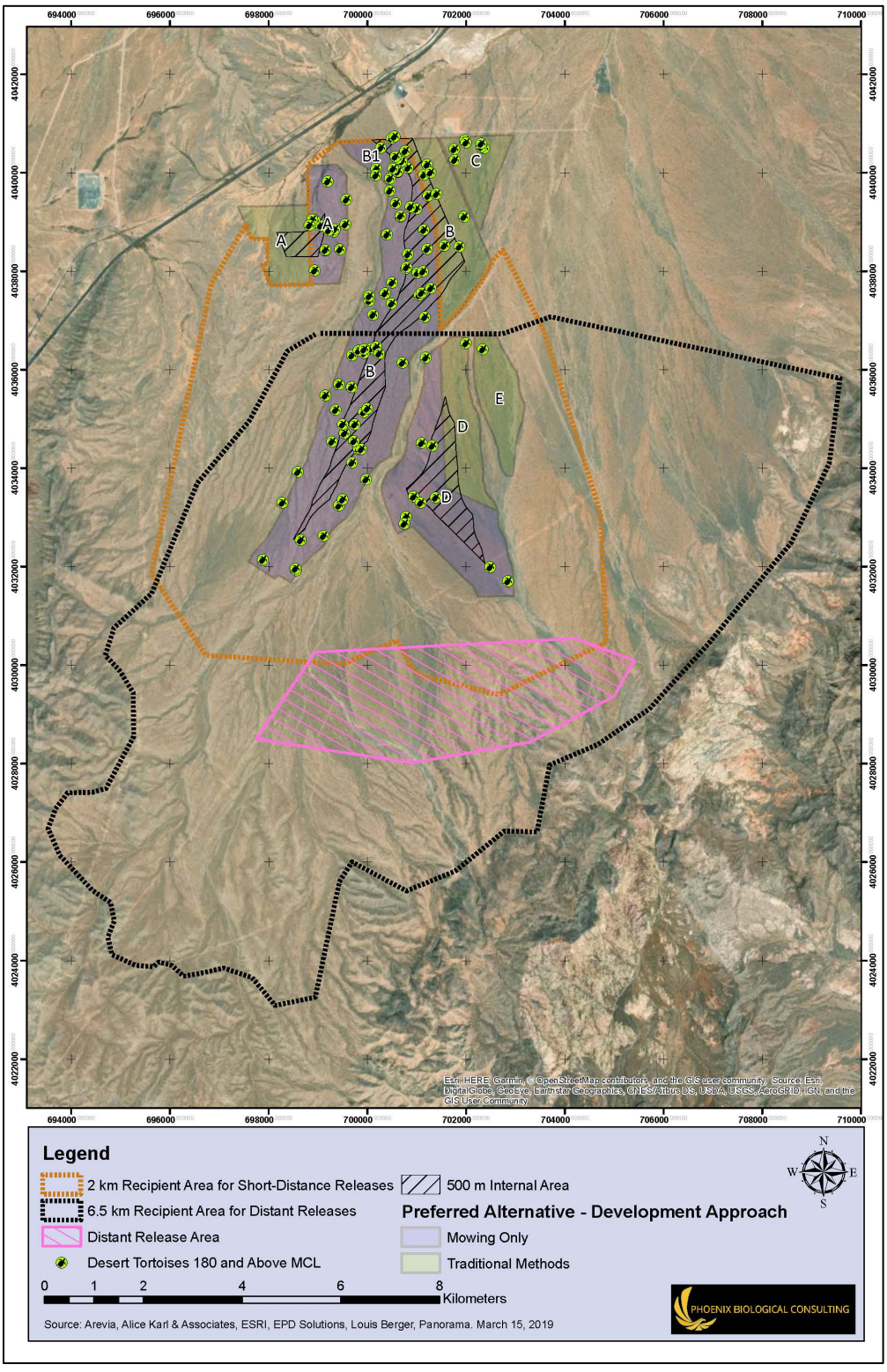

FIGURE 3. Distant and short-distance recipient areas, and tortoises ≥180 mm MCL found during the 2017 and 2018 surveys on the BLM Preferred Alternative. The internal area that is 500 m from the solar development area boundaries is shown.

the toeslopes southeast of the release area and gently rolling in the extreme southern recipient area (Karl field notes). These rolling hills host more open vegetation than the Project area and there are some dense patches of brome grasses, especially red brome (*Bromus madritensis rubens*), both factors suggesting possible historic fire. However, red brome is not restricted to this southern area, but is common throughout the basin. Both the botanical surveys of the solar site (Phoenix Biological 2018a) and the Spring 2019 tortoise surveys of the distant release area (L. Smith, pers. comm.) found red brome to be widespread throughout the solar site, buffer zones, proposed gen-tie routes, and recipient area, with several dense patches.

Control Site

The control site for the LTMP is the Coyote Springs Valley (CSV) site, 23 km (14 mi) northwest (Figure 1). This site is a long, narrow valley between the Arrow Canyon and Las Vegas Ranges. It averages 6-8 km (4 to 5 mi) wide east to west and is 35 km (22 mi) long, with elevations of 680 to 990 m (2230 to 3248 ft). State Highway 93 longitudinally bisects the valley, but is fenced on both sides with tortoise exclusion (protection) fencing along the southern 14 km (9 mi). Other land uses are confined to a distribution line, 500 kV transmission line, and a few unimproved dirt roads that receive light use. Overall there is very little human impact beyond the highway and utilities except in the extreme southeast. West of the highway is the Desert National Wildlife Refuge.

Vegetation is dominated by creosote bush-white bursage scrub, with Mojave yucca (*Yucca schidigera*), indigo bush (*Psorothamnus fremontii*) and blackbrush (*Coleogyne ramosissima)* at higher elevations (Cadre Biological et al. 2019a). Drainage patterns reflect the local topography. Washes generally run east-west and most are deeply incised, especially nearer the mountains, with abundant caliche.

2.0 BASELINE TORTOISE DEMOGRAPHICS, DISEASE LEVELS AND PREDATOR PRESSURE

Project Area

Proposed solar development areas were surveyed in fall 2017 and spring 2018 to determine tortoise abundance (Phoenix 2018b and c, respectively). The adult (>180 mm mid carapace length [MCL]) tortoise density for the BLM preferred (hybrid) alternative was estimated to be 7.7 tortoises/km^2 (BLM 2019a). During both surveys, 16-17% of the tortoises observed were <180 mm MCL, with juvenile tortoises as small as 60 mm, indicating that recruitment is occurring in this population.

Disease levels were assessed in fall 2018 (Cadre Biological et al. 2019a). Health assessments were completed on 100 tortoises on and immediately outside the Project area (Figure 4). The University of Florida analyzed 99 of the 100 samples via Enzyme-linked Immunosorbent Assay (ELISA) and all samples tested negative for *Mycoplasma agassizii* exposure. Eleven samples proved suspect for *M. testudineum* with the remainder negative. Quantitative Polymerase Chain Reaction (qPCR) results on oral swab samples, conducted at the Molecular Diagnostics Lab in Escondido, reported no positive results for *M. agassizii* or *M. testudineum*. Clinical signs were minor and no tortoises were observed to have a nasal discharge or oral plaques that would indicate disease.

During the fall 2018 surveys, trauma was recorded for 27 of 100 tortoises. Most were minor (chips, minor chewing, missing nails) although two tortoises had each lost parts of a limb. In 13 cases, predators (canid or coyote) were the suspected cause of trauma. Carcasses were not evaluated because they were not the focus of this health assessment survey. Shell parts were counted in the Phoenix 2017 and 2018 surveys, but those representing whole tortoises were not separated to determine a mortality rate. Nor was cause of death assessed, although some of those tortoises probably succumbed to predation. While assessing the

level of predator pressure is difficult from these combined data, they indicate at least some predation in the Project area.

Recipient Areas

Because the recipient areas overlap the tortoise surveys conducted in 2017 and 2018 (Phoenix 2018b and c, respectively), the Service agreed that the densities in the recipient areas are assumed to be the same as those in the previously surveyed areas (R. Averill-Murray, DTRO Coordinator, pers. comm to M. Slaughter and A. Karl, 6 March 2019). Due to the proximity to the solar development areas, the short-distance recipient area is expected to have relatively the same adult tortoise density as the preferred (hybrid) Project alternative – 7.7 tortoises/km^2. For the much larger distant recipient area (Figure 3), a more comprehensive density is warranted. In the solar development areas previously surveyed, adult tortoise densities were:

- Areas A, B, C, D, E (29.81 km^2) – 7.1 tortoises/km^2
- Areas B1, B2, G, F (15.06 km^2) – 4.2 tortoises/km^2

Accounting for the size of each survey area, the comprehensive tortoise density for the large, distant recipient area is calculated to be 6.2 tortoises/km^2.

Incidence of disease for the short-distance recipient area is the same as for the Project area, and is discussed above. Disease levels were evaluated on the distant release area in Spring 2019 (Cadre Biological 2019b). With the goal of finding at least 20 tortoises to evaluate for health, crews of four to six biologists walked systematic transects in the better habitats in and immediately adjacent to the distant release area. Surveyors recorded locations of live tortoises, recently used burrows and shell remains. Health assessments were conducted on 21 tortoises (Figure 5). ELISA results were negative for both *M. agassizii* and *M. testudineum* for all 21 tortoises. Oral swabs were able to be collected on 14 tortoises, all of which were qPCR negative for both *Mycoplasma* species. Body condition scores (BCS) were 4 or 5 for all tortoises (i.e., acceptable) and definitive clinical signs were restricted to eroded nares (three tortoises) and a mild serous discharge (one tortoise); none had ticks.

Trauma that was probably predator related was observed on seven tortoises during the distant release site survey. Twenty-two whole carcasses or groups of shell remains that could represent a single tortoise (i.e., at least ~30% of a shell) also were observed, of which nine (only two adults) had predator chew marks. Of the 22 carcasses, 12 were adults. Adult mortality rates, either by time (e.g., annual) or unit effort (transect kilometers walked), have yet to be determined, but preliminary results do not suggest catastrophic mortality die-off" in this area, either from disease or predation. Only five of these 12 died within the previous four years, one within the past two years.

CSV Control Site

Tortoise density and disease levels were evaluated in Fall 2018 (Cadre Biological et al. 2019a). Service-approved probabilistic sampling on 847 linear kilometers found an adult tortoise density of 4.39 tortoises/km^2. Of the 138 tortoises observed, 21 were <180 mm MCL and eight were under 100 mm, indicating that recruitment is occurring in this population. Health assessments were completed on 82 tortoises; blood samples were collected from 81 and oral samples from 77 (Figure 6). University of Florida ELISA test results were all negative for *Mycoplasma agassizii* and a single sample showed a "suspect" antibody response to *M. testudineum.* Results for qPCR on oral swab samples were 100% negative for *M. agassizii*; two tortoises were reported as "equivocal" for *M. testudineum*. Clinical signs were minor and do not indicate current disease at this site.

Trauma to shells or soft tissue was observed on 42 of 100 tortoises, of which 17 were suspected to be caused by canid predation. Mostly the canid-related trauma was very minor, although one tortoise was missing part of a limb. Twelve adult carcasses were found, of which 67% were estimated to have died more than four years prior to the survey, suggesting a low mortality rate given the intensity of the survey. Cause of death was not reported.

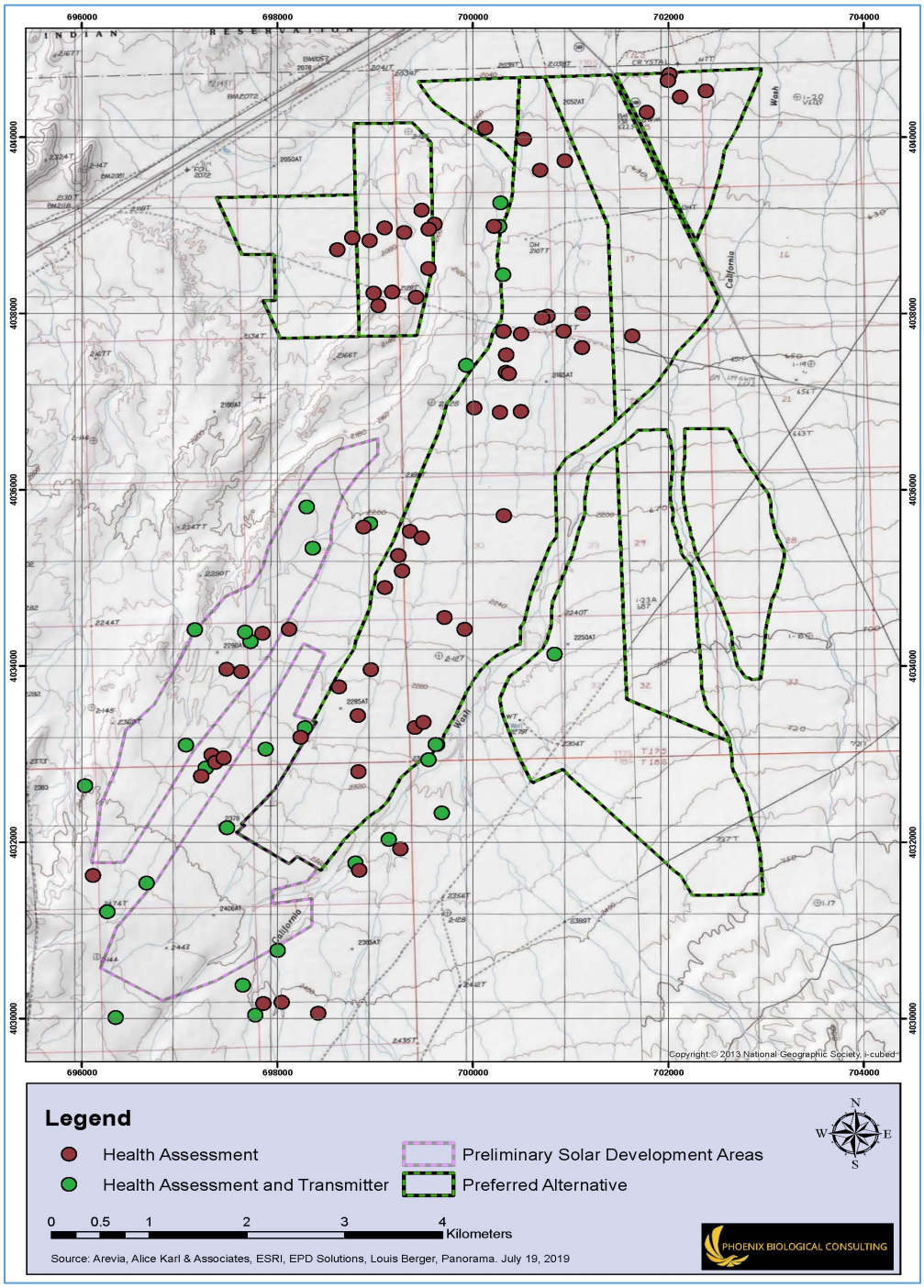

FIGURE 4. Health assessments completed on the Project area in fall 2018.

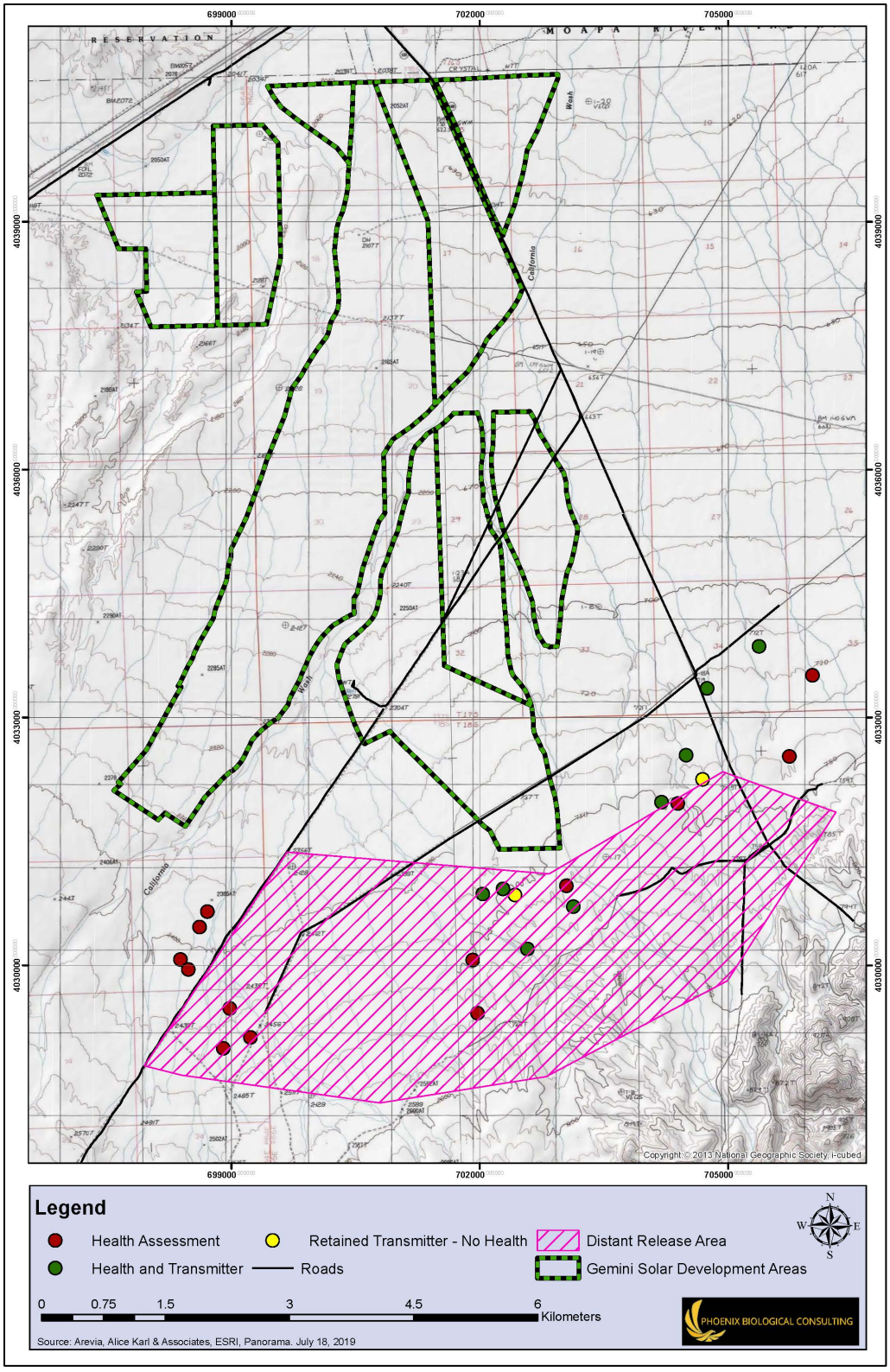

FIGURE 5. Health assessments completed on the distant release area in Spring 2019.

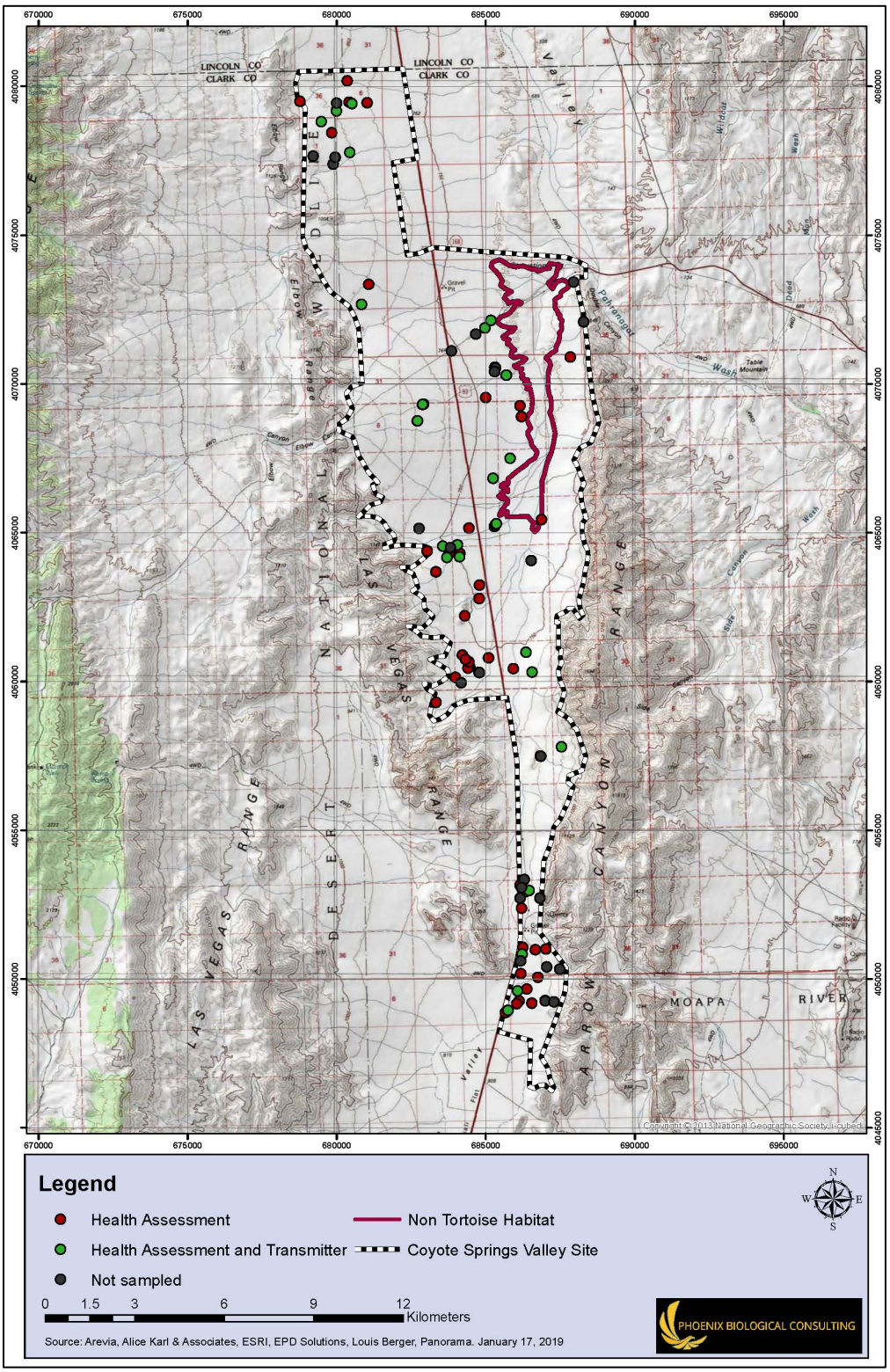

FIGURE 6. Health assessments completed on the Coyote Springs Valley control site in fall 201

3.0 NUMBER OF TORTOISES TO BE TRANSLOCATED AND POST-TRANSLOCATION DENSITIES

The number of tortoises to be translocated cannot be exactly known until clearance surveys are completed. Hence, the number of translocatees discussed in this section and their translocation destinations are based on the number of adult tortoises found and their locations during 2017 and 2018 surveys (Figure 3; Phoenix 2018b and c). The total number of adult tortoises estimated to be moved is 219.

For most of the Project area, tortoises in traditionally developed areas would be moved to the distant release area and all tortoises in mowed areas would be moved outside the site (those within 500 m of the development area boundary) or temporarily held at the holding facility until after construction (those internal to the 500 m division), at which time they would be reintroduced to their capture site in the Project site (see Section 5.6.1 below). However, tortoises in solar development area A, B1 and the northwestern part of area B would likely experience overcrowding under this scenario as a result of the following:

1. Of the 43.1 adult tortoises *within 500 m of the borders* there, roughly only 10 tortoises (8 from A and 2 from B) are sufficiently far south that they could be moved south of A or near of the southern boundary of A (Figure 7). This leaves 33 tortoises to be moved into the corridor between A and B/B1. This narrow corridor has only 1.96 km^2 of suitable tortoise habitat and an estimated adult tortoise density of 17.9 tortoises/km^2 [3], or roughly 36 tortoises. Adding 33 tortoises to the corridor would nearly double the already high density there. Further, this heightened density would exist for over a year during construction (see Section 5.1, below).

2. Additional factors would increase the encounter rate among these tortoises, thereby functionally increasing the density even further. This would include increased tortoise activity while tortoises are adjusting their home ranges, which would likely be exacerbated by the narrow corridor shape. The corridor is only 800 m wide at its widest point and would be nearly enclosed by construction fencing on the development area borders, open only to the far northwest and south. Finally, this heightened tortoise activity and density would occur in the context of continued and proximal construction noise and activities for an extended period.

To alleviate these stressors, the 33 tortoises in this northern area would be temporarily moved to the holding facility, rather than to the corridor (Table 1). After construction, they would be released back into the mowed areas on the solar fields and corridor.

[3] Adult tortoise density in the corridor is assumed to be the as the adjacent, mowed portions of A and B. The mowed portion of A is 1.81 km^2. The mowed portion of B/B1 in this northern portion is 3.0 km^2. During surveys, 29.4 tortoises were calculated for the mowed area of A; 56.7 tortoises were estimated for this northern portion of B/B1. The total number of estimated tortoises, 86.1, divided by the total area, 4.81 km^2, equals 17.9 tortoises/km^2.

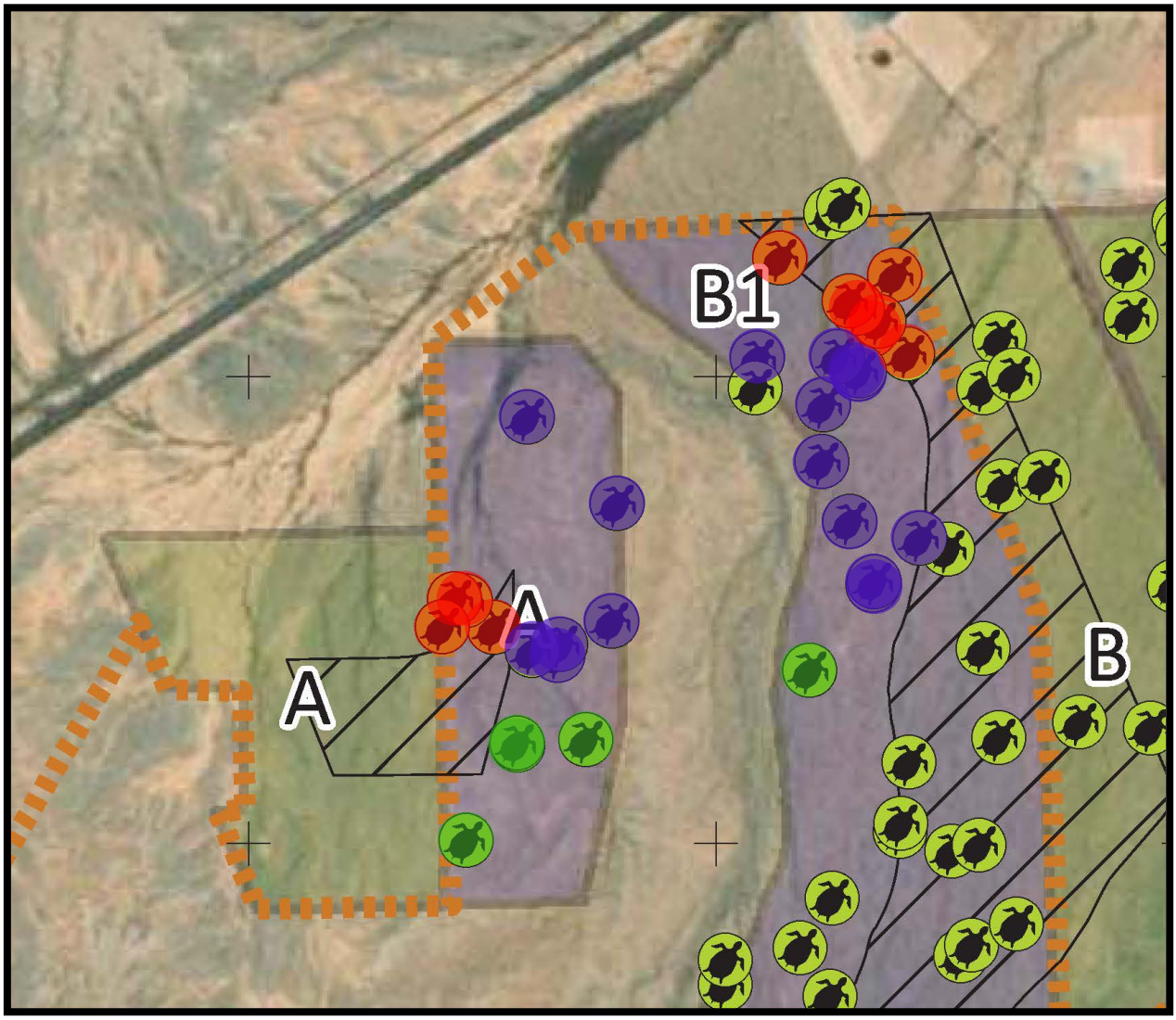

FIGURE 7. Translocation approach for tortoises in the northwestern part of solar development area B/B1 and in area A, to avoid overcrowding in the corridor between A and B/B1. Tortoises colored in green would be moved to the south, near the southern border of A and the large open area to the southwest, and still likely within their home range. Tortoises in purple would be moved temporarily to the BLM Research Facility, for reintroduction after construction was complete. Tortoises in orange would be translocated to the distant release site. Tortoises in yellow would adhere to the same translocation considerations as tortoises on the remainder of the project site. Orange dashed line is boundary of recipient area. (Figure is zoomed-in from Figure 3).

TABLE 1. Translocation approach and tortoise destination based on capture location, densities, and suitable habitat during and following construction. See text for details.

Translocation Approach	Desert Tortoise Translocation Destination			Total Desert Tortoises
	Distant Translocation	Moved Outside the Site, ~500 m from the Capture Location	Moved to Holding Facility until the End of Construction, when Re-placed at Capture Location	
Basic Translocation Approach[1]	36	112	71	219
Adjustments for mowed areas in A, B1 and northwestern B:				
Tortoises within 500 m of development area border		*-33*	*+33*	
Tortoises farther than 500 m from development area border	*+23*		*-23*	
Total	**59**	**79**	**81**	**219**

1. This is the approach presented in the BA (BLM 2019a) and DEIS (BLM 2019b).

A second consideration for tortoises from this northern area concerns tortoises that are *farther than (i.e., internal to) 500 m from the border* (Figure 7). If re-instated into these areas after final construction, these animals would be very constrained by limited suitable habitat. They would be adjacent to the traditionally developed areas, which would be fenced to exclude tortoises, so tortoises will have lost portions of their original home range. Additionally, for area A, there is very limited habitat west of the mowed area. For areas B/B1, the same applies, plus it is unsafe if tortoises move north toward the nearby travel plaza. If a tortoise-impermeable fence were constructed along the northern border of B/B1, extending to the west, tortoises would be safer because they couldn't move to the travel plaza, but the decrease in suitable habitat would still exist. During the re-adjustment phase following re-entry to the site, activity would substantially increase, again functionally increasing the tortoise density (tortoise-tortoise encounters) in this area. To alleviate this overcrowding, these ~23 tortoises will be translocated to the distant release area rather than re-introduced to the mowed area following construction (Table 1).

While the actual number and locations of tortoises may change following clearance surveys, the translocation approaches discussed above for tortoises in area A and the opposite mowed area in B1/B will apply (M. Slaughter, pers. comm. to A. Karl 10 July 2019). To summarize:

(1) Tortoises within 500 m of the solar field border will not be temporarily moved to the corridor between areas A and B, except for tortoises within ~500 m of the southern border of A. Instead, they will be temporarily held at the holding facility, to be reintroduced once construction is complete.
(2) Any tortoises in area A that are beyond (internal to) 500 m from the southern and eastern border of the solar field will be translocated to the distant release area. The exception would be tortoises along the northwestern border, which might be reintroduced, depending on their use of that area prior to translocation (to be determined on a case-by-case basis).
(3) Near the northern border of B/B1, tortoises internal to 500 m will be translocated to the distant release area, again dependent on their known use area prior to translocation.

Tortoise densities in the short-distance and distant release areas would increase immediately following translocation. However, over time it is anticipated that tortoises would re-adjust their home ranges by

dispersing into the adjacent open areas, thereby ameliorating the localized density increase. Over the long-term, post translocation densities in the short-distance and distant *recipient* areas (i.e., release plus dispersal areas) would change marginally over the current densities (Table 2). These two large recipient areas overlap substantially (Figure 1) and it is anticipated that some tortoises released to the distant release site would navigate back toward the Project area, infiltrating the short-distance recipient area and thereby increasing the post-translocation density nearer the Project site. The number of tortoises that may do this is unknown.

TABLE 2. Post-translocation adult tortoise densities in the short-distance and long-distance recipient areas following final translocation and reintroduction. Recipient areas include the release sites as well as the broad areas into which tortoises would disperse. Refer to Figure 3 for a map of the recipient areas.

Recipient Area	Final Recipient Area Size (Minus Traditionally Developed Areas) (km^2)	Current Estimated Density (# tortoises/km^2)	Current # of Tortoises (including Graded Areas)	# of Tortoises Post Translocation	Post-Translocation Density (# tortoises/km^2)
Short-Distance Recipient Area	66.0	7.7	539.0	375.9	7.3
Distant Recipient Area	125.9	6.2	805.4	860[1]	6.9

[1] Four of the 59 tortoises to be translocated to the distant release area were already in the distant recipient area prior to translocation.

4.0 CLEARANCE AND TRANSLOCATION

Clearance and translocation methods in this plan only apply to the solar fields, not the linear facilities outside the solar field (e.g. gen-tie, access roads). Tortoises on these external linear facilities will simply be moved out of harm's way, well within their home range, rather than translocated; those protection measures are discussed fully in the BA**.**

In general, the process of clearance and translocation will be:

- Install tortoise exclusion fencing around areas to be cleared.
- Install internal cross-fencing in areas to be cleared.
- Conduct clearance surveys in the tortoise-active season preceding the active season in which tortoises will be translocated. Attach transmitters and conduct health assessments, with tissue sampling.
- Monitor transmittered tortoises in situ until the next translocation season. Collect pre-translocation data per the LTMP.
- Submit a disposition plan for the tortoises to be translocated
- Translocate tortoises.
- Monitor per the LTMP.

Each step is discussed in detail below.

4.1 PROJECT SCHEDULE

The Project construction schedule is shown in Table 3. Tortoise exclusion fencing to accommodate tortoise clearance would be installed in phases. The northern portion of the Project will be constructed first (Phase I: areas A, B1, C, E and the northern portions of B and D), followed by the southern (Phase II: southern portions of areas B and D). Construction and testing would be complete in approximately two years, after which tortoises could be reintroduced. Tortoises will have been temporarily removed for roughly 1-1.5 years before reintroduction.

TABLE 3. Project construction schedule and timeline for clearance surveys and translocation.

Activity	Start	End
Tortoise Fencing (Phase I)	1/1/2020	3/31/2020
Tortoise Clearance Surveys (Phase I)	4/1/2020	6/1/2020
Pre-Translocation Health Assessments (Phase I)	5/15/2020*	6/5/2020
Laboratory Tests on Tissue Samples	6/1/2020	7/15/2020
Disposition Plan for Phase I Construction Area prepared and submitted to the BLM	7/15/2020	8/15/2020
USFWS Review of Phase I Disposition Plan	8/15/2020	9/15/2020
Translocation of Tortoises in Disposition Plan (Phase I)	9/15/2020	10/10/2020
Solar field construction in Phase I Area commences	11/1/2020	
Tortoise Fencing (Phase II)	7/1/2020	8/31/2020
Tortoise Clearance Surveys (Phase II)	9/1/2020	10/31/2020
Pre-Translocation Health Assessments (Phase I)	9/15/2020	10/20/2020
Laboratory Tests on Tissue Samples	11/1/2020	12/15/2020
Prepare Disposition Plan for Phase II Construction Area	1/15/2021	2/15/2021
USFWS Review of Phase II Disposition Plan	2/15/2021	3/15/2021
Translocation of Tortoises in Disposition Plan (Phase II)	4/1/2021	4/10/2021

Tortoise Fencing (Phase I)	1/1/2020	3/31/2020
Solar field Construction in Phase II Area Commences	6/1/2021	
Testing and Commissioning Phase I	7/1/2021	7/31/2021
Testing and Commissioning Phase II	1/15/2022	2/15/2022
Removal of Tortoise Exclusion Fencing on Mowed/Undisturbed Boundaries	3/1/2022	3/30/2022
Passive and Active Tortoise Reintroduction, including from Holding Facility	4/1/2021	4/10/2022

4.2 PRE-CONSTRUCTION FENCING

Prior to clearing tortoises from each development area, tortoise exclusion fencing will be constructed along the boundaries of the areas that will be mowed and separately along the boundaries of those areas to be traditionally developed. Tortoise exclusion fence material will be galvanized one-inch by two-inch vertical wire mesh fence, extending at least two feet above the ground. Design will follow the recommendations in the Service's (2009) *Field Manual.* For the traditional areas, the tortoise fencing will be permanent and buried at least one foot. For the boundaries of the mowed areas, the tortoise fencing will be temporary, to be removed following construction and testing. Temporary fencing essentially will follow guidelines and materials for permanent fencing. Rebar may replace t-stakes but supporting stakes always will be sufficiently spaced (e.g., ≤8 feet) to maintain fence integrity. Except in traditionally developed areas (e.g., for cross-fencing), temporary fencing will not be buried but rather bent outward at the ground level, with the bent portion tacked and/or held down by rocks, soil, and/or ground staples; anchors will be driven a minimum of every two feet. Tortoise shade structures will be installed along the fence every 250 m on both sides to provide shade for fence-walking tortoises. Soil will be piled on top of shade structures to both hold them in place and provide thermal buffering.

An authorized biologist will survey the fence right-of-way (ROW) within 48 hours prior to fence construction for tortoises and all burrows that could be used by tortoises. Surveys will provide 100% cover in a 27-meter (90-foot) belt centered on the ROW, using 10-meter-wide (33-foot-wide) transects. Tortoise burrows will be mapped using Global Positioning System (GPS), and the burrow size, condition and occupancy recorded. Burrows may be flagged, if flagging will not attract poaching. Tortoise burrows will be avoided if at all possible for permanent fencing and always for temporary fencing. If a burrow must be destroyed for fencing to occur, then it will be visually and tactilely examined for occupancy by tortoises and other wildlife. If occupancy is negative or cannot be established, the burrow will be carefully excavated with hand tools. No burrows that can be avoided will be collapsed during perimeter fence construction.

Fence construction may be completed during any time of the year (Service 2018). All fence construction will be monitored by approved biologists to ensure that no desert tortoise is harmed. The level of monitoring will depend on the specific fencing activity and season, but at least one monitor will accompany each separate construction team, such that no driving, trenching, fence pulling, or any surface disturbing activities will occur without the immediate presence of a monitor. Maps of burrows from the pre-construction survey will be provided to all monitors to assist in protecting tortoises. All tortoises

observed will be recorded, mapped, and temporarily numbered, at a minimum. Larger tortoises may be monitored using temporary transmitters to ensure their safety, if they are prone to being in the construction zone; alternatively, a temporary tortoise fence may be erected to separate the construction from the tortoise. Juvenile tortoises, which are difficult to see, will be temporarily transferred to the BLM Research Facility (formerly the Desert Tortoise Conservation Center) or temporarily kept in individual bins for immediate release when the dangers of construction are past. Open trenches will be checked twice daily.

Tortoises often walk new fences, sometimes to the point of hyperthermia. If exclusion fencing (including temporary fencing) is installed when tortoises are known to be active, either from spring through fall or in winter during unusually warm weather, then all installed exclusion fence (partial or complete) will be checked two to three times daily for two weeks to ensure that no tortoise is fence-walking to the point of exhaustion or overexposure. If midday temperatures are above thresholds at which tortoises must go underground to escape heat (approximately 109 ºF [43ºC] ground temperature; see Section 5.6.2, below), then one of the fence checks will occur within the hour prior to this threshold being reached. This same process will occur for the first two to three weeks of the activity season if the fence is installed in winter, when tortoises are underground.

4.3 CROSS-FENCING

As appropriate, cross-fencing will be installed prior to clearance to ensure a thorough clearance. The purpose of cross-fencing is to decrease the size of the clearance cell so that tortoises are less easily missed as they move around the cell during surveys. Further, if tortoises are found on the final pass, an additional clearance pass will occur over a smaller survey cell than the large solar development area. Cross-fencing materials can be standard wire mesh tortoise fence, silt fence or other acceptable material that will exclude tortoises without being a hazard to tortoises or other wildlife. The lower approximately 15 cm will be bent and flush with the soil surface, then held down by soil, rocks and/or ground staples. Internal permanent fences for the boundaries of the traditionally developed areas will assist in the cross-fencing effort. Temporary cross-fences will be removed after clearance surveys to permit tortoises to more fully use the site.

4.4 CLEARANCE METHODS

Clearance surveys will coincide with heightened tortoise activity to maximize the probability of finding all tortoises - April to May and late September to mid-October in the Project area. To maximize searching efficiency, clearance searches will occur in one square kilometer increments, with crews limited to five searchers. Survey coverage will comprise a minimum of two passes with transects spaced at 5-meter intervals. If more than one adult is found on the second pass, not including focused searches described below, then a third pass will be completed on that survey cell. Transect accuracy will be maintained by an experienced central navigator in each team, using a handheld GPS unit. Transects in the second pass will be walked perpendicular to those on the first pass, or offset by 2.5 m if the terrain suggests greater search efficiency. (The purpose of perpendicular or offset transects on the second pass is to see the ground surface from a different perspective. Both methods achieve this.) During all passes, tortoises will be sought aboveground and in burrows of tortoises and other species (e.g., kit fox, badger) using mirrors, high-intensity flashlights, and probes. Deep caliche burrows or solution cavities that could house a tortoise but may not have obvious tortoise sign, and kit fox dens with active tortoise sign, will be scoped to determine tortoise presence, as necessary. Beginning with oviposition in early May, recent adult tortoise burrows will be gently inspected for nests. To ensure that all tortoises in the immediate area are found, fresh tortoise sign (i.e., burrows, scat, tracks) will be mapped with UTM coordinates, recorded on data forms, and described relative to size and type; fresh scat will be collected or crushed. Fresh burrows,

if not occupied, will be "gated" with small sticks to indicate tortoise ingress/egress. If, after the cell is completely surveyed, no tortoises were found in this or adjacent survey cells near the location where fresh sign was observed, then additional searches will be made in the vicinity of the fresh sign. If no tortoise is found, a separate searcher will be dispatched to the area over one or more days to inspect "gated" burrows and search for the tortoise. These methods have met with high success at a California site where nearly 2000 tortoises, including over 500 juveniles, were found during clearance surveys and translocated (A. Karl, project lead biologist, unpub. data). The site was unfenced, which permitted nearby tortoises to enter the area, so five repeat surveys initially were planned. However, after only three surveys, we found very little sign and few tortoises, very likely due to the additional techniques described above.

No burrows will be collapsed because the clearance will occur several months prior to translocation, so tortoises will need their burrows for shelter. Further, because much of the site will be mowed, the many other fauna that use the burrows will have usable habitat. While some individuals of the less mobile taxa will be killed during construction, those that survive construction will promote habitat functioning in the altered, mowed habitat following construction. Fresh and recent burrows in areas to be mowed will be recorded (UTMs, condition, and size) and flagged for avoidance, if possible, during construction. During reintroduction, tortoises will be placed at their known or likely burrows.

The clearance crew will use electrical tape to temporarily affix a transmitter to all sufficiently large tortoises and will text the UTM coordinates, approximate tortoise size (e.g., adult, large juvenile), sex, and the transmitter frequency to the clearance lead biologist. Within 48 hours, an AB approved to attach transmitters will affix the transmitter with epoxy. During fall or late enough in the spring when health assessments can be conducted, a health team will instead attach the transmitter while conducting health assessments. Health assessments will be conducted on every tortoise found in the clearance area during the clearance survey. Techniques for transmitter attachment, subsequent tracking and health exams are described in greater detail in Section 5.7, below.

Juvenile tortoises present a special challenge because they are not easily seen. Where fresh sign of small juvenile tortoise is found, but no tortoise, or where hatchling(s) are found in the fall, a searcher will be dispatched to the area to search for the missing juvenile or additional hatchlings. Transmitters will be attached to larger juveniles (i.e., larger than ~110 mm MCL); smaller juveniles will be transferred to the BLM Research Facility during the clearance survey.

Nests found from early May through October, when the eggs may be viable, will be excavated and the eggs reburied outside the Project site during clearance. Methods will follow the Service (2009) manual, with the addition that nests will be temporarily protected from predators with chicken wire or other materials that will not affect nest temperatures. The destination will be as near as possible to the original location, but at least several hundred meters from any construction or roads. Because of the limited continuous and safe habitat in the eastern part of the Project site, no nests will be moved east of solar development area B, even if found on the east side of B or in D or E, except in the southern part of B. Details of the nest capture site (e.g., cover, plant species, soil type, substrate, aspect, depth) will be recorded for the LTMP, including the nesting female, if known. Translocated nests will be monitored from a 10-meter distance once a month until December, at which time they will be excavated for examination.

Currently, mortality rates and predation are not well understood in the Project area. To help elucidate these factors, clearance searchers will record, map, and describe shell remains that comprise at least 30 percent of a tortoise (conservatively estimated to represent one tortoise) relative to size, sex, age since death, and cause of death. They will mark carcasses when initially found to prevent collection of duplicate data on subsequent passes. These data will be evaluated following the entire clearance.

4.5 DISPOSITION PLAN AND TRANSLOCATION PACKAGE

After each clearance survey and prior to translocation, a Disposition Plan will be prepared for tortoises that will be translocated the following translocation season or temporarily moved to the holding facility. The Disposition Plan will include translocation recommendations based on prior health assessments, lab results and injuries, and will identify the specific release location (UTMs) for each tortoise. Monthly tracking until the Disposition Plan is written will help inform release sites by providing information on each tortoise's use of the area. The plan will follow the format requested by the Service (Service 2018) with additional information to assist in the Service's review. The overall translocation package will include (a) the Disposition Plan; (b) maps and GIS files of capture and release locations, including resident recipient tortoises; and (c) Service health data forms and photographs of each tortoise. The translocation package will be submitted to the Service for approval at least 30 days prior to translocation. However, health or other concerns that become apparent earlier, and might affect the Service's review, will be discussed with the Service prior to the translocation package submittal, when possible.

A separate Disposition Plan also will be prepared directing the specific release sites for tortoises that were temporarily moved to the holding facility, including juveniles. This plan also may include some tortoises that were moved a short distance outside the solar field boundary.

4.6 TRANSLOCATION

Translocation Destinations and Reintroduction

As identified in Section 4.0, above, the general plan for translocation[4] and reintroduction is:

- Mowed Areas

  Tortoises within 500 m inside the development area border will be moved outside the border to a point 500 m from their capture site, under the assumption that the area outside the border is within their home range[5]. (While 500 m will be outside the home ranges of juveniles, they will be translocated with adults to help maintain the original population structure.) The exception is tortoises in solar development areas A, B1 and the northern portion of B, which will temporarily be moved to the BLM Research Facility in Las Vegas (see Section 4.0, above). After construction is complete, reintroduction to the mowed areas will proceed. For passive reintroduction, the exclusion fence will be removed around the solar field perimeter to allow tortoises to freely access the site. For active reintroduction, the LTMP may designate that some tortoises originally moved outside the border will be actively re-placed inside the mowed area at a one of their original capture burrows.

  Tortoises beyond (internal to) 500 m from the border will be temporarily moved to the BLM Research Facility in Las Vegas, except for tortoises in solar development areas A, B1 and the northern portion of B, which will be released to the distant release site (see

[4] Translocation refers to moving animals beyond their home ranges. For simplicity, the term "translocation" generically applies to all procedures in this document where animals are moved off the Project site, either a short distance (and presumably still within their home range) or distantly.

[5] In the 2011 Service translocation guidance, 500 m was the threshold distance for short-distance translocation. This was consistent with home range studies (Harless et al. 2010), especially longer term studies (O'Connor et al. 1994, TRW 1999) and shorter dispersal distances shown for tortoises translocated ≤500 m. In their 2018 Translocation Guidance, the Service applied a more conservative distance of 300 m. However, in a conference with the BLM and Service on 13 April 2018, R. Averill-Murray (Desert Tortoise Recovery Coordinator) agreed that 500 m was reasonable based on home range studies and the results of the Ivanpah Solar (ISEGS) translocations, wherein 500 m was used as the threshold for short-distance translocation.

Section 4.0, above). Each tortoise at the BLM Facility will be placed in an individual pen; juveniles found within a few hundred meters of each other that are relatively the same size may be penned together. Prior to moving any tortoises to the holding facility, the pens will be renovated:

- All pens will be renovated as necessary to be safe and functional, including irrigation, overhead netting, and walls.
- All pens either will have been vacant and burrows opened for several weeks to ensure that they are naturally disinfected by ultraviolet radiation or a disinfectant (e.g., Trifectant) will be sprayed as necessary.
- Parasite populations will be eliminated.
- New burrows will be dug in each pen that will house one or more tortoises.
- Extra pens will be prepared to accommodate additional animals.

Qualified and knowledgeable tortoise biologists will attend to feeding and caring for the penned tortoises during their captivity.

Based on the construction schedule, it is anticipated that most tortoises will be held roughly one year. Once construction is complete, they will be actively reintroduced at one of their capture burrows.

- Juvenile Tortoises

  At the close of construction, juveniles temporarily housed at the BLM Research Facility and originating from the internal 500 m mowed area will be re-placed at their capture sites or as directed by the Service and BLM if they are at least 140 mm MCL. However, tortoises smaller than 140 mm are less visible[6] and would be more vulnerable during operations. Accordingly, all juveniles from the holding facility that are under 140 mm MCL will be translocated outside the development area, opposite their capture point. None will be translocated east of area B, except in the south. Because small juvenile tortoises are highly vulnerable to predation, they will be released in the morning to avoid inadvertently attracting nocturnal predators to a release site. Juveniles under 60 mm MCL will be released near inactive rodent burrows or other protective cavities.

- Traditionally Developed Areas.

  Tortoises found in areas to be traditionally developed (graded), including juveniles large enough to wear a transmitter, will be translocated directly to the distant release area.

- All Translocations.

  Specific temporary and final release locations will be identified in the Disposition Plan. Patches of abundant brome grasses or other noxious weeds will be avoided.

Timing of Translocation

Tortoises may need weeks after translocation to find or dig new refuges in an unfamiliar translocation area prior to the onset of lethal daily temperatures. The Service's translocation guidance recommends that "release should occur when temperatures range from 18–30°C (65–85°F) are not forecasted to exceed 32°C (90°F) within 3 hours of release or 35° (95°F) within one week post release" (Service 2018:17). Notably, the 35°C stated is a *forecasted* temperature at 1 m, provided by weather services (R. Averill-Murray, pers. comm. to W. Christensen, Environmental Affairs, Marine Corps Air Ground Combat Center, April 2017). A 35°C air temperature at 1 m substantially exceeds the Service's handling

[6] Turner et al. (1984) found that tortoises smaller than 140 mm MCL were statistically more difficult to see than larger tortoises.

temperature maximum of 35°C at 5 cm and coincides with a surface temperature of approximately 48°C (Figure 8). Zimmerman et al. (1994) and Karl (unpub. data) observed that tortoises seek thermal refuge in burrows between surface temperatures of 40 to 45°C to avoid lethal hyperthermia. These values would correspond to an air temperature maximum of 30.5°C (86.9°F; Figure 8), which is what the Gemini translocation will target, rather than 35° (95°F).

Although clearance surveys are conducted in spring and fall, when tortoise activity is greatest, ambient temperatures are generally too high during most of that activity period for successful translocation to occur. At the Project site, April temperatures often exceed 30.5°C (86.9°F) for extended periods (National Oceanic and Atmospheric Administration 2019)[7].

Based on these criteria, and in the interest of conservatism when attending to a listed species, translocation at the Project site would be planned for early April or after 15 September in order to meet these temperature guidelines. There is somewhat greater flexibility for tortoises moved a short distance outside the site, since they are presumably in a familiar area. Cool springs also can lengthen the translocation period in spring, although predicting temperature beyond a week is faulty. In fall, translocation would occur at least one to two weeks before brumation typically begins. For fall, the Service recommendation is that forecasted daily low temperatures should not be cooler than 10°C (50°F) for one week of release in the fall.

Translocation Processes

At the time of translocation, collectors will be dispatched in the morning, each to collect a designated group of a few tortoises. Each tortoise will be put in an individual, sterilized plastic bin and hand carried or carried by backpack to a vehicle to be transported back to the processing site. The processing site will be staffed with a site manager, assistant, and health crews. Health crews will physically assess health, measure, and photograph each tortoise. No tissue samples will be collected as all tortoises will have had tissue samples within one year of translocation. Transmitters will be removed, kept, or changed, depending on the tortoise's designation in the LTMP for post-translocation tracking. All tortoises will be rehydrated via epicoelomic injection (larger tortoises) or soaking (juveniles). Each tortoise's bin will be labeled with the tortoise identification number and release UTMs. Following processing, the site manager will verify that all processing for each tortoise has been correctly completed and the information on the bins is correct. Any tortoise that does not pass the Service's translocation algorithm (Service 2016c) will be removed to the holding facility. As much as possible, tortoises will be translocated the same day that they are collected. Biologists will drive and backpack tortoises in individual bins to the designated release locations. During all transportation, tortoises will be kept shaded, away from hot surfaces, and padded as needed to avoid shell or internal trauma. All tortoises will be released under shrubs and the UTM coordinates recorded digitally and on hard copy.

The current Service translocation guidance (2018) requires that tortoises have two health assessments just prior to translocation, 14-30 days apart, with the final assessment within 1 to 2 days prior to translocation. This requirement may preclude spring translocation if temperatures are warm. Tortoises only become active in very late March or early April, so the two, separated health assessments could delay

[7] For example, in April 2012, daily air temperatures (at 1 m) from 19 through 25 April exceeded 32°C (89°F) and reached 35-37°C (95-99°F) on four of the seven days. In April 2013, air temperatures were in the mid-high 80's between 4 and 15 April, but daily temperatures later in April exceeded 31°C (88°F) and reached 37°C (99°F) degrees, with most days in May well beyond 35°. In April 2014, 2015 and 2016, air temperatures exceeded 32°C on several, often consecutive, days.

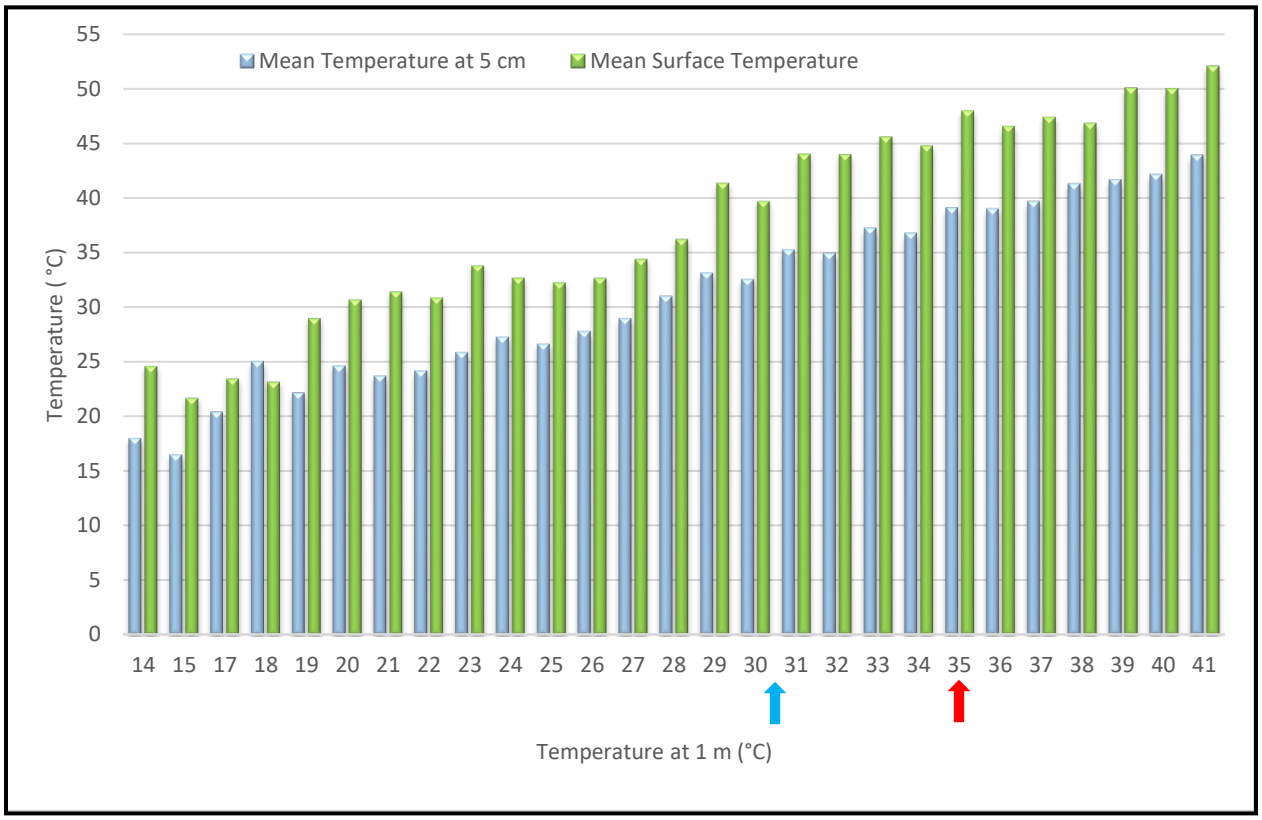

FIGURE 8. Comparison of air temperatures at 1 meter to temperatures on the ground surface and 5 centimeters near Barstow, California from 20 April to 5 May (n=197). Red arrow identifies the 1 m air temperature approved by the Service for translocation. Blue arrow shows that the Service-mandated handling temperature of 35°C (at 5 cm) and a surface temperature below 40°C coincides with a 1 m air temperature of 30.5°C (86.9°F). (Source: A. Karl, unpub. data.)

translocation beyond the time when ambient temperatures are appropriate for translocation. At Gemini, spring translocation would apply primarily to Phase II tortoises (see Table 4); Phase I tortoises would be translocated the prior fall. The Service has agreed (R. Averill-Murray, pers. comm. to A. Karl, 10 July 2019) that the Phase I translocation will provide substantial information about population health, especially combined with the health assessments already completed 2018 and 2019, which indicated no evidence of mycoplasmosis (see Section 3.0, above). Accordingly, only one assessment within 1 to 2 days of translocation will be required for the remaining translocatees in the spring, unless the earlier population health profile suggests that a more intensive evaluation of disease is warranted. Other exceptions would occur for individual tortoises with questionable health assessments; these would require at least one additional assessment seven days following the first.

For tortoises being reintroduced from the BLM Research Facility, all tortoises will have had a health assessment with tissue sampling within the prior year. (Juveniles under 100 g will undergo qPCR testing.) For fall translocations, two physical health assessments will be completed just prior to translocation, 14-30 days apart, with the final assessment within one to two days of translocation. For spring translocations, the modification presented above would apply.

Post-Translocation Tracking

Newly translocated tortoises display increased activity, often moving extreme distances in erratic directions; neither distance nor direction can be accurately predicted. While movements for tortoises translocated immediately outside the site are expected to be much less than the distantly released

tortoises, transmittered tortoises at both release sites will be tracked within 24 hours of release, twice weekly for the first two weeks, weekly from March through early November, and then according to the LTMP schedule. Tortoises actively reintroduced to mowed areas following construction will be tracked similarly at release and then according to the LTMP. Passively reintroduced tortoises will be tracked per the LTMP. Recipient and control tortoises will be identically tracked to compare movements and behaviors.

4.7 METHODS APPLICABLE TO ALL ACTIVITIES

Authorized and Approved Biologists

The Service describes a single designation for biologists who can be approved to handle tortoises - "Authorized Biologist" (AB; Service 2008). Such biologists have demonstrated sufficient desert tortoise knowledge and experience to handle and move tortoises appropriately. Qualifications will be submitted to the Service and BLM for approval at least 30 days prior to activities described in this translocation plan. Certain ABs additionally will be approved to perform specialized tasks, such as health assessments, tissue collection, and transmitter attachment and removal. Only those biologists authorized by the Service and BLM can perform specific tortoise handling tasks.

Desert tortoise monitors will be designated by the Project lead biologist (an AB) to assist in certain tasks, without further approvals from the Service, although the BLM may require approval. Monitors may move tortoises out of harm's way, but for clearance surveys and certain other specialized tasks, ABs must directly supervise monitors (i.e., voice and sight contact).

Handling Techniques and Temperatures

All tortoise handling will be consistent with the biological opinion and techniques outlined in the Service's 2009 *Field Manual* and more recent instruction manuals (Service 2019). Handling time will be minimized to the extent possible to avoid stress to the animals. In accordance with Service (2009) guidance, tortoises may be handled only when air temperature measured at 5 cm (2 in) above the ground (shaded bulb), is not expected to exceed 35°C (95°F) during the handling session.

Transmitters and Tracking

All tortoises greater than 110 mm in length will be transmittered with appropriately sized transmitters (Holohil RI-2B 10 g and 15 g), applied with five-minute gel epoxy to locations on the tortoise that will minimize risks to righting - on the fifth vertebral for males and smaller tortoises, on the first costal for adult females. The transmitter antenna will be fed through a vinyl sheath with a diameter slightly greater than the antenna. This sheath will be epoxied low on the carapace, just above the marginal scutes, and split at the scute seams (growth areas). This technique will permit the antenna to slip freely in the sheath, thereby precluding distortion on growing tortoises. Transmittered tortoises will be radio-tracked within 24 hours, one week and at two weeks after transmitter application. After the second week, tortoises will be tracked monthly until translocation. Transmitters will be changed as necessary, earlier than battery life suggests, or when the units appear to be malfunctioning. Assuming translocation occurs within one year, only the smaller, 11-month units may need replacing.

Health Assessments

Per Service (2019) protocol, tortoises may not have blood drawn until 15 May, or four weeks following initiation of spring activity, if approved by the Service. Certified health personnel will process tortoises with a suite of measurements, assessments, and photographs to evaluate and document health, body condition, parasites, injuries, anomalies, and behavior. They will collect oral swabs from all tortoises and blood samples via subcarapacial venipuncture on tortoises weighing more than 100 g. Data will be recorded on Service forms (Service 2019). Tortoises that void will be rehydrated via epicoelomic injection

(larger tortoises), nasal rehydration, or soaking (juveniles). Heparinized whole blood will be centrifuged, plasma extracted, and the blood cells and plasma and oral swabs frozen. Using priority overnight delivery, all samples will be shipped on dry ice to the University of Florida's *Mycoplasma* laboratory (plasma and nasal exudate) or the Amphibian/Molecular Diagnostics Lab at the San Diego Zoo Institute for Conservation Research (oral swabs) for analysis. Plasma or oral swab samples will be shipped in groups of 100 samples to prevent a large loss of samples in the event of shipping malfunctions. Samples will be shipped early in the week to ensure that they arrive during business hours; both laboratories will be notified of the shipment, when sent. Duplicates and other tissue samples will be stored at a location agreed upon by the Service and BLM.

Digital and Hard Copy Data Management

Electronic data entry in the field will be optimized to avoid interference with field tasks, but sufficient to ensure rapid response and daily transfer of critical data to maintain all project functioning, thereby enabling the necessary lists and GPX files to be generated overnight for trackers, health teams, and others for the next day's activities. Data capture software (e.g., Pendragon©) that downloads into Microsoft Access or a similar data base would be used, with all data undergoing several levels of proofing. Data would be collated and stored in the "Cloud", with backup on a redundant server, for analysis, GIS efforts and reports.

Injuries and Mortalities

Any tortoise injured during translocation will be immediately transported to a veterinarian or wildlife rehabilitation facility recommended by the BLM and reported within 24 hours or the next workday to the BLM and Service. Mortalities will be similarly reported, or as required by the BO. For dead tortoises found during telemetry, the tracker will attempt to determine the cause of death, providing detail, time since death, location and photographs. The tracker will notify the lead biologist immediately who will submit all forms, representative photographs, and a summary to the BLM and Service within 48 hours, or as required by the BO.

4.8 REPORTING

A summary and revised Disposition Plan will be submitted within 30 days following translocation, each season that translocation occurs. Revisions to the Disposition Plan will reflect changes for individual tortoises that occurred during the translocation process (e.g., a tortoise that was not translocated because of pre-translocation health assessments). The LTMP will have a separate reporting schedule, but it is anticipated to be annually, detailing the translocation study activities and results from the previous year.

4.9 FUNDING

Solar Partners XI, LLC, will provide adequate funds to complete all work as described.

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