Solar Partners XI, LLC

Biological Assessment

Gemini Solar Project

N-84631

June 2019

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Prepared for:

United States Fish and Wildlife Service

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ACRONYMS AND ABBREVIATIONS

AC	alternating current
ACEC	Areas of Critical Environmental Concern
APLIC	Avian Protection on Power Lines
Applicant	Solar Partners XI, LLC
BA	Biological Assessment
BBCS	Bird and Bat Conservation Strategy
BESS	battery energy storage system
BLM	Bureau of Land Management
BMPs	Best Management Practices
BO	Biological Opinion
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHU	Critical Habitat Unit
COC	corridor of concern
cms	cubic meters per second
DC	direct current
DOE	Department of Energy
DOI	Department of the Interior
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FCR	Field Contact Representative
FEMA	Federal Emergency Management Agency

FLMPA	Federal Land Policy and Management Act of 1976
FSB	Formulated Soil Binder
gen-tie	generation tie-in
HDPE	high-density polyethylene
hp	horsepower
I-15	Interstate 15
IEEE	Institute of Electrical and Electronics Engineer
kph	kilometers-per-hour
kV	kilovolt
kVA	kilovolt-ampere
MCL	median carapace length
mph	miles-per-hour
MW	megawatt
MWac	megawatt alternating current
NEMA	National Electric Manufacturers Association
NEPA	National Environmental Policy Act
NMRU	Northeastern Mojave Recovery Unit
NOI	Notice of Intent
O&M	operations and maintenance
OHV	off-highway vehicle
PBC	Phoenix Biological Consulting
PCS	power conversion table
PEIS	Programmatic EIS
Project	Gemini Solar Project
psi	pounds per square inch
PUP	Pesticide Use Proposal

PV	photovoltaic
PVC	polyvinyl chloride
PVCS	Photovoltaic Combining Switchgear
ROD	Record of Decision
ROW	right-of-way
SCADA	supervisory control and data acquisition
SEZ	Solar Energy Zone
SPCC	Spill Prevention, Control, and Countermeasure
SRMA	special recreation management area
SWPPP	Stormwater Pollution Prevention Plan
TSDF	Treatment, Storage, and Disposal Facility
UPS	uninterruptible power supply
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WEAP	Worker Education and Awareness Plan

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Solar Partners XI, LLC (Applicant), a wholly owned subsidiary of Valley of Fire, LLC, submitted a right-of-way (ROW) application (N-84631) 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 approximately 7,100 acres (2,873 hectares) of Department of the Interior (DOI), Bureau of Land Management (BLM) land in Clark County, Nevada within a 44,000-acre (17,806-hectare) ROW application area.

The ROW grant would be issued in compliance with FLPMA, BLM ROW regulations, the BLM National Environmental Policy Act (NEPA) Handbook, DOI NEPA regulations, and other applicable federal and state laws and policies. The Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the Project was released July 13, 2018. The completion of the EIS process and issuance of a Record of Decision (ROD) is targeted for December 2019.

The power produced by the Project would be conveyed to the NV Energy transmission system. The Applicant has an active application with NV Energy for a Large Generator Interconnection Agreement (LGIA) to interconnect 440 megawatts alternating current (MWac) at the Crystal Substation, with another 250-MWac planned for California delivery. The Project would generate greenhouse gas-free electricity, averaging an energy production that equates to the annual electricity needs of approximately 260,000 households.

1.2 PURPOSE OF THIS BIOLOGICAL ASSESSMENT

The purpose of this Biological Assessment (BA) is to provide information on federally listed species as part of formal consultation between the BLM and the United States Fish and Wildlife Service (USFWS) under Section 7 of the Federal Endangered Species Act (ESA). This BA presents the potential effects of the Project on the Mojave desert tortoise (*Gopherus agassizii*), a federally threatened species; Yuma clapper rail (*Rallus longirostris yumanensis*), a federally endangered species; yellow-billed cuckoo (*Coccyzus americanus*), a federally threatened species; and southwestern willow flycatcher (*Empidonax traillii extimus*), a federally endangered species.

2 DESCRIPTION OF THE PROJECT

2.1 PROJECT LOCATION

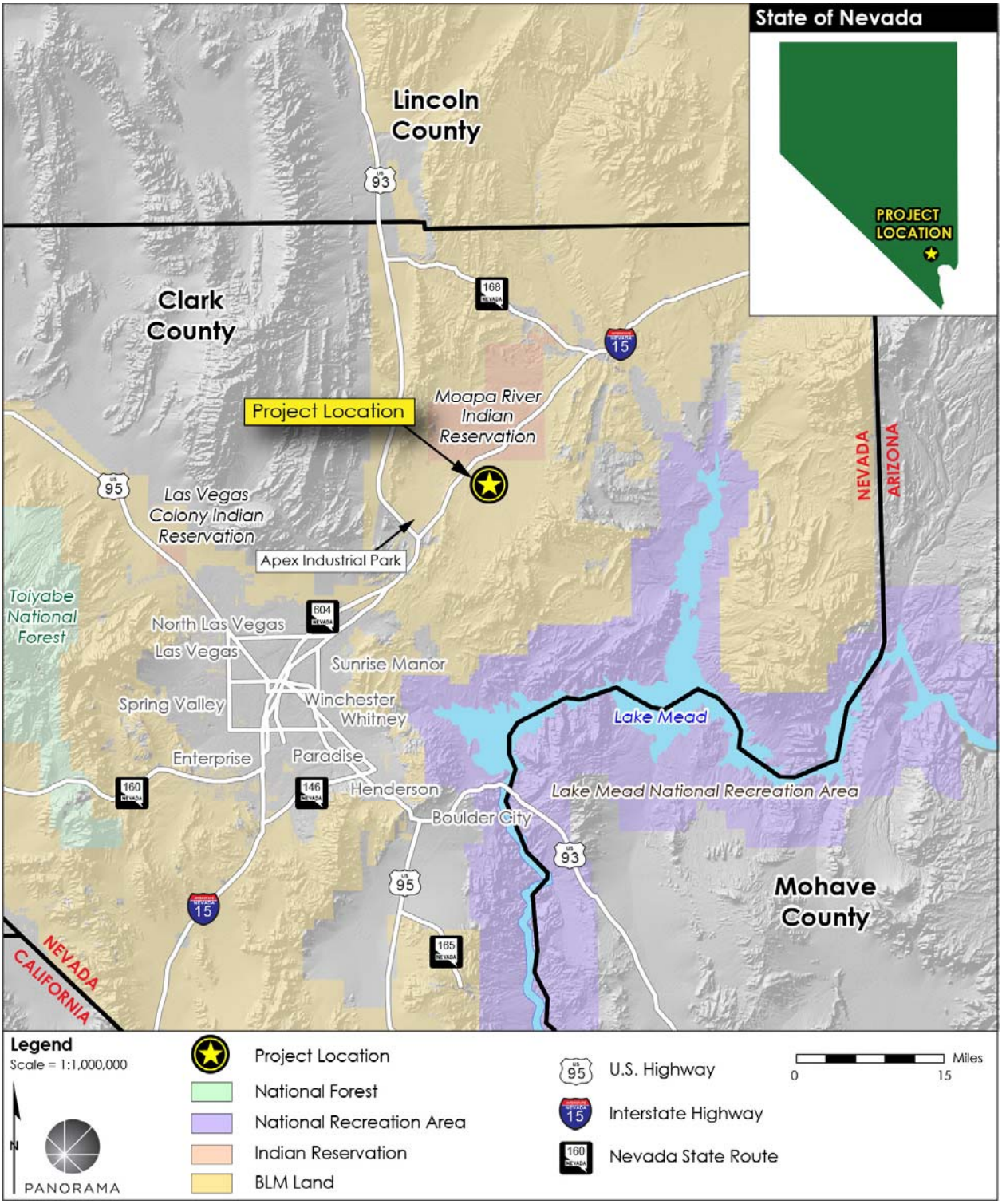
The Project is located on public land administered by the BLM in the northeastern portion of the Mojave Desert; approximately 33 miles (56 kilometers) northeast of the Las Vegas metropolitan area, in an unincorporated area of Clark County, Nevada (Figure 1). The Project is situated immediately south of the Moapa River Indian Reservation and less than 0.5 mile (0.8 kilometer) southeast of Interstate 15 (I-15) within the *Piute Point* and *Dry Lake* United States Geographical Survey (USGS) 7.5-minute topographic quadrangles.

The Project site is divided into several different solar array areas, or development areas, labeled A through E on Figure 2. All components of the Project are located on federal lands administered by the BLM under the 1998 Las Vegas Resource Management Plan (BLM, 1998). Table 1 presents the legal description for the Project. This legal description includes 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 Legal Description of Project Area within the ROW Application Area

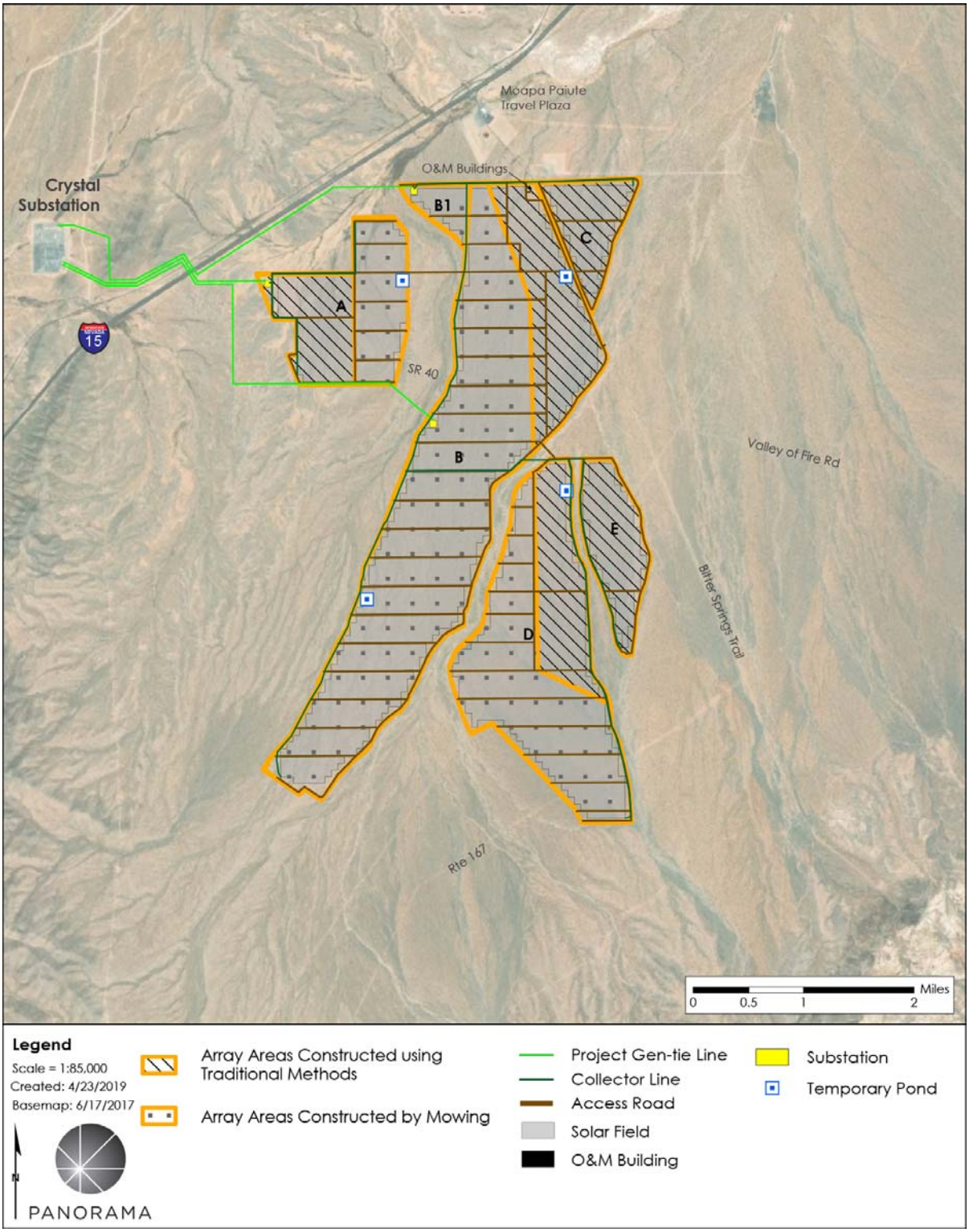
Township	Range	Sections
T.16.S	R.65.E	sec. 31, W1/2 and SE 1/4.
T.17.S	R.64.E	sec. 10, S1/2; sec. 11, S1/2; sec. 12; sec. 13; sec. 14, N1/2 and SE1/4; sec. 15, N1/2; sec. 25, E1/2; sec. 36, E1/2 and SW1/4
	R.65.E	sec. 7; sec. 8; sec. 9, W1/2; sec. 16, W1/2; secs. 17 thru 20; sec. 21, SW1/4; sec. 28,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

Figure 1 Regional Map



Sources: (Esri, 2006; USGS, 2017; The National Map and USGS, 2017; Ventyx, 2010; Tele Atlas, 2010a; Tele Atlas, 2010b; Louis Berger Group, 2018)

Figure 2 Project Layout



Sources: (Louis Berger Group, 2018; USDA-FSA-APFO, 2017; Clark County Nevada GIS Management Office, 2018)

2.2 THE BLM PREFERRED ALTERNATIVE PROJECT

The BLM identified alternatives to the Applicant's proposed Project as part of the NEPA process. This BA is based on one of those alternatives that the BLM has identified as the "Preferred Alternative," which is the Project shown in Figure 2, and referred to herein as the "Project." The BLM Preferred Alternative, which is also called the Hybrid Alternative in the EIS, includes construction and maintenance of approximately 65 percent of the solar array areas with the natural ground contours, washes, and vegetation left in place. The vegetation would be mowed during construction and operation to a height of 24 inches (61 centimeters), although vegetation may be trimmed to between 18 inches (46 centimeters) and 24 inches (61 centimeters) tall under justifiable circumstances. The permanent fencing surrounding the mowed areas would have a gap of approximately 8 inches (20 centimeters) between the fence bottom and the ground to allow desert tortoise to travel through and occupy the solar field during operation and throughout the lifetime of the Project. The remaining approximately 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 tortoise. A detailed description of the components of the solar development under the Hybrid Alternative are described in the following sections. The Hybrid Alternative was chosen as the Preferred Alternative as it resolves significant issues associated with the Applicant's Proposed Action regarding translocation of tortoises.

2.3 PROJECT COMPONENTS

2.3.1 Overview

The Project would include the construction, operations, and decommissioning of a nominal[1] 690-MWac solar PV power generating facility on approximately 7,100 acres (2,873 hectares). The Project components include the solar field, ancillary facilities, and the gen-tie system. Table 2 summarizes the impact acreage of the Project. A detailed description of the Project components, as well as a description of the Project's construction, operations, and decommissioning is provided below.

The Project would be designed in accordance with federal, state, and industry standards, including American Society of Mechanical Engineers standards, National Electrical Safety Code, International Energy Conservation Code, International Building Code, Uniform Plumbing

[1] Nominal power refers to the nameplate or peak capacity of photovoltaic system

Code, Uniform Mechanical Code, National Fire Protection Association, and Occupational Safety and Health Administration regulations.

Table 2 Summary of Permanent Impact Acreages for the Project by Component

Disturbance Type	Disturbance, Acres (Hectares) [1]	Notes
Permanent Disturbance – Vegetation Removed		
Entire Solar Facility	2,578.8 (1,041.6)	690-MWac PV solar facility
Solar Arrays (Traditional Development)	2,351.0 (951.4)	Includes the solar PV panels, steel table frames, trackers, and posts
O&M Building	2.1 (0.85)	Includes the O&M building, parking, and water tank storage, all within solar facility footprint
Substations	7.1 (2.9)	Each of the three substations occupies approximately 2.4 acres (0.97 hectare) within the solar facility footprint
Internal Access Roads for Solar Field and Utility Corridor	170.5 (69.0) [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 (1.6)	Four temporary [3] water ponds would be constructed in development areas A, B, and D
Equipment Areas	14.7 (5.9)	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 (9.9)	Gen-tie foundations assumed to fall within acreage for access roads
Total	**2,602.4 (1,053)**	
Permanent Disturbance – Vegetation Maintained		
Solar Arrays (Mowing) [5]	4,459.8 (1,804.8)	690-MWac PV solar facility
Total	**4,460 (1,805)**	
Temporary Disturbance (granted through a short-term ROW, if outside the project ROW area) [4]		
Gen-tie structure laydown, staging, and installation	36.1 (14.6)	Gen-tie structure laydown, staging, and installation, 200 feet (61 meters) by 200 feet (61 meters) at up to 48 poles, outside the solar facility fence
Gen-tie line conductor stringing	14.8 (6.0)	Multiple pulling sites for each gen-tie line where direction changes sharply; 100 feet (30.5 meters) by 500 feet (152.4 meters)

Disturbance Type	Disturbance, Acres (Hectares) [1]	Notes
Total	**51 (20.6)**	
GRAND TOTAL	**7,113 (2,879)**	

Notes:

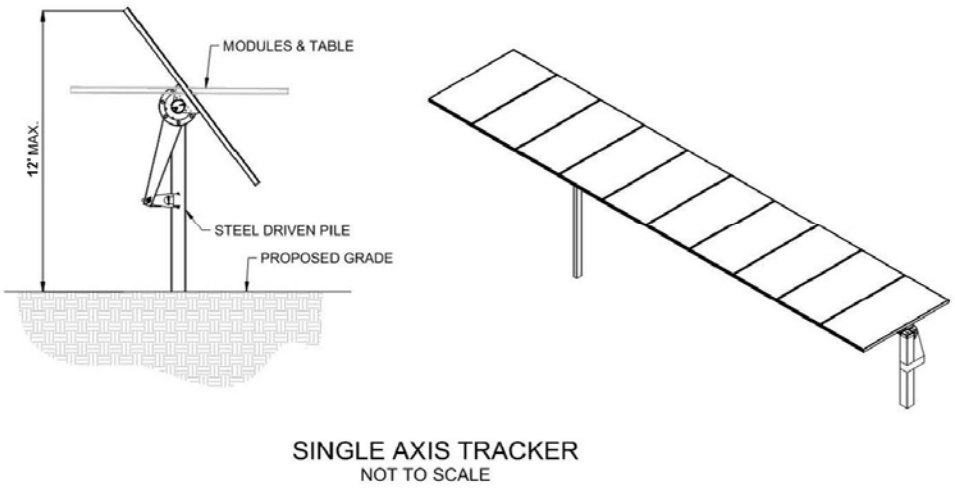
1. All values presented are approximate and subject to change per final engineering.
2. North-south access roads closest to the boundary of mowing and traditional development areas were assumed to be constructed within the traditional development.
3. Although the water ponds are temporary and would be 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. The solar field staging area is assumed to overlap with the access roads, which is considered under permanent impacts.
5. Mowed areas would be maintained throughout the life of the Project through vegetation trimming.

2.3.2 Solar Panel Arrays

The Project would utilize high-efficiency commercially available solar PV modules that are Underwriters Laboratory (UL)-listed or approved by another nationally recognized testing laboratory. Commercial solar panels are typically 77 inches (6.4 feet [2 meters]) long by 39 inches (3.25 feet [0.99 meter]) wide but could be as long as 8 feet (2.4 meters). Materials commonly used for solar PV modules include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride (CdTe), and copper indium selenide/sulfide. 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 (were it to occur). No heat or light is radiated back from the panels. Generally, traditional panels use polycrystalline materials, and bifacial panels use monocrystalline cells. Both types can have antireflective coating added to reduce glare. Mounted PV modules, inverters, and transformers would be combined to form array blocks.

The panel arrays are arranged in north-south oriented rows and 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 trackers 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 and the top edge of the panel would be a maximum of 12 feet (3.7 meters) above the ground surface in areas constructed using traditional methods and 15 feet (4.6 meters) 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 6 feet (1.8 meters) above the ground surface in areas of traditional development and up to 8 feet (2.4 meters) above the ground surface in mowed areas. At the most perpendicular to the ground surface, 1 to 1.5 feet (0.3 to 0.46 meter) of space would generally remain between the bottom of the panel and the ground, depending upon site conditions. In mowed areas, at least 2 to 2.5 feet (0.6 to 0.8 meter)

Figure 3 Diagram of a Single-Axis Tracker



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 consists of foundations that may include concrete posts approximately 18 to 24 inches (46 to 61 centimeters) in diameter and 6 to 8 feet (1.8 to 2.4 meters) deep, or driven posts (wide flange I-beam) approximately 6 to 8 inches (15 to 20 centimeters) across and 6 to 12 feet deep (1.8 to 3.7 meters). 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 24 inches (61 centimeters) deeper based on hydrologic conditions and in areas constructed using mowing, for depths of up to 14 feet (4.3 meters), depending on the type of foundation selected.

In this type of system, each tracker panel row could range from approximately 140 feet (43 meters) to 285 feet (87 meters) 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 only would be operated for a few seconds every 5 to 10 minutes during daylight conditions to move the panels in approximately 1-degree increments. The sound from the tracker motors would be less than 70 decibels at 3 feet (0.9 meter). This sound would equate to less than 30 decibels at 50 feet (15.2 meters).

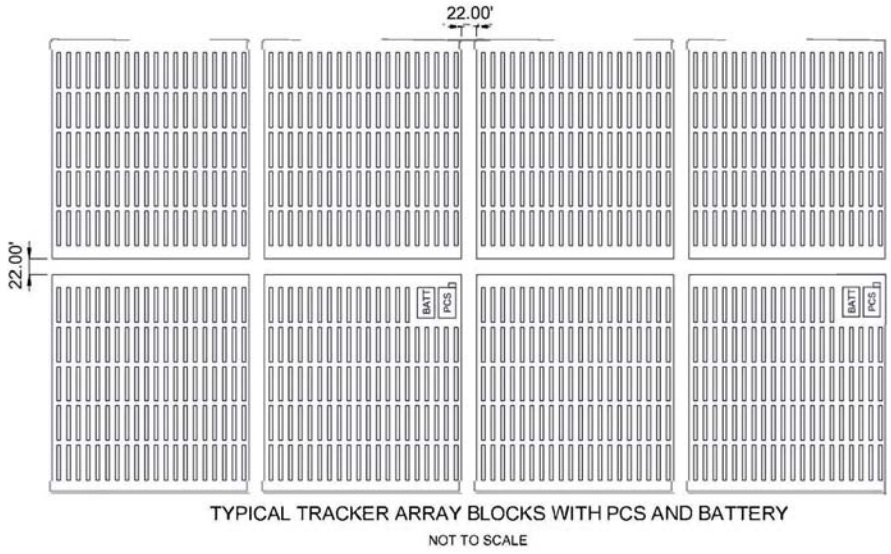
Approximately 20 tracker panel rows comprise one array block. Four array blocks are combined and connected to a power conversion station (PCS) and battery energy storage system (BESS), as shown below in Figure 4.

2.3.3 Meteorological Tower

A meteorological station would be installed at the northern boundary of the solar development area near the operations and maintenance (O&M) facilities to monitor wind speed and

communicate with the tracker units. Monitoring would allow for the trackers to rotate to a flat position to reduce the potential for damage during high wind activity[2]. The meteorological station tower would be monopole or lattice design and would not exceed 30 feet (9.1 meters) in height. The tower would require a small concrete foundation approximately 3 feet by 3 feet (0.9 meter by 0.9 meter) that would extend approximately 4 feet (1.2 meters) into the ground, depending on soil conditions.

Figure 4 Schematic of Solar Tracker Panel Rows Arranged in Array Blocks



2.3.4 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.

2.3.5 Electrical Collection System

2.3.5.1 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**.** The following diagram in Figure 5 shows how power is transferred from the solar array blocks to the grid,

[2] High wind activity is defined as sustained winds of 30 miles-per-hour (mph) (48 kilometers-per-hour [kph]) for one hour and/or frequent gusts of at least 45 mph (72 kph) are occurring or expected within the next 36 hours (NOAA, 2018).

followed by an explanation of the DC to alternating current (AC) power system. A PCS containing inverters and medium voltage transformers (as shown in the diagram), as well as other electrical equipment would serve approximately every four array blocks, as previously described. 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 (described in more detail, below) 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 (3 meters) wide by 20 feet (6.1 meters) long, on concrete pads. A photograph of a typical PCS is shown in Figure 6**.** The PCSs for the Gemini Project would be painted colors determined by the BLM.

Figure 5 Flow Diagram of Power Generation

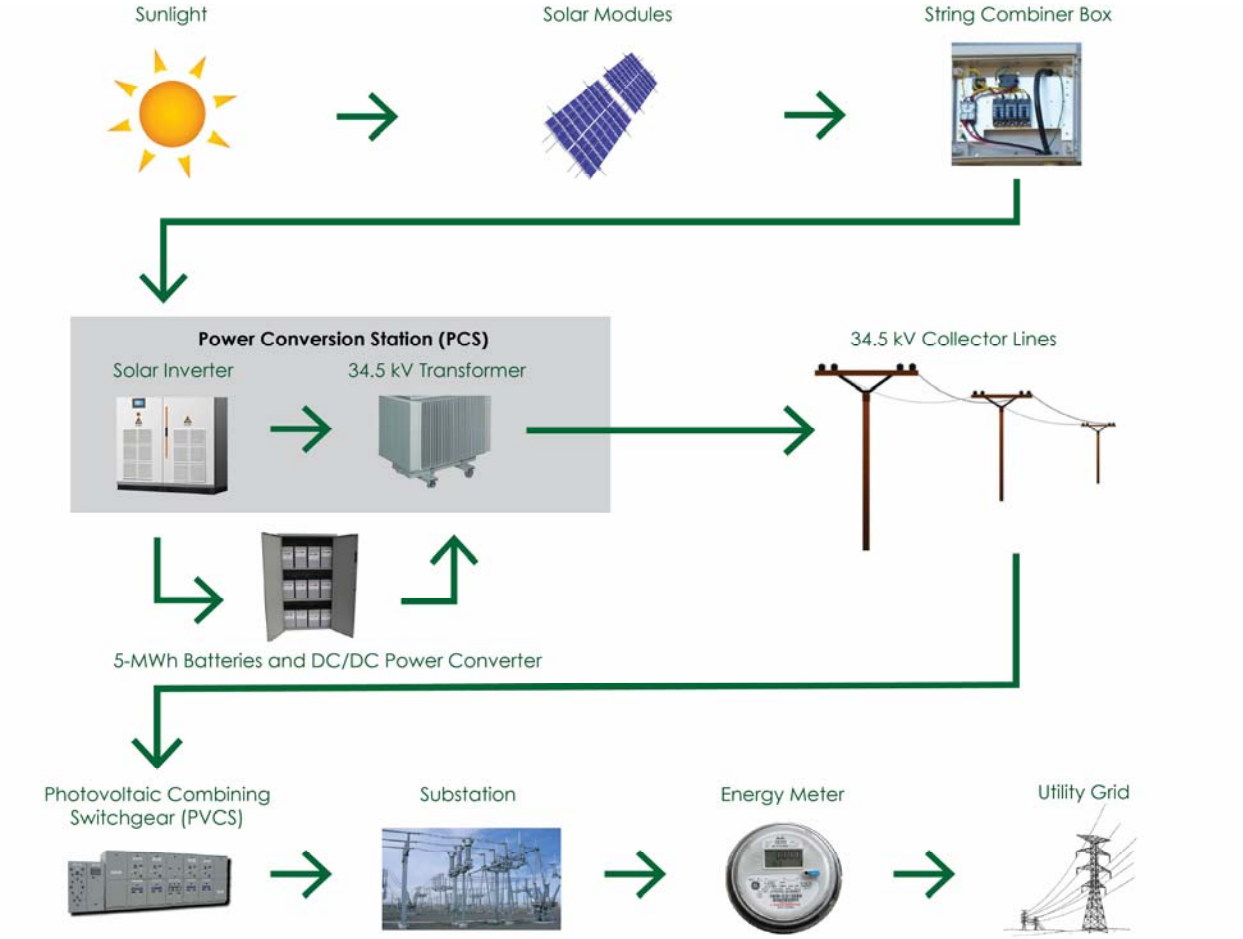


Figure 6 Photographs of a Typical Power Conversion Station/Inverter

Source: (Luminous Energy, n.d.)

Source: (Fotowatio Renewable Ventures , 2017)

2.3.5.2 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/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 to comply with the minimum burial depth in accordance with the National Electrical Code 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 threated 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 (typical of medium voltage installations in electric distribution systems). Poles would have a diameter of approximately 18 inches (46 centimeters) and a height of up to 75 feet (23 meters) 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 (6.1-meter) wide roads. Utility corridors would include 20 feet (6.1 meters) on one side of the road and 10 feet (3 meters) 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 (4.5 meters) wide.

2.3.5.3 Substations

Up to three substations would be developed within the Project site: two 2.4-acre (0.97 hectare) 230 kV substations and one 2.4-acre (0.97 hectare) 525 kV substation. All substations would be constructed based on applicable electrical safety codes. The substation would be separately fenced to provide increased security around the medium and high voltage electrical equipment. The substation area would include a transformer containment area, a microwave tower, a control house, and one or more transformers. Containment measures for all substation equipment would be provided in accordance with Environmental Protection Agency 40 Code of Federal Regulations (CFR) Part 112 and all applicable codes required by the local, state, and federal governing authorities. The transformer containment area would be lined with an impermeable membrane covered with gravel and would include a drain with a normally closed drain valve. 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. Substation layout is shown in Figure 8.

Figure 7 Example of a 34.5 kV Distribution Pole

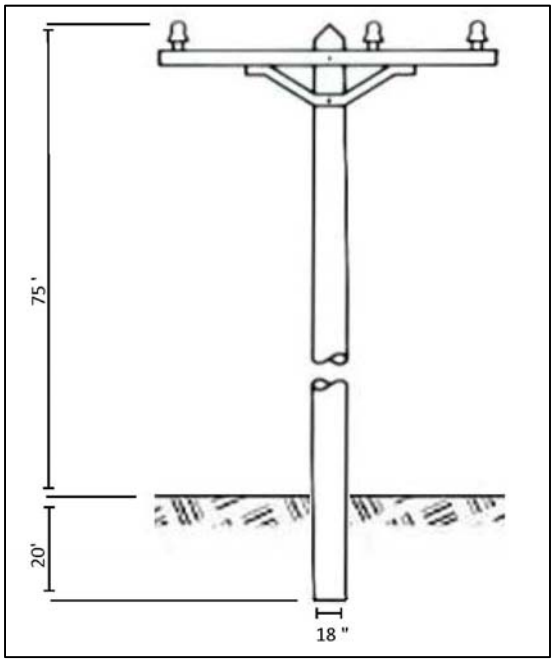
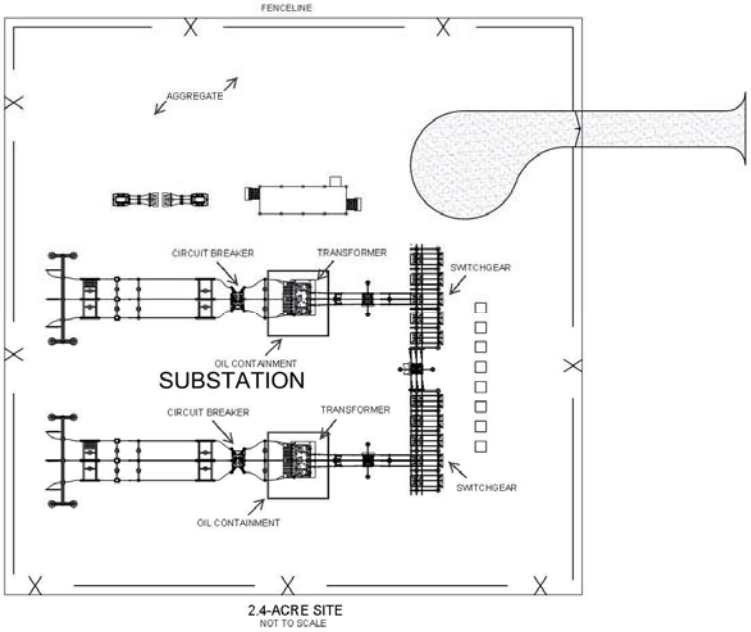


Figure 8 Example of a Similar Substation Layout

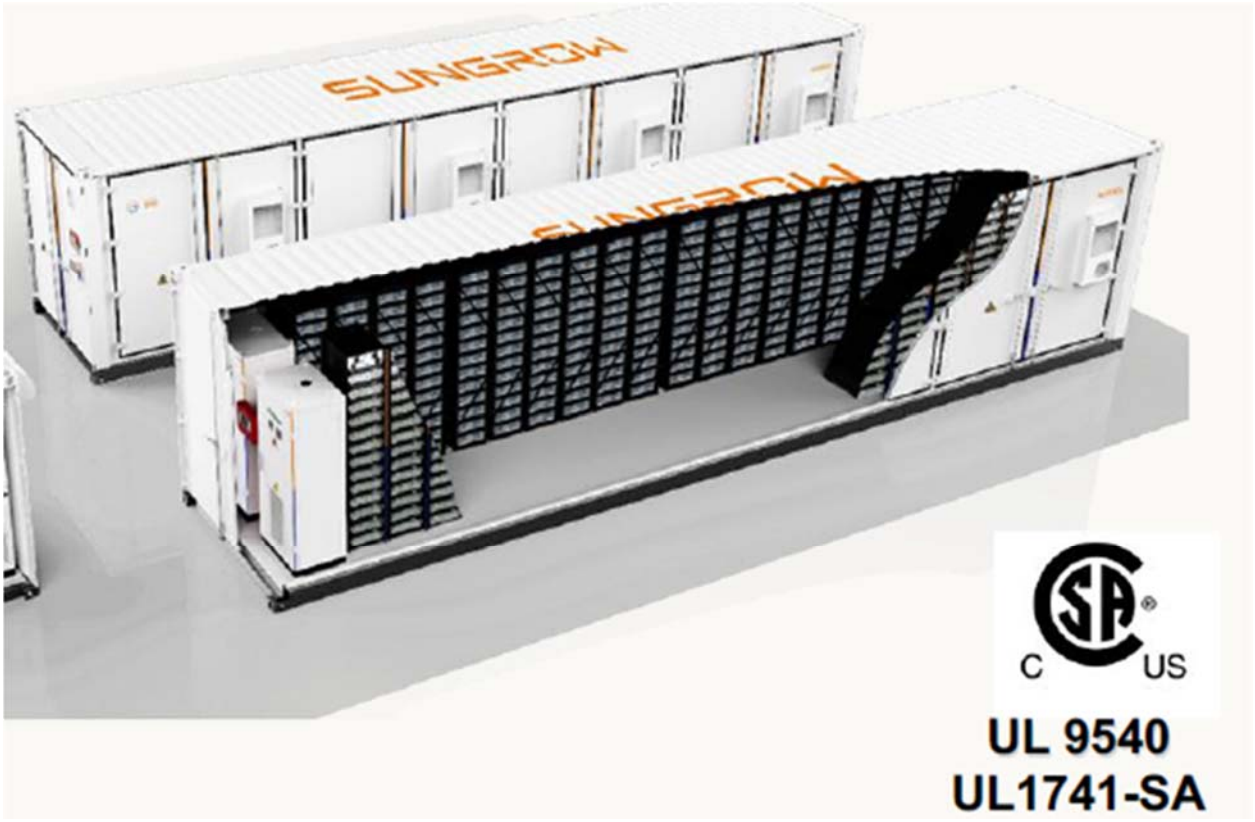


2.3.6 Energy Storage

A BESS would be located within the 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 (MWh) 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 brand and type of unit is not currently known. The battery systems would be enclosed in a container typically 40 feet (12.2 meters) long, by 9.5 feet (2.9 meters) wide, by 8 feet (2.4 meters) 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 (3-meter) long, 9.5-foot (2.9-meter) wide, and 8-foot (2.4-meter) long, adjacent to the battery container. The units would be painted colors determined by the BLM. 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 Photograph of a Battery Energy Storage System



2.3.7 Operations and Maintenance Facilities

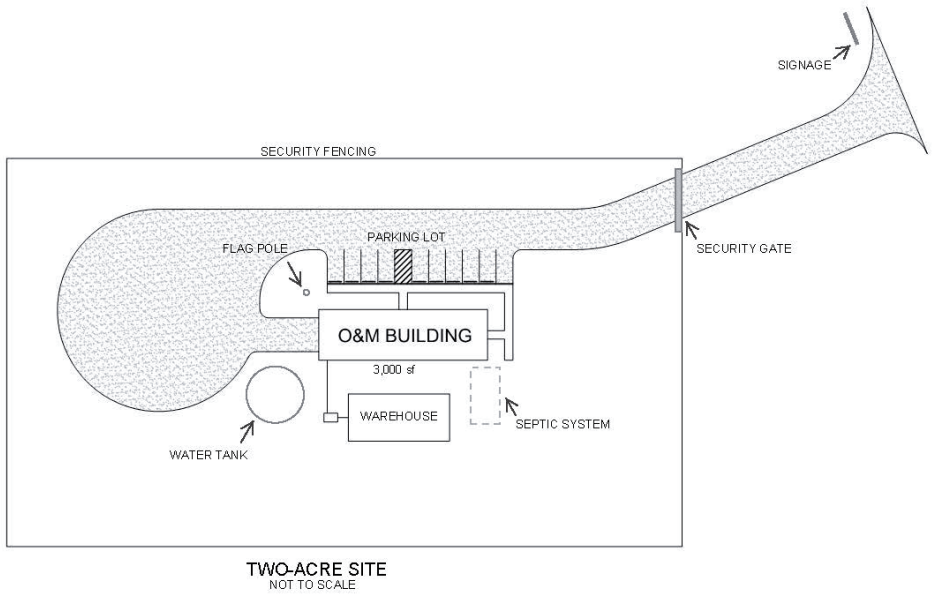
An approximately 2-acre (0.8-hectare) O&M area would be located within the site, as shown in Figure 10. The O&M area would accommodate a permanent O&M building, parking area, and other associated facilities such as a warehouse, aboveground water storage tank, septic system, security gate, signage, and flagpoles. Structures in the O&M area would be a maximum height of approximately 34 feet (10 meters). The permanent O&M building would house administrative, operation, maintenance equipment, and personnel. The building would be up to

approximately 3,000 square feet (279 square meters) in size and would have an adjacent parking area. Typical O&M buildings are 16 to 18 feet (4.9 to 5.5 meters) tall. Warehouse structures are typically up to 20 feet (6.1 meters) tall. The O&M building may include communication equipment, a storage and equipment area, offices, restrooms, and other features necessary for daily use. The design and construction of this building would be consistent with applicable Clark County building standards. The O&M building would be painted colors determined by the BLM.

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 by means of 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 are 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.

Figure 10 Operation and Maintenance Building Layout



2.3.8 Site Security and Fencing

Security at the Project site would be achieved by 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 6- to 7-foot-high (1.8- to 2.1-meter-high) chain link fence, installed on posts, with 1-foot-high (0.3-meter-high) three-strand barbed-wire at the top (the security fence in proximity to the gen-tie lines would be properly grounded). The fence would be treated with a chemical dulling agent that reduces the galvanized steel's potential for glare and reduces contrast. The perimeter security fencing would have a gap of approximately 8 inches (20 centimeters) between the bottom of the fence and the ground around mowed areas to allow desert tortoise to reenter and exit the area after construction. For the approximately 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) and, 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

Source: (PBC, 2018d)

2.3.9 Site Access and Internal Project-Related Roads

The access road for the Project during both construction and operation would be Valley of Fire Road, a paved, public roadway that crosses through the site. Valley of Fire Road connects to I-15 less than 0.5 mile (0.8 kilometer) west of the Project site.

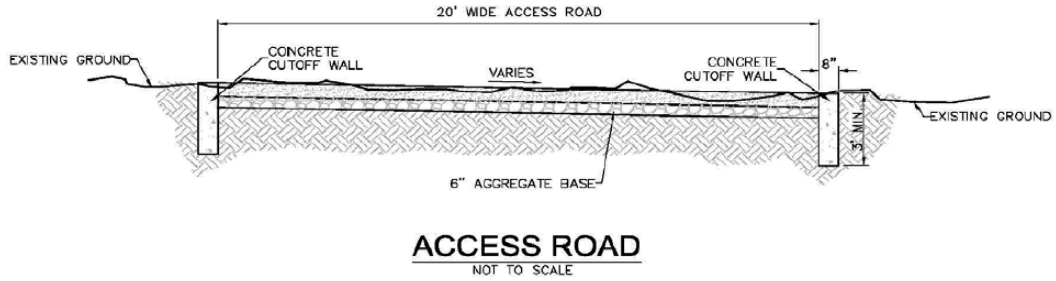
Project-related roads within the solar facility would include the perimeter road around all traditional development areas, and solar field internal access roads as described below. Around mowed areas, a north-south access road would be along one side of the Project site to connect east-west internal access roads. The roads would be constructed to allow access by maintenance and security personnel. The access road would be approximately 20 feet (6.1 meters) 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 to meet Project dust and flood control requirements.

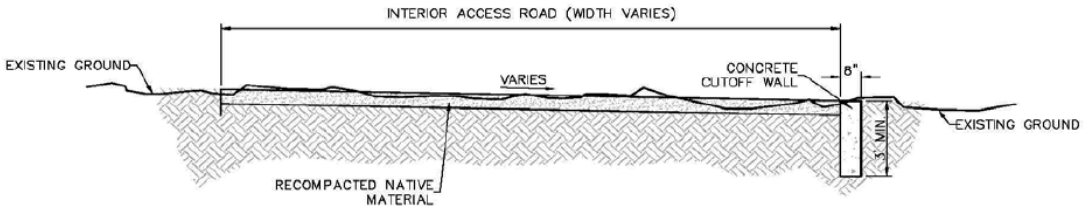
Within the solar field, new internal access roads would be built to provide vehicle access to the solar equipment (PV modules, inverters, transformers) for operation and maintenance activities. These internal access roads would be approximately 15 feet (4.6 meters) wide and approximately every 0.25 mile (0.4 kilometer) to 1.0 mile (1.6 kilometers) apart depending on whether the area is developed via mowing or by traditional development. Roads are more closely spaced (0.25-mile [0.4-kilometer] apart) 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 is needed (either due to high usage or necessary based on the need to facilitate drainage and minimize dust or erosion) approximately 4-6 inches (10 to 15 centimeters) of BLM-approved aggregate is applied over compacted native soils. The design standard for the roads and access ways within the solar field would be consistent with the amount and type of use they would receive. Concrete cut-off walls may also be installed at the edges of the road crossing within the drainages. The cut-off walls are installed in the edge of the road and do not require vegetation removal beyond what is already needed to construct the access road. The purpose of the cut-off walls is to prevent the access road materials from eroding during storm events. Without the cutoff walls, material can erode down the washes and additional heavy equipment would be needed to regrade the washes after major storms. The cut off walls reduce the need for continued maintenance of the road using heavy equipment. Cut off walls can be installed by hand or using small equipment, accessed from the internal road only, and the resultant concrete is 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 is 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. Relatively flat drainages would not likely need any cutoff wall, so the actual acreage impacted may be less. Cross sections of cutoff walls for internal access roads and connector access roads are shown in Figure 12 as well as a photograph of what a typical cutoff wall looks like at the surface (flush to the ground surface). Access roads would include a 10-foot (3-meter) buffer on one side of the road and a 20-foot (6-meter) 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.

Two concrete causeways 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. The causeway between development areas A and B would be 20 feet wide and approximately 60 feet long. Cross sections of the causeways are shown in Figure 13.

Figure 12 Cross Sections of Cutoff Walls and Photograph of Typical Cutoff Wall

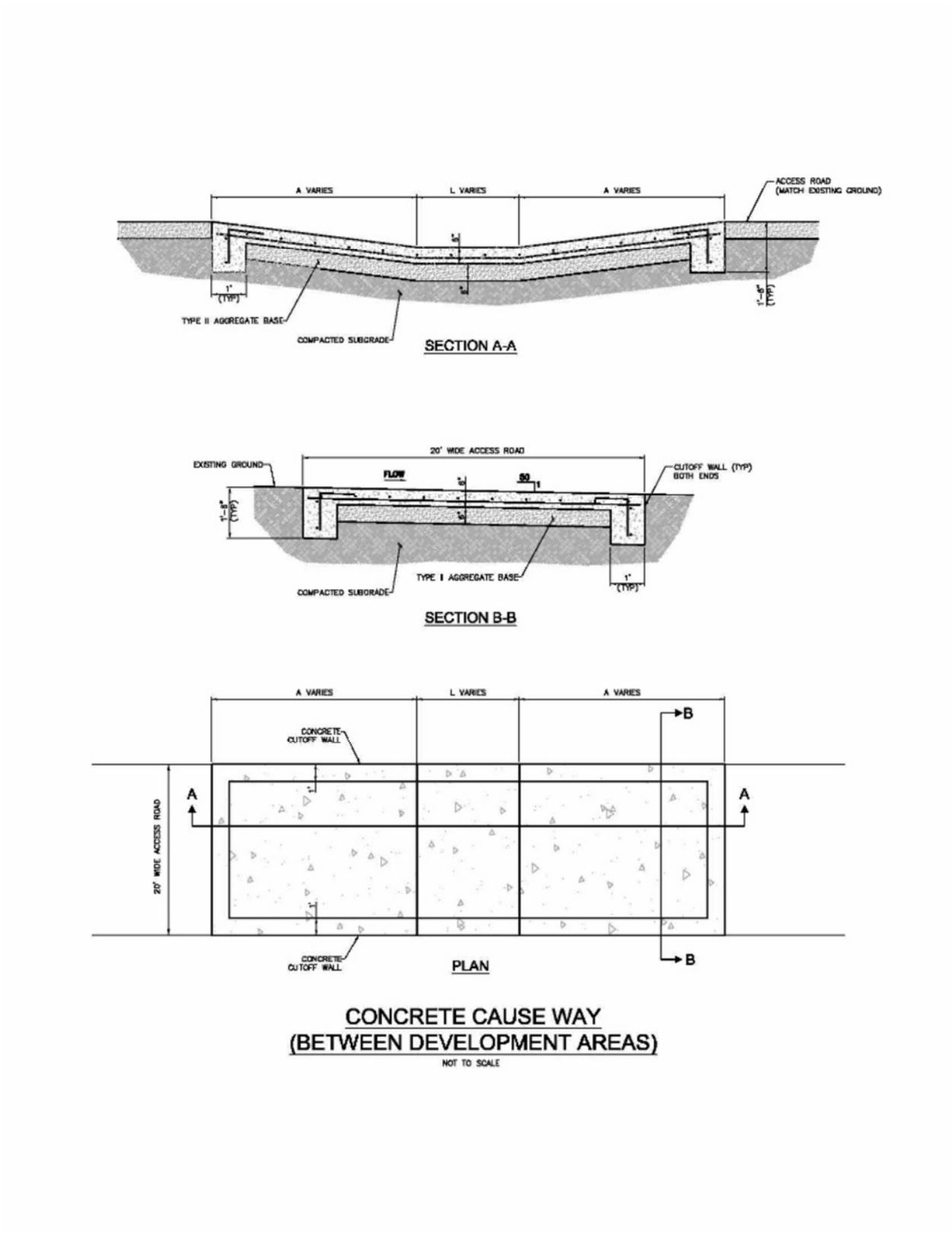


ACCESS ROAD
NOT TO SCALE



INTERIOR ACCESS ROAD
NOT TO SCALE

Figure 13 Cross Sections of Causeways between Development Areas

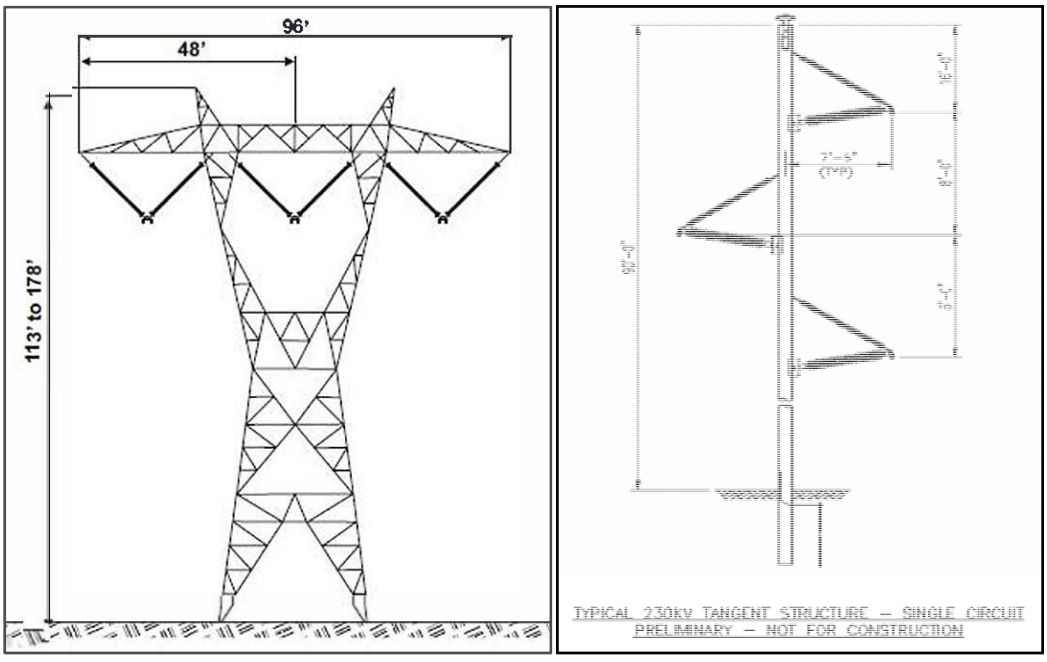


2.3.10 230 kV and 500 kV Gen-Tie Transmission Lines

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 similar to those found in the area (e.g., dull gray galvanized steel monopoles or lattice towers with cross-arm supports and insulators, the type to be decided by BLM at the ROD). Gen-tie support structures are not anticipated to be taller than 200 feet (61 meters) and spaced approximately 1,500 feet (457 meters) apart, depending on topography and clearance requirements. The structures would be installed on concrete pier foundations, up to 20 feet (6.1 meters) 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 from approximately 2 to 4.75 miles (3 to 7.6 kilometers) long, each, with a combined length of approximately 11.5 miles (18.5 kilometers). An estimated 48 transmission structures would be required. Figure 14 shows an example of typical transmission structures. A permanent 20-foot-wide (6-meter-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 (30.5 meters) for an individual 230 kV ROW, 200 feet (61 meters) for an individual 500 kV ROW, and 300 feet (91 meters) where the corridors are together. The overhead 230 kV and 500 kV lines would be installed per local and national electrical code requirements.

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 (BBCS) to address potential impacts to birds and bats during the construction, operations, and maintenance phases of the Project.

Figure 14 Typical Gen-Tie Support Structures for 230 kV and 500 kV Lines



2.3.11 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 (9 kilometers) to the southwest, with facility improvements at both stations (previously permitted)
- Access roads to service the above-referenced interconnection routes and facilities

2.3.12 Water

New appropriations are not likely available in the groundwater basin. 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).

2.3.13 Wastewater

Wastewater generated during construction would include sanitary waste from portable toilets and the O&M septic system (if feasible, or else 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.

2.3.14 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, and/or reduced lumen intensity. The Applicant would prepare a Lighting Plan for construction and operation of the Project.

2.3.15 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 is not feasible.

2.3.16 Waste and Hazardous Materials Management

The primary wastes generated at the Project during construction, operation, and maintenance would be nonhazardous solid and liquid wastes. The types of wastes and their estimated quantities are discussed below and summarized in Table 3. 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, the typical 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 operation and maintenance in the BESS and the battery-based UPS at each PCS. Spent lithium-ion batteries would be sent off-site to be recycled. One of the battery recycling programs available involves feeding the batteries into a mechanical processing stream that reduces them into an inert, non-hazardous shred product. This process removes and recovers battery electrolyte and electrolyte salt. Between 80 and 100 percent of battery constituent materials, including the hydrometallurgical are recovered during this process. 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 operation and maintenance activities. Table 4 lists the hazardous materials anticipated that would be stored and used on-site. Safety Data Sheets (SDSs) for each of these materials would be provided in the Spill Prevention and Emergency Response Plan.

Table 3 Wastes Potentially Generated by the Project

Waste	Origin	Composition	Estimated Quantity		Classification	Disposal
			Construction [1]	O&M [2]		
Scrap wood, steel, glass, plastic, paper	Construction activities	Normal refuse	1,500 tons (1,361 Tonnes)	N/A	Nonhazardous	Recycle and/or dispose of in industrial or municipal landfill
Scrap metals	Construction activities	Parts, containers	15 tons (13.6 Tonnes)	N/A	Nonhazardous	Recycle and/or dispose of in industrial or municipal landfill, wood pallets may be returned for re-use
Empty hazardous material containers	Operation and maintenance of plant	Drums, containers, totes [3]	N/A	<7 tons	Hazardous and nonhazardous solids	Containers <5 gal would be disposed as normal refuse. Containers >5 gal would be returned to vendors for recycling or reconditioning.
Waste oil filters	Construction equipment and vehicles	Solids	3,500 lbs (1,587.6 kilogram)	N/A	Used Oil	Recycle at a permitted Treatment, Storage, and Disposal Facility (TSDF)
Oily rags, oil sorbent excluding lube oil flushes	Cleanup of small spills	Hydrocarbons	Unknown	700 cubic feet (19.8 cubic meters)	Used Oil	Recycle or dispose at a permitted TSDF
Spent lead acid batteries	Construction machinery	Heavy metals	70 units	N/A	Hazardous	Store no more than 10 batteries (up to 1 year)–recycle off-site.
Spent batteries	Solar facility equipment	Lithium-Ion	N/A	10,000 lbs (4,536.9 kilogram)	Universal waste solids	Recycle or dispose off-site in accordance with manufacturer's specifications at the time of disposal
Waste oil	Equipment, vehicles	Hydrocarbons	Unknown	3,500 gallons (13.2 cubic meters)	Used Oil	Dispose at a permitted TSDF

Sanitary waste	Portable toilet holding tanks	Solids and liquids	80,000 gallons (302.8 cubic meters)	N/A	Nonhazardous liquid	Remove by contracted sanitary service

Notes:

1. Over the entire construction period.
2. Annually
3. Containers include <5-gallon (0.02-cubic meter) containers and 55-gallon (0.2-cubic meter) drums or totes

Table 4 Hazardous Material Use

Hazardous Material	Storage Description; Capacity	Storage Practices and Special Handling Precautions
Gas and Diesel Fuel (for equipment)	Fuel is likely to be stored in and dispensed from aboveground tanks with capacities in the range of 500 to 2,000 gallons (1.9 to 7.6 cubic meters).	Would be managed in accordance with the Spill Response and Emergency Response Plan.
Lubricants	Amounts on-site only sufficient to maintain fluid levels and perform preventive maintenance.	Would be managed in accordance with the Spill Response and Emergency Response Plan.
Mineral Insulating Oil	Carbon steel transformers; total on-site inventory of approximately 80,000 gallons (303 cubic meters).	Used only in transformers, secondary containment for each transformer would be managed in accordance with the Spill Response and Emergency Response Plan.
Batteries, lead acid based and/or lithium ion	Battery-based emergency back-up power and BESS at each of the PCS.	Sufficient cooling capacity to maintain ambient temperatures appropriate for the selected battery would be provided.
Propane	Generator-based emergency back-up power at each of the nine PCS shelters (or one centralized generator); tanks at PCS would be sized between 20 and 100 gallons (0.08 and 0.38 cubic meter) (or 1000 gallons (3.8 cubic meters) if one centralized tank).	Would be managed in accordance with the Spill Response and Emergency Response Plan.
Herbicide; Pesticide	Brought on-site by licensed contractor, used immediately.	No mixing would occur on-site and no herbicides would be stored on-site.

2.3.17 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 structures. Any fire that could occur would be contained within the structures, which would be designed to meet National Electric Manufacturers Association (NEMA) 1 or NEMA 3R IP44 standards for electrical enclosures (heavy duty sealed design to withstand harsh outdoor environmental conditions). 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 2-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 is 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. All fire protection system pumps must be shut off manually. Sprinkler systems, if required, would be installed O&M building and fire pump enclosure as required by National Fire Protection Association (NFPA) and local code requirements.

2.3.18 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.

2.3.19 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.

2.3.20 Vegetation Management

Native vegetation (i.e., creosote and burrobush) 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 mowing or trimming of vegetation to keep vegetation height to 18 to 24 inches (46 to 61 centimeters).

For both the areas developed with traditional methods and mowed areas, weeds would be managed in accordance with the Site Restoration Plan, that follows the Las Vegas Resource Management Plan (BLM, 1998), Noxious Weed Plan (BLM, 2006), and the interagency guidance Partners Against Weeds (BLM, 1996) for an active weed management program. A Pesticide Use Proposal (PUP) would be prepared and approved by the BLM prior to receiving a Notice to Proceed.

Herbicides would be one of the methods employed to control weeds throughout the site (BLM, 2017b). The PUP prepared for the Project would provide the exact specifications involve 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 Manual 9011: Chemical Pest Control and BLM Handbook H-9011-1: Chemical Pest Control, 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, 2017b), which is tiered from the PEIS for Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States (BLM, 2007) . The Applicant would implement a Site Restoration Plan and 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 (SOPs) from the Vegetation Treatments PEIS (BLM, 2017b) would be incorporated into the Integrated Weed Management Plan and implemented. The allowed herbicides in mowed areas are identified in the Southern Nevada District Office Programmatic Biological Opinion (File No. 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*) (PBC, 2018a). 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.

2.4 CONSTRUCTION

2.4.1 Overview

Construction is expected to occur over approximately 28 months. 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 phases would overlap. Construction would include the major activities of mobilization, construction grading and site preparation, installation of drainage and erosion controls, PV panel/tracker assembly, and solar field construction. The Applicant is planning to commence construction in the fourth quarter of 2019, if feasible and after issuance of the ROD and a Notice to Proceed. Some aspects of construction would need to be coordinated with NV Energy, including but not limited to interconnection to Crystal Substation and construction power.

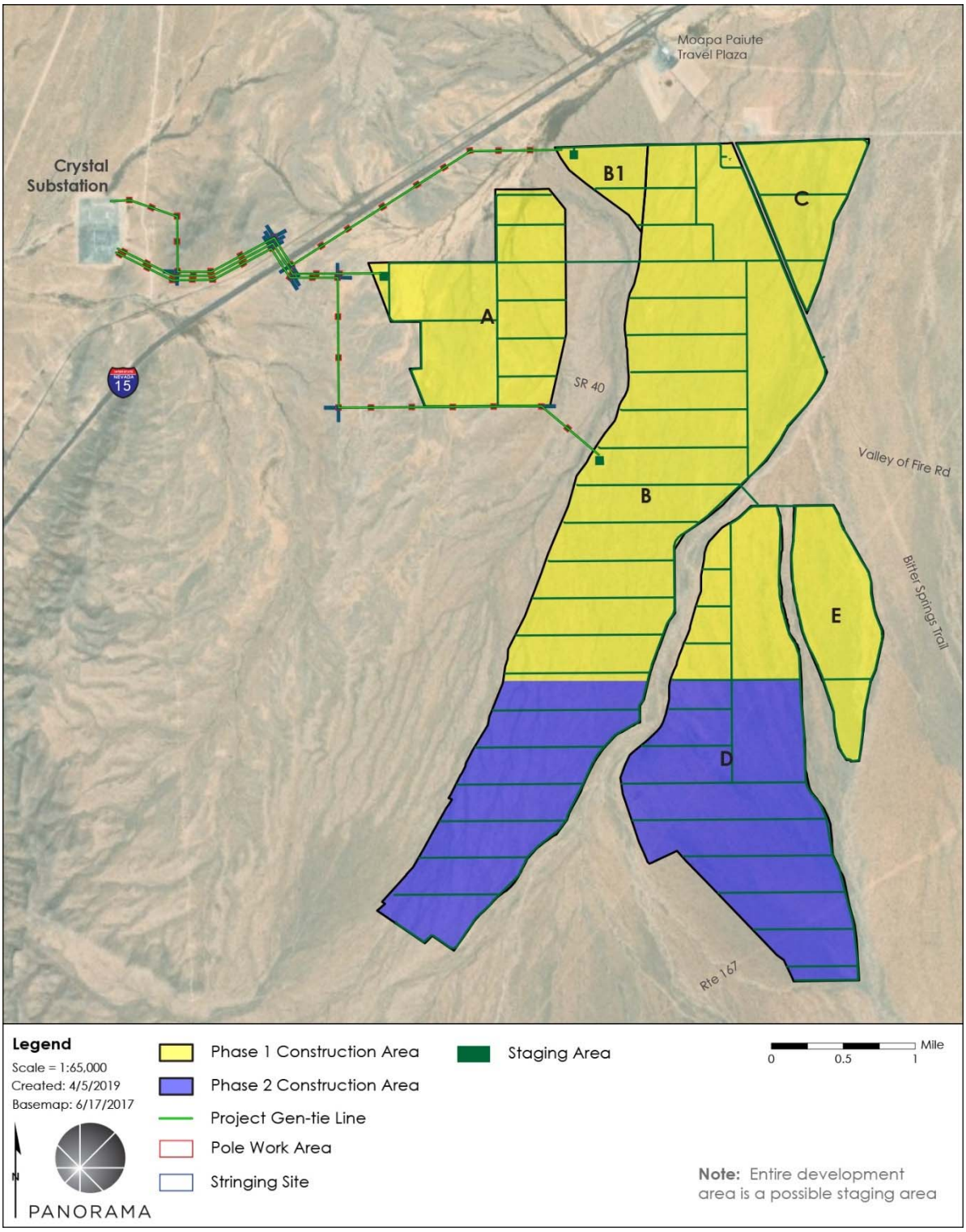
Construction would primarily occur in two phases, as shown in Figure 15. The fencing for Phase I would be installed in early 2020, and the fencing for Phase II would be installed in the fall of 2020, before tortoise translocation from the Phase I fenced areas.

2.4.2 BMPs Used During Construction

Several BMPs would be employed during construction of the Project to minimize environmental degradation. These BMPs include, but are not limited to:

- 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 originally 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 (PBC, 2018b) 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

Figure 15 Construction Phasing and Staging Areas



Sources: (Clark County Nevada GIS Management Office, 2018; Louis Berger Group, 2018; USDA-FSA-APFO, 2017)

- 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 plant to minimize the spread of weeds during construction
- Minimizing soil-disturbing activities on wet soils

2.4.3 Desert Tortoise Clearance Surveys and Translocation

Presence/absence surveys for desert tortoise were conducted on the Project site in the fall of 2017 and spring of 2018 (PBC, 2018b; PBC, 2018c) (refer to Appendix A for survey reports). A translocation plan that details all activities associated with clearance and translocation is appended to this BA (Appendix B). 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 (Phase I areas as shown in Figure 15). All tortoises found would receive health assessments according to the guidelines in the USFWS's 2016 *Health Assessment Procedures for the Mojave Desert Tortoise (Gopherus agassizii): A Handbook Pertinent to Translocation* (USFWS, 2016). 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 can be easily relocated for future translocation. Tortoises that are too small for transmitters would be captured and released immediately with adult tortoises. 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 in accordance with the Desert Tortoise Translocation Plan. Fencing for Phase II of Project construction would be installed prior to translocation of tortoises from Phase I areas (Figure 15). Only approved biologists would conduct these activities. Table 5 identifies the timeline for tortoise clearance for the Project.

Table 5 Tortoise Clearance Timeline for Initial Construction in 2020

Task Name	Duration	Start	Finish
Phase I			
USFWS Issues BO	140 days	5/15/2019	10/2/2019
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
USFWS 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
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
USFWS 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	--

2.4.4 Temporary Construction Workspace, Laydown, and Mobilization Areas

Temporary construction workspace, laydown, and mobilization areas would be established after tortoise clearance, as shown in Figure 15. 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), that 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 5 acres (2 hectares) 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 (61 by 61 meters). These areas would be required for staging equipment and materials for foundation construction and tower installation.

2.4.5 Site Preparation

2.4.5.1 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 and marked. The site then would be prepared for use. Existing vegetation removal and grading in areas where traditional development methods would be used would be minimized to the extent practicable. Mowed areas would be prepared by mowing vegetation. Site preparation techniques are described below by method.

Prior to construction, the limits of construction disturbance areas would be determined by surveying, and where necessary, flagging and staking. Where necessary, the limits of the gen-tie ROW also would 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, also would be staked and flagged. The locations of underground utilities would be located, and then 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 biologists would be retained to survey for and relocate desert tortoise

and perform other sensitive species removal and mitigation 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 that would be presented for BLM review and approval. Commercially obtained or on-site materials would be used.

2.4.5.2 Traditional Methods of Construction

Construction would occur using methods typical for a utility solar development in the Project region, also referred to as "traditional construction methods" or "traditional methods" over 35 percent of the site, as shown in Figure 2. These methods include "disk and roll," where the vegetation is crushed and mixed into the soil using deep disking, then the soil is compacted so that construction equipment can safety traverse the site to construct the solar arrays and infrastructure. The disk and roll technique would be used generally to prepare the surface of the solar field for post and PV panel installation. The disk and roll technique utilizes conventional farming equipment to prepare the site for construction. Typical farming equipment includes 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 burrobush) are typically destroyed using this method. The areas are compacted after disking, which allows for safe access of construction vehicles across the development area. 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 approximately 1 percent maximum slope in either direction. The substation interior would be covered with a BLM-approved aggregate surfacing for safe operation.

2.4.5.3 Mowed Areas

The permanent security fencing would be installed with a gap between the fence bottom and the ground of approximately 8 inches (20 centimeters). 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 tortoise 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 (61 centimeters), to allow for panel construction. Vegetation may be trimmed to no less than 18 inches (46 centimeters) 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 allows extended reach across multiple solar array rows. A flail-type mower mounted on skids that are mounted on a low-ground pressure tractor, approximately 5 to 6 psi (34 to 41 kilopascals), 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 will depend on the equipment used and feasibility in the field. All efforts and planning will 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, if needed, to place equipment such as the PCSs and battery containers. These vehicles typically have a footprint of approximately 4 to 5 feet (1.2 to 1.5 meters) per track. One vehicle can likely access two solar array rows at a time so approximately 8 to 10 feet (2.4 to 3 meters) of vegetation would be crushed every approximately 40 feet (12 meters) (depending on the distance between rows) in the mowed areas. From three to 10 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, as needed. 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, where possible 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 7 acres (2.8 hectares) 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.

2.4.5.4 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).

2.4.6 PV Solar Array Assembly and Construction

Prior to any construction in PV equipment areas, the clearance and site preparation steps for those areas 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 2 to 3 feet (0.6 to 0.9 meter) wide and 2 to 3 feet (0.6 to 0.9 meter) 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.

2.4.7 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 to properly operate, including T-1 internet cables, fiber optic, microwave, and telephone. All communications would be installed during electrical construction.

2.4.8 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 (61-meter by 61-meter) 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 comprise up to 36 acres (15 hectares) of land. In general, little to no grading is expected to be required for these areas. Typical equipment expected 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 soils' 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 (1.2 to 2.1 meters) in diameter, and in depth from 12 to 30 feet (3.7 to 9.1 meters).

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 10 percent of the pole height plus 2 feet (0.6 meter). Installation of wood poles is anticipated to require auguring holes approximately 2 feet (0.6 meter) in diameter and 8 feet (2.4 meters) 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, as necessary, 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 (2.4 to 3.7 meters) long and can be longer if needed by joining multiple rods. For the 34.5 kV wood poles, a 3-foot (0.9-meter) square by 2-foot (0.6-meter) deep area would be excavated to expose the ground rod for connection to the plant's grounding grid.

2.4.9 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, but not limited to 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 (3 meters). A copper grounding grid designed to meet the requirements of Institute of Electrical and Electronics Engineers (IEEE) 80, "IEEE Guide for Safety in AC Substation Grounding," 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 6 inches (15 centimeters) 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.

2.4.10 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 and/or BLM-approved palliatives, as previously discussed.

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.

2.4.11 Water Sources and Storage for Construction

A total of approximately 2,000 acre-feet (246.7 hectare-meters) 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 trucking the water to the Project site where it would then be pumped to up to four 1-acre (0.4 hectare) storage ponds across the construction site (Figure 2). The storage ponds would be encircled by an earthen berm comprised of on-site material fill, with a liner and would be approximately 3 feet (0.9 meter) deep. Each pond would hold approximately 1 million gallons (0.4 hectare-meters) of water. The water would be pumped from the O&M building via a diesel generator pump or an existing distribution drop, through temporary 8-inch (20-centimeter) 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 (15,142 liter) capacity trucks would be needed to deliver water to the Project site at the O&M building, assuming a 2-year construction schedule. The trucks would turn off I-15 onto Valley of Fire Road to access the site through the main entrance near the O&M building. Following construction, the ponds would be removed, and solar panels installed in the graded area.

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 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
- Alternatives as approved by the BLM

2.4.12 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 given 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 7 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 night-time activity for installation, service or electrical connection, inspection, and testing activities.

A preliminary construction schedule for the Project is shown in Table 6 and Figure 15. The table shows how construction would be phased by development area.

Table 6 Construction Schedule

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

Activity	Development Area	Duration	Timeframe
	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
	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

Activity	Development Area	Duration	Timeframe
	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
	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 generally 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

2.4.13 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.

2.4.14 Construction Power

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

2.5 OPERATION AND MAINTENANCE (O&M)

The facility would operate 7 days a week using automated facility controls and monitoring systems with SCADA control systems. Nineteen people would be directly employed on the Project site. It is expected 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 are 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 operation and maintenance program, typical of a project this size, would be implemented to control the quality of operation and maintenance. The frequency and type of maintenance is described in Table 7. 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.

Approximately 20 acre-feet (2.5 hectare-meters) of water per year is estimated as needed for Project operation and maintenance. 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 (15,142 liter) 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 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 Project is expected to have an annual equivalent plant availability of 92 to 98 percent. It would be possible for plant availability to exceed 98 percent for a given 12-month period.

Table 7 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 (61 centimeter) 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 (61 centimeters). 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
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

Equipment	Maintenance Interval	Task
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 terms and conditions of the Project-specific USFWS BO

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, when necessary.
3. Only in the case of a transmission system disconnect would the facility encounter a full shutdown.

Dust during operations and maintenance would be controlled and minimized by applying water and/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 mowed or trimmed to a height of 18 to 24 inches (46 to 61 centimeters). 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. It is anticipated that 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 maintenance.

2.6 DECOMMISSIONING AND RESTORATION

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 5 years prior to planned permanent closure and a Final Closure Plan would be prepared. The ROW requested from BLM is anticipated to be at least 30 years in duration. The ROW may, if granted, be extended, subject to the discretion of the BLM. The extension of the ROW may be subject to additional review under the NEPA.

The Decommissioning Plan addresses dismantling, and removal of Project components and reclamation of areas disturbed over the life of the Project. Reclamation would primarily 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 to be implemented over the life of the Project.

2.7 MANAGEMENT PLANS, MINIMIZATION MEASURES, AND COMPENSATORY MITIGATION

2.7.1 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 PUP. PUPs are subject to NEPA analysis and environmental compliance requirements for pesticide use on BLM managed public lands.
- Bird and Bat Conservation Strategy, including Eagle Management Plan
- Environmental Construction Compliance Monitoring Program
  - Compliance monitoring and mitigation personnel
  - Communication workflows
  - Reporting and documentation
  - Variance process
  - WEAP
- Decommissioning Plan

2.7.2 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 USFWS 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 and comply with the terms and conditions of the USFWS Biological Opinion (BO) issued for the Project.

2.7.2.1 Construction Minimization Measures

Design Measures

- 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

- **Authorized Desert Tortoise Biologists.** The Applicant will employ Authorized Biologists and desert tortoise monitors to ensure compliance with protective measures for the desert tortoise. Use of Authorized Biologists and desert tortoise monitors will be in accordance with the most up-to-date USFWS 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 by the BO to exclude monitoring. The current guidance is entitled Desert Tortoise – Authorized Biologist and Monitor Responsibilities and Qualifications (USFWS, 2013a). 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.

- **Approval of Authorized Biologists**. The Applicant will provide the credentials of all individuals seeking approval as Authorized Biologists to the USFWS for approval at least 30 days prior to the time they must be in the field.
- **Field Contact Representative.** The BLM and the Applicant will designate a Field Contact Representative (FCR) who will be responsible for overseeing compliance of the Terms and Conditions 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.
- **Biological Monitors.** 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). 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 BO 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.
- **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. Personnel will be instructed to check under vehicles before moving them as tortoises often seek shelter under parked vehicles. Personnel will also be instructed on the required procedures if a desert tortoise is encountered or observed within the proposed Project area. 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

- **Construction Reporting Requirements**. Reports are required quarterly during the duration of construction. 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).

Flagging, Fencing, and Clearing

- **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.

- **Desert Tortoise Fencing Requirements**. The exclusion fence will follow current fence specifications established by the USFWS (2009a). 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 2 days of observing the damage and be reported to the Service to determine whether additional measures are necessary.

- **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 USFWS requirements (USFWS, 2013b) and will be constructed prior to desert tortoise clearance in those areas. Temporary fencing along mowed areas may be bent at the bottom and buried or tacked down if the final surface disturbance would be less than trenching in the fence. 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 the 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, as shown in Figure 2. 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 of 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.

  Shade structures (PVC or equivalent half pipe) will be placed every 250 meters along the fence perimeter to provide shade for any tortoises pacing/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 (36

centimeters) or greater for the larger shelters and 6 to 8 inches (15 to 20 centimeters) for the smaller ones. Tubes should be cut into 2- to 3-foot (0.61- to 0.91-meter) length and cut horizontally. Each shade structure would have soil piled on top to keep them from being blown away and to assist with thermoregulation within the shelter.

- **Fence Monitoring.** During the tortoise activity seasons, all new fences will be checked twice a day for the first 2 weeks after construction, or the first 2 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 2 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 2 days of observing the damage and be reported to the USFWS 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.
- **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 main tortoise activity periods – April, May, September, and October (USFWS, 2018). All handling of desert tortoises and their eggs will be conducted solely by Authorized Biologists in accordance with the most current USFWS-approved guidance and the Desert Tortoise Translocation Plan (USFWS, 2013b). All clearance and removal/ translocation techniques are detailed in the USFWS- and BLM-approved Desert Tortoise Translocation Plan. Additional Terms and Conditions in the BO will be implemented.

  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.
- **Desert Tortoise Translocation Monitoring**. If unforeseen circumstances prevent translocation from occurring immediately following the issuance of this Biological Opinion, 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 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 for the project 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 B).

- **Desert Tortoise Clearance along Linear Facilities and Outside Work Areas**. For all linear facilities, pre-construction surveys will include a survey belt 90 feet (27 meters) 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 would increase possible vandalism or predation). Desert tortoises will be monitored during all work activities outside of fenced areas. Temporary fencing may be used in place of or with monitors to keep tortoises safe. On the linear facilities (including fencing), tortoises can be moved at any time of year, within the temperature constraints identified in the USFWS's translocation guidance (USFWS, 2018).

  Outside construction work areas along linear facilities, all potential desert tortoise burrows and pallets within 50 feet (12 meters) 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.

Vegetation Trimming in Mowed Areas

- **Vegetation Mowing**. In areas of the facility to be constructed using mowing, the vegetation will be cut initially to 18 to 24 inches (46 to 61 centimeters) in height. Mowing would 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.

Protection Measures During Construction

- **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 would 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.
- **Speed Limits and Signage.** The Applicant will enforce a 20 miles per hour (mph) (32 kilometers per hour [kph]) 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 (24 kph) 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 USFWS in the BO.

- **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 would 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 would be designed to discourage potential nest sites.
- **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 (8 centimeters) in diameter if they are stored less than 8 inches (20 centimeters) 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.
- **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 USFWS. 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.

- **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

- **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.
- **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 would 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 USFWS. The typical herbicide application rate rather than the maximum application rate will be used where this rate is effective.
- **Raven Control.** A Raven Control Plan will be prepared for the Project. 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.
- **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.
- **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.
- **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 would 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 would be implemented, the retention of plant bases, reduced soil disturbance, and less disturbance to soil crusts/desert pavement would 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 would preclude damage to the adjacent mowed vegetation would be used. In the event that dust is problematic in mowed areas, an adaptive management approach will be used to minimize impacts from fugitive dust.

2.7.2.2 Operation and Maintenance Minimization Measures

Desert tortoise will be present during operation and maintenance 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.

Biological Monitoring and Training

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

  Tortoises found above ground during operation and maintenance 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 would 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.

- **Annual Reporting Submission Requirements**. Reports are required annually during operations and maintenance 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 annual report by February 1, 2023, 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.
- **Monitoring of Translocated Tortoises**. Post-translocation tortoise monitoring will occur in accordance with the Translocation Plan and long-term monitoring plan.

Protection Measures During Operations

- **Speed Limits and Access.** Speed limits within the mowed Project areas, along transmission line routes, and access roads will be restricted to 15 mph (24 kph) will be maintained during the periods of highest tortoise activity (March 1 through November 1) and a limit of 20 mph (32 kph) during periods of lower tortoise activity. Vehicles in mowed areas of the development will remain only on designated roads.
- **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 would be removed or stored in a secure or covered location. Structures would be designed to discourage potential nest sites.
- **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.
- **Vegetation Trimming**. Vegetation in the mowed areas of the solar arrays will be periodically trimmed to maintain a maximum height of 18 to 24 inches (46 and 61 centimeters). Trimming will be conducted from existing roads with workers parking and traveling on-foot, using hand-held trimmers. Mowing would only occur in the solar array areas where vegetation can affect the panels, equipment, or access.
- **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 USFWS.

2.7.2.3 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.

2.7.3 Desert Tortoise Conservation Fees

In order to further offset adverse effects from the proposed Project to the threatened desert tortoise, the Applicant will pay a desert tortoise remuneration fee of $902 per acre to the BLM. BLM will reduce the fee by 50 percent for the 4,460 acres where the vegetation is being mowed, for a total of $2,011,460 (4,460 X 451). The reduction in the fees 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 other permanent disturbance, totaling approximately 2,603 acres, the fee would not be reduced, for a total of $2,347,906. Because of the need for substantial monitoring from the project's effects on the translocated desert tortoise, BLM further proposes this amount be applied to the Long-Term Monitoring Plan cost that are still undetermined and will be established prior to the completion of the Section 7 consultation with the USFWS.

BLM will monitor the construction to ensure that all minimization measures in the BA 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 USFWS to implement additional measures to reduce those adverse effects, including adjustments to the discounted remuneration.

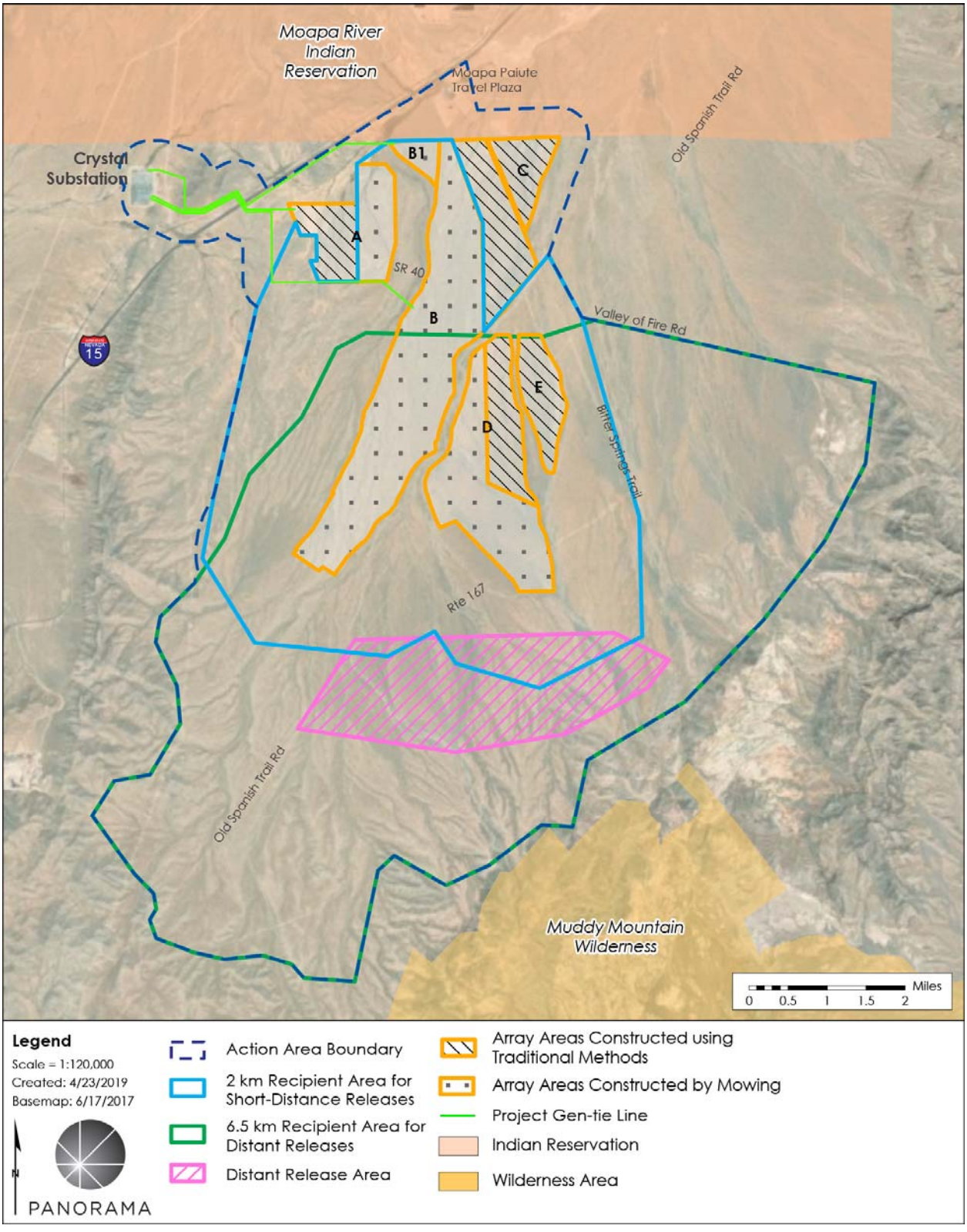
3 ACTION AREA AND EXISTING CONDITIONS

3.1 DEFINITION OF THE ACTION AREA

The implementing regulations for Section 7(a)(2) of the ESA define the "Action Area" as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02). 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
- The area of indirect impacts where sensitive or federally protected species would experience indirect disturbance 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 16:
  - **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. USFWS (2018b) has determined that tortoises moved within 1,640 feet (500 meters) of their capture location may move an average of 0.9 miles (1.5 kilometers). The Project's Action Area would therefore extend to 1.2 miles (2 kilometers), where tortoise habitat is present, beyond the mowed areas of the solar field. This area is shown in blue in Figure 16.
  - **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 16); the average maximum extent that these tortoise would move from the distant translocation site has been determined by USFWS (2018) to be 4.0 miles (6.5 kilometers) within suitable habitat, shown in green in Figure 16.

Figure 16 Action Area



Sources: (Louis Berger Group, 2018; USDA-FSA-APFO, 2017; Clark County Nevada GIS Management Office, 2018)

3.2 PHYSIOGRAHY, TOPOGRAPHY, AND CLIMATE

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 (617 to 747 meters) 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 (21 kilometers) away. The area has an annual rainfall average of 4 to 8 inches (10 to 20 centimeters) and a mean annual temperature between 60 to 70 degrees Fahrenheit (15.5 to 21.1 Celsius).

3.2.1 Soils

The soils in the Action Area are derived from both aeolian and alluvial deposition of limestone and dolomite parent material. The majority of the site consists of either sandy-gravelly loams or fine sand with gravelly substratum. According to the USDA Natural Resource Conservation Service (NRCS) online Web Soil Survey, the Gemini Project Action Area consists of nine soil types: (1) AOB - Arada fine sand, gravelly substratum, (2) ASC - Arada fine sand, hardpan variant, (3) BD – Badland, (4) BHC – Bard gravelly fine sandy loam, (5) BOB – Bard-Rough broken land association, (6) Gs – Glendale loam, (7) MOB – Mormon Mesa fine sandy loam, (8) SP – Spring silty clay loam, and (9) THB – Tonopah gravelly sandy loam (USDA NRCS, 2017). The description of the soil types along with the breakdown by site location are shown in Table 8 and Figure 17.

Table 8 Soil Types Present Within the Project Site

Map Unit Symbol	Percent of Site	Map Unit Name	Description	Solar Field (Areas)
AOB	19.1%	Arada fine sand, gravelly substratum	0-4% slopes, fine sand (0-24 inches [0-61 centimeters]), stratified extremely gravelly loamy coarse sand to extremely gravelly fine sandy loam (24-60 inches [61 to 152 centimeters]), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	D, E
ASC	1.7%	Arada fine sand, hardpan variant	2-8% slopes, fine sand (0-30 inches [0-76 centimeters]), cemented material (30-34 inches [76-86 centimeters]), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	B, D
BD	1.2%	Badland	On fan remnants	A

Map Unit Symbol	Percent of Site	Map Unit Name	Description	Solar Field (Areas)
BHC	30.8%	Bard gravelly fine sandy loam	2-8% slopes, gravelly fine sandy loam (0-3 inches [0-7 centimeters]), fine sandy loam (3-19 inches [7-48 centimeters]), cemented material (19-36 inches [48-91 centimeters]), well drained, fan remnants, and non-saline to very slightly saline	A, B, B1, C, D
BOB	14.2%	Bard-Rough broken land association	2-4% slopes, very gravelly fine sandy loam (0-5 inches [0-13 centimeters]), fine sandy loam (5-19 inches [13-48 centimeters]), cemented material (19-36 inches [48-91 centimeters]), well drained, fan remnants, and non-saline to very slightly saline	A, B, B1
Gs	1.0%	Glendale loam	0-2% slopes, loam (0-9 inches [0-23 centimeters]), stratified very fine sandy loam to silty clay loam (9-60 inches [23-152 centimeters]), well drained, flood plains, and strongly saline	A
MOB	1.5%	Mormon Mesa fine sandy loam	0-8% slopes, fine sandy loam (0-16 inches [0-41 centimeters]), cemented material (16-60 inches [41-152 centimeters]), well drained, fan remnants, and non-saline to very slightly saline	B, B1
SP	9.5%	Spring silty clay loam	0-2% slopes, silty clay loam (0-5 inches [0-13 centimeters]), clay loam (5-11 inches [13-28 centimeters]), gypsiferous material (11-43 inches [28-109 centimeters]), moderately well drained, fan remnants, and strongly saline	A
THB	20.9%	Tonopah gravelly sandy loam	0-4% slopes, gravelly sandy loam (0-6 inches [0-15 centimeters]), extremely gravelly sand (6-60 inches [15-152 centimeters]), excessively drained, and non-saline to slightly saline	A, B, B1, C

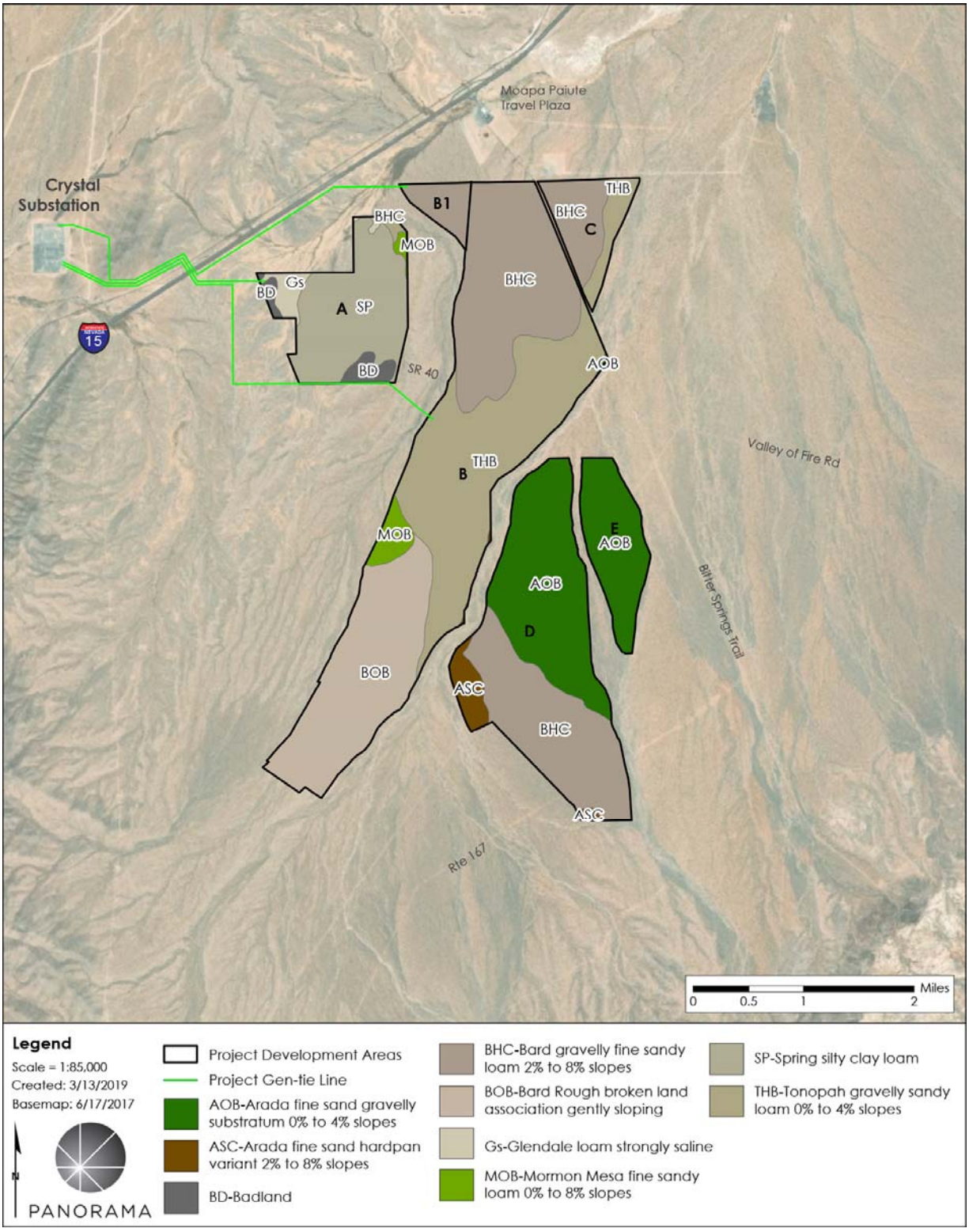
3.2.2 Vegetation

The vegetation community on the Project site consists predominantly of Creosote (*Larrea tridentata*)-White Burrobrush (*Ambrosia dumosa*) Shrubland Alliance, with Catclaw Acacia (*Senegalia greggii*) Shrubland Alliance in some of the larger washes (Baldwin, et al., 2012; Peterson, 2008). Along the western boundary of the Action Area, the vegetation community transitions from Creosote-White Burrobrush Shrubland Alliance to predominantly Shadscale (*Atriplex confertifolia*) Shrubland Alliance with pockets of Big Galleta (*Hilaria rigida*) Herbaceous Alliance (Baldwin, et al., 2012; Peterson, 2008). A vegetation map is shown in Figure 18 and the vegetation communities on the site are quantified in Table 9.

Table 9 Quantified Vegetation Types for Gemini Solar Facility and Gen-Tie Lines

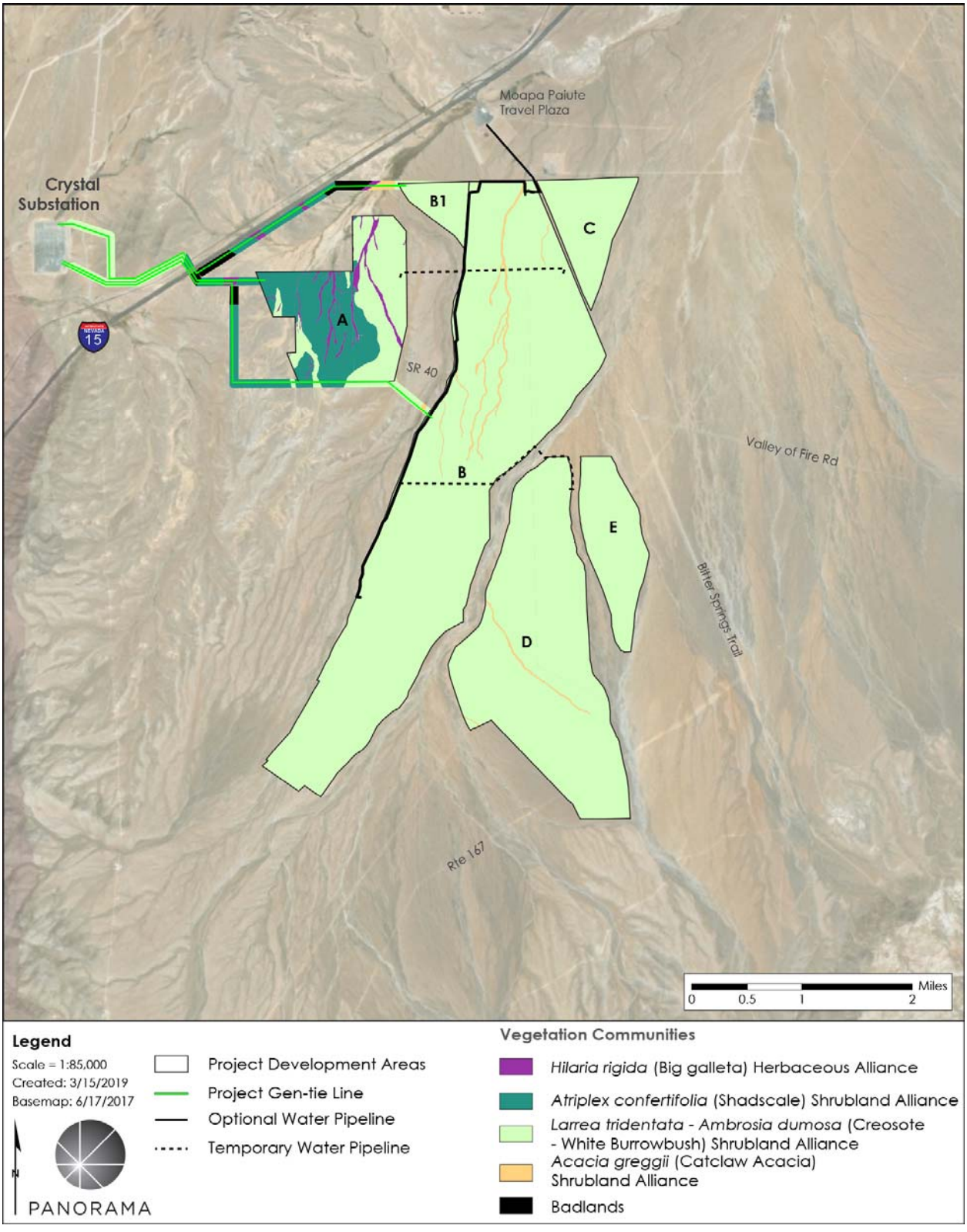
Vegetation Type	Acres (Hectares)	Percentage of Total
Shadscale Shrubland Alliance	419.4 (169.7)	5.9%
Big Galleta Herbaceous Alliance	73.1 (29.6)	1.0%
Creosote-White Burrobush Shrubland Alliance	6,534.7 (2,644.5)	91.9%
Catclaw Acacia Shrubland Alliance	77.6 (31.4)	1.1%
Badlands	8.3 (3.4)	0.1%
TOTAL	**7,113 (2,879)**	**100%**

Figure 17 Soils Map



Source: (Louis Berger Group , 2018; USGS, 2013; Clark County, 2018; USDA NRCS, 2017)

Figure 18 Vegetation Map



Sources: (Louis Berger Group , 2018; USDA-FSA-APFO, 2017; Clark County, 2018; PBC, 2018f)

3.2.3 Water Resources

3.2.3.1 Surface Water

The California Wash is the dominant drainage within the Action Area. The wash is labelled as an intermittent drainage on the two topographic maps that encompass the site: Dry Lake and Piute Point USGS Maps. Based on the *Jurisdictional Delineation Report for the Gemini Solar Project* (PBC, 2018e), over a dozen ephemeral drainages cross the Action Area that are tributaries of the California Wash. California Wash and the adjoining drainages are dry and surface water is not present for the majority of the year. They flow intermittently following rain events in the winter months or summer monsoon season. Several of the larger washes in the Action Area, including California Wash, are within the FEMA 100-year floodplain. However, the Project siting would avoid the FEMA 100-year floodplains. The ephemeral drainages provide distribution of water and sediments, and a local water supply for wildlife and plants. The vegetation along the ephemeral drainages has higher density and species richness due to the increased moisture available.

3.2.3.2 Groundwater

The Project is situated within the California Wash Groundwater Basin (Basin 210), which is situated within the Lower White River Flow System (LWRFS), which is a sub-system of the regional Colorado Flow System. The Colorado River Basin is one of the larger hydrographic regions, covering 246,000 square miles (637,137 square kilometers), and includes parts of seven basin states (USGS, 2016).

Groundwater in the California Wash Basin primarily originates from the underlying carbonate rocks of the White River Flow System and from Coyote Spring Valley via Arrow Canyon to the north (LVVWD, 2001). Groundwater is believed to outflow to the southeast from California Wash Basin through the Dry Lake thrust to Black Mountain Basin, possibly discharging at Rogers and Blue Point Springs. A portion of groundwater discharges to the Muddy River up-gradient from the Glendale thrust complex, with some water moving through the thrust to discharge from the carbonates beneath Lake Mead and the Colorado River (LVVWD, 2001). Groundwater elevations within the basin range between approximately 1,600 and 1,900 feet (488 to 579 meters) relative to the North American Vertical Datum of 1988. Most of the monitored wells within California Wash Basin are located within the northern portion of the basin. Groundwater elevations of approximately 1,800 feet (549 meters), regardless of season, are recorded within wells north and west of California Wash Basin. Groundwater elevations decrease locally to the northeast of the basin, where some groundwater discharges into the Muddy River. Regionally, groundwater elevations decrease to the southeast, where groundwater is thought to discharge at Rogers and Blue Point Springs west of Lake Mead. The nearest USGS monitoring well within this aquifer is located 2 miles (3.2 kilometers) to the southeast. The depth to groundwater in this well averages 895 feet (273 meters) with monitoring from 2011 to 2018 (USGS, 2018).

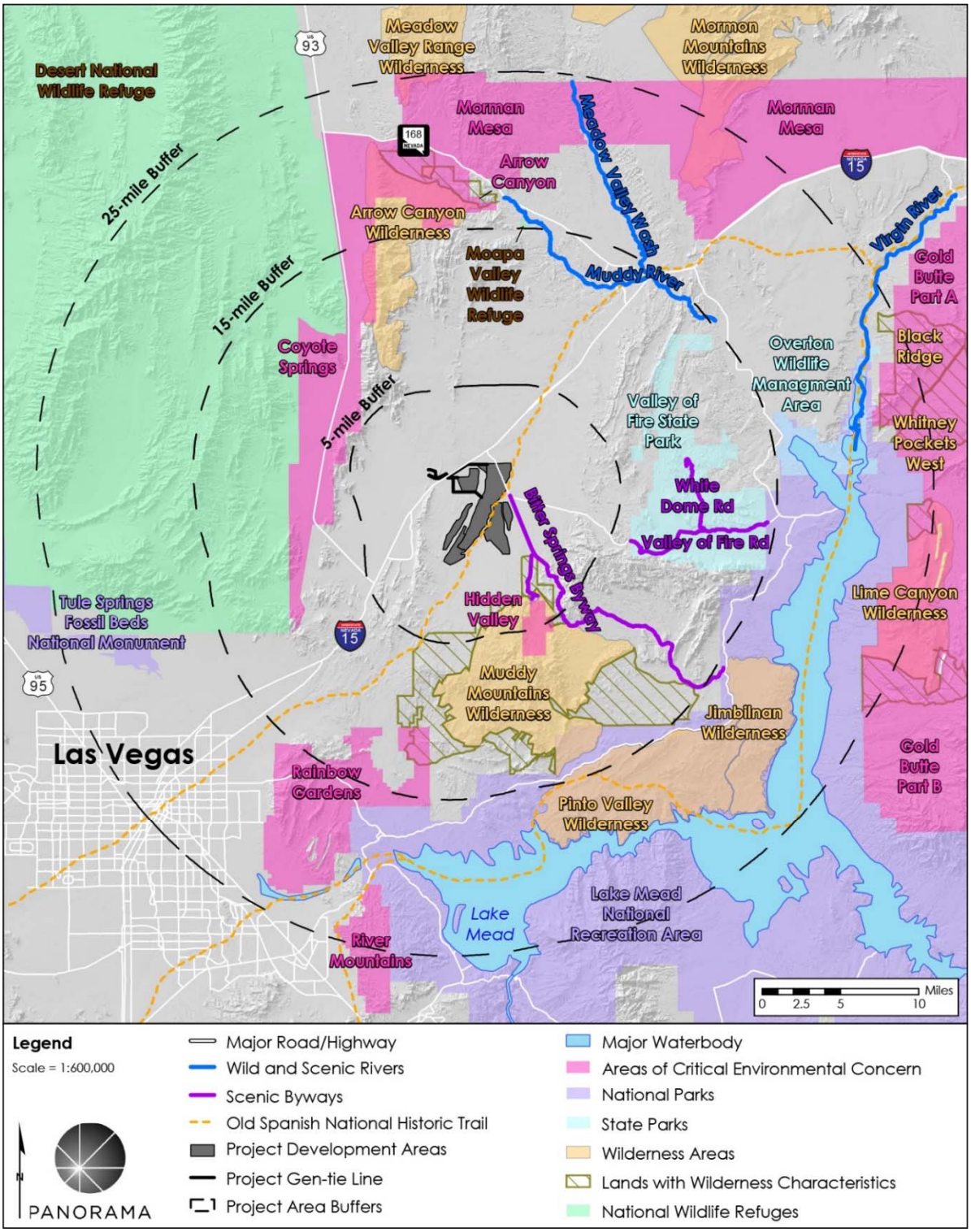
3.2.4 Land Use

The Action Area is located on BLM-administered land. The land to the north of the Action Area is administered by the Bureau of Indian Affairs (Moapa River Indian Reservation). To the east, beyond the North Muddy Mountains, is Valley of Fire State Park. To the west is I-15 and the Dry Lake Range.

The land within the Action Area is currently open desert scrub with minimal signs of human use other than a few unpaved roads that intersect the California Wash Basin. One of the main unpaved roads within the Action Area is named Old Spanish Trail Road, a two-track road that roughly parallels the California Wash in the Action Area. The two-lane Valley of Fire Road is currently the only paved road in the basin, south of I-15. An existing, developed utility corridor, Black Mountain to Crystal Transmission Line, is along the western edge of the lease area. The corridor is considered a "no surface occupancy" or non-development area, per the Solar Energy Development in Six Southwestern States Programmatic EIS (Solar PEIS) (BLM and DOE, 2012a). A ROW easement for a Section 368 Energy corridor of concern (COC), COC 39-113 crosses the southern portion of the lease area. The only noticeable development along this easement is an unpaved road (Route 167). According to the Solar PEIS there are no land use restrictions identified within the Action Area other than the variance area classification that is described in the BLM Solar Energy Program Western Solar Plan (BLM and DOE, 2012b). A special recreation management area (SRMA) is located along the southern edge of Valley of Fire Road, which encompasses a portion of the 44,000-acre (17,806-hectare) ROW application area and overlaps with the distal portion of development area D of the Project. SRMAs recognize unique and distinctive recreation values managed by the BLM to enhance a targeted set of activities, experiences, benefits, and recreation setting characteristics (BLM, 1998).

There are eight existing Areas of Critical Environmental Concern (ACECs) within 25 miles (40 kilometers) of the Action Area, shown in Figure 19. ACECs are areas within existing public lands that require special management to protect important and relevant values. ACECs can protect important resources, unique scenic landscapes, and people and property from hazards on public lands. The closest ACEC is Hidden Valley ACEC located approximately 3.3 miles (5.3 kilometers) southeast of the Action Area. The Desert National Wildlife Refuge Complex is located approximately 8 miles (13 kilometers) northwest of the Action Area. At 1.6 million acres (0.65 million hectares), the Desert National Wildlife Refuge is the largest refuge in the continental United States and the largest protected area in Nevada (USFWS, 2009a). Moapa Valley National Wildlife Refuge is located approximately 15 miles (24 kilometers) north of the Action Area. Moapa Valley National Wildlife Refuge is comprised of approximately 116 acres (187 kilometers) of land situated along the Muddy River. There are seven designated wilderness areas within 25 miles (40 kilometers) of the Action Area. The most recent inventory of lands with wilderness characteristics in Southern Nevada was completed by the BLM in 2010 and 2011. The Action Area did not qualify as Land with Wilderness Characteristics. The specially designated areas are shown in Figure 19.

Figure 19 Specially Designated Areas within 25 Miles of the Project Area



Sources: (Louis Berger Group , 2018; USGS, 2013; USGS and NGTOC, 2017; BLM and NPS, 2017; USGS, 2016; The National Map and USGS, 2017; BLM, 2017a)

4 SPECIES AND CRITICAL HABITAT POTENTIALLY AFFECTED

4.1 MOJAVE DESERT TORTOISE

4.1.1 Introduction

Review of the USFWS's Protected Species List (Appendix C), the Critical Habitat Mapper (USFWS, 2017), and species considered for the Programmatic Biological Opinion for the BLM's Western Solar Energy Program (File No. 84320-2012-F-0200) was undertaken in conjunction with field investigations and discussions with the USFWS. The BLM has determined that the Mojave desert tortoise would be impacted directly and indirectly by the Project. No Critical Habitat exists within the Action Area.

4.1.2 Description of Species

The Mojave desert tortoise is a large herbivorous reptile that occurs in the Mojave and Sonoran deserts of the southwestern United States and northern Mexico. Two species of desert tortoise are found in the United States: the Sonoran desert tortoise (*Gopherus morafkai*) and the Mojave desert tortoise. The Sonoran desert tortoise species is found in western New Mexico, most of Arizona, and south through the state of Sonora, Mexico. The Mojave species of tortoise occurs north and west of the Colorado River in the Mojave Desert of California, Arizona, Nevada, southwestern Utah, and in the Sonoran (Colorado) Desert in California (USFWS, 2011). The Mojave desert tortoise is federally listed as Threatened. The State of Nevada also lists the Mojave desert tortoise species as Threatened. The Mojave desert tortoise is found in the Project area.

4.1.3 Distribution and Life History

Mojave desert tortoise occupy a variety of habitats including creosote bush scrub at lower elevations and blackbrush scrub and juniper woodland transition zones at higher elevations (Germano, 1994). The elevation range for the Mojave desert tortoise has been recorded from below sea level to 7,300 feet (2,225 meters). Typical habitat for Mojave desert tortoises in the Mojave Desert has been characterized as creosote bush scrub below 5,500 feet (1,676 meters) (Luckenbach, 1982). Throughout most of the Mojave Desert, Mojave desert tortoises are most commonly found on gently sloping terrain with sandy-gravel soils and sparse, low-growing shrubs, which allow for the establishment of herbaceous plants. Soils must be friable enough for digging burrows but firm enough to avoid collapse (USFWS, 2011).

Desert tortoises spend most of their lives in burrows, even during seasons of activity. In addition to digging their own burrows, desert tortoises opportunistically use burrows, deep caves, rock and caliche crevices, and overhangs (Germano, 1994). Burrows provide constant temperature and higher humidity, which protect the tortoise during periods of extreme

temperatures and reduces water loss during very dry conditions. The preferred body temperature of the desert tortoise is 69 degrees to 101 degrees Fahrenheit (21 to 38 degrees Celsius) (McGinnis & Voigt, 1971). Desert tortoises are most active during spring and early summer, during summer rains, in the early morning and late afternoon as temperatures increase, and in early fall as new sprouts germinate (Stebbins, 2003). During periods of inactivity, desert tortoises reduce their metabolism and water loss by remaining underground.

Desert tortoises ingest water from plants and from puddles after storms. They store water in their bladders, allowing them the ability to survive for more than a year without access to water of any kind. The diet of desert tortoises consists primarily of winter annuals, perennial grasses, herbaceous perennials, and cacti. Desert tortoises will eat non-native species such as Mediterranean grass (*Schismus* spp.) and red-stem filaree (*Erodium cicutarium*), but they generally prefer native forbs when available (USFWS, 2011).

Desert tortoises are long-lived and have delayed sexual maturity. Maximum longevity for desert tortoises in the wild is between 50 and 70 years, with the average life expectancy around 25 to 35 years (Germano, 1994). Desert tortoises begin reproducing between 12 and 20 years old, when they are roughly 180 to 200 median carapace length (MCL) in size. The number of eggs (1 to 10 per clutch) and the number of clutches (zero to three) 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, tortoise size, and physiological condition (Turner, Hayden, Burge, & Roberson, 1986). Reproductive potential for desert tortoises is low, due to high mortality rates of juvenile tortoises.

4.1.4 Threats to the Species

Some direct causes for the threatened status of the Mojave desert tortoise include disease, predation, and the destruction, modification, and fragmentation of its habitat and range. Over the past several decades prolonged drought has reduced Mojave desert tortoise populations and local carrying capacities by limiting food resources and elevating environmental stressors (Karl, 2018). Human-related activities such as development, agriculture, military activity, mining, waste disposal, road construction, livestock grazing, and off-highway vehicles (OHVs), can cause loss of habitat, subsidization of predators, and the proliferation of invasive plants, limiting the desert tortoises' natural food supply, and ultimately threatening the long-term survival of the species (USFWS, 2011).

Upper Respiratory Tract Disease (URTD), discovered in 1990 and caused by the pathogens *Mycoplasma agassizii* and *M. testudineum*, has been implicated as a factor contributing to declines in desert tortoise populations in the 1990s, although it may only be part of a suite of proximal causes related to drought. *Mycoplasmosis* is typically found in very low percentages, 1 to 3 percent, in most populations. A variety of other pathologies have been determined to affect individual tortoises, such as *Herpesvirus*, cutaneous dyskeratosis (shell lesions and necrosis (Homer, Berry, Brown, Ellis, & Jacobson, 1998)) and urolithiasis (bladder stones), but these diseases rarely affect populations. Hatchling and juvenile desert tortoises are highly vulnerable to predation, due to their slow growth and soft flexible shell. The common raven (*Corvus corax*)

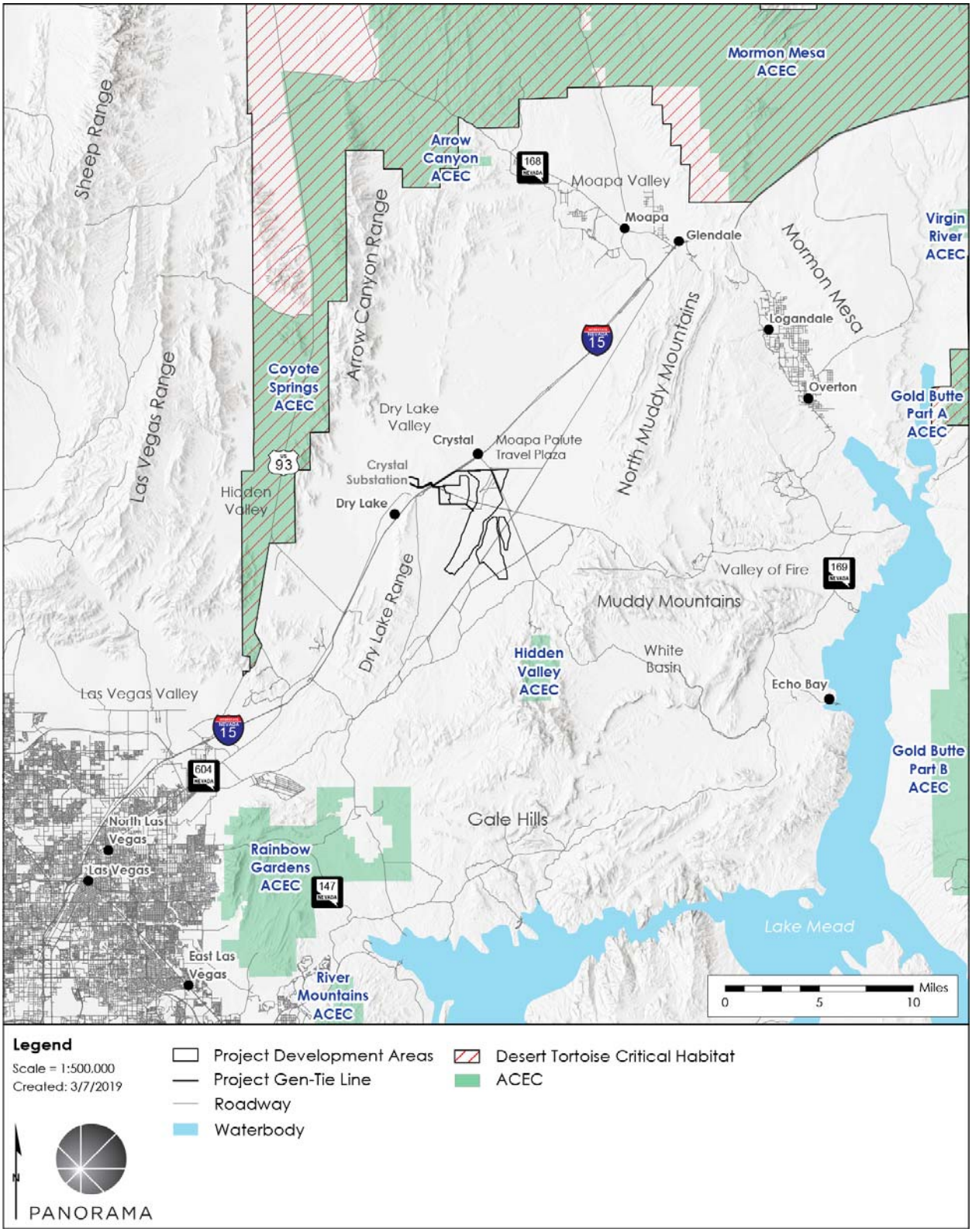
is a predator of small tortoises. Increased human activities support elevated raven populations, due to more available resources for ravens such as food from garbage, water from sewage ponds and municipal areas, and nesting areas such as utility towers and buildings; thus, resulting in increased predation on desert tortoises (Boarman & Kristan, 2006). Other known predators of desert tortoises include coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis*), mountain lions (*Felis concolor*), red-tailed hawks (*Buteo jamaicensis*), and golden eagles (*Aquila chrysaetos*).

4.1.5 Critical Habitat and Desert Tortoise Recovery Units

The Project site is not located within designated Critical Habitat for the Mojave Desert tortoise (USFWS, 2017). Critical Habitat for the desert tortoise is designated by the USFWS and was originally described in the 1994 Desert Tortoise Recovery Plan (Recovery Plan) and updated in the 2011 Recovery Plan (USFWS, 2011). Critical Habitat Units (CHUs) are legally defined areas essential for the conservation of the species and require special management considerations or protection. Primary constituent elements of Critical Habitat are those physical and biological attributes that are necessary for the long-term survival of the species. In the Recovery Plan, these elements were identified as sufficient space to support viable populations within each of five designated Recovery Units and to provide for movement, dispersal, and gene flow; sufficient quantity and quality of forage species and the proper soil conditions to provide for the growth of such species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche (hard layer of subsoil typically containing calcium carbonate) caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators; and, habitat protected from disturbance and human-caused mortality (USFWS, 2011).

The Action Area is located within the Northeastern Mojave Recovery Unit (NMRU) (USFWS, 2011). Recovery Units cover the entire range of the species and are defined as "special units which are geographically identifiable and are essential to the recovery of the entire listed population, i.e., Recovery Units are individually necessary to conserve the genetic, behavioral, morphological, and ecological diversity necessary for long-term sustainability of the entire listed population" (USFWS, 2011). The NMRU encompasses approximately 4.85 million acres (1.96 million hectares) of Mojave desert tortoise habitat within the northeastern portion of the species' range. This Recovery Unit includes the Beaver Dam Slope, Gold Butte-Pakoon, and Mormon Mesa CHUs. The Mormon Mesa CHU is closest to the Action Area and totals 427,000 acres (172,800 hectares) (Figure 20). This CHU also encompasses the Coyote Springs ACEC, Arrow Canyon ACEC, and Mormon Mesa ACEC. In 2005, wildfires burned 12,952 acres (5,241 hectares) of the Mormon Mesa CHU (approximately 3 percent), which have limited suitability for desert tortoises (Nussear, et al., 2009). Based on data collected by the USFWS from 2001 to 2014, the estimated number of tortoises in the NMRU have increased from 4,920 adult sized desert tortoises in 2004 to 18,220 adult tortoises in 2014 (a 270 percent increase). The USFWS attributes the increase to increased survival of adults and sub-adults moving into adult size classes (USFWS, 2015a). However, not all CHUs in the NMRU have increased. The Mormon Mesa CHU decreased from a density of 8.5 adult tortoises per square mile (3.3 per square kilometer) in 2006 to 5.4 adult tortoises per square mile (2.1 per square kilometer) in 2016 and the Beaver Dam Slope CHU remained steady at 3.1 to 3.4 adult tortoises per square mile (1.2 to

Figure 20 Desert Tortoise Critical Habitat (Mormon Mesa CHU) and BLM ACECs



Sources: (USGS, 2013; Clark County Nevada GIS Management Office, 2018; USGS, 2012; BLM, 2017a; USFWS, 2014a; Louis Berger Group, 2018)

1.3 per square kilometer) from 2006 to 2017 (USFWS, 2009b). The Coyote Springs ACEC is the closest ACEC within the Mormon Mesa CHU (Figure 20). The Coyote Springs ACEC totals 75,500 acres (30,554 hectares) and is located approximately 7.5 miles (12 kilometers) west of the Action Area (Clark County, 2007). The Hidden Valley ACEC shown in Figure 20 is an archaeological district in the Muddy Mountains.

4.1.6 Desert Tortoise in the Action Area

Desert tortoise surveys for the Project area and the gen-tie lines were conducted by PBC between September 4 and October 19, 2017 (development areas A, B, C, D, and E), between April 3 and April 12, 2018 (development area F[3]), and between 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, collectively referred to as the "Project Survey Area" (Appendix A). Buffer surveys around the Project area were not conducted, as presence of desert tortoise was confirmed within the Project area. The survey methodology is provided in Appendix A, as well as the maps showing the detailed survey areas. All surveys followed pre-project USFWS guidance (USFWS, 2010).

Table 10 and Table 11 summarize the results of the surveys. A total of 128 adult desert tortoises were found within the Project Survey Area during the fall 2017 survey effort. Within the five survey areas (development areas A through E) 105 tortoises (≥ 180 mm MCL in size) were found. Surveys were conducted over approximately 7,108 acres (hectares) during the fall survey effort (consisting of 1,787 miles [2,876 kilometers] of transects). During spring 2018, 43 tortoises were found; 36 tortoises (≥ 180 mm MCL in size) were observed (PBC, 2018c). spring 2018 surveys were conducted over 3,722 acres (1,506 hectares), consisting of 964 miles (1,552 kilometers) of transects.

A total of 273 adult desert tortoises were estimated to occur in the combined Project Survey Areas. Several of the development areas in Project Survey Areas were not, however, incorporated into the BLM Preferred Alternative, which is the Project area addressed in this BA. The total number of adult desert tortoises estimated to occur in the Project area is 219. The BLM Preferred Alternative, which is the Project described in this BA, includes all the development areas surveyed in fall 2017, plus development area B1, surveyed in spring 2018. However, the boundaries of the development areas have changed since the surveys. The estimated number of desert tortoises (≥ 180 mm MCL) for the Project site is, 215 (fall 2017 survey) plus another 4 for area B1 (spring 2018 survey), for a total of 219 adult desert tortoises or 19.9 adult desert tortoises per square mile (7.7 per square kilometer) and an estimated 1,139 juveniles. The density of

[3] Note that development area F was surveyed during the process of evaluating alternatives; however, this area did not end up in any of the considered alternatives due to presence of threecorner milkvetch, a state-listed endangered plant species.

desert tortoises for the overall action area (which includes all surveyed areas) is 16.1 adult tortoises per square mile (6.2 per square kilometer).

Table 10 Desert Tortoise Survey Results

Desert Tortoise Survey Results for all Project Survey Areas	
Acres Surveyed	10,830
Survey Miles	2,751
Desert Tortoise Observed ≥ 180 mm MCL (Adult)	141
Adult Tortoise Abundance Estimate	273
Juvenile Tortoise Abundance [1]	1,421
Desert Tortoise Burrows	2,887
Desert Tortoise Scat	240
Desert Tortoise Carcass	323
Other Burrows	611

Note:

1. Juvenile tortoise abundance was not estimated for the 2017 survey due to the version of the USFWS protocol in place at that time. However, using the 2018 survey results, where the juvenile density was 58.3 tortoises per square mile (22.5 per square kilometer), and extrapolating using the same ratios for 2018 adult results to the overall 16.1 adult tortoises per square mile (6.2 per square kilometer), the Action Area juvenile tortoise density would be 83.9 tortoises per square mile (32.4 per square kilometer).

Desert tortoise abundance estimates for the fall 2017 survey effort were calculated for the surveyed area using the USFWS' 2010 spreadsheet formula for estimating tortoise abundance. The revised 2017 USFWS' spreadsheet formula was utilized for the spring 2018 desert tortoise abundance estimates. To estimate the number of tortoises that live within the Project Survey Area, the formula (Equation 1) divides the number of adult tortoises observed during the survey by the product of the probability that a tortoise is above ground during the survey (Pa), and the probability that a surveyor would see the tortoise if it is above ground (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 USFWS 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 (3.8 centimeters), and Pd is equal to 0.63, which is the standard searcher efficiency for presence/ absence surveys. A summary of the data collected for the Project Survey Area is also provided in Table 11. A breakdown of the data collected, locations of observed tortoises, and figures depicting desert tortoise information collected is provided in the *Fall 2017 Gemini Solar Project Desert Tortoise Survey Report and Spring 2018 Gemini Solar Project Desert Tortoise Survey Report* (Appendix A: Figures 5-9) (PBC, 2018b; PBC, 2018c).

Table 11 Desert Tortoise Survey Areas and Results and Population Density Estimates

Survey Area	Acres (Square Kilometers) of Total	Percent of Total	Total Desert Tortoise Observed	Number of Desert Tortoise[1]	Acres (Square Kilometers) per Tortoise[1]	Estimated Number of Desert Tortoises using USFWS Confidence Intervals	Estimated Density of Desert Tortoises per Square Mile (Square Kilometers)
Project Areas							
Development Area A	862 (3.4)	11.5%	14	14	62 (0.2)	28	21.1 (8.2)
Development Area B	3,460 (13.8)	46.2%	94	74	47 (0.2)	149	27.8 (10.7)
Development Area C	471 (1.9)	6.3%	6	6	79 (0.3)	12	16.6 (6.4)
Development Area D	1,913 (7.7)	25.6%	11	10	191 (0.8)	20	6.8 (2.6)
Development Area E	402 (1.6)	5.4%	1	1	402 (1.6)	2	3.2 (1.3)
Gen-tie and Collector Lines	103 (0.4)	1.4%	2	2	52 (0.2)	4	25.3 (9.8)
Buffer Areas	270 (1.1)	3.6%	0	0	-	0	0 (0)
TOTAL	**7,481 (30.3)**	**100%**	**128**	**107**	**-**	**215**	**18.6 (7.2)**
Alternative Areas							
Development Area B1	141 (1.1)	3.8%	2	2	71 (0.3)	4	16.6 (7.1)
Development Area B2	979 (3.9)	26.3%	23	20	49 (0.2)	36	23.9 (9.2)
Development Area F	1,832 (7.3)	49.2%	1	0	-	0	0 (0)
Development Area G	770 (3.1)	20.7%	16	14	55 (0.2)	25	21.3 (8.21)
TOTAL	**3,772 (15.3)**	**100%**	**42**	**36**	**-**	**65**	**16.1 (6.2)[2]**

Notes:

1. ≥ 180 mm MCL
2. Without development area F included, which does not appear to support desert tortoise due to the sandy soil type present here, the density is 8.4 adult tortoises per square kilometer. Development area F is not part of the Project site.

Source: (PBC, 2018b; PBC, 2018c)

Equation 1 Tortoise Estimates

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

The average density of adult desert tortoises in the Project site is 19.9 per square mile (7.7 per square kilometer). The Project area and nearby areas appear to support the densest tortoise populations known in the Northeast Mojave Recovery Unit, based on what has been surveyed. The Moapa Solar Project, located approximately 1.5 miles (2.4 kilometers) to the north of the Project site (across I-15), had a higher density of 31.9 per square mile (12.4 per square kilometer). Playa Solar Project, located approximately 6 miles (10 kilometers) to the west/southwest (across I-15), had a lower density of 13.1 per square mile (5.1 per square kilometer. The average density in the desert tortoise critical habitat units (CHUs) within the Northeastern Mojave Recovery Unit, was 10.9 per square mile (4.4 per square kilometer) in 2014 (USFWS, 2014b).

4.1.7 Desert Tortoise Connectivity

This section on connectivity discusses the conditions of both genetic (ecological) and demographic (habitat/landscape) connectivity in the region (Lindenmayer & Fischer, 2006; Lowe & Allendorf, 2010). Genetic connectivity is one aspect of ecological connectivity and is defined as the degree to which gene flow affects evolutionary processes within populations (BLM and DOE, 2012a). Genetic connectivity is maintained when populations of desert tortoises are connected by areas of occupied habitat that support sustainable numbers of reproductive individuals. 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, 2012a). 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 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 and/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 (Figure 20). The Muddy Mountains and Lake Mead form impermeable barriers to the southeast. The Project area likely has very limited connectivity to the Mormon Mesa CHU and the associated

Critical Habitat area (Figure 19). 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 (Wise, 2018), which allows for some but restricted movement. Other impermeable barriers (i.e., the Muddy River) far north and northwest would preclude connection to the north.

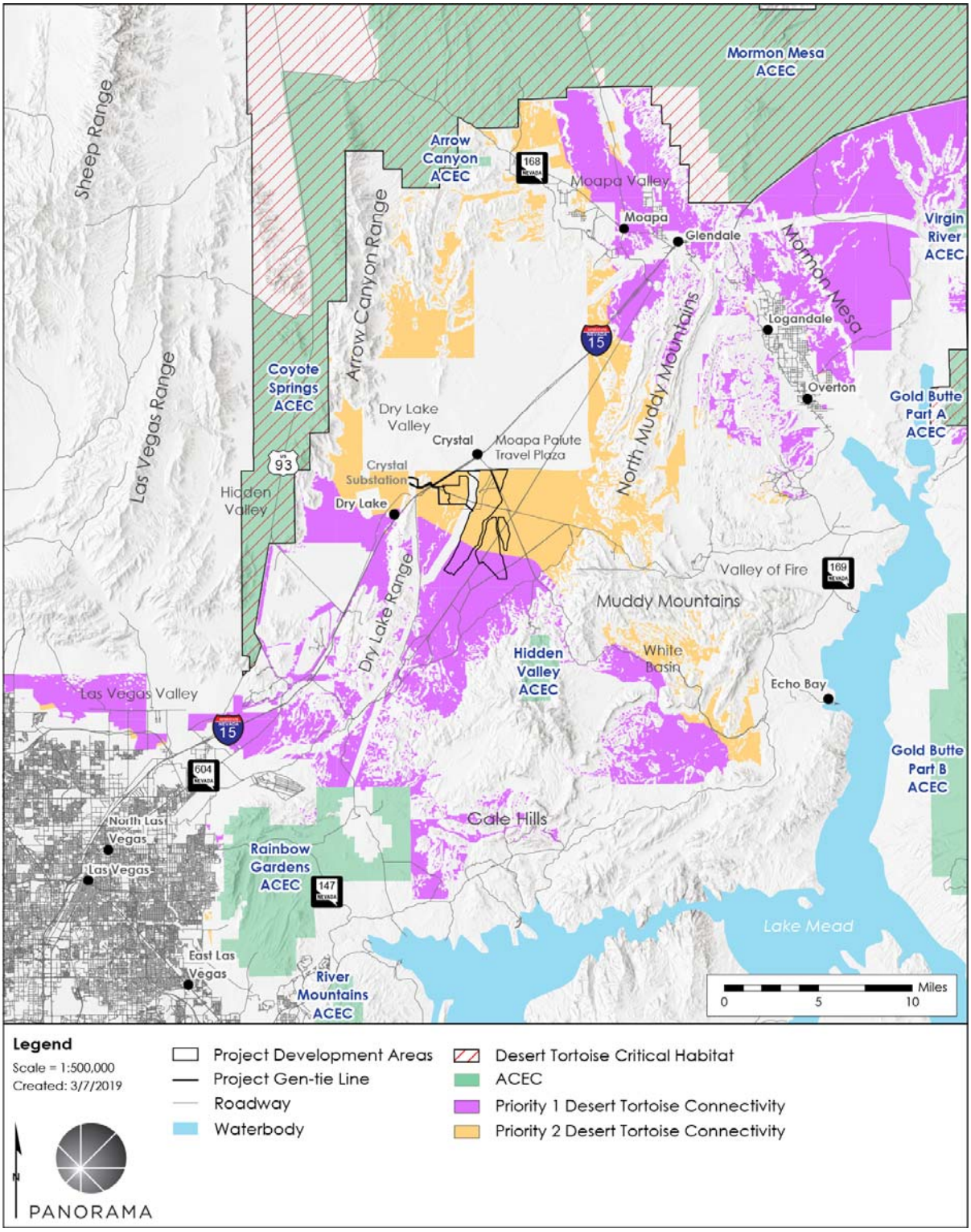
The Revised Desert Tortoise Recovery Plan (USFWS, 2011) recommends connecting blocks of desert tortoise habitat, such as CHUs and other important areas, to maintain gene flow between populations. Desert tortoise connectivity in the region is addressed in the Solar PEIS and the Supplement to the Solar PEIS. The USFWS 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 (USFWS, 2011)) and to define other large blocks of habitat with important value to recovery of the desert tortoise. Based on USFWS 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, USFWS 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, Majka, & Spencer, 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, USFWS 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 21) including predominantly Priority 2 habitat, but some Priority 1 habitat in the southern part of the Project site and south of the site.

4.2 FEDERALLY LISTED BIRD SPECIES

4.2.1 Introduction

Three federally listed bird species may be affected by development of the Project including, Yuma clapper rail, yellow-billed cuckoo, and southwestern willow flycatcher. These three bird species are generally known to occur within riparian and aquatic habitats in the larger geographic region. There is no known population or suitable habitat of these species observed or documented within the Action Area. There are no perennial surface water or other aquatic features in the Action Area. The closest current documented record for these three species and their habitat is over 15 miles (24 kilometers) from the Action Area. Additionally, there is no evidence to indicate that dispersal would occur within the Project area.

Figure 21 Desert Tortoise Connectivity Areas on BLM Land as Mapped in the Solar PEIS



Sources: (USGS, 2013; Clark County Nevada GIS Management Office, 2018; USGS, 2012; BLM, 2017a; USFWS, 2014a; USFWS, 2012a; Louis Berger Group, 2018)

4.2.2 Description of Species

4.2.2.1 Yuma Clapper Rail

Yuma clapper rail is listed as federally endangered under the ESA. No critical habitat has been designated for the species. A recovery plan was issued in 1983 and is under revision. Populations in the United States are concentrated along the Lower Colorado River from the vicinity of Laughlin to Yuma, and in Arizona within four national wildlife refuges. Southern Nevada is the northern-most limit for rail distribution. The species inhabits freshwater or brackish stream-sides and marshes with dense cattails, bulrush, and other aquatic vegetation. As marshes age and become decadent, habitat suitability diminishes for clapper rails.

The range of this species in Nevada includes the Virgin River, Lower Muddy River, Colorado River around Lake Mojave, Las Vegas Wash, and Big Marsh along the Las Vegas Wash (approximately 20 miles [32 kilometers] south of the Project site). Surveys along the Las Vegas Wash between 2009 and 2014 resulted in zero detections there. At Overton Wildlife Management Area (approximately 15 miles [24 kilometers] northeast of the Project site), annual surveys have detected the species. The Overton Wildlife Management Area lies in the lower extremes of the Moapa and Virgin River valleys where they flow into the north end of the Overton Arm of Lake Mead. The species likely follows river/lake corridors for dispersal. Threats to the species include loss of habitat due to water impoundments, stream channelization, environmental contaminants, water diversions, drying and flooding of marshes, and other management practices. These threats contribute to increased loss, modification, and degradation of marsh habitats and alteration of stream hydrology.

4.2.2.2 Yellow-Billed Cuckoo

The yellow-billed cuckoo is listed as federally threatened under the ESA. Designated critical habitat is currently proposed, which includes suitable habitat within Nevada. The range of this species in Nevada includes the Lower Muddy River, Virgin River, Pahranagat Valley, Las Vegas Wash, and historically Warm Springs Natural Area. The species was historically documented at Warm Springs but it has not been detected there since a July 2010 fire. Warm Springs is located 16 miles (26 kilometers) north of the Project site. At Overton Wildlife Management Area (approximately 15 miles [24 kilometers] northeast of the Project site), annual surveys have detected the species almost every year. The species also was detected along the Las Vegas Wash (approximately 20 miles [32 kilometers] south of the Project site) in 2016 and 2017. In Southern Nevada, this species is mostly limited to riparian woodlands along the Muddy and Virgin rivers. Western cuckoos breed in large blocks of riparian habitats, particularly woodlands with cottonwoods and willows. The loss, degradation, and fragmentation of riparian habitat have been identified as the primary factors causing yellow-billed cuckoo declines in the western United States. The overall population trend for the cuckoo is decreasing, but some areas are lacking information to determine a trend. The species is closely tied to riparian habitat and is not expected to widely disperse over non-riparian areas.

4.2.2.3 Southwestern Willow Flycatcher

The southwestern willow flycatcher is listed as federally endangered under the ESA. Critical habitat for the species was first designated in 1997, re-designated in 2005 (70 FR 60886), and

then revised in 2013 (78 FR 30634). In the 2002 Recovery Plan for the species, the USFWS designated six Recovery Units. Two Recovery Units are in Nevada. The Basin and Mojave Recovery Unit includes the Amargosa River and Ash Meadows, and the Lower Colorado Recovery Unit includes the Colorado and Virgin rivers. The only critical habitat designated in the Southern Nevada District Office planning area portion of the Basin and Mojave Recovery Unit is on the Ash Meadows National Wildlife Refuge. Critical habitat designated in the Southern Nevada District Office planning area portion of the Lower Colorado Recovery Unit includes all of the Virgin River, including lands managed by the BLM.

The southwestern willow flycatcher breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands, including lakes. Most of these habitats are classified as forested wetlands or scrub-shrub wetlands. The range of this species in Nevada includes the Virgin River, Lower Muddy River, Pahranagat Valley, and Warm Springs Natural Area. Critical Habitat for the species exists along the Virgin River, north of Lake Mead National Recreation Area. The species was documented annually at Warm Springs prior to a July 2010 fire but was absent until detected again in 2014 and subsequent years (2015, 2016, and 2017). Warm Springs is located 16 miles (26 kilometers) north of the Project site. Annual surveys have detected the species at Overton Wildlife Management Area (approximately 15 miles [24 kilometers] northeast of the Project site). The species is closely tied to riparian habitat and is not expected to widely disperse over non-riparian areas. Threats to the species include habitat loss due to water impoundments and water management practices, introduction of non-native species, and fire.

5 EFFECTS OF THE PROJECT

5.1 MOJAVE DESERT TORTOISE

5.1.1 Overview

The potential effects on desert tortoise within the Action Area were determined through literature review and consideration of the existing conditions observed during field and protocol-level surveys conducted by PBC. 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, water requirements, and amount of earth-moving or surface alteration required. Elements of the Project, described in Chapter 2: Description of the Project of this BA, would result in potential direct, indirect, and cumulative effects to desert tortoise as described here. The Project's construction and operation would impact behavior and, potentially, the health and survival of individual tortoises by:

- **Translocation**:
  - Temporary stress on desert tortoises from handling during translocation efforts
  - Potential stress from on site, adjacent Project activities during construction
  - Potentially increased mortality or reduced recruitment after translocation or removal to areas outside the Project fences, due to increased predation, increased intra-specific aggression, or increased exposure or susceptibility to disease
- **Disturbance or Displacement of Desert Tortoise for Gen-Tie Lines and Roads:**
  - Disturbance and displacement of desert tortoise and potential vehicle strikes during construction of the associated access roads and gen-tie lines, and similar potential for vehicle strikes during operation and maintenance of these facilities
- **Loss or Alteration of Desert Tortoise Habitat:**
  - Temporary and permanent loss of desert tortoise habitat and burrows along and within the Action Area during construction, and operation and maintenance
  - Altered habitat in the mowed areas during operation and maintenance
- **Attraction of Predators:**
  - Potential to attract ravens and other predators of desert tortoise occupying adjacent lands as a result of perches provided by the solar structures, transmission lines, towers, perimeter fencing, and human introduction of trash within or near the Action Area boundary during construction and operation and maintenance
- **Disturbance from Noise, Light, Vibration and Dust**:

  - Temporary disturbance from vibration during construction that could affect tortoise in burrows near the boundary of the Action Area
  - Potential noise and artificial lighting effects on tortoise behavior and movement
  - Potential dust impacts on vegetation used by desert tortoise
- **Exposure to Chemicals:**
  - Potential damage/morbidity/mortality from exposure to chemicals including herbicides, petroleum products, and dust palliatives
- **Weeds:**
  - Introduction or expansion of weeds and invasive species within the traditional and mowed portions of the Action Area during construction, and operations and maintenance
- **Constriction of Movement:**
  - Fragmentation of habitat and constriction of movement corridors following construction of the solar facility, particularly from development area D and to the south

Finally, cumulative effects to desert tortoise could occur from the cumulative projects in the region that would also directly or indirectly impact desert tortoise.

5.1.2 Effects

5.1.2.1 Translocation

Tortoises would be directly affected by translocation (see Desert Tortoise Translocation Plan, Appendix B). Effects would occur both to the translocated tortoises and to the resident tortoises where translocatees are moved. An estimated 109 adult tortoises would be moved to a 500-meter-wide band bordering the Project site and another 36 adult tortoises would be distantly translocated to a recipient site southeast of the Project site (see Figure 16; the Action Area boundary to the south of the site encompasses the translocation areas). Another 74 adult tortoises would be temporarily moved to the holding facility until construction is complete, at which time they would be re-placed back into mowed areas in the site. Translocated tortoises would be handled, transmitted, given health assessments with tissue sampling, and moved. Tortoises could incur injury or death. Approximately 183 adult tortoises would be passively or actively reintroduced to mowed areas of the Project site after construction. As detailed in the Desert Tortoise Translocation Plan, smaller, juvenile tortoises would be moved under the same geographic criteria as adults. Very small juveniles would be temporarily moved the holding facility, then moved to safe locations immediately outside the facility or to the recipient area.

Tortoises moved immediately outside the Project site are expected to remain approximately within their home ranges and would subsequently be familiar with the area and individual tortoises in the area. By contrast, distant translocatees would be unfamiliar with the release area. They may experience increased incidence of predation due to temporary unfamiliarity and may experience increased agonistic encounters with residents. Desert tortoises moved immediately outside the Project site would experience an approximate doubling of the local

density, temporarily, until home ranges shift. Resources are expected to be adequate in the short-term, but agonistic encounters may increase due to social disruption. These tortoises would be adjacent to construction-related activities for over a year, which may result in unknown levels of stress and behavioral disruption. Only tortoises determined to be healthy and asymptomatic of respiratory disease would be translocated. Even so, there is a minor risk that both translocatees and resident tortoises may be adversely affected due to the spread of diseases.

5.1.2.2 Temporary and Permanent Loss, and Modification of Occupied Habitat along the 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 would 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 would 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 (61 meters) by 200 feet (61 meters) at up to 48 poles, outside the solar facility fence, totaling 36 acres (14.6 hectares). Pulling sites would total 15 acres (6.0 hectares) of temporary impacts to desert tortoise habitat, at 100 feet (30.5 meters) by 500 feet (152.4 meters) per site (Table 2). 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 in accordance for use by NV Energy at a minimum 20 feet (6.1 meters) 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 (9.9 hectares) (Table 2). 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.

5.1.2.3 Temporary and Permanent Loss, and Modification of Occupied Habitat in the Solar Field

Construction

Construction would result in both permanent and temporary loss of habitat in the solar field, as the areas are being constructed. The entire 7,038-acre (2,848-hectare) solar development site would not be fenced and constructed all at once. Areas would be fenced and constructed in phases with the first phase most 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, as discussed below under Operation and Maintenance.

Operation and Maintenance
The USFWS considers all traditional ground-disturbing impacts from the Project to be long-term/permanent. Total long-term disturbance from traditional methods of construction within occupied desert tortoise habitat from the Project would be approximately 2,648 acres (1,072 hectares). This acreage would be permanently fenced to exclude desert tortoise and would be considered a permanent loss of habitat for the species.

The remaining 4,390 acres (1,777 hectares) 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 (to 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 (61 centimeters) and in justifiable circumstances, no less than 18 inches (46 centimeters). Mowing would only occur in the solar array areas where vegetation can affect the panels, equipment, or access. Other disturbance in the mowed areas would be limited to roads, which would be 15 feet (4.5 meters) wide with every 4th road 30 feet (9 meters) wide to include a utility corridor. Roads would be constructed of compacted native materials. Concrete cutoff walls would be installed at drainage crossings, as needed. Approximately 110 acres (45 hectares) of vegetation within the mowed areas would be removed for access roads. Impacts from cutoff walls would be approximately 0.01 acres (0.004 hectares) of habitat loss. Cutoff walls would be flush to the ground and generally would be around 15 feet (4.5 meters) long. They would not present as a barrier to tortoise movement. After major storm events, crossings would be examined and repaired to ensure that concrete remains flush to the ground surface.

5.1.2.4 Attraction of Human Subsidized Predators
Avian predators and scavengers such as the common raven (*Corvus corax*) benefit from a myriad of resource subsidies provided by human activities as a result of substantial development within the desert, as compared with undeveloped desert landscapes (Boarman & Kristan, 2006). 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). On a PV solar project, predator attraction is typically considered an indirect impact, because no tortoises remain on the site, except under transmission lines. For the Gemini Solar Project, desert tortoises would re-occupy much of the site after construction, so the effect can be both direct (on site) and indirect (off site).

Ravens and other predators may be attracted to elevated structures associated with the Project such as the perimeter fencing, transmission lines and poles, panels, and the O&M building and facilities. There is a potential for increased sources of food or water both during construction and operation of the Project, particularly near areas where people would concentrate (e.g., the control room of the O&M building). However, an agency-approved Bird and Bat Conservation

Strategy and Raven Control Plan would be developed and approved prior to the initiation of construction activities, which would reduce potential raven- (or other avian predators) related impacts to desert tortoise. Education regarding control of food and trash sources and minimization of water 'perching' areas is the main focus of the Raven Control Plan. All construction personnel would be required to complete a WEAP training to ensure trash and food-related items are removed from the premises and/or placed in sealed containers.

5.1.2.5 Vibration, Noise, Light, and Dust

Vibration

Heavy equipment (bulldozers and backhoes) that would cause surface disturbance and otherwise operate during construction would be needed to construct access roads; install solar arrays, poles, the O&M building, and the proposed electric substation; and, to trench for installation of cable and wiring. A few areas that are just outside of the Action Area may experience short-term/temporary vibrations that could potentially disturb desert tortoises. Vibration from typical construction equipment is barely perceptible farther than 40 to 50 feet (12 to 15 meters) beyond the source of the vibration (Caltrans, 2013). The number of tortoises that could be impacted by vibration is expected to be minimal, if any. Only burrows within 50 feet (15 meters) of the fence at the time of activity could be impacted by vibration. Activity during operation and maintenance would be substantially less than during construction of the Project, such that no adverse effects from ground vibration on desert tortoise are expected to occur during operation of the Project.

Noise

Existing noise sources around the Project 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 (15 meters) from the two loudest equipment types for each construction activity, representing a conservative noise level, are reported in Table 12. 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 operation and maintenance phase of the Project are expected to be insignificant. The amount of noise during operation and maintenance would not represent a significant change from the current ambient levels.

Table 12 Noise Levels Generated by Construction Activities

Construction Activity	Noise Level at 50 feet (15 meters) dB(A) L_{max}	Noise Level at 50 feet (15 meters) dB(A) L_{eq}
Solar Array Blocks and Power Collections Systems		
Install BMP Measures (Part of Site Preparation)	75.0	71.3

Construction Activity	Noise Level at 50 feet (15 meters) dB(A) L_{max}	Noise Level at 50 feet (15 meters) dB(A) L_{eq}
Site Preparation (Solar Block Arrays)	85.0	83.6
Site Preparation (Roads)	85.0	82.3
Install Fencing	75.0	71.3
Install Tracking System Posts	84.4	78.3
Install Support Structures	75.0	71.3
Install Inverters and Switchgear & Sub-Structure	80.6	76.1
DC and AC Cable Installation (Underground)	80.7	78.4
DC and AC Cable Installation (Above-Grade)	75.0	71.3
Module Installation	75.0	71.3
O&M Building	74.7	68.3
Substation		
Insulators, Bus, and Electrical Equipment	80.6	73.8
Control Wiring	80.6	74.9
Gen-Tie/Transmission System		
Structure Installation	80.6	74.9
Conductor/Wire Installation	80.6	78.8
Cleanup	85.0	82.7

Source: (FHWA, 2008; FTA, 2006)

Lighting

Temporary construction 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 and is not expected to have an impact on tortoises, since nighttime construction would be rare and lighting would be shielded.

During operation and maintenance, the Project's lighting system would provide O&M 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.

Dust

Construction activities and operational vehicle traffic on the roads within the Action Area could generate dust that would affect vegetation adjacent to and within the Action Area in the short-term. 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/desert pavement. Construction BMPs from a Dust Control Plan would be in place to monitor and decrease dust pollution if required by use of polymeric stabilizers in the soil or with frequent watering with water trucks or other means.

5.1.2.6 Spills

Spills of fuels, lubricants, and other petroleum products could indirectly impact desert tortoise. The spilled materials could contaminate stormwater runoff. The SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plan would be implementing minimizing risk of stormwater contamination.

5.1.2.7 Dust Palliatives Use

Desert tortoise may be indirectly impacted by palliatives 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. If palliatives are used, the Applicant would contribute funds to a BLM study to understand the effects of dust palliatives on the health of desert tortoises from mobilization in stormwater runoff.

5.1.2.8 Introduction of Weeds and Invasive Species

Invasive species could be introduced to the area via transport by construction vehicles and equipment, or existing populations of weeds already identified as present on the Project site could be expanded. The ground would be disturbed during construction, thereby providing increased opportunity for weed establishment. Weed expansion would impact desert tortoises by reducing the forage for desert tortoises.

Implementation of the Integrated Weed Management Plan would reduce the spread/ colonization of weeds on site and off site in both disturbed areas and downwind/downstream of the Project. The goal of the Integrated 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 Integrated 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 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 Integrated 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 in Chapter 2: Description of the Project of this BA.

5.1.2.9 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 increase human foot traffic, vehicle use, hunting, trash, domestic cats/dogs, and invasive species. The Project includes placement of a permanent security fence along the solar array boundary. Other than impacted burrows or desert tortoises that need to be relocated during Project construction, edge effects from solar development are minimal. 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 Control Plan. Introduction of weeds from construction or soil disturbance was previously addressed.

5.1.2.10 Constriction of Movement

The Project site is located within a 44,000-acre (17,806-hectare) ROW application area. Based on the initial due diligence exercise, recent biological, and review/analysis with agency personnel the following design considerations were used to reduce the direct 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
- Photovoltaic technology options that allow for heterogeneous array layout which provides reduced impacts on biological resources
- Limit constriction of movement by allowing desert tortoises to reoccupy 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 22). The greater concern for connectivity; however, 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, as shown in Figure 22. From the Muddy Mountains to the southern end of development area D is 2.4 miles (3.9 kilometers). This area is a pinch-point of unaltered habitat for tortoise migration in the east/west directions. This area must be preserved 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 (5.6 kilometers), as shown in Figure 22. Some reduced gene flow could occur based on tortoise movement restrictions, as could localized increases in densities and stressors.

As described in Section 4.1.5, desert tortoise connectivity is considered high through the Dry Lake Valley/California Wash area, but the Project area has very limited connectivity to any CHUs.

5.1.3 Desert Tortoise Critical Habitat

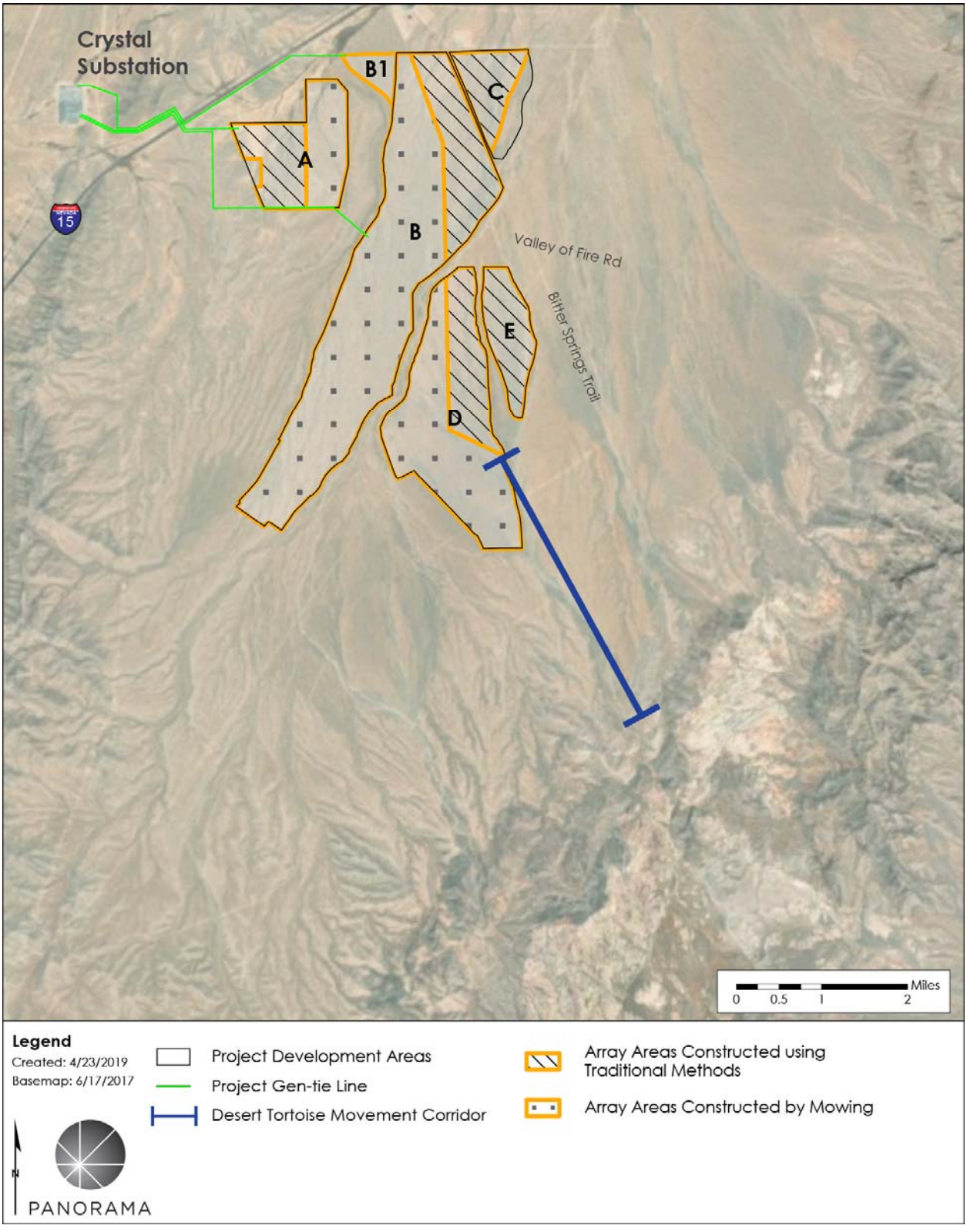
The nearest desert tortoise Critical Habitat to the Project site is the Mormon Mesa CHU, located approximately 10 miles (16 kilometers) northwest of the Action Area (Figure 19), as previously described. The Gold Butte-Pakoon CHU is over 20 miles (32 kilometers) east, but beyond impermeable barriers. There is no Critical Habitat in or adjacent to the Action Area. No direct impacts to Critical Habitat would occur. The Project site is not located in Critical Habitat and tortoises would not be translocated to Critical Habitat.

5.1.4 Cumulative Effects

For purposes of the ESA, cumulative effects are those effects of ongoing and future private, state, or Tribal activities, not involving federal activities, that are reasonably certain to occur within the Action Area (50 CFR 402.02). The BLM, Department of Defense, and Bureau of Indian Affairs administer much of the land surrounding the Action Area. Subsequently, many of the actions that would occur are subject to the requirements of Section 7 consultation. This cumulative effect analysis section for the Project incorporates by reference and tiers to the cumulative effects' analysis of the Solar PEIS and Programmatic BO for the Dry Lake SEZ (BLM and DOE, 2012a; USFWS, 2015b).

Because of the geographic location of the Project site, the private, state, and Tribal activities most likely to contribute to cumulative effects on federally ESA-listed species are urban development, agriculture, and water use (BLM and DOE, 2012a). As described in the Solar PEIS,

Figure 22 Desert Tortoise Movement Corridor Around the Project Site



Sources: (Louis Berger Group, 2018; USDA-FSA-APFO, 2017; Clark County Nevada GIS Management Office, 2018)

reasonably foreseeable future actions identified include several large solar facilities, several transmission line and pipeline projects, a residential development, and a proposed new community airport (BLM and DOE, 2012a).

Desert tortoise and their critical habitat would be impacted by ongoing private, state and Tribal actions within the area of cumulative effects for the Project (defined as an approximate 50-mile [80-kilometer] buffer around the Action Area), including impacts from urban areas, roads, transmission lines, and solar generating facilities described above and identified in the Solar PEIS (BLM and DOE, 2012a) and solar developments on Tribal land. These potential developments cover large areas and long linear distances and are likely to affect desert tortoise by reducing and/or fragmenting habitat and also reducing habitat quality. Contributions to cumulative effects from the Project are expected to be relatively small. The Project would directly impact approximately 7,113 acres (2,879 hectares) (0.14 percent) of potentially suitable desert tortoise habitat out of the total 4.85 million acres (1.96 million hectares) available within the NMRU. The estimated number of tortoises in the NMRU have increased from 2004 to 2014 (a 270 percent increase). The USFWS attributes the increase to increased survival of adults and sub-adults moving into adult size classes (USFWS, 2015a). However, not all CHUs in the NMRU have increased. The Mormon Mesa CHU decreased from 2006 to 2016 and the Beaver Dam Slope CHU remained steady from 2006 to 2017 (USFWS, 2009b).

Other projects with large-scale and permanent impacts to desert tortoise habitat include several solar projects within the cumulative effects area. These projects include other solar developments within the Dry Lake SEZ, with an estimated 3,000 acres (1,214 hectares) of impacts to desert tortoise habitat (USFWS, 2015b); the Moapa Solar Project with an estimated 1,100 acres (445 hectares) of tortoise habitat impacts; the Aiya Solar Project with an estimated 672 acres (272 hectares) of impacts, and the Eagle Shadow Mountain Solar Project. The acreage of impacts for the latter project are not yet known but may be on the order of 2,000 to 3,000 acres (809 to 1,214 hectares). Mowing within the Eagle Shadow Mountain Solar Project site is proposed, which would allow desert tortoise the opportunity to reestablish within the site following construction. Solar projects, therefore, could cumulatively result in approximately 15,000 acres (6,070 hectares) of impacts, with the Gemini Solar Project contributing to nearly half of those impacts. The Project's impact could be reduced by allowing desert tortoises to reoccupy the mowed areas. Cumulative solar projects' impacts to desert tortoise habitat would be approximately 10,500 acres (4,249 hectares) out of 2.63 million acres (1.06 million hectares) or approximately 0.4 percent.

The Project, and likely most projects included in the cumulative scenario, would employ industry standard BMPs and the conservation measures listed in Section 2.7. Adherence to conservation measures and BMPs would be required, as well as observance of all applicable local, state, and federal requirements, all of which would help to avoid and reduce some adverse impacts to desert tortoise.

5.2 FEDERALLY LISTED BIRD SPECIES

5.2.1 Overview

Direct effects to migratory bird species can result from habitat disturbance, direct injury or mortality to individual birds from contact with Project vehicles, solar panels, fencing, buildings, and transmission lines (including possible electrocution), as well as removal of vegetation communities that provide suitable habitat for such species. Indirect impacts may result from surface water and sediment runoff from disturbed areas; dust generated by Project activities; noise; lighting; spread of invasive species; use of herbicides, accidental spills; harassment; territory abandonment; increased opportunity for predators; habitat fragmentation; avoidance due to increased human presence; and altered hydrology.

The Applicant would be required to prepare and implement a BBCS that includes a robust systematic monitoring and adaptive management plan to assist in avoiding and minimizing impacts to migratory birds by the Project. This monitoring would include overall annual mortality, species composition, and spatial differentiation based on established searcher efficiency and carcass persistence trials at the site. Monitoring plans would be designed to account for seasonal differences and fatality events of rare species.

5.2.2 Effects

5.2.2.1 Yuma Clapper Rail

Suitable habitat for Yuma clapper rail does not occur within or near the Project area. There currently is a lack of general information on Yuma clapper rail dispersal beyond its known habitat and range. The species likely follows river/lake corridors for dispersal. Two known Yuma clapper rails have been recorded as mortalities to date at existing solar facilities in California; one of those facilities was located close to suitable habitat and had observations within less than 5 miles (8 kilometers) (BLM, 2015).

There is no evidence to indicate that rail dispersal would occur within the Project area. The Project site is not proposed within a path that would connect any aquatic features, and the closest current documented records for the species and its habitat is over 15 miles (24 kilometers) from the Project site. The low number of known recorded mortalities, the lack of habitat on site, and the long distance from any known occurrence suggests low potential for direct morality to Yuma clapper rail related to the Project. Based on the best available science, the potential direct and indirect effects posed by the Project to the Yuma clapper rail are expected to be negligible. The Project-specific BBCS would include a monitoring plan and a contingency for adaptive management to assist in avoiding, minimizing, and detecting impacts to migratory birds by the Project.

5.2.2.2 Yellow-Billed Cuckoo

Suitable habitat for yellow-billed cuckoo does not occur within or near the Project area. There currently is a lack of general information on yellow-billed cuckoo dispersal beyond its known habitat and range. The species likely follows river/lake corridors for dispersal. One known

yellow-billed cuckoo mortality has been recorded to date at a solar facility in Ivanpah in San Bernardino County, California (BLM, 2015). There is no habitat documented within the Project vicinity aside from Lower Colorado River. There is no evidence to indicate that dispersal would occur within the Project site. The Project site is not within a path that would connect any aquatic features and the closest current documented records for the species and its habitat is more than 15 miles (24 kilometers) from the Project site. The low number of known recorded mortalities, the lack of habitat on site, and the long distance from any known occurrence suggests low potential for direct morality to yellow-billed cuckoo related to the Project. Based on the best available science, the potential direct and indirect effects to the yellow-billed cuckoo from the Project are expected to be negligible. The Project-specific BBCS would include a monitoring plan and a contingency for adaptive management to assist in avoiding, minimizing, and detecting impacts to migratory birds by the Project.

5.2.2.3 Southwestern Willow Flycatcher

Suitable habitat for southwestern willow flycatcher does not occur within or near the Project site. There is currently a lack of general information on southwestern willow flycatcher dispersal beyond its known habitat and range, and little information on mortalities at solar facilities. The species likely follows river/lake corridors for dispersal. Although there are no known mortalities of this species to date, other flycatcher species fatalities have been documented at solar facilities (BLM, 2015).

There is no evidence to indicate that dispersal would occur within the Project site. The Project is not within a path that would connect any aquatic features and the closest current documented records for the species and its habitat is more than 15 miles (24 kilometers) from the Project site. No southwestern willow flycatcher mortalities have been recorded at existing solar facilities and the lack of habitat and long distance from any known occurrence suggests low potential for direct morality related to the Project. Based on the best available science, the potential effects to the southwestern willow flycatcher from the Project are expected to be negligible. The Project-specific BBCS would include a monitoring plan and contingency for adaptive management to assist in avoiding, minimizing, and detecting impacts to migratory birds by the Project.

5.2.3 Cumulative Effects

As described above, impacts to Yuma clapper rail, yellow-billed cuckoo, and southwestern willow flycatcher are expected to be negligible. No cumulative effects from the Project in combination with other projects in the cumulative scenario are anticipated for these species and no further discussion is warranted. A BBSC approved by the BLM and USFWS would be implemented for the Project. The Project-specific BBCS would include a monitoring plan and contingency for adaptive management to assist in avoiding, minimizing, and detecting impacts to migratory birds by the Project.

6 CONCLUSIONS AND DETERMINATION OF EFFECTS

6.1 OVERVIEW

The following conclusions and determination of effect are based on the information described in this BA, as well as information provided in the Programmatic BO for the Solar PEIS (USFWS, 2012b).

6.2 MOJAVE DESERT TORTOISE

Implementation of the Project "may affect and is likely to adversely affect" the desert tortoise in the Action Area. However, the Project would not jeopardize the continued survival or future recovery of the desert tortoise.

This determination is based on the following considerations. Construction-related impacts on the desert tortoise could include direct mortality or injury as a result of being crushed by vehicles and disturbance of soil. Tortoises would be translocated off site. Temporary and permanent disturbance to desert tortoise habitat would occur.

The implementation of design features and minimization measures cited in this BA would not reduce impacts to desert tortoise to negligible levels. Avoidance of all potentially suitable habitat for this species is not a feasible means of minimizing impacts due to the location of the Project site within suitable desert tortoise habitat. However, the desert tortoise reintroduction within 65 percent (4,390 acres [1,777 hectares]; mowed area) of the Project area would potentially offset the impacts. The overall direct and indirect impact on desert tortoise habitat from construction, operation and maintenance, and decommissioning of the Project (7,113 acres [2,879 hectares]) would impact 0.14 percent of the of the 4.85 million acres (1.96 million hectares) of potentially suitable habitat available for this species in the NMRU (USFWS, 2010). Of the 7,038-acre (2,853-hectare) solar field, vegetation would be mowed to no less than 18 to 24 inches (46 to 61 centimeters) and desert tortoise would be reintroduced within 4,390 acres (1,777 hectares).

Presence/absence surveys to determine the abundance of desert tortoise in the Project Survey Area have identified that approximately 219 adult tortoises and an estimated 1,139 juvenile desert tortoises would be affected on the Project. Additional tortoises may be affected in those areas into which tortoises would be moved, as described in the Desert Tortoise Translocation Plan (Appendix B).

To minimize Project impacts to the desert tortoise, the Project would implement conservation measures discussed in Section 2.7.2. A Desert Tortoise Translocation Plan has been developed in

consultation with the USFWS, following current translocation guidance provided by the USFWS (USFWS, 2018). The plan identifies potentially suitable recipient locations, control site options, post-translocation densities, procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing and post-translocation monitoring and reporting requirements. Despite some risk of mortality or decreased fitness, translocation is widely accepted as a useful strategy for the conservation of the desert tortoise (BLM and DOE, 2010).

The Project would create a pinch point between the southern end of development area D and the mountains to the south, however this would not completely restrict local or regional genetic or demographic connectivity of the desert tortoise population. The Project would result in habitat fragmentation for local desert tortoises.

6.3 MOJAVE DESERT TORTOISE CRITICAL HABITAT

The Project will not adversely affect Critical Habitat.

Critical Habitat is located 10 miles (16 kilometers) outside of the Project site. No impacts to critical habitat would occur.

6.4 FEDERALLY LISTED BIRD SPECIES

Based on the best available science, the BLM believes the potential risk by the Project meets the insignificant and discountable definition and the Project may affect, is not likely to adversely affect the Yuma clapper rail.

Based on the best available science, the BLM believes the potential risk by the Project meets the insignificant and discountable definition and the Project may affect, is not likely to adversely affect the yellow-billed cuckoo.

Based on the best available science, the BLM believes the potential risk by the Project meets the insignificant and discountable definition and the Project may affect, is not likely to adversely affect the southwestern willow flycatcher.

Potential indirect impacts to Yuma clapper rail, yellow-billed cuckoo, and southwestern willow flycatcher may result from the Project. However, as discussed in Section 5.2, the Project site is not within a path that would connect any aquatic features and the closest current documented records for the species and their habitats are over 15 miles (24 kilometers) from the Action Area. The potential indirect effects of the Project are considered negligible. The Applicant would prepare a Project-specific BBCS that would include a robust systematic monitoring plan and contingency for adaptive management to assist in avoiding, minimizing, and detecting impacts to migratory birds by the Project.

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APPENDIX A

FALL 2017 GEMINI SOLAR PROJECT DESERT TORTOISE SURVEY REPORT AND SPRING 2018 GEMINI SOLAR PROJECT DESERT TORTOISE SURVEY REPORT

Desert Tortoise Survey Report (Areas A-E)

Gemini Solar Project
N-84631

Prepared for

Arevia Power & Solar Partners XI, LLC

(a wholly owned subsidiary of Valley of Fire, LLC)

Prepared by

Phoenix Biological Consulting

January 30, 2018

Table of Contents

Exhibits

LIST OF ACRONYMS

ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
CHU	Critical Habitat Unit
DWMA	Desert Wildlife Management Area
GIS	Geographical Information System
NNHP	Nevada Natural Heritage Program
USFWS	United States Fish and Wildlife Service

INTRODUCTION

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct the Gemini Solar Project in Clark County, Nevada, approximately 25 miles northeast of the Las Vegas metropolitan area (Exhibit 1). The project would consist of a solar photovoltaic (PV) power-generating facility on Bureau of Land Management (BLM)-administered land, located immediately south of the Moapa Indian Reservation and southeast of Interstate 15 (I-15).

Due to the potential biological impacts associated with the development of the site, Phoenix Biological Consulting conducted protocol level presence/ absence surveys for the Mojave Desert tortoise (*Gopherus agassizii*), a federally threatened species. The desert tortoise surveys were conducted in accordance with U.S. Fish and Wildlife Service (USFWS) 2010 guidelines, for the purpose of estimating desert tortoise densities within the proposed impact area. The desert tortoise surveys were conducted between September 4th and October 19th, 2017.

During the survey, biologists recorded a total of 132 live tortoises, four of which were known repeats, and therefore removed from the data. Only adult tortoises $\geq$ 180mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2010 spreadsheet (USFWS (c)). Based on the density calculations, a total of 208 desert tortoises (≥ 180 mm MCL) are estimated to occur within the survey areas of 7,108 acres. The total survey area included the five site areas (A-E) and gen-tie options and corresponding buffer surveys. However, only areas A-E are included in the Exhibit 12 calculations, per protocol. This report includes a project description, description of the survey area, survey methodology, climate, soils and results on the distribution and abundance of the desert tortoise found within the proposed project area.

PROPERTY AND PROJECT DESCRIPTION

Project Location

The project site is located in the northeastern portion of the Mojave Desert; approximately 25 miles northeast of the Las Vegas metropolitan area, in an unincorporated area of Clark County, Nevada (Exhibit 1). The project site is situated immediately south of the Moapa Indian Reservation, less than 0.5 miles southeast of Interstate 15 (I-15), and less than 4 miles east of the NV Energy Crystal Substation and a NV Energy high-voltage transmission line; in the Piute Point and Dry Lake quadrangles of the United States Geographical Surveys (USGS) 7.5 minute topographic map series (Exhibit 2). The project site is located within a Solar PEIS (Programmatic Environmental Impact Statement) variance area; designated to facilitate environmentally responsible solar energy development, as identified through an amendment to the Las Vegas Resource Management Plan/Record of Decision (ROD). The legal description of the parcels is listed below (Table 1).

Table 1: Township/Range and Section Information

Township	Range	Sections	Description
17S	64E	10 & 11	S ½
		12, 13, 23, 24, 25, 26, 35 & 36	ALL
		14	N ½, E ½
		15	N ½
		22, 27 & 34	E ½
17S	65E	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 & 36	ALL
17S	66E	7, 18 & 19	ALL
18S	64E	1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35 & 36	ALL
		3, 10, 15, 22, 27 & 34	E ½
18S	65E	1, 2, 3, 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20 & 30	ALL
		21	N ½, SW ¼

Project Description

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct, own, operate, and decommission a solar photovoltaic (PV) power-generating facility, known as the Gemini Solar Project, on Bureau of Land Management (BLM)-administered land located in Clark County, Nevada. The proposed Gemini Solar project intends to generate approximately 690-megawatt (MW) alternating current (MWac) of renewable electrical energy by utilizing solar PV modules mounted on single-axis, horizontal tracker structures. Electricity generated by the project would be interconnected to the NV Energy transmission system via overhead generation (gen)-tie lines extending from the project switchyards to Nevada Energy's Crystal Substation. The gen-tie lines would consist of a 230 KV circuit for delivery of 440 MW to Nevada Energy Balancing Authority (Phase I) and a 500 KV circuit for delivery of 250 MW to the Los Angeles Department of Water and Power (LADWP) (Phase II). Additional elements to the proposed solar energy facilities include a 34.5 KV overhead and underground collector line, a 2-acre operations and maintenance area, one to two switchyards, internal access roads, access roads along gen-tie lines, a perimeter road, perimeter fencing, three substations, and improvements to the existing NV Energy facilities to support interconnection.

The approximate disturbance acreage for the proposed site plan is 7,114 acres of permanent disturbance, which includes the solar facility, primary access road, collection line road, collection line single pole site, and gen-tie lines; and 7 acres of temporary disturbance, including a laydown area and two pull sites for collection line construction. The solar facility is divided into five separate polygons; referred to as areas A, B, C, D, and E in this report (Exhibit 2). The five

polygons are connected via connection lines and three gen-tie options that were included in the survey effort.

The proposed project is located on public land entirely within the ~44,000 acres of the BLM right-of-way application (SF299) with serial number N-84631. The ROW application contains a larger area than required for the solar field to allow for adjustments in the facility layout to minimize environmental impacts, based on the National Environmental Policy Act (NEPA) analysis. The project will generate greenhouse gas-free electricity during daylight hours when electricity demand is at its peak, averaging an energy production that equates to the annual daytime electricity needs of approximately 260,000 households.

DESERT TORTOISE NATURAL HISTORY

The desert tortoise is a large herbivorous reptile that occurs in the Mojave and Sonoran deserts, in southwestern Utah, southern Nevada, southeastern California and western Arizona, into northern Sinaloa Mexico. The designated Mojave population of the desert tortoise (*Gopherus agassizii)* is listed as federally and state threatened and occurs north and west of the Colorado River in the Mojave desert of California, Arizona, Nevada, southwestern Utah, and in the Sonoran (Colorado) desert in California (USFWS 1994).

The desert tortoise occupies a variety of habitats including creosote bush scrub at lower elevations and blackbrush scrub and juniper woodland transition zones at higher elevations (Germano, 1994). Elevation range for the desert tortoise has been recorded from below sea level to 7,300 feet. Typical habitat for the desert tortoise in the Mojave Desert has been characterized as creosote bush scrub below 5,500 feet (Luckenbach 1982). Throughout most of the Mojave Desert, the desert tortoise is most commonly found on gently sloping terrain with sandy-gravel soils of sparse low growing shrubs, which allow for the establishment of herbaceous plants. Soils must be friable enough for digging burrows but firm enough to avoid collapse (USFWS 1994).

Desert tortoises spend most of their lives in burrows, even during seasons of activity. In addition to digging their own burrows, desert tortoises will opportunistically use burrows, deep caves, rock and caliche crevices, and overhangs (Germano, 1994). Burrows provide constant temperature and higher humidity which protect the tortoise during periods of extreme temperatures and reduces water loss during very dry conditions. The preferred body temperature of the desert tortoise is 69 degrees to 101 degrees Fahrenheit (McGinnis and Voigt, 1971). Desert tortoises are most active during spring and early summer, during summer rains, in the early morning and late afternoon as temperatures increase, and in early fall as new sprouts

germinate (Stebbins, 2003). During periods of inactivity, desert tortoises reduce their metabolism and water loss by remaining dormant underground.

Desert tortoises ingest most of their water from plants, and store it in their bladders; allowing them the ability to survive for more than a year without access to water of any kind. The diet of desert tortoises consists of winter annuals, perennial grasses, woody perennials, and cacti. Desert tortoises will eat non-native species such a red brome (*Bromus rubens*) and red-stem filaree (*Erodium cicutarium*), but they generally prefer native forbs when available (USFWS, 2011).

The desert tortoise is long lived with delayed sexual maturity. Maximum longevity for desert tortoises in the wild is between 50 and 70 years, with the average life expectancy around 25 to 35 years (Germano, 1994). Desert tortoises begin reproducing between 12 and 20 years, when they are roughly 180 to 200 mcl (median carapace length) in size. The number of eggs (1-10 per clutch) and the number of clutches (0-3) 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). Reproductive potential for the desert tortoise is low, due to high mortality rates before successful reproduction is reached.

Some reasons for the threatened status of the desert tortoise include disease, predation, and the destruction, modification, and fragmentation of its habitat and range. Human related activities such as development, agriculture, military activity, mining, waste disposal, road construction, livestock grazing, and off-highway vehicles (OHVs), can cause loss of habitat and the proliferation of invasive plants, limiting the desert tortoises' natural food supply; ultimately threatening the long-term survival of the species (USFWS 1994).

Disease, specifically Upper Respiratory Tract Disease (URTD), caused by the bacterium *Mycoplasma agassizii*, is associated with major declines in desert tortoise populations in the 1980s. Other diseases affecting desert tortoises include *cutaneous dyskeratosis* (shell lesions), *urolithiasis* (bladder stones), and shell necrosis (Homer at el. 1998). Hatchling and juvenile desert tortoises are vulnerable to predation, due to their slow growth and soft flexible shell. The common raven (*Corvus corax*) is a common predator of small tortoises. Increased human activities lend to elevated raven populations, due to more available resources for ravens such as food from garbage, water from sewage ponds and municipal areas, and nesting areas such as utility towers and buildings; thus resulting in increased predation on desert tortoises (Boarman et al. 2006). Other known predators of desert tortoises include coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis*), mountain lions (*Felis concolor*), red-tailed hawks (*Buteo jamaicensis*) and golden eagles (*Aquila chrysaetos*).

REGIONAL AND LOCAL SETTING

The Action Area is regionally characterized by 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 which encompasses all of the State of Nevada. Plants communities within this region consist of drought tolerant shrubs such as creosote (*Larrea tridentata*), white burr sage (*Ambrosia dumosa*), Yuccas and Cacti and Mesquite & Acacia thornscrub washes.

The action area is locally situated along the lower bajada of a northeasterly sloping landform consisting of multiple, braided, intermittent washes that connect into the California Wash which flows to the northeast, into the Muddy River. The rainfall averages 4-8 inches and a mean annual temperature between 60 to 70 degrees Fahrenheit. The vegetation community consists predominantly of Creosote-White burr sage scrub and Acacia thornscrub, within some of the larger washes. Along the western boundary of the action area, the vegetation community transitions to white burr sage scrub and saltbush associates with pockets of big galleta grass and Badlands further to the west. The topography consists of a mix between gentle, rolling hills and level topography in the lower elevations sloping towards the California Wash. Outside of the action area, the surrounding hills include the Dry Lake Range to the west, the Muddy Mountains to the south and North Muddy Mountains to the east. The topography to the north is relatively flat as the watershed, levels and meanders to the northeast, combining with multiple intermittent washes prior to connecting with the Muddy River, approximately thirteen miles to the northeast. Progressing to the south of the site and along the upper bajada, into the Muddy Mountains, the landscape is intermittently punctuated with limestone outcrops, larger rocks and an increase in cacti. The soils on site are derived from both eolian deposits and limestone and dolomite parent material. Cryptobiotic crust is found throughout the project site in a patchy mosaic with concentrations near drainages banks. The soil consistency within the majority of the site consists of either sandy-gravelly loams or fine sand with gravelly substratum.

EXISTING CONDITIONS

Habitat and land use

The project site is located in the northeastern portion of the Mojave Desert and is surrounded by relatively undeveloped and undisturbed desert scrubland. The Moapa Indian Reservation is located immediately north of the project site, with the remaining surrounding area consisting of undeveloped open access desert that is owned by the federal government and managed by the U.S. Bureau of Land Management (BLM).

Disturbed areas within the project site include multiple two-track unimproved dirt roads that traverse through the project site; including State Road 40 in area A and B, Old Spanish trail Road in areas D and E, and Route 167 in the southern portion of area D. Other disturbed areas in the

vicinity of the project include the Moapa Piute Travel Plaza on the northern edge of the project boundary, Valley of Fire road between areas B and C of the project, I-15 to the northwest of the project site, and K Road Solar approximately 1.5 miles north of the project site on the Moapa Indian Reservation. The Nevada Energy Crystal substation, into which the Gen-tie line would connect, is located approximately 2.5 miles west of the project site.

The dominant vegetation within areas B-E consists of Creosote-White Burrobush scrub *Larrea tridentata-Ambrosia dumosa* Shrubland Alliance, interspersed with Catclaw Thornscrub *Acacia greggii* Shrubland Alliance (Desert wash scrub) within the braided ephemeral drainage channels that traverse the site. Site A is a mixture of Saltbush scrub (*Atriplex confertifolia*), Creosote-White burrobush scrub (*Larrea tridentata-Ambrosia dumosa*) *and* Big Galleta Grass *Pleuraphis rigida* Herbaceous Alliances (Sawyer, J.O. et al., 2009).

A preliminary list of the plants incidentally observed during presence/absence surveys are listed in Exhibit 10.

Topography and soils

The topography of the project site is relatively flat, with elevations ranging from approximately 2025 to 2450 feet (617 to 747 meters) above mean sea level (Exhibit 2). According to the USDA Natural Resource Conservation Service (NRCS) online Web Soil Survey, the Gemini project site consists of nine soil types: (1) AOB - Arada fine sand, gravelly substratum (2) ASC - Arada fine sand, hardpan variant (3) BD – Badland (4) BHC – Bard gravelly fine sandy loam (5) BOB – Bard-Rough broken land association (6) Gs – Glendale loam (7) MOB – Mormon Mesa fine sandy loam (8) SP – Spring silty clay loam (9) THB – Tonopah gravelly sandy loam. The description of the soil types along with the breakdown by site location are shown in Table 2 and Exhibit 3.

Table 2: Soil Types Present Within the Project Site

Map Unit Symbol	Percent of Area	Map Unit Name	Description	Location Areas(s)
AOB	17.8%	Arada fine sand, gravelly substratum	0-4% slopes, fine sand (0-24 inches), stratified extremely gravelly loamy coarse sand to extremely gravelly fine sandy loam (24-60 inches), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	D, E
ASC	2.7%	Arada fine sand, hardpan variant	2-8% slopes, fine sand (0-30 inches), cemented material (30-34 inches), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	B, D
BD	1.4%	Badland	On fan remnants	A
BHC	29.7%	Bard gravelly fine sandy loam	2-8% slopes, gravelly fine sandy loam (0-3 inches), fine sandy loam (3-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	A, B, C, D
BOB	14.2%	Bard-Rough broken land association	2-4% slopes, very gravelly fine sandy loam (0-5 inches), fine sandy loam (5-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	B
Gs	1.1%	Glendale loam	0-2% slopes, loam (0-9 inches), stratified very fine sandy loam to silty clay loam (9-60 inches), well drained, flood plains, and strongly saline	A
MOB	1.6%	Mormon Mesa fine sandy loam	0-8% slopes, fine sandy loam (0-16 inches), cemented material (16-60 inches), well drained, fan remnants, and non-saline to very slightly saline	A, B
SP	9.2%	Spring silty clay loam	0-2% slopes, silty clay loam (0-5 inches), clay loam (5-11 inches), gypsiferous material (11-43 inches), moderately well drained, fan remnants, and strongly saline	A
THB	22.3%	Tonopah gravelly sandy loam	0-4% slopes, gravelly sandy loam (0-6 inches), extremely gravelly sand (6-60 inches), excessively drained, and non-saline to slightly saline	A, B, C

Climate

According to the National Climate Data Center (NCDC) 1981-2010 for Valley of Fire, NV, the average annual temperature range in the area is between 58.3^{o}F and 81.0^{o}F. Average temperatures range from 78.0^{o} F to 102.9^{o} F in summer months, 40.0^{o} F to 59.0^{o} F in winter, and 56.1^{o} F to 81.6^{o} F in spring and fall. Average annual precipitation is 6.5 inches, with the most precipitation occurring during the winter months (NOAA, 2017). Recorded weather data was accessed from the Remote Automatic Weather Stations (RAWS) located at Wamp Springs Nevada which is located approximately 18 miles northwest of the project site. During the previous twelve months, from the survey, rainfall has been above the average for the area. The Wamp Springs

RAWS station rainfall average from October, 2016 to March, 2017 was approximately 6.1 inches (155 mm) (WRCC, 2017). The fall 2017 survey period was advantageous from a rainfall perspective due to the monsoon flow that occurred. The Wamp Springs RAWS station recorded 1.24 inches of rainfall on September 8-9th, at the onset of the survey effort. This additional rainfall may have added to the detectability and increased activity of desert tortoises during the survey effort. Soils moisture and small annual plant growth was observed through most of the September field survey effort.

Proximity to ACECs and DWMAs

Areas of Critical Environmental Concern (ACECs) are limited use areas designated and managed by the BLM to protect sensitive biological, historical, and cultural resources; natural process or systems; and/or natural hazards. ACECs in Clark County, NV protect unique cultural and archeological resources and areas of high-quality habitat for species of concern, including the desert tortoise. The surrounding ACECs that contain desert tortoise critical habitat include the Mormon Mesa, Gold Butte, and Coyote Springs Desert Wildlife Management Areas (DWMAs) (Exhibit 4).

Desert Wildlife Management Areas (DWMAs) have been established to protect high quality habitat for the threatened desert tortoise; ACEC overlap critical habitat for the desert tortoise. Critical habitat, designated under the Endangered Species Act, is protected from "destruction" or "adverse modification" of the habitat; essentially excluding critical habitat from development. The three DWMAs – Mormon Mesa, Gold Butte, and Coyote Springs – surrounding the project area are all within the Northeastern Mojave Recovery Unit. The project site is located roughly 10 miles east of Coyote Springs DWMA, 25 miles south of Mormon Mesa DWMA, and 23 miles west of the Gold Butte DWMA. The project site is not within and does not border any of the DWMAs, so no impacts to DWMAs are anticipated.

METHODOLOGY

Presence/Absence Surveys

Prior to conducting field surveys, Phoenix initiated informal consultation via email in May and June of 2017 with USFWS personnel (Michael Burroughs) to discuss survey schedule, methodology and incidental observations. In addition, BLM biologist's Mark Slaughter and Greg Brooks were contacted via email on June 20, 2017 to confirm survey methodology, timing and approach. Furthermore, Phoenix acquired desert tortoise GIS incidental occurrence data for the Gemini Solar project area from the Nevada Natural Heritage Program in February 2017. The GIS data confirmed desert tortoise occurrences in and around the vicinity of Gemini solar (NNHP, 2017).

Phoenix Biological Consulting conducted presence/absence surveys with qualified biologists for the desert tortoise on the project site and surrounding buffer areas between September 4th and October 19th, 2017, in accordance with the USFWS Desert Tortoise Survey Protocol (USFWS 2010). In an effort to achieve 100% visual coverage of areas containing suitable desert tortoise habitat, the survey consisted of ten-meter wide pedestrian transects walked within the entire polygon of areas A-E and the gen-tie options. Buffer surveys were also conducted at 200, 400, and 600 meters within the Gen-tie and Collection line buffer areas (Exhibit 8). Surveyors also recorded the beginning and ending easting and northing coordinates to ensure all areas were covered and track logs for each team were also recorded on GPS units for redundancy. During the survey efforts, each survey team recorded start and end temperatures, wind and cloud cover. Surveys were conducted during daylight hours and were not conducted during temperatures exceeding 104^{o} F, in accordance with survey protocols.

Biologists recorded desert tortoises and desert tortoise sign, including tortoise burrows, pallets, carcasses, courtship rings, and scat; the presence of eggshell fragments, water depressions/drinking sites, and tracks was also noted when accompanied with a tortoise burrow or pallet. No desert tortoises were handled and no desert tortoise sign was collected. Biologists documented data using Garmin Global Positioning System (GPS) in the Universal Transverse Mercator (UTM) World Geodetic System (WGS) 1984 Zone 11S datum with 3-5 meter accuracy. Field data was recorded on data sheets for each day in which the surveys were conducted. The conditions recorded for each desert tortoise burrow, carcass, and scat observation were classified according to the USFWS 2009 protocol classification system (Table 3). In addition, incidental observations for American badger (*Taxidea taxus*), coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), and burrowing owl (*Athene cunicularia*) sign were also recorded (Exhibit 9).

Table 3: Information Index for Desert Tortoise Sign

Sign	Class	Definition
Burrows and Dens		
	1	currently active, with desert tortoise or recent desert tortoise sign
	2	good condition, definitely desert tortoise; no evidence of recent use
	3	deteriorated condition; definitely desert tortoise
	4	good condition; possibly desert tortoise
	5	deteriorated condition; possibly desert tortoise
Scats		
	1	wet (not from rain or dew) or freshly dried; obvious odor
	2	dried with glaze; some odor; dark brown
	3	dried; no glaze or odor; signs of bleaching (light brown), tightly packed material
	4	dried; light brown to pale yellow, loose material; scaly appearance
	5	bleached, or consisting only of plant fiber
Shell Remains		
	1	fresh or putrid
	2	normal color; scutes adhere to bone
	3	scutes peeling off bone
	4	shell bone is falling apart; growth rings on scutes are peeling
	5	disarticulated and scattered

Abundance Estimates

Abundance estimates are designed to estimate take in the action area and to develop plans to minimize impacts to tortoises in the project footprint. Desert tortoise abundance estimates were calculated using the USFWS 2010 excel spreadsheet for estimating desert tortoise density in the action area (Exhibit 12). This calculation takes into account that not all desert tortoises within the action area are seen by the surveyor. To estimate the number of desert tortoises within the action area, the equation divides the number of adult tortoises (≥ 180 mm MCL) observed during the survey by the product of the probability that a tortoise is above ground during the survey (Pa) and the probability that a surveyor will see the tortoise if it is above ground (Pd). Pa is relative to the previous winter's rainfall, recorded in this case between October 2016 and March 2017 by the Western Regional Climate Center. In accordance with the USFWS protocol, Pa for this project is equal to 0.80 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. The rainfall total for the October 2016 to March 2017 period that was utilized in the calculations (Pa) was approximately 155 mm.

RESULTS

Abundance Estimates

During the survey, biologists recorded a total of 132 live tortoises. Four observations were determined to be repeats, and, therefore, removed from further analysis. Only adult desert tortoises ≥ 180 mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2010 spreadsheet. Average transect length (1.42 km) is utilized in the calculations due to the fact that there were 2,025 unequal transects within the site. Average transect length was calculated by determining the total kilometers walked (2,876 km) divided by total number of transects (2,025 transects). Total tortoises observed, within the five surveys areas (A-E) that were ≥ 180 mm MCL in size is 105 tortoises. The results of the calculation spreadsheet are provided in Exhibit 12. Based on the density calculations, a total of 208 desert tortoises are estimated to occur within the project footprint.

In addition to live tortoises, biologists observed 2,394 desert tortoise burrows, 278 pallets, 234 carcasses, and 201 scats. The location of live desert tortoises, along with desert tortoise burrows Class 1-3, are shown in Exhibits 5 & 6. A comparison of scat distribution to class 1-2 burrows is depicted on Exhibit 7. Carcass distribution is provided on Exhibit 8.

Table 4: Desert Tortoise Density per Area and Total Area

Survey Area	Acres & Percent of Total	Total # of DT observed	# of DT ≥ 180 mm MCL	Acres per Tortoise (≥ 180 mm MCL)
Area A	862 (11.5%)	14	14	62
Area B	3,460 (46.2%)	94	74	47
Area C	471 (6.3%)	6	6	79
Area D	1,913 (25.6%)	11	10	191
Area E	402 (5.4%)	1	1	402
Gen-tie & Collection Lines	103 (1.4%)[1]	2	2[1]	52
Buffer Surveys	270 (3.6%)[1]	0	0	0
TOTAL	7,481 (7,108) [2]	128	107 (105) [2]	-

1-Not included in Exhibit 12 Calculations
2-Exhibit 12 utilizes 7,108 Acres and 105 Tortoises

Confidence Interval

The confidence interval (CI) was calculated using the USFWS 2010 spreadsheet. The lower 95% CI for Gemini solar is 109 and the upper 95% CI is 400 (Exhibit 12).

Density Analysis

Preliminary comparative density analysis from nearby areas of interest are listed in Table 5. The areas of interest include the three closest, surrounding critical habitat units and the two closest solar projects, all located within the Northeast Mojave Recovery Unit. Playa Solar is located approximately 7 miles to the west of Gemini Solar and K Road Solar is situated 1.5 miles to the north. Desert tortoise density estimates for the Mormon Mesa, Coyote Springs, and Gold Butte CHUs, were determined based on data from the range wide monitoring line distance studies prepared by Linda Allison at USFWS. The density estimate for K Road Solar, is based on the actual number of tortoises relocated during the translocation effort (C. Wise, personal communication, November 14, 2017). The Playa Solar density estimates are based on the abundance estimate calculation from the presence/ absence survey report (ESA, 2014).

Table 5: Preliminary Comparative Density Analysis

Area Name	Area Surveyed	Estimate # of Desert Tortoises (≥ 180 mm)	Desert Tortoises Per mi² or km² (Density)
Gemini Solar	7,108 acres	208	18.7 / mi²
	11.11 mi²		7.2 / km²
	28.77 km²		
K Road Solar[1]	2,141 acres	107	31.9 / mi²
	3.35 mi²		12.4 / km²
	8.66 km²		
Playa Solar[2]	2,150 acres	44	13.1 / mi²
	3.36 mi²		5.1 / km²
	8.70 km²		
Coyote Springs CHU[3]	1,025 km²	26	4.2 / km²
Gold Butte CHU[4]	1,977 km²	15	1.7 / km²
Mormon Mesa CHU[3]	968 km²	7	2.1 / km²
Average Density in NE[3] Recovery Unit	-	-	4.4 / km²

1-(USFWS, 2012), 2-(ESA, 2014), 3-(USFWS (e)), 4-(USFWS (f))

Based on preliminary analysis, the Gemini Solar project area has a density of approximately half of K Road Solar and a slightly higher density than Playa Solar. Based on the available data, all three solar projects appear to have higher densities than the average for the Northeast Recovery unit and the three surrounding critical habitat units. Tortoise density within the project site is highest at area B (47 acres/tortoise) followed by area A (62 acres/tortoise). Areas E and D were the lowest, (402 and 191 acres/tortoise, respectively) and Site C (79 acres/tortoise) was within the middle of the density ranges within the site (Table 4).

Incidental Observations of Predators and Other Wildlife

During the presence/ absence surveys, a total of 486 non-tortoise burrows were recorded, including 28 American badger burrows, 11 burrowing owl burrows, and 447 desert kit fox burrows. Of the desert kit fox burrows, 84 were recorded as active (Exhibit 9). One Golden Eagle was observed soaring overhead, 8 burrowing owls were observed in areas B and D, and a partial

Big Horned Sheep horn was observed in area A. Incidental wildlife species that biologists observed during the presence/ absence surveys are listed in Exhibit 11 and include 54 avian species, 9 reptilian species, and 3 mammalian species, including signs for an additional 7 mammalian species.

Discussion

The highest density of live tortoises observed during the surveys were located in the middle of the project site; specifically area B. The eastern portion of area A and the northwestern corner of area C also contained higher desert tortoise densities, with relatively even distribution throughout area D. Only one desert tortoise sighting was observed in the northwestern corner of area E. Lower density areas are located in the southern portion of area C and most of area E. Lower density areas are also located along the western portion of area A, and eastern and southern boundaries of area B (Exhibits 5 & 6). Active Class 1-2 desert tortoise burrows appear to be positively correlated and clustered in areas of higher density near the live tortoise observations. Tortoise scat and Class 1 & 2 burrows were also positively correlated with live tortoise distribution, as depicted in Exhibit 7.

Desert kit fox burrows were found in the highest concentrations in the center of area B and the northern half of area D. Area C contained a small cluster of desert kit fox burrows in the northern 1/3 portion of the site; with sporadic distribution throughout the southern half of area D, area A, and throughout the entirety of area E. The highest density of active desert kit fox burrows were located in the middle of area D. Area C was the only site in which no active desert kit fox burrows were observed. The lowest concentrations of desert kit fox burrows were found in the eastern/middle portion of area A, the northern and southern ends of area B, and the southern 2/3 portion of area C. American badger burrow distribution was focused in the middle half of area B and the upper portion of area D (Exhibit 9).

The majority of the burrowing owl sign, including live burrowing owls and burrows, were located in site B; with most observations recorded in the southern half of area B. Only three additional burrowing owl signs were observed; two in the middle/ western portion of area D and one located just west of area B on the Alt Trans ROW Path #3.

Table 6: Summary of Survey Results

Species/Observation Type	Total Observed in Survey Areas (A-E)[1]
Total Live Desert Tortoises	126
≥ 180 mm MCL	105
< 180 mm MCL	21
Desert Tortoise Scat	
Class 1	47
Class 2	108
Class 3	35
Class 4	7
Class 5	4
Desert Tortoise Carcasses	
Class 1	17
Class 2	18
Class 3	40
Class 4	31
Class 5	128
Desert Tortoise Burrows	
Class 1	494
Class 2	1,359
Class 3	477
Class 4	49
Class 5	15
Desert Kit Fox Burrows	447
American Badger Burrows	28
Burrowing Owl Individuals & Burrows	19
Big Horn Sheep Horn	1

1-Tortoises in Gen-tie options are not included in these calculations.

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USFWS (f). Range-Wide Monitoring of the Mojave Desert Tortoise (Gopherus agassizii): 2013 and 2014 Annual Reporting. Prepared by Linda Allison. Desert Tortoise Monitoring Coordinator. June, 2015

Western Regional Climate Center (WRCC). Monthly Sum of Precipitation for the Valley of Fire SP, NV Station, Number 268588. Website accessed November 2017: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nv8588.

Western Regional Climate Center (WRCC). Monthly Rainfall Totals of the Wamp RAWS station. Website accessed November 2017: https://raws.dri.edu/cgi-bin/rawMAIN.pl?nvNWAM

Project Exhibits

Exhibit 1: Regional View

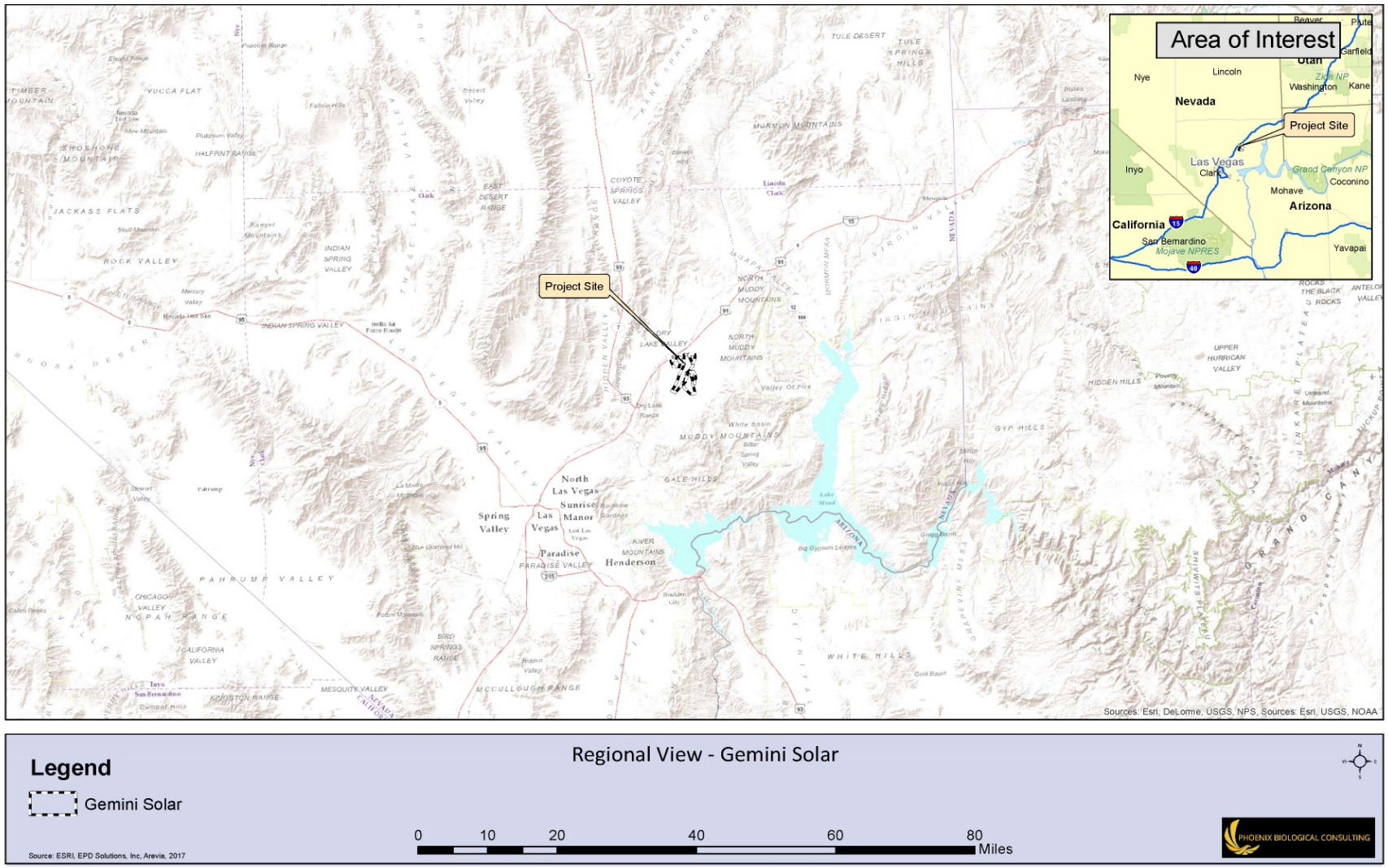

Exhibit 2: Topographic View

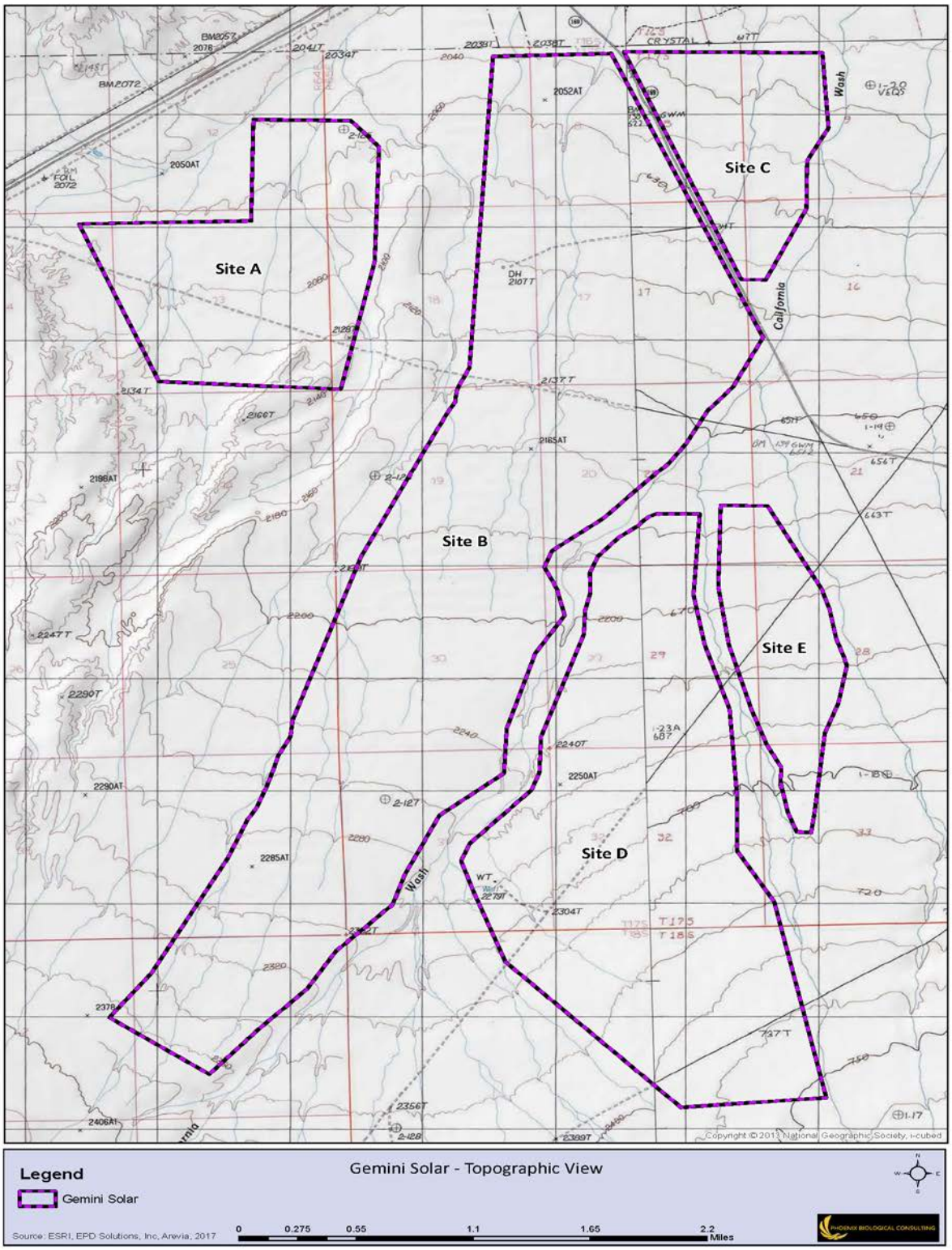

Exhibit 3: Soil Classification

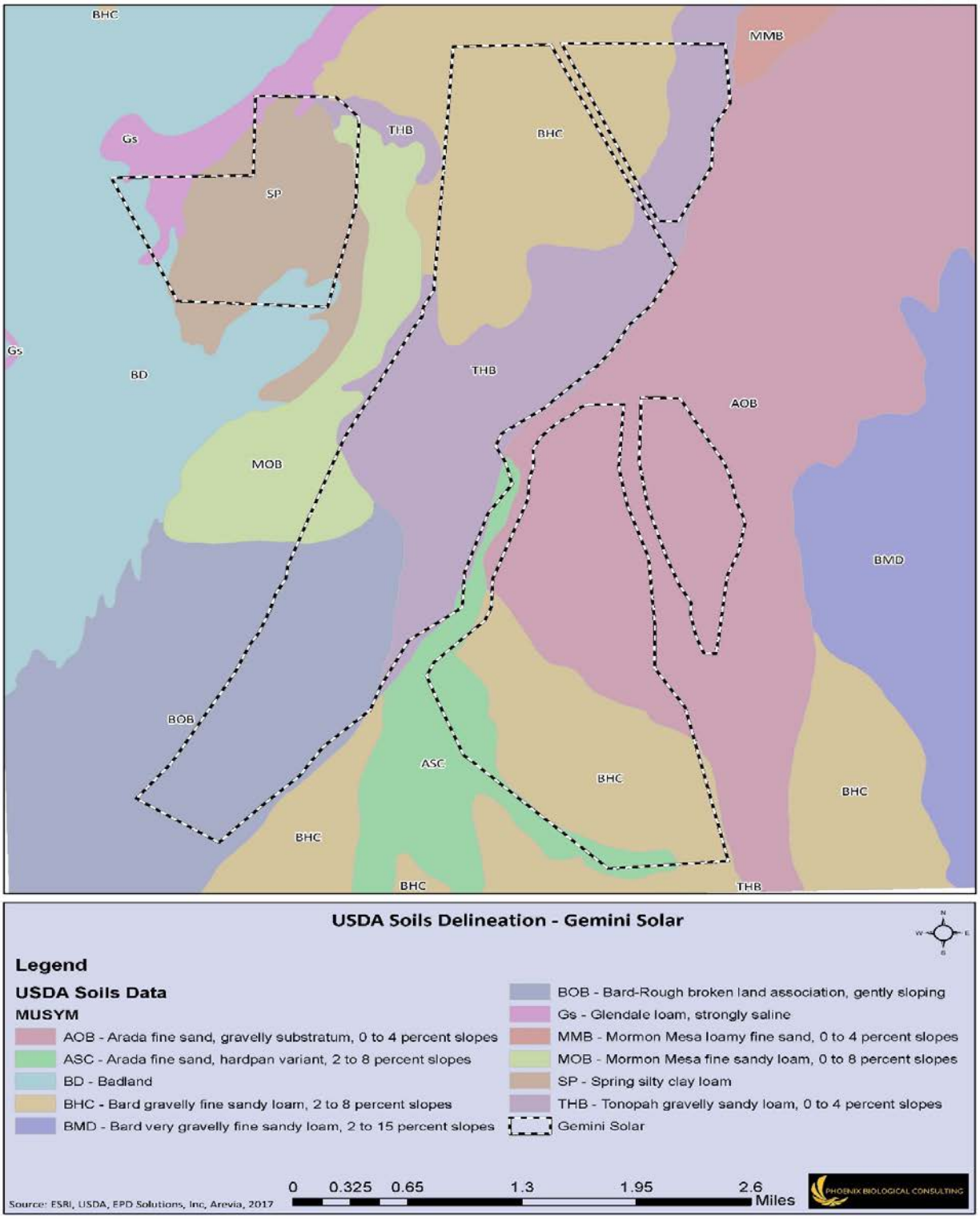

Exhibit 4: Proximity to ACEC and Critical Desert Tortoise Habitat

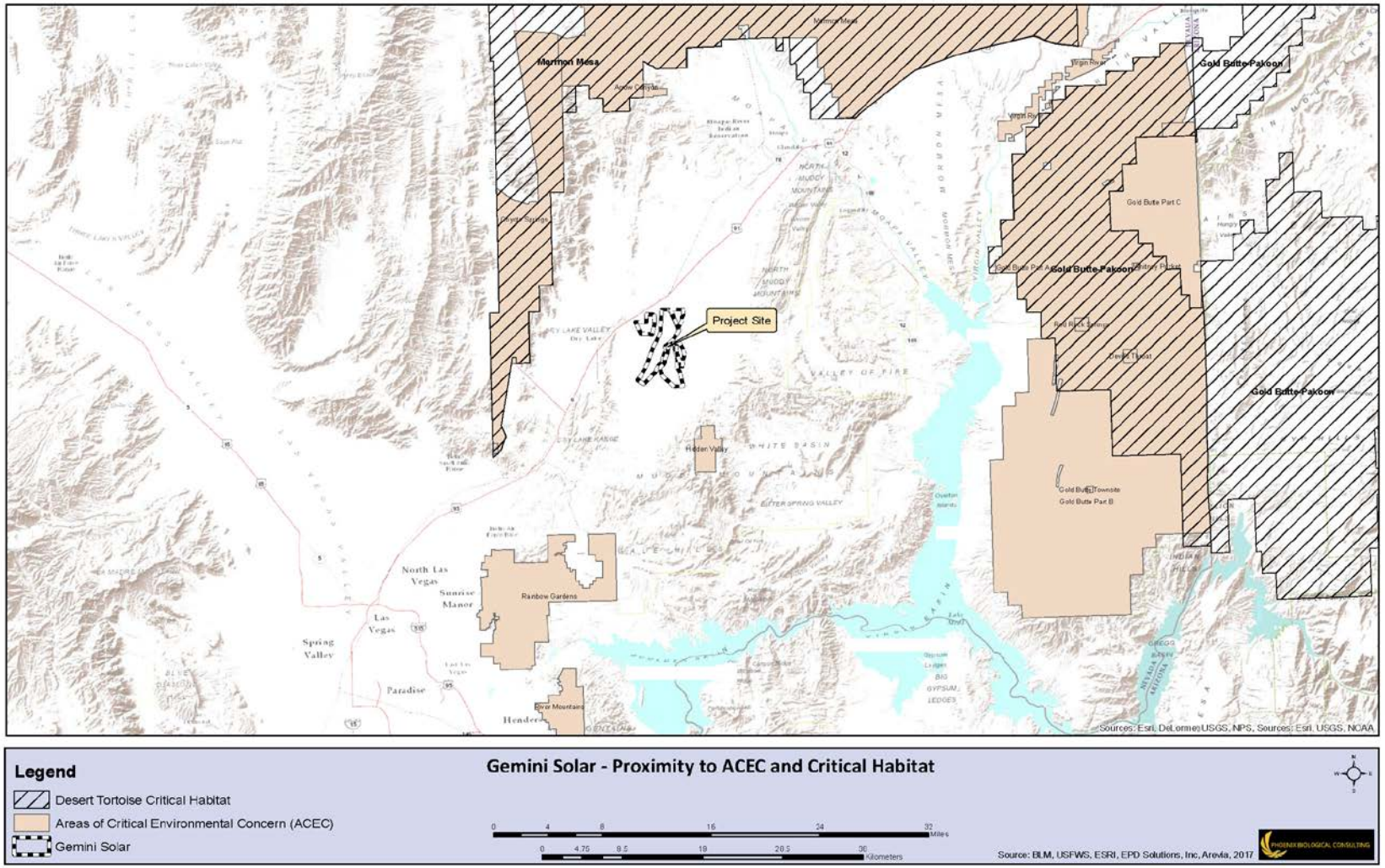

Exhibit 5: Desert Tortoises Observed and Burrow Distribution – Northern Half

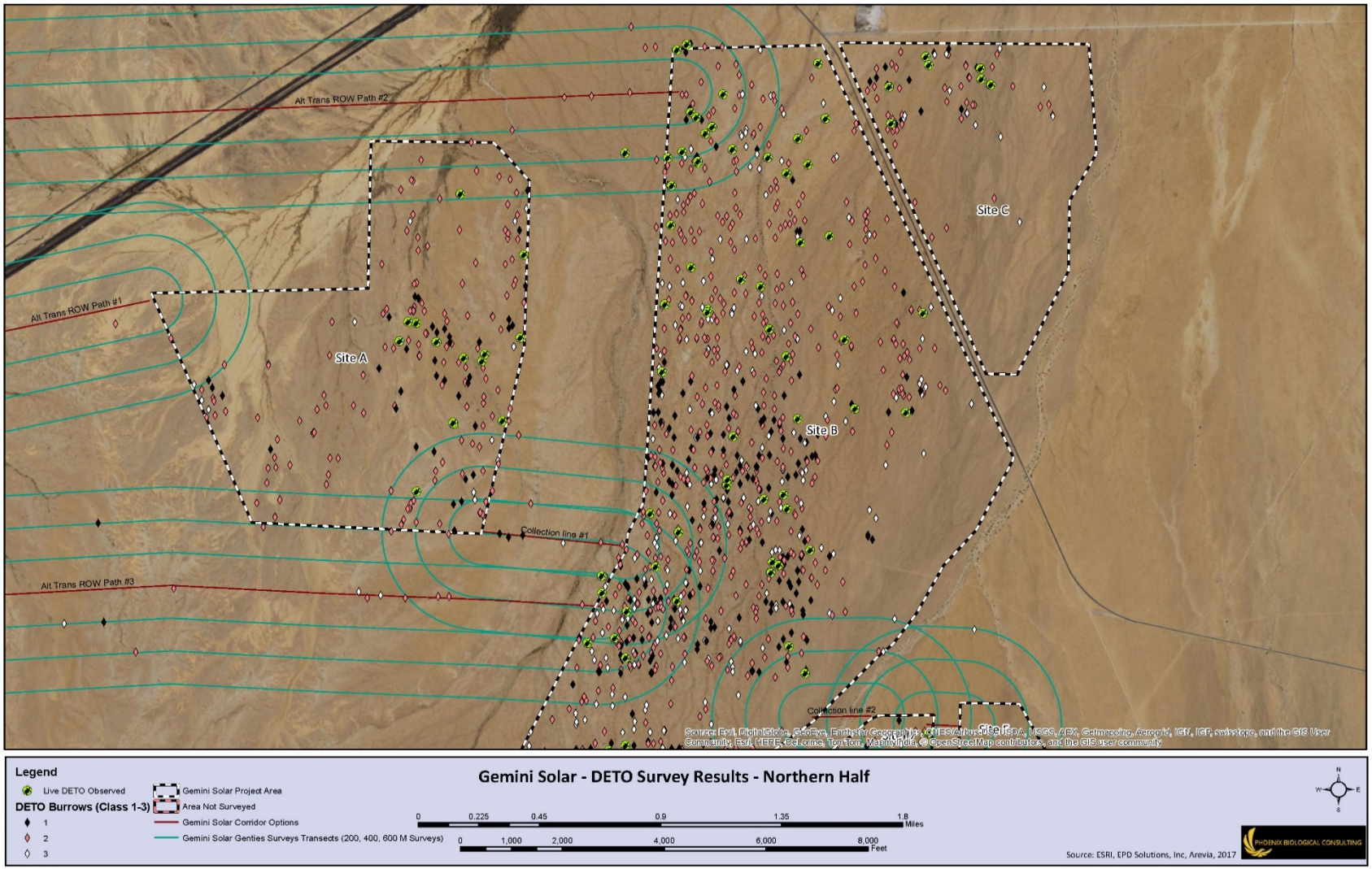

Exhibit 6: Desert Tortoises Observed and Burrow Distribution – Southern Half

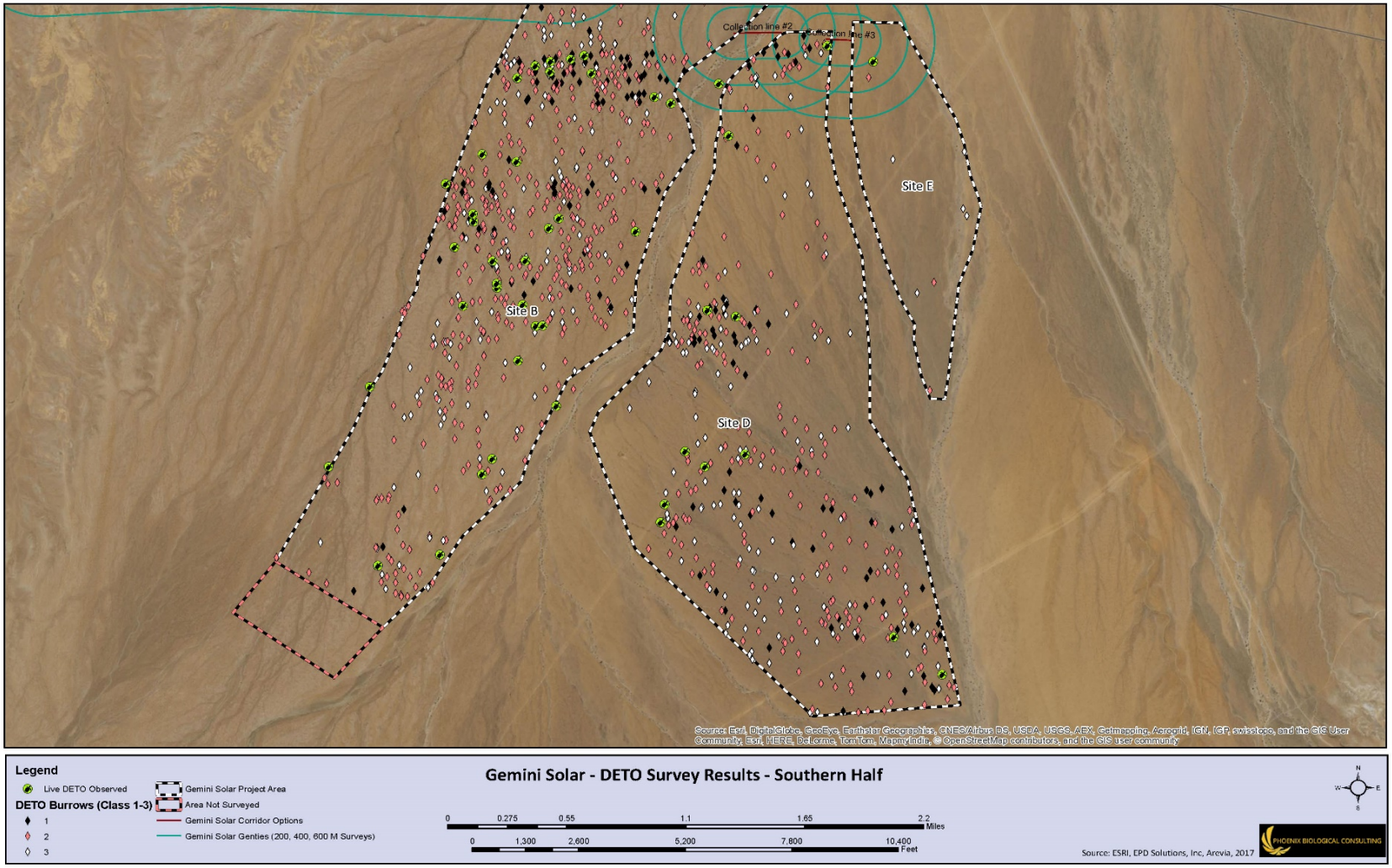

Exhibit 7: Desert Tortoise Scat & Burrow Distribution

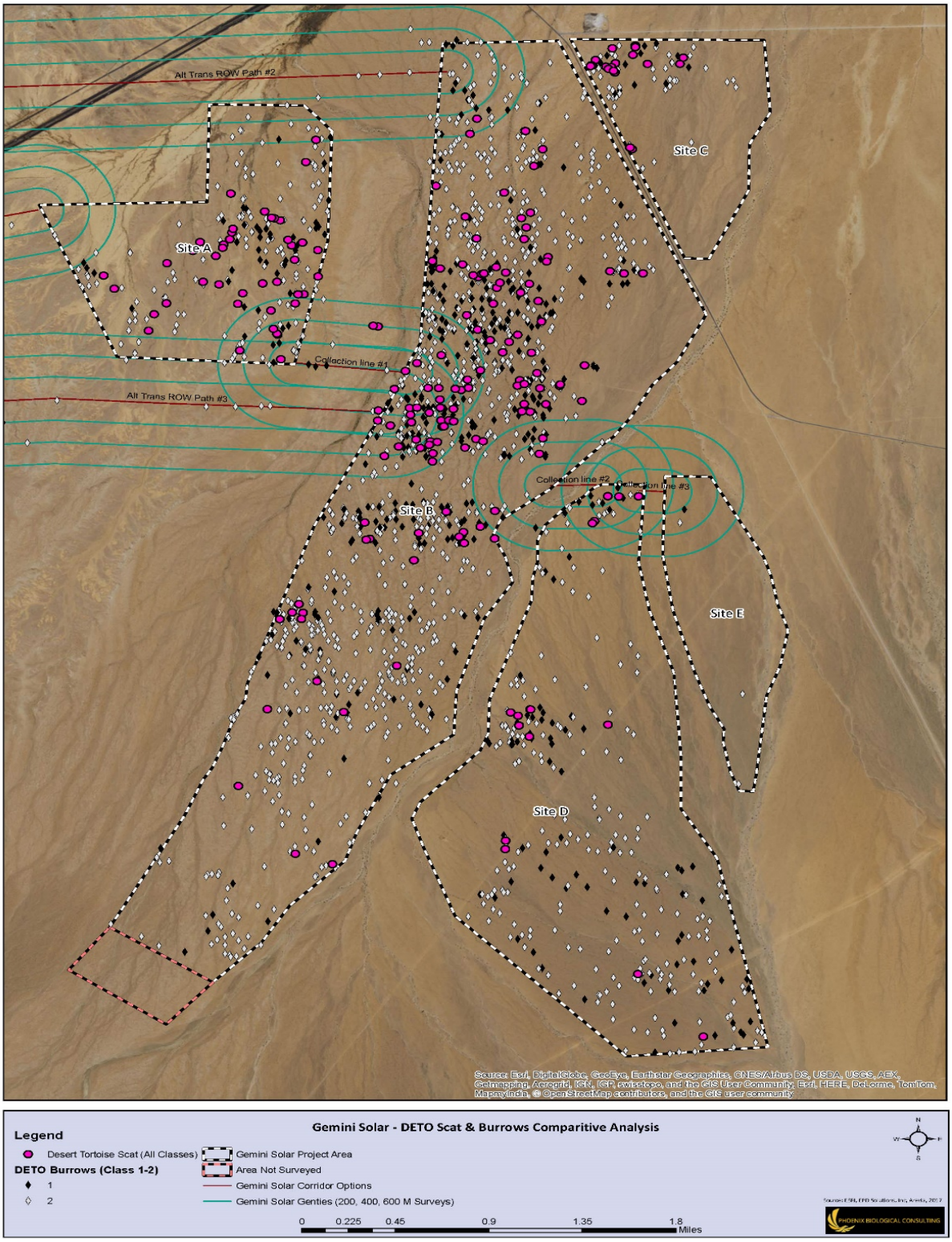

Exhibit 8: Desert Tortoise Carcass Distribution

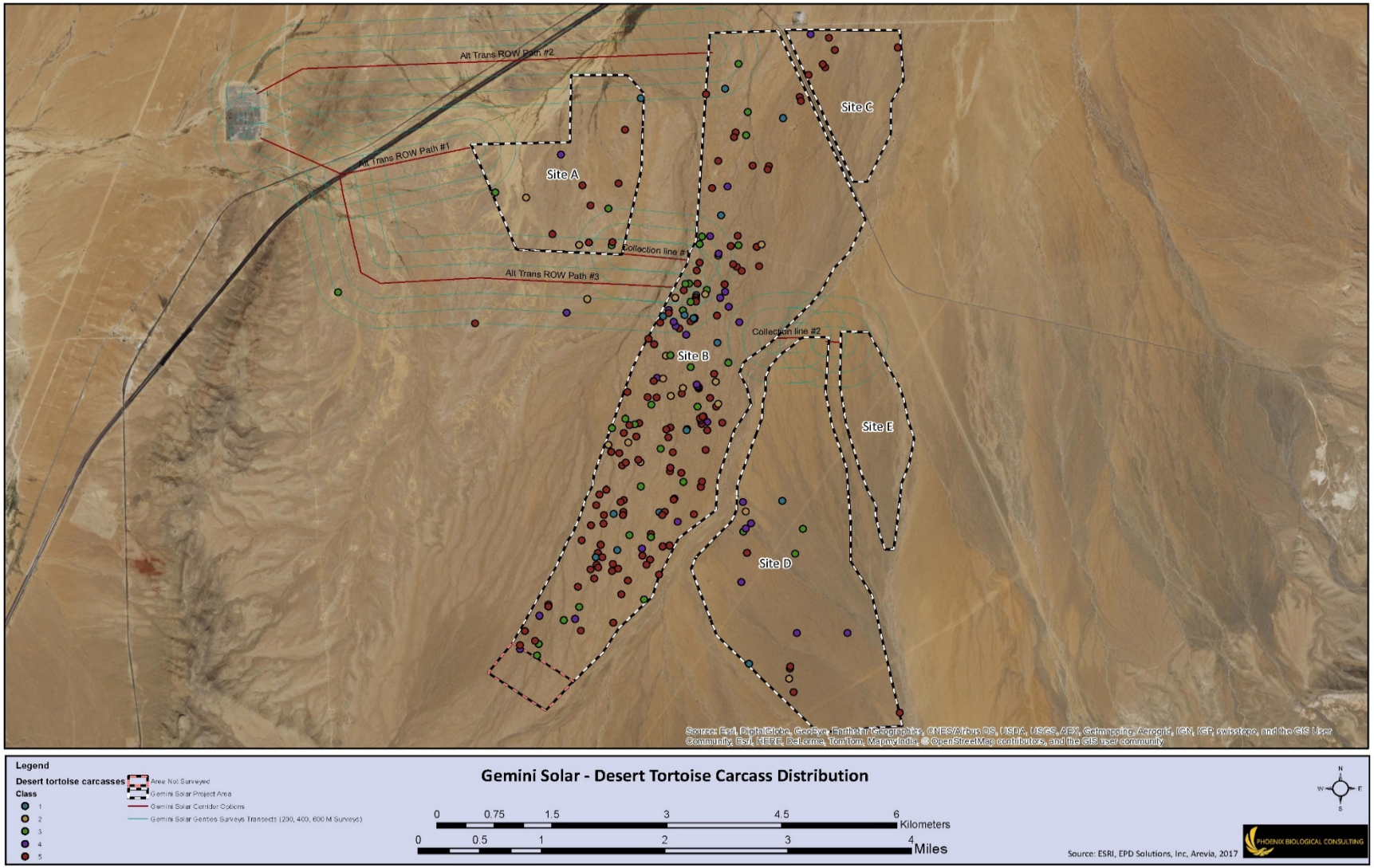

Exhibit 9: Incidental Observations: American Badger, Burrowing Owl & Desert Kit Fox

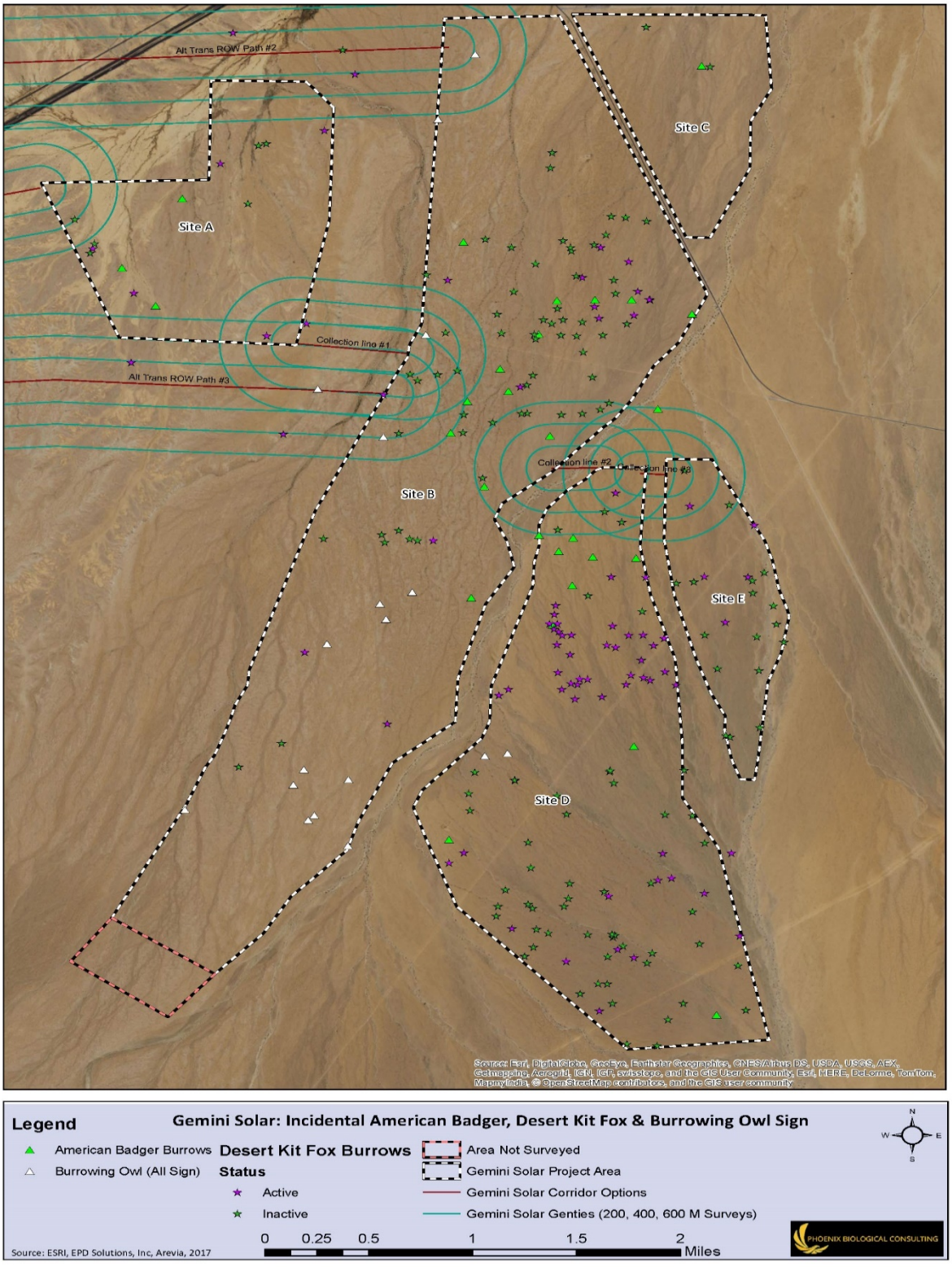

Exhibit 10: Incidental Plant Observation List[1]

Scientific Name	Common Name
Agavaceae	
Yucca schidigera	Mojave yucca
Apocynaceae	
Asclepias erosa	Desert milkweed
Asclepias subulata	Ajamete
Asteraceae	
Acamptopappus sphaerocephalus	Rayless goldenhead
Adenophyllum cooperi	Cooper dyssodia
Ambrosia dumosa	White bur-sage
Ambrosia eriocentra	Wooly bur-sage
Ambrosia salsola	Cheese bush
Baileya multiradiata subs multiradiata	Desert marigold
Baileya pleniradiata	Woolly desert marigold
Chaenactis c.f. carphoclinia	Pebble pincushion
Chaenactis sp.	Desert pincushion
Encelia sp.	-
Ericameria sp.	-
Gutierrezia sarothrae	Broom snakeweed
Pectis papposa	Cinchweed
Porophyllum gracile	Odora
Psathyrotes ramosissima	Turtlebacks
Stephanomeria pauciflora	Wire-lettuce
Thymophila pentachaeta var. belenidium	Five-needled thymophylla
Boraginaceae	
Amsinckia tessellata var. gloriosa	Carrizo fiddleneck
Cryptantha nevadensis	Nevada cryptantha
Nama demissa var. demissa	Purplemat
Phacelia cf. crenulata	Common phacelia
Phacelia sp. Chk googingii	Gooding's phacelia (rare in CA)
Brassicaceae	
Caulanthus c.f. lasiophyllus	California mustard
Lepidium c.f. lasiocarpum	Shaggyfruit pepperweed
Physaria tenella	Moapa bladderpod
Strigosella africana	African mustard
Cactaceae	
Cylindropuntia echinocarpa	Silver cholla
Cynlidropuntia ramaosissima	Pencil cholla
Echinocactus polycephalus var. polycephalus	Barrel cactus
Echinocereus engelmannii	Strawberry hedgehog
Celastraceae	

Scientific Name	Common Name
Mortonia utahensis	Utah mortonia
Chenopodiaceae	
Amaranthus fimbriatus	Fringed amaranth
Atriplex canescens	Fourwing saltbush
Atriplex confertifolia	Shadscale
Atriplex polycarpa	Allscale saltbush
Atriplex hymenelytra	Desert holly
Halogeton glomeratus	Halogeton
Krascheninnikovia lanata	Winter fat
Salsola tragus	Russian thistle
Sueda nigra	Alkali seepweed
Ephedraceae	
Ephedra nevadensis	Nevada ephedra
Ephedra c.f. viridis	Green ephedra
Euphorbiaceae	
Euphorbia albomarginata	Rattlesnake sandmat
Euphorbia micromeris	Desert spurge
Fabaceae	
Peteria thompsoniae	Thompson peteria
Psilostrophe cooperi	Paper daisy
Psorothamnus sp.	-
Senegalia greggii	Catclaw
Geranaceae	
Erodium cicutarium	Coastal heron's bill
Erodium texanum	Desert heron's bill
Krameriaceae	
Krameria bicolor	White rhatany
Krameria erecta	Pima rhatany
Lamiaceae	
Scutellaria mexicana	Bladder-sage
Liliaceae	
Calochortus flexuosus	Winding mariposa
Malvaceae	
Sphaeralcea c.f. ambigua	Apricot mallow
Nyctaginaceae	
Acleisanthes nevadensis	Desert wing-fruit
Oleaceae	
Menodora spinescens chk var.	Spiny menodora
Onagraceae	
Oenothera c.f. deltoides	Devil's lantern
Oenothera suffrutescens	Linda tarde

Scientific Name	Common Name
Plantaginaceae	
Penstamen sp.	-
Plantago ovata var. fastigiata	Desert plantain
Poaceae	
Aristida c.f. purpurea	Purple three awn
Bouteloua barbata	Sixweeks grama
Bromus madritensis	Foxtail chess
Bromus tectorum	Cheat grass
Elymus elymoides var. brevifolius	Squirrel tail grass
Erioneuron pulchellum	Fluff grass
Hilaria rigida	Big galleta
Schismus c.f. arabicus	Arabian schismus
Stipa hymenoides	Sand rice grass
Polygonaceae	
Chorizanthe rigida	Devil's spineflower
Eriogonum sp.	-
Eriogonum brachypodum	Parry's buckwheat
Eriogonum inflatum	Desert trumpet
Eriogonum pusillum	Yellow turbans
Eriogonum trichopes	Wild buckwheat
Resedaceae	
Oligomeris linifolia	Lineleaf whitepuff
Rosaceae	
Prunus fasciculata	Desert almond
Solanaceae	
Lycium andersonii	Anderson thornbush
Lycium cooperi	Cooper's box thorn
Zygophyllaceae	
Larrea tridentata	Creosote bush
Tribulius terrstris	Puncture vine

[1]-The above plant list is for illustrative purposes only. A comprehensive botanical survey would be required to thoroughly evaluate all plant species present. The plants listed above were observed/recorded incidentally during the fall 2017 desert tortoise survey.

Exhibit 11: Incidental Vertebrates Observed

Scientific Name	Common Name
Birds	
Accipiter cooperii	Cooper's Hawk
Accipiter striatus	Sharp-shinned Hawk
Anas platyrhinchos	Mallard
Amphispiza bilineata	Black-throated Sparrow
Aquila chrysaetos	Golden Eagle
Artemesiospiza belli/nevadensis	Sage Sparrow (Complex)
Athene cunicularia	Burrowing Owl
Auriparus flaviceps	Verdin
Buteo jamaicensis	Red-tailed Hawk
Calidris melanota	Pectoral Sandpiper
Calypte costae	Costa's Hummingbird
Campylorhynchus brunneicapillus	Cactus Wren
Cathartes aura	Turkey Vulture
Chaetura vauxi	Vaux's Swift
Charadrius vociferus	Killdeer
Circus cyaneus	Northern Harrier
Colaptes auratus	Northern Flicker
Columba livia	Rock Pigeon
Chordeiles acutipennis	Lesser Nighthawk
Corvus corax	Common Raven
Empidonax wrightii	Gray Flycatcher
Eremophila alpestris	Horned Lark
Falco mexicanus	Prairie Falcon
Falco sparverius	American Kestrel
Hirundo Rustica	Barn Swallow
Lanius ludovicianus	Loggerhead Shrike
Larus californicus	California Gull
Mimus polyglottos	Northern Mockingbird
Oreoscoptes montanus	Sage Thrasher
Oreothlypis celata	Orange-crowned Warbler
Petrochelidon pyrrhonota	Cliff Swallow
Passerculus sandwichensis	Savannah Sparrow
Phalaenoptilus nuttallii	Common Poorwill
Picoides scalaris	Ladder-backed Woodpecker
Pipilo Chlorurus	Green-tailed Towhee
Piranga ludoviciana	Western Tanager
Polioptila caerulea	Blue-gray Gnatcatcher
Polioptila melanura	Black-tailed Gnatcatcher
Recurvarisrostrra americna	American Avocet

Scientific Name	Common Name
Regulus calendula	Ruby-crowned Kinglet
Salpinctes obsoletus	Rock Wren
Sayornis saya	Say's Phoebe
Setophaga coronata	Yellow-rumped Warbler
Spinus psaltrus	Lesser Goldfinch
Spizella breweri	Brewer's Sparrow
Spizella passerina	Chipping Sparrow
Sturnella neglecta	Western Meadowlark
Tachycineta bicolor	Tree Swallow
Thryomanes bewickii	Bewick's Wren
Toxostoma lecontei	Le Conte's Thrasher
Tyrannus verticalis	Western Kingbird
Vireo gilvus	Warbling Vireo
Zenaida macroura	Mourning Dove
Zonotrichia leucophrys	White-crowned Sparrow
Reptiles	
Gopherus agassizii	Mohave Desert Tortoise
Gambelia wislizenii	Long-nosed Leopard Lizard
Callisaurus draconoides	Zebra-tailed Lizard
Dipsosaurus dorsalis	Desert Iguana
Uta stansburiana	Common Side-blotched Lizard
Phrynosoma platyrhinos	Desert Horned Lizard
Aspidoscelis tigris	Tiger Whiptail
Coluber flagellum	Coachwhip
Crotalus cerastes	Sidewinder
Mammals	
Lepus californicus	Black-tailed Jackrabbit
Sylvilagus audubonii	Audubon's cottontail
Canis latrans	Coyote (scat and tracks)
Vulpes macrotis	Kit Fox (burrows, dens & scat)
Ammospermophilus leucurus	White-tailed Antelope Ground Squirrel
Neotoma lepida	Desert Woodrat (middens & scat)
Dipodomys merriami	Kangaroo Rat (prey remains)
Peromyscus maniculatus	Deer Mouse (burrows, scat, & mandible)
Equus asinus	Feral Ass (scat & skeleton)
Taxidea taxus	American Badger (claw marks on burrows)

Exhibit 12: 2010 USFWS Density and Confidence Interval Spreadsheet

Table 3. USFWS Desert Tortoise Pre-Project Survey Guidance

What is the estimated number of tortoises and associated 95% confidence interval for the action area?

INSTRUCTIONS ***Use this tab when all your transects were of equal length.***

Enter the appropriate values from the survey into the yellow cells below. The number of tortoises and assocated 95% confidence interval for the action area will be calculated.

N =	**208.4**
Lower 95%CI =	**108.52**
Upper 95%CI =	**400.24**
Total action area (acres)	**7108**
Prob that a tort is above ground given winter rainfall (Pa from Table 2) =	**0.800**
Total length of transects walked (L, km) =	**2876**
Transect length (km)	**1**
Number of transects walked (k) =	**2025**
Number of tortoises found during surveys (n) =	**105**

Transects all the same length

Number of tortoises (n_i)	Number of transects on which (n_i) tortoises were
0	1932
1	82
2	10
3	1
4	0
5	0
6	0
7	0
8	0
9	0

Desert Tortoise Survey Report
Areas B1, B2, F & G
Gemini Solar Project
N-84631

Prepared for
Arevia Power & Solar Partners XI, LLC
(a wholly owned subsidiary of Valley of Fire, LLC)

Prepared by
Phoenix Biological Consulting

July 25, 2018

Table of Contents

Exhibits

LIST OF ACRONYMS

ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
CHU	Critical Habitat Unit
DWMA	Desert Wildlife Management Area
EIS	Environmental Impact Statement
GIS	Geographical Information System
NEPA	National Environmental Policy Act
NNHP	Nevada Natural Heritage Program
POD	Plan of Development
ROW	Right Of Way
USFWS	United States Fish and Wildlife Service

INTRODUCTION

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct the Gemini Solar Project in Clark County, Nevada, approximately 25 miles northeast of the Las Vegas metropolitan area (Exhibit 1). The project would consist of a solar photovoltaic (PV) power-generating facility on Bureau of Land Management (BLM)-administered land, located immediately south of the Moapa Indian Reservation and southeast of Interstate 15 (I-15).

Due to the potential biological impacts associated with the development of the site, Phoenix Biological Consulting conducted protocol level presence/ absence surveys for the Mojave Desert tortoise (*Gopherus agassizii*), a federally threatened species. The desert tortoise surveys were conducted in accordance with U.S. Fish and Wildlife Service (USFWS) 2017 guidelines, for the purpose of estimating desert tortoise densities within the proposed impact area.

Desert tortoise presence/ absence surveys were conducted by Phoenix Biological Consulting in the fall of 2017 on the initial site plan. Following the fall 2017 surveys, site plan alternatives were introduced through early EIS (Environmental Impact Statement) analysis. Subsequent tortoise surveys were initiated in the spring of 2018 to identify additional areas of potential development in an effort to avoid higher density desert tortoise areas within the proposed impact area. The preliminary alternative analysis added four new polygons, which were combined to create the total spring 2018 survey area; referred to as Areas B1, B2, F and G in this report. The desert tortoise presence/ absence surveys, on the additional polygons, were conducted in the spring of 2018; between April 3rd and April 12th, 2018 on Area F, and between May 7th, 2018 and May 27th, 2018 on Areas B1, B2 and G, respectively.

During the spring 2018 survey, biologists recorded a total of 43 live tortoises. Only adult tortoises ≥ 180mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2017 spreadsheet (USFWS (c)). Based on the density calculations, a total of 65 desert tortoises (≥ 180 mm MCL) are estimated to occur within the survey area of 3,722 acres. This report includes a project description, description of the survey area, survey methodology, climate, soils and results on the distribution and abundance of the desert tortoise found within Areas B1, B2, F and G of the proposed project area.

PROPERTY AND PROJECT DESCRIPTION

Project Location

The project site is located in the northeastern portion of the Mojave Desert; approximately 25 miles northeast of the Las Vegas metropolitan area, in an unincorporated area of Clark County, Nevada (Exhibit 1). The project site is situated immediately south of the Moapa Indian Reservation, less than 0.5 miles southeast of Interstate 15 (I-15), and less than 4 miles east of the NV Energy Crystal Substation and a NV Energy high-voltage transmission line; in the Piute Point and Dry Lake quadrangles of the United States Geographical Surveys (USGS) 7.5-minute topographic map series (Exhibit 2). The legal description of the parcels identified in the Plan of Development (POD) is listed below (Table 1).

Table 1: Township/Range and Section Information

Township	Range	Sections	Description
17S	64E	10 & 11	S ½
		12, 13, 23, 24, 25, 26, 35 & 36	ALL
		14	N ½, E ½
		15	N ½
		22, 27 & 34	E ½
17S	65E	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 & 36	ALL
17S	66E	7, 18 & 19	ALL
18S	64E	1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35 & 36	ALL
		3, 10, 15, 22, 27 & 34	E ½
18S	65E	1, 2, 3, 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20 & 30	ALL
		21	N ½, SW ¼

Project Description

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct, own, operate, and decommission a solar photovoltaic (PV) power-generating facility, known as the Gemini Solar Project, on Bureau of Land Management (BLM)-administered land located in Clark County, Nevada. The proposed Gemini Solar project intends to generate approximately 690-megawatt (MW) alternating current (MWac) of renewable electrical energy by utilizing solar PV modules mounted on single-axis, horizontal tracker structures. Electricity generated by the project would be interconnected to the NV Energy transmission system via overhead generation (gen)-tie lines extending from the project switchyards to Nevada Energy's Crystal Substation. The gen-tie lines would consist of a 230 KV circuit for delivery of 440 MW to Nevada Energy Balancing Authority (Phase I) and a 500 KV circuit for delivery of 250 MW to the Los Angeles Department of Water and Power (LADWP) (Phase II). Additional elements to the proposed solar energy

facilities include 34.5 KV overhead and underground collector lines, a 2-acre operations and maintenance area, one to three substations, internal access roads, access roads along gen-tie lines, a perimeter road, perimeter fencing, other site infrastructure such as fire-protection water storage, a potential water line to the site, and drainage features such as berms, and improvements to the existing NV Energy facilities to support interconnection.

The disturbance acreage for the proposed site plan is approximately 7,115 acres of permanent disturbance, which includes the solar facility, primary access road, collection line road, collection line single pole site, and gen-tie lines; and 7 acres of temporary disturbance, including laydown areas and two pull sites for collection line construction. The solar facility is divided into multiple polygons that are connected via connection lines and gen-tie options (Exhibit 14). This report includes the survey efforts for the polygons that were not previously included in the survey efforts from the fall of 2017; referred to as Areas B1, B2, F, and G in this report (Phoenix, 2018). The total spring 2018 survey area of the aforementioned areas is 3,722 acres.

The proposed project is located on public land entirely within the ~44,000 acres of the BLM right-of-way application (SF299) with serial number N-84631. The ROW application contains a larger area than required for the solar field to allow for adjustments in the facility layout to minimize environmental impacts, based on the National Environmental Policy Act (NEPA) analysis. The project will generate greenhouse gas-free electricity during daylight hours when electricity demand is at its peak, averaging an energy production that equates to the annual daytime electricity needs of approximately 260,000 households.

DESERT TORTOISE NATURAL HISTORY

The desert tortoise is a large herbivorous reptile that occurs in the Mojave and Sonoran deserts, in southwestern Utah, southern Nevada, southeastern California and western Arizona, into northern Sinaloa Mexico. The designated Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as federally and state threatened and occurs north and west of the Colorado River in the Mojave Desert of California, Arizona, Nevada, southwestern Utah, and in the Sonoran (Colorado) desert in California (USFWS 2011).

The desert tortoise occupies a variety of habitats including creosote bush scrub at lower elevations and blackbrush scrub and juniper woodland transition zones at higher elevations (Germano, 1994). Elevation range for the desert tortoise has been recorded from below sea level to 7,300 feet. Typical habitat for the desert tortoise in the Mojave Desert has been

characterized as creosote bush scrub below 5,500 feet (Luckenbach 1982). Throughout most of the Mojave Desert, the desert tortoise is most commonly found on gently sloping terrain with sandy-gravel soils of sparse low growing shrubs, which allow for the establishment of herbaceous plants. Soils must be friable enough for digging burrows but firm enough to avoid collapse (USFWS 2011).

Desert tortoises spend most of their lives in burrows, even during seasons of activity. In addition to digging their own burrows, desert tortoises will opportunistically use burrows, deep caves, rock and caliche crevices, and overhangs (Germano, 1994). Burrows provide constant temperature and higher humidity which protect the tortoise during periods of extreme temperatures and reduces water loss during very dry conditions. The preferred body temperature of the desert tortoise is 69 degrees to 101 degrees Fahrenheit (McGinnis and Voigt, 1971). Desert tortoises are most active during spring and early summer, during summer rains, in the early morning and late afternoon as temperatures increase, and in early fall as new sprouts germinate (Stebbins, 2003). During periods of inactivity, desert tortoises reduce their metabolism and water loss by remaining dormant underground.

Desert tortoises ingest most of their water from plants, and store it in their bladders; allowing them the ability to survive for more than a year without access to water of any kind. The diet of desert tortoises consists of winter annuals, perennial grasses, woody perennials, and cacti. Desert tortoises will eat non-native species such a red brome (*Bromus rubens*) and red-stem filaree (*Erodium cicutarium*), but they generally prefer native forbs when available (USFWS, 2011).

The desert tortoise is long lived with delayed sexual maturity. Maximum longevity for desert tortoises in the wild is between 50 and 70 years, with the average life expectancy around 25 to 35 years (Germano, 1994). Desert tortoises begin reproducing between 12 and 20 years, when they are roughly 180 to 200mm MCL (median carapace length) in size. The number of eggs (1-10 per clutch) and the number of clutches (0-3) 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). Reproductive potential for the desert tortoise is low, due to high mortality rates before successful reproduction is reached.

Some reasons for the threatened status of the desert tortoise include disease, predation, and the destruction, modification, and fragmentation of its habitat and range. Human related activities such as development, agriculture, military activity, mining, waste disposal, road construction,

livestock grazing, and off-highway vehicles (OHVs), can cause loss of habitat and the proliferation of invasive plants, limiting the desert tortoises' natural food supply; ultimately threatening the long-term survival of the species (USFWS 2011).

Disease, specifically Upper Respiratory Tract Disease (URTD), caused by the bacterium *Mycoplasma agassizii*, is associated with major declines in desert tortoise populations in the 1980s. Other diseases affecting desert tortoises include cutaneous dyskeratosis (shell lesions), urolithiasis (bladder stones), and shell necrosis (Homer at el. 1998). Hatchling and juvenile desert tortoises are vulnerable to predation, due to their slow growth and soft flexible shell. The common raven (*Corvus corax*) is a common predator of small tortoises. Increased human activities lend to elevated raven populations, due to more available resources for ravens such as food from garbage, water from sewage ponds and municipal areas, and nesting areas such as utility towers and buildings; thus resulting in increased predation on desert tortoises (Boarman et al. 2006). Other known predators of desert tortoises include coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis)*, mountain lions (*Felis concolor*), red-tailed hawks (*Buteo jamaicensis*) and golden eagles (*Aquila chrysaetos*).

REGIONAL AND LOCAL SETTING

The action area is regionally characterized as typical Nevada landscape, consisting of broad basins and north-south trending mountains, known as the Basin and Range Province, which encompasses the entire state of Nevada. Plant communities within this region consist of drought tolerant shrubs such as creosote (*Larrea tridentata*), white burrobush (*Ambrosia dumosa*), yuccas, cacti, and Mesquite and Acacia thornscrub washes.

The action area is locally situated along the lower bajada of a northeasterly sloping landform consisting of multiple braided intermittent washes that connect into the California Wash, and flow to the northeast, into the Muddy River. The rainfall averages 4-8 inches and a mean annual temperature between 60 to 70 degrees Fahrenheit. The vegetation community consists predominantly of Creosote-White Burrobush and Acacia thornscrub, within some of the larger washes. Along the western boundary of the action area (Area A), the vegetation community transitions to *Atriplex confertifolia* shadscale shrubland alliance interspersed with patches of Big galletta grass and Badlands further to the west. The topography is mostly level with gentle, rolling hills along the lease boundary to the west, south and east. The topography within the lease area slopes towards the California Wash. Outside of the action area, the surrounding hills include the Dry Lake Range to the west, the Muddy Mountains to the south and North Muddy

Mountains to the east. The topography to the north is relatively flat as the California Wash watershed levels and meanders to the northeast, combining with multiple intermittent washes prior to connecting with the Muddy River; which is located approximately thirteen miles to the northeast. Progressing to the south of the site and along the upper bajada, into the Muddy Mountains, the landscape is intermittently punctuated with limestone outcrops, larger rocks and an increase in cacti. The soils on site are derived from both eolian deposition, and limestone and dolomite parent material. Cryptobiotic crust is found throughout the project site in a patchy mosaic with concentrations near drainages banks. The soil consistency within the majority of the site consists of either sandy-gravelly loams or fine sand with gravelly substratum.

EXISTING CONDITIONS

Habitat and Land Use

The project site is located in the northeastern portion of the Mojave Desert and is surrounded by relatively undeveloped and undisturbed desert scrubland. The Moapa Indian Reservation is located immediately north of the project site, with the remaining surrounding area consisting of undeveloped open access desert that is owned by the federal government and managed by the U.S. Bureau of Land Management (BLM).

Disturbed areas within the project site consist of multiple two-track unimproved dirt roads that traverse through the project site; including a BLM-designated trail in Area F. Other disturbed areas in the vicinity of the project include the paved Valley of Fire Road south of Area F, powerline unpaved road to the west of Areas B2 and G, the Moapa Piute Travel Plaza on the northern edge of the project boundary, I-15 to the northwest of the project site, and K Road Solar approximately 1.5 miles north of the project site on the Moapa Indian Reservation. The Nevada Energy Crystal substation – into which the Gen-tie line would connect – is located approximately 2.5 miles west of the project site.

The dominant vegetation consists of Creosote-White Burrobush *Larrea tridentata-Ambrosia dumosa* Shrubland Alliance, interspersed with Catclaw Thornscrub *Acacia greggii* Shrubland Alliance (Desert wash scrub) within the braided ephemeral drainage channels that traverse the site (Sawyer, J.O. et al., 2009).

Topography and Soils

The topography of the site is relatively flat, with elevations ranging from approximately 2,025, along the northern extent, to 2,450 feet, near the southern survey boundary, (617 to 747 meters)

above mean sea level (Exhibit 2). According to the USDA Natural Resource Conservation Service (NRCS) online Web Soil Survey, Areas B1, B2, F and G of the Gemini project site consist of 7 soil types: (1) AOB - Arada fine sand, gravelly substratum (2) BD – Badland (3) BHC – Bard gravelly fine sandy loam (4) BMD – Bard very gravelly fine sandy loam (5) BOB – Bard-Rough broken land association (6) MMB – Mormon Mesa loamy fine sand, and (7) MOB – Mormon Mesa fine sandy loam. The description of the soil types along with the breakdown by site location are shown in Table 2 and Exhibit 3.

Table 2: Soil Types Present Within the Spring 2018 Survey Areas

Map Unit Symbol	Map Unit Name	Description	Location Area(s)
AOB	Arada fine sand, gravelly substratum	0-4% slopes, fine sand (0-24 inches), stratified extremely gravelly loamy coarse sand to extremely gravelly fine sandy loam (24-60 inches), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	F
BD	Badland	On fan remnants	G
BHC	Bard gravelly fine sandy loam	2-8% slopes, gravelly fine sandy loam (0-3 inches), fine sandy loam (3-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	B1, B2
BMD	Bard very gravelly fine sandy loam	2-15% slopes, very gravelly fine sandy loam (0-3 inches), fine sandy loam (3-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	F
BOB	Bard-Rough broken land association	2-4% slopes, very gravelly fine sandy loam (0-5 inches), fine sandy loam (5-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	B2, G
MMB	Mormon Mesa loamy fine sand	0-4% slopes, loamy fine sand (0-2 inches), fine sandy loam (2-16 inches), cemented material (16-60 inches), well drained, fan remnants, and non-saline to very slightly saline	F
MOB	Mormon Mesa fine sandy loam	0-8% slopes, fine sandy loam (0-16 inches), cemented material (16-60 inches), well drained, fan remnants, and non-saline to very slightly saline	G

Climate

According to the National Climate Data Center (NCDC) 1981-2010 for Valley of Fire, NV, the average annual temperature range in the area is between 58.3°F and 81.0°F. Average temperatures range from 78.0° F to 102.9° F in summer months, 40.0° F to 59.0° F in winter, and 56.1° F to 81.6° F in spring and fall. Average annual precipitation is 6.5 inches, with the most precipitation occurring during the winter months (NOAA, 2017). Recorded weather data was accessed from the NOAA Cooperative (COOP) weather station in Valley of Fire State Park,

Nevada, which is located approximately 11 miles east of the project site. The Valley of Fire NOAA Cooperative station rainfall average from October, 2017 to March, 2018 was approximately 2.7 inches (69 mm) (WRCC, 2018).

Proximity to ACECs and DWMAs

Areas of Critical Environmental Concern (ACECs) are limited use areas designated and managed by the BLM to protect sensitive biological, historical, and cultural resources; natural process or systems; and/or natural hazards. ACECs in Clark County, NV protect unique cultural and archeological resources and areas of high-quality habitat for species of concern, including the desert tortoise. The ACECs that are located within the Northeast Recovery unit contain desert tortoise critical habitat include the Mormon Mesa, Gold Butte, and Coyote Springs Desert Wildlife Management Areas (DWMAs) (Exhibit 4).

Desert Wildlife Management Areas (DWMAs) have been established to protect high quality habitat for the threatened desert tortoise; ACEC overlap critical habitat for the desert tortoise. Critical habitat, designated under the Endangered Species Act, is protected from "destruction" or "adverse modification" of the habitat; essentially excluding critical habitat from development. The project site is located roughly 10 miles east of Coyote Springs DWMA, 25 miles south of Mormon Mesa DWMA, and 23 miles west of the Gold Butte DWMA. The project site is not within and does not border any of the DWMAs, so no impacts to DWMAs are anticipated.

METHODOLOGY

Presence/Absence Surveys

Prior to conducting field surveys, Phoenix initiated informal consultation with USFWS personnel (Carla Wise), via electronic mail on March 26, 2018 to discuss survey schedule, methodology and incidental observations. In addition, BLM biologists Mark Slaughter and Greg Brooks were contacted via electronic mail on March 28, 2018 to confirm survey methodology, timing and approach.

In accordance with the 2017 USFWS Desert Tortoise Survey Protocol, Phoenix Biological Consulting conducted desert tortoise presence/ absence surveys on the additional polygons, between April 3rd and April 12th, 2018 for Area F; and between May 7th, 2018 and May 27th, 2018 for Areas B1, B2, and G.

In an effort to achieve 100% visual coverage of areas containing suitable desert tortoise habitat, the survey consisted of ten-meter wide pedestrian transects walked within the entire area of the sites. Surveyors recorded the beginning and ending easting and northing coordinates to ensure all areas were covered and track logs for each team were also recorded on GPS units for redundancy. During the survey efforts, each survey team recorded start and end temperatures, wind and cloud cover. Surveys were conducted during daylight hours and were not conducted during temperatures exceeding 104^{o} F, in accordance with survey protocols.

Biologists recorded desert tortoises and desert tortoise sign, including tortoise burrows, pallets, carcasses, and scat; the presence of eggshell fragments, courtship rings, water depressions/ drinking sites, and tracks was also noted when accompanied with a tortoise burrow or pallet. No desert tortoises were handled and no desert tortoise sign was collected. Biologists documented data using Garmin Global Positioning System (GPS) in the Universal Transverse Mercator (UTM) World Geodetic System (WGS) 1984 Zone 11N datum with 3-5 meter accuracy. Field data was recorded on data sheets for each day in which the surveys were conducted. The conditions recorded for each desert tortoise burrow, carcass, and scat observation were classified according to the USFWS 2009 protocol classification system (Table 3). Incidental observations for American badger (*Taxidea taxus*), desert kit fox (*Vulpes macrotis)*, Bighorn sheep (*Ovis canadensis*), and burrowing owl (*Athene cunicularia*) sign were also recorded (Exhibits 11 & 12). Quality control and quality assurance were accomplished during the continuous GPS track logs, initial data recording, electronic data entry and proofed for accuracy during the spreadsheet assimilation and GIS mapping process.

Table 3: Information Index for Desert Tortoise Sign

Sign	Class	Definition
Burrows and Dens		
	1	currently active, with desert tortoise or recent desert tortoise sign
	2	good condition, definitely desert tortoise; no evidence of recent use
	3	deteriorated condition; definitely desert tortoise
	4	good condition; possibly desert tortoise
	5	deteriorated condition; possibly desert tortoise
Scats		
	1	wet (not from rain or dew) or freshly dried; obvious odor
	2	dried with glaze; some odor; dark brown
	3	dried; no glaze or odor; signs of bleaching (light brown), tightly packed material
	4	dried; light brown to pale yellow, loose material; scaly appearance
	5	bleached, or consisting only of plant fiber
Shell Remains		
	1	fresh or putrid
	2	normal color; scutes adhere to bone
	3	scutes peeling off bone
	4	shell bone is falling apart; growth rings on scutes are peeling
	5	disarticulated and scattered

Abundance Estimates

Abundance estimates are designed to estimate take in the action area and to develop plans to minimize impacts to tortoises in the project footprint. Desert tortoise abundance estimates were calculated using the USFWS 2017 excel spreadsheet for estimating desert tortoise density in the action area (Exhibit 13). This spreadsheet takes into account that not all desert tortoises within the action area and/or project footprint are seen by the surveyor. To estimate the number of desert tortoises within the action area, the equation divides the number of adult tortoises (≥ 180 mm MCL) observed during the survey by the product of the probability that a tortoise is above ground during the survey (Pa) and the probability that a surveyor will see the tortoise if it is above ground (Pd). Pa is relative to the previous winter's rainfall, recorded in this case between October 2017 and March 2018 by the Western Regional Climate Center. In accordance with the USFWS 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. The rainfall total for the October 2017 to March 2018 period that was utilized in the calculations (Pa) was approximately 69 mm.

RESULTS

Abundance Estimates

During the survey, biologists recorded a total of 43 live tortoise. Only adult desert tortoises ≥180 mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2017 spreadsheet. Average transect length (1.1 km) is utilized in the calculations due to the fact that there were 1411 unequal transects within the site. Average transect length was calculated by determining the total kilometers walked (1552 km) divided by total number of transects (1411 transects). Total tortoises observed, that were ≥ 180 mm MCL in size, is 36. The results of the calculation spreadsheet are provided in Exhibit 13. Based on the density calculations, a total of 65 desert tortoises are estimated to occur within the project footprint.

In addition to live tortoises, biologists observed a total of 380 desert tortoise burrows, 113 pallets, 89 carcasses, and 39 scats (Table 6). The location of live desert tortoises, along with a comparison of scat distribution to live tortoise observations, are shown in Exhibits 5 & 6. Carcass distribution is provided in Exhibits 7 & 8. Desert tortoise burrows Class 1-3 and pallets, are shown in Exhibits 9 & 10.

Confidence Interval

The confidence interval (CI) was calculated using the USFWS 2017 spreadsheet. The lower 95% CI for the Gemini Solar spring 2018 survey is 40 and the upper 95% CI is 106 for the project footprint. The number of hatchlings (young of year) is relevant for disturbance occurring in August through December, and the number of tortoises < 180 mm MCL (not young of year) is relevant for disturbance at any time of year (Exhibit 13).

Density Analysis

Preliminary comparative density analysis from nearby areas of interest are listed in Table 4. The areas of interest include the three closest, surrounding critical habitat units and the two closest solar projects, all located within the Northeastern Mojave Recovery Unit. Playa Solar is located approximately 7 miles to the west of Gemini Solar and K Road Solar is situated 1.5 miles to the north. Desert tortoise density estimates for the Mormon Mesa, Coyote Springs, and Gold Butte CHUs, were determined based on data from the range wide monitoring line distance studies prepared by Linda Allison at USFWS. The density estimate for K Road Solar, is based on the actual number of tortoises relocated during the translocation effort (C. Wise, personal communication, November 14, 2017). The Playa Solar density estimates are based on the abundance estimate calculation from the presence/ absence survey report (ESA, 2014).

Table 4: Preliminary Comparative Density Analysis

Area Name		Area Surveyed	Estimate # of Desert Tortoises (≥ 180 mm)	Desert Tortoises Per mi² or km² (Density)
Gemini Solar	Fall 2017	7,108 acres	208	18.7 / mi²
		11.11 mi²		7.2 / km²
		28.77 km²		
	Spring 2018	3,722 acres	65	11.2 / mi²
		5.82 mi²		4.3 / km²
		15.06 km²		
K Road Solar[1]		2,141 acres	107	31.9 / mi²
		3.35 mi²		12.4 / km²
		8.66 km²		
Playa Solar[2]		2,150 acres	44	13.1 / mi²
		3.36 mi²		5.1 / km²
		8.70 km²		
Coyote Springs CHU[3]		1,025 km²	26	4.2 / km²
Gold Butte CHU[4]		1,977 km²	15	1.7 / km²
Mormon Mesa CHU[3]		968 km²	7	2.1 / km²
Average Density in NE[3] Recovery Unit		-	-	4.4 / km²

1-(USFWS, 2012), 2-(ESA, 2014), 3-(USFWS (e)), 4-(USFWS (f))

Based on preliminary analysis, the Gemini Solar spring 2018 survey areas (Area B1, B2, F, and G) have a lower density by more than half of K Road Solar and a slightly lower density than Playa Solar. The Gemini Solar spring 2018 survey areas also have a lower average density then the average density for the Northeastern Recovery unit.

Tortoise density within the project site for the spring 2018 surveys was highest in Area B2, followed by Area G (49 and 55 acres/tortoise, respectively), and Area B1 (71 acres/tortoise) (Table 5), with lowest density in Area F.

Table 5: Desert Tortoise Density per Area and Total Area

Survey Area	Acres & Percent of Total	Total # of DT observed	# of DT ≥ 180 mm MCL	Acres per Tortoise (≥ 180 mm MCL)
Area B1	141 (3.8%)	2	2	71
Area B2	979 (26.3%)	23	20	49
Area F	1,832 (49.2%)	1	0	-
Area G	770 (20.7%)	17	14	55
TOTAL	3,722	43	36	-

Incidental Observations of Predators and Other Wildlife

During the presence/ absence surveys, a total of 117 non-tortoise burrows were recorded, including one American Badger burrow, 3 burrowing owl burrows, and 113 desert kit fox burrows. Of the desert kit fox burrows, 15 of were recorded as active. One Big Horn sheep hoof was observed in Area F, and one partial Big Horn sheep horn was observed in Area G (Exhibits 11 & 12).

Discussion

The highest density of live tortoises observed during the spring 2018 surveys was located in Area B2 (49 acres/tortoise); followed by Area G (55 acres/tortoise) and Area B1 (71 acres/tortoise) (Table 5). Specifically, the middle and western portion of Area B2 contained the highest densities, with relatively even distribution throughout Area G. Only two desert tortoises were observed in Area B1, one in the northeastern portion and one on the southern edge of the site. The lowest overall density occurred in Area F, with only one desert tortoise sighting in the southeastern corner (Exhibit 5). Class 1-2 desert tortoise burrows and tortoise scat appear to be positively correlated and clustered in areas of higher density live tortoise observations, as depicted in Exhibits 6, 9 & 10.

Desert kit fox burrows were found in the highest concentrations throughout Area B1 and F; with the highest density of active desert kit fox burrows located in the western portion of Area F. Desert kit fox burrows were minimal with sporadic distribution in Area G and the southern half of Area B2. Burrowing owl and American Badger sign were only observed in the northern half of Area B2 (Exhibits 11 & 12). The summary of the spring 2018 survey results is listed in Table 6.

Table 6: Summary of Spring 2018 Survey Results

Species/Observation Type	Total Observed
Total Live Desert Tortoises	43
≥ 180 mm MCL	36
< 180 mm MCL	7
Desert Tortoise Scat	39
Desert Tortoise Carcasses	
Class 1	5
Class 2	5
Class 3	11
Class 4	12
Class 5	56
Desert Tortoise Burrows	
Class 1	44
Class 2	123
Class 3	213
Pallets	113
Desert Kit Fox Burrows	113
American Badger Burrows	1
Burrowing Owl Individuals & Burrows	3
Big Horn Sheep Sign	2

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Project Exhibits

Exhibit 1: Regional View

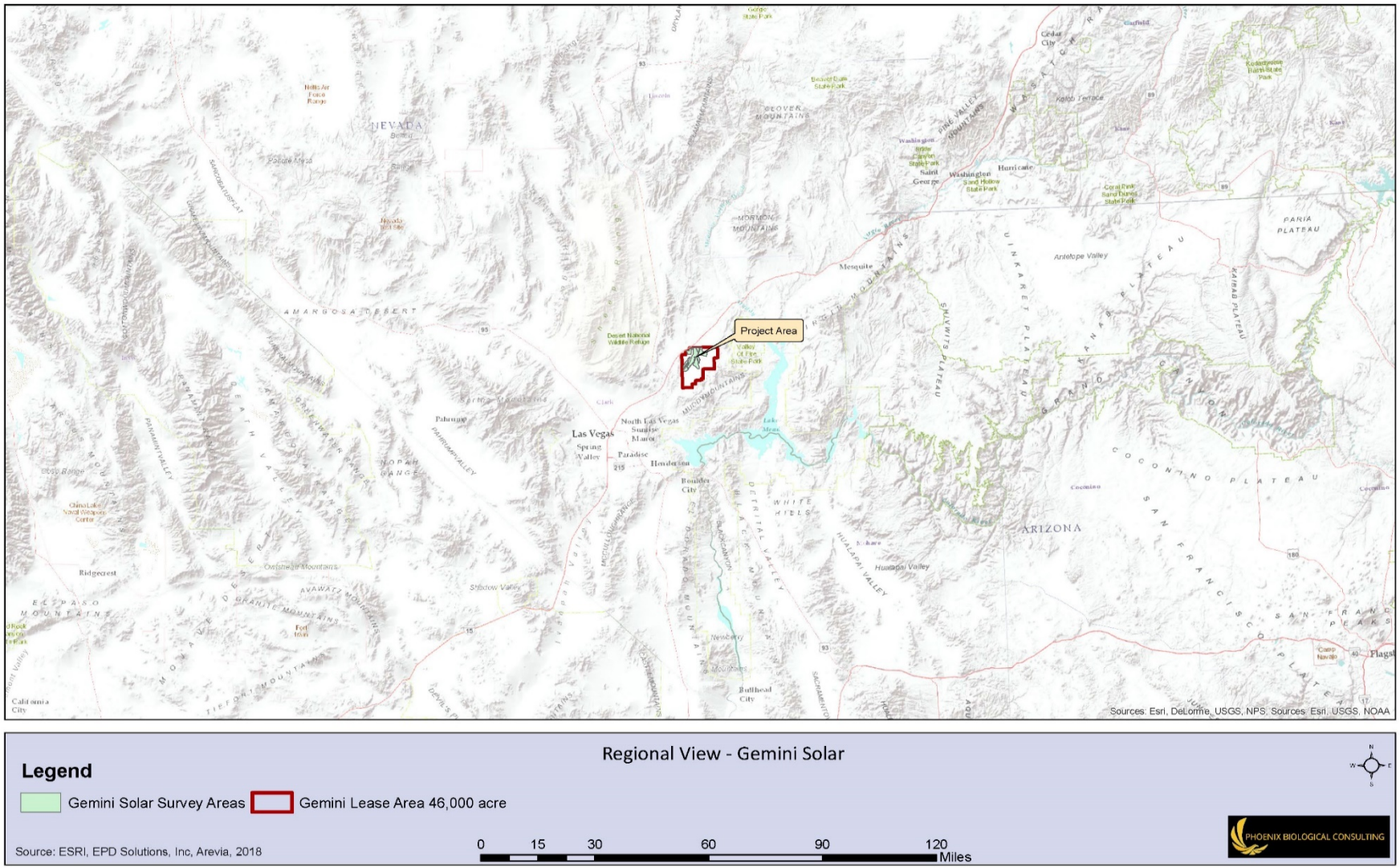


Exhibit 2: Topographic View

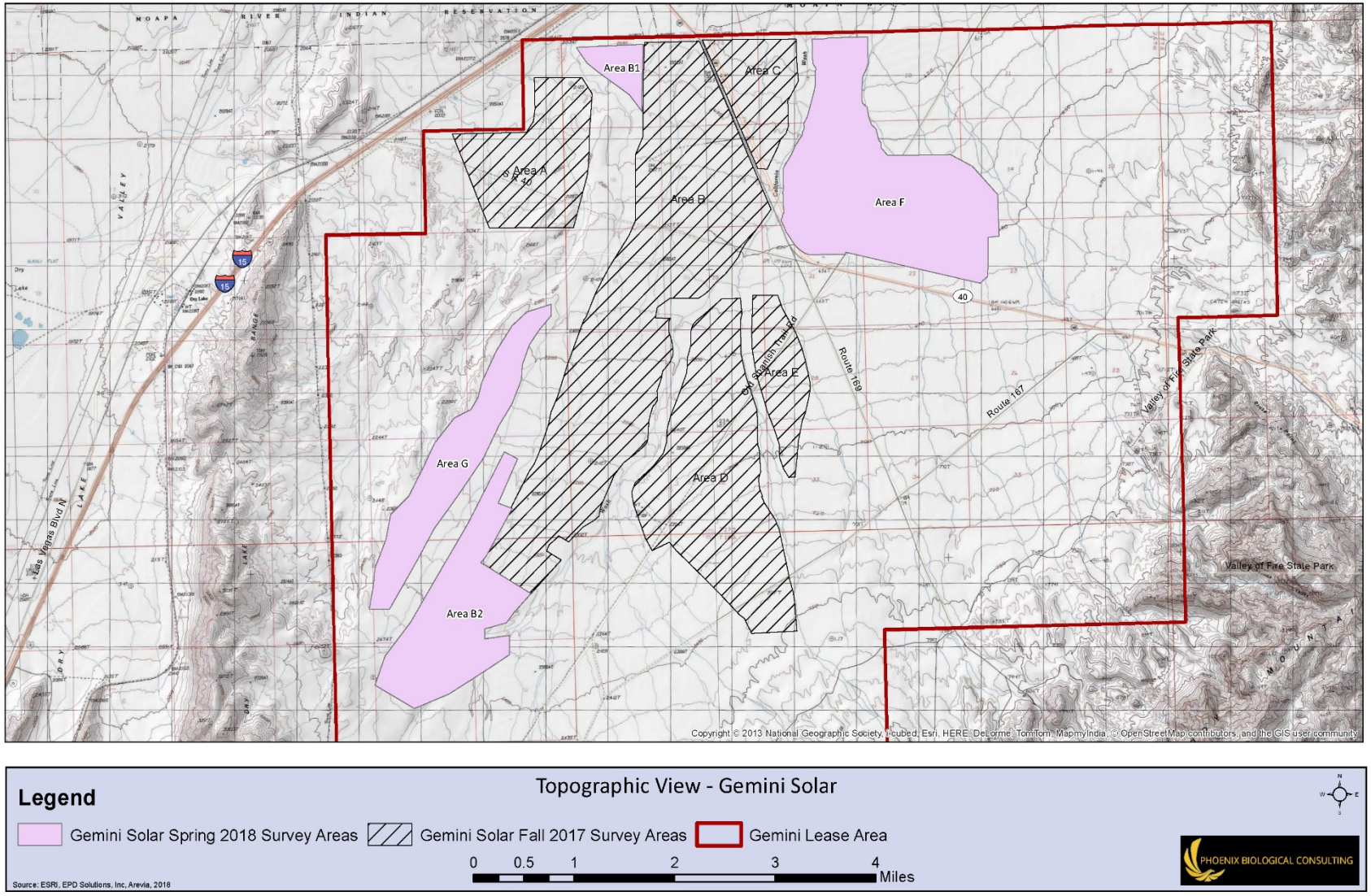
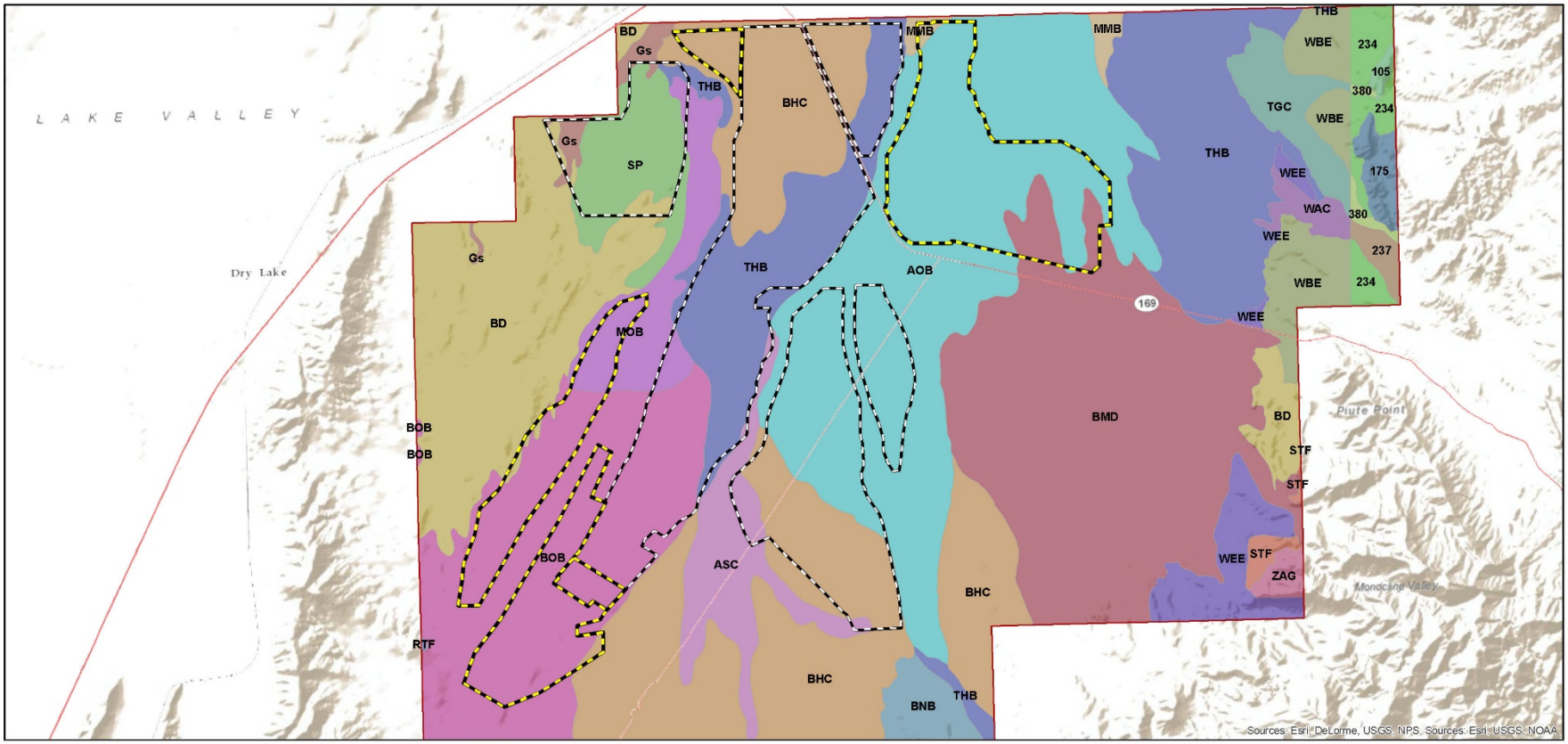


Exhibit 3: Soil Classification



Legend

- Gemini Solar Desert Tortoise Spring 2018 Survey Areas
- Gemini Solar Desert Tortoise Fall 2017 Survey Areas
- Gemini Lease Area 46,000 acre 012318

Gemini Solar - USDA Soil Data

USDA Soils Data

- 105 - Galehills extremely gravelly fine sandy loam, 15 to 50 percent slopes
- 175 - St. Thomas-Rock outcrop complex
- 234 - Wechech very gravelly fine sandy loam, 8 to 30 percent slopes
- 237 - Wechech association
- 380 - Tonopah-Arizo association
- AOB - Arada fine sand, gravelly substratum, 0 to 4 percent slopes
- ASC - Arada fine sand, hardpan variant, 2 to 8 percent slopes
- BD - Badland
- BHC - Bard gravelly fine sandy loam, 2 to 8 percent slopes
- BMD - Bard very gravelly fine sandy loam, 2 to 15 percent slopes
- BNB - Bard very stony loam, 2 to 4 percent slopes
- BOB - Bard-Rough broken land association, gently sloping
- Gs - Glendale loam, strongly saline
- MMB - Mormon Mesa loamy fine sand, 0 to 4 percent slopes
- MOB - Mormon Mesa fine sandy loam, 0 to 8 percent slopes
- RTF - Rock land-St. Thomas association, very steep
- SP - Spring silty clay loam
- SQE - St. Thomas association
- STF - St. Thomas-Rock outcrop complex
- TGC - Tonopah-Arizo association
- THB - Tonopah gravelly sandy loam, 0 to 4 percent slopes
- WAC - Wechech association
- WBE - Wechech very gravelly fine sandy loam, 8 to 30 percent slopes
- WEE - Weiser cobbly sandy loam, 15 to 30 percent slopes
- ZAG

0 0.75 1.5 3 4.5 6 Miles

Source: USDA, ESRI, EPD Solutions, Arevia, 2018

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Exhibit 4: Proximity to ACEC and Desert Tortoise Critical Habitat

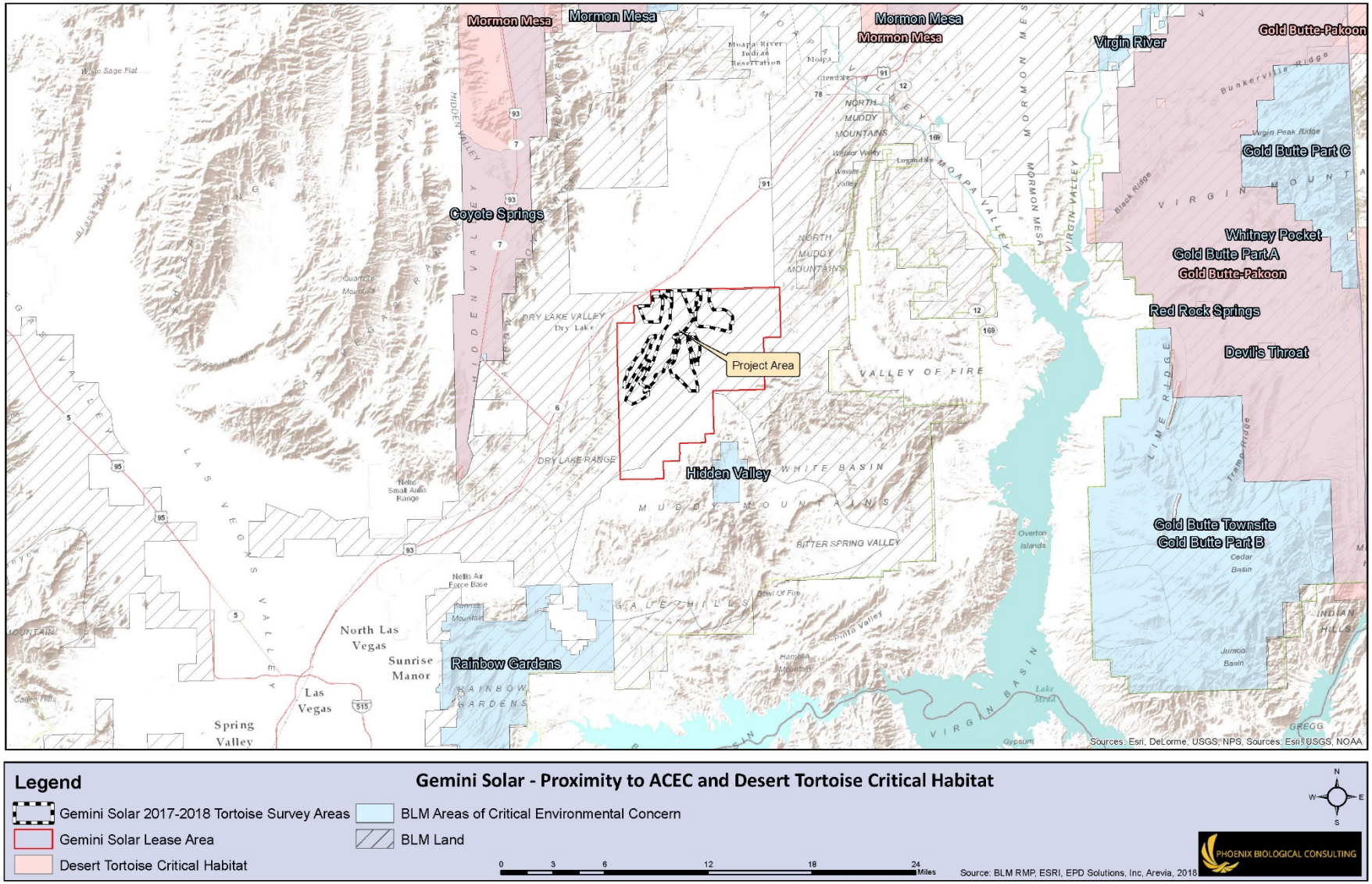


Exhibit 5: Live Desert Tortoise Observations

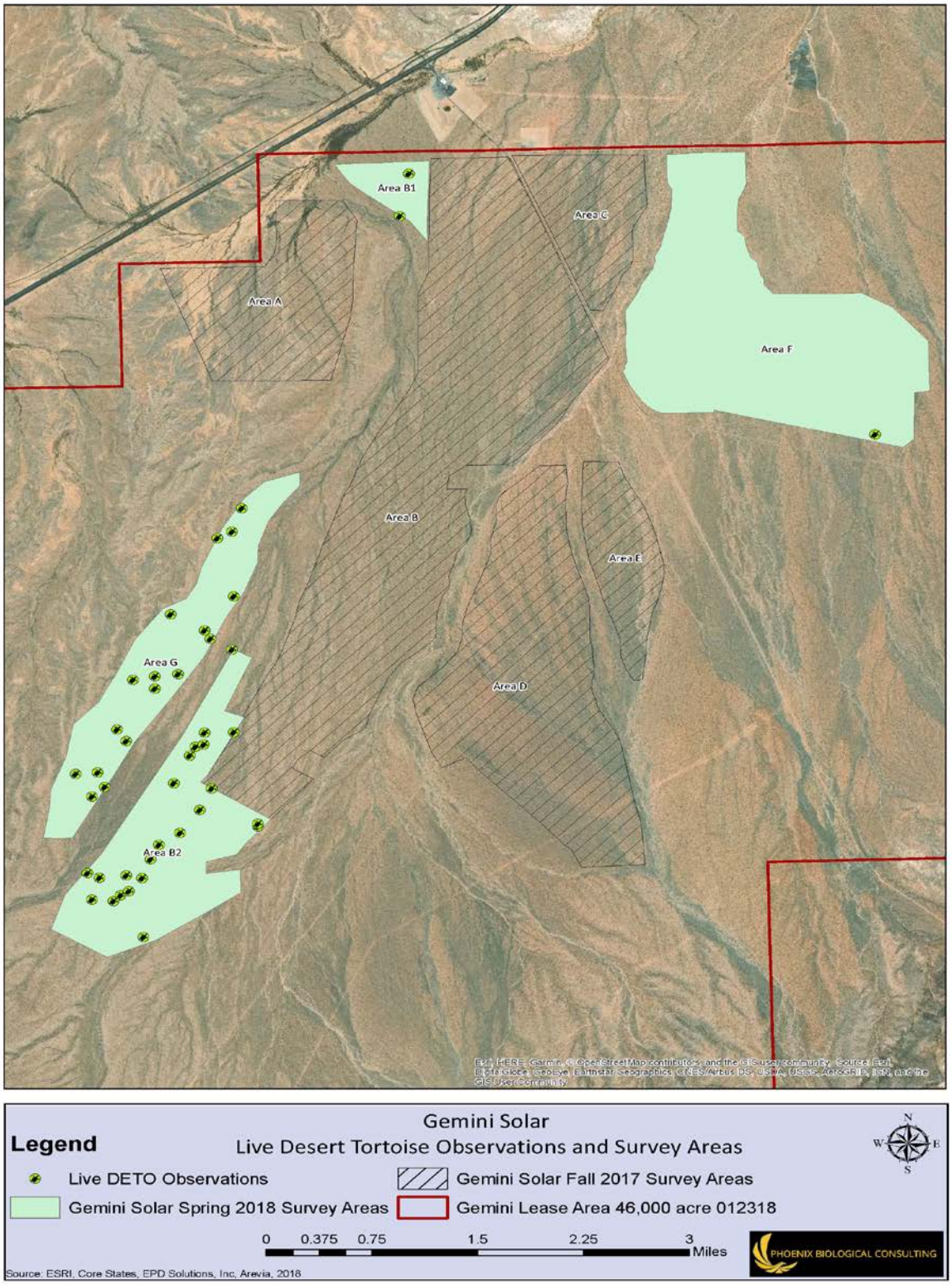


Exhibit 6: Desert Tortoise Scat with Live Tortoise Observations

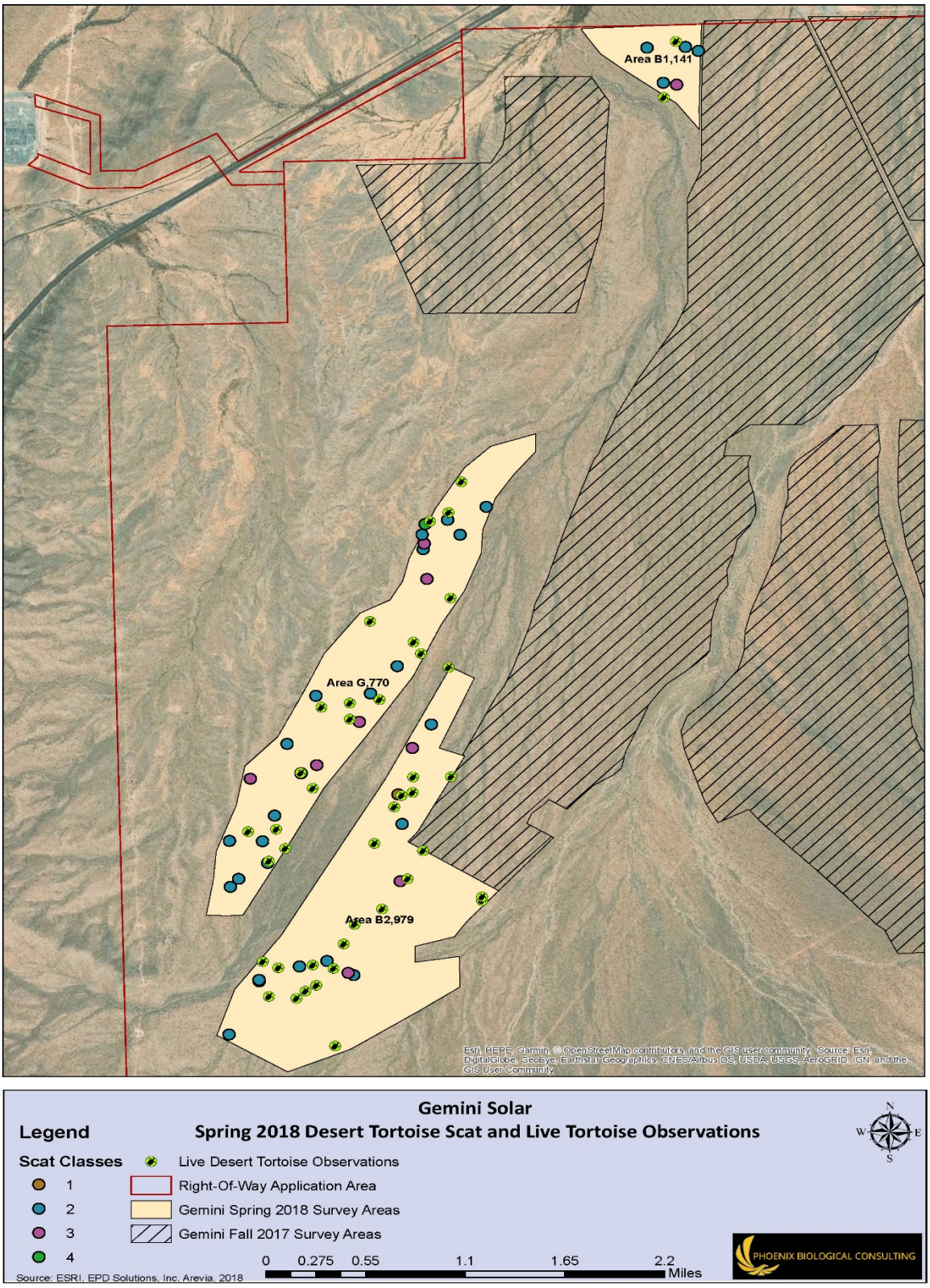


Exhibit 7: Desert Tortoise Carcasses – Areas B1 & F

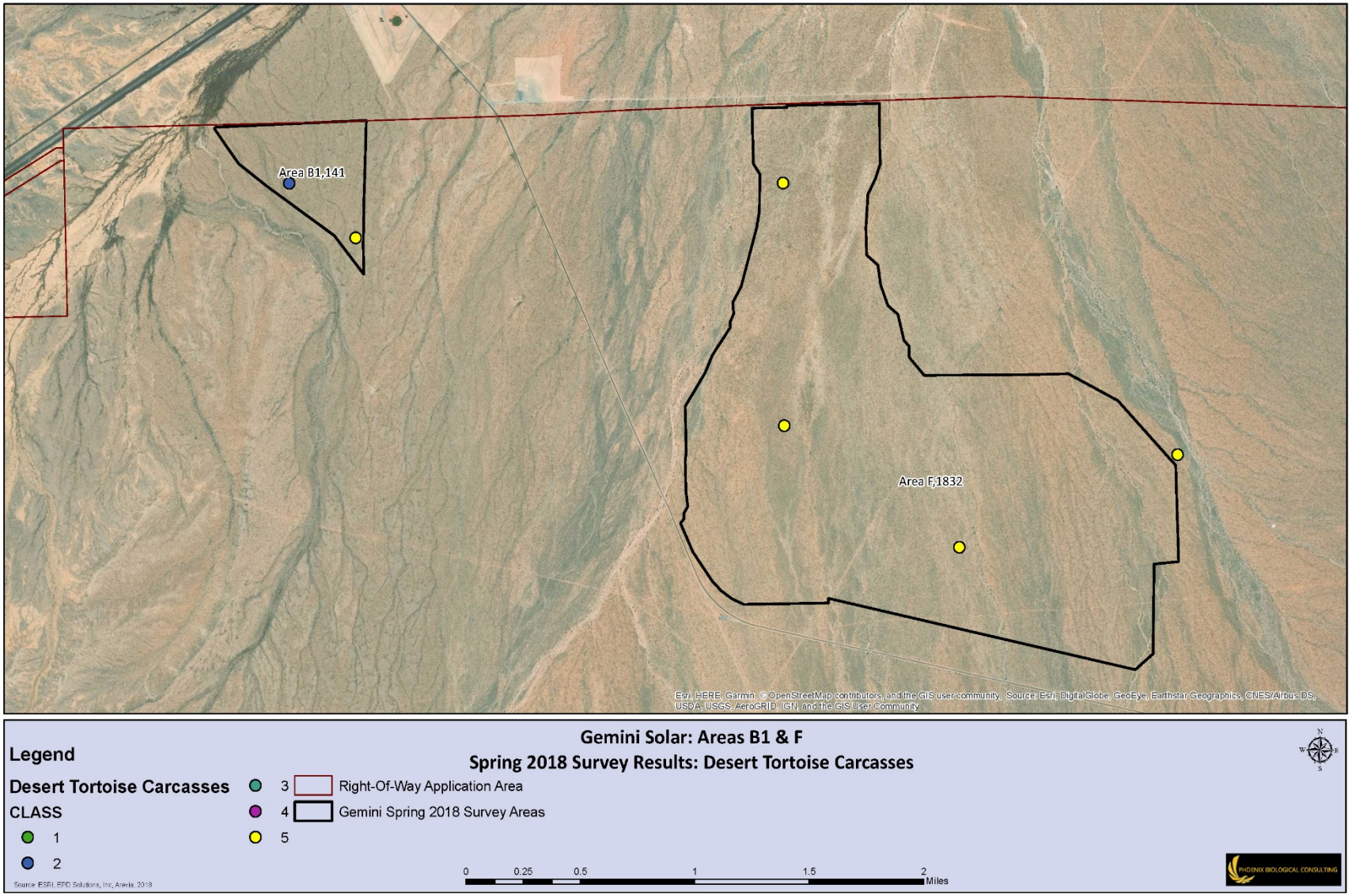


Exhibit 8: Desert Tortoise Carcasses – Areas B2 & G

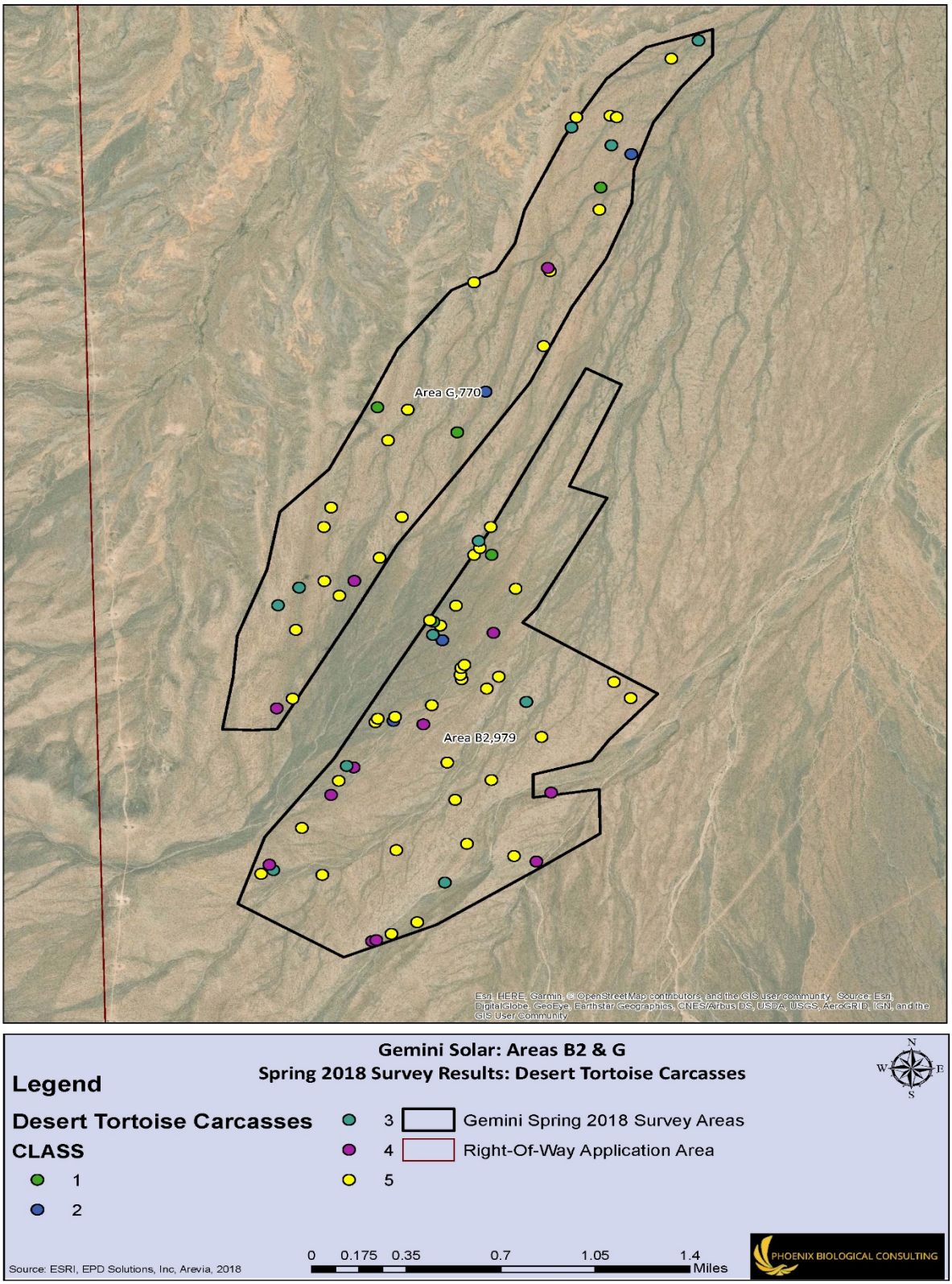


Exhibit 9: Desert Tortoise Burrows and Pallets – Areas B1 & F

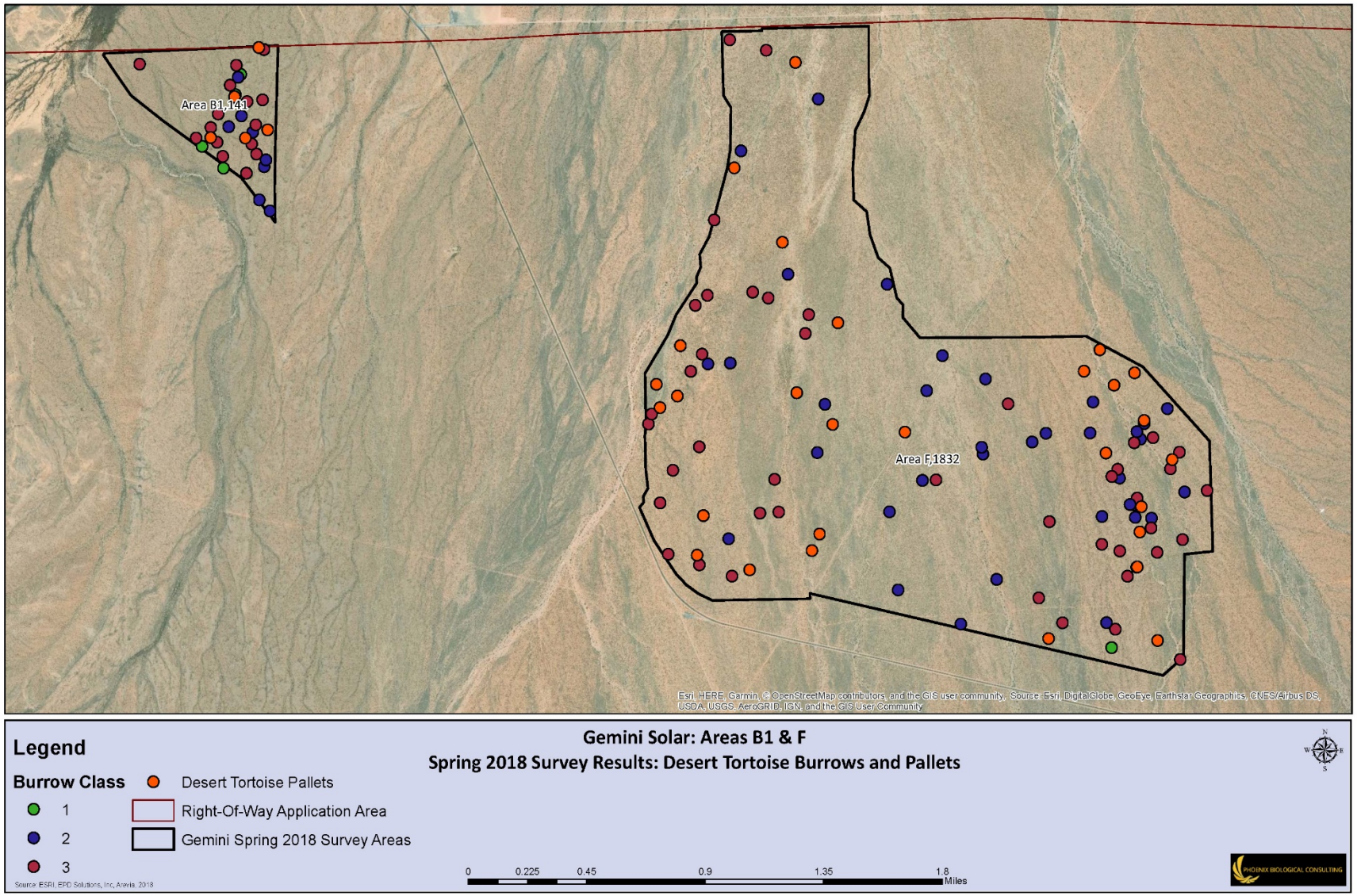


Exhibit 10: Desert Tortoise Burrows and Pallets – Areas B2 & G

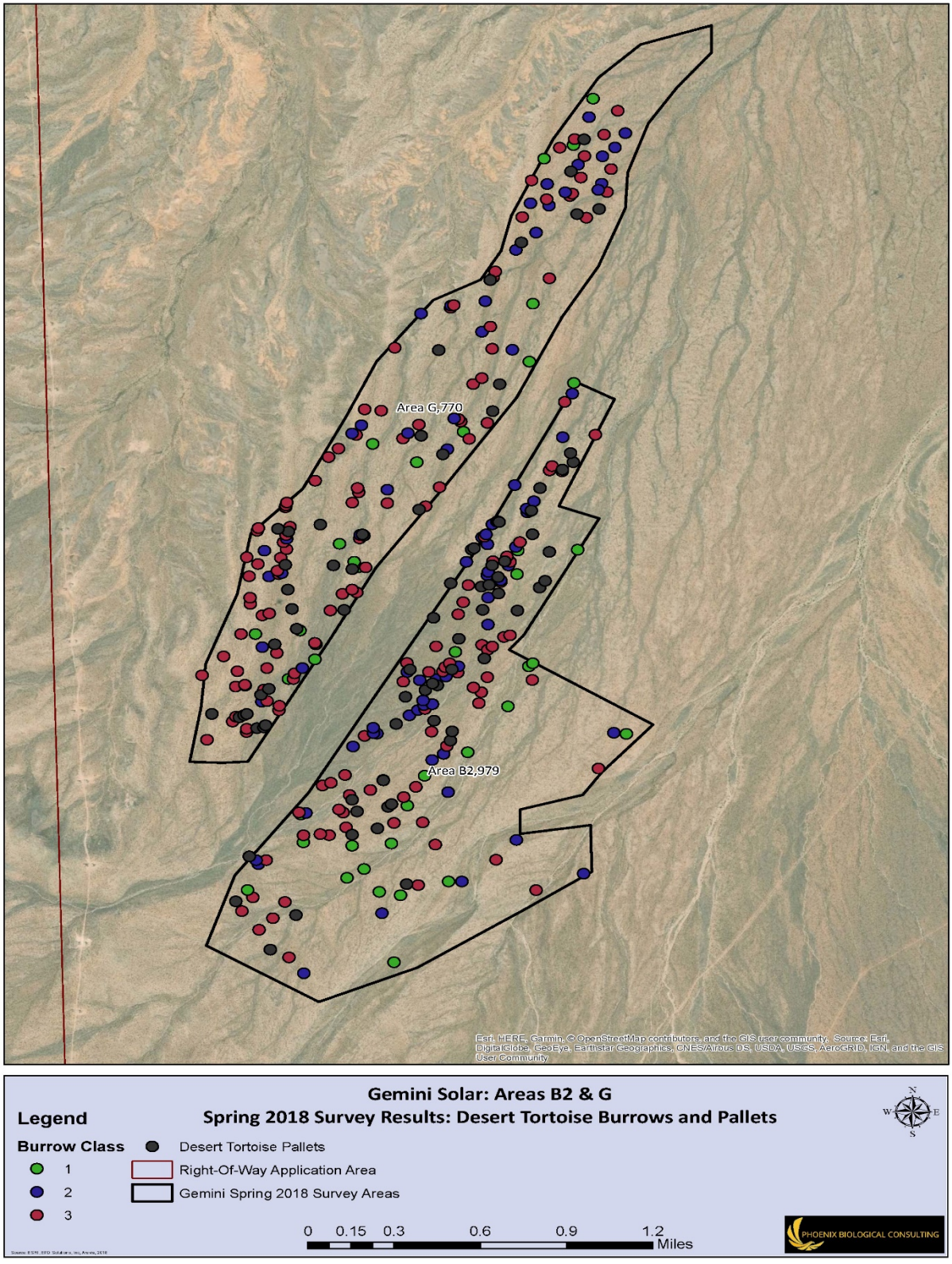


Exhibit 11: Desert Kit Fox Burrows, American Badger, Big Horn Sheep and Burrowing Owl Sign – Areas B1 & F

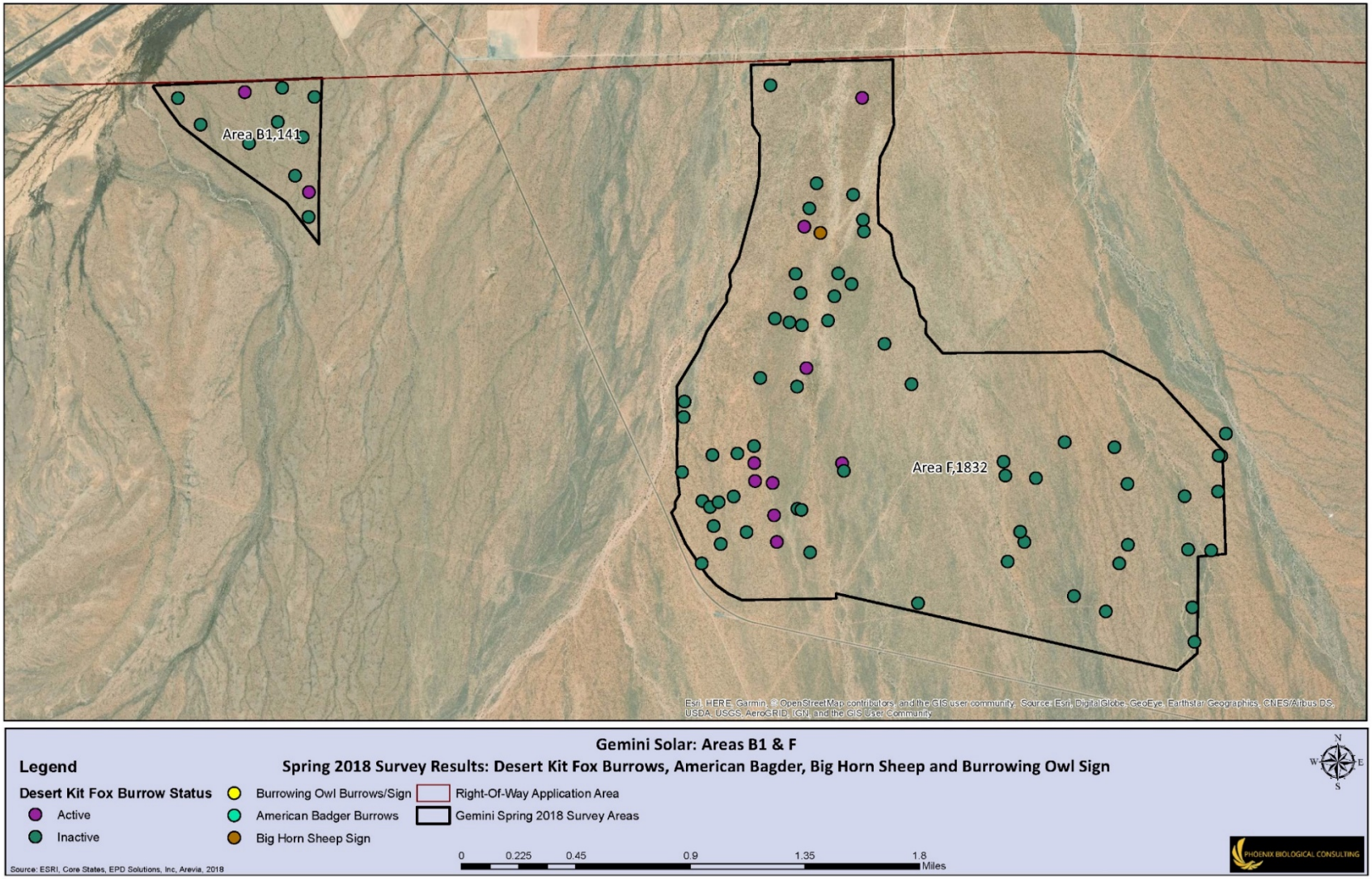


Exhibit 12: Desert Kit Fox Burrows, American Badger, Big Horn Sheep and Burrowing Owl Sign – Areas B2 & G

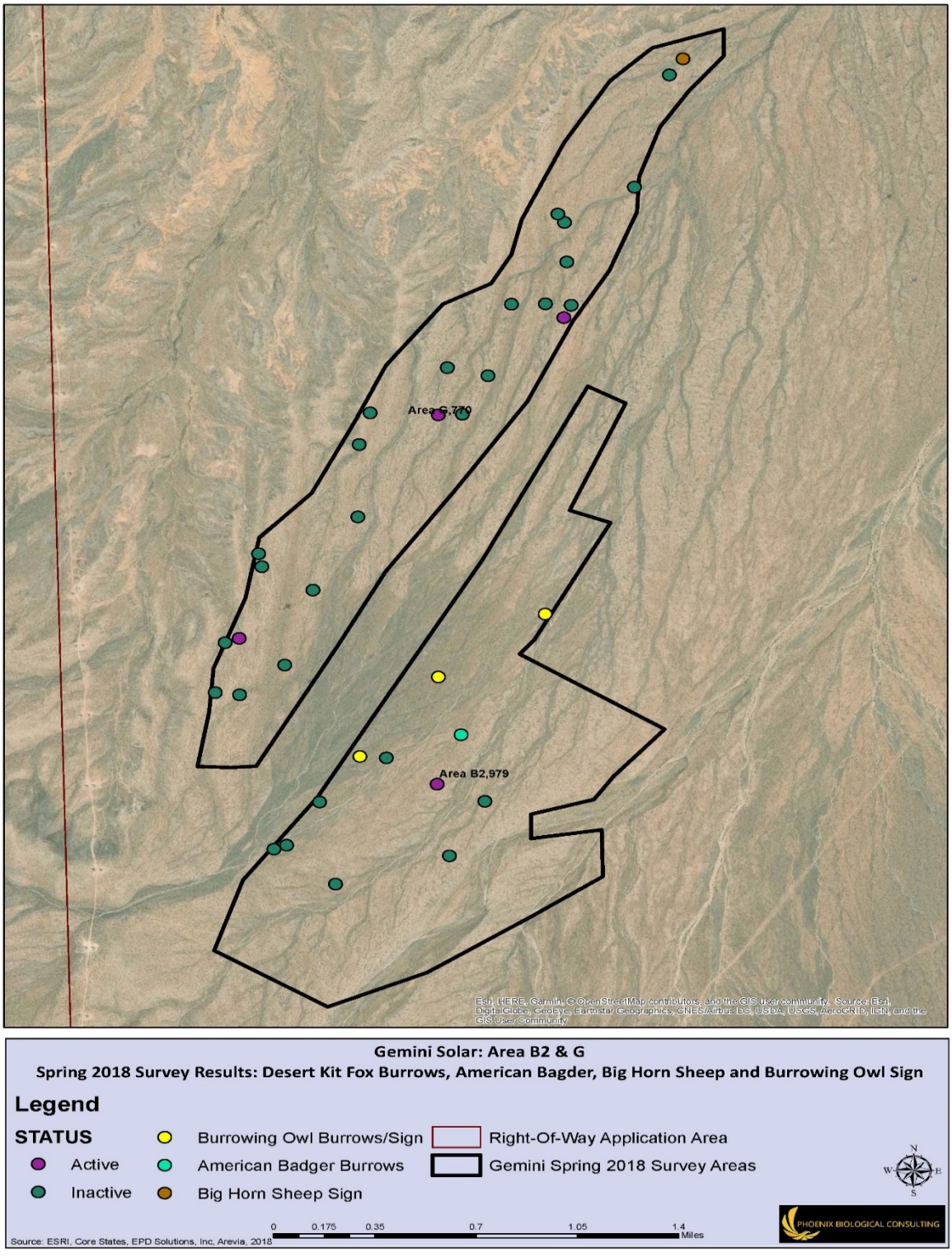


Exhibit 13: 2017 USFWS Density and Confidence Interval Spreadsheet

Table 2. USFWS Desert Tortoise Pre-Project Survey Guidance

What is the estimated number of tortoises in the action area and project footprint?

INSTRUCTIONS *Use this tab when all your transects were of equal length.*

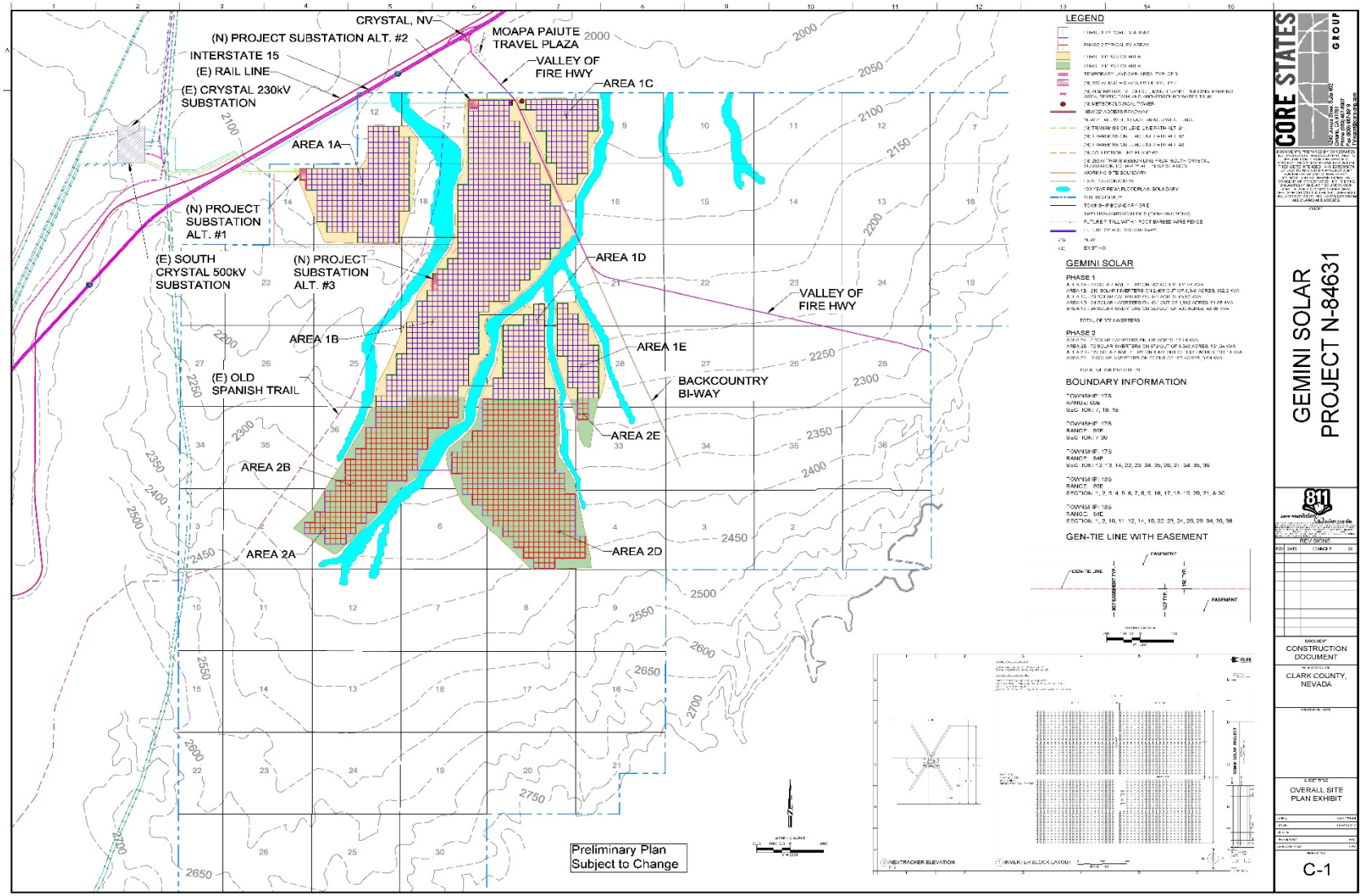
Enter the appropriate values from the survey into the yellow cells below. The number of tortoises for the action area and project footprint will be calculated.

	Action area	Project footprint	
Number of tortoises ≥ 180 mm MCL =	65.2	65.2	
Lower 95%CI =	40.23	40.23	
Upper 95%CI =	105.82	105.82	
Number of hatchlings (young-of-year) =	84.8	84.8	Relevant for disturbance occurring in August - Dec
Number of tortoises < 180 mm MCL, not young-of-year =	339.3	339.3	Relevant for disturbance at any time of year
Project-impacted area (acres)	3722	3722	
D (tortoises/km^2) in surveyed area =	4.3		
Average density in Recovery Unit =	4.4		Based on USFWS (2015) for recovery unit in cell E2
Probability that a tortoise is visible given winter rainfall (Pa in Table 1) =	0.850		
var(Pa) (from Table 1) =	0.002		
Probability of detecting a tortoise, if visible (Pd) =	0.630		
var(Pd) =	0.010		
var(n) (assume all transect lengths equal)	45.113		
var(D)	1.178		
C for N	1.622		
Project/site name	Gemini Solar		
Desert tortoise Recovery Unit	Northeastern Mojave		
Survey start date	4/3/2018		
Survey end date	5/27/2018		
Pre-survey Oct-March rainfall (mm)	180		
Total length of transects walked (L, km) =	1552		
Transect length (km)	1		
Number of transects walked (k) =	1411		
Number of tortoises found during surveys (n) =	36		

Transects all the same length

Number of tortoises ≥ 180 mm MCL (n_i)	Number of transects on which (n_i) tortoises were seen
0	1380
1	26
2	5
3	0
4	0
5	0
6	0
7	0
8	0
9	0

Exhibit 14: Preliminary Site Design



APPENDIX B

DESERT TORTOISE TRANSLOCATION PLAN

[Forthcoming]

APPENDIX C

UNITED STATES FISH AND WILDLIFE SERVICE PROTECTED SPECIES LIST

APPENDIX C

Table C-1 United States Fish and Wildlife Service's Nevada Protected Species List

Latin Name	Common Name	Federal Status	Critical Habitat in NV/CA
	Invertebrates		
	Insects		
Lepidoptera			
HESPERIDAE	SKIPPERS		
Pseudocopaeodes eunus obscurus	Carson wandering skipper	E	N
	Vertebrates		
	Amphibians		
BUFONIDAE	TRUE TOADS		
Anaxyrus canorus	Yosemite toad	T	Y
RANIDAE	TRUE FROGS		
Rana muscosa	Mountain yellow-legged frog	E	Y
Rana sierra	Sierra Nevada yellow-legged frog	E	Y
	Reptiles		
TESTUDINIDAE	TORTOISES		
Gopherus agassizii	Desert tortoise (Mojave population)	T	N/A
	Birds		
CUCULIDAE	CUCKOOS		
Coccyzus americanus	Yellow-billed cuckoo	T	Y
TYRANNIDAE	TYRANT FLYCATCHERS		
Empidonax traillii extimus	Southwestern willow flycatcher	E	N/A
VIREONIDAE	VIREOS		
Vireo bellii pusillus	Least Bell's vireo	E	N/A
	Fishes		
CATOSTOMIDAE	SUCKERS		
Catostomus warnerensis	Warner sucker	T	N/A
Chasmistes cujus	Cui-ui	E	N
CYPRINIDAE	MINNOWS		
Eremichthys acros	Desert dace		
Gila bicolor snyderi	Owens tui chub	E	Y

APPENDIX C

Latin Name	Common Name	Federal Status	Critical Habitat in NV/CA
Lepidomeda albivallis	White River spinedace	E	Y
Rhinichthys osculus lethoporus	Independence Valley speckled dace	T	Y
Rhinichthys osculus oligoporus	Clover Valley speckled dace	E	N
CYPRINODONTIDAE	PUPFISHES	E	N
Cyprinidon radiosus	Owens pupfish		
GOODEIDAE	SPLITFINS		
Crenichthys baileyi grandis	Hiko White River springfish	E	N/A
Crenichthys nevadae	Railroad Valley springfish	T	Y
Empetrichthys latos	Pahrump poolfish	E	N
SALMONIDAE	SALMONIDS		
Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	T	N
Oncorhynchus clarkii seleniris	Paiute cutthroat trout	T	N
Salvelinus confluentus	Bull trout	T	Y
	Mammals		
BOVIDAE	BOVINE		
Ovis canadensis sierra	Sierra Nevada bighorn sheep	E	Y
CANIDAE	CANINE		
Canis lupus	Gray Wolf	E	N
Vulpes vulpes necator	Sierra Nevada red fox	C	N
MUSTELIDAE	WEASELS		
Gula gulo luscus	North American wolverine	PT	N
	Plants		
	Gymnosperms		
Coniferophyta			
PINACEAE	PINES		
Pinus albicaulus	Whitebark pine	C	N
	Angiosperms		

APPENDIX C

Latin Name	Common Name	Federal Status	Critical Habitat in NV/CA
Dictyledons			
FABACEAE	PEA FAMILY		
Astragalus lentiginosus var. piscinensis	Fish Slough milkvetch	T	Y
POLYGONACEAE	KNOTWEED FAMILY		
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat	E	N
ROSACEAE	ROSE FAMILY		
Ivesia webberi	Webber's ivesia	T	Y

Federal Status
E = Endangered
T = Threatened
PT = Protected
C = Candidate