Site Restoration Plan

Gemini Solar Project
N-84631

Clark County, Nevada

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

Prepared by:
Phoenix Biological Consulting

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Table of Contents

Appendices

Exhibits

Tables

Acronyms and Abbreviations

ac	alternating current
AIM	Assessment, Inventory, and Monitoring Program
Applicant	Arevia Power & Solar Partners XI, LLC
ASTM	American Society for Testing and Materials
biocrust	biological soil crust
BLM	Bureau of Land Management
BMP	best management practices
BRTO	*Brassica tournefortii*
DIMA	Database for Inventory, Monitoring, and Assessment
EEA	Environmental Exclusion Area
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
gen-tie	generation tie
GIS	geographic information system
GPS	global positioning system
HAGL	*Halogeton glomeratus*
I-15	Interstate 15
kV	Kilovolt
LVFO	Las Vegas Field Office
mph	miles per hour
MM	Mitigation Measure
MW	Megawatt
NCA	National Conservation Area
NEPA	National Environmental Policy Act
NDA	Nevada Department of Agriculture
NNHP	Nevada Natural Heritage Program
NNPS	Nevada Native Plant Society
OHV	off-highway vehicle
O&M	operations and maintenance
PBC	Phoenix Biological Consulting
PEIS	Preliminary Environmental Impact Statement
Project	Gemini Solar Project
ROW	Right-of-way
PV	Photovoltaic
SATR	*Salsola tragus*
SNDO	Southern Nevada District Office
STAF	*Strigosella africana*
USFWS	United States Fish and Wildlife Service
WEAP	Worker Environmental Awareness Program

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I. Introduction

This Site Restoration Plan (Plan) outlines the measures that will be taken to conserve, protect, salvage, restore, and/or mitigate for impacts to natural vegetation and soils from the construction and operation of the proposed Gemini Solar Project (Project). The proposed Project is being undertaken by Arevia Power & Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC (the Applicant). This plan follows the outline and guidance provided in the Bureau of Land Management (BLM) Southern Nevada District Office (SNDO) *Restoration Plan Template* (BLM 2019a) and *Weed Management Plan Template* (BLM 2019c), and is guided by the BLM's commitment to managing for healthy landscapes, as described in the *Restoration Plan for Energy Projects in the Las Vegas Field Office* (BLM and Native Resources 2001), *Noxious Weed Plan* (BLM 2006), as well as other applicable federal and state laws, regulations, and guidelines. This Plan does not address reclamation of the site following decommissioning, which will be addressed in a separate plan (EPD 2019); however, this Plan may be used as guidance for site reclamation activities.

II. Project Area and Project Description

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

The Project includes the construction, operation, maintenance, and decommissioning of an approximately 690-megawatt (MW) alternating current (MWac) photovoltaic (PV) solar project and ancillary facilities. Project components include on-site facilities, off-site facilities, and temporary facilities needed during Project construction. The major on-site facilities are comprised of solar array blocks, substations, and operations and maintenance (O&M) facilities. Each array block would have an integrated battery energy storage system, inverters, and medium voltage transformers. Electricity generated by the Project would be interconnected to the NV Energy transmission system via overhead generation tie (gen-tie) lines extending from the Project switchyards to NV Energy's Crystal Substation, located less than 4 miles west of the Project. Additional elements include a 34.5-kilovolt (kV) overhead and underground collector line system, a 2-acre O&M area, substations, internal access roads, access roads along gen-tie lines, a perimeter road, perimeter fencing, water storage tanks for fire protection, and improvements to the existing NV Energy facilities to support interconnection.

The Project would have temporary or long-term impacts to an approximately 7,100-acre area, primarily consisting of the solar field (Project Area). Nine separate polygons were identified, referred to as development areas A, B, C, D, E, F, G, B1, and B2. The nine areas (A-G, B1 and B2) were surveyed for weeds and are collectively referred to as the Study Area (Exhibit 3).

HYBRID ALTERNATIVE

One of the alternatives identified during the environmental process was the Hybrid Alternative (BLM's preferred alternative). Six of the development areas comprise the Hybrid Alternative (A, B, C, D, E, and B1) as shown in Exhibit 3. An alternative method of site development, known as mowing, would be implemented across approximately 65 percent of the solar array areas (approximately 4,489 acres) and the remaining 35 percent (approximately 2,351 acres) of the site would be developed using a process

known as “disk and roll” or “traditional development methods” where vegetation is removed through disking and compacting the soils, and drive and crush. Vegetation in the mowed portion of the Project would be maintained at a height of 24 inches but no less than 18 inches where justified, during both construction and operation.

The mowing method preserves the vegetation including the root and seed base in the topsoil with no topsoil removal. Land contours would be maintained throughout the site (Solar Partner XI, LLC 2019).

HYBRID ALTERNATIVE IMPACTS

Under the Hybrid Alternative, the Project would require various levels of temporary and long-term or permanent disturbance to approximately 7,100 acres associated with the solar facility. Impacts include 2,139 acres of permanent disturbance where vegetation is removed, 4,923 acres of permanent disturbance where vegetation is altered but maintained, and 51 acres of temporary disturbance (Table 1).

Permanent disturbances requiring vegetation removal include the traditionally developed solar array areas, O&M building, substations, perimeter and north-south connecting access roads, internal access roads, temporary water ponds, equipment areas, and the gen-tie lines and associated access roads. Permanent disturbance areas where vegetation will be maintained are the mowed areas of the array. The Hybrid Alternative would directly or indirectly disturb approximately 7,062 acres, including the solar facility (7,039 acres) and gen-tie lines and access roads (24 acres).

Temporary disturbance areas include the gen-tie structure laydown, staging, and installation areas consisting of 200-foot-by-200-foot areas adjacent to up to 48 poles for the gen-tie route and multiple pulling sites for each gen-tie line wherever direction changes sharply (each 100 feet by 500 feet) (Solar Partners XI, LLC 2019; Table 1). Staging would otherwise occur within the development areas, in areas that would eventually be covered by panels. Following construction of the facility, the temporary disturbance areas will be cleared of all construction-related equipment, materials, and debris and will be restored as described herein.

Table 1. Summary of temporary and permanent disturbance areas.

Disturbance Type	Acres of Disturbance [1]	Notes
Permanent Disturbance – Vegetation Removed		
Solar Facility	2,114.8	690-MWac PV solar facility
Solar Arrays (Traditional Development)	1,916.4	Developed with traditional construction methods. Includes the solar PV panels, steel table frames, trackers, and posts.
O&M Building	2.1	Includes the O&M building, parking, and water tank storage, all within the solar facility footprint.
Substations	7.1	Each of the three substations occupies approximately 2.4 acres within the solar facility footprint.
Access Roads for Solar Field and Utility Corridor	170.5 [2]	Roads would be graded and covered with gravel base or compacted soil.
Water Ponds	4.0	Four temporary[3] water ponds or tanks would be constructed in development areas A, B, and D.
Equipment Areas	14.7	425 equipment areas, which include batteries (53,550 individual batteries), inverters, and medium voltage transformers within the solar facility footprint.
Gen-tie Lines and Access Roads to Gen-tie Lines	24.4	Gen-tie foundations are assumed to fall within acreage for access roads.
Subtotal	**2,139**	
Permanent Disturbance – Vegetation Maintained		
Solar Arrays (Mowing) [5]	3,366.3	Mowed area of the 690-MWac PV solar facility. Includes the solar PV panels, steel table frames, trackers, and posts with vegetation left in place and kept to a height of approximately 18-24 inches.
Solar Arrays (Drive and Crush) [6]	1,557.7	Drive and crush area of the 690-MWac PV solar facility (20 to 25 percent of mowed area between rows from panel installation and in modeled threecorner milkvetch habitat in traditional development areas). After construction, this vegetation will grow back and then be maintained to a height of approximately 18-24 inches.
Subtotal	**4,923**	
Temporary Disturbance (granted through a short-term ROW, if outside the Project ROW area) [4]		
Gen-tie structure laydown, staging, and installation areas	36.1	Gen-tie structure laydown, staging, and installation areas, 200 feet by 200 feet at up to 48 poles, outside the solar facility fence.
Gen-tie line conductor stringing	14.8	Multiple pulling sites for each gen-tie line wherever direction changes sharply; each 100 feet by 500 feet.
Subtotal	**51**	
TOTAL	**7,113**	

Notes:

1. All values presented are approximate and subject to change per final engineering.

Disturbance Type	Acres of Disturbance [1]	Notes
2. North-south connecting access roads closest to the boundary of mowing and traditional development areas were assumed to be constructed within the traditional development. Includes temporary and permanent disturbance related to water infrastructure.		
3. Although the water ponds or tanks are temporary and would be removed following construction, the impact would be permanent. The areas where ponds or tanks 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.		
6. Within the solar array areas, approximately 436 acres will be constructed through drive and crush, and additional up to 1,122 acres will be crushed by vehicles and equipment during construction in the mowed areas. The vegetation will grow back and then be maintained by mowing (even in traditional development areas)		

III. Project Conservation and Mitigation Measures

GENERAL CONSERVATION MEASURES

The Gemini Solar Plan of Development (Solar Partners XI, LLC 2019) includes the following minimum Best Management Practices (BMPs) to minimize environmental degradation.

- Minimizing vegetation removal by implementing the mowing method of construction on 65 percent of the Project;
- 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 (e.g. straw bales, sandbags, jute netting, or silt fences). Conducting periodic surveys of these areas and removing sediment from barriers and sedimentation devices to restore sediment-control capacity. Removed sediment would likely be spread back onsite;
- Placing barriers and sedimentation devices around drainages and jurisdictional waters;
- Replanting Project areas with native vegetation at spaced intervals to break up areas of exposed soil and reduce soil loss through wind erosion, where possible;
- Minimizing land disturbance (including crossings) in natural drainage systems and groundwater recharge zones (i.e., ephemeral washes);
- Locating and constructing drainage crossings for internal access roads so as not to decrease channel stability or increase water volume or velocity;
- Avoiding clearing and disturbing areas outside the construction zone;
- Conducting construction grading in compliance with industry practice (e.g., the American Society for Testing and Materials [ASTM] international standard methods) and other requirements (e.g., BLM and/or local grading and construction permits);
- Using temporary stabilization devices (i.e., erosion matting blankets, or soil stabilizing agents) for areas that are not actively under construction;

- Upon completion of construction, reapplying any topsoil that is salvaged during excavation and construction;
- Restoring disturbed lands following construction as outlined in the Site Restoration Plan and the Reclamation Plan;
- 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;
- Conducting inventory for non-native and noxious weeds prior to construction and throughout construction, treating weeds when they are found, and following weed plant to minimize the spread of weeds during construction; and,
- Minimizing soil-disturbing activities on wet soils.

VEGETATION MITIGATION MEASURES

The Gemini Solar Project *Resource Management Plan Amendment and Draft Environmental Impact Statement* (RMPA/DEIS) (BLM 2019b) includes the following applicable Mitigation Measures (MMs) to this *Site Restoration Plan*.

MM VG-1: Requirements of the Site Restoration Plan, Integrated Weed Management Plan, and Decommissioning and Site Reclamation Plan (includes only the portion of MM VG-1 related to restoration and monitoring – the full MM can be found in the RMPA/DEIS [BLM 2019b])

The Site Restoration Plan, Integrated Weed Management Plan, and Decommissioning and Site Reclamation Plan shall include the following requirements, at a minimum:

Vegetation

- For the Hybrid Alternative, monitoring shall be address in a long-term monitoring plan.
- Monitoring for vegetation change in the mowed areas shall adhere to this monitoring stipulation.
- Reporting for vegetation monitoring shall be submitted by July 1 of each year.

Cacti and Yucca

- All cacti and yucca within permanent disturbance areas (e.g., roads, battery storage areas, traditional development areas, and transmission line towers) shall be salvaged and transplanted in a natural pattern within the mowed or provided for sale to the public purchase, and then to commercial users for purchase, per BLM's forestry program guidance. More details shall be provided in the Site Restoration Plan.
- Within sensitive plant habitat, where drive and crush methods would be used with the Hybrid Alternative, cacti and yucca shall be avoided when possible. If they are unavoidable, they may be cut down (cacti) or ground down (yucca) to a height of no less than 6 inches (excepting small cacti or barrel cacti – these shall be left in place). Cut or ground materials from cacti and yucca shall be left on site where they fall. Regeneration of cacti and yucca in these areas shall be allowed to occur.
- Within mowed areas, cacti and yucca shall be cut down (cacti) or ground down (yucca) to a height of no less than 16 inches. Cut or ground materials from cacti and yucca shall be left on site where they fall. Smaller cacti or yucca (already under 16 inches) shall not be cut. Cacti and yucca shall be flagged and avoided during construction as much as possible. Flagging shall be removed after construction.

More details shall be provided in the Site Restoration Plan. The designated botanist is responsible for flagging and monitoring cacti and yucca during construction.

- Barrel cacti shall not be reduced in height even if they are over 16 inches. Barrel cacti shall be avoided during construction.
- The salvaged cacti and yucca shall be held in an onsite nursery to be transplanted back into the site after construction. This shall be identified in the Site Restoration Plan in order to provide additional habitat structure for the Mojave Desert tortoise under the Hybrid Alternative.
- The designated botanist shall submit a report to the BLM after construction with the numbers of cacti and yucca damaged by construction activities.

Desert Pavement and Biological Soil Crust

- For any alternative, significant stands of biocrust shall be salvaged by hand or using very small equipment, where it is possible to do so, and stored until it can be restored from the areas where it was removed.

MM VG-2: Threecorner Milkvetch and Other Special Status Plants (includes only the portion of MM-VG-2 related to restoration and monitoring – the full MM can be found in the RMPA/DEIS [BLM 2019b])

- The Applicant is required to submit a permit application for impacts on threecorner milkvetch from the Nevada Division of Forestry. There shall be no disturbance (i.e., any sort of construction) in modeled habitat for threecorner milkvetch unless a final permit from the Nevada Division of Forestry is obtained following pre-construction surveys to identify the locations of threecorner milkvetch individuals.
- Seed collection of threecorner milkvetch seeds shall take place in areas where individuals have been observed prior to ground disturbance of that habitat. Seed shall be collected from any species that emerge in the spring prior to planned disturbance. Disturbance of sensitive plant habitat cannot commence before seed collection from plants has occurred. Seed collection shall be contracted by the Applicant to a BLM-approved botanic garden with staff experienced with conservation seed collections of sensitive species. The botanic garden shall be contracted by the Applicant to store the seed for the 30-year period of the ROW. If the ROW is renewed, the contract shall be extended as long as the Project is ongoing to preserve the seed. The seed shall be used on habitat within the Project site after decommissioning takes place.
- The Applicant shall ensure that seeds collected are stored by an approved botanic garden.
- There shall be no disk and roll in areas of threecorner milkvetch habitat, identified as "known occurrences" according to the Hamilton and Kokos model shown on Figure 3.6-19 under the Hybrid Alternative. These areas shall be developed using drive and crush methods to preserve the sandy soils where habitat for threecorner milkvetch occurs. This approach shall help to mitigate for spread of noxious and non-native weeds and has the best chance of preserving some semblance of habitat for this species. Where the drive and crush method is used, vegetation shall be allowed to regrow to a minimum height of 12 inches after construction.
- A designated, BLM-approved botanist shall be on site during construction and restoration of temporary disturbance areas to monitor sensitive plant habitats and to ensure compliance with these stipulations.
- All Saharan mustard shall be removed from modeled threecorner milkvetch habitat prior to construction.

- Saharan mustard shall be removed annually, before it has gone to seed, from all modeled habitat for threecorner milkvetch. Multiple treatments shall likely be necessary to remove different cohorts of Saharan mustard. All other pre-existing weed species shall be kept below densities found on the Project site pre-disturbance.
- Herbicide treatment would be completed in threecorner milkvetch habitat and in Nye milkvetch habitat prior to March 15 to avoid non-target impacts to sensitive plant species. After March 15, only hand-pulling of weeds in any sensitive milkvetch habitat is permitted.
- There shall be no use of aminopyralid within modeled habitat for threecorner milkvetch or within 656 feet of any modeled habitat. There shall be no use of aminopyralid within habitat for Nye milkvetch (as determined by pre-Project surveys).
- Annual monitoring for threecorner milkvetch (using BLM-approved protocol) within the impacted population group by a BLM-approved botanist is required. Monitoring shall determine the number of threecorner milkvetch plants that emerge each year, including the reproductive success of those plants. Monitoring shall determine if weeds are spreading as a result of Project-related activities, and if and how weed spread is impacting sensitive plant populations. This monitoring shall be summarized in an annual report to BLM, due by July 1 of each year.
- The Applicant shall ensure that threecorner milkvetch in the impacted population group are monitored for the 30-year ROW.
- Worker Environmental Awareness Program (WEAP) training shall include information on habitat for all sensitive species, including how that habitat is marked on the ground (flagging, flagging color, etc.) in order for contractors to follow appropriate avoidance and weed treatment stipulations.

MM NHT-2: Restoration of the Traditional Development Areas – Hybrid Alternative

To minimize the duration of time that the setting of the OSNHT corridor is disrupted by the traditional development areas under the Hybrid Alternative, the Applicant shall:

- Immediately begin restoration of the traditional development areas using the criteria presented in the Site Restoration Plan

Exhibit 1. Gemini Solar Project Location

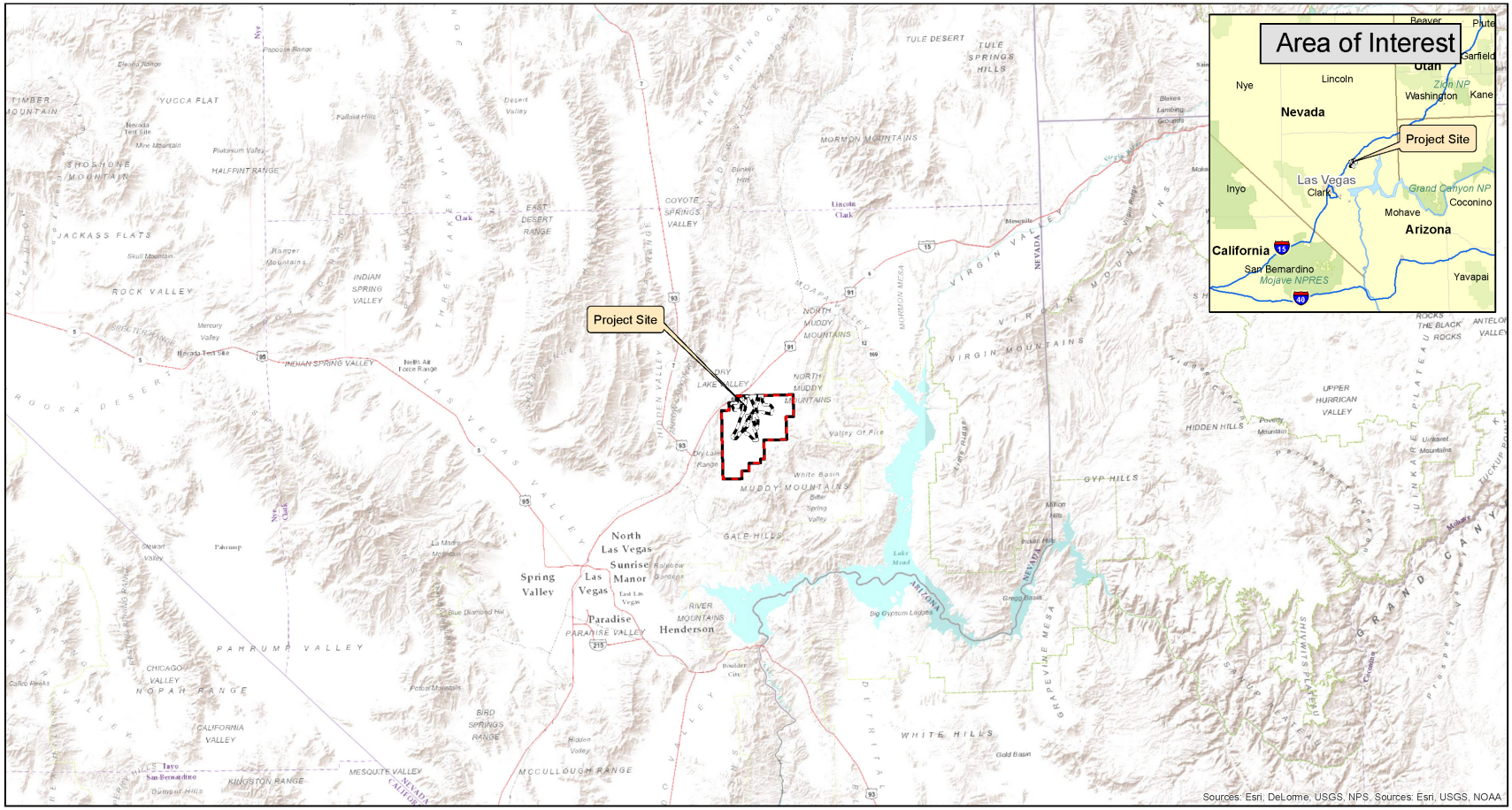


Exhibit 2. Gemini Solar Project Study Area

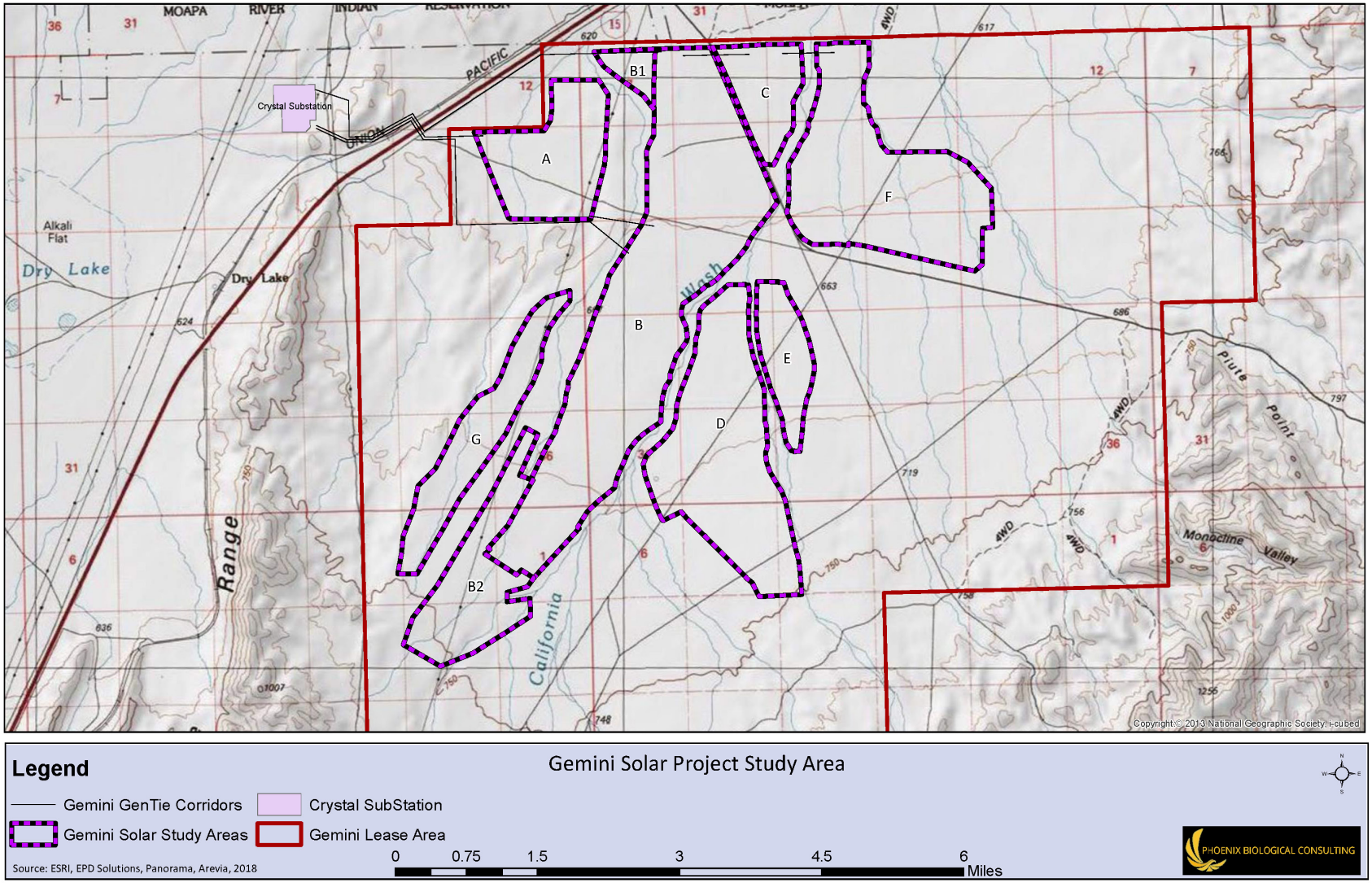
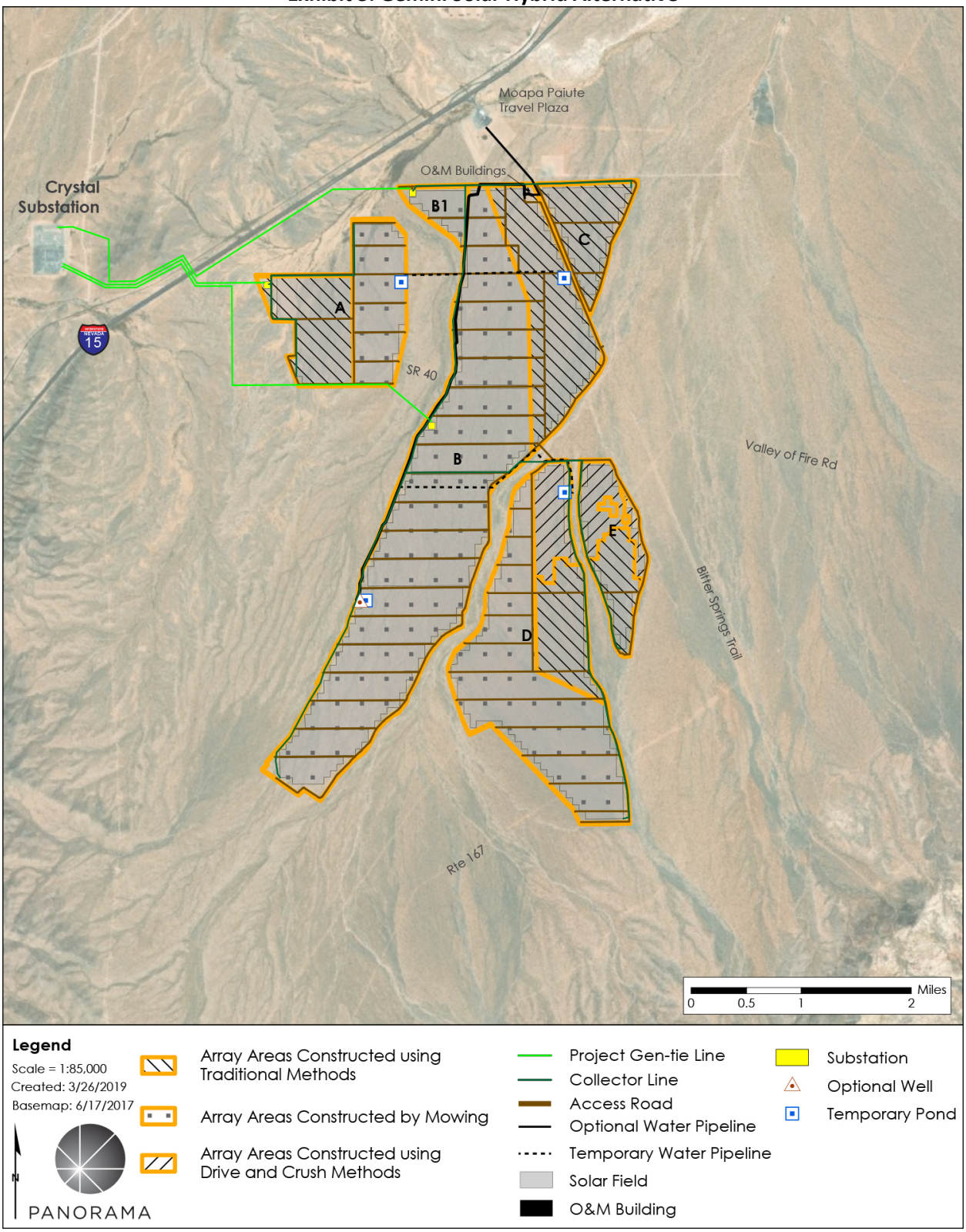


Exhibit 3. Gemini Solar Hybrid Alternative



TYPE OF AREA USE

Following the BLM's guidance in their *Restoration Plan Template* (BLM 2019a), disturbance conditions are divided into three types of disturbance: temporal use (long term and temporary), spatial structure (linear and non-linear), and previous disturbances. The BLM's *Restoration Plan Template* (BLM 2019a) defines "Long-term Use Areas" as follows: "The use of these areas is long-term and the landscape is permanently altered through removing vegetation, site leveling, modifying natural drainages, fencing, and constructing facilities, towers, and other structures. Permanent disturbance also includes constructing access roads needed for regularly scheduled maintenance of facilities and structures." "Temporary Use Areas" are defined as "…using an area only for the amount of time it takes to construct the project. Examples include utilizing various types of heavy equipment to install towers or pipelines, driving across public land [sic] gain access to the project site, and parking vehicles, equipment, and materials in designated staging areas." Lastly, the Spatial Structure type is divided into five subcategories: 1. linear - short (< 5 miles); 2. linear - long (> 5 miles); 3. small area (< 1 acre); 4. large area (1 to 20 acres); and, 5. very large area (> 20 acres). Table 2 shows the acres of Project impacts by type of use category.

The majority of the Project is the solar array, which covers approximately 6,811 acres and is categorized as a very large area spatial structure (> 20 acres) and a long-term type of use. In addition to the solar array, there are approximately 200 combined acres of large area spatial structures (1 to 20 acres) and very large area spatial structures (> 20 acres) that combine with the solar array to encompass the solar facility, all of these are long-term use and include the O&M building, substations, perimeter road, internal access roads, water ponds or tanks, drainage features, berms, and power conservation station and battery energy storage system (Table 2). In addition to the solar facility, there are approximately 24 acres of long-term use, long linear spatial structure (> 5 miles) actions comprised of the gen-tie lines and associated access roads. The approximately 51 acres of gen-tie laydown areas and pulling sites are categorized as large and very large area temporary use actions (Table 2).

Table 2. Project impact totals by type of use.

Spatial or Temporal Use	Action Types (acres)									
	Solar Arrays	*O&M Building*	*Substations*	*Access Roads*	*Water Ponds or Tanks*	*Equipment Areas*	*Gen-tie Lines and Associated Access Roads*	*Gen-tie Laydown Areas*	*Gen-tie Line Pulling Sites*	**Project Total**
Temporary	--	--	--	--	--	--	--	36.1	14.8	**51**
Long-Term	6,839.4	2.1	7.1	170.5	4.0	14.7	24.4	--	--	**7,062**
Totals	**6,8439.4**	**2.1**	**7.1**	**170.5**	**4.0**	**14.7**	**24.4**	**36.1**	**14.8**	**7,113**
Breakdown of Project Impacts by Disturbance Type										
Short-Linear (< 5 miles)	--	--	--	--	--	--	--	--	--	**0**
Long-Linear (> 5 miles)	--	--	--	--	--	--	24.4	--	--	**24.4**
Small Area (< 1 acre)	--	--	--	--	--	--	--	--	--	**0**
Large Area (1 to 20 acres)	--	2.1	7.1	--	4.0	14.7	--	--	14.8	**42.7**
Very Large Area (> 20 acres)	6,839.4	--	--	170.5	--	--	--	36.1	--	**7,046**
Totals	**6,839.4**	**2.1**	**7.1**	**170.5**	**4.0**	**14.7**	**24.4**	**36.1**	**14.8**	**7,113**

DISTURBANCE LEVELS

The three disturbance levels (D-0, D-1, D-2, and D-3) defined in the BLM's *Restoration Plan Template* (BLM 2019a) are excerpted below. The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities. For this Project, it is anticipated that the temporary disturbance areas (laydown areas and pulling sites) will be subjected to a D-1 or D-2 disturbance level, meaning minimal to moderate disturbance, as detailed below (Table 4). Solar array fields in the mowed areas will be subject to the lowest level of disturbance (D-0), and areas of disk and roll subjected to slightly higher disturbance (D-1) (Table 3; Exhibit 4). Permanent impact areas such as access roads, infrastructure footprints, and cleared solar array areas constructed using "traditional" methods, will be subject to D-2 and D-3 disturbance levels (moderate to heavy disturbance), as described below (Table 3; Exhibit 4). The disturbance levels associated with each action type for permanent and temporary impacts are listed in Table 3 and Table 4, respectively.

> *D-0. Mowing.* Mowing is a new technique being utilized to conserve vegetative resources within a large project area. Vegetation is mowed to a height of generally 24 inches, but no less than 18 inches during construction. Depending on site objectives, vegetation can be allowed to reach a normal height or kept trimmed to a height between 18 inches and the plant's full height potential. Crushing of vegetation will be minimal and this disturbance level is designed to have a minimal impact on existing vegetation. Cacti and yucca can be left in place in this disturbance level - yucca may be cut or ground down to 18 inches and allowed to resprout. Cacti taller than 18 inches (primarily Cylindropuntia spp.), may be cut at 18 inches, with the cut portion left on the ground. This method is least likely to result in invasions of non-native plant species.
>
> *D-1. Overland Drive and Crush.* Disturbance caused by accessing a site without significantly modifying the landscape. Vegetation is crushed but not cropped. No surface soil is removed. Examples include utility line tensioning and pulling areas, tower pad sites, overland access to fiber optic meter sites, and spur roads to towers. Approximately 25 percent of the mowed areas will have crushed vegetation for installation of the arrays. Even though vegetation may be damaged and even destroyed, the surface soil and seed bank remains in place. Some crushed vegetation will likely sprout after disturbance ceases. These activities would result in minimal to moderate disturbance. This type of disturbance will result in the fastest recovery time for vegetation and is preferred by the BLM (second only to mowing). Soil seed banks remain largely in place, perennial vegetation can grow back, and minimal external efforts are necessary. This method is less likely to result in invasions of non-native plant species. This would involve crushing or mowing vegetation typically to the ground surface
>
> *D-2. Clear and Cut.* Disturbance caused by accessing the project site but having to brush off all vegetation in order to improve or provide suitable access for other equipment. All vegetation is removed, soils are compacted, but no surface soil is removed. Examples include temporary access roads where the road is improved for access and could include some examples from D-1 above. Clear and cut activities would result in moderate disturbance. This type of disturbance will result in moderate recovery times for vegetation. This method has a moderate risk for invasion of non-native plant species. An example is imprinting to crush vegetation down into the soil.

Table 3. Project permanent impact totals by disturbance level[1].

Disturbance Level	Action Types (acres)							
	Solar Arrays	*O&M Building*	*Substations*	*Access Roads*	*Water Ponds*	*Equipment Areas*	*Gen-tie Lines and Associated Access Roads*	**Project Total**
D-0	3,366.3	--	--	--	--	--	--	**3,366.3**
D-1	1,557.7	--	--	--	--	--	--	**1,557.7**
D-2	1,916.4	**--**	**--**	--	--	**--**	**--**	**1,916.5**
D-3	--	2.1	7.1	170.5	4.0	14.7	24.4	**222.8**
Totals	**6,839.7**	**2.1**	**7.1**	**170.5**	**4.0**	**14.7**	**24.4**	**7,062.4**

[1] The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities.

Table 4. Project temporary impact totals by disturbance level[1].

Disturbance Level	Action Types (acres)		
	Gen-tie Line Laydown Areas	*Gen-tie Line Pulling Sites*	**Project Total**
D-0	--	--	**0**
D-1	36.1	14.8	**50.9**
D-2	--	**--**	**0**
D-3	--	--	**0**
Totals	**36.1**	**14.8**	**50.9**

[1] The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities.

D-3. Clear and Cut with Soil Removal. Disturbance is caused by removing all vegetation in the impact zone, the soils are compacted and the surface soil is displaced, and for project requiring underground installation, the subsurface soils are displaced as well. These activities result in heavy disturbance. Examples include pipelines, buried fiberoptic lines, access roads that require grading and filling. This type of disturbance results in an extensive recovery time for vegetation, and is most likely to lead to invasions of non-native plant species, which can result in lengthy and expensive control efforts. Includes disc-and-roll construction, and other traditional construction methods where no vegetation is left.

RESTORATION LEVELS

The level of restoration required for a given project is based on the land management designation of the Project Area. The definitions of the four restoration levels (R1, R2, R3, and R4) and associated restoration success criteria are included below and are excerpted from the BLM's *Restoration Plan Template* (BLM 2019a). The Project Area appears to fall within the R4 Level, Multiple Use Areas (BLM and Native Resources 2001: Map 18); however, because of rare plant habitat and high density tortoise habitat, it will be designated as R3, Medium Priority Recovery Areas. Some of the restoration requirements may vary based on the location within the site and the applicable requirements will be determined in consultation with the BLM during the final site rehabilitation planning. In addition, special or unique habitats can occur in any of the restoration level areas and may require more effort to restore.

R1. Red Rock Canyon National Conservation Area (NCA) and Sloan Canyon NCA. Management of this land is oriented toward actions which promote its scenic, cultural, and biodiversity values. This area will require state-of-the-art restoration techniques and methodologies available to achieve a "no residual impact" level for projects. In this area, replanting would involve 100 percent cover and diversity of shrubs and perennial grasses. Extensive plant salvage will be required, and use of non-local seed sources will not be allowed.

R2. High Priority Recovery Areas. Management on these lands is oriented toward actions which reduce human impacts to the landscape for the purposes of recovery of federally-listed or special status species (e.g. Mojave desert tortoise, Las Vegas bearpoppy), preservation of scenic values, or protection of cultural property. Examples include visual resources classes 1 and 2, desert tortoise critical habitat, springs, riparian areas, xeroriparian areas, National Monuments, and Areas of Critical Environmental Concern. In the R-2 category the out-planting would be more limited and located in areas that could be accessed for plant maintenance.

R3. Medium Priority Recovery Areas. Management on these lands limits, either spatially or temporally, the range of uses on lands to protect sensitive resources. Examples include herd management areas for wild horses and burros, and crucial habitat for desert bighorn and mule deer.

R4. Multiple Use Areas. Multiple use areas are lands on which human activities are not precluded. Nonetheless, they support significant areas of undisturbed natural vegetation and provide important connectivity with more intensively managed areas. Additionally, at least six of BLM's most sensitive plant species occur in these multiple use areas, and their habitat will require a higher level of restoration.

Restoration will be considered successful if identified measures of native perennial vegetation is equal to or exceeds a designated percentage of the values for these parameters in undisturbed reference areas. The standards required for the four land management designations are: 100% for R1, 80% for R2, 70% for R3, and 60% for R4.

The restoration level (R3) associated with each action type for permanent and temporary impacts are listed in Table 5 and Table 6, respectively.

IV. Baseline Data

Baseline surveys for plants and soils were conducted in the Project Study Area in spring 2018; these surveys included vegetation sampling and mapping, a rare plant inventory, and cacti/yucca, biocrust/desert pavement, and invasive weeds sampling (Appendix A; PBC 2019b). Cacti and yucca, biocrust and desert pavement, and non-native and noxious weeds were all sampled by surveying randomly selected belt transects. The results of these surveys are documented in the *Botanical Resources Report* (PBC 2019b), which is included as Appendix A, and are summarized below. Note that the summary here covers the entire 10,671 acres surveyed. Only approximately 7,100 acres of that area will actually be developed.

EXISTING CONDITIONS

Vegetation

Four natural vegetation communities occur in the Project Area: *Larrea tridentata - Ambrosia dumosa* (Creosote-White Burrobush) Shrubland Alliance, *Atriplex confertifolia* (Shadscale) Shrubland Alliance, *Pleuraphis rigida* [*Hilaria rigida*] (Big Galleta) Herbaceous Alliance, and *Acacia greggii* [*Senegalia greggii*] (Catclaw Acacia) Shrubland Alliance (Peterson 2008; Sawyer et al. 2009; Phoenix Biological Consulting [PBC] 2018). In addition, badlands were mapped along the gen-ties lines. Vegetation communities and badlands are quantified in Table 7 and mapped in Exhibit 4.

***Larrea tridentata - Ambrosia dumosa* (Creosote-White Burrobush) Shrubland Alliance**

The Creosote-White Burrobush Shrubland Alliance is the most common vegetation community in the Project Area, comprising more than 90 percent of the site. This community occupies a variety of soil types in the Project Area including sandy, well-drained soils, caliche, biocrust, desert pavement, and limestone bedrock. Though relative abundance of both creosote and white burrobush varies throughout the site, both species are ubiquitous and can be found everywhere the community exists along with a number of additional shrubs that commonly co-occur including white ratany (*Krameria bicolor*), rayless goldenhead (*Acamptopappus sphaerocephalus*), spiny desert olive (*Menodora spinescens*), and Anderson thornbush (*Lycium andersonii*). Beavertail (*Opuntia basilaris*) and silver cholla (*Cylindropuntia echinocarpa*) are also common in this alliance. The herbaceous layer consists of native and non-native perennial and annual forbs and grasses.

***Atriplex confertifolia* (Shadscale) Shrubland Alliance**

The Shadscale Shrubland Alliance is found in the northwestern portion of the Project Area in development area A and along the gen-ties (Exhibit 4). This community occurs on alkaline soils that are typically fine textured or on coarse calcareous soils where the alliance occurs near badlands. Shadscale, desert holly (*Atriplex hymenelytra*), white burrobush, and alkali seepweed (*Suaeda nigra*) generally co-dominate the alliance. Forbs have low cover within this alliance.

Table 5. Project permanent impact totals by restoration level.

Restoration Level	Action Types (acres)							
	Solar Arrays	*O&M Building*	*Substations*	*Access Roads*	*Water Ponds*	*Equipment Areas*	*Gen-tie Lines and Associated Access Roads*	**Project Total**
R-1	--	--	--	--	--	--	--	**0**
R-2	--	--	--	--	--	--	--	**0**
R-3	6,839.7	2.1	7.1	170.5	4.0	14.7	24.4	**7,062.4**
R-4	--	--	--	--	--	--	--	--
Totals	**6,839.7**	**2.1**	**7.1**	**170.5**	**4.0**	**14.7**	**24.4**	**7,062.4**

Table 6. Project temporary impact totals by restoration level.

Restoration Level	Action Types (acres)		
	Laydown Areas	*Collection Line Pulling Sites*	**Project Total**
R-1	--	--	**0**
R-2	--	--	**0**
R-3	36.1	14.8	**50.9**
R-4	--	--	**0**
Totals	**36.1**	**14.8**	**50.9**

***Pleuraphis rigida* [*Hilaria rigida*] (Big Galleta) Herbaceous Alliance**

The Big Galleta Herbaceous Alliance is found along the small washlets, rivulets, and depressions in the northwest portion of the Project Area in development area A and along the gen-ties (Exhibit 4). The alliance in the Project Area is characterized by small willow swales with fine cracked soils and dense grass. The alliance is dominated by big galleta. Shrubs are common, often dense, and include white burrobush, broom snakeweed, Cooper's box thorn (*Lycium cooperi*), Anderson thornbush, creosote, little leaved rhatany (*Krameria erecta*), and shadscale. Herbs are also common in the rivulets and include native and non-native perennial and annual forbs and grasses.

***Acacia greggii* [*Senegalia greggii*] (Catclaw Acacia) Shrubland Alliance**

The Catclaw Acacia Shrubland Alliance is found along the larger washes in development areas B and D, and along the gen-ties (Exhibit 4). The alliance is found in coarse, sandy soils. The shrub canopy is co-dominated by white burrobush, catclaw acacia, and creosote. Other common shrubs and sub-shrubs include Nevada ephedra (*Ephedra nevadensis*), Torrey's jointfir (*Ephedra torreyana*), little leaved rhatany, desert almond (*Prunus fasciculata*), white rhatany, and Fremont's indigobush (*Psorothamnus arborescens*); desert willows (*Chilopsis linearis*) are occasional in the tree layer. The herbaceous layer includes native and non-native grasses and forbs.

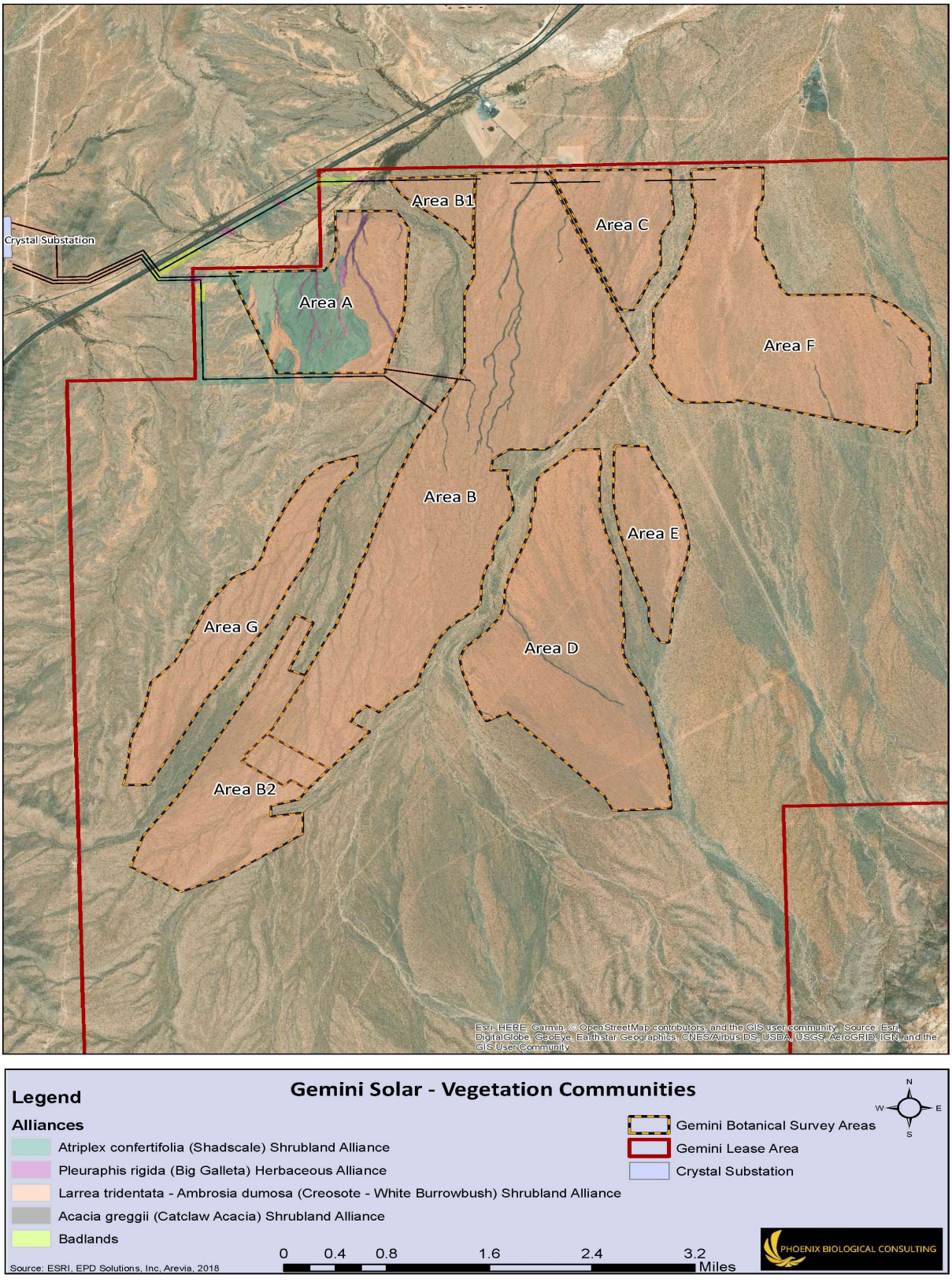
Badlands

Badlands are located in the northwest corner of the Project Area along the gen-ties (Exhibit 4). This area is primarily a series of small flat-topped hills with deeply incised drainages between them. Soils are a mixture of clay and caliche that appear red in some areas and are bleached white in others. Vegetation is extremely sparse throughout most of this area and in some areas, it is completely barren of plant life. Shrubs occur in very low densities and include white burrobush, desert holly, and alkali seepweed.

Table 7. Area and proportion of each vegetation community in each potential development area (PBC 2019b).

Vegetation Community	Approximate Acreage by Development Area									Total Approx. Acreage in the Potential Development Areas	Proportion of the Potential Development Areas
	A	B	C	D	E	F	G	B1	B2		
Creosote-White Burrobush Shrubland Alliance	403	3,398	485	1,789	438	1,823	767	132	867	10,102	**94.7%**
Shadscale Shrubland Alliance	414	--	--	--	--	--	--	--	--	414	**3.9%**
Big Galleta Herbaceous Alliance	69	--	--	--	--	--	--	--	--	69	**0.6%**
Catclaw Acacia Shrubland Alliance	--	61	--	15	--	10	--	--	--	86	**0.8%**
Badlands	--	--	--	--	--	--	--	--	--	--	**--**
Total	**886**	**3,459**	**485**	**1,804**	**438**	**1,833**	**767**	**132**	**867**	**10,671**	**100%**

Exhibit 4. Vegetation Communities in the Gemini Solar Development Areas



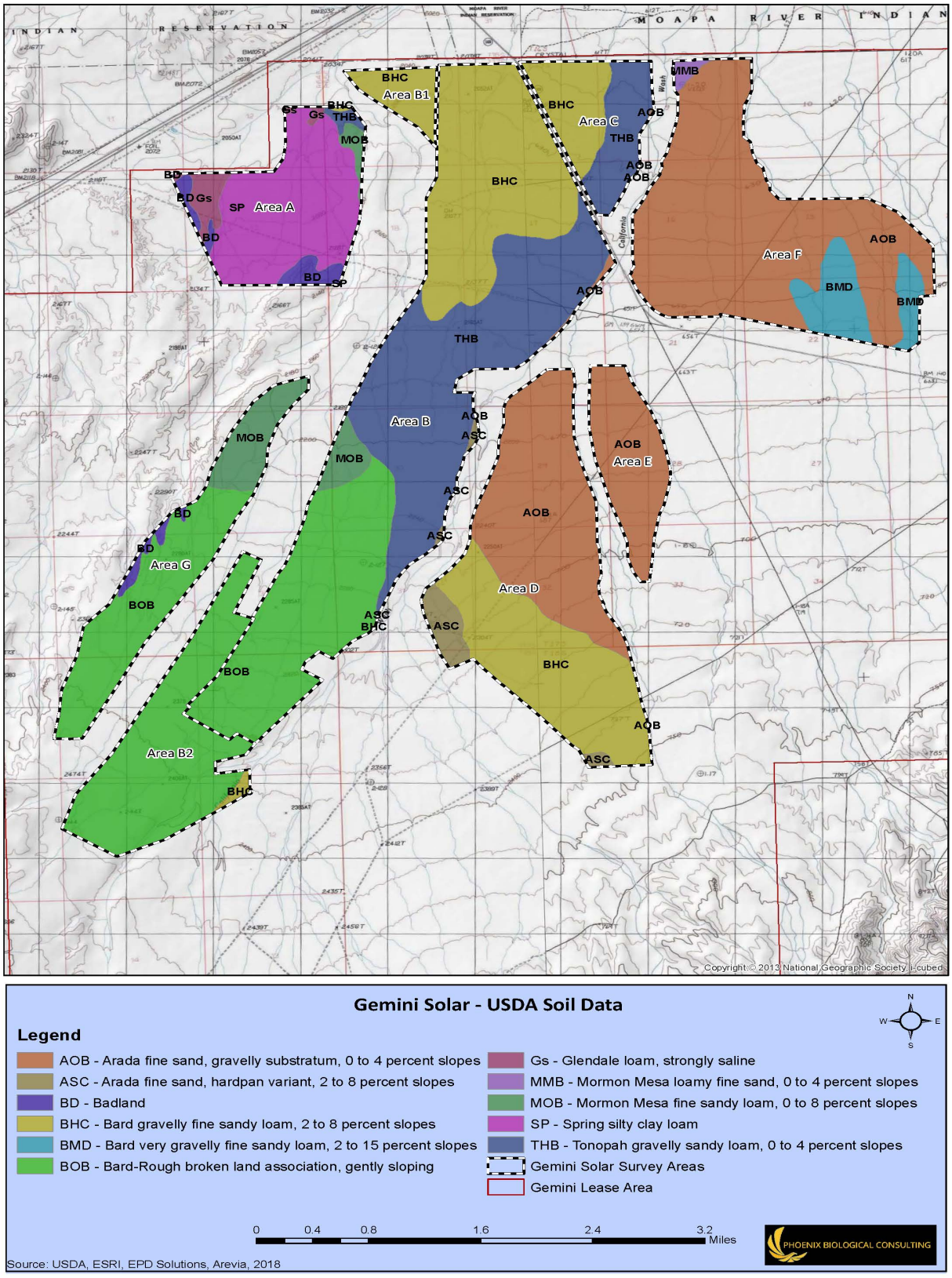
Soils

Soils identified in the Project Area are summarized in Table 8 and shown in Exhibit 5 (NRCS 2018). No unique soils types, such as gypsum, were identified during the survey. Areas of caliche were observed, especially around the badlands along the gen-ties and in development area A and along California Wash. Cracked or puffy alkaline silty clay soils were also unique to development area A in the Shadscale Shrubland Alliance. Aeolian sand deposits were also noted along the perimeters of the washes.

Table 8. Soil units identified in the potential development areas (NRCS 2018).

Map Unit Symbol	Map Unit Name	Description	Location Area(s)	Acreage within Development Areas & Gen-tie
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	D, E, F, Gen-tie	2,900
ASC	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	122
BD	Badland	On fan remnants	A & Gen-tie	147
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	A, B, B1, B2, C, D, Gen-tie	2,191
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 nonsaline to very slightly saline.	F	260
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	B, B2 & Gen-tie	2,407
Gs	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 & Gen-tie	84
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, non-saline to very slightly saline.	F & Gen-tie	22
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	A, B, Gen-tie	288
RTF	Rock land St. Thomas	15-50% slopes, cobbly loam (0-2 inches), extremely cobbly loam (2-12 inches), bedrock (12-22 inches). Well drained. Colluvium derived from limestone and dolomite. Nonsaline to slightly saline.	Gen-tie	7
SP	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, Gen-tie	676
THB	Tonopah gravelly sandy loam	0-4% slopes, gravelly sandy loam (0-6 inches), extremely gravelly sand (6-60 inches), excessively drained, and nonsaline to slightly saline	A, B, C, Gen-tie	1,607

Exhibit 5. Soils in the Gemini Solar Project Area



Gemini Solar - USDA Soil Data

Legend

- 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
- 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
- SP - Spring silty clay loam
- THB - Tonopah gravelly sandy loam, 0 to 4 percent slopes
- Gemini Solar Survey Areas
- Gemini Lease Area

N W E S

0 0.4 0.8 1.6 2.4 3.2 Miles

PHOENIX BIOLOGICAL CONSULTING

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

BASELINE SURVEY RESULTS

Vegetation

Vegetation sampling was conducted within each vegetation community to estimate the cover, density, and species richness for each vegetation community. Vegetation sampling was conducted in 16 plots, each measuring 100 meters by 100 meters or one hectare. Six plots were randomly placed in the Creosote-White Burrobush Shrubland Alliance, four in the Shadscale Shrubland Alliance, two in the Big Galleta Herbaceous Alliance, and four in the Catclaw Acacia Shrubland Alliance. Vegetation cover, density, and species richness was assessed for each plot using the Line Point Intercept method following the BLM's Assessment, Inventory, and Monitoring (AIM) program (USDA-ARS 2018). Data collected was entered in Microsoft Access using the Database for Inventory, Monitoring, and Assessment (DIMA). DIMA is a customizable software program for data collection, management, and interpretation (USDA-ARS 2018). The results of the vegetation sampling are documented in the *Botanical Resources Report* (PBC 2019b) and will be used to inform the replanting and reseeding plans during site rehabilitation.

Percent cover, density, average species richness, total number of species recorded during AIM sampling, and total number of taxa recorded during AIM sampling and the botanical inventory survey are summarized in Table 9 (PBC 2019b; Appendix A).

Table 9. Percent cover, density, average species richness, and total number of species for each vegetation alliance recorded during AIM sampling (PBC 2019b).

Alliance	Number of Plots Sampled[1]	Estimated Percent Cover[2]	Density (plants/ hectare)	Average Species Richness (number of species/ hectare)	Total Number of Species from all Plots Combined	Total Number of Taxa Recorded[3]
Creosote-White Burrobush Shrubland	6	35.9%	6,385	19.5 [2.1] [4]	42	171
Shadscale Shrubland	4	16.6%	2,840	21.5 [5.1]	35	53
Big Galleta Herbaceous	2	90.3%	6,716	31 [N/A]	47	56
Catclaw Acacia Shrubland	4	46.2%	5,914	29.5 [3.1]	43	61

[1] Each plot measured 100 meters by 100 meters or 1 hectare in size

[2] Estimated average annual foliar cover %

[3] All taxa recorded in each alliance during both the botanical inventory survey and the AIM sampling

[4] Standard deviation of sample

Rare Plants

The spring 2018 rare plant inventory survey covered the entire Study Area, was floristic in nature, and resulted in the identification of three taxa of rare plants: threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*), rosy twotone beardtongue (*Penstemon bicolor* ssp. *roseus*), and Nye milkvetch (*Astragalus nyensis*) (PBC 2019b). The results of the rare plant inventory are documented in the *Botanical Resources Report* (PBC 2019b; Appendix A) and are summarized below for each taxon and mapped on Exhibit 6.

Threecorner Milkvetch (*Astragalus geyeri* var. *triquetrus*)

Threecorner milkvetch is a rare fast-maturing annual in the Pea Family (Fabaceae) listed by the State of Nevada as Critically Endangered/Fully Protected, by the BLM as Sensitive, by the Nevada Natural Heritage Program (NNHP) as At-Risk, and by the Nevada Native Plant Society (NNPS) as Threatened. It occurs in dynamic sandy soils such as dunes and open, deep sandy soils typically stabilized by vegetation and/or a gravel veneer with creosote (NNHP 2001; Barneby 1964). It is known only from Clark and Lincoln counties in southern Nevada and in the far northwest corner of Mohave County, Arizona. This taxon is threatened by invasive weeds, urban development and sprawl, off-highway vehicle (OHV) use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, some agricultural practices, and the inundation and fluctuating shoreline of Lake Mead (NPS 2010). Because of its habitat preferences, this taxon occurs in areas that may be invaded by sand-loving weed species such as Saharan mustard (*Brassica tournefortii*), Mediterranean grass (*Schismus* spp.), salt cedar (*Tamarix ramosissima*), and Russian thistle (*Salsola* spp.) (NPS 2010).

During the inventory survey, 1,429 individuals within 616 occurrences were identified in the Study Area. Threecorner milkvetch was found in development areas C, D, E, F, and in the buffer zone (Exhibit 6). The majority of occurrences and highest population numbers were found in development area F with 504 occurrences and a population of 1,102 individuals. All threecorner milkvetch in the Study Area were found in Creosote-White Burrobush Shrubland Alliance in sandy or sandy loam soils (PBC 2019b; Appendix A).

In the RMPA/DEIS (BLM 2019b), the BLM investigated two habitat models that have been developed for threecorner milkvetch: one developed in 2018 that uses known point locations along with a variety of environmental factors and another developed in 2011 that primarily uses the obligate soil types of the taxon (Nussear 2018; Hamilton and Kokos 2011). The modeled threecorner milkvetch habitat in the Project Area predicted by the 2018 model and the 2011 model are shown in Exhibit 7 and Exhibit 8, respectively (figures from BLM 2019b). The following analysis is excerpted from the RMPA/DEIS (BLM 2019b: Section 3.6, page: 3-46).

> *Field data from the Project surveys generally supports both model predictions of habitat for threecorner milkvetch, but plants were not found in all locations predicted by the 2018 model. According to this model, approximately 2,320 acres (939 hectares) of suitable habitat for threecorner milkvetch is in the Project area. According to the 2011 model, approximately 681 acres (275 hectares) of occupied habitat is within the Project area. The 2018 model could be a better predictor of potential habitat for threecorner milkvetch in the future, as water movement and aeolian processes that move sand can create new habitat areas. Because the 2011 model seems to be a better predictor of current threecorner milkvetch occupancy, it was used to analyze Project impacts to occupied threecorner milkvetch habitat.*

Rosy Twotone Beardtongue (*Penstemon bicolor* ssp. *roseus*)

Rosy twotone beardtongue is a short-lived perennial herb in the Plantain Family (Plantaginaceae) listed by the BLM as Sensitive, by NNHP as At-Risk, and included on the NNPS's Watch List. It grows in rocky calcareous, granitic, or volcanic soils in areas that receive enhanced runoff, such as washes, along roadsides, in rocky areas such as scree at the base of rock outcrops, rocky slopes, and rock crevices in creosote-burrobush, blackbrush (*Coleogyne ramosissima*), and mixed-shrub desert vegetation communities (NNHP 2001). It is known from Clark and Nye counties in southern Nevada and also from Arizona and California. Threats include urban development and sprawl, hybridization with Palmer's penstemon (*Penstemon palmeri*) (accelerated by introduction Palmer's penstemon from roads and utility

corridors and in seed mixes used in planting in reclamation areas), road and utility corridor construction and maintenance, and energy development.

During the inventory survey, two occurrences were identified in the buffer zone, each with a population of one. In addition, two other suspected occurrences were found, one in development area E and the other in the buffer (Exhibit 6). Both of these suspected occurrences are expected to be rosy twotone beardtongue based on proximity to other rosy twotone beardtongue populations, but neither was identifiable to species. The two confirmed occurrences of rosy twotone beardtongue were located in sand in the Creosote-White Burrobush Shrubland Alliance. The unconfirmed *Penstemon* occurrence in development area E was located in sandy loam in Creosote-White Burrobush Shrubland Alliance; the other unconfirmed *Penstemon* occurrence, in the buffer, was in sandy loam in Catclaw Acacia Shrubland Alliance (PBC 2019b; Appendix A).

Nye Milkvetch (*Astragalus nyensis*)

Nye milkvetch is a rare ephemeral annual in the Pea Family (Fabaceae) listed by NNHP as At-Risk and included on the NNPS's Watch List. It grows in the foothills of desert mountains, on calcareous outwash fans, and gravelly flats, sometimes in sandy soil, in Mojave Desert scrub vegetation communities (NNHP 2001). It is known only from Clark, Lincoln, and Nye counties in southern Nevada and far southeastern Inyo County, California. Threats to Nye milkvetch are likely similar to those to threecorner milkvetch including invasive weeds, urban development and sprawl, OHV use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, and some agricultural practices.

During the inventory survey, 2,117 individuals within 653 occurrences of Nye milkvetch were identified in the Study Area. Nye milkvetch was found in development areas A, B, C, D, E, F, G, B2, and in the buffer zone. The highest number of occurrences and highest population numbers were found in development areas A and F with 948 individuals in 179 occurrences in development area A and 677 individuals in 341 occurrences development area F (Exhibit 6). Of the 653 occurrences recorded in the Study Area, 610 (93 percent) were located in Creosote-White Burrobush Shrubland Alliance, 32 (five percent) were located in the Big Galleta Herbaceous Alliance, and 11 (two percent) were located in the Shadscale Shrubland Alliance (PBC 2019b; Appendix A).

Exhibit 6. Rare Plant Populations Identified in the Study Area (PBC 2019b)

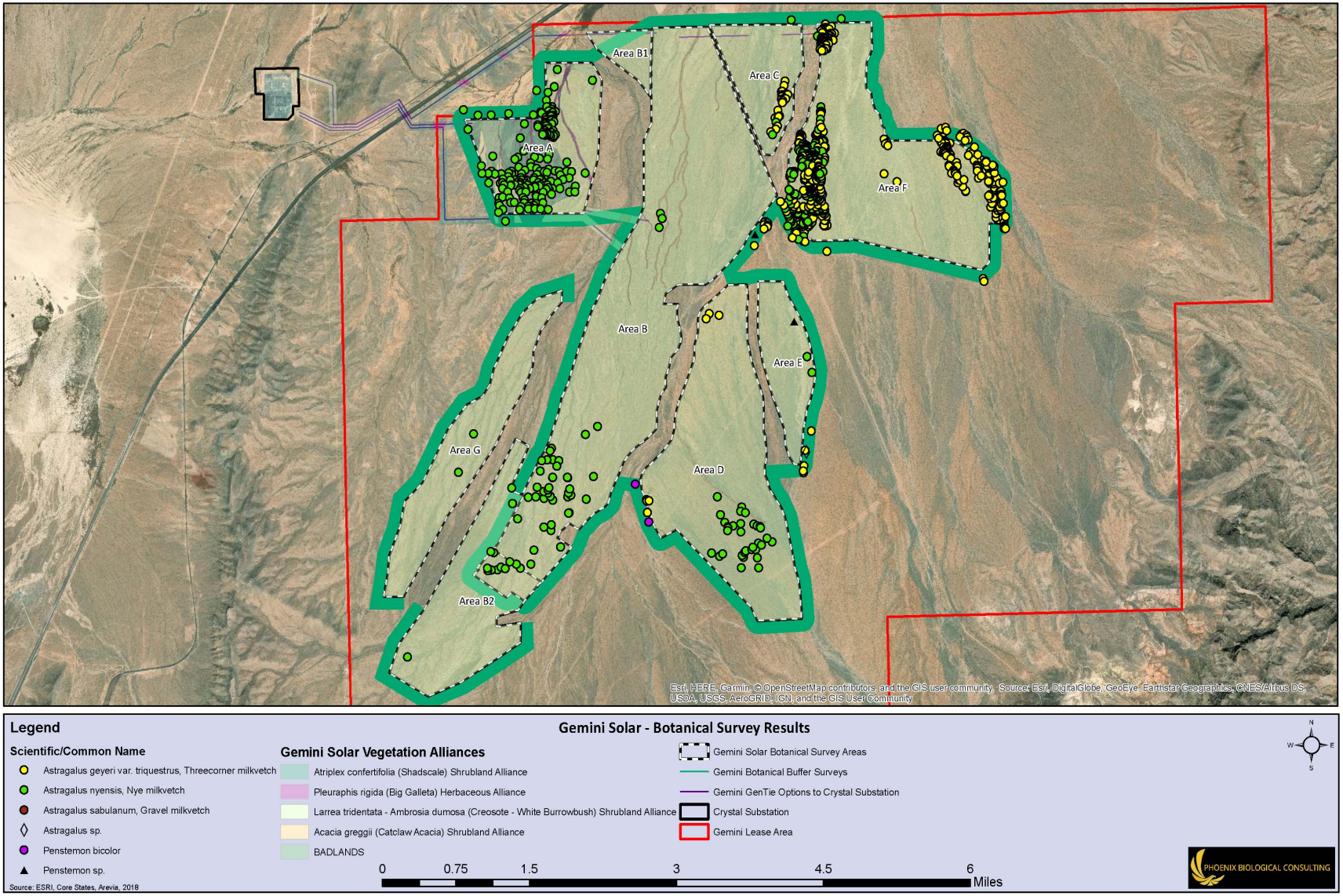


Exhibit 7. Nussear (2018) Modeled Habitat for Threecorner Milkvetch (BLM 2019b)

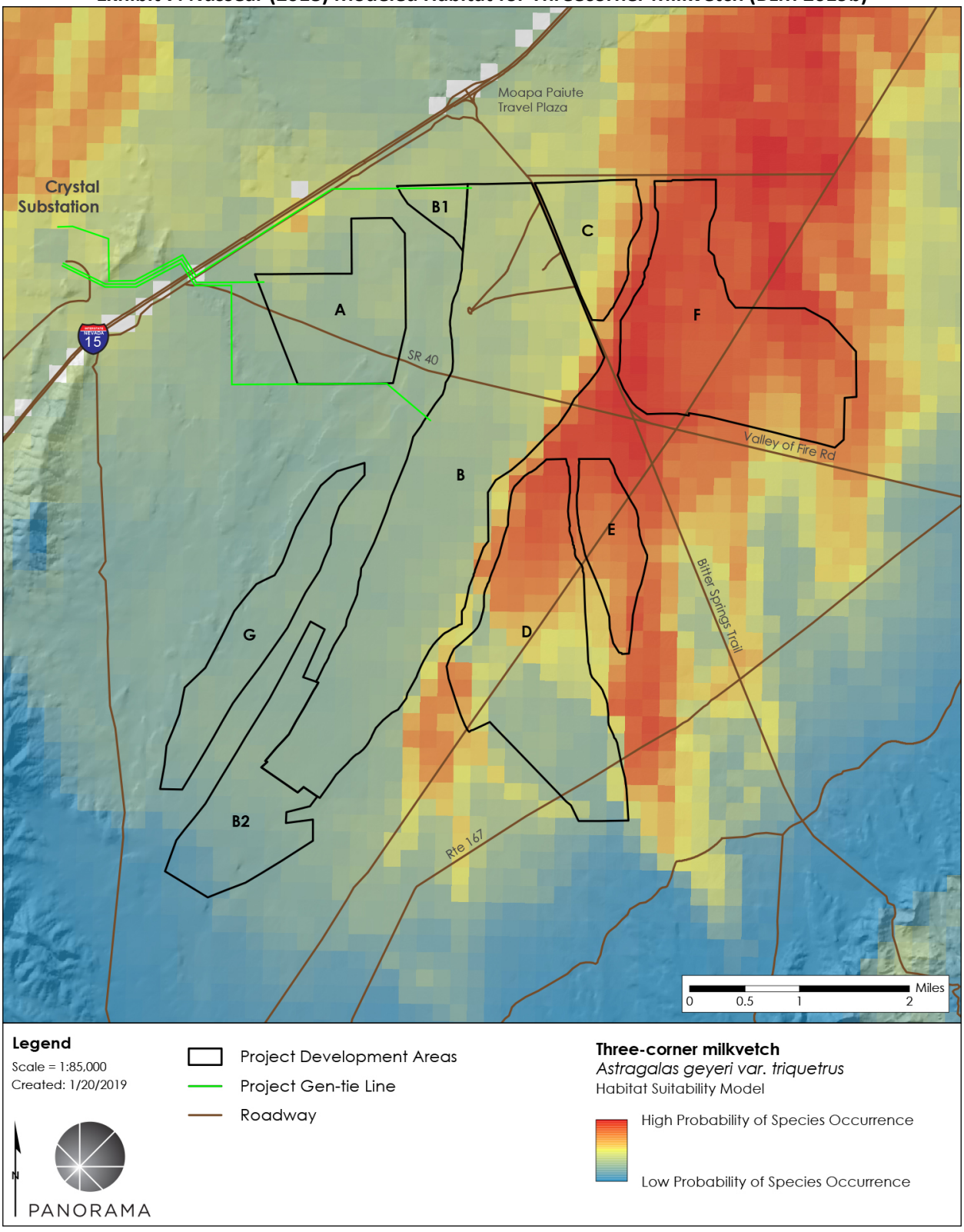
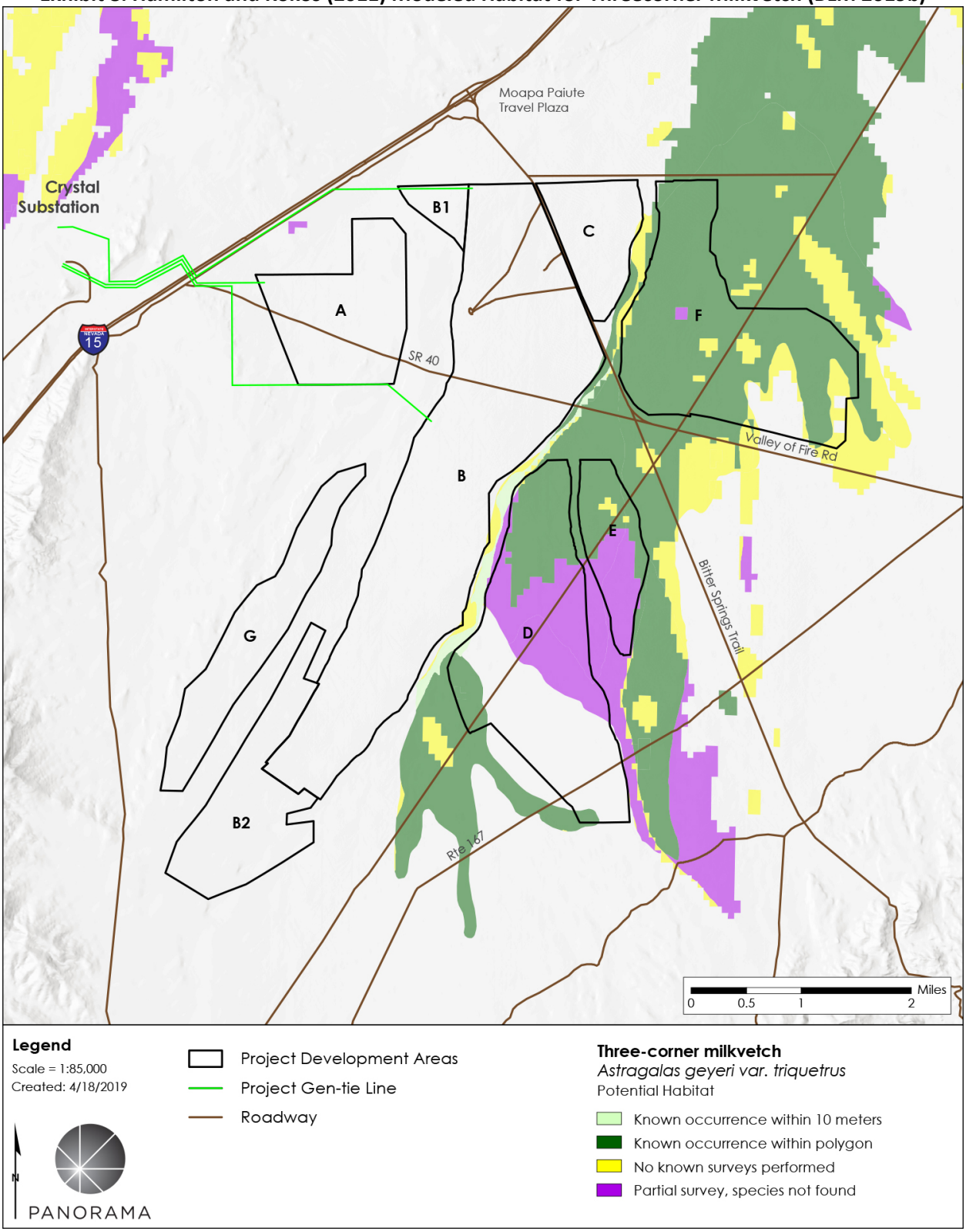


Exhibit 8. Hamilton and Kokos (2011) Modeled Habitat for Threecorner Milkvetch (BLM 2019b)



Cacti and Yucca

Cacti and yucca were sampled during the spring of 2018 by surveying a total of 213 belt transects throughout the Study Area. The results of the belt transect sampling are documented in the *Botanical Resources Report* (PBC 2019b; Appendix A) and summarized below; these results may be used to inform any cacti and yucca salvage activities and replanting during site rehabilitation.

Eight species of cacti occur in the Study Area: silver cholla (*Cylindropuntia echinocarpa*), pencil cholla (*Cylindropuntia ramosissima*), cottontop cactus (*Echinocactus polycephalus* var. *polycephalus*), strawberry hedgehog (*Echinocereus engelmannii*), desert barrel cactus (*Ferocactus cylindraceus*), common fishhook cactus (*Mammillaria tetrancistra*), beavertail (*Opuntia basilaris* var. *basilaris*), and Johnson's fishhook cactus (*Sclerocactus johnsonii*). One species of yucca, Mojave yucca (*Yucca schidigera*) occurs in the Study Area. One species of cactus, common fishhook cactus, was detected during the floristic survey but not during the belt transect sampling.

The results of the belt transect sampling for cacti and yucca are summarized in the tables below. Development area F had the greatest number of cacti, while development area E had the highest density of cacti (Table 10). Table 11 shows the number of each species detected during sampling in each vegetation alliance, as well as the density of cactus in each alliance based on the sampling results. Table 12 gives the extrapolated total number of each cactus species in each alliance in the entire Study Area based on the sampling results. Exhibits depicting the results of the cacti and yucca sampling are included in Appendix A.

Table 10. Cacti and yucca identified during belt transect sampling in the Study Area (PBC 2019b).

Area	Species							Total Cacti/Yucca Individuals	Acreage Sampled	Density (plants/ acre)
	silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beavertail	Mojave yucca			
A	6	16	6	2	0	32	0	62	54.0	1.2
B	57	48	21	6	0	371	0	503	231.5	2.2
C	67	3	5	2	0	135	0	212	40.8	5.2
D	680	0	39	44	1	3,770	0	4,534	100.6	45.1
E	312	2	1	0	0	1,245	2	1,562	24.2	65.6
F	2,703	18	7	9	0	3,356	0	6,093	132.1	46.1
G	21	15	12	7	0	92	0	147	41.9	3.5
B1	1	0	0	1	0	5	0	7	15.7	0.5
B2	10	26	14	4	0	61	0	115	38.1	3.0
Total	**3,857**	**128**	**105**	**75**	**1**	**9,067**	**2**	**13,235**	**678.8**	**19.5**

Table 11. Cacti and yucca identified during belt transect sampling in the Study Area per vegetation alliance (PBC 2019b).

Alliance	Species							Total Cacti/Yucca Individuals	Acreage Sampled	Density (plants/ acre)
	silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beaver-tail	Mojave yucca			
Creosote-White Burrobush Shrubland	3,851	120	101	72	1	9,043	2	13,190	636.3	20.7
Shadscale Shrubland	4	7	3	2	0	19	0	35	31.0	1.1
Catclaw Acacia Shrubland	1	1	0	1	0	3	0	6	5.9	1.0
Big Galleta Herbaceous	1	0	1	0	0	2	0	4	5.6	0.7
Total	**3,857**	**128**	**105**	**75**	**1**	**9,076**	**2**	**13,235**	**678.8**	**19.5**

Table 12. Extrapolated total numbers of cacti and yucca species in the Study Area per vegetation alliance based on the results of the belt transect sampling (PBC 2019b).

Alliance	Total Area of each Alliance in the Study Area (acres)	Extrapolated Total Number of Cacti/Yucca in the Study Area[1]						
		silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beavertail	Mojave yucca
Creosote-White Burrobush Shrubland	10,135	61,339	1,911	1,609	1,147	16	144,037	32
Shadscale Shrubland	540	70	123	52	35	0	331	0
Catclaw Acacia Shrubland	85	14	14	0	14	0	43	0
Big Galleta Herbaceous	101	18	0	18	0	0	36	0
Total	**10,861[2]**	**61,441**	**2,048**	**1,679**	**1,196**	**16**	**144,447**	**32**

[1] Extrapolated total number of cacti/yucca = (acreage of each alliance in the Study Area/acreage of each alliance sampled)*number of each species found during sampling.

[2] Does not include the 49 acres of badlands in the Study Area because no sampling was conducted there.

Non-native and Noxious Weeds

The results of the baseline invasive weed sampling, floristic survey, and invasive weed vector mapping completed for the Project in spring 2018 are summarized below and in the *Botanical Resources Report* prepared for the Project (PBC 2019b; Appendix A). Nineteen species of non-native and noxious weeds are known to occur in or adjacent to the Study Area or along adjacent vectors (i.e., road, transmission line, or highway) (Table 13; PBC 2019b).

A total of 678.8 acres within 213 belt transects were sampled for invasive weeds throughout the Study Area in spring 2018 (PBC 2019b). During the belt transect sampling, three species of invasive weeds were recorded in large numbers: Saharan mustard (*Brassica tournefortii*), halogeton (*Halogeton glomeratus*), and African mustard (*Strigosella africana* [=*Malcolmia africana*]); exhibits depicting the results of the baseline sampling for these three species are included in Appendix A. Of these, Saharan mustard is listed by the NDA on the Nevada Noxious Weed List as a Category B Weed (NDA 2018) and halogeton and African mustard are listed as invasive by the BLM SNDO. The estimated populations and densities of these weed species in the Study Area are listed below in Table 14. In addition, one individual Russian thistle (*Salsola tragus*) was found during the belt transect sampling. Four invasive weed taxa, red brome (*Bromus madritensis* ssp. *rubens*), cheatgrass (*Bromus tectorum*), Mediterranean grass (*Schismus* sp.), and red stem stork's bill (*Erodium cicutarium*) occur throughout the Study Area but were excluded from the transect sampling because they are so widespread.

Several other non-native and noxious weed species that were not found during belt transect sampling were recorded in the Study Area during the botanical inventory survey, including: Russian knapweed (*Acroptilon repens*), Chilean chess (*Bromus berteroanus*), ripgut brome (*Bromus diandrus*), Malta starthistle (*Centaurea melitensis*), Bermuda grass (*Cynodon dactylon*), and salt cedar (*Tamarix ramosissima*). Of these, Malta starthistle is a Category A Weed, Russian knapweed is a Category B Weed, and salt cedar is a Category C Weed (NDA 2018); the rest are on the BLM's invasive list.

Table 13. Non-native and noxious weeds found in or near to the Study Area (PBC 2019b).

Common Name	Scientific Name	Nevada Noxious Weed List Category (NDA 2018)	BLM Invasive List
Russian knapweed	*Acroptilon repens*	B	--
Saharan mustard	*Brassica tournefortii*	B	--
Chilean chess	*Bromus berteroanus* (=*trinii*)	--	X
ripgut brome	*Bromus diandrus*	--	X
red brome	*Bromus madritensis* spp. *rubens*	--	X
cheatgrass	*Bromus tectorum*	--	X
Malta starthistle	*Centaurea melitensis*	A	--
Bermuda grass	*Cynodon dactylon*	--	X
red stem stork's bill	*Erodium cicutarium*	--	X
halogeton	*Halogeton glomeratus*	--	X
crimson fountaingrass	*Pennisetum setaceum*	A	--
annual bluegrass	*Poa annua*	--	X
rabbitfoot grass	*Polypogon monspeliensis*	--	X
Russian thistle	*Salsola* spp.	--	X
Mediterranean grass	*Schismus* sp.	--	X
London rocket	*Sisymbrium irio*	--	X
Indian hedgemustard	*Sisymbrium orientale*	--	X
African mustard	*Strigosella* (=*Malcolmia*) *africana*	--	X
salt cedar	*Tamarix ramosissima*	C	--

Table 14. Non-native and noxious weeds identified during belt transect sampling in the Study Area (PBC 2019b).

Area	Estimated No. of Individuals			Total Weeds	Acreage Sampled	Estimated Density (plants/acre)			Estimated Density (total weeds/ acre)
	BRTO	HAGL	STAF			BRTO	HAGL	STAF	
A	0	7,357	49,738	57,095	54.0	0	136.2	921.1	**1,057.3**
B	6,342	2	36,949	43,293	231.5	27.4	0.008	159.6	**187.0**
C	270	0	560	830	40.8	6.62	0	13.7	**20.3**
D	10,287	0	5	1,0292	100.6	102.3	0	0.05	**102.3**
E	33,147	0	0	33,147	24.2	1,369.7	0	0	**1,369.7**
F	4,489	0	0	4,489	132.1	34.0	0	0	**34.0**
G	0	0	5,375	5,375	41.9	0	0	128.3	**128.3**
B1	0	0	0	0	15.7	0	0	0	**0**
B2	67	0	31,402	31,469	38.1	1.8	0	824.2	**826.0**
Total	**54,602**	**7,359**	**124,029**	**185,990**	**678.8**	**80.4**	**10.8**	**182.7**	**274.0**

[1] Weed species abbreviations are as follows: BRTO=*Brassica tournefortii* (Saharan mustard); HAGL=*Halogeton glomeratus* (halogeton); and, STAF: *Strigosella africana* (African mustard).

The BLM provided weed inventory data provided by the SNDO (see Appendix A for map). Weed vector surveys were conducted in spring 2018 to update the BLM's data and document areas where weeds have spread along the prominent weed vectors in and around the Study Area (PBC 2019b). All of the unpaved and paved roads in and around the Study Area were inspected in order to document new areas of weed invasion and to update the existing BLM data. New or expanded populations of several invasive weed species were found during the vector surveys including Saharan mustard, red brome, cheatgrass, Malta starthistle, halogeton, London rocket (*Sisymbrium irio*), African mustard, and salt cedar (exhibits depicting the results of the vector inventory are included in Appendix A). Several non-native and noxious weed species that the BLM had documented in their inventory were not relocated during PBC's 2018 surveys, including crimson fountaingrass (*Pennisetum setaceum*), annual bluegrass (*Poa annua*), rabbitfoot grass (*Polypogon monspeliensis*), and Indian hedgemustard (*Sisymbrium orientale*). Green fountain grass is a Category A Weed (NDA 2018) and the rest are on the BLM's invasive list.

Biocrust and Desert Pavement

A total of 213 belt transects were sampled for biocrust and desert pavement throughout the Study Area. The results of the belt transect sampling are documented in the *Botanical Resources Report* (PBC 2019b; Appendix A) and summarized below; these results will be used to inform the salvage and replacement activities during site rehabilitation. Biocrust, or biological soil crust, is a surface crust comprised of living organisms including bacteria, algae, fungi, lichen, and moss. Biocrusts play an important role in soil surface stabilization, nutrient cycling, and the soil-water relationship. Desert pavement is a feature of the ground surface in deserts composed of a closely fitted, single layer of rock fragments over fine sand and/or silt; this layer traps dust particles over time which settle beneath the rock layer and form a vesicular horizon below the pavement. Desert pavement and the vesicular horizon beneath control important soil processes, affect water infiltration rates and redistribute water, increase salinization, and accumulate nitrates. Disturbance to or removal of biocrust and desert pavement interrupts or halts the important

processes these substrates provide in soil and slope stabilization, nutrient cycling, and mediating water infiltration and distribution and may result in deleterious effects to the environment including loss of desert soils from wind erosion and water erosion, increased air pollution via dust from wind erosion, increased populations and/or spread of invasive weeds, decreased nutrient/water availability to native plants, and negative effects to native seed germination. Table 15 summarizes the estimated amount of biocrust and desert pavement observed during the belt transect sampling. Development areas B and F had the highest percent cover of biocrust, and development areas B and D had the highest percent cover of desert pavement. Exhibits depicting the results of the biocrust and desert pavement sampling are included in Appendix A.

Table 15. Estimated area and percent cover of biocrust and desert pavement identified during belt transect sampling in the Study Area (PBC 2019b).

Area	Estimated Area (square meters)		Area Sampled (square meters)	Percent Cover[1]	
	Biocrust	Desert Pavement		Biocrust	Desert Pavement
A	700	5,763	218,700	0.3	2.6
B	72,642	81,888	936,885	7.8	8.7
C	6,508	7,800	165,015	3.9	4.7
D	24,537	39,779	406,140	6.0	9.8
E	3,243	0	98,100	3.3	0.0
F	46,228	860	534,645	8.7	0.2
G	1,608	4,406	169,725	1.0	2.6
B1	336	3,835	63,615	0.5	6.0
B2	2,803	1,493	154,200	1.8	1.0
Total	**158,605**	**145,824**	**2,747,025**	**5.8**	**5.3**

[1] Percent cover = the percent of the area sampled covered in biocrust or desert pavement.

V. Survey and Planning Activities

Site restoration actions fall into three categories: pre-construction actions, during construction actions, and post-construction actions. Prior to the start of pre-construction restoration actions, the following survey and planning activities will be completed:

1. Inventory
2. Project Area survey
3. Identification of disturbance levels
4. Determination of restoration levels
5. Determination of vegetation monitoring plots

Prior to the start of pre-construction restoration actions, geographic information system (GIS) coverage layers (ArcView shapefile or ArcInfo export file) and maps of the Project Area showing the special-status plant habitat, temporary use areas, permanent use areas, and their corresponding disturbance and restoration levels, will be provided to the BLM. The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities.

Inventory

All existing potential access roads and disturbance sites which will serve as stockpile areas will be inventoried and will be provided to the BLM as GIS layers and maps prior to the start of pre-construction restoration actions.

Project Area Survey

The Study Area, which includes the entire Project Area, has been surveyed. Prior to the start of pre-construction restoration actions, GIS coverage layers and maps will be provided to the BLM showing the proposed temporary and permanent disturbance areas, along with the proposed locations of all Project infrastructure and roads including permanent facilities, access roads (temporary and permanent), temporary use areas, stockpiling areas, pulling and tensioning sites, transmission line pole/tower locations, and spur roads.

Determination of Vegetation Monitoring Plots

To comply with MM VG-1, four long-term vegetation monitoring plots will be set up within the Project Area. Monitoring plot development, location, and criteria will be determined in coordination with the BLM and detailed in the *Long-Term Monitoring Plan* prepared for the Project.

Project Siting, Design, and Site Preparation

The Project has been sited and designed to avoid many sensitive natural resources. Siting and design measures will be implemented to reduce impacts to natural resources, including avoiding major wash systems. Alternatives were devised that avoided or minimized effects on higher density tortoise areas and known rare plant populations. The mowing, and drive and crush construction methods that will be implemented as part of the Hybrid Alternative will greatly reduce the removal of vegetation and the potential erosion of topsoil. A weed management program will be implemented to control and reduce the spread of invasive weeds in the native plant communities of the Project Area; this program is described in the *Integrated Weed Management Plan* (Phoenix Biological Consulting [PBC] 2019).

As described in the *Decommissioning and Site Reclamation Plan* prepared for the Project (EPD 2019), site preparation activities will minimize earth movement and preserve existing drainage patterns as much as possible. Storm water run-off will be allowed to flow through the site and only minimal grading is proposed at some locations to smooth some surfaces (e.g., bumps and dips). Major drainages within the Federal Emergency Management Agency (FEMA) 100-year floodplain will be avoided.

In the mowed areas, existing vegetation and soils will be maintained in place. Similar to the Valley Electric Solar methodologies, the vegetation in the solar array blocks will be mowed to a height of 18 to 24 inches. The disturbance levels in the areas of temporary disturbance have not been finalized; however, it is anticipated that a drive/crush method will be sufficient for the pulling sites for the gen-tie lines although disking/rolling or grading method may be required at the gen-tie laydown, staging, and installation sites.

In areas of the solar field constructed via mowing, vegetation will be trimmed to a height of 24 inches, although vegetation may be trimmed to between 18 inches and 24 inches tall under justifiable circumstances. Upon project completion, the permanent fencing surrounding the mowed areas would have a gap of approximately 8 inches between the fence bottom and the ground to allow desert tortoise to travel through and occupy the mowed areas of the solar field during operation and maintenance phase and throughout the lifetime of the Project. Areas to be developed by drive and crush will involve construction by operating vehicles and equipment directly across vegetation, resulting in crushing. Soils

will not be rolled and compacted under this method. Within the solar field designated for construction via traditional methods, disking will be implemented to cut vegetation and rolling to bury it and compact soils. Grading or cut-and-fill will be required to smooth the surface and remove large rocks or boulders, as needed. Vertical mulch and rocks and boulders removed will be used as fill or as berm linings, or otherwise windrowed to an area adjacent to, but outside of, the disturbance area. Other areas, such as access roads, will need to be cleared and maintained as bare ground, aggregate, or road base. Additionally, areas required for other infrastructure (e.g., underground collection line conduit, road corridors, building and substation locations) will be cleared and graded.

Surveys

Prior to any construction activities, the permanent and temporary disturbance areas (including staging areas, access roads, and sites for temporary placement of spoils) will be delineated and, in some cases, flagged or staked. Spoils and topsoil will be stockpiled in disturbed areas lacking native vegetation and that do not provide habitat for special-status species. Parking areas, staging, and disposal site locations will be similarly located in areas without native vegetation or special-status species habitat, where feasible. All disturbances, vehicle travel, and equipment use will be confined to the areas flagged during preconstruction surveys. All areas will then be inventoried for rare plants, cacti and yucca, and biocrust or desert pavement, as necessary. All non-native and noxious weeds will also be mapped and documented as described in the *Integrated Weed Management Plan* (PBC 2019a). Surveys for rare plants will be conducted during the spring season when rare plants are visible.

Approximately 2.1% of all cactus and yucca in the temporary disturbance areas will be recorded and mapped with a unique identifier, counted, and marked for salvage. Similarly, within the mowed areas, 2.1% of all cacti and yucca within permanent disturbance areas (e.g., roads, equipment areas, and transmission line towers) will be marked for salvage; these specimens will be transplanted in a natural pattern within the mowed areas. Approximately 2.1% of cacti and yucca from traditionally developed, areas will be salvaged and transplanted within the mowed areas, as detailed in mitigation measures identified in the NEPA analysis. Cacti and yucca not salvaged and transplanted may be provided for sale to the public purchase, and then to commercial users for purchase, if required per BLM's forestry program guidance. The northern orientation of each cactus and yucca marked for salvage will be noted. All barrel cactus will be flagged for avoidance during construction; barrel cactus will not be mowed or removed, unless directly in the panel array or equipment area. During the clearance survey of the permanent disturbance areas, select cactus and yucca specimens will be recorded and mapped with a unique identifier, counted, and marked for salvage. The criteria for salvage will be determined by the BLM but may include all individuals of the species that are relatively uncommon in the Project Area (these include pencil cholla, cottontop cactus, strawberry hedgehog, desert barrel cactus, common fishhook cactus, Johnson's fishhook cactus, and Mojave yucca) and targeted individuals of the most common species (silver cholla and beavertail). Targeted silver cholla for salvage will be under 3 feet tall. All silver cholla and beavertail targeted for salvage will be in excellent (greater than 80% live branches and stable root system) or good (greater than 60% live branches and mostly stable root system) condition (Ironwood Consulting Inc. 2014).

Areas of biocrust and desert pavement will be mapped and recorded and marked for salvage or avoidance, as necessary. Certain impact areas where the level of disturbance is low because the vegetation will not be entirely removed but only cut back and topsoil will not be removed (e.g., mowed areas), will not require cacti/yucca or biocrust salvage; these areas will still be inventoried for monitoring or avoidance purposes, but the resources will not be marked for salvage.

VI. Restoration Actions

As described in the BLM's *Restoration Plan for Energy Projects in the Las Vegas Field Office* (BLM and Native Resources 2001), two types of disturbance conditions are addressed herein, temporary and permanent (Table 3 and Table 4). This Plan focuses on the restoration activities that will be applied to the temporary disturbance areas and how sensitive resources will be inventoried, salvaged, and monitored in the permanent disturbance areas. The permanent impact areas will be reclaimed following decommissioning at the end of the life of the Project, which is expected to be at least 30 years; this process is documented in a separate *Decommissioning and Site Reclamation Plan* but may follow the methods for rehabilitation and monitoring described herein for the temporary disturbance areas (EPD 2019).

Site rehabilitation methods described herein were guided by the BLM's *Restoration Plan Template* (BLM 2019a) and also informed by the BLM LVFO's *Restoration Plan for Energy Projects in the Las Vegas Field Office* (BLM and Native Resources 2001), the BLM LVFO's guidelines in *Salvage, Stockpiling, and Final Transplanting of Cacti and Yucca*, and the *Silver State Solar Power South Site Rehabilitation and Cactus and Yucca Salvage Plan* (Ironwood Consulting Inc. 2014).

The pre-construction, during construction, and post-construction restoration actions that apply to each disturbance level (D-0 through D-3) are listed below in Table 16. The pre-construction, during construction, and post-construction restoration actions listed in Table 16 are then described in detail in the following sections. The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities. The anticipated disturbance levels can be found in Table 3 and Table 4.

Table 16. Restoration actions proposed for each disturbance level[1].

Disturbance Level[1]	**Restoration Actions**		
	Pre-construction	**Construction**	**Post-construction**
D-0 Mowing	• *Geospatial Data* • *Weed Surveys* • *Special-status Plant Measures* • *Biocrust and Desert Pavement Protection Measures* • *Biological Monitoring* • *Seed Collection*	• *Weed Surveys, Treatment, and Monitoring* • *Biological Monitoring* • *Seed Collection* • *Reporting*	• *Weed Management*
D-1 Overland Drive and Crush	• *Geospatial Data* • *Weed Surveys* • *Special-status Plant Measures* • *Biocrust and Desert Pavement Protection Measures* • *Biological Monitoring* • *Seed Collection* • *Cacti and Yucca Salvage Biocrust and Desert Pavement Salvage (if needed)*	• *Weed Surveys, Treatment, and Monitoring* • *Biological Monitoring* • *Salvaged Substrates and Nursery Maintenance and Monitoring* • *Seed Collection* • *Reporting*	• *Replacement of Biocrust and Desert Pavement (if removed)* • *Replanting Cacti and Yucca* • *Seeding* • *Permeon Application (if needed)* • *Signage* • *Weed Management*
D-2 Clear and Cut	• *Geospatial Data* • *Weed Surveys* • *Special-status Plant Measures*	• *Weed Surveys, Treatment, and Monitoring*	• *Replacement of Biocrust and Desert Pavement* • *Replanting Cacti and Yucca*

Disturbance Level[1]	Restoration Actions		
	Pre-construction	**Construction**	**Post-construction**
	• *Biocrust and Desert Pavement Protection Measures* • *Biological Monitoring* • *Seed Collection* • *Cacti and Yucca Salvage Biocrust and Desert Pavement Salvage*	• *Biological Monitoring* • *Salvaged Substrates and Nursery Maintenance and Monitoring* • *Seed Collection* • *Soil Stabilization* • *Reporting*	• *Seeding* • *Permeon Application (if needed)* • *Signage* • *Weed Management*
D-3 Clear and Cut with Soil Removal	• *Geospatial Data* • *Weed Surveys* • *Special-status Plant Measures* • *Biocrust and Desert Pavement Protection Measures* • *Biological Monitoring* • *Seed Collection* • *Cacti and Yucca Salvage Biocrust and Desert Pavement Salvage* • *Vertical Mulch and Rock/Boulder Salvage* • *Surface and Subsurface Soil Salvage*	• *Weed Surveys, Treatment, and Monitoring* • *Biological Monitoring* • *Salvaged Substrates and Nursery Maintenance and Monitoring* • *Seed Collection* • *Soil Stabilization* • *Reporting*	• *Earthwork* • *Replacement of Vertical Mulch and Rocks/Boulders* • *Replacement of Biocrust and Desert Pavement* • *Replanting Cacti and Yucca* • *Seeding* • *Permeon Application (if needed)* • *Signage* • *Weed Management*

[1] The disturbance levels have not been finalized but will be provided to the BLM along with GIS and maps of all type of use areas and the associated disturbance levels prior to the onset of pre-construction activities. Most restoration actions only apply to the temporary disturbance areas, as described below.

PRE-CONSTRUCTION ACTIONS

Pre-construction restoration actions will be performed prior to the start of construction. Pre-construction restoration actions will include weed surveys, special-status plant measures, seed collection, cacti and yucca salvage, vertical mulch and rock salvage, biocrust salvage, and salvage of surface and subsurface soils. Salvage of perennial shrubs is required by the BLM in Restoration Level 1 (R-1) areas only and is not proposed. The pre-construction restoration actions will vary based on the type of impact area (temporary vs. permanent), the disturbance level, and the method of construction proposed (traditional vs. drive and crush vs. mowing).

Geospatial Data

Prior to the start of pre-construction restoration actions, geographic information system (GIS) coverage layers (ArcView shapefile or ArcInfo export file) and maps of the Project Area showing the special-status plant habitat, temporary use areas, permanent use areas, and their corresponding disturbance and restoration levels, will be provided to the BLM botanist.

Weed Surveys

The Project Area will be inventoried for non-native and invasive weeds during the spring and early summer following the protocols of the *Integrated Weed Management Plan* (PBC 2019a). Non-native and noxious weed populations will be mapped with a GPS and the species, phenology, and populations size will be

recorded. The surveys must take place when non-native and noxious weeds species are detectable, typically spring and early summer months.

Problem weed areas will be identified by a Designated Botanist prior to the start of construction, based on the weed inventory results and the proposed level(s) of disturbance. The occurrence of non-native and noxious weeds within the Project Area and along adjacent vectors will be reported to the BLM's LVFO. The Applicant will determine the appropriate weed control procedures, including target species and methods and timing of treatments, in consultation with the BLM. Larger populations or infestations will be removed and/or treated chemically prior to any ground disturbance. To the extent practicable, all non-native and noxious weeds will be removed from the disturbance areas prior to ground disturbance.

Special-status Plant Measures

Conservation and mitigation measures will be undertaken to reduce impacts to rare plant populations including conducting pre-construction rare plant surveys; avoiding rare plant populations; minimizing changes to drainage on rare plant populations; salvaging and re-placing the seed bank (if necessary); seed collection (if necessary); implementing a weed management program to reduce the spread of invasive weeds in the Project Area; implementing BMPs to reduce erosion; and, monitoring rare plant populations. Vehicles and equipment will stay in designated work areas and on established roads to reduce impacts to rare plants. As described below, impacts to special-status plants cannot be fully avoided, but will be minimized. Monitoring of rare plant populations will be implemented. In addition, the mitigation measure, MM VG-2 detailed in Section III, developed by the BLM and included in the RMPA/DEIS will be adhered to (BLM 2019b)**.**

Threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)

Threecorner milkvetch is listed by the State of Nevada as Critically Endangered/Fully Protected, by the BLM as Sensitive, by the NNHP as At-Risk, and by the NNPS as Threatened. All known populations of threecorner milkvetch will either be avoided under the Hybrid Alternative or a permit shall be obtained via the Nevada Division of Forestry for any unavoidable impacts to threecorner milkvetch. Seventy-seven percent of all threecorner milkvetch individuals and 82 percent of all occurrences documented during the spring 2018 special-status plant inventory survey were located in development area F (Exhibit 6; PBC 2019b; Appendix A); for this reason, development area F is not proposed for development under the Hybrid Alternative (Exhibit 3). Any new populations documented during the clearance survey prior to Project construction, or during monitoring, will be reported to the BLM. If new populations are identified that cannot be avoided, the BLM will be consulted, and mitigation will be proposed. Mitigation would include salvage and relocation of the seed bank, seed collection, and/or compensation. Compensation for the loss of milkvetch habitat may be required in accordance with a take permit from the Nevada Division of Forestry.

Environmental Exclusion Areas (EEAs) will be established around the known populations of threecorner milkvetch (e.g., in development areas C, D, E, and F [Exhibit 6]). The EEAs will be established by a Designated Biologist and will be sized to ensure that all existing threecorner milkvetch are included, with an appropriate buffer surrounding the plants based on the plant's habitat affinity as observed in the field. The boundary of the Project will be refined to exclude the EEAs during Project engineering, prior to construction. All Project features, including any recommended drainage facilities, will not be located in the EEAs. Workers will not be allowed in the areas during operation of the facility, except for Designated Biologists monitoring the EEAs for detection and removal of non-native and noxious weeds. EEAs will be clearly delineated in the field with temporary construction fencing and signs prohibiting movement of the

fencing or sediment controls under penalty of work stoppages or compensatory mitigation. EEAs will be designed with appropriate materials to withstand windy conditions.

Weed management will be essential to mitigating indirect effects to rare plants and is detailed in the *Integrated Weed Management Plan* prepared for the Project (PBC 2019a). Rare plant populations will be monitored annually to document any direct effects from construction and any management recommendations will be made to the BLM in the monitoring reports. Invasive weeds will be manually removed during monitoring. In addition, rare plant populations will be monitored annually for 5 years post-construction to document the populations and any indirect impacts that require further adaptive management to ensure their success and survival (e.g., weed management). The annual post-construction monitoring will take place in the spring when the plants are detectable.

Rosy twotone beardtongue (*Penstemon bicolor* ssp. *roseus*)

Rosy twotone beardtongue is listed by the BLM as Sensitive, by NNHP as At-Risk, and is included on the NNPS's Watch List. All known populations of rosy twotone beardtongue documented during the spring 2018 special-status plant inventory survey will be avoided during construction (Exhibit 6; PBC 2019b; Appendix A). The two *Penstemon* plants that could not be identified to the species level during the plant inventory will be revisited to determine if they are rosy twotone beardtongue, if they are, they will be avoided; if a positive identification cannot be made, they will still be avoided. Any new populations documented during the clearance survey or monitoring will also be avoided and will be reported to the BLM. If new populations are identified that cannot be avoided, the BLM will be consulted. The populations will be demarcated in the field with flagging or fencing and signage and will be avoided during construction and O&M of the Project. These populations will be monitored annually to document any indirect or direct effects from construction and any management recommendations will be made to the BLM in the monitoring reports.

Nye milkvetch (*Astragalus nyensis*)

Nye milkvetch is listed by NNHP as At-Risk and is included on the NNPS's Watch List. All populations of Nye milkvetch cannot be entirely avoided; however, elements of the Project design, siting and avoidance/minimization measures and monitoring will offer some protection for this species. The development of the solar field using "traditional methods" in development area A (Exhibit 3) will impact the area with highest number of occurrences and highest population numbers of Nye milkvetch found during the spring 2018 botanical inventory. The area with the second highest number of occurrences and highest population numbers, development area F, will be avoided entirely under the Hybrid Alternative. Construction via mowing in development areas B and D maintains the seed bank allowing Nye milkvetch to be able to repopulation after construction (Exhibit 6; PBC 2019b; Appendix A). Within areas of mowing, disturbance to the vegetation will be limited to cutting back and maintaining a low shrub structure. The adverse impacts to small annual plants in these areas will be limited to potential impacts from construction activities and on-going maintenance of the vegetation beneath the panels and from the spread or infestation of noxious weeds associated with construction. In areas with populations of Nye milkvetch, these maintenance activities will be performed on foot and by hand (though driving will be allowed on the permanent access roads in all locations). Because limited topsoil will be removed (primarily to create permanent access roads and underground utility corridors for the 34.5 kV collection system) in the mowed areas, disturbance to the seed bank of Nye milkvetch will be limited in these locations. Surface and subsurface soil salvage techniques described below will be employed to preserve the Nye milkvetch seed bank. Known populations will be delineated in the field for avoidance where possible. Remaining Nye milkvetch populations in the Project development areas (i.e., Nye milkvetch preserved under mowing alternatives) will be monitored annually to document direct and indirect impacts. Weed management will

be essential to mitigating indirect effects to rare plants and is detailed in the *Integrated Weed Management Plan* prepared for the Project (PBC 2019a). Post-construction monitoring of these populations will occur annually for 5 years to document the populations and any indirect impacts that require further management to ensure their success and survival (e.g., weed management). The annual monitoring will take place in the spring when the plants are detectable.

Biological Monitoring

The Applicant will assign at least one Authorized Biologist to the Project. The Applicant will submit the resume of the proposed Authorized Biologist/Botanist(s) to the BLM for approval in consultation with the U.S. Fish and Wildlife Service (USFWS). Biological monitors will delineate avoidance areas around sensitive resources (i.e., rare plant populations and areas of biocrust or desert pavement) using signs and staking, flagging, or fencing prior to construction.

Monitors will inspect and assess protected sensitive resources prior to the onset of construction and record their observation on monitoring logs that will be used throughout the monitoring of the Project. Observations recorded will include monitor's name, date, location, details of the sensitive resource(s) (e.g., the phenology, number of individuals, health and vigor of rare plant populations), and presence of any threats to resources (e.g., non-native and noxious weed infestations, construction-related impacts, off-road vehicle operation, etc.). Photos will be taken of all sensitive resource areas prior to construction to document the baseline conditions. All areas with sensitive resources designated for vegetation and topsoil removal will be inspected before construction and photos will be taken.

Prior to construction and on an ongoing basis through Project construction, an Authorized Biologist/Botanist will provide a training session to Project personnel, focusing on the avoidance of sensitive resources and proper construction techniques to minimize indirect impacts to sensitive resources.

Seed Collection

Seed collection will be conducted for restoration purposes prior to the start of construction activities, and will be continued during the construction phase, as needed. Seed collection will begin immediately after construction approvals are granted and will continue until enough seed has been collected. Seeds collecting will be conducted with either a free use permit (Form 5510-1) or with written authorization from the BLM. Seed collection will be performed by a qualified and BLM-approved seed company or by an Authorized Biologist/Botanist, with BLM approval. Seeds will be collected either from the Project area or on nearby BLM lands within the LVFO with prior BLM approval (within 20 miles) or from within the provisional Seed Transfer Zones for the Mojave, as identified by the U.S. Geological Survey; if needed, seeds will also be purchased from a BLM-approved source but must be from the appropriate seed zone no more than 30 miles from the Project.

Seed collection will follow standard protocols to minimize environmental impacts, including collecting from multiple plants to increase genetic diversity and collection of only 10 percent or less of an individual plant's available seed. No more than 50 percent of seeds will be collected from one population and ideally seeds will be collected across multiple populations with one exception: seed collection on-site can include 100 percent of the available seed. Only mature seed will be collected. The amount of seeds (pounds of pure live seed) needed will be determined based on the size of the temporary disturbance areas and the approved seed mix(es); under the Hybrid Alternative (refer to Table 2). Following collection, seeds will be cleaned, tested for pounds live seed, certified as weed-free, and stored in dry containers clearly labeled

with the species name, the exact location of collection, date of collection, and the collector's name. Containers will be stored in appropriate and secure locations free of rodents or insects.

An example seed collection mix from the BLM's *Restoration Plan Template* (BLM 2019a) is provided below in Table 17. The seed mix and the total live seed target rate will be determined by the Authorized Biologist/Botanist, with BLM-approval based on seed availability and the vegetation composition of the disturbance areas. Sampling conducted in spring 2018 to estimate the vegetation cover, density, and species richness for each vegetation alliance within the Study Area may be used to inform the seed mix (PBC 2019b; Appendix A). The seed mix will include both perennial grasses and Mojave desert tortoise forage annual species such as *Plantago insularis*. The seed mix cannot contain any non-native species and purity tests must be submitted to the BLM, along with minimum germination rates.

Table 17. Example of perennial seed mix for temporary disturbance areas (BLM 2019a).

Species	Pounds per Acre[1]	Percent Purity	Approximate Weight (pounds per 40 acres)
Ambrosia dumosa white burrobush	3.5	29	140
Atriplex canescens four-wing saltbush	1.5	12	60
Ephedra nevadensis Nevada ephedra	1.5	12	60
Larrea tridentata Creosote	0.5	3	20
Pleuraphis rigida [*Hilaria rigida*] big galleta grass	3.0	25	120
Sphaeralcea ambigua apricot mallow	0.5	3	20
Stipa hymenoides [*Oryzopsis hymenoides*] Indian ricegrass	2.0	16	80

[1] All amounts are based on weight of pure live seed.

Cacti and Yucca Salvage

All cacti and yucca salvage methods will be consistent with the BLM LVFO's guidelines in *Salvage, Stockpiling, and Final Transplanting of Cacti and Yucca* (BLM 2013; Appendix B) and the *Cacti and Yucca Salvage/Transplant BMPs* included in the BLM's *Restoration Plan Template* (BLM 2019a; Appendix B). In addition, the cacti and yucca prescriptions in MM VG-1, listed in Section III, will also be adhered to (BLM 2019b).

Vegetation Salvage Contractor Selection

All plant salvaging will be performed by an experienced vegetation salvage contractor who has been preapproved by the BLM. The vegetation salvage contractor will have a minimum of 3 years of experience with extraction, maintenance, and transplanting of Mojave Desert vegetation. The vegetation salvage contractor will be experienced in proven methods for successful transplantation and all salvage methods will be consistent with the BLM LVFO's guidelines in *Salvage, Stockpiling, and Final Transplanting of Cacti and Yucca* (BLM 2013; Appendix B) and the *Cacti and Yucca Salvage/Transplant BMPs* included in the BLM's *Restoration Plan Template* (BLM 2019a; Appendix B). The vegetation salvage contractor will set up the on-site plant nursery and will be responsible for all plant salvaging, transplanting in the on-site nursery, maintaining the salvaged plants, and transplanting of the salvaged plants during site

rehabilitation. The Designated Botanist and biologist will also be responsible for maintenance and monitoring of the salvaged plants in the nursery during construction.

On-site Plant Nursery

An as-yet undetermined portion of the construction laydown area will be designated as the on-site plant nursery. This area will be used as necessary for storage of plants and soils salvaged from the temporary disturbance areas. The Authorized Biologist/Botanist will consult with the BLM regarding the placement and design of the on-site nursery. The results of the botanical resources studies and the clearance survey will be used to inform the placement of the nursery in an area without sensitive natural resources. Once the area is selected and delineated, large planting beds will be prepared using the native topsoil. The beds will need to be large enough to accommodate planting trenches that will be a minimum of 3 feet wide and 18 inches deep. The area will be fenced, and water will be transported to the nursery via water trucks. The plants and soils placed in the on-site nursery will be maintained by the qualified staff under the supervision of the Designated Botanist until rehabilitation of the temporary disturbance areas is complete.

Cacti and Yucca Salvage

All cacti and yucca identified during clearance surveys in the temporary disturbance areas will be transplanted to the on-site plant nursery following the extraction, handling, and transplanting methods described below. Within the mowed areas, all cacti and yucca within permanent disturbance areas (e.g., roads, equipment areas, and transmission line towers) will be salvaged and transplanted in a natural pattern within the mowed areas. Salvaging and transplanting cacti and yucca from permanent disturbance areas will occur as detailed in mitigation measures identified in the NEPA analysis. It has not yet been determined how many of the cacti and yucca from the permanent disturbance areas will be salvaged. For comparison, the Silver State Solar Power South Project, located in the northern Ivanpah Valley, Clark County, Nevada, had an estimated total of 66,240 cacti and yucca within a permanent disturbance area of approximately 2,350 acres and the BLM requested that they salvage 1,400 individuals, approximately 2.1 percent. Cacti and yucca sampling conducted in spring 2018 extrapolated that an estimated total of 210,859 cacti and yucca occurred in the 10,861-acre Study Area (Table 12; Appendix A; PBC 2019b). Using the permanent disturbance area (with vegetation removed) of the Hybrid Alternative of approximately 3,697 acres[1], a rough estimate of approximately 71,800 cactus and yucca may be permanently impacted by the Project. If the BLM requests a similar proportion be salvaged to that required by the Silver State South Project (approximately 2.1 percent), then about 1,508 cacti and yucca will be salvaged from the permanent disturbance area. Note that these estimates are preliminary, and the BLM has not yet determined whether or not cacti and yucca will be salvaged from the permanent disturbance areas and/or how many they want salvaged, nor where these salvaged specimens will be transplanted. Cacti and yucca will be selected for salvage from the permanent disturbance areas as described above under preconstruction surveys.

Extraction and Handling

During the clearance survey cacti/yucca inventory, all yucca clusters will be counted as separate plants and the north orientation of all cacti and yucca will be marked. In order to minimize plant stress, all plant salvage activities will take place in fall, winter, or early spring. All cacti and yucca will be salvaged except for cholla that are greater than 3 feet tall; these individuals would be included in the vertical mulch.

[1] The 3,697 acres includes 2,139 acres of areas where vegetation is completely cleared including traditional development areas within the solar array, facilities, and gen-tie access roads, as well as 1,558 acres within the traditional development and mowed areas that will be constructed via crush and mow or crushed during construction between rows. Cacti and yucca may be avoidable within these “drive and crush” areas, but to be conservative, were counted as permanently impacted.

Cacti will be extracted by hand using shovels or picks with care taken not to damage roots; pitchforks will be used to move cacti. Cacti will be transplanted immediately following extraction or stored under a shade cloth and transplanted as soon as possible. Yucca salvage will be conducted with heavy equipment, such as a front-end loader, and guided by long pitchforks. Salvage yucca will be transplanted immediately. Yucca material will be handled carefully so as not to damage roots, stems, or the lower part of the plants. Heavy gloves and eye protection will be worn at all times during cacti and yucca salvage and cacti and yucca will be handled with pitchforks exclusively as much as possible. Yuccas can be extremely dangerous to handle because the sharp leaves can penetrate the human body and cause life-threatening damage. Extreme care will be used when handling cacti and yucca.

Transplanting

All cacti and yucca salvaged from temporary disturbance areas will be transplanted to the on-site plant nursery. Cacti and yucca salvaged from permanent impact areas will be transplanted to an as-yet undetermined off-site BLM stockpile area. The transplanting areas will be fully prepared for the salvaged plants prior to extraction, as described above under *On-site Plant Nursery*. The planting trenches will be thoroughly soaked with water prior to transplanting and allowed to drain. Cacti of similar species and size classes will be planted together to help control watering rates (Ironwood Consulting Inc. 2014). Yucca clusters will be broken apart into individual stems and will be planted at least 1 foot apart. All cacti and yucca will be planted in their original northern orientation.

Once plants are placed into the moist trenches, the soil will be carefully tamped down and compacted around the roots of plants to remove all air pockets and a depression will be formed around each plant to hold water. All transplanted cacti and yucca will be watered thoroughly directly after transplanting once approximately 2 weeks after planting. Additional watering will be done as needed, but not more than once every 2 months.

Sale

Cacti and yucca not salvaged and transplanted will be provided for sale to the public purchase, and then to commercial users for purchase, per BLM's forestry program guidance.

Biocrust and Desert Pavement Protection and Salvage

The areas identified during the botanical resources survey with the most biocrust and desert pavement are either excluded from the Hybrid Alternative (development area F) or have large portions designated for mowing (development areas B and D) (Table 15; Appendix A; PBC 2019b). Impacts to native substrates, including biocrust and desert pavement, will be reduced in the drive and crush, and mowed areas. Biocrusts and desert pavement will be inventoried during the preconstruction surveys throughout the Project Area; however, biocrusts and desert pavement in permanent impact areas subject to D-2 and D-3 disturbance levels will not be salvaged or restored.

Signs and possibly stakes will be used to delineate biocrust and desert pavement areas as special habitat to be avoided (if possible) during construction in the temporary disturbance and mowed areas. In temporary disturbance areas and mowed areas, protective mats (plywood) may be used when driving or operating equipment over desert pavement. Biocrust that cannot be avoided in the temporary disturbance areas will be salvaged and returned during site restoration. If work must be conducted on these substrates, it will be limited to lighter equipment or to being conducted on foot. The appropriately sized equipment will be used in areas with biocrust and desert pavement to limit impacts from heavy equipment. Vehicles and equipment will stay in designated work areas and on established roads or

previously tracked routes to reduce impacts to biocrust and desert pavement. Biocrust and desert pavement in the temporary disturbance and mowed areas will be monitored before, during, and after construction to document direct and indirect impacts.

Significant stands of biocrust will be salvaged by hand or using very small equipment (e.g., a small backhoe). Biocrust will be placed in plastic buckets (dry) and stored until it can be restored to the areas it was removed from.

Vertical Mulch and Rock/Boulder Salvage

For the areas that require removal of vegetation and cut-and-fill, the vegetation will be mechanically windrowed to an area near to, but outside of, the disturbance area. This vegetation is considered vertical mulch. Large rocks and boulders will also be removed to an area near to, but outside of, the disturbance area; care will be taken to avoid disturbance to the natural patina or varnish of the rocks and boulders. Some rocks and boulders will also be used for armoring berms and fill. The vertical mulch and rocks/boulders will be stored in place to prevent wind and water erosion during construction activities and will also be used for site rehabilitation.

Surface and Subsurface Soil Salvage

In temporary disturbance areas where topsoil must be removed, salvage of the topsoil will occur. Heavy equipment will be used to salvage topsoil. The top 4 inches, approximately, will be removed along with rocks and vegetation. Rocks that are greater than 6 inches in diameter can be removed and stockpiled separately. Handling of topsoil will be minimized, and topsoil will never be mixed with subsoil. The topsoil will be stockpiled in layers to a height of no greater than 48 inches. Some of the topsoil will be used in creation of the on-site plant nursery, if needed. All topsoil will be labeled with its location of origin and protected from erosion and inadvertent use as fill. All stockpiled topsoil will be treated with a vegetal-based tackifier to a 2-inch wetted depth to minimize erosion. If different soil types are encountered, they will be stockpiled separately. Subsurface soils that need to be extracted and salvaged will be stored separately. All topsoil will be returned to the appropriate areas during site rehabilitation. Deeper soils will likely be used to balance cut and fill across the site.

CONSTRUCTION ACTIONS

Restoration actions during construction will include weed surveys, treatments, and monitoring; special-status plant monitoring; biocrust and desert pavement monitoring; salvage substrates and nursery maintenance and monitoring; additional seed collection, if needed; soil stabilization; and, reporting. The construction restoration actions will vary based on the type of impact area (temporary vs. permanent), the disturbance level, and the method of construction proposed (traditional vs. drive and crush vs. mowing).

Weed Surveys, Treatments, and Monitoring

Following the onset of construction activities, biological monitors will conduct regular non-native and noxious weeds surveys in the disturbance areas, under the direction of the Authorized Biologist/Botanist, to monitor problem areas and detect new populations. The Applicant will determine the appropriate weed control procedures, including target species and methods and timing of treatments, in consultation with the BLM and as described in the *Integrated Weed Management Plan* (PBC 2019a). The threecorner milkvetch populations located at the perimeter of the development areas (Exhibit 6) will also be monitored for non-native and noxious weeds. New and existing infestations will be mapped, and maps will be kept up-to-date to inform treatment methods and timing.

Biological Monitoring

Monitoring will be conducted by the Authorized Biologist/Botanist during construction activities to assess Project impacts to protected resources and to ensure that resources are being protected. Biological monitors under the supervision of the Designated Botanist will regularly inspect and assess protected sensitive resources and record their observation on monitoring logs that will be used throughout the monitoring of the Project. Observations recorded will include monitor's name, date, location, details of the sensitive resource(s) (e.g., the phenology, number of individuals, health and vigor of rare plant populations), and presence of any threats to resources (e.g., non-native and noxious weed infestations, construction-related impacts, off-road vehicle operation, etc.). Photos will be taken of all sensitive resource areas prior to construction to document the baseline conditions. Photos will also be taken regularly during construction to document any changes. All construction work in areas with sensitive resources will be monitored. All vegetation and topsoil removal in areas with sensitive resources will be monitored and before, during, and after photos will be taken. Monitoring will include taking note of all cacti and yucca damaged by construction activities.

On-going maintenance of the flagging, fencing, and signage around sensitive resource areas will be conducted until the construction and site rehabilitation is complete. All maintenance activities will be performed by qualified personnel under the direction of the Authorized Biologist/Botanist.

Prior to construction and on an ongoing basis through Project construction, an Authorized Biologist/Botanist will provide a training session to Project personnel, focusing on the avoidance of EEAs, special-status plant species, and sensitive substrates and habitats, and proper construction techniques to minimize indirect impacts to sensitive resources.

Biocrust and Nursery Maintenance and Monitoring

The plants and soils placed in the on-site nursery will be maintained by the qualified staff under the supervision of the Authorized Biologist/Botanist until rehabilitation of the temporary disturbance areas is complete. Salvaged cacti and yucca transplanted to the nursery will be watered as needed, but not more than every 2 months. Salvaged soils and biocrust will be protected from inadvertent use and stored as described above under *Pre-construction Activities*.

Seed Collection

Seed collection and storage activities will continue as described above under *Pre-construction Activities*.

Soil Stabilization

Dust palliatives and windrows will be utilized during construction to minimize wind erosion of disturbed soils. Dust palliatives and soil binders approved for use by the BLM include water and synthetic polymer derivatives (FSB-1000, Pas Tex, and Soil Sement) (BLM 2019a). Use of dust palliatives and soil binders will be guided by the information in Table 18 which is excerpted from Appendix C of the BLM's *Restoration Plan Template* (BLM 2019a).

Reporting

Informal reports will be delivered to the BLM within 15 days of all weed surveys and treatments. Vegetation/soils/cacti/yucca monitoring reports will be submitted to the BLM on a quarterly basis. Monitoring reports will be submitted via email and will include the following information, at a minimum: name(s) of the biological monitor and date(s) of monitoring and brief discussions of the sensitive resource

areas, summary description of the monitoring activities, any impacts to sensitive resources, as well as any issues and concerns, and the corresponding recommendations to address them.

Table 18. BLM-approved dust palliatives/soil binders (BLM 2019a).

	Water	Synthetic Polymer Derivatives (FSB-1000, Pas Tex, Soil Sement)
Attributes	• agglomerates the surface particles • readily available	• binds surface particles because of polymers' adhesive properties • stabilized product resists wash out from rain events • can be tilled in to create a compact surface in sandier soils
Limitations	• evaporates readily • controls dust generally for less than a day • generally the most expensive and labor intensive of the inorganic suppressants	• difficult to maintain as a completely hard surface • re-grading activity will cause the profile to break apart and destroy the products' bonding capacity
Application	• frequency depends on temperature and humidity • typically only effective from 1/2 to 12 hours	• generally one to two treatments per year • application rates vary significantly depending on the activity (traffic/non-traffic, soil conditions, etc.)
Origin	• any potable water source	• by-product of adhesive or paint manufacturing process
Environmental Impact	• none	• water quality impact: none • freshwater aquatic impact: generally low • plant impact: none

POST-CONSTRUCTION ACTIONS

Following construction of the facility, the temporary disturbance areas, traditional development areas, and mowed areas will be cleared of all construction-related equipment, materials, and debris and will be restored as appropriate as described herein. Site restoration will begin before or at the time that construction is completed. Post-construction restoration activities may include the following (some of these may not be required for D-0 and D-1 disturbance): earthwork (decompaction or ripping), replacing windrowed vertical mulch and rock, replacing removed soils and stabilizing the soil surface, replacing salvaged biocrust, replanting salvaged cacti and yucca, seeding, applying permeon, erecting signage, and weed management. All rehabilitation activities discussed below apply to the temporary disturbance areas, traditional development areas, and, whenever feasible and as appropriate, to the areas where mowing is implemented. Site reclamation of the permanent disturbance areas following decommissioning is addressed in the *Decommissioning and Site Reclamation Plan* prepared for this Project (EPD 2019).

Earthwork

The earthwork will include burying the subsurface soils removed (including caliche) and then restoring the surface soils and decompacting the terrain. All soils will be replaced in the order they were removed and in the locations from which they were removed. Large caliche that was removed will be crushed into a finer material before being replaced, as needed. Surfaces that require decompacting will be scarified, tilled, or ripped to a depth of 6 inches, as required. As needed, cross-ripping will be employed in order to prevent the establishment of “corn rows” of vegetation following seeding. Care will be taken to avoid inverting soil layers during decompaction. Deep, sandy soils will not require decompaction or ripping and will be identified prior to the start of construction. Following recontouring and decompacting of the of

subsurface materials, topsoil will be replaced. The topsoil will be left rough in order to provide sites for seed germination and to protect against erosion; soil will be wetted to a depth of 2 inches. If there is a shortage of salvaged topsoil, then a shallower depth will be used in order to assure there is some topsoil over the entire area. If needed, additional erosion control measure and soil stabilizers will be applied. A BLM-approved vegetal-based soil binder will be used on any steep stockpile slopes. Topsoils will be handled as little as possible and will not be applied or worked in windy conditions.

Vertical Mulch and Rocks/Boulders

Windrowed vertical mulch and rocks and boulders will be returned back to the areas from which they were removed, if not used on-site such as for berms. The large rocks and boulders will be placed in a natural appearing pattern dark side up. Replacement of the vertical mulch and rocks will provide further erosion control to the areas. When necessary, permeon will be applied to rocks to enhance the desert varnish.

Biocrust

Salvaged biocrust will be restored to the areas from which it was removed. Biocrust will be re-placed in the appropriate locations ONLY in the late fall to early spring. It will be spread evenly across the surface soils and watered once per day over a 3-day period. Re-application of biocrust will require that the final application is done by hand or using hand tools or small motorized equipment.

Cacti and Yucca

Extraction and Handling

Cacti will be carefully extracted from the nursery using hand tools; soil will be gently shaken off the roots and the roots will be clipped to the approximate diameter of the plant (Ironwood Consulting Inc. 2014). Yucca will be carefully extracted using backhoes and loaders or tree spades; extreme care will be used to avoid any impacts to the stem, root, or base of the plant. As described above in the salvage section, extreme care will be used when handling cacti and yucca to avoid injury to persons. Heavy gloves and eye protection will be worn at all times during handling, and cacti and yucca will be handled with pitchforks exclusively as much as possible.

Transplanting

All transplanting and seeding shall occur directly after soil placement to reduce the establishment of non-native and noxious weeds. All salvaged cacti and yucca from the temporary disturbance areas will be transplanted in a 'natural' arrangement in the approximate locations from where they were removed. All cacti and yucca will be transplanted in their original northern orientation. Cacti can be randomly distributed, and yuccas will be transplanted in loosely spaced groups of three to four individuals. The transplanting holes for cacti will be approximately 18 inches deep and 24 inches wide. One person will hold the cactus in place with a pitchfork while the other carefully backfills the hole with loose, native soil. The transplanting holes for single stem yucca will be at least 24 inches deep and 36 inches wide and will be proportionally larger as needed for multiple stem plants. Just before planting, each transplanting hole will be filled with water and allowed to drain. For yucca, the holes will then be refilled again and filled with soil to approximately 18 inches from the top to create a muddy matrix into which the yuccas will be placed. Yucca will then be placed into the holes and the holes will be backfilled with native soil. The soil around the transplanted cacti and yucca will be gently tamped down to remove air pockets and a water well will be formed around all plants. All transplanted cacti and yucca will be watered thoroughly directly after transplanting once approximately 2 weeks after planting. Additional watering will be done as needed, but not more than once every 2 months.

Reporting
The Authorized Biologist/Botanist will submit a report to the BLM after construction with the numbers of cacti and yucca damaged by construction activities.

Seeding
Transplanting and seeding shall occur directly after soil placement to reduce the establishment of non-native and noxious weeds. The seed mix and application amount will be pre-approved by the BLM before application. More than one mix will be created depending on the original composition of the disturbance area. Seeding will likely take place in the fall or winter, in temporary disturbance areas, to improve the likelihood of germination and survival; however, seeding timing will also be based on consultation with the BLM. Seed will be applied using pelletizing, imprinting, or hydroseeding methods. The seeding method(s) will be determined based on BMPs, time of year, and new research, in consultation with the BLM. The total live seed target rate for seeding will be approximately 400 pure live seeds per square meter. The final seed rate will be determined by the Lead Botanist in consultation with the BLM and based on final species selection.

Permeon Application
Permeon application will be determined in consultation with the BLM and depending upon the soil type, disturbance level, and if the soil surface contrast is high. Permeon application rates and color tint will be site specific. Whether blanket or spot-treatment applications are needed will be determined dependent on the adjacent natural landscape. If needed, permeon will be applied with backpack sprayers or a truck-mounted sprayer, if accessible.

Signage
Signs will be installed at regular intervals to delineate all restoration areas and deter vehicles or foot traffic from entering the areas. Signage and fencing will be mounted on t-posts. The locations of all signs and fencing around rehabilitation areas will be provided to the BLM. Maintenance and monitoring of Project rehabilitation site signage will be part of post-rehabilitation monitoring activities.

Weed Management
Weed treatments, monitoring, and reporting will be on-going during the post-construction phase of the Project as detailed in the *Integrated Weed Management Plan* (PBC 2019a). Any non-native and noxious weed treatments that are needed in the temporary disturbance areas, traditional development areas, or mowed areas will be conducted following the clearing of the areas of all construction-related materials or debris. If weed treatments (such as herbicide use) would adversely affect the subsequent seeding or planting, then the seeding/planting will be delayed until adverse effects are not anticipated. In areas where salvaged soils are being returned, the seeding and planting should occur directly after soil placement, in order to reduce the establishment of non-native and noxious weeds.

VII. Maintenance, Monitoring, and Reporting

MAINTENANCE
On-going maintenance of the restoration areas will be conducted until the restoration success standards have been met. All maintenance activities will be performed by qualified personnel under the direction of the Designated Botanist. Regular maintenance will include watering the transplanted plants, weed

management, soil stabilization, trash removal, repairs to fencing, protective cages/shelters, damage from erosion, and signage, remediation, and reporting (Table 19). Ongoing weed management will follow the protocols outlined in the *Integrated Weed Management Plan* (PBC 2019a). Additional restoration actions will be taken if sites are not progressing towards meeting standards; the Applicant will employ all reasonable methods, including remediation, to help ensure that the success standards are met. All maintenance tasks will be reported to the BLM during annual reporting.

Table 19. Maintenance schedule for site restoration.

Year	Watering Transplanted Cacti and Yucca	Weed Management	Repairs
One	• Immediately following planting • 2 weeks following planting • As needed to maintain 80% survival rate	As needed to maintain success standards	As needed
Two	As needed to maintain 80% survival rate	Quarterly	As needed
Three+	As needed to maintain 80% survival rate	Annually	As needed

MONITORING

Monitoring will be conducted to document weeds and weed treatments, evaluate the restoration of the temporary disturbance areas and traditional development areas, monitor vegetation including the condition of the mowed areas, and monitor rare plant populations. All monitoring activities will be performed by qualified personnel under the direction of the Designated Botanist according to the schedule outlined in Table 21.

Weed Monitoring

The *Integrated Weed Management Plan* prepared for the Project addresses monitoring (PBC 2019a).

Site Restoration Monitoring

The goal of the site restoration is to restore the temporary disturbance areas to a healthy landscape with self-sustaining plant communities. Photo monitoring will also be conducted as part of the qualitative monitoring. Following the BLM's *Restoration Plan Template* (BLM 2019a), the time periods outlined below in Table 20 indicate how long the Project will require monitoring following restoration. These calculations are based on the disturbance levels, the type of use areas, and with weed risk ratings (as determined in the *Integrated Weed Management Plan* [PBC 2019a]).

Table 20. Post-construction monitoring timeline calculations.

Disturbance Level	Type of Use Area	Weed Risk Rating[1]
• D0 - add 1 year • D1 - add 2 years • D2 - add 6 years • D3 - add 8 years	• Linear - Short (<5 miles) - add 0 years • Linear - Long (>5 miles) - add 2 years • Small Area (<1 acre) - add 0 years • Large Area (1 - 20 acres) - add 1 year • Very Large Area (>20 acres) - add 4 years	• None (0) - add 0 years • Low (1-10) - if D2 or D3 - add 1 year • Moderate (11-49) - add 2 years (add additional 2 years for every year weeds are not treated appropriately) • High (50-100) - add 4 years (add additional 4 years for every year weeds are not treated appropriately)

[1] From *Integrated Weed Management Plan* (PBC 2019a)

Based on these calculations, the restoration areas are expected to require 7 or 14 years of post-construction monitoring. All of the restoration areas are considered to have a High weed risk rating (PBC

2019a) and will require 7-14 years of post-construction monitoring. The temporary gen-tie line pulling sites (disturbance level D-1 in a large type of use area) will require 7 years of post-construction monitoring while the temporary gen-tie line laydown area (disturbance level D-2 in a very large type of use area) will require 14 years of post-construction monitoring.

Quantitative Monitoring

Quantitative monitoring will be conducted annually for as many years as required (likely between 7 and 14 years, as described above) following the completion of restoration of the temporary disturbance areas (Table 21). Success standards (see Table 22) will be measured in the fifth growing season following rehabilitation unless the site appears to have reached these metrics sooner, in which case the success standards will be measured sooner. Quantitative monitoring of the rehabilitation areas will follow the methods used for vegetation sampling to quantify the percent cover, density, and species richness of native perennials and annuals in each area and the percent cover of non-native and noxious weeds (Appendix A; PBC 2019b). These success standard measurements will be compared to the pre-Project conditions documented during the baseline vegetation sampling conducted for the Project (Appendix A; PBC 2019b) or to a pre-elected, comparable reference area. Success of native annuals will be measured against a comparable, but undisturbed, nearby reference site because annual plant germination and growth can vary greatly between years.

Quantitative monitoring will be conducted using line-point intercept, line intercept, or a modified AIM protocol, or a combination of these. Most likely, quantitative monitoring will be performed using the same method used to assess the baseline conditions of the site (the Line Point Intercept method following the BLM's AIM program [USDA-ARS 2018] [PBC 2019b]). Transect locations for quantitative monitoring will be randomly selected from within the restored temporary disturbance areas and from a reference area. Transects will be representative of the entire site, and the number of transects sampled will be enough to estimate means for the success criteria within a given confidence level. If the mean for any of the success criteria within the Project site is less than the success standard, a one-sample, one-tailed t-test will be performed. The null hypothesis is that the cover and density values in the restored areas are equal to or greater than 60 percent of the cover and density values of the baseline data (Appendix A; PBC 2019b) or the reference site data. Failure to reject the null hypothesis indicates that the site has met the success standards for restoration. Species richness will be quantified by comparing the total number of native perennial species within the restoration areas to the number of species found during baseline surveys (Appendix A; PBC 2019b) or on the reference site; there is no measure of variance for species richness data, so no statistical tests will be performed.

Qualitative Monitoring

Qualitative monitoring will be conducted monthly for the first year following the completion of rehabilitation of the temporary disturbance areas, quarterly for the second year, biannually for the third and fourth years, and annually for the fifth year (Table 21). Qualitative monitoring assessments will be recorded on monitoring data sheets that will be used throughout the monitoring of the Project. Observations recorded will include germination of species that were included in the seeding mix; estimates of percent cover, density, and species richness; health and vigor of transplanted cacti and yucca; soil conditions, including documentation of erosion; native plant recruitment, phenology, herbivory, disease or infestation; presence of non-native and noxious weeds; vegetation patterns; and, presence of native animals. In addition, each qualitative monitoring assessment will make a determination about the site's progress toward meeting the success standards and will recommend measures needed to ensure the success of the rehabilitation effort.

Photo monitoring will be conducted twice in the first year (once directly following rehabilitation and once approximately 6 months later) and annually thereafter (Table 21). Photo monitoring will be conducted at established photo points in the interior and on the perimeter of the restoration areas to show change over time. Photos will also be taken during site assessments to document plant health and any management or maintenance concerns, such as soil erosion or weed infestations.

Vegetation Monitoring

The traditional development, drive and crush areas, and mowed areas will be monitored following the specifications of MM VG-1. The *Long-Term Monitoring Plan* prepared for the Project will detail the monitoring requirements.

Rare Plant Monitoring

Annual monitoring for threecorner milkvetch will be conducted within the impacted population group by a BLM-approved botanist following a BLM-approved protocol. Monitoring shall determine the number of threecorner milkvetch plants that emerge each year, including the reproductive success of those plants. Monitoring shall determine if weeds are spreading as a result of Project-related activities, and if and how weed spread is impacting sensitive plant populations. This monitoring shall be summarized in an annual report to BLM, due by July 1 of each year. All known and remaining populations of rosy two-toned beardtongue and Nye milkvetch will also be monitored annually during the spring when they are detectable and identifiable.

REPORTING

Weed Reporting

The *Integrated Weed Management Plan* prepared for the Project addresses reporting (PBC 2019a). Annual weed monitoring reports will be submitted to the BLM by July 1. Progress reports will be submitted each month that weed monitoring occurs (February, March, and August) in each monitoring year (Table 21). Annual and progress reports will be submitted via email and will include the following information, at a minimum: name(s) of the biological monitor and date(s) of the site assessment(s); a brief discussion of the site conditions; and, dates and descriptions of maintenance/management activities. Weed monitoring and treatments will be continually reported to the BLM via email within 15 days of surveys and/or treatments.

Site Restoration Reporting

An as-built report will be prepared to document the initial site restoration and baseline conditions of the restored site and to document the condition of the mowed areas, as needed. During the monitoring period, regular progress reports and annual reports will also be prepared (reporting schedule in Table 21).

As-built Report

Within 60 days of the completion of the initial site restoration effort, an as-built report will be prepared and submitted to the BLM. This date of the report submittal will be the beginning of the monitoring period. The report will document the revegetation and reseeding methods and results including the number, species, and location of all transplanted individuals and the species, amounts, and locations of the seed applications. Photos of the restoration areas before, during, and after restoration will be included. The report will also document the dates restoration work was performed and the personnel who performed the work (including dates of performance and duties). Issues encountered during site restoration will be reported and discussed and any management recommendations or concerns will be also be included. This report will include GIS maps of the restoration areas and copies of seed tags and the record of seed testing.

Quantitative Monitoring Reports

Quantitative monitoring reports will be submitted to the BLM via email annually. These reports will include the methods and results of the transect/plot monitoring, a comparison of the current results with previous results, and an assessment of success in meeting the final success standards; the annual reports will also identify any issues and recommend corrective measures. In the fifth growing season following restoration, all the success standards (Table 22) will be measured and the monitoring report will include the methods and results and a discussion. If a site appears to have reached these metrics sooner, the success standards will be measured and reported sooner.

Qualitative Monitoring Reports

Qualitative site inspection/visual assessment reports will be submitted to the BLM via email monthly in Year 1, quarterly in Year 2, biannually in Years 3 and 4, and annually in Years 5 and 6 (Table 21). Qualitative site inspection/visual assessment reports will include methods and results of qualitative monitoring, documentation of monitoring and maintenance activities, a comparison of the current condition with previous conditions, and an assessment of success in meeting the annual and final success standards; the annual reports will also identify any issues and recommend corrective measures. Photo monitoring reports will include methods, results, and a discussion and will be submitted electronically following each photo monitoring event (Table 21). These reports will include all photos from the current period and photos from previous monitoring for comparison.

Vegetation Reporting

Vegetation monitoring reports will be submitted to the BLM by July 1 (Table 21). Qualitative site inspection/visual assessment reports will include methods and results of qualitative monitoring, documentation of monitoring and maintenance activities, a comparison of the current condition with previous conditions, and an assessment of success in meeting the annual and final success standards; the annual reports will also identify any issues and recommend corrective measures. Photo monitoring reports will include methods, results, and a discussion and will be submitted electronically following each photo monitoring event (Table 21). These reports will include all photos from the current period and photos from previous monitoring for comparison.

Cacti/Yucca Reporting

The cacti/yucca monitoring, salvage, and transplanting activities will be summarized in a final report that will also include the numbers of cacti and yucca damaged by construction activities. This report will address all cacti/yucca activities related to the Project (not just in the restoration sites) and will be submitted to the BLM on July 1 of the first year following completion of construction.

Rare Plant Reporting

Annual monitoring for threecorner milkvetch shall be summarized in an annual report to BLM, due by July 1 of each year. All known and remaining populations of rosy two-toned beardtongue and Nye milkvetch will also be monitored annually during the spring when they are detectable and identifiable; methods and results will be included in the annual rare plant monitoring report due July 1.

ADAPTIVE MANAGEMENT

If monitoring indicates that success standards will not be met, then adaptive management measures will be suggested and implemented to ensure success. Recommendations for corrective measures will be made in reports, or in monitoring data sheets and progress reports if urgent and will be implemented in a timely manner with the approval of the BLM. Examples of adaptive management include increased

watering, more seed applications, additional weed management, herbivory control, planting of additional nursery stock or salvage cacti and yucca, and erosion control. Close attention will be paid to potential issues and adaptive management will be recommended and implemented as soon as problems arise to keep the Project on track for success.

VIII. Success Standards and Site Release

The success standards for site release are detailed below in Table 22 and are guided by the BLM's *Restoration Plan Template* (BLM 2019a). The results of the baseline vegetation sampling completed for the Project in spring 2018 (Appendix A; PBC 2019b), which included sampling of the percent cover, density, and species richness of the four vegetation alliances in the Project Area, may be used as a reference for the target plant community.

For D-0 and D-1 disturbance level areas, vegetation will be qualitatively compared to a pre-selected, comparable reference area and/or to the pre-Project conditions documented during the baseline vegetation sampling conducted for the Project (Appendix A; PBC 2019b); these sites could be released on year 7 or 14 (depending on disturbance levels [Table 20]) following seedling emergence if the BLM determines that key site characteristics have been met. For D-2 and D-3 disturbance level areas, site restoration will be considered successful if plant cover, density, and species richness of native perennial vegetation is equal to or greater than 70% of the values for the reference area or baseline vegetation sampling (Appendix A; PBC 2019b); the site(s) will be released from further maintenance, management, and monitoring if the success standards are met in years 14 or 16 (depending on disturbance levels [Table 20]) and all weed management objectives have been met for the previous two years of monitoring.

Management of non-native and noxious weeds will continue for the life of the Project; weeds will be kept to an equal or lower density than on adjacent reference sites or pre-Project conditions.

Table 21. Monitoring/reporting timeframes.

Monitoring/Reporting Task	PRE-CONSTRUCTION	DURING CONSTRUCTION	POST-CONSTRUCTION			
			Year 1	Year 2	Years 3 and 4	Year 5 +
SITE RESTORATION						
As-Built Report	--	--	60 days following completion	--	--	--
Qualitative Monitoring						
Site Inspection/Visual Assessment	--	--	Monthly	Quarterly	Biannually	Annually
Photo monitoring	--	--	Biannually	Annually	Annually	Annually
Monitoring Report	--	--	Within 2 weeks	Within 1 month	Within 2 months	July 1
Quantitative Monitoring						
Transect/Plot Monitoring	--	--	Annually	Annually	Annually	Annually
Monitoring Report	--	--	July 1	July 1	July 1	July 1
WEED						
Weed Monitoring	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly	Feb., Mar., Aug: multiple visits per month; rest of the year: once monthly
Progress Report	Within 2 weeks	Within 2 weeks	Within 2 weeks	Within 2 weeks	Within 2 weeks	Within 2 weeks
Biannual/Annual Report	--	July 1 and December 31	July 1 and December 31	July 1 and December 31	July 1 and December 31	December 31
VEGETATION						
Plot Monitoring	Set up plots	Annually	Annually	Annually	Annually	Annually
Annual Report	--	July 1	July 1	July 1	July 1	July 1
CACTI/YUCCA						
Cacti/Yucca Report	--	--	July 1	--	--	--
RARE PLANT						
Population Monitoring	Annually	Annually	Annually	Annually	Annually	Annually
Annual Report	July 1	July 1	July 1	July 1	July 1	July 1

Table 22. Final restoration success standards for site release.

Success Metric	Standard for Site Release
Cover of perennial species	70% of reference site or baseline*
Density of perennial species	70% of reference site or baseline*
Richness of perennial species	70% of reference site or baseline*
Number of dominant species	70% of reference site or baseline*
Biocrust cover and richness	70% of reference site or baseline
Survival of outplanted cacti and yucca	80% of salvaged individuals
Annual species	70% of reference site or baseline
Non-native species cover	Equal to or less than reference site or baseline
Non-native species richness	Equal to or less than reference site or baseline
Resistance to non-native species	Qualitative, but generally equal to or greater than reference site or baseline
Seedling recruitment	Qualitative, but generally equal to or greater than reference site or baseline
Lack of significant erosion	Qualitative, but generally equal to or less than reference site or baseline
Evidence of wildlife use	Qualitative, but generally equal to or greater than reference site or baseline

* Does not include cacti or yucca.

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APPENDICES

Appendix A:

Botanical Resources Report for the Gemini Solar Project (PBC 2019b)

[Refer to Botanical Report for full text]

Appendix B:

Salvage, Stockpiling, and Final Transplanting of Cacti and Yucca (BLM 2013) and Cacti and Yucca Salvage/Transplant Best Management Practices (BLM 2019a)

SALVAGE, STOCKPILING, AND FINAL TRANSPLANTING OF CACTI AND YUCCA

Salvage: The salvaging contractor will identify on site with flagging tape all cacti and yucca that are subject for removal and will mark the north orientation for any barrel or Joshua tree. The following plants will be salvaged: 1) all yucca, 2) barrel cactus, 3) hedgehog, 4) cottontops, 5) all beavertail cactus; and 6) all cholla LESS THAN 3 FEET IN HEIGHT.

Cholla over 3 feet in height and Joshua trees over 10 feet in height do **not** need to be salvaged. This material will be used as vertical mulch and spread over the surface of the restored areas to prevent possible trespass.

During the survey, all yucca clusters will be counted as separate plants. Since the material will not be used immediately, it needs to be stockpiled in a location that can be protected (fenced). Cacti and yucca are very willow-rooted.

- Cacti should be dug by hand and carefully removed in order to not damage roots.
- Yucca must be salvaged with heavy equipment (eg, front end loader). The material must be carefully extracted to not damage any of the roots, stems, or lower part of the plant. The material must be transplanted to a stockpiling area immediately.

Stockpiling: The salvage can be transferred to prepared 3-foot wide, 18-inch deep stockpiling trenches of any desired length. If using multiple, parallel trenches, they should be far enough apart to allow heavy equipment access to each trench. Trenches will be watered thoroughly prior to transplanting material. In planting cacti and yucca, they should be placed in the trench and planted with native soil. Care should be taken to properly tamp down and compact all soil around roots of plants to remove all air pockets. A depression around each plant should be formed to hold water. After cacti are transplanted, they will be watered thoroughly one time. A one-time watering approximately 15 days after planting will occur to remove or minimize any air pockets and assure proper soil compaction. Yucca will be placed in the trenches and the soil tamped by hand around the base of the plant so that there are no air pockets. To reduce watering, DriWater can be applied to each yucca. DriWater is a gelatinous polymer that slowly breaks down to water over time. DriWater comes in biodegradable cartons and is applied by cutting the top of the carton and placing it upsidedown around the plant to be watered. The area around the plant must be thoroughly wet to activate the DriWater. The DriWater is applied around the base of the plant at a rate of one quart for every foot in plant height. DriWater cartons are to be buried completely. At the surface, a watering well will be formed around the plant. Afterward, the plant will be watered thoroughly again. A 9-inch soil moisture probe (which can be obtained from any commercial plant nursery) will be used after 2 weeks to assess the moisture of the soil to see if further watering is needed. If the probe reads “dry” on the moisture scale, then a second watering will be done.

Final Planting at Landscape Sites: All salvaged plant material will be replanted in a natural pattern. Large yucca will be carefully removed from the stockpiling area, taking care to not damage stems, roots, or the base of the plant. A hole at least two feet deep and three feet wide will be prepared for each single stem yucca. Multiple stem plantings will be accordingly larger to accommodate the stem size. The hole will be filled with water and allowed to drain once. Then the hole will be filled with water again and then back-filled with soil to form a muddy matrix to about 18 inches from the surface. The yucca will then be planted and the soil tamped around the plant so that there are no air pockets. DriWater will be applied around the plant at a rate of one quart for every foot in height. DriWater cartons are to be

buried completely. At the surface, a watering well will be formed around the plant. Afterward, the plant will be watered thoroughly again. A 9-inch soil moisture probe (which can be obtained from any commercial plant nursery) will be used after 2 weeks to assess the moisture of the soil to see if further watering is needed. If the probe reads “dry” on the moisture scale, then a second watering will be done. Mojave yuccas will be re-planted in groups of three or more for a natural effect. All small cacti will be watered thoroughly one time upon being transplanted into the field. Transplanting and maintenance of plant material will be done such that 80 percent survivorship after 2 years is achieved.

CACTI & YUCCA SALVAGE/TRANSPLANT BMPS

- **Methods for Extraction, Handling, and Transplanting**
  All salvage activities will take place in fall, winter, or early spring to minimize plant stress. It is assumed that an experienced Vegetation Salvage Contractor will already have proven strategies for successful transplantation in hand, including proprietary techniques developed from their own experience; however, they will be provided a copy of Salvage, Stockpiling, and Final Transplanting of Cacti and Yucca, BLM 2013 (Appendix 1) for guidance and reference, and all salvage methods must be consistent with these BLM guidelines. A summary of these measures is provided in this section below.
- **Extraction Procedures**
  - Yuccas will be extracted with heavy equipment (backhoes/front-end loaders), taking care not to damage roots, stems, or lower part of the plants. Salvaged yucca will be transplanted immediately. Large, widely-spaced yucca clones will inevitably break apart during extraction. These clones will be cleaned up by clipping the roots to approximately 1 foot in length and then transplanted as individuals. Yuccas have extremely sharp and stiff leaves which can easily penetrate deeply into human flesh and potentially cause profound internal organ damage. Extreme care will be taken in handling this hazardous plant, including the use of eye protection and gloves. Yuccas will be handled using heavy machinery, using long pitchforks to help with moving and positioning. Salvage workers will keep a safe distance from any yucca elevated above head-level on machinery.
  - Cacti will be extracted by hand using conventional tools (shovels and picks). Cacti will be handled with long pitchforks, and loose soil will be shaken off of the rootball. Roots will be cleanly clipped to about the diameter of the plant, taking care to avoid lacerating the roots. Cacti will be transplanted immediately or stored under shade cloth to prevent sunburn. Cacti have sharp and vicious spines but are mostly a nuisance hazard. Heavy gloves are only moderately effective at blocking spines. Whenever practical, handling cacti will be performed with long pitchforks. Eye protection will be worn at all times while handling cacti.
- **Transplanting to Plant Nurseries**
  - The nursery will be prepared before transplanting begins. Parallel trenches will be dug into the salvaged topsoil with wide-enough spacing to accommodate loaders, backhoes and watering trucks. Each trench will be at least approximately 18 inches deep and 3 feet wide. Immediately before transplanting, each trench will be soaked deeply with water and allowed to drain. It is recommended to plant similar cactus species together, with individuals of similar size class together. This helps in controlling watering rates for different species and sizes of plants (Baker, pers. com.). Cactus and yucca will be transplanted directly into moist trenches, maintaining their original north-facing orientation. Yucca will be planted at least one foot apart. Long pitchforks will be used to hold plants in place while backfilling with trench soil. Soil will be carefully tamped down to reduce air pockets, and a shallow berm will be created around each plant for watering. Watering Guidelines are as follows:
    - Water thoroughly immediately after transplant;

        - Water thoroughly 2 weeks after transplant;
        - Water additionally as needed, but no more frequently than every 2 months to avoid root rot; and
        - Remove or minimize any air pockets and assure proper soil compaction. Care should be taken to properly compact all soil around the roots of plants that are directly transplanted.
    - Cacti will be extracted from the nurseries using hand tools, carefully shaking off loose soil and clipping roots to about the diameter of the plant. Transplanting holes will be dug approximately 1 foot deep and 2 feet wide. Immediately before transplanting each hole will be filled with water and allowed to drain. Cacti will be positioned within the holes, maintaining their original north-facing orientation. One worker will hold the cacti in place while the other worker carefully backfills with loose soil. Soil will be tamped down lightly, and a watering berm will be formed around each plant. Plants will be watered thoroughly after transplanting.
    - For yuccas, transplanting holes will be dug approximately 2 feet deep and 3 feet wide or larger for clones and larger plants. Yuccas will be carefully extracted using backhoes or loaders, being careful to avoid damaging the roots and lower stems. Immediately before transplanting, the holes will be filled with water and allowed to drain. The holes will then be refilled with water and backfilled halfway with soil to create a muddy slurry. Yuccas will be placed into this muddy slurry, maintaining their original north-facing-orientation, and the remainder of the holes will then be backfilled. A watering berm will be formed around each plant, and each plant will then be watered again thoroughly. After 2 weeks, soil water moisture will be checked with a probe to determine if additional watering is needed. Transplanted cacti and yucca will be watered in this sequence:
        - Water thoroughly immediately after transplant;
        - Water thoroughly 2 weeks after transplant; and
        - Water additionally as needed, but no more frequently than every 2 months to avoid root rot.