Ironwood Consulting

550 S. Eastern Ave., Suite 253
Las Vegas, NV 89123
(702) 563-4479
www.ironwoodbio.com

Clark County Rare Plant 2023 Survey Report

August 2023

Final Survey Report

Submitted to:
Clark County, Nevada
Desert Conservation Program
4701 W. Russell Rd. Suite 200
Las Vegas, Nevada 89118
Attn: Stefanie Ferrazzano

Project Number: 2019-Ironwood-1942A

Table of Contents

List of Appendices

List of Tables

List of Figures

List of Appendices

Acronyms

Acronym	Definition
ac	acre
BLM	Bureau of Land Management
DCP	Desert Conservation Program
EO	element occurrence
ft	feet
GIS	Geographic Information System
ha	hectare
in	inches
Ironwood	Ironwood Consulting, Inc.
km	kilometer
m	meter
mi	mile
MSHCP	Multiple Species Habitat Conservation Plan
PM	Project Manager
QA/QC	quality assurance/quality control
NDNH	Nevada Division of Natural Heritage

Executive Summary

This report provides the results from the 2023 field surveys within Clark County, Nevada, completed by Ironwood Consulting, Inc. between April 10 and 22 and again between May 1 and May 20, 2023. The project goals were to 1) expand the known occurrence datasets for 10 target rare plant species, 2) ground-truth habitat suitability models developed for each species, and 3) secure information about rare plant and milkweed presence in areas at risk for development or disturbance by human activities.

Ironwood surveys resulted in 36 rare plant occurrence records occupying 592 of the 12,492 acres (239 of 5,055 hectares [ha]) surveyed within Clark County. Fourteen rare plant taxa were encountered, including seven of the 10 target taxa. Rare plant occurrences were recorded at 23 of the 85 surveyed areas.

Recommendations include completing future surveys to target *Calochortus striatus* (alkali mariposa lily), *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat), and *Phacelia parishii* (Parish phacelia), which were not encountered during these surveys. Ironwood botanists recorded three *Sisyrinchium* spp. occurrences, with one of these identified as *S. radicatum*. However, the taxonomic relationships between *Sisyrinchium radicatum* (St. George Blue Eyed Grass) and its sister taxa occurring within Clark County remain unresolved, making species-level identification ambiguous. Recommendations also include supporting additional research to help untangle the taxonomy within this genus and improve upon available field keys. Finally, we recommend removing two ostensibly incorrect historic element occurrence records for *Penstemon albomarginatus* and *Phacelia parishii* from the existing habitat suitability models provided by the Desert Conservation Program to improve their performance.

1. Introduction

1.1 Project Description

The Clark County Desert Conservation Program (DCP) contracted Ironwood Consulting, Inc. (Ironwood) to complete surveys within Clark County, Nevada (County) for 10 primary target plant species where habitat has been modeled but presence has not yet been verified. In addition to these 10 target plant species, the secondary objective was to also record encounters for rare plant species that are protected by the state of Nevada, covered under the Clark County Multiple Species Habitat Conservation Plan (MSHCP), or have Bureau of Land Management (BLM) sensitive or special status. All modeled and non-modeled primary and secondary species are tracked by the Nevada Division of Natural Heritage (NDNH). Finally, there has been recent interest in the monarch butterfly as a candidate species gaining federal protections under the Endangered Species Act and its possible inclusion in the MSHCP. Therefore, the third objective of this project included mapping basic monarch habitat, identified as stands or individuals of milkweed (*Asclepias* spp.) that were incidentally encountered during the field-based targeted plant surveys. Completing the combined objectives of this project required focused field surveys that implemented a rigorous data collection protocol, using existing habitat models provided by the DCP to determine survey areas.

This annual survey report describes the approach that Ironwood used to meet the project objectives and complete surveys during the spring of 2023 for the primary target species, outlined in Table 1-1. Secondary target species and milkweed species were surveyed for and documented when suitable habitat was present in the survey areas.

Table 1-1. Target plants for survey

Target Species	Upland or Wetland Habitat
Anulocaulis leiosolenus (sticky ringstem)	Upland
Astragalus geyeri var. *triquetrus* (threecorner milkvetch)	Upland
Calochortus striatus (alkali mariposa lily)	Wetland (spring, seep, and wet meadow)
Enceliopsis argophylla (silverleaf sunray)	Upland
Eriogonum bifurcatum (Pahrump Valley buckwheat)	Upland
Eriogonum corymbosum var. *nilesii* (Las Vegas buckwheat)	Upland
Eriogonum viscidulum (sticky buckwheat)	Upland
Penstemon albomarginatus (white margined beardtongue)	Upland
Phacelia parishii (Parish phacelia)	Upland
Sisyrinchium radicatum (St. George blue eyed grass)	Wetland (spring, seep, and wet meadow)

1.2 Goals and Objectives of the Project

The goals of the project, as identified by the DCP, were to:

- Expand the known occurrence datasets for the target species.
- Ground truth habitat suitability models developed for each species.
- Secure information about rare plants and milkweed presence in areas at risk for development or disturbance by human activities.

Further, the DCP also identified the following project parameters:

- Survey a minimum of 12,000 acres (ac; 4856.2 hectares [ha]) throughout the course of the project.
- Prioritize survey areas that are identified in at least one of the habitat suitability models for the primary target species.
- Prioritize (but not be limited to) survey areas that are within or near current or predicted future BLM disposal boundaries, are within current municipal borders, and are on the edge of areas with current (or potential future) human development, including municipalities, townships, alternate energy development and transmission corridors, mining interests, etc.
- Prioritize survey areas that are within the MSHCP Amendment Reserve System.
- Maximize efficiencies by focusing on areas where multiple target species may be found.
- Spatially distribute selected survey sites for the greatest information about the true species range.

2. Methods and Materials

Ironwood completed a project Work Plan (Ironwood 2023b) and a Data Management Plan (Ironwood 2023a) that detailed the rare plant survey methods, including pre-field coordination, survey area selection, equipment

and materials, data management protocols, injury and illness prevention plans, and contingency plans for unexpected events. Field methods, data management practices, and analysis methods are outlined below.

2.1 Survey Area Determination

At the beginning of the pre-survey planning, the County provided Ironwood with the following Geographic Information System (GIS) data:

- Habitat models for each target species, if available
- BLM lands currently available for disposal
- Future BLM disposal lands within Clark County
- MSHCP Amendment proposed Reserve System
- Known survey and occurrence data (clipped by species and region)

The identification of survey sites was completed in coordination with the DCP. The selected sites were discrete locations at 108 unique survey areas. These were separated into two general categories of 1) 53 upland sites, and 2) 55 small wetland survey sites. The upland sites were selected to target *Anulocaulis leiosolenus* (sticky ringstem), *Enceliopsis argophylla* (silverleaf sunray), *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat), *Penstemon albomarginatus* (white margined beardtongue), *Phacelia parishii* (Parish phacelia), *Astragalus geyeri* var. *triquetrus* (threecorner milkvetch), *Eriogonum bifurcatum* (Pahrump valley buckwheat), and *Eriogonum viscidulum* (sticky buckwheat). The wetland survey sites were selected to target *Calochortus striatus* (alkali mariposa lily) and *Sisyrinchium radicatum* (St. George blue eyed grass), which are known to occur in seeps, springs, and wet meadows.

Table ***2-1*** outlines the upland field survey sites and total potential survey acreage. Areas with modeled habitat suitability and areas selected by the BLM for future disposal were prioritized for selection. The wetland sites were excluded from the total potential survey acreage tally in Table ***2-1*** because their footprints were small and their acreage contribution was negligible. Figure 2-1 shows the general locations throughout Clark County where Ironwood delineated upland survey areas. Location names follow named features identified at or near the area, based on USGS and BLM basemaps.

Table 2-1. Upland survey areas and total acreage*

Upland Survey Area Name	Total Area (ac)
Arrow Canyon	1,426.5
Arrow Canyon Wash	256.9
Arrowhead Trail	579.7
Arrowhead Trail North	637.3
Barren	170.0
Bitter Springs North	23.4
Bonus ERBI	1,180.2
Coyote	1,013.1
Dry Lake	774.1
East Mormon 1	338.5
East Mormon 2	199.6
Echo Hills North	85.5

Upland Survey Area Name	Total Area (ac)
Flat Top Mesa	683.1
Gunship ERBI	835.8
Hidden Valley Alkali E	253.2
Hidden Valley Alkali	432.6
Hidden Valley North	640.2
Hidden Valley Disposal	785.1
I-15 Corridor	365.4
Indian Springs	339.1
Indian Springs East	233.0
Jean Lake East	259.2
Jean Lake North	472.1
Landfill Disposal	350.1
Lava	201.5
Lower Niavi Wash	538.3
Mikes Camp	405.7
N Moapa Valley Blvd	180.1
Niavi Wash	1,028.9
Noname ERBI	103.3
Primm Disposal East	385.4
Primm Disposal North	35.9
Primm Disposal West	531.8
Pulsipher Wash	205.5
Railroad Underpass	420.3
Red Needle	1,072.6
Revisit PEAL	440.4
Riverside Road	456.6
Rural ERBI	578.6
Section 11	219.9
Stateline ERBI	49.9
Stateline ERBI Two	359.7
Town Wash	100.9
Unnamed Polygon	389.1
Ute Infill	424.5
Ute Infill 2	1,863.3
West Mormon 1	207.2
West Mormon 2	536.1
West Mormon 3	407.8
West Mormon 4	892.6
West Mormon 5	733.4
West Mormon 6	532.7
Yucca Forest Valley	1,735.0
Total Acreage of Upland Survey Areas:	**27,370.7**

*Wetland survey areas contributed negligible potential survey acreage and are omitted here.

2.2 Field Survey Equipment

The following necessary materials, vehicles, and equipment were used to fulfill the contract:

- GPS units – Each crew (two to six botanists) used a recreational grade GPS receiver or smart phone/tablet which was used to input field data into the data dictionary. These typically have 3- to 6-meter (m) accuracy – enough accuracy for target species to be relocated over time.
- Data collection interface – ESRI Field Maps and Survey123 applications have been used by the contractor with excellent results and allow data to be transferred to the server in real time. Ironwood created a data collection interface compatible with cell phones and tablets that was used in the field for all data required under the contract.
- Data collection devices – botanists used cell phones and tablets in the field that connect to cloud storage and provide accurate, real-time data for QA/QC and analysis.
- Miscellaneous field equipment included data sheets, copies of maps (electronic and paper), compasses, GPS units, field keys, hand lenses, and other field equipment.
- Ironwood created a project binder containing the work plan and all other relevant information (maps, figures, protocols, contact information, worker injury and illness prevention plan); and distributed it to field teams for reference and use.

2.3 Field Data Collection for Targeted Rare Plants

Sample methods followed the BLM Rare Plant Sampling Methods for intuitive controlled surveys and followed the survey and documentation guidelines set by the NDNH Standard Field Survey Methods (Appendix A:).

Surveys included a combination of coarse-scaled surveys that assessed the quality of habitat in an area and focused surveys that more thoroughly covered high-quality habitat areas for the presence or absence of target species, per BLM survey guidance provided by the County in the SOW.

A typical site survey consisted of the following:

- During all surveys, the botanist team collected tracks on a 5-m accuracy GPS unit to document the survey site coverage and acreage.
- The botanist team would have begun surveys by assessing the site for habitat characteristics and quality. Habitat for more than one target species might have been present at any site, based on the habitat models.
- Assessment of a site would have taken place on a coarse scale. Assessments utilized intuitive, controlled survey methods outlined in the BLM guidance. The botanist team would determine habitat quality using survey intervals of up to 50 m (depending on the site's target species) in areas where habitat characteristics for target species were not present or habitat quality was poor.
- In areas where habitat quality for target species was moderate or high, the botanist team conducted more focused surveys with smaller survey intervals (dependent on the target species). For larger, more charismatic species, a wider survey interval (e.g., 20 to 30 m) would be used. For smaller species, a smaller interval (e.g., 5 to 15 m) would be used.

- When a target species individual or population was observed, the botanist team would search the area for individuals, marking each with a pin flag. After the population boundaries were determined, tally data would be collected using a GPS unit and ESRI Field Maps interface. Three photographs would be taken: 1) a close-up photo of a diagnostic part of the plant, 2) a photo of the entire plant, and 3) a photo of the plant in its habitat.
- A NDNH Element Occurrence form would be filled in completely though the Survey123 application form that Ironwood developed. Survey123 then exported a completed form designed to appear identical to the NDNH fillable PDF Element Occurrence form.
- A single population was generally considered to be all individuals separated by a gap between plants of less than 0.5-mile (mi) radius.
- All data was saved and uploaded immediately to Ironwood's cloud interface. If cellular signals were not available, data was uploaded upon entering back into cellular service.
- Survey intervals varied based on terrain, habitat quality, and vegetation cover/visibility. Professional judgement of highly qualified botanists was used in the field to determine survey interval at each site.

During surveys, only existing roads were used to access the survey area. No off-road travel was permitted. All surveys occurred on foot. The project crew typically camped on public lands on or near the survey sites.

2.4 Comprehensive Floristic Inventory List

A running list of every vascular plant taxon encountered within each upland survey area was recorded to document the survey area's floristic diversity. Where applicable, taxa were identified for the subspecies or variety. However, plant phenology sometimes prevented identification to these levels, and in these cases, taxa were only identified to the specific or generic (species or genus) level. The taxonomic authority for species was the *Flora of North America* (Flora of North America Editorial Committee eds 1993+).Taxonomic sources for identifying species included *A Flora of Nevada* (Kartesz 1987), *The Jepson eflora* (Jepson Flora Project 2023). The NDNH's Information, Tracking Lists, element occurrence (EO) forms, and other forms website was referenced for species information and floristic survey protocols (NDNH 2023).

2.5 Field Data Collection for Incidental *Asclepias* spp. (Milkweed) Encounters

While surveying for the ten target plants, if surveyors incidentally encountered any species of *Asclepias*, data was collected. No data form outline was provided by the DCP for this portion of the project. When *Asclepias* was encountered, the following data was collected in Field Maps:

- Scientific name
- Geographic coordinates
- Radius around the point that included occupied habitat
- Number of individuals observed

Data uploads to the cloud and backups followed the procedures described above and in the Data Management Plan (Ironwood 2023b).

2.6 Data Management and Quality Control

All spatial and EO data was recorded electronically on the application interface designed for the project using ESRI Field Maps and ESRI Survey123. Data was uploaded to the cloud server in real time or at the end of the workday (if cellular service was not available at a site) and backed-up each evening. All photos were saved, labeled, and backed up each evening. If necessary, technical adjustments to the data collection interface were made to ensure data quality and efficiency. The field crew collected GPS tracks throughout the entire survey to enable acreage calculations summing to 12,000 per the project contract.

The Project Manager (PM) and/or Assistant PMs were in the field for all data collection to ensure that the workplan was followed and data documentation followed standardized procedures approved by the County. Daily quality assurance/quality control (QA/QC) of data was completed by the PM and/or the Assistant PMs. Data was then reviewed at the end of each field day by the PM and/or Assistant PMs to ensure completeness, accuracy, and quality. Inaccurate or incomplete data was rectified within 24 hours of original data collection whenever possible.

3. Results

3.1 Survey Sites, Habitat, and Acreages

Surveys occurred between April 10 and 22, and again between May 1 and May 20, 2023. Ironwood botanists surveyed in teams of two to six and covered approximately 12,500 ac (5,059 ha) across all survey sites. Maps of each survey area with survey sites delineated and EO record locations shown are included in Appendix B: and Appendix C:. EO records for each rare plant documented during surveys are described below in sections 3.3 and 3.4. All EO records with photo documentation and specific geospatial data for each are included in the 2023 Project Data Deliverable. Representative photos of the survey sites and EOs are in Appendix D:.

Table 3-1. Total surveyed acreage for upland and wetland survey areas and survey area figure number.

Upland Survey Area Name	Surveyed Area (ac)	Figure
Arrow Canyon	932.8	B-1
Arrow Canyon Wash	155.1	B-2
Arrowhead Trail	-	-
Arrowhead Trail North	-	-
Barren	110.4	B-3
Bitter Springs North	13.0	B-4
Bonus ERBI	1,050.5	B-5
Coyote	377.2	B-6
Dry Lake	178.7	B-7
East Mormon 1	29.7	B-8
East Mormon 2	154.0	B-9
Echo Hills North	36.5	B-11
Flat Top Mesa	-	-
Gunship ERBI	766.8	B-12

Upland Survey Area Name	Surveyed Area (ac)	Figure
Hidden Valley Alkali E	161.4	B-13
Hidden Valley Alkali	140.2	B-13
Hidden Valley North	424.6	B-14
Hidden Valley Disposal	412.3	B-15
I-15 Corridor	-	-
Indian Springs	166.5	B-16
Indian Springs East	220.2	B-17
Jean Lake East	127.9	B-18
Jean Lake North	369.0	B-19
Landfill Disposal	527.2	B-20
Lava	18.2	B-21
Lower Niavi Wash	152.9	B-22
Mikes Camp	195.7	B-23
N Moapa Valley Blvd	92.9	B-25
Niavi Wash	202.6	B-27
Noname ERBI	139.5	B-28
Primm Disposal East	385.4	B-29
Primm Disposal North	-	-
Primm Disposal West	485.9	B-29
Pulsipher Wash	-	-
Railroad Underpass	289.3	B-30
Red Needle	333.8	B-31
Revisit PEAL	221.0	B-32
Riverside Road	-	-
Rural ERBI	1,093.0	B-33
Section 11	93.8	B-34
Stateline ERBI	58.8	B-35
Stateline ERBI Two	241.2	B-36
Town Wash	-	-
Unnamed Polygon	206.5	B-37
Ute Infill	-	-
Ute Infill 2	-	-
West Mormon 1	121.9	B-38
West Mormon 2	185.8	B-39
West Mormon 3	206.9	B-40
West Mormon 4	208.9	B-41
West Mormon 5	159.8	B-42
West Mormon 6	192.3	B-43
Yucca Forest Valley	134.2	B-44
Opportunistic Upland Survey Area Name*		
East Mormon Private+	10.9	B-10
Mormon Mesa Reserve	58.6	B-24

Upland Survey Area Name	Surveyed Area (ac)	Figure
Near Sandy Valley	553.5	B-26
Wetland Survey Areas		
Bullion Spring	2.2	C-1
Clarks Well	3.4	C-2
Cow Spring	4.4	C-3
Crescent Spring	0.7	C-4
Gann Spring	1.9	C-5
Gass Spring	1.1	C-6
Highland Spring	1.9	C-7
Huse Spring	2.9	C-8
Kiup Spring	4.3	C-9
Lower White Blotch	2.3	C-10
McCullough Spring	0.3	C-11
Next to Bitter	2.0	C-12
Ninetynine Spring	8.4	C-13
Ora Hanna Spring	0.6	C-14
Perkins Spring	0.6	C-15
Pipe Spring	3.9	C-16
Quail Spring	1.9	C-17
Quail Spring II	1.6	C-18
Rainbow-Bootleg Spring	11.8	C-19
Red Bluff Spring	7.0	C-20
RR Spring 1	0.6	C-21
RR Spring 2	9.4	C-21
Tule Spring	2.1	C-22
Unnamed Seep/Unnamed Repeat	11.0	C-23
Unnamed Spring 1	5.3	C-24
Unnamed Spring 2	4.3	C-25
Upper White Blotch	1.7	C-26
Walker Spring	1.5	C-27
White Spot Spring	2.1	C-28
Willow Spring	4.8	C-29
Total Acreage for All Survey Areas:	**12,492.4**	

*Opportunistic surveys included areas outside of the delineated general survey areas based on suitable habitat observed in the field.

+Permission to access this private parcel was granted by the landowner at the time of survey.

3.2 Comprehensive Floristic Inventory List

Four hundred unique taxa were identified during the 2023 survey. Appendix E: lists the encountered plants by survey area group. The species lists for each individual sample site within the larger survey region were grouped by geographic proximity, as described in Table ***3-2***, to produce the overall Survey Area Species List.

Table 3-2. List of survey areas included in each floristic inventory group.

Floristic Inventory Survey Group	Included Survey Areas
Arrow Canyon/Coyote Springs Group	Arrow Canyon, Coyote Springs
Bitter Springs & Echo Hills North	Bitter Springs, Echo Hills North
Bonus ERBI	Bonus ERBI
Dry Lake & Hidden Valley Alkali Group	Dry Lake, Hidden Valley Alkali, Hidden Valley Alkali East
East Mormon Group	East Mormon 1, East Mormon 2, East Mormon Private
Hidden Valley/Jean Lake Group	Hidden Valley Disposal, Hidden Valley North, Jean Lake East, Jean Lake North
Indian Springs Group	Indian Springs, Indian Springs East, Lower Niavi Wash, Niavi Wash
Laughlin Group	Landfill Disposal, Mikes Camp
Primm Group	Primm Disposal East, Primm Disposal North, Primm Disposal West
Railroad Underpass Group	Arrow Canyon Wash, Barren I15 Corridor, Railroad Underpass, Section 11, Unnamed Polygon
Red Needle & Lava Group	Red Needle, Lava
Revisit PEAL	Revisit PEAL
Sandy Valley Group	Gunship ERBI, Near Sandy Valley, Noname ERBI, Rural ERBI, Stateline ERBI, Stateline ERBI 2
West Mormon Group	N Moapa Valley Blvd, Mormon Mesa Reserve, West Mormon 1, West Mormon 2, West Mormon 3, West Mormon 4, West Mormon 5, West Mormon 6
Yucca Forest Valley	Yucca Forest Valley

3.3 Primary Modeled Target Species Occurrences

3.3.1 *Anulocaulis leiosolenus* (Sticky Ringstem)

Anulocaulis leiosolenus (sticky ringstem) was found at Bitter Springs North and Echo Hills North survey areas, as summarized in Table ***3-3***, and Figures B-4 and B-11 in Appendix B:. Both locations represent new occurrence records. All occupied areas were modeled as optimal habitat suitability by the species-specific habitat model provided by the DCP. The total occupied area included approximately 0.16 ac (0.06 ha) and 11 individuals. The mean elevation range across occurrences was 551 to 581 m (1,807 to 1,906 feet [ft]). Common associated species encountered at multiple occurrences included *Arctomecon californica* (Las Vegas bearpoppy), *Enceliopsis argophylla* (silverleaf sunray), *Larrea tridentata* (creosote bush), *Petalonyx parryi* (Parry's sandpaper plant), *Psorothamnus fremontii* (Fremont indigo bush). At these occurrences, invasive weeds had relatively low cover and were restricted to scattered patches under shade of larger shrubs. The overall quality of each occurrence varied from poor to good, largely due to the presence of invasive weeds, and observed signs from wild burros and OHV use outside of designated routes.

Table 3-3. The 2023 survey occurrence summary for *Anulocaulis leiosolenus* (sticky ringstem).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Anulocaulis leiosolenus Sticky ringstem	2027	Bitter Springs North	Optimal	0.1	3	Good	581	No
	2030	Echo Hills North	Optimal	0.06	8	Poor	551	No
Summary			**Optimal**	**0.16**	**11**	**Poor - Good**	**566**	

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

Astragalus geyeri var. *triquetrus* (threecorner milkvetch) was found at the East Mormon Private and West Mormon 2 survey areas, as summarized in Table ***3-4***, and Figures B-10 and B-39 in Appendix B:. Both locations represent new occurrence records. All occupied areas were modeled as optimal habitat suitability by the species-specific habitat model provided by the DCP. The total occupied area included approximately 0.1 ac (0.04 ha) and 14 individuals. The mean elevation range across occurrences was 399 to 509 m (1,309 to 1,669 ft). Common associated species encountered at both occurrences included *Astragalus sabulonum* (gravel milkvetch), *Hilaria rigida* (big galleta), *Oenothera deltoides* (large desert evening primrose), and *Sphaeralcea ambigua* (apricot mallow). At these occurrences, invasive weeds had relatively low cover. The overall quality of each occurrence was described as fair, largely due to the presence of only a few individuals of diminutive size present at each location.

Table 3-4. The 2023 survey occurrence summary for *Astragalus geyeri* var. *triquetrus* (threecorner milkvetch).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Astragalus geyeri var. *triquetrus* Threecorner milkvetch	1020	East Mormon Private	Optimal	0.001	4	Fair	399	No
	2017	West Mormon 2	Optimal	0.1	10	Fair	509	No
Summary			**Optimal**	**0.1**	**14**	**Fair**	**454**	

3.3.3 *Enceliopsis argophylla* (Silverleaf Sunray)

Enceliopsis argophylla (silverleaf sunray) was found at the Arrow Canyon, Bitter Springs North, Echo Hills North, and Lava survey areas, as summarized in Table ***3-5***, and Figures B-1, B-4, B-11, and B-21 in Appendix B:. All locations represent new occurrence records. The occupied areas were modeled as unsuitable, suitable, or optimal habitat suitability by the species-specific habitat model provided by the DCP. However, one of the occupied locations was not rated by the habitat model. The total occupied area included approximately 21.8 ac (8.9 ha) and 614 individuals. The mean elevation range across occurrences was 472 to 659 m (1,548 to 2,162 ft). Common associated species encountered at multiple occurrences included *Anulocaulis leiosolenus, Arctomecon*

californica, *Ephedra torreyana* (Mormon tea), *Larrea tridentata*, and *Psorothamnus fremontii*. The overall quality of each occurrence varied from poor to good. Factors impacting quality across occurrences included impacts from drought (e.g., few reproductive individuals encountered), and OHV tracks observed off designated routes and running through the occupied area.

At the time of survey, *Enceliopsis* individuals encountered at Arrow Canyon did not have mature reproductive features. Therefore, identification of the plant at this location could not be entirely validated and a return visit would be beneficial to confirm its identity.

Table 3-5. The 2023 survey occurrence summary for *Enceliopsis argophylla* (silverleaf sunray).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Enceliopsis argophylla Silverleaf sunray	1026	Lava	Suitable	14.1	44	Poor	472	No
	2025	Bitter Springs North	Suitable	0.7	100	Good	580	No
	2029	Echo Hills North	Suitable - Optimal	5.6	439	Good	549	No
	5109	Arrow Canyon	Unsuitable	1.4	31	Good	659	No
Summary			**Unsuitable - Optimal**	**21.8**	**614**	**Poor - Good**	**565**	

3.3.4 *Eriogonum bifurcatum* (Pahrump Valley Buckwheat)

Eriogonum bifurcatum (Pahrump Valley buckwheat) was found at the Near Sandy Valley and Rural ERBI survey areas, as summarized in Table ***3-6***, and Figures B-26 and B-33 in Appendix B:. Three of the four occurrences were located within 0.5 mi of an existing record. Occupied areas within the modeled area were rated as unsuitable, marginal, suitable, or optimal habitat suitability by the species-specific habitat model provided by the DCP. However, two of the occupied areas were not rated by the model. The total occupied area included approximately 246.8 ac (99.8 ha) and more than an estimated 92,000 individuals. The mean elevation range across occurrences was 796 to 828m (2,611 to 2,716 ft). Common associated species encountered at multiple occurrences included *Ambrosia dumosa* (bursage), *Atriplex confertifolia* (shadscale saltbush), *Eriogonum trichopes* (little desert trumpet), and *Larrea tridentata*. At these occurrences, invasive weeds, such as *Bromus rubens* and *Salsola tragus* (Russian thistle) had relatively low cover. The overall quality of each occurrence varied from fair to good, largely due to potential habitat loss and proximity to disturbance (e.g., proximity to dusty, unpaved roads and development). Both survey areas hosting *Eriogonum bifurcatum* are located within a proposed BLM disposal area (Figures B-26 and B-33 in Appendix B:).

Table 3-6. The 2023 survey occurrence summary for *Eriogonum bifurcatum* (Pahrump Valley buckwheat).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Eriogonum bifurcatum Pahrump Valley buckwheat	1024	Rural ERBI	Unsuitable - Marginal	0.2	7	Fair	812	Yes
	2023	Near Sandy Valley	Suitable	11.9	17,046	Good	796	Yes
	5117	Rural ERBI	Unsuitable	0.3	11	Good	828	No
	5147	Near Sandy Valley	Suitable - Optimal	234.4	75,000	Fair	796	Yes
Summary			**Unsuitable - Optimal**	**246.8**	**92,064**	**Fair - Good**	**808**	

3.3.5 *Eriogonum viscidulum* (Sticky Buckwheat)

Eriogonum viscidulum (sticky buckwheat) was found at the East Mormon 2, West Mormon 2, and West Mormon 3 survey areas, as summarized in Table ***3-7***, and Figures B-9, B-39, and B-40 in Appendix B:. Two of these occurrences were new records, while one is located within 0.5 mi of an existing record. The East Mormon 2 and West Mormon 2 occupied areas were modeled as unsuitable, marginal, or suitable habitat by the species-specific habitat model provided by the DCP, while the occupied habitat in West Mormon 3 was not rated by the model. Total occupied area included approximately 4.5 ac (1.8 ha) and an estimated 1,733 individuals. The mean elevation range across occurrences was 456 to 550 m (1,496 to 1,804 ft). Common associated species encountered at multiple occurrences included *Ambrosia dumosa*, *Ephedra* spp. (Mormon tea), and *Eriogonum trichopes*. At these occurrences, the invasive weeds *Brassica tournefourtii* (Sahara mustard) and *Schismus barbatus* (Mediterranean grass) had low to moderate cover. The overall quality of each occurrence varied from fair to good, commonly due to the presence of invasive weeds, impacts from livestock grazing, and trash dumping nearby.

Table 3-7. The 2023 survey occurrence summary for *Eriogonum viscidulum* (sticky buckwheat).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Eriogonum viscidulum Sticky buckwheat	2019	West Mormon 2	Marginal - Suitable	2.4	742	Fair	535	No
	2020	West Mormon 3	Unsuitable	1.7	960	Good	550	No
	5145	East Mormon 2	Suitable	0.4	31	Fair	456	Yes
Summary			**Unsuitable - Suitable**	**4.5**	**1,733**	**Fair - Good**	**514**	

3.3.6 *Penstemon albomarginatus* (White Margined Beardtongue)

Penstemon albomarginatus (white margined beardtongue) was found at the Hidden Valley Disposal and Jean Lake East survey areas, as summarized in Table ***3-8*** and Figures B-15 and B-18 in Appendix B:. One of the locations represents a new occurrence record while the other location is within 0.5 mi of an existing record. The occupied areas were both modeled as suitable. However, the habitat model did not rate the Jean Lake East occupied survey area. The total occupied area included approximately 0.3 ac (0.1 ha) and 11 individuals. The mean elevation range across occurrences was 855 to 910 m (2,805 to 2,985 ft). *Hilaria rigida* was the associated species recorded at the Jean Lake East occurrence. The overall quality of both occurrences was rated as poor, due to the small population size and proximity to highly trafficked OHV routes.

Table 3-8. 2023 survey occurrence summary for *Penstemon albomarginatus* (white margined beardtongue).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Penstemon albomarginatus White margined beardtongue	1017	Hidden Valley Disposal	Suitable	0.3	10	Poor	910	No
	4058	Jean Lake East	Suitable	0.005	1	Poor	855	Yes
Summary			**Suitable**	**0.3**	**11**	**Poor**	**883**	

3.3.7 *Sisyrinchium radicatum* (St. George Blue Eyed Grass)

Sisyrinchium radicatum (St. George blue eyed grass) was found at the Kiup Spring survey area, as summarized in Table ***3-9*** and Figure C-9 in Appendix C. This location represents a new occurrence record. The occupied area was rated as unsuitable by the species-specific habitat model provided by the DCP. The total occupied area included approximately 2.3 ac (0.9 ha) and 589 individuals. The mean elevation for this occurrence was 1,578 m (5,177 ft). Associated taxa included *Baccharis* sp. (groundsel tree), *Eleocharis* sp. (spikesedge), *Muhlenbergia* sp. (muhly), *Populus* sp. (cottonwood), and *Salix exigua* (sandbar willow). There was a large stand of *Acroptilon repens* (Russian knapweed) found nearby at this site. The overall quality of this occurrence was excellent due to extensive habitat and lack of direct threats.

Table 3-9. The 2023 survey occurrence summary for *Sisyrinchium radicatum* (St. George Blue Eyed Grass).

Taxon	Project-specific Internal EO No.	Survey Area	Modeled Habitat Suitability	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)	Within 0.5 mi of Existing EO?
Sisyrinchium radicatum St. George blue eyed grass	1021	Kiup Spring	Unsuitable	2.3	589	Excellent	1,578	No
Summary			**Unsuitable**	**2.3**	**589**	**Excellent**	**1,578**	

3.4 Other Species Occurrences

3.4.1 *Arctomecon californica* (Las Vegas Bearpoppy)

Arctomecon californica (Las Vegas bearpoppy) was found at the Bitter Springs North and Echo Hills North survey areas, as summarized in Table ***3-10***, and Figures B-4 and B-11 in Appendix A:. The total occupied area included approximately 0.1 ac (0.04 ha) and seven individuals. The mean elevation range across occurrences was 550 to 574 m (1,804 to 1,883 ft). Common associated species included *Anulocaulis leiosolenus, Enceliopsis argophylla, Larrea tridentata,* and *Psorothamnus fremontii*. The overall quality for both occurrences was rated as fair due to dry conditions and signs of OHV tracks running nearby and off designated routes.

Table 3-10. 2023 survey occurrence summary for *Arctomecon californica* (Las Vegas bearpoppy).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Arctomecon californica Las Vegas bearpoppy	2026	Bitter Springs North	0.01	2	Fair	574
	2028	Echo Hills North	0.05	5	Fair	550
Summary			**0.1**	**7**	**Fair**	**562**

3.4.2 *Astragalus nyensis* (Nye Milkvetch)

Astragalus nyensis (Nye milkvetch) was found at the Bonus ERBI and Rural ERBI survey areas, as summarized in Table ***3-11*** and Figures B-5 and B-33 in Appendix B. The total occupied area included approximately 296.0 ac (119.7 ha) and 62 individuals. The mean elevation range across occurrences was 823 to 876 m (2,700 to 2,874 ft). Common associated species included *Ambrosia dumosa, Larrea tridentata,* and *Menodora spinescens* (spiny menodora). The overall quality for both occurrences was rated as good due to relatively intact populations with minimal direct disturbance.

Table 3-11. 2023 survey occurrence summary for *Astragalus nyensis* (Nye milkvetch).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Astragalus nyensis Nye milkvetch	1023	Bonus ERBI	296.0	60	Good	876
	5116	Rural ERBI	0.001	2	Good	823
Summary			**296.0**	**62**	**Good**	**850**

3.4.3 *Cirsium mohavense* (Virgin River Thistle)

Cirsium mohavense (Synonym: *Cirsium virginense*; Virgin River thistle) was found at the Kiup Spring, Red Bluff Spring, RR Spring 1, and Unnamed Seep/Unnamed Repeat survey areas, as summarized in Table ***3-12*** and Figures C-9, C-20, C-21, and C-23 in Appendix C. The total occupied area included approximately 13.7 ac (5.5 ha) and 2,431 individuals. The mean elevation range across occurrences was 498 to 1,582 m (1,633 to 5,190 ft). Associated species varied at each occurrence and included the following: *Anemopsis californica* (yerba mansa), *Distichlis spicata* (saltgrass), *Juncus acutus* var. *leopoldii* (Leopold's rush), *Pluchea sericea* (arrowweed), *Populus*

sp., *Schoenoplectus americanus* (Olney's threesquare bulrush), *Senegalia greggii,* and *Washingtonia filifera* (California fan palm). At these occurrences, invasive weeds had relatively low cover. The overall quality of each occurrence varied from good to excellent, with common disturbances including impacts from trespass cattle and wild burro.

Table 3-12. The 2023 survey occurrence summary for *Cirsium mohavense* (Synonym: *C. virginense*; Virgin River thistle).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Cirsium mohavense (*C. virginense*) Virgin River thistle	1022	Kiup Spring	1.0	1,200	Excellent	1,582
	1027	Red Bluff Spring	0.3	25	Good	498
	1028	RR Spring 1	0.1	200	Good	575
	4003	Unnamed Seep/ Unnamed Repeat	12.3	1,006	Good	572
Summary			**13.7**	**2,431**	**Good - Excellent**	**807**

3.4.4 *Ivesia jaegeri* (Jaeger's Ivesia)

Ivesia jaegeri (Jaeger's ivesia) was found at the Ninetynine Spring survey area, as summarized in Table ***3-13*** and Figure C-13 in Appendix C. The total occupied area included approximately 0.1 ac (0.04 ha) and 90 individuals. The mean elevation for this occurrence was 1,865 m (6,118 ft). Associated species included *Heuchera rubescens* (pink alumroot) and *Ribes velutinum* (desert gooseberry). The overall occurrence quality was rated as fair, largely due to proximity to rock climbing routes and potential disturbance from climbers attempting to "clean" the routes.

Table 3-13. 2023 survey occurrence summary for *Ivesia jaegeri* (Jaeger's ivesia).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Ivesia jaegeri Jaeger's ivesia	5146	Ninetynine Spring	0.1	90	Fair	1,865
Summary			**0.1**	**90**	**Fair**	**1,865**

3.4.5 *Pediomelum castoreum* (Beaver Dam breadroot)

Pediomelum castoreum (Beaver Dam breadroot) was found at the West Mormon 1, West Mormon 2, West Mormon 6, and East Mormon Private survey areas, as summarized in Table ***3-14*** and Figures B-38, B-39, B-43, and B-10 in Appendix B. The total occupied area included approximately 3.2 ac (1.3 ha) and 145 individuals. The mean elevation range across occurrences was 407 to 505 m (1,335 to 1,656 ft). Common associated species encountered at multiple occurrences included *Ambrosia dumosa, Krameria bicolor* (white ratany), *Larrea tridentata,* and *Oenothera deltoides*. At these occurrences, the invasive weeds *Brassica tournefortii* and *Schismus barbatus* had moderate to high cover. The overall quality of each occurrence varied from poor to good. Common factors impacting habitat quality were high nearby traffic of OHVs and dirt bikes, small population size, and competition with invasive weeds. Two of the occurrences were located within the West Mormon 6 survey area, which is included within a proposed BLM disposal area (Appendix B:).

Table 3-14. The 2023 survey occurrence summary for *Pediomelum castoreum* (Beaver Dam breadroot).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Pediomelum castoreum Beaver Dam breadroot	2016	West Mormon 1	0.4	58	Good	502
	2018	West Mormon 2	2.7	67	Good	505
	2021	West Mormon 6	0.1	2	Poor	461
	2022	West Mormon 6	0.04	3	Poor	488
	5144	East Mormon Private	0.0004	15	Fair	407
Summary			**3.2**	**145**	**Fair - Good**	**473**

3.4.6 *Penstemon bicolor* (Twotone Beardtongue)

Penstemon bicolor (twotone beardtongue) was found at the Cow Spring and Highland Spring survey areas, as summarized in Table ***3-15*** and Figures C-3 and C-7 in Appendix C. The total occupied area included approximately 0.1 ac (0.04 ha) and 34 individuals. The mean elevation range across occurrences was 1,214 to 1,340 m (3,982 to 4,396 ft). Associated species encountered included *Asclepias nyctaginifolia* (Mojave milkweed), *Datura wrightii* (sacred datura), and *Senegalia greggii* (cat claw acacia). At these occurrences, the invasive weed *Bromus rubens* was observed with moderate to high cover. The overall quality of each occurrence was fair, largely due to competition with invasive weeds.

Table 3-15. The 2023 survey occurrence summary for *Penstemon bicolor* (twotone beardtongue).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Penstemon bicolor Twotone beardtongue	2024	Highland Spring	0.1	33	Fair	1,340
	5069	Cow Spring	0.001	1	Fair	1,214
Summary			**0.1**	**34**	**Fair**	**1,277**

3.4.7 *Sisyrinchium funereum* (Death Valley Blue Eyed Grass)

Sisyrinchium funereum (Death Valley blue eyed grass) was found at Rainbow-Bootleg Spring survey area, as summarized in Table ***3-16*** and Figure C-19 in Appendix C. The total occupied area included approximately 3.0 ac (1.2 ha) and an estimated 12,113 individuals. The mean elevation at this occurrence was 1,703 m (5,587 ft). Associated species included *Anemopsis californica*, *Juncus balticus* (Arctic rush), and *Leymus cinereus* (Great Basin wildrye). The overall quality at this occurrence was excellent due to relatively pristine habitat with little evidence of contemporary human use and no evidence of livestock presence.

Table 3-16. 2023 survey occurrence summary for *Sisyrinchium funereum* (Death Valley blue eyed grass).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Sisyrinchium funereum	5110	Rainbow-Bootleg Spring	3.0	12,113	Excellent	1,703
Summary			**3.0**	**12,113**	**Excellent**	**1,703**

3.4.8 *Sisyrinchium* sp. (Blue Eyed Grass)

Sisyrinchium sp. (blue eyed grass) was found at Unnamed Spring 2 survey area, as seen in Table ***3-17*** and Figure C-25 in Appendix C. This occurrence could not be identified to species due to immature morphology. The total occupied area was approximately 0.002 ac (0.0008 ha) and two individuals. The mean elevation at this occurrence was 1,256 m (4,120 ft). Associated species included *Carex praegracilis* (clustered field sedge), *Juncus arcticus* var. *balticus* (Baltic rush), and *Platanthera* sp. (bog orchid). The overall quality at this occurrence was fair based on an ostensibly small population and potential lack of long-term persistence. A protective fence enclosure preventing access by ungulates was also observed to be in disrepair.

Table 3-17. 2023 survey occurrence summary for Sisyrinchium sp. (blue eyed grass).

Taxon	Project-specific Internal EO No.	Survey Area	Area Occupied (ac)	No. Individuals	Overall Occurrence Quality	Mean Elevation (m)
Sisyrinchium sp.	5149	Unnamed Spring 2	0.002	2	Good	1,256
Summary			**0.002**	**2**	**Good**	**1,256**

3.5 Incidental *Asclepias* (Milkweed) Encounters

Ironwood botanists recorded nine incidental occurrences for four distinct *Asclepias* species (Table ***3-18***; Figure 3-1): *Asclepias erosa* (desert milkweed; five occurrences), *Asclepias nyctaginifolia* (Mojave milkweed; one occurrence), *Asclepias speciosa* (showy milkweed; one occurrence), and *Asclepias subulata* (rush milkweed; two occurrences). All point data records with specific geospatial data for each are included in the 2023 Project Data Deliverable (Ironwood 2023).

Table 3-18. 2023 survey occurrence summary for *Asclepias* (milkweed) species.

Species	No. Individuals	Occupied Area Radius (m)	WGS84	
			Latitude	Longitude
Asclepias erosa Desert milkweed	10	380	36.49949145	-114.477996
	20	5	36.15950905	-115.735601
	31	40	36.46353826	-114.218095
	1	1	35.96572131	-115.807424
	2	5	36.01934707	-115.457888
Asclepias nyctaginifolia Mojave milkweed	8	400	35.595085	-115.05914

Species	No. Individuals	Occupied Area Radius (m)	WGS84	
			Latitude	Longitude
Asclepias speciosa Showy milkweed	21	600	35.56633	-115.013853
Asclepias subulata Rush milkweed	10	5	35.16212167	-114.59439
	107	1.5	35.18026345	-114.630276

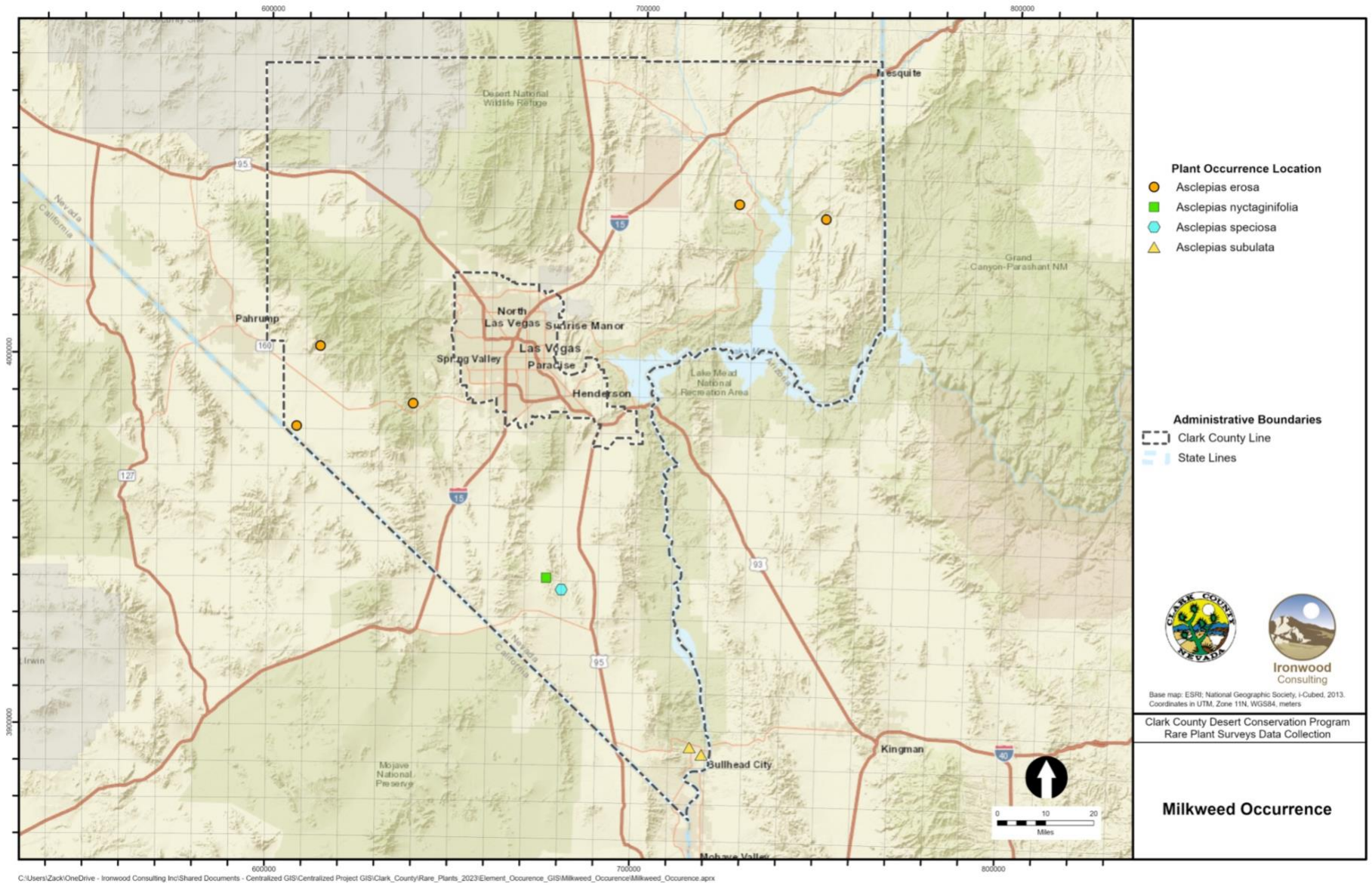

Figure 3-1. 2023 survey occurrence locations for Asclepias (milkweed) species

4. Discussion

4.1 Primary Modeled Target Species Not Encountered During 2023 Surveys

Three of the primary target taxa (*Calochortus striatus*, *Eriogonum corymbosum* var. *nilesii*, and *Phacelia parishii*) were not encountered during 2023 surveys, despite targeting suitable habitat.

Historic collections of *Calochortus striatus* (alkali mariposa lily) in Clark County appear to be confined to a 9-kilometer (km) radius within the Red Rock Canyon National Conservation Area. This also appears to be the easternmost range extent for this species. The remaining collections in Nevada occur approximately 85 km to the northwest near the border with California in Nye County. Any undiscovered occurrences within Nevada are most likely to be found within the 85-km span between the previously documented locations.

The expected range for *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat) within Clark County is limited to the region surrounding Las Vegas and regions to the northeast including Gold Butte National Monument and Mesquite. Further, this taxon often occurs preferentially on gypsiferous soils. While this habitat was visited in 2023, this target taxon was not observed in the associated survey areas.

Phacelia parishii (Parish phacelia) is an ephemerally occurring annual that inhabits clay and alkaline soils along seasonally wet pools and dry lake margins. This plant is dependent upon the timing and duration of annual precipitation. While these habitats were targeted in 2023, *P. parishii* was not encountered at any of the targeted survey locations. It is possible that winter and/or spring precipitation patterns were not suitable for *P. parishii* germination during 2022 to 2023.

4.2 *Astragalus geyeri* var. *triquetrus* Germination Patterns

The 2023 season was anticipated to be a good opportunity to survey for spring annuals (e.g., *Astragalus geyeri* var. *triquetrus*) after the region was reported to have received significant winter precipitation, which had been below average for the previous two years. Although surveys for *A. geyeri* var. *triquetrus* have occurred annually since 2020, Ironwood botanists have only detected this plant at survey locations and/or selected reference populations during the 2020 and 2023 spring seasons. There was, however, a noticeable disparity in the number of encounters between these years. In 2020, more than 250 individuals were observed across 14 occurrences, while in 2023, only 14 individuals were observed at two occurrences. Further, no individuals were observed in 2023 when revisiting several of the occurrences Ironwood botanists reported in 2020.

Review of precipitation data for the Las Vegas area shows that the total annual precipitation for 2022-2023 was only about half of that received during the same period in 2019-2020 (Figure 4-1; NOAA 2023). Moreover, the precise timing of the precipitation, in addition to the amount, may impact *A. geyeri* var. *triquetrus* germination. The 2019-2020 period received an additional 0.2 inches (in) and 1.5 in of precipitation during the winter and spring seasons as compared to 2022-2023 (Figure 4-2). It is possible that a minimum threshold of precipitation is required during both the winter and spring seasons for germination to occur.

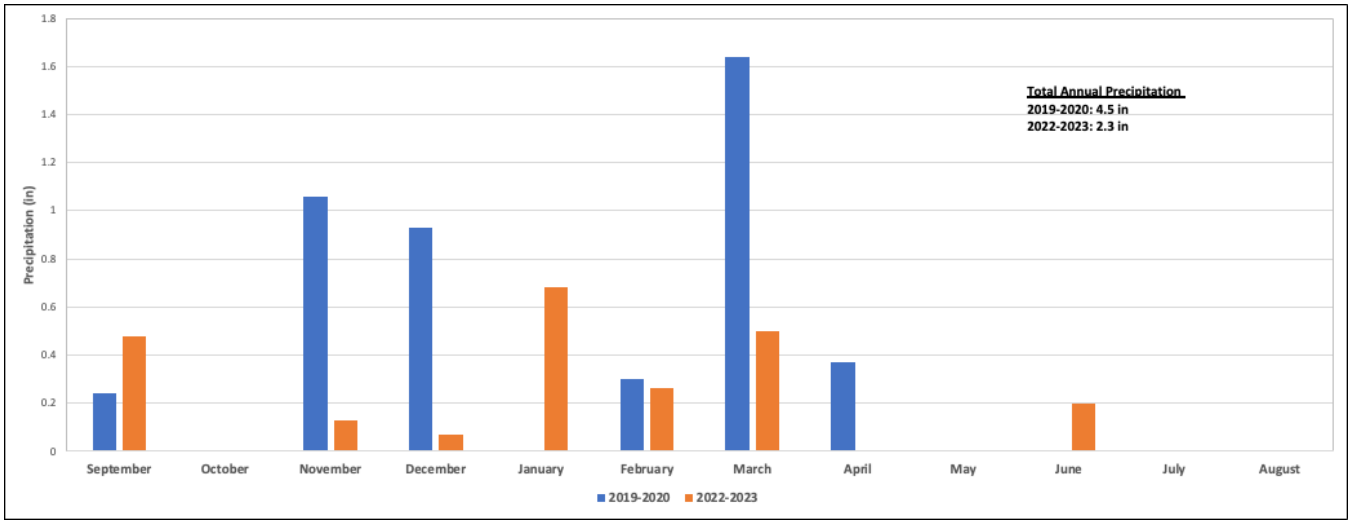

Figure 4-1. Comparison of 2019-2020 and 2022-2023 monthly precipitation for the Las Vegas Area.

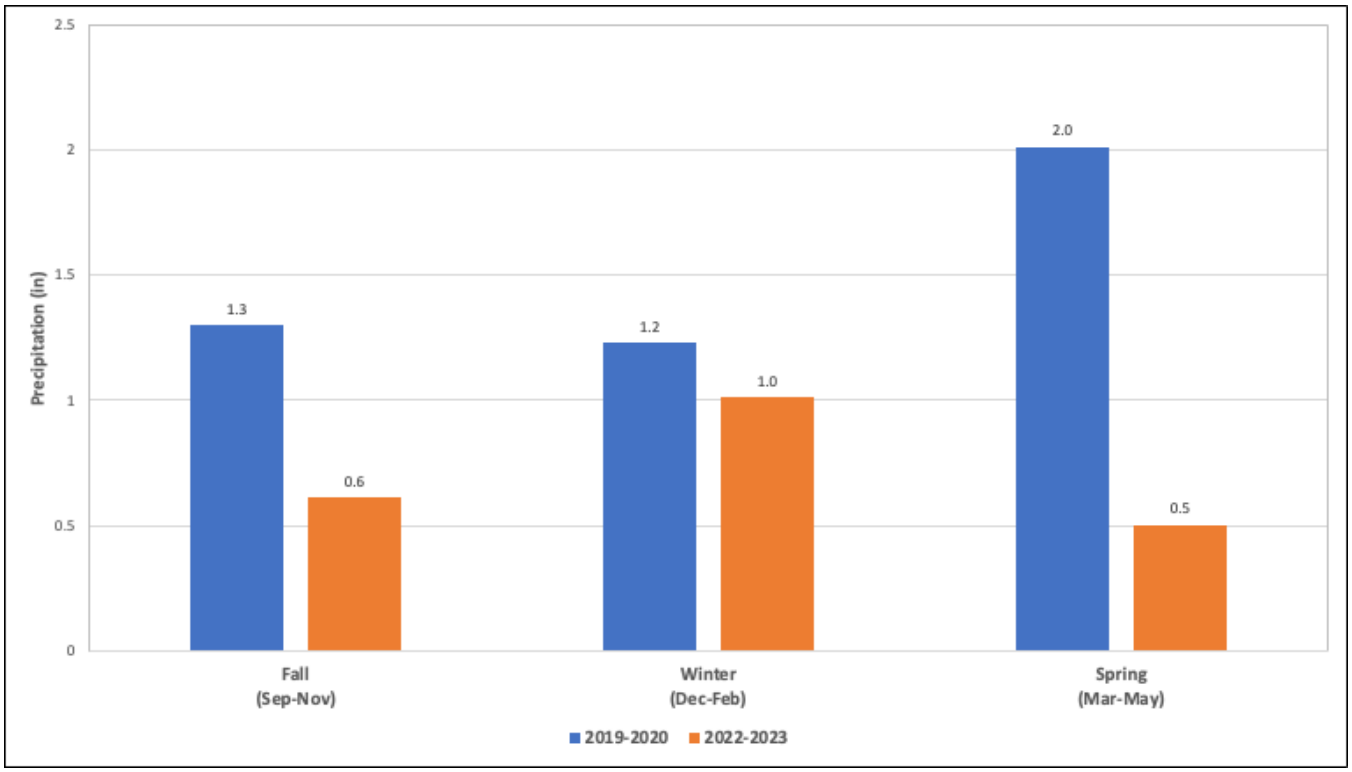

Figure 4-2. Comparison of 2019-2020 and 2022-2023 seasonal precipitation data for the Las Vegas Area.

4.3 Historic *Penstemon albomarginatus* Occurrence Record

In 2023, Ironwood botanists visited a location with a historic EO record for *Penstemon albomarginatus* in the "Revisit PEAL" survey area because of its disparate location in relation to the range and typical habitat of this species. *P. albomarginatus* inhabits areas shaped by wind-blown sand and dunes and the vegetation is typically dominated by *Hilaria rigida*. However, the plant community at the historic EO locality was dominated by *Juniperus osteosperma* (Utah juniper; Figure 4-3) and *Pinus monophylla* (singleleaf pinyon; Figure 4-4) and the substrate was limestone-derived with dense rocks and gravel intermixed. There were no individuals observed at this location and the habitat was clearly unsuitable for this species. It is likely that this historic record was either

a misidentification or the locality details were incorrectly recorded. Removing this historic occurrence from the habitat suitability model would most likely improve its performance.

Figure 4-3. Pinyon-juniper vegetation community at historic EO record locality for *Penstemon albomarginatus*.

Figure 4-4. Limestone substrate at historic EO record locality for *Penstemon albomarginatus*.

4.4 Historic *Phacelia parishii* Occurrence Record

A single record from 1976 within the Desert National Wildlife Refuge was partially used to train the DCP habitat suitability model, but this record was originally misidentified as *Phacelia parishii* and later annotated as *P. rotundifolia*. This record was still used as input to develop the model. We created a study site (Yucca Forest Valley) that allowed Ironwood to survey for potential *P. parishii* habitat near the 1976 locality, but this species was not found. Further, the typical habitat of *P. parishii* is moist to superficially dry, mostly barren, often salt-crusted silty clay soils on valley bottom flats, lake deposits, and playa edges. The habitat near the historic collection did not fit this description (Figure 4-5). This reinforces our belief that the herbarium record was changed sometime after the original determination to *Phacelia rotundifolia*, which we found in abundance at the original 1976 locality, just east of the Yucca Forest Valley survey polygon. Removing this historic occurrence from the habitat suitability model would most likely improve its performance.

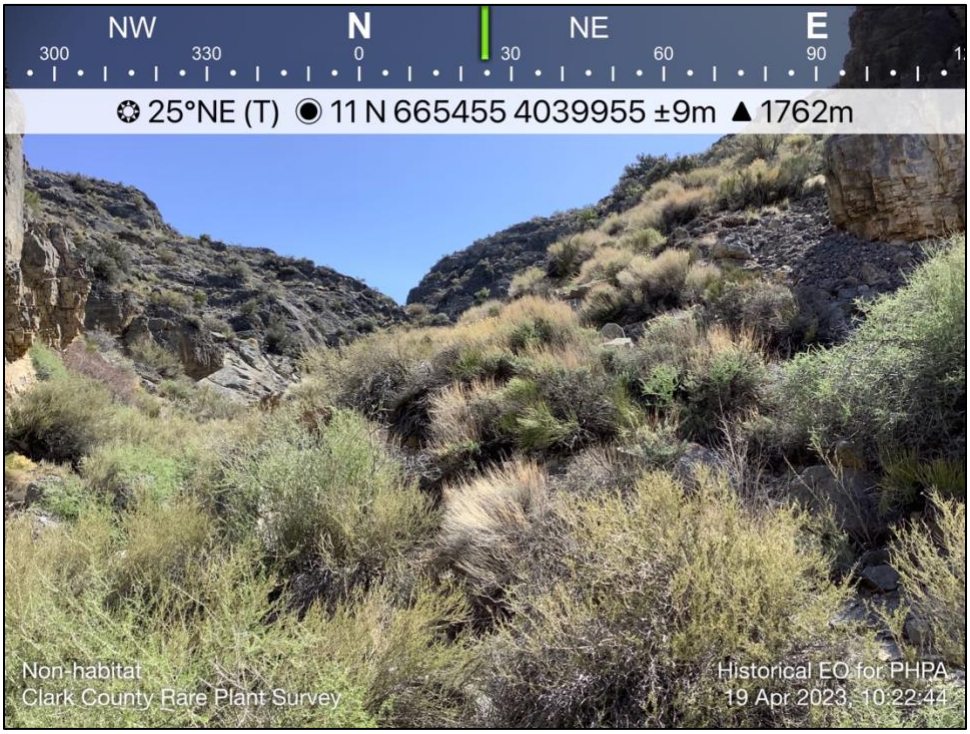

Figure 4-5. Unsuitable habitat for P. parishii at Yucca Forest Valley survey area.

4.5 Unresolved Taxonomy in *Sisyrinchium*

Confidence in the taxonomic identification of *Sisyrinchium* in southern Nevada is somewhat tenuous. The Flora of North America (1993+) notes that *S. radicatum* has been historically confused with *S. demissum*. It also states that S. L. Welsh and G. Moore identified all branched *Sisyrinchium* plants in Utah as *S. radicatum.* Further, S. Goodrich and E. Neese used *S. demissum* and *S. radicatum* synonymously in Utah. In the Flora of Nevada, Kartesz (1987) also does not recognize *S. radicatum*, and notes that *S. demissum* is often confused with *S. halophilum* and *S. funereum*. He asserts that the morphological characters distinguishing these species are not consistent and that *S. demissum* is a "weakly defined taxon of little taxonomic worth even at the infraspecific level."

Inácio et al. (Inácio et al. 2017) completed a phylogenetic analysis of *Sisyrinchium,* and the authors commented that the group within *Sisyrinchium* that includes *S. demissum, S. funereum, S. halophilum*, and *S. radicatum* were not easily distinguished using either genetic or morphological data and their evolutionary relationship remains unresolved. Further, they recommended additional research using complementary analyses such as phylogeography, comparative anatomy, cytology, and ecology to refine our understanding about these taxonomic relationships. Therefore, distinguishing the identities of *Sisyrinchium* plants within Clark County remains unsettled. Future research is needed to resolve these taxonomic relationships, identify actual rarity of these taxa based on the resulting relationships, and to update available field keys.

5. Conclusion

Ironwood surveys resulted in 36 rare plant occurrence records occupying 592 of the 12,492 acres (239 of 5,055 ha) surveyed within Clark County. These field surveys have contributed to the known distribution of the target species in Clark County, Nevada by adding 36 EO records for 14 rare plant taxa, including seven of the target taxa. EO records were recorded in 23 of the total survey areas (Table ***5-1***). The results from these surveys help identify areas within the County that host at least one rare plant taxon, areas that host a diversity of rare plant taxa, and areas that provide unique habitat. These surveys prioritized locations within or near current or predicted future BLM disposal boundaries, and the SNEDCA proposed special management areas.

Table 5-1. Summary of 2023 survey sites where EO records were collected.

Survey Area	No. Target Rare Plant Taxa Encountered	No. Other Rare Plant Taxa Encountered	Rare Plant Taxa Encountered
Arrow Canyon	1	-	*Enceliopsis argophylla*
Bitter Springs North	2	1	*Anulocaulis leiosolenus, Arctomecon californica, Enceliopsis argophylla*
Bonus ERBI	-	1	*Astragalus nyensis*
Cow Spring	-	1	*Penstemon bicolor*
East Mormon 2	1	-	*Eriogonum viscidulum*
East Mormon Private	1	1	*Astragalus geyeri* var. *triquetrus, Pediomelum castoreum*
Echo Hills North	2	1	*Anulocaulis leiosolenus, Arctomecon californica, Enceliopsis argophylla*
Hidden Valley Disposal	1		*Penstemon albomarginatus*
Highland Spring	-	1	*Penstemon bicolor*
Jean Lake East	1	-	*Penstemon albomarginatus*
Kiup Spring	1	1	*Cirsium mohavense, Sisyrinchium radicatum*
Lava	1	-	*Enceliopsis argophylla*
Near Sandy Valley	1	-	*Eriogonum bifurcatum*
Ninetynine Spring	-	1	*Ivesia jaegeri*
Rainbow-Bootleg Spring	-	1	*Sisyrinchium funereum*

Survey Area	No. Target Rare Plant Taxa Encountered	No. Other Rare Plant Taxa Encountered	Rare Plant Taxa Encountered
Red Bluff Spring	-	1	*Cirsium mohavense*
RR Spring 1	-	1	*Cirsium mohavense*
Rural ERBI	1	1	*Astragalus nyensis*, *Eriogonum bifurcatum*
Unnamed Spring	-	1	*Cirsium mohavense*
West Mormon 1	-	1	*Pediomelum castoreum*
West Mormon 2	2	1	*Astragalus geyeri* var. *triquetrus*, *Eriogonum viscidulum*, *Pediomelum castoreum*
West Mormon 3	1	-	*Eriogonum viscidulum*
West Mormon 6	-	1	*Pediomelum castoreum*

6. Recommendations

Recommendations include completing future surveys to target *Calochortus striatus* (alkali mariposa lily), *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat), and *Phacelia parishii* (Parish phacelia), which were not encountered during these surveys. Ironwood botanists recorded three *Sisyrinchium* spp. occurrences, with one of these identified as *S. radicatum*. However, the taxonomic relationships between *Sisyrinchium radicatum* (St. George Blue Eyed Grass) and its sister taxa occurring within Clark County remain unresolved, making species-level identification ambiguous. Recommendations also include supporting additional research to help untangle the taxonomy within this genus and improve upon available field keys. Finally, we recommend removing two ostensibly incorrect historic element occurrence records for *Penstemon albomarginatus* and *Phacelia parishii* from the existing habitat suitability models provided by the Desert Conservation Program to improve their performance.

7. List of Preparers and Contributors

Clark County Desert Conservation Program

Stefanie Ferrazzano	Project Manager/Biologist

Ironwood Environmental Consultants

Project Management, Analysis, and Reporting

Emily Thorn	Project Manager/Ecologist/Report Author
Dave Kesonie	Sr. Botanist/Assistant Project Manager/Report Author
Wendy McBride	Sr. Botanist/Assistant Project Manager/Report Author
Steve Ishii	GIS/Data Stewardship
Zack Webb	GIS Specialist
Eve Armour	Managing Editor

Field Staff

Marc Baker	Sr. Botanist
Kyle Christie	Sr. Botanist
Michelle Cloud-Hughes	Sr. Botanist
Andrea Hazelton	Sr. Botanist
Michael Honer	Sr. Botanist
Chris Lea	Sr. Botanist
Robert Sivinski	Sr. Botanist
Lois Neff	Botanist
Tracy Ridlinghafer	Botanist
Matt Atkinson-Adams	Botany Technician/Sr. Biologist
Marina Lavender	Botany Technician/Staff Biologist

8. Literature Cited

Flora of North America Editorial Committee eds. 1993+. "Flora of North America North of Mexico [Online]." Accessed March 1. http://beta.floranorthamerica.org.

Inácio, C., O. Chauveau, T. Souza-Chies, H. Sauquet, and L. Eggers. 2017. "An updated phylogeny and infra generic classification of the genus Sisyrinchium (Iridaceae): Challenges of molecular and morphological evidence." *Taxon* 66 (6): 1317-1348.

Ironwood Consulting Inc (Ironwood). 2023a. *Rare Plant Surveys Data Management Plan, Clark County, Nevada.* 2019-IRONWOOD-1942A.

---. 2023b. *Rare Plant Surveys Work Plan, Clark County, Nevada.* 2019-IRONWOOD-1942A.

Jepson Flora Project. 2023. "Jepson eFlora." Accessed August 2023. https://ucjeps.berkeley.edu/eflora/.

Kartesz, J. 1987. "A Flora of Nevada." PhD Thesis, University of Nevada Reno.

National Oceanic and Atmospheric Administration (NOAA). 2023. "NOAA Online Weather Data (NOWData)." Accessed August 6, 2023. https://www.weather.gov/wrh/Climate?wfo=vef.

Nevada Division of Natural Heritage (NDNH). 2023. "Nevada Division of Natural Heritage." http://heritage.nv.gov/.

Appendix A: BLM and NNHP Rare Plant Survey Field Methodologies

BLM Rare Plant Sampling Methods

Botanical surveys should be conducted in a manner that will locate any special status or locally significant plants or plant communities that may be present. Specifically, botanical surveys should be:

- Conducted in the field at the proper times of year when special status and locally significant plants are both evident and identifiable. When special status plants are known to occur in the type of habitat present in the project area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the plants are identifiable at the time of survey.
- Floristic in nature. A floristic survey requires that every plant observed be identified to species, subspecies, or variety, as applicable. To properly characterize the site, a complete list of plants observed on the site shall be included in every botanical survey report. In addition, a sufficient number of visits spaced throughout the growing season is necessary to prepare an accurate inventory of all plants that exist on the site. The number of visits and the timing between visits must be determined by geographic location, the plant communities present, and the weather patterns of the year(s) in which the surveys are conducted.
- Conducted in a manner that is consistent with conservation ethics and accepted plant collection and documentation techniques4,5. Collections (voucher specimens) of special status and locally significant plants should be made, unless such actions would jeopardize the continued existence of the population. A single sheet should be collected and deposited at a recognized public herbarium for future reference. All collections shall be made in accordance with applicable state and federal permit requirements. Photography may be used to document plant identification only when the population cannot withstand the collection of voucher specimens.
- Conducted using systematic field techniques in all habitats of the site to ensure thorough coverage of potential impact areas. All habitats within the project site must be surveyed thoroughly to properly inventory and document the plants present. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity.
- Well documented. When a special status plant (or rare plant community) is located, a California Native Species (or Community) Field Survey Form or equivalent written form, accompanied by a copy of the appropriate portion of a 7.5-minute topographic map with the occurrence mapped, shall be completed, included within the survey report, and separately submitted to the California Natural Diversity Database. Population boundaries should be mapped as accurately as possible. The number of individuals in each population should be counted or estimated, as appropriate.

Field Survey – Methodology

Field surveys will be floristic in nature; i.e., the contractor identifies every plant taxon observed in the project area to the taxonomic level necessary to determine rarity and listing status. Surveys will be conducted so they will ensure a high likelihood of locating all the plant taxa in the project area. The survey must be focused solely on plants – an individual should not combine multiple survey elements (e.g., tortoise, other wildlife, etc.). Depending on the size of the project area and the heterogeneity of the habitats within the project area, surveys will involve one or a combination of the following survey methods:

1. Complete Survey

A complete survey is a 100% visual examination of the project area (Figure B 1) using transects. The length of the transect and distance between transects might change as the topography changes throughout the project area. Transects should be spaced so all of the area between transects is visible and so the smallest rare plant expected to occur is visible. The surveyor (1) compiles a species list while traversing the project area and keeps track of

the plant community or habitat type where each taxon occurs; (2) maps the locations of all rare taxa encountered using a GPS unit; and (3) fills out a NNHP Nevada Native Species Site Survey Report (http://heritage.nv.gov/sites/default/files/other_docs/surv_pdf2013.pdf) for each location of each rare taxon encountered.

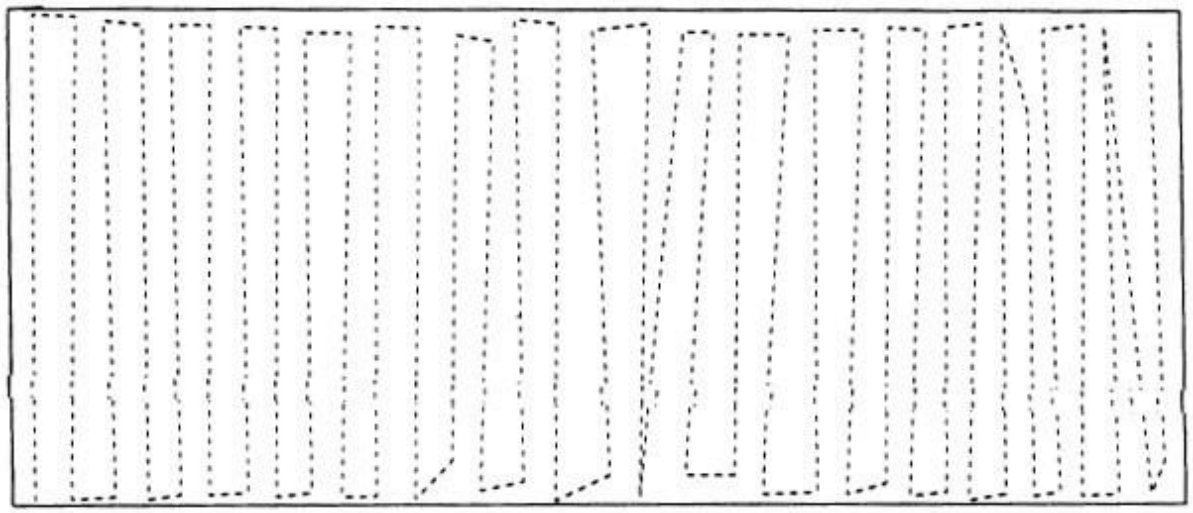

Figure B 1. Complete survey.

2. Intuitive Controlled Survey

An intuitive controlled survey is a complete survey of habitats with the highest potential for supporting rare plant populations and a less intensive survey of all other habitats present (Figure B 2). This type of survey can only be accomplished by botanists familiar with the habitats of all the plant species that may reasonably be expected to occur in the project area. The botanist traverses through the project area enough to see a representative cross section of all the major plant habitats and topographic features. During the survey, the botanist compiles a species list of all plant taxa seen en route and keeps track of the plant community or habitat type where each taxon occurs. The surveyor maps the locations of all rare taxa encountered using a GPS unit and fills out a NNHD Nevada Native Species Site Survey Report (http://heritage.nv.gov/sites/default/files/other_docs/surv_pdf2013.pdf) for each location of each rare taxon encountered. When the surveyor arrives at an area of "high potential" habitat, s/he surveys that area completely as described above and shown in Figure B 1. High potential habitat areas include areas defined in a pre-field review of potential rare plants and habitat and other habitats where a rare species appears during the course of initial field work traversing the project area. Areas within the project area that are not the focus of a complete survey must be surveyed sufficiently so the botanist and BLM reasonably believe that few if any additional species would be added to the complete species list for the project area. The report must justify why the botanist did not consider these areas to have a high potential for supporting rare plant species and thus did not subject the area to a complete survey.

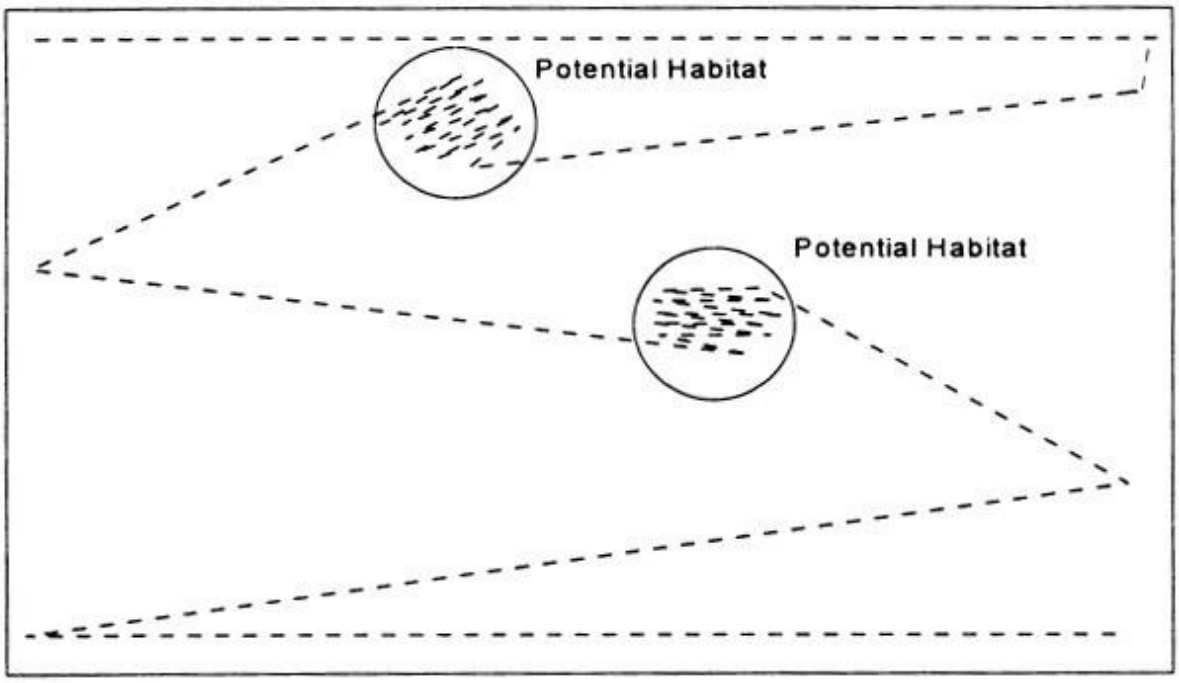

Figure B 2. Intuitive Controlled Survey.

Documenting the Results of Surveys

The results of special status plant inventories should be well documented. This documentation must include, as a minimum, the completion and submission of Field Survey Forms and shapefiles/geodatabases of all special status plants found by BLM personnel or consultants.

Occurrences are defined as being separated from other plant locations by 0.25 mile. These forms are submitted to the BLM Southern Nevada District Office Botanist.

Most special status plant inventories of public lands conducted to assess the impacts of a project are performed by consultants hired by project proponents. These inventories must meet or exceed the intensity level required for the project by BLM. Personnel conducting the inventory must meet the qualifications outlined in this document. For BLM to adequately determine the quality of third-party inventories, the following information must appear in a detailed report to BLM from the consultant or project proponent.

- Project description:
  - Detailed map of the project location and study area
  - Direct and indirect actions that may impact the special status plant communities
  - Acreage of proposed disturbance and buffer area acreage of anticipated indirect impacts
- Plant communities:

  A written description of the biological setting, including descriptions of the plant communities found in the project area and a vegetation map. Plant communities should be described and mapped to at least the alliance level using the vegetation classification system of the Nevada Natural Heritage Program (Heritage). A list and description of the alliances currently recognized by Heritage can be found at: http://heritage.nv.gov/node/174

- Pre-project review:
  - Describe the intensity of the review process
  - Identify which known populations were visited, which flora were used to identify the species, what experts were consulted, and which herbaria were visited
  - If soil surveys were used to determine suitable habitat, include those references
  - Identify which reference populations were visited, the timing of those visits, if rainfall patterns and temperatures were identified for the area from the nearest available weather station, and if any other climatic conditions were taken into account.
  - Identify which resources were used to identify target special status plants in the project area
- Survey methodology:
  - A detailed description of the inventory methodology, including techniques and intensity of the inventory
  - Distance(s) between transects throughout the study area, and how those distances were justified
  - The methodology of special status plant identification (in the field or in a lab) and if the plant was sent to a specialist to be identified, which characteristics distinguished the plant from look-alikes in the area)
  - Maps showing areas searched. This will also include areas searched but no special status plants found (negative survey data)
  - Identify type of GPS unit used
- Survey timing:
  - How inventory timing was determined
  - Exact dates of all the surveys and which special status plants were identified on those dates
  - Timing of visits to reference populations
- Survey results:
  - The type and number of special status plants identified
  - Phenological stage(s) the special-status plant was in when identified
  - Habitat, soil type, vegetation type, and associated species of the special status plant
  - Population boundaries
  - Condition of the population (disease, predation, etc.)
  - Current threats to the population (off-road vehicles, erosion, non-native species, etc.)
- Discussion:

  The assessments of the health, population size, and protective status of any special status plants found. A discussion of any range extensions discovered as a result of the survey. A discussion of the significance of any special-status plant occurrences found, with consideration of other nearby occurrences and the distribution of the species as a whole.

- Contractor qualifications:
  - The name(s) and qualifications of the persons conducting the surveys
  - Include a copy of the email or letter for contractor approval for each surveyor.

- References:
  - List of references cited
  - Persons contacted
  - Herbaria or reference sites visited
- Data:
  - Copies of field data forms
  - Photos
  - Maps (special status plant locations, survey areas, vegetation maps)
  - Shapefiles (special status plants, negative survey areas, total area surveyed)
  - Plant vouchers
  - Any site-specific additional information required by contractor

  Voucher specimens of special-status plants should be collected if necessary to conclusively document the occurrence of the species and if the collection will not adversely affect the health of the population at the site. Collection of federally listed plants on federal lands requires a permit from the Fish and Wildlife Service. If voucher specimens are collected, they should be deposited in major recognized herbaria for future reference.

  Photographs should be taken of the areas inventoried, of all special status plants found (including of identifying characteristics of special-status plants, or look-alikes), and of the habitat associated with each special status plant occurrence.

Data Collection – Data Submission

Data should be collected using a Mapping Grade GPS Receiver with an accuracy of < 3 meters Horizontal Root Mean Squared (HRMS).

All positions should be logged according to the following specifications:

- Maximum PDOP of 6
- Minimum of 5 Satellites
- Minimum elevation mask of 15 degrees
- Datum: NAD83
- Coordinate System: UTM Zone 11
- ESRI compliant formats (Geodatabase, Coverage or Shapefile)

Metadata must be included with the data. The following must be included in the metadata:

- Project Name
- Purpose – Summary of the intentions with which the data set was developed
- Abstract Information – Brief narrative summary of the data set
- Location – What area(s) does your data cover? i.e., list statewide, regions, city, county
- Developer – Who collected the data?

- Data Dictionary – A data dictionary must be used for all projects. The dictionary should include the data that is requested on the Heritage forms. This ensures that the botanist is collecting (electronically) the same data as is requested by DFG. This also ensures that all inventories are collecting the same level/standard of data. An example of the data dictionary and metadata standard can be found at http://heritage.nv.gov/gis under "Species Data: Sample of At-risk Species Occurrence Records."

Qualifications of Personnel Conducting Inventories

All persons conducting special status plant inventories MUST be approved by the contracting agency prior to surveys taking place.

All personnel conducting special status plant inventories must have the following:

- Strong backgrounds in plant taxonomy and plant ecology
- Strong background in field sampling design and methods
- Knowledge of the floras of the survey area including the special status plant species
- Familiarity with natural communities of the area
- Familiarity with state and federal laws and agency policies that pertain to rare plant protection

These qualifications help ensure that all special status plants in the survey area will be located, including taxa that BLM or project proponents did not predict at the start of the inventory. All survey efforts must be coordinated with the BLM botanist. Approvals for changes to protocols or other survey methodology must be approved in writing by the BLM botanist.

Nevada Natural Heritage Program's Standard Field Survey – Methods

Pre-Survey Preparation

- Select species of interest
  - If the project does not specify which plants to survey for, search a large surrounding area to identify any species that may be present in the survey area. Use county species lists to identify species that may be present.
  - If the project does specify particular plants, keep in mind other rare plants that may be found in the same location as the target species and be familiar enough with them to identify them if encountered.
- Review species file

  Prior to beginning field surveys, review the species file to familiarize yourself with the biology of the target species. All surveyors should particularly note the following:

  - Key identifying features. This usually flowers and fruits but may include leaves, stems, bulbs, or other parts.
  - Phenology as it corresponds to those features. For example, if flowers are needed to positively identify the plant, when does the plant normally bloom?
  - Distinctive habitat features. If the plants are found on a particular soil type or in association with particular vegetation this should be noted and used in section 1.c.ii.
- Review reported locations

  Thoroughly review information regarding previously documented locations prior to field visits. The quality of data varies from very old herbarium records with very inaccurate location data to recent surveys with high precision GPS data.

  - Chose locations to visit based on the reason for the survey. For a re-survey of a known location, use data from all available dates to note changes over time at that location. For survey an area that does not have documented populations, plan to visit nearby sites using the most recent data to verify phenological stage and form a search image.
  - If the purpose of the visit is to more precisely map an old, inaccurate location, note inconsistencies in the location description that lead to a larger search area. For very old collections that use road names and mileage to describe the location, review old highway atlases and aerial imagery to account for changes in road names/numbers and possible road realignments.
- Prepare maps

  Maps should include all of the features necessary for finding the plant location. Include primary and alternate access routes in case the road is impassable on your selected route. Note potential hazards such as stream crossings and private land which may have locked gates.

  - Reported locations

Prepare paper or electronic maps that include both the mapped location plus any locational uncertainty (See Biotics website for locational uncertainty mapping methodology http://www.natureserve.org/prodServices/biotics/biotics-learn-more.jsp#method)

- Habitat features

  If the survey includes searching for a poorly documented location or general surveys for rare plants in a previously undocumented area, highlight areas of potential habitat on the maps. A quick model for guiding surveys can be produced by mapping the intersection of the known elevation band with distinctive habitat features such as soil and vegetation types that the plant is known to occupy.

- Contact the landowner for permission before surveying on private land or public land that is subject to travel restrictions, such as wildlife refuges and state parks.

Field Surveys

Conduct surveys in a manner that is safe and consistent with accepted plant collection and documentation techniques.

- Vehicle travel
  - When travelling in vehicles, state employees must adhere to the policies in the State of Nevada Motor Pool Division Vehicle use Handbook, the State Administrative Manual, and state driving laws.
  - State employees must also have a current Defensive Driving certificate on file.
  - Carry adequate safety equipment for emergencies including a fire extinguisher, shovel, emergency supplies backpack, first aid kit, list of county emergency dispatch phone numbers, and the satellite phone if traveling outside of cell phone coverage areas.
- Foot travel
  - Be familiar with hazards associated with outdoor work. See http://www.cdc.gov/niosh/topics/outdoor/ to review potential Physical and Biological hazards that may be encountered outdoors.
  - Wear appropriate protective clothing such as a wide-brimmed hat, long sleeves and pants, and boots or closed toe shoes to avoid sunburn, thorns, poisonous plants and animals, and insect bites.
  - Carry adequate water, first aid kit, and communication devices when traveling more thana few minutes' walk from the vehicle.
- Search methods
  - Census or re-survey of a well-documented location.

    ✓ Plan out a search method that is appropriate for the goals of the survey.

    - If a census is desired, divide populations into smaller sections to reduce error in counting.
    - If a complete census is not feasible, use the methods outlined in "Instructions for Estimating Patch Density"
    - Refer to project guidelines if using a particular transect method or duplicating previous surveys.

- Decide beforehand whether it is more appropriate to collect point locations of individual plants or polygon locations.
- Document evidence of threats and changes in biological processes as these factors are important in determining species ranks.

✓ Search method should be able to accurately locate plants in their environment. For small plants or dense vegetation, areas should be searched very closely and thoroughly. For larger plants or very sparse vegetation, walking more widely spaced transects may be appropriate.

✓ For widely scattered plants, it may be helpful to flag or mark plants or patches to avoid double counting.

- Locating a poorly documented population.
- Familiarize yourself with the target plant(s).

✓ Visit a known location of the target species to observe the current phenology of the plants. Pay careful attention to non-flowering individuals as these may be encountered without flowering individuals nearby. Note particular habitat or vegetation affinities that may help in locating new populations. If the plant is very unfamiliar, make sure you can identify the key features that distinguish it from other species. When visiting any known population, take a few notes and photographs and submit a Species Survey Report.

✓ Keep in mind other rare plants that may be found in the same location as the target species and be familiar enough with them to identify them if encountered.

✓ Travel to the approximate documented location. Take into account ambiguous landmarks or directions that may lead to other sites.

✓ If the habitat is appropriate, search the immediate area in a spiral pattern, adjusting for terrain and vegetation if necessary. Multiple surveyors can divide the search area to work more quickly.

✓ If the habitat is not appropriate, search the surrounding area for suitable habitats. Use maps from 1.C.ii to locate suitable landforms and vegetation types. Repeat search pattern in suitable habitats.

✓ If search is not successful, repeat steps 2-4 in any alternate locations that the directions could refer to.

✓ If there are multiple areas of suitable habitat within the area of locational uncertainty, search several, even if plants are located. Don't assume that the first population encountered is the one referred to in the original collection.

- Searching an undocumented area for rare plants.

✓ Familiarize yourself with the target plant(s).

- Visit a known location of the target species to observe the current phenology of the plants. Pay careful attention to non-flowering individuals as these may be encountered without flowering individuals nearby. Note particular habitat or vegetation affinities that may help in locating new populations. If the plant is very unfamiliar, make sure you can identify the key features that distinguish it from other species.

- Travel around the area of interest and identify areas with suitable habitats for rare plants. You can informally rank by decreasing suitability in order to prioritize search areas.
- Search suitable habitat areas, adjusting the size and walking speed of transects to account for plant size and vegetation density.

✓ Verifying plant identity

- If you are unfamiliar with the target species, carry along a key (or copies of the relevant sections) and photographs to aid in identification. Use step 2.c.ii.(1) to observe the plant at a known location and familiarize yourself with the current phenological stage. Plants can appear very different from drawings and photos as juveniles or during drought years.
- If there are multiple species present and you are unable to determine which plant is the target species, thoroughly document and collect each species to submit to an expert for identification.
- xii) For new locations, collect voucher specimens to submit to a herbarium. See 2.e.iv.(1).

- Documentation

Adequate documentation is essential to the survey process. Without documentation the work cannot be used by others.

- Notes

Take notes in a field notebook, survey form, or electronic format. Notes should include observations about both the target species and the environment. See the Nevada Native Species Survey Report for a list of types of we collect data.

✓ Phenology, associated species, and habitat description are very useful for searching for the species in the future.
✓ Threats, changes in biotic and abiotic processes, pollinator types and numbers, and population count or estimate are all helpful in ranking the viability of the occurrence and species.

- GPS
  - Learn how to use the equipment and store the appropriate data before going out to survey for plants. Set a datum that is appropriate for the project. The standard NNHP datum is now UTM NAD83 Zone 11N.
  - Carry all of the accessories needed to use the device, including data cables, chargers, and spare batteries. For remote work where power is not available, consider a solar charging unit.
  - Decide beforehand whether it is more appropriate to collect point locations of individual plants or polygon locations.
  - Store the data in a way that is not easily confused, either by using unique names for points or by keeping good notes about data collected.

  - If using the GPS to geotag photographs, turn on the track log and synchronize the time on the camera and/or photograph the time display on the GPS.

- Camera
  - Learn how to use the equipment and store the appropriate data before going out to survey for plants.
  - Carry all of the accessories needed to use the device, including data cables, chargers, and spare batteries. For remote work where power is not available, consider a solar charging unit.
  - If using the GPS to geotag photographs, synchronize the time on the camera and/or photograph the time display on the GPS.
  - Take photos of details useful for identifying the plants. Know the key characteristics and try to show them in the photos.
  - Take photos of the habitat, in particular any unique or unusual habitat features or evidence of threats.
  - If using the photos to document plant locations (by geotagging) try to take consistent photos by holding the camera at the same height and angle each time. Try to stand as close to the plant as possible and avoid shading the plants with your body or the camera.
- Voucher Specimens
  - For new locations, collect voucher specimens to submit to a herbarium. See http://www.ibiblio.org/unc-biology/herbarium/courses/chpt18.html for more information about collecting specimens for submission to a herbarium. Key points include:

    ✓ Collect material appropriate for identifying the species.
    ✓ Store and press the material in a way that avoid excessive damage to the plant tissues and makes the parts that are important for identification easy to find.
    ✓ Label specimens with location information and date.
    ✓ Note and/or photograph flower color or three dimensional shapes that will be lost by pressing.
    ✓ Do not collect more than 5% of the plants at a site (1 out of 20). For very small populations, collect only enough material to identify the species (i.e. collect a small piece of the stem with a few leaves or flowers instead of collecting the entire plant) OR take detailed photographs of the diagnostic parts of the plant.

  - If there are multiple species present and you are unable to determine which plant is the target species, thoroughly document and collect each species to submit to a specialist for identification.
- Post-Survey Documentation
  - Transcribe notes

    ✓ Transcribe any paper notes into the Species Survey Report form.
    ✓ Review electronically collected notes for errors soon after the survey.

  - Review GPS data

    ✓ Download data and make a backup copy.
    ✓ Apply differential correction to points if higher accuracy is desired.
    ✓ Export to a shapefile for use in Biotics.

- Review Photographs

  - ✓ Download photos and make a backup copy.
  - ✓ Use PhotoTracker, RoboGeo, or Microsoft Pro Photo Tools to geotag photos, adjusting the time and date of the photo if necessary to match the GPS track.
  - ✓ Tag photos with keywords including: Scientific and common names and EST_ID of species in the photo, project name (if any), location name.
  - ✓ Use caption field to describe anything special about the subject of the photo.
  - ✓ Copy the photos to an appropriate location on the T:// drive for inclusion in the photo library. Send Janel an email if any of the new photos should be added to the website.
  - ✓ Post good quality photos to public online repositories such as CalPhotos. For species that are very rare or subject to poaching (such as cacti) avoid giving detailed location data or posting photos with recognizable landmarks.

- Enter data into Biotics

  - ✓ See documentation at Natureserve.com and NNHP Mapping Methodology Manual.

- References and Additional Resources

California Native Plant Society Survey Guidelines. http://www.cnps.org/cnps/rareplants/pdf/cnps_survey_guidelines.pdf Natureserve

Mapping and Ranking Methodology http://www.natureserve.org/prodServices/biotics/biotics-learn-more.jsp#method

NNHP Nevada Native Species Survey Report forms and other forms http://heritage.nv.gov/submit

J. R. Massey. COLLECTION AND FIELD PREPARATION OF SPECIMENS from Chapter 18 in Vascular Plant Systematics by A. E. Radford, W.C. Dickison, J. R. Massey and C. R. Bell, Harper and Row Publisher, 1974. http://www.ibiblio.org/unc-biology/herbarium/courses/chpt18.html

Centers for Disease Control. NIOSH Workplace Safety and Health Topics. Hazards to Outdoor Workers. http://www.cdc.gov/niosh/topics/outdoor/

Appendix B: Upland Survey Maps and Element Occurrences

Removed to protect sensitive plant location information. Available upon request from the Clark County Desert Conservation Program.

Appendix C: Wetland Survey Maps and Element Occurrences

Removed to protect sensitive plant location information. Available upon request from the Clark County Desert Conservation Program.

Appendix D: Representative Survey Site and Rare Plant Photos

Removed to protect sensitive plant location information. Available upon request from the Clark County Desert Conservation Program.

Appendix E: Floristic Inventory by Survey Area Group

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Abronia villosa S. Watson var. *villosa*			X		X			X							
Acamptopappus shockleyi A. Gray			X				X			X			X		
Acamptopappus sphaerocephalus (Harvey & A. Gray ex A. Gray) A. Gray var. *sphaerocephalus*					X								X	X	
Achnatherum hymenoides (Roem. & Schult.) Barkworth	X		X		X	X	X						X	X	X
Achnatherum speciosum (Trin. & Rupr.) Barkworth			X								X				X
Achyronychia cooperi Torrey & A. Gray					X										
Acleisanthes nevadensis (Standl.) B.L. Turner			X		X					X				X	
Acmispon strigosus var. *strigosus* (Nutt.) Brouillet								X							
Adenophyllum cooperi (A. Gray) Strother	X					X	X		X	X					
Agave utahensis Engelm. var. *eborispina* (Hester) Breitung												X			
Aliciella lottiae (Day) J.M. Porter													X		
Aliciella hutchinsifolia (Rydb.) J.M. Porter															X
Allionia incarnata L.	X					X	X		X	X	X				
Allium sp. L.												X			
Ambrosia dumosa (A. Gray) W.W. Payne	X	X	X			X	X	X	X	X	X		X	X	X
Ambrosia eriocentra (A. Gray) W.W. Payne	X									X				X	
Ambrosia salsola (Torr. & A. Gray) Strother & B.G. Baldwin			X		X	X	X	X	X	X	X			X	X
Amelanchier utahensis Koehne												X			
Amphipappus fremontii Torr. & A. Gray subsp. *fremontii*	X									X			X	X	X
Amsinckia tessellata A. Gray var. *tessellata*						X		X		X				X	
Amsinckia menziesii (Lehm.) A. Nelson & J.F. Macbr. var. *menziesii*	X					X			X						X

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Amsonia tomentosa Torr. & Frém. var. *tomentosa*		X													
Androstephium breviflorum S. Watson			X		X	X	X	X	X	X			X	X	X
Anemone tuberosa Rydb.															X
Anisocoma acaulis Torr. & A. Gray									X						
Antheropeas lanosum (A. Gray) Rydb.	X									X				X	
Antheropeas wallacei (A. Gray) Rydb.								X							
Anulocaulis leiosolenus (Torr.) Standley		X													
Aphyllon cooperi A. Gray			X		X		X						X	X	
Arctomecon californica Torr. & Frém.		X													
Arctostaphylos pungens Kunth												X			
Argemone corymbosa Greene subsp. *corymbosa*						X									
Argemone sp. L.	X														
Argythamnia neomexicana Müll. Arg.										X					
Aristida adscensionis L.								X	X		X				
Aristida purpurea Nutt.	X		X			X	X			X	X		X	X	X
Artemisia arbuscula Nutt.												X			
Artemisia bigelovii A. Gray															X
Artemisia ludoviciana Nutt.															X
Artemisia tridentata Nutt. ssp. *wyomingensis* Beetle & A. L. Young												X			
Asclepias subulata Decne.								X							
Astragalus amphioxys A. Gray var. *amphioxys*												X			
Astragalus geyeri A. Gray var. *triquetrus* (A. Gray) M.E. Jones					X									X	
Astragalus lentiginosus (A. Gray) S. Watson			X												
Astragalus lentiginosus (A. Gray) S. Watson var. *fremontii* (A. Gray) S. Watson													X		

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Astragalus nuttalianus DC. var. *imperfectus* (Rydb.) Barneby					X										
Astragalus nyensis Barneby			X										X		
Astragalus preussii A. Gray													X		
Astragalus sabulonum A. Gray					X									X	
Astragalus sp. L.						X									
Atrichoseris platyphylla (A. Gray) A. Gray	X				X			X							
Atriplex canescens (Pursh) Nutt. var. *canescens*	X		X	X	X	X	X						X	X	
Atriplex confertifolia (Torr. & Frém.) S. Watson	X		X	X			X		X		X		X	X	
Atriplex hymenelytra (Torr.) S. Watson	X									X	X			X	
Atriplex lentiformis (Torr.) S. Watson			X										X		
Atriplex polycarpa (Torr.) S. Watson													X	X	
Atriplex torreyi (S. Watson) S. Watson var. *torreyi*													X		
Baccharis sarothroides A. Gray						X									
Baileya multiradiata Harvey & A. Gray	X		X				X							X	X
Baileya pleniradiata Harvey & A. Gray			X		X	X			X				X	X	
Bassia sp. Allioni													X		
Bebbia juncea (Bentham) Greene								X			X			X	
Berberis fremontii Torr.												X			
Boechera shockleyi (Munz) Dorn												X			
Boerhavea sp. L						X									
Bouteloua barbata Lag.						X			X				X		X
Bouteloua trifida Thurb. ex S. Watson														X	
Brassica tournefortii Gouan*	X				X			X			X			X	
Brickellia atractyloides A. Gray var. *atractyloides*	X						X								X
Brickellia incana A. Gray									X						X
Brickellia microphylla (Nutt.) A. Gray							X								X
Bromus carinatus Hook. & Arn.	X														

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Bromus rubens L.*	X	X	X	X	X	X	X			X			X	X	X
Bromus tectorum L.*	X			X		X				X		X		X	X
Buddleja utahensis Coville							X								X
Calochortus flexuosus S. Watson	X									X				X	X
Calycoseris parryi A. Gray			X												
Calycoseris wrightii A. Gray			X				X							X	
Carex rossii Boott												X			
Castilleja chromosa A. Nelson							X					X			X
Caulanthus cooperi (S. Watson) Payson							X								
Caulanthus crassicaulis (Torr.) S. Watson												X			
Caulanthus lasiophyllus (Hooker & Arnott) Payson			X			X	X	X					X		
Ceanothus greggii A. Gray												X			
Centaurea melitensis L.*	X									X					X
Cercocarpus ledifolius Nutt.												X			
Chaenactis carphoclinia A. Gray var. *carphoclinia*		X	X			X	X	X					X	X	
Chaenactis fremontii A. Gray			X		X	X		X	X	X				X	
Chaenactis macrantha D.C. Eaton	X		X				X								
Chaenactis stevioides Hooker & Arnott			X			X			X				X		
Chaetadelpha wheeleri A. Gray ex S. Watson													X		
Chaetopappa ericoides (Torr.) G. L. Nesom												X			
Chenopodium incanum (S. Watson) A. Heller	X					X									X
Chenopodium incanum (S. Watson) A. Heller *var. occidentale* Crawford			X												
Chenopodium sp. L.													X		
Chilopsis linearis (Cav.) Sweet	X														
Chorispora tenella (Pallas) de Candolle*				X									X		
Chorizanthe brevicornu Torr.	X		X			X	X	X					X	X	
Chorizanthe rigida (Torr.) Torr. & A. Gray	X	X	X		X	X	X	X	X	X	X			X	

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Chrysothamnus viscidiflorus (Hook.) Nutt.															X
Chylismia brevipes (A. Gray) Small	X		X		X			X		X			X	X	
Chylismia claviformis (Torr. & Frém.) A. Heller							X		X					X	
Chylismia multijuga (S. Watson) Small														X	
Chylismia sp. (Torr. & A. Gray) Nutt. ex Raimann								X							
Cirsium neomexicanum A. Grey															X
Claytonia nevadensis S. Watson												X (unverif.)			
Coleogyne ramosissima Torrey	X						X					X			X
Convolvulus arvensis L.															X
Coryphantha vivipara (Nuttall) Britton & Rose							X					X			X
Croton californicus Müller Arg.														X	
Cryptantha angustifolia (Torr.) Greene		X					X		X	X				X	
Cryptantha barbigera (A. Gray) Greene										X				X	
Cryptantha circumcissa (Hook. & Arn.) I.M. Johnst.	X		X		X	X	X			X				X	
Cryptantha juniperensis M.G. Simpson & R.B. Kelley			X												
Cryptantha maritima (Greene) Greene var. *maritima*								X						X	
Cryptantha micrantha (Torr.) I.M. Johnst. subsp. *micrantha*			X		X		X	X	X					X	
Cryptantha nevadensis A. Nelson & P.B. Kenn.	X		X			X	X	X		X				X	X
Cryptantha pterocarya (Torr.) Greene	X		X			X	X		X	X				X	X
Cryptantha recurvata Coville	X		X		X		X						X	X	X
Curcurbita palmata S. Watson	X						X	X	X						
Cuscuta nevadensis I.M. Johnst.								X							
Cuscuta sp. L.			X				X								
Cylindropuntia acanthocarpa (Engelmann & J. M. Bigelow) F. M. Knuth subsp. *acanthocarpa*								X	X				X		

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Cylindropuntia echinocarpa (Engelmann & J. M. Bigelow) F. M. Knuth	X	X	X		X	X	X	X	X	X		X	X	X	X
Cylindropuntia ramosissima (Engelmann) F. M. Knuth						X	X	X	X	X			X		
Cynanchum utahense (Engelm.) Woodson					X									X	
Dalea mollis Benth.											X				
Dalea mollissima (Rydb.) Munz					X	X		X	X	X				X	
Dalea sp. L.											X				
Dasyochloa pulchella (Kunth) Willd. ex Rydb.	X					X	X	X		X	X	X		X	X
Datura wrightii Regel													X		
Delphinium parishii A. Gray subsp. *parishii*	X		X		X	X	X			X		X		X	X
Descurainia pinnata (Walter) Britton	X		X			X	X	X	X	X			X	X	X
Descurainia sophia (L.) Webb ex Prantl*	X						X						X		X
Dichlostemma capitatum (Bentham) Alph. Wood						X									
Dicoria canescens A. Gray					X									X	
Dieteria canescens (Pursh) Nutt. var. *leucanthemifolia* (Greene) D. R. Morgan & R. L. Hartman					X										X
Diplacus bigelovii (A. Gray) G.L. Nesom															X
Ditaxis neomexicana (Mull.Arg.) A. Heller								X							
Dithyrea californica Harv.					X									X	
Draba cuneifolia Nutt. ex Torrey & A. Gray	X				X		X	X				X			
Draba reptans (Lamarck) Fernald														X	
Echinocactus polycephalus Engelm. & J.M. Bigelow var. *polycephalus*	X		X			X	X	X		X			X	X	X
Echinocereus engelmannii (Engelm.) Lem. var. *engelmannii*	X						X		X	X		X	X	X	X
Echinocereus mojavensis Engelm. & J. M. Bigelow												X			
Elymus cinereus Scribn. & Merr.												X			

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Elymus elymoides (Raf.) Swezey												X			
Encelia farinosa A. Gray ex Torr.							X	X		X	X			X	
Encelia frutescens (A. Gray) A. Gray						X		X							
Encelia resinifera C. Clark			X			X	X		X				X		X
Encelia virginensis A. Nelson										X				X	X
Enceliopsis argophylla (D.C. Eaton) A. Nelson	X	X									X				
Ephedra funerea Coville & Morton		X							X					X	
Ephedra nevadensis S. Watson	X		X			X	X			X			X	X	X
Ephedra torreyana S. Watson var. *torreyana*	X	X					X				X			X	
Ephedra viridis Coville												X		X	X
Eremalche rotundifolia (A. Gray) Greene			X												
Eremothera boothii (Douglas) W.L. Wagner & Hoch subsp. *condensata* (Munz) W.L. Wagner & Hoch	X		X			X	X	X		X				X	
Eremothera refracta (S. Watson) W.L. Wagner & Hoch	X							X							
Eriastrum eremicum (Jeps.) H. Mason subsp. *eremicum*					X			X							
Ericameria nana Nutt.												X			
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & Baird var. *mohavensis* (Greene) G. L. Nesom & G. I. Baird															X
Ericameria nauseosa (Pall. ex Pursh) G. L. Nesom & G. I. Baird												X	X		
Ericameria parryi (A. Gray) G.L. Nesom & Baird					X										
Erigeron divergens Torrey & A. Gray							X								
Eriodictyon angustifolium Nutt.												X			
Eriogonum bifurcatum Reveal													X		
Eriogonum brachypodum Torr. & A. Gray										X			X	X	
Eriogonum deflexum Torr. var. *deflexum*	X	X	X	X		X	X	X							

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Eriogonum exaltatum M.E. Jones														X	
Eriogonum fasciculatum Benth. var. *polifolium* (Benth.) Torr. & A. Gray						X		X						X	X
Eriogonum heermannii Durand & Hilg. var. *sulcatum* (S. Watson) Munz & Reveal							X								X
Eriogonum heermannii Durand & Hilg.												X			
Eriogonum inflatum Torr. & Frém.	X	X	X		X		X	X		X	X		X	X	X
Eriogonum insigne S. Watson														X	
Eriogonum maculatum A. Heller			X				X						X		
Eriogonum microtheca Nutt.												X			
Eriogonum nidularum Coville			X				X						X		
Eriogonum palmerianum Reveal								X							
Eriogonum plumatella Durand & Hilgard								X							
Eriogonum reniforme Torr. & Frém.		X					X	X							
Eriogonum thomasii Torr.								X		X			X	X	
Eriogonum trichopes Torr. var. *trichopes*	X	X	X			X	X	X		X	X		X	X	
Eriogonum umbellatum Torr.												X			
Eriogonum viscidulum J.T. Howell					X									X	
Eriophyllum lanatum Pursh (J. Forbes) - this is Antheropeas in FNA								X						X	
Erodium cicutarium (L.) L'Hér. ex Aiton*	X		X	X		X	X	X		X		X	X	X	X
Erodium texanum A. Gray	X						X			X				X	
Eschscholzia glyptosperma Greene	X		X			X	X	X		X				X	
Eschscholzia minutiflora S. Watson subsp. *minutiflora*								X					X	X	
Eucnide urens (Parry ex A. Gray) Parry	X													X	
Eucrypta micrantha (Torr.) A. Heller	X					X			X					X	X
Euphorbia albomarginata (Torr. & A. Gray) Small	X			X		X				X			X		
Euphorbia parryi (Engelm.) Rydb.					X										

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Euphorbia polycarpa Bentham				X				X							
Fallugia paradoxa (D. Don) Endl. ex Torr.												X			X
Ferocactus cylindraceus (Engelmann) Orcutt	X					X	X	X		X			X	X	X
Forestiera pubescens Nutt.												X			
Frasera albomarginata S. Watson												X			
Funastrum hirtellum (A. Gray) Schltr.								X							
Funastrum utahense (Engelm.) Liede & Meve										X					
Galium stellatum Kellogg subsp. *eremicum* (Hilend & J.T. Howell) Ehrend.	X														X
Geraea canescens Torr. & A. Gray			X		X					X	X			X	
Gilia sinuata Douglas ex Benth.			X												
Gilia sp. Ruiz & Pav.	X	X				X	X	X							X
Gilia stellata A. Heller			X										X		
Gilia transmontana (H. Mason & A.D. Grant) A.D. Grant & V.E. Grant						X								X	
Glandularia gooddingii (Briq.) Solbrig												X			
Glyptopleura marginata D.C. Eaton	X					X	X		X				X		
Grayia spinosa (Hook.) Moq.							X								X
Grusonia parishii (Orcutt) Pinkava							X						X		X
Gutierrezia microcephala (DC.) A. Gray	X						X							X	X
Gutierrezia sarothrae (Pursh) Britton & Rusby			X									X			X
Gutierrezia sp. Lagasca	X													X	
Halogeton glomeratus (M. Bieb.) C.A. Mey.*				X									X		
Hedeoma nana (Torr.) Briq.												X			X
Helianthus anomalous S.F. Blake					X									X	
Helianthus sp. L.													X		
Heliotropium convolvulaceum (Nutt.) A. Gray					X										
Herniaria hirsuta L.* *(state record?!)*														X	

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Hesperocallis undulata A. Gray								X							
Hesperostipa neomexicana (Thurb.) Barkworth												X			
Hilaria rigida (Thurb.) Benth. Ex Scribn.	X		X	X	X	X	X	X	X	X	X		X	X	X
Hoffmanseggia glauca (Ortega) Eifert													X		
Hordeum murinum L. subsp. *leporinum* (Link) Arcang.*							X						X		
Hordeum murinum L.*													X	X	
Hyptis emory Torr.								X							
Ipomopsis polycladon (Torr.) V.E. Grant	X		X				X						X		
Isocoma acradenia (Greene) Greene														X	
Johnstonella angustifolia (Torr.) Hasenstab & M.G. Simpson			X		X			X							
Juniperus osteosperma (Torrey) Little												X			X
Krameria bicolor S. Watson	X							X		X				X	
Krameria erecta Willd. ex Schult.	X	X	X		X	X	X		X		X		X	X	X
Krascheninnikovia lanata (Pursh) A. Meeuse & Smit	X		X		X	X	X						X	X	X
Langloisia setosissima (Torr. & A. Gray ex Torr.) Greene subsp. *punctata* (A. Gray ex Coville) Timbrook			X							X					
Langloisia setosissima (Torr. & A. Gray ex Torr.) Greene subsp. *setosissima*			X		X			X					X	X	
Lappula occidentalis (S. Watson) Greene	X			X			X						X		X
Larrea tridentata (DC.) Coville	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Lepidium alyssoides A. Gray														X	
Lepidium flavum Torr.							X								
Lepidium fremontii S. Watson	X		X			X	X		X				X		X
Lepidium lasiocarpum Nutt. var. *lasiocarpum*	X	X	X				X	X	X	X			X	X	X
Leptodactylon pungens (Torrey) Rydb.							X								

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Leptosiphon aureus (Nutt.) J.M. Porter & L.A. Johnson						X			X						
Lesquerella tenella A. Nelson	X													X	
Linanthus demissus (A. Gray) Greene	X							X		X				X	
Linanthus jonesii (A. Gray) Greene	X							X		X	X			X	
Linum lewisii Pursh												X			X
Loeseliastrum matthewsii (A. Gray) Timbrook														X	
Loeseliastrum schottii (Torr.) Timbrook			X		X				X				X	X	
Lomatium nevadense (S. Watson) J.M. Coult. & Rose												X			
Lupinus arizonicus (S. Watson) S. Watson								X							
Lupinus concinnus J. Agardh						X			X						
Lupinus pusillus Pursh						X									
Lupinus sp. L.							X								
Lycium andersonii A. Gray	X		X	X	X	X	X	X	X				X		X
Lycium cooperi A. Gray	X		X	X		X				X				X	
Lycium pallidum Miers										X			X		
Lycium pallidum Miers var. *oligospermum* C. L. Hitchc.														X	
Lycium shockleyi A. Gray				X											
Malacothrix coulteri Harv. & A. Gray			X												
Malacothrix glabrata (A. Gray ex D.C. Eaton) A. Gray			X			X	X	X	X				X		
Malacothrix torreyi A. Gray			X												
Mammillaria tetrancistra Engelm.							X	X			X			X	
Marina parryi (Torr. & A. Gray) Barneby								X							
Menodora spinescens A. Gray	X		X			X	X					X	X		X
Mentzelia affinis Greene						X	X		X						
Mentzelia albicaulis (Hook.) Torr. & A. Gray			X							X			X	X	
Mentzelia involucrata S. Watson		X			X			X							

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Mentzelia sp. L.	X		X		X		X	X							X
Mentzelia tricuspis A. Gray										X				X	
Mirabilis laevis (Benth.) Curran var. *retrorsa* (A. Heller) Jeps.	X		X			X									X
Mirabilis laevis (Benth.) Curran var. *villosa* (Kellogg) Spellenb.								X							
Mollugo cerviana (L.) Ser.									X						
Monoptilon bellidiforme Torr. & A. Gray ex A. Gray						X									
Monoptilon bellioides (A. Gray) H.M. Hall			X				X						X		
Mortonia utahensis (Coville ex A. Gray) A. Nelson														X	
Muhlenbergia porteri Scribn. ex Beal	X														X
Nama demissum A. Gray var. *demissum*	X		X										X		
Nemacladus orientalis (McVaugh) Morin	X		X										X	X	
Nemacladus rubescens Greene			X		X								X	X	
Nemacladus sp. Nutt.								X							
Nicotiana obtusifolia M. Martens & Galeotti var. *obtusifolia*	X													X	X
Nolina bigelovii (Torr.) S. Watson								X							
Oenothera caespitosa Nutt. subsp. *crinita* (Rydb.) Munz	X						X					X			X
Oenothera deltoides Torr. & Frém.					X	X	X							X	
Oenothera primiveris A. Gray subsp. *bufonis* (M.E. Jones) Munz	X		X			X	X		X				X		
Oenothera suffrutescens (Ser.) W.L. Wagner & Hoch	X						X			X					X
Oligomeris linifolia (Vahl) J.F. Macbr.										X				X	
Opuntia basilaris Engelm. & J.M. Bigelow var. *basilaris*	X	X	X		X	X	X	X	X	X	X	X	X	X	
Opuntia chlorotica Engelm. & J. M. Bigelow												X			
Opuntia phaeacantha Engelm.												X			

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Opuntia polyacantha Haw. var. *erinacea* (Engelm. & J.M. Bigelow ex Engelm.) Parfitt	X						X			X		X	X		
Oreocarya confertiflora Greene															X
Oreocarya flavoculata A. Nelson												X			
Oreocarya sp. Greene	X														X
Oreocarya virginensis (M.E. Jones) J.F. Macbr.			X												
Oxytheca perfoliata Torr. & A. Gray						X	X								
Packera multilobata (Torr. & A. Gray ex A. Gray) W.A. Weber & Á. Löve												X			
Palafoxia arida B.L. Turner & Morris var. *arida*					X			X						X	
Pectis papposa Harvey & A. Gray			X			X			X						
Pectocarya heterocarpa (I.M. Johnst.) I.M. Johnst.	X	X	X		X	X	X		X	X			X	X	X
Pectocarya platycarpa (Munz & I.M. Johnst.) Munz & I.M. Johnst.	X		X			X	X		X	X				X	
Pectocarya recurvata I.M. Johnst.	X					X	X	X							
Pediomelum castoreum (S. Watson) Rydb.					X									X	
Penstemon albomarginatus M.E. Jones						X									
Penstemon eatonii A. Gray												X			
Penstemon palmeri A. Gray var. *palmeri*												X			
Penstemon sp. Schmidel															X
Penstemon barbatus (Cav.) Roth												X			
Penstemon linarioides A. Gray												X			
Petalonyx parryi A. Gray		X												X	
Petalonyx thurberi A. Gray					X									X	
Petrophytum caespitosum (Nuttall) Rydberg															X
Peucephyllum schottii A. Gray											X				
Phacelia crenulata Torr. ex S. Watson	X		X			X	X	X		X				X	X
Phacelia crenulata Torr. ex S. Watson var. *minutiflora* (J. Voss) Jeps.														X	

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Phacelia fremontii Torr.	X		X			X	X					X		X	X
Phacelia ivesiana Torr.			X		X								X	X	
Phacelia palmeri Torr. ex S. Watson		X												X	
Phacelia pulchella A. Gray var. *gooddingii* (Brand) J.T. Howell	X		X										X		
Phacelia rotundifolia Torr. ex S. Watson														X	X
Phalaris minor Retz.										X					
Phoradendron californicum Nutt.	X		X				X	X	X				X		
Phoradendron juniperinum A. Gray												X			
Physalis crassifolia Benth.	X							X						X	
Physalis hederifolia A. Gray var. *palmeri* (A. Gray) C. L. Hitchc.											X				
Physaria chambersii Rollins												X			
Physaria tenella (A. Nelson) O'Kane & Al-Shehbaz	X									X				X	
Pinus monophylla Torr. & Frem.												X			X
Plagiobothrys arizonicus (A. Gray) A. Gray								X							
Plagiobothrys jonesii A. Gray														X	
Plantago ovata Forssk.	X	X	X		X			X		X			X	X	
Pleuchea sericea (Nutt.) Coville					X										
Pleuraphis rigida Thurb.								X					X		
Poa fendleriana (Steud.) Vasey															X
Porophyllum gracile Benth.	X					X		X					X	X	
Prenanthella exigua (A. Gray) Rydb.	X		X			X	X		X	X	X		X	X	
Prosopis glandulosa Torr. var. *torreyana* (L.D. Benson) M.C. Johnst.	X		X				X				X		X		
Prosopis pubescens Benth.														X	
Prunus fasciculata (Torr.) A. Gray var. *fasciculata*	X			X								X			
Psathyrotes annua (Nutt.) A. Gray			X		X								X		X
Psathyrotes ramosissima (Torr.) A. Gray			X								X				

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Psilostrophe cooperi (A. Gray) Greene			X											X	
Psorothamnus fremontii (Torr. ex A. Gray) Barneby var. *fremontii*	X	X			X	X	X	X		X	X		X	X	X
Purshia mexicana (D. Don) S.L. Welsh															X
Purshia stansburiana (Torr.) Henrickson												X			X
Quercus turbinella Greene	X											X			X
Rafinesquia neomexicana A. Gray	X		X		X	X	X		X	X			X	X	X
Ranunculus testiculatus Crantz												X			
Rhus aromatica Aiton var. *trilobata* (Nutt.)												X	X		X
Rumex hymenosepalus Torr.	X					X								X	
Salazaria mexicana Torr.	X					X	X	X		X				X	X
Salicornia rubra A. Nelson														X	
Salsola tragus L.*	X		X	X	X	X	X		X				X	X	X
Salvia columbariae Benth.								X							
Salvia dorrii (Kellogg) Abrams	X											X			X
Schismus barbatus (Loefl. ex L.) Thell.*	X	X	X	X	X	X	X	X	X	X			X	X	X
Sclerocactus johnsonii (Parry ex Engelm.) E.M. Baxter	X				X	X					X			X	
Scutellaria mexicana (Torrey) A.Paton			X											X	
Senegalia greggii (A. Gray) Britton & Rose	X	X						X	X	X	X			X	X
Senna armata (S. Watson) Irwin & Barneby	X							X							
Sisymbrium altissimum L.*													X		
Sisymbrium irio L.*	X						X	X					X	X	
Sonchus asper (L.) Hill*										X					
Sphaeralcea ambigua A. Gray	X		X	X	X	X	X		X	X	X	X	X	X	X
Sphaeralcea angustifolia (Cav.) G. Don			X												
Sporobolus airoides (Torr.) Torr.	X		X											X	
Sporobolus contractus Hitchc.															X

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Sporobolus cryptandrus (Torr.) A. Gray						X	X					X			
Stanleya pinnata (Pursh) Britton	X		X				X						X		
Stanleya pinnata var. *integrifolia* (James) Rollins															X
Stephanomeria exigua Nutt. subsp. *exigua*			X		X									X	
Stephanomeria pauciflora (Torr.) A. Nelson	X		X		X	X	X	X	X	X			X	X	X
Streptanthella longirostris (S. Watson) Rydb.	X		X		X	X	X		X	X			X	X	
Strigosella africana (L.) Botsch.*	X	X	X	X	X		X			X				X	
Stylocline micropoides A. Gray			X		X	X		X						X	
Suaeda moquinii (Torr.) Greene									X				X	X	
Symphiotrichum longifolium (Lam.) G.L. Nesom															X
Tamarix chinensis Lour.*	X			X			X							X	
Tamarix sp. L.													X		
Tetraneuris acaulis (Pursh) Greene												X			
Thamnosma montana Torr. & Frém.	X				X		X					X		X	X
Thymophylla pentachaeta (DC.) Small	X										X				X
Tidestromia suffruticosa (Torr.) Standl.											X				
Tiquilia canescens (DC.) A.T. Richardson var. *canescens*	X													X	
Tiquilia latior (I.M. Johnst.) A.T. Richardson														X	
Tiquilia plicata (Torr.) A.T. Richardson					X	X			X						
Tribulus terrestris L.								X							
Tridens muticus (Torr.) Nash														X	
Tridens muticus (Torr.) Nash var. *muticus*							X				X				X
Tripterocalyx micranthus (Torr.) Hooker					X										
Triticum aestivum L.										X			X		
Uropappus lindleyi (DC.) Nutt.			X												
Vulpia octoflora Walter	X		X			X	X			X	X		X		X

Species	Arrow Canyon & Coyote Springs	Bitter Springs North & Echo Hills North	Bonus ERBI	Dry Lake & Hidden Valley Alkali	East Mormon Group	Hidden Valley / Jean Dry Lake Group	Indian Springs Group	Laughlin Group	Primm Group	Railroad Underpass Group	Red Needle & Lava	Revisit PEAL	Sandy Valley Group	West Mormon Group	Yucca Forest Valley
Xanthisma spinulosum (Pursh) D. R. Morgan & R. L. Hartman var. *gooddingii* (A. Nelson) D. R. Morgan & R. L. Hartman														X	
Xylorhiza tortifolia (Torr. & A. Gray) Greene	X		X				X	X			X			X	
Yucca baccata Torr.												X			X
Yucca brevifolia Engelm. var. *jaegeriana* McKelvey	X														X
Yucca schidigera Roezl ex Ortgies	X		X			X	X	X	X	X			X		X