THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

27 February 2017

Mr. David Ennis
Mining and Minerals Division
Wendell Chino Building
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Summary Report: 2015-2016 Biological Surveys at Mill Site Claims & Proposed Substation Area, Copper Flat Mine, Sierra County NM

Dear Mr. Ennis:

New Mexico Copper Corporation (NMCC), a wholly owned subsidiary of THEMAC Resources Group, Ltd. is pleased to submit the enclosed document titled *Summary Report: 2015-2016 Biological Surveys at Mill Site Claims & Proposed Substation Area, Copper Flat Mine, Sierra County NM.* This report concludes field surveys and reporting efforts conducted in response to comments made by the Mining & Minerals Division (MMD) in your letter dated January 5, 2016. NMCC is providing 2 copies of the report to MMD, a copy to New Mexico Game & Fish (NM G&F), another to the Bureau of Land Management Las Cruces District Office (BLM), and a cd containing the report to Solv, BLM's third party contractor. The two MMD copies are enclosed and the other copies are being shipped separately with a copy of this letter.

The purpose of this report submittal is to respond to MMD requests, as we understand them and per our meeting with MMD and NM G&F in late January 2016. For further clarity we present your 5 January 2016 comments and our responses below.

Vegetation Monitoring
COMMENT: *The Sampling and Analysis Plan ("SAP") dated September 2010 indicates that two vegetation sampling events will be performed: one in April 2010 and a second event in late summer/early fall 2010. The Biological Report, however, completed only one vegetation sampling event in April/May 2015. Please addresses the absence of a second vegetation sampling event in late summer/early fall for the mill site claims and substation areas.*

In response to this comment, an additional vegetation sampling event occurred during September 2016. This late-summer/early-fall sampling event was used in combination with April/May observations from the previous year to develop a comprehensive inter-seasonal plant species list for the site.

COMMENT: *The SAP dated September 2010 proposed to quantify numerous vegetation parameters that are required by 19.10.6.602.D(13)(c) NMAC including a description of cover, density and productivity of the plant communities within the proposed permit area. The Biological Report for the mill site claims and substation alternatives does not report percent cover, density or productivity information. Please address this deviation from the SAP.*

A transect based method nearly identical to the method proposed in the SAP was implemented in September 2016 and the data logged during that sampling event were utilized to report ground cover, aerial cover, density, productivity, and frequency. In accordance with the SAP, measurements occurred along randomly oriented 50-m transects, production was measured in 1-m2 quads placed at 25-m intervals, and woody density was tallied in a 2-m wide belt. Instead of using a point-intercept method to capture cover, we utilized a quad frame method (as proposed during the February 2016 meeting with MMD) because we were concerned that 100 laser point measurements along the transect would not detect shrub cover due to recent herbicide treatments, irregular growth, and inconsistent "green-up". Cover is measured across a significantly larger area with the use of frames and cover classes rather than lasers/points.

Wildlife Monitoring

COMMENT: *The SAP dated September 2010 proposed that wildlife presence and activity surveys will occur twice per year: once during the overwintering period (December/January) and once during breeding season (late May/June). Section 19.10.6.602.D(13)(d)(iii) NMAC states that the wildlife data shall include distribution by season and habitat type. The Biological Report for the mill site claims and substation alternatives conducted a single survey in late April/early May, which does not match the frequency or seasonal timing proposed in the SAP. Please address this deviation from the SAP.*

The 2015 wildlife surveys were conducted during two sampling events conducted during April/May 2015 that was the survey window requested at that time by BLM. As this updated report details, a winter survey was also conducted during January 2016 and monitoring also occurred during the late-May to early-June avian breeding season during 2016 in order to address the frequency and seasonal timing concerns expressed by MMD.

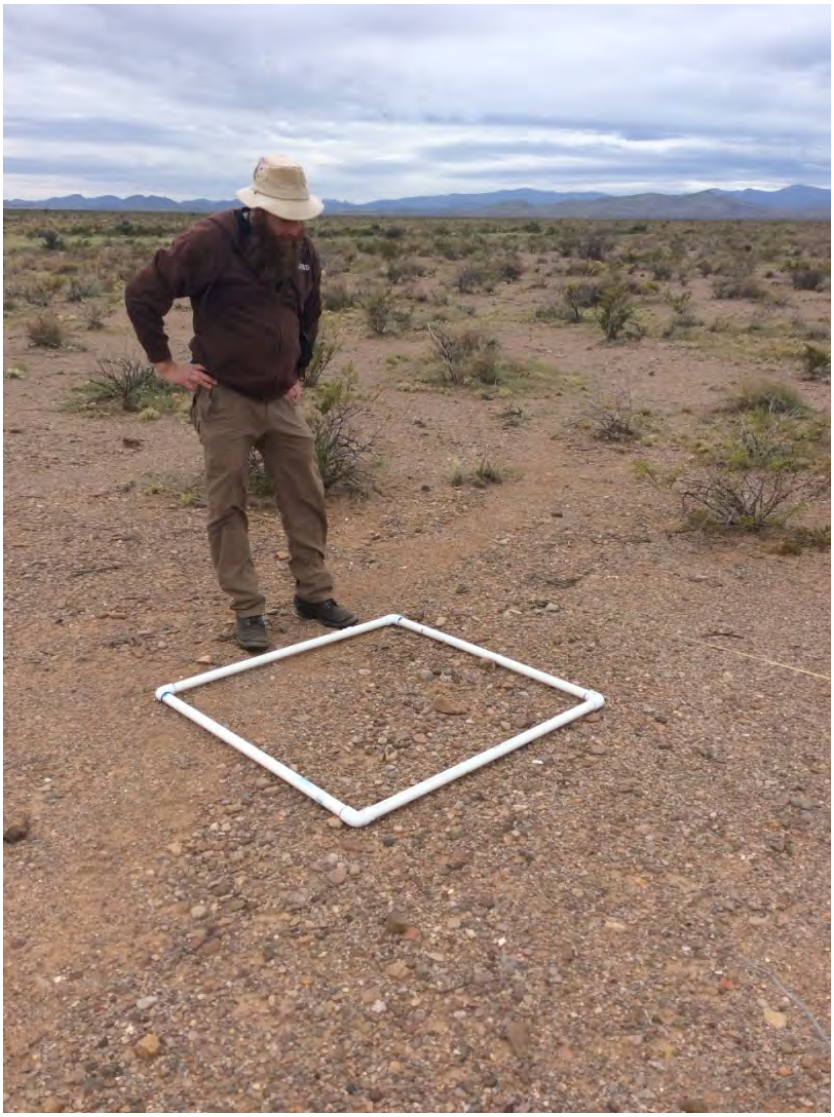
The enclosed report further responds to MMD requests. If you have any questions or comments regarding this submission please let me know.

Best regards,

Katie Emmer

Katie Emmer
Permitting & Environmental Compliance

CC: Ronald Kellermueller, New Mexico Game & Fish
Douglas Haywood, Bureau of Land Management, Las Cruces District Office
Dave Henney, Solv, LLC



Summary Report: 2015-2016 Biological Surveys at Mill Site Claims and Proposed Substation Area, Copper Flat Mine, Sierra County, NM.

Prepared for:
THEMAC Resources/ New Mexico Copper
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DOCUMENT CONTROL SUMMARY

Title:	Summary Report: 2015-2016 Biological Surveys at Mill Site Claims and Proposed Substation Area, Copper Flat Mine, Sierra County, NM.		
Client Company:	THEMAC Resources, New Mexico Copper Company		
Client Contact:	Katie Emmer		
Status:	Client Comments Addressed, Results and Conclusions Sections Revised		
GeoSystems Analysis Job #:	1601		
Project Manager:	Chad McKenna		
Author(s):	Chad McKenna, Quentin Hays		
Revision Number:	Draft 4 (February 17, 2017)		
Notes:	Initial Client Review Draft (1) provided January 5, 2017		
Date:	February 17, 2017		
Distribution (Number of Copies):	Client	Other	GSA Library

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COPPER FLAT PROJECT ---- 2015/2016 MILL SITE AND SUBSTATION SURVEY METHODS AND RESULTS

Citation

GeoSystems Analysis 2017. Summary Report: 2015-2016 Biological Surveys at Mill Site Claims and Proposed Substation Area, Copper Flat Mine, Sierra County, NM. Prepared for New Mexico Copper Company. Prepared by GeoSystems Analysis, Inc. Albuquerque, NM. January 5, 2016.

Name	Affiliation	Role
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INTRODUCTION

The 2010 New Mexico Copper Corporation (NMCC) Mine Plan of Operations (MPO) includes nine mill site claims; plus, Alternative 2 in the Copper Flat Mine Draft Environmental Impact Statement (DEIS) report proposes construction of a substation within a 30-acre site near the nine mill site claims. However, previous biological surveys completed back in 2011-2012 to support in the Copper Flat Mine Sampling and Analysis Plan (SAP) and Baseline Data Report (BDR, NMCC, 2012) did not survey biological resources at the nine mill sites and the proposed substation. In April 2015, NMCC contracted GeoSystems Analysis, Inc. (GSA) to survey the mill sites and substation area in accordance with survey objectives communicated by the Bureau of Land Management (BLM). The approach and results of the mill site and substation surveys were compiled into a summary memorandum (GeoSystems, 2015) and submitted to BLM, New Mexico Mining and Minerals Division (MMD), and New Mexico Department of Game and Fish (NMG&F) in May 2015. MMD and NMG&F provided comments to the mill site and substation area report in a January 2016 letter. NMCC organized a meeting in Santa Fe, NM later in January 2016 in response to MMD's letter to be sure that MMD and NM G&F have all the baseline data required to assess the Copper Flat Mine Project permit application. It was agreed during that meeting that supplemental vegetation and wildlife surveys would be completed during 2016 to address NMG&F and MMD comments.

Prior to biological fieldwork in 2016, a proposed work plan was developed by GSA and NMCC and reviewed by managing agencies to ensure that the proposed monitoring approach for vegetation and wildlife would meet MMD's requirements. Specifically, MMD verified that the proposed sampling methods and objectives published in this report meet requirements for wildlife monitoring in 19.10.6.602.D(13) (d)(iii) NMAC by achieving distribution by season and habitat type; as well as, required vegetation data parameters per 19.10.6.602.D(13) (c) including description of cover, density and productivity of the plant communities. This report summarizes the specific methods employed and survey results for biological fieldwork conducted at the nine mill site claims and the substation area during all survey efforts completed between April 2015 and September 2016.

Project Location

The proposed Copper Flat Mine is in the Chihuahuan Desert region of Sierra County, New Mexico (NM); approximately 20 miles southwest of Truth or Consequences and 4 miles east

of Hillsboro. Sites evaluated in this report lie between two and six miles east of the proposed Copper Flat permit area along NM State Highway 152 (Figure 1). The nine proposed mill site locations are on federal land managed by the BLM while the proposed substation survey area is located on property owned and managed by the State of NM.

Typical elevation in the project area is 4,800 feet above mean sea level. In nearby Hillsboro, NM; precipitation averages 12.5 inches annually with 6.3 inches of average winter snowfall (WRCC, 2015). High temperatures exceed 90°F during summer months and 50°F during winter months. Average lows are approximately 60°F during the summer and 25°F during the winter (WRCC, 2015). Except for the Rio Grande and segments of nearby Animas and Percha Creeks, streamflow along waterways in this region is ephemeral and/or intermittent. Surface flows in arroyos in this area are supplemented by isolated springs, monsoonal storm events, or sometimes spring snowmelt runoff. Greyback Arroyo is the most prominent geomorphic feature near the survey area and it is dry through most of the year. At this location, Greyback Arroyo does not contain springs or seeps and it only wets during localized precipitation events; particularly during monsoon season.

The site falls in Natural Resources Conservation Service (NRCS) Major Land Resource Area 042-Southern Desertic Basins, Plains, and Mountains, soil survey area NM660 (Sierra County, NM). Per electronic soil survey data, (SSURGO, 2015) affected soils include map units 4 (Akela very gravelly loam, moderately rolling), 62 (Nickel very gravelly fine sandy loam, very steep), and 63 (Nickel-Chamberino association, gently sloping). The dominant ecological site is Gravelly (R042XB010NM). According to NRCS descriptions, the Gravelly ecological site is characterized by shallow soils with underlying caliche or limestone layers within 20 inches (ESIS, 2015). That underlying restriction limits vegetation productivity and is also an important aspect of the site ecology. Slopes in these soil types exhibit a high degree of topographic diversity but average less than 5 percent.

The historic plant community type for the Gravelly ecological site is generally assumed to exhibit co-dominance between grasses, including black grama (Bouteloua eriopoda) and bush muhly (Muhlenbergia porteri), and shrubs and half-shrubs, chiefly creosote bush (Larrea tridentata) and mariola (Parthenium incanum). Other regional vegetation maps classify the project area as Chihuahuan Desert Scrub (Dick Peddie, 1999 and Brown and Lowe, 1981) with creosote bush as the dominant species. The Southwest Regional Gap Program vegetation maps describe the site as a mixture of Chihuahuan Creosotebush/Mixed Desert Thorn Scrub and Apacherian-Chihuahuan Piedmont Semi-Desert Grassland Steppe.

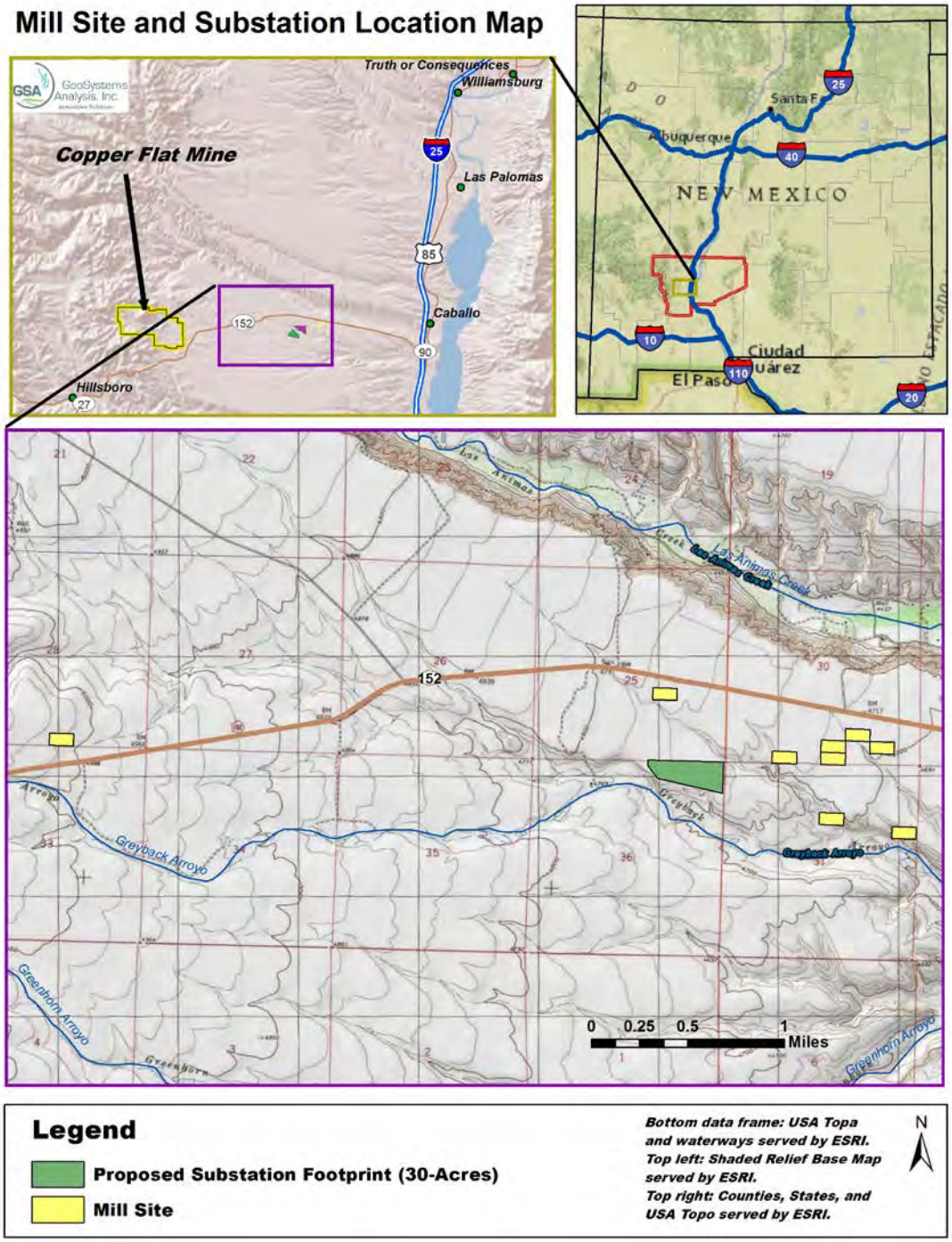

Figure 1 Project location map

Portions of the project area have been previously developed and disturbed during installation of a water pipeline, wells, access roads, fence lines, and livestock management improvements (Figure 2). The project area is currently grazed by cattle. Tebuthiuron brush killer (brand name Spike) was applied by managing agencies to control creosote bush and promote grass establishment in 2012. The herbicide pellets appeared to be variably effective in permanently controlling creosote bush but have effectively reduced creosote cover at least on the short term.

Figure 2. Representative photo of one of the mill site locations in the project area.

METHODS

Biological field surveys at the mill site and substation project area were completed during a total of five multi-day site visits that occurred between April 2015 and September 2016. The specific survey periods were intended to capture seasonal variations in biological activity based on guidance provided by BLM, MMD, and NMDGF, and the approaches also align with survey methods and objectives published in the SAP and BDR documents for the Copper Flat Project. A list of the specific survey periods is provided in the table below (Table 1). The following sub-sections specifically detail field methodologies employed to monitor and measure wildlife, vegetation, and other potentially unique environmental features, as well as state- and federally-regulated biological resources.

Table 1. Timing for various biological surveys at the mill site and substation project area.

Survey Number	**Survey Date**
1	April 21-25, 2015
2	May 2-4, 2015
3	January 29-31, 2016
4	May 29 to June 1, 2016
5	September 25-30, 2016

Wildlife Survey Methods

Wildlife surveys included:

1. Multi-day avian use surveys that began pre-dawn and utilized area searches for detecting bird activity within the mill sites and substation area, as well as, areas immediately surrounding the site within the same general habitat types. Survey timing was:

    - Mid to late-April, 2015.
    - Early-May 2015.
    - A winter bird survey during January 2016.
    - An additional bird survey during late-May to early June to monitor breeding activity.

2. Recording indications (tracks, scat, burrows, etc.) of other wildlife activity or additional species observed.

3. Marking (with a GPS) and photographing active nests, as well as, inactive raptor nests. Recording any behavioral observations that suggest breeding activity especially during the May/June 2016 survey.

4. Updating wildlife detection tables in the report with state- and federal- special status species observed.

Vegetation Surveys

Vegetation work in the mill site and substation site consisted of three survey methodologies of varying intensity, which specifically included:

1. Detailed vegetation mapping of the mill-site and substation area.

2. Pedestrian inventories of all plant species encountered through the 75-acre site (45-acres of mill sites plus the 30-acre substation area) on multiple site visits between April 2015 and September 2016 via traversing the site along regularly spaced walking transects (approximately 50 feet apart). The variable survey timing was intended to capture a comprehensive species list that includes annual plants and/or perennial plants that are only discernable to the species level during a season.

3. Quantitative sampling along vegetation monitoring transects was implemented during September 2016 to quantify plant cover, density, and production. Transect length and specific parameters recorded were consistent with methods utilized during fieldwork to support the Copper Flat BDR.
    a. A total of 18 individual 50-meter long transects were monitored in the mill site and substation project area (see Figure 16 of this report for a map of the transect locations). UTM locations for the transects are included in Appendix 1.
        i. Transects employed a stratified-random sampling design intended to capture vegetation variability through the site based on types identified in the vegetation maps, prevent transect placement in existing developments (roads, wells, etc.) and intentionally distribute transects across both the mill sites and substation area.

ii. Transect orientation was determined randomly in the field via an unobserved spin of the compass dial. In some cases, the transect line partially extended beyond the mill site or substation boundary but the sampling area never extended beyond the affected habitat.

b. Cover, density, and annual production were determined within 10 frames nested at 5-meter intervals along alternating sides of the transects. Individual frames were 1m² in area (Figure 3 and Figure 4.
c. Cover was recorded as:
    i. Aerial cover by species, life form, and total cover.
    ii. Ground cover by live plant, bare soil, rock fragments, and litter.
d. Cover was recorded as ocular estimates via cover classes (i.e. adjusted Daubenmire cover classes).
e. Production was measured as air dry weight by species and lifeform in three of the ten quad frames at each transect (5-m, 25-m, and 45-m marks), like methods employed in the Copper Flat BDR. Actual wet field weights were determined for all species by clipping and weighing material by species and then air drying a representative proportion of the wet material to determine a dry weight correction factor.
f. Shrub and/or tree density was determined via counting the number of live individuals in a two-meter-wide belt transect centered over the transect line.
g. The transect was photo-documented.

Figure 3. Frames were placed on alternating sides of the transect tape every 5-m.

Figure 4. Representative photo of a transect line in a less productive area.

Unique Biological Features

In addition to the wildlife and vegetation surveys described above, our biologists conducted thorough pedestrian-level searches to assess the presence/absence of attributes regulated by state and federal environmental protection policies, and survey for unique biological features that managing agencies considered high importance for baseline data collection in previous biological surveys for the Copper Flat project, specifically:

1. Riparian and wetland habitats, including Waters of the U.S.;
2. Springs and seeps;
3. Suitable habitat for state-, federal- and agency-listed threatened, endangered, and special status species;
4. Potential and active raptor nesting substrate;
5. Abandoned mine adits and/or shafts suitable for bat hibernation and/or roosting;

6. Noxious weeds designated by New Mexico Department of Agriculture (NMDA) and U.S. Department of Agriculture (USDA);
7. Other regionally unique biological resources that might be encountered.

If any of the above listed jurisdictional or regionally important site conditions was observed; the location would have been mapped in the field with a Global Positioning System (GPS) device. If highly suitable habitat for a federally-listed threatened or endangered species was determined to be present, additional surveys for that species would have been proposed during the optimal detection season for that species if that species could not have been correctly identified during the survey.

RESULTS

Results of the 2015-2016 biological surveys are presented in the following section of this report. Of the list of site conditions surveyed for, no riparian or wetland habitats, springs and seeps were found, raptor nesting substrate is relatively limited throughout the project area, no abandoned mine adits or shafts were located, and no regionally unique biological resources were encountered. No rare, threatened, or endangered plant species or plant species of concern were encountered during field surveys. No federally listed wildlife species were observed. One state-listed endangered bird species, common ground-dove (*Columbina passerina*), was recorded during the survey. Five state-listed Species of Greatest Conservation Need (SGCN), the sagebrush sparrow (*Artemisiospiza nevadensis*), golden eagle (*Aquila chrysaetos*), mourning dove (*Zenaida macroura*), loggerhead shrike (*Lanius ludovicianus*), and scaled quail (*Callipepla squamata*), were also detected during the survey. Details on other findings follow below; our results are divided into the following subsections:

- Wildlife
    - Avian species detected
    - Winter bird surveys
    - Avian breeding
    - Raptor nesting substrate
    - Mammalian and herpetofauna observations
    - Special status wildlife
- Vegetation
    - Vegetation mapping
    - Plant species inventory
    - Ground cover

  - Aerial cover
  - Frequency
  - Annual biomass production
  - Woody plant density
  - Noxious weeds
  - Special status plant species
- Other Regionally Unique Biological Features
  - Wetlands, springs and seeps
  - Adits and shafts

Wildlife

Avian Species Detected

Area searches were used to describe avian use throughout the project area and adjacent habitat. The two primary habitat-types useful for distinguishing avian activity within the project area were classified as creosote bush shrubland (shrubland habitat), and arroyo/draw habitat, which includes larger trees/shrubs and more important vertical structure. The mill site and substation area are located primarily within shrubland habitat; however, the bird surveys were expanded into the adjacent arroyo because several of the proposed mill sites and the substation area border the arroyo habitat and some also include draws that soon converge with Greyback Arroyo. Because birds are highly mobile, the mill sites are disjunct, and the project area is relatively small geographically, we expanded our avian use monitoring into adjacent areas during all the surveys.

A total of 46 avian species were detected during the April 2015 through June 2016 surveys (Table 2). Birds were more abundant and diverse in the arroyo and draw habitats versus the surrounding shrublands. All the encountered species were classified as least concern conservation status by the International Union for Conservation of Nature.

Table 2. Bird species observed in the project area by survey period. Conservation status data from the International Union for Conservation of Nature (IUCN).

Common Name	**Scientific Name**	**Combined Relative Abundance**	**International Conservation Status**	**April/ May 2015**	**Winter 2016**	**May/ June 2016**
American kestrel	*Falco sparverius*	Uncommon	Least concern	x		x
Ash-throated flycatcher	*Myiarchus cinerascens*	Common	Least concern	x		x
Black-throated sparrow	*Amphispiza belineata*	Abundant	Least concern	x	x	x
Blue-gray gnatcatcher	*Polioptila caerulea*	Rare	Least concern	x	x	
Brewer's sparrow	*Spizella breweri*	Uncommon	Least concern	x		
Brown-crested flycatcher	*Myiarchus tyrannulus*	Rare	Least concern	x		x
Cactus wren	*Campylorhynchus brunneicapillus*	Uncommon	Least concern	x	x	x
Canyon towhee	*Melazone fusca*	Uncommon	Least concern	x	x	x
Cassin's sparrow	*Peucaea cassinii*	Rare	Least concern		x	
Chihuahuan raven	*Corvus cryptoleucus*	Abundant	Least concern	x	x	x
Chipping	*Spizella*	Uncommon	Least concern	x		

Common Name	**Scientific Name**	**Combined Relative Abundance**	**International Conservation Status**	**April/ May 2015**	**Winter 2016**	**May/ June 2016**
sparrow	*passerina*					
Common ground-dove	*Columbina passerina*	Rare	Least concern			x
Common poorwill	*Phalaenoptilus nuttallii*	Rare	Least concern	x		
Common raven	*Corvus corax*	Common	Least concern	x	x	
Cooper's hawk	*Accipiter cooperii*	Rare	Least concern	x		
Cordilleran flycatcher	*Empidonax occidentalis*	Rare	Least concern	x		
Crissal thrasher	*Toxostoma crissale*	Rare	Least concern	x	x	
Curve-billed thrasher	*Toxostoma curvirostre*	Uncommon	Least concern			x
Eastern meadowlark	*Sturnella magna*	Rare	Least concern	x		
Gambel's quail	*Callipepla gambelii*	Common	Least concern	x	x	x
Golden eagle	*Aquila chrysaetos*	Rare	Least concern		x	
Greater roadrunner	*Geococcyx californianus*	Uncommon	Least concern			x
Great-horned owl	*Bubo virginianus*	Rare	Least concern	x		
Green-tailed towhee	*Pipilo clorurus*	Uncommon	Least concern	x		

Common Name	**Scientific Name**	**Combined Relative Abundance**	**International Conservation Status**	**April/ May 2015**	**Winter 2016**	**May/ June 2016**
House finch	*Haemorhous mexicanus*	Rare	Least concern	x	x	x
Loggerhead shrike	*Lanius ludovicianus*	Uncommon	Least concern	x	x	
Mourning dove	*Zenaida macroura*	Abundant	Least concern	x		x
Northern mockingbird	*Mimus polyglottus*	Abundant	Least concern	x	x	x
Pyrrhuloxia	*Cardinalis sinuatus*	Uncommon	Least concern		x	x
Red-tailed hawk	*Buteo jamaicensis*	Common	Least concern	x	x	x
Rock wren	*Salpinctes obsoletus*	Rare	Least concern	x		
Ruby-crowned kinglet	*Regulus calendula*	Uncommon	Least concern		x	
Sagebrush sparrow	*Artemisiospiza nevadensis*	Rare	Least concern	x		
Sage thrasher	*Oreoscoptes montanus*	Uncommon	Least concern		x	
Sandhill crane	*Grus canadensis*	Rare	Least concern		x	
Say's phoebe	*Sayornis saya*	Uncommon	Least concern	x		
Scaled quail	*Callipepla squamata*	Uncommon	Least concern	x		

Common Name	**Scientific Name**	**Combined Relative Abundance**	**International Conservation Status**	**April/ May 2015**	**Winter 2016**	**May/ June 2016**
Sharp-shinned hawk	*Accipiter striatus*	Rare	Least concern		x	
Swainson's hawk	*Buteo swainsoni*	Common	Least concern	x		x
Turkey vulture	*Cathartes aura*	Abundant	Least concern	x		x
Western kingbird	*Tyrannus verticalis*	Common	Least concern	x		x
Western wood-pewee	*Contopus sordidulus*	Uncommon	Least concern			x
White-crowned sparrow	*Zonotrichia leucophrys*	Rare	Least concern	x		
White-tailed kite	*Elanus leucurus*	Rare	Least concern		x	
White-winged dove	*Zenaida asiatica*	Uncommon	Least concern	x		x
Wilson's warbler	*Wilsonia pusilla*	Rare	Least concern	x		

Winter Bird Surveys

On January 29th, 30th and 31st, 2016, the proposed Copper Flat mill site and substation areas were surveyed to quantify winter avian use of these areas. Although use of these areas by wintering birds was predicted to be lower than during migration or breeding periods, the possibility that some species could be utilizing this habitat during the winter while not occupying the same habitat during breeding or migration is of concern. A possibility also

exists that species of conservation concern may be utilizing these habitats seasonally. Species detected during this survey period are included in Table 2.

As expected, winter surveys determined that overall avian abundance was markedly decreased from levels detected during migration surveys in 2015 (and the breeding surveys that later followed in 2016). However, several year-round resident species were recorded. The most notable new species detected was the golden eagle (*Aquila chrysaetos*), seen during an afternoon survey on January 29th and again during a morning survey on January 30th. Both times this species (it was impossible to determine whether it was the same individual) was first seen perched on a high-voltage transmission line tower near Greyback Arroyo. During both observations, the individual subsequently left its perch and soared over the project area; both observations were of an adult bird. Golden eagles frequent the Lake Valley area, and are known to build nests and reproduce in nearby rock outcrop or cliff habitats. The possibility that golden eagles are regularly utilizing the project area for foraging (there does not appear to be suitable nesting habitat within or directly adjacent to the proposed mill site and substation areas) is of note.

A small group of cranes, noted flying over the project area the morning of January 30th, would not be expected to utilize habitat found within the project area and the observation should be considered incidental. Sage thrashers winter in southern New Mexico, and their breeding range extends south into the northwest part of the state. Although not noted during previous avian surveys, it is possible this is a resident bird. Pyrrhuloxia are not considered a truly migratory species, but are often detected outside of their accepted breeding range during winter. This may indicate a seasonal withdrawal, another incidental observation, or may be a sign of previously undetected year-round use of the area by this species despite not being previously recorded (Pyrrhuloxia breed throughout southern New Mexico). Finally, although rare in New Mexico, white-tailed kites are seen with increasing regularity in the state, and previous winter use has been recorded for southern Lake Valley. The individual detected was seen soaring over Greyback Arroyo during the morning survey on January 31st.

Avian Breeding

On May 29th, 30th, 31st, and June 1st 2016, avian breeding surveys were conducted at the proposed Copper Flat mill site. Consistent with previous surveys at this site, area searches were utilized to monitor breeding season activity. The number of species detected during the May/June 2016 period was decreased from the number detected during migration period

surveys in 2015 (Table 2. The habitat conditions were good in the arroyo/draw areas, but the shrubland (creosote bush flats) habitat appeared to be delayed phenologically, and displayed inconsistent growing season green-up during the survey period possibly due to herbicide application. It's possible that the creosote decadency contributed to the fact that fewer species were confirmed to be breeding in the shrubland habitat compared to those confirmed within arroyo/draw habitat. Some species, such as Chihuahuan raven (*Corvus cryptoleucus*), were determined to be nesting in shrubland habitat, but were classified in this way because nests (located atop transmission line towers) were above shrubland habitat, and this species certainly uses both habitat types during the breeding season. The same is true for Black-throated sparrows (*Amphispiza bilineata*), which were detected in both habitat types; this species is abundant and likely builds nests and rears young in both arroyo/draw and shrubland habitat type.

The following table (Table 3) lists the species detected in arroyo/draw habitat and whether they were determined to be breeding, suspected of breeding, or were likely transients or individuals utilizing habitat for foraging.

Table 3. Avian breeding observations in the Arroyo/Draw habitat type.

Species (in order of detection)	***Breeding / Non-breeding***	***Observed Behavior***
Northern mockingbird *Mimus polyglottos*	Breeding	Territorial singing, nest located
Gambel's quail *Callipepla gambelii*	Breeding	Territorial behavior, fledglings seen
Ash-throated flycatcher *Myiarchus cinerascens*	Undetermined (likely)	Territorial behavior, no confirmation of breeding, typical breeding habitat
Black-throated sparrow *Amphispiza bilineata*	Breeding	Fledglings seen
Turkey vulture *Cathartes aura*	Undetermined (possible)	Soaring over project area, not typical breeding habitat
Chihuahuan raven *Corvus cryptoleucus*	Non-breeding	Nests located adjacent to arroyo habitat (in shrubland)
Cactus wren *Campylorhynchus brunneicapillus*	Breeding	Territorial singing, nests located, fledglings seen
Brown-crested flycatcher *Myiarchus tyrannulus*	Breeding	Territorial singing, nest located
House finch *Haemorhous mexicanus*	Breeding	Fledglings seen
Common ground-dove *Columbina passerina*	Undetermined (possible)	Seen briefly within project, no confirmation of breeding,

Species (in order of detection)	***Breeding / Non-breeding***	***Observed Behavior***
		typical breeding habitat
Greater roadrunner *Geococcyx californianus*	Breeding	Territorial behavior, nest located
Mourning dove *Zenaida macroura*	Undetermined (likely)	Seen within project, no confirmation of breeding, typical breeding habitat
Canyon towhee *Melozone fusca*	Undetermined (likely)	Territorial behavior, no confirmation of breeding, typical breeding habitat
Pyrrhuloxia *Cardinalis sinuatus*	Breeding	Territorial singing, male seen feeding female
Curve-billed thrasher *Toxostoma curvirostre*	Breeding	Nest located
Western wood-pewee *Contopus sordidulus*	Undetermined (unlikely)	Seen within project, not typical breeding habitat
Western kingbird *Tyrranus verticalis*	Undetermined (likely)	Territorial behavior, no confirmation of breeding, typical breeding habitat
Red-tailed hawk *Buteo jamaicensis*	Undetermined (possible)	Seen within project, no confirmation of breeding, typical breeding habitat
White-winged dove *Zenaida asiatica*	Undetermined (likely)	Seen within project, no confirmation of breeding, typical breeding habitat

The following table (Table 4) includes information on the nests located in arroyo/draw habitat including the status of the nest where determinable. Cactus wren (*Campylorhynchus brunneicapillus*) were the most prolific identifiable breeding birds, but this is likely because they nest in very conspicuous locations and actively defend nest sites. Because the entrance to this species' nests is often downward facing, and because every effort was made not to disturb active nests, it was impossible to determine whether some nests held nestlings or eggs. Cactus wren nestlings are also silent when occupying the nest. However, if an adult was observed exiting a nest, it was determined to be active. Other nests were confirmed by presence of agitated adults in the area.

Table 4. Nest locations in the Arroyo/Draw habitat type.

Nest # and species (in order of detection)	***Nest location (UTM – NAD 83)***	***Status***
Nest 1 – Cactus wren *Campylorhynchus brunneicapillus*	13 S 0275636 3649593	Nest inactive, fledglings nearby
Nest 2 – Cactus wren	13 S 0275775 3649540	Nest active, adult on nest,

Nest # and species (in order of detection)	***Nest location (UTM – NAD 83)***	***Status***
Campylorhynchus brunneicapillus		unable to determine whether eggs or nestlings present
Nest 3 – Curve-billed thrasher *Toxostoma curvirostre*	13 S 0277165 3649338	Nest active, adult nearby, 3 eggs
Nest 4 – Greater roadrunner *Geococcyx californianus*	13 S 0277153 3649295	Nest active, adult nearby, 6 eggs
Nest 5 – Northern mockingbird *Mimus polyglottos*	13 S 0277317 3649213	Nest active, adult nearby, 3 eggs
Nest 6 – Cactus wren *Campylorhynchus brunneicapillus*	13 S 0276835 3649641	Nest active, adult on nest, unable to determine whether eggs or nestlings present
Nest 7 – Cactus wren *Campylorhynchus brunneicapillus*	13 S 0276310 3649606	Nest active, adult nearby, 3 nestlings
Nest 8 – Cactus wren *Campylorhynchus brunneicapillus*	13 S 0274512 3650184	Nest active, adult on nest, unable to determine whether eggs or nestlings present
Nest 9 – Brown-crested flycatcher *Myiarchus tyrannulus*	13 S 0274389 3650146	Nest active, adult on nest, 3 eggs

Table 5 (below) lists the species detected in shrubland habitat and whether they were determined to be breeding, suspected of breeding, or were likely transients or individuals utilizing habitat for foraging.

Table 5. Avian breeding use of the shrubland habitat type.

Species (in order of detection)	***Breeding / Non-breeding***	***Observed Behavior***
Black-throated sparrow *Amphispiza bilineata*	Breeding	Fledglings seen
Chihuahuan raven *Corvus cryptoleucus*	Breeding	Nests located
Cactus wren *Campylorhynchus brunneicapillus*	Breeding	Territorial singing, nests located
Northern mockingbird *Mimus polyglottos*	Undetermined (likely)	Territorial singing, no confirmation of breeding
Ash-throated flycatcher *Myiarchus cinerascens*	Undetermined (likely)	Territorial behavior, no confirmation of breeding, typical breeding habitat
Curve-billed thrasher *Toxostoma curvirostre*	Breeding	Nest located
House finch *Haemorhous mexicanus*	Breeding	Fledglings seen

Species (in order of detection)	***Breeding / Non-breeding***	***Observed Behavior***
Turkey vulture *Cathartes aura*	Undetermined (possible)	Soaring over project area, not typical breeding habitat
Mourning dove *Zenaida macroura*	Undetermined (likely)	Seen within project, no confirmation of breeding, typical breeding habitat
American kestrel *Falco sparverius*	Undetermined (possible)	Seen within project, no confirmation of breeding, possible breeding habitat
Western kingbird *Tyrranus verticalis*	Undetermined (likely)	Territorial behavior, no confirmation of breeding, typical breeding habitat
Swainson's hawk *Buteo swainsoni*	Breeding	Nest located

The following table (Table 6) includes information on the nests located in shrubland habitat including the status of the nest where determinable. Cactus wren (*Campylorhynchus brunneicapillus*) were again the most prolific identifiable breeding birds, but this is likely for the same reasons mentioned previously. The constraints in observing status of cactus wren nests apply here as well. Both Chihuahuan raven nests were located atop transmission line towers and were attended by adults. The Swainson's hawk nest, although classified as being found in shrubland habitat, was in a mature mesquite tree in a small arroyo/draw that feeds into Greyback arroyo. Because of the discontinuous nature of the shrubland habitat (it is bisected by numerous small depressions that become arroyos closer to Greyback arroyo), if a species/nest was not detected within Greyback arroyo proper it was classified as a shrubland occupant. This applies only to one confirmed breeding species however, the Swainson's hawk.

Table 6. Nest locations in the shrubland habitat type.

Nest # and species (in order of detection)	***Nest location (UTM – NAD 83)***	***Status***
Nest 10 – Chihuahuan raven *Corvus cryptoleucus*	13 S 0274971 3648824	Nest active, adult on nest, unable to determine whether eggs or nestlings present
Nest 11 – Chihuahuan raven *Corvus cryptoleucus*	13 S 0275011 3650326	Nest active, adult on nest, unable to determine whether eggs or nestlings present
Nest 12 – Cactus wren *Campylorhynchus brunneicapillus*	13 S 0274637 3651015	Nest active, adult on nest, unable to determine whether eggs or nestlings present
Nest 13 – Cactus wren *Campylorhynchus*	13 S 0275057 3650875	Nest active, adult on nest, 4 eggs

Nest # and species (in order of detection)	***Nest location (UTM – NAD 83)***	***Status***
brunneicapillus		
Nest 14 – Curve-billed thrasher *Toxostoma curvirostre*	13 S 0276369 3650397	Nest active, adult nearby, 2 eggs
Nest 15 – Swainson's hawk *Buteo swainsoni*	13 S 0276045 3650143	Nest active, adult on nest, unable to determine whether eggs or nestlings present

The photographs (Figure 5 through Figure 13) below are of several identified active nests located and recorded during the breeding bird surveys at the proposed mill site and substation areas on Copper Flat. The nest numbers correspond to location information in Table 4 and Table 6 above.

Figure 5. Nest 1 - Cactus wren

Figure 6. Nest 3 - Curve - billed thrasher

Figure 7. Nest 4 - Greater roadrunner

Figure 8. Nest 5 - Northern mockingbird

Figure 9. Nest 7 - Cactus wren

Figure 10. Nest 9 – brown-crested flycatcher (inside abandoned windmill pipe)

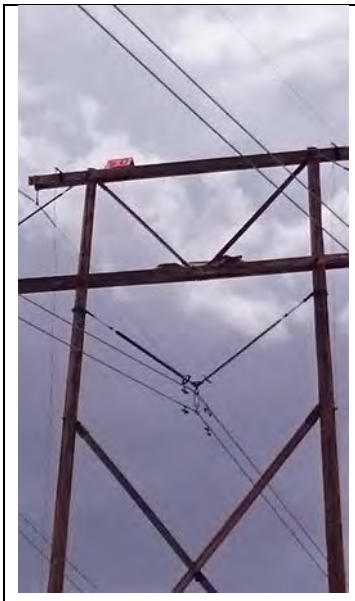

Figure 11. Nest 10 - Chihuahuan raven (lower tier of transmission tower)

Figure 12. Nest 14 - Curve-billed thrasher

Figure 13. Nest 15 - Swainson's hawk

Raptor Nesting Substrate

Nesting substrate for raptors is relatively limited throughout the project area. Potential substrate consisted of powerlines and associated towers that cross the project area and isolated trees and tall shrubs that are more concentrated in the arroyo and draw vegetation types. Two substantial transmission lines with associated towers traverse the project area. Although transmission towers are often not sufficient as nesting platforms in windy areas, towers and transmission lines do provide ideal perch locations for a variety of raptor species as part of normal foraging or hunting behavior.

Additional raptor nesting substrate, particularly in arid areas, is often found along cliffs or rock outcrops. No obviously suitable rock outcrop or cliff nesting habitat was identified in the project area. However, it is worth noting that most raptors have very large areas which are routinely used for hunting. Several raptorial species were noted during avian use surveys, and even if nests are not present within the site, use of the project area for hunting and foraging by raptors was a year-round occurrence.

One large stick nest was noted in a relatively large mesquite tree in Greyback Arroyo, though it did not appear to currently active when detected in May 2015. This nest was most likely

utilized previously by Swainson's hawks, which were seen in the area during avian use surveys and are known to nest in small trees. That site was also revisited during 2016 and the stick nest was no longer active.

During the winter and spring 2016 survey periods, the proposed mill site and substation areas, as well as, suitable habitat adjacent to these areas within approximately 1 km, were searched for raptor nests. Two nests were found in relatively close proximity during the winter survey (Figure 14). The first nest found was located at 13S 0276403 3649799 (NAD83 datum). The second nest found was located at 13S 0274640 3651010 (NAD83 datum). Both nests were checked again for use during the May/June 2016 period and were found to be abandoned, or not currently in use during the breeding season. As mentioned in the Avian Breeding section of this report, one active Swainson's hawk nest and multiple Chihuahuan raven nests were observed in the project area during the May/June 2016 survey. Photographs and GPS locations for those nests were also presented in the Avian Breeding section above. The active Swainson's hawk nest was in the same general vicinity as the first nest mentioned above.

The most notable raptor species detected during our surveys was the golden eagle (*Aquila chrysaetos*), seen during an afternoon survey on January 29th and again during a morning survey on January 30th. Both times this species (it was impossible to determine whether it was the same individual) was first observed perched on a high-voltage transmission line tower near Greyback arroyo. During both observations, the individual subsequently left its perch and soared over the project area; both observations were of an adult bird. Golden eagles frequent the Lake Valley area, and are known to build nests and reproduce in nearby rock outcrop or cliff habitats. The possibility that golden eagles are regularly utilizing the project area for foraging (there does not appear to be suitable nesting habitat within or directly adjacent to the proposed mill site and substation areas) is of note, however, evidence of breeding was investigated further during the breeding season and no golden eagles were observed.

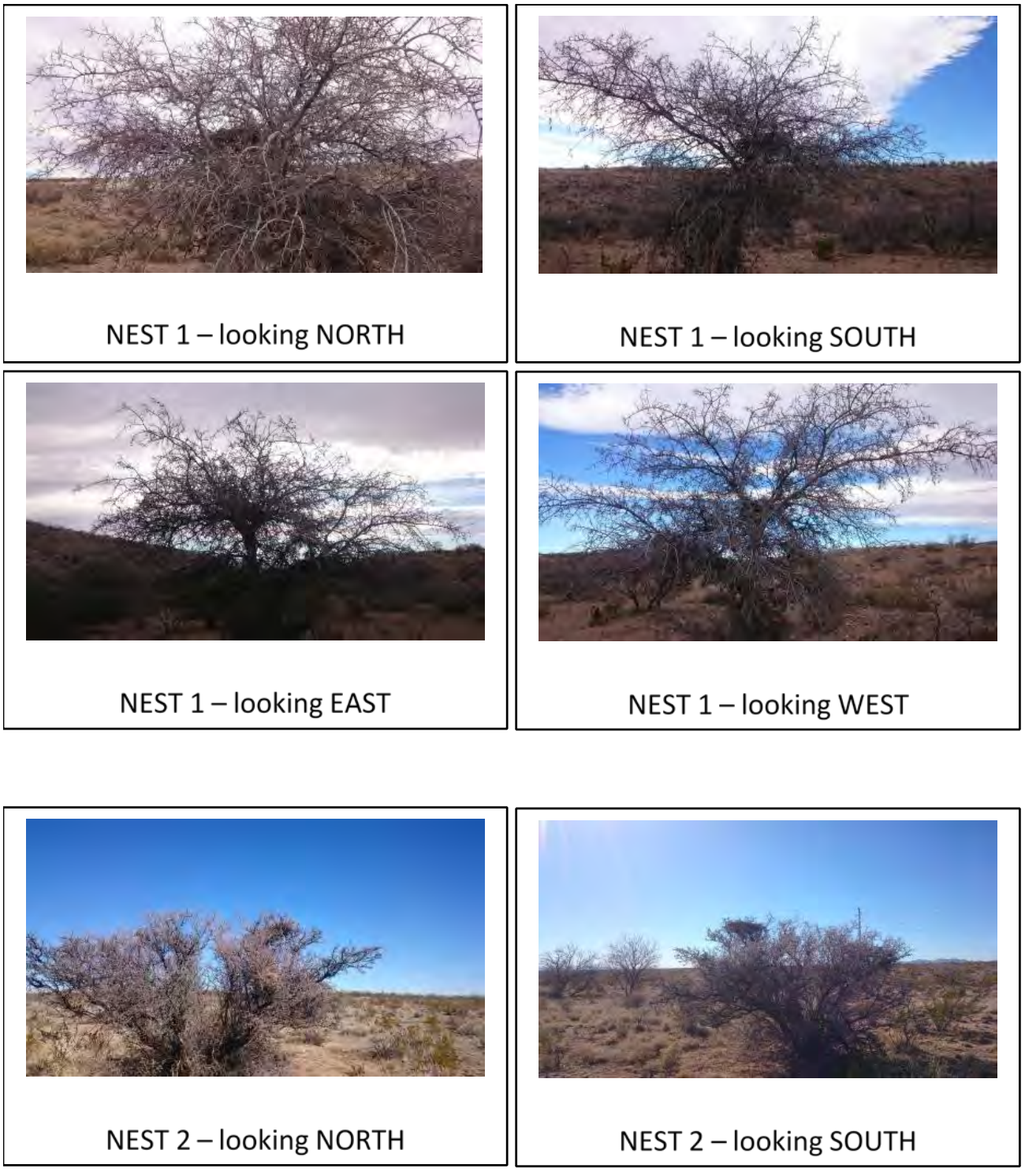

Figure 14. Abandoned raptor nests detected during the winter 2016 survey from various vantage points.

Mammalian and Herpetofauna Observations

Burrow systems were observed for several small mammal species including; kangaroo rat (*Dipodomys* sp.), pocket mouse (*Perognathus* sp.), and Botta's pocket gopher (*Thomomys bottae*). At least one kangaroo rat mound was observed in eight of the nine mill sites and in the substation area. Pocket mouse burrows were abundant throughout the site. Gopher mounds were recorded in five of the nine mill sites and multiple mounds were encountered in the substation area. Woodrat (*Neotoma* sp.) middens were also observed throughout the project area but appeared most prevalent in the arroyo.

One abandoned badger (*Taxidea taxus*) den and another den that appeared to be active was detected. Black tailed jackrabbits (*Lepus californicus*) were observed regularly during the field surveys, regardless of survey period, and desert cottontails (*Sylvilagus audubonii*) were also observed sporadically. Coyote (*Canis latrans*), identified by sound, and collared peccary (*Tayassu tajacu*), identified by tracks, were also detected in winter and May/June 2016 surveys. Additionally, it is likely that gray fox (*Urocyon cinereoargenteus*) also use habitat on the project area.

The only reptiles detected during pedestrian surveys included whiptail lizard (*Aspidoscelis sp*.), lesser earless lizard (*Holbrookia maculata*), prairie lizard (*Sceloporus undulatus*), and short-horned lizard (*Phrynosoma douglasii*). However, reptiles, particularly snakes, are notoriously sparse and difficult to detect in the absence of concentrated, species-specific surveys, so it is likely that several other undetected reptiles are found within the project area. Common snakes known to occupy the area and that we expect to occur include the Great Basin gopher snake (*Pituophis catenifer deserticola*) and the western diamond-backed rattlesnake (*Crotalus atrox*).

Special Status Wildlife Species

Per regional databases (NMDGF, 2015), 55 threatened, endangered, sensitive, or other special status species occur in Sierra County, NM. One state-listed endangered species, the common ground-dove (*Columbina passerina*), was observed once during the survey, as a single detection during the May/June 2016 fieldwork. Common ground-dove was detected in Greyback Arroyo, which was within the survey area but outside the location where ground disturbance is proposed during site development. The ground dove was seen within the arroyo and breeding was undetermined and unlikely but possible. No common ground dove nests or other indications of breeding were observed. In the Southwestern U.S., common

ground doves nest in a variety of habitats including mesquite thickets and cottonwood/willow habitat, neither of which occurs within the project area, however, nests can also be constructed in a variety of locations including the ground and in short statured trees and shrubs. Their habit of nesting on the ground may contribute to their regional decline as breeding is disrupted due to ground clearing activities.

Five state-listed Species of Greatest Conservation Need (SGCN), the loggerhead shrike (*Lanius ludovicianus*), golden eagle (*Aquila chrysaetos*), sagebrush sparrow (*Artemisiospiza nevadensis*), mourning dove (*Zenaida macroura*), and scaled quail (*Callipepla squamata*), were also detected during the survey. Loggerhead shrike, sagebrush sparrow, and scaled quail were each observed during early May 2015, as lone probably transient individuals. No evidence of breeding was observed in 2015 or 2016. Golden eagle was observed on two occasions during the winter 2016 survey but breeding was not observed and no suitable nesting substrate is found in the survey area for eagles. Mourning dove was detected during the May/June 2016 survey and while breeding was not confirmed, suitable nesting habitat is present within the project site.

Potential habitat may be present in the project area for 17 species described as sensitive or threatened by the State. Four of these species were also considered species of concern by the USFWS. The project area does not support potential habitat for any federally-listed threatened or endangered species. Several sensitive bat species were detected in the Copper Flat mine permit area during BDR surveys (Table 7) and it's likely these species could also be detected in the mill site and substation project area (particularly near the livestock watering tank in MS-9) if a formal bat survey was completed; but that was outside the scope of this survey.

Table 7. Wildlife species with special status described by State of NM and/or USFWS that are known to occur in Sierra County per regional databases (NMDGF, 2015). Note that this table does not include state Species of Greatest Conservation Need (SGCN) but loggerhead shrike, golden eagle, scaled quail, mourning dove, and sagebrush sparrow were observed in the project area. Abbreviations: E=Endangered, T=Threatened, Sen=Sensitive, SoC=Species of Concern, Can=Candidate.

Common Name	**Scientific Name**	**USFWS**	**State**	**Detected**	**Habitat Present**	**Notes**
Allen's Big-eared Bat	*Idionycteris phyllotis*	FWS SoC	Sen	No	yes	
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii*	FWS SoC	Sen	No	yes	Detected during Copper Flat Mine BDR Surveys
Arizona Myotis	*Myotis occultus*		Sen	No	yes	
Fringed Myotis	*Myotis thysanodes*		Sen	No	yes	Detected during Copper Flat Mine BDR Surveys
Long-eared Myotis	*Myotis evotis*		Sen	No	yes	
Long-legged Myotis	*Myotis volans*		Sen	No	yes	
Western Small-footed Myotis	*Myotis ciliolabrum*		Sen	No	yes	
Yuma Myotis	*Myotis yumanensis*		Sen	No	yes	Detected during Copper Flat Mine BDR Surveys
Mexican Gray Wolf	*Canis lupus baileyi*	E	E	No	no	

Common Name	**Scientific Name**	**USFWS**	**State**	**Detected**	**Habitat Present**	**Notes**
Common Hog-nosed Skunk	*Conepatus leuconotus*		Sen	No	no	
Western Spotted Skunk	*Spilogale gracilis*		Sen	No	no	
Ringtail	*Bassariscus astutus*		Sen	No	yes	
Gunnison's prairie dog	*Cynomys gunnisoni zuniensis*		Sen	No	yes	
Desert Pocket Gopher	*Geomys arenarius brevirostris*	FWS SoC	Sen	No	yes	
Pecos River Muskrat	*Ondatra zibethicus ripensis*	FWS SoC	Sen	No	no	
White Sands Wood Rat	*Neotoma micropus leucophaea*	FWS SoC		No	no	
Brown Pelican	*Pelecanus occidentalis*		E	No	no	
Reddish Egret	*Egretta rufescens*	FWS SoC		No	no	
Common Black Hawk	*Buteogallus anthracinus*	FWS SoC	T	No	no	
Bald Eagle	*Haliaeetus leucocephalus*		T	No	no	
Northern Goshawk	*Accipiter gentilis*	FWS SoC	Sen	No	no	
Aplomado Falcon	*Falco femoralis*	E	E	No	no	
Peregrine Falcon	*Falco peregrinus*	FWS SoC	T	No	no	
Arctic Peregrine	*Falco peregrinus tundrius*	FWS SoC	T	No	no	

Common Name	**Scientific Name**	**USFWS**	**State**	**Detected**	**Habitat Present**	**Notes**
Falcon						
Mountain Plover	*Charadrius montanus*		Sen	No	no	
Black Tern	*Chlidonias niger*	FWS SoC		No	no	
Least Tern	*Sternula antillarum*	E	E	No	no	
Neotropic Cormorant	*Phalacrocorax brasilianus*		T	No	no	
Common Ground-dove	*Columbina passerina*		E	Yes	yes	Detected during mill site surveys.
Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	T	Sen	No	no	
Burrowing Owl	*Athene cunicularia*	FWS SoC		No	yes	
Mexican Spotted Owl	*Strix occidentalis lucida*	T	Sen	No	no	
Broad-billed Hummingbird	*Cynanthus latirostris*		T	No	yes	
Costa's Hummingbird	*Calypte costae*		T	No	yes	
Lucifer Hummingbird	*Calothorax lucifer*		T	No	yes	
Elegant Trogon	*Trogon elegans*		E	No	no	
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	E	No	no	

Common Name	**Scientific Name**	**USFWS**	**State**	**Detected**	**Habitat Present**	**Notes**
Thick-billed Kingbird	*Tyrannus crassirostris*		E	No	no	
Bell's Vireo	*Vireo bellii*	FWS SoC	T	No	no	
Gray Vireo	*Vireo vicinior*		T	No	no	
Sprague's Pipit	*Anthus spragueii*	Can		No	no	
Baird's Sparrow	*Ammodramus bairdii*	FWS SoC	T	No	no	
Varied Bunting	*Passerina versicolor*		T	No	no	
Big Bend Slider	*Trachemys gaigeae*		Sen	No	no	
Southwestern Fence Lizard	*Sceloporus cowlesi*		Sen	No	yes	
Arizona Toad	*Anaxyrus microscaphus*		Sen	No	no	
Chiricahua Leopard Frog	*Lithobates chiricahuensis*	T	Sen	No	no	
Rio Grande Chub	*Gila pandora*		Sen	No	no	
Headwater Chub	*Gila nigra*	Can	E	No	no	
Rio Grande Cutthroat Trout	*Oncorhynchus clarkii virginalis*		Sen	No	no	
Gila Trout	*Oncorhynchus gilae*	T	T	No	no	
White Sands Pupfish	*Cyprinodon tularosa*	FWS SoC	T	No	no	
Mineral Creek Mountainsnail	*Oreohelix pilsbryi*	FWS SoC	T	No	no	

Common Name	Scientific Name	USFWS	State	Detected	Habitat Present	Notes
Moore's Fairy Shrimp	*Streptocephalus moorei*		Sen	No	no	

Vegetation

Vegetation Mapping

During the preliminary site assessments performed in April/May 2015, a detailed vegetation map was developed for the project site that included the mill sites and substation area, as well as, surrounding habitats (Figure 15). A total of 5 typical vegetation types were described for the broad area: creosote bush shrubland, draw vegetation, arroyo vegetation, grassland flat, and tabosa grass (*Pleuraphis mutica*) swale. The following section includes a brief description of each of the vegetation types characterized during this work. Representative photos of each type are also included in Figure 17).

- **Creosote bush shrubland**: Most of the site is dominated by creosote bush flats. In addition to creosote, other shrubs regularly observed included American tarwart (*Flourensia cernua*), mariola (*Parthenium incanum*), Christmas cactus (*Cylindropuntia leptocaulis*), purple prickly pear (*Opuntia macrocentra*), honey mesquite (*Prosopis glandulosa*), and longleaf jointfir (*Ephedra trifurca*). Common forbs in this type include snakeweed (*Gutierrezia microcephala*), dwarf desertpeony (*Acourtia nana*), desert marigold (*Baileya multiradiata*), spreading fleabane (*Erigeron divergens*), Indian rushpea (*Hoffmannseggia glauca*), Coulter's horseweed (*Laennecia coulteri*), bristly nama (Nama hispidum), fiveneedle prickly leaf (*Thymophylla pentachaeta*), and skyblue phacelia (*Phacelia caerulea*). Bush muhly, burrograss (*Scleropogon brevifolius*), and low woollygrass (*Dasyochloa pulchella*) are the most common grasses. This type was the most dominant community through the project area. Recent application of herbicide pellets appears to have, maybe temporarily depending on response of other plant species, reduced creosote bush cover in this type.
- **Arroyo vegetation:** The bottom of Greyback Arroyo is dominated by honey mesquite, singlewhorl burrobrush (*Ambrosia monogyra*), and Apache plume (*Fallugia paradoxa*). Tall shrubs and trees such as littleleaf sumac (*Rhus microphylla*), Netleaf hackberry (*Celtis reticulata*), whitethorn acacia (*Acacia constricta*), and desert willow (*Chilopsis linearis*) are also present; primarily in the

arroyo bottom or in the confluence of the arroyo bottom with the draws. The trees and taller shrubs appear to diversify the habitat at the site because they add significant vertical structure. Common forbs and grasses include side-oats grama (*Bouteloua curtipendula*), low woolly grass, rose heath (*Chaetopappa ericoides*), and absinth leaf bahia (*Bahia absinthifolia*). This type was surveyed during plant species inventories and wildlife monitoring but not quantitative vegetation transects were placed in the type because the actual mill sites and substation area fall outside this vegetation type.

- **Draws:** Side slopes of the draws that feed into Greyback Arroyo are dominated by honey mesquite and tabosagrass. Other species often found on draw slopes include side-oats grama, featherplume (*Dalea formosa*), and longleaf jointfir. The draw bottoms contain similar species as the arroyo vegetation type but individuals are typically shorter statured and littlefeaf sumac and catclaw mimosa (*Mimosa aculeaticarpa*) are more prominent than in the arroyo type. The draw vegetation type intersects portions of Substation A, Substation B, and mill sites 7 and 8.
- **Grassland flat:** Across the arroyo from the mill sites and the substation area, a large area dominated by annual grasses, tabosagrass, halfmoon milkvetch (*Astragalus allochrous*), and honey mesquite was mapped. Annual grasses, primarily six weeks grama (*Bouteloua barbata*), compose most of the plant cover in this type. This location was under consideration for substation placement during earlier phases of this project so it was surveyed during the April/May plant species inventories and wildlife surveys. However, areas mapped as grassland flat are no longer one of the alternatives being considered for the substation, so quantitative vegetation monitoring transects were not placed in this area.
- **Tabosa grass swale:** Small, linear tabosa grass swales were observed where finer textured soils have accumulated over the gravelly loams that are more characteristic of the project area. The most significant swale was drawn on the map, however, several additional small (most probably less than a half-acre) features dissect the creosote bush shrubland.

The vegetation map was used as a guide for distributing vegetation monitoring transects measured to report vegetation parameters later in this report (e.g. cover, frequency, density, production) but the types were not considered unique analysis "strata" in this report because we wanted to be consistent with the site stratification scale employed in the Copper Flat BDR. Areas on the mine site typified by the dominant species encountered at the mill site area and the Gravelly ecological site were described as "Chihuahuan Desert Shrubland" in the BDR document (NMCC, 2012). Thus, to understand how vegetation compares between the mine site and the mill site/substation area, we recommend comparing the results of this report to vegetation parameters reported for the "CDS" Stratum in the BDR (NMCC, 2012).

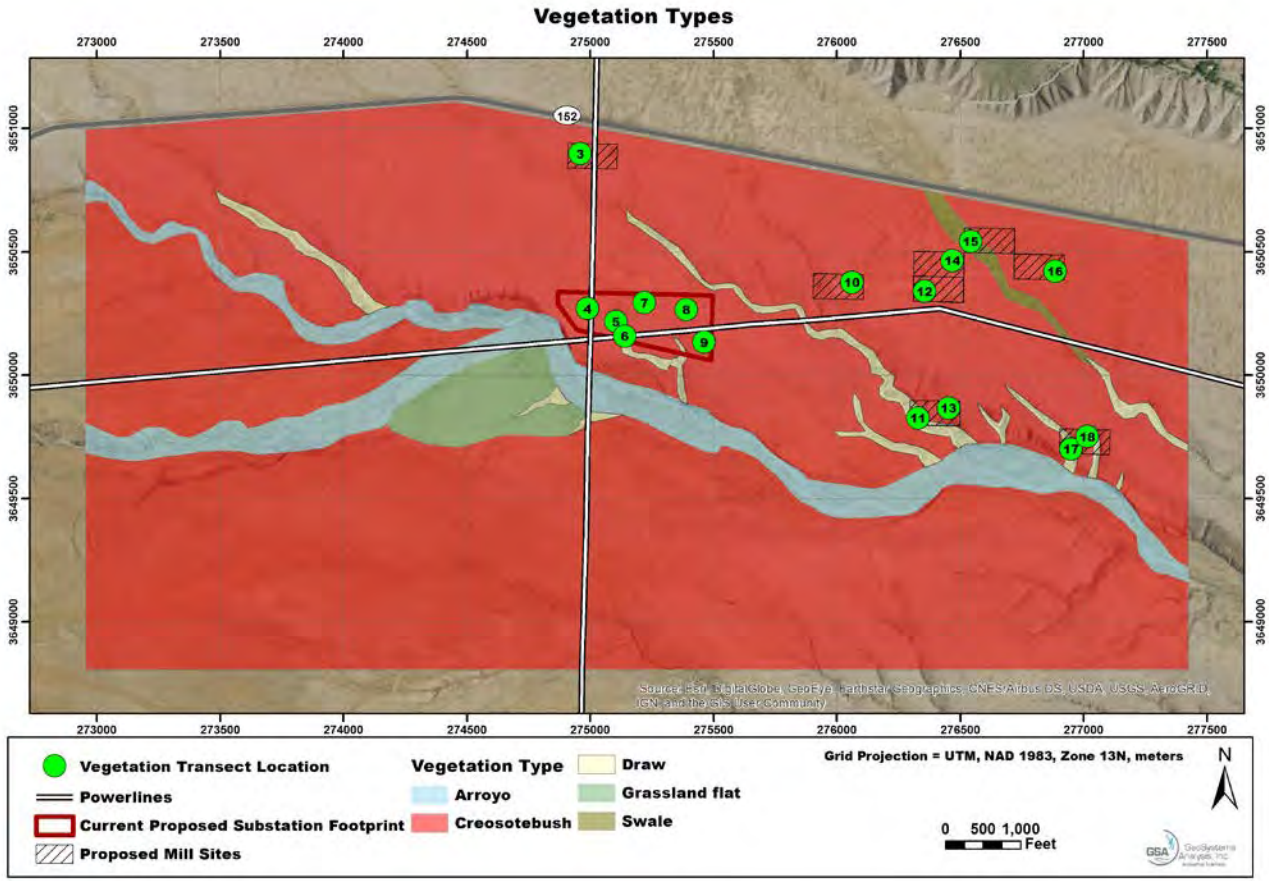

Figure 15. Vegetation types with a portion of the vegetation monitoring transect overlaid. Two of the transects fall outside this view.

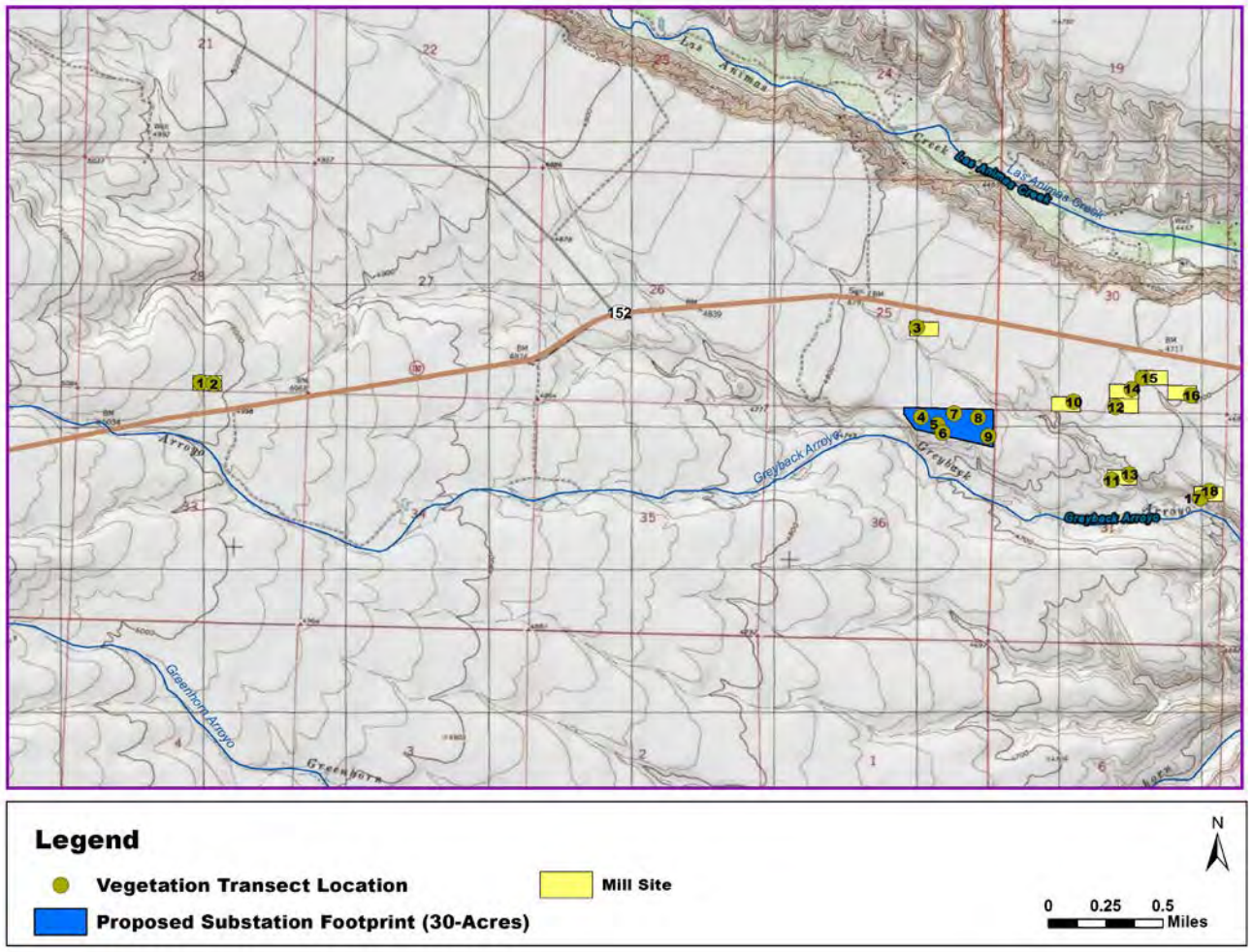

Figure 16. Vegetation transect location map

Creosotebush Shrubland

Draw Vegetation

Arroyo Vegetation

Tabosagrass Swale

Grassland Flat

Figure 17. Representative photos of vegetation types mapped on the project area.

Plant Species Inventory

A total of 156 plant species were detected at the project site (Appendix 2) via inventories completed from 2015 through 2016. As would be expected, the detectable plant species observed varied by season and by year. A typical growth habit (tree, shrub, forb/herb, graminoid), plant duration (perennial, biennial, annual), and native status was assigned to each plant species observed using a combination of field observations, the USDA PLANTS database, and regional floristic databases. Most of the plant species observed were perennial (106), while 47 annual, 3 biennial species were also observed. A total of 93 forb/herb species, 30 shrubs, 2 subshrubs, and 29 graminoids were recorded at the project site. Two trees were also observed, netleaf hackberry (*Celtis reticulata*) and desert willow (*Chilopsis linearis*).

Ninety-six percent (149 of 159) of the plant species encountered were considered native to the region. Seven introduced species were recorded. The introduced species in the project area included prostrate pigweed (*Amaranthus albus*), bermudagrass (*Cynodon dactylon*), herb sophia (*Descurainia sophia*), Mediterranean lovegrass (*Eragrostis barrelieri*), Lehmann lovegrass (*Eragrostis lehmanniana*), Russian thistle (*Salsola tragus*), and spreading fanpetals (*Sida abutifolia*). Of these introduced species, herb sophia and Lehmann lovegrass were the most widespread and abundant but note that none of the introduced species observed in the project area seem to pose a serious management issue.

Ground Cover

As would be expected in the Gravelly ecological site, rock fragments less than three inches composed most the ground cover (Figure 18). Mean cover of small rock fragments was 52% while about one third of the ground cover was composed of bare soil (Table 8). Mean litter and basal vegetation cover were 6% and 3%, respectively. Except for transect 15, which fell in a tabosa grass swale, ground cover of rock fragments was consistently high while basal vegetation cover was consistently low (i.e. consistently less than 5%). Litter cover was also highest in the small swale area (approximately 21% at transect 15). Transects (e.g. 11, 13, 17, 18) which fell within or along draws that soon drop into Greyback Arroyo were also outliers (in terms of ground cover) with a higher percentage of larger rock fragments (Figure 19). Percent bare soil exceeded 50% at two transects (12 and 15) and was less than 10% at only one transect (18, which as previously mentioned fell on the slope of a draw and contained lots of large rock).

Figure 18. Quad frame with high gravel cover.

Figure 19. Quad frame from a draw with larger rock fragments than what was typical across the site.

Table 8. Mean ground cover by transect.

Transect	Bare Soil	Basal Vegetation	Litter	Rock Fragments >3"	Rock Fragments <3"
1	40.8%	0.4%	1.7%	0.9%	56.1%
2	29.3%	0.4%	3.9%	3.6%	62.8%
3	40.2%	3.1%	5.2%	2.0%	49.5%
4	49.7%	1.3%	4.5%	0.2%	44.3%
5	16.1%	7.3%	2.6%	3.9%	69.9%
6	38.6%	1.1%	1.4%	1.0%	58.0%
7	25.3%	3.0%	4.4%	1.9%	65.2%
8	28.8%	2.1%	5.9%	2.6%	60.6%
9	25.6%	2.5%	3.3%	0.5%	68.1%
10	42.1%	4.3%	9.0%	0.3%	44.3%
11	27.6%	1.6%	3.5%	8.7%	58.6%
12	66.0%	0.6%	9.7%	0.1%	23.6%

Transect	Bare Soil	Basal Vegetation	Litter	Rock Fragments >3"	Rock Fragments <3"
13	13.7%	3.4%	10.1%	34.1%	38.6%
14	30.0%	1.0%	1.9%	0.7%	66.4%
15	63.1%	15.7%	20.9%	0.0%	0.3%
16	47.2%	0.7%	4.7%	0.3%	47.2%
17	11.4%	4.2%	12.5%	19.8%	52.1%
18	7.7%	4.1%	11.0%	7.4%	69.9%
Mean	33.2%	3.1%	6.4%	5.0%	52.2%

Aerial Cover

Mean aerial cover was 21% across the site and ranged from 5% to 79% between transects (Table 9). Total plant cover ranged between 10% and 20% at half (nine) of the transects, was less than 10% at two transects (2 and 12), and exceeded 70% in the tabosa swale at transect 15. Additionally, four transects had total plant cover between 20% and 30% while two transects had mean total cover between 30% and 40%.

Table 9. Mean aerial cover for plant life forms by transect.

Transect	Grass	Forb	Shrub	Tree	Total
1	1.3%	4.0%	6.7%	0.0%	11.9%
2	0.8%	0.5%	4.1%	0.0%	5.3%
3	5.2%	1.1%	2.4%	1.6%	10.2%
4	6.2%	3.7%	4.7%	0.0%	14.5%
5	12.0%	3.7%	2.0%	0.0%	17.7%
6	3.5%	4.6%	3.5%	0.0%	11.6%
7	22.1%	0.1%	1.7%	0.0%	23.9%
8	15.0%	1.2%	0.8%	0.0%	17.0%
9	7.4%	0.9%	1.9%	0.0%	10.2%
10	12.0%	1.8%	7.5%	0.0%	21.3%
11	11.3%	1.7%	11.4%	1.9%	26.2%

Transect	Grass	Forb	Shrub	Tree	Total
12	0.9%	0.9%	8.0%	0.0%	9.8%
13	26.3%	5.7%	0.4%	3.8%	36.1%
14	6.1%	0.4%	6.9%	0.0%	13.4%
15	76.0%	1.6%	1.7%	0.0%	79.3%
16	7.4%	0.6%	5.4%	0.0%	13.4%
17	33.4%	1.2%	0.5%	0.7%	35.8%
18	15.3%	6.8%	2.7%	0.0%	24.8%
Mean	14.6%	2.2%	4.0%	0.4%	21.2%

Mean grass cover across transects was 15%. As expected, mean tree cover was low (0.4%). Mean shrub and forb cover was 4% and 2%, respectively. Measured shrub cover was lower than we expected, largely due to recent application of herbicide pellets applied to reduce creosote bush across the site (Figure 21). If herbicide pellets hadn't been applied at the site, we expect that total shrub cover would have neared the measured shrub cover for the Chihuahuan Desert Shrubland stratum within the Copper Flat Mine permit area, which was 20% (NMCC, 2012). That portion of the mine site also lies within the Gravelly ecological site.

Just over half (54%) of the species detected during our plant species inventories at the site through 2015-2016 were also captured in cover quads placed during the quantitative vegetation assessment. Appendix 3 contains a table showing the cover by species measured along each transect. Only six species had a mean measured cover near one percent or greater (Table 10) across the site. The two most dominant grasses (in terms of cover) were tabosagrass and low woollygrass Tabosagrass cover peaked at 76% (Transect 15) and increased at transects that crossed narrow ribbons of tabosagrass swales not necessarily shown on the vegetation map of the site due to their small scale. However, tabosagrass cover was less than 1% at the majority (13 of 18) of the transects. On the other hand, woollygrass cover was more consistently greater than 1% across the site (only 5 of 18 transects at <1%). Regular detection and relatively high cover for sixweeks grama and sandmat, two species that flourish during summer rains, was probably attributed to the post-monsoon survey timing.

Figure 20. Transect line (15) through the tabosa grass swale.

Table 10. Plant species with aerial cover that neared or exceeded 1 percent across the site.

Scientific Name	**Common Name**	**Cover**
Pleuraphis mutica	tobosagrass	8.0%
Dasyochloa pulchella	low woollygrass	4.4%
Larrea tridentata	creosote bush	1.9%
Chamaesyce serpyllifolia	thymeleaf sandmat	1.4%
Muhlenbergia porteri	bush muhly	1.4%
Bouteloua barbata	sixweeks grama	0.9%

As described in other sections of this report, creosote bush cover was reduced at the site due to herbicide pellet application. Creosote bush cover averaged 1.9% during our September 2016 survey. That reduction is like other published literature that describes the effects of tebuthiuron on desert scrub and creosote bush (Vanzant et al, 1997, Jacoby et al., 1982).

Like published research, we also did not observe herbicide effects on various cholla and prickly pear species. It's also possible that herbicide reduced snakeweed cover at our site per findings in Jacoby et al, 1982. Snakeweed was more commonly observed within the mine permit area (NMCC, 2012)

Figure 21. Decadent, herbicide affected creosote bush.

Frequency

Graminoids were the most frequently detected lifeform based on frequency measurements along our transects. Ninety-two percent of the quads placed along transects contained at least one grass species (Table 11). Perennial grasses were more commonly detected than annual grasses. Total forb frequency was 83% but for that lifeform, annuals and perennials were almost equally common. Shrubs and trees were detected within 43% and 7% of the quads, respectively. The summary table in Appendix 4 shows measured frequency by species along each transect.

Table 11. Mean frequency for various plant life forms and durations.

Lifeform and Duration	**Mean Frequency**
Total Forb/herb	**83%**
Annual forb/herb	**62%**
Perennial forb/herb	**65%**
Total Graminoid	**92%**
Annual graminoid	**67%**
Perennial graminoid	**86%**
Shrub	**43%**
Tree, Shrub	**7%**

The mean frequency for the 20 most common species observed is shown in Table 12. Per this information, woollygrass and six weeks grama were recorded in more than half of the quads measured at the site. Creosote bush, bahia, and bush muhly were about evenly distributed across the site. Somewhat surprisingly, (and likely due to recent herbicide application), broom snakeweed was only detected at about 6% of the quads.

Table 12. Mean frequency of the most commonly detected plant species in cover quads placed at the site.

Species	**Common Name**	**Mean Frequency**
Dasyochloa pulchella	low woollygrass	62.8%
Bouteloua barbata	sixweeks grama	56.1%
Chamaesyce serpyllifolia	thymeleaf sandmat	45.6%
Larrea tridentata	creosote bush	26.1%
Bahia absinthifolia	hairyseed bahia	24.4%
Muhlenbergia porteri	bush muhly	23.3%
Hoffmannseggia glauca	Indian rushpea	19.4%
Chamaesyce serrula	sawtooth sandmat	18.9%
Pleuraphis mutica	tobosagrass	18.3%

Species	Common Name	Mean Frequency
Boerhavia spicata	creeping spiderling	16.7%
Acourtia nana	dwarf desertpeony	13.3%
Panicum hirticaule	Mexican panicgrass	13.3%
Parthenium incanum	mariola	10.6%
Thymophylla pentachaeta	fiveneedle pricklyleaf	10.6%
Eragrostis lehmanniana	Lehmann lovegrass	10.0%
Aristida adscensionis	sixweeks threeawn	7.8%
Chamaesaracha sordida	hairy five eyes	7.8%
Gutierrezia sarothrae	broom snakeweed	6.7%
Sanvitalia abertii	Abert's creeping zinnia	6.7%
Scleropogon brevifolius	burrograss	6.7%

Annual Biomass Production

Based on our September 2016 vegetation monitoring at the project area, mean primary production (as dry weight) of all lifeforms was 639 lbs/acre. Mean graminoid production was 363 lbs/acre and perennial grasses produced the most biomass according to our survey (Table 13). Mean shrub and forb production was 204 and 72 lbs/acre, respectively. The tabosa grass swale at transect 15 produced 466 lbs/acre of vine mesquite and 1,403 lbs/acre of tabosa grass. Ignoring that transect, mean primary production falls to 558 lbs/acre and perennial grass production reduces to 248 lbs/acre. Based on comparisons between our September 2016 survey and data previously collected on the mine site (NMCC, 2012), annual biomass production in the mill site/substation area appears to be substantially lower in the current survey area. Per the BDR (NMCC, 2012), total annual production exceeded 1,274 lbs/acre in the undisturbed portions of the mine. That nearly doubles the annual primary production observed in the mill site area during the September 2016 assessment.

Table 13. Mean annual production by life form and duration.

Lifeform and Duration	**Mean Primary Production (lbs/acre)**
Total Forb/herb	72.2
Annual forb/herb	33.0
Perennial forb/herb	39.1
Total Graminoid	363.3
Annual graminoid	24.5
Perennial graminoid	338.8
Total Shrub	203.8
Grand Total	**639.2**

Woody Plant Density

Nineteen woody plant species were detected in belt transects measured to calculate woody plant density. The per acre woody plant density was tallied at just over 2,000 plants per acre (Table 14). That number is consistent with data recorded across similar vegetation communities within the Copper Flat permit boundary. Less disturbed, non-arroyo strata on the mine site also contained between about 2,000 and 3,200 woody plants per acre (NMCC, 2012). The four woody species with the highest density were Mariola (*Parthenium incanum*), creosote bush, broom snakeweed (*Gutierrezia sarothrae*), and American tarwort (*Flourensia cernua*).

Table 14. Summary of the estimated number of plants per acre for all woody species recorded in density transects at the site.

Species	**Common Name**	**Plants per Acre**
Acacia constricta	whitethorn acacia	4
Aloysia wrightii	Wright's beebrush	4
Baccharis pteronioides	yerba de pasmo	2
Cylindropuntia imbricata	tree cholla	2
Cylindropuntia leptocaulis	Christmas cactus	79

Species	Common Name	Plants per Acre
Dalea formosa	featherplume	9
Echinocereus fendleri	pinkflower hedgehog cactus	2
Ephedra trifurca	longleaf jointfir	25
Flourensia cernua	American tarwort	277
Gutierrezia microcephala	threadleaf snakeweed	4
Gutierrezia sarothrae	broom snakeweed	272
Koeberlinia spinosa	crown of thorns	2
Larrea tridentata	creosote bush	443
Lycium berlandieri	Berlandier's wolfberry	4
Mimosa aculeaticarpa	catclaw mimosa	47
Opuntia macrorhiza	twistspine pricklypear	49
Parthenium incanum	mariola	742
Prosopis glandulosa	honey mesquite	47
Rhus microphylla	littleleaf sumac	7
Total		**2,023**

Noxious Weeds

Pursuant to the Noxious Weed Management Act of 1998, the NMDA targets specific weed species as noxious weeds for control or eradication (NMDA, 2015). The NMDA designates noxious weeds into three categories (Class A, B, and C) related to their distribution and abundance, potential impact on the economy, management complexity, and invasiveness. A species "watch list" was also developed in 2009 for problematic species that require additional information to properly classify. The Class A noxious weeds have limited distribution but pose a high potential economic or ecological impact because they are predicted to spread quickly. Class B species are limited to portions of the state while Class C species are already widespread. NMDA considers Class A species to be the highest management priority while Class C weeds are the lowest priority. No noxious weeds were observed in the project area.

Special Status Plant Species

Based on queries of regional floristic databases, a total of 23 rare and/or special status plant species are known to occur within Sierra County, NM (Table 15). Our biologists surveyed

for these species and their habitat during the field effort. No rare, threatened, or endangered species, or plant species of concern were encountered during field surveys but potential habitat does exist for three species. General habitat requirements were present for Sandberg pincushion cactus (*Escobaria sandbergii*) and Wright's campion (*Silene wrightii*); both are species of concern listed by the State of NM. Habitat criteria for the U.S. Fish and Wildlife Service (USFWS) species of concern and state-listed endangered Duncan's pincushion cactus (*Escobaria duncanii*) was marginally present in the Permit Area. The only known New Mexico population of Duncan's pincushion is at the base of Mud Mountain near Black Chute Mine (SEINet, 2015), which lies approximately 10 miles north of this project area.

Table 15. Rare, sensitive, and/or endangered species known to occur in Sierra County, NM (adapted from Copper Flat BDR).

Species Name	**Common Name**	**Habitat Notes**	**USFWS**	**NM**	**Habitat Present (Y/N)**
Agastache cana	Grayish-white giant hyssop	Crevices and bases of granite cliffs or in canyons with small-leaved oaks at the upper edge of the desert and lower edge of the piñon-juniper zone, at 1,400-1,800 m (4,600-5,900 ft).	–	Species of Concern	No
Astragalus castetteri	Castetter's milkvetch	Dry, rocky slopes in montane scrub and open juniper woodland; 1,520 - 2,150 m (5,000 - 7,050 ft).	–	Species of Concern	No
Chenopodium cycloides	Sandhill goosefoot	Open sandy areas especially around blowouts on sand dunes; 800 - 1,500	Species of Concern	Species of Concern	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
		m (2,600 - 5,000 ft).			
Cirsium wrightii	Wright's marsh thistle	Wet, alkaline soils in spring seeps and marshy edges of streams and ponds; 1,130 - 2,600 m (3,450 - 8,500 ft).	–	Endangered	No
Cuscuta warneri	Warner's dodder	Grows on Phyla in open wet areas that support the host species; 1,430 - 1,460 m (4,700 - 4,800 ft.)	–	Species of Concern	No
Desmodium metcalfei	Metcalfe's ticktrefoil	Rocky slopes, canyons in grasslands, oak/pinion-juniper woodland, and riparian forests at 1,310 - 2,000 m (4,000 - 6,500 ft.)	–	Species of Concern	No
Draba mogollonica	Mogollon whitlowgrass	Cool, moist northern slopes of mountains, ravines and canyons on volcanic rocks and soil in montane forests at 1,500 - 2,900 m (5,000 - 9,000 ft.)	–	Species of Concern	No
Draba standleyi	Standley's	Igneous rock faces, bases of	–	Species of	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
	whitlowgrass	overhanging cliffs, clefts of porphyritic and andesitic rocks and soil; 1,675-1,980 m (5,500-6,500 ft).		Concern	
Erigeron scopulinus	Rock fleabane	Crevices in cliff faces of rhyolitic rock in lower montane coniferous forests at 1,800 - 2,800 m (6,000 - 9,000 ft).	–	Species of Concern	No
Escobaria (Corypantha) duncanii	Duncan's pincushion cactus	Cracks in limestone and limy shale in broken terrain in Chihuahuan desert scrub at 1,550 (5,100 ft).	Species of Concern	Endangered	Potential habitat present but species not observed
Escobaria sandbergii	Sandberg pincushion cactus	Rocky, igneous and limestone soils in Chihuahuan desert scrub and open oak and pinion-juniper woodland in mountainous terrain; 1,300 - 2,250 m (4,200 - 7,400 ft).	–	Species of Concern	Potential habitat present but species not observed
Grindelia arizonica var.	New Mexico gumweed	Rocky slopes and ledges in pinion-juniper woodland	–	Species of Concern	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
neomexicana		and lower montane coniferous forests at 2,000 - 2,300 m (6,500 - 7,500 ft.)			
Hedeoma todsenii	Todsen's pennyroyal	Plants grow in loose, gypseous-limestone soils associated with or position immediately below the Permian Yeso Formation; usually on steep north or east-facing slopes in pinon-juniper woodland at 1,900 - 2,300 m (6,200 - 7,400 ft).	Endangered	Endangered	No
Hexalectris spicata var. *arizonica*	Arizona coralroot	In heavy leaf litter in oak, pine, or juniper woodlands over limestone.	–	Endangered	No
Hymenoxys vaseyi	Vasey's bitterweed	Dry sites with coarse soils in montane scrub and pinon-juniper woodland at 2,100 - 2,500 m (6,900 - 8,200 ft).	–	Species of Concern	No
Penstemon metcalfei	Metcalfe's penstemon	Cliffs or steep, north-facing slopes in lower and upper	–	Species of Concern	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
		montane coniferous forest at 2,000 - 2,900 m (6,600 - 9,500 ft).			
Perityle staurophylla var. *homoflora*	San Andres rock daisy	Crevices in limestone clifss, usually on protected north and east exposures at about 1,950-2,150 m (6,400 - 7,000 ft).	–	Species of Concern	No
Perityle staurophylla var. *staurophylla*	New Mexico rock daisy	Crevices in limestone cliffs and boulders, usually on protected north and east exposures; 1,500 - 2,100 m (4,900 - 7,000 ft).	–	Species of Concern	No
Physaria gooddingii	Goodding's bladderpod	Open areas in piñon-juniper woodland and ponderosa pine forest. It occurs occasionally on highway rights-of-way where some populations may be susceptible to disturbance.	–	Species of Concern	No
Silene plankii	Plank's campion	Igneous cliffs and rocky outcrops, 1,500 - 2,800 m	–	Species of Concern	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
		(5,000 - 9,200 ft.)			
Silene thurberi	Thurber's campion	In protected locations on rocky areas and slopes; in arroyos and mountains at elevations possibly between 1,520 - 2,130 m (5,000 - 7,000 ft.)	–	Species of Concern	Potential habitat present but species not observed
Silene wrightii	Wright's campion	Cliffs and rocky outcrops in Rocky Mountain montane and subalpine conifer forests; about 2,070 - 2,440 m (6,800 - 8,000 ft).	–	Species of Concern	No
Talinum humile (Phemeranthus humilis)	Pinos Altos flame flower	Shallow, gravelly, usually clayey soils overlying rhyolite, usually on rock benches in sloping terrain, but also in soil pockets overlying rock in nearly level areas; Madrean grassland, oak woodland or pinion-juniper woodland; often growing with *Nolina microcarpa* and	Species of Concern	Species of Concern	No

Species Name	Common Name	Habitat Notes	USFWS	NM	Habitat Present (Y/N)
		Agave parryii.			

Other Regionally Unique Biological Features

Wetlands, Springs, and Seeps

Wetlands and Waters of the U.S. are protected by Section 404 of the Clean Water Act, which is administered and enforced by the U.S. Army Corps of Engineers (Corps) and protects wetlands from modification, disturbance, or destruction. The Corps defines wetlands as: *Those areas that are inundated or saturated by surface or ground water (hydrology) at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation (hydrophytes) typically adapted for life in saturated soil conditions (hydric soils). Wetlands generally include swamps, marshes, bogs, and similar areas* (40 CFR 232.2(r)). The project area was assessed for the presence of jurisdictional wetlands using standard field procedures for wetland delineation. The biologist also searched for other moist soil or open water features such as springs and seeps that may not technically fit jurisdictional criteria as Waters of the U.S. but might still be ecologically significant. No wetlands, springs, or seeps were identified within the project area.

Adits and Shafts

Adits, shafts, and other abandoned mine features are critical to the survival of numerous bat species due to the loss of natural roosting and hibernation areas (NPS, 2015) but they also pose a human safety risk. Recent efforts to close and reclaim abandoned mine features have threatened bat populations (NPS, 2015). The New Mexico Department of Game and Fish comments for the Copper Flat Mine BDR specifically requested an evaluation of abandoned mine features in the permit area to determine use by roosting or hibernating bats, particularly if the features are expected to be disturbed or destroyed during future mining. Since agency representatives emphasized the regional importance of these features throughout the Copper Flat permitting process, our biologists searched for abandoned mine features during our field

survey. No adits or shafts were observed during field assessments at the mill sites or proposed substation location.

CONCLUSIONS AND RECOMMENDATIONS

The 2015/2016 biological surveys in the mill site and substation areas yielded 156 plant species, most of which were native. A total of 46 bird species were also detected in the project area during field surveys and most of the species were residents. Six state-listed wildlife species, loggerhead shrike, sagebrush sparrow, scaled quail, mourning dove, golden eagle, and common ground-dove, were recorded during the survey. NMCC does not have any plans to do work or construction down in Greyback Arroyo on the southern end of mill site claims before or during the operation of Copper Flat. Given the limited scope of development activities proposed, we do not expect that the proposed project will have any impact on local populations of the state-listed wildlife species observed, however, clearance surveys are recommended prior to development and/or ground clearing. No special status plant species, wetlands, springs/seeps, noxious weeds, adits/shafts, or other biological features critically unique to the region were observed.

Most of the proposed mill sites are in areas with existing developments such as production wells or monitoring wells and each of the sites is bisected by a road. Affected habitats are primarily Chihuahuan desert scrubland with a plant community that has deviated from its ecological potential (as described in the Ecological site report for Gravelly). However, given the shape and size of a typical 5-acre mill site claim, small portions of the mill site boundaries include draws and/or arroyo habitats that contain relatively unique microhabitats for the area. As indicated by the results of this survey, the arroyo habitats and draws contain a higher biological diversity and abundance than the surrounding creosote flats. We recommend avoiding disturbance in draws or in Greyback Arroyo during future developments in this area, to the extent practicable.

Since a state-listed endangered species, the common ground dove, was observed in the arroyo area, which fell within the survey area but outside the locations proposed for development, additional surveys for common ground dove, particularly in locations where ground disturbance is planned, should be considered prior to development of the site. Also, If possible, future construction activities should be completed outside of typical avian breeding season to minimize disturbance to breeding birds. Ideally, future construction at the site will occur between September and February. If activities during breeding season cannot

be avoided, clearance surveys should be conducted immediately prior to construction activities. Clearance surveys will help ensure that common ground dove nests in particular are not disturbed, and will help minimize disturbance to all breeding birds in the area. In addition, a formal nesting/breeding activity survey should be completed and an action plan should be developed if common ground doves are detected again prior to commencement of construction activities.

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APPENDIX 1: Vegetation Transect UTM Locations

Transect	Easting	Northing
1	269928	3650513
2	270023	3650505
3	274960	3650899
4	274990	3650271
5	275105	3650218
6	275140	3650160
7	275220	3650295
8	275391	3650267
9	275463	3650135
10	276061	3650378
11	276329	3649828
12	276356	3650341
13	276454	3649868
14	276468	3650466
15	276543	3650544
16	276885	3650423
17	276950	3649702
18	277016	3649752

APPENDIX 2: Plant Species Observed at the Project Site

Species Code	Scientific Name	Common Name	Duration	Growth Habit	Native Status
ACACON	*Acacia constricta*	whitethorn acacia	Perennial	Shrub	Native
ACONAN	*Acourtia nana*	dwarf desertpeony	Perennial	Forb/herb	Native
ALLINC	*Allionia incarnata*	trailing windmills	Perennial	Forb/herb	Native
ALOWRI	*Aloysia wrightii*	Wright's beebrush	Perennial	Shrub	Native
AMAALB	*Amaranthus albus*	prostrate pigweed	Annual	Forb/herb	Introduced
AMAPAL	*Amaranthus palmeri*	carelessweed	Annual	Forb/herb	Native
AMBCON	*Ambrosia confertiflora*	weakleaf bur ragweed	Perennial	Forb/herb	Native
AMBMON	*Ambrosia monogyra*	hollyleaf bur ragweed	Perennial	Subshrub	Native
AMMCHE	*Ammocodon chenopodioides*	goosefoot moonpod	Perennial	Forb/herb	Native
ARIADS	*Aristida adscensionis*	sixweeks threeawn	Annual	Graminoid	Native
ARIPUR	*Aristida purpurea*	purple threeawn	Perennial	Graminoid	Native
ARITER	*Aristida ternipes*	spidergrass	Perennial	Graminoid	Native
ASTRAGALUS	*Astragalus*	milkvetch	Annual	Forb/herb	Native
ASTALL	*Astragalus allochrous*	halfmoon milkvetch	Annual	Forb/herb	Native
ASTFLE	*Astragalus flexuosus*	flexile milkvetch	Perennial	Forb/herb	Native
ASTNUT	*Astragalus nuttallianus*	smallflowered milkvetch	Annual	Forb/herb	Native
BACPTE	*Baccharis pteronioides*	yerba de pasmo	Perennial	Shrub	Native
BAHABS	*Bahia absinthifolia*	hairyseed bahia	Perennial	Forb/herb	Native
BAIMUL	*Baileya multiradiata*	desert marigold	Perennial	Forb/herb	Native
BERLYR	*Berlandiera lyrata*	lyreleaf greeneyes	Perennial	Forb/herb	Native
BOESPI	*Boerhavia spicata*	creeping spiderling	Annual	Forb/herb	Native
BOTBAR	*Bothriochloa barbinodis*	cane bluestem	Perennial	Graminoid	Native
BOTISC	*Bothriochloa ischaemum*	yellow bluestem	Perennial	Graminoid	Native
BOUARI	*Bouteloua aristidoides*	needle grama	Annual	Graminoid	Native
BOUBAR	*Bouteloua barbata*	sixweeks grama	Annual	Graminoid	Native
BOUCUR	*Bouteloua curtipendula*	sideoats grama	Perennial	Graminoid	Native
BOUERI	*Bouteloua eriopoda*	black grama	Perennial	Graminoid	Native
BOUGRA	*Bouteloua gracilis*	blue grama	Perennial	Graminoid	Native
BOUROT	*Bouteloua rothrockii*	Rothrock's grama	Perennial	Graminoid	Native
BRILAC	*Brickellia laciniata*	splitleaf brickellbush	Perennial	Subshrub	Native
CARLIN	*Carlowrightia linearifolia*	*heath wrightwort*	Perennial	Forb/herb	Native
CELRET	*Celtis reticulata*	netleaf hackberry	Perennial	Tree	Native
CHAERI	*Chaetopappa ericoides*	rose heath	Perennial	Forb/herb	Native
CHACON	*Chamaesaracha coniodes*	gray five eyes	Perennial	Forb/herb	Native
CHASOR	*Chamaesaracha sordida*	hairy five eyes	Perennial	Forb/herb	Native
CHAALB	*Chamaesyce albomarginata*	whitemargin sandmat	Perennial	Forb/herb	Native
CHAREV	*Chamaesyce revoluta*	threadstem sandmat	Annual	Forb/herb	Native
CHASERP	*Chamaesyce serpyllifolia*	thymeleaf sandmat	Annual	Forb/herb	Native
CHASERR	*Chamaesyce serrula*	sawtooth sandmat	Annual	Forb/herb	Native
CHEALBU	*Chenopodium album*	lambsquarters	Annual	Forb/herb	Native
CHLLIN	*Chilopsis linearis*	desert willow	Perennial	Tree	Native
CHLVIR	*Chloris virgata*	feather fingergrass	Annual	Graminoid	Native
CIROCH	*Cirsium ochrocentrum*	yellowspine thistle	Biennial	Forb/herb	Native
CONCAN	*Conyza canadensis*	Canadian horseweed	Biennial	Forb/herb	Native
CORROB	*Coryphantha robustispina*	long-tubercle beehive cactus	Perennial	Shrub	Native
CROPOT	*Croton pottsii*	leatherweed	Perennial	Forb/herb	Native
CRYPUS	*Cryptantha pusilla*	low cryptantha	Annual	Forb/herb	Native
CUCFOE	*Cucurbita foetidissima*	Missouri gourd	Perennial	Forb/herb	Native
CYLIMB	*Cylindropuntia imbricata*	tree cholla	Perennial	Shrub	Native
CYLLEP	*Cylindropuntia leptocaulis*	Christmas cactus	Perennial	Shrub	Native
CYNDAC	*Cynodon dactylon*	Bermudagrass	Perennial	Graminoid	Introduced
DALFOR	*Dalea formosa*	featherplume	Perennial	Shrub	Native
DALLAN	*Dalea lanata*	woolly prairie clover	Perennial	Forb/herb	Native
DALNEO	*Dalea neomexicana*	downy prairie clover	Perennial	Forb/herb	Native
DALPOG	*Dalea pogonathera*	bearded prairie clover	Perennial	Forb/herb	Native
DASPUL	*Dasyochloa pulchella*	low woollygrass	Perennial	Graminoid	Native
DATWRI	*Datura wrightii*	sacred thorn-apple	Perennial	Shrub	Native
DELPHINIUM	*Delphinium sp.*	larkspur	Annual	Forb/herb	Native
DESPIN	*Descurainia pinnata*	western tansymustard	Annual	Forb/herb	Native
DESSOP	*Descurainia sophia*	herb sophia	Annual	Forb/herb	Introduced
ECHFEN	*Echinocereus fendleri*	pinkflower hedgehog cactus	Perennial	Shrub	Native
ECHTRI	*Echinocereus triglochidiatus*	kingcup cactus	Perennial	Shrub	Native
ENNDES	*Enneapogon desvauxii*	nineawn pappusgrass	Perennial	Forb/herb	Native
EPHTRI	*Ephedra trifurca*	longleaf jointfir	Perennial	Shrub	Native
ERABAR	*Eragrostis barrelieri*	Mediterranean lovegrass	Annual	Graminoid	Introduced
ERALEH	*Eragrostis lehmanniana*	Lehmann lovegrass	Perennial	Graminoid	Introduced
ERAMEX	*Eragrostis mexicana*	Mexican lovegrass	Annual	Graminoid	Native

ERIDIFF	*Eriastrum diffusum*	miniature woollystar	Annual	Forb/herb	Native
ERIDIV	*Erigeron divergens*	spreading fleabane	Biennial	Forb/herb	Native
ERITRA	*Erigeron tracyi*	Tracy's fleabane	Perennial	Forb/herb	Native
ERIABE	*Eriogonum abertianum*	Abert's buckwheat	Annual	Forb/herb	Native
ERIPOL	*Eriogonum polycladon*	sorrel buckwheat	Annual	Forb/herb	Native
ERIROT	*Eriogonum rotundifolium*	roundleaf buckwheat	Annual	Forb/herb	Native
EROTEX	*Erodium texanum*	Texas stork's bill	Annual	Forb/herb	Native
EVONUT	*Evolvulus nuttallianus*	shaggy dwarf morning-glory	Perennial	Forb/herb	Native
FALPAR	*Fallugia paradoxa*	Apache plume	Perennial	Shrub	Native
FLOCER	*Flourensia cernua*	American tarwort	Perennial	Shrub	Native
FOUSPL	*Fouquieria splendens*	ocotillo	Perennial	Shrub	Native
GLABIP	*Glandularia bipinnatifida*	Dakota mock vervain	Perennial	Forb/herb	Native
GUTMIC	*Gutierrezia microcephala*	threadleaf snakeweed	Perennial	Shrub	Native
GUTSAR	*Gutierrezia sarothrae*	broom snakeweed	Perennial	Shrub	Native
HETVIL	*Heterotheca villosa*	hairy false goldenaster	Perennial	Forb/herb	Native
HOFGLA	*Hoffmannseggia glauca*	Indian rushpea	Perennial	Forb/herb	Native
HYBVER	*Hybanthus verticillatus*	babyslippers	Perennial	Forb/herb	Native
HYMODO	*Hymenoxys odorata*	bitter rubberweed	Annual	Forb/herb	Native
IPOCOS	*Ipomoea costellata*	crestrib morning-glory	Annual	Forb/herb	Native
KALPAR	*Kallstroemia parviflora*	warty caltrop	Annual	Forb/herb	Native
KOESPI	*Koeberlinia spinosa*	crown of thorns	Perennial	Shrub	Native
LAECOU	*Laennecia coulteri*	Coulter's horseweed	Annual	Forb/herb	Native
LAPOCC	*Lappula occidentalis*	flatspine stickseed	Annual	Forb/herb	Native
LARTRI	*Larrea tridentata*	creosote bush	Perennial	Shrub	Native
LEPLAS	*Lepidium lasiocarpum*	shaggyfruit pepperweed	Annual	Forb/herb	Native
LESFEN	*Lesquerella fendleri*	Fendler's bladderpod	Perennial	Forb/herb	Native
LYCBER	*Lycium berlandieri*	Berlandier's wolfberry	Perennial	Shrub	Native
MACTAN	*Machaeranthera tanacetifolia*	tanseyleaf tansyaster	Perennial	Forb/herb	Native
MALFEN	*Malacothrix fendleri*	Fendler's desertdandelion	Annual	Forb/herb	Native
MELLEU	*Melampodium leucanthum*	plains blackfoot	Perennial	Forb/herb	Native
MENSCA	*Menodora scabra*	rough menodora	Perennial	Forb/herb	Native
MENTZELIA	*Mentzelia sp.*	blazingstar	Annual	Forb/herb	Native
MIMACU	*Mimosa aculeaticarpa*	catclaw mimosa	Perennial	Shrub	Native
MIRLIN	*Mirabilis linearis*	narrowleaf four o'clock	Perennial	Forb/herb	Native
MIRABILIS	*Mirabilis sp.*	four o'clock	Perennial	Forb/herb	Native
MUHPOR	*Muhlenbergia porteri*	bush muhly	Perennial	Graminoid	Native
NAMHIS	*Nama hispidum*	bristly nama	Annual	Forb/herb	Native
OENBRA	*Oenothera brachycarpa*	shortfruit evening primrose	Perennial	Forb/herb	Native
OENOTHERA	*Oenothera sp.*	evening primrose	Perennial	Forb/herb	Native
OENSUF	*Oenothera suffrutescens*	scarlet gaura	Perennial	Forb/herb	Native
OPUENG	*Opuntia engelmannii*	cactus apple	Perennial	Shrub	Native
OPUMAC	*Opuntia macrocentra*	purple pricklypear	Perennial	Shrub	Native
OPUMAC	*Opuntia macrorhiza*	twistspine pricklypear	Perennial	Shrub	Native
OPUPOL	*Opuntia polyacantha*	plains pricklypear	Perennial	Shrub	Native
PANHIR	*Panicum hirticaule*	Mexican panicgrass	Annual	Graminoid	Native
PANOBT	*Panicum obtusum*	vine mesquite	Perennial	Graminoid	Native
PANVIR	*Panicum virgatum*	switchgrass	Perennial	Graminoid	Native
PARCON	*Parthenium confertum*	Gray's feverfew	Perennial	Forb/herb	Native
PARINC	*Parthenium incanum*	mariola	Perennial	Shrub	Native
PECANG	*Pectis angustifolia*	lemonscent	Annual	Forb/herb	Native
PECFIL	*Pectis filipes*	fivebract chinchweed	Annual	Forb/herb	Native
PECPRO	*Pectis prostrata*	spreading chinchweed	Annual	Forb/herb	Native
PHACAE	*Phacelia caerulea*	skyblue phacelia	Annual	Forb/herb	Native
PHACOE	*Phacelia coerulea*	skyblue phacelia	Annual	Forb/herb	Native
PHEAUR	*Phemeranthus aurantiacus*	orange fameflower	Perennial	Forb/herb	Native
PLAPAT	*Plantago patagonica*	woolly plantain	Annual	Forb/herb	Native
PLEMUT	*Pleuraphis mutica*	tobosagrass	Perennial	Graminoid	Native
PORHAL	*Portulaca halimoides*	silkcotton purslane	Annual	Forb/herb	Native
PROGLA	*Prosopis glandulosa*	honey mesquite	Perennial	Shrub	Native
RAFNEO	*Rafinesquia neomexicana*	New Mexico plumeseed	Annual	Forb/herb	Native
RHUMIC	*Rhus microphylla*	littleleaf sumac	Perennial	Shrub	Native
RUMHYM	*Rumex hymenosepalus*	canaigre dock	Perennial	Forb/herb	Native
SALTRA	*Salsola tragus*	prickly Russian thistle	Annual	Forb/herb	Introduced
SANABE	*Sanvitalia abertii*	Abert's creeping zinnia	Annual	Forb/herb	Native
SCHSCO	*Schizachyrium scoparium*	little bluestem	Perennial	Graminoid	Native
SCLBRE	*Scleropogon brevifolius*	burrograss	Perennial	Graminoid	Native
SENFLA	*Senecio flaccidus*	threadleaf ragwort	Perennial	Forb/herb	Native
SENBAU	*Senna bauhinioides*	twinleaf senna	Perennial	Forb/herb	Native

SIDABU	*Sida abutifolia*	spreading fanpetals	Perennial	Forb/herb	Introduced
SIDNEO	*Sida neomexicana*	New Mexico fanpetals	Perennial	Forb/herb	Native
SOLELA	*Solanum elaeagnifolium*	silverleaf nightshade	Perennial	Forb/herb	Native
SPHAMB	*Sphaeralcea ambigua*	desert globemallow	Perennial	Forb/herb	Native
SPHEMO	*Sphaeralcea emoryi*	Emory's globemallow	Perennial	Forb/herb	Native
SPHHAS	*Sphaeralcea hastulata*	spear globemallow	Perennial	Forb/herb	Native
SPOCON	*Sporobolus contractus*	spike dropseed	Perennial	Graminoid	Native
SPOCRY	*Sporobolus cryptandrus*	sand dropseed	Perennial	Graminoid	Native
SPOGIG	*Sporobolus giganteus*	giant dropseed	Perennial	Graminoid	Native
STEPAU	*Stephanomeria pauciflora*	brownplume wirelettuce	Perennial	Forb/herb	Native
THYACE	*Thymophylla acerosa*	pricklyleaf dogweed	Perennial	Forb/herb	Native
THYPEN	*Thymophylla pentachaeta*	fiveneedle pricklyleaf	Perennial	Forb/herb	Native
TIDLAN	*Tidestromia lanuginosa*	woolly tidestromia	Annual	Forb/herb	Native
TIQCAN	*Tiquilia canescens*	woody crinklemat	Perennial	Forb/herb	Native
TRAAMB	*Tragia amblyodonta*	dogtooth noseburn	Perennial	Forb/herb	Native
TRIMUT	*Tridens muticus*	slim tridens	Perennial	Graminoid	Native
YUCBAC	*Yucca baccata*	banana yucca	Perennial	Shrub	Native
YUCELA	*Yucca elata*	soaptree yucca	Perennial	Shrub	Native
ZINGRA	*Zinnia grandiflora*	Rocky Mountain zinnia	Perennial	Forb/herb	Native
ZIZOBT	*Ziziphus obtusifolia*	lotebush	Perennial	Shrub	Native

APPENDIX 3: Cover by Species at Each Transect (1 – 18)

Genus	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Pleuraphis	mutica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	24%	0%	76%	0%	33%	2%	8.042%
Dasyochloa	pulchella	1%	1%	5%	2%	8%	3%	20%	14%	5%	4%	0%	0%	0%	3%	0%	3%	0%	10%	4.447%
Larrea	tridentata	3%	2%	2%	3%	2%	2%	0%	1%	2%	4%	0%	4%	0%	2%	0%	5%	0%	2%	1.947%
Chamaesyce	serpyllifolia	0%	0%	1%	6%	3%	0%	3%	4%	1%	4%	0%	0%	0%	0%	0%	0%	0%	3%	1.433%
Muhlenbergia	porteri	0%	0%	0%	3%	2%	0%	2%	2%	3%	4%	0%	0%	0%	1%	0%	5%	0%	2%	1.356%
Bouteloua	barbata	4%	2%	1%	1%	0%	1%	3%	1%	1%	1%	0%	0%	0%	0%	0%	1%	0%	2%	0.947%
Bahia	absinthifolia	4%	0%	0%	1%	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0.689%
Eragrostis	lehmanniana	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	1%	0%	0%	0%	3%	0.472%
Chamaesyce	serrula	0%	0%	0%	1%	2%	1%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0.467%
Hoffmannseggia	glauca	0%	0%	0%	4%	0%	0%	0%	0%	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0.431%
Flourensia	cernua	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	2%	0%	0%	0%	0.389%
Bouteloua	eriopoda	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	3%	0%	0%	0%	0%	2%	0.367%
Prosopis	glandulosa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	4%	0%	0%	0%	1%	0%	0.358%
Cylindropuntia	leptocaulis	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	4%	0%	1%	0%	0%	0%	0%	0.353%
Gutierrezia	sarothrae	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0.339%
Croton	pottsii	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0.331%
Bouteloua	curtipendula	0%	0%	0%	2%	2%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0.303%
Parthenium	incanum	4%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.286%
Thymophylla	pentachaeta	0%	0%	0%	0%	0%	2%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.236%
Ephedra	trifurca	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0.233%
Acacia	constricta	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0.208%
Opuntia	macrorhiza	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0.156%
Boerhavia	spicata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0.150%
Scleropogon	brevifolius	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0.150%
Sida	abutifolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0.136%
Acourtia	nana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%	0%	0.133%
Allionia	incarnata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0.131%
Chamaesaracha	sordida	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0.122%
Ammocodon	chenopodioides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0.106%
Aristida	purpurea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0.106%
Dalea	formosa	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.106%
Panicum	obtusum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0.106%
Panicum	hirticaule	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0.100%
Sanvitalia	abertii	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.067%
Sphaeralcea	emoryi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0.067%
Aristida	adscensionis	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.056%
Dalea	pogonathera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0.050%
Mimosa	aculeaticarpa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.044%
Baileya	multiradiata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.039%
Eragrostis	barrelieri	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.028%
Zinnia	grandiflora	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.028%
Amaranthus	palmeri	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Aristida	ternipes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Chamaesaracha	coniodes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Chamaesyce	revoluta	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Laennecia	coulteri	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Pectis	angustifolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Sphaeralcea	hastulata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.019%
Bouteloua	aristidoides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.014%
Mirabilis	linearis	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.014%
Thymophylla	acerosa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.011%
Bouteloua	rothrockii	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.008%
Eragrostis	mexicana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.008%
Stephanomeria	pauciflora	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.008%
Evolvulus	nuttallianus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Gutierrezia	microcephala	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Ipomoea	costellata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Kallstroemia	parviflora	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Nama	hispidum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Phemeranthus	aurantiacus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Senna	bauhinioides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.006%
Amaranthus	albus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Berlandiera	lyrata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%

Genus	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Chaetopappa	ericoides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Chloris	virgata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Dalea	neomexicana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Eriogonum	abertianum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Glandularia	bipinnatifida	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Menodora	scabra	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Panicum	virgatum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Pectis	prostrata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Phacelia	coerulea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Portulaca	halimoides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Rhus	microphylla	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Solanum	elaeagnifolium	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%
Tidestromia	lanuginosa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.003%

APPENDIX 4: Frequency by Species at Each Transect (1 – 18)

Transect	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**Mean Frequency**
Dasyochloa pulchella	0%	0%	10%	30%	30%	0%	0%	0%	10%	30%	0%	50%	0%	10%	50%	20%	0%	0%	63%
Bouteloua barbata	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	56%
Chamaesyce serpyllifolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	46%
Larrea tridentata	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	26%
Bahia absinthifolia	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	24%
Muhlenbergia porteri	0%	20%	0%	10%	0%	10%	0%	0%	10%	20%	10%	0%	10%	0%	0%	0%	10%	40%	23%
Hoffmannseggia glauca	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	19%
Chamaesyce serrula	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	19%
Pleuraphis mutica	0%	0%	0%	0%	0%	10%	0%	10%	20%	0%	0%	0%	0%	0%	0%	0%	0%	40%	18%
Boerhavia spicata	70%	20%	20%	40%	30%	50%	10%	30%	20%	10%	20%	0%	10%	0%	10%	10%	10%	80%	17%
Acourtia nana	10%	0%	30%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	10%	0%	10%	13%
Panicum hirticaule	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	13%
Parthenium incanum	0%	40%	0%	0%	10%	10%	0%	10%	10%	0%	40%	0%	70%	10%	0%	0%	20%	80%	11%
Thymophylla pentachaeta	0%	10%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	20%	11%
Eragrostis lehmanniana	90%	90%	50%	80%	60%	100%	100%	80%	80%	60%	50%	10%	10%	10%	0%	40%	30%	70%	10%
Aristida adscensionis	0%	0%	10%	20%	10%	0%	0%	0%	0%	0%	0%	0%	10%	0%	20%	0%	0%	0%	8%
Chamaesaracha sordida	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	30%	0%	60%	0%	0%	0%	20%	10%	8%
Gutierrezia sarothrae	0%	0%	20%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%
Sanvitalia abertii	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%
Scleropogon brevifolius	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%	20%	0%	7%
Bouteloua eriopoda	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	20%	0%	20%	0%	20%	0%	20%	50%	7%
Flourensia cernua	0%	0%	0%	0%	10%	10%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	7%
Croton pottsii	10%	30%	70%	90%	90%	70%	100%	80%	40%	60%	10%	10%	30%	20%	20%	10%	10%	70%	5%
Opuntia macrorhiza	10%	0%	0%	40%	10%	40%	20%	30%	60%	20%	10%	10%	0%	10%	0%	20%	0%	60%	5%
Prosopis glandulosa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	5%
Astragalus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	50%	0%	0%	0%	20%	10%	4%
Baileya multiradiata	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	10%	0%	30%	0%	0%	0%	0%	4%
Panicum obtusum	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	4%
Bouteloua curtipendula	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%
Chamaesaracha coniodes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	20%	0%	0%	0%	30%	0%	4%
Chamaesyce revoluta	60%	30%	70%	90%	90%	100%	100%	100%	100%	80%	20%	20%	10%	70%	0%	80%	10%	100%	4%
Chamaesyce revoluta	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	10%	0%	0%	0%	10%	0%	4%
Pectis angustifolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	10%	0%	10%	0%	10%	0%	4%
Sida abutifolia	0%	20%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	4%
Dalea pogonathera	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	0%	0%	0%	30%	0%	0%	0%	80%	3%
Sphaeralcea emoryi	0%	0%	10%	10%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	3%
Allionia incarnata	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%
Bouteloua aristidoides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	3%
Cylindropuntia leptocaulis	0%	60%	10%	0%	0%	0%	0%	0%	10%	0%	20%	0%	0%	0%	20%	0%	0%	0%	3%
Mirabilis linearis	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%
Ephedra trifurca	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	2%
Eragrostis barrelieri	10%	0%	0%	20%	0%	0%	0%	0%	0%	30%	10%	10%	0%	30%	0%	10%	0%	0%	2%
Mimosa aculeaticarpa	20%	20%	0%	50%	30%	10%	0%	0%	30%	10%	70%	20%	20%	10%	40%	20%	0%	0%	2%
Thymophylla acerosa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	10%	0%	2%
Zinnia grandiflora	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	2%
Bouteloua rothrockii	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	2%
Eragrostis mexicana	40%	50%	30%	30%	20%	40%	0%	40%	10%	60%	0%	40%	0%	30%	0%	30%	10%	40%	2%
Stephanomeria pauciflora	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Ammocodon chenopodioides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	20%	0%	1%

Transect	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**Mean Frequency**
Aristida purpurea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	30%	0%	0%	10%	1%
Dalea formosa	20%	0%	10%	30%	20%	30%	40%	40%	40%	40%	10%	20%	0%	40%	0%	60%	0%	20%	1%
Evolvulus nuttallianus	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	1%
Gutierrezia microcephala	10%	0%	10%	10%	0%	10%	10%	10%	0%	10%	0%	10%	0%	10%	0%	0%	0%	0%	1%
Ipomoea costellata	0%	10%	0%	10%	0%	0%	0%	0%	10%	0%	20%	0%	80%	0%	40%	0%	0%	70%	1%
Kallstroemia parviflora	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	80%	0%	0%	0%	1%
Nama hispidum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	1%
Phemeranthus aurantiacus	80%	50%	0%	0%	0%	10%	0%	0%	0%	10%	0%	20%	0%	0%	0%	10%	0%	10%	1%
Senna bauhinioides	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	60%	0%	0%	0%	0%	0%	0%	0%	1%
Acacia constricta	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Amaranthus albus	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Amaranthus palmeri	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	10%	0%	1%
Aristida ternipes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	0%	80%	0%	100%	0%	100%	10%	1%
Berlandiera lyrata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	1%
Chaetopappa ericoides	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	30%	0%	40%	0%	0%	0%	20%	0%	1%
Chloris virgata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	1%
Dalea neomexicana	70%	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	1%
Eriogonum abertianum	0%	0%	30%	0%	0%	0%	0%	0%	0%	10%	0%	40%	0%	30%	0%	10%	0%	0%	1%
Glandularia bipinnatifida	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	1%
Laennecia coulteri	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	40%	1%
Menodora scabra	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	1%
Panicum virgatum	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	0%	10%	0%	1%
Pectis prostrata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	1%
Phacelia coerulea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	20%	0%	0%	0%	1%
Portulaca halimoides	0%	0%	0%	20%	0%	10%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Rhus microphylla	0%	0%	10%	0%	0%	60%	10%	20%	30%	30%	0%	0%	0%	10%	0%	0%	0%	20%	1%
Solanum elaeagnifolium	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Sphaeralcea hastulata	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	30%	0%	0%	0%	0%	10%	1%
Tidestromia lanuginosa	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%