

**2023
CCH-2 Vegetation Monitoring,
Bronco, Colorado, Site**

October 2023



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

Contents

Abbreviations	ii
1.0 Introduction	1
2.0 Reclamation and Success Criteria	1
3.0 Results	2
4.0 Discussion	2
5.0 References	3
6.0 Photographs	5

Figures

Figure 1. Vegetation Monitoring Locations at Bronco CCH-2	4
Figure 2. Monitoring Location 1, Bronco, Colorado, Site.....	5
Figure 3. Monitoring Location 2, Bronco, Colorado, Site.....	6
Figure 4. Monitoring Location 3, Bronco, Colorado, Site.....	7

Table

Table 1. Data Comparison of DPC, Success Criteria, and Monitoring Results.....	2
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Appendix

Appendix A Comprehensive Data	
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Abbreviations

AEC	U.S. Atomic Energy Commission
BLM	U.S. Bureau of Land Management
CCH-2	Colorado Core Hole No. 2
DPC	desired plant community

1.0 Introduction

This report documents revegetation success monitoring following reclamation work at the Bronco, Colorado, Site at the Project Bronco U.S. Bureau of Mines and U.S. Atomic Energy Commission (AEC) Colorado Core Hole No. 2 (CCH-2) well. Reclamation work included CCH-2 well plugging and abandonment, soil stabilization, downed timber distribution, seed bed preparation, and broadcast seeding the area surrounding the well and the road leading to the well pad. The well was drilled by AEC, a predecessor agency to the U.S. Department of Energy, in 1966. The Bronco site is on land managed by the U.S. Bureau of Land Management (BLM) in NWNE, Section 14, T1S, R99W, 6th PM, in Rio Blanco County, Colorado (Figure 1). Before well abandonment and reclamation began, predisturbance vegetation monitoring was conducted in May 2021 to obtain data for revegetation success comparisons. The well was successfully abandoned in September 2021, and reclamation activities were completed in October 2021. The first revegetation success monitoring was completed in June 2022 (DOE 2022). This report contains 2023 results and revegetation success monitoring will continue annually until success criteria are met.

2.0 Reclamation and Success Criteria

Reclamation activities (including soil stabilization and revegetation) followed methods listed in the *Reclamation Plan for Project Bronco Well CCH-2 Abandonment, Rio Blanco County, Colorado* (DOE 2021) and took place September 24 through October 14, 2021.

Vegetation monitoring methods follow the *Surface Reclamation Plan* (BLM 2007) and *BLM Core Terrestrial Indicators and Methods, Tech Note 440* (MacKinnon et al. 2011). Vegetation monitoring will be conducted annually until success criteria goals are met. Annual vegetation monitoring data (Appendix A) are compared to the desired plant community (DPC) data and the following criteria:

- (1) Self-sustaining vegetative groundcover is (1) consistent with the site DPC and (2) adequately established, as described below, on disturbed surfaces to stabilize soils through the life of the project.
- (2) Vegetation¹ will have 80% similarity of foliar cover, bare ground, and shrub or forb density in relation to the identified DPC.
- (3) To ensure that site species diversity is achieved, the resulting plant community (i.e., species richness) must be composed of at least five desirable plant species, and no one species may exceed 70% relative cover. Desirable species may include native species from the surrounding area; species listed in the range or ecological site description, assessment, inventory, and monitoring data, or reference site; or species from the BLM-approved seed mix. If nonprescribed or unauthorized plant species (e.g., yellow sweetclover [*Melilotus officinalis*]) appear in the reclamation site, BLM may require their removal.

¹ Vegetative cover values for woodland or shrubland sites (such as at Bronco CCH-2) are based on the capability of those sites in a herbaceous state.

- (4) If monitoring results do not demonstrate successful reclamation after 2 years, additional revegetation efforts may be implemented.

3.0 Results

Three permanent monitoring locations were established for annual vegetation monitoring data collection. Average values from the monitoring locations, comparisons to the DPC data, and success criteria are in Table 1. Photographs of each monitoring location are in Figure 2 through Figure 4.

Table 1. Data Comparison of DPC, Success Criteria, and Monitoring Results

Metric	DPC (2021)	Success Criteria (80% similarity of DPC)	2022	2023
Total foliar cover (% absolute cover)	25	25 ± 5	11	41
Bare ground (% absolute cover)	43	43 ± 6	53	39
Desirable foliar cover (% relative cover)	83	83 ± 17	74	50
Undesirable foliar cover (% relative cover)	0	0 ± 1	26	45
Forb foliar cover (% relative cover)	3	3 ± 1	17	41¹
Shrub foliar cover (% relative cover)	63	63 ± 13	9	12¹
Species richness (Number of dominant species)	10	10 ± 2	7	12

Note:

Bold values indicate that data are within success criteria.

4.0 Discussion

Data collected from the 2023 monitoring showed progression toward revegetation success criteria and that much of the site is blending into the surrounding landscape. Mean values from all monitoring locations indicated that five of the seven success criteria were met. The increase in undesirable foliar cover is primarily attributed to desert madwort (*Alyssum desertorum*) and prickly Russian thistle (*Salsola tragus*), nonnoxious annual weeds, and cheatgrass (*Bromus tectorum*), a Colorado “List C” noxious weed². The presence of these species represent the most significant hinderance to achieving success criteria. Grazing by livestock and wildlife has been observed onsite. As of 2023, grazing does not appear to significantly impede revegetation success, but it should continue to be monitored. Based on 2023 monitoring results, ecologists anticipate that vegetation establishment will continue, and success criteria will be achieved within the next 1–5 years.

² List C Species are species for which local governments and other interested parties develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans will not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species (Sections 35-5.5-104.5 to 35-5.5-118, *Colorado Revised Statutes*).

5.0 References

BLM (U.S. Bureau of Land Management), 2007. *Surface Reclamation Plan*, White River Field Office.

CRS 35-5.5-104.5 to 35-5.5-118. “Colorado Noxious Weed Act,” *Colorado Revised Statutes*.

DOE (U.S. Department of Energy), 2021. *Reclamation Plan for Project Bronco Well CCH-2 Abandonment, Rio Blanco County, Colorado*, LMS/S33467, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2022. *CCH-2 Vegetation Monitoring, Bronco, Colorado, Site*, LMS/BRO/42782, Office of Legacy Management, October.

MacKinnon, W.C., J.W. Karl, G.R. Toevs, J.J. Taylor, M. Karl, C.S. Spurrier, and J.E. Herrick, 2011. *BLM Core Terrestrial Indicators and Methods, Tech Note 440*, U.S. Department of the Interior, Bureau of Land Management, National Operations Center, Denver, Colorado.

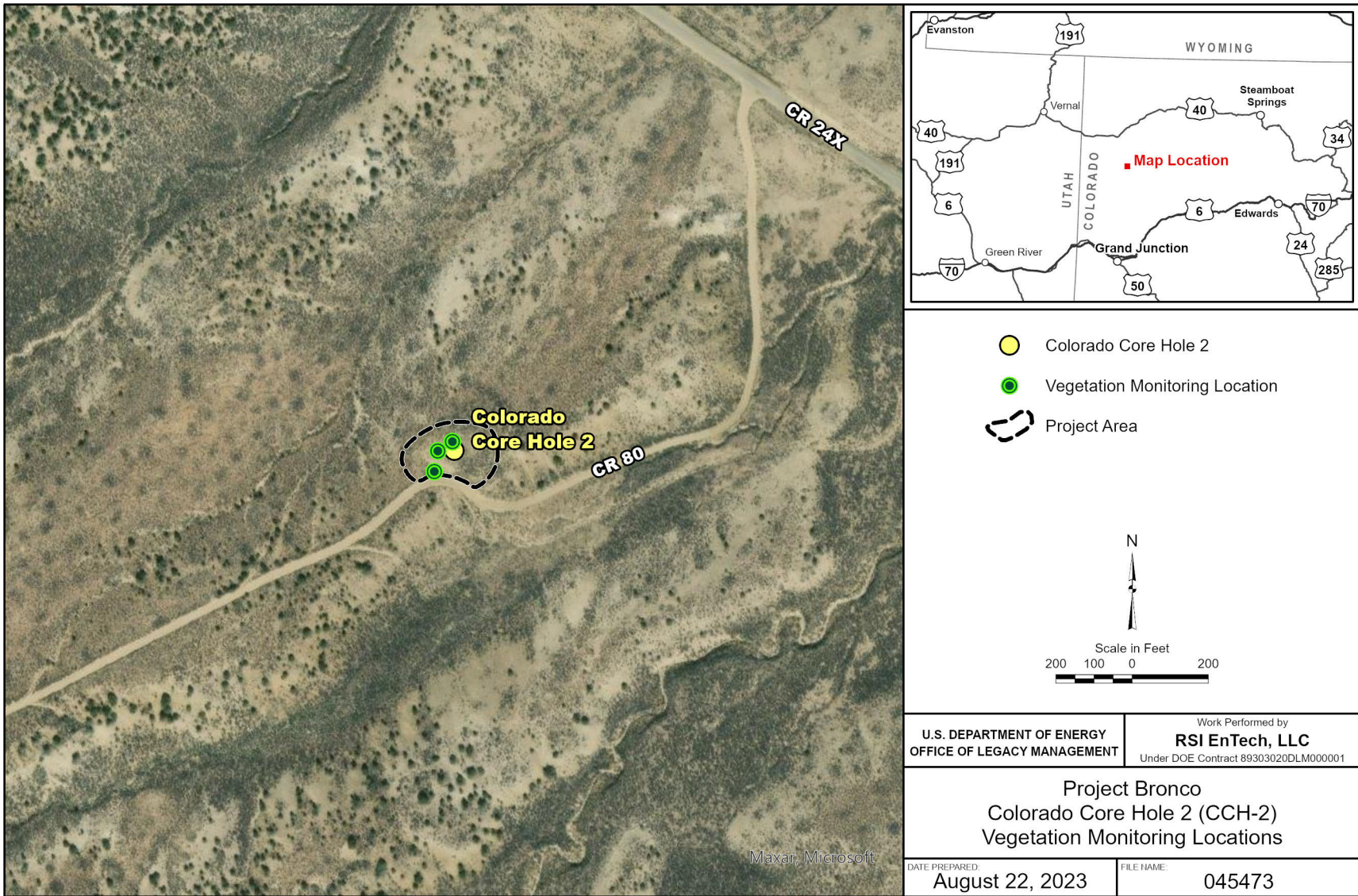


Figure 1. Vegetation Monitoring Locations at Bronco CCH-2

6.0 Photographs

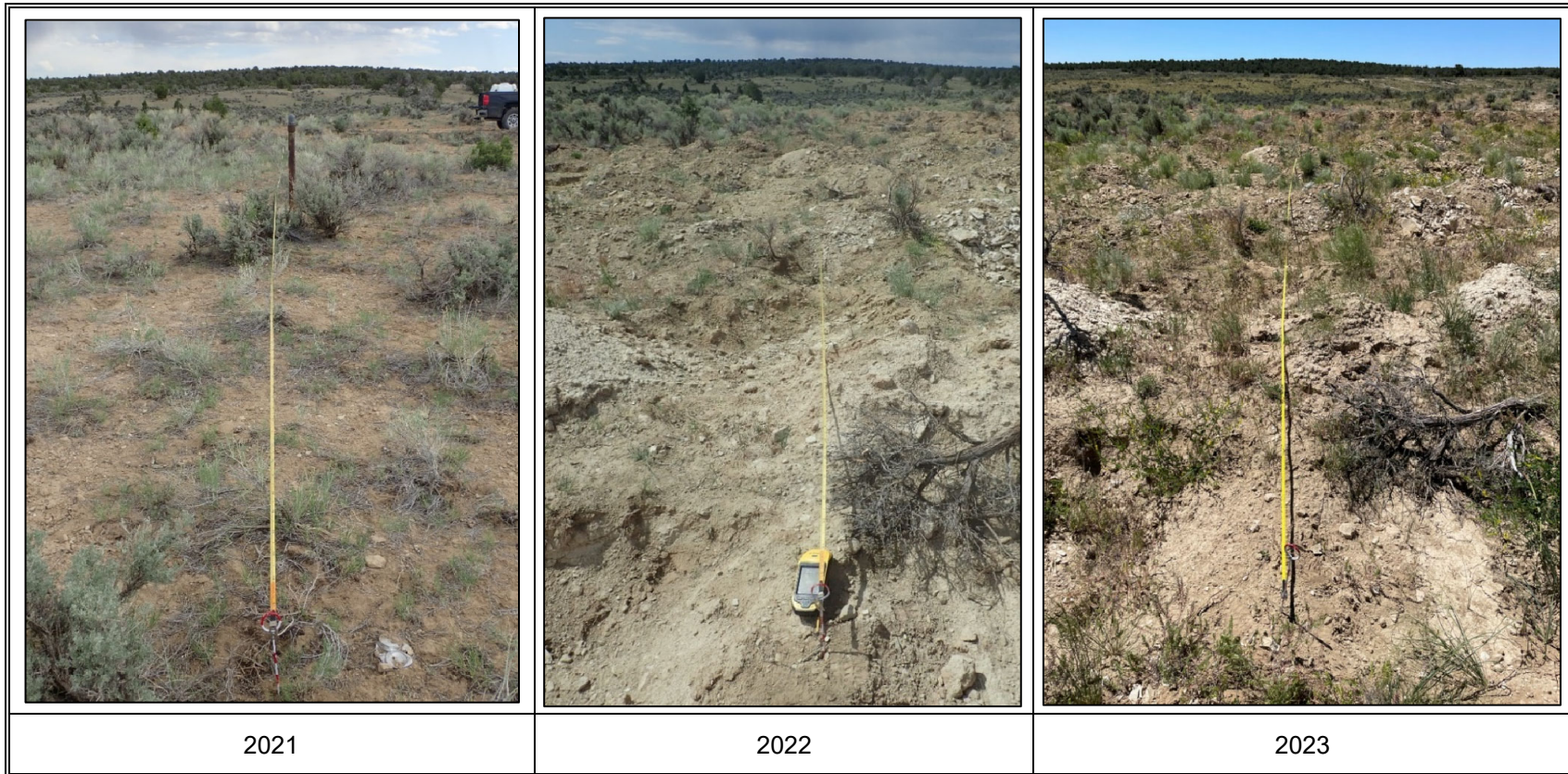


Figure 2. Monitoring Location 1, Bronco, Colorado, Site



Figure 3. Monitoring Location 2, Bronco, Colorado, Site



Figure 4. Monitoring Location 3, Bronco, Colorado, Site

Appendix A
Comprehensive Data

DPC Data (Predisturbance Monitoring Conducted May 19, 2021)

Scientific Name	Common Name	Growth Form	Monitoring Location		1	2	3	AVG
			Origin	Desirable?	Relative Cover (%)			
<i>Achnatherum hymenoides</i>	Indian ricegrass	Grass	Native	D	0	10	8	6
<i>Agropyron cristatum</i>	Crested wheatgrass	Grass	Introduced	N	18	obs	0	6
<i>Artemisia frigida</i>	Prairie sagewort	Shrub	Native	D	obs	0	0	<1
<i>Artemisia tridentata</i>	Wyoming big sagebrush	Shrub	Native	D	24	30	8	20
<i>Astragalus wingatanus</i>	Fort Wingate milkvetch	Forb	Native	D	obs	obs	0	<1
<i>Bromus inermis</i>	Smooth brome	Grass	Introduced	N	obs	0	0	<1
<i>Castilleja linariifolia</i>	Wyoming Indian paintbrush	Forb	Native	D	obs	0	0	<1
<i>Cryptantha flavoculata</i>	Roughseed cryptantha	Forb	Native	D	obs	0	0	<1
<i>Delphinium nuttallianum</i>	Twolobe larkspur	Forb	Native	D	obs	0	0	<1
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	Shrub	Native	D	35	20	38	31
<i>Eriogonum lonchophyllum</i>	Spearleaf buckwheat	Forb	Native	D	0	obs	0	<1
<i>Gutierrezia sarothrae</i>	Broom snakeweed	Shrub	Native	N	0	10	23	11
<i>Hesperostipa comata</i>	Needle and thread	Grass	Native	D	obs	10	8	6
<i>Juniperus osteosperma</i>	Utah juniper	Shrub	Native	D	obs	0	0	<1
<i>Koeleria macrantha</i>	Prairie Junegrass	Grass	Native	D	0	0	15	5
<i>Lomatium</i> sp.	Desert parsley	Forb	Native	D	0	obs	0	<1
<i>Machaeranthera grindelioides</i>	Rayless tansyaster	Forb	Native	D	0	10	0	3
<i>Pascopyrum smithii</i>	Western wheatgrass	Grass	Native	D	12	10	0	7
<i>Phlox longifolia</i>	Longleaf phlox	Forb	Native	D	0	0	obs	<1
<i>Poa secunda</i>	Sandberg bluegrass	Grass	Native	D	12	0	0	4
<i>Tetradymia canescens</i>	Spineless horsebrush	Shrub	Native	D	obs	0	0	<1
Desirable species					82	90	77	83
Neutral species					18	10	23	17
Undesirable species					0	0	0	0
Grasses					41	30	31	34
Forbs					0	10	0	3
Shrubs					59	60	69	63
Slope (%)					0-1	0-1	0-1	0-1
Herbaceous height (cm)					10	11	10	10

DPC Data (Predisturbance Monitoring Conducted May 19, 2021) (continued)

Woody height (cm)	30	26	34	30
Azimuth	160	350	72	NA
	Absolute Cover (%)			
Total foliar cover	30	20	26	25
Bare ground	30	64	34	43
Basal	0	0	0	0
Rock	6	2	6	5
Lichen	0	2	8	3
Standing dead	0	0	0	0
Plant litter	34	12	26	24

Abbreviations:

AVG = average

cm = centimeters

D = desirable

N = neutral

NA = not applicable

obs = observed

Revegetation Success Monitoring Conducted June 29, 2022

Scientific Name	Common Name	Growth Form	Monitoring Location		1	2	3	AVG
			Origin	Desirable?				
<i>Achnatherum hymenoides</i>	Indian ricegrass	Grass	Native	D	0	obs	0	<1
<i>Agropyron cristatum</i>	Crested wheatgrass	Grass	Introduced	N	0	0	0	*
<i>Alyssum desertorum</i>	Desert madwort	Forb	Introduced	U	0	14	25	13
<i>Aristida purpurea</i>	Purple threeawn	Grass	Native	D	0	obs	0	<1
<i>Artemisia frigida</i>	Prairie sagewort	Shrub	Native	D	obs	0	0	<1
<i>Artemisia tridentata</i>	Wyoming big sagebrush	Shrub	Native	D	0	0	13	4
<i>Astragalus wingatanus</i>	Fort Wingate milkvetch	Forb	Native	D	0	0	13	4
<i>Bromus inermis</i>	Smooth brome	Grass	Introduced	N	0	0	0	*
<i>Bromus tectorum</i>	Cheatgrass	Grass	Introduced	U	0	14	25	13
<i>Castilleja linariifolia</i>	Wyoming Indian paintbrush	Forb	Native	D	0	0	0	*
<i>Cryptantha flavoculata</i>	Roughseed cryptantha	Forb	Native	D	obs	0	0	<1
<i>Descurainia sophia</i>	Herb sophia	Forb	Introduced	U	obs	0	0	<1
<i>Elymus elymoides</i>	Squirreltail	Grass	Native	D	0	obs	0	<1
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	Shrub	Native	D	0	14	0	5
<i>Eriogonum lonchophyllum</i>	Spearleaf buckwheat	Forb	Native	D	0	obs	0	<1
<i>Gutierrezia sarothrae</i>	Broom snakeweed	Shrub	Native	N	0	obs	obs	<1
<i>Hesperostipa comata</i>	Needle and thread	Grass	Native	D	obs	0	13	4
<i>Juniperus osteosperma</i>	Utah juniper	Shrub	Native	D	obs	0	0	<1
<i>Koeleria macrantha</i>	Prairie Junegrass	Grass	Native	D	0	0	obs	<1
<i>Lomatium sp.</i>	Desert parsley	Forb	Native	D	0	0	0	*
<i>Lactuca serriola</i>	Prickly lettuce	Forb	Introduced	N	obs	0	0	<1
<i>Machaeranthera grindelioides</i>	Rayless tansyaster	Forb	Native	D	0	obs	0	<1
<i>Melilotus officinalis</i>	Sweetclover	Forb	Introduced	U	obs	0	0	<1
<i>Mirabilis linearis</i>	Narrowleaf four o'clock	Forb	Native	D	0	obs	0	<1
<i>Pascopyrum smithii</i>	Western wheatgrass	Grass	Native	D	0	14	13	9
<i>Physaria acutifolia</i>	Sharpleaf twinpod	Forb	Native	D	0	obs	0	<1
<i>Phlox hoodii</i>	Spiny phlox	Forb	Native	D	0	obs	0	<1
<i>Phlox longifolia</i>	Longleaf phlox	Forb	Native	D	0	0	0	*

Revegetation Success Monitoring Conducted June 29, 2022 (continued)

<i>Poa secunda</i>	Sandberg bluegrass	Grass	Native	D	0	0	obs	<1
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass	Grass	Native	D	100	43	0	48
<i>Salsola tragus</i>	Prickly Russian thistle	Forb	Introduced	U	obs	0	0	<1
<i>Sphaeralcea coccinea</i>	Scarlet globemallow	Forb	Native	D	0	obs	0	<1
<i>Tetradymia canescens</i>	Spineless horsebrush	Shrub	Native	D	obs	0	0	<1
Desirable species					100	71	50	74
Neutral species					0	0	0	0
Undesirable species					<1	29	50	26
Grasses					100	71	50	74
Forbs					<1	14	38	17
Shrubs					<1	14	13	9
Slope (%)					0–1	0–1	0–1	0–1
Herbaceous height (cm)					10	11	10	10
Woody height (cm)					30	26	34	30
Azimuth					160	350	72	NA
					Absolute Cover (%)			
Total foliar cover					4	14	14	11
Bare ground					46	56	56	53
Basal					0	0	0	0
Rock					46	26	26	33
Lichen					0	0	0	0
Standing dead					2	0	0	1
Plant litter					2	4	4	3

Note:

*Indicates species in previous years.

Abbreviations:

AVG = average
 cm = centimeters
 D = desirable
 N = neutral

NA = not applicable
 obs = observed
 U = undesirable

Revegetation Success Monitoring Conducted June 27, 2023

Scientific Name	Common Name	Growth Form	Monitoring Location		1	2	3	AVG
			Origin	Desirable?	Relative Cover (%)			
<i>Achnatherum hymenoides</i>	Indian ricegrass	Grass	Native	D	7	9	14	10
<i>Agropyron cristatum</i>	Crested wheatgrass	Grass	Introduced	N	0	0	0	*
<i>Alyssum desertorum</i>	Desert madwort	Forb	Introduced	U	17	43	24	28
<i>Aristida purpurea</i>	Purple threeawn	Grass	Native	D	0	obs	0	<1
<i>Artemisia frigida</i>	Prairie sagewort	Shrub	Native	D	obs	0	0	<1
<i>Artemisia tridentata</i>	Wyoming big sagebrush	Shrub	Native	D	3	0	10	4
<i>Astragalus wingatanus</i>	Fort Wingate milkvetch	Forb	Native	D	7	0	0	2
<i>Bromus inermis</i>	Smooth brome	Grass	Introduced	N	0	0	0	*
<i>Bromus tectorum</i>	Cheatgrass	Grass	Introduced	U	14	4	24	14
<i>Castilleja linariifolia</i>	Wyoming Indian paintbrush	Forb	Native	D	0	0	0	*
<i>Cryptantha flavoculata</i>	Roughseed cryptantha	Forb	Native	D	obs	0	0	<1
<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush	Shrub	Native	D	3	4	0	3
<i>Cryptantha flavoculata</i>	Roughseed cryptantha	Forb	Native	D	0	0	0	0
<i>Descurainia sophia</i>	herb sophia	Forb	Introduced	U	0	0	0	*
<i>Elymus elymoides</i>	Squirreltail	Grass	Native	D	3	0	5	3
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	Shrub	Native	D	7	9	0	5
<i>Eriogonum lonchophyllum</i>	Spearleaf buckwheat	Forb	Native	D	3	4	0	3
<i>Gutierrezia sarothrae</i>	Broom snakeweed	Shrub	Native	N	0	obs	obs	<1
<i>Hesperostipa comata</i>	Needle and thread	Grass	Native	D	0	9	5	4
<i>Ipomopsis congesta</i>	Ballhead ipomopsis	Forb	Native	D	0	4	5	3
<i>Juniperus osteosperma</i>	Utah juniper	Shrub	Native	D	0	0	0	*
<i>Koeleria macrantha</i>	Prairie Junegrass	Grass	Native	D	0	0	obs	<1
<i>Lomatium sp.</i>	Desert parsley	Forb	Native	D	0	0	0	*
<i>Lactuca serriola</i>	Prickly lettuce	Forb	Introduced	N	0	0	0	*
<i>Lygodesmia grandiflora</i>	Largeflower skeletonplant	Forb	Native	D	0	0	10	3
<i>Koeleria macrantha</i>	Prairie Junegrass	Grass	Native	D	0	0	0	*
<i>Machaeranthera grindelioides</i>	Rayless tansyaster	Forb	Native	D	0	obs	0	<1
<i>Melilotus officinalis</i>	Sweetclover	Forb	Introduced	N	7	9	0	5
<i>Mirabilis linearis</i>	Narrowleaf four o'clock	Forb	Native	D	0	obs	0	<1

Revegetation Success Monitoring Conducted June 27, 2023 (continued)

		Monitoring Location			1	2	3	AVG
Scientific Name	Common Name	Growth Form	Origin	Desirable?	Relative Cover (%)			
<i>Pastorium smithii</i>	Western wheatgrass	Grass	Native	D	14	0	5	6
<i>Physaria acutifolia</i>	Sharpleaf twinpod	Forb	Native	D	0	obs	0	<1
<i>Phlox hoodii</i>	Spiny phlox	Forb	Native	D	0	obs	0	<1
<i>Phlox longifolia</i>	Longleaf phlox	Forb	Native	D	0	0	0	*
<i>Poa secunda</i>	Sandberg bluegrass	Grass	Native	D	0	0	obs	<1
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass	Grass	Native	D	10	0	0	3
<i>Salsola tragus</i>	prickly Russian thistle	Forb	Introduced	U	3	4	0	3
<i>Sphaeralcea coccinea</i>	Scarlet globemallow	Forb	Native	D	3	0	0	1
<i>Tetradymia canescens</i>	Spineless horsebrush	Shrub	Native	D	obs	0	0	<1
Desirable Species					59	39	52	50
Neutral Species					7	9	0	5
Undesirable Species					34	52	48	45
Grasses					48	22	52	41
Forbs					38	61	24	41
Shrubs					14	13	10	12
Slope (%)					0-1	0-1	0-1	0-1
Herbaceous height (cm)					41	32	35	36
Woody height (cm)					35	36	39	36
Azimuth					160	350	72	NA
					Absolute Cover (%)			
Total foliar cover					52	40	32	41
Bare ground					32	34	50	39
Basal					0	0	0	0
Rock					2	20	10	11
Lichen					0	0	0	0
Standing dead					0	2	0	1
Plant litter					14	4	8	9

Note:

*Indicates species in previous years.

Abbreviations:

AVG = average
 cm = centimeters
 D = desirable
 N = neutral

NA = not applicable
 obs = observed
 U = undesirable