COORS ENERGY COMPANY

PO Box 4030
Golden, CO 80402

2020 ANNUAL HYDROLOGY & RECLAMATION REPORT

Prepared for:
COLORADO DIVISION OF RECLAMATION, MINING & SAFETY

PERMIT NO. C-1981-028

TABLE OF CONTENTS

VEGETATION MONITORING
2020

VEGETATION ACTIVITIES

The Habitat Management report is included.

2020 Vegetation Monitoring Report
Reclamation Areas 25, 29, 30, 31, 32, 33, and 34

Coors Energy Company Keenesburg Mine

Keenesburg, Colorado

October 2020

Prepared by:

Habitat Management
Environmental & Natural Resource Services

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

EXECUTIVE SUMMARY

Quantitative vegetation monitoring of Reclamation Areas 25, 29, 30, 31, 32, 33, and 34 at the Coors Energy Company (CEC) Keenesburg Mine was conducted in August 2020. Vegetation cover, herbaceous production, and species composition were evaluated. Comparisons were made between vegetation cover and herbaceous production means from the reclamation areas and predicted values calculated from the approved final revegetation success equations based on on-site precipitation from September 2019 to July 2020. The predictive equations for vegetation cover and herbaceous production were modified in Technical Revisions 43 and 46 to the Colorado Division of Reclamation Mining and Safety (DRMS) Mining and Reclamation Permit C-1981-028. The calculated final revegetation success vegetation cover standard value was 29.8%. The total herbaceous production standard was 26.1 g/m^2.

Reclamation Areas 29, 30, and 31 were evaluated based on the guidelines for Phase III bond release. Reclamation Area 30 has not yet received Phase II bond release, but it was reclaimed more than 10 years ago and is eligible for the first year of Phase III monitoring. All three areas met the species composition standard and Area 31 met the herbaceous production standard. Areas 29 and 30 did not meet the herbaceous production standard and none of the areas met the vegetation cover standard.

Reclamation Areas 25, 30, and 34 were evaluated for Phase II bond release. None of these areas met the vegetation cover standard. While Phase II bond release does not require a production standard, these areas were compared to the Phase III production standard and both Reclamation Areas 25 and 34 did meet this standard. Phase II bond release guidelines only require that four perennial grasses be present to meet the species composition technical standard in the future and this requirement was met for all three Reclamation Areas.

Reclamation Areas 32 and 33 were evaluated using interim reclamation monitoring guidelines. They were compared to the Phase III bond release standards to measure their progress towards future release. Reclamation Areas 32 and 33 met both the production and species composition standards, but neither area met the cover standard.

Quarterly inspections of the entire permitted area were conducted during 2020 to monitor for the presence and impacts of noxious weeds, pests, or disease to the revegetation. No pests or diseases were identified during these inspections. The primary noxious weed observed during these inspections was cheatgrass which is pervasive on the reclamation and is being aggressively treated by CEC.

1 INTRODUCTION

Coors Energy Company (CEC) operated the Keenesburg Mine for coal extraction from 1980 to 1988 and is now conducting reclamation activities under Colorado Division of Reclamation Mining and Safety (DRMS) Mining and Reclamation Permit C-1981-028. Reclamation activities include backfilling, grading, topsoiling, and revegetation in accordance with CEC's approved DRMS reclamation plan. Vegetation monitoring of reclaimed areas is required by DRMS. This report presents the results of annual reclamation monitoring conducted on August 10 – 13, 2020 by Habitat Management, Inc. Quantitative information in this report characterizes the vegetative condition of Reclamation Areas 25, 29, 30, 31, 32, 33, and 34. Vegetation sampling was performed in compliance with Colorado Mined Land Reclamation Board Surface Coal Mining Rules 2.04.10 and 4.15 and currently accepted methods for vegetation sampling.

The Keenesburg Mine is in Weld County, Colorado, approximately seven miles north of the town of Keenesburg and is accessed by Weld County Road 59. In 2002, the Keenesburg Mine assigned numerical designations to each reclamation area starting in the northeast corner of the permit area and continuing clockwise through the reclaimed areas. Newly reclaimed areas are assigned consecutive numbers as needed (Figure 1). Reclamation Areas monitored in 2020 are summarized in Table 1.

Table 1: Reclamation Areas Monitored in 2020

Reclamation Area	Acres	Seeding Date	Bond Release Status	Monitoring Guidelines	
				Cover	Production
25	12.6	2012	Phase I	Phase II	Interim
29*	8.8	2003 (2002*)	Phase II	Phase III	Phase III
30	9.7	2006	Phase I	Phase III	Phase III
31	11.9	2009	Phase II	Phase III	Phase III
32	5.5	2015	Phase II	Interim	Interim
33	12.5	2015	Phase II	Interim	Interim
34	6.9	2016	Phase I	Phase II	Interim

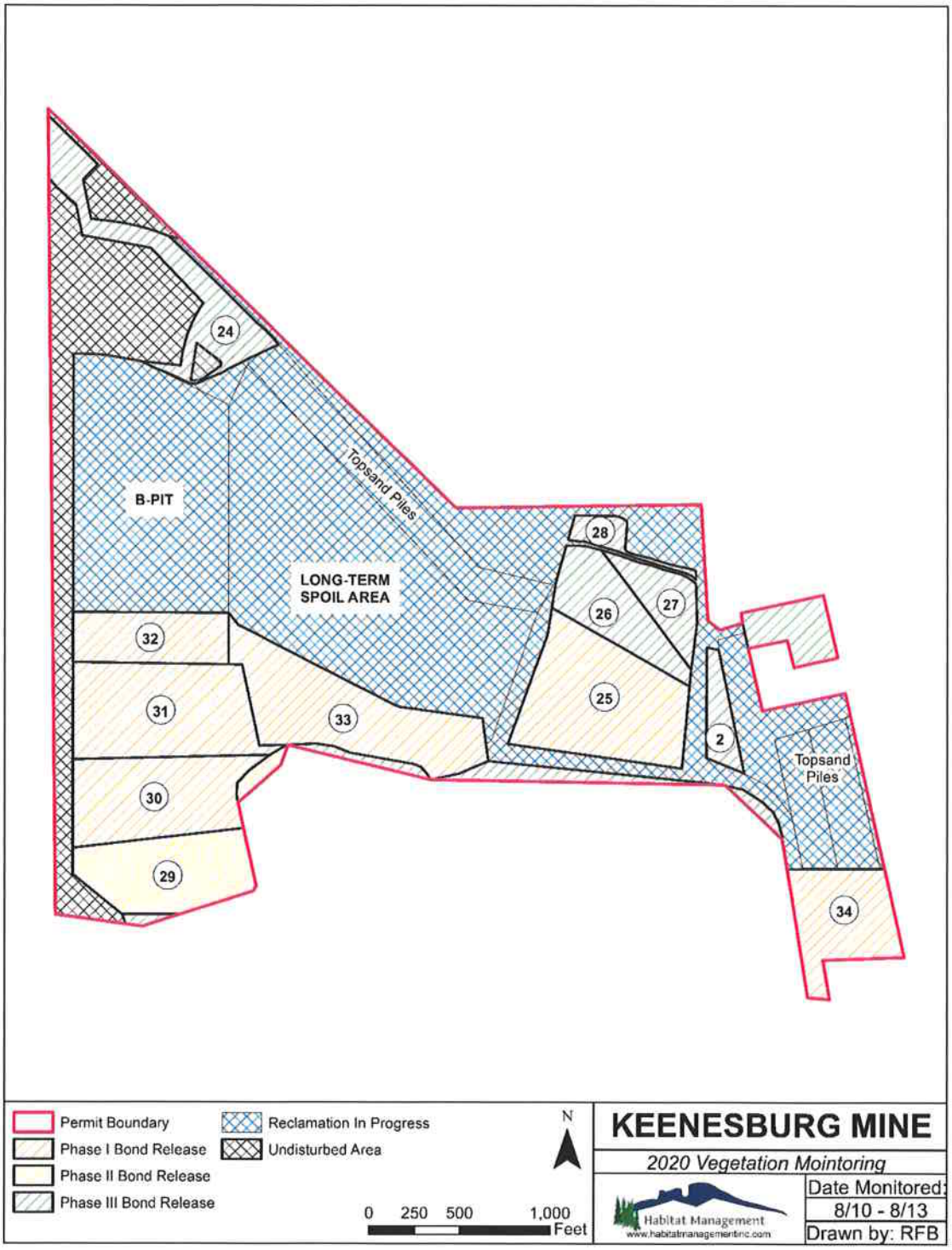
* includes the previously separated Reclamation Area 23.

Reclamation Areas 29, 30, and 31 were monitored using the guidelines for Phase III bond release. Reclamation Areas 25 and 34 were monitored using the guidelines for Phase II bond release. Reclamation Areas 32 and 33 were monitored using the guidelines for interim vegetation monitoring. All of these Reclamation Areas were last monitored in 2019.

2 METHODS

The monitoring methods and revegetation standards used to evaluate these areas are those currently in effect under the Colorado Surface Coal Mining Reclamation Act (CRS 34-33-101) and the Keenesburg Mining and Reclamation Permit.

Figure 1: Keenesburg Mine Site Map



2.1 Sampling Design

Thirty sample points were located prior to going into the field using mapping software to create a square grid overlaid on each Reclamation Area being sampled. The sample points were located at the intersection of each square created by the grid. The grid size was adjusted to create the appropriate number of sample locations within each Reclamation Area. Sample numbers (1-30) were randomly assigned to each generated sample point along with a randomly generated azimuth (Figure 2, Figure 3, Figure 4, and Figure 5). A minimum of 15 vegetation cover samples were collected in Reclamation Areas 25, 29, 30, 31, and 34 with additional samples collected if necessary, to meet sample adequacy in any area per DRMS guidelines. Ten cover samples were collected in Reclamation Areas 32 and 33 per CEC's interim reclamation monitoring guidelines. The maximum of 30 herbaceous production samples were collected from Reclamation Areas 29, 30, and 31 and 15 production samples were collected in Reclamation Areas 25, 32, 33, and 34.

2.2 Sample Timing

Vegetation monitoring occurred on August 10 – 13, 2020 which was consistent with the timing of monitoring in previous years. Monitoring also coincided with maximum vegetation development of most plant species found in the reclaimed and adjacent native areas.

2.3 Vegetation Cover

Point-intercept methods were used to collect vegetation and ground cover, as well as species composition data. Each 25-meter transect represents a single sampling unit. Two data points were recorded at one-meter intervals along each transect, 0.5 m to each side of and at a right angle to the transect. A laser bar was used to determine intercepts, with the beam projected vertically to the ground surface. Each point-intercept represented an absolute cover value of 2%.

"First-hit" point-intercepts (the first item that the laser beam intercepts) were recorded as either: live vegetation (by plant species), litter, rock, or bare ground. Litter includes all dead plant material. Subsequent "hits" on vegetation (prior to interception of the ground) were also recorded. Vegetation cover was reported in absolute percentages from the point-intercept data using all 50 first-hit observations for each sample point. Additional interceptions were used to calculate relative cover of individual plant species and life forms. The quantitative cover data also provided the basis for calculation of species composition and relative importance.

2.4 Herbaceous Production

Herbaceous production was sampled using 0.5-square meter circular plots. For samples where cover data was also collected, the plots were located adjacent to the start point to the right of the transect. Additional production samples were collected with the plot centered on the sample point.

All herbaceous non-noxious growth within each plot's vertical projection was clipped, separated by growth form, and placed in labeled paper bags. Current year's herbaceous growth of shrubs was collected in the same manner, but no woody tissue was harvested. The bags containing the clipped material were returned to the Habitat Management office and dried at 30 degrees Celsius until weights stabilized to within 0.1 gram. Herbaceous production was reported in grams per square meter.

Figure 2: Sample Point Locations (Area 25)

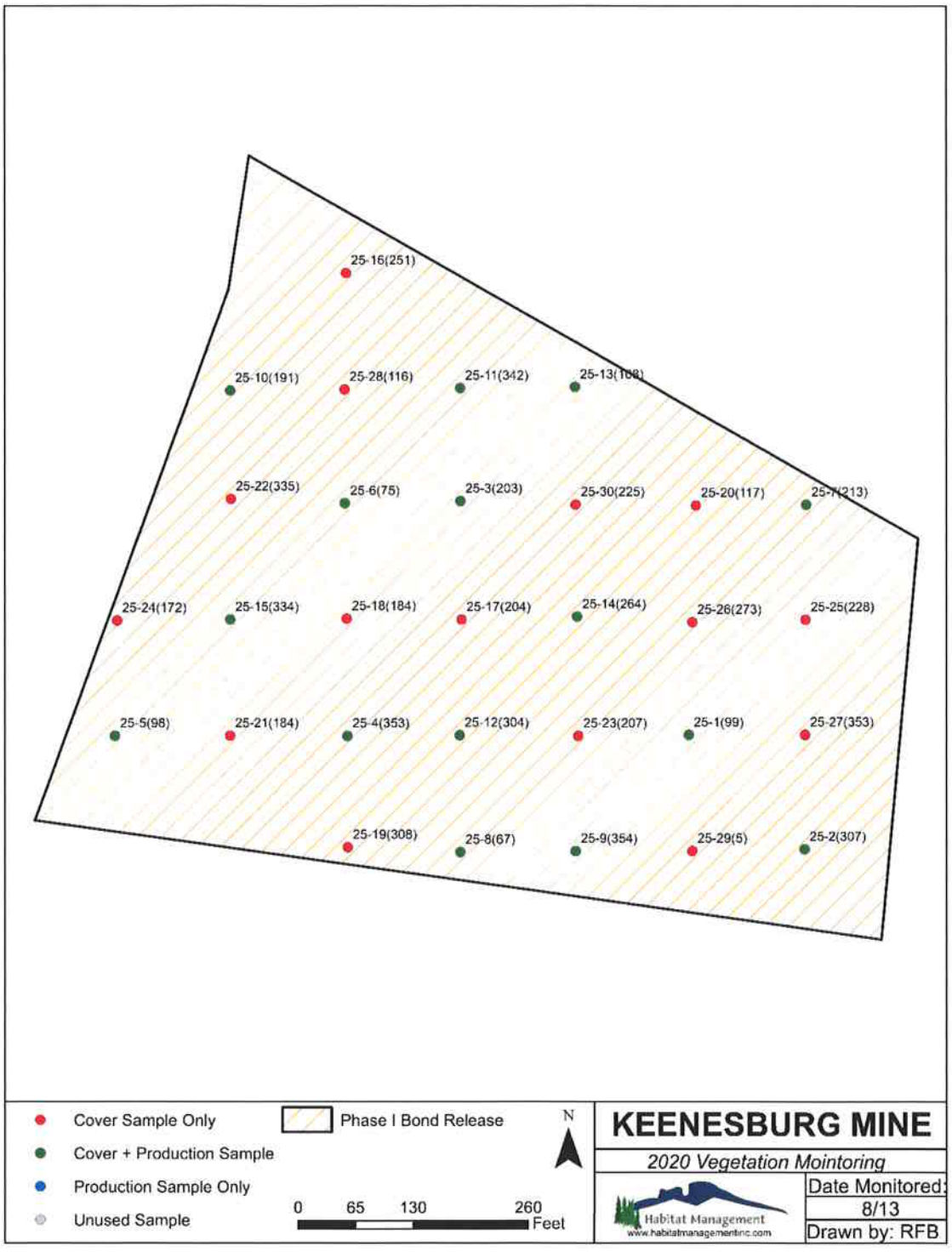


Figure 3: Sample Point Locations (Areas 29, 30, 31, & 32)

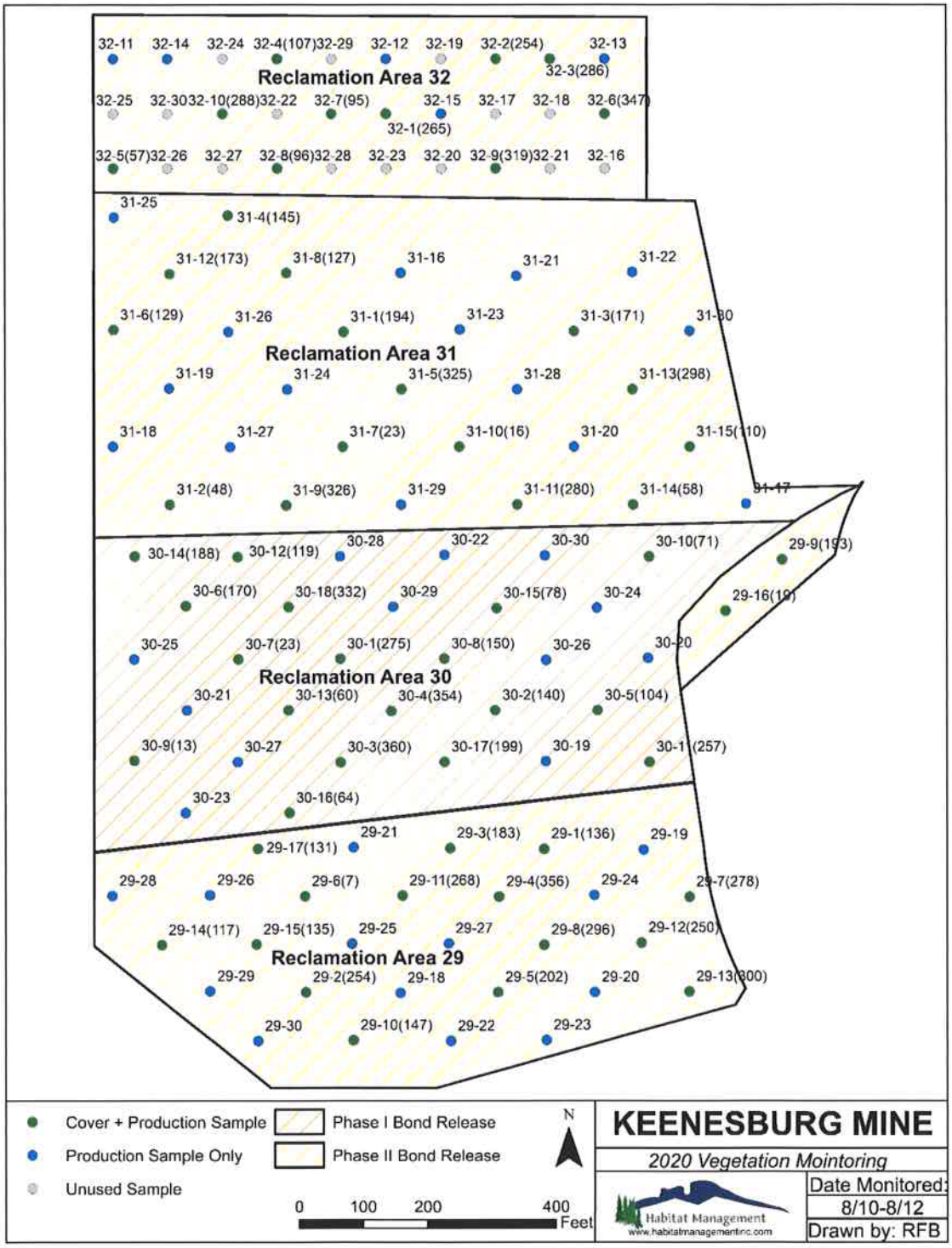


Figure 4: Sample Point Locations (Area 33)

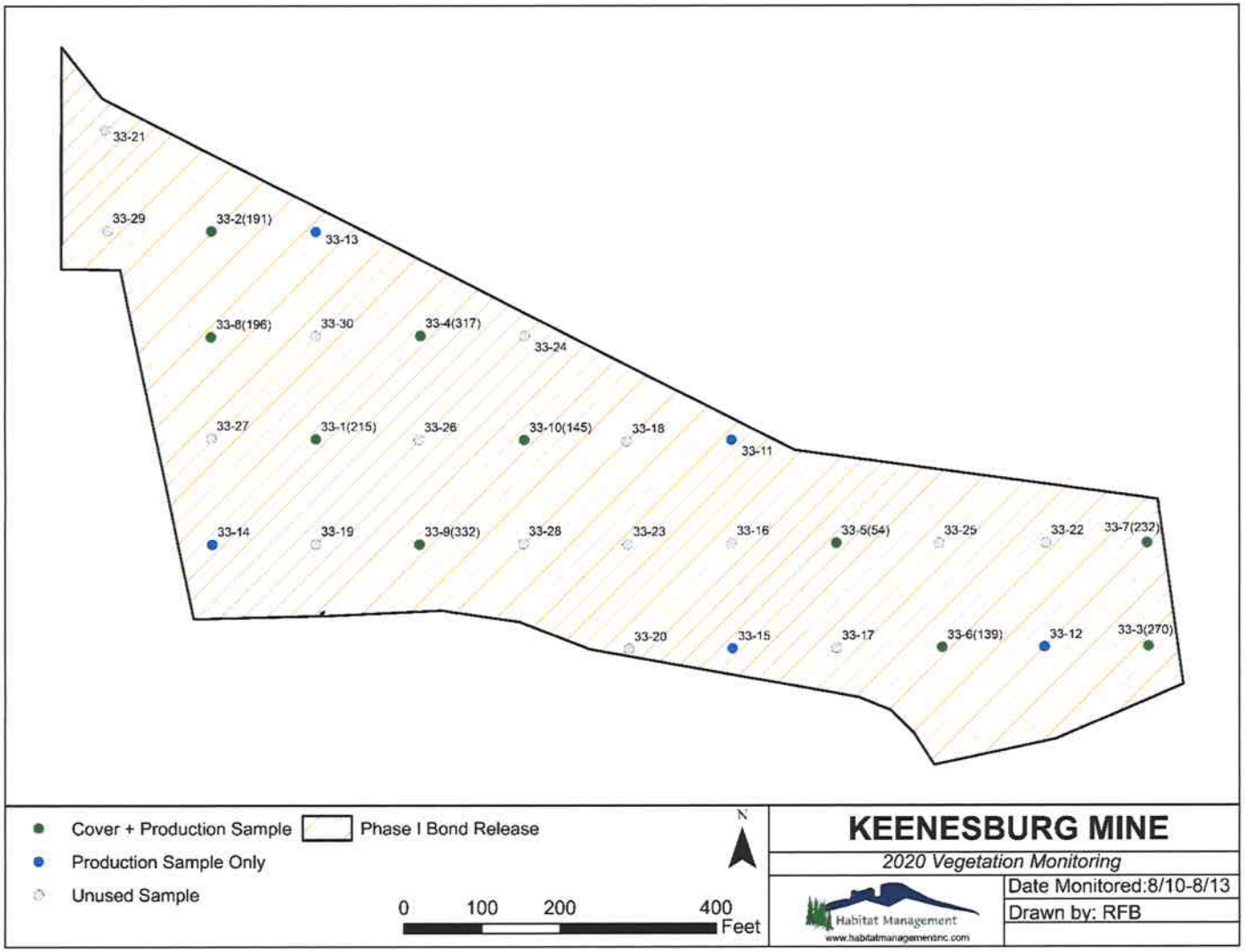
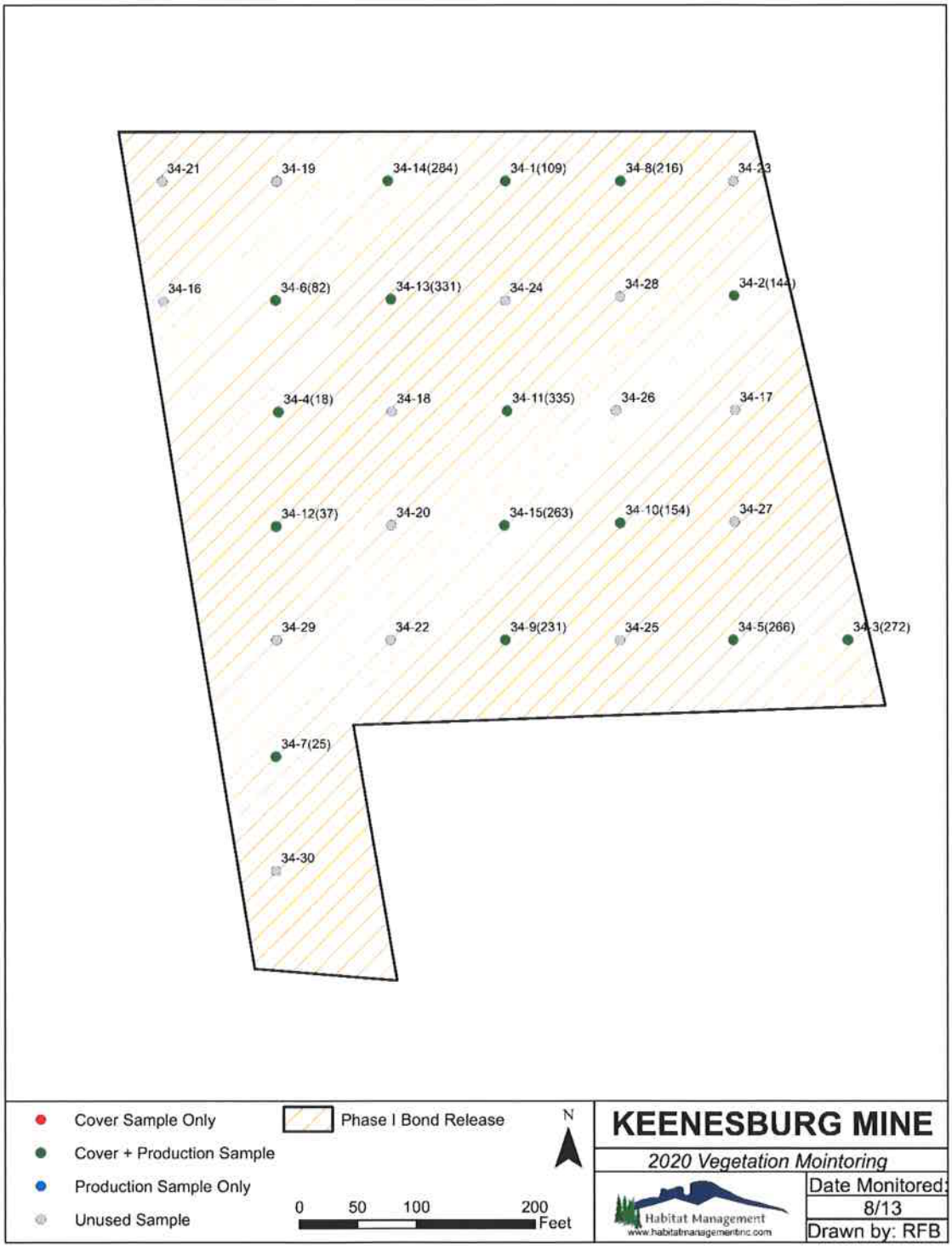


Figure 5: Sample Point Locations (Area 34)



2.5 Species Composition

During cover sampling, all plant species occurring within one meter of either side of the cover sample transect were noted as present within each sample. These species are presented in the data tables for each Reclamation Area (Appendix A) as well as on the complete species list (Appendix C).

Species composition information for comparison to the final revegetation success criterion was derived from quantitative relative vegetation cover data. The total hits (first hits and subsequent hits) for each non-noxious species were used to calculate relative cover as a basis for evaluation of the importance of each encountered plant species and life form.

2.6 Photographs

A photograph was taken at the start point of each cover transect looking along the length of the transect. These photos are presented in Appendix E.

2.7 Species Identification and Nomenclature

Species that were not readily identified in the field were collected for later identification. Specimens were identified using floral keys including Weber and Wittmann (2001) and Wingate (1994). Nomenclature follows the NRCS Plants Database (2019).

3 RECLAMATION SUCCESS STANDARDS

The Keenesburg Mine Reclamation Permit includes a species composition standard and predictive equations to determine the success standards for vegetation cover and herbaceous production. Both the vegetation cover and herbaceous production equations use the previous year's precipitation (September – July) to predict the success standard for any given year. These equations are as follows, where x is equal to the cumulative September – July precipitation:

$$\text{Vegetation Cover Standard} = -0.0127x^3+0.2115x^2+2.1772x$$

$$\text{Herbaceous Production Standard} = 0.4666x^{2.1405}$$

When these equations were developed, species listed by the Colorado Department of Agriculture as noxious weeds were not excluded from the data. In 2012, DRMS approved a Technical Revision (TR43) to the Keenesburg Mine Reclamation Permit to update the equations to remove noxious plant species from both the cover and production standards. The vegetation cover standard was again updated in a Minor Revision (MR46) to the permit.

To meet the reclamation standard specified in the permit, data are subjected to hypothesis testing as described in the DRMS Regulations of the Colorado Mined Land Reclamation Board for Coal Mining (DRMS 2005). Per this guideline, Reclamation Areas meet the success standard if the dataset is not significantly different from 90% of the standard using a one-sample T-test with a one-tailed confidence interval of 90%. Noxious species cover or production is removed as well as annual vegetation cover in excess of 10% of the overall average for each Reclamation Area to derive the allowable vegetation cover value used for hypothesis testing per the DRMS Guideline Regarding Selected Coal Mine Bond Release Issues (DRMS 1995).

Species composition is considered an indicator of successful vegetation establishment and a diverse vegetation community. The species composition standard for the Keenesburg Mine was modified in 2020 with a Technical Revision to the permit (TR47). The revised standard requires

that there be at least four perennial species, each of which comprise between 3% and 40% relative cover. Vegetation species which may be used in the calculation of species composition may be any plant species that is not defined as a noxious or prohibited plant species and may be native or introduced.

The Phase III bond release guidelines require that vegetation cover, herbaceous production, and species composition meet the standards for two years. Phase II bond release guidelines require vegetation cover to meet the standard and that the species be present in the community to potentially meet the species composition standard in the future.

3.1 2020 Revegetation Success Standards

The following standards were calculated for vegetation cover and herbaceous production using the September 2019 through July 2020 precipitation (9.8 inches) in the permitted predictive equations.

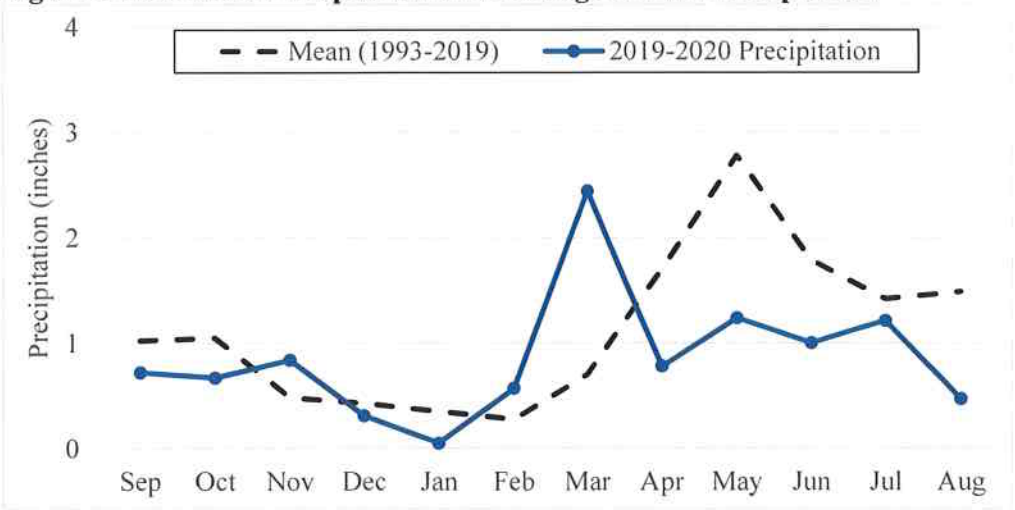
1. Vegetation Cover Standard = 29.8% (90% Standard = 26.8%)
2. Herbaceous Production Standard = 26.1 g/m^2 (90% Standard = 23.5 g/m^2)

4 2019-2020 PRECIPITATION

The climate of the mine and surrounding area is typical of the region and characterized by cold winters and hot, dry summers. CEC has collected local precipitation data at the mine since 1984; however, only data from 1993 – 2020 is presented here to correspond with the duration of vegetation monitoring (Appendix D). Average precipitation is generally lowest during the late fall and winter (October through March) and peaks in April through June (Figure 6).

The Keenesburg Mine Reclamation Permit specifies the use of onsite precipitation from September to July for calculating the vegetation cover and herbaceous production standards. Total cumulative precipitation for the period from September 2019 – July 2020 was 9.8 inches. This represents 82% of the average precipitation amount for the same period (1993-2019). The pattern and timing of the winter (September-February) precipitation was 87% of the average (Figure 6). However, the precipitation in April-July 2020 was only 55% of average and the March 2020 precipitation was 348% of average.

Figure 6: 2019-2020 Precipitation and Average Annual Precipitation



5 2020 PEST & DISEASE INSPECTIONS

Habitat Management was contracted to completed quarterly pest and disease inspections at the Keenesburg Mine in 2020. These inspections were completed on June 22nd, September 29th, and October 9th, respectively. No first quarter inspection was completed due to COVID-19 restrictions in March when it is usually performed. The reports from each quarterly inspection are included in Appendix F.

6 RESULTS

Vegetation cover, species composition, and herbaceous production results for each Reclamation Area are summarized below. Results for Reclamation Areas monitored for Phase III bond release (Areas 29, 30, and 31) are presented first followed by those areas monitored for Phase II bond release (Areas 25 and 34) and then those areas monitored for interim evaluation (Areas 32 and 33).

Complete vegetation cover and herbaceous production data for each Reclamation Area are presented in Appendix A and Appendix B, respectively. A complete species list for all Reclamation Areas is presented in Appendix C.

6.1 Phase III Reclamation Monitoring

Reclamation Areas 29, 30, and 31 were monitored for Phase III bond release. Because Reclamation Area 30 has not yet received Phase II bond release, it was evaluated using both the Phase II and Phase III bond release guidelines.

6.1.1 Reclamation Area 29

Reclamation Area 29 is an 8.1-acre parcel that was formerly part of the B Pit mining area. This area was graded to blend into the undisturbed area to the west and the reclaimed mining and operational areas to the east resulting in a gentle, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in 2003. Per approval from DRMS, Reclamation Area 23 was combined with Reclamation Area 29 in 2019. This area is a 0.7-acre parcel, formerly part of the B Pit mining area, that was graded to blend into the reclaimed mining and operational areas to the east resulting in an almost flat, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in November 2002. The total area included in the Reclamation Area 29 sampling was 8.8 acres.

Total vegetation cover averaged 27.6% (Table 2, Appendix A) which was a substantial decrease from the 44.9% cover observed in 2019. Non-noxious vegetation cover was only 11.4% down from 33.7% observed in 2019. Allowable vegetation cover was the same as non-noxious cover in 2020 with only 7.7% annual relative cover included and met sample adequacy with 17 samples.

The only species contributing to the cover in all 15 transects was cheatgrass (*Bromus tectorum*) which contributed 57.0% of the overall relative cover which was a substantial increase from the 24.3% relative cover observed in 2019. Blue grama (*Bouteloua gracilis*) and prairie sandreed (*Calamovilfa longifolia*) were observed on all 17 transects and contributed 13.2% of the total relative cover. With cheatgrass removed, six species contributed more than 3% of the relative cover including (in decreasing order): sand bluestem (*Andropogon hallii*), prairie sandreed, sand dropseed (*Sporobolus cryptandrus*), blue grama, Indiangrass (*Sorghastrum nutans*), and sixweeks fescue (*Vulpia octoflora*).

Table 2: Reclamation Area 29 Summary Statistics

Summary Statistics	Area 29 Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	92.1	1.0
Total Vegetation Cover	27.6	1.8
Non-Noxious Vegetation Cover	11.4	0.9
Allowable Vegetation Cover	11.4	0.9
Grass Cover	27.1	1.9
Forb Cover	0.2	0.2
Woody Cover	0.4	0.2
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	95.9	1.7
Forb Cover	1.6	1.1
Woody Cover	2.6	1.4
Herbaceous Production Statistics (g/m^2)		
Total Production	22.2	4.3
Allowable Production	22.2	4.3
Perennial Production	21.8	4.3
Annual Production	0.4	0.2

Thirteen species from six life forms contributed to the cover data and another five species were encountered along the transects (Table 3, Appendix C). Nine grasses, seven forbs, and two woody species were recorded, 16 of which were native or desirable and two were introduced. There were 13 perennial species and five annual species.

Table 3: Reclamation Area 29 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	7	7
Annual	2	2
Native	8	8
Introduced	1	1
Cool Season	0	0
Warm Season	7	7
Total	***9***	***9***
Forbs		
Perennial	1	4
Annual	1	3
Native	2	6
Introduced	0	1
Total	***2***	***7***
Woody Plants	2	2
Total Species	**13**	**18**

Total non-noxious herbaceous production averaged only 22.2 g/m^2 in 2020 (Table 2, Appendix A) which is a substantial decrease from the 123.2 g/m^2 production observed in 2019. Annual species accounted for only 0.4% of this production so the average allowable herbaceous production was also 22.2 g/m^2.

Both the allowable vegetation cover and the allowable herbaceous production failed to pass the technical standard when subjected to hypothesis testing (Table 4). However, five perennial grass species contributed greater than 3% and less than 40% of the non-noxious relative cover. The Phase III bond release success criteria were not met.

Table 4: Reclamation Area 29 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	11.4	26.8	No
Allowable Production (g/m^2)	22.2	23.5	No
Species Composition (perennial grass)	5	4	Yes

6.1.2 Reclamation Area 30

Reclamation Area 30 is a 9.7-acre parcel that was formerly part of the B Pit mining area. This area was graded to blend into the undisturbed area to the west and the reclaimed mining and operational areas to the east resulting in a gentle, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in November 2006. This Reclamation Area has previously received Phase I bond release but has not received Phase II release.

Total vegetation cover averaged 34.3% (Table 5, Appendix A) which was a substantial decrease from the 41.5% cover observed in 2019. Non-noxious vegetation cover was only 17.1% down from 31.5% observed in 2019. Allowable vegetation cover met sample adequacy with 17 samples. Five native annual species (two grasses and three forbs) contributed a total of 22.1% of the non-noxious relative cover which exceeded the allowable 10% to be used in final hypothesis testing. Thus, the average allowable vegetation cover was only 15.0% down from 26.5% in 2019.

Sand dropseed was present along all 18 transects and contributed to the cover on 12 of them while sand bluestem contributed to the cover on all 17 transects where it was observed. Together these two species contributed 33.9% of the overall relative cover. Cheatgrass also contributed to the cover on all 18 transects with 48.1% of the relative cover up from only 23.9% in 2019. With cheatgrass removed, six species contributed more than 3% of the relative cover including (in decreasing order): sand bluestem, sand dropseed, sixweeks fescue, prairie sandreed, blue grama, and sideoats grama (*Bouteloua curtipendula*),

Ten species from five life forms contributed to the cover data and another eight species were encountered along the transects (Table 6, Appendix C). Thirteen grasses, three forbs, and two woody species were recorded, 17 of which were native or desirable and one was introduced. There were 12 perennial species and six annual species.

Table 5: Reclamation Area 30 Summary Statistics

Summary Statistics	Area 30 Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	92.1	0.9
Total Vegetation Cover	34.3	1.2
Non-Noxious Vegetation Cover	17.1	1.3
Allowable Vegetation Cover	15.0	1.3
Grass Cover	34.0	1.2
Forb Cover	0.2	0.2
Woody Cover	0.1	0.1
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	98.4	0.9
Forb Cover	1.1	0.7
Woody Cover	0.5	0.5
Herbaceous Production Statistics (g/m^2)		
Total Production	20.9	4.2
Allowable Production	20.9	4.2
Perennial Production	20.2	4.2
Annual Production	0.7	0.4

Table 6: Reclamation Area 30 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	6	10
Annual	2	3
Native	7	12
Introduced	1	1
Cool Season	0	2
Warm Season	6	8
Total	***8***	***13***
Forbs		
Perennial	0	0
Annual	1	3
Native	1	3
Introduced	0	0
Total	***1***	***3***
Woody Plants	1	2
Total Species	**10**	**18**

Total non-noxious herbaceous production averaged 20.9 g/m^2 (Table 5, Appendix A) which is substantially less than the 124.6 g/m^2 production observed in 2019. Annual species accounted for 3.4% of this production. Thus, the average allowable herbaceous production was also 20.9 g/m^2.

Both the allowable vegetation cover and the allowable herbaceous production failed to pass the technical standard when subjected to hypothesis testing (Table 7). However, five perennial grass species contributed greater than 3% and less than 40% of the non-noxious relative cover. The Phase III bond release success criteria were not met. Because the vegetation cover standard was not met, Area 30 did not meet the Phase II bond release criteria either.

Table 7: Reclamation Area 30 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	15.0	26.8	No
Allowable Production (g/m^2)	20.9	23.5	No
Species Composition (perennial grass)	4	4	Yes

6.1.3 Reclamation Area 31

Reclamation Area 31 is an 11.9-acre parcel that was also part of the B Pit mining area. This area was graded to blend into the undisturbed area to the west and the reclaimed mining and operational areas to the east resulting in a gentle, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in the fall of 2009.

Total vegetation cover averaged 27.9% (Table 8, Appendix A) which was a substantial decrease from the 37.9% cover observed in 2019. Non-noxious vegetation cover was only 9.6% which was a larger decrease from the 26.5% observed in 2019. Allowable vegetation cover in Reclamation Area 31 met sample adequacy with the minimum 15 samples. No excess annual cover was recorded; thus, the non-noxious cover was used for hypothesis testing.

Table 8: Reclamation Area 31 Summary Statistics

Summary Statistics	Area 31 Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	89.6	1.2
Total Vegetation Cover	27.9	1.7
Non-Noxious Vegetation Cover	9.6	0.4
Allowable Vegetation Cover	9.6	0.4
Grass Cover	27.6	1.7
Forb Cover	0.0	0.0
Woody Cover	0.3	0.2
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	97.6	1.7
Forb Cover	0.0	0.0
Woody Cover	2.4	1.7
Herbaceous Production Statistics (g/m^2)		
Total Production	29.9	8.2
Allowable Production	29.9	8.2
Perennial Production	29.9	8.2
Annual Production	0.0	0.0

Cheatgrass contributed to the cover on all 15 transects and comprised 64.9% of the total relative cover which was more than double the 29.4% relative cover observed in 2019. The three dominant native species, also observed on all 15 transects, were prairie sandreed, sand dropseed, and sand bluestem which contributed a combined 30.3% of the overall relative cover. With cheatgrass removed five species contributed more than 3% of the relative cover including (in decreasing order): sand bluestem, prairie sandreed, sand dropseed, blue grama, and sideoats grama.

Ten species from three life forms contributed to the cover data and nine more species were encountered along the transects (Table 9). Eleven grasses, five forbs, and three woody species were recorded, 17 of which were native or desirable and two were introduced. There were 14 perennial species and five annual species.

Table 9: Reclamation Area 31 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	7	8
Annual	1	3
Native	7	10
Introduced	1	1
Cool Season	0	0
Warm Season	7	8
Total	***8***	***11***
Forbs		
Perennial	0	3
Annual	0	2
Native	0	4
Introduced	0	1
Total	***0***	***5***
Woody Plants	2	3
Total Species	**10**	**19**

Total non-noxious herbaceous production averaged 29.9 g/m^2 (Table 8, Appendix A) which was substantially less than the 96.3 g/m^2 production observed in 2019. No annual species were included in this production; thus, the total values were used for hypothesis testing.

The allowable herbaceous production passed the technical standard when subjected to hypothesis testing, but the allowable vegetation cover did not (Table 10). Five perennial grass species contributed greater than 3% and less than 40% of the non-noxious relative cover. Thus, the Phase III bond release success criteria were not met.

Table 10: Reclamation Area 31 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	9.6	26.8	No
Allowable Production (g/m^2)	29.9	23.5	Yes
Species Composition (perennial grass)	5	4	Yes

6.2 Phase II Monitoring

Reclamation Areas 25 and 34 were monitored for Phase II bond release. While no production sampling is required as a part of Phase II monitoring, 15 production samples were collected and evaluated based on the Phase III standards as a measure of these areas' progress towards future Phase III release.

6.2.1 Reclamation Area 25

Reclamation Area 25 is a 12.6-acre parcel east of the long-term spoil area. This area was graded to blend into the reclaimed areas resulting in a gentle, southwest-facing slope. Revegetation seeding with the DRMS-approved permanent seed mixture took place in 1995, but it was repeated in 2002 and 2012 due to insufficient vegetation cover.

Total vegetation cover averaged 20.2% (Table 11, Appendix A) which was a substantial decrease from the 45.3% cover observed in 2019. Non-noxious vegetation cover was only 9.9% down from the 22.2% observed in 2019. No excess annual cover was recorded; thus, the allowable cover used for hypothesis testing was also 9.9%. Reclamation Area 25 required the maximum number of 30 samples because sample adequacy was not met.

Table 11: Reclamation Area 25 Summary Statistics

Summary Statistics	Area 25 Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	79.6	3.5
Total Vegetation Cover	20.2	1.3
Non-Noxious Vegetation Cover	9.9	1.0
Allowable Vegetation Cover	9.9	1.0
Grass Cover	20.1	1.3
Forb Cover	0.1	0.1
Woody Cover	0.0	0.0
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	99.7	0.3
Forb Cover	0.3	0.3
Woody Cover	0.0	0.0
Herbaceous Production Statistics (g/m^2)		
Total Production	65.6	12.6
Allowable Production	65.6	12.6
Perennial Production	65.6	12.6
Annual Production	0.0	0.0

The only species observed along all 30 transects were sand dropseed and cheatgrass which comprised 32.2% and 49.4%, respectively, of the relative cover. An additional 7.6% was contributed by prairie sandreed, 5.7% was contributed by sand bluestem, and the other 5.1% was contributed by 8 different species.

Twenty-one species from seven life forms were encountered along the transects (Appendix C). Eleven grasses and one forb species contributed to the cover data; 11 of which were native or desirable and one of which was noxious (Table 12). There were 16 perennial species and five annual species observed.

Table 12: Reclamation Area 25 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	10	12
Annual	1	2
Native	10	13
Introduced	1	1
Cool Season	4	4
Warm Season	6	8
Total	***11***	***14***
Forbs		
Perennial	0	2
Annual	1	3
Native	1	5
Introduced	0	0
Total	***1***	***5***
Woody Plants	0	2
Total Species	**12**	**21**

Total non-noxious herbaceous production averaged 65.6 g/m^2 (Table 11, Appendix A) which is substantially less than the 80.7 g/m^2 production observed in 2019 but substantially more than any of the other Reclamation Areas. Annual species were not included in this production, so no excess annual cover was removed.

Allowable vegetation cover did not pass the technical standard when subjected to hypothesis testing (Table 13). While 30 production samples would have been required for Phase III hypothesis testing, the calculated allowable production based on the 15 samples collected did meet the production standard. Twelve perennial grasses were observed along the transects which meets the Phase II bond release success criteria.

Table 13: Reclamation Area 25 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	9.9	26.8	No
Allowable Production (g/m^2)	65.6	23.5	Yes
Species Composition (perennial grass)	12	4	Yes

6.2.2 Reclamation Area 34

Reclamation Area 34 is a 6.9-acre parcel that was formerly part of Topsand piles A and B. This area was graded to blend into the reclaimed mining and operational areas to the south resulting in an almost flat area. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in October 2016.

Total vegetation cover averaged 14.1% down from 33.9% in 2019 and non-noxious vegetation cover was even lower at 12.5% compared to 23.1% in 2019 (Table 14, Appendix A). No excess annual cover was recorded; thus, the allowable cover used for hypothesis testing was also 12.5%. Allowable vegetation cover met sample adequacy with the minimum 15 samples.

Table 14: Reclamation Area 34 Summary Statistics

Summary Statistics	Area 34 Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	65.9	2.9
Total Vegetation Cover	14.1	1.1
Non-Noxious Vegetation Cover	12.5	0.7
Allowable Vegetation Cover	12.5	0.7
Grass Cover	13.9	1.0
Forb Cover	0.1	0.1
Woody Cover	0.1	0.1
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	97.6	1.7
Forb Cover	1.1	1.1
Woody Cover	1.3	1.3
Herbaceous Production Statistics (g/m^2)		
Total Production	42.9	5.2
Allowable Production	42.9	5.2
Perennial Production	42.9	5.2
Annual Production	0.0	0.0

The only species observed on all 15 transects were sand dropseed and blue grama which contributed 45.8% and 9.3%, respectively, of the overall relative cover. Cheatgrass only contributed to the cover on three transects and only contributed 11.2% of the overall relative cover down from 32% in 2019. When cheatgrass was removed five species contributed more than 3% of the relative cover including (in decreasing order): sand dropseed, prairie sandreed, blue grama, sand bluestem, and sideoats grama.

Twelve species from six life forms contributed to the cover data and 12 other species were encountered along the transects (Table 15, Appendix C). Sixteen grasses, six forbs, and two woody species were recorded, 23 of which were native or desirable and one was introduced. There were 17 perennial species and seven annual species.

Table 15: Reclamation Area 34 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	8	13
Annual	2	3
Native	9	15
Introduced	1	1
Cool Season	2	5
Warm Season	6	8
Total	***10***	***16***
Forbs		
Perennial	0	2
Annual	1	4
Native	1	6
Introduced	0	0
Total	***1***	***6***
Woody Plants	1	2
Total Species	**12**	**24**

Total non-noxious herbaceous production averaged 42.9 g/m^2 with no annual species included (Table 14, Appendix A). This was a substantial decrease from the 68.0 g/m^2 observed in 2019.

The allowable vegetation cover did not pass the technical standard when subjected to hypothesis testing (Table 16). However, thirteen perennial grasses were observed along the transects which does meet the Phase II bond release species composition standard. While 30 production samples would have been required for Phase III hypothesis testing, the calculated allowable production based on the 15 samples collected did meet the production standard.

Table 16: Reclamation Area 34 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	12.5	26.8	No
Allowable Production (g/m^2)	42.9	23.5	Yes
Species Composition (perennial grass)	13	4	Yes

6.3 Interim Monitoring

Reclamation Areas 32 and 33 were monitored under the interim evaluation guidelines. The interim monitoring guidelines call for the collection of 10 cover samples and 15 production

samples which were not a statistically adequate sample sizes for hypothesis testing. However, to evaluate the progress of reclamation establishment on these sites, the data were compared to the Phase III standards anyway.

6.3.1 Reclamation Area 32

Reclamation Area 32 is a 5.5-acre parcel that was formerly part of the B Pit mining area. This area was graded to blend into the undisturbed area to the west and the reclaimed mining and operational areas to the east resulting in a gentle, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in November 2015.

Total vegetation cover averaged 24.2% (Table 17, Appendix A) which was a decrease from the 44.8% cover observed in 2019. Non-noxious vegetation cover was only 16.8% down from 35.0% in 2019. Two non-noxious annual species (one native forb and one introduced forb) contributed a total of 14.3% of the non-noxious relative cover which exceeded the allowable 10% to be used in final hypothesis testing. Thus, the average allowable vegetation cover was only 16.1% down from 35.0% in 2019.

Table 17: Reclamation Area 32 Summary Statistics

	Area 32	
Summary Statistics	Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	74.6	7.1
Total Vegetation Cover	24.2	1.7
Non-Noxious Vegetation Cover	16.8	1.7
Allowable Vegetation Cover	16.1	1.7
Grass Cover	21.8	2.3
Forb Cover	2.4	1.2
Woody Cover	0.0	0.0
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	85.2	7.3
Forb Cover	14.8	7.3
Woody Cover	0.0	0.0
Herbaceous Production Statistics (g/m^2)		
Total Production	48.5	9.0
Allowable Production	37.7	8.8
Perennial Production	31.5	6.3
Annual Production	17.0	8.0

The only species contributing to cover in all 10 transects was prairie sandreed which contributed 44.4% of the overall relative cover. Cheatgrass was also observed on all 10 transects contributing 29.8% of the total relative cover. When cheatgrass was removed six species contributed more than 3% of the relative cover including (in decreasing order): prairie sandreed, redroot amaranth (*Amaranthus retroflexus*), blue grama, sideoats grama, and Russian thistle (*Salsola tragus*).

Nine species from four life forms contributed to the cover data and five other species were encountered along the transects (Table 18, Appendix C). Ten grasses and four forbs were

recorded, 12 of which were native or desirable and two were introduced. There were seven perennial species and seven annual species.

Table 18: Reclamation Area 32 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	6	6
Annual	1	4
Native	6	9
Introduced	1	1
Cool Season	0	0
Warm Season	6	6
Total	***7***	***10***
Forbs		
Perennial	0	1
Annual	2	3
Native	1	3
Introduced	1	1
Total	***2***	***4***
Woody Plants	0	0
Total Species	**9**	**14**

Total non-noxious herbaceous production averaged 48.5 g/m^2 (Table 17, Appendix A) down from 117.7 g/m^2 in 2019. Annual species accounted for 35.1% of this production. Thus, the average allowable herbaceous production was also 37.7 g/m^2.

The interim monitoring guidelines call for the collection of 10 cover samples and 15 production samples. Sample adequacy would have required 19 cover samples and 30 production samples. While the allowable herbaceous production calculated from the samples collected exceeded the technical standard the allowable vegetation cover did not (Table 19). Three perennial grass species contributed greater than 3% and less than 40% of the non-noxious relative cover and a fourth species contributed more than 40% of the relative cover.

Table 19: Reclamation Area 32 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	16.1	26.8	No
Allowable Production (g/m^2)	37.7	23.5	Yes
Species Composition (perennial grass)	3	4	No

6.3.2 Reclamation Area 33

Reclamation Area 33 is a 12.5-acre parcel that was formerly part of the Long-Term Spoil Area. This area was graded to blend into the reclaimed mining and operational areas to the west

resulting in an almost flat, east-facing slope. Final revegetation seeding with the DRMS-approved permanent seed mixture took place in November 2015.

Total vegetation cover averaged 27.8% (Table 20, Appendix A) down from 43.2% in 2019. Non-noxious vegetation cover was 22.8% down from 37.4% in 2019. There was no excess annual cover observed on this site. Total non-noxious herbaceous production averaged 47.0 g/m^2 (Table 20, Appendix A) down from 158.3 g/m^2 in 2019. Annual species accounted for less than 1% of the 2019 production.

Table 20: Reclamation Area 33 Summary Statistics

	Area 33	
Summary Statistics	Mean	SE
Absolute Cover Statistics (%)		
Total Ground Cover	86.2	1.6
Total Vegetation Cover	27.8	2.0
Non-Noxious Vegetation Cover	22.8	2.2
Allowable Vegetation Cover	22.8	2.2
Grass Cover	27.2	1.8
Forb Cover	0.6	0.4
Woody Cover	0.0	0.0
Non-Noxious Relative Cover Statistics (%)		
Grass Cover	97.8	1.5
Forb Cover	2.2	1.5
Woody Cover	0.0	0.0
Herbaceous Production Statistics (g/m^2)		
Total Production	47.0	5.9
Allowable Production	47.0	5.9
Perennial Production	46.8	5.9
Annual Production	0.2	0.2

The only species contributing to cover in all 10 transects was prairie sandreed which contributed 61.0% of the overall relative cover. Four other species were also observed on all 10 transects: blue grama, sand dropseed, switchgrass (*Panicum virgatum*), and cheatgrass. Cheatgrass contributed 17.7% of the total relative cover up from 14.1% in 2019.

Ten species from five life forms contributed to the cover data and four other species were encountered along the transects (Table 21, Appendix C). Eleven grasses and three forbs were recorded, 12 of which were native or desirable and two were introduced. There were 11 perennial species and three annual species.

Sample adequacy would have required 18 cover samples and 30 production samples. While the allowable herbaceous production calculated from the samples collected exceeded the technical standard the allowable vegetation cover did not (Table 22). Two perennial grass species contributed greater than 3% and less than 40% of the non-noxious relative cover and a third species contributed more than 40% of the relative cover.

Table 21: Reclamation Area 33 Species Composition

Life Form	Cover Data	Present
Graminoids		
Perennial	7	9
Annual	1	2
Native	7	9
Introduced	1	2
Cool Season	1	2
Warm Season	6	7
Total	***8***	***11***
Forbs		
Perennial	1	2
Annual	1	1
Native	2	3
Introduced	0	0
Total	***2***	***3***
Woody Plants	0	0
Total Species	**10**	**14**

Table 22: Reclamation Area 33 Success Criteria

Reclamation Success Criteria	Reclamation Area	90% Technical Standard	Pass?
Allowable Cover (%)	22.8	26.8	No
Allowable Production (g/m^2)	47.0	23.5	Yes
Species Composition (perennial grass)	2	4	No

7 DISCUSSION

Reclamation Areas 29, 30, and 31 were monitored in 2015, 2016, 2018, 2019 and 2020, Reclamation Area 25 was monitored in 2016, 2018, 2019, and 2020 and Reclamation Areas 32, 33, and 34 were monitored in 2018, 2019, and 2020. No data were collected in 2017 due to a hailstorm on August 10, 2017 that destroyed the above-ground vegetation.

7.1 Vegetation Cover

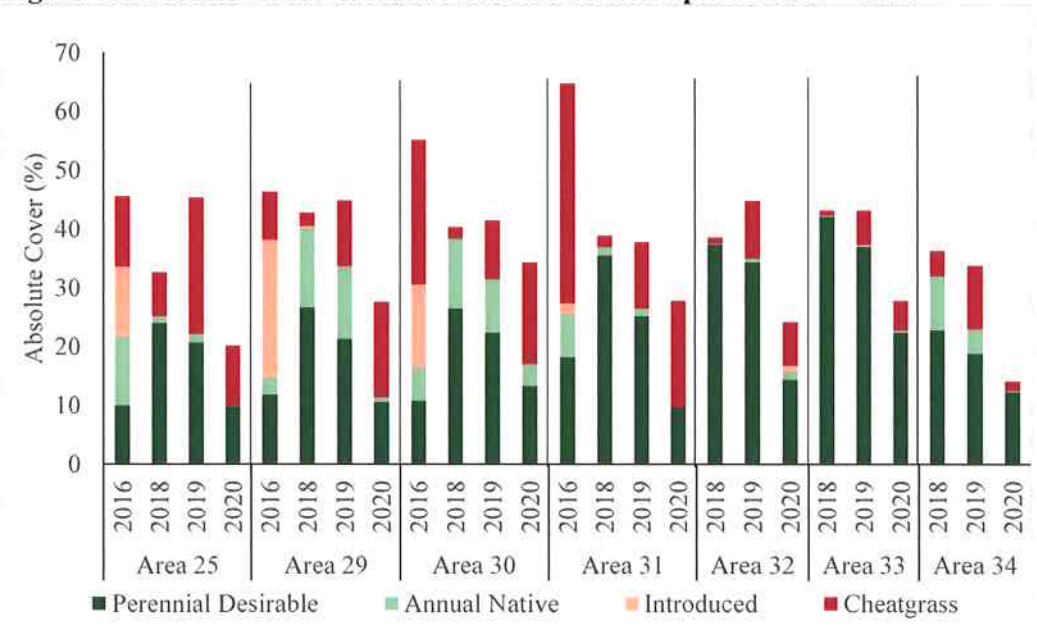
Based on the results of the quantitative sampling, none of the seven Reclamation Areas had allowable vegetation cover that passed the success standard (Table 23). Reclamation Areas 29, 30, and 31 would have passed using the total cover including cheatgrass.

Desirable vegetation cover decreased from 2018 to 2019 in all Reclamation Areas and cover of cheatgrass increased markedly (Figure 7). This trend continued in 2020 with even more substantial decreases in desirable cover in all areas and increases in cheatgrass in Areas 29, 30, and 31. In Reclamation Areas 25, 29, 30, and 31, cheatgrass relative cover has rebounded to above 2016 levels (Figure 8). Cheatgrass relative cover also increased dramatically in Areas 32 and 33 but decreased in Area 34.

Table 23: Vegetation Cover Success Standard Comparison

	Phase III Monitoring			Phase II Monitoring		Interim Monitoring	
Vegetation Cover	**Area 29**	**Area 30**	**Area 31**	**Area 25**	**Area 34**	**Area 32**	**Area 33**
Average Vegetation Cover	27.6	34.3	27.9	20.2	14.1	24.2	27.8
Average Non-Noxious Cover	11.4	17.1	9.6	9.9	12.5	16.8	22.8
Average Allowable Cover	11.4	15.0	9.6	9.9	12.5	16.1	22.8
N	17	18	15	30	15	10	10
Nmin	17	17	6	55	8	19	18
Stdev Allowable Cover	3.5	5.3	1.7	5.6	2.6	5.3	7.0
Standard	29.8						
90% of Standard	26.8						
T (one-tail, α=0.9)	1.337	1.333	1.345	1.311	1.345	1.383	1.383
Standard Passed?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

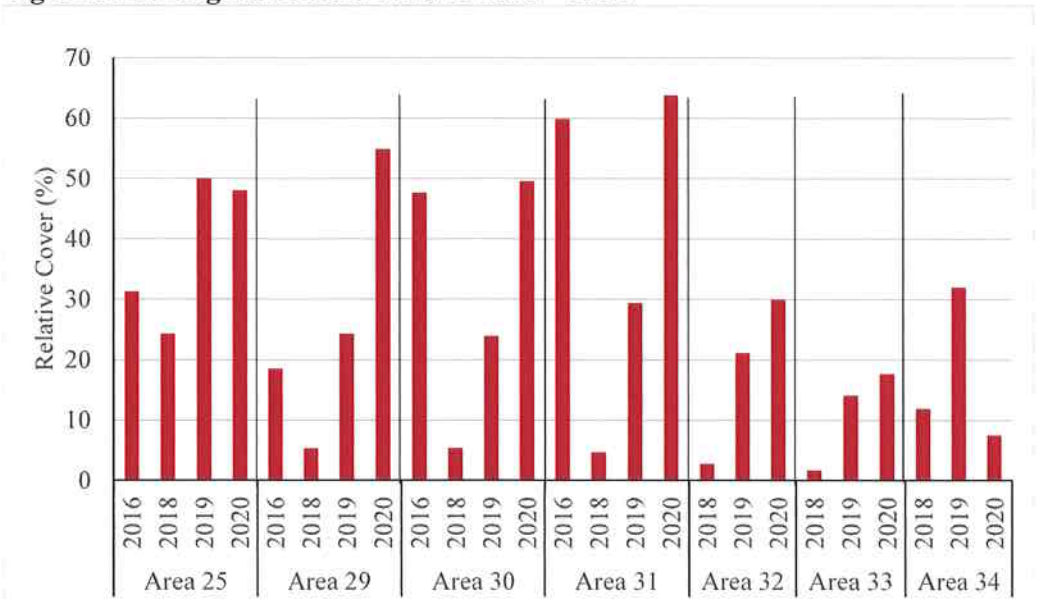
Figure 7: Absolute Cover of Native and Introduced Species 2016 – 2020*



* No data collected in 2017

The decrease in cheatgrass and other annuals in 2018 was attributed to CEC's aggressive weed control and a dry winter and early spring. In both 2019 and 2020, the February and March precipitation was over 300% of average which provided a huge benefit to cheatgrass likely at the expense of the native perennial grasses. This was made worse by a 2020 growing season with only 55% of average precipitation. In addition to the drought conditions, the perennial grasses were further set back by a major grasshopper infestation in late summer. The prairie sandreed, which is one of the dominant species in all Reclamation Areas, experienced an almost complete loss of leaves for some plants (Figure 9).

Figure 8: Cheatgrass Relative Cover 2016 – 2020*



* No data collected in 2017

Figure 9: Prairie Sandreed Stem with Grasshopper

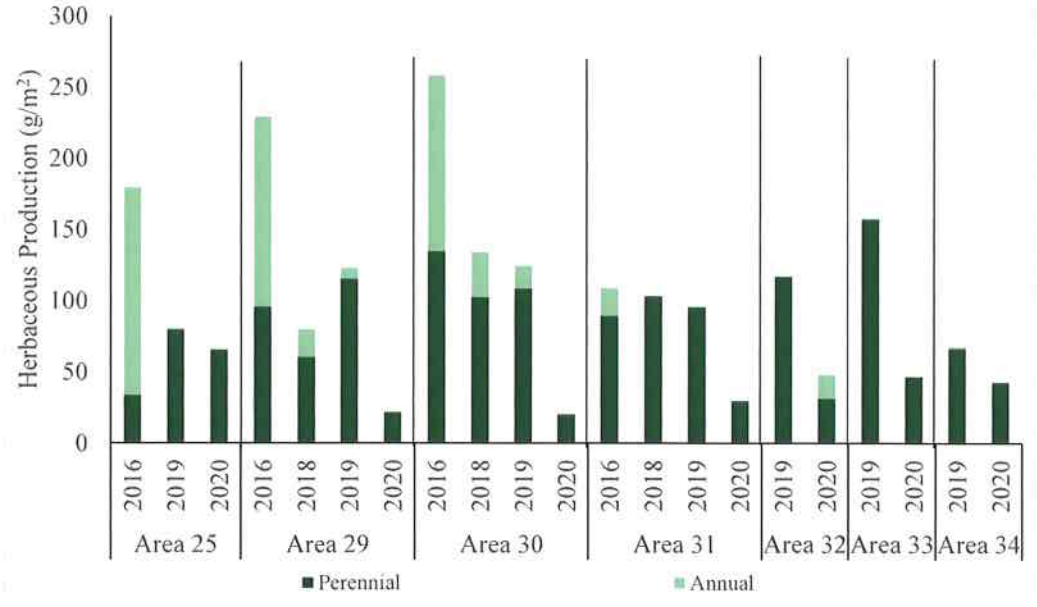
7.2 Herbaceous Production

Based on the results of the herbaceous production sampling, only Reclamation Areas 29 and 30 did not pass the calculated production success standard (Table 24). Herbaceous production decreased in all areas from 2019 to 2020 but the decreased was most pronounced in these two areas (Figure 10). The drought conditions did result in a much-reduced production standard as well; however, the decrease was not enough to offset the losses in vegetation in Areas 29 and 30.

Table 24: Herbaceous Production Success Standard Comparison

	Phase III Monitoring			Phase II Monitoring		Interim Monitoring	
Herbaceous Production	**Area 29**	**Area 30**	**Area 31**	**Area 25**	**Area 34**	**Area 32**	**Area 33**
Average Total Production	22.2	20.9	29.9	65.6	42.9	48.5	47.0
Average Allowable Production	22.2	20.9	29.9	65.6	42.9	37.7	47.0
N	30	30	30	15	15	15	15
Nmin	193	208	389	201	79	296	86
Stdev Allowable Production	23.5	23.0	45.0	69.1	28.3	48.2	32.4
Standard	26.1						
90% of Standard	23.5						
T (one-tail, α=0.9)	1.311	1.311	1.311	1.345	1.345	1.345	1.345
Standard Passed?	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Figure 10: Non-Noxious Herbaceous Production by Life Form 2016 – 2020*



* No data collected in 2017

It is possible that the sample sizes collected in all the other areas except Area 31 were too small to be representative. However, there is another hypothesis for Areas 25, 32 and 33. These Areas are adjacent to newly graded areas that are in the process of reclamation. Several windy days blew sand and manure from the new reclamation onto the edges of the older reclamation creating a band 10 to 20 feet wide where the old vegetation was buried. Initially, there was concern that this edge would have to be re-seeded; however, the existing vegetation grew through the sand and was more vigorous in these areas than the rest of the reclamation (Figure 11). While these areas had larger bare patches, they were also completely devoid of cheatgrass at the time of monitoring. Area 34 is also adjacent to new reclamation and could have received a similar benefit of blowing manure without the obvious burial of the edge vegetation.

Figure 11: Edge Effect on Areas 33 (left) and 32 (right)

7.3 Species Composition

The Phase III species composition bond release standard requires that four perennial grass species each contribute a minimum of 3% and a maximum of 40% to the relative non-noxious vegetation cover. All of the reclamation areas monitored for Phase III release met this standard. The species composition standard for Phase II bond release is that a sufficient number of species be present to meet the future Phase III bond release cover requirements. All three of the reclamation areas monitored for Phase II release exhibited at least four perennial warm season grasses in the data. The two areas monitored using the interim monitoring methods each exhibited at least nine perennial grass species, but neither one has yet met the Phase III standard.

8 SUMMARY

Quantitative monitoring of Reclamation Areas revealed that none of them met the revegetation success standards for Phase II or Phase III bond release (Table 25). Reclamation Areas 29, 30, and 31 were monitored under the Phase III bond release guidelines. While none of them met the vegetation cover standard, and only Area 31 met the production standard, all three areas met the species composition standard. Reclamation Areas 25, 30, and 34 were monitored under the Phase II bond release guidelines. All three of these areas met the Phase II species composition standard and Areas 25 and 34 met the herbaceous production standard, but none of the areas met the vegetation cover standard. Both Reclamation Areas 32 and 33 were monitored under the interim monitoring program and both met the herbaceous production standards. However, nether area met the vegetation cover or species composition standards. All seven reclamation areas will require additional sampling in 2021.

Table 25: Success Standard Summary

	Phase III Monitoring			Phase II Monitoring			Interim Monitoring	
Reclamation Standard	**Area 29**	**Area 30**	**Area 31**	**Area 25**	**Area 30**	**Area 34**	**Area 32**	**Area 33**
Vegetation Cover	No	No	No	No	No	No	No	No
Herbaceous Production	No	No	Yes	Yes	No	Yes	Yes	Yes
Species Composition	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Eligible for Release	**No**	**No**	**No**	**No**	**No**	**No**	**n/a**	**n/a**

9 LITERATURE CITED

Colorado Division of Reclamation Mining and Safety (DRMS). 1995. Guideline Regarding Selected Coal Mine Bond Release Issues (DRMS 1995). URL: http://mining.state.co.us/Programs/Coal/RulesRegs/Documents/BondReleaseGuidelines.pdf [Accessed October 2016].

Colorado Division of Reclamation Mining and Safety (DRMS). 2005. Regulations of the Colorado Mined Land Reclamation Board for Coal Mining, Effective August 30, 1980, revised September 14, 2005. URL: https://mining.state.co.us/SiteCollectionDocuments/CoalRegulations91405.pdf [Accessed October 2019].

USDA, NRCS. 2016. The PLANTS Database. National Plant Data Team, Greensboro, NC. URL: http://plants.usda.gov [Accessed August 2019].

Weber, W. A. and R. C. Wittmann. 2001. Colorado Flora Easter Slope: Third Edition. University Press of Colorado, Boulder, CO.

Wingate, J. L. 1994. Illustrated Keys to the Grasses of Colorado. Wingate Consulting, Denver, CO.

Appendix A: Vegetation Cover Data

Reclamation Area 25 Vegetation Cover Data

Scientific Name	Common Name	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Grass: Annual Native																																					
Munroa squarrosa	false buffalograss							p				p																		p							
Subtotal								p				p																		p							
Grass: Annual Introduced																																					
Bromus tectorum	cheatgrass	2		1		4		3		3		7		5		7		13		4		9		5		7		5		5		3		7		5	
Subtotal		2		1		4		3		3		7		5		7		13		4		9		5		7		5		5		3		7		5	
Grass: Perennial Desirable (Cool)																																					
Achnatherum hymenoides	Indian ricegrass	p		p	1							1																									
Agropyron cristatum	crested wheatgrass															1																					
Bromus inermis	smooth brome																									1											
Pascopyrum smithii	western wheatgrass													p												3				p							
Subtotal		p		p	1							1		p		1										4				p							
Grass: Perennial Desirable (Warm)																																					
Andropogon hallii	sand bluestem	6		1				1																							3				p	
Bouteloua curtipendula	sideoats grama																																				
Bouteloua gracilis	blue grama	p		1						p												1				p					p		p				
Calamovilfa longifolia	prairie sandreed	p		1		2		2		4		p				1				3				2		p		p		3		p		p		1	
Panicum virgatum	switchgrass							p		p																								1		p	
Pleuraphis jamesii	James' galleta																					p															
Schizachyrium scoparium	little bluestem			p																											p					
Sporobolus cryptandrus	sand dropseed	3	1	6		5		p		p		1		4	2	1		1		3		2		4		4	3	5		p		p	1	3		3	
Subtotal		9	1	9		7		3		4		1		4	2	2		1		6		3		6		4	3	5		3		3	1	4		4	
Total Grass Cover		**11**	**1**	**10**	**1**	**11**	**0**	**6**	**0**	**7**	**0**	**9**	**0**	**9**	**2**	**10**	**0**	**14**	**0**	**10**	**0**	**12**	**0**	**11**	**0**	**15**	**3**	**10**	**0**	**8**	**0**	**6**	**1**	**11**	**0**	**9**	**0**
Forbs: Annual & Biennial Native																																					
Amaranthus retroflexus	redroot amaranth									p		p		p																p							
Argemone polyanthemos	crested prickypoppy			p						p						p						p						p		p							
Croton texensis	Texas croton									p																											
Subtotal				p						p		p		p		p						p						p		p							
Forbs: Perennial Native																																					
Ambrosia psilostachya	Cuman ragweed									p																											
Mentzelia nuda	bractless blazingstar									p																											
Subtotal										p																											
Total Forb Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Subshrubs/Shrubs/Succulents: Perennial Native																																					
Artemisia filifolia	sand sagebrush																									p											
Opuntia phaeacantha	tulip pricklypear	p		p																		p															
Subtotal		p		p																		p				p											
Total Shrub Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Rock																																2					
Litter		32		31		33		40		19		34		35		37		30		15		30		35		30		27		21		33		38		37	
Bare Ground		7		9		6		4		24		7		6		3		6		25		8		4		5		13		21		9		1		4	
Total Hits		50	1	50	1	50	0	50	0	50	0	50	0	50	2	50	0	50	0	50	0	50	0	50	0	50	3	50	0	50	0	50	1	50	0	50	0
Total Vegetation Cover		**22**	**2**	**20**	**2**	**22**	**0**	**12**	**0**	**14**	**0**	**18**	**0**	**18**	**4**	**20**	**0**	**28**	**0**	**20**	**0**	**24**	**0**	**22**	**0**	**30**	**6**	**20**	**0**	**16**	**0**	**12**	**2**	**22**	**0**	**18**	**0**
Non-Noxious Vegetation Cover		**18**	**2**	**18**	**2**	**14**	**0**	**6**	**0**	**8**	**0**	**4**	**0**	**8**	**4**	**6**	**0**	**2**	**0**	**12**	**0**	**6**	**0**	**12**	**0**	**16**	**6**	**10**	**0**	**6**	**0**	**6**	**2**	**8**	**0**	**8**	**0**
Total Ground Cover		**86**		**82**		**88**		**92**		**52**		**86**		**88**		**94**		**88**		**50**		**84**		**92**		**90**		**74**		**58**		**82**		**98**		**92**	
Allowable Vegetation Cover		**18.0**		**18.0**		**14.0**		**6.0**		**8.0**		**4.0**		**8.0**		**6.0**		**2.0**		**12.0**		**6.0**		**12.0**		**16.0**		**10.0**		**6.0**		**6.0**		**8.0**		**8.0**	

Non-Noxious Annual Cover	0.1
Excess Annual Cover	0.0

Reclamation Area 25 Vegetation Cover Data (continued)

Scientific Name	Common Name	19 1st	19 2nd	20 1st	20 2nd	21 1st	21 2nd	22 1st	22 2nd	23 1st	23 2nd	24 1st	24 2nd	25 1st	25 2nd	26 1st	26 2nd	27 1st	27 2nd	28 1st	28 2nd	29 1st	29 2nd	30 1st	30 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Non-Noxious Relative Cover (%)
Grass: Annual Native																														
Munroa squarrosa	false buffalograss	p				p														p						0	0	0.0	0.0	0.0
Subtotal		p				p														p						0	0	**0.0**	**0.0**	**0.0**
Grass: Annual Introduced																														
Bromus tectorum	cheatgrass	10		7		8		1		5		p		1		3		2		11		1		10	1	154	155	10.3	49.4	
Subtotal		10		7		8		1		5		p		1		3		2		11		1		10	1	154	155	**10.3**	**49.4**	**0.0**
Grass: Perennial Desirable (Cool)																														
Achnatherum hymenoides	Indian ricegrass																	1								2	3	0.1	1.0	1.9
Agropyron cristatum	crested wheatgrass																									1	1	0.1	0.3	0.6
Bromus inermis	smooth brome																									1	1	0.1	0.3	0.6
Pascopyrum smithii	western wheatgrass																									3	3	0.2	1.0	1.9
Subtotal																		1								7	8	**0.5**	**2.5**	**5.0**
Grass: Perennial Desirable (Warm)																														
Andropogon hallii	sand bluestem							p		p				2		5										18	18	1.2	5.7	11.3
Bouteloua curtipendula	sideoats grama	1				1										p										2	2	0.1	0.6	1.3
Bouteloua gracilis	blue grama	p														p		1				1				4	4	0.3	1.3	2.5
Calamovilfa longifolia	prairie sandreed	p				p		3		p		2		p		p		p		p		p		p		24	24	1.6	7.6	15.1
Panicum virgatum	switchgrass					p																				1	1	0.1	0.3	0.6
Pleuraphis jamesii	James' galleta																									0	0	0.0	0.0	0.0
Schizachyrium scoparium	little bluestem															p										0	0	0.0	0.0	0.0
Sporobolus cryptandrus	sand dropseed	3		9		1		1		3		p		7		6		7	1	2		2		6	1	92	101	6.1	32.2	63.5
Subtotal		4		9		2		4		3		2		9		11		8	1	2		3		6	1	141	150	**9.4**	**47.8**	**94.3**
Total Grass Cover		**14**	**0**	**16**	**0**	**10**	**0**	**5**	**0**	**8**	**0**	**2**	**0**	**10**	**0**	**14**	**0**	**11**	**1**	**13**	**0**	**4**	**0**	**16**	**2**	**302**	**313**	**20.1**	**99.7**	**99.4**
Forbs: Annual & Biennial Native																														
Amaranthus retroflexus	redroot amaranth																			p						0	0	0.0	0.0	0.0
Argemone polyanthemos	crested pricklypoppy	p												p		p		1								1	1	0.1	0.3	0.6
Croton texensis	Texas croton							p																		0	0	0.0	0.0	0.0
Subtotal		p						p						p		p		1		p						1	1	**0.1**	**0.3**	**0.6**
Forbs: Perennial Native																														
Ambrosia psilostachya	Cuman ragweed																									0	0	0.0	0.0	0.0
Mentzelia nuda	bractless blazingstar																					p				0	0	0.0	0.0	0.0
Subtotal																						p				0	0	**0.0**	**0.0**	**0.0**
Total Forb Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0.1**	**0.3**	**0.6**
Subshrubs/Shrubs/Succulents: Perennial Native																														
Artemisia filifolia	sand sagebrush																					p				0	0	0.0	0.0	0.0
Opuntia phaeacantha	tulip pricklypear													p								p				0	0	0.0	0.0	0.0
Subtotal														p								p				0	0	**0.0**	**0.0**	**0.0**
Total Shrub Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Rock																		1								3	3	0.2		
Litter		33		29		35		15		33		5		36		28		31		32		29		25		888	888	59.2		
Bare Ground		3		5		5		30		9		43		4		8		6		5		17		9		306	306	20.4		
Total Hits		50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	1	50	0	50	0	50	2	1500	1511	100.0		
Total Vegetation Cover		**28**	**0**	**32**	**0**	**20**	**0**	**10**	**0**	**16**	**0**	**4**	**0**	**20**	**0**	**28**	**0**	**24**	**2**	**26**	**0**	**8**	**0**	**32**	**4**			**20.2**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**8**	**0**	**18**	**0**	**4**	**0**	**8**	**0**	**6**	**0**	**4**	**0**	**18**	**0**	**22**	**0**	**20**	**2**	**4**	**0**	**6**	**0**	**12**	**2**			**9.9**		
Total Ground Cover		**94**		**90**		**90**		**40**		**82**		**14**		**92**		**84**		**88**		**90**		**66**		**82**				**79.6**		
Allowable Vegetation Cover		**8.0**		**18.0**		**4.0**		**8.0**		**6.0**		**4.0**		**18.0**		**22.0**		**20.0**		**4.0**		**6.0**		**12.0**				**9.9**		

Non-Noxious Annual Cover	0.1
Excess Annual Cover	0.0

Reclamation Area 29 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	11 1st	11 2nd	12 1st	12 2nd	13 1st	13 2nd	14 1st	14 2nd	15 1st	15 2nd	16 1st	16 2nd	17 1st	17 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Noxious Relative Cover (%)
Grass: Annual Native																																							
Vulpia octoflora	sixweeks fescue	p				2		1		p		p		p		p				p		p		1		p		p		p		2	1	p		6	7	0.7	2.9	6.7
Subtotal		p				2		1		p		p		p		p				p		p		1		p		p		p		2	1	p		6	7	**0.7**	**2.9**	**6.7**
Grass: Annual Introduced																																							
Bromus tectorum	cheatgrass	6		12		8		5		4		13		13		1		10		3		11		2		4		8		14		14		10		138	138	16.2	57.0	
Subtotal		6		12		8		5		4		13		13		1		10		3		11		2		4		8		14		14		10		138	138	**16.2**	**57.0**	**0.0**
Grass: Perennial Desirable (Warm)																																							
Andropogon hallii	sand bluestem	2				3				3				1		2		7		4		p	1	1		4		3		p		3		2		35	36	4.1	14.9	34.6
Bouteloua curtipendula	sideoats grama			1		p				1								p		p						p		p						p		2	2	0.2	0.8	1.9
Bouteloua gracilis	blue grama	1		2		p		p		1		1		p		2		p		p		1		1		2		1		p		p		1		13	13	1.5	5.4	12.5
Calamovilfa longifolia	prairie sandreed	1		1	1	p		1		1	1	p		2	1	1		p		p		p		3	1	1		1		2		1		p		15	19	1.8	7.9	18.3
Schizachyrium scoparium	little bluestem																											p		1						1	1	0.1	0.4	1.0
Sorghastrum nutans	Indiangrass			2						2						2				p				1												7	7	0.8	2.9	6.7
Sporobolus cryptandrus	sand dropseed	2				1		1				4	1	1								3														13	14	1.5	5.8	13.5
Subtotal		6		6	1	4		2		8	1	5	1	4	1	7		7		4		4	1	6	1	7		5		3		4		4		86	92	**10.1**	**38.0**	**88.5**
Total Grass Cover		**12**	**0**	**18**	**1**	**14**	**0**	**8**	**0**	**12**	**1**	**18**	**1**	**17**	**1**	**8**	**0**	**17**	**0**	**7**	**0**	**15**	**1**	**9**	**1**	**11**	**0**	**13**	**0**	**17**	**0**	**20**	**1**	**14**	**0**	**230**	**237**	**27.1**	**97.9**	**95.2**
Forbs: Annual & Biennial Native																																							
Argemone polyanthemos	crested pricklypoppy													p		p																				0	0	0.0	0.0	0.0
Chamaesyce glyptosperma	ribseed sandmat																					p				1										1	1	0.1	0.4	1.0
Machaeranthera bigelovii	Bigelow's tansyaster													p										p												0	0	0.0	0.0	0.0
Subtotal														p		p						p		p		1										1	1	**0.1**	**0.4**	**1.0**
Forbs: Perennial Native																																							
Lithospermum incisum	narrowleaf stoneseed																											p								0	0	0.0	0.0	0.0
Physalis hispida	prairie groundcherry					1																														1	1	0.1	0.4	1.0
Ratibida columnifera	upright prairie coneflower																							p												0	0	0.0	0.0	0.0
Subtotal						1																		p				p								1	1	**0.1**	**0.4**	**1.0**
Forbs: Perennial Introduced																																							
Gypsophila paniculata	baby's breath													p																						0	0	0.0	0.0	0.0
Subtotal														p																						0	0	**0.0**	**0.0**	**0.0**
Total Forb Cover		**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0.2**	**0.8**	**1.9**
Subshrubs/Shrubs/Succulents: Perennial Native																																							
Artemisia filifolia	sand sagebrush	p						p								p				1				1		p										2	2	0.2	0.8	1.9
Opuntia phaeacantha	tulip pricklypear							p		p				p		1				p						p		p								1	1	0.1	0.4	1.0
Subtotal		p						p		p				p		1				1				1		p		p								3	3	**0.4**	**1.2**	**2.9**
Total Shrub Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**0.4**	**1.2**	**2.9**
Rock																																				0	0	0.0		
Litter		34		31		29		37		32		29		31		32		31		38		34		36		34		32		29		28		31		548	548	64.5		
Bare Ground		4		1		6		5		6		3		2		9		2		4		1		4		4		5		4		2		5		67	67	7.9		
Total Hits		50	0	50	1	50	0	50	0	50	1	50	1	50	1	50	0	50	0	50	0	50	1	50	1	50	0	50	0	50	0	50	1	50	0	850	857	**100.0**		
Total Vegetation Cover		**24**	**0**	**36**	**2**	**30**	**0**	**16**	**0**	**24**	**2**	**36**	**2**	**34**	**2**	**18**	**0**	**34**	**0**	**16**	**0**	**30**	**2**	**20**	**2**	**24**	**0**	**26**	**0**	**34**	**0**	**40**	**2**	**28**	**0**			**27.6**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**12**	**0**	**12**	**2**	**14**	**0**	**6**	**0**	**16**	**2**	**10**	**2**	**8**	**2**	**16**	**0**	**14**	**0**	**10**	**0**	**8**	**2**	**16**	**2**	**16**	**0**	**10**	**0**	**6**	**0**	**12**	**2**	**8**	**0**			**11.4**		
Total Ground Cover		**92**		**98**		**88**		**90**		**88**		**94**		**96**		**82**		**96**		**92**		**98**		**92**		**92**		**90**		**92**		**96**		**90**				**92.1**		
Allowable Vegetation Cover		**12.0**		**12.0**		**14.0**		**6.0**		**16.0**		**10.0**		**8.0**		**16.0**		**14.0**		**10.0**		**8.0**		**16.0**		**16.0**		**10.0**		**6.0**		**12.0**		**8.0**				**11.4**		

Non-Noxious Annual Cover	0.8
Excess Annual Cover	0.0

Reclamation Area 30 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	11 1st	11 2nd	12 1st	12 2nd	13 1st	13 2nd	14 1st	14 2nd	15 1st	15 2nd	16 1st	16 2nd	17 1st	17 2nd	18 1st	18 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Non-Noxious Relative Cover (%)
Grass: Annual Native																																									
Munroa squarrosa	false buffalograss											p	p	p											p				p						p	0	0	0.0	0.0	0.0
Vulpia octoflora	sixweeks fescue	2		p		2		2		p		4	4	3		p				1		p		3		p		4		2		4		1	32	32	3.6	9.9	19.2
Subtotal		2		p		2		2		p		4	4	3		p				1		p		3		p		4		2		4		1	32	32	**3.6**	**9.9**	**19.2**
Grass: Annual Introduced																																									
Bromus tectorum	cheatgrass	8		7		6		7		13		5		3		14		6		11		9		13		8		15		6		9		8		7	155	155	17.2	48.1	
Subtotal		8		7		6		7		13		5		3		14		6		11		9		13		8		15		6		9		8		7	155	155	**17.2**	**48.1**	**0.0**
Grass: Perennial Desirable (Cool)																																									
Achnatherum hymenoides	Indian ricegrass	p																																		0	0	0.0	0.0	0.0
Hesperostipa comata	needle and thread	p																																		0	0	0.0	0.0	0.0
Subtotal		p																																		0	0	**0.0**	**0.0**	**0.0**
Grass: Perennial Desirable (Warm)																																									
Andropogon hallii	sand bluestem	5		8		1		8	1	4	1	8		5		2		5				2	1	3		6		2		1		1		2		4	67	70	7.4	21.7	41.9
Bouteloua curtipendula	sideoats grama	1				p		p						p		3		p						p						p						2	6	6	0.7	1.9	3.6
Bouteloua gracilis	blue grama	1		p		p		1		p		p		p		p		p						p		p				1		1		1		p	1	5	7	0.6	2.2	4.2
Calamovilfa longifolia	prairie sandreed	p		p		p		p		p		2		1	1	p		2						2		1		p		p								8	9	0.9	2.8	5.4
Panicum virgatum	switchgrass	p		p				p																														0	0	0.0	0.0	0.0
Schizachyrium scoparium	little bluestem			p						p				1		p																						1	1	0.1	0.3	0.6
Sorghastrum nutans	Indiangrass	p										p		p												p												0	0	0.0	0.0	0.0
Sporobolus cryptandrus	sand dropseed	1		p		4	1	p		2	2	p		2		p		p		6	1	3	2	1		p		3		2		2		3	1	3	32	39	3.6	12.1	23.4
Subtotal		8		8		5	1	9	1	6	3	10		9	1	5		7		6	1	5	3	6		7		5		4		4	1	6	1	9	1	119	132	**13.2**	**41.0**	**79.0**
Total Grass Cover		**18**	**0**	**15**	**0**	**13**	**1**	**18**	**1**	**19**	**3**	**19**	**0**	**16**	**1**	**22**	**0**	**13**	**0**	**17**	**1**	**15**	**3**	**19**	**0**	**18**	**0**	**20**	**0**	**14**	**0**	**15**	**1**	**18**	**1**	**17**	**1**	**306**	**319**	**34.0**	**99.1**	**98.2**
Forbs: Annual & Biennial Native																																									
Argemone polyanthemos	crested pricklypoppy	p																																		0	0	0.0	0.0	0.0
Chamaesyce glyptosperma	ribseed sandmat	p				1		p				p		p		p				p				p		p				p				1		p		2	2	0.2	0.6	1.2
Machaeranthera bigelovii	Bigelow's tansyaster							p						p												p												0	0	0.0	0.0	0.0
Subtotal		p				1		p				p		p		p				p				p		p				p				1		p		2	2	**0.2**	**0.6**	**1.2**
Total Forb Cover		**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**0.2**	**0.6**	**1.2**
Subshrubs/Shrubs/Succulents: Perennial Native																																									
Artemisia filifolia	sand sagebrush							p																												0	0	0.0	0.0	0.0
Opuntia phaeacantha	tulip pricklypear	1				p		p				p		p						p				p		p		p						p		p	1	1	0.1	0.3	0.6
Subtotal		1				p		p				p		p						p				p		p		p						p		p	1	1	**0.1**	**0.3**	**0.6**
Total Shrub Cover		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0.1**	**0.3**	**0.6**
Rock																																				0	0	0.0		
Litter		27		31		32		27		29		29		28		22		30		31		32		28		26		27		28		34		29		30	520	520	57.8		
Bare Ground		4		4		4		5		2		2		6		6		7		2		3		3		6		3		8		1		2		3	71	71	7.9		
Total Hits		50	0	50	0	50	1	50	1	50	3	50	0	50	1	50	0	50	0	50	1	50	3	50	0	50	0	50	0	50	0	50	1	50	1	50	1	900	913	**100.0**		
Total Vegetation Cover		**38**	**0**	**30**	**0**	**28**	**2**	**36**	**2**	**38**	**6**	**38**	**0**	**32**	**2**	**44**	**0**	**26**	**0**	**34**	**2**	**30**	**6**	**38**	**0**	**36**	**0**	**40**	**0**	**28**	**0**	**30**	**2**	**38**	**2**	**34**	**2**			**34.3**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**22**	**0**	**16**	**0**	**16**	**2**	**22**	**2**	**12**	**6**	**28**	**0**	**26**	**2**	**16**	**0**	**14**	**0**	**12**	**2**	**12**	**6**	**12**	**0**	**20**	**0**	**10**	**0**	**16**	**0**	**12**	**2**	**22**	**2**	**20**	**2**			**17.1**		
Total Ground Cover		**92**		**92**		**92**		**90**		**96**		**96**		**88**		**88**		**86**		**96**		**94**		**94**		**88**		**94**		**84**		**98**		**96**		**94**				**92.1**		
Allowable Vegetation Cover		**19.9**		**13.9**		**13.9**		**19.9**		**9.9**		**25.9**		**23.9**		**13.9**		**11.9**		**9.9**		**9.9**		**9.9**		**17.9**		**7.9**		**13.9**		**9.9**		**19.9**		**17.9**				**15.0**		

Non-Noxious Annual Cover	3.8
Excess Annual Cover	2.1

Reclamation Area 31 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	11 1st	11 2nd	12 1st	12 2nd	13 1st	13 2nd	14 1st	14 2nd	15 1st	15 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Non-Noxious Relative Cover (%)
Grass: Annual Native																																			
Munroa squarrosa	false buffalograss							p																p						0	0	0.0	0.0	0.0
Vulpia octoflora	sixweeks fescue	p		p		p		p		p		p		p		p		p		p		p		p		p			p	0	0	0.0	0.0	0.0
Subtotal		p		p		p		p		p		p		p		p		p		p		p		p		p			p	0	0	**0.0**	**0.0**	**0.0**
Grass: Annual Introduced																																			
Bromus tectorum	cheatgrass	8		8		16		8		9		5		7		6		11		9		13		5		11		15		6		137	137	18.3	64.9	
Subtotal		8		8		16		8		9		5		7		6		11		9		13		5		11		15		6		137	137	**18.3**	**64.9**	**0.0**
Grass: Perennial Desirable (Warm)																																			
Andropogon hallii	sand bluestem	1		1		1		2		3		p		3		2		4		1		3		2		1		1		1		26	26	3.5	12.3	35.1
Bouteloua curtipendula	sideoats grama	p				p				p		2				p		1		p												3	3	0.4	1.4	4.1
Bouteloua gracilis	blue grama			1						1		p		p		p		p		p						p				1		3	3	0.4	1.4	4.1
Calamovilfa longifolia	prairie sandreed	4		1		1		p		1		1		p		3		p		2		p		1		3		1		2		20	20	2.7	9.5	27.0
Panicum virgatum	switchgrass			p						p		1												p		p						1	1	0.1	0.5	1.4
Schizachyrium scoparium	little bluestem									p														1						p		1	1	0.1	0.5	1.4
Sorghastrum nutans	Indiangrass													p																		0	0	0.0	0.0	0.0
Sporobolus cryptandrus	sand dropseed	p		2		2		2		p		p		2		p		p		1		2		p		1		1	1	3	1	16	18	2.1	8.5	24.3
Subtotal		5		5		4		4		5		4		5		5		5		4		5		4		5		3	1	7	1	70	72	**9.3**	**34.1**	**97.3**
Total Grass Cover		**13**	**0**	**13**	**0**	**20**	**0**	**12**	**0**	**14**	**0**	**9**	**0**	**12**	**0**	**11**	**0**	**16**	**0**	**13**	**0**	**18**	**0**	**9**	**0**	**16**	**0**	**18**	**1**	**13**	**1**	**207**	**209**	**27.6**	**99.1**	**97.3**
Forbs: Annual & Biennial Native																																			
Chamaesyce glyptosperma	ribseed sandmat																	p														0	0	0.0	0.0	0.0
Machaeranthera bigelovii	Bigelow's tansyaster									p																						0	0	0.0	0.0	0.0
Subtotal										p								p														0	0	**0.0**	**0.0**	**0.0**
Forbs: Perennial Native																																			
Cirsium undulatum	wavyleaf thistle																											p				0	0	0.0	0.0	0.0
Physalis hispida	prairie groundcherry					p														p		p										0	0	0.0	0.0	0.0
Subtotal						p														p		p						p				0	0	**0.0**	**0.0**	**0.0**
Forbs: Perennial Introduced																																			
Gypsophila paniculata	baby's breath													p																		0	0	0.0	0.0	0.0
Subtotal														p																		0	0	**0.0**	**0.0**	**0.0**
Total Forb Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0.0**
Subshrubs/Shrubs/Succulents: Perennial Native																																			
Artemisia filifolia	sand sagebrush																											1				1	1	0.1	0.5	1.4
Opuntia phaeacantha	tulip pricklypear			p		p		p				p				p		p						p		p		p				0	0	0.0	0.0	0.0
Yucca glauca	soapweed yucca															1		p								p						1	1	0.1	0.5	1.4
Subtotal				p		p		p				p				1		p						p		p		1				2	2	**0.3**	**0.9**	**2.7**
Total Shrub Cover		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**0.3**	**0.9**	**2.7**
Rock																																0	0	0.0		
Litter		34		27		25		29		32		33		35		33		29		34		25		35		32		28		32		463	463	61.7		
Bare Ground		3		10		5		9		4		8		3		5		5		3		7		6		2		3		5		78	78	10.4		
Total Hits		50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	1	50	1	750	752	100.0		
Total Vegetation Cover		**26**	**0**	**26**	**0**	**40**	**0**	**24**	**0**	**28**	**0**	**18**	**0**	**24**	**0**	**24**	**0**	**32**	**0**	**26**	**0**	**36**	**0**	**18**	**0**	**32**	**0**	**38**	**2**	**26**	**2**			**27.9**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**10**	**0**	**10**	**0**	**8**	**0**	**8**	**0**	**10**	**0**	**8**	**0**	**10**	**0**	**12**	**0**	**10**	**0**	**8**	**0**	**10**	**0**	**8**	**0**	**10**	**0**	**8**	**2**	**14**	**2**			**9.6**		
Total Ground Cover		**94**		**80**		**90**		**82**		**92**		**84**		**94**		**90**		**90**		**94**		**86**		**88**		**96**		**94**		**90**				**89.6**		
Allowable Vegetation Cover		**10.0**		**10.0**		**8.0**		**8.0**		**10.0**		**8.0**		**10.0**		**12.0**		**10.0**		**8.0**		**10.0**		**8.0**		**10.0**		**8.0**		**14.0**				**9.6**		

Non-Noxious Annual Cover	0.0
Excess Annual Cover	0.0

Reclamation Area 32 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Non-Noxious Relative Cover (%)
Grass: Annual Native																										
Cenchrus longispinus	mat sandbur											p										0	0	0.0	0.0	0.0
Munroa squarrosa	false buffalograss			p								p										0	0	0.0	0.0	0.0
Vulpia octoflora	sixweeks fescue									p										p		0	0	0.0	0.0	0.0
Subtotal				p						p		p								p		0	0	**0.0**	**0.0**	**0.0**
Grass: Annual Introduced																										
Bromus tectorum	cheatgrass	7		2		p		5		4		5		5		3		5		1		37	37	7.4	29.8	
Subtotal		7		2		p		5		4		5		5		3		5		1		37	37	**7.4**	**29.8**	**0.0**
Grass: Perennial Desirable (Warm)																										
Andropogon hallii	sand bluestem			1								p										1	1	0.2	0.8	1.1
Bouteloua curtipendula	sideoats grama	2								p		p		p				1	1	1		4	5	0.8	4.0	5.7
Bouteloua gracilis	blue grama	p	1			p				1		p		1		1		p		2		5	6	1.0	4.8	6.9
Calamovilfa longifolia	prairie sandreed	4		11		4		3		5		3		7	1	4		9		4		54	55	10.8	44.4	63.2
Panicum virgatum	switchgrass	p		1		1				2		1		p		1				p		6	6	1.2	4.8	6.9
Sporobolus cryptandrus	sand dropseed							p		1								1		p		2	2	0.4	1.6	2.3
Subtotal		6	1	13		5		3		9		4		8	1	6		11	1	7		72	75	**14.4**	**60.5**	**86.2**
Total Grass Cover		**13**	**1**	**15**	**0**	**5**	**0**	**8**	**0**	**13**	**0**	**9**	**0**	**13**	**1**	**9**	**0**	**16**	**1**	**8**	**0**	**109**	**112**	**21.8**	**90.3**	**86.2**
Forbs: Annual & Biennial Native																										
Amaranthus retroflexus	redroot amaranth			1		2		4				p										7	7	1.4	5.6	8.0
Polygonum ramosissimum	bushy knotweed			p																		0	0	0.0	0.0	0.0
Subtotal				1		2		4				p										7	7	**1.4**	**5.6**	**8.0**
Forbs: Annual & Biennial Introduced																										
Salsola tragus	prickly Russian thistle					3		p				2										5	5	1.0	4.0	5.7
Subtotal						3		p				2										5	5	**1.0**	**4.0**	**5.7**
Forbs: Perennial Native																										
Ambrosia psilostachya	Cuman ragweed			p		p		p														0	0	0.0	0.0	0.0
Subtotal				p		p		p														0	0	**0.0**	**0.0**	**0.0**
Total Forb Cover		**0**	**0**	**1**	**0**	**5**	**0**	**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**12**	**2.4**	**9.7**	**13.8**
Rock																1						1	1	0.2		
Litter		34		13		12		8		37		20		32		30		34		31		251	251	50.2		
Bare Ground		3		21		28		30				19		5		10				11		127	127	25.4		
Total Hits		50	1	50	0	50	0	50	0	50	0	50	0	50	1	50	0	50	1	50	0	500	503	100.0		
Total Vegetation Cover		**26**	**2**	**32**	**0**	**20**	**0**	**24**	**0**	**26**	**0**	**22**	**0**	**26**	**2**	**18**	**0**	**32**	**2**	**16**	**0**			**24.2**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**12**	**2**	**28**	**0**	**20**	**0**	**14**	**0**	**18**	**0**	**12**	**0**	**16**	**2**	**12**	**0**	**22**	**2**	**14**	**0**			**16.8**		
Total Ground Cover		**94**		**58**		**44**		**40**		**100**		**62**		**90**		**80**		**100**		**78**				**74.6**		
Allowable Vegetation Cover		**11.3**		**27.3**		**19.3**		**13.3**		**17.3**		**11.3**		**15.3**		**11.3**		**21.3**		**13.3**				**16.1**		

Non-Noxious Annual Cover	2.4
Excess Annual Cover	0.7

Reclamation Area 33 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Noxious Relative Cover (%)
Grass: Annual Introduced																										
Bromus arvensis	field brome									p												0	0	0.0	0.0	0.0
Bromus tectorum	cheatgrass	2		2		6		1		1		3		7		3		p		p		25	25	5.0	17.7	
Subtotal		2		2		6		1		1		3		7		3		p		p		25	25	5.0	17.7	0.0
Grass: Perennial Desirable (Cool)																										
Agropyron cristatum	crested wheatgrass																			p		0	0	0.0	0.0	0.0
Pascopyrum smithii	western wheatgrass									p		p		2								2	2	0.4	1.4	1.7
Subtotal										p		p		2						p		2	2	0.4	1.4	1.7
Grass: Perennial Desirable (Warm)																										
Andropogon hallii	sand bluestem							1				p		1								2	2	0.4	1.4	1.7
Aristida purpurea	purple threeawn									p												0	0	0.0	0.0	0.0
Bouteloua curtipendula	sideoats grama											p						1				1	1	0.2	0.7	0.9
Bouteloua gracilis	blue grama	p		p		p		p		p		p		p		p		1		1		2	2	0.4	1.4	1.7
Calamovilfa longifolia	prairie sandreed	13		11		5	1	14		11		7		4		6		2		12		85	86	17.0	61.0	74.1
Panicum virgatum	switchgrass	2		p		2		1		2		2		p		1		3		1		14	14	2.8	9.9	12.1
Sporobolus cryptandrus	sand dropseed	p		p		p		p		p		p		3	1	1		1		p		5	6	1.0	4.3	5.2
Subtotal		15		11		7	1	16		13		9		8	1	8		8		14		109	111	21.8	78.7	95.7
Total Grass Cover		**17**	**0**	**13**	**0**	**13**	**1**	**17**	**0**	**14**	**0**	**12**	**0**	**17**	**1**	**11**	**0**	**8**	**0**	**14**	**0**	**136**	**138**	**27**	**98**	**97**
Forbs: Annual & Biennial Native																										
Polygonum ramosissimum	bushy knotweed							2						p								2	2	0.4	1.4	1.7
Subtotal								2						p								2	2	0.4	1.4	1.7
Forbs: Perennial Native																										
Ambrosia psilostachya	Cuman ragweed															1						1	1	0.2	0.7	0.9
Ratibida columnifera	upright prairie coneflower									p				p								0	0	0.0	0.0	0.0
Subtotal										p				p		1						1	1	0.2	0.7	0.9
Total Forb Cover		**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**			**22**	**81**	**98**
Rock																						0	0	0.0		
Litter		28		31		30		22		28		30		21		34		35		33		292	292	58.4		
Bare Ground		5		6		7		9		8		8		12		4		7		3		69	69	13.8		
Total Hits		50	0	50	0	50	1	50	0	50	0	50	0	50	1	50	0	50	0	50	0	500	502	100.0		
Total Vegetation Cover		**34**	**0**	**26**	**0**	**26**	**2**	**38**	**0**	**28**	**0**	**24**	**0**	**34**	**2**	**24**	**0**	**16**	**0**	**28**	**0**			**27.8**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		**30**	**0**	**22**	**0**	**14**	**2**	**36**	**0**	**26**	**0**	**18**	**0**	**20**	**2**	**18**	**0**	**16**	**0**	**28**	**0**			**22.8**		
Total Ground Cover		**90**		**88**		**86**		**82**		**84**		**84**		**76**		**92**		**86**		**94**				**86.2**		
Allowable Vegetation Cover		**30.0**		**22.0**		**14.0**		**36.0**		**26.0**		**18.0**		**20.0**		**18.0**		**16.0**		**28.0**				**22.8**		

Non-Noxious Annual Cover	0.4
Excess Annual Cover	0.0

Reclamation Area 34 Vegetation Cover Data

Scientific Name	Common Name	1 1st	1 2nd	2 1st	2 2nd	3 1st	3 2nd	4 1st	4 2nd	5 1st	5 2nd	6 1st	6 2nd	7 1st	7 2nd	8 1st	8 2nd	9 1st	9 2nd	10 1st	10 2nd	11 1st	11 2nd	12 1st	12 2nd	13 1st	13 2nd	14 1st	14 2nd	15 1st	15 2nd	Total Hits 1st	Total Hits All	Average Absolute Cover (%)	Average Relative Cover (%)	Non-Noxious Relative Cover (%)
Grass: Annual Native																																			
Munroa squarrosa	false buffalograss	p		p		p				p		p				p		p		p		p				p				p		0	0	0.0	0.0	0.0
Vulpia octoflora	sixweeks fescue			1																p												1	1	0.1	0.9	1.1
Subtotal		p		1		p				p		p				p		p		p		p				p				p		1	1	**0.1**	**0.9**	**1.1**
Grass: Annual Introduced																																			
Bromus tectorum	cheatgrass					p		p		p				7				4		1		p		p				p		p		12	12	1.6	11.2	
Subtotal						p		p		p				7				4		1		p		p				p		p		12	12	**1.6**	**11.2**	**0.0**
Grass: Perennial Desirable (Cool)																																			
Achnatherum hymenoides	Indian ricegrass			1												p										p		p				1	1	0.1	0.9	1.1
Agropyron cristatum	crested wheatgrass			p																												0	0	0.0	0.0	0.0
Cyperus schweinitzii	Schweinitz's flatsedge															p																0	0	0.0	0.0	0.0
Elymus elymoides	squirreltail																	p												p		0	0	0.0	0.0	0.0
Pseudoroegneria spicata	bluebunch wheatgrass																											1				1	1	0.1	0.9	1.1
Subtotal				1												p		p								p		1		p		2	2	**0.3**	**1.9**	**2.1**
Grass: Perennial Desirable (Warm)																																			
Andropogon hallii	sand bluestem	1												1		p						p		5		1				1		9	9	1.2	8.4	9.5
Aristida purpurea	purple threeawn																							p								0	0	0.0	0.0	0.0
Bouteloua curtipendula	sideoats grama	p										1				p						p				2						3	3	0.4	2.8	3.2
Bouteloua gracilis	blue grama	p		p		1		1		1		p		p		p	1	p		1		p		p		2		2		1		9	10	1.2	9.3	10.5
Calamovilfa longifolia	prairie sandreed	5		1		1				p		2		1		5		p		1		p		p		p		2		p		18	18	2.4	16.8	18.9
Schizachyrium scoparium	little bluestem			p										p										p						p		0	0	0.0	0.0	0.0
Sorghastrum nutans	Indiangrass													1																		1	1	0.1	0.9	1.1
Sporobolus cryptandrus	sand dropseed	1		3		4		4		5		5		2		p		4		4		5		4		3		p		5		49	49	6.5	45.8	51.6
Subtotal		7		4		6		5		6		8		5		5	1	4		6		5		9		8		4		7		89	90	**11.9**	**84.1**	**94.7**
Total Grass Cover		7	0	6	0	6	0	5	0	6	0	8	0	12	0	5	1	8	0	7	0	5	0	9	0	8	0	5	0	7	0	104	105	13.9	98.1	97.9
Forbs: Annual & Biennial Native																																			
Amaranthus retroflexus	redroot amaranth			p		p						p										p				p						0	0	0.0	0.0	0.0
Argemone polyanthemos	crested prickly poppy			p														p														0	0	0.0	0.0	0.0
Chamaesyce glyptosperma	ribseed sandmat													1				p														1	1	0.1	0.9	1.1
Machaeranthera bigelovii	Bigelow's tansyaster																													p		0	0	0.0	0.0	0.0
Subtotal				p		p						p		1				p				p				p				p		1	1	**0.1**	**0.9**	**1.1**
Forbs: Perennial Native																																			
Cirsium undulatum	wavyleaf thistle							p																								0	0	0.0	0.0	0.0
Physalis hispida	prairie groundcherry																	p														0	0	0.0	0.0	0.0
Subtotal								p										p														0	0	**0.0**	**0.0**	**0.0**
Total Forb Cover		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	**0.1**	**0.9**	**1.1**
Subshrubs/Shrubs/Succulents: Perennial Native																																			
Opuntia phaeacantha	tulip pricklypear					p				p		p		p				1		p				p								1	1	0.1	0.9	1.1
Yucca glauca	soapweed yucca					p																										0	0	0.0	0.0	0.0
Subtotal						p				p		p		p				1		p				p								1	1	**0.1**	**0.9**	**1.1**
Total Shrub Cover		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	**0.1**	**0.9**	**1.1**
Rock																																0	0	0.0		
Litter		29		26		30		29		30		25		33		23		28		29		24		25		16		19		22		388	388	51.7		
Bare Ground		14		18		14		16		14		17		4		22		13		14		21		16		26		26		21		256	256	34.1		
Total Hits		50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	1	50	0	50	0	50	0	50	0	50	0	50	0	50	0	750	751	100.0		
Total Vegetation Cover		14	0	12	0	12	0	10	0	12	0	16	0	26	0	10	2	18	0	14	0	10	0	18	0	16	0	10	0	14	0			**14.1**	**100.0**	**100.0**
Non-Noxious Vegetation Cover		14	0	12	0	12	0	10	0	12	0	16	0	12	0	10	2	10	0	12	0	10	0	18	0	16	0	10	0	14	0			**12.5**		
Total Ground Cover		72		64		72		68		72		66		92		56		74		72		58		68		48		48		58				**65.9**		
Allowable Vegetation Cover		14.0		12.0		12.0		10.0		12.0		16.0		12.0		10.0		10.0		12.0		10.0		18.0		16.0		10.0		14.0				**12.5**		

Non-Noxious Annual Cover	0.3
Excess Annual Cover	0.0

Appendix B: Herbaceous Production Data

Reclamation Area 25 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	68.9	68.9	68.9
2	0	47.8	47.8	47.8
3	0	0	0	0.0
4	0	39.1	39.1	39.1
5	0	19.8	19.8	19.8
6	0	10	10	10.0
7	0	15.2	15.2	15.2
8	0	43.6	43.6	43.6
9	0	0	0	0.0
10	0	128.1	128.1	128.1
11	0	0	0	0.0
12	0	36.7	36.7	36.7
13	0	9.7	9.7	9.7
14	0	60.3	60.3	60.3
15	0	12.8	12.8	12.8
Average	**0.0**	**32.8**	**32.8**	**32.8**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Reclamation Area 29 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	8.2	8.2	8.2
2	0	2.4	2.4	2.4
3	0	1.7	1.7	1.7
4	0	3.8	3.8	3.8
5	0	26.2	26.2	26.2
6	0	14.4	14.4	14.4
7	0	0.6	0.6	0.6
8	0	12.1	12.1	12.1
9	0	4.7	4.7	4.7
10	0	46.2	46.2	46.2
11	0	3.3	3.3	3.3
12	0.1	10.7	10.8	10.8
13	0.5	0.4	0.9	0.9
14	0	17.6	17.6	17.6
15	0.6	3.1	3.7	3.7
16	0	33	33	33.0
17	2.6	5.2	7.8	7.8
18	0	34.6	34.6	34.6
19	0	9.9	9.9	9.9
20	0	0.2	0.2	0.2
21	0	26.6	26.6	26.6
22	0	10.9	10.9	10.9
23	0	0	0	0.0
24	0	18.8	18.8	18.8
25	0.8	0.4	1.2	1.2
26	0	3.4	3.4	3.4
27	0	11	11	11.0
28	1	0.8	1.8	1.8
29	0	13.3	13.3	13.3
30	0	3.4	3.4	3.4
Average	**0.2**	**10.9**	**11.1**	**11.1**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Reclamation Area 30 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	7.8	7.8	7.8
2	0	6.9	6.9	6.9
3	0	3.5	3.5	3.5
4	0.7	38.7	39.4	39.4
5	0.4	6.1	6.5	6.5
6	0.6	3.6	4.2	4.2
7	2.1	7.3	9.4	9.4
8	0	10.6	10.6	10.6
9	0	6.2	6.2	6.2
10	5	3.5	8.5	8.5
11	0	11.8	11.8	11.8
12	0	4.2	4.2	4.2
13	0	1.4	1.4	1.4
14	0	12.5	12.5	12.5
15	0	5.5	5.5	5.5
16	0	8.8	8.8	8.8
17	0	5.5	5.5	5.5
18	0	1.6	1.6	1.6
19	0	5.1	5.1	5.1
20	0	6.4	6.4	6.4
21	1.1	5.8	6.9	6.9
22	0	31.6	31.6	31.6
23	0	0.5	0.5	0.5
24	0	3.7	3.7	3.7
25	0.6	4	4.6	4.6
26	0	48.4	48.4	48.4
27	0	5.4	5.4	5.4
28	0	7	7	7.0
29	0	8.4	8.4	8.4
30	0	30.8	30.8	30.8
Average	**0.4**	**10.1**	**10.4**	**10.4**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Reclamation Area 31 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	5.7	5.7	5.7
2	0	5.9	5.9	5.9
3	0	15.8	15.8	15.8
4	0	8.4	8.4	8.4
5	0	3.4	3.4	3.4
6	0	1.8	1.8	1.8
7	0	1.4	1.4	1.4
8	0	5.8	5.8	5.8
9	0	6.8	6.8	6.8
10	0	15.8	15.8	15.8
11	0	2.7	2.7	2.7
12	0	3	3	3.0
13	0	64.6	64.6	64.6
14	0	3.6	3.6	3.6
15	0	3.1	3.1	3.1
16	0	4.9	4.9	4.9
17	0	18.8	18.8	18.8
18	0	7.5	7.5	7.5
19	0	26.3	26.3	26.3
20	0	4.9	4.9	4.9
21	0	10.3	10.3	10.3
22	0	37.9	37.9	37.9
23	0	9.8	9.8	9.8
24	0	19	19	19.0
25	0	8.4	8.4	8.4
26	0	14.7	14.7	14.7
27	0	4.6	4.6	4.6
28	0	2.1	2.1	2.1
29	0	19.6	19.6	19.6
30	0	112.4	112.4	112.4
Average	**0.0**	**15.0**	**15.0**	**15.0**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Reclamation Area 32 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	34.5	34.5	28.4
2	0	0.8	0.8	0.0
3	81.1	0	81.1	75.0
4	32.8	0	32.8	26.7
5	0	4.2	4.2	0.0
6	0	7.9	7.9	1.8
7	0	23.7	23.7	17.6
8	0	17	17	10.9
9	0	10.1	10.1	4.0
10	0	27.1	27.1	21.0
11	0	2.8	2.8	0.0
12	13.5	61.8	75.3	69.2
13	0	31.2	31.2	25.1
14	0	6.5	6.5	0.4
15	0	8.4	8.4	2.3
Average	**8.5**	**15.7**	**24.2**	**18.9**

Excess Annual Production	6.1

If average annual production is greater than 10%, substract the average excess

Reclamation Area 33 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	0.5	0.5	0.5
2	0	6	6	6.0
3	0	14.1	14.1	14.1
4	0	50.8	50.8	50.8
5	0	25.8	25.8	25.8
6	0	11.8	11.8	11.8
7	1.7	35.9	37.6	37.6
8	0	13	13	13.0
9	0	31.2	31.2	31.2
10	0	30.9	30.9	30.9
11	0	55.9	55.9	55.9
12	0	9.6	9.6	9.6
13	0	29.4	29.4	29.4
14	0	10.9	10.9	10.9
15	0	25.1	25.1	25.1
Average	**0.1**	**23.4**	**23.5**	**23.5**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Reclamation Area 34 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	13.9	13.9	13.9
2	0	57.1	57.1	57.1
3	0	32.5	32.5	32.5
4	0	31.6	31.6	31.6
5	0	16.8	16.8	16.8
6	0	17.9	17.9	17.9
7	0	7.6	7.6	7.6
8	0	15.7	15.7	15.7
9	0	27.7	27.7	27.7
10	0	24.6	24.6	24.6
11	0	14	14	14.0
12	0	36.6	36.6	36.6
13	0	0	0	0.0
14	0	7.5	7.5	7.5
15	0	18	18	18.0
Average	**0.0**	**21.4**	**21.4**	**21.4**

Excess Annual Production	0.0

If average annual production is greater than 10%, substract the average excess

Appendix C: Complete Species List

Keenesburg Mine Reclamation Species List 2020

Scientific Name	Common Name	Area 25	Area 29	Area 30	Area 31	Area 32	Area 33	Area 34
Grass: Annual Native								
Cenchrus longispinus	mat sandbur					10.0		
Munroa squarrosa	false buffalograss	20.0		33.3	13.3	20.0		73.3
Vulpia octoflora	sixweeks fescue		88.2	94.4	93.3	20.0		13.3
Grass: Annual Introduced								
Bromus arvensis	field brome						10.0	
Bromus tectorum	cheatgrass	100.0	100.0	100.0	100.0	100.0	100.0	66.7
Grass: Perennial Desirable (Cool)								
Achnatherum hymenoides	Indian ricegrass	13.3		5.6				26.7
Agropyron cristatum	crested wheatgrass	3.3					10.0	6.7
Bromus inermis	smooth brome	3.3						
Cyperus schweinitzii	Schweinitz's flatsedge							6.7
Elymus elymoides	squirreltail							13.3
Hesperostipa comata	needle and thread			5.6				
Pascopyrum smithii	western wheatgrass	10.0					30.0	
Pseudoroegneria spicata	bluebunch wheatgrass							6.7
Grass: Perennial Desirable (Warm)								
Andropogon hallii	sand bluestem	30.0	82.4	94.4	100.0	20.0	30.0	46.7
Aristida purpurea	purple threeawn						10.0	6.7
Bouteloua curtipendula	sideoats grama	10.0	47.1	50.0	46.7	60.0	20.0	33.3
Bouteloua gracilis	blue grama	36.7	100.0	83.3	60.0	80.0	100.0	100.0
Calamovilfa longifolia	prairie sandreed	86.7	100.0	72.2	100.0	100.0	100.0	93.3
Panicum virgatum	switchgrass	16.7		16.7	33.3	80.0	100.0	
Pleuraphis jamesii	James' galleta	3.3						
Schizachyrium scoparium	little bluestem	10.0	11.8	22.2	20.0			26.7
Sorghastrum nutans	Indiangrass		29.4	22.2	6.7			6.7
Sporobolus cryptandrus	sand dropseed	100.0	41.2	100.0	100.0	40.0	100.0	100.0

Keenesburg Mine Reclamation Species List 2020 (continued)

Scientific Name	Common Name	Area 25	Area 29	Area 30	Area 31	Area 32	Area 33	Area 34
Forbs: Annual & Biennial Native								
Amaranthus retroflexus	redroot amaranth	16.7				40.0		33.3
Argemone polyanthemos	crested pricklypoppy	33.3	11.8	5.6				13.3
Chamaesyce glyptosperma	ribseed sandmat		11.8	66.7	6.7			13.3
Croton texensis	Texas croton	6.7						
Machaeranthera bigelovii	Bigelow's tansyaster		11.8	16.7	6.7			6.7
Polygonum ramosissimum	bushy knotweed					10.0	20.0	
Forbs: Annual & Biennial Introduced								
Salsola tragus	prickly Russian thistle					30.0		
Forbs: Perennial Native								
Ambrosia psilostachya	Cuman ragweed	3.3				30.0	10.0	
Cirsium undulatum	wavyleaf thistle				6.7			6.7
Lithospermum incisum	narrowleaf stoneseed		5.9					
Mentzelia nuda	bractless blazingstar	3.3						
Physalis hispida	prairie groundcherry		5.9		20.0			6.7
Ratibida columnifera	upright prairie coneflower		5.9				20.0	
Forbs: Perennial Introduced								
Gypsophila paniculata	baby's breath		5.9		6.7			
Subshrubs/Shrubs/Succulents: Perennial Native								
Artemisia filifolia	sand sagebrush	6.7	22.6	5.6	6.7			
Opuntia phaeacantha	tulip pricklypear	16.7	48.4	61.1	60.0			46.7
Yucca glauca	soapweed yucca				20.0			6.7

Appendix D: Precipitation Data 1993 – 2020

Keenesburg Mine Precipitation Data 1993-2020

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Sept-Jul	% from Avg Yr	% from Avg Sep-Jul
1993	1	0.05	0.05	2.37	1.2	3	0.38	0.2	1.9	1.2	0.8	0	12.15			
1994	0.4	0.21	0.17	1.24	0.59	0.45	1.01	1.49	0.99	1.7	0.6	0.33	9.18	7.97	-32%	-34%
1995	0.13	0.3	0.57	2.49	4.53	4.55	0.58	0.47	1.07	0.3	0.21	0.04	15.24	16.77	13%	39%
1996	0.32	0.29	0.77	0.2	2.44	2.4	2.25	0.52	2.22	0.67	0.35	0	12.43	10.29	-8%	-15%
1997	0.7	0.58	0.46	1.18	1.17	1.32	1.06	3.51	0.68	1.17	0.84	0.39	13.06	9.71	-3%	-20%
1998	0.14	0.2	0.67	1.34	2.33	2.53	1.09	2.03	0.08	1.95	0.44	0.51	13.31	11.38	-1%	-6%
1999	0.49	0	0.12	4.62	4.21	1.29	2.02	3.16	2.12	0.13	0.4	0.06	18.62	15.73	38%	30%
2000	0.05	0	1.35	0.55	2.64	0.78	1.62	0.9	1.42	0.21	1.1	0.31	10.93	9.7	-19%	-20%
2001	0.61	0.45	0.73	2.41	4.12	1.4	2.92	0.83	0.84	0.51	0.76	0.07	15.65	15.68	16%	30%
2002	0.55	0	0.68	0.3	1.04	1.22	0.49	1.15	0.91	1	0.38	0.05	7.77	6.46	-42%	-47%
2003	0	0.5	2.77	1.93	3.12	1.57	0.35	1.18	0	0.1	0.3	0.45	12.27	12.58	-9%	4%
2004	0.5	0.41	0.04	1.69	1.25	1.55	0.56	0.89	1.31	0.96	0.73	0	9.89	6.85	-26%	-43%
2005	0.23	0.1	0.46	2.25	1.45	2.78	0.51	1.12	0.2	3.01	0.72	0.31	13.14	10.78	-2%	-11%
2006	0.07	0	0.67	0.52	0.21	0.16	2.12	0.95	0.45	1.6	0.45	3.42	10.62	7.99	-21%	-34%
2007	0.79	0.07	0.4	1.58	4.48	0.3	1.44	3.68	0.57	0.53	0.3	1.08	15.22	14.98	13%	24%
2008	0	0.16	0.43	1.03	1.74	1.66	0.56	6.3	1.06	0.63	0.19	0.61	14.37	8.06	7%	-33%
2009	0.07	0.02	0.62	3.51	1.81	2.02	3.17	0.65	1.07	1.92	0.75	0.89	16.5	13.71	23%	14%
2010	0.1	0.34	0.89	2.62	2.28	2.13	1.52	0.75	0.04	0.75	0.12	0.24	11.78	14.51	-12%	20%
2011	0.18	0.51	0	1.43	6.31	1.34	2.45	1.11	0.78	2.86	0.5	0.66	18.13	13.37	35%	11%
2012	0	0.56	0	1.3	1.87	0.63	0.73	0.14	1.56	1.22	0.47	0.22	8.7	9.89	-35%	-18%
2013	0.11	0.62	0.95	1.39	1.67	0.6	1.04	1.55	3.69	1.08	0.19	0.09	12.98	9.85	-4%	-18%
2014	1.24	0.26	0.83	0.48	4.9	2.67	2.03	1.61	1.96	0.45	0.41	0.45	17.29	17.46	29%	45%
2015	0.31	0.34	0.36	2.45	6.79	2.03	1.11	0.42	0.16	1.56	0.83	0.82	17.18	16.66	28%	38%
2016	0.28	0.74	0.64	3.57	2.81	1.99	3.04	0.69	0.45	0.37	0	0	14.58	16.44	8%	36%
2017	0.53	0.08	0.95	1.51	4.5	1.13	0.72	2.62	1.1	1.19	0.15	0.05	14.53	10.63	8%	-12%
2018	0.21	0.29	1	0.65	3.01	4.77	2.13	0.83	0.33	0.56	0.1	0	13.88	14.55	3%	21%
2019	0.48	0.42	2.36	1.22	2.62	2.03	1.36	1.42	0.72	0.67	0.84	0.31	14.45	11.48	7%	-5%
2020	0.05	0.57	2.44	0.78	1.24	1	1.21	0.47					7.76	9.83	-42%	-18%
Mean (1993-2019)	**0.35**	**0.28**	**0.70**	**1.70**	**2.78**	**1.79**	**1.42**	**1.49**	**1.03**	**1.05**	**0.49**	**0.43**	**13.49**	**12.06**		

Appendix E: Cover Transect Photographs

Reclamation Area 25

Transect 1

Transect 2

Transect 3

Transect 4

Transect 5

Transect 6

Transect 7

Transect 8

Reclamation Area 25

Transect 9

Transect 10

Transect 11

Transect 12

Transect 13

Transect 14

Transect 15

Transect 16

Reclamation Area 25

Transect 17

Transect 18

Transect 19

Transect 20

Transect 21

Transect 22

Transect 23

Transect 24

Reclamation Area 25

Transect 25

Transect 26

Transect 27

Transect 28

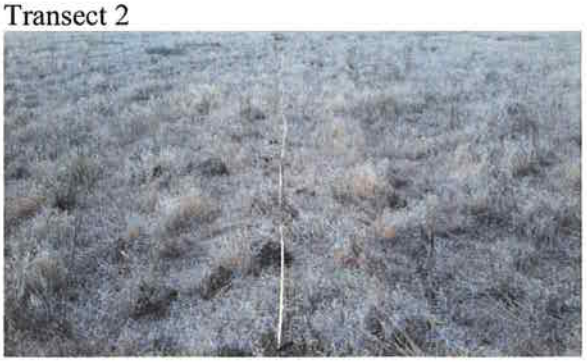
Transect 29

Transect 30

Reclamation Area 29

Transect 1

Transect 2



Reclamation Area 29

Transect 3

Transect 4

Transect 5

Transect 6

Transect 7

Transect 8

Transect 9

Transect 10

Reclamation Area 29

Transect 11

Transect 12

Transect 13

Transect 14

Transect 15

Transect 16

Transect 17

Reclamation Area 30

Transect 1

Transect 2

Transect 3

Transect 4

Transect 5

Transect 6

Transect 7

Transect 8

Reclamation Area 30

Transect 9

Transect 10

Transect 11

Transect 12

Transect 13

Transect 14

Transect 15

Transect 16

Reclamation Area 30

Transect 17

Transect 18

Reclamation Area 31

Transect 1

Transect 2

Transect 3

Transect 4

Transect 5

Transect 6

Reclamation Area 31

Transect 7

Transect 8

Transect 9

Transect 10

Transect 11

Transect 12

Transect 13

Transect 14

Reclamation Area 31

Transect 15

Reclamation Area 32

Transect 1

Transect 2

Transect 3

Transect 4

Transect 5

Transect 6

Reclamation Area 32

Transect 7

Transect 8

Transect 9

Transect 10

Reclamation Area 33

Transect 1

Transect 2

Transect 3

Transect 4

Reclamation Area 33

Transect 5

Transect 6

Transect 7

Transect 8

Transect 9

Transect 10

Reclamation Area 34

Transect 1

Transect 2

Reclamation Area 34

Transect 3

Transect 4

Transect 5

Transect 6

Transect 7

Transect 8

Transect 9

Transect 10

Reclamation Area 34

Transect 11

Transect 12

Transect 13

Transect 14

Transect 15

Appendix F: Pest & Disease Inspection Reports

Keenesburg Mine Second Quarter 2020
Pest & Disease Inspection

Habitat Management
Environmental & Natural Resource Services

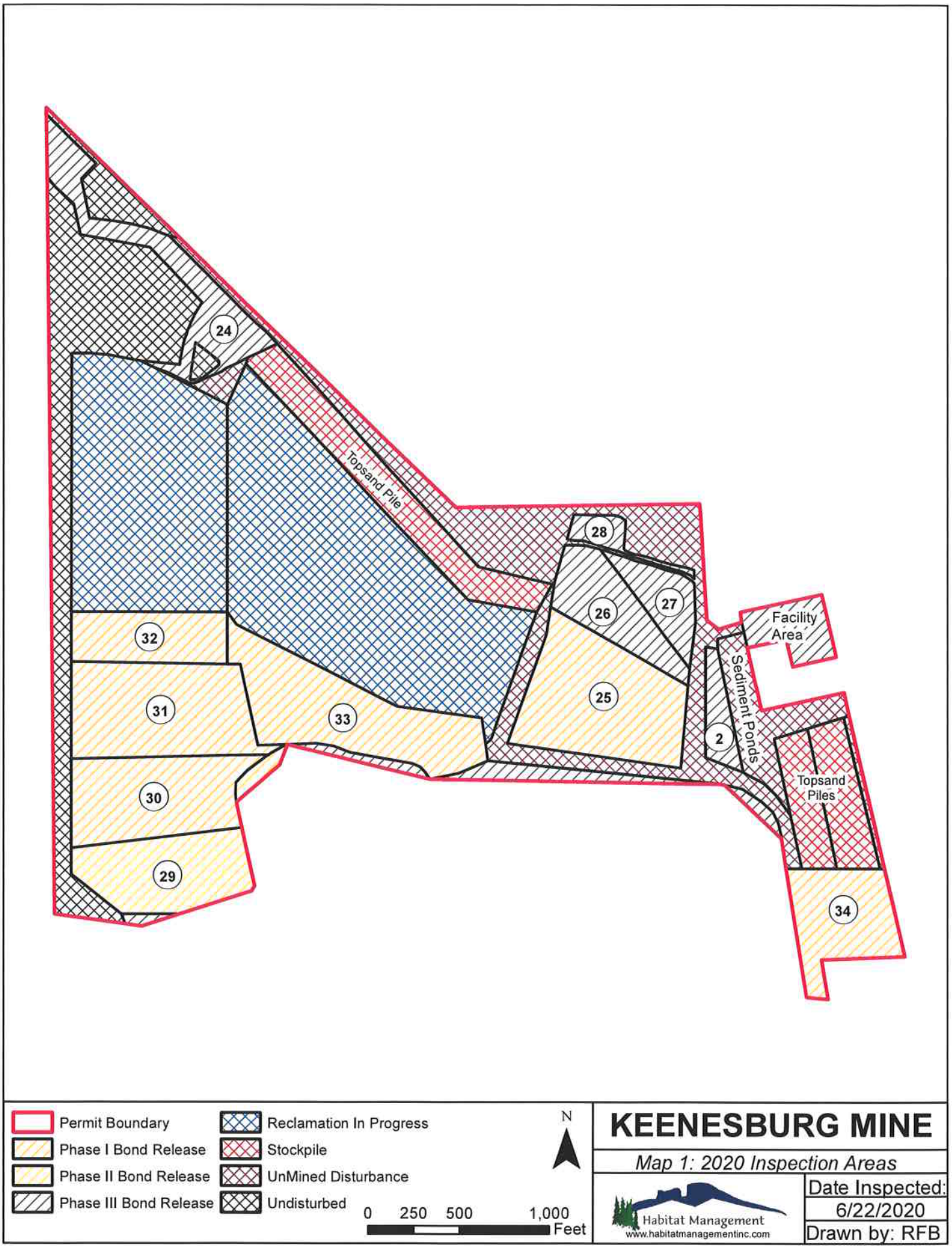
On June 22, 2020 operational, bonded reclaimed and shop areas at the Keenesburg Mine were inspected for plant pests, plant diseases and noxious weeds that could or have affected establishment of vegetation on reclaimed lands. The following areas were inspected:

- Office/shop/facility area;
- Topsoil stockpiles;
- Bonded reclamation;
- Permanent sediment ponds;
- Mine roads; and
- Undisturbed land within the permit boundary.

These areas are depicted on Map 1.

Plant pests or diseases were not observed within the areas inspected. The vegetation has not been adversely affected by plant pests. Areas affected by infestation or blight were not identified during this inspection. No areas were observed where noxious weeds, plant pests or plant disease had adversely impacted the normal growth and establishment of vegetation on reclaimed lands. There was noticeable growth of cheatgrass in some areas this spring; pre-emergent treatment should be conducted later in the year in these areas.

w/attachment



KEENESBURG MINE

Map 1: 2020 Inspection Areas

Habitat Management
www.habitatmanagementinc.com

Date Inspected: 6/22/2020

Drawn by: RFB

Keenesburg Mine Third Quarter 2020
Pest & Disease Inspection

Habitat Management
Environmental & Natural Resource Services

On September 29, 2020 operational, bonded reclaimed and shop areas at the Keenesburg Mine were inspected for plant pests, plant diseases and noxious weeds that could or have affected establishment of vegetation on reclaimed lands. The following areas were inspected:

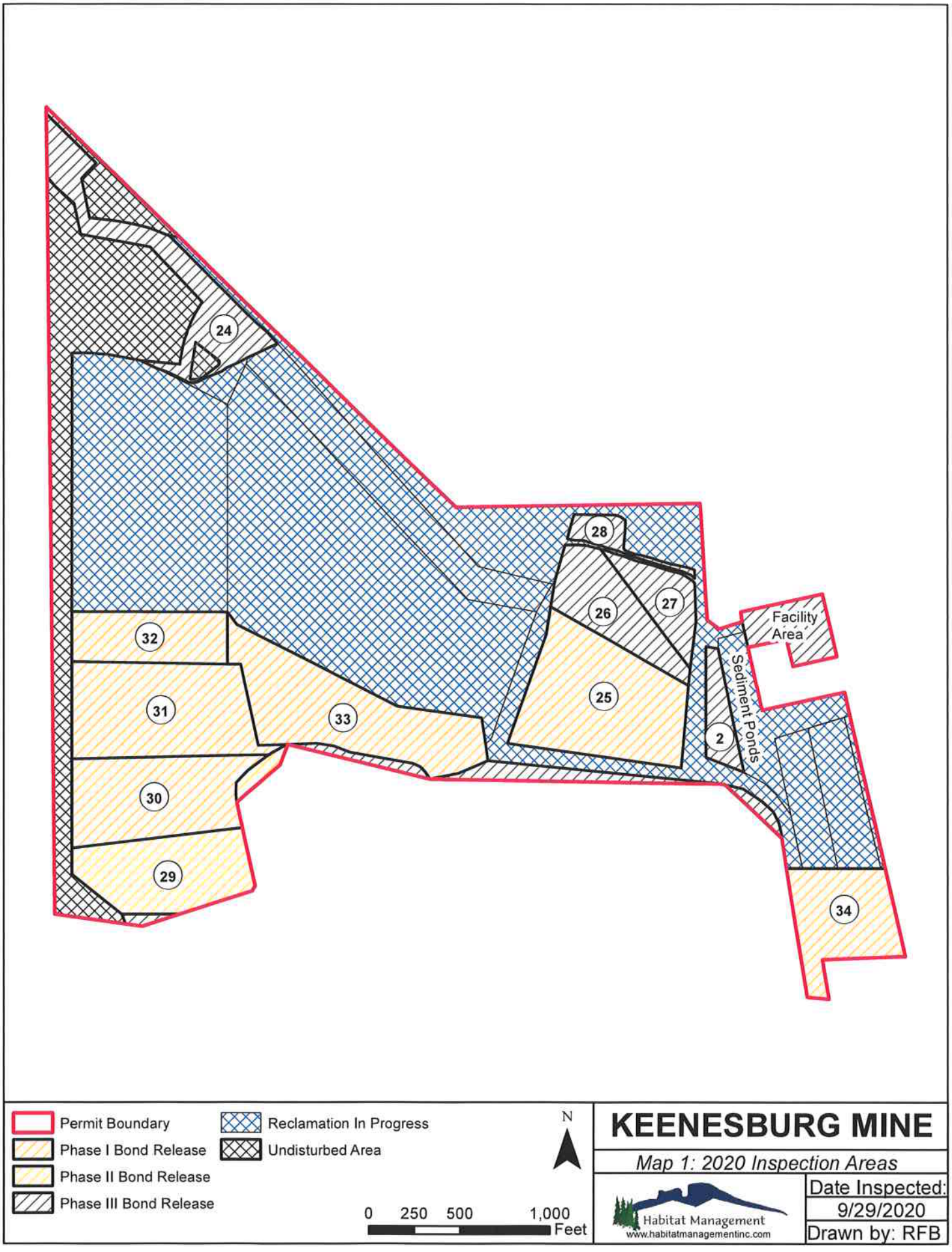
- Office/shop/facility area;
- Bonded reclamation;
- Permanent sediment ponds; and
- Undisturbed land within the permit boundary.

These areas are depicted on Map 1.

Plant pests or diseases were not observed within the areas inspected. The vegetation has not been adversely affected by plant pests. Areas affected by infestation or blight were not identified during this inspection. No areas were observed where noxious weeds, plant pests or plant disease had adversely impacted the normal growth and establishment of vegetation on reclaimed lands.

Pre-emergent treatments for cheatgrass control were applied during the late summer on established reclamation units.

w/attachment



KEENESBURG MINE

Map 1: 2020 Inspection Areas

Habitat Management
www.habitatmanagementinc.com

Date Inspected: 9/29/2020

Drawn by: RFB

Keenesburg Mine Fourth Quarter 2020
Pest & Disease Inspection

Habitat Management
Environmental & Natural Resource Services

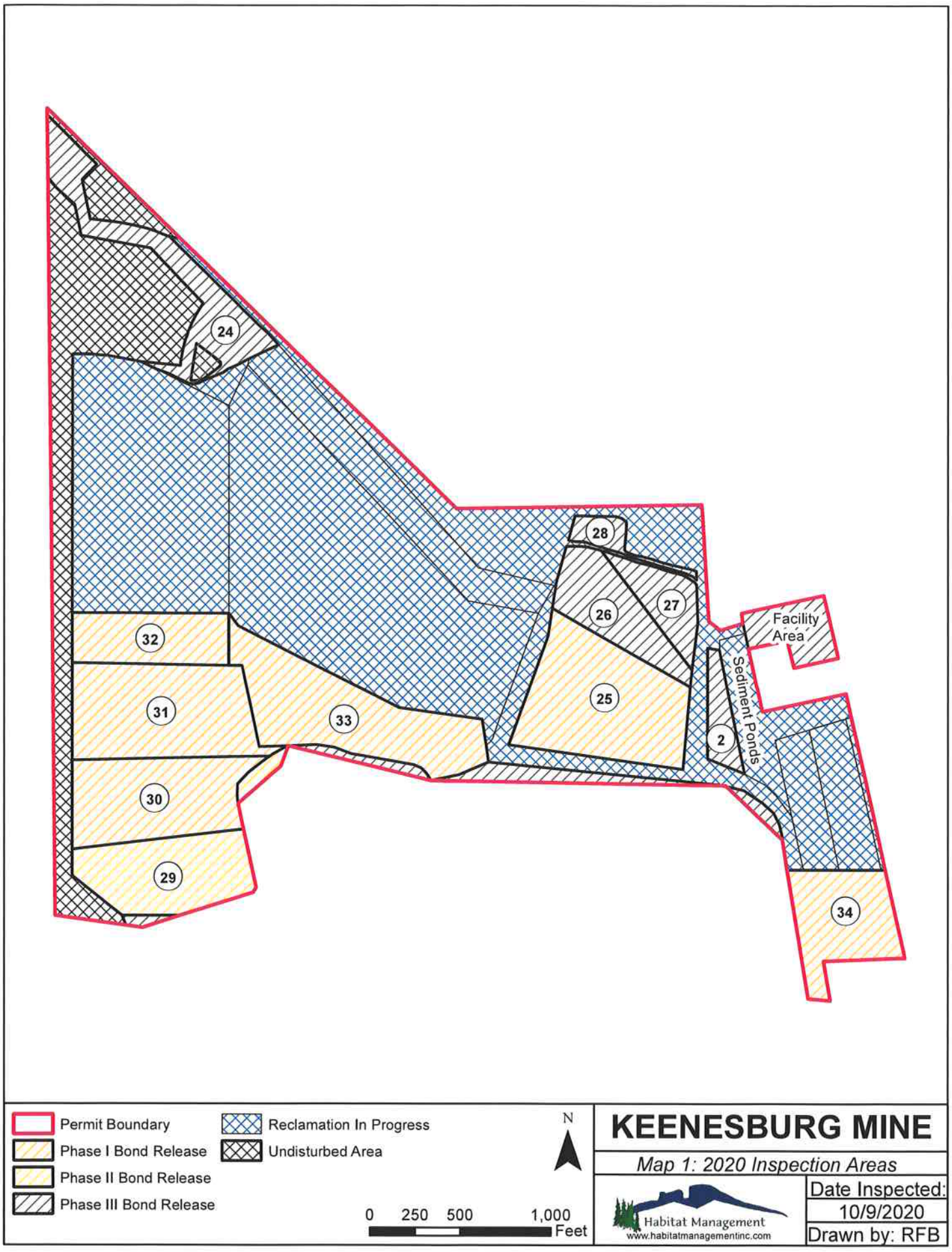
On October 9, 2020 operational, bonded reclaimed and shop areas at the Keenesburg Mine were inspected for plant pests, plant diseases and noxious weeds that could or have affected establishment of vegetation on reclaimed lands. The following areas were inspected:

- Office/shop/facility area;
- Bonded reclamation;
- Permanent sediment ponds; and
- Undisturbed land within the permit boundary.

These areas are depicted on Map 1.

Plant pests or diseases were not observed within the areas inspected. The vegetation has not been adversely affected by plant pests. Areas affected by infestation or blight were not identified during this inspection. No areas were observed where noxious weeds, plant pests or plant disease had adversely impacted the normal growth and establishment of vegetation on reclaimed lands.

w/attachment



KEENESBURG MINE

Map 1: 2020 Inspection Areas

Habitat Management
www.habitatmanagementinc.com

Date Inspected: 10/9/2020

Drawn by: RFB