

# **Savage and Savage** *Environmental*

*practical solutions for environmental issues*

**4610 Haystack Drive  
Windsor, Colorado 80550**

**970 674 8080 telephone  
savageandsavage@earthlink.net**



September 9, 2022

Leigh Simmons, Environmental Protection Specialist  
Colorado Division of Reclamation, Mining & Safety  
1313 Sherman Street, Room 215  
Denver, Colorado 80203

Re: SL-16 Application for Phase II Bond Release, West Elk Mine (CDRMS file C-1980-007)

Mr. Simmons:

Attached is the Phase II bond and liability release application for selected areas of the Mountain Coal Company, LLC West Elk Mine (CDRMS file C-1980-007) east of Somerset in Gunnison and Delta Counties, Colorado.

This application seeks bond and liability release for successful Phase II reclamation at the mine site under CRS 34-33-125(9)(c) and Rule 3.03. Copies of the required notifications, application information, certification, and public notice are attached for review. The public notice will be published in the *Delta County Independent* September 7, 14, 21, and 28, 2022. As soon as publication is complete a proof of publication will be e-mailed to you. When all the certified mail receipts have been returned to us, copies will be forwarded to you.

If any additional materials are required, or if there are any questions regarding the information presented, please contact me or Nicki Poulos at Mountain Coal.

Sincerely,

Michael S. Savage  
Principal

enclosure: West Elk Mine Phase II bond release application (SL-16)

c: Nicki Poulos, Mountain Coal Company, LLC  
Gunnison County Planning Office

**MOUNTAIN COAL COMPANY, LLC  
WEST ELK MINE  
CDRMS FILE C-1980-007  
PHASE II BOND RELEASE APPLICATION (SL-16)**

**Date of Request:** September 9, 2022

**Permittee:** Mountain Coal Company, LLC (MCC)

**Permit Number:** C-1980-007

**Initial Permit Approval Date:** July 1981

**Mine Name:** West Elk Mine

**Bond Release Phase Requested:** Phase II

|                        |  |                      |
|------------------------|--|----------------------|
| <b><u>Acreage:</u></b> | <b><u>Current Permit Area:</u></b>     | $\pm 19,854.9$ acres |
|                        | <b><u>Maximum Area Disturbed:</u></b>  | $\pm 554.53$ acres   |
|                        | <b><u>Area Sought for Release:</u></b> | $\pm 20.74$ acres    |

**Bonding Company:** Indemnity National Insurance Company

**Bond Number:** N-7004698

**Amount of Bond Release Requested:** MCC is requesting 25% of the applicable reclamation bond amount for Phase II bond release areas. This amount has been preliminarily calculated to be \$109,926.02 based on CDRMS methods employed previously for the West Elk Mine bond releases.

**Total Bond Amount Currently Held:** \$15,000,000.00

**Current Actual Bond Liability Amount (as of June 24, 2022):** \$11,756,466.23

The amount requested for release will be based on the amount determined to apply to the reclaimed surface disturbance, drill holes, sites, and roads. This amount is being currently calculated. When the bond amount applicable to the reclamation is determined, MCC requests a total of 85% of the applicable bond amount for areas where Phase II bond release is sought in accordance with CDRMS Rule 3.03.1(2)(b). The amount released will be the difference between the value of 85% of the applicable bond amount and that amount previously released for Phase I for the reclaimed areas where Phase II bond release is now requested under SL-16.

Based on the CDRMS method for calculating reclamation bond to be released for Phase II, the amount requested for release is \$109,926.02.

**Legal Description of the Area Requested for Bond Release:** The following table, Mountain Coal Company West Elk Mine 2022 Phase II Bond Release Eligible Reclaimed Areas presents the locations or sites to be considered for bond release under this application. The reclaimed areas requesting bond release are located within the current permit area and are found within Sections 33-36, T13S, R90 W; and Sections 1-3, T14S, R90W; all within the 6th Prime Meridian, Gunnison County, Colorado.

**Mountain Coal Company West Elk Mine  
2022 Phase II Bond Release Eligible Reclaimed Areas**

| Hole #   | Hole # (as-drilled) | Hole Descriptor  | Road Area (acres) | Pad Area (acres) | Reclamation Date |
|--|---------------------|------------------|-------------------|------------------|------------------|
| E2-56  | E2-54               | E2-54            | 0                 | 1.07             | 2012             |
| E2-55  | E2-52               | E2-52            | 0                 | 0                | 2012             |
| E2-54  | E2-51               | E2-51            | 0                 | 0                | 2012             |
| E2-13  |                     | E2-13            | 0.22              | 0.47             | 2013             |
| E3-72  |                     | E3-72            |                   |                  | 2014             |
| E3-67.5  | E3-68               | E3-68            |                   | 0.91             | 2014             |
| E3-65  |                     | E3-65            |                   |                  | 2014             |
| E3-64  |                     | E3-64            | 0.82              | 0.72             | 2014             |
| E3-52  | E3-51               | E3-51            |                   | 0.5              | 2014             |
| E3-30  | E3-29               | E3-29            | 0.5               | 0.55             | 2015             |
| E4-16  | E4-15               | E4-15            | 0                 | 0.59             | 2016             |
| E4-12.5  | E4-16               | E4-16            | 0.11              | 0.58             | 2016             |
| E4-9   | E4-17               | E4-17            | 0                 | 0.58             | 2016             |
| E5-75  | E5-1                | E5-1             | 0.16              | 1.13             | 2017             |
| E5-74  | E5-2                | E5-2             |                   |                  | 2017             |
| E5-73  | E5-3                | E5-3             |                   |                  | 2017             |
| E5-69  | E5-4                | E5-4             | 0.07              | 0.73             | 2017             |
| E5-65  | E5-5                | E5-5             | 0                 | 0.46             | 2017             |
| E5-61  | E5-6                | E5-6             | 0.2               | 0.54             | 2017             |
| E5-57.5  | E5-7                | E5-7             |                   |                  | 2017             |
| E5-54  | E5-8                | E5-8             | 0.12              | 0.8              | 2017             |
| E5-50  | E5-9                | E5-9             | 0.06              | 0.82             | 2017             |
| E5-46  | E5-10               | E5-10            | 0                 |                  | 2017             |
| E5-42.5  | E5-11               | E5-11            | 0                 | 0.62             | 2017             |
| E5-39  | E5-12               | E5-12            | 0                 | 0.82             | 2017             |
| E5-35  | E5-13               | E5-13            | 0                 |                  | 2017             |
| E5-31  | E5-14               | E5-14            | 1.09              | 0.54             | 2017             |
| E5-27.5  | E5-15               | E5-15            | 1.44              | 0.62             | 2017             |
| E5-24  | E5-16               | E5-16            | 0.91              | 1.16             | 2017             |
| E5-20  | E5-17               | E5-17            | 0                 | 0.32             | 2017             |
| E5-16  | E5-18               | E5-18            | 0                 | 0.51             | 2017             |
|  |                     | 10LWE5X40        | on ATV trl        |                  | 2017             |
|  |                     | 11LWE5X40        | same as E5-12     |                  | 2017             |
|  |                     | 10LWE6X62        |                   |                  | 2017             |
|  |                     | 11LWE6X53        |                   |                  |                  |
| 5-11-1   |                     | 5-11-1 Mon. Well |                   |                  | 2015             |
| 5-12-1   |                     | 5-12-1 Mon. Well |                   |                  | 2015             |
| <b>Eligible Reclaimed Acreage (Road, Pad, Total)</b> |                     |                  | <b>5.7</b>        | <b>15.04</b>     | <b>20.74</b>     |

**Map:** Figure 1. (MCC Reclamation) contained in the mining and reclamation plan permit document identifies the areas requested for bond and liability release.

**Dates of Reclamation Work:** Reclamation work was completed in the areas requested for release between 2012 and 2017 by MCC. Documentation of reclamation work is included within the permit document and CDRMS files.

**Description of Bond Release Amount Request:** This bond release application requests release of bond and liability for successfully establishing vegetation supporting the post-mining land use, meeting the approved success standard for cover, and demonstrating that suspended solids contributions to runoff or streamflow from the eligible reclaimed areas do not exceed pre-mining (native adjacent area) levels of suspended solids contributions.

The sedimentology demonstration in this application shows that the areas reclaimed to the undeveloped land post-mining land use meet the requirements for erosion control and meet the Phase II bond release vegetation standard for cover and species composition.

The areas requested for release are in conformance with the approved post-mining land use(s) which have been implemented. Remaining reclamation at the mine site includes any required repair to reclaimed areas due to minor surficial erosion, weed control, and maintenance. All mining related disturbance has been reclaimed in accordance with the approved reclamation permit.

**Protection of the Hydrologic Balance:** Annual Hydrology Reports (AHR) have been submitted annually for the mine and the information within the AHR's has demonstrated the continued protection of the hydrologic balance at the mine site and off-site. Self-monitoring of the sediment control system has been continual, and where regular inspections have revealed concerns with protection of the hydrologic balance, protection measures have been implemented and maintained.

**Notice to Parties Identified in Rule 3.03.2(1):** Potentially affected parties, Gunnison and Delta Counties, and governmental agencies as specified in CDRMS Rule 3.03.2(1) were noticed of the bond release application, and copies of those certified mail notices and proof of receipt are appended. A copy of the letter to Gunnison County requesting retention of the public copy of the bond release application is appended.

**Newspaper Public Notice:** A copy of the newspaper public notice to be published in the Delta County Independent is attached. A copy of the proof of publication will be forwarded for inclusion when received.

### **Replacement of Adequate Topsoil Depths**

As part of the Phase II bond release evaluation, CDRMS assesses whether a permittee has replaced adequate depths of topsoil material to satisfy the requirements of the mining and reclamation plan and provide sufficient plant growth medium for revegetation.

The approved reclamation plan for the West Elk Mine requires the replacement of six (6) inches of topsoil under the approved reclamation plan.

During the course of the vegetation study in support of this Phase II bond release application, topsoil depth verifications were undertaken. Whenever a vegetation sample point for cover was established, a topsoil core hole was bored with a 2¼ inch auger to determine the topsoil replacement depth at the sample point. Core material from the hole was inspected to verify topsoil replacement and identify the depth of replacement. Topsoil replacement depth was concluded to be that depth at which the auger intersected rock or parent material (C horizon). The following table summarizes the results of the topsoil depth verifications by location.

**West Elk 2022 Phase II Bond Release  
Topsoil Replacement Depths**

| <b>Sample #</b>                          | <b>Native Soil Series</b>                 | <b>Replacement Depth (inches)</b> |
|--|---|-----------------------------------|
| 1  | Shawa-Sandia Family-Kolob Family Complex  | 16.5                              |
| 2  | Shawa-Sandia Family-Kolob Family Complex  | 22                                |
| 3  | Taterheap-Papaspila Complex (5-40%)       | 36                                |
| 4  | Shawa-Sandia Family-Kolob Family Complex  | 18                                |
| 5  | Taterheap-Papaspila Complex (5-40%)       | 25                                |
| 6  | Taterheap-Papaspila Complex (5-40%)       | 14                                |
| 7  | Taterheap-Papaspila Complex (5-40%)       | 26                                |
| 8  | Wetopa-Wesdy Complex (5-65%)              | 11.5                              |
| 9  | Shawa-Sandia Family-Kolob Family Complex  | 17                                |
| 10                                       | Shawa-Sandia Family-Kolob Family Complex  | 14.5                              |
| 11                                       | Shawa-Sandia Family-Kolob Family Complex  | 19                                |
| 12                                       | Wetopa-Wesdy Complex (5-65%)              | 13                                |
| 13                                       | Taterheap-Papaspila Complex (5-40%)       | 17                                |
| 14                                       | Herm-Fughes-Kolob family complex (25-40%) | 18                                |
| 15                                       | Herm-Fughes-Kolob family complex (25-40%) | 14                                |
| <b>Average Replacement Topsoil Depth</b> |   | <b>18.8</b>                       |

**Achievement of Natural Surface Runoff Levels**

In order to satisfy one of the CDRMS requirements for Phase II bond release, reclaimed areas must be shown to contribute equal or less sediment to the receiving waters downstream than adjacent undisturbed areas. A sedimentology evaluation of the reclaimed areas and adjacent undisturbed areas to assess the projected sediment yield was undertaken using the Universal Soil Loss Equation. The 2022 sedimentology evaluation report, Mountain Coal Company, LLC, West Elk Mine (C-1980-007), Somerset, Colorado, 2022 Phase II Bond Release (SL-16), Sedimentology Evaluation is appended to this bond release application.

The projected mean sediment yield from the reclaimed areas is 0.173 tons/acre/year (with individual reclaimed areas ranging from 0.034 to 0.320 tons/acre/year). Projected average sediment yield from adjacent undisturbed areas is 4.938 tons/acre/year (individual areas ranging from 0.719 to 11.245 tons/acre/year).

The results of the USLE calculations illustrate that the eligible reclaimed areas are projected to produce less sediment than the adjacent undisturbed areas. The equation verifies what is expected in this case and also what has been seen at other reclaimed sites in Colorado. Based on the results of the sedimentology evaluation, the reclaimed areas at the West Elk Mine qualify for Phase II bond release at this time.

### **Achievement of Revegetation Success**

Comparison of the reclaimed areas values for total vegetation cover and species composition with the applicable revegetation success criteria indicates whether revegetation has been successful and compliant with requirements for Phase II bond release. CDRMS Rule 3.03.1(2) provides for release of bond, “upon the establishment of vegetation which supports the approved post-mining land use and which meets the approved success standard for cover pursuant to 4.15.8...” The tables below allow the comparison of the parameter values from the 2022 sampling at the reclamation areas with the revegetation criteria to be achieved.

The report, Mountain Coal Company, LLC, West Elk Mine (C-1980-007), Somerset, Colorado, 2022 Phase II Bond Release Vegetation Report (SL-16) documents achievement of the applicable revegetation bond release criteria for reclaimed areas and is appended to this application.

A summary of the applicable revegetation success criteria and sampled values for 2022 for Phase II bond release at the West Elk Mine follows.

### **Phase II Bond Release Reclaimed and Revegetated Areas Reclamation Success: Total Vegetation Cover (2022)**

Demonstration of revegetation success at the West Elk Mine for Phase II bond release requires that the total vegetation cover at the eligible reclaimed areas meets or exceeds the value of the total vegetation cover success criterion established from historic record sampling. The revegetation total cover success criterion is 53.04 percent.

#### **Reclamation Success: Total Vegetation Cover (2022)**

|                                       | <b>2022 Reclaimed Areas</b> |
|---------------------------------------|-----------------------------|
| $\bar{X}$                             | 73.20%                      |
| S                                     | 7.44%                       |
| Number of samples                     | 15                          |
| Number of samples for sample adequacy | 2                           |

Based on the results of the 2022 quantitative sampling, the reclamation areas exceeded the revegetation total live vegetation cover success criterion of 53.04 percent, thereby meeting the revegetation success criterion and supporting the post-mining land use.

## Reclamation Success: Species Composition (2022)

The West Elk Mine permit document specifies that to meet the requirements of the revegetation success criterion for species composition, species composition on any applicable reclaimed areas will be successful when there are at least three perennial species of which two are cool season perennial grasses and one is a cool season perennial forb with no one component of the above three species comprising greater than 40% relative cover nor less than 3% relative cover. The 2022 reclaimed areas exceeded the species composition requirement with four perennial cool season graminoids and one perennial cool season forb.

### Reclamation Success: Species Composition (2022)

|   | Success Standard | 2022 Reclaimed Areas |
|---|------------------|----------------------|
| <b>Total Perennial Species*</b><br>(>3% rel. cover) | 3                | 5                    |
| <b>Cool Season Grasses*</b>                         | 2                | 4                    |
| <b>Cool Season Forbs*</b>                           | 1                | 1                    |
| <b>Relative Importance</b><br>(3%<x<40%)            | All Species      | All Species          |

\* Numbers reflect only those species meeting the relative importance percentage limitation and does not include any prohibited species

The reclaimed areas exceeded the requirements for species composition, thereby meeting the revegetation success criterion and supporting the post-mining land use.

## Reclaimed Areas Revegetation Conclusions

### Vegetation Cover

Mean reclaimed area total vegetation cover (73.20%) exceeded the revegetation success standard for total vegetation cover (53.04%), thereby meeting the revegetation success criterion and supporting the post-mining land use.

These results indicate the establishment of a predominantly perennial, native vegetation community at the reclaimed areas, with total vegetation cover greater than that of the revegetation success criteria.

### Species Composition

The reclaimed areas exceeded the required number of perennial cool season grass and forbs/shrubs thereby meeting the post-mining land use requirements.

**PHASE II BOND RELEASE ATTACHMENTS:**

**STATEMENT OF COMPLIANCE: RECLAMATION  
NOTICES TO AFFECTED PARTIES  
NEWSPAPER PUBLIC NOTICE  
2022 SEDIMENTOLOGY EVALUATION  
2022 PHASE II REVEGETATION STUDY**



## NOTARIZED STATEMENT OF COMPLIANCE

In accordance in Colorado Division of Reclamation, Mining and Safety Rule 3.03.2(e), I hereby certify that to the best of my knowledge and belief, all applicable reclamation activities for which Phase II bond release is being sought at the Mountain Coal Company, LLC West Elk Mine (CDRMS Permit # C-1980-007), have been accomplished in accordance with the requirements of the Act (CRS 34-33-101 *et seq*), the applicable rules pursuant to the Act and the approved reclamation program as detailed and approved in the mining and reclamation permit, C-1980-007.

Signed Jessica Wilczek

Date 9/6/22

Mountain Coal Company, LLC

State of Colorado

Subscribed and sworn to (or affirmed) before me at  
DUMFRIES (city),

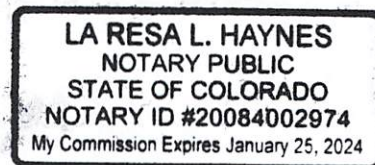
by JESSICA WILCZEK (signer's name)

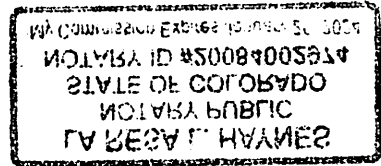
on 9-6-22 (date).

SEAL

LaResa L. Haynes  
Notary Public's Signature

My Commission Expires: 1-25-2024





# **Savage and Savage** *Environmental*

*practical solutions for environmental concerns*

**4610 Haystack Drive  
Windsor, Colorado 80550**

**970. 674. 8080 telephone  
savageandsavage@earthlink.net**



August 30, 2022

Mr. Levi Broyles, District Ranger  
USDA Forest Service  
Paonia Ranger District  
P.O. Box 1030  
Paonia, Colorado 81428

Re: Notice of Application for Phase II Bond Release of Selected Areas of the Mountain Coal Company, LLC West Elk Mine (CDRMS file C-1980-007)

Dear Mr. Broyles:

Mountain Coal Company, LLC (MCC) is applying for a Phase II liability and bond release for portions of the West Elk Mine (Colorado Division of Reclamation, Mining, and Safety permit C-1980-007) in accordance with the approved reclamation plan. The subject of the bond release is a release from liability and reclamation bond for areas where it has been demonstrated that MCC has successfully established vegetation supporting the post-mining land use, met the approved success standard for vegetation cover, and demonstrated that suspended solids contributions to runoff or streamflow from the eligible reclaimed areas do not exceed pre-mining (native adjacent area) levels of suspended solids contributions.

The application for bond release includes reclaimed areas located above the Dry Creek and Deep Creek drainages within the mine site encompassing approximately 20.74 acres. The reclaimed areas requesting bond release are located within the current permit area and are found within Sections 33-36, T13S, R90 W; and Sections 1-3, T14S, R90W; all within the 6th Prime Meridian, Gunnison County, Colorado. The mine permit area entrance is located approximately two miles east of Somerset, Colorado, and is accessed from Colorado Highway 133.

As required by Colorado law, whenever bond release is requested, all interested or affected parties with a valid legal interest must be notified and afforded the opportunity to comment or request an informal conference on the bond release in accordance with Rule 3.03.3 of the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining.

This letter will serve to notify you that MCC is requesting Phase II liability and bond release in the amount of approximately \$109,926.02 of the total calculated current reclamation bond liability amount of \$11,756,466.23. A copy of the entire bond release application submitted to the Colorado Division of Reclamation, Mining, and Safety will be on file with the Division in Denver, Colorado at 1313 Sherman Street, Room 215 (telephone 303.866.3567), and the Gunnison County Planning Office, 221 N. Wisconsin, Suite C, Gunnison, Colorado 81230 during the review period. All information pertinent to the bond release request is presented within this application.

If you have any questions, comments, or concerns regarding the request for bond release, please contact the Colorado Division of Reclamation, Mining, and Safety, 1313 Sherman Street, Room 215, Denver, CO 80203 (telephone 303.866.3567).

Additionally, if I can answer any questions or concerns, please call me at the above number.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael S. Savage", with a long horizontal flourish extending to the right.

Michael S. Savage  
Principal

CERTIFIED MAIL # 7021 2720 0002 5069 7527  
RETURN RECEIPT REQUESTED

c: Leigh Simmons, CDRMS, Denver  
Nicki Poulos, Mountain Coal Company, LLC

# **Savage and Savage** *Environmental*

*practical solutions for environmental concerns*

4610 Haystack Drive  
Windsor, Colorado 80550

970. 674. 8080 telephone  
savageandsavage@earthlink.net



August 30, 2022

Ark Land Company  
c/o Mountain Coal Company, LLC  
5174 Highway 133  
Somerset, Colorado 81434

Re: Notice of Application for Phase II Bond Release of Selected Areas of the Mountain Coal Company, LLC West Elk Mine (CDRMS file C-1980-007)

Dear Ark Land Company:

Mountain Coal Company, LLC (MCC) is applying for a Phase II liability and bond release for portions of the West Elk Mine (Colorado Division of Reclamation, Mining, and Safety permit C-1980-007) in accordance with the approved reclamation plan. The subject of the bond release is a release from liability and reclamation bond for areas where it has been demonstrated that MCC has successfully established vegetation supporting the post-mining land use, met the approved success standard for vegetation cover, and demonstrated that suspended solids contributions to runoff or streamflow from the eligible reclaimed areas do not exceed pre-mining (native adjacent area) levels of suspended solids contributions.

The application for bond release includes reclaimed areas located above the Dry Creek and Deep Creek drainages within the mine site encompassing approximately 20.74 acres. The reclaimed areas requesting bond release are located within the current permit area and are found within Sections 33-36, T13S, R90 W; and Sections 1-3, T14S, R90W; all within the 6th Prime Meridian, Gunnison County, Colorado. The mine permit area entrance is located approximately two miles east of Somerset, Colorado, and is accessed from Colorado Highway 133.

As required by Colorado law, whenever bond release is requested, all interested or affected parties with a valid legal interest must be notified and afforded the opportunity to comment or request an informal conference on the bond release in accordance with Rule 3.03.3 of the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining.

This letter will serve to notify you that MCC is requesting Phase II liability and bond release in the amount of approximately \$109,926.02 of the total calculated current reclamation bond liability amount of \$11,756,466.23. A copy of the entire bond release application submitted to the Colorado Division of Reclamation, Mining, and Safety will be on file with the Division in Denver, Colorado at 1313 Sherman Street, Room 215 (telephone 303.866.3567), and the Gunnison County Planning Office, 221 N. Wisconsin, Suite C, Gunnison, Colorado 81230 during the review period. All information pertinent to the bond release request is presented within this application.

If you have any questions, comments, or concerns regarding the request for bond release, please contact the Colorado Division of Reclamation, Mining, and Safety, 1313 Sherman Street, Room 215, Denver, CO 80203 (telephone 303.866.3567).

Additionally, if I can answer any questions or concerns, please call me at the above number.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael S. Savage", with a long horizontal flourish extending to the right.

Michael S. Savage  
Principal

CERTIFIED MAIL # 7021 2720 0002 5069 7534  
RETURN RECEIPT REQUESTED

c: Leigh Simmons, CDRMS, Denver  
Nicki Poulos, Mountain Coal Company, LLC

# Public Notice

Mountain Coal Company, LLC (MCC), 5174 Highway 133, Somerset, CO 81434, (970) 929-5015, has filed a Phase II Bond Release Request to MCC's Mining and Reclamation Permit No. C-1980-007 with the Colorado Mined Land Reclamation Board (Board), under the provisions of the Colorado Surface Coal Mining Reclamation Act of 1979. The permit was originally issued by the Board in July 1981, and subsequently renewed every five years with the last renewal issued September 2020. The State of Colorado holds a surety reclamation bond in the amount of \$15,000,000.00 that exceeds the current reclamation liability of \$11,756,466.23.

MCC's approved permit area is located in Gunnison and Delta Counties east of the town of Somerset and south of the North Fork of the Gunnison River. MCC's current permit area is included within areas found on the Somerset and Minnesota Pass USGS 7.5 minute quadrangle maps and contains lands in Sections 9-11, 13-36 in T13S, R90W of the 6<sup>th</sup> PM, Sections 23-26, T13S, R91W of the 6<sup>th</sup> Prime Meridian, and Sections 1-5, 8-12, 14-16, and 21-23, T14S, R91W of the 6<sup>th</sup> Prime Meridian of Gunnison and Delta Counties, Colorado. The current permit area contains approximately 19,854.9 acres.

MCC is requesting a Phase II bond release for reclaimed methane vent boreholes (MVBs) and associated roads and surface disturbance. These reclaimed areas comprise approximately 20.74 acres of private and public land, within portions of the mine permit area that include Sections 33-36, T13S, R90 W; and Sections 1-3, T14S, R90W; all of the 6th Prime Meridian. The MVB's and associated disturbances were necessary for prior coal mining operations. MCC is requesting a release of \$109,926.02 which represents the maximum 25% of the reclamation bond applicable to sites proposed for Phase II bond release, as allowed by Colorado Statute and Rule 3.03. This amount will be verified by the State of Colorado. The revegetation on these reclaimed sites has met the applicable vegetation bond release criteria for Phase II bond release and has been shown to control erosion equal to levels of adjacent undisturbed areas.

Reclamation of the sites for which Phase II bond release is being requested was completed between 2012 and 2017. Reclamation included proper plugging and sealing of MVBs, followed by backfilling and regrading of surface disturbance, with subsequent replacement of topsoil and implementation of sediment control measures. The areas proposed for bond release have been revegetated using the methods and plant species consistent with the requirements of the landowners and the approved mining and reclamation permit.

A copy of the bond release application is available for review at the Colorado Division of Reclamation, Mining and Safety (CDRMS), 1313 Sherman Street, Room 215 Denver, CO 80203, (303) 866-3567, and the Gunnison County Planning Office, 221 N. Wisconsin St., Gunnison, CO 81230. All information pertinent to the bond release request is presented within this application. Comments or objections concerning the application should be directed to the CDRMS at the above address not later than 30 days after the last date of publication of this notice (published four times consecutively) in order to be considered.

Published in the Delta County Independent September 7, 14, 21, and 28, 2022.



**Mountain Coal Company, LLC  
West Elk Mine (C-1980-007)  
Somerset, Colorado  
2022 Phase II Bond Release (SL-16)  
Sedimentology Evaluation**



**Prepared by:  
Savage and Savage, Inc.  
4610 Haystack Drive  
Windsor, Colorado 80550  
970.674.8080**

**August 2022**



## **TABLE OF CONTENTS**

|  | <b>Page</b> |
|--|-------------|
| <b>1.0 INTRODUCTION</b>                    | <b>1.</b>   |
| <b>2.0 METHODS</b>                         | <b>2.</b>   |
| <b>2.1 SEDIMENTOLOGY DEMONSTRATION</b>     | <b>2.</b>   |
| <b>2.1.1 RAINFALL FACTOR (R)</b>           | <b>3.</b>   |
| <b>2.1.2 SOIL ERODIBILITY FACTOR (K)</b>   | <b>3.</b>   |
| <b>2.1.3 SLOPE ERODIBILITY FACTOR (LS)</b> | <b>4.</b>   |
| <b>2.1.4 COVER FACTOR (C)</b>              | <b>4.</b>   |
| <b>2.1.5 CONTROL PRACTICE FACTOR (P)</b>   | <b>5.</b>   |
| <b>3.0 RESULTS</b>                         | <b>6.</b>   |
| <b>4.0 DISCUSSION AND CONCLUSION</b>       | <b>6.</b>   |
| <b>5.0 LITERATURE CITED</b>                | <b>7.</b>   |
| <b>6.0 TABLES</b>                          | <b>8.</b>   |

## **TABLES**

|  |            |
|--|------------|
| <b>A. West Elk Mine Sedimentology Evaluation: USLE Factor Derivation: Reclaimed Areas (2022)</b>         | <b>9.</b>  |
| <b>West Elk Mine Sedimentology Evaluation: USLE Factor Derivation: Adjacent Undisturbed Areas (2022)</b> |            |
| <b>B. West Elk Mine USLE Calculation: Reclaimed Areas (2022)</b>   | <b>10.</b> |
| <b>C. West Elk Mine USLE Calculation: Adjacent Undisturbed Areas (2022)</b>                              | <b>10.</b> |

## 1.0 INTRODUCTION

This sedimentology evaluation has been prepared as part of an application for Phase II bond release for eligible reclaimed areas at the Mountain Coal, LLC (MCC) West Elk Mine, Colorado Division of Reclamation, Mining, and Safety (CDRMS) permit C-1980-007. The reclaimed areas included in this evaluation comprise former methane vent borehole (MVB's) drill sites, pads, and access roads that have been backfilled and graded, topsoiled, and revegetated. These areas comprise  $\pm$  20.74 acres within the mine permit boundary and were reclaimed between 2012 and 2017. Documented within is information relative to the erosion and sedimentation condition of these reclaimed areas and the native vegetation community and topography adjacent to the reclaimed areas. Quantitative sampling of reclaimed area vegetation for this Phase II bond release application was performed in June 2022, in compliance with Colorado Mined Land Reclamation Board for Coal Mining Rules and is appended as a separate report to this bond release application. Sedimentation and erosion analysis was conducted by Michael Savage of Savage and Savage, Inc.

## 2.0 METHODS

### 2.1 SEDIMENTOLOGY DEMONSTRATION

In order to satisfy one of the CDRMS requirements for Phase II bond release, reclaimed areas must be shown to contribute equal or less sediment to the receiving waters downstream than equivalent native adjacent areas. There are several methods by which to compare sediment generation from a disturbed site and that from an adjacent undisturbed site. Historically, CDRMS has used a model (SEDCAD+) to evaluate similar or identical watershed sections within the reclaimed area and adjacent undisturbed area. There are limitations to this approach, as there are rarely identical adjacent watersheds. Further, exact knowledge of all of the parameter values for the areas to be compared is often not available. Given the relatively small size of the individual reclaimed disturbances at the West Elk Mine, we elected to compare sediment generation from the reclaimed sites and the adjacent undisturbed native areas through the use of the Universal Soil Loss Equation (USLE) (Wishmeier and Smith, 1978).

The USLE uses readily available information on the rainfall, topography, soil particle size characteristics, vegetation, and cultivation practices to generate the amount of soil loss in tons/acre/year. The USLE accounts for rill and inter-rill erosion, the types of erosion commonly found on reclaimed areas.

The USLE takes the form:

$$A=R*K*LS*C*P$$

where:

A = soil loss in tons/acre/year

R = rainfall factor accounting for the interrelationship between the erosive force of rainfall and runoff

K = soil erodibility factor addressing a given soil's susceptibility to erosion

LS = length slope factor providing the ratio of soil loss at any length and slope to a standard slope and length

C = cover factor accounting for plant and litter cover on the ground surface

P = control practice factor addressing the erosion reduction effectiveness of soil conservation practices

Each of the above factors will be briefly addressed relative to the existing conditions at the West Elk Mine reclaimed areas and undisturbed adjacent areas.

### 2.1.1 RAINFALL FACTOR (R)

The rainfall factor addresses the interrelationship of the erosive forces of falling raindrops and runoff to predict both rill and inter-rill erosion. In this demonstration, an average annual value of R was computed based on a Type II storm event (Barfield, Warner, and Haan, 1983). The equation used to compute the R factor is as follows:

$$\text{Average Annual R} = 27 * (P_{2,6})^{2.2}$$

where  $P_{2,6}$  is the 2-year, 6 hour precipitation in inches from published rainfall data (e.g., Miller, *et al*, 1973).

The 2-year, 6-hour Type II storm event for the Somerset, Colorado area was conservatively identified as 1.1 inches of rainfall (U.S. Dept. of Commerce, 1961). The annual average R factor was computed to be 33.30 for both the reclaimed and adjacent undisturbed areas at the West Elk Mine.

### 2.1.2 SOIL ERODIBILITY FACTOR (K)

The soil erodibility factor K is a measure of a soil's susceptibility to erosion and was determined from several published sources (USDA, 1981, 2022, EPA, 1977).

Four soil map units were determined to be present within the reclaimed areas and adjacent undisturbed areas (USDA, 1981, NRCS, 2022). These are identified below, with their associated K factor value. Where K factors varied by soil horizon in the literature, the K factor value for the surface soil horizon was used for the native undisturbed areas, and an average of the K factor value for the upper and underlying soil horizon for reclaimed areas (as activity at the reclaimed areas was assumed to affect the soils to a depth of 12-20 inches).

#### **West Elk Mine Soil Series and Complexes with Corresponding K Factor Values for Reclaimed and Adjacent Undisturbed Areas: 2022 Phase II Bond Release Evaluation**

| Map Unit Name  | K    | Source                    |
|--|------|---------------------------|
| Herm-Fughes-Kolob family complex 25-40% slopes (Map Unit 158)        | 0.15 | USDA NRCS Web Site 8/2022 |
| Shawa-Sandia family-Kolob family complex 5-40% slopes (Map Unit 185) | 0.24 | USDA NRCS Web Site 8/2022 |
| Taterheap-Papasquia complex 5-40% slopes (Map Unit 188)              | 0.28 | USDA NRCS Web Site 8/2022 |
| Wetopa-Wesdy complex 5-65% slopes (Map Unit 200)                     | 0.15 | USDA NRCS Web Site 8/2022 |

### 2.1.3 SLOPE ERODIBILITY FACTOR (LS)

The steepness of the slope and the length of the slope both affect the degree of soil erosion on a given slope surface. The LS factor is a ratio of soil loss at any length and slope to that of a standard empirical slope. In the instance of the West Elk Mine site, the reclaimed and adjacent undisturbed slopes are of relatively uniform slope for the areas of concern. In this case the LS factor can be calculated by the following equation:

$$LS = (\lambda / 72.6)^m * (430x^2 + 30x + 0.43) / 6.613$$

where:

$\lambda$  is slope length

x is  $\sin \theta$  (where  $\theta$  is the angle of slope)

m is a slope dependent exponent (0.5 in our case)

During prior Phase II bond release reviews, CDRMS staff requested that the LS factors for the sedimentology evaluation be derived from the nomograph contained in Technical Note #51 from the USDA. The characteristics of the slopes at the West Elk Mine within the reclaimed areas to be evaluated for release and adjacent undisturbed areas were derived from direct observations made during the vegetation field study. Slope angles and overall slope lengths were recorded and are presented within Table A., as are the derived LS factors for each area.

The LS factor values for the reclaimed and undisturbed areas were derived from Table 3 in the successor document to Technical Note #51, Agricultural Handbook No. 537 (Wishmeier and Smith, 1978).

### 2.1.4 COVER FACTOR (C)

The cover factor in the USLE accounts for the effect of plant and litter cover on the ground surface in reducing erosion by intercepting raindrops and reducing direct contact with the soil. For the varying vegetation types such as that at the West Elk Mine, Table 2 (Wishmeier and Smith, 1978) was used in conjunction with the 2022 reclaimed area quantitative vegetation data from the vegetation sampling and adjacent undisturbed areas estimates of vegetation cover by life form and litter cover to develop the appropriate factor values.

Within the reclaimed areas, the mean total vegetation cover is comprised largely of sod-forming and bunch grasses with spreading bases, persistent perennial and biennial forbs, and standing litter. These types of vegetation provide significant cover contacting the ground surface. This vegetation community fits within the “no appreciable canopy” category, Type G of Table 2 (Wishmeier and Smith, 1978). Herbaceous cover of the reclaimed areas falls between 54 and 78 percent, while ground cover (herbaceous vegetation plus litter ranges from 70 to 92 percent (Savage and Savage, 2022). C factor values were derived from Table 2 (Wishmeier and Smith, 1978) through interpolation and are presented in Table A.

At the undisturbed adjacent vegetation community, the vegetative cover is a mixture of short trees and tall shrubs with moderate understory brush, and a very sparse herbaceous component (Savage and Savage, 2022). This vegetation community falls into the category of communities with “Trees but no appreciable low brush” and includes the G type of Table 2 (Wishmeier and Smith, 1978).

From the categories in Table 2 (Wishmeier and Smith, 1978), canopy coverage of the undisturbed adjacent mountain shrub community was estimated between 55 and 85 percent in the “Trees but no appreciable low brush” category, with estimated ground cover between 15 to 35 percent. Individual reclaimed area C factor values were derived from Table 2 (Wishmeier and Smith, 1978) through interpolation and are presented in Table A.

#### **2.1.5 CONTROL PRACTICE FACTOR (P)**

This factor is used to identify those soil conservation and sediment control practices which affect the level of sediment generated from a site (e.g., ditches, ponds, sediment traps). In this comparison we are interested in the sediment generated from the reclaimed site above such structures, as if they had been removed. Likewise, for the undisturbed area, there are no such controls. Therefore, for the purposes of our comparison, a value of unity (one) (Barfield, Warner and Hahn, 1983) will be assigned this factor, rendering no impact to our calculations.

### 3.0 RESULTS

#### USLE CALCULATIONS

Table A. summarizes the derivation of site specific USLE factors (factors K, LS, and C) for each sampled location within the reclaimed areas as well as the adjacent undisturbed areas.

The projected mean sediment yield from the reclaimed areas (Table B) is 0.173 tons/acre/year (with individual reclaimed areas ranging from 0.034 to 0.320 tons/acre/year). Projected sediment yield from adjacent undisturbed areas (Table C) is 4.938 tons/acre/year (individual areas ranging from 0.719 to 11.245 tons/acre/year).

#### 4.0 DISCUSSION AND CONCLUSION

Differences in the projected amounts of sediment generated from the West Elk Mine reclaimed areas and adjacent undisturbed slopes is largely resultant from the significant differences in the values of two factors: LS and C.

The LS factors for the reclaimed areas are much lower than the LS factors from the adjacent undisturbed areas since the reclaimed areas are significantly smaller in area and therefore have a significantly shorter slope length. This difference leads to a smaller value for LS and ultimately a lower amount of sediment generation overall.

C factor values for the reclaimed areas are also significantly lower than those from the adjacent undisturbed areas. This is due to the nature of the vegetation communities in the reclaimed areas and undisturbed areas. The predominantly dense, low, and herbaceous vegetation of the reclaimed areas is more effective overall in reducing the erosive impact from rain drops which results in a lower C factor value and a lower overall amount of sediment generation. The mountain shrub vegetation community that comprises the adjacent undisturbed vegetation is comprised of short trees, with a low and relatively sparse shrub understory and a nearly non-existent herbaceous vegetation layer below. Erosive raindrop interception may take place within the tree canopy, but usually continues through the trees, shrubs, and herbaceous layers to impact the ground surface with greater frequency and intensity, resulting in greater erosion. If all other USLE factors were equal, the nature of the vegetation in the reclaimed areas and undisturbed adjacent areas would still reveal lower potential erosion from the reclaimed areas.

The results of the USLE calculations show that the reclaimed areas are projected to produce less sediment than the adjacent native undisturbed areas. The equation verifies what is expected in this case and also what has been seen at other reclaimed sites in Colorado. Based on the results of the sedimentology evaluation, the reclaimed areas at the West Elk Mine are projected to produce lower amounts of sediment than adjacent undisturbed areas, and therefore qualify for Phase II bond release at this time.

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## 6.0 TABLES

TABLE A. WEST ELK MINE SEDIMENTOLOGY EVALUATION: USLE FACTOR DERIVATION: RECLAIMED AREAS (2022)

|                      | K FACTOR DERIVATION                       |         | LS FACTOR DERIVATION |               |         |          | C FACTOR DERIVATION |         |       |        |        |         |
|----------------------|---|---------|----------------------|---------------|---------|----------|---------------------|---------|-------|--------|--------|---------|
|                      |   |         |                      |               |         |          | % TOTAL VEG COVER   |         |       |        |        |         |
| SITE                 | SOIL                                      | K VALUE | SLOPE LENGTH (ft)    | SLOPE ∠ (deg) | % SLOPE | LS VALUE |                     | GRASSES | FORBS | SHRUBS | LITTER | C VALUE |
| 1                    | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 75                   | 15            | 26.8    | 5.85     | 70                  | 48      | 14    | 8      | 20     | 0.005   |
| 2                    | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 30                   | 15            | 26.8    | 1.40     | 88                  | 50      | 14    | 24     | 12     | 0.003   |
| 3                    | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 75                   | 11            | 19.4    | 1.30     | 80                  | 72      | 4     | 4      | 10     | 0.010   |
| 4                    | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 100                  | 20            | 36.4    | 4.00     | 70                  | 62      | 6     | 2      | 18     | 0.010   |
| 5                    | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 100                  | 8             | 8.8     | 0.66     | 70                  | 60      | 8     | 2      | 18     | 0.010   |
| 6                    | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 150                  | 13            | 23.1    | 2.40     | 68                  | 30      | 38    | 0      | 16     | 0.013   |
| 7                    | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 200                  | 7             | 12.3    | 1.30     | 68                  | 52      | 12    | 4      | 22     | 0.009   |
| 8                    | Wetopa-Wesdy Complex (5-65%)              | 0.15    | 75                   | 16            | 28.7    | 2.40     | 66                  | 26      | 34    | 6      | 12     | 0.013   |
| 9                    | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 50                   | 17            | 30.6    | 2.45     | 80                  | 36      | 18    | 26     | 16     | 0.003   |
| 10                   | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 150                  | 7             | 12.3    | 1.00     | 74                  | 34      | 20    | 20     | 20     | 0.013   |
| 11                   | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 150                  | 21            | 38.4    | 5.20     | 70                  | 56      | 12    | 2      | 24     | 0.004   |
| 12                   | Wetopa-Wesdy Complex (5-65%)              | 0.15    | 60                   | 18            | 32.5    | 2.70     | 72                  | 44      | 14    | 14     | 14     | 0.011   |
| 13                   | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 100                  | 5             | 8.8     | 0.53     | 84                  | 52      | 32    | 0      | 8      | 0.013   |
| 14                   | Herm-Fughes-Kolob family complex (25-40%) | 0.15    | 200                  | 13            | 23.1    | 2.70     | 60                  | 54      | 6     | 0      | 24     | 0.012   |
| 15                   | Herm-Fughes-Kolob family complex (25-40%) | 0.15    | 200                  | 13            | 23.1    | 2.70     | 78                  | 66      | 12    | 0      | 14     | 0.010   |
| Mean Reclaimed Areas |   | 0.23    |                      |               |         | 2.44     | 73.20               | 49.47   | 16.27 | 7.47   | 16.53  | 0.009   |

TABLE A. WEST ELK MINE SEDIMENTOLOGY EVALUATION: USLE FACTOR DERIVATION: ADJACENT UNDISTURBED AREAS (2022)

|                                 | K FACTOR DERIVATION                       |         | LS FACTOR DERIVATION |               |         |          | C FACTOR DERIVATION |         |       |        |        |         |
|---------------------------------|---|---------|----------------------|---------------|---------|----------|---------------------|---------|-------|--------|--------|---------|
|                                 |   |         |                      |               |         |          | % TOTAL VEG COVER   |         |       |        |        |         |
| SITE                            | SOIL SERIES                               | K VALUE | SLOPE LENGTH (ft)    | SLOPE ∠ (deg) | % SLOPE | LS VALUE |                     | GRASSES | FORBS | SHRUBS | LITTER | C VALUE |
| 1                               | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 200                  | 18            | 32.5    | 4.95     | 85                  | 7       | 3     | 30     | 20     | 0.17    |
| 2                               | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 300                  | 12            | 21.3    | 3.05     | 75                  | 9       | 1     | 30     | 15     | 0.13    |
| 3                               | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 250                  | 25            | 36.4    | 10.05    | 75                  | 9       | 1     | 30     | 20     | 0.12    |
| 4                               | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 200                  | 15            | 26.8    | 3.60     | 75                  | 8       | 2     | 30     | 15     | 0.13    |
| 5                               | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 150                  | 7             | 26.8    | 1.00     | 70                  | 10      | 5     | 25     | 20     | 0.1     |
| 6                               | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 300                  | 15            | 26.8    | 4.20     | 85                  | 7       | 3     | 30     | 10     | 0.17    |
| 7                               | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 300                  | 10            | 17.6    | 2.45     | 75                  | 6       | 4     | 30     | 20     | 0.12    |
| 8                               | Wetopa-Wesdy Complex (5-65%)              | 0.15    | 300                  | 19            | 34.4    | 6.50     | 75                  | 7       | 3     | 30     | 15     | 0.13    |
| 9                               | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 200                  | 22            | 40.4    | 6.05     | 75                  | 8       | 2     | 30     | 20     | 0.12    |
| 10                              | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 150                  | 7             | 12.3    | 0.90     | 70                  | 12      | 3     | 25     | 20     | 0.1     |
| 11                              | Shawa-Sandia Family-Kolob Family Complex  | 0.24    | 175                  | 24            | 44.5    | 7.50     | 75                  | 5       | 5     | 25     | 15     | 0.18    |
| 12                              | Wetopa-Wesdy Complex (5-65%)              | 0.15    | 150                  | 21            | 38.4    | 5.35     | 70                  | 5       | 10    | 35     | 15     | 0.16    |
| 13                              | Taterheap-Papaspila Complex (5-40%)       | 0.28    | 200                  | 22            | 40.4    | 6.05     | 75                  | 5       | 5     | 40     | 25     | 0.16    |
| 14                              | Herm-Fughes-Kolob family complex (25-40%) | 0.15    | 300                  | 15            | 26.8    | 3.40     | 85                  | 5       | 0     | 40     | 15     | 0.17    |
| 15                              | Herm-Fughes-Kolob family complex (25-40%) | 0.15    | 275                  | 15            | 26.8    | 3.25     | 85                  | 3       | 2     | 40     | 10     | 0.17    |
| Mean Adjacent Undisturbed Areas |   | 0.23    |                      |               |         | 4.55     | 76.67               | 7.07    | 3.27  | 31.33  | 17.00  | 0.142   |

**Table B. West Elk Mine USLE Calculation: Reclaimed Areas (2022)**

|             | <b>R</b>     | <b>K</b>    | <b>LS</b>   | <b>C</b>     | <b>P</b>    | <b>A (Tons/ac/yr)</b> |
|-------------|--------------|-------------|-------------|--------------|-------------|-----------------------|
| 1           | 33.30        | 0.24        | 5.85        | 0.005        | 1.00        | 0.234                 |
| 2           | 33.30        | 0.24        | 1.40        | 0.003        | 1.00        | 0.034                 |
| 3           | 33.30        | 0.28        | 1.30        | 0.010        | 1.00        | 0.121                 |
| 4           | 33.30        | 0.24        | 4.00        | 0.010        | 1.00        | 0.320                 |
| 5           | 33.30        | 0.28        | 0.66        | 0.010        | 1.00        | 0.062                 |
| 6           | 33.30        | 0.28        | 2.40        | 0.013        | 1.00        | 0.291                 |
| 7           | 33.30        | 0.28        | 1.30        | 0.009        | 1.00        | 0.109                 |
| 8           | 33.30        | 0.15        | 2.40        | 0.013        | 1.00        | 0.156                 |
| 9           | 33.30        | 0.24        | 2.45        | 0.003        | 1.00        | 0.059                 |
| 10          | 33.30        | 0.24        | 1.00        | 0.013        | 1.00        | 0.104                 |
| 11          | 33.30        | 0.24        | 5.20        | 0.004        | 1.00        | 0.166                 |
| 12          | 33.30        | 0.15        | 2.70        | 0.011        | 1.00        | 0.148                 |
| 13          | 33.30        | 0.28        | 0.53        | 0.013        | 1.00        | 0.064                 |
| 14          | 33.30        | 0.15        | 2.70        | 0.012        | 1.00        | 0.162                 |
| 15          | 33.30        | 0.15        | 2.70        | 0.010        | 1.00        | 0.135                 |
| <b>MEAN</b> | <b>33.30</b> | <b>0.23</b> | <b>2.44</b> | <b>0.009</b> | <b>1.00</b> | <b>0.173</b>          |

**Table C. West Elk Mine USLE Calculation: Adjacent Undisturbed Areas (2022)**

|             | <b>R</b>     | <b>K</b>    | <b>LS</b>   | <b>C</b>    | <b>P</b>    | <b>A (Tons/ac/yr)</b> |
|-------------|--------------|-------------|-------------|-------------|-------------|-----------------------|
| 1           | 33.30        | 0.24        | 4.95        | 0.17        | 1.00        | 6.725                 |
| 2           | 33.30        | 0.24        | 3.05        | 0.13        | 1.00        | 3.169                 |
| 3           | 33.30        | 0.28        | 10.05       | 0.12        | 1.00        | 11.245                |
| 4           | 33.30        | 0.24        | 3.60        | 0.13        | 1.00        | 3.740                 |
| 5           | 33.30        | 0.28        | 1.00        | 0.1         | 1.00        | 0.932                 |
| 6           | 33.30        | 0.28        | 4.20        | 0.17        | 1.00        | 6.657                 |
| 7           | 33.30        | 0.28        | 2.45        | 0.12        | 1.00        | 2.741                 |
| 8           | 33.30        | 0.15        | 6.50        | 0.13        | 1.00        | 4.221                 |
| 9           | 33.30        | 0.24        | 6.05        | 0.12        | 1.00        | 5.802                 |
| 10          | 33.30        | 0.24        | 0.90        | 0.1         | 1.00        | 0.719                 |
| 11          | 33.30        | 0.24        | 7.50        | 0.18        | 1.00        | 10.789                |
| 12          | 33.30        | 0.15        | 5.35        | 0.16        | 1.00        | 4.276                 |
| 13          | 33.30        | 0.28        | 6.05        | 0.16        | 1.00        | 9.026                 |
| 14          | 33.30        | 0.15        | 3.40        | 0.17        | 1.00        | 2.887                 |
| 15          | 33.30        | 0.15        | 3.25        | 0.17        | 1.00        | 2.760                 |
| <b>MEAN</b> | <b>33.30</b> | <b>0.23</b> | <b>4.55</b> | <b>0.14</b> | <b>1.00</b> | <b>4.938</b>          |

**Mountain Coal Company, LLC  
West Elk Mine (C-1980-007)  
Somerset, Colorado  
2022 Phase II Bond Release Vegetation Report (SL-16)**



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## **TABLE OF CONTENTS**

|   | <b><u>Page</u></b> |
|---|--------------------|
| <b>EXECUTIVE SUMMARY</b>  | <b>1.</b>          |
| <b>1.0 INTRODUCTION</b>   | <b>2.</b>          |
| <b>2.0 METHODS</b>  | <b>3.</b>          |
| 2.1 Sampling Design   | 3.                 |
| 2.2 Field Sampling  | 4.                 |
| 2.2.1 Timing  | 4.                 |
| 2.2.2 Total Vegetation Cover  | 4.                 |
| 2.2.3 Species Composition   | 4.                 |
| 2.3 Sample Numbers/Sample Adequacy  | 5.                 |
| 2.4 Statistical Analysis  | 5.                 |
| 2.5 Species Identification and Verification                                   | 5.                 |
| <b>3.0 RESULTS</b>  | <b>6.</b>          |
| 3.1 Quantitative Evaluation: Reclaimed Areas                                  | 6.                 |
| 3.1.1 Total Vegetation Cover: Reclaimed Areas                                 | 6.                 |
| 3.1.2 Species Composition: Reclaimed Areas                                    | 6.                 |
| 3.2 Comparison of Reclaimed Areas with Phase II Revegetation Success Criteria | 7.                 |
| <b>4.0 DISCUSSION AND CONCLUSIONS</b>   | <b>9.</b>          |
| 4.1 Total Vegetation Cover  | 9.                 |
| 4.1.1 Total Vegetation Cover: Reclaimed Areas                                 | 9.                 |
| 4.2 Species Composition   | 9.                 |
| 4.2.1 Species Composition: Reclaimed Areas                                    | 9.                 |
| 4.3 Pest and Disease Evaluation   | 9.                 |
| <b>5.0 SUMMARY</b>  | <b>10.</b>         |
| <b>6.0 LITERATURE CITED</b>   | <b>11.</b>         |
| <b>7.0 TABLES</b>   | <b>12.</b>         |
| <b>8.0 APPENDIX</b>   | <b>16.</b>         |

## **LIST OF TABLES**

|   | <b><u>Page</u></b> |
|---|--------------------|
| 1. Mountain Coal Company LLC Phase II Bond Release Reclaimed Areas Plant Species List: 2022 | 13.                |
| 2. Vegetation Cover: Mountain Coal Company LLC Phase II Bond Release Reclaimed Areas 2022   | 15.                |

## **APPENDIX**

2022 West Elk Mine Phase II Bond Release Eligible Sites

## **EXECUTIVE SUMMARY**

Quantitative vegetation sampling of reclaimed areas within the Mountain Coal Company LLC (MCC) West Elk Mine eligible for Phase II bond release was conducted during June 2022. Vegetation cover by plant species and species composition data were collected. The total vegetation cover mean of the reclaimed areas and the vegetation cover success standard were compared. Species composition results from the reclaimed areas were compared with the species composition revegetation success criterion from the Colorado Division of Reclamation, Mining and Safety (CDRMS) permit document.

The 2022 mean total vegetation cover in the reclaimed areas (73.20%) exceeded the final total vegetation cover success criterion of 53.04 percent. Relative cover data from the reclaimed areas sampled showed that the reclaimed areas exceeded the species composition final revegetation success criterion (at least three perennial species of which two are cool season perennial grasses and one is a cool season perennial forb with no one component of the above three species should comprise greater than 40% relative cover nor less than 3% relative cover) with four perennial cool season graminoids and one perennial cool season forb.

Based on the results of the 2022 quantitative vegetation sampling at the MCC reclaimed areas, it was concluded that the Phase II bond release and revegetation requirements of CDRMS Rule 3.03.1(2) have been satisfied for total vegetation cover and species composition; and that the overall sampling results demonstrate the establishment of vegetation which supports the approved post-mining land use and which meets the approved success standard for cover.

## 1.0 INTRODUCTION

This report presents the results of the 2022 quantitative vegetation sampling in support of a request for Phase II bond release for eligible reclaimed areas within the MCC West Elk Mine (CDRMS permit C-1980-007) owned and operated by MCC. Quantitative vegetative sampling is required by CDRMS whenever a permittee requests a release from liability and/or reclamation bond in Phase II of the bond release process. Vegetation sampling was performed in compliance with the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining Rules 2.04.10 and 4.15 at the time of sampling, the requirements of the approved reclamation plan, and current botanical and plant ecological methods. Field sampling for the areas sampled for Phase II was conducted between June 23 and 28, 2022 by Savage and Savage, Inc. biologists.

The West Elk Mine site is located in Gunnison and Delta Counties, Colorado, east of Somerset, Colorado and south of the North Fork of the Gunnison River. The underground coal mine began operation in 1981. The reclaimed areas sampled in this report are located in Gunnison County, Colorado; within portions of the mine permit area that encompass Sections 33-36, T13S, R90 W; and Sections 1-3, T14S, R90W; all within the 6th Prime Meridian. The reclaimed areas for which Phase II bond release is sought include methane vent boreholes (MVB's), and associated pads and roads used in mine operations.

Reclaimed areas sampled in 2022 were reclaimed between 2012 and 2017. Reclamation at the eligible sites included plugging and sealing MVB's, backfilling and regrading surface disturbances and roads, replacing topsoil, reseeding and mulching, and installing erosion control materials in accordance with the approved mining and reclamation plan.

The revegetation standards used to evaluate these areas are those currently in effect under the Colorado Surface Coal Mining Reclamation Act (CRS 34-33-101 *et seq*) and the West Elk Mining and Reclamation Permit (C-1980-007).



## **2.0 METHODS**

### **2.1 SAMPLING DESIGN**

Prior to initiation of fieldwork, the current mining and reclamation permit document, applicable maps, and Google Earth<sup>®</sup> aerial photography were reviewed to evaluate topography, reclamation timing, seed mixes, revegetation methods, management, and applicable revegetation standards.

Figure 1. (MCC Reclamation) within the mining and reclamation plan was used to identify, locate and delineate reclaimed areas and individual reclaimed sites. Standard methods of gridding the reclaimed areas and generating random sample points were employed. As the reclaimed areas ranged in age from five to ten years, it was desirable to obtain a representative sampling of the age structure.

The individual drill pads and associated area were considered separate reclaimed sites. Their areal extent was entered into a Microsoft Excel<sup>®</sup> spreadsheet. The area of each reclaimed site was calculated as a percentage of the total area of reclaimed areas, as was the total area of eligible reclaimed locations within the reclamation. By selecting an initial number of total samples, locations for sampling by representative area were assigned.

Sample locations within each sample site were randomly determined by use of a 50'x50' grid representing the reclaimed site. A sample point within the reclaimed site was then selected using a random numbers table. Sample point locations were located in the field through compass triangulation, GPS, and pacing from known landmarks. The Appendix contains an image of the area of the reclaimed areas and extended reference area.

## **2.2 FIELD SAMPLING**

### **2.2.1 Timing**

Field investigation of the Phase II reclaimed areas was undertaken during the period between June 23 and 28, 2022. This time period coincided with anthesis and maximum presence of the majority of plant species found in the reclaimed areas.

### **2.2.2 Total Vegetation Cover**

Vegetation cover was estimated by the use of the point-intercept method. An ocular point frame (ESCO Associates) was used to minimize instrument error and maximize precision and observer accuracy. Cover transects were 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction was established randomly through the use of computer generated random directions (0-360°). In no event were transects allowed to extend within ten feet of reclaimed area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) served as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), soil (bare ground), rock, or organic litter. Subsequent "hits" on vegetation (prior to interception of the ground) were also recorded. Cover data were recorded and reported by individual plant species. The first interception was used to calculate total vegetation cover values. Additional interceptions were used to calculate relative cover of individual plant species and lifeforms for the reclaimed areas. The quantitative cover data provided the basis for calculation of species composition and relative importance.

### **2.2.3 Species Composition**

Species composition information was derived from quantitative vegetation cover data from the reclaimed areas. Relative cover information provided a basis for evaluation of the importance of each encountered plant species and lifeform and for comparison to the applicable final revegetation success criterion. Data summaries for reclaimed area total vegetation cover for each area sampled are included and contain the relative cover by species and a column depicting the numerical ranking of each species by relative cover for the reclaimed areas.

## 2.3 SAMPLE NUMBERS/SAMPLE ADEQUACY

For the purposes of this study, total vegetation cover sampling of the reclaimed areas and extended reference area was undertaken to sample adequacy with a minimum of fifteen (15) samples.

Parameter sample adequacy testing occurred at the one-sided 90% confidence level. Comparisons between sample mean parameter values and the revegetation success standard assume that the sample mean value accurately represents the population mean in all cases.

The following formula was used for sample adequacy calculations:

$$n_{\min} = \frac{(t)^2 (s)^2}{(d \bar{X}_{\text{bar}})^2}$$

where:  $n_{\min}$  = minimum sample size  
s = sample standard deviation  
t = the Student's t distribution value at the 90% level (one-sided)  
d = percent acceptable deviation from the mean (10%)  
 $\bar{X}_{\text{bar}}$  = sample mean

## 2.4 STATISTICAL ANALYSIS

Statistical analysis for the revegetation success criterion of total vegetation cover is required if the value of the sample mean from the reclaimed area is less than 90 percent of the value of the final revegetation success criterion for total vegetation cover. The 2022 reclaimed areas sample mean for total vegetation cover was greater than the corresponding revegetation success criterion (the total vegetation cover standard derived from historical sampling); therefore no statistical analysis was required. A statistical analysis is not required for the evaluation of species composition.

## 2.5 SPECIES IDENTIFICATION AND VERIFICATION

Species identification was accomplished in the field through the use of plant identification keys (Harrington, 1954, Stubbendieck, *et al*, 1995, Weber, 1990; Whitson, 1987; Zimdahl, 1990). In cases where plant identification was inconclusive in the field, voucher specimens were pressed for lab identification and photographed, and verified by Mr. Tim Hogan and Ms. Dina Clark of the University of Colorado, Boulder Herbarium.

## 3.0 RESULTS

### 3.1 QUANTITATIVE EVALUATION: RECLAIMED AREAS

The Phase II eligible reclaimed areas within this report have been reclaimed for a minimum of five years. Specific vegetation information for the reclaimed areas is contained in Tables 1 and 2.

#### 3.1.1 Total Vegetation Cover: Reclaimed Areas

Fifteen quantitative cover samples were collected in the reclaimed areas eligible for Phase II bond release. Total mean vegetation cover of the reclaimed areas was 73.20 percent. Graminoids provided 49.47 percent mean vegetation cover and 65.67 percent relative vegetation cover, forbs accounted for 16.27 percent mean vegetation cover (22.89% relative cover), and six woody species contributed 7.47 percent total vegetation cover and 11.44 percent relative cover.

The most frequently encountered species was *Agropyron smithii* (western wheatgrass), present in 100 percent of the 15 transects sampled for vegetation cover. *Bromus marginatus* (mountain brome) was encountered in 93.3 percent of all transects. *Poa pratensis* (Kentucky bluegrass) and *Achillea lanulosa* (yarrow) were encountered in 66.7 percent of transects, while *Penstemon virens* (beardtongue) was found in 53.3 percent of all transects. All other species were encountered in fewer than fifty percent of the vegetation cover transects.

Within the reclaimed areas the native perennial grass *Agropyron smithii* was dominant, contributing 18.27 percent total vegetation cover and 24.05 percent relative cover. *Poa pratensis* contributed the second highest vegetation cover, with 11.20 percent total mean cover (15.42% relative cover). *Bromus marginatus* contributed the third highest cover, with 10.13 percent total mean cover and 13.10 percent relative cover. *Achillea lanulosa* provided 5.07 percent vegetation cover and 7.30 percent relative vegetation cover. The native shrub *Symphoricarpos rotundifolius* (snowberry) accounted for 4.27 percent total vegetation cover and 5.80 percent relative vegetation cover.

Remaining species contributing significant vegetation cover (> 2% relative cover) were *Thermopsis montanus* (golden banner) providing 1.60 percent mean vegetation cover (2.82% relative cover), *Rosa woodsii* (Wood's rose) contributing 1.33 percent mean vegetation cover and 2.49 percent relative vegetation cover, and *Penstemon virens* with 1.47 percent total vegetation cover and 2.16 percent relative cover.

Vegetative litter (prior years growth, dead wood, and other biologic organic material) comprised 16.53 percent ground cover overall within the reclaimed areas. Bare soil comprised 10.27 percent of the ground cover. No rock was encountered during the sampling.

#### 3.1.2 Species Composition: Reclaimed Areas

Cover sampling identified three lifeforms and thirty-seven plant species within the reclaimed areas (Table 1). The lifeforms included 12 species of perennial grass, one annual graminoid species, 15 perennial forbs, two biennial forbs, one annual forb, and six woody plants.

Of the species encountered within the reclaimed areas, 29 were native and eight were introduced. Perennial species outnumbered biennial and annual species by 33 to four. All herbaceous species were cool season.

Species providing significant relative cover (>2%) included *Agropyron smithii* (24.05%), *Poa pratensis* (15.42%), *Bromus marginatus* (13.10%), *Achillea lanulosa* (7.30%), *Symphoricarpos rotundifolius* (5.80%), *Thermopsis montanus* (2.82%), *Rosa woodsii* (2.49%), and *Penstemon virens* (2.16%).

### 3.2 COMPARISON OF RECLAIMED AREAS WITH PHASE II REVEGETATION SUCCESS CRITERIA

Comparison of the reclaimed area values for total vegetation cover and species composition with the applicable revegetation success criteria indicates whether revegetation has been successful and compliant with requirements for Phase II bond release. CDRMS Rule 3.03.1(2) provides for release of bond, “upon the establishment of vegetation which supports the approved post-mining land use and which meets the approved success standard for cover pursuant to 4.15.8...” The tables below allow the comparison of the parameter values from the 2022 sampling at the reclaimed areas with the final revegetation criteria to be achieved.

#### Reclamation Success: Total Vegetation Cover (2022)

|                                       | 2022 Reclaimed Areas |
|---------------------------------------|----------------------|
| $\bar{X}$                             | 73.20%               |
| S                                     | 7.44%                |
| Number of samples                     | 15                   |
| Number of samples for sample adequacy | 2                    |

Reclamation success for total vegetation cover at the West Elk Mine is judged by the final total vegetation cover success criterion of 53.04 percent.

Based on the results of the 2022 quantitative sampling, the reclaimed areas exceeded the final revegetation total live vegetation cover success criterion of 53.04 percent, thereby meeting the final revegetation success criterion and supporting the post-mining land use.

#### Reclamation Success: Species Composition (2022)

The West Elk Mine permit document specifies that to meet the requirements of the revegetation success criterion for species composition, species composition on any applicable reclaimed areas will be successful when there are at least three perennial species of which two are cool season perennial grasses and one is a cool season perennial forb with no one component of the above three species comprising greater than 40% relative cover nor less than 3% relative cover. The 2022 reclaimed areas exceeded the species composition requirement with four perennial cool season graminoids and one perennial cool season forb.

### Reclamation Success: Species Composition (2022)

|   | Success<br>Standard | 2022 Reclaimed Areas |
|---|---------------------|----------------------|
| <b>Total Perennial Species*</b><br>(>3% rel. cover) | 3                   | 5                    |
| <b>Cool Season Grasses*</b>                         | 2                   | 4                    |
| <b>Cool Season Forbs*</b>                           | 1                   | 1                    |
| <b>Relative Importance</b><br>(3%<x<40%)            | All Species         | All Species          |

\* Numbers reflect only those species meeting the relative importance percentage limitation and does not include any prohibited species

The reclaimed areas exceeded the requirements for species composition, thereby meeting the revegetation success criterion and supporting the post-mining land use.

## **4.0 DISCUSSION AND CONCLUSIONS**

Phase II eligible reclaimed areas were quantitatively sampled in 2022 to evaluate whether they would qualify for CDRMS Phase II bond release.

### **4.1 TOTAL VEGETATION COVER**

#### **4.1.1 Total Vegetation Cover: Reclaimed Areas**

Mean reclaimed area total vegetation cover (73.20%) exceeded the revegetation success criterion for total vegetation cover success criterion (53.04%), thereby meeting the revegetation success criterion and supporting the post-mining land use.

Of the thirty-seven species encountered in reclaimed area cover sampling, thirty-five were perennial or biennial species, accounting for 94.6 percent of all species encountered. Perennial and biennial species provided 98.5 percent of all total relative cover (64.51% graminoids, 22.56% forbs, and 11.44% woody). Native species contributed 78.4 percent of the total number of species encountered (29 of the 37 total species), and 80.9 percent of the relative cover (48.59% graminoids, 20.88% forbs, and 11.44% woody).

These results indicate the establishment of a predominantly perennial, native vegetation community at the reclaimed areas, with total vegetation cover greater than that of the revegetation success criterion.

### **4.2 SPECIES COMPOSITION**

#### **4.2.1 Species Composition: Reclaimed Areas**

The CDRMS considers species composition of the revegetated and reclaimed areas to be an indicator of successful vegetation establishment and a diverse vegetation community. The species composition standard for the West Elk Mine requires that there be at least three perennial species, of which two are cool season perennial grasses and one is a cool season perennial forb. No one component of the above three species should comprise greater than 40% relative importance nor less than 3% relative importance. Relative importance will be measured by calculating relative cover of the revegetation species.

The reclaimed areas exceeded the required number of perennial cool season grass and forbs with contributions by *Agropyron smithii*, *Poa pratensis*, *Bromus marginatus*, *Achillea lanulosa*, and *Agropyron dasystachyum* accounting for between three and forty percent relative cover.

### **4.3 PEST AND DISEASE EVALUATION**

No pest or disease infestations were found within the reclaimed areas, nor was there significant cover of noxious or prohibited annual or weedy species that would negatively impact the longevity of the reclaimed vegetation community.

## **5.0 SUMMARY**

Quantitative vegetation sampling of the reclaimed areas eligible for Phase II bond release at the West Elk Mine revealed that the revegetated areas exceeded the requirements for final revegetation success for total vegetation cover and species composition.

Based on the results of the 2022 quantitative vegetation sampling at the MCC West Elk Mine reclaimed areas, it was concluded that the Phase II bond release and revegetation requirements of CDRMS Rule 3.03.1(2) have been satisfied for vegetation cover and species composition; and that overall the sampling results demonstrate the establishment of vegetation which supports the approved post-mining land use and which meets the approved success standard for cover.



## **6.0 LITERATURE CITED**

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## **7.0 TABLES**

**Table 1. Mountain Coal Company LLC Phase II Bond Release  
Reclaimed Areas Plant Species List: 2022**

| <b>Common Name</b>    | <b>Species Name</b>           | <b>Lifeform</b> |
|-----------------------|-------------------------------|-----------------|
| <b>Graminoids</b>     |                               |                 |
| Thickspike Wheatgrass | <i>Agropyron dasystachyum</i> | P, C, N         |
| Western Wheatgrass    | <i>Agropyron smithii</i>      | P, C, N         |
| Bluebunch Wheatgrass  | <i>Agropyron spicatum</i>     | P, C, N         |
| Slender Wheatgrass    | <i>Agropyron trachycaulum</i> | P, C, N         |
| Mountain Brome        | <i>Bromus marginatus</i>      | P, C, N         |
| Cheatgrass            | <i>Bromus tectorum</i>        | A, C, I         |
| Orchardgrass          | <i>Dactylis glomerata</i>     | P, C, I         |
| Arizona Fescue        | <i>Festuca arizonica</i>      | P, C, N         |
| Junegrass             | <i>Koeleria cristata</i>      | P, C, N         |
| Indian Ricegrass      | <i>Oryzopsis hymenoides</i>   | P, C, N         |
| Kentucky Bluegrass    | <i>Poa pratensis</i>          | P, C, I         |
| Sandberg Bluegrass    | <i>Poa sandbergii</i>         | P, C, N         |
| Needle and Thread     | <i>Stipa comata</i>           | P, C, N         |
| <b>Forbs</b>          |                               |                 |
| Yarrow                | <i>Achillea lanulosa</i>      | P, C, N         |
| Aster                 | <i>Aster glaucodes</i>        | P, C, N         |
| Meadow Thistle        | <i>Cirsium scariosum</i>      | P, C, N         |
| Bull Thistle          | <i>Cirsium vulgare</i>        | B, C, I         |
| Field Bindweed        | <i>Convolvulus arvensis</i>   | P, C, I         |
| Sulfur Buckwheat      | <i>Eriogonum umbellatum</i>   | P, C, N         |
| Little Bedstraw       | <i>Galium septrionale</i>     | P, C, N         |
| Utah Sweetvetch       | <i>Hedysarum boreale</i>      | P, C, N         |
| Western Sticktight    | <i>Lappula occidentalis</i>   | A, C, N         |
| Lupine                | <i>Lupinus argenteus</i>      | P, C, N         |
| Yellow Sweetclover    | <i>Melilotus officinale</i>   | B, C, I         |
| Field Mint            | <i>Mentha arvensis</i>        | P, C, N         |
| Beardtongue           | <i>Penstemon virens</i>       | P, C, N         |
| Dandelion             | <i>Taraxacum officinale</i>   | P, C, I         |
| Meadow Rue            | <i>Thalictrum fendlerii</i>   | P, C, N         |
| Golden Banner         | <i>Thermopsis montanus</i>    | P, C, N         |
| Salsify               | <i>Tragopogon dubius</i>      | P, C, I         |
| Mule's Ears           | <i>Wyethia amplexicaulis</i>  | P, C, N         |

**Table 1. Mountain Coal Company LLC Phase II Bond Release  
Reclaimed Areas Plant Species List: 2022 continued**

| <b>Common Name</b>                  | <b>Species Name</b>                 | <b>Lifeform</b> |
|-------------------------------------|-------------------------------------|-----------------|
| <b>Woody Plants</b>                 |                                     |                 |
| Serviceberry                        | <i>Amelanchier alnifolia</i>        | P, D, N         |
| Big Sagebrush                       | <i>Artemisia tridentata</i>         | P, D, N         |
| Chamisa                             | <i>Chrysothamnus nauseosus</i>      | P, D, N         |
| Chokecherry                         | <i>Prunus virginiana</i>            | P, D, N         |
| Wood's Rose                         | <i>Rosa woodsii</i>                 | P, D, N         |
| Snowberry                           | <i>Symphoricarpos rotundifolius</i> | P, D, N         |
| <i>Total Graminoids</i>             |                                     | 13              |
| <i>Total Perennial Graminoids</i>   |                                     | 12              |
| <i>Total Annual Graminoids</i>      |                                     | 1               |
| <i>Total Native Graminoids</i>      |                                     | 10              |
| <i>Total Introduced Graminoids</i>  |                                     | 3               |
| <i>Total Cool Season Graminoids</i> |                                     | 13              |
| <i>Total Warm Season Graminoids</i> |                                     | 0               |
| <i>Total Forbs</i>                  |                                     | 18              |
| <i>Total Perennial Forbs</i>        |                                     | 15              |
| <i>Total Biennial Forbs</i>         |                                     | 2               |
| <i>Total Annual Forbs</i>           |                                     | 1               |
| <i>Total Native Forbs</i>           |                                     | 13              |
| <i>Total Introduced Forbs</i>       |                                     | 5               |
| <i>Total Cool Season Forbs</i>      |                                     | 18              |
| <i>Total Warm Season Forbs</i>      |                                     | 0               |
| <i>Total Woody Plants</i>           |                                     | 6               |
| <i>SPECIES TOTAL</i>                |                                     | 37              |

**Note: Only plant species encountered during cover sampling  
are represented on this list**

**Lifeform abbreviations:** A: annual  
C: cool season  
N: native  
D:deciduous  
I: introduced

Table 2. Vegetation Cover: Mountain Coal Company LLC Phase II Bond Release Reclaimed Areas 2022

|                              |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | overall         |                   |                 |
|------------------------------|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------------|-------------------|-----------------|
| Species Name                 | Common Name           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | overall<br>mean | relative<br>cover | overall<br>rank |
| Graminoids                   |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |                 |                   |                 |
| Agropyron dasystachyum       | Thickspike Wheatgrass |    | 4  | 16 | 2  | 20 |    |    |    | 6  |    |    | 2  |    |    |    | 3.33            | 4.31              | 6               |
| Agropyron smithii            | Western Wheatgrass    | 34 | 34 | 12 | 22 | 6  | 8  | 2  | 14 | 2  | 2  | 22 | 16 | 6  | 52 | 42 | 18.27           | 24.05             | 1               |
| Agropyron spicatum           | Bluebunch Wheatgrass  | 2  |    |    |    |    |    | 2  |    |    |    |    | 10 | 2  |    |    | 1.07            | 1.66              | 12              |
| Agropyron trachycaulum       | Slender Wheatgrass    | 4  | 2  |    |    |    |    |    |    |    |    | 4  | 6  |    |    |    | 1.07            | 1.33              | 16              |
| Bromus marginatus            | Mountain Brome        | 2  | 10 | 12 | 8  | 8  | 16 | 18 | 10 | 14 | 6  | 4  |    | 18 | 2  | 24 | 10.13           | 13.10             | 3               |
| Bromus tectorum              | Cheatgrass            |    |    |    | 4  |    |    |    |    |    |    | 10 |    |    |    |    | 0.93            | 1.16              | 18              |
| Dactylis glomerata           | Orchardgrass          |    |    | 2  |    | 4  |    |    |    |    |    |    |    |    |    |    | 0.40            | 0.50              | 22              |
| Festuca arizonica            | Arizona Fescue        | 4  |    | 2  | 4  |    | 2  |    |    |    |    |    |    |    |    |    | 0.80            | 1.00              | 20              |
| Koeleria cristata            | Junegrass             |    |    | 2  | 8  | 4  |    |    |    |    |    |    | 8  |    |    |    | 1.47            | 1.99              | 10              |
| Oryzopsis hymenoides         | Indian Ricegrass      |    |    |    |    |    |    |    |    |    | 2  |    |    |    |    |    | 0.13            | 0.17              | 30              |
| Poa pratensis                | Kentucky Bluegrass    |    |    | 26 | 14 | 18 | 4  | 30 | 2  | 10 | 24 | 14 |    | 26 |    |    | 11.20           | 15.42             | 2               |
| Poa sandbergii               | Sandberg Bluegrass    |    |    |    |    |    |    |    |    | 4  |    |    | 2  |    |    |    | 0.40            | 0.50              | 22              |
| Stipa comata                 | Needle and Thread     | 2  |    |    |    |    |    |    |    |    |    | 2  |    |    |    |    | 0.27            | 0.50              | 22              |
| Graminoid Cover              |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 49.47           | 65.67             |                 |
| Forbs                        |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |                 |                   |                 |
| Achillea lanulosa            | Yarrow                |    | 2  | 4  |    | 4  | 36 | 2  | 6  | 4  | 2  |    |    | 14 | 2  |    | 5.07            | 7.30              | 4               |
| Aster glaucodes              | Aster                 | 4  |    |    |    |    |    | 4  | 6  | 4  | 4  |    | 2  |    |    |    | 1.60            | 1.99              | 10              |
| Cirsium scariosum            | Meadow Thistle        |    |    |    |    |    |    | 2  |    |    |    |    |    |    |    |    | 0.13            | 0.17              | 30              |
| Cirsium vulgare              | Bull Thistle          | 2  |    |    |    | 2  |    |    |    |    | 2  |    |    | 6  |    |    | 0.80            | 1.00              | 20              |
| Convolvulus arvensis         | Field Bindweed        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 6  | 0.40            | 0.50              | 22              |
| Eriogonum umbellatum         | Sulfur Buckwheat      |    |    |    | 2  |    | 2  |    |    |    |    |    |    |    |    |    | 0.27            | 0.33              | 28              |
| Galium septentrionale        | Little Bedstraw       |    |    |    |    |    |    |    |    |    | 12 |    |    | 6  |    |    | 1.20            | 1.49              | 13              |
| Hedysarum boreale            | Utah Sweetvetch       | 4  | 4  |    |    |    |    |    |    | 2  |    | 2  | 2  | 2  |    |    | 1.07            | 1.49              | 13              |
| Lappula occidentalis         | Western Sticktight    |    |    |    |    |    |    |    |    |    |    | 4  |    |    |    |    | 0.27            | 0.33              | 28              |
| Lupinus argenteus            | Lupine                |    | 6  |    |    |    |    |    | 4  |    |    |    | 2  |    |    |    | 0.80            | 1.16              | 18              |
| Melilotus officinale         | Yellow Sweetclover    |    |    |    |    |    |    |    | 2  |    |    |    |    |    |    |    | 0.13            | 0.17              | 30              |
| Mentha arvensis              | Field Mint            |    |    |    | 2  |    |    | 4  | 2  |    |    | 4  |    | 2  |    |    | 0.93            | 1.33              | 16              |
| Penstemon virens             | Beardtongue           |    | 2  |    | 2  | 2  |    |    | 2  | 2  |    |    | 2  |    | 4  | 6  | 1.47            | 2.16              | 9               |
| Taraxacum officinale         | Dandelion             |    |    |    |    |    |    |    |    |    |    | 2  |    |    |    |    | 0.13            | 0.17              | 30              |
| Thalictrum fendleri          | Meadow Rue            |    |    |    |    |    |    |    |    |    |    |    |    | 2  |    |    | 0.13            | 0.17              | 30              |
| Thermopsis montanus          | Golden Banner         | 4  |    |    |    |    |    |    | 12 | 4  |    |    | 4  |    |    |    | 1.60            | 2.82              | 7               |
| Tragopogon dubius            | Salsify               |    |    |    |    |    |    |    |    |    |    |    | 2  |    |    |    | 0.13            | 0.17              | 30              |
| Wyethia amplexicaulis        | Mule's Ears           |    |    |    |    |    |    |    |    | 2  |    |    |    |    |    |    | 0.13            | 0.17              | 30              |
| Forb Cover                   |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 16.27           | 22.89             |                 |
| Shrubs                       |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |                 |                   |                 |
| Amelanchier alnifolia        | Serviceberry          | 4  |    |    |    |    |    |    | 2  |    |    |    | 6  |    |    |    | 0.80            | 1.49              | 13              |
| Artemisia tridentata         | Big Sagebrush         |    |    |    | 2  |    |    |    |    |    | 2  |    |    |    |    |    | 0.27            | 0.50              | 22              |
| Chrysothamnus nauseosus      | Chamisa               |    |    | 4  |    |    |    |    |    |    |    |    |    |    |    |    | 0.27            | 0.50              | 22              |
| Prunus virginiana            | Chokecherry           |    |    |    |    |    |    |    |    | 2  | 4  | 2  |    |    |    |    | 0.53            | 0.66              | 21              |
| Rosa woodsii                 | Wood's Rose           | 2  | 4  |    |    |    |    | 4  |    | 4  |    |    | 6  |    |    |    | 1.33            | 2.49              | 8               |
| Symphoricarpos rotundifolius | Snowberry             | 2  | 20 |    |    | 2  |    |    | 4  | 20 | 14 |    | 2  |    |    |    | 4.27            | 5.80              | 5               |
| Shrub Cover                  |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 7.47            | 11.44             |                 |
| Vegetation Cover             |                       | 70 | 88 | 80 | 70 | 70 | 68 | 68 | 66 | 80 | 74 | 70 | 72 | 84 | 60 | 78 | 73.20           | 100.00            |                 |
|                              |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Std. Dev.       | 7.44              |                 |
|                              |                       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | N min           | 2                 |                 |
| Litter                       |                       | 20 | 12 | 10 | 18 | 18 | 16 | 22 | 12 | 16 | 20 | 24 | 14 | 8  | 24 | 14 | 16.53           |                   |                 |
| Bare                         |                       | 10 | 0  | 10 | 12 | 12 | 16 | 10 | 22 | 4  | 6  | 6  | 14 | 8  | 16 | 8  | 10.27           |                   |                 |
| Rock                         |                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0.00            |                   |                 |

Note: all data presented in percent (%) cover

## **8.0 APPENDIX**





2022 West Elk Mine Phase II Bond Release Eligible Sites