



August 16, 2022

Mr. Zach Trujillo
Environmental Protection Specialist
Colorado Division of Reclamation, Mining & Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Colowyo Coal Company L.P.
Permit No. C-1981-019
Technical Revision 155 (TR-155)
Section 3 Ponds & Incidental Permit Boundary Revision

Dear Mr. Trujillo,

Tri-State Generation and Transmission Association Inc. (Tri-State), is the parent company to Axial Basin Coal Company, which is the general partner to Colowyo Coal Company L.P. (Colowyo). Therefore, Tri-State on behalf of Colowyo is submitting technical revision 155 (TR-155) to Permit No. C-1981-019.

TR-155 proposes two sediment ponds, the Upper and Lower Section 3 Ponds respectively, which are proposed to be within Streeter Ditch directly below the primary crushing facility at Colowyo. The sediment ponds will be used in series with the Lower Section 3 Pond being a non-discharging structure. An access road design for the Section 3 Ponds Access Road has been included to provide access for construction and long-term monitoring of both sediment ponds. To accommodate both sediment ponds and the access road, the permit boundary has been revised to incorporate the footprints of all the proposed structures. It is requested that the Division calculate the revised reclamation liability associated with these two sediment ponds and access road.

Included in this technical revision is a change of index sheet to ease incorporation of this technical revision into the permit document, and a public notice for the Division's review. If you should have any additional questions or concerns, please feel free to contact Tony Tennyson at (970) 824-1232 or at ttennyson@tristategt.org.

Sincerely,

DocuSigned by:
A handwritten signature in black ink that reads "Chris Gilbreath".
D250C711D0BF450...

Chris Gilbreath
Senior Manager
Remediation and Reclamation

CG:TT:der



TRI-STATE

August 16, 2022

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Enclosure

cc: Hunter Seim (BLM-LSFO)
Tony Tennyson (via email)
File: C. F. 1.1.2.143 - G471-11.3(21)d

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

Mine Company Name: Colowyo Coal Company L.P.

Permit Number: **C-1981-019**

Date: **August 15, 2022**

Revision Description: **TR-155 Section 3 Ponds & Incidental Permit Boundary Revision**

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
1	Table of Contents page ix and x (2 pages)	Table of Contents page ix and x (2 pages)	List of Maps has been updated.
1	Pages 4-10 through 4-12 (3 pages)	Pages 4-10 through 4-12 (3 pages)	Rule 4 has been updated.
2A			No Change
2B	Page Exh. 7-14TOC-2 (1 page)	Page Exh. 7-14TOC-2 (1 page)	Volume 2B Table of Contents has been updated.
2B		Exhibit 7 Item 20 Page 1, Figure Exh. 7-20-1, and SEDCAD model (7 pages)	Exhibit 7 Item 20 has been inserted into the permit.
2C	Page Exh. 7-14TOC-2 (1 page)	Page Exh. 7-14TOC-2 (1 page)	Volume 2C Table of Contents has been updated.
2C		Appendix Exh. 7-13S3, Pages Exh. 7-14S3-1 and Exh. 7-14S3-2 (2 pages), Figures Exh. 7-14S3-1 and 2, and 22 SEDCAD Output Pages	Appendix Exh. 7-14S3 is being inserted into the permit.
2D	Page Exh. 7-14TOC-2 (1 page)	Page Exh. 7-14TOC-2 (1 page)	Volume 2D Table of Contents has been updated.
2E	Page Exh. 7-14TOC-2 (1 page)	Page Exh. 7-14TOC-2 (1 page)	Volume 2E Table of Contents has been updated.
3			No Change
4			No Change
5A			No Change
5B			No Change
6	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
6	Map 1	Map 1	Map 1 has been updated.
6	Map 2	Map 2	Map 2 has been updated.
6	Map 4	Map 4	Map 4 has been updated.
6	Map 10C	Map 10C	Map 10C has been updated.
7	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.

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Permit Number: **C-1981-019**

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Revision Description: **TR-155 Section 3 Ponds & Incidental Permit Boundary Revision**

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
7	Map 12	Map 12	Map 12 has been updated.
7	Map 19	Map 19	Map 19 has been updated.
8	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
8	Map 22	Map 22	Map 22 has been updated.
8	Map 23	Map 23	Map 23 has been updated.
8		Map 25H	Map 25H has been inserted into the permit.
8	Map 28	Map 28	Map 28 has been updated.
8	Map 29	Map 29	Map 29 has been updated.
9	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
9	Map 33	Map 33	Map 33 has been updated.
10	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
12	South Taylor Lower Wilson page viii (1 page)	South Taylor Lower Wilson page viii (1 page)	List of Maps has been updated.
13			No Change
14	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
14	Map 5A	Map 5A	Map 5A has been updated.
14	Map 5B	Map 5B	Map 5B has been updated.
14	Map 44	Map 44	Map 44 has been updated.
15	List of Maps Page xi (1 page)	List of Maps Page xi (1 page)	List of Maps has been updated.
15	Collom Rule 2, Page 28 (1 page)	Collom Rule 2, Page 28 (1 page)	Map 11C citation has been revised to Map 11B.
15	Collom Rule 2, Page 86 (1 page)	Collom Rule 2, Page 86 (1 page)	Map 11C citation has been revised to Map 11B.
15	Collom Rule 2, Page 94 (1 page)	Collom Rule 2, Page 94 (1 page)	Map 11C citation has been revised to Map 11B.

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Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
16	Exhibit 1 Item 13, Pages Exh. 1 Item 13-1 (1 page) and Pages Exh. 1, Item 13-5 through Exh. 1, Item 13-14 (10 pages)	Exhibit 1 Item 13, Pages Exh. 1 Item 13-1 (1 page) and Pages Exh. 1, Item 13-5 through Exh. 1, Item 13-14 (10 pages)	Exhibit 1, Item 13 has been updated.
17			No Change
18B			No Change
18C			No Change
18D			No Change
19			No Change
20			No Change
21	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
21	Map 7A	Map 7A	Map 7A has been updated.
21	Map 10B	Map 10B	Map 10B has been updated.
21	Map 11B	Map 11B	Map 11B has been updated
21	Map 11C		Map 11C has been consolidated onto Map 11B.
22	List of Maps Pages 1 and 2 (2 pages)	List of Maps Pages 1 and 2 (2 pages)	List of Maps has been updated.
22	Map 13B Sheet 1	Map 13B Sheet 1	Map 13B Sheet 1 has been updated.
22	Map 13B Sheet 2	Map 13B Sheet 2	Map 13B Sheet 2 has been updated.
22	Map 15B Sheet 1	Map 15B Sheet 1	Map 15B Sheet 1 has been updated.
22	Map 15B Sheet 2	Map 15B Sheet 2	Map 15B Sheet 2 has been updated.
22	Map 15B Sheet 3	Map 15B Sheet 3	Map 15B Sheet 3 has been updated.
22	Map 16B	Map 16B	Map 16B has been updated.
22	Map 17	Map 17	Map 17

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No additional diversions of intermittent or perennial streams are planned or provided for at this time..

4.05.5 Sediment Control Measures

Sediment control measures to be implemented are shown Map 12. These facilities, consisting primarily of diversion ditches and sedimentation ponds, will be located, constructed and maintained to avoid erosion and increased contribution of sediment load to runoff. Discussion on the sediment and drainage control is presented under Section. 2.05.6. The design parameters of the various sedimentation control measures are found in Exhibit 7, Hydrology Information.

As necessary, facilities to control sediment will be installed in areas above or below the planned sites of disturbance. “Upstream” facilities, such as temporary diversion ditches and- check dams up slope from the mining activities, will divert runoff away from the disturbed areas. Temporary diversion ditches below the disturbed area will divert runoff into sediment ponds. The actual mining areas will aid in retaining sediment within the disturbed areas by catching water in pits, small depressions and dozer basins, etc. in active, unreclaimed mine workings. Water leaving the reclaimed areas will drain into contour furrows or other sediment traps, as necessary, before entering the sedimentation pond.

Small Area Exemptions from time to time, it may be necessary to have small areas that do not drain to a sediment pond. Alternative sediment control measures will be used for these areas. These will be designed to meet the requirements of Rule 4.05.2.3 and Rule 4.05.5. Exhibit 7, Item 14-P (Volume 2C) provides a specific design for a small borrow pit needed to construct the embankment for the Section 28 Sediment pond.

4.05.6 Sedimentation Ponds

The location of all existing and planned sedimentation ponds are presented Map 12 and 12A. The design plans and specifications for the sedimentation ponds are described in this section. The design parameters and detailed sedimentation calculations for the sedimentation ponds are shown in Exhibit 7, Hydrology Information. The sedimentation pond embankment and emergency spillway design are also shown in Exhibit 7, Hydrology Information. All sedimentation ponds will be located as close as practical to the areas to be disturbed. Other methods of sediment control will be located on the reclaimed areas; these methods include the use of contour furrowing, contour drainage ditches, chisel plowing and revegetation etc.

This application contains calculations used to determine runoff volumes and flow rates for a theoretical 10-year, 24-hour precipitation event and subsequent sediment volumes. The precipitation data were obtained from the NOA Atlas 2, Volume 3 for Colorado; soil types were obtained from the Soil Conservation Service, and are shown on the Soils - South Map (Map 6) and the Soils - North Map (Map 5).

The ongoing mining activities within each watershed of the permit area will create constantly changing hydrologic conditions. The design models are generally based on a static, theoretical

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scenario, utilizing SEDCAD™ which considers a final reclamation and pit closure scenario in each watershed. Please see Map 12 for watershed boundaries used for hydrologic modeling.

It is Colowyo's contention that the proposed models represent nothing more than our best hydrologic estimates for a described range. of conditions. According to Applied -Hydrology and Sedimentology for Disturbed Areas, Barfield, Warner and Haan, 1981, "Hydrologic calculations are estimates, with the error in these estimates increasing as the degree of approximation increases or as the estimation procedure is applied beyond the range of conditions for which it is intended." Accordingly, it would be inappropriate for these modeling scenarios to be used or relied upon other than for their intended purpose: as an aid in the design of sedimentation pond structures to predict compliance with applicable effluent standards. Colowyo believes it would be an inappropriate use of the SEDCAD models to use them as an enforcement tool for such operations as topsoil stripping; backfilling, grading, reclamation, etc.

Sediment will be removed from all sedimentation ponds on an as needed basis or when the sediment level will not allow effective treatment of the runoff resulting from the 10-year, 24-hour precipitation event in accordance with Rule 4.05.2. Quarterly inspections will note the level of sediment in each pond. Ponds will typically be cleaned of sediment when water levels are lowest, and the least amount of precipitation is expected. The removed sediment will be used as topsoil or subsoil if it meets the suitability criteria discussed under Section 2.04.9. The Division will be notified of this determination if the material is selected as overburden material that can be substituted for or as a supplement to topsoil.

All ponds will be designed so that the minimum elevation at the top of the settled embankment is at least one foot above the elevation of the water surface in the pond with the emergency spillway flowing at design depth.

Colowyo will design, construct and maintain the sedimentation ponds to prevent short circuiting to the extent possible. As a general rule, the inflow to the ponds will be at the opposite end from the outflow area. The constructed height of the sedimentation pond embankment will be designed to allow for settling. During construction, a registered professional engineer will ensure that the appropriate embankment height is accomplished. For all sedimentation ponds, the entire embankment, including the surrounding areas disturbed by construction, will be seeded after the embankment is completed. The active upstream side of the embankment where water will be impounded will be riprapped or otherwise stabilized, where necessary. Areas in which revegetation is not successful or, where rills and gullies develop, will be repaired and revegetated.

Sedimentation ponds that are subsequently approved as part of the post-mining land use will remain in place after the termination of mining activities.

Colowyo will inspect the condition of each pond and submit a quarterly report. None of Colowyo's ponds meet the size criteria of 30 CFR 77.216(a)(1989).

A small area exemption for sediment control will be utilized for sediment control for the remaining reclamation area in the Gulch A watershed that has not achieved Phase II or Phase III bond release. This small area exemption allows for a grass filter to be utilized for sediment control for the small

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area exemption. Please see Volume 2C, Item 18 for the small area exemption demonstration (grass filter) for the Gulch A watershed.

4.05.7 Discharge Structures

The sedimentation ponds at Colowyo are designed to treat the 10-year, 24-hour storm event in accordance with Rule 4.05.6(3)(a) or fully contain the 100-year, 24-hour event. As such, the general operation of the ponds that are designed to discharge will be a passive discharge system where water is allowed to discharge automatically as necessary. Ponds designed to the 100-year, 24-hour storm event will fully contain the storm event and be managed as non-discharging structures. Colowyo will sample discharges as appropriate to remain in compliance with applicable CDPS Permit requirements. Pond dewatering through a manual headgate may be performed as necessary to lower the water level depending on operational requirements. Manual dewatering of ponds will meet applicable CDPS Permit standards. Discharge from sedimentation ponds will be controlled by energy dissipaters and flow check devices where necessary. All embankment ponds utilize separate principal and emergency spillways with the emergency spillway located at a minimum of 1 foot above the elevation of the maximum water surface during the discharge of the 10-year, 24-hour storm event through the principal spillway. The principal spillways are designed for the 10-year, 24-hour storm event and the emergency spillways are designed to pass the 25-year, 24-hour storm event in accordance with Rule 4.05.9(2)(c)(i). The design requirements for existing ponds can be found on each of the pond as-built drawings or in Volumes 2D and 2E Exhibit 7. All embankment sedimentation ponds will provide a non-clogging dewatering device or conduit spillway to remove water storage from inflow. Design requirements for all sediment ponds associated with the Collom Pit be found in Exhibit 7, Item 23. For compliance purposes, in systems that incorporate ponds in a series, CDPS effluent quality parameters will only apply to the last pond in the series that directly discharges into the receiving stream or drainage. Out of pit designed ponds internal to the last pond in the series will be inspected and maintained in the same manner as the “compliance” pond to ensure proper sediment control and design performance.

The sumps along Haul Road A are required to have flow measurement devices at the outflow of each sump. Each sump therefore will have a flume installed at the outflow to measure any flow discharged from each sump.

- 19) Point of Compliance Well Investigation Report – Colowyo Mine, AECOM 2021
- 20) Topsoil Pile 15G Grass Filter Demonstration

Volume 2D

Introductory Text - Methodologies and Assumptions for Sediment Pond Design
Appendix Exh. 7-14SP Streeter Pond
Appendix Exh. 7-14S3 Upper and Lower Section 3 Ponds
Work Area Pond
Gossard Pond
Stoker Siding Pond
Rail Loop Pond

Volume 2E

Prospect Pond
West Pit Pond
Appendix Exh. 7-14S Section 16 Pond
Appendix Exh. 7-14ET East Taylor Pond
Taylor Pump Pond

(Note: For hydrology information in the South Taylor Area, See Volume 13, Exhibit 7 Item 20 and for the Collom Area, See Volumes 18B through 18D.)

Exhibit 7, Item 20
Topsoil Pile 15G Grass Filter Demonstration

As shown on Map 12 and Figure Exh. 7-20-1, topsoil pile 15G and a small portion of a road cannot have surface water runoff routed to the Section 3 Ponds for primary sediment control. This demonstration will, in accordance with Rule 4.05.2(3)(a), provide an exemption from the requirements of 4.05.2. Therefore, surface water runoff from this disturbed around will be treated through a grass filter.

For the model demonstration, SEDCADTM grass filter routine has been used to demonstrate that runoff from this area will meet the effluent standards of 0.5 ml/l in accordance with Rule 4.05.2(7) (US EPA, 40 C.F.R. §434.52). Runoff curve numbers assigned to the undisturbed and/or native lands in various stages of mining and reclamation have been selected in accordance with Table 1 in the Introductory Text for Exhibit 7 in Volume 2D or as further described below.

The grass filter physical parameters were taken as the defaults in the SEDCAD drop down tables for a good stand of well established rye grass, except that the stem spacing was conservatively increased from 0.67 inches to 2.0 inches, and the roughness coefficient reduced from 0.0121 to 0.008, as described Reference 1, page 568, for a "fair stand" of grass. Both of these revisions produce a more severe loading on the grass filter by allowing the flow velocity to be higher than in a "good stand".

The results of the SEDCADTM model demonstrates that a grass filter 5 feet in length (direction of flow) that is 300 feet long is adequate to manage sediment for this area. In summary, the grass filter has a trap efficiency of 83.8%, and the settleable solid concretion is 0.14 ml/l, which is below the 0.5 ml/l standard.

References

- 1) Applied Hydrology and Sedimentology for Disturbed Areas, Barfield, Warner and Haan, 1981

Topsoil Pile 15G **Alternative Sediment Control** **Demonstration**

Grass Filter

Tri-State Generation & Transmission Association, Inc.
1100 West 116th Avenue
Westminster, CO 80234

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

Particle Size Distribution:

Size (mm)	Colowyo Particle Size
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure Networking:

Type	Stru #	(flows Into)	Stru #	Musk. K (hrs)	Musk. X	Description
Grass Filter	#1	==>	End	0.000	0.000	Topsoil Pile 15G Grass Filter

#1
Grass
Filter

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	12.100	12.100	1.08	0.08	0.5	11,047	6.30	2.91
Out			1.08	0.07	0.1	2,972	0.14	0.04

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.000%	100.000%
0.0400	33.000%	100.000%
0.0010	20.000%	81.839%

Structure Detail:

Structure #1 (Grass Filter)

Topsoil Pile 15G Grass Filter

Grass Filter Inputs:

Roughness Coefficient	Grass Height (in)	Hydraulic Spacing (in)	Infiltration Rate (iph)	Stiffness Factor (N-sq m)	Filter Length (ft)	Filter Width (ft)	Filter Slope (%)
0.0080	4.0	2.00	0.20	20.000	5.0	300.0	2.0

Grass Filter Results:

Total Infiltration Volume:	0.0071 ac-ft
Filter Infiltration Rate:	0.0069 cfs
Peak Flow Depth:	0.059 in
Critical Prone Velocity:	1.0367 fps
Wedge Location:	0.32 ft
Sediment Depth in Zone D:	0.0200 in
Trap Efficiency:	83.8 %

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.200	0.129	0.000	0.000	47.000	S	0.00	0.000
	2	0.800	0.013	0.000	0.000	47.000	S	0.00	0.000
	3	2.100	0.071	0.000	0.000	80.000	F	1.08	0.078
Σ		12.100						1.08	0.078

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.300	400.00	11.80	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	20.00	2.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	3	0.300	100.00	2.00	0.8000	0.3800	1	0.5	11,047	6.30	2.91
Σ								0.5	11,047	6.30	2.91

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	11.80	150.33	1,274.00	2.740	0.129
#1	1	Time of Concentration:					0.129
#1	2	3. Short grass pasture	2.00	1.10	55.00	1.130	0.013
#1	2	Time of Concentration:					0.013
#1	3	5. Nearly bare and untilled, and alluvial valley fans	2.00	7.28	364.00	1.410	0.071
#1	3	Time of Concentration:					0.071

- 19) Point of Compliance Well Investigation Report – Colowyo Mine, AECOM 2021
- 20) Topsoil Pile 15G Grass Filter Demonstration

Volume 2D

Introductory Text - Methodologies and Assumptions for Sediment Pond Design
Appendix Exh. 7-14SP Streeter Pond
Appendix Exh. 7-14S3 Upper and Lower Section 3 Ponds
Work Area Pond
Gossard Pond
Stoker Siding Pond
Rail Loop Pond

Volume 2E

Prospect Pond
West Pit Pond
Appendix Exh. 7-14S Section 16 Pond
Appendix Exh. 7-14ET East Taylor Pond
Taylor Pump Pond

**(Note: For hydrology information in the South Taylor Area, See Volume 13, Exhibit 7
Item 20 and for the Collom Area, See Volumes 18B through 18D.)**

Appendix Exh. 7-14S3 Upper and Lower Section 3 Ponds

The location of the Upper and Lower Section 3 Ponds are presented on Map 12. These two ponds will eventually replace the Streeter Pond as the primary sediment controls structures in the Streeter Ditch watershed. The profiles of the associated permanent channels associated with the Upper and Lower Section 3 Ponds watershed are presented on Map 33. These channels consist of the Streeter and Buckskin Ditches, and their design information is presented in this appendix. The design configuration for the Upper and Lower Section 3 Ponds are presented on Figure Exh. 7-14S3-1, and Figure Exh. 7-14S3-2 provides the breakdown of drainage areas and hydrologic conditions for this sediment pond.

Exhibit 7, Item 14 in Volume 2D describes the hydrologic methodology used in sediment pond and post mine channel assumptions. Runoff curve numbers assigned to the undisturbed and reclaimed lands in various stages of reclamation have been selected in accordance with Table 1 in the Introductory Text for Exhibit 7 in Volume 2D. For channels protected by a riprap liner, selection of minimum riprap size is done using the Simons/OSM method in SEDCADTM. For channels to be protected by a vegetative liner, the permissible velocities are also determined using SEDCADTM routines.

Upper and Lower Section 3 Ponds

The following pages present the results of the SEDCADTM models for the post mining condition. At this stage the oldest reclamation is on the southern extent of the reclaimed West Pit, and the younger (topsoil and seeded) reclamation is the northern reaches of the Upper and Lower Section 3 Ponds watershed.

The SEDCADTM model herein provides the results of the 100-year, 24-hour design storm and demonstrates the Lower Section 3 Pond will fully contain the modeled event.

The final post mining topographic surface and the final locations of the permanent drainage channels as presented on Map 12 were used to model the watershed for the post-mining condition. Three in-stream stock ponds (SD-1, SD-2, and SD-3) are included in the permanent channels to decrease peak flows from the modeled storm event, and to provide a water source to support the post-mining land use. A typical design for these stock ponds is presented on Figure 2.05-6 in Volume 1; however, each stock pond will ultimately be design and constructed to account for local ground conditions present in the post mine topography at the time of construction.

In summary, for the post mining case, the 100-year, 24-hour storm produces 106.83 acre-feet of runoff into the Upper Section 3 Pond. The storm event peaks in the Lower Section 3 Pond at 7,148.6', which is below the emergency spillway elevation (7,150').

Streeter & Buckskin Permanent Post Mine Channels

The Section 3 Pond watershed is comprised of two post-mining channels. The main channel is the Streeter Ditch, which will convey post mining surface water flows to the Upper and Lower Section 3 Ponds. Buckskin Ditch is a tributary to the Streeter Ditch. The locations of both channels are presented on Map 12 and Figure Exh. 7-14S3-2, and the channel profiles are presented on Map 33.

Both channels have been designed in accordance with Rule 4.05.4(2)(b) for the 100-year, 24-hour storm event as the watershed reporting to the Upper and Lower Section 3 Ponds is greater than one square mile.

A SEDCAD™ model has been included which evaluates the peak flow and total runoff volume for each of the channel segments for the 100 year, 24-hour storm event. The channel configurations for the Streeter and Buckskin Ditches are summarized below.

Streeter Ditch

<u>Station</u>	<u>Peak Flow (CFS)</u>	<u>Average Slope (%)</u>	<u>Channel Type</u>	<u>Side Slopes</u>	<u>Erosion Protection</u>
Station 0+00 to SD-1	104.12	4.7	Trapezoidal 15' bottom	3H:1V	Riprap, D50 = 6"
SD-1 to SD-2	109.89	4.4	Trapezoidal 15' bottom	3H:1V	Riprap, D50 = 9"
SD-2 to SD-3	111.97	2.7	Trapezoidal 15' bottom	3H:1V	Vegetation
SD-3 to Confluence with Buckskin Ditch	104.21	2.1	Trapezoidal 15' bottom	3H:1V	Vegetation
Confluence of Buckskin Ditch to Station 101+46	81.98	2.6	Trapezoidal 15' bottom	3H:1V	Vegetation

Buckskin Ditch

<u>Station</u>	<u>Peak Flow (CFS)</u>	<u>Average Slope (%)</u>	<u>Channel Type</u>	<u>Side Slopes</u>	<u>Erosion Protection</u>
Station 0+00 to 35+00	37.48	4.0	Trapezoidal 12' bottom	3H:1V	Vegetation

Lower and Upper Section 3 Ponds **100-Year 24-Hour Storm Event**

Total Containment Demonstration

Tony Tennyson

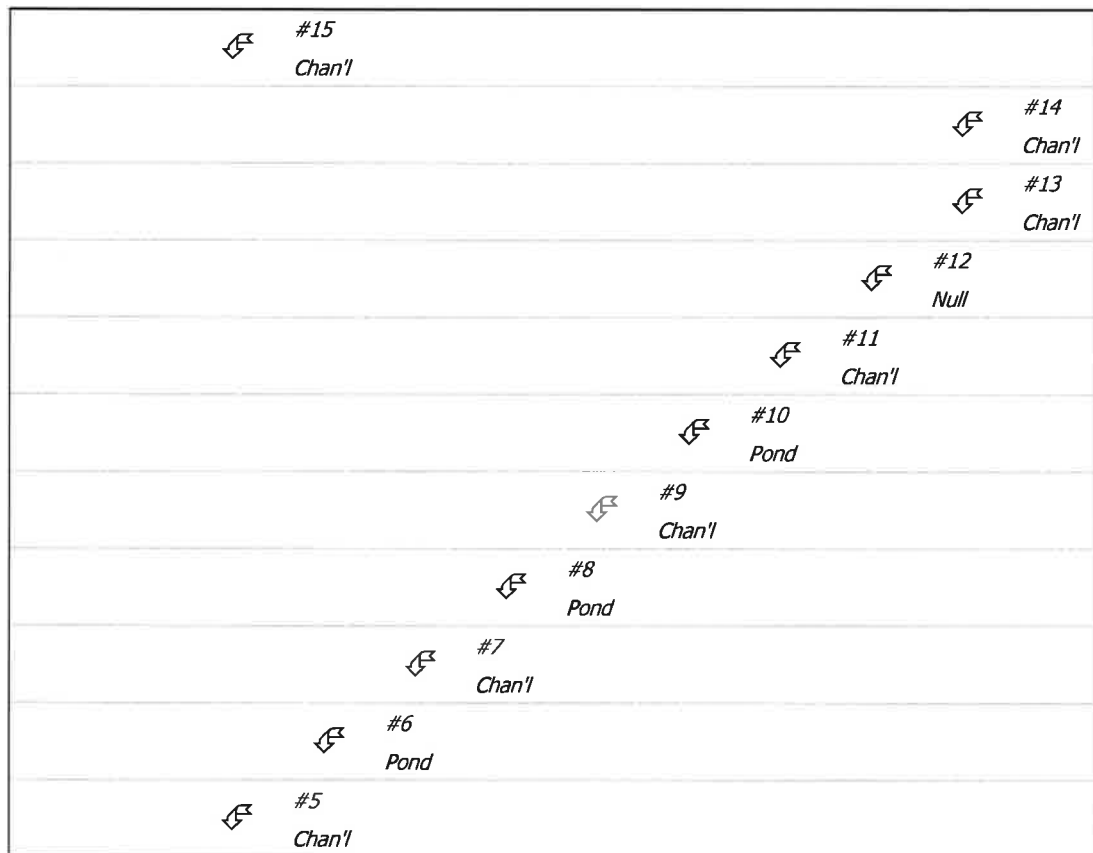
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	2.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Lower Section 3 Pond
Pond	#2	==>	#1	0.000	0.000	Lower Section 3 Pond
Pond	#4	==>	#2	0.000	0.000	Upper Section 3 Pond
Channel	#5	==>	#4	0.000	0.000	Streeter Ditch 0+00 to SD-1
Pond	#6	==>	#5	0.000	0.000	SD-1 Stockpond
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch SD-1 to SD-2
Pond	#8	==>	#7	0.000	0.000	SD-2 Stockpond
Channel	#9	==>	#8	0.000	0.000	Streeter Ditch SD-2 to SD-3
Pond	#10	==>	#9	0.000	0.000	SD-3 Stockpond
Channel	#11	==>	#10	0.000	0.000	Streeter Ditch SD-3 to Confluence w/Buckskin Ditch
Null	#12	==>	#11	0.000	0.000	Null at Confluence of Streeter Ditch & Buckskin Ditch
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch from Confluence to Station 101+46
Channel	#14	==>	#12	0.000	0.000	Buckskin Ditch
Channel	#15	==>	#4	0.000	0.000	Stoker Ditch



	#4 <i>Pond</i>
	#2 <i>Pond</i>
#1	
<i>Null</i>	

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#15	19.600	19.600	19.06	1.43
#14	135.200	135.200	37.48	4.87
#13	350.100	350.100	81.98	14.85
#12	0.000	485.300	98.63	19.72
#11	45.500	530.800	104.21	21.71
#10 In	0.000	530.800	104.21	21.71
Out			101.46	21.71
#9	176.300	707.100	111.97	25.52
#8 In	0.000	707.100	111.97	25.52
Out			106.44	25.47
#7	55.000	762.100	109.89	27.71
#6 In	0.000	762.100	109.89	27.71
Out			102.61	27.56
#5	24.400	786.500	104.12	28.63
#4 In	19.200	825.300	106.83	30.49
Out			10.01	8.12
#2 In	0.000	825.300	10.01	8.12
Out			0.00	0.00
#1	0.000	825.300	0.00	0.00

Structure Detail:

Structure #15 (Vegetated Channel)

Stoker Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B	1.58			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.06 cfs		19.06 cfs	
Depth:	0.92 ft	2.50 ft	1.42 ft	3.00 ft
Top Width:	9.37 ft	22.01 ft	13.38 ft	26.02 ft
Velocity:	3.64 fps		1.74 fps	
X-Section Area:	5.23 sq ft		10.95 sq ft	
Hydraulic Radius:	0.546 ft		0.797 ft	
Froude Number:	0.86		0.34	
Roughness Coefficient:	0.0473		0.1272	

Structure #14 (Vegetated Channel)

Buckskin Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.0	D, B	3.00			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	37.48 cfs		37.48 cfs	
Depth:	0.62 ft	3.62 ft	1.00 ft	4.00 ft
Top Width:	15.70 ft	33.70 ft	17.98 ft	35.98 ft
Velocity:	4.39 fps		2.51 fps	
X-Section Area:	8.55 sq ft		14.95 sq ft	
Hydraulic Radius:	0.537 ft		0.816 ft	
Froude Number:	1.05		0.48	
Roughness Coefficient:	0.0449		0.1037	

Structure #13 (Vegetated Channel)

Streeter Ditch from Confluence to Station 101+46

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B	2.67			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	81.98 cfs		81.98 cfs	
Depth:	0.89 ft	3.56 ft	1.33 ft	4.00 ft
Top Width:	20.33 ft	36.35 ft	23.00 ft	39.02 ft
Velocity:	5.23 fps		3.23 fps	
X-Section Area:	15.69 sq ft		25.35 sq ft	
Hydraulic Radius:	0.761 ft		1.082 ft	
Froude Number:	1.05		0.54	
Roughness Coefficient:	0.0382		0.0782	

Structure #12 (Null)

Null at Confluence of Streeter Ditch & Buckskin Ditch

Structure #11 (Vegetated Channel)

Streeter Ditch SD-3 to Confluence w/Buckskin Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.1	D, B	2.47			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	104.21 cfs		104.21 cfs	
Depth:	1.05 ft	3.52 ft	1.53 ft	4.00 ft
Top Width:	21.28 ft	36.10 ft	24.19 ft	39.01 ft
Velocity:	5.49 fps		3.47 fps	
X-Section Area:	18.99 sq ft		30.02 sq ft	
Hydraulic Radius:	0.878 ft		1.216 ft	
Froude Number:	1.02		0.55	
Roughness Coefficient:	0.0361		0.0709	

Structure #10 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	104.00 ft
Initial Pool:	1.63 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	2.00	0.0150	104.00	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
106.00	30.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	107.47 ft
Dewater Time:	0.84 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
100.00	0.016	0.000	0.000		
101.00	0.096	0.050	0.000		
102.00	0.539	0.338	0.000		
103.00	0.654	0.933	0.000		
104.00	0.735	1.628	0.000		Spillway #1
105.00	0.843	2.416	2.094	4.56*	
106.00	0.872	3.273	4.414	3.60	Spillway #2
107.00	0.872	4.145	49.083	11.35	
107.47	0.872	4.552	101.459	0.70	Peak Stage
108.00	0.872	5.017	161.389		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
100.00	0.000	0.000	0.000
101.00	0.000	0.000	0.000
102.00	0.000	0.000	0.000
103.00	0.000	0.000	0.000
104.00	0.000	0.000	0.000
105.00	(3)>2.094	0.000	2.094
106.00	(5)>4.414	0.000	4.414
107.00	(6)>5.182	43.900	49.083
108.00	(6)>5.793	155.596	161.389

Structure #9 (Vegetated Channel)

Streeter Ditch SD-2 to SD-3

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.7	D, B	2.55			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	111.97 cfs		111.97 cfs	
Depth:	1.00 ft	3.55 ft	1.45 ft	4.00 ft
Top Width:	21.00 ft	36.30 ft	23.68 ft	38.98 ft
Velocity:	6.22 fps		4.00 fps	
X-Section Area:	18.00 sq ft		27.99 sq ft	
Hydraulic Radius:	0.844 ft		1.159 ft	
Froude Number:	1.18		0.65	
Roughness Coefficient:	0.0351		0.0674	

Structure #8 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	104.00 ft
Initial Pool:	1.63 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	2.00	0.0150	104.00	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
106.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	107.44 ft
Dewater Time:	1.03 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
100.00	0.016	0.000	0.000		
101.00	0.096	0.050	0.000		
102.00	0.539	0.338	0.000		
103.00	0.654	0.933	0.000		
104.00	0.735	1.628	0.000		Spillway #1
105.00	0.843	2.416	2.094	4.56*	
106.00	0.872	3.273	4.414	7.70	Spillway #2
107.00	0.872	4.145	53.583	11.70	
107.44	0.872	4.531	106.445	0.75	Peak Stage
108.00	0.872	5.017	173.190		

*Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
100.00	0.000	0.000	0.000
101.00	0.000	0.000	0.000
102.00	0.000	0.000	0.000
103.00	0.000	0.000	0.000
104.00	0.000	0.000	0.000
105.00	(3)>2.094	0.000	2.094
106.00	(5)>4.414	0.000	4.414
107.00	(6)>5.182	48.400	53.583
108.00	(6)>5.793	167.398	173.190

Structure #7 (Riprap Channel)

Streeter Ditch SD-1 to SD-2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	4.4	3.16		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	109.89 cfs	
Depth:	0.84 ft	4.00 ft
Top Width:	20.04 ft	39.00 ft
Velocity*:		
X-Section Area:	14.71 sq ft	
Hydraulic Radius:	0.724 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	104.00 ft
Initial Pool:	1.63 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	2.00	0.0150	104.00	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
106.00	30.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	107.48 ft
Dewater Time:	1.21 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
100.00	0.016	0.000	0.000	
101.00	0.096	0.050	0.000	
102.00	0.539	0.338	0.000	
103.00	0.654	0.933	0.000	
104.00	0.735	1.628	0.000	Spillway #1
105.00	0.843	2.416	2.094	4.56*
106.00	0.872	3.273	4.414	11.60 Spillway #2
107.00	0.872	4.145	49.083	11.90
107.48	0.872	4.561	102.612	1.00 Peak Stage
108.00	0.872	5.017	161.389	

*Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
100.00	0.000	0.000	0.000
101.00	0.000	0.000	0.000
102.00	0.000	0.000	0.000
103.00	0.000	0.000	0.000
104.00	0.000	0.000	0.000
105.00	(3)>2.094	0.000	2.094
106.00	(5)>4.414	0.000	4.414
107.00	(6)>5.182	43.900	49.083
108.00	(6)>5.793	155.596	161.389

Structure #5 (Riprap Channel)

Streeter Ditch 0+00 to SD-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	4.7	3.19		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	104.12 cfs	
Depth:	0.81 ft	4.00 ft
Top Width:	19.87 ft	39.01 ft
Velocity*:		
X-Section Area:	14.15 sq ft	
Hydraulic Radius:	0.703 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Pond)

Upper Section 3 Pond

Pond Inputs:

Initial Pool Elev:	7,155.00 ft
Initial Pool:	0.38 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,181.00	50.00	2.00:1	2.00:1	25.00

Pond Results:

Peak Elevation:	7,181.21 ft
Dewater Time:	1.11 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,146.00	0.004	0.000	0.000	
7,147.00	0.009	0.006	0.000	
7,148.00	0.016	0.019	0.000	
7,149.00	0.022	0.038	0.000	
7,150.00	0.029	0.063	0.000	
7,151.00	0.043	0.098	0.000	
7,152.00	0.060	0.149	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,153.00	0.071	0.215	0.000	
7,154.00	0.083	0.292	0.000	
7,155.00	0.096	0.381	0.000	
7,156.00	0.109	0.484	0.000	
7,157.00	0.123	0.599	0.000	
7,158.00	0.139	0.730	0.000	
7,159.00	0.153	0.876	0.000	
7,160.00	0.168	1.037	0.000	
7,161.00	0.200	1.220	0.000	
7,162.00	0.234	1.437	0.000	
7,163.00	0.287	1.697	0.000	
7,164.00	0.346	2.014	0.000	
7,165.00	0.408	2.391	0.000	
7,166.00	0.475	2.831	0.000	
7,167.00	0.584	3.360	0.000	
7,168.00	0.706	4.004	0.000	
7,169.00	0.864	4.787	0.000	
7,170.00	1.039	5.737	0.000	
7,171.00	1.131	6.822	0.000	
7,172.00	1.228	8.001	0.000	
7,173.00	1.321	9.275	0.000	
7,174.00	1.417	10.644	0.000	
7,175.00	1.506	12.105	0.000	
7,176.00	1.597	13.656	0.000	
7,177.00	1.681	15.294	0.000	
7,178.00	1.766	17.018	0.000	
7,179.00	1.852	18.827	0.000	
7,180.00	1.940	20.723	0.000	
7,181.00	2.003	22.695	0.000	Spillway #1
7,181.21	2.016	23.129	10.011	26.00 Peak Stage
7,182.00	2.065	24.729	46.923	
7,183.00	2.119	26.821	178.257	
7,184.00	2.173	28.967	369.503	
7,185.00	2.218	31.162	631.300	
7,186.00	2.262	33.402	954.483	

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,146.00	0.000	0.000
7,147.00	0.000	0.000
7,148.00	0.000	0.000
7,149.00	0.000	0.000
7,150.00	0.000	0.000
7,151.00	0.000	0.000
7,152.00	0.000	0.000
7,153.00	0.000	0.000
7,154.00	0.000	0.000
7,155.00	0.000	0.000
7,156.00	0.000	0.000
7,157.00	0.000	0.000
7,158.00	0.000	0.000
7,159.00	0.000	0.000
7,160.00	0.000	0.000
7,161.00	0.000	0.000
7,162.00	0.000	0.000
7,163.00	0.000	0.000
7,164.00	0.000	0.000
7,165.00	0.000	0.000
7,166.00	0.000	0.000
7,167.00	0.000	0.000
7,168.00	0.000	0.000
7,169.00	0.000	0.000
7,170.00	0.000	0.000
7,171.00	0.000	0.000
7,172.00	0.000	0.000
7,173.00	0.000	0.000
7,174.00	0.000	0.000
7,175.00	0.000	0.000
7,176.00	0.000	0.000
7,177.00	0.000	0.000
7,178.00	0.000	0.000
7,179.00	0.000	0.000
7,180.00	0.000	0.000
7,181.00	0.000	0.000
7,182.00	46.923	46.923
7,183.00	178.257	178.257
7,184.00	369.503	369.503
7,185.00	631.300	631.300
7,186.00	954.483	954.483

Structure #2 (Pond)

Lower Section 3 Pond

Lower Section 3 Pond

Pond Inputs:

Initial Pool Elev:	7,145.00 ft
Initial Pool:	7.88 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,150.00	40.00	2.00:1	2.00:1	25.00

Pond Results:

Peak Elevation:	7,148.66 ft
Dewater Time:	0.00 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,137.00	0.001	0.000	0.000	
7,138.00	0.072	0.026	0.000	
7,139.00	0.312	0.204	0.000	
7,140.00	0.858	0.767	0.000	
7,141.00	1.188	1.785	0.000	
7,142.00	1.344	3.051	0.000	
7,143.00	1.509	4.477	0.000	
7,144.00	1.701	6.081	0.000	
7,145.00	1.901	7.880	0.000	
7,146.00	2.056	9.858	0.000	
7,147.00	2.225	11.998	0.000	
7,148.00	2.415	14.317	0.000	
7,148.66	2.585	15.983	0.000	0.00 Peak Stage
7,149.00	2.660	16.854	0.000	
7,150.00	2.940	19.653	0.000	Spillway #1
7,151.00	2.971	22.609	51.108	
7,152.00	3.004	25.596	186.888	
7,153.00	3.035	28.615	381.133	
7,154.00	3.057	31.661	654.892	
7,155.00	3.082	34.731	972.263	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,137.00	0.000	0.000
7,138.00	0.000	0.000
7,139.00	0.000	0.000
7,140.00	0.000	0.000
7,141.00	0.000	0.000
7,142.00	0.000	0.000
7,143.00	0.000	0.000
7,144.00	0.000	0.000
7,145.00	0.000	0.000
7,146.00	0.000	0.000
7,147.00	0.000	0.000
7,148.00	0.000	0.000
7,149.00	0.000	0.000
7,150.00	0.000	0.000
7,151.00	51.108	51.108
7,152.00	186.888	186.888
7,153.00	381.133	381.133
7,154.00	654.892	654.892
7,155.00	972.263	972.263

Structure #1 (Null)

Null Below Lower Section 3 Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#15	1	4.000	0.077	0.000	0.000	62.000	M	1.23	0.095
	2	15.600	0.044	0.000	0.000	80.000	F	17.84	1.337
	Σ	19.600						19.06	1.432
#14	1	99.100	0.462	0.000	0.000	62.000	M	8.42	1.881
	2	36.100	0.135	0.000	0.000	80.000	F	34.15	2.985
	Σ	135.200						37.48	4.866
#13	1	10.700	0.077	0.000	0.000	62.000	M	3.29	0.254
	2	6.300	0.085	0.000	0.000	47.000	S	0.02	0.008
	3	52.900	0.288	0.000	0.000	62.000	M	5.84	1.007
	4	221.000	0.830	0.000	0.000	74.000	F	74.84	12.531
	5	9.700	0.118	0.000	0.000	62.000	M	2.98	0.231
	6	35.200	0.164	0.000	0.000	47.000	S	0.06	0.033
	7	7.100	0.102	0.000	0.000	62.000	M	2.18	0.169
	8	7.200	0.058	0.000	0.000	80.000	F	8.23	0.617
	Σ	350.100						81.98	14.850
#12	Σ	485.300						98.63	19.716
#11	1	20.500	0.074	0.000	0.000	80.000	F	23.44	1.757
	2	9.500	0.110	0.000	0.000	62.000	M	2.92	0.226
	3	15.500	0.164	0.000	0.000	47.000	S	0.02	0.014
	Σ	530.800						104.21	21.714
#10	Σ	530.800						104.21	21.714
#9	1	12.100	0.057	0.000	0.000	80.000	F	13.83	1.037
	2	26.700	0.055	0.000	0.000	47.000	S	0.06	0.037
	3	15.100	0.040	0.000	0.000	80.000	F	17.26	1.294
	4	16.600	0.205	0.000	0.000	80.000	F	15.00	1.341
	5	80.000	0.231	0.000	0.000	47.000	S	0.13	0.075
	6	25.800	0.221	0.000	0.000	47.000	S	0.04	0.024
	Σ	707.100						111.97	25.516
#8	Σ	707.100						111.97	25.516
#7	1	0.700	0.023	0.000	0.000	80.000	F	0.80	0.060
	2	6.900	0.054	0.000	0.000	47.000	S	0.02	0.009
	3	18.200	0.055	0.000	0.000	80.000	F	20.81	1.560
	4	3.300	0.022	0.000	0.000	80.000	F	3.77	0.283
	5	7.600	0.107	0.000	0.000	47.000	S	0.02	0.010
	6	6.500	0.080	0.000	0.000	62.000	M	2.00	0.155

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	7	1.700	0.100	0.000	0.000	80.000	F	1.94	0.146
	8	9.300	0.081	0.000	0.000	47.000	S	0.02	0.012
	9	0.800	0.058	0.000	0.000	47.000	S	0.00	0.000
	Σ	762.100						109.89	27.707
#6	Σ	762.100						109.89	27.707
#5	1	12.200	0.042	0.000	0.000	80.000	F	13.95	1.046
	2	12.200	0.122	0.000	0.000	47.000	S	0.03	0.017
	Σ	786.500						104.12	28.627
#4	1	4.800	0.030	0.000	0.000	80.000	F	5.49	0.411
	2	14.400	0.124	0.000	0.000	47.000	S	0.04	0.020
	Σ	825.300						106.83	30.490
#2	Σ	825.300						10.01	8.121
#1	Σ	825.300						0.00	0.000

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	3. Short grass pasture	15.00	51.30	342.00	3.090	0.030
#4	1	Time of Concentration:					0.030
#4	2	3. Short grass pasture	6.00	52.44	874.00	1.950	0.124
#4	2	Time of Concentration:					0.124
#5	2	3. Short grass pasture	6.00	51.60	860.00	1.950	0.122
#5	2	Time of Concentration:					0.122
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	0.85	86.00	1.000	0.023
#7	1	Time of Concentration:					0.023
#7	2	3. Short grass pasture	16.00	99.84	624.00	3.200	0.054
#7	2	Time of Concentration:					0.054
#7	3	5. Nearly bare and untilled, and alluvial valley fans	16.00	128.48	803.00	4.000	0.055
#7	3	Time of Concentration:					0.055
#7	4	5. Nearly bare and untilled, and alluvial valley fans	10.00	26.10	261.00	3.160	0.022
#7	4	Time of Concentration:					0.022
#7	5	3. Short grass pasture	4.00	24.80	620.00	1.600	0.107
#7	5	Time of Concentration:					0.107
#7	6	3. Short grass pasture	5.00	25.75	515.00	1.780	0.080
#7	6	Time of Concentration:					0.080
#7	7	5. Nearly bare and untilled, and alluvial valley fans	2.00	10.24	512.00	1.410	0.100

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	7	Time of Concentration:					0.100
#7	8	3. Short grass pasture	12.00	97.07	809.00	2.770	0.081
#7	8	Time of Concentration:					0.081
#7	9	3. Short grass pasture	2.00	4.71	236.00	1.130	0.058
#7	9	Time of Concentration:					0.058
#9	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	23.10	462.00	2.230	0.057
#9	1	Time of Concentration:					0.057
#9	2	3. Short grass pasture	16.00	101.60	635.00	3.200	0.055
#9	2	Time of Concentration:					0.055
#9	3	5. Nearly bare and untilled, and alluvial valley fans	11.00	52.69	479.00	3.310	0.040
#9	3	Time of Concentration:					0.040
#9	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	82.30	1,646.00	2.230	0.205
#9	4	Time of Concentration:					0.205
#9	5	3. Short grass pasture	10.00	210.40	2,104.00	2.520	0.231
#9	5	Time of Concentration:					0.231
#9	6	3. Short grass pasture	6.30	100.61	1,597.00	2.000	0.221
#9	6	Time of Concentration:					0.221
#11	1	5. Nearly bare and untilled, and alluvial valley fans	13.00	125.84	968.00	3.600	0.074
#11	1	Time of Concentration:					0.074
#11	2	3. Short grass pasture	10.00	100.50	1,005.00	2.520	0.110
#11	2	Time of Concentration:					0.110
#11	3	3. Short grass pasture	9.00	128.25	1,425.00	2.400	0.164
#11	3	Time of Concentration:					0.164
#13	1	3. Short grass pasture	8.00	50.32	629.00	2.260	0.077
#13	1	Time of Concentration:					0.077
#13	2	3. Short grass pasture	10.00	77.90	779.00	2.520	0.085
#13	2	Time of Concentration:					0.085
#13	3	3. Short grass pasture	13.00	389.34	2,995.00	2.880	0.288
#13	3	Time of Concentration:					0.288
#13	4	3. Short grass pasture	9.00	645.57	7,173.00	2.400	0.830
#13	4	Time of Concentration:					0.830
#13	5	3. Short grass pasture	2.00	9.67	484.00	1.130	0.118
#13	5	Time of Concentration:					0.118
#13	6	3. Short grass pasture	9.00	128.07	1,423.00	2.400	0.164
#13	6	Time of Concentration:					0.164
#13	7	3. Short grass pasture	4.00	23.60	590.00	1.600	0.102
#13	7	Time of Concentration:					0.102
#13	8	5. Nearly bare and untilled, and alluvial valley fans	11.00	76.44	695.00	3.310	0.058
#13	8	Time of Concentration:					0.058
#14	1	3. Short grass pasture	8.00	300.95	3,761.87	2.260	0.462

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	1	Time of Concentration:					0.462
#14	2	5. Nearly bare and untilled, and alluvial valley fans	6.00	71.40	1,190.00	2.440	0.135
#14	2	Time of Concentration:					0.135
#15	1	3. Short grass pasture	2.00	6.30	315.00	1.130	0.077
#15	1	Time of Concentration:					0.077
#15	2	5. Nearly bare and untilled, and alluvial valley fans	13.00	75.39	580.00	3.600	0.044
#15	2	Time of Concentration:					0.044

- 19) Point of Compliance Well Investigation Report – Colowyo Mine, AECOM 2021
- 20) Topsoil Pile 15G Grass Filter Demonstration

Volume 2D

Introductory Text - Methodologies and Assumptions for Sediment Pond Design
Appendix Exh. 7-14SP Streeter Pond
Appendix Exh. 7-14S3 Upper and Lower Section 3 Ponds
Work Area Pond
Gossard Pond
Stoker Siding Pond
Rail Loop Pond

Volume 2E

Prospect Pond
West Pit Pond
Appendix Exh. 7-14S Section 16 Pond
Appendix Exh. 7-14ET East Taylor Pond
Taylor Pump Pond

**(Note: For hydrology information in the South Taylor Area, See Volume 13, Exhibit 7
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Water quality data are available for the valley-fill monitoring wells from 2004 through 2006. Additional data collected in 1996 and 1997 from wells MJ-95-01, MJ-95-02, and MJ-95-03 were reviewed. Results of the valley-fill well samples are summarized in Table 2.04.7-42. The complete dataset is provided in Appendix 5.K of the WMC (2005) report (Exhibit 7, Item 21), as are laboratory analysis sheets for samples collected in 1995-1996. Table 2.04.7-42 also lists the Federal MCLs and secondary drinking water quality criteria. All samples except from well MJ-95-02 exceeded the secondary drinking water MCL for TDS of 500 mg/L. Water quality in several wells also exceeded the secondary drinking water MCLs for iron (0.3 mg/L) and manganese (0.05 mg/L).

Groundwater Use – Groundwater use in the Colowyo revised permit area is limited due to the depth to water, the generally poor quality, and its limited overall availability. Colowyo installed and developed two wells in the late 1970s to supply a portion of the domestic needs. The two deep wells, Taylor Creek Nos. 1 and 3, are located in Section 33, T4N, R93W, and in Section 4, T3N, R93W, respectively (Map 11B). Taylor Creek No. 1, completed to a depth of 850 ft in the Williams Fork Formation, produced 40 gpm. Taylor Creek No. 3, completed to a depth of 2,284 ft in the Iles Formation, produced 20 gpm. Neither well has been pumping since the early 1980s. Colowyo installed a new potable water supply well in 2004. That well was completed in the Trout Creek Sandstone and is located in the NW¼ of Section 3, T3N, R93W. The production rate is less than four gpm.

The information from Colowyo's existing operations indicates that groundwater is very limited, even to depths significantly below current mining activities. This conclusion is supported by the depths of the potable wells, Taylor Creek No. 1 and Taylor Creek No. 3, and the newer water well. Further evidence of lack of significant groundwater resources within and adjacent to the mine area is that most residents in the general area haul drinking water from the towns of Craig or Meeker.

A search of the Colorado Office of the State Engineer's files revealed 116 permitted wells located inside or within one mile of the permit revision area (Table 2.04.7-44). Of the 23 wells with reported yields, only three have yields greater than 15 gpm. The maximum reported yield is 50 gpm, and the median reported yield is 8 gpm. Most (91) of the permitted wells are used for monitoring purposes; nine of the permitted wells support domestic or domestic and livestock uses, and 11 are used for livestock. The locations of the permitted wells are illustrated on Map 11B.

Groundwater is not currently used for industrial or mining purposes such as watering haul roads or dust control, but potentially could be depending on availability and demand during the dewatering process. Water for these purposes is currently supplied by Wilson Reservoir located in Section 13, T4N, R93W.

2.04.7 (2) Surface Water Resource Information

Both general and detailed information regarding surface water in the vicinity of the mining areas are presented in the following subsections.

General Surface Water Resource Information

Surface Water Characteristics – The Colowyo Coal Company's area of operation is located within the Lower Yampa River basin in northwestern Colorado. The physiography of the area consists of a montane region and an upland plateau. The montane region typifies the headwater reaches of most drainages, which are characterized by steep, narrow, bedrock-controlled channels. The channels are generally straight with limited sediment accumulation. Active erosion is limited to areas with erodible shale or friable sandstone (Camp Dresser & McKee (CDM), 1985b).

Groundwater

Groundwater in the vicinity of the Collom mining areas occurs in perched (unconfined) and confined water bearing zones of limited areal extent within bedrock of the Williams Fork Formation, the Trout Creek Sandstone (a bedrock aquifer of regional extent), and valley-fill aquifers as described in Section 2.04.7. The Williams Fork Formation water bearing zones have no beneficial use owing to their limited extent and minimal water production. Based on studies in the Collom area, the saturated water table/piezometric surface is at approximately 7150 feet. This level means that the area in and around the Collom Pit outline is under static hydrologic conditions with the water level at approximately 7150 feet. Due to this static condition, Colowyo may dewater this zone to allow mining of the coals below this elevation in the northern cut(s) of the pit.

The Trout Creek Sandstone is a sandstone unit underlying most of the permit area and extending across much of northwestern Colorado. It contains water of useable quantity and quality as demonstrated by beneficial-use wells near the permit area. The Trout Creek Sandstone is stratigraphically several hundred feet below the rock units to be mined and is separated from those strata by low-permeability layers within the Williams Fork Formation, particularly the KM layer, a regionally-continuous clay layer (see Section 2.04.5 and 2.04.6). Additionally, the Trout Creek Sandstone was removed by erosion and structural uplifts north and south of the mining area and so is isolated from the regional perspective. Based on this information, mining is anticipated to have no impact on the Trout Creek Sandstone aquifer.

Groundwater in the shallow valley-fill aquifers of the drainages crossing the permit modification area is calculated to be marginally impacted by surface mining activities, as described in the Probable Hydrologic Consequences section.

There are no registered beneficial-use wells other than monitoring wells in the Colorado Division of Water Resources well database within at least one mile downgradient of the mining area (Map 11B). In Section 2.03.4, Identification of Interests, the legal or equitable owners of record of the property to be mined or affected by surface operations and facilities incidental thereto within the Collom permit expansion area are:

Colowyo Coal Company L.P.
State of Colorado
U.S. Bureau of Land Management

No other private individual or group owns or controls any land in the Collom permit expansion area. Thus, any well within the limits of the Collom permit expansion is controlled by Colowyo. This includes the Dudek and Sweeney wells. Table 2.04.7-44 and Map 11B reflect the location and ownership and control status of these wells.

2.05.6 (3)(b)(i & ii) Hydrologic Controls

Rule 2.05.6(3)(b)(iii) requires determination of probable hydrologic consequences for the mining operations. This rule indicates that these consequences must be defined for both the permit area and adjacent areas, for quantity and quality of surface water and groundwater. Baseline conditions must be established, and possible impacts from the activities must be anticipated.

east, Collom Gulch to the west, and one to two miles north of the pit highwall. The springs that are potentially affected by the dewatering operations are discussed in the section on springs and seeps above.

Potential interactions with valley fill and streams

There is some groundwater flow in the valley fill deposits associated with Little Collom Gulch that eventually enters Collom Gulch at the confluence between Little Collom Gulch and Collom Gulch. Recharge to shallow groundwater in the Little Collom Gulch valley fill will be reduced because the recharge area for valley fill groundwater south of the pit highwall will be eliminated during mining. This may result in an approximate 50% reduction in shallow groundwater flow in the Little Collom Gulch during mining.

The amount of groundwater flow in the Little Collom Gulch valley fill is estimated to be about 2,060 ft³/d (17 ac-ft/yr). This estimate is based on a hydraulic conductivity of the valley fill that averages 33 ft/d (WMC, 2005), a gradient of 0.025 ft/ft, a saturated thickness of valley fill of 25 ft (based on the measurements in valley fill monitoring well MLC-04-1 located near the mouth of Little Collom Gulch), and an estimated lateral extent of the saturated valley fill of 100 ft.

WMC (2006) estimates that the total valley fill groundwater flow is about 18,850 ft³/d to the north in Collom Gulch below the confluence with Little Collom Gulch. Of this amount, about 12,000 ft³/d is flowing in valley fill aquifer and an additional 6,900 ft³/d is groundwater flow that discharges to the stream as base flow. Thus, if the valley fill groundwater inflow from Little Collom Gulch is reduced by 50% from 2,060 to 1,030 ft³/d, this would only reduce the total groundwater flow out of Collom Gulch by about 5%.

The valley fill groundwater system in the West Fork of Jubb Creek is not anticipated to be affected by mining. The Jubb Creek area disturbed by mining is small, less than 3% of the total watershed area, and most of the recharge to the valley fill groundwater system will come from spring runoff from the higher elevation portions of the watershed. No measureable impacts to stream base flow are anticipated.

Dewatering water entering the valley fill groundwater system will not add a significant amount to the total system compared with the total amount of groundwater currently in the system.

Potential effect on existing groundwater users in the area

The Collom mine area and the surrounding land is predominantly owned and/or controlled by Colowyo Coal Company and/or its subsidiaries. There are numerous monitoring wells on these lands which are registered by Colowyo as wells under Colorado State Engineer's rules and regulations. Thus, any well within the limits of the Collom permit expansion is owned and controlled by Colowyo and the only impact from any dewatering will be on Colowyo itself. Table 2.04.7-44 and Map 11B reflect the location, ownership and control status of these wells.

The closest known and registered/permitted non-Colowyo owned domestic or commercial wells are located approximately two miles southeast of the initial Collom boxcut area. These wells are located in the SW1/4, Section 7, T.3N., R.93W and are completed below the base of the Williams Fork formation, in the Iles Formation, or in valley fill material along Wilson Creek. This can be verified by comparing the Geology map (Map 7A) with the well location map (Map 11B). Thus, no impacts to these wells from any dewatering activities in the Collom pit are anticipated.

Exhibit 1, Item 13
Colowyo Mine Permit Boundary Description

In total, Colowyo's permit boundary consists of lands described in the following four tables:

Table 1: That Portion of Colowyo's Permit Boundary Described by Quarter-Quarter Location within Moffat County, Townships 3N and 4N, Ranges 93W and 94W, 6th PM. This portion contains 22,716.2 acres.

Table 2: That Portion of Colowyo's Permit Boundary Described by Quarter-Quarter Location within Rio Blanco County, Township 3N, Ranges 93W and 94W, 6th PM. This portion contains 2,109.6 acres.

Table 3: That Portion of Colowyo's Permit Boundary Described by Metes & Bounds within Moffat County, Township 3N, Range 93W, 6th PM. This portion contains 860.9 acres.

Table 4: That Portion of Colowyo's Permit Boundary Described by Metes & Bounds within Moffat County, Township 4N, Range 93W, 6th PM. This portion contains 490.2 acres.

The total Colowyo permit boundary is 26,176.9 acres.

Table 1
That Portion of Colowyo's Permit Boundary Described by Quarter-Quarter Location
within Moffat County, Townships 3N and 4N, Ranges 93W and 94W, 6th PM

<i>Township</i>	<i>Range</i>	<i>Section</i>	<i>Description</i>	<i>Approx. Acres</i>
T3N	R93W	4	All	653.3
T3N	R93W	5	All	649.5
T3N	R93W	6	All	646.7
T3N	R93W	7	SE1/4, SE1/4 of NE1/4, NE1/4 of NE1/4, SW1/4 of NE1/4 lying South and East of County Road 51 and Lot 1	307.2
T3N	R93W	8	All	640.0
T3N	R93W	9	All	642.3
T3N	R93W	14	that portion of Section 14 lying west of the western right-of-way boundary of State Highway 13	103.7
T3N	R93W	15	that portion of Section 15 lying west of the western right-of-way boundary of State Highway 13	594.2
T3N	R93W	16	All	627.4

Table 3
That Portion of Colowyo's Permit Boundary Described by Metes & Bounds within Moffat
County, Township 3N, Range 93W, 6th PM

The following Metes & Bounds description of a portion of the Colowyo Mine permit boundary within portions of Section 2, portions of Section 3, the W½ and SE¼ of Section 10, and the NW¼ NE¼ of Section 11, all within Township 3N, Range 93W, 6th PM, Moffat County, Colorado, and being more particularly described as follows:

Commencing at the northeast corner of Section 3, Township 3N, Range 93W, thence S 88°30' 15" E 2,576.03 feet along the northern boundary of said Section 3 to the POINT OF BEGINNING,

thence S 08°15'27" E a distance of 57.12'to a ;
thence S 06°22'37" E a distance of 141.34'to a ;
thence S 04°22'47" E a distance of 402.70'to a ;
thence S 02°49'45" E a distance of 207.61'to a ;
thence N 90°00'00" W a distance of 341.80'to a ;
thence N 00°00'00" W a distance of 576.26'to a ;
thence N 76°14'49" W a distance of 150.17'to a ;
thence N 81°45'42" W a distance of 40.11'to a ;
thence N 87°12'57" W a distance of 78.83'to a ;
thence S 88°15'01" W a distance of 68.32'to a ;
thence S 84°36'56" W a distance of 121.16'to a ;
thence S 79°18'14" W a distance of 128.98'to a ;
thence S 80°57'46" W a distance of 117.39'to a ;
thence N 75°04'36" W a distance of 129.38'to a ;
thence N 45°26'40" W a distance of 64.69'to a ;
thence N 43°33'24" W a distance of 38.79'to a ;
thence S 01°35'31" W a distance of 79.55'to a ;
thence S 01°55'59" W a distance of 225.70'to a ;
thence S 00°11'10" E a distance of 189.90'to a ;
thence S 05°52'20" E a distance of 166.09'to a ;
thence S 10°27'08" E a distance of 136.43'to a ;
thence S 11°01'53" E a distance of 127.90'to a ;
thence S 73°52'01" E a distance of 4.40'to a ;
thence S 68°23'34" E a distance of 84.72'to a ;
thence S 64°14'07" E a distance of 87.58'to a ;
thence S 64°00'04" E a distance of 53.32'to a ;
thence S 71°34'45" E a distance of 32.09'to a ;
thence S 57°24'06" E a distance of 38.75'to a ;
thence S 49°00'09" E a distance of 39.15'to a ;
thence S 31°22'15" E a distance of 58.63'to a ;
thence S 28°34'28" E a distance of 70.12'to a ;
thence S 27°35'21" E a distance of 56.38'to a ;
thence S 22°17'26" E a distance of 52.77'to a ;
thence S 17°53'30" E a distance of 44.79'to a ;
thence S 00°53'46" E a distance of 45.44'to a ;

thence S 04°46'06" W a distance of 21.64'to a ;
 thence S 01°52'06" W a distance of 31.01'to a ;
 thence S 01°48'17" E a distance of 55.42'to a ;
 thence S 07°13'56" W a distance of 42.08'to a ;
 thence S 17°04'32" W a distance of 52.61'to a ;
 thence S 19°09'23" W a distance of 49.12'to a ;
 thence S 14°46'29" W a distance of 54.53'to a ;
 thence S 15°08'51" W a distance of 56.46'to a ;
 thence S 21°38'49" W a distance of 54.87'to a ;
 thence S 20°55'56" W a distance of 85.11'to a ;
 thence S 16°31'02" W a distance of 81.04'to a ;
 thence S 10°44'33" W a distance of 110.11'to a ;
 thence S 12°27'41" W a distance of 85.40'to a ;
 thence S 11°46'37" W a distance of 18.96'to a ;
 thence S 13°09'44" W a distance of 32.58'to a ;
 thence S 17°41'34" W a distance of 69.92'to a ;
 thence S 20°47'07" W a distance of 11.10'to a ;
 thence S 12°41'26" W a distance of 31.18'to a ;
 thence S 55°19'30" E a distance of 7.46'to a ;
 thence S 45°01'21" E a distance of 29.15'to a ;
 thence S 45°01'21" E a distance of 6.31'to a ;
 thence S 29°46'04" E a distance of 13.09'to a ;
 thence S 34°43'02" E a distance of 12.08'to a ;
 thence S 29°29'27" E a distance of 15.67'to a ;
 thence S 24°19'17" E a distance of 15.95'to a ;
 thence S 20°56'30" E a distance of 17.62'to a ;
 thence S 14°32'55" E a distance of 18.83'to a ;
 thence S 07°21'33" E a distance of 15.80'to a ;
 thence S 05°23'36" E a distance of 25.73'to a ;
 thence S 06°51'10" W a distance of 32.86'to a ;
 thence S 08°07'50" W a distance of 13.57'to a ;
 thence S 16°19'36" W a distance of 52.93'to a ;
 thence S 32°01'29" W a distance of 19.81'to a ;
 thence S 10°21'12" W a distance of 53.56'to a ;
 thence S 07°24'55" W a distance of 87.65'to a ;
 thence S 08°08'16" W a distance of 13.79'to a ;
 thence S 10°18'39" W a distance of 16.14'to a ;
 thence S 11°19'14" W a distance of 25.98'to a ;
 thence S 28°19'09" W a distance of 35.66'to a ;
 thence S 31°50'20" W a distance of 93.60'to a ;
 thence S 42°43'56" W a distance of 54.63'to a ;
 thence S 04°11'17" W a distance of 89.67'to a ;
 thence S 17°14'20" W a distance of 38.59'to a ;
 thence S 18°52'59" W a distance of 73.18'to a ;
 thence S 24°51'39" W a distance of 107.84'to a ;
 thence S 31°30'38" W a distance of 99.05'to a ;

thence S 36°05'18" W a distance of 121.91'to a ;
 thence S 35°18'31" W a distance of 106.37'to a ;
 thence S 48°50'12" W a distance of 63.62'to a ;
 thence S 54°44'16" W a distance of 89.99'to a ;
 thence S 66°08'08" W a distance of 78.10'to a ;
 thence S 78°41'56" W a distance of 44.20'to a ;
 thence S 60°57'53" W a distance of 10.74'to a ;
 thence S 44°14'46" W a distance of 11.27'to a ;
 thence S 32°47'26" W a distance of 29.14'to a ;
 thence S 25°55'10" W a distance of 87.66'to a ;
 thence S 44°53'11" W a distance of 41.30'to a ;
 thence S 51°31'54" W a distance of 39.24'to a ;
 thence S 59°33'16" W a distance of 81.73'to a ;
 thence S 60°42'42" W a distance of 103.50'to a ;
 thence S 50°32'09" W a distance of 75.31'to a ;
 thence S 42°35'40" W a distance of 43.01'to a ;
 thence S 27°34'20" W a distance of 5.46'to a ;
 thence S 30°04'11" W a distance of 90.51'to a ;
 thence S 29°35'50" W a distance of 80.61'to a ;
 thence S 39°51'48" W a distance of 71.89'to a ;
 thence S 54°49'19" W a distance of 52.61'to a ;
 thence S 57°06'22" W a distance of 101.73'to a ;
 thence S 49°50'31" W a distance of 12.29'to a ;
 thence N 40°09'29" W a distance of 150.00'to a ;
 thence N 49°50'31" E a distance of 21.81'to a ;
 thence N 57°06'22" E a distance of 108.26'to a ;
 thence N 54°49'19" E a distance of 32.25'to a ;
 thence N 41°36'31" E a distance of 28.41'to a ;
 thence N 29°35'50" E a distance of 75.97'to a ;
 thence N 30°04'11" E a distance of 87.86'to a ;
 thence N 27°34'20" E a distance of 21.97'to a ;
 thence N 42°35'40" E a distance of 73.20'to a ;
 thence N 50°32'09" E a distance of 49.73'to a ;
 thence N 51°29'46" E a distance of 54.44'to a ;
 thence N 60°42'42" E a distance of 110.18'to a ;
 thence N 59°33'16" E a distance of 69.70'to a ;
 thence N 51°31'54" E a distance of 20.01'to a ;
 thence N 44°53'11" E a distance of 7.54'to a ;
 thence N 25°55'10" E a distance of 71.61'to a ;
 thence N 32°47'26" E a distance of 53.19'to a ;
 thence N 44°14'46" E a distance of 48.36'to a ;
 thence N 60°57'53" E a distance of 56.19'to a ;
 thence N 78°41'56" E a distance of 51.09'to a ;
 thence N 66°08'08" E a distance of 46.62'to a ;
 thence N 54°44'16" E a distance of 67.29'to a ;
 thence N 48°50'12" E a distance of 38.10'to a ;

thence N 35°18'31" E a distance of 89.60'to a ;
thence N 36°05'18" E a distance of 116.94'to a ;
thence N 31°30'38" E a distance of 84.35'to a ;
thence N 24°51'39" E a distance of 91.29'to a ;
thence N 18°52'59" E a distance of 63.19'to a ;
thence N 17°14'20" E a distance of 19.28'to a ;
thence N 04°11'17" E a distance of 59.82'to a ;
thence N 04°16'19" E a distance of 30.41'to a ;
thence N 12°32'14" E a distance of 24.11'to a ;
thence N 25°47'15" E a distance of 22.83'to a ;
thence N 35°23'01" E a distance of 22.55'to a ;
thence N 42°43'56" E a distance of 54.85'to a ;
thence N 31°50'20" E a distance of 74.68'to a ;
thence N 28°19'09" E a distance of 8.64'to a ;
thence N 10°28'13" E a distance of 14.22'to a ;
thence N 08°08'16" E a distance of 10.00'to a ;
thence N 07°24'55" E a distance of 90.55'to a ;
thence N 10°21'12" E a distance of 78.19'to a ;
thence N 25°21'53" E a distance of 25.24'to a ;
thence N 32°01'29" E a distance of 10.14'to a ;
thence N 16°19'36" E a distance of 7.49'to a ;
thence N 16°19'36" E a distance of 14.02'to a ;
thence N 08°07'50" E a distance of 1.15'to a ;
thence N 06°51'10" E a distance of 15.10'to a ;
thence N 05°23'36" W a distance of 7.06'to a ;
thence N 07°21'33" W a distance of 3.80'to a ;
thence N 14°32'55" W a distance of 1.03'to a ;
thence N 20°56'30" W a distance of 4.82'to a ;
thence N 24°19'17" W a distance of 4.76'to a ;
thence N 29°29'27" W a distance of 2.05'to a ;
thence N 34°43'02" W a distance of 10.97'to a ;
thence N 45°01'21" W a distance of 2.10'to a ;
thence N 55°19'30" W a distance of 4.57'to a ;
thence N 52°37'11" W a distance of 3.96'to a ;
thence N 52°37'11" W a distance of 4.79'to a ;
thence N 47°30'39" W a distance of 9.62'to a ;
thence N 49°12'32" W a distance of 10.70'to a ;
thence N 39°37'58" W a distance of 19.26'to a ;
thence N 26°41'11" W a distance of 44.18'to a ;
thence N 03°48'52" W a distance of 21.74'to a ;
thence N 02°57'52" W a distance of 16.62'to a ;
thence N 01°03'40" E a distance of 19.83'to a ;
thence N 11°34'10" E a distance of 16.29'to a ;
thence N 12°41'26" E a distance of 34.02'to a ;
thence N 12°41'26" E a distance of 10.93'to a ;
thence N 20°47'07" E a distance of 17.67'to a ;

thence N 17°41'34" E a distance of 59.94'to a ;
thence N 13°09'44" E a distance of 24.84'to a ;
thence N 11°46'37" E a distance of 18.05'to a ;
thence N 12°27'41" E a distance of 84.05'to a ;
thence N 10°44'33" E a distance of 115.42'to a ;
thence N 16°31'02" E a distance of 94.39'to a ;
thence N 20°55'56" E a distance of 91.83'to a ;
thence N 21°38'49" E a distance of 49.87'to a ;
thence N 14°46'29" E a distance of 104.68'to a ;
thence N 19°09'23" E a distance of 52.14'to a ;
thence N 17°04'32" E a distance of 36.96'to a ;
thence N 07°13'56" E a distance of 17.31'to a ;
thence N 01°48'17" W a distance of 48.38'to a ;
thence N 01°52'06" E a distance of 39.61'to a ;
thence N 04°46'06" E a distance of 18.02'to a ;
thence N 00°53'46" W a distance of 15.61'to a ;
thence N 17°53'30" W a distance of 16.62'to a ;
thence N 22°17'26" W a distance of 40.07'to a ;
thence N 27°35'21" W a distance of 48.15'to a ;
thence N 28°34'28" W a distance of 65.17'to a ;
thence N 31°22'15" W a distance of 31.70'to a ;
thence N 49°00'09" W a distance of 4.87'to a ;
thence N 57°24'06" W a distance of 9.08'to a ;
thence N 71°34'45" W a distance of 23.37'to a ;
thence N 64°00'04" W a distance of 62.95'to a ;
thence N 64°14'07" W a distance of 81.83'to a ;
thence N 68°23'34" W a distance of 72.11'to a ;
thence N 73°52'01" W a distance of 27.16'to a ;
thence N 64°06'43" W a distance of 39.53'to a ;
thence N 40°37'27" W a distance of 47.16'to a ;
thence N 11°01'53" W a distance of 183.69'to a ;
thence N 10°27'08" W a distance of 143.18'to a ;
thence N 05°52'20" W a distance of 179.53'to a ;
thence N 00°11'10" W a distance of 200.12'to a ;
thence N 01°55'59" E a distance of 231.54'to a ;
thence S 72°05'02" W a distance of 130.45'to a ;
thence N 50°27'37" W a distance of 115.70'to a ;
thence N 35°06'54" W a distance of 133.85'to a ;
thence N 27°05'19" W a distance of 130.44'to a ;
thence N 52°19'31" W a distance of 43.45'to a ;
thence S 81°23'25" W a distance of 77.41'to a ;
thence N 81°32'05" W a distance of 147.39'to a ;
thence N 59°03'15" W a distance of 135.03'to a ;
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thence S 76°14'49" E a distance of 112.55'to a ;
thence N 00°00'00" W a distance of 171.54'to a ;
thence N 90°00'00" E a distance of 303.89'; to the TRUE POINT OF BEGINNING, said parcel
having an area of 860.9 acres more or less

Subtotal, Table 3 860.9 acres

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