TRI-STATE

February 25, 2021

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 No. 145
Second Adequacy Response

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 this second adequacy response for technical revision 145 (TR-145) to Permit No. C-1981-019.

Tri-State received the second adequacy letter from the Division dated February 17, 2021. Adequacy comments that were noted as addressed are noted accordingly in this response letter. Original adequacy comments have not been included either, and the adequacy comments that require an additional response have been included. Therefore, Tri-State is providing the following responses to the Division's concerns:

1. *No additional response required.*

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2. *No additional response required.*

3. *When reviewing the Streeter Pond figures:*

   a. *The Division is referring to page 8 in the file in Laserfiche that is dated 9/9/2015, has the Doc Name "Attachment 1 to Attachment 12," and the Section_Exhibit Name "Exhibit 07 Streeter Pond 001A." This As-Built drawing has Storage Volume Calculations. Please indicate if this file or this page should be removed from the PAP (or if it should have been removed from Laserfiche in past).*

   Response: It appears the noted file needs removed from Laserfiche as it is no longer part of the PAP.

P.O. BOX 33695
DENVER, CO 80233-0695
303-452-6111
WWW.TRISTATE.COOP

b. *What the Division meant is that the drawing needs a scale bar. Please add this feature to the drawing.*

Response: Pond as-builts, especially pond as-builts submitted and approved by the Division within the last 10 years for Colowyo, do not contain a bar scale. There is not a requirement in the Rules for a bar scale specifically to be included on a pond as-built. For consistency in presentation and management of pond as-builts for Colowyo, a bar scale has not been added to the Streeter Pond as-built.

4. *When reviewing the Streeter Pond SEDCAD:*

c. *While checking the initial pool for the SD-1 Stockpond, the Division noticed that some details for this structure in the SEDCAD results pages changed significantly between the November submittal for TR-145 and the January submittal. In particular, the Elevation-Capacity-Discharge Table is quite different. Please explain this change for the SD-1 Stockpond.*

Response: The area for SD-1, which determines the capacity, was not inputted into SEDCAD correctly during the initial submittal of TR-145. Tri-State caught this during the first adequacy review and corrected it. It is now sized consistently with SD-2 and SD-3, and other stock ponds within other watershed models.

d. *No additional response required.*

e. *No additional response required.*

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5. *The Tri-State response does not completely address the Division's comment. Please explain why the worst-case condition, soon after the West Pit has been entirely reclaimed and a large part of the watershed is bare soil, is not modeled for the East Taylor Pond analysis. The Division refers Tri-State to the following language on page Exh. 7-ET-2: "The following pages present the results of the SEDCADTM models for the worst-case hydrologic conditions under the post mining condition. At this stage the oldest reclamation is on the northern extent of the reclaimed West Pit, and the younger (topsoil and seeded) reclamation is the southern reaches of the East Taylor Pond watershed." It is our opinion that this language suggests that the southern parcels of the watershed should by modeled with a curve number higher than 62.*

Response: First, it appears the Division is not reviewing the proper materials submitted under the second adequacy response for TR-145 for Appendix Exh. 7-14ET. Please refer to page Exh. 7-ET-2, dated 1/20/21 on the footer, first paragraph under East Taylor Pond. There are not any references to a worst-case scenario only the post mining condition. Second, all SEDCAD™ models for all watersheds at Colowyo, in the post mining condition, are setup exactly the same manner in accordance with Table 1 in Exhibit 7, and Exhibit 7 Methodologies and Assumptions for Sedimentation Pond Evaluations, Section 1.5. Tri-State believes it might be helpful for the Division to refer to Map 29. The spoil grading timing shown on Map 29 is where the applicable timing corresponds to the curve numbers selected for this pond model and other pond models whose watersheds correspond to the timing on Map 29. This approach is also outlined in in the last sentence in Section 1.5 in Exhibit 7 Methodologies and Assumptions for Sediment Pond Evaluations. Finally, the Division is suggesting with this adequacy comment on changing the approved post mining model methodology that is currently approved in the permit and has been utilized at Colowyo for quite some time. A change in this methodology has drastic impacts to most of the pond models at Colowyo, and Tri-State does not agree there is a need to change a model methodology that has been successfully implemented, nor revising a model that is compliant with the Rules and complies with the model methodology outlined in the permit.

6. *No additional response required.*

7. *No additional response required.*

8. *When reviewing the Section 16 Pond text (Appendix Exh. 7-14S):*

    a. *No additional response required.*

    b. *No additional response required.*

9. *No additional response required.*

10. *The scale on Figure Exh. 7-14S-2 still appears to be incorrect. Please compare the scale bar to the stations for the ditches. For example, if the scale bar is used, the distance along the East Section 16 Ditch from 10+00 to 23+15 is over 2,000 feet. That is not correct.*

    Response: The entire drawing scale has been modified on Figure Exh. 7-14S-2 which should alleviate the Division's concern.

11. *It appears that the pages for the SEDCAD model for the Section 16 Pond were not submitted with the January 20, 2021 package. Please submit these.*

Response: The SEDCAD™ model for the Section 16 Pond have been included with this adequacy as noted.

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12. *No additional response required.*

13. *No additional response required.*

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14. *No additional response required.*

15. *It appears that Figure Exh. 7-20A-2 was not submitted with the January 20, 2021 package. Please submit this.*

Response: Figure Exh. 7-20A-2 has been provided with the adequacy.

16. *When reviewing the West Taylor Pond text:*

    a. *No additional response required.*

    b. *The Division disagrees. It appears that references to figures in the text continue to say "7-20C" rather than "7-20B."*

    Response: Figure citations have been updated on page Exh. 7-20B-1.

    c. *No additional response required.*

    d. *No additional response required.*

    e. *No additional response required.*

17. *When reviewing the West Taylor Pond figures:*

    a. *The Division disagrees. We only see two shades of green for the polygons in the legend. Please check this again. Perhaps an older version of this map was submitted with January 20, 2021 package.*

    Response: Figure Exh. 7-20B-2 as provided is very legible with multiple shades of

green, and is a color scheme Tri-State has used in the past for Colowyo's watershed maps and the Division has reviewed them and approved them before. However, since the Division continues to have an issue with the green colors, the color for curve number 74 areas has been revised.

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18. *The Division understands that the provided volumes associated with Map 35A are meant to assist the Division in its reclamation cost estimate and are not part of the revised pages associated with TR-145.*

Using the information provided, the Division has performed a reclamation cost estimate for changes associated with Colowyo TR-145. The total value of this estimate is $64,031,107.00 (see attached cost estimate). Since the proposed changes are amending currently approved reclamation costs which are already approved as part of the current Colowyo site wide reclamation cost estimate, a cost comparison was done (see Figure 1 below). The Division used all currently approved tasks, including indirect costs specific to those tasks, that correspond to the proposed changes under TR-145. The additional difference in costs between what was approved under Colowyo Mine Midterm No. 8 (MT-8) and TR-145 is the required liability necessary to ensure the Division has sufficient monies to assure completion of the proposed reclamation work to the Colowyo Mine if the work had to be performed by the Division. The total value of this difference is $2,382,850.00 (see Figure 1 below) which will be the increased liability approved under TR-145.

Additionally, the Division has included a "liability tracker" (see Figure 2 below) showing all approved liability increases since MT-8 as well as required liability and liability held by the Division. Knowing Colowyo has additional revisions under review, this tracker is meant to help Colowyo follow the liability costs and assist with future liability increases with other proposed revisions.

Response: Tri-State has reviewed the proposed increase in reclamation liability of $2,382,8500.00, and herby provides concurrence with the Division's reclamation cost estimate.

If you should have any additional questions or concerns, please feel free to contact Tony Tennyson at (970) 326-3560 at your convenience.

Sincerely,

DocuSigned by:
Daniel Casiraro
B70D69F114324DE...

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:TT:der

Enclosure

cc: Chris Gilbreath (via email)
Tony Tennyson (via email)
Angela Aalbers (via email)
File: C. F. 1.1.2.127 - G471-11.3(21)d

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

Mine Company Name: **Colowyo Coal Company**
Permit Number: **C-1981-019**
Date: **February 22, 2021**
Revision Description: **TR-145 West Pit and South Taylor PMT 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					No Change
2A					No Change
2B					No Change
2C					No Change
2D					No Change
2E	Figure Exh. 7-14S-2 (1 page)		Figure Exh. 7-14S-2 (1 page)		Figure Exh. 7-14S-2 has been updated.
2E	Section 16 10-year and 25-year storm event models (27 pages)		Section 16 10-year and 25-year storm event models (27 pages)		Section 16 pond models have been provided.
3					No Change
4					No Change
4					No Change
5A					No Change
5B					No Change
6					No Change
7					No Change
8					No Change
9					No Change
10					No Change
12					No Change
13	Figure Exh. 7-20A-2 (1 page)		Figure Exh. 7-20A-2 (1 page)		Figure Exh. 7-20A-2 has been provided.
13	Page Exh. 7-20B-1 (1 page)		Page Exh. 7-20B-1 (1 page)		Figure citations have been updated.
13	Figure Exh. 7-20B-2 (1 page)		Figure Exh. 7-20B-2 (1 page)		Figure Exh. 7-20B-2 has been updated.
14					No Change
15					No Change
16					No Change

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17					No Change
18A					No Change
18B					No Change
18C					No Change
18D					No Change
19					No Change
20					No Change
21					No Change
22					No Change

Section 16 Pond
10 Year - 24 Hour Storm Event

Effluent Demonstration

Post Mining

Tony Tennyson

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

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

General Information

Storm Information:

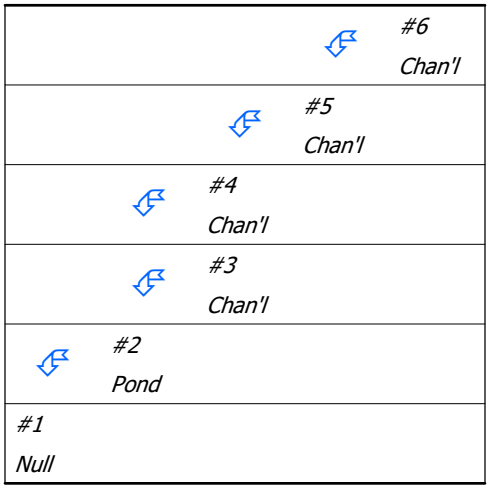
Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

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
Null	#1	==>	End	0.000	0.000	Null Below Section 16 Pond Null Below Section 16 Pond
Pond	#2	==>	#1	0.000	0.000	Section 16 Pond
Channel	#3	==>	#2	0.000	0.000	East Section 16 Ditch 0+00 to 13+15
Channel	#4	==>	#2	0.000	0.000	West Section 16 Ditch 0+00 to 45+00
Channel	#5	==>	#4	0.000	0.000	West Section 16 Ditch at 45+00
Channel	#6	==>	#5	0.000	0.000	West Section 16 Ditch 45+00 to 63+57



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)
#6		34.600	34.600	0.16	0.09	0.0	412	0.23	0.18
#5		15.800	50.400	0.28	0.15	0.1	390	0.22	0.17
#4		147.400	197.800	4.59	0.78	7.9	36,417	20.69	4.24
#3		84.500	84.500	8.95	0.81	26.9	48,946	26.04	12.77
#2	In	1.900	284.200	12.26	1.59	34.8	45,956	24.83	8.61
	Out			0.72	1.57	5.5	2,838	0.00	0.00
#1		0.000	284.200	0.72	1.57	5.5	2,837	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #6 (West Section 16 Ditch 45+00 to 63+57):

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

Structure #5 (West Section 16 Ditch at 45+00):

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

Structure #4 (West Section 16 Ditch 0+00 to 45+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.583%
0.0400	33.264%
0.0010	20.160%

Structure #3 (East Section 16 Ditch 0+00 to 13+15):

Size (mm)	In/Out
4.7500	100.000%
0.0750	85.038%
0.0400	38.442%
0.0010	23.298%

Structure #2 (Section 16 Pond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	82.426%	100.000%
0.0400	37.261%	100.000%
0.0010	22.582%	100.000%

Structure #1:

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	100.000%
0.0010	100.000%

Structure Detail:

Structure #6 (Vegetated Channel)

West Section 16 Ditch 45+00 to 63+57

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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)
10.00	4.0:1	2.0:1	3.0	D, B	1.00			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:	0.16 cfs		0.16 cfs	
Depth:	0.07 ft	1.07 ft	0.23 ft	1.23 ft
Top Width:	10.45 ft	16.45 ft	11.40 ft	17.40 ft
Velocity:	0.22 fps		0.07 fps	
X-Section Area:	0.77 sq ft		2.49 sq ft	
Hydraulic Radius:	0.073 ft		0.217 ft	
Froude Number:	0.14		0.02	
Roughness Coefficient:	0.2072		1.4093	

Structure #5 (Vegetated Channel)

West Section 16 Ditch at 45+00

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	0.28 cfs		0.28 cfs	
Depth:	0.18 ft		0.46 ft	
Top Width:	3.46 ft		5.69 ft	
Velocity:	0.55 fps		0.16 fps	
X-Section Area:	0.50 sq ft		1.77 sq ft	
Hydraulic Radius:	0.142 ft		0.305 ft	
Froude Number:	0.26		0.05	
Roughness Coefficient:	0.1267		0.7505	

Structure #4 (Vegetated Channel)

West Section 16 Ditch 0+00 to 45+00

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	4.59 cfs		4.59 cfs	
Depth:	0.55 ft		0.99 ft	
Top Width:	6.40 ft		9.90 ft	
Velocity:	1.99 fps		0.78 fps	
X-Section Area:	2.31 sq ft		5.88 sq ft	
Hydraulic Radius:	0.353 ft		0.580 ft	
Froude Number:	0.58		0.18	
Roughness Coefficient:	0.0650		0.2296	

Structure #3 (Vegetated Channel)

East Section 16 Ditch 0+00 to 13+15

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	8.95 cfs		8.95 cfs	
Depth:	0.70 ft		1.17 ft	
Top Width:	7.62 ft		11.39 ft	
Velocity:	2.64 fps		1.14 fps	
X-Section Area:	3.38 sq ft		7.86 sq ft	
Hydraulic Radius:	0.434 ft		0.673 ft	
Froude Number:	0.70		0.24	
Roughness Coefficient:	0.0559		0.1740	

Structure #2 (Pond)

Section 16 Pond

Pond Inputs:

Initial Pool Elev:	7,746.00 ft
Initial Pool:	1.22 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
12.00	9.20	12.00	121.00	8.00	0.0250	7,752.90	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,754.50	17.00	2.00:1	2.00:1	19.00

Pond Results:

Peak Elevation:	7,748.36 ft
H'graph Detention Time:	11.35 hrs

Pond Model:	CSTRS
Dewater Time:	1.07 days
Trap Efficiency:	84.31 %

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)	
7,740.18	0.010	0.000	0.000		Top of Sed. Storage
7,740.68	0.035	0.011	0.000		
7,741.18	0.075	0.037	0.000		
7,741.68	0.130	0.088	0.000		
7,742.18	0.200	0.170	0.000		
7,742.68	0.219	0.275	0.000		
7,743.18	0.239	0.389	0.000		
7,743.68	0.260	0.514	0.000		
7,743.70	0.261	0.519	0.000		
7,744.18	0.280	0.649	0.000		
7,744.68	0.297	0.793	0.000		
7,745.18	0.314	0.946	0.000		
7,745.68	0.332	1.107	0.000		
7,746.00	0.343	1.215	0.000		Low hole SPW #1
7,746.18	0.350	1.278	0.201	3.77*	
7,746.68	0.365	1.456	0.390	7.60	
7,747.18	0.379	1.642	0.514	5.00	
7,747.68	0.395	1.836	0.613	4.20	
7,748.18	0.410	2.037	0.698	3.70	
7,748.36	0.416	2.110	0.725	1.45	Peak Stage
7,748.68	0.427	2.246	0.774		
7,749.18	0.444	2.464	0.843		
7,749.68	0.462	2.690	0.907		
7,750.18	0.480	2.926	0.966		
7,750.68	0.499	3.171	1.023		
7,751.18	0.519	3.425	1.076		
7,751.68	0.539	3.690	1.127		
7,752.18	0.560	3.965	1.175		
7,752.68	0.580	4.250	1.222		
7,752.90	0.588	4.378	1.242		Spillway #1
7,753.18	0.599	4.544	1.445		
7,753.68	0.620	4.849	3.340		
7,754.18	0.640	5.164	4.279		
7,754.50	0.647	5.370	4.784		Spillway #2
7,754.68	0.650	5.487	10.402		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,755.14	0.660	5.788	24.690	
7,755.18	0.660	5.814	24.740	
7,755.68	0.666	6.146	63.014	
7,756.00	0.670	6.360	105.193	

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

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,740.18	0.000	0.000	0.000
7,740.68	0.000	0.000	0.000
7,741.18	0.000	0.000	0.000
7,741.68	0.000	0.000	0.000
7,742.18	0.000	0.000	0.000
7,742.68	0.000	0.000	0.000
7,743.18	0.000	0.000	0.000
7,743.68	0.000	0.000	0.000
7,743.70	0.000	0.000	0.000
7,744.18	0.000	0.000	0.000
7,744.68	0.000	0.000	0.000
7,745.18	0.000	0.000	0.000
7,745.68	0.000	0.000	0.000
7,746.00	3.00>0.000	0.000	0.000
7,746.18	0.201	0.000	0.201
7,746.68	0.390	0.000	0.390
7,747.18	0.514	0.000	0.514
7,747.68	0.613	0.000	0.613
7,748.18	0.698	0.000	0.698
7,748.68	0.774	0.000	0.774
7,749.18	0.843	0.000	0.843
7,749.68	0.907	0.000	0.907
7,750.18	0.966	0.000	0.966
7,750.68	1.023	0.000	1.023
7,751.18	1.076	0.000	1.076
7,751.68	1.127	0.000	1.127
7,752.18	1.175	0.000	1.175
7,752.68	1.222	0.000	1.222
7,752.90	1.242	0.000	1.242
7,753.18	1.445	0.000	1.445

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,753.68	3.340	0.000	3.340
7,754.18	4.279	0.000	4.279
7,754.50	4.784	0.000	4.784
7,754.68	5.046	5.356	10.402
7,755.14	5.660	19.030	24.690
7,755.18	5.711	19.030	24.740
7,755.68	6.306	56.708	63.014
7,756.00	6.659	98.534	105.193

Structure #1 (Null)

Null Below Section 16 Pond

Null Below Section 16 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)
#6	1	12.800	0.031	0.000	0.000	47.000	S	0.00	0.000
	2	21.800	0.086	0.000	0.000	62.000	M	0.16	0.089
	Σ	**34.600**						**0.16**	**0.089**
#5	1	1.100	0.016	0.000	0.000	47.000	S	0.00	0.000
	2	14.700	0.044	0.000	0.000	62.000	M	0.11	0.060
	Σ	**50.400**						**0.28**	**0.149**
#4	1	28.000	0.081	0.000	0.000	47.000	S	0.00	0.000
	2	5.400	0.071	0.000	0.000	47.000	S	0.00	0.000
	3	15.700	0.043	0.000	0.000	47.000	S	0.00	0.000
	4	89.400	0.125	0.000	0.000	62.000	M	0.44	0.298
	5	8.900	0.092	0.000	0.000	80.000	F	4.59	0.329
	Σ	**197.800**						**4.59**	**0.776**
#3	1	22.800	0.178	0.000	0.000	80.000	F	8.95	0.812
	2	59.000	0.208	0.000	0.000	47.000	S	0.00	0.000
	3	2.700	0.024	0.000	0.000	47.000	S	0.00	0.000
	Σ	**84.500**						**8.95**	**0.812**
#2	1	1.000	0.050	0.000	0.000	47.000	S	0.00	0.000
	2	0.900	0.046	0.000	0.000	47.000	S	0.00	0.000
	Σ	**284.200**						**12.26**	**1.588**
#1	Σ	**284.200**						**0.72**	**1.567**

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)
#6	1	0.300	200.00	14.60	0.0800	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	11.00	0.0100	0.3800	1	0.0	412	0.23	0.18
	Σ							**0.0**	**412**	**0.23**	**0.18**
#5	1	0.300	100.00	13.90	0.0800	0.9000	1	0.0	1	0.00	0.00
	2	0.300	200.00	14.00	0.0100	0.3800	1	0.0	358	0.20	0.15
	Σ							**0.1**	**390**	**0.22**	**0.17**
#4	1	0.300	400.00	21.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	200.00	8.40	0.0310	0.9000	1	0.0	1	0.00	0.00

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)
	3	0.300	200.00	15.40	0.0800	0.9000	1	0.0	1	0.00	0.00
	4	0.300	400.00	16.00	0.0100	0.3800	1	0.2	694	0.35	0.30
	5	0.300	250.00	4.00	0.8000	0.3800	1	7.6	36,417	20.76	9.63
	Σ							**7.9**	**36,417**	**20.69**	**4.24**
#3	1	0.300	400.00	4.60	0.7000	0.3800	1	26.9	48,946	26.04	12.77
	2	0.300	400.00	12.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	3	0.300	200.00	10.50	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**26.9**	**48,946**	**26.04**	**12.77**
#2	1	0.320	200.00	10.60	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.320	200.00	6.60	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**34.8**	**45,956**	**24.83**	**8.61**
#1	Σ							**5.5**	**2,837**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	10.60	50.13	473.00	2.600	0.050
#2	**1**	**Time of Concentration:**					**0.050**
#2	2	3. Short grass pasture	6.90	24.15	350.00	2.100	0.046
#2	**2**	**Time of Concentration:**					**0.046**
#3	1	3. Short grass pasture	4.60	50.55	1,099.00	1.710	0.178
#3	**1**	**Time of Concentration:**					**0.178**
#3	2	3. Short grass pasture	12.00	249.60	2,080.00	2.770	0.208
#3	**2**	**Time of Concentration:**					**0.208**
#3	3	3. Short grass pasture	10.50	24.15	230.00	2.590	0.024
#3	**3**	**Time of Concentration:**					**0.024**
#4	1	3. Short grass pasture	12.00	195.00	1,625.00	2.770	0.162
#4	**1**	**Time of Concentration:**					**0.081**
#4	2	3. Short grass pasture	21.00	224.70	1,070.00	3.660	0.081
#4	**2**	**Time of Concentration:**					**0.071**
#4	3	3. Short grass pasture	8.40	49.89	594.00	2.310	0.071
#4	**3**	**Time of Concentration:**					**0.043**
#4	4	3. Short grass pasture	16.00	231.04	1,444.00	3.200	0.125
#4	**4**	**Time of Concentration:**					**0.125**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	4.00	26.76	669.00	2.000	0.092
#4	**5**	**Time of Concentration:**					**0.092**
#5	1	3. Short grass pasture	2.00	6.70	335.00	1.130	0.082
#5	**1**	**Time of Concentration:**					**0.016**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	3. Short grass pasture	14.00	66.50	475.00	2.990	0.044
#5	**2**	**Time of Concentration:**					**0.044**
#6	1	3. Short grass pasture	1.50	1.50	100.00	0.970	0.028
#6	**1**	**Time of Concentration:**					**0.031**
#6	2	3. Short grass pasture	11.00	90.86	826.00	2.650	0.086
#6	**2**	**Time of Concentration:**					**0.086**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	8. Large gullies, diversions, and low flowing streams	14.50	89.46	617.00	11.420	0.015
#5	**2**	**Muskingum K:**					**0.000**

Section 16 Pond
25 Year - 24 Hour Storm Event

Emergency Spillway Demonstration

Post Mining

Tony Tennyson

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

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

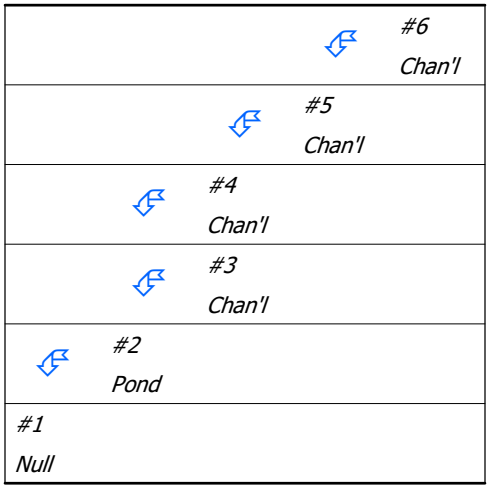
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Section 16 Pond Null Below Section 16 Pond
Pond	#2	==>	#1	0.000	0.000	Section 16 Pond
Channel	#3	==>	#2	0.000	0.000	East Section 16 Ditch 0+00 to 13+15
Channel	#4	==>	#2	0.000	0.000	West Section 16 Ditch 0+00 to 45+00
Channel	#5	==>	#4	0.000	0.000	West Section 16 Ditch at 45+00
Channel	#6	==>	#5	0.000	0.000	West Section 16 Ditch 45+00 to 63+57



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		34.600	34.600	3.01	0.29
#5		15.800	50.400	5.04	0.49
#4		147.400	197.800	13.57	2.01
#3		84.500	84.500	15.50	1.38
#2	In	1.900	284.200	27.64	3.39
	Out			1.10	2.86
#1		0.000	284.200	1.10	2.86

Structure Detail:

Structure #6 (Vegetated Channel)

West Section 16 Ditch 45+00 to 63+57

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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)
10.00	4.0:1	2.0:1	3.0	D, B	1.00			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:	3.01 cfs		3.01 cfs	
Depth:	0.25 ft	1.25 ft	0.55 ft	1.55 ft
Top Width:	11.51 ft	17.51 ft	13.29 ft	19.29 ft
Velocity:	1.11 fps		0.47 fps	
X-Section Area:	2.71 sq ft		6.39 sq ft	
Hydraulic Radius:	0.234 ft		0.475 ft	
Froude Number:	0.40		0.12	
Roughness Coefficient:	0.0880		0.3327	

Structure #5 (Vegetated Channel)

West Section 16 Ditch at 45+00

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	5.04 cfs		5.04 cfs	
Depth:	0.57 ft		1.01 ft	
Top Width:	6.56 ft		10.10 ft	
Velocity:	2.07 fps		0.82 fps	
X-Section Area:	2.44 sq ft		6.12 sq ft	
Hydraulic Radius:	0.364 ft		0.592 ft	
Froude Number:	0.60		0.19	
Roughness Coefficient:	0.0636		0.2207	

Structure #4 (Vegetated Channel)

West Section 16 Ditch 0+00 to 45+00

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	13.57 cfs		13.57 cfs	
Depth:	0.82 ft		1.31 ft	
Top Width:	8.54 ft		12.44 ft	
Velocity:	3.15 fps		1.44 fps	
X-Section Area:	4.30 sq ft		9.42 sq ft	
Hydraulic Radius:	0.493 ft		0.738 ft	
Froude Number:	0.78		0.29	
Roughness Coefficient:	0.0510		0.1464	

Structure #3 (Vegetated Channel)

East Section 16 Ditch 0+00 to 13+15

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

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				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:	15.50 cfs		15.50 cfs	
Depth:	0.86 ft		1.35 ft	
Top Width:	8.85 ft		12.80 ft	
Velocity:	3.34 fps		1.55 fps	
X-Section Area:	4.64 sq ft		9.99 sq ft	
Hydraulic Radius:	0.513 ft		0.761 ft	
Froude Number:	0.81		0.31	
Roughness Coefficient:	0.0495		0.1386	

Structure #2 (Pond)

Section 16 Pond

Pond Inputs:

Initial Pool Elev:	7,746.00 ft
Initial Pool:	1.22 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
12.00	9.20	12.00	121.00	8.00	0.0250	7,752.90	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,754.50	17.00	2.00:1	2.00:1	19.00

Pond Results:

Peak Elevation:	7,751.43 ft
Dewater Time:	1.74 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)	
7,740.18	0.010	0.000	0.000		
7,740.68	0.035	0.011	0.000		
7,741.18	0.075	0.037	0.000		
7,741.68	0.130	0.088	0.000		
7,742.18	0.200	0.170	0.000		
7,742.68	0.219	0.275	0.000		
7,743.18	0.239	0.389	0.000		
7,743.68	0.260	0.514	0.000		
7,743.70	0.261	0.519	0.000		
7,744.18	0.280	0.649	0.000		
7,744.68	0.297	0.793	0.000		
7,745.18	0.314	0.946	0.000		
7,745.68	0.332	1.107	0.000		
7,746.00	0.343	1.215	0.000		Low hole SPW #1
7,746.18	0.350	1.278	0.201	3.77*	
7,746.68	0.365	1.456	0.390	5.54*	
7,747.18	0.379	1.642	0.514	4.38*	
7,747.68	0.395	1.836	0.613	3.82*	
7,748.18	0.410	2.037	0.698	3.70	
7,748.68	0.427	2.246	0.774	3.45	
7,749.18	0.444	2.464	0.843	3.25	
7,749.68	0.462	2.690	0.907	3.15	
7,750.18	0.480	2.926	0.966	3.05	
7,750.68	0.499	3.171	1.023	2.95	
7,751.18	0.519	3.425	1.076	2.95	
7,751.43	0.529	3.557	1.101	1.65	Peak Stage
7,751.68	0.539	3.690	1.127		
7,752.18	0.560	3.965	1.175		
7,752.68	0.580	4.250	1.222		
7,752.90	0.588	4.378	1.242		Spillway #1
7,753.18	0.599	4.544	1.445		
7,753.68	0.620	4.849	3.340		
7,754.18	0.640	5.164	4.279		
7,754.50	0.647	5.370	4.784		Spillway #2
7,754.68	0.650	5.487	10.402		
7,755.14	0.660	5.788	24.690		
7,755.18	0.660	5.814	24.740		
7,755.68	0.666	6.146	63.014		
7,756.00	0.670	6.360	105.193		

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

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,740.18	0.000	0.000	0.000
7,740.68	0.000	0.000	0.000
7,741.18	0.000	0.000	0.000
7,741.68	0.000	0.000	0.000
7,742.18	0.000	0.000	0.000
7,742.68	0.000	0.000	0.000
7,743.18	0.000	0.000	0.000
7,743.68	0.000	0.000	0.000
7,743.70	0.000	0.000	0.000
7,744.18	0.000	0.000	0.000
7,744.68	0.000	0.000	0.000
7,745.18	0.000	0.000	0.000
7,745.68	0.000	0.000	0.000
7,746.00	3.00>0.000	0.000	0.000
7,746.18	0.201	0.000	0.201
7,746.68	0.390	0.000	0.390
7,747.18	0.514	0.000	0.514
7,747.68	0.613	0.000	0.613
7,748.18	0.698	0.000	0.698
7,748.68	0.774	0.000	0.774
7,749.18	0.843	0.000	0.843
7,749.68	0.907	0.000	0.907
7,750.18	0.966	0.000	0.966
7,750.68	1.023	0.000	1.023
7,751.18	1.076	0.000	1.076
7,751.68	1.127	0.000	1.127
7,752.18	1.175	0.000	1.175
7,752.68	1.222	0.000	1.222
7,752.90	1.242	0.000	1.242
7,753.18	1.445	0.000	1.445
7,753.68	3.340	0.000	3.340
7,754.18	4.279	0.000	4.279
7,754.50	4.784	0.000	4.784
7,754.68	5.046	5.356	10.402
7,755.14	5.660	19.030	24.690
7,755.18	5.711	19.030	24.740
7,755.68	6.306	56.708	63.014
7,756.00	6.659	98.534	105.193

Structure #1 (Null)

Null Below Section 16 Pond

Null Below Section 16 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)
#6	1	12.800	0.031	0.000	0.000	47.000	S	0.00	0.000
	2	21.800	0.086	0.000	0.000	62.000	M	3.01	0.290
	Σ	**34.600**						**3.01**	**0.290**
#5	1	1.100	0.016	0.000	0.000	47.000	S	0.00	0.000
	2	14.700	0.044	0.000	0.000	62.000	M	2.03	0.196
	Σ	**50.400**						**5.04**	**0.486**
#4	1	28.000	0.081	0.000	0.000	47.000	S	0.00	0.000
	2	5.400	0.071	0.000	0.000	47.000	S	0.00	0.000
	3	15.700	0.043	0.000	0.000	47.000	S	0.00	0.000
	4	89.400	0.125	0.000	0.000	62.000	M	4.76	0.970
	5	8.900	0.092	0.000	0.000	80.000	F	7.59	0.558
	Σ	**197.800**						**13.57**	**2.014**
#3	1	22.800	0.178	0.000	0.000	80.000	F	15.50	1.376
	2	59.000	0.208	0.000	0.000	47.000	S	0.01	0.000
	3	2.700	0.024	0.000	0.000	47.000	S	0.00	0.000
	Σ	**84.500**						**15.50**	**1.376**
#2	1	1.000	0.050	0.000	0.000	47.000	S	0.00	0.000
	2	0.900	0.046	0.000	0.000	47.000	S	0.00	0.000
	Σ	**284.200**						**27.64**	**3.390**
#1	Σ	**284.200**						**1.10**	**2.855**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	10.60	50.13	473.00	2.600	0.050
#2	**1**	**Time of Concentration:**					**0.050**
#2	2	3. Short grass pasture	6.90	24.15	350.00	2.100	0.046
#2	**2**	**Time of Concentration:**					**0.046**
#3	1	3. Short grass pasture	4.60	50.55	1,099.00	1.710	0.178
#3	**1**	**Time of Concentration:**					**0.178**
#3	2	3. Short grass pasture	12.00	249.60	2,080.00	2.770	0.208
#3	**2**	**Time of Concentration:**					**0.208**
#3	3	3. Short grass pasture	10.50	24.15	230.00	2.590	0.024
#3	**3**	**Time of Concentration:**					**0.024**
#4	1	3. Short grass pasture	12.00	195.00	1,625.00	2.770	0.162

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	**1**	**Time of Concentration:**					**0.081**
#4	2	3. Short grass pasture	21.00	224.70	1,070.00	3.660	0.081
#4	**2**	**Time of Concentration:**					**0.071**
#4	3	3. Short grass pasture	8.40	49.89	594.00	2.310	0.071
#4	**3**	**Time of Concentration:**					**0.043**
#4	4	3. Short grass pasture	16.00	231.04	1,444.00	3.200	0.125
#4	**4**	**Time of Concentration:**					**0.125**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	4.00	26.76	669.00	2.000	0.092
#4	**5**	**Time of Concentration:**					**0.092**
#5	1	3. Short grass pasture	2.00	6.70	335.00	1.130	0.082
#5	**1**	**Time of Concentration:**					**0.016**
#5	2	3. Short grass pasture	14.00	66.50	475.00	2.990	0.044
#5	**2**	**Time of Concentration:**					**0.044**
#6	1	3. Short grass pasture	1.50	1.50	100.00	0.970	0.028
#6	**1**	**Time of Concentration:**					**0.031**
#6	2	3. Short grass pasture	11.00	90.86	826.00	2.650	0.086
#6	**2**	**Time of Concentration:**					**0.086**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	8. Large gullies, diversions, and low flowing streams	14.50	89.46	617.00	11.420	0.015
#5	**2**	**Muskingum K:**					**0.000**

Exhibit 7, Item 20, Part B
West Taylor Pond and Channels

The location of the West Taylor Pond is presented on Map 12. The profiles of the associated permanent channels associated with the West Taylor Pond watershed are presented on Map 33B. These channels consist of the West Fork Taylor Ditch, East Fork Taylor Ditch, Trib 1 through Trib 6 ditches and the terrace ditches that will be constructed across the West Taylor Fill. The permanent channel design information for all channels is presented in this exhibit. The as-built configuration for the West Taylor Pond is presented on Figure Exh. 7-20B-1, and Figure Exh. 720B-2 provides the breakdown of drainage areas and hydrologic conditions for this sediment pond in the post mining condition.

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 SEDCAD^{TM}. For channels to be protected by a vegetative liner, the permissible velocities are also determined using SEDCAD^{TM} routines.

West Taylor Pond

The following pages present the results of the SEDCAD^{TM} models for the post mining condition. At this stage the oldest reclamation is on the eastern and southern extent of the reclaimed South Taylor Pit, and the younger (topsoil and seeded) reclamation is the northern reaches of the West Taylor Pond watershed very near the West Taylor Pond.

The SEDCAD^{TM} model herein provides the results of the 10 year 24 hour design storm and demonstrates the West Taylor Pond will meet the applicable settleable solids standard under this modeled storm event. The second SEDCAD^{TM} model demonstrates that the West Taylor Pond emergency spillway elevation is capable of containing the 25 year 24 hour storm.

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. Four in-stream stock ponds (WFSP-1, WFSP-2, EFSP-1, and, EFSP-2) are included in the permanent channels to decrease peak flows from the modeled storm events, and to provide a water source to support the post-mining land use. A typical design for of each stock pond in the West Taylor Pond watershed are provided on Figure 2.05-6 in Volume 1. However, depending on the ground conditions encountered during reclamation, these stockponds may be constructed similar to ETD-1 (please see Figure Exh. 7-20ET-3) in the East Taylor watershed.

In summary, the post mining case at the West Taylor Pond, the 10 year 24 hour storm produces 5.10 acre feet of runoff, and the seattlable solids discharge is 0.2 ml/l. The 25 year 24 hour storm event peaks at the 7,473.71’ elevation, which is well below the emergency spill way elevation of 7,475.0’.