TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.
HEADQUARTERS: P.O. BOX 33695 DENVER, COLORADO 80233-0695 303-452-6111

February 13, 2020

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. 135
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). Tri-State received your TR-135 adequacy letter dated February 7, 2020 and is providing the responses below to your adequacy concerns on behalf of Colowyo. The Colowyo Mine operates under Permit No. C-1981-019.

1. *On proposed Volume 1, Page 2.03-23, the first sentence is duplicated from approved Volume 1, Page 2.03-22. Additionally, the footer on proposed Volume 1, Page 2.03-23 refers to TR-134. Please provide and updated proposed Volume 1, Page 2.03-23*

Response: The duplicate text on Page 2.03-23 has been removed, and the footer has been updated as noted.

2. *In the fourth paragraph found in proposed Volume 1, Page 2.04-24, it refers to Table 2.04.7-10 twice. Please provide and updated proposed Volume 1, Page 2.04-24 with a corrected reference.*

Response: The duplicate citation has been corrected as noted.

3. *In the first paragraph found in proposed Volume 1, Page 2.05-8, it states that the drainage from Gossard Loadout passes through one of three sedimentation ponds located on the northeast side of the facility as shown on Map 12A. Currently approved Map 12A shows the hydrology for the South Taylor area and does not include the Gossard Loadout area. Please update the map reference found in proposed Volume 1, Page 2.05-8.*

Response: The map citation on Page 2.05-8 has been revised to Map 12 as requested.

4. *Under the third paragraph of Section 4.05.9 in proposed Volume 1, Page 4-13, Map 41A is referenced but has been requested for removal of the Colowyo PAP as noted in Colowyo's Change Sheet for Revisions. Please update the map reference.*

Response: The noted map citation has been corrected to Map 12.

5. *Under Section 4.15.6 in proposed Volume 1, Page 4-41, please update the reference of CDOW to CPW to ensure consistency with references.*

Response: The citation for CDOW has been revised to CPW as requested.

6. *Under the last paragraph in proposed Volume 1, Page 4-49, Map 4 - Sheet 1 is referenced which appears to be left over from a corrected reference of Map 4C – Sheet 1. Please update the reference to just Map 4.*

Response: The citation to Map 4C Sheet 1 has been revised to Map 4 as requested.

7. *It appears that Exhibit 7-14M has been removed from Exhibit 7, Table of Contents and its removal would be consistent with the exercise of this revision. However, Exhibit 7-14M has was not requested for removal from the Colowyo PAP as requested in Colowyo's Change Sheet for Revisions with TR-135. Please provide confirmation that is what Colowyo is requested or provide an updated Exhibit 7, Table of Contents to include Exhibit 7-14M.*

Response: The Division is correct that Exhibit 7-14M should be removed from the PAP as it does not contain any permit information. The Change of Index Sheet included in this adequacy response reflects the removal of Exhibit 7-14M.

8. *When reviewing proposed Exhibit 7, Item 14, Table 1 on Page Exh. 7-14-7, Sections 19+55 through 77+00 were removed for the East Taylor Ditch along with the entirety of the Buckskin Draw Ditch. Please provide an explanation for removing them from proposed Exhibit 7, Item 14, Table 1 as neither has been Phase III released or removed from Colowyo's reclamation plan or re-include them into the table.*

Response: The row for the East Taylor Ditch station 19+55 to 77+00 was inadvertently hidden and has been included back on the table. The Buckskin Draw Ditch is provided already on Exhibit 7, Item 14, Table 1. Please see the last row under Exh7-14E for the Streeter Gulch Ditch & Buckskin Draw Ditch.

9. *In proposed Exhibit 7, Item 14E, Page Exh. 7-14-2, it states that the profile from Streeter and Buckskin Draw Ditch can be found on Map 33. Buckskin Draw Ditch profile is found on Map 33A. Please provide and updated reference for the Buckskin Draw Ditch profile.*

Response: The reference to Map 33A has been included as noted.

10. *When reviewing proposed Exhibit 7, Item 14E, it appears to the Division that there is an error in the network structuring in the SedCAD model. As proposed, Structure 10 (Streeter Ditch 45+00 to 80+00) flows into Structure 6 (Streeter Ditch 10+00 to 25+00) and Structure 9 (Stoker Ditch) flows into Structure 10. It appears to the Division that*

Structure 10 should connect into Structure 7 (Streeter Ditch 25+00 to 45+00) and Structure 9 should connect into Structure 11 (Streeter DitchOn pro 80+00 to SD-1). Please provide the Division an explanation on the current structure networking or an updated SedCAD mode for proposed Exhibit 7, Item 14E.

Response: The routing issues the Division noted are correct. Therefore, the model for Exhibit 7, Item 14E has been corrected. Structure 10 now flows to Structure 7, and Structure 9 flows to Structure 11.

11. *On proposed Volume 2D, Exhibit 7, Page 10, Table 6, the total watershed to the Streeter Pond has been reduced by 3.6 acres. Please provide to the Division an explanation to why the watershed to the Streeter Pond was reduced.*

Response: The Streeter Pond watershed was reduced due to previous mapping errors for the watershed. The previous model included areas below the Streeter South Side Ditch and included watershed runoff from the Streeter Pond itself. These errors were corrected under the initial submittal of TR-135.

12. *When reviewing proposed Exhibit 7, Item 14SP, it appears to the Division that there is the same error in the network structuring of the SedCAD model noted in Adequacy Item 10 of this review letter exists for the noted exhibit in this item. Please refer to Adequacy Item 10 of this review letter but for the proposed Exhibit 7, Item 14SP.*

Response: Please see response to Item 10.

13. *For all the proposed List of Maps, Maps 4B and 4C remain referenced. As requested in Colowyo's Change Sheet for Revisions, Maps 4B and 4C have been requested for removal. Please provide an updated List of Maps to remove reference to Maps 4B and 4C.*

Response: The list of maps has been updated as requested.

14. *For proposed Volume 12, List of Maps, Page viii, Maps 4B and 4C remain referenced. Additionally, there appears to be a page numbering alignment issue between the propose Volume 12 Table of Contents (including List of Maps, Page viii – x) and what the Division has internally. The Division respectfully requests for an updated Volume 12, Table of Contents, including updated map references for the List of Maps portion proposed under TR-135.*

Response: The entire Volume 12 Table of Contents has been provided as requested. Further, the list of maps has been updated to remove Maps 4B and 4C.

15. *On proposed Volume 12, Rule 2, Page 43 refers to Map 4 – Sheet 1. Please provide an updated proposed Volume 12, Rule 2, Page 43 with a corrected map reference.*

Response: The citation to Map 4 Sheet 1 has been revised as noted.

16. *Under Section 2.05.4(2)(a) on proposed Volume 12, Rule 2, Page 74 it references Map 29A which has been requested for removal per Colowyo's Change Sheet for Revisions. Please provide an updated Volume 12, Rule 2, Page 74 with a corrected map reference.*

Response: It is assumed the Division should have noted page Rule 2, Page 76 in this comment, as Rule 2, Page 74 was not updated under the initial submittal of TR-135. That being said, the map citation for Map 29 in Section 2.05.4(2)(a) on page Rule 2, Page 76 has been corrected.

17. *As requested by Colowyo's Change Sheet for Revisions, Map 4C has been requested for removal and Map 4 has been updated to incorporate the information from Map 4C. It appears to the Division that the proposed Map 4 has been mislabeld as Map 4C. Please provide and updated map with the correct map designation.*

Response: The map number for Map 4 has been corrected as noted.

18. *When reviewing the approved Map 33, it came to the Division's attention that the profile for the Gulch A Ditch remains in Map 33 and an updated map was not provided under TR-135. Since the Gulch A Ditch has been Phase III released and is being removed from the Colowyo's PAP and permit boundary as requested under TR-135, it may be appropriate to update Map 33. At Colowyo's discretion, please update Map 33 to remove the Gulch A Ditch as it is no longer necessary with a potential issuance of TR-135.*

Response: Tri-State agrees with the Division, and the Gulch A ditch has been removed from Map 33 as noted.

If you should have any additional questions or concerns please feel free to contact Tony Tennyson at (970) 824-1232 or ttennyson@tristategt.org.

Sincerely,

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:TT:dbr

Enclosure

cc: Chris Gilbreath (via email)
Tony Tennyson (via email)
Angela Aalbers (via email)
File: C. F. 1.1.2.112
G471-11.3(21)b

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

Mine Company Name: **Colowyo Coal Company**

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

Date: **February 13, 2020**

Revision Description: **TR-135 Incidental 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	Page 2.03.-23 (1 page		Page 2.03.-23 (1 page		Citation has been corrected.
1	Page 2.04-24 (1 page)		Page 2.04-24 (1 page)		Citation has been corrected.
1	Page 2.05-8 (1 page)		Page 2.05-8 (1 page)		Citation has been corrected.
1	Page 4-13 (1 page)		Page 4-13 (1 page)		Citation has been corrected.
1	Page 4-41 (1 page)		Page 4-41 (1 page)		Citation has been corrected.
1	Page 4-49 (1 page)		Page 4-49 (1 page)		Citation has been corrected.
2A					
2B					
2C	Pages 7-14-6 and 7-14-7 (2 pages)		Pages 7-14-6 and 7-14-7 (2 pages)		Exhibit 7, Item 14, Table 1 has been updated.
2C	Page Exh. 7-14E-2 (1 page)		Page Exh. 7-14E-2 (1 page)		Exhibit 7 Item 14 had a map citation updated.
2C	Exh. 7-14E SEDCAD Model (21 pages)		Exh. 7-14E SEDCAD Model (21 pages)		Exh. 7-14E SEDCAD Model has been updated.
2C	Exhibit 7-14M All pages (2 pages)				Exhibit 7-14M is removed from the PAP.
2D	Streeter Pond SEDCAD Models All Pages (51 pages)		Streeter Pond SEDCAD Models All Pages (51 pages)		SEDCAD model routing for both storm events has been updated.
2E					
3					
4					
5A					
5B					
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 4		Map 4		Map 4 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.
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.

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

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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
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 i through x (10 pages)		South Taylor/Lower Wilson page i through x (10 pages)		The entire table of contents has been provided, and the list of maps has been updated.
12	South Taylor/Lower Wilson Rule 2, Page 43 (1 page)		South Taylor/Lower Wilson Rule 2, Page 43 (1 page)		Citation has been corrected.
12	Rule 2, Page 76 (1 page)		Rule 2, Page 76 (1 page)		Map citations have been updated.
13					
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.
15	Table of Contents pages xi and xii (2 pages)		Table of Contents pages xi and xii (2 pages)		List of Maps has been updated.
16					
17					
18A					
18B					
18C					
18D					
19					
20					
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.
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.

In regard to the unleased BLM surface and mineral estates included within the permit boundary, no mining or exploration activities will take place on these lands without obtaining the appropriate BLM lease, license, or permits. In June 2004, Colowyo inadvertently extracted 2600 tons of unleased federal coal in SW1/4 of Sec.4, T3N, R93W, 6th PM.

A detailed description of the Permit boundary is contained within Volume 16, Exhibit 1, Item 13.

2.03.7 Relationship to Areas Designated Unsuitable For Mining

The permit area is not within an area designated unsuitable for surface mining activities as defined in Rule 7 or 30 CFR 764 and 765 or under study for designation in an administrative proceeding under Rule 7 or 30 CFR 764 and 765.

2.03.8 Permit Term Information

Colowyo has submitted information within this application to cover the entire life-of-mine area, including the next five year permit term. The anticipated timetable for each phase of mining and reclamation and the anticipated number of acres to be affected are shown on Map 23A and 23B and Table 2.03-1, Affected Areas for Mining and Reclamation. Table 2.03.1 does not include affected acres for the Collom Mine and assoicated facitlies. Please see Volume 15 for information pertaining to the Collom Mine.

The acquisition of the Federal Coal Leases D-034365, C-35874, C-29224, C-29225, C-29226, C-0123475, C-0123476, COC-68590 and State of Colorado Coal Lease 257-13S make a substantially mineable coal reserve at Colowyo.

2.03.9 Personal Injury and Property Damage Insurance Information

The certificate certifying that Colowyo has a public liability insurance policy in force for the surface coal mining and reclamation operation is set forth as Volume 2A, Exhibit 3, Certificate of Insurance.

2.03.10 Identification of Other Licenses and Permits

The following is a list of permits and licenses covering the Colowyo surface coal mining operation:

Colowyo - Facility Wide Air Permit No. 95MF1040 (issued 10/25/17) and 16MF1324F (issued 6/22/18)
Colorado Department of Public Health and Environment
Air Pollution Control Division
4300 Cherry Creek Drive South
Denver, CO 80220-1530

(ET) in inches and runoff in inches and acre-feet (AF). Goodspring Creek, with the largest drainage area of 39.45 mi^2 has the highest annual runoff followed closely by Wilson Creek. Goodspring Creek's drainage area is 1.49 times that of Wilson Creek, but the runoff is only 1.08 times as great. This may be a reflection of localized differences in precipitation near the watershed and the difference in the stream bed itself. Higher ET in the Goodspring Creek valley floor acts to consume water moving through the channel area. Taylor Creek, with a watershed 0.18 times the size of Goodspring Creek has a runoff volume 0.07 times the flow in Goodspring Creek. Again, this is a result of smaller basin area and localized precipitation differences.

Table's 2.04.7-10 and 2.04.7-11 present the monthly water balances for Taylor, Wilson and Goodspring Creeks for the average year (October 1974 through September 1975). These data show runoff occurring primarily in the late winter and early spring months of February, March and April. These are the months of highest snowfall and saturated ground conditions which allow for runoff to take Place. It must be stressed that these data are for runoff, i.e., flow over and above the baseflow values.

Runoff values for these watersheds are extremely low and range between 1.3% and 4.2% of the precipitation falling on the watersheds. ET ranges from 95.6% to 98.6% of total precipitation indicating that nearly all of the precipitation is evaporated in place. This is particularly true of winter snowfall, when dry winds occurring in the late winter and spring may evaporate significant depths of snow before it begins to melt, resulting in no stream flow. Obviously the amount of water left for infiltration and deep percolation is a minute fraction of the total.

The computed runoff figures presented above appear to be reasonable estimates when compared to recorded flows in Table 2.04.7-8. As with all estimates of runoff for semi-arid regions, the probable error in many variables entering into the computations may range from negligible to as large or larger than the predicted runoff values. This is mentioned not to discredit the results, but to remind the reader that these figures are estimates, and would be subject to revision as additional data becomes available.

Flow Estimates

Another part of the requirements for permit approval with respect to the hydrology of the basins in and adjacent to the mine permit area is an estimation of flow values for the high and low flows in each watershed. These calculations assist the mine operations personnel in designing runoff detention ponds, diversion conveyances and channel stabilization structures.

The method used to estimate these flow values for each watershed was the United States Department of Agriculture, Soil Conservation Services' Triangular Unit Hydrograph Procedure. Flow records for Milk Creek, near the general area, from 1952 were analyzed for exceedance values. This information and the design storm, a 100-year, 1-hour precipitation event of 1.5 inches was applied to each basin to- yield peak flow estimates for each drainage. Table 2.04.7-13 is a summary of the flow estimates for each-basin. Average 7-day low flow for the l0-year return period ($Q_{7\text{-}10}$) ranges from 0. cfs for Taylor Creek to 0.29 cfs for Goodspring Creek. These estimates are substantiated by the data presented earlier in Tables 2.04.7-10, 2.04.7-11 and 2.04.7-12. High flow values for each basin, the 1-day high flow 100-year return period, ranged from 8.0

12. Drainage from the Gossard Loadout passes through one of three sedimentation ponds located on the northeast side of the facility as shown on Map 12.

Explosives Storage Area

Details concerning the explosives storage facility are found in Exhibit 16 - Explosives Storage Facility, and Map 22, Existing Structures North.

The storage facility is in compliance with all requirements of the Mine Safety and Health Administration, Bureau of Alcohol, Tobacco and Firearms and the Colorado Division of Mines.

Loadout

Colowyo's loadout, the Gossard Loadout, is located at the end of the Union Pacific rail line. The only segment of the spur within the permit area is shown on Map 22A, Existing Structures North.

Power Lines

Because Colowyo utilizes many electric-powered mining machines, a network of electric power lines is located in the permit area to supply electricity to the equipment. The locations of the Colowyo power lines are shown on the Existing Structures Maps (Map 22A and Map 22B).

Electrical power lines located in the permit area will be constructed in accordance with requirement of Section 4.18 to minimize potential electrical hazards to large raptors.

A right of way from the BLM and the Colorado State Land Board was granted for the existing Tri-State 138kV running along the eastern portion of the permit boundary. The right of way includes a fifty foot corridor on either side of the powerline detailed on the Existing Structures Map (Map 22A and Map 22B). This permanent transmission line will stay in place after final bond release, as it is owned and maintained by Tri-State. The approximate acreage of this right of way is 7.748 acres. Please see Volume 2A, Exhibit 1A.

Three major pieces of equipment at Colowyo, two draglines, and one shovel are powered by electricity. Therefore, during the life of the mine it is necessary to periodically move the existing power line loop to accommodate the advancement of the pit. The location of the anticipated power line loop changes are also- shown on Map 22B, Existing Structures.

In addition to power poles and lines, Colowyo will be using power cable to connect to the equipment that requires electricity (ie. Shovel, draglines, highwall miner, etc.). This is a rubber coated electrical cord that is used to run on top of the ground to convey electrical power from the substation to the electrical operated equipment for mining. If the corridor for the cable is covered with brush, making it inaccessible by a light vehicle, then the surface brush will be removed as a minimum. If not then the power cable will be placed over the surface without additional disturbance. In most cases topsoil will not be removed or salvaged due to the minimal impact to the environment. However, if necessary, the topsoil will be salvaged in either a windrow, stockpile, or placed on a regraded area ready for topsoil placement. The corridor of disturbance

4.05.8 Acid-forming and Toxic-forming Spoil

Acid forming materials do not exist within the overburden to be removed by the mining operations. A discussion on the overburden at the Colowyo operation has been conducted as set forth in Section 2.04.6. A discussion of the overburden monitoring plan is set forth in Section 2.05.

4.05.9 Permanent and Temporary Impoundments

Colowyo constructs small impoundments on reclaimed areas in accordance with Rule 4.05.9. These small impoundments are essential and basic to the management of the rangeland post-mining land use of livestock grazing and wildlife habitat. The design of post-mining impoundments provides for structures having a vertical height less than five feet from the bottom of the channel to the bottom of the spillway and impound less than two acre-feet of water. As such they are exempt from Division of Water Resources, Office of State Engineer requirements. Water harvesting ditches may also be used to enhance the function of the impoundments, which is consistent with practices employed on adjacent rangelands.

The impoundments collect surface runoff from precipitation events and snowmelt from reclaimed areas. The impoundments do not result in the diminution of the quality or quantity of water for downstream water users. Colowyo is the holder of water rights immediately downstream. During periods of low precipitation, the impoundments may be dry, which is consistent with regional practices on similar rangelands. Since the source of water is surface runoff from revegetated areas the quality of the water will meet the requirements of the intended use.

The post-mining impoundments have slopes of 3h:1v or less to provide easy access to both livestock and wildlife. These impoundments and any associated ditches, while intended to be permanent, will be classified as temporary until the requirements of Rule 4.05.9 are met. Prior to construction, all designs are submitted to the Division. A copy of the as-built design information will be submitted after construction for inclusion into the permit document. In addition, sedimentation ponds that are subsequently approved as part of the post-mining land use, as shown on Map 12, will remain as permanent impoundments after the requirements of Rule 4.05.9 have been met. Please refer to Section 4.05.6 for additional information regarding compliance with Rule 4.05.9(7)(a thru e).

All embankments, impoundments, and associated structures will be revegetated if construction materials are conducive to plant growth. If not, rock or gravel will be used on the embankments. The quarterly routine inspections of these structures will be conducted as required by Rule 4.05.9(17) if and until a waiver is granted to allow for annual inspections of these structures in the future. As per Rule 4.05.9(14) requirements, inspections performed during and after construction of these structures will be performed by a qualified registered professional engineer or other qualified professional specialist under the direction of a professional engineer. The inspections will be made regularly during construction, at completion of construction, and at least annually (quarterly until such a time as annual inspections are requested from granted by DRMS) until removal of the structure or release of the performance bond. The qualified registered professional engineer shall provide the Division with a certified report that the impoundment has been constructed and/or maintained as designed, and in accordance with the approved plan and the

areas targeted for the grazingland land use will generally be on slopes greater than 10% and depending on the size of each reclamation unit will need to be chisel plowed (or ripped with a dozer) at a minimum if topsoil laydown activities do not produce sufficient surface roughness to limit the excessive formation of rills on first and second year reclamation blocks by "normal" seasonal runoff events. Contour furrows will be created with regular frequency on slopes greater than 20% and less frequently on areas between 10% and 20% slopes depending on the length of the slope and the size of individual reclamation blocks as determined by topsoil laydown progression in any given year or series of years. Past reclamation efforts undertaken in the East Pit provide a general context to the likely construction frequency of contour furrows in the West Pit and Section 16 reclamation areas. The steeper slopes in the South Taylor area will likely require the construction of contour furrows at a greater frequency than previously mined areas. As indicated under "Mulching Techniques" in Section 2.05.4, use of mulch would be considered a last resort, but is certainly an erosion control metric that may be utilized (where deemed necessary) for long south-facing slopes such as in South Taylor. Spoil will be graded to minimize long, uninterrupted slopes. Replacement of topsoil will be followed by chisel plowing and contour furrowing (when necessary).

The use of these soil stabilizing practices on areas currently undergoing reclamation at Colowyo has been very effective in controlling surface runoff, thereby preventing surface erosion and gullies. The efficacy of these mechanical techniques will continue to be closely monitored as changes to the reclamation program are initiated.

4.15.5 Grazing

All the lands reclaimed by Colowyo will not be grazed by livestock for a period of at least three years after seeding or planting and will be managed to promote the postmining land use.

Grazing by livestock will not commence until Colowyo has demonstrated to the satisfaction of the Division that the vegetation on the reclaimed surface is adequately established and can be expected to withstand grazing pressures. Any grazing studies undertaken by Colowyo will not preclude or interfere with postmining vegetation sampling as required in section 4.15.8.

4.15.6 Field Trials

Aspen and Tall Shrub Establishment Areas

As a result of negotiations with CPW and DRMS, Colowyo has committed to implementing three field trials. Based upon initial estimates of disturbance to aspen and tall shrub habitats in the South Taylor area, a determination was made that the establishment of 20 acres of aspen habitat and 20 acres of tall shrub habitat (combination of thin and thick topsoil locations) be established in the South Taylor reclamation area (mining disturbance area). As a result of subsequent changes to the mine plan, approximately (7% or 14 acres) of the aspen and (41% or 347 acres) of the tall shrub habitat previously targeted for disturbance will no longer be affected. A reduced area of (18.5) acres of aspen and (12.0) acres of tall shrubs will now be pursued at Colowyo. The field trials are meant to provide information to Colowyo, DRMS and the CPW about the appropriate expectations for success/failure of establishing these habitat types at Colowyo in the context of a ten year bond clock and also to provide some baseline information that can be used to modify practices and the

Where necessary, the mean, variance and number of observations for the premine and reference area data were used to perform t-tests on the cover and production data to insure that there were no significant differences, at the 90% level of confidence, between the sets of cover data and production data.

A copy of the transect data summaries for cover, production and woody plant density can be found in Exhibit 10, Vegetation Information.

During the summer of 1980, when the reference areas were chosen, the final mine plan had not been completed and, the sagebrush reference area was inadvertently located within the area to be mined. Since the reference area is to remain undisturbed during the life of the mining- operation to insure that reclamation success criteria can be measured after final reclamation, another suitable sagebrush reference area was chosen.

Since the initial sagebrush reference area had been shown to be statistically comparable to the premine sagebrush community, Colowyo located another sagebrush reference area which was statistically comparable to the existing reference area. This new (1981) reference area was intensively sampled for herbaceous cover and production, using the same sampling methodologies and statistical tests that were used to compare the present reference area to the premine area. On August 21, 1981 Colowyo submitted revised vegetative data summarizing the results of the selection of an alternative sagebrush reference area.

Both the new (1981) sagebrush reference area and old sagebrush reference area were intensively sampled for herbaceous cover and production using the same methodologies and statistical tests as used on all previous vegetative sampling programs with the following two exceptions. For the purpose of sample adequacy, the 90% confidence level has been attained for cover and production, whereas, in the past the 80% confidence level had been attained. For production sampling, a larger 60cm. x 60cm. frame was used rather than the 30cm. x 60cm. frame used to gather baseline production data for the original permit application. The use of a larger frame reduced the sampling variance, thus reducing the numbers of samples needed to achieve sample adequacy.

In 2018, Colowyo submitted information to revise the Danforth Hills aspen reference area (1984) to the Collom Aspen reference area (2005). The Danforth Hills aspen reference area did not comply with Rules 4.15.7(3)(b)(ii) and Rule 4.15.7(3)(d) as it is on BLM private surface. Colowyo cannot control nor manage the reference area in a manner consistent with the approved post mine land use throughout the bond liability period (Rule 3.02.3). However, Colowyo does fully control the Collom Aspen reference area, as it lies on Colowyo deeded surface, and is representative of the soils, slopes, and vegetation within the permit area. Please see Exhibit 10, Item 6 for a statistical demonstration that the Collom Aspen reference area an appropriate reference area. Further, the Collom Aspen reference area has been approved to be used to evaluate revegetation success for the Collom Pit reclamation units, which will be very comparable to the reclamation units in the South Taylor Pit.

For the locations of the (1981) Sagebrush Reference Area and (1980) Mountain Shrub Reference Area please see Map 3, and for the (2005) Aspen Reference Area, refer to Map 4.

Exhibit 7, Item 14, Table 1
Summary of Ditch and Channel Design Parameters

	Emergency Spillway Designs	Flow, Q	Slope, %	Bottom Width	Side Slope, H:1V	Rip Rap, D50, in
Exh7-14A	Streeter Pond Spillway	29.7	8	20.0	1.5	9
	Work Area Pond Spillway	0.0	8	15.0	1.5	NA
	Stoker Siding Pond Spillway	0.0	50	5.0	2.0	NA
	Rail Loop Pond Spillway	0.0	50	7.0	2.0	NA
	Prospect Pond Spillway	3.0	33	12.0	1.5	9
	West Pit Pond Spillway	0.0	33	20.0	1.5	NA
	Section 16 Pond Spillway	2.4	33	19.0	2.0	9
	East Taylor Pond Spillway	3.7	40	20.0	2.0	9
Exh7-14B	**Side Channel Designs (Temporary)**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	(See Exh. 7, Item 14B text)					
Exh7-14C	**Taylor Tributary Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	(All segments designed for 100yr/24 hr storm for simplicity, although only Sta. 0 to 10 requires 100 yr)					
	Taylor Tributary Ditch, Sta 0+00 to 10+00	190.8	9.5	12.0	3.0	24
	Sta 10+00 to 40+00	96.6	7.7	12.0	3.0	18
	Sta 40+00 to 80+00	84.7	7.1	12.0	3.0	18
	Above Sta 80+00	76.0	10.7	12.0	3.0	18
Exh7-14D	**Section 16 Fill Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	Section 16 Fill Ditch	1.9	18	0.0	3.0	12
Exh7-14E	**Streeter Gulch Ditch & Buckskin Draw Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	Streeter Gulch Ditch, 100 Year Design					
	Sta 0+00 to 10+00	11.0	28.3	6.0	2.0	15
	Sta 10+00 to 25+00	218.9	10.9	6.0	2.0	9
	Sta 25+00 to 45+00	13.4	2.0	12.0	3.0	9
	Sta 45+00 to 80+00	214.6	1.9	12.0	3.0	Veg.
	Sta 80+00 to 92+18	201.2	3.8	15.0	3.0	Veg.
	Sta 92+18 to 111+131	197.1	2.8	15.0	3.0	Veg.
	Sta 111+131 to 115+92	189.4	2.6	15.0	3.0	Veg.
	Sta 115+92 to 187+00	152.94	5.0	15.0	3.0	Veg.
	Buck Skin Draw Ditch Sta 0+00 to 35+00	45.3	4.0	12.0	3.0	Veg.
Exh7-14F	**West Pit Fill Ditch & East Taylor Pond Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	(All segments ex. Coal Road Ditch designed for 100 yr storm; WP Coal Rd Ditch designed for 10 year storm)					
	West Pit Fill Ditch, Sta 0 to 2	169.9	17.0	10.0	3.0	21
	West Pit Fill Ditch, Sta 2 to 10	158.2	25.0	10.0	3.0	24
	West Pit Fill Ditch, Sta 10 to 31	108.0	10.0	10.0	3.0	12
	West Pit Coal Road Ditch, Sta 0 to 21	19.2	10.0	10.0	3.0	Veg.
	East Taylor Pond Ditch, Sta 0 to 30	50.2	3.5	0.0	3.0	Veg.

Exhibit 7, Item 14, Table 1
Summary of Ditch and Channel Design Parameters

Exh 7H - Generalized Ditch Design Procedures (See Text)						
Exh7-14I	**East Taylor Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	East Taylor Ditch, Sta 0+00 to 19+55	96.6	22.0	12.0	3.0	18
	Sta 38+33 to 77+00	76.0	10.7	12.0	3.0	18
Exh7-14J	**(Reserved for future use)**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
Exh7-14L	**Taylor Ditch**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	Taylor Ditch, Sta 0 to 10+67	4.4	13	0.0	3.0	n/a; veg.
Exh7-14O	**Section 16 Pond Ditch Extension**	**Flow, Q**	**Slope, %**	**Bottom**	**Side Slope,**	**Rip Rap,**
	Section 16 Pond Ditch Extension	9.7	2	0.0	3.0	NA, in rock
Exh7-14R	**East Pit Reclamation Area**	**Flow, Q**	**Slope, %**	**Bottom Width**	**Side Slope, H:1V**	**Rip Rap, D50, in**
	Prospect Ditch Reach 1 to Sta 1+50	10.0	10.7	12	2	n/a; veg.
	Prospect Ditch, Sta 1+50 to PD-1	4.4	28.2	12	2	n/a; veg.
	Prospect Ditch, above Pond PD-1	4.1	12-15	12	2	n/a; veg.
	N. Trib. East Pit Ditch Reach 1	10.2	21	12	2	n/a; veg.
	N. Trib. East Pit Ditch Reach 2	11.9	10 - 13	12	2	6
	Final East Pit Ditch all 3 Reaches	5.9-27.2	4-16.8	12	2	6
	Combined NTEP/Final E Pit Ditch	35.4	24	12	2	9

Note: For ditches in the South Taylor Area, See Volume 13, Table 1, Exh. 7-20 Part E. (This includes the following Ditches

West Taylor East Tributary Ditch
West Taylor West Tributary Ditch
S29-A Trib
Trib. D Ditch
Trib. F Ditch

Revision Date: 2/13/20
Revision No. TR-135

Appendix Exh7-14E

Streeter Gulch Ditch and Buckskin Draw Ditch

The Streeter Gulch Ditch is located in Sections 2, 3, 9, and 10 of T3N, R93W, and the Buckskin Draw Ditch is located in Sections 9 and 10 of T3N, R93W. The alignments of these ditches are shown on Map 12, and Exh. 7-14SP Figure 1 (in Volume 2D) provides watershed characteristics for both ditches. The design profiles are provided on Maps 33 and 33A, and the applicable SEDCAD modeling results for both ditches are also contained within this appendix.

The upper segments of the Streeter Gulch Ditch and the entirety of Buckskin Draw Ditch have a contributing area of less than one square mile. They could be designed in accordance with Rule 4.05.3. However, for ease since the lower segments of Streeter Gulch Ditch meet the requirements of Rule 4.05.4, both ditches have been designed for the 100-year, 24-hour storm event.

The following pages present the SEDCAD model output for Streeter Gulch Ditch and Buckskin Draw Ditch. Channel parameters and calculated flows are summarized and presented on Exhibit 7, Item 14, Table 1.

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Streeter Ditch & Buckskin Draw Ditch 100 Year 24 Hour Design

Post-Mining Scenario

Tony Tennyson

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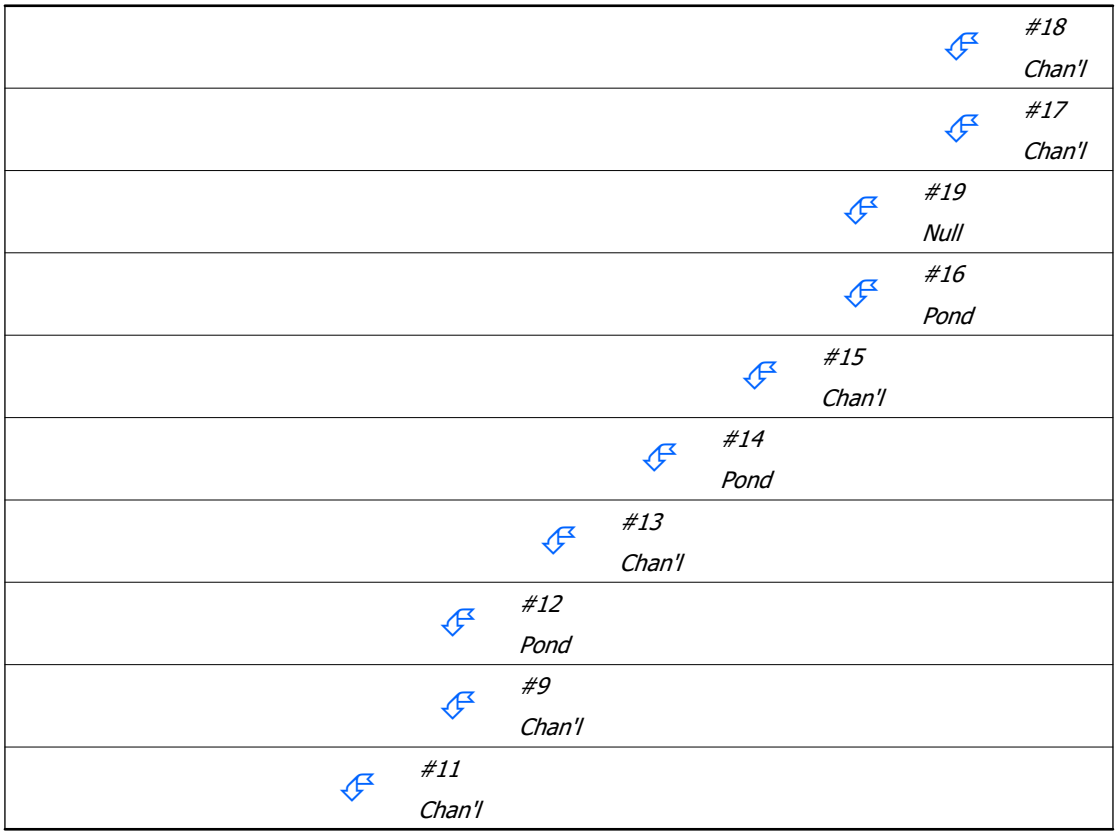
General Information

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	#3	==>	End	0.000	0.000	Null Above Streeter Pond
Channel	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#10	0.000	0.000	Streeter Ditch 80+00 to SD-1
Pond	#12	==>	#11	0.000	0.000	SD-1 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-2 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Pond	#16	==>	#15	0.000	0.000	SD-3 Stockpond
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter



		#10 *Chan'l*
	#7 *Chan'l*	
#6 *Chan'l*		
	#5 *Chan'l*	
#4 *Chan'l*		
#3 *Null*		

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#18		323.400	323.400	152.94	21.59
#17		136.600	136.600	45.29	5.34
#19		0.000	460.000	177.05	26.92
#16	In	0.500	0.500	0.57	0.04
	Out			0.50	0.04
#15		143.100	603.600	189.43	31.64
#14	In	0.000	603.600	189.43	31.64
	Out			187.65	31.64
#13		99.700	703.300	197.13	35.21
#12	In	0.000	703.300	197.13	35.21
	Out			195.51	35.21
#9		19.600	19.600	19.06	1.43
#11		71.300	794.200	213.46	38.79
#10		160.900	955.100	214.60	40.02
#7		144.400	1,099.500	218.93	42.77
#6		58.100	1,157.600	218.93	42.84
#5		164.800	164.800	2.06	1.16
#4		9.500	174.300	11.02	1.97
#3		0.000	1,331.900	228.50	44.81

Structure Detail:

Structure #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

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				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:	152.94 cfs		152.94 cfs	
Depth:	1.15 ft		1.61 ft	
Top Width:	21.92 ft		24.64 ft	
Velocity:	7.19 fps		4.81 fps	
X-Section Area:	21.28 sq ft		31.83 sq ft	
Hydraulic Radius:	0.955 ft		1.265 ft	
Froude Number:	1.29		0.74	
Roughness Coefficient:	0.0324		0.0585	

Structure #17 (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				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:	45.29 cfs		45.29 cfs	
Depth:	0.67 ft		1.05 ft	
Top Width:	16.01 ft		18.33 ft	
Velocity:	4.84 fps		2.83 fps	
X-Section Area:	9.35 sq ft		16.00 sq ft	
Hydraulic Radius:	0.577 ft		0.857 ft	
Froude Number:	1.12		0.53	
Roughness Coefficient:	0.0426		0.0948	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #16 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	100.01 ft
Dewater Time:	0.50 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)
90.00	0.050	0.000	0.000	
90.01	0.050	0.001	0.000	
91.00	0.072	0.061	0.000	
92.00	0.098	0.145	0.000	
93.00	0.128	0.258	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
100.01	0.448	2.013	0.498	12.05	Peak Stage
101.00	0.554	2.473	48.400		
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

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				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:	189.43 cfs		189.43 cfs	
Depth:	1.26 ft		1.71 ft	
Top Width:	22.56 ft		25.27 ft	
Velocity:	8.01 fps		5.50 fps	
X-Section Area:	23.66 sq ft		34.47 sq ft	
Hydraulic Radius:	1.030 ft		1.335 ft	
Froude Number:	1.38		0.83	
Roughness Coefficient:	0.0306		0.0530	

Structure #14 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	102.11 ft
Dewater Time:	0.57 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)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	12.60	
102.00	0.761	3.127	167.398	1.00	
102.11	0.802	3.228	187.649	0.15	Peak Stage
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

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	3.2	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:	197.13 cfs		197.13 cfs	
Depth:	1.20 ft		1.62 ft	
Top Width:	22.22 ft		24.74 ft	
Velocity:	8.80 fps		6.11 fps	
X-Section Area:	22.41 sq ft		32.25 sq ft	
Hydraulic Radius:	0.991 ft		1.276 ft	
Froude Number:	1.54		0.94	
Roughness Coefficient:	0.0301		0.0513	

Structure #12 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	102.16 ft
Dewater Time:	0.58 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)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	12.60	
102.00	0.761	3.127	167.398	1.15	
102.16	0.812	3.267	195.510	0.15	Peak Stage
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #9 (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				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		1.42 ft	
Top Width:	9.37 ft		13.38 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 #11 (Vegetated Channel)

Streeter Ditch 80+00 to SD-1

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	3.2	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:	213.46 cfs		213.46 cfs	
Depth:	1.25 ft		1.66 ft	
Top Width:	22.47 ft		24.97 ft	
Velocity:	9.15 fps		6.43 fps	
X-Section Area:	23.33 sq ft		33.22 sq ft	
Hydraulic Radius:	1.020 ft		1.302 ft	
Froude Number:	1.58		0.98	
Roughness Coefficient:	0.0295		0.0494	

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

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	2.0	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:	214.60 cfs		214.60 cfs	
Depth:	1.57 ft		2.08 ft	
Top Width:	21.43 ft		24.47 ft	
Velocity:	8.17 fps		5.66 fps	
X-Section Area:	26.26 sq ft		37.92 sq ft	
Hydraulic Radius:	1.197 ft		1.508 ft	
Froude Number:	1.30		0.80	
Roughness Coefficient:	0.0291		0.0489	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

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)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	218.93 cfs	
Depth:	1.89 ft	

	w/o Freeboard	w/ Freeboard
Top Width:	23.32 ft	
Velocity:	6.57 fps	
X-Section Area:	33.33 sq ft	
Hydraulic Radius:	1.392 ft	
Froude Number:	0.97	
Manning's n:	0.0400	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

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)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	218.93 cfs	
Depth:	1.91 ft	
Top Width:	13.64 ft	
Velocity:	11.66 fps	
X-Section Area:	18.77 sq ft	
Hydraulic Radius:	1.290 ft	
Froude Number:	1.75	
Manning's n:	0.0500	
Dmin:	7.00 in	
D50:	12.00 in	
Dmax:	18.00 in	

Structure #5 (Vegetated Channel)

Streeter South Side 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				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:	2.06 cfs		2.06 cfs	
Depth:	0.41 ft		0.80 ft	
Top Width:	5.26 ft		8.40 ft	
Velocity:	1.39 fps		0.49 fps	
X-Section Area:	1.48 sq ft		4.16 sq ft	
Hydraulic Radius:	0.276 ft		0.484 ft	
Froude Number:	0.46		0.12	
Roughness Coefficient:	0.0781		0.3207	

Structure #4 (Riprap Channel)

Streeter Ditch 0+00 to 10+00

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)
6.00	2.0:1	2.0:1	28.3			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.02 cfs	
Depth:	0.28 ft	
Top Width:	7.13 ft	
Velocity:	5.92 fps	
X-Section Area:	1.86 sq ft	
Hydraulic Radius:	0.256 ft	
Froude Number:	2.04	
Manning's n:	0.0540	
Dmin:	2.00 in	

	w/o Freeboard	w/ Freeboard
D50:	3.00 in	
Dmax:	4.50 in	

Structure #3 (Null)

Null Above Streeter 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)
#18	1	6.300	0.118	0.000	0.000	47.000	M	0.02	0.008
	2	9.700	0.262	0.000	0.000	47.000	M	0.02	0.010
	3	35.200	0.206	0.000	0.000	47.000	M	0.07	0.039
	4	7.100	0.035	0.000	0.000	62.000	F	2.18	0.169
	5	265.100	0.703	0.000	0.000	80.000	F	152.40	21.362
	Σ	**323.400**						**152.94**	**21.588**
#17	1	37.500	0.127	0.000	0.000	80.000	F	35.48	3.100
	2	99.100	0.326	0.000	0.000	62.000	F	13.79	2.235
	Σ	**136.600**						**45.29**	**5.336**
#19	**Σ**	**460.000**						**177.05**	**26.924**
#16	1	0.500	0.005	0.000	0.000	80.000	F	0.57	0.043
	Σ	**0.500**						**0.57**	**0.043**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.02	0.008
	2	24.800	0.089	0.000	0.000	80.000	F	28.35	2.126
	3	28.500	0.082	0.000	0.000	80.000	F	32.58	2.443
	4	83.200	0.301	0.000	0.000	47.000	M	0.16	0.093
	Σ	**603.600**						**189.43**	**31.637**
#14	**Σ**	**603.600**						**189.43**	**31.637**
#13	1	19.900	0.046	0.000	0.000	80.000	F	22.75	1.706
	2	6.900	0.055	0.000	0.000	47.000	M	0.02	0.009
	3	20.300	0.069	0.000	0.000	47.000	M	0.05	0.028
	4	8.200	0.026	0.000	0.000	80.000	F	9.38	0.703
	5	12.700	0.011	0.000	0.000	80.000	F	14.52	1.089
	6	31.700	0.165	0.000	0.000	47.000	M	0.06	0.036
	Σ	**703.300**						**197.13**	**35.207**
#12	**Σ**	**703.300**						**197.13**	**35.207**
#9	1	4.000	0.078	0.000	0.000	62.000	F	1.23	0.095
	2	15.600	0.073	0.000	0.000	80.000	F	17.84	1.337
	Σ	**19.600**						**19.06**	**1.432**
#11	1	46.800	0.249	0.000	0.000	47.000	M	0.09	0.053
	2	17.700	0.074	0.000	0.000	80.000	F	20.24	1.517
	3	6.800	0.029	0.000	0.000	80.000	F	7.77	0.583

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**794.200**						**213.46**	**38.792**
#10	1	95.700	0.407	0.000	0.000	54.000	M	1.16	0.665
	2	65.200	0.120	0.000	0.000	54.000	M	1.55	0.565
	Σ	**955.100**						**214.60**	**40.022**
#7	1	132.200	0.381	0.000	0.000	62.000	M	12.56	2.508
	2	12.200	0.168	0.000	0.000	62.000	M	1.72	0.236
	Σ	**1,099.500**						**218.93**	**42.766**
#6	1	22.400	0.072	0.000	0.000	47.000	M	0.05	0.031
	2	35.700	0.131	0.000	0.000	47.000	M	0.07	0.041
	Σ	**1,157.600**						**218.93**	**42.838**
#5	1	9.200	0.008	0.000	0.000	54.000	M	0.22	0.080
	2	155.600	0.375	0.000	0.000	54.000	M	1.92	1.077
	Σ	**164.800**						**2.06**	**1.157**
#4	1	9.500	0.058	0.000	0.000	80.000	F	10.86	0.814
	Σ	**174.300**						**11.02**	**1.971**
#3	**Σ**	**1,331.900**						**228.50**	**44.810**

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	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	21.00	24.35	116.00	3.660	0.008
#5	**1**	**Time of Concentration:**					**0.008**
#5	2	3. Short grass pasture	11.60	426.64	3,678.00	2.720	0.375
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,213.00	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	7.70	249.63	3,242.00	2.210	0.407
#10	**1**	**Time of Concentration:**					**0.407**
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#11	1	3. Short grass pasture	9.20	199.91	2,173.00	2.420	0.249
#11	**1**	**Time of Concentration:**					**0.249**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	14.70	150.38	1,022.99	3.830	0.074
#11	**2**	**Time of Concentration:**					**0.074**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**3**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	17.80	124.77	700.95	4.210	0.046
#13	**1**	**Time of Concentration:**					**0.046**
#13	2	3. Short grass pasture	15.70	99.85	635.98	3.160	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	15.80	124.66	789.00	3.170	0.069
#13	**3**	**Time of Concentration:**					**0.069**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	4.80	10.12	211.00	2.190	0.026
#13	**4**	**Time of Concentration:**					**0.026**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	15.40	24.94	162.00	3.920	0.011
#13	**5**	**Time of Concentration:**					**0.011**
#13	6	3. Short grass pasture	6.30	75.09	1,192.00	2.000	0.165
#13	**6**	**Time of Concentration:**					**0.165**
#15	1	3. Short grass pasture	15.00	74.85	499.00	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.089**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	12.10	124.87	1,032.00	3.470	0.082
#15	**3**	**Time of Concentration:**					**0.082**
#15	4	3. Short grass pasture	9.40	250.04	2,660.00	2.450	0.301
#15	**4**	**Time of Concentration:**					**0.301**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	0.19	19.00	1.000	0.005
#16	**1**	**Time of Concentration:**					**0.005**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	7.80	99.84	1,280.00	2.790	0.127

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#17	**1**	**Time of Concentration:**					**0.127**
#17	2	3. Short grass pasture	9.50	274.74	2,892.00	2.460	0.326
#17	**2**	**Time of Concentration:**					**0.326**
#18	1	3. Short grass pasture	9.50	99.94	1,052.00	2.460	0.118
#18	**1**	**Time of Concentration:**					**0.118**
#18	2	3. Short grass pasture	1.50	13.74	916.00	0.970	0.262
#18	**2**	**Time of Concentration:**					**0.262**
#18	3	3. Short grass pasture	8.60	149.81	1,742.00	2.340	0.206
#18	**3**	**Time of Concentration:**					**0.206**
#18	4	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**4**	**Time of Concentration:**					**0.035**
#18	5	5. Nearly bare and untilled, and alluvial valley fans	8.90	672.03	7,551.00	2.980	0.703
#18	**5**	**Time of Concentration:**					**0.703**

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Streeter Pond
10 Year 24 Hour Storm Event

Effluent Demonstration

Post-Mining Condition

Tony Tennyson

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Westminster, CO 80234

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Email: ttennyson@tristategt.org

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General Information

Storm Information:

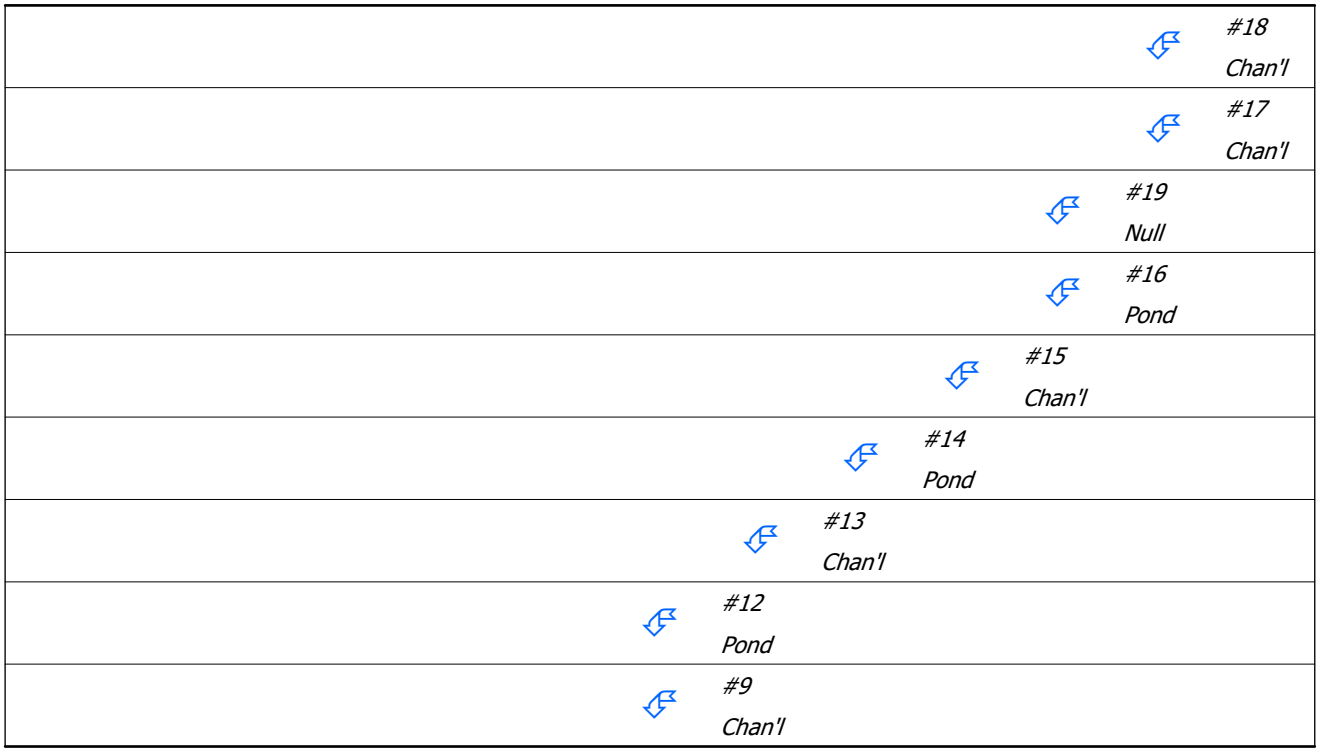
Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

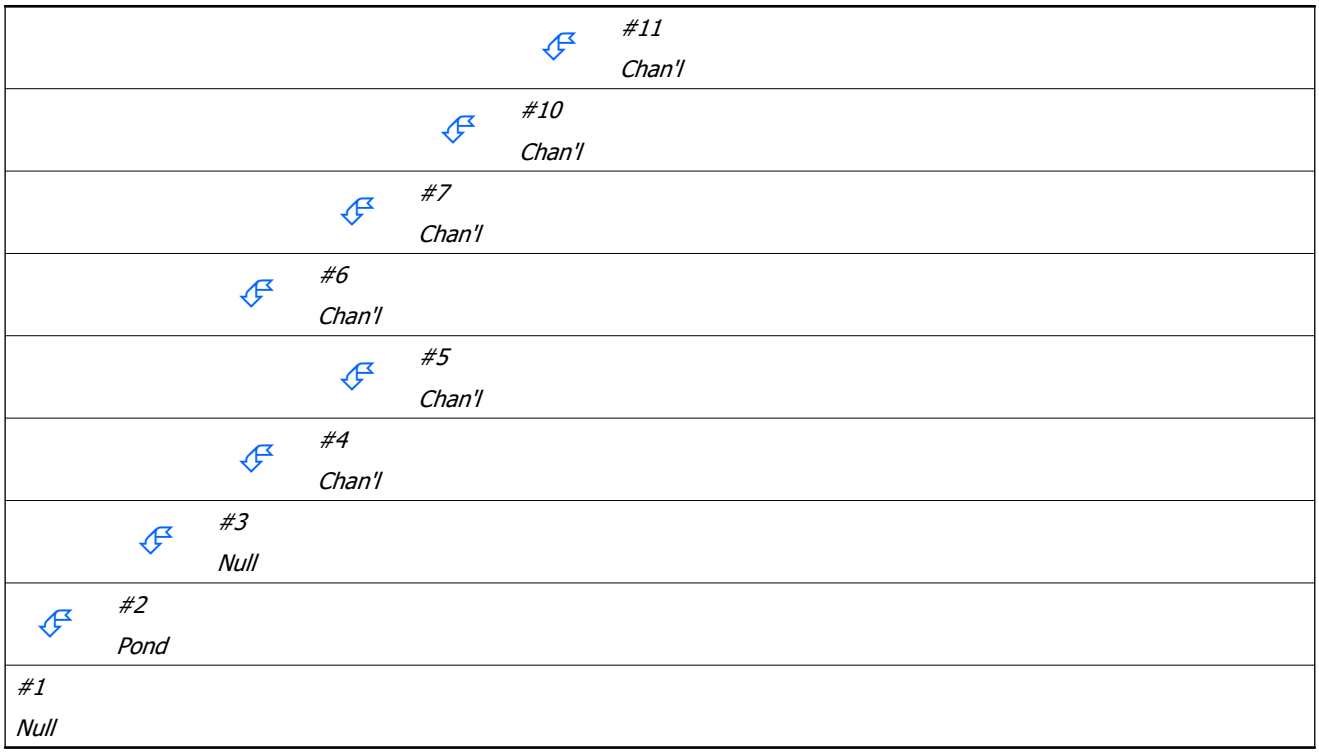
Particle Size Distribution:

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 Streeter Pond
Pond	#2	==>	#1	0.000	0.000	Streeter Pond
Null	#3	==>	#2	0.000	0.000	Null Above Streeter Pond
Channel	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#10	0.000	0.000	Streeter Ditch 80+00 to SD-1
Pond	#12	==>	#11	0.000	0.000	SD-1 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-2 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Pond	#16	==>	#15	0.000	0.000	SD-3 Stockpond
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter





Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

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)
#18		323.400	323.400	58.93	9.25	698.5	95,543	41.28	23.33
#17		136.600	136.600	15.02	1.72	89.8	97,635	52.25	19.99
#19		0.000	460.000	63.98	10.98	788.3	92,552	41.07	22.82
#16	In	0.500	0.500	0.26	0.01	0.0	3,486	1.99	1.08
	Out			0.21	0.00	0.0	0	0.00	0.00
#15		143.100	603.600	69.87	12.97	1,093.7	140,149	67.12	28.75
#14	In	0.000	603.600	69.87	12.97	1,093.7	140,149	67.12	28.75
	Out			68.69	0.00	457.5	0	3.80	2.33
#13		99.700	703.300	73.20	14.48	661.9	80,864	19.23	7.86
#12	In	0.000	703.300	73.20	14.48	661.9	80,864	19.23	7.86
	Out			72.16	0.00	463.1	0	2.17	1.57
#9		19.600	19.600	8.04	0.59	25.0	67,090	38.24	17.33
#11		71.300	774.600	74.92	15.38	618.5	77,876	15.05	5.64
#10		160.900	955.100	76.71	15.99	643.5	70,063	14.56	6.07
#7		144.400	144.400	0.66	0.47	0.1	232	0.12	0.10
#6		58.100	1,157.600	76.85	16.46	643.6	70,063	14.57	5.90
#5		164.800	164.800	0.05	0.01	0.0	1,559	0.82	0.66
#4		9.500	174.300	4.90	0.36	15.4	67,905	38.70	17.52
#3		0.000	1,331.900	77.93	16.82	659.0	68,792	14.88	6.15
#2	In	21.200	1,353.100	77.93	16.82	659.0	68,792	14.88	6.15
	Out			13.61	0.00	208.8	0	0.00	0.00
#1		0.000	1,353.100	13.61	13.84	208.8	12,175	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #18 (Streeter Ditch 125+00 to 187+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	52.855%
0.0010	32.033%

Structure #17 (Buckskin Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	84.073%
0.0400	38.006%
0.0010	23.034%

Structure #19 (Null at Confluence Buckskin/Streeter):

Size (mm)	In/Out
4.7500	100.000%
0.0750	98.185%
0.0400	51.163%
0.0010	31.008%

Structure #16 (SD-3 Stockpond):

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%	100.000%

Structure #15 (Streeter Ditch 111+00 to 125+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	91.153%
0.0400	46.091%
0.0010	27.934%

Structure #14 (SD-2 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	91.153%	100.000%
0.0400	46.091%	100.000%
0.0010	27.934%	66.781%

Structure #13 (Streeter Ditch 91+00 to 111+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	91.661%
0.0400	79.307%
0.0010	52.333%

Structure #12 (SD-1 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	91.661%	100.000%
0.0400	79.307%	100.000%
0.0010	52.333%	74.810%

Structure #9 (Stoker Ditch):

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

Structure #11 (Streeter Ditch 80+00 to SD-1):

Size (mm)	In/Out
4.7500	100.000%
0.0750	93.215%
0.0400	83.163%
0.0010	61.037%

Structure #10 (Streeter Ditch 45+00 to 80+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	92.430%
0.0400	81.215%
0.0010	59.443%

Structure #7 (Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	96.885%
0.0400	43.798%
0.0010	26.544%

Structure #6 (Streeter Ditch 10+00 to 25+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	92.431%
0.0400	81.207%
0.0010	59.436%

Structure #5 (Streeter South Side Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	86.965%
0.0400	39.313%
0.0010	23.826%

Structure #4 (Streeter Ditch 0+00 to 10+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.017%
0.0400	33.008%
0.0010	20.005%

Structure #3 (Null Above Streeter Pond):

Size (mm)	In/Out
4.7500	100.000%
0.0750	91.976%
0.0400	80.079%
0.0010	58.513%

Structure #2 (Streeter Pond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	91.976%	100.000%
0.0400	80.079%	100.000%
0.0010	58.513%	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 #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

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				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:	58.93 cfs		58.93 cfs	
Depth:	0.77 ft		1.21 ft	
Top Width:	19.64 ft		22.25 ft	
Velocity:	4.40 fps		2.62 fps	
X-Section Area:	13.39 sq ft		22.52 sq ft	
Hydraulic Radius:	0.673 ft		0.994 ft	
Froude Number:	0.94		0.46	
Roughness Coefficient:	0.0418		0.0914	

Structure #17 (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				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:	15.02 cfs		15.02 cfs	
Depth:	0.42 ft		0.76 ft	
Top Width:	14.52 ft		16.55 ft	
Velocity:	2.70 fps		1.39 fps	
X-Section Area:	5.57 sq ft		10.84 sq ft	
Hydraulic Radius:	0.380 ft		0.645 ft	
Froude Number:	0.77		0.30	
Roughness Coefficient:	0.0579		0.1604	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #16 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	100.00 ft
H'graph Detention Time:	0.12 hrs
Pond Model:	CSTRS
Dewater Time:	0.21 days
Trap Efficiency:	0.00 %

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)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
100.00	0.447	2.010	0.208	5.10	Peak Stage
101.00	0.554	2.473	48.400		
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

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				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:	69.87 cfs		69.87 cfs	
Depth:	0.83 ft		1.27 ft	
Top Width:	19.98 ft		22.63 ft	
Velocity:	4.81 fps		2.92 fps	
X-Section Area:	14.52 sq ft		23.93 sq ft	
Hydraulic Radius:	0.717 ft		1.039 ft	
Froude Number:	1.00		0.50	
Roughness Coefficient:	0.0399		0.0843	

Structure #14 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	101.17 ft
H'graph Detention Time:	0.11 hrs
Pond Model:	CSTRS
Dewater Time:	0.57 days
Trap Efficiency:	0.00 %

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)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	13.35	
101.17	0.603	2.584	68.692	0.30	Peak Stage
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

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	3.2	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:	73.20 cfs		73.20 cfs	
Depth:	0.79 ft		1.21 ft	
Top Width:	19.77 ft		22.25 ft	
Velocity:	5.30 fps		3.25 fps	
X-Section Area:	13.82 sq ft		22.50 sq ft	
Hydraulic Radius:	0.690 ft		0.994 ft	
Froude Number:	1.12		0.57	
Roughness Coefficient:	0.0392		0.0815	

Structure #12 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	101.20 ft
H'graph Detention Time:	0.11 hrs

Pond Model:	CSTRS
Dewater Time:	0.57 days
Trap Efficiency:	0.00 %

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)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	13.40	
101.20	0.609	2.603	72.160	0.30	Peak Stage
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #9 (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				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:	8.04 cfs		8.04 cfs	
Depth:	0.68 ft		1.14 ft	
Top Width:	7.42 ft		11.14 ft	
Velocity:	2.52 fps		1.07 fps	
X-Section Area:	3.19 sq ft		7.50 sq ft	
Hydraulic Radius:	0.420 ft		0.657 ft	
Froude Number:	0.68		0.23	
Roughness Coefficient:	0.0573		0.1818	

Structure #11 (Vegetated Channel)

Streeter Ditch 80+00 to SD-1

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	3.2	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:	74.92 cfs		74.92 cfs	
Depth:	0.80 ft		1.22 ft	
Top Width:	19.82 ft		22.30 ft	
Velocity:	5.36 fps		3.30 fps	
X-Section Area:	13.98 sq ft		22.68 sq ft	
Hydraulic Radius:	0.696 ft		0.999 ft	
Froude Number:	1.12		0.58	
Roughness Coefficient:	0.0390		0.0806	

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

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	2.0	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:	76.71 cfs		76.71 cfs	
Depth:	1.03 ft		1.53 ft	
Top Width:	18.16 ft		21.20 ft	
Velocity:	4.95 fps		3.01 fps	
X-Section Area:	15.49 sq ft		25.47 sq ft	
Hydraulic Radius:	0.837 ft		1.174 ft	
Froude Number:	0.95		0.48	
Roughness Coefficient:	0.0378		0.0778	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

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)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.66 cfs	
Depth:	0.07 ft	
Top Width:	12.41 ft	
Velocity:	0.79 fps	
X-Section Area:	0.83 sq ft	
Hydraulic Radius:	0.067 ft	
Froude Number:	0.54	
Manning's n:	0.0440	
Dmin:	0.50 in	
D50:	0.75 in	
Dmax:	1.50 in	

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

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)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	76.85 cfs	
Depth:	1.08 ft	
Top Width:	10.31 ft	
Velocity:	8.74 fps	
X-Section Area:	8.79 sq ft	
Hydraulic Radius:	0.812 ft	

	w/o Freeboard	w/ Freeboard
Froude Number:	1.67	
Manning's n:	0.0490	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #5 (Vegetated Channel)

Streeter South Side 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				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:	0.05 cfs		0.05 cfs	
Depth:	0.09 ft		0.29 ft	
Top Width:	2.75 ft		4.33 ft	
Velocity:	0.25 fps		0.06 fps	
X-Section Area:	0.22 sq ft		0.92 sq ft	
Hydraulic Radius:	0.080 ft		0.209 ft	
Froude Number:	0.15		0.02	
Roughness Coefficient:	0.1932		1.5183	

Structure #4 (Riprap Channel)

Streeter Ditch 0+00 to 10+00

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)
6.00	2.0:1	2.0:1	28.3			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.90 cfs	
Depth:	0.17 ft	
Top Width:	6.69 ft	
Velocity:	4.50 fps	
X-Section Area:	1.09 sq ft	
Hydraulic Radius:	0.161 ft	
Froude Number:	1.97	
Manning's n:	0.0520	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #3 (Null)

Null Above Streeter Pond

Structure #2 (Pond)

Streeter Pond

Pond Inputs:

Initial Pool Elev:	6,583.00 ft
Initial Pool:	2.45 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**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	3.00	18.00	87.00	4.50	0.0150	6,585.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,588.00	50.00	1.50:1	1.50:1	20.00

Pond Results:

Peak Elevation:	6,588.18 ft
H'graph Detention Time:	8.14 hrs
Pond Model:	CSTRS
Dewater Time:	0.99 days
Trap Efficiency:	0.00 %

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)	
6,578.00	0.010	0.000	0.000		Top of Sed. Storage
6,579.00	0.070	0.035	0.000		
6,580.00	0.275	0.197	0.000		
6,581.00	0.441	0.551	0.000		
6,582.00	1.100	1.297	0.000		
6,583.00	1.200	2.447	0.000		
6,584.00	1.500	3.794	0.000		
6,585.00	1.600	5.344	0.000		Spillway #1
6,586.00	1.800	7.043	3.782	5.44*	
6,587.00	2.000	8.942	5.348	5.10	
6,588.00	2.100	10.992	6.550	7.55	Spillway #2
6,588.18	2.118	11.387	13.614	5.60	Peak Stage
6,589.00	2.200	13.142	45.017		
6,590.00	2.400	15.441	150.324		
6,591.00	2.500	17.891	302.542		

**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)
6,578.00	0.000	0.000	0.000
6,579.00	0.000	0.000	0.000
6,580.00	0.000	0.000	0.000
6,581.00	0.000	0.000	0.000
6,582.00	0.000	0.000	0.000
6,583.00	0.000	0.000	0.000
6,584.00	0.000	0.000	0.000
6,585.00	0.000	0.000	0.000

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,586.00	3.782	0.000	3.782
6,587.00	5.348	0.000	5.348
6,588.00	6.550	0.000	6.550
6,589.00	7.563	37.453	45.017
6,590.00	8.456	141.868	150.324
6,591.00	9.263	293.279	302.542

Structure #1 (Null)

Null Below Streeter 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)
#18	1	6.300	0.118	0.000	0.000	47.000	M	0.00	0.000
	2	9.700	0.262	0.000	0.000	47.000	M	0.00	0.000
	3	35.200	0.206	0.000	0.000	47.000	M	0.00	0.000
	4	7.100	0.035	0.000	0.000	62.000	F	0.05	0.029
	5	265.100	0.703	0.000	0.000	80.000	F	58.90	9.226
	Σ	**323.400**						**58.93**	**9.255**
#17	1	37.500	0.127	0.000	0.000	80.000	F	15.02	1.339
	2	99.100	0.326	0.000	0.000	62.000	F	0.56	0.385
	Σ	**136.600**						**15.02**	**1.724**
#19	**Σ**	**460.000**						**63.98**	**10.978**
#16	1	0.500	0.005	0.000	0.000	80.000	F	0.26	0.015
	Σ	**0.500**						**0.26**	**0.015**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.00	0.000
	2	24.800	0.089	0.000	0.000	80.000	F	12.78	0.918
	3	28.500	0.082	0.000	0.000	80.000	F	14.69	1.055
	4	83.200	0.301	0.000	0.000	47.000	M	0.00	0.000
	Σ	**603.600**						**69.87**	**12.965**
#14	**Σ**	**603.600**						**69.87**	**12.965**
#13	1	19.900	0.046	0.000	0.000	80.000	F	10.25	0.737
	2	6.900	0.055	0.000	0.000	47.000	M	0.00	0.000
	3	20.300	0.069	0.000	0.000	47.000	M	0.00	0.000
	4	8.200	0.026	0.000	0.000	80.000	F	4.23	0.303
	5	12.700	0.011	0.000	0.000	80.000	F	6.54	0.470
	6	31.700	0.165	0.000	0.000	47.000	M	0.00	0.000
	Σ	**703.300**						**73.20**	**14.475**
#12	**Σ**	**703.300**						**73.20**	**14.475**
#9	1	4.000	0.078	0.000	0.000	62.000	F	0.03	0.016
	2	15.600	0.073	0.000	0.000	80.000	F	8.04	0.577
	Σ	**19.600**						**8.04**	**0.594**
#11	1	46.800	0.249	0.000	0.000	47.000	M	0.00	0.000
	2	17.700	0.074	0.000	0.000	80.000	F	9.12	0.655
	3	6.800	0.029	0.000	0.000	80.000	F	3.50	0.252

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**774.600**						**74.92**	**15.382**
#10	1	95.700	0.407	0.000	0.000	54.000	M	0.03	0.006
	2	65.200	0.120	0.000	0.000	54.000	M	0.03	0.005
	Σ	**955.100**						**76.71**	**15.987**
#7	1	132.200	0.381	0.000	0.000	62.000	M	0.60	0.432
	2	12.200	0.168	0.000	0.000	62.000	M	0.06	0.041
	Σ	**144.400**						**0.66**	**0.472**
#6	1	22.400	0.072	0.000	0.000	47.000	M	0.00	0.000
	2	35.700	0.131	0.000	0.000	47.000	M	0.00	0.000
	Σ	**1,157.600**						**76.85**	**16.459**
#5	1	9.200	0.008	0.000	0.000	54.000	M	0.00	0.000
	2	155.600	0.375	0.000	0.000	54.000	M	0.05	0.011
	Σ	**164.800**						**0.05**	**0.011**
#4	1	9.500	0.058	0.000	0.000	80.000	F	4.90	0.352
	Σ	**174.300**						**4.90**	**0.362**
#3	**Σ**	**1,331.900**						**77.93**	**16.822**
#2	1	16.600	0.056	0.000	0.000	47.000	M	0.00	0.000
	2	4.600	0.048	0.000	0.000	47.000	M	0.00	0.000
	Σ	**1,353.100**						**77.93**	**16.822**
#1	**Σ**	**1,353.100**						**13.61**	**13.837**

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)
#18	1	0.300	400.00	9.50	0.0100	0.3800	1	0.0	1	0.00	0.00
	2	0.300	100.00	1.50	0.0100	0.3800	1	0.0	1	0.00	0.00
	3	0.300	400.00	8.60	0.0100	0.3800	1	0.0	1	0.00	0.00
	4	0.300	100.00	8.50	0.0100	0.3800	1	0.0	104	0.06	0.04
	5	0.300	400.00	8.90	0.8000	0.3800	1	698.5	95,592	41.30	23.41
	Σ							**698.5**	**95,543**	**41.28**	**23.33**
#17	1	0.300	400.00	7.80	0.8000	0.3800	1	89.7	97,635	52.25	25.67
	2	0.300	400.00	9.50	0.0100	0.3800	1	0.1	268	0.14	0.12
	Σ							**89.8**	**97,635**	**52.25**	**19.99**

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)
#19	Σ							**788.3**	**92,552**	**41.07**	**22.82**
#16	1	0.300	20.00	1.00	0.8000	0.3800	1	0.0	3,486	1.99	1.08
	Σ							**0.0**	**3,486**	**1.99**	**1.08**
#15	1	0.300	200.00	15.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	11.50	0.8000	0.3800	1	135.6	215,045	122.57	58.35
	3	0.300	400.00	12.10	0.8000	0.3800	1	169.8	232,493	132.51	63.25
	4	0.300	400.00	9.40	0.0100	0.3800	1	0.0	1	0.00	0.00
	Σ							**1,093.7**	**140,149**	**67.12**	**28.75**
#14	Σ							**1,093.7**	**140,149**	**67.12**	**28.75**
#13	1	0.300	300.00	17.80	0.8000	0.3800	1	155.3	296,018	168.72	81.32
	2	0.300	300.00	15.70	0.0100	0.3800	1	0.0	1	0.00	0.00
	3	0.300	300.00	15.80	0.0100	0.3800	1	0.0	1	0.00	0.00
	4	0.300	200.00	4.80	0.8000	0.3800	1	8.4	43,203	24.62	11.44
	5	0.300	100.00	15.40	0.8000	0.3800	1	40.8	130,890	74.60	35.08
	6	0.300	400.00	6.30	0.0100	0.3800	1	0.0	1	0.00	0.00
	Σ							**661.9**	**80,864**	**19.23**	**7.86**
#12	Σ							**661.9**	**80,864**	**19.23**	**7.86**
#9	1	0.300	200.00	5.00	0.0100	0.3800	1	0.0	79	0.05	0.03
	2	0.300	200.00	7.10	0.8000	0.3800	1	25.0	67,090	38.24	17.82
	Σ							**25.0**	**67,090**	**38.24**	**17.33**
#11	1	0.300	400.00	9.20	0.0100	0.3800	1	0.0	1	0.00	0.00
	2	0.300	400.00	14.70	0.8000	0.3800	1	128.2	277,070	157.92	75.89
	3	0.300	200.00	14.00	0.8000	0.3800	1	27.2	161,215	91.89	43.40
	Σ							**618.5**	**77,876**	**15.05**	**5.64**
#10	1	0.300	400.00	7.70	0.0100	0.0380	1	0.0	30	0.02	0.01
	2	0.300	400.00	11.00	0.0100	0.0380	1	0.0	55	0.03	0.03
	Σ							**643.5**	**70,063**	**14.56**	**6.07**
#7	1	0.300	400.00	8.60	0.0100	0.3800	1	0.1	250	0.12	0.11
	2	0.300	300.00	3.00	0.0100	0.3800	1	0.0	45	0.02	0.02
	Σ							**0.1**	**232**	**0.12**	**0.10**
#6	1	0.300	400.00	26.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	2	0.300	400.00	14.00	0.0100	0.9000	1	0.0	1	0.00	0.00
	Σ							**643.6**	**70,063**	**14.57**	**5.90**
#5	1	0.300	50.00	21.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	11.60	0.0100	0.9000	1	0.0	1,559	0.82	0.66

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)
	Σ							**0.0**	**1,559**	**0.82**	**0.66**
#4	1	0.300	400.00	35.00	0.0310	0.9000	1	15.4	67,905	38.70	18.04
	Σ							**15.4**	**67,905**	**38.70**	**17.52**
#3	Σ							**659.0**	**68,792**	**14.88**	**6.15**
#2	1	0.300	400.00	30.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	2	0.300	400.00	34.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**659.0**	**68,792**	**14.88**	**6.15**
#1	Σ							**208.8**	**12,175**	**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	30.40	270.56	890.00	4.410	0.056
#2	**1**	**Time of Concentration:**					**0.056**
#2	2	3. Short grass pasture	34.00	274.04	806.00	4.660	0.048
#2	**2**	**Time of Concentration:**					**0.048**
#4	1	3. Short grass pasture	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	21.00	24.35	116.00	3.660	0.008
#5	**1**	**Time of Concentration:**					**0.008**
#5	2	3. Short grass pasture	11.60	426.64	3,678.00	2.720	0.375
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,213.00	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	7.70	249.63	3,242.00	2.210	0.407
#10	**1**	**Time of Concentration:**					**0.407**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#11	1	3. Short grass pasture	9.20	199.91	2,173.00	2.420	0.249
#11	**1**	**Time of Concentration:**					**0.249**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	14.70	150.38	1,022.99	3.830	0.074
#11	**2**	**Time of Concentration:**					**0.074**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**3**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	17.80	124.77	700.95	4.210	0.046
#13	**1**	**Time of Concentration:**					**0.046**
#13	2	3. Short grass pasture	15.70	99.85	635.98	3.160	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	15.80	124.66	789.00	3.170	0.069
#13	**3**	**Time of Concentration:**					**0.069**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	4.80	10.12	211.00	2.190	0.026
#13	**4**	**Time of Concentration:**					**0.026**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	15.40	24.94	162.00	3.920	0.011
#13	**5**	**Time of Concentration:**					**0.011**
#13	6	3. Short grass pasture	6.30	75.09	1,192.00	2.000	0.165
#13	**6**	**Time of Concentration:**					**0.165**
#15	1	3. Short grass pasture	15.00	74.85	499.00	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.089**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	12.10	124.87	1,032.00	3.470	0.082
#15	**3**	**Time of Concentration:**					**0.082**
#15	4	3. Short grass pasture	9.40	250.04	2,660.00	2.450	0.301
#15	**4**	**Time of Concentration:**					**0.301**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	0.19	19.00	1.000	0.005
#16	**1**	**Time of Concentration:**					**0.005**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	7.80	99.84	1,280.00	2.790	0.127
#17	**1**	**Time of Concentration:**					**0.127**
#17	2	3. Short grass pasture	9.50	274.74	2,892.00	2.460	0.326
#17	**2**	**Time of Concentration:**					**0.326**
#18	1	3. Short grass pasture	9.50	99.94	1,052.00	2.460	0.118
#18	**1**	**Time of Concentration:**					**0.118**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	2	3. Short grass pasture	1.50	13.74	916.00	0.970	0.262
#18	**2**	**Time of Concentration:**					**0.262**
#18	3	3. Short grass pasture	8.60	149.81	1,742.00	2.340	0.206
#18	**3**	**Time of Concentration:**					**0.206**
#18	4	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**4**	**Time of Concentration:**					**0.035**
#18	5	5. Nearly bare and untilled, and alluvial valley fans	8.90	672.03	7,551.00	2.980	0.703
#18	**5**	**Time of Concentration:**					**0.703**

Streeter Pond
25 Year 24 Hour Storm Event

Emergency Spillway Demonstration
Post-Mining Condition

Tony Tennyson

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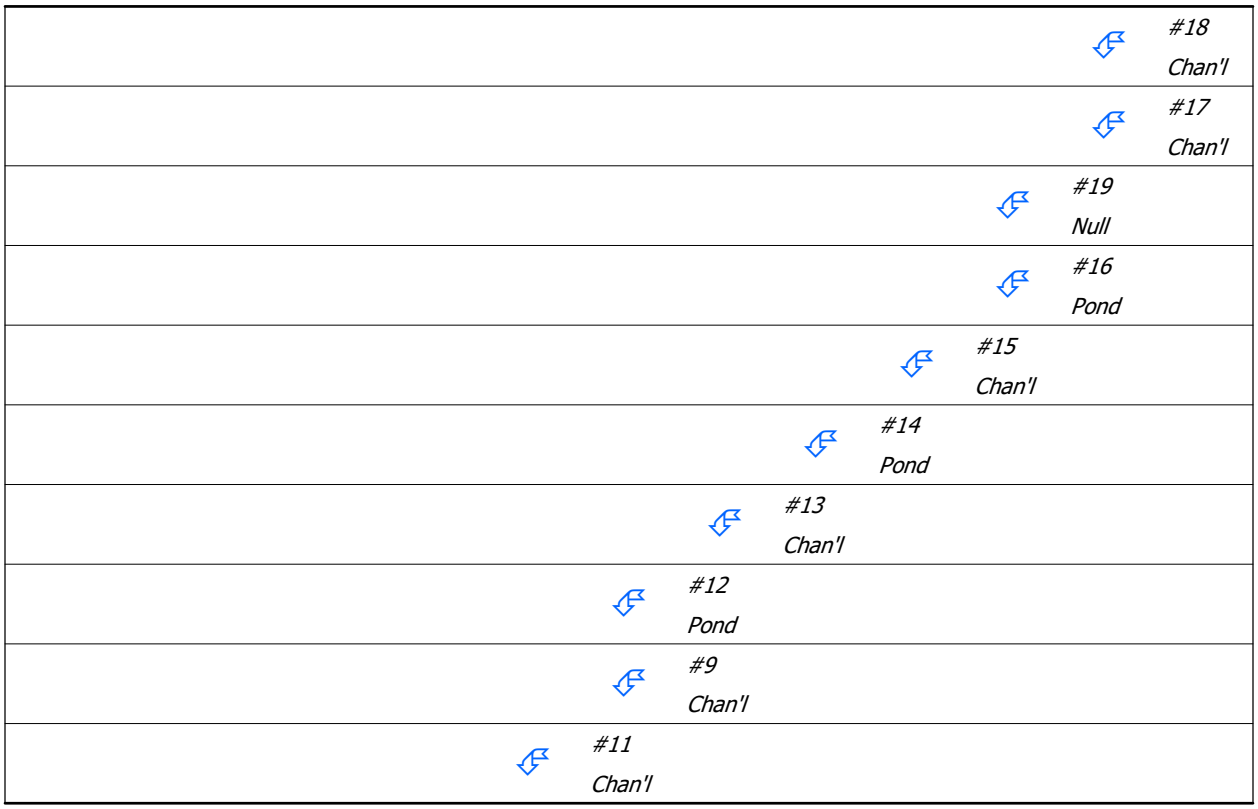
General Information

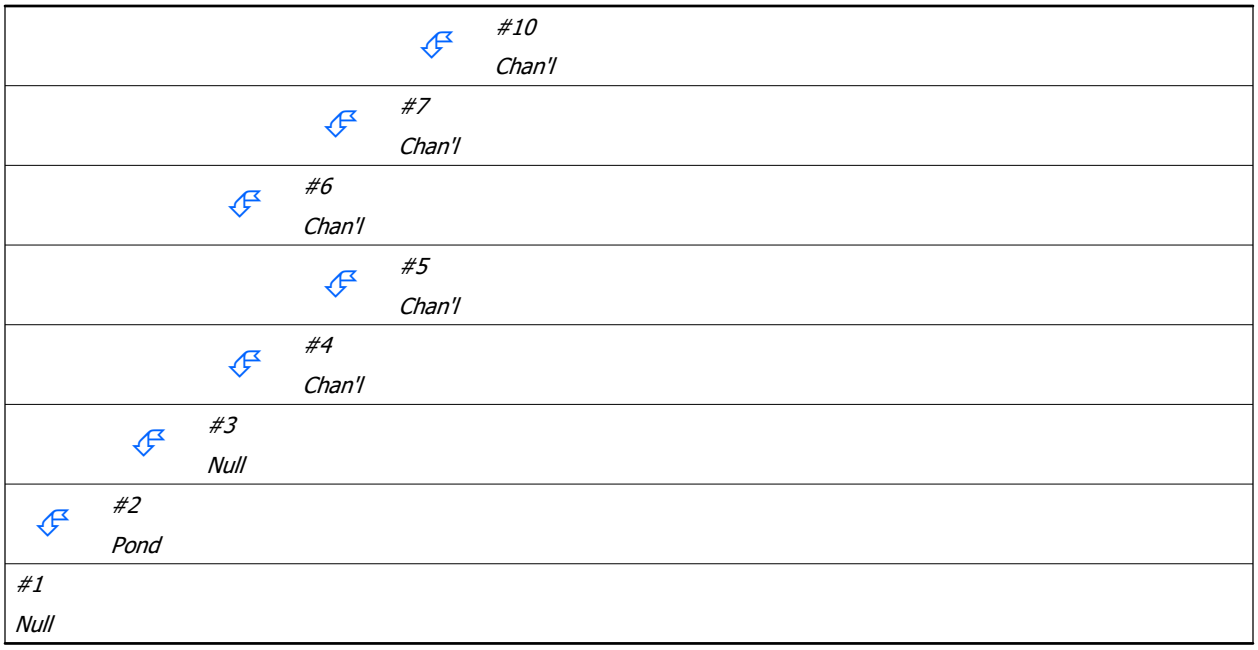
Storm Information:

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 Streeter Pond
Pond	#2	==>	#1	0.000	0.000	Streeter Pond
Null	#3	==>	#2	0.000	0.000	Null Above Streeter Pond
Channel	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#10	0.000	0.000	Streeter Ditch 80+00 to SD-1
Pond	#12	==>	#11	0.000	0.000	SD-1 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-2 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Pond	#16	==>	#15	0.000	0.000	SD-3 Stockpond
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter





Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#18		323.400	323.400	108.61	15.72
#17		136.600	136.600	28.26	3.52
#19		0.000	460.000	121.21	19.25
#16	In	0.500	0.500	0.43	0.03
	Out			0.36	0.00
#15		143.100	603.600	130.62	22.62
#14	In	0.000	603.600	130.62	22.62
	Out			129.13	0.00
#13		99.700	703.300	136.36	25.18
#12	In	0.000	703.300	136.36	25.18
	Out			134.93	0.00
#9		19.600	19.600	13.86	1.03
#11		71.300	774.600	139.31	26.71
#10		160.900	955.100	146.30	27.75
#7		144.400	144.400	0.02	0.00
#6		58.100	1,157.600	146.30	27.75
#5		164.800	164.800	0.02	0.00
#4		9.500	174.300	0.02	0.00
#3		0.000	1,331.900	146.30	27.75
#2	In	21.200	1,353.100	146.30	27.75
	Out			59.41	0.00
#1		0.000	1,353.100	59.41	24.76

Structure Detail:

Structure #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

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				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:	108.61 cfs		108.61 cfs	
Depth:	1.00 ft		1.45 ft	
Top Width:	20.99 ft		23.71 ft	
Velocity:	6.04 fps		3.87 fps	
X-Section Area:	17.98 sq ft		28.08 sq ft	
Hydraulic Radius:	0.843 ft		1.161 ft	
Froude Number:	1.15		0.63	
Roughness Coefficient:	0.0355		0.0686	

Structure #17 (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				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:	28.26 cfs		28.26 cfs	
Depth:	0.55 ft		0.92 ft	
Top Width:	15.29 ft		17.50 ft	
Velocity:	3.78 fps		2.09 fps	
X-Section Area:	7.48 sq ft		13.51 sq ft	
Hydraulic Radius:	0.483 ft		0.759 ft	
Froude Number:	0.95		0.42	
Roughness Coefficient:	0.0485		0.1185	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #16 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	100.01 ft
Dewater Time:	0.34 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)
90.00	0.050	0.000	0.000	
90.01	0.050	0.001	0.000	
91.00	0.072	0.061	0.000	
92.00	0.098	0.145	0.000	
93.00	0.128	0.258	0.000	
94.00	0.162	0.403	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
100.01	0.447	2.012	0.362	8.10	Peak Stage
101.00	0.554	2.473	48.400		
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

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				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:	130.62 cfs		130.62 cfs	
Depth:	1.08 ft		1.53 ft	
Top Width:	21.47 ft		24.20 ft	
Velocity:	6.64 fps		4.35 fps	
X-Section Area:	19.68 sq ft		30.05 sq ft	
Hydraulic Radius:	0.902 ft		1.217 ft	
Froude Number:	1.22		0.69	
Roughness Coefficient:	0.0338		0.0629	

Structure #14 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	101.68 ft
Dewater Time:	0.57 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)
90.00	0.050	0.000	0.000	
91.00	0.072	0.061	0.000	
92.00	0.098	0.145	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	12.85	
101.68	0.700	2.917	129.129	0.80	Peak Stage
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

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	3.2	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:	136.36 cfs		136.36 cfs	
Depth:	1.03 ft		1.45 ft	
Top Width:	21.19 ft		23.72 ft	
Velocity:	7.30 fps		4.84 fps	
X-Section Area:	18.67 sq ft		28.15 sq ft	
Hydraulic Radius:	0.868 ft		1.164 ft	
Froude Number:	1.37		0.78	
Roughness Coefficient:	0.0332		0.0609	

Structure #12 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	100.00 ft
Initial Pool:	2.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	101.73 ft
Dewater Time:	0.58 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)
90.00	0.050	0.000	0.000	
91.00	0.072	0.061	0.000	
92.00	0.098	0.145	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		Spillway #1
101.00	0.554	2.473	48.400	12.95	
101.73	0.709	2.949	134.932	0.90	Peak Stage
102.00	0.761	3.127	167.398		
103.00	1.000	4.005	344.812		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	48.400	48.400
102.00	167.398	167.398
103.00	344.812	344.812

Structure #9 (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				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:	13.86 cfs		13.86 cfs	
Depth:	0.82 ft		1.31 ft	
Top Width:	8.58 ft		12.50 ft	
Velocity:	3.18 fps		1.46 fps	
X-Section Area:	4.36 sq ft		9.51 sq ft	
Hydraulic Radius:	0.496 ft		0.742 ft	
Froude Number:	0.79		0.29	
Roughness Coefficient:	0.0507		0.1451	

Structure #11 (Vegetated Channel)

Streeter Ditch 80+00 to SD-1

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	3.2	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:	139.31 cfs		139.31 cfs	
Depth:	1.04 ft		1.46 ft	
Top Width:	21.25 ft		23.78 ft	
Velocity:	7.38 fps		4.91 fps	
X-Section Area:	18.87 sq ft		28.39 sq ft	
Hydraulic Radius:	0.874 ft		1.170 ft	
Froude Number:	1.38		0.79	
Roughness Coefficient:	0.0330		0.0603	

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

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	2.0	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:	146.30 cfs		146.30 cfs	
Depth:	1.34 ft		1.86 ft	
Top Width:	20.05 ft		23.14 ft	
Velocity:	6.80 fps		4.48 fps	
X-Section Area:	21.51 sq ft		32.63 sq ft	
Hydraulic Radius:	1.050 ft		1.374 ft	
Froude Number:	1.16		0.67	
Roughness Coefficient:	0.0320		0.0581	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

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)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.02 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

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)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	146.30 cfs	
Depth:	1.58 ft	
Top Width:	12.31 ft	
Velocity:	10.12 fps	
X-Section Area:	14.45 sq ft	
Hydraulic Radius:	1.107 ft	
Froude Number:	1.65	
Manning's n:	0.0520	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

Structure #5 (Vegetated Channel)

Streeter South Side 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				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:	0.02 cfs		0.02 cfs	
Depth:	0.06 ft		0.22 ft	
Top Width:	2.50 ft		3.75 ft	
Velocity:	0.15 fps		0.03 fps	
X-Section Area:	0.14 sq ft		0.63 sq ft	
Hydraulic Radius:	0.056 ft		0.165 ft	
Froude Number:	0.11		0.01	
Roughness Coefficient:	0.2522		2.3419	

Structure #4 (Riprap Channel)

Streeter Ditch 0+00 to 10+00

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)
6.00	2.0:1	2.0:1	28.3			

Riprap Channel Results:

PADER Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.02 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Structure #3 (Null)

Null Above Streeter Pond

Structure #2 (Pond)

Streeter Pond

Pond Inputs:

Initial Pool Elev:	6,583.00 ft
Initial Pool:	2.45 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	4.00	18.00	87.00	4.50	0.0150	6,585.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,588.00	50.00	1.50:1	1.50:1	20.00

Pond Results:

Peak Elevation:	6,589.14 ft
Dewater Time:	1.10 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)	
6,578.00	0.010	0.000	0.000		
6,579.00	0.070	0.035	0.000		
6,580.00	0.275	0.197	0.000		
6,581.00	0.441	0.551	0.000		
6,582.00	1.100	1.297	0.000		
6,583.00	1.200	2.447	0.000		
6,584.00	1.500	3.794	0.000		
6,585.00	1.600	5.344	0.000		Spillway #1
6,586.00	1.800	7.043	3.782	5.44*	
6,587.00	2.000	8.942	5.348	5.05	
6,588.00	2.100	10.992	6.550	4.40	Spillway #2
6,589.00	2.200	13.142	45.017	10.80	
6,589.14	2.271	13.456	59.413	0.65	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,590.00	2.400	15.441	150.324	
6,591.00	2.500	17.891	302.542	

**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)
6,578.00	0.000	0.000	0.000
6,579.00	0.000	0.000	0.000
6,580.00	0.000	0.000	0.000
6,581.00	0.000	0.000	0.000
6,582.00	0.000	0.000	0.000
6,583.00	0.000	0.000	0.000
6,584.00	0.000	0.000	0.000
6,585.00	0.000	0.000	0.000
6,586.00	3.782	0.000	3.782
6,587.00	5.348	0.000	5.348
6,588.00	6.550	0.000	6.550
6,589.00	7.563	37.453	45.017
6,590.00	8.456	141.868	150.324
6,591.00	9.263	293.279	302.542

Structure #1 (Null)

Null Below Streeter 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)
#18	1	6.300	0.118	0.000	0.000	47.000	M	0.00	0.000
	2	9.700	0.262	0.000	0.000	47.000	M	0.00	0.000
	3	35.200	0.206	0.000	0.000	47.000	M	0.01	0.000
	4	7.100	0.035	0.000	0.000	62.000	F	0.98	0.095
	5	265.100	0.703	0.000	0.000	80.000	F	108.32	15.630
	Σ	**323.400**						**108.61**	**15.725**
#17	1	37.500	0.127	0.000	0.000	80.000	F	25.95	2.269
	2	99.100	0.326	0.000	0.000	62.000	F	5.04	1.253
	Σ	**136.600**						**28.26**	**3.521**
#19	**Σ**	**460.000**						**121.21**	**19.246**
#16	1	0.500	0.005	0.000	0.000	80.000	F	0.43	0.028
	Σ	**0.500**						**0.43**	**0.028**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.00	0.000
	2	24.800	0.089	0.000	0.000	80.000	F	21.16	1.555
	3	28.500	0.082	0.000	0.000	80.000	F	24.31	1.787
	4	83.200	0.301	0.000	0.000	47.000	M	0.01	0.001
	Σ	**603.600**						**130.62**	**22.618**
#14	**Σ**	**603.600**						**130.62**	**22.618**
#13	1	19.900	0.046	0.000	0.000	80.000	F	16.98	1.248
	2	6.900	0.055	0.000	0.000	47.000	M	0.00	0.000
	3	20.300	0.069	0.000	0.000	47.000	M	0.00	0.000
	4	8.200	0.026	0.000	0.000	80.000	F	7.00	0.514
	5	12.700	0.011	0.000	0.000	80.000	F	10.83	0.796
	6	31.700	0.165	0.000	0.000	47.000	M	0.00	0.000
	Σ	**703.300**						**136.36**	**25.176**
#12	**Σ**	**703.300**						**136.36**	**25.176**
#9	1	4.000	0.078	0.000	0.000	62.000	F	0.55	0.053
	2	15.600	0.073	0.000	0.000	80.000	F	13.31	0.978
	Σ	**19.600**						**13.86**	**1.032**
#11	1	46.800	0.249	0.000	0.000	47.000	M	0.01	0.000
	2	17.700	0.074	0.000	0.000	80.000	F	15.10	1.110
	3	6.800	0.029	0.000	0.000	80.000	F	5.80	0.426
	Σ	**774.600**						**139.31**	**26.713**
#10	1	95.700	0.407	0.000	0.000	47.000	M	0.01	0.001

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	65.200	0.120	0.000	0.000	47.000	M	0.01	0.000
	Σ	**955.100**						**146.30**	**27.746**
#7	1	132.200	0.381	0.000	0.000	47.000	M	0.02	0.001
	2	12.200	0.168	0.000	0.000	47.000	M	0.00	0.000
	Σ	**144.400**						**0.02**	**0.001**
#6	1	22.400	0.072	0.000	0.000	47.000	M	0.00	0.000
	2	35.700	0.131	0.000	0.000	47.000	M	0.01	0.000
	Σ	**1,157.600**						**146.30**	**27.747**
#5	1	9.200	0.008	0.000	0.000	47.000	M	0.00	0.000
	2	155.600	0.375	0.000	0.000	47.000	M	0.02	0.002
	Σ	**164.800**						**0.02**	**0.002**
#4	1	9.500	0.058	0.000	0.000	47.000	F	0.00	0.000
	Σ	**174.300**						**0.02**	**0.002**
#3	**Σ**	**1,331.900**						**146.30**	**27.749**
#2	1	16.600	0.056	0.000	0.000	47.000	M	0.00	0.000
	2	4.600	0.048	0.000	0.000	47.000	M	0.00	0.000
	Σ	**1,353.100**						**146.30**	**27.749**
#1	**Σ**	**1,353.100**						**59.41**	**24.756**

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	30.40	270.56	890.00	4.410	0.056
#2	**1**	**Time of Concentration:**					**0.056**
#2	2	3. Short grass pasture	34.00	274.04	806.00	4.660	0.048
#2	**2**	**Time of Concentration:**					**0.048**
#4	1	3. Short grass pasture	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	21.00	24.35	116.00	3.660	0.008
#5	**1**	**Time of Concentration:**					**0.008**
#5	2	3. Short grass pasture	11.60	426.64	3,678.00	2.720	0.375
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,213.00	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	7.70	249.63	3,242.00	2.210	0.407
#10	**1**	**Time of Concentration:**					**0.407**
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#11	1	3. Short grass pasture	9.20	199.91	2,173.00	2.420	0.249
#11	**1**	**Time of Concentration:**					**0.249**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	14.70	150.38	1,022.99	3.830	0.074
#11	**2**	**Time of Concentration:**					**0.074**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**3**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	17.80	124.77	700.95	4.210	0.046
#13	**1**	**Time of Concentration:**					**0.046**
#13	2	3. Short grass pasture	15.70	99.85	635.98	3.160	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	15.80	124.66	789.00	3.170	0.069
#13	**3**	**Time of Concentration:**					**0.069**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	4.80	10.12	211.00	2.190	0.026
#13	**4**	**Time of Concentration:**					**0.026**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	15.40	24.94	162.00	3.920	0.011
#13	**5**	**Time of Concentration:**					**0.011**
#13	6	3. Short grass pasture	6.30	75.09	1,192.00	2.000	0.165
#13	**6**	**Time of Concentration:**					**0.165**
#15	1	3. Short grass pasture	15.00	74.85	499.00	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.089**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	12.10	124.87	1,032.00	3.470	0.082
#15	**3**	**Time of Concentration:**					**0.082**
#15	4	3. Short grass pasture	9.40	250.04	2,660.00	2.450	0.301
#15	**4**	**Time of Concentration:**					**0.301**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	0.19	19.00	1.000	0.005
#16	**1**	**Time of Concentration:**					**0.005**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#17	1	5. Nearly bare and untilled, and alluvial valley fans	7.80	99.84	1,280.00	2.790	0.127
#17	**1**	**Time of Concentration:**					**0.127**
#17	2	3. Short grass pasture	9.50	274.74	2,892.00	2.460	0.326
#17	**2**	**Time of Concentration:**					**0.326**
#18	1	3. Short grass pasture	9.50	99.94	1,052.00	2.460	0.118
#18	**1**	**Time of Concentration:**					**0.118**
#18	2	3. Short grass pasture	1.50	13.74	916.00	0.970	0.262
#18	**2**	**Time of Concentration:**					**0.262**
#18	3	3. Short grass pasture	8.60	149.81	1,742.00	2.340	0.206
#18	**3**	**Time of Concentration:**					**0.206**
#18	4	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**4**	**Time of Concentration:**					**0.035**
#18	5	5. Nearly bare and untilled, and alluvial valley fans	8.90	672.03	7,551.00	2.980	0.703
#18	**5**	**Time of Concentration:**					**0.703**

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LEGEND

- Permit Boundary
- Vegetation Mapping Boundary (This study)
- Study Area Boundary
- Historic Vegetation Mapping Polygon (Harner, 1985)
- Historic Vegetation Mapping Polygon (Cedar Creek, South Taylor Study)
- V106 or V106 — Vegetation Sample Points
- 25 — Reference Area Sample Points
- Reference Area Boundary

G	Grassland
A	Aspen
Sm	Sagebrush (Mesic)
Sx	Sagebrush (Xeric)
SG	Sagebrush (Historic Mapping)
MSm	Mountain Shrub (Mesic)
MSx	Mountain Shrub (Xeric)
MS	Mountain Shrub (Historic Mapping)
J	Juniper Scrub
B	Bottomland
CF	Cultivated Fields
GL	Grassland

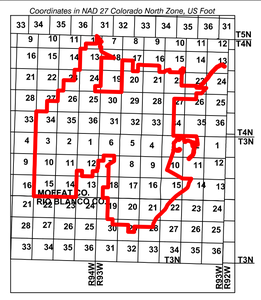
IP	Improved Pasture
DA	Disturbed Area
MD	Mining Disturbance
MF	Mining Facilities
RD	Large Roads (2 lane or larger roads)
H	Homestead or Ranch Buildings / Yards / Stock pens / etc.
RR	Railroad (Rail loop and line)
RO	Rock Outcrop
W	Wetlands
P or ST	Ponds or Stocktanks
R	Riparian

N W E S

1800' 0 1800' 3600'

CONTOUR INTERVAL 25 FT.
PREMINE TOPO

Coordinates in NAD 27 Colorado North Zone, US Foot



ENGINEERS CERTIFICATION

I, BRIAN W. COATES, hereby certify that this map has been reviewed by me and is true and correct to the best of my knowledge and information, relying on information supplied by experts employed by Colowyo Coal Company or qualified consultants working for Colowyo Coal Company, and that I am a Professional Engineer licensed in Colorado as required by the provisions of C.R.S. 12-25-101 through C.R.S. 12-25-119. IN WITNESS WHEREOF, I have hereunder set my hand and affixed my seal.

COLORADO LICENSED
BRIAN W. COATES
55154
2/13/20
PROFESSIONAL ENGINEER

VEGETATION

COLOWYO COAL COMPANY
SAFETY - PEOPLE - PRODUCTION - ENERGY

Colowyo Coal Company
5731 State Highway 13
Meeker, Colorado 81641

SCALE: 1" = 1800'
DATE: 5/19/08
DRWG. BY: TCP-RWF/ESI
APPROVED BY:

DRWG NO.

MAP 4

No.	REVISION	DATE	BY	CHK
RN-07	Updated Permit Boundary, Revised Paper Size	4/2/18	TONY	AA
TR-135	Updated Permit Boundary	12/20/19	TONY	AA
TR-135	Corrected Map Number	2/13/20	TONY	AA

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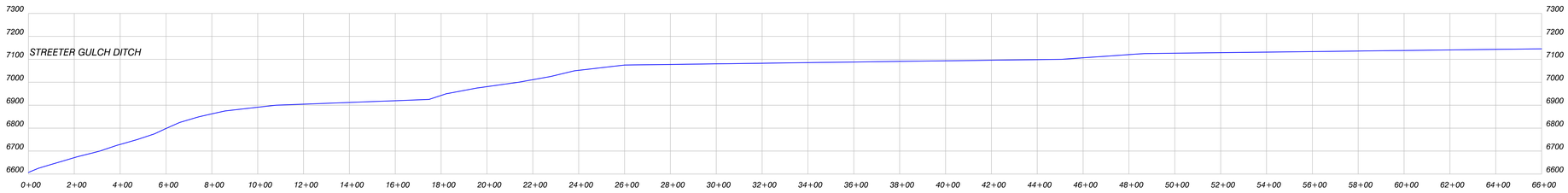
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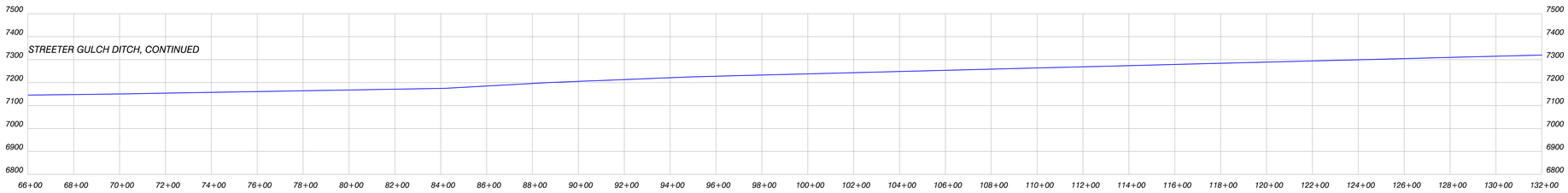
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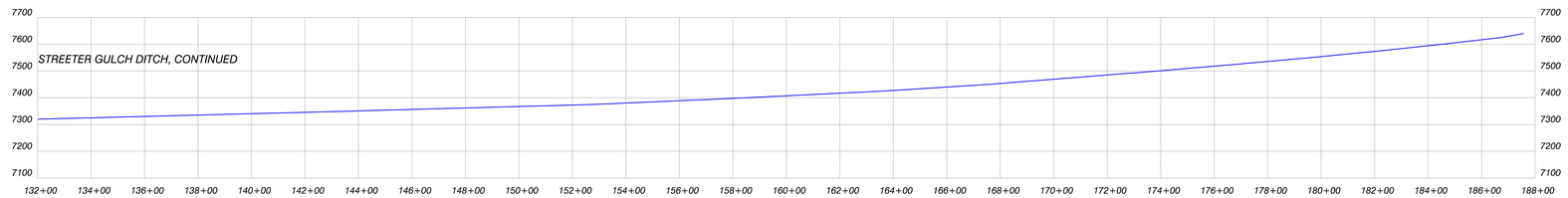
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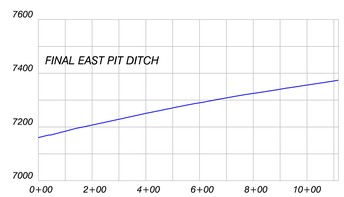
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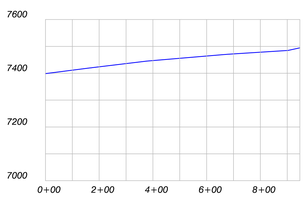




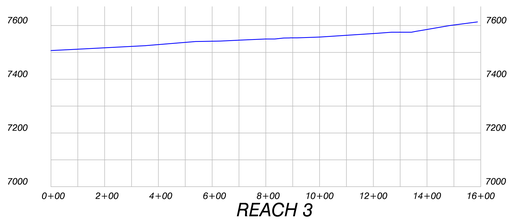




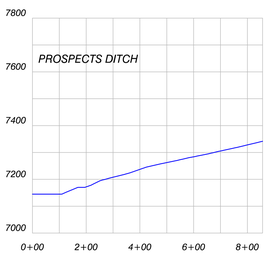
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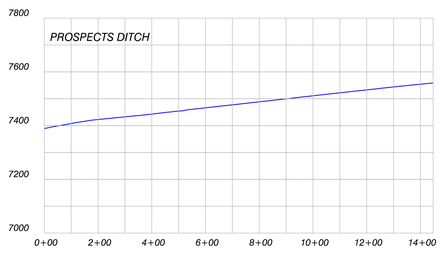
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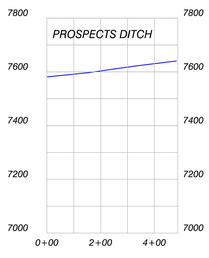
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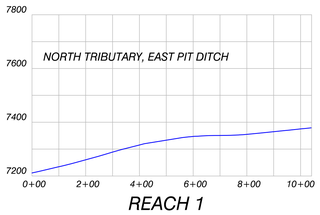
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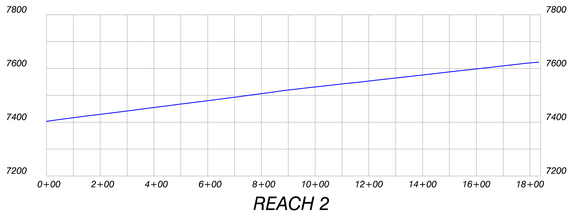
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REACH 3



REACH 1



REACH 2

LEGEND

Permanent Drainage Profiles



ENGINEERS CERTIFICATION

I, BRIAN W. COATES, hereby certify that this map has been reviewed by me and is true and correct to the best of my knowledge and information, relying on information supplied by experts employed by Colowyo Coal Company or qualified consultants working for Colowyo Coal Company, and that I am a Professional Engineer licensed in Colorado as required by the provisions of C.R.S. 12-25-101 through C.R.S. 12-25-119. IN WITNESS WHEREOF, I have hereunder set my hand and affixed my seal.



POSTMINING PERMANENT DRAINAGE PROFILES

Colowyo Coal Company
57371 State Highway 13
Meeker, Colorado 81641

SCALE: SEE PROFILE TEXT
DATE: 2/1/06
DRWG. BY: TCP/ESI
APPROVED BY:

DRWG NO. MAP 33

No.	REVISION	DATE	BY	CHK
TR 87	Logo change and Updated North Trib. East Pit Ditch	9/21/10	TCP	TAT
TR 87	Updated North Trib. East Pit Ditch, Final East Pit Ditch and the Prospect Ditch.	11/5/10	TCP	KRB
MR 118	Logo change, Updated Prospect Ditch Reach 1, added note to Gulch A ditch profile	4/26/12	TCP	KRB
TR 105	Updated Streeter Gulch Ditch profile, edit legend	1/12/15	TCP	KRB
TR 135	Removed All Phase III Release Ditches	2/13/20	Tony	BC

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Exhibit 2	List of Owners and Controllers of Colowyo Mine
Exhibit 6 Item 6	Physiochemical Analyses and Characterization of Overburden in the Project Area Drill Holes 00-03, 00-08, 99-02, 99-04, 99-09, 97-06, 97-09, and 97-15, 83-D3-06, 83-D3-07, 83-D3-10, 83-D3-12, 83-D3-14, and ST-06-08;
Exhibit 7, Item 20	Erosion and Sediment Control Structures
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Exhibit 13A	South Taylor Reclamation Bond
Exhibit 14, Item 4	Pre-Blast Survey – Structures within ½ Mile of Lower Wilson mining area Tri-State Generation and Transmission Association, Inc (Eight 345 KV Power Pole Foundations) and Routsen Properties (6647 Moffat County Road 51 and 7072 Moffat County Road 51).
Exhibit 14, Item 5	Pre-Blast Survey – Structures within ½ Mile of South Taylor mining area Tri-State Generation and Transmission Association, Inc. (Three 345 KV Power Pole Foundations)
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fir comprised less than 1 percent of the area. Several small areas of Juniper comprised less than 1 percent of the area. Areas of native or improved haylands comprised approximately 1 percent of the study area. Several other vegetation types occurred along the railroad corridors. A small area of riparian forest occurred along Wilson Creek. Greasewood vegetation type occurred along the lower stretches of both Wilson and Good Spring Creeks. Wheat and barley are planted in cultivated lands along the Wilson and Good Spring Creek railroad corridors.

Aspen - The aspen vegetation type occurred primarily on northwest facing slopes at elevations above 7,400 feet. Large continuous stands of aspen occurred along the upper portions of the West Fork of Good Spring Creek in sections 6, 31, and 32. In sections 19 and 20, aspen stands occurred on northwest facing slopes leading to the East Fork of Wilson Creek. A typical view of the aspen vegetation type within the study area is at Figure 3.1 of Exhibit 10, Item 5. Two distinct phases occur within the aspen vegetation type; a shrub dominated understory phase and an herbaceous understory phase. The shrub-dominated phase occurred at lower elevations and was dominated by western snowberry. The majority of the study area was comprised of this phase. The other herbaceous understory phase was dominated by perennial forbs, the most prominent being sweet anise, Porter's ligusticum and peavine. This phase occurred at higher elevations. These phases have been recognized in the nearby White River National Forest (Hoffman and Alexander, 1983). They indicate that the snowberry phase occupies the lower edge of the aspen zone and was classified as the driest of any of the phases in their study. In the drier direction of the phase it is replaced by mountain shrub or sagebrush vegetation. The herbaceous phase was described as having a continuous layer of forb species with the near absence of shrub species. Fendler meadowrue may dominate on more well-drained soils while Porter ligusticum and sweet anise dominate on less well-drained soils.

Total understory vegetation cover within the study area aspen type was 66.9 percent (Table 3.3 of Exhibit 10, Item 5). Bare ground was 6.5 percent, while litter and rock cover combined was 26.5 percent. Perennial grasses had 18.3 percent cover while perennial forbs had 34.1 percent. Dominant grasses included Kentucky bluegrass, nodding brome and blue wildrye. Dominant forbs included sweet anise, and western yarrow. Woody species had 23.1 percent cover with western snowberry as the dominant shrub.

Total understory vegetation cover within the Collom aspen reference area (72 percent), shown on Map 4 and described in Exhibit 10, Item 6, was higher than that of the study area. Bare ground exposure was 8.9 percent, while litter and rock cover combined was 19.1 percent combined. Compared with the study area, perennial forbs and shrubs were lower with 26.8 and 5.2 percent cover respectively. Perennial grasses however, were higher with 38.1 percent. Dominant forbs included creeping root violet with 5.2 percent cover and poverty weed with 4.4 percent cover. A test for equivalency of the reference area was made and it was found to be equivalent (please see Exhibit 10, Item 6).

The mean herbaceous production within the aspen vegetation type of the study area was 129.1 grams per square meter (Table 3.3 of Exhibit 10, Item 5). Perennial grasses comprised the majority of the production with 68.7 grams per square meter. Kentucky bluegrass, nodding brome and blue wildrye were the dominant grasses. Perennial forbs produced an average of 48.3 grams per square meter. Ballhead waterleaf and leguminous forbs were the highest producers.

Mean herbaceous production in the Collom aspen reference area was 124.4 grams per square meter. Perennial grasses produced more than 68 percent of the total production with 86.4 grams per square meter. Mean annual above ground herbaceous production in the reference area did not exceed that of the study area samples. A test for equivalency of the reference area was made and it was found to be equivalent.

The reclamation plan for the existing mining areas provides information relevant to the reclamation of the South Taylor mining area, which can be found in Volume 1, Section 2.05.4. Specific topics requested by the regulations and not incorporated into Volume 1 are included in the following subsections.

2.05.4 (2)(a) Reclamation Timetable

The sequence for reclamation following the mining process is shown on Map 29. Final reclamation of the South Taylor pit will be delayed, due to the shape, size and depth of the pit; which will result in leaving the majority of the spoil backfilling process until final pit closure. The majority of the spoil will be stacked in the initial boxcut area and associated valley fill areas, allowing adequate space to perform mining operations in a geotechnically safe environment. Although the final reclamation of the South Taylor will be delayed due to the mining operations in the pit, Colowyo is committed to reclamation in accordance with Rule 4.13 and will perform reclamation activities as contemporaneously as practicable with the South Taylor mining operations. With the limitation of areas available for reclamation prior to final pit backfill, Colowyo will reclaim as many areas as allowed by the mine plan as shown on Map 29, prior to final pit closure. The South Taylor pit reached a steady state operation in 2013; where as all spoil material produced in the advancing cut is backfilled into the previously mined areas. In general, it is anticipated that the vast majority of reclamation activities in the South Taylor pit area will begin in the lower elevation areas and progress upslope to the highest elevation areas. This is a matter of practical necessity due to the operational constraints encountered in the area which were also reflected in the hydrological modeling found in Exhibit 7, Item 20. Major departures from this premise will result in the need to revisit the adequacy of the sediment control structures designed and submitted as part of this permit.

2.05.4 (2)(b) Reclamation Costs

The estimate of the cost of reclamation of the operations required to be covered by the performance bond is found under Rule 3.

2.05.4 (2)(c) Backfilling Plan

As the mining progresses to the west, overburden material from each successive cut will be backfilled into the previously mined out area and the additional spoil will continue to buildup in previously mined areas. This cycle will be repeated for the entire mining area. Due to shape, size and depth of the South Taylor pit results in leaving the majority of the spoil backfilling process until final pit closure. As a result, Colowyo has been granted a variance for a delay in contemporaneous reclamation based on Rule 4.14.1(1)(d) which states that "Rough backfilling and grading shall be completed within 180 days following coal removal and shall not be more than four spoil ridges behind the pit being worked..". The mining techniques utilizing dragline and truck/shovel operation are shown in detail on Mining Range Diagram (Map 24B), and show the approximate distance between topsoil removal and replacement. Premining topography is presented on Map 18A and the postmining topography is shown on Map 19B. Map 20B provides cross-sections of the premining and postmining topography. Map 28 presents the topsoil handling movements and the timing of stripping activities. Map 29 shows the spoil grading sequence timing of reclamation activities.

The backfilled mining areas will be graded to establish a stable post mine topography that blends into the undisturbed areas outside the mining limits (Map 19B). Colowyo will grade all final slopes so that overall grades do not exceed 33% (Map 20B). Additional information on the backfilling and regrading plan are discussed further in Volume 1, Section 2.05.4 and Section 4.14.

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