State of Utah
DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Oil, Gas and Mining

JOHN R. BAZA
Division Director

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

October 27, 2015

Chris Hansen, Environmental Engineer
Canyon Fuel Company, LLC
HC 35 Box 380
Helper, Utah 84526

Subject: Authorization to Proceed & Conditional Approval of Repair Designs, Canyon Fuel Company, LLC, Gordon Creek 2, 7 & 8 Mine, C/007/0016, Task ID #5016

Dear Mr. Hansen:

The above-referenced amendment has been reviewed by Division of Oil, Gas and Mining Staff (the Division). Given that the window of time afforded for implementing the repairs is becoming increasingly limited with the onset of winter, the Division staff has recommended approval. At this time you are authorized to proceed with the repair work as outlined in your amendment. A stamped incorporated copy of the amendment is enclosed for your copy of the MRP. Final approval will be granted when the following conditions have been met:

1) Provide the Division with a minimum 72 hour notice prior to initiating the repair work.
2) Receipt of 2 clean copies prepared for incorporation of the following:
   a. Submission of two as-built drawings of the repair work for incorporation into the Mining and Reclamation Plan (MRP) no later than 30 days following the completion of the repair work.
   b. Submission of two revised reclamation time-lines for incorporation into the MRP. The revised reclamation time-line must discuss the repair work conducted, including but not limited to, a description of the repair work as well as when the work was completed. Provide the MRP revision no later than 30 days following the completion of the repair work.

Once we receive the aforementioned items, final approval will be granted. A stamped incorporated copy of the approved plans will also be returned to you at that time, for insertion into your copy of the Mining and Reclamation Plan.

If you have any questions, please call me at (801) 538-5325.

Sincerely,

Daron R. Haddock
Coal Program Manager

DRH/sqs
O:\FORMS\LETTERS\CONDITIONALAPPROVAL.DOC

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UTAH DNR OIL, GAS & MINING

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Gordon Creek 2, 7 & 8 Mines **Permit Number:** C/007/0016
Title: Reclamation Channel SD-6 Repair

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☒ Add	☐ Replace	☐ Remove	Add "Note" Cover Page to front of Appendix 7-1
☒ Add	☐ Replace	☐ Remove	Add Addendum to Appendix 7-1 with cover page to end of Appendix 7-1 and before Appendix 7-2
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

Received by Oil, Gas & Mining

RECEIVED
OCT 09 2015
DIV. OF OIL, GAS & MINING

NOTE

An Addendum to Appendix 7-1 is located at the end of this appendix and is titled "Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mines, Carbon County, Utah"

This addendum to Appendix 7-1 is intended to be read as an addition to the original designs to reclamation channel SD-6. This redesign is specific to the lower section of SD-6 where erosion of the channel has occurred on two occasions, once following an apparent greater-than-design storm event in the fall of 2014 and a second event that occurred after repairs were completed in the summer of 2015. This redesign is not intended to be implemented at any other reclamation channel at the Gordon Creek Mines.

Addendum to Appendix 7-1

Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mines, Carbon County, Utah

This addendum to Appendix 7-1 is intended to be read as an addition to the original designs to reclamation channel SD-6. This redesign is specific to the lower section of SD-6 where erosion of the channel has occurred on two occasions, once following an apparent greater-than-design storm event in the fall of 2014 and a second event that occurred after repairs were completed in the summer of 2015. This redesign is not intended to be implemented at any other reclamation channel at the Gordon Creek Mines.

Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mine, Carbon County, Utah

Bowie Resource Partners, LLC
Grand Junction, Colorado

October 2015

EarthFax EarthFax Engineering Group, LLC

Engineers / Scientists
www.earthfax.com

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REVISED PLAN FOR REPAIR OF RECLAMATION CHANNEL SD-6 AT THE GORDON CREEK 2,7,8 MINE, CARBON COUNTY, UTAH

1.0 BACKGROUND

Reclamation channel SD-6 was designed to convey a peak flow of 7.08 cfs resulting from a 100-year, 6-hour precipitation event. The cross section of the trapezoidal channel (with a 5-foot bottom width, 2H:1V side slopes, and a depth of 1.5 feet) was based on the minimum design channel slope of 7.5%, while riprap sizing was determined based on a maximum design slope of 40%. Riprap sizing was calculated using the permissible velocity approach presented in the 1967 edition of Hydraulic Engineering Circular No. 11 (Searcy, 1967).

A high-intensity precipitation event in September 2014 caused substantial erosion of channel SD-6 and other reclamation channels at the Gordon Creek 2,7,8 Mine in Carbon County, Utah. As a result, these channels were reconstructed to their original design. Another high-intensity event in the summer of 2015 resulted in erosion of the riprap lining in the downstream (steeper) section of channel SD-6. The upper section of channel SD-6, with a milder slope, was not damaged by the recent event. Photographs of the 2015 erosion are provided in Attachment A. As a result of the most recent erosion, the decision was made to re-evaluate the original design approach prior to repairing the channel.

2.0 DESIGN RE-EVALUATION

The design of channel SD-6 riprap armoring was re-evaluated using the tractive-force approach recommended in the updated Hydraulic Engineering Circular No. 11 (Brown and Clyde, 1989). According to this method, the median diameter of riprap required to be stable in a channel is calculated using the following equation:

$$D_{50} = 0.001 \frac{V_a^3}{d_{avg}^{0.5} K_1^{1.5}}$$

where

D_{50} = median riprap particle size (ft)
V_a = average flow velocity (ft/s)
d_{avg} = average flow depth (ft)
K_1 is defined as:

$$K_1 = [1 - (sin^2\theta / sin^2\emptyset)]^{0.5}$$

where

θ = bank angle with the horizontal
ϕ = riprap material angle of repose

The average flow velocity and depth of flow were determined using FlowMaster, based on a design flow of 7.08 cfs and an as-built maximum slope of 44%. A Manning's roughness coefficient of 0.042 was assumed for these calculations based on an assumed median diameter of 18 inches and the following equation developed by Anderson et al. (1970):

$$n = 0.0395\, D_{50}^{1/6}$$

where

n = Manning's roughness coefficient
D_{50} = median riprap diameter (ft)

These results of these calculations are presented in Attachment B. As indicated, the average velocity in the lower section of reclamation channel SD-6 was calculated to be 7.18 ft/s, with an average flow depth of 0.18 ft. The median riprap diameter was calculated to be 17.7 inches. This was rounded up to a median diameter of 18 inches for construction purposes. This agrees with the diameter initially assumed for calculating Manning's roughness coefficient, thus verifying the appropriateness of that assumed value.

Riprap gradation and the need for filter layers were determined based on the recommendations of Brown and Clyde (1989). The filter material used previously consisted of sandy gravel with a median particle diameter of 0.25 inch. Site observations indicate that a sufficient quantity of this material remains on site for use as a filter layer.

The calculations presented in Attachment B indicate that two filter layers will be required between the riprap layer and the underlying soil. The uppermost filter layer will consist of coarse gravel with a median particle diameter of 1.5 inches. The lower filter layer will consist of the previous filter material with a median particle diameter of 0.25 inch. Based on the recommendations of Brown and Clyde, the armoring materials will have the following approximate gradations:

Percent Passing	Ideal Size (in)			Desirable Size Range (in)		
	Riprap	Upper Filter	Lower Filter	Riprap	Upper Filter	Lower Filter
100	29	2.4	0.40	27-31	2.2-2.4	0.38-0.43
85	23	2.0	0.32	22-25	1.8-2.1	0.30-0.35
50	18	1.5	0.25	18-21	1.5-1.7	0.25-0.29
15	9	0.8	0.12	7-11	0.6-0.9	0.10-0.15

Consistent with the recommendations of Brown and Clyde (1989), each filter layer will be placed to a thickness of 4 to 8 inches. The resulting cross section of the lower portion of reclamation channel SD-6 is shown in Figure 1.

3.0 REPAIR PLAN

Only the lower of channel SD-6 will require repair. In accordance with the above calculations, the channel will be replaced as indicated on Figure 1. The basic plan for repair of the channel is as follows:

- Mobilize equipment and materials to the site and install sediment controls as necessary.
- Recover riprap and filter material that has accumulated at the downstream end of the channel for re-use as appropriate.
- Regrade the lower section of the damaged channel, as necessary, to fill eroded sections and achieve the required grades.
- Install the lower filter bedding (D_{50}=0.25 inch) to a depth of 4 to 8 inches.
- Install the lower filter bedding (D_{50}=1.5 inches) to a depth of 4 to 8 inches.
- Install D_{50} = 18 inch riprap to a depth of 30 inches.
- Revegetate all areas disturbed by this project.

Riprap used in the channel repair will be durable, angular, hard, and free from seams and cracks. The riprap and filter materials will meet the gradations indicated in Section 2.0 of this plan.

Areas that are affected by equipment access will be gouged as necessary as the equipment departs from the site. This will loosen the topsoil and minimize the long-term potential for erosion of these areas. The affected areas will then be revegetated using the seed mix provided in Table 3-3 of the Mining and Reclamation Plan. Certification will be obtained from the seed supplier to ensure that the seed mix does not contain weed seed in excess of 0.5% of the aggregate weight of pure live seed.

Seeding will be accomplished via hydroseeding or broadcast seeding. If hydroseeding is used, the seed will be mixed with a small amount of wood fiber mulch, used as tracer, and water to form a slurry. If broadcast seeding is used, the seed will be broadcast by mechanical means, or by hand, such that the seed is uniformly distributed. Mulch will be applied as indicated in Section 3.5.5.3 of the Mining and Reclamation Plan. Bowie's goal is to complete all seeding this year prior to the onset of significant snowfall.

4.0 REFERENCES

Anderson, A.G., A.S. Paintal, and J.T. Davenport. 1970. Tentative Design Procedure for Riprap-Lined Channels. National Cooperative Highway Research Program Report 108. Highway Research Board, Division of Engineering, National Academy of Sciences. Washington, D.C.

Brown, S.A. and E.S. Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. Federal Highway Administration, Office of Implementation. McLean, VA.

Searcy, J.K. 1967. Use of Riprap for Bank Protection. Hydraulic Engineering Circular No. 11. Federal Highway Administration, Hydraulics Branch, Bridge Division, Office of Engineering and Traffic Operations. Washington, D.C.

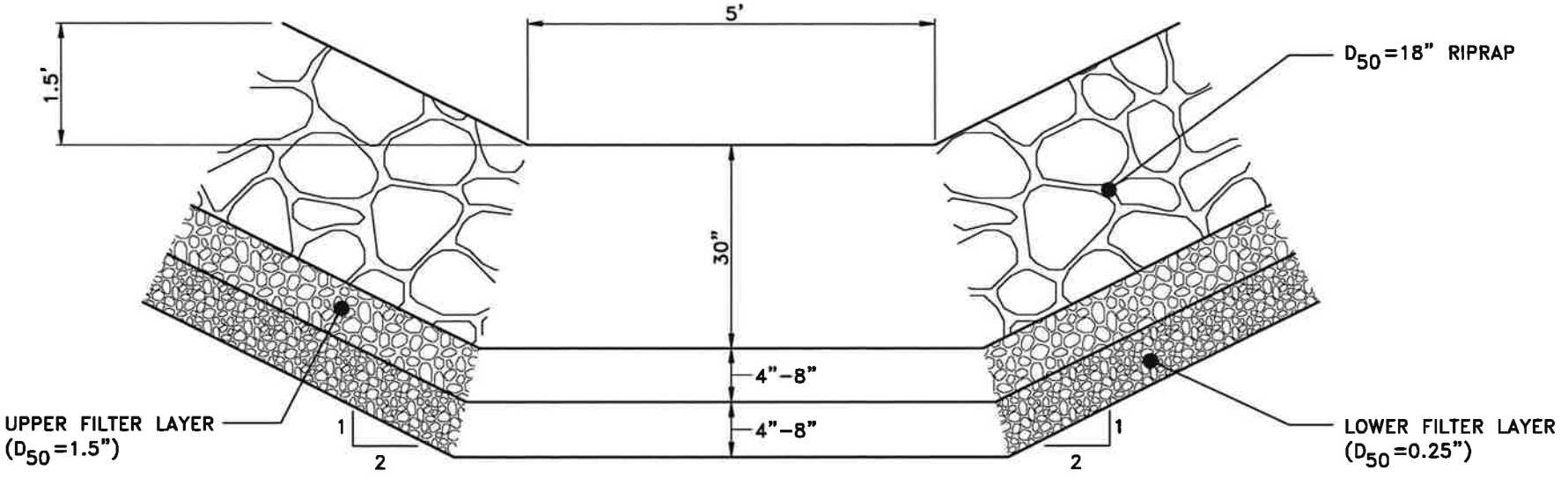

FIGURE 1. REPAIRED RECLAMATION CHANNEL SD-6 CROSS SECTION

EarthFax

ATTACHMENT A

Photographs

Upper (mild slope) section of SD-6. Note lack of erosion.

Downstream view of eroded (steep slope) section of SD-6

Upstream view of eroded (steep slope) section of SD-6

Eroded material collected at the bottom of SD-6

Rock adjacent to downstream end of SD-6, potentially available for use as riprap

Rock and fine filter material at site entrance, potentially available for use in channel repair

ATTACHMENT B

Design Calculations

Rredesign of SD-6 Lower Section
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	SD-6 Lower Sec
Flow Element	Trapezoidal Cha
Method	Manning's Formu
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.042	
Slope	440000	ft/ft
Left Side Slope	0.50	V : H
Right Side Slope	0.50	V : H
Bottom Width	5.00	ft
Discharge	7.08	cfs

Results		
Depth	0.18	ft
Flow Area	1.0	ft²
Wetted Perim	5.82	ft
Top Width	5.73	ft
Critical Depth	0.38	ft
Critical Slope	0.038453	ft/ft
Velocity	7.18	ft/s
Velocity Head	0.80	ft
Specific Energ	0.99	ft
Froude Numb	3.05	
Flow Type	Supercritical	

EarthFax Engineering Inc
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

EARTHFAX ENGINEERING GROUP, LLC
RIPRAP SIZING BASED ON HEC-11

Project #: UC-1489-02
Site: Reclamation channel SD-6, lower section, Gordon Creek 2,7,8 Mine
Engineer: RB White

Bank angle = 2 :1 = 26.57 degrees = 0.464 radians
Rpirap material angle of repose = 39 degrees = 0.681 radians

K1 = 0.704

Channel	Design Velocity (ft/s)	Flow Depth (ft)	Median Riprap Diameter		
			Calculated (ft)	Calculated (in)	Planned (in)
SD-6	7.18	0.18	1.478	17.7	18

Reference:

Brown, S.A. and E,S, Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. U.S. Departmnt of Transportation, Federal Highway Administration. McLean, Virginia.

EARTHFAX ENGINEERING GROUP, LLC
RIPRAP FILTER CALCULATION

Project #: UC-1489-02
Site: Reclamation channel SD-6, lower sction, Gordon Creek 2,7,8 Mine
Engineer: RB White

Assumed median diameters (inches):

Riprap: 18
Upper Fltr: 1.5
Lower Fltr: 0.25 (i.e., old filter material)

Ideal calculated or measured gradations (inches):

Size Class	Riprap	Upper Filter	Lower Filter
D_{100}	28.8	2.4	0.4
D_{85}	23.4	1.95	0.325
D_{50}	18	1.5	0.25
D_{15}	9	0.75	0.125

Calculated gradations based on:
D_{100} = 1.5 D_{50} to 1.7 D_{50}
D_{85} = 1.2 D_{50} to 1.4 D_{50}
D_{50} = 1.0 D_{50} to 1.1 D_{50}
D_{15} = 0.4 D_{50} to 0.6 D_{50}

Filter gradation criteria:

D_{15}(coarser layer)/D_{85}(finer layer) < 5

5 < D_{15}(coarser layer)/D_{15}(finer layer) < 40

Filter gradation check:

Layers Compared	D_{15}(coarse)/D_{85}(fine)	D_{15}(coarse)/D_{15}(fine)	OK?
Riprap vs. Upper	4.6	12.0	Yes
Upper vs. Lower	2.3	6.0	Yes
Criterion	< 5	5 - 40	

Reference:

Brown, S.A. and E.S. Clyde. 1989. Design of Riprap Revetment. Hydraulic Enigneering Circular No. 11. Federal Highway Administration. McLean, VA.