Attachment K
Reclamation Cost Estimate

RECLAMATION COST ESTIMATE

DANEROS MINE

Prepared by

Energy Fuels Resources (USA) Inc.

225 Union Boulevard, Suite 600

Lakewood, CO 80228

December 2015

1.0 Introduction

The existing facilities at the Daneros Portal Area is the basis for the bonding approach presented in this cost estimate.

2.0 Reclamation Tasks

The reclamation tasks at the Daneros Mine are grouped into the following categories: demolition of structures, grading, and revegetation.

2.1 Demolition of Structures

Demolition costs of the constructed structure are estimated. The abandonment of buildings and support items like wells and vent shafts are estimated using RS Means, which is an estimating method that uses unit costs compiled for completing similar construction activities. After finding the unit cost for a specific task, the unit cost is multiplied by the number of units (e.g., liner feet, cubic hours, hours of operation) for that activity.

2.2 Grading

The grading category includes placing stockpiled ore back into the mine, sealing the portals with development rock, ripping compacted area, and contouring the DRA and other areas to achieve slopes of 3H:1V or less (except for the portal seals, which will have slopes of 2H:1V or less). The tasks in the grading category require the use of a low-profile, 2-cy load-haul-dump (LHD) unit and a D-7 track dozer with rippers. The LHD will be used for placing the ore back into the mine as well as sealing the portal with backfilled development rock. The dozer will be utilized for grading and ripping the site in preparation for final soil placement.

The costs for these tasks are based on the quantity of material to be moved, the hourly productivity, and the hourly operating cost of the equipment selected. The design volumes for cut and fill, reclamation areas and facility footprints were generated using AutoCAD. Geometric calculations and typical stockpile sizes for the operation were estimated based on expected operation conditions. The hourly productivity is estimated based on the Cat Handbook, which estimates the productivity of various pieces of equipment for differing operating conditions. The hourly operating costs are based on the equipment hourly rental cost, hourly fuel and maintenance cost and the operator cost. The rental and fuel costs were obtained from Wheeler Equipment Co. Hourly rental costs from Wheeler Equipment Co. are summarized in the attached memo. The operator hourly rate was estimated from Energy Fuels internal fully burdened wage for senior equipment operators. This number was increased to account for taxes and profit.

2.3 Revegetation

The revegetation category includes placing an 18-inch cover of inert rock and soil over the DRAs and a 6-inch soil cover over the remaining disturbed areas followed by scarification (i.e., discing) and broadcast seeding. The costs for placing inert rock and topsoil are based on the quantity of material to be moved and hourly equipment costs in a similar manner as was done for grading. A 966 rubber-tire, front-end loader and D-7 track dozer are utilized for soil placement. The cost for seeding is based on a unit cost per area from RS Means multiplied by the quantity of area to be seeded.

3.0 Summary

Energy Fuels estimates the reclamation costs for the Daneros Mine are as follows:

- Demolition - $40,092
- Grading - $15,040
- Revegetation - $16,959
- Indirects - $19,804

Total $102,000

Daneros Bond Estimate Summary
Bonding Calculations

Direct Costs		
Subtotal Demolition and Removal	$40,092	
Subtotal Backfilling and Grading	$15,040	
Subtotal Revegetation	$26,959	
Subtotal Direct Costs	**$82,092**	
Indirect Costs		
Mob/Demob	$4,500	
Contingency	$4,105	5.0%
Engineering Redesign	$2,052	2.5%
Main Office Expense	$5,582	6.8%
Project Management Fee	$2,052	2.5%
Subtotal	**$18,291**	
Total Cost 2015	$100,384	
Escalation (0.5% every year for 5 years)	$2,535	
Reclamation Cost Escalated	$102,919	
Bond Amount (rounded to nearest $1,000)	$103,000	
Posted Bond	$81,120	
Difference Between Cost Estimate and Posted Bond	-$21,880.00	
Percent Difference	-27.0%	

Notes:
This bond estimate includes the disturbance at the Daneros Portal Area and 2 vents

Ref.	Description Daneros Portal Site	Means Costworks 2012 Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Quantity	Unit	Cost
Demo one 24" Culverts Under Portal Pad Area																		
	Remove Culvert	33.41.13.40.218	$6.20	LF	100											100	LF	$620.00
	Subtotal																	**$620.00**
Removal and Dismantle of Office																		
	Selective Demo, pre-engineered steel bldg	13 05 05 50 0550	$2.81	SF					400						SF	400	SF	$1,124.00
	Removal of debris to landfill in roll off container	Estimated	$1,000.00	EA												3	EA	$3,000.00
	Subtotal																	**$1,124.00**
Removal and Dismantle of Shop																		
	Selective Demo, pre-engineered steel bldg	13 05 05 50 0550	$2.81	SF					1500						SF	1500	SF	$4,215.00
	Subtotal																	**$4,215.00**
Removal of Storage Shed																		
	Selective Demo, pre-engineered steel bldg	13 05 05 50 0550	$2.81	SF					200						SF	200	SF	$562.00
	Subtotal																	**$562.00**
Removal of Concrete Slabs																		
	Demolish concrete slab of office	02 41 13 17 5300	$19.80	SY					45						SY	45	SY	**$891.00**
	Demolish concrete slab of shop	02 41 13 17 5300	$19.80	SY					167						SY	167	SY	**$3,306.60**
	Demolish concrete slab of storage shed	02 41 13 17 5300	$19.80	SY					23						SY	23	SY	**$455.40**
	Subtotal																	**$4,653.00**
Removal of Tanks																		
	Removal of 6,000 gal fuel tank	13 05 05 75 0530	$1,575	EA										2	EA	2	EA	**$3,150.00**
	Removal of 2,500 gal brine tank	13 05 05 75 0530	$1,575	EA										1	EA	1	EA	**$1,575.00**
	Removal of propane tank	13 05 05 75 0520	$730	EA										2	EA	1	EA	**$730.00**
	Subtotal																	**$5,455.00**
Water Well Abandonment																		
	Pull the pump	32.21.13.10.2050	$1,850	EA										2	EA	2	EA	**$3,700.00**
	Labor (20 hours)	Estimate	$72.00	HR												20	HR	**$1,440.00**
	Hole plug	UDOGM	$7	CF												439	CF	**$3,179.74**
	Subtotal																	**$8,319.74**
Abandon Vent Holes (2 Vents)																		
	Polyurethane foam plug	www.sprayez.com	$ 2,525.00	$/vent											EA	2	EA	**$5,050.00**
	Place 15' diameter 18" thick reinforced concrete cap	Estimate	$500.00	CY						20					CY	20	CY	**$10,000.00**
	Excavating, bulk bank measure, 3.5 CY, hydraulic excavator, crawler mounted	31 23 16 42 0305	$1.56	BCY						60					BCY	60	LCY	**$93.60**
	Subtotal																	**$15,143.60**
	Total																	**$40,092.34**

BCY - bank cubic yard
CY - cubic yard
HP - horsepower
LCY - loose cubic yard
MPH - miles per hour

PROJECT:	Daneros Mine Rec. Cost. Est.	COMPUTED BY :	RE	CHECKED BY:	AR
			12/2/2015	DATE CHECKED:	3/18/2014
CLIENT:	Energy Fuels			WRKSHT NO. :	DEMO-DPS

Description: Assumptions and calculations for demolition in support of the reclamation bond for the Daneros Mine - Daneros Portal Site.

Assumed Material Properties

Soil Bulking factor:	1.2	*Conversion from BCY to LCY*
Soil Compaction Factor:	1.1	*Conversion from BCY to ECY*
Soil Compaction Factor:	0.9	*Conversion from LCY to ECY*

BCY - bank cubic yard - in place volume prior to excavation
LCY - loose cubic yards - volume after excavation
ECY - embankment cubic yards (aka compacted cubic yards) - volume after compaction

Demo Culvert

Assumptions

- Assume culvert by office will be removed and not replaced
- Assume demolished inert material can be buried in development rock area
- Assume a trapezoidal volume for the excavation of the culverts
- Assume 3 culverts under county road will remain

Calculations

Number of culverts	1	EA	*Estimated from pdf drawing*
Estimated length of culvert	100	FT	*Estimated from pdf drawing*
Inside diameter of culvert	24	IN	
Cost per foot of removal $	6		*RS Means without material costs*
			33.41.13.40.218
Total feet of culvert to be removed	100		

Remove and Dismantle Office

Assumptions

- Assume building will be dismantled
- Assume 3 roll off Containers will be filled with material not allowed to be placed in the DRA.
- Assume each roll off costs $1000 to fill and haul to landfill in Blanding.

Calculations

Estimated Width of the building	10	FT	*Estimated from pdf drawing*
Estimated length of the building	40	FT	*Estimated from pdf drawing*
Estimated area of the building	**400**	SF	
	45	SY	

Remove and Dismantle Shop

Assumptions

- Assume building will be dismantled

Calculations

Estimated Width of the building	30	FT	*Estimated from pdf drawing*
Estimated length of the building	50	FT	*Estimated from pdf drawing*
Estimated area of the building	**1500**	SF	
	167	SY	

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			12/2/2015	DATE CHECKED:	3/18/2014
CLIENT:	Energy Fuels			WRKSHT NO. :	DEMO-DPS

Description: Assumptions and calculations for demolition in support of the reclamation bond for the Daneros Mine - Daneros Portal Site.

Remove and Dismantle Storage Shed

Assumptions

- Assume building will be dismantled

Calculations

Estimated Width of the building	10	FT	*Estimated from pdf drawing*
Estimated length of the building	20	FT	*Estimated from pdf drawing*
Estimated area of the building	**200**	SF	
	23	SY	

Removal of Above Ground Tanks

Assumptions

- Assume tanks will be removed

Calculations

Number of 6,000 gallon fuel tanks	**2**	EA	*Estimated from pdf drawing*
Number of 2,500 gallon brine tanks	**1**	EA	*Estimated from pdf drawing*
Number of propane tanks	**2**	EA	*Estimated from pdf drawing*

Water Well Abandonment

Assumptions

- Assume well will be abandoned by being filled with Hole Plug
- Pump will be removed prior to abandonment.

Calculations

Number of wells:	1	EA
Diameter of the well:	7	IN
Diameter of the well:	0.58	FT
Depth of the well:	1660	FT
Volume:	439	CF
Volume:	**17.0**	CY

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CLIENT:	Energy Fuels			WRKSHT NO. :	DEMO-DPS

Description: Assumptions and calculations for demolition in support of the reclamation bond for the Daneros Mine - Daneros Portal Site.

Vent Hole Abandonment

Assumptions

- Assume vent hole has a diameter of 7 feet and is 440 feet deep.
- Assume the vent is cased and does not require full backfill.
- See Figure 4-1 For Vent Closure Details.
- Assume concrete collar and backfill extends 4-feet from outside of vent hole.
- Assume soil backfill over concrete collar has a depth of 4 feet.

Calculations

Number of vent holes	2	EA	
Vent hole diameter	7	FT	
Vent hole depth	440	FT	
Polyurethane Foam Backfill Depth	14	FT	
Polyurethane Foam Backfill Volume	539	CF	
Material Cost	$ 2,050.00	$/1000 CF	
Install Labor Cost	$ 3,000.00	$/day	
Concrete collar thickness	18	IN	
	1.5	FT	
Concrete collar extent beyond vent hole	1	FT	
Concrete collar diameter	15	FT	
Concrete collar volume per vent hole	265	CF	
	10	CY	*Rounded up to nearest whole number.*
Reinforcement density	159	LBS/CY	
Reinforcement per vent hole	1590	LBS	
Backfill depth	4	FT	
Backfill diameter	15	FT	
Backfill volume per vent hole	707	CF	
	27	ECY	
	27	BCY	
	30	LCY	
Concrete	**20**	CY	
Reinforcement	**3180**	LBS	
Total backfill	**54**	ECY	
	54	BCY	
	60	LCY	

Backfilling and Grading Costs

Daneros Mine - Daneros Earth

Daneros Portal Site Description	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Labor Hourly Wage Rate	Hourly Cost	Total Eq. & Lab. Costs	Units	Material Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost**
Place Excess Ore into Portal																		
2 yd. LHD placing ore into underground workings	$76.00	$47.50	$136	N/A	$71.75	N/A	$0.00	$207.60	$/HR	$0.00	N/A	1,072	LCY	36	LCY/HR	N/A	N/A	$6,259.36
Subtotal																		**$6,259**
Seal Portals with Development Rock (10'x10'x30' deep)																		
2 yd. LHD	$76.00	$47.50	$136	N/A	$71.75	N/A	$0.00	$207.60	$/HR	$0.00	N/A	222	LCY	36	LCY/HR	N/A	N/A	$1,297.55
Subtotal																		**$1,298**
Grade Rock Pile																		
Dozing material (D-7), 100' push	$101.00	$47.50	$163	N/A	$71.75	N/A	$0.00	$235.10	$/HR	$0.00	N/A	3,960	LCY	435.75	LCY/HR	N/A	N/A	$2,136.54
Subtotal																		**$2,137**
Gamma Scan																		
Gamma Scan (2 days)						72						16	hr					$1,152
Subtotal																		**$1,152**
Grade Development Berm																		
Dozing material (D-7), 100' push	$101.00	$47.50	$163	N/A	$71.75	N/A	$0.00	$235.10	$/HR	$0.00	N/A	464	LCY	435.75	LCY/HR	N/A	N/A	$250.35
Subtotal																		**$250**
Subsurface Ripping																		
Subsurface Ripping (D-7)	$101.00	$47.50	$163	N/A	$71.75	N/A	$0.00	$235.10	$/HR	$0.00	N/A	4,195	LCY	250	LCY/HR	N/A	N/A	$3,944.67
Subtotal																		**$3,945**
Total																		**$15,040.47**

* Hourly rates include overhead and profit
N/A - information not available
LCY - loose cubic yard
HR - hour

LHD Rental Cost	76
LHD fuel cost per hour	12.5
Dozer (D-7) Rental Cost	101
Fuel Cost Per Hour	20
Maintenance Cost Per Hour	35
Operator Fully Burdened Hourly Rate	72

PROJECT:	Daneros Mine Rec. Cost. Est.	COMPUTED BY :	RE	CHECKED BY:	AR
JOB NO.:	0	DATE :	12/2/2015	DATE CHECKED:	3/18/2014
CLIENT:	Energy Fuels			WRKSHT NO. :	EARTH-DPS

Description: Earthwork calculations in support of the reclamation bond for the Daneros Portal Site

Assumed Material Properties for Development Rock Material

Soil Bulking factor:	1.2	*Conversion from BCY to LCY*
Soil Compaction Factor:	1.1	*Conversion from BCY to ECY*
Soil Compaction Factor:	0.9	*Conversion from LCY to ECY*

BCY - bank cubic yard - in place volume prior to excavation
LCY - loose cubic yards - volume after excavation
ECY - embankment cubic yards (aka compacted cubic yards) - volume after compaction

Place Excess Ore Back Into Portal

Assumptions

- Assume 300 tons per day generated at site.
- Assume ore is stockpiled for 5 days.
- Assume density of ore is 1.4 tons/cy.

Calculations

Ore Generated Per Day	300	tons	*Energy fuels Operations Data*
Number of Days Stockpiled	5	days	*Energy fuels Operations Data*
Total Quantity of Ore Stockpiled on Site	1500	tons	
Assumed Density of Ore	1.4	tons/CY	*pg 27-4 CAT Handbook, Edition 36*
Total Volume of Ore Placed Back into Portal	**1,072**	**CY**	

Seal Portals with Development Rock

Assumptions

- Assume portal adit is 10 feet high by 10 feet wide.
- Assume seal will extend 30 feet into the portal adit.
- Assume outside seal will be sloped at 2H:1V
- There are 2 Portals at the Daneros Mine

Calculations

Portal Height	10	FT	
Portal Width	10	FT	
Depth of Seal into Portal	30	FT	*Reclamation Plan*
Volume of Develop Rock to Seal Inner Portion	3000	CF	
	112	**CY**	
Slope of Outer Seal	2	:1	*Reclamation Plan*
2H:1V Outer Seal Slope Length	20	FT	
Front Slope Seal Volume	1000	CF	*Triangular Wedge*
Side Slope Seal Volume	1000	CF	*Half Triangular Wedge by 2 sides*
Volume of Develop Rock to Seal Outer Portion	2000	CF	
	75	**CY**	
Total Volume of Development Rock to Seal Portal	**187**	**CY**	

PROJECT:	Daneros Mine Rec. Cost. Est.	COMPUTED BY :	RE	CHECKED BY:	AR
JOB NO.:	0	DATE :	12/2/2015	DATE CHECKED:	3/18/2014
CLIENT:	Energy Fuels			WRKSHT NO. :	EARTH-DPS

Description: Earthwork calculations in support of the reclamation bond for the Daneros Portal Site

Grade Development Rock Pile

Assumptions

- Material will be pushed with a dozer to rough grade
- No fine grading of surface will be conducted

Calculations

Reclamation re-grade volume	3,300	BCY	*Based on CADD volume determination*
Reclamation re-grade volume	3,960	LCY	*Rounded up to nearest whole number*

Gamma Scan

Assumptions

- Perform gamma scan on 50 ft center grid
- Place elevated gamma count material back in the mine
- Each crew member has a cost of $72/hr
- 8-hour work day
- 2 days to complete survey

Grade Mine Yard Perimeter Berms

Assumptions

- Material will be pushed with a dozer to rough grade
- No fine grading of surface will be conducted

Shape:	Triangular		
Side slopes:	1	:1	
Finished Channel Height:	2	FT	
Bottom width:	4	FT	
Estimated length of berms	1300	FT	
Volume of excavation:	10400	CF	
	386	**BCY**	*Rounded up to nearest whole number*
	464	LCY	*Rounded up to nearest whole number*

Subsurface Ripping

Assumptions

- The entire mine yard will be ripped to a depth of 12" to encourage vegetation root development
- Approximately 20% of the Development Rock Area will be ripped as it will have just recently been graded.

Mine Yard Area	2.00	AC	
20% of DRA Area	0.60	AC	
Ripping Depth	12	inches	
Ripping Volume	4,195	BCY	
D-7 Ripping Productivity	250	BCY/Hr	*No chart in Cat handbook for D-7. Used lowest value for D-8*

Daneros Portal Site Description	Hourly Rental Costs	Hourly O & M Costs	Operator Hourly Cost	Total Eq. & Lab. Costs	Units	Material Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Remove Stockpiled Inert Material and Spread														
966 Removing and Staging Inert Material	$76	$48	$72	$195	$/HR	$0.00	N/A	3,227	LCY	119	LCY/HR	N/A	N/A	$5,316
D-7 Dozer Spreading Inert Material	$101	$55	$72	$228	$/HR	$0.00	N/A	3,227	LCY	435.75	LCY/HR	N/A	N/A	$1,686
Subtotal														**$7,002**
Remove Stockpiled Topsoil and Spread														
966 Removing and Staging Topsoil	$76	$48	$72	$195	$/HR	$0.00	N/A	4,275	LCY	119	LCY/HR	N/A	N/A	$7,044
D-7 Dozer Spreading Topsoil	$101	$55	$72	$228	$/HR	$0.00	N/A	4,275	LCY	435.75	LCY/HR	N/A	N/A	$2,235
Subtotal														**$9,278**
Seeding														
Seeding, 0.45 pounds per MSF, tractor spreader	RS Means	32 92 19 14 0500				$29.50	$/MSF	362	MSF			N/A	N/A	$10,679
Subtotal														**$10,679**
Total														**$26,959**

* Hourly rates include overhead and profit
N/A - information not available
LCY - loose cubic yard
HR - hour

Loader Rental Cost	$	76
Loader fuel cost per hour	$	13
Dozer (D-7) Rental Cost	$	101
Fuel Cost Per Hour	$	20
Maintenance Cost Per Hour	$	35
Operator Fully Burdened Hourly Rate	$	72

PROJECT:	Daneros Mine Rec. Cost. Est.	COMPUTED BY :	RE	CHECKED BY:	AR
JOB NO.:	0	DATE :	12/2/2015	DATE CHECKED:	3/18/2014
CLIENT:	Energy Fuels			WRKSHT NO. :	REVEG-DPS

Description: Calculations in support of the reclamation bond for the Daneros Mine - Daneros Portal Site.

Assumed Material Properties

Soil Bulking factor:	1.2	*Conversion from BCY to LCY*
Soil Compaction Factor:	1.1	*Conversion from BCY to ECY*
Soil Compaction Factor:	0.9	*Conversion from LCY to ECY*

BCY - bank cubic yard - in place volume prior to excavation
LCY - loose cubic yards - volume after excavation
ECY - embankment cubic yards (aka compacted cubic yards) - volume after compaction

Remove Stockpiled Inert Material and Spread

Assumptions

- Material will be moved and staged with a wheeled loader
- Material will be spread with a dozer to rough grade over the DRA.
- The same productivity assumptions apply for the inert material as for the topsoil.

Calculations

Estimated area of development rock area	2	AC	
Assume 12 inch thickness spread	1.0	FT	*Assumption*
Volume	87,120	BCF	
Volume	3,227	BCY	

Remove Stockpiled Topsoil and Spread

Assumptions

- Material will be moved and staged with a wheeled loader
- Material will be spread with a dozer to rough grade.
- Assumed distribution of topsoil windrow along roads will be spread while ripping.

Calculations - Assumes 12" of topsoil over DRA and ~ 6" over remainder of Mine Yard

Soil stockpile volume	3,563	BCY	
Haul and spreading volume	*4,275*	LCY	

Seed

Assumptions

- Assumes surface of topsoil layer will be scarified during seeding
- Assumes broadcast with native seed will be applied over topsoil
- Assumes vent shaft disturbance is 0.25 acres each.
- Assumes access road disturbed areas for each vent shaft is approximately 1.25 acres.

Calculations

Estimated disturbed area of vents	0.5		
Estimated disturbed area of access roads	2.5		
Daneros Portal Area Disturbance	5.3	AC	
	40,172	SY	*Rounded up to nearest whole number*
	362	MSF	*Rounded up to nearest whole number*

Energy Fuels Resources (USA) Inc.
225 Union Blvd. Suite 600
Lakewood, CO, US, 80228
303 974 2140
www.energyfuels.com

MEMORANDUM

To: File cc:

From: Ryan Ellis

Date: 11/20/15

RE: Daneros Mine Reclamation Cost Estimate
Equipment Rental Costs

I obtained the current rental rates for the major equipment planned to be used for final reclamation of the Daneros Mine from the Wheeler Machinery Co. out of Salt Lake City (801-974-0511). Wheeler Equipment no longer publishes the rental costs for the D-7 Dozer. To obtain a rental cost, I used the John Deere 950K which has a similar horsepower and operating weight for a comparable rental cost. The equipment will be rented on a monthly basis and will be returned individually as the reclamation is completed and not as a group. For example, the haul trucks will only be used for a short period of time in comparison to the D-7 dozer, which will be on site for the duration of reclamation activities. Fuel consumption was also obtained from Wheeler for each piece of equipment but is not included in the rental cost because it is included in the operating cost. The rental and operating cost is assumed to be the same for the 2 CY LHD as for the 966 Loader.

D-7 Dozer or John Deere 950K

Monthly Rental Base Cost:	$	14,700
Required 15% Insurance:	$	2,205
Total Monthly Rental Cost:	$	16,905
Conversion to Hourly Rental Cost		
Work Days Per Month		21
Operation hours per day		8
Hourly Rental Cost	$	101

Hourly Fuel Cost @ 2.50 per gallon = $20

966 Loader

Monthly Rental Base Cost:	$	11,100
Required 15% Insurance:	$	1,665
Total Monthly Rental Cost:	$	12,765
Conversion to Hourly Rental Cost		
Work Days Per Month		21
Operation hours per day		8
Hourly Rental Cost	$	76

Hourly Fuel Cost @ 2.50 per gallon = $12.50

12 Yard Haul Truck

Monthly Rental Base Cost:	$	6,000
Conversion to Hourly Rental Cost		
Work Days Per Month		21
Operation hours per day		8
Hourly Rental Cost	$	36

Hourly Fuel Cost @ 2.50 per gallon = $15

Equipment will require 250-hour maintenance service as the reclamation is completed. These maintenance costs are not included in the rental cost, but are added separately. The costs and quantity of maintenance will vary depending on the piece of equipment and the hours operated.

Wheel Loader (966) Productivity Determination -400' haul			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Average Distance, FT:		**400**	
Operator Correction Factor	Factor	0.75	
Bucket Capacity (C.Y)		5.00	
Cycle Time (min)		1.58	
Ideal Loader Productivity	LCY/HR	**190.4**	
Adjusted Loader Productivity	LCY/HR	118.5	

Wheel Loader (966) Productivity Determination -1,000' haul			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Average Distance, FT:		**1,000**	
Operator Correction Factor	Factor	0.75	
Bucket Capacity (C.Y)		5.00	
Cycle Time (min)		2.94	
Ideal Loader Productivity	LCY/HR	**102.1**	
Adjusted Loader Productivity	LCY/HR	63.5	

LHD Productivity Determination -400' haul			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Average Distance, FT:		**400**	
Operator Ability Correction Factor	Factor	0.75	
Bucket Capacity (C.Y)		1.50	
Cycle Time (min)		1.58	
Ideal Loader Productivity	LCY/HR	**57.1**	
Adjusted Loader Productivity	LCY/HR	35.6	

Dozer (D-7) Productivity Determination - 100' Push Distance			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Average Dozing Distance, FT:		**100**	
Work Efficiency	%	83%	
Operator Ability Correction Factor	Factor	0.75	
Ideal Dozer Productivity	LCY/HR	**700**	*CAT Handbook*
Adjusted Dozer Productivity	LCY/HR	435.8	

Dozer (D-7) Productivity Determination - 200' Push Distance			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Average Dozing Distance, FT:		**200**	
Work Efficiency	%	83%	
Operator Correction Factor	Factor	0.75	
Ideal Dozer Productivity	LCY/HR	**400**	*CAT Handbook*
Adjusted Dozer Productivity	LCY/HR	249.0	

Dozer (D-7) Ripping Productivity Determination			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Ripping Depth (FT)		**1**	
Work Efficiency	%	83%	
Operator Correction Factor	Factor	0.75	*The Cat Handbook does not provide a chart for a D-7. Used lowest value for D-8*
Ideal Ripping Productivity	LCY/HR	**250.0**	
Adjusted Ripping Productivity	LCY/HR	155.6	

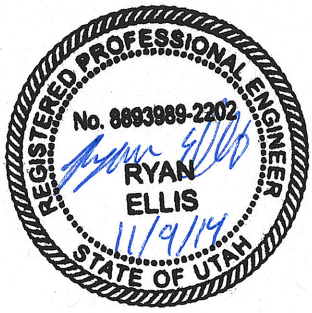
12 CY Highway Dump Truck Productivity Determination			
Hours per Shift, HR:		**8**	
Work Efficiency, %:		**0.83**	Assumes 50 minutes/hour
Truck Capacity (CY)		**12**	
Work Efficiency	%	83%	
Operator Type		Average	
Operator Correction Factor	Factor	0.75	
Average Haul Distance	Feet	26,400	
Ideal Hauling Productivity	LCY/HR	**36.0**	*Assumes 2 trips per hour*
Adjusted Hauling Productivity	LCY/HR	22.4	

Energy Fuels Resources (USA) Inc.
225 Union Blvd. Suite 600
Lakewood, CO, US, 80228
303 974 2140
www.energyfuels.com

MEMORANDUM

To: File

cc: Andrea Reither



From: Ryan Ellis, P.E.

Date: 11/9/14

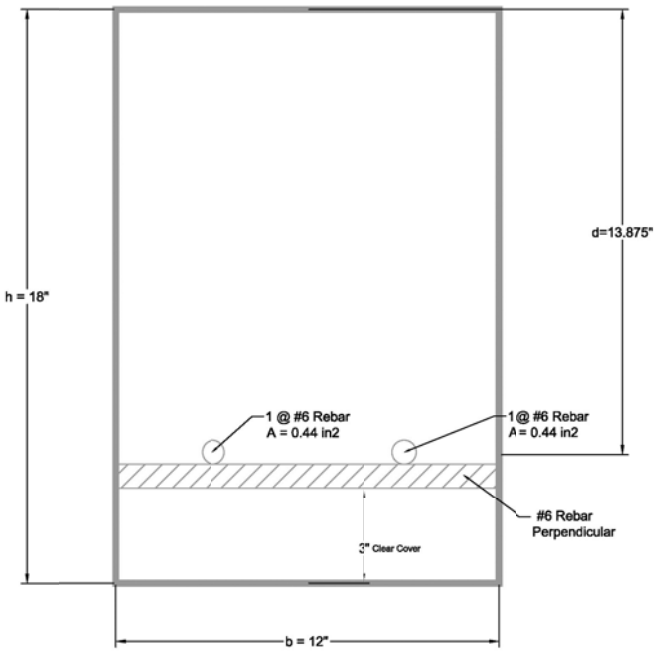
RE: Daneros Mine Reclamation Cost Estimate
Shaft Seal Design

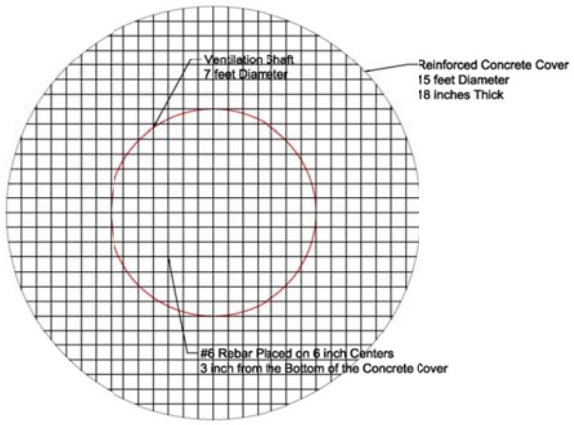
This shaft seal design establishes a general reinforced concrete cap to be placed over the ventilation shafts at the Daneros Mine. The design will be used to estimate the costs to construct the seals during reclamation of the mine. The site information assumptions used in the design are as follows:

- Shaft Diameter 7 feet
- Design Load of 700 lbs per ft^2.
- The shaft casing will be removed to the base of the concrete cap.
- The shaft casing will have polyurethane foam place to the base of the concrete cap and will be used as the bottom form for the concrete.

The general design of the shaft cover will be to analyze a 1 foot wide strip of the cover (as a simple rectangular beam) which represents the center section of the cover with the largest clear span. The section will receive the greatest load and stresses and will be extrapolated as the design cover for the remainder of the cover for simplicity. This represents a conservative design by assuming all portions of the cover will see the maximum stress of the center section. A factor of safety will be analyzed by relating the nominal moment capacity of the beam to the expected moment produced by the load. As shown below, assuming a 7 feet diameter shaft and an 18 inch thick concrete pad with # 6 rebar placed on 6 inch centers covered with 4 feet of soil results in a factor of safety of 12. The design load of 700 lbs per ft^2 is recommended for permanent concrete shaft caps in the BLM's Solid Material Reclamation Handbook, H-3042-1.

Nominal Moment Capacity Calculation





d=13.875"
b=12"
H=18"
f'_c=4,000psi
f_s=60,000psi = 60 ksi
A_s=2 x 0.44in^2 =0.88in^2
a = depth of Whitney stress block
Compression =Tension
C=0.85 x f'_c x b x a
C=0.85 x 4000psi x 12" x a
C=40,800 lb/in x a

T=f_s x A_s
T=60,000psi x 0.88in^2 = 52,800lb
52,800lb / 40,800lb/in = a =1.29in

B_1 = 0.85
c=depth to neutral axis
c=a/b_1
c=1.29/0.85 = 1.52in

E_c= 0.003
$Strain_s$ = ((d x 0.003) / c) - 0.003
$Strain_s$ = ((13.875" x 0.003)/ 1.52)-0.003
$Strain_s$ = 0.0244

Tension Controlled Check
E=29,000ksi
E_{ys} = 60ksi/29,000ksi=.00207
0.00207<0.0244 (OK, Tension Control)

Minimum Steel Requirements
$A_{s\ Min}$= 200/f_s x b x d
$A_{s\ Min}$=200/60,000 x 12" x 13.875"
$A_{s\ Min}$= 0.555in^2 <0.88in^2
Minimum Steel OK

Nominal Moment Capacity
M = 0.9 x T x (d-a/2)
M = 0.9 x 0.88in2 x 60ksi x (13.875in-1.29in/2)
629Kips*in (629Kips*in x 1ft/12in = **52 Kips*ft**)

Expected Moment
M = (wL^2)/8
W=0.7kips/ft^2
L=7ft
M=0.7*7^2/8 = 4.3 Kips*ft

Safety Factor
52 kips*ft/4.3Kips*ft = **12.1 FOS**

Definition of Variables

d	Depth to center of rebar
b	Width of beam
H	Height of beam
f'_c	Concrete compressive strength
f_s	Steel yield stress
A_s	Area of the steel rebar
a	Depth of Whitney Stress Block
C	Compression
T	Tension
B_1	A factor that relates the depth of the Whitney Stress Block to the depth of the neutral axis. B1=0.85 for concrete with an f'_c less or equal to than 4,000.
c	Depth to neutral axis
$Strain_s$	Strain in the steel rebar
E	Young's Modulus
E_{ys}	Steel yield strain
E_c	Strain in Concrete
$A_{s\ Min}$	Minimum area of steel rebar
M	Moment
W	Load (BLM Recommended 700lb/ft^2 or 0.7 kips/ft^2)
L	Beam Length
FOS	Factor of Safety

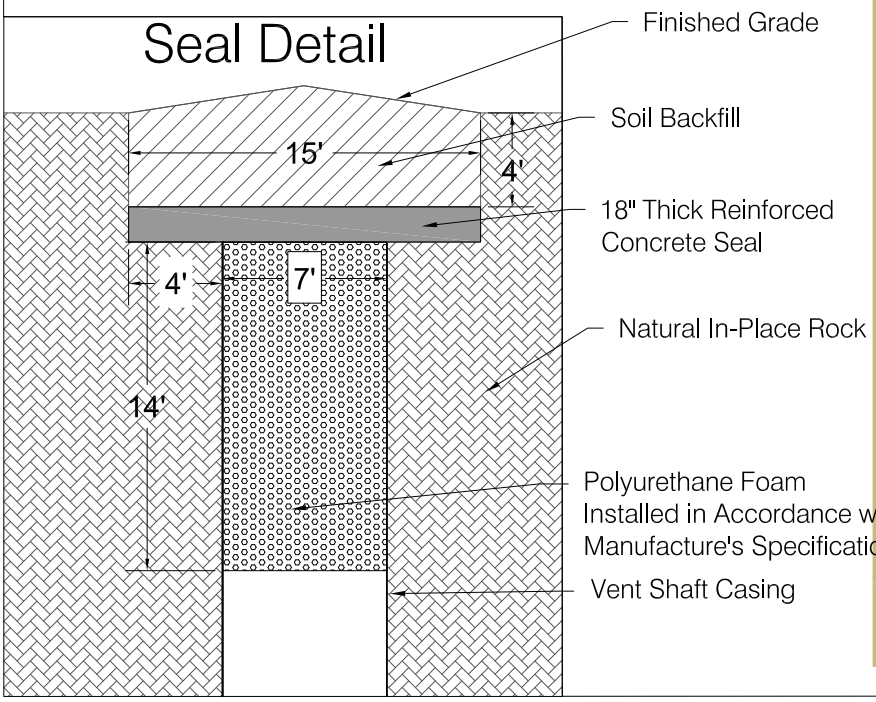
Definition of Units

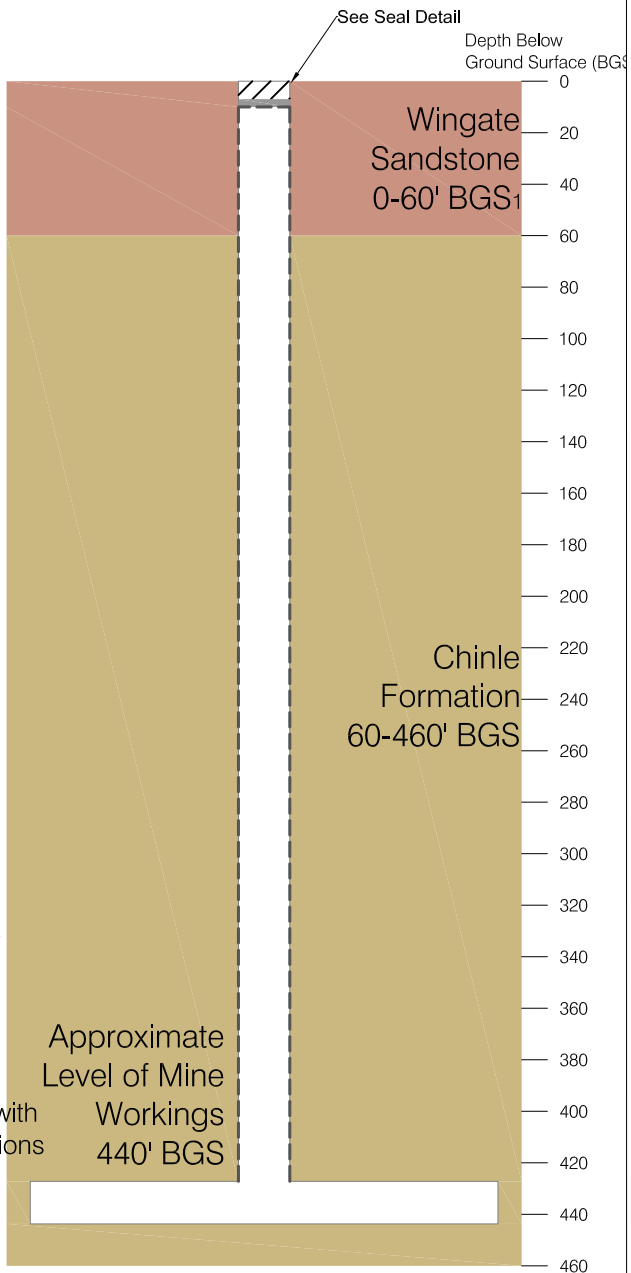
"	Inches
psi	Pounds per square inch
ksi	Thousand pounds per square inch
in^2	Square inch
in	inch
ft	feet
kips	Thousand pounds
ft^2	Square feet
ft3	Cubic feet

s:\source\usa\ut\daneros\maps\vent closure design\vent closure design.dwg cased vents 4-1 rellis

Notes:

1. The Wingate Sanstone varies between 0 feet and greater than 1000 feet thick in the area of the Daneros Mine.
2. The 2 existing vents are 7 feet in diameter and are cased. Future vents are expected to be 7 feet in diameter and cased. All Vents will be cased for the top 20-feet.
3. The concrete foundation for the vent fan shroud will be broken and placed within the vent shaft.
4. The vent casing will be removed to 5.5-feet below ground surface.
5. Approximately 3-inches of surface soil around the vent will be placed within the vent.
6. A bottom form will be placed to hold the initial polyurethane foam. Alternatively, the first lift of foam can be sprayed directly onto the steel casing and allowed to cure creating a stable bottom form for later lifts of foam.
7. Polyurethane foam will be placed and will extend to the top of the remaining steel casing and be a minimum of twice the diameter of the vent in thickness. For a 7-feet diameter shaft, the foam will be a minimum of 14-feet thick.
8. The 18-inch thick reinforced concrete cap will be placed on top of the foam and 4-feet below the ground surface. This cap will extend 4-feet beyond the diameter of the vent shaft.
9. The surface area above the concrete cap will be backfilled with soil and graded to drain away from the vent shaft.





Reinforced Concrete Cap

Vent Casing

Soil Cover

Energy Fuels Resources (USA) Inc.

REVISIONS	
Date	By
10/22/14	RE

Project: Daneros Mine

County: San Juan State: Utah

Location:

Figure 4-1
Vent Closure Design
Cased Vent Shafts

Author: RJE Date: 10/24/14 Drafted By: