

40-8905



# Rio Algom

Quivira Mining Company  
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New Mexico 87020

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June 18, 2001

Mr. Kevin Myers  
Groundwater Section  
New Mexico Environment Department  
P.O. Box 26110  
Santa Fe, NM 87502

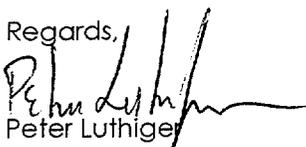
Re: **Discharge Plan - 169**  
**Response to NMED February 1, 2001 Letter**

Dear Mr. Myers,

Please find attached Quivira Mining Company's responses to NMED's February 1, 2001 letter requesting additional information regarding closure plan issues associated with the above referenced permit.

Submittal of this information does not prejudice Quivira's contention that NMED has no jurisdiction over activities associated with discharge permit DP-169 as a result of the federal Nuclear Regulatory Commission having primacy over all aspects of 11e.(2) byproduct material.

If you have any questions or need additional information, please call me at 287-8851, extension 205.

Regards,  
  
Peter Luthiger  
Supervisor, Radiation Safety  
and Environmental Affairs

Attachment: As stated

xc: P. Goranson  
NRC (MD) License SUA-1473, Docket 40-8905  
NRC (TX) ) License SUA-1473, Docket 40-8905  
file

NMSSo1Public

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*Quivira Mining Company*

Discharge Permit – DP-169

Response to  
NMED Comments

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June 18, 2001

Discharge Permit DP-169  
Closure Plan

The following information is provided by Quivira in response to NMED's February 1, 2001 letter requesting additional information regarding closure plan activities associated with DP-169.

Submittal of this information does not prejudice Quivira's contention that NMED has no jurisdiction over activities associated with discharge permit DP-169 as a result of the federal Nuclear Regulatory Commission having primacy over all aspects of 11e.(2) byproduct material.

NMED Request #1

The closure plan for Pond 9 should consider the alternative of moving sediments to immediately west of tailings ponds, rather than disposal of sediments in the interceptor trench and directly in contact with the alluvial aquifer.

Quivira Response

Quivira believes that the proposed closure plan for the lined evaporation cell Pond 9 will result in an acceptable and appropriate closure that will be protective of employees, the public and the environment. NMED's proposal to relocate the pond sediments to west of the tailings ponds should also result in an acceptable closure process; but the additional costs and risks introduced under that option do not justify its selection.

Pond 9 is currently utilized for collection and evaporation of various 11e.(2) byproduct waste streams generated at the mill including the collection of alluvial groundwater associated with the corrective action program implemented at the site. The purpose of the groundwater cleanup plan for the alluvium is to flush the alluvium in order to collect the byproduct material that has seeped from the impoundment. Figure 1 depicts Pond 9, the interceptor trench, and Pond 2.

The approved remedial action plan for the alluvium was designed to control further tailings solution seepage from entering the alluvium from the tailings impoundments. The interceptor trench has been effective as a collection and pump back system that has created a reversed hydrologic gradient within the alluvium due to the dewatering action along the trench, causing solutions east of the trench to flow back towards it where they are collected and pumped to lined evaporation ponds for disposal. This reversed gradient is enhanced through the use of the fresh water channel, located east of the trench, by providing a recharge head that flows toward the trench.

The primary source of water entering Pond 9 is from the continued operation of the intercept trench. Operation of the trench and Pond 9 is anticipated to continue as long as the ground water sweep is required.

The water in the alluvium is present as a result of the continued operation of the groundwater sweep used for alluvial remediation activities. Groundwater modeling performed to evaluate the alluvial system indicates that the alluvium will rapidly dry up upon cessation of operation of the fresh water course. This dewatering will result in essentially drying out the alluvium near the facility. Based on the model predictions, the trench is not expected to be in contact with any ground water as the alluvium will drain quite rapidly once the recharge source provided by the fresh water channel is discontinued.

Placement of Pond 9 sediments into the trench should not result in having the materials in contact with any water as the disposal location is expected to be in a dry environment due to elimination of the recharge source and draining and drying out of the alluvium. Quivira plans on placing the material into the trench in 3 to 5 foot layers with stabilization/compaction performed to minimize voids within each layer. Following placement and stabilization of the pond sediments, a compacted layer of low permeability material will be placed to minimize infiltration of precipitation moisture. Closure of former evaporation pond #3, located immediately west of the trench, will result in the majority of the trench area being included within the footprint of the final outslope of pond 3.

### **Closure Plan Costs**

Cost estimates for Quivira's proposed closure plan for Pond 9 are approximately \$480,000. This cost includes closure of Pond 9, the intercept trench, and plugging the 43 alluvial monitoring wells associated with the discharge permit (Appendix 1).

Cost estimates for NMED's proposal to relocate Pond 9 sediments to Pond 2, placing a cover on the sediments, backfilling the intercept trench, and plugging the 43 alluvial monitoring wells associated with the discharge permit results in a closure cost of \$880,000 (Appendix 2).

NMED's proposal results in a closure cost that is almost 2 times the cost under Quivira's proposed closure plan.

### **Risks to Employees/Contractors**

An additional factor to support Quivira's proposed closure plan is that less material will have to be moved, which will reduce the potential for an accident to occur. Material quantities to be moved are shown in Table 1. The additional

material required under NMED's proposal results from the backfilling of the intercept trench.

Table 1

Soil/Sediment Movement Quantities

Plan	Quantity To Be Moved (yd <sup>3</sup> )
Quivira	307,000
NMED	440,000

NMED's proposal will also require placement of an erosion protection layer (approximately 12,000 yd<sup>3</sup>) on the relocated sediments following completion of the radon barrier upon the relocated sediments on pond 2. This task results in introducing additional risks to employees as well as contract workers who will be required to perform the rock placement necessary under the NMED plan.

**Impact to Public and Environment**

The location of Pond 9 and the proposed disposal locations result in minimal risks to the public and environment. However, an exposure potential does exist under the scenarios, primarily through wind dispersion of material. This potential impact is minimized under Quivira's proposed plan when compared to NMED's proposal. Longer travel routes increase the potential for dispersion of material due to travel speeds, drying of the material, and spillage and resuspension of the material due to vehicle traffic on the haul route.

Additional protections from material dispersion are afforded by Quivira's proposed plan as a result of disposing the material below grade, which will reduce the potential for weather conditions to disperse the material during closure activities.

**Summary**

Quivira contends that it is more feasible to relocate the 11e.(2) byproduct material from Pond 9 to the intercept trench because: 1) Risks to employee and contractor health and safety are minimized; and 2) Relocation is economically feasible compared to the NMED option.

## NMED Request #2

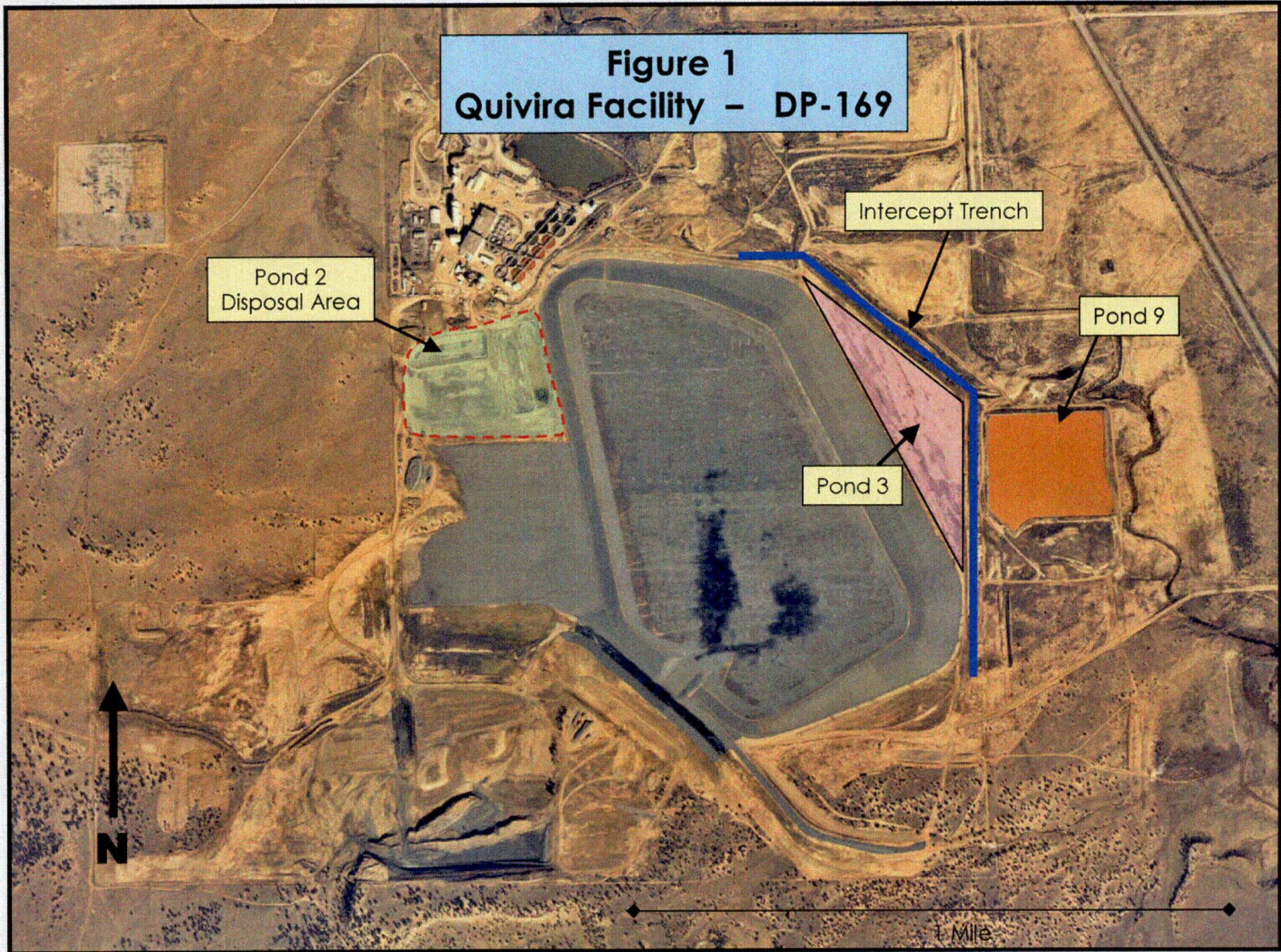
Please submit a schedule with proposed dates for implementation of the closure plan for Pond 9, interceptor trench and the shallow ground water remediation system.

## Quivira Response #2

Quivira intends to initiate Quivira's proposed closure plan upon cessation of operations that require use of the pond. The pond is utilized, in part, for evaporation of ground water containing 11e.(2) byproduct material recovered from the alluvium as part of the NRC approved corrective action plan. Until ground water remediation activities cease, the pond will remain in service.

Under Quivira's proposed plan, pond 9 will be closed by disposing of the dried sediments into the intercept trench, beginning from the southern end of the trench. The remaining capacity of the trench will be backfilled with an appropriate radon barrier and additional soil for revegetation efforts. The former Pond 9 area will also be revegetated. The monitoring wells associated with the discharge permit will be plugged with grout to just below the final surface grade and the hole will be backfilled with native soils and revegetated. The fresh water recharge channel may either be backfilled or realigned for use as a diversion channel.

**Figure 1**  
**Quivira Facility – DP-169**



CO1

APPENDIX 1

COST ESTIMATE  
QUIVIRA PLAN

**Primary Steps to Complete Reclamation**

	Cost
1 - Dry out sediments in preparation for transport	\$8,733
2 - Load and haul sediments to trench edge	\$130,855
3 - Doze sediments into trench	\$97,205
4 - Compact sediments in trench	\$97,205
5 - Place radon barrier over compacted sediments	\$9,473
6 - Compact cover to specifications	\$24,444
7 - remove berms at pond 9 to pond 3	<b>\$74,100</b>
8 - Recontour and topsoil placement at Pond 9 area and tre	\$20,130
9 - Revegetate Pond 9 and trench area	\$14,798
10 - Plug wells	\$3,118
Total reclamation cost for Pond 9	<u>\$480,061</u>

mound up material		Employee Hourly rate	Equipment Hourly rate	workday	Daily Operating Cost
Crew	Task	Hourly ratew/ benefits (\$)	Hourly rate (\$)	(hours)	(\$)
2	Loader	18.00	23.40	8	534
1	Dozer	18.00	23.40	8	587
0.5	supervisor	27.00	35.10	4	70
0.5	maintenance mechanic	18.00	23.40	2	23
daily operating cost					\$1,215
number of days to complete					7
total cost					<b>\$8,733</b>

**Relocate Sediemnts from Pond 9 to trench**

Daily Operating Cost - QMC proposal		Employee Hourly rate	Equipment Hourly rate	Time	Daily Operating Cost
Crew	Task	Hourly ratew/ benefits (\$)	Hourly rate (\$)	(hr)	(\$)
3	end dump trucks	18.00	23.40	8	1041.60
1	Loader operators to load trucks	18.00	23.40	8	587.20
0.5	water wagon for dust control	18.00	23.40	2	63.40
0.5	grader for road maintenance	18.00	23.40	2	38.40
1	supervisor	27.00	35.10	8	280.80
1	maintenance mechanic	20.00	26.00	4	104.00
<b>\$2,115</b>					

Time to relocate material from Pond 9 to trench

**Cycle time per load**

0.3	travel distance (miles)
4.8	load time
1	travel time to dump (min)
2	dump time (min)
1	travel to fill point (min)
10	minutes per load

**Loads per Day**

420	minutes per workday (7 hr day work - 1 hr warm up cool down)
42	loads per day per truck
3	number of trucks running
126	number of loads per day

**Time to complete task**

106000	quantity of material to be moved (yd3)
16	truck capacity (yd3)
0.85	fill factor
13.6	quantity per load (yd3)
7794	number of loads to move material
62	number of work days to move material

**Cost to move material from Pond 9 to trench**

62	number of work days to move material
\$2,115	cost per day
<b>\$130,855 total cost</b>	

dozing material into trench

		Employee Hourly rate	Equipment Hourly rate	Time	Daily Operating Cost
		Hourly rate w/ benefits (\$)	Hourly rate (\$)	(hours)	(\$)
Crew					
1	dozer	18.00	23.40	50.00	8
					587

doze material into trench

**\$587 daily cost**

**8 days required to move material**

**\$4,446 total cost**

waste material compaction

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)	
1	grader	18.00	23.40	15.00	4	154
1	dozer	18.00	23.40	50.00	4	294
2	compactors	18.00	23.40	10.00	8	534
1	supervisor	27.00	35.10		8	281
						\$1,262
				number of days to complete		77
				total cost		\$97,205

Place and grade topsoil on Pond 9 Area and trench area

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)	
3	scraper	18.00	23.40	50.00	8	1762
1	grader	18.00	23.40	15.00	8	307
1	supervisor	27.00	35.10		2	70
						\$2,139
					number of days	9
Place and grade topsoil on Pond 9 Area						\$20,130

Revegetation of Area

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	workday (hours)	Daily Operating Cost (\$)	
1	seeder	18.00	23.40	10.00	8	267
1	mulcher	18.00	23.40	10.00	8	267
1	crimper	18.00	23.40	10.00	8	267
1	supervisor	27.00	35.10		4	140
						\$942
					number of days to complete	2
					seed/mulch/fertilizer cost	\$12,600
					total cost	\$14,798

input parameters for cost calculations

mounding material

loader -mounding material

5 bucket capacity (yd3)  
0.85 bucket fill factor  
0.25 load time (min)  
0.25 haul time (min)  
0.2 return time (min)  
50 work hour (min/hr)  
304 quantity moved per hour  
2125 quantity moved per work day (7 hr)

dozer

2550 soil weight correction (lb/cy)  
2000 normal production (cy/hr)  
50 work hour  
0.75 operator  
1500 quantity moved per hour  
10500 quantity moved per work day (7 hr)  
  
14750 daily material movements during mounding  
106000 material requiring to be mounded  
7 number of work days to complete

**input parameters for cost calculations**

loading and hauling

1520	maximum haul distance (feet)
16	truck capacity (cy)
0.85	fill factor
13.6	quantity per load (cy)
5	loader bucket quantity
0.85	bucket fill factor
3.2	number of buckets to fill truck
1.5	cycle time per bucket load (min)
4.8	load time (min)
1	Haul time @ 25 mph (min)
2	Dump time (min)
1	Return time @ 30 mph (min)
<hr/>	
10	Time to load haul and dump 1 load
6	Number of loads per hour per truck
82	Quantity moved per hour per truck
571	Quantity moved per truck per day (7 hr)
1714	Quantity moved per day (3 trucks)
106000	material requiring to be moved
62	number of work days to complete

**dozing material**

- 2000 rate of material moved - flat ground (cy/hr)
- 14000 material moved each day (7 hr day)
- 106000 amount of material to be moved (cy)
- 8 days required to move material

compaction of material dozed into trench will not be to any specification.  
 compaction will be performed every 3 to 5 feet of fill pushed into trench  
 and will be done by dozer and/or 815 compactors

compaction rate

assumed every 3 feet of fill in trench will receive compaction

trench volume

2000	length of northern section (feet)
25	avg depth of northern end of trench (ft)
450	length of wide portion in northern section
100	avg width at surface in wide section of north half
60	avg width at base of wide section
1550	length of narrow section of northern section
65	avg width at surface in narrow section of north half
15	avg width at base of narrow section
<b>57407</b>	<b>volume of northern end of trench in narrow section(cy)</b>
<b>32292</b>	<b>volume of northern end of trench in wide section(cy)</b>
<b>89699</b>	<b>volume of northern end of trench (cy)</b>
2000	length of southern section (feet)
15	avg depth of southern end of trench (ft)
45	width of southern section in shallow area (top of trench)
10	width of southern section in shallow area (base of trench)
25	avg depth of 450' section at north end of southern section (close to pumps)
75	width of southern section in deep area (from top of trench)
15	width of southern section in deep area (base of trench)
<b>18750</b>	<b>volume of wide section of trench on southern sector (cy)</b>
<b>23681</b>	<b>volume of narrow section of trench in south sector(cy)</b>
<b>42431</b>	<b>volume of southern end of trench (cy)</b>
<b>132130</b>	<b>trench volume (cy)</b>
106000	quantity of material to be placed in trench
5583	quantity of material in 1st 3 foot lift (north sector)
1333	quantity of material added to each successive lift
6917	quantity of material in 2nd 3 foot lift (north sector)
8250	quantity of material in 3rd 3 foot lift (north sector)
9583	quantity of material in 4th 3 foot lift (north sector)
10917	quantity of material in 5th 3 foot lift (north sector)
12250	quantity of material in 6th 3 foot lift (north sector)
13583	quantity of material in 7th 3 foot lift (north sector)
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2472	quantity of material in 1st 3 foot lift (south sector)
1333	quantity of material added to each successive lift
3806	quantity of material in 2nd 3 foot lift (south sector)
5139	quantity of material in 3rd 3 foot lift (south sector)
6472	quantity of material in 4th 3 foot lift (south sector)
1200	quantity of material in 5th 3 foot lift (in 450' section of south sector)
1500	quantity of material in 6th 3 foot lift (in 450' section of south sector)
1800	quantity of material in 7th 3 foot lift (in 450' section of south sector)

compaction process

dozer or grader will spread material in bottom of thrench  
compactor will run over material until stable firm base is aquired  
dozer to push more material into trench and repeat process  
will leave at least 3-5 feet from surface for possible cover material.

- 1500 quantity compacted (cy/day)
- 5 time to compact one lift (days)
- 2 number of additional days for each additional lift
- 7 number of lifts of waste material
- 77 total work days for compaction of waste material

cover placement

- 5 area to be covered (acre)
- 2 depth of cover (ft)
- 16133 quantity of material required for cover
- 1000 yards per scraper per day
- 3 number of scrapers
- 3000 total yards per day
- 5 number of work days to move cover
- 3000 compaction rate [equal number of scrapers as compactors] (cy/d)
- 3.7 area corresponding to amount of material compacted (on 6" lift basis)
- 4 number of lifts
- 15 number of work days to compact cover

loading and hauling

- 4000 maximum haul distance (feet)
- 16 truck capacity (cy)
- 0.85 fill factor
- 13.6 quantity per load (cy)
- 5 loader bucket quantity
- 0.85 bucket fill factor
- 3.2 number of buckets to fill truck
- 1.5 cycle time per bucket load (min)
- 4.8 load time (min)
- 2 Haul time @ 25 mph (min)
- 2 Dump time (min)
- 2 Return time @ 30 mph (min)

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- 12 Time to load haul and dump 1 load
- 5 Number of loads per hour per truck
- 68 Quantity moved per hour per truck
- 476 Quantity moved per truck per day (7 hr)
- 1428 Quantity moved per day (3 trucks)
- 51000 material requiring to be moved
- 36 number of work days to complete

berms are most likely not useable (contaminated)  
will relocate material to pond 3 for disposal

- 51000 quantity of material in berms
- 476 material loaded per truck per day
- 3 number of trucks
- 1428 total yards per day
- 36 number of work days to move berms

grading former pond area

- 2.1 area graded per hour
- 15 area covered in one day (7 hr)
- 30 total area requiring grading/contour work
- 2 number of days to complete contour work

dozer will be required to facilitate efficient grader operation

area is on a shale/sandstone ridge - will require topsoil  
(berm will not be used due to probable contaminated material)

- 0.5 depth of topsoil (ft)
- 35 area requiring topsoil [pond 9 and trench] (ac)
- 28233.333 quantity of topsoil required (yd<sup>3</sup>)
- 1000 quantity moved per scraper per day
- 9 number of days to move material (3 scrapers)

input parameters for cost calculations

revegetation costs

- 35 area to be revegetated (pond 9 and trench area)
- 8.5 cost of seed mix (\$/lb)
- 10 seed application rate (lb/ac)
- 2975 seeding cost
- 120 cost of mulch (\$/T)
- 2 mulch application rate (T/ac)
- 8400 cost to mulch area
- 35 cost of fertilizer (\$/ac)
- 1225 cost to fertilize area
- 12600 cost for seed/mulch/fertilizer
- 15 daily production (ac/day)
- 2.3333333 days required to revegetate area

well plugging costs

wells will be filled with grout to near surface and covered with alluvium material

43	number of wells
0.33	diameter of wells
2250	length of wells (ft)
0.09	area per foot of well (ft <sup>2</sup> )
192	volume of wells (ft <sup>3</sup> )
60	grout mix for well plugging (\$/yd)
\$428	cost of concrete
5	Number of days to plug wells (10 wells/day)
2	Number of employees
\$18	hourly rate
\$1,440	Labor cost
250	Concrete truck 'on-call' cost (\$/day)
\$1,250	concrete truck costs
\$3,118	Cost to plug wells

APPENDIX 2

COST ESTIMATE  
NMED PLAN

**Primary Steps to Complete Reclamation**

	Cost
1 - Dry out sediments in preparation for transport	\$8,733
2 - Load and haul sediments to pond 2 area	\$292,762
3 - Compact relocated sediments to specifications	\$160,723
4 - Place radon barrier over compacted sediments	\$69,115
5 - Compact cover to specifications	\$96,434
6 - Place erosion protection on completed area	\$80,718
7 - Recontour and topsoil placement at Pond 9 area	\$19,184
8 - Revegetate Pond 9 area	\$12,684
9 - Plug wells	\$3,118
10 - Backfill trench	\$128,183
11 - revegetate trench area	\$2,742
Total reclamation cost for Pond 9	\$874,396

mound up material		Employee	Hourly rate	Equipment		Daily
		Hourly rate	w/ benefits	Hourly rate	workday	Operating
Crew		(\$)	(\$)	(\$)	(hours)	Cost
						(\$)
2	Loader	18.00	23.40	10.00	8	534
1	Dozer	18.00	23.40	50.00	8	587
0.5	supervisor	27.00	35.10		4	70
0.5	maintenance mechanic	18.00	23.40		2	23
daily operating cost						\$1,215
number of days to complete						7
total cost						\$8,733

**Relocate Sediemnts from Pond 9 to Pond 2**

Daily Operating Cost - NMED proposal		Employee	Hourly rate	Equipment		Daily
		Hourly rate	w/ benefits	Hourly rate	Time	Operating
Crew	Task	(\$)	(\$)	(\$)	(hr)	Cost
						(\$)
3	end dump trucks	18.00	23.40	20.00	8	1041.60
1	Loader operators to load trucks	18.00	23.40	50.00	8	587.20
1	Dozer to feed loaders	20.00	26.00	50.00	8	608.00
0.5	water wagon for dust control	18.00	23.40	40.00	8	253.60
0.5	grader for road maintenance	18.00	23.40	15.00	8	153.60
1	supervisor	27.00	35.10		8	280.80
1	grader at dump location	18.00	23.40	15.00	8	307.20
1	dozer at dump location	20.00	26.00	50.00	8	608.00
1	maintenance mechanic	20.00	26.00		4	104.00
Total						\$3,944

**Time to relocate material from Pond 9 to Pond 2**

<b>Cycle time per load</b>	
1.1	travel distance (miles)
4.8	load time
3	travel time to dump (min)
2	dump time (min)
2	travel to fill point (min)
12	minutes per load
<b>Loads per Day</b>	
420	minutes per workday (7 hr day work - 1 hr warm up cool down)
35	loads per day per truck
3	number of trucks running
105	number of loads per day
<b>Time to complete task</b>	
106000	quantity of material to be moved (yd3)
16	truck capacity (yd3)
0.85	fill factor
13.6	quantity per load (yd3)
7794	number of loads to move material
74	number of work days to move material

**Cost to move material from Pond 9 to Pond 2**

74	number of work days to move material
\$3,944	cost per day
<b>\$292,762 total cost</b>	

**waste material compaction**

					Daily
		Employee	Hourly rate	Equipment	Operating
Crew		Hourly rate	w/ benefits	Hourly rate	Cost
		(\$)	(\$)	(\$)	(\$)
1	grader	18.00	23.40	15.00	307
1	water wagon	18.00	23.40	40.00	507
3	compactors	18.00	23.40	10.00	802
1	supervisor	27.00	35.10		281
					\$1,897
number of days to complete					85
total cost					\$160,723

**placement of radon cover on pond 2 placed material**

material placed/compacted in 6 inch lifts to 90% proctor and  $\pm$  3% optimum moisture

cover material placed/compacted in 6 inch lifts to 95% proctor and  $\pm$  2% optimum moisture

- 106000 quantity of material placed (yd3) minimum amount
- 30 available area on pond 2 (acre) non-rocked area
  
- 26 compacted depth of placed material over pond 2 area (inches)  
(each 6 inch layer of waste material requires 90% proctor and  $\pm$ 3 % moisture)
- 5 number of layers requiring compaction to 90% proctor &  $\pm$ 3% moisture
  
- 1.5 alluvial cover thickness (feet)  
(each 6 inch layer of cover material requires 95% proctor and  $\pm$  2% moisture)
- 3 number of layers requiring compaction to 95% proctor &  $\pm$ 2% moisture

cover material placement & compaction				Employee	Hourly rate	Equipment		Daily
			Hourly rate	w/ benefits	Hourly rate	Time	Operating	Cost
Crew			(\$)	(\$)	(\$)	(hours)		(\$)
1	dozer (rip borrow area)		18.00	23.40	50.00	8		587
1	water wagon (add moisture)		18.00	23.40	40.00	8		507
3	scraper		18.00	23.40	50.00	8		1762
1	grader		18.00	23.40	15.00	8		307
1	water wagon		18.00	23.40	40.00	8		507
3	compactors		18.00	23.40	10.00	8		802
1	supervisor		27.00	35.10		8		281
							daily cost to place cover	\$2,856
							daily cost to compact cover	\$1,897
							number of days to complete cover placement	24
							number of days to complete cover compaction	51
							total cost	\$165,549

place erosion protection

Crew		Employee Hourly rate (\$)	Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)
1	Loader (fill trucks)	18.00	23.40	10.00	8	\$267
3	belly dump trucks	30.00	39.00	140.00	8	\$4,296
1	water wagon (ground prep)	18.00	23.40	20.00	8	\$347
1	compactor (ground prep)	18.00	23.40	10.00	8	\$267
1	grader (spread rock)	18.00	23.40	15.00	8	\$307
1	supervisor	27.00	35.10		8	\$281
						\$5,766
					number of days	14
					cost to complete erosion protection	\$80,718

Grade/contour Pond 9 Area

Crew		Employee Hourly rate (\$)	Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)
1	Dozer	18.00	23.40	50.00	8	587
1	grader	18.00	23.40	15.00	8	307
1	supervisor	27.00	35.10		2	70
						\$965
					number of days	2
					cost to grade/contour former pond area	\$1,929

Place and grade topsoil on Pond 9 Area

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)
3	scraper	18.00	50.00	8	1762
1	grader	18.00	15.00	8	307
1	supervisor	27.00	35.10	2	70
					\$2,139
					number of days 8
Place and grade topsoil on Pond 9 Area					\$17,255

Revegetation of Area

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Equipment Hourly rate (\$)	workday (hours)	Daily Operating Cost (\$)
1	seeder	18.00	10.00	8	267
1	mulcher	18.00	10.00	8	267
1	crimper	18.00	10.00	8	267
1	supervisor	27.00	35.10	4	140
					\$942
					number of days to complete 2
					seed/mulch/fertilizer cost \$10,800
					total cost \$12,684

Place topsoil in trench

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Hourly rate (\$)	Equipment Hourly rate (\$)	Time (hours)	Daily Operating Cost (\$)
3	scraper	18.00	23.40	50.00	8	1762
1	grader	18.00	23.40	15.00	8	307
1	Dozer	18.00	23.40	50.00	4	294
2	compactors	18.00	23.40	10.00	4	267
1	supervisor	27.00	35.10		8	281
						\$2,910
						number of days 44
Place and compact fill in trench						\$128,183

Revegetation of trench Area

Crew		Employee Hourly rate Hourly rate w/ benefits (\$)	Hourly rate (\$)	Equipment Hourly rate (\$)	workday (hours)	Daily Operating Cost (\$)
1	seeder	18.00	23.40	10.00	8	267
1	mulcher	18.00	23.40	10.00	8	267
1	crimper	18.00	23.40	10.00	8	267
1	supervisor	27.00	35.10		4	140
						\$942
						number of days to complete 1
						seed/mulch/fertilizer cost \$1,800
						total cost \$2,742

## input parameters for cost calculations

### mounding material

#### loader -mounding material

5	bucket capacity (yd <sup>3</sup> )
0.85	bucket fill factor
0.25	load time (min)
0.25	haul time (min)
0.2	return time (min)
50	work hour (min/hr)
304	quantity moved per hour
2125	quantity moved per work day (7 hr)

#### dozer

2550	soil weight correction (lb/cy)
2000	normal production (cy/hr)
50	work hour
0.75	operator
1500	quantity moved per hour
10500	quantity moved per work day (7 hr)
14750	daily material movements during mounding
106000	material requiring to be mounded
7	number of work days to complete

### Input parameters for cost calculations

#### loading and hauling

5700	maximum haul distance (feet)
16	truck capacity (cy)
0.85	fill factor
13.6	quantity per load (cy)
5	loader bucket quantity
0.85	bucket fill factor
3.2	number of buckets to fill truck
1.5	cycle time per bucket load (min)
4.8	load time (min)
3	Haul time @ 25 mph (min)
2	Dump time (min)
2	Return time @ 30 mph (min)
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12	Time to load haul and dump 1 load
5	Number of loads per hour per truck
68	Quantity moved per hour per truck
476	Quantity moved per truck per day (7 hr)
1428	Quantity moved per day (3 trucks)
106000	material requiring to be moved
74	number of work days to complete

cost to backfill trench

132130 trench volume (cy)

1000 yards per scraper per day

3 number of scrapers

3000 total yards per day

44 number of work days to move fill to trench and compact material

compaction process

dozer or grader will spread material in bottom of trench

compactors will run over material until stable firm base is acquired

assumed that stable conditions will be achieved with 2 passes of compactor

compactor will be able to maintain compaction quantity equal to dump quantity.

input parameters for cost calculations

revegetation costs

5 area to be revegetated (pond 9 and trench area)

8.5 cost of seed mix (\$/lb)

10 seed application rate (lb/ac)

425 seeding cost

120 cost of mulch (\$/T)

2 mulch application rate (T/ac)

1200 cost to mulch area

35 cost of fertilizer (\$/ac)

175 cost to fertilize area

1800 cost for seed/mulch/fertilizer

15 daily production (ac/day)

1 days required to revegetate area