

**Red Dog Mine  
Closure and Reclamation Plan**

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**J2: Basis of Estimate – Post Closure Costs**

# **Basis of Estimate – Post-Closure Costs Red Dog Mine, Alaska**

Prepared for

**Teck Alaska Incorporated**

Prepared by



May 2009

# **Basis of Estimate – Post-Closure Costs Red Dog Mine, Alaska**

## **Teck Alaska Incorporated**

**3105 Lakeshore Drive, Building A, Suite 101  
Anchorage, Alaska 99517**

### **SRK Consulting (Canada) Inc.**

**Suite 2200, 1066 West Hastings Street  
Vancouver, B.C. V6E 3X2**

**Tel: 604.681.4196 Fax: 604.687.5532  
E-mail: [vancouver@srk.com](mailto:vancouver@srk.com) Web site: [www.srk.com](http://www.srk.com)**

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# 1 Introduction

Teck Alaska Incorporated and NANA are working closely with State of Alaska agencies, through the Large Mine Permitting Team, to develop an integrated Closure and Reclamation Plan that will support issuance of a Solid Waste Permit for Red Dog Mine, pursuant to 18 AAC 60.210. One objective of the process is to estimate the cost of suspension, closure and post-closure activities. This document provides details about the estimate of post-closure costs.

Estimates of the long-term average annual post-closure cost were developed for two different scenarios:

- **Planned Closure.** This estimate assumes that the post-closure period will commence in 2033, after all of the closure measures described in the Red Dog Mine Closure & Reclamation Plan are implemented.
- **Premature Closure.** This estimate assumes that the mine would close prematurely sometime before 2031. As discussed in the “Closure Cost” report, the year 2012 is selected because it represents the worst case in terms of the amount of disturbed area requiring reclamation. The post-closure period in this case is assumed to commence in 2014.

The total estimated annual post-closure cost for each case is as follows, in undiscounted 2009 dollars.

Scenario	Annual Post-Closure Cost
Planned Closure (2031)	\$10,910,000
Premature Closure (2012)	\$10,540,000

## 2 Scope of Estimate

### 2.1 Estimate Structure

The estimate was prepared in an Excel workbook organized as follows:

- A summary worksheet presents the total annual post-closure costs for both the planned and premature closure scenarios.
- Eight separate worksheets estimate costs under the headings “Manpower”, “Consumables (2031)”, “Consumables (2012)”, “Mobile Equipment”, “Maintenance Materials”, “Capital Replacement”, “Power”, and “Camp, Administration & Environmental”.
- Supporting calculations are provided in the spreadsheets “Environmental Costs”, “Winter Power Consumption”, “Summer Power Consumption” and “Suspension Study Consumables”.

As noted, estimates were prepared for both the “Planned Closure (2031)” scenario described in the Red Dog Mine Closure and Reclamation Plan as well for a “Premature Closure (2012)” scenario. The major differences between the two scenarios are in the long-term water treatment costs, specifically the reagents needed to treat the differing flows and levels of acidity. The workbook therefore includes separate sheets for “Consumables (2031)” and “Consumables (2012)”. Differences in costs for the other areas are expected to be very small, so separate estimates were not prepared for those areas.

In both scenarios, it was assumed that the site would be operated by a long-term contractor under management of the State of Alaska. That assumption is required in all estimates that are used to set the amount of financial security provided to the State.

### 2.2 General Assumptions

Requirements for the post-closure period are described in Section 4 of the Red Dog Closure & Reclamation Plan. The primary activities will be:

- Storage of contaminated water in the Aqqaluk or Main pit, with seasonal treatment and discharge;
- Seasonal treatment and discharge of excess water from the tailings pond;
- Year-round collection of seepage from the Main Dam, Back Dam (if necessary) and toe of the Main Waste stockpile, and piping to the Aqqaluk or Main pit;
- Maintenance of earthworks constructed during the closure period;
- Operation and maintenance of remaining site infrastructure; and
- Environmental monitoring and inspections.

For the purposes of this estimate, it is conservatively assumed that the site will be staffed year-round with daily 12-hour shifts. The use of remote systems for monitoring facilities during low activity periods is becoming more common, and could be explored in later revisions of the plan and estimate.

## **3 Assumptions by Cost Item**

### **3.1 Manpower**

Year-round staffing will consist of the following staff:

- A site/property manager;
- One environmental coordinator;
- One mechanic;
- One electrician;
- One equipment operator; and
- Two camp support staff.

Taking into account shift changes, there will be six or seven people on site during the winter.

In the summer, there will be additional staff to run the two treatment plants and carry out the earthworks maintenance:

- One water treatment plant operator;
- One water treatment plant operator assistant;
- One technician;
- One additional mechanic;
- One additional electrician;
- Two truck drivers to drive consumables from the port to site; and
- One additional equipment operator.

Taking shift changes into account, there will be about 15 people on site for most of the summer.

Salary costs were estimated by applying a multiplier of 2.02 to the 2006 Red Dog hourly wage rates and then applying an inflation rate of 3.0% per year for each of 2007 and 2008. It should also be noted that Red Dog hourly wage rates include an 80% loading for benefits.

### **3.2 Consumables**

The major consumables will be those used in the water treatment system, specifically lime, flocculant, sodium sulfide and anti-scalant.

A post-closure water and load balance is described in the Red Dog Mine Closure and Reclamation Plan, Section 4.2, and Supporting Document E1 – Water and Load Balance. The water and load balance provides estimates of the annual treatment flows and the lime demand from each of the Aqqaluk pit and the tailings pond. Estimates of post-closure water quality were derived using the most recent (April 2008) version of the water and load balance. The flows and lime demands vary slightly over the first few years after closure. The long-term steady state values, which are generally reached about 5-10 years after closure, were used for the estimate.

It was assumed that actual lime demand would be 12.5% greater than the theoretical lime demand provided by the water and load balance. The difference accounts for grit content and unreactive lime.

The amounts of flocculant, sodium sulfide and anti-scalant were assumed to be proportional to the lime demand. The ratios of the amount of each consumable to the lime tonnage were estimated from site records. The resulting estimates of treated flows, lime demand and consumable requirements were as follows.

	<b>Planned Closure (2031)</b>	<b>Premature Closure (2012)</b>
<b>Annual Flows to Treatment (million gallons)</b>		
Tailings pond	535	449
Aqqaluk pit	1050	1020
<b>Total</b>	<b>1585</b>	<b>1469</b>
<b>Theoretical Lime Demand (tonnes/year)</b>		
Tailings pond	209	194
Aqqaluk pit	7291	6556
<b>Total</b>	<b>7500</b>	<b>6750</b>
<b>Actual Lime Demand (tonnes/year)</b>	<b>8438</b>	<b>7594</b>
Flocculant (tonnes)	84	76
Sodium sulfide (tonnes)	220	198
Antiscalant (tonnes)	35	32

The unit cost for lime was estimated at \$350 per tonne, slightly higher than the 2008 price as delivered to the Red Dog port.

Unit costs for the other water treatment consumables (flocculant, sodium sulphide, and antiscalant) were based on the 2008 price for each consumable as delivered to the Red Dog port.

### 3.3 Mobile Equipment

A small fleet of mobile equipment that is owned by the site is assumed to be used in post-closure activities. Equipment sizes were assumed to be the same as equipment presently on site or used to transport consumables to site:



- 16G Grader;
- 966 Loader;
- Medium Truck (35 ton);
- Excavator (2.3 CY);
- 988B Loader;
- V-900 Forklift;
- Portable Generator;
- D6/D7 Dozer;
- Field service truck;
- Semi-tractor (6x4, 75K lbs) and Pneumatic Trailer;
- Heavy equipment trailer (50 ton);
- Van-mounted steam generator; and
- Snow blower.

Hourly equipment rates were based on estimates provided by State of Alaska Department of Natural Resources (March 6, 2009), from Mining Cost Service and Equipment Watch handbooks. Operator and maintenance labor costs were deducted as they are accounted for elsewhere in the estimate.

Usage of the equipment (hours per month) was estimated from historical Red Dog data with allowances for increased use of the grader for road maintenance activities and use of the semi-tractor and forklift to respectively transport and unload consumables for the water treatment plant. A further 150 hours per year of grader time was added for maintenance of the port road.

### **3.4 Maintenance Materials**

Maintenance material costs were estimated based on site maintenance department records. A 12% freight cost was added. Sand filter maintenance was reduced from the current twice per season to once per season, because the combined effluent streams from the post-closure water treatment plants are expected to generate much less scaling than the current effluent. Maintenance labor costs were removed and included under Manpower, except for the sand filter maintenance because it is carried out by contract labor.

### **3.5 Capital Replacement**

An annual capital replacement cost of \$580,000 was included to account for replacement of major capital items. That amount is sufficient to provide for:

- Replacement of 25% of the water treatment system in years 15, 45, 75, 105, etc., and replacement of the other 75% in years 30, 60, 90, 120 etc. (the total capital cost for two new water treatment plants was estimated in the closure cost spreadsheet as \$14,442,000);
- Replacement of generators and switch gear every 20 years;
- Replacement of 1/25<sup>th</sup> of the mobile equipment fleet each year; and
- Replacement of monitoring equipment every 30 years.

Actual capital expenditures will not correspond directly to the above. But comparison of the annual allowance to the above shows that it is conservative. For example, there are many examples of water treatment plants that have been in operation for more than thirty years without complete replacement.

### 3.6 Power

Power requirements were estimated based on a detailed listing of the equipment needed to operate in the both the winter and summer months.

During the winter, power will be required primarily to operate the pumps and heat tracing systems on the tailings seepage and seepage-seepage system and the overburden seepage system. Heat and power will also be provided for a stand-alone office and living area for the small crew that will be accommodated on site. Winter power consumption was estimated to be 500 kW.

During the summer, water treatment will increase the power requirements. In addition to the plant, the operation of water treatment requires operation of the reclaim pumps, Bons Creek pumps, process water distribution pumps, lime, flocculant and sulphide mixing and distribution systems and a compressor. Summer power consumption was estimated to be 2,000 kW.

The power costs were based on:

- Two generators optimally sized for the winter and summer seasons, producing power at an efficiency of 14.1 kW-hours per gallon;
- Maintenance costs of \$0.011 per kW-hour; and
- A fuel cost of \$2.58 per gallon.

The estimated fuel cost is based on the average price paid for fuel delivered to Red Dog port over the five-year period from 2004 to 2008.

### 3.7 Camp and Administration

The estimate of camp and administration costs included:

- Camp operation at \$100 per person per day;

- Turnaround costs of \$770 per trip; and
- An annual port maintenance fee of \$100,000.

The estimated camp fee of \$100 per person day was estimated from the average of two quotes, both referring to camps housing 10-25 people.

### **3.8 Environmental Monitoring**

Environmental monitoring costs include all external sample analysis requirements, sampling and preparation supplies, and external consulting and contracted surfaces.

The sampling and analytical requirements were based on sampling the following locations: Outfall 001, Station 2, Station 9, Station 10, Station 12, Station 20, Station 73, Station 140, Station 150, Station 160, Red Dog Creek Above Qanaiyaq, Shelly Creek, Connie Creek, Rachel Creek, and Sulfur Creek. All analyses were assumed to be completed by external laboratories. Monthly WET (toxicity) testing was assumed to continue during the summer. Costs of sample shipping and data manipulation were included. The bioassessment program was assumed to continue to be carried out by a consultant. Helicopter time for accessing the remote sampling sites was also included.

The courier cost allocation of \$70,000 was based on costs incurred by the mine to ship samples in 2008. An allowance of \$250,000 was added for additional post-closure monitoring and inspections.

### **3.9 Other Indirect Costs**

Other indirect costs added to the estimate were:

- Insurance at 1.6% of manpower and mobile equipment costs;
- Contractor overhead at 10% of manpower costs;
- Contractor profit at 10% of manpower and equipment costs; and
- State contract management based on 1.5 staff at \$90,000 per year.

## 4 Summary - Planned Closure

The total annual post-closure costs under the Planned Closure (2031) scenario are as follows:

	Annual Cost
Manpower	\$1,940,000
Consumables	\$3,670,000
Mobile Equip	\$290,000
Maintenance Materials	\$370,000
Capital Replacement	\$580,000
Power	\$1,890,000
Environmental	\$570,000
Camp & Admin	\$990,000
Insurance	\$40,000
Contractor Overhead	\$190,000
Contractor Profit	\$220,000
State Contract Management	\$140,000
<b>Total Cost</b>	<b>\$10,910,000</b>

## 5 Summary - Premature Closure

The total annual post-closure costs under the Premature Closure (2012) scenario are as follows:

	Annual Cost
Manpower	\$1,940,000
Consumables	\$3,310,000
Mobile Equip	\$290,000
Maintenance Materials	\$370,000
Capital Replacement	\$580,000
Power	\$1,890,000
Environmental	\$570,000
Camp & Admin	\$990,000
Insurance	\$40,000
Contractor Overhead	\$190,000
Contractor Profit	\$220,000
State Contract Management	\$140,000
<b>Total Cost</b>	<b>\$10,540,000</b>



**Table 1. Summary of Estimated Post-Closure Costs**

**Planned Closure (2031)**

**Annual Water Treatment Cost**

	Annual Cost
Manpower	\$570,000
Consumables	\$3,670,000
Maintenance Materials	\$180,000
Capital Replacement	\$300,000
Power	\$1,060,000
<b>Subtotal</b>	<b>\$5,780,000</b>

**Annual Camp, Site Maintenance, Environmental & Administration Costs**

	Annual Cost
Manpower	\$1,370,000
Maintenance Materials	\$190,000
Mobile Equip	\$290,000
Capital Replacement	\$290,000
Power	\$830,000
Environmental	\$570,000
Camp & Admin	\$990,000
<b>Subtotal</b>	<b>\$4,540,000</b>

**Total Annual Post-Closure Operating Cost**

	Annual Cost
Manpower	\$1,940,000
Consumables	\$3,670,000
Mobile Equip	\$290,000
Maintenance Materials	\$370,000
Capital Replacement	\$580,000
Power	\$1,890,000
Environmental	\$570,000
Camp & Admin	\$990,000
Insurance	\$40,000
Contractor Overhead	\$190,000
Contractor Profit	\$220,000
State Contract Mgmt.	\$140,000
<b>Total Cost</b>	<b>\$10,910,000</b>

**Premature Closure (2012)**

**Annual Water Treatment Cost**

	Annual Cost
Manpower	\$570,000
Consumables	\$3,310,000
Maintenance Materials	\$180,000
Capital Replacement	\$300,000
Power	\$1,060,000
<b>Subtotal</b>	<b>\$5,410,000</b>

**Annual Camp, Site Maintenance, Environmental & Administration Costs**

	Annual Cost
Manpower	\$1,370,000
Maintenance Materials	\$190,000
Mobile Equip	\$290,000
Capital Replacement	\$290,000
Power	\$830,000
Environmental	\$570,000
Camp & Admin	\$990,000
<b>Subtotal</b>	<b>\$4,540,000</b>

**Total Annual Post-Closure Operating Cost**

	Annual Cost
Manpower	\$1,940,000
Consumables	\$3,310,000
Mobile Equip	\$290,000
Maintenance Materials	\$370,000
Capital Replacement	\$580,000
Power	\$1,890,000
Environmental	\$570,000
Camp & Admin	\$990,000
Insurance	\$40,000
Contractor Overhead	\$190,000
Contractor Profit	\$220,000
State Contract Mgmt.	\$140,000
<b>Total Cost</b>	<b>\$10,540,000</b>

**Table 2: Post Closure Manpower Schedule**

	On Roll	On Site	Coverage	Turnaround	Hourly Wage	Hourly Wage*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Year-around ops							31	28	31	30	31	30	31	31	30	31	30	31	365
Summer Ops							0	0	0	15	31	30	31	31	30	0	0	0	168
<b>Year-Round</b>																			
Site Manager	1	1				159,135	13,261	13,261	13,261	13,261	13,261	13,261	13,261	13,261	13,261	13,261	13,261	13,261	159,135
Enviro. Co-ord	2	1	12/7	2x2	76.11	63.15	23,492	21,219	23,492	22,734	23,492	22,734	23,492	23,492	22,734	23,492	22,734	23,492	276,599
Enviro. Tech.																			0
Mechanic	2	1	12/7	2x2	71.58	55.85	20,775	18,765	20,775	20,105	20,775	20,105	20,775	20,775	20,105	20,775	20,105	20,775	244,610
Electrician	2	1	12/7	2x2	85.61	55.85	20,775	18,765	20,775	20,105	20,775	20,105	20,775	20,775	20,105	20,775	20,105	20,775	244,610
Equip. Operator Group 1A	2	1	12/7	2x2	68.99	52.44	19,508	17,620	19,508	18,878	19,508	18,878	19,508	19,508	18,878	19,508	18,878	19,508	229,686
Camp Support	0	2	12/7	2x2	0.00	36.07													0
Nightshift coverage	0		12/7	2x2	0.00														0
																			0
	9	7					\$97,811	\$89,629	\$97,811	\$95,084	\$97,811	\$95,084	\$97,811	\$97,811	\$95,084	\$97,811	\$95,084	\$97,811	\$1,154,640
<b>Summer</b>																			
WTP Operator	2	1	12/7	2x2	76.11	52.44	0	0	0	9,439	19,508	18,878	19,508	19,508	18,878	0	0	0	105,718
Operator Assistant	2	1	12/7	2x2	58.17	43.44	0	0	0	7,819	16,159	15,638	16,159	16,159	15,638	0	0	0	87,573
PowerHouse Operator																			0
Technicians	2	1	12/7	2x2	76.11	54.31	0	0	0	9,777	20,205	19,553	20,205	20,205	19,553	0	0	0	109,497
Mechanic	2	1	12/7	2x2	71.58	55.85	0	0	0	10,052	20,775	20,105	20,775	20,775	20,105	0	0	0	112,588
Electrician	2	1	12/7	2x2	85.61	55.85	0	0	0	10,052	20,775	20,105	20,775	20,775	20,105	0	0	0	112,588
Truck Driver	4	2	12/7	2x2	68.76	52.44	0	0	0	0	0	37,757	39,015	39,015	37,757	0	0	0	153,543
Equip. Operator Group 1A	2	1	12/7	2x2	68.99	52.44	0	0	0	9,439	19,508	18,878	19,508	19,508	18,878	0	0	0	105,718
	16	8					\$0	\$0	\$0	\$56,579	\$116,929	\$150,914	\$155,944	\$155,944	\$150,914	\$0	\$0	\$0	\$787,225
<b>Total - Manpower Cost</b>							<b>\$97,811</b>	<b>\$89,629</b>	<b>\$97,811</b>	<b>\$151,662</b>	<b>\$214,740</b>	<b>\$245,998</b>	<b>\$253,755</b>	<b>\$253,755</b>	<b>\$245,998</b>	<b>\$97,811</b>	<b>\$95,084</b>	<b>\$97,811</b>	<b>\$1,941,865</b>

**Table 3: Water Treatment Consumables for Planned Closure (2031)**

**Red Dog Post-Closure Water Treatment Costs - 2031 Scenario (N)**

Supply	Cost/Tonne FOB Seattle	Freight	Cost/Tonne Delivered	2031		2032		2033		2034		2035		2040	
				Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Tonnes*	Total Cost	
Flocculant			\$3,924	39	\$154,029	39	\$151,112	85	\$331,962	84	\$331,368	84	84	84	\$331,072
Lime			\$350	3926	\$1,373,936	3851	\$1,347,917	8460	\$2,961,095	8445	\$2,955,803	8440	8438	8438	\$2,953,157
Sodium sulfide			\$1,007	102	\$103,174	101	\$101,220	221	\$222,359	220	\$221,961	220	220	220	\$221,763
Antiscalant	\$4,482	\$266	\$4,748	16	\$78,281	16	\$76,799	36	\$168,711	35	\$168,410	35	35	35	\$168,259
				\$1,709,419		\$1,677,047		\$3,684,126		\$3,677,542				\$3,674,250	

\*Ratios of consumption of flocculant, sodium sulfide and antiscalant from Susp Study Consumables sheet, Cell S9

\$ 3,081,421

**Calculation of Lime Requirement (to steady state)**

	Year	Flow	Acidity	Acidity	Theoretical Lime Demand	Lime Requirement
		10 <sup>6</sup> USGal	mg/L as CaCO3	Load t/Year	t/Y	t/Y
Tailings Pond	2031	432	307.0	502	281	316
Aqqaluk Pit		462	3276	5729	3208	3609
Total Load		894		6231	3489	3926
Tailings Pond	2032	432	235.0	384	215	242
Aqqaluk Pit		462	3276	5729	3208	3609
Total Load		894		6113	3423	3851
Tailings Pond	2033	535	202.0	409	229	258
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13429	7520	8460
Tailings Pond	2034	535	190.0	385	216	243
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13405	7507	8445
Tailings Pond	2035	535	186.0	377	211	238
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13397	7502	8440
Tailings Pond	2036	535	185.0	375	210	236
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13395	7501	8439
Tailings Pond	2037	535	184.0	373	209	235
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13393	7500	8438
Tailings Pond	2038	535	184.0	373	209	235
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13393	7500	8438
Tailings Pond	2039	535	184.0	373	209	235
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13393	7500	8438
Tailings Pond	2040	535	184.0	373	209	235
Aqqaluk Pit		1050	3276	13020	7291	8203
Total Load		1585		13393	7500	8438

**Filling Period Calcs**

Load to Pit	18749	2031 and 2032 load inputs to pit
Load to storage	13020	(i.e. steady state load inputs = outputs)
Excess load to be treated	5729	

In the W&L balance, it was assumed that these would be flushed out over several years  
For costing purposes, assume that this excess would be treated during the filling period

1) Assumes actual demand : theoretical demand = 1.125

2) Based on water and load balance model update as of April 2008

File Ref: Red Dog Load Balance\_Avg Precip\_2008\_06\_02\_Tetrattech.xls



**Table 4: Water Treatment Consumables for Premature Closure (2012)**

Red Dog Post-Closure Water Treatment Costs - 2012 Scenario (J) \$3,307,031

Supply	Cost/Tonne FOB Seattle	Freight Cost/Tonne	Cost/Tonne Delivered	2012		2013		2014		2015		2016		2021	
				Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Total Cost	Tonnes*	Tonnes*	Total Cost	
Flocculant			\$3,924	49	\$193,803	39	\$154,813	86	\$336,954	77	\$300,604	76	76	\$297,999	
Lime			\$350	4939	\$1,728,618	3945	\$1,380,851	8587	\$3,005,452	7661	\$2,681,229	7610	7594	\$2,657,993	
Sodium sulfide			\$1,007	129	\$129,808	103	\$103,693	224	\$225,690	200	\$201,343	199	198	\$199,598	
Antiscalant	\$4,482	\$266	\$4,748	21	\$98,490	17	\$78,675	36	\$171,239	32	\$152,766	32	32	\$151,442	
				\$2,150,718		\$1,718,033		\$3,739,334		\$3,335,941				\$3,307,031	

\*Ratios of consumption of flocculant, sodium sulfide and antiscalant from Susp Study Consumables sheet, Cell S9

**Calculation of Lime Requirement (to steady state)**

	Year	Flow 10^6 USGal	Acidity mg/L as CaCO3	Acidity Load t/Year	Theoretical Lime	Lime
					Demand t/Y	Requiremen t t/Y
Tailings Pond	2012	1716	1007.2	6543	3664	4122
Main Pit		113	3032	1297	726	817
Total Load		1829		7840	4390	4939
Tailings Pond	2013	1716	764.4	4965	2781	3128
Main Pit		113	3032	1297	726	817
Total Load		1829		6262	3507	3945
Tailings Pond	2014	1082	469.3	1922	1076	1211
Main Pit		1020	3032	11708	6556	7376
Total Load		2102		13630	7633	8587
Tailings Pond	2015	449	265.8	452	253	285
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12160	6809	7661
Tailings Pond	2016	449	218.3	371	208	234
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12079	6764	7610
Tailings Pond	2017	449	207.2	352	197	222
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12060	6754	7598
Tailings Pond	2018	449	204.6	348	195	219
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12056	6751	7595
Tailings Pond	2019	449	204.0	347	194	218
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12055	6751	7594
Tailings Pond	2020	449	203.8	346	194	218
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12054	6750	7594
Tailings Pond	2021	449	203.8	346	194	218
Main Pit		1020	3032	11708	6556	7376
Total Load		1469		12054	6750	7594

**Filling Period Calcs**

Load to Pit	13005	2012 and 2013 load inputs to pit
Load to storage	11708	(i.e. steady state load inputs = outputs)
Excess load to be treated	1297	

In the W&L balance, it was assumed that these would be flushed out over several years  
For costing purposes, assume that this excess would be treated during the filling period

- 1) Assumes actual demand : theoretical demand = 1.125
- 2) Based on water and load balance model update as of April 2008

File Ref: Red Dog Load Balance\_2012 Closure\_K\_2008\_10\_13\_Tetratech.xls

**Table 5. Post-Closure Mobile Equipment Schedule**

	\$/hr	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals	
16G Grader	37.62	\$19,188	30	30	30	30	60	60	60	60	60	60	30	30	30	510
966 Loader	44.43	\$66,640	125	125	125	125	125	125	125	125	125	125	125	125	125	1500
35 ton Haul Truck	34.04	\$16,340	10	10	10	10	10	100	100	100	100	100	10	10	10	480
2.3 cy Excavator	32.72	\$16,689					10	100	100	100	100	100				510
988B Loader	78.43	\$9,412	20	20	20								20	20	20	120
V-900 Forklift	31.36	\$20,384							300	110	110	110	20			650
Portable Generator	25.00	\$3,000	10	10	10	10	10	10	10	10	10	10	10	10	10	120
D6-7 Dozer	46.88	\$22,503	10	10	10	10	10	10	100	100	100	100	10	10	10	480
Field Service Truck	8.79	\$15,827	150	150	150	150	150	150	150	150	150	150	150	150	150	1800
Semi Tractor 6x4, 75klbs	27.90	\$80,366					0		720	720	720	720				2880
Pneumatic Trailer	1.52	\$1,139					150		150	150	150	150				750
Heavy equipment Trailer 50t	3.04	\$759					50		50	50	50	50				250
Van Mounted Steam Generato	4.18	\$669				20	60	60	20							160
Snowblower	35.00	\$3,500	20	20	20	10								10	20	100
<b>SUBTOTALS</b>		<b>\$276,415</b>	<b>375</b>	<b>375</b>	<b>395</b>	<b>415</b>	<b>725</b>	<b>1885</b>	<b>1675</b>	<b>1675</b>	<b>1675</b>	<b>1675</b>	<b>375</b>	<b>365</b>	<b>375</b>	<b>10310</b>
Pickups	5.38	\$12,912	200	200	200	200	200	200	200	200	200	200	200	200	200	2400
<b>Total - Mobile Equipment</b>		<b>\$289,327</b>														
Maint. Hrs		3923														

Table 6. Post-Closure Maintenance Material Costs

	Jan 30	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31	Total	Water Treatment	Maint. manhours
<b>Water Treatment Plant Maintenance</b>															
Non-exempt															267
Stores	0	0	0	1,000	500	500	500	500	500	0	0	0	3,500		
Equipment													0		
Other	0	0	0	5,000	500	500	500	500	500	0	0	0	7,500		
Total				6,000	1,000	1,000	1,000	1,000	1,000	0	0	0	11,000	11,000	267
<b>Sand Filter Maintenance</b>															
Filter 1							0			30,000					
Filter 2							0			30,000					
Filter 3							0			30,000					
Total							0			90,000			90,000	90,000	0
<b>Reagent Systems Maintenance</b>															
Non-exempt													0		
Stores				1000	250	250	250	250	250				2250		
Equipment													0		
Other				250	100	100	100	100	100				750		
Total	0	0	0	1250	350	350	350	350	350	0	0	0	3,000	3,000	0
<b>Lime Slaking Maintenance</b>															
Non-exempt													0		259
Stores				2000	500	500	500	500	500				4500		
Equipment				2000									2000		
Other				500	100	100	100	100	100				1000		
Total	0	0	0	4500	600	600	600	600	600	0	0	0	7,500	7,500	259
<b>Red Dog Creek Pumpback</b>															
Non-exempt													0		1,049
Stores	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	54000		
Equipment													0		
Other	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	12000		
Total	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	66,000		1,049
<b>Tailings Seepage Pumpback</b>															
Non-exempt													0		24
Stores	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	12000		
Equipment													0		
Other	500	500	500	500	500	500	500	500	500	500	500	500	6000		
Total	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	18,000		24
<b>Overburden Pumpback</b>															
Non-exempt													0		1,781
Stores	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	13200		
Equipment	500	500	500	500	500	500	500	500	500	500	500	500	6000		
Other	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	19200		
Total	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	38,400		1,781
<b>Sullaire Compressor</b>															
Non-exempt													0		36
Stores	500	500	500	500	500	500	500	500	500	500	500	500	6000		
Equipment													0		
Other	100	100	100	100	100	100	100	100	100	100	100	100	1200		
Total	600	600	600	600	600	600	600	600	600	600	600	600	7,200	7,200	36
<b>#1 Reclaim Barge</b>															
Non-exempt													0		366
Stores	500	500	500	500	500	500	500	500	500	500	500	500	6000		

	Jan 30	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31	Total	Water Treatment	Maint. manhours
Equipment	50	50	50	50	50	50	50	50	50	50	50	50	600		
Other	100	100	100	100	100	100	100	100	100	100	100	100	1200		
<b>Total</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>650</b>	<b>7,800</b>	<b>7,800</b>	<b>366</b>
<b>Bonns Creek Pumps</b>															
Non-exempt													0		78
Stores					1200	250	250	250	250	500			2700		
Equipment													0		
Other													0		
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1200</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>500</b>	<b>0</b>	<b>0</b>	<b>2,700</b>	<b>2,700</b>	<b>78</b>
<b>Temporary Facilities</b>															
Non-exempt															240
Stores	500	500	500	500	500	500	500	500	500	500	500	500	6000		
Equipment															
Other	200	200	200	200	200	200	200	200	200	200	200	200	2400		
<b>Total</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>700</b>	<b>8,400</b>		<b>240</b>
<b>Building and Camp Maintenance</b>															
Supplies	800	800	800	800	800	800	800	800	800	800	800	800	9,600		
<b>Total</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>9600</b>		
<b>Miscellaneous</b>															
lubricants	25	25	25	25	50	50	50	50	50	25	25	25	425		
supplies	100	100	100	100	100	100	100	100	100	100	100	100	1200		
<b>Total</b>	<b>125</b>	<b>125</b>	<b>125</b>	<b>125</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>125</b>	<b>125</b>	<b>125</b>	<b>1,625</b>		
<b>Total Maint. Cost (including freig</b>	<b>17,842</b>	<b>17,842</b>	<b>17,842</b>	<b>33,875</b>	<b>22,174</b>	<b>20,878</b>	<b>20,878</b>	<b>20,878</b>	<b>20,878</b>	<b>141,334</b>	<b>17,842</b>	<b>17,842</b>	<b>370,103</b>	<b>176,301</b>	<b>5,590</b>

**Table 7. Capital Replacement Allowances**

**Water Treatment Equipment**

Total Capital Cost for two new plants \$14,442,000 see Water Treatment Capital estimate in Red Dog Closure Cost workbook  
 Annual capital replacement cost \$298,716

**Equipment**

Total Capital Cost for replacement fleet \$6,572,400  
 Annual capital replacement cost \$262,896

**Generator/Power Equipment**

Total Capital Cost for replacement \$810,000  
 Annual capital replacement cost \$18,677

**Monitoring Equipment (piezometers, thermistor installations)**

Total Capital Cost for new installations \$250,000 estimate for installations of 10  
 Annual capital replacement cost \$4,238 piezometers, 5 thermistors

**Equipment Capital Costs**

Equipment	Capital Cost	Tt Capital	Tt Capital with Freight and Assembly
16G Grader	\$ 700,000	\$ 630,000	\$ 756,000
966 Loader	\$ 375,000	\$ 394,000	\$ 472,800
35 ton Haul Truck	\$ 475,000	\$ 472,000	\$ 566,400
2.3 cy Excavator	\$ 300,000	\$ 345,000	\$ 414,000
988B Loader	\$ 800,000	\$ 826,000	\$ 991,200
V-900 Forklift	\$ 175,000	\$ 930,000	\$ 1,116,000
Portable Generator	\$ 100,000	\$ 100,000	\$ 120,000
D6-7 Dozer	\$ 925,000	\$ 600,000	\$ 720,000
Snowblower	\$ 100,000	\$ 100,000	\$ 120,000
Van Mounted Steam Gen.		\$ 150,000	\$ 180,000
Field Service Truck	\$ -	\$ 256,000	\$ 307,200
Semi Tractor 6x4, 75klbs		\$ 258,000	\$ 309,600
Pneumatic Trailer		\$ 50,000	\$ 60,000
Heavy equipment Trailer 50t		\$ 106,000	\$ 127,200
Pickups	\$ 260,000	\$ 260,000	\$ 312,000
<b>Total Fleet</b>	<b>\$ 4,210,000</b>	<b>\$ 5,477,000</b>	<b>\$ 6,572,400</b>
<b>Power Equipment</b>			
500 kW Gen	\$ -	\$ 180,000	\$ 216,000
1000 kW Gen	\$ -	\$ 205,000	\$ 246,000
Switchgear	\$ -	\$ 290,000	\$ 348,000
<b>Total Power</b>	<b>\$ -</b>	<b>\$ 675,000</b>	<b>\$ 810,000</b>
<b>Total Capital Cost</b>	<b>\$ 4,210,000</b>	<b>\$ 6,152,000</b>	<b>\$ 7,382,400</b>

**Capital Replacement Schedule**

NPV at net discount of 4.3% per year

	Cost Component				Total Annual Cost	Annual Equivalent
	Water Treatment	Mobile Equipment	Generator/ power	Monitoring Equipment		
Total Capital Replacement	\$14,442,000	\$6,572,400	\$810,000	\$250,000		
Replacement time (years)	30	25	20	30		
<b>Total NPV:</b>	<b>\$6,945,357</b>	<b>\$6,112,513</b>	<b>\$434,247</b>	<b>\$98,525</b>	<b>\$13,590,642</b>	<b>\$13,590,642</b>
<b>Year</b>						
1	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
2	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
3	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
4	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
5	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
6	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
7	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
8	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
9	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
10	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
11	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
12	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
13	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
14	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
15	\$3,610,500	\$262,896	\$0	\$0	\$3,873,396	\$584,526
16	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
17	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
18	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
19	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
20	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
21	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
22	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
23	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
24	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
25	\$0	\$262,896	\$810,000	\$0	\$1,072,896	\$584,526
26	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
27	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
28	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
29	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
30	\$10,831,500	\$262,896	\$0	\$250,000	\$11,344,396	\$584,526
31	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
32	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
33	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
34	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
35	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
36	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
37	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
38	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
39	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
40	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
41	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
42	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
43	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
44	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
45	\$3,610,500	\$262,896	\$0	\$0	\$3,873,396	\$584,526
46	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
47	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
48	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
49	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
50	\$0	\$262,896	\$810,000	\$0	\$1,072,896	\$584,526
51	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
52	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
53	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
54	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
55	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
56	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
57	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
58	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
59	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
60	\$10,831,500	\$262,896	\$0	\$250,000	\$11,344,396	\$584,526
199	\$0	\$262,896	\$0	\$0	\$262,896	\$584,526
200	\$0	\$262,896	\$810,000	\$0	\$1,072,896	\$584,526

**Table 8 - Post-Closure Power Costs**

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
	New	500	31	28	31	30	0	0	0	0	31	30	31		
	New	2000	0	0	0	0	31	30	31	30	0	0	0		
kWh Produced			371,994	335,994	371,994	359,994	1,487,835	1,439,840	1,487,835	1,487,835	1,439,840	371,994	359,994	371,994	9,887,140
			\$68,067	\$61,480	\$68,067	\$65,871	\$272,242	\$263,460	\$272,242	\$272,242	\$263,460	\$68,067	\$65,871	\$68,067	
500 kW op hrs			744	672	744	720	1488	1440	1488	1488	1440	744	720	744	
Fuel \$/op hr															
Maintenance and Supplies \$/hr	no labor		4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
1000 kW op hrs			0	0	0	0	744	720	744	744	720	0	0	0	
Fuel \$/op hr															
Maintenance and Supplies \$/hr	no labor		9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	
Powerhouse Operator	\$	49.14	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
500 kW Cost			\$ 3,125	\$ 2,822	\$ 3,125	\$ 3,024	\$ 6,250	\$ 6,048	\$ 6,250	\$ 6,250	\$ 6,048	\$ 3,125	\$ 3,024	\$ 3,125	
1000 kW Cost			\$ -	\$ -	\$ -	\$ -	\$ 6,733	\$ 6,516	\$ 6,733	\$ 6,733	\$ 6,516	\$ -	\$ -	\$ -	
<b>Total Cost</b>			<b>\$ 71,192</b>	<b>\$ 64,302</b>	<b>\$ 71,192</b>	<b>\$ 68,895</b>	<b>\$ 285,225</b>	<b>\$ 276,024</b>	<b>\$ 285,225</b>	<b>\$ 285,225</b>	<b>\$ 276,024</b>	<b>\$ 71,192</b>	<b>\$ 68,895</b>	<b>\$ 71,192</b>	<b>\$ 1,894,582</b>
500 kW Labor			47.3	42.7	47.3	45.8	94.6	91.6	94.6	94.6	91.6	47.3	45.8	47.3	
1000 kW Labor			0.0	0.0	0.0	0.0	115.9	112.2	115.9	115.9	112.2	0.0	0.0	0.0	
Maint. Labor hours needed			47.3	42.7	47.3	45.8	210.5	203.8	210.5	210.5	203.8	47.3	45.8	47.3	
\$/kWhr			0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	

Average Fuel Cost \$/gal \$ 2.58 Based on 5-year average of Red Dog costs

Powerhouse operator Hourly \$ 27.30 Load factor 1.80 \$ 49.14 Fuel Consumption Rates 14.1 kW-hr per gal Fuel consump

**Table 9: Post-Closure Camp, Administration & Environmental Costs**

	Basis	Jan. 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31	Total
<b>Environmental</b>														
Maintenance	mostly snowmachines	2,000	2,000	1,000	1,000	500	500	500	500	1,000	2,000	2,000	2,000	15,000
Sampling Equipment		250	250	250	500	350	350	350	350	350	350	350	300	4,000
Outside Analytical	Outfall001, Stations 2,9,10,12,2	1,000	1,000	1,000	1,000	15,000	15,000	15,000	15,000	15,000	2,750	1,000	1,000	83,750
Consulting Services	Bioassessment Program	300	300	300	300	25,300	25,300	25,000	25,000	300	300	300	300	103,000
Sampling Supplies		350	350	350	350	350	350	350	350	350	350	350	350	4,200
Helicopter Time						10,000	10,000	10,000	10,000	10,000				50,000
<b>Sub-total - Environmental</b>		<b>3,900</b>	<b>3,900</b>	<b>2,900</b>	<b>3,150</b>	<b>51,500</b>	<b>51,500</b>	<b>51,200</b>	<b>51,200</b>	<b>27,000</b>	<b>5,750</b>	<b>4,000</b>	<b>3,950</b>	<b>259,950</b>
<b>Administration</b>														
Worker Compensation	11% of Labor cost													\$0
Insurance	covered on Summary Tab													\$0
Office Supply	allow \$100/mo	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$1,200
Communications	assume Iridium phone	\$1,030	\$940	\$1,030	\$1,000	\$1,030	\$1,000	\$1,030	\$1,030	\$1,000	\$1,030	\$1,000	\$1,030	\$12,150
Office Heating Fuel	500/200 gal/mo	\$1,290	\$1,290	\$1,290	\$1,290	\$516	\$516	\$516	\$516	\$1,290	\$1,290	\$1,290	\$1,290	\$12,384
Misc. Supplies	allow \$500/mo	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$6,000
Camp Operation	\$100 per person-day	\$21,700	\$19,600	\$21,700	\$48,000	\$49,600	\$48,000	\$49,600	\$49,600	\$48,000	\$21,700	\$21,000	\$21,700	\$420,200
Turnaround costs	\$770/trip x 231 trips	\$9,186	\$8,297	\$9,186	\$20,318	\$20,996	\$20,318	\$20,996	\$20,996	\$20,318	\$9,186	\$8,889	\$9,186	\$177,870
<b>Sub-total - Administration</b>		<b>\$33,806</b>	<b>\$30,727</b>	<b>\$33,806</b>	<b>\$71,208</b>	<b>\$72,742</b>	<b>\$70,434</b>	<b>\$72,742</b>	<b>\$72,742</b>	<b>\$71,208</b>	<b>\$33,806</b>	<b>\$32,779</b>	<b>\$33,806</b>	<b>\$629,804</b>
<b>Road and Port Maintenance</b>														
Grading	(covered by additional grader time in Mobile Equipment)													\$0
Additional Maintenance														\$100,000
<b>Sub-total - Road and Port Maintenance</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$100,000</b>
<b>Total - Supplies and Services</b>		<b>\$37,706</b>	<b>\$34,627</b>	<b>\$36,706</b>	<b>\$74,358</b>	<b>\$124,242</b>	<b>\$121,934</b>	<b>\$123,942</b>	<b>\$123,942</b>	<b>\$98,208</b>	<b>\$39,556</b>	<b>\$36,779</b>	<b>\$37,756</b>	<b>\$989,754</b>

**Table 10: Post-Closure Environmental Monitoring Costs**

Analyte	Unit Cost	Used Oil and Fuel Samples	Used Oil and Fuel Cost	NPDES Samples	NPDES Cost
Aluminum Total EPA 200.8 (W)	\$11.00			160	\$1,760
Ammonia-N by EPA 350.2 (W)	\$23.00			95	\$2,185
Arsenic, SW7060 GF (O)	\$22.95	1	\$23		
Biochemical Oxygen Demand 5	\$34.00			6	\$204
Cadmium by SW6010 ICP (O)	\$13.60	1	\$14		
Cadmium Total EPA 200.8 (W)	\$11.00			240	\$2,640
Calcium Total EPA 200.8 (W)	\$11.00			145	\$1,595
Chloride by Ion Chrom. (W)	\$20.00			150	\$3,000
Chromium by SW6010 ICP (O)	\$13.60	1	\$14		
Chromium Total EPA 200.8 (W)	\$11.00			160	\$1,760
Cobalt Total EPA 200.8 (W)	\$11.00			65	\$715
Copper Total EPA 200.8 (W)	\$11.00			235	\$2,585
Cyanide, Total (W)	\$40.00			60	\$2,400
Fecal Coliform (MF)	\$22.10			8	\$177
Flash Point by ASTM D-3828	\$33.15	1	\$33		
Hardness CaCO3 ICP-MS (W)	\$14.00			125	\$1,750
Iron Total EPA 200.8 (W)	\$11.00			155	\$1,705
Lead by SW6010 ICP (O)	\$13.60	1	\$14		
Lead Total EPA 200.8 (W)	\$11.00			240	\$2,640
Manganese Total EPA 200.8 (W)	\$11.00			150	\$1,650
Mercury by EPA 245.1 CV (DW)	\$30.00			85	\$2,550
Metals Acid Digestion	\$22.95			250	\$5,738
Nickel Total EPA 200.8 (W)	\$11.00			160	\$1,760
Selenium Total EPA 200.8 (W)	\$11.00			150	\$1,650
Silver Total EPA 200.8 (W)	\$11.00			140	\$1,540
Total Dissolved Solids (W)	\$14.00			190	\$2,660
Total Halogens	\$50.15	1	\$50		
Total Sulfur	\$40.00	2	\$80		
Total Suspended Solids	\$15.30			45	\$689
VOC, EPA 624 (W)	\$222.70			4	\$891
Zinc Total EPA 200.8 (W)	\$11.00			240	\$2,640
Monthly WET Tests	\$2,220			12	\$26,640
Courier					\$70,000
Other Manipulations					\$5,000
<b>Total Analytical</b>			<b>\$227</b>		<b>\$148,523</b>

**Bioassessment Program**

Fish Population and Diversity	
Fish Tissue Sampling	
Benthic Invertebrate Sampling	
Dolly Varden Aerial Surveys	\$100,000

**Equipment**

Miscellaneous Sampling Supplies	\$4,200
Sampling Equipment	\$4,000
Telemetry/MET Station Maintenance	\$5,000
Helicopter Time	\$50,000
Meteor Burst Telemetry contract	\$3,000
Snow Mobile Maintenance	\$10,000

**Allowance for Additional Monitoring and Inspections** **\$250,000**

**Total** **\$426,200**

**Grand Total** **\$574,950**



**Table 11: Post-Closure Winter Power Consumption**

		Number Available	Connected Power	Number Operating	Power kW	
Red Dog Pumpback	pumps	3	140		0	
	pumps	4	87	1	65	
	heat tracing				18	
Waste pile seepage	pumps	2				
	heat tracing					
Tailings Seepage	pumps	3	100	2	149	
	heat tracing				2	
Seepage-Seepage	pumps		5	1	4	
	heat tracing				0	
Overburden Pumpback	pumps		50	1	37	
	heat tracing				8	
<b>Pumping Systems</b>					<b>283</b>	<b>283</b>
Temporary Heat	heat tracing				19	
	compressor				15	
	lime plant				15	
	flocculant system				15	
	Reclaim Barge#1				20	
	Generator				25	
	6016 MCC				10	
	2021 MCC				10	
	2020 MCC				10	
	6030 MCC				10	
Barge De-Icing	pump		25	1	19	
Temporary Heat					167	167
Potable Water Plant					0	
Temporary Accommodation	misc heating				30	
	appliances				10	
	lighting				10	
Temporary Accommodation					50	50
<b>Total</b>					<b>500</b>	<b>500</b>

**Table 12: Post-Closure Summer Power Consumption**

			Number Available	Connected Power	Number Operating	Power kW	Standalone Power
Red Dog Pumpback	pumps		3	140	2	146.2	
			4	87	2	90.8	
Tailings Seepage	heat tracing			17.6	0	0.0	
	pumps		3	100	2	104.4	
						0.0	
Seepage-Seepage	heat tracing			1.9	0	0.0	
	pumps			10	2	10.4	
						0.0	
Overburden Pumpback	heat tracing			0.475	0	0.0	
	pumps			50	1	26.1	
						0.0	
	heat tracing			7.64	0	0.0	
						0.0	
Potable Water Plant				1	1	0.7	
						0.0	
Sub-total - Water Collection Pumps						379	379
Reclaim Barge #1	pumps		4	300	4	626.4	
	misc.					0.0	
Sub-total - reclaim barge						626	626
WTP#2	Lime/sludge Agitator	2021-1901	1	15	1	7.8	
	Rapid Mix Agitator	2021-1902	1	25	1	13.0	
	Lime Reactor Agitator	2021-1903	1	100	1	52.2	
	Floc Mix Agitator	2021-1904	1	5	1	2.6	
	Clarifier - rake drive	2006-3301	2	7.5	2	7.8	
	Clarifier - lift drive		1	2	1	1.0	
	Sludge Recycle pumps	2005-1509	2	150	2	156.6	
	Overflow Bypass pump	2020-1540	1	75	1	39.1	
	Emergency Spill Pump	2021-1503	1	10	1	5.2	
Sub-total - WTP2						286	286
Lime Mixing System	Screw Conveyor	2020-2004	1	3	1	1.6	
	Lime slaker	2020-2101	1	5	1	2.6	
	MOL transfer pump	2020-1510	1	7.5	1	3.9	
	MOL storage tank agitator	2020-1920	1	7.5	1	3.9	
	Lime feed pumps	2020-1511	2	25	1	13.0	
	Overhead crane	2020-1002	1	5	1	2.6	
	Sump pump	2020-1521	1	10	1	5.2	
	Dust Collection Filter	2020-2905	1	5	1	2.6	
Sub-total - Lime slaking system						35	35
Flocculant System	Flocculant Transfer Pump	2025-1507	2	5	1	2.6	
	Flocculant Area Sump Pump	2025-1510	1	7.5	1	3.9	
	Flocculant Feed Pump	2025-1512	2	1	1	0.5	
	Flocculant Transfer Blower		1	2.5	1	1.3	
	Flocculant Screw Feeder		1	0.5	1	0.3	
	Flocculant Day Tank Agitator	2025-1902	1	1	1	0.5	
	Flocculant Mix Tank Agitator		1	5	1	2.6	
	Flocculant Hoist	2025-1004	1	1	1	0.5	
Sub-total - flocculant system						12	12
Sodium Sulphide System	Mix tank agitator	2016-2407	1	2	1	1.0	
	Transfer pump	2016-1511	2	5	1	2.6	
	Day tank agitator	2016-24__	1	1.5	1	0.8	
	Head tank feed pumps	2016-1517	2	5	1	2.6	
	Overhead Crane	2016-1002	1	25	1	13.0	
	Exhaust fan	2016-2903	1	2	1	1.0	
	Spill sump pump					0.0	
Sub-total - Sulphide system						21	21

			Number Available	Connected Power	Number Operating	Power kW	Standalone Power
Air Compressor	Sullair compressor	2021-1801	4	200	1	104.4	
	Cooling circulating pumps	2021-1510	2	5	1	2.6	
	Mechical room sump pump	2021-1508	1	2	1	1.0	
	Air Dryer	2021-2801	1	25	1	13.0	
Sub-total - Air Compressor						121	121
Fresh Water Supply	Bon's Creek Pumps		2	50	1	26.1	
	Fresh water transfer pumps	2020-1522	2	5	1	2.6	
	Reagent water supply pumps	2016-1513	2	10	1	5.2	
	Potable Water Plant					0.0	
Sub-total - Fresh water supply						34	34
Process Water Distribution	Cooling Water Standby pump	2025-1513	1	75	1	39.1	
Sub-total - Process water distribution						39.1	39
Generator	Fuel Feed Pump Skid		2	3	1	1.6	
	Fuel Return Skid		1	1	1	0.5	
	Fuel Treatment Feed Pump No. 1		2	15	1	7.8	
	Fuel Treatment Heater No.1 (24 kW)		2	24	1	12.5	
	Fuel Treatment Sludge Tank Heater		1	1	1	0.5	
	Lube Oil Reclaim Skid Separator Motor		1	20	1	10.4	
	Lube Oil Reclaim Skid Feed Pump		1	3	1	1.6	
	Lube Oil Reclaim Skid Electric Heater		1	64	1	33.4	
	Waste Oil Centrifuge		1	5	1	2.6	
	25t / 5t Powerhouse Bridge Crane		1	30	1	15.7	
	Water Pre-Heater (15 kW)		2	15	1	7.8	
	Portable Clean Lube Oil Transfer Pump		2	2	1	1.0	
	Pre-Lube Circulation Oil Pump		1	20	1	10.4	
	Engine Water Jacket Pre-Heating Pump		2	1	1	0.5	
	Oil/Water Separator Sump Pump		1	7.5	1	3.9	
	Spill Trays Sump Pump		1	7.5	1	3.9	
	Heat Recovery Circulating Pump		2	40	1	20.9	
	Starting Air Compressor (Electric) Skid		1	10	1	5.2	
	Starting Air Compressor (Diesel) Skid		1	10	1	5.2	
	Door Heater		1	0.5	1	0.3	
	Electric Unit Heater		1	0.5	1	0.3	
	Control Room HVAC Unit		1	5	1	2.6	
	Switchroom Ventilation (AC) Unit		1	10	1	5.2	
	Mechanical Bay Area Ventilation Unit		1	5	1	2.6	
	Powerhouse Make-Up Air Unit		2	30	1	15.7	
	Mechanical Bay Area Exhaust Fan		1	0.5	1	0.3	
	Vertical Lift Door		1	2	1	1.0	
	Modulating Motorized Relief Damper		3	1	1	0.5	
Sub-total - Generator						174	174
Misc. Heating & Lighting						30	
Temporary Accommodation	Heating appliances					30.0	
	lighting					10.0	
Sub-total - Temporary & Miscellaneous						80	80
Contingency							192
<b>Total</b>							<b>2000</b>