Red Dog Mine 2012 Annual Report for State of Alaska Waste Management Permit No. 0132-BA002 Reclamation Plan Approval F20099958 February 28, 2013



# Contents

Introduction Biomonitoring Program Annual Biomonitoring Report	1
Annual Summary of Biomonitoring Water Quality Sampling	1
Permafrost and Sub-permafrost Groundwater Monitoring Annual Data Report	
Mine Water Management Mine water flows	
Mine water quality	3
Mine Water and Load Balance	3
Visual inspections of mine water systems	3
Reagents Consumed in Water Treatment in 2012	3
Fish weir inspections	3
Significant activities in mine water management	3
Waste Rock Management Quantities, placement locations and analysis of waste rock	
Results of waste rock geochemical monitoring	4
Visual inspections of waste rock facilities	4
Significant activities in waste rock management	5
Geotechnical Hazards Tailings Management Tailings pond elevation	5
Visual inspections of tailings facilities	6
Significant activities in tailings management	6
Inert Solid Waste Landfills Quantities of inert solid waste	
Visual inspections of the inert solid waste landfills	6
Significant activities in inert solid waste landfills	6
Mining and Milling Activities Mining Activities	
Significant activities in Mining and Milling	7
Reclamation Activities Area Disturbed and Reclaimed	
Reclamation Research	7
Reclamation Monitoring	7
Significant reclamation activities	8
Dust	
Dust monitoring activities	
Wildlife interactions	
Financial Assurance Closing	

# List of Tables

Table 1. Water Management Flows	2
Table 2. Tailings Produced during the reporting period	
Table 3. Tailings Pond Water Elevation	
Table 4 Ore Mined During the Reporting Period	
Table 5. Ore Milled During the Reporting Period	
Table 6. Area Disturbed in 2012	7
Table 7. Barrel Test and Oxide Stockpile Runoff Results	8

# Appendices

Appendix A Biomonitoring Water Quality Sample Results for 2012

Appendix B Mine Water Quality Sample Results for 2012

Appendix C Waste Rock Production Summary Fourth Quarter 2012

Appendix D Oxide Stockpile Full-Scale Cove System 2011-12 Annual Performance Monitoring Report

Appendix E Red Dog One Year Mine Plan 2013

Appendix F 2012 TDS Management Plan Progress Report & Updated Management Plan for NPDES Permit AK-003865-2

Appendix G 2012 Annual Date Report for the Long-Term Permafraost and Groundwater Monitoring Program

### Introduction

This report has been prepared to fulfill the quarterly reporting requirements of Red Dog Mine's obligations under the State of Alaska Waste Management Permit No. 0132-BA002 and the Red Dog Mine Reclamation Plan Approval F20099958.

This report covers the time period from January 1, 2012 through December 31, 2012, including quarterly data from October 1, 2012 through December 31, 2012

The report addresses mine water management, waste rock management, tailings management, inert solid waste landfills, mining and milling activities, reclamation activities and wildlife interactions which occur throughout the reporting period.

When appropriate updated plans will be provided with the report and recommendations will be made to modify reporting requirements or the underlying permit conditions.

#### **Biomonitoring Program**

#### Annual Biomonitoring Report

Al Ott and Bill Morris of the Alaska Department of Fish and Game prepared a draft biomonitoring report that has been reviewed and commented on by Red Dog. The report has not been finalized as of the date of this report. Once the final biomonitoring report for 2012 has been finalized, Red Dog will provide the final report to the Large Mine Permitting Team.

#### Annual Summary of Biomonitoring Water Quality Sampling

Results of monthly samples of Biomonitoring water quality for the period can be found in attached electronic file, *Red Dog Biomonitoring Water Quality Analyses 2012.xlsx*, and in Appendix A Biomonitoring Water Quality Sample Results for 2012

Biomonitoring water quality is analyzed using Water Quality Profile I from Table 2-7 of the Red Dog Mine Waste Management, Reclamation and Closure Monitoring Plan. The electronic file has a pivot chart with filters to allow the charting of any Profile I analyte for any biomonitoring station.

No unusual trends in the biomonitoring water chemistry were noted during the year other than the seasonal increase in metals due to deceasing water flows and increases or decreases related to freshet.

#### Permafrost and Sub-permafrost Groundwater Monitoring

#### Annual Data Report

The annual data report for the Long-Term Permafrost and Groundwater Monitoring Program is attached to this report in Appendix G 2012 Annual Date Report for the Long-Term Permafraost and Groundwater Monitoring Program

## **Mine Water Management**

### Mine water flows

Table 1. Water Management Flows, shows the cumulative flows for each month in the reporting period and total flows for the 2012 calendar year.

## **Table 1. Water Management Flows**

Location	Oct-12	Nov-12	Dec-12	Total 2012
Bon's Creek Total Flow	42,280,00	14,780,000	7,225,000	175,378,000
Mine Water Collection Sump Total Flow	43,030,000	8,309,000	13,340,000	320,000,000
Main Dam Seepage Pumpback	61,210,000	49,530,000	27,650,000	514,700,000
Reclaim Flow to Mill	267,700,000 <sup>1</sup>	183,800,000 <sup>1</sup>	215,300,000 <sup>1</sup>	1,287,100,000 <sup>1</sup>
WTP #1 Influent from Reclaim	42,410,000	16,600,000	18,790,000	183,800,000
WTP #1 Influent from Mine Water Collection	0	0	0	9,900
WTP #1 Influent from MWD	13,157,000	9,546,000	3,795,000	26,498,000
WTP #1 Clarifier Underflow Sludge To Tails	420,000	1,400,000	1,946,000	4,201,000
WTP #1 Effluent to Sand filter/Discharge	0	0	0	0
WTP #2 Influent from Reclaim	0	0	0	1,104,100,000
WTP #2 Sludge Discharge To Tails	0	0	0	38,331,000
Sand Filter Effluent Discharged to Red Dog Ck	0	0	0	311,020,000
WTP #3 Influent from MWD	2,203,000	0	0	46,484,000
WTP #3 Influent from Mine Water Collection	0	0	0	0
WTP #3 Total Effluent	2,203,000	0	0	46,484,000
MWD to Pit	1,010,000	31,000	0	1,953,000
Treated Water to Pit	49,346,000	117,000	0	436,083,000
East Overburden Sump	2,270,000	830,000	120,000	24,640,000
West Overburden Sump	2,570,000	1,330,000	160,000	35,160,000
Natural Gas Water	0	0	0	0

Notes to Table 1: 1. The flow meter for the reclaim water to the mill is currently bypassed because of operational requirements. As a result, the reported flows are significantly more than reported. The monthly flow of Reclaim Water to the Mill is usually 290,000,000 to 300,000,000 gallons per month. A plan is being developed to replace or move the flow meter.

Water Treatment Plant #3 was shut down for the season on October 5, 2012. In the interest of trying to maximize the efficiency of treating water from the Main Waste Dump (MWD), piping was installed to allow MWD water to continue to be treated along with Reclaim water in WTP #1 over the winter. MWD water does not freeze over the winter an can be treated year round. Monthly sampling and analysis of the MWD that is treated in WTP #1 began in October 2012 and will continue until WTP #3 resumes seasonal treatment of MWD in Spring 2013.

There were no unusual, non-seasonal changes in flows in the quarter.

## Mine water quality

Results of monthly samples of mine water quality for the period can be found in attached electronic file, Red Dog Mine Water Quality Analyses 2012.xlsx, and in Appendix B Mine Water Quality Sample Results for 2012 2. Mine water quality is analyzed using Water Quality Profile II from Table 2-7 of the Red Dog Mine Waste Management, Reclamation and Closure Monitoring Plan.

Seasonal changes in concentrations in mine water quality occur because of flushing of metals from waste stockpiles in the spring, rain events, drought periods and low flows in winter. Spring time flushing generally causes an increase in the very soluble metals. Rain events can have effects similar to spring time flushing depending on the magnitude of the event. Drought periods often cause the concentrations of metals in the streams to increase because of a reduction in dilution. Trending charts of any Profile II analyte and location can be plotted from the pivot chart tab of the electronic file.

## Mine Water and Load Balance

A mine water balance is maintained at the Mine in GoldSim, a computer simulation program. An electronic copy of the 2012 GoldSim water balance is presented in an electronic file. Viewing the file requires GoldSim Player. The GoldSim Player is free and can be downloaded from <a href="http://www.goldsim.com/Web/Downloads/">http://www.goldsim.com/Web/Downloads/</a> A summary of annual flows and their loads for several chemical parameters are presented in an electronic file, Red Dog Mine 2012 Water and Mass Balance Estimates.xlsx.

The largest source of total dissolved solids (TDS) in the tailings impoundment water continues to be the Main Waste Stockpile. Red Dog has two major efforts underway to reduce the TDS entering the pond from the Main Waste Stockpile, our cover system plans for the Main Waste Stockpile and an investigation into improved methods of intercepting flows from the Main Waste Stockpile for treatment prior to the flow entering the tailings impoundment. See the attached 2012 TDS Management Plan Progress Report & Updated Management Plan for NPDES Permit AK-003865-2 in Appendix F 2012 TDS Management Plan Progress Report & Updated Management Plan for NPDES Permit AK-003865-2 .

#### Visual inspections of mine water systems

No unusual conditions were identified during visual inspections of mine water system during the quarter

#### Reagents Consumed in Water Treatment in 2012

Red Dog Mine Reclamation Plan Approval F20099958 requires the following be provided in the annual report.

- Total volume of water treated in WTP#2; 1.1 billion gal
- Total quantity of flocculant used in WTP#2; can't be separated from WTP1
- Total quantity of lime used in WTP#2; can't be tracked separately from the other WTPs.
- Total quantity of sodium sulfide used in WTP#2; can't be separated from WTP1
- Quantity of any other chemicals used in significant quantities in WTP#2; none.
- Total quantity of flocculant used in WTP#3; none.
- Total quantity of lime used in WTP#3; and, can't be tracked separately from the other WTPs.
- Quantity of any other chemicals used in significant quantities in WTP#3. none

Total lime used throughout season for WTP1, WTP2, and WTP3 = 11,416 metric tonnes. Total flocculent used throughout the season was 38 metric tonnes for WTP1 and WTP2, most of which is for WTP2. Total sodium sulfide used for the season was 321 metric tonnes, most of which was used for WTP2.

#### Fish weir inspections

The Fish Weir was not inspected during the quarter.

#### Significant activities in mine water management

Work was completed on the MWD water collection system that allowed a portion of the MWD water to be collected and subsequently treated in WTP #1 over the winter. The effluent from WTP #1 is a combination of treated Reclaim and MWD water.

#### Waste Rock Management

#### Quantities, placement locations and analysis of waste rock

As per Red Dog Mine Waste Management, Reclamation and Closure Monitoring Plan, Section 2.4 Waste Rock Management, the management of waste rock including quantities, locations and analysis of waste rock are reported in Appendix C Waste Rock Production Summary Fourth Quarter 2012 2.

#### Results of waste rock geochemical monitoring

Other than blast hole analyses, no additional geochemical monitoring was conducted on waste rock materials during the reporting period.

#### Visual inspections of waste rock facilities

Weekly waste stockpile inspections for quarter 4, 2012, began on Oct 3, 2012, and ended on Jan 1, 2013. Dig face inspections were carried out on waste shots to confirm waste characteristics and suitability for designated stockpile locations. Phase 3 clean waste stockpile is still being used as a low grade ore storage area (SP4178). The primary waste storage site is now the Main Pit Dump 2, 3, 4, SEA/SEP & MWD (MPD2/MPD3/MPD4/South East access/South East Pit & Main Waste Dump). There has been minimal strategic placement of reactive waste. We are still in the process of creating the access to the 850 bench dump platform. For the fourth quarter 2012 - 2,346,249 tonnes of waste were hauled from the Aqqaluk Pit.

#### Main Waste Stockpile

436,568 tonnes of "Other Waste", "Most Reactive Waste", and "Construction Waste" (MWD) were taken to the MWD stockpile this quarter. Material taken to the Main Waste Stockpile was from Ikalukrok, Okpikruak, Siksikpuk, Kayak, Otuk and mixed formations (igneous intrusive & kayak shale contact). Most of this material is planned to be used as an interim "cover sponge" to reduce infiltration.

#### Main Pit Stockpile 2

116,440 tonnes of "Other Waste" and "Most Reactive Waste" were taken to the Main Pit Stockpile (MPD2) this quarter. Material taken to the Main Pit Stockpile 2 was from Ikalukrok and mixed formations.

#### Main Pit Stockpile 3

24,190 tonnes of "Other Waste" and "Most Reactive Waste" were taken to the Main Pit Stockpile (MPD3) this quarter. Material taken to the Main Pit Stockpile 3 was from Ikalukrok, Siksikpuk and mixed formations (igneous intrusive & kayak shale contact).

#### Main Pit Stockpile 4

209,674 tonnes of "Other Waste" and "Most Reactive Waste" were taken to the Main Pit Stockpile 4 (MPD4) this quarter. Material taken to the Main Pit Stockpile was from Ikalukrok, Okpikruak, Siksikpuk and mixed formations (igneous intrusive & kayak shale contact).

#### Landfill Stockpile

5,002 tonnes of "Other Waste" and "Most Reactive Waste" (LAN) from the Ikalukrok, Okpikruak, and Siksikpuk formations were used to cover the Landfill.

#### ARD Project

246 tonnes of "Construction waste" (ARD) from the Ikalukrok formation was utilized in building pipe ramps for the ARD project.

#### Crusher Pad (CPD)

1,394 tonnes of "other waste" and "most reactive waste" (CFD/Const) from the Ikalukrok and Okpikruak formations was used to maintain the driving surface of the Crusher pad.

#### Berms

328 tonnes of "construction waste" from the Ikalukrok was used to build up the berm along the road to the prism monitoring hut below "Carters corner".

## Shelly Creek Ramp

23,206 tonnes of "other waste", "construction waste", and "most reactive waste" from the Ikalukrok formation was used to re-route the Shelly Creek Ramp.

## South East Pit & Access

1,487,545 tonnes of "other waste", "most reactive waste" and "construction waste" from the Ikalukrok, Okpikruak, Siksikpuk, Kayak, and mixed formations were used to build an access to the South East Pit and 3 successive lifts.

## Tailings Pipe Bench

33,538 tonnes of "Construction Waste" from the Ikalukrok, Siksikpuk, and Kayak formations were used to build a tailings pipe bench for the water treatment/ARD project

## Significant activities in waste rock management

No new significant activities in waste rock management occurred during the quarter.

## **Geotechnical Hazards**

Because mining in the Main Pit has ceased and all ore is being extracted from Aqqaluk, issues with geotechnical hazards have essentially ceased because development of Aqqaluk has not extended to a depth where geotechnical hazards are expected to begin to occur. Additionally, occurrence of geotechnical hazards into hazards are being factored into the design of the Aqqaluk pit and factoring geotechnical hazards into Aqqaluk pit design will reduce current and future occurrence of geotechnical hazard. Though the possibility of the occurrence of geotechnical hazards has been ongoing monitoring for the development of geotechnical hazards continued during the reporting period.

## **Tailings Management**

Table 2. Tailings Produced during the reporting period, shows the tonnes of tailings produced and the lead, zinc and iron content of the produced tailings for the quarter and the 2012 calendar year.

		Analysis		
Month	Dry Tonnes Tailings	%Pb	%Zn	%Fe
Oct-2012	265,000	1.0	4.4	2.4
Nov-2012	217,000	1.5	4.7	3.1
Dec-2012	206,682	2.2	4.4	4.8
2012 Total	2,441,000	1.6	3.9	3.8

# Table 2. Tailings Produced during the reporting period

There were no additional, non-routine geochemical analyses conducted on tailings during the reporting period.

# Tailings pond elevation

Table 3. Tailings Pond Water Elevation

shows the surveyed Tailings Pond water levels for the reporting period. During the period the crest of the tailings dam was 970 feet above Mean Sea Level (MSL) and the allowable freeboard of the tailings dam was 5 feet below the crest of the tailings dam. The pond level is not supposed to be higher than 5 feet below the crest of the tailings dam which for this reporting period is 965 feet MSL. The tailings pond water elevation did not exceed 965 feet MSL.

Survey Date	Pond Level Feet above MSL
10/04/2012	961.53
10/11/2012	962.28
10/18/2012	962.50
10/25/2012	962.58
11/01/2012	962.78
11/08/2012	962.95
11/15/2012	963.09
11/22/2012	963.12
11/29/2012	963.07
12/06/2012	963.25
12/13/2012	963.19
12/20/2012	963.18
12/27/2012	963.51

# **Table 3. Tailings Pond Water Elevation**

## Visual inspections of tailings facilities

No unusual findings were observed during routine daily and weekly inspections of the tailings facility during the 4<sup>th</sup> quarter.

#### Significant activities in tailings management

No significant activities occurred in the quarter that affected tailings management.

#### Inert Solid Waste Landfills

Red Dog operates two inert solid waste disposal areas at the mine site. One facility is located on the Main Waste Stockpile and is the primary inert solid waste disposal area. The second site is located just south of the incinerators along the shore of the tailings pond. Only incinerator waste is deposited at this location.

#### Quantities of inert solid waste

Approximately 30,000 cubic yards of material as determined by survey volume was placed in the Main Waste Stockpile inert solid waste landfill at the mine.

#### Visual inspections of the inert solid waste landfills

There were no significant activities or changes to inert solid waste landfills during the reporting period. During the November visible inspection of the inert solid waste landfill some food containers were observed at the main waste landfill. Some animal activity was also observed (a fox in November and a raven in December). No other negative findings or wildlife interactions were noted either during routine inspections or otherwise.

#### Significant activities in inert solid waste landfills

No significant activities occurred in the inert solid waste landfills during the quarter.

# **Mining and Milling Activities**

#### **Mining Activities**

Table 4 Ore Mined During the Reporting Period

shows the tonnes of ore hauled to mill feed stockpiles each month during the reporting period.

# Table 4 Ore Mined During the Reporting Period

Date	Ore Mined, tonnes
Oct-2012	192,975
Nov-2012	341,213
Dec-2012	316,230
2012 Total	3,746,526

Table 5. Ore Milled During the Reporting Period shows the tonnes of ore fed to mill grinding each month during the reporting period.

# Table 5. Ore Milled During the Reporting Period

Date	Ore Milled, tonnes
Oct-2012	367,503
Nov-2012	316,642
Dec-2012	315,986
2012 Total	3,575,584

## Significant activities in Mining and Milling

There were no significant activities in mining and milling during the quarter. The updated 2013 Mine Plan is included in Appendix E Red Dog One Year Mine Plan 201.

### **Reclamation Activities**

#### Area Disturbed and Reclaimed

In the calendar year 2012 an additional 27.0 acres were disturbed within the mine air permit boundary. The areas are listed in Table 6. Area Disturbed in 2012. Maps showing the disturbed areas at a scale of 1:2400 are included in this report.

# Table 6. Area Disturbed in 2012

Disturbed Area	Acres
DD-2 Quarry (State Land)	1.2
Aqqaluk	24.6
Tailings Abutment	1.2
Total 2012 Disturbance	22.4

#### **Reclamation Research**

O'Kane Consultants Inc. reported the second year performance of the Oxide Stockpile cover system in the report in Appendix D Oxide Stockpile Full-Scale Cove System 2011-12 Annual Performance Monitoring Report . All indications are that the cover system is performing as designed.

#### **Reclamation Monitoring**

Barrel tests of Okpikruok and Kivilina formations were begun in the summer of 2012. One set of water samples was taken from the Kivilina and Okpikruok in 2012. Barrel testing of Okpikruok and Kivilina formation materials is ongoing. The purpose of the barrel tests is to test the chemical suitability of Kivilina and Okpikruok formations for future cover materials. Samples of runoff water from the surface of the cover were also taken in 2012. The purpose of sampling runoff water from the Oxide Stockpile is to determine if metals are present in Oxide Stockpile runoff waster in concentrations that cause environmental concerns.

The results of both the barrel test and Oxide Stockpile runoff analysis are show below in Table 7. Barrel Test and Oxide Stockpile Runoff Results

Analyte	Barrel Test		Oxide Stockpile Runoff			
	Okpikruok	Kivilina	Site 01	Site 02	Site 03	Site 04
Iron	0.27	< 0.05	0.02	0.02	< 0.05	< 0.05
Magnesium	29.7	7.1	26	21.8	24.9	24.6
Potassium	14.3	1.1	1	1.1	1.9	1.9
Sodium	20.5	3	0.5	0.6	0.6	0.6
Calcium	93.7	174	183	197	348	333
Lead	0.0041	0.011	0.026	0.034	0.012	0.013
Copper	0.1626	0.0006	0.0054	0.0557	0.0065	0.0062
Selenium	0.0128	0.1259	0.0632	0.0407	0.0507	0.0251
Aluminum	4.75	0.0008	0.0111	0.0166	0.0112	0.0085
Manganese	0.93	0.0007	0.0015	0.0019	0.0012	0.0012
Cadmium	0.893	0.033	0.952	0.0045	0.961	0.66
Zinc	36.5	0.0873	0.0053	1.71	0.0046	0.005
Sulfate	285.2	306.18	458.22	480.99	< 12.5	< 12.5
Chloride	102.09	4.02	< 12.5	2.87	814.1	746.6
Ammonia (As N)	2.5	0.4	0.1	0.1	0.2	0.1
Acidity as CACO3	110	< 20	< 20	< 20	< 20	< 20
Total Dissolved Solids	700	670	760	800	1330	1240

Table 7. Barrel Test and Oxide Stockpile Runoff Results

\* Analytical results are presented in mg/l

# Significant reclamation activities

Work continued in the fourth quarter to install an interim cover on the Main Waste Dump. The interim cover is being installed to reduce infiltration of precipitation into the Main Waste Dump. The interim cover is not the final cover which will be completed prior to, or during mine closure.

During the summer of 2012 Cedar Creek Associates conducted a site visit at the Red Dog Mine to review the status and progress of revegetation efforts on the Oxide Stockpile. A report detailing the results of the visit and Cedar Creek's conclusions and recommendations is currently being prepared. Once the report is finalized, a copy of the final report will be provided to the LMPT.

#### Dust

# Dust monitoring activities

Dust monitoring activities during the 4th Quarter included routine Visible Emissions Evaluations as required by the Title V Operating Permit, regular dust fall jar analysis, and continuous data collection by the TEOMs at the Tailings Dam and PAC. Evaluations of new formulations of extreme low-temperature dust control products are currently in process; upon confirmation of minimal environmental and human health risks of each product, on-site testing will occur to determine applicability to site conditions, and effectiveness at reducing fugitive dusting from roadways and exposed areas.

# Wildlife

#### Wildlife interactions

No significant wildlife interactions occurred during the reporting period.

#### **Financial Assurance**

Teck does not feel that the changes from the 2007 mine plan to the current mine plan require substantive changes to the financial assurance for this year. Earthwork conducted to install an interim cover on the Main Waste Dump do not affect the costs to close the Red Dog Mine.

# Closing

Please accept this as the 4<sup>th</sup> Quarter 2012 and 2012 Annual Report for State of Alaska Waste Management Permit No. 0132-BA002 and Reclamation Plan Approval F20099958. If there are any questions, please contact Chris Menefee at (907) 426-9138 or myself at (907) 426-9127.

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Sincerely, Teck Alaska Incorporated

inhich for 1. LETIENT

Henri Letient, P. Eng. General Manager

Cc Tim Pilon, ADEC, Fairbanks Pete McGee, ADEC, Fairbanks Scott Pexton, ADNR, Anchorage Brent Martellaro, ADNR, Fairbanks Jim Vohden, ADNR/DMLW, Fairbanks Sharmon M. Stambaugh, ADNR, Anchorage Al Ott, ADF&G, Fairbanks