

# WOLVERINE MINE

# QUARTZ MINING LICENSE QML-0006

# 2013 ANNUAL REPORT

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Appendix A: Monthly Tailings Monitoring Reports

# 1 Introduction

This Annual Report has been prepared to satisfy requirements contained within Quartz Mining License QML-0006 (QML) Condition 10.5 for activities that occurred during the period of January 1 to December 31, 2013 at the Wolverine Mine.

Table 1-1 outlines the QML Annual Report documentation requirements and the corresponding report section where the information is provided herein. A Socio-Economic Assessment summary is provided in Section 9 of this report, to satisfy requirements of the Environmental Assessment Screening Document (issued September 20, 2006 by the Development Assessment Branch, Government of Yukon).

 Table 1-1:
 QML Annual Report Information Requirements and Corresponding Report Section

QML Section	Requirement	Section
10.5 a)	A summary of mining activities at the mine.	2.3
10.5 b)	A map showing all structures, works and installations associated with the Undertaking.	2.1
10.5 c)	The total amount of ore and waste removed from the mine.	2.7
10.5 d)	The total amount and the average head grade of ore processed through the mill.	2.7
10.5 e)	The total amount and grade of all stockpiled ore.	2.7
10.5 f)	The total amount and grade of concentrate produced, stockpiled, and transported from the Undertaking.	2.7
10.5 g)	As-built drawings of the mine and of all structures, works and installations constructed or altered in the mine.	2.3
10.5 h)	Details respecting any action taken as a result of the recommendations made by the engineer in relation to the inspection referred to in paragraph 10.1.	3
10.5 i)	A summary of any updates to estimates of ore reserves and mine life, including reserve category, tonnage and grade.	2.4
10.5 j)	A summary of any underground stability incidents.	2.5
10.5 k)	A summary of paste backfill placement activities conducted and their locations in the mine.	2.6
10.5 l)	A summary of humidity cell tests undertaken for waste rock and paste backfill.	2.6
10.5 m)	A summary of quantity and related analysis of leachate collected from paste backfill.	2.6
10.5 n)	The total amount of tailings deposited in the tailings impoundment.	2.2
10.5 o)	An evaluation of the performance of the tailings facility, including an estimate of	2.2

QML Section	Requirement			
	remaining available storage capacity in the facility.			
10.5 p)	The data generated from the full depth sampling of the tailings.	2.2		
10.5 q)	A summary of any hydrogeology studies undertaken and related analysis of these data, including groundwater flow pathways as influenced by underground workings.	4		
10.5 r)	A summary and evaluation of data results from the field pilot test of the bio-pass system.	8		
10.5 s)	A summary of surface water quality monitoring, including any acute lethality testing conducted.	5.1		
10.5 t)	A summary of groundwater quality monitoring in wells downslope of the mine workings.	5.2		
10.5 u)	A summary of the programs undertaken for environmental monitoring and surveillance as outlined in the Monitoring and Surveillance Plan and the Wildlife Protection Plan, including an analysis of these data and any action taken or adaptive management strategies implemented to monitor or address any changes in environmental performance.			
10.5 v)	A summary of progressive and ongoing reclamation activities.	8		
10.5 w)	A summary of proposed development and production for the coming year.	0		
10.5 x)	A summary of activities related to care and maintenance of the Undertaking, including any temporary closure activities, if applicable.	8		
10.5 y)	A summary of spills and accidents that occurred as a result of the Undertaking.	6		
10.5 z)	A summary of the previous and projected use of the access road, including maintenance work conducted, a summary of the level of traffic, access control issues, wildlife incidents and other accidents, and upgrade or maintenance work planned for the upcoming year.	7		

### **1.1 Quartz Mining License Requirements**

All major and minor permits are in place for the Wolverine Mine, with all infrastructure located on YZC mineral claims. All QML requirements pertaining to monitoring and reporting were achieved in 2013, and the submissions to Yukon Energy, Mines and Resources (EMR) are summarized in Table 1-2. All plans and reports submitted to EMR are available on the EMR website: http://www.emr.gov.yk.ca/mining/wolverine.html.

#### Table 1-2:QML Submissions in 2013

Submission	Date Submitted
2012 Annual Report for QML-0006	30-Mar-13
2012 Annual Report for QML-0006: Wildlife Protection Plan	30-Mar-13
2012 Annual Report for QML-0006: Monitoring and Surveillance Plan	30-Mar-13
Reclamation and Closure Plan Update (2013-05)	17-Jul-13
Tailings Facility and Waste Rock Pad Inspection by Design Engineer (Klohn)	16-Aug-13
EBA Engineering Consultants Annual Inspections of the On-Site Earth Structures	16-Aug-13
Underground Geotechnical Inspection	16-Aug-13

# 2 2013 Mine Activities

Mine activities in 2013 focused on continuing milling and underground mine operations at full production, as well as continued underground development. However, due to poor metal values, the mine reduced to 75% (or ~1,400 tpd) beginning in July through to the end of the year.

#### 2.1 Mine Development – Surface Infrastructure

Figure 2-1 and Figure 2-2 provide the location of major surface infrastructure for the overall site, and at the industrial complex area, respectively. These figures are updates to the proposed construction figures provided in *General Site Plan V2011-05*.

There were no major construction activities associated with the mine development-surface infrastructure in 2013.

#### 2.2 Tailings Facility Activities

The total amount of tailings deposited into the tailings impoundment in 2013 was 260,213 tonnes tonnes, derived from 519,625 tonnes of ore and waste milled. In addition to the 407,464 tonnes deposited in 2010, 2011 and 2012, the total amount of tailings stored in the facility is estimated at 667,677 tonnes as of the end of 2013.

On August 31<sup>st</sup>, 2013 a bathymetry of the pond was conducted to get a more accurate estimate tailings volume to water volume ratio. The bathymetry resulted in an estimated tailings volume of 371,777 m<sup>3</sup>, translating to 339,262 m<sup>3</sup> of water based on the total surveyed volume of 711,040 m<sup>3</sup> (also completed on August 31<sup>st</sup>, 2013).

The tailings facility has performed as planned and as of December 31, 2013 was surveyed to contain 810,300 m<sup>3</sup>. As the ultimate tailings facility has a capacity of 1,513,900 m<sup>3</sup>, the available volume remaining is 47%. A full-scale water treatment plant is currently being designed and will be commissioned during the summer of 2015.



Picture 2-1: Tailings storage facility after dam lift construction project, looking east (top) and west (bottom).



Figure 2-1: Wolverine Mine General Site Plan End of 2013



Figure 2-2: Wolverine Mine Industrial Complex End of 2013

#### 2.3 Underground Mine

The primary objectives of underground development were to increase the number of stopes available for development to increase the production of ore and the extraction of waste safely and cost effectively. A number of initiatives were completed to facilitate increasing production, including:

- Acquisition of mining equipment to improve operational efficiencies;
  - 1 Maclean MEM-946 Bolter
  - 1 Sandvik DS311D Robolter
  - 2 Sandvik LH410 Scoop
  - 4 Mine Cat MC100E
- Review and optimization of the Ground Control Management Plan and other systems such as the paste fill system;
  - Wolverine GCMP 2013-001 : simplified ground support elements
  - Application of arched shotcrete fill fence: reduced construction time and cost
- establishment of grade cut-off criteria in mine planning to improve milling efficiencies;
  - Application of double blending procedure from underground and surface
  - Mine scheduling for heading by heading relate to grade of ore
- Use of controlled blasting for minimization of damaged ground surrounding underground openings to reduce ground supports and dilution; and,
- Plan of overhand, underhand, and side drift mining adjacent to paste fill, as well as retreat slashing to maximize ore recovery.

One main level and 5 sub levels were developed in 2013 with development of 18 lift headings over paste filled main drifts:

- Main level including ramp development: 1145 Level
- Sub level development between main level:
  - Wolverine: none
  - Lynx: 1310, 1290, 1250, 1170, 1210
- Lift headings over paste filled drift:
  - Wolverine: 1270 L4 & L5, 1250 L3, 1230 L3 & L4, 1210 L2, 1190 L2 & L3, 1170 L1 & L2
- Lynx: 1320 L1, 1310 L1, 1300 L1, 1260 L2 & L3, 1240 L2, 1220 L1, 1180 L2

The following drawings to illustrate the development completed in 2013 are provided below:

- Figure 2-3: Underground workings emphasizing 2013 development; and
- Figure 2-4: Paste backfill locations highlighted 2013 completion.







Figure 2-4: Overall 2013 Underground Development

#### 2.4 Updates to Estimates of Ore Reserves and Mine Life

An update was not determined for the ore reserve or mine life in 2013.

#### 2.5 Underground Stability Incidents

There were no reportable incidents related to underground stability in 2013.

#### 2.6 Paste Backfill

Paste and waste backfill placement underground continued in 2013 and the locations are shown in Figure 2-4. Every sill drives were filled with paste and lift drives were filled with paste and waste. In total, 146,850 cubic metre of underground space was filled with paste and waste in 2013. Details of humidity cell tests conducted for paste backfill analysis are provided in the *Wolverine Mine Monitoring and Surveillance Plan 2013 Annual Report*.

#### 2.7 Mill Operations

The total amount of ore removed from the mine in 2013 was 505,942 tonnes. All waste removed from the stopes were kept underground as backfill material. 150,419 tonnes of ore were from the Wolverine Zone and 355,523 tonnes were from the Lynx Zone. At the end of 2013, there was no ore stock piled on the pad, since mining ceased mid-December through to the end of the year.

A total of 519,625 (includes 13,683 tonnes left over from 2012) tonnes were milled in 2013 with the average head grades of 8.95% Zn, 0.92% Cu, 1.16% Pb, 1.10 g/t Au and 257 g/t Ag. The total amount and grade of concentrate produced, stockpiled, and transported from the Wolverine Mine is summarized in Table 2-1.

# Table 2-1:Total Amount and Average Grade of Concentrate Produced, Stockpiled and Transported<br/>by End of 2013

Concontrato	Cu (%) Db (%) Zp (%) Ag		Δ <i>α</i> (α/ <del>t</del> )		Dry Milled Tonnes		
Concentrate	Cu (///)	PD (%)	211 (%)	Ag (g/ l)	Produced	Stockpiled	Transported
Cu	18.96	2.91	7.53	3,663	16,854	59	16,797
Pb	3.29	18.77	9.96	1,670	11,814	507	11,307
Zn	0.71	1.97	44.71	272.69	83,962	3,334	80,628

Details of humidity cell tests conducted for mine waste rock and ore analysis are provided in the *Wolverine Mine Monitoring and Surveillance Plan 2013 Annual Report*.

# 3 Annual Engineering Inspections

Three engineering inspections occurred in 2013 and subsequent reports were submitted to EMR within 45 days of the inspections being completed. The results of these inspections are summarized below, as are the actions taken to date by YZC.

#### 3.1 Mill and Associated Infrastructure Inspection

An annual inspection of water retaining structures (excluding the tailings storage facility) was conducted on July 9<sup>th</sup> and 10<sup>th</sup>, 2013 by EBA Engineering Consultants, and included a visual inspection of the following structures:

- 1. Industrial Complex cut and fill slopes.
- 2. Industrial Complex Surface and Underground Water Treatment Sumps (1, 2, and 5) liners and slopes.
- 3. Industrial Complex Diversion Ditch 1 cut and fill slopes.
- 4. Industrial Complex Collection Ditches (2, 3, 4 and 5) liners, cut and fill slopes.
- 5. Mine Camp Pad Area including upper generator and water treatment pad, sewage treatment plant pad, and treated effluent pond liner, cut and fill slopes.
- 6. Temporary Waste Rock and Ore Storage Facility including seepage collection sump and ore waste stockpiles contained within the facility cut and fill slopes.
- 7. Land Treatment Facility (Hydrocarbon Contaminated Material) including runoff collection sump liners and fill slopes.
- 8. Vent Raise and Propane Tank Pad cut slopes.
- 9. Truck Shop Pad cut and fill slopes.

The report contained the recommendations for water bearing structures, summarized in Table 3-1 with the corresponding actions taken by YZC in 2013. EBA concluded that all of tension cracks, sloughing, erosion channels, and areas of settlement associated with the on-site earth structures pose no significant risk to the environment or human health and safety. However, these areas should be monitored and repaired as required.

# Table 3-12013 Inspection Recommendations and Actions taken for Mill and Mine Associated<br/>Infrastructure

Structure	Recommendation	Actions
Industrial Complex	Erosion channels on the cut and fill slopes surrounding the Mill, Fuel Tank Farm, and Genset Pad locations, caused by runoff, should be filled	Erosion channels along cut and fill slopes were filled, packed and graded, as required
Industrial complex surface and underground water treatment sumps (1, 2, and 5)	Sumps 2 & 5: settlement along the key trenches as the backfill material was not compacted during placement. No other issues at this area.	Sump 2 received a complete overhaul in 2013 – key trenches were re- positioned, stabilized, and packed to prevent settling/slumping and to allow more room around the sump for navigation. No work was completed on Sump 5 in 2013.
Collection Ditches 1, 3, 4 & 5	Ditch 1: Noticeable tension cracks and an area of depression along the upper portion of the ditch embankment still noticeable. Tension cracks should be filled to reduce the amount of water infiltration. Depression should be graded to match the upper and lower sections of the ditch embankment. Ditch 2: The inlet end of the culvert coming from the upper mill pad had been damaged and should be repaired to reduce the possibility of the inlet end plugging off	Monitored. Monitored – to be repaired in 2014

Structure	Recommendation	Actions
	Ditch 4: Many small tears along both sides of the ditch (caused by snow removal prior to spring run-off). Numerous tension cracks and areas of settlement located along the crest and downslope side of the ditch, and erosion channels throughout the downslope side that require filling in to reduce the amount of water infiltration, which may lead to instability of the embankment.	All the tears and punctures of the liner were repaired. Visible tension cracks and erosion channels along the downslope side were filled and compacted.
	Ditch 5: Discharge end of the culvert at the bottom of the MSE wall was almost completely plugged restricting runoff flow towards Sump 2.	Mud/silt that built up from runoff during 2013-2013 at end of culvert was again removed – will be monitored in spring 2014.
Mine camp pad area including upper generator and water treatment pad, sewage treatment plant pad and treated effluent pond	Noticeable tension cracks along the perimeter of the fill slope of the camp and should be monitored and repaired as required.	Tension cracks along the perimeter of the camp were monitored and filled as required

#### 3.2 Tailings Storage Facility Inspection

Weekly and monthly inspections of the tailings storage facility and associated infrastructure are conducted by site personnel. These inspections include routine inspections regarding the condition of the dam, liner, diversion ditches, seepage collection system and spillways and pipelines. Monthly monitoring of the dam conditions includes inflows, outflows and water level elevation. All 12 reports from January to December, 2012, are provided in Appendix A. Instrumentation (piezometers and inclinometers) is also downloaded monthly and the data reviewed for consistency.

The 2013 Annual Tailings Facility Physical Inspection was carried out by a design engineer with Klohn Crippen Berger from July  $16^{th} - 18^{th}$ , and the full report was submitted to Energy, Mines and Resources on August  $16^{th}$ , 2013, entitled *Wolverine Mine 2013 Tailings Facility Physical Inspection*. The inspection report concluded that the tailings facility is performing as expected. No significant observations were made that would suggest any concerns with the stability of the facility or its ability to store tailings as per the design. The report contained recommendations for future monitoring and work on the facility, summarized in Table 6-2 with the corresponding actions taken by YZC in 2013.

Table 3-2	2013 Inspection Recommendations and Actions taken for Tailings Storage Facility	ty
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Recommendation	Actions
Continue to operate the facility as described in the Operation, Maintenance and Surveillance Manual V2010-01. In particular, complete a bathymetry of	Since the report was issued, YZC has continued to operate the facility as per the OM&S Manual and is monitoring the facility monthly.
the tailings pond to confirm the volume of tailings currently being stored.	As recommended, a bathymetry of the tailings pond was completed on August $31^{st}$ , 2013, and resulted in an estimated tailings volume of 371,777 m <sup>3</sup> , and 339,262 m <sup>3</sup> of water.

Recommendation	Actions
Grade crest at north end to minimize water infiltration into observed cracks, and re-compact and close cracks. Inspect north end weekly to see if cracks have reopened.	A grader and compacter were mobilized to the north end of the facility to re-compact the edge and close the cracks. The cracks have not reappeared since, based on weekly monitoring.
Review water balance and finalize plan to construct water treatment plant.	YZC reviewed the water balance and discussed the plan to construct a full-scale water treatment plant (WTP) with Klohn on November 14 <sup>th</sup> , 2013. A finalized WTP design will be completed in 2014 and set to be commissioned in 2015.
Assess alternatives for relocating the reclaim barge and put a plan in place for this work.	Starting in spring, 2014, YZC intends to extend the discharge spigot to north end of facility to cover liner with tailings, and will then spigot from the Southeast to around the east side to progressively move the pond toward the north. Water depth at the barge and impoundment bathymetry will be regularly monitored. Barge will be relocated in 2015.

#### 3.3 Underground Mine Inspection

An inspection of the geotechnical aspects of the Wolverine underground mine was conducted by Woo Shin, P Eng. Guidelines and recommendations contained within the report continue to be followed for underground mine development activities.

Specific deficiencies identified are being addressed as follows:

- A. 03 Blasting The underground blasting is carried out twice per day at the end of each by designated blasters holding valid or provisional Yukon blasting permits. A new blasting procedure was successfully implemented in 2012 to minimize over break and to prevent misfires and sulphide dust explosions. No sulphide dust explosions have occurred since control measures were implemented and the number of misfires has gone down significantly. Gas testing is performed after blasting by workers in full SCBA to clear all headings of hazardous blast gases.
- B. 14.24 and 14.32 Explosive storage The underground has one powder magazine (YT-543) and one detonator magazine (YT-544) underground on the 1230 level. The new licensed magazines were completed in 2013 and are permitted to store up to one week supply of explosives. The old underground magazines were decommissioned. Three additional licensed magazines are located on surface for additional inventory.
- C. 15.04 and 15.47 Mine plan The technical services department maintains all mine plans and drawings on a central server. Driving layouts for all developments are provided to the mining contractor and posted in the underground mine office. The driving layouts include historic workings and diamond drill holes.
- D. 15.06 and 15.48 Ground control The ground conditions of the active mining areas are inspected daily by dedicated technical services personnel. Ground control was fully complied with and covered by the Wolverine Ground Control Management Plan, and specific ground support instructions are prescribed for all active mining areas on a round by round basis. The Wolverine GCMP published May 18, 2011 and revised August 5, 2012. The most recent version of the GCMP is dated October 7, 2013.
- E. 15.14 Fire protection and emergency preparedness The underground diesel equipment fleet is equipped with fire suppression equipment and fire extinguishers. Fire extinguishers are located

throughout the mine and clearly marked with signage. All fire extinguishers are checked monthly.

- F. 15.15 Refuge station The mine has one refuge station at the 1240m elevation. The refuge is in good condition and in compliance with regulations. The proper operation of the refuge station during an emergency is frequently reviewed with all workers. A second refuge station at the 1,160m elevation is currently under construction.
- G. 15.15 Communications The primary communication system underground is leaky feeder radio. The leaky feeder system was expanded in 2013. Mobile radios were installed in underground equipment and base station radios were installed in designated areas. The secondary communication system is Femco phone. Log books are maintained for ground support instructions, gas test readings and abnormal conditions affecting the safety of workers.
- H. 15.26 Escape ways The fresh air raise on the Lynx side of the ore body is equipped with ladders and landings and serves as an escape way to surface. The Lynx fresh air raise is located near the ramp and is accessible from all Lynx levels and the ramp. The fresh air raise on the Wolverine side of the ore body serves as fresh air bases during an emergency. The fresh air raise is equipped with Femco phones that can be used to communicate with surface during an emergency. Escape way upgrades, including new steel ladders and landings, were completed in 2012 and 2013 in the Lynx fresh air raise.
- I. 15.38 Electrical equipment The underground is serviced by both high and low voltage distribution systems. New underground electrical sub stations were purchased to replace older equipment rented from the mining contractor.
- J. 15.46 and 15.47 Dewatering The mine is dewatered by a series of sumps underground. Currently, the sumps pump mine water to a surface sump where the water is recycled for mill processing and underground drilling. Pump and pumping infrastructure, including development of new sumps and purchase of new pumps, was completed in 2013. The system is capable of handling the natural inrush of ground water and additional inrush during spring runoff.
- K. 15.58, 15.59, and 15.60 Diesel equipment The underground diesel equipment fleet is good working order. Weekly tailpipe testing is performed on each piece of equipment by maintenance personnel. New equipment was purchased in 2012 and 2013 to replace older equipment rented from the mining contractor. Preventative maintenance programs are in place to keep equipment in good working order. The required ventilation air flow volumes for each piece of equipment are posted in the workplace.
- L. 15.61 Ramp The mine is accessed by a single ramp driven at -15% from a surface portal at the 1,355m elevation to the current bottom of the mine at 1,145m elevation. The ramp is supported with steel culvert and sets at the portal and with rock bolts and shotcrete elsewhere underground. The ground support for all ramp development is outlined in the Wolverine Ground Control Management Plan (GCMP) and strictly followed. The support is regularly inspected by the geotechnical engineers and underground supervisors. Rehab work on the steel sets at the portal was completed in May and June 2013.
- M. 15.61 Ventilation The mine is ventilated by a main surface fan that pushes fresh air down a single raise from surface to 1,280m elevation where it splits into two separate raises for the Wolverine and Lynx sides of the ore body. Auxiliary ventilation fans pull fresh air from these raises into the active levels. All air exhausts out of the mine by the ramp. Ventilation upgrades, including the purchase of new auxiliary fans, was completed in 2012 and 2013. Raise development for ventilation will continue as the ramp is extended to new levels. Ventilation air flow volumes are adequate at all active levels and there is additionally capacity available from the main surface fan to ventilate additional future levels. Weekly ventilation surveys are performed by safety or technical services personnel and posted in the workplace for all workers to review.

# 4 Hydrogeology Studies

Hydrological flow rates in the underground workings have been monitored since 2006; however, in 2007 – 2008 the rates were calculated based on discharge volumes from treatment sumps, whereas in 2009 -2012 the flow rates were more accurately monitored using a flow meter on the discharge pipe. These rates are presented in Figure 4-1. Flow rate increases during the summer months were evident in all four years. The average daily flow rates decreased in 2013 to 290 m<sup>3</sup>/d from 316 m<sup>3</sup>/d in 2012. In 2013 recharge rates ranged from 141 m<sup>3</sup>/day (December 2013) to 586 m<sup>3</sup>/day (May 2013) and indicate seasonal variations consistent with previous years. However, these extremes are somewhat artificial, since the May inflow included runoff water from the industrial complex (flow meter was not online during May), and the December inflow was diverted through a line that did not have a flow meter. Both issues have been rectified and will be reported accurately moving forward.



Figure 4-1: 2009-2013 Daily Average Underground Recharge Rates

# 5 Environmental Monitoring and Surveillance

As per annual report requirements, summaries are provided below for:

- Surface water quality monitoring and acute lethality testing; and,
- Groundwater quality monitoring in wells downslope of the mine workings.

In addition, Section 5.3 provides information on construction monitoring. Specific information on wildlife monitoring can be found in the *Wolverine Project Wildlife Protection Plan 2013 Annual Report*, and on environmental monitoring and surveillance in the *Monitoring and Surveillance Plan 2013 Annual* 

*Report*. Specific water quality results (i.e., laboratory reports) for surface and groundwater test work are provided in *Type A Water Use Licence QZ04-065 2013 Annual Report*, which is available upon request.

#### 5.1 Surface Water Quality Monitoring and Acute Lethality Testing

Surface water quality monitoring for the purposes of baseline monitoring (as per Type A Water Use Licence QZ04-065) was taken at the locations and dates summarized in Table 5-1. A total of 190 sample sets were analyzed for physical parameters, TSS, dissolved and total metals (by ICP-MS) and mercury (by CVAS), as well as cyanide and dissolved organic carbon for select sampling sites (W16 & W31).

Because all underground water was pumped, untreated, to the tailings storage facility in 2013, there were no discharges to the environment, and thus no acute lethality testing conducted in 2013.

Sampling Site	January	February	March	April	May	June	July	August	September	October	November	December
L1	Е	23-Feb	А	А	А	11-Jun	1-Jul	11-Aug	8-Sep	5-Oct	А	А
W1	Е	Е	А	А	А	17-Jun	1-Jul	11-Aug	8-Sep	5-Oct	А	А
W8	Е	Е	А	А	А	9-Jun	1-Jul	11-Aug	8-Sep	5-Oct	А	А
W9	Е	Е	А	А	А	9-Jun	1-Jul	11-Aug	8-Sep	5-Oct	А	А
W12	E	E	А	А	А	15-Jun	5-Jul	2-Aug	6-Sep	7-Oct	13-Nov	8-Dec
W14	E	E	А	А	А	15-Jun	5-Jul	2-Aug	6-Sep	7-Oct	13-Nov	8-Dec
W15	21-Jan	13-Feb	12-Mar	14-Apr	28-May	25-Jun	8-Jul	22-Aug	30-Sep	6-Oct	15-Nov	15-Dec
W16	23-Jan	13-Feb	11-Mar	16-Apr	26-May	25-Jun	8-Jul	22-Aug	28-Sep	6-Oct	23-Nov	16-Dec
W21	4-Jan	27-Feb	9-Mar	1-Apr	11-May	7-Jun	17-Jul	5-Aug	10-Sep	10-Oct	16-Nov	10-Dec
W22	4-Jan	27-Feb	9-Mar	1-Apr	11-May	7-Jun	17-Jul	5-Aug	10-Sep	10-Oct	16-Nov	10-Dec
W31	D	D	D	D	24-May	29-Jun	22-Jul	18-Aug	21-Sep	20-Oct	D	D
W40	4-Jan	27-Feb	9-Mar	1-Apr	11-May	7-Jun	17-Jul	5-Aug	10-Sep	10-Oct	16-Nov	10-Dec
W71	7-Jan	D	D	2-Apr	11-May	7-Jun	21-Jul	5-Aug	20-Sep	11-Oct	10-Nov	10-Dec
W72	7-Jan	18-Feb	9-Mar	12-Apr	11-May	7-Jun	21-Jul	5-Aug	20-Sep	11-Oct	10-Nov	10-Dec
W73	7-Jan	18-Feb	9-Mar	3-Apr	11-May	12-Jun	21-Jul	5-Aug	20-Sep	11-Oct	10-Nov	10-Dec
W80	E	24-Feb	А	А	А	15-Jun	5-Jul	2-Aug	6-Sep	7-Oct	13-Nov	8-Dec
W81	30-Jan	10-Feb	12-Mar	14-Apr	28-May	25-Jun	8-Jul	22-Aug	13-Sep	6-Oct	15-Nov	15-Dec
W82	D	11-Feb	10-Mar	10-Apr	28-May	25-Jun	22-Jul	18-Aug	27-Sep	14-Oct	20-Nov	16-Dec
W85	25-Jan	11-Feb	10-Mar	3-Apr	27-May	30-Jun	8-Jul	22-Aug	28-Sep	13-Oct	16-Nov	16-Dec
T1	5-Jan	10-Feb	11-Mar	3-Apr	15-May	17-Jun	9-Jul	24-Aug	21-Sep	14-Oct	16-Nov	11-Dec

 Table 5-1:
 2013 Surface Water Monitoring Sites and Sampling Frequency

A = Site not sampled due to lack of safe access

D = Site dry (i.e., all water tied up in storage) or frozen through to ground

E = Transportation equipment under repair/Sampling equipment under repair

#### 5.2 Groundwater Quality Monitoring

Groundwater wells downslope of the mine workings were sampled monthly in 2013, as required by A Licence QZ04-065. Sampling dates for groundwater wells downslope of the mine workings are summarized in Table 5-2. Gaps in Table 5-2 represent dates when the wells were frozen, and samples were not able to be taken. A total of 24 sample sets were collected from the groundwater

wells downslope of the mine workings, and they were analyzed for physical parameters, TSS, dissolved metals (by ICP-MS) and mercury (by CVAS).

 Table 5-2:
 Groundwater Monitoring Sites and Sampling Frequency

Sampling Site	January	February	March	April	May	June	July	August	September	October	November	December
MW05-3A						24-Jun	14-Jul	08-Aug	27-Sep			
MW05-3B						24-Jun	14-Jul	08-Aug	27-Sep			
MW05-5A	06-Jan	08-Feb	08-Mar	15-Apr	19-May	12-Jun	09-Jul	04-Aug	09-Sep	18-Oct	22-Nov	
MW05-5B		09-Feb			19-May	12-Jun	09-Jul	04-Aug	09-Sep	18-Oct	22-Nov	
MW06-115						24-Jun	31-Jul	21-Aug	27-Sep			

#### 5.3 Environmental Monitoring for Construction Activities

There were no construction activities in 2013, hence environmental reporting was not required.

## 6 Environmental Incidents

There were five reportable spills (defined by the *Yukon Spills Regulations* as "a release of a hazardous substance to the environment in quantities above the spill reporting thresholds, or any amount of spill onto a watercourse") and six unauthorized discharges in 2012 (Table 6-1). Spills were immediately reported and full spill reports were submitted to EMR within 10 days of their respective occurrences. Follow up reports were submitted upon receipt of laboratory results, as required.

Date	Volume and Substance	Cause	Reporting and Follow-up Actions
24-Mar-13	~0.5 m <sup>3</sup> of used oil	Poorly positioned tote of used oil was struck by a vehicle	Initial Report: 26-Mar-13
3-May-13	~11 m <sup>3</sup> melt water from Ditch 4	Flow within Ditch 4 was restricted by ice built up	Initial Report: 11-May-13 Follow-up Report: 29-May-13
5-May-13	~16 kg CuSO4 reagent	Bag arrived at site with small tear, and spilt reagent during transport	Initial Report: 11-May-13
9-May-13	~0.5 m <sup>3</sup> discharge from Waste Rock Surface Sump	Drastic increase in ambient temperature caused quick melt	Initial Report: 16-May-12 Follow-up Report: 29-May-13
28-May-13	~0.6 m <sup>3</sup> of diesel	Faulty valve on storage tank slowly leaked over time	Initial Report: 11-Jun-13 Follow-up Report: 26-Jun-13
21-Jun-13	~745 kg CuSO4 reagent	Poorly stacked bags – delivery truck arrived at gate and a bag tipped over	Initial Report: 26-Jun-13
11-Oct-13	~1.5 m <sup>3</sup> Aero 5100 Promoter	Forklift operator punctured tote during transport	Initial Report: 17-Oct-13
26-Nov-13	~19.5 m <sup>3</sup> tailings filter water	Coupling failure due to deteriorated rubber insert	Initial Report: 6-Dec-13
28-Nov-13	~20 tonne Zinc	Truck driver drove off road	Initial Report: 9-Dec-13

Table 6-1:Environmental Incidents in 2013

Date	Volume and Substance	Cause	Reporting and Follow-up Actions	
	Concentrate			
6-Dec-13	Used water from Assay Lab -quantity unknown	Pump failure in sump tank	Initial Report: 12-Dec-13 Follow-up Report: 8-Jan-14	

## 7 Access Road Operation

Access road activities outlined in the sections below include the 2013 use, maintenance work, access control, and road upgrade or maintenance activities.

#### 7.1 2013 and Projected 2014 Use

In 2013, all freight and service vehicles entering and exiting site were recorded by site personnel and are summarized by month in Table 7-1. The total annual access road usage for 2013 was 4402 vehicles.

Month	Vehicle Traffic
January	430
February	457
March	500
April	564
Мау	596
June	492
July	326
August	270
September	304
October	331
November	286
December	171
Total	4727

#### Table 7-1: 2013 Access Road Vehicle Usage

In 2014, the number of concentrate haul trucks and service vehicles on the road is anticipated to be similar to 2013 with an average of 13 vehicles per day, and traffic peaking during the winter – spring transition period.

#### 7.2 2013 Work and Upgrades Conducted

Improvements to the access road included widening, raising and reducing grade, ditching and drainage control, decreasing side slopes, installation of berms, improvements to existing and additional pull out bays, surfacing and defining shoulders. Culverts and culvert extensions were installed and rip rap was placed at culvert entrances. All these works were ongoing throughout the

spring, summer and fall months as the need arose. However, no major construction works were carried out on the Access Road in 2013.

Sediment and erosion control was conducted throughout construction and included silt fence and geotextile installation, as required.

#### 7.3 Access Control Issues

There have been no issues with access control. There is one Wolverine Mine Access Control Gate at km 0.1, to prevent public use of the access road. A radio-controlled automated gate opener was installed at the gate at km 0.1 in 2008 and is currently in use. The Access Road is patrolled daily by on-site employees for on-going road maintenance. All vehicles entering and leaving the site are required to call security, via radio, to gain access/exit through the radio-controlled gate.

#### 7.4 Projected Road Construction Activities

YZC will continue with road improvements for concentrate haul trucks and service vehicle use as needed in 2014.

#### 7.5 Wildlife Incidents or Other Accidents

In 2013, there were a total of ten wildlife related incidents, of which seven were mortalities. Each incident is described in Table 2-7, along with the action taken by YZC employees.

Date	Incident / Issue	Action Taken
05-May-13	Ducks landed in the unfrozen area of the tailings pond	Bear bangers used to deter birds. Propane canon was programmed and set-up on barge. Also, 6 "gator guards" (plastic gator heads that float on the water and tied to a rope with anchor) were positioned evenly across the pond. No birds returned - very successful.
25-May-13	Young Black bear was seen at 25.7 km on the access road and came close to camp.	Bear Bangers were used to scare the bear away from camp. All recreational trails were closed for 2 days. Bear was not seen again.
31-May-13	At Km 17.5 a porcupine was hit by truck	Porcupine was removed from road and taken to the incinerator.
03-Jun-13	Porcupine struck by vehicle at KM 23	Porcupine was removed from road and taken to the incinerator.
03-Jun-13	Porcupine struck by vehicle at KM 23	Carcass was removed from road by and taken to the incinerator. Truck drivers and site personnel informed of incident and to obey speed limits and "slow" posted signs along road, particularly at KM 23.
30-Jul-13	KM18 - ptarmigan mortality	Appears it was struck by a truck on the road. Carcass was gone when returned to retrieve it.
02-Sep-13	Fox found deceased in pond at KM 27.2	Fencing fell down, so Fox was able to access the water - appears to have been unable to get out. Pond was pumped out immediately, and the fence was re-secured.

Table 7-2:2013 Wildlife Incidents

Date	Incident / Issue	Action Taken
13-Sep-13	Porcupine carcass found at KM 23 - assumed to be struck by haul truck during previous night	Carcass was incinerated. Site personnel and haul truck company was informed of incident and asked to obey posted speed limits.
23-Sep-13	5 Sandhill Cranes observed standing in Tailings pond	4 of the Cranes were deterred successfully using bear bangers, the 5th appeared to be injured and unable to fly away
24-Sep-13	2 cranes from previous day were deceased, 2 others appeared to be standing guard to deter Ravens.	Bear bangers were used to deter the remaining 2 cranes away from site. The propane cannon was re-programmed and re- commissioned on the tailings pond barge, which eliminated wildlife activity in the area for the remainder of the season

## 8 Reclamation Activities

An update to the Reclamation and Closure Plan (Plan) was completed in 2013, and was submitted to the Yukon Government Department of Energy, Mines and Resources on July 17<sup>th</sup>, 2013. As per *QML-0006 Section 8.0*, the updated Plan addresses care and maintenance of the mine site during a temporary closure period, and decommissioning of operations and reclamation of the site at final closure. The Plan was developed to address two possible scenarios for permanent decommissioning:

- 1. The mine site in its current state (Existing Condition), or
- 2. The mine after ore reserves are exhausted (Life of Mine).

Changes to the following surface facilities and infrastructure for mine operations were described:

- 1. Site Access Road
- 2. Airstrip
- 3. Fuel storage pad
- 4. Power generation and distribution
- 5. Process buildings
- 6. Assay laboratory
- 7. Wet shotcrete plant
- 8. Waste rock storage pads
- 9. Tailings facility
- 10. Truck shop
- 11. Mining office complexes
- 12. Administration, first aid and mine rescue buildings, dry, and Camp

The results of reclamation and closure research programs, such as progress made on the Biopass Pilot Testing program, were detailed in the Plan, and recommendations for further testing were described.

The extent to which disturbed areas (e.g., site Access Road, Ditches, Tailings facility, Industrial Complex) were progressively reclaimed through erosion mitigating techniques and seeding programs were also described, and illustrated using select photographs. The final security bond payment required to fully reclaim and close the mine for each of the three situations (i.e., Temporary Closure, Existing Condition closure, and Life of Mine closure) was estimated.

# 9 Socio-Economic Assessment

The EA Screening Report requires that YZC report annually on the following:

- The number of Yukoners and non-Yukoners employed at the mine; and,
- The value of goods and services procured from and payments made to Ross River, Watson Lake and the Yukon as a whole

Over the course of the year, 145 Yukoners and 366 non-Yukoners were employed at the Wolverine Mine by YZC and contracting companies. The contractors included ESS Support Services, Maple Leaf Loading and Procon Mining and Tunnelling Ltd. Wages from the local region are not included in the totals below.

The value of goods and services procured from and payments made to Ross River, Watson Lake and the Yukon as a whole in 2013 is estimated at \$31,700,000 (see Table 9-1). Approximately 80 Yukon vendors were utilized during the year. In addition to these YZC expenditures, the Kaska First Nation communities (Ross River, Watson Lake and three in northern BC), who formed joint venture businesses with ESS Support Services, Maple Leaf Loading, Procon Mining and Tunnelling, and Tu Lidlini Petroleum/Alberta Fuel Distributors shared payments in 2013 estimated at \$1.1 million.

# Table 9-1:Goods and Services Procured From and Payments Made to Ross River, Watson Lake<br/>and Yukon for 2013

Location	Amount
Ross River	\$264,000
Watson Lake	\$1,240,000
Yukon	~\$31,700,000
Kaska Joint Venture Businesses	~\$1,100,000

# **10** Project Development and Production for 2014

In 2014, stopes will continue to be developed for ore extraction. The projected amount of ore to be mined from underground workings is 486,972 tonnes (Table 10-1).

	2014 Mine Production Plan					
	Month	Tonnes				
	January	27,000				
	February	40,088				
(0	March	45,227				
	April	39,877				
Ĕ	Мау	47,018				
E	June	39,630				
ō	July	34,042				
Ĕ	August	48,366				
	September	39,599				
Ψ	October	43,259				
$\bigcirc$	November	41,017				
U	December	41,848				
	Total Ore Tonnes Mined	486,972				
	Tonnes/day Ore Mined	1,334				

#### Table 10-1: Planned Total Ore to be Mined from Underground in 2014

Projected concentrate production in 2014 is summarized in Table 10-2 for lead, copper and zinc concentrates.

#### Table 10-2: Concentrate Production Estimated for 2014

Variable	Dry Milled Tonnes
Copper Concentrate	17,360
Lead Concentrate	12,881
Zinc Concentrate	82,638
Total Concentrate Produced	112,878

# **Appendix A: Monthly Tailings Monitoring Reports**



# Month January 2013 Avg. Daily Temp. Average:-14.3 C; Low: -40 C; High: 3.3 C Mill Record Data: Mill Record Data: Total Monthly Tailings Deposition 23278 Dry Tonnes Average Monthly Tailings % Solids 20-24 % Total Monthly Tailings Slurry Volume 109,826.9 m³ Total Monthly Reclaimed Water Volume 114,080.5 m³

Site Measurements:		
Date of surveyJan 31, 2013 Pond Elevat	ion 1303.40 m Estimated volume	e <u>580,850</u> m <sup>3</sup>
Total Monthly Precipitation	14.8mm	I
Total Monthly Underground Input	<b>7,503</b> m <sup>3</sup>	
Total Monthly STP Effluent Input	<b>921.1</b> m <sup>3</sup>	
Total Monthly Industrial Complex Runoff Input	m³	
Total Volume from Seepage collection pond to Facility	m <sup>3</sup>	
Average Monthly Under drain Flow Rate	L/s	
Average Monthly Ditch A Flow Rate	No flow – see remark L/s	
Average Monthly Ditch B Flow Rate	L/s	
Total Monthly Volume Discharged from Water Treatment	m <sup>3</sup>	
Depth of Water at Reclaim Barge	mm	
See page 3 to Annotate Pond Diagram Pictures Taken? Y 🛛 N 🗌	Photo Sheet Attached? Y	N 🗌



#### **Special Remarks:**

- 1. Milling rates averaged 75 dry tonnes per operating hour with a record amount of tailings 17353 dmt reported to underground for paste fill. 23278 dmt of tailings reported to tsf.
- 2. Brief on any maintenance: Repairs done to reclaim water booster pump.
- 3. The snow/ice level in Ditch A is noticeably high, and the culvert from Ditch A may be blocked with ice. This culvert should be cleared using the steam truck prior to spring break-up



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger / Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	







Average:-8.4 C; Low: -16 C;

#### Month February 2013 Avg. Daily Temp. High: -1 C Mill Record Data: Total Monthly Tailings Deposition22,702Dry Tonnes 18.6 % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume 102,555.4 Total Monthly Reclaimed Water Volume \_\_\_\_\_ 121,515.9 m<sup>3</sup> Site Measurements: m³ Date of survey March 1, 2013 Pond Elevation 1303.5 m Estimated volume 588,400 mm Total Monthly Precipitation 0 m<sup>3</sup> Total Monthly Underground Input 6,132 m³ Total Monthly STP Effluent Input 538.2 m³ Total Monthly Industrial Complex Runoff Input 0 m³ Total Volume from Seepage collection pond to Facility 0 L/s Average Monthly Under drain Flow Rate \_\_\_\_\_1.21 No flow – see remark L/s Average Monthly Ditch A Flow Rate 3 Average Monthly Ditch B Flow Rate 0 L/s m³ Total Monthly Volume Discharged from Water Treatment \_\_\_\_ 0 Depth of Water at Reclaim Barge 24 Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Y 🖂 Photo Sheet Attached? \_\_\_\_\_ Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1784 dry tonnes per day, processing 49953 tonnes ore with 16,163 dmt of tailings reported to underground for paste fill and 22, 702 dmt tailings to TSF.
- 2. Brief on any maintenance: Routine checks including weekly inspections conducted.
- 3. It was discovered in February that ice within the first Ditch A culvert (there are two) has caused a backup of water in Ditch A. This culvert was located and steamed out on February 27<sup>th</sup> to encourage flow in anticipation of the spring melt.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger / Robin McCall	Signature		
Supervisor/Manager	Peter Nelega	Signature & Date	Peter Nelega	










Average:-14.3 C; Low: -30.2 C;

#### Month March 2013 Avg. Daily Temp. High: 1.2 C Mill Record Data: Total Monthly Tailings Deposition 32,718 Dry Tonnes **19.1** % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume 150,247.2 Total Monthly Reclaimed Water Volume 138,965.1 m<sup>3</sup> Site Measurements: m³ Date of survey April 1, 2013 Pond Elevation 1303.65 m Estimated volume 600,000 mm Total Monthly Precipitation 7.6 m<sup>3</sup> Total Monthly Underground Input 5,528 m³ Total Monthly STP Effluent Input 928.3 m³ Total Monthly Industrial Complex Runoff Input 0 Total Volume from Seepage collection pond to Facility 0 m³ L/s Average Monthly Under drain Flow Rate \_\_\_\_\_1.07 No flow – see remark L/s Average Monthly Ditch A Flow Rate 3 Average Monthly Ditch B Flow Rate 0 L/s m³ Total Monthly Volume Discharged from Water Treatment 0 Depth of Water at Reclaim Barge N/A Tape Frozen Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Y 🖂 Photo Sheet Attached? Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1965 dry tonnes per day, processing 60904 tonnes ore with 16,759 dmt of tailings reported to underground for paste fill and 32718 dmt tailings to TSF.
- 2. Brief on any maintenance: Routine checks including weekly inspections conducted.
- 3. Ditch A culverts (there are two) are being monitored closely no flow through observed yet.

150247



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger / Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	Peter Nelega April 7, 2013











#### Average: -6 C ; Low: -16.3 C; Month April 2013 Avg. Daily Temp. High: 5.4 C Mill Record Data: Total Monthly Tailings Deposition 23128 Dry Tonnes 15.2 % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume 141,708 Total Monthly Reclaimed Water Volume 134,305 m<sup>3</sup> Site Measurements: m³ Date of survey May 1, 2013 Pond Elevation 1303.80 m Estimated volume 610,000 mm Total Monthly Precipitation m<sup>3</sup> Total Monthly Underground Input 6,263 m³ Total Monthly STP Effluent Input 827.4 m³ Total Monthly Industrial Complex Runoff Input See remark 3 m³ Total Volume from Seepage collection pond to Facility **0** L/s Average Monthly Under drain Flow Rate 1.23 No flow – see remark L/s 4 Average Monthly Ditch A Flow Rate Average Monthly Ditch B Flow Rate 0 L/s m³ Total Monthly Volume Discharged from Water Treatment 0 Depth of Water at Reclaim Barge N/A Tape Frozen Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Y 🖂 Photo Sheet Attached? Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1753 dry tonnes per day, processing 52602 tonnes ore with 17662 dmt of tailings reported to underground for paste fill and 23128 dmt tailings to TSF.
- 2. Brief on any maintenance: Routine checks including weekly inspections conducted throughout month.
- 3. Runoff started in April. However, the flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input.

4. Ditch A culverts (there are two) are being monitored closely – no flow through observed yet.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger / Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	



Photo 1: Tailings containment looking North from top of	Photo 2: Looking south towards the reclaim barge
the dam.	pumps.
Photo 3: Frozen over no pond level recorded.	Photo 4: Barge Pump.
	1







# WOLVERINE PROJECT Tailings Facility Monitoring

# Monthly Impoundment Monitoring Report

Month _	May 2013		Avg. Daily Temp.	·	Avera	age: 4.2 C ; High: 19	Low: -7.9 .8 C	С;	
Mill Record	Data:								
Total Mon	thly Tailings Deposition		26697	Dry	Tonnes				
Average N	Ionthly Tailings % Solids		18.4	%					
Total Monthl	y Tailings Slurry Volume		136600.2	m³					
Total Monthly Re	eclaimed Water Volume		127916.8	m³					
Site Measurem	ents:			·					
Date of survey	May 29, 2013	Pond Elevation	1304	.61	m	Estimated	volume	675,000	m³
	Total Monthly F	Precipitation	8.6						
	Total Monthly Underg	round Input	18,153				m³		
	Total Monthly STP Ef	fluent Input	635.3				m <sup>3</sup>		
Total Mor	thly Industrial Complex I	Runoff Input	See remar	'k 3			m³		
Total Volume from	m Seepage collection por	nd to Facility	6,832.5				_ m³		
Ανε	erage Monthly Under dra	in Flow Rate	2.42				L/s		
	Average Monthly Ditch	A Flow Rate	8.00				L/s		
	Average Monthly Ditch	B Flow Rate	7.20				L/s		
Total Monthly Volun	ne Discharged from Wate	r Treatment	0				m³		
	Depth of Water at Re	eclaim Barge	28' 4"				- Ft		
See page 3 to Annota	ate Pond Diagram								
Pictures Taken? Y	N	Pł	noto Sheet Attach	ned?			Y 🖂	N 🗌	



#### **Special Remarks:**

- 1. Milling rates averaged 1698 dry tonnes per day, processing 52647 tonnes ore with 14902 dmt of tailings reported to underground for paste fill and 26697 dmt tailings to TSF.
- 2. Brief on any maintenance: Piece of conveyor belting replaced directly under tails discharge line to protect the integrity of the liner.
- 3. Runoff started in April/May. However, the flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Derrick Colquhoun/ Andrea Kenward	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	





Photo 1: Looking South towards Barge

Photo 2: Tails Discharge



Photo 3: South Wall



Photo 4: Barge Pumps from South Wall.







# Average: 11.9 C; Low: -0.2 C; Month June 2013 Avg. Daily Temp. High: 25.2 C Mill Record Data: Total Monthly Tailings Deposition 32,057 Dry Tonnes 24.6 % Average Monthly Tailings % Solids Total Monthly Tailings Slurry Volume 130,278.8 m<sup>3</sup> Total Monthly Reclaimed Water Volume \_\_\_\_\_119,217.8 m<sup>3</sup> Site Measurements: m³ Date of survey June 30<sup>th</sup>, 2013 Pond Elevation 1304.73 m Estimated volume 684, 800 mm Total Monthly Precipitation 29.6 m³ Total Monthly Underground Input 8,354 m³ Total Monthly STP Effluent Input 710.6 m<sup>3</sup> Total Monthly Industrial Complex Runoff Input See remark 3 Total Volume from Seepage collection pond to Facility 1,665 m<sup>3</sup> Average Monthly Under drain Flow Rate 6.87 L/s L/s Average Monthly Ditch A Flow Rate 1.71 L/s Average Monthly Ditch B Flow Rate 1.83 m<sup>3</sup> Total Monthly Volume Discharged from Water Treatment \_\_\_\_\_0 Depth of Water at Reclaim Barge 28 ft 4" Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1804 dry tonnes per day, processing 54126 tonnes ore with 11677 dmt of tailings reported to underground for paste fill and 32057 dmt tailings to TSF.
- 2. Brief on any maintenance: Performed preventative maintenance on tailings barge pumps
- 3. Runoff started in April/May. However, the flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Derrick Colquhoun/ Andrea Kenward	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	











#### Average: 11.6 C; Low: -1.5 C; Month July 2013 Avg. Daily Temp. High: 23.2 C Mill Record Data: Total Monthly Tailings Deposition22,025Dry Tonnes **21.1** % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume 104,525.4 Total Monthly Reclaimed Water Volume \_\_\_\_\_ 96,930.6 m<sup>3</sup> Site Measurements: m³ Date of survey August 2<sup>nd</sup>,2013 Pond Elevation 1304.93 m Estimated volume 701,600 mm Total Monthly Precipitation 74.8 m³ Total Monthly Underground Input 10,359 m³ Total Monthly STP Effluent Input 802.9 m³ Total Monthly Industrial Complex Runoff Input See remark 3 Total Volume from Seepage collection pond to Facility **0** m<sup>3</sup> L/s Average Monthly Under drain Flow Rate 6.07 L/s Average Monthly Ditch A Flow Rate 1.06 L/s Average Monthly Ditch B Flow Rate 0.21 m³ Total Monthly Volume Discharged from Water Treatment 0 Depth of Water at Reclaim Barge 28'9" Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y 🛛 N 🗌 Photo Sheet Attached? Y Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1860 dry tonnes per day (Total of 21 Operating Days), processing 44660.8 tonnes ore with 13123 dmt of tailings reported to underground for paste fill and 22025 dmt tailings to TSF.
- 2. Brief on any maintenance: No Maintenance Performed.
- 3. The flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input. Improvements to Ditch A were made to improve water flow and runoff from surrounding landscape which were potentially contributing to slope failure on the South end of the Tailings Facility monitoring of conditions continue.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Derrick Colquhoun/ Andrea Kenward	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	









Photo 5: Barge Pumps from South Wall



Photo 6: North from South Wall



**Photo 7:** Coconut matting removed from Ditch A culvert to improve water flow.



**Photo 8:** Grader re-contouring road to improve runoff into Ditch and away from liner wall.



## Month August 2013 Avg. Daily Temp. Currently Unavailable Mill Record Data: Total Monthly Tailings Deposition 13225 Dry Tonnes **17.2** % Average Monthly Tailings % Solids m³ 76974.2 Total Monthly Tailings Slurry Volume Total Monthly Reclaimed Water Volume 72413.8 m<sup>3</sup> Site Measurements: Date of survey August 31<sup>st</sup>, 2013 Pond Elevation 1305.03 m m³ Estimated volume 711,040 Currently mm Total Monthly Precipitation Unavailable m³ Total Monthly Underground Input 10,557 m<sup>3</sup> Total Monthly STP Effluent Input 652.8 m³ Total Monthly Industrial Complex Runoff Input See remark 3 Total Volume from Seepage collection pond to Facility **0** m<sup>3</sup> L/s Average Monthly Under drain Flow Rate 2.82 L/s Average Monthly Ditch A Flow Rate 1.12 Average Monthly Ditch B Flow Rate 0 L/s m³ Total Monthly Volume Discharged from Water Treatment 0 \_\_\_\_\_ Ft Depth of Water at Reclaim Barge 29ft 5" See page 3 to Annotate Pond Diagram Y N N Y 🖂 Pictures Taken? Photo Sheet Attached? Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1887 dry tonnes per day (Total of 17 Operating Days), processing 32077 tonnes ore with 10971 dmt of tailings reported to underground for paste fill and 13225 dmt tailings to TSF.
- 2. Brief on any maintenance: Rebuilt #1 Reclaim Booster Pump, Repaired Vac Break Valve on #1 Barge Pump
- 3. The flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input. Improvements to Ditch A were made to improve water flow and runoff from surrounding landscape which were potentially contributing to slope failure on the South end of the Tailings Facility monitoring of conditions continue.



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Derrick Colquhoun/ Andrea Kenward	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	









Photo 5: Barge Pumps from South Wall



Photo 6: North from South Wall



# WOLVERINE PROJECT Tailings Facility Monitoring Monthly Impoundment Monitoring Report

Month September 2013	Avg. Daily Temp	. Currently Unavailable	
Mill Record Data:			
Total Monthly Tailings Deposition	14692	Dry Tonnes	
Average Monthly Tailings % Solids	20.0	%	
		m <sup>3</sup>	
Total Monthly Tailings Slurry Volume	73,302.1	-	
Total Monthly Reclaimed Water Volume	68,235.6	m <sup>3</sup>	
Site Measurements:			
Date of survey <u>September 29<sup>th</sup>, 2013</u>	Pond Elevation 1305.11	m Estimated volume	<u>718,920</u> m <sup>3</sup>
	Currently	mm	
Total Monthly F	Precipitation Unavailab	ble	
Total Monthly Underg	ground Input 10,256	m³	
Total Monthly STP E	ffluent Input 640.6	m³	
Total Monthly Industrial Complex	Runoff Input See rema	r <b>k 3</b> m³	
Total Volume from Seepage collection por	nd to FacilityO	m <sup>3</sup>	
Average Monthly Under dra	in Flow Rate 2.22	L/s	
Average Monthly Ditch	A Flow Rate1.01	L/s	
Average Monthly Ditch	B Flow Rate 0	L/s	
Total Monthly Volume Discharged from Wate	er Treatment 0	m <sup>3</sup>	
Depth of Water at Re	eclaim Barge 29' 6"	Ft	
See page 3 to Annotate Pond Diagram			
Pictures Taken? Y 🛛 N	Photo Sheet Attac	hed? Y 🔀	N

I



#### **Special Remarks:**

- 1. Milling rates averaged 1651.4 dry tonnes per day (Total of 18 Operating Days), processing 29725.5 tonnes ore with 7491.5 dmt of tailings reported to underground for paste fill and 14692.0 dmt tailings to TSF.
- 2. Brief on any maintenance: No Maintenance Performed
- 3. The flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input. Monitoring of conditions continue at Ditch A after improvements were made to improve water flow and runoff from surrounding landscape (which were potentially contributing to slope failure on the South end of the Tailings Facility). Liner patches/repairs were made at 3 locations (refer to Photos 9-12).



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Derrick Colquhoun/ Andrea Kenward	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	













Photo 9: Hole in Tailings Liner along crease (east liner wall)

Photo 10: Hole in Tailings liner repaired (east liner wall)



Photo 11: Hole in Tailings Liner along crease (south liner wall)

Photo 12: Hole in Tailings liner repaired (south liner wall)


#### Average: -1.3 C ; Low: -13.5 C; Month October 2013 Avg. Daily Temp. High: 7.8 C Mill Record Data: Total Monthly Tailings Deposition 19,109 Dry Tonnes 20.4 % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume 93,615 87,025.7 m<sup>3</sup> Total Monthly Reclaimed Water Volume Site Measurements: Pond Elevation 1305.34 m Date of survey October 30, 2013 Estimated volume 743,000 m<sup>3</sup> mm Total Monthly Precipitation 11.8 m³ Total Monthly Underground Input 10,368 m³ Total Monthly STP Effluent Input 660.6 m³ Total Monthly Industrial Complex Runoff Input 0 m³ Total Volume from Seepage collection pond to Facility **0** Average Monthly Under drain Flow Rate 2.47 L/s L/s Average Monthly Ditch A Flow Rate 0.54 L/s Average Monthly Ditch B Flow Rate 0 m³ Total Monthly Volume Discharged from Water Treatment 0 Ft Depth of Water at Reclaim Barge 29'10.5" See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Photo Sheet Attached? Y 🖂 Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1838.3 dry tonnes per day (Total of 21 Operating Days), processing 38604 tonnes ore with 10551 dmt of tailings reported to underground for paste fill and 19109 dmt tailings to TSF.
- 2. Brief on any maintenance: De-icing system up and running.
- <sup>3.</sup> The flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input. Monitoring of conditions continue at Ditch A after improvements were made to improve water flow and runoff from surrounding landscape (which were potentially contributing to slope failure on the South end of the Tailings Facility).



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger/Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	









Photo 5: Barge Pumps from South Wall

Photo 6: North from South Wall West





#### Average: -14.9 C; Low: -36.5 C; Month November 2013 Avg. Daily Temp. High: -1.1 C Mill Record Data: Total Monthly Tailings Deposition 13,467.8 Dry Tonnes 15.60 % Average Monthly Tailings % Solids m³ Total Monthly Tailings Slurry Volume77,513.48 Total Monthly Reclaimed Water Volume 87,247.6 m<sup>3</sup> Site Measurements: Date of survey November 27, 2013 Pond Elevation 1305.47 m Estimated volume 757,200 m³ mm Total Monthly Precipitation 0 m<sup>3</sup> Total Monthly Underground Input \_\_\_\_\_ 8,423 \_\_\_\_\_ m³ Total Monthly STP Effluent Input 574.4 m³ Total Monthly Industrial Complex Runoff Input 0 m³ Total Volume from Seepage collection pond to Facility **0** Average Monthly Under drain Flow Rate 1.03 L/s L/s Average Monthly Ditch A Flow Rate 0.52 L/s Average Monthly Ditch B Flow Rate 0 m³ Total Monthly Volume Discharged from Water Treatment 0 Depth of Water at Reclaim Barge N/A Ft See page 3 to Annotate Pond Diagram Pictures Taken? Y X N Photo Sheet Attached? Y 🖂 Ν



#### **Special Remarks:**

- 1. Milling rates averaged 1546.9 dry tonnes per day (Total of 19 Operating Days), processing 29390 tonnes ore with 10251 dmt of tailings reported to underground for paste fill and 13251 dmt tailings to TSF.
- 2. Brief on any maintenance: De-icing system up and running.
- 3. The flow meter was offline from UG to Sump 2 and thus could not calculate total runoff. This value is therefore included in Total Monthly Underground Input. Monitoring of conditions continue at Ditch A after improvements were made to improve water flow and runoff from surrounding landscape (which were potentially contributing to slope failure on the South end of the Tailings Facility).



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Mike Auger/Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	











Avg. Daily Temp.	Average: -18.7 C ; Low: -32.5 C; High: 0.7 C
18,526.9	Dry Tonnes
23.6	%
	m <sup>3</sup>
63,888.6	
71,929.8	m³
	Avg. Daily Temp.

Site Measurements:						
Date of survey December 29, 2013	Pond Elevation	1305.94	_ m	Estimated volume	810,000	_ m³
Total Monthly I	Precipitation	0		mm		
Total Monthly Underg	round Input	<b>4,360</b> (total not captured due to UG water bypassing flow meters)		m <sup>3</sup>		
Total Monthly STP E	ffluent Input	517		m <sup>3</sup>		
Total Monthly Industrial Complex	Runoff Input	0		m³		
Total Volume from Seepage collection por	nd to Facility	0		m³		
Average Monthly Under dra	in Flow Rate	1.11		L/s		
Average Monthly Ditch	A Flow Rate	Unknown – but	flowing	L/s		
Average Monthly Ditch	B Flow Rate	0		L/s		
Total Monthly Volume Discharged from Wate	er Treatment	0		m³		
Depth of Water at Re	eclaim Barge	unknown		Ft		



!-I	Damaa			
eciai	Remai 1.	rks: Milling rates averaged 1,623.3 with 0.0 dmt of tailings reporte	dry tonnes per day (Total of 15 Operating Days), pr d to underground for paste fill and 18,526.9 dmt ta	ocessing 24,249.7 tonnes ore ailings to TSF.
	2.	Brief on any maintenance: Mai icing pump at month-end was lights inside keeping warm insid	n de-icing system failed during the month, the temp not effective, very little impact. Reclaimed pump ar le the pumping area.	porary 110V-submersible de- ea was tarp with halogen
	3.	The mill was shut down on Dec	19 <sup>th</sup> and was placed under care and maintenance.	



#### Sketch to Include:

- Pond area
- Ice area
- Tailings spigot points
- Tailings beaches
- Reclaim barge location



Operator	Manny Rejano/Robin McCall	Signature	
Supervisor/Manager	Peter Nelega	Signature & Date	







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Photo 5: Covered Barge Reclaim Pump	Photo 6: Frozen Tape measure-unavailable measure
	depth elevation.
Photo 7: Covered reclaim pump – with west wall at	
background.	