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Memo

To:	Jasmin Dobson, Ryan Herbert	**Client:**	Minto Explorations Ltd.
From:	Soren Jensen, Kaitlyn Kooy	**Project No:**	1CM002.024
Cc:	Dylan MacGregor (SRK)	**Date:**	March 31, 2016
Subject:	2015 Water Balance and Water Quality Model Summary for the Minto Mine Site		

1 Introduction and Background

This memorandum provides a summary of the 2015 water balance and water quality model updates for the Minto Mine site. The update covers the period January 1, 2015 through December 31, 2015.

The water balance update includes a review and summary of precipitation, flow and water inventory data for the Mine site. The water quality update includes a comparison of water quality data collected in 2015 to updated water quality model predictions for Phase V/VI of the Mine development. Updated water quality predictions for the Main Pit Tailings Management Facility (MPTMF) and the Water Storage Pond (WSP) are provided for the 2017 and for the post-closure period when predicted concentrations are the same from year to year (steady state concentrations).

2 Water Balance Update

2.1 Precipitation

Table 1 shows a summary of monthly precipitation measured at the Mine site in 2014 and 2015 along with precipitation data from the regional station at Pelly Ranch (Climate ID: 2100880)[1]. Approximately 243 mm of precipitation was collected at the Mine site in the 2014 hydrological year. This roughly corresponds to a 1 in 15 dry year.

Minto's Campbell Scientific meteorological station measures total precipitation using a Geonor and a tipping bucket rain gauge. From October through May, the tipping bucket is equipped with a snowfall conversion adaptor, which allows it to measure snowfall as snow water equivalent. The Geonor precipitation gauge collects precipitation in a bucket (Figure 1) and records precipitation by measuring the weight of the bucket. In the winter months, the bucket is partially filled with an antifreeze solution that melts any snow collected. Figure 2 shows a comparison of monthly precipitation recorded by the two gauges. The Geonor gauge is considered to be more reliable.

[1] Pelly Ranch Data: obtained from Meteorological Service of Canada, Environment Canada.

Table 1: Precipitation Records for the Minto Mine Site and Pelly Ranch

		Campbell Scientific Station (Minto Mine)		
Year	**Month**	**Tipping Bucket Gauge**	**Geonor Gauge[A]**	**Pelly Ranch[B] (Climate ID 2100880)**
		mm/month	mm/month	mm/month
2014	Oct	22.0	n/a	32.5
2014	Nov	2.9	n/a	22.0
2014	Dec	19.4	21.0	23.5
2015	Jan	9.1	12.4	17.0
2015	Feb	6.9	0.0	6.0
2015	Mar	3.1	10.9	10
2015	Apr	3.8	8.0	n/a
2015	May	6.3	4.9	n/a
2015	Jun	18.7	20.5	n/a
2015	Jul	35.3	37.7	n/a
2015	Aug	79.7	80.3	n/a
2015	Sept	19.0	16.7	n/a
2015	Oct	14.7	27.7	n/a
2015	Nov	14.3	7.1	n/a
2015	Dec	9.5	11.5	n/a
SUM Hydrological Year, Nov. 2014 to Oct. 2015		204	243	n/a

Source: Minto Site Data: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\Minto Water Balance\2016 Met Station Data Summary.xlsx

Notes:

A: Tipping bucket measurement used for month of November.
B: Data obtained from Meteorological Service of Canada, Environment Canada.
n/a – not available at time of publication.

Figure 1: Minto's Geonor Precipitation Gauge

The Pelly Ranch meteorological station is located approximately 25 km north of the Mine site and is the closest regional station with a long-term data record, including total precipitation measurements. Table 1 shows that 2015 data was limited.

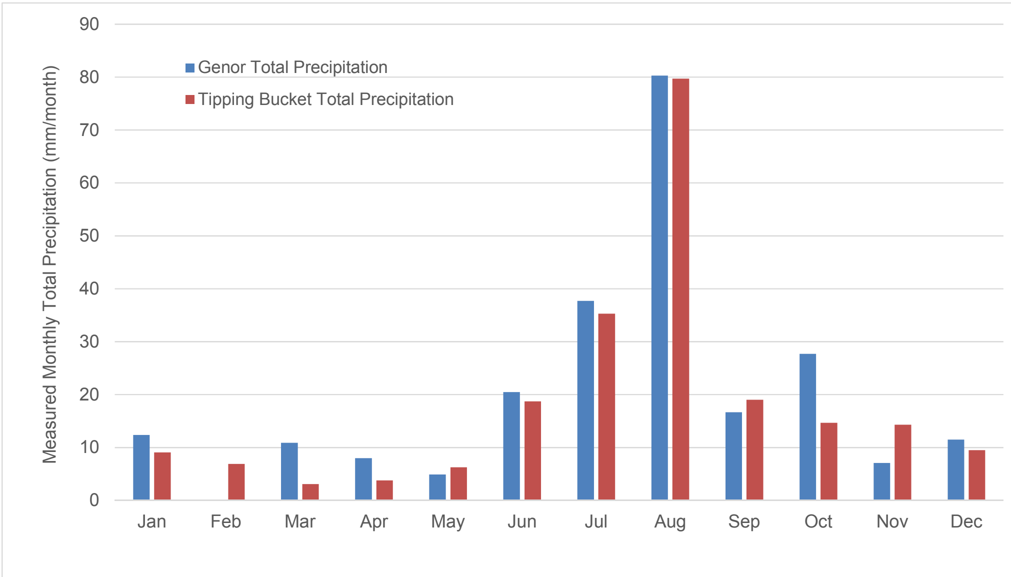

Figure 2: 2015 Monthly Total Precipitation Measurements at Minto by Geonor and Tipping Bucket Gauges

2.2 Snow Course Data

Snow course surveys were completed at the three established snow survey stations at the Mine site in 2015. Table 2 shows a summary of the snow survey data (i.e. an average of the results from the three stations) from 2009 to 2015. The depth and water equivalent of the snow pack provides an indication of the volume of surface runoff that must be managed the following freshet. Between January and late May 2015, approximately 225,000 m^3 of surface runoff was collected from catchments at the Mine site upstream of the Water Storage Dam. This volume corresponds to roughly 22 mm of runoff, or about 30% of the snow pack water equivalent measured in April 2015.

Table 2: Summary of Snow Survey Data for the Minto Mine Site

Year	February			March			April		
	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)
2009	55.6	16.6	92.7	70.2	15.7	110.0	67.4	22.3	150.7
2010	60.5	17.8	107.7	58.1	20.7	120.7	40.4	[A]13.9	56.0
2011	57.2	18.7	106.0	70.3	20.1	141.7	52.3	22.8	111.7
2012	54.7	20.3	111.0	64.6	19.6	127.0	61.3	21.5	132.7
2013	58.7	15.7	91.3	45.8	25.0	106.0	33.7	15.4	62.7
2014	44.3	19.0	84.3	45.8	22.3	99.7	41.0	25.7	67.3
2015	44.3	20.7	90.3	25.3	29.0	76.6	30.0	23	67.8

Source: SRK: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\MintoSnowMaster_Clean.xlsx

Notes:

n/a – not available.

[A]zero snow at #3, density is an average of snowpack at #1 and #2, average depth and water-equivalent is average of all three sites.

2.3 Water Management

Water that is suitable for release into Minto Creek is conveyed to the Water Storage Pond (WSP), while water collected from active mine areas is routed to the Main Pit Tailings Management Facility (MPTMF). Since November 2012, the MPTMF has also been used for subaqueous deposition of tailings. Deposition of mine water and tailings (subaqueous) to the Area 2 Pit Tailings Management Facility (A2PTMF) commenced in April 2015. To date, water and tailings are stored in the Stage 2 area of the A2PTMF only.

Other water management features on the Mine site include:

- W15 sump: collects surface runoff and seepage from:
  - The Southwest Waste Dump;
  - Part of the Main Waste Dump; and
  - Adjacent undisturbed catchments.

Water collected at W15 was routed to the Main Pit TMF in 2015.

- W35a sump: collects surface runoff from the minimally disturbed southern catchments. Water collected at W35a in 2015 was piped to the WSP.
- W36 sump (formerly known as W37 sump): collects surface runoff and seepage from the mill valley, including contributions from the Dry Stack Tailings Storage Facility. Water collected at the W36 sump is pumped to the MPTMF.
- South Diversion Ditch: diverts water from minimally disturbed southern catchments to the WSP (can also be routed to the MPTMF).

- WSP: reservoir for water that meets discharge criteria and is destined for discharge to Minto Creek.

2.4 2015 Water Balance

Table 3 summarizes the monthly water and tailings inventory in Minto's MPTMF and A2PTMF as well as water inventory in the WSP. In 2015, the water inventory in the MPTMF was reduced by approximately 250,000 m^3, while the water inventory in A2PTMF increased by roughly 680,000 m^3. The WSP water inventory was reduced by about 100,000 m^3 between January 1 and December 31, 2015. The reduction in the MPTMF water inventory was a result of ongoing deposition of tailings solids (about 150,000 m^3 bank cubic meters (BCM)) and an overall reduction in the MPTMF water level.

Table 4 shows a summary of the 2015 water balance for the Mine site. The total surface runoff collected on site was estimated to be 650,000 m^3 based on the change in the water inventory and the known volume of water released to Minto Creek. Including an estimated inflow of 60,000 m^3 of groundwater, the total site-wide yield was estimated at about 715,000 m^3 for the year. The total catchment upstream of the Water Storage Dam measures approximately 1,040 ha. Therefore, 715,000 m^3 of runoff from 1,040 ha gives a unit yield of approximately 69 mm/year.

The water and load balance model used for forecasting surface runoff volumes uses a site-wide annual average runoff coefficient, which has been derived based on previous years' water balance results. The runoff coefficient is estimated based on the total annual precipitation as follows:

- For dry years with less than 190 mm total precipitation: runoff coefficient = 0.15.
- For average to wet years with more than 309 mm total precipitation: runoff coefficient = 0.30.
- Runoff coefficients for years with total precipitation between 190 mm and 309 mm: interpolated values between 0.15 and 0.30.

In 2015 (hydraulic year) the estimated total precipitation was 243 mm (Table 1), which corresponds to a modelled runoff coefficient of 0.22. The 2015 site-wide runoff coefficient, based on the 2015 water balance (measured flows, water inventory and total precipitation), is:

$$Annual\ Yield/\ Total\ Annual\ Precipitation = Runoff\ Coefficient \rightarrow \quad 69\ mm/243\ mm = \mathbf{0.28}$$

The calculated value for the annual site-wide runoff coefficient is closer to the value used for average precipitation conditions (0.30) than the interpolated coefficient of 0.22. Overall, the agreement with site-wide runoff coefficients are used for evaluating water management options is good and the model results can be expected to yield reliable estimates of the volume of water that must be managed on site on an annual basis.

Table 3: 2015 Water Inventory and Release to Minto Creek

Month/ Year	MPTMF Volume Occupied (Water + Tailings)A	Change in MPTMF Water Inventory	Tailings Solids Deposition in MPTMF	A2PTMF Volume Occupied (Water + Tailings)A	Change in A2PTMF Water Inventory	Tailings Solids Deposition in A2PTMF	WSP VolumeA	Change in WSP Water Inventory
	m^3	m^3/month	BCM/month	m^3	m^3/month	BCM/month	m^3	m^3/month
Jan 2015	4.214.127	-14.268	34.534	0	0	0	179.106	2.335
Feb 2015	4.234.392	-3.196	34.534	0	0	0	181.441	11.411
Mar 2015	4.265.730	-182.640	34.534	0	203.055	0	192.852	6.713
Apr 2015	4.117.625	-175.799	0	203.055	176.166	47.723	199.565	-119.639
May 2015	3.941.826	-194.091	0	426.944	163.331	47.723	79.926	-45.483
Jun 2015	3.747.735	68.992	21.537	637.997	25.850	23.861	34.442	17.071
Jul 2015	3.838.264	97.094	24.640	687.709	-36.508	17.795	51.513	10.208
Aug 2015	3.959.998	128.619	0	668.996	-43.143	45.380	61.721	10.541
Sep 2015	4.088.617	16.142	0	671.233	86.462	40.116	72.262	10.777
Oct 2015	4.104.759	-505	0	797.812	52.003	43.619	83.039	885
Nov 2015	4.104.254	3.409	0	893.433	33.178	37.282	83.924	-822
Dec 2015	4.107.663	126	0	963.893	19.137	41.058	83.102	-1.403
Jan 2016	4.107.790			1.024.08			81.699	
SUM		**-256.116**	**149.779**	**1.024.08**	**679.531**	**344.556**		**-97.406**

Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\2015 Water Balance Update REV00 SRJ.xlsx

Notes:

A – on the first day of the month.

Table 4: Water Balance Summary of the Minto Mine Site, 2015 (Jan to Dec)

	Units	Main Pit TMF	Area 2 Pit TMF	WSP
Volume Change 2015 (water + tailings)	m^3	-106,337	1,024,087	-97,406
Tailings Deposited, total	BCM	149,779	344,556	-
Water Volume Change 2015	m^3	-256,116	679,531	-97,406
Estimated Groundwater Inflow	m^3	0	60,000	0
Total Water Inventory Increase in 2015	m^3	386,000		
Total Water Discharged to Minto Creek	m^3	328,526		
Total Site-Wide Yield in 2015	m^3	**714,534**		

Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\
2015 Water Balance Update REV00 SRJ

3 Water Quality Model Update

3.1 Solid Phase Geochemistry

The neutralization potential ratio (NPR) and copper content of waste rock and tailings were reviewed in order to identify any new trends in the solid phase geochemistry that may have developed between the last source term update in 2013 and 2015. Significant changes in the solid phase geochemistry would indicate a need for further analysis of the waste rock and tailings to generate new source terms that reflect the observed changes in the geochemistry.

The NPR and copper content of waste rock and tailings are shown in Figure 3 toFigure 6. No significant changes in geochemistry were observed in the properties of the materials produced in 2015 compared to similar materials produced in prior years. Therefore, no further evaluation of 2015 solid phase geochemistry was warranted.

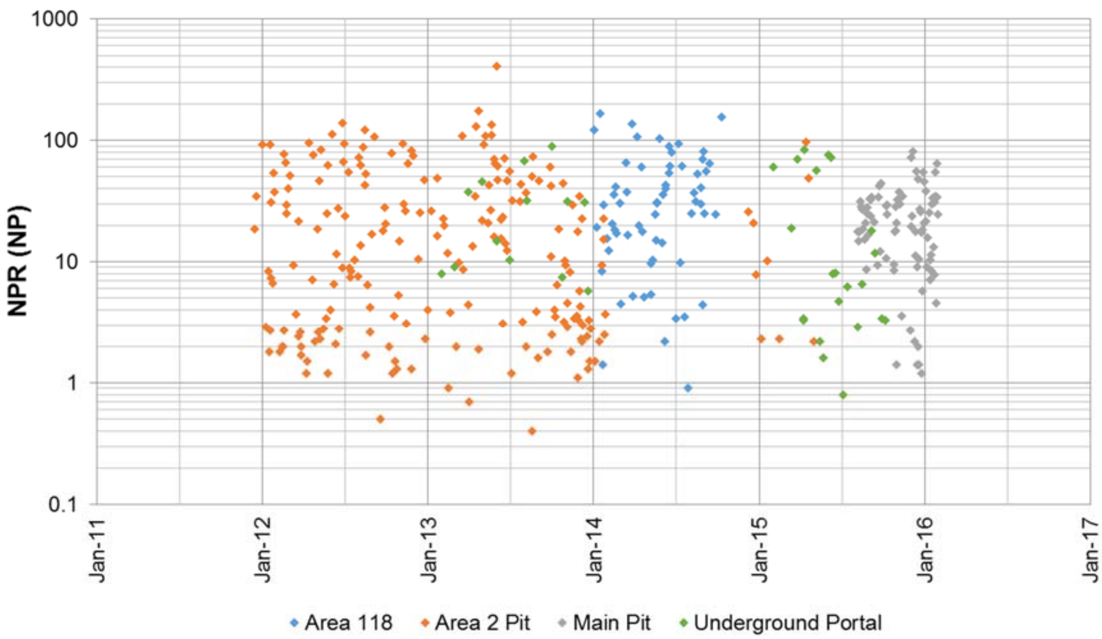

Figure 3: Waste Rock Neutralization Potential Ratio over Time

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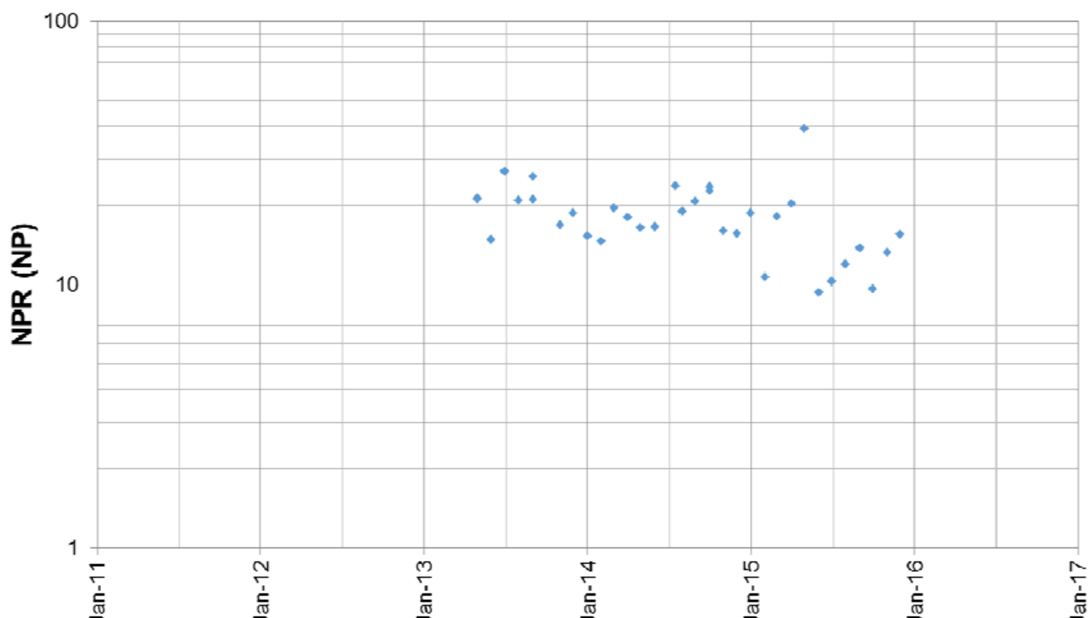

Figure 4: Tailings Neutralization Potential Ratio over Time

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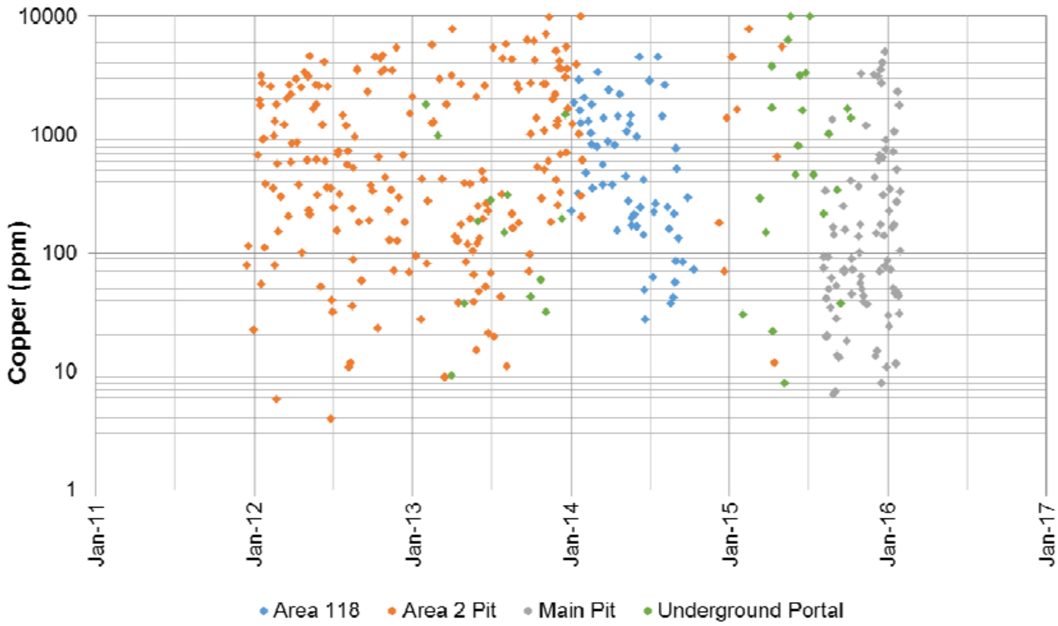

Figure 5: Waste Rock Copper Concentration over Time

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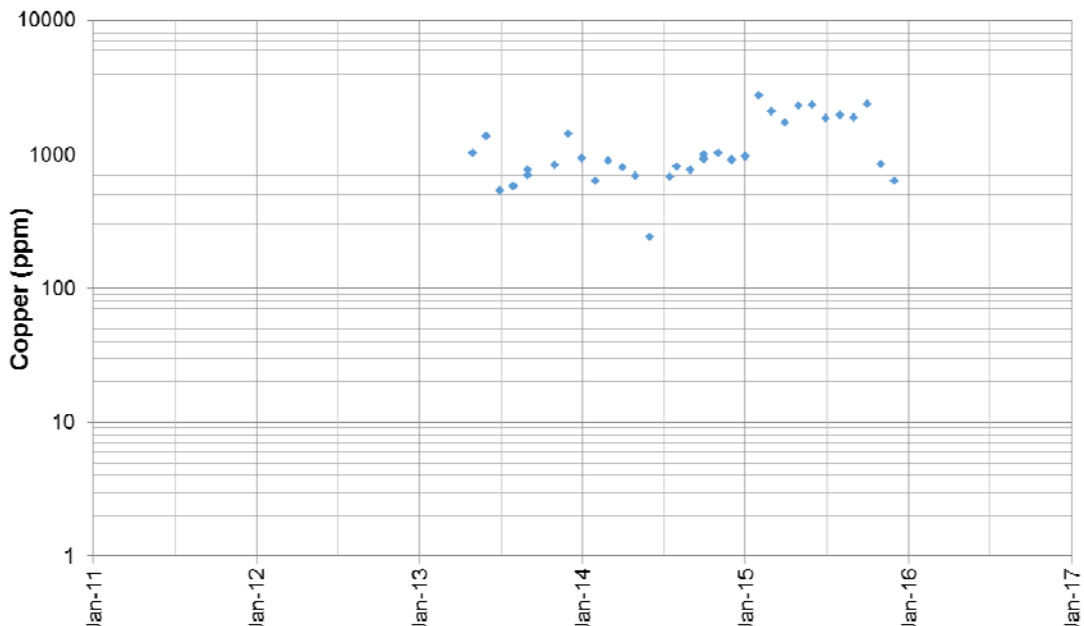

Figure 6: Tailings copper concentration over time

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3.2 Comparison of Measured Water Quality Data to Source Terms

3.2.1 Source Terms – Dry Stack Tailings Storage Facility

The Dry Stack Tailings Storage Facility (DSTSF) source terms used in the 2013 water and load balance model were developed based on the observed water chemistry at station W8. This station was chosen because it had the highest concentrations of copper, cadmium, selenium, and sulphate during the period of record available in 2013. The following points describe the source terms:

- Best Estimate source term: 50th percentile dissolved concentrations from W8 until 2013;
- Reasonable Worst Case source term: 95th percentile dissolved concentrations from W8 until 2013.

A review of the water quality data updated to 2015 from station W8 and as well as from alternate DSTSF monitoring station W8A revealed that the maximum concentrations of key water quality parameters such as copper and selenium prior to 2013 were higher than concentrations measured between 2013 and 2015. The 2013 DSTSF source terms were therefore deemed acceptable and suitably conservative for use in the 2015 Updated Water Balance and Water Quality Model.

3.2.2 Source Terms – Waste Rock

The Main Waste Dump and the Southwest Waste Dump source terms used in the 2013 water and load balance model were defined based on the observed water chemistry at station W15, which collects runoff from the Southwest Waste Dump. Similar to the DSTSF source terms, the Best Estimate waste rock source term was the 50^{th} percentile dissolved concentrations at W15 until 2013 and the Reasonable Worst Case waste rock source term was the 95^{th} percentile dissolved concentrations from W15 until 2013.

Several parameters showed elevated concentrations in March of 2015, possibly due to an early snow melt event. Some concentrations were higher than those used to develop source terms for the 2013 model. Therefore, new waste rock source terms were developed based on the concentrations measured at W15 in 2015, as described in Section 3.3.

3.2.3 Source Term – Tailings Slurry

A survey of water quality in the MPTMF and the A2PTMF indicated that concentrations of certain parameters such as selenium and copper were higher than predicted in 2015. Adjustment of the waste rock source terms were not able to explain the concentration changes. A water quality model sensitivity analyses indicated that a possible explanation could be an increase in loadings assigned to tailings slurry (i.e. loadings released from milled ore), perhaps in response to a subtle change geochemical properties of the ore feed. Alternatively, loadings could originate as “first flush” loadings mobilized when the Area 2 pit and related M-Zone underground workings were inundated.

3.3 Source Term Update

3.3.1 Waste Rock Source Term

Waste rock from the Main Pit was placed in both the Main Waste Dump and in the Southwest Waste Dump, and Area 118 Pit and Area 2 Pit (Stage 1 and 2) waste rock has also been placed in the Southwest Waste Dump. Water chemistry of drainage from these facilities has been monitored at several routine monitoring stations (W15, W30, W31, W32, W38, W39, and W40) since 2007, as well as through semi-annual seepage surveys where a total of 12 seeps have been sampled between 2012 to 2015 (SS1, SS4, SS13, SS21, SS22, SS28, SS29, SS30, SS31, SS44, SS51, and SS52).

All surface drainage from the Main Waste Dump and Southwest Waste Dump catchment areas reports to routine monitoring station W15 and is transferred to the Main Pit by pumping. Pumped volumes are tracked by the mine for water management purposes, and water chemistry at W15 is regularly monitored. These records were used to develop a waste rock volume- based source term as described in the following steps.

1. Water quality records from 2007 through 2015 were compiled, and average and 95th percentile concentrations were calculated.

2. Average and 95th percentile total catchment loadings were estimated using average and 95th percentile concentrations (from step 1) together with flows estimated based on the mean annual runoff (329 mm) and runoff coefficient (0.3) and catchment area of station W15 (253 ha) (SRK 2013b).

3. Loads estimated in step 2 were assumed to be entirely derived from the Southwest Waste Dump and the Main Waste Dump. Estimates of loading rates per volume of waste rock were made by dividing the total step 2 catchment load by the volume of rock that had been placed at end-of-year.

The results of step 3 were then adopted as the expected case and reasonable worst case source terms for volume-based loadings from bulk waste rock. The advantage of source terms based on units of rock volume is that they can be readily applied to existing and proposed new or expanded waste facilities to estimate future loadings. The source term concentrations from step 2 are shown in Table 5.

Table 5: 2015 Waste Rock Source Terms

WQ Parameter	Expected Case Station W15- 50th Percentile (mg/L)	Reasonable Worst Case Station W15- 95th Percentile (mg/L)
Ag-D	0.00002	0.0001
Al-D	0.024	0.1608
Alk-T	161	342
Ammonia	0.072	0.237
As-D	0.0005	0.001
Ba-D	0.108	0.2212
B-D	0.05	0.1
Be-D	0.0001	0.0002
Bi-D	0.001	0.001
Ca-D	66.1	179.7
Cd-D	0.000016	0.0001
Cl-D	3.005	12.45
Co-D	0.0005	0.0012
Cr-D	0.001	0.002
Cu-D	0.0184	0.04998
Fe-D	0.307	1.065
F-D	0.16	0.2735
Hg-D	0.00001	0.0002
K-D	2.69	7.444
Li-D	0.005	0.01
Mg-D	18.9	45.16
Mn-D	0.244	0.9647
Mo-D	0.0027	0.0069
Na-D	9.92	22.19
Ni-D	0.001	0.00279
NO3	5.76	36.48
NO2	0.0488	0.3012
Pb-D	0.0002	0.0002
Sb-D	0.0005	0.0005
S-D	24.25	74.92
Se-D	0.00127	0.007126
Si-D	4.91	8.826
Sn-D	0.005	0.005
SO4-D	52.5	192
Sr-D	0.558	2.224
Ti-D	0.005	0.01
Tl-D	0.00005	0.00005
U-D	0.0011	0.003823
V-D	0.005	0.005
Zn-D	0.005	0.01
Zr-D	0.0005	0.002

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3.3.2 Tailings Slurry Source Term Update

In the current model revision, the tailings slurry term was increased by a factor of 3 to account for the observed increase in selenium loadings to the MPTMF and the A2PTMF. The increase to the tailings source term does not necessarily mean that the additional loadings originate from the milled ore. In that sense, the tailings slurry loading is used as a calibration factor. Monitoring data over the coming year will reveal whether the additional observed loadings indeed are associated with the milled ore or whether the loadings can be attributed to another source.

3.4 Water Quality Model Results

Table 6 and 7 show revised model outputs from the calibrated model of water quality in the Water Storage Pond (WSP) for 2015, 2017 and post-closure (best estimate and worst case) along with concentrations measured in 2015. Table 8 and 9 show revised model predictions of water quality in the MPTMF for 2015, 2017 and post-closure. Predictions for 2017 and post-closure were selected to provide representative short-term and long-term indications of water quality trends. Predictions are for average precipitation conditions. The Water Use Licence (QZ14-031) effluent limits are also listed in the tables. Model runs started on 1 January 2015 and ended on 1 January 2045.

The MPTMF was historically the primary water reservoir on site. In the model, the free water in the MPTMF and A2PTMF are more or less considered to belong to the same reservoir due to the high rate of flow between the two reservoirs. Reclaim water is drawn from the MPTMF and excess free water in the A2PTMF is pumped back to the MPTMF.

Therefore, a comparison of measured MPTMF water quality with concentrations predicted for pit water for the Phase V/VI environmental assessment provides a good measure of actual vs. expected geochemical performance of the site. Water collected in the WSP includes clean (non-contact) runoff and effluent from Minto's water treatment plant.

Median measured concentrations in the WSP in 2015 are comparable to the revised model predictions using best estimate source terms (Table 6). The favorable was agreement indicates that the revised source terms are appropriate for describing the existing geochemical performance and the actual water management practices on site. Best estimate source terms are intended to provide an indication of the general trend in water quality parameter concentrations, but are not intended to capture maximum or outlier concentration values. Therefore, the median values of best estimate model predictions are compared to measured median values.

Revised model predictions using reasonable worst case source terms are generally higher than comparable median and maximum measured values for the WSP (Table 7).

Revised model predictions for water quality in the MPTMF (and by extension the A2PTMF) using the best estimate source terms are in good agreement with median measured concentrations in 2015 (Table 8). Water quality model predictions using reasonable worst case source terms are generally higher than measured median and maximum concentration, with the exception of dissolved copper. Median and maximum measured dissolved copper concentrations were both higher than the concentrations predicted by the reasonable worst case source terms. The increase in dissolved copper concentration is not dramatic and may be caused by the flushing of rock that accompanied the inundation of the Area 2 Pit and related underground workings when deposition of tailings slurry was initiated. The source of the additional copper loadings (or increased copper solubility) will be evaluated based on water quality monitoring results in 2016.

Table 6: WSP Water Quality Model Predictions and Measured Concentrations in 2015, Best Estimate

		WUL Effluent Limits (QZ14-031)	WSP Measured Water Quality (Station W16)	Modelling Predictions of Quality in WSP (Station W16)		
Year			2015	2015	2017	Post-Closure
			Median	Median	Median	Median
Ammonia	mg/L	0.75	0.081	0.14	0.07	0.01
N-NO_2	mg/L	0.18	0.0565	0.11	0.07	0.00
N-NO_3	mg/L	27.3	1.63	3.48	4.56	0.17
Ag-Dissolved	Mg/L	0.0003	0.00002	0.00003	0.00003	0.00003
Al-Dissolved	mg/L	0.3	0.0103	0.09	0.21	0.27
As-Dissolved	mg/L	0.015	0.00031	0.0005	0.0007	0.0011
Cd-Dissolved	mg/L	0.0014[a]	0.00001	0.00002	0.00003	0.00004
Cr-Dissolved	mg/L	0.003	0.001	0.0014	0.0014	0.0012
Cu-Dissolved	mg/L	0.06/0.039[b]	0.0126	0.013	0.018	0.018
Fe-Dissolved	mg/L	3.3	0.0553	0.31	0.65	0.48
Pb-Dissolved	mg/L	0.012	0.0002	0.00029	0.00034	0.00032
Mo-Dissolved	mg/L	0.219	0.0044	0.005	0.003	0.007
Ni-Dissolved	mg/L	0.33	0.001	0.0016	0.0021	0.0017
Se-Dissolved	mg/L	0.006	0.00054	0.0012	0.0013	0.0020
Zn-Dissolved	mg/L	0.09	0.005	0.007	0.007	0.006

Source: SRK, X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\All_Model_Results_for_WQ_Model_Comparison_for_2015_An_Report_SRJ_Rev00.xlsx

Notes:

Analytical data from Minto’s water quality monitoring program.

a) at 50 mg/L hardness.

b) Cu effluent standard is 0.06 when [DOC] @ W2 > 10 mg/L and 0.039 when [DOC] @ W2 ≤ 10 mg/L.

Table 7: WSP Water Quality Model Predictions and Measured Concentrations in 2015, Reasonable Worst Case

Year		WUL Effluent Limits (QZ14-031)	WSP Measured Water Quality (Station W16) 2015		Modelling Predictions of Quality in WSP (Station W16) 2015		2017		Post-Closure	
			Median	Max	Median	Max	Median	Max	Median	Max
Ammonia	mg/L	0.75	0.081	0.29	0.23	0.26	0.20	0.28	0.02	0.03
N-NO_2	mg/L	0.18	0.0565	0.295	0.31	0.32	0.26	0.30	0.01	0.02
N-NO_3	mg/L	27.3	1.63	3.99	6.69	7.89	11.60	11.87	0.43	0.54
Ag-Dissolved	Mg/L	0.0003	0.00002	0.00004	0.00007	0.00009	0.00009	0.00012	0.00008	0.00010
Al-Dissolved	mg/L	0.3	0.0103	0.0531	0.16	0.24	0.32	0.35	0.42	0.47
As-Dissolved	mg/L	0.015	0.00031	0.00054	0.0007	0.0010	0.0011	0.0015	0.0022	0.0026
Cd-Dissolved	mg/L	0.0014[a]	0.00001	0.00009	0.00007	0.00010	0.00009	0.00013	0.00013	0.00015
Cr-Dissolved	mg/L	0.003	0.001	0.001	0.0019	0.0024	0.0022	0.0029	0.0024	0.0027
Cu-Dissolved	mg/L	0.06/0.039[b]	0.0126	0.0246	0.029	0.043	0.042	0.060	0.041	0.046
Fe-Dissolved	mg/L	3.3	0.0553	0.264	0.71	1.07	1.22	1.55	0.84	0.92
Pb-Dissolved	mg/L	0.012	0.0002	0.0002	0.00029	0.00035	0.00034	0.00041	0.00094	0.00110
Mo-Dissolved	mg/L	0.219	0.0044	0.0107	0.007	0.008	0.006	0.009	0.015	0.018
Ni-Dissolved	mg/L	0.33	0.001	0.0012	0.0026	0.0034	0.0034	0.0043	0.0031	0.0035
Se-Dissolved	mg/L	0.006	0.00054	0.00147	0.0042	0.0061	0.0057	0.0083	0.0053	0.0062
Zn-Dissolved	mg/L	0.09	0.005	0.0087	0.009	0.012	0.011	0.014	0.012	0.014

Source: SRK, X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\All_Model_Results_for_WQ_Model_Comparison_for_2015_An_Report_SRJ_Rev00.xlsx

Notes:

Analytical data from Minto's water quality monitoring program.

a) at 50 mg/L hardness.

b) Cu effluent standard is 0.06 when [DOC] @ W2 > 10 mg/L and 0.039 when [DOC] @ W2 ≤ 10 mg/L.

Table 8: MPTMF Water Quality Model Predictions and Measured Concentrations in 2015, Best Estimate

Year		WUL Effluent Limits (QZ14-031)	MPTMF Measured Water Quality (Station W12) 2015	Modelling Predictions of Quality in MPTMF (Station W12) 2015	2017	Post-Closure
			Median	**Median**	**Median**	**Median**
Ammonia	mg/L	0.75	N/A	N/A	N/A	N/A
N-NO_2	mg/L	0.18	N/A	N/A	N/A	N/A
N-NO_3	mg/L	27.3	N/A	N/A	N/A	N/A
Ag-Dissolved	Mg/L	0.0003	0.00002	0.00003	0.00006	0.00004
Al-Dissolved	mg/L	0.3	0.0152	0.09	0.32	0.32
As-Dissolved	mg/L	0.015	0.00044	0.0008	0.0018	0.0013
Cd-Dissolved	mg/L	0.0014[a]	0.00004	0.00003	0.00007	0.00005
Cr-Dissolved	mg/L	0.003	0.001	0.0015	0.0028	0.0015
Cu-Dissolved	mg/L	0.06/0.039[b]	0.0163	0.007	0.026	0.021
Fe-Dissolved	mg/L	3.3	0.0072	0.27	0.42	0.55
Pb-Dissolved	mg/L	0.012	0.0002	0.00032	0.00062	0.00038
Mo-Dissolved	mg/L	0.219	0.0831	0.096	0.113	0.009
Ni-Dissolved	mg/L	0.33	0.0015	0.0028	0.0039	0.0020
Se-Dissolved	mg/L	0.006	0.0105	0.0128	0.0209	0.0024
Zn-Dissolved	mg/L	0.09	0.005	0.008	0.014	0.007

Source: SRK, X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\All_Model_Results_for_WQ_Model_Comparison_for_2015_An_Report_SRJ_Rev00.xlsx

Notes:

Analytical data from Minto's water quality monitoring program.

a) at 50 mg/L hardness.

b) Cu effluent standard is 0.06 when [DOC] @ W2 > 10 mg/L and 0.039 when [DOC] @ W2 ≤ 10 mg/L.

Table 9: MPTMF Water Quality Model Predictions and Measured Concentrations in 2015, Reasonable Worst Case

		WUL Effluent Limits (QZ14-031)	MPTMF Measured Water Quality (Station W12)		Modelling Predictions of Quality in MPTMF (Station W12)					
Year			2015		2015		2017		Post-Closure	
			Median	Max	Median	Max	Median	Max	Median	Max
Ammonia	mg/L	0.75	2.9	4.3	1.04	1.04	1.04	1.04	0.03	0.03
N-NO_2	mg/L	0.18	1.1	2.83	0.64	0.64	0.64	0.64	0.02	0.02
N-NO_3	mg/L	27.3	13.6	26	22.70	22.70	22.70	22.70	0.55	0.61
Ag-Dissolved	Mg/L	0.0003	0.00002	0.00002	0.00005	0.00007	0.00012	0.00014	0.00011	0.00012
Al-Dissolved	mg/L	0.3	0.0152	0.0277	0.15	0.28	0.56	0.60	0.53	0.55
As-Dissolved	mg/L	0.015	0.00044	0.00055	0.0012	0.0019	0.0032	0.0036	0.0029	0.0030
Cd-Dissolved	mg/L	0.0014[a]	0.00004	0.000061	0.00006	0.00010	0.00019	0.00021	0.00017	0.00018
Cr-Dissolved	mg/L	0.003	0.001	0.001	0.0019	0.0027	0.0042	0.0048	0.0031	0.0033
Cu-Dissolved	mg/L	0.06/0.039[b]	**0.0163**	**0.0373**	**0.015**	**0.026**	0.059	0.064	0.048	0.051
Fe-Dissolved	mg/L	3.3	0.0072	0.231	0.36	0.45	0.81	0.89	1.05	1.09
Pb-Dissolved	mg/L	0.012	0.0002	0.0002	0.00051	0.00083	0.00140	0.00156	0.00123	0.00129
Mo-Dissolved	mg/L	0.219	0.0831	0.0972	0.101	0.132	0.133	0.180	0.020	0.021
Ni-Dissolved	mg/L	0.33	0.0015	0.0038	0.0034	0.0047	0.0064	0.0075	0.0039	0.0041
Se-Dissolved	mg/L	0.006	0.0105	0.0207	0.0177	0.0284	0.0370	0.0485	0.0070	0.0075
Zn-Dissolved	mg/L	0.09	0.005	0.0062	0.010	0.014	0.022	0.025	0.015	0.016

Source: SRK, X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2015_Water_Balance_Update\All_Model_Results_for_WQ_Model_Comparison_for_2015_An_Report_SRJ_Rev00.xlsx

Notes:

Analytical data from Minto's water quality monitoring program.

a) at 50 mg/L hardness.

b) Cu effluent standard is 0.06 when [DOC] @ W2 > 10 mg/L and 0.039 when [DOC] @ W2 ≤ 10 mg/L.