Appendix I
Water and Load Balance Model Report 2018

capstone
MINTO MINE

Water and Load Balance Model Report 2018

Prepared for

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Water and Load Balance Model Report 2018

February 2018

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1 Introduction

1.1 Purpose and Overview

This report describes the development and results of the water and load balance model developed for the Minto Mine 2018 Reclamation and Closure Plan (RCP). This report was written in accordance with the Water Use License (WUL) requirements (YWB 2015; Clause 110c). The main features of the 2018 RCP are summarized in Section 1.2.

The water and load balance model builds on previous water balance modelling work prepared for Minto Explorations Ltd. as part of past water license applications, environmental assessments, annual reporting and operational water management efforts. The model covers the end of the operations phase, as well as the active closure and post-closure phases (Post-Closure I and Post Closure II).

The water balance model accounts for all inflows to and outflows from the Minto Mine site, as well as accumulation of water in reservoirs within the mine site. The model can be run in stochastic mode where annual precipitation rates are varied to simulate randomly occurring wet and dry climatic conditions. Water quality results are based on estimates of geochemical loadings applied to modelled water flow. Water quality predictions are presented for ‘expected case’ and ‘reasonable worst case’ scenarios, which represent the best estimate geochemical loading rates and loading rates that are unlikely to be exceeded.

Section 2 describes inputs to and components of the water balance model. Section 3 summarizes the load balance model inputs. Model scenario implementation is described in Section 4 and modelling results are presented in Section 5 followed by a discussion in Section 6.

1.2 Closure Summary

Closure at the Minto Mine has been subdivided into three periods: Active Closure (AC), Post-Closure I (PCI) and Post Closure II (PCII) (Minto 2018). Estimated timelines for the different phases are listed in Table 1-1.

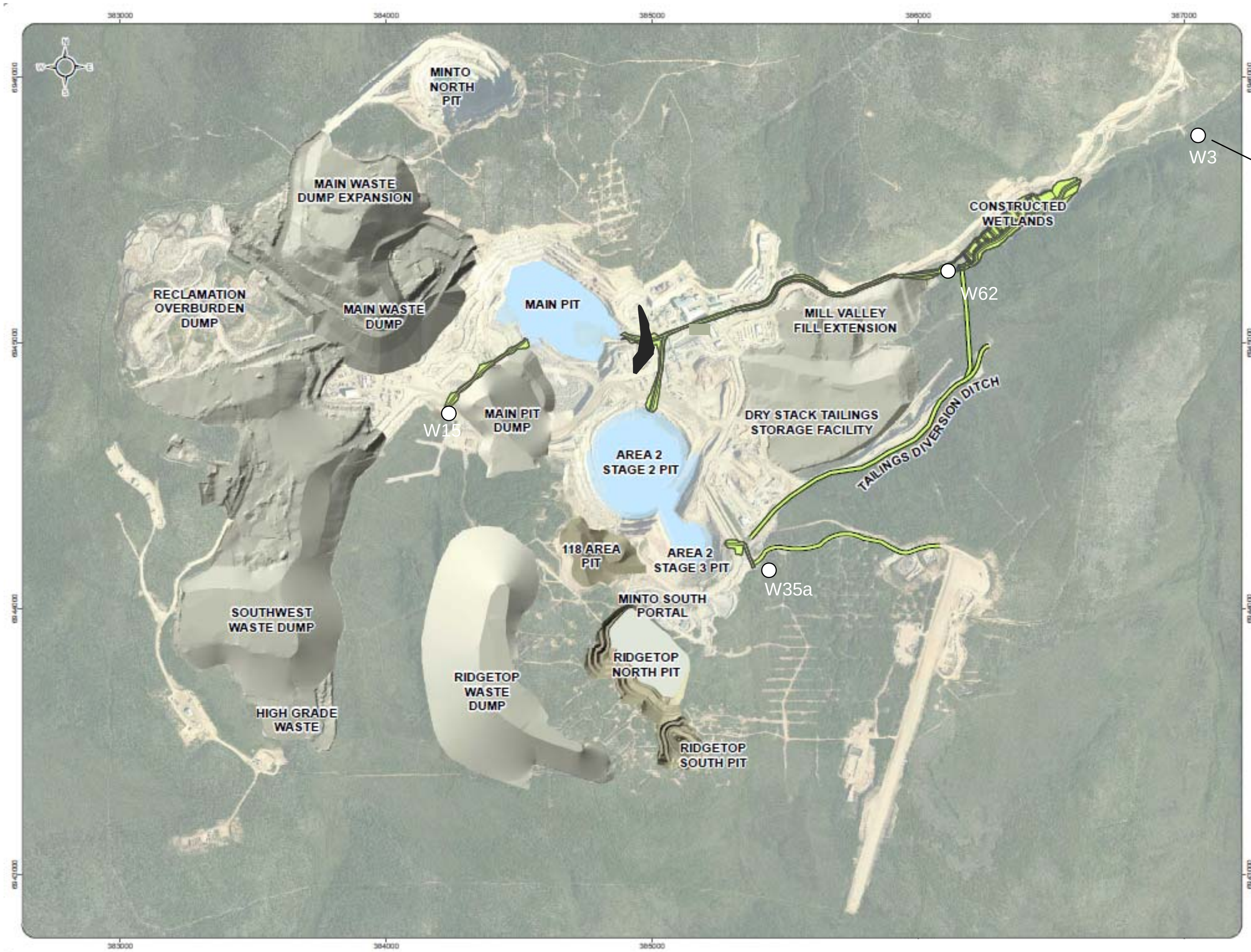
Table 1-1 Project Schedule

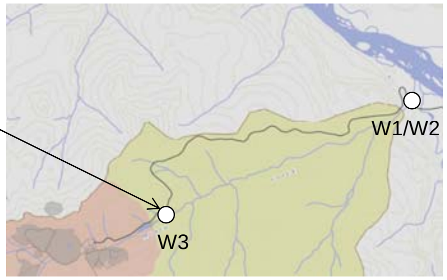
Year	Summary of Main Project Activity
2018	Underground production continues from the Minto South underground portal. Open pit mining continues in Area 2 Stage 3 until the pit is completed by the end of the first quarter of the year. Open pit mining begins at Ridgetop. Underground mining begins at the Copper Keel deposit
2019	Open pit mining continues at Ridgetop until the pit is complete in the second quarter. Underground mining continues at the Minto East deposit until it is completed in the first quarter. Underground mining begins at the Minto East 2 deposit.
2020	Underground mining begins at the Minto North Underground deposit.
2021	Underground mining from the Minto East and the Minto North Underground deposits and milling continues until the last quarter of the year. Active closure to begin.
2022 – 2024	Active closure period continues (total duration expected three years) with post closure one beginning near the end of 2025.
2025 – 2029	Post closure one period continues (total duration expected five years but will be performance based) with post closure two beginning near the end of 2030
2030 – 2039	Post closure two period continues (total duration of post closure two is ten years) until near the end of 2040.

The AC period includes the implementation and construction of most closure measures, including recontouring, soil placement, closure water conveyance construction, revegetation, construction of passive water treatment facilities, decommissioning of the Water Storage Dam, demobilization and demolition. During the AC period, operational water quality objectives/effluent standards will still apply. Active treatment will be used as required to meet discharge water quality limits. The AC period is expected to span approximately three years.

In the PCI period, the closure measures and infrastructure will become operational and the performance will be assessed. During this period, maintenance on soil covers will be undertaken as required as vegetation begins to establish. Water conveyance features will be commissioned along with the passive treatment system. During PCI, operational water quality objectives/effluent standards will still apply. A pump-back system will be established downstream of the passive treatment system to direct any water that does not meet effluent standards to the treatment plant or the open pits. Passive treatment will be commissioned and will over time become the primary water treatment system. The PCI phase nominally spans five years but the duration of this phase will depend on the performance of the closure measures.

During the PCII period, the closure measures and infrastructure will be monitored to confirm that performance meets the design intents. PCII is primarily a monitoring phase with maintenance activities as required. During PCII the closure water quality objectives will apply and passive treatment will be the primary water treatment onsite.





Legend

○ W3	Routine water quality monitoring station
	Pit Lake
	Dump
	Pit
	Tailings
	Water Conveyance System

Source: Adapted from Figure 7-2 (prepared by Access Consulting Group) in Minto Explorations Ltd. 2018. Minto Mine Reclamation and Closure Plan Revision 2018-01.

srk consulting	capstone MINTO MINE	Water and Load Balance Model Report 2018
Job No: 1CM002.044	Minto Mine	**General Arrangement- End of Mine**
Filename: Fig_1-1_EOM_GeneralArrangement.pptx		Date: Feb 2018 · Approved: DBM · Figure: **1-1**

2 Water Balance Model Description

2.1 Water Balance Overview

Figure 2-1 shows a schematic of the conceptual water balance for the Minto Site. The water balance can be described as:

$$Water\ Input = Water\ Storage + Water\ Output \qquad (1)$$

Precipitation is the only source of water to site and therefore the only input. The open pits and the Water Storage Pond (WSP) are the primary water storage reservoirs on site during the Operational Period. Water outputs include water released to Minto Creek and water lost to evapotranspiration. The net input of water to reservoirs on site, or net yield, can be expressed as:

$$Net\ Yield = Precipitation + Groundwater\ Discharge - Evapotranspiration - Groundwater\ Recharge \qquad (2)$$

Note that the yield term includes both surface and groundwater terms. Net yield is a measure of the total volume of water that report to the reservoirs on site, regardless of flow path. Net yield can be described in terms of a yield coefficient, defined as follows:

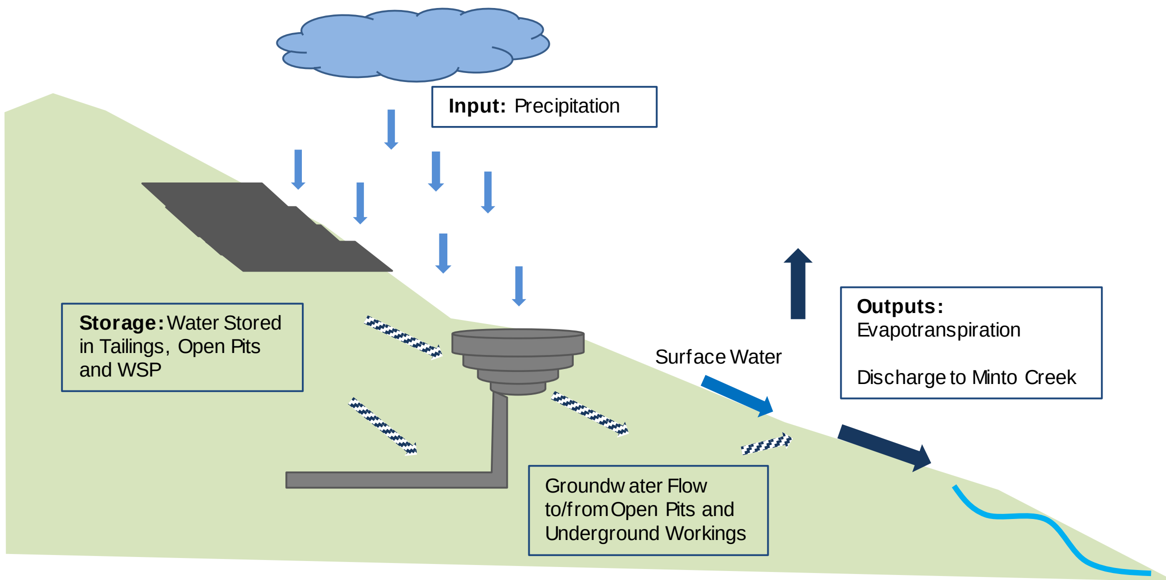
$$Net\ Yield = Precipitation * Yield\ Coefficient \qquad (3)$$

The yield coefficient approach allows the water balance to be simplified to:

$$Net\ Yield - Water\ stored\ on\ Site = Water\ Released\ to\ Minto\ Creek \qquad (4)$$

Figure 2-1 shows a schematic of the simplified water balance. In a year with average annual precipitation (329 mm/year) the net yield from catchments within the Minto Mine site is approximately 950,000 m^3. Of that, approximately 530,000 m^3 will report to tailings pores during the period when the mill is running. The annual volume of water reporting to waste rock pores range from zero to about 200,000 m^3, depending on the volume of waste inundated in any given year. On average, waste rock pore water amounts to roughly 60,000 m^3/year. This leaves approximately 360,000 m^3 of surplus water that must be stored on site or released to Minto Creek in an average-precipitation year.

In previous versions of the water and load balance model for the Minto Mine, groundwater was not included as a discrete path. At Minto, the cross section of the Minto Creek Valley at the Water Storage Dam is narrow and bedrock is relatively shallow. As such, the majority of groundwater that flows toward Minto Creek is expected to report to the stream as surface water and only a small fraction is expected to flow from site via subsurface pathways (SRK, 2015a). In this 2018 revision of the water and load balance model, the assumption that the majority of the groundwater reports to the surface upstream of the Water Storage Pond (WSP) is carried forward. However, discrete groundwater discharge and recharge terms for the open pit zones have been included. The groundwater flow estimates are based on a revised version of the 2015 Groundwater Model as described in SRK (2015a).



Source: X:\01_SITES\Minto\1CM002.0XX_PhaseVII_Support\!080_Deliverables\Water and Load Balance Report\040_Figures\Figure 2.1 and 2.2 Water_Balance_Schematic_Minto_REV01.pptx

Figure 2-1 Water Balance Schematic

2.2 Water Balance Inputs

Inputs for the water balance model are summarized in Table 2-1 and discussed in the following sections.

Table 2-1 Input Required for Water Balance Model

Water Balance Component	Input Required
Net Yield	Annual precipitation rates Open water evaporation rates Sub-catchment areas Site-wide yield coefficient Typical hydrograph
Water storage	Open pit water volumes Tailings and waste rock deposition schedules
Groundwater	Estimated seepage rates to/from open pits Underground dewatering rates
Water Discharged to Minto Creek	Historical WSP pumping schedule

2.2.1 Precipitation

Precipitation is the only input of water to the Minto Mine site water balance model. The water balance model calculates annual yield based on annual precipitation and a site-wide yield coefficient. Therefore, a reliable estimate of the frequency and intensity of total annual precipitation is important for the accuracy of model predictions.

Rainfall data collected on site was used in conjunction with long-term regional precipitation records to estimate the distribution of annual precipitation rates. The precipitation record for the Minto site is shown in Table 2-2. Rainfall data has been recorded at site beginning in September 2005. In October 2011, Minto installed an adapter for measuring snowfall as water equivalent. For this update, on-site rainfall and total precipitation data from the period September 2005 through December 2016 were used.

Table 2-2 Monthly Rainfall and Total Precipitation Measured at Minto

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005	**	**	**	**	**	**	**	**	21.60	23.00	11.60	4.60	60.8
2006	0.00	0.40	2.80	**	22.84	35.80	28.63	29.20	12.20	12.20	0.00	0.00	144.1
2007	0.20	0.00	0.40	5.80	4.60	36.00	47.80	21.00	33.80	11.80	0.00	0.00	161.4
2008	1.20	2.00	0.80	1.80	9.60	26.20	**	100.60	21.80	6.40	0.00	0.00	170.4
2009	5.20	0.00	0.80	3.23	**	**	6.08	50.76	7.20	16.60	0.00	0.00	89.9
2010	0.00	0.00	0.00	0.00	7.60	48.8	75.6	46.4	18.0	16.3	3.05	0.00	215.8
2011	0.00	6.40	0.20	0.40	15.3	56.0	101.8	64.8	15.6	4.40(A)	0.15**	3.94**	269.0
2012	9.0**	9.9**	34.9	0.0	0.1**	32.1	44.8	20.6	26.1	16.5	17.1	18.4	229.5
2013	4.4	73.8	7.4	0.0	7.9	21.0	113.5	46.8	59.7	13.6	36.6	27.0	441.7
2014	16.9	8.0	0.0	3.8	15.0	12.0	50.5	13.4	30.5	22.0	2.9	21.0	196.0
2015	12.4	0.0	10.9	8.0	4.9	20.5	37.7	80.3	16.7	27.7	7.1	11.5	237.7
2016	11.7	7.8	3.3	14.7	31.5	22.2	68.2	35.9	17.8	9.8	13.6	14.1	250.6

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

Notes:

** partial data only.

(A)) Measurement transitioned from rainfall to total precipitation on Oct. 15/2011.

Green highlight: total precipitation measurements.

Regional precipitation data were available from a number of meteorological stations in the Yukon (Table 2-3). Rainfall data up until 2012 from each station were correlated with precipitation data collected from the Minto site to determine whether long-term regional precipitation data would be suitable for use as a basis for estimating annual precipitation at the site.

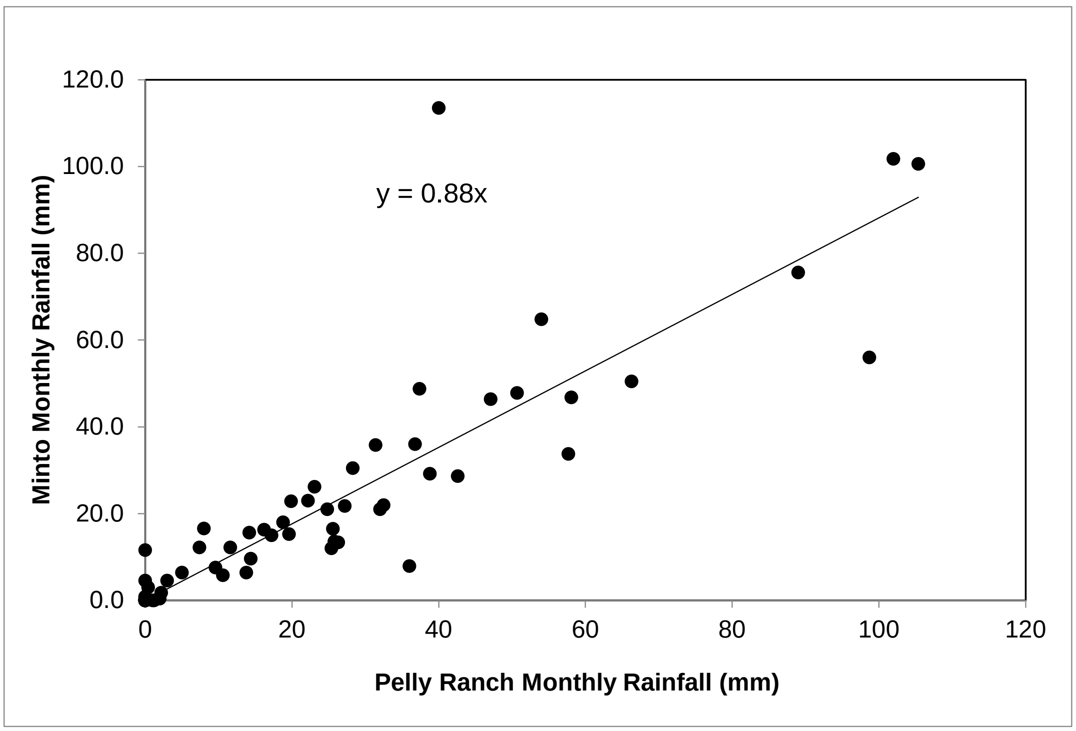
Rainfall data at the closest regional meteorological station at Pelly Ranch (Climate ID: 2100880), located 23 km from the Minto Mine, resulted in the best correlation with rainfall data from site. The precipitation record at Pelly Ranch dates back to December 1951 and has continued to the present day. Figure 2-2 shows a plot of monthly rainfall values at Minto and at the Pelly Ranch station. The correlation can be expressed as:

$$Minto\ Rainfall = 0.88 * Pelly\ Ranch\ Rainfall \qquad (6)$$

Table 2-3 Regional Meteorological Stations

Station	Latitude	Longitude	Distance From Site (km)	Elevation (m)	Record Begins	Record Ends
Minto Site	62°36'59"	137°15'00"	0	887	Sep-05	Present
Burwash Airport	61°22'00"	139°03'00"	168	807	Oct-66	Present
Carmacks	62°06'00"	136°18'00"	109	525	Aug-63	Present
Dawson Airport	64°02'35"	139°07'40"	184	370	Jan-76	Present
Faro Airport	62°12'27"	133°22'33"	205	717	Dec-77	Present
Haines Junction	60°46'21"	137°34'49"	206	595	Oct-44	Present
Mayo Airport	63°37'00"	135°52'00"	131	504	Oct-11	Present
McQuesten	63°36'00"	137°31'00"	110	457	Oct-86	Present
Pelly Ranch	62°49'00"	137°22'00"	23	454	Dec-51	Present
Whitehorse Airport	60°42'34"	135°04'07"	241	706	Apr-42	Present

Source: SRK, :\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\02_Hydrology_and_Meteorology\Regional_Analysis\Regional Precipitation Data\Regional_Met_Station_Summary_1CM002.003_Rev01_TC.xlsx



Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\!080_Deliverables\2016_RCP_Water_and_Quality_Report\040_Figures\Figure 2-3.xlsx

Figure 2-2 Comparing Minto Mine and Pelly Ranch Rainfall (Sept. 2005 to March 2015)

A comparison of snow-water equivalent data from Minto and Pelly Ranch (not shown) resulted in the following correlation:

$$Minto\ Snowfall = 1.24 * Pelly\ Ranch\ Snowfall \quad (7)$$

Based on these correlations the annual precipitation at Minto correlates to the annual precipitation at Pelly Ranch as follows:

$$Minto\ Annual\ Total\ Precip. = 1.09 * Pelly\ Ranch\ Annual\ Total\ Precip. \qquad (8)$$

Table 2-4 shows the estimated average total annual precipitation values for Minto based on the correlation with Pelly Ranch precipitation data. A frequency (or probability) distribution of total annual precipitation was developed for the Minto site based on the long-term total precipitation record available for the Pelly Ranch station. Pelly Ranch precipitation values were only used if a calendar year contained valid information for more than 95% of the total number of days in that year. The use of this data quality criteria resulted in a total of 51 years of valid data to be included in the frequency distribution analysis.

The 51 years of annual precipitation data were fitted against six different statistical distributions: Normal, Log-Normal, Gumbel, Log-Pearson, Pearson III, and GEV. The best fit was obtained with a Pearson III Distribution ($r^2 = 0.99$). This Intensity/frequency distribution was used as input for the water balance model. The final results are presented in Figure 2-3 and Table 2-5.

Table 2-4 Estimated Average Precipitation at Minto Based On Pelly Ranch Precipitation Data

Month	Average Rainfall (mm/month)	Average Snowfall (mm/month)	Average Total Precipitation (mm/month)
Jan	0.08	28.6	28.7
Feb	0.08	20.3	20.4
Mar	0.14	15.9	16.0
Apr	3.10	9.29	12.4
May	19.16	0.63	19.8
Jun	32.38	0.00	32.4
Jul	47.85	0.00	47.9
Aug	34.98	0.02	35.0
Sep	22.91	3.07	26.0
Oct	6.72	22.0	28.7
Nov	0.30	37.3	37.6
Dec	0.08	30.4	30.4
Total (mm/year)	167.8	167.5	335.3

Source:Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\2_Hydrology_and_Meteorology\Met_Data\Minto_MasterStationFile_20130607.xlsx

The estimated average total precipitation for Minto was slightly lower for the frequency analysis (329 mm/year) than for the direct computation using the average total precipitation value from Pelly Ranch (335 mm/year). This difference is a result of the imperfect fit between the data and the distribution model that is used. In the interest of consistency with frequency distribution approach, the total precipitation value generated by the Pearson III distribution (329 mm) was used as input to the water balance model.

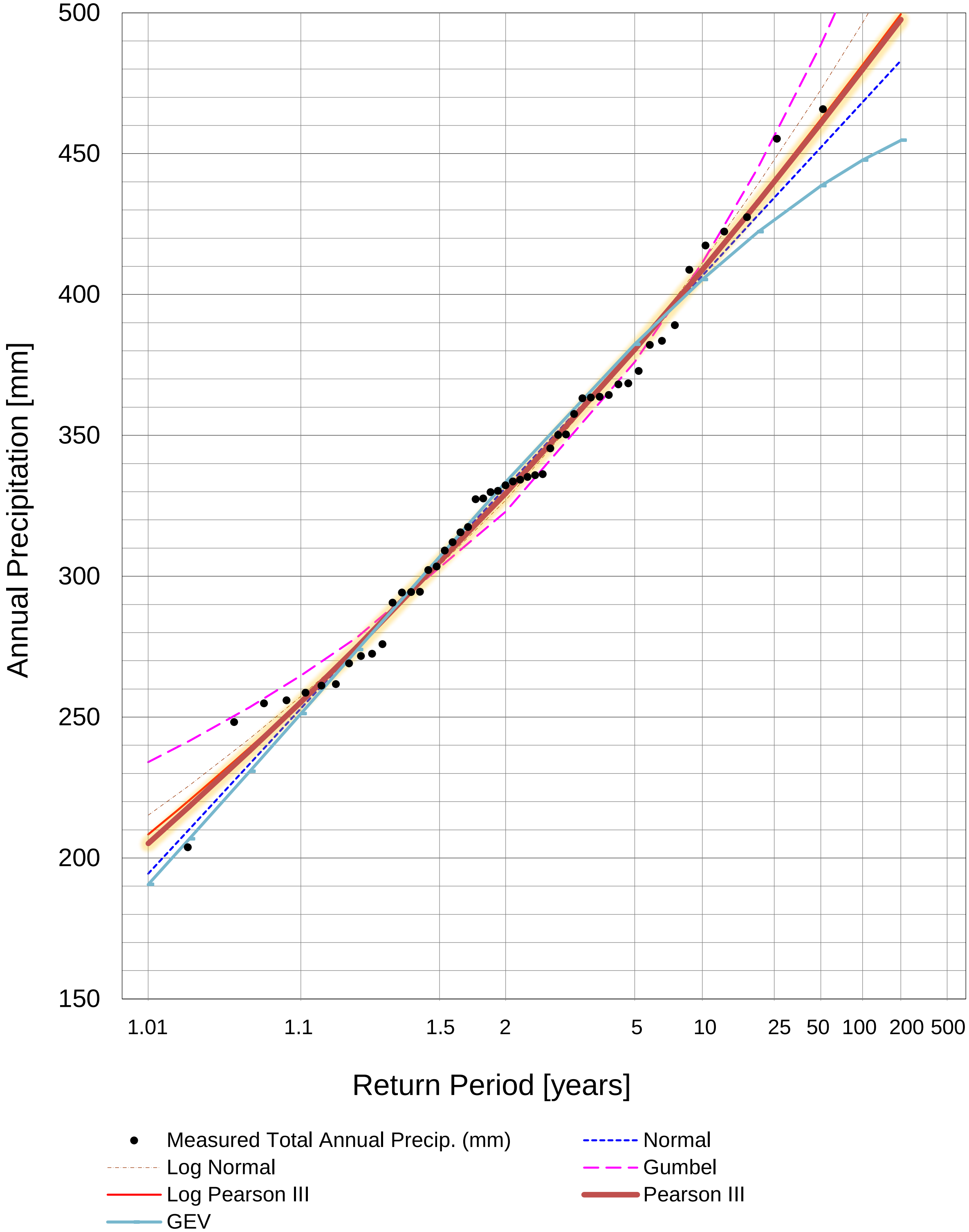


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Figure 2-3 Precipitation Frequency Analysis for the Minto Mine Site

Table 2-5 Precipitation Frequency Analysis Statistics

Cumulative Probability	Return Period	Season	Normal	Log Normal	Gumbel	Log Pearson III	Pearson III	GEV
0.005	200	Wet	483	519	554	499	498	455
0.01	100		468	496	521	481	480	448
0.02	50		452	473	489	462	461	439
0.05	20		428	439	445	434	433	422
0.1	10		407	411	411	409	409	405
0.2	5		381	380	376	380	380	382
0.5	2		331	327	323	329	329	333
0.8	5	Dry	275	275	278	275	275	274
0.9	10		253	257	265	256	255	251
0.95	20		233	242	254	239	238	231
0.98	50		210	226	242	220	218	207
0.99	100		194	215	234	208	205	191
	R^2		0.98	0.98	0.97	0.98	0.99	0.97

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\PMP Hershfield Estimation & Freq Distribution_VM_Rev4_SRJ.xlsx

2.2.2 Evaporation

For modelling purposes evaporation estimates were based on regional data. Monthly lake evaporation (aka potential evaporation) has been recorded at the Pelly Ranch station from 1965 to 2005; the mean annual lake evaporation value is 452 mm. In historical revisions of Minto's water balance, open water evaporation and evapotranspiration were estimated based on the regional data and model estimates.

Estimated evaporation values for the site were adopted from work completed by Clearwater Consultants Ltd. as part of the previous year's water balance update completed for the mine site (CCL 2010). Table 2-6 shows the adopted monthly evaporation values, which for modelling purposes were assumed to be constant for each year included in the scenario runs.

Evaporation estimates are associated with considerable uncertainty. However, in the present model revision, evaporation losses were only discretely applied to open water bodies, including the pit lakes and the Water Storage Pond. A sensitivity analysis was completed to quantify the effect of uncertainties associated with the annual evaporation rate. The analysis showed that a difference of +/- 100 mm of annual evaporation would make a +/- 2.6% difference to the annual water balance (net inflow) estimate, which was considered to be relatively insignificant in the context of other uncertainties and year-to-year variability.

Table 2-6 Estimated Monthly Open Water Evaporation Values for Minto

Month	April	May	June	July	August	September	Total
Evaporation (mm)	12	83	119	112	83	30	439

Source:
Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\04_Amendment_8_Support\02_Source_Term_Archive\[Minto Mine Water Balance_2011 Update Modified Goldsim_SRJ_Rev01

2.2.3 Catchments

The Minto Mine site, excluding the proposed Minto North Pit, is located within the Upper Minto Creek watershed. For the purposes of this report, Upper Minto Creek will refer to the portion of the Minto Creek catchment upstream of the Water Storage Dam. The catchment downstream of the Water Storage Dam will be referred to as Lower Minto Creek. The Upper Minto Creek catchment covers an area of 1,038 ha, which has been divided into sub-catchments for modeling purposes. Table 2-7 and Figure 2-4 show Upper Minto Creek sub-catchments that were delineated for the Phase V/VI water balance model.

The Minto North Pit is located within the McGinty Creek catchment to the north of the Minto Mine. Table 2-8 and Figure 2-5 shows McGinty Creek sub-catchments delineated for the Phase V/VI water and load balance model.

Table 2-7 Upper Minto Creek Catchment Areas

n1_Main_Pit_Undisturbed	11.5
n2_SW_Waste_Rock	40.7
n3_Overburden_Dump	31.5
n4_Overburden_Dump_Undisturbed	16.6
n5_Main_Waste_Dump_Undisturbed	12.8
n6_Main_Waste_Dump	48.1
n7_SW_Waste_Rock_Undisturbed	47.6
n8_W15_Undisturbed	110.9
n9_Main_Pit_Highwall	26.3
n10_Mill_Area_Undisturbed	27.6
n11_Area_2_Pit	18.3
n12_Portal_Area	2.2
n13_Ridgetop_N_Highwall	2.9
n14_Mill_Area	16.0
n15_Ore_Stockpiles	13.3
n16_WSP_Undisturbed_N	139.8
n17_Dry_Stack	19.3
n18_Dry_Stack_Shell	5.6
n19_Main_Pit_Submerged	15.2
n20_Ridgetop_N_Pit	8.2
n21_Mill_Valley_Fill_Stage_1	12.4
n22_Ridgetop_Waste_Dump	28.1
n23_Area_118_Pit	6.9
n24_Ridgetop_South_Pit	2.3
n25_Main_Pit_Dump	14.9
n26_Portal_Undisturbed	7.6
n27_Area_118_Undisturbed	2.7
n28_Ridgetop_N_Undisturbed	13.1
n29_W35_Undisturbed_South	144.1
n30_WSP_Undisturbed_S	66.5
n31_Area_2_Highwall	17.7
n32_Mill_Valley_Fill_Stage_2	4.7
n33_Underground_Laydown	2.9
n34_Drystack_Undisturbed	4.8
n35_Tails_Diversio_Upstr_Undis	27.9
n36_W35_Undisturbed_East	28.8
n42_Contractor_Area	5.0
n43_Overburden_undisturbed	1.1
n44_medium_grade_waste	22.2
n45_high_grade_waste	5.8
n46_ice_rich_overburden	4.2
SUM	1038

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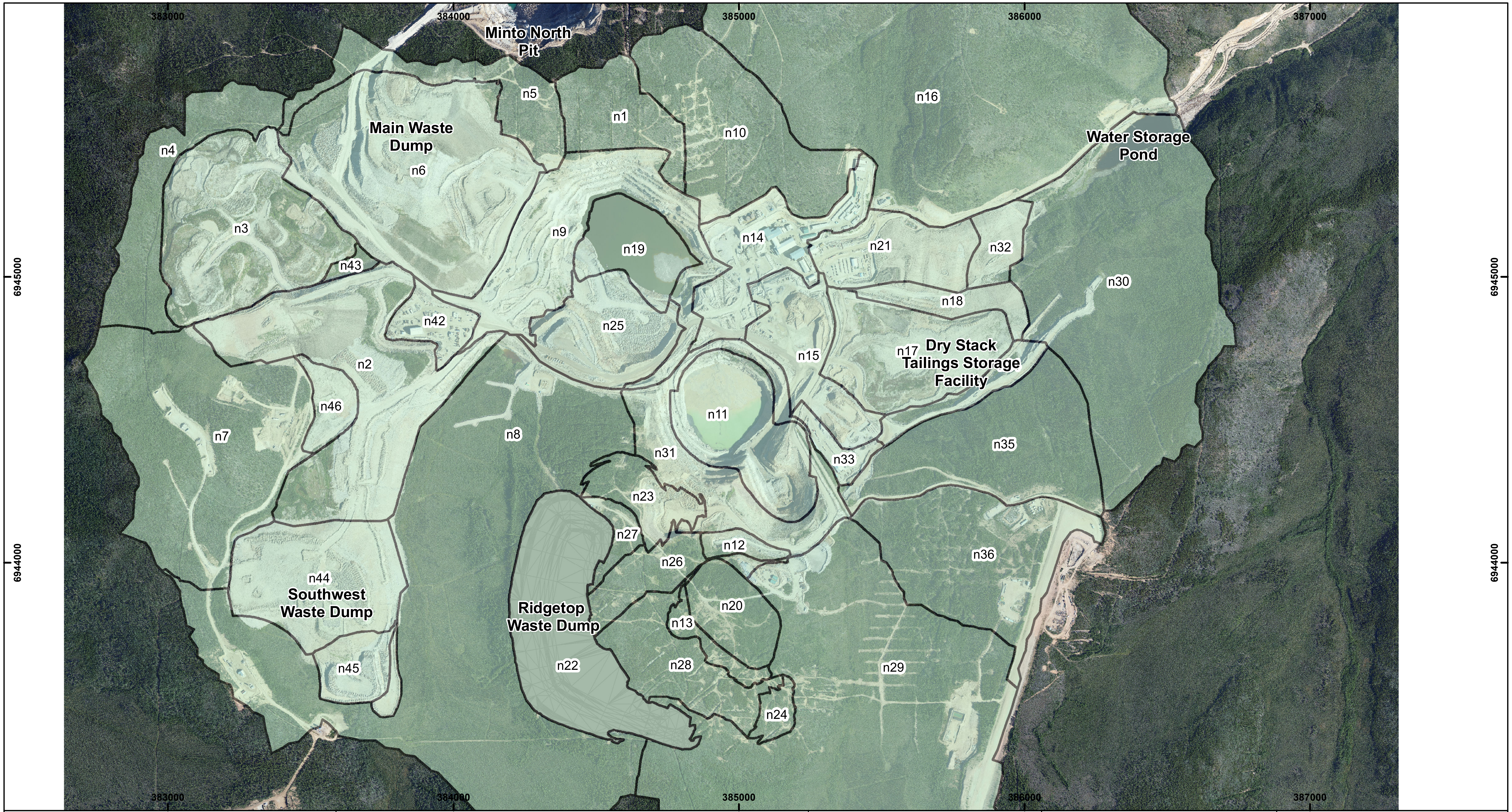

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Subcatchments

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Job No: 1CM002.58	Minto Mine	Water and Load Balance Report Report 2018
Filename: Minto_20171101_SubCatchments_rev00		Subcatchments within Minto Mine Site
		Date: Feb 2018 · Approved: SRJ · Figure: 2.4

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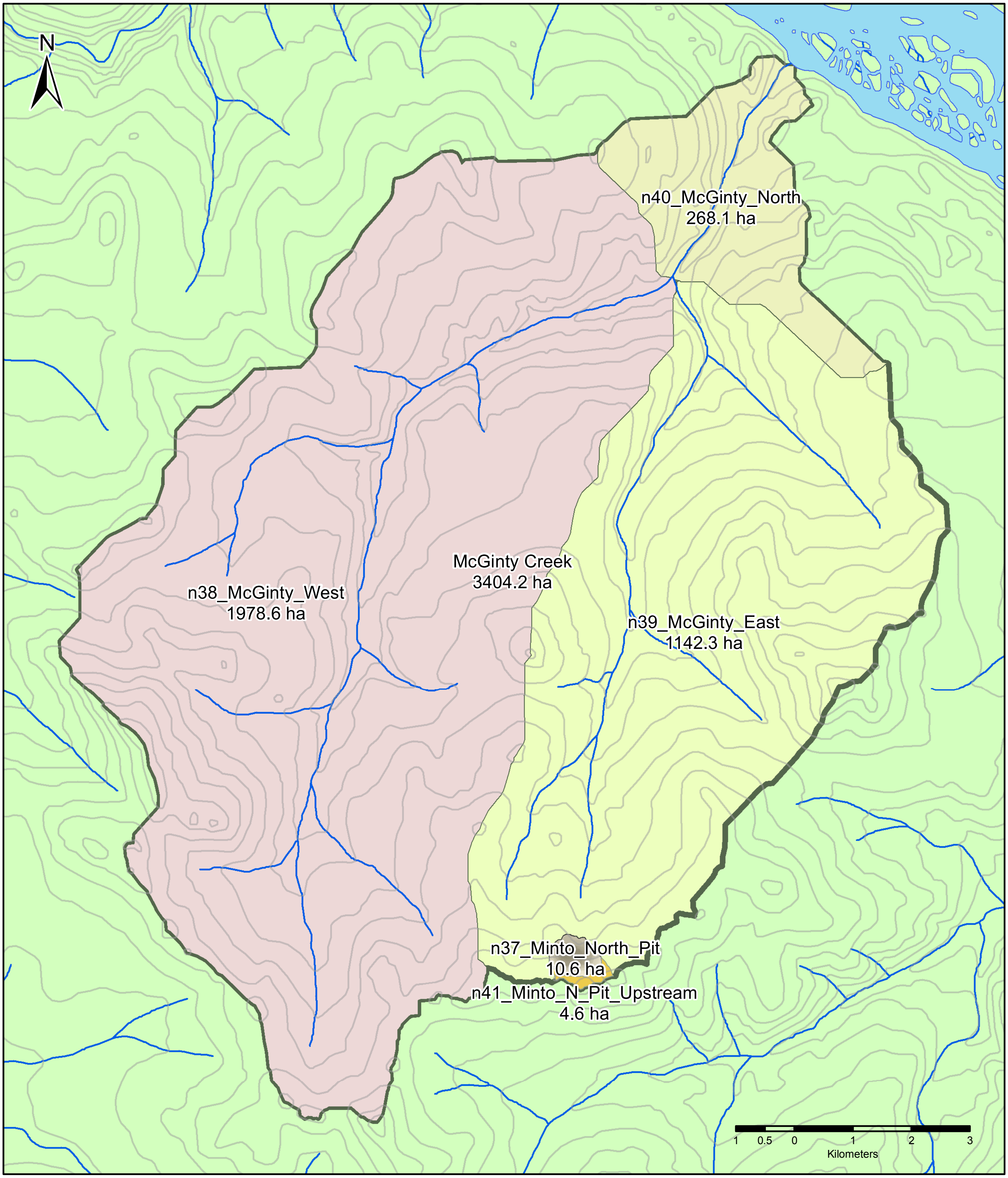

srk consulting	CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.	Water and Load Balance Report 2018
		McGinty Creek Sub-Catchments
Job No: 1CM002.024 Filename: PhV_VI_Minto_North_REV06_AMD	Minto Mine	Date: February 2018 / Approved: KNK / Figure: 2.5

Table 2-8 McGinty Creek Sub-Catchments

Sub-Catchment	Area (ha)
n37_Minto_North_pit	10.6
n38_McGinty_West	1978.6
n39_McGinty_East	1142.3
n40_McGinty_North	268.1
n41_Minto_N_Pit_Upstream	4.6
Total Catchment Area	**3404.2**

Source:X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\04_Catchments\Phase_V_VI_Catchments\Minto_Phase_V_VI_Catchment_Table.xlsx

2.2.4 Yield Coefficient

As described in Section 2.1, annual catchment yield (water that reports to reservoirs on site) can be estimated by multiplying the total annual precipitation by a site-wide yield coefficient (Equation 3). This yield includes surface runoff and steady-state flow of shallow and deep groundwater. Groundwater flows to or from the open pits or underground workings are not included in the yield estimate. Such groundwater flows are caused by advancement and dewatering of underground workings or by inundation of open pits and are therefore not influenced directly by the same-year precipitation and run-off. For the 2018 water and load balance, the use of a site-wide yield coefficient for land areas was found to be more appropriate than assigning specific yield coefficients to areas with different land use and surface cover characteristics. Firstly, flow measurements on site (hydrological monitoring stations and flow meters) measure water collected from different land use areas, *i.e.* a combination of undisturbed and developed mine areas. This makes it difficult to evaluate yield coefficients for any one type of land use area based on actual site performance data. Therefore, uncertainties associated with area-specific yield coefficients would magnify the uncertainty of the site-wide water balance and it would be necessary to arbitrarily adjust each of the yield coefficients to match the site-wide water balance. Secondly, during the operations and closure (pit filling) phases the available water storage capacity on site is generally greater than the annual volume of surface yield, and therefore reliable forecasts of total site-wide annual yield volumes are more important for water management planning than forecasts of yield from individual sub-catchments.

Monitoring data collected on site since 2007 was used to estimate the value of the site-wide yield coefficient for Upper Minto Creek. The yield coefficient estimate is updated once a year in conjunction with the annual water balance update for the site. The 2015 and 2016 water balance updates (Appendix B) generally agreed with the established yield coefficient value of 0.30, which was derived based on previous years' water balance data.

The estimated total annual precipitation at the Minto Mine has generally been greater than 300 mm/year for the period 2007 to 2015. Consequently, the site-wide yield coefficient of 0.30 was effectively derived for annual precipitation greater than 300 mm/year. However, this yield coefficient may overestimate yield in relatively dry years. In order to account for this the site-wide yield coefficient for dry years was assigned lower values in the water balance model. The dry year coefficients were based on work completed by Clearwater Consultants Ltd. (CCL 2010) for the Minto Mine site as follows:

- A yield coefficient of 0.15 was used for dry years with less than 190 mm total precipitation.
- A yield coefficient of 0.30 was used for years with greater than 309 mm total precipitation.
- Yield coefficients for years with total precipitation between 190 mm and 309 mm were interpolated values between 0.15 and 0.30.

Figure 2-6 shows yield coefficient values used in the model as a function of total annual precipitation.

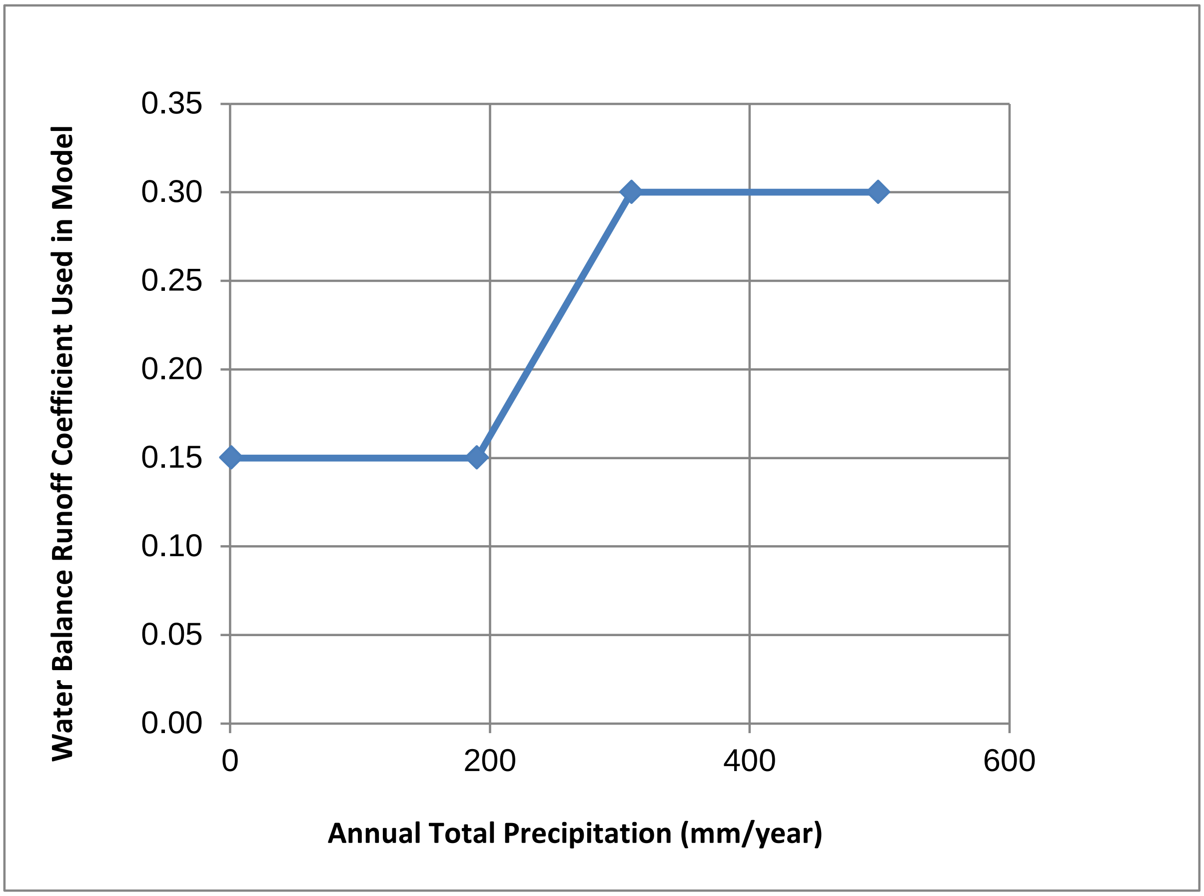

Figure 2-6 Water Balance Yield Coefficient vs. Total Annual Precipitation

The one exception is that open water areas (flooded pits and the WSP) were treated differently than land areas. Open water was assigned a yield coefficient of 1.0 along with an annual evaporation rate. This approach relies on the assumptions that any precipitation that falls on a water body becomes part of the water inventory and that the open water evaporation rate is relatively constant from year to year. As discussed in Section 2.2.2, the effect of uncertainty associated with the estimate of annual evaporation on the site-wide water balance is relatively insignificant.

Catchment yield estimates calculated from the annual precipitation frequency distribution, catchment area and site-wide yield coefficient are listed in Table 2-9.

Table 2-9 Annual Site-Wide Runoff Estimates

Annual Total Precipitation	Description	Total Catchment Runoff
mm/year		m^3/year
498	1:200 Wet	1,480,000
480	1:100 Wet	1,420,000
461	1:50 Wet	1,360,000
433	1:20 Wet	1,280,000
409	1:10 Wet	1,200,000
380	1:5 Wet	1,110,000
329	**Average**	**950,000**
275	1:5 Dry	660,000
255	1:10 Dry	540,000
238	1:20 Dry	450,000
218	1:50 Dry	350,000
205	1:100 Dry	290,000

Notes: Source:\ X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2016_Water_Balance_Update\ 2016 Water Balance Update REV00 KNK.xlsx

2.2.5 Runoff Distribution

The natural hydrograph for the Minto Creek catchment can vary considerably from year to year. This variability is an important consideration when designing conveyance structures and storage reservoirs for shorter-term storm events. However, the specific daily or monthly runoff distribution does not significantly affect Minto's site-wide water balance during operations and closure.

Because Minto's site-wide water balance is relatively unaffected by short-term runoff events, a fixed monthly runoff distribution was adopted for the water balance model. The fixed monthly runoff distribution used in the water balance model was based on observed monthly flows rates at the hydrometric stations at W3 and W1 in Minto Creek. Figure 2-7 shows the measured runoff distributions at W3 and W1 as well as the distribution that was used in the model.

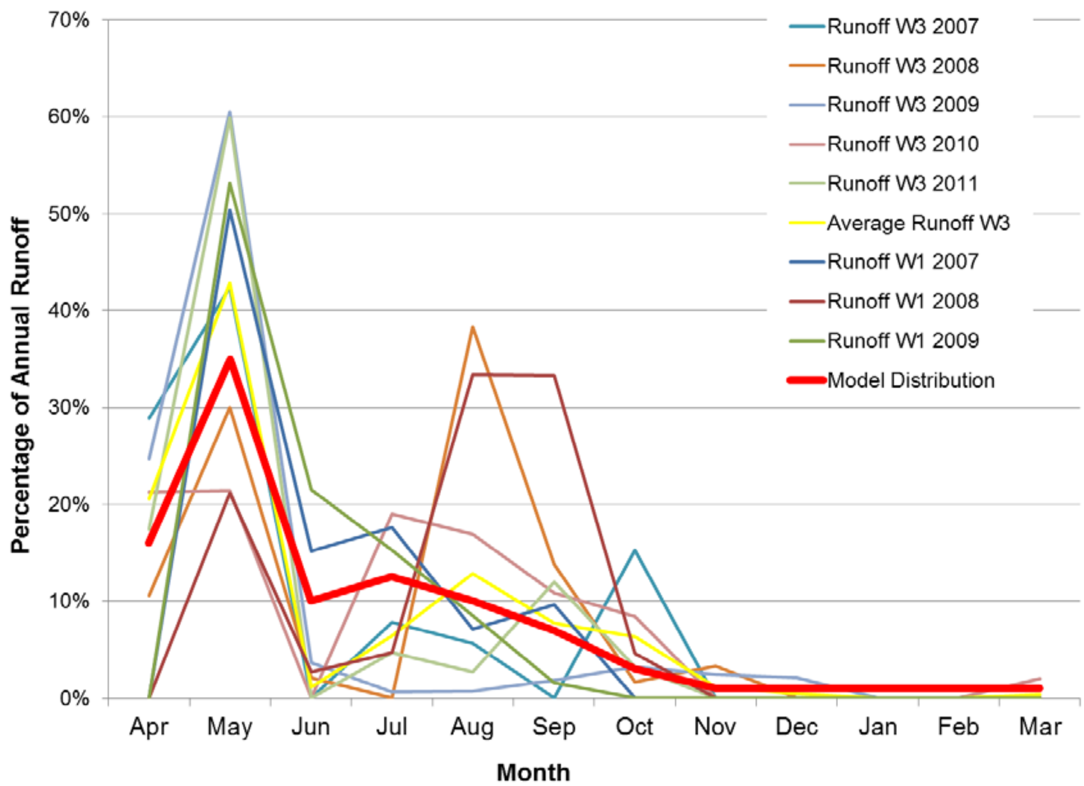

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Figure 2-7 Runoff Distribution Model

2.2.6 Groundwater

Assumptions for groundwater flows from the open pits were based on a revised version of the 2015 Groundwater Model (SRK 2018). Construction details for the model are presented in SRK (2015a). Pit lake water levels were updated for the revised model to reflect current pit level elevations and final pit elevations based on current mine plans:

- Current Pit Levels: Main Pit = 786.28 masl; Area 2 Pit = 765 masl
- Final Pit Levels: Main Pit = 786.28 masl; Area 2 Pit = 799 masl

No other changes were made to the model. The model water balance was queried to determine flows into and out of the pits, and groundwater discharge to surface water features. Table 2-10 summarizes groundwater flows from the open pits to several stations from the revised model.

Table 2-10 Groundwater Flows from Source to Station

Station	Total Groundwater Flow to Station		Total Inflow from Pit Lakes to Station	
	Current Pit Levels	Final Pit Levels	Current Pit Levels	Final Pit Levels
	(m3/d)	(m3/d)	(m^3/d)	(m^3/d)
WSPu	176.36	208.18	29.55	63.66
WSPdg	269.45	304.26	29.98	65.07
W3	338.37	373.09	29.99	65.12
W46	758.19	786.52	29.99	65.12
MC1	1384.70	1404.09	29.99	65.12
YR	1836.00	1844.42	29.99	65.12
Component of Total Inflow to Station from Source				
WSPu			16.8%	30.6%
WSPdg			0.2%	0.5%
W3			0.0%	0.0%
W46			0.0%	0.0%
MC1			0.0%	0.0%
YR			0.0%	0.0%
Percentage of Total Flow from Source Reaching Station				
WSPu			22.7%	49.0%
WSPdg			0.3%	1.1%
W3			0.0%	0.0%
W46			0.0%	0.0%
MC1			0.0%	0.0%
YR			0.0%	0.0%

2.2.7 Reservoirs

Reservoirs on the Minto Mine site include the Main Pit, the Area 2 Pit, and the future Ridgetop North Pit Tailings Management Facilities (TMFs) and the Water Storage Pond. Historically, the dry-stack tailings were also considered a reservoir because of the pore water stored in the tailings mass. In the model, the available storage capacities of the open pit TMFs are defined as the volume that can be filled with water, waste rock and tailings solids. Requirements for freeboard and contingency storage are not considered to be available storage and are therefore not included in values for available storage capacity.

Main Pit

The Main Pit was mined between 2007 and 2011. Since completion of mining, the pit has been used for storage of mine water and for deposition of waste rock and tailings. The estimated storage capacity of the Main Pit above the August 2016 tailings bathymetry surface and below the spill elevation of 786 m is 917,000 m^3 (Minto, 2017). In October 2017 approximately 576,000 m^3 of free mine water was stored in the Main Pit along with approximately 2,500,000 m^3 of bulk saturated tailings and 1,136,000 m^3 of bulk saturated waste rock (Minto, 2017). During the operations phase, reclaim water for processing of ore is sourced from the Main Pit TMF. After the end of the milling operation, excess water will be diverted to the Area 2 Pit until the pit is full. At that time, the Main Pit TMF outflow will be directed towards the lower Minto Creek via constructed channels that will be built as part of the closure water conveyance system.

Area 2 Pit

Development of the Area 2 Pit commenced in 2011 and mining is expected to be completed in 2018. The available storage capacity of the Area 2 Pit was approximately 3,700,000 m^3 as of early 2015 when mining of Stage 2 was complete and will be approximately 7,800,000 m^3 following the completion of Stage 3 in 2018. At the end of the mine life in 2018 it is anticipated that approximately 5,200,000 m^3 of bulk tailings and 50,000 m^3 of waste rock will be stored sub-aqueously in the Area 2 Pit.

Following the operations phase, the Area 2 Pit will be allowed to fill with water. Water from the Main Pit TMF will be directed to the Area 2 Pit through the filling phase. When full, water discharging from Area 2 Pit will flow through the primary water conveyance system via constructed channels toward lower Minto Creek.

Area 118 Pit

The Area 118 Pit is relatively small with estimated storage capacities of approximately 210,000 m^3. The pit is expected to be filled in with overburden during mining of Area 2 Stage 3 Pit. Therefore, Area 118 Pit is not considered to be a reservoir for storage of mine water or runoff.

Ridgetop North Pit

Development of the Ridgetop North Pit is planned for early 2018 and is expected to be completed in 2019. The storage capacity of the Ridgetop North Pit will ultimately be approximately 1,900,000 m^3. Tailings deposition in the Ridgetop North Pit will commence as soon as development is completed and will stop when the pit is full of tailings. The Ridgetop North Pit TSF will be covered in the dry at closure as a local high elevation to prevent a pit lake from forming.

Ridgetop South Pit

The Ridgetop South Pit is relatively small and expected to be filled in with overburden during mining. Therefore, Ridgetop South Pit is not considered to be a reservoir for storage of mine water or runoff.

Minto North

Development at the Minto North Pit began in 2015 and open pit mining is now complete. During that time, mine water was collected in the pit and pumped to Main Pit TMF. Underground development in the Minto North Pit is planned for mid-2020 to late-2021. When underground mining is complete the pit will be allowed to fill; a pit lake is expected to form (based on baseline groundwater levels in the area) but the influence of groundwater losses via pit wall fractures will only be known through performance monitoring once the pit is completed. There are no plans to store tailings or waste rock in the Minto North Pit, or to actively use the pit as a reservoir for water management purposes.

Water Storage Pond

The WSP was constructed in 2007 and has a maximum water storage volume of 320,000 m^3. Initially, the WSP was used as a source of process water for the mill. However, when the Main Pit was converted to a tailings management facility following completion of mining, reclaim from the pit supplied water for the mill, the WSP transitioned to function as a storage reservoir for clean runoff and treated water destined for release to Minto Creek. During Active Closure, the Water Storage Dam will be lowered and the footprint of the existing WSP will be converted to a Constructed Wetland Treatment System and a parallel High Flow Bypass Channel (Contango 2016).

2.2.8 Underground

Minto South Underground

Development of the Minto South Underground began in 2012 and mining is expected to be completed in 2018. Any water collected in the underground is pumped or trucked to the surface to either the Main Pit or the Area 2 Pit. Dewatering of the Minto South Underground will continue until development of the other underground areas, excluding the Minto North Underground, is complete.

Minto East Underground

Development of the Minto East Underground is planned for early 2018 and mining is expected to be completed in early 2019. Any water collected in the underground is pumped or trucked to the surface to either the Main Pit or the Area 2 Pit. Dewatering of the Minto East Underground will continue until development of the other underground areas, excluding the Minto North Underground, is complete.

Copper Keel Underground

Development of the Copper Keel Underground is planned for early 2018 and mining is expected to be completed in late 2021. Any water collected in the underground is pumped or trucked to the surface to either the Main Pit or the Area 2 Pit. Dewatering of the Copper Keel Underground will continue until development of the other underground areas, excluding the Minto North Underground, is complete.

Minto East 2 Underground

Development of the Minto East 2 Underground is planned for early 2019 and mining is expected to be completed in late 2021. Any water collected in the underground is pumped or trucked to the surface to either the Main Pit or the Area 2 Pit. Dewatering of the Minto East 2 Underground will continue until development of the other underground areas, excluding the Minto North Underground, is complete.

Minto North Underground

Development of the Minto North Underground is planned for mid-2020 and mining is expected to be completed in late 2021. Any water collected in the underground is pumped or trucked to the surface to either the Main Pit or the Area 2 Pit.

2.2.9 Tailings Management Facilities

Minto halted deposition of tailings to the Dry Stack Tailings Storage Facility in November 2012 and transitioned to sub-aqueous deposition of tailings in the Main Pit TMF. From now until the end of mine life, tailings will primarily be deposited such that they will be saturated over the long term, with a partial volume forming unsaturated beaches in the Main Pit TMF and Ridgetop North TMF. The water and load balance model incorporates projected water volumes associated with tailings slurry, with mill reclaim water, and with pore-water in the settled tailings mass based on the life-of-mine production schedule provided by Minto.

2.2.10 Waste Rock and Tailings Cover

During the active closure period a cover system will be constructed on all waste rock piles and the Dry Stack Tailings Storage Facility. The water and load balance model assumes that the cover will reduce the infiltration of mean annual precipitation from 30% to 20%. This is consistent with previous modelling efforts for the Minto project and is supported by recent soil cover modelling results (SRK, 2015b).

3 Load Balance Inputs

All geochemical sources in the load balance model, including sources representing mine components and background catchment runoff were incorporated as dissolved loadings. Historically, the model accounted for increases in parameter concentrations arising from suspended solids in mine discharge by adding a separate source term for suspended solids at the point of discharge. Although the model retains this capability, this revision only reports on dissolved constituent loadings and concentrations; this is consistent with the dissolved nature of both effluent standards and receiving environment water quality objectives in the current site water use licence (WUL QZ14-031).

Table 3-1 Summary of Load Balance Source Terms

Source Term	Units	Applies to
Background Upper and Lower Minto Creek	mg/L	Undisturbed catchments within and downstream of the Minto Mine site
Dry Stack Tailings Seepage	mg/L	Seepage from the Dry Stack Tailings Storage Facility
Main Pit TMF Unsaturated Tailings Load	mg/year	Main Pit TMF
Mill Area Loadings	mg/year	Mill Area
Minto North Background	mg/L	Undisturbed sub-catchments in McGinty Creek
Minto North Pit Loadings	mg/year	Minto North Pit

Source Term	Units	Applies to
Nitrogen Contribution	mg/L	Added to all water released from the mine to account for loadings of nitrogen species
Ore Stockpile Concentrations	mg/L	Ore Stockpile Area, Operations
Ore Stockpile Loadings	mg/year	Ore Stockpile Area, Closure
Pit Wall Loadings	mg/year	All pit walls
Tailings Slurry	mg/L	Tailings slurry supernatant
Waste Rock Loadings	mg/m^3/year	Large Waste Rock Dumps and Mill Valley Fill Expansion (Stage 1 and Stage 2)

Source: Z:\01_SITES\Minto\1CM002.024_Water_Balance_Support\!080_Deliverables\2016_RCP_Water_and_Quality_Report\020_Tables\Source_terms_Summary_REV00_SRJ_KNK

For this update of the water and load balance, the sulphate source term for the tailings slurry was reviewed. In 2017, sulphate concentrations is the Area 2 and Main Pit water increased at a greater rate than in previous years. After investigating possible causes, SRK concluded that variability in sulphate loadings from tailings slurry was the most likely cause of the concentration increases. Details of the source term review are described in Appendix D.

In order to properly represent the variability in the mill effluent water quality, the tailings slurry source term was divided into two parts: sulphide ore tailings source term and oxide ore (referred to as POX) tailings source term. Typically, just sulphide ore or a blend of sulphide ore and POX ore are processed in the mill. Elevated concentrations of sulphate in the mill effluent coincided with processing of POX. Accordingly, the tailings slurry source terms for sulphide ore and POX ore were developed based on measured sulphate concentrations in the tailings thickener when sulphide ore and POX ore were milled. The loading rates associated with POX processing are highly variable. To maintain conservatism in the model predictions, the Expected Case and Worst Case POX ore slurry source term that represents the highest sulphate loading rates was used for all model scenarios. Details of this review and source term updates are provided in Appendix D.

3.1 Minto Creek

The load balance model was developed to evaluate the potential effects of water quality parameter loadings from mine components on water quality in lower Minto Creek and McGinty Creek. Table 3-1 shows a summary of updated geochemical source terms used in the load balance. Figure 3-1 shows the allocation of source term by sub-catchments within Upper Minto Creek. Each source term represents an estimate of runoff water quality (mg/L) or parameter loadings (mg/year) contributed by a sub-catchment or mine component.

Source term estimates were generated for two scenarios described as “Expected Case” and “Reasonable Worst Case”. The Expected Case scenario is intended to represent typical geochemical loadings (including the scale of variability observed to date) while the Reasonable Worst Case represents an upper limit to water quality parameter concentrations that may be observed in the mine water on site and consequently in Lower Minto Creek.

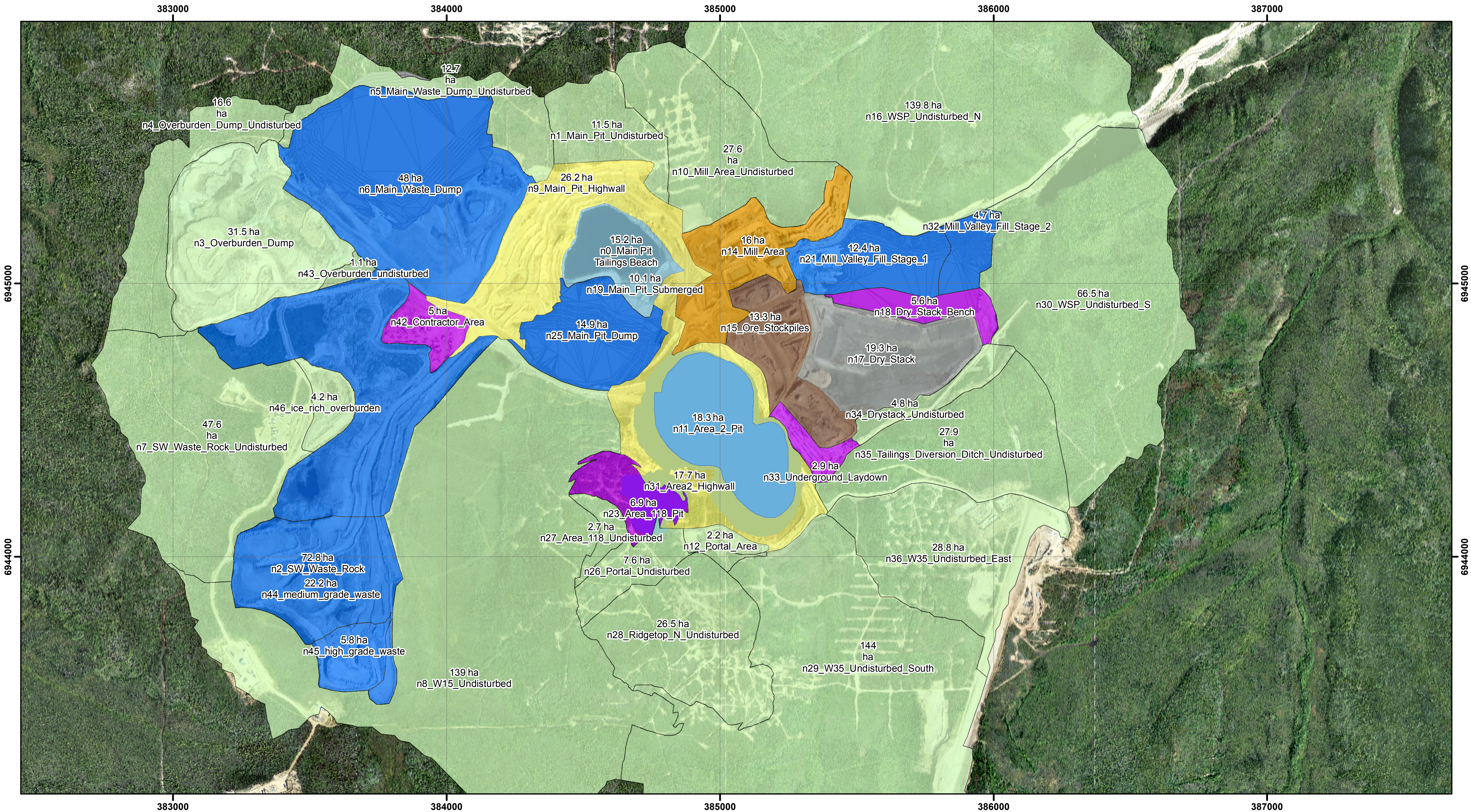
Source terms defined as concentrations (mg/L) were incorporated in the load balance model by assigning the water quality to all flow from the corresponding sub-catchment. Alternately, source terms which were defined as loadings were added as a “dry” load to the appropriate flow or water reservoir.

Details concerning the development of source terms are described in the Minto Mine Expansion-Phase V/VI ML/ARD Assessment and Post-closure Water Quality Predictions report (SRK 2013) and in the 2016 Water Balance and Water Quality Model Summary for the Minto Mine Site provided in Appendix C. Source terms used in the model are provided in Appendix B.

All applicable source terms were updated to include water quality data up to and including December 2016 sampling events. Alexco Environmental Group conducted a review of the dataset used to update the source terms and removed erroneous data and select data points below detection (AEG 2018).

Estimates of background water quality for Minto Creek were initially developed by Minnow Environmental in 2009. Minto Creek water quality monitoring data was compiled into a pooled data set that reflected background conditions (i.e. conditions not affected by mine development activities). The data set was updated and refined in 2016 as part of a process for development of post-closure water quality objectives (WQOs). Details can be found in the Background Water Quality report (Minnow 2016). Post-closure WQOs, based on the summary statistics calculated by Minnow, have been defined by Minto. Details regarding the Post-closure WQOs can be found in the Minto Mine 2018 Reclamation and Closure Plan (RCP 2018-01(Minto 2018)).

It is important to note that both the Post-closure WQOs and background water quality source terms used in the model were derived from the same data set. However the post-closure WQOs were calculated on an annual basis and the background water quality source terms were calculated on a monthly basis. Some months, particularly in the winter, have little water quality sample data. Individual data points in these months therefore have a higher statistical weighting than the more numerous individual data points from summer months in the background water quality summary statistics. Therefore, the monthly summary statistics for background concentrations are in some cases higher than the WQOs, which are based on annual summary statistics. This is the case for dissolved copper and iron concentrations. Figure 3-2 and Figure 3-3 compare measured background concentrations to the WQOs for dissolved copper and iron. Months where background water quality source terms are derived from few data points with elevated measured background concentrations will show consistent exceedance of WQOs in the model results.



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0 75 150 300 450 600 Meters

Legend

Minto Phase V/VI Source Term Allocation

- Background Upper Minto Creek
- Drystack Seepage
- Main Pit TMF Unsaturated Tailings Load
- Mill Area Loadings
- None
- Ore Stockpile Loadings or Concentrations
- Pit Wall Loadings
- Ridgetop TMF Unsaturated Tailings Load
- Waste Rock Concentrations
- Waste Rock Loadings

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Job No: 1CM002.024

Filename: PhV_VI_Source_Terms_REV02_AMD

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Minto Mine

Water and Load Balance Report 2016

Source Term Allocation

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Feb 2018	KNK	3.1

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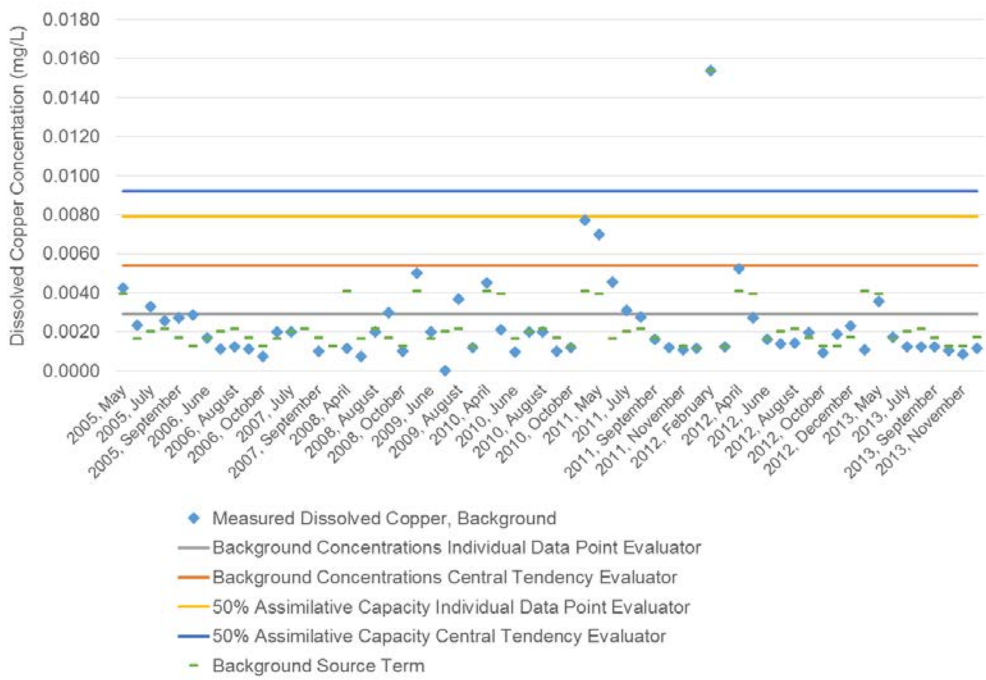

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Figure 3-2 Measured Background Water Quality and WQOs for Dissolved Copper

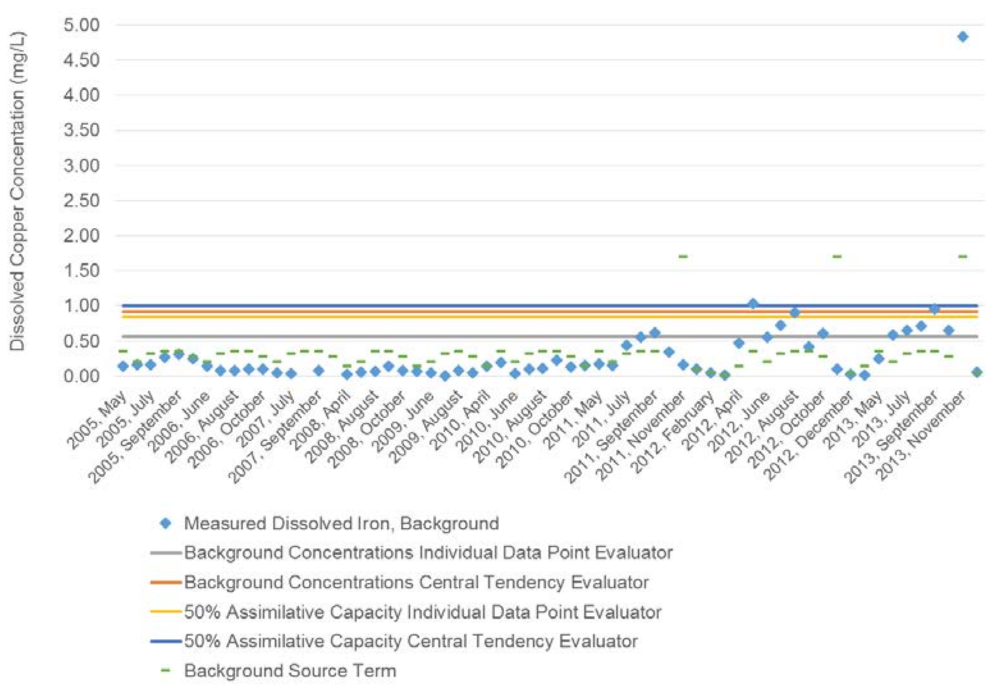

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Figure 3-3 Measured Background Water Quality and WQOs for Dissolved Iron

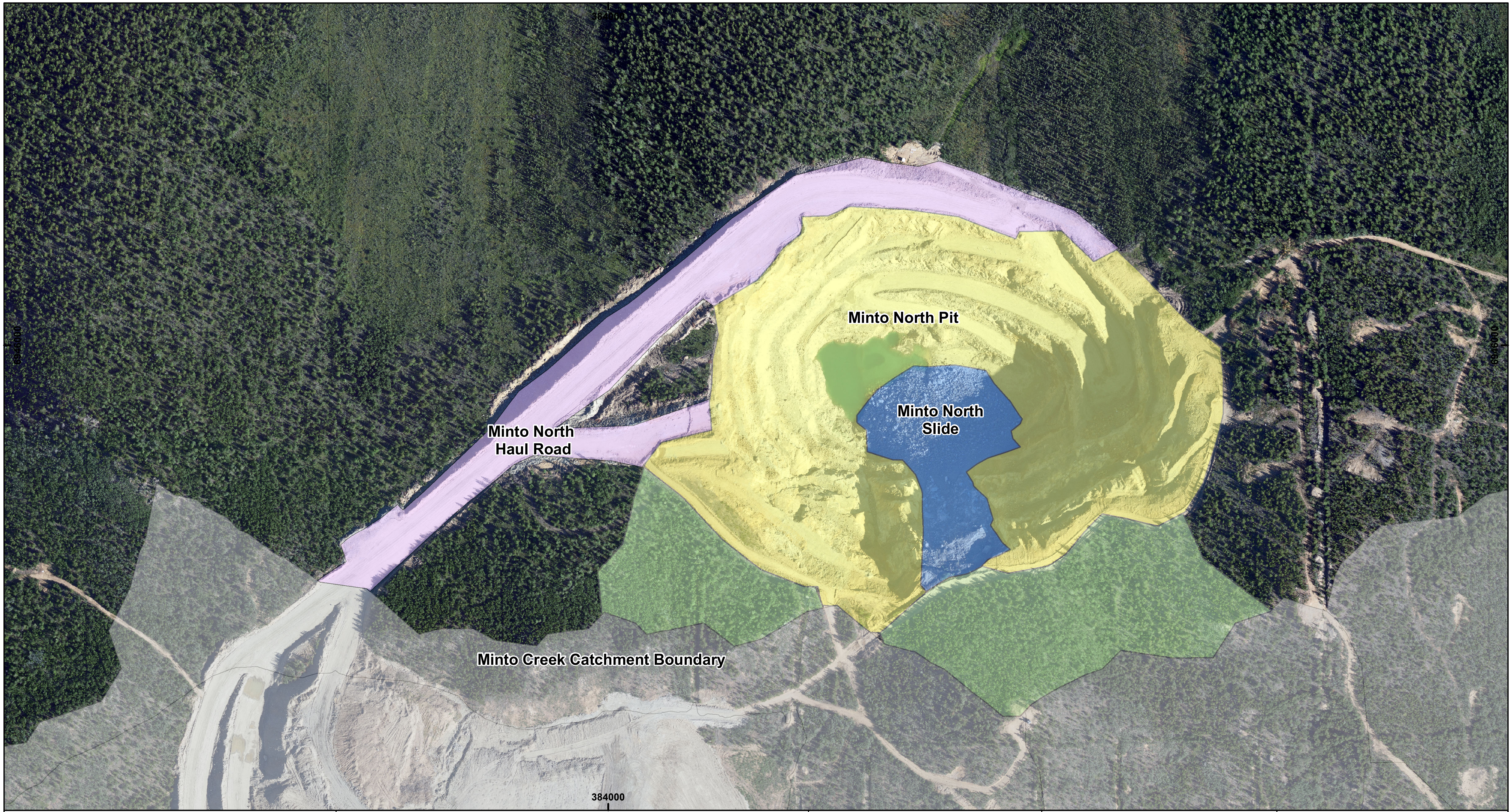
3.2 McGinty Creek

Background water quality data for McGinty Creek is available for the months of April to November. The McGinty background water quality used in the model for all undisturbed sub-catchments was the average of the water quality data at the monitoring station located in McGinty Creek upstream of the confluence with the Yukon River (Station MN-4.5).

The source terms for the Minto North Pit walls were determined based on humidity cell test results (SRK 2013). The source terms for the access road and pit wall failure were assigned the waste rock source term which were determined based on measured water quality at W15.

Figure 3-4 shows the allocation of source terms for the Minto North Pit area. In the water and load balance model, the Minto North Haul Road material was routed towards the upper-eastern catchments of McGinty Creek and from there to lower McGinty Creek. Loadings from the pit walls and slide material was assumed to report to the bottom of the open pit. The rate of seepage of mine water from the open pit to the surrounding groundwater aquifer is difficult to estimate. Therefore, a very conservative approach was adopted to estimate of the theoretical effect of groundwater seepage on water quality in McGinty Creek. It was assumed that all loadings associated with the open pit mine water would report to McGinty Creek after following a lag time of 15 years. This approach is expected to overestimate the transfer of loadings from Minto North Pit to McGinty Creek by at least one order of magnitude.

In addition, the load balance model for Minto North incorporated worst case conditions in terms of source loadings. The entire Minto North Pit wall and waste rock slide material was assumed to remain exposed in the post-closure phase (i.e. maximum exposed area acting as a loading source). The combination of maximum loading rates and maximum pit area exposed is considered to be a very conservative estimate of future loading rates. Partial flooding of the Minto North Pit or application of steady state loading rates, as observed in the humidity cell tests, would result in lower loading rates. Source terms derived for the Minto North Pit are listed in Appendix B.



N

0 20 40 80 120 Meters

Legend

Minto Creek Catchment

Source Term

Background McGinty Creek

Pit Wall Loadings

Waste Rock Concentrations

Waste Rock Loadings

srk consulting

Job No: 1CM002.58

Filename: Minto_20180109_Minto_N_Source_Terms_SRJ

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Minto Mine

Water and Load Balance Report Report 2018

Source Term Allocation Minto North Pit

Date:	Approved:	Figure:
Feb 2018	SRJ	3.4

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4 Model Implementation

4.1 Model Version

The water and load balance model for Minto was developed using the GoldSim software package (version 11.1). The model scenarios described here were implemented in model Version #68.

4.2 General Modelling Approach

4.2.1 Stochastic Water Balance Model

Water balance results for the 2018 water balance model were generated by running the model as a Monte Carlo simulation. Monte Carlo simulations are well suited for situations where the value of a key input cannot be predicted but where the distribution of the input is known or can be adequately estimated. Total annual precipitation for the Minto site is an example of such a variable. Although it is not possible to predict the rate of annual precipitation in any given year, it is possible to develop a probability distribution (see Section 2.2.1).

In the water balance Monte Carlo run, the model randomly selected a value for total annual precipitation from the probability distribution developed for the site (see the Pearson III distribution shown in Table 2-5, Section 2.2.1). Annual runoff volumes were then calculated by multiplying total annual precipitation by a runoff coefficient and catchment area (see Sections 2.2.3 and 2.2.4). The calculated runoff would then be distributed over all months of the year according to the typical hydrograph used in the model (described in Section 2.2.5). The model was run in this manner from year 2015 through 2050, each year with a randomly selected precipitation value, and all results were recorded and stored by the model. A total of 1,000 model runs were completed in this way.

At the end of 1,000 model runs, all results were compiled and probability distributions of the results were generated. Figure 4-1 shows an example of model results for a single year from the Monte Carlo simulation. For illustration purposes, a year well into the post-closure two period is shown to avoid having the example be affected by active water management at site or by transient conditions that correspond to filling of pits in the closure periods. The results show the possible range of flow rates from Upper Minto Creek to W3 as represented by the model. The most likely flow distribution is the mean flow (black line).

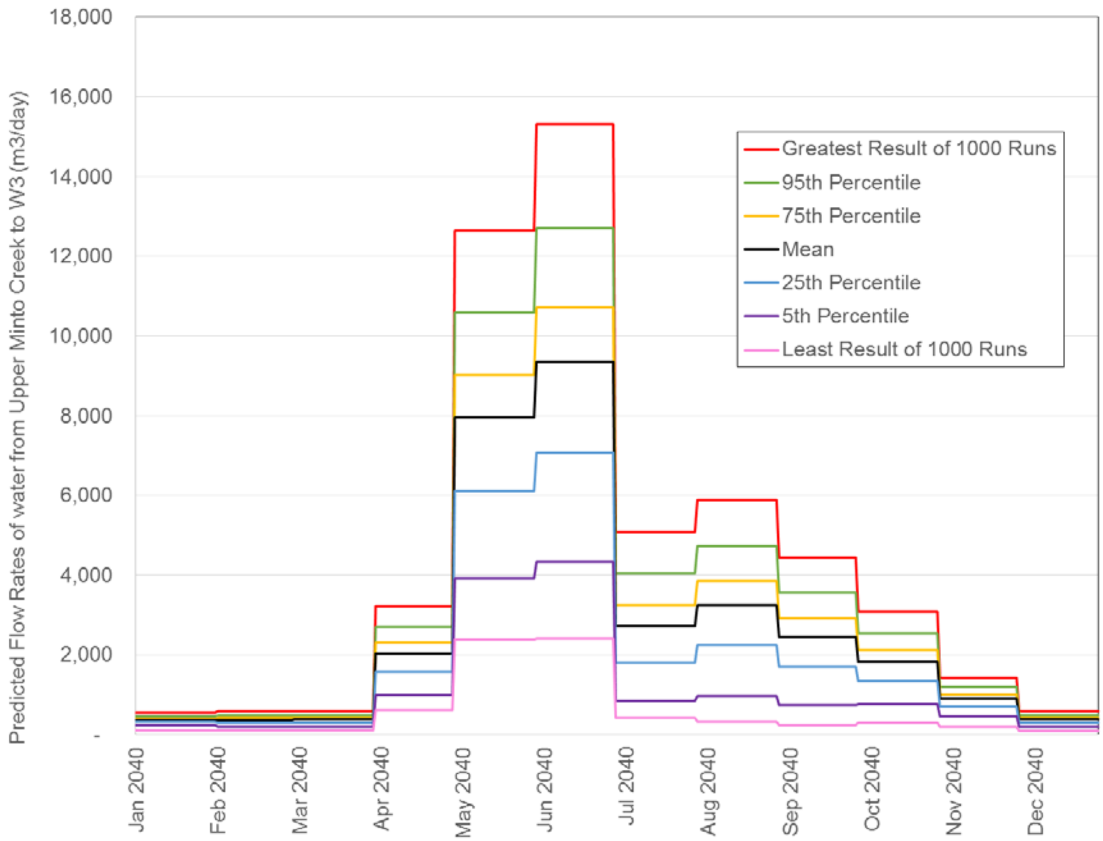

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Figure 4-1 Example of Result Generated by the Monte Carlo Simulation – Predicted Range of Average Flow from Upper Minto Creek to W3 in 2040

Routing of runoff in the model followed the plan detailed in the water management plan and closure plan as described in Section 4.3. The modelling period began on January 1, 2015 and ended on January 1, 2050. The operations period was modelled as ending at the end of April 2022, followed by the closure periods. The water and load balance model assumed that all closure activities were implemented instantaneously at the end of operations.

4.2.2 Loading Balance Model

Loadings were incorporated in the model by associating loadings source terms with the corresponding water flows or mine components as follows:

- Concentration based source terms were applied as constant values to monthly runoff volumes from corresponding sub-catchments as described in Section 3.
- Loading based source terms were incorporated into the model as a “dry” load either to runoff or to water reservoirs. For example, loadings from tailings solids were applied to the water in the reservoir where tailings were deposited.

The development of loadings source terms is discussed in Section 3. The source terms have been updated periodically as new data becomes available. The most recent source term update is described in Appendix B.

4.3 Water Management

The focus of the water management strategy during the operations phase is to maintain a minimal but adequate inventory of mine water on site. The water inventory will, to the extent possible, be managed by diverting clean (i.e. discharge compliant) surface runoff away from developed mine areas and towards the WSP to potentially be released to Minto Creek. The modelling representation of water conveyance and water diversion options are described in the following section.

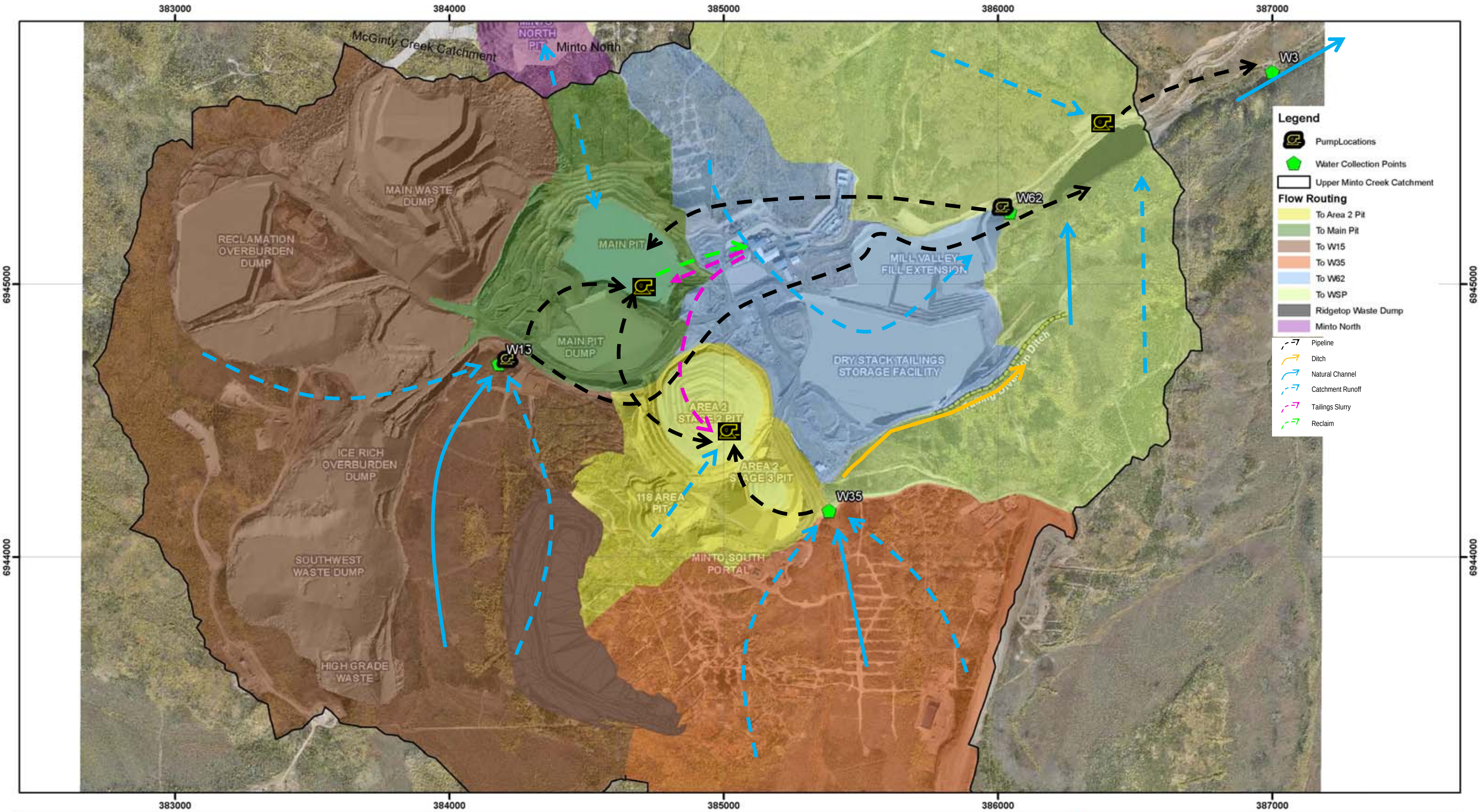
Figure 4-2 and Figure 4-3 show schematics of how water was routed in the water balance model during operations and in the post-closure phases.

During the operations period water collected at W15 is directed to the Main Pit or to the WSP through the piping network on site. Runoff collected by the W35 channel is directed to the Main Pit or to the WSP via a pipeline. Mine water collected at W62 is pumped to the Main Pit. Slurry tailings were deposited in the Main Pit until April 2015 and in the Stage 2 area of the Area 2 Pit thereafter. Tailings are planned to be deposited in the Area 2 Pit Stage 2 and Stage 3 until development of the Ridgetop North Pit is complete. At that time tailings will be deposited in the Ridgetop North Pit until it is full at which point tailings will be deposited in the Area 2 Pit. All mill reclaim water is sourced from the Main Pit throughout the operations period.

The model assumes that the mine enters the post-closure phases immediately following the end of mine life in April 2022. During post-closure (Figure 4-3), water conveyance structures were assumed to be constructed to direct runoff as follows:

- Water collected at W15 reports to the Main Pit along with runoff from upstream catchment areas.
- The Main Pit outflow reports to the Area 2 Pit, until the pit has filled with water and a post-closure pit lake has formed (not shown on Figure 4-3).
- When the Area 2 Pit Lake has formed, the outflow from the Main Pit area reports to the former mill site area, through a channel along the mine access road to the WSP Wetland.
- Catchments upstream of the Area 2 Pit reported directly to the Area 2 pit lake.
- Water in the Area 2 Pit flows via a spill-way through the former mill site and through a channel along the mine access road to the WSP Wetland.
- Runoff from the former mill area and from slopes along the Mill Valley reported directly to the WSP Wetland.
- Water treated by the WSP Wetland report directly to Minto Creek.

Table 4-1 provides further details concerning the implementation of water routing in the water balance model.



Notes: catchment delineation by Access Consulting Group (2013)

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Filename: Minto_Water_Flow_V_VI_20180130_SRJ

Minto Mine

Water and Load Balance Report 2018

Modelled Routing of Water: Operations

Date: Feb 2018

Approved: KNK

Figure: 4.2

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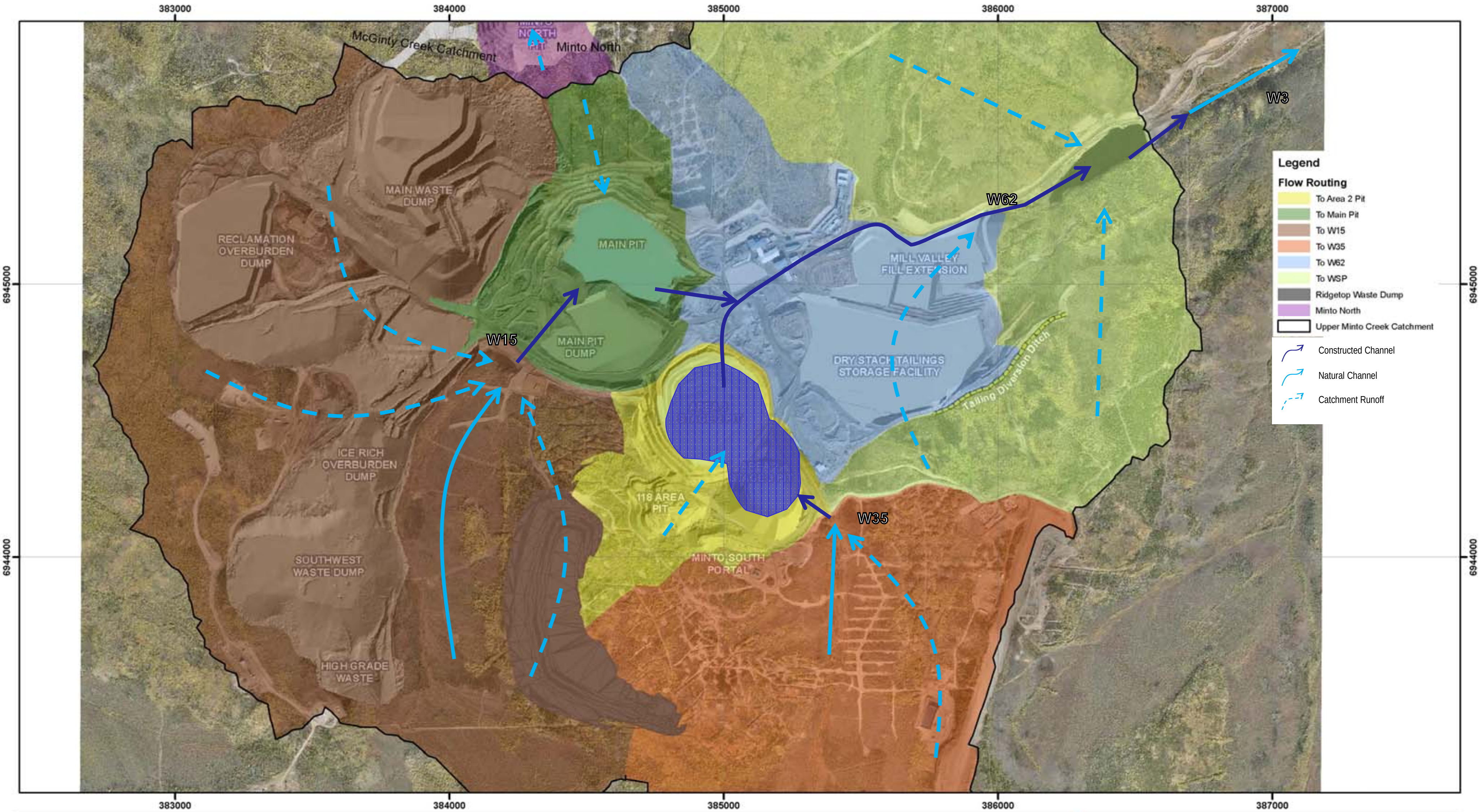

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Notes: catchment delineation by Access Consulting Group (2013)

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Minto Mine

Water and Load Balance Report 2018

Modelled Routing of Water:
Post Closure

Date:	Approved:	Figure:
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Table 4-1 Modelled Routing of Runoff and Mine Water Conveyance

Input	Period	Reservoir	Output	Period
Catchment Yield	Always	**WSP (WSP Wetland as of 2023)**	Minto Creek	Always
W15	Until 2022			
W35	Until 2022			
Area 2 Pit	2025 onwards			
W62	Until 2026	**Main Pit**	to Area 2	2018 to 2024
Catchment Yield	Always			
Minto North Pit	2015 to 2016		Evaporation	Open water seasons
W15	Always		WSP Wetland	2026 onwards
Tailings Slurry Water	Intermittently 2015 to 2016 & in 2018		Reclaim Water	2015 to 2022
Catchment Yield	Always	**Area 2 Pit**	Main Pit	Intermittently 2015-2022
W35	2022 onwards		Evaporation	Open water seasons
Main Pit	2018 onwards			
Tailings Slurry Water	Intermittently 2015 to 2022		WSP Wetland	2025 onwards
			Reclaim Water	Intermittently 2020-2022
Catchment Yield	Until 2022	**Ridgetop North Pit**	Area 2 Pit	2018 to 2022
Tailings Slurry Water	2019 to 2022		W35	2022 onwards
Catchment Yield	Always	**Minto North Pit**	to Main Pit	2015 to 2016
			to McGinty Creek	2017 onwards

4.4 Tailings Slurry Deposition

Tailings slurry deposition was implemented in the water balance as follows:

- Q1 2015 to Main Pit TMF
- Q2 2015 to Main Pit TMF and Area 2 Pit TMF
- Q3 2015 to Q2 2019 to Area 2 Pit TMF
- Q2 2019 to Q1 2021 to Ridgetop North Pit TMF
- Q1 2021 to Q1 2022 to Area 2 Pit TMF

The dry bulk tailings density was assumed to be 1.35 tonnes/m^3. Details concerning tailings slurry deposition for the operations period were provided by Minto.

4.5 Model Calibration

4.5.1 Water Balance Model Calibration

The approach used to calibrate the water model was a site wide yield coefficient that correlated the total annual precipitation to the total annual yield. This approach avoids the uncertainties inherent in quantifying appropriate input values for individual parameters (evaporation, evapotranspiration, sublimation, etc.) by determining a single site wide yield coefficient based on measured values of both precipitation and catchment yield (stream flows) from historical records. The yield coefficient approach integrates all catchment processes into a single empirical factor that describes the relationship between precipitation and catchment yield.

In years for which the total annual precipitation was known, the actual (measured) total annual yield was compared to the modelled total annual yield. The modelled data was calibrated to the measured data by adjusting the yield coefficient to achieve a best fit. After a suitable yield coefficient was identified, it was used to model future site yield estimates.

4.5.2 Loading Balance Model Calibration

The load balance was calibrated by comparing constituent concentrations in the Main Pit and Area 2 Pit water to model predictions and then adjusting source terms accordingly to improve the fit between measured and modelled concentrations. The main sources of loadings to pit water is waste rock seepage and tailings slurry. Source terms for waste rock seepage are based on measured seepage water quality and are therefore, in a sense, already calibrated. Also, waste rock seepage water quality is not expected to change abruptly because of the size of the waste rock areas. Loadings from tailings slurry, on the other hand, are directly related to the characteristics of the ore processed, which can change in short order as the ore type changes. Therefore, the load balance calibration was focused on the ore source term.

The tailings slurry source term update sought to address some of the variability inherent with tailings slurry water quality by generating multiple source terms that characterize sulphide ore tailings slurry and POX ore tailings slurry. These source terms were generated using water quality data from the tailings thickener from 2015 to 2017 as well as the sulphide ore and POX ore milling schedules. Details regarding the updated tailings slurry source terms can be found in Appendix D. In general, the model predictions matched the measured concentrations in the Main Pit and Area 2 Pit reasonably well so calibrations were not needed.

4.6 Water Treatment

4.6.1 Active Treatment

The water treatment plant at Minto can be operated in different configurations depending on the quality of feed water to be treated. Treatment options range from simple TSS removal to sulphide precipitation to reverse osmosis (RO) treatment, which removes 95% to 99.5% of all constituents in the mine water.

In the load balance model scenarios, it was assumed that the water treatment plant would not be operated. This assumption is conservative and allows the effectiveness of the passive water treatment options to be assessed independently.

4.6.2 Passive Treatment

The Minto Mine plans to construct a wetland where the WSP is currently located for long-term passive treatment of water flowing from the mine site during the post-closure phases. The WSP wetland is expected to remove a variety of water quality constituents as described in (Contango 2017). In the load balance model, it was assumed that the wetland will be operational at the start of 2027, approximately 5 years from the end of mine life. The actual commissioning date of the WSP wetland will be contingent on the wetland testing phase that will begin once the wetland has been constructed after the end of mine life. Once the wetland is operational and treats water to an acceptable standard all active water treatment facilities will be decommissioned.

Implementation of the wetland in the water and load balance model was based on the preliminary design basis and operational philosophy. Accordingly, the model assumes that the WSP Wetland will have a total active volume of approximately 2,000 m^3 and a maximum inflow of 3,000 m^3/day. This results in a minimum Hydraulic Retention Time (HRT) of about 16 hours. Should the flow rate into the WSP Wetland exceed 3,000 m^3/day, excess water will be diverted around the wetland untreated. Estimates of removal rates for dissolved cadmium, copper and selenium were incorporated in the model. The estimates rates were based on results of the wetland testing program carried out by Minto (Contango 2016). The estimated removal rate equations are shown in Table 4-2.

Table 4-2 WSP Wetland Load Balance Dissolved Metal Removal

WQ Constituent	Rate Equation	Order	Removal Limit
Ammonia-N	$[NH_3]e^{-0.143/day*HRT}$	First	MDL
Cadmium – Cd	$[Cd]e^{-1.14/day*HRT}$	First	0.000009 mg/L
Copper – Cu	$[Cu]e^{-1.17/day*HRT}$	First	0.015 mg/L
Molybdenum - Mo	$[Mo]-\frac{0.0006\frac{mg}{L}}{hr}*HRT$	Zero	0.005 mg/L
Nitrate-N	$[NO_3]e^{-0.591/day*HRT}$	First	MDL
Selenium - Se	$[Se]e^{-0.319/day*HRT}$	First	0.001 mg/L
Zinc - Zn	$[Zn]e^{-1.14/day*HRT}$	First	0.030 mg/L

Notes:

(1) HRT = Hydraulic Retention Time in hours

(2) MDL = Method Detection Limit

(3) [Cd] = Concentration of dissolved cadmium in WSP Wetland Influent in mg/L

(4) [Cu] = Concentration of dissolved copper in WSP Wetland Influent in mg/L

(5) [Se] = Concentration of dissolved selenium in WSP Wetland Influent in mg/L

The modelled performance of the WSP Wetland was not explicitly adjusted for hydraulic efficiency. Rather, hydraulic efficiencies were assumed to be on the same order of magnitude (or higher) than hydraulic efficiencies associated with the pilot-scale or field scale wetlands that were used as a basis for estimating removal rates.

5 Model Results

5.1 Water Balance Results

5.1.1 Minto Creek Water Balance Results

The primary water management challenge for the Minto Mine is to maintain sufficient storage capacity to meet the anticipated life-of-mine storage requirements and that sufficient stored water is available to meet the needs of the milling operation.

The volume of water that must be released from site each year to maintain an appropriate water inventory is an important factor for managing water on site. By quantifying the volume of water that can be added to the inventory in each year, and consequently the volume of water that should be released, water management staff can implement diversions or plan water treatment campaigns, if required.

Figure 5-1 shows projected volumes of tailings and free mine water in the Area 2 Pit through the operations and post-closure periods for the modelled scenarios. Note that, in the modelled scenarios, filling of Area 2 Stage 2 Pit reaches the saddle elevation prior to the completion of mining in Area 2 Stage 3-4. At that time tailings deposition will be redirected to the Main Pit TMF until Area 2 Stage 3-4 is complete and available for tailings storage. The results indicate that, under the mean runoff model scenario, the Area 2 Pit will be full of water by mid-2024.

5.1.2 McGinty Creek Water Balance Results

The water balance for the Minto North Pit consists of inflows from a small upgradient catchment and from direct precipitation on the open pit. During development and mining of the pit the mine water is being transferred to the Main Pit in the Upper Minto Creek catchment. After mining is complete, the open pit will be allowed to fill. Although it appears that there is a slight net positive water balance for the pit (including the contributions from the upgradient catchment), it is expected that it will take years for the pit to fill and discharge as surface flow to lower McGinty Creek, if it fills at all. Depending on the rate of groundwater flow into and out of the pit area, it is possible that the pit may never discharge via surface overflow (as noted in Section 2.2.7). At this stage of the project, it is not possible to definitively predict whether a lake will form, and what steady state water surface elevation will be established if a lake does form.

The catchment area influenced by the pit is a small component of the overall McGinty Creek catchment (roughly 15 ha vs. 3,400 ha) and therefore the Minto North development is expected to have minimal (i.e. likely not measurable) effect on flow volumes in McGinty Creek.

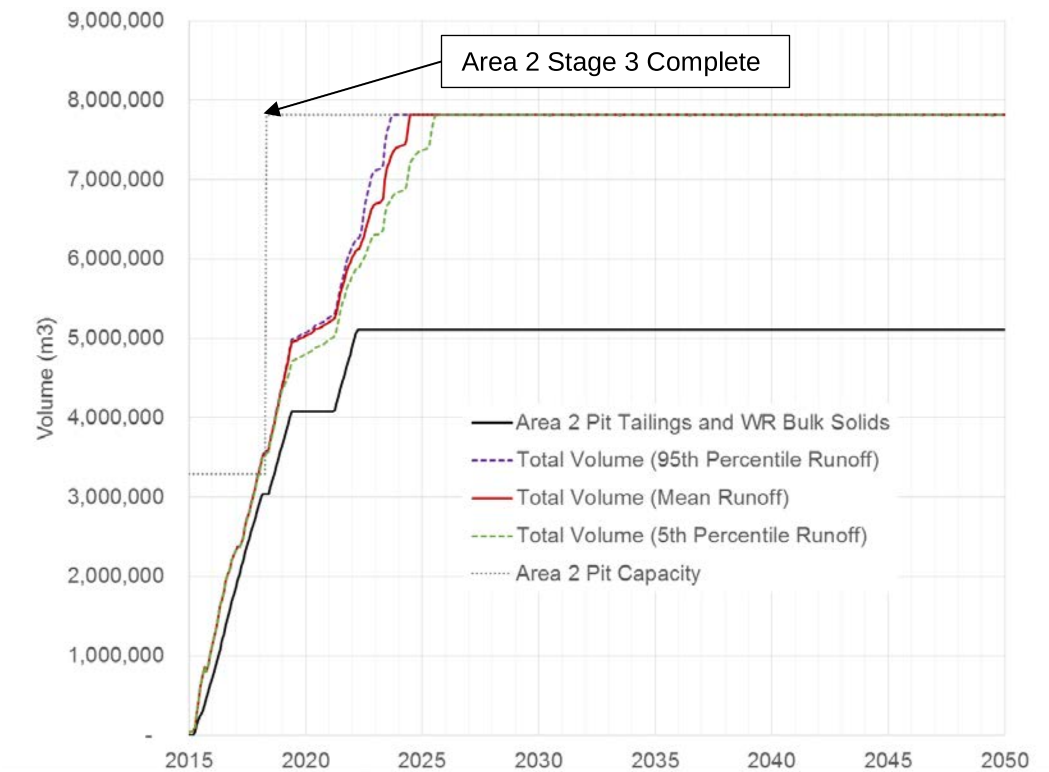

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Figure 5-1 Modelled Area 2 Pit Water and Tailings Volumes

5.1.3 Constructed Wetland Water Balance Results

The design treatment capacity of the wetland is 3,000 m^3/day. The flow rate through the proposed wetland system and high-flow bypass structure during a typical year are shown in Figure 5-2.

As discussed in Section 4.2.1, the stochastic water balance model results produced by the Monte Carlo simulation are probability distributions of water balance outcomes. The average values presented Figure 5-1 are the most likely outcomes, but a range of outcomes are possible. In the results for the post-closure periods when the Area 2 Pit is full, the modelled discharge volumes change with annual rates of precipitation but there is no longer any net change in water storage on site.

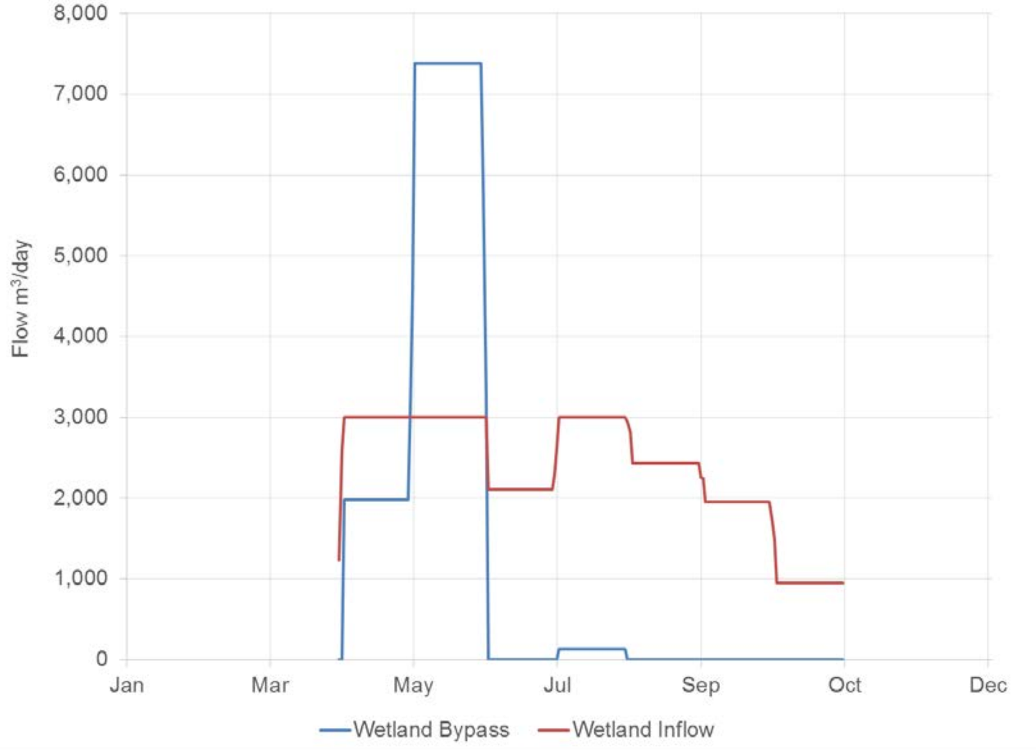

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Figure 5-2 CWTS and High-Flow Bypass Typical Monthly Flow Rates

5.2 Water Quality and Parameter Loadings Results

5.2.1 Post-Closure Water Quality Objectives

Water Quality Objectives (WQOs) have been developed by Minnow Environmental and agreed upon by Minto Explorations and the Selkirk First Nations. Details of the development and application of the WQOs is outlined in the RCP (Minto 2018). In general, the WQOs are summarized as follows:

1. *Closure WQOs that meet the criteria for non-degradation of background concentrations in Minto and McGinty creeks.*

2. *If non-degradation of water quality is not achievable, the closure WQOs shall be set at no more than 50% of the assimilative capacity of Minto Creek using the following formula:*

Closure WQO = BKGD + (0.5[WQO Operations – BKGD])*

where: BKGD = background concentration

The post-closure 50% assimilative capacity WQOs, as calculated using the above equation utilizing the background water quality summary statistics provided by Minnow (2016), are included in the water quality results for station W1 for comparison purposes. A complete list of the Post-closure WQOs is provided in Minto (2018).

5.2.2 Minto Creek Water Quality Results

Water quality predictions for RCP 2018-01 were produced for the five scenarios listed in Table 5-1.

Table 5-1 Model Scenarios

Scenario	Source Term	Phase VII Developments	Passive Treatment
1	Expected Case	Included	None
2	*Reasonable Worst Case*	Included	None
3	*Reasonable Worst Case*	Not Included	None
4	Expected Case	Included	Included
5	*Reasonable Worst Case*	Included	Included

All scenarios include the effect of soil covers as described in Section 2.2.10.

The *Reasonable Worst Case* is a conservative case while the *Expected Case* can be considered to be the most likely outcome, based on the available information. The water quality results shown below include concentrations of copper, selenium, cadmium, and sulphate which currently are parameters of potential concern and are demonstrative of the effectiveness of passive treatment with the exception of sulphate. Copper and selenium are generally indicative of the behaviour of other parameters.

The five scenarios were selected to show the potential effects of source terms, the WSP wetland and the addition of the Phase VII mine developments on the quality of water immediately downstream of site (reported as concentrations at W3) as well as concentrations at W1 in Lower Minto Creek as follows:

- Scenarios 1 and 2 allow for a comparison between effects of *Expected Case* and *Reasonable Worst Case* source terms.
- Scenarios 2 and 3 compare effects on water quality with and without Phase VII mine development.
- Scenario 4 and 5 allow for comparison of wetland performance in cases where the inflow water quality has been influenced by the *Reasonable Worst Case* source terms and by *Expected Case* source terms using the load removal rate equations shown in Table 4-2.

The two model scenarios that do not incorporate passive treatment give a sense of the range of concentrations that may occur based solely on variation in geochemical loading rates from mine-related and background sources and on runoff volumes that vary seasonally with precipitation and melt. The two model scenarios that incorporate passive treatment illustrate the potential improvement in water quality that could be achieved by a constructed wetland treatment system.

Model results for water quality in pits, water released to station W3 in upper Minto Creek and at station W1 in Lower Minto Creek for the entire modelled period (2015 to 2050) are included in Appendix A1. Tabular monthly results are provided for a single year well into post-closure (2045) in Appendix A2 to illustrate typical modelled seasonal variability during the post-closure period. Results are included for open water season only (April to October) as the background water quality source terms for the winter months are highly variable and poorly characterized, and therefore produced misleading results when used as inputs for modelling.

The following acronyms are used in the legends for the figures below:

- EC: *Expected Case* source terms
- WC: *Reasonable Worst Case* source terms
- PhVII UG: Includes Phase VII underground developments
- no PhVII UG: does NOT Includes Phase VII underground developments
- WT: includes wetland treatment
- no WT: does not include wetland treatment

Figure 5-3 to Figure 5-6 show predicted dissolved copper, selenium, cadmium, and sulphate concentrations for mine water in the Main Pit and Area 2 Pit. Concentrations in the pits are expected to increase during the operational stage when waste rock and tailings are deposited. Selenium concentrations increase markedly during periods when tailings are deposited to the pit. After closure, copper, selenium, cadmium, and sulphate concentrations are expected to decline to steady-state levels that are representative of long-term post-mining geochemical loading rates. Concentrations in the Main Pit remain relatively constant, again reflecting geochemical loading rates.

Figure 5-7 to Figure 5-10 show model predictions for dissolved copper, selenium, cadmium, and sulphate concentrations for mine water in the WSP as released to station W3 in Minto Creek. Both profiles show relatively low concentrations during the operational period followed by a modest increase in concentrations at closure. This is because residual mine water stored in the Area 2 TMF begins reporting to Minto Creek at that time.

Figure 5-11 to Figure 5-14 shows modelled values total copper, selenium, cadmium, and sulphate concentrations in Lower Minto Creek (the W1 water quality station). Copper and selenium concentrations follow the trends noted for the W3 water quality predictions but the difference between concentrations during the operations stage and post-closure periods is less pronounced because of dilution from the Lower Minto Creek catchment. Concentrations of nitrate, nitrite and ammonia (not shown) are expected to decrease gradually following the end of active mining in 2018. Residual ammonium nitrate/fuel oil (ANFO) explosives in tailings and water rock contribute the vast majority of nitrogen species to the mine water. Once mining is complete and ANFO use ends, there will be no new sources of nitrate and ammonia loadings.

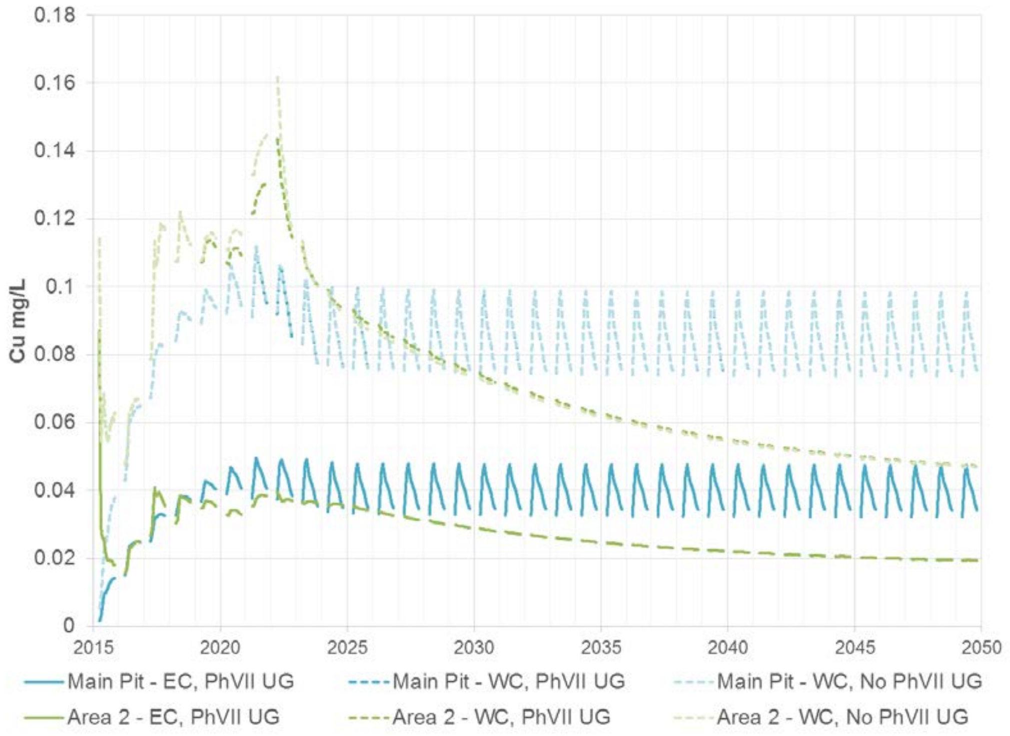

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Figure 5-3 Model Predictions of Dissolved Copper Concentrations in Pit Lake Water

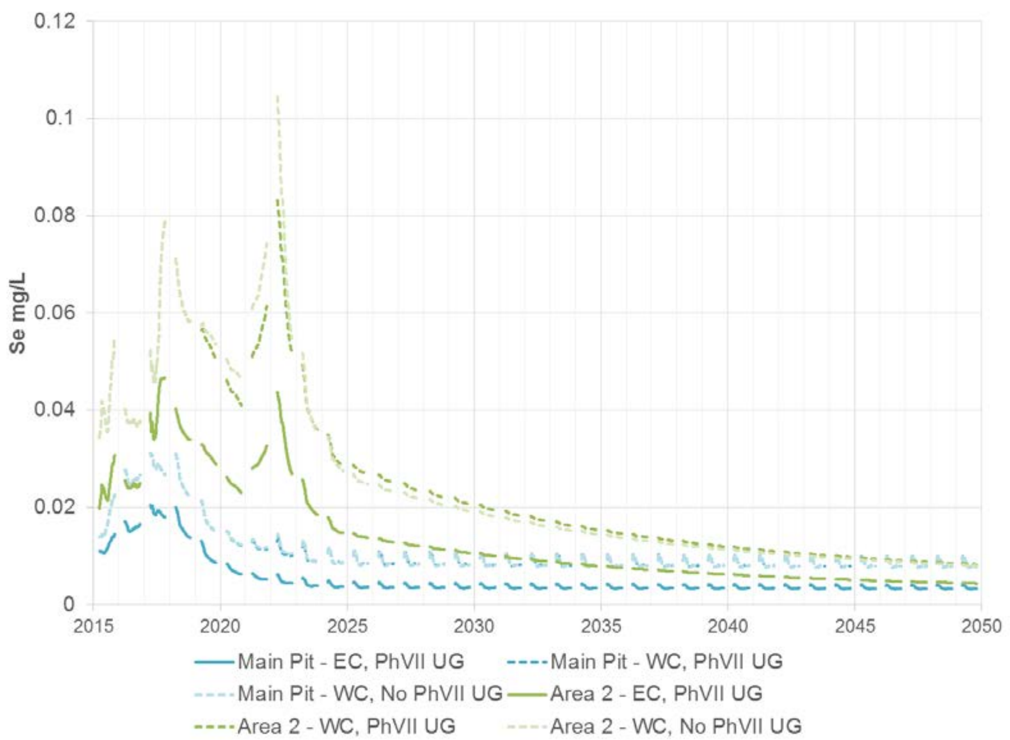

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Figure 5-4 Model Predictions of Dissolved Selenium Concentrations in Pit Lake Water

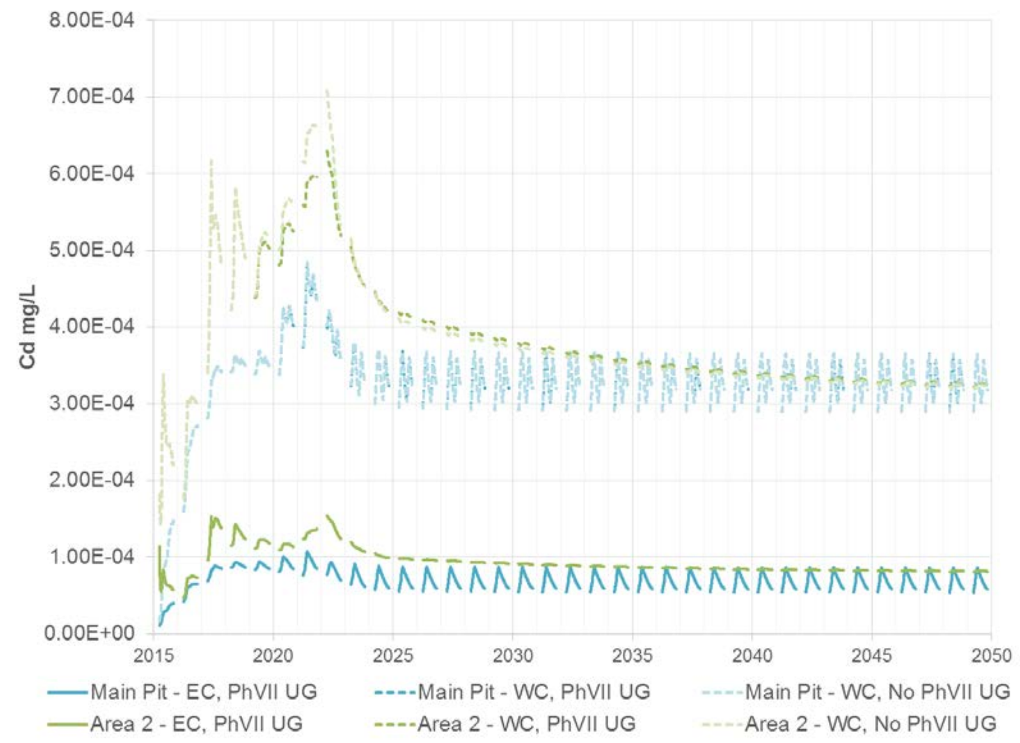

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Figure 5-5 Model Predictions of Dissolved Cadmium Concentrations in Pit Lake Water

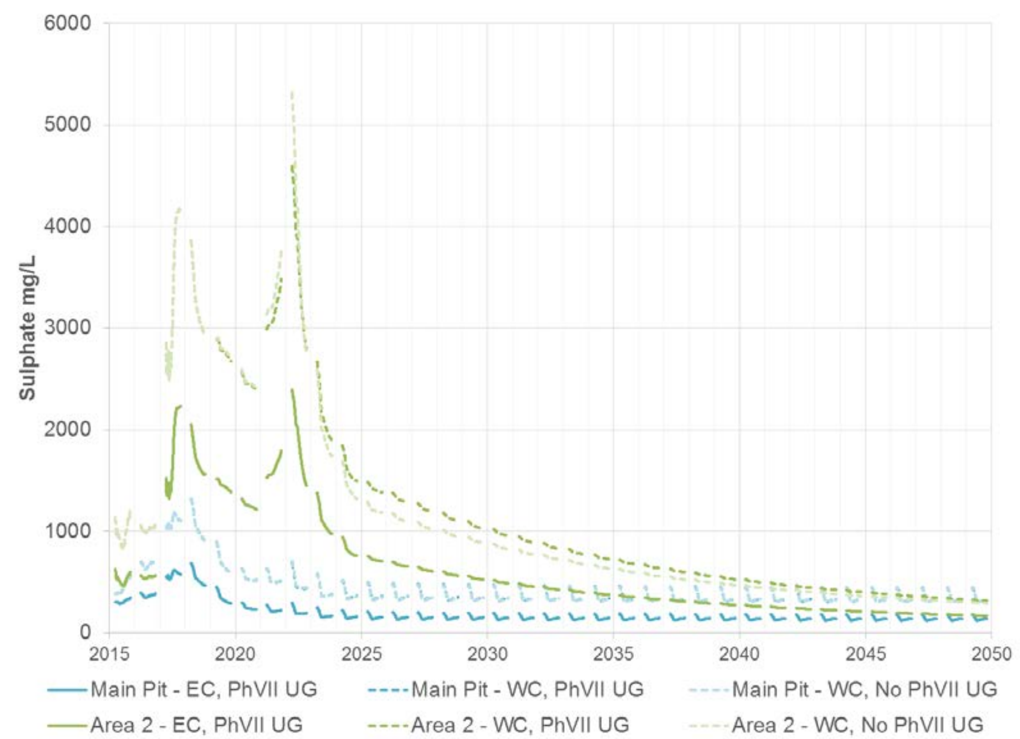

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Figure 5-6 Model Predictions of Sulphate Concentrations in Pit Lake Water

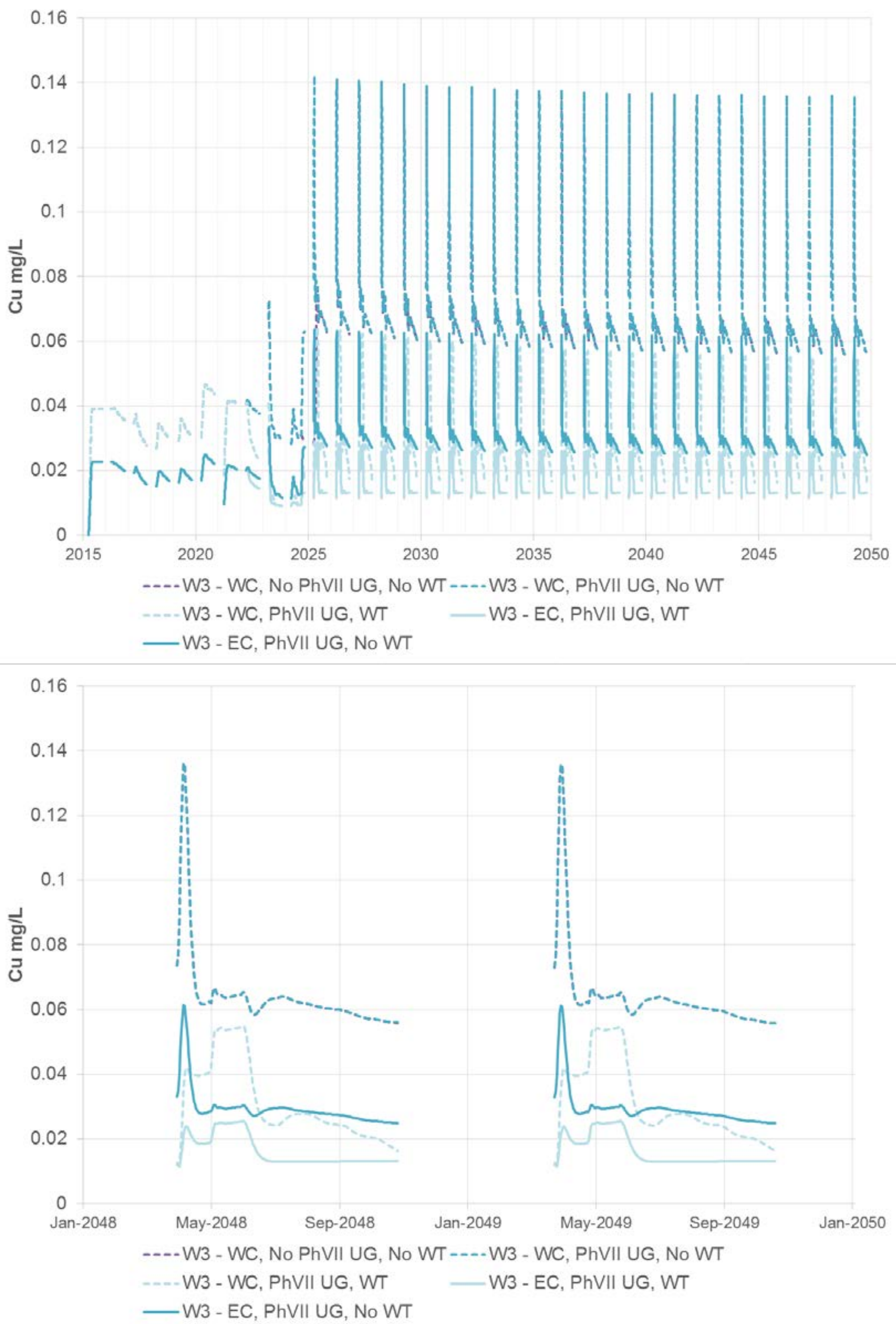

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Figure 5-7 Model Predictions of Dissolved Copper Concentrations at W3

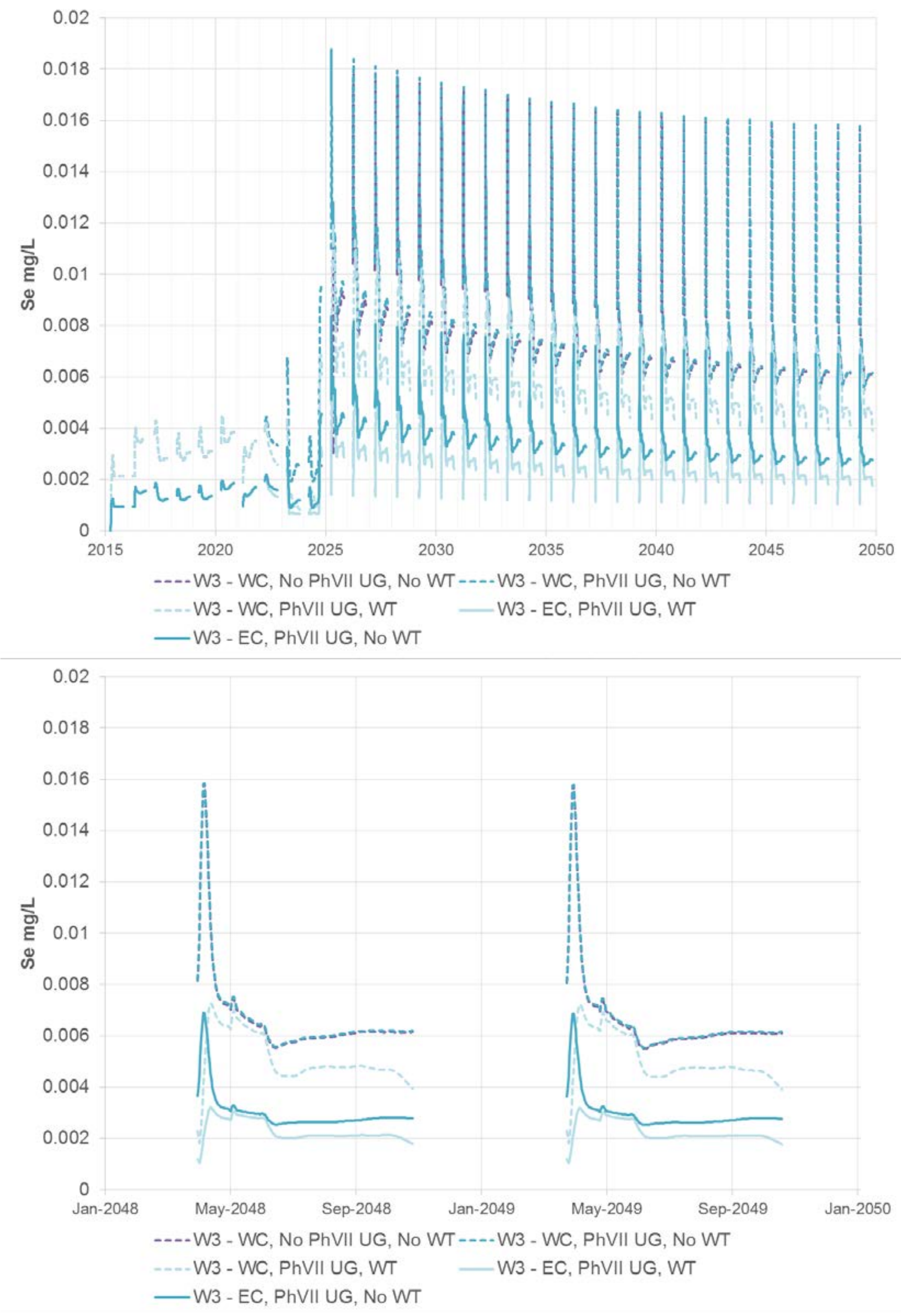

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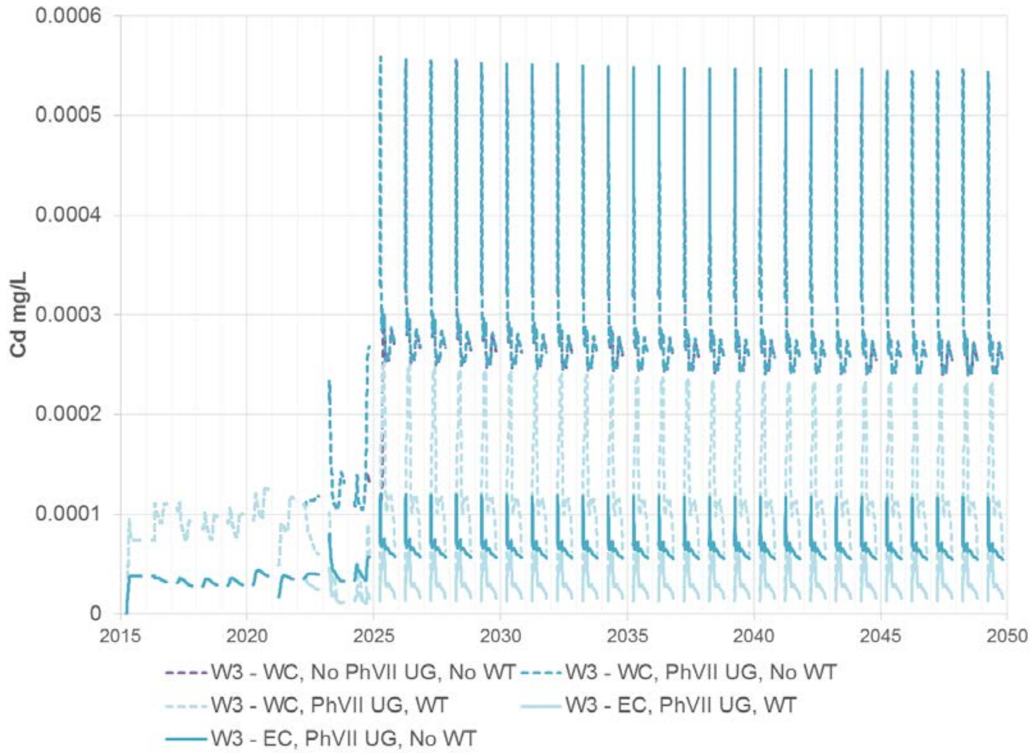
Figure 5-8 Model Predictions of Dissolved Selenium Concentrations at W3



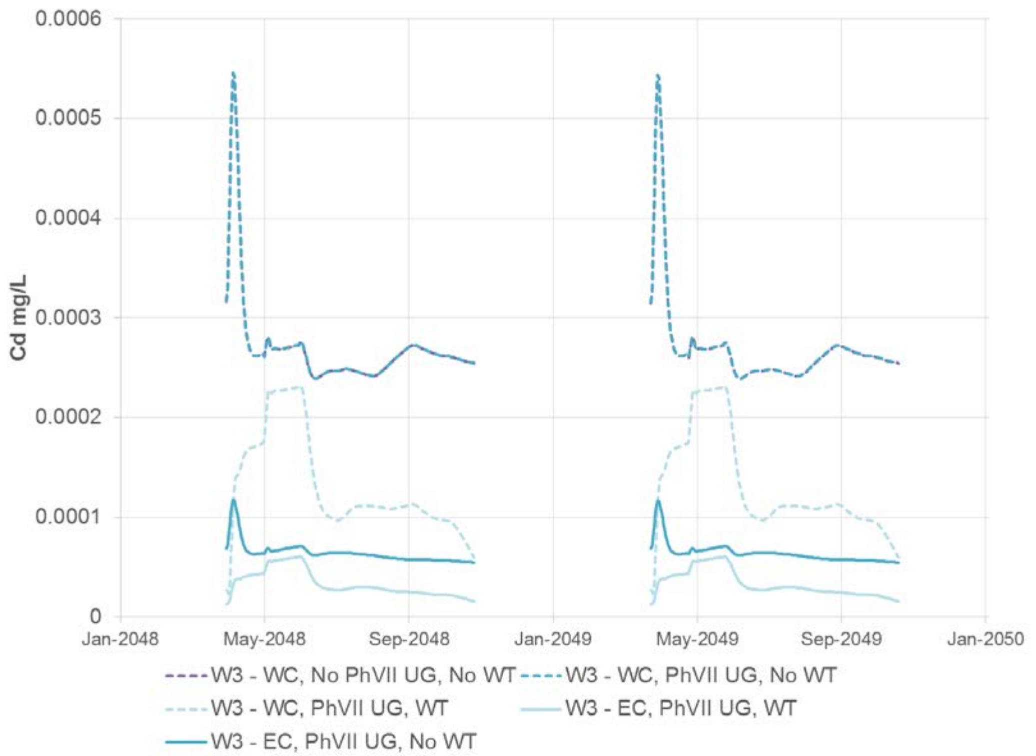


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Figure 5-9 Model Predictions of Dissolved Cadmium Concentrations at W3

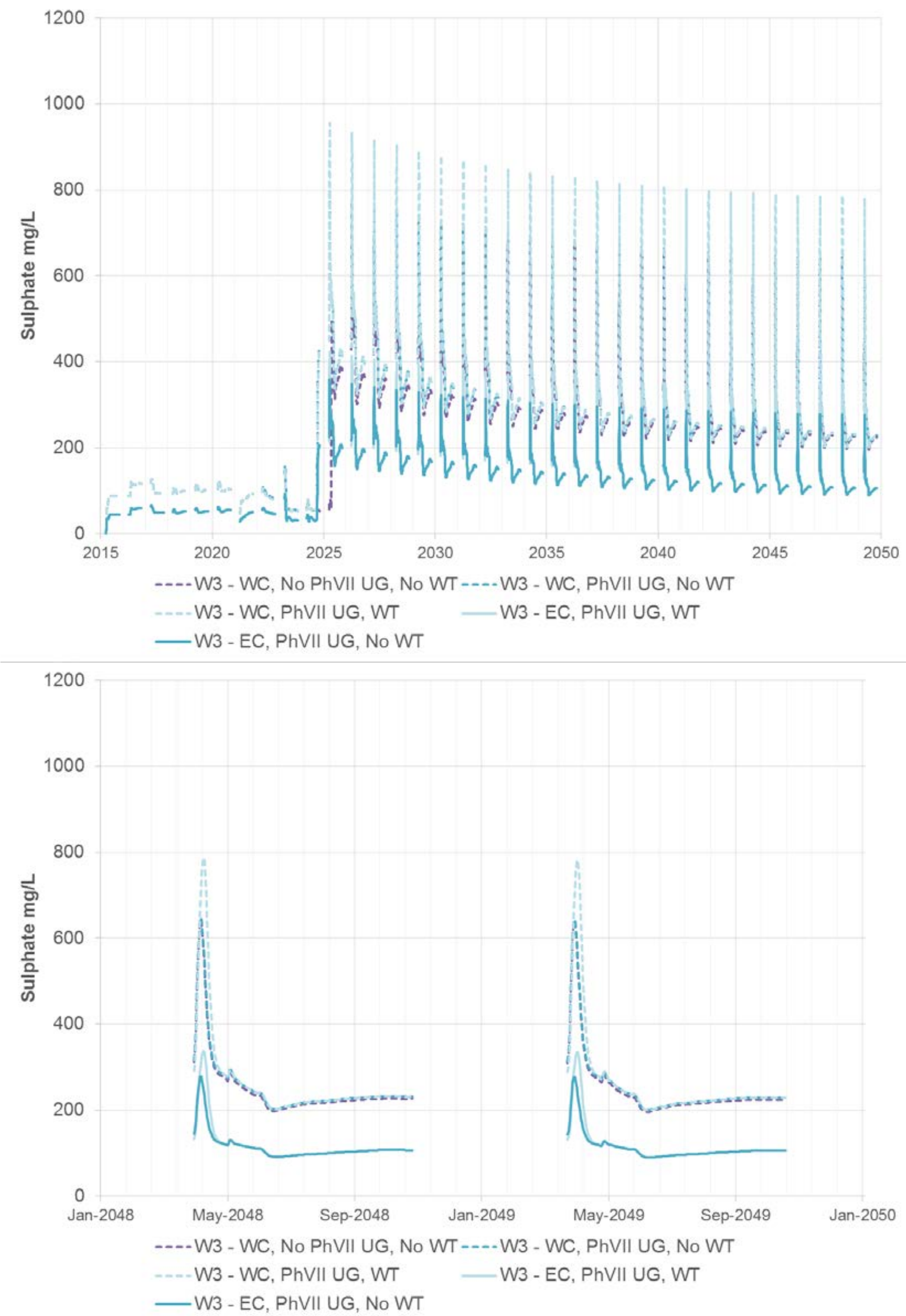

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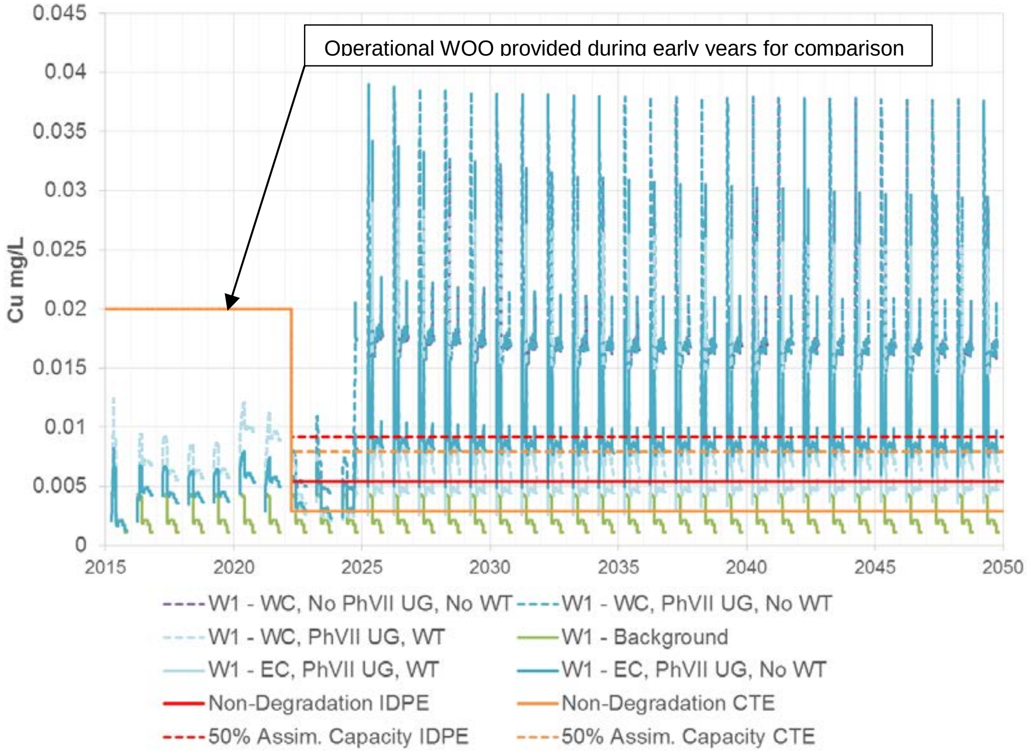
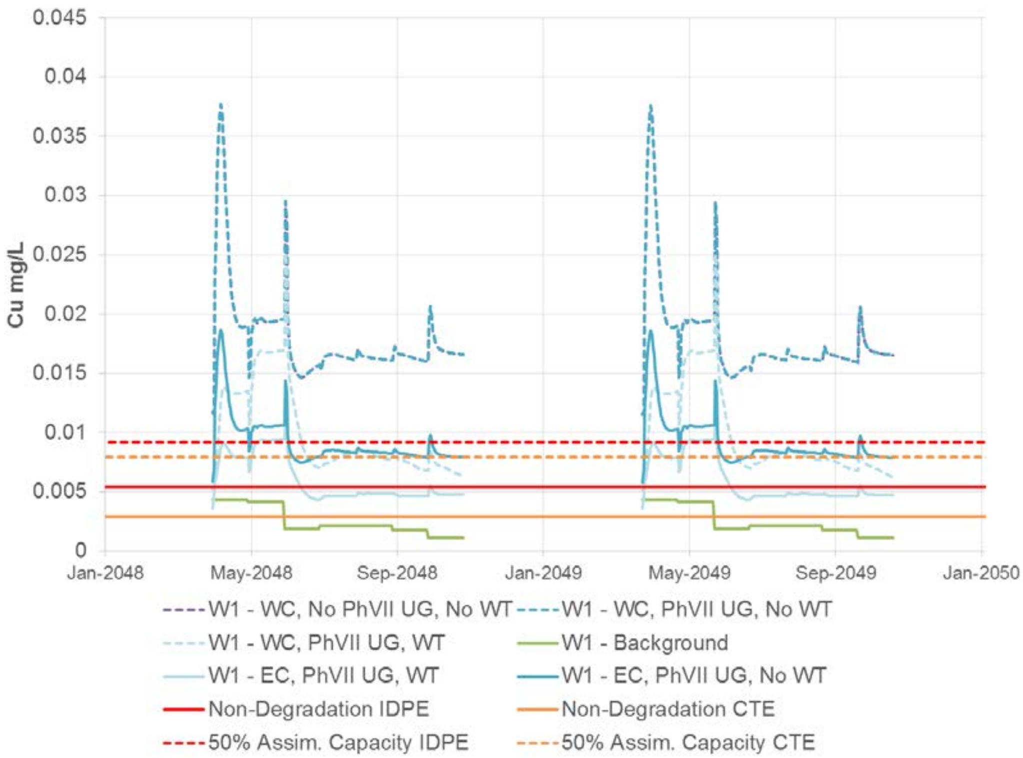
Figure 5-10 Model Predictions of Sulphate Concentrations at W3





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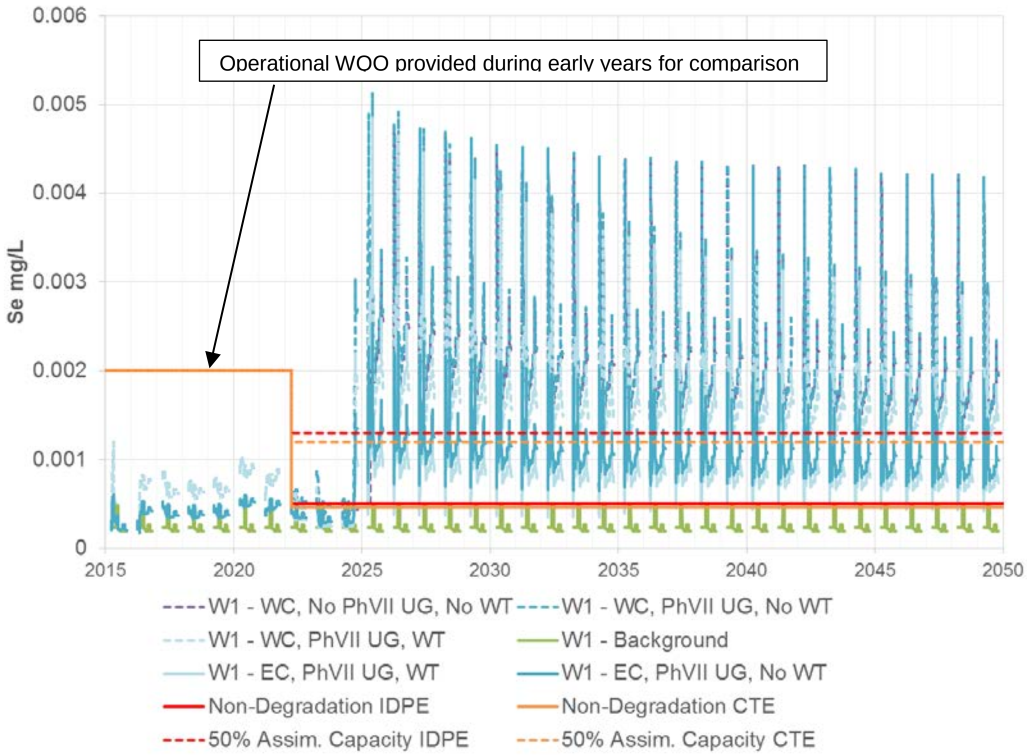
Note: The WQO for copper shown assumes dissolved organic carbon (DOC) < 10 mg/L

Figure 5-11 Model Predictions of Dissolved Copper Concentrations in Lower Minto Creek



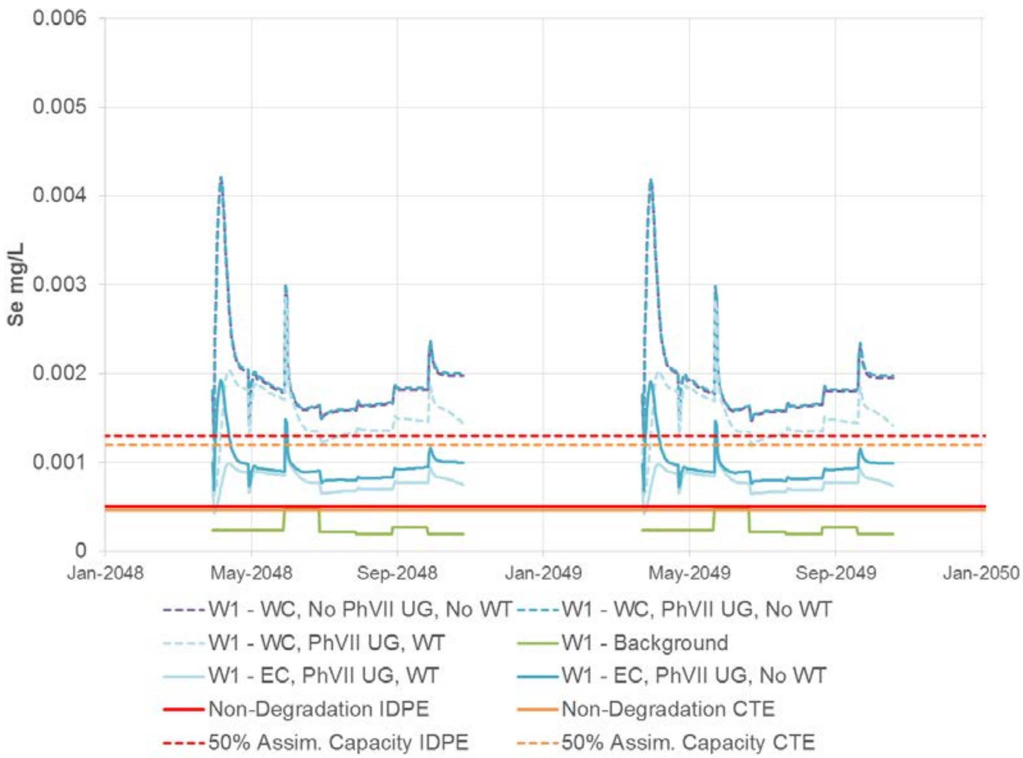


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Figure 5-12 Model Predictions of Dissolved Selenium Concentrations in Lower Minto Creek

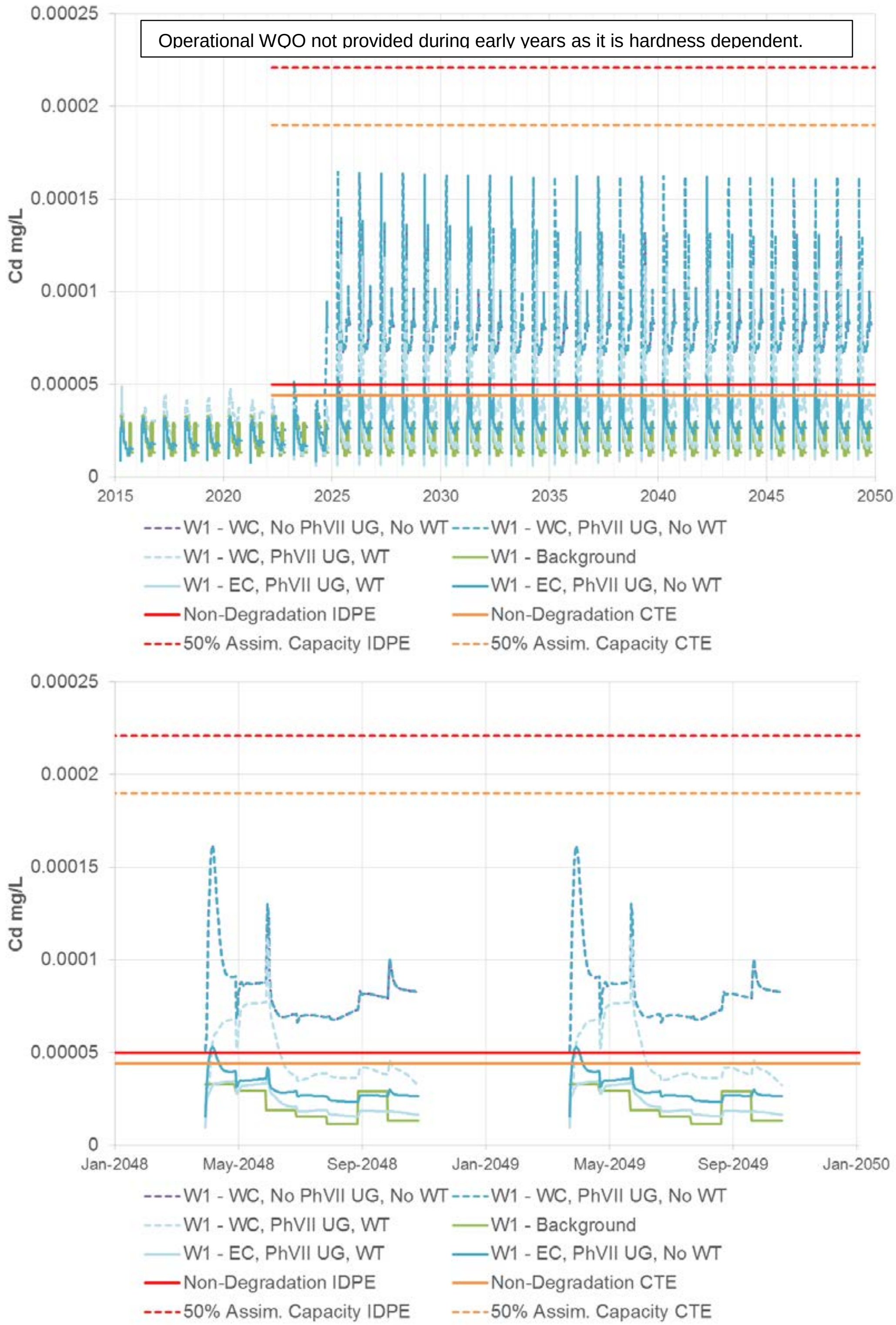

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Figure 5-13 Model Predictions of Dissolved Cadmium Concentrations in Lower Minto Creek

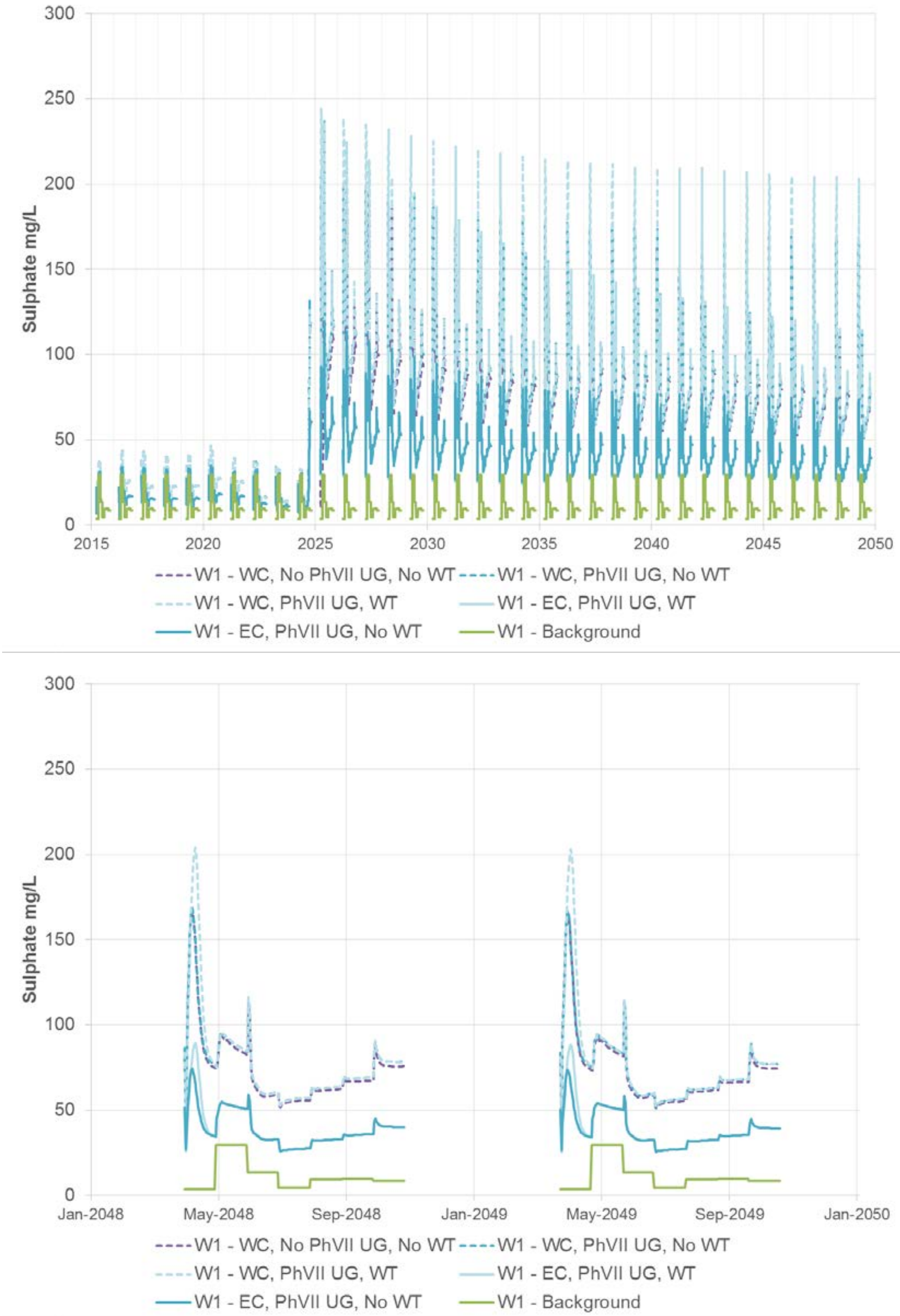

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Figure 5-14 Model Predictions of Dissolved Sulphate Concentrations in Lower Minto Creek

Evaluation of the effects of the predicted water quality on aquatic resources in Minto Creek and McGinty Creek has been addressed elsewhere (Minto 2013) and is not considered here in detail. The predicted concentrations of water quality parameters include ‘Expected Case’ values and ‘Reasonable Worst Case’ values. In the context of actual project performance, the predicted ‘expected case’ concentrations should be considered to be typical performance values (including the range of variability observed over operations at the Minto Mine). The predictions which represent the ‘Reasonable Worst Case’ scenario are considered to be unlikely to occur, and should be considered to represent the upper end of the range of potential water quality performance of the mine. In the unlikely event that water quality concentrations in the range of the ‘Reasonable Worst Case’ values occur, it is expected that this condition would be transient and of short duration (as observed with the upper range of water quality concentrations in the site monitoring results to date).

Comparison of model results between ‘no treatment’ and ‘passive treatment’ cases shows that the CWTS has the potential to materially reduce dissolved concentrations of copper, selenium, and other parameters in surface water leaving the mine site during low flow summer and fall months when most or all of the surface water can be routed through the CWTS. However, under typical spring conditions and under high flow conditions at other times of the year, a portion of the surface water will bypass the CWTS and will therefore report to lower Minto Creek without the benefit of wetland treatment. A number of other factors will affect the performance of the CWTS, and the reclamation research into constructed wetlands treatment system that has been underway for several years will continue going forward with the intent of refining the understanding of factors that will be most critical to optimizing performance at the full scale. At present, given the range of uncertainty, it is prudent to consider the range of performance that is book-ended by the ‘no treatment’ and ‘passive treatment’ scenarios as representative of the range of future surface water quality leaving the mine site.

Comparison of model results between ‘PhVII UG’ and ‘No PhVII UG’ cases show that the inclusion of the Phase VII Underground components in the model have little to no numerical effect on the modelled water quality in the open pits and Minto Creek in post-closure. There are some very minor differences in water quality in the Main Pit and Area 2 Pit during operations but these changes are not reflected in the long-term.

5.2.3 McGinty Creek Water Quality Results

The McGinty Creek water quality modelling was a scoping evaluation for a worst-case scenario that included the following assumptions:

- The magnitude of loadings was set to be equal to the loads determined for the full extent of the pit walls exposed at the end of mining (i.e. there was no gradual decrease in loadings estimates even if the pit was to fill).
- All geochemical loading generated by weathering of the pit walls, pit wall failure debris, and access road is both flushed from the weathering sites and reports to water in the Minto North Pit.

- Accumulated loadings would report unattenuated to McGinty Creek by surface discharge and/ or via groundwater pathways.

Under this scenario, Minto North loadings are maximized. This highly conservative approach evaluates the upper limit of the magnitude of potential changes to McGinty Creek water quality from geochemical loadings from the Minto North Pit.

Average and maximum results of the scoping exercise for lower McGinty Creek are presented in Table 5-2, along with average and maximum values in the baseline water quality results. Long-term steady state results for selected parameters are shown in Figure 5-14a and Figure 5-15b, along with the monthly background source term representing the 95th percentile concentrations in the baseline data. Although the assessment of aquatic effects is addressed elsewhere (Minto 2013 and references therein), inspection of the baseline and worst case post-mining model results in Figure 5-14a and 5-14b reveals that the changes in water quality of McGinty Creek from mining Minto North will be minimal.

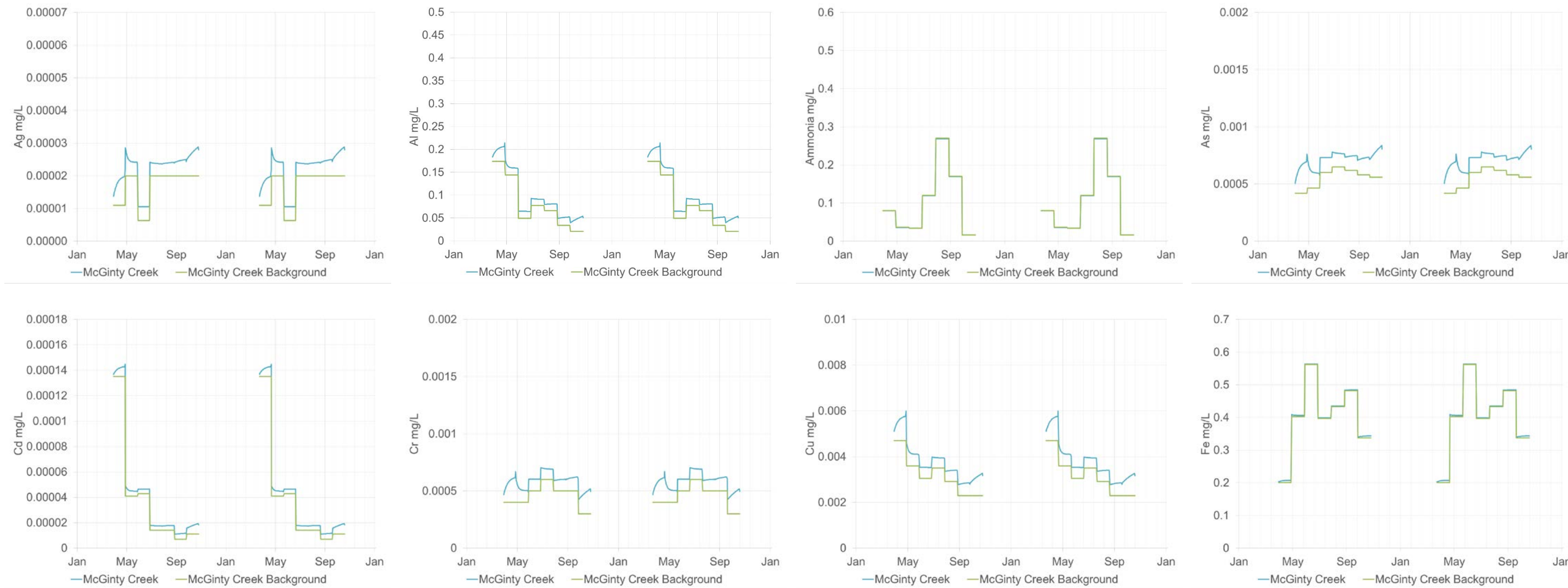

Figure 5-15a McGinty Creek Water Quality Prediction: Worst Case Results (1 of 2)

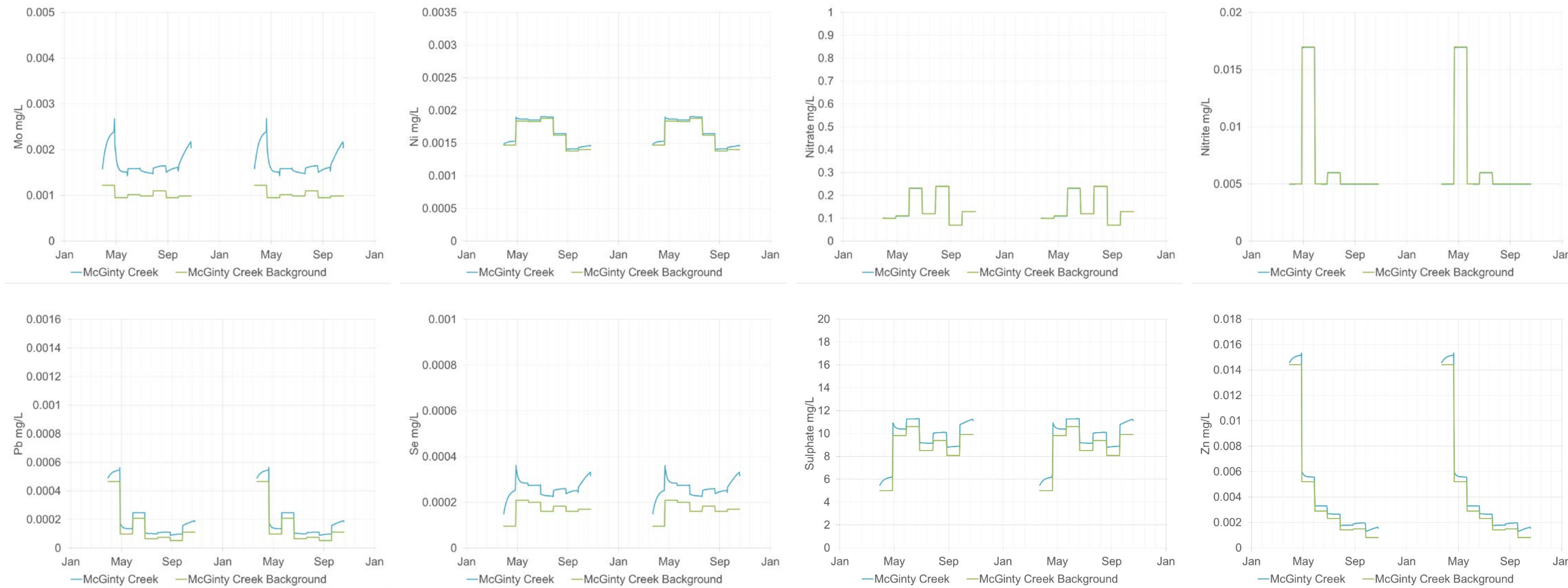

Figure 5-14b McGinty Creek Water Quality Prediction: Worst Case Results (2 of 2)

Table 5-2 Water Quality Modelling Results for McGinty Creek at Mouth

Parameter*/ Unit		Baseline Conditions		After Mining at Minto North	
				Worst Case	
		Average	Max	Average	Max
Ammonia	mg/L	0.104	0.27	0.103	0.269
N-NO_2	mg/L	0.00686	0.017	0.00683	0.0169
N-NO_3	mg/L	0.143	0.24	0.143	0.239
Sulphate	mg/L	8.75	10.6	9.55	11.3
Al	mg/L	0.0807	0.174	0.0995	0.214
As	mg/L	0.000557	0.00065	0.000715	0.000836
Cd	mg/L	0.0000378	0.000135	0.0000425	0.000145
Cr	mg/L	0.000457	0.0006	0.000583	0.000703
Cu	mg/L	0.0032	0.00471	0.00379	0.006
Fe	mg/L	0.402	0.562	0.405	0.564
Mn	mg/L	0.0275	0.0458	0.0347	0.0581
Mo	mg/L	0.00103	0.00122	0.00171	0.00268
Ni	mg/L	0.00163	0.00188	0.00167	0.00191
Se	mg/L	0.000168	0.00021	0.000262	0.000361
Ag	mg/L	0.0000168	0.00002	0.0000219	0.0000289
Zn	mg/L	0.00407	0.0144	0.00454	0.0153

Source: Source: \\VAN-SVR0\Projects\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\Minto_North\[1CM002-003_MintoNorth_WQ_Prediction_2013-06-26.xlsx]

Notes:

*: all concentrations are dissolved concentrations

5.3 Limitations of the Water and Load Balance Model

The water and load balance for Minto was developed according to standard practices and was based on best available input data. However, as with any model representation of a complex system there are inherent uncertainties associated with inputs and modelled processes. In most cases, uncertainties are accounted for by using conservative assumptions that are intended to capture the most adverse conditions. One obvious exception to this approach is the water quality results from the “Expected Case” scenarios.

Uncertainties that may affect the accuracy of the model outcome include:

- Geochemical processes not incorporated in the model. The load balance is a mass conservative model. Chemical reactions such as dissolution, precipitation, oxidation or reduction are not incorporated in the model. In addition, processes such as attenuation of constituents along surface and subsurface flow paths, adsorption, and exposure of more reactive mine waste than previously-mined materials at Minto all may contribute to actual water quality performance being different than the predictions presented here indicate.

- Significant changes to the operations and closure plans used as a basis for the modelling scenarios.
- Change in local climatic conditions that cause the historical climatic record to inaccurately represent the duration, frequency and intensity of precipitation and runoff events.

5.3.1 Variability in Precipitation

The long term results produced by the water and load balance model reflect a case where the site experiences the average annual precipitation each year, and that the annual precipitation is distributed according to a fixed monthly runoff distribution. The future reality of the site will undoubtedly deviate from that model scenario- the example shown in Figure 4-1 suggests that it is reasonable to expect at least 3-to-5-fold variability in annual precipitation over a 10-year period (i.e. the range represented by the 5^{th} and 95th percentile results for different months). Other meteorological and hydrological parameters that affect catchment processes and stream flows in Minto Creek will undoubtedly have analogous variability (monthly distribution of runoff as just one example, as shown in Figure 2-7). For this reason, the water quality values represented by the reported model results should be considered as a range spanning the different model scenarios.

5.3.2 POX Ore and Sulphide Ore Tailings Slurry

During the Minto operations phase, the open pit water quality is sensitive to changes in the tailings slurry water quality due to the large volumes of water circulating through the mill. The tailings slurry water quality is variable over time and is linked to the amount of POX ore being milled. There is a large amount of variability in the grade of POX being milled during operations which introduces variability into the tailings source terms. The water and load balance results presented here are based on the current sulphide ore and POX ore milling schedule which is very subject to change throughout operations.

6 Key Conclusions

The Minto Mine Water and Load Balance Model was updated as part of the 2018 Reclamation and Closure Plan (Minto 2018). The key conclusions of this update are:

- that recent trends in sulphate concentrations in the in-pit tailings management facilities are likely caused by increased sulphate loading due to milling of POX ore, and
- the model results indicate that the inclusion of Phase VII mine components have very little effect on the water quality in the open pits and Minto Creek.

This report, "*Water and Load Balance Model Report 2018*", has been prepared by SRK Consulting (Canada) Inc.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A: Water and Load Balance Results

Appendix A1: Monthly Water and Load Balance Results – 2045

Scenario 1 - Area 2 Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000573	0.448	1.21	0.00277	0.0000819	0.00168	0.0202	0.368	0.247	0.0238	0.00222	7.27	0.356	0.00043	0.00505	207	0.00875
May	0.0000575	0.451	1.18	0.00278	0.0000823	0.00168	0.0202	0.366	0.244	0.0236	0.00221	7.12	0.349	0.000431	0.00501	204	0.00876
June	0.0000579	0.456	1.17	0.00281	0.0000829	0.00169	0.0203	0.366	0.242	0.0235	0.00221	7.04	0.346	0.000433	0.00499	202	0.0088
July	0.0000579	0.456	1.16	0.00281	0.0000829	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7.03	0.345	0.000433	0.00499	202	0.0088
August	0.0000579	0.456	1.16	0.00281	0.0000828	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7	0.344	0.000433	0.00498	201	0.0088
September	0.0000577	0.454	1.15	0.0028	0.0000826	0.00169	0.0202	0.367	0.241	0.0234	0.00222	6.97	0.343	0.000432	0.00496	201	0.00877
October	0.0000576	0.453	1.15	0.00279	0.0000823	0.00168	0.0201	0.367	0.24	0.0233	0.00221	6.95	0.341	0.000431	0.00495	200	0.00875

Scenario 1 - Main Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000573	0.448	1.21	0.00277	0.0000819	0.00168	0.0202	0.368	0.247	0.0238	0.00222	7.27	0.356	0.00043	0.00505	207	0.00875
May	0.0000575	0.451	1.18	0.00278	0.0000823	0.00168	0.0202	0.366	0.244	0.0236	0.00221	7.12	0.349	0.000431	0.00501	204	0.00876
June	0.0000579	0.456	1.17	0.00281	0.0000829	0.00169	0.0203	0.366	0.242	0.0235	0.00221	7.04	0.346	0.000433	0.00499	202	0.0088
July	0.0000579	0.456	1.16	0.00281	0.0000829	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7.03	0.345	0.000433	0.00499	202	0.0088
August	0.0000579	0.456	1.16	0.00281	0.0000828	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7	0.344	0.000433	0.00498	201	0.0088
September	0.0000577	0.454	1.15	0.0028	0.0000826	0.00169	0.0202	0.367	0.241	0.0234	0.00222	6.97	0.343	0.000432	0.00496	201	0.00877
October	0.0000576	0.453	1.15	0.00279	0.0000823	0.00168	0.0201	0.367	0.24	0.0233	0.00221	6.95	0.341	0.000431	0.00495	200	0.00875

Scenario 1 - W3 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000625	0.318	0.272	0.00251	0.0000798	0.00247	0.0385	0.691	0.453	0.0141	0.00307	1.6	0.0766	0.000549	0.00448	180	0.0129
May	0.0000477	0.3	0.332	0.00198	0.0000676	0.00174	0.0297	0.535	0.35	0.0117	0.00222	1.9	0.0931	0.000407	0.00318	125	0.00935
June	0.0000479	0.304	0.253	0.00201	0.0000653	0.00174	0.0287	0.56	0.362	0.0104	0.00217	1.41	0.0702	0.0004	0.00278	102	0.00926
July	0.0000494	0.293	0.193	0.00208	0.0000639	0.00186	0.0293	0.589	0.359	0.00999	0.00232	1.06	0.053	0.000418	0.00269	98.9	0.00967
August	0.0000504	0.279	0.21	0.00208	0.00006	0.00186	0.0281	0.586	0.332	0.0102	0.00236	1.19	0.0586	0.000423	0.00272	104	0.00952
September	0.0000493	0.265	0.223	0.00203	0.0000574	0.00188	0.0268	0.577	0.32	0.0102	0.0024	1.28	0.0626	0.000428	0.00283	109	0.00933
October	0.0000472	0.255	0.237	0.00196	0.000056	0.00185	0.0254	0.553	0.305	0.0102	0.00236	1.38	0.0675	0.000422	0.00289	112	0.00906

Scenario 1 - W1 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000221	0.106	0.0915	0.00084	0.0000426	0.00105	0.0126	0.276	0.142	0.00426	0.00138	0.515	0.0335	0.000216	0.0013	49.7	0.00616
May	0.0000195	0.113	0.132	0.000808	0.0000351	0.000816	0.0104	0.396	0.158	0.00343	0.00151	0.525	0.0275	0.000207	0.000942	53.2	0.00554
June	0.0000174	0.0956	0.126	0.000853	0.0000302	0.000845	0.0084	0.295	0.133	0.00358	0.00151	0.514	0.0327	0.000161	0.000989	37.8	0.00517
July	0.0000182	0.0843	0.0954	0.000956	0.0000268	0.000884	0.0084	0.377	0.136	0.00324	0.00157	0.413	0.0229	0.000185	0.00082	28.3	0.00472
August	0.0000252	0.0825	0.091	0.000985	0.0000239	0.000926	0.0084	0.41	0.145	0.00333	0.00165	0.452	0.024	0.000211	0.000846	33.5	0.00466
September	0.0000198	0.0833	0.0931	0.000957	0.0000267	0.0011	0.00817	0.415	0.142	0.00341	0.00181	0.464	0.0236	0.000259	0.000955	37	0.00444
October	0.0000198	0.084	0.136	0.000934	0.0000272	0.000877	0.00825	0.363	0.154	0.00405	0.00149	0.701	0.0447	0.000187	0.00106	43	0.00413

Notes:
All concentration reported in mg/L

Scenario 2 - Area 2 Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000128	0.859	4.53	0.00689	0.000326	0.00485	0.0497	0.629	0.492	0.0646	0.00531	19.7	0.711	0.00311	0.00961	394	0.0277
May	0.000129	0.866	4.43	0.00693	0.000328	0.00488	0.0497	0.624	0.486	0.0642	0.00531	19.3	0.697	0.00313	0.00951	388	0.0277
June	0.00013	0.874	4.36	0.00699	0.000331	0.00492	0.0499	0.622	0.482	0.0643	0.00533	19	0.688	0.00316	0.00949	385	0.0279
July	0.00013	0.874	4.34	0.00699	0.000331	0.00492	0.0499	0.622	0.481	0.0643	0.00533	19	0.686	0.00316	0.00947	384	0.0279
August	0.00013	0.873	4.32	0.00698	0.00033	0.00491	0.0498	0.622	0.48	0.0642	0.00532	18.9	0.683	0.00316	0.00945	383	0.0278
September	0.00013	0.87	4.3	0.00696	0.000329	0.0049	0.0496	0.62	0.478	0.0639	0.00531	18.8	0.68	0.00315	0.00942	381	0.0277
October	0.000129	0.867	4.28	0.00694	0.000328	0.00489	0.0494	0.619	0.476	0.0637	0.0053	18.8	0.677	0.00314	0.00939	380	0.0277

Scenario 2 - Main Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000801	0.491	0.364	0.00449	0.000309	0.00341	0.0817	1.6	1.3	0.0319	0.00664	1.53	0.0494	0.00152	0.00989	429	0.0295
May	0.000102	0.713	0.264	0.00546	0.000356	0.00418	0.0957	1.76	1.43	0.0347	0.00734	1.11	0.0379	0.00211	0.00915	354	0.0331
June	0.000113	0.776	0.208	0.006	0.000342	0.00455	0.0936	1.87	1.49	0.0348	0.00712	0.844	0.0302	0.00238	0.00792	302	0.0347
July	0.000107	0.699	0.21	0.00575	0.000311	0.00435	0.0876	1.99	1.57	0.0325	0.00709	0.855	0.0304	0.0022	0.00768	308	0.0324
August	0.000102	0.643	0.21	0.00562	0.000324	0.00425	0.0842	2.26	1.73	0.0318	0.00723	0.874	0.0303	0.00204	0.0079	317	0.031
September	0.0000961	0.59	0.214	0.00532	0.000349	0.00413	0.0803	2.22	1.63	0.0315	0.00699	0.898	0.0305	0.00188	0.00798	320	0.03
October	0.0000907	0.543	0.226	0.005	0.000326	0.00392	0.0762	2.09	1.49	0.03	0.00665	0.941	0.0318	0.00175	0.00786	324	0.0289

Scenario 2 - W3 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000106	0.64	0.999	0.00572	0.000354	0.00439	0.0857	1.72	1.35	0.0405	0.00712	4.34	0.154	0.00214	0.0102	413	0.0324
May	0.0000878	0.591	1.2	0.00461	0.000271	0.00348	0.0647	1.09	0.876	0.034	0.00532	5.17	0.186	0.00191	0.00713	277	0.0245
June	0.0000892	0.598	0.882	0.00469	0.000253	0.00352	0.062	1.12	0.891	0.0312	0.00503	3.79	0.139	0.00195	0.00606	224	0.0243
July	0.0000895	0.579	0.656	0.00476	0.000247	0.00357	0.0634	1.28	1.01	0.0296	0.0053	2.82	0.103	0.00192	0.00601	222	0.0243
August	0.0000892	0.553	0.732	0.00476	0.000252	0.00355	0.0612	1.44	1.09	0.0299	0.0054	3.18	0.115	0.00187	0.00618	231	0.0234
September	0.0000864	0.529	0.789	0.00463	0.000269	0.00355	0.0592	1.44	1.06	0.0303	0.00534	3.44	0.124	0.0018	0.00633	237	0.0229
October	0.0000831	0.509	0.849	0.00447	0.00026	0.00347	0.0569	1.37	0.979	0.0299	0.00516	3.7	0.134	0.00176	0.00635	240	0.0223

Scenario 2 - W1 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000033	0.187	0.318	0.00164	0.000111	0.00153	0.0243	0.53	0.366	0.011	0.00239	1.36	0.0577	0.000613	0.00275	109	0.011
May	0.0000296	0.186	0.363	0.00147	0.0000864	0.00125	0.0192	0.536	0.29	0.00909	0.00229	1.39	0.0523	0.000585	0.00194	91.9	0.00935
June	0.0000276	0.168	0.33	0.00152	0.0000767	0.00129	0.0166	0.433	0.264	0.00889	0.00222	1.27	0.0547	0.000545	0.00183	69.6	0.00891
July	0.0000277	0.151	0.243	0.00158	0.0000699	0.00129	0.0164	0.537	0.288	0.00798	0.00226	0.963	0.0389	0.000537	0.00162	58.4	0.00816
August	0.0000346	0.149	0.261	0.00163	0.0000701	0.00134	0.0164	0.614	0.328	0.00824	0.00238	1.09	0.0424	0.00056	0.0017	65.5	0.00804
September	0.0000293	0.151	0.292	0.00163	0.000081	0.00154	0.0165	0.636	0.331	0.00875	0.00257	1.2	0.0449	0.000614	0.00188	71.6	0.00797
October	0.0000303	0.158	0.446	0.00166	0.0000861	0.00135	0.0174	0.596	0.348	0.0102	0.00231	1.84	0.0777	0.000574	0.00213	84.3	0.00802

Notes:
All concentration reported in mg/L

Scenario 3 - Area 2 Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000128	0.858	3.59	0.00684	0.000325	0.00484	0.0494	0.622	0.473	0.0621	0.00524	17.4	0.609	0.0031	0.00923	357	0.027
May	0.000129	0.865	3.51	0.00688	0.000327	0.00486	0.0494	0.617	0.467	0.0619	0.00524	17.1	0.597	0.00313	0.00915	352	0.027
June	0.00013	0.873	3.46	0.00694	0.000329	0.0049	0.0496	0.615	0.464	0.062	0.00526	16.9	0.59	0.00316	0.00913	350	0.0272
July	0.00013	0.873	3.45	0.00694	0.000329	0.0049	0.0496	0.615	0.463	0.062	0.00526	16.8	0.589	0.00316	0.00912	349	0.0272
August	0.00013	0.872	3.44	0.00694	0.000329	0.0049	0.0495	0.614	0.462	0.0619	0.00526	16.8	0.587	0.00315	0.0091	348	0.0272
September	0.000129	0.87	3.42	0.00692	0.000328	0.00488	0.0493	0.613	0.46	0.0617	0.00524	16.7	0.584	0.00315	0.00907	347	0.0271
October	0.000129	0.867	3.41	0.0069	0.000327	0.00487	0.0491	0.612	0.459	0.0615	0.00523	16.6	0.582	0.00313	0.00904	346	0.027

Scenario 3 - Main Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.00008	0.491	0.326	0.00448	0.000309	0.00341	0.0817	1.6	1.3	0.0318	0.00663	1.43	0.0453	0.00152	0.00988	427	0.0294
May	0.000102	0.713	0.237	0.00546	0.000356	0.00418	0.0957	1.76	1.43	0.0346	0.00734	1.04	0.035	0.00211	0.00914	353	0.0331
June	0.000113	0.776	0.188	0.006	0.000342	0.00455	0.0936	1.87	1.49	0.0347	0.00712	0.794	0.028	0.00238	0.00791	301	0.0347
July	0.000107	0.699	0.19	0.00575	0.000311	0.00435	0.0876	1.99	1.57	0.0325	0.00709	0.805	0.0282	0.0022	0.00768	307	0.0324
August	0.000102	0.643	0.19	0.00562	0.000324	0.00425	0.0842	2.26	1.73	0.0318	0.00723	0.825	0.0281	0.00204	0.0079	316	0.031
September	0.0000961	0.59	0.193	0.00532	0.000349	0.00413	0.0803	2.22	1.63	0.0315	0.00699	0.847	0.0282	0.00188	0.00797	319	0.03
October	0.0000907	0.543	0.203	0.005	0.000326	0.00392	0.0761	2.09	1.49	0.0299	0.00665	0.886	0.0293	0.00175	0.00785	323	0.0289

Scenario 3 - W3 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000106	0.64	0.822	0.00571	0.000354	0.00439	0.0857	1.72	1.35	0.04	0.00711	3.91	0.135	0.00214	0.0101	406	0.0323
May	0.0000877	0.591	0.968	0.0046	0.000271	0.00347	0.0646	1.09	0.871	0.0334	0.0053	4.6	0.161	0.00191	0.00704	268	0.0243
June	0.0000891	0.598	0.714	0.00468	0.000252	0.00352	0.062	1.12	0.888	0.0307	0.00502	3.38	0.12	0.00195	0.00599	218	0.0241
July	0.0000895	0.579	0.536	0.00475	0.000247	0.00357	0.0634	1.28	1	0.0293	0.00529	2.52	0.0903	0.00192	0.00596	217	0.0242
August	0.0000891	0.553	0.596	0.00475	0.000252	0.00355	0.0612	1.44	1.09	0.0295	0.00539	2.85	0.1	0.00187	0.00612	225	0.0233
September	0.0000863	0.528	0.641	0.00462	0.000269	0.00355	0.0592	1.44	1.05	0.0299	0.00533	3.08	0.108	0.0018	0.00628	232	0.0228
October	0.000083	0.508	0.688	0.00447	0.000259	0.00347	0.0568	1.37	0.976	0.0295	0.00514	3.31	0.116	0.00175	0.00628	234	0.0221

Scenario 3 - W1 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000329	0.186	0.26	0.00164	0.000111	0.00153	0.0243	0.53	0.364	0.0108	0.00239	1.21	0.0513	0.000612	0.00273	107	0.011
May	0.0000295	0.186	0.3	0.00147	0.0000862	0.00125	0.0192	0.536	0.289	0.00893	0.00228	1.24	0.0455	0.000584	0.00192	89.5	0.00931
June	0.0000276	0.168	0.273	0.00151	0.0000766	0.00129	0.0166	0.433	0.262	0.00874	0.00222	1.14	0.0485	0.000544	0.0018	67.4	0.00887
July	0.0000276	0.151	0.203	0.00158	0.0000698	0.00129	0.0164	0.537	0.287	0.00787	0.00226	0.864	0.0344	0.000536	0.0016	56.8	0.00813
August	0.0000346	0.149	0.214	0.00163	0.0000701	0.00134	0.0164	0.614	0.327	0.00812	0.00238	0.973	0.0372	0.00056	0.00168	63.6	0.00801
September	0.0000293	0.151	0.237	0.00163	0.0000809	0.00153	0.0165	0.635	0.329	0.00861	0.00256	1.07	0.0389	0.000613	0.00186	69.4	0.00793
October	0.0000303	0.157	0.357	0.00166	0.0000859	0.00135	0.0174	0.595	0.346	0.00995	0.0023	1.62	0.068	0.000574	0.00209	80.8	0.00796

Notes:
All concentration reported in mg/L

Scenario 4 - Area 2 Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000573	0.448	1.21	0.00277	0.0000819	0.00168	0.0202	0.368	0.247	0.0238	0.00222	7.27	0.356	0.00043	0.00505	207	0.00875
May	0.0000575	0.451	1.18	0.00278	0.0000823	0.00168	0.0202	0.366	0.244	0.0236	0.00221	7.12	0.349	0.000431	0.00501	204	0.00876
June	0.0000579	0.456	1.17	0.00281	0.0000829	0.00169	0.0203	0.366	0.242	0.0235	0.00221	7.04	0.346	0.000433	0.00499	202	0.0088
July	0.0000579	0.456	1.16	0.00281	0.0000829	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7.03	0.345	0.000433	0.00499	202	0.0088
August	0.0000579	0.456	1.16	0.00281	0.0000828	0.00169	0.0203	0.367	0.242	0.0235	0.00222	7	0.344	0.000433	0.00498	201	0.0088
September	0.0000577	0.454	1.15	0.0028	0.0000826	0.00169	0.0202	0.367	0.241	0.0234	0.00222	6.97	0.343	0.000432	0.00496	201	0.00877
October	0.0000576	0.453	1.15	0.00279	0.0000823	0.00168	0.0201	0.367	0.24	0.0233	0.00221	6.95	0.341	0.000431	0.00495	200	0.00875

Scenario 4 - Main Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000517	0.234	0.0966	0.00197	0.0000608	0.00215	0.0373	0.596	0.422	0.0112	0.00266	0.533	0.0217	0.000466	0.00401	170	0.0111
May	0.0000615	0.344	0.0756	0.00235	0.0000793	0.0024	0.0458	0.759	0.543	0.0113	0.00277	0.388	0.0172	0.000534	0.00372	138	0.0124
June	0.0000661	0.383	0.0665	0.00257	0.0000824	0.00251	0.0452	0.859	0.586	0.0112	0.00283	0.3	0.0139	0.000564	0.00336	121	0.0129
July	0.0000641	0.346	0.0679	0.00248	0.0000756	0.00249	0.0421	0.815	0.525	0.011	0.00288	0.304	0.0144	0.000553	0.00322	126	0.0129
August	0.0000627	0.314	0.0673	0.00241	0.0000694	0.00249	0.0402	0.788	0.478	0.0108	0.00292	0.312	0.0143	0.000546	0.00322	132	0.0127
September	0.0000606	0.285	0.0667	0.0023	0.0000638	0.00243	0.0377	0.762	0.451	0.0104	0.0029	0.324	0.0143	0.000533	0.0033	135	0.0124
October	0.0000579	0.263	0.0686	0.00218	0.0000597	0.00237	0.0351	0.726	0.423	0.0101	0.00284	0.337	0.0147	0.000517	0.00332	137	0.012

Scenario 4 - W3 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000072	0.356	0.273	0.00287	0.0000357	0.00287	0.0189	0.809	0.528	0.0142	0.00356	1.6	0.0754	0.000636	0.0026	207	0.00506
May	0.0000477	0.299	0.332	0.00198	0.0000556	0.00174	0.0241	0.533	0.349	0.0115	0.00222	1.9	0.093	0.000406	0.00297	125	0.00771
June	0.000048	0.305	0.258	0.00202	0.0000411	0.00174	0.0184	0.56	0.362	0.0102	0.00217	1.44	0.0717	0.0004	0.0024	103	0.00582
July	0.0000494	0.293	0.192	0.00208	0.0000284	0.00186	0.013	0.589	0.36	0.00958	0.00232	1.05	0.0527	0.000417	0.00212	98.7	0.00438
August	0.0000504	0.279	0.21	0.00208	0.0000273	0.00186	0.013	0.586	0.333	0.0098	0.00236	1.19	0.0585	0.000423	0.00216	104	0.00442
September	0.0000494	0.265	0.222	0.00203	0.0000239	0.00188	0.013	0.578	0.32	0.00976	0.0024	1.28	0.0623	0.000428	0.00218	109	0.00392
October	0.0000472	0.256	0.238	0.00197	0.0000199	0.00185	0.0131	0.554	0.305	0.00965	0.00236	1.38	0.0677	0.000423	0.00209	112	0.00315

Scenario 4 - W1 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000246	0.116	0.0917	0.000934	0.0000319	0.00116	0.00778	0.306	0.161	0.0043	0.00151	0.515	0.0332	0.000238	0.000845	56.6	0.00427
May	0.0000195	0.113	0.132	0.000808	0.0000322	0.000815	0.00904	0.395	0.158	0.0034	0.00151	0.525	0.0275	0.000206	0.000889	53.3	0.00513
June	0.0000174	0.0958	0.127	0.000854	0.0000248	0.000845	0.00607	0.295	0.133	0.00354	0.00151	0.52	0.033	0.000161	0.000904	37.9	0.0044
July	0.0000182	0.0844	0.0952	0.000956	0.0000186	0.000884	0.00463	0.377	0.137	0.00315	0.00157	0.411	0.0228	0.000185	0.000688	28.3	0.0035
August	0.0000252	0.0827	0.0909	0.000985	0.0000162	0.000926	0.00482	0.41	0.145	0.00325	0.00165	0.451	0.024	0.000211	0.000714	33.5	0.00346
September	0.0000198	0.0835	0.0929	0.000958	0.0000183	0.0011	0.0047	0.415	0.142	0.00331	0.00181	0.462	0.0235	0.000259	0.000794	36.9	0.00309
October	0.0000199	0.0842	0.136	0.000935	0.0000175	0.000878	0.00488	0.363	0.154	0.00391	0.00149	0.702	0.0447	0.000187	0.000852	43	0.00254

Notes:
All concentration reported in mg/L

Scenario 5 - Area 2 Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000128	0.859	4.53	0.00689	0.000326	0.00485	0.0497	0.629	0.492	0.0646	0.00531	19.7	0.711	0.00311	0.00961	394	0.0277
May	0.000129	0.866	4.43	0.00693	0.000328	0.00488	0.0497	0.624	0.486	0.0642	0.00531	19.3	0.697	0.00313	0.00951	388	0.0277
June	0.00013	0.874	4.36	0.00699	0.000331	0.00492	0.0499	0.622	0.482	0.0643	0.00533	19	0.688	0.00316	0.00949	385	0.0279
July	0.00013	0.874	4.34	0.00699	0.000331	0.00492	0.0499	0.622	0.481	0.0643	0.00533	19	0.686	0.00316	0.00947	384	0.0279
August	0.00013	0.873	4.32	0.00698	0.00033	0.00491	0.0498	0.622	0.48	0.0642	0.00532	18.9	0.683	0.00316	0.00945	383	0.0278
September	0.00013	0.87	4.3	0.00696	0.000329	0.0049	0.0496	0.62	0.478	0.0639	0.00531	18.8	0.68	0.00315	0.00942	381	0.0277
October	0.000129	0.867	4.28	0.00694	0.000328	0.00489	0.0494	0.619	0.476	0.0637	0.0053	18.8	0.677	0.00314	0.00939	380	0.0277

Scenario 5 - Main Pit 2045 Monthly Water Quality Results

	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000801	0.491	0.364	0.00449	0.000309	0.00341	0.0817	1.6	1.3	0.0319	0.00664	1.53	0.0494	0.00152	0.00989	429	0.0295
May	0.000102	0.713	0.264	0.00546	0.000356	0.00418	0.0957	1.76	1.43	0.0347	0.00734	1.11	0.0379	0.00211	0.00915	354	0.0331
June	0.000113	0.776	0.208	0.006	0.000342	0.00455	0.0936	1.87	1.49	0.0348	0.00712	0.844	0.0302	0.00238	0.00792	302	0.0347
July	0.000107	0.699	0.21	0.00575	0.000311	0.00435	0.0876	1.99	1.57	0.0325	0.00709	0.855	0.0304	0.0022	0.00768	308	0.0324
August	0.000102	0.643	0.21	0.00562	0.000324	0.00425	0.0842	2.26	1.73	0.0318	0.00723	0.874	0.0303	0.00204	0.0079	317	0.031
September	0.0000961	0.59	0.214	0.00532	0.000349	0.00413	0.0803	2.22	1.63	0.0315	0.00699	0.898	0.0305	0.00188	0.00798	320	0.03
October	0.0000907	0.543	0.226	0.005	0.000326	0.00392	0.0762	2.09	1.49	0.03	0.00665	0.941	0.0318	0.00175	0.00786	324	0.0289

Scenario 5 - W3 2045 Monthly Water Quality Results

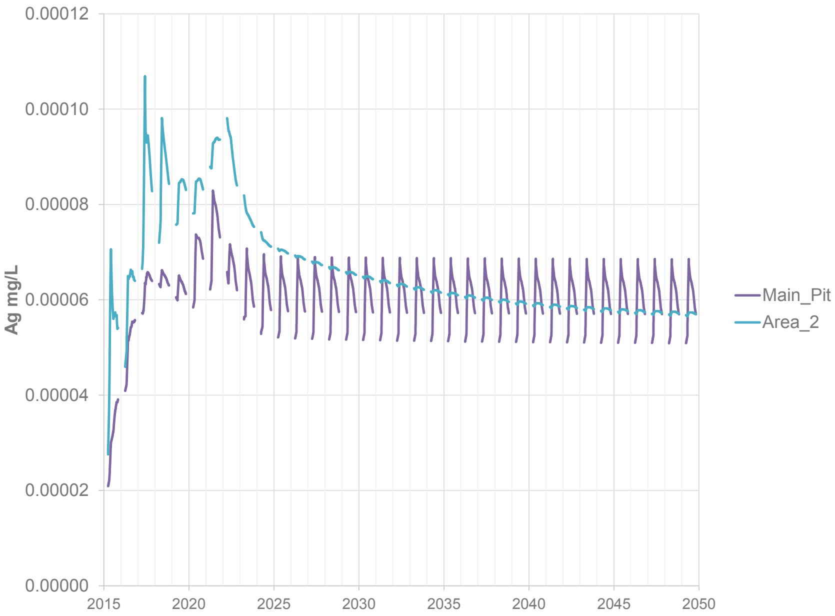
	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.000121	0.72	0.997	0.00653	0.000136	0.00502	0.0355	2.05	1.61	0.0438	0.0082	4.34	0.153	0.00242	0.00574	475	0.0123
May	0.0000876	0.59	1.2	0.0046	0.000221	0.00347	0.0524	1.09	0.875	0.0338	0.00532	5.17	0.186	0.0019	0.00665	278	0.02
June	0.0000894	0.6	0.902	0.0047	0.000156	0.00353	0.0372	1.12	0.89	0.0311	0.00503	3.87	0.142	0.00195	0.00522	225	0.015
July	0.0000895	0.58	0.652	0.00475	0.000105	0.00357	0.0262	1.27	1	0.0292	0.00529	2.8	0.103	0.00192	0.00472	222	0.0105
August	0.0000893	0.554	0.731	0.00476	0.00011	0.00356	0.0263	1.44	1.09	0.0295	0.0054	3.18	0.115	0.00187	0.0049	231	0.0104
September	0.0000865	0.529	0.785	0.00464	0.000107	0.00356	0.0229	1.44	1.06	0.0299	0.00535	3.43	0.123	0.00181	0.00488	237	0.00926
October	0.0000833	0.51	0.851	0.00448	0.0000851	0.00348	0.0191	1.37	0.982	0.0295	0.00517	3.72	0.134	0.00176	0.00457	240	0.00739

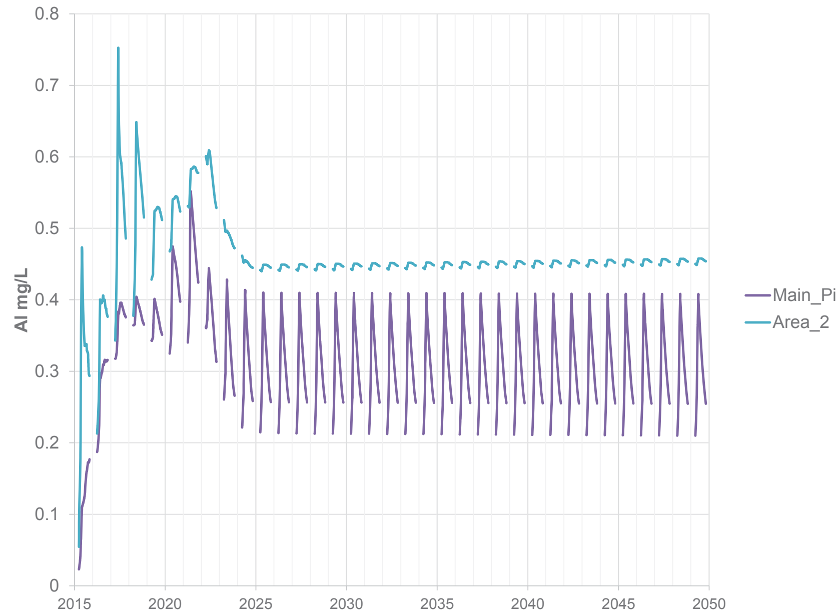
Scenario 5 - W1 2045 Monthly Water Quality Results

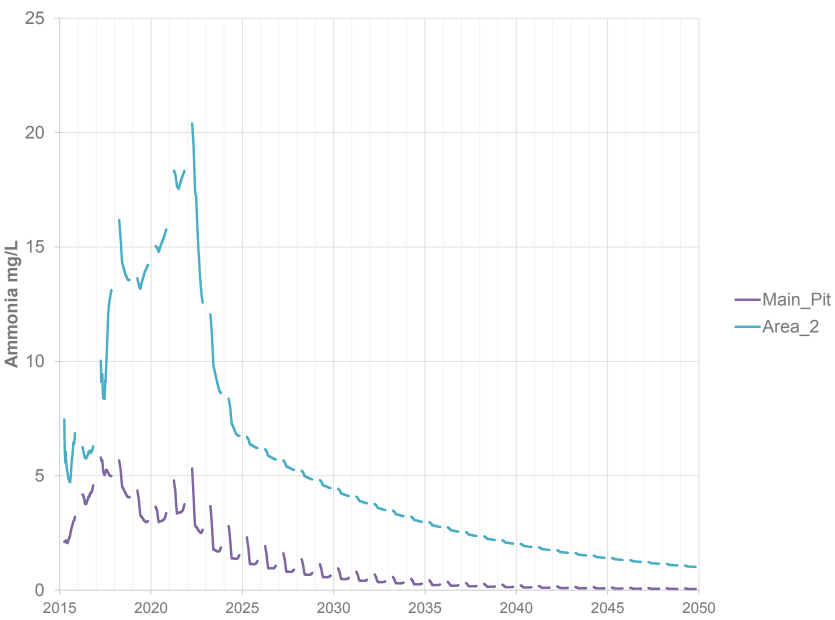
	Ag-Dissolved	Al-Dissolved	Ammonia	As-Dissolved	Cd-Dissolved	Cr-Dissolved	Cu-Dissolved	Fe-Dissolved	Mn-Dissolved	Mo-Dissolved	Ni-Dissolved	Nitrate	Nitrite	Pb-Dissolved	Se-Dissolved	Sulphate	Zn-Dissolved
April	0.0000368	0.207	0.318	0.00185	0.0000577	0.0017	0.0121	0.616	0.431	0.0118	0.00267	1.36	0.0573	0.000683	0.00166	125	0.00616
May	0.0000295	0.186	0.363	0.00147	0.0000738	0.00125	0.0162	0.536	0.29	0.00906	0.00229	1.39	0.0523	0.000584	0.00182	92.1	0.00824
June	0.0000276	0.169	0.334	0.00152	0.000055	0.00129	0.0111	0.433	0.263	0.00887	0.00222	1.29	0.0553	0.000546	0.00164	69.9	0.00683
July	0.0000277	0.151	0.242	0.00158	0.0000372	0.00129	0.00783	0.536	0.287	0.00788	0.00226	0.959	0.0387	0.000536	0.00132	58.3	0.00499
August	0.0000346	0.149	0.261	0.00163	0.0000368	0.00134	0.00816	0.614	0.328	0.00815	0.00238	1.09	0.0423	0.000561	0.0014	65.4	0.00498
September	0.0000293	0.152	0.291	0.00163	0.0000404	0.00154	0.00742	0.636	0.331	0.00865	0.00257	1.2	0.0448	0.000614	0.00152	71.6	0.00455
October	0.0000304	0.158	0.446	0.00167	0.0000391	0.00135	0.00715	0.596	0.349	0.0101	0.00231	1.84	0.0777	0.000575	0.00166	84.3	0.00403

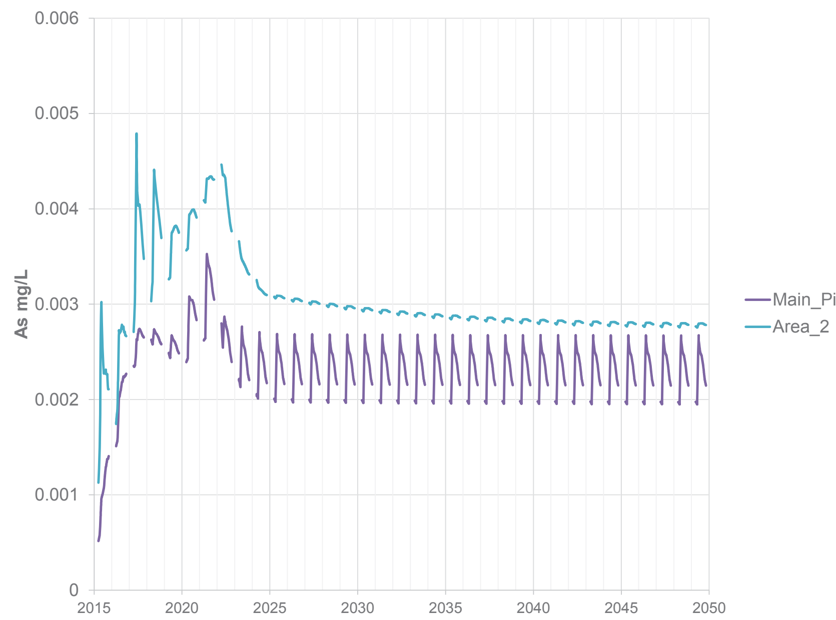
Notes:
All concentration reported in mg/L

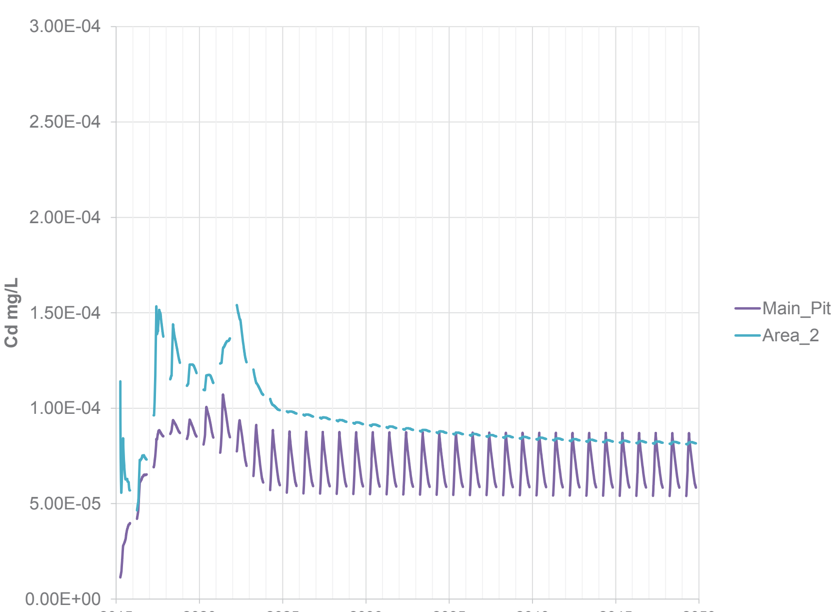
Appendix A2: Water and Load Balance Results Plots

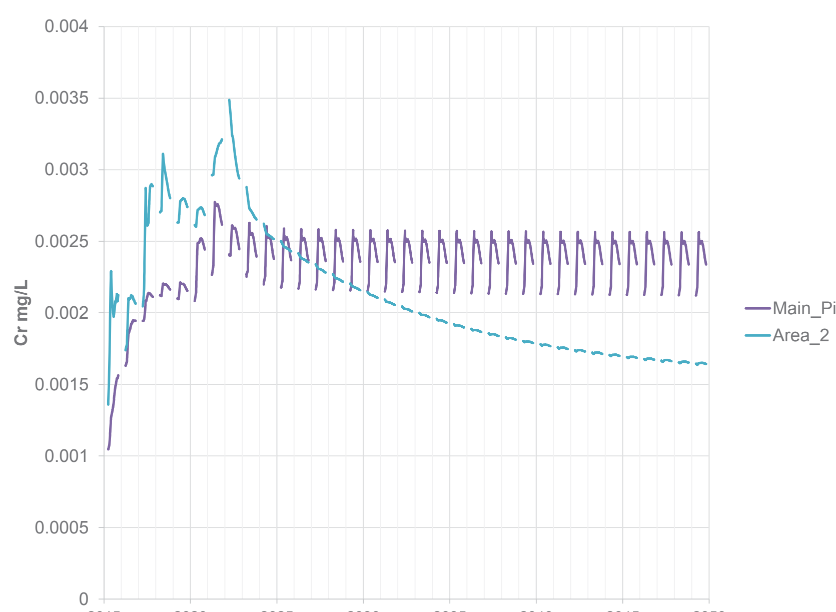


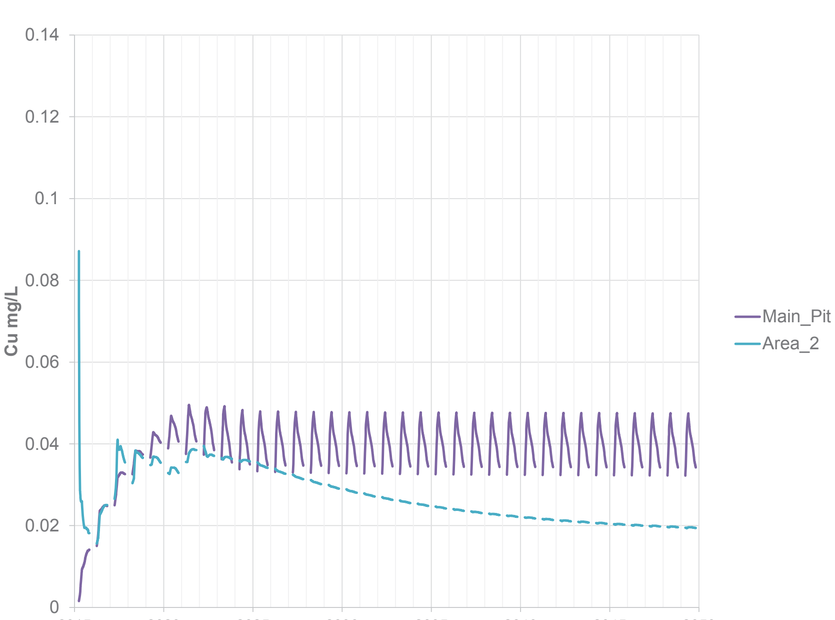


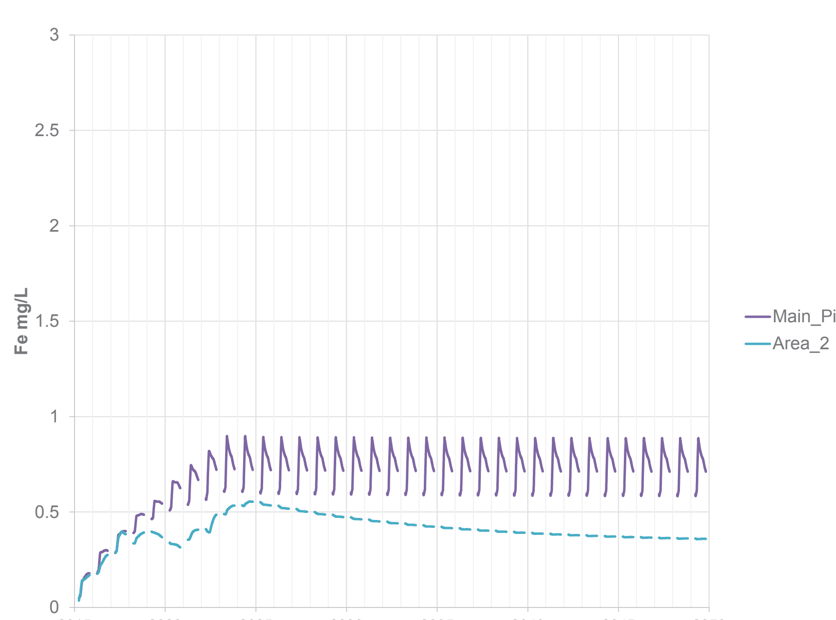












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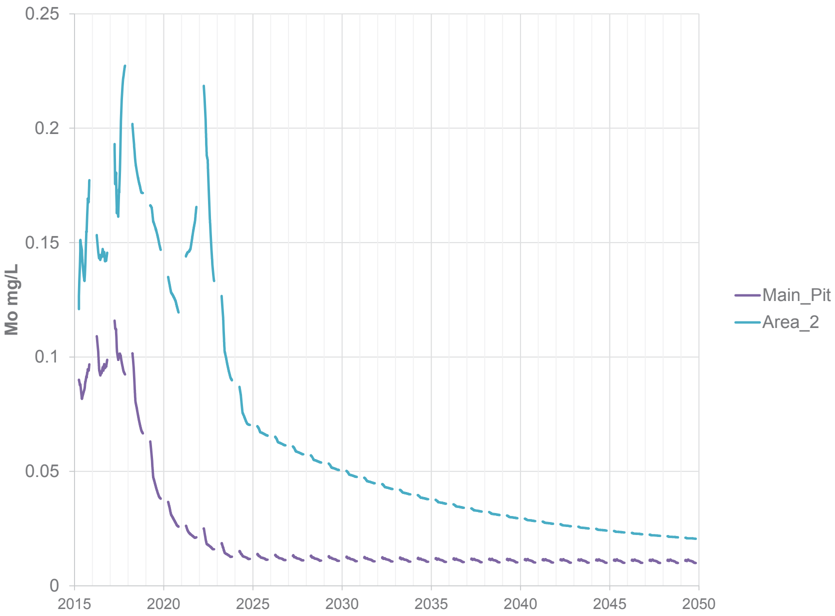

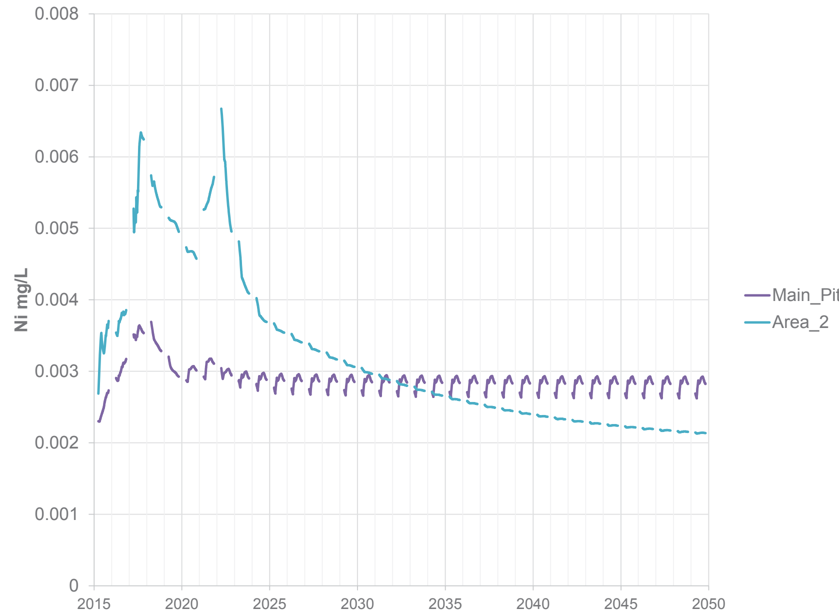

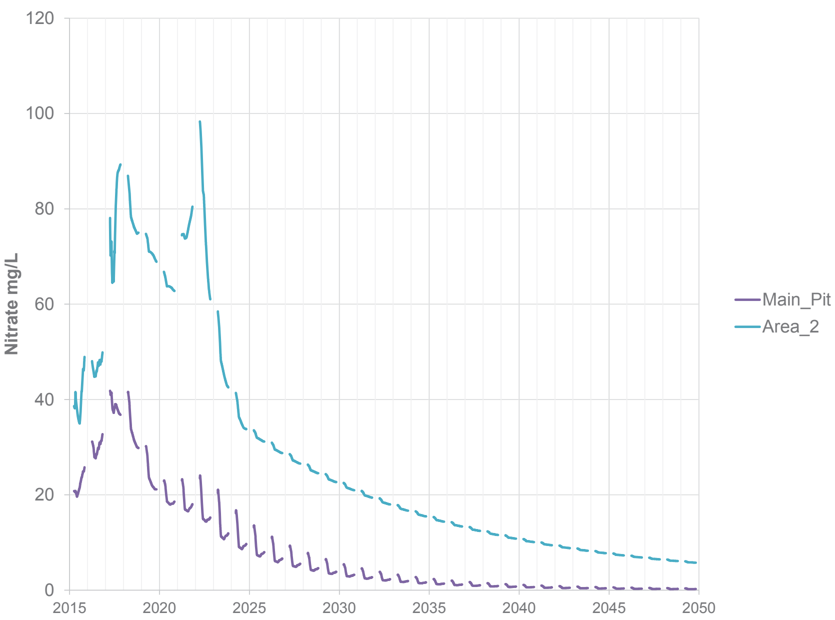

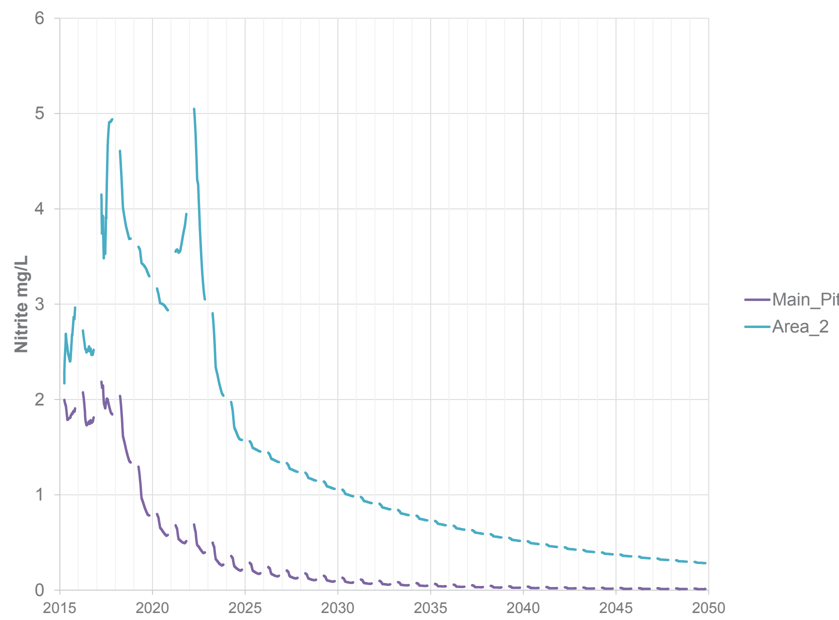

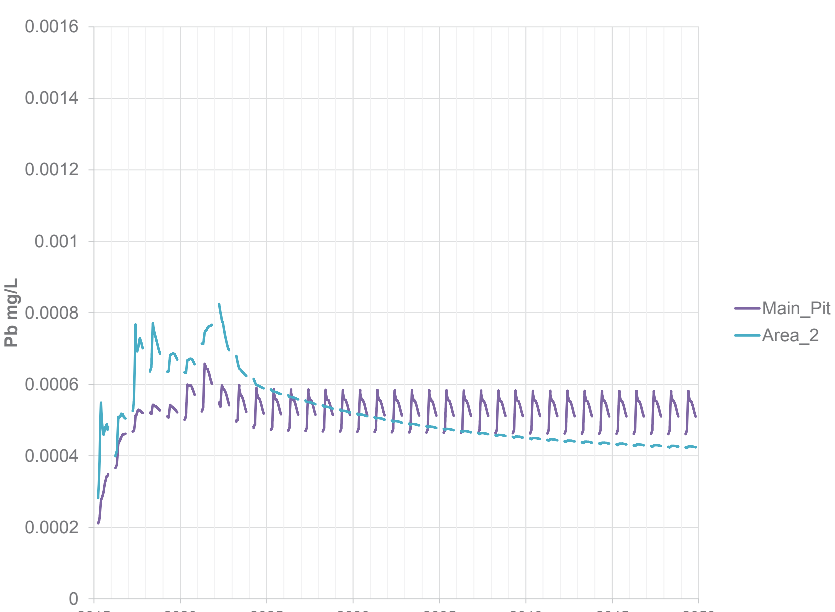

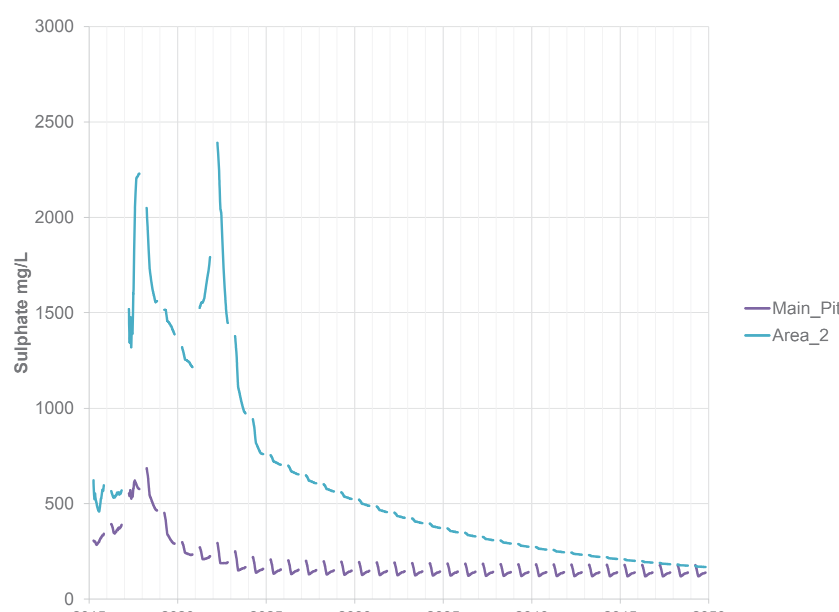

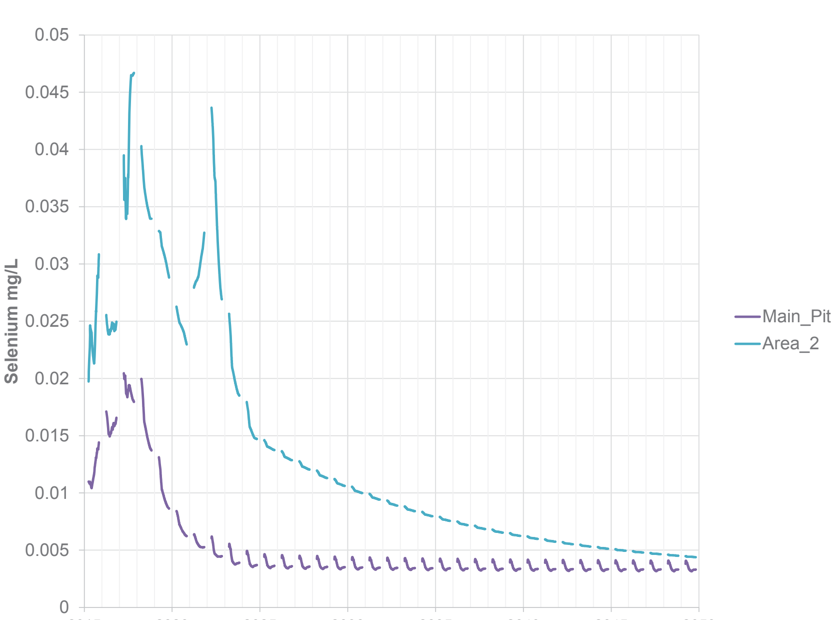

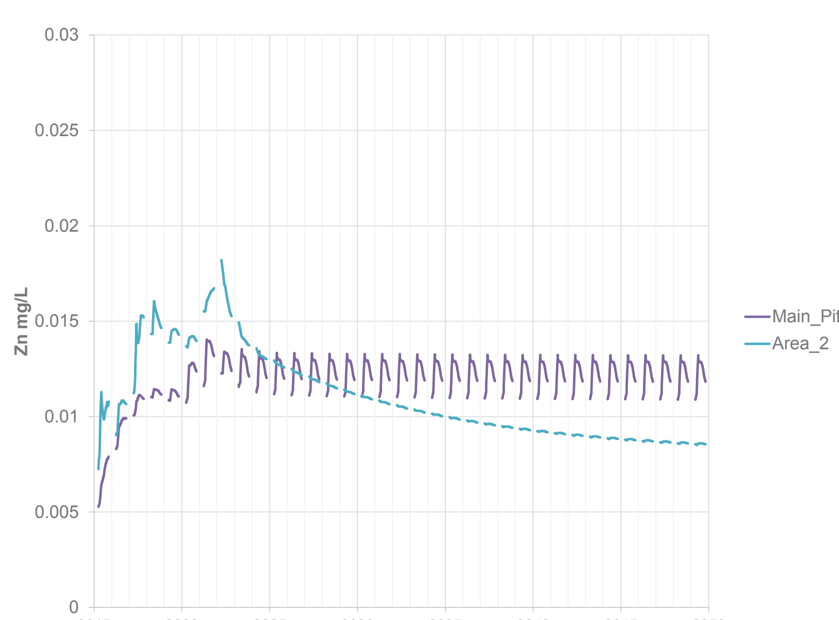

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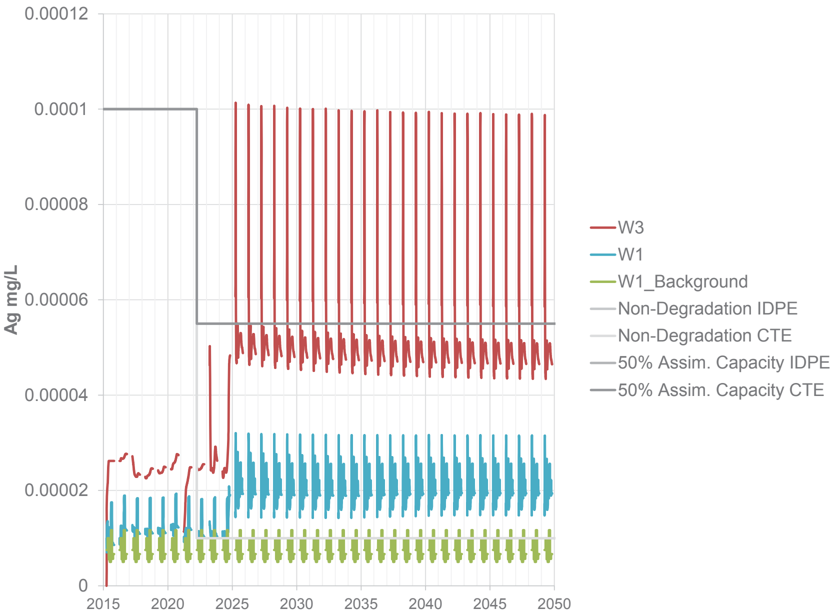
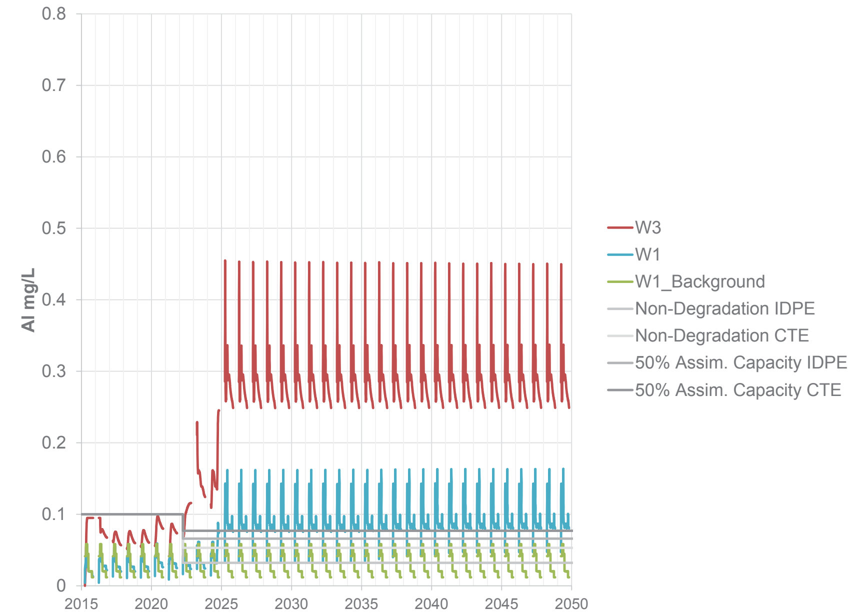
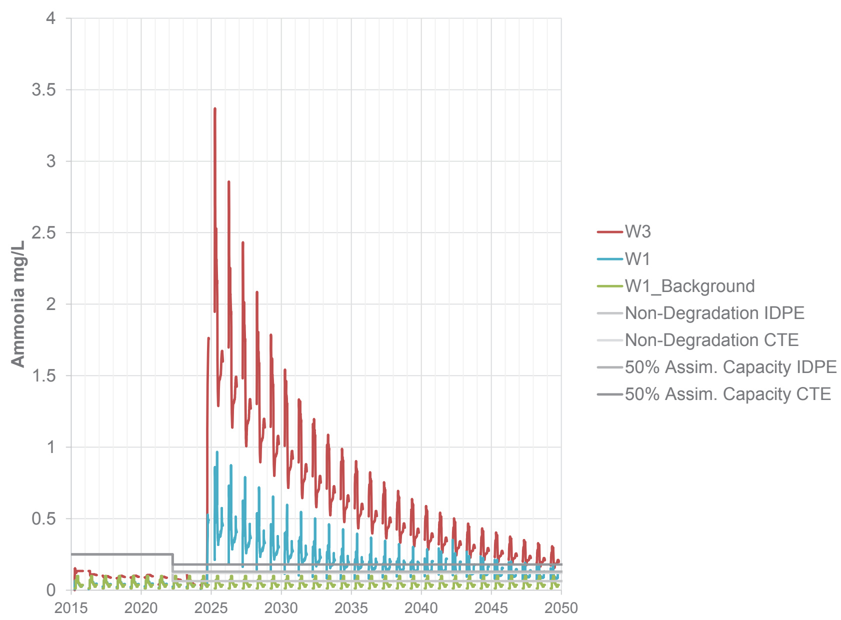
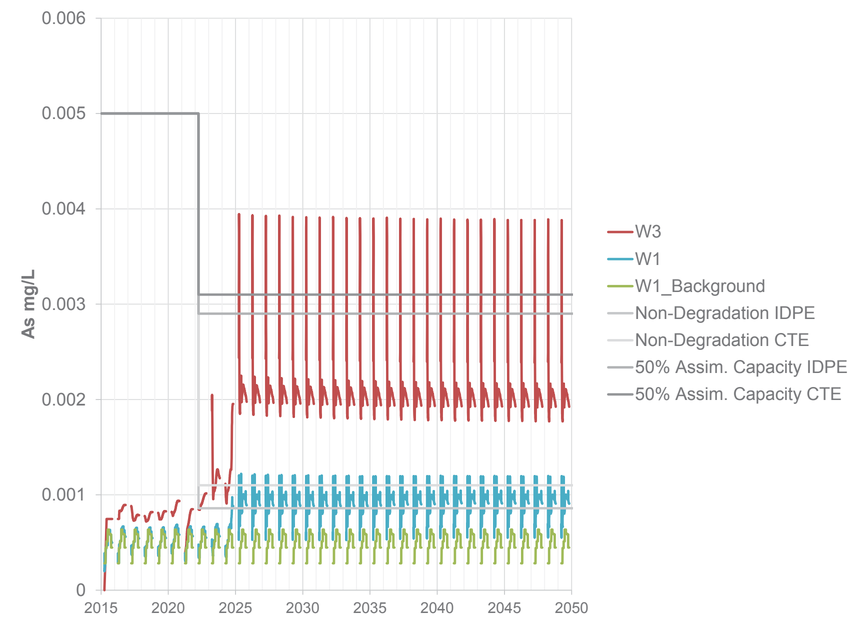
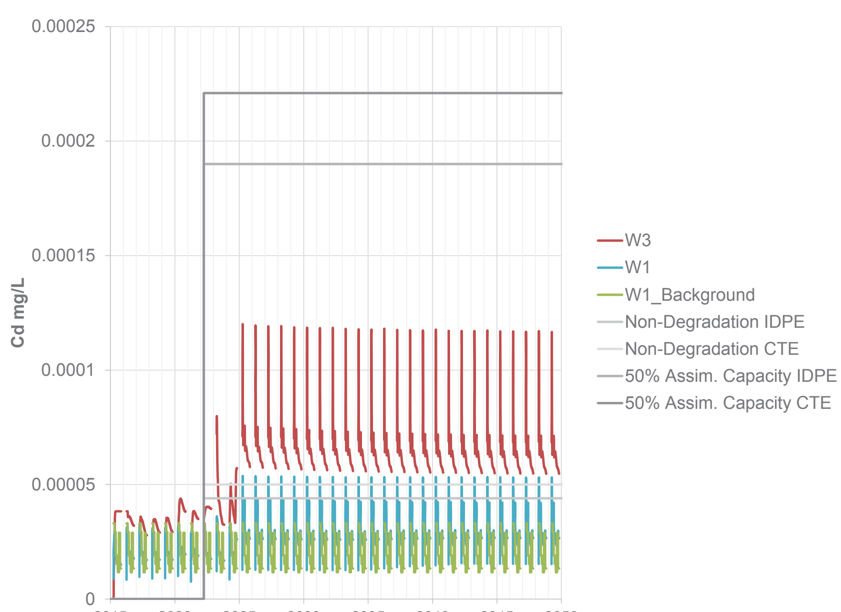
Appendix A2: Water and Load Balance Results
Scenario 1 - Expected Case, No Treatment, With Phase VII Underground

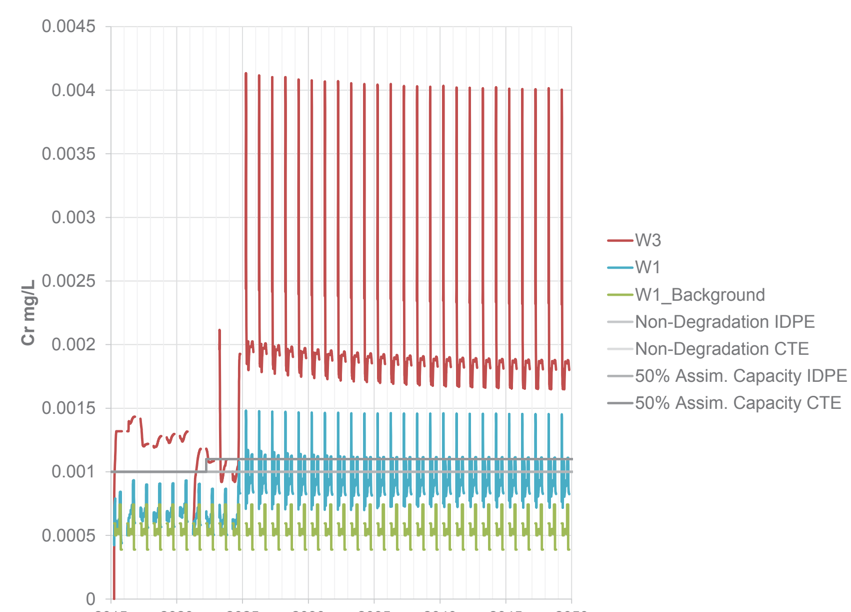


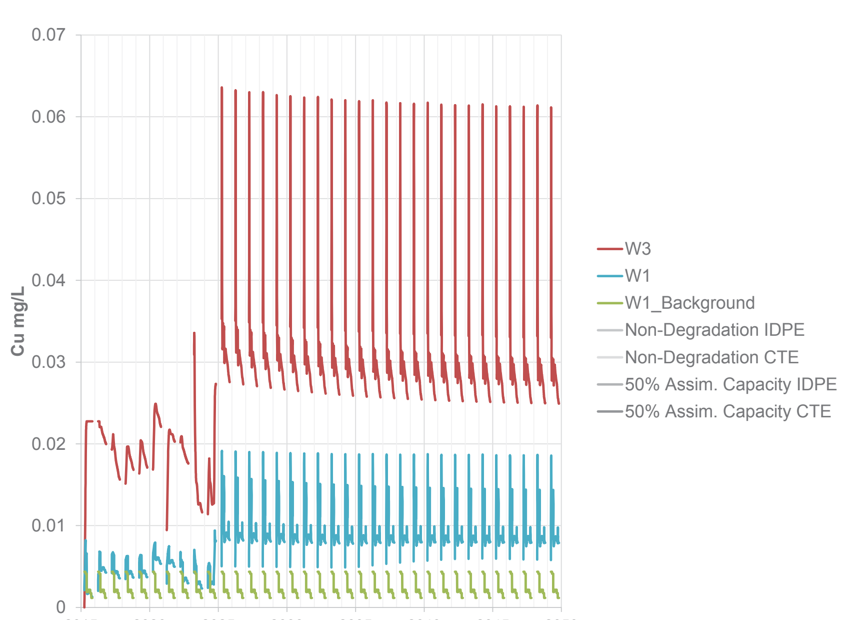


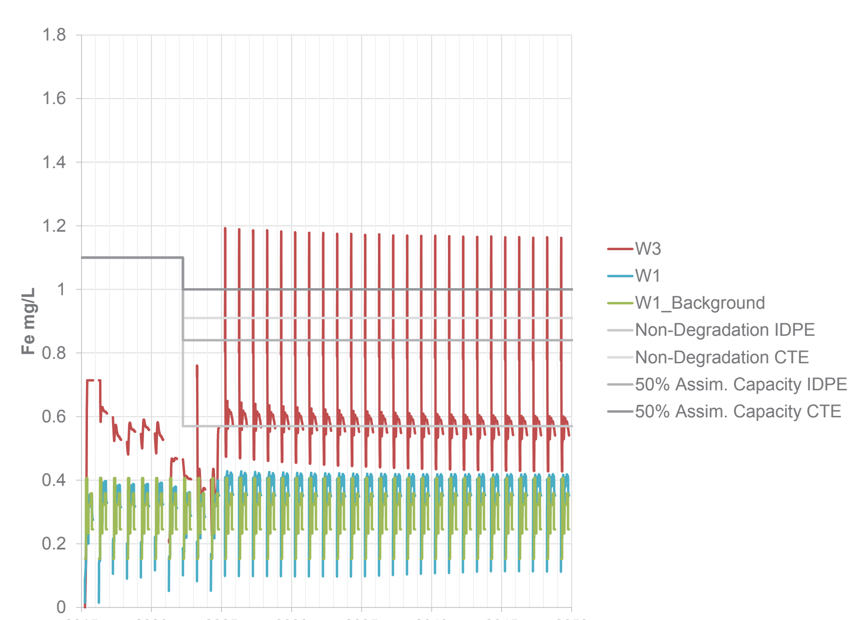












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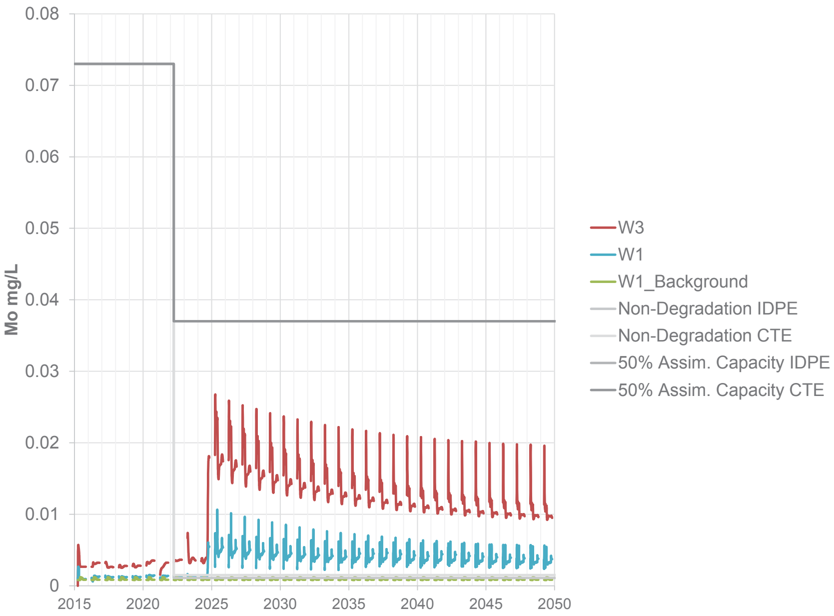

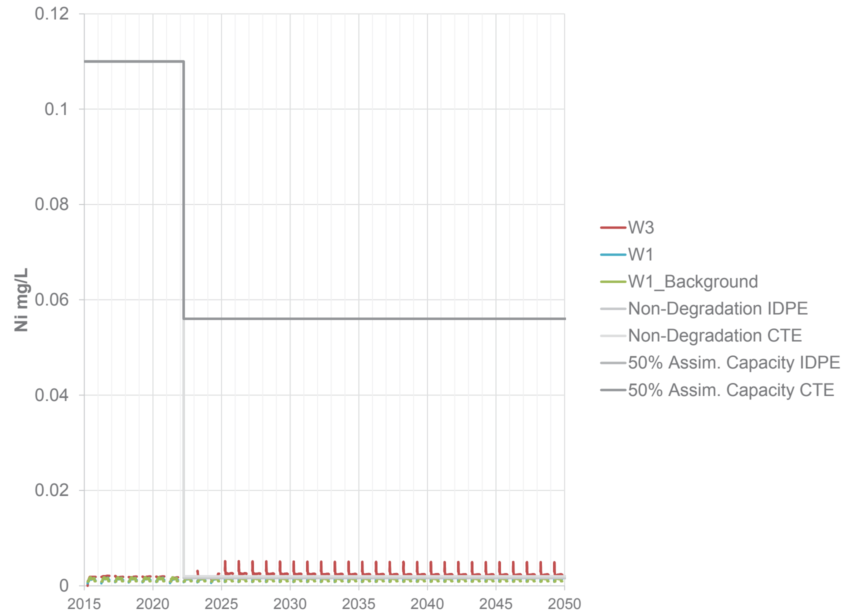

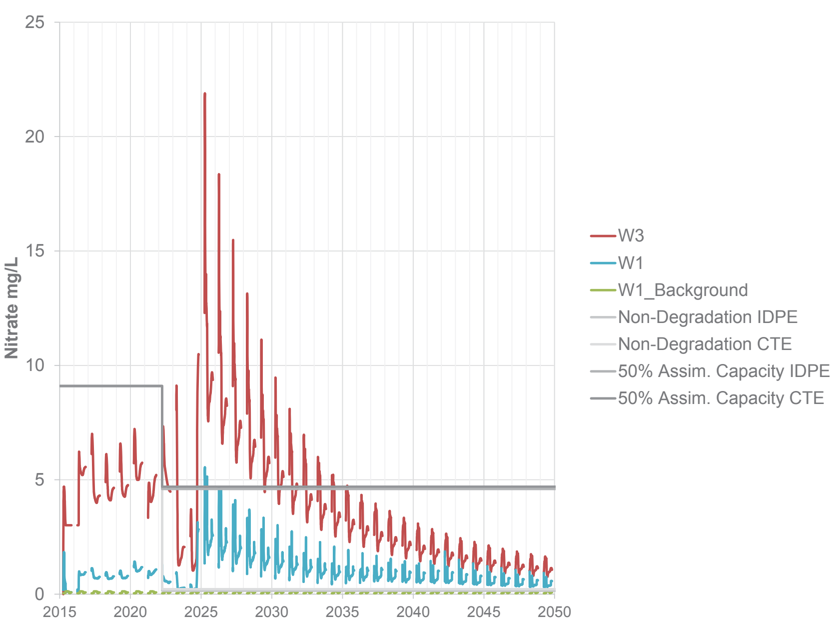

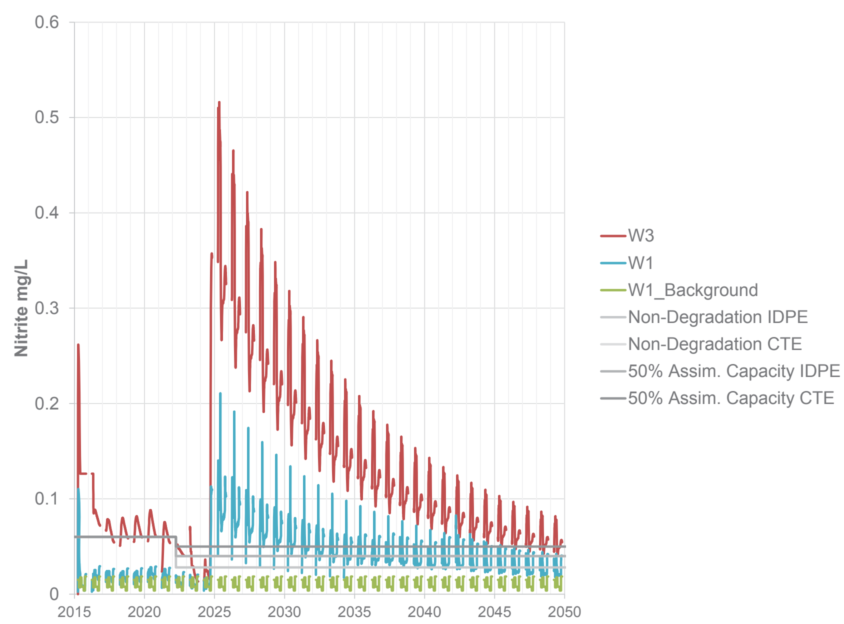

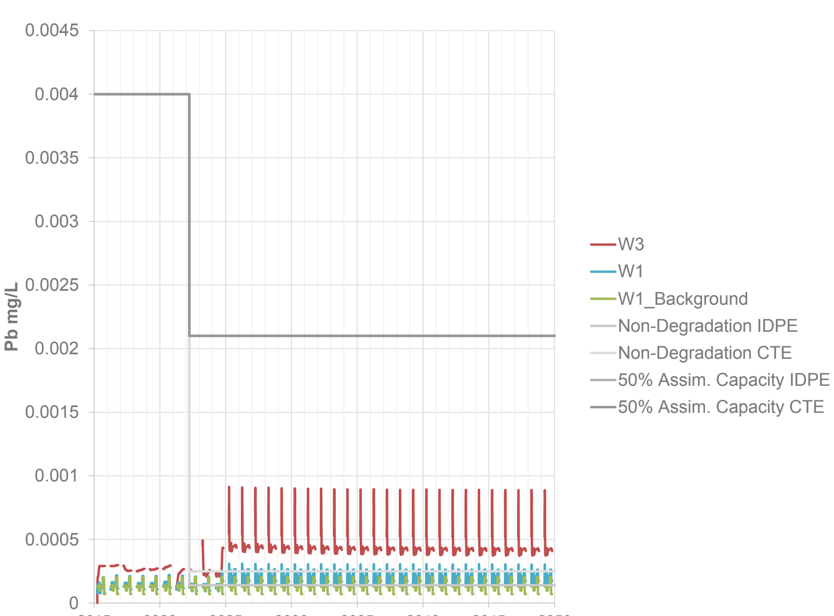

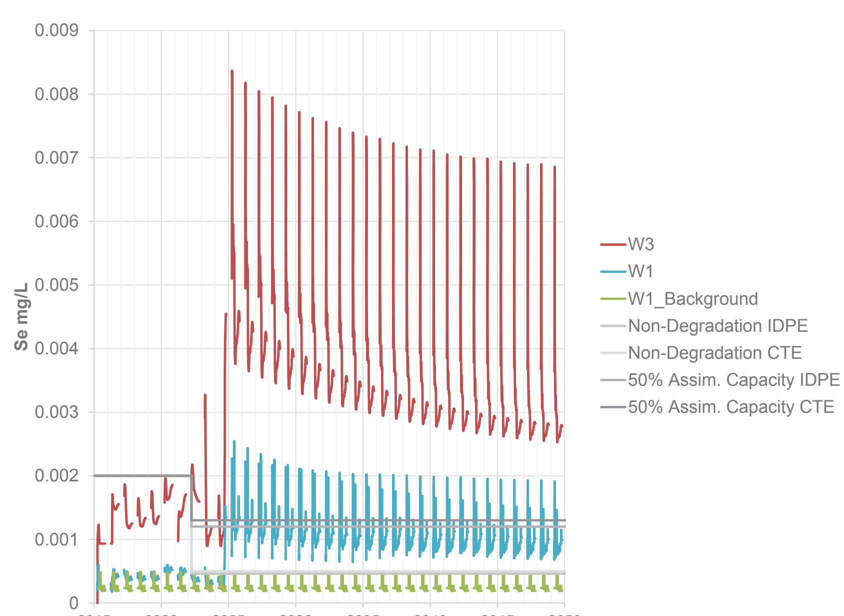

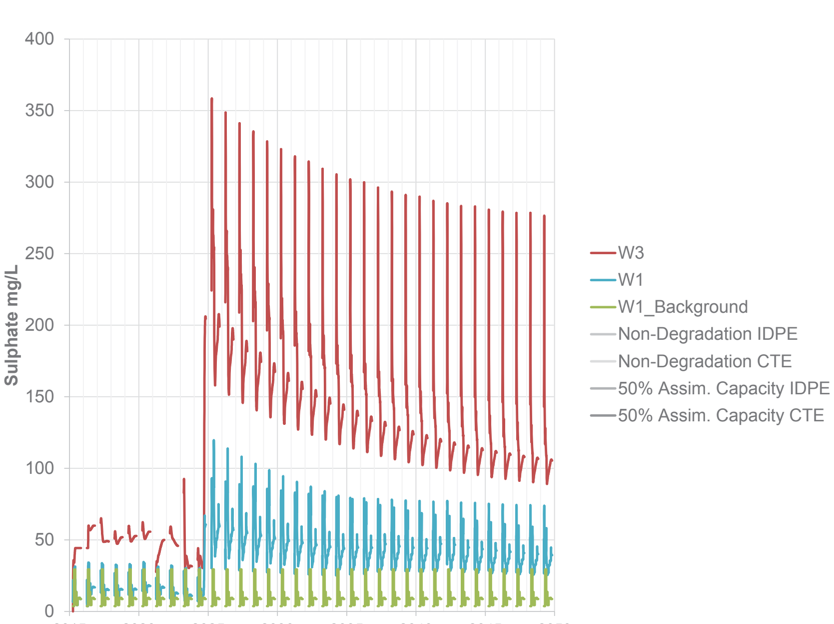

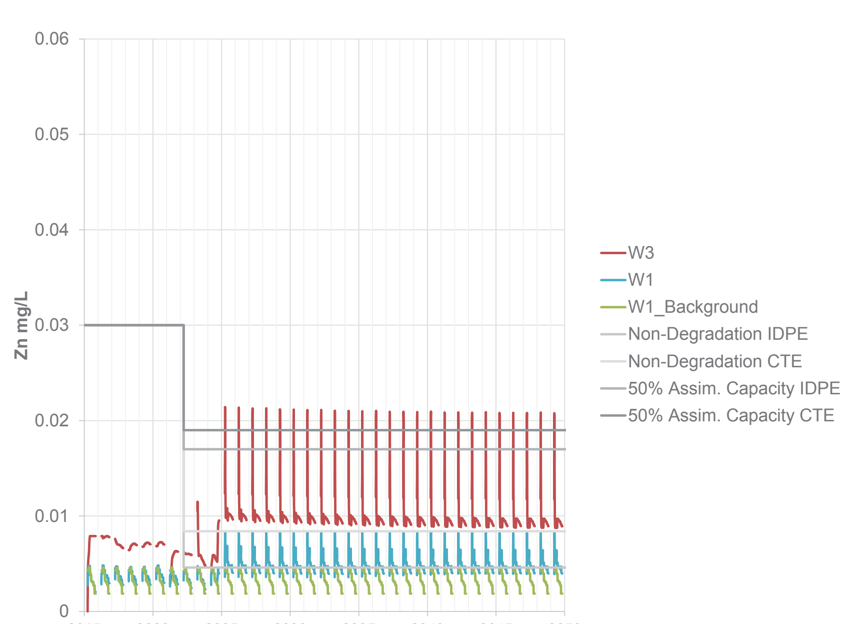

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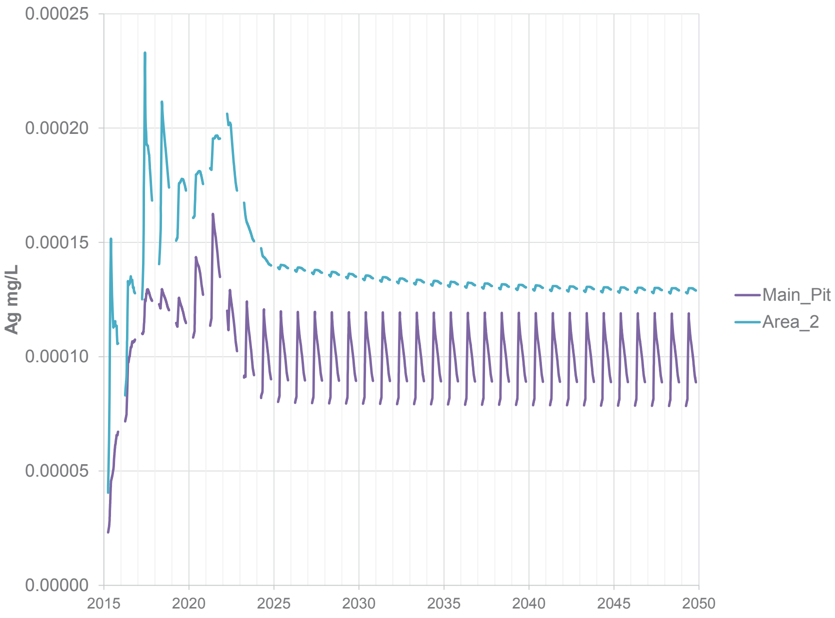
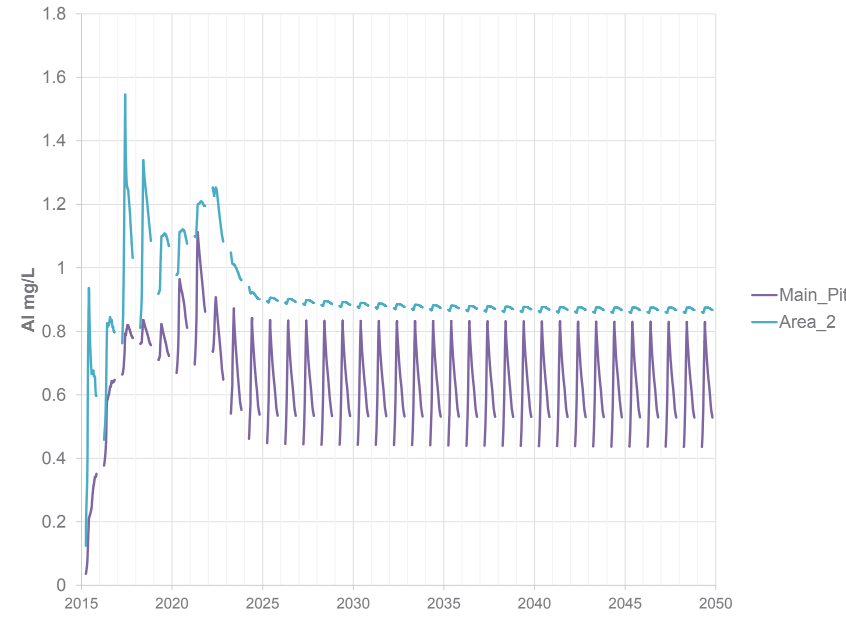
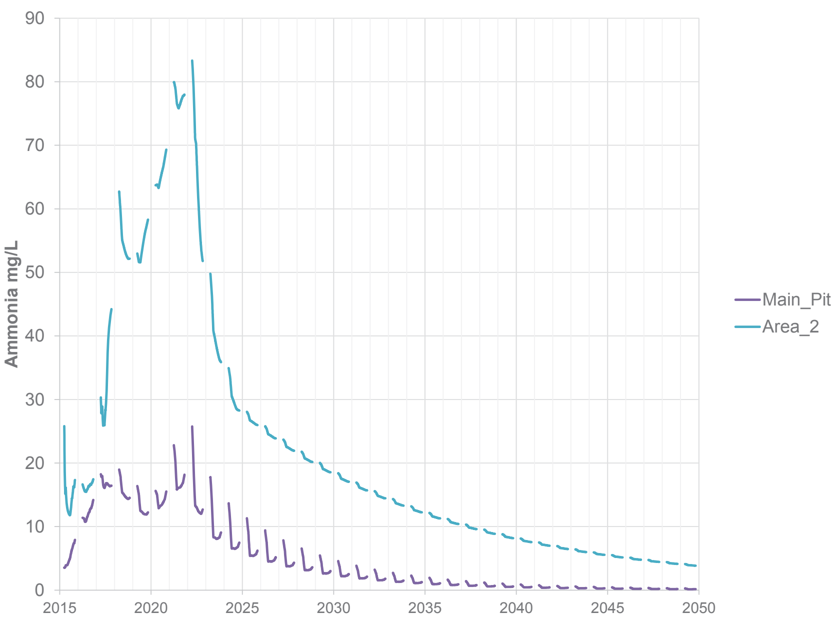
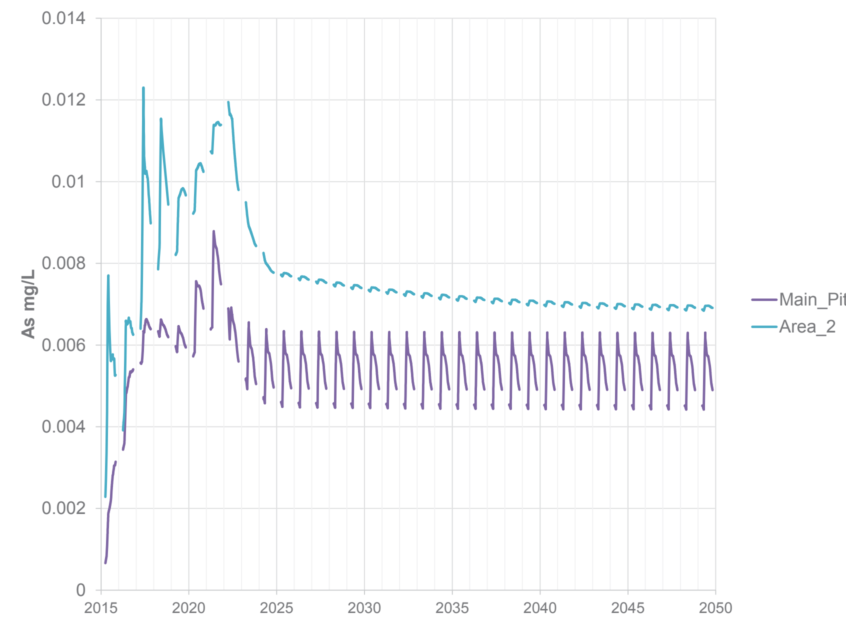
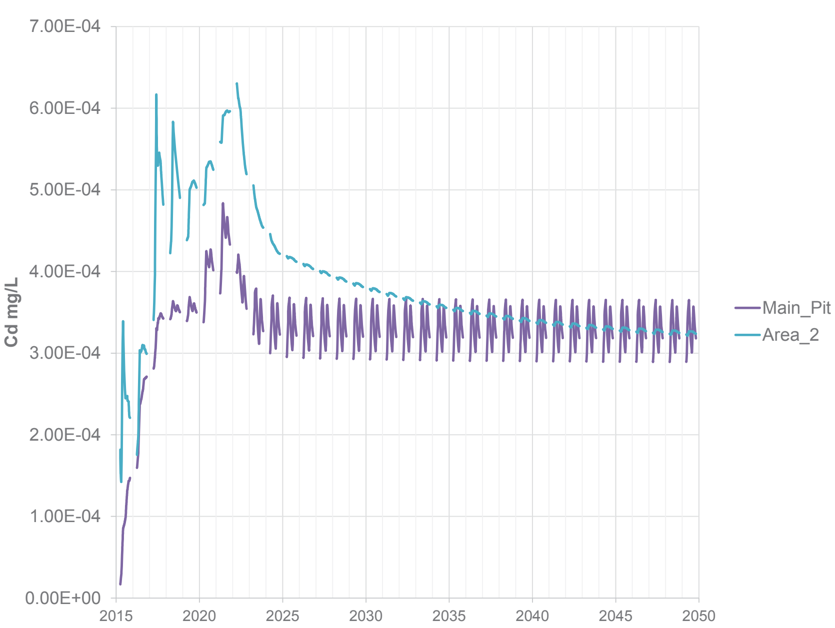
Appendix A2: Water and Load Balance Results
Scenario 2: Worst Case, No Treatment, With Phase VII Underground

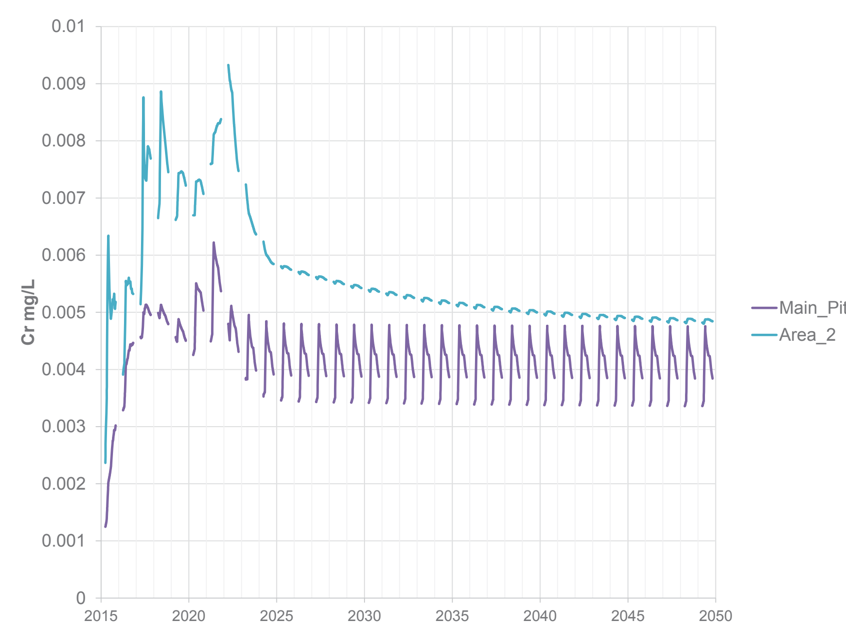


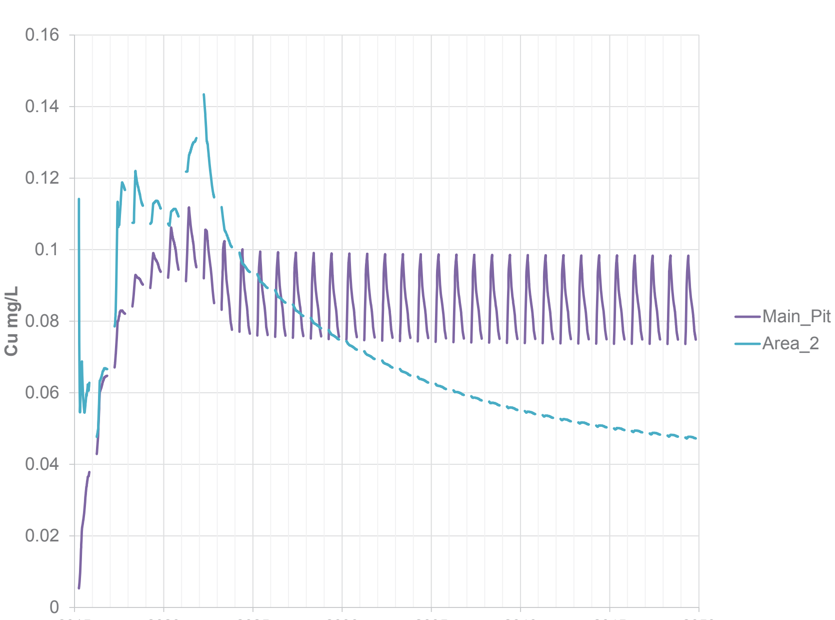


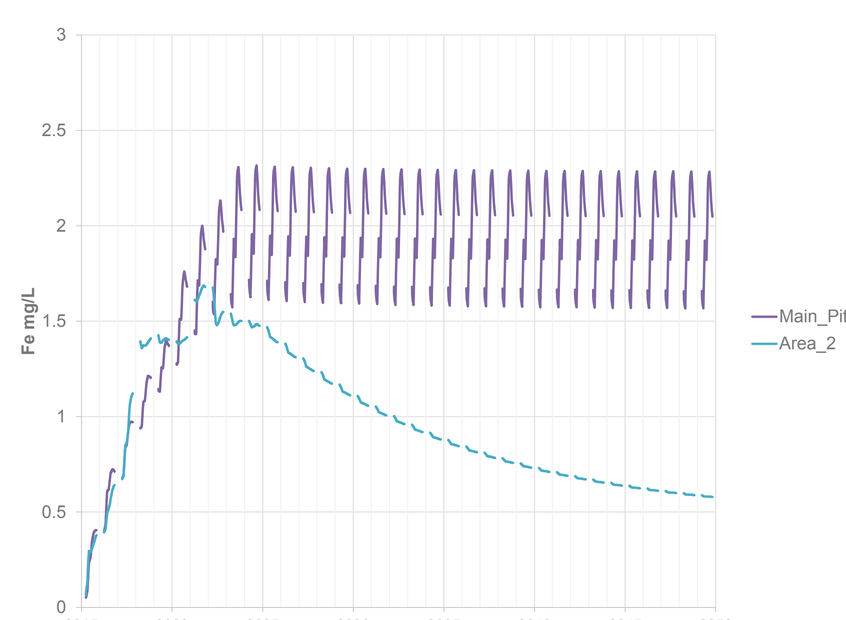












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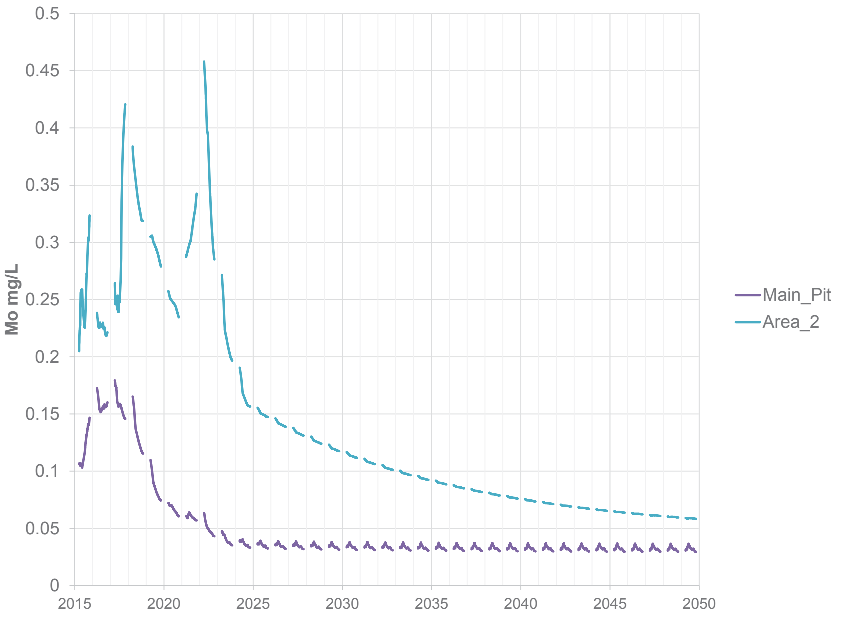

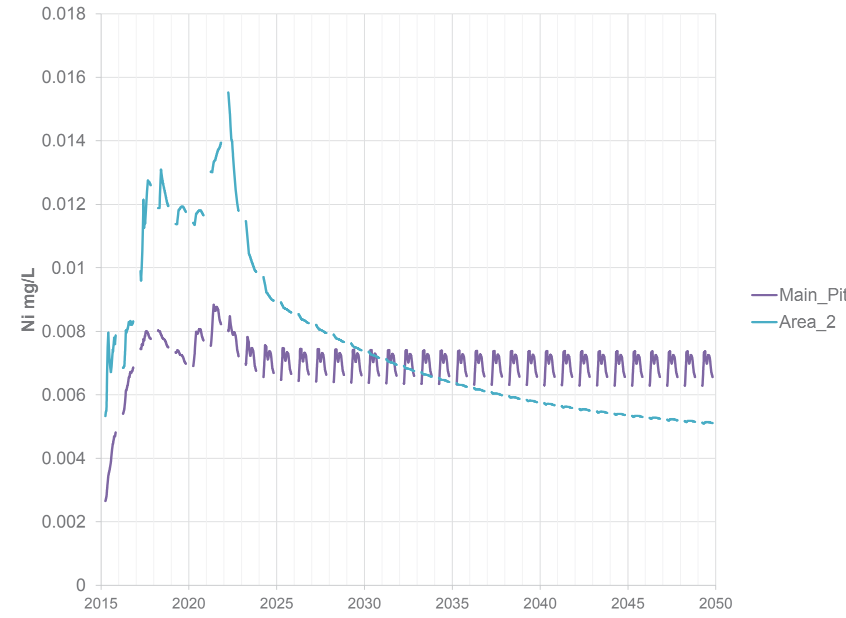

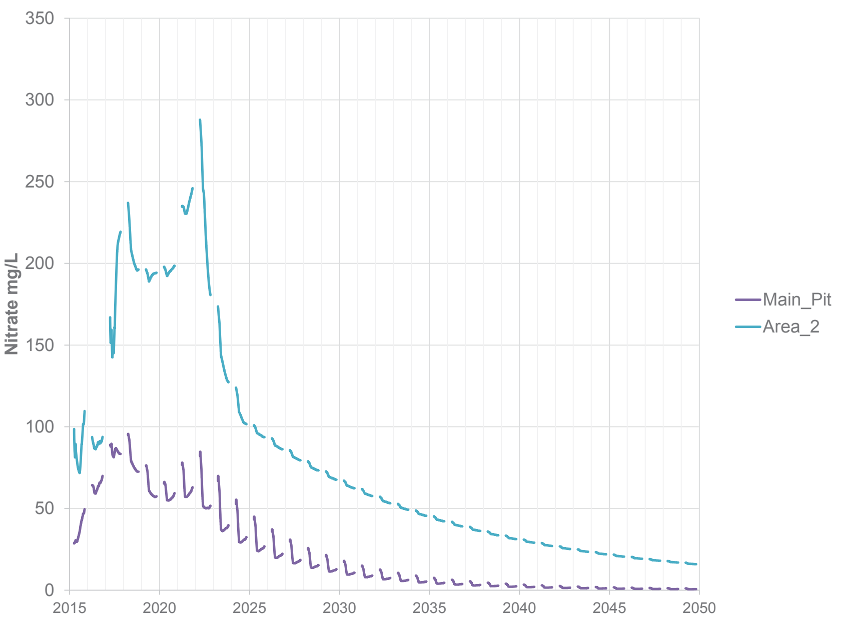

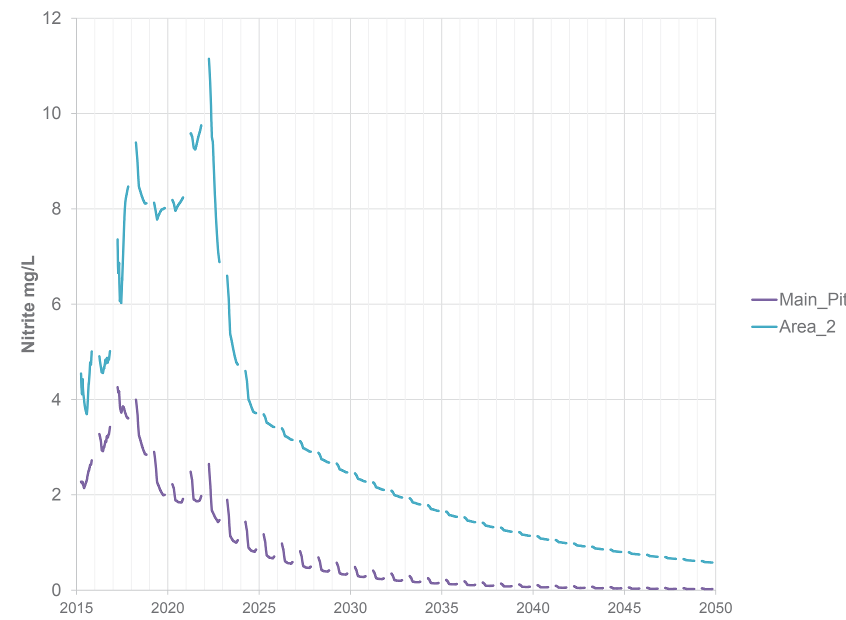

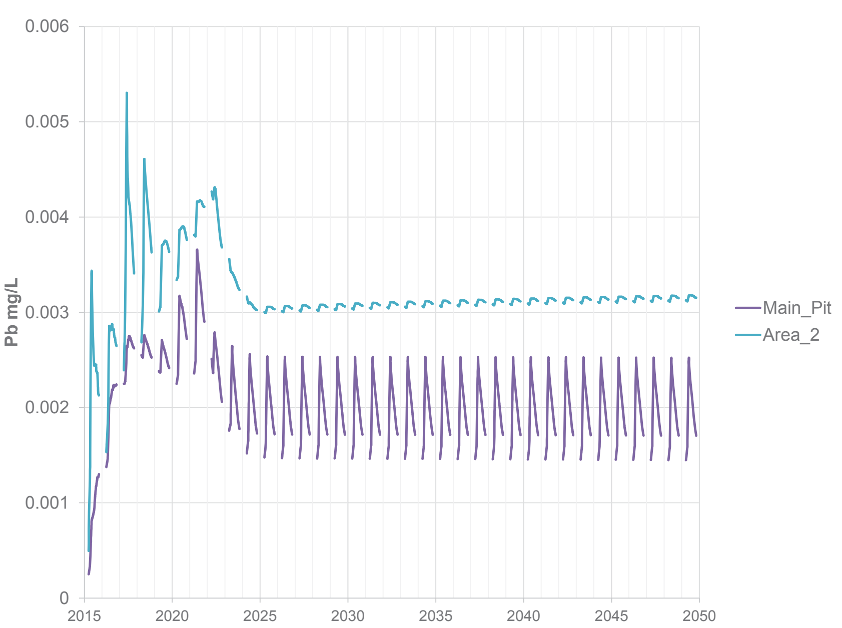

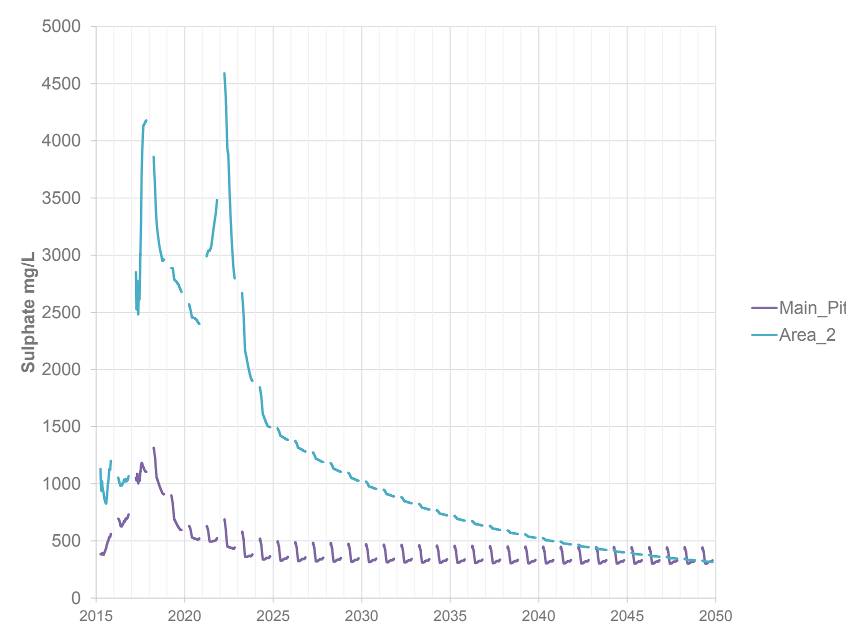

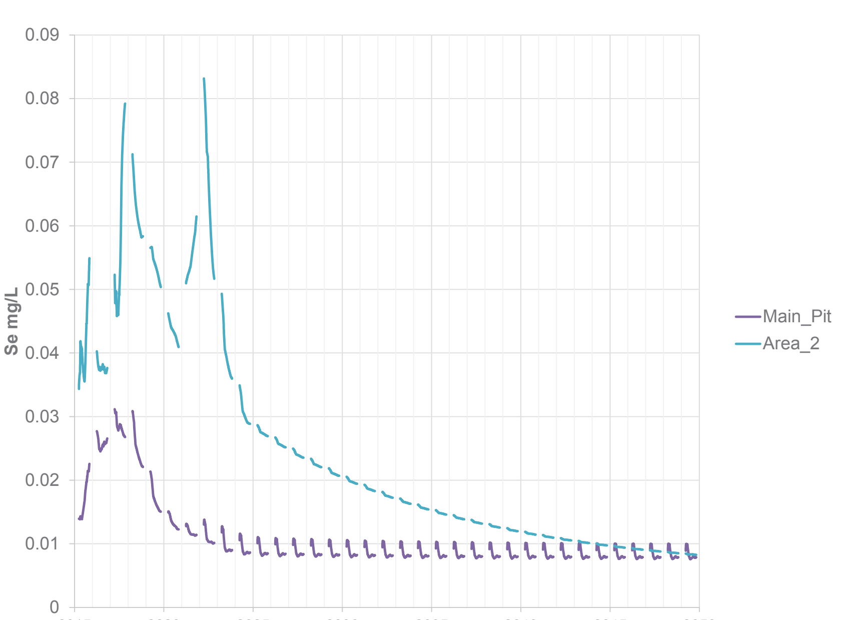

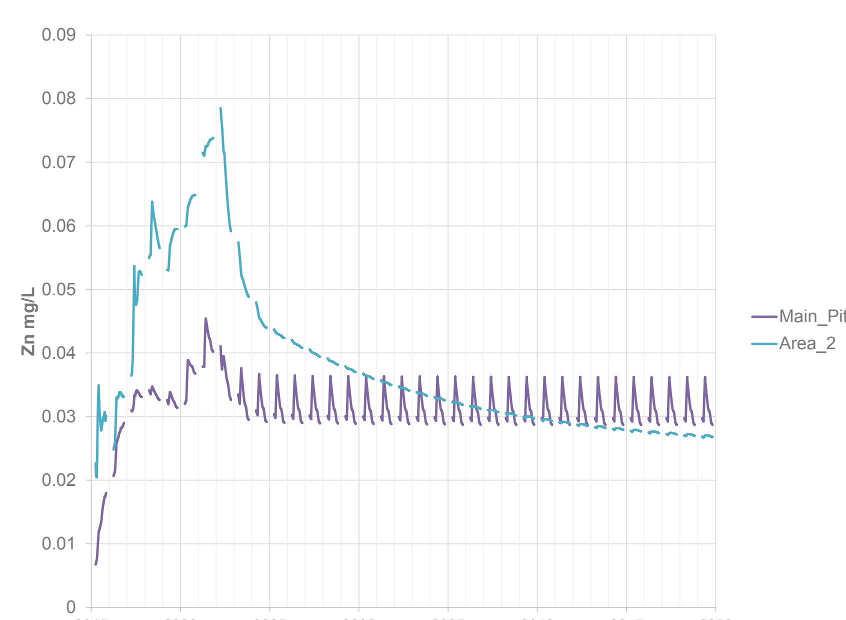

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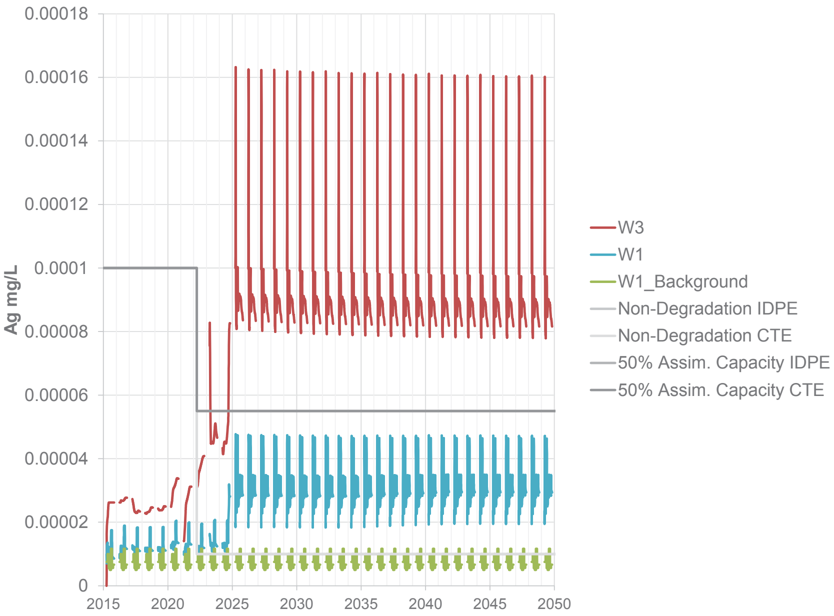
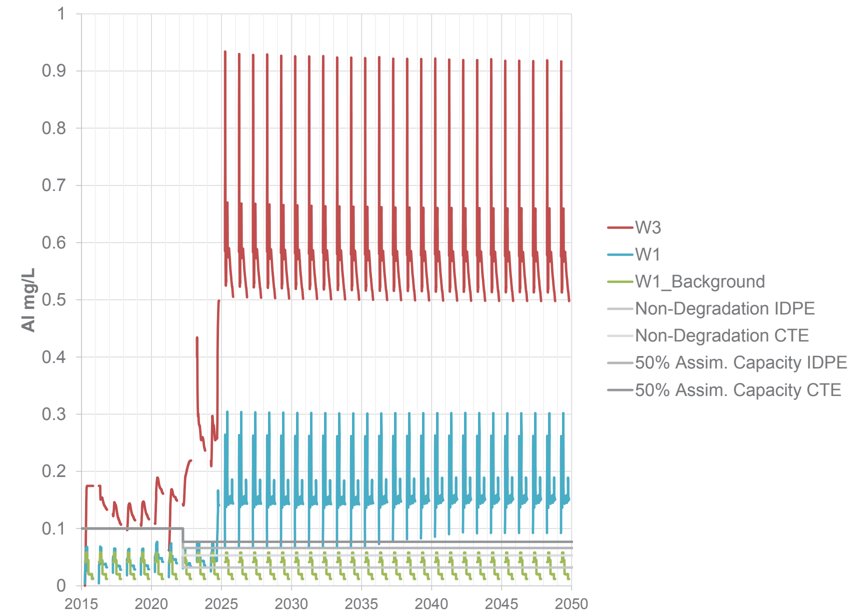
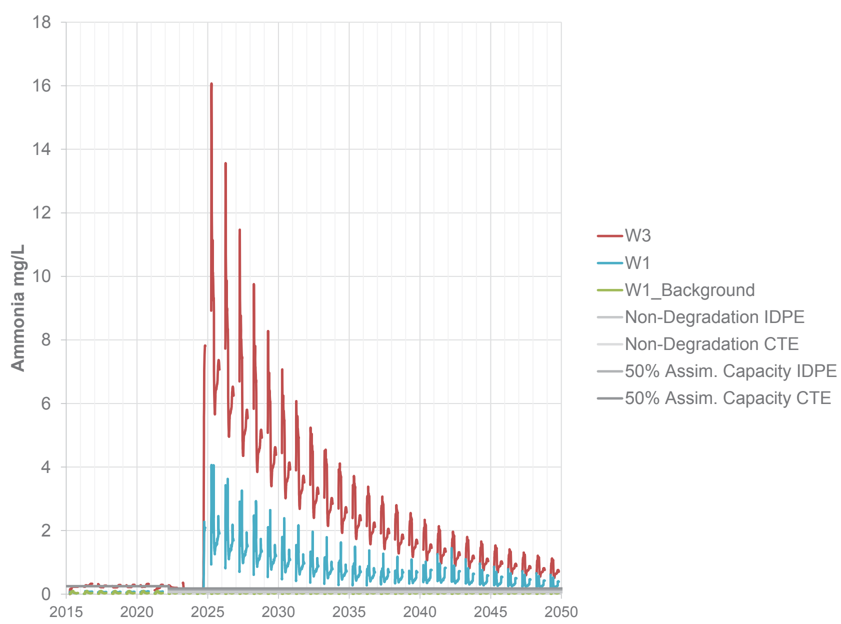
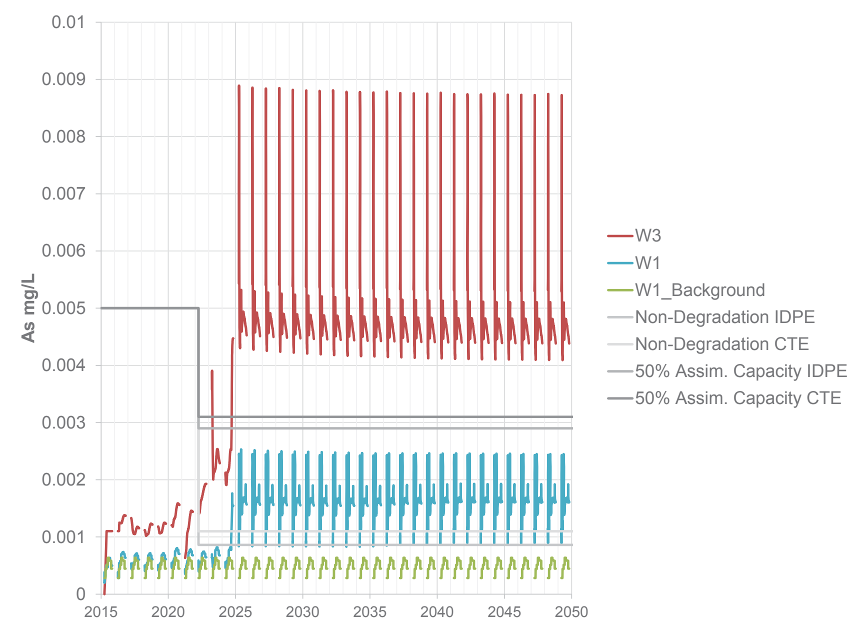
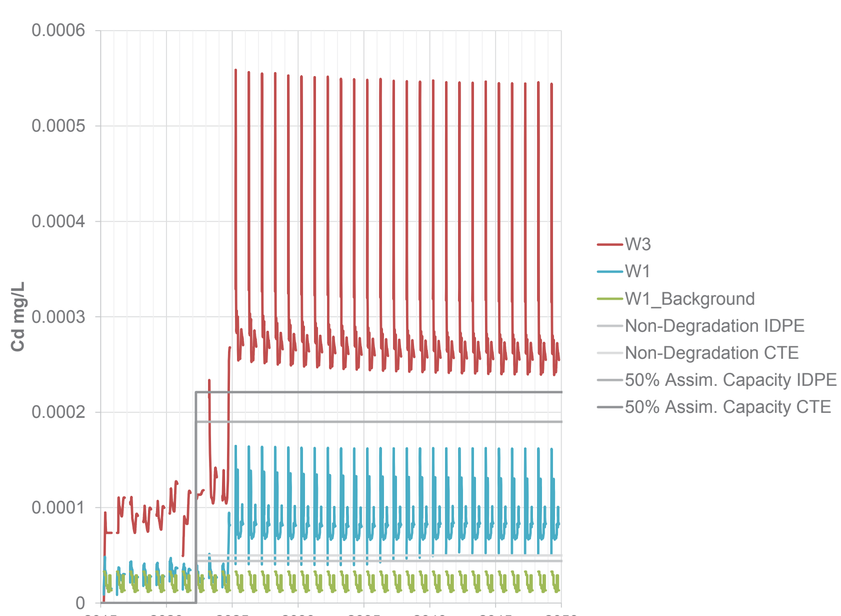
Appendix A2: Water and Load Balance Results
Scenario 2: Worst Case, No Treatment, With Phase VII Underground

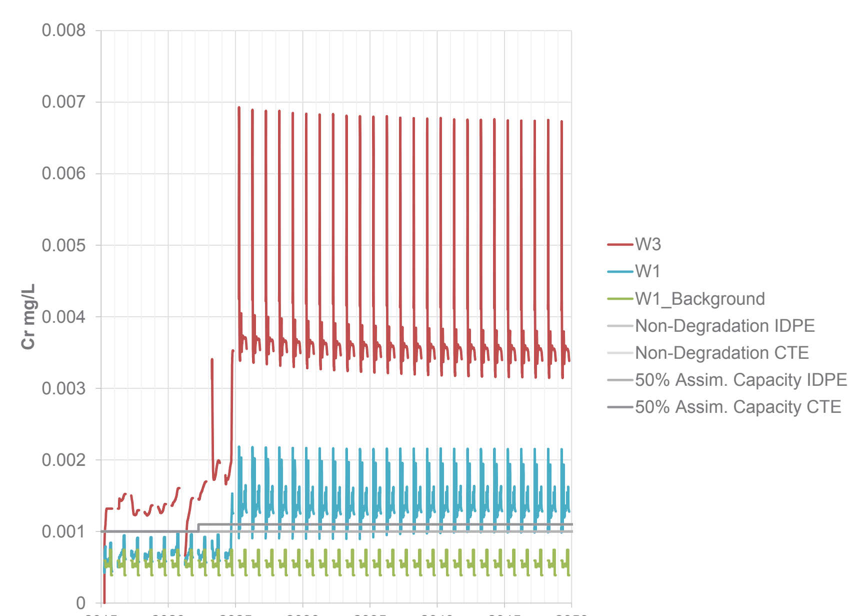


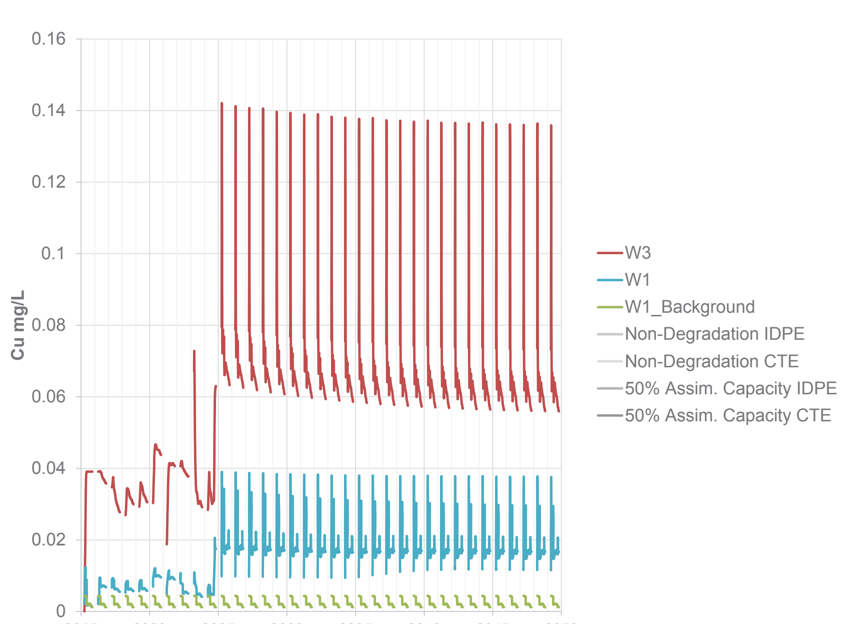


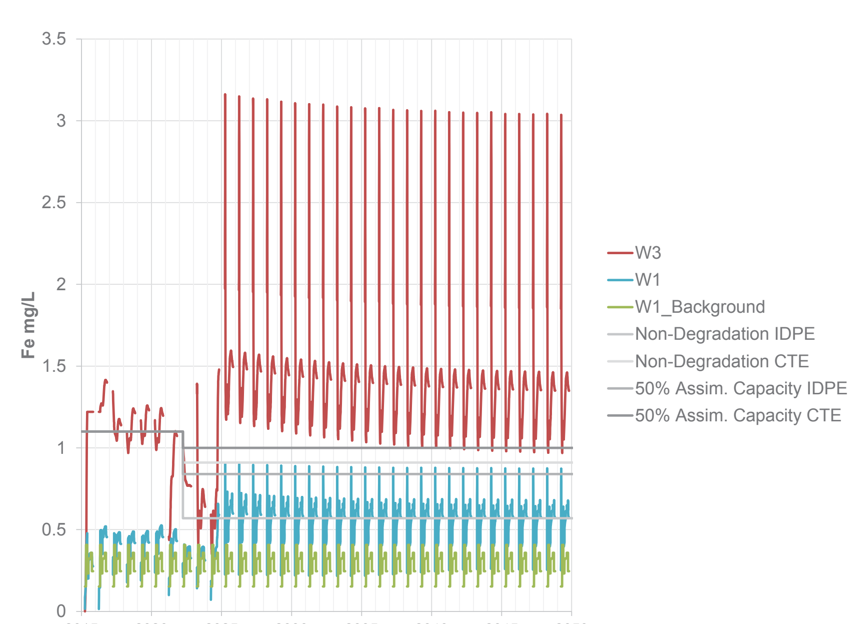












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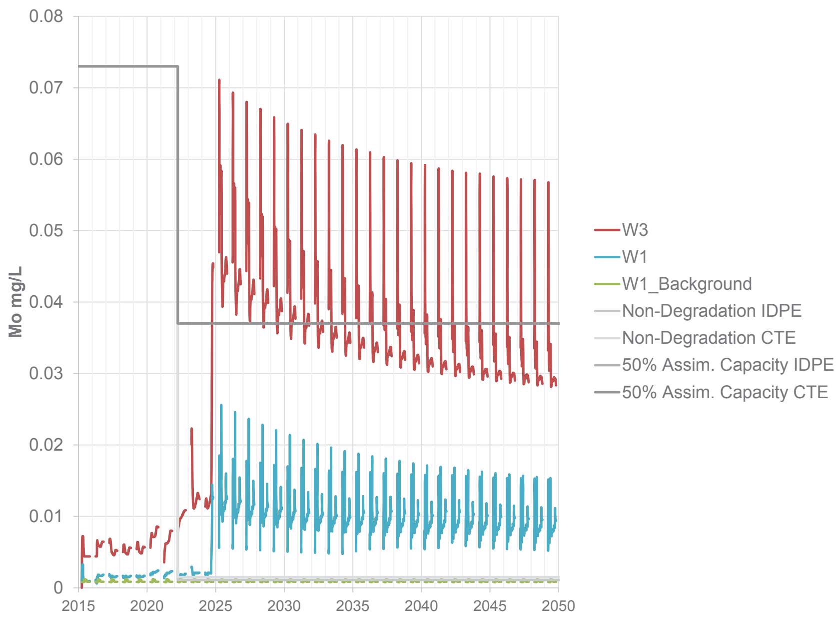
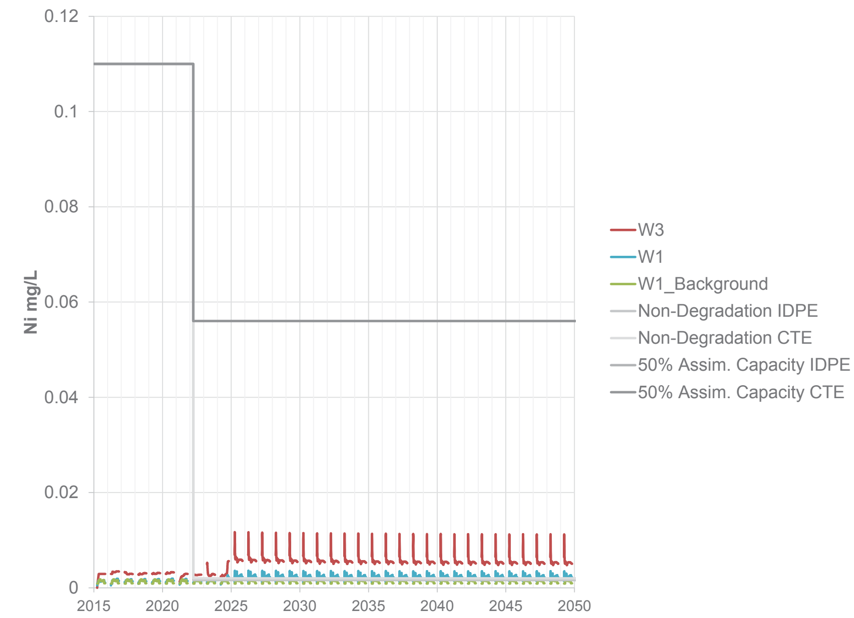
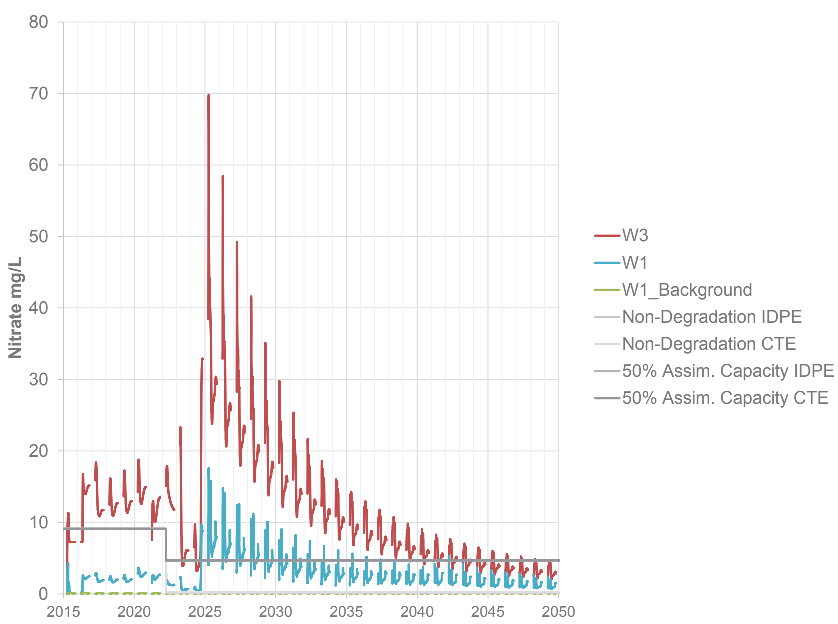
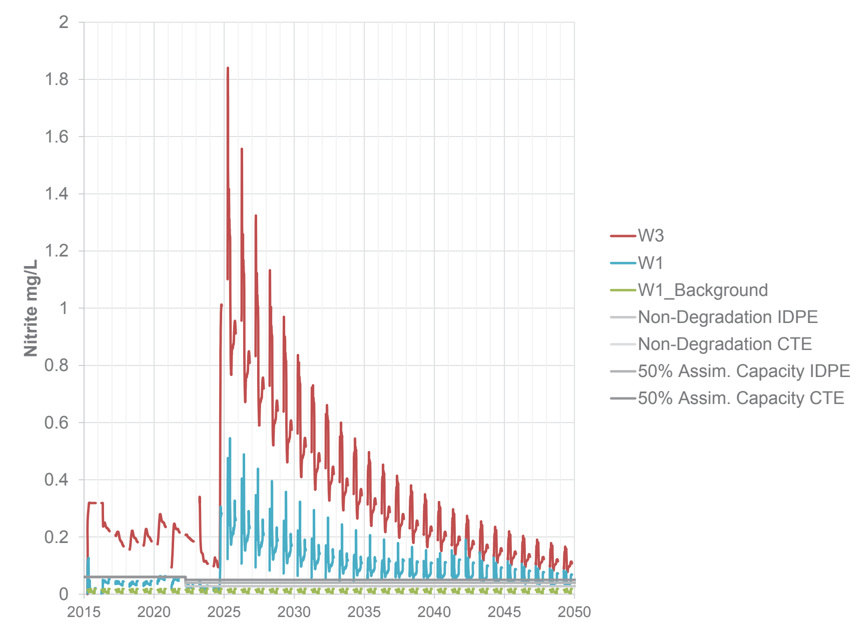
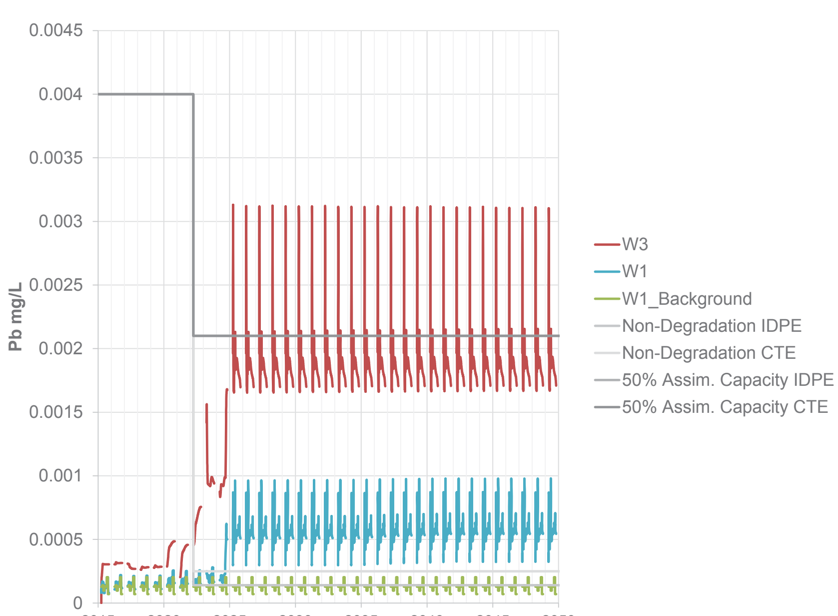
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

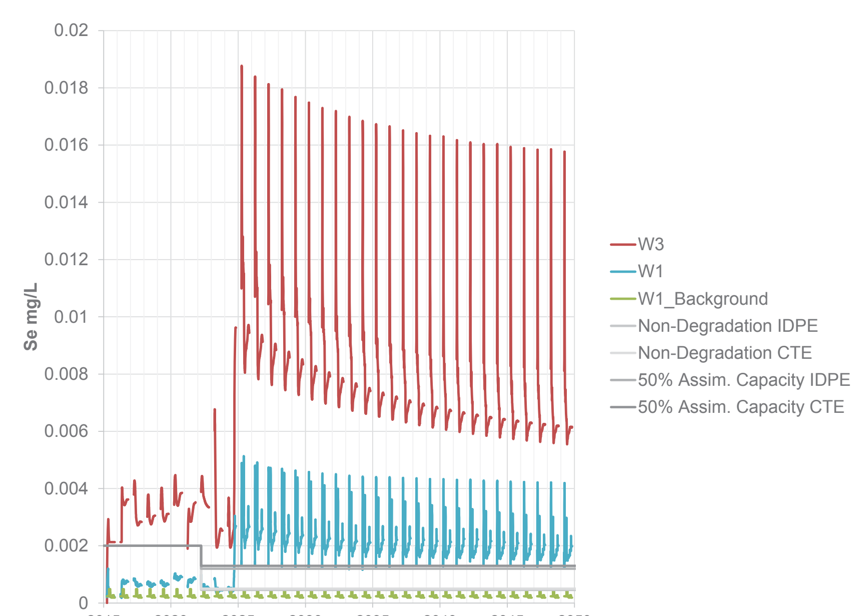


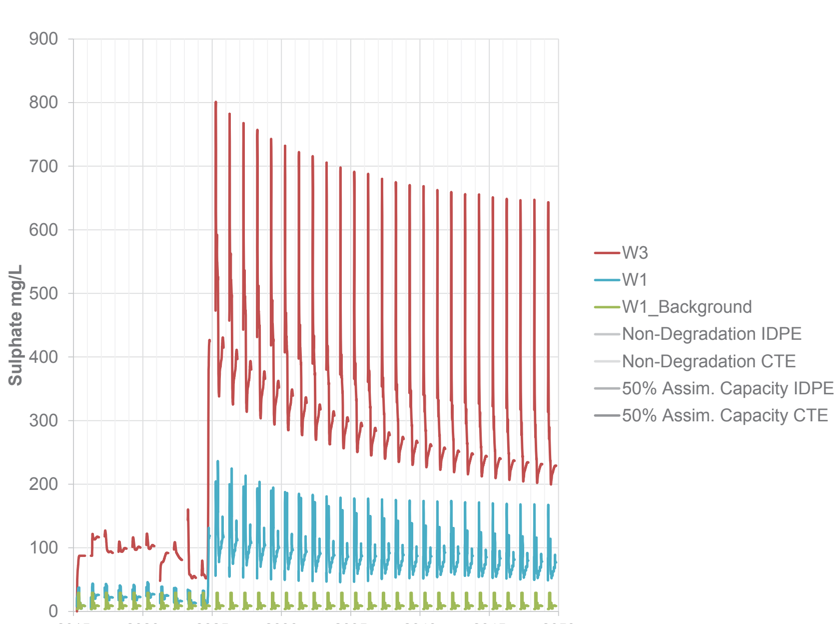


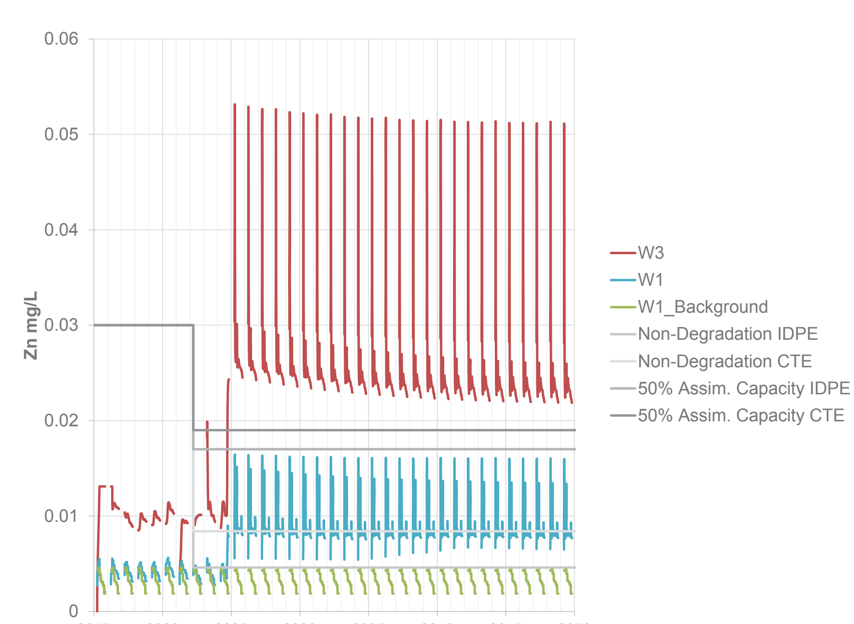












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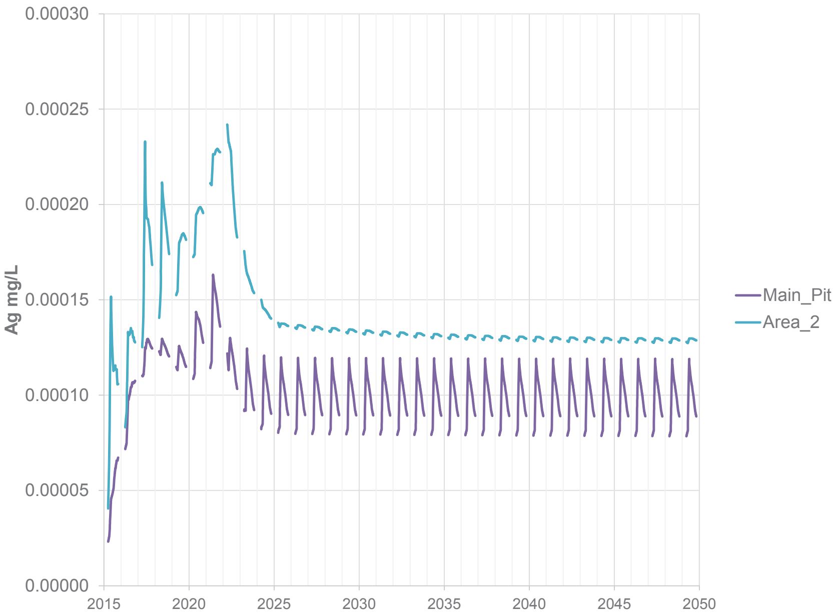
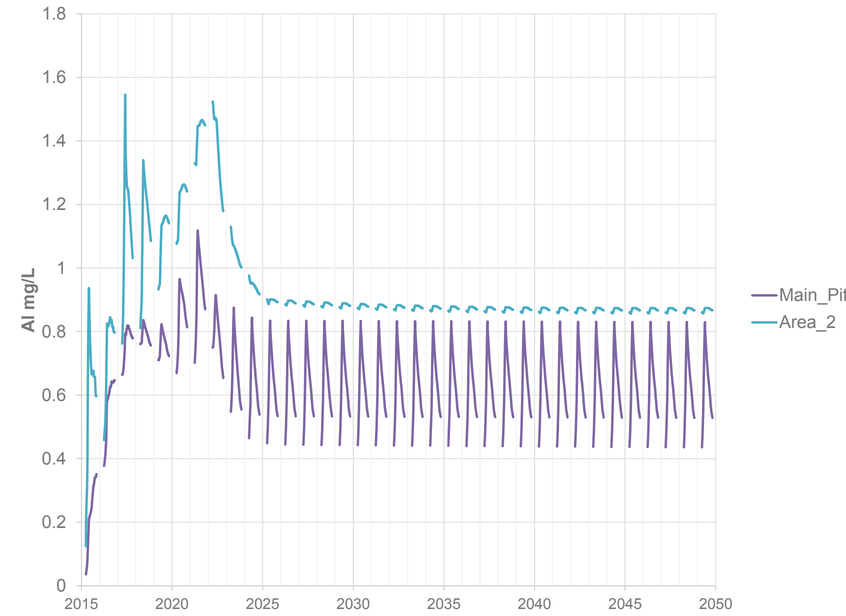
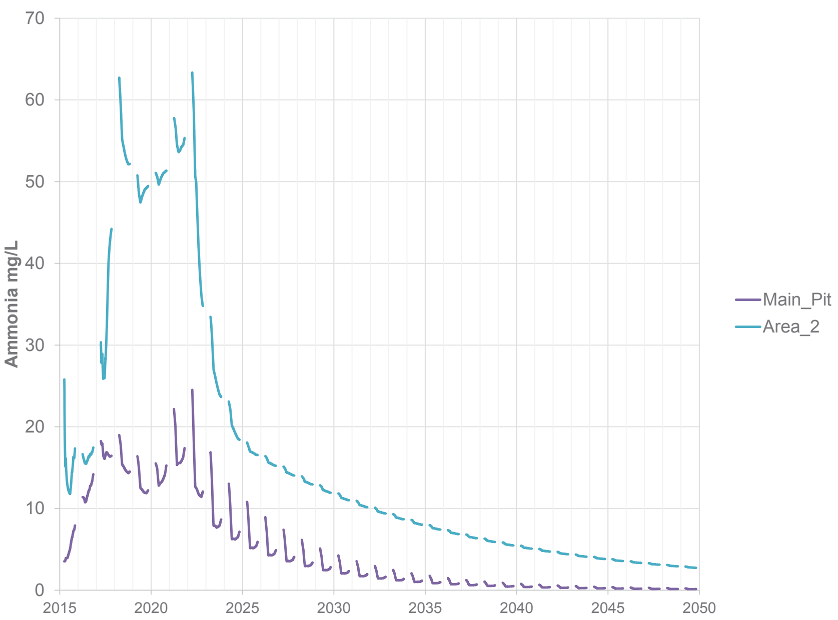
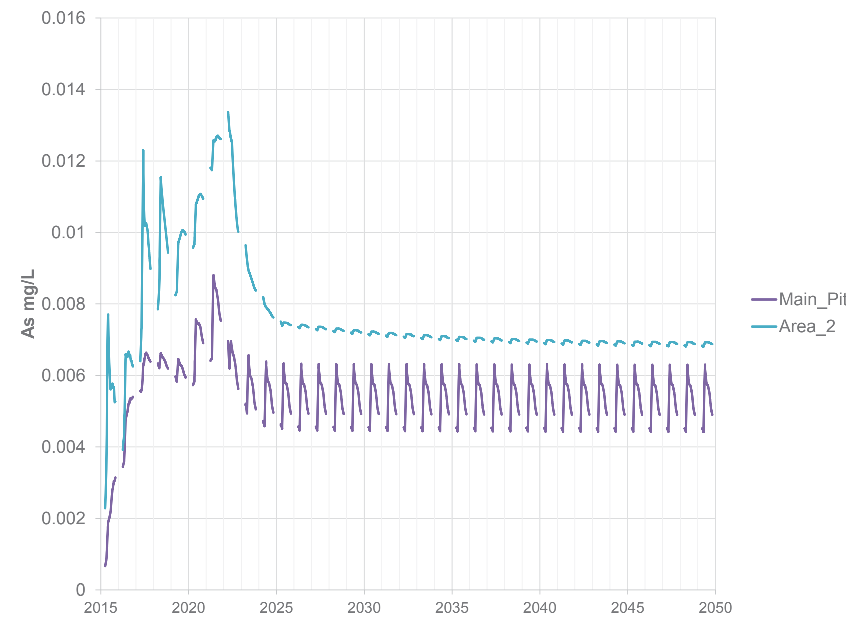
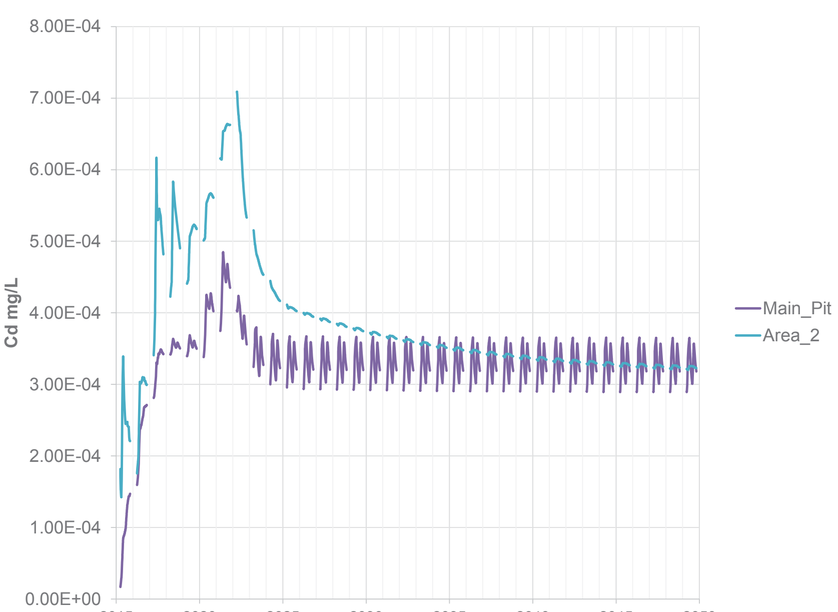
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

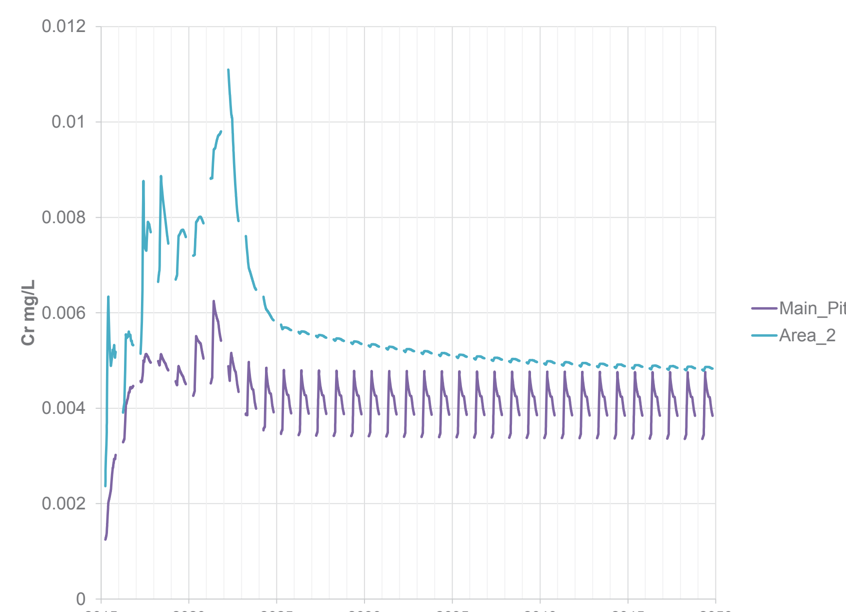


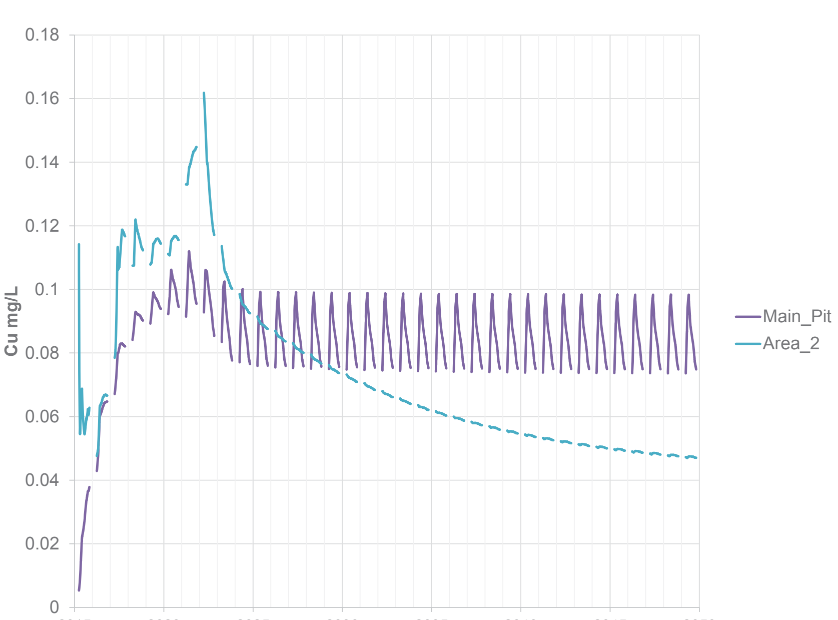


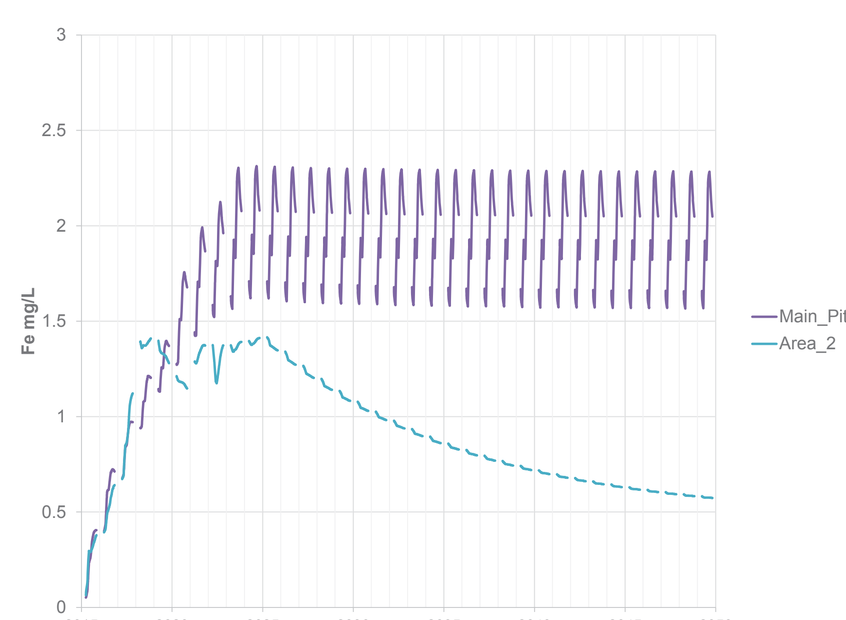












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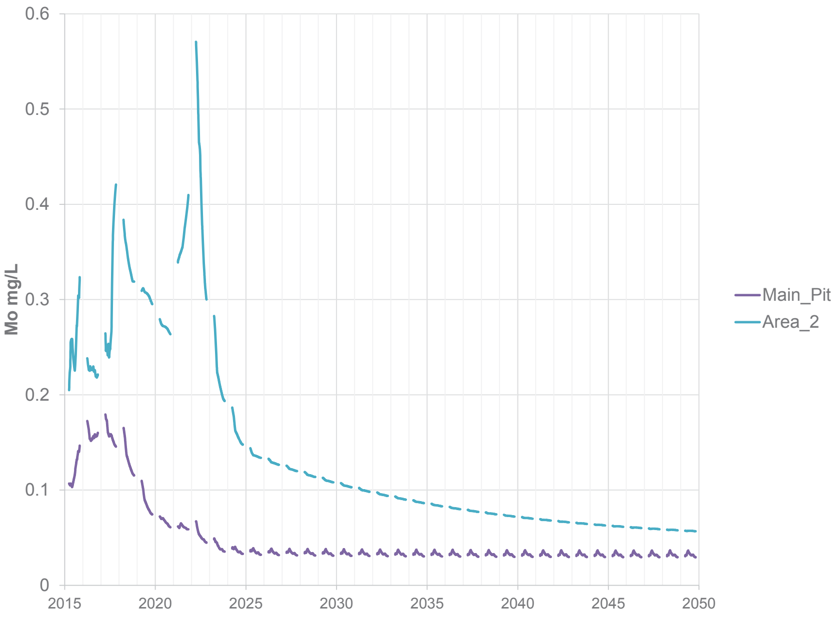
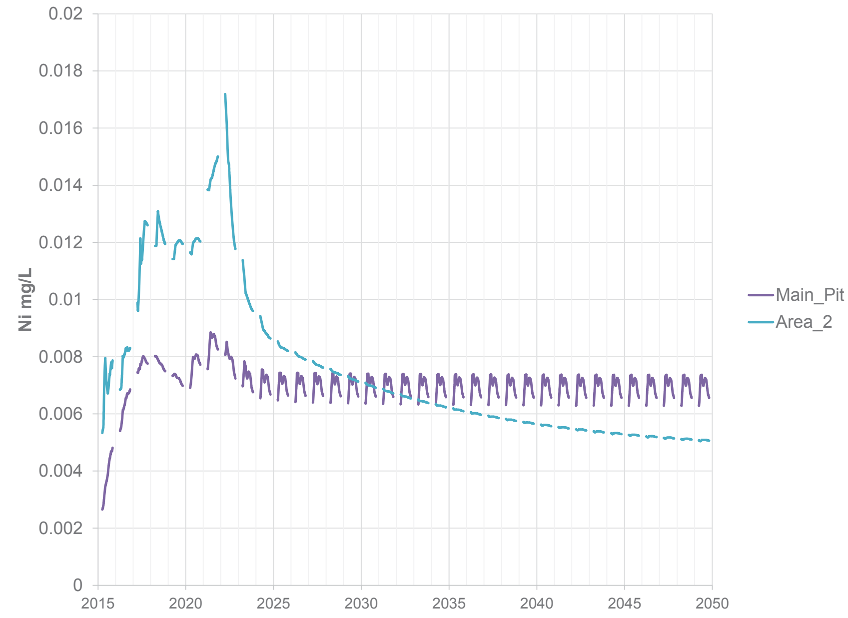
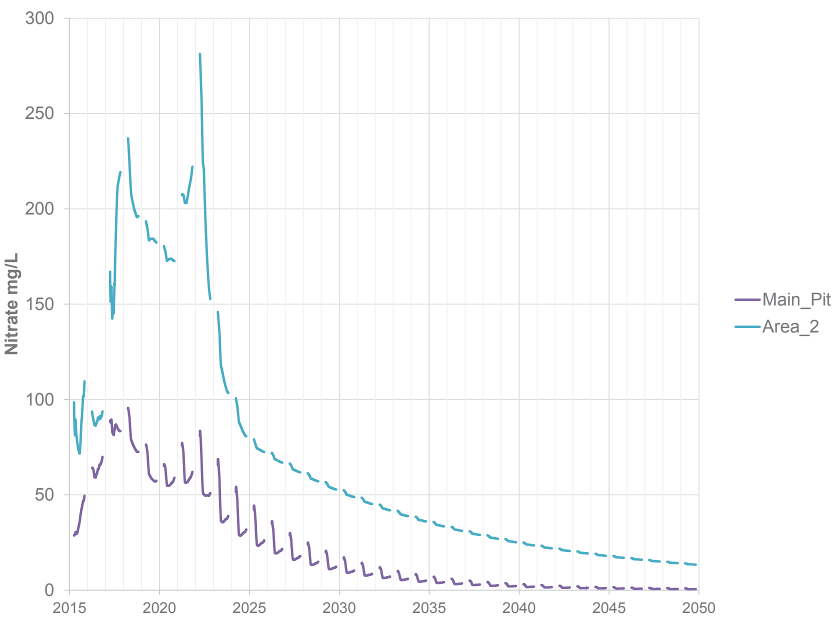
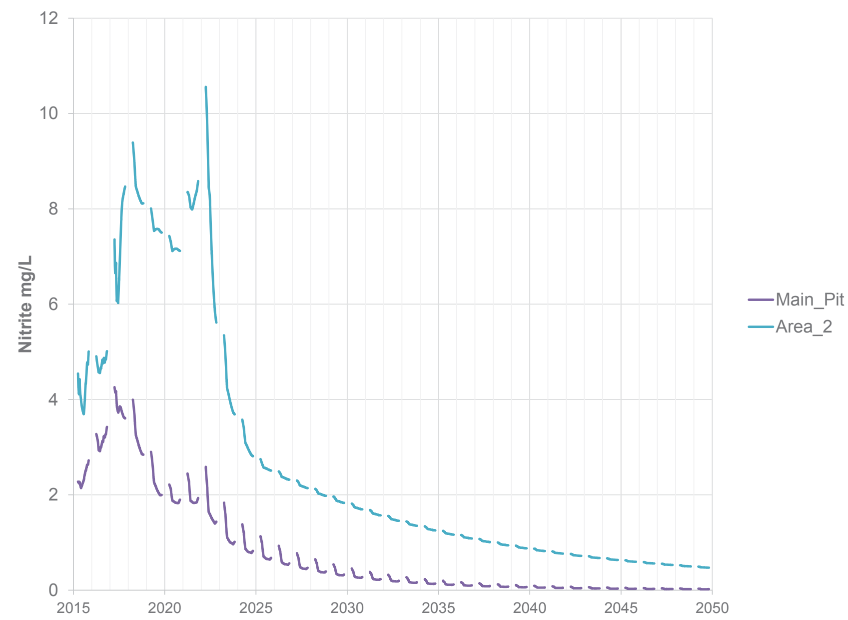
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

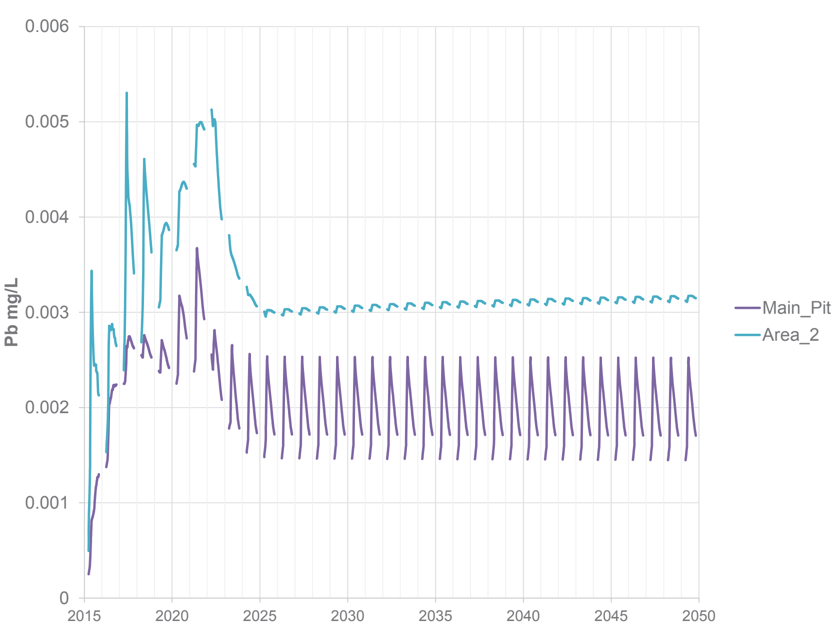
Appendix A2: Water and Load Balance Results
Scenario 3 - Worst Case, No Treatment, No Phase VII Underground

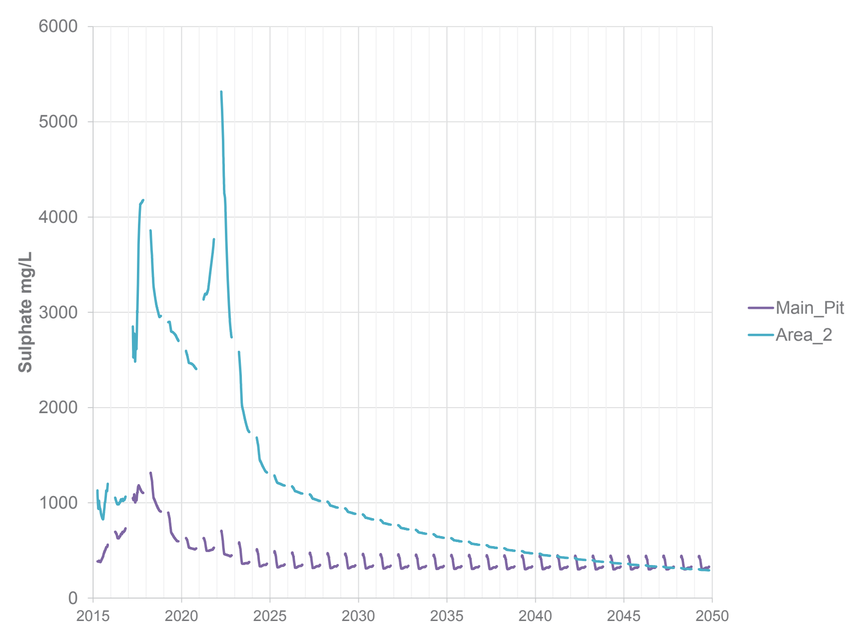


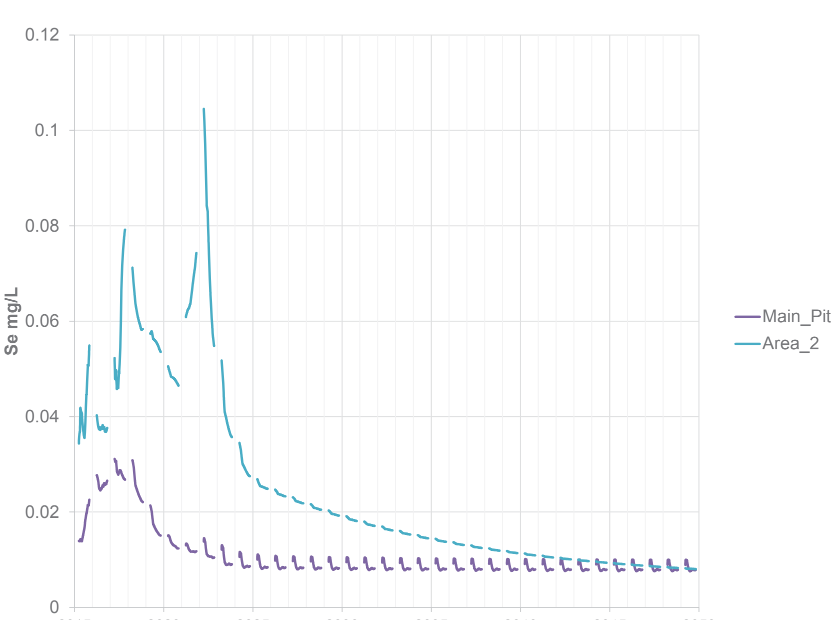


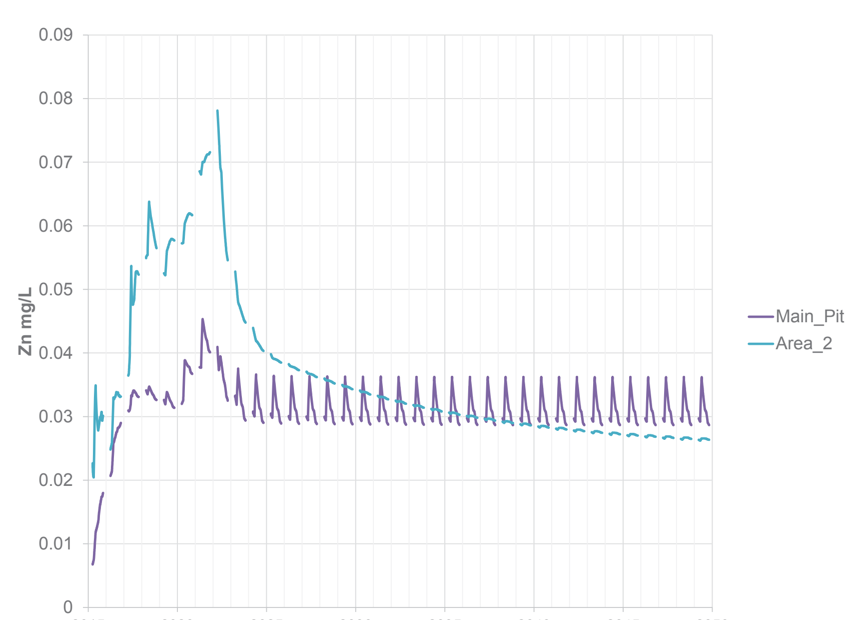












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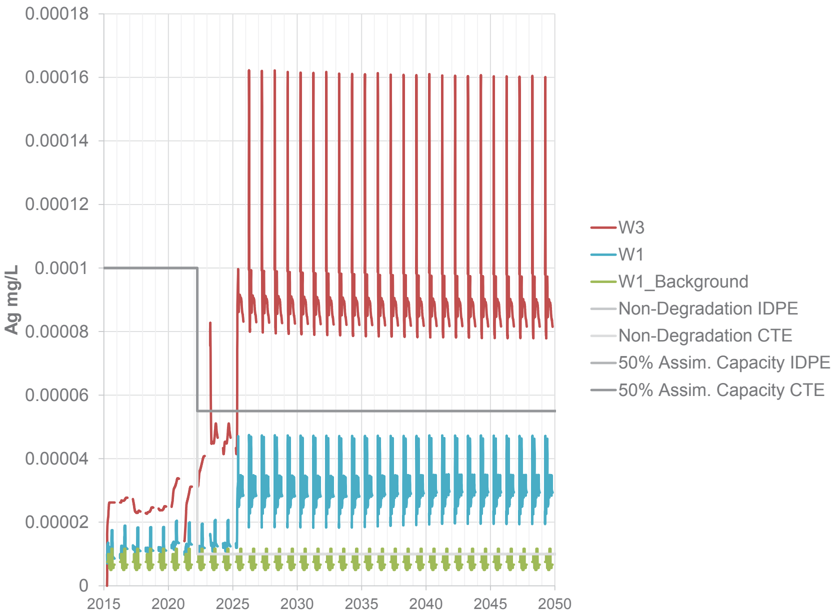
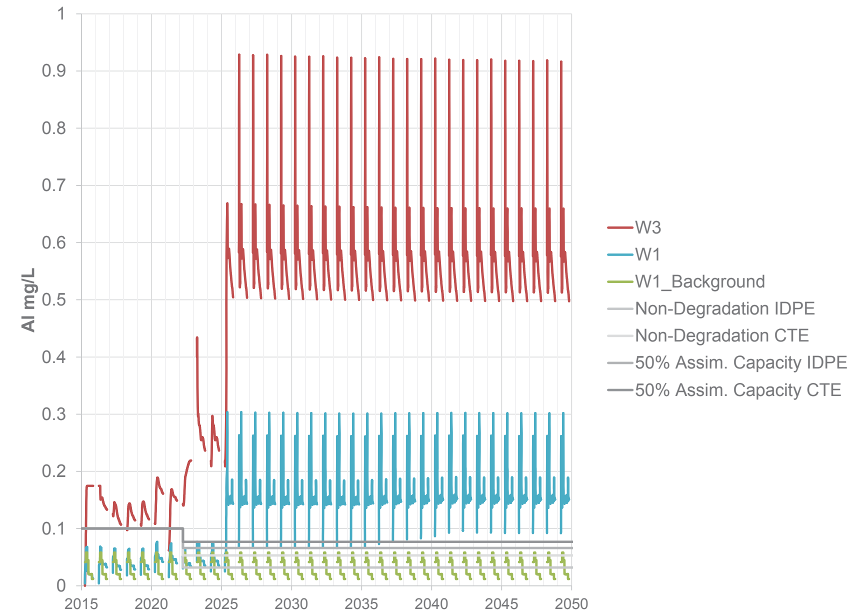
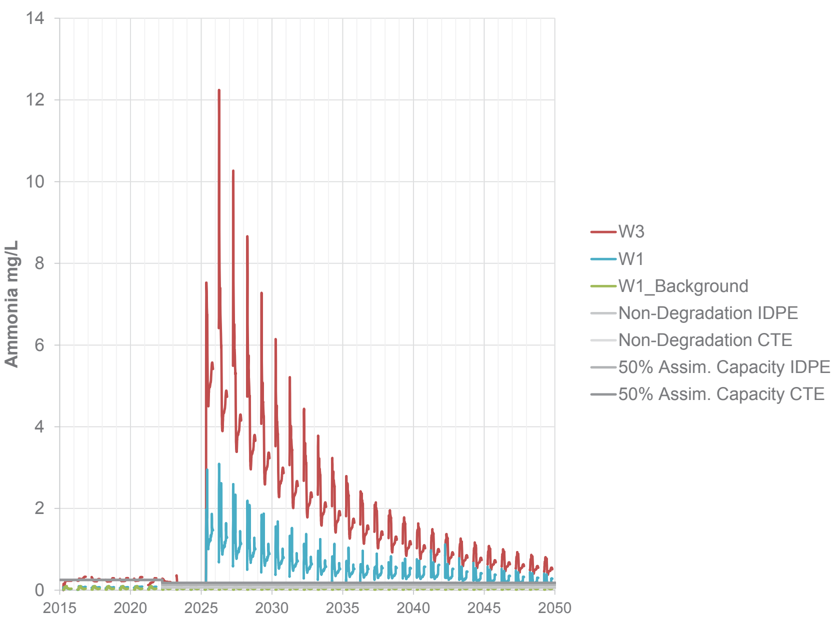
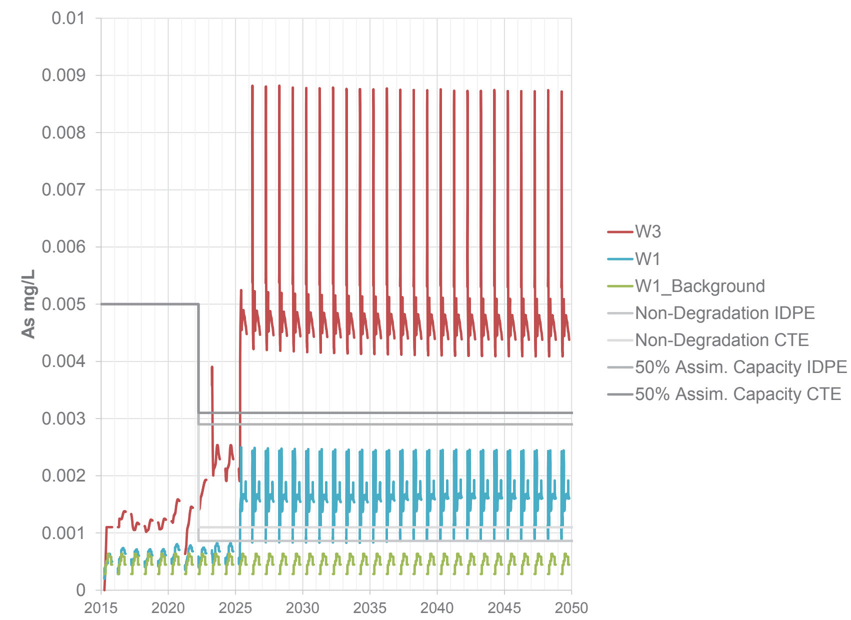
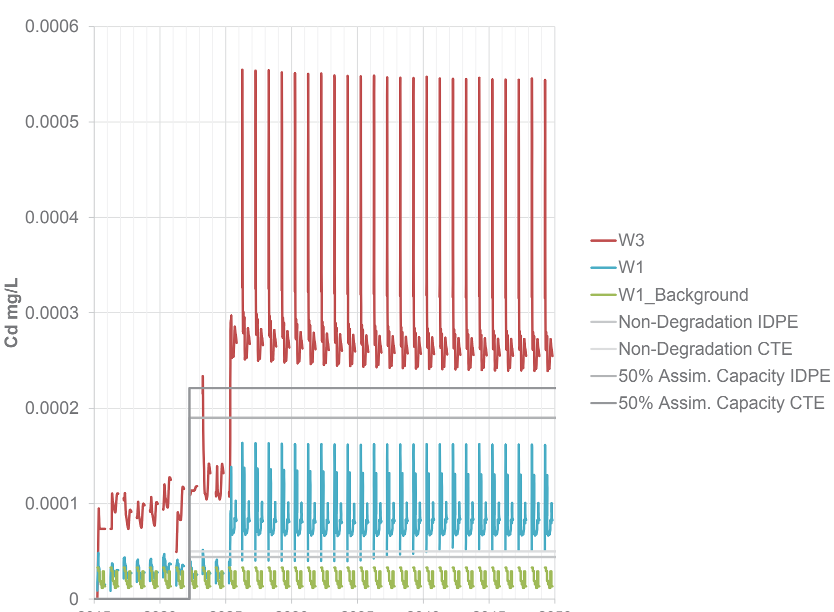
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

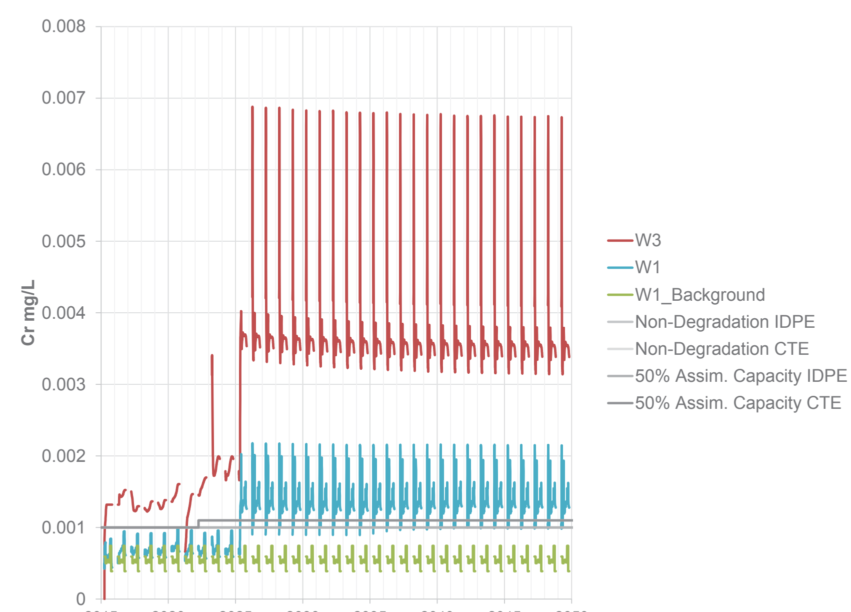


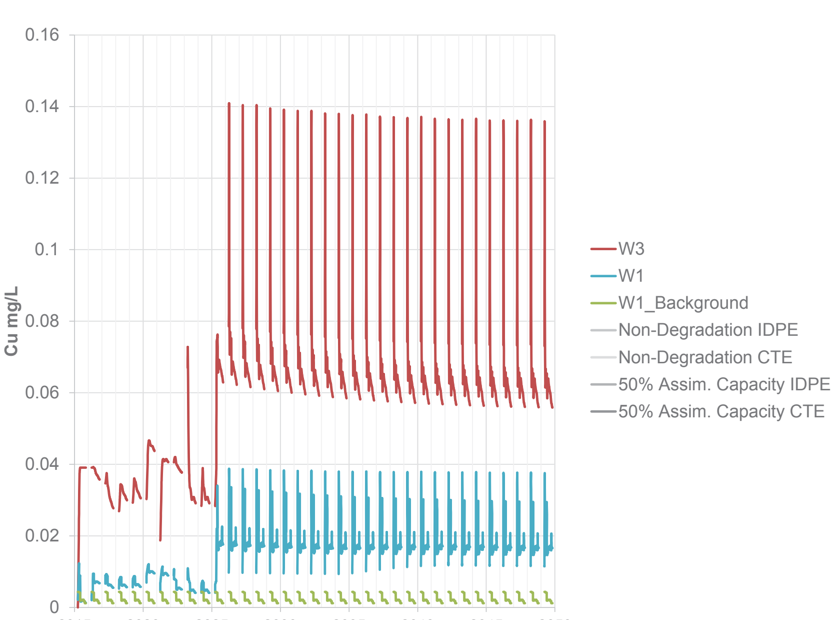


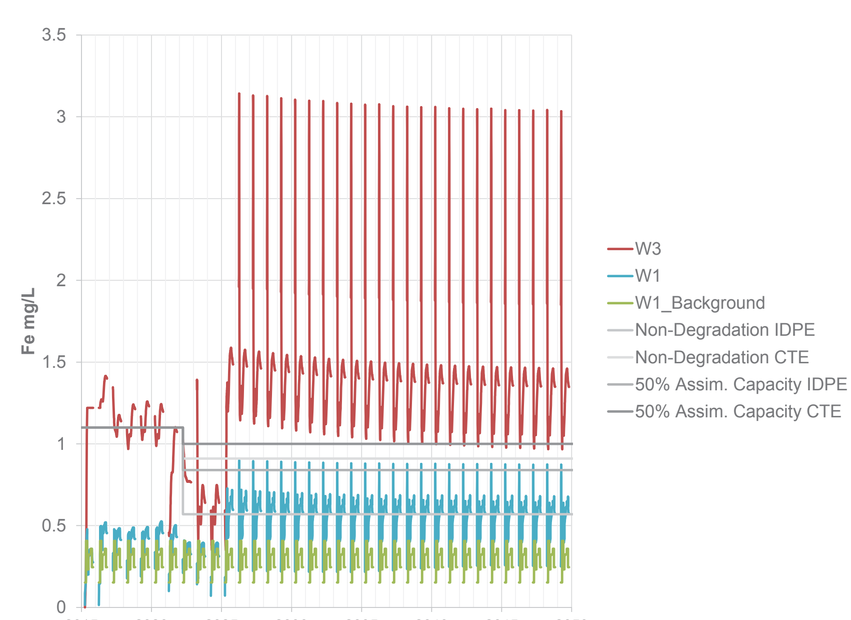












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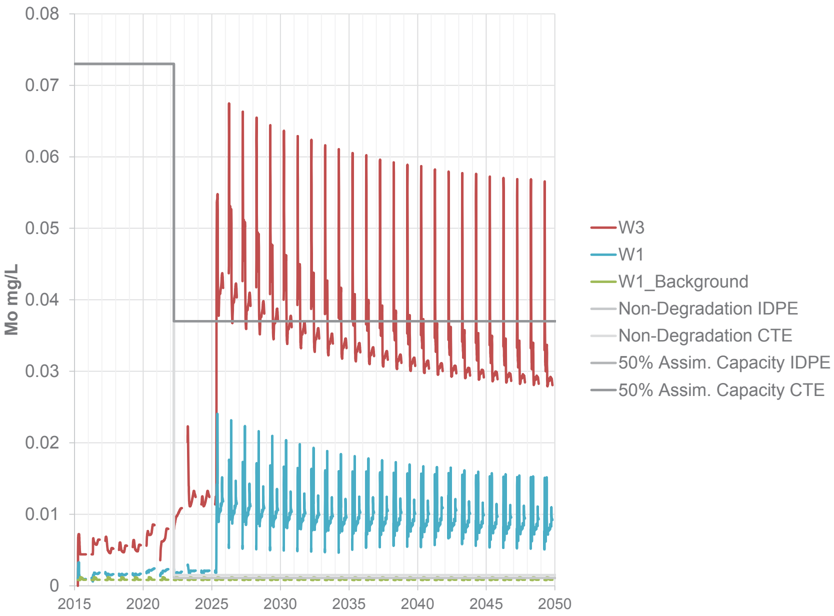
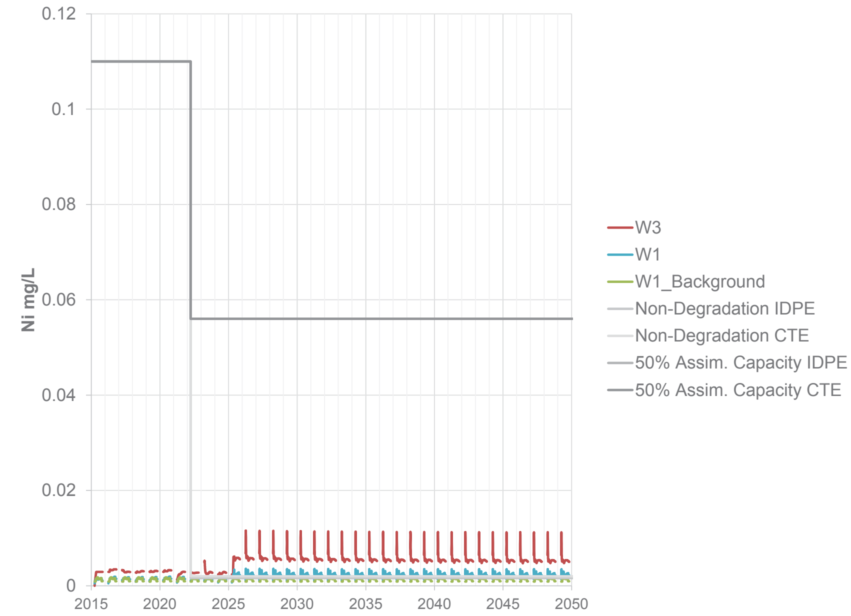
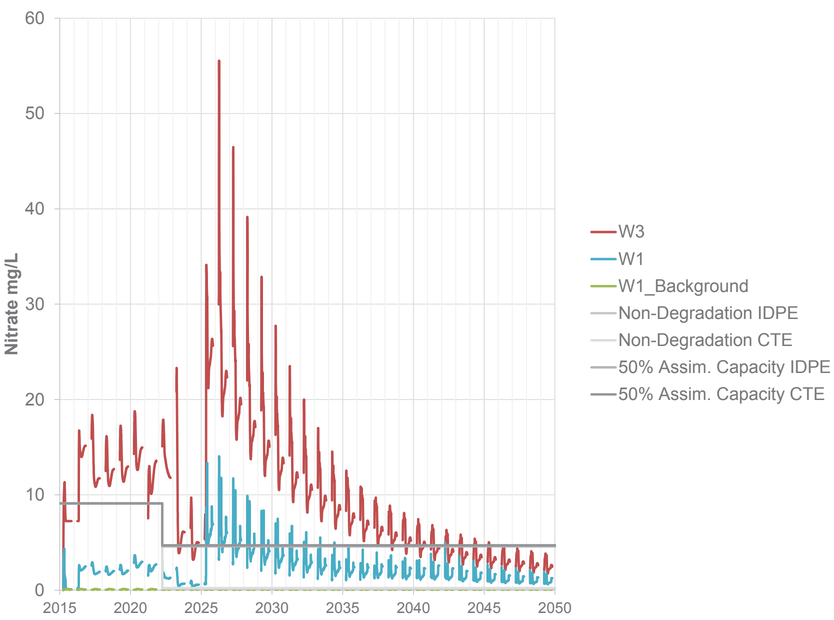
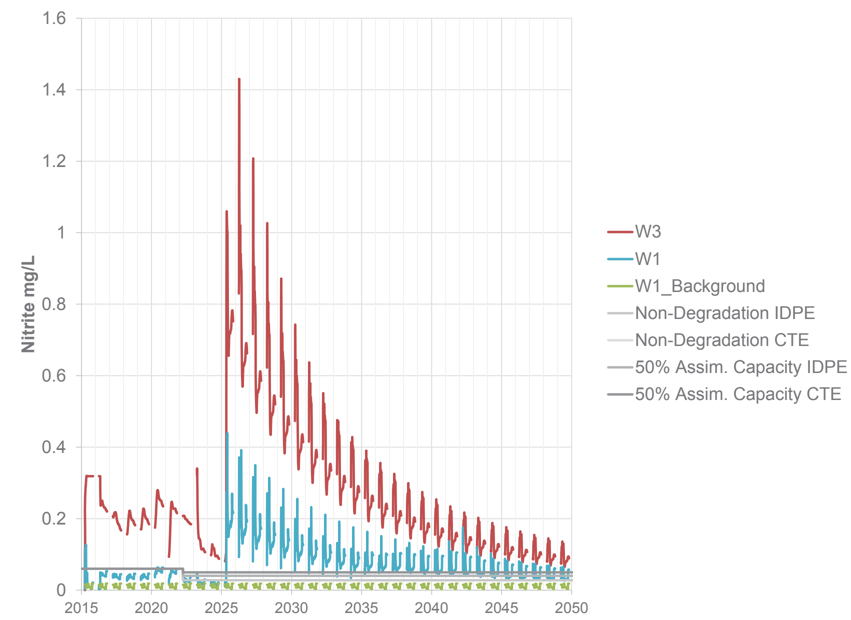
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

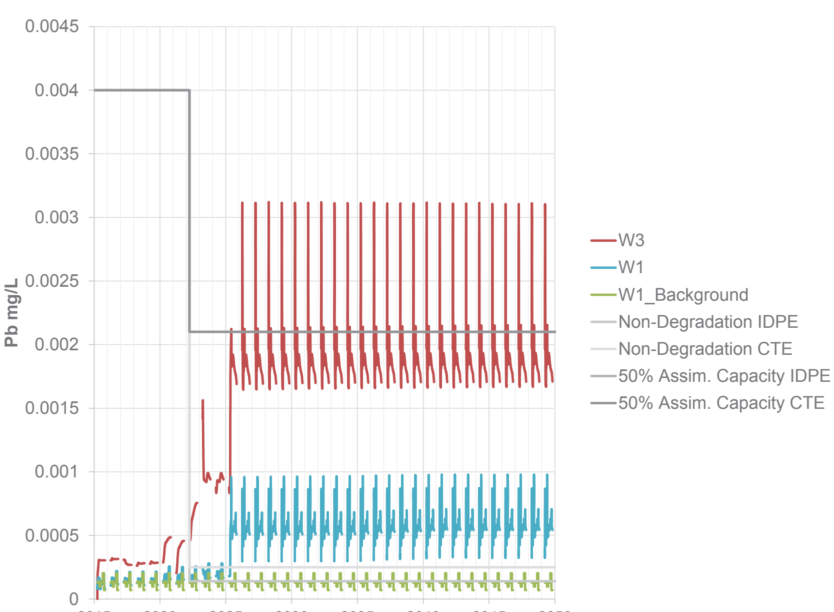
Appendix A2: Water and Load Balance Results
Scenario 3 - Worst Case, No Treatment, No Phase VII Underground

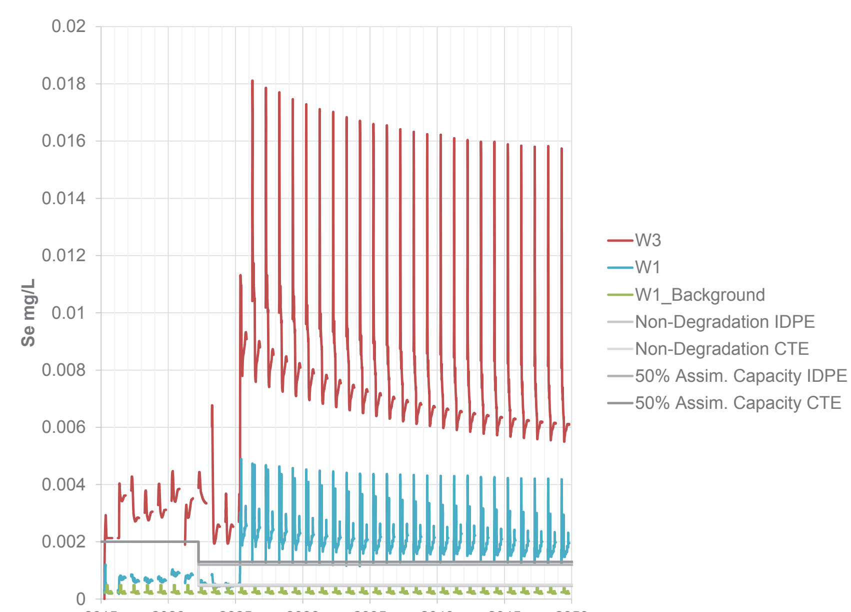


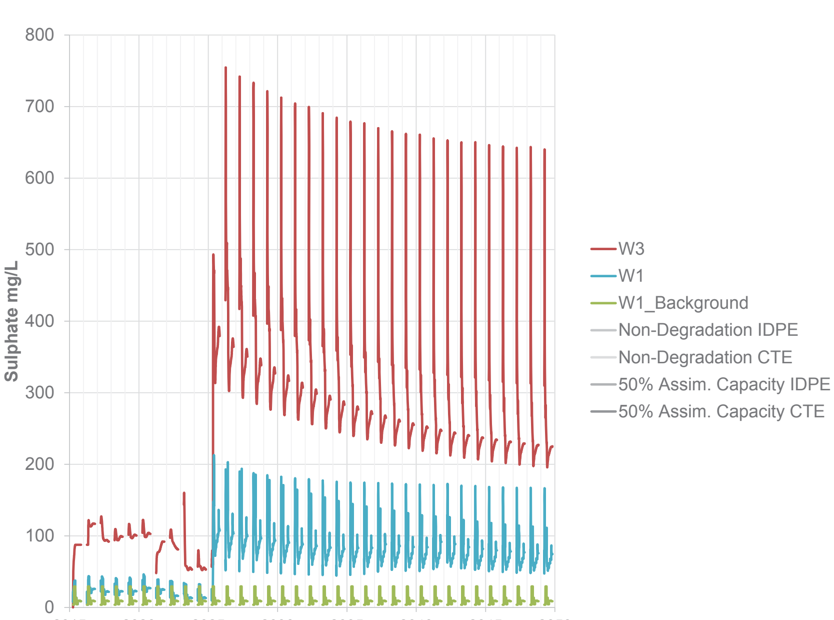


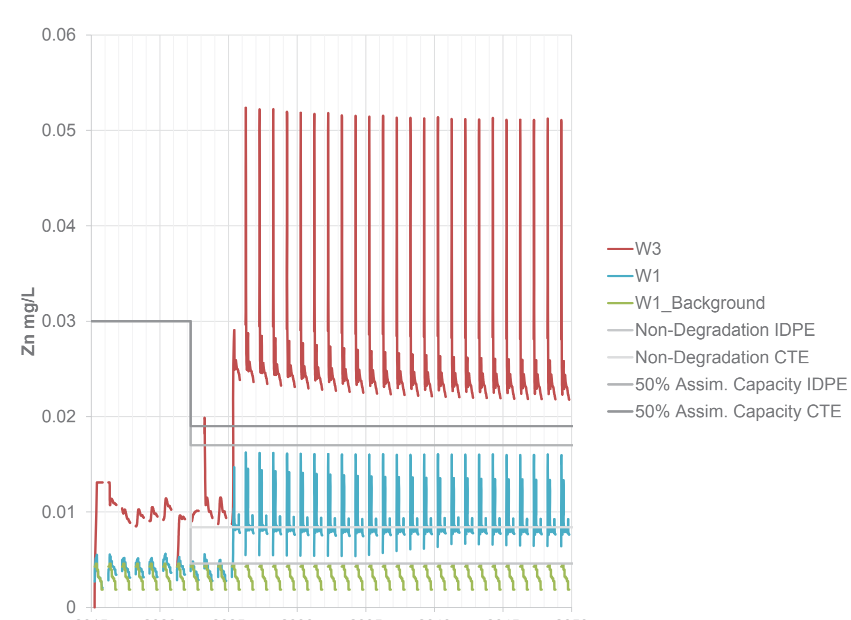












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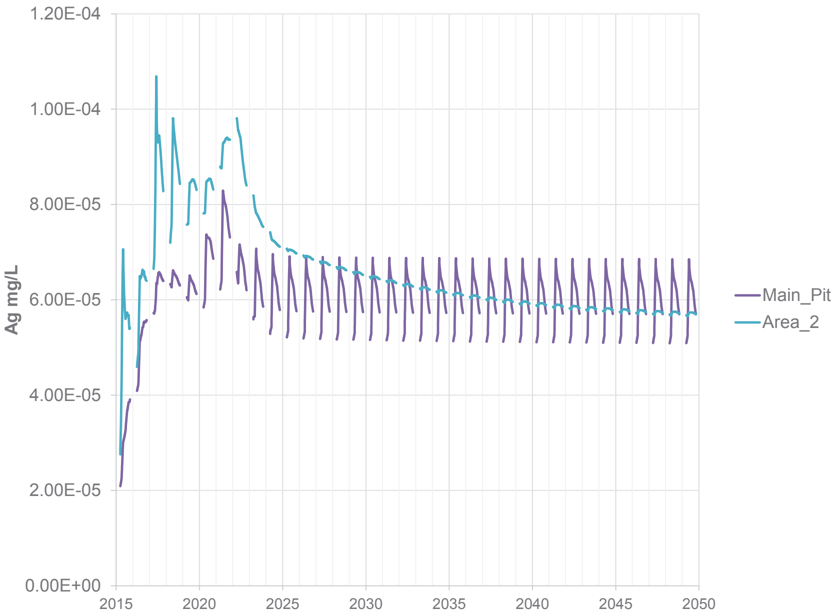
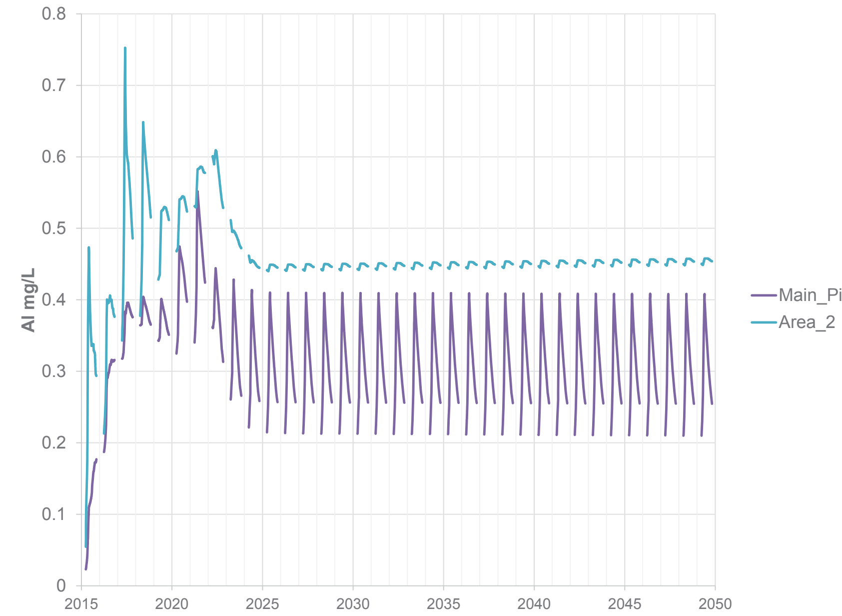
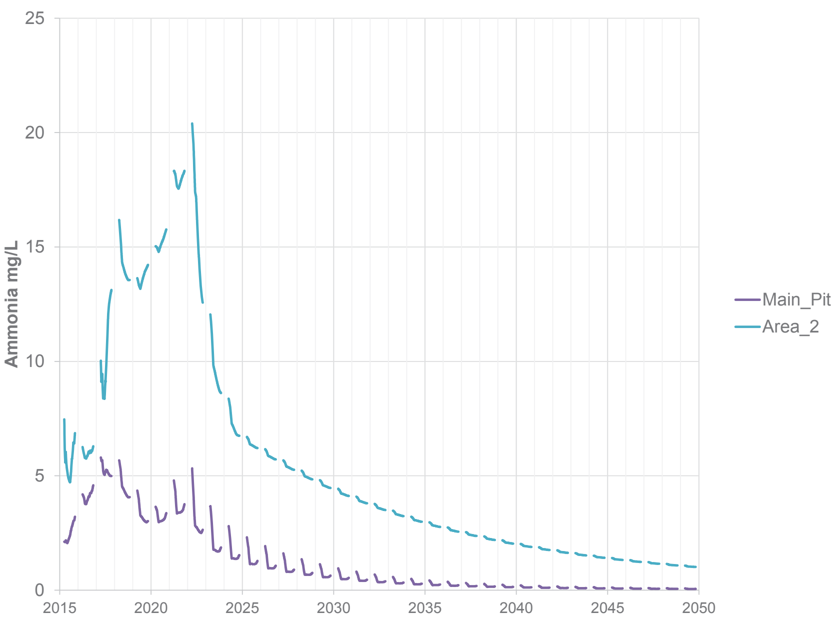
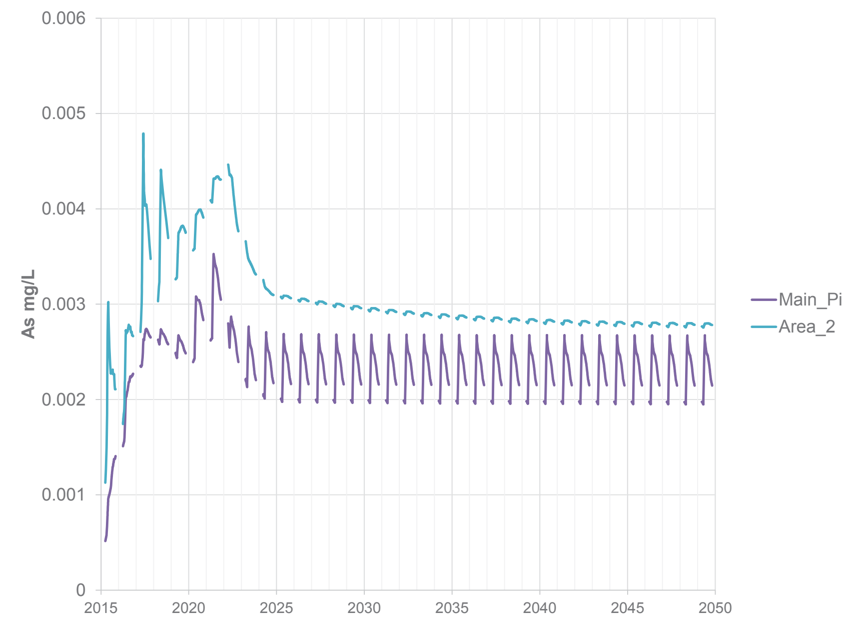
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

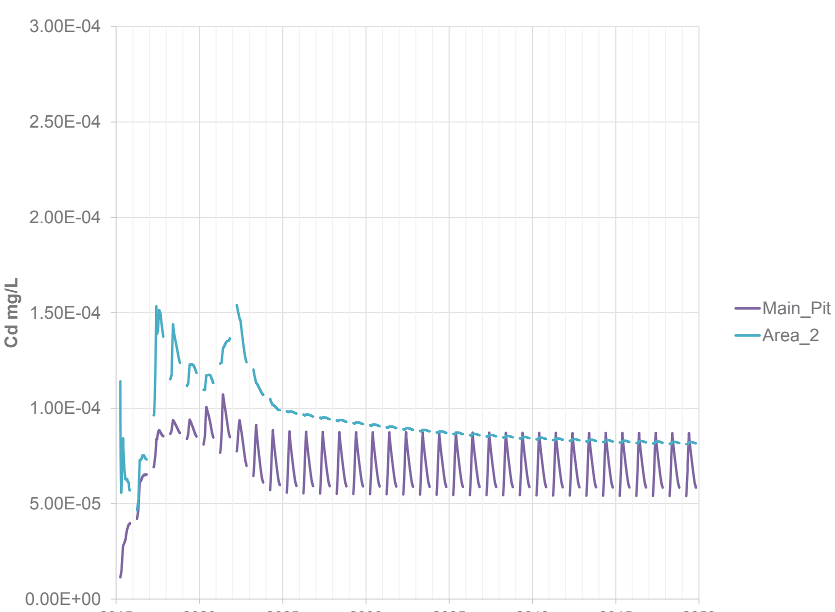
Appendix A2: Water and Load Balance Results
Scenario 4 - Expected Case, With Treatment, With Phase VII Underground

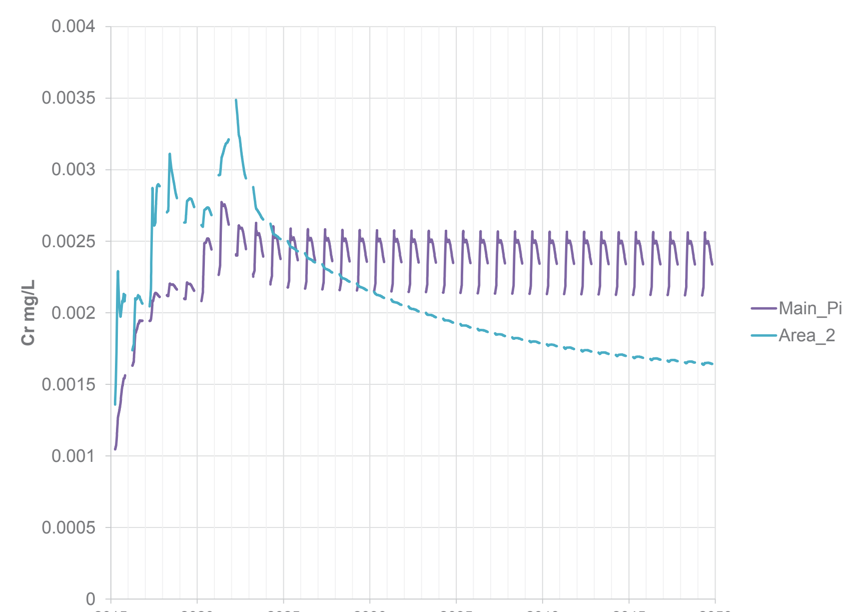


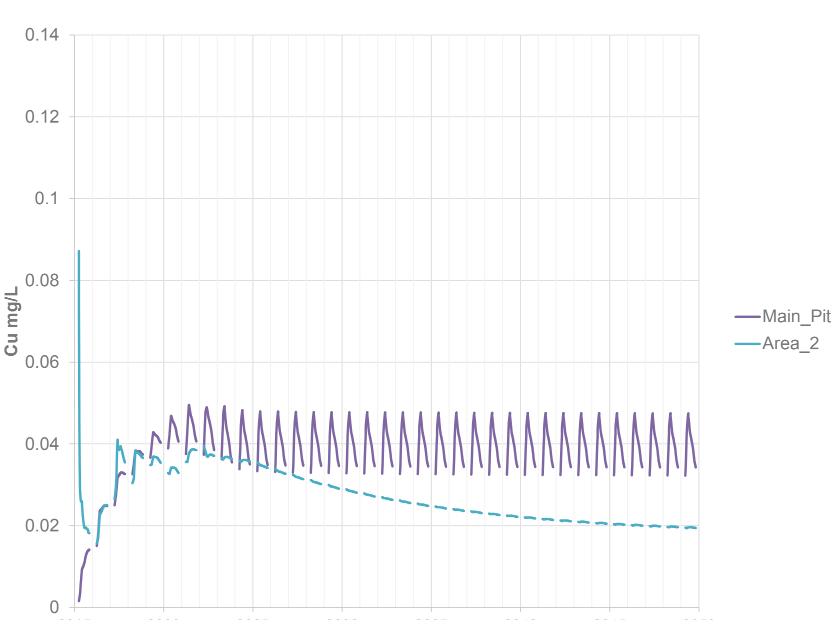


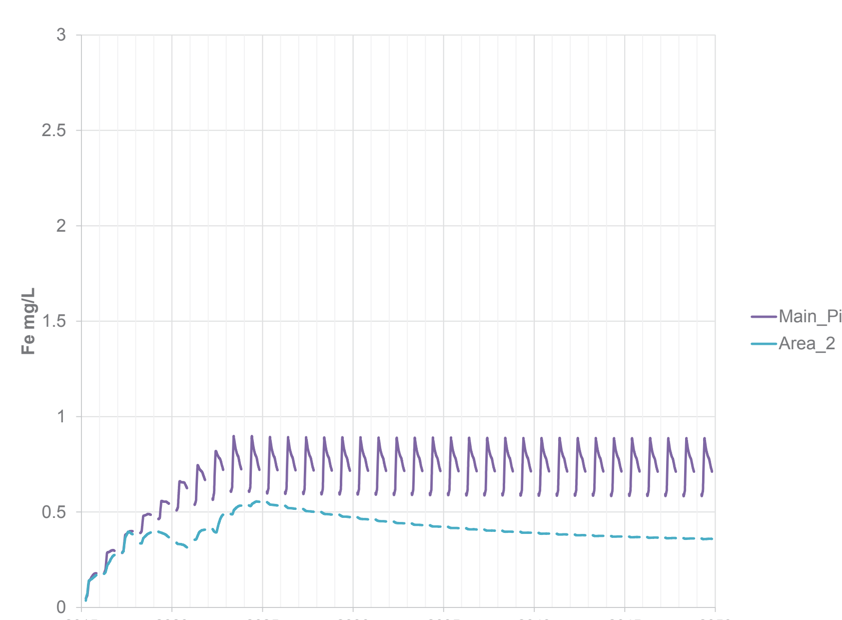












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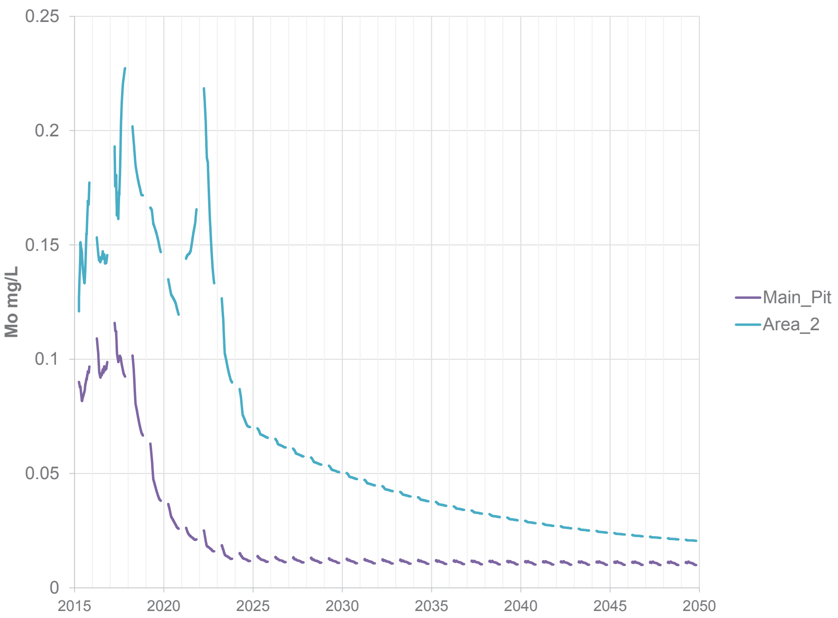
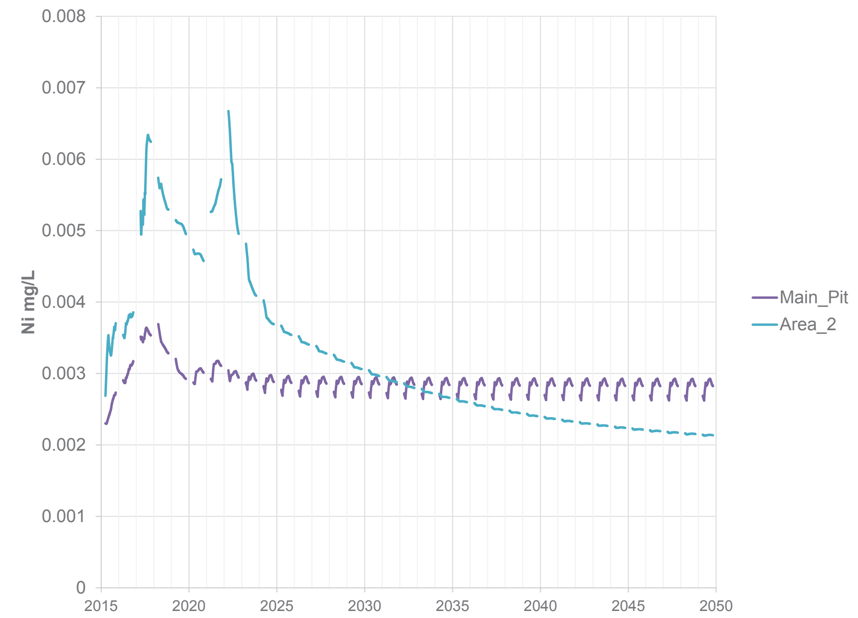
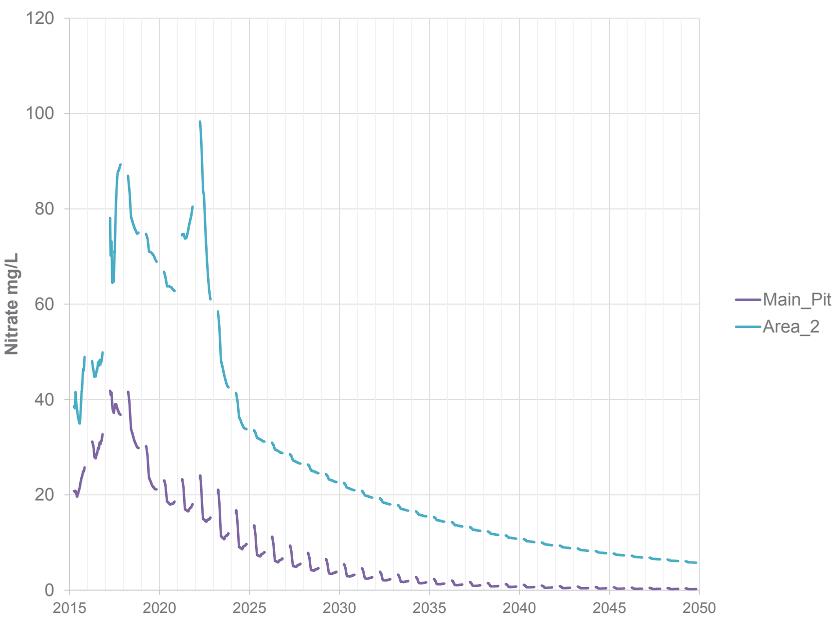
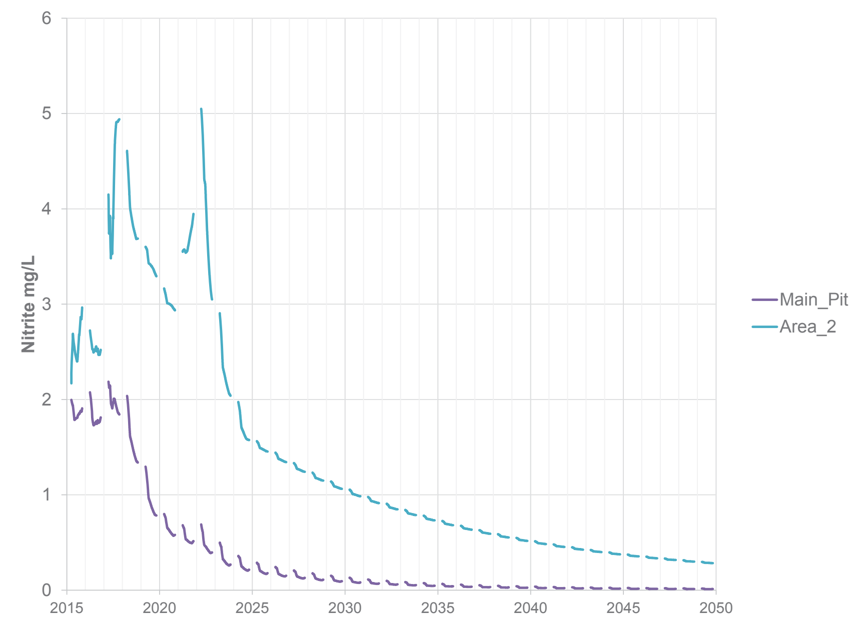
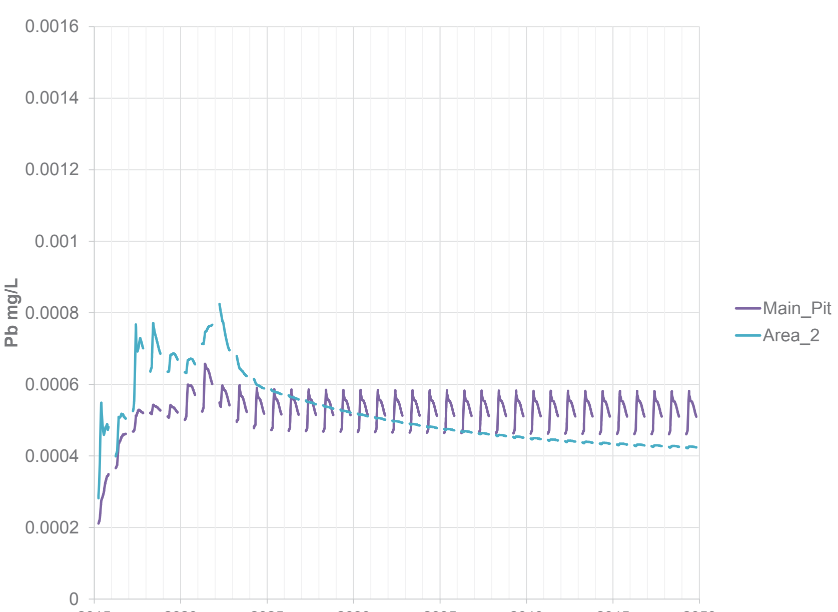
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

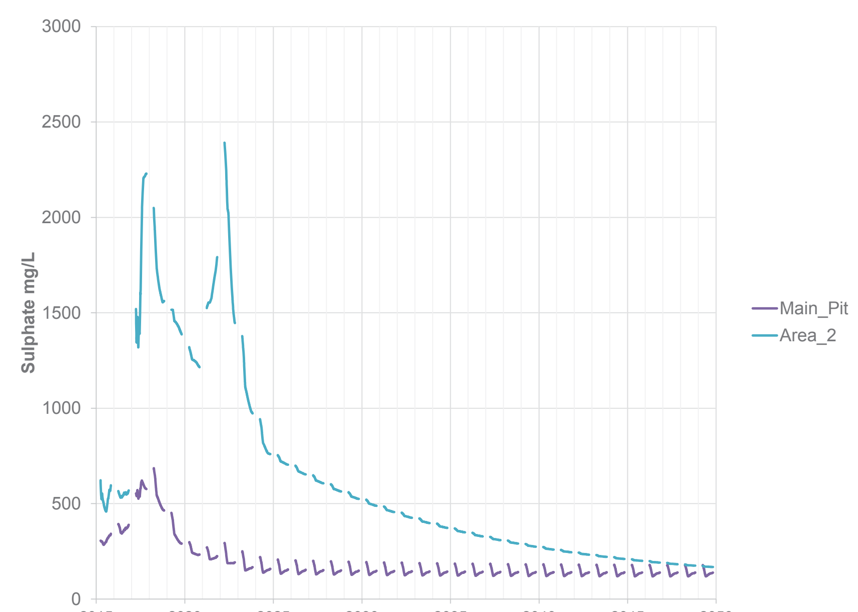


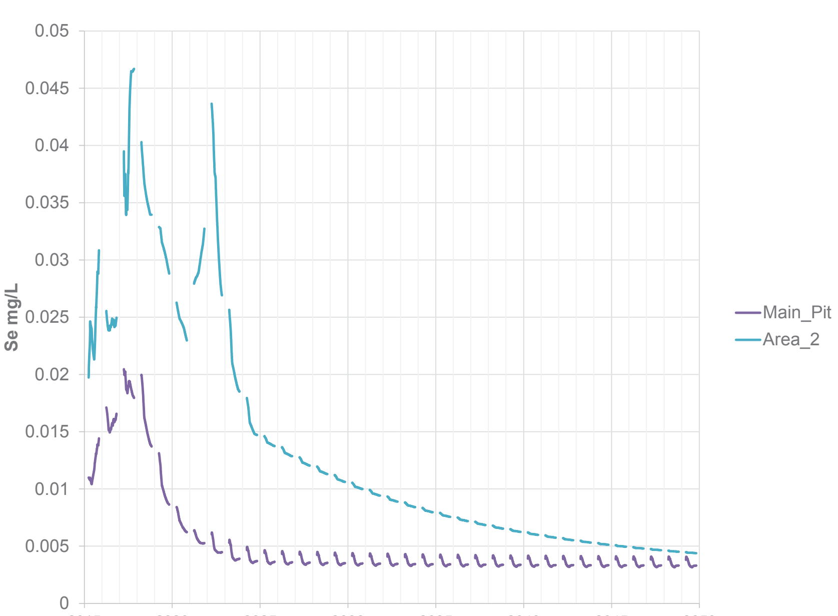


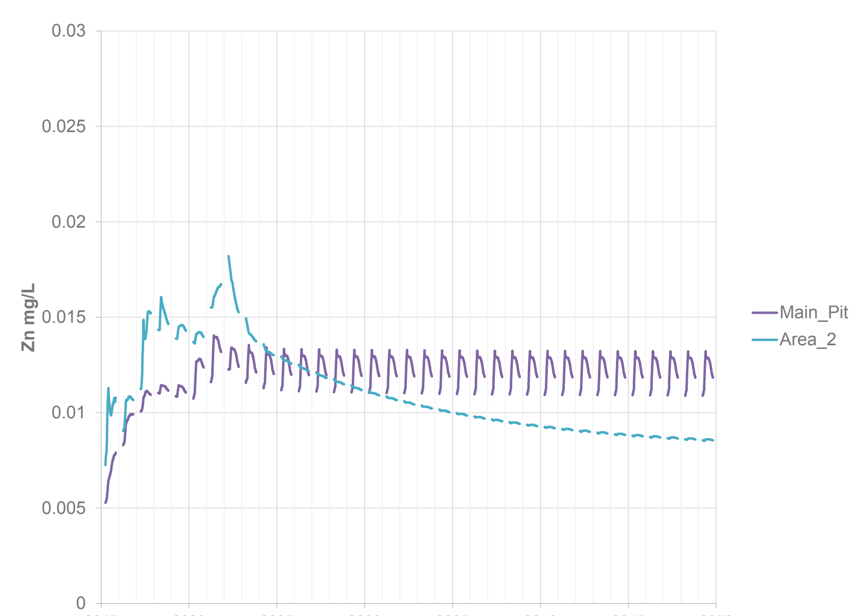












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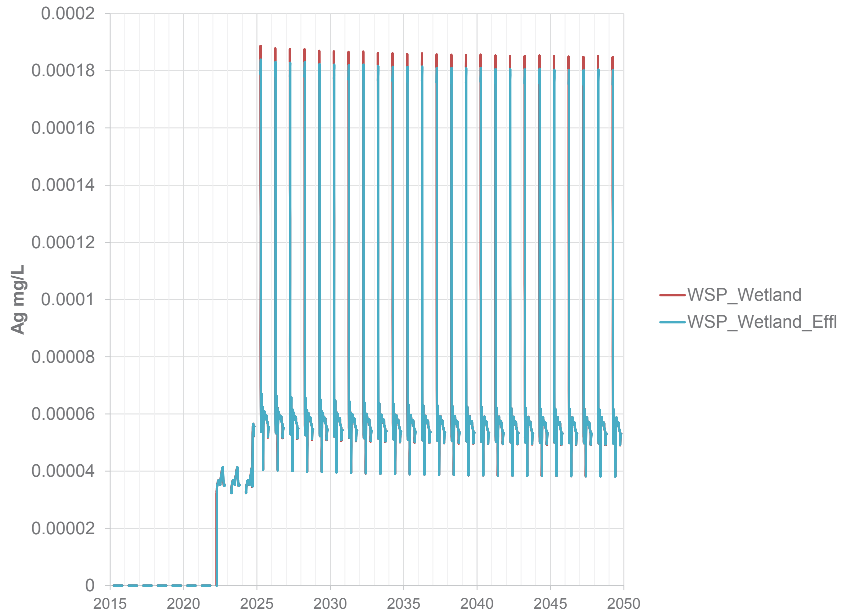
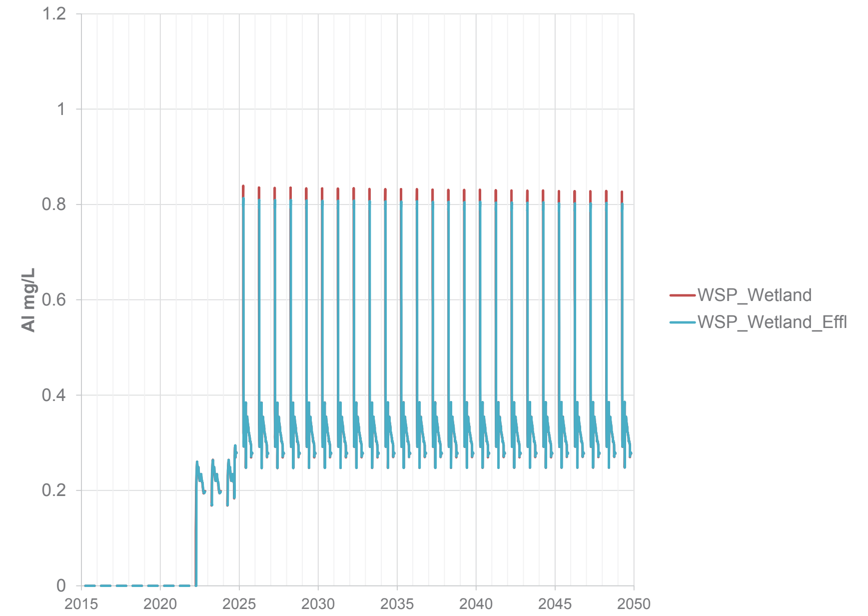
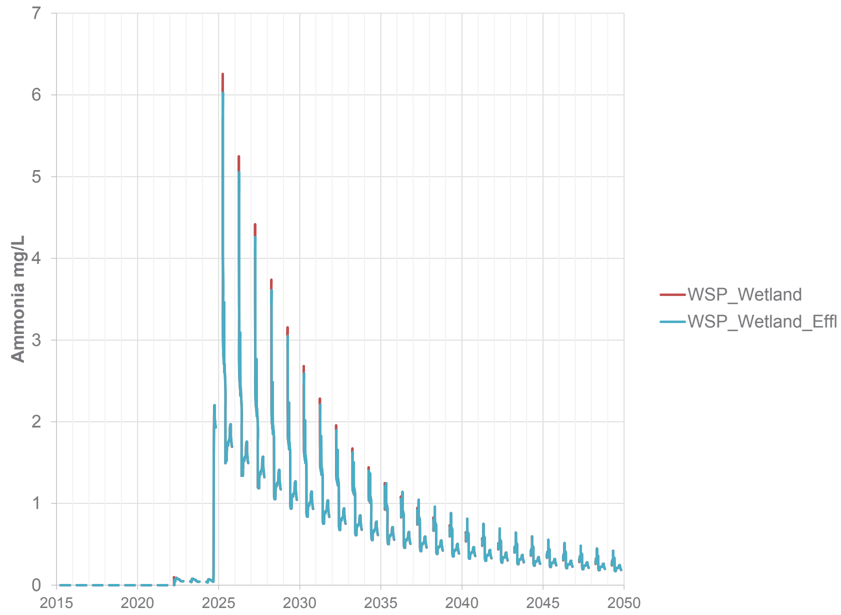
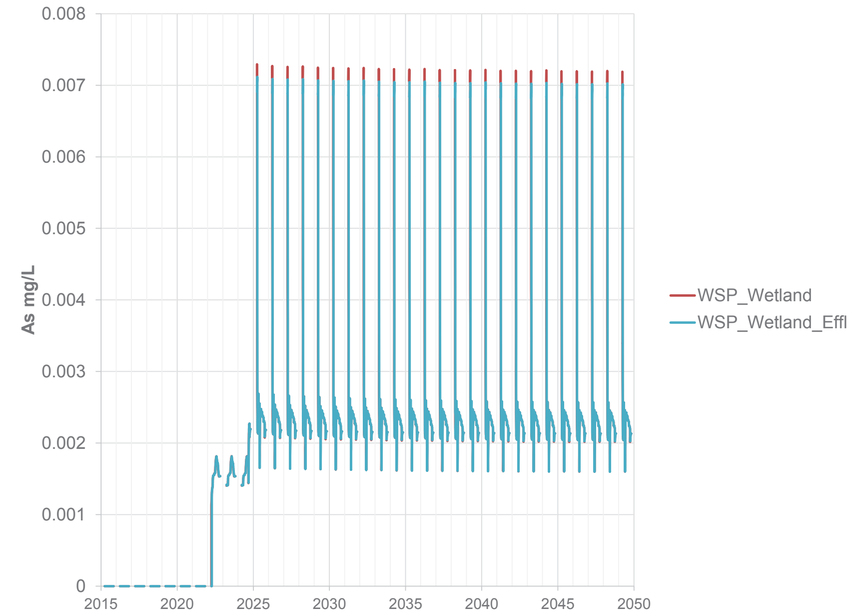
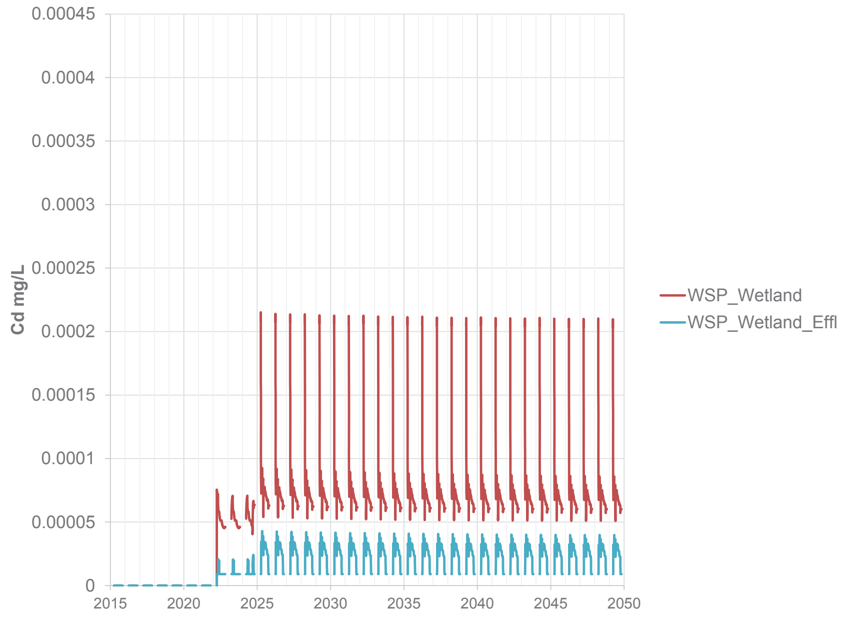
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

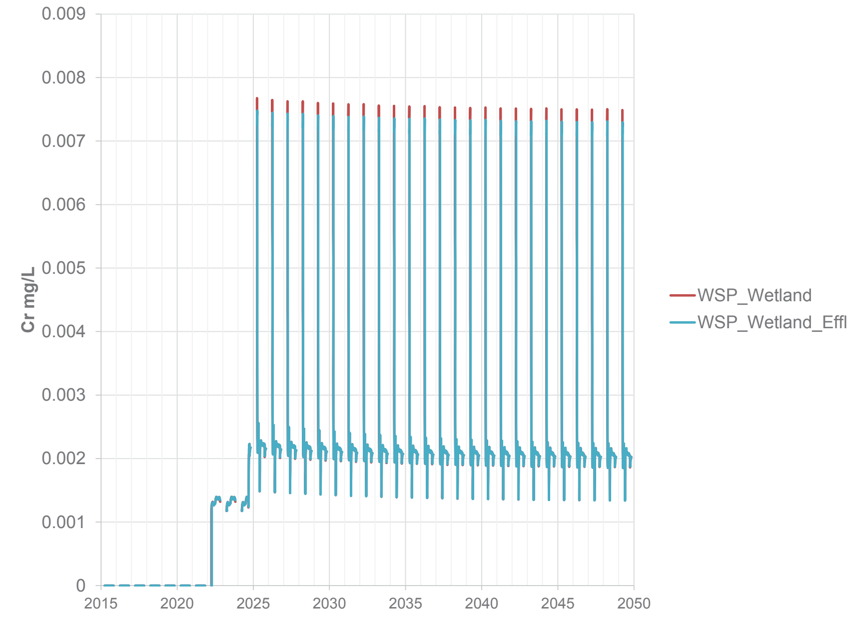


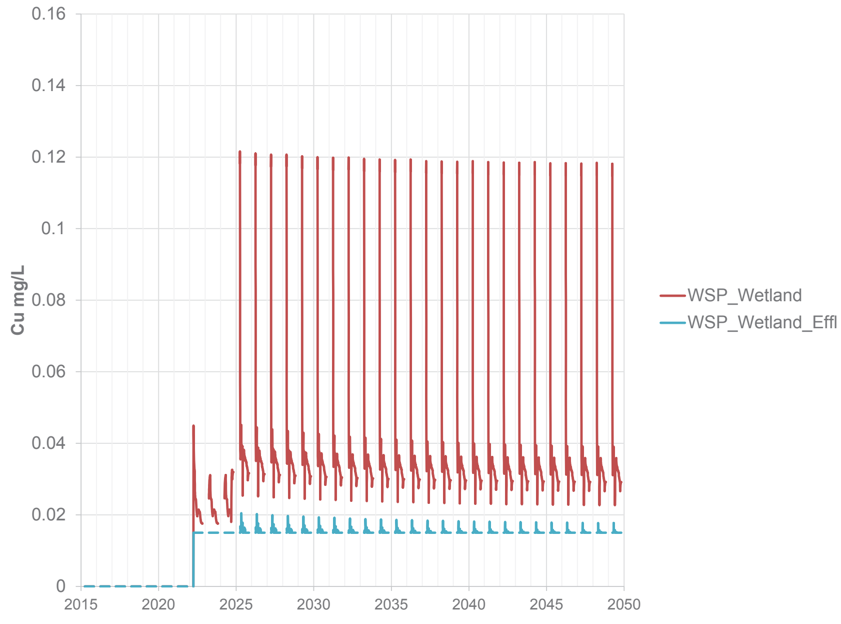


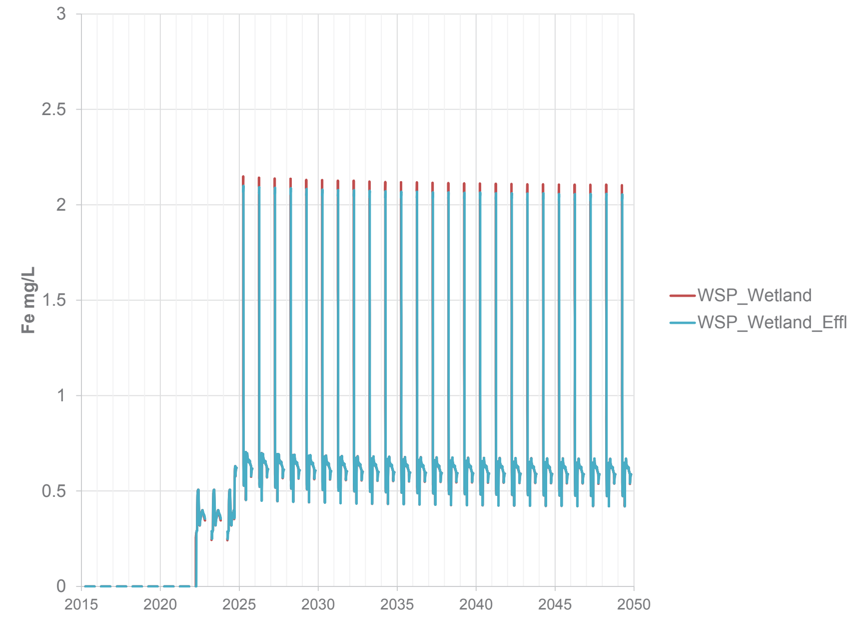












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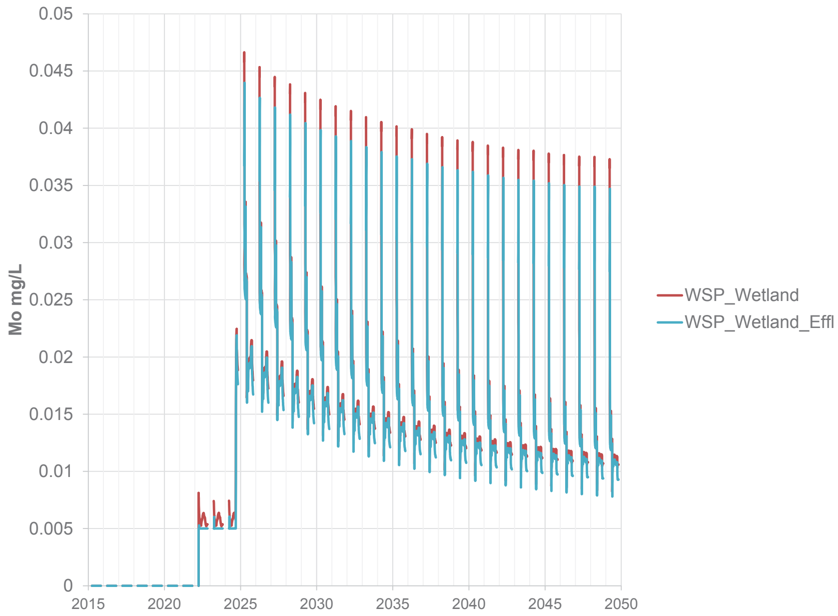
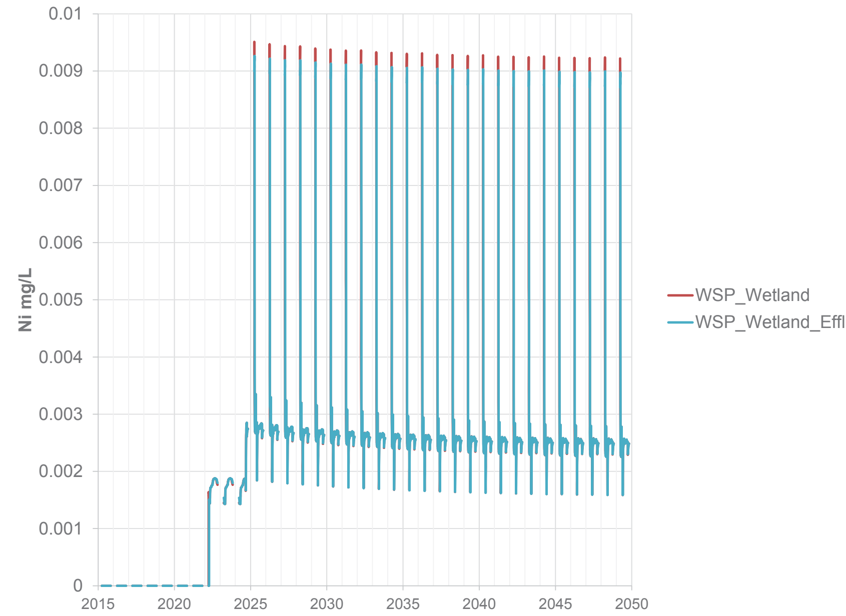
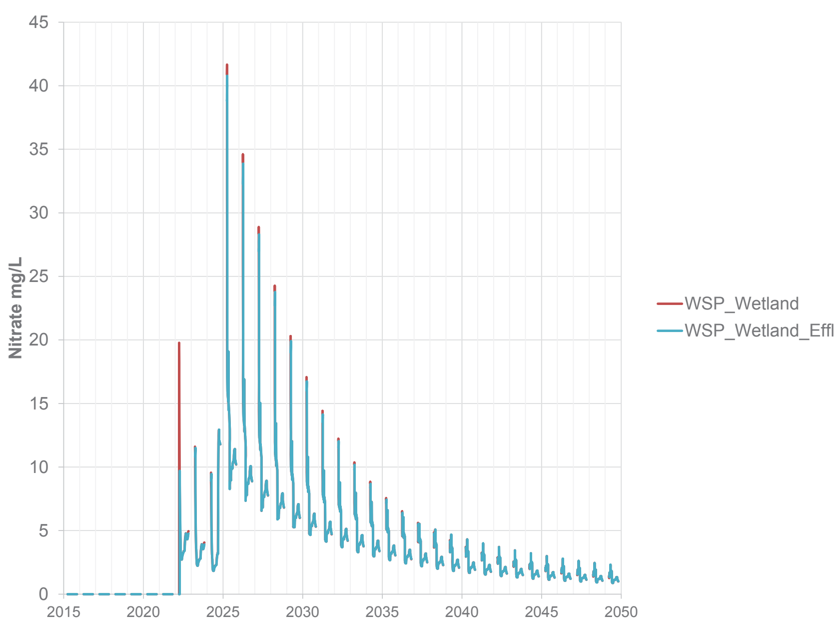
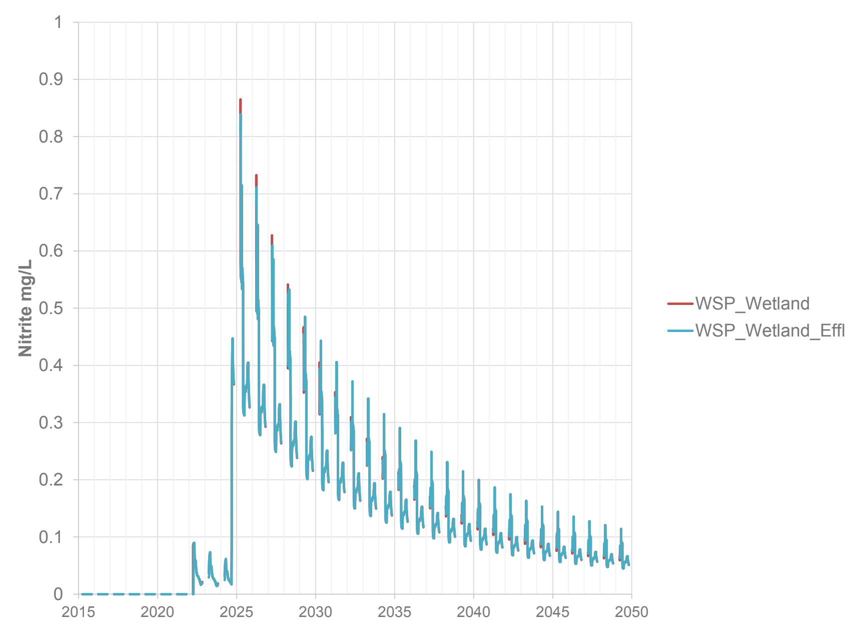
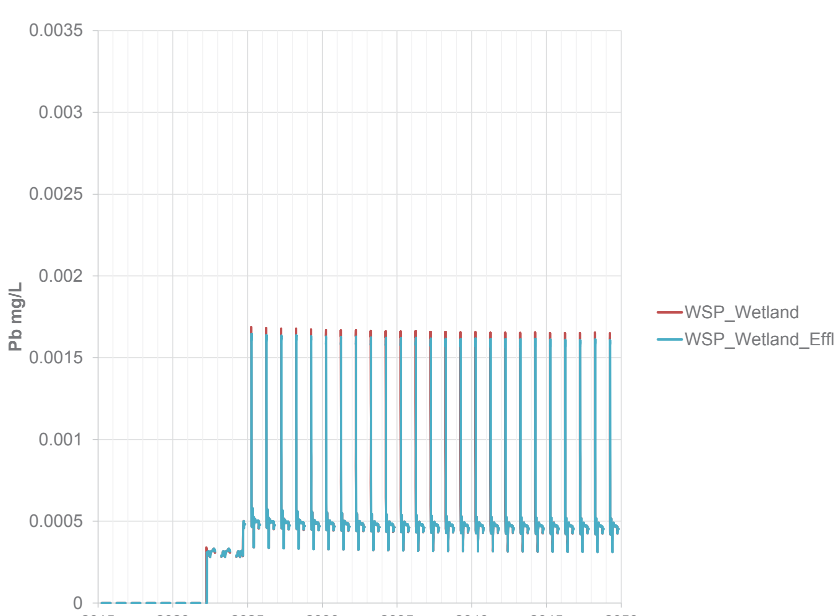
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

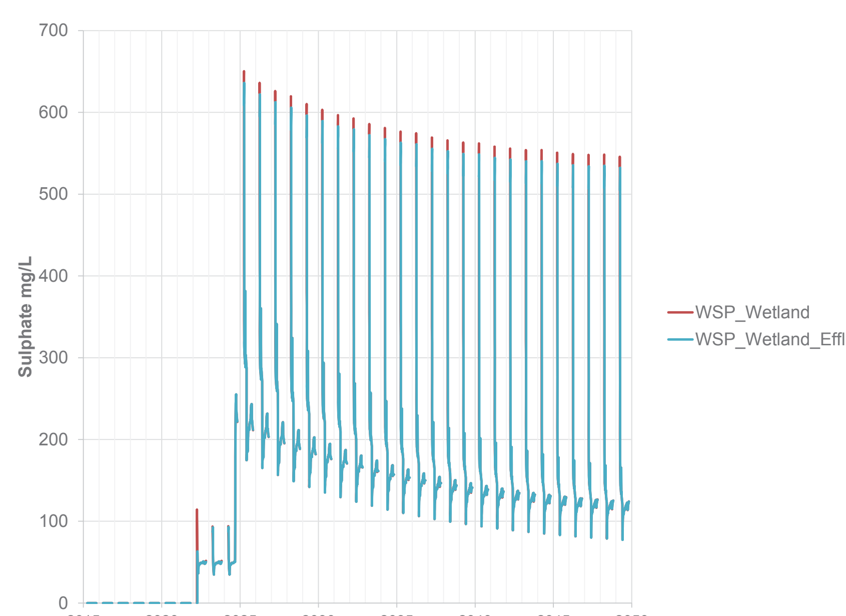


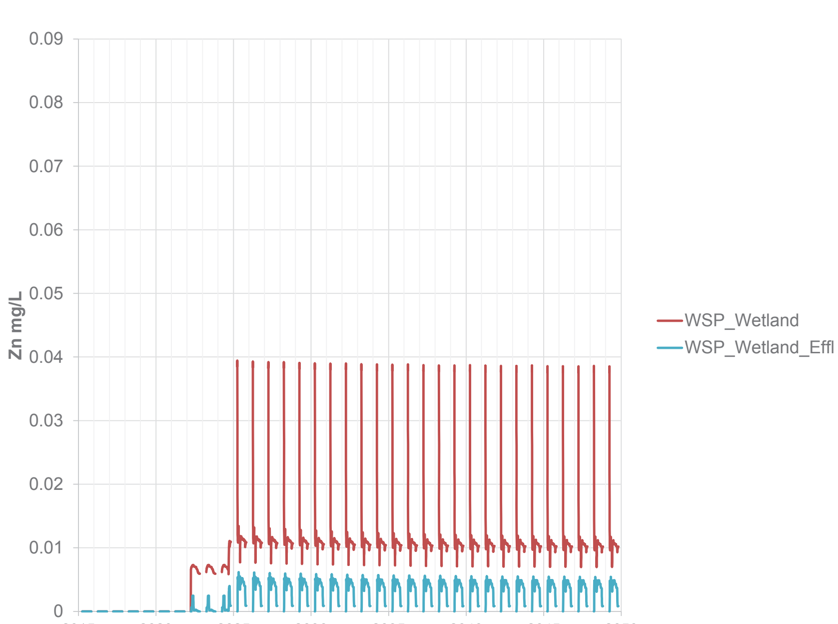


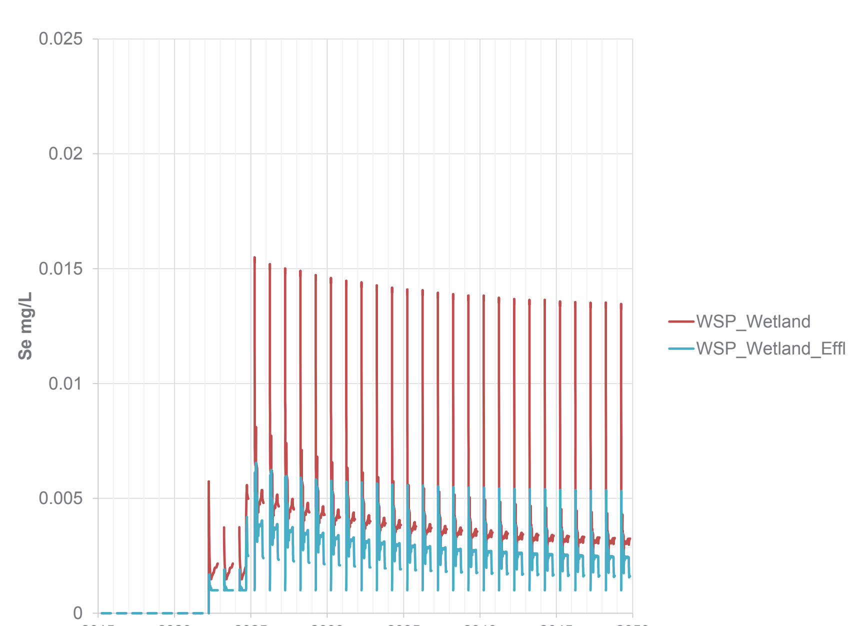












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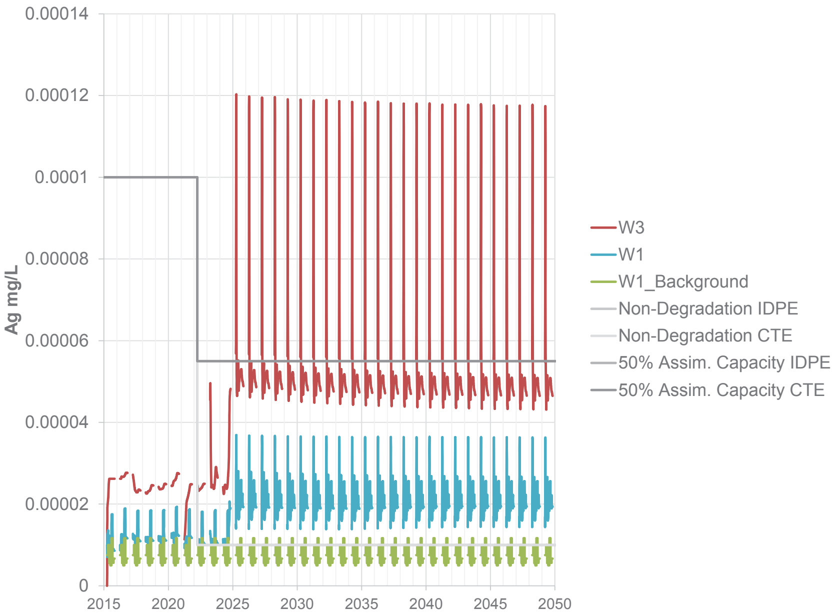

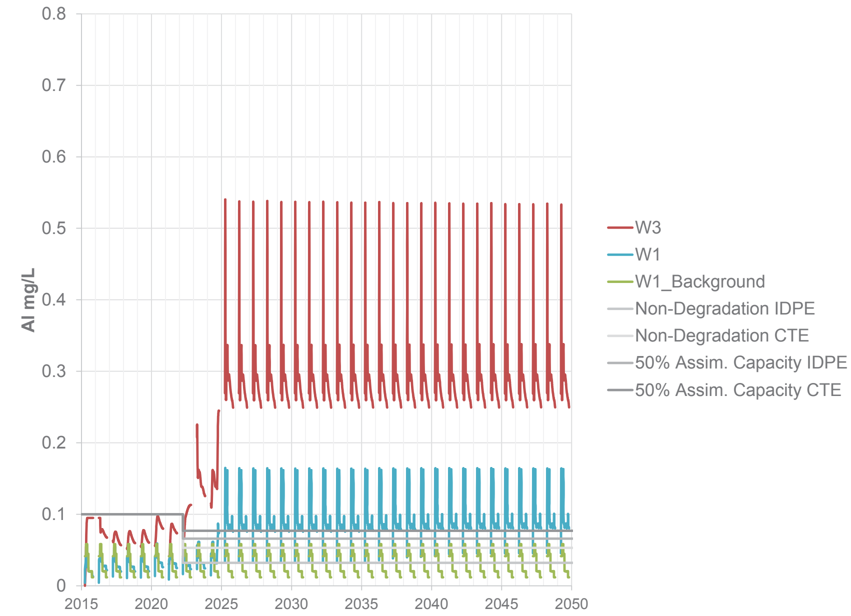

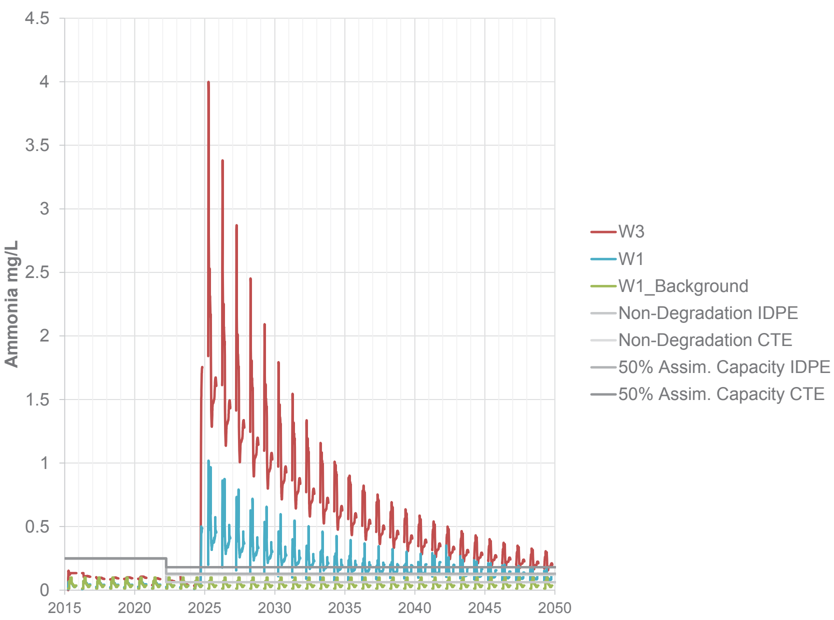

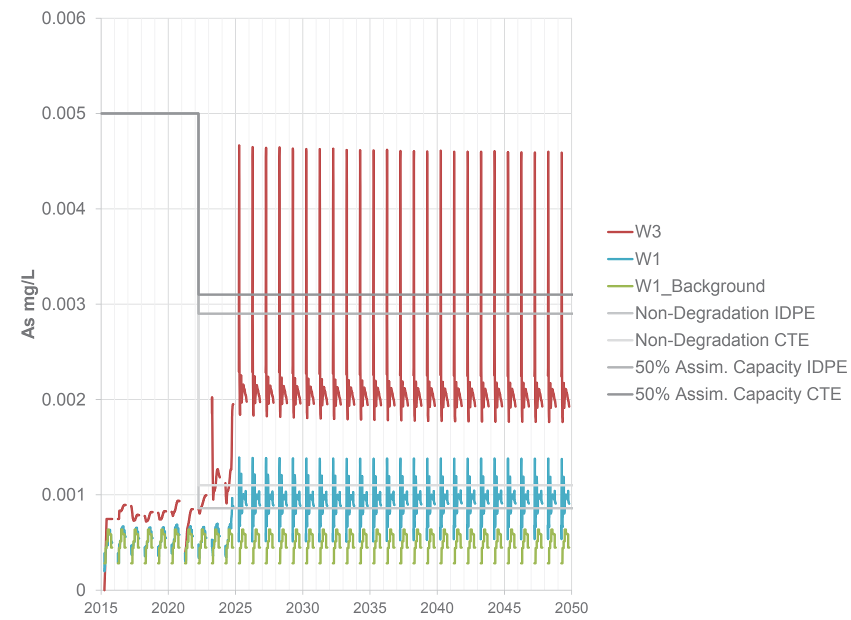

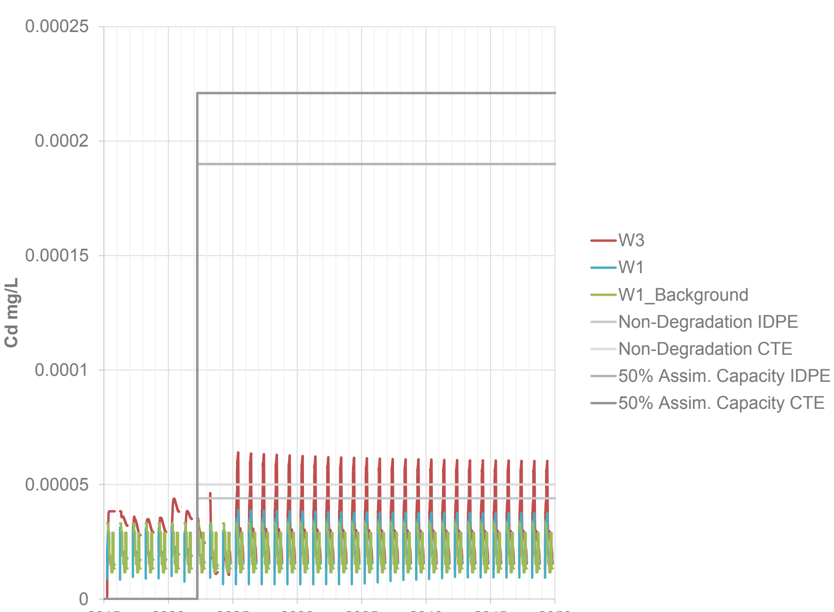

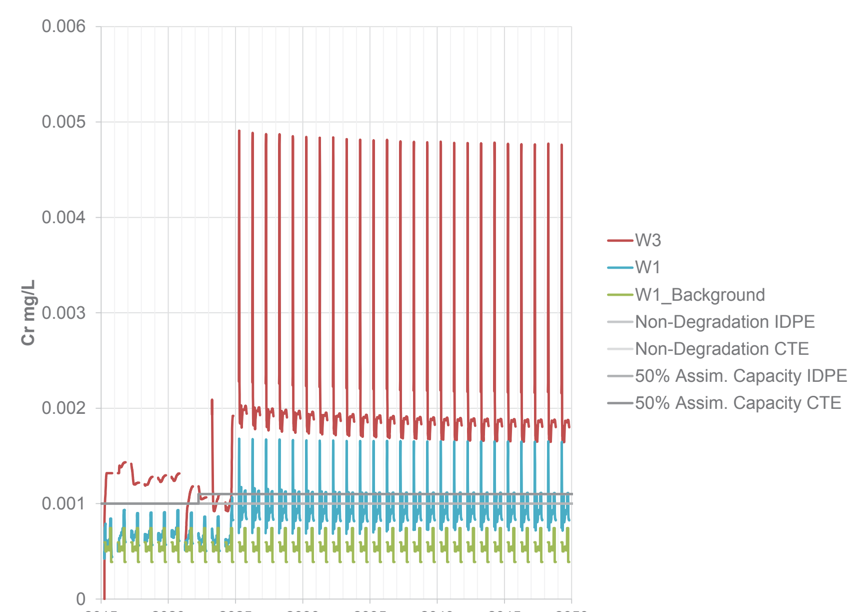

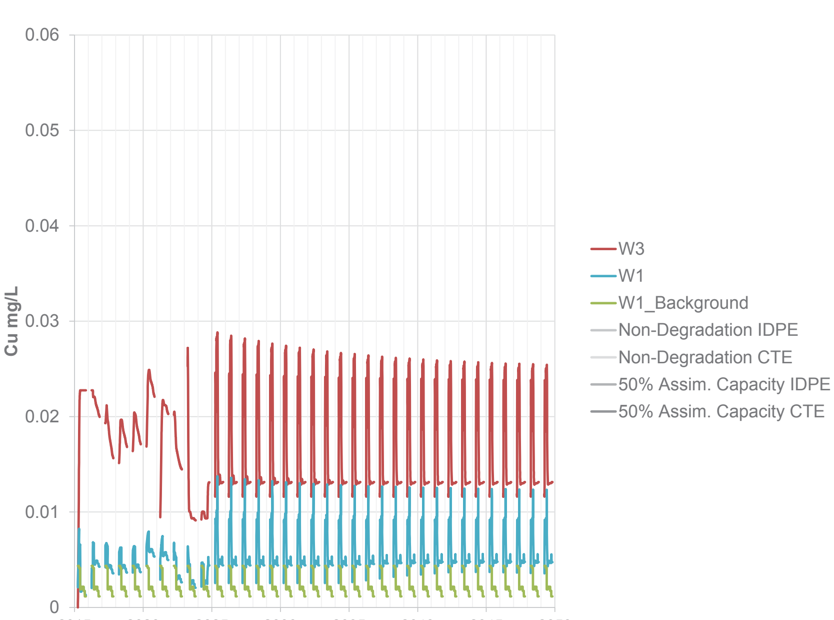

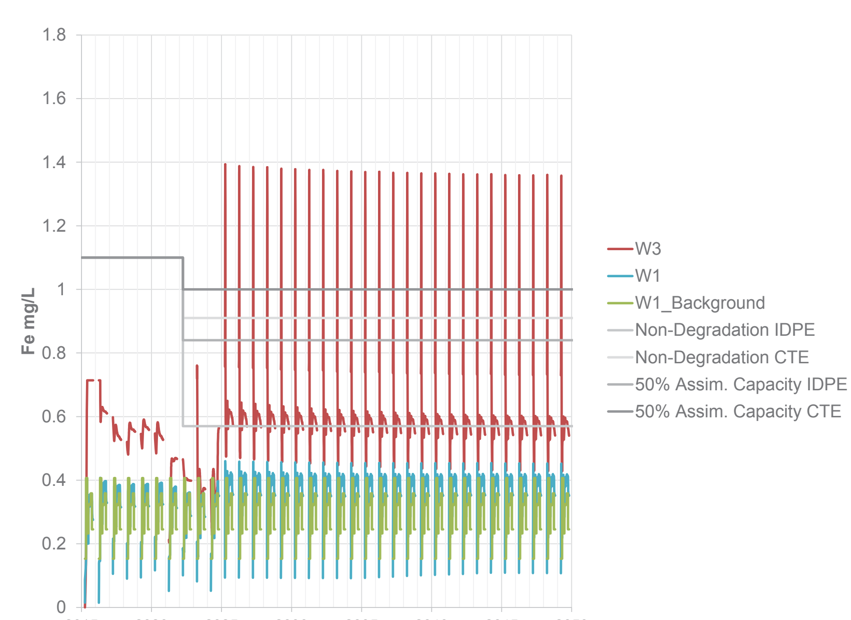

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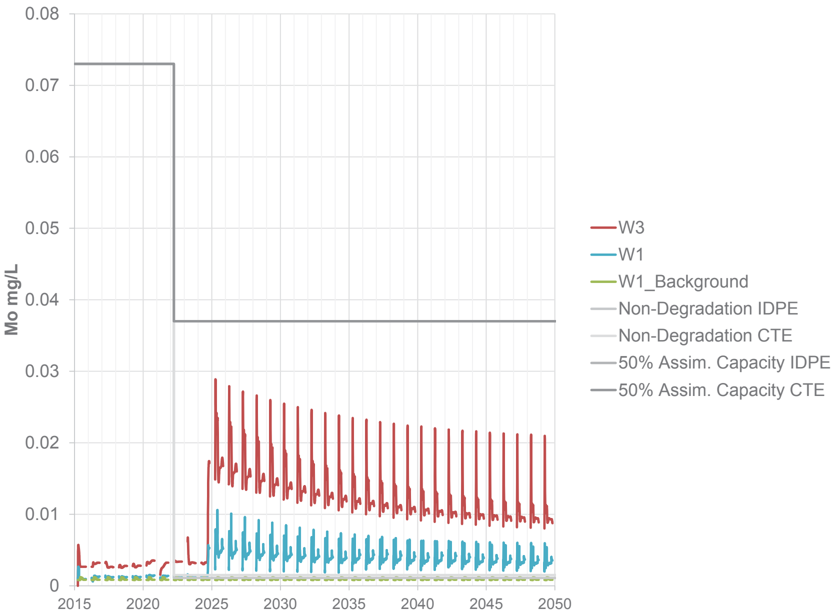

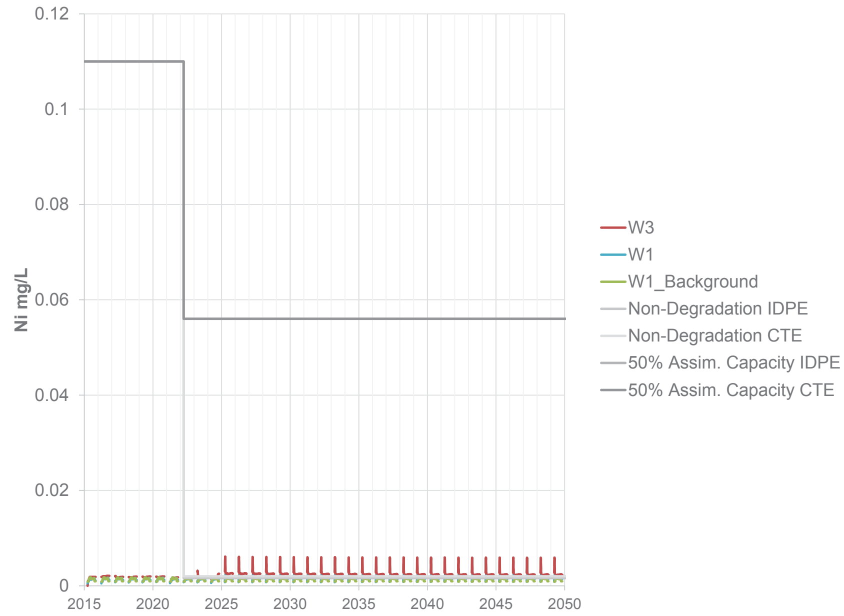

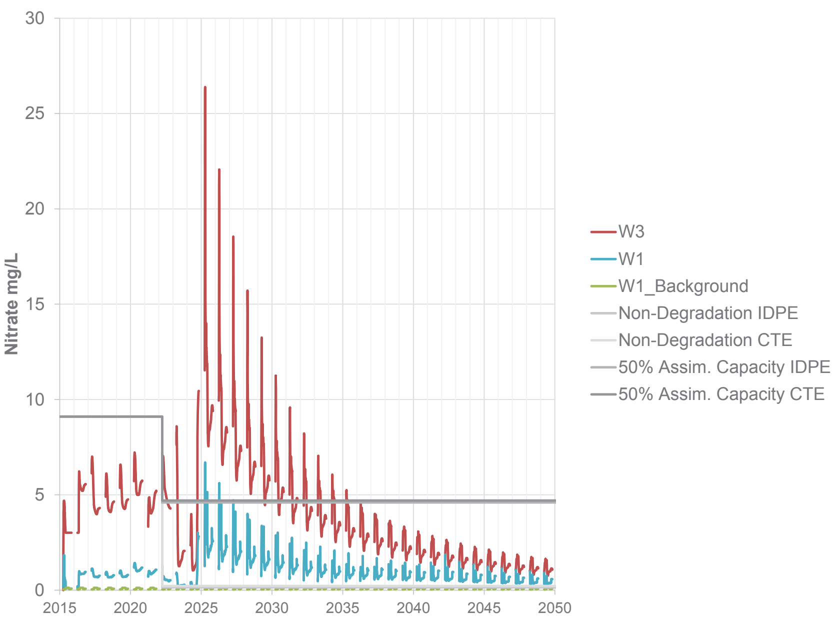

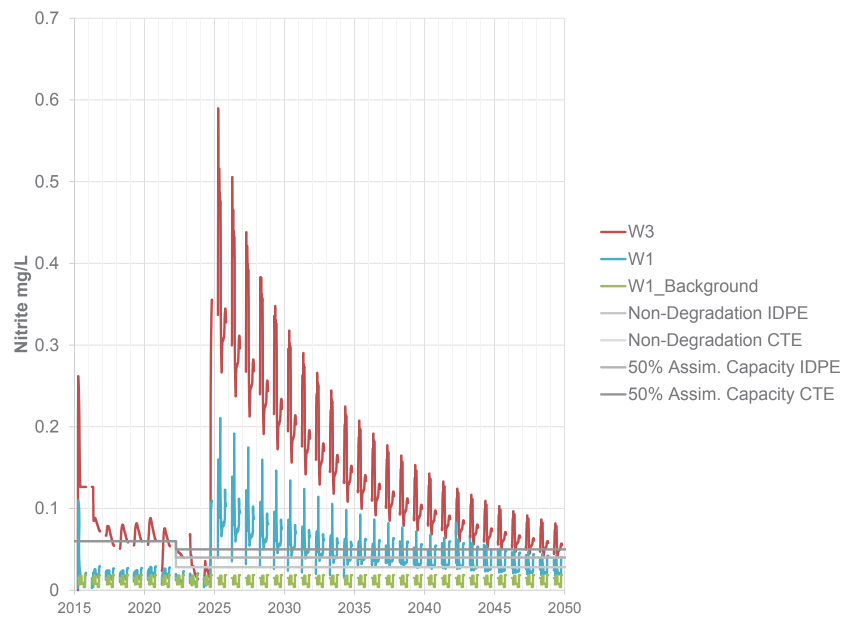

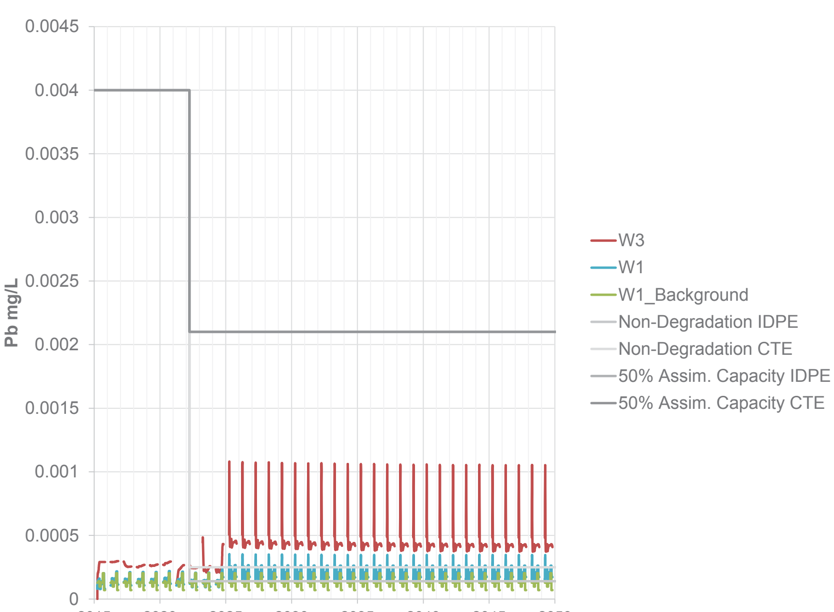

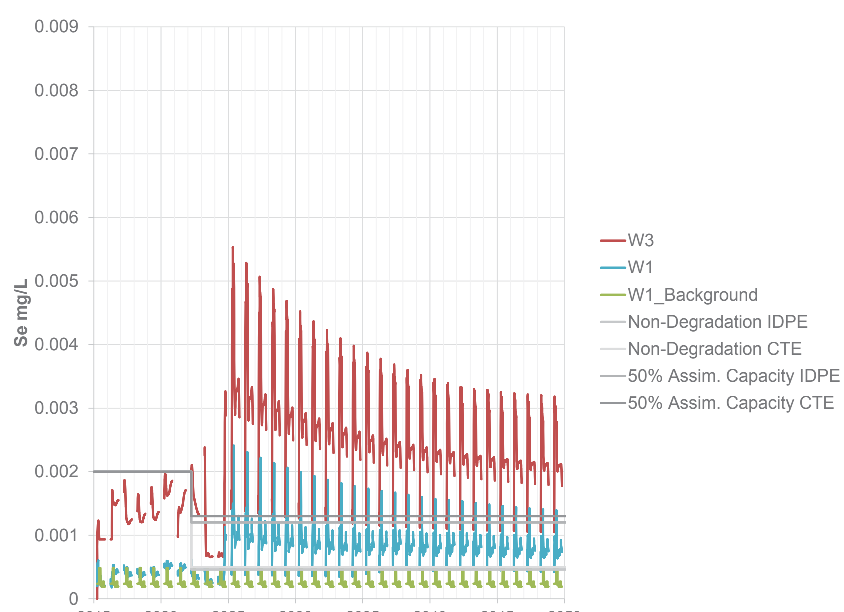

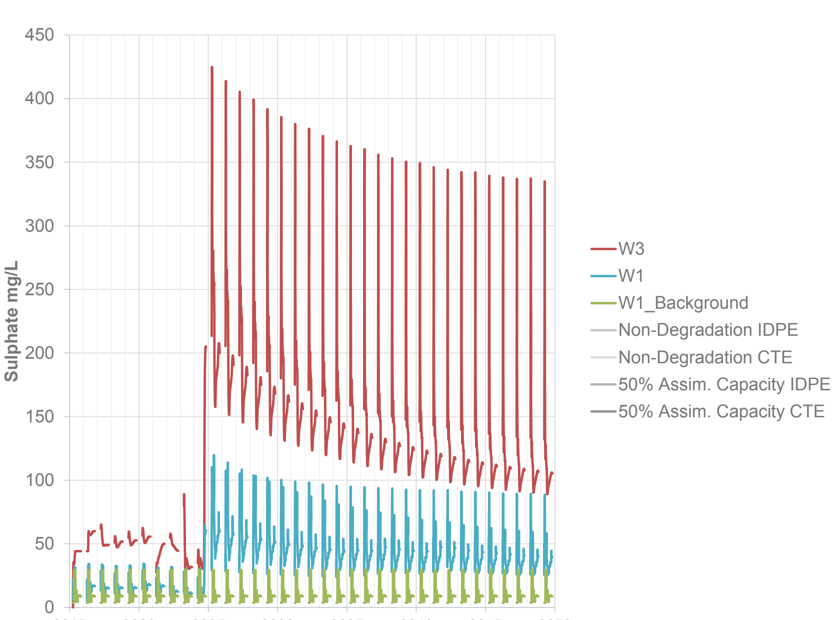

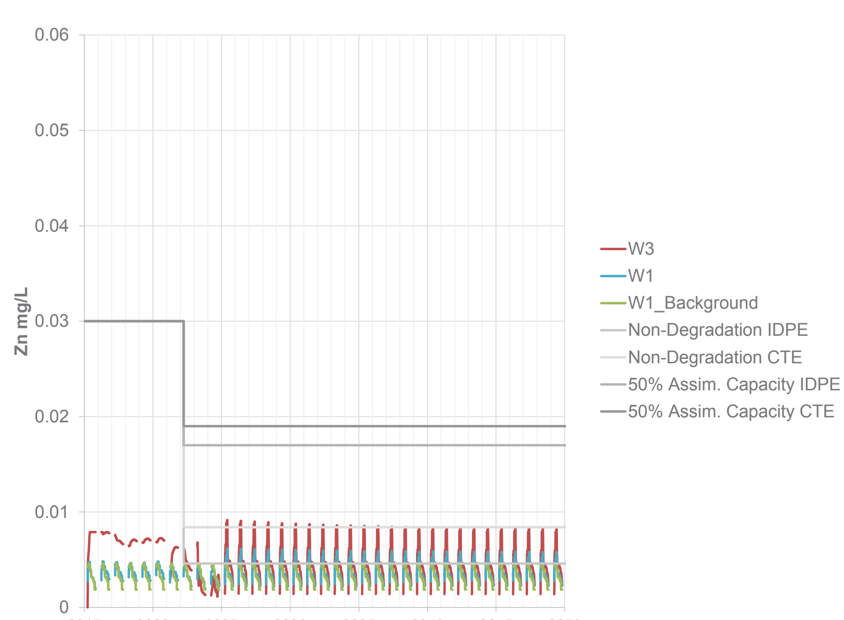

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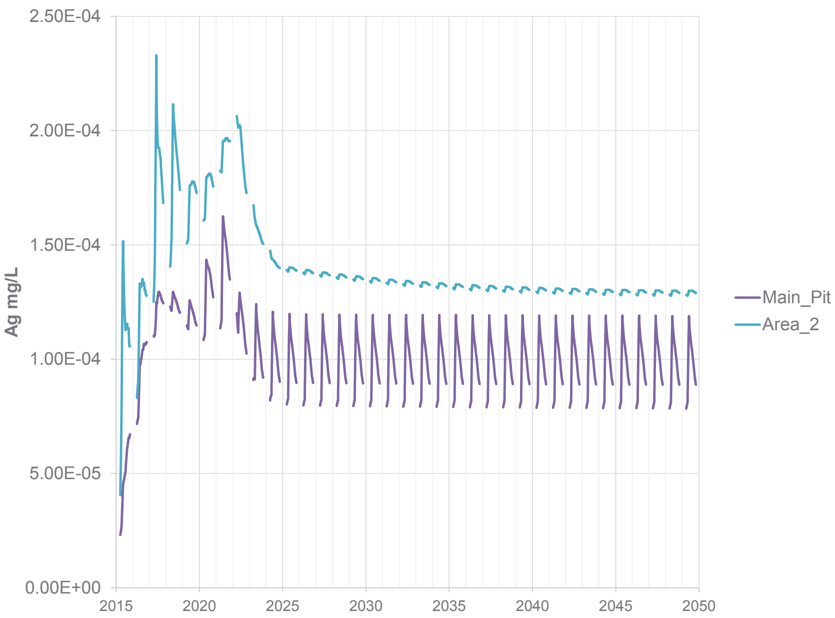

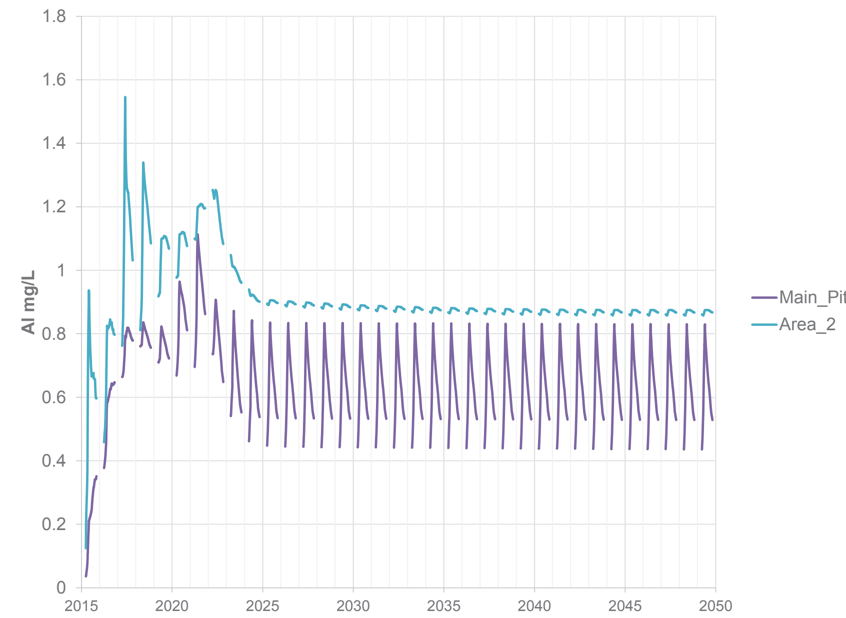

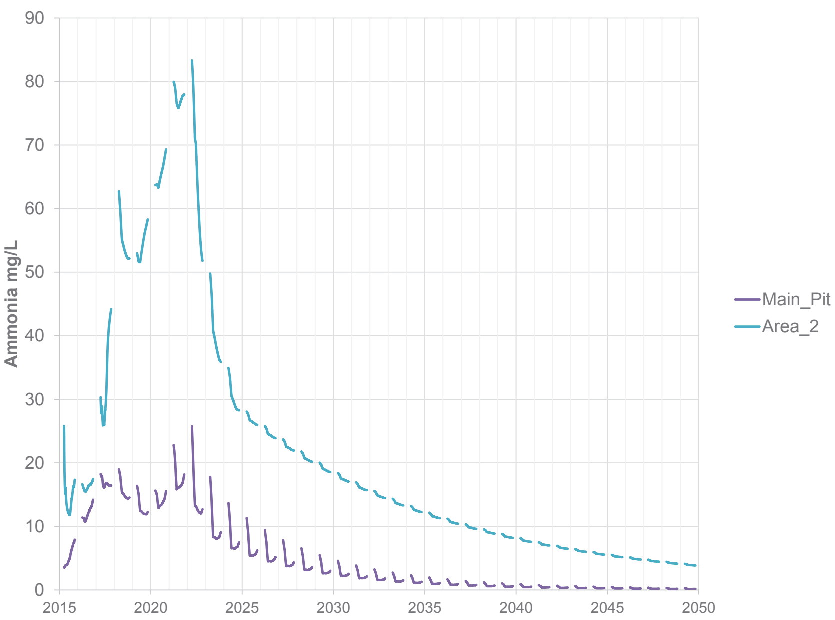

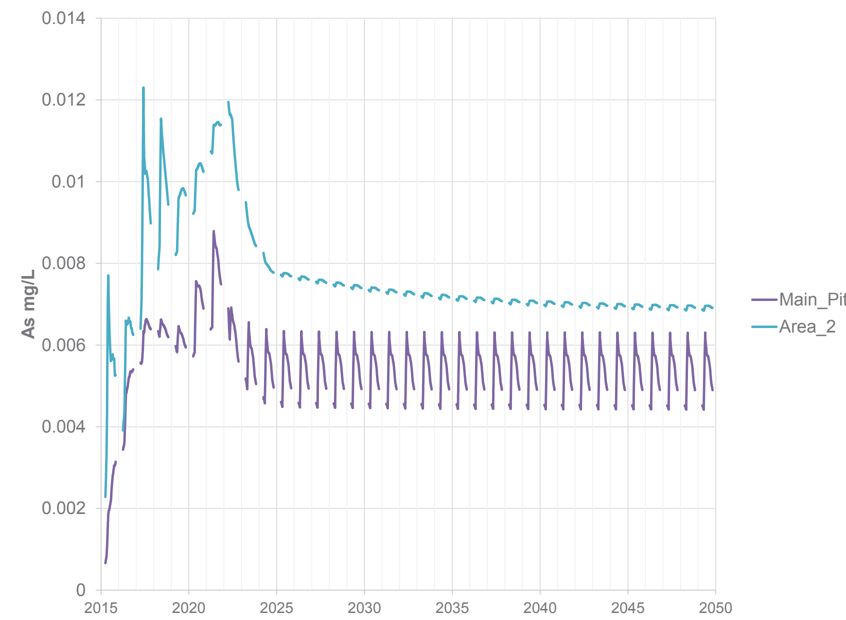

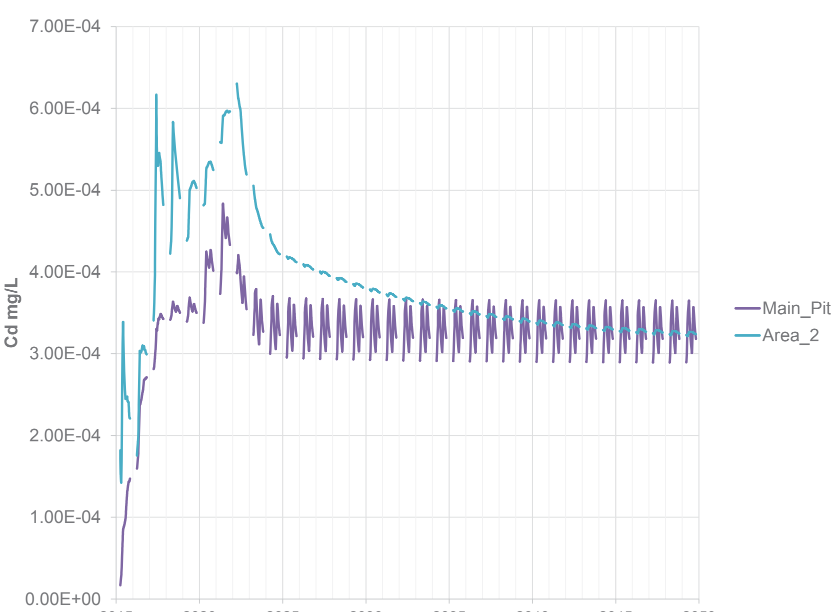

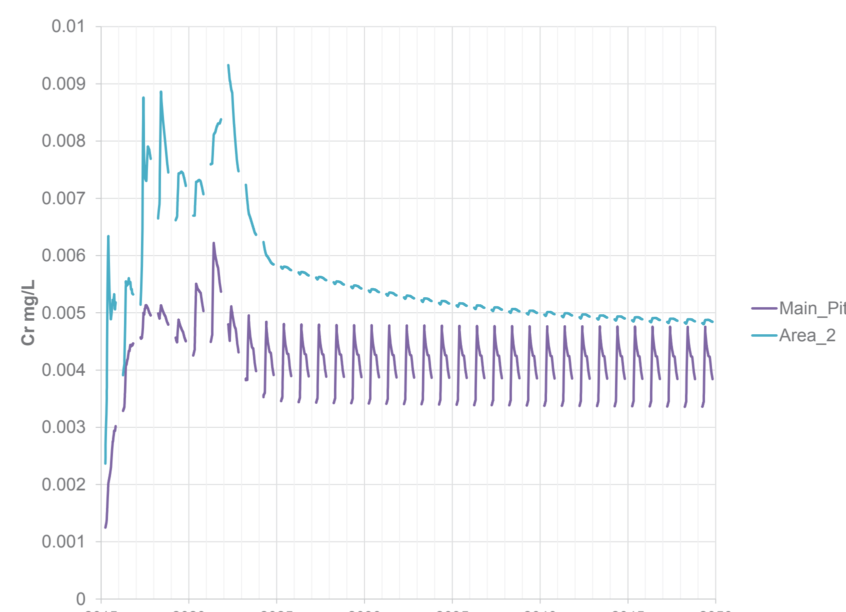

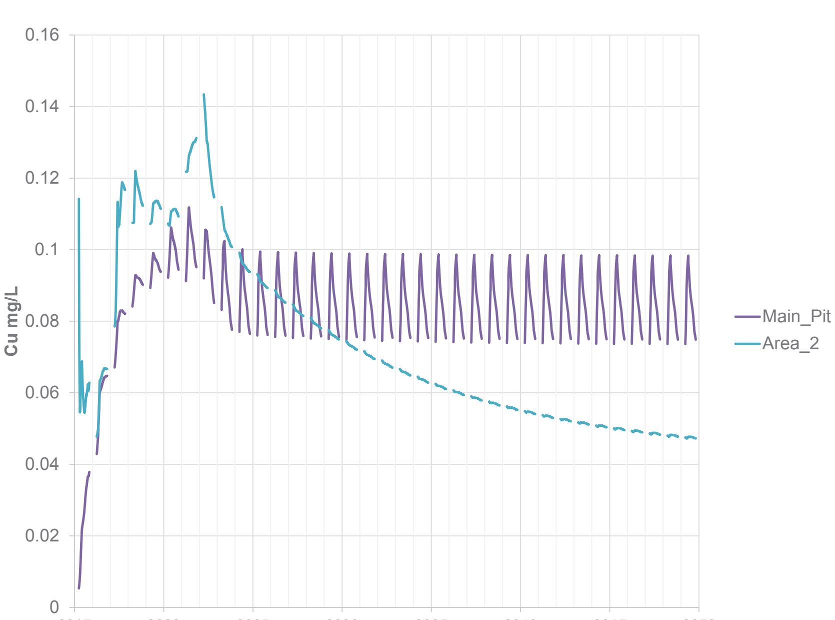

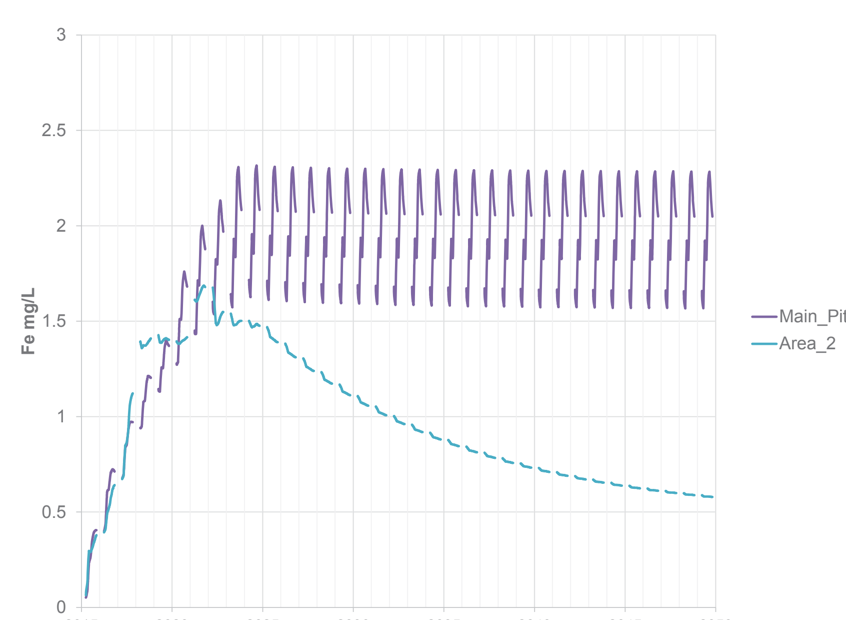

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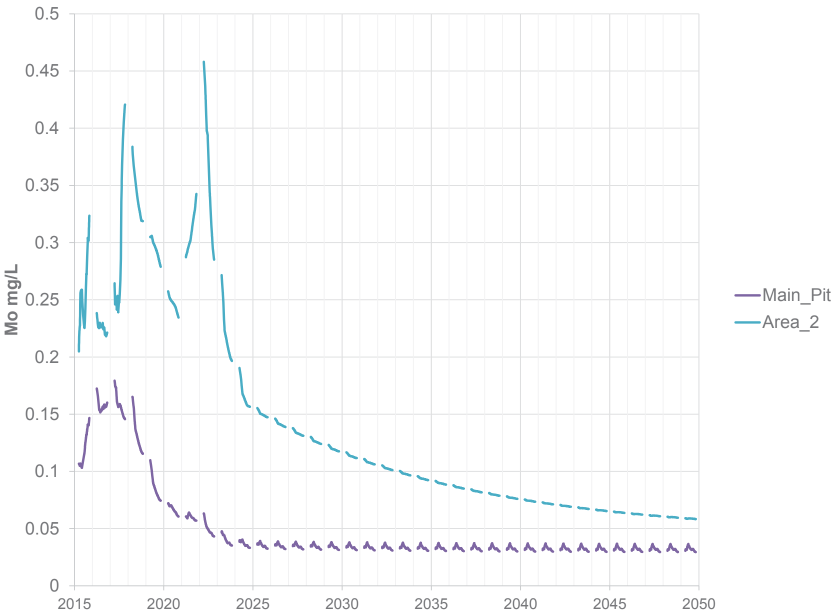
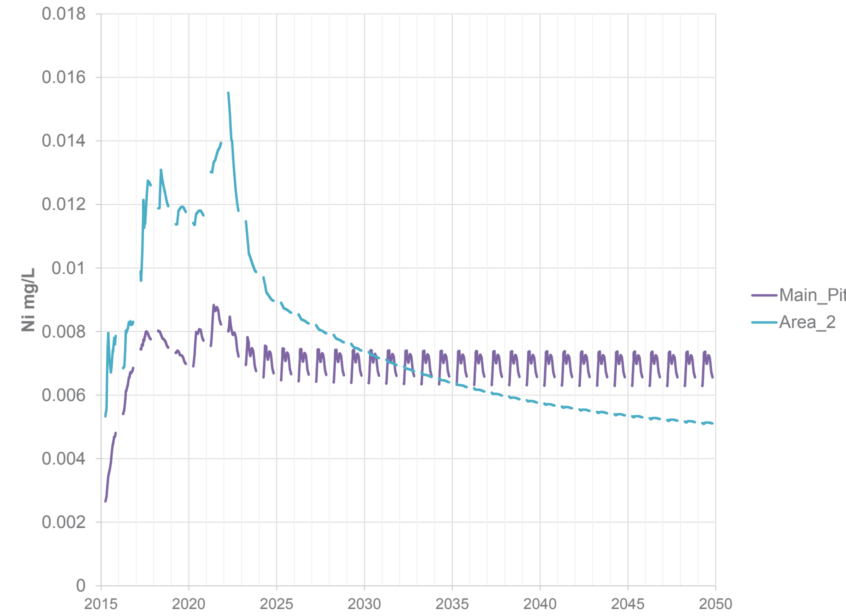
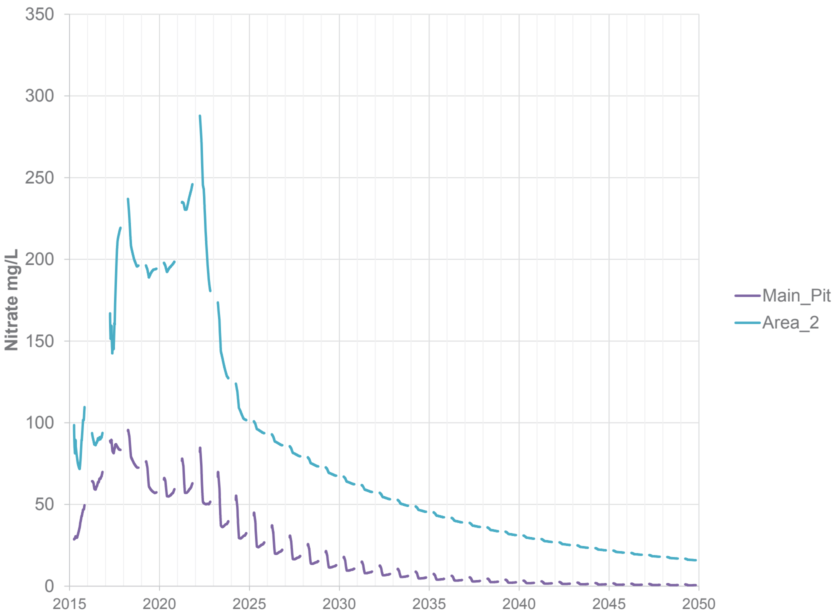
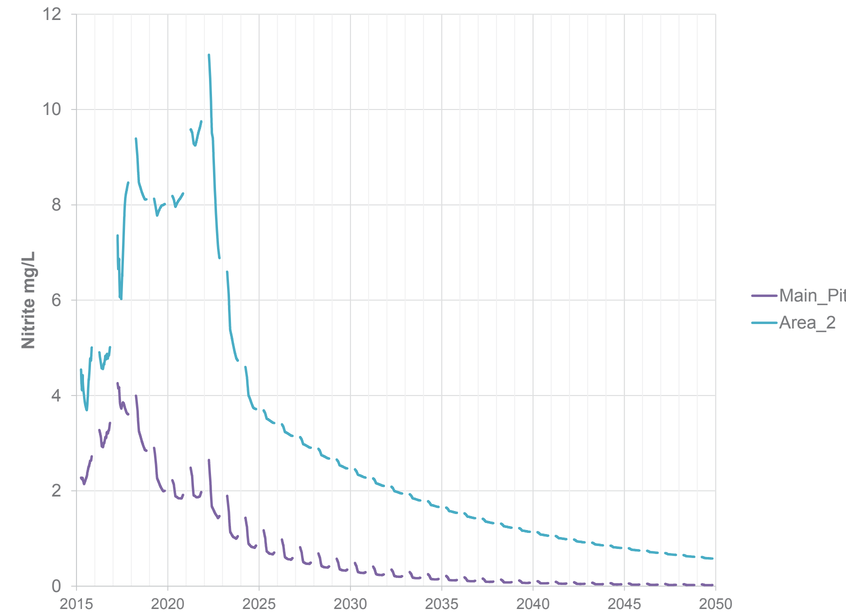
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

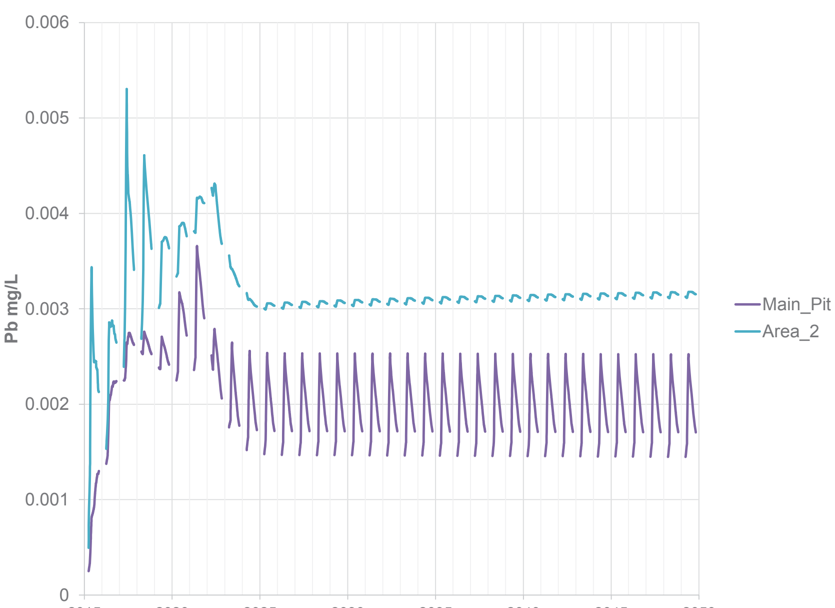
Appendix A2: Water and Load Balance Results
Scenario 5 - Worst Case, With Treatment, With Phase VII Underground

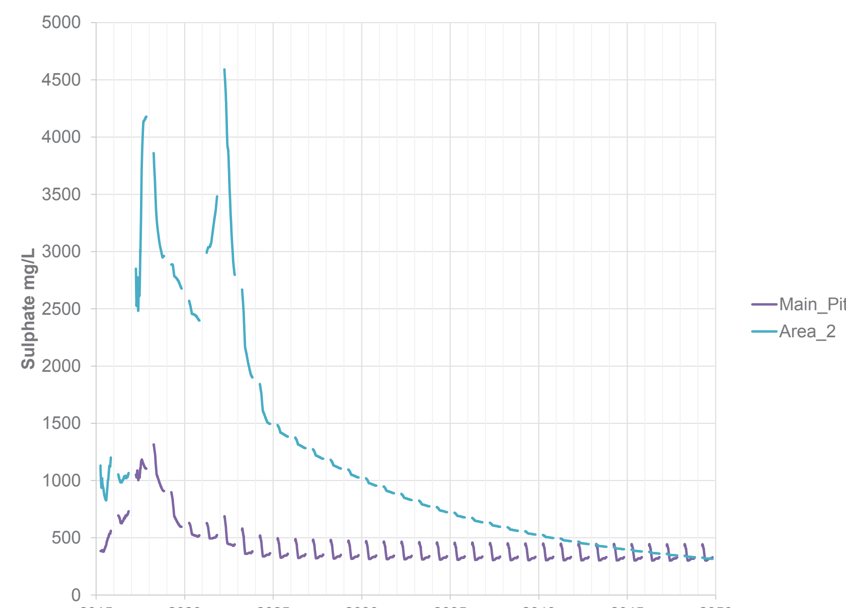


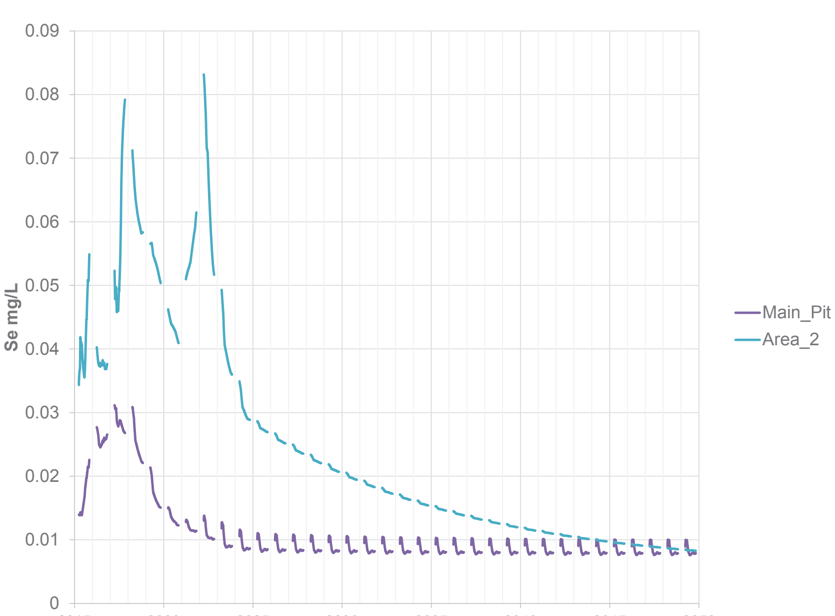


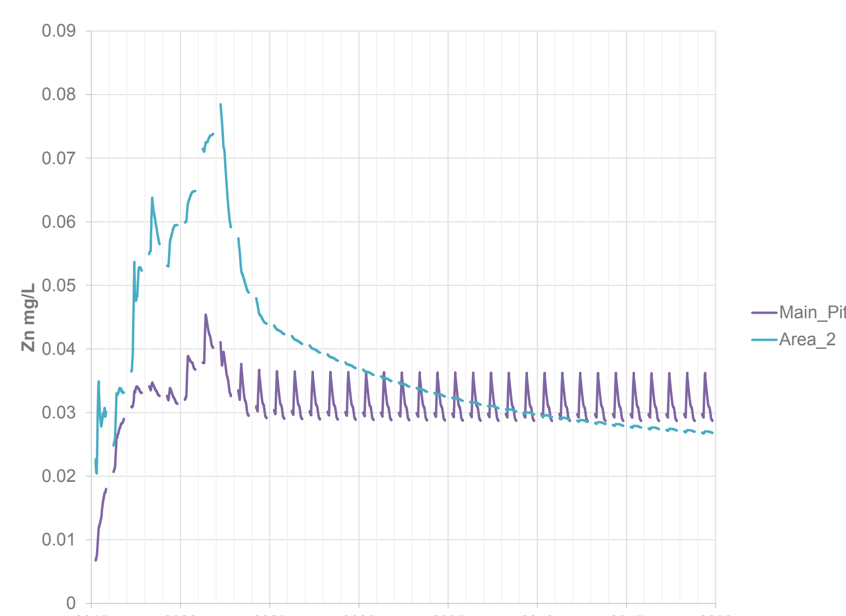






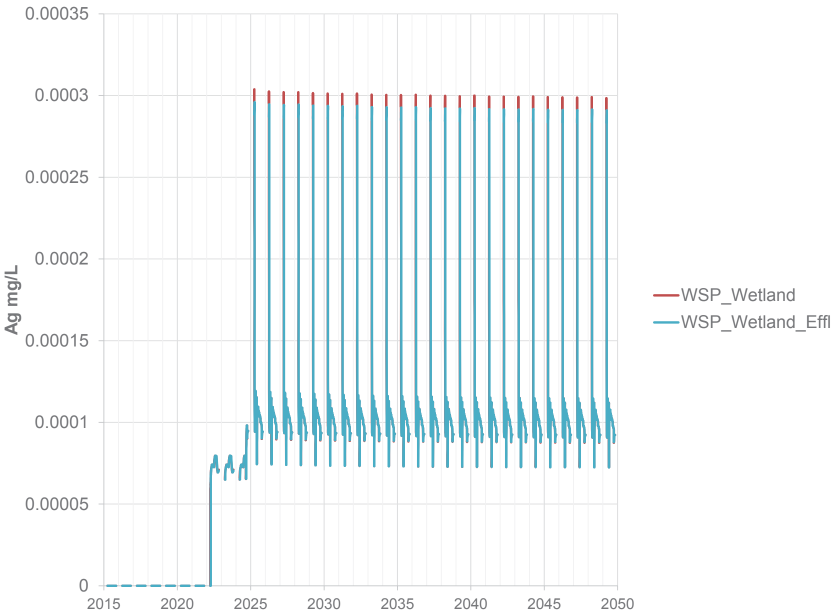


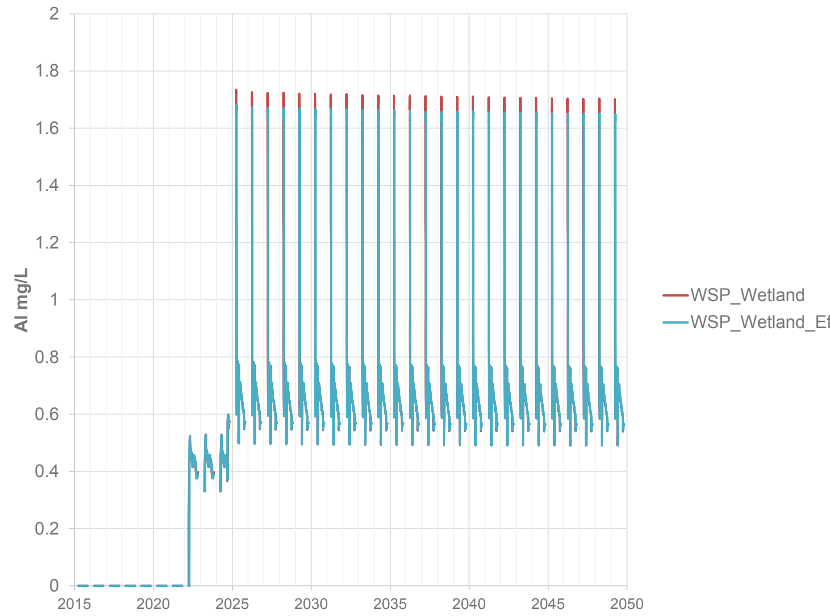


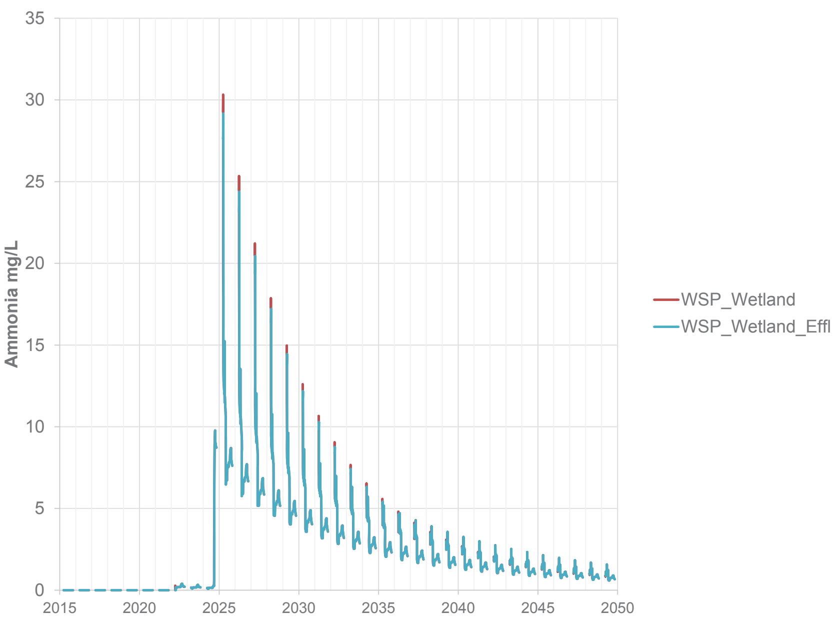


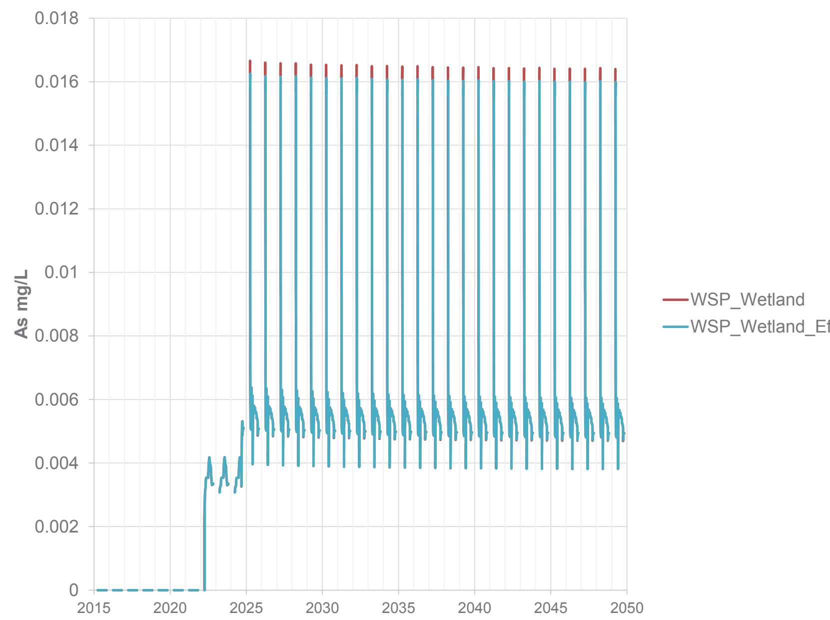
Source: P:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\12_Phase_VII_Files\Model Results\!Model_Results_WC_PhaseVII_WT_Scenario5_REV02_knk.pdf
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

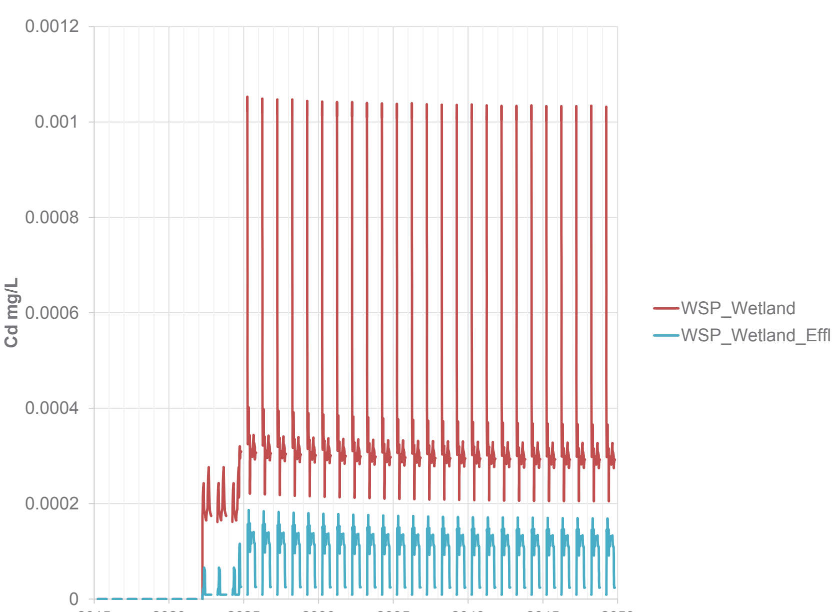
Appendix A2: Water and Load Balance Results
Scenario 5 - Worst Case, With Treatment, With Phase VII Underground

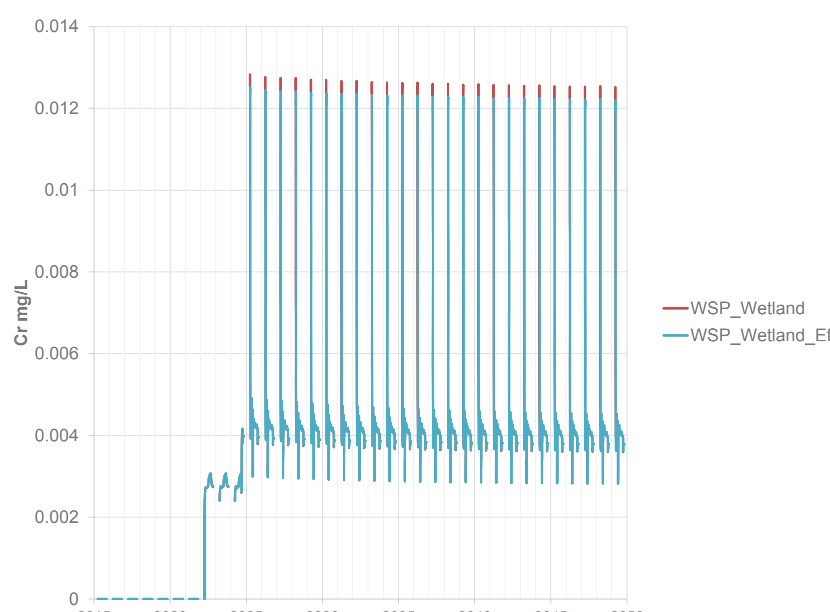


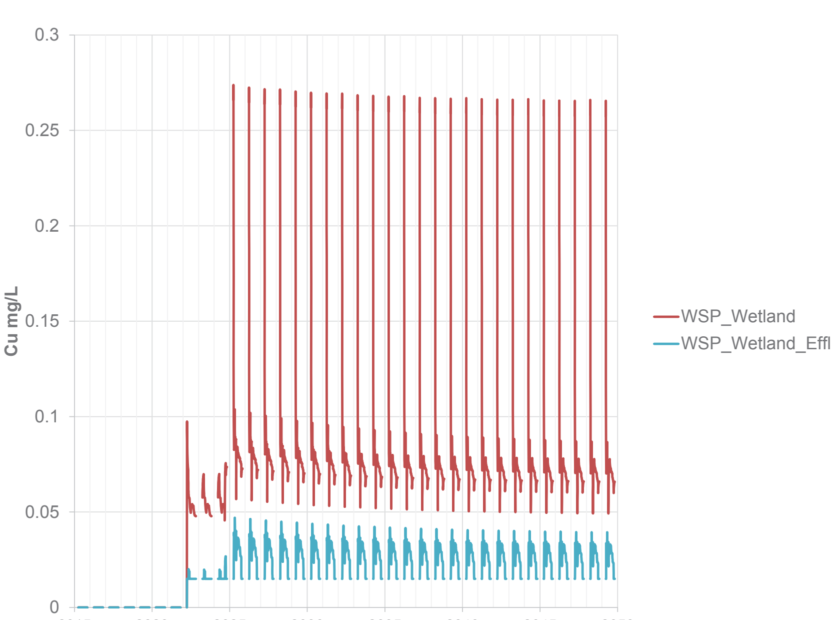


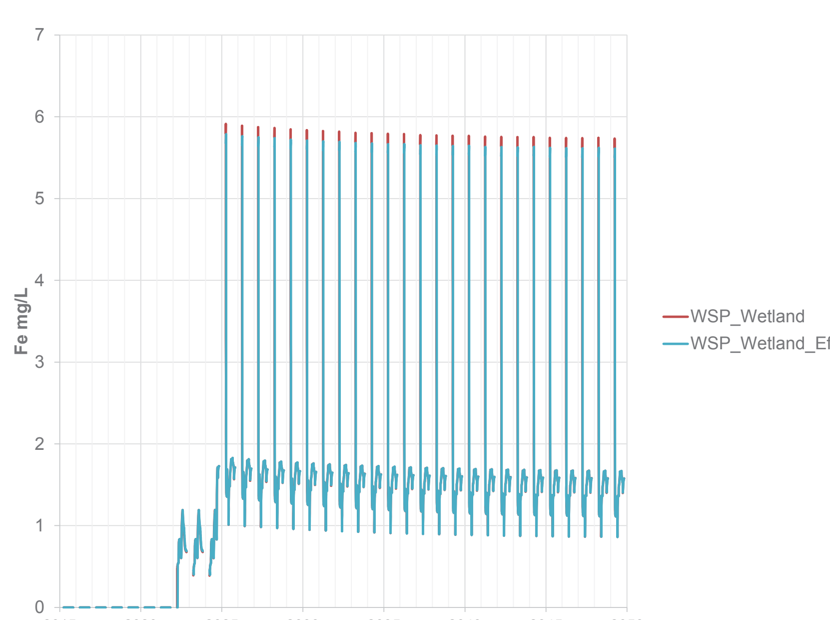












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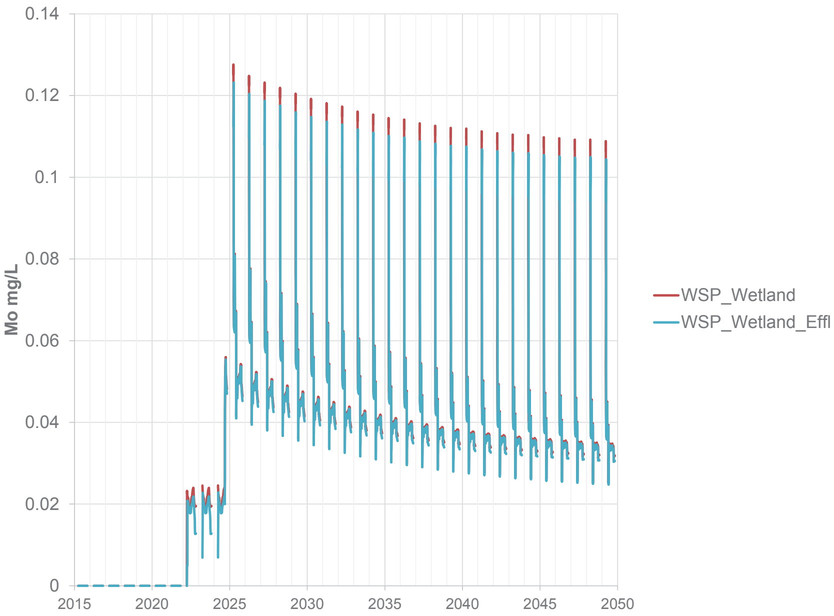
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK


Mo mg/L
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
2015
2020
2025
2030
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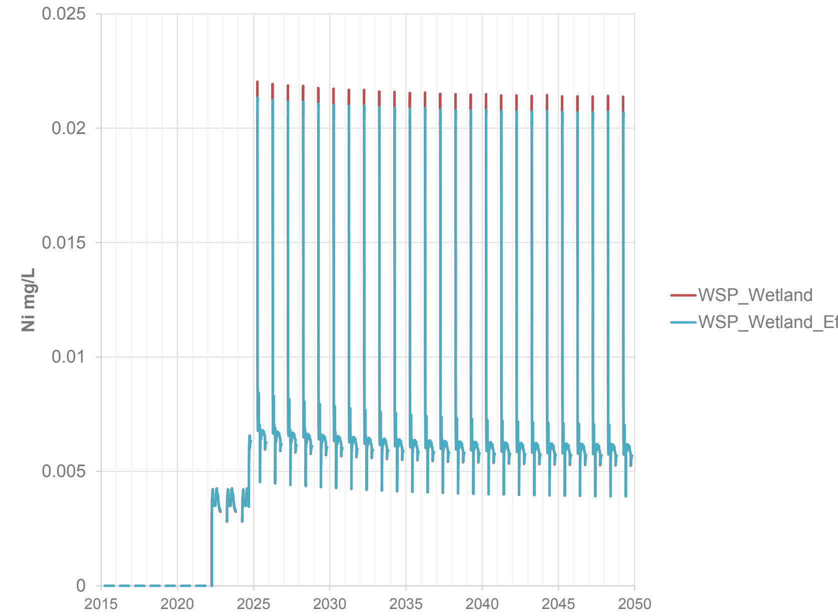
WSP_Wetland
WSP_Wetland_Effl


Ni mg/L
0
0.005
0.01
0.015
0.02
0.025
2015
2020
2025
2030
2035
2040
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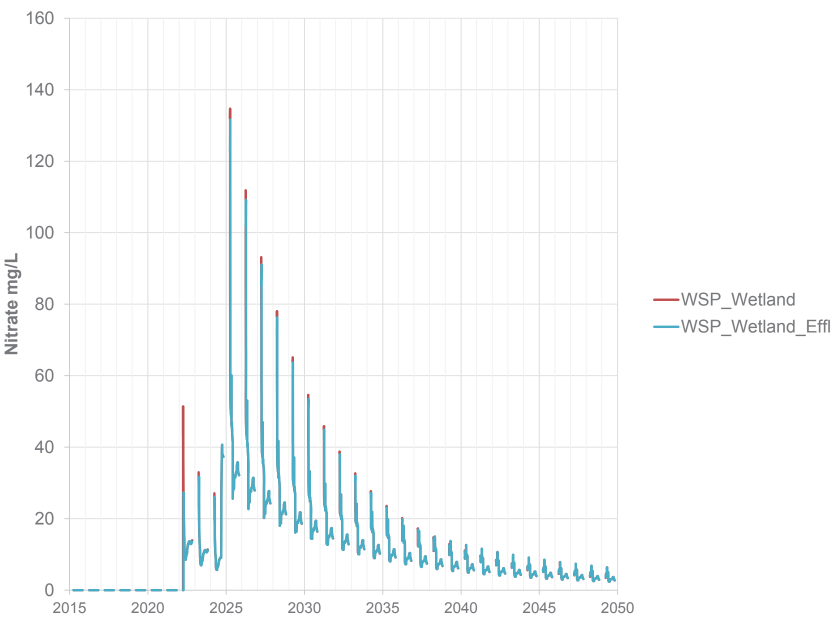
WSP_Wetland_Effl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20
40
60
80
100
120
140
160
2015
2020
2025
2030
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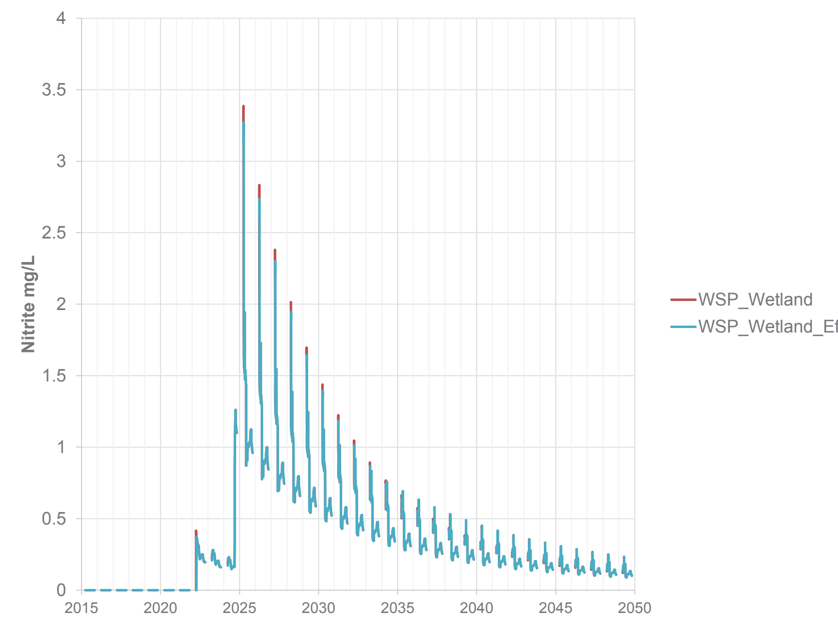
Nitrite mg/L
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0.5
1
1.5
2
2.5
3
3.5
4
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2020
2025
2030
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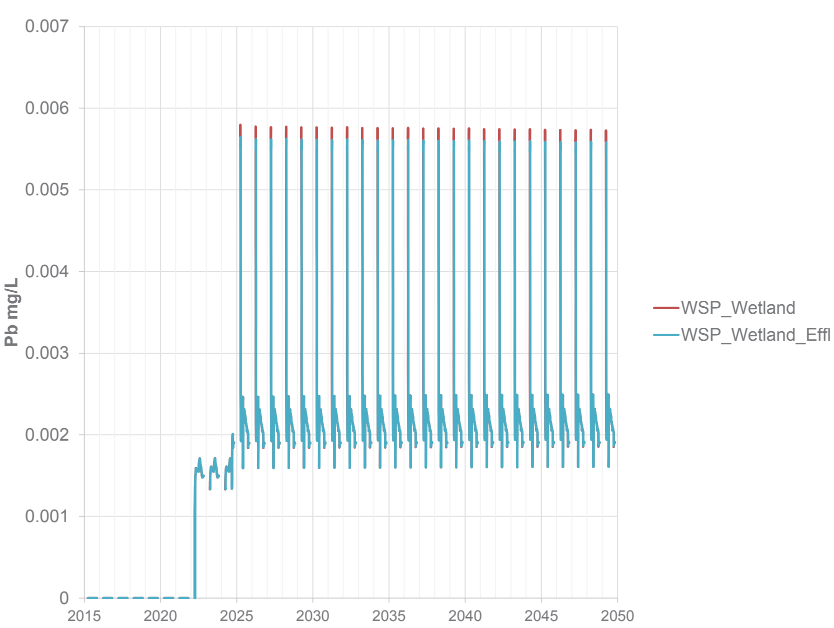
WSP_Wetland_Effl


Pb mg/L
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0.002
0.003
0.004
0.005
0.006
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2020
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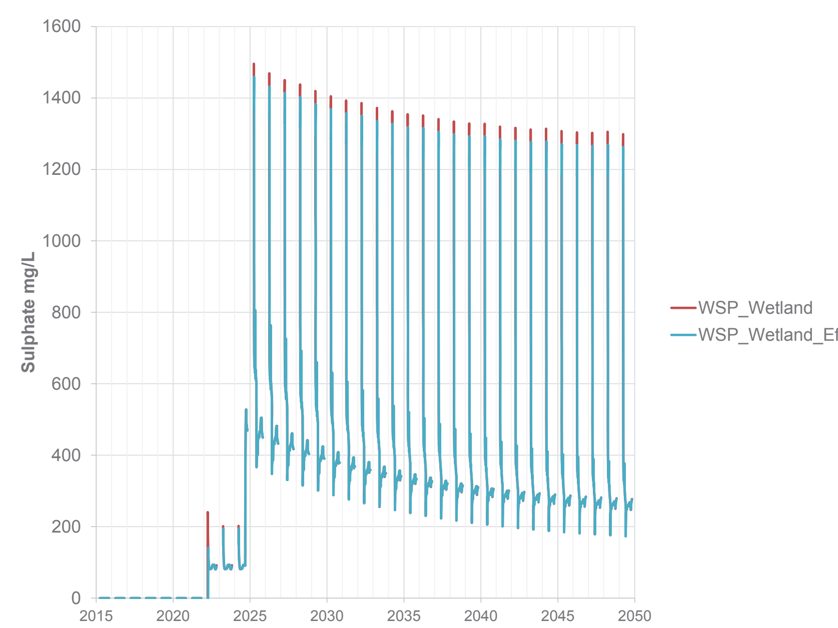
WSP_Wetland_Effl


Sulphate mg/L
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200
400
600
800
1000
1200
1400
1600
2015
2020
2025
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2035
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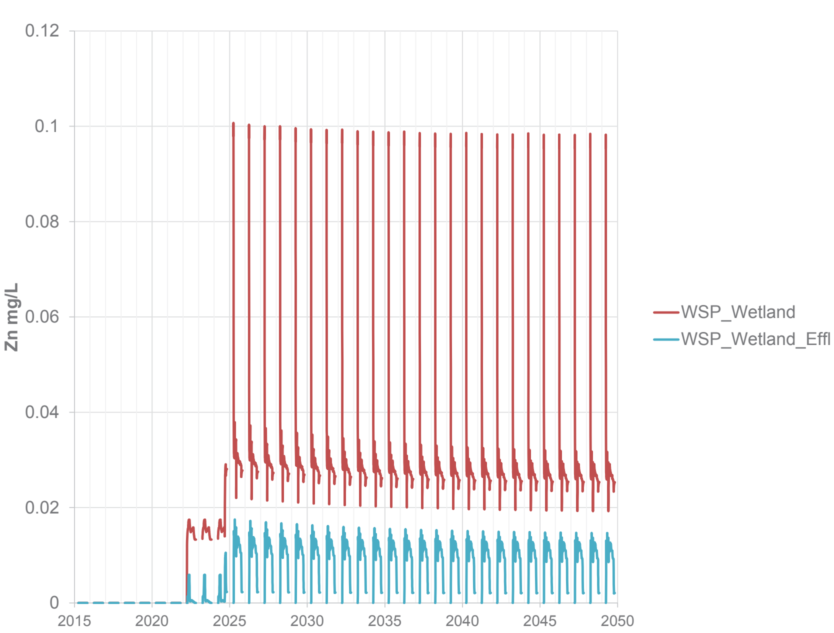
2045
2050
WSP_Wetland
WSP_Wetland_Effl


Zn mg/L
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0.02
0.04
0.06
0.08
0.1
0.12
2015
2020
2025
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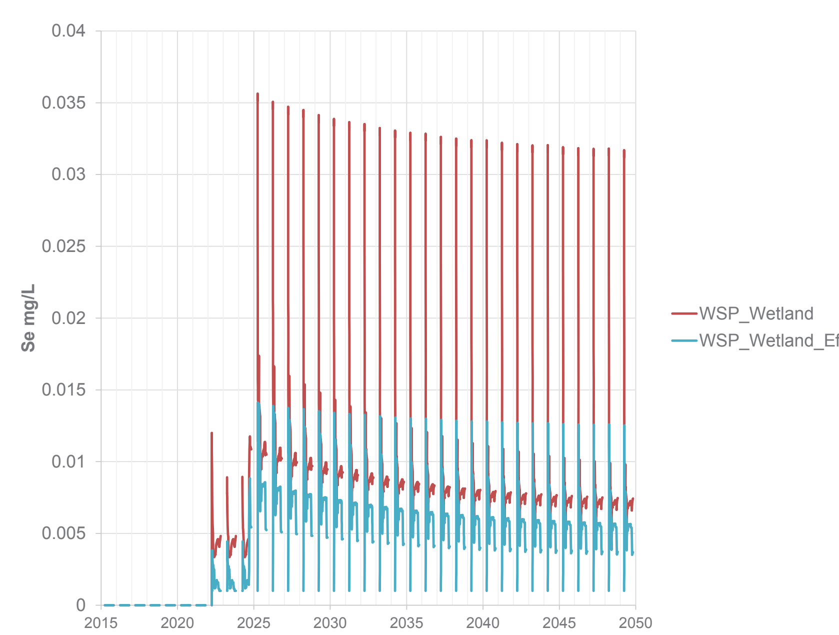
Se mg/L
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
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2020
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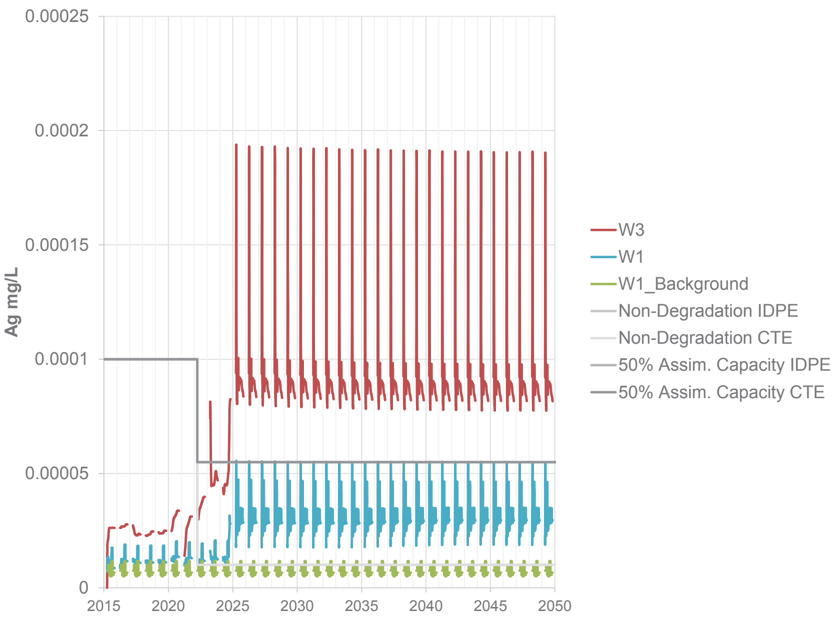

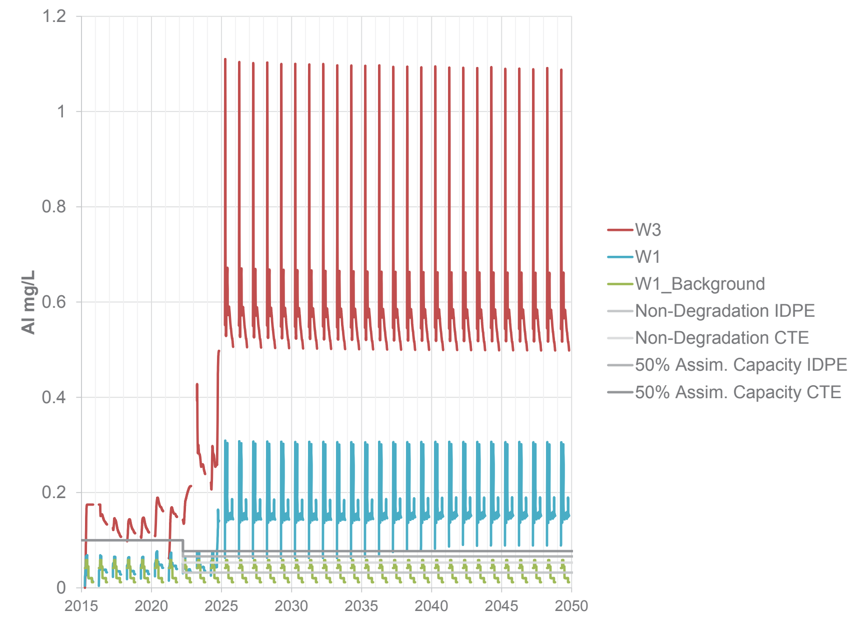

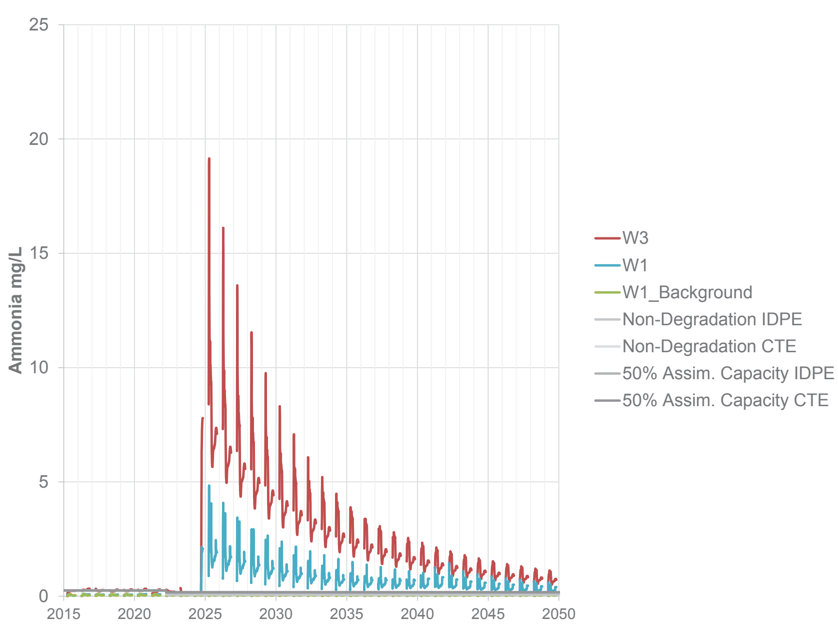

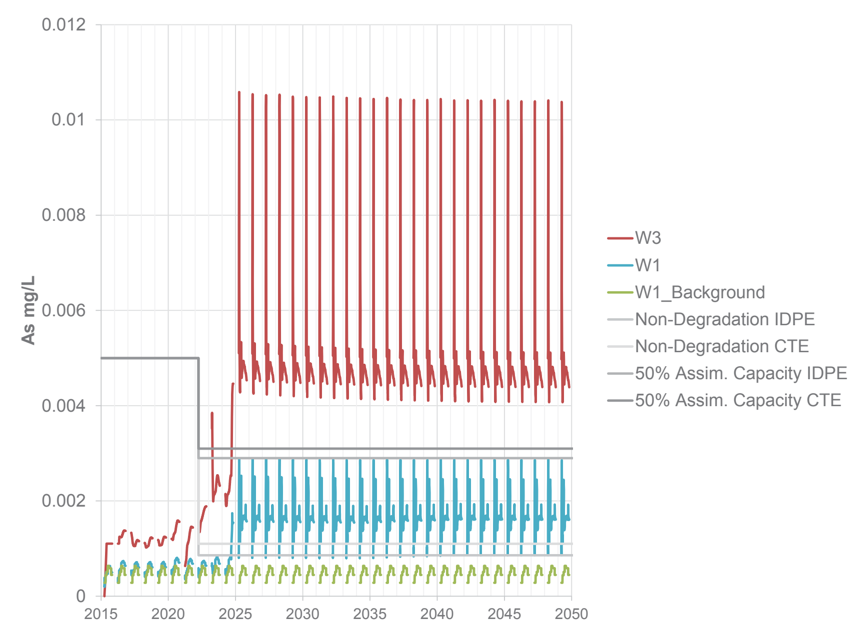

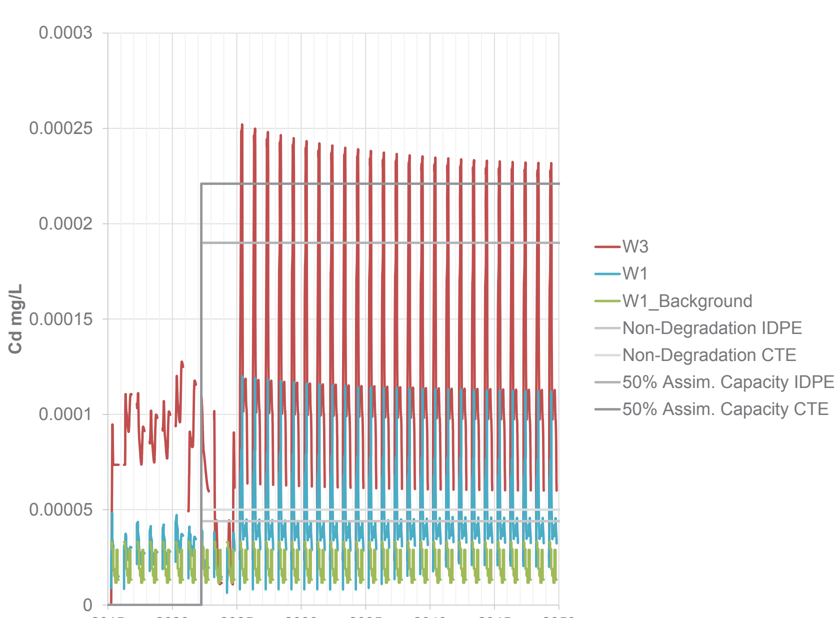

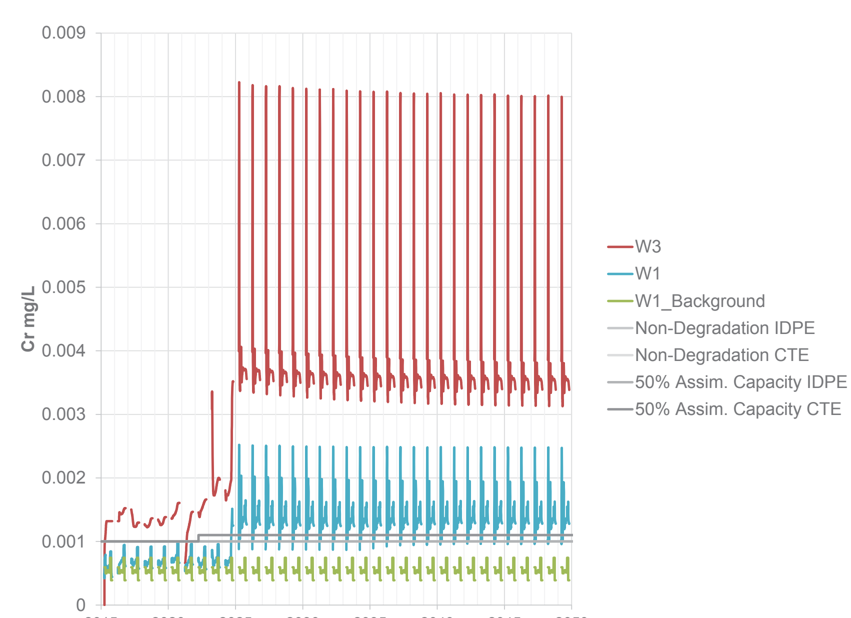

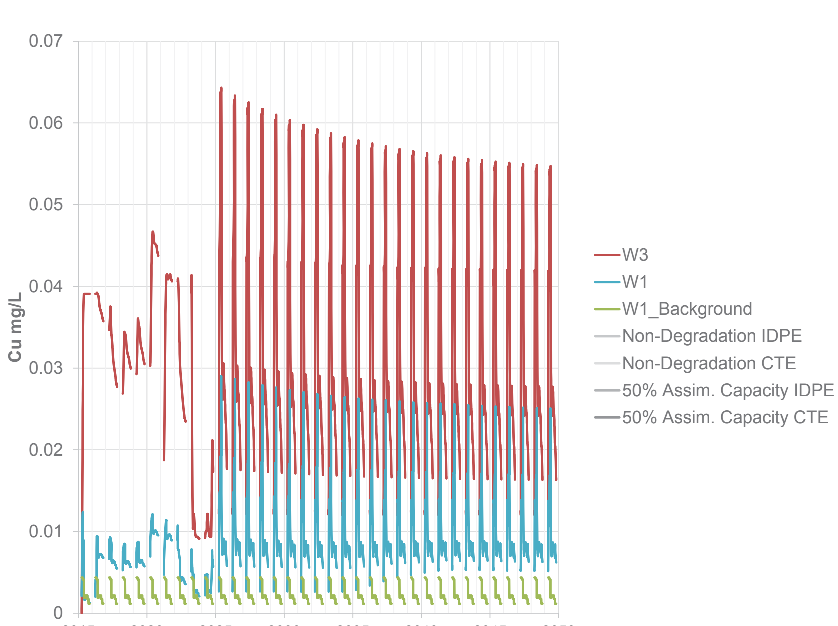

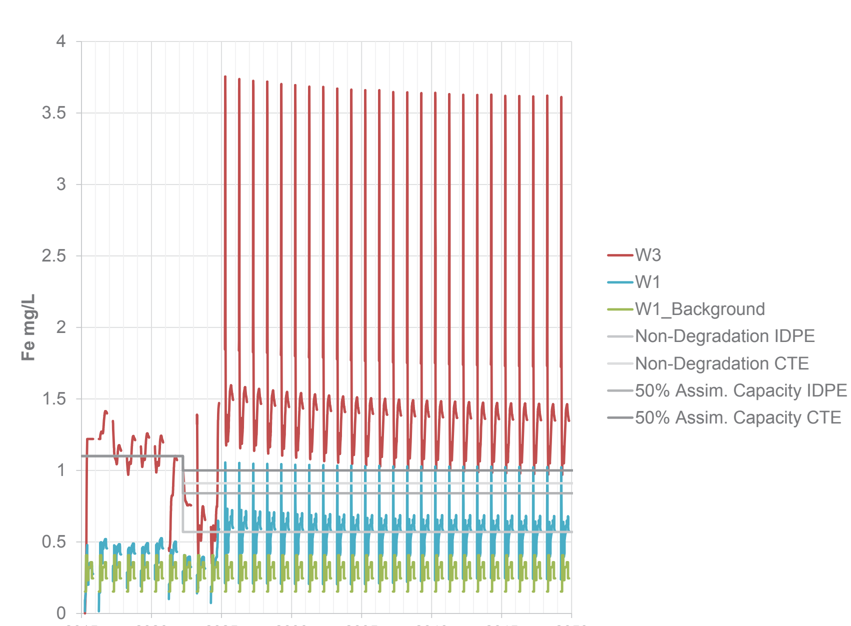

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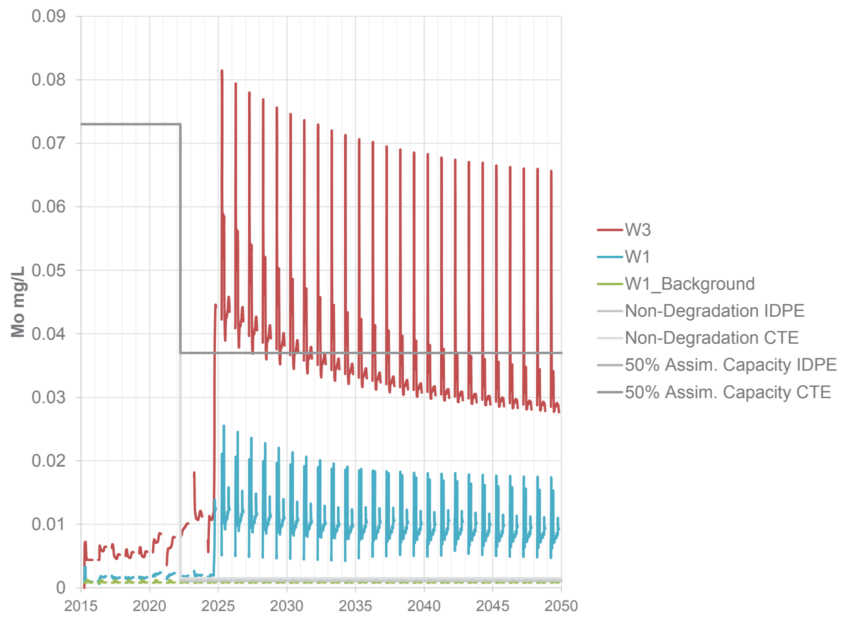
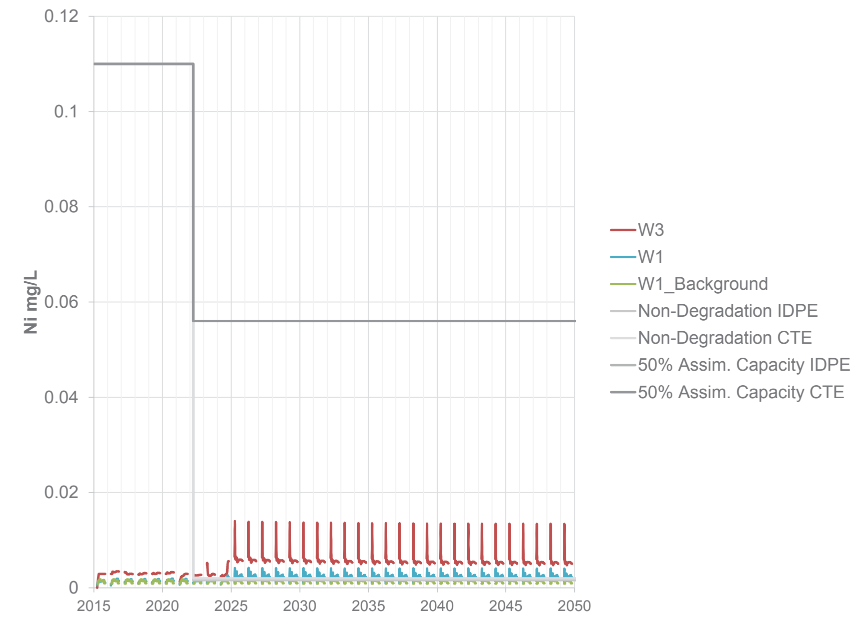
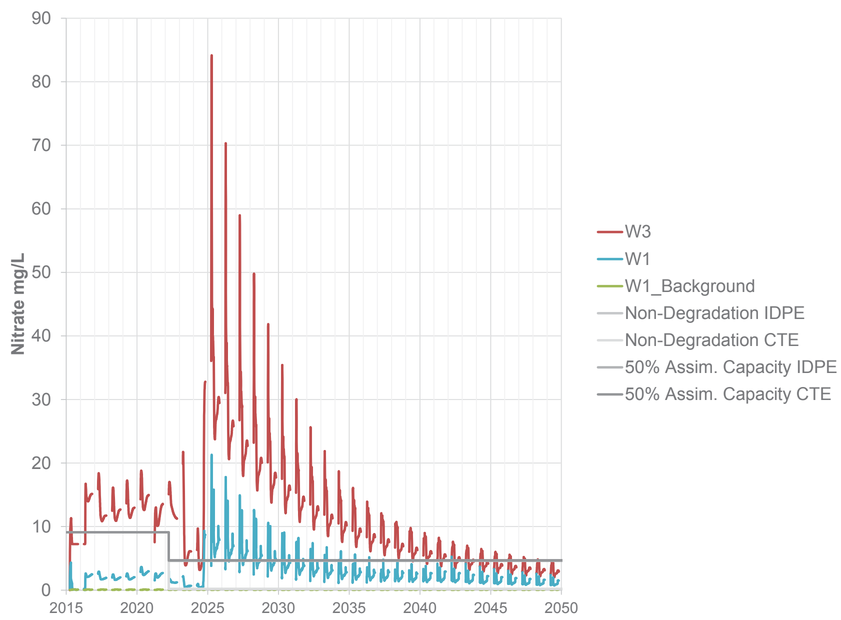
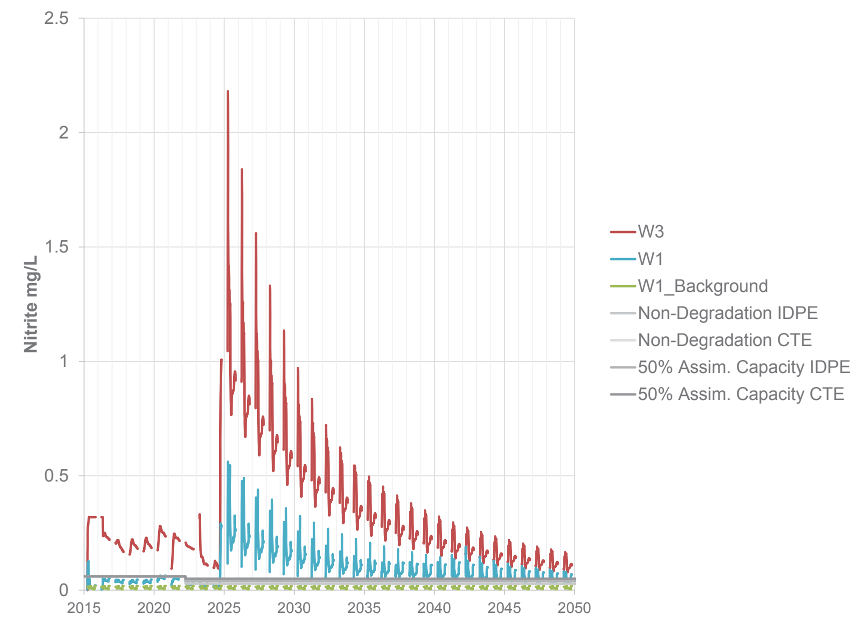
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

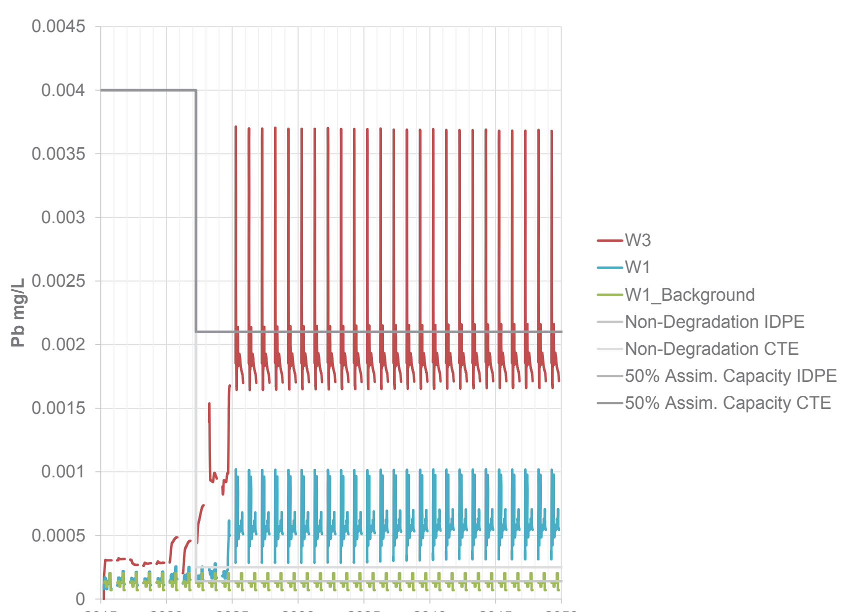
Appendix A2: Water and Load Balance Results
Scenario 5 - Worst Case, With Treatment, With Phase VII Underground

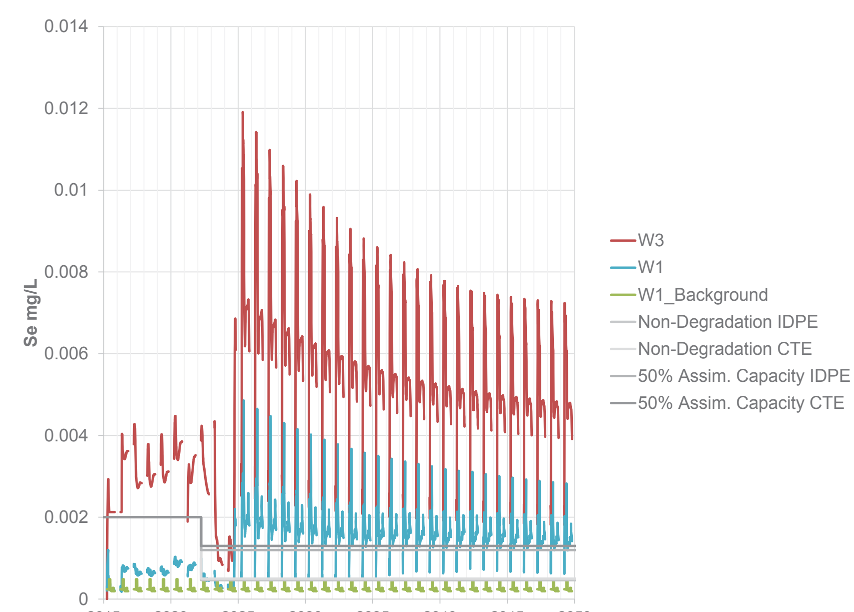


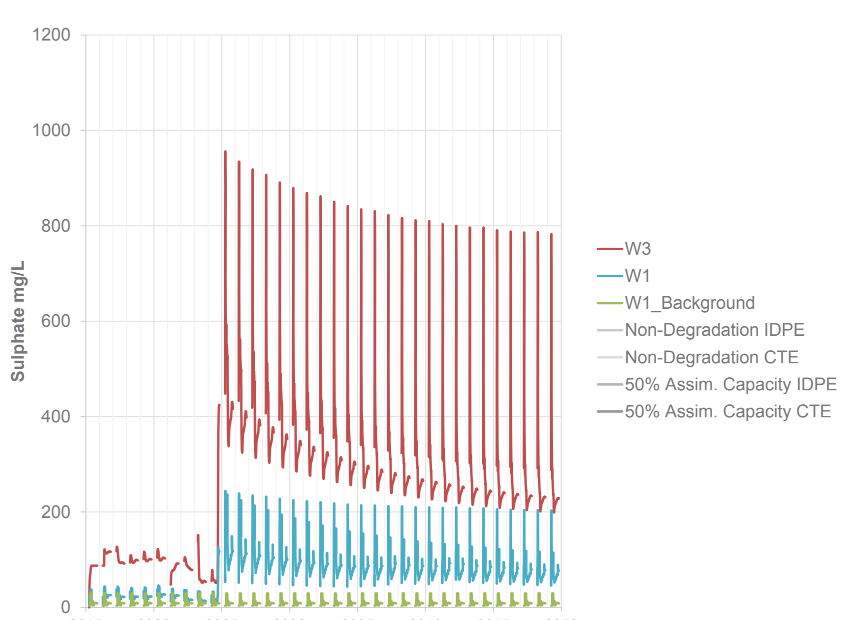


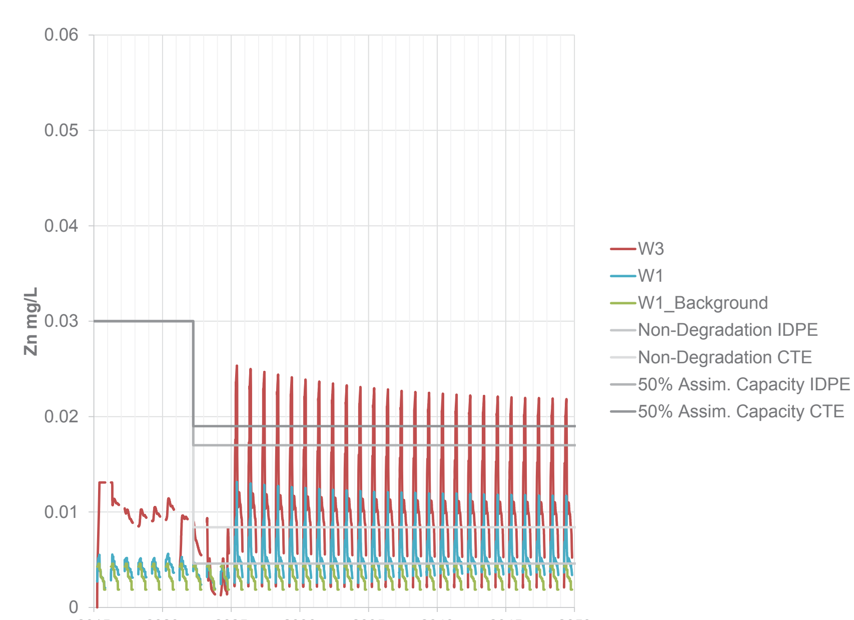












Source: P:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\12_Phase_VII_Files\Model Results\!Model_Results_WC_PhaseVII_WT_Scenario5_REV02_knk.pdf
Model: Minto_2017_1CM002.024_Rev71_SRJ_KNK, 2018/02/06, KNK

Appendix B: Water and Load Balance Source Terms

DSTSF Source Terms

	Expected Case	Worst Case
	mg/L	mg/L
Ag-D	0.00002	0.0001
Al-D	0.01	0.069
Ammonia	0.12	0.98
As-D	0.0005	0.0009
Cd-D	0.00011	0.00024
Cr-D	0.001	0.002
Cu-D	0.094	0.32
Fe-D	0.089	0.39
Mo-D	0.007	0.038
Na-D	24	46
Ni-D	0.0018	0.005
Nitrate	22	84
Nitrite	0.12	2.5
Se-D	0.0039	0.014
Sulphate	120	200
Zn-D	0.005	0.01

POX Ore Tailings Source Term (High Sulphate)

	Expected Case	Worst Case
	mg/kg	mg/kg
Ag-D	0.000016	0.00002
Al-D	0.036	0.097
Ammonia	6.3	20
As-D	0.00049	0.0018
Cd-D	0.000074	0.00016
Cr-D	0.00024	0.00048
Cu-D	0.0052	0.032
Fe-D	0.024	0.049
Mo-D	0.097	0.097
Na-D	250	660
Ni-D	0.0032	0.0032
Nitrate	52	150
Nitrite	3.8	3.8
Se-D	0.032	0.032
Sulphate	2300	4300
Zn-D	0.0024	0.0066

Sulphide Ore Tailings Source Term

	Expected Case	Worst Case
	mg/kg	mg/kg
Ag-D	0.0000041	0.0000082
Al-D	0.016	0.066
Ammonia	1.5	2.8
As-D	0.00017	0.00019
Cd-D	0.0000034	0.0000052
Cr-D	0.000041	0.00041
Cu-D	0.00046	0.00087
Fe-D	0.0041	0.0041
Mo-D	0.04	0.047
Na-D	58	84
Ni-D	0.00061	0.0011
Nitrate	16	22
Nitrite	0.59	1.5
Se-D	0.0074	0.0093
Sulphate	160	300
Zn-D	0.00041	0.002

Waste Rock Volume-based Source Terms

	Expected Case	Worst Case
	mg/m3/yr	mg/m3/yr
Ag-D	0.0005	0.0005
Al-D	0.55	4
Ammonia	1.7	5.7
As-D	0.012	0.025
Cd-D	0.00035	0.0018
Cr-D	0.025	0.025
Cu-D	0.45	1.2
Fe-D	7	26
Mo-D	0.067	0.16
Na-D	250	550
Ni-D	0.025	0.064
Nitrate	150	940
Nitrite	1.1	7.5
Se-D	0.034	0.22
Sulphate	1400	4800
Zn-D	0.12	0.22

Note: load distributed over the year based on the mean hydrograph

Waste Rock Area-based Source Terms

	Expected Case	Worst Case
	mg/L	mg/L
Ag-D	0.000062	0.000062
Al-D	0.068	0.49
Ammonia	0.22	0.71
As-D	0.0015	0.0031
Cd-D	0.000043	0.00023
Cr-D	0.0031	0.0031
Cu-D	0.055	0.15
Fe-D	0.87	3.2
Mo-D	0.0083	0.02
Na-D	31	68
Ni-D	0.0031	0.0079
Nitrate	19	120
Nitrite	0.14	0.92
Se-D	0.0042	0.027
Sulphate	170	600
Zn-D	0.015	0.028

Pit Walls

	Expected Case	Worst Case
	mg/yr	mg/yr
Ag-D	7,700	20,000
Al-D	73,000,000	140,000,000
Ammonia	0	0
As-D	390,000	1,100,000
Cd-D	9,900	49,000
Cr-D	160,000	700,000
Cu-D	2,300,000	6,000,000
Fe-D	8,400,000	25,000,000
Mo-D	1,400,000	5,800,000
Na-D	0	0
Ni-D	120,000	550,000
Nitrate	0	0
Nitrite	0	0
Se-D	290,000	550,000
Sulphate	3,300,000,000	6,600,000,000
Zn-D	740,000	3,500,000

Note: load distributed over the year based on the mean hydrograph

Underground East Source Terms

	Expected Case	Worst Case
	mg/L	mg/L
Ag-D	0.00002	0.00002
Al-D	0.0045	0.016
Ammonia	0.044	0.21
As-D	0.0005	0.0016
Cd-D	0.00001	0.000024
Cr-D	0.00097	0.001
Cu-D	0.0002	0.0031
Fe-D	0.04	3
Mo-D	0.001	0.007
Na-D	110	150
Ni-D	0.001	0.0011
Nitrate	0.023	0.052
Nitrite	0.053	0.27
Se-D	0.0001	0.00098
Sulphate	800	1200
Zn-D	0.005	0.027

Underground South Source Terms

	Expected Case	Worst Case
	mg/L	mg/L
Ag-D	0.00002	0.000031
Al-D	0.011	0.024
Ammonia	18	91
As-D	0.0016	0.0043
Cd-D	0.000017	0.00028
Cr-D	0.001	0.001
Cu-D	0.0074	0.067
Fe-D	0.012	0.076
Mo-D	0.018	0.042
Na-D	36	84
Ni-D	0.0023	0.0082
Nitrate	35	180
Nitrite	1.4	7.7
Se-D	0.00048	0.0044
Sulphate	370	1200
Zn-D	0.0061	0.058

Upper and Lower Minto Creek Background Water Quality

Month	Ag-D	Al-D	Ammonia	As-D	Cd-D	Cr-D	Cu-D	Fe-D	Mn-D	Mo-D	Ni-D	Nitrate	Nitrite	Se-D	Sulphate	Zn-D
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Hg	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.00001	0.0053	0.005	0.00041	0.000035	0.0005	0.0011	0.094	0.034	0.0015	0.0005	0.32	0.0025	0.00043	24	0.0025
February	0.00001	0.021	0.006	0.00033	0.000064	0.0005	0.015	0.049	0.0071	0.0014	0.0005	0.29	0.0025	0.00034	12	0.0083
March	0.00001	0.0031	0.0067	0.00039	0.000005	0.0005	0.0012	0.012	0.0042	0.0011	0.0005	0.2	0.0025	0.00031	23	0.0025
April	0.0000087	0.038	0.012	0.00028	0.000031	0.00059	0.0041	0.15	0.041	0.00078	0.00084	0.035	0.015	0.00021	3.7	0.004
May	0.00001	0.05	0.06	0.00042	0.000024	0.0005	0.0039	0.36	0.095	0.00061	0.0013	0.031	0.0036	0.00018	29	0.0043
June	0.0000071	0.026	0.062	0.00047	0.000018	0.00055	0.0017	0.2	0.055	0.0011	0.0013	0.1	0.015	0.00037	14	0.0038
July	0.0000088	0.02	0.048	0.00061	0.000015	0.00059	0.002	0.32	0.068	0.001	0.0013	0.12	0.0091	0.00021	4.4	0.0032
August	0.000018	0.02	0.033	0.00063	0.000012	0.00063	0.0021	0.36	0.085	0.00096	0.0014	0.11	0.008	0.00021	9.2	0.0031
September	0.000009	0.02	0.024	0.00058	0.000016	0.00084	0.0017	0.36	0.079	0.00083	0.0016	0.046	0.0038	0.00027	9.5	0.0027
October	0.0000086	0.013	0.034	0.0005	0.000015	0.00044	0.0013	0.28	0.089	0.00095	0.0011	0.087	0.021	0.0002	8.6	0.002
November	0.00001	0.01	0.051	0.001	0.000011	0.00059	0.0013	1.7	1.1	0.0011	0.0017	0.12	0.005	0.00016	8.4	0.0025
December	0.00001	0.005	0.021	0.00054	0.0000065	0.0005	0.0017	0.046	0.068	0.001	0.00095	0.086	0.0025	0.0003	36	0.0025

Minto North Background Water Quality

Month	Ag-D	Al-D	Ammonia	As-D	Cd-D	Cr-D	Cu-D	Fe-D	Mn-D	Mo-D	Ni-D	Nitrate	Nitrite	Se-D	Sulphate	Zn-D
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Hg	mg/L	mg/L	mg/L	mg/L	mg/L
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000005	0.041	0.038	0.00038	0.000027	0.00022	0.0026	0.13	0.0073	0.00038	0.00099	0.02	0.005	0.00009	0.5	0.0034
May	0.000005	0.028	0.0065	0.00038	0.0000085	0.0003	0.0024	0.16	0.0093	0.00046	0.0012	0.02	0.005	0.00013	0.5	0.0025
June	0.000005	0.014	0.019	0.00038	0.000006	0.0003	0.0019	0.097	0.0035	0.00082	0.001	0.06	0.005	0.00015	5.9	0.0018
July	0.000005	0.018	0.022	0.00042	0.00001	0.00033	0.0019	0.082	0.0017	0.00083	0.001	0.048	0.005	0.00015	3.2	0.0012
August	0.000005	0.022	0.02	0.00056	0.000007	0.0004	0.0019	0.2	0.0021	0.00086	0.0013	0.062	0.005	0.00013	2.8	0.00096
September	0.00002	0.019	0.02	0.00043	0.0000065	0.00035	0.0019	0.17	0.0067	0.00084	0.0012	0.042	0.005	0.00013	5.4	0.0011
October	0.000005	0.016	0.0093	0.00039	0.00001	0.0002	0.0016	0.11	0.0064	0.00085	0.00098	0.09	0.005	0.00017	6.8	0.0007
November	0.0000025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C: Minto Mine 2016 Water Balance Update

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Memo

To:	Deborah Flemming, Ryan Herbert	**Client:**	Minto Explorations Ltd.
From:	Soren Jensen, Kaitlyn Kooy	**Project No:**	1CM002.024
Cc:	Dylan MacGregor (SRK)	**Date:**	March 28, 2017
Subject:	2016 Water Balance and Water Quality Model Summary for the Minto Mine Site		

1 Introduction and Background

This memorandum provides a summary of the 2016 water balance and water quality model updates for the Minto Mine site. The update covers the period January 1, 2016 through December 31, 2016.

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 2016 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 2018 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 between October 2015 and December 2016 along with precipitation data from the regional station at Carmacks, YT (Climate ID: 2100301)[1], which is located 77 km Southwest of the Minto Mine. In the past, the meteorological station at Pelly Ranch (Climate ID 2100880)[1] located 25 km north of Minto was used as a regional reference station. However, the published data record from Pelly Ranch ends in March 2015 so the Carmacks Station was used instead.

Approximately 242 mm of precipitation was collected at the Mine site in the 2016 hydrological year, which was nearly identical to the annual precipitation of 243 mm measured in 2015. A 242 mm annual total precipitation roughly corresponds to a 1 in 15 dry year.

[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]**	**Carmacks Ranch[B] (Climate ID 2100301)**
		mm/month	mm/month	mm/month
2015	Oct	14.7	27.7	n/a
2015	Nov	14.3	7.1	n/a
2015	Dec	9.5	11.5	n/a
2016	Jan	9.1	11.7	7.5
2016	Feb	6.9	7.8	12.2
2016	Mar	2.6	3.3	5.0
2016	Apr	14.7	14.7	13.1
2016	May	39.3	31.5	28.5
2016	Jun	30.2	22.2	17.1
2016	Jul	74.7	68.2	94.9
2016	Aug	46.0	35.9	26.1
2016	Sept	18.5	17.8	9.6
2016	Oct	6.7	9.8	8.4
2016	Nov	24.2	13.6	14.4
2016	Dec	7.4	14.1	17.5
SUM Hydrological Year, Nov. 2015 to Oct. 2016		273	242	256

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.

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 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 1 shows monthly precipitation recorded by the two gauges as well as total precipitation recorded at Carmacks.

The total annual precipitation measured by the two gauges at Minto differ by 12%. Both gauges at Minto are within 6% of the total precipitation measured at Carmacks on an annual basis. The precipitation measured by the Geonor gauge at Minto was considered more reliable than the tipping bucket gauge and was therefore used for the hydrological analysis.

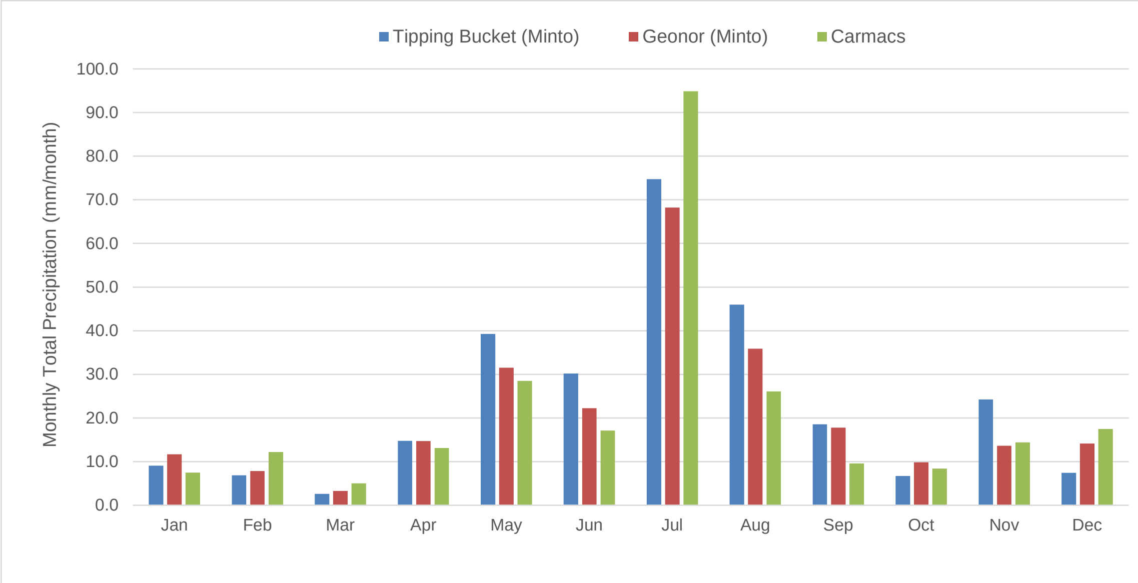

Figure 1: 2015 Monthly Total Precipitation Measurements at Minto and at Carmacks in 2016

2.2 Snow Course Data

Snow course surveys were completed at the three established snow survey stations at the Mine site in 2016. Table 2 shows a summary of the snow survey data (i.e. an average of the results from the three stations) from 2009 to 2016. 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. In April and May 2016, approximately 260,000 m^3 of surface runoff was collected from catchments at the Mine site upstream of the Water Storage Dam. This volume corresponds to roughly 25 mm of runoff, which was slightly greater than the estimated 22 mm of runoff observed in 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
2016	40.7	19.0	80.3	42.3	23.0	80.7	15.5	n/a	n/a

Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2016_Water_Balance_Update\MintoSnowMaster_2016.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) or the Area 2 Pit Tailings Management Facility (A2PTMF). Since November 2012, the MPTMF has also been used for subaqueous deposition of tailings. Deposition of mine water and tailings (subaqueous) to the A2PTMF commenced in April 2015.

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.

  In 2016, water collected at W15 was routed to the Main Pit TMF in early spring (March and most of April). Between April 27 and October 3, water from W15 was routed to the WSP. Approximately 50% of the catchment that report to W15 is covered by waste rock. Therefore, it is notable that water quality parameter concentrations are low enough that the water is suitable for discharge to Quarry Creek.

- W35a sump: collects surface runoff from the minimally disturbed southern catchments. Water collected at W35a in 2016 was piped to the Mai Pit in early April. From April 14 to October 3 the water was conveyed to the WSP. The remainder of the year the W35 water was routed to the Main Pit.

- W62 sump (formerly known as W36 or W37 sump): collects surface runoff and seepage from the mill valley, including contributions from the Dry Stack Tailings Storage Facility. Water collected at the W62 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 2016 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 2016, the water inventory in the MPTMF was reduced by approximately 180,000 m^3, while the water inventory in A2PTMF increased by roughly 530,000 m^3. The increase in water inventory in the A2PTMF roughly corresponds to the volume of pore water in the sub-aqueously deposited tailings in 2016. The WSP water inventory was reduced by about 15,000 m^3 between January 1 and December 31, 2016.

Table 4 shows a summary of the 2016 water balance for the Mine site. The total surface runoff collected on site was estimated to be 590,000 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 30,000 m^3 of groundwater, the total site-wide yield was estimated at about 620,000 m^3 for the year. The total catchment upstream of the Water Storage Dam measures approximately 1,040 ha. Therefore, 620,000 m^3 of runoff from 1,040 ha gives a unit yield of approximately 60 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 2016 (hydraulic year) the estimated total precipitation was 242 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:

$$\textit{Annual Yield/ Total Annual Precipitation} = \textit{Runoff Coefficient} \rightarrow \quad 60\ mm/243\ mm = \boldsymbol{0.25}$$

The calculated value for the annual site-wide runoff coefficient is slightly higher but close to the interpolated coefficient of 0.22. Overall, the agreement with site-wide runoff coefficients 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/	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
Year	m^3	m^3/month	BCM/month	m^3	m^3/month	BCM/month	m^3	m^3/month
Jan-16	4,108,000	-81,000	0	1,024,000	83,000	45,000	82,000	-3,000
Feb-16	4,027,000	-175,000	0	1,152,000	147,000	38,000	79,000	-2,000
Mar-16	3,852,000	-211,000	0	1,337,000	160,000	47,000	77,000	10,000
Apr-16	3,641,000	90,000	0	1,544,000	42,000	44,000	87,000	18,000
May-16	3,731,000	-29,000	0	1,629,000	23,000	49,000	105,000	55,000
Jun-16	3,702,000	28,000	0	1,702,000	-5,000	41,000	160,000	18,000
Jul-16	3,730,000	-28,000	0	1,737,000	52,000	45,000	177,000	23,000
Aug-16	3,702,000	-44,000	0	1,835,000	54,000	47,000	200,000	7,000
Sep-16	3,658,000	90,000	0	1,936,000	13,000	44,000	207,000	-85,000
Oct-16	3,749,000	67,000	0	1,993,000	-4,000	45,000	122,000	-48,000
Nov-16	3,815,000	63,000	0	2,034,000	-18,000	42,000	74,000	-3,000
Dec-16	3,878,000	46,000	0	2,058,000	-18,000	37,000	70,000	-4,000
Jan-17	3,924,000			2,077,000			67,000	
SUM		**-183,000**	**-**		**529,000**	**524,000**		**-15,000**

Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2016_Water_Balance_Update\2016 Water Balance Update REV00 KNK.xlsx

Notes:

A – on the first day of the month.

Table 4: Water Balance Summary of the Minto Mine Site, 2016 (Jan to Dec)

	Units	Main Pit TMF	Area 2 Pit TMF	WSP
Volume Change 2016 (water + tailings)	m^3	-183,000	1,053,000	-15,000
Tailings Deposited, total	BCM	-	524,000	-
Water Volume Change 2016	m^3	-183,000	529,000	-15,000
Estimated Groundwater Inflow	m^3	-	30,000	-
Total Water Inventory Increase in 2016	**m^3**	364,000		
Total Water Discharged to Minto Creek	m^3	254,000		
Total Site-Wide Yield in 2016	**m^3**	**617,000**		

Source: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2016_Water_Balance_Update\2016 Water Balance Update REV00 KNK.xlsx

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 since the last source term update. 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 2 to Figure 5. No significant changes in geochemistry were observed in the properties of the materials produced in 2016 compared to similar materials produced in prior years. Therefore, no further evaluation of 2016 solid phase geochemistry was warranted.

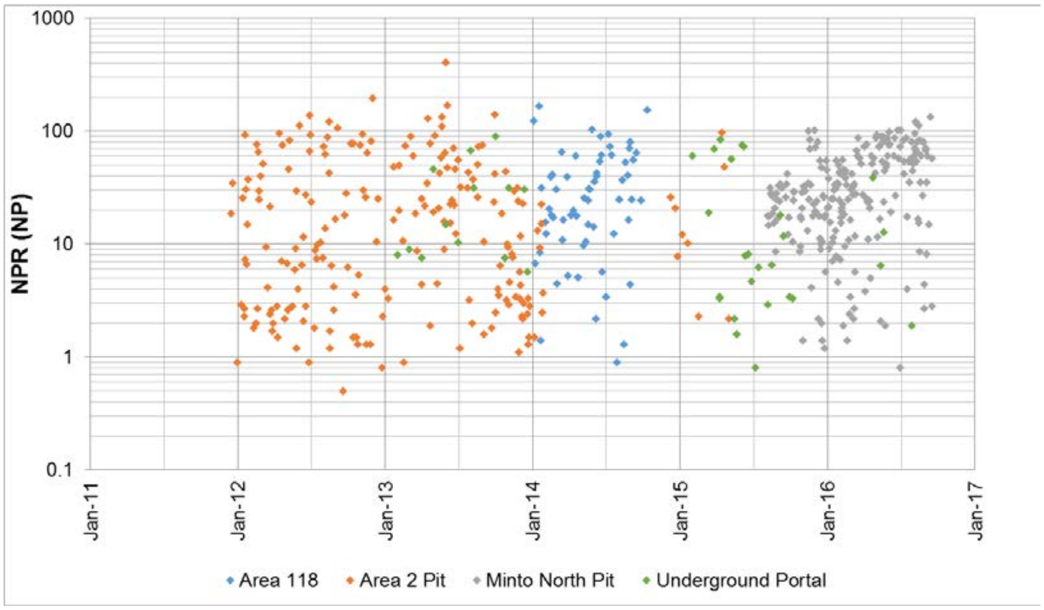

Figure 2: Waste Rock Neutralization Potential Ratio over Time

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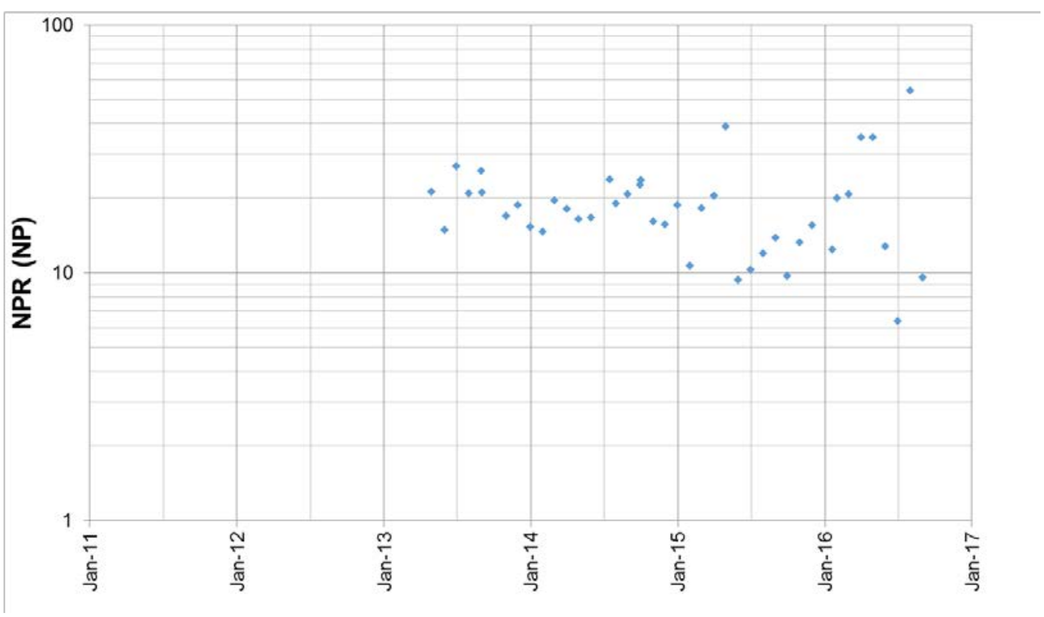

Figure 3: Tailings Neutralization Potential Ratio over Time

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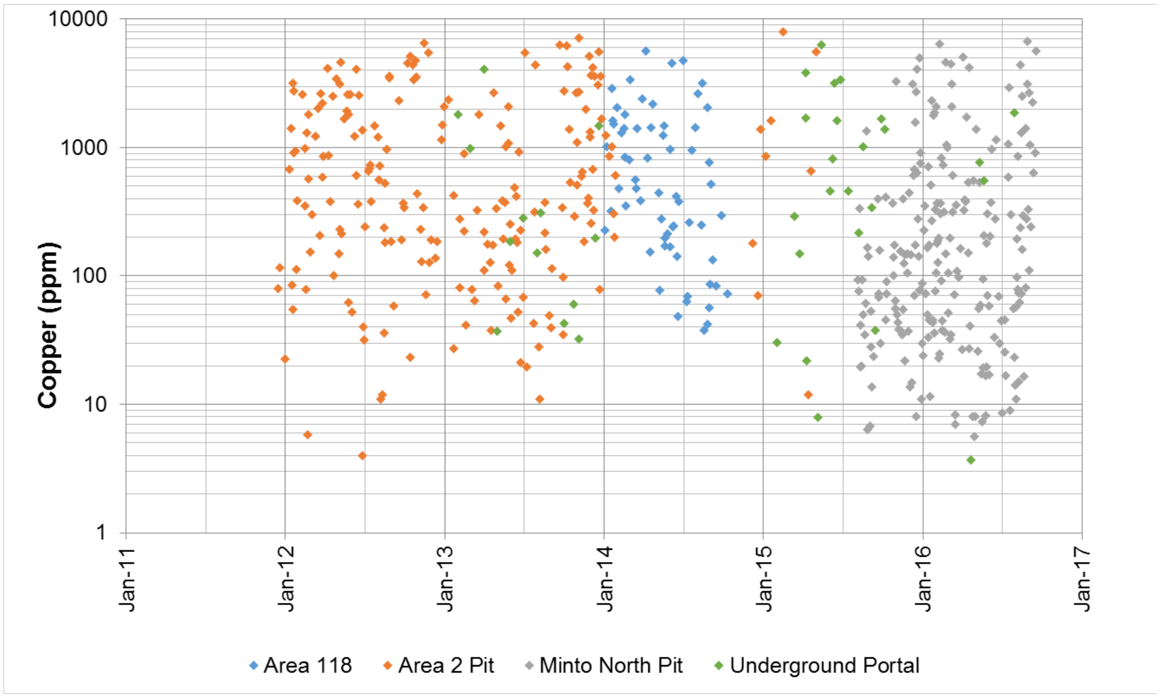

Figure 4: Waste Rock Copper Concentration over Time

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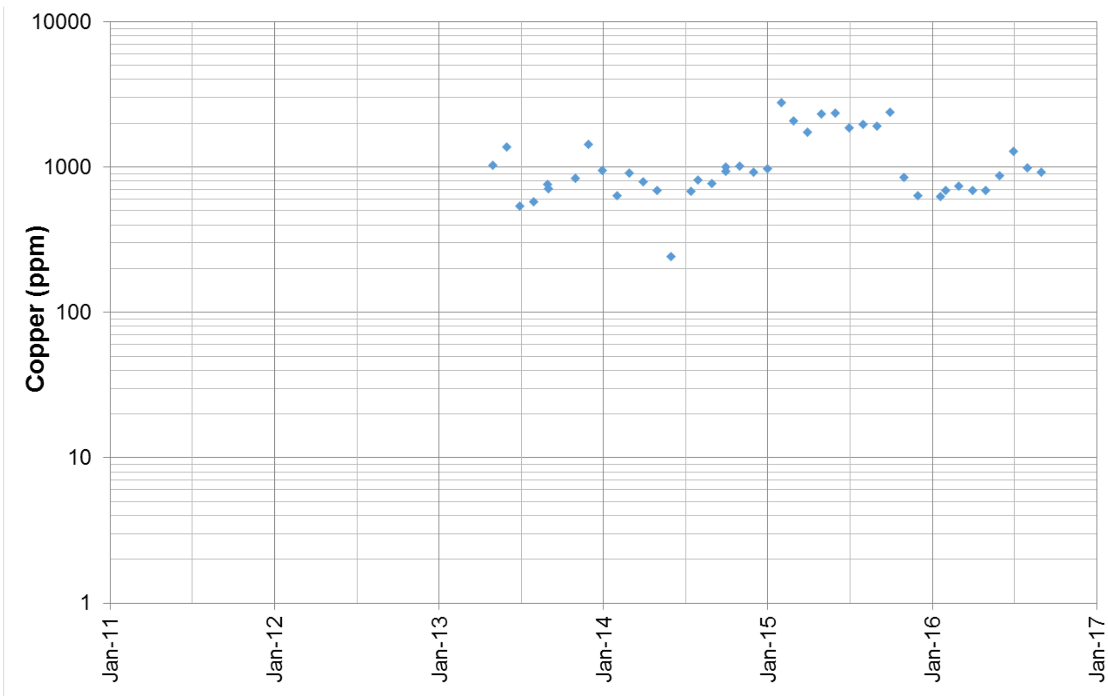

Figure 5: Tailings copper concentration over time

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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.

The Best Estimate and Reasonable Worst Case source terms were updated to include data to 2016 for comparison to the existing source terms. It was found that the updated source terms differed only marginally from the source terms used historically. Therefore, for consistency the 2013 DSTSF source terms will be used in the 2016 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 2015 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 50th percentile dissolved concentrations at W15 until 2015 and the Reasonable Worst Case waste rock source term was the 95th percentile dissolved concentrations from W15 until 2015.

The Best Estimate and Reasonable Worst Case source terms were updated to include data collected in 2016. Similar to the DSTSF source terms, the updated waste rock source terms differed only marginally from the source terms used historically. The 2015 waste rock source terms were therefore deemed acceptable and will be used in the 2016 Updated Water Balance and Water Quality Model for consistency.

3.2.3 Source Term – Tailings Slurry

A review of the mill influent water quality (reclaim water from the MPTMF, W12) and mill effluent water quality (Mill Thickener, W14) revealed that in 2015 and 2016 the processing of ore contributed greater loadings than in previous years. In light of this, the tailings slurry source term for the 2016 Updated Water Balance and Water Quality Model was updated as follows:

- Best Estimate source term: 50th percentile dissolved concentrations from W14 from 2015 and 2016 data only;
- Reasonable Worst Case source term: 95th percentile dissolved concentrations from W14 from 2015 and 2016 data only

However, the adjusted source terms for tailings slurry were not able to account for the greater-than-expected increase in parameter concentrations in the MPTMF. Similarly, adjustment of the waste rock source terms within limits of observed seepage concentrations were also not able to explain the concentration changes. One possible explanation for the additional observed load is that it is flushed from pit walls and waste rock as it is submerged by the rising water in the A2PTMF. This “first flush” effect is commonly observed and is caused by the buildup of weathering products as waste rock is exposed to the atmosphere for a period of time before becoming inundated. Once the A2PTMF has filled to capacity, this term is expected to become negligible. Ongoing monitoring and updates of the load balance will reveal whether flushing is indeed responsible for the additional loadings or if some other loading source not related to seepage or runoff characterized to date is the cause.

3.3 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 2016, 2018, and post-closure (best estimate and worst case) along with concentrations measured in 2016. Table 8 and 9 show revised model predictions of water quality in the MPTMF for 2016, 2018 and post-closure. Predictions for 2018 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 2016 and ended on 1 January 2045, at which point concentrations in the model roughly have reached steady state.

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 2016 are comparable to the revised model predictions using best estimate source terms (Table 6). The favorable 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 2016 (Table 8) when the additional “first flush” load is included in the model. Water quality model predictions using reasonable worst case source terms are generally higher than measured median and maximum concentrations, with the exception of dissolved copper. Median and maximum measured dissolved copper concentrations were both marginally 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 A2PTMF 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 2017.

Table 5: WSP Water Quality Model Predictions and Measured Concentrations in 2016, Best Estimate

		WUL Effluent Limits	WSP Measured Water Quality (Station W16)	Modelling Predictions of Quality in WSP (Station W16)		
Year		(QZ14-031)	2016	2016	2018	Post-Closure
			Median	Median	Median	Median
Ammonia	mg/L	0.75	0.04	0.069	0.057	0.19
$N\text{-}NO_2$	mg/L	0.18	0.033	0.034	0.022	0.053
$N\text{-}NO_3$	mg/L	27.3	4.8	3.2	2	1.2
Ag-Dissolved	mg/L	0.0003	0.00001	0.000018	0.000013	0.000036
Al-Dissolved	mg/L	0.3	0.0066	0.034	0.032	0.14
As-Dissolved	mg/L	0.015	0.00034	0.00059	0.00048	0.0013
Cd-Dissolved	mg/L	0.0014[a]	0.0000075	0.000021	0.00002	0.000049
Cr-Dissolved	mg/L	0.003	0.0001	0.00093	0.00069	0.0015
Cu-Dissolved	mg/L	0.06/0.039[b]	0.018	0.012	0.0084	0.025
Fe-Dissolved	mg/L	3.3	0.027	0.37	0.31	0.49
Pb-Dissolved	mg/L	0.012	0.00005	0.00019	0.00015	0.00035
Mo-Dissolved	mg/L	0.219	0.0036	0.0021	0.0014	0.0076
Ni-Dissolved	mg/L	0.33	0.00066	0.0014	0.0012	0.002
Se-Dissolved	mg/L	0.006	0.0014	0.00084	0.00057	0.0025
Zn-Dissolved	mg/L	0.09	0.0013	0.005	0.0042	0.0081

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 6: WSP Water Quality Model Predictions and Measured Concentrations in 2016, Reasonable Worst Case

		WUL Effluent Limits (QZ14-031)	WSP Measured Water Quality (Station W16)		Modelling Predictions of Quality in WSP (Station W16)					
Year			2016		2016		2018		Post-Closure	
			Median	Max	Median	Max	Median	Max	Median	Max
Ammonia	mg/L	0.75	0.04	0.31	0.16	0.23	0.11	0.21	0.31	0.41
$N\text{-}NO_2$	mg/L	0.18	0.033	0.094	0.17	0.26	0.11	0.24	0.1	0.13
$N\text{-}NO_3$	mg/L	27.3	4.8	5.7	20	30	12	29	3.4	4.5
Ag-Dissolved	mg/L	0.0003	0.00001	0.00002	0.000061	0.000089	0.00004	0.000085	0.00012	0.00019
Al-Dissolved	mg/L	0.3	0.0066	0.029	0.11	0.15	0.08	0.14	0.36	0.63
As-Dissolved	mg/L	0.015	0.00034	0.00088	0.00087	0.0011	0.00063	0.0011	0.0027	0.0047
Cd-Dissolved	mg/L	0.0014[a]	0.0000075	0.000017	0.000067	0.000095	0.000048	0.00009	0.00018	0.00029
Cr-Dissolved	mg/L	0.003	0.0001	0.001	0.0015	0.002	0.001	0.0019	0.0031	0.0049
Cu-Dissolved	mg/L	0.06/0.039[b]	0.018	0.026	0.029	0.043	0.019	0.041	0.062	0.089
Fe-Dissolved	mg/L	3.3	0.027	0.07	0.78	1.1	0.56	1	1.2	1.5
Pb-Dissolved	mg/L	0.012	0.00005	0.0002	0.00019	0.00025	0.00015	0.00024	0.001	0.0019
Mo-Dissolved	mg/L	0.219	0.0036	0.0051	0.0044	0.0063	0.0028	0.006	0.018	0.03
Ni-Dissolved	mg/L	0.33	0.00066	0.001	0.0024	0.0031	0.0017	0.003	0.0041	0.0058
Se-Dissolved	mg/L	0.006	0.0014	0.0016	0.004	0.006	0.0026	0.0057	0.0084	0.012
Zn-Dissolved	mg/L	0.09	0.0013	0.0063	0.0078	0.011	0.0059	0.01	0.016	0.025

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: MPTMF Water Quality Model Predictions and Measured Concentrations in 2016, Best Estimate

		WUL Effluent Limits (QZ14-031)	MPTMF Measured Water Quality (Station W12)	Modelling Predictions of Quality in MPTMF (Station W12)		
Year			2016	2016	2018	Post-Closure
			Median	Median	Median	Median
Ammonia	mg/L	0.75	3.0	3.3	2.4	0.027
$N\text{-}NO_2$	mg/L	0.18	1.5	1.7	0.91	0.0057
$N\text{-}NO_3$	mg/L	27.3	26	22	18	0.14
Ag-Dissolved	mg/L	0.0003	0.00001	0.000037	0.000045	0.000045
Al-Dissolved	mg/L	0.3	0.011	0.13	0.18	0.15
As-Dissolved	mg/L	0.015	0.00045	0.0011	0.0015	0.0015
Cd-Dissolved	mg/L	0.0014[a]	0.000016	0.000038	0.000055	0.000048
Cr-Dissolved	mg/L	0.003	0.0001	0.0016	0.0018	0.002
Cu-Dissolved	mg/L	0.06/0.039[b]	0.025	0.017	0.029	0.031
Fe-Dissolved	mg/L	3.3	0.01	0.21	0.39	0.64
Pb-Dissolved	mg/L	0.012	0.00005	0.00035	0.00042	0.00043
Mo-Dissolved	mg/L	0.219	0.081	0.09	0.052	0.0061
Ni-Dissolved	mg/L	0.33	0.0017	0.0026	0.0025	0.0023
Se-Dissolved	mg/L	0.006	0.015	0.015	0.011	0.0023
Zn-Dissolved	mg/L	0.09	0.0037	0.008	0.0094	0.01

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 2016, Reasonable Worst Case

		WUL Effluent Limits (QZ14-031)	MPTMF Measured Water Quality (Station W12)		Modelling Predictions of Quality in MPTMF (Station W12)					
Year			2016		2016		2018		Post-Closure	
			Median	Max	Median	Max	Median	Max	Median	Max
Ammonia	mg/L	0.75	3	4.7	3.9	7.1	3.5	4.6	0.03	0.03
$N\text{-}NO_2$	mg/L	0.18	1.5	4.3	1.9	2.5	1.4	1.7	0.0099	0.011
$N\text{-}NO_3$	mg/L	27.3	26	29	34	45	45	49	0.65	0.78
Ag-Dissolved	mg/L	0.0003	0.00001	0.00002	0.00008	0.000096	0.00013	0.00014	0.00018	0.0002
Al-Dissolved	mg/L	0.3	0.011	0.018	0.27	0.34	0.42	0.44	0.43	0.46
As-Dissolved	mg/L	0.015	0.00045	0.0005	0.0021	0.0026	0.0031	0.0032	0.0031	0.0033
Cd-Dissolved	mg/L	0.0014[a]	0.000016	0.000034	0.00012	0.00014	0.0002	0.0002	0.00022	0.00024
Cr-Dissolved	mg/L	0.003	0.0001	0.001	0.0026	0.0031	0.0035	0.0038	0.0041	0.0045
Cu-Dissolved	mg/L	0.06/0.039[b]	0.025	0.053	0.039	0.05	0.073	0.078	0.082	0.091
Fe-Dissolved	mg/L	3.3	0.01	0.022	0.49	0.59	1	1.1	1.8	2
Pb-Dissolved	mg/L	0.012	0.00005	0.0002	0.00092	0.0011	0.0013	0.0013	0.001	0.0011
Mo-Dissolved	mg/L	0.219	0.081	0.087	0.098	0.13	0.071	0.087	0.018	0.019
Ni-Dissolved	mg/L	0.33	0.0017	0.0025	0.0038	0.0046	0.0049	0.0052	0.0055	0.006
Se-Dissolved	mg/L	0.006	0.015	0.017	0.019	0.028	0.019	0.022	0.011	0.013
Zn-Dissolved	mg/L	0.09	0.0037	0.0061	0.013	0.015	0.018	0.019	0.021	0.023

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.

4 Closing

The summary of the 2016 Updated Water Balance and Water Quality Model for the Minto Mine was prepared in support of annual reporting. SRK would be pleased to address any questions or comments.

Appendix D: Pit Water Quality Analysis and Source Term Update – Minto Mine

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Memo

To:	Ryan Herbert, Minto Explorations Ltd.	**Client:**	Minto Explorations Inc.
From:	Kaitlyn Kooy	**Project No:**	1CM002.044
Cc:	Dylan MacGregor, Soren Jensen, SRK Consulting	**Date:**	February 7, 2018
Subject:	Pit Water Quality Analysis and Source Term Update- Minto Mine		

1 Introduction

Since the end of 2016, sulphate concentrations in the Main Pit and Area 2 Pit water have been increasing faster than observed previously. The resulting high sulphate concentrations have not been observed at any other surface source at the mine site and it has been unclear as to what has caused the observed sulphate concentrations. SRK was retained to review potential sources of sulphate at the Minto mine and to analyze the available data to determine a plausible explanation for the high concentrations of sulphate in the Main Pit and Area 2 Pit water. Results have contributed to the update of source terms used in the Water and Load Balance Model. This memo summarizes the methodology and results of that analysis and the source term update.

2 Background

Steadily increasing sulphate concentrations have been observed in the Main Pit and Area 2 Pit water since the end of 2016. Both pits are Tailings Management Facilities (TMFs). Currently slurry tailings are pumped to the Area 2 Stage 2 Pit and reclaim water is drawn from the Main Pit free water. Water is actively pumped from Area 2 Pit to the Main Pit to maintain sufficient water levels in the Main Pit to meet the reclaim volume requirements. Since the Area 2 Pit became a TMF concentrations of most water quality constituents are higher in the Area 2 Pit than the Main Pit, as the Main Pit has a much larger catchment area and thus a much larger contribution of diluting waters. An aerial photograph taken in August of 2017 indicates that there is currently very little free water maintained in Area 2 as most of the free water is being pumped to the Main Pit.

Figure 1 shows the sulphate concentrations in both pits over time, and Figure 2 shows the sulphate concentrations in the pits over a shorter time scale (from 2015 to 2017). As shown in these figures, sulphate concentration in the pits has slowly increased from 2013 to mid-2016 before rising rapidly from the end of 2016 to the present day to a maximum of approximately 2000 mg/L in the Area 2 Pit and 1500 mg/L in the Main Pit. It appears as though sulphate levels in the Main Pit have decreased slightly in November and December of 2017 but it is unclear at this time if it will continue to trend downward.

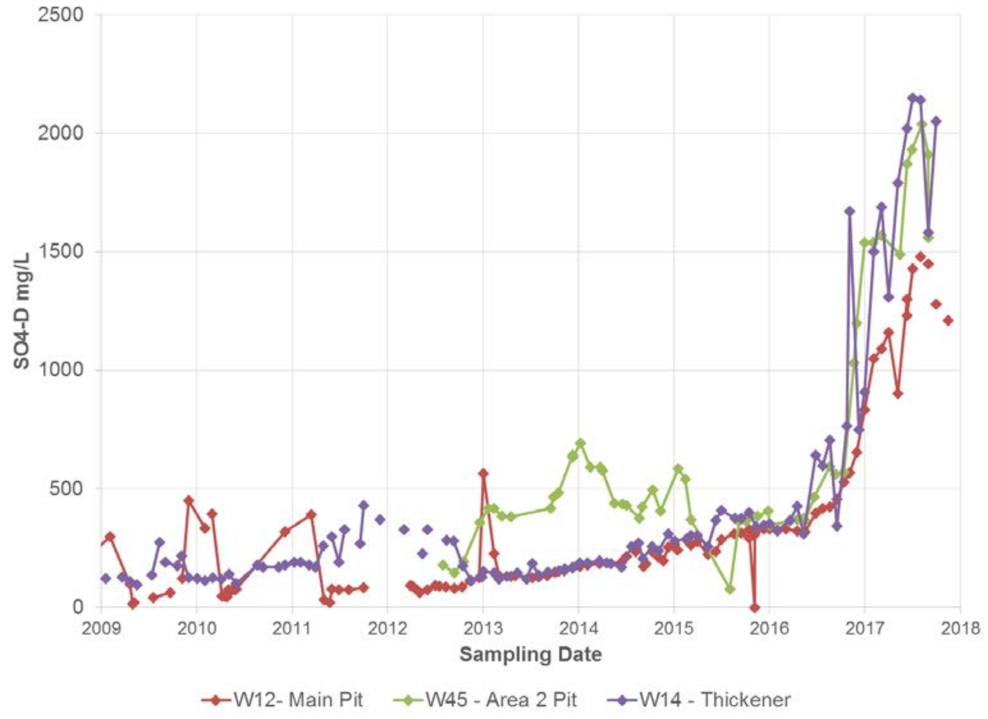

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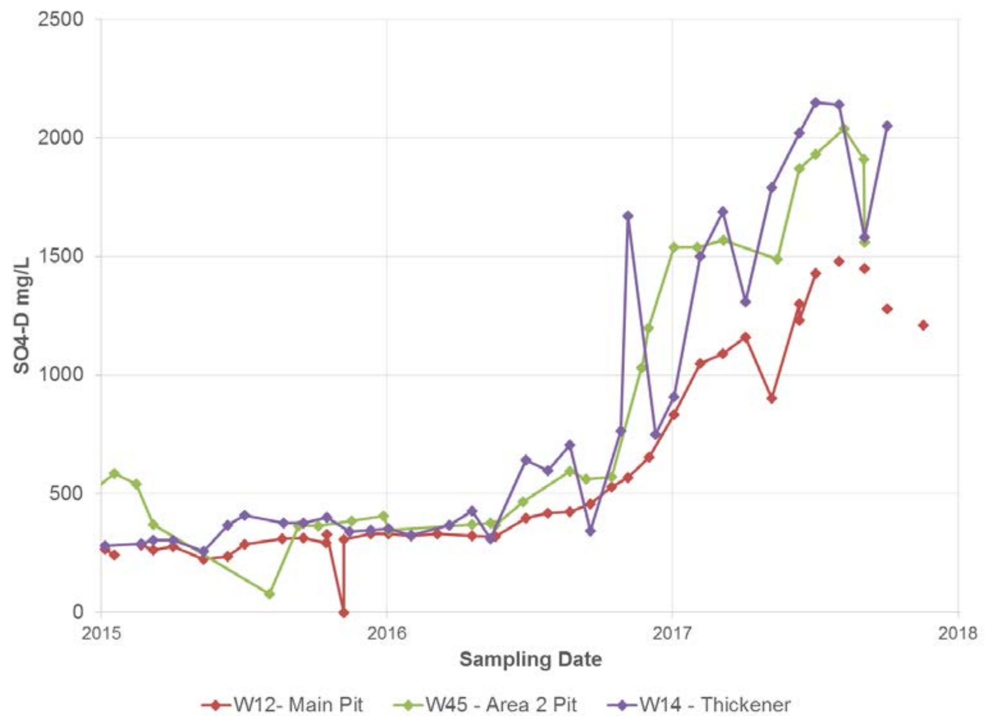
Figure 1: Sulphate Concentrations in Main Pit, Area 2 Pit, and Tailings Thickener over time



Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Raw Data Timeseries\MP_A2_Tails_UG_W15_TimeSeries_REV01_knk

Figure 2: Sulphate Concentrations in Main Pit, Area 2 Pit, and Tailings Thickener from 2015 to 2017

Since very little dilution occurs in the Area 2 Pit and the sulphate concentration is very similar to that of the tailings thickener, the Area 2 Pit sulphate loading was not directly analysed and is considered as a pathway only for sulphate loading in the Main Pit for the purposes of this analysis. The increase in sulphate load in the Main Pit is the primary focus of this analysis. Table 1 summarizes the annual sulphate loading in the Main Pit for the last three years.

Table 1: Sulphate Load in the Main Pit

Year	Sulphate Load in Main Pit at Year End (kg)(1)	Annual Load Increase (kg)
2015	437,324	135,694
2016	955,458	518,261
2017	1,601,671	639,825
	Total	**1,293,781**

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\ Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Notes:

1. Includes sulphate load in free water only

3 Previous Source Terms

Past water quality predictions at the site have been based on source terms generated either by measured water quality at the site or laboratory humidity cell tests (e.g. SRK 2016). The source terms used in previous versions of the Water and Load Balance Model did not forecast the sulphate concentrations that are currently being observed in the open pits. In past modeling efforts in general, there were two groups of source term inputs that were modelled as reporting to the Main Pit and Area 2 Pit: contact water runoff and tailings slurry.

Table 2 below shows the modelled sulphate load reporting to the open pits annually from runoff based on the previous sulphate source terms (SRK 2016). The Best Estimate case is based on source terms generated from the 50th percentile of measured data while the Worst Case scenario is based on source terms generated from the 95th percentile of measured data.

Load from the tailings slurry is highly variable and is discussed further in Section 5.5.

Table 2: Typical Annual Main Pit Loading based on previous source terms

Catchment Type	Total Area Contributing Runoff to Open Pits (ha)	Annual Sulphate Runoff Load - Best Estimate (kg)	Annual Sulphate Runoff Load - Worst Case (kg)
Undisturbed	661	23,503	23,503^(1)
Pit Walls	44	6,653	13,312
Dry Stack Tailings Storage Facility	19	2,285	3,808
Waste rock	196	43,039	157,401
Ore Stockpiles	13	1,735	1,788
Mill Area	16	870	1,740
Total	**950**	**78,085**	**201,552**

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Notes:

1. The Best Estimate undisturbed source term is used for both the Best Estimate and Worst Case predictions

4 Sulphate Source Review: Pre-Screening

There are several possible sources of increased sulphate loading at the site. In order to determine the most likely source that is increasing sulphate loading in the system, all the potential sulphate sources were compiled and a screening process was carried out to eliminate sources that are unlikely to produce sulphate load of any appreciable magnitude. Table 3 summarizes all of the potential sources and whether or not they were carried forward for further evaluation. Figure 3 shows the simplified water routing assumptions used for the purposes of this analysis.

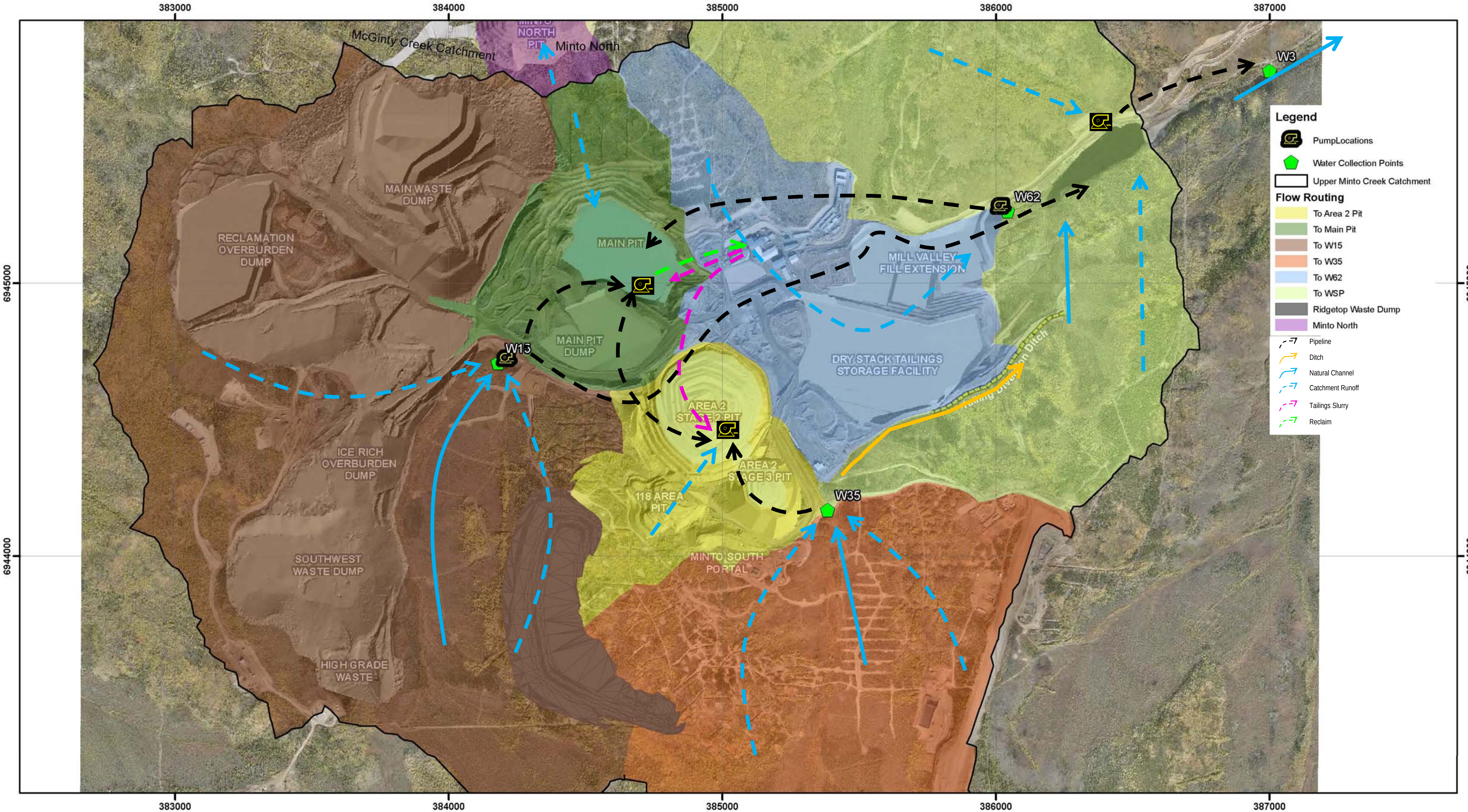
The sources carried forward from pre-screening are the Pit Walls, Main Pit SAT Dump, Underground Dewatering, Tailings Slurry, and Unsaturated Tailings.

Table 3: Potential Sulphate Source Pre-Screening Summary

Potential Sulphate Source	Water Quality Directly Monitored	Observed Increase in Sulphate Concentration	Carried Forward	Comment
Southwest Waste Dump	Yes	No	No	Measured water quality at station W15 and waste rock dump seepage monitoring points indicates no increase in sulphate levels
Main Pit SAT	No	N/A	**Yes**	Not currently monitored, cannot confirm sulphate loading from source has not increased
Dry Stack Tailings Storage Facility	Yes	No	No	Measured water quality at station W8A indicates no increase in sulphate levels
Unsaturated Tailings	No	N/A	**Yes**	Not currently monitored, cannot confirm sulphate loading from source has not increased
Pit Walls	No	N/A	**Yes**	Not currently monitored, cannot confirm sulphate loading from source has not increased
Tailings Slurry	Yes	Yes	**Yes**	Measured water quality in the tailings thickener (station W14) indicates an increase in sulphate concentration
Underground Mine	Yes	Yes	**Yes**	Measured water quality in the underground dewatering sump (station UG1) indicates an increase in sulphate concentration
Ore Stockpile	Yes	No	No	Measured water quality at ore stockpile seepage monitoring points indicates no increase in sulphate levels

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Figure 3: Water Routing Assumptions



Note: Adapted from Figure 4.2 in SRK (2018)

5 Potential Sulphate Source Evaluation

5.1 Main Pit SAT

The Main Pit SAT that is stored within the South Wall Buttress and overlying Main Pit Dump has been identified as a potential source because the dump contains waste rock with neutralization potential ration values less than three and there is currently no data available on the water quality of seepage from the dump.

The Main Pit SAT will be covered or submerged under water in the Main Pit at closure. There are currently no seepage monitoring locations (or opportunities) at the dump. There is no data available directly regarding the water quality of runoff from the dump and seepage from the dump may be a contributing factor to the higher than expected levels of sulphate in the open pits. The previous source terms regarding the water quality of the SAT seepage are based upon measured water quality at station W15.

Due to the lack of water quality data directly from the Main Pit SAT, the evaluation of the material as a potential sulphate source is conceptual in nature and has been undertaken in a conservative manner. In general, the evaluation methodology involved making estimates of maximum potential sulphate concentrations (based on industry experience at other mines) and then calculating the maximum possible sulphate load that may originate from the Main Pit SAT based on applying the mean annual precipitation (MAP) and assumed runoff coefficient to the assumed catchment area. A summary of the evaluation is shown in Table 4.

Table 4: Maximum Potential Load from Main Pit SAT Dump

Annual Runoff Volume (m^3)(1)	Maximum Potential Sulphate Concentration (mg/L)(2)	Maximum Annual Load (kg)
7,400	6,000	44,400

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Notes:

1. Based on a SAT catchment area of 7.45 ha, mean annual precipitation (MAP) of 329 mm and runoff coefficient of 0.3
2. Maximum potential sulphate concentration is not expected but is used to conservatively illustrate the scale of potential loading

In general it was concluded that the Main Pit SAT is unlikely to be the sole source of sulphate in the open pits since its potential annual maximum load is less than a tenth of the sulphate loading observed in the Main Pit over the first eight months of 2017. If a more in-depth refinement of this scoping evaluation is carried out in future, it is expected that the estimate of the maximum possible annual load would decrease. The volume of runoff that comes into contact with the dump is too small to carry the load required to reasonably explain the increase of sulphate in the Main Pit and Area 2 Pit.

5.2 Open Pit TMF Unsaturated Tailings

The Main Pit TMF and Area 2 TMF unsaturated tailings have been identified as a potential sulphate source because residual sulphide minerals contained in unsaturated tailings can weather over time and generate sulphate-bearing seepage, and there is currently no data available on the water quality of runoff from the unsaturated tailings beaches.

Based on the aerial photograph taken in August of 2017, the Main Pit currently has a relatively small tailings beach (approximately 11,000 m^2 as of August 2017) while the Area 2 Pit TMF has a relatively larger tailings beach (approximately 35,000 m^2 as of August 2017) since most of the free water in the Area 2 Pit is pumped to the Main Pit.

Similar to the Main Pit SAT evaluation, the unsaturated tailings evaluation remains conceptual and conservative due to the limited data available. The same methodology was used in this case by adopting estimates of maximum potential sulphate concentrations (based on industry experience at other mines) and calculating the maximum possible sulphate load that may originate from the unsaturated tailings in the Main Pit TMF and Area 2 Pit TMF. A summary of the calculations is shown in Table 5.

Table 5: Maximum Potential Plausible Load from Unsaturated Tailings in the Pit TMFs

Annual Main Pit and Area 2 Pit Tailings Beach Runoff Volume (m^3)(1)	Maximum Potential Sulphate Concentration (mg/L)(2)	Maximum Annual Load (kg)
4,600	6,000	27,600

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Notes:

1. Based on the combined Main Pit and Area 2 Pit tailings beach catchment area of 4.6 ha approximated from the August 2017 aerial photo, mean annual precipitation (MAP) of 329 mm and runoff coefficient of 0.3
2. Maximum potential sulphate concentration is not expected but is used to illustrate the scale of potential loading

In general it was concluded that the unsaturated tailings is unlikely to be the sole source of sulphate in the open pits. The volume of runoff that comes into contact with the tailings beach is too small to carry the load required to reasonably explain the increase in sulphate concentrations in the Main Pit and Area 2 Pit. If a more in-depth refinement of this scoping evaluation is carried out in future, it is expected that the estimate of the maximum possible annual load would decrease.

5.3 Underground Mine

The underground mine dewatering was identified as a potential source because the observed water quality data had not previously been analysed in detail for this purpose, and sulphate concentrations in the underground mine discharge have increased markedly since mid-2016.

Water reporting to the underground workings is actively pumped or trucked to either the Main Pit or the Area 2 Pit. Water Quality is monitored monthly at the underground sump. Sulphate levels had remained relatively steady at approximately 500 mg/L prior to May 2016. After May 2016 sulphate concentrations in the underground mine have increased to a maximum of approximately 1500 mg/L. Figure 4 shows the sulphate concentrations in the underground mine over time as well as the sulphate concentrations in the Main Pit and Area 2 Pit for comparison.

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Raw Data Timeseries\MP_A2_Tails_UG_W15_TimeSeries_REV01_knk

Figure 4: Sulphate Concentrations in Main Pit, Area 2 Pit, and the Underground Mine from 2015 to 2017

The pumping rates from the underground mine sump is tracked, and that allowed the annual sulphate load conveyed from the underground mine to the pits to be calculated. The annual load from the underground is shown in Table 6.

Table 6: Total Water Volume and Sulphate Load Pumped from Underground from 2015 to 2017

Year	Annual Water Pumped (m^3)$^{(1)}$	Annual Sulphate Load (kg)$^{(2)}$
2015	39,492	19,035
2016	23,728	23,074
2017$^{(3)}$	39,632	49,532
Total	**102,852**	**91,641**

Source: \\VAN-SVR0\Projects\01_SITES\Minto\!020_Site_Wide_Data\Water Management Data\Underground_Dewatering_Rev00_knk.xlsm

Notes:

1. Daily pumping rates derived from monthly averages and added together to calculate the annual total
2. Load calculated from interpolated sulphate concentration records
3. 2017 totals are up to and including data from August 8, 2017

The pumping rates from the underground to the pits are relatively low. A groundwater discharge to the pits from underground is unlikely as the underground workings are lower elevation than the pit bottoms, and groundwater modelling carried out on both the Main Pit and the Area 2 Pit indicates that there is a net seepage from the each pit to groundwater of tens of m^3/day (SRK 2018). It would be reasonable to conclude that there is no inflow of elevated sulphate groundwater seeping into the pits as the net groundwater flux is outward seepage from the open pits.

Is it important to note that the increase in sulphate in the underground mine occurred prior to the increase in sulphate in either of the open pits. This timing relationship makes it unlikely that the elevated levels of sulphate in the pits could have caused the elevated sulphate levels in the underground mine.

In general is was concluded that the underground mine discharge is a relatively small source of sulphate in the system, and cannot account for all of the sulphate inventory increase in the open pits.

5.4 Open Pit Walls

The open pit walls have been identified as a potential source of sulphate loading because there is currently no data available on the water quality of runoff from the pit walls. The current assumptions regarding the water quality of the pit walls runoff are based upon laboratory humidity cell tests that had been carried out in 2013.

Due to the lack of water quality data from the pit walls runoff, the evaluation of the pit walls as a potential sulphate source is conceptual and conservative in nature. In general, the evaluation methodology involved making estimates of maximum potential sulphate concentrations (based on the 95th percentile values observed in Minto waste rock seepage) and then calculating the maximum possible sulphate load that may originate from the pit walls based on the mean annual precipitation (MAP) and assumed runoff coefficient. A summary of the evaluation is shown in Table 7.

Table 7: Maximum Potential Load from Open Pit Walls

Annual Main Pit and Area 2 Pit Runoff Volume (m^3)(1)	Maximum Potential Sulphate Concentration (mg/L)(2)	Maximum Annual Load (kg)
32,400	600	19,440

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Sulphate_Review_Compliled_Calcs_Rev00_knk

Notes:

1. Based on a mean annual precipitation (MAP) of 329 mm and runoff coefficient of 0.3
2. Maximum potential sulphate concentration is not expected but is used to illustrate the scale of potential loading

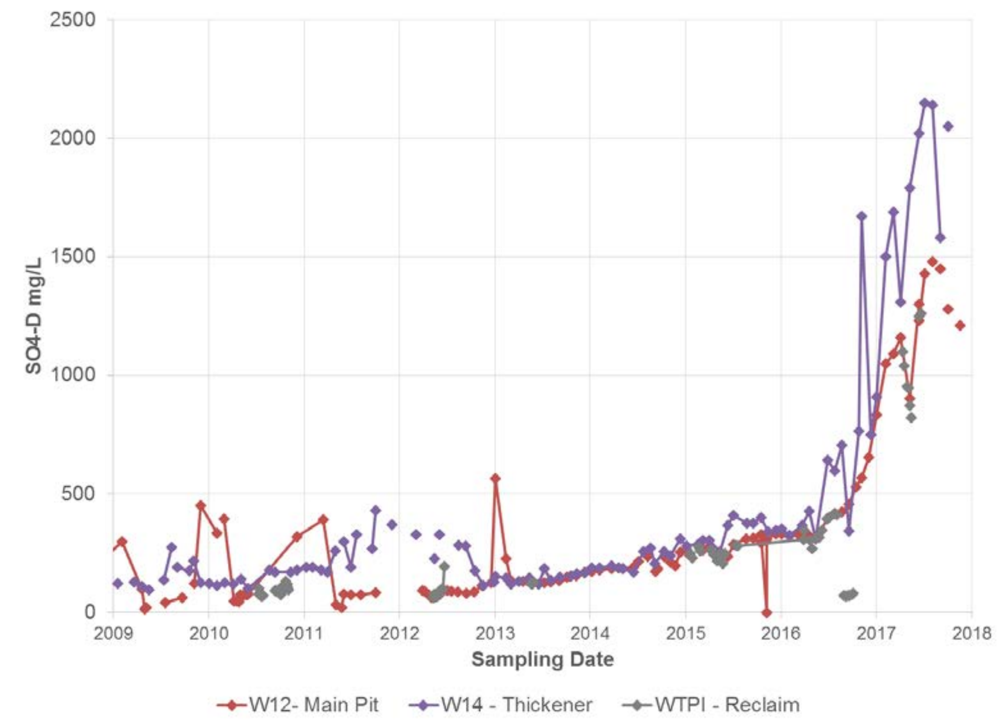
In general it was concluded that the open pit walls are unlikely to be the sole source of sulphate in the open pits since the maximum possible annual sulphate load is less than a twentieth of the sulphate loading observed in the Main Pit in 2017. The volume of runoff that comes into contact with the pit walls is too small to carry the load required to reasonably explain the increase of sulphate in the Main Pit and Area 2 Pit.

5.5 Tailings Slurry

The tailings slurry has been identified as a potential source of sulphate loading because the concentration of sulphate in the tailings thickener has increased significantly since mid-2016 and the tailings slurry water quality significantly influences the water quality in the open pits due to the relatively high volumes of tailings slurry pumped out of the mill.

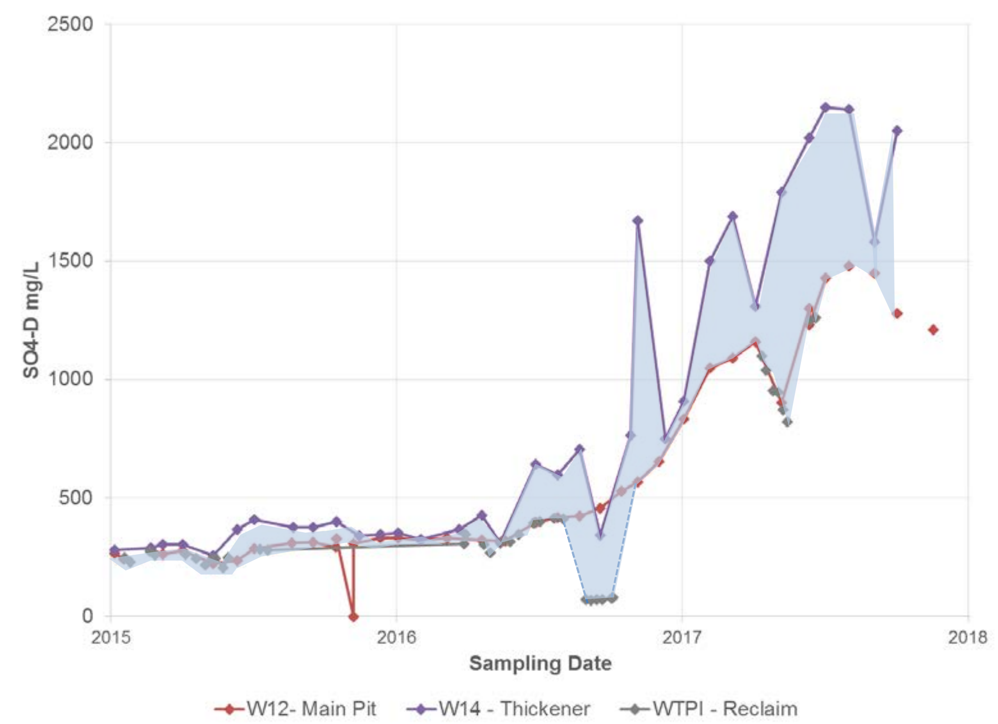
5.5.1 Mill Process Sulphate Loading

Figure 5 shows the sulphate concentration in the Main Pit, Tailings Thickener, and the process water feed tank over time. Mill process water is typically pulled from the Main Pit but there was a brief period of time in the fall of 2016 where treated water from the water treatment plant effluent was used as reclaim water. Figure 6 shows the tailings thickener and reclaim sulphate concentrations from 2015 to 2017 and demonstrates that the difference between the two has increased significantly in 2016 and 2017. The blue shading in Figure 6 highlights this difference and represents the sulphate that is added to the system from the mill.



Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Raw Data Timeseries\MP_A2_Tails_UG_W15_TimeSeries_REV01_knk

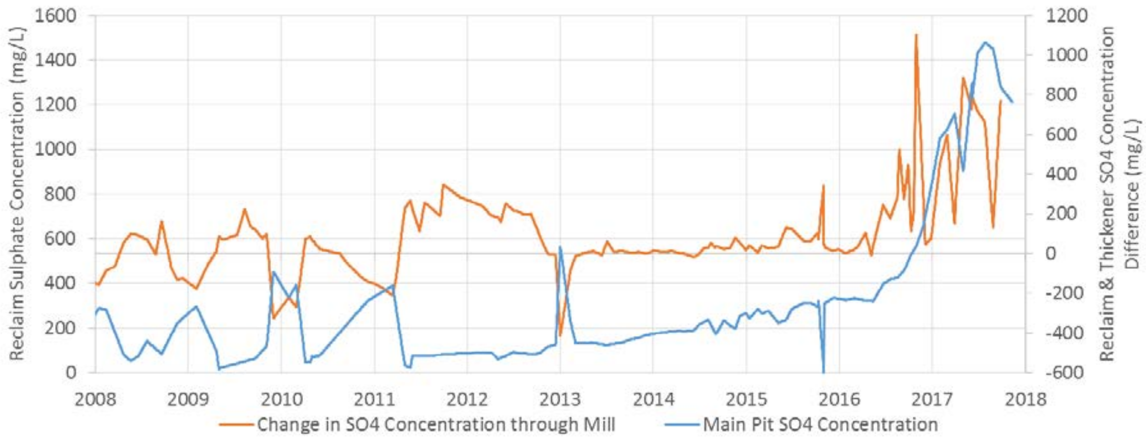
Figure 5: Sulphate Concentrations in Main Pit, Tailings Thickener, and Reclaim Water over time



Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Raw Data Timeseries\MP_A2_Tails_UG_W15_TimeSeries_REV01_knk

Figure 6: Sulphate Concentrations in Main Pit, Tailings Thickener, and Reclaim Water from 2015 to 2017

Figure 7 demonstrates that the higher loading rates in the mill (orange line) coincide with the increase in sulphate concentration in the Main Pit (blue line). The sulphate loading rate in the mill was never previously as high as it was in late 2016 and 2017. Table 8 shows the total additional sulphate load to free water from the tailings slurry from 2015 to 2017.



Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Main_Pit_Mass_Balance_Rev01_knk

Figure 7: Sulphate Concentrations in Reclaim Water and Concentration Change in Mill Tailings Process Water over Time

Table 8: Annual Sulphate Loading to Pits from the Mill since 2015

Year	Annual Sulphate Load Increase in Mill Process (kg)(1)	Assumed load Increase to Tailings Pores (kg)(2)	Annual Sulphate Load Increase to Free Water (kg)3)
2015	135,457	40,490	94,966
2016	398,068	156,335	241,732
2017(4)	588,413	219,654	368,759

Notes:

1. Difference between sulphate load in Main Pit reclaim water and thickener discharge sulphate load
2. Based on the proportion of water that is lost to tailings pores
3. Based on remaining water volume that reports to open water pond (i.e. is not lost to pores)
4. Up to and including August 2017

5.5.2 Sulphide Ore & POX Blend

The type and grade of ore processed in the mill is variable over time. The ore is classified as either sulphide ore or POX (partially oxidized) ore. The degree of oxidation of POX ore is variable and has a variable effect on the water quality of the mill effluent. Figure 8 shows the type of ore milled from 2015 to 2017. Sulphide ore was milled from January to October of 2016 and a blend of sulphide ore and POX was milled in 2015 and from November 2016 to present.

Typically, the milling of purely sulphide ore does not result in high sulphate loading which is evidenced by the record of low sulphate concentrations in the mill effluent. The milling of POX, depending on the grade, can periodically have a significant influence on the water quality of the mill effluent as shown by the 2017 sulphate loading rates.

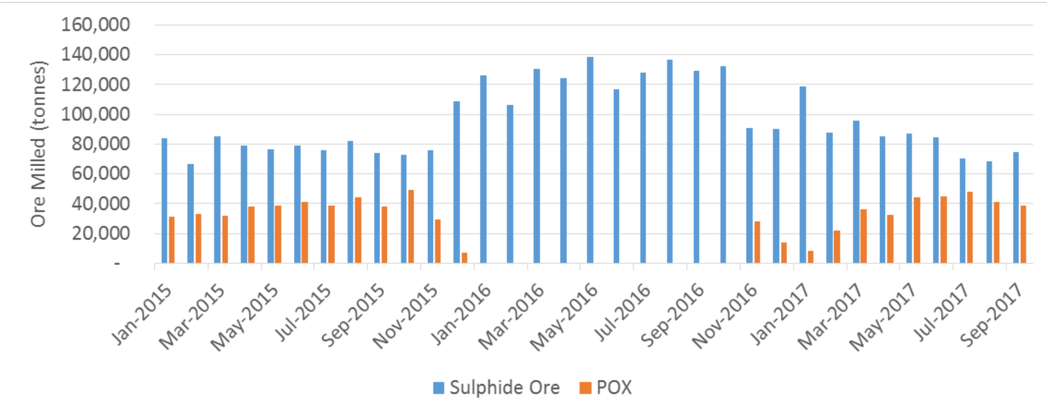


Figure 8: Ore Type Milled from 2015 to 2017

When POX ore is being milled, sodium sulphide is used in the mill process. Figure 9 shows the sodium sulphide use in the mill from 2015 to 2017. Sodium sulphide introduces sulphide ions into the system which eventually oxidize to sulphate in surface water, and therefore represents an imported source of sulphur to the system. However, until that oxidation occurs, the sulphur remains in sulphide form- that sulphur would be reported in a total sulphur analysis, but not in a routine sulphate analysis.

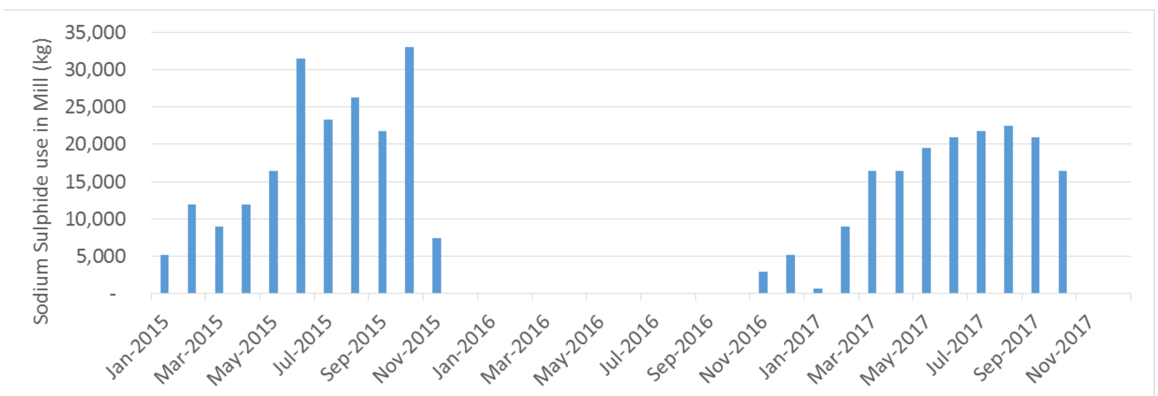


Figure 9: Sodium Sulphide use in the Mill from 2015 to 2017

The introduction of sodium sulphide into the process system in 2015 did not result in any observed increase in sulphate loading in the mill while sodium sulphide use in 2017 coincides with a significant increase in observed sulphate loading. This suggests that the POX being milled in 2015 and 2017 had very different soluble sulphate contents and have responded quite differently to the mill process and addition of sodium sulphide. This is further evidenced by the higher levels of unoxidized total sulphur observed in the tailings thickener, Area 2 Pit, and Main Pit in late 2016 and 2017. Typically the total sulphur observed in the open pits and tailings thickener is nearly entirely in the form of sulphate. However, in late 2016 and 2017 levels of unoxidized sulphur are periodically elevated higher than have been observed previously. Figure 10 shows the concentration of unoxidized sulphur in the tailings thickener, Area 2 Pit, and Main Pit over time. Equation 1 shows the method for calculating unoxidized sulphur.

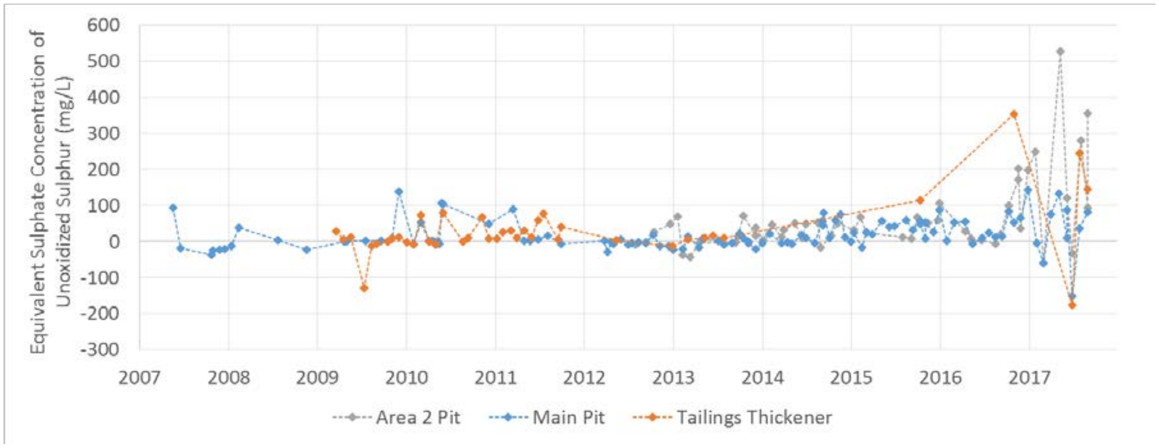


Figure 10: Unoxidized Sulphur Converted to Sulphate Equivalent

Equation 1: Unoxidized sulphur calculation.

$$Sulphur\ Concentration\ x\ \frac{Sulphate\ molar\ mass}{Sulphur\ molar\ mass} - Sulphate\ Concentration = Unoxidized\ Sulphur$$

Unoxidized sulphur appears to decline as the water is pumped from the mill to the Area 2 Pit to the Main Pit. This indicates that there is further additional sulphate generation occurring in the system as sulphur oxidizes. The total sulphur concentration data at the tailings thickener is somewhat limited so further review of the data may provide additional insight as more data becomes available.

The contrast in unoxidized sulphur and sulphate concentration observed in the tailings thickener and open pits in 2015 and 2017, both years where POX was milled, speaks to the variability of the mill ore feed and inherent difficulty in predicting the mill effluent water quality.

5.5.3 Mill Reclaim Residence Time

Currently mill reclaim water is sourced from the Main Pit, slurry tailings are deposited in the Area 2 Pit, and the excess free water in the Area 2 Pit is pumped back to the Main Pit. This circular system has a residence time that is a function of the available free water in the two open pits. Based on the water level record in the open pits, the tailings production schedule, and modelled runoff water volumes, the mill reclaim system residence time has been steadily decreasing since 2015 as water is lost to tailings pores and subaqueous waste rock pores. Figure 11 shows the approximate predicted residence time in the open pit ponds during operations. The available free water and subsequently the residence time in the pits appears to reach a local minimum in early

2017 and then begins to climb. The predicted increase in residence time immediately following the minimum is due to the overall volume in the open pits increasing due to accumulation of runoff and minimal discharge of any water from the system.

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\Waste_Rock\SourceTerm_2017review\Pit Chemistry KNK WORKING\Pit_Source_Proportions_Initial_MP_knk

Figure 11: Predicted Mill Reclaim/TMF System Residence Time

The predicted minimum residence time approximately coincides with the maximum observed sulphate concentration in the Main Pit and Area 2 Pit. The observed sulphate concentration in the open pits is beginning to trend downward as the predicted residence time in the open pits begins to increase. The effects of the higher mill sulphate loading rates observed recently have likely been pronounced by the relatively low pit residence time.

In general it was concluded that the tailings slurry is a significant source of sulphate at the Minto Mine and is highly sensitive to the ore feed and reagents used in the mill process. Water management and residence time in the open pits also has an effect on the water quality

6 Source Term Update

The underground and tailings slurry source terms have been updated to reflect the findings of the analysis and observed current conditions. The other potential sulphate sources reviewed as part of this analysis will not require a source term update as there is no measured data to substantiate any change from previous assumptions.

6.1 Underground Source Term

The underground source terms were generated as follows:

- **South Portal Best Estimate** – 50th Percentile of available water quality data from the underground sump (stations UG1 and W44); applies to Area 118 Underground, Area 2 Underground, and Copper Keel Underground
- **South Portal Worst Case** – 95th Percentile of available water quality data from the underground sump (stations UG1 and W44); applies to Area 118 Underground, Area 2 Underground, and Copper Keel Underground
- **Minto East Best Estimate** – 50th Percentile of available water quality data groundwater monitoring wells with observed elevated sulphate concentrations (stations MW12-05-01, MW12-05-02, MW12-05-03, MW17-12-01, and MW17-12-02); applies to Minto East Underground, Minto East 2 Underground, and Minto North Underground
- **Minto East Worst Case** – 95th Percentile of available water quality data groundwater monitoring wells with observed elevated sulphate concentrations (stations MW12-05-01, MW12-05-02, MW12-05-03, MW17-12-01, and MW17-12-02); applies to Minto East Underground, Minto East 2 Underground, and Minto North Underground

Since the water quality in the groundwater monitoring wells used to generate the Minto East underground source terms are not affected by active underground mining (i.e. do not have nitrogen species concentrations originating from explosive residues) the ammonia, nitrate, and nitrite South Portal source term values were also used for the Minto East underground source term. The underground source terms are provided in Attachment 1.

6.2 Tailings Slurry Source Term

The tailings slurry source terms were generated as follows:

- **Sulphide Ore Source Term Best Estimate** – 50th percentile of monthly average load generated per kg of sulphide ore milled from January to October 2016 (no POX milled during this period)
- **Sulphide Ore Source Term Worst Case** – 95th percentile of monthly average load generated per kg of sulphide ore milled from January to October 2016 (no POX milled during this period)
- **POX Low Sulphate Source Term Best Estimate** – 50th percentile of monthly average load generated per kg of POX ore milled in 2015
- **POX Low Sulphate Source Term Worst Case** – 95th percentile of monthly average load generated per kg of POX ore milled in 2015
- **POX High Sulphate Source Term Best Estimate** – 50th percentile of monthly average load generated per kg of POX ore milled from November 2016 to September 2017
- **POX High Sulphate Source Term Worst Case** – 95th percentile of monthly average load generated per kg of POX ore milled from November 2016 to September 2017

The tailings slurry source terms are provided in Attachment 2.

7 Discussion

The review has identified that the source of the increased sulphate concentration in the Main Pit and Area 2 Pit water is primarily soluble sulphate loadings from POX ore being processed in the mill, and the use of sodium sulphide to process the POX ore. Underground dewatering is also a source of sulphate loading but to a comparatively lesser extent presently; loadings from underground dewatering will increase over the period of mining in Minto East and Minto East 2. The revised sulphide ore, POX ore and underground discharge source terms presented herein should be incorporated into the next update to the Water and Load Balance.

SRK Consulting (Canada) Inc.

Kaitlyn Kooy, EIT
Staff Consultant

reviewed by

Dylan MacGregor, PGeo
Principal Consultant

8 References

SRK Consulting 2016. Water and Load Balance Model Report 2016. Prepared for Minto Explorations Ltd. August 2016.

SRK Consulting 2018. Minto Groundwater Characterization and Hydrogeologic Conceptual Model Update Report. Prepared for Minto Explorations Ltd. January 2018.

Attachment 1: Underground Source Terms

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Memo

To:	File	**Client:**	Minto Explorations Inc.
From:	Kaitlyn Kooy	**Project No:**	1CM002.044
Cc:	Dylan MacGregor, Soren Jensen, SRK Consulting	**Date:**	February 5, 2018
Subject:	Underground discharge source terms: 2018 update		

1 Cover

Updated source terms for the underground discharge were developed in 2018, as described in SRK (2018).

SRK Consulting 2018. Pit Water Quality Analysis and Source Term Update. Prepared for Minto Explorations Ltd. February 2018

South Portal Underground Discharge Source Term

	Expected Case	Worst Case
Parameter	**mg/L**	**mg/L**
Ag-D	0.00002	0.0000306
Al-D	0.0106	0.0242
Ammonia	18	91.4
As-D	0.00156	0.00426
Cd-D	0.0000165	0.000275
Cr-D	0.001	0.001
Cu-D	0.00742	0.0673
Fe-D	0.012	0.0758
Mn-D	0.132	0.205
Mo-D	0.0176	0.0419
Ni-D	0.0023	0.00817
Nitrate	35.1	181
Nitrite	1.44	7.65
Se-D	0.000475	0.00441
Sulphate	366	1170
Zn-D	0.00605	0.0583

Minto East Underground Discharge Source Term

	Site Monitoring Data	
	Expected Case	Worst Case
Parameter	mg/L	mg/L
Ag-D	0.00002	0.00002
Al-D	0.0045	0.016
Ammonia*	18	91.4
As-D	0.0005	0.00161
Cd-D	0.00001	0.0000235
Cr-D	0.000965	0.001
Cu-D	0.0002	0.00313
Fe-D	0.0395	3.04
Mn-D	0.713	2.6
Mo-D	0.001	0.00695
Ni-D	0.001	0.00112
Nitrate*	35.1	181
Nitrite*	1.44	7.65
Se-D	0.000101	0.000981
Sulphate	795	1160
Zn-D	0.005	0.0269

*Nitrogen species are based on South Portal water quality

Attachment 2: Tailings Slurry Source Terms

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Memo

To:	File	**Client:**	Minto Explorations Inc.
From:	Kaitlyn Kooy	**Project No:**	1CM002.054
Cc:	Dylan MacGregor, Soren Jensen, SRK Consulting	**Date:**	February 7, 2018
Subject:	Tailings slurry source terms: 2018 update		

1 Cover

Updated source terms for the tailings slurry were developed in 2018, as described in SRK (2018).

SRK Consulting 2018. Pit Water Quality Analysis and Source Term Update. Prepared for Minto Explorations Ltd. February 2018

Tailings Slurry Sulphide Ore Source Terms

	Expected Case	Worst Case
Parameter	mg/kg	mg/kg
Ag-D	0.0000041	0.00000819
Al-D	0.0159	0.0663
Ammonia	1.53	2.77
As-D	0.000172	0.000188
Cd-D	0.00000338	0.00000522
Cr-D	0.000041	0.00041
Cu-D	0.000463	0.00087
Fe-D	0.0041	0.0041
Mn-D	0.0382	0.0649
Mo-D	0.0399	0.0472
Ni-D	0.000606	0.00112
Nitrate	16.2	22.
Nitrite	0.592	1.45
Se-D	0.0074	0.00933
Sulphate	163.	302.
Zn-D	0.00041	0.00205

Tailings Slurry Low Sulphate POX Ore Source Terms

	Expected Case	**Worst Case**
Parameter	**mg/kg**	**mg/kg**
Ag-D	0.0000163	0.0000413
Al-D	0.101	0.194
Ammonia	6.82	15.7
As-D	0.000565	0.00252
Cd-D	0.0000151	0.0000563
Cr-D	0.00122	0.00372
Cu-D	0.00477	0.055
Fe-D	0.0149	0.0659
Mn-D	0.144	0.771
Mo-D	0.166	0.425
Ni-D	0.00159	0.0053
Nitrate	39.3	129.
Nitrite	2.02	3.7
Se-D	0.0356	0.079
Sulphate	438.	1280.
Zn-D	0.0062	0.0186

Tailings Slurry High Sulphate POX Ore Source Terms

	Expected Case	Worst Case
Parameter	**mg/kg**	**mg/kg**
Ag-D	0.0000159	0.0000202
Al-D	0.0359	0.0967
Ammonia	6.3	20.
As-D	0.000489	0.0018
Cd-D	0.0000741	0.000157
Cr-D	0.000243	0.000479
Cu-D	0.00523	0.0324
Fe-D	0.0243	0.0492
Mn-D	1.41	2.29
Mo-D	0.0974	0.0974
Ni-D	0.00325	0.00325
Nitrate	52.	149.
Nitrite	3.83	3.83
Se-D	0.0325	0.0325
Sulphate	2340.	4320.
Zn-D	0.00243	0.00661

Appendix J1
Minto Mine - Operations Adaptive Management Plan 2020-01

Minto Mine

Operations Adaptive Management Plan

2020-01

Prepared by:
Minto Explorations Ltd.
Minto Mine
September 2020

Minto Mine Operations Adaptive Management Plan

First Issue: June 2014
Version History

Version Number	Issue Date	Description and Revisions Made
2014-01	June 2014	First Issue
2015-01	December 2015	Revisions made as per requirements of WUL QZ14-031 and QML-0001
2016-01	May 2016	Revisions made as per AMP comments from the Yukon Government, Selkirk First Nation and QML-0001 conditions
2017-01	January 2017	Revisions made as per Yukon Water Board and Yukon Government review comments.
2017-02	April 2017	Revisions made as per Yukon Water Board Reasons for Decisions (April 3, 2017).
2018-01	NA – retracted prior to approval	Revised thresholds in Monto Creek Surface Water AMP and made minor modifications to AMP responses and groundwater evaluation frequencies.
2020-01	September 2020	Revised thresholds, specific performance thresholds and responses based on observations and recommendations from QP's based on 2017-2019 data.

Table of 2020-01 Revisions

Section Revised	Description of Revision
2.1	• Revision of SPTs and Responses in Table 2-1 o Replace resample within 24 hrs with expedite next sample to reflect weekly sampling frequency and turnaround time for labs o Provide pathways based on QP input to determine when an exceedance is not mine related o Incorporation an additional quick check for SPT 1 and 2 exceedances to review aspects of mining operations with higher potential to impact water quality

Section Revised	**Description of Revision**
	○ Outsource trend analysis to QP's quarterly for SPT1 and SPT2 exceedances and have them screen all SPT3 exceedances when found ○ Give QP's more latitude to determine what type of aquatic risk assessment is needed for more significant exceedances. ○ Formal integration of bioassay testing into SPT's • Revision to Specific Thresholds at W2 in Table 2-2 • Formal integration of bioassay testing into SPT's in Table 2-4
2.2	• Revision of Specific Thresholds for selenium in Table 2-5 based on historical data from MN-0.5 and QP's observation that Se is naturally elevated in the reference arm (west arm) of McGinty Creek • Revision of SPTs and Responses in Table 2-6 ○ Replace resample within 24 hrs with expedite next sample to reflect monthly sampling frequency and turnaround time for labs ○ Provide pathways based on QP input to determine when an exceedance is not mine related ○ Outsource trend analysis to QP's quarterly for SPT1 and SPT2 exceedances and have them screen all SPT3 exceedances monthly ○ Give QP's more latitude to determine what type of aquatic risk assessment is needed for more significant exceedances.
2.3	• Incorporates QP recommendations regarding the use of MW17-08 as the new baseline monitoring well for the Minto catchment. Greater detail is included in section 2.3, but to summarize, QP's do not feel the well is representative of baseline indicator levels. • Revision of SPTs and Responses in Table 2-7 ○ Outsource trend analysis to QP's quarterly for SPT1 and SPT2 exceedances and have them screen all SPT3 exceedances monthly ○ Give QP's more latitude to determine what type of aquatic risk assessment is needed for more significant exceedances

<table>
<tr><th>Section Revised</th><th>Description of Revision</th></tr>
<tr><td></td><td><li style="list-style:none">
Replace resample within 24 hrs with sample as reasonably practical considering the site can sometimes only be accessed by air</td></tr>
<tr><td>2.4</td><td>Revision of SPTs and Responses in Table 2-9
Outsource trend analysis to QP's quarterly for SPT1 and SPT2 exceedances and have them screen all SPT3 exceedances monthly. An SPT3 has been developed to capture significant changes that would require immediate QP review.
Give QP's more latitude to determine what type of aquatic risk assessment is needed for more significant exceedances
Replace resample within 24 hrs with expedite next sample to reflect monthly sampling frequency and turnaround time for labs
Revision to Specific Thresholds in Table 2-10 to include an ST3 based on groundwater loading levels that could cause a WQO exceedance in McGinty Creek using the same methodology used for the ST3 for the Minto catchment</td></tr>
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1 Introduction

1.1 Overview

Minto Explorations Ltd. (Minto) owns and operates the Minto copper mine. Minto Mine is located within Selkirk First Nation (SFN) Category-A Settlement Land (Parcel R-6A), and is approximately 240 km northwest of Whitehorse, Yukon Territory. The Minto mine commenced commercial operations in October 2007.

AMPs are tools used to address uncertainty or conditions beyond those anticipated in mining operations. AMPs outline a range of possible but unexpected outcomes and the responses that will be undertaken to curb possible negative impacts associated with these unexpected situations.

Mining activities are highly managed operations, with very prescriptive and detailed management plans required for both operational control and regulatory approval. More mature mines such as Minto have management plans which benefit from the operational experience at the site, and uncertainty in the range of conditions expected is reduced through this operational experience.

Minto has developed a number of operational management plans which describe the management and response actions for expected conditions at the site. These plans currently include:

- Solid Waste Management Plan;
- Environmental Monitoring, Surveillance, Reporting Plan;
- Wildlife Protection Plan;
- Spill Contingency Plan;
- Sediment and Erosion Control Plan;
- Mine Development and Operations Plan;
- Underground Mine Development and Operations Plan;
- Mill Operations Plan;
- Water Management Plan;
- Tailings Management Plan;
- Waste Rock and Overburden Management Plan;

- Emergency Response Plan;
- Heritage Resources Protection Plan; and
- Reclamation and Closure Plan

This AMP is intended to provide a framework for responses to conditions beyond those expected and identified in these decision-based management plans. Consequently, this AMP addresses a limited range of components.

1.2 Adaptive Management Plan Objectives

An AMP is a management tool wherein a framework is provided to make quick and effective decisions to guide responses to unforeseen events. This document identifies areas of uncertainty within the operational phase of the Minto Mine life and provides an AMP framework for each. For each component the AMP describes monitoring commitments, thresholds, triggers and responses to underperforming elements or emerging risks within the component. The steps laid out in the AMP framework are precautionary, and therefore they provide the confidence that action will be taken before adverse environmental impacts are observed.

1.2.1 Updated AMP Approach

This version of the AMP has been updated to incorporate recommendations and conclusions reached by the Qualified Professionals (QP) engaged to review surface and groundwater monitoring data.

The Minto Mine has matured to a point where operational observations can be used to challenge some of the original assumptions and modelling results used to form the basis for previous versions of the AMP. In order to evolve the structure of this plan to better accommodate the integration of observations and analysis/recommendations from QPs, verbiage associated with the philosophy behind adaptive management and historical reasoning behind previous approaches to thresholds and responses has been moved to the appendix section of the report.

The major changes to the approach for surface and groundwater include:

- Previous versions of the AMP required internal trend analysis when any performance threshold was triggered. Minto has determined that trend analysis and interpretation is more suited to QP's analysis. The QPs have observed that there is often not enough data from a single trigger to establish a trend and that exceedances due to an identified and corrected issue related to operations may not be suitable to include in a trend analysis. Minto has adapted this version of the AMP to have QPs run trends annually for all indicators as per the WUL and quarterly for indicators with SPT 1 and SPT 2 exceedances. QP's will be informed monthly of any SPT 3 or higher exceedances and will complete trend analysis sooner if warranted.

- Previous versions of the AMP listed several methods what could be used to assess the potential impacts of a WQO threshold exceedance on aquatic resources. Minto has condensed the language to give QPs more latitude to tailor the assessment to fit the risk related to the parameter exceeded and the severity and duration of the exceedance.
- Previous versions of the AMP required resampling within 24 hours in response to an exceedance. Minto's observation is that due to the weekly sampling frequency and lag time to receive results it would be more efficient to expedite the next sample. If the next sample has not been sent out, Minto proposes to sample as soon as practical considering there are times when site access is limited.
- Where events are logged as not mine related, a summary of these events will be provided in the Annual Report.
- The following timelines have been developed and are applicable to all response instances in all AMP components:

Response Type	Description	Timeline
Notification	Notification of relevant parties	Within 1 week of receiving results
Review	Initiating review	Within 1 week of receiving results
	QA/QC review (validation protocol);	1 week
Evaluation	Initiate analysis/comparison	Prior to next sampling event/within 1 week of receiving results
Action	Engage a QP	Within 1 week of AMP requirement
	Initiating implementation upon receipt of recommendations	1 month
	Conduct any relevant review/evaluation-type actions	Prior to or during the next sampling event

1.2.2 AMP Components

The following AMP components have been identified as having the potential for unexpected conditions during the operational period for which the Operational Management Plans may not provide adequate mitigation against potential effects to the environment or human health and safety:

- Surface water quality;
- Groundwater quality;
- Water Management, and
- Physical Stability

The specific AMP framework for these components is described in subsequent sections.

Annual Reporting reflects annual changes made to the AMP as the site conditions change. The AMP should be modified whenever unexpected circumstances are encountered and the protocol is implemented or when additional proven science or technology becomes available. The annual review will include a review of the relevant monitored data and AMP elements. Updates, amendments, performance thresholds crossed, and trigger(s) activated will be provided to the appropriate governmental and SFN representatives as required and will be part of the annual report.

Additional reporting is described further in section 3.1.

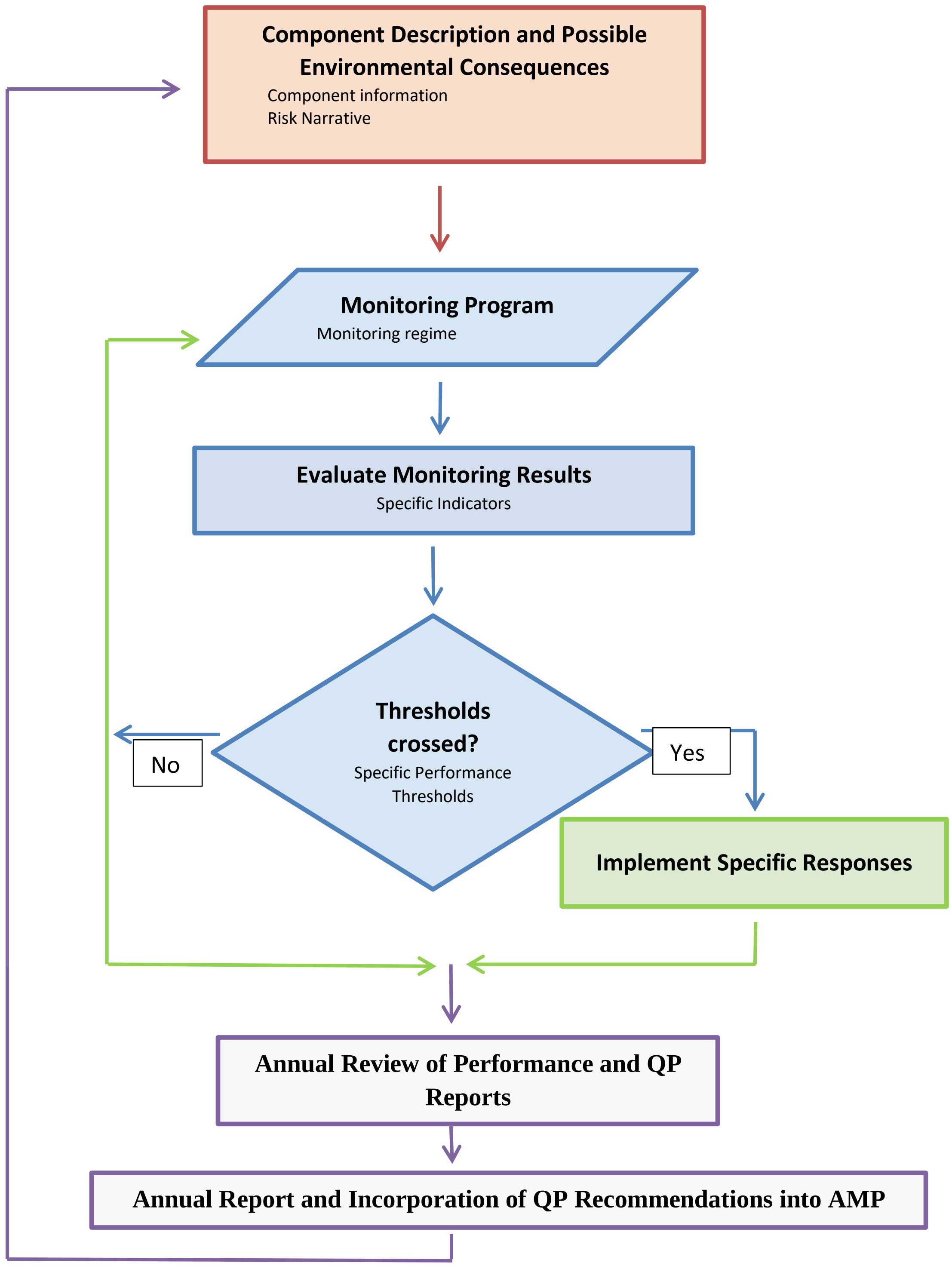

Figure 1-1: Sequential Components of the AMP (Adapted from AECOM 2010)

2 Adaptive Management Plans for Mine Components

2.1 Minto Creek Surface Water Quality

2.1.1 Description

Water Use Licence QZ14-031 identifies the Minto Creek WQO Station as:

- Station W2 during the period when flow is encountered at stations W15 and W35; or
- Station W50 during the period when flow is not encountered at stations W35 and W15.

Clause 11 of the licence identifies the water quality objectives (Table 2-2) for Minto Creek, and states that "any exceedances of these at the defined WQO Station shall trigger the Operations Adaptive Management Plan." The AMP framework in this section ensures that action under the Operational AMP is triggered in advance of exceedances of WQOs at station W2. In the event of the WQO station being W50 (no flow at stations W35 and W15), it is assumed that this would be under winter conditions, and that there will be no contributing flow from the rest of the Minto Creek catchment downstream of the mine. In this case, Minto would adhere to the simple AMP outline listed in tables 2-3 and 2-4.

- The W2 monitoring point near the Yukon River is beyond the final mine water discharge point controlled by Minto
- Station W50 is considered the main control point on Minto Creek, is the last surface monitoring point on the mine site property and is considered a discharge compliance point under the current water licence. Discharging of water from the Minto Creek Mine is sporadic and seasonal.
- Key surface water monitoring locations upgradient of W50 and within the mine footprint are located at W16, W17, W15, W35, and W37.
- Station W3 is downstream of W50 and upstream of most, but not all the unimpacted tributaries that enter Minto Creek. W7 is on a tributary to Minto Creek downstream of W3 and considered a key point to assess natural surface water conditions from tributaries not affected by mine activity.

2.1.2 Risk Narrative

- Increase in contaminant concentrations from the mine causes adverse effects to aquatic resources in the receiving environment (lower Minto Creek) despite adherence to discharge standards.

2.1.3 Specific Indicators, Performance Thresholds, Responses and Adaptions

- The objective of indicators, thresholds and responses is to ensure relevant indicators are paired with conservative thresholds that lead to responses prior to degradation of water quality. Adaptions allow Minto to integrate new information to focus resources on risks related to the mine operations and expend less effort on non-mine related exceedances.
- Indicators, performance thresholds and responses specific to water quality and the monitoring program are provided below in Table 2-1.
- The W2 monitoring point is subject to a broad range of influences from tributaries and catchment areas that are beyond Minto's control.
- Certain parameters at W2 periodically exceed thresholds but analyses by QP's has concluded that most exceedances are not mine related. Specific lines of evidence include:
    - Comparing measurements at W50 and W3. If indicator concentrations are higher at W3 than at W50, impacts from tributaries are likely
    - Comparing measurements at W7 and W3. If indicator concentrations are higher at W7 than at W3, impacts from tributaries are likely
    - Levels of indicators in groundwater. There is significant input from groundwater into Minto Creek. This appears to be the source of the Mo exceedances observed at W2.
- The original specific thresholds for W2 were based on predictions of the expected and worst-case maximum concentrations of selected parameters as well as water quality objectives (WQO's). In response to analysis that non-mine related sources are causing exceedances and that the predicted and worst-case maximum concentrations appear to be low for some indicators, Minto has requested a QP review to determine potential alternative thresholds. The 2018 OAMP changed to 70/85% of WQOs. This approach has continued for 2020 version; however, two values have been updated to be consistent with this approach. Cd was updated based on changes to the CCME Guideline while pH was updated to be a calculated value.
- Previous version of the AMP did not integrate bioassay testing into the SPT's. This has been added in Table 2-4.

The monitoring results that will be evaluated and utilized in this component of the AMP are a requirement of the Surface Water Surveillance Program of the Environmental Monitoring, Surveillance and Reporting Plan (EMSRP) (Minto Explorations Ltd., 2016). The monitoring data will be compared to the specific performance thresholds within a week of receipt of the results.

Table 2-1: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality at Station W2 in lower Minto Creek.

Specific Indicators	Specific Performance Thresholds	Specific Responses
Aqueous Concentrations at Station W2 for the following parameters with water quality objectives Parameters: • NH_4-N • NO_2-N • NO_3-N • pH • Quarterly Bioassay Dissolved • Aluminum • Arsenic • Cadmium • Chromium • Copper • Iron • Lead • Molybdenum • Nickel • Silver • Selenium • Zinc (See Table **2-2** below for specific threshold values)	**Specific Performance Threshold 1** • Exceedance of ST1 value in two consecutive samples (scheduled or re-sample) or first exceedance of ST2 value	**Notification** • Minto Management • Include in scheduled Water Use Licence monthly reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result and re-run/expedite sample if a laboratory error is indicated. Hold next steps until result received. **Evaluation** • Compare with W3, W50 and W7 results or any other sampling data recommended by QPs in previous exceedance investigations • Exceedance data sent to QP's for quarterly trend analysis **Action** • If review of sampling data indicates mine loadings are responsible for exceedance then: ○ Expedite results for subsequent sampling and review the data to see if the exceedance continues. If no other sample has been collected, re-sample as soon as practical ○ Review potential sources of surface water contamination (e.g. seeps, performance of water treatment system if discharging, tailings diversion ditch, site-specific road erosion or sedimentation) ○ Actions will continue until performance thresholds are no longer exceeded or until a new threshold and corresponding response level is reached that may require different actions • If a review of sampling data indicates mine loadings are not responsible for the exceedance ○ log the events as "not mine related" ○ reset the W2 exceedance count to previous value before the exceedance that was determined to be not mine-related
	Specific Performance Threshold 2 • Exceedance of ST2 value in two consecutive samples (scheduled or re-sample) at W2 where evaluation confirmed mine loading responsible for first exceedance.	**Notification** • Minto Management • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result and re-run or expedite sample (where required) if a laboratory error is indicated. Hold next steps until result received. **Evaluation** • Compare with W3, W50 and W7 results or any other sampling data recommended by QPs in previous exceedance investigations • Exceedance data sent to QPs for quarterly trend analysis. If trend analysis suggests WQO exceedance within one year, then initiate actions for Specific Threshold 3. **Action** • If a review of sampling date indicates mine loadings are responsible for the exceedance then: ○ Review potential sources of surface water contamination (e.g. seeps, performance of water treatment system if discharging, tailings diversion ditch, site-specific road erosion or sedimentation) ○ Develop and implement a plan to investigate site candidate load contributions

Specific Indicators	Specific Performance Thresholds	Specific Responses
		○ Expedite results for subsequent sampling and review the data to see if the exceedance continues. If no other sample has been collected, re-sample as soon as practical ○ Review results of investigation and prepare and implement recommendations as appropriate. ○ Actions will continue until the SPT 2 performance thresholds is no longer exceeded or until a new threshold and corresponding response level is reached that may require different actions • If a review of sampling data or result of the investigation indicates mine loadings are not responsible for the exceedance then: ○ log the event(s) as "not mine related" ○ reset the W2 exceedance count to previous value before the exceedance that was determined to be not mine-related
	Specific Performance Threshold 3 • WQO exceeded at W2 in a single sample	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Validate original result and re-run or expedite sample (where required) if a laboratory error is indicated. Hold next steps until result received. **Evaluation** • Compare with W3, W50 and W7 results or any other sampling data recommended by QPs in previous exceedance investigations • Exceedance data sent to QPs to assess need for trend analysis **Action** • If a review of sampling data indicates mine loadings are responsible for the exceedance then: ○ Develop and implement a plan to investigate site candidate load contributions ○ Expedite results for subsequent sampling and review the data to see if the exceedance continues. If no other sample has been collected, re-sample as soon as practical ○ Maintain weekly monitoring at W2, W3 and any other sample points relevant to the event • If the investigation indicates mine loading are responsible for the exceedance then: ○ Engage a QP for the evaluation of potential effects to aquatic resources ○ Review results of investigation and prepare and implement recommendations as appropriate ○ Actions will continue until performance thresholds are no longer exceeded • If a review of sampling data or result of the investigation indicates mine loadings are not responsible for the exceedance then: ○ log the event(s) as "not mine related" ○ reset the W2 exceedance count to zero
	Specific Performance Threshold 4 • WQO or PNEC exceeded in 2 consecutive samples (scheduled or re-sample) at W2 where evaluation confirmed mine loading responsible for first exceedance	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Validate original result and re-run/expedite sample if a laboratory error is indicated. Continue with next steps until result received.

Specific Indicators	Specific Performance Thresholds	Specific Responses

		Evaluation
		• Compare with W3, W50 and W7 results or any other sampling data recommended by QP's in previous exceedance investigations
		• Exceedance data sent to QP's to assess need for trend analysis
		Action
		• If a review of sampling data indicates mine loadings continue to be responsible for the exceedance then:
		  o If discharging, suspend discharge from the mine until water quality is appropriate for discharge
		  o Continue to develop and implement a plan to investigate site candidate load contributions
		  o Provide investigation plan to SFN/YG Inspector. Include in next monthly report.
		  o Expedite results for subsequent sampling and review the data to see if the exceedance continues. If no other sample has been collected, re-sample as soon as practical
		  o Maintain weekly monitoring at W2, W3 and any other sample points relevant to the event. Sample more frequently as advised by QP
		• If the investigation indicates mine loading continues to be responsible for the exceedance then:
		  o Engage a QP for the evaluation of potential effects to aquatic resources
		  o Review results of investigation and prepare and implement recommendations
		  o Implement necessary reasonable and practical measures to reduce contaminant loading from mine to Minto Creek
		  o Actions will continue until performance thresholds are no longer exceeded
		• **If threshold consistently exceeded for 2 months**, then:
		  o Develop revised forecast for near-term (12 months) water quality in Minto Creek.
		  o Develop and implement any additional mitigation measures to reduce loading from mine site, if necessary, with appropriate regulatory approvals.
		  o Actions will continue until performance thresholds are no longer exceeded.
		• If a review of sampling data or result of the investigation indicates mine loadings are not responsible for the exceedance then:
		  o log the event(s) as "not mine related"
		  o reset the W2 exceedance count to previous value before the exceedance that was determined to be not mine-related

Table 2-2: Specific Thresholds for Surface Water Quality in Lower Minto Creek (W2)

	Specific Threshold 1 (ST1) (70% of WQO)	Specific Threshold 2 (ST2) (85% of WQO)	W2 Water Quality Objective
	(mg/L)	(mg/L)	(mg/L)
Ammonia - N, mg/L	0.18	0.21	0.25
Nitrite - N, mg/L	0.04	0.05	0.06
Nitrate - N, mg/L	6.4	7.7	9.1
Aluminum (dissolved), mg/L	0.07	0.09	0.1
Arsenic (dissolved), mg/L	0.0035	0.0043	0.005
Cadmium (dissolved), µg/L[1]	$0.70 * 10^{(0.83(\log(hardness)-2.46)}$	$0.85 * 10^{(0.83(\log(hardness)-2.46)}$	$e^{(0.736(\ln(hardness)-4.943)}$
Chromium (dissolved), mg/L	0.0007	0.0009	0.001
Copper (dissolved), mg/L (when [DOC] @ W2 >10 mg/L)	0.014	0.017	0.02
Copper (dissolved), mg/L (when [DOC] @ W2 ≤10 mg/L)	0.009	0.011	0.013
Iron (dissolved), mg/L	0.77	0.94	1.1
Lead (dissolved), mg/L	0.0028	0.0034	0.004
Molybdenum (dissolved),	0.051	0.062	0.073
Nickel (dissolved), mg/L	0.077	0.094	1.1
Silver (dissolved), mg/L	0.0014	0.0017	0.0001
Selenium (dissolved), mg/L	0.00007	0.00009	0.002
Zinc (dissolved), mg/L	0.021	0.026	0.03
pH (pH units)[2]	6.15 - 8.89	6.07 - 8.93	6.0-9.0

[1] Updated Cadmium based on changes to CCME guideline
[2] Calculated based on H+ concentrations (70 and 85% of WQO values).

Table 2-3: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality at Station W50 in Minto Creek when no flow at W15 and W35

Specific Indicators	Specific Performance Thresholds	Specific Responses
Aqueous Concentrations at Station W50 for the following parameters with water quality objectives Parameters: • NH_4-N • NO_2-N • NO_3-N Dissolved • Aluminum • Arsenic • Cadmium • Chromium • Copper • Iron • Lead • Molybdenum • Nickel • Silver • Selenium • Zinc (See Table **2-2** above for specific threshold values)	• Exceedance of WQO for in a single sample	**Notification** • Minto Management • Include in scheduled Water Use Licence reporting **Action** • Suspend discharge from the mine until water quality is appropriate for discharge.

Table 2.4: Specific Indicators, Performance Thresholds and Responses for Toxicity Testing at Stations W3 and W50 in Minto Creek

Specific Indicators	Specific Performance Thresholds	Specific Responses
• Licensed Bioassay test and analysis (acute and chronic) at W3 or W50	• Failure of any licensed effluent bioassay test while discharging	**Notification** • Minto Management • Include in scheduled Water Use Licence reporting **Action** • Suspend discharge from the mine until QP advises that discharging can continue. Investigation will be conducted to determine whether the result was mine-related • If not already initiated, collect Bioassay samples at W2: 7-day rainow trout test (Lazorchak and Smit 2007), 7-day for Ceridaphnia dubia (EPS/1/RM/21), and continue quarterly until directed by a QP

2.2 McGinty Creek Surface Water Quality

2.2.1 Description

Surface mining in Minto North pit is complete and underground mining has not yet commenced. There is no active water management for McGinty Creek. Runoff and meteoric water are allowed to accumulate in the pit

- Minto has been monitoring surface water quality in the McGinty Creek catchment since 2009. Operations in the McGinty Creek catchment (Minto North Pit) started in 2016 and concluded in 2016. The Minto North Pit is on the east arm of McGinty Creek.
- The specific WQO station for McGinty Creek is not identified in the WUL. Station MN-4.5 downstream of the convergence of the east and west arms of McGinty Creek and near the confluence of McGinty Creek with the Yukon River was established as the WQO station in previous versions of the AMP. Minto has observed some challenges related to the use of this monitoring point at the WQO station.
- Monitoring stations MN-0.2 (upstream of Minto North), MN-0.5 and MN-1.5 (east arm of McGinty Creek) and MN-2.5 (west ore reference arm of McGinty Creek) are sampled monthly as per the WUL and EMSRP.
- Surface water quality at the MN-4.5 monitoring point is subject to periodic TSS influences from catchment area that are beyond Minto's control, so dissolved metals concentrations have been used to track influences from the Minto North development.

2.2.2 Risk Narrative

- Increase in contaminant concentrations from completed Minto North mining activities causes unacceptable changes to surface water quality in McGinty Creek.

2.2.3 Specific Indicators, Performance Thresholds, Responses and Adaptations

- The objective of indicators, thresholds and responses is to ensure relevant indicators are paired with conservative thresholds that lead to responses prior to degradation of water quality. Adaptions allow Minto to integrate new information to focus resources on risks related to the mine operations and expend less effort on non-mine related exceedances.
- Indicators, performance thresholds and responses specific to water quality and the monitoring program are provided in Table 2-6.

- Historical monitoring data was used to calculate the 95th percentile, for use as the maximum water quality objective, or individual data point evaluator (IDPE). The monthly data were then also grouped by year, and the annual medians were calculated. The 95th percentile of these annual medians was calculated for each station to generate the central tendency evaluator (CTE).
- Values lower than the WQOs have been selected as early warning thresholds (ST 1) prior to the WQOs themselves forming the higher-level specific thresholds (ST2 and ST3). For these thresholds, the 85th percentile of the same data was selected.
- Previous versions of the AMP used historical data from MN-4.5 to calculate WQO's. This is proving challenging because the reference arm (west arm) of McGinty creek has naturally elevated Se and is contributing disproportionally to chronic exceedances at MN-4.5. QPs have reviewed the data and have proposed a new Se threshold by applying the statistical methodology to the Se data from MN-0.5, located upstream of the convergence of the east and west arms of McGinty Creek. The proposed selenium threshold has been incorporated into this version of the AMP.

The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Surface Water Surveillance Program of the EMSRP as amended from time to time (Minto Explorations Ltd., 2016).

Table 2-5: Specific Thresholds for McGinty Creek Developed from Station MN-4.5 Data (see note on Selenium)

Analytes	Specific Threshold 1 (85th percentile)	Water Quality Objectives (Two Methods for Specific Thresholds 2)[3]	
		Individual Data Point Evaluator (95th percentile)	Central Tendency Evaluator (95th percentile of annual medians)
Total Suspended Solids (mg/L)	52.0	269	32.0
Ammonia (mg/L)	0.040	0.12	0.046
Nitrite (mg/L)	0.006	0.05	0.005
Nitrate (mg/L)	0.200	0.232	0.083
Dissolved Aluminum (µg/L)	48.6	135.0	47.0
Dissolved Arsenic (µg/L)	0.55	0.61	0.54
Dissolved Cadmium (µg/L)	0.026	0.041	0.015
Dissolved Chromium (µg/L)	1.0	1.0	1.0
Dissolved Copper (µg/L)	2.9	3.5	2.8
Dissolved Iron (µg/L)	334	403	358
Dissolved Lead (µg/L)	0.20	0.20	0.20
Dissolved Molybdenum (µg/L)	1.0	1.0	1.0
Dissolved Nickel (µg/L)	1.6	1.8	1.6
Dissolved Selenium (µg/L)*	0.23	0.26	0.21
Dissolved Silver (µg/L)	0.020	0.020	0.020
Dissolved Zinc (µg/L)	5.0	5.2	5.0

*Based on MN-0.5 data due to naturally elevated Se concentrations in the west (reference) arm of McGinty Creek

[3] These are two alternative approaches to Threshold 2.

Table 2-6: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality in McGinty Creek

<table>
<tr><th>Specific Indicators</th><th>Specific Performance Thresholds</th><th>Specific Responses</th></tr>
<tr><td rowspan="2">Aqueous Concentrations at Station MN-4.5 for parameters with Water Quality Objectives.

(See Table 2-5 above for Water Quality Objective and threshold values.)</td><td>Specific Performance Threshold 1

• Exceedance of ST1 value in two consecutive samples (scheduled or re-sample)</td><td>Notification
• Minto Management
• Include in scheduled Water Use Licence reporting
Review
• Follow QA/QC investigative protocol:
o Review laboratory QA/QC report
o Validate original result and re-run/expedite sample if a laboratory error is indicated. Hold next steps until result received.
Evaluation
• Compare with MN-1.5 and MN-0.5 results
• Exceedance data sent to QP's for quarterly trend analysis
Action
• If review of sampling data indicates mine loadings are responsible for exceedance then:
o Evaluate causes for load contributions and
o If a trend analysis suggests WQO exceedance within one year, initiate actions for Specific Performance Threshold 2
• If a review of sampling data indicates mine loadings are not responsible for the exceedance
o log the events as "not mine related"
o reset the W2 exceedance count to previous value before the exceedance that was determined to be not mine-related</td></tr>
<tr><td>Specific Performance Threshold 2

• Exceedance of the WQO (grab vs. IDPE, or 12-month moving average vs. CTE)</td><td>Notification
• Minto Management
• Include in scheduled Water Use Licence reporting
Review
• Follow QA/QC investigative protocol:
o Review laboratory QA/QC report
o Validate original result and re-run/expedite sample if a laboratory error is indicated. Hold next steps until result received.
Evaluation
• Compare with MN-1.5 and MN-0.5 results
• Exceedance data sent to QP's for quarterly trend analysis.
Action
• If a review of sampling data indicates mine loadings are responsible for the exceedance then:
o Re-sample Mn-1.5 and <M-4.5 within two weeks of original sample result review; and
o Evaluate causes for load contributions
• If the evaluation of load contributions confirms mine loading are responsible for the exceedance then:
o Engage a QP for the evaluation of potential effects to aquatic resources and implement mitigation if appropriate
• If a review of sampling data or result of the investigation indicates mine loadings are not responsible for the exceedance then:
o log the event(s) as "not mine related"</td></tr>
</table>

	Specific Performance Threshold 3
	
	• Exceedance of the WQO (as defined above) in **2 consecutive samples (scheduled or re-sample)** where evaluation confirmed mine loading responsible for first exceedance. The CTE exceedance for 2 consecutive months only applies where there is no IDPE exceedance.
		Notification
		• Notify Minto Management, SFN and YG
		• include in scheduled Water Use Licence reporting
		Review
		• Follow QA/QC investigative protocol:
		  o Review laboratory QA/QC report
		  o Validate original result, or re-run sample if a laboratory error is indicated
		Evaluation
		• Compare with MN-1.5 and MN-0.5 results
		• Exceedance data sent to QPs to assess need for trend analysis.
		Action
		• If comparison with results suggests that Minto North loadings are STILL responsible for exceedance; and validation confirms original result, then:
		  o If not already implemented, increase monitoring frequency.
		  o Implement recommendations from mitigation strategy (SPT2 response). This could include batch water treatment in the Minto North pit if determined or transferring water to the Area 2 pit for further treatment and release during underground operation time period. These measures will be evaluated to determine what measures are reasonable and practical.
		  o Actions will continue until performance thresholds are no longer exceeded
		  o Engage a QP to evaluate potential affects to aquatic resources
		• If a review of sampling data or result of the investigation indicates mine loadings are not responsible for the exceedance then:
		  o log the event(s) as “not mine related”
		  o reset the exceedance count to previous value before the exceedance that was determined to be not mine-related

2.3 Groundwater Quality in Minto Creek Watershed

2.3.1 **Description**

Groundwater quality has the potential to be important in terms of contributions to surface water quality. Groundwater contributes to streamflow as baseflow, which is typically most important during the autumn/winter low flow season when surface water flows are minimal.

- All mine workings and waste facilities within in the Minto Creek catchment are located upgradient of the Water Storage Pond (WSP). The monitoring supporting the AMP framework is defined and described in the Groundwater Monitoring Plan (GMP) (Minto Explorations Ltd., 2016).
- Groundwater is monitored both upgradient (west) and downgradient (east) of the WSP; upgradient monitoring is carried out via a multi-level monitoring well at MW12-06, and downgradient monitoring is carried out via a multi-level monitoring well at MW12-05. Surface water downgradient of the WSP is monitored at several stations including station W3, which is located immediately adjacent to MW12-05.
- Groundwater coming from the mine is expected to discharge to surface water in the vicinity of the Water Storage Pond (i.e. upgradient of monitoring well MW12-05). Minimal groundwater from the mine area is expected to discharge to Minto Creek down gradient of the Water Storage Pond. MW12-05 and MW12-06 are optimally located to monitor expected groundwater flow paths.
- Minto is committed to monitoring groundwater quality at MW12-05 and MW12-06 and surface water quality at W2 as required by Water Use Licence QZ14-031 and responding to changing water quality in groundwater and lower Minto Creek as appropriate.

2.3.2 **Risk Narrative**

- Flux of geochemical load from the mine via groundwater pathways causes surface water quality objectives to be in exceeded in Minto Creek at station W2.

2.3.3 **Specific Indicators, Performance Thresholds, Responses and Adaptations**

- Indicators, performance thresholds and responses specific to groundwater quality in Minto Creek watershed are provided in Table 2.7.
- Specific Performance Thresholds (SPTs) are defined for each of the Effluent Quality Standards (EQS) parameters identified in Clause 9 (a), Table 1 of Water Use Licence QZ14-031, with the exception of pH, oil and grease, iron and nitrite (as discussed later in this section). Additionally, although it is not specified in Clause 9(a), sulphate has

been included in the SPTs. Table 2.8 compiles the concentration of background groundwater for each Specific Indicator and the Specific Performance Threshold values.

- Baseline groundwater data were not available prior to mining for the Minto Creek catchment area. Thresholds for groundwater components of the AMP for the Minto Creek catchment were instead defined considering groundwater concentrations that would be protective of surface water.
    - SPT-1 thresholds correspond to a calculation based assessment designed to flag potential rapid increase in groundwater loadings
    - SPT-2 thresholds were based on Effluent Quality Standards (EQS)
    - SPT-3 thresholds were calculated based on the concentrations that would be needed in groundwater to cause exceedances of the Water Quality Objectives in lower Minto Creek, assuming that all groundwater discharged to surface water
- Previous versions of the AMP referenced the installation of an additional monitoring well to assess baseline data for the Minto Creek catchment. MW17-08 was installed in 2017 to collect background groundwater data upgradient of the mine activities. While MW17-08 is located topographically upgradient of mine activities in the Minto Creek catchment and is considered representative of background conditions near the western limit of the Minto Creek catchment, it does not represent baseline conditions downgradient of the ore body. Due to the mineralization of the ore body, baseline chemistry prior to mining activities down gradient of the ore body or deeper in groundwater system is believed to be significantly different. For example, sulphate concentrations in the deepest monitoring zones of MW12-05 have consistently exceeded SPTs while concentrations of other parameters have not. Observed sulphate concentrations are interpreted to be naturally occurring and representative of baseline conditions in deep groundwater, as has been discussed and supported in previous reports.
- As more groundwater data are gathered and analyzed, MW17-08 no longer seems appropriate to replace existing SPTs as it is located outside the zone of influence on groundwater from the ore body and does not monitor depths as great as downgradient monitoring wells (i.e., MW12-05). As such, it is not believed to be appropriate to incorporate the data from MW17-08 in the calculation of thresholds. Existing values are believed to be conservative as currently set and do not warrant changes at this time. For a detailed discussion of the SPT and consideration of the

values at MW17-08, see Minto Mine – 2019 Groundwater Review and Summary of OAMP SPT Exceedances (SRK, 2019).

- Iron, nitrite, pH and oil&grease continue to be excluded from the specific indicators, however, the parameters above (iron, nitrite and pH) will be monitored, and results included in annual QP analysis where relevant

Three SPTs have been defined for the Minto Creek catchment. Rationale for development of the SPTs is as follows:

- SPT-1 corresponds to a calculation-based assessment designed to detect rapid increases in groundwater loadings that have not yet exceeded concentration based thresholds. This assessment is structured to determine if an indicator is increasing at a consistent rate, prior to reaching the lowest concentration threshold (SPT-2), compared to previous sampling events within each respective quarter. The assessment will be performed as followed:

  $$((C_n - C_{n-1})/(C_{SPT-2} - C_n) > 0.2$$

  Where:

  C_n = the parameter concentration of groundwater from the latest sampling event;

  C_{n-1} = the parameter concentration of groundwater from the last sampling event within the respective quarter;

  C_{SPT-2} = the parameter concentration for the SPT-2;

  If three consecutive monitoring events produce values greater than 0.2, then SPT-1 will be considered exceeded. This removes the potential for outliers to trigger the threshold but still allows identification of consistent concentration increases.

  Data points are compared to previous sampling events within their respective quarter to remove seasonal effects, as concentrations are naturally variable between seasons (i.e. freshet vs. winter) and may unnecessarily trigger the threshold if compared to the sampling event immediately before.

  SPT-1 will be increasingly sensitive to change in concentrations between two sampling events as groundwater approaches the SPT-2, since the size of the denominator decreases as the SPT-2 value is approached.

- SPT-2 generally corresponds to the EQS concentrations defined in Clause 9 (a), Table 1 of Water Use License QZ14-031 (with four exceptions (Cr-D, Cu-D, Ni-D and sulphate) as indicated in the notes to Table 2-8). The EQS are defined for surface water discharge, and the mine is not permitted to discharge water that exceeds any EQS guidelines to surface water. As SPT-2 applies to groundwater (not surface water) concentrations in single zone, this is a highly conservative threshold.

- SPT-3 generally corresponds to the estimated concentrations in groundwater that would be necessary to cause exceedance of the Water Quality Objectives in lower Minto Creek, at W2, under long term steady state conditions (exceptions are listed in the notes to Table 2-8). These concentrations were determined by conducting a mass loading calculation to determine the groundwater concentrations that would be necessary to cause exceedance of WQOs in lower Minto Creek during low flow periods where all streamflow is derived from groundwater discharge. This is a conservative approach because if groundwater concentration of one indicator reached the SPT-3 in an individual port, the quality of the lower Minto Creek at W2 would not yet exceed the Water Quality Objective due to the contribution of groundwater from un-impacted areas of the Minto Creek watershed. The rationale and formula for STP-3 is included in Appendix B.

The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Groundwater Monitoring Program of the EMSRP (Minto Explorations Ltd., 2016).

Table 2-7: Specific Indicators, Performance Thresholds and Responses for Groundwater Quality in Minto Creek

Specific Indicators	Specific Performance Thresholds	Specific Responses

Aqueous concentrations in samples collected from multi-level groundwater monitoring wells MW12-05 or MW12-06 for the following parameters with water quality objectives:
 	
• Dissolved Aluminum
• Dissolved Arsenic
• Dissolved Cadmium
• Dissolved Chromium
• Dissolved Copper
• Dissolved Iron
• Dissolved Lead
• Dissolved Molybdenum
• Dissolved Nickel
• Dissolved Silver
• Dissolved Selenium
• Dissolved Zinc
• NH_4-N
• NO_3-N
• Sulphate
	SPT-1
	Three consecutive calculated values above 0.2, indicating a consistent increase in concentrations collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.
		Notification
		• Minto Management
		• Include in scheduled Water Use Licence monthly reporting
		Review
		• Follow QA/QC investigative protocol:
		    o Review laboratory QA/QC report
		    o Validate original result and re-run or where required expedite sample if a laboratory error is indicated.
		Evaluation
		• Review of groundwater monitoring data (trend analysis included) to be undertaken by QP, and appropriate recommendations to be developed
		    o Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux)
		    o Timing: QP review to take place at quarterly intervals, results will be included in the Minto's next scheduled report
		• Where required, submit recommendations to regulator for review and approval
		    o Timing: submit within 1 week of receipt of recommendations
		Action
		• Follow recommendations arising from review undertaken by QP.
		    o Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval required
		• Once received, include the trend analysis in next scheduled report

	SPT-2
	• Exceedance of ST-2 concentrations in 2 consecutive samples (scheduled or re-sampled) collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.
		Notification
		• Minto Management
		• Include in scheduled Water Use Licence monthly reporting
		Review
		• Follow QA/QC investigative protocol:
		    o Review laboratory QA/QC report
		    o Validate original result and re-run or where required expedite sample if a laboratory error is indicated.
		Evaluation
		• Review of groundwater monitoring data (including trend analysis) to be undertaken by QP, and appropriate recommendations to be developed
		    o Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux)
		    o Timing: QP review to take place at quarterly intervals, results will be included in the Minto's next scheduled report
		• Where required, submit recommendations to regulator for review and approval

Specific Indicators	Specific Performance Thresholds	Specific Responses
		○ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by QP. ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval is required
	SPT-3 • Exceedance of ST-3 in 2 consecutive samples (Scheduled or re-sampled) collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.	**Notification** • Minto Management • Include in scheduled Water Use Licence monthly reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Review of groundwater monitoring data (including a trend analysis) to be undertaken by QP, and appropriate recommendations to be developed ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) ○ Timing: initiate within 1 week of QA/QC review validating original results • Where, required, submit recommendations to regulator for review and approval ○ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by QP. ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval is required • Increase monitoring frequency to monthly sampling of all monitored zones in the affected multi-level well for a period to be defined by QP.

Table 2-8: Background concentrations and STs for the groundwater monitoring in the Minto Creek watershed

Minto Creek	***Concentrations (mg/L)***													
	Ag-D	Al-D	As-D	Cd-D	Cr-D	Cu-D	Pb-D	Mo-D	Ni-D	Se-D	Zn-D	N-NO3	Ammonia	Sulphate [2]
ST-3 [1]	0.00046	0.48	0.025	0.0060	0.0030	0.060	0.020	0.34	0.33	0.0093	0.13	45	1.0	4951
ST-2	0.00030	0.30	0.015	0.0030	0.0015[4]	0.030 [4]	0.012	0.22	0.165[4]	0.0060	0.090	27	0.75	1000
Background Groundwater[3]	0.00001	0.0045	0.0001	0.00002	0.00050	0.0014	0.0001	0.006	0.001	0.0002	0.006	0.07	0.051	12

Notes:

1: For most Specific Indicators, ST-3 is the calculated concentration that <u>all</u> groundwater from the mine catchment must attain to reach the Operational Water Quality Objectives at W2. Model flows were based on 2015 Groundwater Model Update. 15 L/s is the total groundwater discharging to Minto Creek. 3 L/s is the estimated groundwater flow from the Minto Creek catchment up gradient of the Water Storage Pond. The exceptions are dissolved chromium, dissolved copper and dissolved nickel, for which SPT-3 is equal to the Effluent Quality Standard value that applies to surface water discharge from the mine site.

2: There is no Effluent Quality Standard for sulphate. For the ST-2, the guideline for Aquatic Life from the Contaminated Site Regulation Schedule 3 was used as a replacement.

3: The background concentration in groundwater is calculated as the median of concentrations observed at groundwater monitoring well MW09-03.

4: ST-2 for dissolved copper, dissolved chromium and dissolved nickel set at one-half (50%) of Effluent Quality Standard (ST-2 for all remaining parameters (other than sulphate) is equal to (100% of) the Effluent Quality Standard).

2.4 Groundwater Quality in McGinty Creek Watershed

2.4.1 Description

The mine workings in the McGinty Creek catchment are limited to the Minto North Pit. Mining activities are complete in this area for the time being.

- The catchment area of the Minto North Pit is roughly 15 ha or 0.4% of the total 3400 ha catchment area of the McGinty Creek watershed. Only a very small proportion of the groundwater in the McGinty Creek watershed can be affected by the Minto North Pit.
- Groundwater in the McGinty Creek catchment is monitored adjacent to the Minto North Pit for both quality and level in the multi-level monitoring well MW09-03.

2.4.2 Risk Narrative

- Flux of geochemical load from the Minto North Pit via groundwater pathways causes surface water quality objectives to be in exceeded in McGinty Creek at station MN4.5.

2.4.3 Specific Indicators, Performance Thresholds, Responses and Adaptations

- Indicators, performance thresholds and responses specific to groundwater quality in McGinty Creek watershed are provided below in Table 2-9.
- STs are defined for each of the EQS parameters identified in Clause 9 (a), Table 1 of Water Use License QZ14-031, with the exception of pH, Oil & Grease, iron and nitrite. Additionally, although it is not specified in Clause 9(a), sulphate has been included in the STs. The concentration of background groundwater and the Specific Threshold values for each Specific Indicator and each zone (i.e. individual well port) of MW09-03 are compiled in Table 2-10.
- STs for the McGinty Creek catchment were developed using baseline data collected from groundwater monitoring well MW09-03, which is located downgradient of the Minto North ore body and was installed and sampled prior to mining activity (2009-2015). This data remains appropriate for the McGinty Creek Catchment.
- Pre-mining groundwater concentrations for certain parameters such as cadmium and iron have been relatively high, likely due to the adjacent highly mineralized zone.
- Previous versions of the AMP had two Specific Performance Thresholds. Because Minto's observations, backed by QP experience and analysis, are that groundwater deviations are best reviewed by QP's on a quarterly basis, a third SPT was added to ensure a conservative but appropriate trigger was developed to establish a trigger when immediate QP review would be warranted.

- SPT-1: Three consecutive exceedances of the 75th percentile background level in a single monitoring port.
  - The specification of three consecutive exceedances is intended to ensure that any sustained increase from baseline conditions receives appropriate scrutiny.
- SPT-2: Three consecutive exceedances of the 95th percentile background level in a single monitoring port.
  - The specification of three consecutive exceedances is intended to ensure that any sustained increase from baseline conditions receives appropriate scrutiny.
- SPT-3 generally corresponds to one-half the estimated concentrations in groundwater that would be necessary to cause exceedance of the Water Quality Objectives in McGinty Creek, at monitoring station MN-4.5. The calculation was completed using the same methodology described for SPT3 for Minto Creek and can be found in *Minto Mine – 2019 Groundwater Review*, SRK Consulting. The results of the calculation can be found in table 2-10. The exception is Se which is calculated as the 95th percentile at the reference location at MN-0.5[4].

The monitoring results that are evaluated for this component of the AMP are an obligation of the Groundwater Monitoring Program of the EMSRP.

[4] Calculated from 2010 to 2019 values using Kaplan-Meier statistical analysis.

Table 2-9: Specific Indicators, Performance Thresholds and Responses for Groundwater Quality in McGinty Creek

Specific Indicators	Specific Performance Thresholds	Specific Responses

Aqueous concentrations in samples collected from multi-level groundwater monitoring well MW09-03 for the following parameters:
• Dissolved Aluminum
• Dissolved Arsenic
• Dissolved Cadmium
• Dissolved Chromium
• Dissolved Copper
• Dissolved Lead
• Dissolved Molybdenum
• Dissolved Nickel
• Dissolved Silver
• Dissolved Selenium
• Dissolved Zinc
• NH_4-N
• NO_3-N
• Sulphate
	Specific Threshold 1
	• Three consecutive exceedances of the 75th percentile value* from the baseline period (2009-2015) in routine monitoring results from a single monitoring port in MW09-03.
	
	*values provided in Table 2-10
		Notification
		• Minto Management
		• Include in scheduled Water Use Licence monthly reporting
		Review
		• Follow QA/QC investigative protocol:
		  ○ Review laboratory QA/QC report
		  ○ Validate original results, or re-run samples if a laboratory error is indicated
		  ○ Timing: initiate within 1 week of receiving result
		Evaluation
		• Review of groundwater monitoring data (including trend analysis) to be undertaken by QP, and appropriate recommendations to be developed
		  ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux)
		  ○ Timing: QP review to take place at quarterly intervals, results will be included in the Minto's next scheduled report
		• Where required, submit recommendations to regulator for review and approval
		  ○ Timing: submit within 1 week of receipt of recommendations
		Action
		• Follow recommendations arising from review undertaken by QP.
		  ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval is required

	Specific Threshold 2
	• Three consecutive exceedances of the 95th percentile value* from the baseline period (2009-2015) in routine monitoring results from a single monitoring port in MW09-03.
	
	*values provided in Table 2-10
		Notification
		• Minto Management
		• Include in scheduled Water Use Licence monthly reporting
		Review
		• Follow QA/QC investigative protocol:
		  ○ Review laboratory QA/QC report
		  ○ Validate original results, or re-run samples if a laboratory error is indicated
		  ○ Timing: initiate within 1 week of receiving result
		Evaluation
		• Review of groundwater monitoring data (including trend analysis) to be undertaken by a QP, and appropriate recommendations to be developed
		  ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux)
		  ○ Timing: QP review to take place at quarterly intervals, results will be included in the Minto's next scheduled report
		• Submit recommendations to regulator for review and approval
		  ○ Timing: submit within 1 week of receipt of recommendations
		Action
		• Follow recommendations arising from review undertaken by QP.

Specific Indicators	Specific Performance Thresholds	Specific Responses
		◦ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval is required • Increase monitoring frequency to monthly sampling of all monitored zones in the affected multi-level well for a period to be defined by QP. • Trend analysis to be included in scheduled reporting
	Specific Threshold 3 • Exceedance of ST3 in 2 consecutive samples (Scheduled or re-sampled) collected during routine monitoring from a single monitoring port in MW09-03	**Notification** • Minto Management • Include in scheduled Water Use Licence monthly reporting **Review** • Follow QA/QC investigative protocol: ◦ Review laboratory QA/QC report ◦ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Review of groundwater monitoring data (including a trend analysis) to be undertaken by QP, and appropriate recommendations to be developed ◦ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) ◦ Timing: initiate within 1 week of QA/QC review validating original results • Where required, submit recommendations to regulator for review and approval ◦ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by QP. ◦ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator or within receipt of recommendation when no approval is required • Increase monitoring frequency to monthly sampling of all monitored zones in the affected well for a period to be defined by QP.

Table 2-10: Background concentrations and SPTs for the groundwater monitoring in the McGinty Creek watershed

Minto Creek		*Concentrations (mg/L)*[1]													
		Ag-D[3]	Al-D	As-D	Cd-D	Cr-D[3]	Cu-D	Pb-D[3]	Mo-D	Ni-D	Se-D	Zn-D	N-NO3	NH_4-N	Sulphate
MW09-03-01	95th Percentile	0.000016	0.0101	0.00081	0.000272	0.000575	0.00625	0.0003	0.026	0.0060	0.0015	0.022	0.28	0.133	38
	75th Percentile	0.000010	0.0065	0.00011	0.000075	0.000500	0.00155	0.0001	0.005	0.0021	0.0001	0.013	0.13	0.067	24
	Median[2]	0.000010	0.0045	0.00005	0.000022	0.000500	0.00031	0.0001	0.004	0.0015	0.0001	0.006	0.07	0.045	22
MW09-03-02	95th Percentile	0.000034	0.0095	0.00092	0.000272	0.000796	0.01080	0.0002	0.062	0.0026	0.0040	0.015	0.07	0.282	67
	75th Percentile	0.000018	0.0073	0.00074	0.000031	0.000500	0.00263	0.0001	0.018	0.0009	0.0005	0.010	0.03	0.230	7
	Median[2]	0.000010	0.0062	0.00067	0.000026	0.000500	0.00122	0.0001	0.017	0.0005	0.0002	0.008	0.01	0.210	1
MW09-03-03	95th Percentile	0.000010	0.0075	0.00014	0.000069	0.000500	0.00500	0.0003	0.018	0.0011	0.0004	0.011	0.54	0.058	13
	75th Percentile	0.000010	0.0047	0.00005	0.000023	0.000500	0.00247	0.0001	0.006	0.0005	0.0004	0.008	0.50	0.020	12
	Median[2]	0.000010	0.0025	0.00005	0.000015	0.000500	0.00174	0.0001	0.005	0.0005	0.0003	0.003	0.48	0.012	11
MW-09-03 any port	ST3[4]	0.011	4.4	0.0255	0.0023	0.095	0.145	0.017	0.005	0.095	0.00028	0.445	18.5	3.75	-

Notes:

1: For monitoring results where concentrations were below the analytical detection limits, a concentration of half the detection limit was adopted for calculation purposes.

2: For AMP purposes, the background concentration in groundwater at MW09-03 is defined as the median concentration observed in each port over the 2009-2015 baseline monitoring period.

3: For Ag-D, Cr-D and Pb-D, most 2009-2015 concentrations were at the limit of analytical detection, and as such the calculated 75th and 95th percentile values are skewed low.

4: ST-3 values are calculated as ½ the results of the McGinty Creek loading calculations as per SRK Consulting's recommendations in the *Minto Mine – 2019 Groundwater Review*. The exception is Se which is calculated as the 95th percentile at the reference location at MN-0.5. This value was calculated from 2010 to 2019 values using Kaplan-Meier statistical analysis.

2.5 Water Management

2.5.1 Description

The Minto Mine site has a positive water balance. Therefore, it is necessary to release water from site from time to time to prevent accumulation of excess water. The primary objective of Minto's water management strategy is to ensure that water can be released from site in a way that protects the water quality in Minto Creek. Details concerning water management are provided in the Minto Mine Water Management Plan as amended from time to time (Minto Explorations Ltd., 2015).

The strategy can be summarized as follows:

- Mine water will be collected and stored in the Main Pit Tailings Management Facility (MPTMF) and the Area 2 Pit Tailings Management Facility (A2PTMF). Mine water is defined as water that does not meet water quality limits. Mine water will be used for ore processing.
- The site water balance will be used to define mine water inventory targets and targets for volumes to be released to Minto Creek. Inventory targets will be defined on an annual basis and reported in the annual water balance update.
- To the extent possible, water will be released from site by collecting and diverting clean runoff to the Water Storage Pond (WSP) and from there to Minto Creek.
- If collection, diversion and release of clean water does not move enough water off site then Minto has the option of treating and releasing mine water.

The water management strategy is able to deal with most foreseeable conditions that may be encountered though the mine development and operations. However, certain unforeseen conditions may require an adaptive response as described below.

Based on observations and studies conducted for Phase VII and previous licensing, the Minto North Pit is not expected to fill to a surface spilling point during operations. It is a reasonable expectation given the location of the Minto North Pit within the watershed, which is located near the surface water divide between the McGinty Creek and Minto Creek catchments, with a small catchment reporting to the Minto North Pit. Groundwater contributions are also expected to be low, and while the Minto North Pit acts as a hydraulic sink under current conditions, the volume is anticipated to be of limited quantity. Furthermore, during underground mining, Minto will be transporting all underground water to Area 2 Pit for treatment and release.

2.5.2 **Risk Narrative**

The existing water treatment plant is not able to treat and discharge enough mine water, and as a result the mine water inventory exceeds the target.

2.5.3 **Specific Indicators, Performance Thresholds and Responses**

Indicators, performance thresholds and responses specific to water management are provided below in Table 2-. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Water Inventory Tracking of the Water Management Plan as amended from time to time (Minto Explorations Ltd., 2015). The monitoring data will be compared to the specific performance thresholds monthly (by the end of the month following the month in which the data were collected) - this corresponds with the existing monthly reporting schedule.

Table 2-11: Specific Indicators, Performance Thresholds and Responses for Water Management

Specific Indicators	Specific Performance Thresholds	Specific Responses

Water inventory in the Main Pit Tailings Management Facility or the Area 2 Pit Management Facility exceeds target inventory	**Specific Threshold 1**
	
	• Water inventory target is exceeded for a period of three months. The water storage capacity still exceeds 1,000,000 m^3.
		Notification
		• Minto Management
		• Include in monthly report
		
		Review
		• Review site water balance
		• Review recent water management and water treatment practices
		
		Evaluation
		• Evaluate the water inventory targets. For example, how much water can be stored in the pits for how long? Can the inventory target safely be changed to accommodate the excess volume of water?
		
		Action
		• Develop plan to address the water excess inventory such that the target can be met within 6 months. The plan may include:
		    ○ An adjustment of the target inventory,
		    ○ Diverting more clean water to the WSP,
		    ○ Modifying or expanding water treatment including consideration of in pit treatment techniques.
		    ○ Trend analysis to determine when or if SPT2 will be triggered

	Specific Threshold 2 • The water storage capacity is less than 1,000,000 m^3.	**Notification** • Minto Management, SFN and YG Inspector. • Include in scheduled Water Use Licence reporting. **Review** • Review site water balance. • Review recent water management and water treatment practices. **Evaluation** • Evaluate the water inventory targets. For example, how much water can be stored in the pits for how long? Can the inventory target safely be changed to accommodate the excess volume of water? • Evaluate treatment requirements and determine if the exiting water treatment plant has sufficient capacity to meet the requirements. Consider the potential of in pit treatment.

Specific Indicators	Specific Performance Thresholds	Specific Responses

		Action
		• Immediately develop and implement a plan to address the lack of storage capacity such that the capacity can be restored prior to subsequent freshet.
		  ○ The plan may include, modifying or expanding the water treatment plant or in pit treatment.
		  ○ Plans to bring mobile treatment equipment to site may be considered.
		  ○ Trend analysis to determine when or if SPT3 will be triggered

	Specific Threshold 3 • The water storage capacity is less than 500,000 m^3.	**Notification** • Minto Management, SFN, YG Inspector and Regulators. • Include in Water Use Licence reporting. **Review** • Review site water balance. • Review recent water management and water treatment practices. **Evaluation** • Evaluate treatment requirements and determine if the existing water treatment plant has sufficient capacity to meet the requirements. **Action** • Immediately make plans to bring mobile treatment equipment to site, if existing plant does not have sufficient capacity. • Conduct trend analysis to determine duration until spilling

2.5.4 **Freeboard Thresholds for Water Storage Facilities**

The water storage facilities authorized under the WL include the Water Storage Pond, the Mill Water Pond, the Ridgetop North Pit, the Main Pit and the Area 2 Pit. With the exception of the Ridgetop North Pit, all of these facilities have documents associated with their design.

Table 2-12: Freeboard Limits for Storage Facilities

Storage Facility	Freeboard limit (m) from spill elevation
Water Storage Pond	1
Main Pit Tailings Management Facility	2
Area 2 Pit Tailings Management Facility	5

All of the water storage facilities water levels and volumes are managed through permanent pumping and piping systems.

The mill water pond was decommissioned in 2016 and is therefore not included in this AMP.

2.6 Physical Stability

2.6.1 **Description**

The physical stability of the waste rock, tailings and water storage facilities are monitored according to the Physical Monitoring Plan, which forms part of the Environmental Monitoring, Surveillance and Reporting Plan (Minto Explorations Ltd., 2016). The document describes the inspection and instrumentation data collection frequencies, instrument locations, installation details, as well as the data collection procedures.

The purpose of the monitoring program is to identify physical changes to the conditions of the facilities which may lead to future instability and to allow the mine to mitigate these conditions prior to any occurrence of instability. The facilities have been separated into two sets of geotechnical thresholds and response criteria (Table 2-).

Table 2-13: Physical Stability Categories

Category	Facility
1	• Dry Stack Tailings Storage Facility and Mill Valley Fill Extension (Stage 1 and 2) • Southwest Waste Dump • South Wall Buttress / Main Pit Dump
2	• Main Waste Dump and Main Waste Dump Extension • Reclamation Overburden Dump • Ice-Rich Overburden Dump • Water Storage Pond Dam

Category 1 facilities are founded in areas of ice-rich periglacial foundations that have previously experienced deep-seated foundation movement. The Mill Valley Fill Extension (MVFE) and South Wall Buttress (SWB) are designed to mitigate movements in the Dry Stack Tailings Storage Facility (DSTSF) and Main Pit South Wall areas, respectively. Additional monitoring inspection and response requirements for the DSTSF are detailed in the Operations, Maintenance, and Surveillance Manual (OMS) for the facility (Minto Explorations Ltd., 2014).

Category 2 facilities consist of all the remaining waste rock dumps and the Water Storage Pond Dam. These waste dumps are located in areas with good foundation conditions that avoid areas underlain by ice-rich overburden. Additional monitoring inspection and response requirements for the Water Storage Pond Dam are detailed in the Operations, Maintenance, and Surveillance Manual (OMS) for the facility (Tetra Tech EBA, 2014).

2.6.2 **Risk Narrative**

A mass failure of one of the waste facilities has the potential to endanger the health and safety of site employees or visitors, or lead to an increase in contaminant loadings from the mine and subsequent adverse effects to aquatic resources in the receiving environment (lower Minto Creek).

2.6.3 **Specific Indicators, Performance Thresholds and Responses**

Indicators, performance thresholds and responses specific to Category 1 and Category 2 Facilities are provided in Table 2- and Table 2-, respectively. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Physical Monitoring Program of the EMSRP as amended from time to time (Minto Explorations Ltd., 2016). The monitoring data will be compared to the specific performance thresholds monthly (by the end of the month following the month in which the data were collected) - this corresponds with the existing monthly reporting schedule.

Table 2-14: Specific Indicators, Performance Thresholds and Responses for Category 1 Facilities

Specific Indicators	Specific Performance Thresholds	Specific Responses

• Mass movement indicated by monitoring of geotechnical instrumentation
• Visual observations of physical damage
• Visual observations of evidence that could suggest mass movement
• Occurrence of seismic events
	Specific Threshold 1
	
	• Observation of unusual occurrence including:
	  • tension cracks, settlement, or sloughing;
	  • a seismic event that exceeds the 1:475 return period event[5];
	  • abnormal seepage from any area of the slopes;
	  • increased turbidity from seepage; or,
	  • physical damage.
	
	This threshold applies to all Category 1 facilities.
		Notification
		• General Manager
		• Mine Manager
		• Chief Engineer
		• Engineering department
		• Include in annual report
		
		Review
		• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
		
		Evaluation
		• Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
		
		Action
		• Inspect the area for any other signs of instability.
		• Follow any recommendations of the Engineering department (e.g. geotechnical engineer/EIT). At a minimum, the Engineering department will consider the need for:
		  ○ An increase in the frequency of routine inspections and monitoring.
		  ○ Additional inspection, instrumentation, monitoring, or analyses.
		
		• If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 2 • One survey hub or inclinometer reading indicating an increase in the movement rate greater than the long-term trend and outside the range of instrumentation error.	**Notification** • Engineering department **Review** • Review existing instrumentation data. **Evaluation** • Engineer department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results.

[5] This size of a seismic event would be felt by most people on site. It would shake buildings, and rattle or break dishes, hanging objects, etc. Earthquake information may also be found online at: http://www.earthquakescanada.nrcan.gc.ca/index-eng.php

Specific Indicators	Specific Performance Thresholds	Specific Responses
		Action • Retake reading. • If the reading was accurate, increase the survey hub or inclinometer frequency. • If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 3
	• Three consecutive survey hub or inclinometer readings indicating acceleration of movement greater than the long-term trend.
	Or
	• Three consecutive survey hub readings indicating a change in horizontal direction of movement greater than 15 degrees from the long-term trend.-
		Notification
		• General Manager
		• Mine Manager
		• Chief Engineer
		• Engineering department
		• Include in the scheduled report
		Review
		• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
		Evaluation
		• Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
		Action
		• Inspect the area for any other signs of instability.
		• Complete a ground survey of the area of interest to monitor any future displacement.
		• Increase monitoring and data review frequency as directed until determined unnecessary.
		• Follow any additional recommendations. At minimum, the Engineering department (e.g. geotechnical engineer/EIT) will consider the need for:
		  ○ An increase in the frequency of routine inspection monitoring;
		  ○ Additional inspection, instrumentation, monitoring or analyses;
		  ○ Earthwork modifications to the facility including buttressing or unloading, or any other mitigation measures.
		• If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 4 • A rapid failure of the structure has occurred or is imminent. -	**Notification** • General Manager • Mine Manager • Chief Engineer • Engineering department • Include in the scheduled report **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.

Specific Indicators	Specific Performance Thresholds	Specific Responses

		Evaluation
		• Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
		• Engineering department (e.g. geotechnical engineer/EIT) to visit site to assess the situation and identify potential cause(s).
		Action
		• If a rapid failure is imminent, evacuate all personnel below the facility and implement the ERP
		• Inspect the area for any other signs of instability.
		• Document the location, photograph, and survey the area of concern.
		• Increase monitoring and data review frequency as directed until determined unnecessary.
		• Follow any additional recommendations. At minimum, the Engineering department (e.g. geotechnical engineer/EIT) will consider the need for:
		  ○ An increase in the frequency of routine inspections and monitoring.
		  ○ Additional inspection, instrumentation, monitoring, or analyses.
		  ○ Modifications to the waste placement/construction practices.
		• If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

Table 2-15: Specific Indicators, Performance Thresholds and Responses for Category 2 Facilities

Specific Indicators	Specific Performance Thresholds	Specific Responses

• Mass movement indicated by monitoring of geotechnical instrumentation
• Visual observations of physical damage
• Visual observations of evidence that could suggest mass movement
• Occurrence of seismic events
	Specific Threshold 1
	
	• Observation of unusual occurrence including:
	  • tension cracks, settlement, or sloughing;
	  • a seismic event that exceeds the 1:475 return period event;
	  • abnormal seepage from any area of the slopes;
	  • increased turbidity from seepage;
	  • physical damage.
	
	This threshold applies to all Category 2 facilities.
		Notification
		• General Manager
		• Mine Manager
		• Chief Engineer
		• Engineering department
		• Include in scheduled report
		
		Review
		• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
		Evaluation
		• Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
		Action
		• Inspect the area for any other signs of instability.
		• Follow any recommendations of the Engineering department (e.g. geotechnical engineer/EIT). At a minimum, the Engineering department will consider the need for:
		  ○ An increase in the frequency of routine inspections and monitoring.
		  ○ Additional inspection, instrumentation, monitoring, or analyses.
		• If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 2 • Survey hub cumulative displacements between 150 mm and 500 mm.	**Notification** • General Manager • Mine Manager • Chief Engineer • Engineering department • Include in scheduled report **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation** • Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability. **Action** • Inspect the area for any signs of instability.

Specific Indicators	Specific Performance Thresholds	Specific Responses
		• Immediately increase monitoring and data review frequency as directed until determined unnecessary. • Follow any additional recommendations of the Engineering department. • If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 3
	
	• Survey hub cumulative displacements greater than 500 mm.
		Notification
		• General Manager
		• Mine Manager
		• Chief Engineer
		• Engineering department
		• Include in scheduled report
		Review
		• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
		Evaluation
		• Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
		Action
		• Inspect the area for any other signs of instability.
		• Complete a ground survey of the area of interest to allow for a stability assessment to be completed (if required by the Engineering department), and to monitor any future displacement.
		• Increase monitoring and data review frequency as directed until determined unnecessary:
		• Follow any additional recommendations of the Engineering department. At a minimum, the Engineering department will consider the need for:
		  o An increase in the frequency of routine inspections and monitoring.
		  o Additional inspection, instrumentation, monitoring, or analyses
		  o Earthwork modifications to the facility including buttressing or unloading, or any other mitigation measure.
		• If the results of the analysis indicate there is a stability concern, the mine inspector and SFN will be notified immediately.

	Specific Threshold 4 • Three consecutive survey hub readings indicating increase in movement outside range of instrumentation error.	**Notification** • General Manager • Mine Manager • Chief Engineer • Engineering department • SFN • YG • Include in scheduled report

<table>
<tr><th>Specific Indicators</th><th>Specific Performance Thresholds</th><th>Specific Responses</th></tr>
<tr><td></td><td></td><td>Review
Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
Evaluation
Engineering department (e.g. geotechnical engineer/EIT) to compare recent monitoring results against older results for additional evidence of instability.
Engineering department to visit site to assess the situation and identify potential cause(s)
Action
If a rapid failure is imminent, evacuate all personnel below the facility and implement the ERP.
Inspect the area for any other signs of instability.
Document the location, photograph, and survey the area of concern
Increase monitoring and data review frequency as directed until determined unnecessary.
Follow any additional recommendations of the Engineering department. At a minimum, the Engineering department will consider the need for:
An increase in the frequency of routine inspections and monitoring.
Additional inspection, instrumentation, monitoring, or analyses
Modifications to the waste placement/construction practices and other mitigation measures.</td></tr>
</table>

Table 2-16: Equivalent Water Elevations for Piezometric Pressure Thresholds

Instrument	Facility	Threshold 1	Threshold 2	Threshold 3	Threshold 4	Threshold 5
DSP-05a	DSTSF	n/a	n/a	785.03 m	794.82 m	n/a
DSP-06a	DSTSF	n/a	n/a	784.18 m	791.49 m	n/a
DSP-06b	DSTSF	n/a	n/a	783.06 m	791.81 m	n/a
DSP-07 #1	DSTSF	n/a	n/a	777.89 m	781.13 m	n/a
DSP-07 #2	DSTSF	n/a	n/a	775.65 m	781.77 m	n/a
DSP-07 #3	DSTSF	n/a	n/a	773.69 m	782.33 m	n/a
DSP-07 #4	DSTSF	n/a	n/a	772.85 m	782.57 m	n/a
DSP-07 #5	DSTSF	n/a	n/a	772.29 m	782.73 m	n/a
DSP-07 #6	DSTSF	n/a	n/a	771.17 m	783.06 m	n/a
DSP-08 #1	DSTSF	n/a	n/a	774.32 m	786.20 m	n/a
DSP-08 #2	DSTSF	n/a	n/a	752.75 m	756.35 m	n/a
DSP-08 #3	DSTSF	n/a	n/a	751.35 m	756.75 m	n/a
DSP-08 #4	DSTSF	n/a	n/a	749.86 m	757.07 m	n/a
DSP-08 #5	DSTSF	n/a	n/a	748.46 m	757.47 m	n/a
DSP-08 #6	DSTSF	n/a	n/a	745.67 m	758.27 m	n/a
DSP-10	DSTSF	n/a	n/a	722.47 m	725.10 m	n/a
SDP-2A	SWD	n/a	n/a	846.40 m	847.90 m	n/a
SDP-2B	SWD	n/a	n/a	846.21 m	847.96 m	n/a
SDP-3A	SWD	n/a	n/a	859.10 m	861.52 m	n/a
SDP-3B	SWD	n/a	n/a	858.90 m	861.57 m	n/a
SDP-4A	SWD	n/a	n/a	860.47 m	861.46 m	n/a
SDP-4B	SWD	n/a	n/a	860.28 m	861.52 m	n/a

3 Reporting and Review

Reporting and review represent an essential part of the Adaptive Management Framework, as described in section **Error! Reference source not found.**, and reporting on adaptive management is included in the notification component of all specific responses described in section 2.

3.1 Monthly and Annual Reporting

Monthly reports are required to be submitted to the Yukon Water Board under Water Licence QZ14-031, and annual reports are required for submission under both the Water Licence and the Quartz Mining License. Both licenses require reporting on adaptive management.

Monthly reporting includes all activities carried out under the AMP. The monthly report will include a comparison of monitoring results to AMP thresholds as well as status of responses implemented due to thresholds triggered.

Annual reporting will include summaries of all activities carried out under the AMP including a summary of the comparisons conducted monthly and any actions taken. The annual report will also include follow: water levels, a trend analysis (where applicable) for all parameters that triggered responses and a yearly comparison summary of all physical stability monitoring results to AMP thresholds.

3.2 Annual Review

The AMP may be modified when unexpected circumstances are encountered and the protocol is implemented or when additional understanding becomes available. An annual review of the AMP will take place prior to annual reporting, and Annual Reports will include a summary of proposed updates and revisions to the AMP and include a revised AMP, if warranted.

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Yukon Water Board. (2016). Letter to Ryan Herbert, Permitting Manager, Minto Explorations Ltd., from Jennifer Logan, Yukon Water Board Secretariat Licensing Officer. October 17, 2016. 6 pages. RE: QZ14-031, Minto Explorations Ltd. – Operational Adaptive Management Plan, Clause 109, Review and Approval.

Appendix A – Adaptive Management Narrative from 2017-02 Plan

2. Adaptive Management Planning

Adaptive management is an approach to environmental management that is appropriate when a mitigation measure may not function as intended or when broad-scale environmental change is possible. Adaptive management plans are precautionary in nature, and provide a level of security in long term environmental planning. Adaptive management plans also allow for the inclusion of improved science into mitigation measures as they are continually revised.

Adaptive management has been evolving since its emergence in the 1970s. Adaptive approaches include an ability to incorporate knowledge into the management plan as the knowledge is gleaned and circumstances change. Eberhard et al. (Eberhard, et al., 2009) described the categories of knowledge that may trigger changes to water quality management plans; system understanding, measuring progress and anticipating changes. These categories allow for the inclusion of knowledge and adaptation of management to changed conditions. Embedding adaptation into environmental plans involves thinking about how the results of monitoring will change management actions. Adaptive management plans are a way to accept uncertainties and build a structured framework to respond to changing conditions.

Adaptive management conducts a flexible path with actions to take when specific triggers occur. AMPs are a formalization of a plan for performance monitoring and project re-evaluation in the future. The general structure of adaptive management can be described by the following steps:

1. Identify risk triggers associated with vulnerabilities or uncertainties;
2. Quantify impacts and uncertainties;
3. Evaluate strategies and define implementation path that allows for multiple options at specific triggers;
4. Monitor the performance and critical variables in the system; and
5. Implement or re-evaluate strategies when triggers are reached.

Although there are no widely used AMP terms, the steps listed above are representative of typical AMP processes. Within AMPs, triggers provide decision points in a stepwise decision-making framework that identifies how and when management action should be taken. A key characteristic of adaptive management is monitoring, which is used to advance scientific understanding and to adjust management policies in an iterative process. Adaptive management is a rigorous method for addressing uncertainties in ecosystem management.

3. Adaptive Management Plan Objectives

An AMP is a management tool wherein a framework is provided to make quick and effective decisions to guide responses to unforeseen events. This document identifies areas of uncertainty within the operational phase of the Minto Mine life and provides an AMP framework for each. For each component the AMP describes monitoring commitments, thresholds, triggers and responses to underperforming elements or emerging risks within the component. The steps laid out in the AMP framework are precautionary, and therefore they provide the confidence that action will be taken before adverse environmental impacts are observed.

Response planning, and results for anticipated events are contained within site management plans while AMPs guide responses to unforeseen or contingency events. This AMP provides a framework to guide responses to unanticipated monitoring results and to potential but low probability events where uncertainty exists.

It is difficult to predict the specific environmental condition that may arise which requires a response from management and, therefore, the AMP does not provide specific detailed descriptions of responses to a situation. The AMP provides a range of possible responses to use as a guide to respond to specific environmental conditions encountered. Management should use the information provided in the AMP and undertake the appropriate response.

1. Updated AMP Objectives

This version of the AMP has been updated to include the requirements of the QML and WL.

The QML was issued December 18, 2014 and was accompanied by a letter entitled outlining the components required in an Adaptive Management Plan (Yukon Government - Energy, Mines and Resources, 2014). The AMP includes the requirements outlined in the letter with the exception of Cover Systems, as they are more appropriately addressed in the Closure Adaptive Management Plan which forms part of the Reclamation and Closure Plan. Additionally, two conditions have been adopted into this plan as part of the March 2nd, 2016 EMR approval of the AMP.

The WL was issued August 5, 2015 and the requirements for the AMP are outlined in clause 109 (Yukon Water Board, 2015).

Clause 109 details and the sections in the AMP where these are addressed are summarized in Table 11.

Table 11: QZ14-031 Concordance table

109) The Licensee shall submit to the Board for Review and Approval an updated Operational Adaptive Management Plan. This plan shall be submitted by December 18, 2015, and shall be implemented once approved. The updated plan shall include, without limitation:	Section addressed
a) a surface water quality Adaptive Management Plan for McGinty Creek;	2.2
b) groundwater quality Adaptive Management Plans, including establishment of thresholds, for the Minto Creek and McGinty Creek watersheds;	2.3, 2.4
c) freeboard thresholds for each water storage facility;	2.5
d) WQOs, as stated in clause 8; (note: Clause 8 is presumed to be incorrect reference, and therefore W2 WQOs from licence have been included)	2.1
e) specifications for Monthly Reports that will include, but not be limited to the activities carried out under the Adaptive Management Plan, and	3.1
f) specifications for the Annual Report to include but not be limited to:	3.1, 3.2

i. activities undertaken in relation to the Adaptive Management Plan; ii. trend analysis and water levels in Minto and McGinty creeks; iii. proposed updates and revisions to the Adaptive Management Plan, and iv. any other revisions	

4. Adaptive Management Plan Approach

In addition to the conclusions drawn from research, the approach presented in this AMP follows the Environmental Code of Practice for Metal Mines, Section 4.1.17 on Adaptive Management:

"Mine owners/operators should use adaptive management methods to revise and refine the environmental management strategy. Adaptive management should consider a wide range of factors, including:

•The results of environmental audits or other evaluation activities;

•The results of environmental monitoring;

•The results of monitoring of the performance or condition of environmental infrastructure, such as containment structures, water management systems or treatment facilities;

•Technological developments; and

•Changing environmental conditions." (Environment Canada, 2009)

In addition to the guidance provided by the Environmental Code of Practice for Metal Mines, the AMP serves to meet the Yukon Government's Decision Document following the YESAA review of Minto's Phase V/VI project proposal which identifies some areas that an AMP for operations should be prepared to address including "*water quality, physical stability, covers, water treatment, and water management;"*. Though some covers are anticipated to be placed as part of progressive reclamation, they are not an operational feature and therefore have not been included in this AMP.

1. AMP Components

The following AMP components have been identified as having the potential for unexpected conditions during the operational period for which the Operational Management Plans may not provide adequate mitigation against potential effects to the environment or human health and safety:

- Surface water quality;
- Groundwater quality;
- Water Management, and
- Physical Stability

The specific AMP framework for these components is described in subsequent sections.

2. AMP Framework

The AMPs for each component are laid out using a common element approach to create consistency in implementation of the AMP protocol for all components as illustrated in Figure 11. The common elements are:

1.Description of the component

- *Description* - description and understanding of the component leads to risk narrative and specific performance thresholds.
- *Risk Narrative* describe the possible environmental impacts and environmental conditions that implementation of the AMP will prevent.

2.Monitoring the component

- *Specific Indicators* are the environmental or physical parameters to be monitored and assessed. Specific indicators are measurable or observable, and are indicative of changes from the designed or expected condition.
- *Monitoring Requirements* describes the monitoring regime for the component including frequency, type of data required and interpretation of results.
- *Specific Performance Thresholds* define the conditions, in terms of specific indicators, when action is triggered. Performance thresholds are staged to accommodate levels of concern and a diversity of actions. To the extent possible, specific performance thresholds will include early warning thresholds so that timely and informative responses are initiated before higher impact thresholds are triggered. Trend analysis at early warning thresholds are included to determine the potential of triggering subsequent thresholds.

3.Responding to unexpected conditions of the component

Specific Responses are staged according to specific performance thresholds describes the actions to be implemented if specific performance thresholds are crossed. They are provided in the following categories:

a. Notification

b. Review

c. Evaluation

d. Action

4.Annual Reporting and Review

Annual Reporting reflects annual changes made to the AMP as the site conditions change. The AMP should be modified whenever unexpected circumstances are encountered and the protocol is implemented or when additional proven science or technology becomes available. The annual review will include a review of the relevant monitored data and AMP elements. Updates, amendments, performance thresholds crossed, and trigger(s) activated will be provided to the appropriate governmental (including SFN) organizations as required and will be part of the annual report.

Additional reporting is described further in section 3.1.

Appendix B: Methodology for ST3 Calculation for Minto Creek Groundwater Catchment

SPT-3 generally corresponds to the estimated concentrations in groundwater that would be necessary to cause exceedance of the Water Quality Objectives in lower Minto Creek, at W2, under long term steady state conditions (exceptions are listed in the notes to Table 2-). These concentrations were determined by conducting a mass loading calculation to determine the groundwater concentrations that would be necessary to cause exceedance of WQOs in lower Minto Creek during low flow periods where all streamflow is derived from groundwater discharge. The mass loading calculation was structured to represent a low-flow period when all surface flows in lower Minto Creek originate from groundwater discharge to the creek.

Minto feels this is a conservative approach because if the groundwater concentration of one indicator reached the SPT-3 in an individual port, the quality of the lower Minto Creek at W2 would not yet exceed the Water Quality Objective due to the contribution of groundwater from un-impacted areas of the Minto Creek watershed and the fact that groundwater concentrations at a specific monitoring well port represents only a portion of the flow and not the whole groundwater flow field.

$$C_{gw\text{-}mine\_max} = ((Q_{W2} \text{ x } C_{W2\text{-}WQO}) - (Q_{gw\text{-}bgrnd} \text{ x } C_{gw\text{-}bgrnd}))/Q_{gw\text{-}mine}$$

Where:

- $C_{gw\text{-}mine\_max}$ = the indicator parameter concentration of all groundwater upgradient of MW12-05 that reports to Minto Creek that would be required to cause surface water to exceed the WQO at station W2.
- Q_{W2} = the combined groundwater flow discharging to Minto Creek (total groundwater discharge to Minto Creek from the 2015 groundwater model update) during low flow periods
- $C_{W2\text{-}WQO}$ = the WQO parameter concentration for surface water at W2
- $Q_{gw\text{-}bgrnd}$ = background groundwater flow discharging to Minto Creek (groundwater discharge down gradient of the Water Storage Pond from the 2015 groundwater model update) during low flow periods
- $C_{gw\text{-}bgrnd}$ = background groundwater concentration (based on median concentrations from the 2009-2015 baseline monitoring period in MW09-03)

- $Q_{gw\text{-}mine}$ = the estimated groundwater flow from the mine at the Water Storage Pond (from the 2015 groundwater model update)

Appendix J2
Closure Adaptive Management Plan 2020-01

Minto Mine

CLOSURE ADAPTIVE MANAGEMENT PLAN

v2020-01

MINTO

Prepared by:
Minto Explorations Ltd.
Minto Mine
October 2020

Minto Mine Closure Adaptive Management Plan

AMP Version History

AMP Version	Issue Date	Description and Revisions Made
2014-01	June 2014	First Issue
2016-01	August 2016	Revisions made as per requirements of WUL QZ14-031 and QML-0001
2017-01	February 2017	Revisions made to reflect finalization of closure water quality objectives with SFN, with associated updates and adjustments
2018-01	February 2018	Revisions made based on YWB review and subsequent information requests.
2020-01	October 2020	Revisions made based on SFN review and BTWG meeting discussions, operational AMP experience, and YWB review.

2017-01 Revisions

AMP Section	Description of Revision
1	Included a description of all three closure periods. Included a recommendation to revise the AMP prior to implementation.
2.1	Included an introduction paragraph which provides context by explaining how the surface water quality AMP components are integrated. Also, included Table 2-1, which clarifies what AMP component applies to a given closure period.
2.1.1.1	Included clarification regarding what closure period the Mine Site AMP Component applies.
2.1.1.3	Revised all of the values in Table 2-2 (formerly 2-1) so that they actually represent maximum predicted concertation for the Post Closure II period. Revised Table 2-3 (formerly 2-2) to include applicable closure period to each specific threshold and revised wording to improve clarity.
2.1.2.1	Included explanation for when the CWTS AMP component applies.
2.1.2.3	Revised Table 2-5 (formerly 2-4) to include applicable closure period to each specific threshold.
2.1.3.1	Significant revisions made to describe how the Minto Creek AMP component will apply to the PCI period.
2.1.3.2	Significant revisions made to separate out risk narrative for PCI and PCII periods.
2.1.3.3	Significant revisions made to incorporate a PCI specific AMP component for Minto Creek. Includes the addition of Table 2-6 for the PCI period. Significant revisions made to the PCII specific AMP component to incorporate the finalized WQOs. Table 2-7 (formerly Table 2-5) revised with WQOs. Revisions specific threshold 1 of Table 2-8 (formerly Table 2-6). Revisions to Table 2-9 (formerly Table 2-7) to incorporate central tendency WQO, revised resample frequency in specific threshold 1 response, included applicable closure period to each specific threshold and revised specific threshold 5.
2.1.4	Significant revisions to match what is in the updated operational AMP (2016-02).
2.2.1.3	Significant revisions to match what is in the updated operational AMP (2016-02).

2018-01 Revisions

AMP Section	Description of Revision
1	Corrected errors in Table 1-2
2.1.1	Added details on the investigation/evaluation in response to SPT-1 in Table 2-3.
2.1.2	Included specific definition in SPT-3 in Table 2-5.
2.1.3	Included details on the application of trend analysis (both annual and the proposed monthly methods) in Table 2-6. Corrected errors in Table 2-7. Included trend analysis and more details on investigation/evaluation elements in Table 2-8.
2.1.4	Specified a 12-month moving average for comparison with the CTE in Table 2-11.
2.3.1	Included a list of specific facilities to which the Water Management Infrastructure AMP applies.
2.5.2	New section, AMP for Minto North Pit Water Levels

2020-01 Revisions

AMP Section	Description of Revision
1.2.1	• Changed section title to "Regulatory Concordance"
1.3.1	• Clarified planning drivers for Closure AMP
1.3.2	• Changed title of item #4 in AMP Framework list to "Reporting and Review"
1.3.3	• Added table of global response timelines
1.3.4	• Added summary of RCP monitoring programs for reference • Increased monitoring frequency of stations W12, W45, W15 and W62 to Monthly (during open water) – will harmonize monitoring frequency with RCP v2020-01
2.1	• Added summary (and appendix) of trend assessment methodology
2.1.1	• Changed language in Risk Narrative to account for stable and not decreasing contaminant concentrations • Lowered threshold values for Pit station SPT-1 to expected case estimates to be more proactive • Updated threshold values for most recent water quality estimates • Added new frameworks for stations W15 and W62 • Added more examples of range of mitigation actions to be considered
2.1.2.1	• Clarified the CWTS commissioning performance criteria Clarified timing of application of this AMP component
2.1.2.3	• Updated treatment rate coefficients from demonstration scale research results in Table 2-6 and clarified intention for this calculation to include flow measurements in calculations. • Table 2-7: clarified 'stage' definition for timing expectations, simplified SPT-1, added review/notification elements for consistency, clarified actions, added new SPT-3,

	added examples of staged mitigation options in action responses, clarified language in SPT-4
2.1.3.1	• Clarified continuous improvement intention and duration over different phases
2.1.3.2	• Changed title of first Risk Narrative Period to also apply to first 5 years of PCII
2.1.3.3	• Clarified sequential WQO target strategy for continuous improvement framework in PC1 • Added clarification language for timing and applicability, defined the key WQ parameters (Cu, NO_3, Se, and As) that will be evaluated for triggering transition to PCII. • Table 2-8: clarified trend analysis comparison timeframe, added consideration of groundwater sources in evaluation responses, changed 'prepare' to 'implement recommendations' in action responses and specified re-evaluation of passive treatment system. • Table 2-10: updated station W3 to W50 for closure consistency, added detail on range of mitigation measures to be considered, added detail on expanding monitoring in Action of SPT-1, added re-sampling clarification in action for SPT-2, added time allowance for mitigation measures to continue of progress is being observed (action in SPT-3). Table footnote includes clarification of trend assessment methodology and detail on fixed duration of non-degradation WQO effort in PCII. • Removed discussion regarding attainment of WQOs – this is left to RCP v2020 • Table 2-11: clarified expanded monitoring details for SPT actions, specified intention of mitigation recommendations (reducing contaminant loading from site).
2.1.4.3	• Table 2-13: specified intention of mitigation recommendations (reducing contaminant loading to achieve water quality objectives).
2.2.1.3	• Clarified location of groundwater monitoring program details for closure (RCP). • Text updated to reflect decision to keep MW09-03 as baseline for SPTs in Minto Creek catchment. • Clarified intention and sequencing of possible mitigation measures. • Tables 2-14 and Table 2-16: specified intention of mitigation recommendations development.
2.3.1	• Removed reference to WSP and WSP Dam in relevant infrastructure list – they will be decommissioned (and replaced with CWTS) in closure condition.
2.4.3	• Table 2-20 and 2-21: substantial revisions to thresholds and responses based on expert re-evaluation.
APPENDICES	• Added Appendices A and B

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Appendix A: Memo – Trend Analyses for the Minto Mine Closure Adaptive Management Plan
Appendix B: Memo – Upper Limits of C-AMP Regulated Parameters During Operation

1 Introduction

Minto Explorations Ltd. (Minto), a wholly owned subsidiary of Capstone Mining Corp. (Capstone), owns and operates the Minto copper mine. Minto Mine is located within Selkirk First Nation (SFN) Category-A Settlement Land (Parcel R-6A), and is approximately 240 km northwest of Whitehorse, Yukon Territory. The Minto mine commenced commercial operations in October 2007.

As an outcome of the Phase V/VI mine licensing processes, Minto was required to update the mine Reclamation and Closure Plan (RCP) for the updated mine plan and with additional information outlined in its Quartz Mining License QML-0001 (QML) and Water Use Licence QZ14-031 (WUL) and approval letters. Both authorizations required the updating of the Adaptive Management Plan (AMP) for the closure and post-closure periods. AMPs are tools used to address uncertainty or conditions beyond those expected in reclamation and closure. AMPs outline a range of possible but unexpected outcomes and the responses that will be undertaken to curb possible negative impacts associated with these unexpected situations.

Closure failure modes and effects analyses (FMEA) have been conducted to determine both the probability and severity of postulated component failures at the Minto mine site and the associated infrastructure and environmental management systems. The FMEAs have been used to determine potential failure modes with the greatest risk rating, and identified components and scenarios where uncertainty and attendant risk could be reduced through adaptive management.

Mining activities are highly managed operations, with very prescriptive and detailed management plans required for both operational control and regulatory approval. More mature mines such as Minto have management plans which benefit from the operational experience at the site, and uncertainty in the range of conditions expected is reduced through this operational experience.

Minto has developed and implemented an operational Adaptive Management Plan to address uncertainty in site performance during the operational period (MEL, 2016). Uncertainty is reduced in the operational period through the development and implementation of operational management plans. Minto has developed a number of operational management plans which describe the management and response actions for expected conditions at the site during operations. These plans currently include:

- Solid Waste Management Plan;
- Environmental Monitoring, Surveillance, Reporting Plan;
- Wildlife Protection Plan;
- Spill Contingency Plan;
- Sediment and Erosion Control Plan;
- Mine Development and Operations Plan;
- Underground Mine Development and Operations Plan;
- Mill Operations Plan;
- Water Management Plan;
- Tailings Management Plan;
- Waste Rock and Overburden Management Plan;
- Emergency Response Plan; and
- Heritage Resources Protection Plan.

For the closure and post closure periods, planning and management of site activities are guided by the Minto Mine Reclamation and Closure Plan (RCP). This includes the identification of distinct closure periods with defined activities and performance expectations:

1. Active Closure (AC) - includes the implementation and construction of the large majority of the selected closure measures. Closure measures completed during this period include, but are not limited recontouring, soil placement, closure water conveyance construction, revegetation, construction of passive water treatment facilities and partial decommissioning of the Water Storage Dam, demobilization and demolition. Further details regarding the planned closure measures can be found in Section 7 of the RCP. During the AC period, operational water quality objectives/effluent standards and AMP will still apply and active treatment is expected to be the primary source of water treatment. The AC period is expected to span three years but may be completed sooner as closure measures are completed.
2. Post Closure I (PCI) - The PCI period is intended to provide time which allows the closure measures to establish and assessments to be completed on the performance of the chosen closure measure. The expected duration of this period is 5 years, however the close of this phase and the transition to PCII will be performance based, and will be triggered by the attainment of closure water quality objectives . During this period, maintenance on soil covers will be ongoing as vegetation begins to establish. Water conveyance features will be commissioned along with the passive treatment system. The passive treatment system is expected to take two years to reach design performance expectations. A pump back system will be established from the passive treatment system to the water treatment plant as there is potential that water quality will not meet effluent standards without active treatment. During PCI, operational water quality objectives/effluent standards will still apply. Passive treatment will be commissioned over the first two years of PCI and will become the primary water treatment system utilizing active treatment as required to meet operational water quality objectives and manage site water inventory. During the PCI period the Operational AMP and Closure AMP will both apply to specific components and are identified in this AMP.
3. Post Closure II (PCII) - is intended as a confirmatory period which will monitor that the closure measures continue to perform as expected. PCII is primarily a monitoring phase with maintenance activities as required. During PCII the closure water quality objectives will apply and passive treatment will be the primary water treatment onsite. The Closure AMP will be the sole AMP in PCII and will cover all of the components detailed in this plan.

This AMP is intended to provide a framework for responses to conditions beyond those expected and identified in the RCP for primarily the Post Closure I and II (PCI and PCII) periods. It has been constructed to meet the licensing requirements under both main authorizations and has benefited from an initial adequacy review by the Yukon Water Board (version 2017-01), with updates included based on that review in this version 2018-01.

Given the complexities of this AMP and the duration until implementation, it is recommended that this plan be reviewed and revised as required prior to implementation.

1.1 Adaptive Management Overview

Adaptive management is an approach to environmental management that is appropriate when mitigation measures may not function as intended or when broad-scale environmental change is possible. Adaptive management plans are precautionary in nature and provide a level of security in long term environmental planning. Adaptive management plans also allow for the inclusion of improved science into mitigation measures as they are continually revised.

Adaptive management has been evolving since its emergence in the 1970s. Adaptive approaches include an ability to incorporate knowledge into the management plan as the knowledge is gleaned and circumstances change. Embedding adaptation into environmental plans involves thinking about how the results of monitoring will change management actions. Eberhard et al. (Eberhard, et al., 2009) described the categories of knowledge that may trigger changes to water quality management plans; system understanding, measuring progress and anticipating changes. These categories allow for the inclusion of knowledge and adaptation of management to changed conditions. Adaptive management plans are a way to accept uncertainties and build a structured framework to respond to changing conditions.

Adaptive management conducts a flexible path with actions to take when specific triggers occur. AMPs are a formalization of a plan for performance monitoring and project re-evaluation in the future. The general structure of adaptive management can be described by the following steps:

1. Identify risk triggers associated with vulnerabilities or uncertainties;
2. Quantify impacts and uncertainties;
3. Evaluate strategies and define implementation path that allows for multiple options at specific triggers;
4. Monitor the performance and critical variables in the system; and
5. Implement or re-evaluate strategies when triggers are reached.

Although there are no widely used AMP terms, the steps listed above are representative of typical AMP processes. Within AMPs, triggers provide decision points in a stepwise decision-making framework that identifies how and when management action should be taken. A key characteristic of adaptive management is monitoring, which is used to advance scientific understanding and to adjust management policies in an iterative process. Adaptive management is a rigorous method for addressing uncertainties in ecosystem management.

1.2 Adaptive Management Plan Objectives

An AMP is a management tool wherein a framework is provided to make quick and effective decisions to guide responses to unforeseen events. This document identifies areas of uncertainty within the post closure phases of the Minto Mine life and provides an AMP framework for each. For each component the AMP describes thresholds, triggers and responses to underperforming elements or emerging risks within the component. The steps laid out in the AMP framework are precautionary, and therefore they provide the confidence that action will be taken before adverse environmental impacts are observed.

Response planning, and results for anticipated events are contained within site management plans while AMPs guide responses to unforeseen or contingency events. This AMP provides a framework to guide responses to unanticipated monitoring results and to potential but low probability events where uncertainty exists.

It is difficult to predict the specific environmental condition that may arise which requires a response from management and, therefore, the AMP does not provide specific detailed descriptions of responses to a situation. The AMP provides a range of possible responses to use as a guide to respond to specific environmental conditions encountered. Management should use the information provided in the AMP and undertake the appropriate response.

1.2.1 Regulatory Concordance

The 2016-01 version of the AMP was updated to include the requirements of the QML and WUL.

The QML was issued December 18, 2014 and was accompanied by a letter entitled outlining the components required in an Adaptive Management Plan (Yukon Government - Energy, Mines and Resources, 2014). The AMP includes the requirements outlined in the letter, which have also been addressed in the Operational AMP (the QML approval letter is non-specific as to the mine phase, so the requirements have been included in both AMPs). The QML approval letter requirements and where the items are addressed in the AMP are presented in the following concordance Table 1-1.

Table 1-1: QML Approval Letter Concordance Table

1. Adaptive Management Plan An adaptive management plan must include:	Section addressed
(a) key pathways and events that lead to uncertainty about site performance, including but not limited to:	1.3 2.1 – 2.5
○ water quality	2.1
○ physical stability	2.2
○ cover systems	2.3.1
○ water treatment, and	2.1, 2.5
○ water management	2.5
(b) detailed descriptions of effective indicators of performance, monitoring programs, triggers for adaptive management responses, and actions that will be taken for each event or pathway. Triggers and actions should be defined and described for various levels of response, initially requiring investigation of causes and proceeding to implementation of appropriate contingency measures; and	2.1 – 2.5
(c) detailed descriptions of procedures for investigating causes of adaptive management trigger exceedances, and corrective actions should be provided. These should demonstrate that actions can be taken prior to causing unacceptable effects	2.1 – 2.5

The WUL was issued August 5, 2015 and the requirements for the Closure AMP are outlined in clause 110 e) (Yukon Water Board, 2015).

Clause 110 e) details and the sections in the AMP where these are addressed are summarized in Table 1-2.

Table 1-2: QZ14-031 Concordance Table

110) The updated RCP shall include, but not necessarily be limited to, the following: e) an updated Closure AMP including, but not necessarily be limited to, the following:	Section addressed
i) numerical values of thresholds for each parameter for each specific threshold for each AMP component	all
ii) consideration of statistical trend analysis to provide future forecasting of potential exceedances;	2.1
iii) thresholds for action and responses related to potential poor performance of the Main Pit Dam; and	n/a[1]
iv) management measures to responds to changing conditions in:	2.1
• McGinty Creek	2.1.4
• water quality at internal monitoring locations	2.1.1
• pit water quality	2.1.1
• passive treatment system performance; and	2.1.2
• water levels in open pits	2.5.2

[1] Main Dam is no longer part of the proposed Mine Plan

1.3 Adaptive Management Plan Approach

In addition to the conclusions drawn from research, the approach presented in this AMP follows the Environmental Code of Practice for Metal Mines, Section 4.1.17 on Adaptive Management:

"Mine owners/operators should use adaptive management methods to revise and refine the environmental management strategy. Adaptive management should consider a wide range of factors, including:

- The results of environmental audits or other evaluation activities;
- The results of environmental monitoring;
- The results of monitoring of the performance or condition of environmental infrastructure, such as containment structures, water management systems or treatment facilities;
- Technological developments; and
- Changing environmental conditions." (Environment Canada, 2009)

1.3.1 AMP Components

The following AMP components have been identified as either:

a) having the potential for unexpected conditions during the operational period for which the Operational Management Plans may not provide adequate mitigation against potential effects to the environment or human health and safety, therefore, these components have been carried over into the AMP for the closure periods; or

b) having potential for unexpected conditions in the closure periods, as identified in closure planning exercises:
   - Surface water quality;
   - Groundwater quality;
   - Water Management Infrastructure;
   - Physical Stability; and
   - General Reclamation Measures

The specific AMP framework for these components is described in Sections 2.1 through 2.5.

1.3.2 AMP Framework

The AMPs for each component are laid out using a common element approach to create consistency in implementation of the AMP protocol for all components as illustrated in Figure 1-1. The common elements are:

1. Description of the component

- *Description* - description and understanding of the component leads to risk narrative and specific performance thresholds.
- *Risk Narrative* describe the possible environmental impacts and environmental conditions that implementation of the AMP will prevent.

2. Monitoring the component

- *Specific Indicators* are the environmental or physical parameters to be monitored and assessed. Specific indicators are measurable or observable, and are indicative of changes from the designed or expected condition.
- *Monitoring Requirements* describes the monitoring regime for the component including frequency, type of data required and interpretation of results – outlined in the Minto RCP document.
- *Specific Performance Thresholds* define the conditions, in terms of specific indicators, when action is triggered. Performance thresholds are staged to accommodate levels of concern and a diversity of actions. To the extent possible, specific performance thresholds will include early warning thresholds.

3. Responding to unexpected conditions of the component

Specific Responses are staged according to specific performance thresholds describes the actions to be implemented if specific performance thresholds are crossed. They are provided in the following categories:

a) Notification

b) Review

c) Evaluation

d) Action

4. Reporting and Review

Annual Reporting reflects annual changes made to the AMP as the site conditions change. The AMP should be modified whenever unexpected circumstances are encountered and the protocol is implemented or when additional proven science or technology becomes available. The annual review will include a review of the relevant monitored data and AMP elements. Updates, amendments, performance thresholds crossed, and trigger(s) activated will be provided to the appropriate governmental (including SFN) organizations as required and will be part of the annual report.

Additional reporting is described further in section 3.

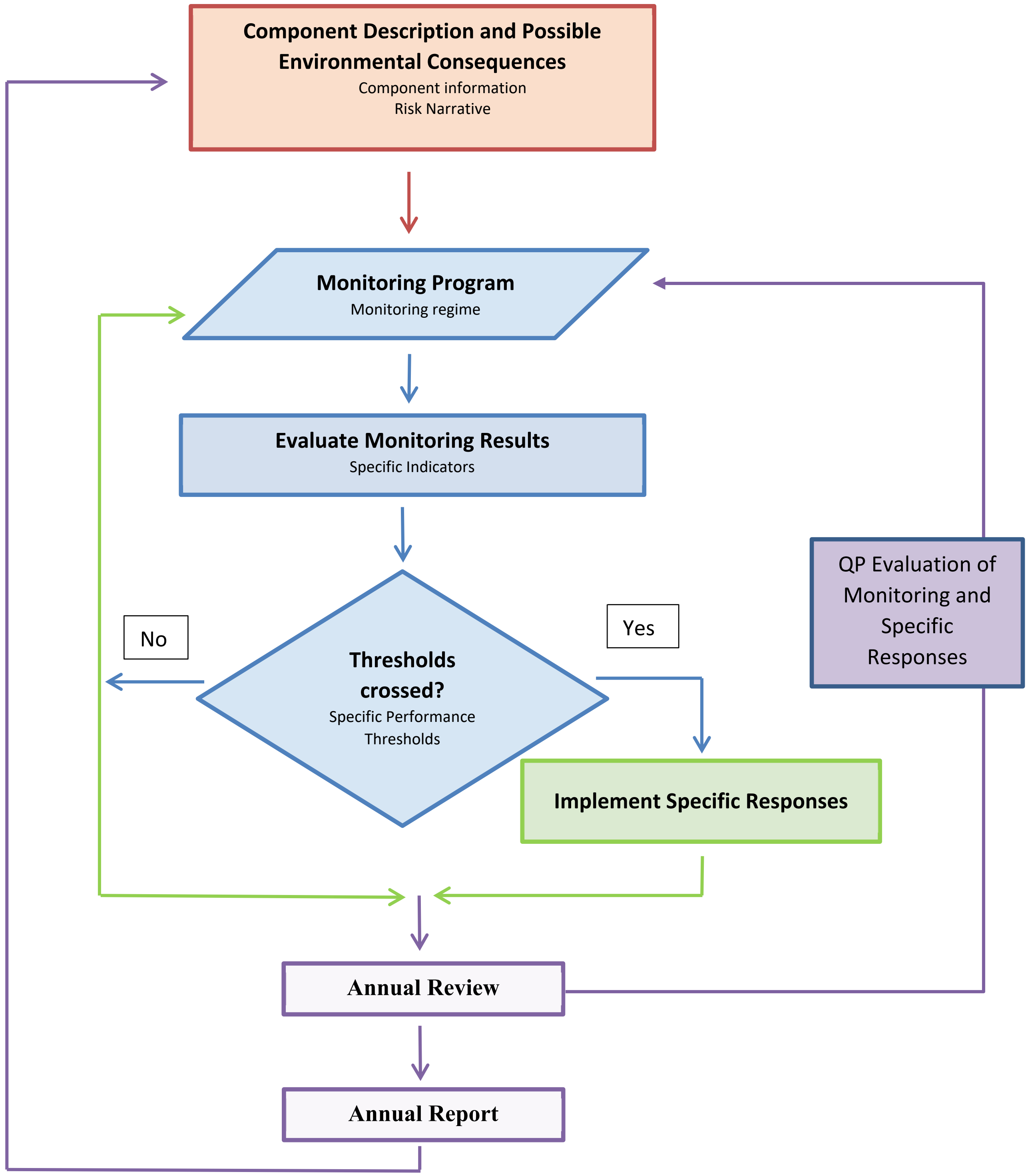

Figure 1-1: Sequential Components of the AMP (Adapted from AECOM 2010)

1.3.3 Response Timelines

The following timelines have been developed and are applicable to all response instances in all AMP components:

Table 1-3: Global AMP response timelines.

Response Type	Description	Timeline
Notification	Notification of relevant parties	Within 1 week of receiving results
Review	Initiating review	Within 1 week of receiving results
	QA/QC review (validation protocol);	1 week
Evaluation	Submitting to regulators upon receipt of recommendation	1 week
Action	Engage a QP	Within 1 week of AMP requirement
	Initiating implementation upon receipt of approval if required	1 month
	Conduct any relevant review/evaluation-type actions	Prior to or during the next sampling event

The timeline for initiating implementation would be suitable for many actions; however, there are situations where implementation would be delayed due to site conditions (e.g. frozen) or the availability of materials. In cases where implementation cannot be initiated within a month then the timeline would be part of the approval. For example, if a significant mitigation plan had to be approved before implementing the plan.

1.3.4 Monitoring Programs

The foundation of adaptive management is monitoring, and for continuity and clarity the closure and post closure monitoring programs from the Minto Mine Reclamation and Closure Plan (RCP) are reproduced here from RCP Section 7.11:

> *Environmental and geotechnical monitoring, inspections and treatment wetland monitoring conducted during the post-closure periods (years 4-18 after cessation of mining) will be undertaken by site-based staff or during periodic visits to the site. Water sample collection and data downloads from geotechnical monitoring instrumentation will be completed as per Tables 7-1 and 7-2, while geotechnical inspections and reporting will be completed as per Table 7-3. Treatment wetland monitoring will be completed as per Table 7-4. Access to the property for post-closure monitoring would be by road while the Main Access Road is maintained or via ATV, snowmobile, and/or helicopter after the road is decommissioned.*

During the post-closure period, reporting on all environmental and inspection programs carried out on the property will continue (Table 7-3). These reports will be filed with the YWB, and EMR in accordance with conditions contained in the Water Use Licence, Quartz Mining Licence and other operating permits and approvals.

Company personnel responsible for the management of the Minto Mine would continue to meet with regulatory agencies, SFN, and the community (Pelly Crossing) on an as-needed basis to keep interested parties appraised of decommissioning activities and the results of post-closure monitoring.

These tables have been reproduced following as Tables 1-4 through 1-7.

Table 1-4: Post Closure Water Monitoring Program

		YEAR 1-3 FREQUENCY (Active Closure)				YEAR 4 - 8 FREQUENCY (Post Closure I)				YEAR 9 -18 FREQUENCY (Post Closure II)		
SITE	**DESCRIPTION**	**Water Quality**	**Sediment[4]**	**Benthos[4]**	**Flows**	**Water Quality**	**Sediment[4]**	**Benthos[4]**	**Flows**	**Water Quality**	**Sediment[4]**	**Benthos[4]**
	Receiving/Background Water Stations											
W-2	Mainstem Minto Creek directly u/s Access Road Crossing	Monitoring to be carried as per an approved Environmental Surveillance and Reporting Plan				Wd*/M	A2	A2	Wd/M	SSF	A2	A2
W-3	Mainstem Minto Creek - MMER Compliance Point					M	A2	A2	M	SSF	A2	A2
W-7	Tributary to Minto Creek					SSF			SSF	A		
MN-0.5	Lower west arm of McGinty Creek - Reference Station					SSF			SSF	A		
MN-1.5	Upper east are of McGinty Creek - downstream of Minto North Pit					SSF			SSF	SSF		
MN-4.5	McGinty Creek at confluence with Yukon River					SSF			SSF	SSF		
W-50	50m downstream of end of pipe discharge (WUL Compliance Point)					Wd*/M			Wd	A		
	Mine Site Stations											
W-12	Discharge from Main Pit	Monitoring to be carried as per an approved Environmental Surveillance and Reporting Plan				Mow			SA	SSF		
W-45	Discharge from Area 2 Pit					Mow			SA	SSF		
MN	Minto North Pit[5]					SSF			SA	SSF		
W-15	Minto Creek, downstream of the SWD					Mow			SA	A		
W-16	Main Water Storage Pond Discharge (or Main Water Storage Pond if not discharging)					NLA			NLA	NLA		
W-17	Main Water Storage Dam Seepage					NLA			NLA	NLA		
W-62	Seepage from toe of MVFES2					Mow				A		
HFBP	CWTS High Flow By-Pass					Mwf			Mwf	SSF		

		YEAR 1-3 FREQUENCY (Active Closure)				YEAR 4 - 8 FREQUENCY (Post Closure I)				YEAR 9 -18 FREQUENCY (Post Closure II)		
SITE	**DESCRIPTION**	**Water Quality**	**Sediment**	**Benthos**	**Flows**	**Water Quality**	**Sediment**	**Benthos**	**Flows**	**Water Quality**	**Sediment**	**Benthos**
	Groundwater Wells											
MW17-08	Upgradient of Mine Activities – TBD (Select zones as recommended by a qualified professional)	A - F				NRM				NRM		
MW17-09	Down gradient of SWD – TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW12-05	Down gradient of –all mine workings TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW17-10	Down gradient of MWD – TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW12-06	Down gradient of DSTSF – TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW12-07	Down gradient of Main Pit - TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW09-03	Down gradient of Minto North Pit - TBD (Select zones as recommended by a qualified professional)	SA - SF				NRM						
MW17-11	Down gradient of Minto North Pit - TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		
MW17-12	Down gradient of Water Storage Pond - TBD (Select zones as recommended by a qualified professional)	SA - SF				A - F				A2 - F		

*** Unless structure has been decommissioned/reclaimed**

Frequency Description

W	Weekly	A2	Every 2 Years
Wd	Weekly when discharging (*active treatment only)	NLA	No longer active
W2	Every 2 Weeks	DCR	Daily Continuous Record during open season
M	Monthly	SSF	Spring, Summer, Fall (May, July/August, September)
Md	Monthly when discharging	SF	Spring and Fall (May, Sept)
Q	Quarterly	F	Fall
SA	Semi-annually	Mwf	Monthly when flowing
A	Annually	NRM	No routine monitoring
		Mow	Monthly during open water (May-Oct)

Table 1-5: Geotechnical Monitoring and Instrumentation Download Frequency

		YEAR 1-3 FREQUENCY (Active Closure)		YEAR 4-8 FREQUENCY (Post Closure I)		YEAR 9-18 FREQUENCY (Post Closure II)	
AREA	**STURCTURE**	**Instrumentation**	**Data Download Frequency**	**Description**	**Data Download Frequency**	**Description**	**Data Download Frequency**
UNDERGROUND	Vent Raises	Visual Inspection	Semi-annually	Visual Inspection	Annually	Visual Inspection	Every 5 years
OPEN PITS	Area 118 Pit	SH	Semi-annually	SH	Annually	SH	Every 5 years
	Area 2 Pit	SH	Weekly during mining, quarterly thereafter	SH	Annually	SH	Every 5 years
	Main Pit	SH I	Quarterly Quarterly	SH I	Annually	SH I	Every 5 years
	Minto North Pit	NA	NA	NA	NA	NA	NA
TAILINGS FACILITIES	Area 2 Pit Tailings Management Facility	Visual Inspection	Quarterly	Visual Inspection	Annually	Visual Inspection	Every 5 years
	Dry Stack Tailings Storage Facility	I P SH T	Quarterly Monthly Monthly/Weekly Quarterly	I P SH T	Semi-annually	I P SH T	Annually
	Main Pit Tailings Management Facility	Visual Inspection	Quarterly	Visual Inspection	Annually	Visual Inspection	Every 5 years
WASTE ROCK AND OVERBURDEN DUMPS	Area 118 Backfill Dump	Visual Inspection	Semi-annually	Visual Inspection	Annually	Visual Inspection	Every 5 years
	Ice-rich Overburden Dump	Visual Inspection	Semi-annually	Visual Inspection	Annually	Visual Inspection	Every 5 years
	Main Pit Dump / South Wall Buttress	SH	Semi-annually	SH	Annually	SH	Every 5 years
	Main Waste Dump Main Waste Dump Expansion	I	NA	I	NA	I	NA
	Mill Valley Fill Extension	P SH	Monthly Weekly	P SH	Semi-annually	P SH	Annually
	Reclamation Overburden Dump	Visual Inspection	Semi-annually	Visual Inspection	Annually	Visual Inspection	Every 5 years
	Southwest Waste Dump	I P SH T	Quarterly Monthly Monthly Quarterly	I P SH T	Semi-annually	I P SH T	Every 5 years
MINE INFRASTRUCTURE	Includes all reclaimed camp, mill, warehousing and fuel storage facilities	Visual Inspection	Annually	Visual Inspection	Biannually	Visual Inspection	Every 5 years
ROADS AND ACCESS	Includes main access road, site access roads, and airstrip	Visual Inspection	Annually	Visual Inspection	Biannually	Visual Inspection	Every 5 years
WATER MANAGEMENT	Conveyance Channels	Visual Inspection	Semi-annually	Visual Inspection	Annually	Visual Inspection	Every 5 years
	Water Storage Dam	P SH T	Monthly Monthly Monthly	P SH T	Semi-annually	Visual Inspection	Every 5 years

I Inclinometers
P Piezometers
T Thermistors
SH Survey Hubs
NA Not Applicable

Table 1-6: Post Closure Geotechnical Inspection Program

		YEAR 1-3 FREQUENCY (Active Closure)		YEAR 4-8 FREQUENCY (Post Closure I)		YEAR 9-18 FREQUENCY (Post Closure II)	
AREA	**STURCTURE**	**Description**	**Inspection Frequency**	**Description**	**Inspection Frequency**	**Description**	**Inspection Frequency**
UNDERGROUND	Vent Raises	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
OPEN PITS	Area 118 Pit	Backfilled; inspection no longer required and not possible	N/A		N/A		N/A
	Area 2 Pit	Visual inspection by Geotechnical Engineer and review of monitoring data	Quarterly	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Main Pit	Visual inspection by Geotechnical Engineer and review of monitoring data	Quarterly	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Minto North Pit	Visual inspection by Geotechnical Engineer and review of monitoring data	Quarterly	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
TAILINGS FACILITIES	Area 2 Pit Tailings Management Facility	Visual inspection by Geotechnical Engineer as per OMS manual	Quarterly, in conjunction with pit inspection	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Dry Stack Tailings Storage Facility	Visual inspection by Geotechnical Engineer and review of monitoring data as per OMS Manual	Monthly	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Main Pit Tailings Management Facility	Visual inspection by Geotechnical Engineer as per OMS Manual	Quarterly, in conjunction with pit inspection	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
WASTE ROCK AND OVERBURDEN DUMPS	Area 118 Backfill Dump	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Ice-rich Overburden Dump	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Main Pit Dump / South Wall Buttress	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Main Waste Dump Main Waste Dump Expansion	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Mill Valley Fill Extension	Visual inspection by Geotechnical Engineer and review of monitoring data	Monthly; in conjunction with the DSTSF inspection	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Reclamation Overburden Dump	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Southwest Waste Dump	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
MINE INFRASTRUCTURE	Includes all reclaimed camp, mill, warehousing and fuel storage facilities	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause	Annually	Included in site-wide geotechnical inspection	Biannually	Included in site-wide geotechnical inspection	Every 5 years

		100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year					
ROADS AND ACCESS	Includes main access road, site access roads, and airstrip	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Annually	Included in site-wide geotechnical inspection	Biannually	Included in site-wide geotechnical inspection	Every 5 years
WATER MANAGEMENT	Conveyance Channels	Included in site-wide geotechnical inspection - Inspection and data review by Professional Engineer as per QZ14-031 (Clause 100) and QML-0001 (Clause 13.2). Q2 inspection must be completed by an independent engineer by June 30 each year	Semi-Annually –May/June post thaw, and September pre freeze-up	Included in site-wide geotechnical inspection	Annually	Included in site-wide geotechnical inspection	Every 5 years
	Water Storage Dam	Visual inspection by Geotechnical Engineer as per OMS Manual. Dam Safety Reviews (DSR) to be completed by an independent engineer as per CDA requirements for a dam with a 'Significant' dam hazard classification.	Monthly Visual inspection; next DSR required in 2020	Visual inspection by Geotechnical Engineer as per OMS Manual	Monthly	No longer required; Dam decommissioned	N/A

Table 1-7: Wetland Monitoring Schedule and Frequency

		YEAR 1 - 3 FREQUENCY (Active Closure)	YEAR 4 - 8 FREQUENCY (Post Closure I)								YEAR 9 -18 FREQUENCY (Post Closure II)			
		Construction	Commissioning (year 4-5)				Early Operation (year 6-8)				Long-term Operation (year 9-18)			
SITE	DESCRIPTION	No Monitoring Required	Water Quality	Substrate/Sediment	Flows	Vegetation	Water Quality	Substrate/Sediment	Flows	Vegetation	Water Quality	Substrate/ Sediment	Flows	Vegetation
CWTS IN	Inflow to the CWTS system	NA	W,M	NA	W,M	NA	M	NA	M	NA	SSF	NA	SSF	NA
CWTS MID	Mid points within the CWTS system, for water, between the cells, and for soils, within the cells	NA	W,M	M,SSF,A	W,M	W,M,A	M	M,A	NA	SSF,A	A	A	A	A
CWTS OUT	Outflow of constructed wetland treatment system	NA	W,M	NA	W,M	NA	M	NA	M	NA	SSF	NA	SSF	NA

Frequency Description

W	Weekly	BA	Bi-annually
Wd	Weekly when discharging	NLA	No longer active
W2	Every 2 Weeks	DCR	Daily Continuous Record during open season
M	Monthly	SSF	Spring, Summer, Fall (May, July/August, September)
Md	Monthly when discharging	SF	Spring and Fall
Q	Quarterly	F	Fall
SA	Semi-annually	NA	Not Applicable
A	Annually	NRM	No routine monitoirng

2 Adaptive Management Plans for Mine Components

2.1 Surface Water Quality

The Surface Water Quality section of this AMP aims to integrate the mine site (Area 2 and Main Pits) water quality with the performance of the CWTS to reach the overall goal of meeting water quality objectives (WQO) in Minto Creek's receiving environment (W2). The McGinty Creek AMP component is also included but does not have the same source control uncertainty as Minto Creek and is therefore not integrated with other AMP components. The Surface Water Quality components are intended to address the uncertainty that arise in specific closure periods and are therefore not completely inclusive of PCI and PCII closure periods. The applicable closure periods will be identified to the corresponding components in the sections below. A summary of the closure periods and corresponding AMP components is broken down in Table 2-1 below.

Table 2-1: Surface water AMP components and corresponding closure period

AMP Component	Applicable Closure Period	Exceptions
Mine Site	PCII	No exceptions
Constructed Wetland Treatment Systems (CWTS)	PCI and PCII	Applies after the CWTS commissioning period only
Minto Creek	PCI and PCII	Only applies in PCI after the CWTS is performing as expected
McGinty Creek	PCI and PCII	No exceptions

Trend Assessment Methodology

Several thresholds in the Surface Water Quality AMP rely on an analysis of trends in water quality data. The approach to these analyses is to complete an initial trend analysis that will support the future ability to complete trend analyses on a monthly basis and in a more detailed manner on an annual basis. The approaches to the initial trend analysis and to ongoing trend analysis are similar and involve two comprehensive methods to assess trends for all parameters. For the initial trend analysis, Method 1 will be conducted over multiple time spans and tests for increasing or decreasing trends over each period. Method 2 will be conducted over the last 5 and 10 years and assesses differences among each year included in the analysis. Following this initial trend analysis, two approaches for continued monitoring will be conducted within the Minto Mine water quality data management system to evaluate each new observation (monthly mean concentration) and annual differences over the last 10 years.

The initial trend analysis will be conducted using parametric and non-parametric analyses over multiple time periods. Both approaches will utilize monthly mean concentrations estimated using the Kaplan-Meier method. After the initial trend analysis, continued trend analysis will be conducted using comparisons of monthly mean COPC concentration to monthly percentiles, and annually using an ANOVA comparison of monthly mean concentrations over the previous year to concentrations over the preceding 9 years (10 year time period in total). Further detail on the trend analysis methods to be employed can be found in Appendix 1 -Trend Analyses for Minto Mine Closure AMP (Minnow, 2020).

2.1.1 **Mine Site**

2.1.1.1 Description

During the closure and post-closure period, the management of runoff and site water will become increasingly more passive, as described in the RCP. Attention to the quality of site runoff, seepage, and surface water at some key locations will be important indicators of reclamation success of site facilities and will provide an indication of potential water quality issues upstream of the passive treatment installation at the former water storage pond footprint. In particular, attention to the water quality in the two upstream pit outflows (Main Pit – W12, Area 2 Pit – W45) and waste seepage locations W15 (below Southwest Waste Dump) and W62 (at toe of DSTSF and Mill Valley Fill Extension) will provide site managers with indications of water quality that may lead to passive treatment performance problems, and possibly to water quality objectives not being attained further downstream in the receiving environment of Minto Creek (W2).

As active water treatment will be employed and utilized in Active Closure as well as available during the PCI period, with a high degree of certainty around effluent quality, the AMP framework for the mine site facilities below are relevant to the post closure PCII period only.

Risk Narrative

Increasing (or stable and not decreasing) concentrations of contaminants from closed site facilities and flooded open pits lead to passive treatment challenges, exceedance of downstream water quality objectives, and/or adverse effects to aquatic resources in the receiving environment (lower Minto Creek).

Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water quality and the monitoring program are provided below in Tables 2-3, 2-4, and 2-5, and the specific thresholds are identified in Table 2-2. The monitoring results that will be evaluated and utilized in this component of the AMP are outlined in Section 7.11 of the Minto Mine RCP (2018-01).

Table 2-2a: Specific Performance Thresholds for Mine Site Pit Stations for SPT-1

Parameter	Expected Case Maximum Predicted Concentration for Post-Closure II Period					
	W45 (Area 2 Pit)			W12 (Main Pit)		
	May	July	Sept	May	July	Sept
Ammonia - N, mg/L	4.37	4.21	4.16	0.78	0.49	0.49
Nitrite - N, mg/L	1.04	1.01	0.99	0.12	0.08	0.08
Nitrate - N, mg/L	22	21	21	4.7	2.9	3.1
Aluminum (dissolved), mg/L	0.46	0.46	0.46	0.41	0.36	0.30
Arsenic (dissolved), mg/L	0.0030	0.0030	0.0030	0.0027	0.0025	0.0024
Cadmium (dissolved), µg/L	0.00009	0.00009	0.00009	0.00009	0.00008	0.00007
Chromium (dissolved), mg/L	0.0021	0.0021	0.0021	0.0026	0.0025	0.0025
Copper (dissolved), mg/L	0.029	0.028	0.028	0.048	0.043	0.039
Iron (dissolved), mg/L	0.47	0.46	0.46	0.88	0.84	0.78
Lead (dissolved), mg/L	0.00052	0.00052	0.00051	0.00058	0.00056	0.00054
Molybdenum (dissolved), mg/L	0.050	0.048	0.048	0.012	0.012	0.011
Nickel (dissolved), mg/L	0.0030	0.0030	0.0030	0.0029	0.0029	0.0029
Silver (dissolved), mg/L	0.000065	0.000065	0.000065	0.000069	0.000065	0.000062
Selenium (dissolved), mg/L	0.010	0.010	0.010	0.0042	0.0034	0.0035
Zinc (dissolved), mg/L	0.011	0.0110	0.0110	0.0132	0.0129	0.0127

Table 2-3b: Specific Performance Thresholds for Mine Site Pit Stations for SPT-2/3.

Parameter	Worst Case Maximum Predicted Concentration for Post-Closure II Period					
	W45 (Area 2 Pit)			W12 (Main Pit)		
	May	July	Sept	May	July	Sept
Ammonia - N, mg/L	18.13	17.45	17.22	3.69	2.23	2.30
Nitrite - N, mg/L	2.41	2.33	2.30	0.42	0.29	0.28
Nitrate - N, mg/L	66	64	63	15.7	9.7	10.2
Aluminum (dissolved), mg/L	0.89	0.89	0.89	0.83	0.73	0.62
Arsenic (dissolved), mg/L	0.0074	0.0074	0.0074	0.0063	0.0058	0.0055
Cadmium (dissolved), µg/L	0.00038	0.00038	0.00038	0.00037	0.00032	0.00036
Chromium (dissolved), mg/L	0.0054	0.0054	0.0054	0.0048	0.0044	0.0043
Copper (dissolved), mg/L	0.074	0.073	0.073	0.099	0.090	0.083
Iron (dissolved), mg/L	1.10	1.07	1.06	1.93	2.21	2.30
Lead (dissolved), mg/L	0.0032	0.0032	0.0032	0.0025	0.0023	0.0020
Molybdenum (dissolved), mg/L	0.115	0.113	0.113	0.038	0.035	0.034
Nickel (dissolved), mg/L	0.0073	0.0072	0.0072	0.0074	0.0073	0.0072
Silver (dissolved), mg/L	0.00014	0.00014	0.00014	0.00012	0.00011	0.00010
Selenium (dissolved), mg/L	0.020	0.020	0.020	0.0105	0.0081	0.0083
Zinc (dissolved), mg/L	0.036	0.036	0.036	0.036	0.034	0.031

Table 2-4: Specific Indicators, Performance Thresholds and Responses for Mine Site Pit Monitoring Locations W12 and W45.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Dissolved metal parameters in Table 2-2a.	**Specific Threshold 1** Expected Case Maximum water quality prediction is exceeded	**PCII**	**Notification** • Minto Management **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Compare with previous results and evaluate if concentrations are trending upwards • review all other available monitoring results (e.g. W15) and assess whether results show evidence of related conditions. • test appropriate other pit inflow locations to help isolate the source • Depending on which pit and parameters show elevated concentrations, evaluate the scale (single station, site- wide, specific facility, etc.) • Engage qualified professional to evaluate potential for passive treatment challenges from pit outflow concentrations **Action** • If result is validated, **AND** • concentrations are trending upwards significantly, then: ○ Re-sample within one month of triggering ST1
Dissolved metal parameters in Table 2-2b.	**Specific Threshold 2** • Subsequent exceedance of ST1 in subsequent sampling (resampled or routine) and evaluation confirms upward trend in concentrations **AND** • Potential or existing challenges to passive treatment are identified by QP as a result of pit water quality	**PCII**	**Notification** • Minto Management • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • All evaluation measures identified in ST1 **Action** • Increase sampling frequency to monthly • Retain qualified expert to develop mitigation plan, including recommendations. This could include, for example, consideration of the use of batch treatment to mitigate water quality in pits.
Dissolved metal parameters in Table 2-2b.	**Specific Threshold 3** • Continued exceedance of ST2 in subsequent sampling **AND** • Potential or existing challenges to passive treatment are identified as a result of pit water quality	**PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Verify original result, or re-run sample if laboratory error indicated **Evaluation** • All evaluation measures for ST2 **Action** • Implement recommendations from Mitigation Plan • Maintain monthly sampling frequency

Table 2-5: Specific Indicators, Performance Thresholds and Responses for Mine Site Monitoring Location W15.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Key parameters – Cu, Nitrate, Nitrite, SO4: 95th percentile of baseline dataset determined after PCI Other parameters – (low conc at detection limit, high variability): Cd, Ag, Pb, Ni (See Appendix B for statistical basis, methodology to be determined after PCI)	**Specific Threshold 1** TBD based on baseline W15 WQ record collected during active closure and PCI	PCII	**Notification** • Minto Management **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Compare with previous results and evaluate if concentrations are trending upwards • At next sampling event, investigate upstream seepage/runoff contributions for cause/source if any • **Action** • If result is validated, **AND** • concentrations are trending upwards significantly, then: ○ Re-sample within one month of triggering ST1 • Engage qualified professional to evaluate potential for passive treatment challenges from loading contributions.
	Specific Threshold 2 • Subsequent exceedance of ST1 in subsequent sampling (resampled or routine) and evaluation confirms upward trend in concentrations	PCII	**Notification** • Minto Management • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • All evaluation measures identified in ST1 **Action** • Increase sampling frequency to monthly at W15 and W12. • Retain qualified expert to develop mitigation plan, including recommendations. This could include, for example, consideration of cover improvements, installation of seepage collection trenches and bioreactors at identified seepage source, wetland augmentation at W15, or use of batch treatment to mitigate water quality in pits.
	Specific Threshold 3 • Continued exceedance of ST2 in subsequent sampling **AND** • Potential or existing challenges to passive treatment are identified as a result of W15 water quality contribution.	PCII	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Verify original result, or re-run sample if laboratory error indicated **Evaluation** • All evaluation measures for ST2 **Action** • Implement recommendations from Mitigation Plan • Maintain monthly sampling frequency

Table 2-6: Specific Indicators, Performance Thresholds and Responses for Mine Site Monitoring Location W62.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Key parameters – Cu, Nitrate, Nitrite, SO4: 95th percentile of baseline dataset determined after PCI Other parameters – (low conc at detection limit, high variability): Cd, Ag, Pb, Ni (See Appendix B for statistical basis, methodology to be determined after PCI)	**Specific Threshold 1** TBD based on baseline W62 and potentially other locations (e.g. W8/W8A, MCDS) WQ record collected during active closure and PCI	PCII	**Notification** • Minto Management **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Compare with previous results and evaluate if concentrations are trending upwards **Action** • If result is validated, **AND** • concentrations are trending upwards significantly, then: ○ Re-sample within one month of triggering ST1 • Engage qualified professional to evaluate potential for passive treatment challenges from seepage contributions
	Specific Threshold 2 • Subsequent exceedance of ST1 in subsequent sampling (resampled or routine) and evaluation confirms upward trend in concentrations **AND** • Potential or existing challenges to passive treatment are identified by QP	PCII	**Notification** • Minto Management • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • All evaluation measures identified in ST1 **Action** • Increase sampling frequency to monthly • Retain qualified expert to develop mitigation plan, including recommendations. This could include, for example, consideration of the installation of seepage collection trenches and bioreactor.
	Specific Threshold 3 • Continued exceedance of ST2 in subsequent sampling **AND** • Potential or existing challenges to passive treatment are identified	PCII	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Verify original result, or re-run sample if laboratory error indicated **Evaluation** • All evaluation measures for ST2 **Action** • Implement recommendations from Mitigation Plan • Maintain monthly sampling frequency

2.1.2 Constructed Wetland Treatment Systems

2.1.2.1 Description

The RCP describes how surface water quality will be managed during the post closure period. This includes the construction and operation of a constructed wetland treatment system (CWTS) in the footprint of the existing water storage pond. Based on site specific research, it is expected that the CWTS will take at least 2 full years to commission and before the wetland will be performing as designed. Research to date, also outlined in the RCP, on wetland performance at the Minto site suggests that a constructed wetland treatment system can be expected to mitigate certain water quality constituent loading during some months of the year, particularly during base flow summer months. Although some routine maintenance is expected for this facility, there also exists some remaining uncertainty regarding how the wetland will perform in decreasing aqueous constituent loads.

Section 2.1.1 above outlines how contributing loads from upstream sources will be managed adaptively, and section 2.3 outlines how an adaptive management approach will be used to respond to changing conditions related to the physical integrity of the CWTS as a water management infrastructure component. This section outlines how unexpected changes in the performance of the CWTS related to aqueous constituent load reduction will be identified and responded to after the expected commissioning period (anticipated two years after construction). For clarity, the commissioning criteria are defined as:

- Plant establishment and maturation such that the plants have grown into densities visually similar to natural wetlands in the area, but in monoculture;
- Establishment of reducing conditions within the CWTS (i.e., average soil redox is below -100 mV); and
- Microbial population establishment and maturation to levels similar or better to the demonstration-scale test system, as determined by genetic analysis.

These criteria are based on pilot-scale trials and refined through demonstration-scale test work and are in agreement with literature for anaerobic conditions to promote sulphide production (Contango Strategies Ltd, 2017).

The CWTS AMP framework will provide a response towards continuous improvement of the system during PCI period and will address unexpected performance in PCII. The CWTS will mature as a treatment installation during the first two years of PCI – the Commissioning Period – and after it will be transitioned to the primary water treatment component for the duration of PCI (as long as Operational WQO can be met) and for the entirety of PCII. The CWTS AMP framework below applies in PCI once the above commissioning criteria have been met (assumed to be the third year of PCI) and through the entire duration of PCII.

2.1.2.2 Risk Narrative

Aqueous constituent load reduction does not meet expectations or design criteria, resulting in downstream water quality objectives not being met, and/or adverse effects to aquatic resources in the receiving environment (lower Minto Creek).

2.1.2.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to performance of the CWTS are provided below in Table 2-7. Specific thresholds are identified in Table 2-6. The monitoring results that will be evaluated and utilized in this component of the AMP are outlined in the Minto Mine RCP (2018-01) (Section 7.11).

Table 2-7: Specific Performance Thresholds for CWTS AMP.

<table>
<tr><th>Specific Indicator</th><th>Specific Threshold Value</th><th>Basis/rationale for threshold value</th></tr>
<tr><td>CWTS Soil Redox Probe reading</td><td>-100 mV</td><td>Desired range for optimal performance is -250 to -100 mV. Performance can still be expected as high as -50, so -100 as threshold is conservative</td></tr>
<tr><td colspan="3">Treatment Rate Coefficient[1]</td></tr>
<tr><td>Cadmium (dissolved)</td><td>0.70 (first order)</td><td rowspan="3">Treatment rate coefficients should be evaluated as an annual average[2], based on inflow and outflow concentrations and flows, and retention time within the CWTS (formulae are provided in CWTS Design Document, appended to Minto RCP, and incorporate flow calculations and wetland volume). The threshold values here are from the design basis, based on expected performance from reclamation research to date.</td></tr>
<tr><td>Copper (dissolved)</td><td>0.64 (first order)</td></tr>
<tr><td>Selenium (dissolved)</td><td>0.26 (first order)</td></tr>
<tr><td colspan="3">[1] There are typically two orders for treatment rate coefficients in a CWTS: zero-order and first order. Treatment with a zero-order removal rate is linear and does not depend on concentration, whereas treatment with a first-order removal rate is exponential and proportional to concentration (a half-life type of reaction). Units for the first order treatment rate coefficients presented here are day^{-1}.

[2]Weighted averages will be considered for later stages. Exact approach will be determined during active closure.</td></tr>
</table>

Table 2-8: Specific Indicators, Performance Thresholds and Responses for CWTS performance.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Soil Redox	**Specific Threshold 1** average of all probes >-100 mV over 3 consecutive sampling events **OR** 25% of all probes reading > - 100 in any sampling event	**After commissioning criteria reached – expected to be year 3 of PCI and all of PCII**	**Notification** • Minto Management • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol: ○ Validate redox results ○ Confirm water depth around probes in question ○ Confirm flow rate through wetland **Evaluation** • Consider installation of duplicate probes to confirm readings • Consider sampling of soil in vicinity of probes in question for total organic carbon (TOC) and nutrients (NPK). **Action** • If probe readings confirmed and TOC is low, add organic carbon as directed by qualified expert • If probe readings confirmed and soil nutrients are low, add fertilizer as directed by qualified expert • If water depths less than or flow rate outside of design amount, mitigate as recommended by qualified expert
Treatment rate coefficient	**Specific Threshold 2** Target treatment rate coefficient for specific aqueous constituent is not achieved in any year of monitoring	**After commissioning criteria reached – expected to be year 3 of PCI and all of PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Increase sampling frequency of influent/effluent to monthly (if not already implemented) • Sample between cells to isolate problem cell(s) • Consider analysis for interfering/facilitating issues (e.g. iron/Sulphur) **Action** • Retain qualified expert to develop Stage A and Stage B mitigation plans, including recommendations • Continue with Actions in ST1
Treatment rate coefficient	**Specific Threshold 3** Target treatment rate coefficient for specific aqueous constituent is not achieved **for 2 consecutive years**	**After commissioning criteria reached – expected to be year 3 of PCI and all of PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use Licence reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • All evaluation measures for ST2 **Action** • Implement recommendations from Stage A Mitigation Plan, which could include additional wetland optimizations such as plant transplanting
Treatment rate coefficient	**Specific Threshold 4** Target treatment rate coefficient for specific aqueous constituent is not achieved for **3 consecutive years** **AND** Applicable downstream water quality objectives have been exceeded as defined by: SPT-3 (or higher) is triggered from Minto Creek AMP in Table 2-11, in a single sample where evaluation confirms that mine loading is responsible for exceedance.	**After commissioning criteria reached – expected to be year 3 of PCI and all of PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol ○ Review laboratory QA/QC report ○ Verify original result, or re-run sample if laboratory error indicated **Evaluation** • All evaluation measures for ST2 **Action** Implement recommendations from Stage B Mitigation Plan, which could include consideration of addition of new passive treatment installations if needed

2.1.3 Minto Creek

2.1.3.1 Description

The majority of the Minto Mine footprint (with the exception of the Minto North pit) is in the headwaters of the catchment area for Minto Creek. The W2 monitoring point on lower Minto Creek near the Yukon River is beyond the final mine water discharge point (W50) controlled by Minto and is subject to a broad range of influences from tributaries and catchment areas that are beyond Minto's control. However, Minto is committed to monitoring the water quality at W2 and responding to changing water quality in lower Minto Creek as appropriate. The AMP frameworks below compliment the closure water management plan at the mine site with a decision-based structure for ensuring that negative impacts to lower Minto Creek from mining activities are avoided.

The monitoring results that will be evaluated and utilized in this component of the AMP are outlined in section 7.11 of the Minto Mine RCP (2018-01). The Operational Water Quality Objectives will continue to be employed in the Active Closure and PCI periods. As such, the Minto Mine Operational AMP is relevant and will be utilized during the Active Closure and PCI periods. To address the uncertainty of meeting the post closure water quality objectives (PC-WQO) within the expected 5-year duration of the PCI period, a PCI AMP framework (Table 2-8) has been developed for Minto Creek and is intended to be used as a supplement to the Operational AMP.

The PCI period AMP framework was developed to guide continuous improvement towards meeting PC-WQO after the CTWS has reached the expected performance and will only apply during the PCI period, but the concept of continuous improvement applies beyond that with the actions identified in the PCII framework Tables 2-10 and 2-11. The portion of the Minto Creek AMP that applies to the PCII period is intended to respond to uncertainty regarding meeting the non-degradation and 50% of assimilative capacity WQOs.

In the sections below, the PCI period AMP framework and the PCII period AMP framework for Minto Creek have been separated to simplify what AMP frameworks apply to what closure period.

2.1.3.2 Risk Narrative

Post Closure I Period (and first 5 years of PCII)

The CWTS performs as designed, however, the water quality in the receiving environment is not trending towards meeting PC-WQO by the end (year 5) of the expected PCI period.

Post Closure II Period (after first 5 years)

Increase in contaminant concentrations from the mine causes exceedance of the PC-WQO in the receiving environment (lower Minto Creek).

2.1.3.3 Indicator, Specific Performance Thresholds and Responses

Post Closure I Period

The indicator, performance thresholds and responses specific to continuous improvement of water quality during the PCI period are provided in Table 2-8. The AMP framework for the PCI period applies to the receiving environment of Minto Creek (W2) and utilizes the results of trend analysis of routine monitoring to guide responses to improving water quality towards meeting the post closure water quality objectives prior to the completion of the PCI period (expected approximately 5 years). The specific water quality objectives targeted with the continuous improvement framework will be firstly the 50%AC objectives, and then when these 50%AC objectives are achieved for the key parameters[2], the trend analysis will then target the non-degradation WQOs. The WQOs will be targeted with reasonable and practical passive treatment mitigation options as required by clause #33 of the YESAA Decision Document for Phase IV of Minto Mine. The RCP (section 3.1.3.1.2) outlines the water closure objectives and explains what reasonable and practical passive mitigation options are. Continuous improvement of water quality leaving the site is a commitment that extends beyond the formal PCI framework with considerations to improve water quality mitigation measures now built into responses in the PCII response programs (Tables 2-9, 2-10)

With respect to timing, this AMP only applies after the CWTS has met the commissioning objectives (see Section 2.1.2.1 above) and water quality at W2 is not meeting post closure water quality objectives. The distinguishing of the PCI AMP framework only applying after the CWTS is performing as designed is intentional and important in focusing responses where needed in closure. If the CTWS is not performing, it will be addressed in the CWTS AMP and if contaminant loading is unacceptable then the Mine Site AMP will catch and direct responses at source, without redundant actions and administration triggered without value in the Minto Creek AMP

[2] Key parameters include Cu, Se (design basis elements of CWTS), NO_3 and As.

Table 2-9: Continuous improvement for water quality at W2 during the PCI period.

Indicator	Specific Performance Threshold	Stage	Specific Responses
Complete an annual Trend Analysis of receiving environment water quality data (Minto Creek Station W2) to determine if water quality meets or is trending towards meeting PC-WQOs. To be initiated after successful establishment of the CWTS (PCI Years 3,4,5 at minimum). And Complete an ongoing analysis with monthly W2 data to detect deviation from prediction limits.	Annual analysis shows trending towards meeting PC-WQO and will likely meet them by year 5 of PCI.	**PCI**	**Action:** • Re-evaluate in subsequent years and confirm or repudiate previous year's results
	Annual analysis shows trending towards meeting PC-WQO but will likely not meet before end of PCI.	**PCI**	**Notification:** • Minto Management **Review:** • Follow QA/QC investigative protocol: - Review laboratory QA/QC report - Validate original result, or re-run sample if a laboratory error is indicated **Evaluation:** • Review site water quality results - e.g. does pit water quality exceed expected concentrations? • Compare with W50 and/or CWTS results. Consider potential groundwater inflows and reference conditions. If comparison indicates elevated site concentrations are responsible for exceedance; and validation confirms original result, then: - Engage qualified expert(s) to develop mitigation plan **Action:** • Review results of investigations/evaluations and implement recommendations if appropriate. • Re-evaluate in subsequent years and confirm or repudiate previous year's results
	Annual analysis shows water quality stable, neither trending towards nor away from PC-WQO OR Monthly Analysis shows 2 or more consecutive results above the upper prediction limit.	**PCI**	**Notification**: • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review:** • Follow QA/QC investigative protocol: - Review laboratory QA/QC report - Validate original result, or re-run sample if a laboratory error is indicated **Evaluation:** • Review site water quality results - e.g. does pit water quality exceed expected concentrations? • Compare with W50 and/or CWTS results. Consider potential groundwater inflows and reference conditions. If comparison indicates elevated site concentrations are responsible for exceedance; and validation confirms original result, then: - Engage qualified expert(s) to develop mitigation plan, which will evaluate the water quality management system's feasibility and effectiveness. **Action:** • Review results of investigations/evaluations and implement recommendations if appropriate. • Engage SFN and Regulators • Re-evaluate in subsequent years and confirm or repudiate previous year's results
	Annual analysis shows trending away from meeting PC-WQO OR Monthly Analysis shows 3 or more consecutive results above the upper prediction limit.	**PCI**	**Notification:** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review:** • Follow QA/QC investigative protocol: - Review laboratory QA/QC report - Validate original result, or re-run sample if a laboratory error is indicated **Evaluation:** • Review site water quality results - e.g. does pit water quality exceed expected concentrations? • Compare with W50 and/or CWTS results. Consider potential groundwater inflows and reference conditions. If comparison indicates elevated site concentrations are responsible for exceedance; and validation confirms original result, then: - Engage qualified expert(s) to develop mitigation plan, where one of the considerations could be re-evaluation of the water quality management system (i.e. passive treatment plan).

			Action: • Review results of investigations/evaluations and implement recommendations if appropriate. • Engage SFN and Regulators • Re-assess Passive treatment option • Re-evaluate in subsequent years and confirm or repudiate previous year's results

Post Closure II Period

Indicators, performance thresholds and responses specific to water quality and the monitoring program are provided below in Table 2-10 and 2-11. Specific performance thresholds for the PCII period AMP framework are identified in Table 2-9. This portion of closure AMP for Minto Creek water quality utilizes the post closure water quality objectives (WQOs) at station W2 as the basis for specific thresholds.

To apply these WQOs as the basis of specific performance thresholds in this plan, the following abbreviations, definitions and assumptions are being used:

> **BGWQ:** Background Water Quality, as compiled and outlined in Appendix A (Minnow, 2016) of Appendix 1-3 (Surface Water Quality) of Appendix H (Site Characterization Plan) of the RCP 2018-01.
>
> **ND**: Non-degradation of water quality, statistically unchanged from BGWQ
>
> **NDIDPE-WQO**: Non-degradation Maximum water quality objective, as defined by the 95th percentile of the BGWQ data set
>
> **NDCT-WQO**: Non-degradation Central Tendency water quality objective, as defined as the 95th percentile of the annual medians of the BGWQ data set.
>
> **50IDPE-WQO**: 50% of assimilative capacity Individual Data Point Evaluator water quality objective, as calculated using the 95th percentile of background concentrations and the Post Closure WQO formula outlined in Section 3.1.3.1 of RCP 2018-01.
>
> **50CT-WQO**: 50% of assimilative capacity Central Tendency water quality objective, as calculated using the NDCT-WQO as background and the Post Closure WQO formula outlined in Section 3.1.3.1 of RCP 2018-01.
>
> **75%-STI**: Specific Threshold One value, as calculated using 75 percent of the 50IDPE-WQO and is intended to be an early warning threshold for the 50% of assimilative capacity WQO.

As identified above for PCI, continuous improvement of water quality leaving the site is a commitment that extends beyond the formal PCI framework with considerations to improve water quality mitigation measures now built into responses in the PCII response programs (Tables 2-10, 2-11). The range of mitigations considered in this closure period encompasses those that are reasonable and practical, as required by clause #33 of the YESAA Decision Document for Phase IV of Minto Mine. The RCP (section 3.1.3.1.2) outlines the water closure objectives and explains what reasonable and practical passive mitigation options are.

Table 2-10: Specific Performance Thresholds for Surface Water Quality in Lower Minto Creek (W2)

Parameter	Non-Degradation - Individual Data Point Evaluator	Non-Degradation - Central Tendency	75% of 50% Assimilative Capacity Individual Data Point Evaluator	50% Assimilative Capacity - Individual Data Point Evaluator	50% Assimilative Capacity - Central Tendency
	Water Quality Objective	Water Quality Objective	STP-1	Water Quality Objective	Water Quality Objective
	(NDIDPE-WQO)	(NDCT-WQO)	Table 2-8	(50IDPE-WQO)	(50CT-WQO)
Ammonia - N, mg/L	0.12	0.06	0.14	0.18	0.13
Nitrite - N, mg/L	0.04	0.03	0.04	0.05	0.04
Nitrate - N, mg/L	0.22	0.15	3.5	4.7	4.6
Aluminum (dissolved), mg/L	0.053	0.032	0.058	0.077	0.066
Arsenic (dissolved), mg/L	0.0011	0.0009	0.0023	0.0031	0.0029
Cadmium[1] (dissolved), µg/L	0.00005	0.000044	0.00017	0.00022	0.00019
Chromium (dissolved), mg/L	0.0011	0.0010	0.0008	0.0011	0.0010
Copper (dissolved), mg/L (when [DOC] @ W2 >10 mg/L)	0.0054	0.0029	0.010	0.013	0.011
Copper (dissolved), mg/L (when [DOC] @ W2 ≤10 mg/L)	0.0054	0.0029	0.0069	0.0092	0.0079
Iron (dissolved), mg/L	0.91	0.57	0.75	1.0	0.84
Lead (dissolved), mg/L	0.00025	0.00014	0.0016	0.0021	0.0021
Molybdenum (dissolved), mg/L	0.0015	0.0011	0.028	0.037	0.037
Nickel (dissolved), mg/L	0.0020	0.0016	0.042	0.056	0.056
Selenium (dissolved), mg/L	0.00050	0.00046	0.0010	0.0013	0.0012
Silver (dissolved), mg/L	0.00001	0.00001	0.000041	0.000055	0.000055
Zinc (dissolved), mg/L	0.008	0.005	0.014	0.019	0.017

[1]Cadmium value calculated using 95th percentile hardness (225.2 mg/L) in Operational Stage WQO calculation. Actual objective for comparison with monitoring results will be calculated with observed hardness.

Table 2-10 below presents the specific thresholds and actions proposed to respond to changing water quality, i.e. deviation from a non-degradation condition, in lower Minto Creek, as measured at water quality station W2.

Table 2-11: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality at Station W2 in lower Minto Creek during Post Closure II, using Non-Degradation Water Quality Objectives.

Specific Indicators	Specific Performance Thresholds	Specific Responses
Aqueous Concentrations at Station W2 for parameters with water quality objectives (See Table **2-9** above for specific threshold values)	**Specific Threshold 1** • Exceedance of 2 consecutive NDIDPE-WQOs **OR** • Exceedance of NDCT-WQO once	**Notification** • Minto Management • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated **Evaluation** • Review site water quality results – e.g. does pit water quality exceed expected concentrations? • Conduct a trend analysis • Compare with site water quality results, including W50, CWTS results, potential groundwater inflows, and contributions from the bypass channel if applicable. If comparison indicates either elevated site concentrations or poor CWTS performance is responsible for exceedance; and validation confirms original result, then: ○ Engage qualified expert(s) to develop mitigation plan ○ Mitigations must be based on objective of reducing/mitigating contaminant loads using reasonable and practical passive water treatment technologies and reasonable and practical source control measures. **Action** • On next scheduled sampling event, ensure sampling conducted at all mine site stations if not already scheduled unless and until a qualified expert determines that it is not required. • Review results of investigations/evaluations and prepare recommendations if appropriate. This could include a recommendation that certain parameters be immediately subject to the AMP framework in Table 2-9 – 50%AC-WQOs if concentrations are determined by a qualified expert to be unlikely to achieve ND-WQOs. • if trend analysis suggests a continued (sustained) exceedance of Threshold 1 within one year, then initiate actions from SPT-2 • Actions will continue until performance thresholds are no longer exceeded.
	Specific Threshold 2 • Continued Exceedance of Threshold 1 in subsequent sampling	**Notification** • Minto Management, SFN • Include in scheduled Water Use License reporting **Review** • All review measures for ST1 **Evaluation** • All evaluation measures from ST1 **Action** • Re-sample both W2 and W50 within **one month** of original sample result review or expedite results for subsequent sampling unless and until a qualified expert determines that it is not required; and • Implement recommendations from mitigation plan • Actions will continue until performance thresholds are no longer exceeded.
	Specific Threshold 3 • Continued exceedance of Threshold 1 for 3 years	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • All review measures for ST2 **Evaluation** • All evaluation measures for ST2 **Action** • If all results are confirmed and implemented mitigation measures from the SPT-2 mitigation plan are not demonstrating progress* towards achievement of the ND-WQO, then non-degradation is declared unattainable. In this case the specific indicator (i.e. parameter) is then subject to the Specific Indicators in Table 2-9 and the AMP framework in Table 2-11 (50%AC-WQOs).

**progress (downward trend) will be evaluated using the methodology for trend assessment in Section 2.1 (and as appended in Appendix 1) and a fixed duration 'cap' of five (5) years will be placed on the continuous improvement expectations for the application of this non-degradation framework. In other words, efforts will continue to attempt to achieve non-degradation objectives for a maximum of five years in PCII. This balance has been struck with SFN to ensure efforts continue towards non-degradation objectives, but that a reasonable timeline is established for transition to the 50%AC objectives if non-degradation is not being achieved.*

***In the case of the non-degradation condition being declared unattainable for any given specific indicator through the decision framework above, that parameter will be subject only to Table 2-11 which applies the 50% of assimilative capacity water quality objectives. Until such time, the specific indicators will be subject to both frameworks to ensure that actions are implemented in the case where 50% assimilative capacity WQOs are approached or exceeded early in the post closure period.*

Table 2-12: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality at Station W2 in Minto Creek, using the 50% Assimilative Capacity Water Quality Objectives.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

Aqueous Concentrations at Station W2 for parameters with water quality objectives
 	
(See Table **2-9** above for specific threshold values)
	Specific Threshold 1
	• Exceedance of SPT1 from Table 2-9
		PCII	**Notification**
			• Minto Management
			• Include in scheduled Water Use License reporting
			Review
			• Follow QA/QC investigative protocol:
			  ○ Review laboratory QA/QC report
			  ○ Validate original result, or re-run sample if a laboratory error is indicated
			Evaluation
			• Compare with W50/CWTS results and other lines of analysis to evaluate if mine loadings are responsible
			Action
			• On next scheduled sampling event, ensure sampling conducted at all mine site stations in RCP Table 7-1) if not already scheduled unless and until a qualified expert determines that it is not required.

	Specific Threshold 2
	• Exceedance of SPT1 in **2 consecutive samples at W2** where evaluation confirmed mine loading responsible for first exceedance
		PCII	**Notification**
			• Minto Management
			• Include in scheduled Water Use License reporting
			Review
			• Follow QA/QC investigative protocol:
			  ○ Review laboratory QA/QC report
			  ○ Validate original result, or re-run sample if a laboratory error is indicated
			Evaluation
			• Compare with W50 results. If comparison with W50 result and other lines of analysis indicates that mine loadings are responsible for exceedance; and validation confirms original result, then:
			  ○ Evaluate causes for load contributions and develop investigation plan; and
			  ○ A trend analysis will be conducted by a qualified person.
			Action
			• Implement investigation plan, including at a minimum:
			  ○ Re-sampling both W2 and W50 within **one month** of original sample result review or expedite results for subsequent sampling unless and until a qualified expert determines that it is not required; and
			  ○ Site investigation of candidate load contributions.
			• Review results of investigation and prepare recommendations if appropriate.
			• If trend analysis suggests WQO exceedance within one year, then initiate actions for Specific Threshold 3.

	Specific Threshold 3
	• 50IDPE-WQO exceeded at W2 in a single sample where evaluation confirms that mine loading is responsible for exceedance.
		PCII	**Notification**
			• Minto Management, SFN, YG Inspector
			• Include in scheduled Water Use License reporting
			Review
			• Follow QA/QC investigative protocol
			  ○ Review laboratory QA/QC report
			  ○ Verify original result, or re-run sample if laboratory error indicated
			Evaluation
			• Compare with W50 results. If comparison with W50 result and other lines of analysis indicates mine loadings responsible for exceedance – and verification confirms original result – then:
			  ○ Evaluate candidate causes for load contributions and develop investigation plan (or review/revise as appropriate)
			Action
			• Implement investigation plan, including any reviews/revisions, and at a minimum:
			  ○ Re-sampling both W2 and W50 within **two weeks** of original sample result review or expedite subsequent samples unless and until a qualified expert determines that it is not required; and
			  ○ Site investigation of candidate load contributions
			• Review results of investigation and prepare recommendations if not already prepared from ST2.
			• Implement recommendations from above.

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
	Specific Threshold 4 • Exceedance of 50IDPE-WQO in **2 consecutive samples (scheduled or re-sample) at W2 or twice in one year** where evaluation confirmed mine loading responsible for first exceedance **Or** • 50CT-WQO exceeded at W2 by a 3-year rolling average value (ST-4 = Attainment as defined in the RCP 2018-01)	**PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in scheduled Water Use License reporting **Review** • Compare with W50 results • Follow QA/QC investigative protocol **Evaluation** • Compare with W50 results. If comparison with W50 result and other lines of analysis indicates mine loadings responsible for exceedance; and verification confirms original result, then: ○ Evaluate candidate causes for load contributions and develop investigation plan (or review/revise as appropriate) ○ Provide investigation plan to SFN/YG Inspector • Engage a qualified individual for the evaluation of potential effects to aquatic resources (e.g. Compare to Predicted No Effect Concentration (PNEC) and apply Biotic Ligand Model (BLM) for D-Cu, invertebrate tissue for Se, compare with calculated acute guideline for D-Cd.) This may include but not be limited to the evaluation of existing data and results from effluent toxicity, surface water toxicity, sediment chemistry, sediment toxicity, benthic invertebrate community structure and fish health testing/programs. **Action** • Implement monthly monitoring at W2 and W50/CWTS unless and until a qualified expert determines that it is not required. • recommended by qualified individual evaluating for the potential for effects at aquatic resources. • Revise investigation plan, including at a minimum: ○ Re-sampling both W2 and W3 within **one week** of original sample result review; and ○ Additional site investigation of load contributions • Review results of investigation and prepare additional recommendations aimed at reducing contaminant loading from site. • Implement recommendations for reducing contaminant loading from site arising from investigations.
	Specific Threshold 5 • 50IDPE-WQO exceeded in **3 consecutive samples (scheduled or re-sample) at W2** where evaluation confirmed mine loading responsible for exceedances	**PCII**	**Notification** • Minto Management, SFN, YG Inspector • Include in Water Use License reporting **Review** • Compare with W3/CWTS results and any other WQ data as appropriate • Follow QA/QC investigative protocol **Evaluation** • All evaluation measures for ST4 **Action** • Maintain monthly monitoring and collect samples at greater frequency as required unless and until a qualified expert determines that it is not required. • Review and revise mitigation plans with qualified individuals, and implement necessary reasonable and practical measures to reduce contaminant loading from mine to Minto Creek. This could include consideration of: additional passive treatment installations. • Actions will continue until performance thresholds are no longer exceeded.

2.1.4 McGinty Creek

2.1.4.1 Description

The Minto North deposit is an extension of the mineralized corridor being mined within the Minto Creek catchment. It is within the McGinty Creek catchment area, to the north of Minto Creek. Minto has been monitoring surface water quality in the McGinty Creek catchment since 2009, and the results from monitoring program (until the end of 2015) are presented in McGinty Creek Water Quality Characterization, July 2016 (AEG, 2016).

As described in the Water Management Plan (Minto Explorations Ltd., 2015), during the recently completed active mining of Minto North, Minto actively managed water directly impacted by open pit mining with pump trucks. With surface mining in Minto North now complete, there is no active water management, with runoff and meteoric water now allowed to accumulate in the pit.

The AMP framework below provides a decision-based structure with the goal of avoiding changes to background water quality in lower McGinty Creek that result from completed mining activities at Minto North. Station MN-4.5 is the monitoring station on the lower main stem of McGinty Creek, after the north and south tributaries converge, and near the confluence of McGinty Creek with the Yukon River. Surface water quality at the MN-4.5 monitoring point is subject to periodic TSS influences from catchment area that are beyond Minto's control, so dissolved metals concentrations will be used to track influences from the Minto North development.

2.1.4.2 Risk Narrative

Increase in contaminant concentrations from completed Minto North mining activities causes unacceptable changes to surface water quality in McGinty Creek.

2.1.4.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water quality and the monitoring program are provided below in Table 2-13. The specific indicators are total suspended solids and contaminant (nitrogen species and dissolved metals/metalloids) concentrations for parameters identified in the Water Use License QZ14-031 Table 2 – Water Quality Objectives. Thresholds are all based on a proposed water quality objective (WQO), and the specific indicators station, as identified above, is MN-4.5. The discussion below applies to data collected from this station. The selection of this indicator station, along with other aspects of the AMP framework, is consistent with the approach taken for closure water quality objective development in Minto Creek (i.e. downstream indicator station, non-degradation water quality objectives, and a focus on dissolved metal concentrations.)

Essentially, Minto has adopted the statistical definitions of non-degradation (from the discussions and agreement with SFN regarding Minto Creek closure water quality objectives) as the basis of developing these revised McGinty Creek Water Quality Objectives. Monthly monitoring has continued in the McGinty Creek catchment, and the background dataset has been updated to include all monitoring data from initiation of the program in May 2009 until July 2015 (stripping of the Minto North Pit began in August 2015.) Similar to the data treatment used in Minto Creek, data from monitoring stations were collapsed into monthly results (most monitoring has been undertaken monthly anyway, and this was only required for May 2009 when sampling was weekly.) All monthly data were then used to calculate the 95th percentile, for use as the maximum water quality objective, or individual data point evaluator (IDPE). The monthly data were then also grouped by year, and the annual medians were calculated. The 95th percentile of these annual medians was calculated for each station to generate the central tendency evaluator (CTE).

These objectives form the basis of the AMP thresholds. Values lower than the WQOs have been selected as early warning thresholds (ST 1) prior to the WQOs themselves forming the higher-level specific thresholds (ST2 and ST3). For these thresholds, the 85th percentile of the same data selected. Utilizing a statistic such as this is more effective and reliable than using a percentage (e.g. 75%) of maximum value, as it considers the actual statistical distribution of the background data.

The actual calculated threshold values are presented in Table 2-12.

The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Surface Water Surveillance Program of the EMSRP (Minto Explorations Ltd., 2016). The monitoring data will be compared to the specific performance thresholds monthly (by the end of the month following the month in which samples were collected) - this corresponds to the existing monthly reporting schedule.

Table 2-13: Specific Thresholds for McGinty Creek, Station MN-4.5

Analytes	Specific Threshold 1 (85th percentile)	Water Quality Objectives (Specific Thresholds 2 and 3)	
		Individual Data Point Evaluator (95^{th} percentile)	Central Tendency Evaluator (95th percentile of annual medians)
Total Suspended Solids (mg/L)	52.0	269	32.0
Ammonia (mg/L)	0.040	0.12	0.046
Nitrite (mg/L)	0.006	0.05	0.005
Nitrate (mg/L)	0.200	0.232	0.083
Dissolved Aluminum (µg/L)	48.6	135.0	47.0
Dissolved Arsenic (µg/L)	0.55	0.61	0.54
Dissolved Cadmium (µg/L)	0.026	0.041	0.015
Dissolved Chromium (µg/L)	1.0	1.0	1.0
Dissolved Copper (µg/L)	2.9	3.5	2.8
Dissolved Iron (µg/L)	334	403	358
Dissolved Lead (µg/L)	0.20	0.20	0.20
Dissolved Molybdenum (µg/L)	1.0	1.0	1.0
Dissolved Nickel (µg/L)	1.6	1.8	1.6
Dissolved Selenium (µg/L)	0.17	0.20	0.16
Dissolved Silver (µg/L)	0.020	0.020	0.020
Dissolved Zinc (µg/L)	5.0	5.2	5.0

Table 2-14: Specific Indicators, Performance Thresholds and Responses for Surface Water Quality in McGinty Creek

Specific Indicators	Specific Performance Thresholds	Specific Responses

Aqueous Concentrations at Station MN-4.5 for parameters with Water Quality Objectives.
 	
(See Table 2-12 above for Water Quality Objective and threshold values.)
	Specific Threshold 1
	• Exceedance of ST1 value in two consecutive samples **(scheduled or re-sample)**
		Notification
		• Minto Management
		• Include in scheduled Water Use License reporting
		Review
		• Follow QA/QC investigative protocol:
		  ○ Review laboratory QA/QC report
		  ○ Validate original result, or re-run sample if a laboratory error is indicated
		Evaluation
		• Compare with MN-1.5 results
		• A trend analysis will be conducted by Minto's senior level environmental personnel.
		Action
		• If comparison with other results suggests that Minto North loading may be responsible for exceedance and validation confirms original result, then:
		  ○ Evaluate causes for load contributions, and
		  ○ If trend analysis suggests WQO exceedance within one year, then initiate actions for threshold 2.

	Specific Threshold 2
	• Exceedance of the WQO (grab vs. IDPE, or 12-month moving average vs. CTE)
		Notification
		• Minto Management
		• Include in scheduled Water Use License reporting
		Review
		• Follow QA/QC investigative protocol:
		  ○ Review laboratory QA/QC report
		  ○ Validate original result, or re-run sample if a laboratory error is indicated
		Evaluation
		• Measures from ST1, and
		• Engage a qualified professional to evaluate potential effects to aquatic resources
		• A trend analysis will be conducted by Minto's senior level environmental personnel.
		Action
		• If comparison with results suggests that Minto North loadings are responsible for exceedance and validation confirms original result, then:
		  ○ Re-sample MN-1.5 and MN-4.5 within **two weeks** of original sample result review; and
		  ○ Evaluate causes for load contributions
		  ○ Develop a mitigation strategy with recommendations based on the findings of the potential effects to aquatic resources evaluation and based on a goal of reducing load contributions to achieve water quality objectives.
		• Actions will continue until performance thresholds are no longer exceeded.

	Specific Threshold 3
	• Exceedance of the WQO (as defined above) in **2 consecutive samples (scheduled or re-sample)** where evaluation confirmed mine loading responsible for first exceedance
		Notification
		• Notify management, SFN and YG
		• include in scheduled Water Use License reporting
		Review
		• Follow QA/QC investigative protocol:
		  ○ Review laboratory QA/QC report
		  ○ Validate original result, or re-run sample if a laboratory error is indicated
		Evaluation
		• Measures from ST2
		Action
		• If comparison with results (evaluation, above) suggests that Minto North loadings are STILL responsible for exceedance; and validation confirms original result, then:
		  ○ If not already implemented, increase monitoring frequency.
		  ○ Implement recommendations from mitigation strategy (threshold 2 response). This could include batch water treatment in the Minto North pit if determined feasible and appropriate.
		  ○ Actions will continue until performance thresholds are no longer exceeded.

2.2 Groundwater Quality

2.2.1 Minto Creek Watershed

2.2.1.1 Description

Groundwater quality has the potential to be important in terms of contributions to surface water quality. Groundwater contributes to streamflow as baseflow, which is typically most important during the autumn/winter low flow season when surface water flows are minimal.

All mine workings and waste facilities within in the Minto Creek catchment are located upgradient (and west) of the Water Storage Pond (WSP). During final closure, the WSP will be decommissioned and a passive treatment system (wetlands) established within its footprint.

The groundwater monitoring supporting the Closure AMP framework is defined and described in the Monitoring and Maintenance program, which is included in Section 7.11 of the RCP. The monitoring requirements build on those of the Groundwater Monitoring Program of the Environmental Monitoring, Surveillance and Reporting Plan (EMSRP) (Minto Explorations Ltd., 2018b) implemented in the mine operations phase. The purpose of the operational groundwater monitoring program is to provide information to better understand the potential for off-site migration of contamination and to better understand and define source terms and conditions of waste emplacement, for comparison to source terms used in the predictive Water Balance and Water Quality model. An additional objective of the operational groundwater monitoring plan is to provide for the development of baseline hydrogeological conditions in areas where future mine components are being planned.

Groundwater monitoring is carried out both upgradient and downgradient of the WSP, via multi-level monitoring wells at MW12-06, MW12-05 and MW17-12 (MW12-05 is located downgradient of the new MW17-12. Both wells will be monitored until comparison by a qualified professional determines that the use of MW12-05 should be discontinued).

As described in the 2018 Minto Groundwater Characterization Hydrogeologic Conceptual Model Update Report (SRK 2018), groundwater coming from the mine area (the western and highest elevation portion of the Minto Creek catchment) is expected to discharge to surface water in the vicinity of the WSP. Minimal groundwater from the mine area is expected to discharge to Minto Creek down gradient of the WSP. Surface water downgradient of the WSP is monitored at several stations including station W2 located near the Yukon River. W2 is 6 km downstream of the Minto lease boundary and water reporting to W2 is subject to influences from groundwater and surface water outside the mine area.

The Closure AMP framework below complements the RCP water management plan for the mine site with a decision-based structure for ensuring that negative impacts to lower Minto Creek from mining and closure activities are avoided.

2.2.1.2 Risk Narrative

Flux of geochemical load from a mine component via groundwater pathways causes surface water quality objectives to be in exceeded in Minto Creek at station W2.

2.2.1.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to groundwater quality in Minto Creek watershed are provided in Table 2-12. Specific Performance Thresholds (SPTs) are defined for each of the Effluent Standards (ES) parameters identified in Clause 9 (a), Table 1 of Water Use Licence QZ14-031, with the exception of pH, oil and grease, iron and nitrite (as discussed later in this section). Additionally, although it is not specified in Clause 9(a), sulphate has been included in the SPTs. Table 2-13 compiles the concentration of background groundwater for each Specific Indicator and the Specific Performance Threshold values.

The concentrations of background groundwater are based on the respective median parameter concentrations at monitoring well MW09-03 (including all monitoring ports), which is located in the McGinty Creek catchment and was the only monitoring well on site with a sufficient period of data collection at the time SPTs were developed. At present (October 2020), the MW09-03 monitoring record is still considered to be the most representative indicator of the baseline groundwater conditions for the entire project site. Previous versions of the AMP referenced the installation of an additional monitoring well to assess baseline data specific to the Minto Creek catchment. MW17-08 was installed in 2017 to collect background groundwater data upgradient of the mine activities and was to be considered as a replacement for MW09-03 in the development of SPTs once three years of data were available. While MW17-08 is located topographically upgradient of mine activities in the Minto Creek catchment and is considered representative of background conditions near the western limit of the catchment, it does not represent baseline conditions downgradient of the ore body. Due to the mineralization of the ore body, baseline chemistry prior to mining activities down gradient of the ore body or deeper in groundwater system is believed to be significantly different. For example, sulphate concentrations in the deepest monitoring zones of MW12-05 have consistently exceeded SPTs while concentrations of other parameters have not. Observed sulphate concentrations are interpreted to be naturally occurring and representative of baseline conditions in deep groundwater, as has been discussed and supported in previous reports. As more groundwater data are gathered and analyzed, MW17-08 no longer seems appropriate to replace existing SPTs as it is located outside the zone of influence on groundwater from the ore body and does not monitor depths as great as downgradient monitoring wells (i.e., MW12-05). As such, it is not believed to be appropriate to incorporate the data from MW17-08 in the calculation of thresholds. Existing values are believed to be conservative as currently set and do not warrant changes at this time.

Iron and nitrite have been excluded from the Specific Indicators for groundwater quality because of the magnitude of the natural variability observed in groundwater at Minto. In addition, pH as also been excluded as a Specific Indicator for groundwater quality because it is not as useful an early warning indicator as sulphate and metal/ metalloid concentrations, and Oil & Grease has been excluded because it is not relevant as a specific indicator for groundwater. Although iron, nitrite and pH are excluded from the Specific Indicator list, these three constituents are monitored and would be included in the review of groundwater quality if an SPT was exceeded.

Three SPTs have been defined for the Minto Creek watershed. Rationale for development of the SPTs is as follows:

- SPT-1 corresponds to a trend-based assessment designed to flag a potential rapid increase in groundwater loadings that has not yet exceeded concentration-based thresholds. The assessment is structured to determine if an indicator has increased significantly compared to the last sampling event. The assessment will be performed as followed:

$$((C_n - C_{n-1})/(C_{SPT-2} – C_n) > 0.2$$

Where:

- C_n = the parameter concentration of groundwater from the latest sampling event;

- C_{n-1} = the parameter concentration of groundwater from the last sampling event ;
- C_{SPT-2} = the parameter concentration for the SPT-2;

The SPT-1 provides a conservative threshold considering that it is weighted against the concentration for the SPT-2. The SPT-1 will be increasingly sensitive to change in concentrations between two sampling events as groundwater approaches the SPT-2, since the size of the denominator decreases as the SPT-2 value is approached.

- SPT-2 generally corresponds to the EQS concentrations defined in Clause 9 (a), Table 1 of Water Use License QZ14-031 (with four exceptions (Cr-D, Cu-D, Ni-D and sulphate) as indicated in the notes to Table 2-16). The EQS are defined for surface water discharge, and the mine is not permitted to discharge water that exceeds any EQS guidelines to surface water. As SPT-2 applies to groundwater (not surface water) concentrations in single zone, this is a highly conservative threshold.
- SPT-3 generally corresponds to the estimated concentrations in groundwater that would be necessary to cause exceedance of the Water Quality Objectives in lower Minto Creek, at W2, under long term steady state conditions (exceptions are listed in the notes to Table 2-16). These concentrations were determined by conducting a mass loading calculation to determine the groundwater concentrations that would be necessary to cause exceedance of WQOs in lower Minto Creek during low flow periods where all streamflow is derived from groundwater discharge. The mass loading calculation was structured to represent a low-flow period when all surface flows in lower Minto Creek originate from groundwater discharge to the creek. The calculation was done using the following formula:

$$C_{gw-mine\_max} = ((Q_{W2} \times C_{W2-WQO})-(Q_{gw-bgrnd} \times C_{gw-bgrnd}))/Q_{gw-mine}$$

Where:

- $C_{gw-mine\_max}$ = the indicator parameter concentration of all groundwater upgradient of MW12-05 that reports to Minto Creek that would be required to cause surface water to exceed the WQO at station W2.
- Q_{W2} = the combined groundwater flow discharging to Minto Creek (total groundwater discharge to Minto Creek from the 2015 groundwater model update) during low flow periods
- C_{W2-WQO} = the WQO parameter concentration for surface water at W2
- $Q_{gw-bgrnd}$ = background groundwater flow discharging to Minto Creek (groundwater discharge down gradient of the Water Storage Pond from the 2015 groundwater model update) during low flow periods
- $C_{gw-bgrnd}$ = background groundwater concentration (based on median concentrations from the 2009-2015 baseline monitoring period in MW09-03)
- $Q_{gw-mine}$ = the estimated groundwater flow from the mine at the Water Storage Pond (from the 2015 groundwater model update)

If groundwater concentration of one indicator reached the SPT-3 in an individual port, the quality of the lower Minto Creek at W2 would not yet exceed the Water Quality Objective due to the contribution of groundwater from un-impacted areas of the Minto Creek watershed and the fact that groundwater concentrations at a specific monitoring well port represents only a portion of the flow and not the whole groundwater flow field. The SPT-3 provides therefore a conservative threshold for action before any significant effect would be observed in surface water.

The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the RCP (current version, section 7.11 and as presented in section 1.3.4 above). The monitoring data will be compared to the specific performance thresholds immediately upon receipt of laboratory data from monitoring programs.

Examples of actions that may arise from recommendations include:

- Continuation of monitoring;
- Continuation monitoring with an increase in monitoring frequency;
- Development of additional monitoring points and monitoring of those newly established monitoring locations;
- Completion of appropriate risk assessment; and
- Development and execution of a focused study to better understand the cause of exceedance.

These are examples of actions that provide the first steps in understanding issues that arise, and once the appropriate data are collected, further recommendations will be made by the Qualified Expert on how to manage the risk (which may include recommendations on how to reduce contaminant loading to groundwater).

Table 2-15: Specific Indicators, Performance Thresholds and Responses for Groundwater Quality in Minto Creek

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Aqueous concentrations in samples collected from multi-level groundwater monitoring wells MW12-05 or MW12-06 for the following parameters with water quality objectives: • Dissolved Aluminum • Dissolved Arsenic • Dissolved Cadmium • Dissolved Chromium • Dissolved Copper • Dissolved Iron • Dissolved Lead • Dissolved Molybdenum • Dissolved Nickel • Dissolved Silver • Dissolved Selenium • Dissolved Zinc • NH_4-N • NO_3-N • Sulphate	**SPT-1** • Exceedance of SPT-1 for any sample collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.	**All Stages**	**Notification** • Minto Management • Include in scheduled Water Use Licence monthly reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated ○ Timing: initiate within 1 week of triggering SPT **Evaluation** • Review of groundwater monitoring data (trend analysis included) to be undertaken by qualified professional, and appropriate recommendations to be developed ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) • Submit recommendations to regulator for review and approval ○ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by qualified professional. • Include the trend analysis in scheduled reporting ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator
	SPT-2 • Exceedance of SPT-2 concentrations in 2 consecutive samples (scheduled or re-sampled) collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.	**All Stages**	**Notification** • Minto Management • Include in scheduled Water Use License monthly reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated ○ Timing: initiate within 1 week of triggering SPT **Evaluation** • Review of groundwater monitoring data (including trend analysis) to be undertaken by qualified professional, and appropriate recommendations to be developed ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) ○ Timing: initiate within 1 week of QA/QC review validating original results • Submit recommendations to regulator for review and approval ○ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by qualified professional. ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
	SPT-3 • Exceedance of SPT-3 in 2 consecutive samples (Scheduled or re-sampled) collected during routine monitoring from multilevel groundwater monitoring wells MW12-05 or MW12-06.	**All Stages**	**Notification** • Minto Management • Include in scheduled Water Use Licence monthly reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original result, or re-run sample if a laboratory error is indicated ○ Timing: initiate within 1 week of triggering SPT **Evaluation** • Review of groundwater monitoring data (including a trend analysis) to be undertaken by qualified professional, and appropriate recommendations to be developed, which will include actions aimed at avoiding or reducing groundwater related contributions to surface water and/or improving groundwater conditions. ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) ○ Timing: initiate within 1 week of QA/QC review validating original results • Submit recommendations to regulator for review and approval ○ Timing: submit within 1 week of receipt of recommendations **Action** • Follow recommendations arising from review undertaken by qualified professional. ○ Timing: initiate implementation of recommendations within 1 month of receipt of approval from regulator • Increase monitoring frequency to monthly sampling of all monitored zones in the affected multi-level well for a period to be defined by qualified professional.

Table 2-16: Background concentrations and SPTs for the groundwater monitoring in the Minto Creek watershed

Minto Creek	*Concentrations (mg/L)*													
	Ag-D	Al-D	As-D	Cd-D	Cr-D	Cu-D	Pb-D	Mo-D	Ni-D	Se-D	Zn-D	N-NO3	Ammonia	Sulphate[2]
SPT-3 [1]	0.00046	0.48	0.025	0.0060	0.0030	0.060	0.020	0.34	0.33	0.0093	0.13	45	1.0	4951
SPT-2	0.00030	0.30	0.015	0.0030	0.0015[4]	0.030 [4]	0.012	0.22	0.165[4]	0.0060	0.090	27	0.75	1000
Background Groundwater[3]	0.00001	0.0045	0.0001	0.00002	0.00050	0.0014	0.0001	0.006	0.001	0.0002	0.006	0.07	0.051	12

Notes:

1: For most Specific Indicators, SPT-3 is the calculated concentration that all groundwater from the mine catchment must attain to reach the Operational Water Quality Objectives at W2. Model flows were based on 2015 Groundwater Model Update. 15 L/s is the total groundwater discharging to Minto Creek. 3 L/s is the estimated groundwater flow from the Minto Creek catchment up gradient of the Water Storage Pond. The exceptions are dissolved chromium, dissolved copper and dissolved nickel, for which SPT-3 is equal to the Effluent Quality Standard value that applies to surface water discharge from the mine site.

2: There is no Effluent Quality Standard for sulphate. For the SPT-2, the guideline for Aquatic Life from the Contaminated Site Regulation Schedule 3 was used as a replacement.

3: The background concentration in groundwater is calculated as the median of concentrations observed at groundwater monitoring well MW09-03.

4: SPT-2 for dissolved copper, dissolved chromium and dissolved nickel set at one-half (50%) of Effluent Quality Standard (SPT-2 for all remaining parameters (other than sulphate) is equal to (100% of) the Effluent Quality Standard).

2.2.2 McGinty Creek Watershed

2.2.2.1 Description

The mine workings in the McGinty Creek catchment are limited to the Minto North Pit. The catchment area of the Minto North Pit is roughly 15 ha and the catchment area of the McGinty Creek watershed is roughly 3400 ha (SRK 2013); in other words, the Minto North Pit catchment is roughly 0.4% of the total McGinty Creek catchment area. While a groundwater model encompassing the full extent of the McGinty Creek catchment has not been developed, it is clear that only a very small proportion of the groundwater in the McGinty Creek watershed can be affected by the Minto North Pit.

The monitoring supporting the closure AMP framework is defined and described in the Post-Closure Monitoring Plan of the RCP. The monitoring requirements build on those of the operational Groundwater Monitoring Plan (part of the EMSRP ((Minto Explorations Ltd., 2018b)). Groundwater in the McGinty Creek catchment downgradient of the Minto North Pit is currently monitored at multi-level monitoring well MW09-03. MW09-03 was installed in 2009 and monitored to collect baseline at the Minto North ore body. Mining of this ore body began in Q3 2015 and as such the monitoring record prior for the 2009-2015 period reflects baseline conditions. An additional multi-level groundwater well MW17-11 was installed downgradient of the Minto North Pit in late 2017 to fulfill WUL requirements.

2.2.2.2 Risk Narrative

Flux of geochemical load from the Minto North Pit via groundwater pathways causes surface water quality objectives to be in exceeded in McGinty Creek at station MN4.5.

2.2.2.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to groundwater quality in McGinty Creek watershed are provided below in Table 2-17. SPTs are defined for each of the Effluent Standards (ES) parameters identified in Clause 9 (a), Table 1 of Water Use License QZ14-031, with the exception of pH, Oil & Grease, iron and nitrite (for reasons described in the Minto Creek groundwater section (Section 2.2.1). Additionally, although it is not specified in Clause 9(a), sulphate has been included in the SPTs. The concentration of background groundwater and the Specific Performance Threshold values for each Specific Indicator and each zone (i.e. individual well port) of MW09-03 are compiled in Table 2-18. The monitoring record for MW09-03 for the 2009-2015 period reflects baseline conditions (prior to the development of the open pit). Pre-mining groundwater concentrations for certain parameters such as cadmium and iron have been relatively high, likely due to the adjacent highly mineralized zone.

Two Specific Performance Thresholds have been defined for McGinty Creek watershed groundwater- both are conservative given the application of the thresholds at individual ports, the small proportion of catchment groundwater that will be influenced by the mine workings and the expected slow rates of groundwater movement. Rationale for development of the two specific performance thresholds is as follows:

- SPT-1: Three consecutive exceedances of the 75th percentile background level in a single monitoring port.
    - The specification of three consecutive exceedances is intended to avoid triggering the AMP unnecessarily, but to ensure that any sustained increase from baseline conditions receives appropriate scrutiny.
- SPT-2: Three consecutive exceedances of the 95th percentile background level in a single monitoring port.

- The specification of three consecutive exceedances is intended to avoid triggering the AMP unnecessarily, but to ensure that any sustained increase from baseline conditions receives appropriate scrutiny.

The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the operational Groundwater Monitoring Program of the EMSRP (Minto Explorations Ltd., 2018b) and the Post-Closure Monitoring Plan of the RCP.

Table 2-17: Specific Indicators, Performance Thresholds and Responses for Groundwater Quality in McGinty Creek

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Aqueous concentrations in samples collected from multi-level groundwater monitoring well MW09-03 for the following parameters: • Dissolved Aluminum • Dissolved Arsenic • Dissolved Cadmium • Dissolved Chromium • Dissolved Copper • Dissolved Lead • Dissolved Molybdenum • Dissolved Nickel • Dissolved Silver • Dissolved Selenium • Dissolved Zinc • NH_3-N • NO_3-N • Sulphate	**Specific Threshold 1** • Three consecutive exceedances of the 75^{th} percentile value* from the baseline period (2009-2015) in routine monitoring results from a single monitoring port in MW09-03. *values provided in Table 2-13	**All Stages**	**Notification** • Mine/Project Manager • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original results, or re-run samples if a laboratory error is indicated **Evaluation** • Review of groundwater monitoring data to be undertaken by qualified professional, and appropriate recommendations to be developed ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) **Action** • Follow recommendations arising from review undertaken by qualified professional.
	Specific Threshold 2 • Three consecutive exceedances of the 95^{th} percentile value* from the baseline period (2009-2015) in routine monitoring results from a single monitoring port in MW09-03. *values provided in Table 2-13	**All Stages**	**Notification** • Mine/Project Manager • Include in scheduled Water Use License reporting **Review** • Follow QA/QC investigative protocol: ○ Review laboratory QA/QC report ○ Validate original results, or re-run samples if a laboratory error is indicated **Evaluation** • Review of groundwater monitoring data to be undertaken by a qualified professional, and appropriate recommendations to be developed, which will include actions aimed at avoiding or reducing groundwater related contributions to surface water and/or improving groundwater conditions. ○ Review must consider the risk narrative (i.e. exceedance of surface water quality objectives as a result of groundwater flux) **Action** • Follow recommendations arising from review undertaken by qualified professional. • Increase monitoring frequency of all monitored zones in the affected multi-level well for a period to be defined by qualified professional.

Table 2-18: Background Concentrations and SPTs for the Groundwater Monitoring in the McGinty Creek Watershed

Minto Creek		*Concentrations (mg/L)[1]*													
		Ag-D[3]	Al-D	As-D	Cd-D	Cr-D[3]	Cu-D	Pb-D[3]	Mo-D	Ni-D	Se-D	Zn-D	N-NO3	NH_4-N	Sulphate
MW09 -03-01	95th Percentile	0.000016	0.0101	0.00081	0.000272	0.000575	0.00625	0.0003	0.026	0.0060	0.0015	0.022	0.28	0.133	38
	75th Percentile	0.000010	0.0065	0.00011	0.000075	0.000500	0.00155	0.0001	0.005	0.0021	0.0001	0.013	0.13	0.067	24
	Median[2]	0.000010	0.0045	0.00005	0.000022	0.000500	0.00031	0.0001	0.004	0.0015	0.0001	0.006	0.07	0.045	22
MW09 -03-02	95th Percentile	0.000034	0.0095	0.00092	0.000272	0.000796	0.01080	0.0002	0.062	0.0026	0.0040	0.015	0.07	0.282	67
	75th Percentile	0.000018	0.0073	0.00074	0.000031	0.000500	0.00263	0.0001	0.018	0.0009	0.0005	0.010	0.03	0.230	7
	Median[2]	0.000010	0.0062	0.00067	0.000026	0.000500	0.00122	0.0001	0.017	0.0005	0.0002	0.008	0.01	0.210	1
MW09 -03-03	95th Percentile	0.000010	0.0075	0.00014	0.000069	0.000500	0.00500	0.0003	0.018	0.0011	0.0004	0.011	0.54	0.058	13
	75th Percentile	0.000010	0.0047	0.00005	0.000023	0.000500	0.00247	0.0001	0.006	0.0005	0.0004	0.008	0.50	0.020	12
	Median[2]	0.000010	0.0025	0.00005	0.000015	0.000500	0.00174	0.0001	0.005	0.0005	0.0003	0.003	0.48	0.012	11

Notes:

1: For monitoring results where concentrations were below the analytical detection limits, a concentration of half the detection limit was adopted for calculation purposes.

2: For AMP purposes, the background concentration in groundwater at MW09-03 is defined as the median concentration observed in each port over the 2009-2015 baseline monitoring period.

3: For Ag-D, Cr-D and Pb-D, most 2009-2015 concentrations were at the limit of analytical detection, and as such the calculated 75th and 95th percentile values are skewed low.

2.3 Water Management Infrastructure

2.3.1 Description

The closure water conveyance infrastructure is a network of channels, erosion protection features, and energy dissipation structures that convey surface water from the mine surface to Minto Creek. The network of channels is designed to collect, intercept, and convey water through the mine in its closed state. In addition to the conveyance system, three reservoirs will be present into active closure and post closure phases. Two of the reservoirs, the Main Pit Lake and the Area 2 Pit Lake will remain in perpetuity, while the third one, the WSP, will be decommissioned and the dam deconstructed. The Water Storage Dam has been excluded from the closure AMP as the facility is to be managed according to its Operation, Maintenance and Surveillance (OMS) Manual (Tetra Tech EBA, 2014) until it is decommissioned. A Constructed Wetland Treatment System (CWTS) is to be constructed within the footprint currently occupied by the WSP as part of mine closure works at Minto Mine.

Conveyance and collection structures and reservoirs are used to convey drainage from the major waste infrastructure to treatment systems prior to release. As discussed in the Section 7.7.1 of the RCP the water treatment plant used during operations will remain in operational until WUL criteria can be achieved consistently without its utilization.

The design criteria for the water conveyance system is described in the Section 3 of the Minto Mine – Closure Water Conveyance System Design Update Report (Appendix G2, Minto Mine RCP). Design details specific to each of the five conveyance channels are provided in Section 5 of the design report.

The water management system is able to deal with most foreseeable conditions that may be encountered though the mine closure. However, certain unforeseen conditions may require an adaptive response as described below.

For clarity, this AMP component applies to the following water management infrastructure:

- Tailings Diversion Ditch;
- All primary and secondary conveyance ditches and pit inflow/outflow structures;
- CWTS head ponds;
- CWTS High Flow Bypass Ditch;

2.3.2 CWTS treatment cells and outflow channel Risk Narrative

A mass failure of one of the conveyance and collection facilities has the potential to endanger the health and safety of site employees or visitors, or lead to an increase in contaminant loadings from the mine and subsequent adverse effects to aquatic resources in the receiving environment (lower Minto Creek).

2.3.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water management are provided below in Table 2-19. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Post-Closure Monitoring Program.

Table 2-19: Specific Indicators, Performance Thresholds and Responses for Water Management Infrastructure

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

• Failure or blockage of conveyance structures resulting in changed flow paths and/or overtopping of drainage ditches
• Failure of upstream diversions leads to excessive infiltration into upgradient base of DSTF, resulting in increased flows and/or metal loads and unacceptable water quality conditions downstream.
• Occurrence of a major precipitation event
• Increased sediment load in ditch flow and or downstream (increased TSS)
• Pit wall failure
	Specific Threshold 1
	• Observation of unusual occurrence including:
	  • Partial blockage;
	  • Physical damage;
	  • Turbulent flow where laminar flow is expected or is normal;
	  • Cracks, settlement of sloughing;
	  • Downstream movement of channel bedding material (rip rap or liner);
	  • Erosion channels or flowing water outside of the designed structures;
	  • Abnormal seepage;
	  • Rainfall event that exceeds the design criteria;
	  • Increase turbidity of flow.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, survey data and precipitation records
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of the need for design modifications
			Action
			• Inspect area to determine source of blockage and potential for repeated occurrence
			• Develop plan to address the need for repairs or modifications.
			• Increase frequency of monitoring as recommended by a qualified professional

	Specific Threshold 2
	• Observation of unusual occurrence including:
	  • Complete blockage;
	  • Substantial physical damage;
	  • overtopping of drainage ditches;
	  • Downstream water quality exceeds TSS criteria.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, survey data and precipitation records.
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of the need for design modifications
			Action
			• Inspect area to determine source of blockage and potential for repeated occurrence
			• Immediately develop and implement a plan to address the need for repairs or modifications
			• Increase frequency of monitoring as recommended by a qualified professional

	Specific Threshold 3 • Complete compromise of functionality.	**All Stages**	**Notification** • Mine/Project Manager, SFN and YG • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review previous inspection reports, survey data and precipitation records. **Evaluation** • Engage a qualified professional to evaluate potential effects to aquatic resources. **Action** • Inspect the area for any other signs of instability. • Complete a ground survey of the area accommodate modifications/repairs. • Follow any additional recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for modifications to the conveyance and retention structures and the need for an increased frequency of monitoring.

2.4 Physical Stability of Waste Rock, Overburden and Tailings Storage Facilities

2.4.1 Description

The physical stability of the site, during Post Closure I and II periods, will be monitored according to the Monitoring and Maintenance section (7.11) of the Minto Mine RCP. During active closure the physical stability of the waste rock, overburden dumps, tailings and water storage facilities are will be monitored according to the Physical Monitoring Plan, which forms part of the Environmental Monitoring, Surveillance and Reporting Plan (Minto Explorations Ltd., 2016). These monitoring plans describe the inspection and instrumentation data collection frequencies, instrument locations, installation details, as well as the data collection procedures.

The purpose of the monitoring program is to identify physical changes to the conditions of the facilities which may lead to future instability and to allow Minto to mitigate these conditions prior to any occurrence of instability. The facilities have been separated into two sets of geotechnical thresholds and response criteria (Table 2-20). Soil cover performance and stability is addressed under Section 2.5 General Reclamation Measures of this plan.

Table 2-20: Physical Stability Categories

Category	Facility
1	• Dry Stack Tailings Storage Facility and Mill Valley Fill Extension (Stage 1 and 2) • Southwest Waste Dump • South Wall Buttress of the Main Pit Dump
2	• Main Waste Dump and Main Waste Dump Extension • Reclamation Overburden Dump • Ice-Rich Overburden Dump • Main Pit Dump (except the South Wall Buttress) • Area 118 Backfill Dump

Category 1 facilities are founded in areas of ice-rich periglacial foundations that have previously experienced deep-seated foundation movement. The Mill Valley Fill Extension (MVFE) and South Wall Buttress (SWB) are designed to mitigate movements in the Dry Stack Tailings Storage Facility (DSTSF) and Main Pit South Wall areas, respectively, and the Main Pit Dump provides further stabilization to the Main Pit South Wall area. Additional monitoring inspection and response requirements for the DSTSF are detailed in the Operations, Maintenance, and Surveillance Manual (OMS) for the facility (Minto Explorations Ltd., 2014).

Category 2 facilities consist of all the remaining waste rock dumps. These waste dumps are located in areas with good foundation conditions that avoid areas underlain by ice-rich overburden.

2.4.2 Risk Narrative

A mass failure of one of the waste facilities has the potential to endanger the health and safety of site employees or visitors, or lead to an increase in contaminant loadings from the mine and subsequent adverse effects to aquatic resources in the receiving environment (lower Minto Creek).

2.4.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to Category 1 and Category 2 Facilities are provided in Table 2-21 and Table 2-22, respectively. The responses are dependent on the phase of closure as indicated in the tables. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Physical Monitoring Program of the EMSRP (Minto Explorations Ltd., 2016) and the Monitoring and Maintenance section (7.11) of the Minto RCP.

Table 2-21: Specific Indicators, Performance Thresholds and Responses for Category 1 Facilities

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

• Mass movement indicated by monitoring of geotechnical instrumentation
• Visual observations of physical damage
• Visual observations of evidence that could suggest mass movement
• Occurrence of seismic events
	Specific Threshold 1
	• Observation of unusual occurrence including:
	  ◦ tension cracks, settlement, or sloughing;
	  ◦ a seismic event that exceeds the 1:475 return period event[3];
	  ◦ abnormal seepage from any area of the slopes;
	  ◦ increased turbidity from seepage;
	  ◦ physical damage.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability.
			Action
			• Inspect the area for any other signs of instability.
			• Follow any recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for:
			  ◦ An increase in the frequency of routine inspections and monitoring.
			  ◦ Additional inspection, instrumentation, monitoring, or analyses
			• If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

	Specific Threshold 2 • One survey hub or inclinometer reading indicating acceleration of movement greater than the long-term trend and outside range of instrumentation error	**All Stages**	**Notification** • Geotechnical Engineer **Review** • Review existing instrumentation data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results. **Action** • Retake reading. • If the reading was accurate, increase the survey hub or inclinometer frequency. • If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

	Specific Threshold 3
	• Three consecutive survey hub or inclinometer readings indicating acceleration of movement greater than the long-term trend.
	Or
	
	Three consecutive survey hub readings indicating a change in horizontal direction of movement greater than 15 degrees from the long term trend.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability.
			Action
			• Inspect the area for any other signs of instability.
			• Complete a ground survey of the area of interest to monitor any future displacement.
			• Increase monitoring and data review frequency as directed by the Engineer until determined unnecessary.
			• Follow any additional recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for:
			  ◦ An increase in the frequency of routine inspections and monitoring.
			  ◦ Additional inspection, instrumentation, monitoring, or analyses
			  ◦ Earthwork modifications to the facility including buttressing or unloading, or any other mitigation measure.
			• If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

	Specific Threshold 4 • A rapid failure of the structure has occurred or is imminent.	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • SFN • YG • Include in scheduled WUL reporting **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation**

[3] This size of a seismic event would be felt by most people on site. It would shake buildings, and rattle or break dishes, hanging objects, etc. Earthquake information may also be found online at: http://www.earthquakescanada.nrcan.gc.ca/index-eng.php

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability.
			• Engineer to visit site to assess the situation and identify potential cause(s)
			Action
			• If a rapid failure is imminent, evacuate all personnel below the facility and implement the ERP.
			• Inspect the area for any other signs of instability.
			• Document the location, photograph, and survey the area of concern
			• Increase monitoring and data review frequency as directed by the Engineer until determined unnecessary.
			• Follow any additional recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for:
			  ○ An increase in the frequency of routine inspections and monitoring.
			  ○ Additional inspection, instrumentation, monitoring, or analyses
			  ○ Earthwork modifications to the facility including buttressing or unloading, or any other mitigation measure

Table 2-22: Specific Indicators, Performance Thresholds and Responses for Category 2 Facilities

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

• Mass movement indicated by monitoring of geotechnical instrumentation
• Visual observations of physical damage
• Visual observations of evidence that could suggest mass movement
• Occurrence of seismic events
	Specific Threshold 1
	• Observation of unusual occurrence including:
	  • tension cracks, settlement, or sloughing;
	  • a seismic event that exceeds the 1:475 return period event;
	  • abnormal seepage from any area of the slopes;
	  • increased turbidity from seepage;
	  • physical damage.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability.
			Action
			• Inspect the area for any other signs of instability.
			• Follow any recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for:
			  ○ An increase in the frequency of routine inspections and monitoring.
			  ○ Additional inspection, instrumentation, monitoring, or analyses.
			• If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

	Specific Threshold 2 • Survey hub cumulative displacements between 150 mm and 500 mm;	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability. **Action** • Inspect the area for any signs of instability. • Immediately Increase monitoring and data review frequency as directed by the Engineer until determined unnecessary: • Follow any additional recommendations of the Geotechnical Engineer. • If the results of the analysis indicates there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.
	Specific Threshold 3 • Survey hub cumulative displacements greater than 500 mm.	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation**

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability. **Action** • Inspect the area for any other signs of instability. • Complete a ground survey of the area of interest to allow for a stability assessment to be completed (if required by the Engineer), and to monitor any future displacement. • Increase monitoring and data review frequency as directed by the Engineer until determined unnecessary: • Follow any additional recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for: ○ An increase in the frequency of routine inspections and monitoring. ○ Additional inspection, instrumentation, monitoring, or analyses ○ Earthwork modifications to the facility including buttressing or unloading, or any other mitigation measure. • If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.
	Specific Threshold 4 A rapid failure of the structure has occurred or is imminent.	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • SFN • YG • Include in scheduled WUL reporting **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability. • Engineer to visit site to assess the situation and identify potential cause(s) **Action** • If a rapid failure is imminent, evacuate all personnel below the facility and implement the ERP. • Inspect the area for any other signs of instability. • Document the location, photograph, and survey the area of concern • Increase monitoring and data review frequency as directed by the Engineer until determined unnecessary. • Follow any additional recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for: ○ An increase in the frequency of routine inspections and monitoring. ○ Additional inspection, instrumentation, monitoring, or analyses Modifications to the waste placement/construction practices and other mitigation measures.

2.5 General Reclamation Measures

2.5.1 Soil Cover Performance

2.5.1.1 Description

Soil covers are to be placed over the dry stacked tailings storage facility (DSTSF) and the waste rock storage facilities. Various waste rock storage facilities exist across the site including the Main Waste Dump (MWD), Main Waste Dump Expansion (MWDE), the Main Pit Dump (MPD), the Southwest Waste Dump (SWD), the High Grade Waste (HGW), the Area 118 Dump, and the Mill Valley Fill (MVF). An infiltration reduction soil cover is to be placed on these features either as part of the progressive reclamation program or during final closure activities. The cover on the HGW is to include a very low infiltration cover system incorporating a geosynthetic membrane. The primary cover functions are to:

- Minimize infiltration to the extent practical using locally available material;
- Ensure a stable landform that will promote establishment of natural vegetation endemic to the area; and
- Minimize ponding and surface erosion on the final landform.

The design criteria for the site is described in the Section 2.2 of the preliminary cover design report (SRK 2016). Design details specific to the DSTSF and each of the waste rock storage facilities are provided in Sections 5 thru 10 of the design report.

2.5.1.2 Risk Narrative

- Covers do not perform as designed resulting in unacceptable water quality conditions downstream of the site.
- Cover on a steeper slope becomes over saturated and slumps.

2.5.1.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water management are provided below in Table 2-23. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Post-Closure Geotechnical Monitoring Program.

Table 2-23: Specific Indicators, Performance Thresholds and Responses for Cover Performance

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses

• Visual observations of physical damage
• Visual observation of ponding water
• Visual observation of surface erosion
	Specific Threshold 1
	• Observation of unusual occurrence including:
	  • settlement, or sloughing;
	  • abnormal seepage from any area of the slopes;
	  • increased turbidity from seepage;
	  • isolated pockets of vegetation stress;
	  • physical damage.
		All Stages	**Notification**
			• Mine/Project Manager
			• Geotechnical Engineer
			• Include in scheduled WUL reporting
			Review
			• Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data.
			Evaluation
			• Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability.
			Action
			• Inspect the area for any other signs of instability.
			• Repair the cover to adhere to design specifications.
			• Follow any recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for:
			  ○ An increase in the frequency of routine inspections and monitoring.
			  ○ Additional inspection, instrumentation, monitoring, or analyses.
			• If the results of the analysis indicates there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

	Specific Threshold 2 • Erosion of cover; • Large scale vegetation stress	**All Stages**	**Notification** • Mine Manager • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review previous inspection reports, existing instrumentation including piezometer, temperature, inclinometer, and survey data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability. **Action** • Inspect the area for any signs of instability. • Immediately increase monitoring and data review frequency as directed by the Engineer until determined unnecessary. • Follow recommendations of the Geotechnical Engineer to repair the cover. • If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

2.5.2 Minto North Pit Water Level

2.5.2.1 Description

At closure, the Minto North Pit will be allowed to flood. Groundwater observations and preliminary water balance monitoring under most scenarios indicate the pit is not likely to fill to the point where it would spill. Monitoring of pit water levels have been included in the post-closure monitoring Program, in Section 7.11, Table 7-1. The water balance model will be reviewed and updated annually during the post closure, and should the water level in the pit be projected to overflow, an engineered spillway may be required to control outflow from the pit and mitigate erosion.

2.5.2.2 Risk Narrative

Water levels rise higher than predicted by the site water balance model and overtop the pit resulting in erosion of surficial materials at the spill location and unacceptable water quality conditions downstream of the site.

2.5.2.3 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water management are provided below in Table 2-23. The monitoring results that are evaluated and utilized for this component of the AMP are included in Section 7.11 of the RCP.

Table 2-24: Specific Indicators, Performance Thresholds and Responses for Minto North Pit Water Level

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
Updated water balance model indicates pit will overtop	**Specific Threshold 1** • Updated water balance model indicates Minto North Pit overtop within 10 years.	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review water balance inputs and survey data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of the need for spillway design considerations. **Action** • Develop spillway design. • Follow any recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for: ○ An increase in the frequency of monitoring. ○ Additional inspection, instrumentation, monitoring, or analyses.
	Specific Threshold 2 • Updated water balance model indicates Minto North Pit overtop within 3 years.	**All Stages**	**Notification** • Mine/Project Manager • Geotechnical Engineer • SFN and YG • Include in scheduled WUL reporting **Review** • Review water balance inputs and survey data. **Evaluation** • Geotechnical Engineer to compare recent monitoring results against older results for additional evidence of instability for subsequent design modifications. **Action** • Develop spillway design (if not already completed). • Construct the spillway within the three-year period (or implement plan to manage water to prevent uncontrolled release from the pit). • Follow any recommendations of the Geotechnical Engineer. At a minimum, the Engineer will consider the need for: ○ An increase in the frequency of monitoring. ○ Additional inspection, instrumentation, monitoring, or analyses.

2.5.3 Revegetation

The primary objective is the minimization of erosion (and corresponding sediment delivery) from sloped cover areas. Revegetation treatments at Minto are designed to achieve restoration and land-use objectives, while achieving the protection objective of maintaining surficial substrate stability and erosion control where necessary.

2.5.3.1 Risk Narrative

- Vegetation does not establish fast enough to prevent rill erosions on covers
- Deep rooted vegetation not established before a forest fire.

2.5.3.2 Specific Indicators, Performance Thresholds and Responses

Indicators, performance thresholds and responses specific to water management are provided below in Table 2-25. The monitoring results that are evaluated and utilized for this component of the AMP are a requirement of the Monitoring and Maintenance program of this RCP.

Table 2-25: Specific Indicators, Performance Thresholds and Responses for Vegetation Performance

Specific Indicators	Specific Performance Thresholds	Stage	Specific Responses
• Visual observations of failure of vegetation to establish • Visual observation of failure of native species to establish. • Visual observation of stressed vegetation.	**Specific Threshold 1** • Observation of isolated pockets of stressed vegetation.	**All Stages**	**Notification** • Mine/Project Manager • Include in scheduled WUL reporting **Review** • Review previous inspection reports. **Evaluation** • Compare recent monitoring results against older results for additional evidence of vegetation stress. • Evaluate cover integrity. **Action** • Follow any recommendations of a qualified professional to determine if a reapplication of seeds and fertilizer is required. • Repair covers as recommended by a Geotechnical Engineer
	Specific Threshold 2 • Large scale stressed vegetation. • Failure of vegetation to establish in erosion-control areas.	**All Stages**	**Notification** • Mine Manager • Geotechnical Engineer • Include in scheduled WUL reporting **Review** • Review previous inspection reports and precipitation data. **Evaluation** • Compare recent monitoring results against older results for additional evidence of vegetation stress. • Evaluate cover integrity **Action** • Inspect the area for any signs of a source of contamination. • Immediately increase monitoring and data review frequency as directed by a qualified professional until determined unnecessary. • Follow recommendations of a qualified professional to restore vegetation to the area. • Repair covers as recommended by a Geotechnical Engineer. • If the results of the analysis indicate there is a stability concern, the mine inspector and Selkirk First Nation will be notified immediately.

3 Reporting and Review

Reporting and review represent an essential part of the Adaptive Management Framework, as described in section 1.3.2, and reporting on adaptive management is included in the notification component of all specific responses described in section 1.3.4.

3.1 Monthly and Annual Reporting

Monthly reports are required to be submitted to the Yukon Water Board under Water License QZ14-031, and annual reports are required for submission under both the Water License and the Quartz Mining License. Both licenses require reporting on adaptive management.

Monthly reporting includes all activities carried out under the Adaptive Management Plan and will be continued throughout active closure but will reduce frequency to annually for PCI and PCII.

Annual reporting will include summaries of all activities carried out under the Closure Adaptive Management Plan, including monitoring results compared to thresholds and any actions taken.

3.2 Annual Review

The AMP may be modified when unexpected circumstances are encountered and the protocol is implemented or when additional understanding becomes available. An annual review of the AMP will take place prior to annual reporting, and Annual Reports will include a summary of proposed updates and revisions to the Adaptive Management Plan and include a revised Adaptive Management Plan, if warranted.

4 References

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Appendix A: Memo – Trend Analyses for the Minto Mine Closure Adaptive Management Plan

Technical Memo

Date: August 24, 2020

To: Journey Paulus, Minto Explorations Inc.

From: Jeff Row and Pierre Stecko, Minnow Environmental Inc.

RE: Trend Analyses for the Minto Mine Closure Adaptive Management Plan

Trend Analyses for the Minto Mine Closure Adaptive Management Plan

The Minto Mine Closure Adaptive Management Plan (AMP) included responses to be implemented based on the outcomes of annual water quality trend analysis (Minto 2017). An information request document provided by the Yukon Water Board to the Minto Mine requested rationale for the proposed annual trend assessment frequency (YWB 2017). Specifically, YWB (2017) requested the following (IR3-11):

> *Please provide rationale as to how the proposed annual trend assessment frequency will ensure timely AMP activation and implementation of any required responses to achieve the ultimate objective of meeting the PC-WQO. If warranted, the Minto Creek PCI AMP should be updated to include a more frequent analysis of the proposed performance thresholds.*

A response to the information request, which is also applicable to related requests (IR3-16, IR3-17, and IR3-19) is provided herein and is followed by an expanded statistical methodology that could be applied during the Post Closure 1 (PC1) period.

Briefly, the trend assessment was proposed to be conducted annually due to the confounding influence of seasonal variability in water quality at the Minto Mine site on the statistically-defensible identification of temporal trends. Simply put, trends can only be defensibly identified based on comparison to concentrations at similar times of the year.

Having said that, we agree with an objective of timely activation of AMP responses to the greatest extent that is possible and defensible. Accordingly, an expanded approach has been developed to achieve the goals of the trend analyses identified in IR3-11, IR3-16, IR3-17, and IR3-18 (YWB 2017). The approach will require an initial trend analysis that will support future trend analyses to be completed on a monthly basis and in a more detailed manner on an annual basis. The approaches to the initial trend analysis and to ongoing trend analysis are similar and involve two comprehensive methods to assess trends for all parameters. For the initial trend analysis, Method 1 will be conducted over multiple time spans and tests for increasing or decreasing trends over each period. Method 2 will be conducted over the last 5 and 10 years and assesses differences among each year included in the analysis. Following this initial trend analysis, two approaches applicable to continued monitoring will be conducted within the Minto Mine water quality data management system to evaluate each new observation (monthly mean concentration) and annual differences over the last 10 years.

Initial Trend Analysis

The initial trend analysis will be conducted using parametric and non-parametric analyses over multiple time periods. Both approaches will utilize monthly mean concentrations estimated using the Kaplan-Meier method. This method involves transforming the left censored (i.e., < value) dataset to a right censored (i.e., > value) dataset, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculation will be conducted using the survfit() function in the survival package (Therneau 2017) in R (R Core Team 2019) and involves calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs. This method of estimating the mean is equivalent to using the distribution of detectable values below the LRL to represent values that are < LRL. For example, the mean of the data set {1, 2, <4, 5} is estimated as the mean of 1, 2, [½×1 + ½×2], and 5 which is 2.375. The value <4 is replaced by the distribution of values below 4 (i.e., 1 and 2 with equal weight of ½). Similarly, the mean of the data set {1, 1.6, 2, 2.1, <4, 5} is estimated as the mean of 1, 1.6, 2, 2.1, [¼×1 + ¼×1.6 + ¼×2 + ¼×2.1], and 5 which is 2.229. Again, the value <4 is replaced by the distribution of values below 4 (i.e., 1, 1.6, 2, and 2.1 with equal weight of ¼). If there is only one LRL and no detected values below the LRL, then the K-M estimate of the mean is equivalent to replacing the value below the LRL with the LRL (i.e., the best estimate for the values < LRL is the LRL).

Method 1: Seasonal Kendall Test for Increasing or Decreasing Trends (5 and 10 years)

Quantitative tests for temporal trends in monthly mean concentrations will first be conducted over two time periods using the non-parametric seasonal Kendall test described by Hirsch et al. (1982). The tests will be conducted using scripts written in R software (R Core Team 2019). The seasonal Kendall test assesses temporal trends separately for each season (or month in this case) and combines the results for each season into an overall test for trend. The test is non-parametric and assesses whether there is a monotonic increasing or monotonic decreasing trend over time. The test is conducted by calculating the test statistic S_i which is equal to the sum of the number of increases and decreases from a time period t to all time periods after t for each observation in season i. The overall test statistic S is computed as the sum of S_i for all seasons. The significance of the observed S is determined by comparing it to a critical value of S (at the significance level α = 0.05) determined from the exact sampling distribution of S (calculated by determining all possible permutations and combinations of S based on the increases and decreases from the number of pairwise comparisons made; Hirch et al. 1982). If more than 45 pairwise comparisons are made (equivalent to the number of pairwise comparisons for n = 10 in a single season), then the normal approximation is used to calculate a p-value and to assess significance (Hirch et al. 1982). The standard normal deviate Z is calculated as:

$$Z = \begin{cases} \dfrac{S-1}{\sqrt{\sigma_S}} if\ S > 0 \\ 0 \quad if\ S = 0 \\ \dfrac{S+1}{\sqrt{\sigma_S}} if\ S < 0 \end{cases}$$

where $\sigma_S = \sum_{i=1}^{k} \frac{n_i(n_i-1)(2n_i+5)-\sum_{T_i} t_i(t_i-1)(2t_i+5)}{18}$ and n_i is the number of samples in month i, t_i is the number of tied values for each tied value T_i, and k is the number of seasons (Hirch et al. 1982).

An estimate of the trend slope over time is estimated by computing the median of all slopes between data pairs within the same month (Helsel and Hirsch 2002). The slope is reported as a change in concentration per year and as a percentage change in concentration per year. The intercept of a line through the time series is estimated as the median intercept of all lines through each point with the estimated slope (Pohlert 2016). The trend analysis can only be conducted on data sets with 5 or more pairwise comparisons, the minimum number required for all consecutive increases or decrease to be significant at α = 0.05.

Method 2: ANOVA comparison among years (10 years)

Temporal changes in monthly mean water concentrations will also be evaluated for each station (reference and mine-exposed) from 2011 to 2020 using an Analysis of Variance (ANOVA). Only years with at least 6 months of data will be included in the analysis. Because of the presence of < LRL results for many parameters, a censored regression ANOVA model with factors *Year* and *Month* and assuming a log-normal distribution of the response variable, will be fit with maximum likelihood estimation for each station. The significance of each term in the model will be assessed using likelihood-ratio tests to determine if there is a significant change in log-likelihood with the addition of the term in the model. This tests for an overall difference among years and including the *Month* term in the model controls for seasonal effects within a year. If the year term is significant (α = 0.05) then post-hoc contrasts will be conducted to test for all pairwise differences among years with an α = 0.05 in a Tukey's Honestly Significant Difference test (HSD) which corrects for the number of comparisons. Magnitudes of difference (MOD) will be calculated as the percent change in the concentration in *Year$_i$* relative to the concentration in the first year:

$$MOD = \frac{Year_i - Year_1}{Year_1} x100\%$$

Continued Trend Analysis

After the initial trend analysis, continued trend analysis will be conducted using comparisons of monthly mean AMP analyte concentrations to monthly percentiles, and annually using an ANOVA comparison of monthly mean concentrations over the previous year to concentrations over the preceding 9 years (10 year time period in total).

Monthly Tests for Each Observation

Monthly mean AMP analyte concentrations will be plotted in a time series plot (minimum five years) relative to 95% prediction limits (that capture the between year variability during a period of temporal stability) defined for the monthly mean concentrations. An example is provided in Figure 1. This analysis will be used to detect deviation in monthly means from the predicted values and can be used for early warning detection of temporal change. An observation (monthly mean) falling outside of the prediction limits is expected 5% of the time by chance alone, so multiple observations falling outside of the prediction limits provides an indication of a change. This level of chance exceedance must be considered; for example, a response could be implemented following 2 or more subsequent observations of data outside the prediction limits.

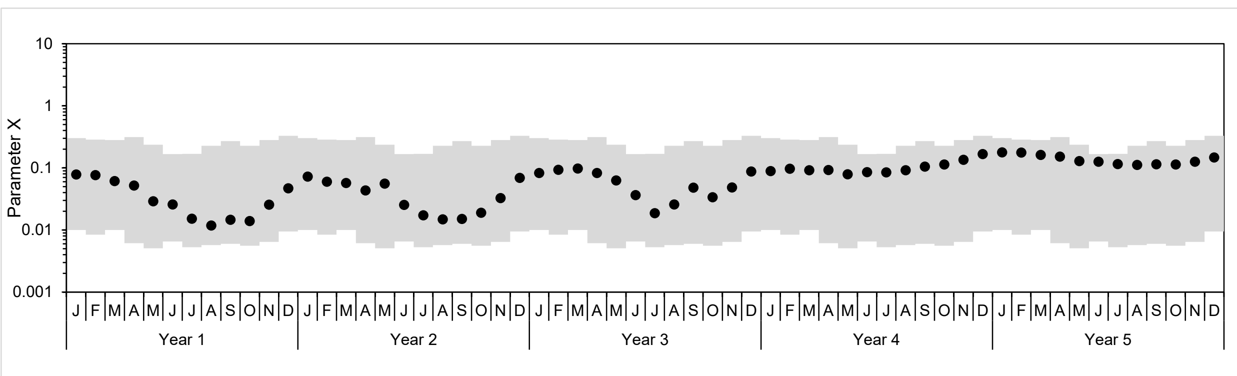

Figure 1. Scatterplot of monthly mean concentrations of an example parameter (Parameter X) over five years, relative to the 95% prediction limits for the monthly mean concentration (shaded area).

ANOVA Comparison of Previous Ten Years

An ANOVA comparison will be conducted annually using the approach described above (*Initial Trends: Method 2*) using concentrations over the previous 10 years. A response could be triggered when the concentrations from the previous year are significantly greater than the nine years before it.

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Appendix B: Memo – Upper Limits of C-AMP Regulated Parameters During Operation

Technical Memo

Date: September 15, 2020

To: Journey Paulus, Minto Explorations Inc.

From: Jeff Row and Pierre Stecko, Minnow Environmental Inc.

RE: Upper Limits of C-AMP Regulated Parameters During Operation

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Upper Limits of Closure-AMP Regulated Parameters During Operation

In support of the development of the Minto Mine Closure Adaptive Management Plan (C-AMP), summary statistics for C-AMP regulated parameters were derived for six stations (W15, W62, W12, W45, W3, and W2). Summary statistics were derived by station and year and over the last 5 years (2015-2020) and 10 years (2010-2020) using two different approaches with different underlying assumptions.

Kaplan-Meier Summary Statistics

Summary statistics were first calculated using Kaplan-Meier (K-M) methods. The summary statistics included sample size, % of samples less than [<] the LRL, mean, standard deviation, median, upper percentiles (95th, 97.5th, 99th), and maximum values. The K-M method involves transforming the left censored (i.e., < value) dataset to a right censored (i.e., > value) dataset, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean and percentiles. The calculation was conducted using the survfit() function in the survival package (Therneau 2017) in R (R Core Team 2019) and involved calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs. The method of estimating the mean is equivalent to using the distribution of detectable values below the LRL to represent values that are < LRL. For example, the mean of the data set {1, 2, <4, 5} is estimated as the mean of 1, 2, [½×1 + ½×2], and 5 which is 2.375. The value <4 is replaced by the distribution of values below 4 (i.e., 1 and 2 with equal weight of ½). Similarly, the mean of the data set {1, 1.6, 2, 2.1, <4, 5} is estimated as the mean of 1, 1.6, 2, 2.1, [¼×1 + ¼×1.6 + ¼×2 + ¼×2.1], and 5 which is 2.229. Again, the value <4 is replaced by the distribution of values below 4 (i.e., 1, 1.6, 2, and 2.1 with equal weight of ¼). If there is only one LRL and no detected values below the LRL, then the K-M estimate of the mean is equivalent to replacing the value below the LRL with the LRL (i.e., the best estimate for the values < LRL is the LRL).

For percentiles, the K-M method uses the distribution of values below a detection limit to represent a non-detected value. For example, the maximum value in a data set with values <2, 3, 4, <5, 6, 7, and <10, would be 7 (instead of <10) and the median would be 4 (instead of <5). When a greater proportion of the data is below the LRL than the percentile being estimated, the KM method in R does not provide an estimate for that measure of position. Instead a 'maximum' percentile is calculated by replacing values with their detection limit and calculating the percentiles using the quantile function in R (Type 7; Hyndman and Fan 1996). If the estimated quantile is between values in the dataset, the higher value is reported as the percentile as a '<' and the value.

Maximum Likelihood Estimation

Unlike the K-M approach, which is non-parametric, maximum likelihood (ML) estimation assumes the observed censored data come from an underlying distribution (e.g., normal, lognormal). Using the uncensored values and the proportions of data that are below one or more detection limits, mean, variance and percentiles of the censored data are estimated with ML under the assumed distribution (Helsel and Hirsch 2002). Because an adequate number of samples are required to accurately estimate parameters under the assumed distribution, this approach is not recommended for small sample sizes (reviewed in Helsel and Hirsch 2002) and thus no annual summaries could be calculated using this approach. Here, the mean, standard deviation and upper percentiles were estimated using ML and an assumed lognormal distribution.

Summary statistics for both approaches were estimated in R (R Core Team 2019).

Results

Summary statistics by year (2010 to 2020) are presented in Tables 1 to 6. An expanded set of statistics for the most recent ten-year period (2010 to 2019) and the most recent five-year period (2015 to 2019) are presented in Tables 7 to 12.

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Table 1: Summary Statistics for Station W12, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
	N	10	7	7	10	8	8	8	6	8	8	8	8	7	8	8	8
	Mean	7.66	4.99	0.610	32.6	0.0312	0.000686	0.0000954	<0.000400	0.148	0.125	0.000200	0.0197	<0.00100	0.00451	0.0000213	0.00300
	SD	0.403	8.40	0.773	39.0	0.0227	0.000190	0.0000868	-	0.137	0.113	-	0.00625	-	0.00230	-	-
2010	Median	7.87	2.10	0.351	12.8	0.0230	0.000700	0.0000600	<0.00100	0.111	0.0875	<0.000200	0.0195	<0.00100	0.00385	<0.0000200	0.00300
	95th Percentile	8.05	24.0	2.36	119	0.0790	0.000900	0.000280	<0.00100	0.476	0.386	0.000200	0.0290	<0.00100	0.00980	0.000100	0.00300
	Max	8.05	24.0	2.36	119	0.0790	<0.00100	0.000280	<0.00100	0.476	0.386	0.000200	0.0290	<0.00100	0.00980	0.000100	<0.0100
	% < LRL	0	0	0	10.0	12.5	12.5	25.0	100	0	0	87.5	0	100	0	87.5	87.5
	N	3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Mean	7.47	0.726	0.120	13.9	0.0205	0.00101	0.0000552	<0.00100	0.0721	0.0661	<0.000200	0.0172	0.00126	0.00529	<0.0000200	0.00830
	SD	0.315	1.36	0.176	7.83	0.0255	0.000396	0.0000317	-	0.0300	0.0799	-	0.00971	0.000439	0.00252	-	0.00842
2011	Median	7.56	0.181	0.0600	15.6	0.0125	0.00100	0.0000500	<0.00100	0.0717	0.0283	<0.000200	0.0190	0.00100	0.00590	<0.0000200	<0.00500
	95th Percentile	7.73	4.40	0.600	27.0	0.0890	0.00170	0.000140	<0.00100	0.148	0.225	<0.000200	0.0370	0.00200	0.00950	<0.0000200	0.0310
	Max	7.73	4.40	0.600	27.0	0.0890	0.00170	0.000140	<0.00100	0.148	0.225	<0.000200	0.0370	0.00200	0.00950	<0.0000200	0.0310
	% < LRL	0	20.0	0	0	0	0	0	100	0	10.0	100	0	20.0	0	100	70.0
	N	11	13	13	13	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.91	0.103	0.0866	17.3	0.0398	0.000698	0.0000420	<0.00100	0.0553	0.0232	<0.000200	0.0197	0.00117	0.00630	<0.0000200	0.00665
	SD	0.465	0.0770	0.0593	5.53	0.0404	0.000173	0.0000239	-	0.0228	0.0190	-	0.00378	-	0.000764	-	0.00547
2012	Median	7.96	0.0920	0.0750	17.1	0.0240	0.000630	0.0000345	<0.00100	0.0660	0.0122	<0.000200	0.0192	<0.00100	0.00652	<0.0000200	<0.00500
	95th Percentile	8.52	0.269	0.255	33.1	0.124	0.00102	0.0000970	<0.00100	0.0784	0.0604	<0.000200	0.0286	0.00300	0.00704	<0.0000200	0.0219
	Max	8.52	0.269	0.255	33.1	0.124	0.00102	0.0000970	<0.00100	0.0784	0.0604	<0.000200	0.0286	0.00300	0.00704	<0.0000200	0.0219
	% < LRL	0	7.69	0	0	0	0	0	100	0	0	100	0	91.7	0	100	83.3
	N	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.86	1.07	0.284	16.6	0.0175	0.000599	0.0000182	<0.00100	0.0119	0.0103	<0.000200	0.0423	0.00195	0.00376	<0.0000200	<0.00500
	SD	0.332	1.11	0.226	5.87	0.00835	0.000500	0.00000489	-	0.0101	0.00786	-	0.00827	0.000681	0.00208	-	-
2013	Median	7.96	0.670	0.229	15.0	0.0159	0.000445	0.0000180	<0.00100	0.00743	0.00650	<0.000200	0.0455	0.00175	0.00452	<0.0000200	<0.00500
	95th Percentile	8.34	4.40	0.940	32.2	0.0288	0.00213	0.0000270	<0.00100	0.0354	0.0292	<0.000200	0.0525	0.00320	0.00586	<0.0000200	<0.00500
	Max	8.34	4.40	0.940	32.2	0.0288	0.00213	0.0000270	<0.00100	0.0354	0.0292	<0.000200	0.0525	0.00320	0.00586	<0.0000200	<0.00500
	% < LRL	0	0	0	0	0	0	8.33	100	0	41.7	100	0	0	0	100	100
	N	23	15	15	15	15	15	15	22	15	15	15	15	15	15	15	15
	Mean	8.03	1.36	0.199	13.7	0.0209	0.000475	0.0000171	<0.00100	0.00506	0.0250	<0.000200	0.0598	0.00234	0.00598	<0.0000200	0.00516
	SD	0.478	0.224	0.0974	2.13	0.00627	0.0000865	0.00000591	-	0.00316	0.0292	-	0.00868	0.000822	0.00110	-	-
2014	Median	8.09	1.40	0.197	13.7	0.0198	0.000480	0.0000180	<0.00100	0.00432	0.0130	<0.000200	0.0576	0.00230	0.00617	<0.0000200	<0.00500
	95th Percentile	8.40	1.70	0.457	16.8	0.0332	0.000620	0.0000270	<0.00100	0.0123	0.107	<0.000200	0.0732	0.00360	0.00763	<0.0000200	0.00740
	Max	8.66	1.70	0.457	16.8	0.0332	0.000620	0.0000270	<0.00100	0.0123	0.107	<0.000200	0.0732	0.00360	0.00763	<0.0000200	0.00740
	% < LRL	0	0	0	0	0	0	13.3	100	0	6.67	100	0	0	0	100	93.3
	N	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
	Mean	8.10	2.66	1.30	14.8	0.0160	0.000432	0.0000323	<0.00100	0.0162	0.0280	<0.000200	0.0820	0.00173	0.0123	<0.0000200	0.00514
	SD	0.173	0.964	0.802	6.11	0.00550	0.0000640	0.0000144	-	0.0111	0.0628	-	0.0140	0.000740	0.00427	-	0.000226
2015	Median	8.19	2.80	1.49	13.6	0.0152	0.000440	0.0000320	<0.00100	0.0140	0.00675	<0.000200	0.0834	0.00150	0.00975	<0.0000200	<0.00500
	95th Percentile	8.28	4.30	2.83	26.0	0.0277	0.000550	0.0000565	<0.00100	0.0373	0.231	<0.000200	0.0972	0.00380	0.0207	<0.0000200	0.00620
	Max	8.28	4.30	2.83	26.0	0.0277	0.000550	0.0000565	<0.00100	0.0373	0.231	<0.000200	0.0972	0.00380	0.0207	<0.0000200	0.00620
	% < LRL	0	0	0	0	0	0	15.4	100	0	23.1	100	0	15.4	0	100	84.6
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.95	3.28	2.14	26.4	0.0112	0.000442	0.0000171	<0.000100	0.0277	0.0124	0.0000502	0.0797	0.00181	0.0148	0.0000100	0.00366
	SD	0.345	0.830	1.50	1.82	0.00398	0.0000495	0.0000105	-	0.0114	0.00437	-	0.00610	0.000359	0.00140	-	0.00123
2016	Median	7.87	2.97	1.54	26.0	0.0106	0.000450	0.0000160	<0.000100	0.0246	0.00970	<0.0000500	0.0814	0.00171	0.0146	<0.0000100	0.00360
	95th Percentile	9.00	4.72	4.33	29.4	0.0176	0.000500	0.0000342	<0.00100	0.0526	0.0220	0.0000520	0.0866	0.00253	0.0171	0.0000100	0.00610
	Max	9.00	4.72	4.33	29.4	0.0176	0.000500	0.0000342	<0.00100	0.0526	0.0220	<0.000200	0.0866	0.00253	0.0171	<0.0000200	0.00610
	% < LRL	0	0	0	0	0	0	25.0	100	0	50.0	91.7	0	0	0	91.7	8.33

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 1: Summary Statistics for Station W12, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	34	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
	Mean	7.60	4.67	3.98	18.3	0.00590	0.000442	0.0000662	<0.000100	0.0410	0.0178	0.0000813	0.0780	0.00351	0.0128	0.0000107	0.00585
	SD	0.432	1.21	1.83	6.81	0.00199	0.0000443	0.0000800	-	0.0185	0.0121	0.0000566	0.00560	0.000616	0.00137	-	0.00227
	Median	7.70	4.34	4.68	15.1	0.00530	0.000430	0.0000520	<0.000200	0.0389	0.0120	<0.0000500	0.0790	0.00346	0.0129	<0.0000100	0.00685
	95th Percentile	7.97	6.94	6.71	28.9	0.0102	0.000540	0.000205	<0.000200	0.0740	0.0470	0.000210	0.0847	0.00460	0.0153	0.0000120	0.00870
	Max	8.60	6.94	6.71	28.9	0.0102	0.000540	0.000205	<0.000200	0.0740	0.0470	0.000210	0.0847	0.00460	0.0153	<0.0000500	<0.00900
	% < LRL	0	0	0	0	0	0	61.5	100	0	61.5	69.2	0	0	0	92.3	7.69
2018	N	33	15	15	15	15	15	15	15	15	15	14	15	15	15	15	15
	Mean	7.67	4.03	5.00	7.54	0.00859	0.000428	0.0000845	0.000199	0.0430	0.0277	0.0000795	0.0717	0.00428	0.00774	0.0000103	0.00533
	SD	0.205	0.648	2.08	3.27	0.00977	0.0000322	0.0000251	0.000342	0.0146	0.0225	0.0000218	0.0147	0.000947	0.00161	0.000000490	0.00283
	Median	7.76	4.21	5.25	5.72	0.00540	0.000420	0.0000770	<0.000200	0.0390	0.0160	0.0000880	0.0672	0.00410	0.00719	<0.0000100	0.00410
	95th Percentile	7.93	4.74	8.49	13.2	0.0430	0.000500	0.000137	0.00132	0.0641	0.0840	0.000160	0.0975	0.00650	0.0116	0.0000110	0.0106
	Max	8.10	4.74	8.49	13.2	0.0430	0.000500	<0.000200	0.00132	0.0641	0.0840	0.000160	0.0975	0.00650	0.0116	<0.0000200	0.0106
	% < LRL	0	0	0	0	0	0	60.0	86.7	0	40.0	71.4	0	6.67	0	86.7	6.67
2019	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.84	0.244	0.136	9.35	0.00451	0.000635	0.0000627	0.000119	0.0817	0.0110	<0.0000500	0.0243	0.000914	0.00500	<0.0000100	0.00372
	SD	0.259	0.180	0.0799	6.72	0.00269	0.000214	0.0000628	0.0000329	0.0671	-	-	0.00737	0.000310	0.00253	-	0.00360
	Median	7.82	0.238	0.105	7.20	0.00370	0.000588	0.0000560	<0.000100	0.0537	<0.0100	<0.0000500	0.0264	0.000800	0.00442	<0.0000100	0.00258
	95th Percentile	8.20	0.524	0.289	28.1	0.0101	0.00103	0.000217	0.000200	0.220	0.0220	<0.000100	0.0334	0.00152	0.0106	<0.0000200	0.0132
	Max	8.20	0.524	0.289	28.1	0.0101	0.00103	0.000217	0.000200	0.220	0.0220	<0.000100	0.0334	0.00152	0.0106	<0.0000200	0.0132
	% < LRL	0	8.33	8.33	0	8.33	0	41.7	66.7	0	91.7	100	0	16.7	0	100	33.3
2020	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Mean	7.58	1.76	0.983	10.8	0.00448	0.000426	0.000133	0.000102	0.0760	0.0196	0.0000638	0.0316	0.00250	0.00533	0.0000148	0.00430
	SD	0.154	0.837	0.489	4.87	0.00494	0.0000623	0.0000560	-	0.0322	-	-	0.00708	0.000722	0.00111	-	0.00110
	Median	7.53	1.41	0.702	8.69	0.00220	0.000440	0.000110	<0.000100	0.0641	<0.0100	<0.0000500	0.0338	0.00241	0.00523	<0.0000100	0.00460
	95th Percentile	7.79	3.00	1.78	19.2	0.0133	0.000500	0.000229	0.000110	0.113	0.0580	0.000119	0.0384	0.00366	0.00718	0.0000340	0.00530
	Max	7.79	3.00	1.78	19.2	0.0133	0.000500	0.000229	<0.000200	0.113	0.0580	0.000119	0.0384	0.00366	0.00718	0.0000340	0.00530
	% < LRL	0	0	0	0	0	0	0	80.0	0	80.0	80.0	0	0	0	80.0	0
2010 to 2019	N	162	122	122	125	122	122	122	127	122	122	121	122	121	122	122	122
	Mean	7.80	2.25	1.51	16.5	0.0169	0.000564	0.0000433	0.000121	0.0450	0.0297	0.0000639	0.0523	0.00205	0.00803	0.0000109	0.00419
	SD	0.396	2.65	2.08	13.5	0.0192	0.000270	0.0000465	0.000135	0.0551	0.0519	0.0000517	0.0272	0.00131	0.00429	0.00000911	0.00393
	Median	7.84	1.60	0.290	13.6	0.0116	0.000470	0.0000270	<0.000100	0.0302	0.0120	<0.0000500	0.0541	0.00170	0.00686	<0.0000100	0.00320
	95th Percentile	8.32	4.72	5.80	29.1	0.0570	0.00100	0.000137	0.000200	0.122	0.103	0.000160	0.0882	0.00444	0.0162	0.0000110	0.00900
	Max	9.00	24.0	8.49	119	0.124	0.00213	0.000280	0.00132	0.476	0.386	0.000210	0.0975	0.00650	0.0207	0.000100	0.0310
	% < LRL	0	3.28	0.820	0.800	1.64	0.820	26.2	95.3	0	33.6	91.7	0	20.7	0	95.9	55.7
	ML Mean	7.80	4.97	2.09	19.2	0.0164	0.000558	0.0000439	0.0000647	0.0522	0.0277	0.0000431	0.0551	0.00209	0.00835	0.00000431	0.00408
	ML SD	0.413	25.5	9.48	21.2	0.0175	0.000205	0.0000497	0.000148	0.0930	0.0514	0.0000492	0.0442	0.00161	0.00604	0.00000597	0.00319
	ML 95th Percentile	8.50	18.9	8.05	56.0	0.0471	0.000941	0.000129	0.000240	0.183	0.0981	0.000128	0.137	0.00509	0.0197	0.0000138	0.0100
2015 to 2019	N	104	65	65	65	65	65	65	65	65	65	64	65	65	65	65	65
	Mean	7.75	3.05	2.63	15.0	0.00928	0.000472	0.0000474	0.000130	0.0416	0.0184	0.0000638	0.0678	0.00250	0.0105	0.0000101	0.00436
	SD	0.356	1.71	2.31	8.49	0.00692	0.000126	0.0000502	0.000169	0.0374	0.0311	0.0000402	0.0235	0.00144	0.00430	0.000000783	0.00263
	Median	7.78	3.20	1.88	12.6	0.00730	0.000440	0.0000320	<0.000100	0.0305	0.00960	<0.0000500	0.0770	0.00210	0.0105	<0.0000100	0.00370
	95th Percentile	8.22	5.40	6.71	28.1	0.0203	0.000680	0.000131	0.000200	0.0937	0.0490	0.000160	0.0945	0.00480	0.0168	0.0000110	0.00910
	Max	9.00	6.94	8.49	29.4	0.0430	0.00103	0.000217	0.00132	0.220	0.231	0.000210	0.0975	0.00650	0.0207	<0.0000500	0.0132
	% < LRL	0	1.54	1.54	0	1.54	0	41.5	90.8	0	52.3	85.9	0	7.69	0	93.8	27.7
	ML Mean	7.75	5.52	4.26	15.2	0.00924	0.000471	0.0000506	0.0000684	0.0440	0.0164	0.0000428	0.0701	0.00256	0.0107	0.00000864	0.00448
	ML SD	0.370	15.0	13.3	10.4	0.00680	0.000102	0.0000727	0.000188	0.0450	0.0234	0.0000544	0.0387	0.00186	0.00575	0.00000135	0.00307
	ML 95th Percentile	8.38	21.0	16.4	34.8	0.0220	0.000655	0.000165	0.000260	0.124	0.0533	0.000133	0.143	0.00604	0.0216	0.0000110	0.0102

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 2: Summary Statistics for Station W15, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010	N	40	37	39	43	45	44	29	26	45	45	45	45	43	45	25	25
	Mean	7.53	0.111	0.175	5.71	0.134	0.000643	0.000159	0.000582	0.0382	0.632	0.000171	0.00246	0.00167	0.000994	<0.0000100	0.00528
	SD	0.389	0.101	0.108	6.53	0.390	0.000240	0.000434	0.000559	0.0590	0.447	0.000426	0.00265	0.00125	0.00123	-	0.00784
	Median	7.58	0.0810	0.163	2.65	0.0420	0.000600	0.0000400	0.000500	0.0260	0.563	<0.000200	0.00200	0.00100	0.000300	<0.0000200	0.00400
	95th Percentile	8.02	0.430	0.367	20.8	0.208	0.00100	0.000500	0.000700	0.0630	1.22	0.000300	0.00370	0.00300	0.00360	<0.0000200	0.00900
	Max	8.29	0.450	0.402	21.1	2.65	0.00160	0.00234	0.00300	0.415	2.91	0.00270	0.0190	0.00800	0.00520	<0.0000200	0.0410
	% < LRL	0	10.8	2.56	0	0	2.27	3.45	73.1	0	0	91.1	6.67	4.65	28.9	100	64.0
2011	N	6	26	29	29	29	29	29	29	29	29	29	29	29	29	29	29
	Mean	7.66	0.0907	0.0875	11.0	0.0460	0.000442	0.0000285	<0.00100	0.0216	0.280	0.000210	0.00278	0.00124	0.00222	<0.0000200	0.00570
	SD	0.293	0.136	0.114	10.8	0.0449	0.000237	0.0000218	-	0.0154	0.153	-	0.00200	0.000612	0.00218	-	0.00202
	Median	7.68	0.0555	0.0180	6.40	0.0260	0.000400	0.0000200	<0.00100	0.0154	0.285	<0.000200	0.00200	0.00100	0.00160	<0.0000200	<0.00500
	95th Percentile	8.00	0.253	0.338	29.6	0.145	0.000600	0.0000700	<0.00100	0.0500	0.571	<0.000200	0.00700	0.00200	0.00465	<0.0000200	0.0100
	Max	8.00	0.701	0.383	56.1	0.179	0.00158	0.0000780	<0.00100	0.0597	0.605	0.000500	0.00900	0.00380	0.0124	<0.0000200	0.0130
	% < LRL	0	3.85	3.45	0	0	0	17.2	100	0	0	96.6	3.45	41.4	0	100	79.3
2012	N	42	44	44	44	42	42	42	42	42	42	42	42	42	42	42	42
	Mean	7.64	0.0953	0.0493	8.12	0.0397	0.000548	0.0000210	0.000220	0.0161	0.652	0.0000450	0.00218	0.00120	0.00165	0.00000600	0.00349
	SD	0.508	0.0877	0.0537	8.55	0.0284	0.000199	0.0000123	-	0.00938	0.986	0.0000768	0.000732	0.000423	0.00165	0.00000129	0.00149
	Median	7.56	0.0665	0.0372	4.66	0.0299	0.000520	0.0000160	0.000220	0.0124	0.490	0.0000310	0.00220	0.00110	0.00101	<0.0000200	0.00295
	95th Percentile	8.42	0.220	0.171	26.9	0.0955	0.000680	0.0000500	0.000220	0.0289	1.07	0.0000310	0.00310	0.00180	0.00521	<0.0000200	0.00680
	Max	9.95	0.500	0.269	42.5	0.112	0.00163	0.0000600	<0.00100	0.0488	6.48	0.000340	0.00440	0.00320	0.00715	0.0000290	0.00830
	% < LRL	0	0	2.27	0	0	0	16.7	97.6	0	0	92.9	2.38	40.5	0	95.2	83.3
2013	N	53	34	34	34	33	33	33	33	33	33	33	33	33	33	33	33
	Mean	7.81	0.131	0.0487	12.7	0.0310	0.000520	0.0000152	<0.00100	0.0195	0.306	<0.000200	0.00303	0.00116	0.00303	<0.0000200	0.00568
	SD	0.469	0.197	0.0429	11.1	0.0348	0.000179	0.00000867	-	0.0122	0.320	-	0.000679	0.000209	0.00224	-	0.00170
	Median	7.72	0.0915	0.0356	7.28	0.0208	0.000500	<0.0000100	<0.00100	0.0144	0.219	<0.000200	0.00310	0.00110	0.00200	<0.0000200	<0.00500
	95th Percentile	8.42	0.230	0.136	34.0	0.118	0.000870	0.0000330	<0.00100	0.0470	1.09	<0.000200	0.00410	0.00160	0.00680	<0.0000200	0.00940
	Max	9.63	1.20	0.219	36.0	0.158	0.000880	0.0000420	<0.00100	0.0529	1.40	<0.000200	0.00450	0.00190	0.00683	<0.0000200	0.0140
	% < LRL	0	0	14.7	0	0	0	51.5	100	0	0	100	3.03	30.3	0	100	81.8
2014	N	58	28	28	28	27	27	27	27	27	27	27	27	27	27	27	27
	Mean	7.87	0.0842	0.0567	9.61	0.0312	0.000457	0.0000145	<0.00100	0.0196	0.244	0.000214	0.00310	0.00108	0.00192	<0.0000200	0.00501
	SD	0.423	0.0569	0.0533	9.15	0.0406	0.0000874	0.0000104	-	0.0147	0.213	-	0.000758	0.000105	0.00178	-	-
	Median	8.05	0.0700	0.0329	6.26	0.0146	0.000460	<0.0000100	<0.00100	0.0149	0.163	<0.000200	0.00320	0.00100	0.00133	<0.0000200	<0.00500
	95th Percentile	8.38	0.160	0.172	30.4	0.152	0.000630	0.0000320	<0.00100	0.0423	0.774	<0.000200	0.00420	0.00120	0.00558	<0.0000200	<0.00500
	Max	8.46	0.300	0.249	42.4	0.161	0.000630	0.0000570	<0.00100	0.0746	0.853	0.000570	0.00520	0.00140	0.00875	<0.0000200	0.00540
	% < LRL	0	0	0	0	0	0	59.3	100	0	0	96.3	0	33.3	0	100	96.3
2015	N	73	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	Mean	7.81	0.263	0.231	30.9	0.0186	0.000550	0.0000198	0.00113	0.0270	0.137	0.000201	0.0128	0.00125	0.00673	0.0000202	0.00585
	SD	0.421	0.908	0.650	50.0	0.0197	0.000377	0.0000132	-	0.0176	0.138	0.00000485	0.0239	0.000513	0.00983	-	0.00190
	Median	7.85	0.0830	0.0790	15.3	0.0131	0.000450	0.0000130	<0.00100	0.0238	0.0931	<0.000200	0.00320	0.00110	0.00410	<0.0000200	<0.00500
	95th Percentile	8.26	0.410	0.510	122	0.0776	0.00138	0.0000410	<0.00100	0.0541	0.449	0.000200	0.0725	0.00270	0.0230	<0.0000200	0.0122
	Max	9.76	5.30	3.78	265	0.0833	0.00220	0.0000600	0.00530	0.101	0.450	0.000220	0.113	0.00280	0.0504	0.0000270	0.0149
	% < LRL	0	0	0	0	0	0	39.4	97.0	0	6.06	93.9	0	33.3	0	97.0	78.8
2016	N	178	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Mean	7.72	0.0489	0.0377	20.2	0.00879	0.000332	0.0000206	0.000150	0.0228	0.0542	<0.0000500	0.00333	0.000753	0.00484	<0.0000100	0.00201
	SD	0.243	0.0453	0.0266	12.4	0.00938	0.0000930	0.0000284	0.0000445	0.0204	0.0590	-	0.000998	0.000145	0.00241	-	0.00152
	Median	7.68	0.0363	0.0326	14.8	0.00650	0.000360	0.0000110	0.000150	0.0161	0.0345	<0.0000500	0.00350	0.000770	0.00435	<0.0000100	0.00140
	95th Percentile	8.02	0.174	0.113	39.3	0.0383	0.000470	0.000108	0.000290	0.0853	0.238	<0.000200	0.00500	0.00110	0.00963	<0.0000200	0.00550
	Max	9.10	0.174	0.113	39.3	0.0383	0.000470	0.000108	<0.00100	0.0853	0.238	<0.000200	0.00500	0.00110	0.00963	<0.0000200	0.00550
	% < LRL	0	0	0	0	0	0	35.7	42.9	0	7.14	100	0	28.6	0	100	21.4

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 2: **Summary Statistics for Station W15, Minto Mine, 2010 to 2019**

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	94	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
	Mean	7.57	0.136	0.137	14.3	0.0204	0.000422	0.0000147	0.000183	0.0242	0.123	<0.0000500	0.00334	0.000961	0.00399	<0.0000100	0.00351
	SD	0.331	0.224	0.160	14.4	0.0189	0.0000755	0.0000166	0.0000731	0.00921	0.0667	-	0.00235	0.000267	0.00383	-	0.00603
	Median	7.59	0.0503	0.0378	8.90	0.0117	0.000430	0.00000820	0.000180	0.0242	0.122	<0.0000500	0.00270	0.000935	0.00233	<0.0000100	<0.00100
	95th Percentile	8.03	0.577	0.438	44.2	0.0601	0.000490	0.0000612	0.000310	0.0378	0.233	<0.0000500	0.00780	0.00159	0.0128	<0.0000100	0.0230
	Max	8.25	1.03	0.548	58.8	0.0712	0.000670	0.0000680	0.000320	0.0401	0.280	<0.000100	0.0126	0.00170	0.0132	<0.0000200	0.0230
	% < LRL	0	0	0	0	0	0	34.6	19.2	0	0	100	0	11.5	0	100	65.4
2018	N	97	15	15	15	15	15	15	15	15	15	15	14	15	15	15	15
	Mean	7.84	0.0637	0.0803	13.5	0.0235	0.000440	0.0000196	0.000179	0.0264	0.101	0.0000514	0.00319	0.000943	0.00522	<0.0000100	0.00332
	SD	0.181	0.0560	0.0752	13.5	0.0400	0.000115	0.0000277	0.0000539	0.0122	0.0656	-	0.00148	0.000221	0.00469	-	0.00541
	Median	7.86	0.0307	0.0557	7.49	0.0101	0.000420	0.00000690	0.000180	0.0218	0.102	<0.0000500	0.00282	0.000920	0.00370	<0.0000100	<0.00100
	95th Percentile	8.09	0.210	0.224	46.7	0.164	0.000690	0.0000988	0.000330	0.0614	0.269	0.0000710	0.00650	0.00142	0.0157	<0.0000100	0.0206
	Max	8.33	0.210	0.224	46.7	0.164	0.000690	0.0000988	0.000330	0.0614	0.269	0.0000710	0.00650	0.00142	0.0157	<0.0000100	0.0206
	% < LRL	0	0	0	0	6.67	0	33.3	40.0	0	6.67	93.3	0	13.3	0	100	53.3
2019	N	17	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13
	Mean	7.67	0.0873	0.0595	9.65	0.0139	0.000497	0.0000185	0.000201	0.0366	0.113	<0.0000500	0.00379	0.000974	0.00419	<0.0000100	0.00242
	SD	0.345	0.128	0.111	15.7	0.0125	0.000185	0.0000181	0.0000699	0.0419	0.0856	-	0.00259	0.000394	0.00750	-	0.00352
	Median	7.65	0.0367	0.0141	3.68	0.00940	0.000450	0.00000940	0.000175	0.0238	0.0880	<0.0000500	0.00271	0.000940	0.00110	<0.0000100	<0.00100
	95th Percentile	8.38	0.474	0.410	56.8	0.0467	0.00102	0.0000632	0.000370	0.172	0.330	<0.0000500	0.00945	0.00217	0.0273	<0.0000100	0.0124
	Max	8.38	0.474	0.410	56.8	0.0467	0.00102	0.0000632	0.000370	0.172	0.330	<0.0000500	0.00945	0.00217	0.0273	<0.0000100	0.0124
	% < LRL	0	0	0	0	0	0	23.1	16.7	0	0	100	0	15.4	0	100	61.5
2020	N	6	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4
	Mean	7.69	0.0184	0.0286	7.70	0.0587	0.000315	0.0000166	0.000230	0.0284	0.105	<0.0000500	0.00360	0.000672	0.00507	<0.0000100	0.00160
	SD	0.204	0.00509	0.0111	3.63	0.0560	0.0000443	0.00000763	-	0.0104	0.0954	-	0.000665	0.0000550	0.00253	-	0.00120
	Median	7.62	0.0193	0.0246	6.20	0.0545	0.000330	0.0000157	0.000230	0.0323	0.0925	<0.0000500	0.00354	0.000700	0.00436	<0.0000100	0.00105
	95th Percentile	8.08	0.0235	0.0449	13.1	0.119	0.000350	0.0000245	0.000360	0.0355	0.218	<0.0000500	0.00444	0.000790	0.00868	<0.0000100	0.00330
	Max	8.08	0.0235	0.0449	13.1	0.119	0.000350	0.0000245	0.000360	0.0355	0.218	<0.0000500	0.00444	0.000790	0.00868	<0.0000100	0.00330
	% < LRL	0	0	0	0	0	0	25.0	50.0	0	0	100	0	25.0	0	100	25.0
2010 to 2019	N	658	270	275	279	277	276	261	257	277	277	277	276	275	277	257	257
	Mean	7.73	0.120	0.103	13.0	0.0458	0.000509	0.0000339	0.000236	0.0249	0.333	0.0000512	0.00405	0.00115	0.00310	0.00000525	0.00289
	SD	0.359	0.341	0.246	21.0	0.163	0.000227	0.000150	0.000423	0.0288	0.497	0.000178	0.00895	0.000674	0.00466	0.000000549	0.00434
	Median	7.74	0.0697	0.0406	6.54	0.0200	0.000460	0.0000130	0.000170	0.0199	0.217	0.0000310	0.00270	0.00100	0.00154	<0.0000200	0.00100
	95th Percentile	8.25	0.253	0.338	41.4	0.152	0.000880	0.0000632	0.000500	0.0500	0.888	0.0000710	0.00780	0.00200	0.0113	<0.0000200	0.00940
	Max	9.95	5.30	3.78	265	2.65	0.00220	0.00234	0.00530	0.415	6.48	0.00270	0.113	0.00800	0.0504	0.0000290	0.0410
	% < LRL	0	1.85	2.91	0	0.361	0.362	31.0	77.8	0	1.44	95.7	2.17	26.2	4.69	98.8	73.5
	ML Mean	7.73	0.107	0.099	12.8	0.0381	0.000505	0.0000261	0.000226	0.0241	0.384	0.0000364	0.00338	0.00113	0.00303	0.00000140	0.00283
	ML SD	0.355	0.136	0.185	18.8	0.0563	0.000182	0.0000439	0.000206	0.0167	0.742	0.000729	0.00245	0.000504	0.00446	0.00000540	0.00575
	ML 95th Percentile	8.33	0.331	0.352	42.0	0.125	0.000844	0.0000897	0.000601	0.0555	1.37	0.000102	0.00798	0.00207	0.00996	0.00000540	0.0102
2015 to 2019	N	459	101	101	101	101	101	101	100	101	101	101	100	101	101	101	101
	Mean	7.73	0.148	0.136	19.8	0.0178	0.000464	0.0000179	0.000230	0.0269	0.113	0.0000535	0.00651	0.00100	0.00521	0.0000102	0.00298
	SD	0.305	0.535	0.387	31.5	0.0221	0.000244	0.0000196	0.000522	0.0206	0.0995	0.0000238	0.0144	0.000414	0.00682	-	0.00443
	Median	7.75	0.0550	0.0360	9.16	0.0101	0.000420	0.00000940	0.000170	0.0218	0.0880	<0.0000500	0.00290	0.000950	0.00277	<0.0000100	<0.00100
	95th Percentile	8.14	0.410	0.410	56.8	0.0596	0.000700	0.0000612	0.000320	0.0472	0.313	<0.0000500	0.0224	0.00170	0.0157	<0.0000200	0.0122
	Max	9.76	5.30	3.78	265	0.164	0.00220	0.000108	0.00530	0.172	0.450	0.000220	0.113	0.00280	0.0504	0.0000270	0.0230
	% < LRL	0	0	0	0	0.990	0	34.7	51.0	0	3.96	97.0	0	21.8	0	99.0	61.4
	ML Mean	7.73	0.106	0.117	19.0	0.0170	0.000458	0.0000182	0.000200	0.0265	0.130	0.0000120	0.00496	0.000988	0.00517	0.000000806	0.00298
	ML SD	0.303	0.155	0.246	28.9	0.0185	0.000169	0.0000291	0.000167	0.0160	0.199	0.000124	0.00465	0.000413	0.00741	0.0000111	0.00829
	ML 95th Percentile	8.24	0.349	0.426	63.2	0.0492	0.000773	0.0000616	0.000508	0.0567	0.434	0.0000404	0.0134	0.00176	0.0168	0.00000253	0.0114

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 3: Summary Statistics for Station W2, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
	N	187	178	182	194	197	194	76	8	197	197	197	197	194	197	75	79
	Mean	7.93	0.0444	0.00852	3.24	0.0190	0.000417	0.0000236	0.000425	0.00244	0.0876	0.000104	0.00422	0.00110	0.00101	<0.0000100	0.00290
	SD	0.343	0.0661	0.00515	3.00	0.0157	0.000103	0.0000413	0.0000935	0.00132	0.0840	0.0000159	0.00297	0.000394	0.000938	-	0.00480
2010	Median	8.02	0.0270	0.00600	2.77	0.0170	0.000400	0.0000100	<0.000400	0.00200	0.0620	<0.000200	0.00400	0.00100	0.000700	<0.0000200	0.00200
	95th Percentile	8.33	0.125	0.0190	8.20	0.0530	0.000500	0.000100	0.000600	0.00460	0.312	<0.000200	0.00900	0.00200	0.00240	<0.0000200	0.0100
	Max	8.54	0.550	0.0310	8.90	0.103	0.000600	0.000260	0.000600	0.0135	0.505	0.000400	0.00900	0.00400	0.00260	<0.0000200	0.0200
	% < LRL	0	10.7	47.3	4.12	22.3	22.2	43.4	75.0	0	7.61	97.5	7.11	30.4	41.6	100	87.3
	N	12	32	35	35	35	35	35	0	35	35	35	35	35	35	35	35
	Mean	7.90	0.0282	0.00713	0.201	0.0291	0.000665	0.0000216	-	0.00383	0.380	0.000206	0.00119	0.00170	0.000150	<0.0000200	0.00512
	SD	0.156	0.0480	0.00343	0.148	0.0170	0.000191	0.0000239	-	0.00233	0.227	0.0000408	0.000368	0.000444	0.0000721	-	0.000207
2011	Median	7.96	0.0159	<0.00500	0.170	0.0270	0.000700	0.0000100	-	0.00290	0.324	<0.000200	0.00100	0.00200	0.000100	<0.0000200	<0.00500
	95th Percentile	8.07	0.110	0.0170	0.478	0.0630	0.00100	0.0000600	-	0.00730	0.745	0.000200	0.00200	0.00200	0.000300	<0.0000200	0.00620
	Max	8.07	0.269	0.0210	0.807	0.0780	0.00100	0.000130	-	0.0124	0.811	0.000400	0.00200	0.00200	0.000400	<0.0000200	0.00700
	% < LRL	0	3.12	57.1	5.71	0	0	22.9	-	0	0	91.4	28.6	5.71	8.57	100	91.4
	N	58	45	42	45	42	42	42	0	42	42	42	42	42	42	42	42
	Mean	7.86	0.0620	0.00921	0.165	0.0271	0.000731	0.0000137	-	0.00268	0.459	<0.000200	0.00126	0.00153	0.000148	<0.0000200	0.00504
	SD	0.364	0.0602	0.0119	0.114	0.0118	0.000183	0.00000512	-	0.00136	0.218	-	0.000243	0.000261	0.0000414	-	-
2012	Median	7.92	0.0450	0.00405	0.150	0.0291	0.000765	0.0000120	-	0.00200	0.495	<0.000200	0.00120	0.00160	0.000140	<0.0000200	<0.00500
	95th Percentile	8.32	0.200	0.0376	0.457	0.0412	0.000955	0.0000230	-	0.00562	0.761	<0.000200	0.00160	0.00190	0.000230	<0.0000200	<0.00500
	Max	8.70	0.230	0.0440	0.546	0.0505	0.000990	0.0000370	-	0.00634	0.905	<0.000200	0.00170	0.00190	0.000290	<0.0000200	0.00650
	% < LRL	0	4.44	45.2	8.89	0	0	45.2	-	0	0	100	31.0	9.52	7.14	100	97.6
	N	41	40	38	40	40	40	40	1	40	40	40	40	40	40	40	40
	Mean	8.08	0.0492	0.00829	0.290	0.0234	0.000711	0.0000106	<0.00100	0.00376	0.350	<0.000200	0.00140	0.00142	0.000172	<0.0000200	<0.00500
	SD	0.416	0.0366	0.00691	0.374	0.0301	0.000192	0.00000127	-	0.00343	0.193	-	0.000395	0.000235	0.000111	-	-
2013	Median	8.04	0.0340	0.00515	0.167	0.0190	0.000750	<0.0000100	<0.00100	0.00193	0.378	<0.000200	0.00135	0.00140	0.000138	<0.0000200	<0.00500
	95th Percentile	8.80	0.106	0.0240	1.40	0.0396	0.000980	0.0000150	<0.00100	0.0115	0.616	<0.000200	0.00210	0.00180	0.000428	<0.0000200	<0.00500
	Max	9.42	0.217	0.0383	1.55	0.201	0.00101	0.0000160	<0.00100	0.0161	0.680	<0.000200	0.00290	0.00200	0.000640	<0.0000200	<0.00500
	% < LRL	0	0	50.0	15.0	0	0	82.5	100	0	0	100	17.5	10.0	10.0	100	100
	N	48	39	39	39	39	39	39	1	39	39	38	39	38	39	39	38
	Mean	8.02	0.0265	0.00742	0.405	0.0112	0.000514	0.0000108	0.00230	0.00337	0.140	<0.000200	0.00188	0.00117	0.000222	<0.0000200	<0.00500
	SD	0.275	0.0212	0.00524	0.666	0.00810	0.000155	0.00000187	-	0.00249	0.0975	-	0.00119	0.000217	0.000174	-	-
2014	Median	8.06	0.0190	<0.00500	0.118	0.00870	0.000500	<0.0000100	0.00230	0.00221	0.142	<0.000200	0.00150	0.00110	0.000120	<0.0000200	<0.00500
	95th Percentile	8.38	0.0800	0.0235	2.38	0.0300	0.000660	0.0000150	0.00230	0.00879	0.345	<0.000200	0.00560	0.00160	0.000690	<0.0000200	<0.00500
	Max	8.43	0.100	0.0243	2.60	0.0461	0.00122	<0.0000200	0.00230	0.0123	0.357	<0.000200	0.00590	0.00190	0.000690	<0.0000400	<0.00500
	% < LRL	0	2.56	71.8	7.69	5.13	0	79.5	0	0	0	100	7.69	31.6	17.9	100	100
	N	34	34	33	34	34	34	34	0	34	34	34	34	34	34	34	34
	Mean	7.92	0.0267	0.00543	0.200	0.0123	0.000455	0.0000108	-	0.00260	0.0915	<0.000200	0.00159	0.00106	0.000151	<0.0000200	<0.00500
	SD	0.179	0.0154	0.000382	0.272	0.00607	0.0000765	0.00000445	-	0.00156	0.0628	-	0.000604	0.000111	0.0000827	-	-
2015	Median	7.89	0.0265	<0.00500	0.115	0.0111	0.000450	<0.0000100	-	0.00186	0.0633	<0.000200	0.00140	<0.00100	0.000117	<0.0000200	<0.00500
	95th Percentile	8.34	0.0460	0.00960	0.746	0.0225	0.000560	0.0000120	-	0.00638	0.236	<0.000200	0.00230	0.00130	0.000300	<0.0000200	<0.00500
	Max	8.34	0.0900	0.0106	1.38	0.0389	0.000710	0.0000325	-	0.00651	0.261	<0.000200	0.00460	0.00140	0.000490	<0.0000200	<0.00500
	% < LRL	0	0	90.9	5.88	0	0	91.2	-	0	0	100	0	61.8	26.5	100	100
	N	40	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	Mean	7.95	0.00672	0.00119	0.453	0.00924	0.000469	0.00000569	0.000221	0.00285	0.0916	<0.0000500	0.00143	0.00105	0.000196	<0.0000100	0.00154
	SD	0.182	0.00434	0.000327	0.593	0.00978	0.0000965	0.00000203	0.000102	0.00128	0.0564	-	0.000353	0.000224	0.000118	-	0.000942
2016	Median	7.95	<0.00500	<0.00100	0.228	0.00680	0.000470	<0.00000500	0.000200	0.00248	0.0950	<0.0000500	0.00145	0.00104	0.000164	<0.0000100	0.00120
	95th Percentile	8.24	0.0182	0.00215	2.11	0.0232	0.000640	0.0000128	0.000350	0.00556	0.184	<0.0000500	0.00201	0.00156	0.000526	<0.0000100	0.00425
	Max	8.41	0.0269	0.00230	2.16	0.0597	0.000680	0.0000134	0.000720	0.00796	0.189	<0.0000500	0.00203	0.00169	0.000588	<0.0000100	0.00525
	% < LRL	0	51.4	77.1	5.71	0	0	80.0	0	0	0	100	0	0	0	100	40.0

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 3: Summary Statistics for Station W2, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	39	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	Mean	7.62	0.0108	0.00128	0.106	0.0132	0.000482	0.00000797	0.000222	0.00427	0.0946	0.0000574	0.00123	0.00111	0.000147	<0.0000100	0.00166
	SD	0.286	0.0128	0.000769	0.106	0.0122	0.000104	0.00000483	0.0000980	0.00358	0.0787	0.0000336	0.000353	0.000262	0.0000491	-	0.00122
	Median	7.61	0.00700	<0.00100	0.0934	0.00970	0.000470	<0.00000500	0.000190	0.00263	0.0600	<0.0000500	0.00133	0.00103	0.000141	<0.0000100	<0.00100
	95th Percentile	8.04	0.0348	0.00375	0.363	0.0409	0.000720	0.0000185	0.000430	0.00995	0.300	0.0000865	0.00174	0.00156	0.000254	<0.0000100	0.00520
	Max	8.07	0.0722	0.00420	0.364	0.0604	0.000770	0.0000217	0.000510	0.0173	0.338	0.000230	0.00175	0.00168	0.000290	<0.0000100	0.00580
	% < LRL	0	34.3	74.3	22.9	0	0	57.1	2.86	0	0	85.7	0	0	0	100	54.3
2018	N	25	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	Mean	7.96	0.00700	0.00118	0.0807	0.0152	0.000496	0.00000719	0.000218	0.00509	0.0733	<0.0000500	0.00137	0.00109	0.000162	<0.0000100	0.00128
	SD	0.296	0.00283	0.000352	0.101	0.0175	0.000109	0.00000345	0.0000826	0.00437	0.0540	-	0.000523	0.000306	0.0000616	-	0.000605
	Median	7.98	0.00560	<0.00100	0.0375	0.00980	0.000508	0.00000555	0.000205	0.00333	0.0552	<0.0000500	0.00135	0.000998	0.000146	<0.0000100	<0.00100
	95th Percentile	8.25	0.0120	0.00170	0.247	0.0578	0.000600	0.0000145	0.000385	0.0136	0.183	<0.0000500	0.00215	0.00160	0.000285	<0.0000100	0.00230
	Max	8.42	0.0156	0.00290	0.381	0.0737	0.000830	0.0000178	0.000390	0.0184	0.229	<0.0000500	0.00219	0.00164	0.000346	<0.0000100	0.00325
	% < LRL	0	45.5	77.3	45.5	0	0	40.9	9.09	0	0	100	0	0	0	100	63.6
2019	N	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Mean	7.78	0.00728	0.00120	0.0205	0.00778	0.000463	0.00000652	0.000206	0.00285	0.0556	<0.0000500	0.00133	0.000765	0.000191	<0.0000100	0.00104
	SD	0.356	0.00389	-	0.0330	0.00543	0.0000826	0.00000250	0.0000783	0.00152	0.0471	-	0.000372	0.000312	0.000122	-	0.0000203
	Median	7.80	0.00560	<0.00100	<0.00500	0.00590	0.000425	0.00000570	0.000180	0.00233	0.0430	<0.0000500	0.00122	0.000705	0.000166	<0.0000100	<0.00100
	95th Percentile	8.33	0.0174	0.00320	0.0987	0.0227	0.000630	0.0000135	0.000370	0.00707	0.187	<0.0000500	0.00208	0.00161	0.000537	<0.0000100	0.00125
	Max	8.33	0.0174	0.00320	0.0987	0.0227	0.000630	0.0000135	0.000370	0.00707	0.187	<0.0000500	0.00208	0.00161	0.000537	<0.0000100	0.00125
	% < LRL	0	36.4	90.9	72.7	9.09	0	27.3	0	0	0	100	0	0	0	100	81.8
2020	N	6	10	10	10	10	10	10	6	10	10	10	10	10	10	10	10
	Mean	7.73	0.00758	<0.00100	0.0104	0.0291	0.000498	0.0000102	0.000327	0.00552	0.0985	0.0000585	0.00105	0.00113	0.000157	<0.0000100	0.00148
	SD	0.387	0.00326	-	0.00548	0.0358	0.0000401	0.00000799	0.000157	0.00398	0.0589	0.0000276	0.000488	0.000389	0.0000348	-	0.000804
	Median	7.87	0.00577	<0.00100	<0.00500	0.0132	0.000490	0.00000655	0.000335	0.00392	0.0748	<0.0000500	0.00117	0.00103	0.000158	<0.0000100	<0.00100
	95th Percentile	8.01	0.0129	<0.00100	0.0261	0.105	0.000550	0.0000287	0.000530	0.0130	0.213	0.000125	0.00165	0.00175	0.000218	<0.0000100	0.00340
	Max	8.01	0.0129	<0.00100	0.0261	0.105	0.000550	0.0000287	0.000530	0.0130	0.213	0.000125	0.00165	0.00175	0.000218	<0.0000100	0.00340
	% < LRL	0	30.0	100	60.0	0	0	50.0	16.7	0	0	80.0	0	0	0	100	60.0
2010 to 2019	N	495	471	472	490	490	487	369	113	490	490	489	490	486	490	368	371
	Mean	7.92	0.0347	0.00509	1.42	0.0181	0.000514	0.0000118	0.000242	0.00304	0.166	0.0000544	0.00253	0.00116	0.000507	<0.0000100	0.00167
	SD	0.332	0.0511	0.00681	2.41	0.0166	0.000167	0.0000217	0.000220	0.00229	0.181	0.0000310	0.00239	0.000429	0.000721	-	0.00211
	Median	7.97	0.0200	<0.00100	0.166	0.0150	0.000500	0.00000530	0.000200	0.00208	0.0867	<0.0000500	0.00150	0.00100	0.000153	<0.0000200	<0.00100
	95th Percentile	8.35	0.110	0.0190	7.00	0.0470	0.000880	0.0000300	0.000400	0.00769	0.590	0.0000525	0.00800	0.00200	0.00230	<0.0000200	0.00400
	Max	9.42	0.550	0.0440	8.90	0.201	0.00122	0.000260	0.00230	0.0184	0.905	0.000400	0.00900	0.00400	0.00260	<0.0000400	0.0200
	% < LRL	0	14.2	59.7	10.8	9.59	8.83	58.3	8.85	0	3.06	97.3	9.59	21.0	22.0	100	83.6
	ML Mean	7.92	0.0352	0.00686	2.76	0.0180	0.000513	0.0000101	0.000234	0.00294	0.166	0.0000194	0.00247	0.00116	0.000479	-	0.00144
	ML SD	0.339	0.0578	0.0242	34.1	0.0153	0.000156	0.0000138	0.000113	0.00158	0.231	0.0000618	0.00237	0.000382	0.000834	-	0.00181
	ML 95th Percentile	8.49	0.120	0.0265	8.91	0.0462	0.000801	0.0000322	0.000447	0.00594	0.534	0.0000748	0.00673	0.00187	0.00166	-	0.00443
2015 to 2019	N	149	137	136	137	137	137	137	103	137	137	137	137	137	137	137	137
	Mean	7.85	0.0128	0.00141	0.207	0.0118	0.000473	0.00000682	0.000219	0.00351	0.0865	0.0000521	0.00140	0.00103	0.000166	<0.0000100	0.00144
	SD	0.283	0.0131	0.00141	0.366	0.0112	0.0000947	0.00000400	0.0000933	0.00287	0.0636	0.0000176	0.000469	0.000275	0.0000895	-	0.000970
	Median	7.89	0.00710	<0.00100	0.0947	0.00865	0.000470	<0.00000500	0.000200	0.00240	0.0600	<0.0000500	0.00138	0.000990	0.000145	<0.0000100	<0.00100
	95th Percentile	8.25	0.0355	0.00320	0.780	0.0355	0.000640	0.0000145	0.000370	0.00955	0.218	<0.0000500	0.00209	0.00156	0.000300	<0.0000200	0.00325
	Max	8.42	0.0900	0.0106	2.16	0.0737	0.000830	0.0000325	0.000720	0.0184	0.338	0.000230	0.00460	0.00169	0.000588	<0.0000200	0.00580
	% < LRL	0	32.1	80.9	21.9	0.730	0	66.4	2.91	0	0	96.4	0	15.3	6.57	100	65.7
	ML Mean	7.85	0.0122	0.000919	0.452	0.0114	0.000473	0.00000558	0.000218	0.00338	0.0858	0.0000133	0.00141	0.00103	0.000163	-	0.00122
	ML SD	0.288	0.0156	0.00185	3.84	0.00837	0.0000932	0.00000492	0.0000866	0.00209	0.0643	0.0000276	0.000505	0.000274	0.0000717	-	0.00110
	ML 95th Percentile	8.33	0.0380	0.00332	1.60	0.0271	0.000639	0.0000146	0.000381	0.00733	0.206	0.0000485	0.00235	0.00153	0.000298	-	0.00322

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 4: Summary Statistics for Station W3, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
	N	194	193	191	211	212	209	96	97	212	212	212	212	209	212	97	105
	Mean	7.69	0.0726	0.0521	6.69	0.0415	0.000362	0.00592	0.000512	0.00386	0.0376	0.000404	0.00842	0.00120	0.00194	<0.0000100	0.00737
	SD	0.340	0.0703	0.0563	4.90	0.0407	0.000141	0.0578	0.000293	0.00270	0.0676	0.00427	0.00582	0.000651	0.00175	-	0.0191
2010	Median	7.80	0.0450	0.00800	8.00	0.0190	0.000300	0.0000100	0.000400	0.00305	0.0150	<0.000100	0.00500	<0.00100	0.00185	<0.0000200	0.00300
	95th Percentile	8.05	0.220	0.142	14.1	0.100	0.000500	0.000210	0.000800	0.00940	0.150	0.000200	0.0180	0.00300	0.00490	<0.0000200	0.0220
	Max	8.18	0.330	0.171	15.2	0.297	0.00120	0.565	0.00160	0.0250	0.750	0.0603	0.0190	0.00600	0.00560	<0.0000200	0.143
	% < LRL	0	14.0	28.8	0	28.3	33.0	31.2	84.5	0	42.0	92.9	0	57.9	27.4	100	72.4
	N	27	63	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	Mean	7.45	0.0239	0.00838	2.75	0.0143	0.000250	0.0000253	<0.00100	0.00334	0.0310	0.000205	0.00384	0.00117	0.000672	0.0000202	0.00628
	SD	0.289	0.0453	0.0155	1.89	0.0161	0.0000627	0.0000236	-	0.00219	0.0294	-	0.000905	0.000424	0.000360	0.00000175	0.00442
2011	Median	7.50	0.0150	<0.00500	2.85	0.00850	0.000205	0.0000200	<0.00100	0.00265	0.0230	<0.000200	0.00400	<0.00100	0.000570	<0.0000200	<0.00500
	95th Percentile	7.75	0.0440	0.0110	8.40	0.0540	0.000400	0.0000800	<0.00100	0.00690	0.0760	<0.000200	0.00530	0.00200	0.00170	<0.0000200	0.0120
	Max	7.76	0.316	0.109	8.70	0.0850	0.000400	0.000100	<0.00100	0.0127	0.203	0.000500	0.00700	0.00300	0.00200	0.0000300	0.0340
	% < LRL	0	11.1	70.3	0	6.25	0	26.6	100	0	4.69	98.4	0	59.4	0	96.9	84.4
	N	72	61	61	61	60	60	60	60	60	60	60	60	60	60	60	60
	Mean	7.58	0.0250	0.00282	1.06	0.00977	0.000263	0.0000117	0.000112	0.00398	0.0260	0.0000226	0.00450	0.000896	0.000570	<0.00000500	0.00120
	SD	0.447	0.0279	0.00394	0.857	0.0242	0.0000509	0.0000284	-	0.00479	0.0402	0.0000991	0.000357	0.000404	0.000273	-	0.00282
2012	Median	7.69	0.0130	0.00200	0.681	0.00475	0.000250	0.00000500	0.000112	0.00220	0.0188	0.00000900	0.00450	0.000866	0.000485	<0.0000200	0.000725
	95th Percentile	7.99	0.0912	0.00672	3.18	0.0206	0.000390	0.0000303	0.000125	0.0180	0.0509	0.00000900	0.00530	0.00125	0.00137	<0.0000200	0.00306
	Max	8.89	0.110	<0.0500	4.18	0.190	0.000410	0.000208	<0.00100	0.0224	0.317	0.000605	0.00555	0.00140	0.00168	<0.0000200	0.0184
	% < LRL	0	3.28	77.0	1.64	6.67	0	76.7	98.3	0	0	95.0	0	61.7	0	100	93.3
	N	76	58	58	58	57	57	56	55	57	57	55	57	55	57	55	55
	Mean	7.79	0.0443	0.00772	0.761	0.00914	0.000260	0.0000103	<0.00100	0.00507	0.0320	<0.000200	0.00448	0.00105	0.000410	<0.0000200	<0.00500
	SD	0.578	0.0726	0.00834	1.42	0.0140	0.0000403	0.00000128	-	0.00793	0.0422	-	0.000876	0.000122	0.0000846	-	-
2013	Median	7.78	0.0220	<0.00500	0.469	0.00430	0.000250	<0.0000100	<0.00100	0.00223	0.0195	<0.000200	0.00470	<0.00100	0.000400	<0.0000200	<0.00500
	95th Percentile	8.52	0.111	0.0290	2.58	0.0570	0.000310	0.0000130	<0.00100	0.0289	0.157	<0.000200	0.00520	0.00140	0.000560	<0.0000200	<0.00500
	Max	10.1	0.540	<0.0500	10.8	0.0603	0.000470	<0.0000200	<0.00100	0.0315	0.189	<0.000200	0.00530	0.00160	0.000750	<0.0000200	<0.00500
	% < LRL	0	0	86.2	1.72	26.3	1.75	91.1	100	0	0	100	1.75	65.5	1.75	100	100
	N	156	58	58	58	56	56	56	59	56	56	56	56	56	56	56	56
	Mean	7.86	0.0398	0.00863	0.716	0.00663	0.000292	0.0000111	<0.00100	0.00543	0.0298	0.000200	0.00521	0.00102	0.000444	0.0000204	0.00506
	SD	0.255	0.0420	0.00806	0.831	0.00665	0.0000732	0.00000405	-	0.00653	0.0501	-	0.000903	0.0000548	0.000170	0.00000243	0.000496
2014	Median	7.86	0.0205	<0.00500	0.292	0.00410	0.000270	<0.0000100	<0.00100	0.00293	0.0155	<0.000200	0.00505	<0.00100	0.000390	<0.0000200	<0.00500
	95th Percentile	8.23	0.150	0.0314	2.99	0.0235	0.000410	0.0000180	<0.00100	0.0232	0.152	<0.000200	0.00830	0.00120	0.000900	<0.0000200	<0.00500
	Max	8.44	0.180	0.0357	3.16	0.0329	0.000560	0.0000360	<0.00100	0.0262	0.265	0.000210	0.00900	0.00120	0.000955	0.0000370	0.00800
	% < LRL	0	0	77.6	0	25.0	0	78.6	100	0	0	98.2	0	78.6	0	96.4	96.4
	N	100	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
	Mean	7.76	0.0488	0.00942	0.634	0.00848	0.000268	0.0000107	<0.00100	0.00429	0.0313	0.000203	0.00483	0.00106	0.000396	<0.0000200	0.00506
	SD	0.190	0.0831	0.0114	0.821	0.00849	0.0000456	0.00000267	-	0.00403	0.0329	-	0.000888	0.000222	0.000226	-	0.000177
2015	Median	7.80	0.0278	<0.00500	0.243	0.00630	0.000260	<0.0000100	<0.00100	0.00255	0.0207	<0.000200	0.00480	<0.00100	0.000340	<0.0000200	<0.00500
	95th Percentile	7.97	0.100	0.0420	2.76	0.0203	0.000340	0.0000130	<0.00100	0.0151	0.131	<0.000200	0.00660	0.00150	0.000880	<0.0000200	0.00560
	Max	8.22	0.620	0.0474	2.93	0.0570	0.000395	0.0000290	<0.00100	0.0177	0.178	0.000340	0.00790	0.00220	0.00106	<0.0000200	0.00660
	% < LRL	0	0	79.6	0	14.8	0	83.3	100	0	0	98.1	0	81.5	7.41	100	94.4
	N	215	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
	Mean	7.65	0.0222	0.00448	1.22	0.00920	0.000282	0.00000606	0.000116	0.00612	0.0322	0.0000511	0.00403	0.000905	0.000535	0.0000102	0.00150
	SD	0.454	0.0283	0.00664	1.25	0.0115	0.0000572	0.00000258	0.0000432	0.00402	0.0197	0.00000269	0.000815	0.000251	0.000269	-	0.00124
2016	Median	7.71	0.0120	0.00110	0.583	0.00500	0.000280	<0.00000500	<0.000100	0.00571	0.0300	<0.0000500	0.00416	0.000900	0.000389	<0.0000100	<0.00100
	95th Percentile	7.92	0.0961	0.0155	4.43	0.0397	0.000380	0.0000130	0.000210	0.0132	0.0739	<0.0000500	0.00488	0.00146	0.00119	<0.0000200	0.00390
	Max	9.00	0.168	0.0429	4.61	0.0540	0.000460	0.0000186	<0.00100	0.0154	0.0950	<0.000200	0.00670	0.00169	0.00133	0.0000200	0.00780
	% < LRL	0	5.08	54.2	0	0	0	74.6	71.2	0	1.69	96.6	0	23.7	0	98.3	61.0

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 4: Summary Statistics for Station W3, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	123	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
	Mean	7.54	0.0173	0.00336	0.421	0.00376	0.000253	0.00000786	0.000109	0.00484	0.0314	0.0000516	0.00419	0.000927	0.000333	<0.0000100	0.00130
	SD	0.296	0.0217	0.00769	0.486	0.00360	0.0000400	0.00000509	0.0000227	0.00488	0.0160	0.0000155	0.000549	0.000152	0.000107	-	0.000800
	Median	7.58	0.0107	<0.00100	0.204	0.00255	0.000240	0.00000513	<0.000100	0.00281	0.0260	<0.0000500	0.00434	0.000905	0.000326	<0.0000100	<0.00100
	95th Percentile	7.92	0.0546	0.0147	1.58	0.00980	0.000335	0.0000209	0.000160	0.0157	0.0640	<0.0000500	0.00490	0.00122	0.000561	<0.0000100	0.00320
	Max	8.43	0.143	0.0511	1.91	0.0238	0.000350	0.0000267	0.000190	0.0220	0.0650	0.000135	0.00529	0.00132	0.000679	<0.0000100	0.00540
	% < LRL	0	7.14	67.9	0	0	0	42.9	78.6	0	0	96.4	0	0	1.79	100	69.6
2018	N	51	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
	Mean	7.63	0.00983	0.00116	0.251	0.00631	0.000257	0.00000853	0.000121	0.00556	0.0304	0.0000508	0.00445	0.000943	0.000344	<0.0000100	0.00289
	SD	0.298	0.00468	0.000503	0.307	0.0118	0.0000565	0.00000431	0.0000581	0.00585	0.0252	0.00000350	0.000673	0.000360	0.000114	-	0.00385
	Median	7.74	0.00893	<0.00100	0.150	0.00250	0.000232	0.00000740	<0.000100	0.00338	0.0250	<0.0000500	0.00467	0.000890	0.000314	<0.0000100	0.00140
	95th Percentile	7.92	0.0196	0.00220	1.02	0.0213	0.000390	0.0000161	0.000270	0.0199	0.106	<0.0000500	0.00522	0.00194	0.000626	<0.0000100	0.00950
	Max	7.99	0.0276	0.00370	1.53	0.0657	0.000420	0.0000237	0.000420	0.0291	0.135	0.0000800	0.00554	0.00245	0.000834	<0.0000100	0.0226
	% < LRL	0	15.4	82.7	0	3.85	0	28.8	65.4	1.92	1.92	96.2	0	0	0	100	36.5
2019	N	54	55	55	55	55	55	55	53	55	55	55	55	55	55	55	54
	Mean	7.52	0.0187	0.00130	0.0967	0.00268	0.000293	0.0000126	0.000139	0.00368	0.0307	0.0000503	0.00503	0.000932	0.000308	<0.0000100	0.00313
	SD	0.358	0.0230	0.00130	0.0340	0.00299	0.000201	0.0000113	0.000217	0.00353	0.0364	-	0.000697	0.000271	0.0000613	-	0.00502
	Median	7.58	0.0117	<0.00100	0.0979	0.00190	0.000245	0.00000710	<0.000100	0.00252	0.0130	<0.0000500	0.00523	0.000930	0.000312	<0.0000100	0.00130
	95th Percentile	7.88	0.0746	0.00185	0.160	0.00660	0.000470	0.0000322	0.000175	0.0138	0.116	<0.0000500	0.00579	0.00125	0.000402	<0.0000100	0.0134
	Max	8.19	0.125	<0.0100	0.168	0.0221	0.00166	0.0000623	0.00164	0.0212	0.188	0.0000640	0.00592	0.00246	0.000423	<0.0000100	0.0302
	% < LRL	0	3.64	78.2	1.82	1.82	0	29.1	60.4	0	27.3	98.2	0	1.82	0	100	40.7
2020	N	21	24	24	24	24	24	24	14	24	24	24	24	24	24	24	24
	Mean	7.48	0.0297	0.00104	0.107	0.0164	0.000280	0.0000119	0.000209	0.00713	0.0410	<0.0000500	0.00475	0.00127	0.000317	<0.0000100	0.00151
	SD	0.186	0.0694	0.000103	0.0301	0.0317	0.0000997	0.00000879	0.000178	0.0111	0.0550	-	0.000974	0.000684	0.0000411	-	0.000722
	Median	7.44	0.0131	<0.00100	0.122	0.00240	0.000242	0.00000820	0.000112	0.00261	0.0177	<0.0000500	0.00503	0.00101	0.000314	<0.0000100	0.00108
	95th Percentile	7.82	0.0291	0.00120	0.130	0.0996	0.000470	0.0000266	0.000565	0.0300	0.177	<0.0000500	0.00559	0.00279	0.000397	<0.0000100	0.00300
	Max	7.84	0.354	0.00140	0.135	0.112	0.000600	0.0000416	0.000565	0.0463	0.185	<0.0000500	0.00562	0.00306	0.000427	<0.0000100	0.00325
	% < LRL	0	0	79.2	0	0	0	25.0	35.7	0	29.2	100	0	0	0	100	41.7
2010 to 2019	N	1068	709	708	728	725	722	608	609	725	725	723	725	720	725	608	615
	Mean	7.68	0.0394	0.0166	2.59	0.0175	0.000294	0.000943	0.000145	0.00444	0.0330	0.000105	0.00564	0.000990	0.000901	0.00000517	0.00281
	SD	0.383	0.0580	0.0371	3.87	0.0291	0.000112	0.0229	0.000207	0.00457	0.0462	0.00228	0.00369	0.000473	0.00117	0.000000911	0.00866
	Median	7.74	0.0189	<0.00100	0.761	0.00540	0.000265	0.00000610	<0.000100	0.00290	0.0195	0.00000900	0.00470	0.000920	0.000400	<0.0000200	0.00110
	95th Percentile	8.15	0.150	0.119	12.4	0.0810	0.000500	0.0000304	0.000400	0.0138	0.108	0.0000640	0.0160	0.00200	0.00410	<0.0000200	0.00800
	Max	10.1	0.620	0.171	15.2	0.297	0.00166	0.565	0.00164	0.0315	0.750	0.0603	0.0190	0.00600	0.00560	0.0000370	0.143
	% < LRL	0	7.48	62.3	0.412	14.9	9.70	54.6	86.2	0.138	15.0	96.1	0.138	46.5	8.83	99.2	75.1
	ML Mean	7.68	0.0384	0.0416	2.87	0.0161	0.000293	0.0000133	0.000110	0.00416	0.0307	0.0000329	0.00553	0.000932	0.000814	0.000000933	0.00224
	ML SD	0.270	0.0557	1.53	9.22	0.0348	0.0000853	0.0000279	0.000141	0.00300	0.0306	0.000992	0.00291	0.000351	0.000903	0.00000505	0.00484
	ML 95th Percentile	8.13	0.125	0.0936	11.1	0.0590	0.000450	0.0000485	0.000342	0.00978	0.0852	0.0000798	0.0110	0.00159	0.00238	0.00000353	0.00822
2015 to 2019	N	543	276	276	276	276	276	276	274	276	276	276	276	276	276	276	275
	Mean	7.63	0.0234	0.00335	0.537	0.00608	0.000271	0.00000843	0.000119	0.00491	0.0311	0.0000520	0.00450	0.000927	0.000385	0.0000100	0.00210
	SD	0.367	0.0433	0.00738	0.826	0.00887	0.000101	0.00000662	0.000104	0.00457	0.0269	0.0000201	0.000823	0.000275	0.000194	-	0.00304
	Median	7.70	0.0121	<0.00100	0.200	0.00300	0.000250	0.00000530	<0.000100	0.00277	0.0228	<0.0000500	0.00460	0.000900	0.000329	<0.0000100	0.00100
	95th Percentile	7.94	0.0738	0.0147	2.55	0.0204	0.000380	0.0000228	0.000180	0.0148	0.0772	<0.0000500	0.00556	0.00134	0.000800	<0.0000200	0.00600
	Max	9.00	0.620	0.0511	4.61	0.0657	0.00166	0.0000623	0.00164	0.0291	0.188	0.000340	0.00790	0.00246	0.00133	0.0000200	0.0302
	% < LRL	0	6.16	72.1	0.362	3.99	0	52.2	75.2	0.362	6.16	97.1	0	21.4	1.81	99.6	60.7
	ML Mean	7.65	0.0210	0.00386	0.476	0.00550	0.000269	0.00000755	0.0000882	0.00468	0.0305	0.0000109	0.00450	0.000915	0.000386	0.000000428	0.00179
	ML SD	0.266	0.0229	0.0383	0.726	0.00597	0.0000612	0.00000694	0.0000627	0.00367	0.0240	0.0000278	0.000906	0.000245	0.000183	0.00000241	0.00277
	ML 95th Percentile	8.09	0.0609	0.0132	1.58	0.0159	0.000380	0.0000201	0.000206	0.0115	0.0751	0.0000410	0.00613	0.00136	0.000732	0.00000161	0.00598

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 5: **Summary Statistics for Station W45, Minto Mine, 2010 to 2019**

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenu m (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	N	3	4	4	4	4	4	4	0	4	4	4	4	4	4	4	4
	Mean	7.68	6.58	1.15	41.1	0.0146	0.00162	0.0000125	-	0.0800	0.0727	0.000245	0.0300	0.00125	0.0106	0.0000250	0.00505
	SD	0.168	2.42	0.766	15.9	0.0140	0.000505	0.00000490	-	0.0401	0.0525	-	0.0154	-	0.0128	0.00000367	-
	Median	7.72	6.50	0.851	41.0	0.00950	0.00149	0.0000105	-	0.0669	0.0640	<0.000200	0.0301	<0.00100	0.00472	0.0000235	<0.00500
	95th Percentile	7.83	9.60	2.27	55.9	0.0353	0.00228	0.0000190	-	0.137	0.139	0.000380	0.0467	0.00200	0.0298	0.0000330	0.00520
	Max	7.83	9.60	2.27	55.9	0.0353	0.00228	0.0000190	-	0.137	0.139	0.000380	0.0467	0.00200	0.0298	0.0000330	0.00520
	% < LRL	0	0	0	0	0	0	50.0	-	0	0	75.0	0	75.0	0	50.0	75.0
2013	N	7	8	8	8	8	8	8	0	8	8	8	8	8	8	8	8
	Mean	7.60	10.9	1.78	29.3	0.0105	0.00151	0.000124	-	0.0817	0.0667	<0.000200	0.0265	0.00105	0.00321	0.0000292	0.00939
	SD	0.434	14.2	0.516	26.8	0.0180	0.000352	0.0000905	-	0.0755	0.0775	-	0.00677	0.000187	0.00184	0.0000177	0.00449
	Median	7.65	3.35	1.76	17.2	0.00365	0.00136	0.000155	-	0.0531	0.0315	<0.000200	0.0253	<0.00100	0.00344	0.0000205	0.00875
	95th Percentile	8.22	37.0	2.53	77.2	0.0549	0.00234	0.000261	-	0.223	0.195	<0.000200	0.0419	0.00140	0.00536	0.0000670	0.0186
	Max	8.22	37.0	2.53	77.2	0.0549	0.00234	0.000261	-	0.223	0.195	<0.000200	0.0419	0.00140	0.00536	0.0000670	0.0186
	% < LRL	0	0	0	0	0	0	0	-	0	12.5	100	0	75.0	0	50.0	37.5
2014	N	11	11	11	11	11	11	11	0	11	11	11	11	11	11	11	11
	Mean	7.78	3.48	0.535	6.87	0.0385	0.00131	0.000183	-	0.0865	0.0900	0.000242	0.0280	0.00186	0.00168	0.0000274	0.0185
	SD	0.230	3.37	0.426	3.92	0.0991	0.000374	0.0000970	-	0.0847	0.215	-	0.00702	0.000909	0.000774	0.0000313	0.0107
	Median	7.83	2.50	0.358	5.97	0.00800	0.00123	0.000154	-	0.0627	0.0124	<0.000200	0.0321	0.00130	0.00154	<0.0000200	0.0141
	95th Percentile	8.14	13.0	1.68	17.3	0.337	0.00197	0.000358	-	0.276	0.726	0.000660	0.0363	0.00330	0.00329	0.0000990	0.0421
	Max	8.14	13.0	1.68	17.3	0.337	0.00197	0.000358	-	0.276	0.726	0.000660	0.0363	0.00330	0.00329	0.0000990	0.0421
	% < LRL	0	0	0	0	0	0	0	-	0	9.09	90.9	0	36.4	0	81.8	0
2015	N	8	8	8	8	8	8	8	0	8	8	8	8	8	8	8	8
	Mean	8.01	2.96	0.545	17.3	0.0182	0.000631	0.000171	-	0.0674	0.0655	<0.000200	0.0660	0.00129	0.0118	<0.0000200	0.0170
	SD	0.242	2.26	0.510	13.5	0.0131	0.000285	0.000205	-	0.0960	0.0889	-	0.0486	0.000361	0.0116	-	0.0268
	Median	8.02	2.80	0.466	17.0	0.0193	0.000480	0.0000560	-	0.0124	0.0329	<0.000200	0.0687	0.00110	0.0107	<0.0000200	<0.00500
	95th Percentile	8.39	7.10	1.59	33.9	0.0382	0.00103	0.000517	-	0.268	0.260	<0.000200	0.117	0.00180	0.0239	<0.0000200	0.0673
	Max	8.39	7.10	1.59	33.9	0.0382	0.00103	0.000517	-	0.268	0.260	<0.000200	0.117	0.00180	0.0239	<0.0000200	0.0673
	% < LRL	0	0	0	0	0	0	25.0	-	0	12.5	100	0	25.0	0	100	62.5
2016	N	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10
	Mean	7.85	3.59	3.67	29.3	0.0142	0.000413	0.0000187	<0.000100	0.00429	0.0353	<0.0000500	0.0937	0.00296	0.0185	<0.0000100	0.00130
	SD	0.226	1.24	2.27	2.88	0.00340	0.0000653	0.0000217	-	0.00540	0.0562	-	0.00388	0.000965	0.000783	-	0.0000468
	Median	7.82	3.70	2.31	29.2	0.0135	0.000395	0.0000112	<0.000100	0.00206	0.0165	<0.0000500	0.0942	0.00288	0.0188	<0.0000100	<0.00200
	95th Percentile	8.16	5.75	7.60	32.9	0.0219	0.000530	0.0000750	<0.000200	0.0163	0.188	<0.000200	0.100	0.00472	0.0195	<0.0000200	0.00240
	Max	8.16	5.75	7.60	32.9	0.0219	0.000530	0.0000750	<0.000200	0.0163	0.188	<0.000200	0.100	0.00472	0.0195	<0.0000200	<0.00500
	% < LRL	0	0	0	0	0	0	30.0	100	0	40.0	100	0	0	0	100	80.0

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 5: Summary Statistics for Station W45, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Mean	7.61	5.79	4.25	23.3	0.0120	0.000420	0.0000599	<0.000200	0.00632	0.0476	0.000104	0.101	0.00591	0.0161	<0.0000200	0.00222
	SD	0.371	1.91	3.38	8.86	0.00219	0.0000638	0.0000591	-	0.00623	0.0416	-	0.0137	0.00111	0.00150	-	0.000326
	Median	7.60	5.26	3.88	22.0	0.0120	0.000415	0.0000365	<0.000200	0.00336	0.0370	<0.000100	0.0982	0.00610	0.0160	<0.0000200	0.00202
	95th Percentile	8.29	9.02	11.4	35.5	0.0148	0.000560	0.000180	<0.000200	0.0208	0.158	0.000140	0.121	0.00820	0.0181	<0.0000200	0.00300
	Max	8.29	9.02	11.4	35.5	0.0148	0.000560	0.000180	<0.000200	0.0208	0.158	0.000140	0.121	0.00820	0.0181	<0.0000200	0.00300
	% < LRL	0	0	0	0	0	0	50.0	100	0	20.0	90.0	0	0	0	100	50.0
2018	N	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Mean	7.76	6.60	4.26	17.0	0.0120	0.000391	0.0000325	<0.000200	0.00740	0.0240	0.000103	0.102	0.00701	0.00849	<0.0000200	0.0120
	SD	0.378	1.78	1.23	4.13	0.00336	0.0000543	0.0000223	-	0.00357	-	0.00000667	0.0137	0.00204	0.00176	-	0.0287
	Median	7.86	6.19	4.68	17.8	0.0105	0.000380	0.0000400	<0.000200	0.00594	<0.0200	<0.000100	0.0993	0.00790	0.00778	<0.0000200	0.00330
	95th Percentile	8.11	9.63	5.91	24.6	0.0174	0.000515	0.0000850	<0.000200	0.0137	0.0560	0.000120	0.134	0.00950	0.0130	<0.0000200	0.0851
	Max	8.11	9.63	5.91	24.6	0.0174	0.000515	<0.000200	<0.000200	0.0137	0.0560	0.000120	0.134	0.00950	0.0130	<0.0000200	0.0851
	% < LRL	0	0	0	0	0	0	77.8	100	0	88.9	77.8	0	0	0	100	44.4
2019	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Mean	7.82	3.39	0.0806	2.75	0.00814	0.000176	0.0000438	<0.000100	0.00294	<0.0100	<0.0000500	0.0311	0.00343	0.00218	<0.0000100	0.00146
	SD	0.184	0.963	0.119	4.73	0.00388	0.000130	0.00000168	-	0.00198	-	-	0.0196	0.00220	0.00247	-	0.000962
	Median	7.81	3.61	0.0300	0.760	0.00910	0.000150	0.0000477	<0.000200	0.00206	<0.0200	<0.000100	0.0254	0.00270	0.00106	<0.0000200	0.00120
	95th Percentile	8.07	4.24	0.287	11.2	0.0124	0.000380	0.0000512	<0.000200	0.00603	<0.0200	<0.000100	0.0645	0.00730	0.00659	<0.0000200	0.00290
	Max	8.07	4.24	0.287	11.2	0.0124	0.000380	0.0000512	<0.000200	0.00603	<0.0200	<0.000100	0.0645	0.00730	0.00659	<0.0000200	0.00290
	% < LRL	0	0	20.0	0	0	60.0	40.0	100	0	100	100	0	0	0	100	60.0
2020	N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Mean	7.80	16.7	1.68	33.9	0.0197	0.000450	<0.0000250	0.000240	0.00215	0.0875	<0.000100	0.0759	0.00528	0.00366	<0.0000200	<0.00200
	SD	0.184	4.67	0.247	13.4	0.00806	0.0000283	-	-	0.00163	-	-	0.00120	0.00190	0.000163	-	-
	Median	7.80	16.7	1.68	33.9	0.0197	0.000450	<0.0000300	0.000240	0.00215	0.0875	<0.000100	0.0759	0.00528	0.00366	<0.0000200	<0.00200
	95th Percentile	7.93	20.0	1.85	43.4	0.0254	0.000470	<0.0000300	0.000280	0.00331	0.155	<0.000100	0.0768	0.00662	0.00378	<0.0000200	<0.00200
	Max	7.93	20.0	1.85	43.4	0.0254	0.000470	<0.0000300	0.000280	0.00331	0.155	<0.000100	0.0768	0.00662	0.00378	<0.0000200	<0.00200
	% < LRL	0	0	0	0	0	0	100	50.0	0	50.0	100	0	0	0	100	100
2010 to 2019	N	63	65	65	65	65	65	65	33	65	65	65	65	65	65	65	65
	Mean	7.77	5.31	2.26	20.1	0.0173	0.000781	0.0000862	<0.000100	0.0408	0.0509	0.0000708	0.0644	0.00328	0.00945	0.0000139	0.00832
	SD	0.315	5.68	2.34	15.4	0.0413	0.000557	0.000111	-	0.0652	0.102	0.0000850	0.0383	0.00247	0.00800	0.0000121	0.0152
	Median	7.77	4.07	1.64	17.7	0.0105	0.000450	0.0000400	<0.000200	0.0121	0.0178	<0.000100	0.0851	0.00259	0.00742	<0.0000200	0.00240
	95th Percentile	8.22	9.63	5.91	53.7	0.0353	0.00175	0.000318	<0.000200	0.212	0.188	0.000140	0.117	0.00820	0.0232	0.0000330	0.0387
	Max	8.39	37.0	11.4	77.2	0.337	0.00234	0.000517	<0.000200	0.276	0.726	0.000660	0.134	0.00950	0.0298	0.0000990	0.0851
	% < LRL	0	0	1.54	0	0	4.62	32.3	100	0	33.8	92.3	0	23.1	0	87.7	47.7
	ML Mean	7.77	5.53	3.48	24.7	0.0141	0.000793	0.000105	-	0.0490	0.0495	0.0000421	0.0681	0.00342	0.0110	0.00000936	0.00971
	ML SD	0.318	5.63	10.8	38.5	0.0127	0.000665	0.000276	-	0.197	0.118	0.000173	0.0620	0.00408	0.0192	0.0000253	0.0384
	ML 95th Percentile	8.30	15.5	13.4	82.9	0.0373	0.00202	0.000396	-	0.189	0.185	0.000163	0.181	0.0103	0.0383	0.0000356	0.0375
2015 to 2019	N	42	42	42	42	42	42	42	33	42	42	42	42	42	42	42	42
	Mean	7.80	4.61	2.91	19.8	0.0133	0.000423	0.0000603	<0.000100	0.0173	0.0350	0.0000565	0.0844	0.00427	0.0126	<0.0000100	0.00623
	SD	0.318	2.21	2.65	10.9	0.00675	0.000180	0.000107	-	0.0469	0.0543	0.00000892	0.0330	0.00252	0.00731	-	0.0173
	Median	7.80	4.19	2.14	20.5	0.0122	0.000385	0.0000280	<0.000200	0.00428	0.0130	<0.000100	0.0942	0.00410	0.0149	<0.0000200	0.00120
	95th Percentile	8.27	9.02	7.35	33.9	0.0250	0.000940	0.000318	<0.000200	0.112	0.158	0.000120	0.118	0.00880	0.0232	<0.0000200	0.0387
	Max	8.39	9.63	11.4	35.5	0.0382	0.00103	0.000517	<0.000200	0.268	0.260	<0.000200	0.134	0.00950	0.0239	<0.0000200	0.0851
	% < LRL	0	0	2.38	0	0	7.14	45.2	100	0	47.6	92.9	0	4.76	0	100	59.5
	ML Mean	7.80	5.31	6.39	27.5	0.0133	0.000429	0.0000616	-	0.0120	0.0367	0.0000330	0.0936	0.00441	0.0159	-	0.00476
	ML SD	0.320	5.17	32.7	48.6	0.00707	0.000194	0.000153	-	0.0269	0.0806	0.0000413	0.0790	0.00354	0.0249	-	0.0202
	ML 95th Percentile	8.34	14.6	24.3	95.8	0.0267	0.000794	0.000232	-	0.0442	0.135	0.000102	0.239	0.0110	0.0535	-	0.0184

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 6: Summary Statistics for Station W62, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2010	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Median	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% < LRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	12	12	12	12	12	12	12	10	12	12	10	12	12	12	10	12
	Mean	7.70	0.0355	0.0285	7.47	0.00508	0.000350	0.0000213	0.000153	0.0398	0.0420	<0.0000500	0.00604	0.00106	0.00344	<0.0000100	0.210
	SD	0.254	0.0657	0.0301	3.03	0.00352	0.0000948	0.00000833	0.0000359	0.0177	0.0189	-	0.00211	0.000217	0.00122	-	0.229
2016	Median	7.80	0.00770	0.0214	7.04	0.00405	0.000380	0.0000193	0.000145	0.0458	0.0455	<0.0000500	0.00623	0.00104	0.00360	<0.0000100	0.122
	95th Percentile	8.12	0.230	0.119	11.3	0.0144	0.000440	0.0000383	0.000220	0.0629	0.0720	<0.0000500	0.00822	0.00161	0.00485	<0.0000100	0.799
	Max	8.12	0.230	0.119	11.3	0.0144	0.000440	0.0000383	0.000220	0.0629	0.0720	<0.0000500	0.00822	0.00161	0.00485	<0.0000100	0.799
	% < LRL	0	33.3	8.33	0	0	0	8.33	10.0	0	0	100	0	16.7	0	100	0

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 6: Summary Statistics for Station W62, Minto Mine, 2010 to 2019

Year	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2017	N	13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Mean	7.70	0.0155	0.0361	5.98	0.00475	0.000378	0.0000170	0.000177	0.0520	0.0294	0.0000540	0.00638	0.00102	0.00296	<0.0000100	0.0944
	SD	0.309	0.0129	0.0170	0.841	0.00378	0.0000279	0.00000464	0.0000305	0.00662	0.00982	0.0000102	0.000671	0.0000988	0.000637	-	0.0501
	Median	7.73	0.0116	0.0407	5.92	0.00350	0.000385	0.0000162	0.000180	0.0494	0.0285	<0.0000500	0.00626	0.00101	0.00300	<0.0000100	0.0774
	95th Percentile	8.23	0.0563	0.0546	7.35	0.0166	0.000420	0.0000312	0.000230	0.0633	0.0530	0.0000920	0.00782	0.00124	0.00393	<0.0000100	0.193
	Max	8.23	0.0563	0.0546	7.35	0.0166	0.000420	0.0000312	0.000230	0.0633	0.0530	0.0000920	0.00782	0.00124	0.00393	<0.0000100	0.193
	% < LRL	0	7.14	7.14	0	0	0	0	0	0	0	85.7	0	0	0	100	0
2018	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.48	0.0131	0.0427	9.07	0.00493	0.000505	0.0000326	0.000180	0.0565	0.0302	<0.0000500	0.00868	0.00108	0.00385	0.0000107	0.0649
	SD	0.572	0.00574	0.0268	6.14	0.00288	0.0000992	0.0000170	0.0000621	0.0103	0.0140	-	0.00269	0.000216	0.00262	0.00000235	0.0522
	Median	7.74	0.0118	0.0447	8.67	0.00415	0.000495	0.0000285	0.000165	0.0581	0.0290	<0.0000500	0.00944	0.00112	0.00364	<0.0000100	0.0451
	95th Percentile	7.92	0.0242	0.0786	26.5	0.0108	0.000720	0.0000798	0.000355	0.0711	0.0570	<0.0000500	0.0138	0.00146	0.0115	0.0000170	0.176
	Max	7.92	0.0242	0.0786	26.5	0.0108	0.000720	0.0000798	0.000355	0.0711	0.0570	<0.0000500	0.0138	0.00146	0.0115	0.0000170	0.176
	% < LRL	0	0	8.33	0	0	0	0	25.0	0	8.33	100	0	0	0	83.3	0
2019	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	7.65	0.0110	0.00930	8.86	0.00407	0.000512	0.0000248	0.000216	0.0514	0.0332	<0.0000500	0.00829	0.00113	0.00368	<0.0000100	0.0334
	SD	0.426	0.00144	0.00611	1.66	0.00438	0.0000561	0.00000869	0.0000274	0.00539	0.0138	-	0.00120	0.0000878	0.000827	-	0.0265
	Median	7.86	0.0109	0.00660	8.49	0.00250	0.000530	0.0000225	0.000218	0.0522	0.0295	<0.0000500	0.00803	0.00114	0.00360	<0.0000100	0.0308
	95th Percentile	8.09	0.0142	0.0257	11.1	0.0178	0.000600	0.0000479	0.000250	0.0578	0.0740	<0.0000500	0.0109	0.00123	0.00519	<0.0000100	0.0945
	Max	8.09	0.0142	0.0257	11.1	0.0178	0.000600	0.0000479	0.000250	0.0578	0.0740	<0.0000500	0.0109	0.00123	0.00519	<0.0000100	0.0945
	% < LRL	0	0	33.3	0	0	0	0	0	0	0	100	0	0	0	100	0
2020	N	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5
	Mean	7.48	0.0131	0.0128	12.8	0.00292	0.000572	0.0000529	0.000223	0.0511	0.0274	<0.0000500	0.00920	0.00111	0.00538	<0.0000100	0.271
	SD	0.280	0.00731	0.0120	6.69	0.000650	0.0000630	0.0000444	0.0000350	0.00827	0.00261	-	0.00290	0.000159	0.00302	-	0.216
	Median	7.38	0.00960	<0.0100	10.0	0.00290	0.000600	0.0000244	0.000240	0.0529	0.0270	<0.0000500	0.00836	0.00112	0.00382	<0.0000100	0.316
	95th Percentile	7.95	0.0256	0.0351	24.8	0.00390	0.000610	0.000115	0.000240	0.0614	0.0300	<0.0000500	0.0143	0.00134	0.0107	<0.0000100	0.482
	Max	7.95	0.0256	0.0351	24.8	0.00390	0.000610	0.000115	0.000240	0.0614	0.0300	<0.0000500	0.0143	0.00134	0.0107	<0.0000100	0.482
	% < LRL	0	0	60.0	0	0	0	0	0	0	0	100	0	0	0	100	0
2010 to 2019	N	49	50	50	50	50	50	50	48	50	50	48	50	50	50	48	50
	Mean	7.64	0.0187	0.0290	7.77	0.00471	0.000434	0.0000236	0.000182	0.0500	0.0335	0.0000512	0.00731	0.00107	0.00346	0.0000102	0.101
	SD	0.404	0.0328	0.0246	3.60	0.00359	0.000103	0.0000117	0.0000482	0.0122	0.0148	0.00000566	0.00210	0.000164	0.00150	0.00000121	0.132
	Median	7.78	0.0109	0.0249	6.99	0.00350	0.000415	0.0000197	0.000180	0.0504	0.0310	<0.0000500	0.00711	0.00110	0.00342	<0.0000100	0.0609
	95th Percentile	8.09	0.0563	0.0744	11.2	0.0144	0.000600	0.0000452	0.000250	0.0656	0.0630	<0.0000500	0.0109	0.00131	0.00493	<0.0000100	0.402
	Max	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	% < LRL	0	10.0	14.0	0	0	0	2.00	8.33	0	2.00	95.8	0	4.00	0	95.8	0
	ML Mean	7.64	0.0161	0.0344	10.8	0.00457	0.000436	0.0000236	0.000182	0.0532	0.0337	0.0000151	0.00761	0.00107	0.00370	0.00000367	0.107
	ML SD	0.420	0.0148	0.0556	14.3	0.00280	0.000125	0.0000110	0.0000552	0.0294	0.0166	0.0000187	0.00370	0.000162	0.00240	0.00000312	0.172
	ML 95th Percentile	8.35	0.0430	0.117	34.1	0.00987	0.000665	0.0000443	0.000284	0.109	0.0651	0.0000463	0.0146	0.00136	0.00823	0.00000941	0.364
2015 to 2019	N	49	50	50	50	50	50	50	48	50	50	48	50	50	50	48	50
	Mean	7.64	0.0187	0.0290	7.77	0.00471	0.000434	0.0000236	0.000182	0.0500	0.0335	0.0000512	0.00731	0.00107	0.00346	0.0000102	0.101
	SD	0.404	0.0328	0.0246	3.60	0.00359	0.000103	0.0000117	0.0000482	0.0122	0.0148	0.00000566	0.00210	0.000164	0.00150	0.00000121	0.132
	Median	7.78	0.0109	0.0249	6.99	0.00350	0.000415	0.0000197	0.000180	0.0504	0.0310	<0.0000500	0.00711	0.00110	0.00342	<0.0000100	0.0609
	95th Percentile	8.09	0.0563	0.0744	11.2	0.0144	0.000600	0.0000452	0.000250	0.0656	0.0630	<0.0000500	0.0109	0.00131	0.00493	<0.0000100	0.402
	Max	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	% < LRL	0	10.0	14.0	0	0	0	2.00	8.33	0	2.00	95.8	0	4.00	0	95.8	0
	ML Mean	7.64	0.0161	0.0344	10.8	0.00457	0.000436	0.0000236	0.000182	0.0532	0.0337	0.0000151	0.00761	0.00107	0.00370	0.00000367	0.107
	ML SD	0.420	0.0148	0.0556	14.3	0.00280	0.000125	0.0000110	0.0000552	0.0294	0.0166	0.0000187	0.00370	0.000162	0.00240	0.00000312	0.172
	ML 95th Percentile	8.35	0.0430	0.117	34.1	0.00987	0.000665	0.0000443	0.000284	0.109	0.0651	0.0000463	0.0146	0.00136	0.00823	0.00000941	0.364

Note: "ML" = Maximum Likelihood, "CI" = Confidence Interval, "-" indicates no available data.

Table 7: Expanded Summary Statistics for Station W12, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	162	122	122	125	122	122	122	127	122	122	121	122	121	122	122	122
		% < LRL	0	3.28	0.820	0.800	1.64	0.820	26.2	95.3	0	33.6	91.7	0	20.7	0	95.9	55.7
		Max	9.00	24.0	8.49	119	0.124	0.00213	0.000280	0.00132	0.476	0.386	0.000210	0.0975	0.00650	0.0207	0.000100	0.0310
	Kaplan–Meier	Mean	7.80	2.25	1.51	16.5	0.0169	0.000564	0.0000433	0.000121	0.0450	0.0297	0.0000639	0.0523	0.00205	0.00803	0.0000109	0.00419
		SD	0.396	2.65	2.08	13.5	0.0192	0.000270	0.0000465	0.000135	0.0551	0.0519	0.0000517	0.0272	0.00131	0.00429	0.00000911	0.00393
		Mean + 2SD	8.59	7.55	5.67	43.5	0.0553	0.00110	0.000136	0.000391	0.155	0.134	0.000167	0.107	0.00467	0.0166	0.0000291	0.0121
		Mean + 3SD	8.99	10.2	7.75	57.0	0.0745	0.00137	0.000183	0.000526	0.210	0.185	0.000219	0.134	0.00598	0.0209	0.0000382	0.0160
		Median	7.84	1.60	0.290	13.6	0.0116	0.000470	0.0000270	<0.000100	0.0302	0.0120	<0.0000500	0.0541	0.00170	0.00686	<0.0000100	0.00320
		95th Percentile	8.32	4.72	5.80	29.1	0.0570	0.00100	0.000137	0.000200	0.122	0.103	0.000160	0.0882	0.00444	0.0162	0.0000110	0.00900
		97.5th Percentile	8.40	6.04	6.71	33.1	0.0790	0.00120	0.000150	0.000350	0.148	0.204	0.000160	0.0945	0.00480	0.0168	0.0000120	0.0106
		99th Percentile	8.66	6.94	8.12	71.4	0.0890	0.00170	0.000217	0.000350	0.220	0.231	0.000200	0.0972	0.00580	0.0174	0.0000120	0.0219
	Maxium Likelihood	Mean	7.80	4.97	2.09	19.2	0.0164	0.000558	0.0000439	0.0000647	0.0522	0.0277	0.0000431	0.0551	0.00209	0.00835	0.00000431	0.00408
		SD	0.413	25.5	9.48	21.2	0.0175	0.000205	0.0000497	0.000148	0.0930	0.0514	0.0000492	0.0442	0.00161	0.00604	0.00000597	0.00319
		Mean + 2SD	8.63	56.0	21.1	61.6	0.0514	0.000968	0.000143	0.000361	0.238	0.131	0.000142	0.144	0.00531	0.0204	0.0000162	0.0105
		Mean + 3SD	9.04	81.5	30.5	82.8	0.0688	0.00117	0.000193	0.000510	0.331	0.182	0.000191	0.188	0.00692	0.0265	0.0000222	0.0137
		95th Percentile	8.50	18.9	8.05	56.0	0.0471	0.000941	0.000129	0.000240	0.183	0.0981	0.000128	0.137	0.00509	0.0197	0.0000138	0.0100
		97.5th Percentile	8.64	33.6	14.0	74.2	0.0619	0.00105	0.000172	0.000367	0.266	0.144	0.000170	0.171	0.00631	0.0241	0.0000192	0.0124
		99th Percentile	8.81	65.4	26.6	102.8	0.0851	0.00120	0.000240	0.000604	0.412	0.225	0.000238	0.222	0.00810	0.0306	0.0000280	0.0160
2015 to 2019	Summary indices	N	104	65	65	65	65	65	65	65	65	65	64	65	65	65	65	65
		% < LRL	0	1.54	1.54	0	1.54	0	41.5	90.8	0	52.3	85.9	0	7.69	0	93.8	27.7
		Max	9.00	6.94	8.49	29.4	0.0430	0.00103	0.000217	0.00132	0.220	0.231	0.000210	0.0975	0.00650	0.0207	<0.0000500	0.0132
	Kaplan–Meier	Mean	7.75	3.05	2.63	15.0	0.00928	0.000472	0.0000474	0.000130	0.0416	0.0184	0.0000638	0.0678	0.00250	0.0105	0.0000101	0.00436
		SD	0.356	1.71	2.31	8.49	0.00692	0.000126	0.0000502	0.000169	0.0374	0.0311	0.0000402	0.0235	0.00144	0.00430	0.000000783	0.00263
		Mean + 2SD	8.46	6.47	7.25	32.0	0.0231	0.000724	0.000148	0.000468	0.116	0.0806	0.000144	0.115	0.00538	0.0191	0.0000117	0.00962
		Mean + 3SD	8.82	8.18	9.56	40.5	0.0300	0.000850	0.000198	0.000637	0.154	0.112	0.000184	0.138	0.00682	0.0234	0.0000124	0.0123
		Median	7.78	3.20	1.88	12.6	0.00730	0.000440	0.0000320	<0.000100	0.0305	0.00960	<0.0000500	0.0770	0.00210	0.0105	<0.0000100	0.00370
		95th Percentile	8.22	5.40	6.71	28.1	0.0203	0.000680	0.000131	0.000200	0.0937	0.0490	0.000160	0.0945	0.00480	0.0168	0.0000110	0.00910
		97.5th Percentile	8.28	6.66	8.12	29.1	0.0277	0.00100	0.000205	0.000350	0.191	0.0840	0.000160	0.0972	0.00580	0.0174	0.0000120	0.0106
		99th Percentile	8.60	6.94	8.49	29.4	0.0430	0.00103	0.000217	0.00132	0.220	0.231	0.000210	0.0975	0.00650	0.0207	0.0000120	0.0132
	Maxium Likelihood	Mean	7.75	5.52	4.26	15.2	0.00924	0.000471	0.0000506	0.0000684	0.0440	0.0164	0.0000428	0.0701	0.00256	0.0107	0.00000864	0.00448
		SD	0.370	15.0	13.3	10.4	0.00680	0.000102	0.0000727	0.000188	0.0450	0.0234	0.0000544	0.0387	0.00186	0.00575	0.00000135	0.00307
		Mean + 2SD	8.49	35.5	30.9	36.0	0.0228	0.000675	0.000196	0.000445	0.134	0.0633	0.000152	0.147	0.00628	0.0222	0.0000113	0.0106
		Mean + 3SD	8.86	50.5	44.2	46.5	0.0296	0.000777	0.000269	0.000634	0.179	0.0867	0.000206	0.186	0.00814	0.0279	0.0000127	0.0137
		95th Percentile	8.38	21.0	16.4	34.8	0.0220	0.000655	0.000165	0.000260	0.124	0.0533	0.000133	0.143	0.00604	0.0216	0.0000110	0.0102
		97.5th Percentile	8.50	33.2	26.6	42.3	0.0270	0.000701	0.000230	0.000413	0.161	0.0743	0.000181	0.169	0.00742	0.0253	0.0000116	0.0125
		99th Percentile	8.65	56.6	46.8	53.2	0.0344	0.000758	0.000339	0.000707	0.220	0.109	0.000259	0.204	0.00942	0.0304	0.0000122	0.0156

Table 8: Expanded Summary Statistics for Station W15, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	658	270	275	279	277	276	261	257	277	277	277	276	275	277	257	257
		% < LRL	0	1.85	2.91	0	0.361	0.362	31.0	77.8	0	1.44	95.7	2.17	26.2	4.69	98.8	73.5
		Max	9.95	5.30	3.78	265	2.65	0.00220	0.00234	0.00530	0.415	6.48	0.00270	0.113	0.00800	0.0504	0.0000290	0.0410
	Kaplan–Meier	Mean	7.73	0.120	0.103	13.0	0.0458	0.000509	0.0000339	0.000236	0.0249	0.333	0.0000512	0.00405	0.00115	0.00310	0.00000525	0.00289
		SD	0.359	0.341	0.246	21.0	0.163	0.000227	0.000150	0.000423	0.0288	0.497	0.000178	0.00895	0.000674	0.00466	0.000000549	0.00434
		Mean + 2SD	8.45	0.802	0.595	55.0	0.372	0.000963	0.000334	0.00108	0.0825	1.33	0.000407	0.0220	0.00250	0.0124	0.00000635	0.0116
		Mean + 3SD	8.81	1.14	0.841	76.0	0.535	0.00119	0.000484	0.00151	0.111	1.82	0.000585	0.0309	0.00317	0.0171	0.00000690	0.0159
		Median	7.74	0.0697	0.0406	6.54	0.0200	0.000460	0.0000130	0.000170	0.0199	0.217	0.0000310	0.00270	0.00100	0.00154	<0.0000200	0.00100
		95th Percentile	8.25	0.253	0.338	41.4	0.152	0.000880	0.0000632	0.000500	0.0500	0.888	0.0000710	0.00780	0.00200	0.0113	<0.0000200	0.00940
		97.5th Percentile	8.40	0.474	0.402	56.1	0.170	0.00119	0.000100	0.000500	0.0630	1.09	0.000300	0.0190	0.00270	0.0145	<0.0000200	0.0130
		99th Percentile	8.68	1.03	0.510	76.0	0.208	0.00160	0.000400	0.000700	0.101	1.95	0.000500	0.0525	0.00380	0.0230	0.0000230	0.0230
	Maxium Likelihood	Mean	7.73	0.107	0.0995	12.8	0.0381	0.000505	0.0000261	0.000226	0.0241	0.384	0.0000364	0.00338	0.00113	0.00303	0.00000140	0.00283
		SD	0.355	0.136	0.185	18.8	0.0563	0.000182	0.0000439	0.000206	0.0167	0.742	0.000729	0.00245	0.000504	0.00446	0.00000540	0.00575
		Mean + 2SD	8.44	0.378	0.469	50.4	0.151	0.000869	0.000114	0.000639	0.0576	1.87	0.00149	0.00829	0.00213	0.0119	0.0000122	0.0143
		Mean + 3SD	8.80	0.514	0.653	69.2	0.207	0.00105	0.000158	0.000845	0.0743	2.61	0.00222	0.0107	0.00264	0.0164	0.0000176	0.0201
		95th Percentile	8.33	0.331	0.352	42.0	0.125	0.000844	0.0000897	0.000601	0.0555	1.37	0.000102	0.00798	0.00207	0.0100	0.00000540	0.0102
		97.5th Percentile	8.45	0.451	0.517	58.9	0.176	0.000942	0.000129	0.000768	0.0677	2.03	0.000221	0.00979	0.00237	0.0140	0.00000912	0.0153
		99th Percentile	8.59	0.646	0.808	87.3	0.261	0.00107	0.000198	0.00102	0.0852	3.21	0.000541	0.0124	0.00278	0.0207	0.0000168	0.0245
2015 to 2019	Summary indices	N	459	101	101	101	101	101	101	100	101	101	101	100	101	101	101	101
		% < LRL	0	0	0	0	0.990	0	34.7	51.0	0	3.96	97.0	0	21.8	0	99.0	61.4
		Max	9.76	5.30	3.78	265	0.164	0.00220	0.000108	0.00530	0.172	0.450	0.000220	0.113	0.00280	0.0504	0.0000270	0.0230
	Kaplan–Meier	Mean	7.73	0.148	0.136	19.8	0.0178	0.000464	0.0000179	0.000230	0.0269	0.113	0.0000535	0.00651	0.00100	0.00521	0.0000102	0.00298
		SD	0.305	0.535	0.387	31.5	0.0221	0.000244	0.0000196	0.000522	0.0206	0.0995	0.0000238	0.0144	0.000414	0.00682	-	0.00443
		Mean + 2SD	8.34	1.22	0.910	82.8	0.0620	0.000952	0.0000571	0.00127	0.0681	0.312	0.000101	0.0353	0.00183	0.0189	-	0.0118
		Mean + 3SD	8.65	1.75	1.30	114.3	0.0841	0.00120	0.0000767	0.00180	0.0887	0.412	0.000125	0.0497	0.00224	0.0257	-	0.0163
		Median	7.75	0.0550	0.0360	9.16	0.0101	0.000420	0.00000940	0.000170	0.0218	0.0880	<0.0000500	0.00290	0.000950	0.00277	<0.0000100	<0.00100
		95th Percentile	8.14	0.410	0.410	56.8	0.0596	0.000700	0.0000612	0.000320	0.0472	0.313	<0.0000500	0.0224	0.00170	0.0157	<0.0000200	0.0122
		97.5th Percentile	8.26	0.577	0.510	76.0	0.0776	0.00119	0.0000680	0.000350	0.0853	0.409	0.0000710	0.0525	0.00270	0.0230	<0.0000200	0.0206
		99th Percentile	8.60	1.03	0.548	122	0.0833	0.00138	0.0000988	0.00284	0.101	0.449	0.000200	0.0928	0.00270	0.0273	<0.0000200	0.0230
	Maxium Likelihood	Mean	7.73	0.106	0.117	19.0	0.0170	0.000458	0.0000182	0.000200	0.0265	0.130	0.0000120	0.00496	0.000988	0.00517	0.000000806	0.00298
		SD	0.303	0.155	0.246	28.9	0.0185	0.000169	0.0000291	0.000167	0.0160	0.199	0.000124	0.00465	0.000413	0.00741	0.0000111	0.00829
		Mean + 2SD	8.33	0.417	0.610	76.7	0.0539	0.000795	0.0000765	0.000534	0.0585	0.529	0.000260	0.0143	0.00181	0.0200	0.0000230	0.0196
		Mean + 3SD	8.64	0.573	0.856	105.6	0.0724	0.000964	0.000106	0.000700	0.0745	0.728	0.000384	0.0189	0.00223	0.0274	0.0000341	0.0279
		95th Percentile	8.24	0.349	0.426	63.2	0.0492	0.000773	0.0000616	0.000508	0.0567	0.434	0.0000404	0.0134	0.00176	0.0168	0.00000253	0.0114
		97.5th Percentile	8.34	0.488	0.642	89.1	0.0649	0.000865	0.0000879	0.000638	0.0676	0.613	0.0000799	0.0172	0.00200	0.0235	0.00000521	0.0181
		99th Percentile	8.46	0.722	1.03	133.0	0.0897	0.000985	0.000133	0.000832	0.0830	0.917	0.000177	0.0230	0.00232	0.0346	0.0000121	0.0310

Table 9: Expanded Summary Statistics for Station W2, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	495	471	472	490	490	487	369	113	490	490	489	490	486	490	368	371
		% < LRL	0	14.2	59.7	10.8	9.59	8.83	58.3	8.85	0	3.06	97.3	9.59	21.0	22.0	100	83.6
		Max	9.42	0.550	0.0440	8.90	0.201	0.00122	0.000260	0.00230	0.0184	0.905	0.000400	0.00900	0.00400	0.00260	<0.0000400	0.0200
	Kaplan–Meier	Mean	7.92	0.0347	0.00509	1.42	0.0181	0.000514	0.0000118	0.000242	0.00304	0.166	0.0000544	0.00253	0.00116	0.000507	<0.0000100	0.00167
		SD	0.332	0.0511	0.00681	2.41	0.0166	0.000167	0.0000217	0.000220	0.00229	0.181	0.0000310	0.00239	0.000429	0.000721	-	0.00211
		Mean + 2SD	8.58	0.137	0.0187	6.24	0.0513	0.000848	0.0000552	0.000682	0.00762	0.528	0.000116	0.00731	0.00202	0.00195	-	0.00589
		Mean + 3SD	8.92	0.188	0.0255	8.65	0.0679	0.00102	0.0000769	0.000902	0.00991	0.709	0.000147	0.00970	0.00245	0.00267	-	0.00800
		Median	7.97	0.0200	<0.00100	0.166	0.0150	0.000500	0.00000530	0.000200	0.00208	0.0867	<0.0000500	0.00150	0.00100	0.000153	<0.0000200	<0.00100
		95th Percentile	8.35	0.110	0.0190	7.00	0.0470	0.000880	0.0000300	0.000400	0.00769	0.590	0.0000525	0.00800	0.00200	0.00230	<0.0000200	0.00400
		97.5th Percentile	8.43	0.190	0.0243	7.70	0.0604	0.000950	0.0000500	0.000600	0.00955	0.671	0.0000865	0.00800	0.00200	0.00240	<0.0000200	0.00600
		99th Percentile	8.69	0.260	0.0370	8.60	0.0780	0.00100	0.000130	0.000720	0.0135	0.745	0.000200	0.00900	0.00200	0.00250	<0.0000200	0.0100
	Maxium Likelihood	Mean	7.92	0.0352	0.00686	2.76	0.0180	0.000513	0.0000101	0.000234	0.00294	0.166	0.0000194	0.00247	0.00116	0.000479	-	0.00144
		SD	0.339	0.0578	0.0242	34.1	0.0153	0.000156	0.0000138	0.000113	0.00158	0.231	0.0000618	0.00237	0.000382	0.000834	-	0.00181
		Mean + 2SD	8.60	0.151	0.0553	71.0	0.0486	0.000825	0.0000377	0.000460	0.00611	0.628	0.000143	0.00721	0.00192	0.00215	-	0.00505
		Mean + 3SD	8.93	0.209	0.0795	105.1	0.0640	0.000981	0.0000515	0.000573	0.00769	0.859	0.000205	0.00958	0.00230	0.00298	-	0.00685
		95th Percentile	8.49	0.120	0.0265	8.91	0.0462	0.000801	0.0000322	0.000447	0.00594	0.534	0.0000748	0.00673	0.00187	0.00166	-	0.00443
		97.5th Percentile	8.60	0.172	0.0441	18.1	0.0582	0.000880	0.0000446	0.000517	0.00696	0.741	0.000122	0.00868	0.00206	0.00241	-	0.00603
		99th Percentile	8.74	0.262	0.0796	41.1	0.0763	0.000981	0.0000650	0.000612	0.00837	1.08	0.000215	0.0117	0.00232	0.00372	-	0.00861
2015 to 2019	Summary indices	N	149	137	136	137	137	137	137	103	137	137	137	137	137	137	137	137
		% < LRL	0	32.1	80.9	21.9	0.730	0	66.4	2.91	0	0	96.4	0	15.3	6.57	100	65.7
		Max	8.42	0.0900	0.0106	2.16	0.0737	0.000830	0.0000325	0.000720	0.0184	0.338	0.000230	0.00460	0.00169	0.000588	<0.0000200	0.00580
	Kaplan–Meier	Mean	7.85	0.0128	0.00141	0.207	0.0118	0.000473	0.00000682	0.000219	0.00351	0.0865	0.0000521	0.00140	0.00103	0.000166	<0.0000100	0.00144
		SD	0.283	0.0131	0.00141	0.366	0.0112	0.0000947	0.00000400	0.0000933	0.00287	0.0636	0.0000176	0.000469	0.000275	0.0000895	-	0.000970
		Mean + 2SD	8.42	0.0390	0.00423	0.939	0.0342	0.000662	0.0000148	0.000406	0.00925	0.214	0.0000873	0.00234	0.00158	0.000345	-	0.00338
		Mean + 3SD	8.70	0.0521	0.00564	1.31	0.0454	0.000757	0.0000188	0.000499	0.0121	0.277	0.000105	0.00281	0.00186	0.000435	-	0.00435
		Median	7.89	0.00710	<0.00100	0.0947	0.00865	0.000470	<0.00000500	0.000200	0.00240	0.0600	<0.0000500	0.00138	0.000990	0.000145	<0.0000100	<0.00100
		95th Percentile	8.25	0.0355	0.00320	0.780	0.0355	0.000640	0.0000145	0.000370	0.00955	0.218	<0.0000500	0.00209	0.00156	0.000300	<0.0000200	0.00325
		97.5th Percentile	8.34	0.0430	0.00420	1.38	0.0578	0.000710	0.0000178	0.000430	0.0101	0.261	0.0000710	0.00220	0.00161	0.000524	<0.0000200	0.00425
		99th Percentile	8.41	0.0722	0.00960	2.11	0.0604	0.000770	0.0000217	0.000510	0.0173	0.300	0.0000865	0.00230	0.00168	0.000537	<0.0000200	0.00525
	Maxium Likelihood	Mean	7.85	0.0122	0.000919	0.452	0.0114	0.000473	0.00000558	0.000218	0.00338	0.0858	0.0000133	0.00141	0.00103	0.000163	-	0.00122
		SD	0.288	0.0156	0.00185	3.84	0.00837	0.0000932	0.00000492	0.0000866	0.00209	0.0643	0.0000276	0.000505	0.000274	0.0000717	-	0.00110
		Mean + 2SD	8.42	0.0434	0.00462	8.13	0.0281	0.000659	0.0000154	0.000392	0.00756	0.214	0.0000685	0.00242	0.00157	0.000307	-	0.00342
		Mean + 3SD	8.71	0.0590	0.00647	12.0	0.0365	0.000752	0.0000203	0.000478	0.00966	0.279	0.0000961	0.00292	0.00185	0.000379	-	0.00452
		95th Percentile	8.33	0.0380	0.00332	1.60	0.0271	0.000639	0.0000146	0.000381	0.00733	0.206	0.0000485	0.00235	0.00153	0.000298	-	0.00322
		97.5th Percentile	8.43	0.0518	0.00495	3.07	0.0333	0.000680	0.0000185	0.000429	0.00878	0.254	0.0000728	0.00262	0.00166	0.000341	-	0.00411
		99th Percentile	8.54	0.0742	0.00790	6.55	0.0423	0.000730	0.0000244	0.000494	0.0108	0.325	0.000117	0.00297	0.00182	0.000397	-	0.00544

Table 10: Expanded Summary Statistics for Station W3, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	1068	709	708	728	725	722	608	609	725	725	723	725	720	725	608	615
		% < LRL	0	7.48	62.3	0.412	14.9	9.70	54.6	86.2	0.138	15.0	96.1	0.138	46.5	8.83	99.2	75.1
		Max	10.1	0.620	0.171	15.2	0.297	0.00166	0.565	0.00164	0.0315	0.750	0.0603	0.0190	0.00600	0.00560	0.0000370	0.143
	Kaplan–Meier	Mean	7.68	0.0394	0.0166	2.59	0.0175	0.000294	0.000943	0.000145	0.00444	0.0330	0.000105	0.00564	0.000990	0.000901	0.00000517	0.00281
		SD	0.383	0.0580	0.0371	3.87	0.0291	0.000112	0.0229	0.000207	0.00457	0.0462	0.00228	0.00369	0.000473	0.00117	0.000000911	0.00866
		Mean + 2SD	8.45	0.155	0.0908	10.3	0.0757	0.000518	0.0467	0.000559	0.0136	0.125	0.00467	0.0130	0.00194	0.00324	0.00000699	0.0201
		Mean + 3SD	8.83	0.213	0.128	14.2	0.105	0.000630	0.0696	0.000766	0.0182	0.172	0.00695	0.0167	0.00241	0.00441	0.00000790	0.0288
		Median	7.74	0.0189	<0.00100	0.761	0.00540	0.000265	0.00000610	<0.000100	0.00290	0.0195	0.00000900	0.00470	0.000920	0.000400	<0.0000200	0.00110
		95th Percentile	8.15	0.150	0.119	12.4	0.0810	0.000500	0.0000304	0.000400	0.0138	0.108	0.0000640	0.0160	0.00200	0.00410	<0.0000200	0.00800
		97.5th Percentile	8.22	0.200	0.133	13.8	0.0940	0.000500	0.0000800	0.000600	0.0210	0.150	0.000200	0.0170	0.00200	0.00460	<0.0000200	0.0134
		99th Percentile	8.39	0.260	0.145	14.2	0.108	0.000600	0.000100	0.000700	0.0250	0.189	0.000340	0.0180	0.00300	0.00500	<0.0000200	0.0270
	Maxium Likelihood	Mean	7.68	0.0384	0.0416	2.87	0.0161	0.000293	0.0000133	0.000110	0.00416	0.0307	0.0000329	0.00553	0.000932	0.000814	0.000000933	0.00224
		SD	0.270	0.0557	1.53	9.22	0.0348	0.0000853	0.0000279	0.000141	0.00300	0.0306	0.00099	0.00291	0.000351	0.000903	0.00000505	0.00484
		Mean + 2SD	8.22	0.150	3.10	21.3	0.0856	0.000464	0.0000692	0.000392	0.0102	0.0919	0.00202	0.0113	0.00163	0.00262	0.0000110	0.0119
		Mean + 3SD	8.49	0.206	4.63	30.5	0.120	0.000549	0.0000971	0.000532	0.0132	0.122	0.00301	0.0142	0.00198	0.00352	0.0000161	0.0168
		95th Percentile	8.13	0.125	0.0936	11.1	0.0590	0.000450	0.0000485	0.000342	0.00978	0.0852	0.0000798	0.0110	0.00159	0.00238	0.00000353	0.00822
		97.5th Percentile	8.22	0.176	0.218	18.1	0.0894	0.000492	0.0000730	0.000467	0.0120	0.111	0.000182	0.0129	0.00178	0.00315	0.00000633	0.0125
		99th Percentile	8.33	0.259	0.583	32.0	0.145	0.000546	0.000117	0.000669	0.0152	0.150	0.000473	0.0154	0.00203	0.00438	0.0000124	0.0202
2015 to 2019	Summary indices	N	543	276	276	276	276	276	276	274	276	276	276	276	276	276	276	275
		% < LRL	0	6.16	72.1	0.362	3.99	0	52.2	75.2	0.362	6.16	97.1	0	21.4	1.81	99.6	60.7
		Max	9.00	0.620	0.0511	4.61	0.0657	0.00166	0.0000623	0.00164	0.0291	0.188	0.000340	0.00790	0.00246	0.00133	0.0000200	0.0302
	Kaplan–Meier	Mean	7.63	0.0234	0.00335	0.537	0.00608	0.000271	0.00000843	0.000119	0.00491	0.0311	0.0000520	0.00450	0.000927	0.000385	0.0000100	0.00210
		SD	0.367	0.0433	0.00738	0.826	0.00887	0.000101	0.00000662	0.000104	0.00457	0.0269	0.0000201	0.000823	0.000275	0.000194	-	0.00304
		Mean + 2SD	8.36	0.110	0.0181	2.19	0.0238	0.000473	0.0000217	0.000327	0.0141	0.0849	0.0000922	0.00615	0.00148	0.000773	-	0.00818
		Mean + 3SD	8.73	0.153	0.0255	3.02	0.0327	0.000574	0.0000283	0.000431	0.0186	0.112	0.000112	0.00697	0.00175	0.000967	-	0.0112
		Median	7.70	0.0121	<0.00100	0.200	0.00300	0.000250	0.00000530	<0.000100	0.00277	0.0228	<0.0000500	0.00460	0.000900	0.000329	<0.0000100	0.00100
		95th Percentile	7.94	0.0738	0.0147	2.55	0.0204	0.000380	0.0000228	0.000180	0.0148	0.0772	<0.0000500	0.00556	0.00134	0.000800	<0.0000200	0.00600
		97.5th Percentile	8.03	0.100	0.0345	2.88	0.0395	0.000410	0.0000267	0.000270	0.0177	0.122	0.0000640	0.00579	0.00169	0.00106	<0.0000200	0.00950
		99th Percentile	8.22	0.143	0.0429	4.43	0.0555	0.000470	0.0000322	0.000370	0.0220	0.146	0.0000820	0.00670	0.00220	0.00119	<0.0000200	0.0176
	Maxium Likelihood	Mean	7.65	0.0210	0.00386	0.476	0.00550	0.000269	0.00000755	0.0000882	0.00468	0.0305	0.0000109	0.00450	0.000915	0.000386	0.000000428	0.00179
		SD	0.266	0.0229	0.0383	0.726	0.00597	0.0000612	0.00000694	0.0000627	0.00367	0.0240	0.0000278	0.000906	0.000245	0.000183	0.00000241	0.00277
		Mean + 2SD	8.18	0.0667	0.0804	1.93	0.0174	0.000391	0.0000214	0.000214	0.0120	0.0784	0.0000665	0.00632	0.00140	0.000752	0.00000524	0.00732
		Mean + 3SD	8.45	0.0896	0.119	2.65	0.0234	0.000453	0.0000284	0.000276	0.0157	0.102	0.0000942	0.00722	0.00165	0.000936	0.00000765	0.0101
		95th Percentile	8.09	0.0609	0.0132	1.58	0.0159	0.000380	0.0000201	0.000206	0.0115	0.0751	0.0000410	0.00613	0.00136	0.000732	0.00000161	0.00598
		97.5th Percentile	8.18	0.0804	0.0259	2.24	0.0210	0.000407	0.0000258	0.000252	0.0143	0.0934	0.0000641	0.00652	0.00148	0.000844	0.00000291	0.00847
		99th Percentile	8.29	0.111	0.0568	3.34	0.0290	0.000442	0.0000343	0.000319	0.0184	0.120	0.000108	0.00702	0.00163	0.00100	0.00000576	0.0127

Table 11: Expanded Summary Statistics for Station W45, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	63	65	65	65	65	65	65	33	65	65	65	65	65	65	65	65
		% < LRL	0	0	1.54	0	0	4.62	32.3	100	0	33.8	92.3	0	23.1	0	87.7	47.7
		Max	8.39	37.0	11.4	77.2	0.337	0.00234	0.000517	<0.000200	0.276	0.726	0.000660	0.134	0.00950	0.0298	0.0000990	0.0851
	Kaplan–Meier	Mean	7.77	5.31	2.26	20.1	0.0173	0.000781	0.0000862	<0.000100	0.0408	0.0509	0.0000708	0.0644	0.00328	0.00945	0.0000139	0.00832
		SD	0.315	5.68	2.34	15.4	0.0413	0.000557	0.000111	-	0.0652	0.102	0.0000850	0.0383	0.00247	0.00800	0.0000121	0.0152
		Mean + 2SD	8.40	16.7	6.94	50.9	0.100	0.00190	0.000308	-	0.171	0.255	0.000241	0.141	0.00822	0.0255	0.0000381	0.0387
		Mean + 3SD	8.72	22.4	9.28	66.3	0.141	0.00245	0.000419	-	0.236	0.357	0.000326	0.179	0.0107	0.0335	0.0000502	0.0539
		Median	7.77	4.07	1.64	17.7	0.0105	0.000450	0.0000400	<0.000200	0.0121	0.0178	<0.000100	0.0851	0.00259	0.00742	<0.0000200	0.00240
		95th Percentile	8.22	9.63	5.91	53.7	0.0353	0.00175	0.000318	<0.000200	0.212	0.188	0.000140	0.117	0.00820	0.0232	0.0000330	0.0387
		97.5th Percentile	8.29	30.5	7.60	67.2	0.0549	0.00228	0.000379	<0.000200	0.268	0.260	0.000380	0.121	0.00880	0.0239	0.0000670	0.0673
		99th Percentile	8.39	37.0	11.4	77.2	0.337	0.00234	0.000517	<0.000200	0.276	0.726	0.000660	0.134	0.00950	0.0298	0.0000990	0.0851
	Maxium Likelihood	Mean	7.77	5.53	3.48	24.7	0.0141	0.000793	0.000105	-	0.0490	0.0495	0.0000421	0.0681	0.00342	0.0110	0.00000936	0.00971
		SD	0.318	5.63	10.8	38.5	0.0127	0.000665	0.000276	-	0.197	0.118	0.000173	0.0620	0.00408	0.0192	0.0000253	0.0384
		Mean + 2SD	8.41	16.8	25.2	101.8	0.0396	0.00212	0.000658	-	0.444	0.286	0.000387	0.192	0.0116	0.0494	0.0000599	0.0865
		Mean + 3SD	8.73	22.4	36.0	140.3	0.0523	0.00279	0.000934	-	0.641	0.404	0.000560	0.254	0.0157	0.0686	0.0000852	0.125
		95th Percentile	8.30	15.5	13.4	82.9	0.0373	0.00202	0.000396	-	0.189	0.185	0.000163	0.181	0.0103	0.0383	0.0000356	0.0375
		97.5th Percentile	8.41	20.2	21.7	117.6	0.0475	0.00254	0.000624	-	0.322	0.285	0.000278	0.231	0.0139	0.0555	0.0000562	0.0637
		99th Percentile	8.54	27.6	38.2	176.6	0.0630	0.00332	0.00106	-	0.598	0.473	0.000517	0.307	0.0196	0.0856	0.0000958	0.118
2015 to 2019	Summary indices	N	42	42	42	42	42	42	42	33	42	42	42	42	42	42	42	42
		% < LRL	0	0	2.38	0	0	7.14	45.2	100	0	47.6	92.9	0	4.76	0	100	59.5
		Max	8.39	9.63	11.4	35.5	0.0382	0.00103	0.000517	<0.000200	0.268	0.260	<0.000200	0.134	0.00950	0.0239	<0.0000200	0.0851
	Kaplan–Meier	Mean	7.80	4.61	2.91	19.8	0.0133	0.000423	0.0000603	<0.000100	0.0173	0.0350	0.0000565	0.0844	0.00427	0.0126	<0.0000100	0.00623
		SD	0.318	2.21	2.65	10.9	0.00675	0.000180	0.000107	-	0.0469	0.0543	0.00000892	0.0330	0.00252	0.00731	-	0.0173
		Mean + 2SD	8.44	9.03	8.21	41.6	0.0268	0.000783	0.000274	-	0.111	0.144	0.0000743	0.150	0.00931	0.0272	-	0.0408
		Mean + 3SD	8.75	11.2	10.9	52.5	0.0336	0.000963	0.000381	-	0.158	0.198	0.0000833	0.183	0.0118	0.0345	-	0.0581
		Median	7.80	4.19	2.14	20.5	0.0122	0.000385	0.0000280	<0.000200	0.00428	0.0130	<0.000100	0.0942	0.00410	0.0149	<0.0000200	0.00120
		95th Percentile	8.27	9.02	7.35	33.9	0.0250	0.000940	0.000318	<0.000200	0.112	0.158	0.000120	0.118	0.00880	0.0232	<0.0000200	0.0387
		97.5th Percentile	8.29	9.20	7.60	34.6	0.0303	0.000940	0.000379	<0.000200	0.127	0.188	0.000140	0.121	0.00880	0.0236	<0.0000200	0.0673
		99th Percentile	8.39	9.63	11.4	35.5	0.0382	0.00103	0.000517	<0.000200	0.268	0.260	0.000140	0.134	0.00950	0.0239	<0.0000200	0.0851
	Maxium Likelihood	Mean	7.80	5.31	6.39	27.5	0.0133	0.000429	0.0000616	-	0.0120	0.0367	0.0000330	0.0936	0.00441	0.0159	-	0.00476
		SD	0.320	5.17	32.7	48.6	0.00707	0.000194	0.000153	-	0.0269	0.0806	0.0000413	0.0790	0.00354	0.0249	-	0.0202
		Mean + 2SD	8.44	15.7	71.7	124.6	0.0275	0.000817	0.000368	-	0.0657	0.198	0.000116	0.252	0.0115	0.0658	-	0.0452
		Mean + 3SD	8.76	20.8	104.4	173.2	0.0345	0.00101	0.000521	-	0.0926	0.278	0.000157	0.331	0.0150	0.0907	-	0.0654
		95th Percentile	8.34	14.6	24.3	95.8	0.0267	0.000794	0.000232	-	0.0442	0.135	0.000102	0.239	0.0110	0.0535	-	0.0184
		97.5th Percentile	8.45	18.9	43.2	139.4	0.0312	0.000910	0.000360	-	0.0674	0.205	0.000138	0.301	0.0137	0.0760	-	0.0315
		99th Percentile	8.58	25.4	84.0	215.7	0.0375	0.00107	0.000603	-	0.110	0.334	0.000197	0.394	0.0178	0.114	-	0.0591

Table 12: Expanded Summary Statistics for Station W62, Minto Mine, 2010 to 2019

Year	Methods	Summary Statistics	pH	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Arsenic (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Chromium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Lead (mg/L)	Dissolved Molybdenum (mg/L)	Dissolved Nickel (mg/L)	Dissolved Selenium (mg/L)	Dissolved Silver (mg/L)	Dissolved Zinc (mg/L)
2010 to 2019	Summary indices	N	49	50	50	50	50	50	50	48	50	50	48	50	50	50	48	50
		% < LRL	0	10.0	14.0	0	0	0	2.00	8.33	0	2.00	95.8	0	4.00	0	95.8	0
		Max	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	Kaplan–Meier	Mean	7.64	0.0187	0.0290	7.77	0.00471	0.000434	0.0000236	0.000182	0.0500	0.0335	0.0000512	0.00731	0.00107	0.00346	0.0000102	0.101
		SD	0.404	0.0328	0.0246	3.60	0.00359	0.000103	0.0000117	0.0000482	0.0122	0.0148	0.00000566	0.00210	0.000164	0.00150	0.00000121	0.132
		Mean + 2SD	8.45	0.0843	0.0782	15.0	0.0119	0.000640	0.0000470	0.000278	0.0744	0.0631	0.0000625	0.0115	0.00140	0.00646	0.0000126	0.365
		Mean + 3SD	8.85	0.117	0.103	18.6	0.0155	0.000743	0.0000587	0.000327	0.0866	0.0779	0.0000682	0.0136	0.00156	0.00796	0.0000138	0.497
		Median	7.78	0.0109	0.0249	6.99	0.00350	0.000415	0.0000197	0.000180	0.0504	0.0310	<0.0000500	0.00711	0.00110	0.00342	<0.0000100	0.0609
		95th Percentile	8.09	0.0563	0.0744	11.2	0.0144	0.000600	0.0000452	0.000250	0.0656	0.0630	<0.0000500	0.0109	0.00131	0.00493	<0.0000100	0.402
		97.5th Percentile	8.12	0.0630	0.0786	11.3	0.0166	0.000600	0.0000479	0.000260	0.0666	0.0720	0.0000640	0.0113	0.00146	0.00519	0.0000110	0.406
		99th Percentile	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	Maxium Likelihood	Mean	7.64	0.0161	0.0344	10.8	0.00457	0.000436	0.0000236	0.000182	0.0532	0.0337	0.0000151	0.00761	0.00107	0.00370	0.00000367	0.107
		SD	0.420	0.0148	0.0556	14.3	0.00280	0.000125	0.0000110	0.0000552	0.0294	0.0166	0.0000187	0.00370	0.000162	0.00240	0.00000312	0.172
		Mean + 2SD	8.48	0.0458	0.146	39.4	0.0102	0.000686	0.0000455	0.000292	0.112	0.0670	0.0000525	0.0150	0.00139	0.00850	0.00000991	0.452
		Mean + 3SD	8.90	0.0606	0.201	53.7	0.0130	0.000811	0.0000565	0.000348	0.142	0.0836	0.0000712	0.0187	0.00156	0.0109	0.0000130	0.625
		95th Percentile	8.35	0.0430	0.117	34.1	0.00987	0.000665	0.0000443	0.000284	0.109	0.0651	0.0000463	0.0146	0.00136	0.00823	0.00000941	0.364
		97.5th Percentile	8.49	0.0550	0.167	46.8	0.0118	0.000727	0.0000509	0.000311	0.128	0.0754	0.0000628	0.0169	0.00142	0.00992	0.0000119	0.519
		99th Percentile	8.66	0.0733	0.253	67.7	0.0145	0.000805	0.0000598	0.000347	0.155	0.0895	0.0000893	0.0200	0.00150	0.0123	0.0000155	0.785
2015 to 2019	Summary indices	N	49	50	50	50	50	50	50	48	50	50	48	50	50	50	48	50
		% < LRL	0	10.0	14.0	0	0	0	2.00	8.33	0	2.00	95.8	0	4.00	0	95.8	0
		Max	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	Kaplan–Meier	Mean	7.64	0.0187	0.0290	7.77	0.00471	0.000434	0.0000236	0.000182	0.0500	0.0335	0.0000512	0.00731	0.00107	0.00346	0.0000102	0.101
		SD	0.404	0.0328	0.0246	3.60	0.00359	0.000103	0.0000117	0.0000482	0.0122	0.0148	0.00000566	0.00210	0.000164	0.00150	0.00000121	0.132
		Mean + 2SD	8.45	0.0843	0.0782	15.0	0.0119	0.000640	0.0000470	0.000278	0.0744	0.0631	0.0000625	0.0115	0.00140	0.00646	0.0000126	0.365
		Mean + 3SD	8.85	0.117	0.103	18.6	0.0155	0.000743	0.0000587	0.000327	0.0866	0.0779	0.0000682	0.0136	0.00156	0.00796	0.0000138	0.497
		Median	7.78	0.0109	0.0249	6.99	0.00350	0.000415	0.0000197	0.000180	0.0504	0.0310	<0.0000500	0.00711	0.00110	0.00342	<0.0000100	0.0609
		95th Percentile	8.09	0.0563	0.0744	11.2	0.0144	0.000600	0.0000452	0.000250	0.0656	0.0630	<0.0000500	0.0109	0.00131	0.00493	<0.0000100	0.402
		97.5th Percentile	8.12	0.0630	0.0786	11.3	0.0166	0.000600	0.0000479	0.000260	0.0666	0.0720	0.0000640	0.0113	0.00146	0.00519	0.0000110	0.406
		99th Percentile	8.23	0.230	0.119	26.5	0.0178	0.000720	0.0000798	0.000355	0.0711	0.0740	0.0000920	0.0138	0.00161	0.0115	0.0000170	0.799
	Maxium Likelihood	Mean	7.64	0.0161	0.0344	10.8	0.00457	0.000436	0.0000236	0.000182	0.0532	0.0337	0.0000151	0.00761	0.00107	0.00370	0.00000367	0.107
		SD	0.420	0.0148	0.0556	14.3	0.00280	0.000125	0.0000110	0.0000552	0.0294	0.0166	0.0000187	0.00370	0.000162	0.00240	0.00000312	0.172
		Mean + 2SD	8.48	0.0458	0.146	39.4	0.0102	0.000686	0.0000455	0.000292	0.112	0.0670	0.0000525	0.0150	0.00139	0.00850	0.00000991	0.452
		Mean + 3SD	8.90	0.0606	0.201	53.7	0.0130	0.000811	0.0000565	0.000348	0.142	0.0836	0.0000712	0.0187	0.00156	0.0109	0.0000130	0.625
		95th Percentile	8.35	0.0430	0.117	34.1	0.00987	0.000665	0.0000443	0.000284	0.109	0.0651	0.0000463	0.0146	0.00136	0.00823	0.00000941	0.364
		97.5th Percentile	8.49	0.0550	0.167	46.8	0.0118	0.000727	0.0000509	0.000311	0.128	0.0754	0.0000628	0.0169	0.00142	0.00992	0.0000119	0.519
		99th Percentile	8.66	0.0733	0.253	67.7	0.0145	0.000805	0.0000598	0.000347	0.155	0.0895	0.0000893	0.0200	0.00150	0.0123	0.0000155	0.785

Appendix K
Minto Mine Closure Cost Estimates – RCP Revision 2020-01

Minto Mine Closure Cost Estimate – RCP Revision 2020-01 - DRAFT

Prepared for

Minto Explorations Ltd.

Prepared by

SRK Consulting (Canada) Inc.
1CM002.045
October 2020

Minto Mine Closure Cost Estimate – RCP Revision 2020-01 - DRAFT

October 2020

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Appendices

Appendix A – Cost Estimate Worksheets

1 Introduction

1.1 General

This document presents the estimates for reclamation and closure liability based on the Minto Mine Reclamation Closure Plan, Revision 2020-01. The estimates have been prepared in accordance with the costing guidance from YG EMR in the document Reclamation and Closure Planning for Quartz Mining Projects: Plan Requirements and Closure Costing Guidance (YG, 2013).

The report describes the basis of the estimate and the major costing assumptions. This document should be read in conjunction with the entire RCP, which provides details on the level of engineering for each cost component, as well as the cost estimate spreadsheet provided in Appendix B, which provides complete costing details and assumptions.

1.2 Scope of Estimate

YG (2013) guidance document requires liability estimates for three separate conditions:

- Current status (i.e. Year 0)
- Peak Liability within the next two-year period
- End-of-mine (EOM) Life.

For the Minto Mine, the peak liability is expected to occur following mining of the Ridgetop North and Ridgetop South Open Pits, assumed to be completed in 2022. The Year 0 liability estimate was prepared to represent conditions on the site as of August 2020. The end-of-mine life closure liability occurs following completion of all open pit and underground mining, as well as the milling of all ore stockpiles by Q2 of 2025, with active closure also beginning in 2025.

Closure implementation is estimated to take 3 years for each liability estimate with construction occurring between April and September. The site is estimated to be accessed by air during the spring, and by barge following spring break-up. Two years of interim care and maintenance is assumed to be required after mining ceases and prior to implementation of the final closure plan for the Year 0 and Peak liability estimates. These costs are not included in the EOM estimate as the closure plan would be finalized at the end-of-mining.

As noted in Section 8 of the RCP, the Post-Closure I and Post-Closure II periods have durations of 5 years and 10 years, respectively. During Post-Closure I, site access is maintained by air during the spring, and by barge following spring break-up. During Post-Closure II, site maintenance is assumed to be required every 5 years with the site accessed by barge and work completed in one month. Site access for monitoring events and geotechnical inspections when no barge is in place are assumed to be completed by helicopter. During Post-Closure II, the geotechnical inspection completed by helicopter will also be used to determine the maintenance requirements to be completed during the next summer.

Costs have also been allocated for on-going site maintenance past the Post-Closure II period into perpetuity. Routine site inspections and maintenance were assumed to be completed every 10 years, with access to the site established by barge. During these 10-year maintenance events, costs were allocated for passive treatment maintenance, site grading, as well as maintenance of the access road (including Big Creek Bridge).

2 Unit Rates

2.1 Equipment Rates

The equipment rates used in the Minto cost estimate are based on 2020-21 BC Blue Book equipment rates[1] and on on-site rates currently paid to a third-party contractor. The BC Blue Book rates are determined by the BC Ministry of Transportation based on recommendations from the BC Road Builders and Heavy Construction Association and is validated from its own research and calculations. The BC Blue book publishes ‘all-found rates’ that includes all ownership and operating costs including:

- Ownership: financing costs and depreciation
- Maintenance: repair, lube, wear items, and tire costs
- Operator costs: wages including benefits and overhead
- Equipment overhead, profit.

The BC Blue Book also publishes “all-found, less operator” rates that exclude the operator costs. Ranges of ‘all-found’ and ‘all-found, less operator’ rates are provided in the BC Blue Book that depend on the equipment age, with new equipment costed at a higher rate compared to older equipment. For the Minto cost estimate, the highest listed unit rates (for 2017-2020 equipment) were adopted for the cost model.

As many of the above items are site-specific and are included in other portions of the cost estimate (labour, overhead, profit, fuel), these costs are removed from the “all-found” rate to obtain the base ownership and maintenance (O&M) hourly rates to avoid double-accounting of costs. The BC Rates were selected for use as a basis in the cost estimate as the methodology to obtain the base O&M rate from the published ‘all-found’ hourly rates is known, and use of the O&M rates in the cost estimate allows for site-specific mark-ups to be applied in a clear and transparent way. The details of the calculation details and mark-ups applied are provided in Section 3.2.

Use of the O&M rates in the cost estimate is a robust methodology to develop the overall project costs as the cost of ownership and maintenance is not expected to vary significantly between project locations, and allows for the site-specific project mark-ups to be costed based on the expected execution of the actual project.

[1] B.C. Road Builders and Heavy Construction Association.

The BC Blue Book ‘all-found less operator’ unit rates were broken down to obtain the base ownership and maintenance costs for each piece of equipment as follows:

- 20% profit and overhead was removed. This percentage mark-up was obtained from communications with the BC Road Builders and Heavy Construction Association.
- Fuel was removed based on a $1.04/L and based on fuel consumption rates obtained from the Caterpillar Performance Handbook. The fuel rate to remove was obtained from the BC Ministry of Transportation website and is the base price included in the BC Blue Book Equipment rates.

A site-specific fuel operating cost was then added back to the equipment rates based on a delivered diesel fuel cost of $0.99/L based on actual site costs in 2020. The equipment costs are further marked-up in the project indirect costs where contractor profit (10%), contract administration (5%), bonding (3%), insurance (1.5%) are applied, resulting in a further mark-up of 19.5%.

The BC Blue Book equipment rates were compared to current equipment rates paid to the 3rd party contractor on site. The benchmarking assessment determined that the rates paid to the 3rd party contractor generally 6% lower compared to the BC Blue Book rates used in the model, and as a result a 0.94 adjustment factor was included in the model. The BC Blue Book rates used in the model are believed to be higher because they assume all brand-new equipment, while the actual equipment used on site is of variable age. On this basis, it was concluded that reliance on BC Blue Book rates as inputs to the cost model was sound.

2.2 Labour Rates

Labour rates for a third-party contractor were built up from base hourly rates presented in the Yukon Government Fair Wage Schedule effective April 1, 2020. Workers were assumed to work a ‘3 weeks in, 3 weeks out’ schedule, working 12-hour days while on site. The base wages were adjusted to account for: travel, overtime, vacation, statutory holidays, and other benefits as follows:

- **Travel Time:** Workers were compensated for travel time at the start and end of each rotation. Staff were assumed to originate either from Pelly Crossing or Whitehorse, and were compensated either 2.5 or 4 hours, respectively, for each trip between home origin and the site.
- **Overtime:** Each hour worked in addition to a standard 40-hour work week was compensated at a rate 1.5 times the base hourly wage.
- **Statutory Holidays**: Workers were compensated a pro-rated amount of 80 hours of pay over each year worked.

- **Employment Insurance (EI)**: EI was added at a rate of 1.6% of base earnings up to the maximum insurable earning of $54,200 as per Canadian Revenue Agency guidance.[2]
- **Canada Pension Plan (CPP):** CPP contributions were added at a rate of 5.25% of base earnings up to the CPP salary limit of $58,700.[3]
- **Worker's compensation**: Added for all workers at a rate prescribed by the Yukon Workers' Compensation Health and Safety Board (YWC) that varied depending on the worker's group assessment rate as determined by YWC. Rates varied from $1.67/hr for camp support staff to $4.79/hr for equipment operators.[4]
- A small tool allowance was added at $250 per year for trades workers based on InfoMine (2017) for a British Columbian mine site.

The labour rates do not include costs of camp accommodation or flights that are included elsewhere in the cost estimate indirect costs. In addition, labour rates do not include MSP, as the Yukon Territory has no employer or employee premiums or payroll taxes for health care.

Including all benefits paid by the third-party contractor, the 'loaded' labour rates are generally 42 to 55% higher than the base hourly wage depending on the labour category.

2.3 Material Rates

Primary material rates used in the estimate consisted of: revegetation materials, fuel, and geosynthetic materials. The revegetation, fuel, and geotextile costs were provided by supplier quotes. The remaining material costs were obtained using RSMeans Online – a cost database service that provides up-to-date construction cost data.

Material quotes that were obtained from sources south of Yukon were increased by 15% to account for shipping (10%) and taxes (5%). Material costs that were obtained from RSMeans were factored to be located in Whitehorse and were further increased by 11% to account for shipping (5%) and taxes (5%).

Where required, material quotes were updated as required to 2020 dollars using the Bank of Canada inflation calculator (www.bankofcanada.ca/rates/related/inflation-calculator).

3 Basis of Estimate – Closure

3.1 Direct Costs

Direct costs were estimated based on the construction fleet and productivities assigned to each task. Determination of the construction fleet and productivities were obtained based on first principals, from experience on similar projects, or from the RS Means Online cost database. Earthmoving unit rates were based on calculated productivities that followed standard methods,

[2] http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/ei/cnt-chrt-pf-eng.html
[3] http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/cpp-rpc/cnt-chrt-pf-eng.html
[4] http://www.wcb.yk.ca/QuestionResults/Assessments/Rates/Q0269.aspx

as used by earthwork contractors. The calculations make use of equipment specifications obtained from manufacturer's data, in this case the Caterpillar Handbook.

Table 1 provides a summary of the major direct cost quantity sources and assumptions. Further details are provided in the cost estimate worksheets provided in Appendix B.

Table 1: Direct Cost Inputs and Costing Assumptions

Area	**Inputs and Assumptions**
Waste Dumps	• Waste rock dump and ore stockpile dimensions were obtained from AutoCAD drawings of 2020 site topography with dimensions for waste dump facilities currently under construction estimated based on design drawings. • The dump slopes were assumed to be regraded to be flatter than 3H:1V and flat areas were assumed to be regraded to form tertiary drainage catchments with a minimum 2% grade. • In 2019, a portion of the SWD high grade waste stockpile was processed by the mill. Due to uncertainties on the remaining stockpile volume, it was conservatively assumed that 50% of the 2017 stockpile volume provided by Minto is still present. The remaining volume is assumed to be relocated to the Main Pit. • The waste rock covers were assumed to be entirely sourced from the Reclamation Overburden Dump. Areas remaining to be covered were determined from the 2020 site orthophoto.
Overburden Dumps	• Dump dimensions were obtained from AutoCAD drawings of the 2020 site topography. • The dump slopes were assumed to be regraded to be flatter than 3H:1V and flat areas were assumed to be regraded to form tertiary drainage catchments with a minimum 2% grade.
Ore Stockpiles	• Year 0 stockpile volumes were provided by Minto on August 19, 2020. Peak liability stockpile volumes are assumed to occur following mining of Ridgetop, with estimated volumes based on the 2014 Mine Development and Operations Plan. • Stockpile materials are assumed to be relocated into the Main Pit, along with the upper two meters of the ore pads. • Stockpile pad dimensions were obtained from AutoCAD drawings of the 2020 site topography.
Open Pits	• Earthen safety berms are assumed to be placed around the pit high walls, with large boulders placed near pit access points and warning signs placed at key locations around the perimeter. • Perimeter lengths were obtained from the latest site topography for completed pits, or design drawings for pits currently under construction, or yet to be mined.
Underground Openings	• A backfill plug is assumed to placed at all portals with backfill material sourced from near-by waste rock. The areas near the portal are assumed to be backfilled and recontoured. • All vent raises are assumed to be sealed with a reinforced concrete cap with a vent raise pipe and covered with fill.
External Tailings Facilities	• Dimensions of the DSTSF were obtained from AutoCAD drawings of 2020 site topography.

Area	Inputs and Assumptions
Roads	• Road dimensions were obtained from the 2020 site topography and aerial photos. Roads no longer required following closure are assumed to be scarified and revegetated. • The main site access road is assumed to be maintained for long-term site access.
Demolition	• Building dimensions were obtained from site drawings for all major structures and were estimated based on site photos for minor structures where drawings were not available. • All equipment was assumed to be dismantled and removed from site. Equipment lists were provided by Minto in 'Issued-for-Construction' Drawings or based on the Hatch 2006 feasibility study equipment list. • Demolition debris was assumed to be disposed in the on-site landfill located near the airstrip, with all hazardous material, recyclables, and re-useable equipment removed an appropriate off-site facility.
Site infrastructure	• Pipeline and power line lengths and details were provided by Minto in AutoCAD format. • The pipelines were assumed to be disposed on-site, with the power lines and power poles disposed off-site once no longer needed.
Water Detention Structures	• The water storage dam volumes were obtained from dam as-built drawings. The dam material is assumed to be partially utilized as construction material for the wetland system upstream of the dam.
Yards	• Yard areas were obtained from AutoCAD drawings and aerial photography. The yard boundaries are provided in Figure 9-1.
Waste Disposal	• Hydrocarbon contaminated soils were assumed to be hauled to the on-site landfill located at the airstrip, with the landfarm operated for a period of three years. • Areas of hydrocarbon contaminated soils were assumed to be present near fuelling storage and mechanic working areas, with an average contamination depth of 1.0 m.
Surface water conveyance	• Excavation volumes, channel lengths, alignments, and other quantities for the primary catchment channels were obtained from AutoCAD drawings. • The secondary catchment quantities were calculated based on the typical section provided in Section 7 of the RCP, with an allowance of 40 m of secondary channel lengths per hectare of dump.
Water Treatment	• Fill used to construct the wetland cells was assumed to be sourced from the Water Storage Pond Dam. • The wetland cells are assumed to be lined with HDPE with organics assumed to be produced using a power mulcher from vegetation cleared from the water storage pond footprint. • The passive treatment system is assumed to be constructed in Year 3 of active closure with the first year of operation in Year 1 of post-closure. • The active treatment system is assumed to be decommissioned and removed from site at the end of Post-Closure 1.

3.2 Indirect Costs

Indirect costs during the closure implementation include costs for mobilization-demobilization, site transport costs, site and road maintenance, construction support, project management, and quality assurance. A summary of the major indirect assumptions is provided in Table 2. Further details regarding assumptions and cost sources are provided in the cost estimate worksheets in Appendix B.

Table 2: Indirect Cost Inputs and Costing Assumptions

Area	**Inputs and Assumptions**
Mobilization	• The assumed closure equipment fleet is listed in Worksheet 24 in Appendix B. Each piece of equipment is likely not required throughout the entire closure period, however, for the purposes of the estimate, the entire fleet was assumed to be mobilized in Year 1 of closure, with most equipment demobilized from site at the end of Year 3. • A small site maintenance fleet was assumed to remain on site to allow for earthwork repairs and passive treatment maintenance during the post-closure period. The storage location of the equipment has yet to be finalized but is expected to consist of an existing site warehouse. • All equipment was assumed to be mobilized from Whitehorse.
Site Transport	• Site transport costs include barge and bus operations, as well as air transport and airstrip operations during periods where the barge is not in service.
Road and Site Maintenance	• A water truck and grader were both assumed to be required 150 hours per month. • An allowance of 7 km of silt fencing and 1 ha of erosion control matting was assumed for erosion protection prior to vegetation being established.
Construction Support	• Field support staff, vehicles, and support equipment were estimated based on past project experience on projects of similar size. • The existing camp and office facilities are assumed to be used by the closure contractor. • Camp cost man-days were estimate based on a sum of the calculated man-hours required for RCP implementation. • Camp costs including power and heat were provided by Minto.
QA, Project Management	• Project management and QA during implementation includes costs for staffing to provide on-site management of the contractor to ensure the project is implemented as per the RCP.
Indirect Percentage Add-on Costs	• Additional indirect add-ons included the following: o Contingency = 12% o Worker's Compensation = 0% (included in labour rates) o Insurance = 1.2% of labour costs (equipment insurance included in equipment rates). o Bonding = 3% of project implementation and care and maintenance costs. o Contractor profit = 10% o Contract administration = 5% o Taxes = 0% (5% is included in material costs)

3.3 Contingency

As noted in Table 2, contingency is added to all costs at a rate of 12%. In Worksheet 1 (Cost Summary), the implementation cost contingency is applied to the direct costs (A01 through A14), interim monitoring and care and maintenance, and Indirect Costs (B1 through B5). The closure cost contingency is applied to the direct cost items 1 to 7 in Worksheet 1. Contingency is also distributed in the cost schedules and subjected to inflation and net present value calculations as detailed in Section 6.

The contingency value was selected based on a review of the site uncertainty and available published reclamation guidance. The contingency value was lowered from 15% to 12% in the 2016 version of the RCP because of advancement in the engineering design (i.e. landform design, wetland treatment, and conveyance channels) and reduction in the performance uncertainty related to the DSTSF and Mill Valley Fill Extension Stage 2. RECLAIM guidance recommends a contingency of 10% for definitive or construction level drawings, and 15% for preliminary or budget level drawings (GNWT 2017). The level of engineering for the Minto closure is believed to be between these two values. 12% was selected because the engineering design has already adopted generally conservative assumptions where uncertainty remains.

4 Basis of Estimate – Post Closure and C&M Costs

The following section describes the costs allocated for care and maintenance of the site for all phases of closure. Further details of the costs for each closure phase are provided in Worksheets 3, 8 and 13 for the Year 0, Peak, and EOM liability estimates, respectively, in Appendix B.

4.1 Water Treatment

Active treatment operational costs are based on on-site costs for 2015. Based on a review of water treatment costs from 2013 through 2016, 2015 was found to best represent typical conditions in terms of days operating per year and operating costs. The 2015 costs were updated to 2020 dollars based on an inflation factor of 1.08 obtained from the Bank of Canada inflation calculator. The active treatment system is assumed to be operated through Active Closure and Post-Closure I. Costs for capital replacement and maintenance of the active treatment system are included through to the end of the Post-Closure II period, after which the system is assumed to be dismantled and removed from site.

The passive treatment wetlands are assumed to start operations in Year 1 of Post-Closure 1. Allocated costs for operation and maintenance of the system includes costs for staffing and oversight of the system, an allowance for replacement of the organic media, as well as for carbon source injections.

4.2 Reclamation and Site Maintenance

Reclamation and site maintenance costs include allowances for equipment maintenance, road maintenance, repair of earthworks including site grading, cover, and revegetation repair.

4.3 Site Management

Costs are included for the management of the site and care and maintenance activities, as well as camp operation.

4.4 Transport Costs

Transport costs include staffing transport between site and Whitehorse, as well as barge operations and mobilization-demobilization. Barge costs are based on Minto's operational site costs and assumed to be operated 20 hrs per week.

4.5 Post-Closure Indirect Costs

Post-closure indirect costs include the same percentage add-on costs as used during closure. These costs include: contingency (12%), insurance, bonding, contractor profit, and contract administration.

5 Closure Planning, Engineering, Permitting, and Monitoring

Planning, permitting and engineering cost details are provided in Worksheets 6, 11, and 16 for the Year 0, Peak, and EOM liability estimates, respectively.

Planning and permitting costs are included for the Year 0 and Peak liability estimates and are assumed to be included during operations in the End-of-Mine Scenario. Planning and permitting costs include: reclamation research and planning, and allowance for additional technical studies, monitoring and management plans, and permitting staffing and meetings.

Engineering, Design, and Construction plans are calculated as 5% of the direct implementation costs. Costs for engineering oversight during construction is included in the indirect costs during implementation (i.e. on Worksheets 4, 9, and 14).

Monitoring of the site was costed according to the monitoring schedule presented in Section 7 of the RCP. Monitoring costing details are provided in Worksheet 25 in Appendix B.

6 Inflation and Net Present Value Analysis

Inflation and net present value (NPV) calculations are presented in Worksheets 2, 7, and 12 of Appendix B for the Year 0, Peak, and EOM liability estimates respectively. The tables include the cost schedule and undiscounted cash flow starting in 2018 through post-closure year 105 (100 years after the end of Post-Closure 1). As required by YG (2013a), inflation has been applied to the period of active implementation, while NPV discount rates were applied to post-closure monitoring and maintenance costs. The NPV calculations include annual cash flows to perpetuity (modeled as 105 years after decommissioning and reclamation).

Inflation has been applied at a rate of 1.9%, which corresponds to the average annual rate of inflation for the past ten years based on the CPI published by Statistics Canada[5].

As per Yukon Mine Site Reclamation and Closure Policy Financial Guidelines (YG 2013b), the discount rate used in NPV calculation are to be the most recent Government of Canada benchmark bond yields as published by the Bank of Canada, with the bond term selected to be the longest term published that does not exceed the expected duration of the post-closure reclamation, monitoring and maintenance program. For the Minto site, this corresponds to a bond term of ten years; as of September 2020, this corresponds to a bond yield of 0.55%. Given the historically low yield, a variable discount rate has been selected for the NPV calculations. The NPV calculations apply a discount rate of 0.55% for the first two years[6], 1% for the next 3 years, and 1.9% thereafter. The 1.9% corresponds to the average yield for the past 10 years.

7 Cost Summary

Table 3 summarizes the reclamation and closure liability for the Year 0, Peak, and End-of-Mine scenarios. The costs are presented in 2020 Canadian Dollars.

Table 3: Reclamation and Closure Liability Cost Summary

Description of Cost	Year 0	Peak	EOM
Closure Implementation			
Direct Costs	$18,167,154	$21,084,411	$17,147,647
Care & Maintenance Costs to the end of implementation	$10,246,065	$10,391,928	$4,049,135
Indirect Costs	$19,659,131	$20,760,146	$17,079,141
Cost Inflation	*$3,302,443*	*$5,761,732*	*$4,593,428*
Sub-total - Implementation Costs	$51,374,793	$57,998,217	$42,869,351
Post-Closure NPV	$15,320,181	$14,753,778	$14,267,425
TOTAL FINANCIAL SECURITY	$66,694,975	$72,751,995	$57,136,776

[5] https://www150.statcan.gc.ca/n1/pub/71-607-x/2018016/cpilg-ipcgl-eng.htm
[6] 1% is the average yield over the last year. https://www.bankofcanada.ca/rates/interest-rates/lookup-bond-yields/?rangeType=dates&rangeValue=1&rangeWeeklyValue=1&rangeMonthlyValue=1&lP=lookup_bond_yields.php&sR=2010-08-06&se=L_V122543&dF=2019-09-06&dT=2020-08-06

This report, Minto Mine Closure Cost Estimate – RCP Revision 2020-01 - DRAFT, was prepared by

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

8 References

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Appendix A – Cost Estimate Worksheets

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Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

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4	Year 0 Estimate - Implementation Costs	04-Yr0Active
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7	Peak Liability Estimate - Cashflow Calculations	07-PeakNPV
8	Peak Liability Estimate - Annual C&M costs	08-PeakCCM
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10	Peak Liability Estimate - Schedule Details	10-PeakSched
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Worksheet 1 - Cost Summary

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

COST SUMMARY - YEAR 0 (August 2020)

WBS	Description of Cost	Proposed Cost
Closure Implementation		
Direct Costs		
A01	Waste Dump	$7,096,688
A02	Overburden Dumps	$424,256
A03	Ore Stockpiles	$1,835,127
A04	Open Pits	$179,036
A05	Underground Openings	$59,131
A06	External Tailings Facilities	$232,973
A07	Roads	$153,441
A08	Demolition	$1,995,640
A09	Surface Infrastructure	$175,792
A10	Water Detention Structures	$840,997
A11	Yards/Laydown Areas	$827,890
A12	Waste Disposal	$461,883
A13	Surface Water Conveyance	$3,309,856
A14	Water Treatment	$574,445
Subtotal - Direct Implementation		**$18,167,154**
Monitoring and C&M		
P	Planning, Permitting, Monitoring	$2,396,168
CM	Care and Maintenance	$7,849,897
Subtotal - Monitoring and C&M		**$10,246,065**
Indirect Costs		
B1	Mobilization/Demobilization	$344,806
B2	Transport Costs	$408,224
B3	Site/Road Maintenance	$796,356
B4	Construction Support	$5,029,776
B5	QA and Project Management	$1,958,293
-	Other Indirects	$6,706,222
-	Contingency (12%)	$4,415,454
Subtotal - Indirect Costs		**$19,659,131**
Cost Inflation		*$3,302,443*
SUB-TOTAL IMPLEMENTATION COSTS		**$51,374,793**
Post-Closure Costs (Undiscounted)		
Direct Costs		
	1 Monitoring	$1,844,567
	2 Water Treatment - Active Treatment	$4,653,957
	3 Passive Treatment	$583,243
	4 Reclamation Maintenance	$1,905,246
	5 Site Maintenance	$1,685,224
	6 Site Management	$4,412,702
	7 Transportation Costs	$1,009,561
Subtotal Direct Costs		**$16,094,502**
Indirect Costs		
	1 Indirects	$2,938,033
	2 Contingency (12%)	$1,949,967
Subtotal - Indirects		**$4,888,000**
SUB-TOTAL - POST-CLOSURE COSTS		*$20,982,501*
POST-CLOSURE NPV		**$15,320,181**
TOTAL FINANCIAL SECURITY		**$66,694,975**

COST SUMMARY - Peak Liability (2022)

WBS	Description of Cost	Proposed Cost
Closure Implementation		
Direct Costs		
A01	Waste Dump	$7,935,918
A02	Overburden Dumps	$472,870
A03	Ore Stockpiles	$3,408,266
A04	Open Pits	$641,203
A05	Underground Openings	$92,291
A06	External Tailings Facilities	$77,263
A07	Roads	$153,441
A08	Demolition	$2,005,083
A09	Surface Infrastructure	$175,792
A10	Water Detention Structures	$840,997
A11	Yards/Laydown Areas	$827,890
A12	Waste Disposal	$461,883
A13	Surface Water Conveyance	$3,417,069
A14	Water Treatment	$574,445
Subtotal - Direct Implementation		**$21,084,411**
Monitoring and C&M		
P	Planning, Permitting, Monitoring	$2,542,030
CM	Care and Maintenance	$7,849,897
Subtotal - Monitoring and C&M		**$10,391,928**
Indirect Costs		
B1	Mobilization/Demobilization	$344,806
B2	Transport Costs	$420,735
B3	Site/Road Maintenance	$832,270
B4	Construction Support	$5,341,188
B5	QA and Project Management	$1,737,427
-	Other Indirects	$7,284,653
-	Contingency (12%)	$4,799,067
Subtotal - Indirect Costs		**$20,760,146**
Cost Inflation		*$5,761,732*
SUB-TOTAL IMPLEMENTATION COSTS		**$57,998,217**
Post-Closure Costs (Undiscounted)		
Direct Costs		
	1 Monitoring	$1,844,567
	2 Water Treatment - Active Treatment	$4,653,957
	3 Passive Treatment	$583,243
	4 Reclamation Maintenance	$1,905,246
	5 Site Maintenance	$1,685,224
	6 Site Management	$4,412,702
	7 Transportation Costs	$1,009,561
Subtotal Direct Costs		**$16,094,502**
Indirect Costs		
	1 Indirects	$2,936,544
	2 Contingency (12%)	$1,950,605
Subtotal - Indirects		**$4,887,149**
SUB-TOTAL - POST-CLOSURE COSTS		*$20,981,651*
POST-CLOSURE NPV		**$14,753,778**
TOTAL FINANCIAL SECURITY		**$72,751,995**

COST SUMMARY - End-of-Mine Liability (2025)

WBS	Description of Cost	Proposed Cost
Closure Implementation		
Direct Costs		
A01	Waste Dump	$6,580,637
A02	Overburden Dumps	$454,219
A03	Ore Stockpiles	$845,436
A04	Open Pits	$641,203
A05	Underground Openings	$92,291
A06	External Tailings Facilities	$77,263
A07	Roads	$153,441
A08	Demolition	$2,005,083
A09	Surface Infrastructure	$175,792
A10	Water Detention Structures	$840,997
A11	Yards/Laydown Areas	$827,890
A12	Waste Disposal	$461,883
A13	Surface Water Conveyance	$3,417,069
A14	Water Treatment	$574,445
Subtotal - Direct Implementation		**$17,147,647**
Monitoring and C&M		
P	Planning, Permitting, Monitoring	$781,816
CM	Care and Maintenance	$3,267,319
Subtotal - Monitoring and C&M		**$4,049,135**
Indirect Costs		
B1	Mobilization/Demobilization	$344,806
B2	Transport Costs	$407,086
B3	Site/Road Maintenance	$796,356
B4	Construction Support	$4,998,665
B5	QA and Project Management	$1,655,893
-	Other Indirects	$5,367,011
-	Contingency (12%)	$3,509,324
Subtotal - Indirect Costs		**$17,079,141**
Cost Inflation		*$4,593,428*
SUB-TOTAL IMPLEMENTATION COSTS		**$42,869,351**
Post-Closure Costs (Undiscounted)		
Direct Costs		
	1 Monitoring	$1,844,567
	2 Water Treatment - Active Treatment	$4,653,957
	3 Passive Treatment	$583,243
	4 Reclamation Maintenance	$1,451,435
	5 Site Maintenance	$1,685,224
	6 Site Management	$4,245,299
	7 Transportation Costs	$1,009,561
Subtotal Direct Costs		**$15,473,287**
Indirect Costs		
	1 Indirects	$2,825,388
	2 Contingency (12%)	$1,875,421
Subtotal - Indirects		**$4,700,809**
SUB-TOTAL - POST-CLOSURE COSTS		*$20,174,097*
POST-CLOSURE NPV		**$14,267,425**
TOTAL FINANCIAL SECURITY		**$57,136,776**

Worksheet 2 - Year 0 Estimate - Cashflow Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

NPV CALCULATION INPUTS

NOTE: Some columns between Years 2042 and 2130 may be hidden for printing purposes.

Short-Term Interest Rate (Interim Care/Implementation Costs)

##	Inflation Rate	Years in effect	Start Year	End Year
1	1.9%	109	2021	2130

Input Parameters

Scenario:	Year 0 Closure	
First year in scenario:	2021	Typically year that the estimate is costed
Closure Year 1:	2025	
Closure Period:	3	yrs
Post-Closure Year 1:	2028	

Long-Term Monitoring/Maintenance NPV Discount Rates

##	Discount Rate	Years in effect	Start Year	End Year
1	0.55%	2	2021	2022
2	1.0%	3	2023	2025
3	1.9%	-	2026	

SCHEDULE

Implementation Schedule

			INTERIM CARE		CLOSURE			POST CLOSURE														
		Closure Year:	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16
	Area	Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Direct Costs	Waste Dumps	100%			60%	40%																
	Overburden Dumps	100%					100%															
	Ore Stockpiles	100%			100%																	
	Open Pits	100%				50%	50%															
	Underground Openings	100%					100%															
	External Tailings Facilities	100%			100%																	
	Roads	100%					100%															
	Demolition	100%			10%	75%	15%															
	Surface Infrastructure	100%			25%	50%	25%															
	Water Detention Structures	100%				50%	50%															
	Yards/Laydown Areas	100%			25%	25%	50%															
	Waste Disposal	100%				11%	75%	3%	3%	3%	6%											
	Surface Water Conveyance	100%			20%	30%	50%															
	Water Treatment	100%					87%					13%										
Indirect	Mobilization-Demobilization	100%			50%		45%					5%										
	Transport Costs	100%			34%	33%	33%															
	Road Maintenance	100%			34%	33%	33%															
	Construction Support	100%			34%	33%	33%															
	QA and Pro. Mgmt.	100%			34%	33%	33%															

Closure Year:	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 37	Year 38	Year 39	Year 40	Year 41	Year 105	Year 106
Area	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Waste Dumps																	
Overburden Dumps																	
Ore Stockpiles																	
Open Pits																	
Underground Openings																	
External Tailings Facilities																	
Roads																	
Demolition																	
Surface Infrastructure																	
Water Detention Structures																	
Yards/Laydown Areas																	
Waste Disposal																	
Surface Water Conveyance																	
Water Treatment																	
Mobilization-Demobilization																	
Transport Costs																	
Road Maintenance																	
Construction Support																	
QA and Pro. Mgmt.																	

Monitoring Schedule

		Set Monitoring/C&M Stage:	1 - Interim	1 - Interim	2 - Active	2 - Active	2 - Active	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2
		Post-Closure Year:	Year -7	Year -6	Year -5	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
		Sum																				
Planning and permitting	Reclamation Research and Planning	100%	50%	50%																		
	Technical Studies and Investigations	100%	50%	50%																		
	Engineering, Design, and Construction Plans	100%	30%	40%	10%	10%	10%															
	Monitoring and Management Plans	100%	50%	50%																		
	Permitting	100%	50%	50%																		
Monitoring	Water Quality Monitoring (surface and groundwater)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Sediment Monitoring		1	1	1	1	1	1		1		1					1					1
	Biological Monitoring		1	1	1	1	1	1		1		1					1					1
	Geotechnical Monitoring		1	1	1	1	1	1	1	1	1	1					1					1
	Revegetation Monitoring				1	1	1	1	1	1	1	1					1					1
	Annual Inspection Reporting		1	1	1	1	1	1	1	1	1	1					1					

Set Monitoring/C&M Stage:										5 - Perpetual							5 - Perpetual
Post-Closure Year:	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 34	Year 35	Year 36	Year 37	Year 38	Year 102	Year 103
Reclamation Research and Planning																	
Technical Studies and Investigations																	
Engineering, Design, and Construction Plans																	
Monitoring and Management Plans																	
Permitting																	
Water Quality Monitoring (surface and groundwater)										1							1
Sediment Monitoring										1							1
Biological Monitoring										1							1
Geotechnical Monitoring										1							1
Revegetation Monitoring										1							1
Annual Inspection Reporting										1							1

Care and Maintenance Schedule

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Water Treatment/Management	Active System		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Passive System							x	x	x	x	x					x					x
Reclamation Maintenance	Revegetation, cover repair, etc.							x	x	x	x	x										
Site Maintenance			x	x	x	x	x	x	x	x	x	x					x					x
On-site Management			x	x	x	x	x	x	x	x	x	x					x					x
Transportation Costs			x	x	x	x	x	x	x	x	x	x					x					

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Active System																	
Passive System										x							x
Reclamation Maintenance										x							x
Site Maintenance										x							x
On-site Management										x							x
Transportation Costs										x							x

UNDISCOUNTED CASH FLOW (TO 100 YEARS POST CLOSURE)

Implementation Costs

					Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16
	Area	Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Direct Costs	Waste Dumps	$7,096,688	27%	$7,096,688	$0	$0	$4,258,013	$2,838,675	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps	$424,256	2%	$424,256	$0	$0	$0	$0	$424,256	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles	$1,835,127	7%	$1,835,127	$0	$0	$1,835,127	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits	$179,036	1%	$179,036	$0	$0	$0	$89,518	$89,518	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings	$59,131	0%	$59,131	$0	$0	$0	$0	$59,131	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities	$232,973	1%	$232,973	$0	$0	$232,973	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads	$153,441	1%	$153,441	$0	$0	$0	$0	$153,441	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition	$1,995,640	7%	$1,995,640	$0	$0	$199,564	$1,496,730	$299,346	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure	$175,792	1%	$175,792	$0	$0	$43,948	$87,896	$43,948	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures	$840,997	3%	$840,997	$0	$0	$0	$420,498	$420,498	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas	$827,890	3%	$827,890	$0	$0	$206,972	$206,972	$413,945	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal	$461,883	2%	$461,883	$0	$0	$0	$50,990	$346,412	$11,953	$11,953	$11,953	$28,622	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance	$3,309,856	12%	$3,309,856	$0	$0	$661,971	$992,957	$1,654,928	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment	$574,445	2%	$574,445	$0	$0	$0	$0	$501,799	$0	$0	$0	$0	$72,646	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization	$344,806	1%	$344,806	$0	$0	$172,403	$0	$154,305	$0	$0	$0	$0	$18,098	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs	$408,224	2%	$408,224	$0	$0	$138,796	$134,714	$134,714	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Site/Road Maintenance	$796,356	3%	$796,356	$0	$0	$270,761	$262,797	$262,797	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support	$5,029,776	19%	$5,029,776	$0	$0	$1,710,124	$1,659,826	$1,659,826	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.	$1,958,293	7%	$1,958,293	$0	$0	$665,820	$646,237	$646,237	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs		**$26,704,609**		$26,704,609	**$0**	**$0**	**$10,396,473**	**$8,887,811**	**$7,265,101**	**$11,953**	**$11,953**	**$11,953**	**$28,622**	**$90,744**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 37	Year 38	Year 39	Year 40	Year 41	Year 105	Year 106
Area	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Waste Dumps	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overburden Dumps	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ore Stockpiles	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Open Pits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Underground Openings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
External Tailings Facilities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Roads	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Demolition	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Surface Infrastructure	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Detention Structures	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Yards/Laydown Areas	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Waste Disposal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Surface Water Conveyance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mobilization-Demobilization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Transport Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Site/Road Maintenance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction Support	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
QA and Pro. Mgmt.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Monitoring Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Planning and	Reclamation Research and Planning	$400,000	9%	$400,000	$200,000	$200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Permitting	Technical Studies and Investigations	$58,500	1%	$58,500	$29,250	$29,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$908,358	21%	$908,358	$272,507	$363,343	$90,836	$90,836	$90,836	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$209,158	5%	$209,158	$104,579	$104,579	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$1,431,082	34%	$1,431,082	$115,778	$115,778	$131,618	$131,618	$131,618	$53,168	$53,168	$53,168	$53,168	$53,168	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129
2		Sediment Monitoring	$68,476	2%	$68,476	$3,604	$3,604	$3,604	$3,604	$3,604	$3,604	$0	$3,604	$0	$3,604	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$3,604
3		Biological Monitoring	$245,928	6%	$245,928	$12,944	$12,944	$12,944	$12,944	$12,944	$12,944	$0	$12,944	$0	$12,944	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$12,944
4		Geotechnical Monitoring	$397,593	9%	$397,593	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$24,387
5		Revegetation Monitoring	$213,780	5%	$213,780	$0	$0	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$11,252
6		Annual Inspection Reporting	$307,860	7%	$307,860	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$25,700
Post Closure Costs Subtotal			**$4,240,735**		$4,240,735	**$754,112**	**$844,947**	**$265,703**	**$265,703**	**$265,703**	**$96,417**	**$79,869**	**$96,417**	**$79,869**	**$96,417**	**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**	**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Reclamation Research and Planning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Technical Studies and Investigations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering, Design, and Construction Plans	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Monitoring and Management Plans	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Quality Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,616	$0	$0	$0	$0	$0	$0	$28,616
Sediment Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$0	$0	$3,604
Biological Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$0	$0	$12,944
Geotechnical Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$0	$0	$24,387
Revegetation Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$0	$0	$11,252
Annual Inspection Reporting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$0	$0	$25,700
Post Closure Costs Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$106,502**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$106,502**

Care and Maintenance Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Water Treatment	Active System	$8,353,198	38%	$8,353,198	$739,848.15	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472
2		Passive System	$583,243	3%	$583,243	$0	$0	$0	$0	$0	$36,453	$36,453	$36,453	$36,453	$36,453	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$36,453
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,905,246	9%	$1,905,246	$0	$0	$0	$0	$0	$381,049	$381,049	$381,049	$381,049	$381,049	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$2,497,136	11%	$2,497,136	$360,956	$360,956	$30,000	$30,000	$30,000	$99,783	$99,783	$99,783	$99,783	$99,783	$0	$0	$0	$0	$99,783	$0	$0	$0	$0	$99,783
5	On-site Management		$7,446,956	34%	$7,446,956	$1,038,240	$1,038,240	$319,258	$319,258	$319,258	$546,716	$546,716	$546,716	$546,716	$546,716	$0	$0	$0	$0	$69,415	$0	$0	$0	$0	$69,415
6	Transportation Costs		$1,314,051	6%	$1,314,051	$152,245	$152,245	$0	$0	$0	$64,947	$64,947	$64,947	$64,947	$64,947	$0	$0	$0	$0	$20,939	$0	$0	$0	$0	$20,939
Post Closure Costs Subtotal			**$22,099,831**		$22,099,831	**$2,291,289**	**$2,291,289**	**$1,089,106**	**$1,089,106**	**$1,089,106**	**$1,868,796**	**$1,868,796**	**$1,868,796**	**$1,868,796**	**$1,868,796**	**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**	**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Active System	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Passive System	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$0	$0	$36,453
Reclamation Maintenance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Site Maintenance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$109,639	$0	$0	$0	$0	$0	$0	$109,639
On-site Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$171,143	$0	$0	$0	$0	$0	$0	$171,143
Transportation Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$71,439	$0	$0	$0	$0	$0	$0	$71,439
Post Closure Costs Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$388,673**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$388,673**

Other Add-on Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Contingency	12% % of above costs	$6,365,421		$6,365,421	$365,448	$376,348	$1,410,154	$1,229,114	$1,034,389	$237,260	$235,274	$237,260	$237,275	$246,715	$14,832	$14,832	$14,832	$14,832	$51,369	$14,832	$14,832	$14,832	$14,832	$51,369
2	Worker's compensation	0% (Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	1.5% % of above labour costs	$223,345.29		$223,345	$12,823	$13,205	$49,478	$43,126	$36,294	$8,325	$8,255	$8,325	$8,325	$8,657	$520	$520	$520	$520	$1,802	$520	$520	$520	$520	$1,802
4	Bonding	3% % of Implem. & C&M costs	$1,464,133.21		$1,464,133	$68,738.68	$68,739	$344,567	$299,308	$250,626	$56,422	$56,422	$56,422	$56,923	$58,786	$2,864	$2,864	$2,864	$2,864	$9,662	$2,864	$2,864	$2,864	$2,864	$9,662
5	Contractor Profit	10% % of above costs	$5,304,518		$5,304,518	$304,540	$313,624	$1,175,128	$1,024,262	$861,991	$197,717	$196,062	$197,717	$197,729	$205,596	$12,360	$12,360	$12,360	$12,360	$42,808	$12,360	$12,360	$12,360	$12,360	$42,808
6	Contract Administration	5% % of above costs	$2,652,259		$2,652,259	$152,270	$156,812	$587,564	$512,131	$430,996	$98,858	$98,031	$98,858	$98,864	$102,798	$6,180	$6,180	$6,180	$6,180	$21,404	$6,180	$6,180	$6,180	$6,180	$21,404
Other Add-On Costs Subtotal			**$16,009,676**		$16,009,676	**$903,819**	**$928,728**	**$3,566,892**	**$3,107,941**	**$2,614,296**	**$598,582**	**$594,045**	**$598,582**	**$599,116**	**$622,551**	**$36,757**	**$36,757**	**$36,757**	**$36,757**	**$127,044**	**$36,757**	**$36,757**	**$36,757**	**$36,757**	**$127,044**
TOTAL			**$69,054,851**		$69,054,851	**$3,949,220**	**$4,064,964**	**$15,318,174**	**$13,350,561**	**$11,234,206**	**$2,575,748**	**$2,554,663**	**$2,575,748**	**$2,576,403**	**$2,678,508**	**$160,357**	**$160,357**	**$160,357**	**$160,357**	**$555,120**	**$160,357**	**$160,357**	**$160,357**	**$160,357**	**$555,120**

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
Contingency	$0	$0	$0	$0	$0	$0	$0	$0	$0	$59,421	$0	$0	$0	$0	$0	$0	$59,421
Worker's compensation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Insurance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,085	$0	$0	$0	$0	$0	$0	$2,085
Bonding	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,660	$0	$0	$0	$0	$0	$0	$11,660
Contractor Profit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,518	$0	$0	$0	$0	$0	$0	$49,518
Contract Administration	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,759	$0	$0	$0	$0	$0	$0	$24,759
Other Add-On Costs Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$147,443**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$147,443**
TOTAL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$642,618**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$642,618**

INFLATION FACTORED INTERIM CARE AND CLOSURE IMPLEMENTATION COSTS

	Area		Present Value	% of Total	Future Value	Year -4 2021	Year -3 2022	Year -2 2023	Year -1 2024	Year 1 2025	Year 2 2026	Year 3 2027	Year 4 2028	Year 5 2029	Year 6 2030	Year 7 2031	Year 8 2032	Year 9 2033	Year 10 2034	Year 11 2035	Year 12 2036	Year 13 2037	Year 14 2038	Year 15 2039	Year 16 2040	Year 17 2041	Year 18 2042	Year 19 2043	Year 20 2044	Year 21 2045	Year 22 2046	Year 23 2047	Year 24 2048	Year 25 2049	Year 26 2050	Year 37 2061	Year 38 2062	Year 39 2063	Year 40 2064	Year 41 2065	Year 105 2129	Year 106 2130
Direct Costs	Waste Dumps		$7,096,688	27%	$7,566,002	$0	$0	$4,505,360	$3,060,641	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps		$424,256	2%	$466,121	$0	$0	$0	$0	$466,121	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles		$1,835,127	7%	$1,941,730	$0	$0	$1,941,730	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits		$179,036	1%	$194,870	$0	$0	$0	$96,518	$98,352	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings		$59,131	0%	$64,966	$0	$0	$0	$0	$64,966	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities		$232,973	1%	$246,506	$0	$0	$246,506	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads		$153,441	1%	$168,583	$0	$0	$0	$0	$168,583	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition		$1,995,640	7%	$2,153,806	$0	$0	$211,157	$1,613,765	$328,885	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure		$175,792	1%	$189,554	$0	$0	$46,501	$94,769	$48,285	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures		$840,997	3%	$915,371	$0	$0	$0	$453,379	$461,993	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas		$827,890	3%	$896,944	$0	$0	$218,995	$223,156	$454,793	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal		$461,883	2%	$510,391	$0	$0	$0	$54,977	$380,596	$13,382	$13,636	$13,895	$33,906	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance		$3,309,856	12%	$3,589,260	$0	$0	$700,425	$1,070,600	$1,818,235	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment		$574,445	2%	$639,006	$0	$0	$0	$0	$551,316	$0	$0	$0	$0	$87,690	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization		$344,806	1%	$373,796	$0	$0	$182,418	$0	$169,532	$0	$0	$0	$0	$21,846	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs		$408,224	2%	$440,114	$0	$0	$146,859	$145,248	$148,008	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Road Maintenance		$796,356	3%	$858,566	$0	$0	$286,489	$283,346	$288,730	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support		$5,029,776	19%	$5,422,695	$0	$0	$1,809,465	$1,789,614	$1,823,616	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.		$1,958,293	7%	$2,111,272	$0	$0	$704,497	$696,768	$710,007	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs			**$26,704,609**		**$28,749,554**	**$0**	**$0**	**$11,000,402**	**$9,582,780**	**$7,982,016**	**$13,382**	**$13,636**	**$13,895**	**$33,906**	**$109,536**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Monitoring Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
1	Planning and permitting	Reclamation Research and Planning	$400,000	9%	$411,472	$203,800	$207,672	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Technical Studies and Investigations	$58,500	1%	$60,178	$29,806	$30,372	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$908,358	21%	$948,817	$277,685	$377,281	$96,112	$97,939	$99,799	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$209,158	5%	$215,157	$106,566	$108,591	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$626,411	15%	$663,978	$117,978	$120,220	$139,264	$141,910	$144,606	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Sediment Monitoring	$18,020	0%	$19,074	$3,672	$3,742	$3,813	$3,886	$3,960	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Biological Monitoring	$64,718	2%	$68,502	$13,190	$13,440	$13,695	$13,956	$14,221	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Geotechnical Monitoring	$64,668	2%	$68,449	$13,179	$13,430	$13,685	$13,945	$14,210	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Revegetation Monitoring	$33,755	1%	$36,399	$0	$0	$11,905	$12,131	$12,362	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6		Annual Inspection Reporting	$12,580	0%	$13,315	$2,564	$2,613	$2,662	$2,713	$2,764	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			**$2,396,168**		**$2,505,339**	**$768,440**	**$877,361**	**$281,137**	**$286,479**	**$291,922**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Care and Maintenance Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
1	Water Treatment	Active System	$3,699,241	17%	$3,915,516	$753,905	$768,229	$782,826	$797,700	$812,856	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$811,912	4%	$839,666	$367,814	$374,803	$31,743	$32,346	$32,960	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	On-site Management		$3,034,254	14%	$3,168,823	$1,057,967	$1,078,068	$337,804	$344,222	$350,762	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Transportation Costs		$304,490	1%	$313,223	$155,138	$158,085	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			**$7,849,897**		$8,237,227	**$2,334,824**	**$2,379,185**	**$1,152,372**	**$1,174,267**	**$1,196,578**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Other Add-on Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
1	Contingency	12% % of above costs	$4,415,454		$4,716,932	$372,392	$390,786	$1,492,069	$1,325,223	$1,136,462	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Worker's compensation	0% (Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$154,926		$165,504	$13,066	$13,712	$52,353	$46,498	$39,875	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Bonding	3% % of Implem. & C&M costs	$1,031,978		$1,104,073	$70,045	$71,376	$364,583	$322,711	$275,358	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	Contractor Profit	10% % of above costs	$3,679,545		$3,930,776	$310,326	$325,655	$1,243,391	$1,104,353	$947,052	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Contract Administration	5% % of above costs	$1,839,772		$1,965,388	$155,163	$162,827	$621,696	$552,176	$473,526	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Add-On Costs Subtotal			**$11,121,676**		$11,882,673	**$920,992**	**$964,355**	**$3,774,092**	**$3,350,962**	**$2,872,273**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL			**$48,072,350**		**$51,374,793**	**$4,024,256**	**$4,220,900**	**$16,208,004**	**$14,394,489**	**$12,342,789**	**$13,382**	**$13,636**	**$13,895**	**$33,906**	**$109,536**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

NET PRESENT VALUE CALCULATIONS - LONG TERM MONITORING AND MAINTENANCE

Monitoring Costs

			Undiscounted	% of Total	NPV - 2021	Year -4 2021	Year -3 2022	Year -2 2023	Year -1 2024	Year 1 2025	Year 2 2026	Year 3 2027	Year 4 2028	Year 5 2029	Year 6 2030	Year 7 2031	Year 8 2032	Year 9 2033	Year 10 2034	Year 11 2035	Year 12 2036	Year 13 2037	Year 14 2038	Year 15 2039	Year 16 2040	Year 17 2041	Year 18 2042	Year 19 2043	Year 20 2044	Year 21 2045	Year 22 2046	Year 23 2047	Year 24 2048	Year 25 2049	Year 26 2050	Year 37 2061	Year 38 2062	Year 39 2063	Year 40 2064	Year 41 2065	Year 105 2129	Year 106 2130
1	Monitoring	Water Quality Monitoring	$804,671	19%	$544,856						$50,090	$49,156	$48,239	$47,340	$46,457	$24,120	$23,670	$23,229	$22,796	$22,371	$21,953	$21,544	$21,142	$20,748	$20,361	$0	$0	$0	$0	$0	$0	$0	$0	$0	$17,160	$0	$0	$0	$0	$0	$0	$3,807
2		Sediment Monitoring	$50,456	1%	$25,571						$3,395	$0	$3,270	$0	$3,149	$0	$0	$0	$0	$2,866	$0	$0	$0	$0	$2,609	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,161	$0	$0	$0	$0	$0	$0	$479
3		Biological Monitoring	$181,210	4%	$91,838						$12,194	$0	$11,744	$0	$11,310	$0	$0	$0	$0	$10,294	$0	$0	$0	$0	$9,369	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,762	$0	$0	$0	$0	$0	$0	$1,722
4		Geotechnical Monitoring	$332,925	8%	$165,316						$12,185	$11,958	$11,735	$11,516	$11,301	$0	$0	$0	$0	$19,395	$0	$0	$0	$0	$17,653	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,624	$0	$0	$0	$0	$0	$0	$3,244
5		Revegetation Monitoring	$180,026	4%	$100,254						$10,600	$10,402	$10,209	$10,018	$9,831	$0	$0	$0	$0	$8,948	$0	$0	$0	$0	$8,145	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,747	$0	$0	$0	$0	$0	$0	$1,497
6		Annual Inspection Reporting	$295,280	7%	$123,780						$2,370	$2,326	$2,283	$2,240	$2,198	$0	$0	$0	$0	$20,439	$0	$0	$0	$0	$18,603	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,412	$0	$0	$0	$0	$0	$0	$3,419
Post Closure Costs Subtotal			**$1,844,567**		**$1,051,614**	**$0**	**$0**	**$0**	**$0**	**$0**	**$90,835**	**$73,842**	**$87,479**	**$71,114**	**$84,247**	**$24,120**	**$23,670**	**$23,229**	**$22,796**	**$84,313**	**$21,953**	**$21,544**	**$21,142**	**$20,748**	**$76,741**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$63,867**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$14,169**

Care and Maintenance Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
1	Water Treatment	Active System	$4,653,957	21%	$4,110,769						$697,012	$684,016	$671,262	$658,745	$646,463	$81,866	$80,339	$78,841	$77,371	$75,928	$74,513	$73,123	$71,760	$70,422	$69,109	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$583,243	3%	$324,800						$34,342	$33,702	$33,073	$32,457	$31,852	$0	$0	$0	$0	$28,991	$0	$0	$0	$0	$26,387	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,860	$0	$0	$0	$0	$0	$0	$4,850
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,905,246	9%	$1,729,235						$358,987	$352,293	$345,725	$339,278	$332,952	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$1,685,224	8%	$917,197						$94,005	$92,252	$90,532	$88,844	$87,188	$0	$0	$0	$0	$79,357	$0	$0	$0	$0	$72,229	$0	$0	$0	$0	$0	$0	$0	$0	$0	$65,748	$0	$0	$0	$0	$0	$0	$14,586
5	On-site Management		$4,412,702	20%	$3,074,758						$515,062	$505,458	$496,034	$486,785	$477,708	$0	$0	$0	$0	$55,206	$0	$0	$0	$0	$50,247	$0	$0	$0	$0	$0	$0	$0	$0	$0	$102,631	$0	$0	$0	$0	$0	$0	$22,769
6	Transportation Costs		$1,009,561	5%	$530,353						$61,187	$60,046	$58,926	$57,827	$56,749	$0	$0	$0	$0	$16,652	$0	$0	$0	$0	$15,157	$0	$0	$0	$0	$0	$0	$0	$0	$0	$42,840	$0	$0	$0	$0	$0	$0	$9,504
Post Closure Costs Subtotal			**$14,249,934**		$10,687,112	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,760,595**	**$1,727,767**	**$1,695,552**	**$1,663,937**	**$1,632,912**	**$81,866**	**$80,339**	**$78,841**	**$77,371**	**$256,134**	**$74,513**	**$73,123**	**$71,760**	**$70,422**	**$233,129**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$233,078**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$51,709**

Other Add-on Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2061	2062	2063	2064	2065	2129	2130
1	Contingency	12% % of above costs	$1,949,967		$1,425,199						$223,523	$217,519	$215,265	$211,264	$215,574	$12,718	$12,481	$12,248	$12,020	$40,854	$11,576	$11,360	$11,148	$10,940	$37,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$35,633	$0	$0	$0	$0	$0	$0	$7,905
2	Worker's compensation	0% (Included in labour rates)	$0		$0						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$68,419		$50,006						$7,843	$7,632	$7,553	$7,413	$7,564	$446	$438	$430	$422	$1,433	$406	$399	$391	$384	$1,305	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,250	$0	$0	$0	$0	$0	$0	$277
4	Bonding	3% % of Implem. & C&M costs	$432,155		$324,751						$53,156	$52,165	$51,192	$50,683	$51,366	$2,456	$2,410	$2,365	$2,321	$7,684	$2,235	$2,194	$2,153	$2,113	$6,994	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,992	$0	$0	$0	$0	$0	$0	$1,551
5	Contractor Profit	10% % of above costs	$1,624,973		$1,187,666						$186,269	$181,266	$179,388	$176,054	$179,645	$10,599	$10,401	$10,207	$10,017	$34,045	$9,647	$9,467	$9,290	$9,117	$30,987	$0	$0	$0	$0	$0	$0	$0	$0	$0	$29,695	$0	$0	$0	$0	$0	$0	$6,588
6	Contract Administration	5% % of above costs	$812,486		$593,833						$93,135	$90,633	$89,694	$88,027	$89,822	$5,299	$5,200	$5,103	$5,008	$17,022	$4,823	$4,733	$4,645	$4,559	$15,493	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,847	$0	$0	$0	$0	$0	$0	$3,294
Other Add-On Costs Subtotal			**$4,888,000**		$3,581,455	**$0**	**$0**	**$0**	**$0**	**$0**	**$563,925**	**$549,215**	**$543,091**	**$533,440**	**$543,971**	**$31,518**	**$30,931**	**$30,354**	**$29,788**	**$101,038**	**$28,687**	**$28,153**	**$27,628**	**$27,112**	**$91,963**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$88,418**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$19,616**
TOTAL			**$20,982,501**		**$15,320,181**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,415,354**	**$2,350,824**	**$2,326,122**	**$2,268,491**	**$2,261,130**	**$137,504**	**$134,940**	**$132,424**	**$129,955**	**$441,485**	**$125,154**	**$122,820**	**$120,530**	**$118,283**	**$401,833**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$385,363**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$85,494**
GRAND-TOTAL					**$66,694,975**	**$4,024,256**	**$4,220,900**	**$16,208,004**	**$14,394,489**	**$12,342,789**	**$2,428,736**	**$2,364,461**	**$2,340,017**	**$2,302,397**	**$2,370,666**	**$137,504**	**$134,940**	**$132,424**	**$129,955**	**$441,485**	**$125,154**	**$122,820**	**$120,530**	**$118,283**	**$401,833**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$385,363**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$85,494**

Worksheet 3 - Year 0 Estimate - Annual C&M Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY

srk consulting

Summary of Annual Care and Maintenance Costs

		Annual Cost Per Phase							Number of Years				
		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	n/a	Total Cost	1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual
1	Active Water Treatment System	$739,848	$739,848	$739,848	$95,472	$0	$0	$8,353,198	2	3	5	10	0
2	Passive Treatment System	$0	$0	$36,453	$36,453	$36,453	$0	$583,243	2	3	5	2	9
3	Reclamation Maintenance	$0	$0	$381,049	$0	$0	$0	$1,905,246	2	3	5	2	9
4	Site Maintenance	$360,956	$30,000	$99,783	$99,783	$109,639	$0	$2,497,136	2	3	5	2	9
5	On-site Management	$1,038,240	$319,258	$546,716	$69,415	$171,143	$0	$7,446,956	2	3	5	2	9
6	Transportation Costs	$152,245	$0	$64,947	$20,939	$71,439	$0	$1,314,051	2	3	5	2	9

NOTES:
1. This table is used as a check to the NPV calculation spreadsheet.

Phase 1 - Annual Care & Maintenance Costs - Prior to Closure

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S1.1	**Water Treatment**															**$739,848**	
S1.1.1	*Active Treatment System*														$739,848		
S1.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S1.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S1.2	**Onsite Management**															**$1,038,240**	
S1.2.1	*Field Support Staff*														$693,929		
S1.2.1.1		Mine Manager		4	months	360	site working hours per month			$25,631				$89,709			(Notes: staffing costs include cross-shifts)
S1.2.1.2		Office/Camp manager		6	months	360	site working hours per month			$23,201				$139,203			
S1.2.1.3		Administrative Assistants/HR/Accounting		0	months	360	site working hours per month			$18,296				$0			
S1.2.1.4		Water Treatment Staff Operator		5	months	360	site working hours per month			$19,438				$97,192			
S1.2.1.5		Environmental/Safety Manager		4	months	360	site working hours per month			$23,201				$92,802			
S1.2.1.6		Environmental Technicians		7	months	360	site working hours per month			$15,985				$103,906			
S1.2.1.7		Mechanic		2	months	360	site working hours per month			$0				$0			Included in equipment rates
S1.2.1.8		Tradesmen		2	months	360	site working hours per month			$19,438				$43,736			
S1.2.1.9		General Labour/helpers		10	months	360	site working hours per month			$13,409				$127,381			
S1.2.2	*Field support Vehicles*														$121,111		
S1.2.2.1		Pick-up trucks (3 required)		12	months					$4,875				$58,495			
S1.2.2.2		Mechanic service vehicle		2	months					$0				$0			Included in equipment rates
S1.2.2.3		Emergency transport vehicle		12	months					$5,218				$62,616			
S1.2.3	*Field Support Equipment/Supplies*														$223,200		
S1.2.3.1		Office supplies		12	months					$1,000				$12,000			
S1.2.3.2		Communications		12	months					$1,000				$12,000			
S1.2.3.3		Misc. supplies		12	months					$500				$6,000			
S1.2.3		Camp Operation		1,890	man-days					$80				$151,200			
S1.2.3		Power, heat, fuel		12	months					$3,500				$42,000			
S1.3	**Site Maintenance**														$360,956	**$360,956**	
S1.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S1.3.2		Road Maintenance	Grader (assume 80 hrs/month)	1	ls	960		$46	$102	$148	$0	$44,108	$97,851	$141,959			Operator cost included in Field support staff
S1.3.3		Earthwork Repair allowance (assume 40 hrs per month)		1	ls	480	$0	$137	$352	$352			$168,997	$168,997			Task Code C.2.14
S1.3.4		Sundry equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S1.4	**Transportation Costs**														$152,245	**$152,245**	
S1.4.1		Barge Operations		5	months					$10,939				$54,693			
S1.4.2		Staffing Bus trips during barge operation period		20	ea					$678				$13,552			One per week
S1.4.3		Air transport and airstrip operations		8	flights					$3,000				$24,000			One flight per week
S1.4.4		Helicopter transport		20	flights					$3,000				$60,000			One flight per week
TOTAL														**$2,291,289**	**$2,291,289**	**$2,291,289**	

Phase 2 - Annual Care & Maintenance Costs During Active Closure

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S2.1	**Water Treatment**															**$739,848**	
S2.1.1	*Active Treatment System*														$739,848		
S2.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S2.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S2.2	**Onsite Management**															**$319,258**	
S2.2.1	*Field Support Staff*														$253,936		
S2.2.1.1		Water Treatment Staff Operator		5	months	360	site working hours per month			$19,438				$97,192			
S2.2.1.2		Environmental/Safety Manager		4	months	360	site working hours per month			$23,201				$92,802			
S2.2.1.3		Environmental Technicians		4	months	360	site working hours per month			$15,985				$63,942			
S2.2.2	*Field support Vehicles*														$34,122		
S2.2.2.1		Pick-up trucks (1 required)		7	months					$4,875				$34,122			
S2.2.3	*Field Support Equipment/Supplies*														$31,200		
S2.2.3.1		Camp Operation		390	man-days					$80				$31,200			
S2.3	**Site Maintenance**														$30,000	**$30,000**	
S2.3.1		Pumping equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S2.4	**Transportation Costs**														$0	**$0**	
S2.4.1		Barge Operations		0	months					$10,939				$0			Included in construction indirect costs
TOTAL														**$1,089,106**	**$1,089,106**	**$1,089,106**	

Phase 3 - Annual Care & Maintenance Costs - Post Closure I

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S3.1	**Water Treatment**															**$776,301**	
S3.1.1	*Active Treatment System*														$739,848		
S3.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S3.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S3.1.1	*Passive Treatment System*														$36,453		
S3.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S3.2	**Onsite Management**															**$546,716**	
S3.2.1	*Field Support Staff*														$334,708		
S3.2.1.1		Mine Manager		3	months	360	site working hours per month			$25,631				$64,078			(Notes: staffing costs include cross-shifts)
S3.2.1.2		Office/Camp manager		3	months	360	site working hours per month			$23,201				$69,602			
S3.2.1.3		Administrative Assistants/HR/Accounting		0	months	360	site working hours per month			$18,296				$0			
S3.2.1.4		Water Treatment Staff Operator		2	months	360	site working hours per month			$19,438				$34,017			
S3.2.1.5		Environmental/Safety Manager		3	months	360	site working hours per month			$23,201				$58,001			
S3.2.1.6		Environmental Technicians		3	months	360	site working hours per month			$15,985				$39,964			
S3.2.1.7		Mechanic		2	months	360	site working hours per month			$0				$0			Included in equipment rates
S3.2.1.8		Tradesmen		2	months	360	site working hours per month			$19,438				$38,877			
S3.2.1.9		General Labour/helpers		2	months	360	site working hours per month			$13,409				$30,169			
S3.2.2	*Field support Vehicles*														$99,209		
S3.2.2.1		Pick-up trucks (3 required)		15	months					$4,875				$73,119			
S3.2.2.2		Mechanic service vehicle		2	months					$0				$0			Included in equipment rates
S3.2.2.3		Emergency transport vehicle		5	months					$5,218				$26,090			
S3.2.3	*Field Support Equipment/Supplies*														$112,800		
S3.2.3.1		Office supplies		5	months					$1,000				$5,000			
S3.2.3.2		Communications		5	months					$1,000				$5,000			
S3.2.3.3		Misc. supplies		5	months					$500				$2,500			
S3.2.3		Camp Operation		1,035	man-days					$80				$82,800			
S3.2.3		Power, heat, fuel		5	months					$3,500				$17,500			
S3.3	**Reclamation Maintenance**															**$381,049**	
S3.3.1	*Cover repairs*														$331,292		
S3.3.1.1		Cover Repair allowance	Load, haul, dump, spread (spoil lo	2%	of total	1,281,867	m3 of cover required replacement at:			$5.53	/m3			$141,718			Assumes 10% of area reseeded over 5 yr PC1 perioc
S3.3.1.2			Seed/Fertilize: broadcast seeding	64	ha					$2,957.77	/ha			$189,573			
S3.3.2.1	*Revegetation*														$49,758		
S3.3.2.2		Reseeding allowance	Seed/Fertilize: broadcast seeding	5%	of total	336	ha requires reseeding at			$2,957.77	/ha			$49,758			Assumes 25% of area reseeded over 5 yr PC1 perioc
S3.3	**Site Maintenance**														$99,783	**$99,783**	
S3.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S3.3.2		Road Maintenance	Grader (assume 40 hrs/month)	1	ls	200		$46	$102	$148	$0	$9,189	$20,386	$29,575			Operator cost included in Field support staff
S3.3.3		Earthwork Repair allowance (assume 20 hrs per month)		1	ls	100	$0	$137	$352	$352			$35,208	$35,208			Task Code C.2.14
S3.3.4		Sundry equipment/consumables allowance		1	ls					$15,000				$15,000			Allowance for pump maintenance/fuel etc.
S3.4	**Transportation Costs**														$64,947	**$64,947**	
S3.4.1		Barge Operations		3	months					$10,939				$32,816			
S3.4.2		Staffing Bus trips during barge operation period		12	ea					$678				$8,131			One per week
S3.4.3		Air transport and airstrip operations		8	flights					$3,000				$24,000			One flights per week
TOTAL														**$1,868,796**	**$1,868,796**	**$1,868,796**	

Phase 4 - Annual Care & Maintenance Costs - Post Closure II

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S4.1	**Water Treatment**															**$131,924**	
S4.1.1	*Active Treatment System*														$95,472		
S4.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S4.1.1	*Passive Treatment System*														$36,453		
S4.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S4.2	**Onsite Management**															**$69,415**	
S4.2.1	*Field Support Staff*														$38,848		
S4.2.1.1		Project Manager		0.5	months	360	site working hours per month			$25,631				$12,816			(Notes: staffing costs include cross-shifts)
S4.2.1.2		Passive Treatment specialist		0.5	months	360	site working hours per month			$45,360				$22,680			
S4.2.1.3		Mechanic		0.5	months	360	site working hours per month			$0				$0			Included in equipment rates
S4.2.1.4		General Labour/helpers		0.3	months	360	site working hours per month			$13,409				$3,352			
S4.2.2	*Field support Vehicles*														$14,967		
S4.2.2.1		Pick-up trucks (2 required)		2.0	months					$4,875				$9,749			
S4.2.2.2		Mechanic service vehicle		0.5	months					$0				$0			Included in equipment rates
S4.2.2.3		Emergency transport vehicle		1.0	months					$5,218				$5,218			
S4.2.3	*Field Support Equipment/Supplies*														$15,600		
S4.2.3.1		Office supplies		1	months					$1,000				$1,000			
S4.2.3.2		Communications		1	months					$1,000				$1,000			
S4.2.3.3		Misc. supplies		1	months					$500				$500			
S4.2.3		Camp Operation		120	man-days					$80				$9,600			
S4.2.3		Power, heat, fuel		1	months					$3,500				$3,500			
S4.3	**Reclamation Maintenance**															**$0**	
S4.3.1	*Cover repairs*														$0		
S4.3.2	*Revegetation*														$0		
S4.3	**Site Maintenance**														$29,999	**$29,999**	
S4.3.1		Equipment Maintenance (parts, supplies)		1	ls		$10,000							$10,000			Labour included in field support staff
S4.3.2		Road Maintenance	Grader (assume 20 hrs/month)	1	ls	20		$46	$102	$148	$0	$919	$2,039	$2,957			Operator cost included in Field support staff
S4.3.3		Earthwork Repair allowance (assume 20 hrs per month)		1	ls	20	$0	$137	$352	$352			$7,042	$7,042			Task Code C.2.14
S4.3.4		Sundry equipment/consumables allowance		1	ls					$10,000				$10,000			Allowance for pump maintenance/fuel etc.
S4.4	**Transportation Costs**														$20,939	**$20,939**	
S4.4.1		Barge Operations		1	months					$10,939				$10,939			
S4.4.2		Staffing Bus trips during barge operation period		0	ea					$678				$0			Pick-up trucks used (time included in labour rate)
S4.4.3		Barge mob/demob		1	LS					$10,000				$10,000			
TOTAL														**$252,277**	**$252,277**	**$252,277**	

Phase 5 - Perpetual Care & Maintenance Event Year Annual Costs

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S5.1	**Water Treatment**															**$36,453**	
S5.1.1	*Passive Treatment System*														$36,453		
S5.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S5.2	**Onsite Management**															**$171,143**	
S5.2.1	*Field Support Staff*														$126,520		
S5.2.1.1		Project Manager		1.0	months	360	site working hours per month			$25,631				$25,631			(Notes: staffing costs include cross-shifts)
S5.2.1.2		Passive Treatment specialist		1.0	months	360	site working hours per month			$45,360				$45,360			
S5.2.1.3		Site Engineer		1.0	months	360	site working hours per month			$42,120				$42,120			
S5.2.1.4		HD mechanic		0.5	months	360	site working hours per month			$0				$0			Included in equipment rates
S5.2.1.5		General Labour/helpers		1.0	months	360	site working hours per month			$13,409				$13,409			
S5.2.2	*Field support Vehicles*														$14,624		
S5.2.2.1		Pick-up trucks (3 required)		3	months					$4,875				$14,624			
S5.2.2.2		Mechanic service vehicle		1	months					$0				$0			Included in equipment rates
S5.2.3	*Field Support Equipment/Supplies*														$30,000		
S5.2.3.1		Office supplies		1	months					$1,000				$1,000			
S5.2.3.2		Communications		1	months					$1,000				$1,000			
S5.2.3.3		Misc. supplies		1	months					$500				$500			
S5.2.3.4		Camp Operation		300	man-days					$80				$24,000			
S5.2.3.5		Power, heat, fuel		1	months					$3,500				$3,500			
S5.3	**Reclamation Maintenance**															**$0**	
S5.4	**Site Maintenance**														$109,639	**$109,639**	
S5.4.1		Grader Maintenance	Grader (assume 2 weeks, 10hrs/d	1	ls	140		$46	$102	$148	$0	$6,432	$14,270	$20,702			Operator cost included in Field support staff
S5.4.2		Earthwork Repair allowance (assume 3 weeks, 10hrs/day)		1	ls	210	$0	$137	$352	$352			$73,936	$73,936			Task Code C.2.14
S5.4.3		Big Creek Bridge - Capital replacement allowance		1	ls					$15,000				$15,000			Allowance for supplies, pumping, etc.
S5.4.4		Sundry allowance		1	ls					$2,500				$2,500			Allowance for supplies, pumping, etc.
S5.5	**Transportation Costs**														$71,439	**$71,439**	
S5.5.1		Barge Operations		1	months					$10,939				$10,939			
S5.5.2		Barge mobilization/demob and set up		1	ls					$10,000				$10,000			assumed
S5.5.3		Camp Mob/demob		1	ls					$10,000				$10,000			assumed
S5.5.4		Equipment mobilization and demobilization		2	ls					$20,250				$40,500.14			See details on 'mob-demob 'worksheet
TOTAL														**$391,173**	**$388,673**	**$388,673**	

Worksheet 4 - Year 0 Estimate - Implementation Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY
srk consulting

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
DIRECT COSTS																					
A1	**Waste Dumps**																			**$7,096,688**	
A1.1	*Main Waste Dump (inc. MWDE and Wrap)*																		$1,132,891		Does not include MWD Wrap
A1.1.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	308	hrs	C.2.13	308	$45.95	$14,156	$213.35	$65,734	$69.10	21,505	$21,290	$0.00	$0	$328.40	$101,181			
A1.1.1.2			Slopes: Re-grade to 3H:1V	225	hrs	C.2.13	225	$45.95	$10,355	$213.35	$48,082	$69.10	15,730	$15,573	$0.00	$0	$328.40	$74,010			
A1.1.2.1		Cover	Flat area cover material: Load, haul, dump spread	87,898	Cm3	R.050	1,639.8	$0.85	$74,771	$2.76	$242,538	$0.91	80,454	$79,649	$0.00	$0	$4.52	$396,958			
A1.1.2.2			Slope area cover material: Load, haul, dump along crest	67,134	Cm3	R.051	1,095.9	$0.74	$49,915	$2.43	$163,066	$0.82	55,695	$55,138	$0.00	$0	$3.99	$268,119			
A1.1.2.3			Slope area cover material: Spread down slope	50	hrs	C.2.13	49.9	$45.95	$2,294	$213.35	$10,653	$69.10	3,485	$3,450	$0.00	$0	$328.40	$16,397			
A1.1.3.1		Revegetate	Seed/Fertilize: tractor application	40	ha	C.6.01	1,324.7	$1,069.47	$42,767	$556.88	$22,269	$240.22	9,703	$9,606	$1,091.19	$43,636	$2,958	$118,278			
A1.1.3.2			Tree seedling application (1,000 stems/ha)	50	ha	C.6.06	2,561.8	$1,919.72	$95,960	$35.26	$1,763	$15.47	781	$773	$1,189.36	$59,451	$3,160	$157,947			
A1.2	*Southwest Dump (excluding high grade waste area)*																		$873,709		
A1.2.1		Re-grade	Slopes: Re-grade remaining to 3H:1V	39	hrs	C.2.13	39.2	$45.95	$1,798.85	$213.35	$8,353	$69.10	2,733	$2,705.42	$0.00	$0.00	$328.40	$12,857			
A1.2.2		Cover	Load, haul, dump spread	126,276	m3	R.059	2,198.4	$0.79	$100,304.11	$2.58	$326,048	$0.84	107,311	$106,238.11	$0.00	$0.00	$4.22	$532,591			
A1.2.3.1		Revegetate	Seed/Fertilize: tractor application	43.93	ha	C.6.01	1,455.4	$1,069.47	$46,985.43	$556.88	$24,466	$240.22	10,660	$10,553.85	$1,091.19	$47,939.82	$2,957.77	$129,945			
A1.2.3.2			Tree seedling application (1,000 stems/ha)	62.76	ha	C.6.06	3,216.6	$1,919.72	$120,485.89	$35.26	$2,213	$15.47	981	$970.85	$1,189.36	$74,646.37	$3,159.81	$198,316			
A1.3	*Southwest Dump High-Grade Waste*																		$176,103		
A1.3.1.1		Relocate High-grade waste	Load, haul, dump, spread in pit (below long-term water elevation)	22,856	Bm3	R.069	344.0	$0.69	$15,676.33	$2.25	$51,398	$0.76	17,483	$17,307.86	$0.00	$0.00	$3.69	$84,382			Assumes 50% has been relocated due to the uncertainty as to
A1.3.2.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	31	hrs	C.2.13	31.1	$45.95	$1,426.78	$213.35	$6,625	$69.10	2,168	$2,145.84	$0.00	$0.00	$328.40	$10,198			
A1.3.3.1		Cover	Flat area cover material: Load, haul, dump spread	15,583	Cm3	R.060	257.8	$0.75	$11,762.85	$2.45	$38,236	$0.80	12,585	$12,458.74	$0.00	$0.00	$4.01	$62,458			
A1.3.4.1		Revegetate	Seed/Fertilize: broadcast seeding	3.12	ha	C.6.01	103.2	$1,069.47	$3,333.00	$556.88	$1,736	$240.22	756	$748.66	$1,091.19	$3,400.70	$2,957.77	$9,218			
A1.3.4.2			Tree seedling application (1,000 stems/ha)	3.12	ha	C.6.06	159.7	$1,919.72	$5,982.82	$35.26	$110	$15.47	49	$48.21	$1,189.36	$3,706.62	$3,159.81	$9,848			
A1.4	*Main Pit SAT*																		$3,909,864		
A1.4.1.1		Relocate SAT below water	Load, haul, dump, spread in pit	1,040,000	Cm3	R.012	17,781.5	$0.78	$812,732.25	$1.61	$1,677,117	$0.53	555,290	$549,736.96	$0.00	$0.00	$2.92	$3,039,586			
A1.4.1.2			Allowance for additional SAT material from SAT Dump	30,000	Cm3	R.012	512.9	$0.78	$23,444.20	$1.61	$48,378	$0.53	16,018	$15,857.80	$0.00	$0.00	$2.92	$87,680			
A1.4.2.1		Backfill SAT Excavation	Load, haul, dump WR to form buttress below MPD	245,000	Cm3	R.013	3,226.9	$0.60	$147,360.45	$1.96	$480,353	$0.63	156,449	$154,884.60	$0.00	$0.00	$3.19	$782,598			Cover and revegetation of backfill included in MPD (A1.5)
A1.5	*Main Pit Dump (Incl. SWB, In-Pit Dumps)*																		$831,420		
A1.5.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	66	hrs	C.2.13	65.8	$45.95	$3,022.31	$213.35	$14,034	$69.10	4,591	$4,545.48	$0.00	$0.00	$328.40	$21,602			Assumes MPD is fully constructed
A1.5.1.2			Slopes: Re-grade to 3H:1V	395	hrs	C.2.13	395.3	$45.95	$18,160.50	$213.35	$84,329	$69.10	27,589	$27,312.94	$0.00	$0.00	$328.40	$129,803			
A1.5.2.1		Cover	Flat area cover material: Load, haul, dump spread	45,708	m3	R.053	739.1	$0.74	$33,723.79	$2.40	$109,622	$0.78	36,080	$35,718.89	$0.00	$0.00	$3.92	$179,065			
A1.5.2.2			Slope area cover material: Load, haul, dump along crest	90,174	m3	R.054	1,249.9	$0.63	$56,960.44	$2.07	$186,757	$0.70	63,524	$62,888.67	$0.00	$0.00	$3.40	$306,606			
A1.5.2.3			Slope area cover material: Spread down slope	86	hrs	C.2.13	85.5	$45.95	$3,930.31	$213.35	$18,251	$69.10	5,971	$5,911.09	$0.00	$0.00	$328.40	$28,092			
A1.5.3.1		Revegetate	Seed/Fertilize: broadcast seeding	27.2	ha	C.6.01	900.2	$1,069.47	$29,064.18	$556.88	$15,134	$240.22	6,594	$6,528.38	$1,091.19	$29,654.54	$2,957.77	$80,381			
A1.5.3.2			Tree seedling application (1,000 stems/ha)	27.2	ha	C.6.06	1,392.8	$1,919.72	$52,170.99	$35.26	$958	$15.47	425	$420.38	$1,189.36	$32,322.25	$3,159.81	$85,872			
A1.6.0.0	*Mill Valley Fill Extension (Stage 1 and 2)*																		$172,700		
A1.6.1.1		Complete Fill Placement	Waste Rock fill: Load, haul, dump spread	0	m3	R.041	0.0	$1.00	$0.00	$3.25	$0	$1.07	0	$0.00	$0.00	$0.00	$5.32	$0			Quantitiies updated in 2020 to reflect progressive reclamation completed at the facility.
A1.6.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	81	hrs	C.2.13	81.2	$45.95	$3,732.25	$213.35	$17,331	$69.10	5,670	$5,613.22	$0.00	$0.00	$328.40	$26,676			
A1.6.2.2			Slopes: Re-grade to 3H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.6.3.1		Cover	Flat area cover material: Load, haul, dump spread	5,743	m3	R.056	116.9	$0.93	$5,331.76	$3.01	$17,295	$0.99	5,737	$5,679.63	$0.00	$0.00	$4.93	$28,306			
A1.6.3.2			Slope area cover material: Load, haul, dump along crest	7,482	m3	R.057	133.3	$0.81	$6,071.31	$2.65	$19,834	$0.90	6,774	$6,706.64	$0.00	$0.00	$4.36	$32,612			
A1.6.3.3			Slope area cover material: Spread down slope	12	hrs	C.2.13	12.4	$45.95	$568.73	$213.35	$2,641	$69.10	864	$855.35	$0.00	$0.00	$328.40	$4,065			
A1.6.4.1		Revegetate	Seed/Fertilize: broadcast seeding	8.74	ha	C.6.01	289.4	$1,069.47	$9,342.10	$556.88	$4,865	$240.22	2,120	$2,098.42	$1,091.19	$9,531.86	$2,957.77	$25,837			
A1.6.4.2			Tree seedling application (1,000 stems/ha)	17.47	ha	C.6.06	895.4	$1,919.72	$33,538.64	$35.26	$616	$15.47	273	$270.25	$1,189.36	$20,778.68	$3,159.81	$55,204			
A2	**Overburden Dumps**																			**$424,256**	
A2.1	*Area 118 Pit Backfill Dump*																		$30,234		
A2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	14	hrs	C.2.13	14.0	$45.95	$643.83	$213.35	$2,990	$69.10	978	$968.31	$0.00	$0.00	$328.40	$4,602			
A2.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	4	ha	C.6.01	138.8	$1,069.47	$4,480.97	$556.88	$2,333	$240.22	1,017	$1,006.51	$1,091.19	$4,571.99	$2,957.77	$12,393			
A2.2.2.2			Tree seedling application (1,000 stems/ha)	4	ha	C.6.06	214.7	$1,919.72	$8,043.46	$35.26	$148	$15.47	65	$64.81	$1,189.36	$4,983.28	$3,159.81	$13,239			
A2.2	*Ice-rich Overburden Dump*																		$16,874		
A2.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A2.2.1.2			Berm: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			WR Berm area included in Southwest Dump
A2.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2.76	ha	C.6.01	91.4	$1,069.47	$2,949.92	$556.88	$1,536	$240.22	669	$662.61	$1,091.19	$3,009.83	$2,957.77	$8,158			
A2.2.3.2			Tree seedling application (1,000 stems/ha)	2.76	ha	C.6.06	141.4	$1,919.72	$5,295.18	$35.26	$97	$15.47	43	$42.67	$1,189.36	$3,280.60	$3,159.81	$8,716			
A2.3	*Reclamation Overburden Dump*																		$377,148		
A2.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	594	hrs	C.2.13	593.6	$45.95	$27,272.60	$213.35	$126,641	$69.10	41,432	$41,017.30	$0.00	$0.00	$328.40	$194,931			
A2.3.1.2			Slopes: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Assumes borrow removed in such a manner that significant resloping is not required.
A2.3.2.1		Revegetate	Seed/Fertilize: broadcast seeding	29.79	ha	C.6.01	986.7	$1,069.47	$31,854.87	$556.88	$16,587	$240.22	7,228	$7,155.23	$1,091.19	$32,501.92	$2,957.77	$88,099			
A2.3.2.2			Tree seedling application (1,000 stems/ha)	29.79	ha	C.6.06	1,526.5	$1,919.72	$57,180.35	$35.26	$1,050	$15.47	465	$460.75	$1,189.36	$35,425.77	$3,159.81	$94,117			
A2.4	*Ridgetop South Backfill Dump*																		$0		
A3	**Ore Stockpiles**																			**$1,835,127**	
A3.1	*High and Medium Grade Sulphide Ore Stockpile (South of Mill)*																		$1,640,167		(North, West, East, and South Stockpiles)
A3.1.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	313,843	m3	R.044	3,691.9	$0.54	$168,390.90	$1.77	$554,891	$0.59	187,659	$185,782.77	$0.00	$0.00	$2.90	$909,064			
A3.1.1.2			Ore Pads (over-excavate): Load, haul, dump spread into Main Pit	71,007	m3	R.044	835.3	$0.54	$38,098.34	$1.77	$125,544	$0.59	42,458	$42,033.24	$0.00	$0.00	$2.90	$205,675			
A3.1.1.3			Complete confirmation testing	1,421	ea	C.3.02	236.8	$7.40	$10,516.36	$5.08	$7,216	$0.00	0	$0.00	$14.95	$21,243.95	$27.43	$38,976			
A3.1.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	289	hrs	C.2.13	289.4	$45.95	$13,294.67	$213.35	$61,734	$69.10	20,197	$19,994.85	$0.00	$0.00	$328.40	$95,024			
A3.1.3.1		Cover	Cover material: Load, haul, dump spread (0.5m)	69,653	m3	R.055	1,264.9	$0.83	$57,676.68	$2.69	$187,089	$0.88	62,060	$61,439.78	$0.00	$0.00	$4.40	$306,205			
A3.1.4.1		Revegetate	Seed/Fertilize: broadcast seeding	13.93	ha	C.6.01	461.5	$1,069.47	$14,898.42	$556.88	$7,758	$240.22	3,380	$3,346.48	$1,091.19	$15,201.05	$2,957.77	$41,204			
A3.1.4.2			Tree seedling application (1,000 stems/ha)	13.93	ha	C.6.06	713.9	$1,919.72	$26,743.07	$35.26	$491	$15.47	218	$215.49	$1,189.36	$16,568.52	$3,159.81	$44,018			
A3.2	*Low Grade Sulphide Ore Stockpile (Main Dump Area)*																		$194,960		
A3.2.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	25,986	m3	R.036	328.7	$0.58	$14,978.69	$1.89	$49,111	$0.64	16,705	$16,537.61	$0.00	$0.00	$3.10	$80,627			
A3.2.1.2			Ore Pad (over-excavate): Load, haul, dump spread into Main Pit	31,316	m3	R.036	396.1	$0.58	$18,050.68	$1.89	$59,183	$0.64	20,131	$19,929.33	$0.00	$0.00	$3.10	$97,163			
A3.2.1.3			Complete confirmation testing	626	ea	C.3.02	104.3	$7.40	$4,632.82	$5.08	$3,179	$0.00	0	$0.00	$14.95	$9,358.70	$27.43	$17,170			
A3.2.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Included in Main Waste Dump Closure
A3.2.3.1		Cover	Cover material: Load, haul, dump spread	0	m3	R.050	0.0	$0.85	$0.00	$2.76	$0	$0.91	0	$0.00	$0.00	$0.00	$4.52	$0			Included in Main Waste Dump Closure
A3.2.4.1		Revegetate	Seed/Fertilize: broadcast seeding	0	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			Included in Main Waste Dump Closure
A3.2.4.2			Tree seedling application (1,000 stems/ha)	0	ha	C.6.06	0.0	$1,919.72	$0.00	$35.26	$0	$15.47	0	$0.00	$1,189.36	$0.00	$3,159.81	$0			Included in Main Waste Dump Closure
A4	**Open Pits**																			**$179,036**	
A4.1	*Main Pit*																		$152,469		
A4.1.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	7,500	m2	C.2.03	28.5	$0.17	$1,309.98	$0.54	$4,039	$0.14	1,048	$1,037.31	$0.00	$0.00	$0.85	$6,386			
A4.1.1.2			Safety Berm: Construct around highwall perimeter	4,860	m3	C.2.02	45.8	$0.43	$2,106.59	$0.72	$3,515	$0.26	1,267	$1,253.91	$0.00	$0.00	$1.41	$6,876			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A4.1.1.3			Place large boulders across any pit access points	52	m3	R.001	1.6	$1.44	$74.74	$3.16	$164	$0.93	49	$48.22	$0.00	$0.00	$5.53	$287			
A4.1.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.1.2.1		Exposed tailings cover	Trafficability Layer: Load, haul, dump spread	17,750	m3	R.014	554.4	$1.42	$25,287.15	$2.69	$47,664	$0.84	15,091	$14,940.14	$0.00	$0.00	$4.95	$87,891			
A4.1.2.2			Overburden Layer: Load, haul, dump spread	8,875	m3	R.052	158.4	$0.81	$7,222.87	$2.64	$23,429	$0.87	7,772	$7,694.13	$0.00	$0.00	$4.32	$38,346			
A4.1.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2	ha	C.6.01	58.8	$1,069.47	$1,898.31	$556.88	$988	$240.22	431	$426.40	$1,091.19	$1,936.87	$2,957.77	$5,250			
A4.1.3.2			Tree seedling application (1,000 stems/ha)	2	ha	C.6.06	91.0	$1,919.72	$3,407.51	$35.26	$63	$15.47	28	$27.46	$1,189.36	$2,111.11	$3,159.81	$5,609			
A4.2	*Area 2 Pit*																		$9,490		
A4.2.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			
A4.2.1.2			Safety Berm: Construct around highwall perimeter	5,317	m3	C.2.02	50.2	$0.43	$2,304.71	$0.72	$3,846	$0.26	1,386	$1,371.84	$0.00	$0.00	$1.41	$7,522			
A4.2.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.2.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.3	*Area 118 Pit*																		$5,586		
A4.3.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	2,580	m2	C.2.03	9.8	$0.17	$450.63	$0.54	$1,389	$0.14	360	$356.83	$0.00	$0.00	$0.85	$2,197			
A4.3.1.2			Safety Berm: Construct around highwall perimeter	1,435	m3	C.2.02	13.5	$0.43	$621.95	$0.72	$1,038	$0.26	374	$370.20	$0.00	$0.00	$1.41	$2,030			
A4.3.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.3.1.4			Allowance: Install warning signs around pit perimeter at key locations	4	ea	C.5.13	3.7	$41.73	$166.92	$24.39	$98	$5.74	23	$22.96	$232.08	$928.32	$303.94	$1,216			
A4.4	*Minto North Pit*																		$11,491		
A4.4.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	5,900	m2	C.2.03	22.4	$0.17	$1,030.52	$0.54	$3,177	$0.14	824	$816.01	$0.00	$0.00	$0.85	$5,024			
A4.4.1.2			Safety Berm: Construct around highwall perimeter	3,610	m	C.2.02	34.1	$0.43	$1,564.90	$0.72	$2,611	$0.26	941	$931.48	$0.00	$0.00	$1.41	$5,108			
A4.4.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.4.1.4			Allowance: Install warning signs around pit perimeter at key locations	4	ea	C.5.13	3.7	$41.73	$166.92	$24.39	$98	$5.74	23	$22.96	$232.08	$928.32	$303.94	$1,216			
A5	**Underground Openings**																			**$59,131**	
A5.1	*~~Minto North Portal~~*		**Does not yet exist**																$0		
A5.1.1.1		Seal portal	Load, Haul, Dump backfill plug	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			Material sourced from nearby laydown area rockfill
A5.1.1.2			Doze backfill plug into portal with small dozer	0	hrs	C.2.19	0.0	$45.95	$0.00	$69.66	$0	$24.01	0	$0.00	$0.00	$0.00	$139.61	$0			
A5.2	*~~Minto North Portal Egress~~*		**Does not yet exist**																$0		
A5.2.1.1		Seal portal	Load, Haul, Dump backfill plug	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			Material sourced from nearby laydown area rockfill
A5.2.1.2			Doze backfill plug into portal with small dozer	0	hrs	C.2.19	0.0	$45.95	$0.00	$69.66	$0	$24.01	0	$0.00	$0.00	$0.00	$139.61	$0			
A5.3	*Minto South Portal*																		$16,580		
A5.3.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.3.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.3.2.1		Revegetate	Included in Yards (WBS No. A11-10)																		
A5.4	*Area 118 Vent Raise*																		$14,255		
A5.4.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.4.1.2			Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.4.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.4.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.4.2.3			Ringwall Rebar: supply and install	32	m	C.8.05	0.8	$1.31	$41.88	$0.00	$0	$0.00	0	$0.00	$5.03	$161.05	$6.34	$203			
A5.4.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.4.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.4.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.5	*Minto East Vent Raise*																		$14,143		
A5.5.1.2		Preparation	Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.5.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.5.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.5.2.3			Ringwall Rebar: supply and install	14	m	C.8.05	0.3	$1.31	$18.84	$0.00	$0	$0.00	0	$0.00	$5.03	$72.47	$6.34	$91			
A5.5.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.5.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.5.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.6	*Minto East 2 Vent Raise*																		$14,153		
A5.6.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.6.1.2			Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.6.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.6.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.6.2.3			Ringwall Rebar: supply and install	16	m	C.8.05	0.4	$1.31	$20.94	$0.00	$0	$0.00	0	$0.00	$5.03	$80.52	$6.34	$101			
A5.6.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.6.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.6.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A6	**External Tailings Facilities**																			**$232,973**	
A6.1	*Dry Stack Tailings Storage Facility*																		$232,973		
A6.1.1.1		Waste Rock Shell	Regrade WR shell slopes to 4H:1V	3	hrs	C.2.13	3.4	$45.95	$157.73	$213.35	$732	$69.10	240	$237.23	$0.00	$0.00	$328.40	$1,127			
A6.1.1.2			Cover material: Load, haul, dump spread (0.5m)	5,296	m3	R.048	102.8	$0.89	$4,689.51	$2.87	$15,212	$0.94	5,046	$4,995.47	$0.00	$0.00	$4.70	$24,897			
A6.1.1.3			Scarify surface	0	m2	C.2.16	0.0	$0.04	$0.00	$0.06	$0	$0.01	0	$0.00	$0.00	$0.00	$0.11	$0			
A6.1.1.4			Seed/Fertilize: broadcast seeding	1.06	ha	C.6.01	35.1	$1,069.47	$1,132.72	$556.88	$590	$240.22	257	$254.43	$1,091.19	$1,155.73	$2,957.77	$3,133			
A6.1.1.5			Tree seedling application (1,000 stems/ha)	5.30	ha	C.6.06	271.4	$1,919.72	$10,166.32	$35.26	$187	$15.47	83	$81.92	$1,189.36	$6,298.49	$3,159.81	$16,733			
A6.1.2.1		Fill Area at south end of DS	Load, haul, dump, spread	9,090	Cm3	R.001	286.5	$1.44	$13,065.84	$3.16	$28,753	$0.93	8,514	$8,428.55	$0.00	$0.00	$5.53	$50,248			Fill from TDD road and/or unsuitable DSTSF cover material
A6.1.3.1		Tailings surface	Regrade tailings area south of the tailings	4	hrs	C.2.13	4.2	$45.95	$191.89	$213.35	$891	$69.10	292	$288.59	$0.00	$0.00	$328.40	$1,372			
A6.1.3.2			Regrade surface to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.3.3			Cover: Excavate unsuitable temporary cover material	0	m3	R.003	0.0	$0.53	$0.00	$1.74	$0	$0.59	0	$0.00	$0.00	$0.00	$2.85	$0			
A6.1.3.4			Cover material: Load, haul, dump spread (0.5m)	3,887	m3	R.048	75.5	$0.89	$3,442.21	$2.87	$11,166	$0.94	3,704	$3,666.80	$0.00	$0.00	$4.70	$18,275			
A6.1.3.5			Seed/Fertilize: broadcast seeding	19.16	ha	C.6.01	634.6	$1,069.47	$20,486.85	$556.88	$10,668	$240.22	4,648	$4,601.75	$1,091.19	$20,902.98	$2,957.77	$56,659			
A6.1.3.6			Tree seedling application (1,000 stems/ha)	19.16	ha	C.6.06	981.8	$1,919.72	$36,774.44	$35.26	$676	$15.47	299	$296.32	$1,189.36	$22,783.40	$3,159.81	$60,530			
A7	**Roads**																			**$153,441**	
A7.1	*Exploration Roads*																		$39,012		
A7.1.1.1		Regrade/Scarify	Scarify road surface	54,285	m2	C.2.16	0.0	$0.04	$1,952.53	$0.06	$3,166	$0.01	691	$683.65	$0.00	$0.00	$0.11	$5,803			
A7.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.43	ha	C.6.01	179.8	$1,069.47	$5,805.61	$556.88	$3,023	$240.22	1,317	$1,304.05	$1,091.19	$5,923.54	$2,957.77	$16,056			
A7.1.2.2			Tree seedling application (1,000 stems/ha)	5.43	ha	C.6.06	278.2	$1,919.72	$10,421.23	$35.26	$191	$15.47	85	$83.97	$1,189.36	$6,456.41	$3,159.81	$17,153			
A7.2	*Access Roads (excl. Main Site Access Road)*																		$8,737		
A7.2.1.1		Regrade/Scarify	Regrade side slopes	9	hrs	C.2.13	9.5	$45.95	$434.59	$213.35	$2,018	$69.10	660	$653.61	$0.00	$0.00	$328.40	$3,106			
A7.2.1.2			Scarify road surface	52,636	m2	C.2.16	0.0	$0.04	$1,893.21	$0.06	$3,070	$0.01	670	$662.89	$0.00	$0.00	$0.11	$5,626			
A7.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.80	$556.88	$0	$240.22	0	$0.18	$1,091.19	$0.81	$2,957.77	$2			
A7.2.2.2			Tree seedling application (1,000 stems/ha)	0.00	ha	C.6.06	0.0	$1,919.72	$1.43	$35.26	$0	$15.47	0	$0.01	$1,189.36	$0.88	$3,159.81	$2			
A7.3	*Main Site Access Road*																		$1,798		
A7.3.1.1		New Access over MVFE	Regrade new access through MVFE	0	m3																
A7.3.2.1		Signage	Install large sign on east and west side of barge landing on Yukon River	2	ea.	C.5.14	1.9	$41.73	$83.46	$24.39	$49	$5.74	12	$11.48	$827.13	$1,654.27	$898.99	$1,798			
A7.4	*Haul Roads*																		$84,151		

WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		Source / Comments
							Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	
A7.4.1.1		Regrade/Scarify	Regrade side slopes	21	hrs	C.2.13	20.5	$45.95	$942.69	$213.35	$4,377	$69.10	1,432	$1,417.78	$0.00	$0.00	$328.40	$6,738			
A7.4.1.2			Scarify road surface	91,084	m2	C.2.16	0.0	$0.04	$3,276.11	$0.06	$5,313	$0.01	1,159	$1,147.09	$0.00	$0.00	$0.11	$9,736			
A7.4.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.06	ha	C.6.01	366.5	$1,069.47	$11,831.20	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.52	$2,957.77	$32,721			
A7.4.2.2			Tree seedling application (1,000 stems/ha)	11.06	ha	C.6.06	567.0	$1,919.72	$21,237.32	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.46	$3,159.81	$34,956			
A7.5	*Culvert Removal*																		$19,743		
A7.5.1.1		Excavate culverts	Mobilization allowance for excavation fleet to various sites	6	hrs	C.7.01	12.0	$91.33	$548.00	$126.32	$758	$45.54	276	$273.24	$0.00	$0.00	$263.20	$1,579			
A7.5.1.2			Load, haul, dump, spread (spoil locally)	18,020	m3	R.901	59.1	$0.15	$2,714.88	$0.57	$10,324	$0.21	3,841	$3,802.32	$0.00	$0.00	$0.93	$16,841			
A7.5.1.2		Waste disposal	On-site disposal (demolition debris, etc.)	190	Lm3	R.037	8.1	$1.94	$368.95	$3.84	$730	$1.18	227	$224.34	$0.00	$0.00	$6.96	$1,323			
A8	**Demolition**																			**$1,995,640**	
A8.1	*Airstrip Area*																		$22,217		
A8.1.1.1		Remove tanks/equipment	Dismantle and prep for transport	7	hrs	C.1.13	28.0	$174.43	$1,221.03	$115.96	$812	$17.92	127	$125.44	$0.00	$0.00	$308.32	$2,158			
A8.1.2.1		Waste Oil Tanker Secondar	Bedding Material: Load, haul dump bedding material to landfarm	47	Cm3	R.001	1.5	$1.44	$68.05	$3.16	$150	$0.93	44	$43.90	$0.00	$0.00	$5.53	$262			
A8.1.2.2			Cut and fold liner	219	m2	C.1.15	2.5	$0.45	$99.09	$0.19	$43	$0.07	16	$15.60	$0.00	$0.00	$0.72	$157			
A8.1.2.3			Regrade area to promote positive drainage	192	m2	C.2.11	1.9	$0.46	$88.22	$1.42	$272	$0.36	71	$69.85	$0.00	$0.00	$2.24	$430			
A8.1.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	10	hrs	C.1.22	40.0	$165.83	$1,658.25	$104.46	$1,045	$27.77	281	$277.70	$0.00	$0.00	$298.06	$2,981			
A8.1.3.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.1.4.1		Demolition	Structural building demolition: wooden buildings/tents	1,149	m3	C.1.08	87.7	$3.01	$3,457.31	$1.60	$1,835	$0.59	680	$672.90	$0.00	$0.00	$5.19	$5,965			
A8.1.4.2			Other demolition: covered storage, debris, etc.	530	m3	C.1.07	52.5	$3.90	$2,068.21	$2.07	$1,097	$0.76	407	$402.54	$0.00	$0.00	$6.74	$3,568			
A8.1.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	379	m3	R.006	12.8	$1.53	$581.90	$3.01	$1,141	$0.94	361	$357.73	$0.00	$0.00	$5.49	$2,080			
A8.1.5.2			Off-site disposal (re-usable equipment, etc.)	4	m3	C.7.07	34.6	$367.57	$1,590.89	$485.20	$2,100	$116.87	511	$505.83	$0.00	$0.00	$969.64	$4,197			
A8.2	*Airport Laydown Area*																		$34,345		
A8.2.1.1		Remove tanks/equipment	Dismantle and prep for transport	2	hrs	C.1.13	8.0	$174.43	$348.87	$115.96	$232	$17.92	36	$35.84	$0.00	$0.00	$308.32	$617			
A8.2.2.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.2.2.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.2.3.1		Demolition	Structural building demolition: steel structures	96	tonnes	C.1.05	191.3	$71.87	$6,873.40	$139.79	$13,369	$34.90	3,371	$3,337.39	$0.00	$0.00	$246.56	$23,579			
A8.2.3.2			Other demolition: covered storage etc.	560	m3	C.1.07	55.5	$3.90	$2,186.62	$2.07	$1,160	$0.76	430	$425.58	$0.00	$0.00	$6.74	$3,773			
A8.2.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	393	Lm3	R.005	15.8	$1.83	$717.72	$3.61	$1,420	$1.11	441	$436.41	$0.00	$0.00	$6.55	$2,574			
A8.2.4.2			Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	23.0	$367.57	$1,056.76	$485.20	$1,395	$116.87	339	$336.00	$0.00	$0.00	$969.64	$2,788			
A8.3	*Camp Area*																		$392,884		
A8.3.1.1		Equipment Removal	Remove salvageable equipment	48	hrs	C.1.13	192.0	$174.43	$8,372.81	$115.96	$5,566	$17.92	869	$860.14	$0.00	$0.00	$308.32	$14,799			
A8.3.2.1		Remove modular buildings	Dismantle and prep for transport	92	ea.	C.1.20	1,794.0	$881.68	$81,114.84	$750.86	$69,079	$171.67	15,953	$15,793.27	$0.00	$0.00	$1,804.21	$165,987			
A8.3.2.2			Transport structures off-site (Whitehorse)	92	ea.	C.7.04	736.0	$363.66	$33,456.48	$360.37	$33,154	$116.87	10,861	$10,751.99	$0.00	$0.00	$840.90	$77,363			
A8.3.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	1	hrs	C.1.22	4.0	$165.83	$165.83	$104.46	$104	$27.77	28	$27.77	$0.00	$0.00	$298.06	$298			
A8.3.3.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.3.4.1		Demolition	Structural building demolition: Steel	175	tonnes	C.1.05	350.7	$71.87	$12,601.23	$139.79	$24,509	$34.90	6,180	$6,118.54	$0.00	$0.00	$246.56	$43,229			
A8.3.4.2			Structural building demolition: Wood/misc. structures	10,959	m3	C.1.08	836.7	$3.01	$32,982.53	$1.60	$17,502	$0.59	6,484	$6,419.39	$0.00	$0.00	$5.19	$56,904			
A8.3.4.4			Other demolition: Utilidors, etc.	466	m3	C.1.07	46.1	$3.90	$1,819.22	$2.07	$965	$0.76	358	$354.07	$0.00	$0.00	$6.74	$3,139			
A8.3.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	3,867	m3	R.007	175.3	$2.06	$7,981.07	$4.08	$15,786	$1.25	4,902	$4,852.92	$0.00	$0.00	$7.40	$28,620			
A8.3.5.2			Off-site disposal (re-usable equipment, etc.)	1	trips	C.7.07	8.0	$367.57	$367.57	$485.20	$485	$116.87	118	$116.87	$0.00	$0.00	$969.64	$970			
A8.3.6.1		Demolish foundations	Break in place concrete foundations	51	m3	C.1.01	4.1	$2.47	$126.44	$9.40	$481	$2.56	132	$130.77	$0.00	$0.00	$14.43	$738			
A8.4	*Explosives Plant and Storage Areas*																		$32,905		
A8.4.1.1		Remove equipment	Small equipment: dismantle and prep for transport	37	hrs	C.1.13	149.3	$174.43	$6,512.18	$115.96	$4,329	$17.92	676	$668.99	$0.00	$0.00	$308.32	$11,510			
A8.4.2.1		Remove modular buildings	Dismantle and prep for transport	1	ea.	C.1.20	19.5	$881.68	$881.68	$750.86	$751	$171.67	173	$171.67	$0.00	$0.00	$1,804.21	$1,804			
A8.4.2.2			Transport structures off-site (Whitehorse)	1	ea.	C.7.04	8.0	$363.66	$363.66	$360.37	$360	$116.87	118	$116.87	$0.00	$0.00	$840.90	$841			
A8.4.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	4	hrs	C.1.22	16.0	$165.83	$663.30	$104.46	$418	$27.77	112	$111.08	$0.00	$0.00	$298.06	$1,192			
A8.4.3.2			Disconnect services	2	hrs	C.1.09	6.0	$91.24	$182.48	$8.59	$17	$4.95	10	$9.90	$0.00	$0.00	$104.78	$210			
A8.4.4.1		Demolition	Structural building demolition: Steel	47	tonnes	C.1.05	94.2	$71.87	$3,384.63	$139.79	$6,583	$34.90	1,660	$1,643.41	$0.00	$0.00	$246.56	$11,611			
A8.4.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	103	m3	R.008	5.4	$2.40	$247.67	$4.76	$490	$1.46	152	$150.60	$0.00	$0.00	$8.62	$888			
A8.4.5.2			Off-site disposal (re-usable equipment, etc.)	5	trips	C.7.07	40.0	$367.57	$1,837.85	$485.20	$2,426	$116.87	590	$584.35	$0.00	$0.00	$969.64	$4,848			
A8.5	*Fuel Storage Area*																		$125,560		
A8.5.1.1		Remove equipment/disman	Small equipment: dismantle and prep for transport	24	hrs	C.1.13	96.0	$174.43	$4,186.40	$115.96	$2,783	$17.92	434	$430.07	$0.00	$0.00	$308.32	$7,400			
A8.5.1.2			Large equipment (crane req'd): dismantle and prep for transport	192	hrs	C.1.14	1,153.4	$279.25	$53,683.19	$199.44	$38,340	$24.11	4,681	$4,634.34	$0.00	$0.00	$502.79	$96,657			
A8.5.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.5.2.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.5.2.3			Clean out tanks, pressure wash, remove sludge	10	hrs	C.1.04	10.3	$37.25	$382.69	$16.65	$171	$2.00	21	$20.55	$0.00	$0.00	$55.90	$574			
A8.5.3.1		Demolish structures	Misc. debris/scraps (tanks included in dismantling above)	75	m3	C.1.08	5.7	$3.01	$225.72	$1.60	$120	$0.59	44	$43.93	$0.00	$0.00	$5.19	$389			
A8.5.4.1		Remove secondary contain	Bedding Material: Load, haul dump bedding material to landfarm	623	Cm3	R.009	32.8	$2.40	$1,493.67	$4.74	$2,954	$1.46	917	$908.23	$0.00	$0.00	$8.60	$5,356			
A8.5.4.2			Cut and fold liner	1,747	m2	C.1.15	20.3	$0.45	$792.35	$0.19	$340	$0.07	126	$124.75	$0.00	$0.00	$0.72	$1,257			
A8.5.4.3			Regrade area to promote positive drainage	1,666	m2	C.2.11	16.7	$0.46	$765.46	$1.42	$2,360	$0.36	612	$606.13	$0.00	$0.00	$2.24	$3,732			
A8.5.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	229	m3	R.009	12.1	$2.40	$549.94	$4.74	$1,088	$1.46	338	$334.39	$0.00	$0.00	$8.60	$1,972			
A8.5.5.2			Off-site disposal (re-usable equipment, etc.)	7	trips	C.7.07	56.0	$367.57	$2,572.99	$485.20	$3,396	$116.87	826	$818.09	$0.00	$0.00	$969.64	$6,787			
A8.6	*Mill Area*																		$1,320,887		Excludes WTP
A8.6.1.1		Remove equipment	Small equipment: dismantle and prep for transport	379	hrs	C.1.13	1,515.0	$174.43	$66,065.39	$115.96	$43,920	$17.92	6,855	$6,786.88	$0.00	$0.00	$308.32	$116,772			
A8.6.1.2			Large equipment (crane req'd): dismantle and prep for transport	466	hrs	C.1.14	2,796.5	$279.25	$130,153.53	$199.44	$92,954	$24.11	11,349	$11,235.85	$0.00	$0.00	$502.79	$234,344			
A8.6.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	65	hrs	C.1.22	260.0	$165.83	$10,778.64	$104.46	$6,790	$27.77	1,823	$1,805.02	$0.00	$0.00	$298.06	$19,374			Off-site disposal included in 'Waste Disposal'
A8.6.2.6			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.6.2.7			Decontaminate buildings: wash equipment/structures, etc.	38	hrs	C.1.04	37.8	$37.25	$1,407.51	$16.65	$629	$2.00	76	$75.58	$0.00	$0.00	$55.90	$2,112			
A8.6.2.8			Decontaminate buildings: Wash floors etc.	4,732	m2	C.1.03	40.8	$0.32	$1,517.80	$0.14	$679	$0.02	82	$81.50	$0.00	$0.00	$0.48	$2,278			
A8.6.3.1		Demolition	Structural building demolition: Steel	2,660	tonnes	C.1.05	5,319.1	$71.87	$191,148.68	$139.79	$371,780	$34.90	93,750	$92,812.46	$0.00	$0.00	$246.56	$655,741			
A8.6.3.2			Structural building demolition: Wood/misc. structures	960	m3	C.1.08	73.3	$3.01	$2,889.24	$1.60	$1,533	$0.59	568	$562.33	$0.00	$0.00	$5.19	$4,985			
A8.6.3.3			Other demolition: Steel	526	tonnes	C.1.05	1,052.7	$71.87	$37,828.55	$139.79	$73,576	$34.90	18,553	$18,367.70	$0.00	$0.00	$246.56	$129,772			
A8.6.3.4			Other demolition: concrete	602	m3	C.1.06	323.7	$16.48	$9,915.65	$62.67	$37,706	$17.04	10,359	$10,255.28	$0.00	$0.00	$96.19	$57,877			
A8.6.3.5			Other demolition: miscellaneous	244	m3	C.1.07	24.1	$3.90	$951.10	$2.07	$505	$0.76	187	$185.11	$0.00	$0.00	$6.74	$1,641			
A8.6.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	5,985	m3	R.037	255.1	$1.94	$11,613.36	$3.84	$22,971	$1.18	7,133	$7,061.54	$0.00	$0.00	$6.96	$41,646			
A8.6.4.2			Off-site disposal (re-usable equipment, etc.)	33	trips	C.7.07	266.0	$367.57	$12,220.77	$485.20	$16,132	$116.87	3,925	$3,885.61	$0.00	$0.00	$970	$32,238			
A8.6.5.1		Demolish foundations	Break in place concrete foundations	1,532	m3	C.1.01	123.7	$2.47	$3,787.52	$9.40	$14,403	$2.56	3,957	$3,917.25	$0.00	$0.00	$14.43	$22,108			
A8.7	*Mill Valley Fill Extension (Stage 1 and 2)*																		$29,908		
A8.7.1.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	8	hrs	C.1.22	30.0	$165.83	$1,243.69	$104.46	$783	$27.77	210	$208.27	$0.00	$0.00	$298.06	$2,235			
A8.7.1.2			Reagents: Disposal and tipping fees	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.7.2.1		Demolish buildings	Structural building demolition: Wood/misc. structures (Reagent tent)	1,800	m3	C.1.08	137.4	$3.01	$5,417.33	$1.60	$2,875	$0.59	1,065	$1,054.38	$0.00	$0.00	$5.19	$9,346			
A8.7.3.1		Haul waste to landfill	Demolition debris	594	m3	R.037	25.3	$1.94	$1,152.57	$3.84	$2,280	$1.18	708	$700.82	$0.00	$0.00	$6.96	$4,133			
A8.7.3.2			Remove tires off-site for disposal	10	trips	C.7.07	78.8	$367.57	$3,618.27	$485.20	$4,776	$116.87	1,162	$1,150.43	$0.00	$0.00	$969.64	$9,545			
A8.7.3.3			Misc. debris/scraps	652	m3	R.037	27.8	$1.94	$1,265.11	$3.84	$2,502	$1.18	777	$769.25	$0.00	$0.00	$6.96	$4,537			
A8.7.4.1		Demolish foundations	Break and bury concrete foundations	8	m3	C.1.01	0.6	$2.47	$19.13	$9.40	$73	$2.56	20	$19.79	$0.00	$0.00	$14.43	$112			
A8.8	*Minto South Portal*																		$8,966		
A8.8.1.1		Remove equipment	Small equipment: dismantle and prep for transport	6	hrs	C.1.13	24.0	$174.43	$1,046.60	$115.96	$696	$17.92	109	$107.52	$0.00	$0.00	$308.32	$1,850			
A8.8.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			

WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Labour: Total Mhrs	Labour: Unit Rate	Labour: Cost	Equipment: Unit Rate	Equipment: Cost	Fuel: Unit Rate	Fuel: Consumed (L)	Fuel: Cost	Material: Unit Rate	Material: Cost	Activity Totals: Unit Rate	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
A8.8.3.1		Demolition	Other demolition: miscellaneous	462	m3	C.1.07	45.7	$3.90	$1,803.50	$2.07	$957	$0.76	355	$351.01	$0.00	$0.00	$6.74	$3,112			
A8.8.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	462	m3	R.043	20.9	$2.06	$950.61	$4.07	$1,880	$1.25	584	$578.02	$0.00	$0.00	$7.38	$3,409			
A8.9	~~Minto North Portal~~		**Does not yet exist**																$0		Qntys assumed to be same as Minto South Portal
A8.9.1.1		Remove equipment	Small equipment: dismantle and prep for transport	0	hrs	C.1.13	0.0	$174.43	$0.00	$115.96	$0	$17.92	0	$0.00	$0.00	$0.00	$308.32	$0			
A8.9.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	0	hrs	C.1.22	0.0	$165.83	$0.00	$104.46	$0	$27.77	0	$0.00	$0.00	$0.00	$298.06	$0			
A8.9.3.1		Demolition	Other demolition: miscellaneous	0	m3	C.1.07	0.0	$3.90	$0.00	$2.07	$0	$0.76	0	$0.00	$0.00	$0.00	$6.74	$0			
A8.9.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	0	m3	R.042	0.0	$2.35	$0.00	$4.64	$0	$1.43	0	$0.00	$0.00	$0.00	$8.41	$0			
A8.10	*Pelly Laydown (Includes propane tanks by W15 Sump)*																		$21,793		
A8.10.1.1		Remove modular buildings/t	Dismantle and prep for transport	7	ea.	C.1.20	136.5	$881.68	$6,171.78	$750.86	$5,256	$171.67	1,214	$1,201.66	$0.00	$0.00	$1,804.21	$12,629			
A8.10.1.2			Transport structures off-site (Whitehorse)	7	ea.	C.7.04	56.0	$363.66	$2,545.60	$360.37	$2,523	$116.87	826	$818.09	$0.00	$0.00	$840.90	$5,886			
A8.10.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.10.3.1		Waste disposal	On-site disposal (demolition debris, etc.)	71	m3	R.045	3.3	$2.10	$150.18	$4.16	$297	$1.28	92	$91.32	$0.00	$0.00	$7.54	$539			
A8.10.3.2			Off-site disposal (re-usable equipment, etc.)	2	trips	C.7.07	15.0	$367.57	$689.19	$485.20	$910	$116.87	221	$219.13	$0.00	$0.00	$969.64	$1,818			
A8.10.4.1		Demolish foundations	Break and bury concrete foundations	23	m3	C.1.01	1.8	$2.47	$55.62	$9.40	$211	$2.56	58	$57.52	$0.00	$0.00	$14.43	$325			
A8.11	*Vent Raise - Area 118*																		$6,174		
A8.11.1.1		Remove equipment	Small equipment: dismantle and prep for transport	20	hrs	C.1.13	80.0	$174.43	$3,488.67	$115.96	$2,319	$17.92	362	$358.39	$0.00	$0.00	$308.32	$6,166			
A8.11.2.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	1	trips	R.043	0.0	$2.06	$2.06	$4.07	$4	$1.25	1	$1.25	$0.00	$0.00	$7.38	$7			
A9	**Surface Infrastructure**																			**$175,792**	
A9.1	*Tailings and Water Conveyance Pipelines*																		$94,952		
A9.1.1.1		Dismantle piping systems	Flush and clean tailings pipeline systems	8	ls	C.1.21	32.0	$209.63	$1,677.06	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$209.63	$1,677			
A9.1.1.2			Cut pipelines and prep for transport (6 to 8" HDPE pipes)	6,800	m	C.1.17	1,070.9	$7.46	$50,709.93	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$7.46	$50,710			
A9.1.1.3			Cut pipelines and prep for transport (10 to 18" HDPE pipes)	1,740	m	C.1.18	456.7	$12.43	$21,626.29	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$12.43	$21,626			
A9.1.1.4			Cut pipelines and prep for transport (20 to 36" HDPE pipes)	885	m	C.1.19	348.4	$18.64	$16,499.37	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$18.64	$16,499			
A9.2.2.1		Waste disposal	Haul pipes lines and debris to landfill	638	m3	R.037	27.2	$1.94	$1,237.84	$3.84	$2,448	$1.18	760	$752.67	$0.00	$0.00	$6.96	$4,439			
A9.2	*Conveyance Pipeline Equipment*																		$13,051		
A9.2.1.1		Dismantle piping systems	Remove pumps and prep for transport	15	ea.	C.1.24	198.0	$623.39	$9,350.78	$33.85	$508	$14.85	225	$222.75	$0.00	$0.00	$672.09	$10,081			
A9.2.1.2			Remove barges/Support Equipment prep for transport	2	ea.	C.1.23	52.8	$1,246.77	$2,493.54	$67.71	$135	$29.70	60	$59.40	$0.00	$0.00	$1,344.18	$2,688			
A9.2.2.1		Waste disposal	Transport pumps, barge and support equip. offsite (Whitehorse)	6.7	tonnes	C.7.02	2.7	$18.18	$121.83	$18.02	$121	$5.84	40	$39.15	$0.00	$0.00	$42.04	$282			
A9.3	*Powerlines*																		$67,789		
A9.3.1.1		Dismantle	Dismantle and collect powerlines	3.2	km	C.1.10	217.9	$2,731.94	$8,632.93	$816.44	$2,580	$259.77	829	$820.86	$0.00	$0.00	$3,808.14	$12,034			
A9.3.1.2			Remove power poles and load for transport off-site	60	ea.	C.1.11	548.6	$437.79	$26,267.37	$95.85	$5,751	$18.86	1,143	$1,131.43	$0.00	$0.00	$552.49	$33,150			
A9.3.1.3			Disconnect transformers and load for transport	4	ea.	C.1.12	93.3	$924.00	$3,695.99	$276.14	$1,105	$87.86	355	$351.43	$0.00	$0.00	$1,287.99	$5,152			
A9.3.2.1		Waste disposal	Transport powerlines, poles and transformers off-site	18	trips	C.7.07	144.0	$367.57	$6,616.26	$485.20	$8,734	$116.87	2,125	$2,103.65	$0.00	$0.00	$969.64	$17,453			
A10	**Water Detention Structures**																			**$840,997**	
A10.1	*W15 Sump*																		$1,081		
A10.1.1.1		Remove secondary contain	Cut and fold liner	1,310	m2	C.1.15	15.2	$0.45	$594.09	$0.19	$255	$0.07	94	$93.53	$0.00	$0.00	$0.72	$943			
A10.1.1.2			Haul liner to landfill	20	Lm3	R.070	0.8	$1.97	$38.67	$3.89	$76	$1.20	24	$23.51	$0.00	$0.00	$7.06	$139			
A10.2	*Sewage Lagoon (near IROD)*																		$24,809		
A10.2.1		Remove pond	Backfill pond	4,488	m3	R.001	141.4	$1.44	$6,450.99	$3.16	$14,196	$0.93	4,203	$4,161.42	$0.00	$0.00	$5.53	$24,809			
A10.3	*Water Storage Pond Dam*																		$815,107		
A10.3.1.1		Water Management	Install pump and pump around system	4	hrs	C.4.14	16.0	$125.31	$501.25	$37.01	$148	$6.95	28	$27.80	$0.00	$0.00	$169.27	$677			
A10.3.1.2			Pump pond water to discharge	400,000	m3	C.4.12	146.8	$0.01	$5,466.88	$0.10	$41,707	$0.01	2,965	$2,935.56	$0.00	$0.00	$0.13	$50,109			
A10.3.1.3			Maintain pump around system during WSP closure activities	103	days	C.4.13	10.3	$3.72	$381.83	$28.42	$2,913	$2.00	207	$205.03	$0.00	$0.00	$34.14	$3,500			Duration calculated as sum of associated tasks plus 20% contingency
A10.3.2.1		Breach dam	Granular zones/gen. fill: Load, haul, dump, spread in upstream North ab	62,301	m3	R.001	1,963.4	$1.44	$89,551.16	$3.16	$197,071	$0.93	58,351	$57,767.92	$0.00	$0.00	$5.53	$344,390			
A10.3.2.2			Dam Core: Load, haul, dump in temporary stockpile	23,617	m3	R.001	744.3	$1.44	$33,946.33	$3.16	$74,704	$0.93	22,119	$21,898.20	$0.00	$0.00	$5.53	$130,549			
A10.3.2.3			Rip-rap: Sort and stockpile durable rip-rap for reuse	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.3.2.4			Rip-rap: Load haul, dump unsuitable rip-rap in upstream North abutmen	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.3.3.1		Channel restoration	Excavate stream channel	5,584	m3	R.902	97.1	$0.80	$4,459.86	$1.33	$7,442	$0.48	2,681	$2,654.66	$0.00	$0.00	$2.61	$14,556			
A10.3.3.2			Bedding layer: Load haul, dump, place granular bedding layer along cha	726	m3	R.001	22.9	$1.44	$1,044.18	$3.16	$2,298	$0.93	680	$673.58	$0.00	$0.00	$5.53	$4,016			
A10.3.3.3			Rip-rap: Load, haul dump from temporary stockpile	964	m3	R.001	30.4	$1.44	$1,384.96	$3.16	$3,048	$0.93	902	$893.41	$0.00	$0.00	$5.53	$5,326			
A10.3.3.4			Rip-rap: place and secure	964	m3	R.904	10.5	$0.50	$481.43	$0.91	$877	$0.33	325	$321.57	$0.00	$0.00	$1.74	$1,680			
A10.3.4.1		Cover	Cover material: Load, haul, dump spread (1m)	6,975	m3	R.001	219.8	$1.44	$10,025.77	$3.16	$22,063	$0.93	6,533	$6,467.45	$0.00	$0.00	$5.53	$38,556			Cover sourced from dam core material
A10.3.5.1		Revegetate	Seed/Fertilize: broadcast seeding	1.4	ha	C.6.01	46.2	$1,069.47	$1,491.91	$556.88	$777	$240.22	338	$335.11	$1,091.19	$1,522.21	$2,957.77	$4,126			
A10.3.5.2			Tree seedling application (1,000 stems/ha)	1.4	ha	C.6.06	71.5	$1,919.72	$2,678.02	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,659.15	$3,159.81	$4,408			
A11	**Yards/Laydown Areas**																			**$827,890**	
A11.1	*Airstrip Area*																		$46,265		
A11.1.1.1		Re-grade	Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.1.1.2			Scarify surface	64,378	m2	C.2.16	0.0	$0.04	$2,315.53	$0.06	$3,755	$0.01	819	$810.75	$0.00	$0.00	$0.11	$6,881			
A11.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	6.4	ha	C.6.01	213.3	$1,069.47	$6,884.97	$556.88	$3,585	$240.22	1,562	$1,546.50	$1,091.19	$7,024.82	$2,957.77	$19,041			
A11.1.2.2			Tree seedling application (1,000 stems/ha)	6.4	ha	C.6.06	329.9	$1,919.72	$12,358.71	$35.26	$227	$15.47	101	$99.58	$1,189.36	$7,656.77	$3,159.81	$20,342			
A11.2	*Airport Laydown Area*																		$15,291		
A11.2.1.1		Re-grade	Scarify surface	21,277	m2	C.2.16	0.0	$0.04	$765.29	$0.06	$1,241	$0.01	271	$267.96	$0.00	$0.00	$0.11	$2,274			
A11.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.1	ha	C.6.01	70.5	$1,069.47	$2,275.51	$556.88	$1,185	$240.22	516	$511.12	$1,091.19	$2,321.73	$2,957.77	$6,293			
A11.2.2.2			Tree seedling application (1,000 stems/ha)	2.1	ha	C.6.06	109.0	$1,919.72	$4,084.60	$35.26	$75	$15.47	33	$32.91	$1,189.36	$2,530.59	$3,159.81	$6,723			
A11.3	*Camp Area*																		$125,373		
A11.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	7	hrs	C.2.13	6.9	$45.95	$316.95	$213.35	$1,472	$69.10	481	$476.68	$0.00	$0.00	$328.40	$2,265			
A11.3.1.2			Re-grade slopes to be 3H:1V or flatter	22	hrs	C.2.13	21.5	$45.95	$987.92	$213.35	$4,587	$69.10	1,501	$1,485.81	$0.00	$0.00	$328.40	$7,061			Slope between camp and main access road
A11.3.1.3			Scarify surfaces	20,626	m2	C.2.16	0.0	$0.04	$741.88	$0.06	$1,203	$0.01	262	$259.76	$0.00	$0.00	$0.11	$2,205			
A11.3.2.1		Cover	Flat area cover material: Load, haul, dump spread	10,313	Cm3	R.046	198.2	$0.88	$9,037.45	$2.84	$29,315	$0.93	9,724	$9,627.10	$0.00	$0.00	$4.65	$47,980			
A11.3.2.2			Slope area cover material: Load, haul, dump along crest	9,349	Cm3	R.047	157.2	$0.77	$7,160.89	$2.50	$23,394	$0.85	7,990	$7,910.23	$0.00	$0.00	$4.11	$38,465			
A11.3.2.3			Slope area cover material: Spread down slope	10	hrs	C.2.13	10.2	$45.95	$467.31	$213.35	$2,170	$69.10	710	$702.82	$0.00	$0.00	$328.40	$3,340			
A11.3.3.1		Revegetate	Seed/Fertilize: broadcast seeding	3.93	ha	C.6.01	130.3	$1,069.47	$4,205.66	$556.88	$2,190	$240.22	954	$944.67	$1,091.19	$4,291.09	$2,957.77	$11,631			
A11.3.3.2			Tree seedling application (1,000 stems/ha)	3.93	ha	C.6.06	201.5	$1,919.72	$7,549.27	$35.26	$139	$15.47	61	$60.83	$1,189.36	$4,677.11	$3,159.81	$12,426			
A11.4	*Crusher Area*																		$78,725		
A11.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	9	hrs	C.2.13	9.0	$45.95	$414.34	$213.35	$1,924	$69.10	629	$623.15	$0.00	$0.00	$328.40	$2,961			
A11.2.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	13,482	m3	R.055	244.8	$0.83	$11,163.80	$2.69	$36,213	$0.88	12,012	$11,892.19	$0.00	$0.00	$4.40	$59,269			
A11.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2.70	ha	C.6.01	89.3	$1,069.47	$2,883.71	$556.88	$1,502	$240.22	654	$647.74	$1,091.19	$2,942.29	$2,957.77	$7,975			
A11.2.3.2			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	138.2	$1,919.72	$5,176.35	$35.26	$95	$15.47	42	$41.71	$1,189.36	$3,206.98	$3,159.81	$8,520			
A11.5	*Exploration Disturbances*																		$24,993		
A11.5.1.1		Ridgetop Area	Scarify surfaces	34,778	m2	C.2.16	0.0	$0.04	$1,250.90	$0.06	$2,029	$0.01	442	$437.99	$0.00	$0.00	$0.11	$3,717			
A11.5.1.2			Seed/Fertilize: broadcast seeding	3	ha	C.6.01	115.2	$1,069.47	$3,719.40	$556.88	$1,937	$240.22	844	$835.45	$1,091.19	$3,794.95	$2,957.77	$10,287			
A11.5.1.3			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	178.2	$1,919.72	$6,676.42	$35.26	$123	$15.47	54	$53.80	$1,189.36	$4,136.34	$3,159.81	$10,989			
A11.6	*Explosives Plant and Storage Areas*																		$49,332		
A11.6.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	30	hrs	C.2.13	29.6	$45.95	$1,360.54	$213.35	$6,318	$69.10	2,067	$2,046.22	$0.00	$0.00	$328.40	$9,725			
A11.6.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.6.1.3			Scarify surfaces	55,113	m2	C.2.16	0.0	$0.04	$1,982.32	$0.06	$3,215	$0.01	701	$694.09	$0.00	$0.00	$0.11	$5,891			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A11.6.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.5	ha	C.6.01	182.6	$1,069.47	$5,894.20	$556.88	$3,069	$240.22	1,337	$1,323.95	$1,091.19	$6,013.93	$2,957.77	$16,301			
A11.6.2.2			Tree seedling application (1,000 stems/ha)	5.5	ha	C.6.06	282.5	$1,919.72	$10,580.26	$35.26	$194	$15.47	86	$85.25	$1,189.36	$6,554.94	$3,159.81	$17,415			
A11.7	*Fuel Storage Areas*																		$26,425		
A11.7.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	5	hrs	C.2.13	4.5	$45.95	$207.36	$213.35	$963	$69.10	315	$311.87	$0.00	$0.00	$328.40	$1,482			
A11.7.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	4,200	m3	R.049	81.8	$0.89	$3,730.31	$2.88	$12,100	$0.95	4,014	$3,973.69	$0.00	$0.00	$4.72	$19,804			
A11.7.3.1		Revegetate	Seed/Fertilize: broadcast seeding	0.84	ha	C.6.01	27.8	$1,069.47	$898.35	$556.88	$468	$240.22	204	$201.79	$1,091.19	$916.60	$2,957.77	$2,485			
A11.7.3.2			Tree seedling application (1,000 stems/ha)	1	ha	C.6.06	43.1	$1,919.72	$1,612.57	$35.26	$30	$15.47	13	$12.99	$1,189.36	$999.06	$3,159.81	$2,654			
A11.8	*IROD Laydown Area*																		$21,006		
A11.8.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	15	hrs	C.2.13	14.8	$45.95	$677.95	$213.35	$3,148	$69.10	1,030	$1,019.62	$0.00	$0.00	$328.40	$4,846			
A11.8.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.8.1.3			Scarify surface	18,106	m2	C.2.16	0.0	$0.04	$651.24	$0.06	$1,056	$0.01	230	$228.02	$0.00	$0.00	$0.11	$1,935			
A11.8.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.33	ha	C.6.01	77.0	$1,069.47	$2,486.84	$556.88	$1,295	$240.22	564	$558.59	$1,091.19	$2,537.35	$2,957.77	$6,878			
A11.8.2.2			Tree seedling application (1,000 stems/ha)	2.33	ha	C.6.06	119.2	$1,919.72	$4,463.94	$35.26	$82	$15.47	36	$35.97	$1,189.36	$2,765.61	$3,159.81	$7,348			
A11.9	*Mill Area*																		$143,245		
A11.9.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	60	hrs	C.2.13	59.9	$45.95	$2,753.36	$213.35	$12,785	$69.10	4,183	$4,140.98	$0.00	$0.00	$328.40	$19,680			
A11.9.1.2			Scarify surface	42,365	m2	C.2.16	0.0	$0.04	$1,523.78	$0.06	$2,471	$0.01	539	$533.53	$0.00	$0.00	$0.11	$4,528			
A11.9.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	21,182	m3	R.055	384.7	$0.83	$17,540.10	$2.69	$56,896	$0.88	18,873	$18,684.50	$0.00	$0.00	$4.40	$93,120			
A11.9.3.1		Revegetate	Seed/Fertilize: broadcast seeding	4.24	ha	C.6.01	140.3	$1,069.47	$4,530.77	$556.88	$2,359	$240.22	1,028	$1,017.70	$1,091.19	$4,622.80	$2,957.77	$12,530			
A11.9.3.2			Tree seedling application (1,000 stems/ha)	4.24	ha	C.6.06	217.1	$1,919.72	$8,132.86	$35.26	$149	$15.47	66	$65.53	$1,189.36	$5,038.67	$3,159.81	$13,386			
A11.10	*Mill Valley Fill Extension (Stage 1 and 2)*																		$0		
A11.10.1		Costs included in Waste Rock Dump Section (WBS#: A1.5)		0	hrs																
A11.11	*Minto South Portal*																		$99,427		
A11.11.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	51	hrs	C.2.13	51.5	$45.95	$2,364.92	$213.35	$10,982	$69.10	3,593	$3,556.78	$0.00	$0.00	$328.40	$16,903			
A11.11.1.2			Re-grade slopes to be 3H:1V or flatter	25	hrs	C.2.13	24.8	$45.95	$1,138.55	$213.35	$5,287	$69.10	1,730	$1,712.36	$0.00	$0.00	$328.40	$8,138			
A11.11.1.3			Scarify surface	62,765	m2	C.2.16	0.0	$0.04	$2,257.53	$0.06	$3,661	$0.01	798	$790.45	$0.00	$0.00	$0.11	$6,709			
A11.11.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.1	ha	C.6.01	366.5	$1,069.47	$11,831.22	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.54	$2,957.77	$32,721			
A11.11.2.2			Tree seedling application (1,000 stems/ha)	11.1	ha	C.6.06	567.0	$1,919.72	$21,237.35	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.48	$3,159.81	$34,956			
A11.12	*Pelly Laydown Area*																		$159,143		
A11.12.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	107	hrs	C.2.13	107.4	$45.95	$4,934.92	$213.35	$22,916	$69.10	7,497	$7,421.99	$0.00	$0.00	$328.40	$35,272			
A11.12.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	25,855	m3	R.058	380.7	$0.67	$17,371.17	$2.18	$56,467	$0.71	18,585	$18,398.86	$0.00	$0.00	$3.57	$92,237			
A11.12.3.1		Revegetate	Seed/Fertilize: broadcast seeding	5.17	ha	C.6.01	171.3	$1,069.47	$5,530.22	$556.88	$2,880	$240.22	1,255	$1,242.20	$1,091.19	$5,642.55	$2,957.77	$15,295			
A11.12.3.2			Tree seedling application (1,000 stems/ha)	5.17	ha	C.6.06	265.0	$1,919.72	$9,926.90	$35.26	$182	$15.47	81	$79.99	$1,189.36	$6,150.15	$3,159.81	$16,339			
A11.13	*W15 Sump Area Laydown*																		$38,663		
A11.13.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	9	hrs	C.2.13	8.8	$45.95	$403.82	$213.35	$1,875	$69.10	613	$607.34	$0.00	$0.00	$328.40	$2,886			
A11.13.1.2			Slopes: Re-grade to 3H:1V	2	hrs	C.2.13	1.6	$45.95	$73.97	$213.35	$344	$69.10	112	$111.26	$0.00	$0.00	$328.40	$529			
A11.13.1.3			Scarify surface	9,484	m2	C.2.16	0.0	$0.04	$341.11	$0.06	$553	$0.01	121	$119.44	$0.00	$0.00	$0.11	$1,014			
A11.13.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	6,974	m3	R.065	106.1	$0.69	$4,840.42	$2.26	$15,734	$0.74	5,179	$5,126.78	$0.00	$0.00	$3.69	$25,701			
A11.13.3.1		Revegetate	Seed/Fertilize: broadcast seeding	1.39	ha	C.6.01	46.2	$1,069.47	$1,491.72	$556.88	$777	$240.22	338	$335.07	$1,091.19	$1,522.02	$2,957.77	$4,126			
A11.13.3.2			Tree seedling application (1,000 stems/ha)	1.39	ha	C.6.06	71.5	$1,919.72	$2,677.68	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,658.94	$3,159.81	$4,407			
A12	**Waste Disposal**																			**$461,883**	
A12.1	*Hydrocarbon contaminated soils*																		$74,871		
A12.1.1.1		Excavate HC contaminated	Complete testing for contaminated soils	48	test pits	C.3.03	24.0	$22.59	$1,084.20	$5.03	$242	$3.01	146	$144.34	$292.57	$14,043.43	$323.20	$15,513			
A12.1.1.2			Excavate and haul contaminated soils to on-site landfarm facility	726	m3	R.038	26.0	$1.63	$1,184.49	$3.25	$2,355	$0.99	723	$715.46	$0.00	$0.00	$5.86	$4,255			
A12.1.2.1		Construct landfarm	Existing Facility assumed to have sufficient capacity	0	m3																
A12.1.3.1		Operate landfarm	Aerate contaminated soils (mix)	12	event	C.3.04	270.0	$1,016.97	$12,203.66	$943.36	$11,320	$344.03	4,170	$4,128.30	$0.00	$0.00	$2,304.35	$27,652			
A12.1.3.2			Annual confirmation sampling	3	years	C.3.05	48.0	$722.80	$2,168.41	$161.01	$483	$96.23	292	$288.68	$1,755.43	$5,266.29	$2,735.47	$8,206			
A12.1.4.1		Close landfarm	Remove soils and collect liner	726	m3	R.001	22.9	$1.44	$1,043.11	$3.16	$2,296	$0.93	680	$672.89	$0.00	$0.00	$5.53	$4,012			
A12.1.4.2			Cut/fold liner and place into waste disposal container	4,265	m2	C.1.15	49.6	$0.45	$1,934.18	$0.19	$830	$0.07	308	$304.52	$0.00	$0.00	$0.72	$3,069			
A12.1.4.3			Regrade area	4,265	m2	C.2.11	42.7	$0.46	$1,959.61	$1.42	$6,042	$0.36	1,567	$1,551.71	$0.00	$0.00	$2.24	$9,553			
A12.1.4.4			Revegetation: Seed/Fertilizer: broadcast seeding	0.43	ha	C.6.01	14.1	$1,069.47	$456.13	$556.88	$238	$240.22	103	$102.46	$1,091.19	$465.39	$2,957.77	$1,261			
A12.1.4.5			Tree seedling application (1,000 stems/ha)	0.43	ha	C.6.06	21.9	$1,919.72	$818.76	$35.26	$15	$15.47	7	$6.60	$1,189.36	$507.26	$3,159.81	$1,348			
	Metal Contaminated soils																		$177,013		
A12.2.1.1		Crusher area	Delineate contaminated soil areas	197	test pits	C.3.01	98.5	$22.59	$4,449.75	$5.03	$991	$3.01	598	$592.40	$299.00	$58,903.00	$329.63	$64,936			
A12.2.1.2			Load, haul, dump contaminated soils to underground	2,949	m3	R.039	102.1	$1.58	$4,658.36	$3.48	$10,251	$1.02	3,035	$3,005.03	$0.00	$0.00	$6.07	$17,915			
A12.2.1.3			Complete confirmation testing	197	ea	C.3.02	32.8	$7.40	$1,457.93	$5.08	$1,000	$0.00	0	$0.00	$14.95	$2,945.15	$27.43	$5,403			
A12.2.2.1		Mill Area	Delineate contaminated soil areas	198	test pits	C.3.01	99.0	$22.59	$4,472.34	$5.03	$996	$3.01	601	$595.41	$299.00	$59,202.00	$329.63	$65,266			
A12.2.2.2			Load, haul, dump contaminated soils to underground	2,973	m3	R.039	103.0	$1.58	$4,696.51	$3.48	$10,335	$1.02	3,060	$3,029.64	$0.00	$0.00	$6.07	$18,062			
A12.2.2.3			Complete confirmation testing	198	ea	C.3.02	33.0	$7.40	$1,465.33	$5.08	$1,005	$0.00	0	$0.00	$14.95	$2,960.10	$27.43	$5,431			
A12.3	*Solid Waste Landfill*																		$199,187		
A12.3.1.1		Construction landfill	Place waste from site facilities	10,827	LCM	C.2.07	461.4	$1.96	$21,200.33	$9.09	$98,445	$2.94	32,207	$31,884.76	$0.00	$0.00	$14.00	$151,530			
A12.3.1.2			Place fill to minimize voids in the debris	2,824	m3	R.001	89.0	$1.44	$4,059.85	$3.16	$8,934	$0.93	2,645	$2,618.94	$0.00	$0.00	$5.53	$15,613			
A12.3.2.1		Close landfill	Soil Cover: Load haul, dump spread, compact (0.6m)	5,024	m3	R.002	190.0	$1.67	$8,400.65	$3.36	$16,884	$1.02	5,196	$5,144.21	$0.00	$0.00	$6.06	$30,429			
A12.3.2.2			Revegetation: Seed/Fertilizer: broadcast seeding	0.55	ha	C.6.01	18.1	$1,069.47	$583.88	$556.88	$304	$240.22	132	$131.15	$1,091.19	$595.74	$2,957.77	$1,615			
A12.4	*Hazardous Material Off-Site Disposal*																		$10,812		
A12.4.1.1		Hazardous Waste	From Building Demo: Transport off-site for disposal	2	trip	C.7.04	14.5	$363.66	$657.38	$360.37	$651	$116.87	213	$211.26	$0.00	$0.00	$840.90	$1,520			
A12.4.3.3			Hazardous materials: Disposal and Tipping fees.	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0	$0			
A12.4.2.1		Reagents	Reagents: Transport to Whitehorse	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A12.4.2.2			Reagents: Disposal and tipping fees	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A13	**Surface Water Conveyance**																			**$3,309,856**	
A13.1	*Channel A - W-15 to Main Pit*																		$204,169		
A13.1.1.1		Excavate channel	Load, haul, dump locally	40,300	m3	R.902	700.5	$0.80	$32,184.77	$1.33	$53,704	$0.48	19,351	$19,157.46	$0.00	$0.00	$2.61	$105,046			
A13.1.2.1		Place channel materials	Geotextile: Supply and place	7,785	m3	C.5.08	221.4	$1.14	$8,887.42	$0.19	$1,485	$0.11	897	$887.61	$2.68	$20,895.25	$4.13	$32,155			
A13.1.2.2			Rip-rap (angular, high quality): Screen and stockpile	3,855	m3	C.2.15	0.0	$2.63	$10,120.59	$6.44	$24,818	$1.92	7,462	$7,387.04	$0.00	$0.00	$10.98	$42,325			
A13.1.2.3			Rip-rap: Load, haul, dump	3,855	m3	R.018	102.2	$1.21	$4,660.08	$2.66	$10,255	$0.78	3,037	$3,006.14	$0.00	$0.00	$4.65	$17,921			
A13.1.2.4			Rip-rap: Place and secure	3,855	m3	R.904	41.9	$0.50	$1,926.02	$0.91	$3,507	$0.33	1,299	$1,286.49	$0.00	$0.00	$1.74	$6,720			
A13.2	*Channel B - W-35 to Area 2 Pit*																		$190,419		
A13.2.1.1		Excavate channel	Load, haul, dump locally	48,038	m3	R.902	835.0	$0.80	$38,364.63	$1.33	$64,016	$0.48	23,067	$22,835.92	$0.00	$0.00	$2.61	$125,216			
A13.2.2.1		Place channel materials	Geotextile: Supply and place	4,682	m2	C.5.08	133.1	$1.14	$5,344.90	$0.19	$893	$0.11	539	$533.81	$2.68	$12,566.42	$4.13	$19,338			
A13.2.2.2			Rip-rap (angular, high quality): Screen and stockpile	2,554	m3	C.2.15	0.0	$2.63	$6,704.89	$6.44	$16,442	$1.92	4,943	$4,893.91	$0.00	$0.00	$10.98	$28,041			
A13.2.2.3			Rip-rap: Load, haul, dump	2,554	m3	R.020	76.2	$1.36	$3,476.91	$3.00	$7,651	$0.88	2,266	$2,242.89	$0.00	$0.00	$5.24	$13,371			
A13.2.2.4			Rip-rap: Place and secure	2,554	m3	R.904	27.8	$0.50	$1,275.99	$0.91	$2,324	$0.33	861	$852.30	$0.00	$0.00	$1.74	$4,452			
A13.3	*Channel C - Main Pit to Main Access Road*																		$128,241		
A13.3.2.1		Excavate channel	Load, haul, dump locally	8,656	m3	R.902	150.5	$0.80	$6,913.18	$1.33	$11,535	$0.48	4,157	$4,114.96	$0.00	$0.00	$2.61	$22,564			
A13.3.3.1		Intake structure	Excavate soils to competent foundation materials	2,450	Bm3	R.902	42.6	$0.80	$1,956.44	$1.33	$3,265	$0.48	1,176	$1,164.54	$0.00	$0.00	$2.61	$6,386			
A13.3.3.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.3.3.6			Backfill and compact around structure	2,450	Cm3	C.2.04	237.3	$2.69	$6,581.75	$3.00	$7,361	$1.07	2,638	$2,611.71	$0.00	$0.00	$6.76	$16,554			
A13.3.4.1		Place channel materials	Geotextile: Supply and place	3,171	m2	C.5.08	90.2	$1.14	$3,619.88	$0.19	$605	$0.11	365	$361.53	$2.68	$8,510.72	$4.13	$13,097			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A13.3.4.2			Rip-rap (angular, high quality): Screen and stockpile	1,037	m3	C.2.15	0.0	$2.63	$2,723.66	$6.44	$6,679	$1.92	2,008	$1,988.01	$0.00	$0.00	$10.98	$11,391			
A13.3.4.3			Rip-rap: Load, haul, dump	1,037	m3	R.022	36.4	$1.60	$1,656.75	$3.47	$3,599	$1.02	1,064	$1,053.00	$0.00	$0.00	$6.08	$6,309			
A13.3.4.4			Rip-rap: Place and secure	1,037	m3	R.904	11.3	$0.50	$518.33	$0.91	$944	$0.33	350	$346.22	$0.00	$0.00	$1.74	$1,808			
A13.4	*Channel D - Area 2 Pit to Channel E*																		$198,109		
A13.4.1.1		Excavate channel	Load, haul, dump locally	17,840	m3	R.902	310.1	$0.80	$14,247.16	$1.33	$23,773	$0.48	8,566	$8,480.39	$0.00	$0.00	$2.61	$46,501			
A13.4.2.1		Intake structure	Excavate soils to competent foundation materials	4,453	Bm3	R.902	77.4	$0.80	$3,556.10	$1.33	$5,934	$0.48	2,138	$2,116.71	$0.00	$0.00	$2.61	$11,607			
A13.4.2.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.4.2.6			Backfill and compact around structure	4,453	Cm3	C.2.04	431.4	$2.69	$11,963.28	$3.00	$13,379	$1.07	4,795	$4,747.16	$0.00	$0.00	$6.76	$30,090			
A13.4.3.1		Place channel materials	Geotextile: Supply and place	4,910	m2	C.5.08	139.6	$1.14	$5,604.81	$0.19	$937	$0.11	565	$559.77	$2.68	$13,177.49	$4.13	$20,279			
A13.4.3.2			Rip-rap (angular, high quality): Screen and stockpile	2,199	m3	C.2.15	0.0	$2.63	$5,774.66	$6.44	$14,161	$1.92	4,258	$4,214.94	$0.00	$0.00	$10.98	$24,150			
A13.4.3.3			Rip-rap: Load, haul, dump	2,199	m3	R.020	65.7	$1.36	$2,994.53	$3.00	$6,590	$0.88	1,951	$1,931.72	$0.00	$0.00	$5.24	$11,516			
A13.4.3.4			Rip-rap: Place and secure	2,199	m3	R.904	23.9	$0.50	$1,098.96	$0.91	$2,001	$0.33	741	$734.05	$0.00	$0.00	$1.74	$3,834			
A13.5	*Channel E - Main Access Road to toe of MVFE*																		$784,793		
A13.5.1.1		Construct channel	Bulk fill to grade: Load, haul, dump, spread	29,750	m3																Vol. from AutoCAD3D; Vol. placed as part of excavation of re
A13.5.1.2			Excavate/form Channel: Load, haul, dump locally	46,386	m3	R.001	1,461.8	$1.44	$66,673.96	$3.16	$146,727	$0.93	43,445	$43,010.23	$0.00	$0.00	$5.53	$256,411			
A13.5.2.1		Place channel materials	Geotextile: Supply and place	27,307	m2	C.5.08	776.5	$1.14	$31,173.50	$0.19	$5,209	$0.11	3,145	$3,113.39	$2.68	$73,292.13	$4.13	$112,788			
A13.5.2.2			Rip-rap (angular, high quality): Screen and stockpile	20,558	m3	C.2.15	0.0	$2.63	$53,973.88	$6.44	$132,355	$1.92	39,794	$39,395.64	$0.00	$0.00	$10.98	$225,725			
A13.5.2.3			Rip-rap: Load, haul, dump	20,558	m3	R.025	845.7	$1.87	$38,540.15	$4.07	$83,728	$1.19	24,743	$24,495.41	$0.00	$0.00	$7.14	$146,763			
A13.5.2.4			Rip-rap: Place and secure	20,558	m3	R.904	223.6	$0.50	$10,271.59	$0.91	$18,706	$0.33	6,930	$6,860.95	$0.00	$0.00	$1.74	$35,838			
A13.5.3.1		Stilling Basin/Energy Dissipa	Excavate basin (spoil locally)	645	m3	R.902	11.2	$0.80	$515.35	$1.33	$860	$0.48	310	$306.75	$0.00	$0.00	$2.61	$1,682			
A13.5.3.2			Geotextile: Supply and place	540	m2	C.5.08	15.4	$1.14	$616.54	$0.19	$103	$0.11	62	$61.58	$2.68	$1,449.56	$4.13	$2,231			
A13.5.3.3			Bedding layer: Screen and stockpile	131	m3	C.2.01	2.7	$0.99	$129.06	$2.29	$299	$0.45	59	$58.25	$0.00	$0.00	$3.72	$486			
A13.5.3.4			Bedding layer: Load, haul, dump and place	131	m3	R.028	7.7	$2.68	$349.60	$6.08	$793	$1.74	229	$227.00	$0.00	$0.00	$10.50	$1,370			
A13.5.3.5			Rip-rap (at inlet and outlet): Screen and stockpile	75	m3	C.2.15	0.0	$2.63	$196.91	$6.44	$483	$1.92	145	$143.73	$0.00	$0.00	$10.98	$824			
A13.5.3.6			Rip-rap (at inlet and outlet): Load, haul, dump	75	m3	R.027	3.2	$1.92	$144.06	$4.13	$310	$1.21	91	$90.58	$0.00	$0.00	$7.26	$545			
A13.5.3.7			Rip-rap (at inlet and outlet): Place and secure	75	m3	R.904	0.8	$0.50	$37.47	$0.91	$68	$0.33	25	$25.03	$0.00	$0.00	$1.74	$131			
A13.6	*Minto Creek Wetland By-Pass Channel*																		$236,362		
A13.6.1.1		Excavate channel	Load, haul, dump locally	29,668	m3	R.902	515.7	$0.80	$23,693.38	$1.33	$39,535	$0.48	14,246	$14,103.10	$0.00	$0.00	$2.61	$77,332			
A13.6.2.1		Place channel materials	Geotextile: Supply and place	12,212	m2	C.5.08	347.3	$1.14	$13,940.93	$0.19	$2,330	$0.11	1,406	$1,392.32	$2.68	$32,776.56	$4.13	$50,439			
A13.6.2.2			Rip-rap (angular, high quality): Screen and stockpile	5,950	m3	C.2.15	0.0	$2.63	$15,621.11	$6.44	$38,306	$1.92	11,517	$11,401.88	$0.00	$0.00	$10.98	$65,329			
A13.6.2.3			Rip-rap: Load, haul, dump	5,950	m3	R.001	187.5	$1.44	$8,552.11	$3.16	$18,820	$0.93	5,573	$5,516.82	$0.00	$0.00	$5.53	$32,889			Assumes WSP rip-rap can be re-used
A13.6.2.4			Rip-rap: Place and secure	5,950	m3	R.904	64.7	$0.50	$2,972.80	$0.91	$5,414	$0.33	2,006	$1,985.70	$0.00	$0.00	$1.74	$10,372			
A13.7	*Allowance: Minto North Spillway*																		$84,151		
A13.7.1.1		Excavate channel	Load, haul, dump locally	13,035	m3	R.902	226.6	$0.80	$10,410.10	$1.33	$17,370	$0.48	6,259	$6,196.44	$0.00	$0.00	$2.61	$33,977			
A13.7.2.1		Place channel materials	Geotextile: Supply and place	4,136	m2	C.5.08	117.6	$1.14	$4,721.21	$0.19	$789	$0.11	476	$471.52	$2.68	$11,100.06	$4.13	$17,082			
A13.7.2.2			Rip-rap (angular, high quality): Screen and stockpile	1,943	m3	C.2.15	0.0	$2.63	$5,102.17	$6.44	$12,512	$1.92	3,762	$3,724.08	$0.00	$0.00	$10.98	$21,338			
A13.7.2.3			Rip-rap: Load, haul, dump	1,943	m3	R.024	47.7	$1.12	$2,175.48	$2.46	$4,787	$0.72	1,418	$1,403.37	$0.00	$0.00	$4.31	$8,366			Assumes WSP rip-rap can be re-used
A13.7.2.4			Rip-rap: Place and secure	1,943	m3	R.904	21.1	$0.50	$970.98	$0.91	$1,768	$0.33	655	$648.57	$0.00	$0.00	$1.74	$3,388			
A13.8	*Secondary Catchment Channels*																		$822,938		
A13.8.1.1		Southwest Dump	Excavate mild-graded channels (good access), spoil locally	10,787	Bm3	R.902	187.5	$0.80	$8,615.00	$1.33	$14,375	$0.48	5,180	$5,127.94	$0.00	$0.00	$2.61	$28,118			
A13.8.1.2			Excavate steep-graded channels (poor access), spoil locally	6,640	Bm3	R.903	131.0	$0.91	$6,019.60	$1.51	$10,044	$0.54	3,619	$3,583.07	$0.00	$0.00	$2.96	$19,647			
A13.8.1.3			Geotextile: Supply and place	25,206	m2	C.5.08	716.7	$1.14	$28,774.54	$0.19	$4,809	$0.11	2,903	$2,873.80	$2.68	$67,651.92	$4.13	$104,109			
A13.8.1.4			Bedding layer: Screen and stockpile	2,054	Cm3	C.2.01	41.8	$0.99	$2,031.02	$2.29	$4,703	$0.45	926	$916.60	$0.00	$0.00	$3.72	$7,651			
A13.8.1.5			Bedding layer: Load, haul, dump and place in steep areas	2,054	Cm3	R.032	72.2	$1.60	$3,288.73	$3.48	$7,145	$1.02	2,111	$2,090.26	$0.00	$0.00	$6.10	$12,524			
A13.8.1.6			Rip-rap (angular, high quality): Screen and stockpile	6,806	Cm3	C.2.15	0.0	$2.63	$17,870.15	$6.44	$43,821	$1.92	13,175	$13,043.46	$0.00	$0.00	$10.98	$74,735			
A13.8.1.7			Rip-rap: Load, haul, dump	6,806	m3	R.031	223.5	$1.50	$10,194.10	$3.30	$22,434	$0.97	6,642	$6,576.04	$0.00	$0.00	$5.76	$39,204			
A13.8.1.8			Rip-rap: Place in mild-graded channels (good access)	3,787	m3	R.904	41.2	$0.50	$1,892.29	$0.91	$3,446	$0.33	1,277	$1,263.96	$0.00	$0.00	$1.74	$6,602			
A13.8.1.9			Rip-rap: Place in steep-graded channels (poor access)	3,019	m3	R.905	74.5	$1.13	$3,424.74	$1.89	$5,715	$0.68	2,059	$2,038.52	$0.00	$0.00	$3.70	$11,178			
A13.8.2.1		Main Waste Dump	Excavate mild-graded channels (good access), spoil locally	6,477	Bm3	R.902	112.6	$0.80	$5,172.45	$1.33	$8,631	$0.48	3,110	$3,078.81	$0.00	$0.00	$2.61	$16,882			
A13.8.2.2			Excavate steep-graded channels (poor access), spoil locally	3,986	Bm3	R.903	78.6	$0.91	$3,613.24	$1.51	$6,029	$0.54	2,172	$2,150.72	$0.00	$0.00	$2.96	$11,793			
A13.8.2.3			Geotextile: Supply and place	15,132	m2	C.5.08	430.3	$1.14	$17,274.69	$0.19	$2,887	$0.11	1,743	$1,725.28	$2.68	$40,614.58	$4.13	$62,501			
A13.8.2.4			Bedding layer: Screen and stockpile	1,233	Cm3	C.2.01	25.1	$0.99	$1,219.11	$2.29	$2,823	$0.45	556	$550.18	$0.00	$0.00	$3.72	$4,592			
A13.8.2.5			Bedding layer: Load, haul, dump and place in steep areas	1,233	Cm3	R.030	34.8	$1.29	$1,589.78	$2.89	$3,566	$0.85	1,059	$1,048.15	$0.00	$0.00	$5.03	$6,204			
A13.8.2.6			Rip-rap (angular, high quality): Screen and stockpile	4,086	Cm3	C.2.15	0.0	$2.63	$10,728.01	$6.44	$26,307	$1.92	7,909	$7,830.40	$0.00	$0.00	$10.98	$44,866			
A13.8.2.7			Rip-rap: Load, haul, dump	4,086	m3	R.029	101.4	$1.13	$4,630.74	$2.54	$10,386	$0.75	3,084	$3,053.08	$0.00	$0.00	$4.42	$18,070			
A13.8.2.8			Rip-rap: Place in mild-graded channels (good access)	2,274	m3	R.904	24.7	$0.50	$1,136.13	$0.91	$2,069	$0.33	767	$758.88	$0.00	$0.00	$1.74	$3,964			
A13.8.2.9			Rip-rap: Place in steep-graded channels (poor access)	1,812	m3	R.905	44.7	$1.13	$2,055.69	$1.89	$3,430	$0.68	1,236	$1,223.61	$0.00	$0.00	$3.70	$6,709			
A13.8.3.1		Reclamation Overburden D	Excavate mild-graded channels (good access), spoil locally	4,886	Bm3	R.902	84.9	$0.80	$3,902.25	$1.33	$6,511	$0.48	2,346	$2,322.75	$0.00	$0.00	$2.61	$12,736			
A13.8.3.2			Excavate steep-graded channels (poor access), spoil locally	3,007	Bm3	R.903	59.3	$0.91	$2,725.94	$1.51	$4,549	$0.54	1,639	$1,622.57	$0.00	$0.00	$2.96	$8,897			
A13.8.3.3			Geotextile: Supply and place	11,416	m2	C.5.08	324.6	$1.14	$13,032.55	$0.19	$2,178	$0.11	1,315	$1,301.60	$2.68	$30,640.87	$4.13	$47,153			
A13.8.3.4			Bedding layer: Screen and stockpile	930	Cm3	C.2.01	18.9	$0.99	$919.73	$2.29	$2,130	$0.45	419	$415.07	$0.00	$0.00	$3.72	$3,465			
A13.8.3.5			Bedding layer: Load, haul, dump and place in steep areas	930	Cm3	R.034	34.7	$1.70	$1,581.31	$3.74	$3,480	$1.10	1,030	$1,020.08	$0.00	$0.00	$6.54	$6,081			
A13.8.3.6			Rip-rap (angular, high quality): Screen and stockpile	3,083	Cm3	C.2.15	0.0	$2.63	$8,093.54	$6.44	$19,847	$1.92	5,967	$5,907.49	$0.00	$0.00	$10.98	$33,848			
A13.8.3.7			Rip-rap: Load, haul, dump	3,083	m3	R.033	97.0	$1.43	$4,422.65	$3.16	$9,733	$0.93	2,882	$2,852.98	$0.00	$0.00	$5.52	$17,008			
A13.8.3.8			Rip-rap: Place in mild-graded channels (good access)	1,715	m3	R.904	18.7	$0.50	$857.13	$0.91	$1,561	$0.33	578	$572.53	$0.00	$0.00	$1.74	$2,991			
A13.8.3.9			Rip-rap: Place in steep-graded channels (poor access)	1,367	m3	R.905	33.8	$1.13	$1,550.87	$1.89	$2,588	$0.68	932	$923.13	$0.00	$0.00	$3.70	$5,062			
A13.8.4.1		DSTSF & MVFE	Excavate mild-graded channels (good access), spoil locally	7,378	Bm3	R.902	128.3	$0.80	$5,892.66	$1.33	$9,833	$0.48	3,543	$3,507.51	$0.00	$0.00	$2.61	$19,233			
A13.8.4.2			Excavate steep-graded channels (poor access), spoil locally	4,541	Bm3	R.903	89.6	$0.91	$4,116.35	$1.51	$6,869	$0.54	2,475	$2,450.19	$0.00	$0.00	$2.96	$13,435			
A13.8.4.3			Geotextile: Supply and place	17,239	m2	C.5.08	490.2	$1.14	$19,680.03	$0.19	$3,289	$0.11	1,985	$1,965.50	$2.68	$46,269.77	$4.13	$71,204			
A13.8.4.4			Bedding layer: Screen and stockpile	1,405	Cm3	C.2.01	28.6	$0.99	$1,388.86	$2.29	$3,216	$0.45	633	$626.79	$0.00	$0.00	$3.72	$5,232			
A13.8.4.5			Bedding layer: Load, haul, dump and place in steep areas	1,405	Cm3	R.028	82.5	$2.68	$3,762.08	$6.08	$8,538	$1.74	2,467	$2,442.81	$0.00	$0.00	$10.50	$14,743			
A13.8.4.6			Rip-rap (angular, high quality): Screen and stockpile	4,655	Cm3	C.2.15	0.0	$2.63	$12,221.79	$6.44	$29,970	$1.92	9,011	$8,920.70	$0.00	$0.00	$10.98	$51,113			
A13.8.4.7			Rip-rap: Load, haul, dump	4,655	m3	C.5.08	132.4	$1.14	$5,314.15	$0.19	$888	$0.11	536	$530.74	$2.68	$12,494.11	$4.13	$19,227			
A13.8.4.8			Rip-rap: Place in mild-graded channels (good access)	2,590	m3	R.904	28.2	$0.50	$1,294.33	$0.91	$2,357	$0.33	873	$864.55	$0.00	$0.00	$1.74	$4,516			
A13.8.4.9			Rip-rap: Place in steep-graded channels (poor access)	2,065	m3	R.905	51.0	$1.13	$2,341.92	$1.89	$3,908	$0.68	1,408	$1,393.99	$0.00	$0.00	$3.70	$7,644			
A13.8	*Tailings Diversion Ditch*																		$660,675		
A13.8.1.2		Regrade	Slopes: Re-grade to 3H:1V	36	hrs	C.2.13	36	$45.95	$1,644	$213.35	$7,635	$69.10	2,498	$2,473	$0.00	$0	$328.40	$11,751			
A13.8.2.1		Cover	Flat area cover material: Load, haul, dump spread	25,182	Cm3	R.066	562.3	$1.02	$25,637	$3.30	$83,160	$1.08	27,585	$27,310	$0.00	$0	$5.40	$136,106			
A13.8.2.2			Slope area cover material: Load, haul, dump along crest	18,049	Cm3	R.067	352.6	$0.89	$16,061	$2.91	$52,469	$0.98	17,921	$17,742	$0.00	$0	$4.78	$86,272			
A13.8.2.3			Slope area cover material: Spread down slope	14	hrs	C.2.13	14.0	$45.95	$643	$213.35	$2,985	$69.10	977	$967	$0.00	$0	$328.40	$4,595			
A13.8.3.1		Revegetate	Seed/Fertilize: tractor application	9	ha	C.6.01	286.4	$1,069.47	$9,247	$556.88	$4,815	$240.22	2,098	$2,077	$1,091.19	$9,435	$2,958	$25,574			
A13.8.3.2			Tree seedling application (1,000 stems/ha)	9	ha	C.6.06	443.1	$1,919.72	$16,598	$35.26	$305	$15.47	135	$134	$1,189.36	$10,284	$3,160	$27,321			
A13.8.4.1		Extend Channel to WSP	Clear and grub footprint	13,889	m2	C.2.03	52.8	$0.17	$2,426	$0.54	$7,480	$0.14	1,940	$1,921	$0.00	$0	$0.85	$11,826			
A13.8.4.2			Geotextile: Supply and place	13,889	m2	C.5.08	394.9	$1.14	$15,855	$0.19	$2,650	$0.11	1,600	$1,584	$2.68	$37,277	$4.13	$57,366			
A13.8.4.3			Rip-rap (angular, high quality): Screen and stockpile	13,169	m3	C.2.15	0.0	$2.63	$34,576	$6.44	$84,788	$1.92	25,492	$25,237	$0.00	$0	$10.98	$144,601			
A13.8.4.4			Rip-rap: Load, haul, dump	13,169	m3	R.035	618.4	$2.14	$28,168	$4.60	$60,626	$1.34	17,890	$17,712	$0.00	$0	$8.09	$106,506			
A13.8.4.5			Rip-rap: Place in steep-graded channels (poor access)	13,169	m3	R.905	325.1	$1.13	$14,939	$1.89	$24,927	$0.68	8,982	$8,892	$0.00	$0	$3.70	$48,757			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A14	**Water Treatment**																			**$574,445**	
A14.1	*Passive Treatment System - Minto Creek Valley*																		$485,215		
A14.1.1.1		Water Management	Install pump and pump around system	8	hrs	C.4.14	32.0	$125.31	$1,002.50	$37.01	$296	$6.95	56	$55.60	$0.00	$0.00	$169.27	$1,354			Assumed
A14.1.1.2			Maintain pump around system during wetland construction activities	1,440	hrs	C.4.13	144.0	$3.72	$5,363.40	$28.42	$40,918	$2.00	2,909	$2,880.00	$0.00	$0.00	$34.14	$49,161			Assumes wetlands constructed over 2 months
A14.1.2.1		Valley Fill placement	Load, haul, dump material from the WSP excavation	85,918	m3	n/a - costed	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.1.2.1			Load, haul dump valley fill material	0	m3	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			Fill from WSP excavation exceeds the required amount.
A14.1.3.1		Construct wetlands	Excavate cells: Load, haul dump, spoil locally	14,459	m3	R.902	251.3	$0.80	$11,547.30	$1.33	$19,268	$0.48	6,943	$6,873.34	$0.00	$0.00	$2.61	$37,689			
A14.1.3.2			Subgrade preparation: remove sharp objects, place fill as required	9,273	m2	C.2.18	317.0	$1.37	$12,669.07	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$12,669			
A14.1.3.3			Geotextile: Supply and install	10,201	m2	C.5.08	290.1	$1.14	$11,644.99	$0.19	$1,946	$0.11	1,175	$1,163.02	$2.68	$27,378.58	$4.13	$42,133			
A14.1.3.4			HDPE liner: Supply and install	10,201	m2	C.5.11	1,187.0	$4.93	$50,253.33	$0.47	$4,778	$0.28	2,884	$2,855.60	$13.70	$139,698.09	$19.37	$197,585			
A14.1.3.5			Organics: Mulch organics, produce and stockpile	5,122	Cm3	C.2.10	577.1	$4.68	$23,965.81	$5.04	$25,817	$1.86	9,609	$9,513.16	$0.00	$0.00	$11.58	$59,295			
A14.1.3.6			Organics: Load, haul, dump, place in cell	5,122	Cm3	R.001	161.4	$1.44	$7,362.27	$3.16	$16,202	$0.93	4,797	$4,749.28	$0.00	$0.00	$5.53	$28,313			
A14.1.3.7			Plant wetland vegetation	0.9	ha	C.6.05	40.6	$1,505.47	$1,396.08	$406.33	$377	$185.63	174	$172.14	$1,216.54	$1,128.14	$3,313.97	$3,073			
A14.1.4.1		Conveyance channels	Excavate channels: Load, haul, dump locally	1,402	m3	R.902	24.4	$0.80	$1,119.89	$1.33	$1,869	$0.48	673	$666.59	$0.00	$0.00	$2.61	$3,655			
A14.1.4.2			Surface preparation: remove sharp objects, place fill as required	1,858	m2	C.2.18	63.5	$1.37	$2,538.03	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$2,538			
A14.1.4.3			Geotextile: Supply and place	1,858	m2	C.5.08	52.8	$1.14	$2,120.80	$0.19	$354	$0.11	214	$211.81	$2.68	$4,986.21	$4.13	$7,673			
A14.1.4.4			HDPE Liner: Supply and install	1,858	m2	C.5.11	216.2	$4.93	$9,152.18	$0.47	$870	$0.28	525	$520.06	$13.70	$25,441.93	$19.37	$35,984			
A14.1.4.5			Bedding/Protection layer: Screen and stockpile	442	m3	C.2.01	9.0	$0.99	$437.26	$2.29	$1,013	$0.45	199	$197.34	$0.00	$0.00	$3.72	$1,647			
A14.1.4.6			Bedding/Protection layer: Load, haul, dump and place	442	m3	R.001	13.9	$1.44	$635.70	$3.16	$1,399	$0.93	414	$410.08	$0.00	$0.00	$5.53	$2,445			Assumes WSP fill can be re-used
A14.1.5.1		Operation and maintenance	System to be started Yr. 1 post-closure	0	yr	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.2	*Southwest Wetlands*																		$16,583		
A14.2.1		Berm construction	Construct 3 berms across valley	3,000	m3	R.001	94.5	$1.44	$4,312.16	$3.16	$9,490	$0.93	2,810	$2,781.70	$0.00	$0.00	$5.53	$16,583			Assumed
A14.2.2		Outlet structures	Excavate outlet channels through berms	1	ls																Allowance
A14.3	*Decommission/demolish Water Treatment System*																		$72,646		
A14.3.1.1		Remove equipment	Small equipment: dismantle and prep for transport	17	hrs	C.1.13	67.1	$174.43	$2,927.27	$115.96	$1,946	$17.92	304	$300.72	$0.00	$0.00	$308.32	$5,174			
A14.3.1.2			Large equipment (crane req'd): dismantle and prep for transport	29	hrs	C.1.14	175.7	$279.25	$8,178.13	$199.44	$5,841	$24.11	713	$706.00	$0.00	$0.00	$502.79	$14,725			
A14.3.2.1		Prepare for demolition	Reagents: Load for transport	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A14.3.2.2			Reagents: Transport to Whitehorse	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A14.3.2.3			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.3.3.1		Demolition	Structural building demolition	163	tonnes	C.1.05	325.0	$71.87	$11,680.66	$139.79	$22,719	$34.90	5,729	$5,671.56	$0.00	$0.00	$246.56	$40,071			
A14.3.3.2			Other demolition: miscellaneous	15	m3	C.1.07	1.5	$3.90	$58.57	$2.07	$31	$0.76	12	$11.40	$0.00	$0.00	$6.74	$101			
A14.3.4.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	27.1	$367.57	$1,244.53	$485.20	$1,643	$116.87	400	$395.70	$0.00	$0.00	$970	$3,283			
Subtotal Direct Costs - Active Closure							**115,810**		**$5,099,488**		**$8,766,775**		**2,771,211**	**$2,743,499**		**$1,557,393**				**$18,167,154**	
INDIRECT COSTS																					
B1	**Mobilization-Demobilization**																			**$344,806**	
B1.1		Mobilization	Year 0	1	LS												$172,403	$172,403.02			
B1.2		Demobilization	Year 3 (end of Active Closure)	1	LS												$154,305	$154,304.96			
B1.4		Demobilization	End of Passive closure	1	LS												$18,098	$18,098.05			
B2	**Transportation Costs**																			**$408,224**	
B2.1.1		Barge Operations		14	month												$10,939	$153,140			
		Staffing Bus trips during barge operation period		56	ea (one per week)												$698	$39,084			Turnaround labour costs included in labour build-up
B2.2.2		Air transport and airstrip operations		72	flights												$3,000	$216,000			Three flights per week
B3	**Site/Road Maintenance**																			**$796,356**	
B3.1	*Road Maintenance*																		$718,289		
B3.1.1		Water Truck	Assume needed 150 hrs per month	20	month												$13,733	$274,666			
B3.1.2		Grader	Assume needed 150 hrs per month (16H + Operator)	20	month												$22,181	$443,622			Includes Main Access Road throughout closure period.
B3.2	*Soil Erosion*																		$78,067		
B3.2.1		Erosion control allowance	Silt fencing: supply, install remove at strategic locations	7023.7	m	C.2.17	283.5	$3.36	$23,588.40	$1.91	$13,417	$0.57	4,026	$3,986.02	$1.85	$12,979.80	$7.68	$53,971			
B3.2.2			Supply and install erosion control matting	10000	m2	C.2.09	175.4	$0.69	$6,915.95	$0.12	$1,237	$0.05	548	$542.76	$1.54	$15,400.00	$2.41	$24,096			
B4	**Construction Support**																			**$5,029,776**	
B4.1	*Field Support Staff*																		$2,850,986		Turnaround labour costs included in labour build-up
B4.1.1		Mine Manager		20	month		(	360) site working hours per month									$25,631	$512,623			
B4.1.2		Office/Camp manager		20	month		(	360) site working hours per month									$23,201	$464,010			
B4.1.3		Security/Administrative Assistant		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.4		Foreman		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.5		Mechanic		20	month		(	360) site working hours per month									$0	$0			Included in Equipment rates
B4.1.6		Surveyor		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.7		Engineering technician	Material & QA/QC testing	10	month		(	360) site working hours per month									$42,120	$421,200			Assumed needed 1/2 of time
B4.1.8		Medic/H&S supervisor		20	month		(	360) site working hours per month									$17,771	$355,420			
B4.2	*Field support Vehicles*																		$540,551		
B4.2.1		Pick-up trucks (4 required)		80	month												$4,875	$389,967			
B4.2.3		Mechanic service vehicle		20	month												$0	$0			Included in Equipment rates
B4.2.4		Emergency transport vehicle		20	month												$5,218	$104,360			
B4.2.5		Passenger bus		20	month												$2,311	$46,224			
B4.3	*Field Support Equipment/Supplies*																		$1,638,239		
B4.3.1		Light Towers		20	month			2 # of Units									$3,978	$79,563			
B4.3.2		Material/Laboratory testing allowance		20	month												$1,000	$20,000			
B4.4		Construction, Environmental, and H&S Management Plans		1	LS												$25,000	$25,000			
B4.5		Office supplies		20	month												$1,000	$20,000			
B4.6		Communications		20	month												$1,000	$20,000			
B4.7		Misc. supplies		20	month												$500	$10,000			
B4.8		Camp costs	Includes catering and housekeeping	11,581	man-day (direct)			5840 man-day (indirect)									$80	$1,393,676			
B4.9		Power and heat		20	month												$3,500	$70,000			
B5	**QA and Project Management**																			**$1,958,293**	
B5.1		EOR Engineer		20	month		(	84) project hours per month									$15,120	$302,400			
B5.2		Field Engineer		20	month		(	360) site working hours per month									$48,600	$972,000			
B5.3		Engineer travel/turnaround costs		47	ls												$3,600	$169,200			Assumes Vancouver origin
B5.4		Environmental Monitor		20	month		(	360) site working hours per month									$15,985	$319,709			
B5.5		Engineering , Design, and Construction plans (included in Planning and Permitting Costs)															$0.00	$0			
B5.6		Field support vehicles (2 vehicles)		40	month												$4,875	$194,984			
Subtotal Indirect Costs - Active Closure																				**$8,537,455**	
CLOSURE IMPLEMENTATION COSTS - TOTAL																				**$26,704,609**	

Worksheet 5 - Year 0 Estimate - Schedule Details

Project:	Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.:	1CM002.044
Client:	Minto Explorations Ltd.
Date of Submission:	Sept. 17, 2020
File Location:	\\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Year 0 Site Access Schedule

Stage	Flight Months	Helicopter Months	Barge Months	Total Months	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Interim Care	2	5	5	12	H	H	H	F	F	B	B	B	B	B	H	H	
SUB-TOTAL INTERIM CARE	**2**	**5**	**5**	**12**													
Active Closure 1	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 2	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 3	2	0	4	6				F	F	B	B	B	B				
SUB-TOTAL ACTIVE CLOSURE	**6**	**0**	**14**	**20**													
Post-Closure 1	2	0	3	5				F	F	B	B	B					
SUB-TOTAL POST-CLOSURE 1	**2**	**0**	**3**	**5**													
Post-Closure 2	0	0	1	1						B							
SUB-TOTAL POST-CLOSURE 2	**0**	**0**	**1**	**1**													

B: Annual C&M Staffing Schedule - Interim Operations

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**12**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
Administration/Office															
1	Mine Manager	4				0.5	0.5	0.5	0.5	0.5	0.5	0.5			
2	Office/Camp Mgr	6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
3	Payroll/Accounting/HR	0												Done Remotely	
Water Treatment/Environmental Staffing															
1	Warehouse/Water Treatment Operator	5				1.0	1.0	1.0	1.0	1.0					
2	Environmental Manager	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
3	Environmental Technician	7	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Operations															
4	Barge Operator	10						2.0	2.0	2.0	2.0	2.0			
5	Equipment operators	13				2.0	3.0	1.5	1.5	1.5	1.5	1.5			
6	HD Mechanic	2				0.5	0.3	0.3	0.3	0.25	0.25	0.25			
7	Tradesmen	2				0.5	0.3	0.3	0.3	0.25	0.25	0.5			
8	Labour/Helpers	10	1	1	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	1.0	1.0	
Camp/Support															
1	Cooks/Housecleaning etc.	0				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		Contract (accounted for in camp costs)
Other															
1	Visitors	2				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.0		
TOTAL		**63.0**	**2.0**	**2.0**	**2.0**	**8.3**	**7.8**	**7.8**	**7.8**	**7.8**	**6.8**	**7.0**	**2.0**	**2.0**	
	Annual man-days:	**1,890**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

C: Annual C&M Staffing Schedule - During Active Phase

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**7**				**1**	**1**	**1**	**1**	**1**	**1**	**1**			
Water Treatment/Environmental Staffing															
1	Warehouse/Water Treatment Operator	5				1.0	1.0	1.0	1.0	1.0					
2	Environmental Manager	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
3	Environmental Technician	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
TOTAL		**13**	**0**	**0**	**0**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**0**	**0**	
	Annual man-days:	**390**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)

D: Annual C&M Staffing Schedule - Post Closure 1

#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
				Month												
Months Active at Site			**5**				**1**	**1**	**1**	**1**	**1**					
Administration/Office																
1	Mine Manager		3				0.5	0.5	0.5	0.5	0.5					
2	Office/Camp Mgr		3				1.0	0.5	0.5	0.5	0.5					
3	Payroll/Accounting/HR		0													Done remotely
Water Treatment/Environmental Staffing																
1	Water Treatment Operator		2				0.5	0.5	0.3	0.3	0.3					
2	Environmental Manager		3				0.5	0.5	0.5	0.5	0.5					
3	Environmental Technician		3				0.5	0.5	0.5	0.5	0.5					
Operations																
4	Barge Operator		6						2.0	2.0	2.0					
5	Equipment operators		10				2.0	3.0	1.5	1.5	1.5					
6	HD Mechanic		2				1.0	0.25	0.25	0.25	0.25					
7	Tradesmen		2				1.0	0.25	0.25	0.25	0.25					
8	Labour/Helpers		2				1.0	0.25	0.25	0.25	0.5					
Camp/Support																
1	Cooks/Housecleaning etc.		0				0.0	0.0	0.0	0.0	0.0					Contract (accounted for in camp costs)
Other																
1	Visitors		1				0.25				0.25					
TOTAL			**35**	**0**	**0**	**0**	**8**	**6**	**7**	**7**	**7**	**0**	**0**	**0**	**0**	
		Annual man-days:	**1,035**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Post Closure 2

#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
				Month												
Months Active at Site			**1**						**1**							
Administration/Office																
1	Mine Manager		1						0.5							
2	Office/Camp Mgr		0						0.0							
3	Payroll/Accounting/HR		0						0.00							
Water Treatment/Environmental Staffing																
1	Passive Treatment Scientist		1						0.5							
2	Environmental Manager		0													
3	Environmental Technician		0													
Operations																
4	Barge Operator		1						1.0							
5	Equipment operators		1						1.0							
6	HD Mechanic		1						0.50							
7	Tradesmen		0													
8	Labour/Helpers		0						0.25							
Camp/Support																
1	Cooks/Housecleaning etc.		0						0.0							Contract (accounted for in camp costs)
Other																
1	Visitors		0						0.25							
TOTAL			**4**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**120**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Long-term perpetual maintenance year

#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
				Month												
Months Active at Site			**1**							**1**						
Administration/Office																
1	Project Manager/Foreman		1							1.0						
Water Treatment/Engineering Staffing																
1	Passive Treatment Scientist		1							1.0						
2	Site Engineer		1							1.0						
3	Environmental Technician		0													
Operations																
4	Barge Operator		1							1.0						Assumed required 1/2 the time (near mob and demob)
5	Equipment operators		4							4.0						
6	HD Mechanic		1							0.50						
7	Tradesmen		0													
8	Labour/Helpers		1							1.00						
Camp/Support																
1	Cooks/Housecleaning etc.		0													Contract (accounted for in camp costs)
Other																
1	Visitors		1							0.50						
TOTAL			**10**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**300**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

Worksheet 6- Year 0 Estimate - Planning and Permitting Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

Planning And Permitting

WBS	Facility/Area	Task	Activity	Qnty	Unit	Total Unit Rate ($/unit)	Activity Total	Subtotal	Source / Comments
M1	**Planning and Permitting**								
M1.1	*Reclamation Research/Planning*							$400,000	
M1.1.1		Complete reclamation closure and research plan		2	yr	$200,000	$400,000		
M1.2	*Technical studies and investigations*							$58,500	
M1.2.1		Allowance for additional technical studies		1	ls	$58,500	$58,500		
M1.3	*Monitoring and Management Plans*							$209,158	
M1.3.1		Adaptive Mgmt Plans	Physcial, water quality, etc	1	ls	$15,000	$15,000		
M1.3.2		Revegetation plan		1	ls	$30,000	$30,000		
M1.3.3		Waste Management Plan	Water treatment, sludge, landfarm, etc.	1	ls	$50,000	$50,000		
M1.3.4		MMER Final Monitoring Study		1	ls	$114,158	$114,158		
M1.4	*Engineering, Design, and Construction Plans*							$908,358	
M1.4.1		Percentage of direct implementation costs		5%	of	$18,167,154	$908,358		
M1.5	*Permitting*							$0	
M1.5.1.1		Permit Staffing	Permitting Manager	0	ls	$0	$0		Staffing costs included in tasks above
M1.5.1.2			Environmental Manager	0	ls	$0	$0		
M1.5.1.3			Technical Consultants	0	ls	$0	$0		
TOTAL								**$1,576,016**	

Worksheet 7 - Peak Liability Estimate - Cashflow Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

NPV CALCULATION INPUTS

NOTE: Some columns between Years 2042 and 2130 may be hidden for printing purposes.

Short-Term Interest Rate (Interim Care/Implementation Costs)

##	Inflation Rate	Years in effect	Start Year	End Year
1	1.9%	109	2021	2130

Input Parameters

Scenario:	Peak Liability	
First year in scenario:	2021	Typically year that the estimate is costed
Closure Year 1:	2025	
Closure Period:	3	yrs
Post-Closure Year 1:	2028	

Long-Term Monitoring/Maintenance NPV Discount Rates

##	Discount Rate	Years in effect	Start Year	End Year
1	0.55%	2	2021	2022
2	1.0%	3	2023	2025
3	1.9%	-	2026	

SCHEDULE

			OPERATIONS		INTERIM CARE		CLOSURE			POST CLOSURE																										
Implementation Schedule		Closure Year:	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 99	Year 107	Year 108
	Area	Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
Direct Costs	Waste Dumps	100%					40%	60%																														
	Overburden Dumps	100%							100%																													
	Ore Stockpiles	100%					100%																															
	Open Pits	100%						50%	50%																													
	Underground Openings	100%					100%																															
	External Tailings Facilities	100%					50%	50%																														
	Roads	100%							100%																													
	Demolition	100%					10%	75%	15%																													
	Surface Infrastructure	100%					25%	50%	25%																													
	Water Detention Structures	100%						50%	50%																													
	Yards/Laydown Areas	100%					25%	25%	50%																													
	Waste Disposal	100%						12%	75%	2%	2%	2%	6%																									
	Surface Water Conveyance	100%					20%	30%	50%																													
	Water Treatment	100%							86%					14%																								
Indirect	Mobilization-Demobilization	100%					50%		45%					5%																								
	Transport Costs	100%					34%	33%	33%																													
	Road Maintenance	100%					34%	33%	33%																													
	Construction Support	100%					34%	33%	33%																													
	QA and Pro. Mgmt.	100%					34%	33%	33%																													

Monitoring Schedule		Post-Closure Year:	Year -7	Year -6	Year -5	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 96	Year 104	Year 105
		Set Monitoring/C&M Stage:			1 - Interim	1 - Interim	2 - Active	2 - Active	2 - Active	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2										5 - Perpetual				5 - Perpetual
		Sum																																				
Planning and permitting	Reclamation Research and Planning	100%			50%	50%																																
	Technical Studies and Investigations	100%			50%	50%																																
	Engineering, Design, and Construction Plans	100%			30%	40%	10%	10%	10%																													
	Monitoring and Management Plans	100%			50%	50%																																
	Permitting	100%			50%	50%																																
Monitoring	Water Quality Monitoring (surface and groundwater)				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										1				1
	Sediment Monitoring				1	1	1	1	1	1		1		1					1					1										1				1
	Biological Monitoring				1	1	1	1	1	1		1		1					1					1										1				1
	Geotechnical Monitoring				1	1	1	1	1	1	1	1	1	1					1					1										1				1
	Revegetation Monitoring						1	1	1	1	1	1	1	1					1					1										1				1
	Annual Inspection Reporting				1	1	1	1	1	1	1	1	1	1					1					1										1				1
Care and Maintenance Schedule																																						
Water Treatment/Management	Active System				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x														
	Passive System									x	x	x	x	x					x					x										x				x
Reclamation Maintenance	Revegetation, cover repair, etc.									x	x	x	x	x																				x				x
Site Maintenance					x	x	x	x	x	x	x	x	x	x					x					x										x				x
On-site Management					x	x	x	x	x	x	x	x	x	x					x					x										x				x
Transportation Costs					x	x	x	x	x	x	x	x	x	x					x					x										x				x

UNDISCOUNTED CASH FLOW (TO 100 YEARS POST CLOSURE)

Implementation Costs

	Area	Total	% of Total	Check Sum	Year -4 2021	Year -3 2022	Year -2 2023	Year -1 2024	Year 1 2025	Year 2 2026	Year 3 2027	Year 4 2028	Year 5 2029	Year 6 2030	Year 7 2031	Year 8 2032
Direct Costs	Waste Dumps	$7,935,918	27%	$7,935,918	$0	$0	$0	$0	$3,174,367	$4,761,551	$0	$0	$0	$0	$0	$0
	Overburden Dumps	$472,870	2%	$472,870	$0	$0	$0	$0	$0	$0	$472,870	$0	$0	$0	$0	$0
	Ore Stockpiles	$3,408,266	11%	$3,408,266	$0	$0	$0	$0	$3,408,266	$0	$0	$0	$0	$0	$0	$0
	Open Pits	$641,203	2%	$641,203	$0	$0	$0	$0	$0	$320,602	$320,602	$0	$0	$0	$0	$0
	Underground Openings	$92,291	0%	$92,291	$0	$0	$0	$0	$92,291	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities	$77,263	0%	$77,263	$0	$0	$0	$0	$38,632	$38,632	$0	$0	$0	$0	$0	$0
	Roads	$153,441	1%	$153,441	$0	$0	$0	$0	$0	$0	$153,441	$0	$0	$0	$0	$0
	Demolition	$2,005,083	7%	$2,005,083	$0	$0	$0	$0	$200,508	$1,503,813	$300,763	$0	$0	$0	$0	$0
	Surface Infrastructure	$175,792	1%	$175,792	$0	$0	$0	$0	$43,948	$87,896	$43,948	$0	$0	$0	$0	$0
	Water Detention Structures	$840,997	3%	$840,997	$0	$0	$0	$0	$0	$420,498	$420,498	$0	$0	$0	$0	$0
	Yards/Laydown Areas	$827,890	3%	$827,890	$0	$0	$0	$0	$206,972	$206,972	$413,945	$0	$0	$0	$0	$0
	Waste Disposal	$461,883	2%	$461,883	$0	$0	$0	$0	$0	$55,913	$346,412	$11,366	$11,366	$11,366	$25,461	$0
	Surface Water Conveyance	$3,417,069	11%	$3,417,069	$0	$0	$0	$0	$683,414	$1,025,121	$1,708,534	$0	$0	$0	$0	$0
	Water Treatment	$574,445	2%	$574,445	$0	$0	$0	$0	$0	$0	$492,221	$0	$0	$0	$0	$82,224
Indirect	Mobilization-Demobilization	$344,806	1%	$344,806	$0	$0	$0	$0	$172,403	$0	$153,642	$0	$0	$0	$0	$18,761
	Transport Costs	$420,735	1%	$420,735	$0	$0	$0	$0	$143,050	$138,843	$138,843	$0	$0	$0	$0	$0
	Site/Road Maintenance	$832,270	3%	$832,270	$0	$0	$0	$0	$282,972	$274,649	$274,649	$0	$0	$0	$0	$0
	Construction Support	$5,341,188	18%	$5,341,188	$0	$0	$0	$0	$1,816,004	$1,762,592	$1,762,592	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.	$1,737,427	6%	$1,737,427	$0	$0	$0	$0	$590,725	$573,351	$573,351	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs		**$29,760,838**		$29,760,838	**$0**	**$0**	**$0**	**$0**	**$10,853,553**	**$11,170,432**	**$7,576,310**	**$11,366**	**$11,366**	**$11,366**	**$25,461**	**$100,985**

	Area	Year 9 2033	Year 10 2034	Year 11 2035	Year 12 2036	Year 13 2037	Year 14 2038	Year 15 2039	Year 16 2040	Year 17 2041	Year 18 2042	Year 19 2043	Year 20 2044	Year 21 2045	Year 22 2046	Year 23 2047	Year 24 2048	Year 25 2049	Year 26 2050	Year 27 2051	Year 28 2052	Year 29 2053	Year 99 2123	Year 107 2131	Year 108 2132
Direct Costs	Waste Dumps	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Site/Road Maintenance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Monitoring Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1	Planning and	Reclamation Research and Planning	$400,000	9%	$400,000	$0	$0	$200,000	$200,000	$0	$0	$0	$0	$0	$0	$0	$0
2	Permitting	Technical Studies and Investigations	$58,500	1%	$58,500	$0	$0	$29,250	$29,250	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$1,054,221	24%	$1,054,221	$0	$0	$316,266	$421,688	$105,422	$105,422	$105,422	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$209,158	5%	$209,158	$0	$0	$104,579	$104,579	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$1,431,082	33%	$1,431,082	$0	$0	$115,778	$115,778	$131,618	$131,618	$131,618	$53,168	$53,168	$53,168	$53,168	$53,168
2		Sediment Monitoring	$68,476	2%	$68,476	$0	$0	$3,604	$3,604	$3,604	$3,604	$3,604	$3,604	$0	$3,604	$0	$3,604
3		Biological Monitoring	$245,928	6%	$245,928	$0	$0	$12,944	$12,944	$12,944	$12,944	$12,944	$12,944	$0	$12,944	$0	$12,944
4		Geotechnical Monitoring	$397,593	9%	$397,593	$0	$0	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934
5		Revegetation Monitoring	$213,780	5%	$213,780	$0	$0	$0	$0	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252
6		Annual Inspection Reporting	$307,860	7%	$307,860	$0	$0	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516
Post Closure Costs Subtotal			**$4,386,598**		$4,386,598	**$0**	**$0**	**$797,871**	**$903,293**	**$280,289**	**$280,289**	**$280,289**	**$96,417**	**$79,869**	**$96,417**	**$79,869**	**$96,417**

			2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Planning and	Reclamation Research and Planning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Permitting	Technical Studies and Investigations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,616	$0	$0	$0	$28,616
2		Sediment Monitoring	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,604	$0	$0	$0	$3,604
3		Biological Monitoring	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,944	$0	$0	$0	$12,944
4		Geotechnical Monitoring	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,387	$0	$0	$0	$24,387
5		Revegetation Monitoring	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,252	$0	$0	$0	$11,252
6		Annual Inspection Reporting	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,700	$0	$0	$0	$25,700
Post Closure Costs Subtotal			**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**	**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$106,502**	**$0**	**$0**	**$0**	**$106,502**

Care and Maintenance Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1	Water Treatment	Active System	$8,353,198	38%	$8,353,198	$0.00	$0	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848
2		Passive System	$583,243	3%	$583,243	$0	$0	$0	$0	$0	$0	$0	$36,453	$36,453	$36,453	$36,453	$36,453
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,905,246	9%	$1,905,246	$0	$0	$0	$0	$0	$0	$0	$381,049	$381,049	$381,049	$381,049	$381,049
4	Site Maintenance		$2,497,136	11%	$2,497,136	$0	$0	$360,956	$360,956	$30,000	$30,000	$30,000	$99,783	$99,783	$99,783	$99,783	$99,783
5	On-site Management		$7,446,956	34%	$7,446,956	$0	$0	$1,038,240	$1,038,240	$319,258	$319,258	$319,258	$546,716	$546,716	$546,716	$546,716	$546,716
6	Transportation Costs		$1,314,051	6%	$1,314,051	$0	$0	$152,245	$152,245	$0	$0	$0	$64,947	$64,947	$64,947	$64,947	$64,947
Post Closure Costs Subtotal			**$22,099,831**		$22,099,831	**$0**	**$0**	**$2,291,289**	**$2,291,289**	**$1,089,106**	**$1,089,106**	**$1,089,106**	**$1,868,796**	**$1,868,796**	**$1,868,796**	**$1,868,796**	**$1,868,796**

			2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Water Treatment	Active System	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,453	$0	$0	$0	$36,453
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$0	$0	$0	$0	$99,783	$0	$0	$0	$0	$99,783	$0	$0	$0	$0	$0	$0	$0	$0	$0	$109,639	$0	$0	$0	$109,639
5	On-site Management		$0	$0	$0	$0	$69,415	$0	$0	$0	$0	$69,415	$0	$0	$0	$0	$0	$0	$0	$0	$0	$171,143	$0	$0	$0	$171,143
6	Transportation Costs		$0	$0	$0	$0	$20,939	$0	$0	$0	$0	$20,939	$0	$0	$0	$0	$0	$0	$0	$0	$0	$71,439	$0	$0	$0	$71,439
Post Closure Costs Subtotal			**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**	**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$388,673**	**$0**	**$0**	**$0**	**$388,673**

Other Add-on Costs

				Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1	Contingency	12%	% of above costs	$6,749,672		$6,749,672	$0	$0	$370,699	$383,350	$1,466,754	$1,504,779	$1,073,485	$237,189	$235,204	$237,189	$236,895	$247,944
2	Worker's compensation	0%	(Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	1.5%	% of above labour costs	$228,286.85		$228,287	$0	$0	$12,538	$12,966	$49,608	$50,895	$36,307	$8,022	$7,955	$8,022	$8,012	$8,386
4	Bonding	3%	% of Implem. & C&M costs	$1,555,820.08		$1,555,820	$0.00	$0	$68,739	$68,739	$358,280	$367,786	$259,962	$56,405	$56,405	$56,405	$56,828	$59,093
5	Contractor Profit	10%	% of above costs	$5,624,727		$5,624,727	$0	$0	$308,916	$319,458	$1,222,295	$1,253,983	$894,571	$197,658	$196,003	$197,658	$197,413	$206,620
6	Contract Administration	5%	% of above costs	$2,812,363		$2,812,363	$0	$0	$154,458	$159,729	$611,147	$626,991	$447,285	$98,829	$98,002	$98,829	$98,706	$103,310
Other Add-On Costs Subtotal				**$16,970,869**		$16,970,869	**$0**	**$0**	**$915,350**	**$944,241**	**$3,708,084**	**$3,804,434**	**$2,711,610**	**$598,103**	**$593,568**	**$598,103**	**$597,854**	**$625,353**
TOTAL				**$73,218,136**		$73,218,136	**$0**	**$0**	**$4,004,509**	**$4,138,823**	**$15,931,033**	**$16,344,261**	**$11,657,316**	**$2,574,682**	**$2,553,599**	**$2,574,682**	**$2,571,980**	**$2,691,551**

				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Contingency	12%	% of above costs	$14,832	$14,832	$14,832	$14,832	$51,369	$14,832	$14,832	$14,832	$14,832	$51,369	$0	$0	$0	$0	$0	$0	$0	$0	$0	$59,421	$0	$0	$0	$59,421
2	Worker's compensation	0%	(Included in labour rates)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	1.5%	% of above labour costs	$502	$502	$502	$502	$1,737	$502	$502	$502	$502	$1,737	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,010	$0	$0	$0	$2,010
4	Bonding	3%	% of Implem. & C&M costs	$2,864	$2,864	$2,864	$2,864	$9,662	$2,864	$2,864	$2,864	$2,864	$9,662	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,660	$0	$0	$0	$11,660
5	Contractor Profit	10%	% of above costs	$12,360	$12,360	$12,360	$12,360	$42,808	$12,360	$12,360	$12,360	$12,360	$42,808	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,518	$0	$0	$0	$49,518
6	Contract Administration	5%	% of above costs	$6,180	$6,180	$6,180	$6,180	$21,404	$6,180	$6,180	$6,180	$6,180	$21,404	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,759	$0	$0	$0	$24,759
Other Add-On Costs Subtotal				**$36,738**	**$36,738**	**$36,738**	**$36,738**	**$126,979**	**$36,738**	**$36,738**	**$36,738**	**$36,738**	**$126,979**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$147,367**	**$0**	**$0**	**$0**	**$147,367**
TOTAL				**$160,338**	**$160,338**	**$160,338**	**$160,338**	**$555,055**	**$160,338**	**$160,338**	**$160,338**	**$160,338**	**$555,055**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$642,543**	**$0**	**$0**	**$0**	**$642,543**

INFLATION FACTORED INTERIM CARE AND CLOSURE IMPLEMENTATION COSTS

						Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 99	Year 107	Year 108
	Area		Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
Direct Costs	Waste Dumps		$7,935,918	27%	$8,818,426	$0	$0	$0	$0	$3,487,612	$5,330,814	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps		$472,870	2%	$539,462	$0	$0	$0	$0	$0	$0	$539,462	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles		$3,408,266	11%	$3,744,592	$0	$0	$0	$0	$3,744,592	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits		$641,203	2%	$724,681	$0	$0	$0	$0	$0	$358,931	$365,751	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings		$92,291	0%	$101,398	$0	$0	$0	$0	$101,398	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities		$77,263	0%	$85,694	$0	$0	$0	$0	$42,444	$43,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads		$153,441	1%	$175,050	$0	$0	$0	$0	$0	$0	$175,050	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition		$2,005,083	7%	$2,247,012	$0	$0	$0	$0	$220,294	$1,683,600	$343,118	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure		$175,792	1%	$196,826	$0	$0	$0	$0	$48,285	$98,404	$50,137	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures		$840,997	3%	$950,486	$0	$0	$0	$0	$0	$470,771	$479,715	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas		$827,890	3%	$931,352	$0	$0	$0	$0	$227,396	$231,717	$472,239	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal		$461,883	2%	$529,506	$0	$0	$0	$0	$0	$62,597	$395,196	$13,213	$13,464	$13,719	$31,317	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance		$3,417,069	11%	$3,847,670	$0	$0	$0	$0	$750,852	$1,147,678	$1,949,140	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment		$574,445	2%	$664,598	$0	$0	$0	$0	$0	$0	$561,538	$0	$0	$0	$0	$103,060	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization		$344,806	1%	$388,209	$0	$0	$0	$0	$189,416	$0	$175,279	$0	$0	$0	$0	$23,515	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs		$420,735	1%	$471,003	$0	$0	$0	$0	$157,166	$155,442	$158,395	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Road Maintenance		$832,270	3%	$931,707	$0	$0	$0	$0	$310,895	$307,485	$313,327	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support		$5,341,188	18%	$5,979,333	$0	$0	$0	$0	$1,995,206	$1,973,317	$2,010,810	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.		$1,737,427	6%	$1,945,009	$0	$0	$0	$0	$649,018	$641,898	$654,094	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs			**$29,760,838**		**$33,272,014**	**$0**	**$0**	**$0**	**$0**	**$11,924,574**	**$12,505,903**	**$8,643,249**	**$13,213**	**$13,464**	**$13,719**	**$31,317**	**$126,575**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Monitoring Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Planning and permitting	Reclamation Research and Planning	$400,000	9%	$427,257	$0	$0	$211,618	$215,639	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Technical Studies and Investigations	$58,500	1%	$62,486	$0	$0	$30,949	$31,537	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$1,054,221	24%	$1,143,418	$0	$0	$334,638	$454,662	$115,825	$118,026	$120,268	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$209,158	5%	$223,410	$0	$0	$110,654	$112,756	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$626,411	14%	$689,449	$0	$0	$122,504	$124,831	$144,606	$147,354	$150,153	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Sediment Monitoring	$18,020	0%	$19,805	$0	$0	$3,813	$3,886	$3,960	$4,035	$4,112	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Biological Monitoring	$64,718	1%	$71,130	$0	$0	$13,695	$13,956	$14,221	$14,491	$14,766	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Geotechnical Monitoring	$64,668	1%	$71,075	$0	$0	$13,685	$13,945	$14,210	$14,480	$14,755	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Revegetation Monitoring	$33,755	1%	$37,795	$0	$0	$0	$0	$12,362	$12,597	$12,836	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6		Annual Inspection Reporting	$12,580	0%	$13,826	$0	$0	$2,662	$2,713	$2,764	$2,817	$2,870	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			**$2,542,030**		**$2,759,651**	**$0**	**$0**	**$844,219**	**$973,924**	**$307,948**	**$313,799**	**$319,761**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Care and Maintenance Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Water Treatment	Active System	$3,699,241	17%	$4,065,719	$0	$0	$782,826	$797,700	$812,856	$828,300	$844,038	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$811,912	4%	$871,876	$0	$0	$381,924	$389,180	$32,960	$33,587	$34,225	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	On-site Management		$3,034,254	14%	$3,290,382	$0	$0	$1,098,551	$1,119,424	$350,762	$357,427	$364,218	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Transportation Costs		$304,490	1%	$325,238	$0	$0	$161,089	$164,150	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			**$7,849,897**		**$8,553,215**	**$0**	**$0**	**$2,424,390**	**$2,470,453**	**$1,196,578**	**$1,219,313**	**$1,242,480**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Other Add-on Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Contingency	12% % of above costs	$4,799,067		$5,326,391	$0	$0	$392,233	$413,325	$1,611,492	$1,684,682	$1,224,659	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Worker's compensation	0% (Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$162,314		$180,149	$0	$0	$13,266	$13,979	$54,504	$56,979	$41,420	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Bonding	3% % of Implem. & C&M costs	$1,123,506		$1,248,808	$0	$0	$72,732	$74,114	$393,635	$411,756	$296,572	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	Contractor Profit	10% % of above costs	$3,999,222		$4,438,659	$0	$0	$326,861	$344,438	$1,342,910	$1,403,902	$1,020,549	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Contract Administration	5% % of above costs	$1,999,611		$2,219,330	$0	$0	$163,430	$172,219	$671,455	$701,951	$510,275	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Add-On Costs Subtotal			**$12,083,720**		$13,413,337	**$0**	**$0**	**$968,522**	**$1,018,075**	**$4,073,995**	**$4,259,270**	**$3,093,475**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL			**$52,236,485**		**$57,998,217**	**$0**	**$0**	**$4,237,131**	**$4,462,453**	**$17,503,095**	**$18,298,285**	**$13,298,965**	**$13,213**	**$13,464**	**$13,719**	**$31,317**	**$126,575**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

NET PRESENT VALUE CALCULATIONS - LONG TERM MONITORING AND MAINTENANCE

Monitoring Costs

						Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 99	Year 107	Year 108
			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Monitoring	Water Quality Monitoring	$804,671	18%	$524,726								$48,239	$47,340	$46,457	$45,591	$44,741	$23,229	$22,796	$22,371	$21,953	$21,544	$21,142	$20,748	$20,361	$19,982	$19,609	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,526	$0	$0	$0	$3,666
2		Sediment Monitoring	$50,456	1%	$24,627								$3,270	$0	$3,149	$0	$3,033	$0	$0	$0	$0	$2,760	$0	$0	$0	$0	$2,512	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,081	$0	$0	$0	$462
3		Biological Monitoring	$181,210	4%	$88,445								$11,744	$0	$11,310	$0	$10,892	$0	$0	$0	$0	$9,914	$0	$0	$0	$0	$9,023	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,475	$0	$0	$0	$1,658
4		Geotechnical Monitoring	$332,925	8%	$159,208								$11,735	$11,516	$11,301	$11,090	$10,884	$0	$0	$0	$0	$18,678	$0	$0	$0	$0	$17,001	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,084	$0	$0	$0	$3,125
5		Revegetation Monitoring	$180,026	4%	$96,550								$10,209	$10,018	$9,831	$9,648	$9,468	$0	$0	$0	$0	$8,618	$0	$0	$0	$0	$7,844	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,498	$0	$0	$0	$1,442
6		Annual Inspection Reporting	$295,280	7%	$119,207								$2,283	$2,240	$2,198	$2,157	$2,117	$0	$0	$0	$0	$19,684	$0	$0	$0	$0	$17,916	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,842	$0	$0	$0	$3,293
Post Closure Costs Subtotal			**$1,844,567**		**$1,012,764**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$87,479**	**$71,114**	**$84,247**	**$68,487**	**$81,135**	**$23,229**	**$22,796**	**$22,371**	**$21,953**	**$81,198**	**$21,142**	**$20,748**	**$20,361**	**$19,982**	**$73,906**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$61,507**	**$0**	**$0**	**$0**	**$13,646**

Care and Maintenance Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Water Treatment	Active System	$4,653,957	21%	$3,958,901								$671,262	$658,745	$646,463	$634,409	$622,580	$78,841	$77,371	$75,928	$74,513	$73,123	$71,760	$70,422	$69,109	$67,820	$66,556	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$583,243	3%	$312,800								$33,073	$32,457	$31,852	$31,258	$30,675	$0	$0	$0	$0	$27,920	$0	$0	$0	$0	$25,412	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,052	$0	$0	$0	$4,671
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,905,246	9%	$1,665,351								$345,725	$339,278	$332,952	$326,744	$320,652	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$1,685,224	8%	$883,313								$90,532	$88,844	$87,188	$85,562	$83,967	$0	$0	$0	$0	$76,425	$0	$0	$0	$0	$69,561	$0	$0	$0	$0	$0	$0	$0	$0	$0	$63,319	$0	$0	$0	$14,047
5	On-site Management		$4,412,702	20%	$2,961,164								$496,034	$486,785	$477,708	$468,801	$460,060	$0	$0	$0	$0	$53,166	$0	$0	$0	$0	$48,391	$0	$0	$0	$0	$0	$0	$0	$0	$0	$98,839	$0	$0	$0	$21,928
6	Transportation Costs		$1,009,561	5%	$510,760								$58,926	$57,827	$56,749	$55,691	$54,653	$0	$0	$0	$0	$16,037	$0	$0	$0	$0	$14,597	$0	$0	$0	$0	$0	$0	$0	$0	$0	$41,257	$0	$0	$0	$9,153
Post Closure Costs Subtotal			**$14,249,934**		$10,292,289	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,695,552**	**$1,663,937**	**$1,632,912**	**$1,602,465**	**$1,572,586**	**$78,841**	**$77,371**	**$75,928**	**$74,513**	**$246,671**	**$71,760**	**$70,422**	**$69,109**	**$67,820**	**$224,516**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$224,468**	**$0**	**$0**	**$0**	**$49,799**

Other Add-on Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2123	2131	2132
1	Contingency	12% % of above costs	$1,950,605		$1,373,067								$215,201	$209,421	$207,251	$203,134	$208,644	$12,248	$12,020	$11,796	$11,576	$39,344	$11,148	$10,940	$10,736	$10,536	$35,811	$0	$0	$0	$0	$0	$0	$0	$0	$0	$34,317	$0	$0	$0	$7,613
2	Worker's compensation	0% (Included in labour rates)	$0		$0								$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$65,973		$46,440								$7,279	$7,083	$7,010	$6,870	$7,057	$414	$407	$399	$392	$1,331	$377	$370	$363	$356	$1,211	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,161	$0	$0	$0	$257
4	Bonding	3% % of Implem. & C&M costs	$432,314		$312,884								$51,176	$50,222	$49,285	$48,729	$49,727	$2,365	$2,321	$2,278	$2,235	$7,400	$2,153	$2,113	$2,073	$2,035	$6,735	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,734	$0	$0	$0	$1,494
5	Contractor Profit	10% % of above costs	$1,625,504		$1,144,223								$179,334	$174,517	$172,709	$169,278	$173,870	$10,207	$10,017	$9,830	$9,647	$32,787	$9,290	$9,117	$8,947	$8,780	$29,842	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,597	$0	$0	$0	$6,344
6	Contract Administration	5% % of above costs	$812,752		$572,111								$89,667	$87,259	$86,354	$84,639	$86,935	$5,103	$5,008	$4,915	$4,823	$16,393	$4,645	$4,559	$4,474	$4,390	$14,921	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,299	$0	$0	$0	$3,172
Other Add-On Costs Subtotal			**$4,887,149**		$3,448,725	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$542,657**	**$528,501**	**$522,609**	**$512,651**	**$526,232**	**$30,338**	**$29,773**	**$29,218**	**$28,673**	**$97,256**	**$27,613**	**$27,099**	**$26,593**	**$26,097**	**$88,521**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$85,108**	**$0**	**$0**	**$0**	**$18,881**
TOTAL			**$20,981,651**		**$14,753,778**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,325,688**	**$2,263,552**	**$2,239,768**	**$2,183,603**	**$2,179,953**	**$132,408**	**$129,939**	**$127,517**	**$125,139**	**$425,126**	**$120,516**	**$118,269**	**$116,063**	**$113,899**	**$386,942**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$371,083**	**$0**	**$0**	**$0**	**$82,326**
GRAND-TOTAL					**$72,751,995**	**$0**	**$0**	**$4,237,131**	**$4,462,453**	**$17,503,095**	**$18,298,285**	**$13,298,965**	**$2,338,900**	**$2,277,016**	**$2,253,487**	**$2,214,920**	**$2,306,527**	**$132,408**	**$129,939**	**$127,517**	**$125,139**	**$425,126**	**$120,516**	**$118,269**	**$116,063**	**$113,899**	**$386,942**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$371,083**	**$0**	**$0**	**$0**	**$82,326**

Worksheet 8 - Peak Liability Estimate - Annual C&M Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY

srk consulting

Summary of Annual Care and Maintenance Costs

	Annual Cost Per Phase						Total Cost	Number of Years				
	1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	n/a		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual
1 Active Water Treatment System	$739,848	$739,848	$739,848	$95,472	$0	$0	$8,353,198	2	3	5	10	0
2 Passive Treatment System	$0	$0	$36,453	$36,453	$36,453	$0	$583,243	2	3	5	2	9
3 Reclamation Maintenance	$0	$0	$381,049	$0	$0	$0	$1,905,246	2	3	5	2	9
4 Site Maintenance	$360,956	$30,000	$99,783	$99,783	$109,639	$0	$2,497,136	2	3	5	2	9
5 On-site Management	$1,038,240	$319,258	$546,716	$69,415	$171,143	$0	$7,446,956	2	3	5	2	9
6 Transportation Costs	$152,245	$0	$64,947	$20,939	$71,439	$0	$1,314,051	2	3	5	2	9

NOTES:
1. This table is used as a check to the NPV calculation spreadsheet.

Phase 1 - Annual Care & Maintenance Costs - Prior to Closure

WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Unit Rates: Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Activity Totals: Material Cost	Labour Cost	Equipment Cost	Cost	Subtotals: WBS Level 2	WBS Level 1	Source / Comments
S1.1	**Water Treatment**															**$739,848**	
S1.1.1	*Active Treatment System*														$739,848		
S1.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S1.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S1.2	**Onsite Management**															**$1,038,240**	
S1.2.1	*Field Support Staff*														$693,929		
S1.2.1.1		Mine Manager		4	months	360	site working hours per month			$25,631				$89,709			(Notes: staffing costs include cross-shifts)
S1.2.1.2		Office/Camp manager		6	months	360	site working hours per month			$23,201				$139,203			
S1.2.1.3		Administrative Assistants/HR/Accounting		0	months	360	site working hours per month			$18,296				$0			
S1.2.1.4		Water Treatment Staff Operator		5	months	360	site working hours per month			$19,438				$97,192			
S1.2.1.5		Environmental/Safety Manager		4	months	360	site working hours per month			$23,201				$92,802			
S1.2.1.6		Environmental Technicians		7	months	360	site working hours per month			$15,985				$103,906			
S1.2.1.7		Mechanic		2	months	360	site working hours per month			$0				$0			Included in equipment rates
S1.2.1.8		Tradesmen		2	months	360	site working hours per month			$19,438				$43,736			
S1.2.1.9		General Labour/helpers		10	months	360	site working hours per month			$13,409				$127,381			
S1.2.2	*Field support Vehicles*														$121,111		
S1.2.2.1		Pick-up trucks (3 required)		12	months					$4,875				$58,495			
S1.2.2.2		Mechanic service vehicle		2	months					$0				$0			Included in equipment rates
S1.2.2.3		Emergency transport vehicle		12	months					$5,218				$62,616			
S1.2.3	*Field Support Equipment/Supplies*														$223,200		
S1.2.3.1		Office supplies		12	months					$1,000				$12,000			
S1.2.3.2		Communications		12	months					$1,000				$12,000			
S1.2.3.3		Misc. supplies		12	months					$500				$6,000			
S1.2.3		Camp Operation		1,890	man-days					$80				$151,200			
S1.2.3		Power, heat, fuel		12	months					$3,500				$42,000			
S1.3	**Site Maintenance**														$360,956	**$360,956**	
S1.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S1.3.2		Road Maintenance	Grader (assume 80 hrs/month)	1	ls	960		$46	$102	$148	$0	$44,108	$97,851	$141,959			Operator cost included in Field support staff
S1.3.3		Earthwork Repair allowance (assume 40 hrs per month)		1	ls	480	$0	$137	$352	$352			$168,997	$168,997			Task Code C.2.14
S1.3.4		Sundry equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S1.4	**Transportation Costs**														$152,245	**$152,245**	
S1.4.1		Barge Operations		5	months					$10,939				$54,693			
S1.4.2		Staffing Bus trips during barge operation period		20	ea					$678				$13,552			One per week
S1.4.3		Air transport and airstrip operations		8	flights					$3,000				$24,000			One flight per week
S1.4.4		Helicopter transport		20	flights					$3,000				$60,000			One flight per week
TOTAL														**$2,291,289**	**$2,291,289**	**$2,291,289**	

Phase 2 - Annual Care & Maintenance Costs During Active Closure

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S2.1	**Water Treatment**															**$739,848**	
S2.1.1	*Active Treatment System*														$739,848		
S2.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S2.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S2.2	**Onsite Management**															**$319,258**	
S2.2.1	*Field Support Staff*														$253,936		
S2.2.1.1		Water Treatment Staff Operator		5	months	360	site working hours per month			$19,438				$97,192			
S2.2.1.2		Environmental/Safety Manager		4	months	360	site working hours per month			$23,201				$92,802			
S2.2.1.3		Environmental Technicians		4	months	360	site working hours per month			$15,985				$63,942			
S2.2.2	*Field support Vehicles*														$34,122		
S2.2.2.1		Pick-up trucks (1 required)		7	months					$4,875				$34,122			
S2.2.3	*Field Support Equipment/Supplies*														$31,200		
S2.2.3.1		Camp Operation		390	man-days					$80				$31,200			
S2.3	**Site Maintenance**														$30,000	**$30,000**	
S2.3.1		Pumping equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S2.4	**Transportation Costs**														$0	**$0**	
S2.4.1		Barge Operations		0	months					$10,939				$0			Included in construction indirect costs
TOTAL														**$1,089,106**	**$1,089,106**	**$1,089,106**	

Phase 3 - Annual Care & Maintenance Costs - Post Closure I

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S3.1	**Water Treatment**															**$776,301**	
S3.1.1	*Active Treatment System*														$739,848		
S3.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S3.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S3.1.1	*Passive Treatment System*														$36,453		
S3.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S3.2	**Onsite Management**															**$546,716**	
S3.2.1	*Field Support Staff*														$334,708		
S3.2.1.1		Mine Manager		3	months	360	site working hours per month			$25,631				$64,078			(Notes: staffing costs include cross-shifts)
S3.2.1.2		Office/Camp manager		3	months	360	site working hours per month			$23,201				$69,602			
S3.2.1.3		Administrative Assistants/HR/Accounting		0	months	360	site working hours per month			$18,296				$0			
S3.2.1.4		Water Treatment Staff Operator		2	months	360	site working hours per month			$19,438				$34,017			
S3.2.1.5		Environmental/Safety Manager		3	months	360	site working hours per month			$23,201				$58,001			
S3.2.1.6		Environmental Technicians		3	months	360	site working hours per month			$15,985				$39,964			
S3.2.1.7		Mechanic		2	months	360	site working hours per month			$0				$0			Included in equipment rates
S3.2.1.8		Tradesmen		2	months	360	site working hours per month			$19,438				$38,877			
S3.2.1.9		General Labour/helpers		2	months	360	site working hours per month			$13,409				$30,169			
S3.2.2	*Field support Vehicles*														$99,209		
S3.2.2.1		Pick-up trucks (3 required)		15	months					$4,875				$73,119			
S3.2.2.2		Mechanic service vehicle		2	months					$0				$0			Included in equipment rates
S3.2.2.3		Emergency transport vehicle		5	months					$5,218				$26,090			
S3.2.3	*Field Support Equipment/Supplies*														$112,800		
S3.2.3.1		Office supplies		5	months					$1,000				$5,000			
S3.2.3.2		Communications		5	months					$1,000				$5,000			
S3.2.3.3		Misc. supplies		5	months					$500				$2,500			
S3.2.3		Camp Operation		1,035	man-days					$80				$82,800			
S3.2.3		Power, heat, fuel		5	months					$3,500				$17,500			
S3.3	**Reclamation Maintenance**															**$381,049**	
S3.3.1	*Cover repairs*														$331,292		
S3.3.1.1		Cover Repair allowance	Load, haul, dump, spread (spoil lo	2%	of total	1,281,867	m3 of cover required replacement at:			$5.53	/m3			$141,718			Assumes 10% of area reseeded over 5 yr PC1 perioc
S3.3.1.2			Seed/Fertilize: broadcast seeding	64	ha					$2,957.77	/ha			$189,573			
S3.3.2.1	*Revegetation*														$49,758		
S3.3.2.2		Reseeding allowance	Seed/Fertilize: broadcast seeding	5%	of total	336	ha requires reseeding at			$2,957.77	/ha			$49,758			Assumes 25% of area reseeded over 5 yr PC1 perioc
S3.3	**Site Maintenance**														$99,783	**$99,783**	
S3.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S3.3.2		Road Maintenance	Grader (assume 40 hrs/month)	1	ls	200		$46	$102	$148	$0	$9,189	$20,386	$29,575			Operator cost included in Field support staff
S3.3.3		Earthwork Repair allowance	(assume 20 hrs per month)	1	ls	100	$0	$137	$352	$352			$35,208	$35,208			Task Code C.2.14
S3.3.4		Sundry equipment/consumables allowance		1	ls					$15,000				$15,000			Allowance for pump maintenance/fuel etc.
S3.4	**Transportation Costs**														$64,947	**$64,947**	
S3.4.1		Barge Operations		3	months					$10,939				$32,816			
S3.4.2		Staffing Bus trips during barge operation period		12	ea					$678				$8,131			One per week
S3.4.3		Air transport and airstrip operations		8	flights					$3,000				$24,000			One flights per week
TOTAL														**$1,868,796**	**$1,868,796**	**$1,868,796**	

Phase 4 - Annual Care & Maintenance Costs - Post Closure II

WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Unit Rates: Material Cost ($/unit)	Unit Rates: Labour Rate ($/hr)	Unit Rates: Equipment Rate ($/hr)	Unit Rates: Total Unit Rate ($/unit)	Activity Totals: Material Cost	Activity Totals: Labour Cost	Activity Totals: Equipment Cost	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
S4.1	**Water Treatment**															**$131,924**	
S4.1.1	*Active Treatment System*														$95,472		
S4.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S4.1.1	*Passive Treatment System*														$36,453		
S4.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S4.2	**Onsite Management**															**$69,415**	
S4.2.1	*Field Support Staff*														$38,848		
S4.2.1.1		Project Manager		0.5	months	360	site working hours per month			$25,631				$12,816			(Notes: staffing costs include cross-shifts)
S4.2.1.2		Passive Treatment specialist		0.5	months	360	site working hours per month			$45,360				$22,680			
S4.2.1.3		Mechanic		0.5	months	360	site working hours per month			$0				$0			Included in equpment rates
S4.2.1.4		General Labour/helpers		0.3	months	360	site working hours per month			$13,409				$3,352			
S4.2.2	*Field support Vehicles*														$14,967		
S4.2.2.1		Pick-up trucks (2 required)		2.0	months					$4,875				$9,749			
S4.2.2.2		Mechanic service vehicle		0.5	months					$0				$0			Included in equipment rates
S4.2.2.3		Emergency transport vehicle		1.0	months					$5,218				$5,218			
S4.2.3	*Field Support Equipment/Supplies*														$15,600		
S4.2.3.1		Office supplies		1	months					$1,000				$1,000			
S4.2.3.2		Communications		1	months					$1,000				$1,000			
S4.2.3.3		Misc. supplies		1	months					$500				$500			
S4.2.3		Camp Operation		120	man-days					$80				$9,600			
S4.2.3		Power, heat, fuel		1	months					$3,500				$3,500			
S4.3	**Reclamation Maintenance**															**$0**	
S4.3.1	*Cover repairs*														$0		
S4.3.2	*Revegetation*														$0		
S4.3	**Site Maintenance**														$29,999	**$29,999**	
S4.3.1		Equipment Maintenance (parts, supplies)		1	ls		$10,000							$10,000			Labour included in field support staff
S4.3.2		Road Maintenance	Grader (assume 20 hrs/month)	1	ls	20		$46	$102	$148	$0	$919	$2,039	$2,957			Operator cost included in Field support staff
S4.3.3		Earthwork Repair allowance (assume 20 hrs per month)		1	ls	20	$0	$137	$352	$352			$7,042	$7,042			Task Code C.2.14
S4.3.4		Sundry equipment/consumables allowance		1	ls					$10,000				$10,000			Allowance for pump maintenance/fuel etc.
S4.4	**Transportation Costs**														$20,939	**$20,939**	
S4.4.1		Barge Operations		1	months					$10,939				$10,939			
S4.4.2		Staffing Bus trips during barge operation period		0	ea					$678				$0			Pick-up trucks used (time included in labour rate)
S4.4.3		Barge mob/demob		1	LS					$10,000				$10,000			
TOTAL														**$252,277**	**$252,277**	**$252,277**	

Phase 5 - Perpetual Care & Maintenance Event Year Annual Costs

WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Unit Rates: Material Cost ($/unit)	Unit Rates: Labour Rate ($/hr)	Unit Rates: Equipment Rate ($/hr)	Unit Rates: Total Unit Rate ($/unit)	Activity Totals: Material Cost	Activity Totals: Labour Cost	Activity Totals: Equipment Cost	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
S5.1	**Water Treatment**															**$36,453**	
S5.1.1	*Passive Treatment System*														$36,453		
S5.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S5.2	**Onsite Management**															**$171,143**	
S5.2.1	*Field Support Staff*														$126,520		
S5.2.1.1		Project Manager		1.0	months	360	site working hours per month			$25,631				$25,631			(Notes: staffing costs include cross-shifts)
S5.2.1.2		Passive Treatment specialist		1.0	months	360	site working hours per month			$45,360				$45,360			
S5.2.1.3		Site Engineer		1.0	months	360	site working hours per month			$42,120				$42,120			
S5.2.1.4		HD mechanic		0.5	months	360	site working hours per month			$0				$0			Included in equipment rates
S5.2.1.5		General Labour/helpers		1.0	months	360	site working hours per month			$13,409				$13,409			
S5.2.2	*Field support Vehicles*														$14,624		
S5.2.2.1		Pick-up trucks (3 required)		3	months					$4,875				$14,624			
S5.2.2.2		Mechanic service vehicle		1	months					$0				$0			Included in equipment rates
S5.2.3	*Field Support Equipment/Supplies*														$30,000		
S5.2.3.1		Office supplies		1	months					$1,000				$1,000			
S5.2.3.2		Communications		1	months					$1,000				$1,000			
S5.2.3.3		Misc. supplies		1	months					$500				$500			
S5.2.3.4		Camp Operation		300	man-days					$80				$24,000			
S5.2.3.5		Power, heat, fuel		1	months					$3,500				$3,500			
S5.3	**Reclamation Maintenance**															**$0**	
S5.4	**Site Maintenance**														$109,639	**$109,639**	
S5.4.1		Grader Maintenance	Grader (assume 2 weeks, 10hrs/d	1	ls	140		$46	$102	$148	$0	$6,432	$14,270	$20,702			Operator cost included in Field support staff
S5.4.2		Earthwork Repair allowance (assume 3 weeks, 10hrs/day)		1	ls	210	$0	$137	$352	$352			$73,936	$73,936			Task Code C.2.14
S5.4.3		Big Creek Bridge - Capital replacement allowance		1	ls					$15,000				$15,000			Allowance for supplies, pumping, etc.
S5.4.4		Sundry allowance		1	ls					$2,500				$2,500			Allowance for supplies, pumping, etc.
S5.5	**Transportation Costs**														$71,439	**$71,439**	
S5.5.1		Barge Operations		1	months					$10,939				$10,939			
S5.5.2		Barge mobilization/demob and set up		1	ls					$10,000				$10,000			assumed
S5.5.3		Camp Mob/demob		1	ls					$10,000				$10,000			assumed
S5.5.4		Equipment mobilization and demobilization		2	ls					$20,250				$40,500.14			See details on 'mob-demob 'worksheet
TOTAL														**$391,173**	**$388,673**	**$388,673**	

Worksheet 9 - Peak Liability Estimate - Implementation Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY
srk consulting

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
DIRECT COSTS																					
A1	Waste Dumps																			$7,935,918	
A1.1	Main Waste Dump (inc. MWDE and Wrap)																		$157,947		
A1.1.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.1.2			Slopes: Re-grade to 3H:1V	0	hrs	C.2.13	0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.2.1		Cover	Flat area cover material: Load, haul, dump spread	0	Cm3	R.050	0.0	$0.85	$0	$2.76	$0	$0.91	0	$0	$0.00	$0	$4.52	$0			
A1.1.2.2			Slope area cover material: Load, haul, dump along crest	0	Cm3	R.051	0.0	$0.74	$0	$2.43	$0	$0.82	0	$0	$0.00	$0	$3.99	$0			
A1.1.2.3			Slope area cover material: Spread down slope	0	hrs	C.2.13	0.0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.3.1		Revegetate	Seed/Fertilize: tractor application	0	ha	C.6.01	0.0	$1,069.47	$0	$556.88	$0	$240.22	0	$0	$1,091.19	$0	$2,958	$0			
A1.1.3.2			Tree seedling application (1,000 stems/ha)	50	ha	C.6.06	2,561.8	$1,919.72	$95,960	$35.26	$1,763	$15.47	781	$773	$1,189.36	$59,451	$3,160	$157,947			
A1.3	Southwest Dump (excluding high grade waste area)																		$1,713,934		
A1.3.1		Re-grade	Slopes: Re-grade remaining to 3H:1V	20	hrs	C.2.13	19.6	$45.95	$899.42	$213.35	$4,177	$69.10	1,366	$1,352.71	$0.00	$0.00	$328.40	$6,429			
A1.3.2.1		Cover	Load, haul, dump spread	313,810	m3	R.059	5,463.2	$0.79	$249,268.18	$2.58	$810,271	$0.84	266,682	$264,014.91	$0.00	$0.00	$4.22	$1,323,554			
A1.3.3.1		Revegetate	Seed/Fertilize: tractor application	62.76	ha	C.6.01	2,079.1	$1,069.47	$67,122.05	$556.88	$34,951	$240.22	15,229	$15,076.93	$1,091.19	$68,485.46	$2,957.77	$185,636			
A1.3.3.2			Tree seedling application (1,000 stems/ha)	62.76	ha	C.6.06	3,216.6	$1,919.72	$120,485.89	$35.26	$2,213	$15.47	981	$970.85	$1,189.36	$74,646.37	$3,159.81	$198,316			
A1.4	Southwest Dump High-Grade Waste																		$19,065		
A1.4.1		Relocate High-grade waste	Load, haul, dump, spread in pit (below long-term water elevation)	0	Bm3	R.069	0.0	$0.69	$0.00	$2.25	$0	$0.76	0	$0.00	$0.00	$0.00	$3.69	$0			
A1.4.2		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.4.3		Cover	Flat area cover material: Load, haul, dump spread	0	Cm3	R.060	0.0	$0.75	$0.00	$2.45	$0	$0.80	0	$0.00	$0.00	$0.00	$4.01	$0			
A1.4.4.1		Revegetate	Seed/Fertilize: broadcast seeding	3.12	ha	C.6.01	103.2	$1,069.47	$3,333.00	$556.88	$1,736	$240.22	756	$748.66	$1,091.19	$3,400.70	$2,957.77	$9,218			
A1.4.4.2			Tree seedling application (1,000 stems/ha)	3.12	ha	C.6.06	159.7	$1,919.72	$5,982.82	$35.26	$110	$15.47	49	$48.21	$1,189.36	$3,706.62	$3,159.81	$9,848			
A1.5	Main Pit SAT																		$3,822,184		
A1.5.1		Relocate SAT below water	Load, haul, dump, spread in pit	1,040,000	Cm3	R.012	17,781.5	$0.78	$812,732.25	$1.61	$1,677,117	$0.53	555,290	$549,736.96	$0.00	$0.00	$2.92	$3,039,586			
A1.5.2		Backfill SAT Excavation	Load, haul, dump WR to form buttress below MPD	245,000	Cm3	R.013	3,226.9	$0.60	$147,360.45	$1.96	$480,353	$0.63	156,449	$154,884.60	$0.00	$0.00	$3.19	$782,598			Cover and revegetation of backfill included in MPD (A1.6)
A1.6	Main Pit Dump (Incl. SWB, In-Pit Dumps)																		$831,420		
A1.6.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	66	hrs	C.2.13	65.8	$45.95	$3,022.31	$213.35	$14,034	$69.10	4,591	$4,545.48	$0.00	$0.00	$328.40	$21,602			
A1.6.1.2			Slopes: Re-grade to 3H:1V	395	hrs	C.2.13	395.3	$45.95	$18,160.50	$213.35	$84,329	$69.10	27,589	$27,312.94	$0.00	$0.00	$328.40	$129,803			
A1.6.2.1		Cover	Flat area cover material: Load, haul, dump spread	45,708	m3	R.053	739.1	$0.74	$33,723.79	$2.40	$109,622	$0.78	36,080	$35,718.89	$0.00	$0.00	$3.92	$179,065			
A1.6.2.2			Slope area cover material: Load, haul, dump along crest	90,174	m3	R.054	1,249.9	$0.63	$56,960.44	$2.07	$186,757	$0.70	63,524	$62,888.67	$0.00	$0.00	$3.40	$306,606			
A1.6.2.3			Slope area cover material: Spread down slope	86	hrs	C.2.13	85.5	$45.95	$3,930.31	$213.35	$18,251	$69.10	5,971	$5,911.09	$0.00	$0.00	$328.40	$28,092			
A1.6.3.1		Revegetate	Seed/Fertilize: broadcast seeding	27.2	ha	C.6.01	900.2	$1,069.47	$29,064.18	$556.88	$15,134	$240.22	6,594	$6,528.38	$1,091.19	$29,654.54	$2,957.77	$80,381			
A1.6.3.2			Tree seedling application (1,000 stems/ha)	27.2	ha	C.6.06	1,392.8	$1,919.72	$52,170.99	$35.26	$958	$15.47	425	$420.38	$1,189.36	$32,322.25	$3,159.81	$85,872			
A1.6.0.0	Mill Valley Fill Extension (Stage 1 and 2)																		$55,204		
A1.6.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.6.1.2			Slopes: Re-grade to 3H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.6.2.1		Cover	Flat area cover material: Load, haul, dump spread	0	m3	R.056	0.0	$0.93	$0.00	$3.01	$0	$0.99	0	$0.00	$0.00	$0.00	$4.93	$0			
A1.6.2.2			Slope area cover material: Load, haul, dump along crest	0	m3	R.057	0.0	$0.81	$0.00	$2.65	$0	$0.90	0	$0.00	$0.00	$0.00	$4.36	$0			
A1.6.2.3			Slope area cover material: Spread down slope	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.6.3.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A1.6.3.2			Tree seedling application (1,000 stems/ha)	17.47	ha	C.6.06	895.4	$1,919.72	$33,538.64	$35.26	$616	$15.47	273	$270.25	$1,189.36	$20,778.68	$3,159.81	$55,204			
A1.7.0.0	Ridgetop Waste Dump																		$1,336,164		
A1.7.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	88	hrs	C.2.13	88	$45.95	$4,040	$213.35	$18,761	$69.10	6,138	$6,077	$0.00	$0	$328.40	$28,878			
A1.7.1.2			Slopes: Re-grade to 3H:1V	340	hrs	C.2.13	340	$45.95	$15,642	$213.35	$72,635	$69.10	23,763	$23,525	$0.00	$0	$328.40	$111,802			
A1.7.2.1		Cover	Flat area cover material: Load, haul, dump spread	22,063	Cm3	R.063	590.5	$1.22	$26,924	$3.96	$87,336	$1.30	28,971	$28,681	$0.00	$0	$6.48	$142,941			
A1.7.2.2			Slope area cover material: Load, haul, dump along crest	142,998	Cm3	R.064	3,348.7	$1.07	$152,526	$3.48	$498,281	$1.18	170,188	$168,486	$0.00	$0	$5.73	$819,293			
A1.7.2.3			Slope area cover material: Spread down slope	95	hrs	C.2.13	95.3	$45.95	$4,378	$213.35	$20,332	$69.10	6,652	$6,585	$0.00	$0	$328.40	$31,295			
A1.7.3.1		Revegetate	Seed/Fertilize: tractor application	33	ha	C.6.01	1,093.6	$1,069.47	$35,305	$556.88	$18,384	$240.22	8,010	$7,930	$1,091.19	$36,023	$2,958	$97,642			
A1.7.3.2			Tree seedling application (1,000 stems/ha)	33	ha	C.6.06	1,691.9	$1,919.72	$63,374	$35.26	$1,164	$15.47	516	$511	$1,189.36	$39,263	$3,160	$104,312			
A2	Overburden Dumps																			$472,870	
A2.1	Area 118 Pit Backfill Dump																		$48,750		
A2.1.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	17	hrs	C.2.13	16.7	$45.95	$768.82	$213.35	$3,570	$69.10	1,168	$1,156.29	$0.00	$0.00	$328.40	$5,495			
A2.1.1.2			Slopes: Regrade to 3H:1V or flatter	2	hrs	C.2.13	2.4	$45.95	$108.84	$213.35	$505	$69.10	165	$163.70	$0.00	$0.00	$328.40	$778			
A2.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	7	ha	C.6.01	230.0	$1,069.47	$7,425.70	$556.88	$3,867	$240.22	1,685	$1,667.96	$1,091.19	$7,576.54	$2,957.77	$20,537			
A2.1.2.2			Tree seedling application (1,000 stems/ha)	7	ha	C.6.06	355.8	$1,919.72	$13,329.34	$35.26	$245	$15.47	108	$107.41	$1,189.36	$8,258.12	$3,159.81	$21,940			
A2.2	Ice-rich Overburden Dump																		$8,716		
A2.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A2.2.1.2			Berm: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			WR Berm area included in Southwest Dump
A2.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A2.2.3.2			Tree seedling application (1,000 stems/ha)	2.76	ha	C.6.06	141.4	$1,919.72	$5,295.18	$35.26	$97	$15.47	43	$42.67	$1,189.36	$3,280.60	$3,159.81	$8,716			
A2.3	Reclamation Overburden Dump																		$377,148		
A2.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	594	hrs	C.2.13	593.6	$45.95	$27,272.60	$213.35	$126,641	$69.10	41,432	$41,017.30	$0.00	$0.00	$328.40	$194,931			
A2.3.1.2			Slopes: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Assumes borrow removed in such a manner that significant resloping is not required.
A2.3.2.1		Revegetate	Seed/Fertilize: broadcast seeding	29.79	ha	C.6.01	986.7	$1,069.47	$31,854.87	$556.88	$16,587	$240.22	7,228	$7,155.23	$1,091.19	$32,501.92	$2,957.77	$88,099			
A2.3.2.2			Tree seedling application (1,000 stems/ha)	29.79	ha	C.6.06	1,526.5	$1,919.72	$57,180.35	$35.26	$1,050	$15.47	465	$460.75	$1,189.36	$35,425.77	$3,159.81	$94,117			
A2.4	Ridgetop South Backfill Dump																		$38,257		
A2.4.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	17	hrs	C.2.13	16.9	$45.95	$777.42	$213.35	$3,610	$69.10	1,181	$1,169.21	$0.00	$0.00	$328.40	$5,557			
A2.4.1.2			Slopes: Regrade to 3H:1V or flatter	28	hrs	C.2.13	28.4	$45.95	$1,306.69	$213.35	$6,068	$69.10	1,985	$1,965.22	$0.00	$0.00	$328.40	$9,340			
A2.4.2.1		Revegetate	Seed/Fertilize: broadcast seeding	3.82	ha	C.6.01	126.5	$1,069.47	$4,083.92	$556.88	$2,127	$240.22	927	$917.33	$1,091.19	$4,166.87	$2,957.77	$11,295			
A2.4.2.2			Tree seedling application (1,000 stems/ha)	3.82	ha	C.6.06	195.7	$1,919.72	$7,330.74	$35.26	$135	$15.47	60	$59.07	$1,189.36	$4,541.72	$3,159.81	$12,066			
A3	Ore Stockpiles																			$3,408,266	
A3.1	High and Medium Grade Sulphide Ore Stockpile (South of Mill)																		$3,293,933		(North, West, East, and South Stockpiles)
A3.1.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	884,785	m3	R.044	10,408.2	$0.54	$474,726.93	$1.77	$1,564,345	$0.59	529,049	$523,758.02	$0.00	$0.00	$2.90	$2,562,830			
A3.1.1.2			Ore Pads (over-excavate): Load, haul, dump spread into Main Pit	71,007	m3	R.044	835.3	$0.54	$38,098.34	$1.77	$125,544	$0.59	42,458	$42,033.24	$0.00	$0.00	$2.90	$205,675			
A3.1.1.3			Complete confirmation testing	1,421	ea	C.3.02	236.8	$7.40	$10,516.36	$5.08	$7,216	$0.00	0	$0.00	$14.95	$21,243.95	$27.43	$38,976			
A3.1.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	289	hrs	C.2.13	289.4	$45.95	$13,294.67	$213.35	$61,734	$69.10	20,197	$19,994.85	$0.00	$0.00	$328.40	$95,024			
A3.1.3.1		Cover	Cover material: Load, haul, dump spread (0.5m)	69,653	m3	R.055	1,264.9	$0.83	$57,676.68	$2.69	$187,089	$0.88	62,060	$61,439.78	$0.00	$0.00	$4.40	$306,205			
A3.1.4.1		Revegetate	Seed/Fertilize: broadcast seeding	13.93	ha	C.6.01	461.5	$1,069.47	$14,898.42	$556.88	$7,758	$240.22	3,380	$3,346.48	$1,091.19	$15,201.05	$2,957.77	$41,204			
A3.1.4.2			Tree seedling application (1,000 stems/ha)	13.93	ha	C.6.06	713.9	$1,919.72	$26,743.07	$35.26	$491	$15.47	218	$215.49	$1,189.36	$16,568.52	$3,159.81	$44,018			
A3.2	Low Grade Sulphide Ore Stockpile (Main Dump Area)																		$114,333		

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A3.2.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	0	m3	R.036	0.0	$0.58	$0.00	$1.89	$0	$0.64	0	$0.00	$0.00	$0.00	$3.10	$0			
A3.2.1.2			Ore Pad (over-excavate): Load, haul, dump spread into Main Pit	31,316	m3	R.036	396.1	$0.58	$18,050.68	$1.89	$59,183	$0.64	20,131	$19,929.33	$0.00	$0.00	$3.10	$97,163			
A3.2.1.3			Complete confirmation testing	626	ea	C.3.02	104.3	$7.40	$4,632.82	$5.08	$3,179	$0.00	0	$0.00	$14.95	$9,358.70	$27.43	$17,170			
A3.2.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Included in Main Waste Dump Closure
A3.2.3.1		Cover	Cover material: Load, haul, dump spread	0	m3	R.050	0.0	$0.85	$0.00	$2.76	$0	$0.91	0	$0.00	$0.00	$0.00	$4.52	$0			Included in Main Waste Dump Closure
A3.2.4.1		Revegetate	Seed/Fertilize: broadcast seeding	0	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			Included in Main Waste Dump Closure
A3.2.4.2			Tree seedling application (1,000 stems/ha)	0	ha	C.6.06	0.0	$1,919.72	$0.00	$35.26	$0	$15.47	0	$0.00	$1,189.36	$0.00	$3,159.81	$0			Included in Main Waste Dump Closure
A4	**Open Pits**																			**$641,203**	
A4.1	*Main Pit*																		$152,469		
A4.1.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	7,500	m2	C.2.03	28.5	$0.17	$1,309.98	$0.54	$4,039	$0.14	1,048	$1,037.31	$0.00	$0.00	$0.85	$6,386			
A4.1.1.2			Safety Berm: Construct around highwall perimeter	4,860	m3	C.2.02	45.8	$0.43	$2,106.59	$0.72	$3,515	$0.26	1,267	$1,253.91	$0.00	$0.00	$1.41	$6,876			
A4.1.1.3			Place large boulders across any pit access points	52	m3	R.001	1.6	$1.44	$74.74	$3.16	$164	$0.93	49	$48.22	$0.00	$0.00	$5.53	$287			
A4.1.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.1.2.1		Exposed tailings cover	Trafficability Layer: Load, haul, dump spread	17,750	m3	R.014	554.4	$1.42	$25,287.15	$2.69	$47,664	$0.84	15,091	$14,940.14	$0.00	$0.00	$4.95	$87,891			
A4.1.2.2			Overburden Layer: Load, haul, dump spread	8,875	m3	R.052	158.4	$0.81	$7,222.87	$2.64	$23,429	$0.87	7,772	$7,694.13	$0.00	$0.00	$4.32	$38,346			
A4.1.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2	ha	C.6.01	58.8	$1,069.47	$1,898.31	$556.88	$988	$240.22	431	$426.40	$1,091.19	$1,936.87	$2,957.77	$5,250			
A4.1.3.2			Tree seedling application (1,000 stems/ha)	2	ha	C.6.06	91.0	$1,919.72	$3,407.51	$35.26	$63	$15.47	28	$27.46	$1,189.36	$2,111.11	$3,159.81	$5,609			
A4.2	*Area 2 Pit*																		$9,490		
A4.2.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			
A4.2.1.2			Safety Berm: Construct around highwall perimeter	5,317	m3	C.2.02	50.2	$0.43	$2,304.71	$0.72	$3,846	$0.26	1,386	$1,371.84	$0.00	$0.00	$1.41	$7,522			
A4.2.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.2.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.3	*Area 118 Pit*																		$0		
A4.3.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			Pit filled it by Area 118 Backfill Dump
A4.3.1.2			Safety Berm: Construct around highwall perimeter	0	m3	C.2.02	0.0	$0.43	$0.00	$0.72	$0	$0.26	0	$0.00	$0.00	$0.00	$1.41	$0			
A4.3.1.3			Place large boulders across any pit access points	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			
A4.3.1.4			Allowance: Install warning signs around pit perimeter at key locations	0	ea	C.5.13	0.0	$41.73	$0.00	$24.39	$0	$5.74	0	$0.00	$232.08	$0.00	$303.94	$0			
A4.4	*Minto North Pit*																		$11,491		
A4.4.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	5,900	m2	C.2.03	22.4	$0.17	$1,030.52	$0.54	$3,177	$0.14	824	$816.01	$0.00	$0.00	$0.85	$5,024			
A4.4.1.2			Safety Berm: Construct around highwall perimeter	3,610	m	C.2.02	34.1	$0.43	$1,564.90	$0.72	$2,611	$0.26	941	$931.48	$0.00	$0.00	$1.41	$5,108			
A4.4.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.4.1.4			Allowance: Install warning signs around pit perimeter at key locations	4	ea	C.5.13	3.7	$41.73	$166.92	$24.39	$98	$5.74	23	$22.96	$232.08	$928.32	$303.94	$1,216			
A4.5	*Ridgetop North*																		$467,753		
A4.5.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	10,110	m2	C.2.03	38.4	$0.17	$1,765.85	$0.54	$5,445	$0.14	1,412	$1,398.29	$0.00	$0.00	$0.85	$8,609			
A4.5.1.2			Safety Berm: Construct around highwall perimeter	3,648	m	C.2.02	34.4	$0.43	$1,581.20	$0.72	$2,638	$0.26	951	$941.18	$0.00	$0.00	$1.41	$5,161			
A4.5.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.5.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.5.2.1		Exposed tailings cover	Trafficability Layer: Load, haul, dump spread	62,477	m3	R.068	816.5	$0.60	$37,210.06	$1.95	$122,001	$0.66	41,498	$41,082.74	$0.00	$0.00	$3.21	$200,294			
A4.5.2.2			Overburden Layer: Load, haul, dump spread	31,239	m3	R.062	882.0	$1.29	$40,215.13	$4.18	$130,448	$1.37	43,272	$42,838.96	$0.00	$0.00	$6.83	$213,502			
A4.5.3.1		Revegetate	Seed/Fertilize: broadcast seeding	6	ha	C.6.01	207.0	$1,069.47	$6,681.72	$556.88	$3,479	$240.22	1,516	$1,500.85	$1,091.19	$6,817.44	$2,957.77	$18,479			
A4.5.3.2			Tree seedling application (1,000 stems/ha)	6	ha	C.6.06	320.2	$1,919.72	$11,993.87	$35.26	$220	$15.47	98	$96.64	$1,189.36	$7,430.73	$3,159.81	$19,742			
A4.6	*Ridgetop South*																		$0		
A4.6.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			Piit to be backfilled with overburden from Ridgetop North
A4.6.1.2			Safety Berm: Construct around highwall perimeter	0	m	C.2.02	0.0	$0.43	$0.00	$0.72	$0	$0.26	0	$0.00	$0.00	$0.00	$1.41	$0			
A4.6.1.3			Place large boulders across any pit access points	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			
A4.6.1.4			Allowance: Install warning signs around pit perimeter at key locations	0	ea	C.5.13	0.0	$41.73	$0.00	$24.39	$0	$5.74	0	$0.00	$232.08	$0.00	$303.94	$0			
A5	**Underground Openings**																			**$92,291**	
A5.1	*Minto North Portal*																		$16,580		
A5.1.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.1.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.2	*Minto North Portal Egress*																		$16,580		
A5.2.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.2.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.3	*Minto South Portal*																		$16,580		
A5.3.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.3.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.3.2.1		Revegetate	Included in Yards (WBS No. A11-10)																		
A5.4	*Area 118 Vent Raise*																		$14,255		
A5.4.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.4.1.2			Excavate and clean perimeter around shaft to suitable material.	4	ea	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.4.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.4.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.4.2.3			Ringwall Rebar: supply and install	32	m	C.8.05	0.8	$1.31	$41.88	$0.00	$0	$0.00	0	$0.00	$5.03	$161.05	$6.34	$203			
A5.4.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.4.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.4.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.5	*Minto East Vent Raise*																		$14,143		
A5.5.1.2		Preparation	Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.5.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.5.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.5.2.3			Ringwall Rebar: supply and install	14	m	C.8.05	0.3	$1.31	$18.84	$0.00	$0	$0.00	0	$0.00	$5.03	$72.47	$6.34	$91			
A5.5.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.5.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.5.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.6	*Minto East 2 Vent Raise*																		$14,153		
A5.6.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.6.1.2			Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.6.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.6.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.6.2.3			Ringwall Rebar: supply and install	16	m	C.8.05	0.4	$1.31	$20.94	$0.00	$0	$0.00	0	$0.00	$5.03	$80.52	$6.34	$101			
A5.6.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.6.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.6.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A6	**External Tailings Facilities**																			**$77,263**	
A6.1	*Dry Stack Tailings Storage Facility*																		$77,263		
A6.1.1.1		Waste Rock Shell	Regrade WR shell slopes to 4H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.1.2			Cover material: Load, haul, dump spread (0.5m)	0	m3	R.048	0.0	$0.89	$0.00	$2.87	$0	$0.94	0	$0.00	$0.00	$0.00	$4.70	$0			

WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Total Mhrs	Labour Unit Rate	Labour Cost	Equipment Unit Rate	Equipment Cost	Fuel Unit Rate	Fuel Consumed (L)	Fuel Cost	Material Unit Rate	Material Cost	Activity Totals Unit Rate	Activity Totals Cost	Subtotals WBS Level 2	Subtotals WBS Level 1	Source / Comments
A6.1.1.3			Scarify surface	0	m2	C.2.16	0.0	$0.04	$0.00	$0.06	$0	$0.01	0	$0.00	$0.00	$0.00	$0.11	$0			
A6.1.1.4			Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A6.1.1.5			Tree seedling application (1,000 stems/ha)	5.30	ha	C.6.06	271.4	$1,919.72	$10,166.32	$35.26	$187	$15.47	83	$81.92	$1,189.36	$6,298.49	$3,159.81	$16,733			
A6.1.2.1		Fill Area at south end of DS	Load, haul, dump, spread	0	Cm3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			Fill from TDD road and/or unsuitable DSTSF cover material
A6.1.3.1		Tailings surface	Regrade tailings area south of the tailings	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.3.2			Regrade surface to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.3.3			Cover: Excavate unsuitable temporary cover material	0	m3	R.003	0.0	$0.53	$0.00	$1.74	$0	$0.59	0	$0.00	$0.00	$0.00	$2.85	$0			
A6.1.3.4			Cover material: Load, haul, dump spread (0.5m)	0	m3	R.048	0.0	$0.89	$0.00	$2.87	$0	$0.94	0	$0.00	$0.00	$0.00	$4.70	$0			
A6.1.3.5			Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A6.1.3.6			Tree seedling application (1,000 stems/ha)	19.16	ha	C.6.06	981.8	$1,919.72	$36,774.44	$35.26	$676	$15.47	299	$296.32	$1,189.36	$22,783.40	$3,159.81	$60,530			
A7	**Roads**																			**$153,441**	
A7.1	*Exploration Roads*																		$39,012		
A7.1.1.1		Regrade/Scarify	Scarify road surface	54,285	m2	C.2.16	0.0	$0.04	$1,952.53	$0.06	$3,166	$0.01	691	$683.65	$0.00	$0.00	$0.11	$5,803			
A7.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.43	ha	C.6.01	179.8	$1,069.47	$5,805.61	$556.88	$3,023	$240.22	1,317	$1,304.05	$1,091.19	$5,923.54	$2,957.77	$16,056			
A7.1.2.2			Tree seedling application (1,000 stems/ha)	5.43	ha	C.6.06	278.2	$1,919.72	$10,421.23	$35.26	$191	$15.47	85	$83.97	$1,189.36	$6,456.41	$3,159.81	$17,153			
A7.2	*Access Roads (excl. Main Site Access Road)*																		$8,737		
A7.2.1.1		Regrade/Scarify	Regrade side slopes	9	hrs	C.2.13	9.5	$45.95	$434.59	$213.35	$2,018	$69.10	660	$653.61	$0.00	$0.00	$328.40	$3,106			
A7.2.1.2			Scarify road surface	52,636	m2	C.2.16	0.0	$0.04	$1,893.21	$0.06	$3,070	$0.01	670	$662.89	$0.00	$0.00	$0.11	$5,626			
A7.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.80	$556.88	$0	$240.22	0	$0.18	$1,091.19	$0.81	$2,957.77	$2			
A7.2.2.2			Tree seedling application (1,000 stems/ha)	0.00	ha	C.6.06	0.0	$1,919.72	$1.43	$35.26	$0	$15.47	0	$0.01	$1,189.36	$0.88	$3,159.81	$2			
A7.3	*Main Site Access Road*																		$1,798		
A7.3.1.1		New Access over MVFE	Regrade new access through MVFE	0	m3																
A7.3.2.1		Signage	Install large sign on east and west side of barge landing on Yukon River	2	ea.	C.5.14	1.9	$41.73	$83.46	$24.39	$49	$5.74	12	$11.48	$827.13	$1,654.27	$898.99	$1,798			
A7.4	*Haul Roads*																		$84,151		
A7.4.1.1		Regrade/Scarify	Regrade side slopes	21	hrs	C.2.13	20.5	$45.95	$942.69	$213.35	$4,377	$69.10	1,432	$1,417.78	$0.00	$0.00	$328.40	$6,738			
A7.4.1.2			Scarify road surface	91,084	m2	C.2.16	0.0	$0.04	$3,276.11	$0.06	$5,313	$0.01	1,159	$1,147.09	$0.00	$0.00	$0.11	$9,736			
A7.4.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.06	ha	C.6.01	366.5	$1,069.47	$11,831.20	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.52	$2,957.77	$32,721			
A7.4.2.2			Tree seedling application (1,000 stems/ha)	11.06	ha	C.6.06	567.0	$1,919.72	$21,237.32	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.46	$3,159.81	$34,956			
A7.5	*Culvert Removal*																		$19,743		
A7.5.1.1		Excavate culverts	Mobilization allowance for excavation fleet to various sites	6	hrs	C.7.01	12.0	$91.33	$548.00	$126.32	$758	$45.54	276	$273.24	$0.00	$0.00	$263.20	$1,579			
A7.5.1.2			Load, haul, dump, spread (spoil locally)	18,020	m3	R.901	59.1	$0.15	$2,714.88	$0.57	$10,324	$0.21	3,841	$3,802.32	$0.00	$0.00	$0.93	$16,841			
A7.5.1.2		Waste disposal	On-site disposal (demolition debris, etc.)	190	Lm3	R.037	8.1	$1.94	$368.95	$3.84	$730	$1.18	227	$224.34	$0.00	$0.00	$6.96	$1,323			
A8	**Demolition**																			**$2,005,083**	
A8.1	*Airstrip Area*																		$22,217		
A8.1.1.1		Remove tanks/equipment	Dismantle and prep for transport	7	hrs	C.1.13	28.0	$174.43	$1,221.03	$115.96	$812	$17.92	127	$125.44	$0.00	$0.00	$308.32	$2,158			
A8.1.2.1		Waste Oil Tanker Secondar	Bedding Material: Load, haul dump bedding material to landfarm	47	Cm3	R.001	1.5	$1.44	$68.05	$3.16	$150	$0.93	44	$43.90	$0.00	$0.00	$5.53	$262			
A8.1.2.2			Cut and fold liner	219	m2	C.1.15	2.5	$0.45	$99.09	$0.19	$43	$0.07	16	$15.60	$0.00	$0.00	$0.72	$157			
A8.1.2.3			Regrade area to promote positive drainage	192	m2	C.2.11	1.9	$0.46	$88.22	$1.42	$272	$0.36	71	$69.85	$0.00	$0.00	$2.24	$430			
A8.1.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	10	hrs	C.1.22	40.0	$165.83	$1,658.25	$104.46	$1,045	$27.77	281	$277.70	$0.00	$0.00	$298.06	$2,981			
A8.1.3.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.1.4.1		Demolition	Structural building demolition: wooden buildings/tents	1,149	m3	C.1.08	87.7	$3.01	$3,457.31	$1.60	$1,835	$0.59	680	$672.90	$0.00	$0.00	$5.19	$5,965			
A8.1.4.2			Other demolition: covered storage, debris, etc.	530	m3	C.1.07	52.5	$3.90	$2,068.21	$2.07	$1,097	$0.76	407	$402.54	$0.00	$0.00	$6.74	$3,568			
A8.1.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	379	m3	R.006	12.8	$1.53	$581.90	$3.01	$1,141	$0.94	361	$357.73	$0.00	$0.00	$5.49	$2,080			
A8.1.5.2			Off-site disposal (re-usable equipment, etc.)	4	m3	C.7.07	34.6	$367.57	$1,590.89	$485.20	$2,100	$116.87	511	$505.83	$0.00	$0.00	$969.64	$4,197			
A8.2	*Airport Laydown Area*																		$34,345		
A8.2.1.1		Remove tanks/equipment	Dismantle and prep for transport	2	hrs	C.1.13	8.0	$174.43	$348.87	$115.96	$232	$17.92	36	$35.84	$0.00	$0.00	$308.32	$617			
A8.2.2.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.2.2.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.2.3.1		Demolition	Structural building demolition: steel structures	96	tonnes	C.1.05	191.3	$71.87	$6,873.40	$139.79	$13,369	$34.90	3,371	$3,337.39	$0.00	$0.00	$246.56	$23,579			
A8.2.3.2			Other demolition: covered storage etc.	560	m3	C.1.07	55.5	$3.90	$2,186.62	$2.07	$1,160	$0.76	430	$425.58	$0.00	$0.00	$6.74	$3,773			
A8.2.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	393	Lm3	R.005	15.8	$1.83	$717.72	$3.61	$1,420	$1.11	441	$436.41	$0.00	$0.00	$6.55	$2,574			
A8.2.4.2			Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	23.0	$367.57	$1,056.76	$485.20	$1,395	$116.87	339	$336.00	$0.00	$0.00	$969.64	$2,788			
A8.3	*Camp Area*																		$392,884		
A8.3.1.1		Equipment Removal	Remove salvageable equipment	48	hrs	C.1.13	192.0	$174.43	$8,372.81	$115.96	$5,566	$17.92	869	$860.14	$0.00	$0.00	$308.32	$14,799			
A8.3.2.1		Remove modular buildings	Dismantle and prep for transport	92	ea.	C.1.20	1,794.0	$881.68	$81,114.84	$750.86	$69,079	$171.67	15,953	$15,793.27	$0.00	$0.00	$1,804.21	$165,987			
A8.3.2.2			Transport structures off-site (Whitehorse)	92	ea.	C.7.04	736.0	$363.66	$33,456.48	$360.37	$33,154	$116.87	10,861	$10,751.99	$0.00	$0.00	$840.90	$77,363			
A8.3.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	1	hrs	C.1.22	4.0	$165.83	$165.83	$104.46	$104	$27.77	28	$27.77	$0.00	$0.00	$298.06	$298			
A8.3.3.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.3.4.1		Demolition	Structural building demolition: Steel	175	tonnes	C.1.05	350.7	$71.87	$12,601.23	$139.79	$24,509	$34.90	6,180	$6,118.54	$0.00	$0.00	$246.56	$43,229			
A8.3.4.2			Structural building demolition: Wood/misc. structures	10,959	m3	C.1.08	836.7	$3.01	$32,982.53	$1.60	$17,502	$0.59	6,484	$6,419.39	$0.00	$0.00	$5.19	$56,904			
A8.3.4.4			Other demolition: Utilidors, etc.	466	m3	C.1.07	46.1	$3.90	$1,819.22	$2.07	$965	$0.76	358	$354.07	$0.00	$0.00	$6.74	$3,139			
A8.3.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	3,867	m3	R.007	175.3	$2.06	$7,981.07	$4.08	$15,786	$1.25	4,902	$4,852.92	$0.00	$0.00	$7.40	$28,620			
A8.3.5.2			Off-site disposal (re-usable equipment, etc.)	1	trips	C.7.07	8.0	$367.57	$367.57	$485.20	$485	$116.87	118	$116.87	$0.00	$0.00	$969.64	$970			
A8.3.6.1		Demolish foundations	Break in place concrete foundations	51	m3	C.1.01	4.1	$2.47	$126.44	$9.40	$481	$2.56	132	$130.77	$0.00	$0.00	$14.43	$738			
A8.4	*Explosives Plant and Storage Areas*																		$32,905		
A8.4.1.1		Remove equipment	Small equipment: dismantle and prep for transport	37	hrs	C.1.13	149.3	$174.43	$6,512.18	$115.96	$4,329	$17.92	676	$668.99	$0.00	$0.00	$308.32	$11,510			
A8.4.2.1		Remove modular buildings	Dismantle and prep for transport	1	ea.	C.1.20	19.5	$881.68	$881.68	$750.86	$751	$171.67	173	$171.67	$0.00	$0.00	$1,804.21	$1,804			
A8.4.2.2			Transport structures off-site (Whitehorse)	1	ea.	C.7.04	8.0	$363.66	$363.66	$360.37	$360	$116.87	118	$116.87	$0.00	$0.00	$840.90	$841			
A8.4.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	4	hrs	C.1.22	16.0	$165.83	$663.30	$104.46	$418	$27.77	112	$111.08	$0.00	$0.00	$298.06	$1,192			
A8.4.3.2			Disconnect services	2	hrs	C.1.09	6.0	$91.24	$182.48	$8.59	$17	$4.95	10	$9.90	$0.00	$0.00	$104.78	$210			
A8.4.4.1		Demolition	Structural building demolition: Steel	47	tonnes	C.1.05	94.2	$71.87	$3,384.63	$139.79	$6,583	$34.90	1,660	$1,643.41	$0.00	$0.00	$246.56	$11,611			
A8.4.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	103	m3	R.008	5.4	$2.40	$247.67	$4.76	$490	$1.46	152	$150.60	$0.00	$0.00	$8.62	$888			
A8.4.5.2			Off-site disposal (re-usable equipment, etc.)	5	trips	C.7.07	40.0	$367.57	$1,837.85	$485.20	$2,426	$116.87	590	$584.35	$0.00	$0.00	$969.64	$4,848			
A8.5	*Fuel Storage Area*																		$125,560		
A8.5.1.1		Remove equipment/dismant	Small equipment: dismantle and prep for transport	24	hrs	C.1.13	96.0	$174.43	$4,186.40	$115.96	$2,783	$17.92	434	$430.07	$0.00	$0.00	$308.32	$7,400			
A8.5.1.2			Large equipment (crane req'd): dismantle and prep for transport	192	hrs	C.1.14	1,153.4	$279.25	$53,683.19	$199.44	$38,340	$24.11	4,681	$4,634.34	$0.00	$0.00	$502.79	$96,657			
A8.5.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.5.2.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.5.2.3			Clean out tanks, pressure wash, remove sludge	10	hrs	C.1.04	10.3	$37.25	$382.69	$16.65	$171	$2.00	21	$20.55	$0.00	$0.00	$55.90	$574			
A8.5.3.1		Demolish structures	Misc. debris/scraps (tanks included in dismantling above)	75	m3	C.1.08	5.7	$3.01	$225.72	$1.60	$120	$0.59	44	$43.93	$0.00	$0.00	$5.19	$389			
A8.5.4.1		Remove secondary contain	Bedding Material: Load, haul dump bedding material to landfarm	623	Cm3	R.009	32.8	$2.40	$1,493.67	$4.74	$2,954	$1.46	917	$908.23	$0.00	$0.00	$8.60	$5,356			
A8.5.4.2			Cut and fold liner	1,747	m2	C.1.15	20.3	$0.45	$792.35	$0.19	$340	$0.07	126	$124.75	$0.00	$0.00	$0.72	$1,257			
A8.5.4.3			Regrade area to promote positive drainage	1,666	m2	C.2.11	16.7	$0.46	$765.46	$1.42	$2,360	$0.36	612	$606.13	$0.00	$0.00	$2.24	$3,732			
A8.5.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	229	m3	R.009	12.1	$2.40	$549.94	$4.74	$1,088	$1.46	338	$334.39	$0.00	$0.00	$8.60	$1,972			
A8.5.5.2			Off-site disposal (re-usable equipment, etc.)	7	trips	C.7.07	56.0	$367.57	$2,572.99	$485.20	$3,396	$116.87	826	$818.09	$0.00	$0.00	$969.64	$6,787			
A8.6	*Mill Area*																		$1,320,887		Excludes WTP
A8.6.1.1		Remove equipment	Small equipment: dismantle and prep for transport	379	hrs	C.1.13	1,515.0	$174.43	$66,065.39	$115.96	$43,920	$17.92	6,855	$6,786.88	$0.00	$0.00	$308.32	$116,772			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A8.6.1.2			Large equipment (crane req'd): dismantle and prep for transport	466	hrs	C.1.14	2,796.5	$279.25	$130,153.53	$199.44	$92,954	$24.11	11,349	$11,235.85	$0.00	$0.00	$502.79	$234,344			
A8.6.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	65	hrs	C.1.22	260.0	$165.83	$10,778.64	$104.46	$6,790	$27.77	1,823	$1,805.02	$0.00	$0.00	$298.06	$19,374			Off-site disposal included in 'Waste Disposal'
A8.6.2.6			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.6.2.7			Decontaminate buildings: wash equipment/structures, etc.	38	hrs	C.1.04	37.8	$37.25	$1,407.51	$16.65	$629	$2.00	76	$75.58	$0.00	$0.00	$55.90	$2,112			
A8.6.2.8			Decontaminate buildings: Wash floors etc.	4,732	m2	C.1.03	40.8	$0.32	$1,517.80	$0.14	$679	$0.02	82	$81.50	$0.00	$0.00	$0.48	$2,278			
A8.6.3.1		Demolition	Structural building demolition: Steel	2,660	tonnes	C.1.05	5,319.1	$71.87	$191,148.68	$139.79	$371,780	$34.90	93,750	$92,812.46	$0.00	$0.00	$246.56	$655,741			
A8.6.3.2			Structural building demolition: Wood/misc. structures	960	m3	C.1.08	73.3	$3.01	$2,889.24	$1.60	$1,533	$0.59	568	$562.33	$0.00	$0.00	$5.19	$4,985			
A8.6.3.3			Other demolition: Steel	526	tonnes	C.1.05	1,052.7	$71.87	$37,828.55	$139.79	$73,576	$34.90	18,553	$18,367.70	$0.00	$0.00	$246.56	$129,772			
A8.6.3.4			Other demolition: concrete	602	m3	C.1.06	323.7	$16.48	$9,915.65	$62.67	$37,706	$17.04	10,359	$10,255.28	$0.00	$0.00	$96.19	$57,877			
A8.6.3.5			Other demolition: miscellaneous	244	m3	C.1.07	24.1	$3.90	$951.10	$2.07	$505	$0.76	187	$185.11	$0.00	$0.00	$6.74	$1,641			
A8.6.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	5,985	m3	R.037	255.1	$1.94	$11,613.36	$3.84	$22,971	$1.18	7,133	$7,061.54	$0.00	$0.00	$6.96	$41,646			
A8.6.4.2			Off-site disposal (re-usable equipment, etc.)	33	trips	C.7.07	266.0	$367.57	$12,220.77	$485.20	$16,132	$116.87	3,925	$3,885.61	$0.00	$0.00	$970	$32,238			
A8.6.5.1		Demolish foundations	Break in place concrete foundations	1,532	m3	C.1.01	123.7	$2.47	$3,787.52	$9.40	$14,403	$2.56	3,957	$3,917.25	$0.00	$0.00	$14.43	$22,108			
A8.7	*Mill Valley Fill Extension (Stage 1 and 2)*																		$29,908		
A8.7.1.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	8	hrs	C.1.22	30.0	$165.83	$1,243.69	$104.46	$783	$27.77	210	$208.27	$0.00	$0.00	$298.06	$2,235			
A8.7.1.2			Reagents: Disposal and tipping fees	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.7.2.1		Demolish buildings	Structural building demolition: Wood/misc. structures (Reagent tent)	1,800	m3	C.1.08	137.4	$3.01	$5,417.33	$1.60	$2,875	$0.59	1,065	$1,054.38	$0.00	$0.00	$5.19	$9,346			
A8.7.3.1		Haul waste to landfill	Demolition debris	594	m3	R.037	25.3	$1.94	$1,152.57	$3.84	$2,280	$1.18	708	$700.82	$0.00	$0.00	$6.96	$4,133			
A8.7.3.2			Remove tires off-site for disposal	10	trips	C.7.07	78.8	$367.57	$3,618.27	$485.20	$4,776	$116.87	1,162	$1,150.43	$0.00	$0.00	$969.64	$9,545			
A8.7.3.3			Misc. debris/scraps	652	m3	R.037	27.8	$1.94	$1,265.11	$3.84	$2,502	$1.18	777	$769.25	$0.00	$0.00	$6.96	$4,537			
A8.7.4.1		Demolish foundations	Break and bury concrete foundations	8	m3	C.1.01	0.6	$2.47	$19.13	$9.40	$73	$2.56	20	$19.79	$0.00	$0.00	$14.43	$112			
A8.8	*Minto South Portal*																		$8,966		
A8.8.1.1		Remove equipment	Small equipment: dismantle and prep for transport	6	hrs	C.1.13	24.0	$174.43	$1,046.60	$115.96	$696	$17.92	109	$107.52	$0.00	$0.00	$308.32	$1,850			
A8.8.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.8.3.1		Demolition	Other demolition: miscellaneous	462	m3	C.1.07	45.7	$3.90	$1,803.50	$2.07	$957	$0.76	355	$351.01	$0.00	$0.00	$6.74	$3,112			
A8.8.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	462	m3	R.043	20.9	$2.06	$950.61	$4.07	$1,880	$1.25	584	$578.02	$0.00	$0.00	$7.38	$3,409			
A8.9	*Minto North Portal*																		$9,444		Qntys assumed to be same as Minto South Portal
A8.9.1.1		Remove equipment	Small equipment: dismantle and prep for transport	6	hrs	C.1.13	24.0	$174.43	$1,046.60	$115.96	$696	$17.92	109	$107.52	$0.00	$0.00	$308.32	$1,850			
A8.9.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.9.3.1		Demolition	Other demolition: miscellaneous	462	m3	C.1.07	45.7	$3.90	$1,803.50	$2.07	$957	$0.76	355	$351.01	$0.00	$0.00	$6.74	$3,112			
A8.9.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	462	m3	R.042	23.8	$2.35	$1,083.67	$4.64	$2,143	$1.43	666	$658.93	$0.00	$0.00	$8.41	$3,886			
A8.10	*Pelly Laydown (Includes propane tanks by W15 Sump)*																		$21,793		
A8.10.1.1		Remove modular buildings/t	Dismantle and prep for transport	7	ea.	C.1.20	136.5	$881.68	$6,171.78	$750.86	$5,256	$171.67	1,214	$1,201.66	$0.00	$0.00	$1,804.21	$12,629			
A8.10.1.2			Transport structures off-site (Whitehorse)	7	ea.	C.7.04	56.0	$363.66	$2,545.60	$360.37	$2,523	$116.87	826	$818.09	$0.00	$0.00	$840.90	$5,886			
A8.10.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.10.3.1		Waste disposal	On-site disposal (demolition debris, etc.)	71	m3	R.045	3.3	$2.10	$150.18	$4.16	$297	$1.28	92	$91.32	$0.00	$0.00	$7.54	$539			
A8.10.3.2			Off-site disposal (re-usable equipment, etc.)	2	trips	C.7.07	15.0	$367.57	$689.19	$485.20	$910	$116.87	221	$219.13	$0.00	$0.00	$969.64	$1,818			
A8.10.4.1		Demolish foundations	Break and bury concrete foundations	23	m3	C.1.01	1.8	$2.47	$55.62	$9.40	$211	$2.56	58	$57.52	$0.00	$0.00	$14.43	$325			
A8.11	*Vent Raise - Area 118*																		$6,174		
A8.11.1.1		Remove equipment	Small equipment: dismantle and prep for transport	20	hrs	C.1.13	80.0	$174.43	$3,488.67	$115.96	$2,319	$17.92	362	$358.39	$0.00	$0.00	$308.32	$6,166			
A8.11.2.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	1	trips	R.043	0.0	$2.06	$2.06	$4.07	$4	$1.25	1	$1.25	$0.00	$0.00	$7.38	$7			
A9	**Surface Infrastructure**																			**$175,792**	
A9.1	*Tailings and Water Conveyance Pipelines*																		$94,952		
A9.1.1.1		Dismantle piping systems	Flush and clean tailings pipeline systems	8	ls	C.1.21	32.0	$209.63	$1,677.06	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$209.63	$1,677			
A9.1.1.2			Cut pipelines and prep for transport (6 to 8" HDPE pipes)	6,800	m	C.1.17	1,070.9	$7.46	$50,709.93	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$7.46	$50,710			
A9.1.1.3			Cut pipelines and prep for transport (10 to 18" HDPE pipes)	1,740	m	C.1.18	456.7	$12.43	$21,626.29	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$12.43	$21,626			
A9.1.1.4			Cut pipelines and prep for transport (20 to 36" HDPE pipes)	885	m	C.1.19	348.4	$18.64	$16,499.37	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$18.64	$16,499			
A9.2.2.1		Waste disposal	Haul pipes lines and debris to landfill	638	m3	R.037	27.2	$1.94	$1,237.84	$3.84	$2,448	$1.18	760	$752.67	$0.00	$0.00	$6.96	$4,439			
A9.2	*Conveyance Pipeline Equipment*																		$13,051		
A9.2.1.1		Dismantle piping systems	Remove pumps and prep for transport	15	ea.	C.1.24	198.0	$623.39	$9,350.78	$33.85	$508	$14.85	225	$222.75	$0.00	$0.00	$672.09	$10,081			
A9.2.1.2			Remove barges/Support Equipment prep for transport	2	ea.	C.1.23	52.8	$1,246.77	$2,493.54	$67.71	$135	$29.70	60	$59.40	$0.00	$0.00	$1,344.18	$2,688			
A9.2.2.1		Waste disposal	Transport pumps, barge and support equip. offsite (Whitehorse)	6.7	tonnes	C.7.02	2.7	$18.18	$121.83	$18.02	$121	$5.84	40	$39.15	$0.00	$0.00	$42.04	$282			
A9.3	*Powerlines*																		$67,789		
A9.3.1.1		Dismantle	Dismantle and collect powerlines	3.2	km	C.1.10	217.9	$2,731.94	$8,632.93	$816.44	$2,580	$259.77	829	$820.86	$0.00	$0.00	$3,808.14	$12,034			
A9.3.1.2			Remove power poles and load for transport off-site	60	ea.	C.1.11	548.6	$437.79	$26,267.37	$95.85	$5,751	$18.86	1,143	$1,131.43	$0.00	$0.00	$552.49	$33,150			
A9.3.1.3			Disconnect transformers and load for transport	4	ea.	C.1.12	93.3	$924.00	$3,695.99	$276.14	$1,105	$87.86	355	$351.43	$0.00	$0.00	$1,287.99	$5,152			
A9.3.2.1		Waste disposal	Transport powerlines, poles and transformers off-site	18	trips	C.7.07	144.0	$367.57	$6,616.26	$485.20	$8,734	$116.87	2,125	$2,103.65	$0.00	$0.00	$969.64	$17,453			
A10	**Water Detention Structures**																			**$840,997**	
A10.1	*W15 Sump*																		$1,081		
A10.1.1.1		Remove secondary contain	Cut and fold liner	1,310	m2	C.1.15	15.2	$0.45	$594.09	$0.19	$255	$0.07	94	$93.53	$0.00	$0.00	$0.72	$943			
A10.1.1.2			Haul liner to landfill	20	Lm3	R.070	0.8	$1.97	$38.67	$3.89	$76	$1.20	24	$23.51	$0.00	$0.00	$7.06	$139			
A10.2	*Mill Water Pond*																		$0		
A10.3	*Sewage Lagoon (near IROD)*																		$24,809		
A10.3.1		Remove pond	Backfill pond	4,488	m3	R.001	141.4	$1.44	$6,450.99	$3.16	$14,196	$0.93	4,203	$4,161.42	$0.00	$0.00	$5.53	$24,809			
A10.4	*Water Storage Pond Dam*																		$815,107		
A10.4.1.1		Water Management	Install pump and pump around system	4	hrs	C.4.14	16.0	$125.31	$501.25	$37.01	$148	$6.95	28	$27.80	$0.00	$0.00	$169.27	$677			
A10.4.1.2			Pump pond water to discharge	400,000	m3	C.4.12	146.8	$0.01	$5,466.88	$0.10	$41,707	$0.01	2,965	$2,935.56	$0.00	$0.00	$0.13	$50,109			
A10.4.1.3			Maintain pump around system during WSP closure activities	103	days	C.4.13	10.3	$3.72	$381.83	$28.42	$2,913	$2.00	207	$205.03	$0.00	$0.00	$34.14	$3,500			Duration calculated as sum of associated tasks plus 20% contingency
A10.4.2.1		Breach dam	Granular zones/gen. fill: Load, haul, dump, spread in upstream North ab	62,301	m3	R.001	1,963.4	$1.44	$89,551.16	$3.16	$197,071	$0.93	58,351	$57,767.92	$0.00	$0.00	$5.53	$344,390			
A10.4.2.2			Dam Core: Load, haul, dump in temporary stockpile	23,617	m3	R.001	744.3	$1.44	$33,946.33	$3.16	$74,704	$0.93	22,119	$21,898.20	$0.00	$0.00	$5.53	$130,549			
A10.4.2.3			Rip-rap: Sort and stockpile durable rip-rap for reuse	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.4.2.4			Rip-rap: Load haul, dump unsuitable rip-rap in upstream North abutmen	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.4.3.1		Channel restoration	Excavate stream channel	5,584	m3	R.902	97.1	$0.80	$4,459.86	$1.33	$7,442	$0.48	2,681	$2,654.66	$0.00	$0.00	$2.61	$14,556			
A10.4.3.2			Bedding layer: Load haul, dump, place granular bedding layer along cha	726	m3	R.001	22.9	$1.44	$1,044.18	$3.16	$2,298	$0.93	680	$673.58	$0.00	$0.00	$5.53	$4,016			
A10.4.3.3			Rip-rap: Load, haul dump from temporary stockpile	964	m3	R.001	30.4	$1.44	$1,384.96	$3.16	$3,048	$0.93	902	$893.41	$0.00	$0.00	$5.53	$5,326			
A10.4.3.4			Rip-rap: place and secure	964	m3	R.904	10.5	$0.50	$481.43	$0.91	$877	$0.33	325	$321.57	$0.00	$0.00	$1.74	$1,680			
A10.4.4.1		Cover	Cover material: Load, haul, dump spread (1m)	6,975	m3	R.001	219.8	$1.44	$10,025.77	$3.16	$22,063	$0.93	6,533	$6,467.45	$0.00	$0.00	$5.53	$38,556			Cover sourced from dam core material
A10.4.5.1		Revegetate	Seed/Fertilize: broadcast seeding	1.4	ha	C.6.01	46.2	$1,069.47	$1,491.91	$556.88	$777	$240.22	338	$335.11	$1,091.19	$1,522.21	$2,957.77	$4,126			
A10.4.5.2			Tree seedling application (1,000 stems/ha)	1.4	ha	C.6.06	71.5	$1,919.72	$2,678.02	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,659.15	$3,159.81	$4,408			
A11	**Yards/Laydown Areas**																			**$827,890**	
A11.1	*Airstrip Area*																		$46,265		
A11.1.1.1		Re-grade	Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.1.1.2			Scarify surface	64,378	m2	C.2.16	0.0	$0.04	$2,315.53	$0.06	$3,755	$0.01	819	$810.75	$0.00	$0.00	$0.11	$6,881			
A11.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	6.4	ha	C.6.01	213.3	$1,069.47	$6,884.97	$556.88	$3,585	$240.22	1,562	$1,546.50	$1,091.19	$7,024.82	$2,957.77	$19,041			
A11.1.2.2			Tree seedling application (1,000 stems/ha)	6.4	ha	C.6.06	329.9	$1,919.72	$12,358.71	$35.26	$227	$15.47	101	$99.58	$1,189.36	$7,656.77	$3,159.81	$20,342			
A11.2	*Airport Laydown Area*																		$15,291		

WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Labour Total Mhrs	Labour Unit Rate	Labour Cost	Equipment Unit Rate	Equipment Cost	Fuel Unit Rate	Fuel Consumed (L)	Fuel Cost	Material Unit Rate	Material Cost	Activity Totals Unit Rate	Activity Totals Cost	Subtotals WBS Level 2	Subtotals WBS Level 1	Source / Comments
A11.2.1.1		Re-grade	Scarify surface	21,277	m2	C.2.16	0.0	$0.04	$765.29	$0.06	$1,241	$0.01	271	$267.96	$0.00	$0.00	$0.11	$2,274			
A11.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.1	ha	C.6.01	70.5	$1,069.47	$2,275.51	$556.88	$1,185	$240.22	516	$511.12	$1,091.19	$2,321.73	$2,957.77	$6,293			
A11.2.2.2			Tree seedling application (1,000 stems/ha)	2.1	ha	C.6.06	109.0	$1,919.72	$4,084.60	$35.26	$75	$15.47	33	$32.91	$1,189.36	$2,530.59	$3,159.81	$6,723			
A11.3	*Camp Area*																		$125,373		
A11.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	7	hrs	C.2.13	6.9	$45.95	$316.95	$213.35	$1,472	$69.10	481	$476.68	$0.00	$0.00	$328.40	$2,265			
A11.3.1.2			Re-grade slopes to be 3H:1V or flatter	22	hrs	C.2.13	21.5	$45.95	$987.92	$213.35	$4,587	$69.10	1,501	$1,485.81	$0.00	$0.00	$328.40	$7,061			Slope between camp and main access road
A11.3.1.3			Scarify surfaces	20,626	m2	C.2.16	0.0	$0.04	$741.88	$0.06	$1,203	$0.01	262	$259.76	$0.00	$0.00	$0.11	$2,205			
A11.3.2.1		Cover	Flat area cover material: Load, haul, dump spread	10,313	Cm3	R.046	198.2	$0.88	$9,037.45	$2.84	$29,315	$0.93	9,724	$9,627.10	$0.00	$0.00	$4.65	$47,980			
A11.3.2.2			Slope area cover material: Load, haul, dump along crest	9,349	Cm3	R.047	157.2	$0.77	$7,160.89	$2.50	$23,394	$0.85	7,990	$7,910.23	$0.00	$0.00	$4.11	$38,465			
A11.3.2.3			Slope area cover material: Spread down slope	10	hrs	C.2.13	10.2	$45.95	$467.31	$213.35	$2,170	$69.10	710	$702.82	$0.00	$0.00	$328.40	$3,340			
A11.3.3.1		Revegetate	Seed/Fertilize: broadcast seeding	3.93	ha	C.6.01	130.3	$1,069.47	$4,205.66	$556.88	$2,190	$240.22	954	$944.67	$1,091.19	$4,291.09	$2,957.77	$11,631			
A11.3.3.2			Tree seedling application (1,000 stems/ha)	3.93	ha	C.6.06	201.5	$1,919.72	$7,549.27	$35.26	$139	$15.47	61	$60.83	$1,189.36	$4,677.11	$3,159.81	$12,426			
A11.4	*Crusher Area*																		$78,725		
A11.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	9	hrs	C.2.13	9.0	$45.95	$414.34	$213.35	$1,924	$69.10	629	$623.15	$0.00	$0.00	$328.40	$2,961			
A11.2.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	13,482	m3	R.055	244.8	$0.83	$11,163.80	$2.69	$36,213	$0.88	12,012	$11,892.19	$0.00	$0.00	$4.40	$59,269			
A11.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2.70	ha	C.6.01	89.3	$1,069.47	$2,883.71	$556.88	$1,502	$240.22	654	$647.74	$1,091.19	$2,942.29	$2,957.77	$7,975			
A11.2.3.2			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	138.2	$1,919.72	$5,176.35	$35.26	$95	$15.47	42	$41.71	$1,189.36	$3,206.98	$3,159.81	$8,520			
A11.5	*Exploration Disturbances*																		$24,993		
A11.5.1.1		Ridgetop Area	Scarify surfaces	34,778	m2	C.2.16	0.0	$0.04	$1,250.90	$0.06	$2,029	$0.01	442	$437.99	$0.00	$0.00	$0.11	$3,717			
A11.5.1.2			Seed/Fertilize: broadcast seeding	3	ha	C.6.01	115.2	$1,069.47	$3,719.40	$556.88	$1,937	$240.22	844	$835.45	$1,091.19	$3,794.95	$2,957.77	$10,287			
A11.5.1.3			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	178.2	$1,919.72	$6,676.42	$35.26	$123	$15.47	54	$53.80	$1,189.36	$4,136.34	$3,159.81	$10,989			
A11.6	*Explosives Plant and Storage Areas*																		$49,332		
A11.6.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	30	hrs	C.2.13	29.6	$45.95	$1,360.54	$213.35	$6,318	$69.10	2,067	$2,046.22	$0.00	$0.00	$328.40	$9,725			
A11.6.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.6.1.3			Scarify surfaces	55,113	m2	C.2.16	0.0	$0.04	$1,982.32	$0.06	$3,215	$0.01	701	$694.09	$0.00	$0.00	$0.11	$5,891			
A11.6.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.5	ha	C.6.01	182.6	$1,069.47	$5,894.20	$556.88	$3,069	$240.22	1,337	$1,323.95	$1,091.19	$6,013.93	$2,957.77	$16,301			
A11.6.2.2			Tree seedling application (1,000 stems/ha)	5.5	ha	C.6.06	282.5	$1,919.72	$10,580.26	$35.26	$194	$15.47	86	$85.25	$1,189.36	$6,554.94	$3,159.81	$17,415			
A11.7	*Fuel Storage Areas*																		$26,425		
A11.7.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	5	hrs	C.2.13	4.5	$45.95	$207.36	$213.35	$963	$69.10	315	$311.87	$0.00	$0.00	$328.40	$1,482			
A11.7.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	4,200	m3	R.049	81.8	$0.89	$3,730.31	$2.88	$12,100	$0.95	4,014	$3,973.69	$0.00	$0.00	$4.72	$19,804			
A11.7.3.1		Revegetate	Seed/Fertilize: broadcast seeding	0.84	ha	C.6.01	27.8	$1,069.47	$898.35	$556.88	$468	$240.22	204	$201.79	$1,091.19	$916.60	$2,957.77	$2,485			
A11.7.3.2			Tree seedling application (1,000 stems/ha)	1	ha	C.6.06	43.1	$1,919.72	$1,612.57	$35.26	$30	$15.47	13	$12.99	$1,189.36	$999.06	$3,159.81	$2,654			
A11.8	*IROD Laydown Area*																		$21,006		
A11.8.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	15	hrs	C.2.13	14.8	$45.95	$677.95	$213.35	$3,148	$69.10	1,030	$1,019.62	$0.00	$0.00	$328.40	$4,846			
A11.8.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.8.1.3			Scarify surface	18,106	m2	C.2.16	0.0	$0.04	$651.24	$0.06	$1,056	$0.01	230	$228.02	$0.00	$0.00	$0.11	$1,935			
A11.8.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.33	ha	C.6.01	77.0	$1,069.47	$2,486.84	$556.88	$1,295	$240.22	564	$558.59	$1,091.19	$2,537.35	$2,957.77	$6,878			
A11.8.2.2			Tree seedling application (1,000 stems/ha)	2.33	ha	C.6.06	119.2	$1,919.72	$4,463.94	$35.26	$82	$15.47	36	$35.97	$1,189.36	$2,765.61	$3,159.81	$7,348			
A11.9	*Mill Area*																		$143,245		
A11.9.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	60	hrs	C.2.13	59.9	$45.95	$2,753.36	$213.35	$12,785	$69.10	4,183	$4,140.98	$0.00	$0.00	$328.40	$19,680			
A11.9.1.2			Scarify surface	42,365	m2	C.2.16	0.0	$0.04	$1,523.78	$0.06	$2,471	$0.01	539	$533.53	$0.00	$0.00	$0.11	$4,528			
A11.9.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	21,182	m3	R.055	384.7	$0.83	$17,540.10	$2.69	$56,896	$0.88	18,873	$18,684.50	$0.00	$0.00	$4.40	$93,120			
A11.9.3.1		Revegetate	Seed/Fertilize: broadcast seeding	4.24	ha	C.6.01	140.3	$1,069.47	$4,530.77	$556.88	$2,359	$240.22	1,028	$1,017.70	$1,091.19	$4,622.80	$2,957.77	$12,530			
A11.9.3.2			Tree seedling application (1,000 stems/ha)	4.24	ha	C.6.06	217.1	$1,919.72	$8,132.86	$35.26	$149	$15.47	66	$65.53	$1,189.36	$5,038.67	$3,159.81	$13,386			
A11.10	*Mill Valley Fill Extension (Stage 1 and 2)*																		$0		
A11.10.1		Costs included in Waste Rock Dump Section (WBS#: A1.5)		0	hrs																
A11.11	*Minto South Portal*																		$99,427		
A11.11.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	51	hrs	C.2.13	51.5	$45.95	$2,364.92	$213.35	$10,982	$69.10	3,593	$3,556.78	$0.00	$0.00	$328.40	$16,903			
A11.11.1.2			Re-grade slopes to be 3H:1V or flatter	25	hrs	C.2.13	24.8	$45.95	$1,138.55	$213.35	$5,287	$69.10	1,730	$1,712.36	$0.00	$0.00	$328.40	$8,138			
A11.11.1.3			Scarify surface	62,765	m2	C.2.16	0.0	$0.04	$2,257.53	$0.06	$3,661	$0.01	798	$790.45	$0.00	$0.00	$0.11	$6,709			
A11.11.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.1	ha	C.6.01	366.5	$1,069.47	$11,831.22	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.54	$2,957.77	$32,721			
A11.11.2.2			Tree seedling application (1,000 stems/ha)	11.1	ha	C.6.06	567.0	$1,919.72	$21,237.35	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.48	$3,159.81	$34,956			
A11.12	*Pelly Laydown Area*																		$159,143		
A11.12.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	107	hrs	C.2.13	107.4	$45.95	$4,934.92	$213.35	$22,916	$69.10	7,497	$7,421.99	$0.00	$0.00	$328.40	$35,272			
A11.12.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	25,855	m3	R.058	380.7	$0.67	$17,371.17	$2.18	$56,467	$0.71	18,585	$18,398.86	$0.00	$0.00	$3.57	$92,237			
A11.12.3.1		Revegetate	Seed/Fertilize: broadcast seeding	5.17	ha	C.6.01	171.3	$1,069.47	$5,530.22	$556.88	$2,880	$240.22	1,255	$1,242.20	$1,091.19	$5,642.55	$2,957.77	$15,295			
A11.12.3.2			Tree seedling application (1,000 stems/ha)	5.17	ha	C.6.06	265.0	$1,919.72	$9,926.90	$35.26	$182	$15.47	81	$79.99	$1,189.36	$6,150.15	$3,159.81	$16,339			
A11.13	*W15 Sump Area Laydown*																		$38,663		
A11.13.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	9	hrs	C.2.13	8.8	$45.95	$403.82	$213.35	$1,875	$69.10	613	$607.34	$0.00	$0.00	$328.40	$2,886			
A11.13.1.2			Slopes: Re-grade to 3H:1V	2	hrs	C.2.13	1.6	$45.95	$73.97	$213.35	$344	$69.10	112	$111.26	$0.00	$0.00	$328.40	$529			
A11.13.1.3			Scarify surface	9,484	m2	C.2.16	0.0	$0.04	$341.11	$0.06	$553	$0.01	121	$119.44	$0.00	$0.00	$0.11	$1,014			
A11.13.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	6,974	m3	R.065	106.1	$0.69	$4,840.42	$2.26	$15,734	$0.74	5,179	$5,126.78	$0.00	$0.00	$3.69	$25,701			
A11.13.3.1		Revegetate	Seed/Fertilize: broadcast seeding	1.39	ha	C.6.01	46.2	$1,069.47	$1,491.72	$556.88	$777	$240.22	338	$335.07	$1,091.19	$1,522.02	$2,957.77	$4,126			
A11.13.3.2			Tree seedling application (1,000 stems/ha)	1.39	ha	C.6.06	71.5	$1,919.72	$2,677.68	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,658.94	$3,159.81	$4,407			
A12	**Waste Disposal**																			**$461,883**	
A12.1	*Hydrocarbon contaminated soils*																		$74,871		
A12.1.1.1		Excavate HC contaminated	Complete testing for contaminated soils	48	test pits	C.3.03	24.0	$22.59	$1,084.20	$5.03	$242	$3.01	146	$144.34	$292.57	$14,043.43	$323.20	$15,513			
A12.1.1.2			Excavate and haul contaminated soils to on-site landfarm facility	726	m3	R.038	26.0	$1.63	$1,184.49	$3.25	$2,355	$0.99	723	$715.46	$0.00	$0.00	$5.86	$4,255			
A12.1.2.1		Construct landfarm	Existing Facility assumed to have sufficient capacity	0	m3																
A12.1.3.1		Operate landfarm	Aerate contaminated soils (mix)	12	event	C.3.04	270.0	$1,016.97	$12,203.66	$943.36	$11,320	$344.03	4,170	$4,128.30	$0.00	$0.00	$2,304.35	$27,652			
A12.1.3.2			Annual confirmation sampling	3	years	C.3.05	48.0	$722.80	$2,168.41	$161.01	$483	$96.23	292	$288.68	$1,755.43	$5,266.29	$2,735.47	$8,206			
A12.1.4.1		Close landfarm	Remove soils and collect liner	726	m3	R.001	22.9	$1.44	$1,043.11	$3.16	$2,296	$0.93	680	$672.89	$0.00	$0.00	$5.53	$4,012			
A12.1.4.2			Cut/fold liner and place into waste disposal container	4,265	m2	C.1.15	49.6	$0.45	$1,934.18	$0.19	$830	$0.07	308	$304.52	$0.00	$0.00	$0.72	$3,069			
A12.1.4.3			Regrade area	4,265	m2	C.2.11	42.7	$0.46	$1,959.61	$1.42	$6,042	$0.36	1,567	$1,551.71	$0.00	$0.00	$2.24	$9,553			
A12.1.4.4			Revegetation: Seed/Fertilizer: broadcast seeding	0.43	ha	C.6.01	14.1	$1,069.47	$456.13	$556.88	$238	$240.22	103	$102.46	$1,091.19	$465.39	$2,957.77	$1,261			
A12.1.4.5			Tree seedling application (1,000 stems/ha)	0.43	ha	C.6.06	21.9	$1,919.72	$818.76	$35.26	$15	$15.47	7	$6.60	$1,189.36	$507.26	$3,159.81	$1,348			
	Metal Contaminated soils																		$177,013		
A12.2.1.1		Crusher area	Delineate contaminated soil areas	197	test pits	C.3.01	98.5	$22.59	$4,449.75	$5.03	$991	$3.01	598	$592.40	$299.00	$58,903.00	$329.63	$64,936			
A12.2.1.2			Load, haul, dump contaminated soils to underground	2,949	m3	R.039	102.1	$1.58	$4,658.36	$3.48	$10,251	$1.02	3,035	$3,005.03	$0.00	$0.00	$6.07	$17,915			
A12.2.1.3			Complete confirmation testing	197	ea	C.3.02	32.8	$7.40	$1,457.93	$5.08	$1,000	$0.00	0	$0.00	$14.95	$2,945.15	$27.43	$5,403			
A12.2.2.1		Mill Area	Delineate contaminated soil areas	198	test pits	C.3.01	99.0	$22.59	$4,472.34	$5.03	$996	$3.01	601	$595.41	$299.00	$59,202.00	$329.63	$65,266			
A12.2.2.2			Load, haul, dump contaminated soils to underground	2,973	m3	R.039	103.0	$1.58	$4,696.51	$3.48	$10,335	$1.02	3,060	$3,029.64	$0.00	$0.00	$6.07	$18,062			
A12.2.2.3			Complete confirmation testing	198	ea	C.3.02	33.0	$7.40	$1,465.33	$5.08	$1,005	$0.00	0	$0.00	$14.95	$2,960.10	$27.43	$5,431			
A12.3	*Solid Waste Landfill*																		$199,187		
A12.3.1.1		Construction landfill	Place waste from site facilities	10,827	LCM	C.2.07	461.4	$1.96	$21,200.33	$9.09	$98,445	$2.94	32,207	$31,884.76	$0.00	$0.00	$14.00	$151,530			
A12.3.1.2			Place fill to minimize voids in the debris	2,824	m3	R.001	89.0	$1.44	$4,059.85	$3.16	$8,934	$0.93	2,645	$2,618.94	$0.00	$0.00	$5.53	$15,613			
A12.3.2.1		Close landfill	Soil Cover: Load haul, dump spread, compact (0.6m)	5,024	m3	R.002	190.0	$1.67	$8,400.65	$3.36	$16,884	$1.02	5,196	$5,144.21	$0.00	$0.00	$6.06	$30,429			

WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Labour: Total Mhrs	Labour: Unit Rate	Labour: Cost	Equipment: Unit Rate	Equipment: Cost	Fuel: Unit Rate	Fuel: Consumed (L)	Fuel: Cost	Material: Unit Rate	Material: Cost	Activity Totals: Unit Rate	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
A12.3.2.2			Revegetation: Seed/Fertilizer: broadcast seeding	0.55	ha	C.6.01	18.1	$1,069.47	$583.88	$556.88	$304	$240.22	132	$131.15	$1,091.19	$595.74	$2,957.77	$1,615			
A12.4	*Hazardous Material Off-Site Disposal*																		$10,812		
A12.4.1.1		Hazardous Waste	From Building Demo: Transport off-site for disposal	2	trip	C.7.04	14.5	$363.66	$657.38	$360.37	$651	$116.87	213	$211.26	$0.00	$0.00	$840.90	$1,520			
A12.4.3.3			Hazardous materials: Disposal and Tipping fees.	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0	$0			
A12.4.2.1		Reagents	Reagents: Transport to Whitehorse	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A12.4.2.2			Reagents: Disposal and tipping fees	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A13	**Surface Water Conveyance**																			**$3,417,069**	
A13.1	*Channel A - W-15 to Main Pit*																		$204,169		
A13.1.1.1		Excavate channel	Load, haul, dump locally	40,300	m3	R.902	700.5	$0.80	$32,184.77	$1.33	$53,704	$0.48	19,351	$19,157.46	$0.00	$0.00	$2.61	$105,046			
A13.1.2.1		Place channel materials	Geotextile: Supply and place	7,785	m3	C.5.08	221.4	$1.14	$8,887.42	$0.19	$1,485	$0.11	897	$887.61	$2.68	$20,895.25	$4.13	$32,155			
A13.1.2.2			Rip-rap (angular, high quality): Screen and stockpile	3,855	m3	C.2.15	0.0	$2.63	$10,120.59	$6.44	$24,818	$1.92	7,462	$7,387.04	$0.00	$0.00	$10.98	$42,325			
A13.1.2.3			Rip-rap: Load, haul, dump	3,855	m3	R.018	102.2	$1.21	$4,660.08	$2.66	$10,255	$0.78	3,037	$3,006.14	$0.00	$0.00	$4.65	$17,921			
A13.1.2.4			Rip-rap: Place and secure	3,855	m3	R.904	41.9	$0.50	$1,926.02	$0.91	$3,507	$0.33	1,299	$1,286.49	$0.00	$0.00	$1.74	$6,720			
A13.2	*Channel B - W-35 to Area 2 Pit*																		$190,419		
A13.2.1.1		Excavate channel	Load, haul, dump locally	48,038	m3	R.902	835.0	$0.80	$38,364.63	$1.33	$64,016	$0.48	23,067	$22,835.92	$0.00	$0.00	$2.61	$125,216			
A13.2.2.1		Place channel materials	Geotextile: Supply and place	4,682	m2	C.5.08	133.1	$1.14	$5,344.90	$0.19	$893	$0.11	539	$533.81	$2.68	$12,566.42	$4.13	$19,338			
A13.2.2.2			Rip-rap (angular, high quality): Screen and stockpile	2,554	m3	C.2.15	0.0	$2.63	$6,704.89	$6.44	$16,442	$1.92	4,943	$4,893.91	$0.00	$0.00	$10.98	$28,041			
A13.2.2.3			Rip-rap: Load, haul, dump	2,554	m3	R.020	76.2	$1.36	$3,476.91	$3.00	$7,651	$0.88	2,266	$2,242.89	$0.00	$0.00	$5.24	$13,371			
A13.2.2.4			Rip-rap: Place and secure	2,554	m3	R.904	27.8	$0.50	$1,275.99	$0.91	$2,324	$0.33	861	$852.30	$0.00	$0.00	$1.74	$4,452			
A13.3	*Channel C - Main Pit to Main Access Road*																		$128,241		
A13.3.2.1		Excavate channel	Load, haul, dump locally	8,656	m3	R.902	150.5	$0.80	$6,913.18	$1.33	$11,535	$0.48	4,157	$4,114.96	$0.00	$0.00	$2.61	$22,564			
A13.3.3.1		Intake structure	Excavate soils to competent foundation materials	2,450	Bm3	R.902	42.6	$0.80	$1,956.44	$1.33	$3,265	$0.48	1,176	$1,164.54	$0.00	$0.00	$2.61	$6,386			
A13.3.3.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.3.3.6			Backfill and compact around structure	2,450	Cm3	C.2.04	237.3	$2.69	$6,581.75	$3.00	$7,361	$1.07	2,638	$2,611.71	$0.00	$0.00	$6.76	$16,554			
A13.3.4.1		Place channel materials	Geotextile: Supply and place	3,171	m2	C.5.08	90.2	$1.14	$3,619.88	$0.19	$605	$0.11	365	$361.53	$2.68	$8,510.72	$4.13	$13,097			
A13.3.4.2			Rip-rap (angular, high quality): Screen and stockpile	1,037	m3	C.2.15	0.0	$2.63	$2,723.66	$6.44	$6,679	$1.92	2,008	$1,988.01	$0.00	$0.00	$10.98	$11,391			
A13.3.4.3			Rip-rap: Load, haul, dump	1,037	m3	R.022	36.4	$1.60	$1,656.75	$3.47	$3,599	$1.02	1,064	$1,053.00	$0.00	$0.00	$6.08	$6,309			
A13.3.4.4			Rip-rap: Place and secure	1,037	m3	R.904	11.3	$0.50	$518.33	$0.91	$944	$0.33	350	$346.22	$0.00	$0.00	$1.74	$1,808			
A13.4	*Channel D - Area 2 Pit to Channel E*																		$198,109		
A13.4.1.1		Excavate channel	Load, haul, dump locally	17,840	m3	R.902	310.1	$0.80	$14,247.16	$1.33	$23,773	$0.48	8,566	$8,480.39	$0.00	$0.00	$2.61	$46,501			
A13.4.2.1		Intake structure	Excavate soils to competent foundation materials	4,453	Bm3	R.902	77.4	$0.80	$3,556.10	$1.33	$5,934	$0.48	2,138	$2,116.71	$0.00	$0.00	$2.61	$11,607			
A13.4.2.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.4.2.6			Backfill and compact around structure	4,453	Cm3	C.2.04	431.4	$2.69	$11,963.28	$3.00	$13,379	$1.07	4,795	$4,747.16	$0.00	$0.00	$6.76	$30,090			
A13.4.3.1		Place channel materials	Geotextile: Supply and place	4,910	m2	C.5.08	139.6	$1.14	$5,604.81	$0.19	$937	$0.11	565	$559.77	$2.68	$13,177.49	$4.13	$20,279			
A13.4.3.2			Rip-rap (angular, high quality): Screen and stockpile	2,199	m3	C.2.15	0.0	$2.63	$5,774.66	$6.44	$14,161	$1.92	4,258	$4,214.94	$0.00	$0.00	$10.98	$24,150			
A13.4.3.3			Rip-rap: Load, haul, dump	2,199	m3	R.020	65.7	$1.36	$2,994.53	$3.00	$6,590	$0.88	1,951	$1,931.72	$0.00	$0.00	$5.24	$11,516			
A13.4.3.4			Rip-rap: Place and secure	2,199	m3	R.904	23.9	$0.50	$1,098.96	$0.91	$2,001	$0.33	741	$734.05	$0.00	$0.00	$1.74	$3,834			
A13.5	*Channel E - Main Access Road to toe of MVFE*																		$784,793		
A13.5.1.1		Construct channel	Bulk fill to grade: Load, haul, dump, spread	29,750	m3																
A13.5.1.2			Excavate/form Channel: Load, haul, dump locally	46,386	m3	R.001	1,461.8	$1.44	$66,673.96	$3.16	$146,727	$0.93	43,445	$43,010.23	$0.00	$0.00	$5.53	$256,411			
A13.5.2.1		Place channel materials	Geotextile: Supply and place	27,307	m2	C.5.08	776.5	$1.14	$31,173.50	$0.19	$5,209	$0.11	3,145	$3,113.39	$2.68	$73,292.13	$4.13	$112,788			
A13.5.2.2			Rip-rap (angular, high quality): Screen and stockpile	20,558	m3	C.2.15	0.0	$2.63	$53,973.88	$6.44	$132,355	$1.92	39,794	$39,395.64	$0.00	$0.00	$10.98	$225,725			
A13.5.2.3			Rip-rap: Load, haul, dump	20,558	m3	R.025	845.7	$1.87	$38,540.15	$4.07	$83,728	$1.19	24,743	$24,495.41	$0.00	$0.00	$7.14	$146,763			
A13.5.2.4			Rip-rap: Place and secure	20,558	m3	R.904	223.6	$0.50	$10,271.59	$0.91	$18,706	$0.33	6,930	$6,860.95	$0.00	$0.00	$1.74	$35,838			
A13.5.3.1		Stilling basin/Energy Dissipa	Excavate basin (spoil locally)	645	m3	R.902	11.2	$0.80	$515.35	$1.33	$860	$0.48	310	$306.75	$0.00	$0.00	$2.61	$1,682			
A13.5.3.2			Geotextile: Supply and place	540	m2	C.5.08	15.4	$1.14	$616.54	$0.19	$103	$0.11	62	$61.58	$2.68	$1,449.56	$4.13	$2,231			
A13.5.3.3			Bedding layer: Screen and stockpile	131	m3	C.2.01	2.7	$0.99	$129.06	$2.29	$299	$0.45	59	$58.25	$0.00	$0.00	$3.72	$486			
A13.5.3.4			Bedding layer: Load, haul, dump and place	131	m3	R.028	7.7	$2.68	$349.60	$6.08	$793	$1.74	229	$227.00	$0.00	$0.00	$10.50	$1,370			
A13.5.3.5			Rip-rap (at inlet and outlet): Screen and stockpile	75	m3	C.2.15	0.0	$2.63	$196.91	$6.44	$483	$1.92	145	$143.73	$0.00	$0.00	$10.98	$824			
A13.5.3.6			Rip-rap (at inlet and outlet): Load, haul, dump	75	m3	R.027	3.2	$1.92	$144.06	$4.13	$310	$1.21	91	$90.58	$0.00	$0.00	$7.26	$545			
A13.5.3.7			Rip-rap (at inlet and outlet): Place and secure	75	m3	R.904	0.8	$0.50	$37.47	$0.91	$68	$0.33	25	$25.03	$0.00	$0.00	$1.74	$131			
A13.6	*Minto Creek Wetland By-Pass Channel*																		$236,362		
A13.6.1.1		Excavate channel	Load, haul, dump locally	29,668	m3	R.902	515.7	$0.80	$23,693.38	$1.33	$39,535	$0.48	14,246	$14,103.10	$0.00	$0.00	$2.61	$77,332			
A13.6.2.1		Place channel materials	Geotextile: Supply and place	12,212	m2	C.5.08	347.3	$1.14	$13,940.93	$0.19	$2,330	$0.11	1,406	$1,392.32	$2.68	$32,776.56	$4.13	$50,439			
A13.6.2.2			Rip-rap (angular, high quality): Screen and stockpile	5,950	m3	C.2.15	0.0	$2.63	$15,621.11	$6.44	$38,306	$1.92	11,517	$11,401.88	$0.00	$0.00	$10.98	$65,329			
A13.6.2.3			Rip-rap: Load, haul, dump	5,950	m3	R.001	187.5	$1.44	$8,552.11	$3.16	$18,820	$0.93	5,573	$5,516.82	$0.00	$0.00	$5.53	$32,889			Assumes WSP rip-rap can be re-used
A13.6.2.4			Rip-rap: Place and secure	5,950	m3	R.904	64.7	$0.50	$2,972.80	$0.91	$5,414	$0.33	2,006	$1,985.70	$0.00	$0.00	$1.74	$10,372			
A13.7	*Allowance: Minto North Spillway*																		$84,151		
A13.7.1.1		Excavate channel	Load, haul, dump locally	13,035	m3	R.902	226.6	$0.80	$10,410.10	$1.33	$17,370	$0.48	6,259	$6,196.44	$0.00	$0.00	$2.61	$33,977			
A13.7.2.1		Place channel materials	Geotextile: Supply and place	4,136	m2	C.5.08	117.6	$1.14	$4,721.21	$0.19	$789	$0.11	476	$471.52	$2.68	$11,100.06	$4.13	$17,082			
A13.7.2.2			Rip-rap (angular, high quality): Screen and stockpile	1,943	m3	C.2.15	0.0	$2.63	$5,102.17	$6.44	$12,512	$1.92	3,762	$3,724.08	$0.00	$0.00	$10.98	$21,338			
A13.7.2.3			Rip-rap: Load, haul, dump	1,943	m3	R.024	47.7	$1.12	$2,175.48	$2.46	$4,787	$0.72	1,418	$1,403.37	$0.00	$0.00	$4.31	$8,366			Assumes WSP rip-rap can be re-used
A13.7.2.4			Rip-rap: Place and secure	1,943	m3	R.904	21.1	$0.50	$970.98	$0.91	$1,768	$0.33	655	$648.57	$0.00	$0.00	$1.74	$3,388			
A13.8	*Ridgetop North Outlet Channel*																		$77,037		
A13.8.1.1		Excavate channel	Load, haul, dump locally	7,758	m3	R.902	134.9	$0.80	$6,195.89	$1.33	$10,339	$0.48	3,725	$3,688.01	$0.00	$0.00	$2.61	$20,222			
A13.8.2.1		Place channel materials	Geotextile: Supply and place	3,995	m2	C.5.08	113.6	$1.14	$4,560.10	$0.19	$762	$0.11	460	$455.43	$2.68	$10,721.27	$4.13	$16,499			
A13.8.2.2			Rip-rap (angular, high quality): Screen and stockpile	2,531	m3	C.2.15	0.0	$2.63	$6,644.96	$6.44	$16,295	$1.92	4,899	$4,850.17	$0.00	$0.00	$10.98	$27,790			
A13.8.2.3			Rip-rap: Load, haul, dump	2,531	m3	R.068	33.1	$0.60	$1,507.37	$1.95	$4,942	$0.66	1,681	$1,664.25	$0.00	$0.00	$3.21	$8,114			Assumes WSP rip-rap can be re-used
A13.8.2.4			Rip-rap: Place and secure	2,531	m3	R.904	27.5	$0.50	$1,264.58	$0.91	$2,303	$0.33	853	$844.68	$0.00	$0.00	$1.74	$4,412			
A13.9	*Secondary Catchment Channels*																		$837,519		
A13.9.1.1		Southwest Dump	Excavate mild-graded channels (good access), spoil locally	10,787	Bm3	R.902	187.5	$0.80	$8,615.00	$1.33	$14,375	$0.48	5,180	$5,127.94	$0.00	$0.00	$2.61	$28,118			
A13.9.1.2			Excavate steep-graded channels (poor access), spoil locally	6,640	Bm3	R.903	131.0	$0.91	$6,019.60	$1.51	$10,044	$0.54	3,619	$3,583.07	$0.00	$0.00	$2.96	$19,647			
A13.9.1.3			Geotextile: Supply and place	25,206	m2	C.5.08	716.7	$1.14	$28,774.54	$0.19	$4,809	$0.11	2,903	$2,873.80	$2.68	$67,651.92	$4.13	$104,109			
A13.9.1.4			Bedding layer: Screen and stockpile	2,054	Cm3	C.2.01	41.8	$0.99	$2,031.02	$2.29	$4,703	$0.45	926	$916.60	$0.00	$0.00	$3.72	$7,651			
A13.9.1.5			Bedding layer: Load, haul, dump and place in steep areas	2,054	Cm3	R.032	72.2	$1.60	$3,288.73	$3.48	$7,145	$1.02	2,111	$2,090.26	$0.00	$0.00	$6.10	$12,524			
A13.9.1.6			Rip-rap (angular, high quality): Screen and stockpile	6,806	Cm3	C.2.15	0.0	$2.63	$17,870.15	$6.44	$43,821	$1.92	13,175	$13,043.46	$0.00	$0.00	$10.98	$74,735			
A13.9.1.7			Rip-rap: Load, haul, dump	6,806	m3	R.031	223.5	$1.50	$10,194.10	$3.30	$22,434	$0.97	6,642	$6,576.04	$0.00	$0.00	$5.76	$39,204			
A13.9.1.8			Rip-rap: Place in mild-graded channels (good access)	3,787	m3	R.904	41.2	$0.50	$1,892.29	$0.91	$3,446	$0.33	1,277	$1,263.96	$0.00	$0.00	$1.74	$6,602			
A13.9.1.9			Rip-rap: Place in steep-graded channels (poor access)	3,019	m3	R.905	74.5	$1.13	$3,424.74	$1.89	$5,715	$0.68	2,059	$2,038.52	$0.00	$0.00	$3.70	$11,178			
A13.9.2.1		Main Waste Dump	Excavate mild-graded channels (good access), spoil locally	6,477	Bm3	R.902	112.6	$0.80	$5,172.45	$1.33	$8,631	$0.48	3,110	$3,078.81	$0.00	$0.00	$2.61	$16,882			
A13.9.2.2			Excavate steep-graded channels (poor access), spoil locally	3,986	Bm3	R.903	78.6	$0.91	$3,613.24	$1.51	$6,029	$0.54	2,172	$2,150.72	$0.00	$0.00	$2.96	$11,793			
A13.9.2.3			Geotextile: Supply and place	15,132	m2	C.5.08	430.3	$1.14	$17,274.69	$0.19	$2,887	$0.11	1,743	$1,725.28	$2.68	$40,614.58	$4.13	$62,501			
A13.9.2.4			Bedding layer: Screen and stockpile	1,233	Cm3	C.2.01	25.1	$0.99	$1,219.11	$2.29	$2,823	$0.45	556	$550.18	$0.00	$0.00	$3.72	$4,592			
A13.9.2.5			Bedding layer: Load, haul, dump and place in steep areas	1,233	Cm3	R.030	34.8	$1.29	$1,589.78	$2.89	$3,566	$0.85	1,059	$1,048.15	$0.00	$0.00	$5.03	$6,204			
A13.9.2.6			Rip-rap (angular, high quality): Screen and stockpile	4,086	Cm3	C.2.15	0.0	$2.63	$10,728.01	$6.44	$26,307	$1.92	7,909	$7,830.40	$0.00	$0.00	$10.98	$44,866			
A13.9.2.7			Rip-rap: Load, haul, dump	4,086	m3	R.029	101.4	$1.13	$4,630.74	$2.54	$10,386	$0.75	3,084	$3,053.08	$0.00	$0.00	$4.42	$18,070			
A13.9.2.8			Rip-rap: Place in mild-graded channels (good access)	2,274	m3	R.904	24.7	$0.50	$1,136.13	$0.91	$2,069	$0.33	767	$758.88	$0.00	$0.00	$1.74	$3,964			

WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Labour: Total Mhrs	Labour: Unit Rate	Labour: Cost	Equipment: Unit Rate	Equipment: Cost	Fuel: Unit Rate	Fuel: Consumed (L)	Fuel: Cost	Material: Unit Rate	Material: Cost	Activity Totals: Unit Rate	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
A13.9.2.9			Rip-rap: Place in steep-graded channels (poor access)	1,812	m3	R.905	44.7	$1.13	$2,055.69	$1.89	$3,430	$0.68	1,236	$1,223.61	$0.00	$0.00	$3.70	$6,709			
A13.9.3.1		Reclamation Overburden Du	Excavate mild-graded channels (good access), spoil locally	4,886	Bm3	R.902	84.9	$0.80	$3,902.25	$1.33	$6,511	$0.48	2,346	$2,322.75	$0.00	$0.00	$2.61	$12,736			
A13.9.3.2			Excavate steep-graded channels (poor access), spoil locally	3,007	Bm3	R.903	59.3	$0.91	$2,725.94	$1.51	$4,549	$0.54	1,639	$1,622.57	$0.00	$0.00	$2.96	$8,897			
A13.9.3.3			Geotextile: Supply and place	11,416	m2	C.5.08	324.6	$1.14	$13,032.55	$0.19	$2,178	$0.11	1,315	$1,301.60	$2.68	$30,640.87	$4.13	$47,153			
A13.9.3.4			Bedding layer: Screen and stockpile	930	Cm3	C.2.01	18.9	$0.99	$919.73	$2.29	$2,130	$0.45	419	$415.07	$0.00	$0.00	$3.72	$3,465			
A13.9.3.5			Bedding layer: Load, haul, dump and place in steep areas	930	Cm3	R.034	34.7	$1.70	$1,581.31	$3.74	$3,480	$1.10	1,030	$1,020.08	$0.00	$0.00	$6.54	$6,081			
A13.9.3.6			Rip-rap (angular, high quality): Screen and stockpile	3,083	Cm3	C.2.15	0.0	$2.63	$8,093.54	$6.44	$19,847	$1.92	5,967	$5,907.49	$0.00	$0.00	$10.98	$33,848			
A13.9.3.7			Rip-rap: Load, haul, dump	3,083	m3	R.033	97.0	$1.43	$4,422.65	$3.16	$9,733	$0.93	2,882	$2,852.98	$0.00	$0.00	$5.52	$17,008			
A13.9.3.8			Rip-rap: Place in mild-graded channels (good access)	1,715	m3	R.904	18.7	$0.50	$857.13	$0.91	$1,561	$0.33	578	$572.53	$0.00	$0.00	$1.74	$2,991			
A13.9.3.9			Rip-rap: Place in steep-graded channels (poor access)	1,367	m3	R.905	33.8	$1.13	$1,550.87	$1.89	$2,588	$0.68	932	$923.13	$0.00	$0.00	$3.70	$5,062			
A13.9.4.1		DSTSF & MVFE	Excavate mild-graded channels (good access), spoil locally	7,378	Bm3	R.902	128.3	$0.80	$5,892.66	$1.33	$9,833	$0.48	3,543	$3,507.51	$0.00	$0.00	$2.61	$19,233			
A13.9.4.2			Excavate steep-graded channels (poor access), spoil locally	4,541	Bm3	R.903	89.6	$0.91	$4,116.35	$1.51	$6,869	$0.54	2,475	$2,450.19	$0.00	$0.00	$2.96	$13,435			
A13.9.4.3			Geotextile: Supply and place	17,239	m2	C.5.08	490.2	$1.14	$19,680.03	$0.19	$3,289	$0.11	1,985	$1,965.50	$2.68	$46,269.77	$4.13	$71,204			
A13.9.4.4			Bedding layer: Screen and stockpile	1,405	Cm3	C.2.01	28.6	$0.99	$1,388.86	$2.29	$3,216	$0.45	633	$626.79	$0.00	$0.00	$3.72	$5,232			
A13.9.4.5			Bedding layer: Load, haul, dump and place in steep areas	1,405	Cm3	R.028	82.5	$2.68	$3,762.08	$6.08	$8,538	$1.74	2,467	$2,442.81	$0.00	$0.00	$10.50	$14,743			
A13.9.4.6			Rip-rap (angular, high quality): Screen and stockpile	4,655	Cm3	C.2.15	0.0	$2.63	$12,221.79	$6.44	$29,970	$1.92	9,011	$8,920.70	$0.00	$0.00	$10.98	$51,113			
A13.9.4.7			Rip-rap: Load, haul, dump	4,655	m3	R.027	196.3	$1.92	$8,941.32	$4.13	$19,245	$1.21	5,679	$5,622.17	$0.00	$0.00	$7.26	$33,808			
A13.9.4.8			Rip-rap: Place in mild-graded channels (good access)	2,590	m3	R.904	28.2	$0.50	$1,294.33	$0.91	$2,357	$0.33	873	$864.55	$0.00	$0.00	$1.74	$4,516			
A13.9.4.9			Rip-rap: Place in steep-graded channels (poor access)	2,065	m3	R.905	51.0	$1.13	$2,341.92	$1.89	$3,908	$0.68	1,408	$1,393.99	$0.00	$0.00	$3.70	$7,644			
A13.9.5.1		Ridgetop Waste Dump	Excavate mild-graded channels (good access), spoil locally	574	Bm3	R.902	10.0	$0.80	$458.32	$1.33	$765	$0.48	276	$272.81	$0.00	$0.00	$2.61	$1,496			
A13.9.5.2			Excavate steep-graded channels (poor access), spoil locally	353	Bm3	R.903	7.0	$0.91	$320.16	$1.51	$534	$0.54	192	$190.57	$0.00	$0.00	$2.96	$1,045			
A13.9.5.3			Geotextile: Supply and place	876	m2	C.5.08	24.9	$1.14	$1,000.22	$0.19	$167	$0.11	101	$99.89	$2.68	$2,351.61	$4.13	$3,619			
A13.9.5.4			Bedding layer: Screen and stockpile	465	Cm3	C.2.01	9.4	$0.99	$459.41	$2.29	$1,064	$0.45	209	$207.33	$0.00	$0.00	$3.72	$1,731			
A13.9.5.5			Bedding layer: Load, haul, dump and place in steep areas	109	Cm3	R.063	2.9	$1.22	$133.33	$3.96	$432	$1.30	143	$142.03	$0.00	$0.00	$6.48	$708			
A13.9.5.6			Rip-rap (angular, high quality): Screen and stockpile	362	Cm3	C.2.15	0.0	$2.63	$950.58	$6.44	$2,331	$1.92	701	$693.83	$0.00	$0.00	$10.98	$3,975			
A13.9.5.7			Rip-rap: Load, haul, dump	362	m3	R.064	8.5	$1.07	$386.18	$3.48	$1,262	$1.18	431	$426.59	$0.00	$0.00	$5.73	$2,074			
A13.9.5.8			Rip-rap: Place in mild-graded channels (good access)	201	m3	R.904	2.2	$0.50	$100.67	$0.91	$183	$0.33	68	$67.24	$0.00	$0.00	$1.74	$351			
A13.9.5.9			Rip-rap: Place in steep-graded channels (poor access)	161	m3	R.905	4.0	$1.13	$182.15	$1.89	$304	$0.68	110	$108.42	$0.00	$0.00	$3.70	$595			
A13.10	*Tailings Diversion Ditch*																		$660,675		
A13.10.1.2		Regrade	Slopes: Re-grade to 3H:1V	36	hrs	C.2.13	36	$45.95	$1,644	$213.35	$7,635	$69.10	2,498	$2,473	$0.00	$0	$328.40	$11,751			
A13.10.2.1		Cover	Flat area cover material: Load, haul, dump spread	25,182	Cm3	R.066	562.3	$1.02	$25,637	$3.30	$83,160	$1.08	27,585	$27,310	$0.00	$0	$5.40	$136,106			
A13.10.2.2			Slope area cover material: Load, haul, dump along crest	18,049	Cm3	R.067	352.6	$0.89	$16,061	$2.91	$52,469	$0.98	17,921	$17,742	$0.00	$0	$4.78	$86,272			
A13.10.2.3			Slope area cover material: Spread down slope	14	hrs	C.2.13	14.0	$45.95	$643	$213.35	$2,985	$69.10	977	$967	$0.00	$0	$328.40	$4,595			
A13.10.3.1		Revegetate	Seed/Fertilize: tractor application	9	ha	C.6.01	286.4	$1,069.47	$9,247	$556.88	$4,815	$240.22	2,098	$2,077	$1,091.19	$9,435	$2,958	$25,574			
A13.10.3.2			Tree seedling application (1,000 stems/ha)	9	ha	C.6.06	443.1	$1,919.72	$16,598	$35.26	$305	$15.47	135	$134	$1,189.36	$10,284	$3,160	$27,321			
A13.10.4.1		Extend Channel to WSP	Clear and grub footprint	13,889	m2	C.2.03	52.8	$0.17	$2,426	$0.54	$7,480	$0.14	1,940	$1,921	$0.00	$0	$0.85	$11,826			
A13.10.4.2			Geotextile: Supply and place	13,889	m2	C.5.08	394.9	$1.14	$15,855	$0.19	$2,650	$0.11	1,600	$1,584	$2.68	$37,277	$4.13	$57,366			
A13.10.4.3			Rip-rap (angular, high quality): Screen and stockpile	13,169	m3	C.2.15	0.0	$2.63	$34,576	$6.44	$84,788	$1.92	25,492	$25,237	$0.00	$0	$10.98	$144,601			
A13.10.4.4			Rip-rap: Load, haul, dump	13,169	m3	R.035	618.4	$2.14	$28,168	$4.60	$60,626	$1.34	17,890	$17,712	$0.00	$0	$8.09	$106,506			
A13.10.4.5			Rip-rap: Place in steep-graded channels (poor access)	13,169	m3	R.905	325.1	$1.13	$14,939	$1.89	$24,927	$0.68	8,982	$8,892	$0.00	$0	$3.70	$48,757			
A14	**Water Treatment**																			**$574,445**	
A14.1	*Passive Treatment System - Minto Creek Valley*																		$485,215		
A14.1.1.1		Water Management	Install pump and pump around system	8	hrs	C.4.14	32.0	$125.31	$1,002.50	$37.01	$296	$6.95	56	$55.60	$0.00	$0.00	$169.27	$1,354			Assumed
A14.1.1.2			Maintain pump around system during wetland construction activities	1,440	hrs	C.4.13	144.0	$3.72	$5,363.40	$28.42	$40,918	$2.00	2,909	$2,880.00	$0.00	$0.00	$34.14	$49,161			Assumes wetlands constructed over 2 months
A14.1.2.1		Valley Fill placement	Load, haul, dump material from the WSP excavation	85,918	m3	n/a - costed	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.1.2.1			Load, haul dump valley fill material	0	m3	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			Fill from WSP excavation exceeds the required amount.
A14.1.3.1		Construct wetlands	Excavate cells: Load, haul dump, spoil locally	14,459	m3	R.902	251.3	$0.80	$11,547.30	$1.33	$19,268	$0.48	6,943	$6,873.34	$0.00	$0.00	$2.61	$37,689			
A14.1.3.2			Subgrade preparation: remove sharp objects, place fill as required	9,273	m2	C.2.18	317.0	$1.37	$12,669.07	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$12,669			
A14.1.3.3			Geotextile: Supply and install	10,201	m2	C.5.08	290.1	$1.14	$11,644.99	$0.19	$1,946	$0.11	1,175	$1,163.02	$2.68	$27,378.58	$4.13	$42,133			
A14.1.3.4			HDPE liner: Supply and install	10,201	m2	C.5.11	1,187.0	$4.93	$50,253.33	$0.47	$4,778	$0.28	2,884	$2,855.60	$13.70	$139,698.09	$19.37	$197,585			
A14.1.3.5			Organics: Mulch organics, produce and stockpile	5,122	Cm3	C.2.10	577.1	$4.68	$23,965.81	$5.04	$25,817	$1.86	9,609	$9,513.16	$0.00	$0.00	$11.58	$59,295			
A14.1.3.6			Organics: Load, haul, dump, place in cell	5,122	Cm3	R.001	161.4	$1.44	$7,362.27	$3.16	$16,202	$0.93	4,797	$4,749.28	$0.00	$0.00	$5.53	$28,313			
A14.1.3.7			Plant wetland vegetation	0.9	ha	C.6.05	40.6	$1,505.47	$1,396.08	$406.33	$377	$185.63	174	$172.14	$1,216.54	$1,128.14	$3,313.97	$3,073			
A14.1.4.1		Conveyance channels	Excavate channels: Load, haul, dump locally	1,402	m3	R.902	24.4	$0.80	$1,119.89	$1.33	$1,869	$0.48	673	$666.59	$0.00	$0.00	$2.61	$3,655			
A14.1.4.2			Surface preparation: remove sharp objects, place fill as required	1,858	m2	C.2.18	63.5	$1.37	$2,538.03	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$2,538			
A14.1.4.3			Geotextile: Supply and place	1,858	m2	C.5.08	52.8	$1.14	$2,120.80	$0.19	$354	$0.11	214	$211.81	$2.68	$4,986.21	$4.13	$7,673			
A14.1.4.4			HDPE Liner: Supply and install	1,858	m2	C.5.11	216.2	$4.93	$9,152.18	$0.47	$870	$0.28	525	$520.06	$13.70	$25,441.93	$19.37	$35,984			
A14.1.4.5			Bedding/Protection layer: Screen and stockpile	442	m3	C.2.01	9.0	$0.99	$437.26	$2.29	$1,013	$0.45	199	$197.34	$0.00	$0.00	$3.72	$1,647			
A14.1.4.6			Bedding/Protection layer: Load, haul, dump and place	442	m3	R.001	13.9	$1.44	$635.70	$3.16	$1,399	$0.93	414	$410.08	$0.00	$0.00	$5.53	$2,445			Assumes WSP fill can be re-used
A14.1.5.1		Operation and maintenance	System to be started Yr. 1 post-closure	0	yr	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.2	*Southwest Wetlands*																		$16,583		
A14.2.1		Berm construction	Construct 3 berms across valley	3,000	m3	R.001	94.5	$1.44	$4,312.16	$3.16	$9,490	$0.93	2,810	$2,781.70	$0.00	$0.00	$5.53	$16,583			Assumed
A14.2.2		Outlet structures	Excavate outlet channels through berms	1	ls																Allowance
A14.3	*Decommission/demolish Water Treatment System*																		$72,646		
A14.3.1.1		Remove equipment	Small equipment: dismantle and prep for transport	17	hrs	C.1.13	67.1	$174.43	$2,927.27	$115.96	$1,946	$17.92	304	$300.72	$0.00	$0.00	$308.32	$5,174			
A14.3.1.2			Large equipment (crane req'd): dismantle and prep for transport	29	hrs	C.1.14	175.7	$279.25	$8,178.13	$199.44	$5,841	$24.11	713	$706.00	$0.00	$0.00	$502.79	$14,725			
A14.3.2.1		Prepare for demolition	Reagents: Load for transport	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A14.3.2.2			Reagents: Transport to Whitehorse	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A14.3.2.3			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.3.3.1		Demolition	Structural building demolition	163	tonnes	C.1.05	325.0	$71.87	$11,680.66	$139.79	$22,719	$34.90	5,729	$5,671.56	$0.00	$0.00	$246.56	$40,071			
A14.3.3.2			Other demolition: miscellaneous	15	m3	C.1.07	1.5	$3.90	$58.57	$2.07	$31	$0.76	12	$11.40	$0.00	$0.00	$6.74	$101			
A14.3.4.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	27.1	$367.57	$1,244.53	$485.20	$1,643	$116.87	400	$395.70	$0.00	$0.00	$970	$3,283			
Subtotal Direct Costs - Active Closure							**129,247**		**$5,704,922**		**$10,465,243**			**$3,308,979**		**$1,605,268**				**$21,084,411**	

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	Peak Liability Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
INDIRECT COSTS																					
B1	**Mobilization-Demobilization**																			**$344,806**	
B1.1		Mobilization	Year 0	1	LS												$172,403	$172,403.02			
B1.2		Demobilization	Year 3 (end of Active Closure)	1	LS												$154,305	$154,304.96			
B1.4		Demobilization	End of Passive closure	1	LS												$18,098	$18,098.05			
B2	**Transportation Costs**																			**$420,735**	
B2.1.1		Barge Operations		15	month												$10,939	$164,079			
		Staffing Bus trips during barge operation period		60	ea (one per week)												$678	$40,656			Turnaround labour costs included in labour build-up
B2.2.2		Air transport and airstrip operations		72	flights												$3,000	$216,000			Three flights per week
B3	**Site/Road Maintenance**																			**$832,270**	
B3.1	*Road Maintenance*																		$754,203		
B3.1.1		Water Truck	Assume needed 150 hrs per month	21	month												$13,733	$288,400			
B3.1.2		Grader	Assume needed 150 hrs per month (16H + Operator)	21	month												$22,181	$465,803			Includes Main Access Road throughout closure period.
B3.2	*Soil Erosion*																		$78,067		
B3.2.1		Erosion control allowance	Silt fencing: supply, install remove at strategic locations	7024	m	C.2.17	283.5	$3.36	$23,588.40	$1.91	$13,417	$0.57	4,026	$3,986.02	$1.85	$12,979.80	$7.68	$53,971			
B3.2.2			Supply and install erosion control matting	10000	m2	C.2.09	175.4	$0.69	$6,915.95	$0.12	$1,237	$0.05	548	$542.76	$1.54	$15,400.00	$2.41	$24,096			
B4	**Construction Support**																			**$5,341,188**	
B4.1	*Field Support Staff*																		$2,993,535		Turnaround labour costs included in labour build-up
B4.1.1		Mine Manager		21	month		(	360) site working hours per month									$25,631	$538,254			
B4.1.2		Office/Camp manager		21	month		(	360) site working hours per month									$23,201	$487,211			
B4.1.3		Security/Administrative Assistant		21	month		(	360) site working hours per month									$18,296	$384,207			
B4.1.4		Foreman		21	month		(	360) site working hours per month									$18,296	$384,207			
B4.1.5		Mechanic		21	month		(	360) site working hours per month									$0	$0			Included in Equipment rates
B4.1.6		Surveyor		21	month		(	360) site working hours per month									$18,296	$384,207			
B4.1.7		Engineering technician	Material & QA/QC testing	10.5	month		(	360) site working hours per month									$42,120	$442,260			Assumed needed 1/2 of time
B4.1.8		Medic/H&S supervisor		21	month		(	360) site working hours per month									$17,771	$373,191			
B4.2	*Field support Vehicles*																		$567,579		
B4.2.1		Pick-up trucks (4 required)		84	month												$4,875	$409,465			
B4.2.2		Fuel truck		21	month												$0	$0			Included in Equipment rates
B4.2.3		Mechanic service vehicle		21	month												$0	$0			Included in Equipment rates
B4.2.4		Emergency transport vehicle		21	month												$5,218	$109,578			
B4.2.5		Passenger bus		21	month												$2,311	$48,535			
B4.3	*Field Support Equipment/Supplies*																		$1,780,075		
B4.3.1		Light Towers		21	month			2 # of Units									$3,978	$83,541			
B4.3.2		Material/Laboratory testing allowance		21	month												$1,000	$21,000			
B4.4		Construction, Environmental, and H&S Management Plans		1	LS												$25,000	$25,000			
B4.5		Office supplies		21	month												$1,000	$21,000			
B4.6		Communications		21	month												$1,000	$21,000			
B4.7		Misc. supplies		21	month												$500	$10,500			
B4.8		Camp costs	Includes catering and housekeeping	12,925	man-day	(direct)		6132 man-day (indirect)									$80	$1,524,534			
B4.9		Power and heat		21	month												$3,500	$73,500			
B5	**QA and Project Management**																			**$1,737,427**	
B5.1		EOR Engineer		21	month		(	84) project hours per month									$0	$0			
B5.2		Field Engineer		21	month		(	360) site working hours per month									$48,600	$1,020,600			
B5.3		Engineer travel/turnaround costs		49	ls												$3,600	$176,400			Assumes Vancouver origin
B5.3		Environmental Monitor		21	month		(	360) site working hours per month									$15,985	$335,695			
B5.4		Engineering , Design, and Construction plans (included in Planning and Permitting Costs)															$0.00	$0			
B5.5		Field support vehicles (2 vehicles)		42	month												$4,875	$204,733			
Subtotal Indirect Costs - Active Closure																				**$8,676,427**	
CLOSURE IMPLEMENTATION COSTS - TOTAL																				**$29,760,838**	

Worksheet 10 - Peak Liability Estimate - Schedule Details

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Year 0 Site Access Schedule

Stage	Flight Months	Helicopter Months	Barge Months	Total Months	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Interim Care	2	5	5	12	H	H	H	F	F	B	B	B	B	B	H	H	
SUB-TOTAL INTERIM CARE	**2**	**5**	**5**	**12**													
Active Closure 1	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 2	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 3	2	0	5	7				F	F	B	B	B	B	B			
SUB-TOTAL ACTIVE CLOSURE	**6**	**0**	**15**	**21**													
Post-Closure 1	2	0	3	5				F	F	B	B	B					
SUB-TOTAL POST-CLOSURE 1	**2**	**0**	**3**	**5**													
Post-Closure 2	0	0	1	1						B							
SUB-TOTAL POST-CLOSURE 2	**0**	**0**	**1**	**1**													

B: Annual C&M Staffing Schedule - Interim Operations

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**12**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
Administration/Office															
1	Mine Manager	4				0.5	0.5	0.5	0.5	0.5	0.5	0.5			
2	Office/Camp Mgr	6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
3	Payroll/Accounting/HR	0													Done remotely
Water Treatment/Environmental Staffing															
1	Warehouse/Water Treatment Operator	5				1.0	1.0	1.0	1.0	1.0					
2	Environmental Manager	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
3	Environmental Technician	7	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Operations															
4	Barge Operator	10						2.0	2.0	2.0	2.0	2.0			
5	Equipment operators	13				2.0	3.0	1.5	1.5	1.5	1.5	1.5			
6	HD Mechanic	2				0.5	0.3	0.3	0.3	0.25	0.25	0.25			
7	Tradesmen	2				0.5	0.3	0.3	0.3	0.25	0.25	0.5			
8	Labour/Helpers	10	1	1	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	1.0	1.0	
Camp/Support															
1	Cooks/Housecleaning etc.	0				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		Contract (accounted for in camp costs)
Other															
1	Visitors	2				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.0		
TOTAL		**63.0**	**2.0**	**2.0**	**2.0**	**8.3**	**7.8**	**7.8**	**7.8**	**7.8**	**6.8**	**7.0**	**2.0**	**2.0**	
	Annual man-days:	**1,890**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

C: Annual C&M Staffing Schedule - During Active Phase

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**7**				**1**	**1**	**1**	**1**	**1**	**1**	**1**			
Water Treatment/Environmental Staffing															
1	Warehouse/Water Treatment Operator	5				1.0	1.0	1.0	1.0	1.0					
2	Environmental Manager	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
3	Environmental Technician	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
TOTAL		**13**	**0**	**0**	**0**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**0**	**0**	
	Annual man-days:	**390**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)

D: Annual C&M Staffing Schedule - Post Closure 1

				Month												
#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site			**5**				**1**	**1**	**1**	**1**	**1**					
Administration/Office																
1	Mine Manager		3				0.5	0.5	0.5	0.5	0.5					
2	Office/Camp Mgr		3				1.0	0.5	0.5	0.5	0.5					
3	Payroll/Accounting/HR		0													Done Removely
Water Treatment/Environmental Staffing																
1	Water Treatment Operator		2				0.5	0.5	0.3	0.3	0.3					
2	Environmental Manager		3				0.5	0.5	0.5	0.5	0.5					
3	Environmental Technician		3				0.5	0.5	0.5	0.5	0.5					
Operations																
4	Barge Operator		6						2.0	2.0	2.0					
5	Equipment operators		10				2.0	3.0	1.5	1.5	1.5					
6	HD Mechanic		2				1.0	0.25	0.25	0.25	0.25					
7	Tradesmen		2				1.0	0.25	0.25	0.25	0.25					
8	Labour/Helpers		2				1.0	0.25	0.25	0.25	0.5					
Camp/Support																
1	Cooks/Housecleaning etc.		0				0.0	0.0	0.0	0.0	0.0					Contract (accounted for in camp costs)
Other																
1	Visitors		1				0.25				0.25					
TOTAL			**35**	**0**	**0**	**0**	**8**	**6**	**7**	**7**	**7**	**0**	**0**	**0**	**0**	
		Annual man-days:	**1,035**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Post Closure 2

				Month												
#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site			**1**						**1**							
Administration/Office																
1	Mine Manager		1						0.5							
2	Office/Camp Mgr		0						0.0							
3	Payroll/Accounting/HR		0						0.00							
Water Treatment/Environmental Staffing																
1	Passive Treatment Scientist		1						0.5							
2	Environmental Manager		0													
3	Environmental Technician		0													
Operations																
4	Barge Operator		1						1.0							
5	Equipment operators		1						1.0							
6	HD Mechanic		1						0.50							
7	Tradesmen		0													
8	Labour/Helpers		0						0.25							
Camp/Support																
1	Cooks/Housecleaning etc.		0						0.0							Contract (accounted for in camp costs)
Other																
1	Visitors		0						0.25							
TOTAL			**4**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**120**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Long-term perpetual maintenance year

				Month												
#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Comments/Notes**
Months Active at Site			**1**							**1**						
Administration/Office																
1	Project Manager/Foreman		1							1.0						
Water Treatment/Engineering Staffing																
1	Passive Treatment Scientist		1							1.0						
2	Site Engineer		1							1.0						
3	Environmental Technician		0													
Operations																
4	Barge Operator		1							1.0						Assumed required 1/2 the time (near mob and demob)
5	Equipment operators		4							4.0						
6	HD Mechanic		1							0.50						
7	Tradesmen		0													
8	Labour/Helpers		1							1.00						
Camp/Support																
1	Cooks/Housecleaning etc.		0													Contract (accounted for in camp costs)
Other																
1	Visitors		1							0.50						
TOTAL			**10**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**300**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

Worksheet 11- Peak Liability Estimate - Planning and Permitting Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

Planning And Permitting

WBS	Facility/Area	Task	Activity	Qnty	Unit	Total Unit Rate ($/unit)	Activity Total	Subtotal	Source / Comments
M1	**Planning and Permitting**								
M1.1	*Reclamation Research/Planning*							$400,000	
M1.1.1		Complete reclamation closure and research plan		2	yr	$200,000	$400,000		
M1.2	*Technical studies and investigations*							$58,500	
M1.2.1		Allowance for additional technical studies		1	ls	$58,500	$58,500		
M1.3	*Monitoring and Management Plans*							$209,158	
M1.3.1		Adaptive Mgmt Plans	Physcial, water quality, etc	1	ls	$15,000	$15,000		
M1.3.2		Revegetation plan		1	ls	$30,000	$30,000		
M1.3.3		Waste Management Plan	Water treatment, sludge, landfarm, etc.	1	ls	$50,000	$50,000		
M1.3.4		MMER Final Monitoring Study		1	ls	$114,158	$114,158		
M1.4	*Engineering, Design, and Construction Plans*							$1,054,221	
M1.4.1		Percentage of direct implementation costs		5%	of	$21,084,411	$1,054,221		
M1.5	*Permitting*							$0	
M1.5.1.1		Permit Staffing	Permitting Manager	0	ls	$0	$0		Staffing costs included in tasks above
M1.5.1.2			Environmental Manager	0	ls	$0	$0		
M1.5.1.3			Technical Consultants	0	ls	$0	$0		
TOTAL								**$1,721,879**	

Worksheet 12 - End-of-Mine Liability Estimate - Cashflow Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

NPV CALCULATION INPUTS

NOTE: Some columns between Years 2042 and 2130 may be hidden for printing purposes.

Short-Term Interest Rate (Interim Care/Implementation Costs)

##	Inflation Rate	Years in effect	Start Year	End Year
1	1.9%	100	2021	2121

Input Parameters

Scenario:	EOM - 2025	
Current Year:	2021	Year that the estimate is costed
Closure Year 1:	2025	
Closure Period:	3	yrs
Post-Closure Year 1:	2028	

Long-Term Monitoring/Maintenance NPV Discount Rates

##	Discount Rate	Years in effect	Start Year	End Year
1	0.55%	2	2021	2022
2	1.0%	3	2023	2025
3	1.9%	-	2026	

SCHEDULE

Implementation Schedule

			OPERATIONS				CLOSURE			POST CLOSURE																											
		Closure Year:	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 107	Year 108
	Area	Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
Direct Costs	Waste Dumps	100%					40%	60%																													
	Overburden Dumps	100%							100%																												
	Ore Stockpiles	100%					100%																														
	Open Pits	100%						50%	50%																												
	Underground Openings	100%					100%																														
	External Tailings Facilities	100%					50%	50%																													
	Roads	100%							100%																												
	Demolition	100%					10%	75%	15%																												
	Surface Infrastructure	100%					25%	50%	25%																												
	Water Detention Structures	100%						50%	50%																												
	Yards/Laydown Areas	100%					25%	25%	50%																												
	Waste Disposal	100%						11%	75%	3%	3%	3%	6%																								
	Surface Water Conveyance	100%					20%	30%	50%																												
	Water Treatment	100%							87%					13%																							
Indirect	Mobilization-Demobilization	100%					50%		45%					5%																							
	Transport Costs	100%					34%	33%	33%																												
	Road Maintenance	100%					34%	33%	33%																												
	Construction Support	100%					34%	33%	33%																												
	QA and Pro. Mgmt.	100%					34%	33%	33%																												

Monitoring Schedule

		Set Monitoring/C&M Stage:					2 - Active	2 - Active	2 - Active	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	3 - PC 1	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2	4 - PC 2										5 - Perpetual			5 - Perpetual
		Post-Closure Year:	Year -7	Year -6	Year -5	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 104	Year 105
		Sum																																			
Planning and permitting	Reclamation Research and Planning	100%			50%	50%																															
	Technical Studies and Investigations	100%			50%	50%																															
	Engineering, Design, and Construction Plans	100%			30%	40%	10%	10%	10%																												
	Monitoring and Management Plans	100%			50%	50%																															
	Permitting	100%			50%	50%																															
Monitoring	Water Quality Monitoring (surface and groundwater)						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										1			1
	Sediment Monitoring						1	1	1	1		1		1					1					1										1			1
	Biological Monitoring						1	1	1	1		1		1					1					1										1			1
	Geotechnical Monitoring						1	1	1	1	1	1	1	1					1					1										1			1
	Revegetation Monitoring						1	1	1	1	1	1	1	1					1					1										1			1
	Annual Inspection Reporting						1	1	1	1	1	1	1	1					1					1										1			1

Care and Maintenance Schedule

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
Water Treatment/Management	Active System						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
	Passive System									x	x	x	x	x					x					x										x			x
Reclamation Maintenance	Revegetation, cover repair, etc.									x	x	x	x	x																				x			x
Site Maintenance							x	x	x	x	x	x	x	x					x					x										x			x
On-site Management							x	x	x	x	x	x	x	x					x					x										x			x
Transportation Costs							x	x	x	x	x	x	x	x					x					x										x			x

UNDISCOUNTED CASH FLOW (TO 100 YEARS POST CLOSURE)

Implementation Costs

					Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 107	Year 108
	Area	Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
Direct Costs	Waste Dumps	$6,580,637	26%	$6,580,637	$0	$0	$0	$0	$2,632,255	$3,948,382	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps	$454,219	2%	$454,219	$0	$0	$0	$0	$0	$0	$454,219	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles	$845,436	3%	$845,436	$0	$0	$0	$0	$845,436	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits	$641,203	3%	$641,203	$0	$0	$0	$0	$0	$320,602	$320,602	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings	$92,291	0%	$92,291	$0	$0	$0	$0	$92,291	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities	$77,263	0%	$77,263	$0	$0	$0	$0	$38,632	$38,632	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads	$153,441	1%	$153,441	$0	$0	$0	$0	$0	$0	$153,441	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition	$2,005,083	8%	$2,005,083	$0	$0	$0	$0	$200,508	$1,503,813	$300,763	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure	$175,792	1%	$175,792	$0	$0	$0	$0	$43,948	$87,896	$43,948	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures	$840,997	3%	$840,997	$0	$0	$0	$0	$0	$420,498	$420,498	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas	$827,890	3%	$827,890	$0	$0	$0	$0	$206,972	$206,972	$413,945	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal	$461,883	2%	$461,883	$0	$0	$0	$0	$0	$50,990	$346,412	$11,953	$11,953	$11,953	$28,622	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance	$3,417,069	13%	$3,417,069	$0	$0	$0	$0	$683,414	$1,025,121	$1,708,534	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment	$574,445	2%	$574,445	$0	$0	$0	$0	$0	$0	$501,799	$0	$0	$0	$0	$72,646	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization	$344,806	1%	$344,806	$0	$0	$0	$0	$172,403	$0	$154,305	$0	$0	$0	$0	$18,098	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs	$407,086	2%	$407,086	$0	$0	$0	$0	$138,409	$134,338	$134,338	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Site/Road Maintenance	$796,356	3%	$796,356	$0	$0	$0	$0	$270,761	$262,797	$262,797	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support	$4,998,665	20%	$4,998,665	$0	$0	$0	$0	$1,699,546	$1,649,560	$1,649,560	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.	$1,655,893	7%	$1,655,893	$0	$0	$0	$0	$563,004	$546,445	$546,445	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs		**$25,350,453**		$25,350,453	**$0**	**$0**	**$0**	**$0**	**$7,587,579**	**$10,196,045**	**$7,411,605**	**$11,953**	**$11,953**	**$11,953**	**$28,622**	**$90,744**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Monitoring Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Planning and	Reclamation Research and Planning	$200,000	5%	$200,000	$0	$0	$100,000	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Permitting	Technical Studies and Investigations	$58,500	2%	$58,500	$0	$0	$29,250	$29,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$857,382	23%	$857,382	$0	$0	$257,215	$342,953	$85,738	$85,738	$85,738	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$209,158	6%	$209,158	$0	$0	$104,579	$104,579	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$1,199,525	32%	$1,199,525	$0	$0	$0	$0	$131,618	$131,618	$131,618	$53,168	$53,168	$53,168	$53,168	$53,168	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$28,129	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,616	$0	$0	$28,616
2		Sediment Monitoring	$61,268	2%	$61,268	$0	$0	$0	$0	$3,604	$3,604	$3,604	$3,604	$0	$3,604	$0	$3,604	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$3,604	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,604	$0	$0	$3,604
3		Biological Monitoring	$220,041	6%	$220,041	$0	$0	$0	$0	$12,944	$12,944	$12,944	$12,944	$0	$12,944	$0	$12,944	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$12,944	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,944	$0	$0	$12,944
4		Geotechnical Monitoring	$371,726	10%	$371,726	$0	$0	$0	$0	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$12,934	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$24,387	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,387	$0	$0	$24,387
5		Revegetation Monitoring	$213,780	6%	$213,780	$0	$0	$0	$0	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$11,252	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$11,252	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,252	$0	$0	$11,252
6		Annual Inspection Reporting	$302,828	8%	$302,828	$0	$0	$0	$0	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$2,516	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$25,700	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,700	$0	$0	$25,700
Post Closure Costs Subtotal			**$3,694,209**		$3,694,209	**$0**	**$0**	**$491,044**	**$576,782**	**$260,605**	**$260,605**	**$260,605**	**$96,417**	**$79,869**	**$96,417**	**$79,869**	**$96,417**	**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**	**$28,129**	**$28,129**	**$28,129**	**$28,129**	**$106,015**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$106,502**	**$0**	**$0**	**$106,502**

Care and Maintenance Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Water Treatment	Active System	$6,873,502	41%	$6,873,502	$0	$0	$0	$0	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$739,848	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$95,472	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$583,243	3%	$583,243	$0	$0	$0	$0	$0	$0	$0	$36,453	$36,453	$36,453	$36,453	$36,453	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$36,453	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,453	$0	$0	$36,453
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,451,435	9%	$1,451,435	$0	$0	$0	$0	$0	$0	$0	$290,287	$290,287	$290,287	$290,287	$290,287	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$1,775,224	11%	$1,775,224	$0	$0	$0	$0	$30,000	$30,000	$30,000	$99,783	$99,783	$99,783	$99,783	$99,783	$0	$0	$0	$0	$99,783	$0	$0	$0	$0	$99,783	$0	$0	$0	$0	$0	$0	$0	$0	$0	$109,639	$0	$0	$109,639
5	On-site Management		$5,203,074	31%	$5,203,074	$0	$0	$0	$0	$319,258	$319,258	$319,258	$572,586	$572,586	$572,586	$572,586	$572,586	$0	$0	$0	$0	$69,415	$0	$0	$0	$0	$69,415	$0	$0	$0	$0	$0	$0	$0	$0	$0	$138,171	$0	$0	$138,171
6	Transportation Costs		$1,009,561	6%	$1,009,561	$0	$0	$0	$0	$0	$0	$0	$64,947	$64,947	$64,947	$64,947	$64,947	$0	$0	$0	$0	$20,939	$0	$0	$0	$0	$20,939	$0	$0	$0	$0	$0	$0	$0	$0	$0	$71,439	$0	$0	$71,439
Post Closure Costs Subtotal			**$16,896,039**		$16,896,039	**$0**	**$0**	**$0**	**$0**	**$1,089,106**	**$1,089,106**	**$1,089,106**	**$1,803,903**	**$1,803,903**	**$1,803,903**	**$1,803,903**	**$1,803,903**	**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**	**$95,472**	**$95,472**	**$95,472**	**$95,472**	**$322,060**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$355,701**	**$0**	**$0**	**$355,701**

Other Add-on Costs

			Total	% of Total	Check Sum	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Contingency	12% % of above costs	$5,512,884		$5,512,884	$0	$0	$58,925	$69,214	$1,072,475	$1,385,491	$1,051,358	$229,473	$227,487	$229,473	$229,487	$238,928	$14,832	$14,832	$14,832	$14,832	$51,369	$14,832	$14,832	$14,832	$14,832	$51,369	$0	$0	$0	$0	$0	$0	$0	$0	$0	$55,464	$0	$0	$55,464
2	Worker's compensation	0% (Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	1.5% % of above labour costs	$198,691		$198,691	$0	$0	$2,124	$2,495	$38,653	$49,935	$37,892	$8,270	$8,199	$8,270	$8,271	$8,611	$535	$535	$535	$535	$1,851	$535	$535	$535	$535	$1,851	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,999	$0	$0	$1,999
4	Bonding	3% % of Implem. & C&M costs	$1,267,395		$1,267,395	$0.00	$0.00	$0.00	$0	$260,301	$338,555	$255,021	$54,476	$54,476	$54,476	$54,976	$56,839	$2,864	$2,864	$2,864	$2,864	$9,662	$2,864	$2,864	$2,864	$2,864	$9,662	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,671	$0	$0	$10,671
5	Contractor Profit	10% % of above costs	$4,594,070		$4,594,070	$0	$0	$49,104	$57,678	$893,729	$1,154,576	$876,132	$191,227	$189,573	$191,227	$191,239	$199,106	$12,360	$12,360	$12,360	$12,360	$42,808	$12,360	$12,360	$12,360	$12,360	$42,808	$0	$0	$0	$0	$0	$0	$0	$0	$0	$46,220	$0	$0	$46,220
6	Contract Administration	5% % of above costs	$2,297,035		$2,297,035	$0	$0	$24,552	$28,839	$446,865	$577,288	$438,066	$95,614	$94,786	$95,614	$95,620	$99,553	$6,180	$6,180	$6,180	$6,180	$21,404	$6,180	$6,180	$6,180	$6,180	$21,404	$0	$0	$0	$0	$0	$0	$0	$0	$0	$23,110	$0	$0	$23,110
Other Add-On Costs Subtotal			**$13,870,075**		$13,870,075	**$0**	**$0**	**$134,706**	**$158,226**	**$2,712,022**	**$3,505,844**	**$2,658,469**	**$579,060**	**$574,520**	**$579,060**	**$579,593**	**$603,038**	**$36,771**	**$36,771**	**$36,771**	**$36,771**	**$127,093**	**$36,771**	**$36,771**	**$36,771**	**$36,771**	**$127,093**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$137,465**	**$0**	**$0**	**$137,465**
TOTAL			**$59,810,776**		$59,810,776	**$0**	**$0**	**$625,749**	**$735,008**	**$11,649,313**	**$15,051,600**	**$11,419,786**	**$2,491,333**	**$2,470,246**	**$2,491,333**	**$2,491,988**	**$2,594,102**	**$160,371**	**$160,371**	**$160,371**	**$160,371**	**$555,169**	**$160,371**	**$160,371**	**$160,371**	**$160,371**	**$555,169**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$599,668**	**$0**	**$0**	**$599,668**

INFLATION FACTORED INTERIM CARE AND CLOSURE IMPLEMENTATION COSTS

					Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 107	Year 108
	Area	Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
Direct Costs	Waste Dumps	$6,580,637	26%	$7,312,431	$0	$0	$0	$0	$2,892,004	$4,420,427	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Overburden Dumps	$454,219	2%	$518,184	$0	$0	$0	$0	$0	$0	$518,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ore Stockpiles	$845,436	3%	$928,863	$0	$0	$0	$0	$928,863	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Open Pits	$641,203	3%	$724,681	$0	$0	$0	$0	$0	$358,931	$365,751	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Underground Openings	$92,291	0%	$101,398	$0	$0	$0	$0	$101,398	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	External Tailings Facilities	$77,263	0%	$85,694	$0	$0	$0	$0	$42,444	$43,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Roads	$153,441	1%	$175,050	$0	$0	$0	$0	$0	$0	$175,050	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Demolition	$2,005,083	8%	$2,247,012	$0	$0	$0	$0	$220,294	$1,683,600	$343,118	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Infrastructure	$175,792	1%	$196,826	$0	$0	$0	$0	$48,285	$98,404	$50,137	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Detention Structures	$840,997	3%	$950,486	$0	$0	$0	$0	$0	$470,771	$479,715	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yards/Laydown Areas	$827,890	3%	$931,352	$0	$0	$0	$0	$227,396	$231,717	$472,239	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Waste Disposal	$461,883	2%	$529,970	$0	$0	$0	$0	$0	$57,086	$395,196	$13,895	$14,159	$14,428	$35,206	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Surface Water Conveyance	$3,417,069	13%	$3,847,670	$0	$0	$0	$0	$750,852	$1,147,678	$1,949,140	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water Treatment	$574,445	2%	$663,519	$0	$0	$0	$0	$0	$0	$572,465	$0	$0	$0	$0	$91,054	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Indirect	Mobilization-Demobilization	$344,806	1%	$388,135	$0	$0	$0	$0	$189,416	$0	$176,035	$0	$0	$0	$0	$22,684	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Transport Costs	$407,086	2%	$455,723	$0	$0	$0	$0	$152,067	$150,399	$153,257	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Road Maintenance	$796,356	3%	$891,501	$0	$0	$0	$0	$297,479	$294,216	$299,806	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Construction Support	$4,998,665	20%	$5,595,887	$0	$0	$0	$0	$1,867,256	$1,846,771	$1,881,860	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	QA and Pro. Mgmt.	$1,655,893	7%	$1,853,733	$0	$0	$0	$0	$618,560	$611,774	$623,398	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal - Closure Implementation Costs		$25,350,453		$28,398,116	$0	$0	$0	$0	$8,336,316	$11,415,024	$8,455,349	$13,895	$14,159	$14,428	$35,206	$113,738	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Monitoring Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Planning and permitting	Reclamation Research and Planning	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Technical Studies and Investigations	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Engineering, Design, and Construction Plans	$257,215	7%	$288,000	$0	$0	$0	$0	$94,199	$95,989	$97,812	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Monitoring and Management Plans	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Permitting	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	Monitoring	Water Quality Monitoring	$394,855	11%	$442,113	$0	$0	$0	$0	$144,606	$147,354	$150,153	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Sediment Monitoring	$10,812	0%	$12,106	$0	$0	$0	$0	$3,960	$4,035	$4,112	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3		Biological Monitoring	$38,831	1%	$43,478	$0	$0	$0	$0	$14,221	$14,491	$14,766	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4		Geotechnical Monitoring	$38,801	1%	$43,445	$0	$0	$0	$0	$14,210	$14,480	$14,755	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5		Revegetation Monitoring	$33,755	1%	$37,795	$0	$0	$0	$0	$12,362	$12,597	$12,836	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6		Annual Inspection Reporting	$7,548	0%	$8,451	$0	$0	$0	$0	$2,764	$2,817	$2,870	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			$781,816		$875,389	$0	$0	$0	$0	$286,322	$291,762	$297,305	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Care and Maintenance Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Water Treatment	Active System	$2,219,544	13%	$2,485,194	$0	$0	$0	$0	$812,856	$828,300	$844,038	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$90,000	1%	$100,772	$0	$0	$0	$0	$32,960	$33,587	$34,225	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	On-site Management		$957,774	6%	$1,072,407	$0	$0	$0	$0	$350,762	$357,427	$364,218	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Transportation Costs		$0	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post Closure Costs Subtotal			$3,267,319		$3,658,372	$0	$0	$0	$0	$1,196,578	$1,219,313	$1,242,480	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Other Add-on Costs

			Present Value	% of Total	Future Value	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Contingency	12% % of above costs	$3,509,324		$3,928,854	$0	$0	$0	$0	$1,178,306	$1,551,132	$1,199,416	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Worker's compensation	0% (Included in labour rates)	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$126,481		$141,601	$0	$0	$0	$0	$42,468	$55,905	$43,228	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Bonding	3% % of Implem. & C&M costs	$853,876		$955,952	$0	$0	$0	$0	$285,987	$379,030	$290,935	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	Contractor Profit	10% % of above costs	$2,924,436		$3,274,045	$0	$0	$0	$0	$981,922	$1,292,610	$999,513	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Contract Administration	5% % of above costs	$1,462,218		$1,637,022	$0	$0	$0	$0	$490,961	$646,305	$499,757	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Add-On Costs Subtotal			$8,876,335		$9,937,474	$0	$0	$0	$0	$2,979,643	$3,924,982	$3,032,850	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL			$38,275,923		$42,869,351	$0	$0	$0	$0	$12,798,858	$16,851,081	$13,027,985	$13,895	$14,159	$14,428	$35,206	$113,738	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

NET PRESENT VALUE CALCULATIONS - LONG TERM MONITORING AND MAINTENANCE

Monitoring Costs

						Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 107	Year 108
			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Monitoring	Water Quality Monitoring	$804,671	22%	$524,726								$48,239	$47,340	$46,457	$45,591	$44,741	$23,229	$22,796	$22,371	$21,953	$21,544	$21,142	$20,748	$20,361	$19,982	$19,609	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,526	$0	$0	$3,666
2		Sediment Monitoring	$50,456	1%	$24,627								$3,270	$0	$3,149	$0	$3,033	$0	$0	$0	$0	$2,760	$0	$0	$0	$0	$2,512	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,081	$0	$0	$462
3		Biological Monitoring	$181,210	5%	$88,445								$11,744	$0	$11,310	$0	$10,892	$0	$0	$0	$0	$9,914	$0	$0	$0	$0	$9,023	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,475	$0	$0	$1,658
4		Geotechnical Monitoring	$332,925	9%	$159,208								$11,735	$11,516	$11,301	$11,090	$10,884	$0	$0	$0	$0	$18,678	$0	$0	$0	$0	$17,001	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,084	$0	$0	$3,125
5		Revegetation Monitoring	$180,026	5%	$96,550								$10,209	$10,018	$9,831	$9,648	$9,468	$0	$0	$0	$0	$8,618	$0	$0	$0	$0	$7,844	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,498	$0	$0	$1,442
6		Annual Inspection Reporting	$295,280	8%	$119,207								$2,283	$2,240	$2,198	$2,157	$2,117	$0	$0	$0	$0	$19,684	$0	$0	$0	$0	$17,916	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,842	$0	$0	$3,293
Post Closure Costs Subtotal			$1,844,567		$1,012,764	$0	$0	$0	$0	$0	$0	$0	$87,479	$71,114	$84,247	$68,487	$81,135	$23,229	$22,796	$22,371	$21,953	$81,198	$21,142	$20,748	$20,361	$19,982	$73,906	$0	$0	$0	$0	$0	$0	$0	$0	$0	$61,507	$0	$0	$13,646

Care and Maintenance Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Water Treatment	Active System	$4,653,957	28%	$3,958,901								$671,262	$658,745	$646,463	$634,409	$622,580	$78,841	$77,371	$75,928	$74,513	$73,123	$71,760	$70,422	$69,109	$67,820	$66,556	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2		Passive System	$583,243	3%	$312,800								$33,073	$32,457	$31,852	$31,258	$30,675	$0	$0	$0	$0	$27,920	$0	$0	$0	$0	$25,412	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,052	$0	$0	$4,671
3	Reclamation Maintenance	(Cover/Reveg Repairs)	$1,451,435	9%	$1,268,680								$263,376	$258,465	$253,646	$248,917	$244,276	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Site Maintenance		$1,685,224	10%	$883,313								$90,532	$88,844	$87,188	$85,562	$83,967	$0	$0	$0	$0	$76,425	$0	$0	$0	$0	$69,561	$0	$0	$0	$0	$0	$0	$0	$0	$0	$63,319	$0	$0	$14,047
5	On-site Management		$4,245,299	25%	$2,983,633								$519,505	$509,818	$500,313	$490,984	$481,829	$0	$0	$0	$0	$53,166	$0	$0	$0	$0	$48,391	$0	$0	$0	$0	$0	$0	$0	$0	$0	$79,797	$0	$0	$17,703
6	Transportation Costs		$1,009,561	6%	$510,760								$58,926	$57,827	$56,749	$55,691	$54,653	$0	$0	$0	$0	$16,037	$0	$0	$0	$0	$14,597	$0	$0	$0	$0	$0	$0	$0	$0	$0	$41,257	$0	$0	$9,153
Post Closure Costs Subtotal			$13,628,720		$9,918,088	$0	$0	$0	$0	$0	$0	$0	$1,636,675	$1,606,158	$1,576,210	$1,546,820	$1,517,979	$78,841	$77,371	$75,928	$74,513	$246,671	$71,760	$70,422	$69,109	$67,820	$224,516	$0	$0	$0	$0	$0	$0	$0	$0	$0	$205,425	$0	$0	$45,574

Other Add-on Costs

			Undiscounted	% of Total	NPV - 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2131	2132
1	Contingency	12% % of above costs	$1,875,421		$1,327,642								$208,200	$202,550	$200,508	$196,782	$201,057	$12,248	$12,020	$11,796	$11,576	$39,344	$11,148	$10,940	$10,736	$10,536	$35,811	$0	$0	$0	$0	$0	$0	$0	$0	$0	$32,032	$0	$0	$7,106
2	Worker's compensation	0% (Included in labour rates)	$0		$0								$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Insurance	2% % of above labour costs	$67,593		$47,850								$7,504	$7,300	$7,227	$7,092	$7,246	$441	$433	$425	$417	$1,418	$402	$394	$387	$380	$1,291	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,154	$0	$0	$256
4	Bonding	3% % of Implem. & C&M costs	$413,518		$301,528								$49,426	$48,504	$47,600	$47,141	$47,830	$2,365	$2,321	$2,278	$2,235	$7,400	$2,153	$2,113	$2,073	$2,035	$6,735	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,163	$0	$0	$1,367
5	Contractor Profit	10% % of above costs	$1,562,851		$1,106,369								$173,500	$168,791	$167,090	$163,985	$167,547	$10,207	$10,017	$9,830	$9,647	$32,787	$9,290	$9,117	$8,947	$8,780	$29,842	$0	$0	$0	$0	$0	$0	$0	$0	$0	$26,693	$0	$0	$5,922
6	Contract Administration	5% % of above costs	$781,426		$553,184								$86,750	$84,396	$83,545	$81,993	$83,774	$5,103	$5,008	$4,915	$4,823	$16,393	$4,645	$4,559	$4,474	$4,390	$14,921	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13,347	$0	$0	$2,961
Other Add-On Costs Subtotal			$4,700,809		$3,336,573	$0	$0	$0	$0	$0	$0	$0	$525,379	$511,541	$505,969	$496,993	$507,454	$30,366	$29,799	$29,244	$28,698	$97,343	$27,638	$27,123	$26,617	$26,121	$88,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$79,389	$0	$0	$17,613
TOTAL			$20,174,097		$14,267,425	$0	$0	$0	$0	$0	$0	$0	$2,249,533	$2,188,813	$2,166,426	$2,112,300	$2,106,568	$132,435	$129,966	$127,543	$125,165	$425,213	$120,541	$118,293	$116,087	$113,923	$387,022	$0	$0	$0	$0	$0	$0	$0	$0	$0	$346,322	$0	$0	$76,833
GRAND-TOTAL					$57,136,776	$0	$0	$0	$0	$12,798,858	$16,851,081	$13,027,985	$2,263,428	$2,202,972	$2,180,855	$2,147,506	$2,220,306	$132,435	$129,966	$127,543	$125,165	$425,213	$120,541	$118,293	$116,087	$113,923	$387,022	$0	$0	$0	$0	$0	$0	$0	$0	$0	$346,322	$0	$0	$76,833

Worksheet 13 - End-of-Mine Liability Estimate - Annual C&M Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

Summary of Annual Care and Maintenance Costs

		Annual Cost Per Phase							Number of Years				
		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	n/a	Total Cost	1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual
1	Active Water Treatment System		$739,848	$739,848	$95,472	$0	$0	$6,873,502	0	3	5	10	0
2	Passive Treatment System		$0	$36,453	$36,453	$36,453	$0	$583,243	0	3	5	2	9
3	Reclamation Maintenance		$0	$290,287	$0	$0	$0	$1,451,435	0	3	5	2	9
4	Site Maintenance		$30,000	$99,783	$99,783	$109,639	$0	$1,775,224	0	3	5	2	9
5	On-site Management		$319,258	$572,586	$69,415	$138,171	$0	$5,203,074	0	3	5	2	9
6	Transportation Costs		$0	$64,947	$20,939	$71,439	$0	$1,009,561	0	3	5	2	9

NOTES:
1. This table is used as a check to the NPV calculation spreadsheet.

Phase 1 - Annual Care & Maintenance Costs - Prior to Closure

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S1.1	**Water Treatment**															**$739,848**	
S1.1.1	*Active Treatment System*														$739,848		
S1.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S1.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S1.2	**Onsite Management**															**$193,111**	
S1.2.1	*Field Support Staff*														$0		
S1.2.1.1		Mine Manager		0	months	360	site working hours per month			$25,631				$0			(Notes: staffing costs include cross-shifts)
S1.2.1.2		Office/Camp manager		0	months	360	site working hours per month			$23,201				$0			
S1.2.1.3		Administrative Assistants/HR/Accounting		0	months	360	site working hours per month			$18,296				$0			
S1.2.1.4		Water Treatment Staff Operator		0	months	360	site working hours per month			$19,438				$0			
S1.2.1.5		Environmental/Safety Manager		0	months	360	site working hours per month			$23,201				$0			
S1.2.1.6		Environmental Technicians		0	months	360	site working hours per month			$15,985				$0			
S1.2.1.7		Mechanic		0	months	360	site working hours per month			$18,296				$0			
S1.2.1.8		Tradesmen		0	months	360	site working hours per month			$19,438				$0			
S1.2.1.9		General Labour/helpers		0	months	360	site working hours per month			$13,409				$0			
S1.2.2	*Field support Vehicles*														$121,111		
S1.2.2.1		Pick-up trucks (3 required)		12	months					$4,875				$58,495			
S1.2.2.2		Mechanic service vehicle		0	months					$14,611				$0			
S1.2.2.3		Emergency transport vehicle		12	months					$5,218				$62,616			
S1.2.3	*Field Support Equipment/Supplies*														$72,000		
S1.2.3.1		Office supplies		12	months					$1,000				$12,000			
S1.2.3.2		Communications		12	months					$1,000				$12,000			
S1.2.3.3		Misc. supplies		12	months					$500				$6,000			
S1.2.3		Camp Operation		0	man-days					$80				$0			
S1.2.3		Power, heat, fuel		12	months					$3,500				$42,000			
S1.3	**Site Maintenance**														$360,956	**$360,956**	
S1.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S1.3.2		Road Maintenance	Grader (assume 80 hrs/month)	1	ls	960		$46	$102	$148	$0	$44,108	$97,851	$141,959			Operator cost included in Field support staff
S1.3.3		Earthwork Repair allowance (assume 40 hrs per month)		1	ls	480	$0	$137	$352	$352			$168,997	$168,997			Task Code C.2.14
S1.3.4		Sundry equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S1.4	**Transportation Costs**														$0	**$0**	
S1.4.1		Barge Operations		0	months					$10,939				$0			
S1.4.2		Staffing Bus trips during barge operation period		0	ea					$678				$0			One per week
S1.4.3		Air transport and airstrip operations		0	flights					$3,000				$0			One flight per week
S1.4.4		Helicopter transport		0	flights					$3,000				$0			One flight per week
TOTAL														**$1,293,915**	**$1,293,915**	**$1,293,915**	

Phase 2 - Annual Care & Maintenance Costs During Active Closure

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S2.1	**Water Treatment**															**$739,848**	
S2.1.1	*Active Treatment System*														$739,848		
S2.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S2.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S2.2	**Onsite Management**															**$319,258**	
S2.2.1	*Field Support Staff*														$253,936		
S2.2.1.1		Water Treatment Staff Operator		5	months	360	site working hours per month			$19,438				$97,192			
S2.2.1.2		Environmental/Safety Manager		4	months	360	site working hours per month			$23,201				$92,802			
S2.2.1.3		Environmental Technicians		4	months	360	site working hours per month			$15,985				$63,942			
S2.2.2	*Field support Vehicles*														$34,122		
S2.2.2.1		Pick-up trucks (1 required)		7	months					$4,875				$34,122			
S2.2.3	*Field Support Equipment/Supplies*														$31,200		
S2.2.3.1		Camp Operation		390	man-days					$80				$31,200			
S2.3	**Site Maintenance**														$30,000	**$30,000**	
S2.3.1		Pumping equipment/consumables allowance		1	ls					$30,000				$30,000			Allowance for pump maintenance/fuel etc.
S2.4	**Transportation Costs**														$0	**$0**	
S2.4.1		Barge Operations		0	months					$10,939				$0			Included in construction indirect costs
TOTAL														**$1,089,106**	**$1,089,106**	**$1,089,106**	

Phase 3 - Annual Care & Maintenance Costs - Post Closure I

							Unit Rates				Activity Totals				Subtotals		
WBS	Facility/Area	Task	Activity	Qnty	Unit	Hours or Cost Code Ref.	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Total Unit Rate ($/unit)	Material Cost	Labour Cost	Equipment Cost	Cost	WBS Level 2	WBS Level 1	Source / Comments
S3.1	**Water Treatment**															**$776,301**	
S3.1.1	*Active Treatment System*														$739,848		
S3.1.1.1		Operation and maintenance		1	yr						$536,652	$67,009	$40,716	$644,377			See details on 'Water Treatment' worksheet.
S3.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S3.1.1	*Passive Treatment System*														$36,453		
S3.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S3.2	**Onsite Management**															**$572,586**	
S3.2.1	*Field Support Staff*														$357,577		
S3.2.1.1		Mine Manager		3	months	360	site working hours per month			$25,631				$64,078			(Notes: staffing costs include cross-shifts)
S3.2.1.2		Office/Camp manager		3	months	360	site working hours per month			$23,201				$69,602			
S3.2.1.3		Administrative Assistants/HR/Accounting		1	months	360	site working hours per month			$18,296				$22,869			
S3.2.1.4		Water Treatment Staff Operator		2	months	360	site working hours per month			$19,438				$34,017			
S3.2.1.5		Environmental/Safety Manager		3	months	360	site working hours per month			$23,201				$58,001			
S3.2.1.6		Environmental Technicians		3	months	360	site working hours per month			$15,985				$39,964			
S3.2.1.7		Mechanic		2	months	360	site working hours per month			$0				$0			Included in equipment unit rates
S3.2.1.8		Tradesmen		2	months	360	site working hours per month			$19,438				$38,877			
S3.2.1.9		General Labour/helpers		2	months	360	site working hours per month			$13,409				$30,169			
S3.2.2	*Field support Vehicles*														$99,209		
S3.2.2.1		Pick-up trucks (3 required)		15	months					$4,875				$73,119			
S3.2.2.2		Mechanic service vehicle		2	months					$0				$0			Included in equipment unit rates
S3.2.2.3		Emergency transport vehicle		5	months					$5,218				$26,090			
S3.2.3	*Field Support Equipment/Supplies*														$115,800		
S3.2.3.1		Office supplies		5	months					$1,000				$5,000			
S3.2.3.2		Communications		5	months					$1,000				$5,000			
S3.2.3.3		Misc. supplies		5	months					$500				$2,500			
S3.2.3		Camp Operation		1,073	man-days					$80				$85,800			
S3.2.3		Power, heat, fuel		5	months					$3,500				$17,500			
S3.3	**Reclamation Maintenance**															**$290,287**	
S3.3.1	*Cover repairs*														$260,432		
S3.3.1.1		Cover Repair allowance	Load, haul, dump, spread (spoil lo	1%	of total	1,281,867	m3 of cover required replacement at:			$5.53	/m3			$70,859			Assumes 5% of area reseeded over 5 yr PC1 period.
S3.3.1.2			Seed/Fertilize: broadcast seeding	64	ha					$2,957.77	/ha			$189,573			
S3.3.2.1	*Revegetation*														$29,855		
S3.3.2.2		Reseeding allowance	Seed/Fertilize: broadcast seeding	3%	of total	336	ha requires reseeding at			$2,957.77	/ha			$29,855			Assumes 15% of area reseeded over 5 yr PC1 perioc
S3.3	**Site Maintenance**														$99,783	**$99,783**	
S3.3.1		Equipment Maintenance		1	ls		$20,000							$20,000			Labour included in field support staff
S3.3.2		Road Maintenance	Grader (assume 40 hrs/month)	1	ls	200		$46	$102	$148	$0	$9,189	$20,386	$29,575			Operator cost included in Field support staff
S3.3.3		Earthwork Repair allowance (assume 20 hrs per month)		1	ls	100	$0	$137	$352	$352			$35,208	$35,208			Task Code C.2.14
S3.3.4		Sundry equipment/consumables allowance		1	ls					$15,000				$15,000			Allowance for pump maintenance/fuel etc.
S3.4	**Transportation Costs**														$64,947	**$64,947**	
S3.4.1		Barge Operations		3	months					$10,939				$32,816			
S3.4.2		Staffing Bus trips during barge operation period		12	ea					$678				$8,131			One per week
S3.4.3		Air transport and airstrip operations		8	flights					$3,000				$24,000			One flights per week
TOTAL														**$1,803,903**	**$1,803,903**	**$1,803,903**	

Phase 4 - Annual Care & Maintenance Costs - Post Closure II

							Unit Rates				Activity Totals				Subtotals		
WBS	**Facility/Area**	**Task**	**Activity**	**Qnty**	**Unit**	**Hours or Cost Code Ref.**	**Material Cost ($/unit)**	**Labour Rate ($/hr)**	**Equipment Rate ($/hr)**	**Total Unit Rate ($/unit)**	**Material Cost**	**Labour Cost**	**Equipment Cost**	**Cost**	**WBS Level 2**	**WBS Level 1**	**Source / Comments**
S4.1	**Water Treatment**															**$131,924**	
S4.1.1	*Active Treatment System*														$95,472		
S4.1.1.2		Capital Replacement	annual allowance	1	yr						$91,152	$4,320	$0	$95,472			See details on 'Water Treatment' worksheet.
S4.1.1	*Passive Treatment System*														$36,453		
S4.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S4.2	**Onsite Management**															**$69,415**	
S4.2.1	*Field Support Staff*														$38,848		
S4.2.1.1		Project Manager		0.5	months	360	site working hours per month			$25,631				$12,816			(Notes: staffing costs include cross-shifts)
S4.2.1.2		Passive Treatment specialist		0.5	months	360	site working hours per month			$45,360				$22,680			
S4.2.1.3		Mechanic		0.5	months	360	site working hours per month			$0				$0			Included in equipment unit rates
S4.2.1.4		General Labour/helpers		0.3	months	360	site working hours per month			$13,409				$3,352			
S4.2.2	*Field support Vehicles*														$14,967		
S4.2.2.1		Pick-up trucks (2 required)		2.0	months					$4,875				$9,749			
S4.2.2.2		Mechanic service vehicle		0.5	months					$0				$0			Included in equipment unit rates
S4.2.2.3		Emergency transport vehicle		1.0	months					$5,218				$5,218			
S4.2.3	*Field Support Equipment/Supplies*														$15,600		
S4.2.3.1		Office supplies		1	months					$1,000				$1,000			
S4.2.3.2		Communications		1	months					$1,000				$1,000			
S4.2.3.3		Misc. supplies		1	months					$500				$500			
S4.2.3		Camp Operation		120	man-days					$80				$9,600			
S4.2.3		Power, heat, fuel		1	months					$3,500				$3,500			
S4.3	**Reclamation Maintenance**															**$0**	
S4.3.1	*Cover repairs*														$0		
S4.3.2	*Revegetation*														$0		
S4.3	**Site Maintenance**														$29,999	**$29,999**	
S4.3.1		Equipment Maintenance (parts, supplies)		1	ls		$10,000							$10,000			Labour included in field support staff
S4.3.2		Road Maintenance	Grader (assume 20 hrs/month)	1	ls	20		$46	$102	$148	$0	$919	$2,039	$2,957			Operator cost included in Field support staff
S4.3.3		Earthwork Repair allowance (assume 20 hrs per month)		1	ls	20	$0	$137	$352	$352			$7,042	$7,042			Task Code C.2.14
S4.3.4		Sundry equipment/consumables allowance		1	ls					$10,000				$10,000			Allowance for pump maintenance/fuel etc.
S4.4	**Transportation Costs**														$20,939	**$20,939**	
S4.4.1		Barge Operations		1	months					$10,939				$10,939			
S4.4.2		Staffing Bus trips during barge operation period		0	ea					$678				$0			Pick-up trucks used (time included in labour rate)
S4.4.3		Barge mob/demob		1	LS					$10,000				$10,000			
TOTAL														**$252,277**	**$252,277**	**$252,277**	

Phase 5 - Perpetual Care & Maintenance Event Year Annual Costs

							Unit Rates				Activity Totals				Subtotals		
WBS	**Facility/Area**	**Task**	**Activity**	**Qnty**	**Unit**	**Hours or Cost Code Ref.**	**Material Cost ($/unit)**	**Labour Rate ($/hr)**	**Equipment Rate ($/hr)**	**Total Unit Rate ($/unit)**	**Material Cost**	**Labour Cost**	**Equipment Cost**	**Cost**	**WBS Level 2**	**WBS Level 1**	**Source / Comments**
S5.1	**Water Treatment**															**$36,453**	
S5.1.1	*Passive Treatment System*														$36,453		
S5.1.1.1		Operation and maintenance		1	yr						$10,000	$12,428	$14,025	$36,453			See details on 'Water Treatment' worksheet.
S5.2	**Onsite Management**															**$138,171**	
S5.2.1	*Field Support Staff*														$93,547		
S5.2.1.1		Project Manager		1.0	months	360	site working hours per month			$25,631				$25,631			(Notes: staffing costs include cross-shifts)
S5.2.1.2		Passive Treatment specialist		1.0	months	360	site working hours per month			$45,360				$45,360			
S5.2.1.3		Site Engineer		1.0	months	360	site working hours per month			$0				$0			
S5.2.1.4		HD mechanic		0.5	months	360	site working hours per month			$18,296				$9,148			Included in equipment unit rates
S5.2.1.5		General Labour/helpers		1.0	months	360	site working hours per month			$13,409				$13,409			
S5.2.2	*Field support Vehicles*														$14,624		
S5.2.2.1		Pick-up trucks (3 required)		3	months					$4,875				$14,624			
S5.2.2.2		Mechanic service vehicle		1	months					$0				$0			Included in equipment unit rates
S5.2.3	*Field Support Equipment/Supplies*														$30,000		
S5.2.3.1		Office supplies		1	months					$1,000				$1,000			
S5.2.3.2		Communications		1	months					$1,000				$1,000			
S5.2.3.3		Misc. supplies		1	months					$500				$500			
S5.2.3.4		Camp Operation		300	man-days					$80				$24,000			
S5.2.3.5		Power, heat, fuel		1	months					$3,500				$3,500			
S5.3	**Reclamation Maintenance**															**$0**	
S5.4	**Site Maintenance**														$109,639	**$109,639**	
S5.4.1		Grader Maintenance	Grader (assume 2 weeks, 10hrs/d	1	ls	140		$46	$102	$148	$0	$6,432	$14,270	$20,702			Operator cost included in Field support staff
S5.4.2		Earthwork Repair allowance (assume 3 weeks, 10hrs/day)		1	ls	210	$0	$137	$352	$352			$73,936	$73,936			Task Code C.2.14
S5.4.3		Big Creek Bridge - Capital replacement allowance		1	ls					$15,000				$15,000			Allowance for supplies, pumping, etc.
S5.4.4		Sundry allowance		1	ls					$2,500				$2,500			Allowance for supplies, pumping, etc.
S5.5	**Transportation Costs**														$71,439	**$71,439**	
S5.5.1		Barge Operations		1	months					$10,939				$10,939			
S5.5.2		Barge mobilization/demob and set up		1	ls					$10,000				$10,000			assumed
S5.5.3		Camp Mob/demob		1	ls					$10,000				$10,000			assumed
S5.5.4		Equipment mobilization and demobilization		2	ls					$20,250				$40,500.14			See details on 'mob-demob 'worksheet
TOTAL														**$358,201**	**$355,701**	**$355,701**	

Worksheet 14 - End-of-Mine Liability Estimate - Implementation Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY
srk consulting

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
DIRECT COSTS																					
A1	Waste Dumps																			$6,580,637	
A1.1	*Main Waste Dump (inc. MWDE)*																		$157,947		
A1.1.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.1.2			Slopes: Re-grade to 3H:1V	0	hrs	C.2.13	0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.2.1		Cover	Flat area cover material: Load, haul, dump spread	0	Cm3	R.050	0.0	$0.85	$0	$2.76	$0	$0.91	0	$0	$0.00	$0	$4.52	$0			
A1.1.2.2			Slope area cover material: Load, haul, dump along crest	0	Cm3	R.051	0.0	$0.74	$0	$2.43	$0	$0.82	0	$0	$0.00	$0	$3.99	$0			
A1.1.2.3			Slope area cover material: Spread down slope	0	hrs	C.2.13	0.0	$45.95	$0	$213.35	$0	$69.10	0	$0	$0.00	$0	$328.40	$0			
A1.1.3.1		Revegetate	Seed/Fertilize: tractor application	0	ha	C.6.01	0.0	$1,069.47	$0	$556.88	$0	$240.22	0	$0	$1,091.19	$0	$2,958	$0			
A1.1.3.2			Tree seedling application (1,000 stems/ha)	50	ha	C.6.06	2,561.8	$1,919.72	$95,960	$35.26	$1,763	$15.47	781	$773	$1,189.36	$59,451	$3,160	$157,947			
A1.3	*Southwest Dump (excluding high grade waste area)*																		$198,316		
A1.3.1		Re-grade	Slopes: Re-grade remaining to 3H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.3.2.1		Cover	Load, haul, dump spread	0	m3	R.059	0.0	$0.79	$0.00	$2.58	$0	$0.84	0	$0.00	$0.00	$0.00	$4.22	$0			
A1.3.3.1		Revegetate	Seed/Fertilize: tractor application	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A1.3.3.2			Tree seedling application (1,000 stems/ha)	62.76	ha	C.6.06	3,216.6	$1,919.72	$120,485.89	$35.26	$2,213	$15.47	981	$970.85	$1,189.36	$74,646.37	$3,159.81	$198,316			
A1.4	*Southwest Dump High-Grade Waste*																		$91,721		
A1.4.1		Relocate High-grade waste	Load, haul, dump, spread in pit (below long-term water elevation)	0	Bm3	R.069	0.0	$0.69	$0.00	$2.25	$0	$0.76	0	$0.00	$0.00	$0.00	$3.69	$0			
A1.4.2		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	31	hrs	C.2.13	31.1	$45.95	$1,426.78	$213.35	$6,625	$69.10	2,168	$2,145.84	$0.00	$0.00	$328.40	$10,198			
A1.4.3		Cover	Flat area cover material: Load, haul, dump spread	15,583	Cm3	R.060	257.8	$0.75	$11,762.85	$2.45	$38,236	$0.80	12,585	$12,458.74	$0.00	$0.00	$4.01	$62,458			
A1.4.4.1		Revegetate	Seed/Fertilize: broadcast seeding	3.12	ha	C.6.01	103.2	$1,069.47	$3,333.00	$556.88	$1,736	$240.22	756	$748.66	$1,091.19	$3,400.70	$2,957.77	$9,218			
A1.4.4.2			Tree seedling application (1,000 stems/ha)	3.12	ha	C.6.06	159.7	$1,919.72	$5,982.82	$35.26	$110	$15.47	49	$48.21	$1,189.36	$3,706.62	$3,159.81	$9,848			
A1.5	*Main Pit SAT*																		$3,909,864		
A1.5.1.1		Relocate SAT below water	Load, haul, dump, spread in pit	1,040,000	Cm3	R.012	17,781.5	$0.78	$812,732.25	$1.61	$1,677,117	$0.53	555,290	$549,736.96	$0.00	$0.00	$2.92	$3,039,586			
A1.5.1.2			Allowance for additional SAT material from SAT Dump	30,000	Cm3	R.012	512.9	$0.78	$23,444.20	$1.61	$48,378	$0.53	16,018	$15,857.80	$0.00	$0.00	$2.92	$87,680			
A1.5.2		Backfill SAT Excavation	Load, haul, dump WR to form buttress below MPD	245,000	Cm3	R.013	3,226.9	$0.60	$147,360.45	$1.96	$480,353	$0.63	156,449	$154,884.60	$0.00	$0.00	$3.19	$782,598			Cover and revegetation of backfill included in MPD (A1.6)
A1.6	*Main Pit Dump (Incl. SWB, In-Pit Dumps)*																		$831,420		
A1.6.2.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	66	hrs	C.2.13	65.8	$45.95	$3,022.31	$213.35	$14,034	$69.10	4,591	$4,545.48	$0.00	$0.00	$328.40	$21,602			
A1.6.2.2			Slopes: Re-grade to 3H:1V	395	hrs	C.2.13	395.3	$45.95	$18,160.50	$213.35	$84,329	$69.10	27,589	$27,312.94	$0.00	$0.00	$328.40	$129,803			
A1.6.3.1		Cover	Flat area cover material: Load, haul, dump spread	45,708	m3	R.053	739.1	$0.74	$33,723.79	$2.40	$109,622	$0.78	36,080	$35,718.89	$0.00	$0.00	$3.92	$179,065			
A1.6.3.2			Slope area cover material: Load, haul, dump along crest	90,174	m3	R.054	1,249.9	$0.63	$56,960.44	$2.07	$186,757	$0.70	63,524	$62,888.67	$0.00	$0.00	$3.40	$306,606			
A1.6.3.3			Slope area cover material: Spread down slope	86	hrs	C.2.13	85.5	$45.95	$3,930.31	$213.35	$18,251	$69.10	5,971	$5,911.09	$0.00	$0.00	$328.40	$28,092			
A1.6.4.1		Revegetate	Seed/Fertilize: broadcast seeding	27.2	ha	C.6.01	900.2	$1,069.47	$29,064.18	$556.88	$15,134	$240.22	6,594	$6,528.38	$1,091.19	$29,654.54	$2,957.77	$80,381			
A1.6.4.2			Tree seedling application (1,000 stems/ha)	27.2	ha	C.6.06	1,392.8	$1,919.72	$52,170.99	$35.26	$958	$15.47	425	$420.38	$1,189.36	$32,322.25	$3,159.81	$85,872			
A1.7.0.0	*Mill Valley Fill Extension (Stage 1 and 2)*																		$55,204		
A1.7.1.1		Complete Fill Placement	Waste Rock fill: Load, haul, dump spread	0	m3	R.041	0.0	$1.00	$0.00	$3.25	$0	$1.07	0	$0.00	$0.00	$0.00	$5.32	$0			
A1.7.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.7.2.2			Slopes: Re-grade to 3H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.7.3.1		Cover	Flat area cover material: Load, haul, dump spread	0	m3	R.056	0.0	$0.93	$0.00	$3.01	$0	$0.99	0	$0.00	$0.00	$0.00	$4.93	$0			
A1.7.3.2			Slope area cover material: Load, haul, dump along crest	0	m3	R.057	0.0	$0.81	$0.00	$2.65	$0	$0.90	0	$0.00	$0.00	$0.00	$4.36	$0			
A1.7.3.3			Slope area cover material: Spread down slope	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A1.7.4.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A1.7.4.2			Tree seedling application (1,000 stems/ha)	17.47	ha	C.6.06	895.4	$1,919.72	$33,538.64	$35.26	$616	$15.47	273	$270.25	$1,189.36	$20,778.68	$3,159.81	$55,204			
A1.8.0.0	*Ridgetop Waste Dump*																		$1,336,164		
A1.8.1.1		Regrade	Flat areas: Re-grade to form tertiary drainage catchments	88	hrs	C.2.13	88	$45.95	$4,040	$213.35	$18,761	$69.10	6,138	$6,077	$0.00	$0	$328.40	$28,878			
A1.8.1.2			Slopes: Re-grade to 3H:1V	340	hrs	C.2.13	340	$45.95	$15,642	$213.35	$72,635	$69.10	23,763	$23,525	$0.00	$0	$328.40	$111,802			
A1.8.2.1		Cover	Flat area cover material: Load, haul, dump spread	22,063	Cm3	R.063	590.5	$1.22	$26,924	$3.96	$87,336	$1.30	28,971	$28,681	$0.00	$0	$6.48	$142,941			
A1.8.2.2			Slope area cover material: Load, haul, dump along crest	142,998	Cm3	R.064	3,348.7	$1.07	$152,526	$3.48	$498,281	$1.18	170,188	$168,486	$0.00	$0	$5.73	$819,293			
A1.8.2.3			Slope area cover material: Spread down slope	95	hrs	C.2.13	95.3	$45.95	$4,378	$213.35	$20,332	$69.10	6,652	$6,585	$0.00	$0	$328.40	$31,295			
A1.8.3.1		Revegetate	Seed/Fertilize: tractor application	33	ha	C.6.01	1,093.6	$1,069.47	$35,305	$556.88	$18,384	$240.22	8,010	$7,930	$1,091.19	$36,023	$2,958	$97,642			
A1.8.3.2			Tree seedling application (1,000 stems/ha)	33	ha	C.6.06	1,691.9	$1,919.72	$63,374	$35.26	$1,164	$15.47	516	$511	$1,189.36	$39,263	$3,160	$104,312			
A2	Overburden Dumps																			$454,219	
A2.1	*Area 118 Pit Backfill Dump*																		$21,940		
A2.1.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A2.1.1.2			Berm: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A2.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	0	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A2.1.2.2			Tree seedling application (1,000 stems/ha)	7	ha	C.6.06	355.8	$1,919.72	$13,329.34	$35.26	$245	$15.47	108	$107.41	$1,189.36	$8,258.12	$3,159.81	$21,940			
A2.2	*Ice-rich Overburden Dump*																		$16,874		
A2.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A2.2.1.2			Berm: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			WR Berm area included in Southwest Dump
A2.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2.76	ha	C.6.01	91.4	$1,069.47	$2,949.92	$556.88	$1,536	$240.22	669	$662.61	$1,091.19	$3,009.83	$2,957.77	$8,158			
A2.2.3.2			Tree seedling application (1,000 stems/ha)	2.76	ha	C.6.06	141.4	$1,919.72	$5,295.18	$35.26	$97	$15.47	43	$42.67	$1,189.36	$3,280.60	$3,159.81	$8,716			
A2.3	*Reclamation Overburden Dump*																		$377,148		
A2.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	594	hrs	C.2.13	593.6	$45.95	$27,272.60	$213.35	$126,641	$69.10	41,432	$41,017.30	$0.00	$0.00	$328.40	$194,931			
A2.3.1.2			Slopes: Regrade to 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Assumes borrow removed in such a manner that significant resloping is not required.
A2.3.2.1		Revegetate	Seed/Fertilize: broadcast seeding	29.79	ha	C.6.01	986.7	$1,069.47	$31,854.87	$556.88	$16,587	$240.22	7,228	$7,155.23	$1,091.19	$32,501.92	$2,957.77	$88,099			
A2.3.2.2			Tree seedling application (1,000 stems/ha)	29.79	ha	C.6.06	1,526.5	$1,919.72	$57,180.35	$35.26	$1,050	$15.47	465	$460.75	$1,189.36	$35,425.77	$3,159.81	$94,117			
A2.4	*Ridgetop South Backfill Dump*																		$38,257		
A2.4.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	17	hrs	C.2.13	16.9	$45.95	$777.42	$213.35	$3,610	$69.10	1,181	$1,169.21	$0.00	$0.00	$328.40	$5,557			
A2.4.1.2			Slopes: Regrade to 3H:1V or flatter	28	hrs	C.2.13	28.4	$45.95	$1,306.69	$213.35	$6,068	$69.10	1,985	$1,965.22	$0.00	$0.00	$328.40	$9,340			
A2.4.2.1		Revegetate	Seed/Fertilize: broadcast seeding	3.82	ha	C.6.01	126.5	$1,069.47	$4,083.92	$556.88	$2,127	$240.22	927	$917.33	$1,091.19	$4,166.87	$2,957.77	$11,295			
A2.4.2.2			Tree seedling application (1,000 stems/ha)	3.82	ha	C.6.06	195.7	$1,919.72	$7,330.74	$35.26	$135	$15.47	60	$59.07	$1,189.36	$4,541.72	$3,159.81	$12,066			
A3	Ore Stockpiles																			$845,436	
A3.1	*High and Medium Grade Sulphide Ore Stockpile (South of Mill)*																		$731,103		(North, West, East, and South Stockpiles)
A3.1.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	0	m3	R.044	0.0	$0.54	$0.00	$1.77	$0	$0.59	0	$0.00	$0.00	$0.00	$2.90	$0			
A3.1.1.2			Ore Pads (over-excavate): Load, haul, dump spread into Main Pit	71,007	m3	R.044	835.3	$0.54	$38,098.34	$1.77	$125,544	$0.59	42,458	$42,033.24	$0.00	$0.00	$2.90	$205,675			
A3.1.1.3			Complete confirmation testing	1,421	ea	C.3.02	236.8	$7.40	$10,516.36	$5.08	$7,216	$0.00	0	$0.00	$14.95	$21,243.95	$27.43	$38,976			
A3.1.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	289	hrs	C.2.13	289.4	$45.95	$13,294.67	$213.35	$61,734	$69.10	20,197	$19,994.85	$0.00	$0.00	$328.40	$95,024			
A3.1.3.1		Cover	Cover material: Load, haul, dump spread (0.5m)	69,653	m3	R.055	1,264.9	$0.83	$57,676.68	$2.69	$187,089	$0.88	62,060	$61,439.78	$0.00	$0.00	$4.40	$306,205			
A3.1.4.1		Revegetate	Seed/Fertilize: broadcast seeding	13.93	ha	C.6.01	461.5	$1,069.47	$14,898.42	$556.88	$7,758	$240.22	3,380	$3,346.48	$1,091.19	$15,201.05	$2,957.77	$41,204			
A3.1.4.2			Tree seedling application (1,000 stems/ha)	13.93	ha	C.6.06	713.9	$1,919.72	$26,743.07	$35.26	$491	$15.47	218	$215.49	$1,189.36	$16,568.52	$3,159.81	$44,018			
A3.2	*Low Grade Sulphide Ore Stockpile (Main Dump Area)*																		$114,333		
A3.2.1.1		Relocate to Pit	Ore: Load, haul, dump, spread into Main Pit	0	m3	R.036	0.0	$0.58	$0.00	$1.89	$0	$0.64	0	$0.00	$0.00	$0.00	$3.10	$0			
A3.2.1.2			Ore Pad (over-excavate): Load, haul, dump spread into Main Pit	31,316	m3	R.036	396.1	$0.58	$18,050.68	$1.89	$59,183	$0.64	20,131	$19,929.33	$0.00	$0.00	$3.10	$97,163			

WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Labour: Total Mhrs	Labour: Unit Rate	Labour: Cost	Equipment: Unit Rate	Equipment: Cost	Fuel: Unit Rate	Fuel: Consumed (L)	Fuel: Cost	Material: Unit Rate	Material: Cost	Activity Totals: Unit Rate	Activity Totals: Cost	Subtotals: WBS Level 2	Subtotals: WBS Level 1	Source / Comments
A3.2.1.3			Complete confirmation testing	626	ea	C.3.02	104.3	$7.40	$4,632.82	$5.08	$3,179	$0.00	0	$0.00	$14.95	$9,358.70	$27.43	$17,170			
A3.2.2.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			Included in Main Waste Dump Closure
A3.2.3.1		Cover	Cover material: Load, haul, dump spread	0	m3	R.050	0.0	$0.85	$0.00	$2.76	$0	$0.91	0	$0.00	$0.00	$0.00	$4.52	$0			Included in Main Waste Dump Closure
A3.2.4.1		Revegetate	Seed/Fertilize: broadcast seeding	0	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			Included in Main Waste Dump Closure
A3.2.4.2			Tree seedling application (1,000 stems/ha)	0	ha	C.6.06	0.0	$1,919.72	$0.00	$35.26	$0	$15.47	0	$0.00	$1,189.36	$0.00	$3,159.81	$0			Included in Main Waste Dump Closure
A4	**Open Pits**																			**$641,203**	
A4.1	*Main Pit*																		$152,469		
A4.1.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	7,500	m2	C.2.03	28.5	$0.17	$1,309.98	$0.54	$4,039	$0.14	1,048	$1,037.31	$0.00	$0.00	$0.85	$6,386			
A4.1.1.2			Safety Berm: Construct around highwall perimeter	4,860	m3	C.2.02	45.8	$0.43	$2,106.59	$0.72	$3,515	$0.26	1,267	$1,253.91	$0.00	$0.00	$1.41	$6,876			
A4.1.1.3			Place large boulders across any pit access points	52	m3	R.001	1.6	$1.44	$74.74	$3.16	$164	$0.93	49	$48.22	$0.00	$0.00	$5.53	$287			
A4.1.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.1.2.1		Exposed tailings cover	Trafficability Layer: Load, haul, dump spread	17,750	m3	R.014	554.4	$1.42	$25,287.15	$2.69	$47,664	$0.84	15,091	$14,940.14	$0.00	$0.00	$4.95	$87,891			
A4.1.2.2			Overburden Layer: Load, haul, dump spread	8,875	m3	R.052	158.4	$0.81	$7,222.87	$2.64	$23,429	$0.87	7,772	$7,694.13	$0.00	$0.00	$4.32	$38,346			
A4.1.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2	ha	C.6.01	58.8	$1,069.47	$1,898.31	$556.88	$988	$240.22	431	$426.40	$1,091.19	$1,936.87	$2,957.77	$5,250			
A4.1.3.2			Tree seedling application (1,000 stems/ha)	2	ha	C.6.06	91.0	$1,919.72	$3,407.51	$35.26	$63	$15.47	28	$27.46	$1,189.36	$2,111.11	$3,159.81	$5,609			
A4.2	*Area 2 Pit*																		$9,490		
A4.2.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			
A4.2.1.2			Safety Berm: Construct around highwall perimeter	5,317	m3	C.2.02	50.2	$0.43	$2,304.71	$0.72	$3,846	$0.26	1,386	$1,371.84	$0.00	$0.00	$1.41	$7,522			
A4.2.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.2.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.3	*Area 118 Pit*																		$0		
A4.3.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			Pit filled it by Area 118 Backfill Dump
A4.3.1.2			Safety Berm: Construct around highwall perimeter	0	m3	C.2.02	0.0	$0.43	$0.00	$0.72	$0	$0.26	0	$0.00	$0.00	$0.00	$1.41	$0			
A4.3.1.3			Place large boulders across any pit access points	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			
A4.3.1.4			Allowance: Install warning signs around pit perimeter at key locations	0	ea	C.5.13	0.0	$41.73	$0.00	$24.39	$0	$5.74	0	$0.00	$232.08	$0.00	$303.94	$0			
A4.4	*Minto North Pit*																		$11,491		
A4.4.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	5,900	m2	C.2.03	22.4	$0.17	$1,030.52	$0.54	$3,177	$0.14	824	$816.01	$0.00	$0.00	$0.85	$5,024			
A4.4.1.2			Safety Berm: Construct around highwall perimeter	3,610	m	C.2.02	34.1	$0.43	$1,564.90	$0.72	$2,611	$0.26	941	$931.48	$0.00	$0.00	$1.41	$5,108			
A4.4.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.4.1.4			Allowance: Install warning signs around pit perimeter at key locations	4	ea	C.5.13	3.7	$41.73	$166.92	$24.39	$98	$5.74	23	$22.96	$232.08	$928.32	$303.94	$1,216			
A4.5	*Ridgetop North*																		$467,753		
A4.5.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	10,110	m2	C.2.03	38.4	$0.17	$1,765.85	$0.54	$5,445	$0.14	1,412	$1,398.29	$0.00	$0.00	$0.85	$8,609			
A4.5.1.2			Safety Berm: Construct around highwall perimeter	3,648	m	C.2.02	34.4	$0.43	$1,581.20	$0.72	$2,638	$0.26	951	$941.18	$0.00	$0.00	$1.41	$5,161			
A4.5.1.3			Place large boulders across any pit access points	26	m3	R.001	0.8	$1.44	$37.37	$3.16	$82	$0.93	24	$24.11	$0.00	$0.00	$5.53	$144			
A4.5.1.4			Allowance: Install warning signs around pit perimeter at key locations	6	ea	C.5.13	5.6	$41.73	$250.38	$24.39	$146	$5.74	35	$34.43	$232.08	$1,392.48	$303.94	$1,824			
A4.5.2.1		Exposed tailings cover	Trafficability Layer: Load, haul, dump spread	62,477	m3	R.068	816.5	$0.60	$37,210.06	$1.95	$122,001	$0.66	41,498	$41,082.74	$0.00	$0.00	$3.21	$200,294			
A4.5.2.2			Overburden Layer: Load, haul, dump spread	31,239	m3	R.062	882.0	$1.29	$40,215.13	$4.18	$130,448	$1.37	43,272	$42,838.96	$0.00	$0.00	$6.83	$213,502			
A4.5.3.1		Revegetate	Seed/Fertilize: broadcast seeding	6	ha	C.6.01	207.0	$1,069.47	$6,681.72	$556.88	$3,479	$240.22	1,516	$1,500.85	$1,091.19	$6,817.44	$2,957.77	$18,479			
A4.5.3.2			Tree seedling application (1,000 stems/ha)	6	ha	C.6.06	320.2	$1,919.72	$11,993.87	$35.26	$220	$15.47	98	$96.64	$1,189.36	$7,430.73	$3,159.81	$19,742			
A4.6	*Ridgetop South*																		$0		
A4.6.1.1		Secure Access	Safety Berm: Clear land around highwall perimeter (10m width)	0	m2	C.2.03	0.0	$0.17	$0.00	$0.54	$0	$0.14	0	$0.00	$0.00	$0.00	$0.85	$0			Pit to be backfilled
A4.6.1.2			Safety Berm: Construct around highwall perimeter	0	m	C.2.02	0.0	$0.43	$0.00	$0.72	$0	$0.26	0	$0.00	$0.00	$0.00	$1.41	$0			
A4.6.1.3			Place large boulders across any pit access points	0	m3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			
A4.6.1.4			Allowance: Install warning signs around pit perimeter at key locations	0	ea	C.5.13	0.0	$41.73	$0.00	$24.39	$0	$5.74	0	$0.00	$232.08	$0.00	$303.94	$0			
A5	**Underground Openings**																			**$92,291**	
A5.1	*Minto North Portal*																		$16,580		
A5.1.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.1.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.2	*Minto North Portal Egress*																		$16,580		
A5.2.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.2.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.3	*Minto South Portal*																		$16,580		
A5.3.1.1		Seal portal	Load, Haul, Dump backfill plug	2,588	m3	R.001	81.5	$1.44	$3,719.24	$3.16	$8,185	$0.93	2,423	$2,399.22	$0.00	$0.00	$5.53	$14,303			Material sourced from nearby laydown area rockfill
A5.3.1.2			Doze backfill plug into portal with small dozer	16	hrs	C.2.19	0.0	$45.95	$749.32	$69.66	$1,136	$24.01	395	$391.53	$0.00	$0.00	$139.61	$2,277			
A5.3.2.1		Revegetate	Included in Yards (WBS No. A11-10)																		
A5.4	*Area 118 Vent Raise*																		$14,255		
A5.4.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.4.1.2			Excavate and clean perimeter around shaft to suitable material.	4	ea	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.4.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.4.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.4.2.3			Ringwall Rebar: supply and install	32	m	C.8.05	0.8	$1.31	$41.88	$0.00	$0	$0.00	0	$0.00	$5.03	$161.05	$6.34	$203			
A5.4.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.4.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.4.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.5	*Minto East Vent Raise*																		$14,143		
A5.5.1.2		Preparation	Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.5.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.5.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.5.2.3			Ringwall Rebar: supply and install	14	m	C.8.05	0.3	$1.31	$18.84	$0.00	$0	$0.00	0	$0.00	$5.03	$72.47	$6.34	$91			
A5.5.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.5.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.5.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A5.6	*Minto East 2 Vent Raise*																		$14,153		
A5.6.1.1		Site Preparation	Removal of Heater/Fan included in Demolition																		
A5.6.1.2			Excavate and clean perimeter around shaft to suitable material.	4	m3	C.8.01	8.0	$87.22	$348.87	$18.39	$74	$7.01	28	$28.06	$0.00	$0.00	$112.62	$450			
A5.6.2.1		Concrete Cap installation	Structural steel - Supply and install I-Beam structural support	8	m	C.8.02	9.8	$51.78	$414.24	$16.14	$129	$6.23	50	$49.88	$64.45	$515.59	$138.60	$1,109			
A5.6.2.2			Formwork: Supply and install concrete ring-wall formwork	8	m2	C.8.03	51.3	$319.20	$2,553.56	$0.00	$0	$0.00	0	$0.00	$34.28	$274.21	$353.47	$2,828			
A5.6.2.3			Ringwall Rebar: supply and install	16	m	C.8.05	0.4	$1.31	$20.94	$0.00	$0	$0.00	0	$0.00	$5.03	$80.52	$6.34	$101			
A5.6.2.4			Concrete slab: supply and install	8.6	m3	C.8.06	61.1	$340.18	$2,939.19	$10.93	$94	$3.59	31	$31.01	$664.62	$5,742.32	$1,019.32	$8,807			Includes slab formwork, rebar, finishing.
A5.6.2.5			Vent Raise Pipe Supply and install	1	ea.	C.8.07	0.5	$18.62	$18.62	$0.00	$0	$0.00	0	$0.00	$700.88	$700.88	$719.50	$719			
A5.6.3.1		Backfill cap area	Backfill: Load, haul, dump, place over concrete cap	25	m3	R.001	0.8	$1.44	$35.93	$3.16	$79	$0.93	23	$23.18	$0.00	$0.00	$5.53	$138			
A6	**External Tailings Facilities**																			**$77,263**	
A6.1	*Dry Stack Tailings Storage Facility*																		$77,263		
A6.1.1.1		Waste Rock Shell	Regrade WR shell slopes to 4H:1V	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.1.2			Cover material: Load, haul, dump spread (0.5m)	0	m3	R.048	0.0	$0.89	$0.00	$2.87	$0	$0.94	0	$0.00	$0.00	$0.00	$4.70	$0			
A6.1.1.3			Scarify surface	0	m2	C.2.16	0.0	$0.04	$0.00	$0.06	$0	$0.01	0	$0.00	$0.00	$0.00	$0.11	$0			
A6.1.1.4			Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A6.1.1.5			Tree seedling application (1,000 stems/ha)	5.30	ha	C.6.06	271.4	$1,919.72	$10,166.32	$35.26	$187	$15.47	83	$81.92	$1,189.36	$6,298.49	$3,159.81	$16,733			
A6.1.2.1		Fill Area at south end of DS	Load, haul, dump, spread	0	Cm3	R.001	0.0	$1.44	$0.00	$3.16	$0	$0.93	0	$0.00	$0.00	$0.00	$5.53	$0			Fill from TDD road and/or unsuitable DSTSF cover material
A6.1.3.1		Tailings surface	Regrade tailings area south of the tailings	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A6.1.3.2			Regrade surface to form tertiary drainage catchments	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A6.1.3.3			Cover: Excavate unsuitable temporary cover material	0	m3	R.003	0.0	$0.53	$0.00	$1.74	$0	$0.59	0	$0.00	$0.00	$0.00	$2.85	$0			
A6.1.3.4			Cover material: Load, haul, dump spread (0.5m)	0	m3	R.048	0.0	$0.89	$0.00	$2.87	$0	$0.94	0	$0.00	$0.00	$0.00	$4.70	$0			
A6.1.3.5			Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.00	$556.88	$0	$240.22	0	$0.00	$1,091.19	$0.00	$2,957.77	$0			
A6.1.3.6			Tree seedling application (1,000 stems/ha)	19.16	ha	C.6.06	981.8	$1,919.72	$36,774.44	$35.26	$676	$15.47	299	$296.32	$1,189.36	$22,783.40	$3,159.81	$60,530			
A7	**Roads**																			$153,441	
A7.1	*Exploration Roads*																		$39,012		
A7.1.1.1		Regrade/Scarify	Scarify road surface	54,285	m2	C.2.16	0.0	$0.04	$1,952.53	$0.06	$3,166	$0.01	691	$683.65	$0.00	$0.00	$0.11	$5,803			
A7.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.43	ha	C.6.01	179.8	$1,069.47	$5,805.61	$556.88	$3,023	$240.22	1,317	$1,304.05	$1,091.19	$5,923.54	$2,957.77	$16,056			
A7.1.2.2			Tree seedling application (1,000 stems/ha)	5.43	ha	C.6.06	278.2	$1,919.72	$10,421.23	$35.26	$191	$15.47	85	$83.97	$1,189.36	$6,456.41	$3,159.81	$17,153			
A7.2	*Access Roads (excl. Main Site Access Road)*																		$8,737		
A7.2.1.1		Regrade/Scarify	Regrade side slopes	9	hrs	C.2.13	9.5	$45.95	$434.59	$213.35	$2,018	$69.10	660	$653.61	$0.00	$0.00	$328.40	$3,106			
A7.2.1.2			Scarify road surface	52,636	m2	C.2.16	0.0	$0.04	$1,893.21	$0.06	$3,070	$0.01	670	$662.89	$0.00	$0.00	$0.11	$5,626			
A7.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	0.00	ha	C.6.01	0.0	$1,069.47	$0.80	$556.88	$0	$240.22	0	$0.18	$1,091.19	$0.81	$2,957.77	$2			
A7.2.2.2			Tree seedling application (1,000 stems/ha)	0.00	ha	C.6.06	0.0	$1,919.72	$1.43	$35.26	$0	$15.47	0	$0.01	$1,189.36	$0.88	$3,159.81	$2			
A7.3	*Main Site Access Road*																		$1,798		
A7.3.1.1		New Access over MVFE	Regrade new access through MVFE	0	m3																
A7.3.2.1		Signage	Install large sign on east and west side of barge landing on Yukon River	2	ea.	C.5.14	1.9	$41.73	$83.46	$24.39	$49	$5.74	12	$11.48	$827.13	$1,654.27	$898.99	$1,798			
A7.4	*Haul Roads*																		$84,151		
A7.4.1.1		Regrade/Scarify	Regrade side slopes	21	hrs	C.2.13	20.5	$45.95	$942.69	$213.35	$4,377	$69.10	1,432	$1,417.78	$0.00	$0.00	$328.40	$6,738			
A7.4.1.2			Scarify road surface	91,084	m2	C.2.16	0.0	$0.04	$3,276.11	$0.06	$5,313	$0.01	1,159	$1,147.09	$0.00	$0.00	$0.11	$9,736			
A7.4.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.06	ha	C.6.01	366.5	$1,069.47	$11,831.20	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.52	$2,957.77	$32,721			
A7.4.2.2			Tree seedling application (1,000 stems/ha)	11.06	ha	C.6.06	567.0	$1,919.72	$21,237.32	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.46	$3,159.81	$34,956			
A7.5	*Culvert Removal*																		$19,743		
A7.5.1.1		Excavate culverts	Mobilization allowance for excavation fleet to various sites	6	hrs	C.7.01	12.0	$91.33	$548.00	$126.32	$758	$45.54	276	$273.24	$0.00	$0.00	$263.20	$1,579			
A7.5.1.2			Load, haul, dump, spread (spoil locally)	18,020	m3	R.901	59.1	$0.15	$2,714.88	$0.57	$10,324	$0.21	3,841	$3,802.32	$0.00	$0.00	$0.93	$16,841			
A7.5.1.2		Waste disposal	On-site disposal (demolition debris, etc.)	190	Lm3	R.037	8.1	$1.94	$368.95	$3.84	$730	$1.18	227	$224.34	$0.00	$0.00	$6.96	$1,323			
A8	**Demolition**																			$2,005,083	
A8.1	*Airstrip Area*																		$22,217		
A8.1.1.1		Remove tanks/equipment	Dismantle and prep for transport	7	hrs	C.1.13	28.0	$174.43	$1,221.03	$115.96	$812	$17.92	127	$125.44	$0.00	$0.00	$308.32	$2,158			
A8.1.2.1		Waste Oil Tanker Secondar	Bedding Material: Load, haul dump bedding material to landfarm	47	Cm3	R.001	1.5	$1.44	$68.05	$3.16	$150	$0.93	44	$43.90	$0.00	$0.00	$5.53	$262			
A8.1.2.2			Cut and fold liner	219	m2	C.1.15	2.5	$0.45	$99.09	$0.19	$43	$0.07	16	$15.60	$0.00	$0.00	$0.72	$157			
A8.1.2.3			Regrade area to promote positive drainage	192	m2	C.2.11	1.9	$0.46	$88.22	$1.42	$272	$0.36	71	$69.85	$0.00	$0.00	$2.24	$430			
A8.1.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	10	hrs	C.1.22	40.0	$165.83	$1,658.25	$104.46	$1,045	$27.77	281	$277.70	$0.00	$0.00	$298.06	$2,981			
A8.1.3.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.1.4.1		Demolition	Structural building demolition: wooden buildings/tents	1,149	m3	C.1.08	87.7	$3.01	$3,457.31	$1.60	$1,835	$0.59	680	$672.90	$0.00	$0.00	$5.19	$5,965			
A8.1.4.2			Other demolition: covered storage, debris, etc.	530	m3	C.1.07	52.5	$3.90	$2,068.21	$2.07	$1,097	$0.76	407	$402.54	$0.00	$0.00	$6.74	$3,568			
A8.1.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	379	m3	R.006	12.8	$1.53	$581.90	$3.01	$1,141	$0.94	361	$357.73	$0.00	$0.00	$5.49	$2,080			
A8.1.5.2			Off-site disposal (re-usable equipment, etc.)	4	m3	C.7.07	34.6	$367.57	$1,590.89	$485.20	$2,100	$116.87	511	$505.83	$0.00	$0.00	$969.64	$4,197			
A8.2	*Airport Laydown Area*																		$34,345		
A8.2.1.1		Remove tanks/equipment	Dismantle and prep for transport	2	hrs	C.1.13	8.0	$174.43	$348.87	$115.96	$232	$17.92	36	$35.84	$0.00	$0.00	$308.32	$617			
A8.2.2.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.2.2.2			Disconnect services	4	hrs	C.1.09	12.0	$91.24	$364.97	$8.59	$34	$4.95	20	$19.80	$0.00	$0.00	$104.78	$419			
A8.2.3.1		Demolition	Structural building demolition: steel structures	96	tonnes	C.1.05	191.3	$71.87	$6,873.40	$139.79	$13,369	$34.90	3,371	$3,337.39	$0.00	$0.00	$246.56	$23,579			
A8.2.3.2			Other demolition: covered storage etc.	560	m3	C.1.07	55.5	$3.90	$2,186.62	$2.07	$1,160	$0.76	430	$425.58	$0.00	$0.00	$6.74	$3,773			
A8.2.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	393	Lm3	R.005	15.8	$1.83	$717.72	$3.61	$1,420	$1.11	441	$436.41	$0.00	$0.00	$6.55	$2,574			
A8.2.4.2			Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	23.0	$367.57	$1,056.76	$485.20	$1,395	$116.87	339	$336.00	$0.00	$0.00	$969.64	$2,788			
A8.3	*Camp Area*																		$392,884		
A8.3.1.1		Equipment Removal	Remove salvageable equipment	48	hrs	C.1.13	192.0	$174.43	$8,372.81	$115.96	$5,566	$17.92	869	$860.14	$0.00	$0.00	$308.32	$14,799			
A8.3.2.1		Remove modular buildings	Dismantle and prep for transport	92	ea.	C.1.20	1,794.0	$881.68	$81,114.84	$750.86	$69,079	$171.67	15,953	$15,793.27	$0.00	$0.00	$1,804.21	$165,987			
A8.3.2.2			Transport structures off-site (Whitehorse)	92	ea.	C.7.04	736.0	$363.66	$33,456.48	$360.37	$33,154	$116.87	10,861	$10,751.99	$0.00	$0.00	$840.90	$77,363			
A8.3.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	1	hrs	C.1.22	4.0	$165.83	$165.83	$104.46	$104	$27.77	28	$27.77	$0.00	$0.00	$298.06	$298			
A8.3.3.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.3.4.1		Demolition	Structural building demolition: Steel	175	tonnes	C.1.05	350.7	$71.87	$12,601.23	$139.79	$24,509	$34.90	6,180	$6,118.54	$0.00	$0.00	$246.56	$43,229			
A8.3.4.2			Structural building demolition: Wood/misc. structures	10,959	m3	C.1.08	836.7	$3.01	$32,982.53	$1.60	$17,502	$0.59	6,484	$6,419.39	$0.00	$0.00	$5.19	$56,904			
A8.3.4.4			Other demolition: Utilidors, etc.	466	m3	C.1.07	46.1	$3.90	$1,819.22	$2.07	$965	$0.76	358	$354.07	$0.00	$0.00	$6.74	$3,139			
A8.3.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	3,867	m3	R.007	175.3	$2.06	$7,981.07	$4.08	$15,786	$1.25	4,902	$4,852.92	$0.00	$0.00	$7.40	$28,620			
A8.3.5.2			Off-site disposal (re-usable equipment, etc.)	1	trips	C.7.07	8.0	$367.57	$367.57	$485.20	$485	$116.87	118	$116.87	$0.00	$0.00	$969.64	$970			
A8.3.6.1		Demolish foundations	Break in place concrete foundations	51	m3	C.1.01	4.1	$2.47	$126.44	$9.40	$481	$2.56	132	$130.77	$0.00	$0.00	$14.43	$738			
A8.4	*Explosives Plant and Storage Areas*																		$32,905		
A8.4.1.1		Remove equipment	Small equipment: dismantle and prep for transport	37	hrs	C.1.13	149.3	$174.43	$6,512.18	$115.96	$4,329	$17.92	676	$668.99	$0.00	$0.00	$308.32	$11,510			
A8.4.2.1		Remove modular buildings	Dismantle and prep for transport	1	ea.	C.1.20	19.5	$881.68	$881.68	$750.86	$751	$171.67	173	$171.67	$0.00	$0.00	$1,804.21	$1,804			
A8.4.2.2			Transport structures off-site (Whitehorse)	1	ea.	C.7.04	8.0	$363.66	$363.66	$360.37	$360	$116.87	118	$116.87	$0.00	$0.00	$840.90	$841			
A8.4.3.1		Prepare for demolition	Remove hazardous materials/prep for transport offsite	4	hrs	C.1.22	16.0	$165.83	$663.30	$104.46	$418	$27.77	112	$111.08	$0.00	$0.00	$298.06	$1,192			
A8.4.3.2			Disconnect services	2	hrs	C.1.09	6.0	$91.24	$182.48	$8.59	$17	$4.95	10	$9.90	$0.00	$0.00	$104.78	$210			
A8.4.4.1		Demolition	Structural building demolition: Steel	47	tonnes	C.1.05	94.2	$71.87	$3,384.63	$139.79	$6,583	$34.90	1,660	$1,643.41	$0.00	$0.00	$246.56	$11,611			
A8.4.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	103	m3	R.008	5.4	$2.40	$247.67	$4.76	$490	$1.46	152	$150.60	$0.00	$0.00	$8.62	$888			
A8.4.5.2			Off-site disposal (re-usable equipment, etc.)	5	trips	C.7.07	40.0	$367.57	$1,837.85	$485.20	$2,426	$116.87	590	$584.35	$0.00	$0.00	$969.64	$4,848			
A8.5	*Fuel Storage Area*																		$125,560		
A8.5.1.1		Remove equipment/dismant	Small equipment: dismantle and prep for transport	24	hrs	C.1.13	96.0	$174.43	$4,186.40	$115.96	$2,783	$17.92	434	$430.07	$0.00	$0.00	$308.32	$7,400			
A8.5.1.2			Large equipment (crane req'd): dismantle and prep for transport	192	hrs	C.1.14	1,153.4	$279.25	$53,683.19	$199.44	$38,340	$24.11	4,681	$4,634.34	$0.00	$0.00	$502.79	$96,657			
A8.5.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.5.2.2			Disconnect services	8	hrs	C.1.09	24.0	$91.24	$729.93	$8.59	$69	$4.95	40	$39.60	$0.00	$0.00	$104.78	$838			
A8.5.2.3			Clean out tanks, pressure wash, remove sludge	10	hrs	C.1.04	10.3	$37.25	$382.69	$16.65	$171	$2.00	21	$20.55	$0.00	$0.00	$55.90	$574			
A8.5.3.1		Demolish structures	Misc. debris/scraps (tanks included in dismantling above)	75	m3	C.1.08	5.7	$3.01	$225.72	$1.60	$120	$0.59	44	$43.93	$0.00	$0.00	$5.19	$389			
A8.5.4.1		Remove secondary contain	Bedding Material: Load, haul dump bedding material to landfarm	623	Cm3	R.009	32.8	$2.40	$1,493.67	$4.74	$2,954	$1.46	917	$908.23	$0.00	$0.00	$8.60	$5,356			
A8.5.4.2			Cut and fold liner	1,747	m2	C.1.15	20.3	$0.45	$792.35	$0.19	$340	$0.07	126	$124.75	$0.00	$0.00	$0.72	$1,257			
A8.5.4.3			Regrade area to promote positive drainage	1,666	m2	C.2.11	16.7	$0.46	$765.46	$1.42	$2,360	$0.36	612	$606.13	$0.00	$0.00	$2.24	$3,732			
A8.5.5.1		Waste disposal	On-site disposal (demolition debris, etc.)	229	m3	R.009	12.1	$2.40	$549.94	$4.74	$1,088	$1.46	338	$334.39	$0.00	$0.00	$8.60	$1,972			
A8.5.5.2			Off-site disposal (re-usable equipment, etc.)	7	trips	C.7.07	56.0	$367.57	$2,572.99	$485.20	$3,396	$116.87	826	$818.09	$0.00	$0.00	$969.64	$6,787			
A8.6	*Mill Area*																		$1,320,887		Excludes WTP
A8.6.1.1		Remove equipment	Small equipment: dismantle and prep for transport	379	hrs	C.1.13	1,515.0	$174.43	$66,065.39	$115.96	$43,920	$17.92	6,855	$6,786.88	$0.00	$0.00	$308.32	$116,772			
A8.6.1.2			Large equipment (crane req'd): dismantle and prep for transport	466	hrs	C.1.14	2,796.5	$279.25	$130,153.53	$199.44	$92,954	$24.11	11,349	$11,235.85	$0.00	$0.00	$502.79	$234,344			
A8.6.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	65	hrs	C.1.22	260.0	$165.83	$10,778.64	$104.46	$6,790	$27.77	1,823	$1,805.02	$0.00	$0.00	$298.06	$19,374			Off-site disposal included in 'Waste Disposal'
A8.6.2.6			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.6.2.7			Decontaminate buildings: wash equipment/structures, etc.	38	hrs	C.1.04	37.8	$37.25	$1,407.51	$16.65	$629	$2.00	76	$75.58	$0.00	$0.00	$55.90	$2,112			
A8.6.2.8			Decontaminate buildings: Wash floors etc.	4,732	m2	C.1.03	40.8	$0.32	$1,517.80	$0.14	$679	$0.02	82	$81.50	$0.00	$0.00	$0.48	$2,278			
A8.6.3.1		Demolition	Structural building demolition: Steel	2,660	tonnes	C.1.05	5,319.1	$71.87	$191,148.68	$139.79	$371,780	$34.90	93,750	$92,812.46	$0.00	$0.00	$246.56	$655,741			
A8.6.3.2			Structural building demolition: Wood/misc. structures	960	m3	C.1.08	73.3	$3.01	$2,889.24	$1.60	$1,533	$0.59	568	$562.33	$0.00	$0.00	$5.19	$4,985			
A8.6.3.3			Other demolition: Steel	526	tonnes	C.1.05	1,052.7	$71.87	$37,828.55	$139.79	$73,576	$34.90	18,553	$18,367.70	$0.00	$0.00	$246.56	$129,772			
A8.6.3.4			Other demolition: concrete	602	m3	C.1.06	323.7	$16.48	$9,915.65	$62.67	$37,706	$17.04	10,359	$10,255.28	$0.00	$0.00	$96.19	$57,877			
A8.6.3.5			Other demolition: miscellaneous	244	m3	C.1.07	24.1	$3.90	$951.10	$2.07	$505	$0.76	187	$185.11	$0.00	$0.00	$6.74	$1,641			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A8.6.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	5,985	m3	R.037	255.1	$1.94	$11,613.36	$3.84	$22,971	$1.18	7,133	$7,061.54	$0.00	$0.00	$6.96	$41,646			
A8.6.4.2			Off-site disposal (re-usable equipment, etc.)	33	trips	C.7.07	266.0	$367.57	$12,220.77	$485.20	$16,132	$116.87	3,925	$3,885.61	$0.00	$0.00	$970	$32,238			
A8.6.5.1		Demolish foundations	Break in place concrete foundations	1,532	m3	C.1.01	123.7	$2.47	$3,787.52	$9.40	$14,403	$2.56	3,957	$3,917.25	$0.00	$0.00	$14.43	$22,108			
A8.7	*Mill Valley Fill Extension (Stage 1 and 2)*																		$29,908		
A8.7.1.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	8	hrs	C.1.22	30.0	$165.83	$1,243.69	$104.46	$783	$27.77	210	$208.27	$0.00	$0.00	$298.06	$2,235			
A8.7.1.2			Reagents: Disposal and tipping fees	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A8.7.2.1		Demolish buildings	Structural building demolition: Wood/misc. structures (Reagent tent)	1,800	m3	C.1.08	137.4	$3.01	$5,417.33	$1.60	$2,875	$0.59	1,065	$1,054.38	$0.00	$0.00	$5.19	$9,346			
A8.7.3.1		Haul waste to landfill	Demolition debris	594	m3	R.037	25.3	$1.94	$1,152.57	$3.84	$2,280	$1.18	708	$700.82	$0.00	$0.00	$6.96	$4,133			
A8.7.3.2			Remove tires off-site for disposal	10	trips	C.7.07	78.8	$367.57	$3,618.27	$485.20	$4,776	$116.87	1,162	$1,150.43	$0.00	$0.00	$969.64	$9,545			
A8.7.3.3			Misc. debris/scraps	652	m3	R.037	27.8	$1.94	$1,265.11	$3.84	$2,502	$1.18	777	$769.25	$0.00	$0.00	$6.96	$4,537			
A8.7.4.1		Demolish foundations	Break and bury concrete foundations	8	m3	C.1.01	0.6	$2.47	$19.13	$9.40	$73	$2.56	20	$19.79	$0.00	$0.00	$14.43	$112			
A8.8	*Minto South Portal*																		$8,966		
A8.8.1.1		Remove equipment	Small equipment: dismantle and prep for transport	6	hrs	C.1.13	24.0	$174.43	$1,046.60	$115.96	$696	$17.92	109	$107.52	$0.00	$0.00	$308.32	$1,850			
A8.8.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.8.3.1		Demolition	Other demolition: miscellaneous	462	m3	C.1.07	45.7	$3.90	$1,803.50	$2.07	$957	$0.76	355	$351.01	$0.00	$0.00	$6.74	$3,112			
A8.8.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	462	m3	R.043	20.9	$2.06	$950.61	$4.07	$1,880	$1.25	584	$578.02	$0.00	$0.00	$7.38	$3,409			
A8.9	*Minto North Portal*																		$9,444		
A8.9.1.1		Remove equipment	Small equipment: dismantle and prep for transport	6	hrs	C.1.13	24.0	$174.43	$1,046.60	$115.96	$696	$17.92	109	$107.52	$0.00	$0.00	$308.32	$1,850			Qnty assumed to be same as Minto South Portal
A8.9.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			Qnty assumed to be same as Minto South Portal
A8.9.3.1		Demolition	Other demolition: miscellaneous	462	m3	C.1.07	45.7	$3.90	$1,803.50	$2.07	$957	$0.76	355	$351.01	$0.00	$0.00	$6.74	$3,112			Qnty assumed to be same as Minto South Portal
A8.9.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	462	m3	R.042	23.8	$2.35	$1,083.67	$4.64	$2,143	$1.43	666	$658.93	$0.00	$0.00	$8.41	$3,886			Qnty assumed to be same as Minto South Portal
A8.10	*Pelly Laydown (Includes propane tanks by W15 Sump)*																		$21,793		
A8.10.1.1		Remove modular buildings/t	Dismantle and prep for transport	7	ea.	C.1.20	136.5	$881.68	$6,171.78	$750.86	$5,256	$171.67	1,214	$1,201.66	$0.00	$0.00	$1,804.21	$12,629			
A8.10.1.2			Transport structures off-site (Whitehorse)	7	ea.	C.7.04	56.0	$363.66	$2,545.60	$360.37	$2,523	$116.87	826	$818.09	$0.00	$0.00	$840.90	$5,886			
A8.10.2.1		Prepare for demolition	Hazardous materials: Gather and prep for transport offsite	2	hrs	C.1.22	8.0	$165.83	$331.65	$104.46	$209	$27.77	56	$55.54	$0.00	$0.00	$298.06	$596			
A8.10.3.1		Demolish buildings	Structural building demolition: Steel	0	tonnes	C.1.05	0.0	$71.87	$0.00	$139.79	$0	$34.90	0	$0.00	$0.00	$0.00	$246.56	$0			
A8.10.3.2			Structural building demolition: Wood/misc. structures	0	m3	C.1.08	0.0	$3.01	$0.00	$1.60	$0	$0.59	0	$0.00	$0.00	$0.00	$5.19	$0			
A8.10.4.1		Waste disposal	On-site disposal (demolition debris, etc.)	71	m3	R.045	3.3	$2.10	$150.18	$4.16	$297	$1.28	92	$91.32	$0.00	$0.00	$7.54	$539			
A8.10.4.2			Off-site disposal (re-usable equipment, etc.)	2	trips	C.7.07	15.0	$367.57	$689.19	$485.20	$910	$116.87	221	$219.13	$0.00	$0.00	$969.64	$1,818			
A8.10.5.1		Demolish foundations	Break and bury concrete foundations	23	m3	C.1.01	1.8	$2.47	$55.62	$9.40	$211	$2.56	58	$57.52	$0.00	$0.00	$14.43	$325			
A8.11	*Vent Raise - Area 118*																		$6,174		
A8.11.1.1		Remove equipment	Small equipment: dismantle and prep for transport	20	hrs	C.1.13	80.0	$174.43	$3,488.67	$115.96	$2,319	$17.92	362	$358.39	$0.00	$0.00	$308.32	$6,166			
A8.11.2.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	1	trips	R.043	0.0	$2.06	$2.06	$4.07	$4	$1.25	1	$1.25	$0.00	$0.00	$7.38	$7			
A9	**Surface Infrastructure**																			**$175,792**	
A9.1	*Tailings and Water Conveyance Pipelines*																		$94,952		
A9.1.1.1		Dismantle piping systems	Flush and clean tailings pipeline systems	8	ls	C.1.21	32.0	$209.63	$1,677.06	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$209.63	$1,677			
A9.1.1.2			Cut pipelines and prep for transport (6 to 8" HDPE pipes)	6,800	m	C.1.17	1,070.9	$7.46	$50,709.93	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$7.46	$50,710			
A9.1.1.3			Cut pipelines and prep for transport (10 to 18" HDPE pipes)	1,740	m	C.1.18	456.7	$12.43	$21,626.29	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$12.43	$21,626			
A9.1.1.4			Cut pipelines and prep for transport (20 to 36" HDPE pipes)	885	m	C.1.19	348.4	$18.64	$16,499.37	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$18.64	$16,499			
A9.2.2.1		Waste disposal	Haul pipes lines and debris to landfill	638	m3	R.037	27.2	$1.94	$1,237.84	$3.84	$2,448	$1.18	760	$752.67	$0.00	$0.00	$6.96	$4,439			
A9.2	*Conveyance Pipeline Equipment*																		$13,051		
A9.2.1.1		Dismantle piping systems	Remove pumps and prep for transport	15	ea.	C.1.24	198.0	$623.39	$9,350.78	$33.85	$508	$14.85	225	$222.75	$0.00	$0.00	$672.09	$10,081			
A9.2.1.2			Remove barges/Support Equipment prep for transport	2	ea.	C.1.23	52.8	$1,246.77	$2,493.54	$67.71	$135	$29.70	60	$59.40	$0.00	$0.00	$1,344.18	$2,688			
A9.2.2.1		Waste disposal	Transport pumps, barge and support equip. offsite (Whitehorse)	6.7	tonnes	C.7.02	2.7	$18.18	$121.83	$18.02	$121	$5.84	40	$39.15	$0.00	$0.00	$42.04	$282			
A9.3	*Powerlines*																		$67,789		
A9.3.1.1		Dismantle	Dismantle and collect powerlines	3.2	km	C.1.10	217.9	$2,731.94	$8,632.93	$816.44	$2,580	$259.77	829	$820.86	$0.00	$0.00	$3,808.14	$12,034			
A9.3.1.2			Remove power poles and load for transport off-site	60	ea.	C.1.11	548.6	$437.79	$26,267.37	$95.85	$5,751	$18.86	1,143	$1,131.43	$0.00	$0.00	$552.49	$33,150			
A9.3.1.3			Disconnect transformers and load for transport	4	ea.	C.1.12	93.3	$924.00	$3,695.99	$276.14	$1,105	$87.86	355	$351.43	$0.00	$0.00	$1,287.99	$5,152			
A9.3.2.1		Waste disposal	Transport powerlines, poles and transformers off-site	18	trips	C.7.07	144.0	$367.57	$6,616.26	$485.20	$8,734	$116.87	2,125	$2,103.65	$0.00	$0.00	$969.64	$17,453			
A10	**Water Detention Structures**																			**$840,997**	
A10.1	*W15 Sump*																		$1,081		
A10.1.1.1		Remove secondary contain	Cut and fold liner	1,310	m2	C.1.15	15.2	$0.45	$594.09	$0.19	$255	$0.07	94	$93.53	$0.00	$0.00	$0.72	$943			
A10.1.1.2			Haul liner to landfill	20	Lm3	R.070	0.8	$1.97	$38.67	$3.89	$76	$1.20	24	$23.51	$0.00	$0.00	$7.06	$139			
A10.2	*Mill Water Pond*																		$0		
A10.3	*Sewage Lagoon (near IROD)*																		$24,809		
A10.3.1		Remove pond	Backfill pond	4,488	m3	R.001	141.4	$1.44	$6,450.99	$3.16	$14,196	$0.93	4,203	$4,161.42	$0.00	$0.00	$5.53	$24,809			
A10.4	*Water Storage Pond Dam*																		$815,107		
A10.4.1.1		Water Management	Install pump and pump around system	4	hrs	C.4.14	16.0	$125.31	$501.25	$37.01	$148	$6.95	28	$27.80	$0.00	$0.00	$169.27	$677			
A10.4.1.2			Pump pond water to discharge	400,000	m3	C.4.12	146.8	$0.01	$5,466.88	$0.10	$41,707	$0.01	2,965	$2,935.56	$0.00	$0.00	$0.13	$50,109			
A10.4.1.3			Maintain pump around system during WSP closure activities	103	days	C.4.13	10.3	$3.72	$381.83	$28.42	$2,913	$2.00	207	$205.03	$0.00	$0.00	$34.14	$3,500			Duration calculated as sum of associated tasks plus 20% contingency
A10.4.2.1		Breach dam	Granular zones/gen. fill: Load, haul, dump, spread in upstream North ab	62,301	m3	R.001	1,963.4	$1.44	$89,551.16	$3.16	$197,071	$0.93	58,351	$57,767.92	$0.00	$0.00	$5.53	$344,390			
A10.4.2.2			Dam Core: Load, haul, dump in temporary stockpile	23,617	m3	R.001	744.3	$1.44	$33,946.33	$3.16	$74,704	$0.93	22,119	$21,898.20	$0.00	$0.00	$5.53	$130,549			
A10.4.2.3			Rip-rap: Sort and stockpile durable rip-rap for reuse	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.4.2.4			Rip-rap: Load haul, dump unsuitable rip-rap in upstream North abutmen	19,285	m3	R.001	607.8	$1.44	$27,720.62	$3.16	$61,004	$0.93	18,063	$17,882.10	$0.00	$0.00	$5.53	$106,606			
A10.4.3.1		Channel restoration	Excavate stream channel	5,584	m3	R.902	97.1	$0.80	$4,459.86	$1.33	$7,442	$0.48	2,681	$2,654.66	$0.00	$0.00	$2.61	$14,556			
A10.4.3.2			Bedding layer: Load haul, dump, place granular bedding layer along cha	726	m3	R.001	22.9	$1.44	$1,044.18	$3.16	$2,298	$0.93	680	$673.58	$0.00	$0.00	$5.53	$4,016			
A10.4.3.3			Rip-rap: Load, haul dump from temporary stockpile	964	m3	R.001	30.4	$1.44	$1,384.96	$3.16	$3,048	$0.93	902	$893.41	$0.00	$0.00	$5.53	$5,326			
A10.4.3.4			Rip-rap: place and secure	964	m3	R.904	10.5	$0.50	$481.43	$0.91	$877	$0.33	325	$321.57	$0.00	$0.00	$1.74	$1,680			
A10.4.4.1		Cover	Cover material: Load, haul, dump spread (1m)	6,975	m3	R.001	219.8	$1.44	$10,025.77	$3.16	$22,063	$0.93	6,533	$6,467.45	$0.00	$0.00	$5.53	$38,556			Cover sourced from dam core material
A10.4.5.1		Revegetate	Seed/Fertilize: broadcast seeding	1.4	ha	C.6.01	46.2	$1,069.47	$1,491.91	$556.88	$777	$240.22	338	$335.11	$1,091.19	$1,522.21	$2,957.77	$4,126			
A10.4.5.2			Tree seedling application (1,000 stems/ha)	1.4	ha	C.6.06	71.5	$1,919.72	$2,678.02	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,659.15	$3,159.81	$4,408			
A11	**Yards/Laydown Areas**																			**$827,890**	
A11.1	*Airstrip Area*																		$46,265		
A11.1.1.1		Re-grade	Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.1.1.2			Scarify surface	64,378	m2	C.2.16	0.0	$0.04	$2,315.53	$0.06	$3,755	$0.01	819	$810.75	$0.00	$0.00	$0.11	$6,881			
A11.1.2.1		Revegetate	Seed/Fertilize: broadcast seeding	6.4	ha	C.6.01	213.3	$1,069.47	$6,884.97	$556.88	$3,585	$240.22	1,562	$1,546.50	$1,091.19	$7,024.82	$2,957.77	$19,041			
A11.1.2.2			Tree seedling application (1,000 stems/ha)	6.4	ha	C.6.06	329.9	$1,919.72	$12,358.71	$35.26	$227	$15.47	101	$99.58	$1,189.36	$7,656.77	$3,159.81	$20,342			
A11.2	*Airport Laydown Area*																		$15,291		
A11.2.1.1		Re-grade	Scarify surface	21,277	m2	C.2.16	0.0	$0.04	$765.29	$0.06	$1,241	$0.01	271	$267.96	$0.00	$0.00	$0.11	$2,274			
A11.2.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.1	ha	C.6.01	70.5	$1,069.47	$2,275.51	$556.88	$1,185	$240.22	516	$511.12	$1,091.19	$2,321.73	$2,957.77	$6,293			
A11.2.2.2			Tree seedling application (1,000 stems/ha)	2.1	ha	C.6.06	109.0	$1,919.72	$4,084.60	$35.26	$75	$15.47	33	$32.91	$1,189.36	$2,530.59	$3,159.81	$6,723			
A11.3	*Camp Area*																		$125,373		
A11.3.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	7	hrs	C.2.13	6.9	$45.95	$316.95	$213.35	$1,472	$69.10	481	$476.68	$0.00	$0.00	$328.40	$2,265			
A11.3.1.2			Re-grade slopes to be 3H:1V or flatter	22	hrs	C.2.13	21.5	$45.95	$987.92	$213.35	$4,587	$69.10	1,501	$1,485.81	$0.00	$0.00	$328.40	$7,061			Slope between camp and main access road
A11.3.1.3			Scarify surfaces	20,626	m2	C.2.16	0.0	$0.04	$741.88	$0.06	$1,203	$0.01	262	$259.76	$0.00	$0.00	$0.11	$2,205			
A11.3.2.1		Cover	Flat area cover material: Load, haul, dump spread	10,313	Cm3	R.046	198.2	$0.88	$9,037.45	$2.84	$29,315	$0.93	9,724	$9,627.10	$0.00	$0.00	$4.65	$47,980			
A11.3.2.2			Slope area cover material: Load, haul, dump along crest	9,349	Cm3	R.047	157.2	$0.77	$7,160.89	$2.50	$23,394	$0.85	7,990	$7,910.23	$0.00	$0.00	$4.11	$38,465			
A11.3.2.3			Slope area cover material: Spread down slope	10	hrs	C.2.13	10.2	$45.95	$467.31	$213.35	$2,170	$69.10	710	$702.82	$0.00	$0.00	$328.40	$3,340			
A11.3.3.1		Revegetate	Seed/Fertilize: broadcast seeding	3.93	ha	C.6.01	130.3	$1,069.47	$4,205.66	$556.88	$2,190	$240.22	954	$944.67	$1,091.19	$4,291.09	$2,957.77	$11,631			
A11.3.3.2			Tree seedling application (1,000 stems/ha)	3.93	ha	C.6.06	201.5	$1,919.72	$7,549.27	$35.26	$139	$15.47	61	$60.83	$1,189.36	$4,677.11	$3,159.81	$12,426			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A11.4	*Crusher Area*																		$78,725		
A11.2.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	9	hrs	C.2.13	9.0	$45.95	$414.34	$213.35	$1,924	$69.10	629	$623.15	$0.00	$0.00	$328.40	$2,961			
A11.2.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	13,482	m3	R.055	244.8	$0.83	$11,163.80	$2.69	$36,213	$0.88	12,012	$11,892.19	$0.00	$0.00	$4.40	$59,269			
A11.2.3.1		Revegetate	Seed/Fertilize: broadcast seeding	2.70	ha	C.6.01	89.3	$1,069.47	$2,883.71	$556.88	$1,502	$240.22	654	$647.74	$1,091.19	$2,942.29	$2,957.77	$7,975			
A11.2.3.2			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	138.2	$1,919.72	$5,176.35	$35.26	$95	$15.47	42	$41.71	$1,189.36	$3,206.98	$3,159.81	$8,520			
A11.5	*Exploration Disturbances*																		$24,993		
A11.5.1.1		Ridgetop Area	Scarify surfaces	34,778	m2	C.2.16	0.0	$0.04	$1,250.90	$0.06	$2,029	$0.01	442	$437.99	$0.00	$0.00	$0.11	$3,717			
A11.5.1.2			Seed/Fertilize: broadcast seeding	3	ha	C.6.01	115.2	$1,069.47	$3,719.40	$556.88	$1,937	$240.22	844	$835.45	$1,091.19	$3,794.95	$2,957.77	$10,287			
A11.5.1.3			Tree seedling application (1,000 stems/ha)	3	ha	C.6.06	178.2	$1,919.72	$6,676.42	$35.26	$123	$15.47	54	$53.80	$1,189.36	$4,136.34	$3,159.81	$10,989			
A11.6	*Explosives Plant and Storage Areas*																		$49,332		
A11.6.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	30	hrs	C.2.13	29.6	$45.95	$1,360.54	$213.35	$6,318	$69.10	2,067	$2,046.22	$0.00	$0.00	$328.40	$9,725			
A11.6.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.6.1.3			Scarify surfaces	55,113	m2	C.2.16	0.0	$0.04	$1,982.32	$0.06	$3,215	$0.01	701	$694.09	$0.00	$0.00	$0.11	$5,891			
A11.6.2.1		Revegetate	Seed/Fertilize: broadcast seeding	5.5	ha	C.6.01	182.6	$1,069.47	$5,894.20	$556.88	$3,069	$240.22	1,337	$1,323.95	$1,091.19	$6,013.93	$2,957.77	$16,301			
A11.6.2.2			Tree seedling application (1,000 stems/ha)	5.5	ha	C.6.06	282.5	$1,919.72	$10,580.26	$35.26	$194	$15.47	86	$85.25	$1,189.36	$6,554.94	$3,159.81	$17,415			
A11.7	*Fuel Storage Areas*																		$26,425		
A11.7.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	5	hrs	C.2.13	4.5	$45.95	$207.36	$213.35	$963	$69.10	315	$311.87	$0.00	$0.00	$328.40	$1,482			
A11.7.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	4,200	m3	R.049	81.8	$0.89	$3,730.31	$2.88	$12,100	$0.95	4,014	$3,973.69	$0.00	$0.00	$4.72	$19,804			
A11.7.3.1		Revegetate	Seed/Fertilize: broadcast seeding	0.84	ha	C.6.01	27.8	$1,069.47	$898.35	$556.88	$468	$240.22	204	$201.79	$1,091.19	$916.60	$2,957.77	$2,485			
A11.7.3.2			Tree seedling application (1,000 stems/ha)	1	ha	C.6.06	43.1	$1,919.72	$1,612.57	$35.26	$30	$15.47	13	$12.99	$1,189.36	$999.06	$3,159.81	$2,654			
A11.8	*IROD Laydown Area*																		$21,006		
A11.8.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	15	hrs	C.2.13	14.8	$45.95	$677.95	$213.35	$3,148	$69.10	1,030	$1,019.62	$0.00	$0.00	$328.40	$4,846			
A11.8.1.2			Re-grade slopes to be 3H:1V or flatter	0	hrs	C.2.13	0.0	$45.95	$0.00	$213.35	$0	$69.10	0	$0.00	$0.00	$0.00	$328.40	$0			
A11.8.1.3			Scarify surface	18,106	m2	C.2.16	0.0	$0.04	$651.24	$0.06	$1,056	$0.01	230	$228.02	$0.00	$0.00	$0.11	$1,935			
A11.8.2.1		Revegetate	Seed/Fertilize: broadcast seeding	2.33	ha	C.6.01	77.0	$1,069.47	$2,486.84	$556.88	$1,295	$240.22	564	$558.59	$1,091.19	$2,537.35	$2,957.77	$6,878			
A11.8.2.2			Tree seedling application (1,000 stems/ha)	2.33	ha	C.6.06	119.2	$1,919.72	$4,463.94	$35.26	$82	$15.47	36	$35.97	$1,189.36	$2,765.61	$3,159.81	$7,348			
A11.9	*Mill Area*																		$143,245		
A11.9.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	60	hrs	C.2.13	59.9	$45.95	$2,753.36	$213.35	$12,785	$69.10	4,183	$4,140.98	$0.00	$0.00	$328.40	$19,680			
A11.9.1.2			Scarify surface	42,365	m2	C.2.16	0.0	$0.04	$1,523.78	$0.06	$2,471	$0.01	539	$533.53	$0.00	$0.00	$0.11	$4,528			
A11.9.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	21,182	m3	R.055	384.7	$0.83	$17,540.10	$2.69	$56,896	$0.88	18,873	$18,684.50	$0.00	$0.00	$4.40	$93,120			
A11.9.3.1		Revegetate	Seed/Fertilize: broadcast seeding	4.24	ha	C.6.01	140.3	$1,069.47	$4,530.77	$556.88	$2,359	$240.22	1,028	$1,017.70	$1,091.19	$4,622.80	$2,957.77	$12,530			
A11.9.3.2			Tree seedling application (1,000 stems/ha)	4.24	ha	C.6.06	217.1	$1,919.72	$8,132.86	$35.26	$149	$15.47	66	$65.53	$1,189.36	$5,038.67	$3,159.81	$13,386			
A11.10	*Mill Valley Fill Extension (Stage 1 and 2)*																		$0		
A11.10.1		Costs included in Waste Rock Dump Section (WBS#: A1.5)		#VALUE!	hrs																
A11.11	*Minto South Portal*																		$99,427		
A11.11.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	51	hrs	C.2.13	51.5	$45.95	$2,364.92	$213.35	$10,982	$69.10	3,593	$3,556.78	$0.00	$0.00	$328.40	$16,903			
A11.11.1.2			Re-grade slopes to be 3H:1V or flatter	25	hrs	C.2.13	24.8	$45.95	$1,138.55	$213.35	$5,287	$69.10	1,730	$1,712.36	$0.00	$0.00	$328.40	$8,138			
A11.11.1.3			Scarify surface	62,765	m2	C.2.16	0.0	$0.04	$2,257.53	$0.06	$3,661	$0.01	798	$790.45	$0.00	$0.00	$0.11	$6,709			
A11.11.2.1		Revegetate	Seed/Fertilize: broadcast seeding	11.1	ha	C.6.01	366.5	$1,069.47	$11,831.22	$556.88	$6,161	$240.22	2,684	$2,657.52	$1,091.19	$12,071.54	$2,957.77	$32,721			
A11.11.2.2			Tree seedling application (1,000 stems/ha)	11.1	ha	C.6.06	567.0	$1,919.72	$21,237.35	$35.26	$390	$15.47	173	$171.13	$1,189.36	$13,157.48	$3,159.81	$34,956			
A11.12	*Pelly Laydown Area*																		$159,143		
A11.12.1.1		Re-grade	Flat areas: Re-grade to form tertiary drainage catchments	107	hrs	C.2.13	107.4	$45.95	$4,934.92	$213.35	$22,916	$69.10	7,497	$7,421.99	$0.00	$0.00	$328.40	$35,272			
A11.12.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	25,855	m3	R.058	380.7	$0.67	$17,371.17	$2.18	$56,467	$0.71	18,585	$18,398.86	$0.00	$0.00	$3.57	$92,237			
A11.12.3.1		Revegetate	Seed/Fertilize: broadcast seeding	5.17	ha	C.6.01	171.3	$1,069.47	$5,530.22	$556.88	$2,880	$240.22	1,255	$1,242.20	$1,091.19	$5,642.55	$2,957.77	$15,295			
A11.12.3.2			Tree seedling application (1,000 stems/ha)	5.17	ha	C.6.06	265.0	$1,919.72	$9,926.90	$35.26	$182	$15.47	81	$79.99	$1,189.36	$6,150.15	$3,159.81	$16,339			
A11.13	*W15 Sump Area Laydown*																		$38,663		
A11.13.1.1		Re-grade	Flat areas: Re-grade to ensure positive drainage	9	hrs	C.2.13	8.8	$45.95	$403.82	$213.35	$1,875	$69.10	613	$607.34	$0.00	$0.00	$328.40	$2,886			
A11.13.1.2			Slopes: Re-grade to 3H:1V	2	hrs	C.2.13	1.6	$45.95	$73.97	$213.35	$344	$69.10	112	$111.26	$0.00	$0.00	$328.40	$529			
A11.13.1.3			Scarify surface	9,484	m2	C.2.16	0.0	$0.04	$341.11	$0.06	$553	$0.01	121	$119.44	$0.00	$0.00	$0.11	$1,014			
A11.13.2.1		Cover	Load, haul, dump spread 0.5 m overburden cover	6,974	m3	R.065	106.1	$0.69	$4,840.42	$2.26	$15,734	$0.74	5,179	$5,126.78	$0.00	$0.00	$3.69	$25,701			
A11.13.3.1		Revegetate	Seed/Fertilize: broadcast seeding	1.39	ha	C.6.01	46.2	$1,069.47	$1,491.72	$556.88	$777	$240.22	338	$335.07	$1,091.19	$1,522.02	$2,957.77	$4,126			
A11.13.3.2			Tree seedling application (1,000 stems/ha)	1.39	ha	C.6.06	71.5	$1,919.72	$2,677.68	$35.26	$49	$15.47	22	$21.58	$1,189.36	$1,658.94	$3,159.81	$4,407			
A12	**Waste Disposal**																			**$461,883**	
A12.1	*Hydrocarbon contaminated soils*																		$74,871		
A12.1.1.1		Excavate HC contaminated	Complete testing for contaminated soils	48	test pits	C.3.03	24.0	$22.59	$1,084.20	$5.03	$242	$3.01	146	$144.34	$292.57	$14,043.43	$323.20	$15,513			
A12.1.1.2			Excavate and haul contaminated soils to on-site landfarm facility	726	m3	R.038	26.0	$1.63	$1,184.49	$3.25	$2,355	$0.99	723	$715.46	$0.00		$5.86	$4,255			
A12.1.2.1		Construct landfarm	Existing Facility assumed to have sufficient capacity	0	m3																
A12.1.3.1		Operate landfarm	Aerate contaminated soils (mix)	12	event	C.3.04	270.0	$1,016.97	$12,203.66	$943.36	$11,320	$344.03	4,170	$4,128.30	$0.00	$0.00	$2,304.35	$27,652			
A12.1.3.2			Annual confirmation sampling	3	years	C.3.05	48.0	$722.80	$2,168.41	$161.01	$483	$96.23	292	$288.68	$1,755.43	$5,266.29	$2,735.47	$8,206			
A12.1.4.1		Close landfarm	Remove soils and collect liner	726	m3	R.001	22.9	$1.44	$1,043.11	$3.16	$2,296	$0.93	680	$672.89	$0.00	$0.00	$5.53	$4,012			
A12.1.4.2			Cut/fold liner and place into waste disposal container	4,265	m2	C.1.15	49.6	$0.45	$1,934.18	$0.19	$830	$0.07	308	$304.52	$0.00	$0.00	$0.72	$3,069			
A12.1.4.3			Regrade area	4,265	m2	C.2.11	42.7	$0.46	$1,959.61	$1.42	$6,042	$0.36	1,567	$1,551.71	$0.00	$0.00	$2.24	$9,553			
A12.1.4.4			Revegetation: Seed/Fertilizer: broadcast seeding	0.43	ha	C.6.01	14.1	$1,069.47	$456.13	$556.88	$238	$240.22	103	$102.46	$1,091.19	$465.39	$2,957.77	$1,261			
A12.1.4.5			Tree seedling application (1,000 stems/ha)	0.43	ha	C.6.06	21.9	$1,919.72	$818.76	$35.26	$15	$15.47	7	$6.60	$1,189.36	$507.26	$3,159.81	$1,348			
	Metal Contaminated soils																		$177,013		
A12.2.1.1		Crusher area	Delineate contaminated soil areas	197	test pits	C.3.01	98.5	$22.59	$4,449.75	$5.03	$991	$3.01	598	$592.40	$299.00	$58,903.00	$329.63	$64,936			
A12.2.1.2			Load, haul, dump contaminated soils to underground	2,949	m3	R.039	102.1	$1.58	$4,658.36	$3.48	$10,251	$1.02	3,035	$3,005.03	$0.00	$0.00	$6.07	$17,915			
A12.2.1.3			Complete confirmation testing	197	ea	C.3.02	32.8	$7.40	$1,457.93	$5.08	$1,000	$0.00	0	$0.00	$14.95	$2,945.15	$27.43	$5,403			
A12.2.2.1		Mill Area	Delineate contaminated soil areas	198	test pits	C.3.01	99.0	$22.59	$4,472.34	$5.03	$996	$3.01	601	$595.41	$299.00	$59,202.00	$329.63	$65,266			
A12.2.2.2			Load, haul, dump contaminated soils to underground	2,973	m3	R.039	103.0	$1.58	$4,696.51	$3.48	$10,335	$1.02	3,060	$3,029.64	$0.00	$0.00	$6.07	$18,062			
A12.2.2.3			Complete confirmation testing	198	ea	C.3.02	33.0	$7.40	$1,465.33	$5.08	$1,005	$0.00	0	$0.00	$14.95	$2,960.10	$27.43	$5,431			
A12.3	*Solid Waste Landfill*																		$199,187		
A12.3.1.1		Construction landfill	Place waste from site facilities	10,827	LCM	C.2.07	461.4	$1.96	$21,200.33	$9.09	$98,445	$2.94	32,207	$31,884.76	$0.00	$0.00	$14.00	$151,530			
A12.3.1.2			Place fill to minimize voids in the debris	2,824	m3	R.001	89.0	$1.44	$4,059.85	$3.16	$8,934	$0.93	2,645	$2,618.94	$0.00	$0.00	$5.53	$15,613			
A12.3.2.1		Close landfill	Soil Cover: Load haul, dump spread, compact (0.6m)	5,024	m3	R.002	190.0	$1.67	$8,400.65	$3.36	$16,884	$1.02	5,196	$5,144.21	$0.00	$0.00	$6.06	$30,429			
A12.3.2.2			Revegetation: Seed/Fertilizer: broadcast seeding	0.55	ha	C.6.01	18.1	$1,069.47	$583.88	$556.88	$304	$240.22	132	$131.15	$1,091.19	$595.74	$2,957.77	$1,615			
A12.4	*Hazardous Material Off-Site Disposal*																		$10,812		
A12.4.1.1		Hazardous Waste	From Building Demo: Transport off-site for disposal	2	trip	C.7.04	14.5	$363.66	$657.38	$360.37	$651	$116.87	213	$211.26	$0.00	$0.00	$840.90	$1,520			
A12.4.3.3			Hazardous materials: Disposal and Tipping fees.	1	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0	$0			
A12.4.2.1		Reagents	Reagents: Transport to Whitehorse	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A12.4.2.2			Reagents: Disposal and tipping fees	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A13	**Surface Water Conveyance**																			**$3,417,069**	
A13.1	*Channel A - W-15 to Main Pit*																		$204,169		
A13.1.1.1		Excavate channel	Load, haul, dump locally	40,300	m3	R.902	700.5	$0.80	$32,184.77	$1.33	$53,704	$0.48	19,351	$19,157.46	$0.00	$0.00	$2.61	$105,046			
A13.1.2.1		Place channel materials	Geotextile: Supply and place	7,785	m3	C.5.08	221.4	$1.14	$8,887.42	$0.19	$1,485	$0.11	897	$887.61	$2.68	$20,895.25	$4.13	$32,155			
A13.1.2.2			Rip-rap (angular, high quality): Screen and stockpile	3,855	m3	C.2.15	0.0	$2.63	$10,120.59	$6.44	$24,818	$1.92	7,462	$7,387.04	$0.00	$0.00	$10.98	$42,325			
A13.1.2.3			Rip-rap: Load, haul, dump	3,855	m3	R.018	102.2	$1.21	$4,660.08	$2.66	$10,255	$0.78	3,037	$3,006.14	$0.00	$0.00	$4.65	$17,921			
A13.1.2.4			Rip-rap: Place and secure	3,855	m3	R.904	41.9	$0.50	$1,926.02	$0.91	$3,507	$0.33	1,299	$1,286.49	$0.00	$0.00	$1.74	$6,720			
A13.2	*Channel B - W-35 to Area 2 Pit*																		$190,419		
A13.2.1.1		Excavate channel	Load, haul, dump locally	48,038	m3	R.902	835.0	$0.80	$38,364.63	$1.33	$64,016	$0.48	23,067	$22,835.92	$0.00	$0.00	$2.61	$125,216			
A13.2.2.1		Place channel materials	Geotextile: Supply and place	4,682	m2	C.5.08	133.1	$1.14	$5,344.90	$0.19	$893	$0.11	539	$533.81	$2.68	$12,566.42	$4.13	$19,338			
A13.2.2.2			Rip-rap (angular, high quality): Screen and stockpile	2,554	m3	C.2.15	0.0	$2.63	$6,704.89	$6.44	$16,442	$1.92	4,943	$4,893.91	$0.00	$0.00	$10.98	$28,041			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
A13.2.2.3			Rip-rap: Load, haul, dump	2,554	m3	R.020	76.2	$1.36	$3,476.91	$3.00	$7,651	$0.88	2,266	$2,242.89	$0.00	$0.00	$5.24	$13,371			
A13.2.2.4			Rip-rap: Place and secure	2,554	m3	R.904	27.8	$0.50	$1,275.99	$0.91	$2,324	$0.33	861	$852.30	$0.00	$0.00	$1.74	$4,452			
A13.3	*Channel C - Main Pit to Main Access Road*																		$128,241		
A13.3.2.1		Excavate channel	Load, haul, dump locally	8,656	m3	R.902	150.5	$0.80	$6,913.18	$1.33	$11,535	$0.48	4,157	$4,114.96	$0.00	$0.00	$2.61	$22,564			
A13.3.3.1		Intake structure	Excavate soils to competent foundation materials	2,450	Bm3	R.902	42.6	$0.80	$1,956.44	$1.33	$3,265	$0.48	1,176	$1,164.54	$0.00	$0.00	$2.61	$6,386			
A13.3.3.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.3.3.6			Backfill and compact around structure	2,450	Cm3	C.2.04	237.3	$2.69	$6,581.75	$3.00	$7,361	$1.07	2,638	$2,611.71	$0.00	$0.00	$6.76	$16,554			
A13.3.4.1		Place channel materials	Geotextile: Supply and place	3,171	m2	C.5.08	90.2	$1.14	$3,619.88	$0.19	$605	$0.11	365	$361.53	$2.68	$8,510.72	$4.13	$13,097			
A13.3.4.2			Rip-rap (angular, high quality): Screen and stockpile	1,037	m3	C.2.15	0.0	$2.63	$2,723.66	$6.44	$6,679	$1.92	2,008	$1,988.01	$0.00	$0.00	$10.98	$11,391			
A13.3.4.3			Rip-rap: Load, haul, dump	1,037	m3	R.022	36.4	$1.60	$1,656.75	$3.47	$3,599	$1.02	1,064	$1,053.00	$0.00	$0.00	$6.08	$6,309			
A13.3.4.4			Rip-rap: Place and secure	1,037	m3	R.904	11.3	$0.50	$518.33	$0.91	$944	$0.33	350	$346.22	$0.00	$0.00	$1.74	$1,808			
A13.4	*Channel D - Area 2 Pit to Channel E*																		$198,109		
A13.4.1.1		Excavate channel	Load, haul, dump locally	17,840	m3	R.902	310.1	$0.80	$14,247.16	$1.33	$23,773	$0.48	8,566	$8,480.39	$0.00	$0.00	$2.61	$46,501			
A13.4.2.1		Intake structure	Excavate soils to competent foundation materials	4,453	Bm3	R.902	77.4	$0.80	$3,556.10	$1.33	$5,934	$0.48	2,138	$2,116.71	$0.00	$0.00	$2.61	$11,607			
A13.4.2.2			Supply an install precast-concrete intake wingwall intake structure	1	ls	C.5.12	140.0	$6,169	$6,168.93	$4,391	$4,391	$722.71	730	$722.71	$38,850	$38,850.00	$50,133	$50,133			
A13.4.2.6			Backfill and compact around structure	4,453	Cm3	C.2.04	431.4	$2.69	$11,963.28	$3.00	$13,379	$1.07	4,795	$4,747.16	$0.00	$0.00	$6.76	$30,090			
A13.4.3.1		Place channel materials	Geotextile: Supply and place	4,910	m2	C.5.08	139.6	$1.14	$5,604.81	$0.19	$937	$0.11	565	$559.77	$2.68	$13,177.49	$4.13	$20,279			
A13.4.3.2			Rip-rap (angular, high quality): Screen and stockpile	2,199	m3	C.2.15	0.0	$2.63	$5,774.66	$6.44	$14,161	$1.92	4,258	$4,214.94	$0.00	$0.00	$10.98	$24,150			
A13.4.3.3			Rip-rap: Load, haul, dump	2,199	m3	R.020	65.7	$1.36	$2,994.53	$3.00	$6,590	$0.88	1,951	$1,931.72	$0.00	$0.00	$5.24	$11,516			
A13.4.3.4			Rip-rap: Place and secure	2,199	m3	R.904	23.9	$0.50	$1,098.96	$0.91	$2,001	$0.33	741	$734.05	$0.00	$0.00	$1.74	$3,834			
A13.5	*Channel E - Main Access Road to toe of MVFE*																		$784,793		
A13.5.1.1		Construct channel	Bulk fill to grade: Load, haul, dump, spread	29,750	m3																
A13.5.1.2			Excavate/form Channel: Load, haul, dump locally	46,386	m3	R.001	1,461.8	$1.44	$66,673.96	$3.16	$146,727	$0.93	43,445	$43,010.23	$0.00	$0.00	$5.53	$256,411			
A13.5.2.1		Place channel materials	Geotextile: Supply and place	27,307	m2	C.5.08	776.5	$1.14	$31,173.50	$0.19	$5,209	$0.11	3,145	$3,113.39	$2.68	$73,292.13	$4.13	$112,788			
A13.5.2.2			Rip-rap (angular, high quality): Screen and stockpile	20,558	m3	C.2.15	0.0	$2.63	$53,973.88	$6.44	$132,355	$1.92	39,794	$39,395.64	$0.00	$0.00	$10.98	$225,725			
A13.5.2.3			Rip-rap: Load, haul, dump	20,558	m3	R.025	845.7	$1.87	$38,540.15	$4.07	$83,728	$1.19	24,743	$24,495.41	$0.00	$0.00	$7.14	$146,763			
A13.5.2.4			Rip-rap: Place and secure	20,558	m3	R.904	223.6	$0.50	$10,271.59	$0.91	$18,706	$0.33	6,930	$6,860.95	$0.00	$0.00	$1.74	$35,838			
A13.5.3.1		Stilling basin/Energy Dissipa	Excavate basin (spoil locally)	645	m3	R.902	11.2	$0.80	$515.35	$1.33	$860	$0.48	310	$306.75	$0.00	$0.00	$2.61	$1,682			
A13.5.3.2			Geotextile: Supply and place	540	m2	C.5.08	15.4	$1.14	$616.54	$0.19	$103	$0.11	62	$61.58	$2.68	$1,449.56	$4.13	$2,231			
A13.5.3.3			Bedding layer: Screen and stockpile	131	m3	C.2.01	2.7	$0.99	$129.06	$2.29	$299	$0.45	59	$58.25	$0.00	$0.00	$3.72	$486			
A13.5.3.4			Bedding layer: Load, haul, dump and place	131	m3	R.028	7.7	$2.68	$349.60	$6.08	$793	$1.74	229	$227.00	$0.00	$0.00	$10.50	$1,370			
A13.5.3.5			Rip-rap (at inlet and outlet): Screen and stockpile	75	m3	C.2.15	0.0	$2.63	$196.91	$6.44	$483	$1.92	145	$143.73	$0.00	$0.00	$10.98	$824			
A13.5.3.6			Rip-rap (at inlet and outlet): Load, haul, dump	75	m3	R.027	3.2	$1.92	$144.06	$4.13	$310	$1.21	91	$90.58	$0.00	$0.00	$7.26	$545			
A13.5.3.7			Rip-rap (at inlet and outlet): Place and secure	75	m3	R.904	0.8	$0.50	$37.47	$0.91	$68	$0.33	25	$25.03	$0.00	$0.00	$1.74	$131			
A13.6	*Minto Creek Wetland By-Pass Channel*																		$236,362		
A13.6.1.1		Excavate channel	Load, haul, dump locally	29,668	m3	R.902	515.7	$0.80	$23,693.38	$1.33	$39,535	$0.48	14,246	$14,103.10	$0.00	$0.00	$2.61	$77,332			
A13.6.2.1		Place channel materials	Geotextile: Supply and place	12,212	m2	C.5.08	347.3	$1.14	$13,940.93	$0.19	$2,330	$0.11	1,406	$1,392.32	$2.68	$32,776.56	$4.13	$50,439			
A13.6.2.2			Rip-rap (angular, high quality): Screen and stockpile	5,950	m3	C.2.15	0.0	$2.63	$15,621.11	$6.44	$38,306	$1.92	11,517	$11,401.88	$0.00	$0.00	$10.98	$65,329			
A13.6.2.3			Rip-rap: Load, haul, dump	5,950	m3	R.001	187.5	$1.44	$8,552.11	$3.16	$18,820	$0.93	5,573	$5,516.82	$0.00	$0.00	$5.53	$32,889			Assumes WSP rip-rap can be re-used
A13.6.2.4			Rip-rap: Place and secure	5,950	m3	R.904	64.7	$0.50	$2,972.80	$0.91	$5,414	$0.33	2,006	$1,985.70	$0.00	$0.00	$1.74	$10,372			
A13.7	*Allowance: Minto North Spillway*																		$84,151		
A13.7.1.1		Excavate channel	Load, haul, dump locally	13,035	m3	R.902	226.6	$0.80	$10,410.10	$1.33	$17,370	$0.48	6,259	$6,196.44	$0.00	$0.00	$2.61	$33,977			
A13.7.2.1		Place channel materials	Geotextile: Supply and place	4,136	m2	C.5.08	117.6	$1.14	$4,721.21	$0.19	$789	$0.11	476	$471.52	$2.68	$11,100.06	$4.13	$17,082			
A13.7.2.2			Rip-rap (angular, high quality): Screen and stockpile	1,943	m3	C.2.15	0.0	$2.63	$5,102.17	$6.44	$12,512	$1.92	3,762	$3,724.08	$0.00	$0.00	$10.98	$21,338			
A13.7.2.3			Rip-rap: Load, haul, dump	1,943	m3	R.024	47.7	$1.12	$2,175.48	$2.46	$4,787	$0.72	1,418	$1,403.37	$0.00	$0.00	$4.31	$8,366			Assumes WSP rip-rap can be re-used
A13.7.2.4			Rip-rap: Place and secure	1,943	m3	R.904	21.1	$0.50	$970.98	$0.91	$1,768	$0.33	655	$648.57	$0.00	$0.00	$1.74	$3,388			
A13.8	*Ridgetop North Outlet Channel*																		$77,037		
A13.8.1.1		Excavate channel	Load, haul, dump locally	7,758	m3	R.902	134.9	$0.80	$6,195.89	$1.33	$10,339	$0.48	3,725	$3,688.01	$0.00	$0.00	$2.61	$20,222			
A13.8.2.1		Place channel materials	Geotextile: Supply and place	3,995	m2	C.5.08	113.6	$1.14	$4,560.10	$0.19	$762	$0.11	460	$455.43	$2.68	$10,721.27	$4.13	$16,499			
A13.8.2.2			Rip-rap (angular, high quality): Screen and stockpile	2,531	m3	C.2.15	0.0	$2.63	$6,644.96	$6.44	$16,295	$1.92	4,899	$4,850.17	$0.00	$0.00	$10.98	$27,790			
A13.8.2.3			Rip-rap: Load, haul, dump	2,531	m3	R.068	33.1	$0.60	$1,507.37	$1.95	$4,942	$0.66	1,681	$1,664.25	$0.00	$0.00	$3.21	$8,114			Assumes WSP rip-rap can be re-used
A13.8.2.4			Rip-rap: Place and secure	2,531	m3	R.904	27.5	$0.50	$1,264.58	$0.91	$2,303	$0.33	853	$844.68	$0.00	$0.00	$1.74	$4,412			
A13.9	*Secondary Catchment Channels*																		$837,519		
A13.9.1.1		Southwest Dump	Excavate mild-graded channels (good access), spoil locally	10,787	Bm3	R.902	187.5	$0.80	$8,615.00	$1.33	$14,375	$0.48	5,180	$5,127.94	$0.00	$0.00	$2.61	$28,118			
A13.9.1.2			Excavate steep-graded channels (poor access), spoil locally	6,640	Bm3	R.903	131.0	$0.91	$6,019.60	$1.51	$10,044	$0.54	3,619	$3,583.07	$0.00	$0.00	$2.96	$19,647			
A13.9.1.3			Geotextile: Supply and place	25,206	m2	C.5.08	716.7	$1.14	$28,774.54	$0.19	$4,809	$0.11	2,903	$2,873.80	$2.68	$67,651.92	$4.13	$104,109			
A13.9.1.4			Bedding layer: Screen and stockpile	2,054	Cm3	C.2.01	41.8	$0.99	$2,031.02	$2.29	$4,703	$0.45	926	$916.60	$0.00	$0.00	$3.72	$7,651			
A13.9.1.5			Bedding layer: Load, haul, dump and place in steep areas	2,054	Cm3	R.032	72.2	$1.60	$3,288.73	$3.48	$7,145	$1.02	2,111	$2,090.26	$0.00	$0.00	$6.10	$12,524			
A13.9.1.6			Rip-rap (angular, high quality): Screen and stockpile	6,806	Cm3	C.2.15	0.0	$2.63	$17,870.15	$6.44	$43,821	$1.92	13,175	$13,043.46	$0.00	$0.00	$10.98	$74,735			
A13.9.1.7			Rip-rap: Load, haul, dump	6,806	m3	R.031	223.5	$1.50	$10,194.10	$3.30	$22,434	$0.97	6,642	$6,576.04	$0.00	$0.00	$5.76	$39,204			
A13.9.1.8			Rip-rap: Place in mild-graded channels (good access)	3,787	m3	R.904	41.2	$0.50	$1,892.29	$0.91	$3,446	$0.33	1,277	$1,263.96	$0.00	$0.00	$1.74	$6,602			
A13.9.1.9			Rip-rap: Place in steep-graded channels (poor access)	3,019	m3	R.905	74.5	$1.13	$3,424.74	$1.89	$5,715	$0.68	2,059	$2,038.52	$0.00	$0.00	$3.70	$11,178			
A13.9.2.1		Main Waste Dump	Excavate mild-graded channels (good access), spoil locally	6,477	Bm3	R.902	112.6	$0.80	$5,172.45	$1.33	$8,631	$0.48	3,110	$3,078.81	$0.00	$0.00	$2.61	$16,882			
A13.9.2.2			Excavate steep-graded channels (poor access), spoil locally	3,986	Bm3	R.903	78.6	$0.91	$3,613.24	$1.51	$6,029	$0.54	2,172	$2,150.72	$0.00	$0.00	$2.96	$11,793			
A13.9.2.3			Geotextile: Supply and place	15,132	m2	C.5.08	430.3	$1.14	$17,274.69	$0.19	$2,887	$0.11	1,743	$1,725.28	$2.68	$40,614.58	$4.13	$62,501			
A13.9.2.4			Bedding layer: Screen and stockpile	1,233	Cm3	C.2.01	25.1	$0.99	$1,219.11	$2.29	$2,823	$0.45	556	$550.18	$0.00	$0.00	$3.72	$4,592			
A13.9.2.5			Bedding layer: Load, haul, dump and place in steep areas	1,233	Cm3	R.030	34.8	$1.29	$1,589.78	$2.89	$3,566	$0.85	1,059	$1,048.15	$0.00	$0.00	$5.03	$6,204			
A13.9.2.6			Rip-rap (angular, high quality): Screen and stockpile	4,086	Cm3	C.2.15	0.0	$2.63	$10,728.01	$6.44	$26,307	$1.92	7,909	$7,830.40	$0.00	$0.00	$10.98	$44,866			
A13.9.2.7			Rip-rap: Load, haul, dump	4,086	m3	R.029	101.4	$1.13	$4,630.74	$2.54	$10,386	$0.75	3,084	$3,053.08	$0.00	$0.00	$4.42	$18,070			
A13.9.2.8			Rip-rap: Place in mild-graded channels (good access)	2,274	m3	R.904	24.7	$0.50	$1,136.13	$0.91	$2,069	$0.33	767	$758.88	$0.00	$0.00	$1.74	$3,964			
A13.9.2.9			Rip-rap: Place in steep-graded channels (poor access)	1,812	m3	R.905	44.7	$1.13	$2,055.69	$1.89	$3,430	$0.68	1,236	$1,223.61	$0.00	$0.00	$3.70	$6,709			
A13.9.3.1		Reclamation Overburden D	Excavate mild-graded channels (good access), spoil locally	4,886	Bm3	R.902	84.9	$0.80	$3,902.25	$1.33	$6,511	$0.48	2,346	$2,322.75	$0.00	$0.00	$2.61	$12,736			
A13.9.3.2			Excavate steep-graded channels (poor access), spoil locally	3,007	Bm3	R.903	59.3	$0.91	$2,725.94	$1.51	$4,549	$0.54	1,639	$1,622.57	$0.00	$0.00	$2.96	$8,897			
A13.9.3.3			Geotextile: Supply and place	11,416	m2	C.5.08	324.6	$1.14	$13,032.55	$0.19	$2,178	$0.11	1,315	$1,301.60	$2.68	$30,640.87	$4.13	$47,153			
A13.9.3.4			Bedding layer: Screen and stockpile	930	Cm3	C.2.01	18.9	$0.99	$919.73	$2.29	$2,130	$0.45	419	$415.07	$0.00	$0.00	$3.72	$3,465			
A13.9.3.5			Bedding layer: Load, haul, dump and place in steep areas	930	Cm3	R.034	34.7	$1.70	$1,581.31	$3.74	$3,480	$1.10	1,030	$1,020.08	$0.00	$0.00	$6.54	$6,081			
A13.9.3.6			Rip-rap (angular, high quality): Screen and stockpile	3,083	Cm3	C.2.15	0.0	$2.63	$8,093.54	$6.44	$19,847	$1.92	5,967	$5,907.49	$0.00	$0.00	$10.98	$33,848			
A13.9.3.7			Rip-rap: Load, haul, dump	3,083	m3	R.033	97.0	$1.43	$4,422.65	$3.16	$9,733	$0.93	2,882	$2,852.98	$0.00	$0.00	$5.52	$17,008			
A13.9.3.8			Rip-rap: Place in mild-graded channels (good access)	1,715	m3	R.904	18.7	$0.50	$857.13	$0.91	$1,561	$0.33	578	$572.53	$0.00	$0.00	$1.74	$2,991			
A13.9.3.9			Rip-rap: Place in steep-graded channels (poor access)	1,367	m3	R.905	33.8	$1.13	$1,550.87	$1.89	$2,588	$0.68	932	$923.13	$0.00	$0.00	$3.70	$5,062			
A13.9.4.1		DSTSF & MVFE	Excavate mild-graded channels (good access), spoil locally	7,378	Bm3	R.902	128.3	$0.80	$5,892.66	$1.33	$9,833	$0.48	3,543	$3,507.51	$0.00	$0.00	$2.61	$19,233			
A13.9.4.2			Excavate steep-graded channels (poor access), spoil locally	4,541	Bm3	R.903	89.6	$0.91	$4,116.35	$1.51	$6,869	$0.54	2,475	$2,450.19	$0.00	$0.00	$2.96	$13,435			
A13.9.4.3			Geotextile: Supply and place	17,239	m2	C.5.08	490.2	$1.14	$19,680.03	$0.19	$3,289	$0.11	1,985	$1,965.50	$2.68	$46,269.77	$4.13	$71,204			
A13.9.4.4			Bedding layer: Screen and stockpile	1,405	Cm3	C.2.01	28.6	$0.99	$1,388.86	$2.29	$3,216	$0.45	633	$626.79	$0.00	$0.00	$3.72	$5,232			
A13.9.4.5			Bedding layer: Load, haul, dump and place in steep areas	1,405	Cm3	R.028	82.5	$2.68	$3,762.08	$6.08	$8,538	$1.74	2,467	$2,442.81	$0.00	$0.00	$10.50	$14,743			
A13.9.4.6			Rip-rap (angular, high quality): Screen and stockpile	4,655	Cm3	C.2.15	0.0	$2.63	$12,221.79	$6.44	$29,970	$1.92	9,011	$8,920.70	$0.00	$0.00	$10.98	$51,113			
A13.9.4.7			Rip-rap: Load, haul, dump	4,655	m3	R.027	196.3	$1.92	$8,941.32	$4.13	$19,245	$1.21	5,679	$5,622.17	$0.00	$0.00	$7.26	$33,808			
A13.9.4.8			Rip-rap: Place in mild-graded channels (good access)	2,590	m3	R.904	28.2	$0.50	$1,294.33	$0.91	$2,357	$0.33	873	$864.55	$0.00	$0.00	$1.74	$4,516			
A13.9.4.9			Rip-rap: Place in steep-graded channels (poor access)	2,065	m3	R.905	51.0	$1.13	$2,341.92	$1.89	$3,908	$0.68	1,408	$1,393.99	$0.00	$0.00	$3.70	$7,644			
A13.9.5.1		Ridgetop Waste Dump	Excavate mild-graded channels (good access), spoil locally	574	Bm3	R.902	10.0	$0.80	$458.32	$1.33	$765	$0.48	276	$272.81	$0.00	$0.00	$2.61	$1,496			
A13.9.5.2			Excavate steep-graded channels (poor access), spoil locally	353	Bm3	R.903	7.0	$0.91	$320.16	$1.51	$534	$0.54	192	$190.57	$0.00	$0.00	$2.96	$1,045			
A13.9.5.3			Geotextile: Supply and place	876	m2	C.5.08	24.9	$1.14	$1,000.22	$0.19	$167	$0.11	101	$99.89	$2.68	$2,351.61	$4.13	$3,619			

WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Labour Total Mhrs	Labour Unit Rate	Labour Cost	Equipment Unit Rate	Equipment Cost	Fuel Unit Rate	Fuel Consumed (L)	Fuel Cost	Material Unit Rate	Material Cost	Activity Totals Unit Rate	Activity Totals Cost	Subtotals WBS Level 2	Subtotals WBS Level 1	Source / Comments
A13.9.5.4			Bedding layer: Screen and stockpile	465	Cm3	C.2.01	9.4	$0.99	$459.41	$2.29	$1,064	$0.45	209	$207.33	$0.00	$0.00	$3.72	$1,731			
A13.9.5.5			Bedding layer: Load, haul, dump and place in steep areas	109	Cm3	R.063	2.9	$1.22	$133.33	$3.96	$432	$1.30	143	$142.03	$0.00	$0.00	$6.48	$708			
A13.9.5.6			Rip-rap (angular, high quality): Screen and stockpile	362	Cm3	C.2.15	0.0	$2.63	$950.58	$6.44	$2,331	$1.92	701	$693.83	$0.00	$0.00	$10.98	$3,975			
A13.9.5.7			Rip-rap: Load, haul, dump	362	m3	R.064	8.5	$1.07	$386.18	$3.48	$1,262	$1.18	431	$426.59	$0.00	$0.00	$5.73	$2,074			
A13.9.5.8			Rip-rap: Place in mild-graded channels (good access)	201	m3	R.904	2.2	$0.50	$100.67	$0.91	$183	$0.33	68	$67.24	$0.00	$0.00	$1.74	$351			
A13.9.5.9			Rip-rap: Place in steep-graded channels (poor access)	161	m3	R.905	4.0	$1.13	$182.15	$1.89	$304	$0.68	110	$108.42	$0.00	$0.00	$3.70	$595			
A13.10	*Tailings Diversion Ditch*																		$660,675		
A13.10.1.2		Regrade	Slopes: Re-grade to 3H:1V	36	hrs	C.2.13	36	$45.95	$1,644	$213.35	$7,635	$69.10	2,498	$2,473	$0.00	$0	$328.40	$11,751			
A13.10.2.1		Cover	Flat area cover material: Load, haul, dump spread	25,182	Cm3	R.066	562.3	$1.02	$25,637	$3.30	$83,160	$1.08	27,585	$27,310	$0.00	$0	$5.40	$136,106			
A13.10.2.2			Slope area cover material: Load, haul, dump along crest	18,049	Cm3	R.067	352.6	$0.89	$16,061	$2.91	$52,469	$0.98	17,921	$17,742	$0.00	$0	$4.78	$86,272			
A13.10.2.3			Slope area cover material: Spread down slope	14	hrs	C.2.13	14.0	$45.95	$643	$213.35	$2,985	$69.10	977	$967	$0.00	$0	$328.40	$4,595			
A13.10.3.1		Revegetate	Seed/Fertilize: tractor application	9	ha	C.6.01	286.4	$1,069.47	$9,247	$556.88	$4,815	$240.22	2,098	$2,077	$1,091.19	$9,435	$2,958	$25,574			
A13.10.3.2			Tree seedling application (1,000 stems/ha)	9	ha	C.6.06	443.1	$1,919.72	$16,598	$35.26	$305	$15.47	135	$134	$1,189.36	$10,284	$3,160	$27,321			
A13.10.4.1		Extend Channel to WSP	Clear and grub footprint	13,889	m2	C.2.03	52.8	$0.17	$2,426	$0.54	$7,480	$0.14	1,940	$1,921	$0.00	$0	$0.85	$11,826			
A13.10.4.2			Geotextile: Supply and place	13,889	m2	C.5.08	394.9	$1.14	$15,855	$0.19	$2,650	$0.11	1,600	$1,584	$2.68	$37,277	$4.13	$57,366			
A13.10.4.3			Rip-rap (angular, high quality): Screen and stockpile	13,169	m3	C.2.15	0.0	$2.63	$34,576	$6.44	$84,788	$1.92	25,492	$25,237	$0.00	$0	$10.98	$144,601			
A13.10.4.4			Rip-rap: Load, haul, dump	13,169	m3	R.035	618.4	$2.14	$28,168	$4.60	$60,626	$1.34	17,890	$17,712	$0.00	$0	$8.09	$106,506			
A13.10.4.5			Rip-rap: Place in steep-graded channels (poor access)	13,169	m3	R.905	325.1	$1.13	$14,939	$1.89	$24,927	$0.68	8,982	$8,892	$0.00	$0	$3.70	$48,757			
A14	**Water Treatment**																			**$574,445**	
A14.1	*Passive Treatment System - Minto Creek Valley*																		$485,215		
A14.1.1.1		Water Management	Install pump and pump around system	8	hrs	C.4.14	32.0	$125.31	$1,002.50	$37.01	$296	$6.95	56	$55.60	$0.00	$0.00	$169.27	$1,354			Assumed
A14.1.1.2			Maintain pump around system during wetland construction activities	1,440	hrs	C.4.13	144.0	$3.72	$5,363.40	$28.42	$40,918	$2.00	2,909	$2,880.00	$0.00	$0.00	$34.14	$49,161			Assumes wetlands constructed over 2 months
A14.1.2.1		Valley Fill placement	Load, haul, dump material from the WSP excavation	85,918	m3	n/a - costed	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.1.2.1			Load, haul dump valley fill material	0	m3	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			Fill from WSP excavation exceeds the required amount.
A14.1.3.1		Construct wetlands	Excavate cells: Load, haul dump, spoil locally	14,459	m3	R.902	251.3	$0.80	$11,547.30	$1.33	$19,268	$0.48	6,943	$6,873.30	$0.00	$0.00	$2.61	$37,689			
A14.1.3.2			Subgrade preparation: remove sharp objects, place fill as required	9,273	m2	C.2.18	317.0	$1.37	$12,669.07	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$12,669			
A14.1.3.3			Geotextile: Supply and install	10,201	m2	C.5.08	290.1	$1.14	$11,644.99	$0.19	$1,946	$0.11	1,175	$1,163.02	$2.68	$27,378.58	$4.13	$42,133			
A14.1.3.4			HDPE liner: Supply and install	10,201	m2	C.5.11	1,187.0	$4.93	$50,253.33	$0.47	$4,778	$0.28	2,884	$2,855.60	$13.70	$139,698.09	$19.37	$197,585			
A14.1.3.5			Organics: Mulch organics, produce and stockpile	5,122	Cm3	C.2.10	577.1	$4.68	$23,965.81	$5.04	$25,817	$1.86	9,609	$9,513.16	$0.00	$0.00	$11.58	$59,295			
A14.1.3.6			Organics: Load, haul, dump, place in cell	5,122	Cm3	R.001	161.4	$1.44	$7,362.27	$3.16	$16,202	$0.93	4,797	$4,749.28	$0.00	$0.00	$5.53	$28,313			
A14.1.3.7			Plant wetland vegetation	0.9	ha	C.6.05	40.6	$1,505.47	$1,396.08	$406.33	$377	$185.63	174	$172.14	$1,216.54	$1,128.14	$3,313.97	$3,073			
A14.1.4.1		Conveyance channels	Excavate channels: Load, haul, dump locally	1,402	m3	R.902	24.4	$0.80	$1,119.89	$1.33	$1,869	$0.48	673	$666.59	$0.00	$0.00	$2.61	$3,655			
A14.1.4.2			Surface preparation: remove sharp objects, place fill as required	1,858	m2	C.2.18	63.5	$1.37	$2,538.03	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$1.37	$2,538			
A14.1.4.3			Geotextile: Supply and place	1,858	m2	C.5.08	52.8	$1.14	$2,120.80	$0.19	$354	$0.11	214	$211.81	$2.68	$4,986.21	$4.13	$7,673			
A14.1.4.4			HDPE Liner: Supply and install	1,858	m2	C.5.11	216.2	$4.93	$9,152.18	$0.47	$870	$0.28	525	$520.06	$13.70	$25,441.93	$19.37	$35,984			
A14.1.4.5			Bedding/Protection layer: Screen and stockpile	442	m3	C.2.01	9.0	$0.99	$437.26	$2.29	$1,013	$0.45	199	$197.34	$0.00	$0.00	$3.72	$1,647			
A14.1.4.6			Bedding/Protection layer: Load, haul, dump and place	442	m3	R.001	13.9	$1.44	$635.70	$3.16	$1,399	$0.93	414	$410.08	$0.00	$0.00	$5.53	$2,445			Assumes WSP fill can be re-used
A14.1.5.1		Operation and maintenance	System to be started Yr. 1 post-closure	0	yr	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.2	*Southwest Wetlands*																		$16,583		
A14.2.1		Berm construction	Construct 3 berms across valley	3,000	m3	R.001	94.5	$1.44	$4,312.16	$3.16	$9,490	$0.93	2,810	$2,781.70	$0.00	$0.00	$5.53	$16,583			Assumed
A14.2.2		Outlet structures	Excavate outlet channels through berms	1	ls																Allowance
A14.3	*Decommission/demolish Water Treatment System*																		$72,646		
A14.3.1.1		Remove equipment	Small equipment: dismantle and prep for transport	17	hrs	C.1.13	67.1	$174.43	$2,927.27	$115.96	$1,946	$17.92	304	$300.72	$0.00	$0.00	$308.32	$5,174			
A14.3.1.2			Large equipment (crane req'd): dismantle and prep for transport	29	hrs	C.1.14	175.7	$279.25	$8,178.13	$199.44	$5,841	$24.11	713	$706.00	$0.00	$0.00	$502.79	$14,725			
A14.3.2.1		Prepare for demolition	Reagents: Load for transport	25	hrs	C.1.22	99.3	$165.83	$4,117.99	$104.46	$2,594	$27.77	697	$689.61	$0.00	$0.00	$298.06	$7,402			
A14.3.2.2			Reagents: Transport to Whitehorse	2.2	trips	C.7.04	18.0	$363.66	$817.41	$360.37	$810	$116.87	265	$262.69	$0.00	$0.00	$840.90	$1,890			
A14.3.2.3			Reagents: Disposal and tipping fees	1.0	ls	n/a	0.0	$0.00	$0.00	$0.00	$0	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0			
A14.3.3.1		Demolition	Structural building demolition	163	tonnes	C.1.05	325.0	$71.87	$11,680.66	$139.79	$22,719	$34.90	5,729	$5,671.56	$0.00	$0.00	$246.56	$40,071			
A14.3.3.2			Other demolition: miscellaneous	15	m3	C.1.07	1.5	$3.90	$58.57	$2.07	$31	$0.76	12	$11.40	$0.00	$0.00	$6.74	$101			
A14.3.4.1		Waste disposal	Off-site disposal (re-usable equipment, etc.)	3	trips	C.7.07	27.1	$367.57	$1,244.53	$485.20	$1,643	$116.87	400	$395.70	$0.00	$0.00	$970	$3,283			
Subtotal Direct Costs - Active Closure							**111,921**		**$4,944,185**		**$8,138,333**			**$2,532,913**		**$1,532,216**				**$17,147,647**	
INDIRECT COSTS																					
B1	**Mobilization-Demobilization**																			**$344,806**	
B1.1		Mobilization	Year 0	1	LS												$172,403	$172,403.02			
B1.2		Demobilization	Year 3 (end of Active Closure)	1	LS												$154,305	$154,304.96			
B1.4		Demobilization	End of Passive closure	1	LS												$18,098	$18,098.05			
B2	**Transportation Costs**																			**$407,086**	
B2.1.1		Barge Operations		14	month												$10,939	$153,140			
		Staffing Bus trips during barge operation period		56	ea (one per week)												$678	$37,946			Turnaround labour costs included in labour build-up
B2.2.2		Air transport and airstrip operations		72	flights												$3,000	$216,000			Three flights per week
B3	**Site/Road Maintenance**																			**$796,356**	
B3.1	*Road Maintenance*																		$718,289		
B3.1.1		Water Truck	Assume needed 150 hrs per month	20	month												$13,733	$274,666			
B3.1.2		Grader	Assume needed 150 hrs per month (16H + Operator)	20	month												$22,181	$443,622			Includes Main Access Road throughout closure period.
B3.2	*Soil Erosion*																		$78,067		
B3.2.1		Erosion control allowance	Silt fencing: supply, install remove at strategic locations	7024	m	C.2.17	283.5	$3.36	$23,588.40	$1.91	$13,417	$0.57	4,026	$3,986.02	$1.85	$12,979.80	$7.68	$53,971			
B3.2.2			Supply and install erosion control matting	10000	m2	C.2.09	175.4	$0.69	$6,915.95	$0.12	$1,237	$0.05	548	$542.76	$1.54	$15,400.00	$2.41	$24,096			
B4	**Construction Support**																			**$4,998,665**	
B4.1	*Field Support Staff*																		$2,850,986		Turnaround labour costs included in labour build-up
B4.1.1		Mine Manager		20	month		(	360) site working hours per month									$25,631	$512,623			
B4.1.2		Office/Camp manager		20	month		(	360) site working hours per month									$23,201	$464,010			
B4.1.3		Security/Administrative Assistant		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.4		Foreman		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.5		Mechanic		20	month		(	360) site working hours per month									$0	$0			Included in Equipment rates
B4.1.6		Surveyor		20	month		(	360) site working hours per month									$18,296	$365,911			
B4.1.7		Engineering technician	Material & QA/QC testing	10	month		(	360) site working hours per month									$42,120	$421,200			Assumed needed 1/2 of time
B4.1.8		Medic/H&S supervisor		20	month		(	360) site working hours per month									$17,771	$355,420			
B4.2	*Field support Vehicles*																		$540,551		
B4.2.1		Pick-up trucks (4 required)		80	month												$4,875	$389,967			
B4.2.2		Fuel truck		20	month												$0	$0			Included in Equipment rates
B4.2.3		Mechanic service vehicle		20	month												$0	$0			Included in Equipment rates
B4.2.4		Emergency transport vehicle		20	month												$5,218	$104,360			
B4.2.5		Passenger bus		20	month												$2,311	$46,224			
B4.3	*Field Support Equipment/Supplies*																		$1,607,129		
B4.3.1		Light Towers		20	month			2 # of Units									$3,978	$79,563			
B4.3.2		Material/Laboratory testing allowance		20	month												$1,000	$20,000			
B4.4		Construction, Environmental, and H&S Management Plans		1	LS												$25,000	$25,000			
B4.5		Office supplies		20	month												$1,000	$20,000			
B4.6		Communications		20	month												$1,000	$20,000			
B4.7		Misc. supplies		20	month												$500	$10,000			

							Labour			Equipment		Fuel			Material		Activity Totals		Subtotals		
WBS	Facility/Area	Task	Activity	EOM Qnty	Units	Cost Code	Total Mhrs	Unit Rate	Cost	Unit Rate	Cost	Unit Rate	Consumed (L)	Cost	Unit Rate	Cost	Unit Rate	Cost	WBS Level 2	WBS Level 1	Source / Comments
B4.8		Camp costs	Includes catering and housekeeping	11,192	man-day	(direct)		5840	man-day (indirect)								$80	$1,362,566			
B4.9		Power and heat		20	month												$3,500	$70,000			
B5	**QA and Project Management**																			**$1,655,893**	
B5.1		EOR Engineer		20	month		(	84	) project hours per month								$0	$0			
B5.2		Field Engineer		20	month		(	360	) site working hours per month								$48,600	$972,000			
B5.3		Engineer travel/turnaround costs		47	ls												$3,600	$169,200			Assumes Vancouver origin
B5.3		Environmental Monitor		20	month		(	360	) site working hours per month								$15,985	$319,709			
B5.4		Engineering , Design, and Construction plans (included in Planning and Permitting Costs)															$0.00	$0			
B5.5		Field support vehicles (2 vehicles)		40	month												$4,875	$194,984			
Subtotal Indirect Costs - Active Closure																				**$8,202,806**	
CLOSURE IMPLEMENTATION COSTS - TOTAL																				**$25,350,453**	

Worksheet 15 - End-of-Mine Liability Estimate - Schedule Details

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Year 0 Site Access Schedule

Stage	Flight Months	Helicopter Months	Barge Months	Total Months	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Interim Care	0	0	0	0													
SUB-TOTAL INTERIM CARE	**0**	**0**	**0**	**0**													
Active Closure 1	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 2	2	0	5	7				F	F	B	B	B	B	B			
Active Closure 3	2	0	4	6				F	F	B	B	B	B				
SUB-TOTAL ACTIVE CLOSURE	**6**	**0**	**14**	**20**													
Post-Closure 1	2	0	3	5				F	F	B	B	B					
SUB-TOTAL POST-CLOSURE 1	**2**	**0**	**3**	**5**													
Post-Closure 2	0	0	1	1						B							
SUB-TOTAL POST-CLOSURE 2	**0**	**0**	**1**	**1**													

B: Annual C&M Staffing Schedule - Interim Operations

No Interim operations included under the EOM scenario.

C: Annual C&M Staffing Schedule - During Active Phase

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**7**				**1**	**1**	**1**	**1**	**1**	**1**	**1**			
Water Treatment/Environmental Staffing															
1	Warehouse/Water Treatment Operator	5				1.0	1.0	1.0	1.0	1.0					
2	Environmental Manager	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
3	Environmental Technician	4				1.0	0.5	0.5	0.5	0.5	0.5	0.5			
TOTAL		**13**	**0**	**0**	**0**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**0**	**0**	
	Annual man-days:	**390**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)

D: Annual C&M Staffing Schedule - Post Closure 1

#	Role	Months Required	Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site		**5**				**1**	**1**	**1**	**1**	**1**					
Administration/Office															
1	Mine Manager	3				0.5	0.5	0.5	0.5	0.5					
2	Office/Camp Mgr	3				1.0	0.5	0.5	0.5	0.5					
3	Payroll/Accounting/HR	1				0.25	0.25	0.25	0.25	0.25					
Water Treatment/Environmental Staffing															
1	Water Treatment Operator	2				0.5	0.5	0.3	0.3	0.3					
2	Environmental Manager	3				0.5	0.5	0.5	0.5	0.5					
3	Environmental Technician	3				0.5	0.5	0.5	0.5	0.5					
Operations															
4	Barge Operator	6						2.0	2.0	2.0					
5	Equipment operators	10				2.0	3.0	1.5	1.5	1.5					
6	HD Mechanic	2				1.0	0.25	0.25	0.25	0.25					
7	Tradesmen	2				1.0	0.25	0.25	0.25	0.25					
8	Labour/Helpers	2				1.0	0.25	0.25	0.25	0.5					
Camp/Support															
1	Cooks/Housecleaning etc.	0				0.0	0.0	0.0	0.0	0.0					Contract (accounted for in camp costs)
Other															
1	Visitors	1				0.25				0.25					
TOTAL		**36**	**0**	**0**	**0**	**9**	**7**	**7**	**7**	**7**	**0**	**0**	**0**	**0**	
	Annual man-days:	**1,073**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Post Closure 2

				Month												
#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site			**1**						**1**							
Administration/Office																
1	Mine Manager		1						0.5							
2	Office/Camp Mgr		0						0.0							
3	Payroll/Accounting/HR		0						0.00							
Water Treatment/Environmental Staffing																
1	Passive Treatment Scientist		1						0.5							
2	Environmental Manager		0													
3	Environmental Technician		0													
Operations																
4	Barge Operator		1						1.0							
5	Equipment operators		1						1.0							
6	HD Mechanic		1						0.50							
7	Tradesmen		0													
8	Labour/Helpers		0						0.25							
Camp/Support																
1	Cooks/Housecleaning etc.		0						0.0							Contract (accounted for in camp costs)
Other																
1	Visitors		0						0.25							
TOTAL			**4**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**120**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

E: Annual C&M Staffing Schedule - Long-term perpetual maintenance year

				Month												
#	Role		Months Required	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments/Notes
Months Active at Site			**1**							**1**						
Administration/Office																
1	Project Manager/Foreman		1							1.0						
Water Treatment/Engineering Staffing																
1	Passive Treatment Scientist		1							1.0						
2	Site Engineer		1							1.0						
3	Environmental Technician		0													
Operations																
4	Barge Operator		1							1.0						Assumed required 1/2 the time (near mob and demob)
5	Equipment operators		4							4.0						
6	HD Mechanic		1							0.50						
7	Tradesmen		0													
8	Labour/Helpers		1							1.00						
Camp/Support																
1	Cooks/Housecleaning etc.		0													Contract (accounted for in camp costs)
Other																
1	Visitors		1							0.50						
TOTAL			**10**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	
		Annual man-days:	**300**													

Notes:
1. 0.5 personnel indicates staff on site 50% of time (i.e. no cross shift)
2. Orange highlighted cells are used for camp-man day calculations only.

Worksheet 16 - End-of-Mine Liability Estimate - Planning and Permitting Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

Planning And Permitting

WBS	Facility/Area	Task	Activity	Qnty	Unit	Total Unit Rate ($/unit)	Activity Total	Subtotal	Source / Comments
M1	**Planning and Permitting**								
M1.1	*Reclamation Research/Planning*							$200,000	
M1.1.1		Complete reclamation closure and research plan		1	yr	$200,000	$200,000		
M1.2	*Technical studies and investigations*							$58,500	
M1.2.1		Allowance for additional technical studies		1	ls	$58,500	$58,500		
M1.3	*Monitoring and Management Plans*							$209,158	
M1.3.1		Adaptive Mgmt Plans	Physcial, water quality, etc	1	ls	$15,000	$15,000		
M1.3.2		Revegetation plan		1	ls	$30,000	$30,000		
M1.3.3		Waste Management Plan	Water treatment, sludge, landfarm, etc.	1	ls	$50,000	$50,000		
M1.3.4		MMER Final Monitoring Study		1	ls	$114,158	$114,158		Quote: Minnow
M1.4	*Engineering, Design, and Construction Plans*							$857,382	
M1.4.1		Percentage of direct implementation costs		5%	of	$17,147,647	$857,382		
M1.5	*Permitting*							$0	
M1.5.1.1		Permit Staffing	Permitting Manager	0	ls	$0	$0		Staffing costs included in tasks above
M1.5.1.2			Environmental Manager	0	ls	$0	$0		
M1.5.1.3			Technical Consultants	0	ls	$0	$0		
TOTAL								**$1,325,040**	

Worksheet 17 - Labour Rate Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS
A PEMBRIDGE RESOURCES COMPANY
srk consulting

LABOUR RATES

Benefit Factors

Employment Insurance (EI) percentage:	1.60%	of base earnings	2020 Source: http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/ei/hstrc-eng.html
EI salary limit	$54,200		2020 Source: http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/ei/hstrc-eng.html
Canada Pension Plan (CPP) percentage:	5.25%	of base earnings	2020 Source: http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/cpp-rpc/hstrc-eng.html
CPP salary limit:	$58,700		2020 Source: http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/cpp-rpc/hstrc-eng.html
MSP/Health Benefits:	$0	per month	Yukon Territory has no employer or employee premiums or payroll taxes for health care (Source: CostMine 2014)
Small tools/safety gear allowance:	$250	per year	Estimated based on a BC mine site (CostMine 2014)

Workers Compensation: 2020 YWC rates http://www.wcb.yk.ca/QuestionResults/Assessments/Rates/Q0269.aspx

Resources (low)	$2.97	Metal mining, gravel crushing and screening, air services
Resources (med.)	$4.73	**DEFAULT** - Reclamation, Exploration, short haul trucking
Resources (high)	$7.70	Diamond drilling, forestry, long haul trucking, oil/gas
Services (med.)	$1.67	Catering, Housekeeping, Consultants doing fieldwork

Cost Code	Item	Base Hourly Wage ($/hr)	Loading Rate (%)	Rate Used in Estimate ($/hr)	Source (See Notes)	Include Loading Calculations?	Rotation Details: Rotation Type	Weeks Onsite per Year	Hours Worked per Day	Days per Week	Site Hours per Year	Rotations per year	Travel Hours per year
P.01	Camp Labourer	$25.19	144%	$36.30	1	Yes	3 in - 3 out	28	12	7	2,352	9	47
P.02	Field Engineer	$150.00	90%	$135.00	3, 4		3 in - 3 out	35	12	7	2,940	12	117
P.03	Driller / Blaster	$31.30	147%	$45.95	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.04	Engineering Technician (Consultant)	$130.00	90%	$117.00	3, 4								
P.05	Environmental Monitor	$31.30	142%	$44.40	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.06	Environmental Scientist (Consultant)	$140.00	90%	$126.00	3, 4								
P.07	Foreman	$34.91	146%	$50.82	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.08	Head Camp Cook	$34.91	141%	$49.28	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.09	Health and Safety Supervisor	$34.91	141%	$49.36	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.10	Heavy Equip. Operator 1: Crane, Dragline, Shovels	$34.91	146%	$50.82	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.11	Heavy Equip. Operator 2: Excavator, Loader, Dozers	$31.30	147%	$45.95	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.12	Heavy Equip. Operator 3: Rollers and compactors	$25.19	148%	$37.25	1	Yes	3 in - 3 out	35	12	7	2,940	12	58
P.13	Heavy Equip. Mechanic	$34.91	146%	$50.82	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.14	Heavy Equip. Servicer	$31.30	147%	$45.95	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.15	Helicopter Pilot	$34.91	143%	$49.90	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.16	Labourers	$25.19	148%	$37.25	1	Yes	3 in - 3 out	35	12	7	2,940	12	58
P.17	Linesperson (electric)	$34.91	146%	$50.82	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.18	Medic, First Aid Attendant	$25.19	149%	$37.61	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.19	Office Manager	$45.00	143%	$64.45	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.20	EOR Engineer	$200.00	90%	$180.00	3, 4		3 in - 3 out	35	12	7	2,940	12	117
P.21	Mine Manager	$50.00	142%	$71.20	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.22	Security Guard	$25.19	148%	$37.25	1	Yes	3 in - 3 out	35	12	7	2,940	12	58
P.23	Site Caretaker	$27.76	148%	$41.17	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.24	Site Clerk / Administration	$34.91	146%	$50.82	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.25	Site Supervisor	$45.00	143%	$64.45	3	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.26	Surveyor	$34.91	146%	$50.82	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.27	Trades Labourer (carpenter, electrician, welder etc.)	$34.91	155%	$54.00	1	Yes	3 in - 3 out	35	12	7	2,940	12	93
P.28	Truck Driver 1: 10 Ton GVW and up.	$31.30	145%	$45.39	1	Yes	3 in - 3 out	35	12	7	2,940	12	58
P.29	Truck Driver 2: 3 - 10 Ton GVW	$27.76	147%	$40.67	1	Yes	3 in - 3 out	35	12	7	2,940	12	58

Cost Code	Travel Costs: Travel Time (1 way) (hrs)	Travel Origin	Flights (1 way)	Hotel (1 way)	Meals (1 way)	Total Per Rotation	Overtime: Overtime Multiplier	Overtime Hourly Wage	Other: Small Tool Allowance ?	Worker's Comp Classification
P.01	2.5	Pelly	$0	$0	$0	$0	1.5	$37.79	No	Services (med.)
P.02	5	Vancouver	$400	$100	$50	$1,100	1	$150.00	No	Resources (med.)
P.03	4	Whitehorse	$0	$0	$0	$0	1.5	$46.95	Yes	Resources (med.)
P.04										
P.05	4	Whitehorse	$0	$0	$0	$0	1.5	$46.95	No	Services (med.)
P.06										
P.07	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.08	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	No	Services (med.)
P.09	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Services (med.)
P.10	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.11	4	Whitehorse	$0	$0	$0	$0	1.5	$46.95	Yes	Resources (med.)
P.12	2.5	Pelly	$0	$0	$0	$0	1.5	$37.79	Yes	Resources (med.)
P.13	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.14	4	Whitehorse	$0	$0	$0	$0	1.5	$46.95	Yes	Resources (med.)
P.15	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	No	Resources (low)
P.16	2.5	Pelly	$0	$0	$0	$0	1.5	$37.79	Yes	Resources (med.)
P.17	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.18	4	Whitehorse	$0	$0	$0	$0	1.5	$37.79	No	Resources (med.)
P.19	4	Whitehorse	$0	$0	$0	$0	1.5	$67.50	Yes	Resources (med.)
P.20	5	Vancouver	$400	$100	$50	$1,100	1	$200.00	No	Resources (med.)
P.21	4	Whitehorse	$0	$0	$0	$0	1.5	$75.00	Yes	Resources (med.)
P.22	2.5	Pelly	$0	$0	$0	$0	1.5	$37.79	Yes	Resources (med.)
P.23	4	Whitehorse	$0	$0	$0	$0	1.5	$41.64	Yes	Resources (med.)
P.24	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.25	4	Whitehorse	$0	$0	$0	$0	1.5	$67.50	Yes	Resources (med.)
P.26	4	Whitehorse	$0	$0	$0	$0	1.5	$52.37	Yes	Resources (med.)
P.27	4	Whitehorse	$0	$0	$50	$100	1.5	$52.37	Yes	Resources (med.)
P.28	2.5	Pelly	$0	$0	$0	$0	1.5	$46.95	Yes	Resources (med.)
P.29	2.5	Pelly	$0	$0	$0	$0	1.5	$41.64	Yes	Resources (med.)

Cost Code	Hours: Base Work Hours per Year	Overtime Work Hours per Year	Vacation Hours	Stat Hours	Total Hours Paid per Year	Annual Totals: Base Earnings ($/yr)	Base Salary	Overtime Salary	EI	CPP	Worker's Comp.	Small Tool Allowance	MSP/Health Benefits	Travel Cost	Annual Total
P.01	1120	1359	0	80	2479	$59,247	$28,213	$51,337	$867	$3,082	$1,870	$0	$0	$0	$85,369
P.02	1400	1737	0	80	3137	$441,000	$210,000	$260,500	$867	$3,082	$6,622	$0	$0	$128,333	$609,404
P.03	1400	1713	0	80	3113	$92,022	$43,820	$80,441	$867	$3,082	$6,622	$250	$0	$0	$135,082
P.04															
P.05	1400	1713	0	80	3113	$92,022	$43,820	$80,441	$867	$3,082	$2,338	$0	$0	$0	$130,548
P.06															
P.07	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.08	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$2,338	$0	$0	$0	$144,880
P.09	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$2,338	$250	$0	$0	$145,130
P.10	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.11	1400	1713	0	80	3113	$92,022	$43,820	$80,441	$867	$3,082	$6,622	$250	$0	$0	$135,082
P.12	1400	1678	0	80	3078	$74,059	$35,266	$63,416	$867	$3,082	$6,622	$250	$0	$0	$109,503
P.13	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.14	1400	1713	0	80	3113	$92,022	$43,820	$80,441	$867	$3,082	$6,622	$250	$0	$0	$135,082
P.15	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$4,158	$0	$0	$0	$146,700
P.16	1400	1678	0	80	3078	$74,059	$35,266	$63,416	$867	$3,082	$6,622	$250	$0	$0	$109,503
P.17	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.18	1400	1713	0	80	3113	$74,059	$35,266	$64,738	$867	$3,082	$6,622	$0	$0	$0	$110,575
P.19	1400	1713	0	80	3113	$132,300	$63,000	$115,650	$867	$3,082	$6,622	$250	$0	$0	$189,471
P.20	1400	1737	0	80	3137	$588,000	$280,000	$347,333	$867	$3,082	$6,622	$0	$0	$128,333	$766,238
P.21	1400	1713	0	80	3113	$147,000	$70,000	$128,500	$867	$3,082	$6,622	$250	$0	$0	$209,321
P.22	1400	1678	0	80	3078	$74,059	$35,266	$63,416	$867	$3,082	$6,622	$250	$0	$0	$109,503
P.23	1400	1713	0	80	3113	$81,614	$38,864	$71,343	$867	$3,082	$6,622	$250	$0	$0	$121,028
P.24	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.25	1400	1713	0	80	3113	$132,300	$63,000	$115,650	$867	$3,082	$6,622	$250	$0	$0	$189,471
P.26	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$0	$149,414
P.27	1400	1713	0	80	3113	$102,635	$48,874	$89,719	$867	$3,082	$6,622	$250	$0	$9,333	$158,747
P.28	1400	1678	0	80	3078	$92,022	$43,820	$78,798	$867	$3,082	$6,622	$250	$0	$0	$133,439
P.29	1400	1678	0	80	3078	$81,614	$38,864	$69,886	$867	$3,082	$6,622	$250	$0	$0	$119,571

Notes:
1 Basic Rate: Yukon Government Fair Wage Schedule - Effective Apr 1, 2020 (Accessed July 2020)
2 CostMine 2019 for an active BC mine site
3 Estimated from project experience
4 Consultants rates are reduced by 10% as this value is added back in later in the estimate (Contractor Profit = 10%)

Worksheet 18 - Equipment Rate Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS
A PEMBRIDGE RESOURCES COMPANY

srk consulting

EQUIPMENT RATES

Adjustment Factors

Equipment Rates used in estimate: 3rd-Party - BC Blue Book
Fuel Consumption Rates: 2 - Medium Note: Medium consumption applied to most situations
On-site fuel cost per litre (diesel): $0.99 Averaged delivered price (2020)
Adjustment Factor to convert BC Blue Book bare rates (Column S) to On-site Paid 3rd Party Rates: 0.94 See equipment rate details/info section below for details of how this factor was derived.

BC Blue Book Cost Breakdown Assumptions

BC Blue Book Source: 2020-2021
Owner overhead rate: 10% BC Roadbuilder Association (2000)
Profit rate: 10% BC Roadbuilder Association (2000)
BC Govt Fuel Price Adjustment Factors:
Avg. BC diesel cost: $1.04 Base diesel cost included in BC Blue-Book ($0.94 base price plus $0.10 carbon tax)
Date: 8/1/2020
Source: http://www2.gov.bc.ca/gov/content/industry/construction-industry/transportation-infrastructure/hired-equipment-program/fuel-price-adjustment

Equipment		Rate Summary				Operator Details			Weight	Fuel Consumption Details				BC Blue Book Cost Breakdown						
Equip Code	Model	Source Used in Estimate	Equipment Cost ($/hr)	Fuel Operating Cost ($/hr)	Total Equipment Rate ($/hr)	Number of Operators	Operator Type	Operator Rate ($/hr)	Shipping Weight (tonnes)	On-Road/ Off-Road	Low (liters/hr)	Medium (liters/hr)	High (liters/hr)	All-Found Rate ($/hr)	Operators Wage ($/hr)	Ownership/ Maintenance Cost ($/hr)	Fuel Operating Cost ($/hr)	Contractor Overhead Cost ($/hr)	Contractor Profit ($/hr)	Comments
	Backhoe																			
E.01.1	CAT430E (4x4)	3rd Party	$20.13	$12.03	$32.16	1	E. Operator 2	$45.95	7.4	Off	8.1	12.15	21.95	$104.00	$52.00	$21.31	$12.64	$8.60	$9.45	
	Compactors																			
E.02.1	CAT CP563 (Class 7 - 12-13.99 tons)	3rd Party	$31.35	$15.35	$46.70	1	Roller Operator	$37.25	11.5	Off	13	15.5	18.5	$122.60	$52.00	$33.20	$16.12	$10.13	$11.15	
E.02.2	Walk-behind vibrating (30 in)	3rd Party	$9.36	$2.32	$11.69	0	Roller Operator	$0.00	n/a	n/a	1.2	2.3	3.5	$12.00	$0.00	$9.92	$0.00	$0.99	$1.09	Fuel rate estimated from a 22 in Wacker Neuson (3.5L/hr under 100%operation)
	Dozers																			
E.03.1	CAT D6R	3rd Party	$69.66	$24.01	$93.67	1	E. Operator 2	$45.95	18.0	Off	18	24.25	30.5	$182.70	$52.00	$73.77	$25.22	$15.10	$16.61	
E.03.2	CAT D8R	3rd Party	$141.67	$36.38	$178.05	1	E. Operator 2	$45.95	37.6	Off	27.25	36.75	46.25	$290.70	$52.00	$150.03	$38.22	$24.02	$26.43	
E.03.3	CAT D10T	3rd Party	$213.35	$69.10	$282.46	1	E. Operator 2	$45.95	66.4	Off	51.45	69.8	88.6	$424.15	$52.00	$225.95	$72.59	$35.05	$38.56	
E.03.4	CAT D11R	3rd Party	$228.26	$99.00	$327.26	1	E. Operator 2	$45.95	104.6	Off	71.7	100	126.25	$481.25	$52.00	$241.73	$104.00	$39.77	$43.75	
	Drills																			
E.04.1	Air Rotary, 200 cfm compressor	3rd Party	$163.45	$24.75	$188.20	2	Driller / Blaster	$91.89	n/a	Off	20	25	30	$366.75	$104.00	$173.10	$26.00	$30.31	$33.34	Med. Fuel consumption rate estimated based on DR10 drill (http://www.orbitdrilling.com.au/mineralexp.html)
E.04.2	Air track production drill rig (900cfm)	3rd Party	$77.76	$49.50	$127.26	2	Driller / Blaster	$91.89	41.0	Off	33.35	50	66.5	$288.40	$104.00	$82.35	$52.00	$23.83	$26.22	Med. Fuel consumption rate estimated from Cost Mine 2015
	Excavators																			
E.05.1	CAT 330	3rd Party	$83.67	$30.69	$114.36	1	E. Operator 2	$45.95	35.1	Off	21.5	31	36.5	$209.15	$52.00	$88.61	$32.24	$17.29	$19.01	
E.05.2	CAT 385	3rd Party	$174.72	$64.35	$239.07	1	E. Operator 2	$45.95	83.0	Off	45.5	65	74.5	$368.60	$52.00	$185.03	$67.60	$30.46	$33.51	
	Graders																			
E.06.1	CAT 140M (Class 6 - 200-248 FWHP)	3rd Party	$74.51	$16.09	$90.60	1	E. Operator 2	$45.95	13.6	Off	10.35	16.25	24.2	$178.85	$52.00	$78.91	$16.90	$14.78	$16.26	10% grader attachment allowance added.
E.06.2	CAT 16M (Class 7 - 250-300 FWHP)	3rd Party	$79.45	$22.47	$101.93	1	E. Operator 2	$45.95	24.7	Off	14.7	22.7	37.25	$193.30	$52.00	$84.14	$23.61	$15.98	$17.57	10% grader attachment allowance added.
	Haul Trucks																			
E.07.1	Std Tandem Haul Truck (12 yd3)	3rd Party	$18.60	$11.88	$30.48	1	Truck Driver 1	$45.39	n/a	On	8.04	12	15.96	$101.85	$52.00	$19.69	$12.48	$8.42	$9.26	Fuel Consumption source: http://www.equipmentworld.com/owning-and-operating-costs-8/ (3.2 gal/hr for short hauls
E.07.2	CAT 735	3rd Party	$92.18	$26.68	$118.86	1	Truck Driver 1	$45.39	29.9	Off	16.55	26.95	37.35	$214.95	$52.00	$97.62	$28.03	$17.76	$19.54	
E.07.3	CAT 769D	3rd Party	$81.28	$35.34	$116.62	1	Truck Driver 1	$45.39	35.4	Off	25.5	35.7	45.9	$212.00	$52.00	$86.08	$37.13	$17.52	$19.27	
E.07.4	CAT 773G	3rd Party	$145.04	$50.29	$195.33	1	Truck Driver 1	$45.39	45.0	Off	36.25	50.8	65.35	$312.70	$52.00	$153.60	$52.83	$25.84	$28.43	
E.07.5	CAT 777D	3rd Party	$159.64	$64.99	$224.63	1	Truck Driver 1	$45.39	72.6	Off	46.85	65.65	84.4	$350.10	$52.00	$169.06	$68.28	$28.93	$31.83	
	Lifting																			
E.08.1	Hydraulic Crane, 30Ton	3rd Party	$83.47	$6.19	$89.66	1	E. Operator 1	$50.82	30.0	Off	4.19	6.25	8.31	$177.75	$52.00	$88.40	$6.50	$14.69	$16.16	Med. Fuel consumption rate estimated from CostMine 2015
	Loaders																			
E.09.1	CAT 950H	3rd Party	$61.81	$12.92	$74.73	1	E. Operator 2	$45.95	18.3	Off	9.65	13.05	16.6	$158.55	$52.00	$65.46	$13.57	$13.10	$14.41	
E.09.2	CAT 990	3rd Party	$104.20	$64.60	$168.79	1	E. Operator 2	$45.95	77.8	Off	50	65.25	84.75	$278.55	$52.00	$110.35	$67.86	$23.02	$25.32	
	Support Vehicles																			
E.10.1	Concrete Transit Mix Truck	3rd Party	$30.17	$11.19	$41.36	1	Labourer	$37.25	n/a	On	7.54	11.3	15.03	$115.80	$52.00	$31.95	$11.75	$9.57	$10.53	Med. Fuel consumption from NRCA (http://www.nrmca.org/operations/documents/2012fleetsurveyfinal repot.pdf)
E.10.2	Fuel Truck	3rd Party	$7.76	$9.54	$17.31	1	Equip. Servicer	$45.95	n/a	On	6.43	9.64	12.82	$85.00	$52.00	$8.22	$10.03	$7.02	$7.73	Med. Fuel consumption from CostMine2015 (mobile field fuel/lube truck)
E.10.3	Highway, Line Truck, with Aerial Platform	3rd Party	$62.90	$12.38	$75.27	1	Trade Labour	$54.00	n/a	On	8.34	12.5	16.63	$159.25	$52.00	$66.61	$13.00	$13.16	$14.48	Med. Fuel consumption from CostMine2015 (Flatbed truck)
E.10.4	Highway Service/Flatbed Truck (HIAB) 5 ton	3rd Party	$28.21	$12.38	$40.59	1	Equip. Servicer	$45.95	n/a	On	8.34	12.5	16.63	$114.80	$52.00	$29.88	$13.00	$9.49	$10.44	Med. Fuel consumption from CostMine2015 (Flatbed truck)
E.10.5	Lowbed Tractor/Trailer - 5 Axle (25 tonnes)	3rd Party	$36.15	$11.88	$48.03	1	Truck Driver 1	$45.39	n/a	Off	8.00	12	15.96	$124.35	$52.00	$38.29	$12.48	$10.28	$11.30	Fuel consumption estimated
E.10.6	Lowbed Tractor Trailer - 6 Axle (33 tonnes)	3rd Party	$42.65	$14.85	$57.50	1	Truck Driver 1	$45.39	n/a	Off	10.01	15	19.95	$136.45	$52.00	$45.17	$15.60	$11.28	$12.40	Fuel consumption estimated
E.10.7	Lowbed Tractor Trailer - 7 Axle (41 tonnes)	3rd Party	$57.79	$14.85	$72.64	1	Truck Driver 1	$45.39	n/a	Off	10.01	15	19.95	$155.85	$52.00	$61.20	$15.60	$12.88	$14.17	Fuel consumption estimated
E.10.8	Lowbed Tractor Trailer - 8 Axle (48 tonnes)	3rd Party	$60.48	$14.85	$75.33	1	Truck Driver 1	$45.39	n/a	Off	10.01	15	19.95	$159.30	$52.00	$64.05	$15.60	$13.17	$14.48	Fuel consumption estimated
E.10.9	Pick-up Truck (1.5T) 4x4	3rd Party	$8.59	$4.95	$13.54	0		$0.00	n/a	On	3	5	10	$17.30	$0.00	$9.10	$5.20	$1.43	$1.57	Fuel consumption rate estimated
E.10.10	Pilot Vehicle	3rd Party	$12.32	$4.95	$17.27	1	Labourer	$37.25	n/a	On	3	5	10	$85.00	$52.00	$13.05	$5.20	$7.02	$7.73	Fuel consumption rate estimated; BCBlueBook operator rate reduced to obtain a bare rate to match BlueBook rate
E.10.12	Water Truck (5,000 gal)	3rd Party	$23.79	$22.37	$46.17	1	Truck Driver 1	$45.39	n/a	Off	15.07	22.6	30.06	$121.85	$52.00	$25.20	$23.50	$10.07	$11.08	Med. Fuel consumption from CostMine2015 (5,000gel water truck)

Notes:
1 Fuel consumption obtained from the Caterpillar Performance Handbook Version 42.
2 All-found BC Blue Book rate excludes the fuel adjustment factor
3 Equipment weights from Caterpillar Performance Handbook Version 35; values of n/a means the equipment would be driven to site/towed by an pick-up.

	Misc. Equipment and Attachments	Unit	Equipment Rate ($/Unit)	Fuel Rate ($/Unit)	Total Equipment Rate ($/Unit)	Number of Operators	Operator Type	Operator Rate ($/hr)	Shipping Weight (tonnes)	Source
E.11.1	ATV (4 wheel)	month	$1,427.95	$20.00	$1,447.95	0		$0.00	0.3	BC Blue Book 2020-21; fuel rate estimated
E.11.2	Boomlift: 60' articulating	hr	$54.15	$5.00	$59.15	0		$0.00	10.0	United rental 2020; fuel rate estimated
E.11.3	Soil auger (Truck mounted	hr	$48.75	$0.00	$48.75	0		$0.00	n/a	Home Depot (2020)
E.11.4	Bus: Passenger Bus (24 person cap.)	month	$1,411.20	$900.00	$2,311.20	0		$0.00	n/a	BC Blue Book 2020-21; fuel rate estimated
E.11.5	Butt-fusion welding machine	hr	$69.67	$17.42	$87.09	0		$0.00	n/a	RSMeans2020; fuel rate estimated
E.11.6	Cleaning Equipment - High pressure washer	hr	$16.65	$2.00	$18.65	0		$0.00	n/a	BC Blue Book 2020-21; fuel rate estimated, 2,000 gallons, includes 3 wands
E.11.7	Crusher (200 Tons/hr)	hr	$343.00	$35.00	$378.00	1	E. Operator 2	$45.95	25.0	Nova Scotia Road Builder Association, 2017, fuel rate estimated, adjusted to 2020 dollars.
E.11.8	Demolition shears (excavator attach.)	hr	$150.00	$0.00	$150.00	0		$0.00	7.0	Estimated; S390 (fits CAT 365-385)
E.11.9	Demolition grapples (excavator attach.)	hr	$21.00	$0.00	$21.00	0		$0.00	7.0	Estimated; G330 (fits CAT 345-365
E.11.10	Emergency Transport Vehicle	Month	$5,208.00	$10.00	$5,218.00	0		$0.00	n/a	BC Blue Book 2020-21; fuel rate estimated
E.11.11	Helicopter	hr	$1,500.00	$131.96	$1,631.96	1	Trade Labour	$54.00	n/a	Estimated from past project (2020)
E.11.12	Hydraulic hammer (excavator attachment)	hr	$91.05	$0.00	$91.05	0		$0.00	4.0	BC Blue Book 2020-21; 2,500 kg energy class
E.11.13	Hydraulic plate tamper (excavator attach.)	hr	$14.10	$0.00	$14.10	0		$0.00	3.0	BC Blue Book 2020-21; 454-680kg
E.11.14	Hydroseed Truck	hr	$55.00	$16.25	$71.25	0		$0.00	n/a	BC Blue Book 2020-21; 3,000gal water truck with highpressure spray nozzle
E.11.15	Light towers	month	$1,708.40	$280.67	$1,989.07	0		$0.00	1.0	BC Blue Book 2020-21; telescopic trailor mounted, multi-vaor light (3kV); (fuel assumes used average 5 hrs per day)
E.11.16	Power mulcher, (20 ton/hr, 115 HP	hr	$29.19	$24.33	$53.52	0		$0.00	n/a	RSMeans 2020 (015433202860)
E.11.17	Pump: mud pump 6 in discharge	hr	$28.42	$2.00	$30.42	0		$0.00	n/a	BC Blue Book 2020-21; fuel rate estimated; includes 100ft of intake hose, and 100ft of discharge hose
E.11.18	Screener (finley 583) (~400tonnes/hr)	hr	$214.22	$40.00	$254.22	1	E. Operator 2	$45.95	75.0	Nova Scotia Road Builder Association, 2012, fuel rate estimated, adjusted to 2020 dollars.
E.11.19	Spreader (for reveg appliction)	hr	$9.20	$0.00	$9.20	0		$0.00	n/a	BC Blue Book 2020-21; based on "hopper sander' for truck attachments
E.11.20	Welding outfit (truck mounted) - 400 amps	hr	$18.34	$0.00	$18.34	0		$0.00	n/a	RSMeans 2020 (050521900020) added 15%
E.11.21	XRF rental	month	$4,875.00	$0.00	$4,875.00	0		$0.00	n/a	Quote: EON products inc (2020)

Worksheet 19 - Material Rates and Indirect Cost Inputs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MATERIAL RATES

Sources and Adjustment Factors

RSMeans Source: RSMeans Online (2020)
Costmine:
Notes:
1 All RSMeans material costs are in CAD and have been adjusted for location (Whitehorse).
2 Inflation factors applied as required based on the Bank of Canada CPI calculator to 2020 dollars (dec. 31 2019/Jan2020)
3 1.15 Factor applied to material quotes obtained south of 60 to account for shipping (10%) and sales taxes (5%).
4 1.10 Factor applied to mateiral quotes from RSMeans (FOB Whitehorse) to account for shipping (5%) and sales taxes (5%)
5 1.00 Material unit rate adjustor toggle (for sensitivity analysis)

Cost Code	Item	Unit Cost	Unit	Additional Details	Source
M.01	Bitumen Geomembrane (BGM) Liner	$20.81	m2		Quote: Skookum, 2018 for other Yukon project; material rate adjusted such that installed c
M.02	Concrete: elevated slabs	$664.62	m3	Includes forms, grade 60 rebar, concrete, pla	RSMeans2020 (33053401900)
M.03	Erosion control mats (jute mesh), 4' wide	$1.54	m2		RSMeans2020 (312515160020)
M.04	Fertilizer	$1.29	kg		RSMeans2020 (329219147000)
M.05	Fertilizer tablets (for tree-planting)	$0.09			Quote: Pickseed (Prince George), 2014; factor of 15% applied for shipment to site,
M.06	Formwork: curb forms, wood, 12" high, on grade, 1 use	$34.28	m2	Unit is m2 contact area	RSMeans2020 (31113.65.2000)
M.07	Geosynthetic Clay Liner	$11.28	m2		Quote: Nilex Vancouver 15% added for shipment to site
M.08	Geotextile	$2.68	m2		RSMeans2020 (313219161510)
M.09	HDPE liner (60mil)	$13.70	m2		RSMeans2020 (310519531200)
M.10	HDPE pipe: 100mm	$20.48	m	Butt fusion joints, 40'length, SDR 21	RSMeans2020 (33 11 13-350-100)
M.11	HDPE pipe: 150mm	$44.46	m	Butt fusion joints, 40'length, SDR 21	RSMeans2020 (33 11 13-350-200)
M.12	HDPE pipe: 300mm	$126.53	m	Butt fusion joints, 40'length, SDR 21	RSMeans2020 (33 11 13-350-500)
M.13	Intake Structure: precast concrete panel wall	$38,850	each		Quote : Precon (2017) FOB Edmonton. Adjusted 15% for shipment
M.14	Lab testing: Hydrocarbons	$146	each		Quote: ALS (2018) plus 15%
M.15	Lab testing: SAL metals + pH (BC CSR package)	$150	each		Quote: ALS (2018) plus 15% - ABA/Metals package
M.16	Mulch (for hydroseeding)	$1.09	kg		Quote: Pickseed (Prince George), 2014; factor of 15% applied for shipment to site
M.17	Rebar (#6 bar)	$5.03	m		RSMeans2020 (032111600400) , (#6 bar = 1.5 lbs per foot)
M.18	Seed/Fertilizer Mix 1: Dry mix	$17.06	kg		Pickseed (2015) onsite cost
M.19	Seed/Fertilizer Mix 2: Wet area mix	$19.08	kg		Access (2014) Closure Plan
M.20	Signage: Open Pit Warning signs (incl. posts)	$232.08	each		Includes concrete, post and sign
M.21	Signage: Large warning signs at entries (incl. posts)	$827.13	each		Assumed to be 3 times open pit signs.
M.22	Silt Fencing (3ft high)	$1.85	m		RSMeans2020 (31251416100),
M.23	Steel Beam: I-Beam W6x9	$64.45	m		RSMeans2020 (051223750100)
M.24	Steel decking (floor decking):	$43.74	m2		RSMeans2020 (53113505700)
M.25	Cast iron vent piping: 6"	$175.22	m		RSMeans2020 (221316202200)
M.26	Tackifier (for hydroseeding)	$3.95	kg		Quote: Pickseed (Prince George), 2014; factor of 15% applied for shipment to site
M.27	Wetland planting	$1,216.54	ha		EPA, 1997. Costs for Wetland Creation and Restoration Projects in the Glaciated Northeast. Average cost adjusted up by 37% for location factor, 15% for shippin
M.28	Tree seedlings	$1.10	stem		Source Another Yukon Project (2018), updated from inflation

INDIRECT COSTS

Cost Code	Category	Rate Used in Estimate	Unit		Source/Comments
I.01	Barge Operating Costs	$10,939	month		Based on Minto site costs ($36,800/month) (2018), assumes is required 20 hours per week (down from existing 70hrs per week)
I.02	Bonding	3.0%	%	of direct costs	Past Project (2014)
I.03	Camp Operation Costs	$80	$/day/person	includes catering and housekeeping	Estimated; Note: this rate is higher than the exisitng camp cost and is conservatively estimated to account for the smaller camp size during closure/post-closure.
I.04	Camp power and heating costs	$3,500	month		Typical 2015 monthly cost between May and Oct 2015, and halved under assumption that only 1/2 of camp is required.
I.05	Communications	$1,000	month		Estimated
I.06	Contract Administration	5%	%	Of Direct and other indirect costs	
I.07	Contractor Profit	10%	%	Of Direct and other indirect costs	
I.08	Contingency	12%	%		
I.09	Engineering, Design, and Construction Plans	5%	%		allowance
I.10	Flight - Whitehorse-Minto Return	$3,000	ea		
I.11	Helicopter trip Carmacks-Minto Return	$3,000	ea		Based on site costs, assumes 2 hrs helicoptor time.
I.12	Freight	0%	%	Included in material costs	
I.13	Taxes	0%	%	Included in material costs	
I.14	Insurance	1.5%	%	Of labour costs	
I.15	Laboratory/Material Testing	$1,000	month		Estimated
I.16	Misc. Admin Supplies	$500	month		Estimated
I.17	Office Supplies	$1,000	month		Estimated

Worksheet 20 - Task Unit Rate Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

Cost Code	Item	Unit	Rates: Total Unit Cost	Manhours per Unit (hrs/Unit)	Labor Cost Per Unit ($/Unit)	Equipment Cost Per Unit ($/Unit)	Fuel Cost Per Unit ($/Unit)	Material Cost Per Unit ($/Unit)	Productivity: Productivity (unit/hr)	Productivity/Crew/Fleet Source (RSMeans line item)
Demolition/Equipment Removal										
C.1.01	Concrete foundations: break in place	m2	**$14.43**	0.081	$2.47	$9.40	$2.56	$0.00	37	RSMeans (02 41 6.17-0400)
C.1.02	Decontamination: Metal cleaning treatment, pressure washing	tonne	**$4.01**	0.072	$2.67	$1.19	$0.14	$0.00	13.94	RSMeans (050110516215)
C.1.03	Decontamination: Concrete cleaning treatment, pressure washing	m2	**$0.48**	0.009	$0.32	$0.14	$0.02	$0.00	116.13	RSMeans (050110516215)
C.1.04	Decontamination: General pressure washing	hrs	**$55.90**	1.000	$37.25	$16.65	$2.00	$0.00	1.00	n/a
C.1.05	Demolition: Structural, steel	tonne	**$246.56**	2.000	$71.87	$139.79	$34.90	$0.00	5.0	Assumes average 50ton/shift (see right)
C.1.06	Demolition: Structural, concrete	m3	**$96.19**	0.538	$16.48	$62.67	$17.04	$0.00	5.58	Based on foundation demolition, assu
C.1.07	Demolition: selective misc. demolition (wood)	m3	**$6.74**	0.099	$3.90	$2.07	$0.76	$0.00	40.38	RSMeans (24119180500)
C.1.08	Demolition: Small wooden buildings (non selective demo)	m3	**$5.19**	0.076	$3.01	$1.60	$0.59	$0.00	52.39	RSMeans (24116130700)
C.1.09	Disconnect services	hrs	**$104.78**	3.000	$91.24	$8.59	$4.95	$0.00	1.00	n/a
C.1.10	Electrical demolition: remove conduits (incl. fittings/hangers)	km	**$3,808.14**	68.957	$2,731.94	$816.44	$259.77	$0.00	0.20	Based in RSMeans (337139130150_
C.1.11	Electrical demolition: remove powerpoles	each	**$552.49**	9.143	$437.79	$95.85	$18.86	$0.00	0.66	Based in RSMeans (337116335140)
C.1.12	Electrical demolition: remove transformers	each	**$1,287.99**	23.323	$924.00	$276.14	$87.86	$0.00	0.58	Based in RSMeans (337323201200)
C.1.13	Equipment removal: Small equip., dismantle, prep for transport	hrs	**$308.32**	4.000	$174.43	$115.96	$17.92	$0.00	1	n/a
C.1.14	Equipment removal: Small equip., dismantle, prep for transport	hrs	**$502.79**	6.000	$279.25	$199.44	$24.11	$0.00	1	n/a
C.1.15	HDPE Liner: cut and fold	m2	**$0.72**	0.012	$0.45	$0.19	$0.07	$0.00	430	Assumes can be removed 20 times q
C.1.16	HDPE pipe demolition - 0.75 to 4 inches (19-100 mm)	m	**$5.33**	0.112	$5.33	$0.00	$0.00	$0.00	27	RSMeans2005 (02 41 13.38-1600)
C.1.17	HDPE pipe demolition - 6 to 8 inches (150-200 mm)	m	**$7.46**	0.157	$7.46	$0.00	$0.00	$0.00	19	RSMeans2005 (02 41 13.38-1700)
C.1.18	HDPE pipe demolition - 10 to 18 inches (250-450 mm)	m	**$12.43**	0.262	$12.43	$0.00	$0.00	$0.00	11	RSMeans2005 (02 41 13.38-1800)
C.1.19	HDPE pipe demolition - 20 to 36 inches (500-915 mm)	m	**$18.64**	0.394	$18.64	$0.00	$0.00	$0.00	8	RSMeans2005 (02 41 13.38-1900)
C.1.20	Modular Buildings: dismantle and load for transport	each	**$1,804.21**	19.500	$881.68	$750.86	$171.67	$0.00	0.33	Assumes 1 every 3 hours
C.1.21	Pipelines: flushing	each	**$209.63**	4.000	$209.63	$0.00	$0.00	$0.00	0.5	Assumes 2hrs to flush 1 line
C.1.22	Reagents: Load for transport off-site	hrs	**$298.06**	4.000	$165.83	$104.46	$27.77	$0.00	1.0	n/a
C.1.23	Reclaim pump systems: Dismantle and prep for transport	each	**$1,344.18**	26.400	$1,246.77	$67.71	$29.70	$0.00	0.1	Assumed 6hr duration
C.1.24	Tailing system pumps: Dismantle and prep for transport	each	**$672.09**	13.200	$623.39	$33.85	$14.85	$0.00	0.3	RSMeans2005 (16010639)
Earthworks										
C.2.01	Bedding: Produce and stockpile	m3	**$3.72**	0.020	$0.99	$2.29	$0.45	$0.00	148	Based on avg 400tonne/hr screener
C.2.02	Berm: Construct berm (locally sourced, no truck required)	m3	**$1.41**	0.009	$0.43	$0.72	$0.26	$0.00	212	Factored productivity of CAT 330
C.2.03	Clearing land: tree removal by dozer	m2	**$0.85**	0.004	$0.17	$0.54	$0.14	$0.00	263	RSMeans2005(31 13 13.20-0500)
C.2.04	Compact soil with vibratory plate (Hand): 15 cm lifts	Cm3	**$6.76**	0.097	$2.69	$3.00	$1.07	$0.00	30.96	RSMeans2005 (17-03-0508)
C.2.05	Compact soil with roller on flat ground: 15 cm lifts, 4 passes	m2	**$0.08**	0.001	$0.05	$0.03	$0.01	$0.00	1210.54	RSMeans2016 (312323235040)
C.2.06	Compact soil with roller on slopes: 15 cm lifts, 4 passes (one way)	m2	**$0.21**	0.003	$0.12	$0.06	$0.03	$0.00	484.22	Based on flat ground, productivity adjusted by factor of 0.4
C.2.07	Compaction, placement of materials in landfill	m3	**$14.00**	0.043	$1.96	$9.09	$2.94	$0.00	23.47	RSMeans 241191880500
C.2.08	Earthwork repair/maintenance fleet (post-closure)	hrs	**$488.80**	3.000	$136.72	$268.03	$84.05	$0.00	1	n/a
C.2.08	Earthwork repair/maintenance fleet (perpetual maintenance)	hrs	**$628.41**	4.000	$182.67	$337.69	$108.06	$0.00	1	n/a
C.2.09	Erosion Control Mats (Jute mesh), Supply and install	m2	**$2.41**	0.018	$0.69	$0.12	$0.05	$1.54	228	RSMeans2016(312514160020)
C.2.10	Mulch: tree chipping/mulch production	m3	**$11.58**	0.113	$4.68	$5.04	$1.86	$0.00	35.5	Based on 20ton/hr mulcher. See note
C.2.11	Regrading - Rough grading to provide drainage (small areas)	m2	**$2.24**	0.010	$0.46	$1.42	$0.36	$0.00	100	Estimate
C.2.12	Regrading - Rough grading to provide drainage - yards	m2	**$0.45**	0.002	$0.09	$0.28	$0.07	$0.00	500	Estimate
C.2.13	Regrading - Waste Rock Dumps (D10)	hrs	**$328.40**	1.000	$45.95	$213.35	$69.10	$0.00	**1**	n/a
C.2.14	Rip-Rap (rounded, low quality): Screen and Stockpile	m3	**$7.69**	0.000	$1.84	$4.51	$1.34	$0.00	50	Based on 75% productivity of CAT 33
C.2.15	Rip-Rap (angular, high quality): Screen and Stockpile	m3	**$10.98**	0.000	$2.63	$6.44	$1.92	$0.00	35	Based on 50% productivity of CAT 33
C.2.16	Scarification: roads, yards, etc.	m2	**$0.11**	0.000	$0.04	$0.06	$0.01	$0.00	1277	RSMeans2016(32 91 13-2620
C.2.17	Silt fencing: Supply, Install, and remove	m	**$7.68**	0.040	$3.36	$1.91	$0.57	$1.85	50	RSMeans2016 (312514131100)
C.2.18	Surface preparation for liner	m2	**$1.37**	0.034	$1.37	$0.00	$0.00	$0.00	73.125	RSMeans2013 (31 22 16.10-1150)
C.2.19	Underground plug placement with small dozer	hrs	**$139.61**	0.000	$45.95	$69.66	$24.01	$0.00	1	n/a
Environmental Monitoring/Investigations										
C.3.01	Contaminated soil investigation test pits	ea	**$329.63**	0.500	$22.59	$5.03	$3.01	$299.00	**4**	4 per hour
C.3.02	Contaminated soil confirmation testing	ea	**$27.43**	0.167	$7.40	$5.08	$0.00	$14.95	**6**	6 per hour
C.3.03	HC soil test pits	ea	**$323.20**	0.500	$22.59	$5.03	$3.01	$292.57	**4**	4 per hour
C.3.04	Aerate soils in landfarm	event	**$2,304.35**	22.500	$1,016.97	$943.36	$344.03	$0.00	**0.1**	Assumed 10 hours per event (incl. mo
C.3.05	Landfarm confirmation testing	yr	**$2,735.47**	16.000	$722.80	$161.01	$96.23	$1,755.43	**0.125**	Assumed 8 hours for sampling
Groundwater / Piping										
C.4.01	HDPE pipe: 100mm; supplied and installed	m	**$43.63**	0.328	$14.78	$7.56	$0.81	$20.48	**15.2**	RSMeans2016 (33 11 13-350-100)
C.4.02	HDPE pipe: 150mm; supplied and installed	m	**$68.83**	0.345	$15.55	$7.96	$0.85	$44.46	**14.5**	RSMeans2016 (33 11 13-350-200)
C.4.05	HDPE pipe: 300mm, perforated	m	**$162.15**	0.505	$22.73	$11.64	$1.25	$126.53	**9.9**	RSMeans2016 (33 11 13-350-500)
C.4.11	Pump water: small 2" centrifugal pump (100GPM) (small head)	m3	**$0.36**	0.002	$0.08	$0.23	$0.05	$0.00	22	100 gallons per minute
C.4.12	Pump water: large 6" mud pump	m3	**$0.13**	0.000	$0.01	$0.10	$0.01	$0.00	273	1200 gallons per minute
C.4.13	Pump water: operate large 6" mud pump	hr	**$34.14**	0.100	$3.72	$28.42	$2.00	$0.00	1	n/a
C.4.14	Pump water: Set-up pumps hoses, etc.	hr	**$169.27**	4.000	$125.31	$37.01	$6.95	$0.00	1	n/a

Equipment Fleet (Including Operators)

Cost Code	Excavators: CAT 330	CAT 385	CAT430E (4x4)	Haul Trucks: Std Tandem Haul Truck (12	CAT 735	Loader: CAT 950H	Dozers: CAT D6R	CAT D8R	CAT D10T	Compactor: CAT CP563 (Class 7 - 12-	Walk-behind vibrating (30 in)	Grader: CAT 140M (Class 6 - 200-	CAT 16M (Class 7 - 250-	Support Vehicles/Equipment: Hydraulic Crane, 30Ton	Concrete Transit Mix Truck	Highway, Line Truck, with Aerial Platform	Highway Service/Flatbed Truck (HIAB) 5	Lowbed Tractor Trailer - 6 Axle (33 tonnes)	Pick-up Truck (1.5T) 4x4	Demolition shears (excavator	Demolition grapples (excavator	Hydraulic hammer (excavator
C.1.01	1.0	1.0																				1.0
C.1.02																						
C.1.03																						
C.1.04																						
C.1.05		2.0			1.0	1.0								1.0							1.0	1.0
C.1.06	1.0	1.0																				1.0
C.1.07	1.0																					
C.1.08	1.0																					
C.1.09																			1.0			
C.1.10							1.0							0.4		0.2	1.0		2.0			
C.1.11																1.0						
C.1.12							1.0							0.4		0.2	1.0		2.0			
C.1.13						1.0																
C.1.14						1.0								1.0								
C.1.15	1.0																					
C.1.16																						
C.1.17																						
C.1.18																						
C.1.19																						
C.1.20	1.0					1.0								1.0				0.5				
C.1.21																						
C.1.22						1.0												1.0				
C.1.23																	0.3					
C.1.24																	0.3					
C.2.01						2.0																
C.2.02	1.0						1.0															
C.2.03								1.0														
C.2.04	1.0										1.0											
C.2.05										1.0												
C.2.06										1.0												
C.2.07									1.0													
C.2.08	1.0				2.0																	
C.2.08	1.0				2.0		1.0															
C.2.09																	1.0					
C.2.10	0.5				0.5	1.0																
C.2.11								1.0														
C.2.12								1.0														
C.2.13									1.0													
C.2.14	1.0							1.0														
C.2.15	1.0							1.0														
C.2.16												1.0										
C.2.17			1.0									1.0										
C.2.18																						
C.2.19							1.0															
C.3.01			1.0																			
C.3.02																						
C.3.03			1.0																			
C.3.04	1.0																	0.3				
C.3.05			1.0																			
C.4.01																	1.0					
C.4.02																	1.0					
C.4.05																	1.0					
C.4.11																						
C.4.12																						
C.4.13																						
C.4.14																			1.0			

Cost Code	Other: Equip Cost ($/hr)	Fuel Cost ($/hr)	Description	Labour: Environmental Monitor	Foreman	Heavy Equip. Mechanic	Heavy Equip. Servicer	Labourers	Trades Labourer (carpenter	Material Details: Cost Code	Item	Unit Rate	Unit	Multiplier (unit/unit)	Other Comments/Details
C.1.01															Crew B13L
C.1.02	$16.65	$2.00	Cleaning Equipment - High pressure washer					1.0							Based on RSMeans productivity of 15,000ft2/day, assumes avg. thickness of 1cm
C.1.03	$16.65	$2.00	Cleaning Equipment - High pressure washer					1.0							
C.1.04	$16.65	$2.00	Cleaning Equipment - High pressure washer					1.0							
C.1.05					1.0			2.0							based on an average productivity for a XS4000 demolition shear (http://www.terrafirmaequipment.com/images/stories/virtuemart/product/series-ds-&-xs-shears.pdf)
C.1.06															Crew B13L
C.1.07								3.0							Crew B3. (loader sub'ed for an excavator)
C.1.08								3.0							Crew B3. small wood buildings (loader sub'ed for an excavator)
C.1.09								1.0	1.0						
C.1.10					1.0			4.0	4.0						Based on RSMeans for conduit installation. Assumes 3 wires, dismantling is 50% more productive than installation
C.1.11					1.0			2.0	2.0						Based on RSMeans for 60' pole installation. Assumes dismantling is 50% more productive than installation
C.1.12					1.0			4.0	4.0						Based on RSMeans for transformer installation. Assumes dismantling is 50% more productive than installation
C.1.13	$54.15	$5.00	Boomlift					2.0	1.0						
C.1.14	$54.15	$5.00	Boomlift					2.0	2.0						
C.1.15								4.0							
C.1.16					1.0			1.0	1.0						
C.1.17					1.0			1.0	1.0						
C.1.18					1.0			1.0	1.0						
C.1.19					1.0			1.0	1.0						
C.1.20								2.0	1.0						
C.1.21					1.0				1.0						No real basis to task, but cost is expected to be small and insignificant
C.1.22								2.0							No real basis to task, but cost is expected to be small and insignificant
C.1.23					1.0			1.0	1.0						RSMEANS description: Remove pump to 200HP
C.1.24					1.0			1.0	1.0						RSMEANS description: Remove pump to 200HP
C.2.01	$214.22	$40.00	Screen Plant						1.0						Assumes avg. material density of 1,800 km/m3, 50min/hr, and 20% wastage
C.2.02															Berm shaped by excavator, dozer used to push suitable material to excavator
C.2.03															
C.2.04								1.0							
C.2.05								0.5							RSMeans crew: B-10Y
C.2.06								0.5							RSMeans crew: B-10Y
C.2.07															
C.2.08															
C.2.08															
C.2.09								3.0		M.03	Erosion control mats (jute me	$1.54	m2	1.0	
C.2.10	$29.19	$24.33	Power Mulcher					2.0							Applied factors of .833 for job efficiency, and .75 for equipment availability/operator skill.
C.2.11															
C.2.12															
C.2.13															Check that the dozer model matches that used on resloping worksheet
C.2.14															
C.2.15															
C.2.16															
C.2.17								2.0		M.22	Silt Fencing (3ft high)	$1.85	m	1.0	
C.2.18					0.5			2.0							RSMeans = Fine/finish grading, hand grading for slab on grade
C.2.19															
C.3.01				1.0						M.15	Lab testing: SAL metals + pH	$149.50	each	2.0	
C.3.02	$30.47		XRF rental	1.0						M.15	Lab testing: SAL metals + pH	$149.50	each	0.1	Assumes on-site testing using XRF, and 1 out of every 10 samples submitted for laboratory analysis
C.3.03				1.0						M.14	Lab testing: Hydrocarbons	$146.29	each	2.0	
C.3.04				1.0											
C.3.05				1.0						M.14	Lab testing: Hydrocarbons	$146.29	each	12.0	Costs exclude reporting
C.4.01	$87.09		Butt fusion machine		1.0			2.0	1.0	M.10	HDPE pipe: 100mm	$20.48	m	1	Crew B-22A
C.4.02	$87.09		Butt fusion machine		1.0			2.0	1.0	M.11	HDPE pipe: 150mm	$44.46	m	1.0	Crew B-22A
C.4.05	$87.09		Butt fusion machine		1.0			2.0	1.0	M.12	HDPE pipe: 300mm	$126.53	m	1.0	Crew B-22A
C.4.11	$5.00	$1.00	Small 2" pump					0.1							
C.4.12	$28.42	$2.00	6" mud Pump					0.1							
C.4.13	$28.42	$2.00	6" mud Pump					0.1							
C.4.14	$28.42	$2.00	6" mud Pump		1.0			2.0							Estimated crew

			Rates						Productivity		Equipment Fleet (Including Operators)																									Labour						Material Details					
											Excavators			Haul Trucks		Loader	Dozers			Compactor		Grader		Support Vehicles/Equipment									Other														
Cost Code	Item	Unit	Total Unit Cost	Manhours per Unit (hrs/Unit)	Labor Cost Per Unit ($/Unit)	Equipment Cost Per Unit ($/Unit)	Fuel Cost Per Unit ($/Unit)	Material Cost Per Unit ($/Unit)	Productivity (unit/hr)	Productivity/Crew/Fleet Source (RSMeans line item)	CAT 330	CAT 385	CAT430E (4x4)	Std Tandem Haul Truck (12	CAT 735	CAT 950H	CAT D6R	CAT D8R	CAT D10T	CAT CP563 (Class 7 - 12-	Walk-behind vibrating (30 in)	CAT 140M (Class 6 - 200-	CAT 16M (Class 7 - 250-	Hydraulic Crane, 30Ton	Concrete Transit Mix Truck	Highway, Line Truck, with Aerial Platform	Highway Service/Flatbed Truck (HIAB) 5	Lowbed Tractor Trailer - 6 Axle (33 tonnes)	Pick-up Truck (1.5T) 4x4	Demolition shears (excavator	Demolition grapples (excavator	Hydraulic hammer (excavator	Equip Cost ($/hr)	Fuel Cost ($/hr)	Description	Environmental Monitor	Foreman	Heavy Equip. Mechanic	Heavy Equip. Servicer	Labourers	Trades Labourer (carpenter	Cost Code	Item	Unit Rate	Unit	Multiplier (unit/unit)	Other Comments/Details
Materials																																															
C.5.01	BGM Liner: Supplied and Installed	m2	$23.90	0.047	$2.01	$0.79	$0.29	$20.81	105.5	SRK measured productivity (2015)	1.0																													3.0	1.0	M.01	Bitumen Geomembrane (BG	$20.81	m2	1.0	Productivity measured by SRK on a 2015 cover installation project
C.5.07	Geotextile: Supply and Install (large areas, no seaming)	m2	$3.41	0.014	$0.57	$0.10	$0.06	$2.68	211	Assumed 2x value below (assumes no seaming			1.0																											2.0		M.08	Geotextile	$2.68	m2	1.0	
C.5.08	Geotextile: Supply and Install (channels)	m2	$4.13	0.028	$1.14	$0.19	$0.11	$2.68	105.5	Productivity adjusted to match installed quote ($4			1.0																											2.0		M.08	Geotextile	$2.68	m2	1.0	
C.5.09	Geosynthetic Clay Liner: Supplied & Installed	m2	$12.91	0.033	$1.41	$0.13	$0.08	$11.28	150	Estimated from a 2014 quote for a cover installati			1.0																											3.0	1.0	M.07	Geosynthetic Clay Liner	$11.28	m2	1.0	
C.5.10	HDPE liner (60mil): Supplied & Installed (large areas)	m2	$16.01	0.047	$2.01	$0.19	$0.11	$13.70	105.5	Productivity adjusted to match BGM			1.0																											3.0	1.0	M.09	HDPE liner (60mil)	$13.70	m2	1.0	
C.5.11	HDPE liner: Supplied & Installed (channels)	m2	$19.37	0.116	$4.93	$0.47	$0.28	$13.70	43	RSMeans2016(33-47-13.53-1100)			1.0																											3.0	1.0	M.09	HDPE liner (60mil)	$13.70	m2	1.0	
C.5.12	Intake structure: Supply and Install (precast concrete)	each	$50,132.92	140.00	$6,169	$4,391	$723	$38,850	0.05	SRK measured productivity (2011) (2 days)			1.0			1.0								1.0									$54.15	$5.00	Boomlift					3.0	1.0	M.13	Intake Structure: precast con	$38,850	each	1.0	Two days installation
C.5.13	Signage: Open Pit warning signs	each	$303.94	0.928	$41.73	$24.39	$5.74	$232.08	4.3	RSMeans2016(32-31-13.30-6600)																	2.0						$48.75		Auger attachment		1.0			1.0		M.20	Signage: Open Pit Warning s	$232.08	each	1.0	8 foot galvanized steel post set in concrete with a 18"x24" reflective warning sign
C.5.14	Signage: Large signs at main entrance	each	$898.99	0.928	$41.73	$24.39	$5.74	$827.13	4.3	RSMeans2016(32-31-13.30-6600)																	2.0						$48.75		Auger attachment		1.0			1.0		M.21	Signage: Large warning signs	$827.13	each	1.0	8 foot galvanized steel post set in concrete with a 18"x24" reflective warning sign
Revegetation																																															
C.6.01	Seeding/Fertilizing: Tractor Application, Dry seed mix	ha	$2,957.77	33.126	$1,069.47	$556.88	$240.22	$1,091.19	0.060375	RSMeans2016 (32 92 19-14-0100)			1.0																0.5				$9.20		Spreader					0.5		n/a	Seed Mix #1	$1,091.19	ha	1.0	See 'SeedMix' worksheet for seed mix details and application rates
C.6.02	Seeding/Fertilizing: Tractor Application, Wet seed mix	ha	$2,957.77	33.126	$1,069.47	$556.88	$240.22	$1,091.19	0.060375	RSMeans2016 (32 92 19-14-0100)			1.0																0.5				$9.20		Spreader					0.5		n/a	Seed Mix #2	$1,091.19	ha	1.0	See 'SeedMix' worksheet for seed mix details and application rates
C.6.03	Seeding/Fertilizing: Hydroseeding Application, Dry seed mix	ha	$5,525.77	32.292	$1,296.38	$1,070.59	$133.20	$3,025.59	0.0929	RSMeans2016 (32 92 19.14-0200)																	1.0						$71.25		Water truck w/ nozzle					2.0		n/a	Seed Mix #3	$3,025.59	ha	1.0	See 'SeedMix' worksheet for seed mix details and application rates
C.6.04	Seeding/Fertilizing: Hydroseeding Application, Wet Area mix	ha	$5,525.77	32.292	$1,296.38	$1,070.59	$133.20	$3,025.59	0.0929	RSMeans2016 (32 92 19.14-0200)																	1.0						$71.25		Water truck w/ nozzle					2.0		n/a	Seed Mix #4	$3,025.59	ha	1.0	See 'SeedMix' worksheet for seed mix details and application rates
C.6.05	Wetland planting: by hand	ha	$3,313.97	43.750	$1,505.47	$406.33	$185.63	$1,216.54	0.08	Assume 50% productivity as tree planting																	1.0		0.5											2.0		M.27	Wetland planting	$1,216.54	ha	1.0	
C.6.06	Tree planting (1,000 stems/ha)	ha	$3,159.81	51.250	$1,919.72	$35.26	$15.47	$1,189.36	0.16	8 planters, 8hrs/day. WorkSafeBC: avg. tree planter plants 1,600 stems/day																	0.2													8.0		n/a	Tree planting #1	$1,189.36	ha	1.0	See 'SeedMix' worksheet for seed mix details and application rates A pickup truck and 0.2 time for support flatbed truck added to move materials around site
Transportation																																															
C.7.01	Misc. On-site Mobilization/Demobilization	hr	$263.20	2.000	$91.33	$126.32	$45.54	$0.00	1.0000	n/a	1.0																	1.0																			
C.7.02	Off-site disposal to Whitehorse in 6-Axle Semi-Trailer (by weight)	tonne	$42.04	0.400	$18.18	$18.02	$5.84	$0.00	2.8571	Assumes 80% capacity/7 hr travel/offload time						0.1												1.0																			
C.7.03	Off-site Debris disposal to Whitehorse in 6-Axle Semi-Trailer (by volume)	m3	$28.10	0.267	$12.15	$12.04	$3.91	$0.00	4.2745	Assumes 80% capacity/7 hr travel/offload time						0.1												1.0																			
C.7.04	Off-site disposal to Whitehorse in 6-Axle Semi-Trailer (by trip)	trip	$840.90	8.000	$363.66	$360.37	$116.87	$0.00	0.1429	Assumes 7 hr travel/offload time						0.1												1.0																			
C.7.05	Off-site disposal to Whitehorse in 8-Axle Semi-Trailer (by weight)	tonne	$25.25	0.208	$9.57	$12.64	$3.04	$0.00	5.4857	Assumes 80% capacity/7 hr travel/offload time						0.1																	$60.48	$14.85	8 axle lowboy trailer				1.0								
C.7.06	Off-site Debris disposal to Whitehorse in 8-Axle Semi-Trailer (by volume)	m3	$16.88	0.139	$6.40	$8.45	$2.03	$0.00	8.2070	Assumes 80% capacity/7 hr travel/offload time						0.1																	$60.48	$14.85	8 axle lowboy trailer				1.0								
C.7.07	Off-site disposal to Whitehorse in 8-Axle Semi-Trailer (by trip)	trip	$969.64	8.000	$367.57	$485.20	$116.87	$0.00	0.1429	Assumes 7 hr travel/offload time						0.1																	$60.48	$14.85	8 axle lowboy trailer				1.0								
Underground Opening Seals																																															
C.8.01	Excavate to competent soils around perimeter and clean (pressure wash)	m3	$112.62	2.000	$87.22	$18.39	$7.01	$0.00	2	Assumed			1.0																				$16.65	$2.00	quipment - High pressure washer					2.0	1.0						
C.8.02	Structural I-Beams: supply and install	m	$138.60	1.225	$51.78	$16.14	$6.23	$64.45	5.7	RSMeans 51223750100 (see notes)	1.0																		1.0								1.0			1.0	3.0	M.23	Steel Beam: I-Beam W6x9	$64.45	m	1.0	Productivity was reduced by 75% to account for dangerous conditions, and small job
C.8.03	Formwork: concrete ringwall	m2	$353.47	6.408	$319.20	$0.00	$0.00	$34.28	0.6	RSMeans 31113652000 (see notes)																														1.0	3.0	M.06	Formwork: curb forms, wood	$34.28	m2	1.0	Productivity was reduced by 75% to account for dangerous conditions, and small job
C.8.04	Steel decking (q-deck): supply and install	m2	$86.36	0.574	$29.92	$9.76	$2.94	$43.74	10.5	RSMeans 53133506700	1.0																						$18.34	$0.00	utfit (truck mounted) - 400 an		1.0				4.0	M.24	Steel decking (floor decking)	$43.74	m2	1.0	Productivity was reduced by 75% to account for dangerous conditions, and small job
C.8.05	Rebar: supplied and installed	m	$6.34	0.024	$1.31	$0.00	$0.00	$5.03	165	RSMeans 32111600400 (see notes)																															4.0	M.17	Rebar (#6 bar)	$5.03	m	1.0	#6 rebar assumed (1.5 lbs per ft.)
C.8.06	Concrete: Supply and install elevated slab (incl. formwork, rebar)	m3	$1,019.32	7.076	$340.18	$10.93	$3.59	$664.62	3.6744	RSMeans 33053401900															1.0								$10.00	$2.00	Gas Eng. Vibrator		1.0			8.0	16.0	M.02	Concrete: elevated slabs	$664.62	m3	1.0	
C.8.07	Vent raise: supply and install	ea	$719.50	0.500	$18.62	$0.00	$0.00	$700.88	2	assumed																														1.0		M.25	Cast iron vent piping: 6"	$175.22	m	4.0	

Worksheet 21 - Relocation Unit Rates

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate

MINTO EXPLORATIONS A PEMBRIDGE RESOURCES COMPANY
srk consulting

						Unit Rate Summary								Fleet					
Cost Code	Source	Destination	Activities	Material	Costed Volume Unit	Total Unit Rate ($/m^3)	Manhours (hrs/m^3)	Labor Rate ($/m^3)	Equipment Rate ($/m^3)	Fuel Rate ($/m^3)	Productivity (m^3/hr)	Total Dist. (1-way) (km)	Avg. Grade (%)	Excavator	Truck Fleet	Max. # of Trucks	# of Dozers	Dozer Size	Compaction?
R.001	Misc. 1km flat haul w/ Articulated Trucks		Load, haul, dump, spread	Earth, moist	CCM	$5.53	0.03	$1.44	$3.16	$0.93	159	1.0	0.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.002	Misc. 1km flat haul w/ Articulated Trucks w/ compaction		Load, haul, dump, spread, compact	Earth, moist	CCM	$6.06	0.04	$1.67	$3.36	$1.02	159	1.0	0.0%	CAT 330	CAT 735	5	1	CAT D8R	Yes
R.003	Misc. 1km flat haul w/ Large Fleet		Load, haul, dump, spread	Earth, moist	CCM	$2.85	0.01	$0.53	$1.74	$0.59	516	1.0	0.0%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.004	Misc. 1km flat haul w/ Large Fleet		Load, haul, dump, spread	Earth, moist	CCM	$2.85	0.01	$0.53	$1.74	$0.59	516	1.0	0.0%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.005	Airport Laydown	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$6.55	0.04	$1.83	$3.61	$1.11	100	2.4	3.2%	CAT 330	CAT 735	5	0	CAT D8R	No
R.006	Airstrip Area	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$5.49	0.03	$1.53	$3.01	$0.94	89	1.0	0.0%	CAT 330	CAT 735	5	0	CAT D8R	No
R.007	Camp Area	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$7.40	0.05	$2.06	$4.08	$1.25	88	3.1	2.7%	CAT 330	CAT 735	5	0	CAT D8R	No
R.008	Dyno Compound	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$8.62	0.05	$2.40	$4.76	$1.46	76	5.5	-0.5%	CAT 330	CAT 735	5	0	CAT D8R	No
R.009	Fuel Farm Area	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$8.60	0.05	$2.40	$4.74	$1.46	76	3.6	2.3%	CAT 330	CAT 735	5	0	CAT D8R	No
R.010	Fuel Farm Area	Landfarm	Load, haul, dump	Earth, moist	CCM	$8.07	0.05	$2.24	$4.48	$1.35	122	3.6	2.3%	CAT 330	CAT 735	5	0	CAT D8R	No
R.011	IROD Laydown	SWD-High Grade Waste	Load, haul, dump, spread, compact	Sand, dry	CCM	$3.25	0.01	$0.65	$1.95	$0.65	547	1.6	-0.8%	CAT 385	CAT 773G	5	2	CAT D8R	Yes
R.012	Main Pit (SAT)	Main Pit (SAT)	Load, haul, dump	Waste Rock (Minto	CCM	$2.92	0.02	$0.78	$1.61	$0.53	409	0.4	0.0%	CAT 385	CAT 735	3	3	CAT D6R	No
R.013	Main Pit Dump	Main Pit Dump Buttress	Load, haul, dump	Waste Rock (Minto	CCM	$3.19	0.01	$0.60	$1.96	$0.63	456	1.0	-5.0%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.014	Main Pit Dump	Main Pit Tailings Cover	Load, haul, dump, spread	Waste Rock (Minto	CCM	$4.95	0.03	$1.42	$2.69	$0.84	160	1.5	-5.0%	CAT 330	CAT 735	5	1	CAT D6R	No
R.015	Main Waste Dump Extension	Main Pit Access Point	Load, haul, dump, place	Rip-rap (Minto)	CCM	$4.96	0.03	$1.29	$2.84	$0.83	177	1.8	-6.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.016	Main Waste Dump Extension	Area 2 Pit Access point	Load, haul, dump, place	Rip-rap (Minto)	CCM	$4.76	0.03	$1.24	$2.72	$0.80	184	1.6	-6.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.017	Main Waste Dump Extension	Area 118 Pit Access Point	Load, haul, dump, place	Rip-rap (Minto)	CCM	$6.70	0.04	$1.76	$3.82	$1.12	156	3.2	-1.4%	CAT 330	CAT 735	5	1	CAT D8R	No
R.018	Main Waste Dump Extension	W15/Main Pit Channel	Load, haul, dump	Rip-rap (Minto)	CCM	$4.65	0.03	$1.21	$2.66	$0.78	189	1.2	-10.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.019	Main Waste Dump Extension	W15/Main Pit Channel	Load, haul, dump, place	Sand & gravel, dry	CCM	$6.82	0.04	$1.70	$3.98	$1.14	162	1.2	-10.0%	CAT 330	CAT 735	5	2	CAT D8R	No
R.020	Main Waste Dump Extension	Ditch B1 (W35 to Mill area)	Load, haul, dump	Rip-rap (Minto)	CCM	$5.24	0.03	$1.36	$3.00	$0.88	168	2.0	-4.8%	CAT 330	CAT 735	5	1	CAT D8R	No
R.021	Main Waste Dump Extension	Ditch B1 (W35 to Mill area)	Load, haul, dump, place	Sand & gravel, dry	CCM	$7.76	0.04	$1.93	$4.53	$1.29	142	2.0	-4.8%	CAT 330	CAT 735	5	2	CAT D8R	No
R.022	Main Waste Dump Extension	Mill Area	Load, haul, dump	Rip-rap (Minto)	CCM	$6.08	0.04	$1.60	$3.47	$1.02	171	2.1	-5.3%	CAT 330	CAT 735	5	1	CAT D8R	No
R.023	Main Waste Dump Extension	Mill Area	Load, haul, dump, place	Sand & gravel, dry	CCM	$8.88	0.05	$2.24	$5.17	$1.48	142	2.1	-5.3%	CAT 330	CAT 735	5	2	CAT D8R	No
R.024	Main Waste Dump Extension	Minto North	Load, haul, dump	Rip-rap (Minto)	CCM	$4.31	0.02	$1.12	$2.46	$0.72	204	1.1	-5.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.025	Main Waste Dump Extension	MVFE2 (by access road)	Load, haul, dump	Rip-rap (Minto)	CCM	$7.14	0.04	$1.87	$4.07	$1.19	146	2.5	-4.9%	CAT 330	CAT 735	5	1	CAT D8R	No
R.026	Main Waste Dump Extension	MVFE2 (by access road)	Load, haul, dump, place	Sand & gravel, dry	CCM	$9.51	0.05	$2.43	$5.51	$1.58	150	2.5	-4.9%	CAT 330	CAT 735	5	2	CAT D8R	No
R.027	Main Waste Dump Extension	MVFE2 Toe area	Load, haul, dump	Rip-rap (Minto)	CCM	$7.26	0.04	$1.92	$4.13	$1.21	166	2.9	-5.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.028	Main Waste Dump Extension	MVFE2 Toe area	Load, haul, dump, place	Sand & gravel, dry	CCM	$10.50	0.06	$2.68	$6.08	$1.74	136	2.9	-5.0%	CAT 330	CAT 735	5	2	CAT D8R	No
R.029	Main Waste Dump Extension	Main Waste Dump	Load, haul, dump	Rip-rap (Minto)	CCM	$4.42	0.02	$1.13	$2.54	$0.75	161	0.4	-6.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.030	Main Waste Dump Extension	Main Waste Dump	Load, haul, dump	Sand & gravel, dry	CCM	$5.03	0.03	$1.29	$2.89	$0.85	142	0.4	-6.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.031	Main Waste Dump Extension	Southwest Dump	Load, haul, dump	Rip-rap (Minto)	CCM	$5.76	0.03	$1.50	$3.30	$0.97	152	2.0	-3.5%	CAT 330	CAT 735	5	1	CAT D8R	No
R.032	Main Waste Dump Extension	Southwest Dump	Load, haul, dump	Sand & gravel, dry	CCM	$6.10	0.04	$1.60	$3.48	$1.02	171	2.0	-3.5%	CAT 330	CAT 735	5	1	CAT D8R	No
R.033	Main Waste Dump Extension	Reclamation OVB Dump	Load, haul, dump	Rip-rap (Minto)	CCM	$5.52	0.03	$1.43	$3.16	$0.93	159	1.3	1.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.034	Main Waste Dump Extension	Reclamation OVB Dump	Load, haul, dump, place	Sand & gravel, dry	CCM	$6.54	0.04	$1.70	$3.74	$1.10	134	1.3	1.0%	CAT 330	CAT 735	5	1	CAT D8R	No
R.035	Main Waste Dump Extension	Tailings Diversion Ditch	Load, haul, dump	Rip-rap (Minto)	CCM	$8.09	0.05	$2.14	$4.60	$1.34	149	3.3	-4.8%	CAT 330	CAT 735	5	1	CAT D8R	No
R.036	MWD Low Grade Stockpile	Main Pit	Load, haul, dump, spread	Waste Rock (Minto	CCM	$3.10	0.01	$0.58	$1.89	$0.64	474	1.9	-5.4%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.037	Mill Area	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$6.96	0.04	$1.94	$3.84	$1.18	94	3.0	3.1%	CAT 330	CAT 735	5	0	CAT D8R	No
R.038	Mill Area	Landfarm	Load, haul, dump	Waste Rock (Minto	CCM	$5.86	0.04	$1.63	$3.25	$0.99	139	3.0	3.1%	CAT 330	CAT 735	5	0	CAT D8R	No
R.039	Mill Area	Minto South Portal	Load, haul, dump	Waste Rock (Minto	CCM	$6.07	0.03	$1.58	$3.48	$1.02	144	1.6	3.8%	CAT 330	CAT 735	5	1	CAT D8R	No
R.040	Mill Pond	Main Pit	Load, haul, dump	Sand, wet	CCM	$3.38	0.02	$0.95	$1.86	$0.58	144	0.4	5.0%	CAT 330	CAT 735	5	0	CAT D8R	No
R.041	Minto North	MVFE Stage 2	Load, haul, dump, spread	Waste Rock (Minto	CCM	$5.32	0.02	$1.00	$3.25	$1.07	364	4.1	-3.1%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.042	Minto North Portal	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$8.41	0.05	$2.35	$4.64	$1.43	78	5.7	0.2%	CAT 330	CAT 735	5	0	CAT D8R	No
R.043	Minto South Portal	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$7.38	0.05	$2.06	$4.07	$1.25	88	3.2	0.3%	CAT 330	CAT 735	5	0	CAT D8R	No
R.044	Ore Stockpile Area (Mill)	Main Pit	Load, haul, dump, spread	Waste Rock (Minto	CCM	$2.90	0.01	$0.54	$1.77	$0.59	425	1.1	1.5%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.045	Pelly Laydown	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$7.54	0.05	$2.10	$4.16	$1.28	87	4.3	-0.7%	CAT 330	CAT 735	5	0	CAT D8R	No
R.046	Reclamation Ovb. Dump	Camp Area	Load, haul, dump, spread	Earth, moist	CCM	$4.65	0.02	$0.88	$2.84	$0.93	416	2.9	-4.3%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.047	Reclamation Ovb. Dump	Camp Area	Load, haul, dump	Earth, moist	CCM	$4.11	0.02	$0.77	$2.50	$0.85	416	2.9	-4.3%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.048	Reclamation Ovb. Dump	DSTSF	Load, haul, dump, spread	Earth, moist	CCM	$4.70	0.02	$0.89	$2.87	$0.94	412	3.1	-4.2%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.049	Reclamation Ovb. Dump	Fuel Storage Area	Load, haul, dump, spread	Earth, moist	CCM	$4.72	0.02	$0.89	$2.88	$0.95	411	2.7	-3.7%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.050	Reclamation Ovb. Dump	Main Dump	Load, haul, dump, spread	Earth, moist	CCM	$4.52	0.02	$0.85	$2.76	$0.91	429	1.5	2.0%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.051	Reclamation Ovb. Dump	Main Dump	Load, haul, dump	Earth, moist	CCM	$3.99	0.02	$0.74	$2.43	$0.82	429	1.5	2.0%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.052	Reclamation Ovb. Dump	Main Pit	Load, haul, dump, spread	Earth, moist	CCM	$4.32	0.02	$0.81	$2.64	$0.87	448	2.6	-4.8%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.053	Reclamation Ovb. Dump	Main Pit Dump	Load, haul, dump, spread	Earth, moist	CCM	$3.92	0.02	$0.74	$2.40	$0.78	433	1.7	-5.5%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.054	Reclamation Ovb. Dump	Main Pit Dump	Load, haul, dump	Earth, moist	CCM	$3.40	0.01	$0.63	$2.07	$0.70	433	1.7	-5.5%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.055	Reclamation Ovb. Dump	Mill Area	Load, haul, dump, spread	Earth, moist	CCM	$4.40	0.02	$0.83	$2.69	$0.88	441	2.7	-4.8%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.056	Reclamation Ovb. Dump	MVFE Stage 1 and 2	Load, haul, dump, spread	Earth, moist	CCM	$4.93	0.02	$0.93	$3.01	$0.99	393	3.4	-3.8%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.057	Reclamation Ovb. Dump	MVFE Stage 1 and 2	Load, haul, dump	Earth, moist	CCM	$4.36	0.02	$0.81	$2.65	$0.90	393	3.4	-3.8%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.058	Reclamation Ovb. Dump	Pelly Laydown	Load, haul, dump, spread	Earth, moist	CCM	$3.57	0.01	$0.67	$2.18	$0.71	475	1.4	-4.5%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.059	Reclamation Ovb. Dump	Southwest Dump	Load, haul, dump, spread	Earth, moist	CCM	$4.22	0.02	$0.79	$2.58	$0.84	402	1.7	0.2%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.060	Reclamation Ovb. Dump	SWD-High Grade Waste	Load, haul, dump, spread	Earth, moist	CCM	$4.01	0.02	$0.75	$2.45	$0.80	423	1.9	-0.8%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.061	Reclamation Ovb. Dump	SWD-High Grade Waste	Load, haul, dump	Earth, moist	CCM	$3.40	0.01	$0.63	$2.07	$0.70	433	2.0	-1.0%	CAT 385	CAT 773G	5	1	CAT D8R	No

R.062	Reclamation Ovb. Dump	Ridgetop Pit	Load, haul, dump, spread	Earth, moist	CCM	$6.83	0.03	$1.29	$4.18	$1.37	283	4.6	1.5%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.063	Reclamation Ovb. Dump	Ridgetop Waste Dump	Load, haul, dump, spread	Earth, moist	CCM	$6.48	0.03	$1.22	$3.96	$1.30	299	4.0	1.7%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.064	Reclamation Ovb. Dump	Ridgetop Waste Dump	Load, haul, dump	Earth, moist	CCM	$5.73	0.02	$1.07	$3.48	$1.18	299	4.0	1.7%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.065	Reclamation Ovb. Dump	W15 Sump Area	Load, haul, dump, spread	Earth, moist	CCM	$3.69	0.02	$0.69	$2.26	$0.74	460	1.5	-4.8%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.066	Reclamation Ovb. Dump	Tailings Diversion Ditch	Load, haul, dump, spread	Earth, moist	CCM	$5.40	0.02	$1.02	$3.30	$1.08	358	4.1	-3.2%	CAT 385	CAT 773G	5	2	CAT D8R	No
R.067	Reclamation Ovb. Dump	Tailings Diversion Ditch	Load, haul, dump	Earth, moist	CCM	$4.78	0.02	$0.89	$2.91	$0.98	358	4.1	-3.2%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.068	Ridgetop Waste Dump	Ridgetop Pit	Load, haul, dump	Waste Rock (Minto	CCM	$3.21	0.01	$0.60	$1.95	$0.66	459	2.0	-4.4%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.069	SWD-High Grade Waste	Main Pit	Load, haul, dump, spread	Waste Rock (Minto	CCM	$3.69	0.02	$0.69	$2.25	$0.76	399	2.8	-3.7%	CAT 385	CAT 773G	5	1	CAT D8R	No
R.070	W15 Sump	Solid Waste Landfill	Load, haul, dump	Demo Debris	LCM	$7.06	0.04	$1.97	$3.89	$1.20	93	3.7	1.1%	CAT 330	CAT 735	5	0	CAT D8R	No
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EXCAVATION UNIT RATES (NO HAULING)

				Unit Rate Summary						Inputs				
Cost Code	Description	Material	Costed Volume Unit	Total Unit Rate ($/m^3)	Manhours (hrs/m^3)	Labor Rate ($/m^3)	Equipment Rate ($/m^3)	Fuel Rate ($/m^3)	Productivity (m^3/hr)	Excavator	# of Dozers	Dozer Size	Job Condition	Source, Comments/Notes
R.901	Culvert removal, large excavator	Waste Rock (Minto	BCM	$0.93	0.00	$0.15	$0.57	$0.21	305	CAT 385	0	CAT D8R	Avg. (Typical	
R.902	Channel excavation, small excavator, dozer used to spoil locally	Earth, moist	BCM	$2.61	0.02	$0.80	$1.33	$0.48	115	CAT 330	1	CAT D6R	Below Avg.	Below average conditions used to account for channel shaping
R.903	Channel excavation in steep areas, small excavator, dozer used to spoil locally	Earth, moist	BCM	$2.96	0.02	$0.91	$1.51	$0.54	101	CAT 330	1	CAT D6R	Severe	Severe conditions used to account for channel shaping, difficult access
R.904	Channel rip-rap placement	Rip-rap (Minto)	CCM	$1.74	0.01	$0.50	$0.91	$0.33	92	CAT 330	0	CAT D6R	Below Avg.	Below average conditions used to account for channel shaping/placement
R.905	Channel rip-rap placement in difficult access areas	Rip-rap (Minto)	CCM	$3.70	0.02	$1.13	$1.89	$0.68	81	CAT 330	1	CAT D6R	Severe	Severe conditions used to account for channel shaping/placement, dozer added to help
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Notes:

Worksheet 22 - Area Calculations for Covers and Revegetation

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans) \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg

A: Existing Yards, Waste Rock Dumps

	Areas						Reveg Prescription						Calculated Quantities								
Facility	Total 2D Area (pre-regrade) (m2)	2D Slope Area (from 'Regrade' worksheet) (m^2)	3D Slope Area (from 'Regrade' worksheet) (m^2)	Footprint Area increase due to regrading (from 'Regrade' worksheet) (m^2)	3D slope Area override (m^2)	Flat Area (post-regrade) override (m^2)	Flat Area Cover Thickness (m)	Slope Area Cover Thickness (m)	Flat Area Scarified/ Ripped?	Slopes Scarified/ Ripped?	Percentage of flat areas seeded/fertilized	Percentage of sloped Areas seeded/fertilized?	Estimated Flat Area (post-regrade)	3D Sloped Area (m^2)	Scarified flat areas (m^2)	Scarified sloped areas (m^2)	Cover Volume in Flat Areas (m^2)	Cover Volume - Sloped Areas (m^3)	Revegetated Area (ha)	Comments/Notes
Airport Laydown	21,277								Yes		100%		21,277	0	21,277	0	0	0	2.13	
Airstrip	64,378								Yes		100%		64,378	0	64,378	0	0	0	6.44	
Area 118 Backfill Dump	41,899			0			0	0	Yes	Yes	100%	100%	41,899	0	41,899	0	0	0	4.19	
Camp	33,525	17,739	18,699	4,840			0.5	0.5	Yes	Yes	100%	100%	20,626	18,699	20,626	18,699	10,313	9,349	3.93	
Crusher Area	26,964			0	0	26,964	0.5		Yes	Yes	100%	100%	26,964	0	26,964	0	13,482	0	2.70	
DSTSF WR Shell	50,237	51,376	52,957			0	0.5	0.5	Yes	No	100%	100%	0	52,957	0	0	0	26,479	5.30	
DSTSF Tailings Surface	191,561	10,000	10,308			48,000	0.5	0.5	No	No	100%	100%	48,000	10,308	0	0	24,000	5,154	19.16	Assumes areas covered in residuum only require covers. Note: Reveg area formula has been adjusted compared to the other rows so that the entire DSTSF area is included in the reveg area calculation.
Explosive Plant & Storage Areas	55,113						0	0	Yes	No	100%	100%	55,113	0	55,113	0	0	0	5.51	Roads between laydown/storage areas included in 'Roads' worksheet
Fuel Storage Area	8,400						0.5	0	No	No	100%	0%	8,400	0	0	0	4,200	0	0.84	
Ice Rich Overburden Dump	27,583				0		0	0	No	No	100%	100%	27,583	0	0	0	0	0	2.76	
IROD Laydown	23,055	4,949	5,147	0			0	0	Yes	No	100%	100%	18,106	5,147	18,106	0	0	0	2.33	Roads between laydown/storage areas included in 'Roads' worksheet
Main Waste Dump	475,909	205,350	216,458	12,845			0.5	0.5	No	No	100%	100%	283,404	216,458	0	0	141,702	108,229	49.99	
Main Pit Dump	239,401	171,093	180,347	23,107			0.5	0.5	No	No	100%	100%	91,415	180,347	0	0	45,708	90,174	27.18	
Mill Area	42,365						0.5	0.5	Yes	Yes	100%	100%	42,365	0	42,365	0	21,182	0	4.24	
Mill Valley Fill Extension (1 and 2)	171,634				59,852	114,853	0.5	0.5	No	No	100%	100%	114,853	59,852	0	0	57,427	29,926	17.47	
Minto South Portal	105,446	45,406	47,862	2,725			0	0	Yes	No	100%	100%	62,765	47,862	62,765	0	0	0	11.06	
Ore Stockpile Area	139,307				0		0.5		Yes	No	100%	100%	139,307	0	139,307	0	69,653	0	13.93	
Pelly Laydown	51,710						0.5	0.5	Yes	No	100%	100%	51,710	0	51,710	0	25,855	0	5.17	
Reclamation OVB Dump	297,857				0	297,857			No	No	100%	100%	297,857	0	0	0	0	0	29.79	
Ridgetop Exploration Area	34,778				0				Yes	No	100%	100%	34,778	0	34,778	0	0	0	3.48	Assumes 50% of area scarified/reveged.
Ridgetop Waste Dump	286,836	271,319	285,996	28,609			0.5	0.5	No	No	100%	100%	44,126	285,996	0	0	22,063	142,998	33.01	
Ridgetop South Backfill Dump	30,662	28,172	29,696	6,001			0	0	No	No	100%	100%	8,491	29,696	0	0	0	0	3.82	
Southwest Dump	627,621				0		0.5	0.5	No	No	100%	100%	627,621	0	0	0	313,810	0	62.76	Excludes High Grade Waste Stockpile
SWD - High Grade Waste (In-place)	31,165	40,679	41,485	15,430			1	1	No	No	100%	100%	5,915	41,485	0	0	5,915	41,485	4.74	
SWD - High Grade Waste (removed)	31,165						0.5	0.5	No	No	100%	100%	31,165	0	0	0	15,583	0	3.12	
Tailings Diversion Ditch	72,143	34,246	36,099	12,467			0.5	0.5	No	No	100%	100%	50,364	36,099	0	0	25,182	18,049	8.65	
WSP Dam Breach	13,950				13,950	0	0.5	0.5	No	No	100%	100%	0	13,950	0	0	0	6,975	1.40	Cover volume is an allowance: it is unlikely it will be to be placed over a large portion of the dam footprint due to slopes steeper than 2H:1V
W15 Sump Area	12,306	4,235	4,465	1,413			0.5	0.5	Yes	No	100%	100%	9,484	4,465	9,484	0	4,742	2,232	1.39	
TOTAL																	**800,817**	**481,050**	**336**	

Notes:

B: Future Yards, Waste Rock Dumps

	Areas						Reveg Prescription						Calculated Quantities								
Facility	Total 2D Area (pre-regrade) (m^2)	2D Slope Area (from 'Regrade' worksheet) (m^2)	3D Slope Area (from 'Regrade' worksheet) (m^2)	Footprint Area increase due to regrading (from 'Regrade' worksheet) (m^2)	3D slope Area override (m^2)	Flat Area (post-regrade) override (m^2)	Flat Area Cover Thickness (m)	Slope Area Cover Thickness (m)	Flat Area Scarified/ Ripped?	Slopes Scarified/ Ripped?	Percentage of flat areas seeded/fertilized	Percentage of sloped Areas seeded/fertilized?	Estimated Flat Area (post-regrade)	3D Sloped Area (m^2)	Scarified flat areas (m^2)	Scarified sloped areas (m^2)	Cover Volume Flat Areas (m^2)	Cover Sloped Areas (m^3)	Revegetated Area (ha)	Comments/Notes
Area 118 Backfill Dump	68,438	18,405	19,401	0			0	0	Yes	Yes	100%	100%	50,033	19,401	50,033	19,401	0	0	6.94	

C: Complex Covers

	Inputs							Calculated Quantities												
Facility	Flat Area (m^2)	3D Slope Area (from 'Regrade' worksheet) (m^2)	Bedding Layer Thickness (m)	Liner (Y/N)	Geotextile Layers	Protection Layer Thickness (m)	Growth Medium Cover Thickness (m)	Liner Area (m^2)	Geotextile Area (m^2)	Bedding Volume - Flat Areas (m^3)	Bedding Volume - Sloped Areas (m^3)	Total Bedding Volume (m^3)	Protection Layer Volume - Flat Areas (m^3)	Protection Layer Volume - Sloped Areas (m^3)	Total Protection Layer Volume (m^3)	Growth Medium Volume - Flat Areas (m^3)	Growth Medium Volume - Sloped Areas (m^3)	Total Growth Medium Volume (m^3)	Revegetated Area (ha)	Comments/Notes
Main Pit Tailings	17,750			No	0	1	0.5	0	0	0	0	0	17,750	0	17,750	8,875	0	8,875	1.78	Protection layer = waste rock
Ridgetop Tailings	62,477			No	0	1	0.5	0	0	0	0	0	62,477	0	62,477	31,239	0	31,239	6.25	

Worksheet 23 - Demolition Quantity Calculations

Project: Minto Mine Closure Cost Estimate
Project No.: 1CM002.P04
Client: Minto Explorations Ltd.
Date of Submission: August 2016
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

TOTAL DEMOLITION/SOLID WASTE VOLUME FOR SOLID WASTE LANDFILL 10,827 LCM

A: Building Demolition

				Exterior Building Dimensions					Sub-component Measurements						Disposal	Steel Quantity Calcs			Concrete Quantity Calcs		Wood/Misc. Qnty Calcs.		Off-site Transport		On-site Disposal	
No.	**Area**	**Sub Area**	**Sub-component/ Building/ Section**	Building Demolition Type	Length (m)	Width (m)	Height (m)	Modular Building Loads	Material	Wall thickness (m)[1]	# of Exterior Steel Columns	Avg. Ext. Column X-Section Area (m2)	# of Steel Trusses	Average Truss x section area (m2)	Disposal Location	Wall mass (tonnes)	Column and Truss Mass (tonnes)	Total Mass (tonnes)	In-Place Concrete Volume (m3)	Concrete Debris Volume (LCM)	In-Place Demo Volume (m3)	Debris Volume (LCM)	Modular Building Truckloads (Offsite)	Off-site Debris Trips	On-site Demolition Debris Volume (LCM)	**Comments/Notes**
Airport Laydown																										
1	Airport Laydown	Mechanics Shop	Entire building	Steel Building - Small	24.00	25.00	6.00		Steel	0.01					On-site	95.6	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	137	AutoCAD/Photos
2		Covered Storage		Wooden Building - Large	70.00	4.00	2.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	560.0	184.8	0.0	0.0	185	Photos
SUBTOTAL - Airport Laydown																		**96**		**0**	**560**		**0**	**0**	**321**	
Airstrip Area																										
1	Airstrip	Exploration Camp	Camp tents (11)	Wooden Building - Small	44.00	4.00	2.50		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	440.0	145.2	0.0	0.0	145	AutoCAD/Photos (lengths summed to account for 11 structures
2			Exploration core shed 1	Wooden Building - Small	7.50	4.50	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	101.3	33.4	0.0	0.0	33	AutoCAD/Photos
3			Exploration core shed 2	Wooden Building - Small	10.00	4.50	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	135.0	44.6	0.0	0.0	45	AutoCAD/Photos
4			Core Logging Shack	Wooden Building - Small	25.00	6.30	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	472.5	155.9	0.0	0.0	156	AutoCAD/Photos
SUBTOTAL - Airstrip																		**0**		**0**	**1149**		**0**	**0**	**379**	
Camp Area																										
1	Offices	Safety Building	Prefab Bldg. Shell	Steel Building - Small	17.00	18.00	6.00		Steel	0.03					On-site	175.3	0.0	175.3	0.0	0.0	0.0	0.0	0.0	0.0	250	AutoCAD/Photos
2		Mine Offices	Entire building	Wooden Building - Small	50.00	10.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	1500.0	495.0	0.0	0.0	495	AutoCAD/Photos
3	Old Camp Complex	Capstone Building	Entire building	Wooden Building - Small	56.00	9.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	1512.0	499.0	0.0	0.0	499	AutoCAD/Photos
4		Building betw Capstone & Sherwood		Wooden Building - Small	19.00	7.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	399.0	131.7	0.0	0.0	132	AutoCAD/Photos
5		Sherwood Building		Wooden Building - Small	110.00	7.50	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	2475.0	816.8	0.0	0.0	817	AutoCAD/Photos
6		Minto Building		Wooden Building - Small	70.00	7.50	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	1575.0	519.8	0.0	0.0	520	AutoCAD/Photos
7		Dining Hall/Dry		Wooden Building - Small	64.00	9.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	1728.0	570.2	0.0	0.0	570	AutoCAD/Photos
8		Gym/Muster		Wooden Building - Small	16.00	8.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	384.0	126.7	0.0	0.0	127	AutoCAD/Photos
9		Site Services/IT Offices		Wooden Building - Small	28.00	9.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	756.0	249.5	0.0	0.0	249	AutoCAD/Photos
10	North End of Camp	Trailer betw/Minto and Selkirk Tower		Wooden Building - Small	30.00	7.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	630.0	207.9	0.0	0.0	208	AutoCAD/Photos
11		Selkirk Towers		Modular Buildings - Dismantle/Prep				87							Off-site								87.0			Photos
12	Other	Misc. Seacans		Modular Buildings - Dismantle/Prep				5							Off-site								5.0			Photos
SUBTOTAL - Camp Area																		**175**		**0**	**10959**		**92**	**0**	**3867**	
Explosive Plant and Storage Areas																										
1	Explosive Plant	Dyno Compound	Dyno Garage	Steel Building - Small	15.00	15.00	6.00		Steel	0.01					On-site	47.1	0.0	47.1	0.0	0.0	0.0	0.0	0.0	0.0	67	AutoCAD/Photos
2		Dyno office		Modular Buildings - Dismantle/Prep				1							Off-site								1.0			Photos
SUBTOTAL - Explosive Plant and Storage Areas																		**47**		**0**	**0**		**1**	**0**	**67**	
Fuel Farm Area																										
1	Fuel Farm Area	Generators	Sheds	Wooden Building - Small	5.00	5.00	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	75.0	24.8	0.0	0.0	25	AutoCAD/Photos
SUBTOTAL - Fuel Farm Area																		**0**		**0**	**75**		**0**	**0**	**25**	
Mill Area Complex																										
1	Mill Complex	Process Building	Prefab Bldg. Shell	Steel Building - Large	59.76	21.34	15.24		Steel	0.03	20	0.0055914	10	0.0223656	On-site	905.1	52.1	957.2	0.0	0.0	0.0	0.0	0.0	0.0	1367	Drawings: 16-10-001 and 105
2		Concentrator Storage	Bayline 1	Steel Building - Large	30.49	6.71	9.15		Steel	0.03					On-site	213.7	0.0	213.7	0.0	0.0	0.0	0.0	0.0	0.0	305	Drawing 34-14-004
3		Tailings filter building	Prefab Bldg. Shell	Steel Building - Large	36.5854	20	15.24		Steel	0.03					On-site	593.3	0.0	593.3	0.0	0.0	0.0	0.0	0.0	0.0	848	Drawings 35-10-106 and 35-10-104
4		Mill Building	Phase 2 shell	Steel Building - Large	24.3902	14.4817	13.72		Steel	0.03	5	0.0055914	10	0.0223656	On-site	342.9	29.2	372.0	0.0	0.0	0.0	0.0	0.0	0.0	531	Drawings: 16-10-001 and 105
5		Mill Warehouse	Shell	Steel Building - Large	30.4878	24.3902	7.32		Steel	0.03					On-site	373.5	0.0	373.5	0.0	0.0	0.0	0.0	0.0	0.0	534	
6		Assay Lab	Entire building	Wooden Building - Small	17	10	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	510.0	168.3	0.0	0.0	168	
7		Mechanics Shop	Shell	Steel Building - Small	14	20	5.00		Steel	0.03					On-site	149.7	0.0	149.7	0.0	0.0	0.0	0.0	0.0	0.0	214	AutoCAD/Photos
8		Electricians shop	Entire building	Wooden Building - Small	15	10	3.00		Wood/Mixed Debris						On-site	0.0	0.0	0.0	0.0	0.0	450.0	148.5	0.0	0.0	149	AutoCAD/Photos
SUBTOTAL - Mill Area Complex																		**2660**		**0**	**960**		**0**	**0**	**4116**	
Mill Valley Fill Laydown																										
1	Reagent Storage Area		Tent	Wooden Building - Small	25.00	18.00	4.00		Wood/Mixed	0.01					On-site	0.0	0.0	0.0	0.0	0.0	1800.0	594.0	0.0	0.0	594	height negatively adjusted to reduce demo vol.
SUBTOTAL - Mill Valley Fill Laydown																		**0**		**0**	**1800**		**0**	**0**	**594**	
Pelly Laydown and W15 propane farm																										
5	W15 Sump Area	W15 Laydown	7 propane tanks	Modular Buildings - Dismantle/Prep				7							Off-site								7.0			AutoCAD/Photos
SUBTOTAL - Pelly Laydown																		**0**		**0**	**0**		**7**	**0**	**0**	
Water Treatment Plant																										
1	Water Treatment Plant		Prefab Bldg. Shell	Steel Building - Large	46.04	18.29	9.15		Steel	0.01					Off-site	162.5	0.0	162.5	0.0	0.0	0.0	0.0	0.0	3.4	0	
SUBTOTAL - Water Treatment Plant																		**163**		**0**	**0**		**0**	**3**	**0**	

Notes:
1. Internal steel structure/demo debris accounted for in part C
2. Steel wall thickness adjusted to account for airspace, insulation, HVAC debris, etc.
3. Wall areas includes the roof
4. Building debris volume for wooden structures based on FEMA "Debris Estimating Field Guide" FEMA publication No. 329.

B: Concrete Foundations

				Disposal	Exterior Building		Foundation Dimensions					Calculations					
No.	Area	Sub Area	Sub-component/ Building/ Section	Disposal Location	Length (m)	Width (m)	Slab Thickness (m)	Wall Thickness (m)	Wall Height (m)	Requires washing/decontamination?	In-place Concrete Vol. User Override (m3)	In-Place Concrete Volume (m3)	Concrete Debris Volume (m3)	Total Mass (tonnes)	Washing Area (m2)	On-site Demolition Debris Volume (LCM)	Comments/Notes
Camp Area																	
1	Offices	Safety Building	Concrete foundation	Bury-in-place	17	18	0.15	0.25	0.3	No		51.2	86.1	122.8	0.0	0.0	
SUBTOTAL - Camp Area												**51**	**86**	**123**	**0**	**0**	
Mill Area Complex																	
1	Mill Complex	Crusher and Ore Storage	Concrete - Ore Dump	Bury-in-place	12	6	0.3	0.305	1	No		32.6	54.9	78.2	0.0	0.0	
2		Mill Building	phase 1 portion	Bury-in-place	59.7561	21.3415	0.203	0.254	0.3	Yes		271.6	457.4	651.8	1275.3	0.0	Dwg. 16-10-022 and 16--10-001
3		Mill Building	Phase 2 portion	Bury-in-place	24.3902	14.4817	0.203	0.254	0.3	Yes		77.6	130.7	186.3	353.2	0.0	Dwg. 16-10-022 and 16--10-001
4		Mill Building	Compressor/generator area	Bury-in-place	12.1951	10.061	0.203	0.254	0.3	Yes		28.3	47.7	67.9	122.7	0.0	Dwg. 16-10-022 and 16--10-001
5		Concentrate Storage	Concrete foundation	Bury-in-place	73.7805	30.4878	0.3	0.45	2.21037	Yes		882.2	1485.9	2117.4	2249.4	0.0	Dwg. 34-15-001
6		Tailings Filter Building	Concrete foundation	Bury-in-place	36.5854	20	0.3	0.305	0.3	Yes		229.9	387.1	551.7	731.7	0.0	Dwg 35-10-022 and 35-10-101
7		Mill Warehouse	Concrete foundation	Bury-in-place	30.4878	24.3902	0	0.305	0.3	No		10.0	16.9	24.1	0.0	0.0	Dwg. 131-20020-00-C-2001 and 2002
SUBTOTAL - Mill Area Complex												**1532**	**2581**	**3677**	**4732**	**0**	
Mill Valley Fill Laydown																	
1	Reagent storage area	Strip footings		Bury-in-place	25	18	0	0.3	0.3	No		7.7	13.0	18.6	0.0	0.0	AutoCAD/Photos
SUBTOTAL - Mill Valley Fill Laydown												**8**	**13**	**19**	**0**	**0**	
Pelly Laydown																	
1	Pelly Laydown	Washpad		Bury-in-place	15	5	0.3	0	0	No		22.5	37.9	54.0	0.0	0.0	Photos
SUBTOTAL - Pelly Laydown												**23**	**38**	**54**	**0**	**0**	
Water Treatment Plant																	
1	Water Treatment Plant	No foundation present															
SUBTOTAL - Water Treatment Plant												**0**	**0**	**0**	**0**	**0**	

Notes:

1. Regrading of the areas are included in the elsewhere in the estimate.

C: Other Demolition

				Dimensions									Disposal	Demolition Quantities (Manual Calcs)				Transport			
No.	Area	Sub Area	Sub-component/ Building/ Section	Material	Quantity	Length (m)	Width (m)	Area (m^2)	Height/ Thickness (m)	Diameter (m)	Volume (m^3)	Air Factor	Disposal Location	Steel (tonnes)	Concrete In-place volume (m3)	Concrete Debris Volume (LCM)	Misc. Demolition Volume (m3)	Total Mass (tonnes)	Off-site Demolition Debris Trips	On-site Demolition Debris Volume (LCM)	Comments/Notes
Airstrip Area																					
1	Airstrip area	Exploration camp	misc. debris	Wood/Mixed Debris							50	1	On-site				50.0	35.0	0.0	50.0	Allowance based on photos
2		Waste Storage Areas	misc. debris	Wood/Mixed Debris							100	1	On-site				100.0	70.0	0.0	100.0	Allowance based on photos
3			Special waste pole barn	Wood/Mixed Debris		55	5		2.5		687.5	0.33	On-site				226.9	158.8	0.0	226.9	
4				Wood/Mixed Debris		32	2		2.5		160	0.33	On-site				52.8	37.0	0.0	52.8	
5		Storage East of strip	misc. debris	Wood/Mixed Debris							100	1	On-site				100.0	70.0	0.0	100.0	Allowance based on photos
SUBTOTAL - Airstrip Area														**0**	**0**	**0**	**530**	**371**	**0**	**530**	
Camp Area																					
1	Camp area	Utilidors	Mill to Camp	Wood/Mixed Debris		229	1		1		229	0.5	On-site				114.5	80.2	0.0	114.5	
2			East side of camp	Wood/Mixed Debris		181	1		1		181	0.5	On-site				90.5	63.4	0.0	90.5	
3		Covered walkways	Camp to Selkirk towers	Wood/Mixed Debris		55	2		2.5		275	0.33	On-site				90.8	63.5	0.0	90.8	
4			Misc. walkway/corridor allowa	Wood/Mixed Debris		100	2		2.5		500	0.33	On-site				165.0	115.5	0.0	165.0	
5		Smokers area	Building	Wood/Mixed Debris		2.5	2.5		2.5		15.625	0.33	On-site				5.2	3.6	0.0	5.2	
SUBTOTAL - Camp Area														**0**	**0**	**0**	**466**	**326**	**0**	**466**	
Fuel Farm Area																					
1	Fuel Farm Area	Generators	Generator wooden support st	Wood/Mixed Debris	8	6	3		1		18	0.33	On-site				5.9	10.0	0.0	14.3	AutoCAD/Photos
			Misc. piping/electrical condui	Wood/Mixed Debris									On-site				15.0	25.3	0.0	36.1	Allowance
SUBTOTAL - Fuel Farm Area														**0**	**0**	**0**	**21**	**35**	**0**	**50**	
Mill Area Complex																					
1	Crushing & Ore Storage Re	Reclaim Tunnel	Feeder floor, stairs, ladders	Steel									On-site	7				6.8	0.0	9.7	Source Hatch: FS (2006)
2			Grating feeder floor	Steel	1			42	0.01				On-site	3				3.4	0.0	4.8	Source Hatch: FS (2006)
3			Mechanical (liners, conveyor	Steel									On-site	28				28.2	0.0	40.3	Source Hatch: FS (2006)
4		Ore Dump	Concrete components	Concrete	1						44.5		Bury-in-place		44.5	75		0.0	0.0	0.0	Source Hatch: FS (2006)
5		Reclaim area	Concrete components	Concrete	1						329		Bury-in-place		329.0	554		0.0	0.0	0.0	Source Hatch: FS (2006)
6	Mill Area	Mill Building	Process building elevated sla	Concrete									Bury-in-place		96.9	163		0.0	0.0	0.0	Source Hatch: FS (2006)
7			Structural steel platforms	Steel									On-site	108				108.0	0.0	154.3	Source Hatch: FS (2006)
8			Grating	Steel				527.9	0.01				On-site	42				42.5	0.0	60.7	Source Hatch: FS (2006)
9			Q-deck	Steel				690.3	0.001				On-site	6				5.6	0.0	7.9	Source Hatch: FS (2006)
10			Partition walls	Wood/Mixed Debris				130	0.15			0.5	On-site				9.8	16.4	0.0	23.5	Source Hatch: FS (2006)
11			Concrete separation walls	Concrete				408	0.15			1.3	On-site		61.2	79.6		113.4	0.0	162.0	Source Hatch: FS (2006)
12		Concentrate storage area	Coverall structure	Wood/Mixed Debris				2044	0.005		10.21925	10	On-site				102.2	172.1	0.0	245.9	Source Hatch: FS (2006)
13			Metal trusses	Steel	12	39.6341				0.3	33.6	2	On-site				67.2	113.2	0.0	161.8	Estimated based on dwg and photo
14		Grinding circuit	Misc. grinding ancillary equip	Steel	1								On-site	0.7				0.7	0.0	1.0	Source Hatch: FS (2006)
15			Process water tank	Steel	1								On-site	14.0				14.0	0.0	20.0	Source Hatch: FS (2006)
16			Fresh water tank	Steel	1								On-site	4.0				4.0	0.0	5.7	Source Hatch: FS (2006)
17		Flotation circuit	Misc. mechanical equip. stee	Steel									On-site	3.0				3.0	0.0	4.3	Source Hatch: FS (2006) (mostly pump frames
18		Concentrate dewatering	Concentrate Thickener	Steel	1			70.08312	2.13414634	6.097561	2.102494		On-site	16.9				16.9	0.0	24.2	Source Hatch: FS (2006)
19			Misc. mechanical equip. stee	Steel									On-site	5.2				5.2	0.0	7.4	Source Hatch: FS (2006)
20		Tailings Filter building	Concrete components	Concrete	1						313		Bury-in-place		44.5	75		0.0	0.0	0.0	Source Hatch: FS (2006)
21			Filter support steel and platfo	Steel									On-site	102.0				102.0	0.0	145.7	Source Hatch: FS (2006)
22			Q-deck	Steel				28	0.01				On-site	2				2.3	0.0	3.2	Source Hatch: FS (2006)
23			Concrete separation walls	Concrete				112	0.15			1.3	On-site		16.8	21.8		31.1	0.0	44.5	Source Hatch: FS (2006)
24			Architectural walls	Wood/Mixed Debris				100	0.1			0.5	On-site				5.0	8.4	0.0	12.0	Source Hatch: FS (2006)
25			Tanks & misc. mechanical ec	Steel									On-site	36				36.1	0.0	51.5	Source Hatch: FS (2006)
26			Thickener	Steel				205.8692	4.88	9.15	6.176075		On-site	49.7				49.7	0.0	71.0	
27		Reagents	Tanks & misc. mechanical ec	Steel									On-site	1				1.5	0.0	2.1	Source Hatch: FS (2006)
28		Mill building - phase 2	Interior retaining wall	Concrete									Bury-in-place		8.8	15		0.0	0.0	0.0	Source Hatch: FS (2006)
29			Structural steel platforms	Steel									On-site	37.1				37.1	0.0	53.0	Source Hatch: FS (2006)
30			Grating	Steel				696.8	0.01				On-site	56				56.1	0.0	80.1	Source Hatch: FS (2006)
31			Misc. mechanical equip. stee	Steel									On-site	1				1.0	0.0	1.4	Source Hatch: FS (2006)
32			Misc. mechanical equip. stee	Steel									On-site	2				2.4	0.0	3.4	Source Hatch: FS (2006)
33		Electricians shop	Entire building	Wood/Mixed Debris	1	12	10		1.5		180	0.33	On-site				59.4	100.0	0.0	142.9	
SUBTOTAL - Mill Area Complex														**526**	**602**	**983**	**244**	**1081**	**0**	**1544**	

Minto South Portal																					
1	Minto South Portal	Pad A	Misc. small storage areas/co	Wood/Mixed Debris	3	6	3		2		36	0.33	On-site				35.6	24.9	0.0	35.6	Allowance based on photos
2		Pad B	Green tents	Wood/Mixed Debris	2	18	12		5		1080	0.025	On-site				54.0	37.8	0.0	54.0	AutoCAD/Photos
3			Culverts/Debris	Wood/Mixed Debris	1	10	16		1.5		240	0.33	On-site				79.2	55.4	0.0	79.2	Allowance based on photos
4		Pad C	Culverts/Debris	Wood/Mixed Debris	1	37	12		2		888	0.33	On-site				293.0	205.1	0.0	293.0	Allowance based on photos
SUBTOTAL - Pelly Laydown														**0**	**0**	**0**	**462**	**323**	**0**	**462**	
Pelly Laydown																					
1	Pelly Laydown																0.0	0.0	0.0	0.0	
SUBTOTAL - Pelly Laydown														**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Water Treatment Plant																					
1	Water Treatment Plant		Misc. wooden walkways etc.	Wood/Mixed Debris	1												15.0	10.5			Estimated based on site photos.
SUBTOTAL - Water Treatment Plant														**0**	**0**	**0**	**15**	**11**	**0**	**0**	

Notes:
1. Where noted, demolition quantities were taken directly from the Hatch 2006 feasibility study.

D: Equipment and Material Removal

				Dimensions/Measurements									Disassembly/Disposal Details					Calculated Quantities			Transport		
No.	**Area**	**Sub Area**	**Sub-component/ Building/ Section**	Quantity	Length (m)	Width (m)	Height (m)	Diameter (m)	Volume (m3)	Surface Area (m2)	Volume (m3)	Mass of Item (tonnes)	Disposal Location	Requires washing/decontamination?	Crew Size	OVERRIDE - Time to dismantle (hrs)	OVERRIDE - Off-site number of trips	Small Disassembly Crew Time (hrs)	Large Disassembly Crew Time (hrs)	Decontamination Time (hrs)	Off-site Removal Trips	On-site Demolition Debris Volume (LCM)	Comments/Notes
Airport Laydown																							
1	Airport Laydown	Tires			30	3	2				180.00	90.0	Off-site	No	Small	0		0.0	0.0	0.0	1.9	0.0	
		Seacans		1	16.0								Off-site	No	Small	0	0	0.0	0.0	0.0	0.0	0.0	Assumed to be filled other materials and removed.
		Propane tank		1									Off-site	No	Small	2	1.00	2.0	0.0	0.0	1.0	0.0	
		Misc. equipment		1								50.0	On-site	No	Small	0		0.0	0.0	0.0	0.0	71.4	Allowance based on photos
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Airport Laydown																		**2**	**0**	**0**	**3**	**71**	
Airstrip Area																							
1	Airstrip area	Meteorological station		1								0.3	Off-site	No	Small	3		3.0	0.0	0.0	0.01	0.0	
		Land treatment facility	Waste Oil tanker	1								40.0	Off-site	Yes	Small	2	1	2.0	0.0	2.9	1.0	0.0	Mass of item bumped up to increase the decont. Time
		Incinerators	Primary incinerator	1								1.0	Off-site	No	Small	1		1.0	0.0	0.0	0.0	0.0	mass assumed
			Secondary incinerator	1								1.0	Off-site	No	Small	1		1.0	0.0	0.0	0.0	0.0	mass assumed
		Special waste pole barn	Poles	1	30	5	1.5		225			157.5	Off-site	No	Small	0		0.0	0.0	0.0	3.3	0.0	Dimensions/mass assumed based on aerial photos/size of facility
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Airstrip Area																		**7**	**0**	**3**	**4**	**0**	
Camp Area																							
1	Camp Area	Offices	Safety equipment	1									Off-site	No	Small	8	0.25	8.0	0.0	0.0	0.3	0.0	
			Computer/office equipment	1									Off-site	No	Small	16	0.25	16.0	0.0	0.0	0.3	0.0	
			communication equip.	1									Off-site	No	Small	16	0.25	16.0	0.0	0.0	0.3	0.0	
		Camp	kitchen equipment/freezers, e	1									Off-site	No	Small	8	0.25	8.0	0.0	0.0	0.3	0.0	
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Camp Area																		**48**	**0**	**0**	**1**	**0**	
Explosives Plant and Storage Areas																							
1	Explosives Plant/Fueling are	Dyno compound	Fuel tank	1									Off-site	No	Small	2	1	2.0	0.0	0.0	1.0	0.0	Photos
2			Misc. tanks/debris etc.									25.0	On-site	No	Small			33.3	0.0	0.0	0.0	35.7	Allowance based on photos
3			Vertical tank	1									Off-site	No	Small	2	1	2.0	0.0	0.0	1.0	0.0	Photos
4			Explosive Storage	3	12	4	2		96				Off-site	No	Small	0	3	0.0	0.0	0.0	3.0	0.0	
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Explosives Plant and Storage Areas																		**37**	**0**	**0.0**	**5**	**36**	
Fuel Farm Area																							
1	Fuel Farm Area	Generators	Generators	8	5	3	2.5		37.5				Off-site	No	Small	16	2	16.0	0.0	0.0	2.0	0.0	
2		Fueling Area	Northern Steel fuel tanks	4									Off-site	No	Small	4	4	4.0	0.0	0.0	4.0	0.0	
3			Misc. fuel lines/power/piping									2.0	On-site	Yes	Small	4		4.0	0.0	0.1	0.0	2.9	Allowance/photos
4			Diesel tank in NE corner of fa	1			6	3.5					Off-site	No	Large	4	1.00	0.0	4.0	0.0	1.0	0.0	
5			Large tanks	2			12.00	14.5		876.89705	9	141.2	On-site	Yes	Large			0.0	188.2	10.1	0.0	201.7	
SUBTOTAL - Fuel Farm Area																		**24**	**192**	**10.3**	**7**	**205**	
Mill Area Complex																							
1	Crushing & Ore Storage Re	Mobile Crusher/Feeder		1									Off-site	Yes	Small	10	1	10.0	0.0	1.0	1.0	0.0	Assume 1 day to prep for transport
2		Reclaim apron feeder			7.3	0.91	2.44						Off-site	Yes	Small	2	1	2.0	0.0	1.0	1.0	0.0	Dimensions form dwg. 1216002-R1
3		Slewing-Stockpile feed conv	Conveyor 36"x107 feet 40 h	1	51.8	1.0	4.39		227				Off-site	Yes	Large	30	4.2	0.0	30.0	1.0	4.2	0.0	Dimensions form dwg. 1216001-R1
4		SAG Mill Feed	Weightometer	1	3	1	0.6		2				Off-site	Yes	Small	2	0.19	2.0	0.0	1.0	0.2	0.0	Dimensions assumed
5		SAG Mill Feed	Conveyor, 36" x 130 feet	1	39.6	1.0	4.39		174				Off-site	Yes	Large	30	3.5	0.0	30.0	1.0	3.5	0.0	Dimensions form Hatch 2006
6	Mill Building - Phase 1	Mechanical	Small pumps (fire water)	3									Off-site	Yes	Small	1	0.0	1.0	0.0	1.0	0.0	0.0	Hatch (2006)
7		Mechanical	Fire water tank									14.0	On-site	No	Small			18.7	0.0	0.0	0.0	20.0	Hatch (2006)
8		Mechanical	O/H Crane	1									Off-site	Yes	Large	1	0.0	0.0	1.0	1.0	0.0	0.0	Hatch (2006)
9		Mechanical	Dust collector (20HP)	1									Off-site	Yes	Small	1	0.0	1.0	0.0	1.0	0.0	0.0	Hatch (2006)
10	Grinding Circuit - Phase 1	SAG Mill	Sag Mill	1				5.030488				50.0	Off-site	Yes	Large		3.0	0.0	66.7	3.6	3.0	0.0	Scaled from previous project based on diameter
11		Ball Mill Phase 1	10.5' x 12'	1	3.2	3.7						60.0	Off-site	Yes	Large		2.0	0.0	80.0	4.3	2.0	0.0	Scaled from previous project based on diameter
12		Grinding ancillary equip.	Pump box	1								2.0	Off-site	Yes	Small			2.7	0.0	0.1	0.0	0.0	
13			Rubber lining - 6.5'x6.5'x10'	1						27		0.2	On-site	Yes	Small			0.3	0.0	0.0	0.0	0.3	
14			Discharge chutes	2								2.6	On-site	Yes	Small			3.5	0.0	0.2	0.0	3.7	
15			Cyclo-pac 3x15" dia.	1	3.0	4.6	3.05		42.51			8.6	Off-site	Yes	Large			0.0	11.4	0.6	0.2	0.0	pick-up truck factor applied'
16			Cyclone feed pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
17			Sump pump #1	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
18			Pump 8"x6' process water pu	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
19			Pump 1" x 1.5" fresh water pu	2								2.0	Off-site	No	Small	2		2.0	0.0	0.0	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
20	Flotation Circuit - Phase 1	Flotation mechanical equip.	Reclaim/conc feed pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
21			Flotation Area 1 sump pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
22			Floatation cells 15m3	5			3.00	2.523133	15.00	23.779971	0	9.6	On-site	Yes	Large			0.0	12.8	0.7	0.0	13.7	Assumed dimensions and steel thickness
23			Flotation cells (2.8m3)	6			2.00	1.335118	2.80	8.3887937	0	4.1	On-site	Yes	Small			5.4	0.0	0.3	0.0	5.8	
24			Rougher concentrate pump 1	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
25			Concentrate thickener feed p	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
26			Flotation blowers	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
27			Hoist	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
28	Concentrate Dewatering	Mechanical equip.	Filter, 30m2 40 hp	1	4.6	3.7	4.57				77	15.4	Off-site	Yes	Large	16		0.0	16.0	1.1	0.3	0.0	pick-up truck factor applied'
29			Concentrate discharge conve	1	50.0	0.6	2.44						Off-site	Yes	Large	16	2.1	0.0	16.0	1.0	2.1	0.0	
30			Concentrate thickener OF pu	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
31			Concentrate filter feed pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
32			Sump pump, 2" vert 5HP	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
33			Truck scale	1									Off-site	Yes	Large	4	1.0	0.0	4.0	1.0	1.0	0.0	
34	Tailings Filter Building	Mechanical equip.	Tailings pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
35			Process water tank feed pum	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
36			Tailings U/F Pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
37			Belt filter feed pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
38			Belt filter	2	11.0	3.0	6.10						Off-site	Yes	Large	16	2.0	0.0	16.0	1.0	2.0	0.0	

39			Concentrate discharge conve	1	50.0	1.0	2.44						Off-site	Yes	Large	16	2.1	0.0	16.0	1.0	2.1	0.0	
40			Concentrate stockpile feed co	1	50.0	1.0	2.44						Off-site	Yes	Large	16	2.1	0.0	16.0	1.0	2.1	0.0	
41			Haul truck freed conveyor	1	92.3	1.0	2.44						Off-site	Yes	Large	16	3.4	0.0	16.0	1.0	3.4	0.0	
42			Fresh water pumps	2								2.0	Off-site	No	Small	2		2.0	0.0	0.0	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
43			Wash water pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
44			Vacuum pump #1	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
45			Tailings filtrate pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
46			Filter area sump pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
47			Tailings area sump pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
48			Belt filter compressors	2	3.0	3.0	2.44		22.67			9.1	Off-site	Yes	Large			0.0	12.2	0.7	0.2	0.0	
49			Tailings Area Boiler	1	4.6	1.5	1.22		8.50			1.7	Off-site	Yes	Small			2.3	0.0	0.1	0.0	0.0	
50			Boiler feed pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
51			Boiler blower	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
52			Boiler fuel pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
53			Water collection pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
54	Reagents	Mechanical equip.	Metering pumps	11								11.0	Off-site	Yes	Small	11		11.0	0.0	0.8	0.2	0.0	assumed 1 hr for dismantling, 1 tonne each
55			Pax transfer pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
56			Thickener flocculent unit	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
57	Mill Services	Mechanical equip.	Reclaim water pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
58			Mill water Pump	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
59			Mill water Booster Pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
60			Plant air compressors	2	1.8	0.9	0.91		1.53			2.0	Off-site	Yes	Small	2	0.1	2.0	0.0	0.1	0.1	0.0	
61	First fills	Grinding balls	Ball Mill and SAG Mill									184.5	On-site	No	Small			246.0	0.0	0.0	0.0	263.6	
62	Mill Building - Phase 2	Mechanical equip.	O/H Crane Ball Mill area		22.9					0.0055914		1.5	Off-site	Yes	Large			0.0	2.0	0.1	0.0	0.0	Assumed I-beam dimensions for crane rail, plus 0.5 tonnes for crane
63	Grinding Circuit - Phase 2	Mechanical Grinding	Grinding area sump pump#2	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
64			Cyclo-pac 2x26' dia.	1	3.0	4.6	3.05		42.51			8.6	Off-site	Yes	Large			0.0	11.4	0.6	0.2	0.0	pick-up truck factor applied'
65		Grinding ancillary equip.	No. 2 floatation feed sampler	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
66			Pump box	1								2.0	Off-site	Yes	Small			2.7	0.0	0.1	0.0	0.0	
67			SAG discharge pump	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
68			VFD cyclone feed pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
69	Flotation Circuit - Phase 2	Mechanical equip.	Floatation feed pumps	2								2.0	Off-site	Yes	Small	2		2.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
70			Floatation cells 15m3	5			3.00	2.523133	15.00	23.779971	0	9.6	On-site	Yes	Large			0.0	12.8	0.7	0.0	13.7	Assumed dimensions and steel thickness
71			Pump box	1								2.0	Off-site	Yes	Small			2.7	0.0	0.1	0.0	0.0	
72			Sump pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
73			Recleaner tails pump	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
74			Rougher concentrate pump 2	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
75			Floatation cells 100 cu. Ft	4			2.00	1.335118	2.80	8.3887937	0	2.7	On-site	Yes	Small			3.6	0.0	0.2	0.0	3.9	
76	Tailings Deposal - phase 2	Mechanical equip.	Belt filter #3 (90m2 x 3m)	1	18.3	3.0	6.10		334.62			67.3	Off-site	Yes	Large		3.0	0.0	89.8	4.8	3.0	0.0	dwg. 35-10-105; 'pick-up truck factor applied)
77			Fresh water pumps	1								1.0	Off-site	No	Small	1		1.0	0.0	0.0	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
78			Wash water pumps	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
79			Vacuum pump #3	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
80			Tailings filtrate pumps	1								1.0	Off-site	Yes	Small	1		1.0	0.0	0.1	0.0	0.0	assumed 1 hr for dismantling, 1 tonne each
81			Belt filter compressor	1	3.0	3.0	2.44		22.67			4.6	Off-site	Yes	Large			0.0	6.1	0.3	0.1	0.0	pick-up truck factor applied'
SUBTOTAL - Mill Area Complex																		**379**	**466**	**38**	**33**	**325**	
Mill Valley Fill Laydown																							
1	MVF Laydown Area	Grinding media											On-site	No	Small			0.0	0.0	0.0	0.0	0.0	
2		Steel rack	misc.		76.0	2.00	1.00		152			106.4	On-site	No	Small	0		0.0	0.0	0.0	0.0	152.0	
3		Tire racks	Tires		150.0	3.0	1.50		675			472.5	Off-site	No	Small	0		0.0	0.0	0.0	9.8	0.0	
4		Site Services			100	2	1		200			140.0	On-site	No	Small	0		0.0	0.0	0.0	0.0	200.0	
5		Mill Elect			40	2	2.5		200			140.0	On-site	No	Small	0		0.0	0.0	0.0	0.0	200.0	
6		Misc.			50	2	1		100			70.0	On-site	No	Small	0		0.0	0.0	0.0	0.0	100.0	
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Mill Valley Fill Laydown																		**0**	**0**	**0**	**10**	**652**	
Minto South Portal																							
1	Minto South Portal	Pad A	Fuel tank	1									Off-site	No	Small	2	1	2.0	0.0	0.0	1.0	0.0	
2		Pad C	Propane Fuel tanks	2									Off-site	No	Small	4	2	4.0	0.0	0.0	2.0	0.0	
																		0.0	0.0	0.0	0.0	0.0	
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Minto South Portal																		**6**	**0**	**0**	**3**	**0**	
Pelly Laydown																							
1	Pelly Laydown	Tires			30	3	2				180.00	90.0	Off-site	No	Small	0		0.0	0.0	0.0	1.9	0.0	
2		Misc. equipment		1								50.0	On-site	No	Small	0		0.0	0.0	0.0	0.0	71.4	Allowance based on photos
																		0.0	0.0	0.0	0.0	0.0	
SUBTOTAL - Pelly Laydown																		**0**	**0**	**0**	**2**	**71**	
Vent Raises - Area 118																							
1	Area 118	Air Heater	All components	1								44.6	Off-site	No	Small	20	1	20.0	0.0	0.0	1.0	0.0	Dwg. 9057-MGD; Mass of equipment listed on drawings.
2																							
SUBTOTAL - Vent Raises - Area 118																		**20**	**0**	**0**	**1**	**0**	
Water Treatment Plant																							
1	Water Treatment Plant	WTP building	Actifllo clarifier	1	6.85976	2.7439	3.04878		57.39			11.5	Off-site	No	Large		1	0.0	15.4	0.0	1.0	0.0	Dwg. MIN-000-GA-01 and-02; pick-up truck factor applied
2			BQE skid #1	1	9.1	2.62	1.52		36.56			1.5	Off-site	No	Small		1	2.0	0.0	0.0	1.0	0.0	Dwg. MIN-000-GA-01 and-02
3			BQE Skid #2	1	4.6	2.13	2.22		22.05			1.5	Off-site	No	Small		0.5	2.0	0.0	0.0	0.5	0.0	Dwg. MIN-000-GA-01 and-02
4			BQE Skid #3	1	5.9	3.57	2.44		51.75			10.4	Off-site	No	Large		1	0.0	13.9	0.0	1.0	0.0	Dwg. MIN-000-GA-01 and-02
5			BQE Skid #4	1	8.2	3.05	0.91		22.95			1.0	Off-site	No	Small		0.5	1.3	0.0	0.0	0.5	0.0	Dwg. MIN-000-GA-01 and-02
6			RO Skids	2	7.8	1.83	1.50		21.33			8.6	Off-site	No	Small		0.5	11.4	0.0	0.0	0.5	0.0	Dwg. MIN-000-GA-01 and-02
SUBTOTAL - Water Treatment Plant																		**17**	**29**	**0**	**5**	**0**	

Notes:

1. Assumes steel material
2. See disassembly crew details below
3. Time to dismantle includes time to prepare for transport
4. Where noted, demolition quantities were taken directly from the Hatch 2006 feasibility study.
5. HVAC equipment (fans, ducts, heater, etc.) assumed to be part of demo debris and considered as part of the wall thickness in Part A.
6. 'pick-p truck factor' = 20 m3 bulk volume ~ 4 tonnes

Worksheet 24 - Mobilization-Demobilization Calculations

Project:	Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.:	1CM002.044
Client:	Minto Explorations Ltd.
Date of Submission:	Sept. 17, 2020
File Location:	\\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Equipment Mobilization - Year 0

Equipment

		Equipment Input				**Breakdown and Assembly Time (each)**			**Transport Time (each)**							**Calculations**											
Equip. Code	**Equipment**	**Qnty**	Shipping Weight (tonne)	Transport Vehicle 1 (axles)	Transport Vehicle #2 (axles)	Breakdown Time (hrs)	Assembly Time (hrs)	Mechanic Workforce Size	Shipping Origin	Shipping Distance (km)	Average Speed to Barge (km/hr)	Average Speed from Barge to Site (km/hr)	Loading and Off-Loading Time (hrs)	# of Pilot Vehicles required per equip.	Meals/Hotel Allowance ($)	Total Mechanic Hourly Rate ($/hr)	Breakdown-Assembly Cost Per Equip.	Travel Time to Barge (hrs)	Travel Time Barge to Site (hrs)	Total Travel Time (1-way) (hrs)	Equipment Rate	Transport Vehicle 1 Hourly Rate	Transport Vehicle 2 Hourly Rate	Total Transport Cost per Equip.	Total cost Per Equip.	**TOTAL COST**	Comments/Notes
E.03.1	CAT D6R	1	18	5	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$69.66	$93.42	$0.00	$1,752.72	$3,444	$3,444	
E.03.2	CAT D8R	2	38	8	0	4	8	3	Whitehorse	283	80	35	3	2	$50	$211.39	$2,537	4	1.1	5	$141.67	$120.72	$0.00	$3,650.40	$6,187	$12,374	
E.03.3	CAT D10T	2	66	8	5	4	8	3	Whitehorse	283	80	35	3	2	$100	$211.39	$2,537	4	1.1	5	$213.35	$120.72	$93.42	$5,395.67	$7,932	$15,865	
E.05.1	CAT 330	3	35	7	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$83.67	$118.03	$0.00	$2,162.03	$3,853	$11,559	
E.05.2	CAT 385	1	83	8	8	8	16	3	Whitehorse	283	80	35	3	2	$100	$211.39	$5,073	4	1.1	5	$174.72	$120.72	$120.72	$5,435.74	$10,509	$10,509	
E.06.2	CAT 16M (Class 7 - 250-300 FWHP)	1	25	6	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$79.45	$102.89	$0.00	$1,943.84	$3,635	$3,635	
E.07.2	CAT 735	5	30	6	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$92.18	$102.89	$0.00	$2,041.05	$3,732	$18,661	
E.07.4	CAT 773G	5	45	8	5	4	12	3	Whitehorse	283	80	35	3	2	$100	$211.39	$3,382	4	1.1	5	$145.04	$120.72	$93.42	$4,873.64	$8,256	$41,280	
E.08.1	Hydraulic Crane, 30Ton	1	30	7	0	4	4	3	Whitehorse	283	80	35	3	2	$100	$211.39	$1,691	4	1.1	5	$83.47	$118.03	$0.00	$3,222.65	$4,914	$4,914	
E.09.1	CAT 950H	1	18	5	0	4	4	3	Whitehorse	283	80	35	3	0	$100	$211.39	$1,691	4	1.1	5	$61.81	$93.42	$0.00	$1,742.75	$3,434	$3,434	
E.09.2	CAT 990	1	78	8	8	8	16	3	Whitehorse	283	80	35	3	2	$100	$211.39	$5,073	4	1.1	5	$104.20	$120.72	$120.72	$4,896.87	$9,970	$9,970	
E.10.2	Fuel Truck	1	n/a	0	0	0	0	0	Whitehorse	283	80	60	3	0	$100	$0.00	$0	4	0.8	4	$7.76	$46.39	$0.00	$718.74	$719	$719	
E.10.4	Highway Service/Flatbed Truck (HIAB) 5 ton	1	n/a	0	0	0	0	0	Whitehorse	283	80	60	3	0	$100	$0.00	$0	4	0.8	4	$28.21	$46.39	$0.00	$868.41	$868	$868	
E.10.12	Water Truck (5,000 gal)	1	n/a	0	0	0	0	0	Whitehorse	283	80	60	3	0	$100	$0.00	$0	4	0.8	4	$23.79	$46.39	$0.00	$836.08	$836	$836	
E.11.2	Boomlift: 60' articulating	1	10	2	0	0	0	0	Whitehorse	283	80	60	3	0	$100	$0.00	$0	4	0.8	4	$54.15	$38.73	$0.00	$969.16	$969	$969	
E.11.4	Bus: Passenger Bus (24 person cap.)	1	n/a	0	0	0	0	0	Whitehorse	283	80	50	3	0	$100	$0.00	$0	4	0.9	4	$77.04	$45.39	$0.00	$1,229.57	$1,230	$1,230	
E.11.7	Crusher (200 Tons/hr)	1	25	8	8	8	16	3	Whitehorse	283	80	35	3	2	$100	$211.39	$5,073	4	1.1	5	$343.00	$120.72	$120.72	$6,721.66	$11,795	$11,795	
E.11.10	Emergency Transport Vehicle	1	n/a	0	0	0	0	0	Whitehorse	283	80	60	0	0	$0	$0.00	$0	4	0.8	4	$173.60	$45.39	$0.00	$1,142.10	$1,142	$1,142	
E.11.18	Screener (finley 583) (~400tonnes/hr)	1	75	8	8	8	16	3	Whitehorse	283	80	35	3	2	$100	$211.39	$5,073	4	1.1	5	$214.22	$120.72	$120.72	$5,737.60	$10,811	$10,811	
n/a	Misc. Equipment/Supplies	4	#N/A	8	0	0	0	0	Whitehorse	283	80	40	3	0	$100	$0.00	$0	4	1.0	5	$0.00	$120.72	$0.00	$1,582.15	$1,582	$6,329	
TOTAL - Equipment Mobilization Costs																										**$172,403**	

Notes:
1. See Transport vehicle details below for number capacity.
2. Loading and off-loading time is a total (ie. Include both loading and unloading).
3. Calculations include costs for transport vehicles to return to shipping origin.
4. Mob costs for materials are included in the material rates.

B: Equipment Demobilization - End of Post-Closure 2

1. Demobilization assumed to consist of the same equipment assumed in the Year 0 mobilization, EXCEPT for a reduced fleet that is assumed to remain for post closure maintenance/repairs activities.

Equip. Code	**Equipment to remain during post closure**	**Qnty**	**TOTAL MOB COST (from Part A)**
E.03.1	CAT D6R	1	$3,444
E.05.1	CAT 330	1	$3,853
E.07.2	CAT 735	2	$3,732
E.09.1	CAT 950H	1	$3,434
E.06.2	CAT 16M (Class 7 - 250-300 FWHP)	1	$3,635
TOTAL:			**$18,098**

TOTAL Equipment Demobilization Cost at end of Active Closure: **$154,305**

C: Equipment Mobilization - Perpetual Care Year

Equipment

		Equipment Input				**Breakdown and Assembly Time (each)**			**Transport Time (each)**							**Calculations**											
Equip. Code	**Equipment**	**Qnty**	Shipping Weight (kg)	Transport Vehicle 1 (axles)	Transport Vehicle #2 (axles)	Breakdown Time (hrs)	Assembly Time (hrs)	Mechanic Workforce Size	Shipping Origin	Shipping Distance (km)	Average Speed to Barge (km/hr)	Average Speed from Barge to Site (km/hr)	Loading and Off-Loading Time (hrs)	# of Pilot Vehicles required per equip.	Meals/Hotel Allowance ($)	Total Mechanic Hourly Rate ($/hr)	Breakdown-Assembly Cost Per Equip.	Travel Time to Barge (hrs)	Travel Time Barge to Site (hrs)	Total Travel Time (1-way) (hrs)	Equipment Rate	Transport Vehicle 1 Hourly Rate	Transport Vehicle 2 Hourly Rate	Total Transport Cost per Equip.	Total cost Per Equip.	**TOTAL COST**	Comments/Notes
E.03.1	CAT D6R	1	18	5	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$69.66	$93.42	$0.00	$1,752.72	$3,444	$3,444	
E.05.1	CAT 330	1	35	7	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$83.67	$118.03	$0.00	$2,162.03	$3,853	$3,853	
E.07.2	CAT 735	2	30	6	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$92.18	$102.89	$0.00	$2,041.05	$3,732	$7,464	
E.09.1	CAT 950H	1	18	5	0	4	4	3	Whitehorse	283	80	35	3	0	$50	$211.39	$1,691	4	1.1	5	$61.81	$93.42	$0.00	$1,692.75	$3,384	$3,384	
E.10.4	Highway Service/Flatbed Truck (HIAB) 5 ton	1	n/a	0	0	0	0	0	Whitehorse	283	80	60	0	0	$50	$0.00	$0	4	0.8	4	$28.21	$46.39	$0.00	$572.66	$573	$573	
n/a	**MISC. Equipment**	1	#N/A	8	0	0	0	0	Whitehorse	283	80	40	3	0	$50	$0.00	$0	4	1.0	5	$0.00	$120.72	$0.00	$1,532.15	$1,532	$1,532	Fuel tanks, etc.
TOTAL - Equipment Mobilization Costs																										$20,250	

Notes:
1. See Transport vehicle details below for number capacity.
2. Loading and off-loading time is a total (i.e.. Include both loading and unloading).
3. Calculations include costs for transport vehicles to return to shipping origin.

Worksheet 25 - Monitoring Costs

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Subr Sept. 17, 2020
File Locatio \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

Summary of Monitoring Costs Per Event

		Annual Cost Per Phase						
		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	n/a	Comments/Notes
1	Water Quality Monitoring	$115,778	$131,618	$53,168	$28,129	$28,616	$0	
2	Sediment Monitoring	$3,604	$3,604	$3,604	$3,604	$3,604	$0	Assumes samples collected during water quality sampling.
3	Biological Monitoring	$12,944	$12,944	$12,944	$12,944	$12,944	$0	
4	Geotechnical Monitoring	$12,934	$12,934	$12,934	$24,387	$24,387	$0	
5	Revegetation Monitoring	$0	$11,252	$11,252	$11,252	$11,252	$0	
6	Annual Inspection Reporting	$2,516	$2,516	$2,516	$25,700	$25,700	$0	

Monitoring Schedule and Total Cost Summary

1. Year 0 and Peak Scenario

		# of Years						
		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	TOTAL COST	Comments/Notes
1	Water Quality Monitoring	2	3	5	10	9	$1,431,082	
2	Sediment Monitoring	2	3	3	2	9	$68,476	
3	Biological Monitoring	2	3	3	2	9	$245,928	
4	Geotechnical Monitoring	2	3	5	2	9	$397,593	
5	Revegetation Monitoring	0	3	5	2	9	$213,780	
6	Annual Inspection Reporting	2	3	5	2	9	$307,860	

2. EOM Scenario

		# of Years						
		1 - Interim	2 - Active	3 - PC 1	4 - PC 2	5 - Perpetual	TOTAL COST	Comments/Notes
1	Water Quality Monitoring	0	3	5	10	9	$1,199,525	
2	Sediment Monitoring	0	3	3	2	9	$61,268	
3	Biological Monitoring	0	3	3	2	9	$220,041	
4	Geotechnical Monitoring	0	3	5	2	9	$371,726	
5	Revegetation Monitoring	0	3	5	2	9	$213,780	
6	Annual Inspection Reporting	0	3	5	2	9	$302,828	

NOTES:
1. These tables are used as a check to the NPV calculation spreadsheets.

Phase 1 - Annual Monitoring Costs - Prior to Closure

						Unit Rates			Activity Totals					
WBS	Facility/Area	Task	Crew/ Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Material Cost	Labour Cost	Equipment Cost	Cost	Sub-Totals	Source / Comments
M1.1	**Water Quality Monitoring**												$115,778	
M1.1.1		Collect water quality sampling (by onsite staff)	2	ea	144		$44	$14		$12,788	$1,950	$14,738		
M1.1.2		Complete lab testing	640	yr		$150			$96,000			$96,000		test unit rate based on actual site costs.
M1.1.3		Reporting	1	ea	40		$126			$5,040		$5,040		
M1.2	**Sediment Monitoring**												$3,604	
M1.2.1		Collect data/samples	2	ea	0		$44	$14		$0.00	$0.00	$0		
M1.2.2		Laboratory Analysis	2	ea		$290			$580			$580		Test unit rate based on actual costs. (Total metals + contaminates)
M1.2.3		Reporting	1	ls	24		$126			$3,024		$3,024		
M1.3	**Biological Monitoring**												$12,944	
M1.3.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M1.3.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M1.3.3		Collect data/samples	2	ls	8		$126			$2,016		$2,016		
M1.3.4		Laboratory Analysis	10	ea		$270			$2,700			$2,700		Biological test actual costs range from $180 to $270 depending on test type
M1.3.5		Reporting	1	ls	40		$126			$5,040		$5,040		
M1.4	**Geotechnical Monitoring**												$12,934	
M1.4.1.1	Annual Geotech Inspection	Consultant travel - Whitehorse to/from site	1	ls	8.1	$50	$126		$50	$1,019		$1,069		
M1.4.1.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M1.4.1.3		Site Inspection	1	ls	12		$126			$1,512		$1,512		
M1.4.1.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M1.4.2.1	Instrumentation Monitoring	Collect data, plot and review trends	1	ls	96		$44			$4,263		$4,263		
M1.5	**Annual Reclamation Reports**												$2,516	
M1.5.1		Reporting	1	ls	16	$500	$126		$500	$2,016		$2,516		
TOTAL												$147,775	$147,775	

NOTES:
1. Assumes water quality sampling completed by site personnel; Number of test obtained from Table 2-2 in EMSRP
2. Assumes sediment samples collected during water quality sampling.
3. Assumes biological sampling completed by consultants based in Whitehorse, and sampling takes place while barge in place.
4. Assumes geotechnical instrumentation readings collected and plotted by on-site staff.
5. Assumes annual reclamation report compiled by on-site staff whose salary is included in indirect costs; cost included here is for additional consultant review.

Phase 2 - Annual Monitoring Costs - Active Closure

						Unit Rates			Activity Totals					
WBS	Facility/Area	Task	Crew/ Qnty	Unit	Hours	Material Cost ($/unit)	Labour Rate ($/hr)	Equipment Rate ($/hr)	Material Cost	Labour Cost	Equipment Cost	Cost	Sub-Totals	Source / Comments
M2.1	**Water Quality Monitoring**												$131,618	
M2.1.1	Sampling during camp ops.	Collect water quality sampling (by onsite staff)	2	ea	42		$44	$14		$3,730	$1,137.40	$4,867		
M2.2.1	Winter sampling	Helicopter time (5 months)	5	ea	2.25		$50	$1,632		$561	$18,360	$18,921		Helicopter cost based on onsite costs
M2.2.2		Consultant time incl. travel	5	ea	8		$126			$5,040		$5,040		1 consultant
M2.2.3		Car Rental (inc. fuel)	5	days				$350			$1,750	$1,750		
M2.3.1	Lab testing	Complete lab testing	640	ea		$150			$96,000			$96,000		
M2.3.2		Reporting	1	ea	40		$126			$5,040		$5,040		
M2.2	**Sediment Monitoring**												$3,604	
M2.2.1		Collect data/samples	2	ea	0		$44	$14		$0	$0	$0		
M2.2.2		Laboratory Analysis	2	ea		$290			$580			$580		
M2.2.3		Reporting	1	ls	24		$126			$3,024		$3,024		
M2.3	**Biological Monitoring**												$12,944	
M2.3.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M2.3.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M2.3.3		Collect data/samples	2	ls	8		$126			$2,016		$2,016		
M2.3.4		Laboratory Analysis	10	ea		$270			$2,700			$2,700		
M2.3.5		Reporting	1	ls	40		$126			$5,040		$5,040		
M2.4	**Geotechnical Monitoring**												$12,934	
M2.4.1.1	Annual Geotech Inspection	Consultant travel - Whitehorse to/from site	1	ls	8.1	$50	$126		$50	$1,019		$1,069		
M2.4.1.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M2.4.1.3		Site Inspection	1	ls	12		$126			$1,512		$1,512		
M2.4.1.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M2.4.2.1	Instrumentation Monitoring	Collect data, plot and review trends	1	ls	96		$44			$4,263		$4,263		
M2.5	**Reclamation Monitoring**												$11,252	
M2.5.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M2.5.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M2.5.3		Inspect vegetation	2	ls	12		$126			$3,024		$3,024		
M2.5.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M2.6	**Annual Reclamation Reports**												$2,516	
M2.6.1		Reporting	1	ls	16	$500	$126		$500	$2,016		$2,516		
TOTAL												$174,867	$174,867	

NOTES:
1. Assumes water quality sampling completed by site personnel when camp in operation, and by helicopter during the winter months
2. Assumes sediment samples collected during water quality sampling.
3. Assumes biological sampling completed by consultants based in Whitehorse, and sampling takes place while barge in place.
4. Assumes geotechnical instrumentation readings collected and plotted by on-site staff.
5. Assumes annual reclamation report compiled by on-site staff whose salary is included in indirect costs; cost included here is for additional consultant review.

Phase 3 - Annual Monitoring Costs - Post-Closure 1

WBS	Facility/Area	Task	Crew/ Qnty	Unit	Hours	Unit Rates: Material Cost ($/unit)	Unit Rates: Labour Rate ($/hr)	Unit Rates: Equipment Rate ($/hr)	Activity Totals: Material Cost	Activity Totals: Labour Cost	Activity Totals: Equipment Cost	Activity Totals: Cost	Sub-Totals	Source / Comments
M3.1	**Water Quality Monitoring**												**$53,168**	
M3.1.1.1	Sampling during camp ops.	Collect water quality samples	2	ea	42		$44	$14		$3,730	$1,137	$4,867		
M3.1.2.1	Winter sampling	Helicopter time (5 months)	5	ea	2.25		$50	$1,632		$561	$18,360	$18,921		Helicopter cost based on onsite costs
M3.1.2.2		Consultant time incl. travel	5	ea	8		$126			$5,040		$5,040		1 consultant
M3.1.2.3		Car Rental (inc. fuel)	5	days				$350			$1,750	$1,750		
M3.1.3.1	Lab testing	Complete lab testing	117	ea		$150			$17,550			$17,550		
M3.1.3.2		Reporting	1	ea	40		$126			$5,040		$5,040		
M3.2	**Sediment Monitoring (Bi - Annual)**												**$3,604**	
M3.2.1		Collect data/samples	2	ea	0		$44	$14		$0.00	$0.00	$0		Samples collected during water sampling
M3.2.2		Laboratory Analysis	2	ea		$290			$580			$580		
M3.2.3		Reporting	1	ls	24		$126			$3,024		$3,024		
M3.3	**Biological Monitoring (Bi-Annual)**												**$12,944**	
M3.3.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M3.3.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M3.3.3		Collect data/samples	2	ls	8		$126			$2,016		$2,016		
M3.3.4		Laboratory Analysis	10	ea		$270			$2,700			$2,700		
M3.3.5		Reporting	1	ls	40		$126			$5,040		$5,040		
M3.4	**Geotechnical Monitoring**												**$12,934**	
M3.4.1.1	Annual Geotech Inspection	Consultant travel - Whitehorse to/from site	1	ls	8.1	$50	$126		$50	$1,019		$1,069		
M3.4.1.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M3.4.1.3		Site Inspection	1	ls	12		$126			$1,512		$1,512		
M3.4.1.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M3.4.2.1	Instrumentation Monitoring	Collect data, plot and review trends	1	ls	96		$44			$4,263		$4,263		
M3.5	**Reclamation Monitoring**												**$11,252**	
M3.5.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M3.5.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M3.5.3		Inspect vegetation	2	ls	12		$126			$3,024		$3,024		
M3.5.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M3.6	**Annual Reclamation Reports**												**$2,516**	
M3.6.1		Reporting	1	ls	16	$500	$126		$500	$2,016		$2,516		
TOTAL												**$96,417**	**$96,417**	

NOTES:
1. Assumes water quality sampling completed by site personnel when camp in operation, and by helicopter during the winter months
2. Assumes sediment samples collected during water quality sampling.
3. Assumes biological sampling completed by consultants based in Whitehorse, and sampling takes place while barge in place.
4. Assumes geotechnical instrumentation readings collected and plotted by on-site staff.
5. Assumes annual reclamation report compiled by on-site staff whose salary is included in indirect costs; cost included here is for additional consultant review.

Phase 4 - Annual Monitoring Costs - Post-Closure 2

WBS	Facility/Area	Task	Crew/ Qnty	Unit	Hours	Unit Rates: Material Cost ($/unit)	Unit Rates: Labour Rate ($/hr)	Unit Rates: Equipment Rate ($/hr)	Activity Totals: Material Cost	Activity Totals: Labour Cost	Activity Totals: Equipment Cost	Activity Totals: Cost	Sub-Totals	Source / Comments
M4.1	**Water Quality Monitoring**												**$28,129**	
M4.1.1		Helicopter time (3 rounds)	3	ea	2.25		$50	$1,632		$337	$11,016	$11,353		Helicopter cost based on onsite costs
M4.1.2		Consultant time incl. travel	3	ea	12		$126			$4,536		$4,536		1 consultant
M4.1.3		Car Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M4.1.4		Complete lab testing	41	ea		$150			$6,150			$6,150		
M4.1.5		Reporting	1	ea	40		$126			$5,040		$5,040		
M4.2	**Sediment Monitoring (Bi - Annual)**												**$3,604**	
M4.2.1		Collect data/samples	2	ea	0		$44	$14		$0.00	$0.00	$0		Samples collected during water sampling
M4.2.2		Laboratory Analysis	2	ea		$290			$580			$580		
M4.2.3		Reporting	1	ls	24		$126			$3,024		$3,024		
M4.3	**Biological Monitoring (Bi-Annual)**												**$12,944**	
M4.3.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M4.3.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M4.3.3		Collect data/samples	2	ls	8		$126		$0	$2,016		$2,016		
M4.3.4		Laboratory Analysis	10	ea		$270			$2,700			$2,700		
M4.3.5		Reporting	1	ls	40		$126			$5,040		$5,040		
M4.4	**Geotechnical Monitoring**												**$24,387**	
M4.4.1	Annual Geotech Inspection	Consultant travel/on-site time	2	ea	16.0	$50	$126		$100	$4,032		$4,132		
M4.4.2		Car Rental (2 days)	2	days				$350			$700	$700		
M4.4.3		Helicopter time	1	ea	5		$50	$1,632		$249	$8,160	$8,409		
M4.4.4		Instrumentation review	1	ls	24		$44			$1,066		$1,066		
M4.4.5		Reporting/Maintenance Planning	1	ls	80		$126			$10,080		$10,080		
M4.5	**Reclamation Monitoring**												**$11,252**	
M4.5.1		Consultant travel - Whitehorse to site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M4.5.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M4.5.3		Inspect vegetation	2	ls	12		$126		$0	$3,024		$3,024		
M4.5.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M4.6	**Annual Reclamation Reports**												**$25,700**	
M4.6.1		Reporting	1	ls	200	$500	$126		$500	$25,200		$25,700		Includes as-built reporting
TOTAL												**$106,015**	**$106,015**	

NOTES:
1. Water quality sampling assumes 2 rounds of sampling completed by helicopter from Carmacks, and one round when the barge is in place.
2. Assumes sediment samples collected during water quality sampling.
3. Assumes biological sampling completed by consultants based in Whitehorse, and sampling takes place while barge in place.
4. Geotechnical inspection assumed to be completed by helicopter. Two consultants assumed to be present to also collect geotech data. The inspection is also used to determine the site maintenance required for the year.
5. Assumes annual reclamation report compiled by outside consultants.

Phase 5 - Annual Monitoring Costs - Perpetual Maintenance Year

WBS	Facility/Area	Task	Crew/ Qnty	Unit	Hours	Unit Rates: Material Cost ($/unit)	Unit Rates: Labour Rate ($/hr)	Unit Rates: Equipment Rate ($/hr)	Activity Totals: Material Cost	Activity Totals: Labour Cost	Activity Totals: Equipment Cost	Activity Totals: Cost	Sub-Totals	Source / Comments
M5.1	**Water Quality Monitoring**												**$28,616**	
M5.1.1		Helicopter time (3 rounds)	3	ea	2.25		$50	$1,632		$337	$11,016	$11,353		Helicopter cost based on onsite costs
M5.1.2		Consultant time incl. travel	3	ea	12		$126	$14		$4,536	$487	$5,023		1 consultant
M5.1.3		Car Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M5.1.4		Complete lab testing	41	ea		$150			$6,150			$6,150		
M5.1.5		Reporting	1	ea	40		$126			$5,040		$5,040		
M5.2	**Sediment Monitoring**												**$3,604**	
M5.2.1		Collect data/samples	2	ea	0		$44	$14		$0.00	$0.00	$0		Collected during water sampling
M5.2.2		Laboratory Analysis	2	ea		$290			$580			$580		
M5.2.3		Reporting	1	ls	24		$126			$3,024		$3,024		
M5.3	**Biological Monitoring**												**$12,944**	
M5.3.1		Consultant travel - Whitehorse to/from site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M5.3.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M5.3.3		Collect data/samples	2	ls	8		$126			$2,016		$2,016		
M5.3.4		Laboratory Analysis	10	ea		$270			$2,700			$2,700		
M5.3.5		Reporting	1	ls	40		$126			$5,040		$5,040		
M5.4	**Geotechnical Monitoring**												**$24,387**	
M5.4.1	Annual Geotech Inspection	Consultant travel/on-site time	2	ea	16.0	$50	$126		$100	$4,032		$4,132		
M5.4.2		Car Rental (2 days)	2	days				$350			$700	$700		
M5.4.3		Helicopter time	1	ea	5		$50	$1,632		$249	$8,160	$8,409		
M5.4.4		Instrumentation review	1	ls	24		$44			$1,066		$1,066		
M5.4.5		Reporting/Maintenance Planning	1	ls	80		$126			$10,080		$10,080		
M5.5	**Reclamation Monitoring**												**$11,252**	
M5.5.1		Consultant travel - Whitehorse to site	2	ls	8.1	$50	$126		$100	$2,038		$2,138		
M5.5.2		Truck Rental (inc. fuel)	3	days				$350			$1,050	$1,050		
M5.5.3		Inspect vegetation	2	ls	12		$126			$3,024		$3,024		
M5.5.4		Reporting	1	ls	40		$126			$5,040		$5,040		
M5.6	**Annual Reclamation Reports**												**$25,700**	
M5.6.1		Reporting	1	ls	200	$500	$126		$500	$25,200		$25,700		Includes Asbuilt reporting
TOTAL												**$106,502**	**$106,502**	

NOTES:
1. Water quality sampling assumes 2 rounds of sampling completed by helicopter from Carmacks, and one round when the barge is in place.
2. Assumes sediment samples collected during water quality sampling.
3. Assumes biological sampling completed by consultants based in Whitehorse, and sampling takes place while barge in place.
4. Geotechnical inspection assumed to be completed by helicopter. Two consultants assumed to be present to also collect geotech data. The inspection is also used to determine the site maintenance required for the year.
5. Assumes annual reclamation report compiled by outside consultants and includes additional hours for asbuilt reporting

Worksheet 26 - Ore Stockpiles and Misc. Volume Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans) \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg

A: Ore Stockpile Excavation

		Inputs				Calculated Quantities			
Area	Description	Volume of Ore Remaining (m^3)	Ore Pad Area (m^2)	Ore Pad Excavation depth (m)	Confirmation Test Grid Spacing (m)	Ore Relocation Volume (m^3)	Ore Pad Excavation Volume (m^3)	Confirmation Tests Required	Comments/Notes
Year 0 Scenario									
Mill Area	North Stockpile	0	13,760	0.5	10	0	6,880	138	Source: Minto 2020
	West Stockpile	132,737	38,670	0.5	10	132,737	19,335	387	Source: Minto 2020
	East Stockpile	0	31,190	0.5	10	0	15,595	312	Source: Minto 2020
	South Stockpile	181,106	41,571	0.5	10	181,106	20,786	416	Source: Minto 2020
	Nuway Stockpiles	0	4,145	0.5	10	0	2,073	41	Source: Minto 2020
	Crusher Stockpile	0	12,678	0.5	10	0	6,339	127	Source: Minto 2020
Mill Area	**TOTAL**					313,843	71,007	1,421	
Main Waste Dump	Low Grade Ore Stockpiles	25,986	62,631	0.5	10	25,986	31,316	626	"Top of the World Stockpile" (2020)
Main Waste Dump	**TOTAL**					25,986	31,316	626	
SWD	High grade waste	45,711				45,711			Volume is uncertain as some has been milled. This is the 2016 volume. For the 2020 RCP estimate, 50% complete have been applied.
South West Dump	**TOTAL**					45,711	0	0	
Peak Liability Scenario									
Mill Area	North Stockpile	0	13,760	0.5	10	0	6,880	138	
	West Stockpile	0	38,670	0.5	10	0	19,335	387	
	East Stockpile	0	31,190	0.5	10	0	15,595	312	
	South Stockpile	884,785	41,571	0.5	10	884,785	20,786	416	All mill area ore was allocated to this stockpile.
	Crushed Ore Stockpiles	0	4,145	0.5	10	0	2,073	41	
	Crusher Stockpile	0	12,678	0.5	10	0	6,339	127	
Mill Area	**TOTAL**					884,785	71,007	1,421	
Main Waste Dump	Low Grade Ore Stockpiles	25,986	62,631	0.5	10	25,986	31,316	626	
Main Waste Dump	**TOTAL**					25,986	31,316	626	
SWD	High grade waste	45,711				45,711			Based of HGW covered as per SWD perscription
South West Dump	**TOTAL**					45,711	0	0	

Notes:
1. Year 0 stockpile tonnes provided by Minto in August 2020. Stockpile density = 2 tonnes/m3
2. Peak ore stockpile volume occurs is estiamted based on the 2018 closure plan production profile. For the EOM scenario, the stockpile volumes are 0.
3. Covers and revegetation of the ore stockpiles included in the "Areas" worksheet.

B: Misc. Volumes

		Inputs				Calculated Quantities			
Area	Description	Length (m)	Width (m)	Area (m2)	Average Thickness (m)	Volume (Cm3)	Volume (Lm3)		Comments/Notes
DSTSF	Fill at south side of DSTSF to cover tailings and provide drainage to the east.	404	25		3	30,300			Material assumed to be sourced from the Tailings Diversion Ditch road
DSTSF	Unsuitable existing cover material to be removed.			69,467	0.75	52,100			Area based on 2014 aerial photo
Main Pit/SAT	SAT in the Main Pit to be relocated to below 786 m elevation					1,040,000			Volume provided by Minto Dec. 2015, and includes a projection of the SAT volume to be placed from Minto North
Main Pit/SAT	Allowance for backfill to stabilize MPD/Main Pit South Wall following removal of SAT					245,000			Buttress volume from E. Ketilison from AutoCAD
Main Pit	Est. Tailings near outlet above long term water table elevation of 786.			2,311	1.50	3,467			Area estimated from 2014 site aerial photographs and June 2016 site photography
Southwest Wetlands	3 Berms acrros valley	300	5		2.00	3,000			Assumed width, thickness. Length estimated from 2014 orthophoto.
Ridgetop North	Waste Rock Volume						3,416,000	0.84	From WROMP June 2014
Ridgetop South	Waste rock volume						637,000	0.16	From WROMP June 2014

Notes:

Worksheet 27 - Open Pit Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg
Layer: ~Pits

Open Pit Quantity Calculations

		Safety Berms							Boulder Fence		Warning Signs			Quantity Calculations					
Pit	Scenario	Berm Placement Length (m)	% Open Space in Berm	Length of berm requiring land clearing (m)	Land clearing width (m)	Berm Height (m)	Berm Side-Slope Angle (H:1V)	Berm Crest Width (m)	Fence Length (m)	Boulder Spacing (m)	Warning Sign Perimeter Length (m)	Sign Spacing (m)	User Override - Number of Signs	Berm Volume (m^3/m)	Berm Volume (m^3)	Land Clearing Area (m^2)	Boulder Fence Volume (m^3)	Warning Signs	Comments/Notes
Main Pit	All	1680	14%	750	10	1.5	1.3	0.3	40	1	2741	100	6	3.4	4,860	7,500	52	6	
Area 2 Pit (updated for 2017	Yr0	1838	14%	0	10	1.5	1.3	0.3	20	1	1506	100	6	3.4	5,317	0	26	6	
Area 2 Pit (inc. Stage 3)	EOM	1838	14%	0	10	1.5	1.3	0.3	20	1	1506	100	6	3.4	5,317	0	26	6	
Area 118 Pit	All	496	14%	258	10	1.5	1.3	0.3	20	1	600	100	4	3.4	1,435	2,580	26	4	
Minto North	All	1248	14%	590	10	1.5	1.3	0.3	20	1	1248	100	4	3.4	3,610	5,900	26	4	
Ridgetop North	Peak	1261	14%	1011	10	1.5	1.3	0.3	20	1	1506	100	6	3.4	3,648	10,110	26	6	
Ridgetop South	Peak	534	14%	534	10	1.5	1.3	0.3	20	1	1506	100	6	3.4	1,545	5,340	26	6	

Notes:
1. Vegetated areas of the highwall require clearing to ensure visibility of the safety berm.
2. Main Pit Rock fence assumed to be placed near the entrance ramp of the pit.

Worksheet 28 - Resloping Quantity Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

Notes/Instructions: 1. When adding a new row, make sure all columns are copied (there are a lot of calculations hidden in columns to the right).
2. Once complete, check that the Dozer used on this sheet matches the correct task unit rate used on the cost estimate worksheet
References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg
(Layer ~Regrading)

A: Slopes

		Dump							Dozing Conditions					Calculated Quantities					Total Quantities						
Facility	Segment	Mid-bench length (m)	Height (m)	Existing Side Slope Angle (H:1V)	Final Side-Slope Angle (H:1V)	Underlying slope grade (%) (See Note 2)	Does regrading increase the dump footprint?	Soil Cover Thickness (m)	Dozer Size	Material Type	Dozing Condition	Bank or Placed? (See note 3)	Slot or Side-by-side Dozing?	Cut Volume per m crest (m^3)	Average Regrade Push Distance (m)	Unfactored Dozer Productivity (Lm^3/hr)	Factored Dozer Productivity (Bm^3/hr)	Time to complete 1m width (hrs)	Time Required - Regrading (Hrs)	Time Required - Spreading Cover (hrs)	Total Regrade Volume (Bm^3)	3D Surface Area (m^2)	2D Sloped Area (m^2)	2D Footprint increase due to regrading (m^2)	Comments/Notes
Existing Facilities																									
Camp Area	R1	309	18	1.3	3	0	Yes	0.5	D10	Sand & gravel,	Normal	Bank	No	68.9	37.9	1114.1	994.5	0.1	21	10	21,275	17,589	16,686	4,728	
Camp Area	R2	73	3	1.3	3	0	No	0.5	D10	Sand & gravel,	Normal	Bank	No	1.9	6.3	2293.7	2047.4	0.0	0	0	140	693	657	0	
Camp Area	R3	44	3	1.3	3	0	Yes	0.5	D10	Sand & gravel,	Normal	Bank	No	1.9	6.3	2293.7	2047.4	0.0	0	0	84	417	396	112	
Camp Area	**TOTAL**																		**22**	**10**	**21,498**	**18,699**	**17,739**	**4,840**	
DSTSF - WR Shell	R1	3211	4	1.3	4	0	No	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	5.4	11.0	2293.7	1010.2	0.0	17	14	17,339	52,957	51,376	0	
DSTSF - WR Shell	**TOTAL**																		**17**	**35**	**17,339**	**52,957**	**51,376**	**0**	
DSTSF - South end	R1	500	5	1.3	4	0	No	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	8.4	13.7	2293.7	1010.2	0.0	4	3	4,219	10,308	10,000	0	
DSTSF - South End	**TOTAL**																		**4**	**72**	**4,219**	**10,308**	**10,000**	**0**	
IROD Laydown	R1	101	14	3.5	3.5	0	No	0	D10	Sand & gravel,	Normal	Placed	No	0.0	0.0	2293.7	1787.2	0.0	0	0	0	5,147	4,949	0	
IROD Laydown	**TOTAL**																		**0**	**0**	**0**	**5,147**	**4,949**	**0**	
Main Dump	R1	200	21	2.5	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	27.6	44.3	1405.4	847.8	0.0	7	6	5,513	13,282	12,600	0	
Main Dump	R2	185	25	2.5	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	39.1	52.7	1191.3	718.7	0.1	10	8	7,227	14,626	13,875	0	
Main Dump	R3	293	15	1.3	3	0	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	47.8	31.6	1933.4	1166.4	0.0	12	4	14,009	13,898	13,185	3,736	
Main Dump	R4	191	18	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	68.9	37.9	1626.5	981.2	0.1	13	4	13,150	10,872	10,314	0	
Main Dump	R5	266	22	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	102.9	46.4	1344.7	811.2	0.1	34	9	27,358	18,506	17,556	0	
Main Dump	R6	73	17	1.5	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	54.2	35.8	1717.1	1035.9	0.1	4	1	3,956	3,924	3,723	0	
Main Dump	R7	50	7	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	10.4	14.8	3440.0	2075.3	0.0	0	0	521	1,107	1,050	0	
Main Dump	R8	261	9	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	17.2	19.0	3137.8	1893.0	0.0	2	1	4,492	7,428	7,047	0	
Main Dump	R9	300	12	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	30.6	25.3	2388.9	1441.1	0.0	6	3	9,180	11,384	10,800	0	
Main Dump	R10	215	7	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	10.4	14.8	3440.0	2075.3	0.0	1	1	2,239	4,759	4,515	0	
Main Dump	R11	200	20	1.3	3	-75	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	65.2	32.9	1863.8	1124.4	0.1	12	3	13,049	9,861	9,355	0	
Main Dump	R12	235	20	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	85.0	42.2	1471.9	888.0	0.1	22	6	19,975	14,863	14,100	0	
Main Dump	R13	185	14	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	41.7	29.5	2064.1	1245.2	0.0	6	2	7,705	8,190	7,770	0	
Main Dump	R14	112	3	1.3	3	-75	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	1.5	4.9	3440.0	2075.3	0.0	0	0	164	828	786	0	
Main Dump	R15	220	20	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	85.0	42.2	1471.9	888.0	0.1	21	6	18,700	13,914	13,200	0	
Main Dump (wrap)	R16	290	10	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	21.3	21.1	2839.6	1713.0	0.0	4	2	6,163	9,171	8,700	0	
Main Dump (wrap)	R17	443	20	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	85.0	42.2	1471.9	888.0	0.1	42	12	37,655	28,018	26,580	0	
Main Dump (wrap)	R18	430	15	1.3	3	5	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	50.1	33.2	1848.0	1114.8	0.0	19	7	21,551	21,392	20,294	6,304	
Main Dump (wrap)	R19	220	15	1.3	3	0	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	47.8	31.6	1933.4	1166.4	0.0	9	3	10,519	10,436	9,900	2,805	
MWD E (Year 0)	**TOTAL**																		**225**	**80**	**223,124**	**216,458**	**205,350**	**12,845**	
Main Pit Dump	R1	277	16	1.3	3	15	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	65.2	40.8	1518.2	915.9	0.1	20	7	18,066	16,956	16,086	6,268	
Main Pit Dump	R2	566	35	1.3	3	0	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	260.3	73.8	865.9	522.4	0.5	282	45	147,337	62,645	59,430	16,839	
Main Pit Dump	R3	266	18	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	68.9	37.9	1626.5	981.2	0.1	19	6	18,314	15,141	14,364	0	
Main Pit Dump	R4	467	12	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	30.6	25.3	2388.9	1441.1	0.0	10	5	14,290	17,721	16,812	0	
Main Pit Dump	R5	388	18	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	68.9	37.9	1626.5	981.2	0.1	27	8	26,714	22,085	20,952	0	
Main Pit Dump	R6	100	21	1.5	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	82.7	44.3	1405.4	847.8	0.1	10	3	8,269	6,641	6,300	0	
Main Pit Dump	R7	226	14	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	41.7	29.5	2064.1	1245.2	0.0	8	3	9,413	10,005	9,492	0	
Main Pit Dump	R8	354	11	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	25.7	23.2	2594.3	1565.1	0.0	6	3	9,102	12,314	11,682	0	
Main Pit Dump	R9	355	15	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Placed	No	47.8	31.6	1933.4	1166.4	0.0	15	5	16,973	16,839	15,975	0	
Main Pit Dump - EOM	**TOTAL**																		**395**	**86**	**268,478**	**180,347**	**171,093**	**23,107**	
Main Pit Dump - Yr 0 (2018	**TOTAL**																		**395**	**86**	**268,478**	**180,347**	**171,093**	**23,107**	
MVFE Stage 1 and 2	R1	255	17	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	61.4	35.8	1717.1	799.4	0.1	20	5	15,660	13,708	13,005	0	
MVFE Stage 1 and 2	R2	188	12	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	30.6	25.3	2388.9	1112.1	0.0	5	2	5,753	7,134	6,768	0	
MVFE Stage 1 and 2	R3	250	10	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	4	2	5,313	7,906	7,500	0	
MVFE Stage 1 and 2	R4	265	12	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	30.6	25.3	2388.9	1112.1	0.0	7	3	8,109	10,056	9,540	0	
MVFE Stage 1 and 2	R5	400	5	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	5.3	10.5	3440.0	1601.5	0.0	1	1	2,125	6,325	6,000	0	
MVFE Stage 1 and 2	**TOTAL**																		**37**	**12**	**36,959**	**45,129**	**42,813**	**0**	
Minto South Portal	R1	200	7	1.3	3	0	Yes	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	10.4	14.8	3440.0	1601.5	0.0	1	0	2,083	4,427	4,200	1,190	
Minto South Portal	R2	133	10	1.3	3	10	Yes	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	23.6	23.5	2561.5	1192.5	0.0	3	0	3,142	4,689	4,448	1,535	
Minto South Portal	R3	200	7	1.3	3	10	No	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	11.6	16.5	3592.1	1672.3	0.0	1	0	2,315	4,936	4,682	0	
Minto South Portal	R4	80	10	1.3	3	10	No	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	23.6	23.5	2561.5	1192.5	0.0	2	0	1,890	2,820	2,676	0	
Minto South Portal	R5	490	20	2.5	3	0	No	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	25.0	42.2	1471.9	685.2	0.0	18	0	12,250	30,990	29,400	0	
Minto South Portal	**TOTAL**																		**25**	**0**	**21,678**	**47,862**	**45,406**	**2,725**	
Southwest Dump	Allowance	500	15	1.3	3	0	No	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	47.8	31.6	1311.6	610.6	0.1	39	11	23,906	23,717	22,500	0	
Southwest Dump	**TOTAL**																		**39**	**11**	**23,906**	**23,717**	**22,500**	**0**	
SWD - High Grade Waste	R1	320	8	1.3	5	0	Yes	1	D11	Waste Rock (M	Rock, ripped or	Bank	No	29.6	27.2	2230.6	913.0	0.0	10	7	9,472	13,053	12,800	4,736	
SWD - High Grade Waste	R2	113	11	1.3	5	0	Yes	1	D11	Waste Rock (M	Rock, ripped or	Bank	No	56.0	37.4	1649.4	675.1	0.1	9	5	6,324	6,338	6,215	2,300	
SWD - High Grade Waste	R3	245	17	1.3	5	2	Yes	1	D11	Waste Rock (M	Rock, ripped or	Bank	No	139.0	60.1	1051.5	430.4	0.3	79	26	34,054	22,093	21,664	8,394	
SWD - High Grade Waste	**TOTAL**																		**99**	**38**	**49,849**	**41,485**	**40,679**	**15,430**	
Tailings Diversion Ditch	R1	260	7	1.3	3	17	Yes	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	13.0	18.6	2108.3	981.5	0.0	3	2	3,368	7,257	6,884	2,833	
Tailings Diversion Ditch	R2	454	13	1.3	3	10	Yes	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	39.9	30.6	1352.6	629.7	0.1	29	10	18,123	20,807	19,739	6,811	
Tailings Diversion Ditch	R3	311	7	1.3	3	13	Yes	0.5	D10	Waste Rock (M	Rock, ripped or	Bank	No	12.1	17.2	2259.2	1051.8	0.0	4	2	3,757	8,035	7,623	2,823	
Tailings Diversion Ditch	**TOTAL**																		**36**	**14**	**25,248**	**36,099**	**34,246**	**12,467**	
W15 Sump Area	R1	124	6	1.3	3	0	Yes	0	D10	Waste Rock (M	Rock, ripped or	Bank	No	7.7	12.6	2293.7	1067.8	0.0	1	0	949	2,353	2,232	632	
W15 Sump Area	R2	92	6	1.3	3	15	Yes	0	D10	Waste Rock (M	Rock, ripped or	Bank	No	9.2	15.3	2511.4	1169.2	0.0	1	0	844	2,112	2,003	781	
Minto South Portal	**TOTAL**																		**2**	**0**	**1,792**	**4,465**	**4,235**	**1,413**	
Future Facilities																									
Area 118 Backfill Dump	R1	1227	5	1.3	3	0	No	0	D11	Earth, moist	Normal	Bank	No	5.3	10.5	3440.0	2751.6	0.0	2	0	6,518	19,401	18,405	0	Source: A118 Backfill Dump.dwg
Area 118 Backfill Dump	**TOTAL**																		**2**	**0**	**6,518**	**19,401**	**18,405**	**0**	
Ridgetop South Backfill Dum	R1	257	15	1.3	3	17	Yes	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	59.5	39.9	1552.0	722.5	0.1	21	0	15,287	15,371	14,582	6,001	
Ridgetop South Backfill Dum	R2	253	10	1.3	3	0	No	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	4	0	5,376	8,001	7,590	0	
Ridgetop South Backfill Dum	R3	200	10	1.3	3	0	No	0	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	3	0	4,250	6,325	6,000	0	
Ridgetop Waste Dump	**TOTAL**																		**28**	**0**	**24,913**	**29,696**	**28,172**	**6,001**	
Ridgetop Waste Dump	R1	919	20	1.3	3	17	Yes	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	105.7	53.2	1181.5	550.1	0.2	177	39	97,182	73,285	69,524	28,609	
Ridgetop Waste Dump	R2	1183	15	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	47.8	31.6	1933.4	900.1	0.1	63	18	56,562	56,115	53,235	0	
Ridgetop Waste Dump	R3	1495	10	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	24	10	31,769	47,276	44,850	0	
Ridgetop Waste Dump	R4	1265	10	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	20	9	26,881	40,003	37,950	0	
Ridgetop Waste Dump	R5	203	10	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	21.3	21.1	2839.6	1322.0	0.0	3	1	4,314	6,419	6,090	0	
Ridgetop Waste Dump	R6	1530	13	1.3	3	0	No	0.5	D11	Waste Rock (M	Rock, ripped or	Bank	No	35.9	27.4	2214.3	1030.9	0.0	53	18	54,946	62,898	59,670	0	
Ridgetop Waste Dump	**TOTAL**																		**340**	**95**	**271,654**	**285,996**	**271,319**	**28,609**	

Notes:
1. Regrading productivity calculations/details are provided in below (spreadsheet).
2. A positive grade indicates the toe is being extended downward; a negative valley indicates the dump toe is moving uphill.
2. Bank materials are insitu, natural soils.

B: Flat Area Tertiary Catchments

Dimensions	Dozing Conditions	Calculated Quantities	Total Quantities

Facility	Total Flat Area (m^2)	Maximum Tertiary Catchment Area (m^2)	Avg. Final Slope (%)	Length of dozing direction over-ride (m)	Dozer Size	Material Type	Dozing Condition	Bank or Placed? (See note 3)	Number of catchments	Catchment Length (in dozing direction) (m)	Average Regrade Push Distance (m)	Unfactored Dozer Productivity (Lm^3/hr)	Factored Dozer Productivity (Bm^3/hr)	Cut Volume Per Catchment (Bm^3)	Time to complete 1 catchment (hrs)	**Total Time Required (Hrs)**	**Avg. Regrade Productivity (m^2/hr)**	**Comments/Notes**
A118 Backfill dump (2018)	41,899	15,000	3%	50	D10	Sand & gravel	Normal	Placed	3	50.0	33.3	1251.2	560.6	2,813	5.0	14	2,990	
A118 Backfill dump (EOM)	50,033	15,000	3%	50	D10	Sand & gravel	Normal	Placed	3	50.0	33.3	1251.2	560.6	2,813	5.0	17	2,990	
Camp Area	20,626	15,000	3%	50	D10	Sand & gravel	Normal	Placed	1	50.0	33.3	1251.2	560.6	2,813	5.0	7	2,990	
Crusher Area	26,964	15,000	3%	50	D10	Sand & gravel	Normal	Placed	2	50.0	33.3	1251.2	560.6	2,813	5.0	9	2,990	
DSTSF	0	15,000	1%		D10	Earth, moist	Normal	Placed	0	122.5	81.6	561.2	241.3	2,296	9.5	0	#DIV/0!	
Explosive Plant/Storage area	55,113	15,000	3%	60	D10	Waste Rock (	Hard to cut; fro	Placed	4	60.0	40.0	1062.8	418.8	3,375	8.1	30	1,861	
Fuel Storage Area	8,400	15,000	3%	60	D10	Waste Rock (	Hard to cut; fro	Placed	1	60.0	40.0	1062.8	418.8	3,375	8.1	5	1,861	
Ice Rich Overburden Dump	0	15,000	3%	80	D10	Earth, moist	Normal	Placed	0	80.0	53.3	821.5	337.4	4,500	13.3	0	#DIV/0!	
IROD Laydown	18,106	15,000	3%	80	D10	Sand & gravel	Normal	Placed	1	80.0	53.3	821.5	368.1	4,500	12.2	15	1,227	
Main Dump	148,333	15,000	3%		D10	Waste Rock (	Hard to cut; fro	Placed	10	122.5	81.6	561.2	221.1	6,889	31.2	308	481	Total Flat Area was reduced by 13.5 ha (flat area at the top of the MWDE) that is being constructed at a 2% grade during ops.
Main Pit Dump (Yr 0)	91,415	15,000	3%	70	D10	Waste Rock (	Hard to cut; fro	Placed	6	70.0	46.7	925.8	364.8	3,938	10.8	66	1,390	
Mill Area	42,365	15,000	3%	100	D10	Waste Rock (	Hard to cut; fro	Placed	3	100.0	66.7	672.8	265.1	5,625	21.2	60	707	
MVFE Stage 1 and 2	114,853	15,000	3%	100	D10	Waste Rock (	Hard to cut; fro	Placed	8	100.0	66.7	672.8	265.1	5,625	21.2	162	707	
Minto South Portal	62,765	15,000	3%	75	D10	Waste Rock (	Hard to cut; fro	Placed	4	75.0	50.0	870.4	343.0	4,219	12.3	51	1,219	
Ore Stockpile Area	139,307	15,000	3%		D10	Waste Rock (	Hard to cut; fro	Placed	9	122.5	81.6	561.2	221.1	6,889	31.2	289	481	
Pelly Laydown	51,710	15,000	3%		D10	Waste Rock (	Hard to cut; fro	Placed	3	122.5	81.6	561.2	221.1	6,889	31.2	107	481	
Reclamation OVB Dump	297,857	15,000	3%		D10	Earth, moist	Normal	Placed	20	122.5	81.6	561.2	230.5	6,889	29.9	594	502	
Ridgetop South Backfill Dum	8,491	15,000	3%		D10	Earth, moist	Normal	Placed	1	122.5	81.6	561.2	230.5	6,889	29.9	17	502	
Ridgetop Waste Dump	44,126	15,000	3%		D10	Earth, moist	Normal	Placed	3	122.5	81.6	561.2	230.5	6,889	29.9	88	502	
SWD - High Grade Waste	15,583	15,000	3%		D10	Earth, moist	Normal	Placed	1	122.5	81.6	561.2	230.5	6,889	29.9	31	502	
W15 Sump Area	9,484	15,000	3%	80	D10	Waste Rock (	Hard to cut; fro	Placed	1	80.0	53.3	821.5	323.7	4,500	13.9	9	1,079	
																1,878		

Notes:
1. Regrading productivity calculations/details are provided in below (spreadsheet).
2. Productivity calculations assumes the dozer is pushing uphill
3. Dozer pushing distance calculations assume the tertiary catchments are approximately square, unless the 'length of dozing direction' user over-ride is used.

C: Miscellaneous Regrading

Facility	Volume to Push (m^2)	Avg. Grade (%)	Dozer Size	Material Type	Dozing Condition	Bank or Placed? (See note 3)	Average Regrade Push Distance (m)	Unfactored Dozer Productivity (Lm^3/hr)	Factored Dozer Productivity (Bm^3/hr)	**Total Time Required (Hrs)**	Comments/Notes
Mill Pond Backfilling	7,088	0%	D10	Waste Rock (	Hard to cut; fro	Bank	50.0	870.4	283.2	**25**	Assumes material pushed from the north (crusher area)
SWD Cover placement on sl	0	20%	D10	Earth, moist	Loose Stockpi	Bank	40.0	1062.8	351.1	**0**	

Notes:
1. Regrading productivity calculations/details are provided in below (spreadsheet).
2. Productivity calculations assumes the dozer is pushing uphill
3. Dozer pushing distance calculations assume the tertiary catchments are approximately square, unless the 'length of dozing direction' user over-ride is used.
4. Bank materials are insitu, natural soils. Placed are materials that have been placed and compacted and are generally denser than Bank/In-situ materials (See densities and bulking factors below). **For Waste Rock - Use 'Placed"**.

Worksheet 29 - Revegetation Prescriptions

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Tractor-Applied Seed Mixes

Seed Mix 1 - DRY AREA SEED MIX

Item	Target Application Rate (kg/ha)	Over-application Allowance (%)	Applied Rate (kg/ha)	Unit Cost ($/kg)	Item Cost ($/ha)	Comment
Seed Mix	30		45	$17.06	$767.88	
Fertilizer	200	25%	250	$1.29	$323.31	
Mulch	0	0%	0	$1.09		
Tackifier	0	0%	0	$3.95		
TOTAL SEED MIX COST PER HA:					**$1,091.19**	

Seed Mix 2 - WET AREA SEED MIX

Item	Target Application Rate (kg/ha)	Over-application Allowance (%)	Applied Rate (kg/ha)	Unit Cost ($/kg)	Item Cost ($/ha)	Comment
Seed Mix	30		45	$17.06	$767.88	
Fertilizer	200	25%	250	$1.29	$323.31	
Mulch	0	0%	0	$1.09	$0.00	
Tackifier	0	0%	0	$3.95	$0.00	
TOTAL SEED MIX COST PER HA:					**$1,091.19**	

B: Tree Planting

Item	Target Application Rate (stem/ha)	Over-application Allowance (%)	Applied Rate (kg/ha)	Unit Cost ($/kg)	Item Cost ($/ha)	Comment
Trees	Seedlings per ha					
Tree seedlings	1,000	0%	1,000			Target application rates from Closure Plan
Subtotal - Seed Mix	1000		1000	$1.10	$1,100	
Fertilizer	1000	0%	1000	$0.09	$89.36	
TOTAL TREE PLANTING COST PER HA:					**$1,189**	

Worksheet 30-Road Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dv \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg

A: Exploration Roads

		Road Parameters						Safety Berms				Reclamation Prescription				X-Section Quantities				Total Quantities				
Area	Description	Length (m)	Width (at crest) (m)	Average Fill Height (m)	Number of slopes to regrade (0, 1 or 2)	Existing Side Slope Angle (H:1V)	Final Side-Slope Angle (H:1V)	Number of Berms (0, 1 or 2)	Berm Height (m)	Berm Side-Slope Angle (H:1V)	Berm Crest Width (m)	Dozer Size	Scarify (y/n)	Growth Media Thickness (m)	Revegetate (y/n)	Berm Volume (1-side) (m^3/m)	Regrade Cut Volume (m^3/m)	Average Regrade Push Distance (m)	Factored Dozer Productivity (m/hr)	Scarification Area (m^2)	Cover Volume (Cm^3)	Revegetation Area (ha)	Regrade Hours	Comments/Notes
Airstrip East	Area east of airstrip	4581	3		0	1	3	0	0	0	0		Yes	0	Yes	0.0	0.0	0.0	#N/A	13,743	0	1.37	0.0	
Airstrip West	Area west of airstrip	4299	3		0	1	3	0	0	0	0		Yes	0	Yes	0.0	0.0	0.0	#N/A	12,897	0	1.29	0.0	
Ridgetop		4252	3		0	1	3	0	0	0	0		Yes	0	Yes	0.0	0.0	0.0	#N/A	12,756	0	1.28	0.0	
North	North of Main Pit	4963	3		0	1	3	0	0	0	0		Yes	0	Yes	0.0	0.0	0.0	#N/A	14,889	0	1.49	0.0	
TOTALS																				**54,285**	**0**	**5**	**0**	

Notes:
1. Dozer regrading productivity calculations details are provided in the "reslope" worksheet.
2. If a side slope is not regraded, it is assumed that it is not revegetated, and no cover is placed.

B: Access Roads

		Road Parameters						Safety Berms				Reclamation Prescription				X-Section Quantities				Total Quantities				
Area	Description	Length (m)	Width (at crest) (m)	Average Fill Height (m)	Number of slopes to regrade (0, 1 or 2)	Existing Side Slope Angle (H:1V)	Final Side-Slope Angle (H:1V)	Number of Berms (0, 1 or 2)	Berm Height (m)	Berm Side-Slope Angle (H:1V)	Berm Crest Width (m)	Dozer Size	Scarify (y/n)	Growth Media Thickness (m)	Revegetate (y/n)	Berm Volume (1-side) (m^3/m)	Regrade Cut Volume (m^3/m)	Average Regrade Push Distance (m)	Factored Dozer Productivity (m/hr)	Scarification Area (m^2)	Cover Volume (Cm^3)	Revegetation Area (ha)	Regrade Hours	Comments/Notes
Airstrip	Airport Access Road	968	14	1.5	2	1.3	3	2	1	1.3	0	D8	Yes	0	Yes	1.3	3.2	3.2	266.0	13,552	0	2.27	3.6	
	Betw. Landfill/waste storage	236	10	1.5	0	1.3	3	1	1	1.3	0	D8	Yes	0	Yes	1.3	1.3	3.2	648.8	2,360	0	0.24	0.4	
	Old Exploration camp road	460	10	1.5	0	1.3	3	1	1	1.3	0	D8	Yes	0	Yes	1.3	1.3	3.2	648.8	4,600	0	0.46	0.7	
Camp	2 Access Roads	238	14	1.5	2	1.3	3	2	1	1.3	0	D8	Yes	0	Yes	1.3	3.2	3.2	266.0	3,332	0	0.56	0.9	
Explosives	Roads between explosive plant a	1633	10	2	1	1.3	3	1	1	1.3	0	D8	Yes	0	Yes	1.3	1.7	4.2	501.9	16,330	0	2.67	3.3	
IROD Laydown	Road between yard areas	703	10	0	0	1.3	3	0	1	1.3	0	D8	Yes	0	Yes	1.3	0.0	0.0	#DIV/0!	7,030	0	0.70	0.0	
W15 Laydown	2 "F" shaped roads	388	14	0	1	1.3	3	1	1	1.3	0	D8	Yes	0	Yes	1.3	1.3	0.0	648.8	5,432	0	0.54	0.6	
TOTALS																				**52,636**	**0**	**7**	**9**	

Notes:
1. Dozer regrading productivity calculations details are provided in the "reslope" worksheet.
2. If a side slope is not regraded, it is assumed that it is not revegetated, and no cover is placed.

C: Haul Roads

		Road Parameters						Safety Berms				Reclamation Prescription				X-Section Quantities				Total Quantities				
Area	Description	Length (m)	Width (at crest) (m)	Average Fill Height (m)	Number of slopes to regrade (0, 1 or 2)	Existing Side Slope Angle (H:1V)	Final Side-Slope Angle (H:1V)	Number of Berms (0, 1 or 2)	Berm Height (m)	Berm Side-Slope Angle (H:1V)	Berm Crest Width (m)	Dozer Size	Scarify (y/n)	Growth Media Thickness (m)	Revegetate (y/n)	Berm Volume (1-side) (m^3/m)	Regrade Cut Volume (m^3/m)	Average Regrade Push Distance (m)	Factored Dozer Productivity (m/hr)	Scarification Area (m^2)	Cover Volume (Cm^3)	Revegetation Area (ha)	Regrade Hours	Comments/Notes
Main Pit	Mill to Main Dump	1193	28	1.5	0	1.3	3	1	1.5	1.3	0	D8	Y	0	Yes	2.9	2.9	3.2	288.3	33,404	0	3.34	4.1	
Area 118	Area 118 Backfill Road	1060	28	1.5	2	1.3	3	2	1.5	1.3	0	D8	Y	0	Yes	2.9	6.7	3.2	125.8	29,680	0	3.97	8.4	
Minto North Hau	MWDE to Minto North	1000	28	1.5	2	1.3	3	2	1.5	1.3	0	D8	Y	0	Yes	2.9	6.7	3.2	125.8	28,000	0	3.75	8.0	
TDD Road	Area costed as WR dump															0.0				0	0	0.00	0.0	Area costed as WR Dump
TOTALS																				**91,084**	**0**	**11**	**21**	

Notes:
1. Dozer regrading productivity calculations details are provided in the "reslope" worksheet.
2. If a side slope is not regraded, it is assumed that it is not revegetated, and no cover is placed.
3. Most haul road costs are included within their respective areas.

D: Culvert Removal

		Input Parameters							Total Quantities			
Area	Description	Qnty	Culvert length (m)	Culvert Diameter (m)	Average Excavation Depth (m)	Excavation Side-Slope (H:1V)	Excavation Base Width (m)	Mobilization time (hrs)	Mobilization/Demobilization Hours	Excavation Volume (BCM)	Demolition Volume (LCM)	Comments/Notes
Mill Water Pond	Upstream Culvert	1	210	1.4	4	2	2	0	1.0	8,400	69	Average excavation depth assumed
	Tailings line to Main Pit	1	38	1	4	2	2	0	0.0	1,520	9	diameter assumed
	Reclaim line culvert by ore stockpile	1	35	1	2	2	2	0	0.0	420	8	diameter assumed
Mill	Tailings line culverts between confluence area and mill	4	50	1	2	2	2	0	0.0	2,400	12	diameter assumed
	Culverts between mill and main access road	2	50	1	2	2	2	0	0.0	1,200	12	diameter assumed
Area 2	Tailings discharge culvert by Area 2 pit	1	86	1	2	2	2	0	1.0	1,032	20	diameter assumed
	Culvert for water line between Main and Area 2 pit	1	54	1	2	2	2	0	0.0	648	13	diameter assumed
Pelly laydown		1	200	1	2	2	2	0	1.0	2,400	47	diameter assumed
TOTAL									**3.0**	**18020.0**	**190.1**	

Notes:
1. Demolition volume assumes culvert is flattened and then has an average height of 15 cm.

Worksheet 31 - Surface Infrastructure Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg
Layer: ~Pipelines

A. Conveyance Pipelines

Calculation Inputs
Pipe Debris Bulking Factor: 1.30

					Pipeline Details					Calculated Quantities: HDPE Pipe Demolition Lengths (m)					
Line	**Type**	**Details**	**From**	To	Length (m)	Pipe Diameter (inches)	Total Diameter (incl. insulation) (inch)	Pipe Diameter Category	Lines to flush	0.75 to 4 inch	6 to 8 inches	10 to 18 inches	20 to 36 inches	Pipe Debris Volume (Lm3)	Comments/Notes
8" Insulated tailings lines	Tailings	8" Insulated discharge	varies	varies	2600	8	12	6 to 8 inch	1	0	2,600	0	0	247	
4" HDPE lines	Tailings				2800	4	8	6 to 8 inch	1	0	2,800	0	0	118	
4" Insulated HDPE lines					1400	4	4	0.75 to 4 inch	1	1,400	0	0	0	15	
4" Steel lines, heat traced					450	4	4	0.75 to 4 inch	1	450	0	0	0	4	
8" HDPE					1400	8	8	6 to 8 inch	1	0	1,400	0	0	45	
3: HDPE					600	3	3	0.75 to 4 inch	1	600	0	0	0	3	
10" Steel					240	10	10	10 to 18 inch	1	0	0	240	0	12	
16" HDPE					1500	16	16	10 to 18 inch	1	0	0	1,500	0	195	
24" HDPE					885	24	24	20 to 36 inch	0	0	0	0	885	0	
TOTALS:									8	**2,450**	**6,800**	**1,740**	**885**	**638**	

Notes:
Updated to match Table 6.1 in RCP

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B. Pipeline Infrastructure/Equipment

Area	**Details**	**Quantity**	**Estimated Weight (kg)**	**Total Weight (kg)**	**Comments/Notes**
Pumps		**15**			
Main Pit	Reclaim Pump	6	100	600	
Area 2	Dewatering Pumps	1	500	500	
Misc Pumps	Tsynami	7	200	1400	
W15 Sump	W15 Pump	1	200	200	
Barges/Misc. Equipment		**2**			
Main Pit	Reclaim Barge	1	2000	2000	
Main Pit	Power Shack	1	2000	2000	
TOTALS:				**6700**	

Notes:
1. Weights of pumping equipment are assumed
2. Equipment is assumed to be placed in semi-trailers for transport to Whitehorse for disposal/salvage.

C. Power Line and Substation Removal

				Off-site Disposal Trips				
Line	**Power Line Length (km)**	**Number of power poles**	**Number of Transformers**	**Power Pole Trips**	**Power Line Reels**	**Transformer/ Powerline Trips**	**TOTAL TRIPS**	**Comments/Notes**
Mill to Water Storage Pond	1.58	30	2	1.2	5.2	1.5		
Mill to Minto South Portal	1.58	30	2	1.2	5.2	1.5		
TOTALS:	**3.16**	**60**	**4**	**3**	**11**	**4**	**18**	

Notes:
1. Power line lengths and number of poles provide by Minto in file "powerpoles.dxf"

Worksheet 32- Underground

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg

A: Existing Portals

	Inputs							Calculated Quantities					
Description	Height (m)	Width (m)	Backfill Plug Thickness (m)	Backfill height above portal opening (m)	Backfill width outside of portal (m)	Backfill outside side slope (H:1V)	Relocation Cost Code for LHD	Underground Plug Volume (m^3)	Plug Volume in Front of Portal (m3)	Total Plug Volume (m^3)	Backfill LHD Productivity (m^3/hr)	Small Dozer Hours	Comments/Notes
Existing Portals													
Minto South Portal	5	7	15	5	12	3	R.001	788	1,800	2,588	159	16	
Minto North Portal	5	7	15	5	12	3	R.001	788	1,800	2,588	159	16	
Minto North Portal Egress	5	7	15	5	12	3	R.001	788	1,800	2,588	159	16	
Future Portals													
								0	0	0	#N/A	#N/A	

Notes:

B: Shafts and Vent Raises

	Inputs								Calculated Quantities												
Facility	Length (m)	Width (m)	Depth to competent material (m)	Concrete Cap Length (m)	Concrete Cap Width (m)	Concrete Slab Thickness (m)	Concrete Slab rebar layers	Backfill Thickness over cap (m)	Concrete Cap Perimeter (m)	Excavation Volume (m3)	Vent Raise Pipe Length (m)	I-beams required (W 250x33)	Total I-Beam Length (m)	Concrete Ring Wall Formwork (m2)	Concrete Ring Wall Rebar Length (m)	Ringwall Dowell Length (m)	Steel Decking (q-deck) (m2)	Total Rebar Length (m)	Total Concrete Volume (m3)	Backfill Volume (m3)	Comments/Notes
Existing shafts and vent raises																					
Area 118 Vent Raise	3	3	0.5	4	4	0.45	2	1	16	4.0	4	2	8	8	16	16	16	32	8.6	25	
Minto East	3	3	0.5	4	4	0.45	2	1	16	4.0	4	2	8	8	6	8	16	14	8.6	25	Assumed same dimentions as Area 118
Minto East 2	3	3	0.5	4	4	0.45	2	1	16	4.0	4	2	8	8	16	0	16	16	8.6	25	
Future shafts and vent raises																					
Minto South																					
Wildfire																					

CALCULATION INPUTS

Vent Raise design

I-Beam spacing (m):	2
Concrete ring wall height (m):	0.5
Concrete ring wall rebar spacing (into bedrock) (m):	1
Concrete ring wall rebar (into bedrock) length (m):	1
Ringwall dowel spacing at top of wall (m):	0.4
Ringwall dowel length (m):	0.4
Concrete slab rebar spacing:	0.2

Worksheet 33 - Waste Disposal

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg

A: Reagents

		Inputs					Calculated Quantities										
Area	**Reagents**	Solid/Liquid	Mass of Solid (kg)	Volume of Liquid (m^3)	Container Type	Disposal Fee (per container)	Number of drums	Number of tote bags	Number of Solid Bulk Carriers	Number of Small Tankers	Number of Large Tankers	Loading Time (hrs)	Trips Required - 55 Gal. Drums	Trips Required - Tote Bags	Disposal Fees ($)	**TOTAL TRIPS**	Comments/Notes
Mill Area	PAX	Solid	2,000		55 gal. drum	$0	7	0	0	0	0	1	0.1	0.0	$0		
	MIBC	Solid	3,652		55 gal. drum	$0	12	0	0	0	0	2	0.1	0.0	$0		
	MagnaFlocc 338	Solid	5,000		55 gal. drum	$0	17	0	0	0	0	3	0.2	0.0	$0		
	MagnaFlocc 155	Solid	500		55 gal. drum	$0	2	0	0	0	0	0	0.0	0.0	$0		
	Filter cleaning agent (HNO	Liquid		3.20	Liquid - 2,200 gal. tank	$0	0	0	0	1	0	4	0.0	0.0	$0		
Water Treatment Plant	Reagents	Solid	20,000		Tote bags	$0	0	15	0	0	0	8	0.0	0.4	$0		Assumes 15 totes remaining
MVF Reagent Tent	Reagents	Solid	20,000		Tote bags	$0	0	15	0	0	0	8	0.0	0.4	$0		Assumes 15 totes
TOTAL	**TOTAL**						38	30	**0**	**1**	**0**	**25**	**0.4**	**0.9**	**$0**	**2.2**	

Notes:
1. See details on container types below
1. Reagents assumed to be returned to supplier (no disposal fee)

B: Hazardous Materials

		Inputs					Calculated Quantities										
Area	**Description**	Solid/Liquid	Mass of Solid (kg)	Volume of Liquid (m^3)	Container Type	Disposal Fee (per container)	Number of drums	Number of tote bags	Number of Solid Bulk Carriers	Number of Small Tankers	Number of Large Tankers	Loading Time (hrs)	Trips Required - 55 Gal. Drums	Trips Required - Tote Bags	Disposal Fees ($)	**TOTAL TRIPS**	Comments/Notes
Mill Area	Misc. drums, oils, glycol &	Solid	20,000		55 gal. drum	$750	65	0	0	0	0	65	0.6	0.0	$48,750		
Camp Area	Misc. oils, cleaning supplie	Solid	100		55 gal. drum	$750	1	0	0	0	0	1	0.0	0.0	$750		
Fuel Farm Area	Misc. fuel containers/oil	Solid	500		55 gal. drum	$750	2	0	0	0	0	2	0.0	0.0	$1,500		
Explosives Plant	Misc. explosive material	Solid	2,000		Solid - Bulk	$0	0	0	1	0	0	4	0.0	0.0	$0		Assumed
Airport Laydown	Misc. fuel containers/oil	Solid	500		55 gal. drum	$750	2	0	0	0	0	2	0.0	0.0	$1,500		Assumed
Pelly Laydown	Misc. fuel containers/oil	Solid	500		55 gal. drum	$750	2	0	0	0	0	2	0.0	0.0	$1,500		Assumed
Minto South Portal	Misc. fuel containers/oil	Solid	500		55 gal. drum	$750	2	0	0	0	0	2	0.0	0.0	$1,500		Assumed
Airstrip Area	Recycling storage area ma	Solid	3,000		55 gal. drum	$750	10	0	0	0	0	10	0.1	0.0	$7,500		Assumed
TOTAL							84	0	**1**	**0**	**0**	**88**	**0.8**	**0.0**	**$63,000**	**1.8**	

Notes:
1. See details on container types below
2. Mill area parameters are assumed, and were adjusted to total $61,000 in the cost estimate to match a contractor quote from General waste management to MEL.

C: Metal Contaminated Soils

			Inputs				Calculated Quantities			
Area	**Description**	Disposal Location	Suspected Contaminated Area (m2)	Test Grid Spacing (m)	Assumed % Contaminated	Assumed Average Excavation Depth (m)	Delineation Test Pits Required	Confirmation Tests Required	Volume of Contaminated Soil (m3)	Comments/Notes
Crusher Area	Metal Contaminated Soils	UG	19,661	10	50%	0.3	197	197	2949	Suspected area is near processing/tailings/concentrate buildings
Mill Area	Metal Contaminated Soils	UG	19,822	10	50%	0.3	198	198	2973	Suspected area is near processing/tailings/concentrate buildings
TOTAL							395		5922	

Notes:
1. During investigation program, 2 soil tests completed per grid location (1 near surface and 1 at depth)

D: Hydrocarbon Contaminated Soils

			Inputs				Calculated Quantities			
Area	**Suspected location**	Disposal Location	Suspected Contaminated Area (m2)	Test Grid Spacing (m)	Assumed % Contaminated	Assumed Average Excavation Depth (m)	Delineation Test Pits Required	Confirmation Tests Required	Volume of Contaminated Soil (m3)	Comments/Notes
Fuel Storage Area	near fueling areas	Landfarm	1,644	10	15%	1.0	16	16	247	Entrance, fueling area, and near generators.
Mill area	near mechanic shop	Landfarm	550	10	15%	1.0	6	6	83	
Airstrip	allowance	Landfarm	500	10	15%	1.0	5	5	75	
Dundas area	allowance	Landfarm	500	10	15%	1.0	5	5	75	
Pelly laydown	allowance	Landfarm	1,644	10	15%	1.0	16	16	247	
TOTAL							48		725.7	

Notes:
1. During investigation program, 2 soil tests completed per grid location (1 near surface and 1 at depth)

E: Landfarm

Facility	Location	Inputs: Total Volume to be treated (m3)	Maximum thickness (m)	Containment berm height (m)	Liner Protection Layer thickness (m)	Mixing events per year	Years mixing required	Calculated Quantities: Landfarm Area (m2)	Landfarm Length/Width (m)	Landfarm Perimeter Length (m)	Containment Berm Volume (m3)	Liner Area (m2)	Total Mixing Events	Comments/Notes
Existing Landfarm	Airstrip	726				4.0	3.0	4265				4265	12	Overall areas provided by Minto
TOTAL								4265		0	0			

Notes:
1. During investigation program, 2 soil tests completed per grid location (1 near surface and 1 at depth)

F: Solid Waste Landfill

Facility	Location	Inputs: Total Demolition Waste to be stored (LCM)	Assumed Percentage of fill to be added to provide compaction	Maximum fill thickness (m)	Landfill Side slopes (H:1V)	Landfill base length (m)	Landfill cover thickness (m)	Calculated Quantities: Compacted Waste Volume (CCM)	Fill Volume (CCM)	Total Required Landfill Volume (CCM)	Calculated Landfill Volume (CCM)	Landfill Cover Volume	Revegetation Area (ha)	Comments/Notes
Solid Waste Landfill	Airstrip	10,827	30%	5	4	73	0.6	9,415	2,824	12,239	14712	5024	0.55	
TOTAL														

Notes:
1. During investigation program, 2 soil tests completed per grid location (1 near surface and 1 at depth)

Worksheet 34 - Water Conveyance/Storage Quantity Calculations

Project: Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.: 1CM002.044
Client: Minto Explorations Ltd.
Date of Submission: Sept. 17, 2020
File Location: \\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

References (dwgs/plans): \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\!040_AutoCAD\1CM002-45_ClosureQuantities.dwg
Layer: For secondary conveyance channel - "Drainage Paths"

A: Primary Conveyance Channels

	Channel Parameters													X-Section Quantities					Total Quantities					
Area	Length (m)	Channel Base Width, Bc (m)	Side Slope, z (:1)	Average Final Channel Depth, Df (m)	Flow depth including Freeboard, D (m)	Excavation Volume User Over-ride (BCM)	Rip-Rap Thickness (m)	Bedding Layer Thickness (m)	Geotextile Layers	Liner? (Y/N)	Geosynthetic Wastage	Geosynthetic Anchor Trench Allowance (m)	Average Excavation Depth (m)	Average Excavated Area (m^2)	Rip-Rap Area (m^2)	Bedding Layer Area (m^2)	Geotextile Length (m)	Liner Length (m)	Excavation Volume (m^3)	Rip-Rap Volume (CCM)	Bedding Layer Volume (CCM)	Geotextile Area (m^2)	Liner Area (m^2)	Comments/Notes
WSP Breach Channel Restoration (pilot channel	250	2	2	2	1		0.5	0.3	1	No	10%	0.3	2.8	22.3	3.9	2.9	11.0	0.0	5,584	964	726	3,033	0	
Channel A1 (W15 to Main Pit)	83	10	2	10	1.5	40300	0.6	0	1	No	10%	0.3	n/a	485.5	10.9	0.0	20.3	0.0	40,300	906	0	1,851	0	1CM002-042/Jan. 16.
Channel A2	159	10	2	1.5	1.5	0	0.4	0	1	No	10%	0.3	n/a	0.0	7.1	0.0	19.3	0.0	0	1,126	0	3,373	0	1CM002-042/Jan. 16.
Channel A3	107	10	2	1.5	1.5	0	0.9	0	1	No	10%	0.3	n/a	0.0	17.0	0.0	21.8	0.0	0	1,823	0	2,561	0	1CM002-042/Jan. 16.
SUBTOTAL - Channel A																			40,300	3,855	0	7,785		
Channel B1 (W35 to Area 2 Pit)	72	7	2	2	1.35		0.4	0	1	No	10%	0.3	2.4	28.8	5.6	0.0	15.6	0.0	2,072	404	0	1,237	0	1CM002-042
Channel B2	52	7	2	2	1.23		0.6	0	1	No	10%	0.3	2.6	32.5	8.4	0.0	16.1	0.0	1,688	436	0	919	0	1CM002-042
Channel B3	83	7	2	10	1		0.9	0	1	No	10%	0.3	10.9	318.6	12.3	0.0	16.5	0.0	26,440	1,023	0	1,508	0	1CM002-042
Channel B4	56	7	2	10	1		0.9	0	1	No	10%	0.3	10.9	318.6	12.3	0.0	16.5	0.0	17,839	690	0	1,018	0	1CM002-042
SUBTOTAL - Channel B																			48,038	2,554	0	4,682	0	
Channel C (Main Pit to Main Access Road)	182	7	2	3	1.4		0.4	0	1	No	10%	0.3	3.4	47.6	5.7	0.0	15.8	0.0	8,656	1,037	0	3,171	0	1CM002-042
Channel D1 (Area 2 Pit to Main Pit Channel)	160	7	2	4	2.1		0.4	0	1	No	10%	0.3	4.4	70.4	7.0	0.0	19.0	0.0	11,256	1,112	0	3,339	0	1CM002-042
Channel D2	78	7	2	4	1.4		0.9	0	1	No	10%	0.3	4.9	84.4	13.9	0.0	18.3	0.0	6,583	1,087	0	1,571	0	1CM002-042
SUBTOTAL - Channel D																			17,840	2,199	0	4,910	0	
Channel E1 (Mill area)	278	7	2	2	2		0.4	0	1	No	10%	0.3	2.4	28.8	6.8	0.0	18.5	0.0	7,999	1,883	0	5,664	0	1CM002-042
Channel E2 to E6	647	7	2	2	2		0.9	0	1	No	10%	0.3	2.9	38.4	16.4	0.0	21.0	0.0	24,814	10,580	0	14,942	0	1CM002-042
Channel E7	33	7	2	2	2		1.2	0	1	No	10%	0.3	3.2	44.7	22.7	0.0	22.5	0.0	1,475	749	0	816	0	1CM002-042
Channel E8	46	7	2	2	2		0.9	0	1	No	10%	0.3	2.9	38.4	16.4	0.0	21.0	0.0	1,764	752	0	1,062	0	1CM002-042
Channel E9	150	7	2	2	2		2	0	1	No	10%	0.3	4	63.8	41.8	0.0	26.4	0.0	9,567	6,267	0	4,361	0	1CM002-042
Channel E10	20	7	2	2	2		0.9	0	1	No	10%	0.3	2.9	38.4	16.4	0.0	21.0	0.0	767	327	0	462	0	1CM002-042
SUBTOTAL - Channel E (SEE NOTE 3)																			46,386	20,558	0	27,307	0	
Tailings Diversion Ditch	420	0	6	0.5	0.8	0	1.6	0	1	No	10%	0.3	n/a	0.0	31.4	0.0	30.1	0.0	0	13,169	0	13,889	0	1CM002-042
Mill Valley Fill Wetland conveyance channels	160	4	2	1	1		0	0.3	1	Yes	10%	0.3	1.3	8.8	0.0	2.8	10.6	10.6	1,402	0	442	1,858	1,858	1CM002-042
Minto Creek Wetland By-Pass Channel	569	7	2	3	2		0.6	0	1	No	10%	0.3	3.6	52.1	10.5	0.0	19.5	0.0	29,668	5,950	0	12,212	0	
Minto North Spillway	250	7	2	3	1		0.6	0	1	No	10%	0.3	3.6	52.1	7.8	0.0	15.0	0.0	13,035	1,943	0	4,136	0	Allowance
Ridgetop North Outlet Channel (to Minto Crk)	290	3	2	2	1		0.9	0	1	No	10%	0.3	2.9	26.8	8.7	0.0	12.5	0.0	7,758	2,531	0	3,995	0	

Notes:
1. See channel drawing and parameter definitions below.
2. Channel A rip-rap thickness is a weighted average based on Jan. 16. 2018 design drawings.
3. 27,500 m3 of bulk fill required to form Channel E - this volume has been hardcoded into the cost estimate (A13.5). Volume was calculated in AutoCAD Civil3d

B: Secondary Conveyance Channels

	Channel Parameters										X-Section Quantities				Total Quantities				
Area	Length (m)	Channel Base Width, Bc (m)	Side Slope, z (:1)	Average Final Channel Depth, (m)	Rip-Rap Thickness (m)	Bedding Layer Thickness (m)	Geotextile Layers	Geotextile Wastage	Geosynthetic Anchor Trench Allowance (m)	Average Excavation Depth (m)	Average Excavated Area (m^2)	Rip-Rap Area (m^2)	Bedding Layer Area (m^2)	Geotextile Length (m)	Excavation Volume (m^3)	Rip-Rap Volume (CCM)	Bedding Layer Volume (CCM)	Geotextile Area (m^2)	Comments/Notes
Southwest Dump																			
SWD SC1 - Shallow grade	389	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	2,398	842	0	3,661	See Note 1
SWD SC3 - Shallow grade	825	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	5,085	1,785	0	7,764	
SWD SC4 - Shallow grade	276	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	1,701	597	0	2,597	
SWD SC5 - Shallow grade	260	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	1,603	563	0	2,447	
SWD SC1 - Steep grade	21	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	171	78	53	225	
SWD SC2 - Steep grade	240	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	1,953	888	604	2,570	
SWD SC3 - Steep grade	225	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	1,831	832	566	2,409	
SWD SC4 - Steep grade	190	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	1,546	703	478	2,034	
SWD SC5 - Steep grade	140	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	1,139	518	352	1,499	
SUBTOTAL - South West Dump															**17,427**	**6,806**	**2,054**	**25,206**	
Main Waste Dump																			
MWD - Shallow grade	1051	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	6,477	2,274	0	9,888	
MWD - Steep grade	490	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	3,986	1,812	1,233	5,244	
SUBTOTAL - Main Waste Dump															**10,462**	**4,086**	**1,233**	**15,132**	
Reclamation Overburden Dump																			
ROD - Shallow grade	793	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	4,886	1,715	0	7,460	
ROD - Steep grade	370	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	3,007	1,367	930	3,956	
SUBTOTAL - Reclamation Overburden Dump															**7,893**	**3,083**	**930**	**11,416**	
Ridgetop Waste Dump																			
RWD - Shallow grade	93	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	574	201	0	876	
RWD - Steep grade	43	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	353	161	109	465	
SUBTOTAL - Ridgetop Waste Dump															**927**	**362**	**109**	**1,341**	
Dry Stack Tailings Storage Facility and Mill Valley Fill Buttress (Stage 1 and 2)																			
DSTSF - Shallow grade	692	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	4,263	1,497	0	6,509	
MVFE - Shallow grade	505	2	2	1	0.3	0	1	10%	0.3	1.3	6.2	2.2	0.0	8.6	3,115	1,094	0	4,756	
DSTSF - Steep grade	322	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	2,623	1,193	812	3,452	
MFVE - Steep grade	236	2	2	0.6	0.6	0.3	1	10%	0.3	1.5	8.1	3.7	2.5	9.7	1,917	872	593	2,522	
SUBTOTAL - DSTSF and MVFE															**11,919**	**4,655**	**1,405**	**17,239**	
TOTAL - Year 0 Estimate	7024																		
TOTAL - Peak Liability Estimate	7024																		

Notes:
1. SWD secondary channel lengths obtained from SRK project number 1CM002.031 (Progressive reclamation)
2. Channel lengths for all other dumps were based on SWD design scaled by area. 26.6 m of shallow sloped channel length per dump area (ha) were applied, and 12.4 m of steep sloped channel length area
3. 26.6 m of shallow sloped channel length per dump area (ha) was applied, and 12.4 m of steep sloped channel length per dump area (ha) was applied
4. Approx. dump areas used in the calculations are: SWD - 65.8 ha, MWD - 39.5 ha, ROD - 29.8 ha, DSTSF - 26 ha, and MVFE - 19 ha.

C1: Construct New Ponds/Sediment Basins

	Pond Parameters													Total Quantities					
Area	Pond Base Length (m)	Channel Base Width, Bc (m)	Side Slope, z (:1)	Final Pond Depth, Df (m)	Protected depth including Freeboard, D (m)	Excavation Volume User Over-ride (BCM)	Rip-Rap Thickness (m)	Rip-Rap Volume User Over-ride (BCM)	Bedding Layer Thickness (m)	Geotextile Layers	Liner? (Y/N)	Geosynthetic Wastage	Geosynthetic Anchor Trench Allowance (m)	Excavation Depth (m)	Excavation Volume (BCM)	Rip-Rap Volume (CCM)	Bedding Layer Volume (CCM)	Geotextile Area (m^2)	Liner Area (m^2)	Comments/Notes
Stilling Basin at MVFE Stage 2 Toe	15	5	2	2.5	2.5		0	75	0.3	1	No	10%	0.3	2.8	645	75.00	131	540	0	Rip-rap assumes an area of 75m2 at both the inlet and outlet with a thickness of 0.5m

Notes:
1. See channel drawing and parameter definitions below.

C2: Decommission Ponds/Sediment Basins

	Pond Parameters							Calculations			Total Quantities					
Name	Base Length (m)	Base Width (m)	Pond Side Slope (:1)	Pond Depth (m)	Sediment Depth (m)	Water Depth (m)	Liner Bulking Factor (See note 1)	Top Length (m)	Top Width (m)	Liner X-Section Width (mid-pond) (m)	Backfill Volume (m3)	Water Volume (m^3)	Sediment Volume (BCM)	Liner Area (m^2)	Liner Debris Volume (LCM)	Source, Comments/Notes
Mill Water Pond	43	2.5	4	5	0.5	4	10	83.0	42.5	43.7	7,088	4,366	101	3,630	54	Pond to be Filled In; dimension source: 2011 Annual Review plan drawing
Sewage Lagoon at IROD Laydown	35	25	3	3	0	0	n/a	53.0	43.0	44.0	4,488	0	0	2,331	#VALUE!	No liner present - dimensions from AutoCAD
W15 Sump							10	131.0	10.0	10.0				1,310	20	Liner Length from AutoCAD; width/depth assumed
Fuel Tank Farm	45	30	1	2	0.45	0	10	49.0	34.0	35.7	3,008	0	623	1,747	26	Farm dimensions from AutoCAD;
Waste Oil Tanker Containment	12	8	1	2	0.45	0	10	16.0	12.0	13.7	280	0	47	219	3	Farm dimensions from AutoCAD;

Notes:
1. Liner assumed to be 60mil HDPE (thickness 1.5mm); bulking factor estimated

D: Dams

	Dewatering Inputs				Dam Volumes									Calculations								
Name	Storage Capacity (m^3)	Pond Drawdown Rate (m^3/hr)	Seepage during drawdown (L/s)	Pump dewatering system install time (hrs)	Stripping Volume (BCM)	General backfill (CCM)	Upstream Shell (CCM)	Dam Core (CCM)	Filter Layers (CCM)	Downstream Shell (CCM)	Toe Berm (CCM)	Spillway Rip-rap (CCM)	Rip-rap % able to be reused	Time Required to dewater (days)	Total Dewatering Volume (m^3)	Rip-rap for Reuse (CCM)	Rip-rap to discard (CCM)	Total Dam Fill Vol	General Fill to Breach (CCM)	Dam Core to Breach (CCM)	Downstream Shell to breach (CCM)	Source, Comments/Notes
Water Storage Pond Dam	360,000	1080	30	4	33,031	10,740	30,449	29,883	31,630	43,005	6,013	5,800	50%	15	400,000	19,285	19,285	157,520	62,301	23,617	38,571	Max drawdown rate: 300L/s (1,080m3/hr)

Notes:
1. WSP max drawdown rate from "Dam Stability Analysis - Water Retention Dam Reservoir Dewatering (EBA 2008)
2. Dam volumes from asbuilt report (EBA 2008)
3. Upstream shell is residuum, downstream shell is rip-rap sized material, the core is fine-grained clayey material, the filters are screened/crushed materials

E: Intake Structures

	Pond Parameters							Total Quantities		
Name	Quantity	Length (m)	Width (m)	Height (m)	Depth to Competent Foundation (m)	Over-excavation Allowance (m) (See note 1)	Excavation Side Slopes (H:1)	Excavation Volume (BCM)	Backfill volume (CCM)	Source, Comments/Notes
Main Pit Pre-cast concrete intake structure	1	15	4	3	3	2	1	2,450	2,450	Based on pre-cast concrete panel wall manufactured by Precon
Area 2 Pit pre-cast concrete intake structure	1	15	4	3	5	2	1	4,453	4,453	Based on pre-cast concrete panel wall manufactured by Precon

Notes:
1. The perimeter around the intake structure assumed to be over excavated around the perimeter to for worker access during installation.

F: Passive Treatment System/Wetlands

	Valley Fill Parameters				Wetland Cell Parameters												Calculated Quantities							
Area	Length (m)	Average Width (m)	Average Fill Thickness (m)	Valley Fill Volume User Over-ride (CCM)	Number of cells	Base of organics Length (m)	Base of organics width, Bc (m)	Organic Thickness (m)	Final Pond Depth, Df (m)	Side Slope, z (:1)	Excavation Volume User Over-ride (BCM)	Organic Volume User Over-ride (BCM)	Geotextile Layers	Liner? (Y/N)	Geosynthetic Wastage	Geosynthetic Anchor Trench Allowance (m)	Valley Fill Volume	Cell Excavation Depth (m)	Cell Excavation Volume (BCM)	Organic Media Volume (CCM)	Subgrade preparation area (m2)	Geotextile Area (m^2)	Liner Area (m^2)	Comments/Notes
Stilling Basin at MVFE Stage 2 Toe	400	40	4.5		7	41	15	1	1.3	2			1	Yes	10%	0.3	72,000	2.3	14,459	5,122	9,273	10,201	10,201	

Notes:
1. See channel drawing and parameter definitions below.
2. The domains/formulas in the channel drawing below are adjusted in the Wetlands calculations as follows: Wetland media is the equivalent of 'water' (blue), the protection layer is the equivalent to bedding/filter layer (green), and rip-rap was not included in the calculations.

Worksheet 35 - Annual Water Treatment Cost Calculations

Project:	Minto Mine Closure Cost Estimate - RCP 2020-01 - DRAFT
Project No.:	1CM002.044
Client:	Minto Explorations Ltd.
Date of Submission:	Sept. 17, 2020
File Location:	\\srk.ad\dfs\na\van\Projects\01_SITES\Minto\1CM002.045_ClosureCosts\RCP2020-1_CostEstimate\

A: Active Treatment

Adjustment Factors

Inflation factor 1.08 Applied to 2015 site costs to 2020 Dollars based on Bank of Canada Inflation Calculator

Operating Costs

Item	Crew/ Unit	Hours	Materials ($)	Labor Cost ($/hr)	Equipment Cost ($/hr)	Total Materials ($)	Total Labor ($/hr)	Total Equip ($/hr)	Total Cost ($)	Comments/Notes
Contractor Equipment	1	1			$40,716	$0	$0	$40,716	$40,716	
Reagents	1	1	$49,572			$49,572	$0	$0	$49,572	
Filters	1	1	$67,068			$67,068	$0	$0	$67,068	
Operating Parts	1	1	$208,224			$208,224	$0	$0	$208,224	
Power	1	1	$153,360			$153,360	$0	$0	$153,360	
O&M Supplies	1	1	$17,172			$17,172	$0	$0	$17,172	
Membranes	1	1	$41,256			$41,256	$0	$0	$41,256	
Labour	1	1241		$54.00		$0	$67,009	$0	$67,009	Based on plant availability 34%, 10hr/day.
TOTAL - Annual Active Treatment Operating Costs						**$536,652**	**$67,009**	**$40,716**	**$644,377**	

NOTES:
1. Based on site costs - 2015, which have been found to be a typical year for the plant operation.
2. Source: "2015 - WTP Costs.xlsx' supplied by Minto in April 2016.

Capital Replacement Costs

Item	Crew/ Unit	Hours	Materials ($)	Labor Cost ($/hr)	Equipment Cost ($/hr)	Total Materials ($)	Total Labor ($/hr)	Total Equip ($/hr)	Total Cost ($)	Comments/Notes
Mechanical/Electrical Parts	1	1	$64,908			$64,908	$0	$0	$64,908	
Pipes & Fittings	1	1	$26,244			$26,244	$0	$0	$26,244	
Replacement Labour	1	80		$54.00		$0	$4,320	$0	$4,320	Hours assumed.
TOTAL - Annual Active Treatment Operating Costs						**$91,152**	**$4,320**	**$0**	**$95,472**	

NOTES:
1. Based on site costs - 2015
2. Source: "2015 - WTP Costs.xlsx' supplied by Minto in April 2016.

B: Passive Treatment

Wetland maintenance

Item	Crew/ Unit	Hours	Materials ($)	Labor Cost ($/hr)	Equipment Cost ($/hr)	Total Materials ($)	Total Labor ($/hr)	Total Equip ($/hr)	Total Cost ($)	Comments/Notes
Excavator	1	80		$46	$114	$0	$3,676	$9,149	$12,825	
Std. Dump Truck	2	80		$45	$30	$0	$7,262	$4,876	$12,138	
Misc. supplies	1	1	$10,000			$10,000	$0	$0	$10,000	Reveg, bacteria, etc.
Labour	1	40		$37		$0	$1,490	$0	$1,490	
TOTAL - Annual Active Treatment Operating Costs						**$10,000**	**$12,428**	**$14,025**	**$36,453**	

NOTES:
1. Assumed costs for earthwork repairs/cell repair and hydraulic adjustments.