CMC
METALS LTD

Silver Hart Site Water Balance

August 2009

LORAX
ENVIRONMENTAL

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1. Introduction

CMC Metals Ltd. is planning to develop an open pit and underground mine operation with milling facilities at the Silver Hart Property located in the south central Yukon approximately 132 km west of Watson Lake. The Silver Hart Property contains a high-grade silver, lead and zinc deposit and current productions plans target the mining of 63,213 tonnes of ore over a period of 3 years. This indicates that the planned mine development at the Silver Hart Property is rather small. A brief summary of the proposed mine development is provided below.

Once the open pit (192 x 57 m with max. depth of 50 m) is completed in year two, underground mining of deeper zones will start and continue until the end of year 3. Of the estimated 152,047 BCM of waste rock extracted from the pit, 145,398 BCM (95% granodiorite and 5% andesite dyke) will be placed in a waste rock dump (1.28 ha). The remainder of the waste rock will be used for the construction of the tailings impoundment. Overburden from the pit area (44,100 BCM) will be used for the construction of the process and tailings facilities and as road fill. The estimated 2,167 BCM of waste rock from the underground mine will be stored in the old underground workings. The estimated 24,589 m^3 of tailings produced over 3 years will be stored in a tailings facility (0.89 ha) with a total storage capacity of 39,500 m^3 (up to freeboard).

In the evaluation of the environmental and socio-economic effects of the Silver Hart Mine Development and Production project for approval by the YESAB Designated Office (Watson Lake) several recommendations were raised. Although most of the recommendations have been resolved in several communications between YESAB and CMC Metals, there remain a few outstanding concerns that will be addressed in this report. These concerns are:

- ***Hydrological Analysis:*** In the absence of sufficient representative stream flow data, a hydrological analysis will be required to estimate low, average and high flows. The hydrological analysis uses both regional and site data.
- ***Development of a Site Water Balance:*** A detailed site water balance is required for each mining phase (*e.g.* operation and closure) and its water management plan.
- ***Estimates of Receiving Water Quality:*** Based on the integration of the hydrological analysis and the site water balance, estimates of the receiving water quality are made for each of the mining phases.

- ***Mitigation and Treatment:*** The need for specific mitigation measures or water treatment will be identified after a review of the estimated receiving water quality.

2. Hydrologic System

2. Hydrologic System

The hydrologic setting for the Silver Hart project is presented in this section and a description of climate, hydrology, and hydrogeology of the project area is outlined.

2.1 Climate

The project area is located between Watson Lake and Teslin and climate data for both stations are available from Environment Canada. For a more conservative estimate, the climate data from Watson Lake (1938-2009) are chosen because its mean annual precipitation (423 mm) is higher than that of Teslin (334 mm). Table 2-1 provides a summary of the annual climate conditions for Watson Lake on a monthly basis and also presents the predicted distributions of precipitation for 1:100 dry year and 1:200 wet year.

Table 2-1:
Climate Data for the Project Area (Watson Lake)

AVERAGE YEAR

	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Mean Monthly Temp °C (from min-T & max-T)	-24.7	-17.9	-10.5	-0.3	7.2	13.0	15.0	13.0	7.5	-0.3	-14.5	-21.9	
Mean Monthly Temp °C (from hourly-T)	-23.2	-17.7	-9.6	0.5	8.0	13.9	15.4	13.5	7.6	-0.5	-13.6	-20.2	
Monthly Total Precipitation (mm)	**32.3**	**24.0**	**19.2**	**15.7**	**32.4**	**52.4**	**57.5**	**45.0**	**42.5**	**34.9**	**32.5**	**34.5**	**423**
Monthly Rainfall (mm)	0.2	0.2	0.4	3.5	27.0	47.6	54.8	40.5	37.1	15.7	1.3	0.4	**229**
Monthly Snowfall (SWE in mm)	35.1	28.4	21.4	11.7	4.4	0.0	0.0	0.1	2.5	19.6	33.3	37.9	**194**
Snow Accumulation (mm)[1]	125.8	154.2	175.5	120.4	30.1					19.6	52.8	90.8	
Monthly Potential Evaporation (mm)[2]	0.0	0.0	1.1	45.6	102.5	122.0	110.1	75.6	29.4	5.4	0.1	0.0	492
Actual Evaporation (mm)[3]	**0.0**	**0.0**	**0.6**	**23.2**	**52.1**	**62.0**	**55.9**	**38.4**	**15.0**	**2.8**	**0.0**	**0.0**	**250**
Net Precipitation (mm)	32.3	24.0	18.6	-7.4	-19.7	-9.6	1.6	6.6	27.5	32.2	32.4	34.5	**173**

PRECIPITATION (mm)

	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
1:100 Dry Year	19.7	14.6	11.7	9.6	19.7	32.0	35.1	27.4	25.9	21.3	19.8	21.1	258
Average Year	**32.3**	**24.0**	**19.2**	**15.8**	**32.4**	**52.5**	**57.6**	**45.1**	**42.6**	**35.0**	**32.5**	**34.6**	**423**
1:200 Wet Year	46.3	34.4	27.6	22.6	46.4	75.2	82.6	64.6	61.0	50.1	46.6	49.5	606

NOTES:
1: snow accumulation equals October to April snow with 15% of snowpack ablating in late April
2: Evaporation calculated with Combined Penman Equation
3: Actual Evaporation ~50% of Potential Evaporation

2.2 Hydrology

For the assessment of baseline water quality and stream flow, several monitoring stations are established in the area. A schematic with the monitoring stations in McCrory Creek, Oake Creek and Meister River is shown in Figure 2-1 and a map of these stations relative to the project are provided in Figure 2-2. Potential impacts from the proposed development on the stream water quality would first be evident in the McCrory Creek (station M2) (note that M1 is upstream of the development area and is not expected to shouldn't see any impacts) and progress downstream into Oake Creek and finally into the Meister River. Stream water samples were collected at the monitoring stations in Sept.'85, Nov. '86, May '87, Oct.'87, Sept. '06 (2x) and Aug.'07. Flow measurements at the monitoring station were made in Sept. '06 (2x) and Aug. '07. The water quality data and flow measurements at the monitoring stations are presented in Appendix A. CMC is continuing to collect water quality and flow data monthly since May 2009.

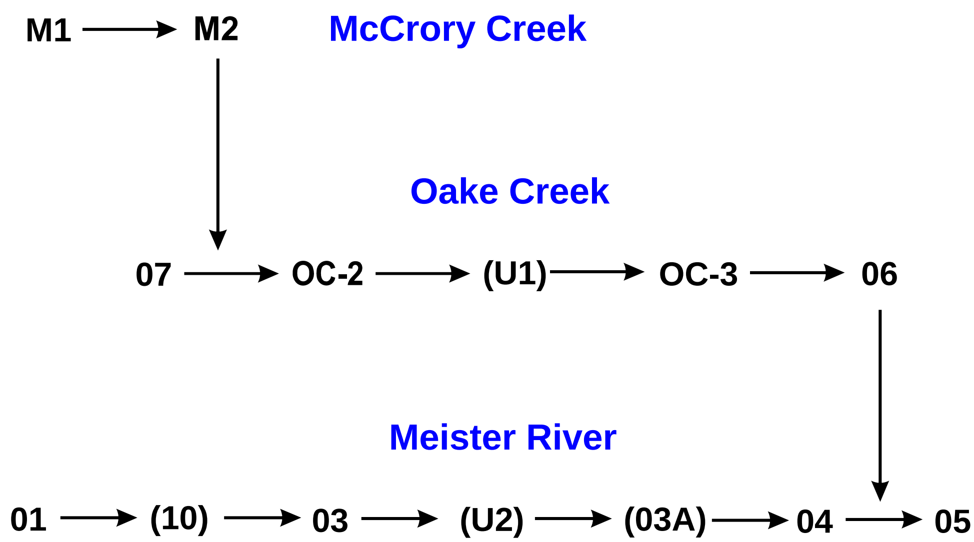
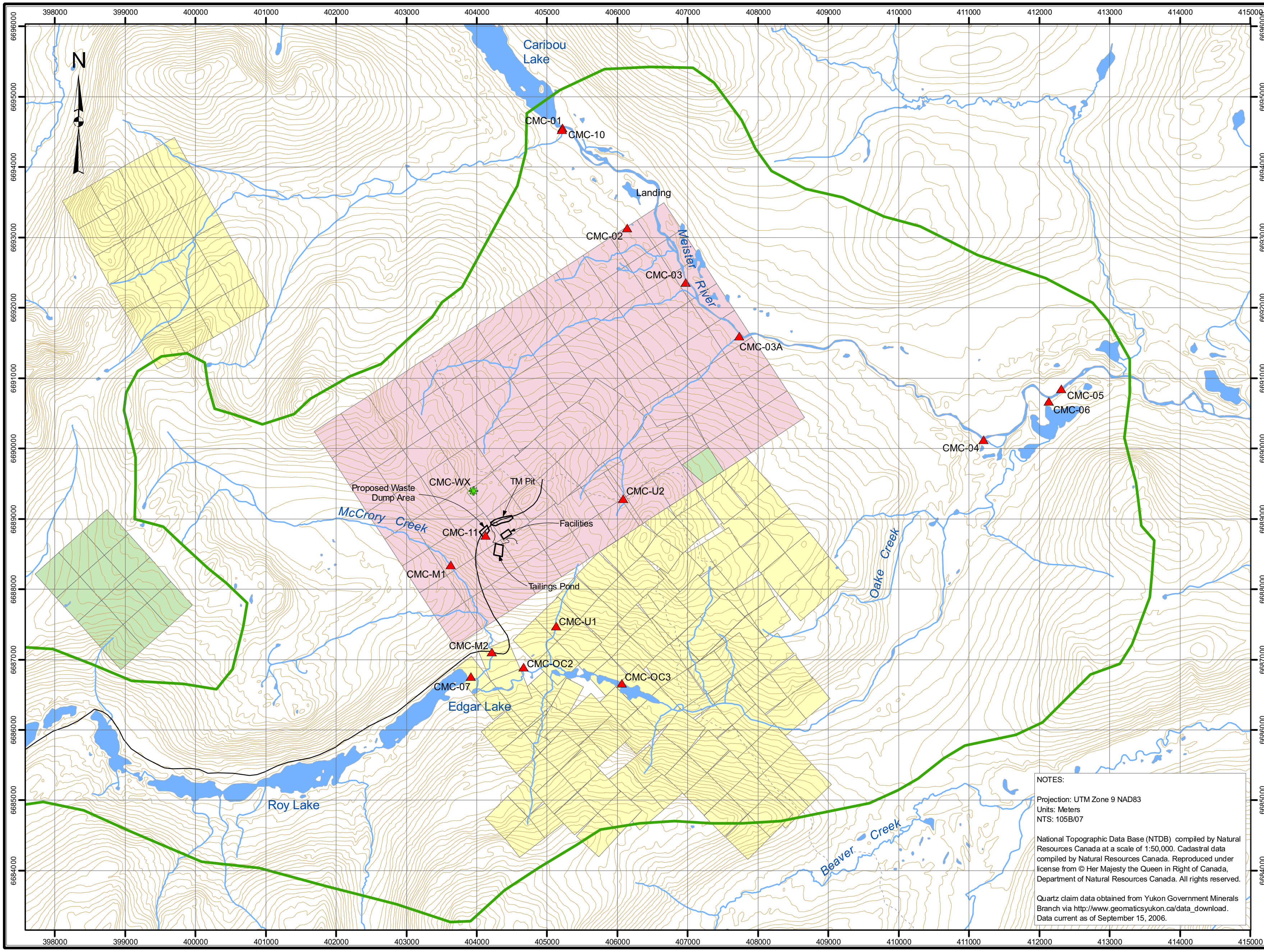


Figure 2-1: Schematic with Monitoring Stations in Project Area

For estimates of the receiving water quality (average), monthly flow data are required for the various monitoring stations. Stream flow data for the monitoring stations are derived by a hydrological analysis of regional and site data. After examination of available data from Environment Canada on catchments in the Yukon, 14 regional catchments were selected as potential analogues for catchments in the project area. Among the 14 catchments, relationships between mean annual runoff (mm), catchment area and average catchment elevation were established. Based on its size and proximity to the project area, the Big Creek catchment (station # 10AA005 at km 1084.8 of the Alaska Highway, 45 km from the site) was chosen as an analogue for the catchments represented by the different monitoring stations in the project area. The flow data (1989-2007) for the Big Creek catchment were obtained from Environment Canada. The flow data included both average annual and average monthly flows.



NOTES:

Projection: UTM Zone 9 NAD83
Units: Meters
NTS: 105B/07

National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced under license from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Quartz claim data obtained from Yukon Government Minerals Branch via http://www.geomaticsyukon.ca/data_download. Data current as of September 15, 2006.

CMC METALS LTD. PROPERTY

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Legend

- Weather Station
- Water Quality Station
- Trail
- Limited-Use Road
- Contour
- Water Course
- Environmental Assessment Project Spatial Boundary
- Infrastructure

Quartz Claims
Claim Owner, Status

- Expired
- Archer, Cathro & Associates, Active
- CMC Metals Ltd., Active

Figure 2-2

Site Overview

Scale:
1:50,000
0 250 500 1,000 1,500 2,000 m

Drawn by: HD | Checked by: PI

Date: November 2006

Our File: D:\Projects\AllProjects\CMC_Metals\gis\mxd\YESAB_Fall06\Fig2_AreaOverview50K.mxd

After a frequency analysis (Log Pearson Type III) of the hydrological data from the Big Creek catchment, average annual and average monthly flows were also obtained for an 1:100 dry year and a 1:200 wet year. Using the established relationships between flow, catchment area and average catchment elevation, flows from the Big Creek catchment were then scaled to the catchments with monitoring stations in the project area. The results are shown in Table 2-2 (average year), Table 2-3 (1:200 wet year) and Table 2-4 (1:100 dry year). More details about the procedure followed to derive flow data for the project area are provided in Appendix B.

Table 2-2:
Predicted Discharges at Monitoring Stations for an Average Year

	Average Monthly Flow (m^3/d)											
Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CMC-01	282,000	245,000	231,000	298,000	1,470,000	2,230,000	1,240,000	762,000	757,000	629,000	427,000	341,000
CMC-02	796	693	653	843	4,160	6,320	3,500	2,150	2,140	1,780	1,210	963
CMC-03	299,000	261,000	246,000	317,000	1,560,000	2,380,000	1,320,000	810,000	806,000	669,000	454,000	362,000
CMC-03A	303,000	264,000	249,000	321,000	1,580,000	2,410,000	1,340,000	821,000	816,000	678,000	460,000	367,000
CMC-04	335,000	292,000	275,000	355,000	1,750,000	2,660,000	1,480,000	907,000	902,000	749,000	508,000	406,000
CMC-05	337,000	293,000	276,000	357,000	1,760,000	2,670,000	1,480,000	911,000	905,000	752,000	510,000	407,000
CMC-06	337,000	293,000	276,000	357,000	1,760,000	2,670,000	1,480,000	911,000	905,000	752,000	510,000	407,000
CMC-07	15,700	13,700	12,900	16,700	82,200	125,000	69,300	42,600	42,300	35,100	23,900	19,000
CMC-10	9,230	8,030	7,570	9,780	48,200	73,300	40,700	25,000	24,800	20,600	14,000	11,200
CMC-11	99.2	86.3	81.3	105	518	787	437	268	267	221	150	120
CMC-M1	5,550	4,830	4,550	5,880	29,000	44,000	24,400	15,000	14,900	12,400	8,410	6,710
CMC-M2	6,230	5,420	5,110	6,610	32,600	49,500	27,500	16,900	16,800	13,900	9,450	7,540
CMC-OC2	25,200	21,900	20,600	26,700	131,000	200,000	111,000	68,100	67,700	56,200	38,200	30,500
CMC-OC3	27,400	23,900	22,500	29,100	143,000	218,000	121,000	74,200	73,800	61,300	41,600	33,200
CMC-U1	227	198	186	241	1,190	1,800	1,000	615	612	508	345	275
CMC-U2	248	216	204	263	1,300	1,970	1,090	672	668	555	377	301

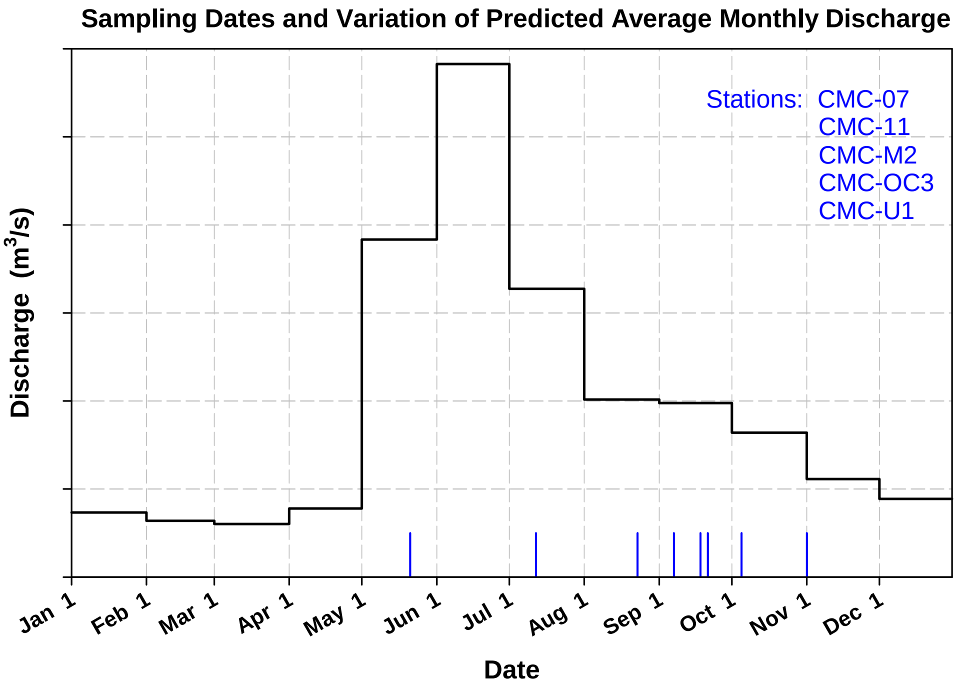
Table 2-3:
Predicted Discharges at Monitoring Stations for a 1:200 Wet Year

	Average Monthly Flow (m^3/d)											
Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CMC-01	526,494	457,415	431,277	556,366	2,744,490	4,163,410	2,315,080	1,422,654	1,413,319	1,174,343	797,209	636,647
CMC-02	1486	1294	1219	1574	7,767	11,799	6,535	4,014	3,995	3,323	2,259	1798
CMC-03	558,233	487,287	459,282	591,839	2,912,520	4,443,460	2,464,440	1,512,270	1,504,802	1,249,023	847,618	675,854
CMC-03A	565,701	492,888	464,883	599,307	2,949,860	4,499,470	2,501,780	1,532,807	1,523,472	1,265,826	858,820	685,189
CMC-04	625,445	545,164	513,425	662,785	3,267,250	4,966,220	2,763,160	1,693,369	1,684,034	1,398,383	948,436	758,002
CMC-05	629,179	547,031	515,292	666,519	3,285,920	4,984,890	2,763,160	1,700,837	1,689,635	1,403,984	952,170	759,869
CMC-06	629,179	547,031	515,292	666,519	3,285,920	4,984,890	2,763,160	1,700,837	1,689,635	1,403,984	952,170	759,869
CMC-07	29,312	25,578	24,084	31,179	153,467	233,375	129,383	79,534	78,974	65,532	44,621	35,473
CMC-10	17,232	14,992	14,133	18,259	89,989	136,851	75,987	46,675	46,302	38,460	26,138	20,910
CMC-11	185.2	161.1	151.8	196	967	1469	816	500	498	413	280	224
CMC-M1	10,362	9,018	8,495	10,978	54,143	82,148	45,555	28,005	27,818	23,151	15,701	12,528
CMC-M2	11,631	10,119	9,540	12,341	60,864	92,417	51,343	31,552	31,366	25,951	17,643	14,077
CMC-OC2	47,048	40,887	38,460	49,849	244,577	373,400	207,237	127,143	126,396	104,925	71,319	56,944
CMC-OC3	51,156	44,621	42,008	54,330	266,981	407,006	225,907	138,531	137,785	114,447	77,667	61,984
CMC-U1	424	370	347	450	2,222	3,361	1,867	1148	1143	948	644	513
CMC-U2	463	403	381	491	2,427	3,678	2,035	1255	1247	1036	704	562

Table 2-4:
Predicted Discharges at Monitoring Stations for a 1:100 Dry Year

Location	Average Monthly Flow (m^3/d)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CMC-01	202,000	175,000	165,000	213,000	1,050,000	1,590,000	887,000	545,000	541,000	450,000	305,000	244,000
CMC-02	569	496	467	603	2,970	4,520	2,500	1,540	1,530	1,270	865	689
CMC-03	214,000	187,000	176,000	227,000	1,120,000	1,700,000	944,000	579,000	576,000	478,000	325,000	259,000
CMC-03A	217,000	189,000	178,000	230,000	1,130,000	1,720,000	958,000	587,000	584,000	485,000	329,000	262,000
CMC-04	240,000	209,000	197,000	254,000	1,250,000	1,900,000	1,060,000	649,000	645,000	536,000	363,000	290,000
CMC-05	241,000	210,000	197,000	255,000	1,260,000	1,910,000	1,060,000	651,000	647,000	538,000	365,000	291,000
CMC-06	241,000	210,000	197,000	255,000	1,260,000	1,910,000	1,060,000	651,000	647,000	538,000	365,000	291,000
CMC-07	11,200	9,800	9,220	11,900	58,800	89,400	49,600	30,500	30,200	25,100	17,100	13,600
CMC-10	6,600	5,740	5,410	6,990	34,500	52,400	29,100	17,900	17,700	14,700	10,000	8,010
CMC-11	70.9	61.7	58.1	75.1	370	563	312	192	191	158	107	85.8
CMC-M1	3,970	3,450	3,250	4,200	20,700	31,500	17,400	10,700	10,700	8,870	6,010	4,800
CMC-M2	4,450	3,880	3,650	4,730	23,300	35,400	19,700	12,100	12,000	9,940	6,760	5,390
CMC-OC2	18,000	15,700	14,700	19,100	93,700	143,000	79,400	48,700	48,400	40,200	27,300	21,800
CMC-OC3	19,600	17,100	16,100	20,800	102,000	156,000	86,500	53,100	52,800	43,800	29,700	23,700
CMC-U1	162	142	133	172	851	1,290	715	440	438	363	247	197
CMC-U2	177	154	146	188	930	1,410	779	481	478	397	270	215

A comparison between the timing of water quality sampling (vertical bars) and the variation in (average) monthly flow is shown in Figure 2-3. The average monthly flows shown are relative (*e.g.* applicable to all monitoring stations) although the magnitude of the flow varies considerably between the various stations (Table 2-2). The data in Figure 2-3 demonstrate that baseline water quality samples have been collected at both high (June-Aug) and low (Sept-Nov) flows.



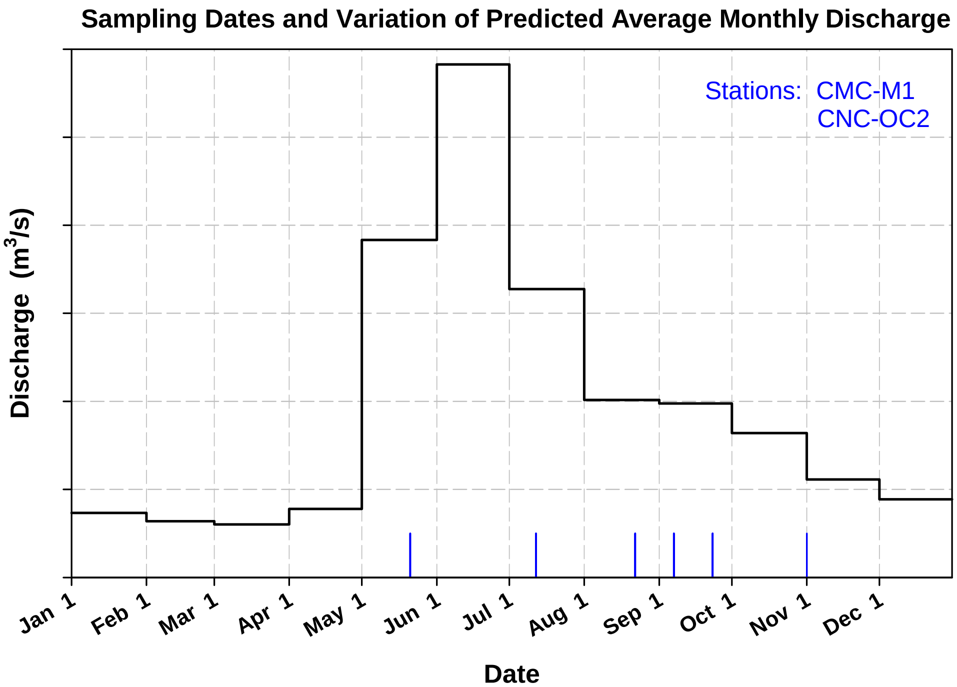


Figure 2-3: Frequency of Water Quality Sampling and Stream Flow Conditions

2.3 Hydrogeology

Presently, groundwater data from past drill holes are not yet available. However, based on the water level measurement taken during the summer of 2009, the groundwater level is approximately at 1400.5 meter elevation or at the level of the adit. This is supported by a lack of seeps from the hillside above the level of the adit and their appearance below the adit level.

There is also some evidence that the groundwater level dropped after the installation of the adit. On September 18, 1985 three diamond drill holes (85-13, 85-18 and 85-19) were noted as water producing by members of DIAND Water Resources. These drill holes were then revisited in 1987 after the construction of the adit and there was no water being produced and no flow has been noted in the intervening years.

3. Site Water Balance

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3. Site Water Balance

3.1 Description Site Water Management

The layout of the mine site with the locations of the various facilities, including the open pit with the underground workings, the waste rock dump, the tailings pond, the mill facilities and the camp is shown in Figure 3-1. A schematic of the site water balance with the various inputs and outputs is presented in Figure 3-2.

The tailings facility, the process plant (mill facilities) and water treatment plant occupy a central position in the water management at the mine site. Most of the water used in the ore processing is reclaimed from the tailings facility. The make-up water for the process plant is obtained from a groundwater well. Other inputs to the tailings facility include the seepage water from the closed adit, the runoff and seepage water from the open pit and the runoff and seepage water from the waste rock dump. After collection in ponds, the water from three input sources of water is piped to the tailings facility. Net precipitation (precipitation minus evaporation) constitutes an additional source of water input to the tailings facility. To maintain sufficient storage capacity in the tailings pond for emergency situations, the surplus water (inputs-outputs) of the tailings facility is treated and temporarily stored in polishing ponds before being discharged into McCrory Creek (not shown in Figure 3-1).

The seepage and runoff water from the waste rock dump is collected in perimeter ditches that discharge into a collection pond. Similarly, the seepage from the tailings pond is collected in perimeter ditches and returned to the tailings pond. Runoff and seepage water from the open pit is pumped into a collection and settling pond prior to being piped to the tailings pond. To minimize the potential effect of site runoff on the water quality of the natural drainage, a drainage system is designed that routes surface runoff around the mine site facilities. Diversion ditches are used to divert 'clean' runoff water away from the open pit, the waste rock dump, the tailings pond and the process plant. Ultimately the diverted runoff water is discharged via two major drainage ditches into McCrory Creek.

Provided that the seepage and runoff waters from the open pit, the waste rock dump and the closed adit meet MMER guidelines, the 'clean' water from the diversion ditches could potentially be used to dilute the 'dirty' seepage and runoff waters during closure. This would imply that the 'dirty' water would no longer have to be piped to the tailings facility but could be released into the main drainage ditches that discharge into McCrory Creek where CCME guidelines would have to be met.

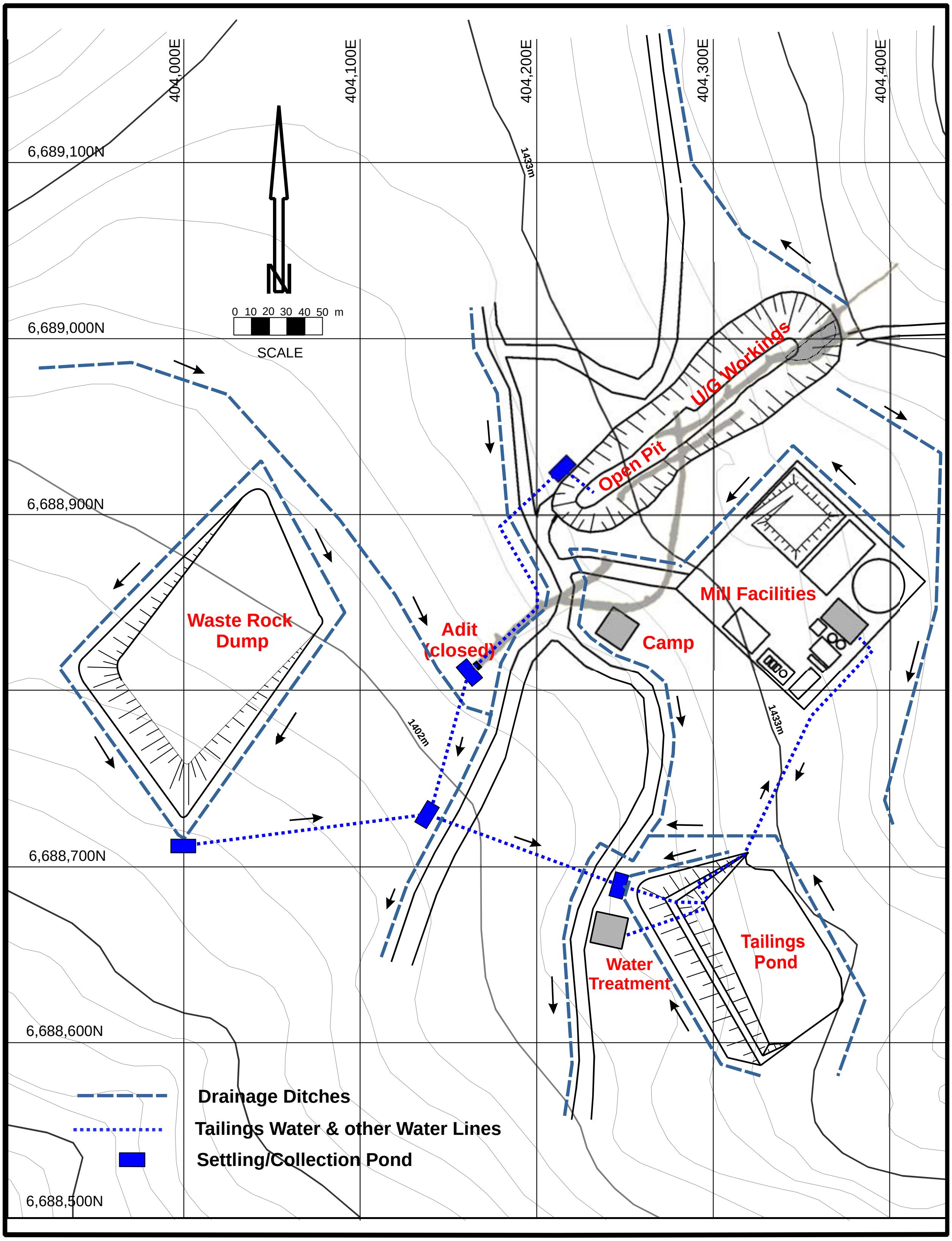

Figure 3-1: Layout of the Mine Site.

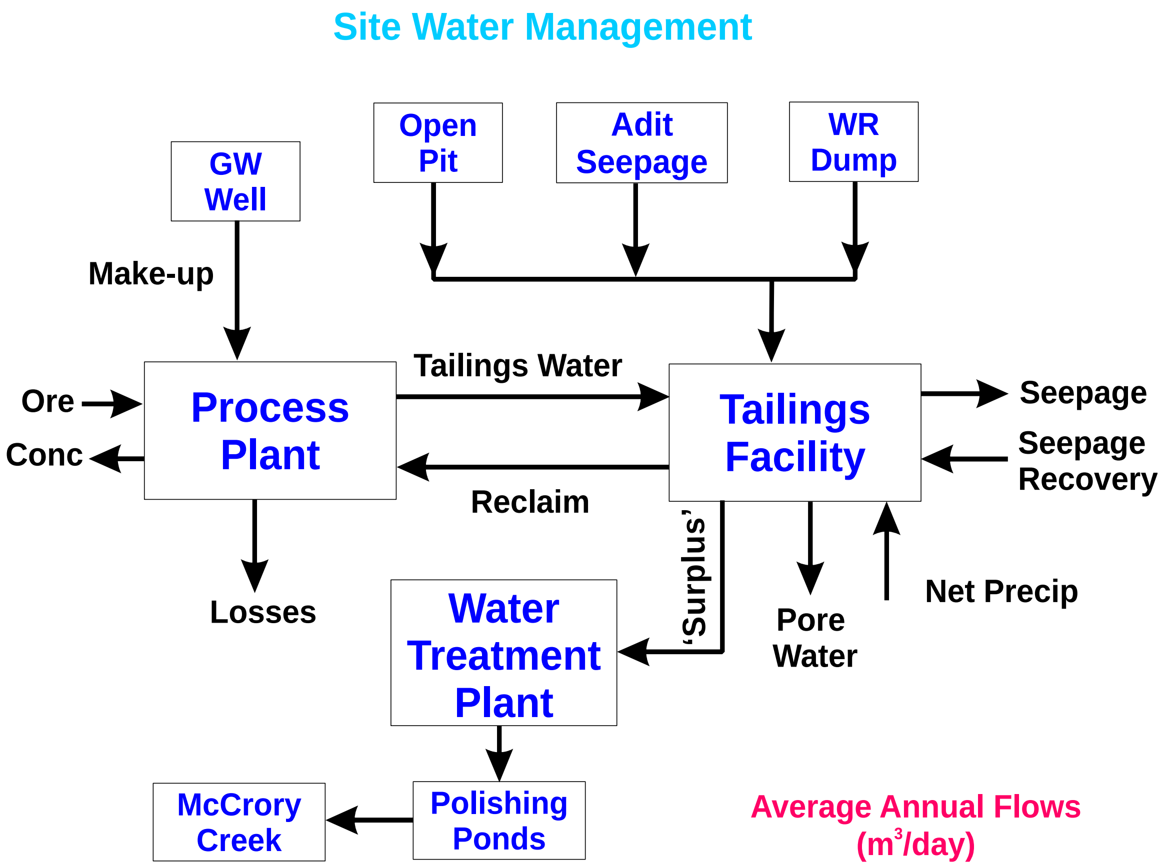

Figure 3-2: Schematic Water Balance Mine Site.

3.2 Site Water Balance

The key features and main assumptions of the site water balance can be summarized as follows:

- The tailings facility is the ultimate repository for all water produced at site that is not acceptable for direct discharge into the environment.
- The tailings facility receives tailings water from the process plant, runoff and seepage water from the open pit and the waste rock dump, net precipitation and seepage from the closed adit.
- The site water balance operates as a positive balance and the excess water that accumulates in the tailings facility is treated and discharged into McCrory Creek.
- Treatment of excess water only occurs during a six-month period of the year: from May to October.

- The tailings facility is lined and no water loss due to seepage through the liner is assumed.
- Most of the water used in the process plant is reclaimed from the tailings facility with additional make-up water from a groundwater well.

Using estimates of average annual flows (m^3/day) between the different mine site facilities in the site water management system (Figure 3-1), a site water balance is established for average annual conditions. The most current and reliable climate data for the site is the climate data of Watson Lake (1938-2000) and was used to determine 1:200 wet year and 1:100 dry year frequency. The site water balance during mining operations is shown in Figure 3-3. Detailed water balance scenarios (average year, 1:200 wet year, 1:100 dry year) that have been considered for the tailings facility are discussed in section 3.3.

In the water balance the estimated water inputs to each mine site facility match the estimated water outputs; there is no water storage. For example, the surplus of water from the tailings facility that is directed to the water treatment plant (24.9 m^3/day or 0.34 L/s) represents the difference between total inputs (136.8 m^3/day) and total outputs (111.9 m^3/day) at the tailings facility.

Most of the water in the site water balance (108-120 m^3/day) is continuously recycled between the process plant and the tailings facility. The inputs to the site water balance are dominated by the contributions from the groundwater well (13.0 m^3/day), runoff and seepage from the waste rock dump (5.2 m^3/day) and open pit (4.6 m^3/day) and the net precipitation on the tailings pond (4.2 m^3/day). The discharge of treated water into McCrory Creek (24.9 m^3/day) and the pore water accumulating in the deposited tailings (3.4 m^3/day) are the main contributions to the output from the site water balance.

The treated water that is discharged into McCrory Creek, will meet CCME water quality objectives downstream of monitoring station M2. Moreover, treated water in the polishing ponds that does not meet water quality criteria will be returned to the tailings pond.

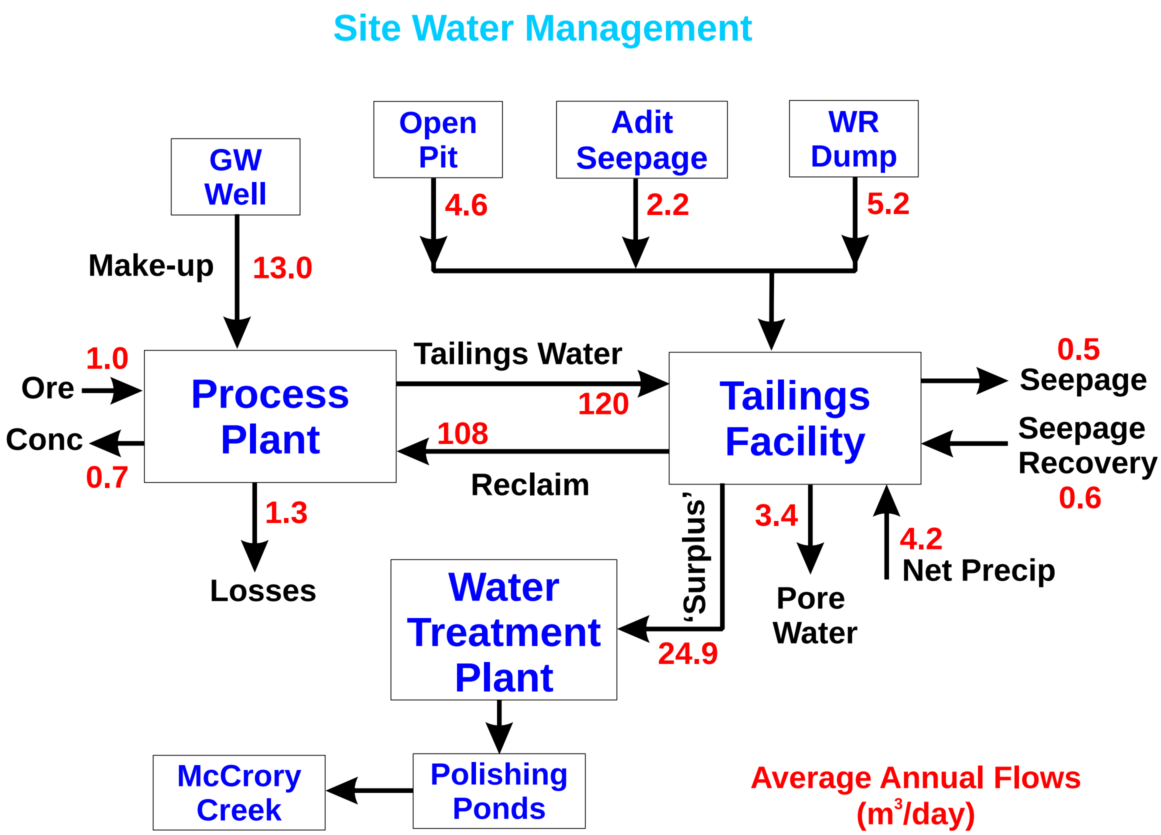

Figure 3-3: Water Balance of the Mine Site during Mining Operations.

3.3 Process Plant and Tailings Facility

The estimated average process water demand is 44.8 m^3/day. Except for the fresh water from the groundwater well used for make-up water (13.0 m^3/day), most of the water used in the process plant (mill) is reclaimed supernatant from the tailings facility (108 m^3/day). Together with the water in the mined ore (1.0 m^3/day), the total input of water to the process plant is 122 m^3/day. The largest output from the process plant is the water that is pumped to the tailings facility (120 m^3/day). Additional outputs from the process plant include water in the concentrate (0.7 m^3/day) and dryer water losses (1.3 m^3/day).

The tailings facility consists of an impoundment with a surface area of an estimated 0.89 ha and a storage capacity of 39,500 m^3. Based on available precipitation data from Watson Lake (1938-2000), water balances of the tailings pond during operation and closure have been prepared on a monthly basis for an average year (423 mm), a 1:200 wet year (606 mm) and a 1:100 dry year (258 mm). The water balances of the tailings pond for the six different scenarios are shown in Tables 3-1 to 3-6. The data reported for the site water balance (Figure 3-3) represent data of an average year during operation of the tailings facility.

The water discharged from the process plant (120 m^3/day) constitutes the main input to the tailings facility. In addition to net precipitation (4.2 m^3/day), other major inputs to the tailings pond include runoff and seepage from the waste rock dump (5.2 m^3/day) and the open pit (4.6 m^3/day). Whereas annual potential evaporation of 492 mm was estimated with the Penman Combination equation for a free water surface using hourly data from Watson Lake Airport, the climate atlas of Canada suggests an annual evaporation of 300 mm. In the calculation of the net precipitation a conservative estimate of 250 mm was assumed for the actual evaporation. The runoff and seepage from the waste rock dump was derived by applying the net precipitation to the surface area of the waste rock dump while assuming a runoff coefficient of 0.85. The same approach but with a runoff coefficient of 0.90 was used for the open pit. The runoff is purposely overestimated to account at least for some of the unknown seepage. Seepage from the closed adit (2.2 m^3/day) is estimated at 5% from the measured maximum adit flow (0.5 L/s).

The major output from the tailings facility is reclaim water recycled to the process plant (108 m^3/day). Assuming a porosity of 15% (v/v) for the deposited tailings (53 tpd), the water retained in the tailings is 3.4 m^3/day. Although there will be a liner at the bottom of the tailings facility, there will be seepage through the tailings dam (0.5 m^3/day) that is collected in perimeter ditches and returned to the tailings pond (0.6 m^3/day).

The difference between total inputs (136.8 m^3/day) and outputs (111.9 m^3/day) at the tailings facility during operation (average precipitation year) is a surplus of water (24.9 m^3/day or 0.34 L/s) that is directed to the water treatment plant. Hence, except the deposited tailings (22.45 m^3/day) with pore water, there will be no net storage of water in the tailings facility. This applies to all six scenarios shown in Tables 3-1 to 3-6 which implies that the volume of water to be treated will vary for the different scenarios. Over the three years of operation, this would leave approximately 15,000 m^3 of the available 39,500 m^3 storage capacity in the tailings pond unoccupied. According to the data in Tables 3-1, to 3-6 there will be surplus water in the tailings facility during mine operation and after closure for the average year, the 1:200 wet year and the 1:100 dry year. Considering the impact of frozen conditions on the hydrological conditions in McCrory Creek, the surplus of water collected in the tailings facility is only treated in the period May-October. As such, surplus water delivered to the water treatment plant (average year conditions) is approximately 49.5 m3/day or (0.6 L/s). The incremental volume shown in Tables 3-1 to 3-6 refers to the volume of water that has temporarily accumulated in the tailings facility prior to removal for treatment during the months May to October. During closure, the tailings will be covered and the facility will be no longer operational as a water storage facility. The inputs to the tailings facility during closure will actually be collected in a pond adjacent to the old tailings pond prior to treatment.

Table 3-1:
Water Balance of the Tailings Facility during Operations (average year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	32.3	24.0	19.2	15.7	32.4	52.4	57.5	45.0	42.5	34.9	32.5	34.5	**423**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	32.3	24.0	18.6	-7.4	-19.7	-9.6	1.6	6.6	27.5	32.2	32.4	34.5	**173**
Water Inputs (m^3/day)													**Average**
Tailings Water	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Net Precipitation on TF	9.3	7.6	5.4	-2.2	-5.7	-2.8	0.5	1.9	8.2	9.2	9.6	9.9	4.2
WR Dump	11.3	9.3	6.5	-2.7	-6.9	-3.5	0.6	2.3	10.0	11.3	11.8	12.1	5.2
Open Pit	10.2	8.4	5.9	-2.4	-6.2	-3.1	0.5	2.1	9.0	10.2	10.6	10.9	4.7
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**153.6**	**148.1**	**140.6**	**115.5**	**104.0**	**113.4**	**124.4**	**129.1**	**150.0**	**153.5**	**154.8**	**155.7**	**136.9**
Water Losses (m^3/day)													**Average**
Reclaim	108	108	108	108	108	108	108	108	108	108	108	108	108.0
Tailings Pore Water	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**
Net Water Surplus (m^3/day)	**41.7**	**36.2**	**28.7**	**3.6**	**-7.9**	**1.5**	**12.5**	**17.2**	**38.1**	**41.6**	**42.9**	**43.8**	**24.9**
Water Treatment (m^3/day)	0.0	0.0	0.0	0.0	49.5	49.5	49.5	49.5	49.5	49.5	0.0	0.0	**49.5**
Incremental volume (m^3)	3,938	4,952	5,842	5,949	4,170	2,729	1,580	579	237	-9	1,286	2,645	

Table 3-2:
Water Balance of the Tailings Facility during Operations (1:200 wet year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	46.3	34.4	27.6	22.6	46.4	75.2	81.7	64.6	61.0	50.1	46.6	49.5	**606**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	46.3	34.4	27.0	-0.6	-5.6	13.2	25.7	26.2	46.0	47.3	46.5	49.5	**356**
Water Inputs (m^3/day)													**Average**
Tailings Water	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Net Precipitation on TF	13.3	10.9	7.8	-0.2	-1.6	3.9	7.4	7.5	13.7	13.6	13.8	14.2	8.7
WR Dump	16.2	13.4	9.5	-0.2	-2.0	4.8	9.0	9.2	16.7	16.6	16.9	17.4	10.6
Open Pit	14.6	12.1	8.5	-0.2	-1.8	4.3	8.1	8.3	15.0	15.0	15.2	15.7	9.6
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**167.0**	**159.2**	**148.6**	**122.2**	**117.4**	**135.9**	**147.4**	**147.8**	**168.2**	**168.0**	**168.7**	**170.1**	**151.7**
Water Losses (m^3/day)													**Average**
Reclaim	108	108	108	108	108	108	108	108	108	108	108	108	108.0
Tailings Pore Water	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**
Net Water Surplus (m^3/day)	**55.1**	**47.3**	**36.7**	**10.3**	**5.5**	**24.0**	**35.5**	**35.9**	**56.3**	**56.1**	**56.8**	**58.2**	**39.7**
Water Treatment (m^3/day)	0.0	0.0	0.0	0.0	78.9	78.9	78.9	78.9	78.9	78.9	0.0	0.0	**78.9**
Incremental volume (m^3)	5,214	6,537	7,674	7,984	5,709	4,061	2,715	1,381	703	-4	1,704	3,507	

Table 3-3:
Water Balance of the Tailings Facility during Operations (1:100 dry year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	19.7	14.6	11.7	9.6	19.7	32.0	35.1	27.4	25.9	21.3	19.8	21.1	**258**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	19.7	14.6	11.2	-13.6	-32.3	-30.0	-20.8	-10.9	11.0	18.5	19.8	21.1	**8**
Water Inputs (m³/day)													**Average**
Tailings Water	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Net Precipitation on TF	5.6	4.6	3.2	-4.0	-9.3	-8.9	-6.0	-3.1	3.3	5.3	5.9	6.0	0.2
WR Dump	6.9	5.7	3.9	-4.9	-11.3	-10.9	-7.3	-3.8	4.0	6.5	7.2	7.4	0.2
Open Pit	6.2	5.1	3.5	-4.4	-10.2	-9.8	-6.6	-3.5	3.6	5.9	6.5	6.7	0.2
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**141.6**	**138.3**	**133.4**	**109.4**	**91.9**	**93.2**	**102.9**	**112.4**	**133.6**	**140.5**	**142.3**	**142.9**	**123.5**
Water Losses (m³/day)													**Average**
Reclaim	108	108	108	108	108	108	108	108	108	108	108	108	108.0
Tailings Pore Water	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**	**111.9**
Net Water Surplus (m³/day)	**29.7**	**26.4**	**21.5**	**-2.5**	**-20.0**	**-18.7**	**-9.0**	**0.5**	**21.7**	**28.6**	**30.4**	**31.0**	**11.5**
Water Treatment (m³/day)	0.0	0.0	0.0	0.0	22.9	22.9	22.9	22.9	22.9	22.9	0.0	0.0	**22.9**
Incremental volume (m³)	2,793	3,531	4,198	4,124	2,796	1,548	560	-136	-171	6	912	1,872	

Table 3-4:
Water Balance of the Tailings Facility after Closure (average year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	32.3	24.0	19.2	15.7	32.4	52.4	57.5	45.0	42.5	34.9	32.5	34.5	**423**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	32.3	24.0	18.6	-7.4	-19.7	-9.6	1.6	6.6	27.5	32.2	32.4	34.5	**173**
Water Inputs (m³/day)													**Average**
Tailings Water	0.0	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 Precipitation on TF	9.3	7.6	5.4	-2.2	-5.7	-2.8	0.5	1.9	8.2	9.2	9.6	9.9	4.2
WR Dump	11.3	9.3	6.5	-2.7	-6.9	-3.5	0.6	2.3	10.0	11.3	11.8	12.1	5.2
Open Pit	10.2	8.4	5.9	-2.4	-6.2	-3.1	0.5	2.1	9.0	10.2	10.6	10.9	4.7
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**33.6**	**28.1**	**20.6**	**-4.5**	**-16.0**	**-6.6**	**4.4**	**9.1**	**30.0**	**33.5**	**34.8**	**35.7**	**16.8**
Water Losses (m³/day)													**Average**
Reclaim	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tailings Pore Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Net Water Surplus (m³/day)	**33.1**	**27.6**	**20.1**	**-5.0**	**-16.5**	**-7.1**	**3.9**	**8.6**	**29.5**	**33.0**	**34.3**	**35.2**	**16.3**
Water Treatment (m³/day)	0.0	0.0	0.0	0.0	32.4	32.4	32.4	32.4	32.4	32.4	0.0	0.0	**32.4**
Incremental volume (m³)	3,146	3,920	4,543	4,393	2,876	1,691	806	68	-20	-1	1,028	2,121	

Table 3-5:
Water Balance of the Tailings Facility after Closure (1:200 wet year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	46.3	34.4	27.6	22.6	46.4	75.2	81.7	64.6	61.0	50.1	46.6	49.5	**606**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	46.3	34.4	27.0	-0.6	-5.6	13.2	25.7	26.2	46.0	47.3	46.5	49.5	**356**
Water Inputs (m³/day)													**Average**
Tailings Water	0.0	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 Precipitation on TF	13.3	10.9	7.8	-0.2	-1.6	3.9	7.4	7.5	13.7	13.6	13.8	14.2	8.7
WR Dump	16.2	13.4	9.5	-0.2	-2.0	4.8	9.0	9.2	16.7	16.6	16.9	17.4	10.6
Open Pit	14.6	12.1	8.5	-0.2	-1.8	4.3	8.1	8.3	15.0	15.0	15.2	15.7	9.6
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**47.0**	**39.2**	**28.6**	**2.2**	**-2.6**	**15.9**	**27.4**	**27.8**	**48.2**	**48.0**	**48.7**	**50.1**	**31.6**
Water Losses (m³/day)													**Average**
Reclaim	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tailings Pore Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Net Water Surplus (m³/day)	**46.5**	**38.7**	**28.1**	**1.7**	**-3.1**	**15.4**	**26.9**	**27.3**	**47.7**	**47.5**	**48.2**	**49.6**	**31.1**
Water Treatment (m³/day)	0.0	0.0	0.0	0.0	61.8	61.8	61.8	61.8	61.8	61.8	0.0	0.0	**61.8**
Incremental volume (m³)	4,423	5,505	6,375	6,427	4,416	3,023	1,940	870	447	3	1,446	2,982	

Table 3-6:
Water Balance of the Tailings Facility after Closure (1:100 dry year).

Month	Jan.	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Total Precipitation (mm)	19.7	14.6	11.7	9.6	19.7	32.0	35.1	27.4	25.9	21.3	19.8	21.1	**258**
Monthly Actual Evaporation (mm)	0.0	0.0	0.6	23.2	52.1	62.0	55.9	38.4	15.0	2.8	0.0	0.0	**250**
Net Precipitation (mm)	19.7	14.6	11.2	-13.6	-32.3	-30.0	-20.8	-10.9	11.0	18.5	19.8	21.1	**8**
Water Inputs (m³/day)													**Average**
Tailings Water	0.0	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 Precipitation on TF	5.6	4.6	3.2	-4.0	-9.3	-8.9	-6.0	-3.1	3.3	5.3	5.9	6.0	0.2
WR Dump	6.9	5.7	3.9	-4.9	-11.3	-10.9	-7.3	-3.8	4.0	6.5	7.2	7.4	0.2
Open Pit	6.2	5.1	3.5	-4.4	-10.2	-9.8	-6.6	-3.5	3.6	5.9	6.5	6.7	0.2
Adit seepage	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Seepage Recovery	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Subtotal	**21.6**	**18.3**	**13.4**	**-10.6**	**-28.1**	**-26.8**	**-17.1**	**-7.6**	**13.6**	**20.5**	**22.3**	**22.9**	**3.4**
Water Losses (m³/day)													**Average**
Reclaim	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tailings Pore Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seepage Loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Net Water Surplus (m³/day)	**21.1**	**17.8**	**12.9**	**-11.1**	**-28.6**	**-27.3**	**-17.6**	**-8.1**	**13.1**	**20.0**	**21.8**	**22.4**	**2.9**
Water Treatment (m³/day)	0.0	0.0	0.0	0.0	5.9	5.9	5.9	5.9	5.9	5.9	0.0	0.0	**5.9**
Incremental volume (m³)	2,001	2,499	2,900	2,567	1,499	504	-224	-659	-443	-5	654	1,348	

4. Water Treatment

4. Water Treatment

4.1 Water Quality Predictions

The surplus water from the tailings facility is largely made up of tailings water, precipitation, runoff and seepage water from the waste rock dump and the open pit, and seepage water from the adit. For estimates of the tailings water quality, the chemistry of the tailings supernatant specified in the SGS Report (April, 2007) is used. For simplicity the precipitation is assumed to be pure water.

The average chemistry of shake-flask tests with three pit wall samples (FW-01, HW-01 and HW-02), specified in the SGS Report (June, 2008), is used in the estimates of seepage water quality from the waste rock dump and the open pit.

For the adit water the average chemistry of the water quality data (9) for monitoring station CMC-11 (adit) is used. The chemistry of the major source terms that make up the surplus water from the tailings pond is shown in Table 4-1 along with the predicted chemistry of the surplus water for three different scenarios during operation and after closure. The predicted chemistry of the surplus water is addressed in the next two sections (4.2 and 4.3).

Regarding the chemical data used to develop estimates of tailings water quality and the seepage/runoff chemistry of waste rock, two important facts need to be raised. The processed high-grade ore sample from which the tailings supernatant was obtained is not representative for the average grade of the ore that will be processed. The latter will contain 1099 g/t Ag and 3.55% Pb whereas the processed high grade ore sample contained 8365 g/t Ag and 37.8% Pb. This discrepancy explains the high Pb concentration predicted for the tailings water (0.542 mg/L); a value that exceeds MMER guidelines. The metallurgical testing of the above sample was for the purpose of testing the metallurgical recoveries of high grade ore going through the mill. A more representative ore sample would have provided a better estimate of the tailings water chemistry.

Similarly, the use of shake-flask data from three waste rock samples to predict seepage chemistry from the waste rock dump is not standard practice. These estimates are ideally derived from field based kinetic tests or alternatively, laboratory humidity cell or column testing. It is possible that an overestimate of metal concentrations has occurred as the shake flask results to not evaluate long-term metal release rates; particularly given the apparent absence of acid rock drainage potential from the waste rock. As will be apparent later, the use of more appropriate samples and test procedures would likely have resulted in the compliance of the water surplus chemistry with MMER guidelines. Moreover, it would make the treatment of the surplus water from the tailings facility redundant, as CCME guidelines would likely be met when the surplus water would be discharged into McCrory Creek at station M1.

The predicted chemistry of the water surplus, obtained after mixing the source terms in appropriate proportions, is shown in Table 4-1 for three different scenarios during operations and after closure. The data demonstrate that MMER guidelines will be exceeded during operation (Pb) and after closure (Zn); hence perpetual treatment of the water surplus will be required.

Table 4-1:
Predicted Chemistry of the Water Surplus from the Tailings Facility

				Source Terms			*average year*		*1:100 dry year*		*1:200 wet year*	
		MMER	*CCME*	Tailings Water	WR Water	Adit Water	Operation Surplus Water	Closure Surplus Water	Operation Surplus Water	Closure Surplus Water	Operation Surplus Water	Closure Surplus Water
pH		5.0-6.0	6.5-9.0	8.42	6.58	7.69	7.65	6.80	8.31	7.27	7.41	6.76
Alk	*mg/L*			214	8.3	159	191	27	212	126	173	17
EC	*uS/cm*			4150	118.3	440	3667	131	4063	362	3317	108
Hard	*mg/L*					259.7						
TSS	*mg/L*	25-50				<2						
TDS	*mg/L*			3050		308.7						
NH4-N	*mg/L*		0.019	0.1		0.033						
Cl	*mg/L*			18	0.4							
SO4	*mg/L*			1800	25.3							
NO3-N	*mg/L*		13	<0.5		0.03						
TCN	*mg/L*		0.005	<0.01		<0.001						
T-Al	*mg/L*		0.1	0.0632	0.08	0.065	0.062	0.057	0.063	0.062	0.062	0.057
T-Sb	*mg/L*			0.466	0.0084	0.0046	0.4107	0.0057	0.4554	0.0048	0.3712	0.0058
T-As	*mg/L*	0.50	0.005	0.0108	0.0011	0.016	0.010	0.003	0.011	0.013	0.009	0.002
T-Ba	*mg/L*			0.00537	0.0893	0.014	0.011	0.056	0.006	0.024	0.016	0.059
T-Be	*mg/L*			<0.00004		<0.0001						
T-Bi	*mg/L*				0.0000	<0.0005						
T-B	*mg/L*			0.052	0.106	0.005	0.053	0.065	0.051	0.019	0.056	0.069
T-Cd	*mg/L*		0.000017	0.00018	0.0107	0.00630	0.00102	0.00731	0.00032	0.00648	0.00166	0.00738
T-Ca	*mg/L*				2.7	65.9						
T-Cr	*mg/L*		0.001		<0.0003	<0.0005						
T-Co	*mg/L*			0.000312	0.000058	0.0002	0.0003	0.0001	0.0003	0.0002	0.0003	0.0001
T-Cu	*mg/L*	0.3	0.002 - 0.004	0.0138	0.0058	0.003	0.013	0.004	0.014	0.003	0.012	0.004
T-Fe	*mg/L*		0.3	0.11	0.015	0.2	0.10	0.04	0.11	0.18	0.1	0.0
T-Pb	*mg/L*	0.20	0.001 - 0.007	0.542	0.040	0.0014	0.480	0.024	0.530	0.007	0.436	0.026
T-Li	*mg/L*			<0.002	<0.002	0.009	0.001	0.002	0.001	0.007	0.001	0.001
T-Mg	*mg/L*			3.99	0.73	12.9	3.8	2.2	4.1	10.2	3.4	1.4
T-Mn	*mg/L*			0.458	0.378	0.073	0.431	0.238	0.450	0.111	0.415	0.251
T-Hg	*ug/L*			<0.0001	<0.0001	0.03	0.00049	0.00377	0.00054	0.02162	0.00043	0.00196
T-Mo	*mg/L*		0.073	0.0124	0.00067	0.004	0.0110	0.0010	0.0122	0.0034	0.0100	0.0007
T-Ni	*mg/L*	0.50	0.025 - 0.15		0.0013	0.004						
T-K	*mg/L*			10.5	12.3	0.9	10.1	7.6	10.3	2.5	10.0	8.1
T-Se	*mg/L*		0.001	0.007		0.0005						
T-Si	*mg/L*			1.23	4.59	4.12	1.47	3.34	1.29	3.90	1.65	3.27
T-Ag	*mg/L*		0.0001	0.00482	0.00022	<0.0002	0.0043	0.0002	0.0047	0.0002	0.0039	0.0002
T-Na	*mg/L*			905	1.86	2.3	797	1.4	884	2.0	719	1
T-Sr	*mg/L*			0.0018	0.0233	0.4	0.009	0.064	0.008	0.291	0.010	0.041
T-Tl	*mg/L*		0.0008		<0.0001	<0.0001						
T-Sn	*mg/L*			0.0042	<0.0003	<0.001	0.0037	0.0002	0.0041	0.0004	0.0034	0.0001
T-Ti	*mg/L*			0.0132	0.0005	0.0026	0.0117	0.0006	0.0129	0.0021	0.0106	0.0005
T-U	*mg/L*				0.00027	0.0194						
T-V	*mg/L*				0.00006	0.00075						
T-Zn	*mg/L*	0.50	0.03	0.0104	1.08	3.60	0.144	1.14	0.08	2.98	0.20	0.96

4.2 Required Water Treatment during Operation

The predicted chemistry of the water surplus during mining operations in Table 4-1 shows that the predicted concentrations of T-Pb exceed the MMER guideline value (0.2 mg/L). Therefore, prior to its possible discharge into McCrory Creek at monitoring station M2, the water surplus from the tailings facility will require treatment to decrease the T-Pb concentration below 0.2 mg/L.

Provided that the chemistry of the water surplus meets MMER guidelines, there is an alternative approach to estimate the required treatment level for the water surplus. The mass balance approach uses existing baseline conditions (discharge and chemistry) at station M2 in McCrory Creek and specific water quality objectives (*e.g.* CCME guidelines) to estimate the required concentration levels of constituents in the treated water surplus that will meet CCME guidelines when discharged into McCrory Creek at station M2. The required treatment levels for the three scenarios during operation are shown in Table 4-2 (average year), Table 4-3 (1:200 wet year) and Table 4-4 (1:100 dry year). Treatment and subsequent discharge into McCrory Creek (M2) would only occur during the months May to October. The data for all three scenarios show that the required treatment levels are higher than the actual concentrations in the water surplus from the tailings facility (Table 4-1). Hence, no additional treatment beyond removal of Pb and Zn, is required to meet CCME guidelines at M2 in McCrory Creek.

Table 4-2:
Threshold Concentrations of Water Surplus - Operation (average year) that Achieve Receiving Water Quality Objectives.

operation		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
average flow M2	m^3/day			6230	5420	5110	6610	32600	49500	27500	16900	16800	13900	9450	7540	16463
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	*0.005*	0.019					9.2	14.0	7.8	4.8	4.8	4.0			
Nitrate	mg/L	*0.02*	13					8561	12993	7224	4445	4418	3658			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	*0.10*					14.6	22.1	12.3	7.6	7.6	6.3			
Antimony T-Sb	mg/L	*0.0002*	*0.006*					3.83	5.81	3.23	1.99	1.97	1.63			
Arsenic T-As	mg/L	*0.0002*	0.005					3.17	4.81	2.67	1.64	1.63	1.35			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	*0.000010*	0.000017					0.00463	0.00702	0.00391	0.00241	0.00239	0.00198			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	*0.0005*	0.002					0.99	1.50	0.84	0.51	0.51	0.42			
Iron T-Fe	mg/L	*0.10*	0.30					132.0	200.3	111.4	68.6	68.2	56.5			
Lead T-Pb	mg/L	0.00020	0.001					0.528	0.801	0.445	0.274	0.273	0.226			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	*0.00100*	0.073					47.5	72.1	40.1	24.7	24.5	20.3			
Nickel T-Ni	mg/L	*0.00050*	0.0250					16.2	24.5	13.6	8.4	8.3	6.9			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	*0.0003*	0.001					0.46	0.70	0.39	0.24	0.24	0.20			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	*0.00005*	0.0001					0.033	0.050	0.028	0.017	0.017	0.014			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	*0.0001*	0.0008					0.46	0.70	0.39	0.24	0.24	0.20			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					17.8	27.0	15.0	9.2	9.2	7.6			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

Table 4-3:
Threshold Concentrations of Water Surplus - Operation (1:200 wet yr).

operation		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1:200 wet yr flow M2	m^3/day			11631	10119	9540	12341	60864	92417	51343	31552	31366	25951	17643	14077	30737
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	*0.005*	0.019					10.8	16.4	9.1	5.6	5.6	4.6			
Nitrate	mg/L	*0.02*	13					10026	15217	8460	5204	5173	4282			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	*0.10*					17.1	25.9	14.4	8.9	8.8	7.3			
Antimony T-Sb	mg/L	*0.0002*	*0.006*					4.48	6.80	3.78	2.33	2.31	1.91			
Arsenic T-As	mg/L	*0.0002*	0.005					3.71	5.63	3.13	1.92	1.91	1.58			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	*0.000010*	0.000017					0.00542	0.00822	0.00457	0.00282	0.00280	0.00232			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	*0.0005*	0.002					1.16	1.76	0.98	0.60	0.60	0.50			
Iron T-Fe	mg/L	*0.10*	0.30					154.6	234.6	130.4	80.3	79.8	66.1			
Lead T-Pb	mg/L	0.00020	0.001					0.618	0.938	0.522	0.321	0.319	0.264			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	*0.00100*	0.073					55.6	84.4	46.9	28.9	28.7	23.8			
Nickel T-Ni	mg/L	*0.00050*	0.0250					18.9	28.7	16.0	9.8	9.8	8.1			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	*0.0003*	0.001					0.54	0.82	0.46	0.28	0.28	0.23			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	*0.00005*	0.0001					0.039	0.059	0.033	0.020	0.020	0.017			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	*0.0001*	0.0008					0.54	0.82	0.46	0.28	0.28	0.23			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					20.9	31.7	17.6	10.8	10.8	8.9			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

Table 4-4:
Threshold Concentrations of Water Surplus - Operation (1:100 dry yr).

operation		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1:100 dry yr flow M2	m^3/day			4450	3880	3650	4730	23300	35400	19700	12100	12000	9940	6760	5390	10463
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	*0.005*	0.019					14.3	21.7	12.1	7.4	7.4	6.1			
Nitrate	mg/L	*0.02*	13					13220	20078	11179	6871	6815	5647			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	*0.10*					22.5	34.1	19.0	11.7	11.6	9.6			
Antimony T-Sb	mg/L	*0.0002*	*0.006*					5.91	8.97	5.00	3.07	3.05	2.52			
Arsenic T-As	mg/L	*0.0002*	0.005					4.89	7.43	4.13	2.54	2.52	2.09			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	*0.000010*	0.000017					0.00714	0.01084	0.00604	0.00372	0.00369	0.00306			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	*0.0005*	0.002					1.53	2.32	1.29	0.79	0.79	0.65			
Iron T-Fe	mg/L	*0.10*	0.30					203.8	309.5	172.4	106.0	105.1	87.1			
Lead T-Pb	mg/L	0.00020	0.001					0.815	1.238	0.689	0.424	0.420	0.348			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	*0.00100*	0.073					73.3	111.4	62.0	38.1	37.8	31.3			
Nickel T-Ni	mg/L	*0.00050*	0.0250					25.0	37.9	21.1	13.0	12.9	10.7			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	*0.0003*	0.001					0.71	1.08	0.60	0.37	0.37	0.30			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	*0.00005*	0.0001					0.051	0.077	0.043	0.027	0.026	0.022			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	*0.0001*	0.0008					0.71	1.08	0.60	0.37	0.37	0.30			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					27.5	41.8	23.3	14.3	14.2	11.7			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

4.3 Required Treatment after Closure

The site water balance after closure for an average year is shown in Figure 4-1. Details on the water balance of the tailings facility after closure are provided in Table 3-1 for the three precipitation scenarios. Although both the process plant and tailings facility are closed, water from the waste rock dump, open pit and adit will still need to be collected and treated to meet MMER guidelines for T-Zn (0.5 mg/L).

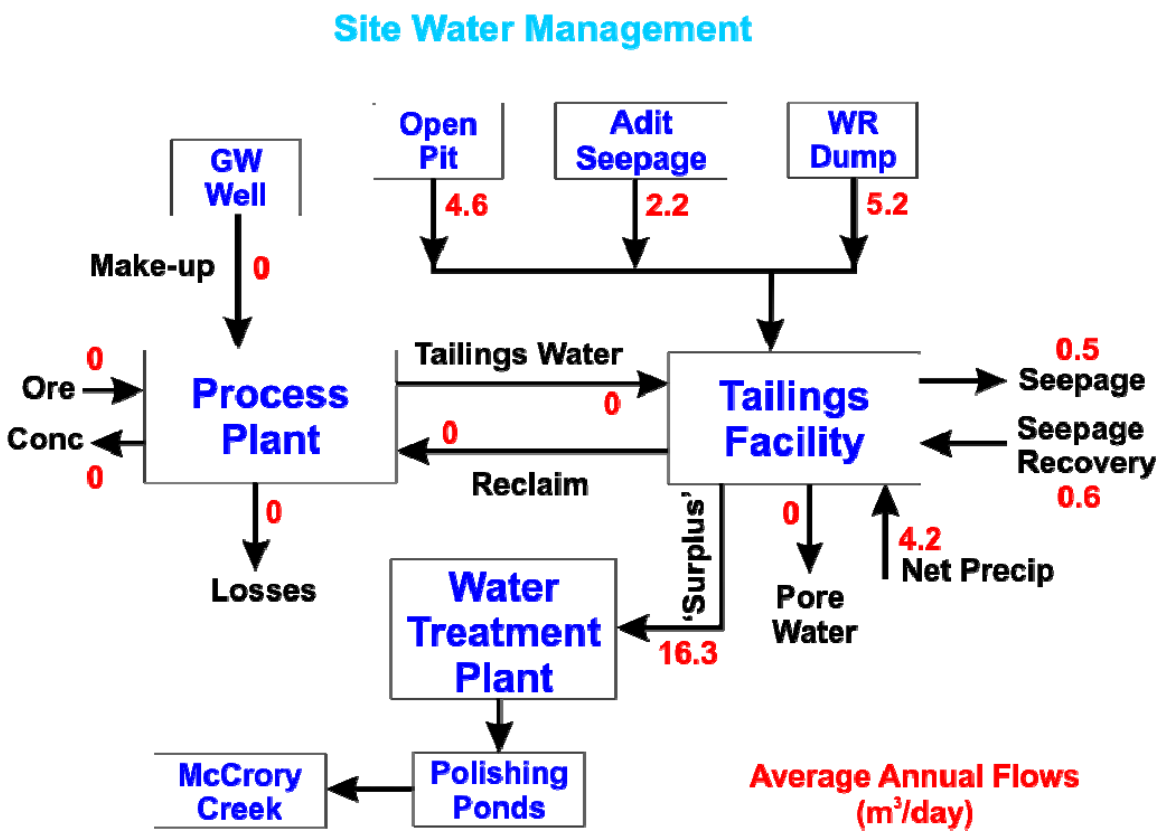

Figure 4-1: Water Balance of the Mine Site after Closure (average year).

The required treatment levels to meet CCME guidelines at M2 in McCrory Creek after closure are shown in Table 4-5 (average year), Table 4-6 (1:200 wet year) and Table 4-7 (1:100 dry year). Comparison of the required treatment levels with the predicted concentrations of the water surplus in Table 4-1 demonstrates that no treatment of the water surplus is required for the 1:100 dry year after closure. However, for the average year and the 1:200 wet year predicted T-Cd concentrations in the water surplus (Table 4-1) exceed required treatment levels. This implies that additional treatment will be required to lower the T-Cd concentrations and meet CCME guidelines for T-Cd at M2 in McCrory Creek. Depending on the effectiveness of the initial treatment aimed at lowering the T-Zn concentration below 0.5 mg/L (MMER guidelines), also the T-Cd concentration in the water surplus may have been lowered sufficiently to meet the CCME guidelines at M2 in McCrory Creek. Additional treatment would then no longer be necessary.

Table 4-5:
Threshold Concentrations of Water Surplus after Closure (average yr).

closure		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
average flow M2	m^3/day			6230	5420	5110	6610	32600	49500	27500	16900	16800	13900	9450	7540	16463
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	*0.005*	0.019					14.1	21.4	11.9	7.3	7.3	6.0			
Nitrate	mg/L	*0.02*	13					13073	19844	11030	6783	6743	5582			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	*0.10*					22.2	33.7	18.8	11.6	11.5	9.5			
Antimony T-Sb	mg/L	*0.0002*	*0.006*					5.84	8.87	4.93	3.03	3.01	2.49			
Arsenic T-As	mg/L	*0.0002*	0.005					4.83	7.34	4.08	2.51	2.49	2.06			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	*0.000010*	0.000017					**0.00706**	0.01071	0.00596	**0.00367**	**0.00365**	**0.00302**			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	*0.0005*	0.002					1.51	2.29	1.28	0.78	0.78	0.65			
Iron T-Fe	mg/L	*0.10*	0.30					201.5	305.9	170.1	104.6	104.0	86.1			
Lead T-Pb	mg/L	0.00020	0.001					0.806	1.223	0.680	0.418	0.416	0.344			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	*0.00100*	0.073					72.5	110.1	61.2	37.6	37.4	31.0			
Nickel T-Ni	mg/L	*0.00050*	0.0250					24.7	37.5	20.8	12.8	12.7	10.5			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	*0.0003*	0.001					0.71	1.07	0.60	0.37	0.36	0.30			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	*0.00005*	0.0001					0.050	0.076	0.043	0.026	0.026	0.022			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	*0.0001*	0.0008					0.71	1.07	0.59	0.37	0.36	0.30			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					27.2	41.3	22.9	14.1	14.0	11.6			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

Table 4-6:
Threshold Concentrations of Water Surplus after Closure (1:200 wet yr).

closure		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1:200 wet yr flow M2	m^3/day			11631	10119	9540	12341	60864	92417	51343	31552	31366	25951	17643	14077	30737
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	*0.005*	0.019					13.8	21.0	11.7	7.2	7.1	5.9			
Nitrate	mg/L	*0.02*	13					12796	19424	10797	6640	6601	5464			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	*0.10*					21.8	33.0	18.4	11.3	11.3	9.3			
Antimony T-Sb	mg/L	*0.0002*	*0.006*					5.72	8.68	4.82	2.97	2.95	2.44			
Arsenic T-As	mg/L	*0.0002*	0.005					4.73	7.18	3.99	2.46	2.44	2.02			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	*0.000010*	0.000017					0.00691	0.01048	0.00583	0.00359	0.00357	0.00296			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	*0.0005*	0.002					1.48	2.25	1.25	0.77	0.76	0.63			
Iron T-Fe	mg/L	*0.10*	0.30					197.3	299.4	166.5	102.4	101.8	84.3			
Lead T-Pb	mg/L	0.00020	0.001					0.789	1.197	0.666	0.409	0.407	0.337			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	*0.00100*	0.073					71.0	107.7	59.9	36.8	36.6	30.3			
Nickel T-Ni	mg/L	*0.00050*	0.0250					24.2	36.7	20.4	12.5	12.5	10.3			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	*0.0003*	0.001					0.69	1.05	0.58	0.36	0.36	0.29			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	*0.00005*	0.0001					0.049	0.075	0.042	0.026	0.025	0.021			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	*0.0001*	0.0008					0.69	1.05	0.58	0.36	0.36	0.29			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					26.6	40.4	22.5	13.8	13.7	11.4			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

Table 4-7: Required Treatment Levels of Water Surplus after Closure (1:100 dry yr).

closure		Baseline Chem	Compliance Levels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1:100 dry yr flow M2	m^3/day			4450	3880	3650	4730	23300	35400	19700	12100	12000	9940	6760	5390	10463
Physical Tests																
Conductivity (uS/cm)	uS/cm	40														
Total Dissolved Solids	mg/L	43														
Hardness CaCO3	mg/L	18														
pH		7.04														
Total Suspended Solids	mg/L	<2														
Turbidity (NTU)	NTU															
Dissolved Anions																
Alkalinity-Total CaCO3	mg/L	12.0														
Chloride Cl	mg/L															
Fluoride F	mg/L															
Sulphate SO4	mg/L															
Nutrients																
Ammonia Nitrogen N	mg/L	0.005	0.019					55.3	84.0	46.8	28.7	28.5	23.6			
Nitrate	mg/L	0.02	13					51273	77893	43353	26633	26413	21881			
Nitrite	mg/L															
Nitrite/Nitrate	mg/L															
Total Metals																
Aluminum T-Al	mg/L	0.08	0.10					87.0	132.1	73.6	45.2	44.8	37.2			
Antimony T-Sb	mg/L	0.0002	0.006					22.91	34.81	19.37	11.90	11.80	9.78			
Arsenic T-As	mg/L	0.0002	0.005					18.96	28.81	16.03	9.85	9.77	8.09			
Barium T-Ba	mg/L	0.009														
Beryllium T-Be	mg/L	<0.0001														
Bismuth T-Bi	mg/L	<0.0005														
Boron T-B	mg/L	<0.002														
Cadmium T-Cd	mg/L	0.000010	0.000017					0.02766	0.04202	0.02339	0.01437	0.01425	0.01181			
Calcium T-Ca	mg/L	5.9														
Chromium T-Cr	mg/L	<0.0005														
Cobalt T-Co	mg/L	<0.0001														
Copper T-Cu	mg/L	0.0005	0.002					5.93	9.00	5.01	3.08	3.05	2.53			
Iron T-Fe	mg/L	0.10	0.30					790.1	1200.3	668.1	410.5	407.1	337.2			
Lead T-Pb	mg/L	0.00020	0.001					3.160	4.801	2.672	1.642	1.628	1.349			
Lithium T-Li	mg/L	<0.001														
Magnesium T-Mg	mg/L	0.5														
Manganese T-Mn	mg/L	<0.005														
Mercury T-Hg	mg/L	<0.02														
Molybdenum T-Mo	mg/L	0.00100	0.073					284.4	432.1	240.5	147.7	146.5	121.4			
Nickel T-Ni	mg/L	0.00050	0.0250					96.8	147.0	81.8	50.3	49.9	41.3			
Phosphorus T-P	mg/L															
Potassium T-K	mg/L	0.6														
Selenium T-Se	mg/L	0.0003	0.001					2.77	4.20	2.34	1.44	1.42	1.18			
Silicon T-Si	mg/L	3.5														
Silver T-Ag	mg/L	0.00005	0.0001					0.198	0.300	0.167	0.103	0.102	0.084			
Sodium T-Na	mg/L	1.300														
Strontium T-Sr	mg/L	0.100														
Thallium T-Tl	mg/L	0.0001	0.0008					2.77	4.20	2.34	1.44	1.42	1.18			
Tin T-Sn	mg/L	<0.001														
Titanium T-Ti	mg/L	0.0022														
Uranium T-U	mg/L	0.00060														
Vanadium T-V	mg/L	0.0003														
Zinc T-Zn	mg/L	0.0030	0.03					106.7	162.0	90.2	55.4	54.9	45.5			

numbers in bold red indicate required treatment level is below actual concentration in surplus water, hence treatment will be required

4.4 Conceptual Water Treatment: The HDS Process

For the water treatment a number of alternative methods were considered including High Density Sludge (HDS), lime neutralization, reverse osmosis, activated silica gel, biological treatment and activated carbon. The HDS method was selected because it is robust, it is reasonably affordable, has minimal sludge production with near stable sludge quality and is easy to fine-tune once constructed.

However, due to the low iron concentration and the potential for combined heavy metal concentration of less than 2 mg/L in the contaminated water, ferrous sulphate will be added to provide iron for co-precipitation of heavy metals. As demonstrated at other mining projects, the addition of iron results in the efficient removal of heavy metals, and the resulting precipitate is chemically stable. The addition of iron salts is a common practice in North America to remove arsenic, antimony, nickel, cadmium, and metals.

The HDS process has many advantages over other lime precipitation systems. The most important of these is a substantial reduction in sludge volume resulting from an increase in sludge density. Typical HDS plants can densify the influent from 2% to 30% solids resulting in reduction of the volume of sludge produced by over 95% compared to conventional neutralization plants. The resulting reduction in sludge disposal costs increases the cost effectiveness of the process. In addition to reduced sludge volume and superior sludge density, there is an increase in sludge stability, both chemically and physically. Within a few days of deposition, the sludge can drain to in excess of 50% solids. The sludge produced by a HDS process can be co-deposited with tailings and/or at separate facilities. Other advantages of the HDS process include:

- a high quality effluent is produced;
- the process is easily automated;
- HDS is a proven technology;
- operating plants consist of standard equipment available from many competitive manufactures, which reduces the need for large spare parts inventories; and
- lower neutralization costs are achieved compared to conventional lime treatment.

The effective removal of base metals in a chemically stable form in the HDS process is primarily the result of the formation of co-precipitates with iron on the surfaces of the recycled sludge particles. A high iron to total metals ratio in the treatment plant feed is sought to provide for chemical stability of the precipitates. In all cases, the oxidation of ferrous iron to ferric iron is the principal oxygen-consuming reaction; oxygen transfer into solution is controlling the reaction rate and hence the reactor tank sizing. The rate of oxygen transfer is often the dominant factor in agitator design.

The products of the neutralization reactions are metal hydroxide precipitates ($Me(OH)_2$ or ($Me(OH)_3$) and gypsum ($CaSO_4$ $2H_2O$). The primary equipment and processes steps required for HDS water treatment facility can be summarized as follows. Lime and recycled sludge are added to the lime-sludge mix tank at the head of the process, providing the main neutralization agent. This mixture is discharged to the lime/sludge tank where it is mixed with influent, thereby achieving neutralization. Iron salts are typically added to the influent to achieve the required iron to metals ratio. The lime/sludge mixture is fed to the main Lime Reactor 1 and Lime Reactor 2 where a combination of aggressive aeration and high shear agitation ensures optimum process chemistry and subsequent clarifier performance. The discharge from the lime reactors is treated with flocculent. In the final step, the clarifier separates the treated effluent from the sludge; a portion of the sludge is recycled to the head of the process. The HDS process is operated most effectively at a pH between 9.0 and 9.5, the operating pH for the Silver Hart project will be set at pH 9.5, as most metals encountered will precipitate at or below this concentration of hydroxide ions. Oxidation of ferrous to ferric takes place rapidly at this pH, with air being the most common oxidizing agent. For efficiency, the process relies on sludge recycle from a treated effluent. This will take place in a thickener-style clarifier, which provides sludge in the underflow as the separated solids product. The sludge will need to be stored in a separate reservoir.

4.5 Conceptual Treatment: Required Testing

The sludge produced at most of the HDS plants has historically passed the EPA TCLP extractions tests as the sludge is fully oxidized and it does not release any metals. The lime treatment process offers extra alkalinity in the sludge as the lime is a slow reacting reagent and there is typically excess lime present in the sludge to keep the sludge pH at or above the treatment (precipitation) pH. Testing will need to be carried out on the sludge that will be generated during the feasibility stage of the project to confirm sludge characteristic with a full sweep of analysis and testing.

Testing will be carried out during the feasibility stage to generate the expected solution for treatment at a bench scale level (HDS simulations) to confirm the treatment parameters as well as evaluate the effluent quality and quantity of sludge produced. This can be achieved with the waste rock effluent, adit water and tailings supernatant as predicted in this report. The bench scale testing results will support the process selection and provide information on the level of risk management involved.

5. Conclusions

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5. Conclusions

Based on the analysis of the hydrologic system, the site water balance and the water quality predictions, the following main conclusions of the study can be presented:

- The tailings facility occupies a key position in the site water management. It is the ultimate repository for all the water produced at site that cannot be discharged directly into the environment.
- The main input to the tailings facility is the tailings water while reclaim water for the process plant constitutes the main output.
- Additional major input sources to the tailings facility include: net precipitation, seepage from the closed adit and runoff and seepage from the waste rock dump and open pit.
- The difference between the total inputs and outputs to the tailings facility is the surplus water. Prior to discharge into the environment, the surplus water needs to meet MMER guidelines. In addition, it needs to meet CCME guidelines once it is released (diluted) into streams of the project area.
- Except the deposited tailings with pore water, there will be no net storage of water in the tailings facility. Over the three years of operation this would leave approximately 15,000 m^3 of the available 39,500 m^3 storage capacity of the tailings pond unoccupied.
- The chemistry of the surplus water from the tailings facility, based on the current sample data, is predicted for three precipitation scenarios during operation and after closure. During operation and after closure the surplus water does not meet MMER guidelines for T-Pb (operation) or T-Zn (after closure) and needs to be treated.
- Based on the current estimates, treatment will only occur in the months May to October. During the remainder of the year the surplus water is temporarily stored in the tailings pond.
- The predicted chemistry of the surplus water during operation and closure is adversely affected by the worst case scenario sample used for the characterization of the tailings water chemistry and the (shake-flask) test used for the chemistry of the runoff and seepage water from the waste rock dump and open pit. The use of average representation samples and more appropriate tests would likely have

resulted in predictions of surplus water meeting MMER guidelines during operation and after closure.

- Provided that the surplus water meets MMER guidelines, back-calculations were used to verify if CCME guidelines would be met if the surplus water would be released into McCrory Creek at station M2. Except for the average year and 1:200 wet year after closure when T-Cd concentrations exceed CCME guidelines, treatment of the water surplus will not be required during operation and after closure to meet CCME guidelines at M2 in McCrory Creek.
- The High Density Sludge (HDS) process is selected as the preferred water treatment method and will produce effluent that will be able to meet CCME guidelines.

Appendix A: Baseline Water Quality and Flow Data

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Sample #			2006613	2026040	2424768	2006614	2026042	2006615	2026039	2424770	2006626	2026038	2424771	2006616	2026037	2424781	2006617	2026035	2424782	2006618	2026036	2424776				
Sample ID			**CMC-01**	**CMC - 01**	**CMC-01**	**CMC-02**	**CMC - 02**	**CMC-03**	**CMC - 03**	**CMC-03**	**CMC-3A**	**CMC-3A**	**CMC-3A**	**CMC-04**	**CMC - 04**	**CMC-04**	**CMC-05**	**CMC-05**	**CMC-05**	**CMC-06**	**CMC - 06**	**CMC-06**	**CMC-07**	**CMC-07**	**CMC-07**	**CMC-07**
Sampling Date			**6-Sep-06**	**22-Sep-06**	**21-Aug-07**	**6-Sep-06**	**22-Sep-06**	**6-Sep-06**	**22-Sep-06**	**21-Aug-07**	**6-Sep-06**	**22-Sep-06**	**21-Aug-07**	**7-Sep-06**	**22-Sep-06**	**22-Aug-07**	**6-Sep-06**	**22-Sep-06**	**22-Aug-07**	**6-Sep-06**	**22-Sep-06**	**23-Aug-07**	**18-Sep-85**	**1-Nov-86**	**21-May-87**	**5-Oct-87**
Parameter	**Unit**	**Detection**																								
Measured Flow	m3/sec		3.82	3	10.75	0.009	0.005	0.043	0.048	0.108	0.015	0.012	0.033	too high	2.785	11.18	too high	7.77	too high	1.15	0.492	1.83				
pH			7.6	7.35	7.7	7.5	7.34	7.9	7.32	7.77	7.8	7.29	7.72	7.9	7.26	7.75	7.9	7.05	7.76	7.5	7.22	7.66	7.0	7.8	7.3	7.7
Alkalinity																							18	20	15	19
Electrical Conductivity	uS/cm	1	105	101	96	97	96	112	114	105	116	118	105	106	102	96	105	102	94	94	93	90				
Hardness	mg/L		48.2	49.8	48.5	44	46	52	57	54	53.8	57.6	52.9	49	51.1	48.4	47.4	50	47.2	43	45	45.2	19.2	17	18	21
Total Suspended Solids	mg/L	1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2				
Total Dissolved Solids	mg/L	5	54.8	53.2	80	48.7	50.6	56.5	61.7	116	59.3	63.5	98	50.3	54.5	58	51.7	50.3	80	47.6	49.3	78				
Turbidity	NTU	0.1	0.4		<0.1	0.2		0.3		<0.1	0.5		<0.1	0.4		0.2	0.5		<0.1	0.4		0.2	0.18	0.1	0.1	0.5
Ammonium - N	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.006	<0.005	<0.005	<0.005
Dissolved Organic Carbon	mg/L	0.5	1.5	2.1	2.4	1.6	1.5	1.6	2	2.4	3.1	2.5	3.1	1.6	1.7	2.1	1.9	1.8	2.6	1.9	1.7	2.1				
Dissolved Orthophosphate-P	mg/L	0.01	0.01	0.03	0.04	0.01	0.03	0.01	0.03	0.04	0.01	0.03	0.05	<0.010	0.03	0.03	<0.010	0.03	0.03	<0.010	0.03	0.03				
Nitrate and Nitrite - N	mg/L	0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	0.04	0.04	0.03	0.02	0.012		
Total Cyanide	mg/L	0.001	0.001	<0.001		0.001	<0.001	0.001	<0.001		0.001	<0.001		0.001	<0.001		0.001	0.001		0.002	<0.001				<0.001	<0.001
Total Inorganic carbon	mg/L	0.5	11.6	10.6	10	11.1	10.2	11.8	11.7	11.1	11.4	11.3	10.2	11.4	10.5	10.1	11.3	10.5	10	10.6	10.1	9.9				
Sulfate	mg/L																									
Total Kjeldahl Nitrogen	mg/L	0.06	0.11	0.12	0.11	0.08	0.19	0.08	0.11	0.08	0.08	0.12	0.09	0.08	0.16	0.1	0.06	0.16	0.12	0.07	0.12	0.19				
Total Kjeldahl Nitrogen and Phosphorus	mg/L	0.05	<0.05		<0.05	<0.05		<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05				
Total Organic Carbon	mg/L	0.5	2.3	2.2	2.5	2.5	1.9	3.4	2.5	2.3	3.8	2.5	3.1	2.4	2	2.3	2.3	1.9	2.2	2.3	2.4	2.3	2	<1	<1	<1
Dissolved Aluminum	mg/L	0.005	0.011	0.006	0.025	0.01	<0.005	0.018	0.005	0.02	0.016	0.008	0.023	0.012	0.005	0.025	0.011	<0.005	0.031	0.008	<0.005	0.016				
Dissolved Antimony	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.002	<0.002	<0.002
Dissolved Arsenic	mg/L	0.0002	0.0002	0.0003	0.0002	0.0011	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.0003	<0.0002	0.0002	0.0003	0.0002	<0.0002	0.0002	<0.0002		<0.001	<0.001	<0.001
Dissolved Barium	mg/L	0.001	0.009	0.009	0.009	0.004	0.004	0.004	0.005	0.004	0.005	0.006	0.006	0.009	0.009	0.009	0.008	0.008	0.008	0.006	0.007	0.007		0.005	<0.005	<0.005
Dissolved Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				
Dissolved Bismuth	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				
Dissolved Boron	mg/L	0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
Dissolved Cadmium	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	0.00003	0.00002	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		<0.0002	<0.0002	<0.0002
Dissolved Calcium	mg/L	0.2	17.5	18.1	17.5	16.2	16.9	19.4	21.3	20	19.2	20.6	18.7	17.8	18.3	17.5	17.2	17.9	17	15.5	16.3	16.2				
Dissolved Chromium	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0029	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				
Dissolved Cobalt	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				
Dissolved Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		0.0005	0.0005	<0.0005
Dissolved Iron	mg/L	0.01	0.03	0.01	0.0001	0.02	<0.010	0.02	<0.010	0.0001	0.02	<0.010	<0.0001	<0.010	0.01	<0.0001	0.03	<0.010	<0.0001	0.05	0.02	<0.0001		0.014	0.005	0.006
Dissolved Lead	mg/L	0.0001	0.0001	<0.0001	0.03	0.0013	<0.0001	0.0002	<0.0001	<0.010	0.0001	<0.0001	<0.010	0.0002	0.0001	0.03	0.0005	<0.0001	0.03	0.0001	<0.0001	0.03		<0.001	<0.001	<0.001
Dissolved Lithium	mg/L	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.002	0.001				
Dissolved Magnesium	mg/L	0.1	1.1	1.1	1.2	0.9	0.9	0.9	1	1	1.4	1.5	1.5	1.1	1.3	1.2	1.1	1.3	1.2	1	1	1.1				
Dissolved Manganese	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				
Dissolved Mercury	ug/L	0.02	<0.02			<0.02		<0.02						<0.02			<0.02			<0.02						
Dissolved Molybdenum	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.002	0.003	0.003	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
Dissolved Nickel	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	<0.0005	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				
Dissolved Potassium	mg/L	0.4	0.5	0.4	0.5	1	0.9	0.4	<0.4	0.4	0.5	0.4	0.4	0.6	0.5	0.5	0.5	<0.4	0.4	<0.4	0.4	<0.4				
Dissolved Selenium	mg/L	0.0002	<0.0002	0.0004	<0.0002	<0.0002	0.0002	<0.0002	0.0004	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	0.0004	<0.0002				
Dissolved Silicon	mg/L	0.05	2.73	2.94	3.25	3.63	3.71	4.06	4.32	4.32	4.21	4.47	4.76	2.75	2.91	3.21	2.71	2.92	3.15	2.5	2.88	3.06				
Dissolved Silver	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0002	<0.0002	<0.0002
Dissolved Sodium	mg/L	0.4	1.5	1.4	1.4	1.2	1.2	1.2	1.2	1.8	1.4	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4				
Dissolved Stronium	mg/L	0.001	0.097	0.097	0.098	0.055	0.05	0.088	0.087	0.088	0.12	0.122	0.114	0.099	0.097	0.1	0.104	0.104	0.109	0.12	0.116	0.126				
Dissolved Sulfur	mg/L	0.3	2.4	2.2	2.3	1.6	1.7	2.8	2.9	2.5	3.7	3.7	3.4	2.3	2.3	2.3	2.2	1.8	2.1	1.7	1.8	1.8				
Dissolved Thallium	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005				
Dissolved Tin	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
Dissolved Titanium	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0011	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005				
Dissolved Uranium	mg/L	0.0005	0.0009	0.0009	0.0009	<0.0005	<0.0005	0.0005	0.0006	0.0005	<0.0005	0.0006	<0.0005	0.0009	0.0009	0.0009	0.0009	0.0009	0.001	0.001	0.001	0.0012				
Dissolved Vanadium	mg/L	0.0001	0.0004	0.0001	0.0005	0.0003	<0.0001	0.0002	<0.0001	0.0005	0.0003	0.0001	0.0004	0.0003	0.0001	0.0004	0.0003	0.0002	0.0004	0.0003	<0.0001	0.0004				
Dissolved Zinc	mg/L	0.001	0.001	0.003	0.007	0.002	0.002	0.004	0.004	0.006	0.004	0.004	0.007	0.002	0.003	0.006	0.002	0.003	0.004	0.004	0.005	0.005		0.0016	0.0006	0.0007
Total Aluminum	mg/L	0.005	0.02	0.025	0.036	0.01	0.01	0.021	0.02	0.027	0.024	0.02	0.168	0.023	0.022	0.056	0.02	0.02	0.036	0.02	0.02	0.03	0.05			
Total Antimony	mg/L	0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.05	<0.002	<0.002	<0.002
Total Arsenic	mg/L	0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.05	<0.001	<0.001	<0.001
Total Barium	mg/L	0.001	0.009	0.01	0.009	0.004	0.005	0.004	0.005	0.005	0.006	0.006	0.01	0.009	0.009	0.01	0.008	0.01	0.009	0.007	0.008	0.008	0.017	0.01	<0.005	<0.005
Total Beryllium	mg/L	0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001				
Total Bismuth	mg/L	0.0005	<0.001	<0.001	<0.0005	0.002	<0.001	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005				
Total Boron	mg/L	0.002	<0.004	<0.004	<0.002	<0.004	<0.004	<0.004	<0.004	<0.002	<0.004	<0.004	<0.002	<0.004	<0.004	<0.002	<0.004	<0.004	<0.002	<0.004	<0.004	0.002				
Total Cadmium	mg/L	0.00001	<0.00002	<0.00002	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	0.00002	<0.00002	<0.00002	0.00001	<0.00002	<0.00002	<0.00001	<0.00002	<0.00002	<0.00001	<0.00002	<0.00002	<0.00001	<0.002	<0.0002	<0.0002	<0.0002
Total Calcium	mg/L	0.2	17	17	16.5	15	16	18	20.3	18.8	18	20.2	17.4	17	17	17.4	16	18	16.9	14	15	15.6				
Total Chromium	mg/L	0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.001	<0.001	0.0055	0.001	<0.001	0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.005			
Total Cobalt	mg/L	0.0001	<0.0002	<0.0002	0.0001	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	0.0003	<0.005			
Total Copper	mg/L	0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.005	0.0007	<0.0005	<0.0005
Total Iron	mg/L	0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	0.017	0.015	0.014	0.01
Total Lead	mg/L	0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.02	<0.001	<0.001	<0.001
Total Lithium	mg/L	0.001	<0.002	<0.002	0.001	<0.002	0.002	<0.002	<0.002	0.001	0.002	0.002	0.002	<0.002	<0.002	0.002	<0.002	<0.002	0.002	<0.002	<0.002	0.002				
Total Magnesium	mg/L	0.1	1	1	1.1	0.8	0.9	0.8	1	1	1	2	1.7	1	1	1.2	1	1	1.1	0.9	1	1.1				
Total Manganese	mg/L	0.005	<0.010	<0.010	<0.005	<0.010	<0.010	<0.010	<0.010	<0.005	<0.010	<0.010	<0.005	<0.010	<0.010	<0.005	<0.010	0.023	<0.005	<0.010	<0.010	<0.005				
Total Mercury	ug/L	0.02																					<0.05	<0.05	<0.05	<0.05
Total Molybdenum	mg/L	0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	0.003	0.002	0.003	0.004	0.003	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.005			
Total Nickel	mg/L	0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.001	<0.001	0.0011	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.02			
Total Potassium	mg/L	0.4	<0.8	<0.8	0.5	1	1	<0.8	<0.8	0.4	<0.8	<0.8	0.6	<0.8	<0.8	0.5	<0.8	<0.8	0.5	<0.8	<0.8	0.4				
Total Selenium	mg/L	0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002	<0.0004	<0.0004	<0.0002				
Total Silicon	mg/L	0.05	2.87	2.38	3.12	3.66	3.08	4.13	3.23	4.03	4.46	4.19	4.76	2.97	2.71	3.13	2.82	2.36	3.02	2.64	2.68	2.9				
Total Silver	mg/L	0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001		<0.0002	<0.0002	<0.0002
Total Sodium	mg/L	0.4	1	1	1.3	1	1	1	1	1.1	1	1	2	1	1	1.4	1	1	1.4	1	1	1.4				
Total Strontium	mg/L	0.001	0.099	0.09	0.1	0.053	0.052	0.082	0.083	0.093	0.11	0.12	0.126	0.1	0.099	0.111	0.1	0.1	0.118	0.12	0.11	0.136				
Total Sulfur	mg/L	0.3	2.3	2	2.3	1	2	2.6	2.7	2.4	3.5	3.5	3.3	2.3	2.2	2.3	2.2	2.1	2.2	2	2	1.8				
Total Thallium	mg/L	0.00005	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005				
Total Tin	mg/L	0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001				
Total Titanium	mg/L	0.0005	0.001	<0.001	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.001	<0.001	0.0199	<0.001	<0.001	0.0007	<0.001	<0.001	0.0009	<0.001	<0.001	<0.0005				
Total Uranium	mg/L	0.0005	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	0.001	0.001	<0.001	0.0011	0.001	0.001	0.0013				
Total Vanadium	mg/L	0.0001	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0001	<0.0002	<0.0002	0.0003	0.0002	<0.0002	0.0003	0.0002	<0.0002	0.0003	0.0002	<0.0002	0.0002				
Total Zinc	mg/L	0.001	<0.002	0.002	0.006	<0.002	0.002	0.003	0.004	0.008	0.003	0.003	0.007	<0.002	0.002	0.005	<0.002	0.004	0.005	<0.002	0.002	0.005	0.03	0.0019	0.0006	0.0009
Total Zirconium	mg/L	0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001				

Sample #	2006624	2026031	2384379	2424773	2006625	2026041	2424772				2006627	2026033	2384429	2384435	2384436	2424779
Sample ID	CMC-07	CMC - 07	CMC-07	CMC-07	CMC-10	CMC - 10	CMC-10	CMC-11	CMC-11	CMC-11	CMC-11	CMC - 11	CMC-11	CMC-11	CMC-11	CMC-11
Sampling Date	7-Sep-06	21-Sep-06	12-Jul-07	23-Aug-07	6-Sep-06	22-Sep-06	21-Aug-07	1-Nov-86	21-May-87	5-Oct-87	7-Sep-06	21-Sep-06	12-Jul-07	12-Jul-07	12-Jul-07	23-Aug-07
Parameter																
Measured Flow	0.449	0.319		0.842	0.222	0.165	0.216				too low	too low				0.989
pH	7.2	6.41	6.66	7.35	7.2	7.51	7.72	7.6	7.7	8.1	7.3	7.84	7.58			7.68
Alkalinity								161	155	160						
Electrical Conductivity	45	48	47	40	118	120	104				517	515	496	420	200	489
Hardness	19	20		19	54	58.1	52	286	272	205	257	278				260
Total Suspended Solids	<2	<2	3	<2	<2	<2	<2				2	<2	<2			<2
Total Dissolved Solids	24.1	24		76	56.9	64.2	116				289	261				376
Turbidity	0.6		0.1	0.2	0.2		<0.1	2	3.2	0.8	0.4		<0.1			<0.1
Ammonium - N	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.058	0.046	0.024	<0.05	<0.05	<0.05			<0.05
Dissolved Organic Carbon	2	2.5	4.8	2.7	2	1.5	2.6				<0.5	0.6	<0.5			<0.5
Dissolved Orthophosphate-P	<0.010	0.03	0.02	0.03	<0.010	0.03	0.04				0.01	0.04	0.03			0.04
Nitrate and Nitrite - N	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	0.02	0.057	0.04	0.03	<0.02	<0.02	0.06			0.03
Total Cyanide	0.001	<0.001			0.001	<0.001			<0.001	<0.001	0.001	<0.001				
Total Inorganic carbon	4.9	4.8	6	4.3	10.6	9.6	9.2				37.7	36.9	37.2			33.8
Sulfate																
Total Kjeldahl Nitrogen	0.09	0.48	0.31	0.09	0.06	0.13	0.07				<0.06	0.14	0.15			0.07
Total Kjeldahl Nitrogen and Phosphorus	<0.05			<0.05	<0.05		<0.05				<0.05					<0.05
Total Organic Carbon	2.2	2.2	5	2.4	3.4	1.9	2.2	125	116	117	4.2	0.7	0.6			<0.5
Dissolved Aluminum	0.019	0.008	0.037	0.038	0.014	0.006	0.026				<0.005	<0.005	0.005	0.165	0.013	0.01
Dissolved Antimony	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	0.008	0.007	0.0045	0.0049	0.0051	0.0029	0.0012	0.0047
Dissolved Arsenic	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.037	0.032	0.0165	0.017	0.0151	0.0031	0.0006	0.0164
Dissolved Barium	0.004	0.005	0.006	0.005	0.005	0.005	0.005	0.013	<0.005	0.012	0.01	0.011	0.011	0.017	0.015	0.011
Dissolved Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Bismuth	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Boron	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				0.004	0.003	0.003	0.004	<0.002	0.003
Dissolved Cadmium	<0.00001	<0.00001	0.00002	<0.00001	0.00001	<0.00001	<0.00001	0.0065	<0.0002	0.0058	0.00628	0.0068	0.0102	0.00373	0.00041	0.00942
Dissolved Calcium	6.5	7	7.2	6.5	20.1	21.6	19.3				78.1	82.7	75.5	70.5	30.1	78.9
Dissolved Chromium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.0005	<0.0005	0.0005	0.0005	<0.0005	<0.0005
Dissolved Cobalt	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				0.0002	0.0001	0.0003	0.0001	<0.0001	0.0002
Dissolved Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0023	0.0009	0.0016	0.002	0.002	0.001	0.003	<0.001	0.004
Dissolved Iron	0.02	<0.010	0.01	<0.0001	0.02	<0.010	<0.0001	0.01	0.005	0.015	<0.010	<0.010	<0.010	0.04	<0.010	0.0006
Dissolved Lead	0.0003	<0.0001	<0.0001	0.01	<0.0001	<0.0001	<0.010	<0.001	<0.001	<0.001	0.0014	0.001	0.0008	0.0013	0.0002	<0.010
Dissolved Lithium	0.001	0.001	<0.001	<0.001	0.002	0.002	0.001				0.011	0.012	0.01	0.008	0.003	0.011
Dissolved Magnesium	0.6	0.7	0.6	0.6	0.9	1	0.9				15	17.3	14.8	11.8	5	15.3
Dissolved Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				0.082	0.066	0.153	0.014	<0.005	0.123
Dissolved Mercury			<0.02										<0.02	<0.02	<0.02	
Dissolved Molybdenum	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001				0.005	0.005	0.004	0.004	0.002	0.004
Dissolved Nickel	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0009	<0.0005				0.0039	0.0029	0.0042	0.0042	<0.0005	0.0042
Dissolved Potassium	<0.4	<0.4	<0.4	<0.4	0.6	0.5	0.6				0.8	1.1	1	0.9	0.5	1
Dissolved Selenium	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Silicon	2.36	2.66	3.61	2.76	3.3	3.39	3.86				4.1	4.67	4.4	4.18	3.87	4.52
Dissolved Silver	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Sodium	1.3	1.3	2.1	1.3	1.1	1.1	1.1				2.1	2.1	2.5	3.2	2.2	2.1
Dissolved Stronium	0.064	0.062	0.079	0.062	0.092	0.096	0.089				0.41	0.384	0.42	0.34	0.181	0.398
Dissolved Sulfur	0.7	0.8	1.1	0.8	4.7	5.7	4.1				40.5	42.5	39.9	33	14.6	41.8
Dissolved Thallium	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005				<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Dissolved Tin	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Titanium	<0.0005	<0.0005	<0.0005	0.0009	<0.0005	<0.0005	<0.0005				0.002	0.0031	0.0021	0.0032	0.001	0.0027
Dissolved Uranium	0.0011	0.001	0.001	0.0012	0.0007	0.0008	0.0006				0.0217	0.0251	0.0228	0.0117	0.002	0.0227
Dissolved Vanadium	0.0002	0.0002	<0.0001	0.0003	0.0003	<0.0001	0.0004				0.0005	<0.0001	0.0012	0.0027	0.0006	0.001
Dissolved Zinc	0.003	0.002	0.001	0.005	0.002	0.004	0.005	2.05	2.21	2.29	5.3	5.38	6.87	2.36	0.266	6.55
Total Aluminum	0.023	0.025	0.039	0.04	0.02	0.02	0.03				0.01	0.01	0.011	0.33	0.02	0.008
Total Antimony	<0.0004	<0.0004	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.002	0.009	0.008	0.0044	0.0043	0.005	0.0029	0.0011	0.0046
Total Arsenic	<0.0004	<0.0004	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.001	0.037	0.04	0.015	0.016	0.0165	0.0031	0.0007	0.0156
Total Barium	0.004	0.005	0.006	0.005	0.005	0.005	0.005	0.014	0.015	0.015	0.01	0.01	0.012	0.022	0.016	0.011
Total Beryllium	<0.0002	<0.0002	<0.0001	<0.0001	<0.0002	<0.0002	<0.0001				<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Total Bismuth	0.001	<0.001	<0.0005	<0.0005	<0.001	<0.001	<0.0005				<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
Total Boron	<0.004	<0.004	0.004	<0.002	<0.004	<0.004	<0.002				0.004	0.004	0.006	0.006	0.003	0.005
Total Cadmium	<0.00002	<0.00002	0.00001	<0.00001	<0.00002	<0.00002	0.00002	0.0066	0.0053	0.0073	0.00654	0.0064	0.0106	0.00399	0.00042	0.00958
Total Calcium	5.9	6.6	6.8	6.2	19	21.1	18.3				74.2	79.8	74.8	61	28.4	77.1
Total Chromium	<0.001	<0.001	<0.0005	<0.0005	<0.001	<0.001	<0.0005				<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
Total Cobalt	<0.0002	<0.0002	<0.0001	<0.0001	<0.0002	<0.0002	0.0001				0.0002	<0.0002	0.0005	0.0002	<0.0001	0.0004
Total Copper	<0.002	<0.002	<0.001	<0.001	<0.002	<0.002	<0.001	0.0027	0.0055	0.0021	<0.002	<0.002	0.003	0.006	<0.001	0.002
Total Iron	<0.2	<0.2	<0.1	<0.1	<0.2	<0.2	<0.1	0.16	1.45	0.17	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1
Total Lead	0.0006	<0.0002	0.0003	<0.0001	<0.0002	<0.0002	<0.0001	<0.001	0.004	<0.001	0.002	0.001	0.0012	0.0027	0.0002	0.0009
Total Lithium	<0.002	<0.002	<0.001	<0.001	<0.002	<0.002	0.002				0.01	0.01	0.012	0.008	0.004	0.012
Total Magnesium	0.5	0.5	0.6	0.6	0.8	1	0.9				14	16	14.9	12.1	4.9	15.2
Total Manganese	<0.010	<0.010	<0.005	<0.005	<0.010	<0.010	<0.005				0.074	0.069	0.157	0.012	<0.005	0.122
Total Mercury			<0.02					<0.05	<0.05	<0.05			<0.02	0.06	0.02	
Total Molybdenum	<0.002	<0.002	<0.001	<0.001	<0.002	0.002	0.001				0.004	0.006	0.005	0.004	0.002	0.004
Total Nickel	<0.001	<0.001	<0.0005	0.0009	<0.001	<0.001	<0.0005				0.0039	0.004	0.0066	0.0053	<0.0005	0.0063
Total Potassium	<0.8	<0.8	<0.4	<0.4	<0.8	<0.8	0.6				0.9	1.1	1	0.9	0.5	1
Total Selenium	<0.0004	<0.0004	0.0002	<0.0002	<0.0004	<0.0004	<0.0002				<0.0004	<0.0004	0.0008	0.0007	0.0003	0.0005
Total Silicon	2.5	2.34	3.11	2.59	3.64	2.94	3.6				4.47	4.12	4.34	3.84	3.66	4.3
Total Silver	<0.0002	<0.0002	<0.0001	<0.0001	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Total Sodium	1	1	2.1	1.3	1	1	1.1				2	2.1	2.6	2.8	2	2.1
Total Strontium	0.06	0.063	0.074	0.062	0.092	0.094	0.094				0.406	0.41	0.423	0.331	0.177	0.45
Total Sulfur	0.6	0.6	1	0.8	4.6	5.5	4				39.5	38.2	39.5	33.1	14.4	41
Total Thallium	<0.0001	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.00005				<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005
Total Tin	<0.002	<0.002	<0.001	<0.001	<0.002	<0.002	<0.001				<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Total Titanium	<0.001	<0.001	<0.0005	<0.0005	<0.001	<0.001	<0.0005				0.0022	0.0024	0.0025	0.0047	0.0013	0.0022
Total Uranium	0.001	0.001	0.0012	0.0013	<0.001	<0.001	0.0007				0.0247	0.0255	0.0245	0.0136	0.0023	0.0256
Total Vanadium	<0.0002	<0.0002	0.0002	0.0002	<0.0002	<0.0002	0.0002				<0.0002	<0.0002	0.0001	0.0035	0.0005	0.0002
Total Zinc	<0.002	<0.002	0.004	0.005	<0.002	0.003	0.005	2.08	2.48	2.31	4.8	4.84	6.52	2.44	0.247	6.64
Total Zirconium	<0.002	<0.002	<0.001	<0.001	<0.002	<0.002	<0.001				<0.002	<0.002	<0.001	<0.001	<0.001	<0.001

Sample #		2006622	2026043	2384430	2424778					2006623	2026032	2384431	2424780
Sample ID	CMC-M1	CMC-M1	CMC - M1	CMC-M1	CMC-M1	CMC-M2	CMC-M2	CMC-M2	CMC-M2	CMC-M2	CMC - M2	CMC-M2	CMC-M2
Sampling Date	21-May-87	7-Sep-06	23-Sep-06	12-Jul-07	22-Aug-07	18-Sep-85	1-Nov-86	21-May-87	5-Oct-87	7-Sep-06	21-Sep-06	12-Jul-07	23-Aug-07
Parameter													
Measured Flow		0.699	0.26		0.092					0.247	0.339		0.239
pH	6.6	7.6	6.74	6.95	7.3	7.3	7.8	7	7.8	7.3	6.76	7.03	7.44
Alkalinity	12					14.9	17	10	12				
Electrical Conductivity		41	44	33	41					48	52	42	52
Hardness	14	17	20		19	18.2	20	15	14	20	23		24
Total Suspended Solids		<2	<2	<2	<2					<2	<2	<2	<2
Total Dissolved Solids		29.4	24.6		76					26.2	28		62
Turbidity	0.6	0.8		0.3	0.6	0.28	0.5	0.7	0.9	0.5		<0.1	<0.1
Ammonium - N	<0.005	<0.05	<0.05	<0.05	<0.05	0.015	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05
Dissolved Organic Carbon		3.9	2.9	5	4					3.3	2.8	5.2	3.8
Dissolved Orthophosphate-P		<0.010	0.03	0.02	0.04					<0.010	0.03	0.02	0.04
Nitrate and Nitrite - N		<0.02	<0.02	<0.02	0.08	0.018	0.017		0.006	<0.02	<0.02	<0.02	<0.02
Total Cyanide	<0.001	0.001	0.001					<0.001	<0.001	0.001	<0.001		
Total Inorganic carbon		3.8	3.9	3.4	3.8					4.5	4.5	4.3	5
Sulfate													
Total Kjeldahl Nitrogen		0.11	0.16	0.17	<0.06					0.09	0.2	0.16	0.11
Total Kjeldahl Nitrogen and Phosphorus		<0.05			<0.05					<0.05			<0.05
Total Organic Carbon	<1	4.5	3.5	5.3	3.6	4	5	<1	4	5.9	2.8	4.9	3.4
Dissolved Aluminum		0.084	0.056	0.091	0.078					0.051	0.029	0.066	0.05
Dissolved Antimony	<0.002	<0.0002	<0.0002	<0.0002	<0.0002		<0.002	<0.002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Arsenic	<0.001	<0.0002	<0.0002	0.0002	<0.0002		<0.001	<0.001	<0.001	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Barium	<0.005	0.007	0.007	0.006	0.008		<0.005	<0.005	0.005	0.007	0.007	0.006	0.008
Dissolved Beryllium		<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Bismuth		0.001	<0.0005	<0.0005	<0.0005					0.0006	<0.0005	<0.0005	<0.0005
Dissolved Boron		<0.002	<0.002	<0.002	<0.002					<0.002	<0.002	<0.002	<0.002
Dissolved Cadmium	<0.0002	0.00002	<0.00001	<0.00001	<0.00001		<0.0002	<0.0002	<0.0002	<0.00001	0.00001	<0.00001	0.00001
Dissolved Calcium		5.9	6.9	5	6.6					6.9	7.8	4	8.2
Dissolved Chromium		<0.0005	<0.0005	<0.0005	<0.0005					0.0005	<0.0005	<0.0005	<0.0005
Dissolved Cobalt		<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Copper	<0.0005	<0.001	<0.001	<0.001	<0.001		0.0008	0.001	0.0005	<0.001	<0.001	<0.001	<0.001
Dissolved Iron	0.26	0.07	0.03	0.05	<0.0001		0.033	0.17	0.024	0.03	0.01	<0.010	<0.0001
Dissolved Lead	<0.001	0.0002	<0.0001	<0.0001	0.04		<0.001	<0.001	<0.001	0.0002	<0.0001	<0.0001	0.02
Dissolved Lithium		0.001	0.001	<0.001	<0.001					0.001	0.001	<0.001	<0.001
Dissolved Magnesium		0.5	0.6	0.4	0.6					0.6	0.7	0.5	0.8
Dissolved Manganese		<0.005	<0.005	<0.005	<0.005					<0.005	<0.005	<0.005	<0.005
Dissolved Mercury				<0.02								<0.02	
Dissolved Molybdenum		0.001	<0.001	<0.001	<0.001					0.001	<0.001	<0.001	<0.001
Dissolved Nickel		<0.0005	<0.0005	<0.0005	<0.0005					<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Potassium		<0.4	<0.4	<0.4	<0.4					<0.4	<0.4	<0.4	<0.4
Dissolved Selenium		<0.0002	0.0003	<0.0002	<0.0002					<0.0002	0.0003	<0.0002	<0.0002
Dissolved Silicon		3.34	3.72	3.28	3.97					3.3	3.68	3.35	3.96
Dissolved Silver	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001		<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Sodium		1.5	1.4	1.8	1.6					1.5	1.5	1.3	1.6
Dissolved Stronium		0.066	0.066	0.05	0.068					0.076	0.074	0.067	0.083
Dissolved Sulfur		1.3	1.9	1.2	1.4					1.5	2	1.4	1.7
Dissolved Thallium		<0.00005	<0.00005	<0.00005	<0.00005					<0.00005	<0.00005	<0.00005	<0.00005
Dissolved Tin		<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001
Dissolved Titanium		0.0016	0.001	0.0013	0.0017					0.0009	0.0006	0.001	0.0006
Dissolved Uranium		0.0007	0.0005	0.0007	0.0005					0.0007	0.0005	0.0006	0.0007
Dissolved Vanadium		0.0003	0.0001	0.0003	0.0003					0.0002	0.0001	0.0007	0.0003
Dissolved Zinc	0.0036	0.003	0.003	0.007	0.005		0.0028	0.0076	0.0016	0.003	0.004	0.005	0.008
Total Aluminum		0.11	0.089	0.125	0.119	0.1				0.065	0.064	0.099	0.077
Total Antimony	<0.002	<0.0004	<0.0004	<0.0002	<0.0002	<0.05	<0.002	<0.002	<0.002	<0.0004	<0.0004	<0.0002	<0.0002
Total Arsenic	<0.001	<0.0004	<0.0004	<0.0002	<0.0002	<0.05	<0.001	<0.001	<0.001	<0.0004	<0.0004	<0.0002	<0.0002
Total Barium	0.01	0.008	0.01	0.007	0.008	0.017	<0.005	0.007	0.006	0.007	0.008	0.008	0.011
Total Beryllium		<0.0002	<0.0002	<0.0001	<0.0001					<0.0002	<0.0002	<0.0001	<0.0001
Total Bismuth		<0.001	<0.001	<0.0005	<0.0005					<0.001	<0.001	<0.0005	<0.0005
Total Boron		<0.004	<0.004	<0.002	<0.002					<0.004	<0.004	0.002	<0.002
Total Cadmium	<0.0002	<0.00002	<0.00002	<0.00001	<0.00001	<0.002	<0.0002	<0.0002	<0.0002	<0.00002	<0.00002	0.00001	0.00001
Total Calcium		5.8	6.4	4.9	6.3					6.5	7.6	6.3	7.9
Total Chromium		<0.001	<0.001	<0.0005	<0.0005	<0.005				<0.001	0.001	<0.0005	<0.0005
Total Cobalt		<0.0002	<0.0002	<0.0001	0.0001	<0.005				<0.0002	<0.0002	<0.0001	0.0003
Total Copper	<0.0005	<0.002	<0.002	<0.001	0.006	<0.005	0.001	0.0012	0.0016	<0.002	<0.002	0.002	<0.001
Total Iron	0.31	<0.2	<0.2	<0.1	<0.1	0.037	0.07	0.19	0.035	<0.2	<0.2	<0.1	<0.1
Total Lead	<0.001	0.0002	<0.0002	<0.0001	0.0002		<0.001	<0.001	<0.001	0.0002	<0.0002	0.0001	<0.0001
Total Lithium		<0.002	<0.002	<0.001	0.001					<0.002	<0.002	0.001	0.001
Total Magnesium		0.4	0.5	0.4	0.5					0.5	0.7	0.6	0.8
Total Manganese		<0.010	<0.010	<0.005	<0.005					<0.010	<0.010	<0.005	<0.005
Total Mercury	<0.05			<0.02		<0.05	<0.05	<0.05	<0.05			<0.02	
Total Molybdenum		<0.002	<0.002	<0.001	<0.001	<0.005				<0.002	<0.002	<0.001	0.001
Total Nickel		<0.001	<0.001	<0.0005	<0.0005	<0.02				<0.001	<0.001	<0.0005	<0.0005
Total Potassium		<0.8	<0.8	<0.4	<0.4					<0.8	<0.8	<0.4	<0.4
Total Selenium		<0.0004	<0.0004	<0.0002	<0.0002					<0.0004	<0.0004	0.0002	<0.0002
Total Silicon		3.8	3.44	3.1	3.76					3.57	3.41	3.23	3.84
Total Silver	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001
Total Sodium		1	1	1.7	1.5					1	2	1.7	1.6
Total Strontium		0.065	0.067	0.048	0.069					0.072	0.073	0.069	0.094
Total Sulfur		1	2	1.1	1.3					1	2	1.4	1.7
Total Thallium		<0.0001	<0.0001	<0.00005	<0.00005					<0.0001	<0.0001	<0.00005	<0.00005
Total Tin		<0.002	<0.002	<0.001	<0.001					<0.002	<0.002	<0.001	<0.001
Total Titanium		0.0023	0.002	0.0027	0.0016					0.001	0.001	0.0017	0.0011
Total Uranium		<0.001	<0.001	0.0007	0.0006					<0.001	<0.001	0.0008	0.0008
Total Vanadium		0.0003	<0.0002	0.0003	0.0003					0.0002	<0.0002	0.0003	0.0003
Total Zinc	0.0043	<0.002	0.003	0.005	0.004	0.022	0.004	0.0089	0.0041	<0.002	0.005	0.006	0.007
Total Zirconium		<0.002	<0.002	<0.001	<0.001					<0.002	<0.002	<0.001	<0.001

Sample #		**2006620**	**2026045**	**2384432**	**2424775**				**2006621**	**2026044**	**2384433**	**2424777**					**2026034**	**2384434**	**2424774**	**2006619**	**2384439**			
Sample ID	**CMC-OC2**	**CMC-OC2**	**CMC - OC2**	**CMC-OC2**	**CMC-OC2**	**CMC-OC3**	**CMC-OC3**	**CMC-OC3**	**CMC - OC3**	**CMC - OC3**	**CMC-OC3**	**CMC-OC3**	**CMC-U1**	**CMC-U1**	**CMC-U1**	**CMC-U1**	**CMC - U1**	**CMC-U1**	**CMC-U1**	**CMC-U2**	**waste rock**	**T1**	**T1**	**T1**
Sampling Date	**1-Nov-86**	**7-Sep-06**	**23-Sep-06**	**12-Jul-07**	**22-Aug-07**	**1-Nov-86**	**21-May-87**	**5-Oct-87**	**7-Sep-06**	**23-Sep-06**	**13-Jul-07**	**22-Aug-07**	**18-Sep-85**	**1-Nov-86**	**21-May-87**	**5-Oct-87**	**21-Sep-06**	**13-Jul-07**	**23-Aug-07**	**7-Sep-06**	**12-Jul-07**	**1-Nov-86**	**21-May-87**	**5-Oct-87**
Parameter																								
Measured Flow		7.50E-05	0.543		0.685				0.610	1.211		1.174					too low		1.684	too low				
pH	7.4	7.3	6.88	7.04	7.27	7.5	7.1	7.5	7.2	6.92	7.02	7.32	7	7.5	7.3	7.7	7.05	7.31	7.56	7.5		7.4	7	7.4
Alkalinity	20					23	19	20					40	37	23	35						42	18	126
Electrical Conductivity		48	50	44	46				51	55	49	50					134	106	132	101				
Hardness	19	20	23		21	19	22	19	22	25		23	19.2	41	31	45	66		71.1	44.2		53	27	127
Total Suspended Solids		<2	<2	<2	<2				<2	<2	<2	<2					<2	<2	4	<2				
Total Dissolved Solids		50.8	29.5		60				25.8	30.1		78					73.2		128	43.1				
Turbidity	0.4	0.5		<0.1	<0.1	0.2	0.4	4	1		<0.1	<0.1	0.13	1.2	0.6	0.5		<0.1	1.4	0.5		9	500	23
Ammonium - N	<0.005	<0.05	<0.05	<0.05	<0.05	<0.005	<0.005	0.006	<0.05	<0.05	<0.05	<0.05	0.017	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05		0.057	0.076	1.45
Dissolved Organic Carbon		2.3	1.9	4	3				2.2	1.9	3.5	2.8					3.3	6.7	5.7	4.5				
Dissolved Orthophosphate-P		<0.010	0.03	0.02	0.03				<0.010	0.03	0.02	0.03					0.04	0.03	0.05	<0.010				
Nitrate and Nitrite - N	0.022	<0.02	<0.02	<0.02	<0.02	0.024	0.01	0.013	<0.02	0.02	<0.02	<0.02	0.081	0.029		0.025	<0.02	<0.02	<0.02	<0.02		0.07	0.768	1.194
Total Cyanide		0.001	0.001				<0.001	<0.001	0.001	0.001					<0.001	<0.001	<0.001			0.001			<0.001	<0.001
Total Inorganic carbon		5.5	5.3	5	4.7				5.8	5.7	5.9	5.4					12.8	5	12.2	7.7				
Sulfate																								
Total Kjeldahl Nitrogen		0.1	0.11	0.15	0.12				0.1	0.15	0.15	0.17					0.28	0.24	0.13	0.13				
Total Kjeldahl Nitrogen and Phosphoru		<0.05			<0.05				<0.05			<0.05							<0.05	<0.05				
Total Organic Carbon	<1	3.4	2.4	3.7	10.4	<1	<1	3	3.1	2.2	3.1	2.4	8	12	<1	14	3.4	7.4	5.4	4.9		16	7	14
Dissolved Aluminum		0.022	0.012	0.031	0.044				0.026	0.015	0.028	0.026					0.015	0.053	0.107	0.03				
Dissolved Antimony	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.002	<0.002	0.0002	<0.0002	<0.0002	<0.0002		<0.002	<0.002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002		<0.002	<0.002	<0.002
Dissolved Arsenic	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	0.0003	<0.0002	0.0002	<0.0002		<0.001	<0.001	<0.001	<0.0002	<0.0002	<0.0002	<0.0002		<0.001	<0.001	0.011
Dissolved Barium	<0.005	0.005	0.005	0.005	0.008	<0.005	<0.005	0.005	0.006	0.007	0.006	0.006		<0.005	<0.005	0.005	0.007	0.007	0.011	0.006		0.005	<0.005	0.033
Dissolved Beryllium		<0.0001	<0.0001	<0.0001	<0.0001				0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001	<0.0001	<0.0001				
Dissolved Bismuth		<0.0005	<0.0005	<0.0005	<0.0005				0.0038	<0.0005	<0.0005	<0.0005					<0.0005	<0.0005	<0.0005	<0.0005				
Dissolved Boron		<0.002	<0.002	<0.002	<0.002				0.005	<0.002	<0.002	<0.002					<0.002	<0.002	<0.002	<0.002				
Dissolved Cadmium	<0.0002	<0.00001	<0.00001	<0.00001	<0.00001	<0.0002	<0.0002	<0.0002	0.00004	<0.00001	<0.00001	<0.00001		<0.0002	<0.0002	<0.0002	0.00002	0.00002	0.00003	<0.00001		<0.0002	<0.0002	0.0026
Dissolved Calcium		7.1	8	6.8	7.1				7.6	8.6	7.6	8					24.8	19.4	26.8	15.8				
Dissolved Chromium		<0.0005	0.001	<0.0005	<0.0005				0.002	<0.0005	<0.0005	<0.0005					<0.0005	<0.0005	0.0012	0.0006				
Dissolved Cobalt		<0.0001	<0.0001	<0.0001	<0.0001				0.0001	<0.0001	<0.0001	<0.0001					<0.0001	0.0004	<0.0001	<0.0001				
Dissolved Copper	0.0005	<0.001	<0.001	<0.001	<0.001	0.0005	<0.0005	0.0005	0.001	<0.001	<0.001	<0.001		0.0009	<0.0005	0.0009	<0.001	0.001	0.001	0.001		0.0011	0.0017	0.0011
Dissolved Iron	0.021	0.03	0.02	0.02	<0.0001	0.016	0.07	0.027	0.04	0.04	0.03	<0.0001		0.024	0.05	0.01	0.01	0.03	0.0002	0.09		0.024	0.032	0.63
Dissolved Lead	<0.001	0.0004	<0.0001	<0.0001	0.04	<0.001	<0.001	<0.001	0.0003	0.0002	<0.0001	0.04		<0.001	<0.001	<0.001	<0.0001	<0.0001	0.07	0.0002		<0.001	<0.001	0.002
Dissolved Lithium		<0.001	0.001	<0.001	<0.001				0.002	0.001	<0.001	<0.001					0.002	0.001	0.002	0.001				
Dissolved Magnesium		0.7	0.7	0.6	0.7				0.7	0.9	0.7	0.8					0.9	0.7	1	1.1				
Dissolved Manganese		<0.005	<0.005	<0.005	<0.005				<0.005	<0.005	0.006	0.005					0.012	<0.005	0.01	0.039				
Dissolved Mercury				<0.02							<0.02							<0.02						
Dissolved Molybdenum		<0.001	<0.001	<0.001	<0.001				0.002	<0.001	<0.001	<0.001					0.011	0.011	0.013	0.003				
Dissolved Nickel		<0.0005	<0.0005	<0.0005	<0.0005				0.0011	<0.0005	<0.0005	<0.0005					<0.0005	<0.0005	<0.0005	<0.0005				
Dissolved Potassium		<0.4	<0.4	<0.4	<0.4				<0.4	<0.4	<0.4	<0.4					<0.4	<0.4	<0.4	<0.4				
Dissolved Selenium		<0.0002	0.0004	<0.0002	<0.0002				0.0003	0.0003	<0.0002	<0.0002					0.0004	<0.0002	<0.0002	<0.0002				
Dissolved Silicon		2.64	2.78	2.8	2.96				2.61	2.91	2.79	2.96					2.54	4.23	4.94	3.27				
Dissolved Silver	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001		<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001		<0.0002	<0.0002	0.0004
Dissolved Sodium		1.4	1.4	1.8	1.4				1.6	1.5	1.3	1.5					1.2	1.7	1.2	1.5				
Dissolved Stronium		0.075	0.074	0.065	0.072				0.081	0.086	0.08	0.083					0.116	0.096	0.117	0.146				
Dissolved Sulfur		1	1.1	1.1	1				1.1	1.2	1.1	1.1					4.6	3.9	5.4	5.3				
Dissolved Thallium		<0.00005	<0.00005	<0.00005	<0.00005				<0.00005	<0.00005	<0.00005	<0.00005					<0.00005	<0.00005	<0.00005	<0.00005				
Dissolved Tin		<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001				
Dissolved Titanium		<0.0005	<0.0005	<0.0005	0.0013				0.0008	<0.0005	<0.0005	<0.0005					0.0005	0.0008	0.0047	0.0006				
Dissolved Uranium		0.0008	0.0009	0.0011	0.0011				0.0014	0.001	0.0011	0.0011					<0.0005	<0.0005	0.0005	0.0016				
Dissolved Vanadium		0.0002	<0.0001	0.0003	0.0002				0.0003	<0.0001	0.0002	0.0002					<0.0001	0.0004	0.0006	0.0002				
Dissolved Zinc	0.0011	0.002	0.003	0.002	0.004	0.0018	0.0029	0.0016	0.003	0.003	<0.001	0.006		0.0036	0.0037	0.0039	0.004	<0.001	0.008	0.007		0.16	0.05	1.68
Total Aluminum		0.028	0.027	0.04	0.042				0.058	0.025	0.043	0.038	0.08				0.048	0.079	0.286	0.098	0.025			
Total Antimony	<0.002	<0.0004	<0.0004	<0.0002	<0.0002	<0.002	<0.002	<0.002	<0.0004	<0.0004	<0.0002	<0.0002	<0.05	<0.002	<0.002	<0.002	<0.0004	<0.0002	<0.0002	<0.0004	0.003	<0.002	0.005	<0.002
Total Arsenic	<0.001	<0.0004	<0.0004	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.0004	<0.0004	0.0002	<0.0002	<0.05	<0.001	<0.001	<0.001	<0.0004	<0.0002	<0.0002	<0.0004	0.0034	<0.001	0.068	0.022
Total Barium	<0.005	0.005	0.007	0.007	0.006	0.005	<0.005	0.005	0.007	0.007	0.006	0.006	0.024	<0.005	<0.005	0.005	0.008	0.007	0.011	0.008	0.015	0.049	0.64	0.035
Total Beryllium		<0.0002	<0.0002	<0.0001	<0.0001				<0.0002	<0.0002	<0.0001	<0.0001					<0.0002	<0.0001	<0.0001	<0.0002	<0.0001			
Total Bismuth		<0.001	<0.001	<0.0005	<0.0005				<0.001	<0.001	<0.0005	<0.0005					<0.001	<0.0005	<0.0005	<0.001	<0.0005			
Total Boron		<0.004	<0.004	<0.002	0.002				<0.004	<0.004	0.002	0.002					<0.004	0.003	0.003	<0.004	0.004			
Total Cadmium	<0.0002	<0.00002	<0.00002	<0.00001	<0.00001	<0.0002	<0.0002	<0.0002	<0.00002	<0.00002	<0.00001	<0.00001	<0.002	<0.0002	<0.0002	<0.0002	<0.00002	<0.00001	0.00002	<0.00002	0.00402	0.0003	0.0008	0.0043
Total Calcium		6.5	7.4	6.7	6.7				7	8.2	7.6	7.7					24.6	18.4	24.9	15	62			
Total Chromium		<0.001	<0.001	<0.0005	<0.0005				<0.001	<0.001	<0.0005	<0.0005	<0.005				<0.001	<0.0005	0.0008	<0.001	<0.0005			
Total Cobalt		<0.0002	<0.0002	<0.0001	<0.0001				<0.0002	<0.0002	<0.0001	0.0002	<0.005				<0.0002	<0.0001	0.0003	<0.0002	<0.0001			
Total Copper	0.0006	<0.002	<0.002	<0.001	<0.001	0.0005	<0.0005	0.0009	<0.002	<0.002	<0.001	<0.001	<0.005	0.0013	0.0009	0.0009	<0.002	<0.001	0.001	<0.002	<0.001	0.0014	0.29	0.0029
Total Iron	0.023	<0.2	<0.2	<0.1	<0.1	0.034	0.1	0.1	<0.2	<0.2	<0.1	<0.1	0.031	0.034	0.13	0.014	<0.2	<0.1	0.2	0.2	<0.1	0.33	22	1.15
Total Lead	<0.001	<0.0002	<0.0002	<0.0001	<0.0001	<0.001	<0.001	<0.001	0.0003	<0.0002	<0.0001	<0.0001		<0.001	<0.001	<0.001	<0.0002	<0.0001	0.0003	0.0003	0.0008	<0.001	0.13	0.005
Total Lithium		<0.002	<0.002	<0.001	<0.001				<0.002	<0.002	<0.001	0.001					<0.002	0.002	0.003	<0.002	0.008			
Total Magnesium		0.5	0.7	0.6	0.7				0.6	0.9	0.7	0.8					0.9	0.7	0.9	1	12.3			
Total Manganese		<0.010	<0.010	<0.005	<0.005				0.024	<0.010	0.006	0.008					0.02	<0.005	0.017	0.1	0.011			
Total Mercury	<0.05			0.18		<0.05	<0.05	<0.05			1.19			<0.05	<0.05	<0.05		0.06			<0.02	<0.05	<0.05	<0.05
Total Molybdenum		<0.002	<0.002	<0.001	<0.001				<0.002	<0.002	<0.001	<0.001	<0.005				0.01	0.012	0.014	0.003	0.004			
Total Nickel		<0.001	<0.001	<0.0005	<0.0005				<0.001	<0.001	<0.0005	<0.0005	<0.02				0.001	<0.0005	0.0012	<0.001	<0.0005			
Total Potassium		<0.8	<0.8	<0.4	<0.4				<0.8	<0.8	<0.4	<0.4					<0.8	<0.4	0.4	<0.8	0.9			
Total Selenium		<0.0004	<0.0004	<0.0002	<0.0002				<0.0004	<0.0004	0.0002	<0.0002					<0.0004	0.0003	<0.0002	<0.0004	0.0005			
Total Silicon		2.86	2.5	2.82	2.72				2.93	2.73	2.84	2.81					3.79	4.2	4.88	3.7	3.75			
Total Silver	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001		<0.0002	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0002	<0.0001	<0.0002	0.0023	0.0014
Total Sodium		1	1	1.8	1.4				1	2	1.9	1.5					1	1.7	1.2	1	2.4			
Total Strontium		0.071	0.075	0.063	0.074				0.076	0.083	0.075	0.086					0.12	0.094	0.124	0.15	0.342			
Total Sulfur		0.9	1	1	0.9				1	1	1.1	1.1					4.3	3.8	5.1	5.1	34			
Total Thallium		<0.0001	<0.0001	<0.00005	<0.00005				<0.0001	<0.0001	<0.00005	<0.00005					<0.0001	<0.00005	<0.00005	<0.0001	<0.00005			
Total Tin		<0.002	<0.002	<0.001	<0.001				<0.002	<0.002	<0.001	<0.001					<0.002	<0.001	<0.001	<0.002	<0.001			
Total Titanium		<0.001	<0.001	<0.0005	<0.0005				0.002	<0.001	0.0006	<0.0005					0.002	0.0018	0.0068	0.0028	0.0024			
Total Uranium		<0.001	<0.001	0.0012	0.0012				0.001	0.001	0.0013	0.0012					<0.001	<0.0005	0.0006	0.0021	0.0142			
Total Vanadium		<0.0002	<0.0002	0.0002	0.0002				0.0002	<0.0002	0.0002	0.0002					<0.0002	0.0002	0.0006	0.0003	0.0002			
Total Zinc	0.0012	<0.002	0.002	0.004	0.005	0.002	0.0035	0.0043	<0.002	0.003	0.002	0.007	0.035	0.0039	0.004	0.0039	0.004	0.003	0.008	0.008	2.48	0.18	1.5	1.72
Total Zirconium		<0.002	<0.002	<0.001	<0.001				<0.002	<0.002	<0.001	<0.001					<0.002	<0.001	<0.001	<0.002	<0.001			

Silver Hart Property

			Sample ID	**CMC-01**	**CMC-01**	**CMC-02**	**CMC-03**	**CMC-03a**	**CMC-06**	**CMC-07**	**CMC-10**	**CMC-11**	**CMC-M1**	**CMC-M2**	**CMC-OC-02**	**CMC-U2**
			Sampling Date	**9/6/2006**	**9/6/2006**	**9/6/2006**	**9/6/2006**	**9/6/2006**	**9/6/2006**	**9/7/2006**	**9/6/2006**	**9/7/2006**	**9/7/2006**	**9/7/2006**	**9/7/2006**	**9/7/2006**
			Sampling Method	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
			Matrix	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**
Parameter	**Method**	**Unit**	**Detection**		**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
pH	1:2 Soil:Water	pH	0.5		7.2	7.2	7.1	7	6.9	6.4	7	7.2	6.6	6.4	6.5	6.5
Aluminum	Strong Acid Extractable	ug/g	1		21600	16700	20300	18600	18800	8740	19100	18700	14100	14400	9830	17700
Antimony	Strong Acid Extractable	ug/g	0.5		0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7
Arsenic	Strong Acid Extractable	ug/g	0.2		28.8	11.3	10.6	11.8	8.6	1.7	10.8	24.8	3.6	4.4	2.2	4
Barium	Strong Acid Extractable	ug/g	0.03		111	49.1	85.9	99.1	96	77.5	76.5	186	95.7	133	64.3	181
Beryllium	Strong Acid Extractable	ug/g	0.01		1.37	0.92	1.15	0.89	1.75	1.09	1.1	2.47	1.3	1	0.71	1.14
Bismuth	Strong Acid Extractable	ug/g	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	Strong Acid Extractable	ug/g	0.05		1.6	1.2	3.5	2.4	0.82	0.59	1.1	1.4	0.93	1	0.4	2.7
Calcium	Strong Acid Extractable	ug/g	2		3130	17200	12000	8760	10800	10900	8280	13300	5370	7980	3920	5010
Chromium	Strong Acid Extractable	ug/g	0.04		26.9	62.9	73.8	91.4	23.4	16.8	30.5	77.2	32.4	32.2	11	15.5
Cobalt	Strong Acid Extractable	ug/g	0.05		11.1	14.6	8.71	10.3	9.08	2	8.4	12.1	4.3	5.06	2.4	8.32
Copper	Strong Acid Extractable	ug/g	0.05		28.9	83	48.7	60.8	33	26.5	29.8	42.2	27.3	19.8	13.3	36.6
Iron	Strong Acid Extractable	ug/g	1		37800	32500	29300	30800	25700	11700	27700	36100	20500	22100	10500	27600
Lead	Strong Acid Extractable	ug/g	0.3		101	43	51.8	72.6	32.7	18.4	24.1	72	30.2	41.3	14.1	21.8
Lithium	Strong Acid Extractable	ug/g	0.1		59.8	46.7	57.8	61.3	59.2	23.5	60.9	45.6	42.2	53.6	34.6	51.2
Magnesium	Strong Acid Extractable	ug/g	1		6590	4750	4990	5690	4340	1890	5320	3190	3420	4080	2690	3530
Manganese	Strong Acid Extractable	ug/g	0.3		641	614	425	1010	356	279	683	391	562	884	147	958
Mercury	Strong Acid Extractable	ug/g	0.003		0.006	0.091	0.094	0.052	0.088	0.057	0.044	0.081	0.041	0.05	0.029	0.046
Molybdenum	Strong Acid Extractable	ug/g	0.05		1.4	5.63	7.54	11.6	1.5	3.9	2.9	6.91	4.1	4.7	1.5	18.4
Nickel	Strong Acid Extractable	ug/g	0.1		33.4	94.2	62.5	72.4	21	11	30.5	59.3	24.6	22.4	8.22	13.8
Phosphorus	Strong Acid Extractable	ug/g	0.5		299	1160	1180	855	912	615	868	1210	626	956	909	999
Potassium	Strong Acid Extractable	ug/g	5		2020	1140	2520	2180	1380	1050	2440	2180	1780	2900	975	1990
Selenium	Strong Acid Extractable	ug/g	0.3		<0.3	5	1.5	0.3	1.4	<0.3	<0.3	<0.3	<0.3	<0.3	0.3	<0.3
Silicon	Strong Acid Extractable	ug/g	1		271	201	142	77	206	36	72	625	67	54	64	289
Silver	Strong Acid Extractable	ug/g	0.2		1	0.5	1.3	0.6	0.4	0.2	0.4	0.2	0.3	0.8	<0.2	0.5
Sodium	Strong Acid Extractable	ug/g	1		170	148	252	158	161	93	191	257	108	159	91	126
Strontium	Strong Acid Extractable	ug/g	0.02		50.6	61.8	76.4	64.1	98.1	120	56.7	110	62.1	82	38.8	61
Thallium	Strong Acid Extractable	ug/g	0.3		<0.3	1.2	<0.3	<0.3	<0.3	<0.3	<0.3	4.3	<0.3	<0.3	<0.3	4.2
Tin	Strong Acid Extractable	ug/g	0.2		2	20.2	17.7	20.9	0.9	2.4	1.5	33.4	9.3	3.8	1.3	1.2
Titanium	Strong Acid Extractable	ug/g	0.05		434	121	184	219	100	217	303	131	278	307	242	318
Vanadium	Strong Acid Extractable	ug/g	0.1		41.6	18.7	28.3	29.1	24.8	22.7	30.8	39.6	33.3	35.2	20	35.4
Zinc	Strong Acid Extractable	ug/g	0.1		1140	208	571	496	255	70.6	317	161	523	254	95.2	549
Zirconium	Strong Acid Extractable	ug/g	0.05		2	2	1.7	1.4	2	1.4	1.2	2.6	0.96	1.6	1.1	1.9

Appendix B: Hydrological Analysis Details

MEMORANDUM

To:	**Don Wedman**	**Date: June 26, 2009**
From:	**Justin Bourne, M.Eng., P.Eng.**	**Project #: 898-1**
Subject:	**Description of Regional Hydrology Analysis**	

This memorandum describes the regional hydrology analysis that was performed for CMC Metals' Silver Hart project (the Site) in southern Yukon.

First, Lorax conducted a search for hydrometric stations within 150 km of the Site through the Water Survey of Canada's online data archive[1]. This was based on the assumption that hydrometric responses would be most similar amongst stations located in the same geoclimatic region. This search returned fourteen stations.

For each of the above stations, the mean annual runoff (MAR, equal to mean annual precipitation divided by catchment area) was plotted against catchment area (as MAR commonly decreases with increasing catchment area). On the initial plot, four stations appeared to be outliers that did not share the same MAR versus catchment area (CA) relationship as the other ten. On closer inspection, it was discovered that these four stations were all near the outer limits of the 150 km search radius defined above. After removing these four outlier stations from the MAR vs CA plot, the remaining stations appeared to follow a log-linear relationship (see Figure 1).

In a given geoclimatic region, MAR typically increases with elevation. Figure 2 shows a plot of MAR versus apparent average catchment elevation for the ten stations above. As expected, a positive correlation between MAR and elevation was observed.

Many of the watersheds of interest at the Site have catchment areas in the 600 to 800 km^2 range. Given the above and that CA and geographic location are two key factors affecting the hydrometric response of a site, it was determined that the Big Creek hydrometric station (station ID 10AA005) would make the best proxy for monthly flow distribution patterns with a CA of 607 km^2 and a distance of only 60 km from the Site. Further, Big Creek passes within 25 km of the Site on the south side, and drains tributaries originating near the south-western boundary of the Site.

[1] http://www.wsc.ec.gc.ca/hydat/H2O/index_e.cfm?cname=main_e.cfm

Mean monthly flow estimates were made for each water quality monitoring location at the Site by scaling from the mean monthly flows at Big Creek station using the relationships described above. Further, a frequency analysis (Log Pearson Type III) was performed on the Big Creek MAR's to obtain the 1 in 100 year return period dry year MAR. Monthly flows for the 1 in 100 year return period dry event were then estimated by scaling using the factors obtained in the Big Creek frequency analysis.

We trust this meets your current requirements. Should you have any questions or comments, please contact us at your convenience.

Respectfully submitted,

Lorax Environmental Services Ltd.

Justin Bourne, M.Eng., P.Eng.
Hydrogeological Engineer

JB

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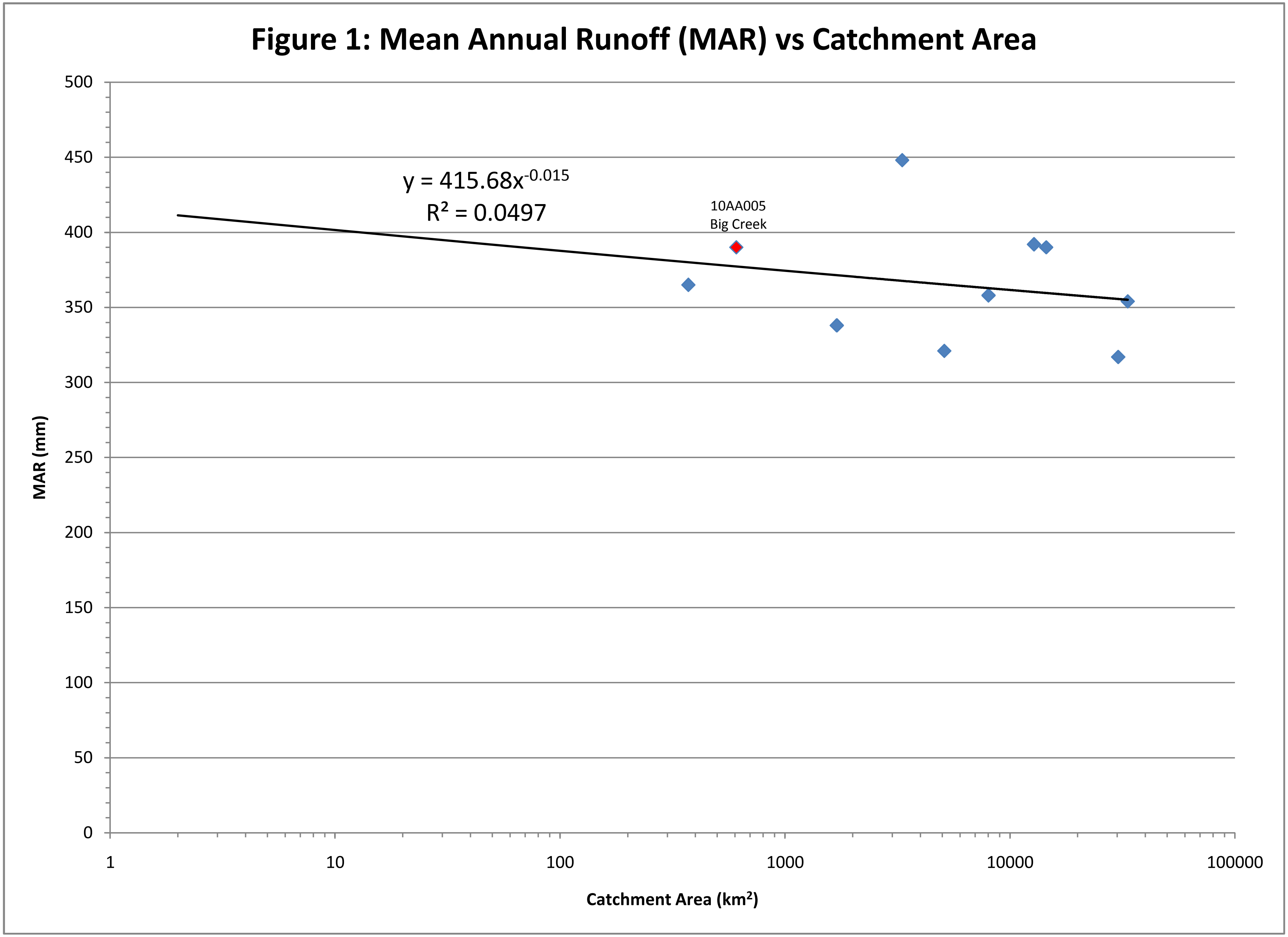

Figure 1: Mean Annual Runoff (MAR) vs Catchment Area
y = 415.68x^-0.015
R² = 0.0497
10AA005
Big Creek
MAR (mm)
500
450
400
350
300
250
200
150
100
50
0
1
10
100
1000
10000
100000
Catchment Area (km²)

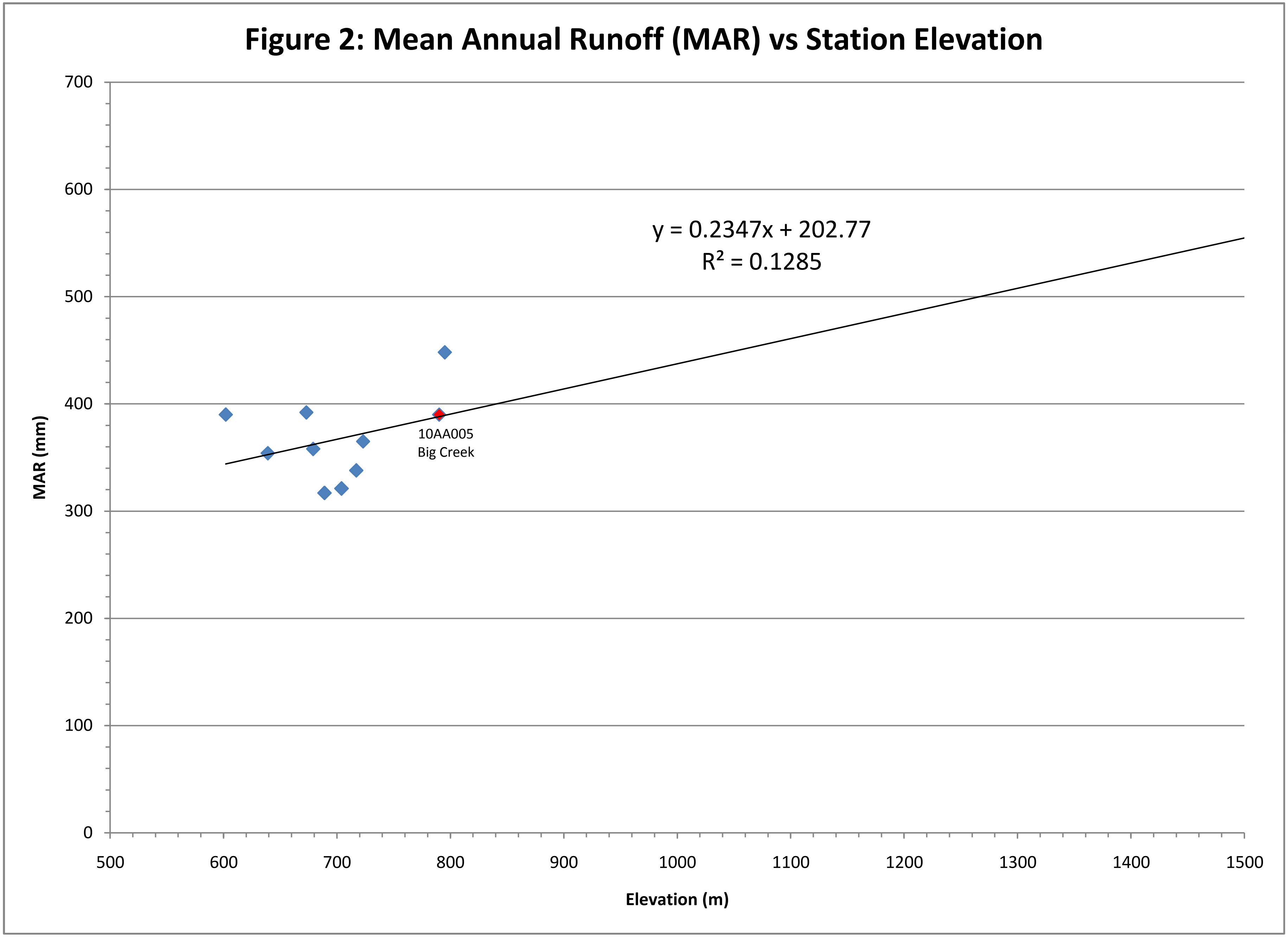
Figure 2: Mean Annual Runoff (MAR) vs Station Elevation
y = 0.2347x + 202.77
R² = 0.1285
10AA005
Big Creek
MAR (mm)
0
100
200
300
400
500
600
700
Elevation (m)
500
600
700
800
900
1000
1100
1200
1300
1400
1500