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Ministry of Environment
Mining Operations Environmental Protection
2080 Labieux Road
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PERMIT 11678 MARCH 2017 MONTHLY REPORT

This report satisfies the requirements of Section 3.9 of *EMA* Permit 11678 (last amended September 19, 2016) and the changes to Section 3.9 provided in an approval letter from the Ministry of Environment (MoE) on February 7, 2017 (Attachment 1). This report includes the following components:

- Summary of volume of treated effluent discharged
- Update on Springer Pit lake elevation
- Update on Springer Pit monitoring well levels
- Water quality results for treated effluent
- Water quality results for Springer Pit related wells
- Summarized analysis of treated effluent turbidity/TSS discharged.

Water Treatment and Discharge

Discharge of treated water continued this month with an average discharge rate of 0.188 m³/s. The total amount of treated water discharged from March 1 to March 31, 2017 was 501,285 m³.

Springer Pit and Groundwater Wells

Water elevations of Springer Pit and the associated groundwater monitoring wells are provided in Table 1. Water quality monitoring is conducted on a monthly basis from the groundwater wells associated with Springer Pit. Springer wells GW15-1a and 1b, and GW15-2a were sampled on March 20, 2017 and are reported in Tables 4 through 6. Due to equipment failure, GW15-2a and GW12-2a and 2b were sampled in early April and the results will be reported in the next monthly report. Monthly sampling for April will be conducted in late April. The previous six months' analytical results for the parameters of interest are provided in Tables 2 through 7.

Table 1. Water elevations for Springer Pit and groundwater wells

	Start of Month	End of Month	Change
	1-Mar-17	31-Mar-17	(m)
Springer	1007.28	1004.43	-2.85
GW12-2a	1012.06	1011.69	-0.37
GW12-2b	1012.11	1011.67	-0.44
GW15-1a	1011.00	1010.23	-0.77
GW15-1b	1010.86	1010.12	-0.74
GW15-2a	1020.04	1020.40	0.36
GW15-2b	1020.35	1020.71	0.36

Table 2. GW 12-2a water chemistry results

		GW12-2A					
Date Sampled		15-Sep-16	24-Oct-16	08-Nov-16	19-Dec-16	16-Jan-17	22-Feb-17
Physical Tests							
Conductivity	µS/cm	230	232	228	238	236	232
Hardness (as CaCO3)	mg/L	48.5	48.3	47.0	46.5	50.5	49.0
pH	pH	7.99	8.02	7.92	8.07	7.88	7.97
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO4)	mg/L	63.8	65.1	65.5	65.8	66.0	65.9
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0045	0.0046	0.0041	0.0048	0.0045	0.0053
Arsenic (As)-Dissolved	mg/L	0.00237	0.00224	0.00240	0.00238	0.00244	0.00236
Cadmium (Cd)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0393	0.0403	0.0392	0.0370	0.0394	0.0402
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000063

Table 3. GW 12-2b water chemistry results

		GW12-2B					
Date Sampled		15-Sep-16	24-Oct-16	08-Nov-16	19-Dec-16	16-Jan-17	22-Feb-17
Physical Tests							
Conductivity	µS/cm	638	617	606	612	591	578
Hardness (as CaCO3)	mg/L	312.0	305.0	291.0	271.0	298.0	280.0
pH	pH	8.16	8.22	8.19	8.06	8.13	8.23
Anions and Nutrients							
Nitrate (as N)	mg/L	2.98	3.08	2.95	2.75	2.54	2.37
Sulfate (SO4)	mg/L	169	166	158	150	137	126
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00057	0.00052	0.00057	0.00055	0.00056	0.00053
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	0.0000074	0.0000066	0.0000062	0.0000061	<0.0000050
Copper (Cu)-Dissolved	mg/L	0.00081	0.00084	0.00077	0.00071	0.00069	0.00071
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0210	0.0213	0.0208	0.0192	0.0211	0.0220
Selenium (Se)-Dissolved	mg/L	0.010200	0.009110	0.008730	0.006320	0.006440	0.007120

Table 4. GW 15-1a water chemistry results

		GW15-1A					
Date Sampled		24-Oct-16	09-Nov-16	21-Dec-16	18-Jan-17	22-Feb-17	20-Mar-17
Physical Tests							
Conductivity	µS/cm	280	281	284	279	274	281
Hardness (as CaCO3)	mg/L	73.7	76.6	75.7	74.3	74.8	72.9
pH	pH	8.02	7.96	8.11	8.07	8.06	7.90
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO4)	mg/L	66.3	68.2	65.4	64.2	63.4	60.9
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00432	0.00416	0.00408	0.00444	0.00435	0.00444
Cadmium (Cd)-Dissolved	mg/L	0.0000099	<0.0000050	<0.0000050	<0.0000050	0.0000055	0.0000075
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0259	0.0265	0.0259	0.0249	0.0259	0.0276
Selenium (Se)-Dissolved	mg/L	0.000065	<0.000050	<0.000050	<0.000050	0.000083	0.000063

Table 5. GW 15-1b water chemistry results

		GW15-1B					
Date Sampled		24-Oct-16	08-Nov-16	09-Dec-16	16-Jan-17	22-Feb-17	20-Mar-17
Physical Tests							
Conductivity	µS/cm	740	703	648	577	532	508
Hardness (as CaCO3)	mg/L	338	322	274	256	232	207
pH	pH	8.15	8.16	8.11	8.05	8.16	8.13
Anions and Nutrients							
Nitrate (as N)	mg/L	1.42	1.37	1.36	1.02	0.861	0.709
Sulfate (SO4)	mg/L	234	203	172	165	146	123
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00149	0.00155	0.00156	0.00167	0.00160	0.00163
Cadmium (Cd)-Dissolved	mg/L	0.0000094	0.0000101	0.0000060	<0.0000050	0.0000072	0.0000056
Copper (Cu)-Dissolved	mg/L	0.00072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0048	0.0049	0.0048	0.0047	0.0053	0.0056
Selenium (Se)-Dissolved	mg/L	0.007660	0.006670	0.003730	0.007710	0.006970	0.007340

Table 6. GW 15-2a water chemistry results

		GW15-2A					
Date Sampled		24-Oct-16	08-Nov-16	09-Dec-16	16-Jan-17	21-Feb-17	20-Mar-17
Physical Tests							
Conductivity	µS/cm	200	197	201	194	202	195
Hardness (as CaCO3)	mg/L	56.4	53.6	52.4	55.0	54.6	54.6
pH	pH	8.10	8.06	8.20	8.04	8.17	8.08
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO4)	mg/L	37.1	37.1	37.4	37.1	36.5	36.3
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0051
Arsenic (As)-Dissolved	mg/L	0.00388	0.00412	0.00370	0.00413	0.00390	0.00381
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000015
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0431	0.0417	0.0408	0.0425	0.0430	0.0470
Selenium (Se)-Dissolved	mg/L	0.000074	0.000058	<0.000050	<0.000050	<0.000050	<0.000050

Table 7. GW 15-2b water chemistry results

		GW15-2B					
Date Sampled		15-Sep-16	24-Oct-16	08-Nov-16	09-Dec-16	16-Jan-17	22-Feb-17
Physical Tests							
Conductivity	µS/cm	375	368	358	353	342	351
Hardness (as CaCO3)	mg/L	142.0	138.0	133.0	125.0	131.0	135.0
pH	pH	8.12	8.13	8.11	8.14	8.07	8.10
Anions and Nutrients							
Nitrate (as N)	mg/L	0.649	0.502	0.44	0.301	0.259	0.345
Sulfate (SO4)	mg/L	82.5	81.0	80.0	75.0	73.2	75.6
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00210	0.00195	0.00215	0.00236	0.00238	0.00217
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0436	0.0447	0.0437	0.0423	0.0445	0.0443
Selenium (Se)-Dissolved	mg/L	0.000339	0.000307	0.000377	0.000242	0.000294	0.000338

Water Quality Monitoring

Samples were collected at end of pipe at the water treatment plant (station HAD-03) and throughout Hazeltine Creek weekly in March. Five sampling events occurred in Hazeltine Creek and six sampling events occurred at HAD-03 in March. Results for HAD-03 from these sampling events are shown in Table 8.

Table 8. Sample analysis results for HAD-03 (end of pipe from the water treatment plant)

Lab Analysis Results for HAD-03							Permit 11678
	01-Mar-17	07-Mar-17	14-Mar-17	21-Mar-17	27-Mar-17	30-Mar-17	mg/L
Total Suspended Solids (mg/L)	11.1	9.3	10.7	7.1	7.7	7.38	15
Nitrate (as N)- Total (mg/L)	8.74	8.32	8.4	8.54	8.52	7.85	9.7
Ammonia (as N) - Total (mg/L)	0.0197	0.0197	0.0219	0.0129	0.0096	0.0106	0.41
Phosphorus (P) - Total (mg/L)	0.004	<0.0020	0.0024	0.0036	0.0039	0.0023	0.09
Sulphate (mg/L)	540	528	524	534	537	493	720
Arsenic (As) - Total (mg/L)	0.00077	0.00082	0.00081	0.00077	0.00066	0.00071	0.0034
Copper (Cu)-Total (mg/L)	0.0053	0.0052	0.00604	0.0056	0.00487	0.00568	0.012
Cadmium (Cd)-Total (mg/L)	<0.000055	<0.000060	<0.000050	<0.000080	<0.000060	<0.000060	N/A
Chromium (Cr) - Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0011
Iron (Fe) - Total (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.11
Molybdenum (Mo)-Total (mg/L)	0.168	0.172	0.167	0.174	0.162	0.169	0.2
Selenium (Se)-Total (mg/L)	0.0354	0.0357	0.0359	0.0337	0.033	0.0355	0.06
Vanadium (V) - Total (mg/L)	0.00106	0.00108	0.00119	0.00116	0.00105	0.00114	0.0081
Zinc (Zn) - Total (mg/L)	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030	0.0083

The water treatment plant was operating in active treatment mode until March 30, 2017 when it was shutdown due to high flows in Hazeltine Creek. Analytical results from samples collected in March 2017 for TSS ranged from 7.1 mg/L to 11.1 mg/L.

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