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Ministry of Environment
Mining Operations Environmental Protection
2080 Labieux Road
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WEEKLY UPDATE REPORT – NOVEMBER 3 TO NOVEMBER 10, 2016

Water Management

Springer Pit

Water elevations are recorded daily at the Springer Pit. Surrounding groundwater elevations are recorded daily with a few exceptions. The summarized weekly data are presented here in Table 1.

Water quality monitoring is conducted at the Springer Pit (sample point E11a) weekly and the surrounding groundwater wells monthly. All results are reported to the Ministry of Environment (MoE) each quarter, and results are included here as they become available. Results for the Springer Pit and the associated Springer Pit wells from the last six sampling events are shown in Tables 2 to 8. These wells were purged and sampled again this week.

Water Treatment and Discharge

Discharge of treated water continued this week; the total amount of treated water discharged between November 1st and November 7th was 178,342 m³ with an average discharging rate of 0.294 m³/s throughout this same period.

Rehabilitation Work

Hazeltine Creek Rehabilitation

Rehabilitation work at upper Hazeltine Creek has been completed for 2016. Rehabilitation and erosion control work is continuing in Reach 2 and 3.

Environmental Monitoring Program

Water Quality Monitoring

Samples were collected at end of pipe at the water treatment plant (station HAD-03) and throughout Hazeltine Creek on November 8th. Results for HAD-03 from the November 1st sampling event are shown in Table 3.

QUL-58 was profiled on October 26th, and the most recent profile data for QUL-58 is provided in Figure 1. Results from QUL-58 sampling events compared to the BC Water Quality Guidelines (WQG) for aquatic life are reported here when they become available.

For previous results see the November 3rd, 2016 report available on the Imperial Metals website:

https://www.imperialmetals.com/assets/docs/mt-polley/11-03-16-weekly_update_SEC.pdf

A map of monitoring stations is available on the Imperial Metals website:

<http://www.imperialmetals.com/assets/docs/mt-polley/12.03.15.weekly-update.pdf>

The update for the Post-Event Environmental Impact Assessment Report is available on the Imperial Metals website:

https://www.imperialmetals.com/assets/docs/mt-polley/2016-06-03_1411734-124-R-Rev0-10000.pdf

Figure 1 shows field parameter profile results for turbidity and temperature at station QUL-58 in Quesnel Lake (station 100m from the Hazeltine Creek outflow diffusers, at the edge of the initial dilution zone).

Figure 2 shows field turbidity readings for upper, middle and lower Hazeltine Creek. Increases in turbidity along the creek between June and early October 2016 were generally a result of the construction in the upper reaches of the creek and quickly dropped out in the sedimentation pond at lower Hazeltine.

Figure 3 shows a time series graph of turbidity readings at site QUR-1/QUR-11 in the upper Quesnel River.

Table 1. Water elevations for Springer Pit and groundwater wells

	Last Week	This Week	Change
	2-Nov-16	9-Nov-16	(m)
Springer	1020.90	1019.60	-1.30
GW12-2a	1016.47	1016.24	-0.23
GW12-2b	1017.22	1017.03	-0.19
GW15-1a	1025.49	1024.39	-1.10
GW15-1b	1025.53	1024.42	-1.11
GW15-2a	1025.30	1024.88	-0.42
GW15-2b	1026.56	1026.00	-0.56

Table 2. Springer Pit supernatant water chemistry results

		Springer Pit Supernatant					
Date Sampled		27-Sep-16	03-Oct-16	11-Oct-16	18-Oct-16	24-Oct-16	01-Nov-16
Physical Tests							
Conductivity	µS/cm	1150	1200	1150	1120	1150	1160
Hardness (as CaCO ₃)	mg/L	509	505	505	498	495	476
pH	pH	7.86	7.77	7.85	7.74	7.81	7.84
Total Suspended Solids	mg/L	1.10	<1.0	<1.0	1.10	1.60	1.40
Turbidity	NTU	0.39	0.41	0.43	0.86	0.92	0.95
Anions and Nutrients							
Nitrate (as N)	mg/L	8.97	8.85	9.10	8.73	8.65	9.06
Sulfate (SO ₄)	mg/L	549	547	567	545	537	565
Total Metals							
Aluminum (Al)-Total	mg/L	0.04	0.04	0.04	0.08	0.09	0.08
Arsenic (As)-Total	mg/L	0.00098	0.00098	0.00111	0.00106	0.00104	0.00116
Cadmium (Cd)-Total	mg/L	<0.000020	0.0000188	<0.000020	<0.000030	0.0000144	<0.000040
Copper (Cu)-Total	mg/L	0.00384	0.00344	0.00375	0.00515	0.00617	0.00591
Iron (Fe)-Total	mg/L	<0.030	<0.030	<0.030	0.039	0.046	0.039
Lead (Pb)-Total	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Total	mg/L	0.180	0.182	0.180	0.176	0.177	0.176
Selenium (Se)-Total	mg/L	0.0362	0.0362	0.0345	0.0361	0.0357	0.0355
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0220	0.0226	0.0201	0.0192	0.0190	0.0195
Arsenic (As)-Dissolved	mg/L	0.00092	0.00095	0.00099	0.00098	0.00096	0.00115
Cadmium (Cd)-Dissolved	mg/L	<0.000020	0.0000136	<0.000015	<0.000030	0.0000145	<0.000040
Copper (Cu)-Dissolved	mg/L	0.00264	0.00236	0.00255	0.00288	0.00305	0.00359
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	0.174	0.171	0.171	0.171	0.167	0.153
Selenium (Se)-Dissolved	mg/L	0.0337	0.0365	0.0356	0.0346	0.0344	0.0372

Table 3. GW 12-2a water chemistry results

		GW 12-2A					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	18-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	230	229	232	231	230	232
Hardness (as CaCO ₃)	mg/L	49.4	50.7	50.8	46.2	48.5	48.3
pH	pH	7.97	8.20	7.95	7.92	7.99	8.02
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	65.6	64.5	64.1	62.8	63.8	65.1
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0047	0.0070	0.0046	0.0040	0.0045	0.0046
Arsenic (As)-Dissolved	mg/L	0.00209	0.00242	0.00234	0.00218	0.00237	0.00224
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	0.0394	0.0398	0.0407	0.0388	0.0393	0.0403
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Table 4. GW 12-2b water chemistry results

		GW 12-2B					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	598	631	660	668	638	617
Hardness (as CaCO ₃)	mg/L	324.0	331.0	343.0	324.0	312.0	305.0
pH	pH	7.97	8.00	7.81	8.25	8.16	8.22
Anions and Nutrients							
Nitrate (as N)	mg/L	3.33	3.05	2.98	2.96	2.98	3.08
Sulfate (SO ₄)	mg/L	132	150	166	174.0	169.0	166.0
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00050	0.00058	0.00057	0.00052	0.00057	0.00052
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	0.0000073	0.0000052	<0.0000050	0.0000074
Copper (Cu)-Dissolved	mg/L	0.00077	0.00081	0.00081	0.00081	0.00081	0.00084
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	0.0208	0.0194	0.0219	0.0210	0.0210	0.0213
Selenium (Se)-Dissolved	mg/L	0.0108	0.0117	0.0111	0.011200	0.010200	0.009110

Table 5. GW 15-1a water chemistry results

		GW 15-1A					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	18-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	272	271	275	279	277	280
Hardness (as CaCO ₃)	mg/L	81.3	81.0	70.9	70.5	72.7	73.7
pH	pH	8.04	8.12	8.08	8.03	8.05	8.02
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	62.5	61.6	62.6	63.2	64.9	66.3
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	0.0030	0.0082	<0.0030	0.0030
Arsenic (As)-Dissolved	mg/L	0.00460	0.00474	0.00450	0.00404	0.00460	0.00432
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	0.0000066	<0.0000050	<0.0000050	<0.0000050	0.0000099
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	0.0246	0.0258	0.0263	0.0256	0.0256	0.0259
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	0.000067	0.000065

Table 6. GW 15-1b water chemistry results

		GW 15-1B					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	712	844	902	866	820	740
Hardness (as CaCO ₃)	mg/L	350.0	428.0	447.0	404.0	379.0	338.0
pH	pH	7.98	7.93	7.80	8.16	8.08	8.15
Anions and Nutrients							
Nitrate (as N)	mg/L	0.66	1.74	2.36	2.12	1.85	1.42
Sulfate (SO ₄)	mg/L	217	298	341	295.0	278.0	234.0
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00148	0.00156	0.00148	0.00149	0.00152	0.00149
Cadmium (Cd)-Dissolved	mg/L	0.0000065	0.0000110	0.0000095	0.0000091	0.0000119	0.0000094
Copper (Cu)-Dissolved	mg/L	0.00062	<0.00050	<0.00050	0.00052	<0.00050	0.00072
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	0.0045	0.0046	0.0044	0.0046	0.0048
Selenium (Se)-Dissolved	mg/L	0.0092	0.0108	0.0107	0.008450	0.007090	0.007660

Table 7. GW 15-2a water chemistry results

		GW 15-2A					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	200	201	200	200	200	200
Hardness (as CaCO ₃)	mg/L	58.3	59.7	58.7	55.4	56.5	56.4
pH	pH	8.10	8.35	8.10	8.08	8.08	8.10
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	37.5	36.8	36.4	35.7	36.4	37.1
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00353	0.00382	0.00403	0.00394	0.00401	0.00388
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	0.0427	0.0429	0.0433	0.0430	0.0430	0.0431
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	0.000054	<0.000050	0.000052	0.000074

Table 8. GW 15-2b water chemistry results

		GW 15-2B					
Date Sampled		11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16	24-Oct-16
Physical Tests							
Conductivity	µS/cm	384	386	386	384	375	368
Hardness (as CaCO ₃)	mg/L	160.0	160.0	155.0	143.0	142.0	138.0
pH	pH	8.09	8.14	8.00	8.12	8.12	8.13
Anions and Nutrients							
Nitrate (as N)	mg/L	1	0.962	0.805	0.696	0.649	0.502
Sulfate (SO ₄)	mg/L	84.2	84.9	83.0	81.5	82.5	81.0
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00188	0.00205	0.00212	0.00197	0.00210	0.00195
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Copper (Cu)-Dissolved	mg/L	<0.00050	0.0005	<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	0.0436	0.0444	0.0437	0.0436	0.0447
Selenium (Se)-Dissolved	mg/L	0.000289	0.000344	0.000303	0.000353	0.000339	0.000307

Table 3. Sample analysis results for HAD-03 (end of pipe from the water treatment plant)

	Lab Analysis Results for HAD-03		Permit 11678
		01-Nov-16	mg/L
Total Suspended Solids (mg/L)		<1.0	15
Nitrate (as N)- Total (mg/L)		8.72	9.7
Ammonia (as N) - Total (mg/L)		0.0269	0.41
Phosphorus (P) - Total (mg/L)		0.0046	0.09
Sulphate (mg/L)		544	720
Arsenic (As) - Total (mg/L)		0.00111	0.0034
Copper (Cu)-Total (mg/L)		0.00536	0.012
Cadmium (Cd)-Total (mg/L)		<0.000020	N/A
Chromium (Cr) - Total (mg/L)		<0.00050	0.0011
Iron (Fe) - Total (mg/L)		0.039	0.11
Molybdenum (Mo)-Total (mg/L)		0.173	0.2
Selenium (Se)-Total (mg/L)		0.0348	0.06
Vanadium (V) - Total (mg/L)		0.00119	0.0081
Zinc (Zn) - Total (mg/L)		<0.0030	0.0083

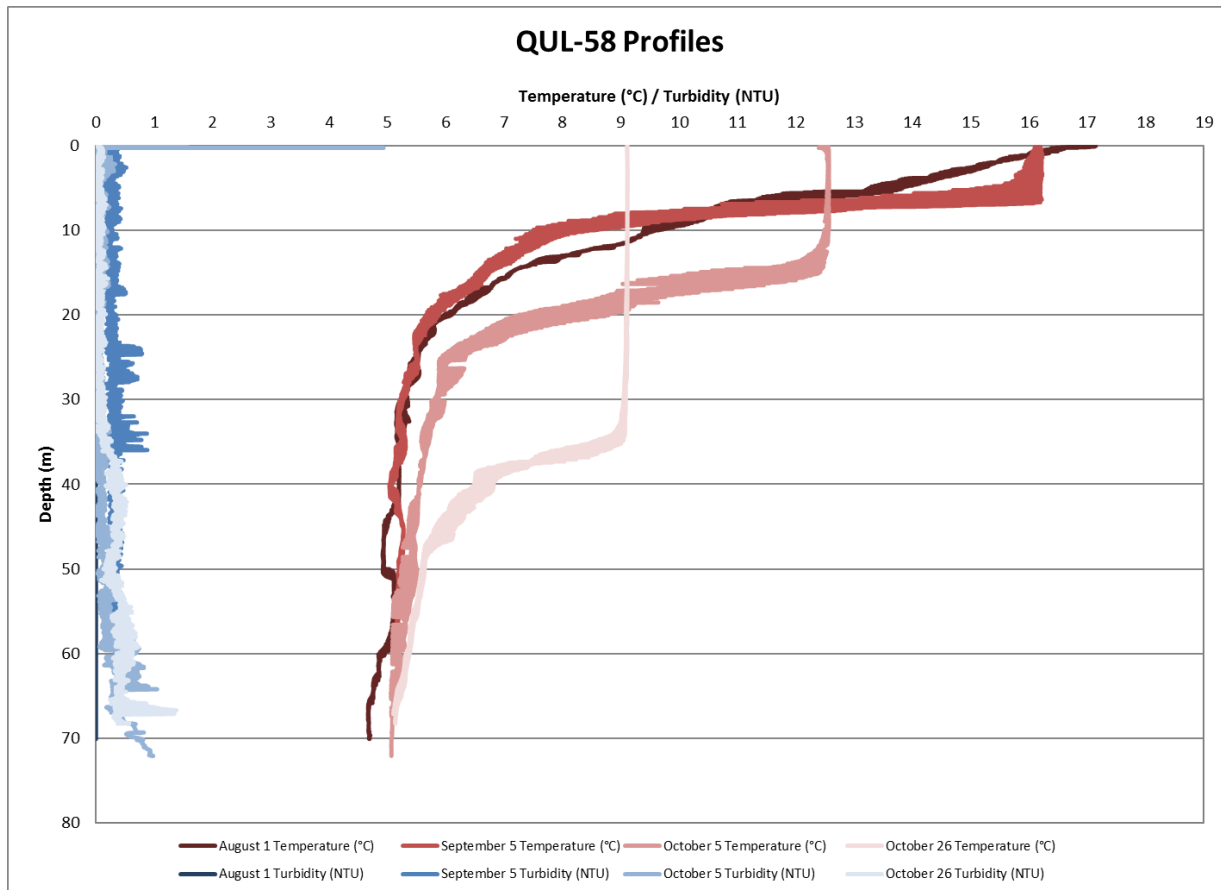


Figure 1. Turbidity and temperature profiles at QUL-58 on Aug 1, Sep 5, Oct 5, and Oct 26, 2016.

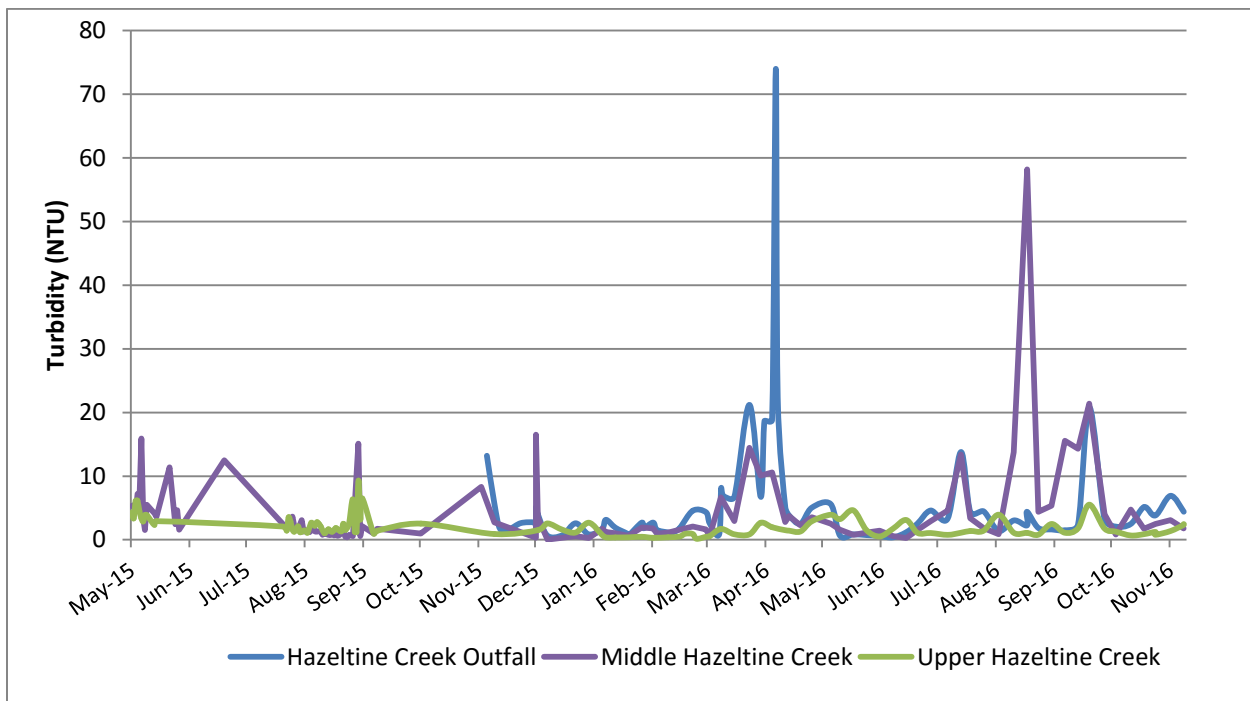


Figure 2. Time series graph for May 15, 2015 – November 8, 2016 showing turbidity levels at monitoring locations in upper and lower Hazeltine Creek

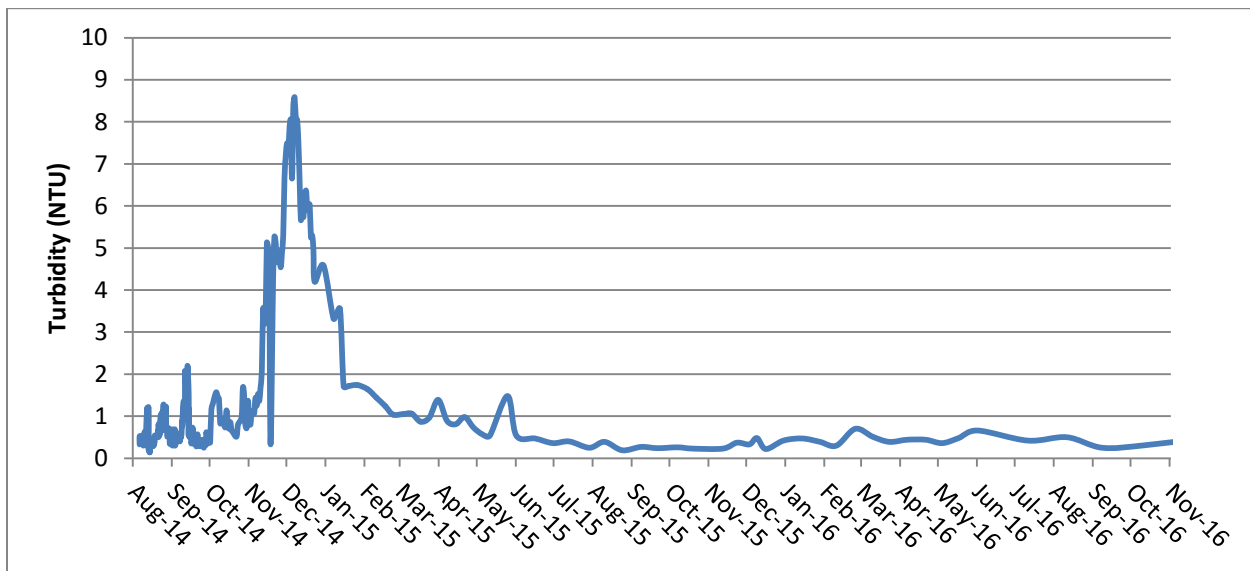


Figure 3. Time series of turbidity readings at site QUR-1/QUR-11 in the upper Quesnel River. Samples are collected monthly from this site.