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November 24, 2016

Ministry of Environment
Mining Operations Environmental Protection
2080 Labieux Road
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WEEKLY UPDATE REPORT – NOVEMBER 18 TO NOVEMBER 24, 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 Springer Pit wells are shown in Tables 2 to 8.

## Water Treatment and Discharge

Discharge of treated water continued this week; the total amount of treated water discharged between November 15 and November 21, 2016 was 176,078 $m^3$ with an average discharging rate of 0.292 $m^3/s$ 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 22nd. Results for HAD-03 from the November 8th sampling event are shown in Table 9.

QUL-58 was sampled and profiled on November 21st, 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 17th, 2016 report available on the Imperial Metals website:
https://www.imperialmetals.com/assets/docs/mt-polley/11.17.16.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 |
|---|---|---|---|---|
| | 16-Nov-16 | 23-Nov-16 | | (m) |
| Springer | 1018.50 | 1017.52 | | -0.98 |
| GW12-2a | 1016.04 | 1015.86 | | -0.18 |
| GW12-2b | 1016.74 | 1016.49 | | -0.25 |
| GW15-1a | 1023.10 | 1022.15 | | -0.95 |
| GW15-1b | 1023.09 | 1022.12 | | -0.96 |
| GW15-2a | 1024.84 | 1024.58 | | -0.26 |
| GW15-2b | 1025.27 | 1024.09 | | -1.18 |

**Table 2. Springer Pit supernatant water chemistry results**

| | | Springer Pit Supernatant | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **03-Oct-16** | **11-Oct-16** | **18-Oct-16** | **24-Oct-16** | **01-Nov-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | . |
| Conductivity | µS/cm | 1200 | 1150 | 1120 | 1150 | 1160 | 1170 |
| Hardness (as CaCO3) | mg/L | 505 | 505 | 498 | 495 | 476 | 479 |
| pH | pH | 7.77 | 7.85 | 7.74 | 7.81 | 7.84 | 7.78 |
| Total Suspended Solids | mg/L | <1.0 | <1.0 | 1.10 | 1.60 | 1.40 | 1.10 |
| Turbidity | NTU | 0.41 | 0.43 | 0.86 | 0.92 | 0.95 | 0.78 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | 8.85 | 9.10 | 8.73 | 8.65 | 9.06 | 8.74 |
| Sulfate (SO4) | mg/L | 547 | 567 | 545 | 537 | 565 | 544 |
| **Total Metals** | | | | | | | |
| Aluminum (Al)-Total | mg/L | 0.04 | 0.04 | 0.08 | 0.09 | 0.08 | 0.07 |
| Arsenic (As)-Total | mg/L | 0.00098 | 0.00111 | 0.00106 | 0.00104 | 0.00116 | 0.00108 |
| Cadmium (Cd)-Total | mg/L | 0.0000188 | <0.000020 | <0.000030 | 0.0000144 | <0.000040 | 0.0000223 |
| Copper (Cu)-Total | mg/L | 0.00344 | 0.00375 | 0.00515 | 0.00617 | 0.00591 | 0.00588 |
| Iron (Fe)-Total | mg/L | <0.030 | <0.030 | 0.039 | 0.046 | 0.039 | <0.030 |
| Lead (Pb)-Total | mg/L | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| Molybdenum (Mo)-Total | mg/L | 0.182 | 0.180 | 0.176 | 0.177 | 0.176 | 0.180 |
| Selenium (Se)-Total | mg/L | 0.0362 | 0.0345 | 0.0361 | 0.0357 | 0.0355 | 0.0369 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | 0.0226 | 0.0201 | 0.0192 | 0.0190 | 0.0195 | 0.0155 |
| Arsenic (As)-Dissolved | mg/L | 0.00095 | 0.00099 | 0.00098 | 0.00096 | 0.00115 | 0.00108 |
| Cadmium (Cd)-Dissolved | mg/L | 0.0000136 | <0.000015 | <0.000030 | 0.0000145 | <0.000040 | 0.000017 |
| Copper (Cu)-Dissolved | mg/L | 0.00236 | 0.00255 | 0.00288 | 0.00305 | 0.00359 | 0.00329 |
| 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 | 0.171 | 0.171 | 0.171 | 0.167 | 0.153 | 0.162 |
| Selenium (Se)-Dissolved | mg/L | 0.0365 | 0.0356 | 0.0346 | 0.0344 | 0.0372 | 0.0326 |

**Table 3. GW 12-2a water chemistry results**

| | | GW 12-2A | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **08-Jun-16** | **12-Jul-16** | **18-Aug-16** | **15-Sep-16** | **24-Oct-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 229 | 232 | 231 | 230 | 232 | 228 |
| Hardness (as CaCO3) | mg/L | 50.7 | 50.8 | 46.2 | 48.5 | 48.3 | 47.0 |
| pH | pH | 8.20 | 7.95 | 7.92 | 7.99 | 8.02 | 7.92 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Sulfate (SO4) | mg/L | 64.5 | 64.1 | 62.8 | 63.8 | 65.1 | 65.5 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | 0.0070 | 0.0046 | 0.0040 | 0.0045 | 0.0046 | 0.0041 |
| Arsenic (As)-Dissolved | mg/L | 0.00242 | 0.00234 | 0.00218 | 0.00237 | 0.00224 | 0.00240 |
| 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 | 0.0398 | 0.0407 | 0.0388 | 0.0393 | 0.0403 | 0.0392 |
| 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** | | **08-Jun-16** | **12-Jul-16** | **17-Aug-16** | **15-Sep-16** | **24-Oct-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 631 | 660 | 668 | 638 | 617 | 606 |
| Hardness (as CaCO3) | mg/L | 331.0 | 343.0 | 324.0 | 312.0 | 305.0 | 291.0 |
| pH | pH | 8.00 | 7.81 | 8.25 | 8.16 | 8.22 | 8.19 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | 3.05 | 2.98 | 2.96 | 2.98 | 3.08 | 2.95 |
| Sulfate (SO4) | mg/L | 150 | 166 | 174.0 | 169.0 | 166.0 | 158.0 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| Arsenic (As)-Dissolved | mg/L | 0.00058 | 0.00057 | 0.00052 | 0.00057 | 0.00052 | 0.00057 |
| Cadmium (Cd)-Dissolved | mg/L | <0.0000050 | 0.0000073 | 0.0000052 | <0.0000050 | 0.0000074 | 0.0000066 |
| Copper (Cu)-Dissolved | mg/L | 0.00081 | 0.00081 | 0.00081 | 0.00081 | 0.00084 | 0.00077 |
| 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 | 0.0194 | 0.0219 | 0.0210 | 0.0210 | 0.0213 | 0.0208 |
| Selenium (Se)-Dissolved | mg/L | 0.0117 | 0.0111 | 0.011200 | 0.010200 | 0.009110 | 0.008730 |

**Table 5. GW 15-1a water chemistry results**

| | | GW 15-1A | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **08-Jun-16** | **12-Jul-16** | **18-Aug-16** | **15-Sep-16** | **24-Oct-16** | **09-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 271 | 275 | 279 | 277 | 280 | 281 |
| Hardness (as CaCO3) | mg/L | 81.0 | 70.9 | 70.5 | 72.7 | 73.7 | 76.6 |
| pH | pH | 8.12 | 8.08 | 8.03 | 8.05 | 8.02 | 7.96 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Sulfate (SO4) | mg/L | 61.6 | 62.6 | 63.2 | 64.9 | 66.3 | 68.2 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | <0.0030 | 0.0030 | 0.0082 | <0.0030 | 0.0030 | <0.0030 |
| Arsenic (As)-Dissolved | mg/L | 0.00474 | 0.00450 | 0.00404 | 0.00460 | 0.00432 | 0.00416 |
| Cadmium (Cd)-Dissolved | mg/L | 0.0000066 | <0.0000050 | <0.0000050 | <0.0000050 | 0.0000099 | <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 | 0.0258 | 0.0263 | 0.0256 | 0.0256 | 0.0259 | 0.0265 |
| Selenium (Se)-Dissolved | mg/L | <0.000050 | <0.000050 | <0.000050 | 0.000067 | 0.000065 | <0.000050 |

**Table 6. GW 15-1b water chemistry results**

| | | GW 15-1B | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **08-Jun-16** | **12-Jul-16** | **17-Aug-16** | **15-Sep-16** | **24-Oct-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 844 | 902 | 866 | 820 | 740 | 703 |
| Hardness (as CaCO3) | mg/L | 428.0 | 447.0 | 404.0 | 379.0 | 338.0 | 322.0 |
| pH | pH | 7.93 | 7.80 | 8.16 | 8.08 | 8.15 | 8.16 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | 1.74 | 2.36 | 2.12 | 1.85 | 1.42 | 1.37 |
| Sulfate (SO4) | mg/L | 298 | 341 | 295.0 | 278.0 | 234.0 | 203.0 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| Arsenic (As)-Dissolved | mg/L | 0.00156 | 0.00148 | 0.00149 | 0.00152 | 0.00149 | 0.00155 |
| Cadmium (Cd)-Dissolved | mg/L | 0.0000110 | 0.0000095 | 0.0000091 | 0.0000119 | 0.0000094 | 0.0000101 |
| Copper (Cu)-Dissolved | mg/L | <0.00050 | <0.00050 | 0.00052 | <0.00050 | 0.00072 | <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 | 0.0045 | 0.0046 | 0.0044 | 0.0046 | 0.0048 | 0.0049 |
| Selenium (Se)-Dissolved | mg/L | 0.0108 | 0.0107 | 0.008450 | 0.007090 | 0.007660 | 0.006670 |

**Table 7. GW 15-2a water chemistry results**

| | | GW 15-2A | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **08-Jun-16** | **12-Jul-16** | **17-Aug-16** | **15-Sep-16** | **24-Oct-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 201 | 200 | 200 | 200 | 200 | 197 |
| Hardness (as CaCO3) | mg/L | 59.7 | 58.7 | 55.4 | 56.5 | 56.4 | 53.6 |
| pH | pH | 8.35 | 8.10 | 8.08 | 8.08 | 8.10 | 8.06 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Sulfate (SO4) | mg/L | 36.8 | 36.4 | 35.7 | 36.4 | 37.1 | 37.1 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | 0.0035 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| Arsenic (As)-Dissolved | mg/L | 0.00382 | 0.00403 | 0.00394 | 0.00401 | 0.00388 | 0.00412 |
| 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 | 0.0429 | 0.0433 | 0.0430 | 0.0430 | 0.0431 | 0.0417 |
| Selenium (Se)-Dissolved | mg/L | <0.000050 | 0.000054 | <0.000050 | 0.000052 | 0.000074 | 0.000058 |

**Table 8. GW 15-2b water chemistry results**

| | | GW 15-2B | | | | | |
|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **08-Jun-16** | **12-Jul-16** | **17-Aug-16** | **15-Sep-16** | **24-Oct-16** | **08-Nov-16** |
| **Physical Tests** | | | | | | | |
| Conductivity | µS/cm | 386 | 386 | 384 | 375 | 368 | 358 |
| Hardness (as CaCO3) | mg/L | 160.0 | 155.0 | 143.0 | 142.0 | 138.0 | 133.0 |
| pH | pH | 8.14 | 8.00 | 8.12 | 8.12 | 8.13 | 8.11 |
| **Anions and Nutrients** | | | | | | | |
| Nitrate (as N) | mg/L | 0.962 | 0.805 | 0.696 | 0.649 | 0.502 | 0.44 |
| Sulfate (SO4) | mg/L | 84.9 | 83.0 | 81.5 | 82.5 | 81.0 | 80.0 |
| **Dissolved Metals** | | | | | | | |
| Aluminum (Al)-Dissolved | mg/L | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| Arsenic (As)-Dissolved | mg/L | 0.00205 | 0.00212 | 0.00197 | 0.00210 | 0.00195 | 0.00215 |
| Cadmium (Cd)-Dissolved | mg/L | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 |
| Copper (Cu)-Dissolved | mg/L | 0.0005 | <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 | 0.0444 | 0.0437 | 0.0436 | 0.0447 | 0.0437 |
| Selenium (Se)-Dissolved | mg/L | 0.000344 | 0.000303 | 0.000353 | 0.000339 | 0.000307 | 0.000377 |

**Table 9. Sample analysis results for HAD-03 (end of pipe from the water treatment plant)**

| | Lab Analysis Results for HAD-03 | Permit 11678 |
|---|---|---|
| | 08-Nov-16 | mg/L |
| Total Suspended Solids (mg/L) | 1.7 | 15 |
| Nitrate (as N)- Total (mg/L) | 8.94 | 9.7 |
| Ammonia (as N) - Total (mg/L) | 0.0198 | 0.41 |
| Phosphorus (P) - Total (mg/L) | <0.010 | 0.09 |
| Sulphate (mg/L) | 557 | 720 |
| Arsenic (As) - Total (mg/L) | 0.00117 | 0.0034 |
| Copper (Cu)-Total (mg/L) | 0.00608 | 0.012 |
| Cadmium (Cd)-Total (mg/L) | 0.0000110 | 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) | 0.179 | 0.2 |
| Selenium (Se)-Total (mg/L) | 0.0362 | 0.06 |
| Vanadium (V) - Total (mg/L) | 0.00120 | 0.0081 |
| Zinc (Zn) - Total (mg/L) | <0.030 | 0.0083 |

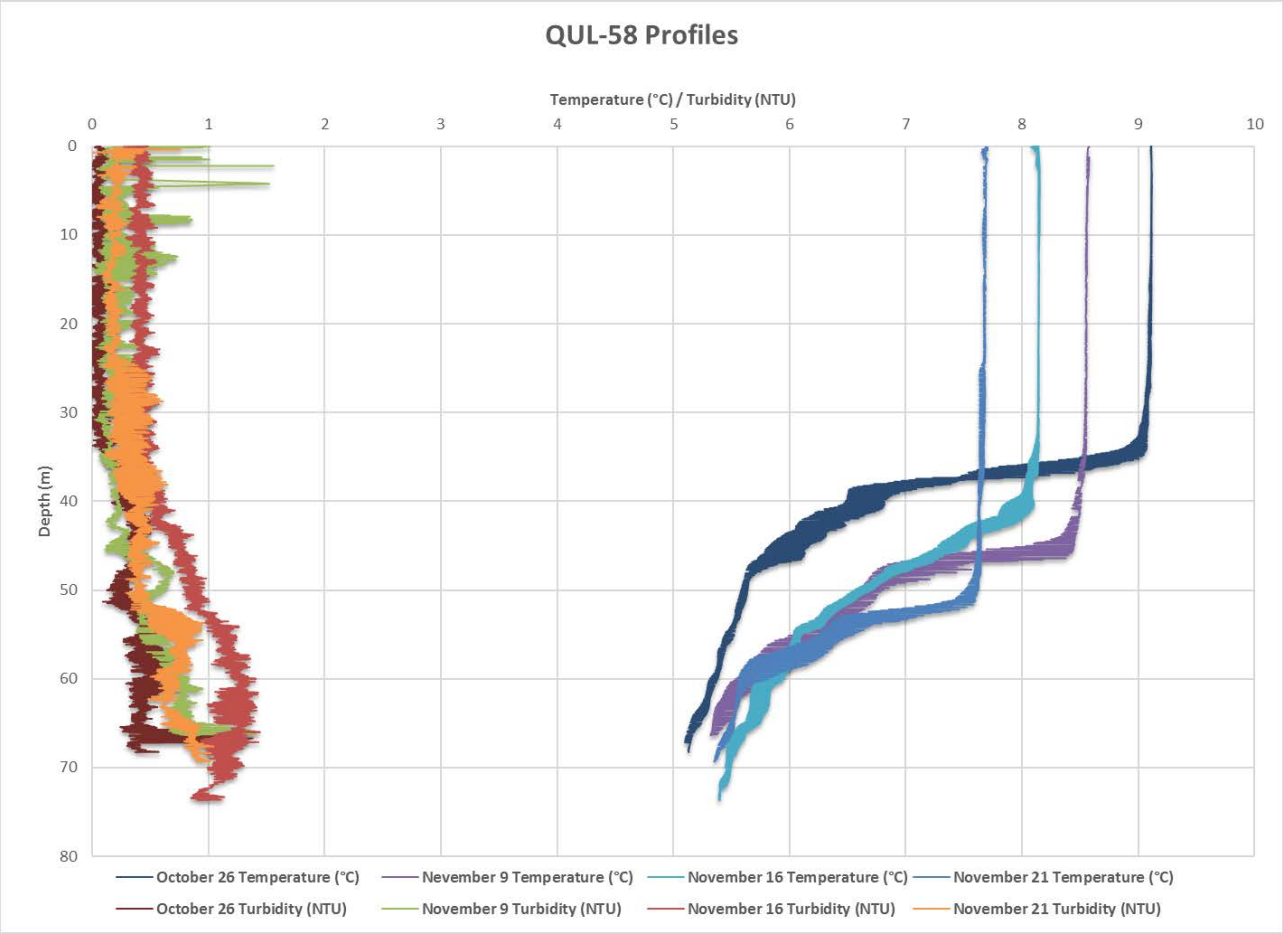


**Figure 1. Turbidity and temperature profiles at QUL-58 on Oct 26, Nov 9, Nov 16, and Nov 21, 2016.**

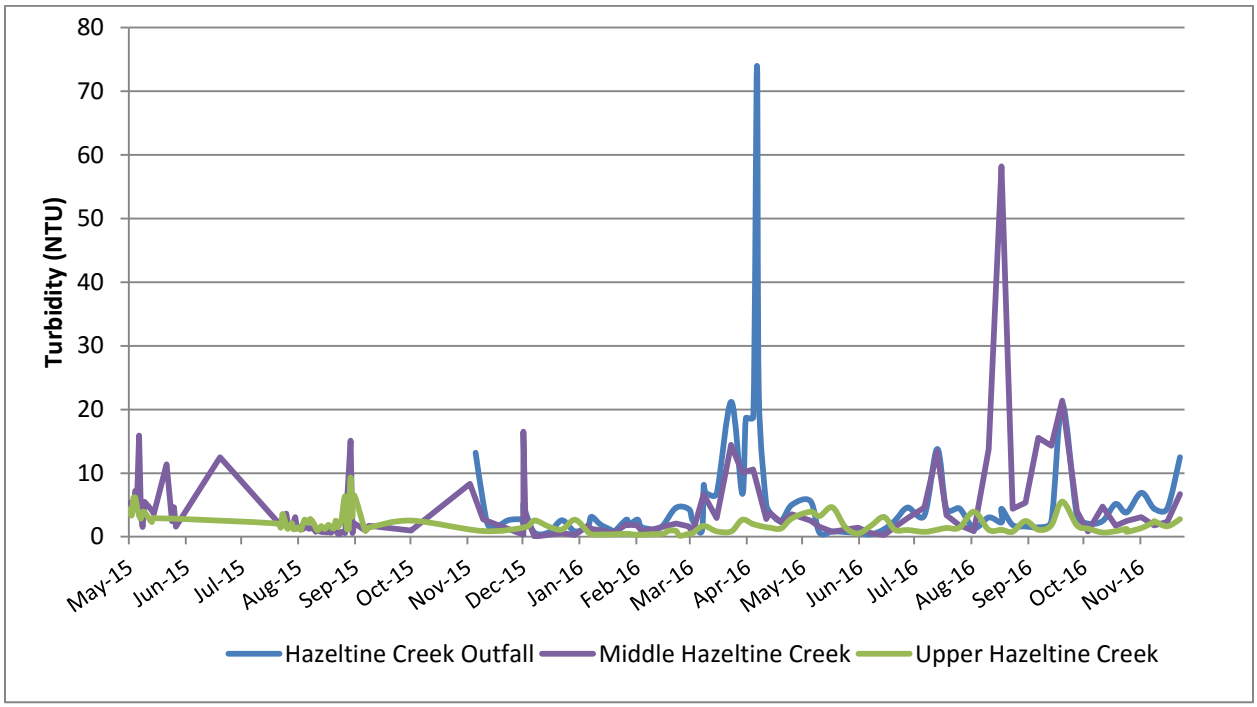


**Figure 2. Time series graph for May 15, 2015 – November 22, 2016 showing turbidity levels at monitoring locations in upper and lower Hazeltine Creek**

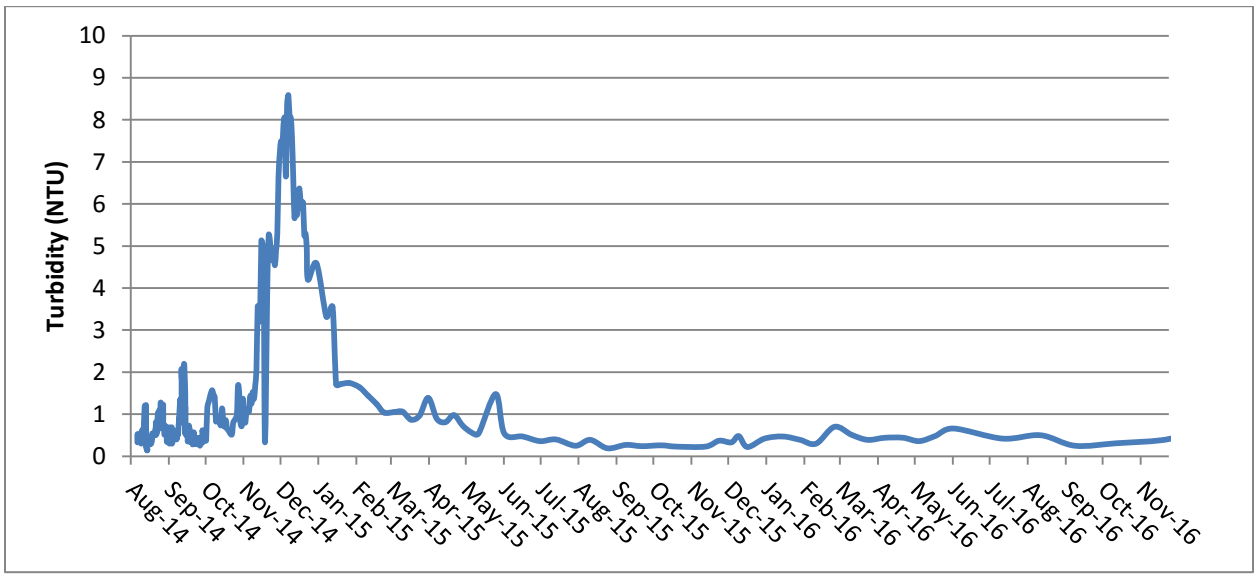


**Figure 3. Time series of turbidity readings at site QUR-1/QUR-11 in the upper Quesnel River. Samples are collected monthly from this site.**