ALEXCO ENVIRONMENTAL GROUP

# FISHERIES MONITORING PROGRAM, MINTO CREEK

## 2015 SUMMARY REPORT

**FINAL**

March 2016

Prepared for:

**MINTO EXPLORATIONS LTD**

## ALEXCO ENVIRONMENTAL GROUP INC. SIGNATURES

Report prepared by:

Catherine Henry, M.Sc.
Environmental Scientist

Report reviewed by:

David Petkovich B.Sc., P. Biol.
Senior Aquatic Biologist

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# 1 INTRODUCTION

Minto Explorations Ltd. (MEL), a wholly owned subsidiary of Capstone Mining Corp. (Capstone), owns and operates the Minto Mine, a high-grade copper mine, located approximately 240 km northwest of Whitehorse, Yukon Territory (Figure 1-1). The project is located within Selkirk First Nation (Selkirk) Category A Settlement Land Parcel R6A, and is centered at approximately 62°37'N latitude and 137°15'W longitude. The Minto Mine commenced commercial operation in October 2007 and is permitted to conduct mining and milling operations at a rate of 4,200 tonnes of ore per day (tpd). Some of the Minto ore deposits (copper/gold/silver) currently being mined are located in the upper reaches of the Minto Creek watershed approximately 12 km to the west of the Minto Creek confluence with the Yukon River (Figure 1-2). MEL is required, under the terms of its water use license #QZ14-031 (Amendment 1), to conduct an aquatic environmental monitoring program, of which this fisheries monitoring program in Minto Creek is a component. This current report provides details of the monitoring conducted during the open water season in 2015 and the results of the work undertaken. This program was carried out under DFO Scientific Collection Licence number XR 163 2015.

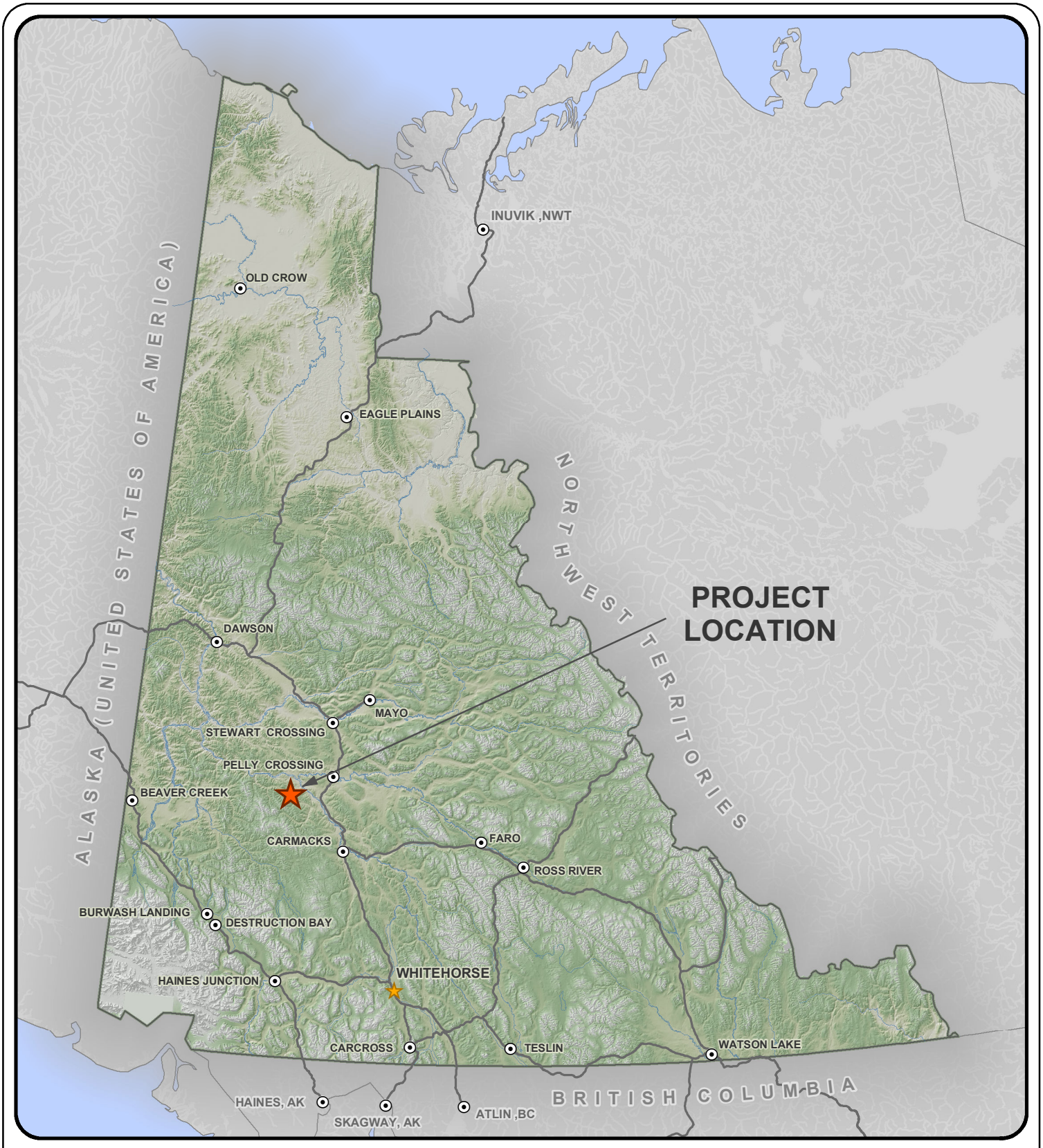


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**FIGURE 1 -1**

**PROJECT LOCATION**

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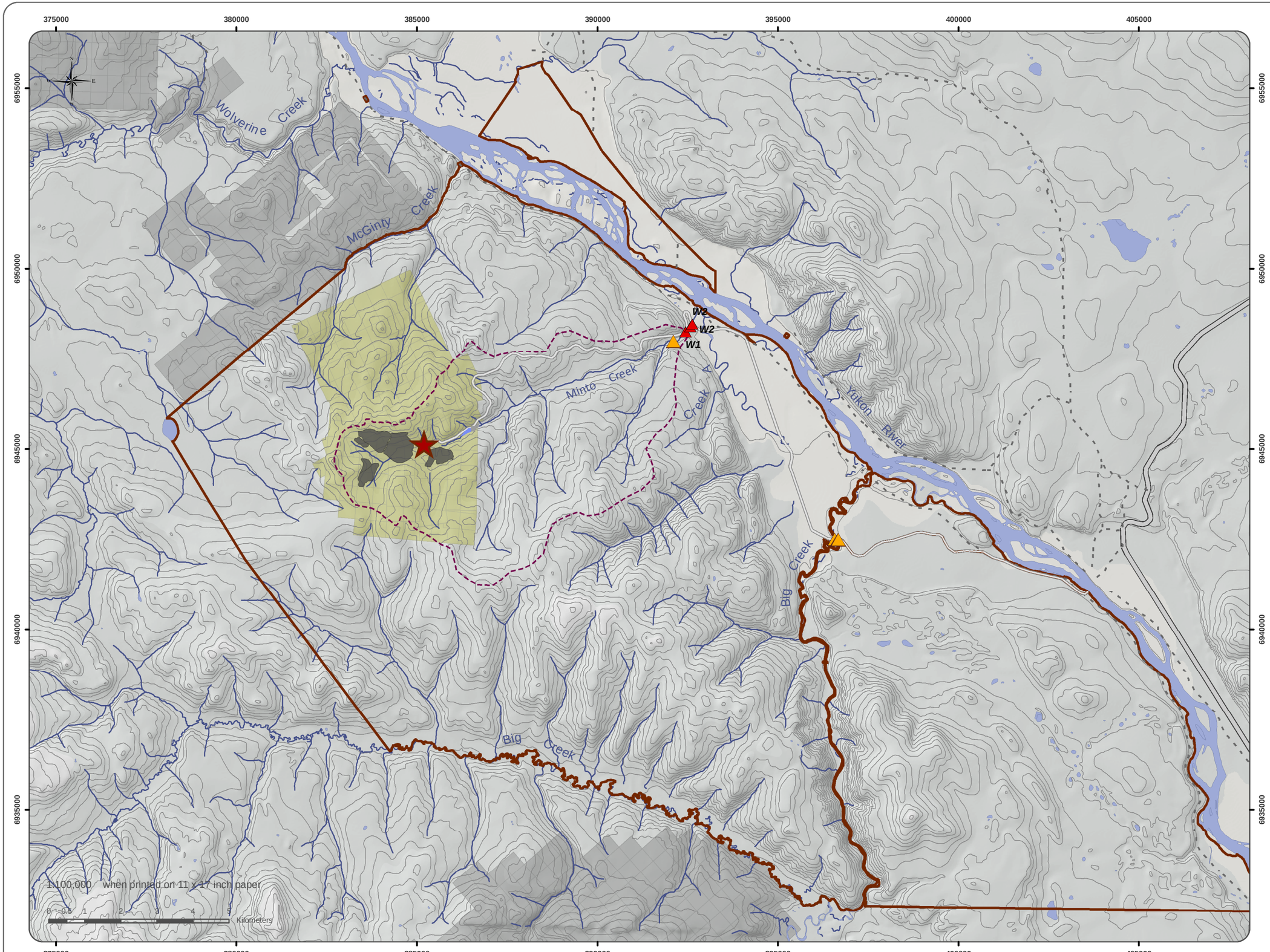
# FIGURE 1-2
# AREA OVERVIEW




Minto Mine Site

Fish Monitoring Station

Surface Water Quality Station

Mine Access Road

Road

Trail

Existing Minto Mine Footprints

Minto Creek Catchment

Quartz Claims owned by others

Minto Explorations Ltd Quartz Claims

First Nation Settlement Land

National Topographic Data Base (NTDB) and Canvec compiled by Natural Resources Canada at a scale of 1:50,000.Reproduced under license from Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada. All rights reserved.

Quartz claims data obtained from Energy, Mines and Ressources, YTG. Data currrent as of February[st] 2016.

NAD 83 UTM Zone 8N



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(*Last edited by: amatlashevska;3/23/2016/12:32 PM*)

# 2 PREVIOUS STUDIES

Numerous studies on fisheries and fish habitat have been conducted over the recent history of the Minto Mine. These studies are summarized chronologically in Table 2-1, below.

**Table 2-1 Minto Creek Fish Investigations**

| Year | Months | Purpose of Study | Conducted by |
|---|---|---|---|
| 1994 | June, August, September | Baseline Collection | Hallam Knight Piesold (HKP) |
| 2006 | September | Baseline Collection | Access Consulting Group (ACG) |
| 2007 | May, June, August, September | Environmental Effects Monitoring Study Design Development | ACG / Minnow Environmental (Minnow) |
| 2008 | June, September | Environmental Effects Monitoring, Cycle I | ACG / Minnow |
| 2009 | June, July | Monitoring | ACG |
| 2009 | September, October | Fish Re-location | ACG |
| 2010 | June, July, August, September, October | Juvenile Chinook Salmon Mark-recapture program, compliance Monitoring | ACG |
| 2011 | July, August, September, October | Environmental Effects Monitoring Cycle II, Compliance Monitoring | ACG, Minnow |
| 2011 | July, August | EEM Cycle II – Growth Trials | ACG, Minnow |
| 2012 | May, June, July, August, September | Compliance Monitoring<br>Se in tissue study | ACG, MEL (Minto Exploration Ltd.) |
| 2013-2015 | May to October | Compliance Monitoring | ACG, MEL |

The majority of fish using the system are juvenile chinook salmon (*Onchoryhnchus tshawytscha*) as determined by the above investigations. Other species encountered during sampling events include: round whitefish (*Prosopium cylindraceum*), arctic grayling (*Thymallus arcticus*), slimy sculpin (*Cottus cognatus*), longnose sucker (*Catostomus catostomus)* and burbot (*Lota lota*). Of these, only slimy sculpin have been captured on a regular basis.

Juvenile chinook salmon (JCS) have never been encountered in the creek before July and their numbers tend to peak in late August or early September. Moreover, the mark-recapture investigation conducted in 2010 on JCS, indicates that use of the creek is transient (the majority of JCS using the system stay in the system for about two to three weeks or less).

A summary of past fish sampling results in Minto Creek is presented in Table 2-2.

**Table 2-2 Summary of Fish captures in Minto Creek between 2008 and 2014.**

| Year | Method | Effort | Summary Statistics | Units | Juvenile Chinook Salmon | All Other Species |
|---|---|---|---|---|---|---|
| 2008 | Backpack Electrofishing | 796 s | Catch | # | 1 | 0 |
| | | | CPUE | Fish/min | 0.075 | 0 |
| | Baited Gee Minnow Trapping | 28.6 days | Catch | # | 18 | 0 |
| | | | CPUE | Fish/day | 0.63 | 0 |
| 2009* | Baited Gee Minnow Trapping | 28.6 days | Catch | # | 136 | 142 |
| | | | CPUE | Fish/day | 4.76 | 4.97 |
| 2010 | Baited Gee Minnow Trapping | 145.9 days | Catch | # | 2293 | 2307 |
| | | | CPUE | Fish/day | 15.72 | 15.81 |
| 2011 | Baited Gee Minnow Trapping | 71 days | Catch | # | 12 | 29 |
| | | | CPUE | Fish/day | 0.17 | 0.41 |
| 2012 | Backpack Electrofishing | 1051 s | Catch | # | 0 | 4 |
| | | | CPUE | Fish/min | 0 | 0.23 |
| | Baited Gee Minnow Trapping | 43.0 days | Catch | # | 3 | 6 |
| | | | CPUE | Fish/day | 0.07 | 0.14 |
| 2013 | Backpack Electrofishing | 3402 s | Catch | # | 0 | 4 |
| | | | CPUE | Fish/min | 0 | 0.07 |
| | Baited Gee Minnow Trapping | 62.5 days | Catch | # | 121 | 7 |
| | | | CPUE | Fish/day | 1.94 | 0.11 |
| 2014 | Baited Gee Minnow Trapping | 70.2 days | Catch | # | 151 | 3 |
| | | | CPUE | Fish/day | 2.15 | 0.04 |

**Does not include the fish relocation program*

JCS presence in Minto creek was observed to be influenced by mine water discharge. During non-discharge periods, and prior to operations (baseline), numbers of JCS and other species of fish in the system were found to be very low. In contrast, during the two major discharge events (2009 and 2010), numbers of JCS were 20 to 30 times higher in the system (see Table 2-3 below), indicating that they may have been attracted into the system as a likely result of a more consistent temperature and flow regime associated with mine water discharge. Numbers of other species of fish during discharge events did not increase. It is important to note however that numbers of other species using the system has been consistently very low prior to mine development and during operations.

**Table 2-3 Maximum Catch per Unit Effort (CPUE) of Juvenile Chinook Salmon in Minto Creek using baited minnow traps 1994-2015.**

| Year | Month | JCS – CPUE (#fish/trap-day)* | Minto Creek Conditions |
|---|---|---|---|
| 1994 | September | 0 | Pre-development – no discharge |
| 2008 | September | 0.9 | Operational – no discharge |

| Year | Month | JCS – CPUE (#fish/trap-day)* | Minto Creek Conditions |
|---|---|---|---|
| 2009 | September/October | 20.0 | Discharge |
| 2010 | August | 30.0 | Discharge |
| 2011 | September | 0.43 | No discharge – high TSS contribution from tributary |
| 2012 | September | 0.19 | No discharge – high TSS contribution from tributary |
| 2013 | October | 5.01 | Operational – no discharge |
| 2014 | September | 5.05 | Operational – no discharge |
| 2015 | July | 0.30 | Operational – no discharge |

**CPUE calculated for actual 24-hr period (rather than nominal 24-hr period)*

The hatchery based fish (JCS) study, conducted as part of the Cycle 2 Environmental Effects Monitoring (EEM) program, indicated that Minto Creek water mixed with mine effluent (at a concentration comparable to conditions in lower Minto Creek) provided a condition that slightly enhanced growth as compared to water derived from an artesian spring that is used as the water supply at the hatchery facility where the exposure trials were conducted (Minnow and ACG, 2011).

Minto Creek freezes in the winter and therefore is not a viable habitat for overwintering or for fall spawners. Lower Minto Creek is also subject to low or zero flow conditions during periods in the summer when a portion (or all) of the flow sometimes infiltrates the ground following passage through a canyon located approximately 2.0 km upstream of the Yukon River, preventing the establishment of resident fish populations in this section of the stream. A natural barrier to fish passage exists at approximately km 1.2 upstream from the Yukon River, therefore limiting fish use to the reach downstream of the barrier. This barrier is largely comprised of organic debris and can be considered to be temporary as it will likely degrade over time, although it has been consistently observed since it was first characterized in 2010. Sampling effort has been applied upstream of it during every sampling event since 2010 and resulted in no fish capture. New temporary barriers may also be established in any given year and could occur both upstream and further downstream of the current barrier location. The canyon located upstream of the current barrier however is a permanent barrier to fish passage, due to its high gradient, thus limiting fish habitat to the lower 2.0 km of the system.

Water temperature tends to remain cooler in Minto Creek than in the Yukon River until late June or early July. This likely deters fish, in particular JCS, from entering the system until creek temperatures equilibrate with the Yukon River. Minto Creek is subject to large diurnal fluctuations in temperature (up to 5°C or more) throughout the open water season. This daily variation is not ideal for fish and may limit their interest in using the creek for rearing.

Creek bottom substrate is comprised mostly of fines (silt/sand) with limited cobble/gravel sections which are more desirable for fish. In addition, significant input of suspended solids from a tributary in 2011 and 2012 may have further limited the use of the system by JCS during those years.

Bottom substrate at the mouth of Minto Creek and at the Yukon River confluence consists primarily of silt and mud which is not considered suitable substrate for salmonid spawning (grayling, salmon etc.). Aerial surveys for spawning fish were conducted in 2011, 2012, 2013 and 2014, and no adult fish were observed spawning in the vicinity of the Minto Creek/Yukon River confluence, or no signs that this area is used for spawning (such as redds or carcasses) were observed.

Starting in 2012, the compliance monitoring program included sampling efforts in Big Creek, which serves as a reference site. The same fish species as in Minto Creek were generally observed in Big Creek, and the CPUE has generally been slightly higher in Big Creek. Table 2-4 summarizes fish captures in Big Creek.

**Table 2-4 Summary of Fish captures in Big Creek in 2012 and 2014.**

| Year | Method | Effort | Summary Statistics | Units | Juvenile Chinook Salmon | All Other Species |
|---|---|---|---|---|---|---|
| 2012 | Backpack Electrofishing | 273 s | Catch | # | 1 | 23 |
| | | | CPUE | Fish/min | 0.22 | 5.05 |
| | Baited Gee Minnow Trapping | 11.8 days | Catch | # | 7 | 2 |
| | | | CPUE | Fish/day | 0.59 | 0.17 |
| 2013 | Backpack Electrofishing | 911 s | Catch | # | 0 | 27 |
| | | | CPUE | Fish/min | 0 | 1.78 |
| | Baited Gee Minnow Trapping | 14.8 days | Catch | # | 19 | 2 |
| | | | CPUE | Fish/day | 1.28 | 0.14 |
| 2014 | Baited Gee Minnow Trapping | 16.4 days | Catch | Fish/min | 96 | 3 |
| | | | CPUE | # | 5.86 | 0.18 |

# 3 OBJECTIVES

The objectives of the 2015 Fisheries Monitoring Program were to monitor, assess and characterize fish usage in Minto Creek during open water season, and to provide data allowing interpretation of the potential role and influence of the Minto Mine on the fish community. The 2015 fisheries program was a continuation of the previous year's components, and targeted on all species that have previously been encountered as well as any new species. As part of the 2015 monitoring program, assessments at Big Creek were made concurrently with sampling in Minto Creek, to compare fish use in a neighbouring system relative to Minto Creek. Fish monitoring studies were conducted in support of the requirements of Water Use License QZ14-031.

Past observations have indicated that the area at the confluence of Minto Creek and the Yukon River is not used by spawning salmon or other species.

# 4 METHODOLOGY

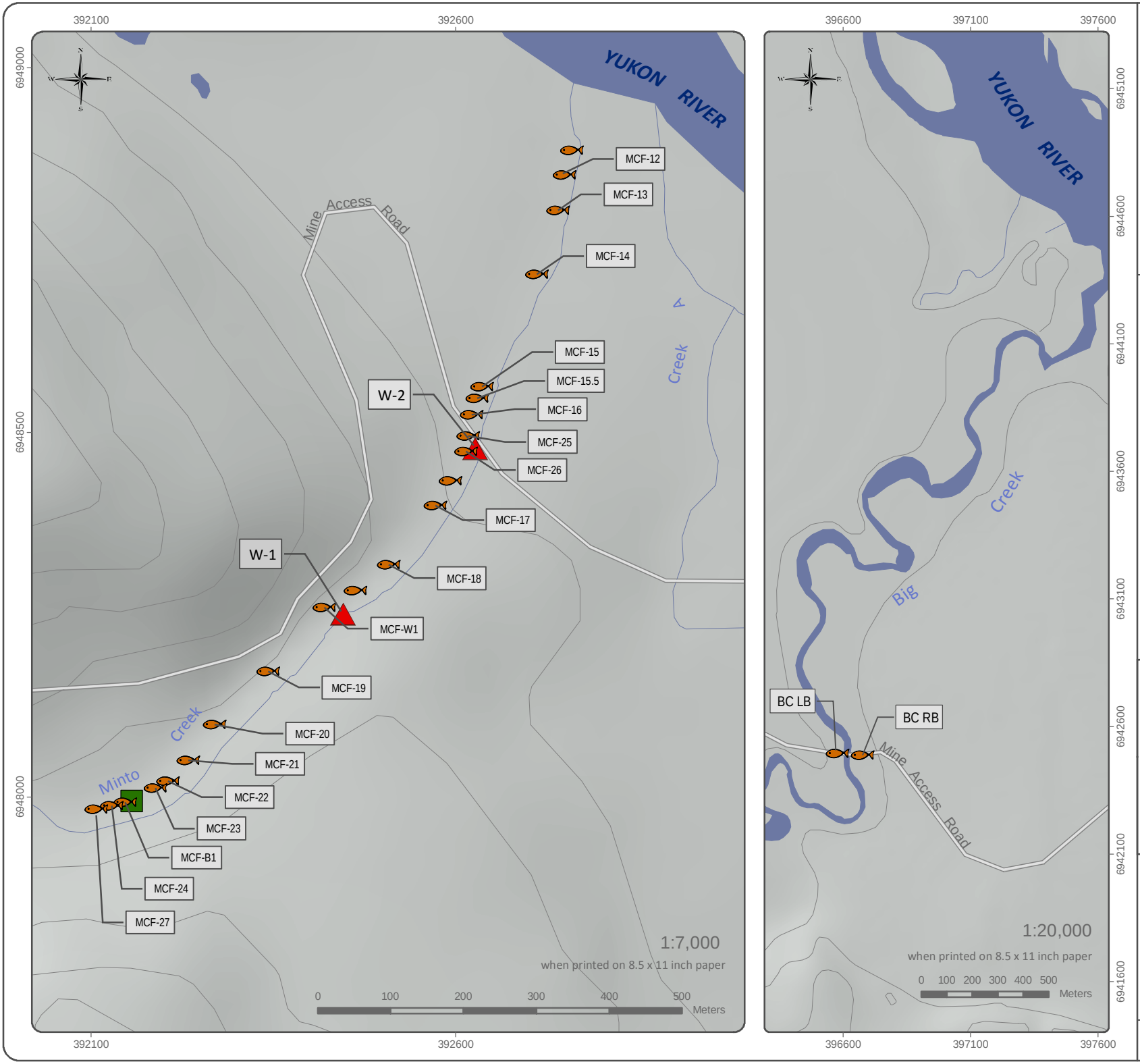
## 4.1 FISH MONITORING

Fish monitoring of Minto Creek and Big Creek was conducted monthly during open water season, from June to October 2015, at trapping sites consistent with the 2010 mark-recapture study and the 2011 to 2014 fish monitoring programs (Figure 4-1). Capture effort included the use of Gee-type Minnow traps with 0.635 cm wire mesh size baited with Yukon River origin chinook salmon roe. A total of 17 or 18 minnow traps were set each time in Minto Creek, depending on water levels and availability of pools and backwater areas. Four traps were set each time in Big Creek, in the vicinity of the Minto access road bridge.

All fish captured were identified, enumerated and measured for fork length or total length ($\pm$ 1 mm), inspected for abnormalities, and released in the vicinity of their trapping location. JCS were also weighed ($\pm$ 0.01g) prior to being released.

Additional supporting information collected included photo documentation of the creek, water level readings at W1 staff gauge, in situ water parameters in Minto Creek, Big Creek and the Yukon River (temperature, dissolved oxygen, conductivity, pH, ORP), discharge at W1, as well as weather conditions at time of sampling. Continuous temperature loggers (TidbiT) were deployed in the Yukon River and Big Creek for the duration of the project, while a Levelogger records continuous temperature and stage in Minto Creek. Supporting variables also included monitoring of the previously identified fish barrier (1.2 km upstream of the Yukon River confluence) and/or any new barriers that may have developed.

Selected photographs documenting field activities and site conditions are presented in Appendix A.

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# FIGURE 4-1
# MINTO CREEK AND BIG CREEK FISHERIES MONITORING STATIONS

- Observed Fish Barrier
- Fish Monitoring Stations
- Surface Water Quality Stations
- Mine Access Road
- Contours
- Watercourse
- Waterbody



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# 5 RESULTS

The following sections present the fisheries statistics and effort in Minto Creek and Big Creek between June and October 2015.

## 5.1 FISH USAGE AND DISTRIBUTION

### 5.1.1 Minto Creek

Minto Creek was assessed monthly between June and October 2015. A total of 6 fish were captured in Minto Creek, all of which were juvenile chinook salmon (JCS). Four JCS were captured in July and two in September, and all fish were found in the trap located the most downstream (MCF-12). The average catch per unit effort (CPUE) for JCS was 0.089 fish/trap-day throughout the open water season, but was the highest in July at 0.301 fish/trap-day. In comparison, the average JCS CPUE for the same period (June to October) in 2014 was 2.153 fish/trap-day and a maximum of 5.047 fish/trap-day was reached in September. Of note is the fact that a portion of Minto Creek was found to be dry during the fish monitoring events in June and in August 2015, which could have played an important role in preventing fish movement up and down Minto Creek. The following table (Table 5-1) presents the effort applied and the summary of fish capture in Minto Creek in 2015.

**Table 5-1 Summary statistics of Minnow Trapping in Minto Creek in 2015.**

| Month | Effort (trap-hours) | Effort (trap-days) | Juvenile Chinook Salmon (*Onchoryhnchus tshawytscha*) | |
|---|---|---|---|---|
| | | | Results | CPUE* |
| June | 304.6 | 12.7 | 0 | 0 |
| July | 319.1 | 13.3 | 4 | 0.301 |
| August | 320.3 | 13.3 | 0 | 0 |
| September | 322.8 | 13.5 | 2 | 0.149 |
| October | 347.5 | 14.5 | 0 | 0 |
| **TOTAL** | **1614.3** | **67.3** | **6** | **0.089** |

** CPUE = fish/trap-day (for actual 24-hr period)*

### 5.1.2 Big Creek

Fisheries sampling effort in Big Creek was initiated in June, and conducted monthly until October, resulting in the capture of 63 fish, 58 of which were JCS. JCS were captured during every monthly sampling event in 2015, with highest numbers captured in September (35). In addition, two slimy sculpin and three burbot were captured. The average catch per unit effort for JCS in Big Creek was much higher than in Minto Creek at 3.393 JCS/trap-day and was highest in September (10.448 fish/trap-day). In comparison, the average JCS CPUE for the same period (June to October) in 2014 was higher at 5.863 JCS/trap-day and was as high as 23.010 fish/trap-day in September 2014. In 2012, 2014 and 2015, the average JCS CPUE was much higher in Big Creek

than in Minto Creek but it was the opposite situation in 2013. The following table (Table 5-2) presents the effort undertaken and the resulting fish capture in Big Creek in 2015.

**Table 5-2 Summary statistics of Minnow Trapping in Big Creek in 2015.**

| Month | Effort (trap-hours) | Effort (trap-days) | Juvenile Chinook Salmon (*Onchoryhnchus tshawytscha*) | | Slimy Sculpin (*Cottus cognatus*) | | Burbot (*Lota lota*) | |
|---|---|---|---|---|---|---|---|---|
| | | | Results | CPUE* | Results | CPUE* | Results | CPUE* |
| June** | 81.4 | 3.4 | 6 | 1.769 | 0 | 0 | 1 | 0.295 |
| July | 79.3 | 3.3 | 1 | 0.303 | 1 | 0.303 | 0 | 0 |
| August | 83.2 | 3.5 | 5 | 1.442 | 1 | 0.288 | 0 | 0 |
| September | 80.4 | 3.4 | 35 | 10.448 | 0 | 0 | 1 | 0.299 |
| October | 86 | 3.6 | 11 | 3.070 | 0 | 0 | 1 | 0.000 |
| **TOTAL** | **410.3** | **17.1** | **58** | **3.393** | **2** | **0.118** | **3** | **0.175** |

**CPUE = fish/trap-day (for actual 24-hr period)*

*** Several small fish (10-25 mm in length) were observed near one of the minnow traps but not captured*

Figure 5-1 presents a comparison between monthly JCS capture and CPUE in Minto Creek and Big Creek for 2015.

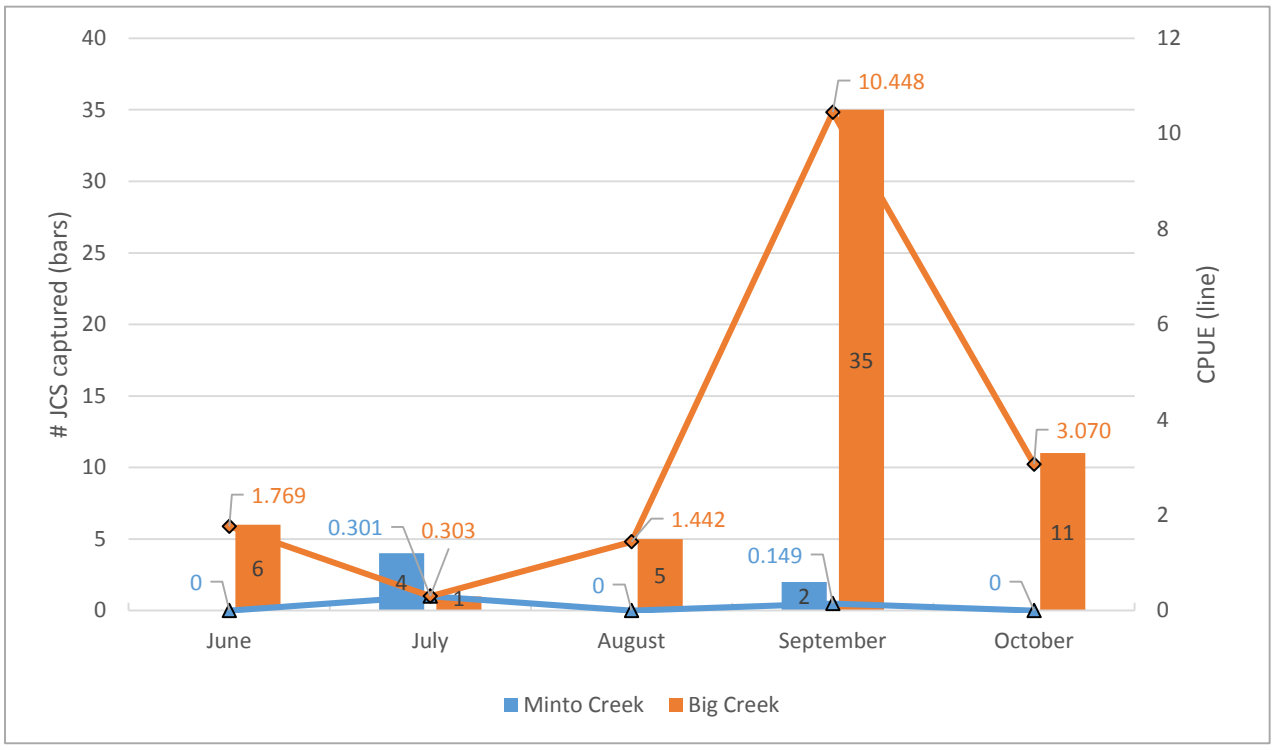


**Figure 5-1 Monthly JCS capture in Minto Creek and Big Creek, 2015.**

## 5.2 FISH METRICS

Fork lengths of JCS captured in Minto Creek ranged from 45 to 73 mm and their weights ranged from 1.56 to 4.64 g, while in Big Creek, JCS fork lengths ranged from 46 to 87 mm and their weights ranged from 1.02 to 7.21 g. The lengths and weights observed throughout the season were consistent with 0+ aged fish (young of year). Figure 5-2 presents the monthly averages for both creeks. Individual results for all fish captured are presented in Appendix B. These monthly average weights and lengths are generally lower than average values obtained in 2014 for both creeks. This could indicate that growth conditions were suboptimal this year, although 2015 averages are based on a much smaller sample size. Figure 5-2 also shows that growth seems to level out after August, likely as a result of decreasing water temperature. Similar growth patterns have been observed in previous years.

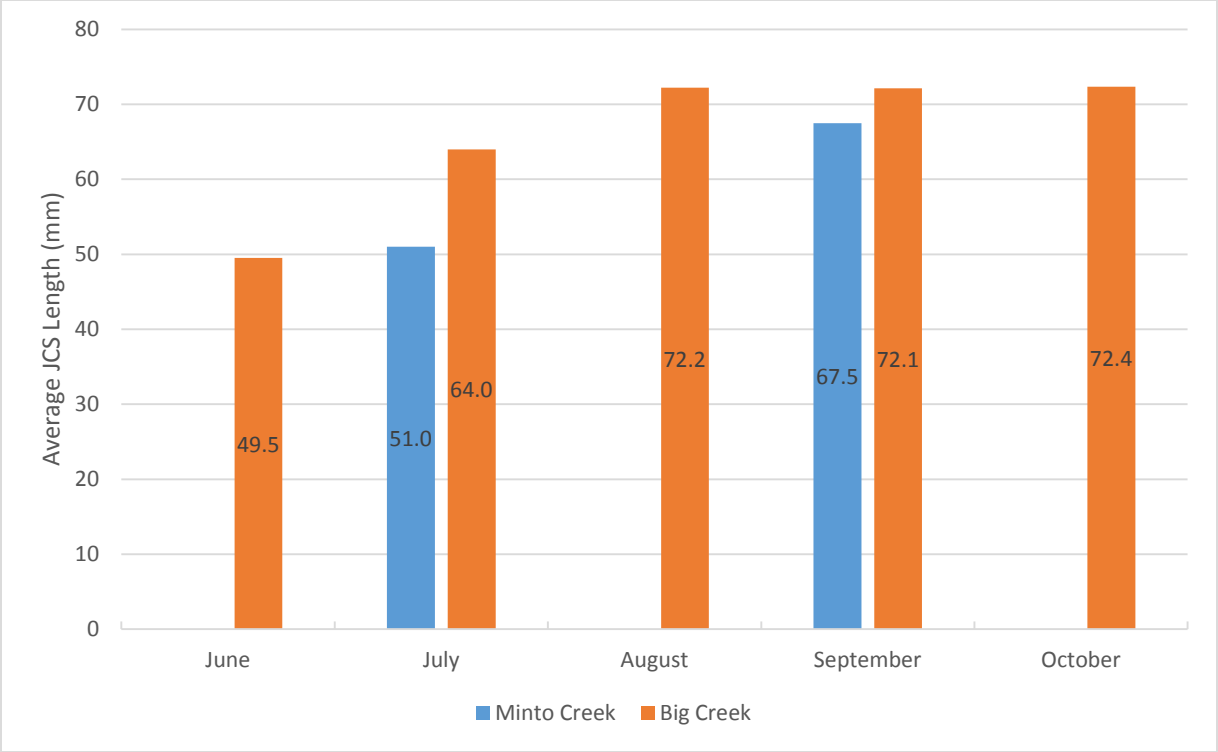


**Figure 5-2 Average JCS length (fork) in Minto Creek and Big Creek, 2015.**

## 5.3 WATER QUALITY PARAMETERS

In situ data was collected in Minto Creek (W2), Big Creek (bridge) and the Yukon River (W4) during each site visit and results are summarized in Table 5-3. In situ parameters were collected with a YSI Professional Plus multimeter, which was calibrated prior to each trip.

**Table 5-3 In situ data in Minto Creek, Big Creek and Yukon River, 2015.**

| Site | Date | Time | Temperature (°C) | Dissolved Oxygen (%) | Dissolved Oxygen (m/L) | Specific Conductance (µS/cm) | pH |
|---|---|---|---|---|---|---|---|
| Minto Creek | 15/06/2015 | 16:21 | 8.8 | 97 | 10.7 | 383.4 | 7.82 |
| | 09/07/2015 | 16:22 | 9.0 | 99 | 10.7 | 319.2 | 8.05 |
| | 10/07/2015 | 8:28 | 7.1 | 98 | 11.2 | 332.3 | 8.22 |
| | 06/08/2015 | 15:52 | 9.4 | 94.0 | 10.7 | 367.3 | 7.97 |
| | 10/09/2015 | 16:14 | 5.7 | 104 | 12.2 | 320.6 | 7.87 |
| | 11/09/2015 | 8:24 | 4.6 | 101 | 12.1 | 316.0 | 8.02 |
| | 22/10/2015 | 14:02 | 1.1 | 94 | 12.5 | 315.7 | 7.78 |
| | 23/10/2015 | 9:10 | 0.3 | 94 | 12.9 | 319.6 | 7.88 |
| Big Creek | 15/06/2015 | 13:45 | 12.4 | 93 | 9.5 | 228.2 | 7.84 |
| | 09/07/2015 | 14:30 | 14.0 | 98 | 9.5 | 167.3 | 8.18 |
| | 06/08/2015 | 13:40 | 12.6 | 101.6 | 10.8 | 192.2 | 8.07 |
| | 10/09/2015 | 14:13 | 7.1 | 104 | 11.6 | 171.4 | 7.67 |
| | 11/09/2015 | 9:45 | 5.7 | 100 | 11.8 | 172.4 | 7.94 |
| | 22/10/2015 | 13:44 | 2.4 | 105 | 13.4 | 208.6 | 7.95 |
| | 23/10/2015 | 10:39 | 1.8 | 97 | 12.7 | 209.5 | 7.86 |
| Yukon River | 15/06/2015 | 14:25 | 12.7 | 87 | 8.9 | 168.4 | 7.85 |
| | 09/07/2015 | 14:42 | 16.5 | 102 | 9.4 | 150.5 | 8.08 |
| | 06/08/2015 | 13:55 | 16.1 | 96.2 | 9.5 | 159.0 | 8.12 |
| | 10/09/2015 | 14:30 | 9.5 | 104 | 11.1 | 148.6 | 7.82 |
| | 22/10/2015 | 13:56 | 5.2 | 94 | 11.2 | 155.9 | 7.88 |
| | 23/10/2015 | 10:28 | 4.9 | 92 | 11.1 | 155.1 | 7.86 |

TidbiT water temperature loggers were deployed in the Yukon River at station W4 (between the barge landing and the mouth of Minto Creek) and in Big Creek (near the bridge) during the open water season, while a continuous logger located at W1 records the water temperature and stage of lower Minto Creek. Figure 5-3 present the three temperature curves, together with manual measurements (shown by triangular markers) taken from Table 5-3 above. This figure indicates that the temperatures of Minto Creek is generally colder than that of Big Creek, which itself is colder than that of the Yukon River and that the diurnal cycle is greater in Minto Creek and Big Creek than in the Yukon River. The average difference in water temperature over this period between the Yukon River and Big Creek was 3.2°C, while the difference between Big Creek and Minto Creek was 4.0°C. The 2015 data record does not indicate that the water temperature of Minto Creek equilibrated with that of the Yukon River during the 2015 open water season, although this has occasionally been observed to happen for a short period in June in the past. In 2013 for example, the maximum water temperature observed in Minto Creek was 15.7°C in late June, at which time the temperature of the Yukon River was very similar. In 2014 and 2015 however, the water temperature in Minto Creek did not exceed 10.6°C and 9.7°C respectively, and did not reach equilibrium with the Yukon River.

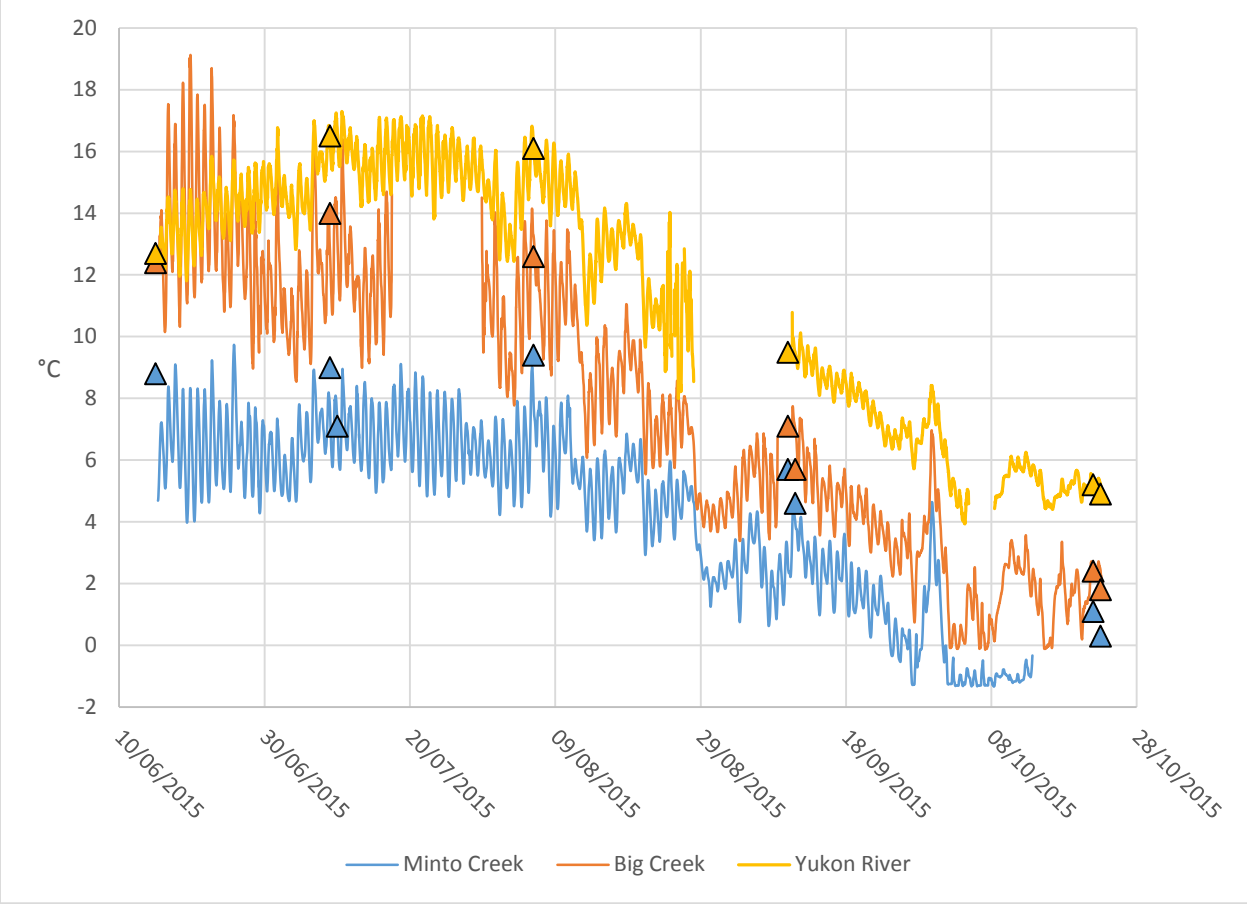


**Figure 5-3 Water Temperature, Minto Creek and Yukon River, 2015**

Turbidity in Minto Creek was observed to be generally low throughout the season (except during freshet), as opposed to previous years where it was observed to be higher, particularly during early to mid-season. Figure 5-4 presents Total Suspended Solids (TSS) values measured at W2 from May 1st to October 31st, 2015; the dotted line indicates the trend. W2 TSS records for the open water season from 2011 to 2015 are presented in Appendix C for comparison. The mean TSS value for the May-Oct period in 2015 was 12.5 mg/L, compared to 45.5 mg/L for the same period in 2014, and up to 480.2 mg/L in 2012.

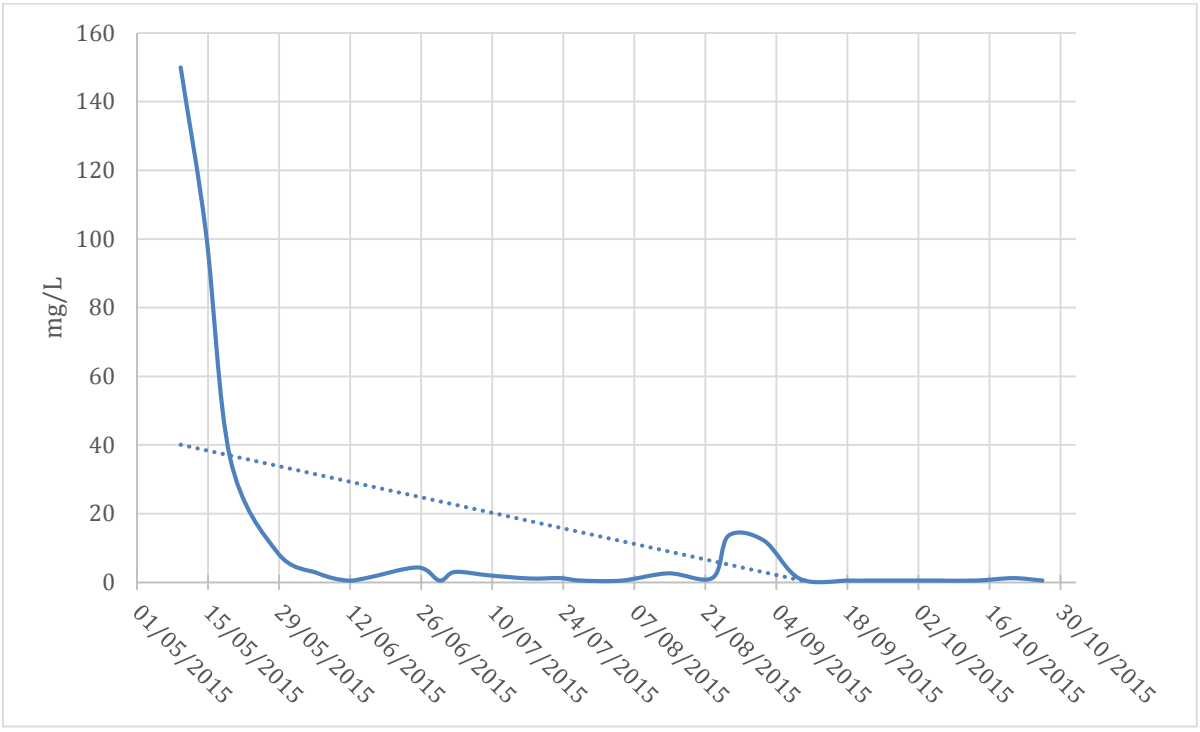


**Figure 5-4 Total Suspended Solids (mg/L) measured at W2 in 2015**

## 5.4 STAGE AND DISCHARGE

The staff gauge located at W1 in Minto Creek was read during each trip and discharge was measured at W1 with a Marsh McBirney Flo-Mate electromagnetic flow meter or a with a Hach FH950 electromagnetic flow meter. A continuously logging water level recorder is also located at W1 where Minto staff regularly measure discharge to construct a continuous discharge record. Water levels and discharge for Minto Creek and Big Creek are presented in Table 5-4 below, for dates when fisheries surveys occurred. Big Creek values were obtained through the Water Survey of Canada on-line database (Water Survey Canada, 2015) and are subject to change as they have not yet be validated by Water Survey Canada.

**Table 5-4 Stage and Discharge in Minto Creek and Big Creek, 2015.**

| Date | Time (PDT) | Minto Creek | | Big Creek | |
|---|---|---|---|---|---|
| | | Stage (m) | Discharge ($m^3/s$) | Stage (m) | Discharge ($m^3/s$) |
| 15/06/2015 | 10:26 | 0.115 | 0.006 | 6.087 | 4.747 |
| 15/06/2015 | 15:18 | 0.113 | n/a | 6.08 | 4.536 |
| 16/06/2015 | 9:44 | 0.113 | n/a | 6.065 | 4.1 |
| 09/07/2015 | 9:48 | 0.210 | 0.009 | 6.11 | 5.471 |
| 09/07/2015 | 15:30 | 0.115 | n/a | n/a | 5.342 |
| 10/07/2015 | 9:40 | 0.115 | n/a | 6.098 | 5.087 |
| 06/08/2015 | 14:45 | 0.105 | n/a | 6.189 | 8.327 |
| 06/08/2015 | 15:37 | 0.110 | 0.004 | 6.194 | 8.527 |
| 07/08/2015 | 8:57 | 0.133 | 0.013 | 6.195 | 8.567 |
| 10/09/2015 | 16:02 | 0.133 | 0.019 | 6.365 | 17.08 |
| 11/09/2015 | 9:32 | 0.148 | n/a | 6.369 | 17.292 |
| 22/10/2015 | 15:28 | 0.133 | 0.019 | 6.129 | n/a |
| 23/10/2015 | 10:08 | 0.128 | n/a | 6.125 | n/a |

Figure 5-5 shows the continuous record available from May to early October. AEG processes those data gathered by Minto Staff.


**Figure 5-5 Stage and discharge in Minto Creek at monitoring station W1, 2015**

The Big Creek hydrometric station (Water Survey of Canada station ID # 09AH003) is located downstream of the Minto access road bridge, near its confluence with the Yukon River, at the following coordinates: 62° 34' 07'' N; 137° 00' 58'' W. It records continuous water level and discharge. Figure 5-6 presents data from June to October 2015.

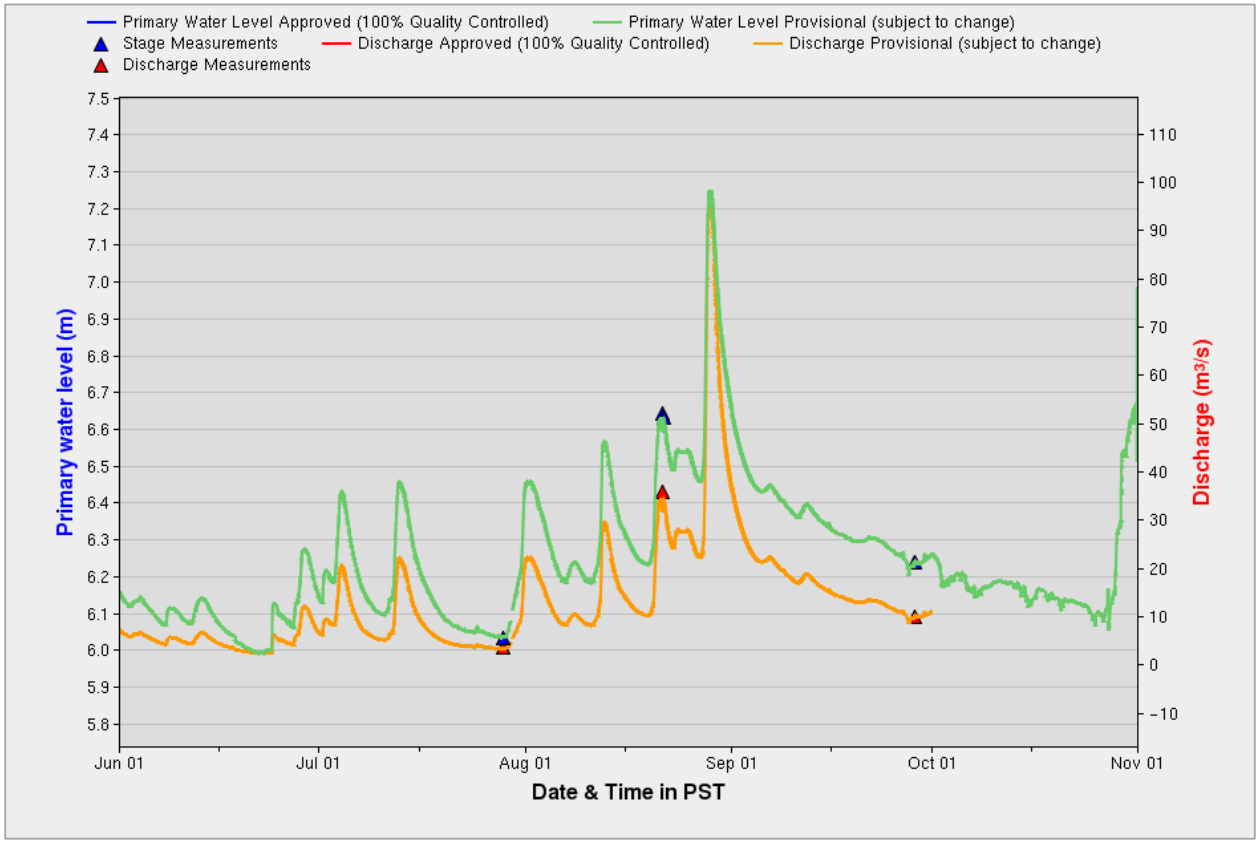


**Figure 5-6 Water Level and Discharge in Big Creek 2015** ***(Source: Water Survey of Canada, 2015).***

## 5.5 FISH BARRIER

The fish barrier located approximately 1.2 km upstream of the Yukon River (MCF-B1 on Figure 4-1), which was documented in previous years, was re-confirmed in 2015. Fish use upstream of the barrier, which consists of a log jam (Figure 5-7), was assessed by setting traps upstream of it during each sampling event. No fish were captured upstream of the barrier during 2015. Another log jam is located just upstream of station MCF-21 (see Figure 4-1 and Figure 5-8) and is thought to act as a temporary fish barrier during low flow conditions. No fish were captured upstream of it in 2015.

**Figure 5-7 Fish Barrier and Minnow Trap at MCF-B1 (June 2015)**

**Figure 5-8 Log jam upstream of MCF-21, potentially acting as temporary fish barrier (August 2015)**

# 6 DISCUSSION

In 2015, no JCS were captured in Minto Creek in June, as has been the case in previous years, however six JCS were captured in Big Creek in June, indicating that fish may start to move up the Big Creek system earlier than in Minto Creek. This is consistent with a higher water temperature observed in Big Creek at that time (see Figure 5-3). More generally this supports previous findings that that JCS do not tend to enter Minto Creek (or Big Creek) until the water temperature has equilibrated with that of the Yukon River or reached a minimum threshold temperature. An important factor to note is that a section of lower Minto Creek (downstream of MCF-14) was dry during the June 2015 sampling event, preventing fish movement up the system. The period of time during which this section of the creek was going to ground is unknown, however this situation was also observed during the August sampling event, and could have occurred on other occasions throughout the summer. The highest JCS catch per unit effort (CPUE) was observed in July in Minto Creek and in September in Big Creek.

Figure 6-1 shows the CPUE trends since 2008 for JCS (Minnow trapping only) in Minto Creek and since 2012 in Big Creek. The average CPUE in Minto Creek has shown some variability since 2008 but has generally been relatively low. Once exception is the year 2010 where the average CPUE in Minto Creek was 15.7 fish/trap-day and some trapping events returned over 400 JCS. Those high numbers were thought to be associated at least in part with mine water discharge occurring throughout the open water season in Minto Creek that year (ACG, 2010), the more consistent temperature and flows regimes possibly acting as attractants to fish. The average CPUE for JCS in Minto Creek in 2015 was the second lowest since 2008 and could be explained in part by the fact that a section of the lower creek went dry on at least two documented occasions during the summer, preventing fish movement up or down the creek, combined with a relatively low temperature profile in 2015. In some years, water temperature of Minto Creek and Yukon River reach equilibrium for a short period in June, however this did not happen in 2014 or 2015. In 2015, Minto Creek's maximum water temperature stayed below 10°C, whereas the Yukon River minimum temperature largely stayed above 10°C throughout the summer. The colder temperature profile of Minto Creek in 2015 may have deterred the movement of JCS into the system.

In Big Creek, the average CPUE for 2015 was less than in 2014 but greater than in 2012 or 2013. The CPUE was generally higher in Big Creek than in Minto Creek, except in 2013 where it was the opposite. A higher CPUE in Big Creek than in Minto Creek could be explained by the fact that Big Creek is a larger system, with a higher water temperature, generally providing better rearing conditions for JCS.

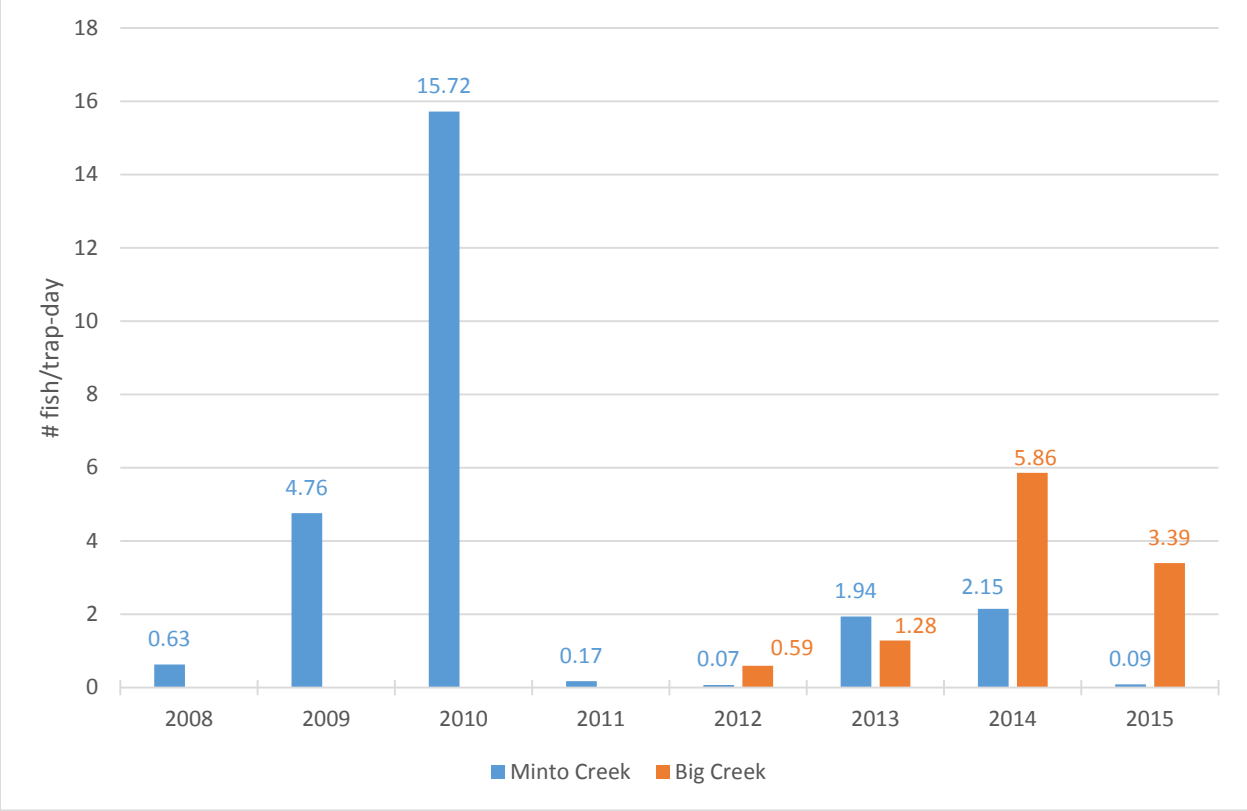


**Figure 6-1 JCS average CPUE, Minnow Trapping, 2008-2015**

In 2009 and 2010, the mine was discharging water into Minto Creek, causing higher and more consistent flow and temperature regimes in lower Minto Creek, conditions which may have been more attractive to JCS. Mine water discharge only occurred during spring freshet from 2012 to 2015 and no discharge occurred in 2011.

Additionally, following a forest fire in 2010, more sediment entered Minto Creek through runoff in 2011 and 2012 increasing turbidity. A small landslide was also documented by Minto personnel in an upstream tributary in May 2012, likely contributing to high TSS levels observed downstream. The elevated turbidity may have deterred fish from entering Minto Creek. Average TSS values at W2 in 2015 were the lowest since 2011, and the highest were observed in 2012 (see Appendix C for details). Turbidity/TSS did not likely influence fish presence or absence in Minto Creek in 2015 as values remained low throughout the season.

The natural fish barrier identified in Minto Creek in previous years was again confirmed in 2015. Therefore the area of usable fish habitat in Minto Creek is limited to the lower 1.2 km of the creek.

Aerial surveys for spawning fish were carried out in the vicinity of the Minto Creek/Yukon River confluence from 2010 to 2014 and no spawning activity was ever observed or suspected. Bottom substrate in the confluence area consists primarily of silt and mud which is not suitable substrate for salmon spawning.

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# APPENDIX A

## 2015 PHOTO LOG

Photo 1: Big Creek looking upstream (June)

Photo 2: Minto Creek dry at MCF-13 (June)

Photo 3: Burbot captured in Big Creek (June)

Photo 4: JCS captured in Big Creek (June)

Photo 5: Small fish (unidentified) observed in Big Creek (June)

Photo 6: Minto Creek mouth (June)

Photo 7: Minnow trap set in Big Creek (July)

Photo 8: Trap set in Minto Creek (MCF-13), clear water (July)

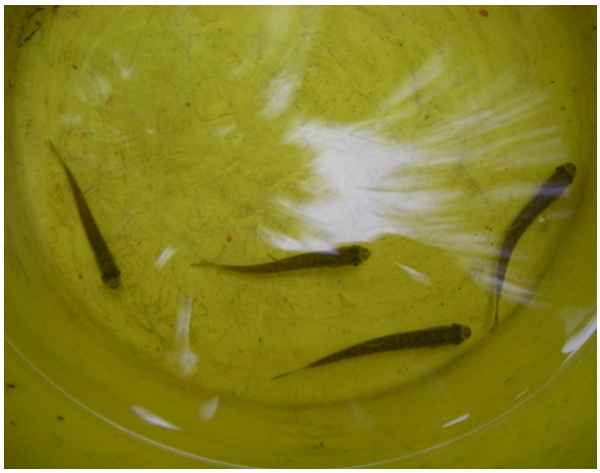


Photo 9: JCS captured at MCF-12 in Minto Creek (July)

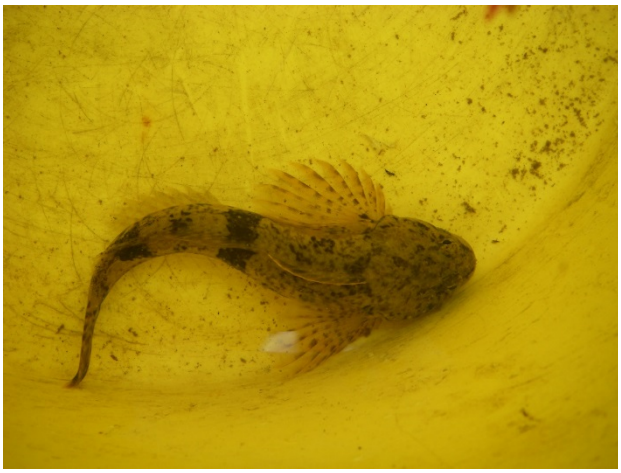


Photo 10: Slimy Sculpin captured in Big Creek (July)

Photo 11: Yukon River looking upstream at W4 (August)

Photo 12: Big Creek looking downstream (August)

Photo 13: Minto Creek dry at MCF-14 (August 6)

Photo 14: Minto Creek – water present at MCF-14 (August 7)

Photo 15: Big Creek looking upstream (September)

Photo 16: Trap set in Minto Creek, MCF-12 (September)

Photo 17: JCS captured in Big Creek (September)


Photo 18: Burbot captured in Big Creek (September)

Photo 19: Big Creek, minnow trap on left bank, downstream of the bridge (October)

Photo 20: Minto Creek, minnow trap set at MCF-W1 (October)

Photo 17: Minto Creek, ice formed on trap overnight (October)

Photo 18: Minto Creek, ice forming over fish barrier at MCF-B1 (October)

Photo 23: JCS captured in Big Creek (October)

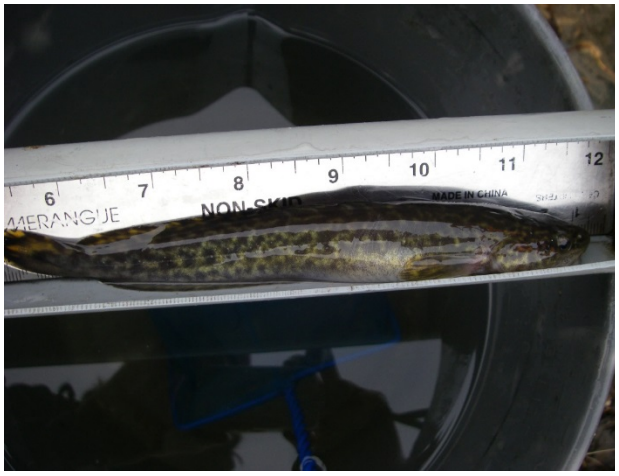



Photo 24: Burbot captured in Big Creek (October)

# APPENDIX B

## FISH DATA, MINTO CREEK AND BIG CREEK, 2015

**MINTO CREEK**

| Date | Method | Location of capture | Species* | Length (mm)** | Weight (g) | Fate | Comments |
|---|---|---|---|---|---|---|---|
| 10/07/2015 | MT | MCF-12 | JCS | 57 | 1.76 | Released (good) | |
| 10/07/2015 | MT | MCF-12 | JCS | 49 | 1.56 | Released (good) | |
| 10/07/2015 | MT | MCF-12 | JCS | 45 | 1.83 | Released (good) | |
| 10/07/2015 | MT | MCF-12 | JCS | 53 | 1.84 | Released (good) | |
| 11/09/2015 | MT | MCF-12 | JCS | 62 | 2.78 | Released (good) | |
| 11/09/2015 | MT | MCF-12 | JCS | 73 | 4.64 | Released (good) | |

* SS=Slimy Sculpin, JCS=Juvenile Chinook Salmon, BB=Burbot
**Fish length refers to fork length for JCS and LS and to total length for other species

**BIG CREEK**

| Date | Method | Location of capture | Species* | Length (mm)** | Weight (g) | Fate | Comments |
|---|---|---|---|---|---|---|---|
| 16/06/2015 | MT | L.Bank u/s of bridge | BB | 141 | n/a | Released (good) | |
| 16/06/2015 | MT | L.Bank u/s of bridge | JCS | 47 | 1.02 | Released (good) | |
| 16/06/2015 | MT | L.Bank u/s of bridge | JCS | 52 | 1.57 | Released (good) | |
| 16/06/2015 | MT | L.Bank u/s of bridge | JCS | 49 | 1.11 | Released (good) | |
| 16/06/2015 | MT | L.Bank u/s of bridge | JCS | 53 | 1.51 | Released (good) | |
| 16/06/2015 | MT | L.Bank u/s of bridge | JCS | 46 | 1.05 | Released (good) | |
| 16/06/2015 | MT | R.Bank u/s of bridge | JCS | 50 | 1.14 | Released (good) | |
| 10/07/2015 | MT | L.Bank u/s of bridge | SS | 87 | n/a | Released (good) | |
| 10/07/2015 | MT | L.Bank u/s of bridge | JCS | 64 | 2.23 | Released (good) | |
| 07/08/2015 | MT | L.Bank d/s of bridge | SS | 54 | n/a | Released (good) | |
| 07/08/2015 | MT | L.Bank d/s of bridge | JCS | 63 | 2.87 | Released (good) | |
| 07/08/2015 | MT | L.Bank u/s of bridge | JCS | 81 | 4.78 | Released (good) | |
| 07/08/2015 | MT | L.Bank u/s of bridge | JCS | 77 | 4.5 | Released (good) | |
| 07/08/2015 | MT | R.Bank u/s of bridge | JCS | 74 | 4.51 | Released (good) | |
| 07/08/2015 | MT | R.Bank u/s of bridge | JCS | 66 | 3.07 | Released (good) | |
| 11/09/2015 | MT | L.Bank d/s of bridge | JCS | 77 | 4.74 | Released (good) | |
| 11/09/2015 | MT | L.Bank d/s of bridge | JCS | 71 | 3.47 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 72 | 4.61 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 74 | 4.36 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 65 | 2.86 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 72 | 3.81 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 82 | 6.17 | Released (good) | |
| 11/09/2015 | MT | L.Bank u/s of bridge | JCS | 74 | 4.14 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 77 | 4.77 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 67 | 3.62 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 65 | 3.66 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 65 | 4 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 69 | 3.91 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 68 | 3.72 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 73 | 3.93 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 79 | 5.57 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 78 | 5.3 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 77 | 5.14 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 74 | 4.36 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 68 | 3.27 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 69 | 3.4 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 76 | 5.04 | Released (good) | |

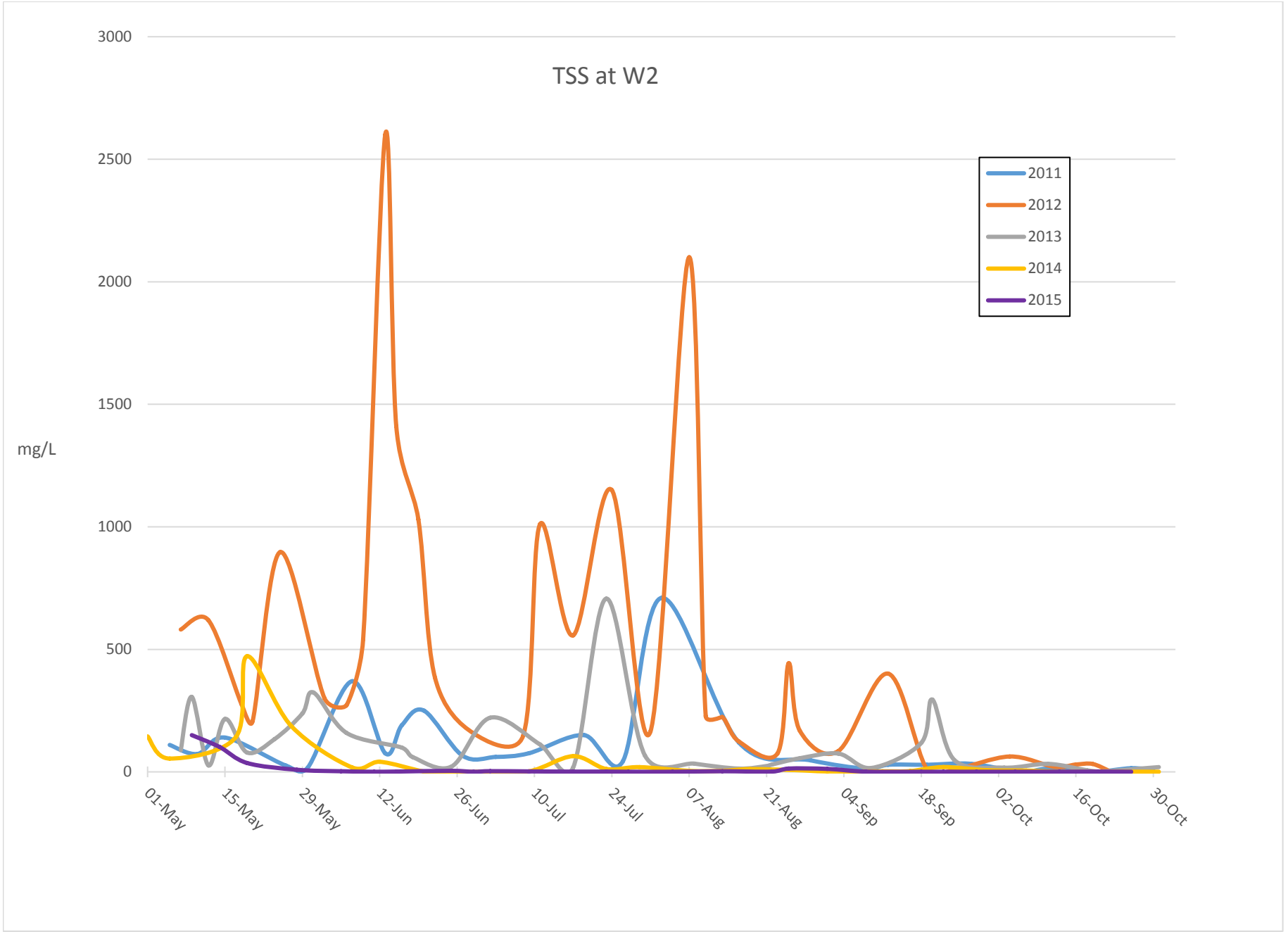
| Date | Method | Location of capture | Species* | Length (mm)** | Weight (g) | Fate | Comments |
|---|---|---|---|---|---|---|---|
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 65 | 3.15 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 76 | 5.36 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 67 | 3.68 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 67 | 3.55 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 76 | 4.93 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 72 | 4.44 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 71 | 3.98 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 74 | 4.61 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 66 | 3.51 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 87 | 7.21 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 71 | 4.12 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 82 | 6.14 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | JCS | 58 | 2.22 | Released (good) | |
| 11/09/2015 | MT | R.Bank u/s of bridge | BB | 133 | n/a | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 75 | 4.91 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 64 | 3.99 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 78 | 5.26 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 73 | 4.77 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 74 | 4.42 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 81 | 6 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 75 | 4.75 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 67 | 2.99 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 78 | 5.27 | Retreived dead | |
| 23/10/2015 | MT | L.Bank u/s of bridge | JCS | 74 | 4.81 | Released (good) | |
| 23/10/2015 | MT | L.Bank u/s of bridge | BB | 161 | n/a | Released (good) | |
| 23/10/2015 | MT | R.Bank u/s of bridge | JCS | 57 | 2.02 | Released (good) | |

* SS=Slimy Sculpin, JCS=Juvenile Chinook Salmon, BB=Burbot, LS=Longnose Sucker

**Fish length refers to fork length for JCS and LS and to total length for other species

# APPENDIX C

## TSS RESULTS AT W2, 2011-2015


TSS at W2
mg/L
3000
2500
2000
1500
1000
500
0
01-May
15-May
29-May
12-Jun
26-Jun
10-Jul
24-Jul
07-Aug
21-Aug
04-Sep
18-Sep
02-Oct
16-Oct
30-Oct
2011
2012
2013
2014
2015

| TSS @ W2 (mg/L) | | | | | |
|---|---|---|---|---|---|
| **Date** | **2011** | **2012** | **2013** | **2014** | **2015** |
| 01-May | | | | 145 | |
| 02-May | | | | | |
| 03-May | | | | | |
| 04-May | | | | | |
| 05-May | 110 | | | 54.4 | |
| 06-May | | | | | |
| 07-May | | 581 | 88.3 | | |
| 08-May | | | | | |
| 09-May | | | 306 | | 150 |
| 10-May | 73 | | | | |
| 11-May | | | | | |
| 12-May | | 619 | 26.5 | | |
| 13-May | | | | | |
| 14-May | | | | | 102 |
| 15-May | 140 | | 216 | | |
| 16-May | | | | | |
| 17-May | | | | 143 | |
| 18-May | | 276 | | | |
| 19-May | | | 79 | 472 | 36.3 |
| 20-May | | 207 | | | |
| 21-May | | | | | |
| 22-May | | | | | |
| 23-May | | | | | |
| 24-May | | | 134 | | |
| 25-May | | 897 | | | |
| 26-May | 26 | | | | |
| 27-May | | | | 187 | |
| 28-May | | | | | 8.7 |
| 29-May | | | 238 | | |
| 30-May | 18 | | | | |
| 31-May | | | 324 | | |
| 01-Jun | | | | | |
| 02-Jun | | 301 | | | |
| 03-Jun | | | | | |
| 04-Jun | | | | | |
| 05-Jun | | | | | 2.6 |
| 06-Jun | | 272 | 159 | | |
| 07-Jun | 370 | | | 18.2 | |
| 08-Jun | | | | | |
| 09-Jun | | 540 | | | |
| 10-Jun | | | | | |
| 11-Jun | | | | | <1.0 |
| 12-Jun | | | | 41.2 | |
| 13-Jun | 76 | 2600 | | | |
| 14-Jun | | | | | |

| TSS @ W2 (mg/L) | | | | | |
|---|---|---|---|---|---|
| **Date** | **2011** | **2012** | **2013** | **2014** | **2015** |
| 15-Jun | | 1410 | | | 1.3 |
| 16-Jun | 190 | | 99 | | |
| 17-Jun | | | | | |
| 18-Jun | | | 60 | | |
| 19-Jun | | 1030 | | | |
| 20-Jun | 250 | | | 1.3 | |
| 21-Jun | | | | | |
| 22-Jun | | 385 | | | |
| 23-Jun | | | | | |
| 24-Jun | | | | <1.0 | |
| 25-Jun | | | 21.8 | | 4.3 |
| 26-Jun | | | | | |
| 27-Jun | 66 | | | | |
| 28-Jun | | | | | |
| 29-Jun | | 157 | | | <1.0 |
| 30-Jun | | | | <1.0 | |
| 01-Jul | | | | | |
| 02-Jul | | | 221 | | 3 |
| 03-Jul | 61 | | | | |
| 04-Jul | | | | | |
| 05-Jul | | | | | |
| 06-Jul | | | | | |
| 07-Jul | | | | | |
| 08-Jul | | 150 | | | |
| 09-Jul | 76 | | | 2.1 | 2 |
| 10-Jul | | | | | |
| 11-Jul | | 1010 | 112 | | |
| 12-Jul | | | | | |
| 13-Jul | | | | | |
| 14-Jul | | | | | |
| 15-Jul | | | | | |
| 16-Jul | | | | | |
| 17-Jul | | 557 | 17.4 | 64.1 | 1.1 |
| 18-Jul | | | | | |
| 19-Jul | 150 | | | | |
| 20-Jul | | | | | |
| 21-Jul | | | | | |
| 22-Jul | | | | | |
| 23-Jul | | | 707 | 11.9 | 1.2 |
| 24-Jul | | 1150 | | | |
| 25-Jul | | | | | |
| 26-Jul | 43 | | | | |
| 27-Jul | | | | | <1.0 |
| 28-Jul | | | | | |
| 29-Jul | | | | 19.4 | |

| TSS @ W2 (mg/L) | | | | | |
|---|---|---|---|---|---|
| **Date** | **2011** | **2012** | **2013** | **2014** | **2015** |
| 30-Jul | | | 66.7 | | |
| 31-Jul | | 165 | | | |
| 01-Aug | | | | | |
| 02-Aug | 710 | | | | |
| 03-Aug | | | | | |
| 04-Aug | | | | | <1.0 |
| 05-Aug | | | | | |
| 06-Aug | | | | | |
| 07-Aug | | 2100 | | 4.2 | |
| 08-Aug | | | 33.5 | | |
| 09-Aug | | | | | |
| 10-Aug | | 228 | | | |
| 11-Aug | | | | | |
| 12-Aug | | | | | |
| 13-Aug | | 224 | | 4.4 | 2.6 |
| 14-Aug | | | | | |
| 15-Aug | | | | | |
| 16-Aug | 120 | 124 | 13.4 | | |
| 17-Aug | | | | | |
| 18-Aug | | | | 11.4 | |
| 19-Aug | | | | | |
| 20-Aug | | | | | |
| 21-Aug | | | 23.9 | | |
| 22-Aug | | | 30 | | 1.3 |
| 23-Aug | | 75.8 | | | |
| 24-Aug | | | | | |
| 25-Aug | | 443 | | | 13.6 |
| 26-Aug | | | | 7.3 | |
| 27-Aug | | 169 | 55.5 | | |
| 28-Aug | | | | | |
| 29-Aug | 47 | | | | |
| 30-Aug | | | | | |
| 31-Aug | | | | | |
| 01-Sep | | | | 2 | 12.2 |
| 02-Sep | | | | | |
| 03-Sep | | 85.1 | 74.7 | | |
| 04-Sep | | | | | |
| 05-Sep | | | | | |
| 06-Sep | | | | | |
| 07-Sep | | | | | |
| 08-Sep | 13 | | | | 1 |
| 09-Sep | | | 16.1 | | |
| 10-Sep | | | | | |
| 11-Sep | | | | 2.4 | |
| 12-Sep | 29 | 401 | | | |

| TSS @ W2 (mg/L) | | | | | |
|---|---|---|---|---|---|
| **Date** | **2011** | **2012** | **2013** | **2014** | **2015** |
| 13-Sep | | | | | |
| 14-Sep | | | | | |
| 15-Sep | | | | | |
| 16-Sep | | | | 3.3 | |
| 17-Sep | | | | | |
| 18-Sep | | | 118 | | <1.0 |
| 19-Sep | 29 | 11.7 | | | |
| 20-Sep | | | 295 | | |
| 21-Sep | | | | | |
| 22-Sep | | | | 19.7 | <1.0 |
| 23-Sep | | | | | |
| 24-Sep | | 9.3 | 48.2 | | |
| 25-Sep | | | | | |
| 26-Sep | | | | | |
| 27-Sep | 33 | | | | |
| 28-Sep | | | | | <1.0 |
| 29-Sep | | | | | |
| 30-Sep | | | | 6.9 | |
| 01-Oct | | | | | |
| 02-Oct | | | | | |
| 03-Oct | | | 17.3 | | |
| 04-Oct | | 62.8 | | | |
| 05-Oct | | | | | <1.0 |
| 06-Oct | <4 | | | | |
| 07-Oct | | | | 5.3 | |
| 08-Oct | | | | | |
| 09-Oct | | | | | |
| 10-Oct | | | | | |
| 11-Oct | 13 | | 32.6 | | |
| 12-Oct | | 21 | | | |
| 13-Oct | | | | | <1.0 |
| 14-Oct | | | | <1.0 | |
| 15-Oct | | | | | |
| 16-Oct | | 30 | | | |
| 17-Oct | | | | | |
| 18-Oct | | | 6.5 | | |
| 19-Oct | <4 | 32.4 | | | |
| 20-Oct | | | | | 1.2 |
| 21-Oct | | | 2.3 | | |
| 22-Oct | | 4.1 | | | |
| 23-Oct | | | | | |
| 24-Oct | | | | | |
| 25-Oct | | | | 1 | |
| 26-Oct | 15 | | | | <1.0 |
| 27-Oct | | | | | |

| TSS @ W2 (mg/L) | | | | | |
|---|---|---|---|---|---|
| **Date** | **2011** | **2012** | **2013** | **2014** | **2015** |
| 28-Oct | | | | | |
| 29-Oct | | | | | |
| 30-Oct | 7 | | | | |
| 31-Oct | | | 19.5 | <1.0 | |
| **Average** | **103** | **480.2** | **114.4** | **45.5** | **12.5** |
| **Count** | **26** | **34** | **32** | **27** | **28.0** |
| **Minimum** | **2** | **4.1** | **2.3** | **<1.0** | **<1.0** |
| **Maximum** | **710** | **2600** | **707** | **472** | **150.0** |
| **Geometric Mean** | **45** | **205.6** | **58.3** | **8.1** | **2.0** |
| **Count <DL** | **2** | **0** | **0** | **4** | **10** |
| **Standard Deviation** | **151** | **599.9** | **143.4** | **98.8** | **33.5** |
| **1st Quartile** | **20** | **94.8** | **23.4** | **2.1** | **<1.0** |
| **Median** | **54** | **250** | **63.4** | **6.9** | **1.2** |
| **3rd Quartile** | **118** | **575** | **140.2** | **30.5** | **3.3** |