APPENDIX 5

Environmental Baseline Report: Fish and Fish Habitat

Victoria GOLD CORP

Stantec

EAGLE GOLD PROJECT

Environmental Baseline Report: Fish and Fish Habitat

FINAL REPORT

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EXECUTIVE SUMMARY

Stantec was retained by Victoria Gold Corporation to prepare an environmental baseline report to characterize freshwater fish and fish habitat in the vicinity of the Eagle Gold Project area. Field programs were conducted in 2007, 2008, and 2009; following a review of current regulatory requirements and of historic data from consultant reports written in 1995, 1996, and 2006. This report presents background information, methods, and results for the baseline fisheries assessment.

Field surveys were completed on watercourses within the Project's local study area to obtain biophysical data, determine fish presence, and characterize fish populations. Ageing structures (scales and otoliths) and tissue samples (liver and muscle tissue) were collected for population assessments and metals analysis respectively. Field studies were completed at 69 sites within the local study area over four sampling periods (August 2007, October 2007, April 2008, and July 2009). The sites are situated in the South McQuesten River drainage mainly within four drainage sub basins (Lynx Creek, Haggart Creek, Ironrust Creek, and Dublin Gulch).

Of the 69 sites sampled, 38 sites were assessed as fish bearing due to the capture or observation of Arctic grayling and/or slimy sculpin. The remaining 31 sites were assessed as non fish bearing due to both the presence of downstream permanent barriers to upstream fish passage (e.g., cascades), and the lack of fish capture during multiple sampling periods. Chinook salmon were not captured at any of the sites during the field programs, but Chinook parr were observed in the South McQuesten River in July 2009.

Arctic grayling and slimy sculpin are the key fish species of interest for this report. Arctic grayling are important as an indicator of aquatic health, due to their position as a top predator in the aquatic food chain, and as the focus of recreational and food fisheries. Slimy sculpin are of interest as an alternative or complimentary species to Arctic grayling for long term monitoring of fish population characteristics and metal levels in fish tissue. Recent practice in environmental effects monitoring programs for mining activities has demonstrated the value of using smaller non sport fish species, such as sculpin, due to their generally lower mobility and greater site fidelity compared to larger species, and some reluctance for using larger sports fish for longer term lethal sampling programs.

Good to excellent quality fish habitats were observed at 21 of 38 fish bearing sites. Fish sampled during autumn (October 2007) appeared to utilize similar habitats as fish sampled during summer months (July 2009, August 2007) and fish had not moved into downstream overwintering habitats. Fish sampling during April 2008, after ice freeze up and prior to ice break up, identified a large pool on Haggart Creek to be utilized by Arctic grayling.

Chinook Salmon

Previous studies reported the presence of Chinook salmon in Haggart Creek and the South McQuesten River. There is no known record of Chinook salmon presence in Dublin Gulch or its tributaries. In the current study, Chinook salmon were not captured at any of the Haggart Creek or Dublin Gulch sites during any of the four sampling programs.

Chinook salmon occur in the South McQuesten River, which was confirmed by the sighting of juvenile Chinook (est. age 1+) during a snorkel survey of the South McQuesten River at the access road crossing on July 23, 2009. During the snorkel survey, no Chinook spawning was observed which may be attributed to the timing of the survey, or low to nil returns.

Arctic Grayling

The mean Arctic grayling catch rate across all sampling sites and sampling programs was 1.6 fish/100 m^2. Projected Arctic grayling densities are highest in Haggart Creek (4.5 fish/100 m^2); and lowest at Ironrust Creek (0.2 fish/100 m^2). Across all Arctic Grayling sampled, ages ranged from young of year (0+) to 8 years, and body lengths ranged from 61 mm to 400 mm.

The age and length frequency distributions of Arctic grayling varied among creeks, with a relatively even distribution of small to medium sized fish (111 to 295 mm) in Dublin Gulch, a strong dominance of small fish (81 – 100 mm) in Haggart Creek, and a bimodal distribution of fish lengths (at 65 and 385 mm) in Lynx Creek.

Mean values for relative condition factor (i.e., relative weight at length) of Arctic grayling were similar among watercourses sampled, with average values ranging from 0.89 (Haggart Creek) to 0.92 (Lynx Creek). These similarities in relative condition factor suggest that the nutritional status of Arctic grayling was similar across the watercourses sampled.

Levels of metals in liver and muscle tissue of Arctic grayling were measured and compared to guidelines and reference values available in the scientific literature. These include British Columbia guidelines for mercury and selenium, an extensive dataset developed for uncontaminated lakes in British Columbia, and toxicology based values developed by the United States Environmental Protection Agency. Among the metals tested, only concentrations of aluminum, arsenic, manganese, selenium and zinc in the livers and muscle tissues of Arctic grayling sampled from all three creeks (Haggart Creek, Lynx Creek, and Dublin Gulch) were higher than many of the guidelines and reference levels. Concentrations of barium (Lynx Creek, Dublin Gulch) and cadmium (Lynx Creek) also exceeded these guidelines and reference levels in liver tissue. No exceedances of consumption guidelines for mercury in fish muscle were identified.

The high concentrations of certain metals found in Arctic grayling tissues may be a result of the high natural mineralization in the area, rather than current and historical placer mining practices in these watersheds, given that levels tended to be similar or higher in Lynx Creek, which has had no historical placer mining operations, compared to Haggart Creek and Dublin Gulch.

Slimy Sculpin

The mean slimy sculpin catch rate for all sites was determined to be 2.9 fish/100 m^2. Population estimates are highest in Haggart Creek (6.0 fish/100 m^2) and lowest in Ironrust Creek (0.7 fish/100 m^2).

Slimy sculpin ages at all sites ranged from 3 to 9 years. Slimy sculpin less than three years of age were not sampled because the smallest fish sampled were not selected for ageing. Fish length ranged from 35 mm to 131 mm in length. Length frequency distributions for slimy sculpin in Dublin

Gulch, Haggart Creek and Lynx Creek are relatively similar, though Haggart Creek has a higher relative frequency of smaller fish (41 – 70 mm) and Ironrust Creek demonstrates an absence of smaller slimy sculpin (<86 mm) from the general population.

Mean values for relative condition factor for slimy sculpin ranged from 0.94 at Ironrust Creek to 1.14 at Dublin Gulch. The only statistically significant difference was a lower mean condition for slimy sculpin from Haggart Creek (0.96) compared to Lynx Creek (1.05) suggesting that the nutritional status or ~~"~~fatness" of slimy sculpin was higher in Lynx Creek compared to Haggart Creek.

Concentrations of selenium in whole tissue of slimy sculpin exceeded the BC tissue quality guideline for fish caught in Haggart, Lynx and Ironrust creeks. There are no reference values in the literature for metals levels in slimy sculpin. Among the three creeks surveyed, slimy sculpin captured in Ironrust Creek had the highest metal concentrations.

As for Arctic grayling, the high concentrations of certain metals in slimy sculpin tissues may be a result of mineralization in the general area, as levels in fish tissue were not correlated with current and historical placer mining practices in these watersheds.

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1 INTRODUCTION

This report presents results of the baseline fish and fish habitat assessment completed by Stantec between 2007 and 2009 for the Eagle Gold Project proposed by Victoria Gold Corporation. The Eagle Gold Project is a proposed open pit gold mine within the Dublin Gulch watershed located 85 km northeast of the Village of Mayo, Yukon Territory.

Stantec was contracted by the Stratagold Corporation to begin environmental baseline studies in 2007. In 2009, Stratagold Corporation was acquired by Victoria Gold Corporation. During this time, the project was renamed from Dublin Gulch to Eagle Gold and the local study area was updated to reflect any changes to the geographic extent of the proposed Eagle Gold Project.

This report presents background information, methods, and results for the baseline fisheries assessment. The results of the baseline assessment include:

1. Characterizations of watercourses (i.e., fish presence, and habitat attributes and quality)
2. Fish population characteristics (i.e., catch rates, size, age, and condition)
3. Background levels of bio-accumulated metals in fish tissues.

Arctic grayling (*Thymallus arcticus*) and slimy sculpin (*Cottus cognatus*) were the only two fish species caught during this baseline assessment and as a result are species of interest for this report. Arctic grayling are important as an indicator of aquatic health, due to their position as a top predator in the aquatic food chain, and as the focus of recreational and food fisheries. Slimy sculpin are of interest as an alternative or complimentary species to Arctic grayling for long term monitoring of fish population characteristics and metal levels in fish tissue. Recent practice in environmental effects monitoring programs for mining activities has demonstrated the value of using smaller non sport fish species, such as sculpin, due to their generally lower mobility and greater site fidelity compared to larger species, and some reluctance for using larger sports fish for longer term lethal sampling programs.

2 METHODS

2.1 Study Area Boundaries

The local study area, shown in Figure 2-1, includes:

- All watercourses in the Dublin Gulch watershed, where the Project would be centered
- Reference watercourses that should be uninfluenced by flows from the Dublin Gulch watershed (namely Ironrust and Lynx creeks)
- Watercourses that cross or approach within 30 m of the existing access road.

2.2 Review of Existing Literature

Prior to the field surveys, existing information on the freshwater aquatic environment in the local study area was collected and reviewed. This information consisted of previous studies in the area, maps, and federal government websites, and included the following sources:

- A report on the life history and habitat utilization of Arctic grayling in two central Yukon drainages (Pendray 1983)
- Fisheries survey reports conducted in the Eagle Gold local study area (Hallam Knight Piésold Ltd. 1995, 1996a,b)
- A gap analysis for the Dublin Gulch Project (Madrone Environmental Services Ltd. 2006)
- 1:20,000 terrain resource information mapping (TRIM) for the area
- Government of Canada *Species at Risk Public Registry* website (GoC 2008).

2.3 Field Study Design

Field surveys were completed at 69 sites located on mapped and some unmapped (i.e., field identified) watercourses within the local study area (Figure 2-1). These sites included both potential impact and reference sites for comparison purposes. The field surveys were completed in four seasonal assessment programs: August 2007, October 2007, April 2008, and July 2009.

The objectives of the field sampling program were to characterize physical habitat characteristics; determine fish presence; measure the size and weight of individual fish, collect fish ageing structures; and obtain fish tissue for analysis of metal concentrations. A summary of the sampling activities conducted during each of the seasonal assessment programs is provided below.

Program 1: August 2007

- Collection of biophysical watercourse data including fish habitat characteristics
- Mapping and sampling of unknown watercourses
- Determination of fish presence through various sampling methods (electrofishing and minnow trapping)
- Estimates of fish population density through electrofishing depletion surveys
- Determination of fork length (mm) and weight (g) of fish captured
- Lethal sampling of fish to analyze for metal concentrations in tissue samples and collect fish ageing structures.

Program 2: October 2007

- Collection of biophysical watercourse data including fish habitat characteristics
- Watercourse surveys to determine fish occurrence and distribution during early fall
- Determination of fork length (mm) and weight (g) of fish captured.

Program 3: April 2008

- A large pool on Haggart Creek was identified as potential Arctic grayling overwintering habitat during the August 2007 survey. The April 2008 sampling program was conducted to determine if Arctic grayling utilize this pool as overwintering habitat.
- Determination of fork length (mm) of fish captured.

Program 4: July 2009

- Collection of biophysical watercourse data including fish habitat characteristics at all road crossings and road encroachment locations (within 30m of top of bank)
- Determination of fish presence through various sampling methods (electrofishing, minnow trapping, snorkel surveys, angling, visual observation)
- Determination of fork length (mm) and weight (g) of fish captured
- Estimate of the Dublin Gulch fish population density by electrofishing depletion surveys.

Most fish bearing watercourses within the local study area (Dublin Gulch, Ironrust, Haggart, and Lynx Creek watersheds) were sampled three times (during Programs 1, 2, and 4); however, the large man-made pool on Haggart Creek was sampled twice (Programs 3 and 4). The sites surveyed during October 2007 (Program 2) were Haggart Creek (HC1, 2, and 3), Lynx Creek (L1), and Ironrust Creek (IR2).

An overview of the methods used for the fish habitat assessments is provided below.

2.4 Biophysical Habitat Characteristics

2.4.1 *In situ* Water Quality

In situ water quality parameters that directly affect the quality of habitat for fish were collected during seasonal assessment programs 1, 2, and 4. A YSI 85 multi parameter water quality meter was used to measure dissolved oxygen (% and mg/L), temperature (°C), and conductivity (µs/cm). A Hanna™ pHTestr 30™ ‗pen' and a Hanna™ Combo Meter™ were used to collect pH data. All instruments were calibrated according to the manufacturer's instructions prior to the field program. As there are no water quality guidelines for the Yukon Territory, results are evaluated using Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life (CCME 2007) or British Columbia Ministry of Environment (BC MoE) guidelines (2006) where CCME guidelines for specific parameters do not exist.

2.4.2 Habitat Surveys

As the Yukon Territory does not have its own set of published watercourse sampling guidelines, sampling programs utilized a customized version of the field protocols outlined in *Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures* (v. 2.0; BCMSRM 2001) established by the British Columbia Ministry of Sustainable Resource Management, Resource Inventory Standards Committee (RISC). This customized protocol included the collection of

additional biophysical information such as more detailed channel bed material composition and fish habitat descriptions. Associated RISC manuals (BCMSRM 1997), Forest Practices Code (FPC) guidebooks (MoF 1995, 1998), and relevant field guides were also consulted.

Sampled watercourses and road crossing sites without any evidence of a channel bed or banks (i.e., no evidence of scour or deposits of mineral alluvium caused by water) were classified as having no visible channel (NVC). Sampled watercourses and road crossing sites that did not have a continuously defined channel bed (i.e., less than 100 m long) and appeared to contain water only during precipitation events were defined as non classified drainages (NCD) (MoF 1998). These watercourses are not considered to be fish habitat.

Generally, 400 m of stream channel was surveyed at sites where a defined channel with continuous channel banks and evidence of channel bed scour were observed. At sites classified as NVC or NCD a minimum sampling length of 50 m was surveyed (Appendix A). Site sampling lengths were a minimum of six channel widths long at all sites. As habitat features of watercourses are typically repeated approximately every six channel widths, this sampling distance ensures that all representative habitat types are sampled (BCMSRM 2001).

The following physical attributes were assessed to characterize watercourse conditions and fish habitat:

- Watercourse length
- Fish cover (provides hiding, resting or feeding places for fish)
- Bankfull and residual pool depths
- Stream stage
- Crown closure
- Bank shape and textures
- Turbidity
- Dominant and subdominant bed materials
- Bed material D95 and D (refers to particle size)
- Channel morphology
- Disturbance indicators.

Additional habitat features that were identified and recorded were obstructions to fish passage, fisheries sensitive zones (e.g., flood channels and depressions, ponds, or swamps and sloughs), and any other special features (e.g., culverts, beaver dams, logjams). Watercourse characteristics were documented through upstream, downstream, and stream bank photographs (Appendix A).

Based on all the biophysical data collected above, fish habitat quality for Arctic grayling was characterized at each fish bearing watercourse for specific life history functions (rearing, overwintering, spawning, migration, and stageing/holding potential). A grade of nil, poor, moderate, good, or excellent was assigned to each function of habitat based on the assessed quality of fish habitat and its potential to support Arctic grayling production. Habitat quality for slimy sculpin was not specifically assessed as part of this study. Slimy sculpin was selected as an alternative study species to Arctic grayling for long term monitoring of fish population characteristics and metal levels in tissue.

All field data were recorded in the field on modified RISC site cards, entered into a spreadsheet, and summarized in site summary tables (Appendix A).

2.5 Fish Sampling

Depletion surveys, described in section 2.5.1, were conducted to estimate fish density at all sites in known or suspected fish bearing watercourses (Haggart, Ironrust, and Lynx creeks and lower Dublin Gulch) (Figure 2-1, 2-2, 2-3 and, 2-4). At the remaining sites (i.e., watercourses that were suspected to be non-fish bearing) single pass (i.e., non depletion) surveys were performed to test for fish presence (described in section 2.4.2). If fish were found in watercourses assumed to be non fish bearing, depletion surveys were employed.

The primary sampling method was backpack electrofishing using a Smith-Root Model LR24 electrofisher. Sampling of deeper habitats, where backpack electrofishing might be less effective, was done using minnow traps, gillnets, and/or angling. Fish collection methods, gear specifications, and identification of captured fish were recorded on RISC fish collection forms. Fish were identified using the *Field Key to the Freshwater Fishes of BC, Region 5 - Yukon* (McPhail and Carveth 1993).

The following biological data were collected from Arctic grayling and slimy sculpin captured in waterbodies in the local study area during all sampling programs[1]:

- Fork length (to the nearest 1 mm) for Arctic grayling and total length (to the nearest 1 mm) for slimy sculpin
- Whole weight (to the nearest 0.1 g).

As part of the August 2007 sampling program, scales and otoliths were removed from sub samples of Arctic grayling and slimy sculpin respectively, and sent to Hamaguchi Fish Ageing Services in Kamloops, BC to determine fish age. Samples that were not confidently aged by Hamaguchi Fish Ageing Services were independently analyzed by two Stantec fisheries biologists experienced in assessing fish ageing structures in an attempt to reach a consensus on a given age. If the two fisheries biologists could not agree on an age, the result was not used in further analyses. Of the 105 fish sampled for ageing structures only two could not be aged confidently enough to use (Appendix F).

Fish tissue sampling was conducted to analyze for the concentrations of metals in muscle and liver tissues. All fish samples were sent to ALS Environmental Laboratories (Vancouver) to perform dissections and analyses for a total of 30 metals. The suite of metals analyzed included that of previous fish sampling programs (Hallam Knight Piésold Ltd. 1995, 1996a,b) as well as Hg, Ni, As, Cd, and Se as these metals are known to pose potential health risks when present above concentrations outlined in tissue quality guidelines for human consumption of fish tissue (BC MoE 2006).

All fish sampling information was recorded in the field on RISC fish collection cards, entered into a spreadsheet, and summarized in site summary tables (Appendix A).

[1] The whole weight of fish sampled during program 3 was not measured because of equipment malfunctions.

2.5.1 Depletion Survey

Fish density was estimated using a multiple pass depletion technique that involved backpack electrofishing within enclosed sites. Field crews chose to enclose sampling sections that were representative of the reach and attempted to include portions of each mesohabitat type present. As a result, the electrofishing depletion survey length was typically 100 m, and varied from 55 m to 116 m. Stream wetted width measurements were taken for each enclosure to calculate the total area of stream enclosed. Electrofishing was conducted along the entire length of the enclosed area for a total of two, three, or four passes depending on how effectively fish density was depleted by previous passes. Each pass involved sampling the entire enclosed section in one direction. Fifteen minute rest periods were taken between each successive pass to allow remaining fish to recover. Effort (i.e., the total number of electrofishing seconds) and catch (i.e., the number of each fish species captured) for each pass were recorded on field cards. All fish were retained in holding buckets filled with ambient stream water and released at the site following the last sampling pass and physical data collection (with the exception of those retained for tissue analysis).

Enclosure of depletion survey sites was accomplished by the placement of a 10 m long and 1.5 m high, ¼ inch mesh stop net across the upstream and downstream ends of the stream section sampled. The nets were secured in place by tying each end to sturdy trees on the stream bank and installing rebar posts embedded in the stream substrate. The downstream stop net was installed first and field crews walked on the steam bank where possible prior to installing the upstream stop net so as not to frighten fish from within the section. To ensure a constant seal between the net and stream channel, leadlines attached to the bottom of each net were weighted down using large rocks.

2.5.2 Fish Presence

Sampling for fish presence was conducted over a minimum of 200 m stream length, or ten times the average channel width, whichever was greater. As habitat features of watercourses are typically repeated approximately every six channel widths, this sampling distance ensures that all representative habitat types are sampled (BCMSRM 2001).

While the sampling effort included all habitat types, increased effort was expended in areas that typically provide refuge for fish (e.g., pools, undercut banks, submerged logs, boulder cover, overhanging vegetation). Electrofishing was performed both upstream and downstream of fish barriers (e.g., perched culverts or falls/cascades). Fish trapping using Gee type traps was conducted at sites where water was too deep to permit effective electrofishing. Traps were baited with canned salmon and allowed to fish overnight for a minimum of 17 hours. During the July 2009 field program, fish presence was also assessed by fly fishing in many of the ponds and large pools in the local study area.

Two, three panel gill nets of variable mesh size (¾ to 3 inch) were used to sample Arctic grayling from a large pool on Haggart Creek (located approximately halfway between sites HC1 and HC2) during the April 2008 sampling program (Figure 2-2). The first net was 45 m in length and comprised three, 15 m panels; the second net was 60 m in length and comprised four 15 m panels. However,

approximately 5 m of each net (2.5 m on either end) were used to anchor the net in the water and, as a result, did not actively fish the pool.

2.5.3 Fish Tissue Sampling

A total of 21 Arctic grayling and 53 slimy sculpin were sampled to analyze for the concentrations of 30 metals in their tissue (Appendix B). Fish were euthanized, placed in individual, clean, sealed plastic bags, appropriately labeled, placed in coolers with pre frozen gel packs, and shipped to ALS Environmental (Vancouver, BC) for dissection and analysis. For Arctic grayling, all metals except mercury were analyzed in both muscle and liver tissue. Mercury was analyzed in muscle tissue only, given the relevance of edible tissue for human consumption and that mercury tends to bioaccumulate in muscle. Liver is the main organ of interest for the other metals, as they tend to accumulate in the liver. For the much smaller slimy sculpin, whole fish were analyzed for metals (except mercury) and a composite of several fish was often created to provide at least 50g of tissue for analysis, as required by the laboratory.

All tissue samples were collected during assessment program 1 (August 2007) at six sites located in Lynx, Haggart and Ironrust creeks, and in Dublin Gulch (Appendix B). Arctic grayling with a fork length greater than 170 mm were preferentially selected to provide an adequate amount of liver and muscle tissue for analysis. However, due to low Arctic grayling densities at most sites, smaller sized fish were sometimes selected (minimum length = 74.4 mm from Lynx Creek [L1]). In addition, due to low fish densities, the number of Arctic grayling sacrificed at each site for metals analysis was low (Lynx Creek – n=5; Dublin Gulch – n=9; Haggart Creek – n=7) (Appendix B).

Tissue samples (whole fish) from slimy sculpins were composited into a single sample for each watercourse due to their small size (minimum length = 46.6 mm from Haggart Creek [HC1]). For Haggart Creek, Lynx Creek and Ironrust Creek, whole fish analyses were based on composites of three size classes of slimy sculpin. No analysis of Dublin Gulch slimy sculpin was conducted, as members of this species were not captured in Dublin Gulch during the August 2007 assessment and insufficient fish (n=4, less than 50g of tissue) were captured during the July 2009 assessment.

Sampling methods followed guidelines provided by RISC (BCMSRM 2001). Fish were predominantly captured by electrofishing; however, minnow traps and gill nets were also utilized. Details regarding laboratory analytical techniques are provided in Section 2.6.3.1.

2.5.4 Collection Licenses

Pursuant to Part VII of the federal Fishery (General) Regulations, licenses to collect fish for scientific purposes were obtained from Fisheries and Oceans, Yukon/Transboundary Rivers Area for the 2007, 2008, and 2009 sampling programs: license numbers CL-07-66, CL-08-05, and S-09/10-1025-NU-A1, respectively (Appendix C).

The fisheries sampling programs in 2007 and 2008 also required a license under the *Yukon-Canada Scientists and Explorers Act*. License numbers 07-99S&E were granted by the Cultural Services Branch - Heritage Resources Unit of the Yukon Tourism and Culture office. Policy changes to the *Yukon-Canada Scientists and Explorers Act* in 2009 eliminated the need for a permit for the July 2009 field program and as a result no permit was issued.

All conditions of each license and reporting requirements were met. Copies of each license are included in Appendix C.

2.6 Analysis

2.6.1 Watercourse Fish Bearing Status

According to the BC Forest Practices Code's (FPC) *Riparian Management Area Guidebook (RMAG)* (MoF 1995), a stream can be classified as non fish bearing if it:

- Has an average gradient of >20%
- Is located upstream of a permanent barrier to upstream fish passage
- No perennial fish habitat exists upstream of the barrier (e.g., a headwater lake)
- Fish absence has been demonstrated upstream of the barrier using an acceptable fish survey.

Examples of permanent barriers to upstream fish passage include falls, cascades, and stream gradients greater than 20%. While there is no specific height criteria for barriers, factors such as splash pool depth, potential species presence, water drop height, and professional judgment were all considered before determining barrier status. Barriers that are not considered permanent (i.e., temporary barriers) include beaver dams, logjams, and culverts (MoF 1998).

Fish bearing status was applied only to the sampled reach and not to the entire stream. Therefore stream classification may change upstream or downstream if channel characteristics (e.g., morphology) change or if a barrier is encountered. When dry stream channels were encountered, the likelihood of temporary fish presence was inferred based on the distance and connectivity to known fish bearing watercourses, the presence of downstream barriers, and professional judgment.

2.6.2 Fish Population Characteristics

2.6.2.1 Fish per Unit Area

For sites where fish depletion surveys were completed, estimates of fish density per unit area sampled (fish/100 m^2) were calculated for Arctic grayling and slimy sculpin using both total catch rates and depletion estimates of total abundance.

Total fish abundance at a site was estimated based on the depletion survey data using methods outlined in Zippen (1958) and the Microfish 3.0© software program for Windows (Microfish 2008). Confidence intervals (95%) were also developed to determine the range of estimated fish density and to determine variability.

Predicted fish density could only be calculated for watercourses where the depletion survey results followed a decreasing removal pattern. Although it is unlikely that all fish were caught in any depletion survey, the pattern of depletion at most sites was strong and consistent enough to effectively estimate fish abundance.

2.6.2.2 Fish Size, Condition and Age

Fish size and condition were determined for all Arctic grayling and slimy sculpin captured from all watercourses sampled within the local study area. Fish ages were determined by analyzing fish ageing structures collected from Arctic grayling and slimy sculpins captured in the local study area. Arctic grayling ages were determined by analyzing the scales of 45 fish captured from Dublin Gulch, Haggart Creek, Lynx Creek, and Ironrust Creek. Otoliths were analyzed to determine the age of 58 slimy sculpin captured from Haggart Creek, Lynx Creek, and Ironrust Creek. One sample from Ironrust Creek (IR2) was not included in the data, as the otolith could not be confidently aged. The following analyses were completed:

- Species specific length at age relationships (i.e., population growth curves) and length frequency relationships
- Length frequency histograms for each species and watercourse
- Relative condition factor for each species and watercourse.

Fish population growth patterns (i.e., the average length of fish in each age class) were represented using a Von Bertalanffy growth model according to the following equation:

$$L_t = L_\infty \ (1-e^{(-K(t-t_o))})$$

where:

L_t = length (mm) at age t

L_∞ = mean length (mm) of a fish if it were allowed to grow infinitely

K = growth constant ($year^{-1}$)

t_o = age of fish at zero length (Pauly 1984).

Length data were also used to create length frequency histograms. These histograms provide insight into the rates of reproduction, growth, and mortality within a population, since from the relative abundance of fish in each length class we can infer the age structure of the population.

The relationship between weight and length was represented by the power function:

$$W = a\ L^b,$$

where:

W is weight (g)

L is length (mm)

a and b are parameters.

Linear regression was used to estimate parameters *a* and *b*, after making the power function linear using logarithmic transformation (Anderson and Neumann 1996). A value of 3 for parameter "*b*" indicates that growth is isometric (i.e., fish shape does not change as it grows).

Relative condition was chosen as an index of fish health, instead of the more commonly used Fulton's condition (K), because the length and weight data suggested that the growth pattern of Arctic grayling was positively allometric (i.e., they appeared to become more rotund in shape with increasing length). A linear regression analysis on the Arctic grayling length and weight data confirmed a statistically significant relationship between Fulton's condition (K) and length ($P<0.05$). As such, relative condition factor was used instead and was calculated according to the following equation:

$$K_n = (W/Wi)$$

where:

W is the actual weight (g) of the individual fish, and

Wi is the mean length specific weight (g) predicted for that individual fish based on its actual length (mm) and the length weight equation calculated for all Arctic grayling captured.

Fish that have a K_n value greater than 1.0 are considered to have a better nutritional state of health, whereas fish with a value less than 1.0 are considered to be less healthy in comparison (Anderson and Neumann 1996).

All statistical analyses were performed using JMP-IN Version 8.0.1™ software (Appendix D).

2.6.3 Metals in Fish Tissue

2.6.3.1 Laboratory Analysis

ALS Environmental analyzed Arctic grayling (muscle and liver samples removed at the lab) and slimy sculpin (whole fish) tissues for a total of 30 metals. Fish gender was not determined at the lab during dissections. Samples were either analyzed using Inductively Coupled Plasma Mass Spectrometry (ICPMS) or Inductively Coupled Plasma Optical Emission Spectrophotometry (ICPOES). Mercury (Hg) was analyzed by Cold Vapour Atomic Fluorescence Spectrometry (CVAFS).

Laboratory analyses were carried out using procedures adapted from *Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples* prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority (1995). Analytical methodologies used by ALS Environmental are presented in Appendix B.

2.6.3.2 Data Analysis and Interpretation

As there are no specific guidelines relating to metal concentrations in fish tissue for the Yukon Territory, analytical results for Arctic grayling were compared to a number of reference concentrations reported in the literature:

- A report on metal levels in Arctic grayling muscle and liver tissue from 54 uncontaminated lakes in British Columbia (Rieberger 1992)
- The tissue quality guidelines for human consumption of fish tissue (BC MoE 2006), which lists maximum human consumption concentrations for selenium and mercury
- The US Environmental Protection Agency's Environmental Residue-Effects Database (ERED) on biological effects and contaminant concentrations in fish species (ERED 2008) for metals not listed by Rieberger (1992) or BC MoE (2006). Where data for Arctic grayling were not listed in ERED, species as similar as possible were used (in some cases data from only one test species were available).

There are no applicable guidelines or reference values available specifically for metals levels in slimy sculpin tissue, although BCMoE (2006) provides interim guidelines for selenium in fish tissue. Results for metals were compared among sites.

Results presented in Rieberger (1992) are useful as indicators of metal concentrations in tissues of fish from lakes considered unaffected by human activity, while values from ERED are related to scientifically derived effects and are important for interpreting potential impacts of metals on fish from waterbodies affected by mining activities. The BCMoE guidelines are designed to protect the aquatic environment as well as human health.

Mercury levels in fish muscle increase with increasing age, size and weight of fish. The relationships between mercury levels and fish length in Arctic grayling muscle tissue were characterized and compared among sample sites. Statistical analyses were performed using Statgraphics™.

2.6.3.3 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) was an integral part of the field work during the fish tissue metal assessment. Standardized procedures were implemented in the field, and included the following practices:

- Data for each site were recorded on standardized RISC cards
- All sample bags of fish were carefully labelled and recorded on ALS Environmental Chain of Custody forms
- Trained personnel completed sampling and operated equipment according to prescribed methods, with strict adherence to protocols (example, BCMSRM 1997)
- Samples were kept frozen as specified for the type of sample
- Samples were delivered to the laboratory within the specified period (fish were frozen).

Standard QA/QC procedures were followed throughout all laboratory analyses; these practices included the use of replicate sample analysis, quality control samples, and calibration checks.

3 RESULTS

Field surveys were conducted at 69 sites within the local study area (Figure 2-1). These sites are situated within five main watersheds: Lynx Creek, Haggart Creek, Ironrust Creek, Dublin Gulch, and South McQuesten River. The locations of some watercourse have changed from their original base map locations due to historical placer mining operations. The current watercourse alignments are presented in Figure 2-1 and in greater detail in Figures 2-2, 2-3 and, 2-4.

3.1 Review of Existing Literature

Previous studies conducted in the vicinity of the Eagle Gold local study area were reviewed to identify data gaps and ensure all data gaps were filled by the field study design. Fisheries related reports prepared by Hallam Knight Piésold Ltd. (1996a, b) were reviewed and the fish presence data from those studies, along with data collected by Stantec (formerly Jacques Whitford AXYS) in 2007, 2008, and 2009, are presented in Figure 2-1. After reviewing previous work (pre 1998) conducted by others for the Dublin Gulch Project, the following data gaps were identified:

- **Spatial sampling gaps**—watercourses in the Dublin Gulch watershed, Ironrust Creek, and Lynx Creek were not sampled
- **Temporal sampling gaps**—no investigation of Arctic grayling fall and winter distributions or local migration patterns was performed
- **Fish tissue sampling gaps**—the following metals were not included in the 1996 suite of analysis: Ni, As, Cd, and Se
- **Repeat sampling gap**—sampling was only conducted during one season
- **Historical sampling gap**—some watercourse alignments and fish distribution have changed as a result of placer mining activities in the local study area between 1996 and the present.

Each of the indentified sampling gaps were incorporated by Stantec into a multi season, multi year (2007 to 2009) study design, which has resulted in a comprehensive examination of baseline fish and fish habitat in areas associated with the Project. Results of the baseline studies conducted by Stantec are detailed in the sections that follow.

3.1.1 Review of Fish Species at Risk

There are no freshwater fish species in the Yukon Territory that are included on Schedules 1 or 2 of the Federal *Species at Risk Act* (SARA) (GoC 2008).

3.2 Biophysical Habitat Characteristics and Fish Presence

3.2.1 *In Situ* Water Quality

A total of 55 water quality sampling events were completed at 47 sampling sites between 2007 and 2009 (Appendix A). Unreliable data resulting from equipment failure at Eagle Pup Placer Ponds 2 and 3 are not presented.

Mean watercourse temperatures in the local study area varied by month and year. In summer months mean temperatures ranged from 7.2°C (n=16; range =1.5 – 13.2°C) in August 2007 to 10°C (n=30; range 1.8 – 19.0°C) in July 2009. Mean winter temperatures ranged from 0.3°C taken at one site in April 2008 under ice, to 0.6°C (n=8; range=0 – 2.4°C) in October 2007.

Eight of the 55 water sampling sites had water temperatures exceeding 12°C, which is the maximum daily water temperature for Arctic grayling rearing streams, according to the British Columbia MoE water quality guidelines for the protection of aquatic life (BC MoE 2006). Seven of these water temperature exceedances were measured during the July 2009 sampling program in Haggart Creek (two sites), Haldane Creek, North Star Creek, South McQuesten River, and in two previously unmapped watercourses (RC1, RC3). The only temperature exceedance was measured in August 2007, and occurred in Stuttle Gulch. There are no federal guidelines establishing water temperature tolerance criteria for fish.

Apart from water temperature, all water quality parameters measured were generally similar among watercourses in the local study area (Appendix A). Mean conductivity was 275.8µS and ranged from 70 – 740µS with a standard deviation (SD) of 131.6. There are no territorial, provincial or federal water quality guidelines for the protection of aquatic life relating to conductivity. Measurements of pH show a slightly alkaline mean value of 8.02 and range from 6.2 – 9.0 (SD=0.4). Stuttle Gulch (pH of 6.2) was the only watercourse that had a pH level outside the range specified by CCME water quality guidelines for the protection of aquatic life (pH 6.5 to 9.0) (CCME 2007). Dissolved oxygen concentrations ranged from 6.7 – 13.4 mg/L with a mean value of 10.6 mg/L (SD=1.2). All sites exceeded CCME guidelines for minimum dissolved oxygen concentrations for cold water biota (6.5 to 9.5 mg/L; CCME 2007).

Water quality values in the fish bearing portion of Dublin Gulch were similar to those measured at most watercourses within the local study area. Conductivity, pH, and dissolved oxygen levels did not vary significantly among seasons and temperature measurements show a typical seasonal variation (7.7-11.4°C in the summer months and 0°C in winter months).

3.2.2 Physical Habitat Characteristics

The following section summarizes biophysical habitat characteristics observed at the 69 field sites that were sampled (Table 3-1). Mean channel widths were:

- <1.5 m for 14 sites
- 1.5 m to 5 m for 10 sites
- 5 m to 20 m for 25 sites

- >20 m for two sites
- No defined channel at 18 sites.

Of the 25 streams with mean channel widths from 5 m to 20 m, 12 were the road encroachment sites along Haggart Creek (RE1 – RE12).

Channel gradients at all sites averaged 10% and ranged from 1 to 28%. With the exception of Lynx Creek (L1) and South McQuesten River (RC11), all sites had low residual pool depths of <0.8 m. As all ice depths measured during the April 2008 program were ≥ 0.8 m, sites with pool depths less than 0.8 m would likely freeze solid in winter months (Photo 3-1). Watercourse channel beds were primarily dominated by cobble substrates. Total cover ranged from trace (<5%) to abundant (>20%), with the majority of sites (25 of 69) having abundant cover (>20%) (Appendix A).

The Dublin Gulch watershed and the upper reaches of the Haggart creek watershed have been heavily impacted by placer mining activity. As a result the width and integrity of the existing the riparian forest in most of these areas is on average narrow or nonexistent and composed mostly of small shrubs. The riparian forest along of the right bank of Haggart creek (looking downstream) has also been affected by the site access road in areas where the road encroaches with 30 m of the stream bank (sites RE1-RE12, Appendix A). In areas that have not been affected by placer mining or by the existing access road, the riparian forest was greater than 30 m in width and composed of mature Subalpine forest dominated by spruce, willow and birch.

The 18 sites with no defined channel all had evidence of flow in the form of a culvert, road scour, or an excavated ditch, with the exception of RC9 (Appendix A). These 18 sites had no defined banks or scoured channel beds. The majority (15 sites) are road crossing sites (Appendix A).

While the mean gradient at all streams was relatively low (<10%), Eagle Pup (EP1) and Platinum Gulch (PG2 – new) had average gradients greater than 16%, and are considered to have a low probability of containing fishes (MoF 1998). Stuttle Gulch (SG1), Olive Gulch (OG2), and Eagle Pup (EP2) had average gradients greater than 20%, and are considered to have no probability of containing fishes.

Table 3-1: Summary of Biophysical Habitat Characteristics for All Sampling Sites within the Local Study Area

Site	Mean Channel Width (m)	Fish bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over wintering Habitat Quality
Ann Gulch (AG1)	1.02	Non fish bearing	–	–	–
Ann Gulch (AG2)	0.63	Non fish bearing	–	–	–
Bawn-Boy Gulch (BB1)	2.03	Non fish bearing	–	–	–
Bawn-Boy Gulch (BB2)	0.7	Non fish bearing (NFC)	–	–	–
Bighorn Creek (RC10)	2.6	Inferred fish bearing	Good	Excellent	Moderate
Cadillac Creek (RC12)	8.4	Inferred fish bearing	Poor	Poor	Nil
Cascallen Gulch (CG1)	0.68	Non fish bearing	–	–	–
Dublin Gulch (DG1)	3.6	Fish bearing (GR)	Poor	Moderate	Poor

Site	Mean Channel Width (m)	Fish bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over wintering Habitat Quality
Dublin Gulch (DG1.1)	5.58	Fish bearing (GR, CCG)	Poor	Moderate	Poor
Dublin Gulch (DG1.2)	7.9	Fish bearing (GR)	Poor	Moderate	Poor
Dublin Gulch (DG1.3)	7.07	Fish bearing (GR)	Poor	Moderate	Poor
Dublin Gulch (DG2)	3.73	Non fish bearing	–	–	–
Dublin Gulch (DG3)	3.16	Non fish bearing (NFC)	–	–	–
Eagle Pup (EP1)	1.47	Non fish bearing	–	–	–
Eagle Pup (EP2)	1.07	Non fish bearing	–	–	–
Eagle Pup Placer Pond 1	N/A	Fish bearing (GR, CCG)	Poor	Moderate	Poor
Eagle Pup Placer Pond 2	N/A	Fish bearing (NFC)	Poor	Moderate	Poor
Eagle Pup Placer Pond 3	N/A	Non fish bearing	–	–	–
Haggart Creek (HC1)	11.32	Fish bearing (GR, CCG)	Moderate	Excellent	Good
Haggart Creek (HC2)	9.2	Fish bearing (GR, CCG)	Moderate	Moderate	Moderate
Haggart Creek (HC3)	6.47	Fish bearing (GR, CCG)	Moderate	Excellent	Good
Haggart Creek (HC4)	8.2	Fish bearing	Nil	Poor	Nil
Haggart Creek (HC5)	17.7	Fish bearing (GR,CCG,BB)	Moderate	Moderate	Poor
Haggart Creek (RC24)	12	Fish bearing (GR)	Excellent	Moderate	Poor
Haggart Creek (RE1)	16.9	Fish bearing	Good	Excellent	Good
Haggart Creek (RE10)	8.2	Fish bearing	Good	Excellent	Good
Haggart Creek (RE11)	11.3	Fish bearing	Moderate	Excellent	Excellent
Haggart Creek (RE12)	12.5	Fish bearing	Nil	Nil	Nil
Haggart Creek (RE2)	18.2	Fish bearing	Good	Good	Poor
Haggart Creek (RE3)	19.5	Fish bearing	Good	Good	Moderate
Haggart Creek (RE4)	18.8	Fish bearing	Moderate	Moderate	Moderate
Haggart Creek (RE5)	17	Fish bearing	Good	Good	Moderate
Haggart Creek (RE6)	18.6	Fish bearing	Good	Excellent	Moderate
Haggart Creek (RE7)	19.8	Fish bearing	Good	Excellent	Moderate
Haggart Creek (RE8)	15.8	Fish bearing	Excellent	Excellent	Moderate
Haggart Creek (RE9)	14	Fish bearing	Good	Excellent	Poor
Haldane Creek (RC5)	6.65	Fish bearing	Good	Excellent	Good
Ironrust Creek (IR2)	4.1	Fish bearing (GR, CCG)	Moderate	Good	Poor
Lynx Creek (L1)	8.02	Fish bearing (GR, CCG)	Good	Excellent	Excellent
Lynx Creek (L4)	6.05	Fish bearing (GR, CCG)	Moderate	Good	Moderate
No visible drainage (RC9)	NVC	Non fish bearing	–	–	–
North Star Creek (RC6)	0.98	Fish bearing	Nil	Good	Good
Olive Gulch (OG1)	2	Non fish bearing	–	–	–
Olive Gulch (OG2)	NVC	Non fish bearing	–	–	–

Site	Mean Channel Width (m)	Fish bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over wintering Habitat Quality
Platinum Gulch (PG1 – historic)	0.7	Non fish bearing	–	–	–
Platinum Gulch (PG2 – new)	0.9	Non fish bearing	–	–	–
Platinum Gulch (PG3)	2.13	Non fish bearing	–	–	–
Secret Creek (RC14)	28.6	Fish bearing (GR)	Good	Moderate	Moderate
Secret Creek side channel (RC13)	4.0	Inferrred non fish bearing	–	–	–
South McQuesten River (RC11)	38.8	Fish bearing (CH,GR,BB,CCG,LSU)	Excellent	Excellent	Excellent
Stewart Gulch (ST1)	1.42	Non fish bearing	–	–	–
Stewart Gulch (ST2)	1.86	Non fish bearing	–	–	–
Stuttle Gulch (SG1)	1	Non fish bearing	–	–	–
Stuttle Gulch (SG2)	0.4	Non fish bearing			
Tributary to Eagle Pup Placer Pond 2	0.75	Fish bearing (CCG)	Poor	Moderate	Nil
Unnamed Culvert (RC1)	2.5	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC15)	1.2	Inferred fish bearing	Nil	Poor	Nil
Unnamed Culvert (RC16)	0.8	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC17)	NCD	Inferred non fish bearing			
Unnamed Culvert (RC18)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC19)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC2)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC20)	NCD	Inferred fish bearing	–	–	–
Unnamed Culvert (RC21)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC22)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC23)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC3)	N/A	Inferred fish -bearing	Nil	Poor	Nil
Unnamed Culvert (RC4)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC7)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC8)	N/A	Inferred fish bearing	–	–	–
Platinum Gulch (PG2 – new)	0.9	Non fish bearing	–	–	–
Platinum Gulch (PG3)	2.13	Non fish bearing	–	–	–
Secret Creek (RC14)	28.6	Fish bearing (GR)	Good	Moderate	Moderate
Secret Creek side channel (RC13)	4.0	Inferrred non fish bearing	–	–	–
South McQuesten River (RC11)	38.8	Fish bearing (CH,GR,BB,CCG,LSU)	Excellent	Excellent	Excellent
Stewart Gulch (ST1)	1.42	Non fish bearing	–	–	–
Stewart Gulch (ST2)	1.86	Non fish bearing	–	–	–
Stuttle Gulch (SG1)	1	Non fish bearing	–	–	–
Stuttle Gulch (SG2)	0.4	Non fish bearing			

Site	Mean Channel Width (m)	Fish bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over wintering Habitat Quality
Tributary to Eagle Pup Placer Pond 2	0.75	Fish bearing (CCG)	Poor	Moderate	Nil
Unnamed Culvert (RC1)	2.5	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC15)	1.2	Inferred fish bearing	Nil	Poor	Nil
Unnamed Culvert (RC16)	0.8	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC17)	NCD	Inferred non fish bearing			
Unnamed Culvert (RC18)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC19)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC2)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC20)	NCD	Inferred fish bearing	–	–	–
Unnamed Culvert (RC21)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC22)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC23)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC3)	N/A	Inferred fish bearing	Nil	Poor	Nil
Unnamed Culvert (RC4)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC7)	NCD	Inferred non fish bearing	–	–	–
Unnamed Culvert (RC8)	N/A	Inferred fish bearing	–	–	–

NOTES:
NCD = Non classified drainage
NVC = No visible channel
N/A = data not available
—= not applicable
M = moderate (5-20%)
LSU = longnose sucker
CH = Chinook salmon
GR = Arctic grayling
CCG = slimy sculpin
BB = burbot
NFC = no fish captured

3.2.3 Barriers to Fish Passage

Seven barriers to fish passage, including discontinuous channels, no visible channels, high gradient velocity barriers (>20%), or falls/cascades, affected nine watercourses within the local study area (Figure 2-2). Barriers observed during the field surveys included:

- A 35% gradient barrier section on Ann Gulch (AG1) immediately upstream from the confluence with Dublin Gulch
- A 20 m high cascade barrier on Dublin Gulch (DG2) (Photo 3-2). This barrier prevents fish passage upstream from this point. Tributaries upstream from this barrier (Bawn-Boy Gulch, Cascallen Gulch, Olive Gulch, and Stewart Gulch) were presumed and later confirmed to be non fish bearing.
- A culvert barrier and 45% gradient barrier on Eagle Pup (EP1) (Photo 3-3). The culvert prevents fish passage, and as a result, Eagle Pup Placer Pond 3, Stuttle Gulch, and Eagle Pup are non fish bearing.

- A subsurface flow barrier on Platinum Gulch (PG1)
- A 20% gradient barrier on Platinum Gulch (PG2)
- A 20% gradient barrier on Stuttle Gulch (SG1)
- A 20% gradient barrier on the Tributary to Eagle Pup Placer Pond 2.

3.2.4 Fish Presence and Watercourse Fish Bearing Status

Extensive fish sampling effort was expended during the field programs at 33 sites with sufficient water flow. This included:

- 48,186 electrofishing seconds expended at 25 sites (includes depletion and non depletion surveys)
- Two to four minnow traps, set for an average of 24 hours each, at each of seven sites (Haggart Creek [HC1], Unnamed culvert [RC3], Haldane Creek [RC5], North Star Creek [RC6], and at Eagle Pup Placer Ponds 1, 2, and 3)
- Two gill nets set for an average of 17 hours at the large pool on Haggart Creek.

In total, 38 of the 69 sampling sites were assessed as actually or potentially fish bearing. These 38 sampling sites are located in ten watercourses, all of which support Arctic grayling and/or slimy sculpin (with the exception of site RC3) (Photo 3-4).

Common characteristics of these 10 fish bearing watercourses included no downstream barriers to upstream fish passage and larger catchment areas, higher base flows, and higher physical habitat quality relative to the average non fish bearing watercourse surveyed.

The remaining 31 sampling sites were assessed as non fish bearing due to the presence of a permanent barrier to fish passage (cascades, high gradient, subsurface flow, etc.) and because fish were not captured during multiple sampling periods. Electrofishing was conducted in Platinum and Stuttle Gulches in 2009 as a second season of sampling to confirm the absence of fish. Continuous stretches of 200 to 500 m Dublin Gulch and Eagle Pup were sampled immediately above barriers to fish passage in 2009 and 2010, to confirm their impassibility to fish.

Previous studies reported the presence of Chinook salmon (*Oncorhynchus tshawytscha*) in Haggart Creek (Madrone 1996; Hallam Knight Piésold 1995, 1996a,b). In the current study, Chinook salmon were not captured at any of the Haggart creek sites during any of the four sampling programs.

Those studies also reported the presence of Chinook salmon in the South McQuesten River, which was confirmed by the sighting of juvenile Chinook (est. age 1+) during a snorkel survey of the South McQuesten River at the access road crossing on July 23, 2009 (Photo 3-5). During the snorkel survey, no adult spawning Chinook or Chinook redds were observed which may be attributed to the timing of the survey, or low to nil returns.

3.2.5 Fish Habitat Quality

General notes were recorded on fish habitat quality at each of the 38 fish bearing sites in the local study area. Habitat quality notes were not recorded at non fish bearing sites.

Habitat quality in the ten fish bearing streams varied from nil to excellent, depending on the biophysical attributes (e.g., substrate composition, fish cover, residual pool depth; Table 3-1 and Appendix A). Good to excellent quality habitats were present at 21 of the 38 sites assessed as fish bearing:

- **Spawning Habitat**–Excellent spawning habitat was present in the South McQuesten River and at two sites in Haggart Creek. Haggart Creek sites had sufficient flow, gradient, and substrates suitable for Arctic grayling spawning (e.g., 2 to 4 cm size gravel, McPhail, 2007) and the South McQuesten River had conditions suitable for spawning by both Arctic grayling and Chinook salmon (e.g., 2 to 8 cm substrates; McPhail, 2007). Good quality spawning habitat for Arctic grayling was also present at a total of twelve sites in five different watercourses; Bighorn Creek, Haggart Creek, Haldane Creek, Lynx Creek, and Secret Creek (Table 3-1).
- **Rearing Habitat**—Excellent rearing habitat was present at a total of 13 sites in five different watercourses (Bighorn Creek, Haggart Creek, Haldane Creek, Lynx Creek, and South McQuesten River). Each of these watercourses had abundant complex cover, and a good representation of pool, riffle, and run habitats (Photo 3-6). Four watercourses; Haggart, Ironrust, Lynx, and North Star creeks exhibited good rearing conditions.
- **Overwintering Habitat**—South McQuesten River, Lynx Creek, and Haggart Creek provided excellent overwintering habitat potential because their mean residual pool depths were likely adequate (mean of 1.01 m) to allow overwintering. Good overwintering habitat potential was provided by the moderate pool depths present (1.0 – 0.8 m) in Haggart Creek (four sites), Haldane Creek, and North Star Creek. The remaining sites did not have adequate residual pool depths (e.g., >0.8 m) to provide potential overwintering habitat.

Although relatively few fish bearing sample sites (9 of 69) had adequate residual pool depths to provide overwintering habitat, the largest streams surveyed (South McQuesten River, Lynx Creek, and Haggart Creek) contained overwintering habitat in adjacent reaches based on the presence of deep pools that may not freeze solid in winter (i.e., upstream or downstream of sampled sites).

The fish bearing reaches of Dublin Gulch provided poor overwintering and spawning habitats for Arctic grayling as there were no deep pools and very few spawning gravels present. The rearing habitat potential was classified as moderate based on the moderate gradient (3.5 to 9%) and moderate amount of cover provided by boulders and small scour pools.

3.2.5.1 Fish Usage of Overwintering Habitat

Results of the October 2007 field program indicate that fish utilized the same habitats as those observed during the August 2007 field program and had not yet moved into downstream overwintering habitats. Although anchor ice was forming on the stream banks of these sites during October, they still had flowing water and ice free channel beds. However, Arctic grayling catch rates

were lower in the October survey relative to the August survey (see also section 3.4.1). These results suggest that the expected downstream migration of Arctic grayling into overwintering habitats is not completed until after October.

A second field survey was conducted in early spring (April) of 2008 at a large pool on Haggart Creek (1.1 ha), approximately halfway between sites HC1 and HC2 (Figure 2-2) to determine whether Arctic grayling utilize overwintering habitat at this location (Photo 3-7). This pool was created by placer mining operations, and was not present during previous fish surveys conducted in 1996 (Hallam Knight Piésold 1996).

Catch results (n=40) indicate that this pool is heavily utilized as overwintering habitat by Arctic grayling prior to ice breakup. The large pool sampled on Haggart Creek and the South McQuesten River provide important overwintering habitat for fish species present in the local study area.

3.3 Fish Population Characteristics

3.3.1 Fish per Unit Area

Population density estimates were determined for ten sites using data from the electrofishing depletion surveys completed in August 2007, October 2007, and July 2009 (Appendix E). Only Haggart Creek (HC1 and 2) was re-sampled in October due to ice up of other watercourses. Estimated fish density could not be calculated for some sites (and are not presented in Figures 3-1 and 3-2), as depletion rates did not follow a typical decreasing removal pattern. This may be attributed to low overall fish abundance and/or varying capture efficiency.

Mean Arctic grayling catch rate for all sites from all three sampling programs was 1.6 fish/100 m^2. Catch rates and population density estimates (derived by depletion sampling) for Arctic grayling were highest in Haggart Creek (3.4 fish/100 m^2, and 4.5 fish/100 m^2, respectively), and were lowest in Ironrust Creek (0.2 fish/100 m^2, and 0.2 fish/100 m^2, respectively). Arctic grayling were not captured at Haggart Creek (HC2) during the October 2007 survey.

Mean catch rate for slimy sculpin for all sites was 2.9 fish/100 m^2, and the mean population density estimate was 2.9 fish/100 m^2. Haggart Creek (HC3) had the highest observed catch rate (5.7 fish/100 m^2) and highest population density estimates of slimy sculpin (6.0 fish/100 m^2). Ironrust Creek (IR2) had the lowest observed catch rate (0.7 fish/100 m^2), and lowest population density estimate (0.7 fish/100 m^2) of slimy sculpin. Slimy sculpin were not captured in Dublin Gulch (DG1) during the August 2007 survey, but four fish were captured at a nearby site in Dublin Gulch (DG1.1) during the July 2009 survey.

Catch rates for both fish species were lower during the October field program, indicating that Arctic grayling and slimy sculpin may move to larger watercourses (e.g., South McQuesten River) or different habitats (e.g., deep pool habitat on Haggart Creek) to overwinter. As population estimates could not be calculated at some sites, some watercourses may contain lower or higher population densities than suggested by the measured catch rates. For example, estimated slimy sculpin density

at Haggart Creek (HC3 – Aug 07) was likely the highest based on catch rates; however, the depletion data could not be used.

3.3.2 Fish Size, Age and Condition

3.3.2.1 Arctic Grayling

Population Growth Pattern

Ageing structures (scales) were collected from a total of 45 Arctic grayling from Dublin Gulch, Haggart Creek, Ironrust Creek and Lynx Creek. Arctic grayling age at all sites ranged from young of year (YoY; 0+) to 8 years; no 7 year old fish were captured (Table 3-2; Appendix F). One ageing structure sample from Haggart Creek (HC3) was not included in the data, as the scale could not be confidently aged. Haggart Creek exhibited the largest number of age classes (7), while Dublin Gulch (DG1) had the fewest (3 age classes) (Appendix F). Mean fork length increased from 76 mm for YOY fish to 379 mm at age 6 (Table 3-2), with a predicted asymptotic length of 416 mm (Figure 3-3).

Table 3-2: Mean Fork Length and Standard Deviation for Arctic Grayling Age Classes from Dublin Gulch, Haggart Creek, and Lynx Creek

Age		YOY	1	2	3	4	5	6	7	8
All Sites	Mean length (mm)	76	123	155	259	337	352	379	–	358
	SD	14	18	18	100	24	34	23	–	N/A
	n	12	11	8	2	3	6	2	–	1

Length at age results were compared to results from Pendray (1983), who reported mean length and standard deviation of Arctic grayling from the South McQuesten River in the Yukon Territory (includes fish from Haggart and Lynx Creeks). With the exception of the 1 year old age class (represented in Table 3-2 as young of year), all Arctic grayling captured from the project area were larger than the averages in each age class presented in Pendray (1983). Fewer fish of older size classes (≥age 4) were captured during this study, compared to Pendray (1983), however a smaller sample size could lower the precision of our length at age estimates, but does not account for the observation of consistently larger fish in each age class being captured in 2007 as compared to fish caught in1983.

The lack of older age classes (>2+) of Arctic grayling in Dublin Gulch (DG1) is likely explained by the habitat characteristics of the fish bearing section (shallow depth, steep gradient, few pools, lack of cover etc.) (Appendix F). The young age classes (0+ to 2+) observed at this site also indicate that younger Arctic grayling may be using Dublin Gulch to rear.

The largest Arctic grayling captured was five years old and 400 mm in length (Lynx Creek – L4) (Figure 3-3). Lynx Creek fish were amongst the oldest, with a mean age of 3.1 years while Dublin Gulch had the youngest fish (mean of 1.3 years) (Appendix F). Of note is the large increase in lengths between the 2 and 4 year old fish (Table 3-2), indicating a fast growth period.

Pendray (1983) also reports an increase in growth rate of Arctic grayling between these age classes (3 to 4 year olds) from the McQuesten River watershed (which includes fish from Haggart and Lynx Creeks). Based on the information available, we can only speculate regarding potential explanations for the increased growth rate for fish in these age classes. Potential explanations include a change in foraging behavior and/or a shift in diet at this life stage.

Length – Frequency Distribution

Individual length frequency histograms of Arctic grayling were created for Dublin Gulch, Haggart Creek, and Lynx Creek, where a large enough (>10) sample size was captured (Figure 3-4). These distributions reflect the interaction of rates of reproduction, growth, and mortality of a population. Data from multiple sites were pooled for all creeks. Data from the large pool on Haggart Creek are not presented due to bias in sampling methods (gill net resulted in larger Arctic grayling captured during the April 2008 field program). Arctic grayling data from Ironrust Creek (IR2) are not presented as a separate graph due to the small sample size of fish captured (n=2); however, these data are included in the final graph (All Sites – Arctic grayling).

The overall Arctic grayling length frequency distribution suggests all size classes are represented in watercourses within the local study area, with a strong population of small sized fish (61 - 80 mm). The length frequency data for Arctic grayling of Haggart Creek mirror the overall distribution and was strongly dominated by small fish (61 - 80 mm) at the time of sampling. Data from Dublin Gulch (DG1) indicate that the creek is dominated by 101 - 200 mm sized Arctic grayling with an absence of larger fish. Fish lengths in Lynx Creek were bimodal relative to data from other watercourses. Of note is the absence of smaller sized Arctic grayling (<60 mm) from watercourses in the local study area. As electrofishing can be size selective towards capturing larger fish (Reynolds 1996), the length frequency data in Figure 3-4 may be biased against smaller fish (<60mm).

Length – Weight Relationship and Condition

Length and weight of fish sampled from watercourses in the local study area are presented in Appendix E. Figure 3-5 presents pooled length versus weight results for Arctic grayling from Dublin Gulch, and Haggart, Lynx, and Ironrust creeks. (Appendix E).

Using the length versus weight distribution equation in Figure 3-5, the predicted weight of an Arctic grayling of average length (149 mm) was determined to be 37.3 g. Predicted weight was 2.2 g for the smallest length class (61 – 80 mm) and 847.2 g for the largest length class (381 – 400 mm) (Figure 3-4).

Arctic grayling in the local study area exhibited a consistent growth pattern, as evidenced by the tight fit of the length-weight relationship (high R^2 value – 0.99) for all four streams combined. Growth appears to be positively allometric (b>3) in weight versus length (i.e., they appear to become more rotund in shape with increasing length).

Arctic grayling relative condition factor values were similar (ANOVA; P<0.05, Appendix D) between Dublin Gulch, Haggart Creek, and Lynx Creek with average values ranging from K_n = 0.90 at Haggart Creek to K_n = 0.93 for Lynx Creek (Figure 3-6). Data for Ironrust Creek (IR2) are not

presented due to the small sample size (n=2). Fish condition is influenced by age of fish, sex, season, stage of maturation, fullness of gut, type of food consumed, amount of fat reserve, and degree of muscular development (Barnham and Baxter 1998).

3.3.2.2 Slimy Sculpin

Population Growth Pattern

Otoliths were collected from 58 slimy sculpin from Haggart Creek, Lynx Creek, and Ironrust Creek. One sample from Ironrust Creek (IR2) was not included in the data, as the otolith could not be confidently aged. Slimy sculpin ages at all sites ranged from 3 to 9 years (Table 3-3; Appendix F); Lynx Creek (all sites) had the largest number of age classes (7), while Ironrust Creek (IR2) exhibited the fewest (3 age classes) (Table 3-3; Appendix F). It is unknown why there were fewer age classes of slimy sculpin at Ironrust Creek, as habitat conditions were similar to other watercourses. Mean fork length increased from 70 mm for three year old fish to 120 mm at age 9 (Table 3-3), with a predicted asymptotic length of 137 mm (Figure 3-7).

Table 3-3: Mean Total Length and Standard Deviation for Slimy Sculpin Age Classes from Haggart Creek, Lynx Creek, and Ironrust Creek

Age		YOY	1	2	3	4	5	6	7	8	9
All Sites	Mean (mm)	–	–	–	70	87	97	94	94	114	120
	SD	–	–	–	6	12	11	21	16	11	N/A
	n	–	–	–	10	24	8	5	3	7	1

Of note was the absence of slimy sculpin younger than 3 years of age being captured in sites in the local study area; however, this may be due to selective sampling for ageing purposes. While fish size 35 to 65 mm were well represented in the length frequency distribution for captured slimy sculpin, individual fish less than 65 mm total length were not sacrificed for age analysis.

The largest slimy sculpin captured was an 8 year old fish, which was 130 mm in length (Lynx Creek L4). Lynx Creek (all sites) fish were the oldest (mean of 5.5 years), while fish from Haggart Creek (all sites) were the youngest, with a mean age of 4.3 years (Appendix F).

Length – Frequency Distribution

Individual length frequency histograms of slimy sculpin were created for Ironrust Creek, Haggart Creek, and Lynx Creek, where a large enough (>10) sample size was captured (Figure 3-8). These distributions reflect the interaction of rates of reproduction, growth, and mortality of a population. Data from multiple sites were pooled for all creeks. Data from the large pool on Haggart Creek are not presented due to bias in sampling methods (gill net resulted in larger Arctic grayling captured during the April 2008 field program). Slimy sculpin data from Dublin Gulch (DG1.1) are not presented as a separate graph due to the small sample size of fish captured (n=4). However, these data are included in the final graph (All Sites – slimy sculpin).

The overall length frequency distribution for slimy sculpin is heavily weighted by the distribution of slimy sculpin in Haggart Creek, where all size ranges are represented with majority of the population consisting of small fish (≤70mm). Lynx Creek and Haggart Creek distributions are similar; however, Haggart Creek had a higher concentration of smaller sized fish (41 to 70 mm). Smaller sized slimy sculpin (<86 mm) were absent from the length frequency distribution for Ironrust Creek (IR2). The predominance of smaller size fish in Haggart Creek may be due to poor habitat conditions at the site (e.g., shallow pool depth, limited food availability).

As electrofishing can be size selective towards capturing larger fish (Reynolds 1996), the length frequency data in Figure 3-8 may be biased against smaller fish (<30mm).

Length – Weight Relationship and Condition

Slimy sculpin from watercourses in the local study area exhibited a strong and consistent length to weight relationship, as evidenced by the high R^2 value (0.97). The predicted weight of a slimy sculpin of average length (67.6 mm) was determined to be 2.8 g. The predicted weight of a fish in the smallest length class (31 to 35 mm) was calculated to be 0.4 g, and 15.6 g in the 116 to120 mm length class (Figure 3-9).

Relative condition factor (K_n) values varied between sites, ranging from 0.9 (Eagle Pup Placer Pond #1) to 1.14 (Dublin Gulch) (Anderson and Neumann 1996). The only statistically significant difference in mean condition of slimy sculpin was between Lynx Creek (K_n = 1.05) and Haggart Creek (K_n = 0.96) (ANOVA and Tukey tests; $P<0.05$). The lack of statistically significant differences between the remaining watercourses could be due to lower sample sizes (i.e., at least 55 replicates for Haggart and Lynx creeks versus no more than 11 replicates for the other streams) which lowers the precision of their mean condition estimates. Higher condition of fish at Lynx Creek compared to Haggart creek may be due to better sculpin habitat conditions (e.g., deeper pool habitat) (Figure 3-10).

3.4 Metals in Fish Tissue

Arctic grayling and slimy sculpin tissue were sampled for metal concentrations in three watercourses: Haggart Creek, Lynx Creek, and Dublin Gulch. Metal concentrations (mean total levels) found in Arctic grayling liver and muscle tissue and slimy sculpin tissue (whole fish) are presented in Table 3-4 and Figure 3-11 for metals with known toxicity to fish. Mean values in Table 3-4 are presented both with and without (in brackets) outliers (i.e., an order of magnitude greater relative to other results) that were identified in data from Lynx Creek. All tissue sample data are presented in Appendix B. A summary of ERED effects criteria is presented in Appendix G. Various elements are common tissue constituents and important in physiological processes, including calcium, iron, magnesium, phosphorus, sodium, and potassium), and are typically found in high concentrations (mean of ≥210 mg/kg). Some of the other metals (e.g., copper, selenium, zinc) are required for biological processes in small amounts but are toxic at higher levels.

Table 3-4: Summary of Selected Mean Total Metal Concentrations in Fish Tissue[a]

Analyte	Liver Tissue – Arctic Grayling (mg/kg wet weight)			Reference Value (SD)	Muscle Tissue – Arctic Grayling (mg/kg wet weight)			Reference Value (SD)	Whole Fish – Slimy Sculpin (mg/kg wet weight)		
	Haggart Creek n=7	Lynx Creek[f] n=5	Dublin Gulch n=9		Haggart Creek n=7	Lynx Creek n=5	Dublin Gulch n=9		Haggart Creek[f] n=3	Lynx Creek n=3	Ironrust Creek n=3
Aluminum[b]	**6.9**	**25.3 (4.3)**	**12.8**	1.49 (1.76)	**2.2**	**3.0**	**2.8**	0.56 (0.25)	39.2	44.6	80.8
Arsenic[b]	**0.408**	**1.54**	**2.23**	0.02 (0.00)	**0.163**	**0.272**	**0.516**	0.02 (0.00)	0.849	0.966	0.319
Barium[b]	0.145	**0.711** (0.194)	**0.350**	0.22 (0.04)	0.078	0.062	0.100	0.24 (0.13)	2.51	3.01	3.07
Cadmium[b]	0.263	**0.417**	0.288	0.24 (0.09)	0.0138	0.0242	0.0297	0.20 (0.02)	0.034	0.047	0.053
Copper[b]	2.19	3.78	2.88	5.00 (3.10)	0.669	0.663	0.829	0.45 (0.44)	0.864	0.948	1.06
Iron[b]	78.8	90.3	62.1	83.5 (42.6)	7.10	6.68	7.42	5.62 (2.63)	89.5	72.3	207
Lead[b]	0.061	0.089	0.050	0.28 (0.17)	<0.020	<0.020	<0.020	0.46 (1.13)	0.073	0.063	0.091
Manganese[b]	**7.38**	**6.57**	**2.93**	1.76 (0.45)	**0.860**	**0.682**	**0.681**	0.21 (0.05)	16.5	9.24	15.7
Mercury[c]	–	–	–	–	0.0446	0.0412	0.0262	0.1 to 0.5	–	–	–
Molybdenum[d]	0.093	0.141	0.130	16	<0.010	<0.010	0.008	16	0.050	0.034	0.033
Nickel[b]	0.18	0.40 (0.13)	0.33	1.12 (0.21)	0.10	<0.10	0.10	1.02 (0.10)	0.52 (0.39)	0.28	0.58
Selenium[c]	**4.79**	**6.42**	**5.80**	1.0	**2.10**	**2.11**	**2.54**	1.0	1.81	1.49	1.85
Strontium	0.440	0.938 (0.383)	1.56	none	0.569	0.428	0.710	none	13.3	17.3	13.9
Thallium[e]	0.021	<0.30	0.030	0.27	<0.010	<0.010	<0.010	0.27	<0.020	<0.020	0.009
Zinc[b]	**34.3**	**40.6**	**45.5**	24.5 (5.85)	8.81	8.65	**12.3**	6.05 (2.79)	33.1	34.9	34.0

NOTES:

[a] Individual samples that were below detection limits were given a value of one half of the detection limit. Where the detection limit differed between samples of the same analyte at one site, the highest value was used to calculate the mean

[b] Metal concentrations in bold exceeded levels (plus one standard deviation) in Rieberger (1992) for Arctic grayling

[c] Metal concentrations in bold exceeded BC MoE Tissue Quality Guidelines (2006) for human consumption of edible tissue (range of HG values associated with range of consumption recommendations (servings of fish per week)

[d] Metal concentrations in bold exceeded levels in ERED 2008 for sockeye salmon (*Oncorhynchus nerka*), selected in the absence of data for arctic grayling

[e] Metal concentrations in bold exceeded levels in ERED 2008 for Atlantic salmon (*Salmo salar*), selected in the absence of data for arctic grayling

[f] Value in parentheses represents the mean metal concentration without outliers

3.4.1 Arctic Grayling

3.4.1.1 Liver Tissue

Concentrations of aluminum, arsenic, manganese, and zinc in Arctic grayling liver tissue (Table 3-4) exceeded the average concentrations reported by Rieberger (1992) for Arctic grayling from uncontaminated lakes in all three sampled watercourses; barium levels exceeded the reference value in Lynx Creek and Dublin Gulch; and cadmium exceeded the reference value in Lynx Creek. Selenium concentrations in Arctic grayling liver tissue exceeded BC guidelines for the protection of aquatic life (BCMoE 2006) at all three watercourses. The remaining metals tested did not exceed the Rieberger average or ERED value for liver tissue. When outlier values were excluded from the analysis, fish from Lynx Creek had the highest mean metal concentrations in liver tissue.

3.4.1.2 Muscle Tissue

With the exception of aluminum, arsenic, manganese, selenium, and zinc (present in all three sampled watercourses), all metal concentrations analyzed in Arctic grayling muscle tissue were below the average concentrations reported by Rieberger (1992) for Arctic grayling from uncontaminated lakes, ERED values, and BCMoE guidelines (Table 3-4, Figure 3-12). Metal levels in muscle tissue from Dublin Gulch were consistently higher than those from Lynx or Haggart creeks.

3.4.1.3 Mercury Levels

The majority of mercury concentrations in Arctic grayling muscle tissue ranged from 0.0178 mg/kg to 0.0546 mg/kg wet weight, well below consumption guidelines for humans; however, one sample had a value of 0.0914 mg/kg, which is near the lowest value of concern for human consumption according to BCMoE guidelines. The guideline (BCMoE 2006) ranges from 0.1 to 0.5 mg/kg and corresponds to maximum weekly consumption of fish ranging from 1050 g (for 0.1 mg/kg mercury) to 210 g (for 0.5 mg/kg mercury). The sample with the maximum mercury level was from a large Arctic grayling captured at Haggart Creek (HC3) (333 mm, 558.6 g). Water chemistry results (JWA 2008b) indicate that levels of mercury in water samples were low (mean of 0.0138 µg/L) for all three watercourses that were sampled for fish tissue.

The relationship between mercury levels in Arctic grayling muscle tissue and fish length was examined at each site. Results are considered statistically significant at $P \leq 0.05$, with a positive relationship, indicating the expected, a generally increasing trend in mercury concentration with fish size. Results were statistically significant for samples from Lynx Creek at L1 ($P = 0.0047$; $r = +0.97$), but not from Haggart Creek at HC3 ($P = 0.0512$, $r = +0.75$) or Dublin Gulch at DG1 ($P = 0.0685$, $r = -0.0002$). The correlation and significance would have been stronger if there had been more data available for a wider range of fish sizes; however, the low numbers of fish captured in the system precluded heavy capture rates. The negative correlation noted for Dublin Gulch was counter-intuitive and could be related to the small size range of fish sampled in Dublin Gulch (length range of 92 mm to 166 mm).

An analysis of covariance (ANCOVA) test, using fish length as the covariate, was performed to determine whether fish at Lynx Creek and Haggart Creek were accumulating mercury at the same rate. No significant difference in slope (P=0.4635) or y-intercept (P=0.5116) between the two sites was observed (Appendix D). The lack of a difference in slope indicates that Arctic grayling at both sites are accumulating mercury at a similar rate.

3.4.1.4 Comparison of Metals Levels in Tissue and Water

The relationship between levels of metals in Arctic grayling tissue and in water was examined. Water chemistry data presented in the Environmental Baseline Report for Water Quality and Aquatic Biota (Stantec 2010) indicate that concentrations of arsenic exceeded CCME water quality guidelines for the protection of aquatic life at the majority of sampling sites in the three watercourses; however, there were fewer exceedances for other metals in water.

For metals with levels exceeding either guidelines or reference values in liver or muscle tissue:

- Arsenic levels in tissue exceeded average levels reported by Rieberger (1992) and the CCME (2007) water quality guidelines in all three watercourses.
- Aluminum concentrations in muscle and liver were above values reported by Rieberger (1992) in all three watercourses; concentrations in surface water exceeded CCME (2007) water quality guidelines for total aluminum occasionally, mostly associated with freshet and elevated suspended solids levels, and not associated with placer mining.
- Iron and copper levels in tissues did not exceed Rieberger (1992) reference values and levels in water rarely (mainly during freshet) exceeded CCME (2007) water quality guidelines.
- Zinc and selenium concentrations were high in Arctic grayling muscle and liver tissue and exceeded the Reiberger (1992) reference values and BCMoE tissue guidelines, respectively; however, levels in water did not exceed CCME (2007) water quality guidelines.
- Levels of barium and cadmium exceeded the reference values (Rieberger 1992) in some systems; however, levels in water did not exceed CCME (2007) guidelines.

3.4.2 Slimy Sculpin

The BCMoE (2006) guidelines include a level of 1.0 mg/kg selenium for fish tissue, to protect against bioaccumulation of selenium. Aside from selenium, there are currently no reference values against which to compare data for slimy sculpin. Excluding outlier values, metal levels were consistently higher for whole fish sampled in Ironrust Creek than in either Haggart or Lynx Creek (Table 3-4, Figure 3-13).

Slimy sculpin are bottom dwellers, predominantly found in streams with cobble substrates, and metals levels in tissue may be influenced by rearing habitat preferences and metals levels in bottom sediments. In contrast, Arctic grayling typically rear off the bottom, in the water column (Scott and Crossman 1973).

Levels of several metals in sculpin tissue were similar in both Haggart Creek, which has been affected by placer mining, and Lynx Creek, which has not. This observation, along with the elevated arsenic levels in waters of Lynx as well as the other watercourses discussed in Section 3.4.1.4, suggests that mineralization throughout this area affects water quality and the aquatic biota that inhabit the watercourses.

Though high levels of certain metals were found in Arctic grayling muscle and liver tissue as well as in slimy sculpin (whole body), the presence of established fish populations indicate that these metals may not be having a deleterious effect on fish. This may be, in part, due to the slightly alkaline conditions in watercourses in the area (mean pH of 7.9 in 2009 and 8.1 in 2007/08) and the presence of high concentrations of calcium, magnesium, and other minerals (Appendix B), which can reduce metal toxicity by increasing the buffering capacity of water (Earle and Callaghan 1998).

4 CLOSURE

Stantec has prepared this report for the sole benefit of Victoria Gold for the purpose of documenting baseline conditions in anticipation of an environmental assessment under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA). The report may not be relied upon by any other person or entity, other than for its intended purposes without the express written consent of Stantec and Victoria Gold. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by Victoria Gold, and field data compiled by Stantec (formerly Jacques Whitford AXYS Ltd.). This report represents the best professional judgment of our personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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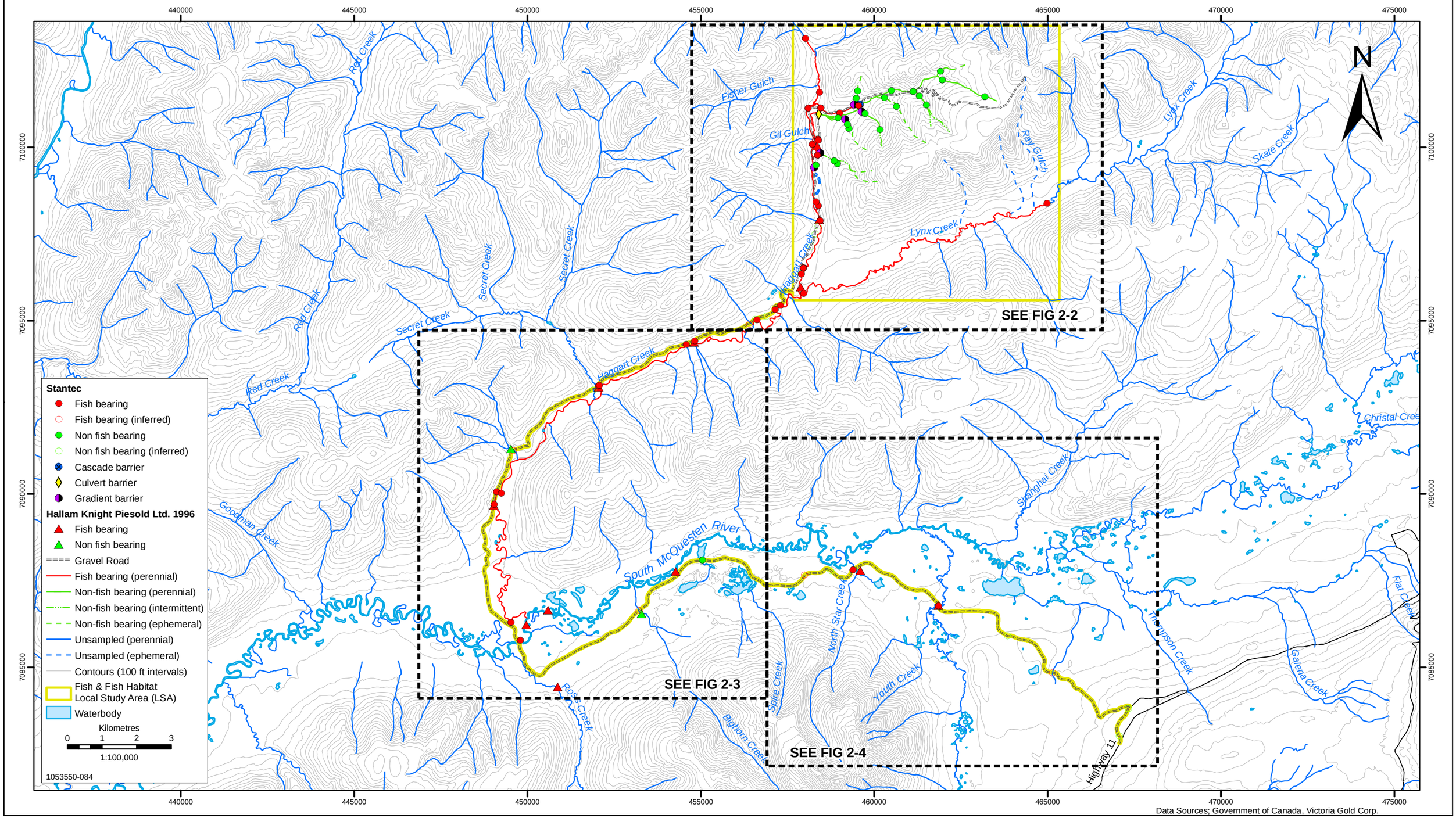
6 FIGURES

Please see the following pages.



Data Sources; Government of Canada, Victoria Gold Corp.

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Victoria GOLD CORP

FISH AND FISH HABITAT - REGIONAL STUDY AREA

EAGLE GOLD PROJECT
YUKON TERRITORY

PROJECTION: UTM - ZONE 8	DRAWN BY: NP
DATUM: NAD 83	CHECKED BY:
DATE: 20-Nov-09	FIGURE NO.: 2-1

R:\2009Fiscal\1053550_EagleGold\GIS\MXD

Stantec
- Fish bearing
- Fish bearing (inferred)
- Non fish bearing
- Non fish bearing (inferred)
- Cascade barrier
- Culvert barrier
- Gradient barrier

Hallam Knight Piesold Ltd. 1996
- Fish bearing
- Non fish bearing
- Gravel Road
- Fish bearing (perennial)
- Non-fish bearing (perennial)
- Non-fish bearing (intermittent)
- Non-fish bearing (ephemeral)
- Unsampled (perennial)
- Unsampled (ephemeral)
- Contours
- Fish & Fish Habitat Local Study Area (LSA)
- Waterbody

Fish Code	Definition
AL	Arctic lamprey
BB	Burbot
CCG	Slimy sculpin
CH	Chinook salmon
GR	Arctic grayling
LSU	Longnose sucker
NFC	No Fish Caught
NFS	No Fish Sampling
NP	Northern pike
RW	Round whitefish

Sampling Site Codes	
RC sites	Road crossing sites
RE sites	Road encroachment sites
All other two letter sites (eg DB = Dublin Gulch)	Watercourse sampling sites

Creek ID CG1 - NFC Fish Species

Kilometers
0 0.5 1 1.5 2
1:50,000

1053550-073a

IR2 - GR, CCG
HC3 - GR, CCG
DG1.2 - GR
DG1 - GR
HC2 - GR, CCG
DG1.1 - GR, CCG
Trib TO EPPP2 - NFC
HC4 - NFS
EPPP2 - CCG
HC2 - CH, GR, BB, CCG
RE12 - NFS
RC24 - GR, CCG
RC22 - NFS
HC1 - GR, CCG
RC20 - NFS
RC19 - NFS
RE10 - GR, CCG
RC18 - NFS
RE9 - NFS
RE8 - NFS
RC16 - NFS
RC17 - NFS
RC15 - NFS
RE7 - GR
AG2 - NFS
AG1 - NFS
DG1.3 - GR
ST1 - NFC
DG2 - NFC
DG3 - NFC
CG1 - NFC
BB2 - NFC
BB1 - NFC
OG1 - NFC
OG2 - NFS
EP1 - NFC
EP2 - NFS
ST2 - NFC
EPPP3 - NFC
SG1 - NFC
SG2 - NFS
EPPP1 - GR, CCG
PG1 - NFS
PG3 - NFS
PG2 - NFC
Pool on Haggart Creek
F3 - GR, CCG
RC23 - NFS
RC21 - NFS
RE11 - GR, CCG
HC1 - GR, NP, AL, CCG
L1 - GR, CCG
L4 - GR, CCG

Ironrust Creek
Haggart Creek
Fisher Gulch
Ann Gulch
Dublin Gulch
Castallen Gulch
Bawn Boy Gulch
Olive Gulch
Stewart Gulch
Eagle Pup
Gil Gulch
Shuttle Catch
Platinum Gulch
Ray Gulch
Skate Creek
15 Pup
Eagle Creek
Lynx Creek
Ski Creek

N

452000 454000 456000 458000 460000 462000 464000 466000 468000 470000
7104000 7102000 7100000 7098000 7096000

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Victoria GOLD CORP

FISH AND FISH HABITAT SAMPLING SITES - SHEET 1 OF 3

EAGLE GOLD PROJECT
YUKON TERRITORY

PROJECTION: UTM - ZONE 8	DRAWN BY: NP
DATUM: NAD 83	CHECKED BY:
DATE: 20-Nov-09	FIGURE NO.: 2-2

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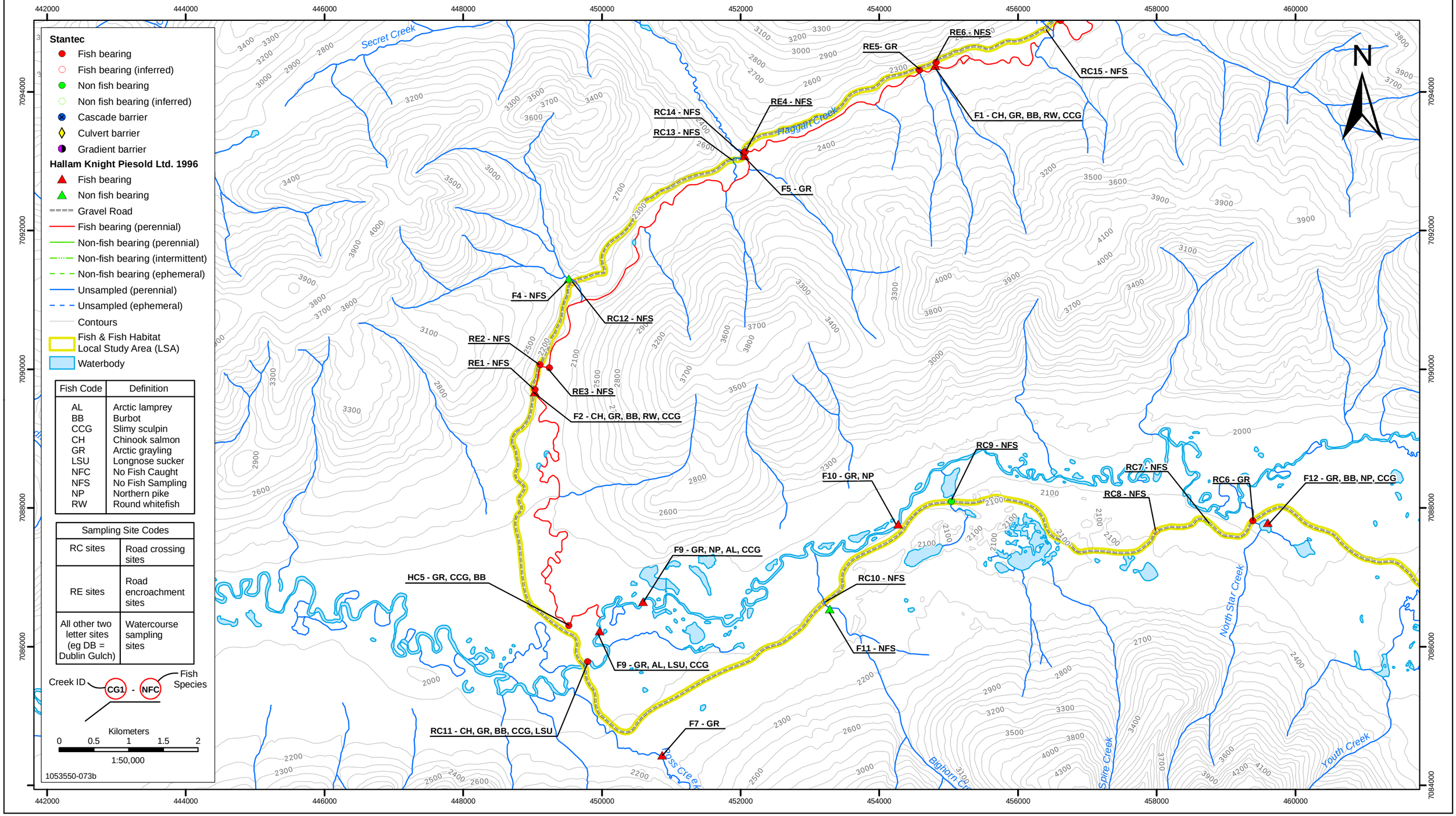

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Victoria GOLD CORP

FISH AND FISH HABITAT SAMPLING SITES - SHEET 2 OF 3

EAGLE GOLD PROJECT
YUKON TERRITORY

PROJECTION: UTM - ZONE 8	DRAWN BY: NP
DATUM: NAD 83	CHECKED BY:
DATE: 19-Oct-09	FIGURE NO.: 2-3

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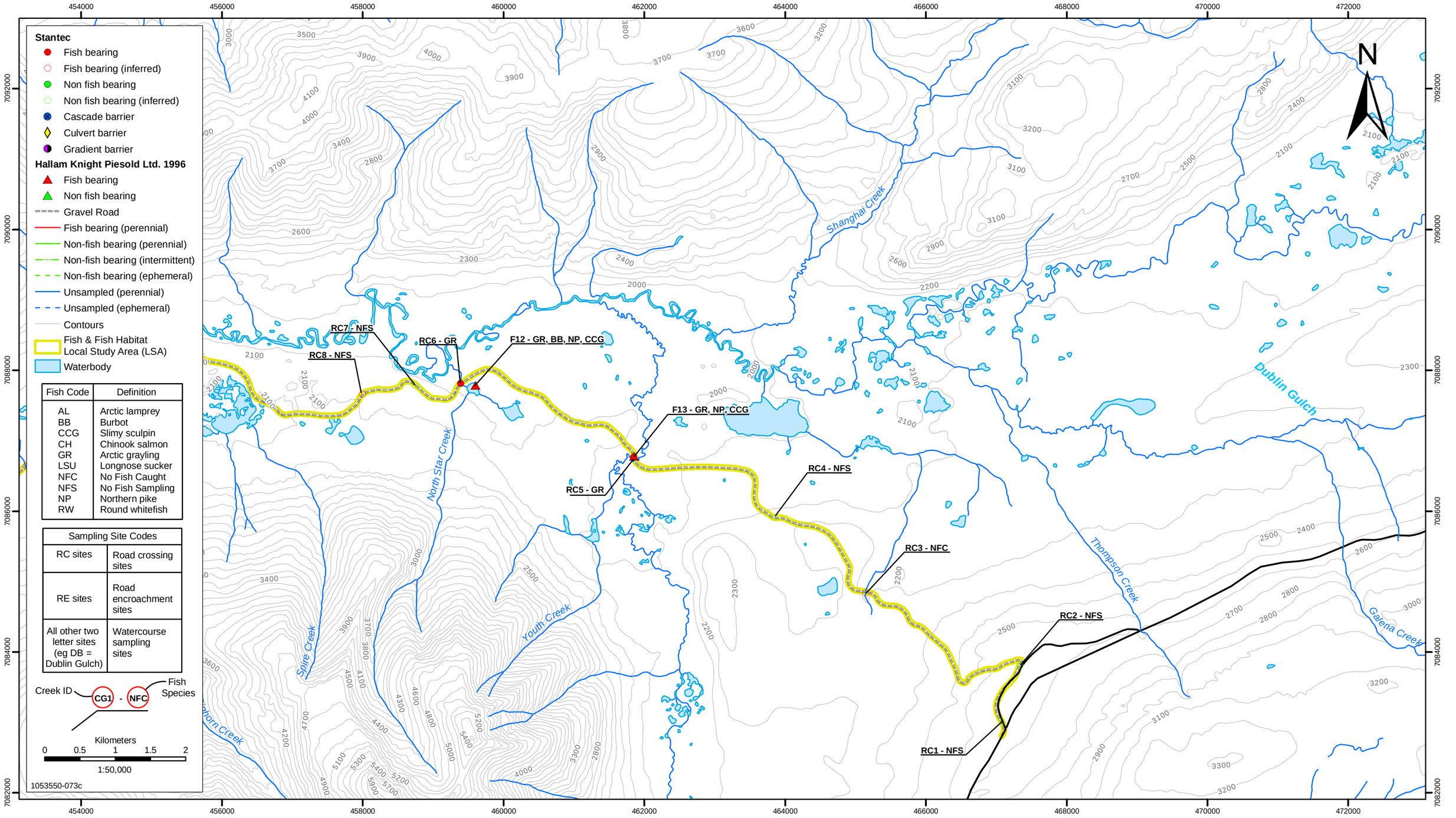

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Victoria GOLD CORP

FISH AND FISH HABITAT SAMPLING SITES - SHEET 3 OF 3

EAGLE GOLD PROJECT
YUKON TERRITORY

PROJECTION: UTM - ZONE 8	DRAWN BY: NP
DATUM: NAD 83	CHECKED BY:
DATE: 19-Oct-09	FIGURE NO.: 2-4

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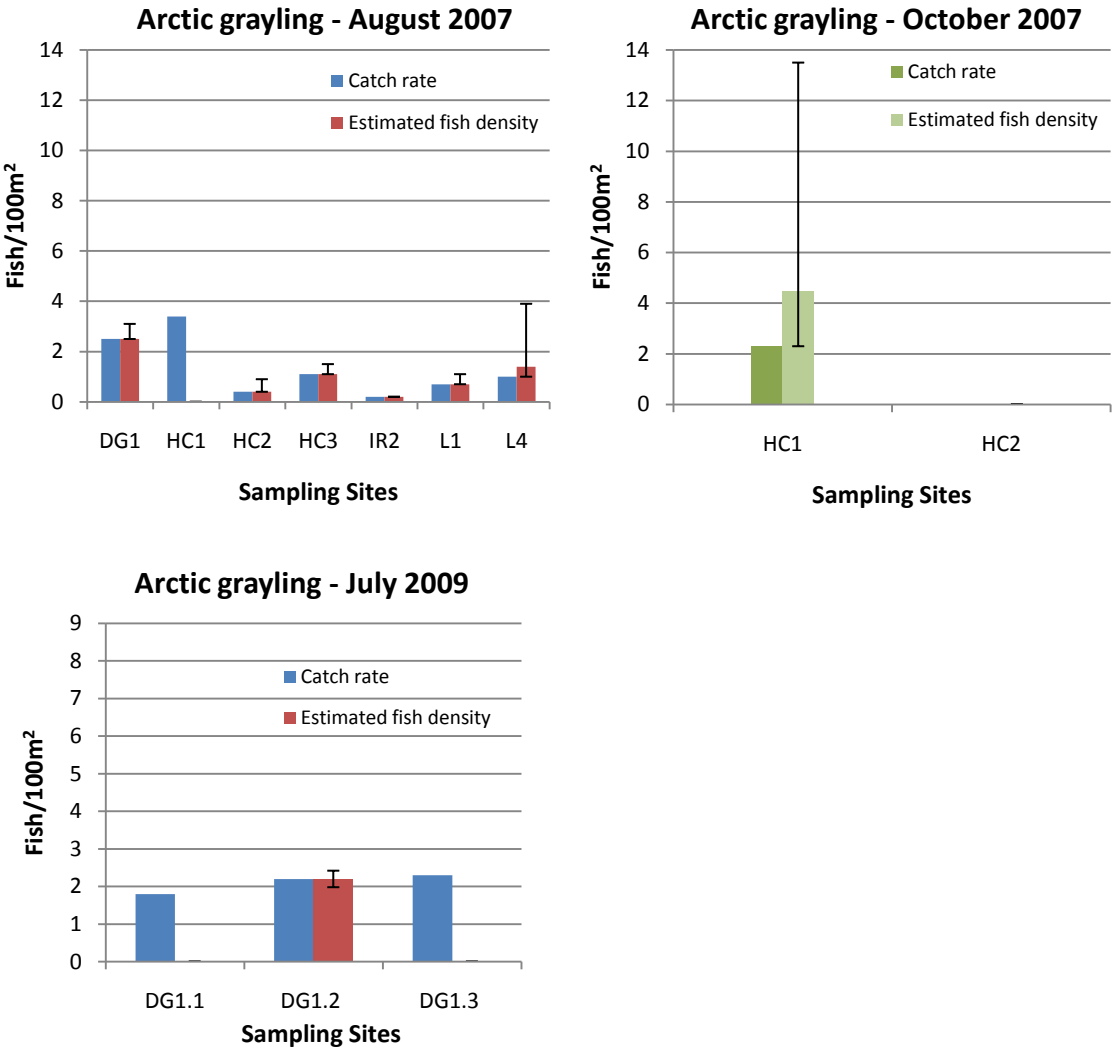


Figure 3-1: Catch rates and estimated densities (± 95% confidence intervals) per unit area for Arctic grayling sampled at sites in four creeks during August 2007, October 2007, and July 2009

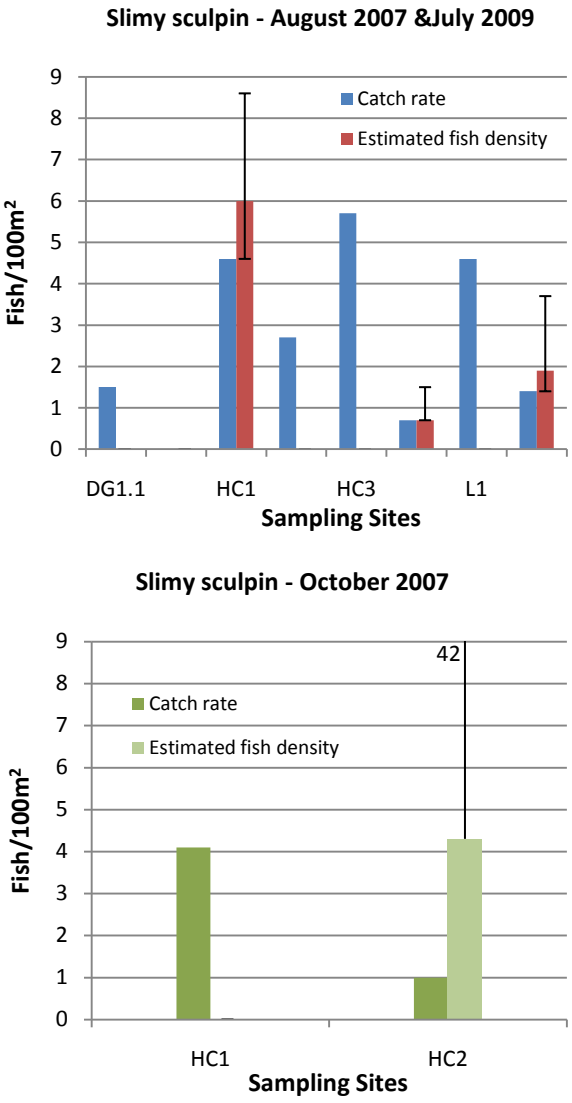


Figure 3-2: Observed catch rates and estimated densities (± 95% confidence intervals) per unit area for slimy sculpin sampled at sites in 4 creeks during August 2007, October 2007, and July 2009.

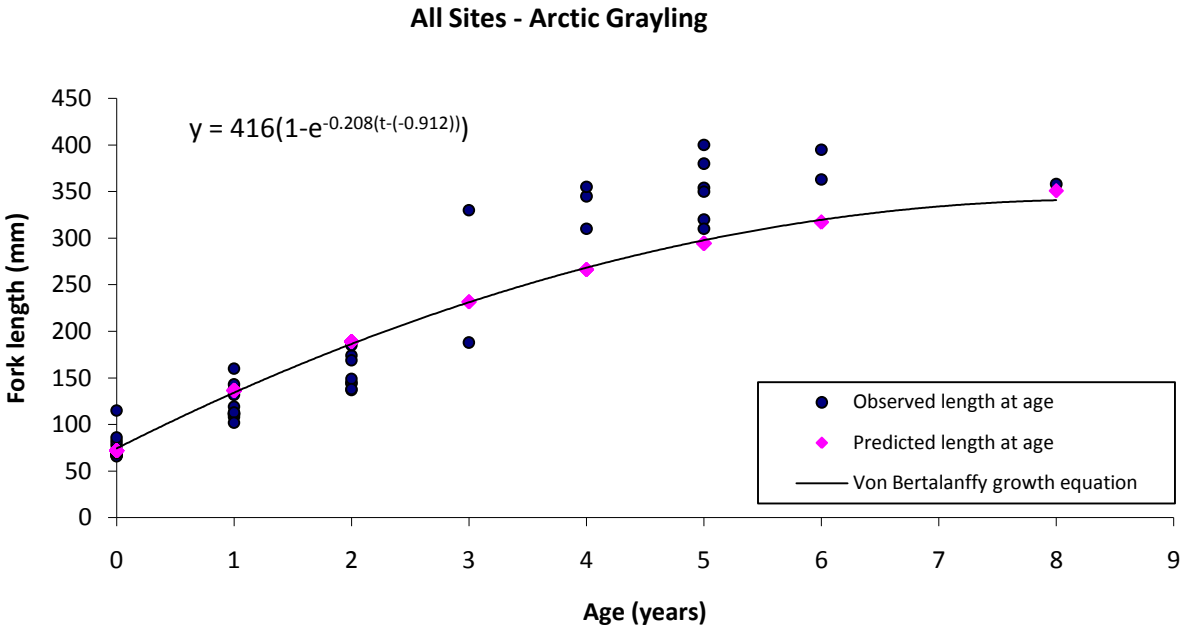


Figure 3-3: Population growth pattern for Arctic grayling

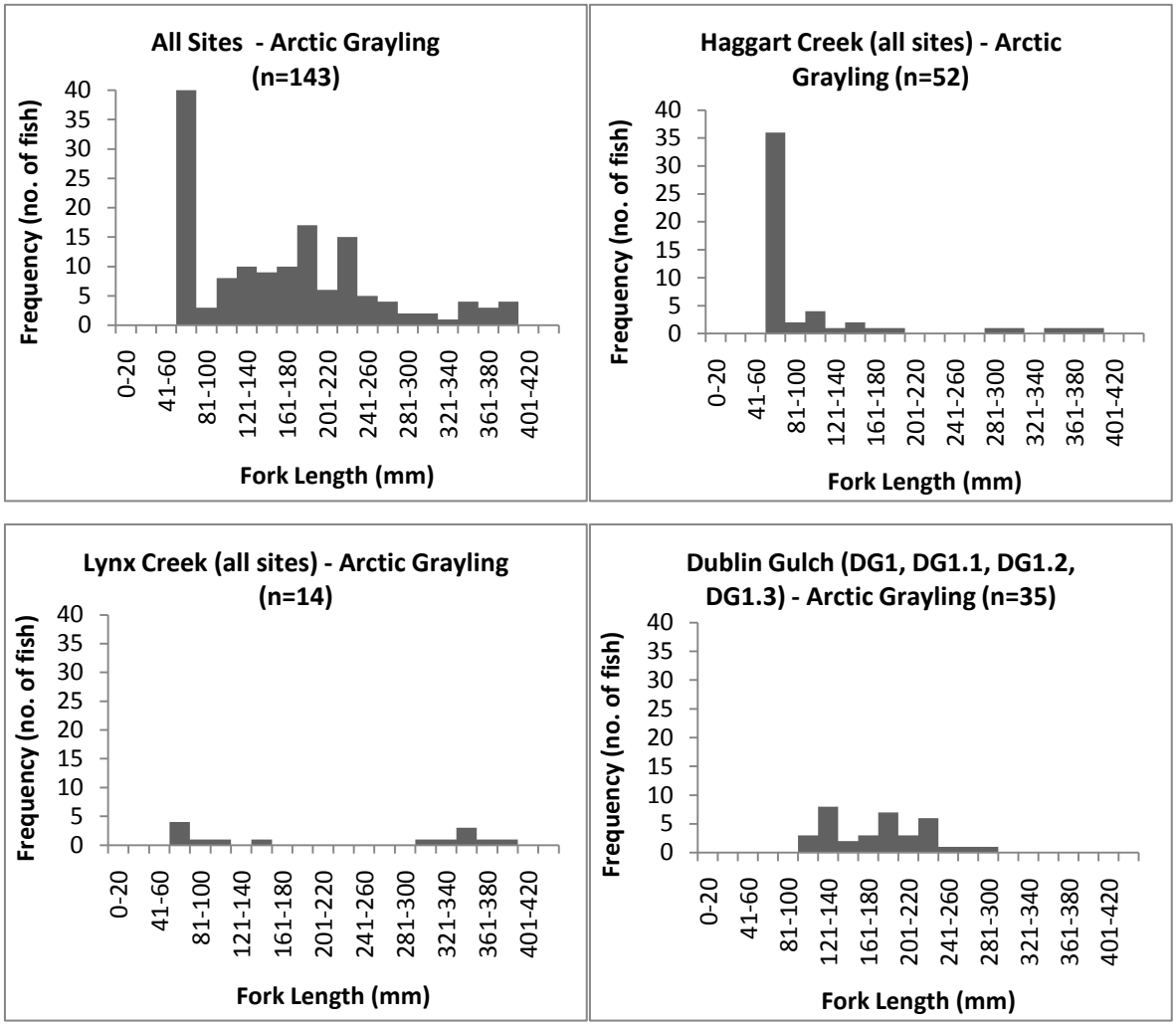


Figure 3-4: Length frequency histograms for Arctic grayling

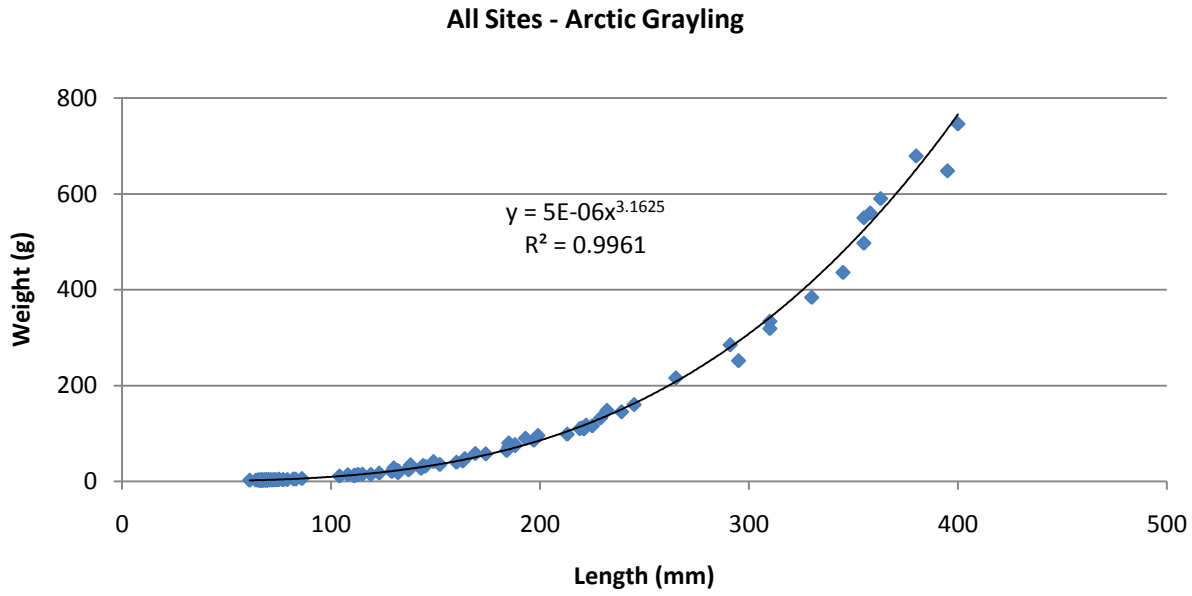


Figure 3-5: Weight versus length relationship for Arctic grayling

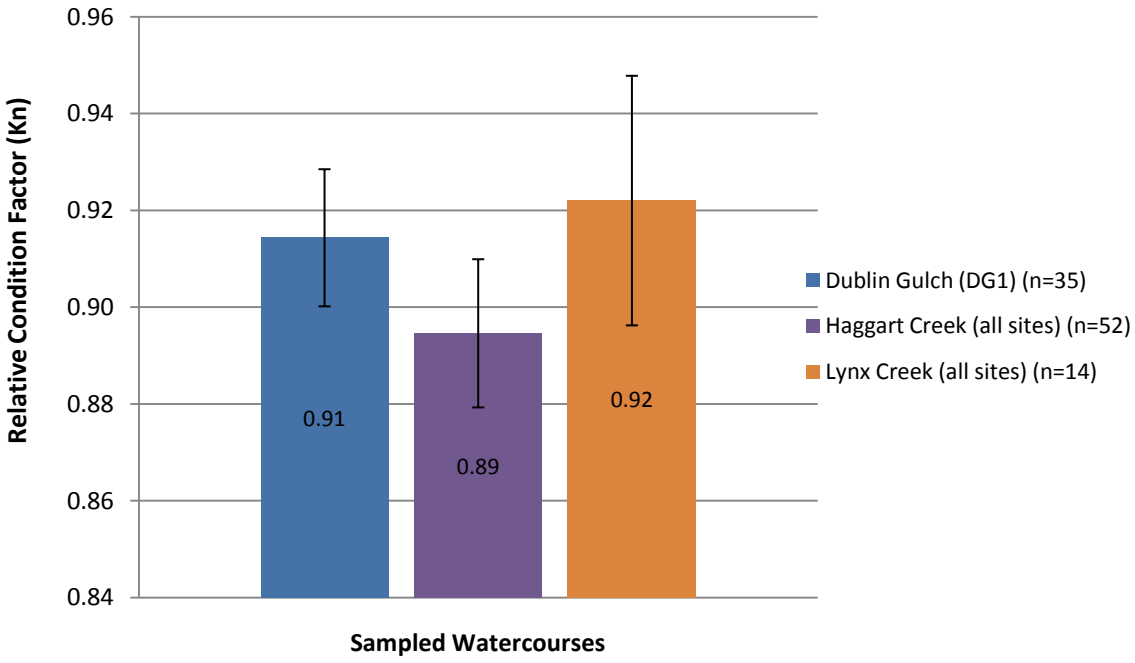


Figure 3-6: Mean relative condition factor (K_n) (± SE) of Arctic grayling for individual watercourses

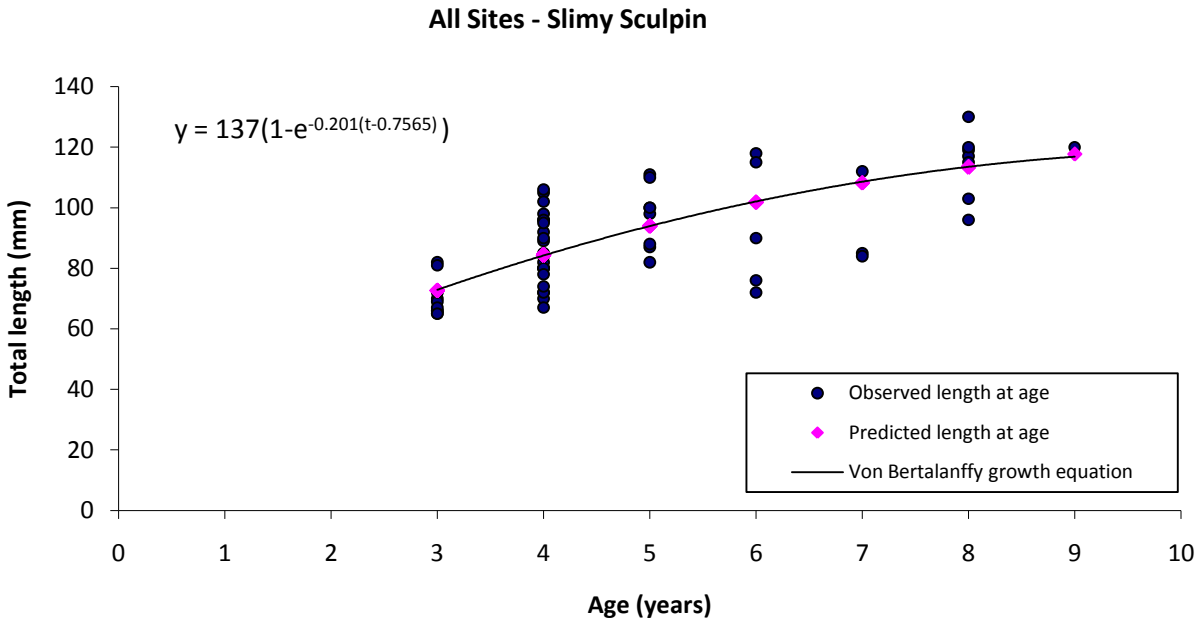


Figure 3-7: Population growth pattern for all slimy sculpin

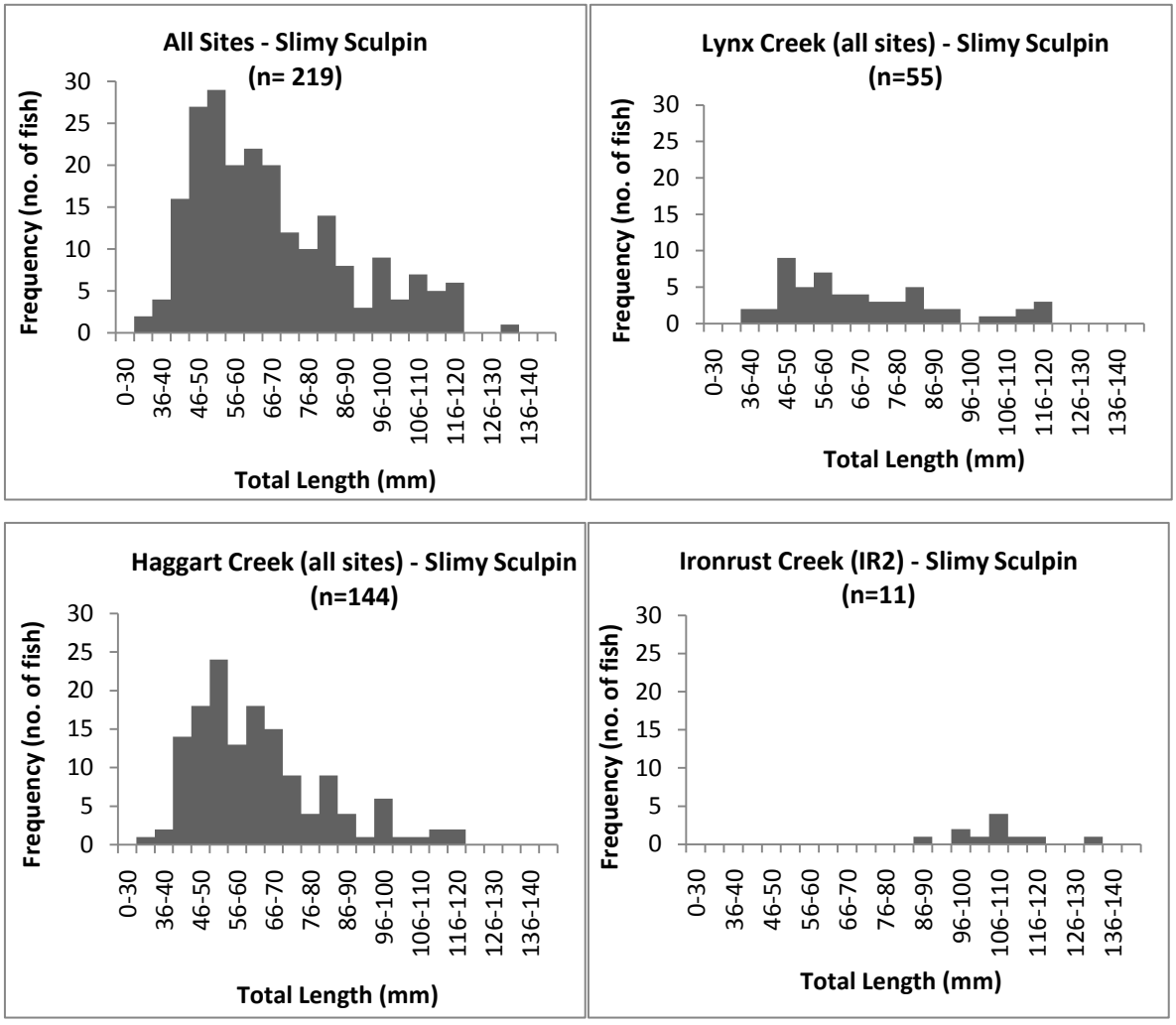


Figure 3-8: Length frequency histograms for slimy sculpin. The histogram for all sites combined includes five fish captured in Eagle Pup Placer Ponds and four fish in Dublin Gulch

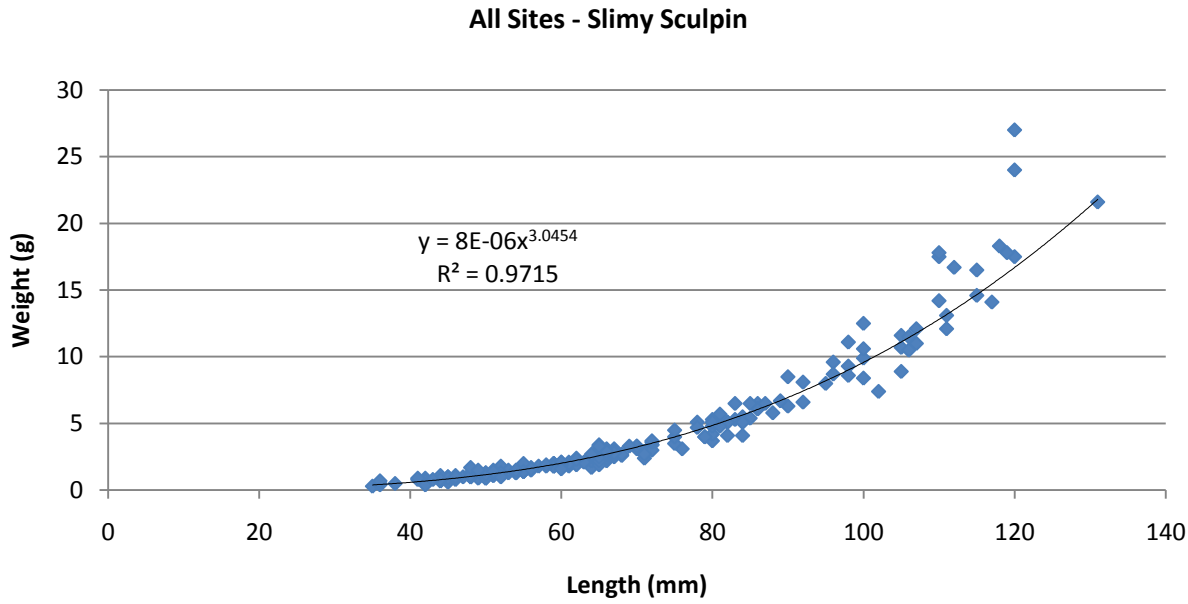


Figure 3-9: Weight versus length relationship for slimy sculpin

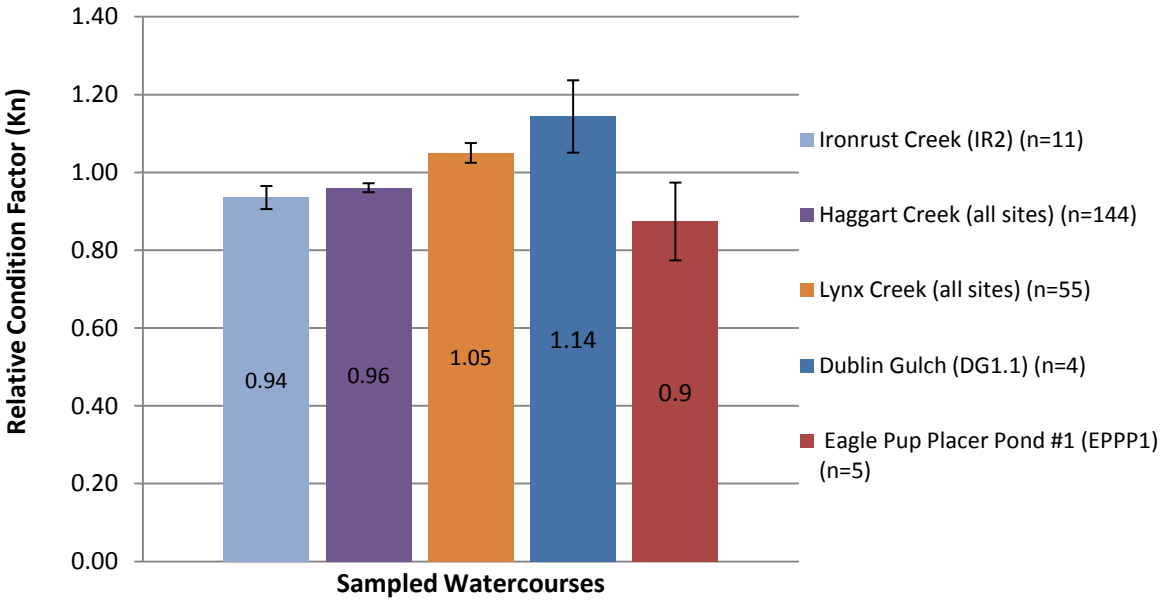


Figure 3-10: Mean (± SE) relative condition factor (K_n) of slimy sculpin for individual watercourses.

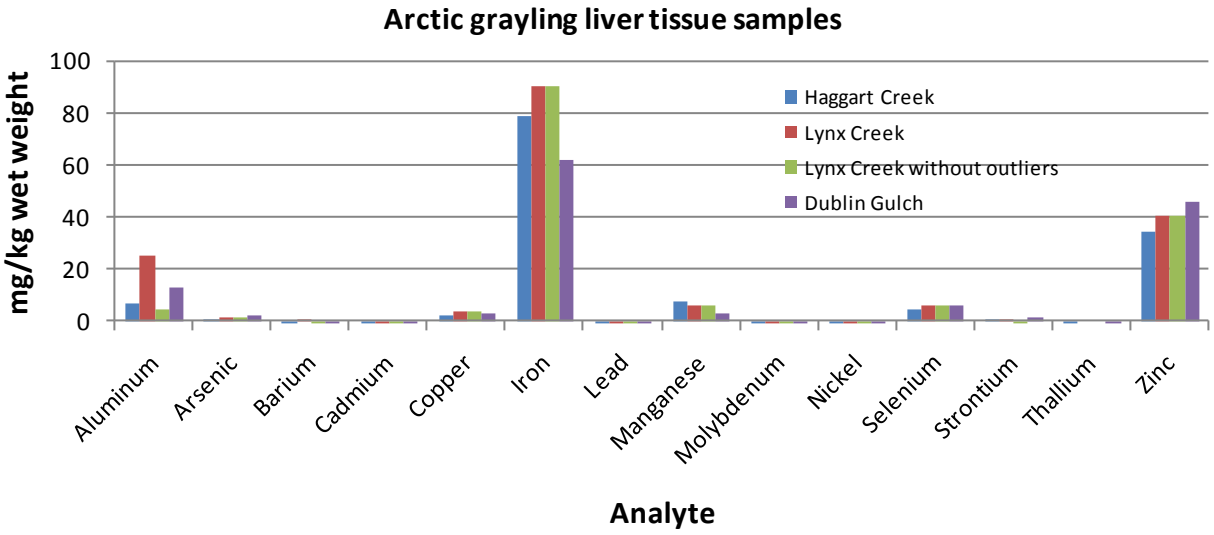


Figure 3-11: Select total metal concentrations in Arctic grayling liver tissue

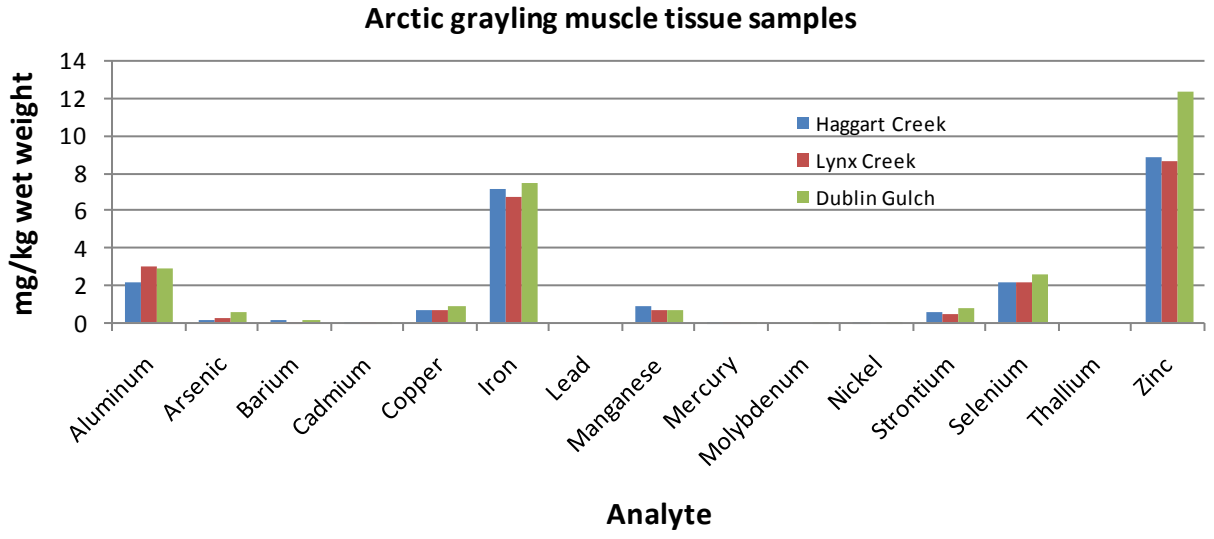


Figure 3-12: Select total metal concentrations in Arctic grayling muscle tissue

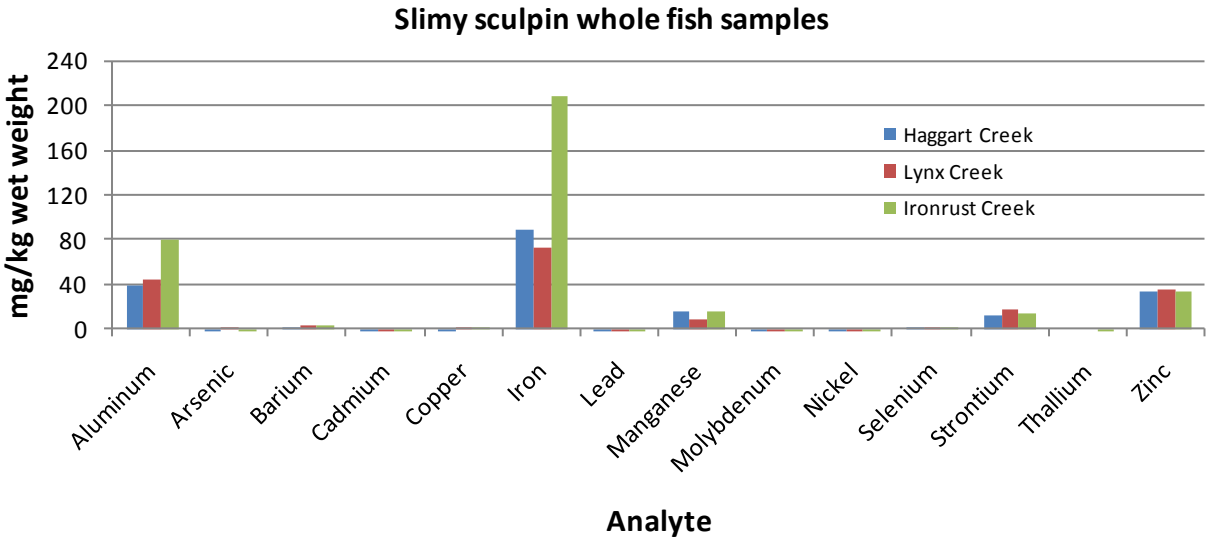


Figure 3-13: Select total metal concentrations in slimy sculpin (whole fish)

7 PHOTOS

Please see the following pages.

Photo 3-1: Photo of Ironrust Creek (IR2) indicating a lack of residual pool depth, photo taken facing upstream on August 21, 2007

Photo 3-2: 20 m high cascade barrier on Dublin Gulch, photo taken facing upstream on July 22, 2009

Photo 3-3: Culvert barrier on lower Eagle Pup, photo taken facing upstream on August 15, 2008

Photo 3-4: Arctic grayling (*Thymallus arcticus)* captured on Haggart Creek (HC1), photo taken on August 14, 2007

Photo 3-5: Chinook salmon parr observed during snorkel survey of the South McQuesten River on July 23, 2009

Photo 3-6: Excellent quality rearing habitat on Lynx Creek (L1), photo taken facing upstream on September 15, 2009

Photo 3-7: Overwintering habitat use sampling at a large, deep pool on Haggart Creek, approximately halfway between sites HC1 and HC2. Photo taken April 25, 2008

APPENDIX A

Site Summary Tables

Victoria GOLD CORP

Stantec

SITE – LYNX CREEK (L4)

UTM Coordinates: E 464984 **N** 7098396

Watercourse name: Lynx Creek

Surveyed length (m): 200

Survey date: 2007/08/12
2007/10/03

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Lynx Creek

Mean channel width (m): 6.05
Mean bank full depth (m): 0.80
Channel gradient (%): 1.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: G, C

Temperature (°C): 4.0 (Aug 07)
Conductivity (µs/cm):340 (Aug 07)
pH: 8.0 (Aug 07)

Right bank (RB)
RB shape: Vertical
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: None
Fish cover total: Moderate
Confinement: Unconfined
Dominant cover type: Undercut Banks
Channel pattern: Irregular Meandering
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, K. Whitehead, T. Goodsell

HABITAT

Spawning: Moderate (few small gravels, mostly large cobbles)
Overwintering: Good (hyporheic flow, deep pools)
Rearing: Good (moderate cover, abundant food sources)
Migration: Good (no barriers observed)
Staging / Holding: Good (good velocity with staging areas)

FISH SAMPLING

Sampling method(s): Electrofishing
Effort: 3,385 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures, for biophysical data description

GENERAL SITE COMMENTS

No placer operations have occurred in area. Large woody debris observed downstream of site. Hyporheic flow prevalent.

Photos taken: 2007/08/12

SITE – HAGGART CREEK (HC1)

UTM Coordinates: E 457962 **N** 7096530 **Watercourse Name:** Haggart Creek

Surveyed length (m): 200 **Survey date:** 2007/08/13
2007/10/02

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 11.32
Mean bank full depth (m): 1.4
Channel gradient (%): 3.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 7.3 (Aug 07)
Conductivity (µs/cm):300 (Aug 07)
pH: 8.4 (Aug 07)

Right bank (RB)
RB shape: Vertical
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Few
Fish cover total: N/A
Confinement: Unconfined
Dominant cover type: Deep Pools
Channel pattern: N/A
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Moderate (few small gravels (for grayling); mainly cobbles (maybe for Chinook)
Overwintering: Excellent (abundant deep pools, groundwater likely)
Rearing: Excellent (abundant cover, riffle/pools, cut banks)
Migration: Good (no barriers observed)
Staging / Holding: Excellent (no extensive riffle areas, many pools for holding)

FISH

Sampling method(s): Electrofishing, minnow trapping
Effort: 2,231 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Few placer effects observed on this reach. Creek appears to be in natural state.

Photos taken: 2007/08/13

SITE – LYNX CREEK (L1)

UTM Coordinates: E 457965 **N** 7095795

Watercourse Name: Lynx Creek

Surveyed length (m): 300

Survey date: 2007/08/14
2007/10/03

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Lynx Creek

Mean channel width (m): 8.02
Mean bank full depth (m): 1.77
Channel gradient (%): 1.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: G

Temperature (°C): 5.9 (Aug 07)
Conductivity (µs/cm):320 (Aug 07)
pH: 8.2 (Aug 07)

Right bank (RB)
RB shape: N/A
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Few
Fish cover total: Abundant
Confinement: Unconfined
Dominant cover type: Deep Pools
Channel pattern: Irregular Meandering
Dominant bed material: Gravels
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Good (abundant gravels, variable velocity throughout reach)
Overwintering: Excellent (numerous deep pools)
Rearing: Excellent (abundant cover, frequent riffles/pools, moderate gradient)
Migration: Excellent (no observed barriers)
Staging / Holding: Excellent (abundant deep pools [>1.5m], with good overhanging vegetation for cover)

FISH

Sampling method(s): Electrofishing
Effort: 3,070 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

At 200m d/s of CL is confluence with Haggart Creek (457861.7095673). Area has multiple high flow channels that are currently dry. 5 surf scoters observed. Algae on rocks; both filamentous and macrophytic. Moss on lower banks throughout stream reach.

Photos taken: 2007/08/14

SITE - Tributary to Eagle Pup Placer Pond 2

UTM Coordinates: E 458370 **N** 7100251

Watercourse Name: Unnamed

Surveyed length (m): 200

Survey date: 2007/08/15

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Unnamed

Mean channel width (m): 0.75
Mean bank full depth (m): 0.2
Channel gradient (%): 12.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: PS
LB texture: F, G, C

Temperature (°C): 11.3
Conductivity (µs/cm): 500
pH: 9.0

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: PS
RB texture: F, G, C

Functioning LWD: None
Fish cover total: Abundant
Confinement: Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Straight
Dominant bed material: Cobbles
Sub-dominant bed material: Fines

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor
Overwintering: Nil
Rearing: Moderate (abundant overhanging vegetation for cover)
Migration: Moderate
Staging / Holding: Moderate

FISH

Sampling method(s): Electrofishing
Effort: 318 seconds
Fish captured: slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

CL is 10m d/s of CV on high road to camp. 35% gradient d/s of CV. CV is hung by 0.8m with no pool. 10-15% gradient u/s of CV. Gradient barrier - 458370.7100251. CV - 458433.7100278. Habitat assessment for first 20m from Eagle Pup Pond #2 where one 35 mm sculpin was caught.
Photos taken: 2007/08/15

SITE – PLATINUM GULCH (PG1 – HISTORIC)

UTM Coordinates: E 458848 **N** 7099623 **Watercourse Name:** Platinum Gulch

Surveyed length (m): N/A **Survey date:** 2007/08/15

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Platinum Gulch

Mean channel width (m): 0.70
Mean bank full depth (m): N/A
Channel gradient (%): 12.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: N/A

Functioning LWD: None
Fish cover total: N/A
Confinement: Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Straight
Dominant bed material: Organics
Sub-dominant bed material: Cobbles

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil

FISH

Sampling method(s): N/A
Effort: N/A
Fish captured: N/A

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Few pockets of standing water d/s of road. Distance between 2 roads on creek is ~400m. No fish habitat. Surveyed location: Platinum Gulch at high road to camp

Photos taken: 2007/08/15

SITE - PLATINUM GULCH (PG2 – NEW)

UTM Coordinates: E 458325 **N** 7099500 **Watercourse name:** Platinum Gulch

Surveyed length (m): 300 **Survey date:** 2007/08/16

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Platinum Gulch

Mean channel width (m): 0.9
Mean bank full depth (m): 0.53
Channel gradient (%): 18.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: PS
LB texture: C

Temperature (°C): 1.5
Conductivity (µs/cm): 470
pH: 7.7

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: PS
RB texture: C

Functioning LWD: N/A
Fish cover total: Abundant
Confinement: Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Straight
Dominant bed material: Cobbles
Sub-dominant bed material: Fines

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil

FISH

Sampling method(s): Electrofishing
Effort: 281 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

No fish captured; gradient barriers present. Diverted from original draw u/s of road from road building. No fish habitat. Steep narrow creek with low flow and multiple gradient barriers flow over road for 70m in shallow trickle.

Photos taken: 2007/08/16

SITE – HAGGART CREEK (HC2)

UTM Coordinates: E 458090 **N** 7101143 **Watercourse Name:** Haggart Creek

Surveyed length (m): 400 **Survey date:** 2007/08/16
2007/10/04

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 9.20
Mean bank full depth (m): 0.73
Channel gradient (%): 2.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: SHR/PS
LB texture: C

Temperature (°C): 10.0 (Aug 07)
Conductivity (µs/cm):300 (Aug 07)
pH: 8.1 (Aug 07)

Right bank (RB)
RB shape: Vertical
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: None
Fish cover total: N/A
Confinement: Frequently Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Moderate (gravels at few, mostly cobble)
Overwintering: Moderate (few pools)
Rearing: Moderate (limited complexity, few deep pools)
Migration: Good (no barriers but high velocity with refuge)
Staging / Holding: Moderate (few staging areas)

FISH

Sampling method(s): Electrofishing
Effort: 2,537 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Stream has been pushed to right bank against slope for placer mining. Road on side at CL for 100m +05

Photos taken: 2007/08/16

SITE – HAGGART CREEK (HC3)

UTM Coordinates: E 458427 **N** 7101598 **Watercourse Name:** Haggart Creek

Surveyed length (m): 400 **Survey date:** 2007/08/16
2007/10/04

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 6.47
Mean bank full depth (m): 1.13
Channel gradient (%): 2.0

Left bank (LB)
LB shape: Vertical
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 10.0 (Aug 07)
Conductivity (µs/cm):300 (Aug 07)
pH: 8.1 (Aug 07)

Right bank (RB)
RB shape: Vertical
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: None
Fish cover total: Abundant
Confinement: Occasionally Confined
Dominant cover type: Boulders, Deep Pools
Channel pattern: Sinuous
Dominant bed material: Large Cobbles
Sub-dominant bed material: Boulders

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Moderate (few small/large gravels, scouring flows in spring)
Overwintering: Excellent (abundant deep pools, likely flows year-round)
Rearing: Excellent (abundant cover (pools, boulders, cutbanks))
Migration: Excellent (good complexity, no barriers observed, gentle gradient)
Staging / Holding: Excellent (good pools/boulders for velocity refuge)

FISH

Sampling method(s): Electrofishing
Effort: 2,857 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Old road along west side of creek towards Iron Rust Creek.

Photos taken: 2007/08/16

SITE – DUBLIN GULCH (DG1)

UTM Coordinates: E 458460 **N** 7101147 **Watercourse Name:** Dublin Gulch

Surveyed length (m): 400 **Survey date:** 2007/08/17
2007/10/04

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 3.60
Mean bank full depth (m): 0.63
Channel gradient (%): 9.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 11.4 (Aug 07)
Conductivity (µs/cm):170 (Aug 07)
pH: 8.5 (Aug 07)

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: None
Fish cover total: Abundant
Confinement: Frequently Confined
Dominant cover type: Boulders
Channel pattern: Straight
Dominant bed material: Large Cobbles
Sub-dominant bed material: Boulders

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (few small gravels, high velocity)
Overwintering: Poor (few deep pools may freeze in winter)
Rearing: Moderate (steep gradient for juvenile fish)
Migration: Moderate (cascade pool morphology)
Staging / Holding: Moderate (boulders only refuge)

FISH

Sampling method(s): Electrofishing
Effort: 2,260 seconds (depletion survey)
Fish captured: Arctic grayling

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

CL is opposite core shack (north of camp). At 100m u/s of confluence with Haggart, creek spreads out along cobble fan with multiple channels. Gradient on lower reach 100m u/s of confluence is 3-5%. LWD jam - 458401.7101210; 5m length, 100m from CL. Confluence with Haggart Creek - 458268.7101250. Culvert on creek for road to Eagle zone (458639.7101005); CV is 1.5m diameter with 0.6m plunge pool (no drop).
Photos taken: 2007/08/17

SITE – STUTTLE GULCH (SG1)

UTM Coordinates: E 459232 **N** 7100676 **Watercourse Name:** Stuttle Gulch

Surveyed length (m): N/A **Survey date:** 2007/08/18

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Stuttle Gulch

Mean channel width (m): 1.0
Mean bank full depth (m): 0.4
Channel gradient (%): 28.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 13.2
Conductivity (µs/cm): 520
pH: 7.9

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: PS
RB texture: C

Functioning LWD: None
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders
Channel pattern: Straight
Dominant bed material: Large Cobbles
Sub-dominant bed material: Small Cobbles

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (few small gravels; low flow, shallow depth for adults)
Overwintering: Nil (freezes solid in winter)
Rearing: Poor (poor access, little cover)
Migration: Poor (10% at 200m d/s. 30% at CL)
Staging / Holding: Nil (low flows, small pools at best)

FISH

Sampling method(s): Electrofishing
Effort: N/A
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

At 120m u/s from Eagle Pup, stream is 20%; at 200m u/s from Eagle Pup, stream is 30%. At ~275m u/s of confluence, stream flattens to 15% and goes into shrub cover. CL is 200m from where stream goes subsurface near Eagle Pup. Placer affected reach @ CL. Stream goes subsurface @ 459131.7101917. Stuttle Gulch likely changed by placer mining and merges with Eagle Pup downstream (200m).
Photos taken: 2007/08/18

SITE – ANN GULCH (AG1)

UTM Coordinates: E 459483 **N** 7101425

Tributary to: Dublin Gulch

Surveyed length (m): 300

Survey date: 2007/08/19

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Ann Gulch

Mean channel width (m): 1.02
Mean bank full depth (m): 0.32
Channel gradient (%): 11.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Few
Fish cover total: Moderate
Confinement: Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Straight
Dominant bed material: Gravels
Sub-dominant bed material: Cobbles

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Nil (when flowing, has gravels likely too steep)
Overwintering: Nil (will freeze if flowing in winter)
Rearing: Nil (dry at time of survey, steep with fast velocity when wet)
Migration: Nil (passage/gradient barrier @ Dublin Gulch)
Staging / Holding: Nil (few pools/boulders)

FISH

Sampling method(s): N/A
Effort: N/A
Fish captured: N/A

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Steep gradient immediately u/s from Dublin Gulch that would be barriers to fish if flowing. Gradient from Dublin Gulch is ~35% to road for ~25m. Creek flows along road for approx 50m u/s (459431.7101246). Road - 459394.7101193. Good access from road along Dublin Gulch, old historical mining camps ~200m u/s and east. Natural springs - 459395.7101163. Confluence with Dublin Gulch - 459392.7101159.
Photos taken: 2007/08/19

SITE – OLIVE GULCH (OG1)

UTM Coordinates: E 461306 **N** 7101499 **Watercourse Name:** Olive Gulch

Surveyed length (m): 300 **Survey date:** 2007/08/19

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Olive Gulch

Mean channel width (m): 2.0
Mean bank full depth (m): 0.73
Channel gradient (%): 10.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: YF
LB texture: O

Temperature (°C): 5.7
Conductivity (µs/cm): 110
pH: 8.3

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: YF
RB texture: O

Functioning LWD: Few
Fish cover total: Abundant
Confinement: Frequently Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Boulders
Sub-dominant bed material: Cobbles

HABITAT

Spawning: Poor (few gravels, mostly cobble/boulder)
Overwintering: Nil (likely freezes in winter, no pools > 30cm deep)
Rearing: Good (abundant cover, pools adequate for small juveniles)
Migration: Poor (cascade and 15% on low reach from Dublin)
Staging / Holding: Good (boulder pools provide refuge)

FISH

Sampling method(s): Electrofishing
Effort: 247 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road to Shamrock @ 461204.7101616. Road above CL that follows creek for ~200m from road to Shamrock crosses creek @ 461326.7101484. Creek flows for 30m down road to Shamrock and Dublin Gulch @ 15% gradient. Olive is highly impacted by past placer activities. Creek splits into more channels @ 461430.7101350. Good access along old placer road along creek. Historical buildings in area along creek ~200m u/s of confluence with Dublin. Falls is 0.6m in height (185 m from CL) @ 461183.7101640. Confluence with Dublin is 200m d/s from CL (461175.7101645).
Photos taken: 2007/08/19

SITE – STEWART GULCH (ST1)

UTM Coordinates: E 460299 **N** 7101441 **Watercourse Name:** Stewart Gulch

Surveyed length (m): 400 **Survey date:** 2007/08/19

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Stewart Gulch

Mean channel width (m): 1.42
Mean bank full depth (m): 0.42
Channel gradient (%): 8.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: YF
LB texture: O

Temperature (°C): 6.2
Conductivity (µs/cm): 310
pH: 8.7

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: YF
RB texture: O

Functioning LWD: Few
Fish cover total: Abundant
Confinement: Frequently Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Nil (step-pool/cascade morphology)
Overwintering: Nil (likely freezes solid in winter)
Rearing: Good (abundant cover)
Migration: Poor (2m cascade barrier d/s and 15-20% gradient barrier u/s (100m))
Staging / Holding: Poor (boulders but shallow pools)

FISH

Sampling method(s): Electrofishing
Effort: 441 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

0.8m falls 100m u/s of CL. 2m cascade - 460140.7101436 (210m d/s from CL). Confluence with Dublin - 460048.7101467 (330m d/w from CL).

Photos taken: 2007/08/19

Eagle Gold Project	**Project No.:** **1053550**	**Date:** November 2009	Stantec

SITE – CASCALLEN GULCH (CG1)

UTM Coordinates: E 461716 **N** 7102085 **Watercourse Name:** Cascallen Gulch

Surveyed length (m): 200 **Survey date:** 2007/08/19

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Cascallen Gulch

Mean channel width (m): 0.68
Mean bank full depth (m): 0.77
Channel gradient (%): 10.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 4.9
Conductivity (µs/cm): 90
pH: 7.8

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: None
Fish cover total: Abundant
Confinement: Frequently Confined
Dominant cover type: Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (gravels, but narrow/barrier d/s on Dublin Gulch)
Overwintering: Nil (freezes solid)
Rearing: Moderate (abundant cover)
Migration: Nil (barrier downstream)
Staging / Holding: Moderate (boulders, pools present on Dublin Gulch)

FISH

Sampling method(s): Electrofishing
Effort: 427 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Much more narrow/smaller stream than neighbouring Bawn Boy Gulch. Difficult access. Old placer roads abound in area from road, but are overgrown (15+ years since use). Confluence with Bawn Boy - 461641.7102032.

Photos taken: 2007/08/19

SITE – BAWN BOY GULCH (BB1)

UTM Coordinates: E 461731 **N** 7102067 **Watercourse Name:** Bawn Boy Gulch

Surveyed length (m): 200 **Survey date:** 2007/08/19

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Bawn Boy Gulch

Mean channel width (m): 2.03
Mean bank full depth (m): 1.13
Channel gradient (%): 11.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 8.4
Conductivity (µs/cm): 70
pH: 7.6

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Few
Fish cover total: N/A
Confinement: Confined
Dominant cover type: Boulders, Overhanging Vegetation
Channel pattern: Straight
Dominant bed material: Boulders
Sub-dominant bed material: Cobbles

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (few gravels)
Overwintering: Nil (freezes)
Rearing: Good (abundant cover)
Migration: Nil (barrier d/s on Dublin Gulch)
Staging / Holding: Moderate (pools and boulders present)

FISH

Sampling method(s): Electrofishing
Effort: 589 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Twice the size of Cascallen Gulch. Fast velocity and high flows after rain. Creek turbid from upstream road work/exposed soils. Could drive to ~400m from CC and then hike on steep grade over boulder field (lichen covered).

Photos taken: 2007/08/19

SITE – DUBLIN GULCH (DG2)

UTM Coordinates: E 460498 **N** 7101650 **Watercourse Name:** Dublin Gulch

Surveyed length (m): 400 **Survey date:** 2007/08/20
2007/10/03

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 3.73
Mean bank full depth (m): 0.97
Channel gradient (%): 14.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 5.7 (Aug 07)
Conductivity (µs/cm):110 (Aug 07)
pH: 8.3 (Aug 07)

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Abundant
Fish cover total: Abundant
Confinement: Confined
Dominant cover type: Boulders, Deep Pools
Channel pattern: Sinuous
Dominant bed material: Boulders
Sub-dominant bed material: Cobbles

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (few gravels)
Overwintering: Good (deep pools (>0.6m), may freeze in winter)
Rearing: Good (abundant cover, velocity refuge)
Migration: Poor (numerous cascades and steep gradient throughout)
Staging / Holding: Good (deep pools, LWD, boulders provide refuge)

FISH

Sampling method(s): Electrofishing
Effort: 922 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

10m cascade 260m d/s of CL. Confined by steep hillside on RB and placer tailings on LB. Dublin Gulch cascade - 35% gradient - 459595.7101247 (~980m d/s from CL). Road to Shamrock zone - 466207.7101531 (300m d/s of CL).

Photos taken: 2007/08/20

SITE – EAGLE PUP (EP1)

UTM Coordinates: E 459740 **N** 7100989 **Watercourse Name:** Eagle Pup

Surveyed length (m): 400 **Survey date:** 2007/08/18

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Eagle Pup

Mean channel width (m): 1.47
Mean bank full depth (m): 0.47
Channel gradient (%): 19.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 4.5
Conductivity (µs/cm): 400
pH: 8.8

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: PS
RB texture: O

Functioning LWD: None
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders
Channel pattern: Straight
Dominant bed material: Cobbles
Sub-dominant bed material: Boulders

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor (few gravels, steep gradient)
Overwintering: Nil (likely freezes solid)
Rearing: Poor (few pools, scouring flows apparent, low cover)
Migration: Nil (45% barrier d/s)
Staging / Holding: Poor (few pools)

FISH

Sampling method(s): Electrofishing
Effort: 62 seconds
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

From 270m u/s to 170m d/s, gradient is ~5%. From 170m d/s to CL, gradient is 15%. ~300m d/s of CL, creek falls down canyon w/45% gradient. Confluent with unnamed creek at bottom of canyon (old Dublin Gulch?).

Photos taken: 2007/08/18

SITE – IRONRUST CREEK (IR2)

UTM Coordinates: E 458015 **N** 7103158 **Watercourse name:** Ironrust Creek

Surveyed length (m): 400 **Survey date:** 2007/08/21
2007/10/03

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Two Creek

Mean channel width (m): 4.10
Mean bank full depth (m): 1.17
Channel gradient (%): 4.0

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 4.5 (Aug 07)
Conductivity (µs/cm):220(Aug 07)
pH: 8.0 (Aug 07)

Right bank (RB)
RB shape: Sloping
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: Few
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders, Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird. T. Goodsell

HABITAT

Spawning: Moderate (gravels, but high velocity at 4% gradient)
Overwintering: Poor (few pools, none over 0.5m deep)
Rearing: Good (moderate cover, good velocity refuge)
Migration: Good (no barriers, good gradient)
Staging / Holding: Moderate (boulders, no deep pools, extensive riffles)

FISH

Sampling method(s): Electrofishing
Effort: 3,172 seconds (depletion survey)
Fish captured: Arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Confluence with Haggart Creek - 458312.7102774 (300m d/s of CL). Abandoned side channel is 5.5m wide. Multiple side channels off RB through 100m u/s of CL.

Photos taken: 2007/08/21

SITE – Haggart Creek (RE1)

UTM Coordinates: E 449038 **N** 7089709

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 140

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/20

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 16.9
Mean bank full depth (m): 0.8
Channel gradient (%): 1.0

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O, F

Temperature (°C): 11.5
Conductivity (µs/cm): 300
pH: 8.2
DO (mg/L): 10.5
Turbidity (NTU): 1.26

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O, B

Functioning LWD: few
Fish cover total: abundant
Confinement: frequently confined (by road)
Dominant cover type: deep pools
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – spawning substrates abundant
Overwintering: Good – deep pools (>1m)
Rearing: Excellent – abundant cover and complexity
Migration: Excellent – no barriers, refuge areas abundant
Staging / Holding: Moderate – flow refuge areas abundant
Comments:

- Signs of flooding observed (dry high flow channel)

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE1

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Creek is within 15 m of road at center line. Steep gradient on RB up to road grade (~60%)

Photos taken: 2009/08/12 & 2009/07/20

Eagle Gold Project	**Project No.:** **1053550**	**Date:** **November 2009**	Stantec

SITE – Haggart Creek (RE2)

UTM Coordinates: E 449108 **N** 7090071

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 250

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/20

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 18.2
Mean bank full depth (m): 1.2
Channel gradient (%): 1.0

Left bank (LB)
LB shape: sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O, F

Temperature (°C): 11.5
Conductivity (µs/cm):300
pH:8.2
DO (mg/L): 10.5
Turbidity (NTU): 1.5

Right bank (RB)
RB shape: vertical
RB riparian veg: G, S, D
RB veg. stage: PS
RB texture: O, B

Functioning LWD: few
Fish cover total: moderate
Confinement: frequently confined
Dominant cover type: deep pools, boulders
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: boulders

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – gravels present but cobble dominant
Overwintering: Poor – few pools >1m
Rearing: Good – moderate cover in pools
Migration: Good – no passage barriers, shallow, low gradient
Staging / Holding: Poor – mostly shallow, fast water
Comments:

- Road appears to be affecting stream complexity by straightening the d/s reach

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE2

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road rip-rap failing next to creek at centerline. Steep rock face on opposite side (west) of road.

Photos taken: 2009/08/12 & 2009/07/20

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE3)

UTM Coordinates: E 449244 **N** 7090025

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 200

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/20

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 19.5
Mean bank full depth (m): 1.1
Channel gradient (%): 1.0

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 11.5
Conductivity (µs/cm): 300
pH:8.1
DO (mg/L): 10.1
Turbidity (NTU): 1.5

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: few
Fish cover total: abundant
Confinement: occasionally confined
Dominant cover type: SWD, deep pools
Channel pattern: irregular meander
Dominant bed material: gravel
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – abundant gravels,
Overwintering: Moderate – few pools >1m
Rearing: Good – abundant cover
Migration: Good – no barriers, varying flow velocities
Staging / Holding: Moderate – no backwater eddies, limited areas of refuge from flow
Comments:

- Channel is split in two by a vegetated island in u/s section of encroachment

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE3

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road is ~10 m from the creek at centerline. Right bank is steep (~30% grade) and is heavily vegetated

Photos taken: 2009/08/12 & 2009/07/20

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE4)

UTM Coordinates: E 452070 **N** 7093141

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 140

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/20

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 18.8
Mean bank full depth (m): 1.4
Channel gradient (%): 1.8

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O,F,G,C

Temperature (°C): 11.7
Conductivity (µs/cm):315
pH:7.5
DO (mg/L): 9.8
Turbidity (NTU): 2.6

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: SHR
RB texture: O

Functioning LWD: few
Fish cover total: abundant
Confinement: unconfined
Dominant cover type: deep pools, SWD, undercut banks
Channel pattern: irregular meandering
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Moderate – some gravels, bed mostly armoured
Overwintering: Moderate – few pools >1m deep
Rearing: Moderate – higher gradient relative to other nearby reaches
Migration: Good – no barriers observed, shallow sections of high velocity riffle
Staging / Holding: Moderate – high velocity reach with few pools.
Comments:

- Road banks are failing and falling into creek around culvert and at u/s section of encroachment

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE4

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Right bank failing in most of the encroachment area (60%). Large confluence pool below culvert (secret creek).

Photos taken: 2009/08/12 & 2009/07/20

Eagle Gold Project	**Project No.:** **1053550**	**Date:** **November 2009**	Stantec

SITE – Haggart Creek (RE5)

UTM Coordinates: E 454579 **N** 7094321

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 360

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/21

AERIAL VIEW

UPSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 17
Mean bank full depth (m): 1.3
Channel gradient (%): 1.0

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O,G,C,F

Temperature (°C): 8.5
Conductivity (µs/cm):300
pH:7.6
DO (mg/L): 10.4
Turbidity (NTU): 1.3

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O,F,G,C

Functioning LWD: few
Fish cover total: moderate
Confinement: occasionally confined
Dominant cover type: deep pools, overhanging vegetation
Channel pattern: irregular meander
Dominant bed material: gravel
Sub-dominant bed material: fines

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – abundant small gravels
Overwintering: Moderate – few pools >1m
Rearing: Good – abundant cover types with slow water and refuge
Migration: Good – no barriers observed, velocity varies throughout reach
Staging / Holding: Good – abundant areas of velocity refuge
Comments:

- Road is within 15m of right bank at center line
- Right bank has a 70% gradient at center line
- Juvenile arctic grayling and slimy sculpin observed

NO FISH SAMPLING

Fish were observed in the surveyed reach.
Fish presence documented in Haggart Creek u/s and d/s of RE5.

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Dry high flow channel observed that is separated from the main channel by a partially vegetated island

Photos taken: 2009/08/12 & 2009/07/21

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE6)

UTM Coordinates: E 454821 **N** 7094428

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 340

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/21

AERIAL VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 18.6
Mean bank full depth (m): 1.3
Channel gradient (%): 1.3

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O,F,G,C

Temperature (°C): 8.3
Conductivity (µs/cm):305
pH:7.8
DO (mg/L): 10.1
Turbidity (NTU): 1.3

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O,F,C,B

Functioning LWD: few
Fish cover total: moderate
Confinement: occasionally confined
Dominant cover type: undercut banks, overhanging vegetation
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – abundant gravels
Overwintering: moderate – few pools >1m, mostly between 0.4-1.0m
Rearing: Excellent – abundant cover, off-channel habitat
Migration: Good – velocity refuge present
Staging / Holding: Moderate – few deep pools or low velocity areas
Comments:

- Off channel habitat present in d/s section of encroachment zone

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE6

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

The downstream end of RE6 is connected to the upstream extent of RE5.

Photos taken: 2009/08/12 & 2009/07/21

Eagle Gold Project	**Project No.:** **1053550**	**Date:** **November 2009**	Stantec

SITE – Haggart Creek (RE7)

UTM Coordinates: E 454985 **N** 7095058

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 100

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/21

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 19.8
Mean bank full depth (m): 1.0
Channel gradient (%): 1.5

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 11.3
Conductivity (µs/cm):315
pH:7.6
DO (mg/L): 10.0
Turbidity (NTU): 1.0

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: PS
RB texture: F,G,C,B

Functioning LWD: few
Fish cover total: abundant d/s of centerline
Confinement: occasionally confined
Dominant cover type: overhanging vegetation
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – gravels abundant on bars
Overwintering: Moderate – few pools >1m
Rearing: Excellent – off channel habitat (~600m^2)
Migration: Excellent – frequent sections of slack water
Staging / Holding: Excellent – frequent sections of slack water with abundant cover
Comments:

- Road bank (right bank) failure at centerline

NO FISH SAMPLING

Large adult arctic grayling observed d/s of center line
Fish presence documented in Haggart Creek u/s and d/s of RE7

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Right bank is unstable and contributing sediment directly to Haggart creek.

Photos taken: 2009/08/12 & 2009/07/21

SITE – Haggart Creek (RE8)

UTM Coordinates: E 457143 **N** 7095334

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 200

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/19

AERIAL VIEW

UPSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 15.8
Mean bank full depth (m): 1.6
Channel gradient (%): 1.3

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: C,G,F,O

Temperature (°C): 11.0
Conductivity (µs/cm):310
pH:8.0
DO (mg/L): 9.9
Turbidity (NTU): 5.4

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O,F,G

Functioning LWD: few
Fish cover total: abundant
Confinement: unconfined
Dominant cover type: deep pools
Channel pattern: irregular meander
Dominant bed material: gravels
Sub-dominant bed material: cobbles

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Excellent – gravels abundant on bars
Overwintering: Moderate – few pools >1m
Rearing: Excellent – abundant cover and flow refuge
Migration: Excellent – no passage barriers, frequent sections of slack water
Staging / Holding: Excellent – abundant areas of flow refuge and deep water sections
Comments:

- High habitat complexity
- Road does not seem to have a significant influence on this reach

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE8

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road approaches within 12 meters of Haggart creek at centerline. The gradient change is small between the top of right bank and the road bank.

Photos taken: 2009/08/12 & 2009/07/19

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE9)

UTM Coordinates: E 457294 **N** 7095452

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 100

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/19

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 14
Mean bank full depth (m): 1.1
Channel gradient (%): 1.0

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 11.1
Conductivity (µs/cm):300
pH:8.0
DO (mg/L): 9.9
Turbidity (NTU): 5.4

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: few
Fish cover total: abundant
Confinement: occasionally confined
Dominant cover type: overhanging vegetation
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Good – abundant gravels and small cobble
Overwintering: Poor – few pools >1m
Rearing: Excellent – abundant cover, mostly along RB
Migration: Excellent – no passage barriers observed, low gradient
Staging / Holding: Excellent – refuge areas in pools, created by rod wads, log jam
Comments:

- Section of right bank failing 15m u/s of centerline

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE9

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road approaches to within 15m of creek at centerline. Right bank failure contributing sediment directly to Haggart Creek. The downstream end of RE9 is connected to the upstream extent of RE8.

Photos taken: 2009/08/12 & 2009/07/19

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE10)

UTM Coordinates: E 457901 **N** 7096357

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 75

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/21

AERIAL VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 8.2
Mean bank full depth (m): 0.9
Channel gradient (%): 1.5

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O,F,C

Temperature (°C): 13.6
Conductivity (µs/cm):250
pH:7.75
DO (mg/L): 9.5
Turbidity (NTU): 1.5

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: few
Fish cover total: moderate
Confinement: unconfined
Dominant cover type: overhanging vegetation, undercut bank
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Good – abundant gravels
Overwintering: Good – undercut banks often >1m depth
Rearing: Excellent – backwater habitat and deep pools
Migration: Good – no barriers observed, frequent flow refuge areas along undercut right bank
Staging / Holding: Good – frequent flow refuge areas
Comments:

- Reach is not significantly affected by road encroachment

NO FISH SAMPLING

Many adult arctic grayling and slimy sculpin were observed during the survey.

Fish presence documented in Haggart Creek u/s and d/s of RE10

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road approaches within 20m of right bank. Slope between road grade and the top of right bank is ~20%.

Photos taken: 2009/08/12 & 2009/07/21

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (RE11)- see HC1

UTM Coordinates: E 457962 **N** 7096530

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 120

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/19 & 2009/07/27

AERIAL VIEW

CROSS SECTION

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 11.3
Mean bank full depth (m): 1.4
Channel gradient (%): 3.0

See Site – Haggart Creek HC1 for water quality results

Water quality was not measured during the July 2009 sampling program**.**

Functioning LWD: few
Fish cover total: abundant
Confinement: unconfined
Dominant cover type: deep pools
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

HABITAT

Spawning: Moderate
Overwintering: Excellent
Rearing: Excellent
Migration: Good
Staging / Holding: Excellent
Comments:

- RE11 was surveyed and sampled during the August 2007 and October 2007 programs and is also known as Site - HC1

FISH SAMPLING

Sampling method(s): electrofishing (no enclosure)
Effort: 1370seconds/ 100m^2
Fish captured: arctic grayling, slimy sculpin
Note: Electrofishing was performed to determine the presence/absence of juvenile Chinook (2009/07/27)

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road encroaches within 12m of Haggart Creek at the closest point and does not appear to have any direct impact on watercourse alignment/pattern.

Photos taken: 2009/08/12 & 2009/07/19

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Haggart Creek (RE12)

UTM Coordinates: E 458389 **N** 7098332

Watercourse name: Haggart Creek

Surveyed length (m): 400

Encroachment length (m): 285

Fish-bearing Status: Fish-bearing

Survey date: 2009/07/21

AERIAL VIEW

UPSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 12.5
Mean bank full depth (m): 0.5
Channel gradient (%): 2.0

Temperature (°C): 13.0
Conductivity (µs/cm):320
pH:8.2
DO (mg/L): 9.6
Turbidity (NTU): 2.7

Left bank (LB)
LB shape: vertical
LB riparian veg: shrubs
LB veg. stage: INIT
LB texture: F,G,C

Right bank (RB)
RB shape: vertical
RB riparian veg: shurbs
RB veg. stage: INIT
RB texture: F,G,C

Functioning LWD: none
Fish cover total: trace
Confinement: occasionally confined
Dominant cover type: N/A
Channel pattern: straight
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Nil – large particle size with mostly armoured channel bed
Overwintering: Nil – shallow area would freeze solid
Rearing: Nil – shallow high velocity riffle without cover
Migration: Poor – shallow high velocity riffle for most of reach
Staging / Holding: Poor – small boulder eddies could provide refuge to small fish
Comments:

- Reach has been subjected to extensive placer mining
- Large, mid-channel, man-made pond at d/s end of encroachment provides excellent fish habitat

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of RE12

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Bank failures are frequent throughout reach. Minimal riparian vegetation has reestablished post placer mining.

Photos taken: 2009/08/12 & 2009/07/21

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Stewart Gulch (ST2)

UTM Coordinates: E 4600644 **N** 7101190

Watercourse name: Stewart Gulch

Surveyed length (m): 400

Survey date: 2009/07/26

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Stewart Gulch

Mean channel width (m): 1.9
Mean bank full depth (m): 0.3
Channel gradient (%): 15

Left bank (LB)
LB shape: undercut
LB riparian veg: mixed
LB veg. stage: MF
LB texture: G,C

Temperature (°C): 3.6
Conductivity (µs/cm):114
pH: N/A
DO (mg/L): 10.3
Turbidity (NTU): N/A

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: G,C

Functioning LWD: few
Fish cover total: abundant (during higher flow conditions)
Confinement: frequently confined (by the road)
Dominant cover type: undercut banks
Channel pattern: sinuous
Dominant bed material: gravel
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil – high gradient and intermittent
Overwintering: Nil – intermittent, no pools
Rearing: Nil – intermittent, high gradient, reach is above a barrier to fish passage
Migration: Nil – high gradient, intermittent, above barrier to fish passage
Staging / Holding: Nil – no pools, high gradient
Comments:

- Flow is intermittent throughout reach
- Channel is blocked d/s by a placer berm and flow passes underneath

FISH SAMPLING

Sampling method(s): electrofishing (no enclosure)
Effort: 250 seconds; 100m^2
Fish captured: NFC
Low flow conditions limited the amount of effort required to sample this section
NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

No water was found above this site. Channel flows seasonally and is intermittent in this section.

Photos taken: 2009/07/26

SITE – Stuttle Gulch (SG2)

UTM Coordinates: E 459269 **N** 7100558

Watercourse name: Stuttle Gulch

Surveyed length (m): 100

Survey date: 2009/07/26

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

EXAMPLE OF SEEP

BIOPHYSICAL DATA

Watercourse name: Stuttle Gulch

Mean channel width (m): 0.4
Mean bank full depth (m): 0.3
Channel gradient (%): 15

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): 1.8
Conductivity (µs/cm): 320
pH: 6.18
DO (mg/L): N/A
Turbidity (NTU): N/A

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: none
Fish cover total: trace
Confinement: confined
Dominant cover type: overhanging vegetation
Channel pattern: sinuous
Dominant bed material: cobble
Sub-dominant bed material: fines

Crew: T. Gardener

HABITAT

Spawning: Nil – few gravel substrates, heavy infilling with fines
Overwintering: Nil – freezes solid during winter months
Rearing: Nil – high gradient, low turbid flows
Migration: Nil – u/s of multiple passage barriers, low flow
Staging / Holding: Nil – no deep pools, high gradient
Comments:

- Flow emanating from springs is highly turbid
- Ephemeral channel
- No fish observed
- Incised channel

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Flow is intermittent and low in upper reaches. Originates from multiple springs as permafrost melt, which is heavily laden with clays and fines (high turbidity). Multiple barriers exist d/s including; the road which forces the flow to run subsurface; a 28% gradient cascade; and extreme low flows throughout most of reach.

Photos taken: 2009/07/26

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Dublin Gulch (DG3)

UTM Coordinates: E 461124 **N** 7101621

Watercourse name: Dublin Gulch

Surveyed length (m): 400

Survey date: 2009/07/26

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 3.1
Mean bank full depth (m): 0.5
Channel gradient (%): 8 – 20

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: B

Temperature (°C): 6.8
Conductivity (µs/cm): 88
pH: N/A
DO (mg/L): 11.0
Turbidity (NTU): N/A

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: B

Functioning LWD: few
Fish cover total: abundant
Confinement: occasionally confined
Dominant cover type: overhanging vegetation
Channel pattern: sinuous
Dominant bed material: boulder
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Poor – limited gravels, high velocity
Overwintering: Nil – likely freezes, no pools >0.4m
Rearing: Poor – high velocity and gradient
Migration: Nil – above known barrier
Staging / Holding: Poor – limited pools and flow refuge areas
Comments:

- Site u/s of confluence with Olive Gulch
- Cascade with gradient of 20% present at d/s end of reach

FISH SAMPLING

Sampling method(s): electrofishing (no enclosure)
Effort: 352 seconds; 225m^2
Fish captured: NFC

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Gradient changes significantly downstream of confluence with Olive Gulch

Photos taken: 2009/07/26

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Ann Gulch (AG2)

UTM Coordinates: E 459528 **N** 7101642 **Watercourse name:** Ann Gulch

Surveyed length (m): 400 **Survey date:** 2009/07/28

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Ann Gulch

Mean channel width (m): 0.6
Mean bank full depth (m): 0.3
Channel gradient (%): 8

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): dry
Conductivity (µs/cm): dry
pH:dry
DO (mg/L): dry
Turbidity (NTU): dry

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: none
Fish cover total: abundant
Confinement: frequently confined
Dominant cover type: overhanging vegetation
Channel pattern: sinuous
Dominant bed material: organics
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Channelization begins 50 m d/s of CL where gradient approaches 30%
- Gradient is a barrier to fish passage
- Dry conditions at the time of sampling

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Above centerline there is no fluvial deposition, discontinuous banks, and terrestrial vegetation in channel.

Photos taken: 2009/07/28

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Olive Gulch (OG2)

UTM Coordinates: E 461505 **N** 7101237

Watercourse name: Olive Gulch

Surveyed length (m): 400

Survey date: 2009/07/26

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Olive Gulch

Mean channel width (m): NVC
Mean bank full depth (m): N/A
Channel gradient (%): 23.5
Subsurface flow under boulder field

Temperature (°C): 6.5
Conductivity (µs/cm):80
pH: N/A
DO (mg/L): 11.5
Turbidity (NTU): N/A
Water quality taken d/s of road crossing

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- 5m cascade of +30% gradient present 150m d/s of centerline, surface flows appear d/s of this cascade
- Likely freezes during winter months
- Gradient presents a barrier to fish passage

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Flowing water was audible through gaps in the boulder field at the time of sampling..

Photos taken: 2009/07/26

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Eagle Pup (EP2)

UTM Coordinates: E 460167 **N** 7100521 **Watercourse name:** Eagle Pup

Surveyed length (m): 200 **Survey date:** 2009/07/27

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Eagle Pup

Mean channel width (m): 1.0
Mean bank full depth (m): 1.0
Channel gradient (%): 24

Left bank (LB)
LB shape: undercut
LB riparian veg: mixed
LB veg. stage: MF
LB texture: C,B

Temperature (°C): dry
Conductivity (µs/cm): dry
pH: dry
DO (mg/L): dry
Turbidity (NTU): dry

Right bank (RB)
RB shape: undercut
RB riparian veg: mixed
RB veg. stage: MF
RB texture: C,B

Functioning LWD: abundant
Fish cover total: abundant
Confinement: occasionally confined
Dominant cover type: overhanging vegetation
Channel pattern: sinuous
Dominant bed material: cobble
Sub-dominant bed material: boulder

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Nil – lack of spawning substrates
Overwintering: Nil – likely freezes solid
Rearing: Nil – dry, steep, likely high velocity when wetted
Migration: Nil – multiple barriers (gradient, canyon, road, culvert)
Staging / Holding: Nil – no large pools when flowing
Comments:

- Channel dry at the time of sampling
- Channel is intermittent in the upper reaches

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Downstream road culvert is blocked with large rocks (E460036 N7100815).

Photos taken: 2009/07/27

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Platinum Gulch (PG3)

UTM Coordinates: E 458944 **N** 7099539 **Watercourse name:** Platinum Gulch

Surveyed length (m): 400 **Survey date:** 2009/07/28

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Platinum Gulch

Mean channel width (m): 2.1
Mean bank full depth (m): 0.4
Channel gradient (%): 14

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): dry
Conductivity (µs/cm): dry
pH: dry
DO (mg/L): dry
Turbidity (NTU): dry

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O

Functioning LWD: none
Fish cover total: moderate
Confinement: frequently confined
Dominant cover type: overhanging vegetation
Channel pattern: sinuous
Dominant bed material: cobble
Sub-dominant bed material: sand, fines

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Nil – lack of substrates
Overwintering: Nil – likely freezes solid
Rearing: Nil – steep gradient, lack of pools when wet
Migration: Nil – d/s barrier, steep gradient without areas of flow refuge
Staging / Holding: Nil – no deep pools
Comments:

- Channel dry at the time of sampling
- Channel appears to originate from groundwater seeps
- Upper section of watercourse appears to be ephemeral, taking on a large quantities of water during the spring melt

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Creek is intercepted by the road downstream, and there is evidence of scour over the road surface.

Photos taken: 2009/07/28

SITE – Bawn Boy Gulch (BB2)

UTM Coordinates: E 463194 **N** 7101467

Watercourse name: Bawn Boy Gulch

Surveyed length (m): 400

Survey date: 2009/07/26

Fish-bearing Status: Non fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Bawn Boy Gulch

Mean channel width (m): 0.7
Mean bank full depth (m): 0.3
Channel gradient (%): 5

Temperature (°C): 8.8
Conductivity (µs/cm): 80
pH: N/A
DO (mg/L): 10.2
Turbidity (NTU): N/A

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: C

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: C

Functioning LWD: none
Fish cover total: moderate
Confinement: frequently confined
Dominant cover type: undercut banks
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: fines

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Poor – limited spawning gravels
Overwintering: Nil – freezes solid in winter
Rearing: Moderate – limited pools, moderate cover shallow depth
Migration: Good – in this reach, becomes poor d/s
Staging / Holding: Nil – no large pools
Comments:

- D/s reach becomes steep with high velocities and no plunge pools

FISH SAMPLING

Sampling method(s): electrofishing (no enclosure)
Effort: 320 seconds; 100m^2
Fish captured: NFC
Low flow conditions limited the amount of effort required to sample this section
NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Upstream of centerline the watercourse is intersected by a road and flows over it.

Photos taken: 2009/07/26

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Dublin Gulch (DG1.1)

UTM Coordinates: E 458460 **N** 7101147

Watercourse name: Dublin Gulch

Surveyed length (m): 400

Survey date: 2009/07/22

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 5.6
Mean bank full depth (m): 0.8
Channel gradient (%): 5

Temperature (°C): 7.2
Conductivity (µs/cm):170
pH: N/A
DO (mg/L): 10.2
Turbidity (NTU): 1.2

Left bank (LB)
LB shape: vertical
LB riparian veg: shrubs
LB veg. stage: SHR
LB texture: O,F,G,B

Right bank (RB)
RB shape: vertical
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O,F,G,B

Functioning LWD: none
Fish cover total: moderate
Confinement: confined
Dominant cover type: boulder
Channel pattern: straight
Dominant bed material: cobble
Sub-dominant bed material: boulders

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Poor – few small gravels, high velocity
Overwintering: Poor – likely freezes solid during winter months
Rearing: Moderate – high gradient, moderate cover
Migration: Moderate – no barriers d/s, cascade pool morphology
Staging / Holding: Moderate - no deep pools, boulders provide flow refuge
Comments:

- Repeat sampling site (sampled during Aug & Oct 2007 programs
- Site narrows d/s, and canopy cover increases

FISH SAMPLING

Sampling method(s): electrofishing (depletion survey)
Effort: 2181 seconds; 275m^2
Fish captured: GR, CCG

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Stop nets were placed in the same location as nets placed during the 2007 surveys.

Photos taken: 2009/07/22

Eagle Gold Project	**Project No.:** **1053550**	**Date:** **November 2009**	Stantec

SITE – Dublin Gulch (DG1.2)

UTM Coordinates: E 459111 **N** 7101008

Watercourse name: Dublin Gulch

Surveyed length (m): 400

Survey date: 2009/07/22

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 7.9
Mean bank full depth (m): 0.7
Channel gradient (%): 3.5

Left bank (LB)
LB shape: vertical
LB riparian veg: deciduous
LB veg. stage: PS
LB texture: O,G,C,B

Temperature (°C): 7.2
Conductivity (µs/cm):170
pH: N/A
DO (mg/L): 10.9
Turbidity (NTU): 1.6

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: MF
RB texture: O,G,C,B

Functioning LWD: none
Fish cover total: moderate
Confinement: confined
Dominant cover type: boulders
Channel pattern: straight
Dominant bed material: boulder
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Poor – few small gravels, high velocity
Overwintering: Poor – likely freezes solid during winter months
Rearing: Moderate – high gradient, moderate cover
Migration: Moderate – no barriers d/s, cascade pool morphology
Staging / Holding: Moderate - few deep pools, boulders provide some areas of flow refuge
Comments:

- Steep placer piles on the left bank side
- Right bank remains relatively unaffected by mining activities

FISH SAMPLING

Sampling method(s): electrofishing
Effort: 2005 seconds ; 464m^2 (depletion survey)
Fish captured: GR

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Site is upstream of the Dublin Gulch road crossing (culvert).

Photos taken: 2007/07/22

SITE – Dublin Gulch (DG1.3)

UTM Coordinates: E 459552 **N** 7101214

Watercourse name: Dublin Gulch

Surveyed length (m): 400

Survey date: 2009/07/22

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Dublin Gulch

Mean channel width (m): 7.1
Mean bank full depth (m): 0.7
Channel gradient (%): 7.4

Temperature (°C): 7.1
Conductivity (µs/cm):110
pH: N/A
DO (mg/L): 10.9
Turbidity (NTU): 2.6

Left bank (LB)
LB shape: vertical
LB riparian veg: shrubs
LB veg. stage: SHR
LB texture: B

Right bank (RB)
RB shape: sloping
RB riparian veg: shrubs
RB veg. stage: SHR
RB texture: B

Functioning LWD: none
Fish cover total: moderate
Confinement: confined
Dominant cover type: boulders
Channel pattern: straight
Dominant bed material: boulders
Sub-dominant bed material: cobble

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Poor – few small gravels, high velocity
Overwintering: Poor – likely freezes solid during winter months
Rearing: Moderate – high gradient, moderate cover
Migration: Moderate – no barriers d/s, cascade pool morphology
Staging / Holding: Moderate - few deep pools, boulders provide some areas of flow refuge
Comments:

- u/s section of reach enters area of dense vegetation

FISH SAMPLING

Sampling method(s): electrofishing
Effort: 1913 seconds; 300m^2 (depletion survey)
Fish captured: GR

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Large cascade known as the Dublin Gulch cascade (35% gradient) located ~50m upstream of site.

Photos taken: 2009/07/22

Eagle Gold Project	**Project No.:** **1053550**	**Date:** **November 2009**	Stantec

SITE – Haggart Creek (HC4)

UTM Coordinates: E 458211 **N** 7100095 **Watercourse name:** Haggart Creek

Surveyed length (m): 400 **Survey date:** 2009/07/24

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 6.7
Mean bank full depth (m): 0.9
Channel gradient (%): 2.5

Temperature (°C): 9.1
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L): N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: sloping
LB riparian veg: shrubs
LB veg. stage: SHR
LB texture: O,F,G,C

Right bank (RB)
RB shape: vertical
RB riparian veg: deciduous
RB veg. stage: PS
RB texture: O

Functioning LWD: none
Fish cover total: moderate
Confinement: confined
Dominant cover type: boulders
Channel pattern: straight
Dominant bed material: cobble
Sub-dominant bed material: boulder

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Nil – few spawning gravels
Overwintering: Nil – No deep pools in this reach
Rearing: Poor – high velocity, moderate to low cover availablity
Migration: Moderate – high flow with limited cover
Staging / Holding: Poor – few areas of flow refuge
Comments:

- Site located near confluence with Gill Gulch
- Creek has been highly disturbed by placer mining activity
- Multiple areas of slope failures along both banks

NO FISH SAMPLING

Fish presence documented in Haggart Creek u/s and d/s of HC4

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

A creek ford is located up stream of sampling location (E 458214 N7099662).

Photos taken: 2009/07/24

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haggart Creek (HC5)

UTM Coordinates: E 449601 **N** 7086226

Watercourse name: Haggart Creek

Surveyed length (m): 400

Survey date: 2009/07/27

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart Creek

Mean channel width (m): 17.7
Mean bank full depth (m): 1.0
Channel gradient (%): 1.0

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L): N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: undercut
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: MF
RB texture: F,G

Functioning LWD: few
Fish cover total: moderate
Confinement: unconfined
Dominant cover type: undercut banks
Channel pattern: irregular meander
Dominant bed material: fines
Sub-dominant bed material: gravels

Crew: T. Hicks, T. Goodsell, M. Whelen

HABITAT

Spawning: Poor – low gradient, abundant fines over gravels in most areas
Overwintering: Poor – few pools >1m in depth
Rearing: Moderate – moderate cover, low gradient, low habitat complexity
Migration: Excellent – low gradient, low velocity, no barriers
Staging / Holding: Poor – mostly shallow riffles and runs
Comments:

- Lack of suitable substrates for Chinook spawning or rearing
- School of juv. Arctic Grayling observed (~30 fish)
- No Chinook were observed or captured in this reach

FISH SAMPLING

Sampling method(s): electrofishing
Effort: 600 seconds; 2000m^2 (no enclosure)
Fish captured: GR, CCG, BB
Note: Electrofishing was performed to determine the presence/absence of juvenile Chinook in the reach

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Site is within one km upstream of confluence with South McQueston River.

Photos taken: 2009/07/27

SITE – Unnamed Culvert (RC1)

UTM Coordinates: E 467070 **N** 7083023

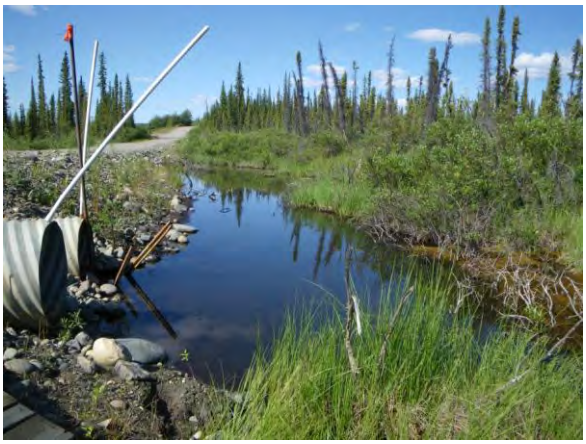
Surveyed length (m): 150

Fish-bearing Status: Inferred non-fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/16

UPSTREAM VIEW



DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Unnamed drainage to S. McQueston

Mean channel width (m): 2.5
Mean bank full depth (m): 0.95
Channel gradient (%): 1.0

Temperature (°C): 13.2
Conductivity (µs/cm):520
pH:7.7
DO (mg/L) : 9.0
Turbidity (NTU): 4.9

Left bank (LB)
LB shape: Sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: G
RB veg. stage: INIT
RB texture: G,C,B,F

Functioning LWD: None
Fish cover total: trace
Confinement: N/A
Dominant cover type: Instream vegetation, SWD
Channel pattern: Straight
Dominant bed material: Fines
Sub-dominant bed material: Cobble

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- No defined inlet or outlet to channel
- Flows from/to swamp
- Likely freezes in winter
- No fish observed
- No apparent connection to S. McQueston
- Road construction created ditch (100 u/s - 50m d/s)

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Swamp on both sides of road. Unnamed drainage has been channelized into a ditch along the road starting 100m u/s of culverts and ending 50 m d/s in a swamp. Area west of road (d/s) is highly disturbed. Water is extracted via pump in u/s ditch and used as a water source by road maintenance crews to suppress dust on Highway 2 during dry weather.

Photos taken: 2009/07/16

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Unnamed Culvert (RC2)

UTM Coordinates: E 467334 **N** 7083810

Surveyed length (m): 100

Fish-bearing Status: Inferred non-fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/16

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to S. McQueston
Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%): N/A

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): N/A
Conductivity (µs/cm):N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Right bank (RB)
RB shape: sloping
RB riparian veg: G,S
RB veg. stage: INIT
RB texture: O

Functioning LWD: none
Fish cover total: 50%
Confinement: N/A
Dominant cover type: submerged vegetation
Channel pattern: N/A
Dominant bed material: Organics
Sub-dominant bed material: Fines

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- No defined inlet or outlet to swamp/standing water
- No flowing water – likely freezes in winter
- Culvert - highly perched, crushed on both sides
- No apparent connection through culvert – heavily vegetated inlet and outlet
- No fish observed
- No apparent connection to S. McQueston

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Low lying areas on both sides of road contain shallow pools of standing water with no visible channel and no scour.

Photos taken: 2009/07/16

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Unnamed Culvert (RC3)

UTM Coordinates: E 465146 **N** 7084843

Surveyed length (m): 100

Fish-bearing Status: Inferred fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/16

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Unnamed drainage to S. McQueston

Mean channel width (m): N/A
Mean bank full depth (m): N/A
Channel gradient (%): N/A

Temperature (°C): 13.8
Conductivity (µs/cm):740
pH:7.5
DO (mg/L) : 6.7
Turbidity (NTU): 1.5

Left bank (LB)
LB shape: Sloping
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: G, S
RB veg. stage: INIT
RB texture: O

Functioning LWD: none
Fish cover total: abundant
Confinement: N/A
Dominant cover type: submerged vegetation
Channel pattern: N/A
Dominant bed material: organics
Sub-dominant bed material: fines

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Poor (fish stranding following spring melt floods)
Migration: Poor (during flood conditions only)
Staging / Holding: Nil
Comments:

- No defined inlet or outlet to swamp/standing water
- Some flowing water into u/s end of culvert
- No flowing water from d/s end of culvert
- Likely freezes in winter
- No fish observed
- Inferred intermittent connection to S. McQueston

FISH SAMPLING

Sampling method(s): Minnow Traps (2)
Effort: 24hr soak time baited with catfood.
Fish captured: none

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Swamp/marsh on both sides of the road. No evidence of scour d/s or u/s of culvert. Road surface shows signs of scour/flood.

Photos taken: 2009/07/16

SITE – Unnamed Culvert (RC4)

UTM Coordinates: E 463841 **N** 7085911

Surveyed length (m): 100

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/16

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to S. McQueston

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Functioning LWD: none
Fish cover total: none
Confinement: entrenched/excavated
Dominant cover type: N/A
Channel pattern: straight
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Dry excavated ditch with new culvert
- Some evidence of scour at d/s end of ditch
- Channel is man-made
- Begins and ends in swamp without a defined channel
- Freezes in winter
- No apparent connection to S. McQueston

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Ditch has been recently excavated to improve drainage within 10m of road. The ditch was dry at the time of visit.

Photos taken: 2009/07/16

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Haldane Creek (RC5)

UTM Coordinates: E 461851 **N** 7086774

Surveyed length (m): 400

Fish-bearing Status: Fish-bearing

Watercourse name: Haldane Creek

Survey date: 2009/07/16

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Haldane Creek

Mean channel width (m): 6.65
Mean bank full depth (m): 1.75
Channel gradient (%): 2

Temperature (°C): 15.5
Conductivity (µs/cm):330
pH:8.1
DO (mg/L) : 8.5
Turbidity (NTU): 4.95

Left bank (LB)
LB shape: vertical
LB riparian veg: G,S,D
LB veg. stage: MF
LB texture: O,F,G

Right bank (RB)
RB shape: vertical
RB riparian veg: G,S,C,D
RB veg. stage: MF
RB texture: O,F,G

Functioning LWD: Few
Fish cover total: Abundant
Confinement: unconfined – except by the bridge
Dominant cover type: Deep pools
Channel pattern: Irregular meander
Dominant bed material: sm. cobble
Sub-dominant bed material: lg. gravel

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Good – grayling(abundant sm. Gravel d/s of CL)
Overwintering: Good – multiple >1m pools may not freeze
Rearing: Excellent – abundant cover
Migration: Poor – beaver dam passage barrier; D/s - good
Staging / Holding: Excellent pool : run : riffle ratio

Comments:

- 2 beavers observed actively repairing/constructing dam 10 u/s of bridge
- Known connection to S. McQueston

FISH SAMPLING

Sampling method(s): Minnow Traps (2)
Effort: 24 hr soak baited with catfood **Fish captured:** none

Visually Observed Fish: ~12 YOY grayling

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

No placer mining has occurred in this area. Beaver dam flooding area u/s of bridge beginning to impact road.

Photos taken: 2009/07/16

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – North Star Creek (RC6)

UTM Coordinates: E 459391 **N** 7087821

Surveyed length (m): 300

Fish-bearing Status: fish-bearing

Watercourse name: North Star Creek

Survey date: 2009/07/17

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: North Star Creek
Mean channel width (m): 0.98
Mean bank full depth (m): 0.55
Channel gradient (%): 0.5

Left bank (LB)
LB shape: vertical
LB riparian veg: C,D,W
LB veg. stage: MF
LB texture: O

Temperature (°C): 19.0
Conductivity (µs/cm):135
pH:8.2
DO (mg/L): 8.3
Turbidity (NTU): 5.3

Right bank (RB)
RB shape: vertical
RB riparian veg: C,D,W
RB veg. stage: MF
RB texture: O

Functioning LWD: none
Fish cover total: abundant
Confinement: unconfined – marsh like conditions u/s and d/s
Dominant cover type: deep pools
Channel pattern: Irregular meander
Dominant bed material: organics
Sub-dominant bed material: fines

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil – lack of gravels, low flow
Overwintering: Good – deep pools >1m present
Rearing: Good – abundant cover
Migration: Nil – culvert trash racks are clogged and are a likely a barrier to fish passage
Staging / Holding: Excellent **–** low flows & deep pools
Comments:

- Likely connection to S. McQueston

FISH SAMPLING

Sampling method(s): Minnow Traps (2)
Effort: 24 hr soak time **Fish captured:** none

Visually Observed Fish: 2 ~20mm arctic grayling d/s of culvert in pond
NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Channel d/s frequently splits and rejoins through low lying marsh like area. Large ponded area u/s is partially confined by the road which acts as a berm.

Photos taken: 2009/07/17

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC7)

UTM Coordinates: E 458742 **N** 7087792

Surveyed length (m): 100

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/17

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to S. McQueston
Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

Left bank (LB)
LB shape: sloping
LB riparian veg: G,S,D,C
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: G,S,D,C
RB veg. stage: MF
RB texture: O

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Dry channel with no evidence of scour
- Small pool of standing water on the N. side of road
- Culvert on the north side of road is buried/crushed
- No evidence scour over road
- No apparent connection to S. McQueston

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Significant amounts of rooted vegetation growing in low laying depression on d/s side of culvert.

Photos taken: 2009/07/17

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC8)

UTM Coordinates: E 457994 **N** 7087665

Surveyed length (m): 100

Fish-bearing Status: Inferred fish-bearing

Watercourse name: unnamed drainage to S. McQueston

Survey date: 2009/07/17

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to S. McQueston
Mean channel width (m): N/A
Mean bank full depth (m): N/A
Channel gradient (%): N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: none
Fish cover total: N/A
Confinement:
Dominant cover type: N/A
Channel pattern: straight
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

Left bank (LB)
LB shape: sloping
LB riparian veg: S,D,C
LB veg. stage: MF
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: S,D,C
RB veg. stage: MF
RB texture: O

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- No defined inlet to swamp/standing water
- No flowing water through culvert – d/s end is dry
- Excavation/dredging evident d/s of culvert for ~50m
- Recent culvert replacement evident
- Likely freezes in winter
- No fish observed
- Inferred intermittent connection to S. McQueston

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Some over road scour observed. Fish stranding potential following flood conditions.

Photos taken: 2009/07/17

Eagle Gold Project	Project No.: 1053550	Date: November 2009	

SITE – No Visible Drainage (RC9)

UTM Coordinates: E 455043 **N** 7088099

Surveyed length (m): 50

Fish-bearing Status: Non fish-bearing

Watercourse name: No visible channel

Survey date: 2009/07/16

NO PHOTOS

BIOPHYSICAL DATA

Watercourse name: no visible channel

Mean channel width (m): NVC
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil

Comments:

- No defined channel visible at this location
- No culvert present
- No evidence of scour on or beside road
- Large lake/pond visible from this location ~500m down slope west of this location
- No visible inlet to the pond was observed
- No apparent connection to S. McQueston

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

No culvert observed. No channel or pooled water observed within 5m of 100m length of the road in this vicinity. Large lake/pond observed down steep slope to the west approximately 500m from road. Access road to lake within 50m of site.

SITE – Bighorn Creek (RC10)

UTM Coordinates: E 453216 **N** 7086642

Surveyed length (m): 350

Fish-bearing Status: Inferred fish-bearing

Watercourse name: Bighorn Creek

Survey date: 2009/07/17

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Bighorn Creek

Mean channel width (m): 2.6
Mean bank full depth (m): 1.1
Channel gradient (%): 3.5

Temperature (°C): 4.3
Conductivity (µs/cm): 210
pH: 8.0
DO (mg/L) : 12.7
Turbidity (NTU): 1.3

Left bank (LB)
LB shape: sloping
LB riparian veg: G,S,M
LB veg. stage: MF
LB texture: O,F,G,C

Right bank (RB)
RB shape: sloping
RB riparian veg: G,S,M
RB veg. stage: MF
RB texture: O,F,G,C

Functioning LWD: abundant, clumped distribution
Fish cover total: abundant
Confinement: unconfined – except by road
Dominant cover type: deep pools and overhanging vegetation
Channel pattern: irregular meander
Dominant bed material: cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Good (grayling) – abundant gravels
Overwintering: Moderate – some deep pools
Rearing: Excellent – abundant cover and flow refuge
Migration: good – no passage barriers observed
Staging / Holding: good – deep pools, cover, & flow refuge

Comments:

- 3 functioning culverts that do not appear to be a barrier to fish passage except in low flow
- No fish observed, although stream conditions are consistent with good fish habitat
- Inferred connection to S. McQueston

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Channel separates d/s into braided channel through area of dense tussocks and rejoins further d/s. U/s channel is entrenched through dense willow stand. Inferred connection to S. McQueston.

Photos taken: 2009/07/17

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – South McQueston River (RC11)

UTM Coordinates: E 449795 **N** 7085785

Surveyed length (m): 400

Fish-bearing Status: Fish-bearing

Watercourse name: South McQueston River

Survey date: 2009/07/23

AERIAL OVERVIEW

AERIAL VIEW

BIOPHYSICAL DATA

Watercourse name: South McQueston River

Mean channel width (m): 39
Mean bank full depth (m): 2.5
Channel gradient (%): 1.0

Temperature (°C): 12.4
Conductivity (µs/cm):375
pH: meter malfunction
DO (mg/L) : 9.44
Turbidity (NTU): 3.3

Left bank (LB)
LB shape: vertical
LB riparian veg: Mixed
LB veg. stage: PS
LB texture: O

Right bank (RB)
RB shape: vertical
RB riparian veg: Mixed
RB veg. stage: MF
RB texture: O,F

Functioning LWD: Few
Fish cover total: Abundant
Confinement: Unconfined – except by bridge
Dominant cover type: deep pools
Channel pattern: sinuous
Dominant bed material: gravels
Sub-dominant bed material: fines

Crew: T. Hicks, T. Goodsell, M. Arden

HABITAT

Spawning: Excellent – abundant gravel at tail-outs/bars, large gravel/cobble for Chinook spawning
Overwintering: Excellent – deep, fast runs & deep pools
Rearing: Excellent – off-channel habitats and u/s slough
Migration: Excellent – no barriers observed, abundant flow refugia
Staging / Holding: numerous backwater eddies and off-channel pools
Comments:

- Most fish observed during snorkel survey were associated with deep scour pools created by LWD and backwater eddies. Parr observed near undercut banks and riffle tail outs.

FISH SAMPLING

Sampling method(s): electrofishing, snorkel survey.
Effort: 600 seconds (electrofishing); 800m snorkel survey
Fish captured: burbot, slimy sculpin, longnose sucker.
Fish observed (snorkel survey): arctic grayling (adults and parr), chinook salmon (parr), longnose sucker (adult).

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Presence of Chinook parr suggests Chinook spawning in S. McQueston. Road flooded by u/s slough ~ 50 south of bridge.

Photos taken: 2009/08/12

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – CADILLAC CREEK (RC12)

UTM Coordinates: E 449590 **N** 7091254

Surveyed length (m): 400

Fish-bearing Status: Inferred fish-bearing

Watercourse name: Cadillac creek

Survey date: 2009/07/17

AERIAL VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Cadillac creek

Mean channel width (m): 8.4
Mean bank full depth (m): 2.0
Channel gradient (%): 8.0

Left bank (LB)
LB shape: sloping
LB riparian veg: none
LB veg. stage: N/A
LB texture: F,G,C,B

Temperature (°C): 9.5
Conductivity (µs/cm):460
pH:8.5
DO (mg/L) : 11.7
Turbidity (NTU): 5.8

Right bank (RB)
RB shape: sloping
RB riparian veg: none
RB veg. stage: N/A
RB texture: F,G,C,B

Functioning LWD: none
Fish cover total: few
Confinement: frequently confined
Dominant cover type: boulders
Channel pattern: straight
Dominant bed material: sm. cobble
Sub-dominant bed material: gravel

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Poor – limited staging, high gradient
Overwintering: Nil – no pools
Rearing: Poor – high gradient, limited cover & food sources
Migration: Nil – perched culverts are a fish passage barrier
Staging / Holding: Poor – no deep runs or deep pools
Comments:

- Creek has been subjected to placer mining activity
- 150 m d/s of culvert, creek remains in natural state
- Confluence with Haggart creek is 260m d/s of culvert

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Culverts are perched and partially blocked by debris on the u/s side. A large ground water seep is visible on the left side of the aerial photo above.

Photos taken: 2009/08/12 & 2009/07/17

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – SECRET CREEK SIDE CHANNEL (RC13)

UTM Coordinates: E 451894 **N** 7093013

Surveyed length (m): 400

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: Secret creek side channel

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Secret creek side channel
Mean channel width (m): 4.0
Mean bank full depth (m): 0.8
Channel gradient (%):1.0

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: PS
LB texture: O, F

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: PS
RB texture: O, F

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A
Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Channel dry at the time of sampling
- Side channel is man-made, a result of placer mining activities.
- Channel appears to flood during high flows only
- There is no visible connection to Haggart creek
- Channel ends 110m d/s of the culvert in flat, low lying area with firm ground and multiple depressions.

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

This channel is wet only in high flow and floods a vegetated, low lying area that does not appear to be connected to Haggart creek.

Photos taken: 2009/07/18

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – SECRET CREEK (RC14)

UTM Coordinates: E 452047 **N** 7093130

Surveyed length (m): 400

Fish-bearing Status: Fish-bearing

Watercourse name: Secret creek

Survey date: 2009/07/18

AERIAL VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Secret creek

Mean channel width (m): 18 (u/s of road influence)
Mean bank full depth (m): 1.75
Channel gradient (%): 1.0

Temperature (°C): 11.5
Conductivity (µs/cm):275
pH:7.9
DO (mg/L) : 10.7
Turbidity (NTU): 0.9

Left bank (LB)
LB shape: sloping
LB riparian veg: G,S,D
LB veg. stage: PS
LB texture: O,G,F

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: PS
RB texture: O,G,F

Functioning LWD: none
Fish cover total: low
Confinement: frequently confined
Dominant cover type: deep pools
Channel pattern: sinuous
Dominant bed material: clay, silt
Sub-dominant bed material: organics

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Good (GR) – small gravels 50m u/s of culvert
Overwintering: Moderate – some deep pools
Rearing: Moderate – limited cover, some deep pools and undercut banks
Migration: Good – culvert is slightly perched but does not present a barrier at stage observed
Staging / Holding: Good – some deep pools,
Comments:

- Secret creek and Haggart creek confluence is directly d/s of culvert
- Fish observed u/s and d/s of culvert
- Culvert is not a barrier to fish passage
- Second culvert 20m d/s of main culvert is perched and functions only during extreme high flows

FISH SAMPLING

Sampling method(s): angling, visual observation
Fish captured: arctic grayling
Fish observed: arctic grayling

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

There is active placer mining in the secret creek valley. Turbidity plume visible in aerial photo d/s of culvert in Haggart creek. Large plunge pool immediately d/s of culvert.

Photos taken: 2009/08/12 & 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	

SITE – Unnamed Culvert (RC15)

UTM Coordinates: E 456407 **N** 7094905

Surveyed length (m): 200

Fish-bearing Status: Inferred fish-bearing

Watercourse name: unnamed drainage to Haggart creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart creek

Mean channel width (m): 1.2
Mean bank full depth (m): 0.5
Channel gradient (%): 2

Temperature (°C): 10.1
Conductivity (µs/cm):315
pH:8.1
DO (mg/L) : 11.3
Turbidity (NTU): 28.1

Left bank (LB)
LB shape: vertical
LB riparian veg: mixed
LB veg. stage: MF
LB texture: O,F

Right bank (RB)
RB shape: sloping
RB riparian veg: S
RB veg. stage: SHR
RB texture: O,F

Functioning LWD: none
Fish cover total: trace
Confinement: occasionally confined
Dominant cover type: SWD and instream vegetation
Channel pattern: straight
Dominant bed material: fines
Sub-dominant bed material: organics

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil – lack of spawning substrates
Overwintering: Nil - freezes
Rearing: Poor - shallow channel with limited cover
Migration: poor –shallow in most places (2-3cm)
Staging / Holding: Nil
Comments:

- Drainage channel drains large marsh area above the road.
- Connection to Haggart creek 85m d/s of culvert
- No fish observed

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Multiple drainage channels draining marsh area u/s of road flow through this culvert. Evidence of occasional road flooding.

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC16)

UTM Coordinates: E 456570 **N** 7095040

Surveyed length (m): 125

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart creek

Mean channel width (m): 0.8
Mean bank full depth (m): dry
Channel gradient (%): 20

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: sloping
LB riparian veg: mixed
LB veg. stage: PS
LB texture: O

Right bank (RB)
RB shape: sloping
RB riparian veg: mixed
RB veg. stage: PS
RB texture: O

Functioning LWD: none
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: straight
Dominant bed material: organics
Sub-dominant bed material: clay, silt, sand

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil – high gradient
Overwintering: Nil – intermittent drainage
Rearing: Nil – intermittent, high gradient
Migration: Nil – gradient barrier
Staging / Holding: Nil – high gradient
Comments:

- +20% gradient drainage reaches Haggart creek 25m d/s of culvert
- Some signs of drainage channel u/s of road at ~50m north along road.
- Channel dry at time of sampling
- No fish observed

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Drainage channel is intermittent. Under wet conditions water flow is intercepted by the road 50m north of culvert and runs in a ditch parallel to the road before flowing through the culvert and discharging to Haggart creek.

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC17)

UTM Coordinates: E 456890 **N** 7095135

Surveyed length (m): 50

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Channel dry at the time of sampling
- Culvert appears to drain a seasonal wetland with no defined channel on either side of road
- No fish observed
- No apparent connection to Haggart Creek

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Multiple depressions without any defined channels on either side of culvert suggest a seasonally flooded wetland. No apparent connection to Haggart creek. Culvert dry at the time of sampling.

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC18)

UTM Coordinates: E 457340 **N** 7095816

Surveyed length (m): 150

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- No defined inlet or outlet to marshland
- Minimal flowing water through culvert
- Small culvert with no evidence of scour over road
- Likely freezes in winter
- No fish observed
- No apparent connection to Haggart Creek

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Culvert helps to drain marshland area with no visible channels present u/s or d/s of culvert.

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC19)

UTM Coordinates: E 457882 **N** 7096374

Surveyed length (m): 100

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Culvert drains u/s willow dominated marsh area with no visible channel
- Minimal flowing water through culvert
- Likely freezes in winter
- Connection to Haggart Creek via multiple small seeps

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Culvert drains marshy area in the vicinity of site RE 11. A small pond is present on the upstream side of the road ~50 meter south along the road. Connection with Haggart Creek within 20m of road is via multiple small seeps that flow over the right bank without any defined channel.

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Culvert (RC20)

UTM Coordinates: E 457927 **N** 7096547

Surveyed length (m): 50

Fish-bearing Status: Inferred fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/19

AERIAL VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Culvert dry at the time of sampling
- Marshy damp area on the d/s side of the culvert
- No flowing water from u/s end of culvert which has no visible channel
- Likely freezes in winter
- Inferred seasonal connection to Haggart Creek

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Culvert within ~12 meters of Haggart creek. Flows drain into marshy area next to Haggart Creek backwater side-channel. Inferred seasonal fish habitat during flood events. No channel observed u/s of culvert.

Photos taken: 2009/08/12 & 2009/07/19

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – Unnamed Drainage (RC21)

UTM Coordinates: E 458176 **N** 7097160

Surveyed length (m): 50

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Dry conditions observed at the time of sampling
- No culvert present
- Evidence of flooding over the road and erosion on d/s hill slope (~25% gradient)
- Flow originates from u/s marsh area via multiple seeps

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Road scour visible over road surface suggests periodic flooding. Area on the d/s side of the road shows evidence of erosion over 25% gradient hill slope. Gradient presents barrier to fish passage. Flows originate from Black spruce/willow marsh by way of multiple seeps along road side ditch.

Photos taken: 2009/07/18

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Unnamed Culvert (RC22)

UTM Coordinates: E 458301 **N** 7097507

Surveyed length (m): 50

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- Minimal flows observed at the time of sampling
- Erosion visible on d/s hill slope (~25% gradient)
- Flow originates from u/s drainage ditch and flow to steep ravine (~25% gradient) towards Haggart Creek
- No defined channel d/s of culvert

NO FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Water in u/s ditch originates from multiple seeps along the road. Gradient barrier to fish passage observed d/s of culvert.

Photos taken: 2009/07/18

Eagle Gold Project	**Project No.:** 1053550	**Date:** November 2009	Stantec

SITE – Unnamed Culvert (RC23)

UTM Coordinates: E 458380 **N** 7097735

Surveyed length (m): 100

Fish-bearing Status: Inferred non fish-bearing

Watercourse name: unnamed drainage to Haggart Creek

Survey date: 2009/07/18

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: unnamed drainage to Haggart Creek

Mean channel width (m): NCD
Mean bank full depth (m): N/A
Channel gradient (%):N/A

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A
DO (mg/L) : N/A
Turbidity (NTU): N/A

Left bank (LB)
LB shape: N/A
LB riparian veg: N/A
LB veg. stage: N/A
LB texture: N/A

Right bank (RB)
RB shape: N/A
RB riparian veg: N/A
RB veg. stage: N/A
RB texture: N/A

Functioning LWD: N/A
Fish cover total: N/A
Confinement: N/A
Dominant cover type: N/A
Channel pattern: N/A
Dominant bed material: N/A
Sub-dominant bed material: N/A

Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Nil
Overwintering: Nil
Rearing: Nil
Migration: Nil
Staging / Holding: Nil
Comments:

- No flowing water from d/s end of culvert
- Some standing water at u/s end of culvert
- Water in u/s ditch originates from multiple seeps along the road
- No visible channel observed d/s of culvert
- Flow passes through forested area before discharging to Haggart Creek

FISH SAMPLING

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Water in u/s ditch originates from multiple seeps along the road which flow through a shallow drainage ditch. Gradient barrier to fish passage observed d/s of culvert

Photos taken: 2009/07/18

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – HAGGART CREEK (RC24)

UTM Coordinates: E 458438 **N** 7097897

Surveyed length (m): 400

Fish-bearing Status: Fish-bearing

Watercourse name: Haggart creek

Survey date: 2009/07/19

UPSTREAM AERIAL VIEW

DOWNSTREAM AERIAL VIEW

BIOPHYSICAL DATA

Watercourse name: Haggart creek

Mean channel width (m): 12(u/s); 44(d/s)
Mean bank full depth (m): 1.0
Channel gradient (%): 2.0

Temperature (°C): 10
Conductivity (µs/cm): 320
pH: 7.7
DO (mg/L) : 10.2
Turbidity (NTU): 9.3

Left bank (LB)
LB shape: sloping
LB riparian veg: none
LB veg. stage: N/A
LB texture: F,G,C

Right bank (RB)
RB shape: sloping
RB riparian veg: G,S,D
RB veg. stage: SHR
RB texture: O,F,G

Functioning LWD: none
Fish cover total: trace
Confinement: occasionally confined
Dominant cover type: boulders
Channel pattern: straight
Dominant bed material: cobble
Sub-dominant bed material: gravel
Crew: T. Hicks, T. Goodsell

HABITAT

Spawning: Excellent (AG, CCG) – good substrates, bars
Overwintering: Poor – small plunge pool d/s of culvert
Rearing: Moderate – trace cover, a few off channel ponds
Migration: Good – no barriers, many shallow areas, limited areas of flow refuge
Staging / Holding: Moderate – few deep pools, mostly shallow riffle
Comments:

- Large pool on left bank formed by placer operations (300m d/s of culvert) – seasonal rearing habitat

FISH SAMPLING

Sampling method(s): angling, visual observation
Fish captured: arctic grayling
Fish observed: arctic grayling, slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Haggart creek has been heavily subjected to placer mining activity. Many visible bars.

Photos taken: 2009/08/12

Eagle Gold Project	Project No.: 1053550	Date: November 2009	Stantec

SITE – EAGLE PUP (EPPP1)

UTM Coordinates: E 458348 **N** 7099740 **Watercourse name:** Eagle Pup

Surveyed length (m): N/A **Survey date:** 2007/08/15
2008/04/24

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Eagle Pup

Mean channel width (m): N/A
Mean bank full depth (m): ~1.5m
Channel gradient (%):N/A

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A

Right bank (RB)
RB shape: Sloping
RB riparian veg: Shrub
RB veg. stage: SH
RB texture: C

Functioning LWD: Few
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders, Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor
Overwintering: Poor (freezes to bottom in winter)
Rearing: Moderate (moderate cover, good velocity refuge)
Migration: Good (no barriers, good gradient)
Staging / Holding: Good

FISH

Sampling method(s): MT
Effort: 3 x 24 hours
Fish captured: slimy sculpin

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Large shallow pond created by past placer activity. Too shallow for overwintering habitat. Moderate rearing habitat for grayling and sculpin

Photos taken: 2007/08/15

SITE – EAGLE PUP (EPPP2)

UTM Coordinates: E 458335 **N** 7100139 **Watercourse name:** Eagle Pup

Surveyed length (m): N/A **Survey date:** 2007/08/15

Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Eagle Pup

Mean channel width (m): N/A
Mean bank full depth (m): ~1.5m
Channel gradient (%):N/A

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A

Right bank (RB)
RB shape: Sloping
RB riparian veg: Shrub
RB veg. stage: SH
RB texture: C

Functioning LWD: Few
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders, Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor
Overwintering: Poor (freezes to bottom in winter)
Rearing: Moderate (moderate cover, good velocity refuge)
Migration: Good (no barriers, good gradient)
Staging / Holding: Good

FISH

Sampling method(s): MT
Effort: 3 x 24 hours
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Large shallow pond created by past placer activity. Too shallow for overwintering habitat. Moderate rearing habitat for grayling and sculpin.

Photos taken: 2007/08/15

SITE – EAGLE PUP (EPPP3)

UTM Coordinates: E 458551 **N** 7100884 **Watercourse name:** Eagle Pup

Surveyed length (m): N/A **Survey date:** 2007/08/15

Fish-bearing Status: Non-fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

Watercourse name: Eagle Pup

Mean channel width (m): N/A
Mean bank full depth (m): ~1.5m
Channel gradient (%):N/A

Left bank (LB)
LB shape: Sloping
LB riparian veg: Mixed
LB veg. stage: MF
LB texture: O

Temperature (°C): N/A
Conductivity (µs/cm): N/A
pH: N/A

Right bank (RB)
RB shape: Sloping
RB riparian veg: Shrub
RB veg. stage: SH
RB texture: C

Functioning LWD: Few
Fish cover total: Moderate
Confinement: Frequently Confined
Dominant cover type: Boulders, Overhanging Vegetation
Channel pattern: Sinuous
Dominant bed material: Cobbles
Sub-dominant bed material: Gravels

Crew: J. Baird, T. Goodsell

HABITAT

Spawning: Poor
Overwintering: Poor (freezes to bottom in winter)
Rearing: Moderate (moderate cover, good velocity refuge)
Migration: Good (no barriers, good gradient)
Staging / Holding: Good

FISH

Sampling method(s): MT
Effort: 3 x 24 hours
Fish captured: No fish captured

NOTE: Refer to Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures for biophysical data description

GENERAL SITE COMMENTS

Above barrier to fish passage (perched culvert) in Eagle Pup. Non-fish-bearing shallow placer created pond.

Photos taken: 2007/08/15

Appendix A – Site Summary Spread Sheet

Site	Mean Channel Width (m)	Mean Residual Pool Depth (m)	Mean Gradient (%)	Substrate (dominant/ subdom.)	Total Cover	Fish-bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over-wintering Habitat Quality	Water Temperature (°C)			Conductivity (µS/cm)			pH			Dissolved Oxygen (mg/L)		
										Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009
Ann Gulch (AG1)	1.02	0.05	11	G, C	M	Non-fish-bearing	–	–	–	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A
Ann Gulch (AG2)	0.63	0	8	O,C	A	Non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Bawn Boy Gulch (BB1)	2.03	0.32	11	B, C	N/A	Non-fish-bearing	–	–	–	8.4	N/A	N/A	70	N/A	N/A	7.6	N/A	N/A	10.3	N/A	N/A
Bawn Boy Gulch (BB2)	0.7	0.25	5	C, F	M	Non-fish-bearing (NFC)	–	–	–	N/A	N/A	8.8	N/A	N/A	80	N/A	N/A	N/A	N/A	N/A	10.2
Bighorn Creek (RC10)	2.6	0.37	3.5	C, G	A	Inferred fish -bearing	Good	Excellent	Moderate	N/A	N/A	4.3	N/A	N/A	210	N/A	N/A	8.0	N/A	N/A	12.7
Cadillac Creek (RC12)	8.4	0.1	8	C, G	T	Inferred fish -bearing	Poor	Poor	Nil	N/A	N/A	9.5	N/A	N/A	460	N/A	N/A	8.5	N/A	N/A	11.7
Cascallen Gulch (CG1)	0.68	0.22	10	C, G	A	Non-fish-bearing	–	–	–	4.9	N/A	N/A	90	N/A	N/A	7.8	N/A	N/A	10.9	N/A	N/A
Dublin Gulch (DG1)	3.6	0.25	9	C, B	A	Fish-bearing (GR)	Poor	Moderate	Poor	11.4	0.0	N/A	170	170	N/A	8.5	8.5	N/A	9.75	N/A	N/A
Dublin Gulch (DG1.1)	5.58	0.1	5	B, C	M	Fish-bearing (GR, CCG)	Poor	Moderate	Poor	N/A	N/A	7.2	N/A	N/A	170	N/A	N/A	N/A	N/A	N/A	10.2
Dublin Gulch (DG1.2)	7.9	0.31	4	B, C	M	Fish-bearing (GR)	Poor	Moderate	Poor	N/A	N/A	7.2	N/A	N/A	170	N/A	N/A	N/A	N/A	N/A	10.9
Dublin Gulch (DG1.3)	7.07	0.27	7.5	B, R	M	Fish-bearing (GR)	Poor	Moderate	Poor	N/A	N/A	7.1	N/A	N/A	110	N/A	N/A	N/A	N/A	N/A	10.9
Dublin Gulch (DG2)	3.73	0.32	14	B, C	A	Non-fish-bearing	–	–	–	5.7	0.9	N/A	110	100	N/A	8.2	7.9	N/A	10.8	11.4	N/A
Dublin Gulch (DG3)	3.16	0.17	14	B, C	A	Non-fish-bearing (NFC)	–	–	–	N/A	N/A	6.8	N/A	N/A	88	N/A	N/A	N/A	N/A	N/A	11.0
Eagle Pup (EP1)	1.47	0.15	19	C, B	M	Non-fish-bearing	–	–	–	4.5	N/A	N/A	400	N/A	N/A	8.8	N/A	N/A	10.3	N/A	N/A
Eagle Pup (EP2)	1.07	0	24	C, B	A	Non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Eagle Pup Placer Pond 1	N/A	N/A	N/A	N/A	N/A	Fish-bearing (GR, CCG)	Poor	Moderate	Poor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eagle Pup Placer Pond 2	N/A	N/A	N/A	N/A	N/A	Fish-bearing (NFC)	Poor	Moderate	Poor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eagle Pup Placer Pond 3	N/A	N/A	N/A	N/A	N/A	Non-fish-bearing	–	–	–	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Haggart Creek (HC1)	11.32	0.78	3	C, G	N/A	Fish-bearing (GR, CCG)	Moderate	Excellent	Good	7.3	2.4	N/A	300	300	N/A	8.4	8.2	N/A	10.7	13.4	N/A
Haggart Creek (HC2)	9.2	0.2	2	C, G	N/A	Fish-bearing (GR, CCG)	Moderate	Moderate	Moderate	10	0.1	N/A	300	300	N/A	8.1	7.9	N/A	12.0	8.9	N/A
Haggart Creek (HC3)	6.47	0.63	2	C, B	A	Fish-bearing (GR, CCG)	Moderate	Excellent	Good	10	0.1	N/A	300	280	N/A	8.1	8.3	N/A	11.8	13.3	N/A
Haggart Creek (HC4)	8.2	0.11	2.5	C, B	M	Fish-bearing	Nil	Poor	Nil	N/A	N/A	9.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Haggart Creek (HC5)	17.7	0.63	1	F, G	M	Fish-bearing (GR,CCG,BB)	Moderate	Moderate	Poor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Haggart Creek (RC24)	12	0.18	2	C, G	T	Fish-bearing (GR)	Excellent	Moderate	Poor	N/A	N/A	10.0	N/A	N/A	320	N/A	N/A	7.7	N/A	N/A	10.2
Haggart Creek (RE1)	16.9	0.33	1	C, G	A	Fish-bearing	Good	Excellent	Good	N/A	N/A	11.5	N/A	N/A	300	N/A	N/A	8.2	N/A	N/A	10.5
Haggart Creek (RE10)	8.2	0.65	1.5	C, G	M	Fish-bearing	Good	Excellent	Good	N/A	N/A	13.6	N/A	N/A	250	N/A	N/A	7.8	N/A	N/A	9.5
Haggart Creek (RE11)	11.3	0.8	3	C, G	A	Fish-bearing	Moderate	Excellent	Excellent	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1	see site HC1
Haggart Creek (RE12)	12.5	0.08	2	C, G	T	Fish-bearing	Nil	Nil	Nil	N/A	N/A	13.0	N/A	N/A	320	N/A	N/A	8.2	N/A	N/A	9.6
Haggart Creek (RE2)	18.2	0.38	1	C, B	M	Fish-bearing	Good	Good	Poor	N/A	N/A	11.5	N/A	N/A	300	N/A	N/A	8.2	N/A	N/A	10.5
Haggart Creek (RE3)	19.5	0.58	1	G, C	A	Fish-bearing	Good	Good	Moderate	N/A	N/A	11.5	N/A	N/A	300	N/A	N/A	8.1	N/A	N/A	10.1
Haggart Creek (RE4)	18.8	0.63	1.8	C, G	A	Fish-bearing	Moderate	Moderate	Moderate	N/A	N/A	11.7	N/A	N/A	315	N/A	N/A	7.5	N/A	N/A	9.8
Haggart Creek (RE5)	17	0.72	1	G, F	M	Fish-bearing	Good	Good	Moderate	N/A	N/A	8.5	N/A	N/A	300	N/A	N/A	7.6	N/A	N/A	10.4
Haggart Creek (RE6)	18.6	0.58	1.3	C, G	M	Fish-bearing	Good	Excellent	Moderate	N/A	N/A	8.3	N/A	N/A	305	N/A	N/A	7.8	N/A	N/A	10.1
Haggart Creek (RE7)	19.8	0.43	1.5	C, G	A	Fish-bearing	Good	Excellent	Moderate	N/A	N/A	11.3	N/A	N/A	315	N/A	N/A	7.6	N/A	N/A	10.0
Haggart Creek (RE8)	15.8	0.4	1.3	G, C	A	Fish-bearing	Excellent	Excellent	Moderate	N/A	N/A	11.0	N/A	N/A	310	N/A	N/A	8.0	N/A	N/A	9.9
Haggart Creek (RE9)	14	0.38	1	C, G	A	Fish-bearing	Good	Excellent	Poor	N/A	N/A	11.1	N/A	N/A	300	N/A	N/A	8.0	N/A	N/A	9.9
Haldane Creek (RC5)	6.65	0.43	2	C, G	A	Fish-bearing	Good	Excellent	Good	N/A	N/A	15.5	N/A	N/A	330	N/A	N/A	8.1	N/A	N/A	8.5
Ironrust Creek (IR2)	4.1	0.13	4	C, G	M	Fish-bearing (GR, CCG)	Moderate	Good	Poor	4.5	0.3	N/A	220	210	N/A	8.0	7.9	N/A	11.7	10.7	N/A
Lynx Creek (L1)	8.02	1.14	1	G, G	A	Fish-bearing (GR, CCG)	Good	Excellent	Excellent	5.9	0.5	N/A	320	290	N/A	8.2	8.0	N/A	10.9	11.7	N/A
Lynx Creek (L4)	6.05	0.39	1	C, G	M	Fish-bearing (GR, CCG)	Moderate	Good	Moderate	4	0.2	N/A	340	310	N/A	8.0	8.0	N/A	11.3	11.5	N/A
No visible drainage (RC9)	NVC	N/A	N/A	N/A	N/A	Non-fish-bearing	–	–	–	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix A – Site Summary Spread Sheet

Site	Mean Channel Width (m)	Mean Residual Pool Depth (m)	Mean Gradient (%)	Substrate (dominant/ subdom.)	Total Cover	Fish-bearing Status (fish captured)	Spawning Habitat Quality	Rearing Habitat Quality	Over-wintering Habitat Quality	Water Temperature (°C)			Conductivity (µS/cm)			pH			Dissolved Oxygen (mg/L)		
										Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009	Aug 2007	Oct 2007	July 2009
North Star Creek (RC6)	0.98	0	0.5	O, F	A	Fish-bearing	Nil	Good	Good	N/A	N/A	19.0	N/A	N/A	135	N/A	N/A	8.2	N/A	N/A	8.3
Olive Gulch (OG1)	2	0.14	10	B, C	A	Non-fish-bearing	–	–	–	5.7	N/A	N/A	110	N/A	N/A	8.3	N/A	N/A	11.3	N/A	N/A
Olive Gulch (OG2)	NVC	N/A	23.5	B, B	N/A	Non-fish-bearing	–	–	–	N/A	N/A	6.5	N/A	N/A	80	N/A	N/A	N/A	N/A	N/A	11.5
Platinum Gulch (PG1 – historic)	0.7	N/A	12	O, C	N/A	Non-fish-bearing	–	–	–	Dry	Dry	N/A	Dry	Dry	N/A	Dry	Dry	N/A	Dry	Dry	N/A
Platinum Gulch (PG2 – new)	0.9	0.05	18	C, F	A	Non-fish-bearing	–	–	–	1.5	N/A	N/A	470	N/A	N/A	7.7	N/A	N/A	11.8	N/A	N/A
Platinum Gulch (PG3)	2.13	0	14	C, F	M	Non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Secret Creek (RC14)	28.6	0.4	1	F, O	T	Fish bearing (GR)	Good	Moderate	Moderate	N/A	N/A	11.5	N/A	N/A	275	N/A	N/A	7.9	N/A	N/A	10.7
Secret Creek side channel (RC13)	4.0	0	1	N/A	N/A	Inferrred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
South McQueston River (RC11)	38.8	1.08 (centerline)	1	G, F	A	Fish-bearing (CH,GR,BB,CCG,LSU)	Excellent	Excellent	Excellent	N/A	N/A	12.4	N/A	N/A	375	N/A	N/A	N/A	N/A	N/A	9.4
Stewart Gulch (ST1)	1.42	0.15	8	C, G	A	Non-fish-bearing	–	–	–	6.2	N/A	N/A	310	N/A	N/A	8.7	N/A	N/A	12.2	N/A	N/A
Stewart Gulch (ST2)	1.86	0.1	15	G, F	A	Non-fish-bearing	–	–	–	N/A	N/A	3.6	N/A	N/A	114	N/A	N/A	N/A	N/A	N/A	10.3
Stuttle Gulch (SG1)	1	0.04	28	C, C	T	Non-fish-bearing	–	–	–	13.2	N/A	N/A	520	N/A	N/A	7.9	N/A	N/A	8.3	N/A	N/A
Stuttle Gulch (SG2)	0.4	0.04	15	C, F	T	Non-fish-bearing				N/A	N/A	1.8	N/A	N/A	320	N/A	N/A	6.2	N/A	N/A	N/A
Tributary to Eagle Pup Placer Pond 2	0.75	0.05	12	C, F	A	Fish-bearing (CCG)	Poor	Moderate	Nil	11.3	N/A	N/A	500	N/A	N/A	9.0	N/A	N/A	9.6	N/A	N/A
Unnamed Culvert (RC1)	2.5	0.16	1	F, C	T	Inferred non-fish-bearing	–	–	–	N/A	N/A	13.2	N/A	N/A	520	N/A	N/A	7.7	N/A	N/A	9.0
Unnamed Culvert (RC15)	1.2	0.05	2	F, O	T	Inferred fish -bearing	Nil	Poor	Nil	N/A	N/A	10.1	N/A	N/A	315	N/A	N/A	8.1	N/A	N/A	11.3
Unnamed Culvert (RC16)	0.8	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC17)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing				N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC18)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC19)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC2)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC20)	NCD	N/A	N/A	N/A	N/A	Inferred fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC21)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC22)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC23)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC3)	N/A	N/A	N/A	O, F	A	Inferred fish -bearing	Nil	Poor	Nil	N/A	N/A	13.8	N/A	N/A	740	N/A	N/A	7.5	N/A	N/A	6.7
Unnamed Culvert (RC4)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC7)	NCD	N/A	N/A	N/A	N/A	Inferred non-fish-bearing	–	–	–	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry	N/A	N/A	Dry
Unnamed Culvert (RC8)	N/A	N/A	N/A	N/A	N/A	Inferred fish-bearing	–	–	–	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

NCD = Non classified drainage
NVC = No visible channel
N/A = data not available
"–" = not applicable
M = moderate (5-20%)

F = fines
G = gravel
C = cobble
B = boulder
R = bedrock

A = abundant (>20%)
M = moderate (5-20%)
T = trace (<5%)

CH = Chinook salmon
GR = Arctic grayling
CCG = slimy sculpin
BB = burbot
LSU = longnose sucker

NFC = no fish captured

APPENDIX B

Fish Tissue Results

Victoria GOLD CORP

Stantec

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ANALYTICAL REPORT

JACQUES WHITFORD

ATTN: TODD GOODSELL

4370 DOMINION STREET, 5TH FLOOR
PO BOX 21
BURNABY BC V5G 4L7

Reported On: 27-MAR-08 06:41 PM
Revision: 1

Lab Work Order #: L600816 **Date Received:** 08-FEB-08

Project P.O. #:
Job Reference: 1028268.12
Legal Site Desc:
CofC Numbers: A019631

Other Information:

Comments: Please note that certain Metals detection limits have been increased for some of the samples due to the interferences encountered during the analysis.

Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

NATASHA MARKOVIC-MIROVIC

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L600816-1 Description: DG1-GRAYLING #1 MUSCLE	L600816-2 DG1-GRAYLING #1 LIVER	L600816-3 DG1-GRAYLING #2 MUSCLE	L600816-4 DG1-GRAYLING #2 LIVER	L600816-5 DG1-GRAYLING #3 MUSCLE
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	2.8	21	3.0	59	4.0
	Antimony (Sb)-Total (mg/kg wwt)	<0.010	<0.10	<0.010	<0.10	<0.010
	Arsenic (As)-Total (mg/kg wwt)	0.681	3.25	0.669	2.74	0.721
	Barium (Ba)-Total (mg/kg wwt)	0.089	0.43	0.122	0.27	0.102
	Beryllium (Be)-Total (mg/kg wwt)	<0.10	<1.0	<0.10	<1.0	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)	<0.030	<0.30	<0.030	<0.30	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)	0.0336	0.203	0.0441	0.433	0.0719
	Calcium (Ca)-Total (mg/kg wwt)	684	1980	933	2350	847
	Chromium (Cr)-Total (mg/kg wwt)	<0.10	<1.0	<0.10	<1.0	<0.10
	Cobalt (Co)-Total (mg/kg wwt)	0.141	0.34	0.163	0.37	0.172
	Copper (Cu)-Total (mg/kg wwt)	1.03	3.93	0.974	3.58	0.962
	Iron (Fe)-Total (mg/kg wwt)	11.4	86.4	8.93	71.3	8.00
	Lead (Pb)-Total (mg/kg wwt)	<0.020	<0.20	<0.020	<0.20	<0.020
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<1.0	<0.10	<1.0	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	223	231	209	304	236
	Manganese (Mn)-Total (mg/kg wwt)	0.721	3.18	1.36	1.89	1.27
	Mercury (Hg)-Total (mg/kg wwt)	0.0340		0.0240		0.0297
	Molybdenum (Mo)-Total (mg/kg wwt)	0.011	0.16	0.012	0.24	0.013
	Nickel (Ni)-Total (mg/kg wwt)	<0.10	<1.0	0.10	<1.0	<0.10
	Phosphorus (P)-Total (mg/kg wwt)	2110	4110	2470	4110	2530
	Potassium (K)-Total (mg/kg wwt)	3180	7180	3540	7020	3940
	Selenium (Se)-Total (mg/kg wwt)	2.76	6.0	2.55	6.7	2.45
	Sodium (Na)-Total (mg/kg wwt)	934	1990	994	2110	1100
	Strontium (Sr)-Total (mg/kg wwt)	0.631	1.03	0.874	0.76	0.795
	Thallium (Tl)-Total (mg/kg wwt)	<0.010	<0.10	<0.010	<0.10	<0.010
	Tin (Sn)-Total (mg/kg wwt)	<0.050	<0.50	<0.050	<0.50	<0.050
	Titanium (Ti)-Total (mg/kg wwt)	<0.30	<1.0	<0.30	<1.0	<0.30
	Uranium (U)-Total (mg/kg wwt)	<0.0020	<0.020	<0.0020	<0.020	<0.0020
	Vanadium (V)-Total (mg/kg wwt)	<0.10	<1.0	<0.10	<1.0	<0.10
	Zinc (Zn)-Total (mg/kg wwt)	14.0	57.0	14.5	61.2	16.6

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-6 DG1-GRAYLING #3 LIVER	L600816-7 DG1-GRAYLING #4 MUSCLE	L600816-8 DG1-GRAYLING #4 LIVER	L600816-9 DG1-GRAYLING #5 MUSCLE	L600816-10 DG1-GRAYLING #5 LIVER
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		<20	2.0	4.4	3.2	8.8
	Antimony (Sb)-Total (mg/kg wwt)		<0.10	<0.010	<0.020	<0.010	<0.030
	Arsenic (As)-Total (mg/kg wwt)		4.18	0.444	1.41	0.498	2.60
	Barium (Ba)-Total (mg/kg wwt)		0.57	0.111	0.649	0.147	0.522
	Beryllium (Be)-Total (mg/kg wwt)		<1.0	<0.10	<0.20	<0.10	<0.30
	Bismuth (Bi)-Total (mg/kg wwt)		<0.30	<0.030	<0.060	<0.030	<0.090
	Cadmium (Cd)-Total (mg/kg wwt)		0.881	0.0235	0.225	0.0147	0.149
	Calcium (Ca)-Total (mg/kg wwt)		2840	1110	5450	915	3470
	Chromium (Cr)-Total (mg/kg wwt)		<1.0	<0.10	<0.20	<0.10	<0.30
	Cobalt (Co)-Total (mg/kg wwt)		0.61	0.062	0.135	0.078	0.152
	Copper (Cu)-Total (mg/kg wwt)		5.05	0.786	1.98	0.728	2.16
	Iron (Fe)-Total (mg/kg wwt)		109	7.42	40.6	7.31	78.3
	Lead (Pb)-Total (mg/kg wwt)		<0.20	<0.020	0.054	<0.020	<0.060
	Lithium (Li)-Total (mg/kg wwt)		<1.0	<0.10	<0.20	<0.10	<0.30
	Magnesium (Mg)-Total (mg/kg wwt)		273	237	299	248	267
	Manganese (Mn)-Total (mg/kg wwt)		4.33	0.771	7.54	0.486	3.32
	Mercury (Hg)-Total (mg/kg wwt)			0.0250		0.0333	
	Molybdenum (Mo)-Total (mg/kg wwt)		0.22	<0.010	0.132	0.011	0.075
	Nickel (Ni)-Total (mg/kg wwt)		<1.0	<0.10	<0.20	<0.10	<0.30
	Phosphorus (P)-Total (mg/kg wwt)		5360	2540	5010	2260	3640
	Potassium (K)-Total (mg/kg wwt)		9660	3600	5240	3410	4250
	Selenium (Se)-Total (mg/kg wwt)		7.6	2.68	4.92	2.40	4.67
	Sodium (Na)-Total (mg/kg wwt)		2860	945	1320	842	1280
	Strontium (Sr)-Total (mg/kg wwt)		1.50	1.02	4.94	0.984	2.62
	Thallium (Tl)-Total (mg/kg wwt)		<0.10	<0.010	<0.020	<0.010	<0.030
	Tin (Sn)-Total (mg/kg wwt)		<0.50	<0.050	<0.10	<0.050	<0.15
	Titanium (Ti)-Total (mg/kg wwt)		<1.0	<0.30	<1.0	<0.10	<1.0
	Uranium (U)-Total (mg/kg wwt)		<0.020	<0.0020	<0.0040	<0.0020	0.0069
	Vanadium (V)-Total (mg/kg wwt)		<1.0	<0.10	<0.20	<0.10	<0.30
	Zinc (Zn)-Total (mg/kg wwt)		60.5	11.7	45.0	12.0	32.8

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-11 DG1-GRAYLING #6 MUSCLE	L600816-12 DG1-GRAYLING #6 LIVER	L600816-13 DG1-GRAYLING #7 MUSCLE	L600816-14 DG1-GRAYLING #7 LIVER	L600816-15 DG1-GRAYLING #8 MUSCLE
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		4.0	<6.0	2.6	4.5	<2.0
	Antimony (Sb)-Total (mg/kg wwt)		<0.010	<0.030	<0.010	<0.020	<0.010
	Arsenic (As)-Total (mg/kg wwt)		0.471	1.91	0.241	0.767	0.501
	Barium (Ba)-Total (mg/kg wwt)		0.152	0.187	0.067	0.226	0.055
	Beryllium (Be)-Total (mg/kg wwt)		<0.10	<0.30	<0.10	<0.20	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)		<0.030	<0.090	<0.030	<0.060	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)		0.0260	0.115	0.0312	0.289	0.0122
	Calcium (Ca)-Total (mg/kg wwt)		819	1950	656	1710	347
	Chromium (Cr)-Total (mg/kg wwt)		<0.10	<0.30	<0.10	<0.20	<0.10
	Cobalt (Co)-Total (mg/kg wwt)		0.069	0.139	0.033	0.093	0.060
	Copper (Cu)-Total (mg/kg wwt)		0.991	2.14	0.611	2.02	0.755
	Iron (Fe)-Total (mg/kg wwt)		7.21	46.3	5.82	51.4	5.53
	Lead (Pb)-Total (mg/kg wwt)		<0.020	<0.060	<0.020	<0.040	<0.020
	Lithium (Li)-Total (mg/kg wwt)		<0.10	<0.30	<0.10	<0.20	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)		250	194	238	210	238
	Manganese (Mn)-Total (mg/kg wwt)		0.414	0.856	0.493	1.23	0.259
	Mercury (Hg)-Total (mg/kg wwt)		0.0274		0.0227		0.0178
	Molybdenum (Mo)-Total (mg/kg wwt)		<0.010	0.070	<0.010	0.085	<0.010
	Nickel (Ni)-Total (mg/kg wwt)		<0.10	<0.30	<0.10	<0.20	<0.10
	Phosphorus (P)-Total (mg/kg wwt)		2350	2890	2240	3560	2100
	Potassium (K)-Total (mg/kg wwt)		3340	4850	3550	5100	3590
	Selenium (Se)-Total (mg/kg wwt)		2.72	5.49	2.36	5.13	2.35
	Sodium (Na)-Total (mg/kg wwt)		873	1500	826	1330	730
	Strontium (Sr)-Total (mg/kg wwt)		0.861	0.785	0.537	1.06	0.278
	Thallium (Tl)-Total (mg/kg wwt)		<0.010	<0.030	<0.010	<0.020	<0.010
	Tin (Sn)-Total (mg/kg wwt)		<0.050	<0.15	<0.050	<0.10	<0.050
	Titanium (Ti)-Total (mg/kg wwt)		<0.10	<1.0	<0.30	<1.0	<0.10
	Uranium (U)-Total (mg/kg wwt)		<0.0020	<0.0060	<0.0020	<0.0040	<0.0020
	Vanadium (V)-Total (mg/kg wwt)		<0.10	<0.30	<0.10	<0.20	<0.10
	Zinc (Zn)-Total (mg/kg wwt)		12.2	35.0	11.0	34.5	9.19

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID				
		L600816-16 DG1-GRAYLING #8 LIVER	L600816-17 DG1-GRAYLING #9 MUSCLE	L600816-18 DG1-GRAYLING #9 LIVER	L600816-19 HC3A-GRAYLING #1 MUSCLE	L600816-20 HC3A-GRAYLING #1 LIVER
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	3.6	2.8	<2.0	2.3	16.9
	Antimony (Sb)-Total (mg/kg wwt)	<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg wwt)	1.59	0.415	1.59	0.187	0.482
	Barium (Ba)-Total (mg/kg wwt)	0.190	0.055	0.144	0.072	0.224
	Beryllium (Be)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)	<0.030	<0.030	<0.030	<0.030	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)	0.0974	0.0104	0.196	0.0147	0.180
	Calcium (Ca)-Total (mg/kg wwt)	1180	455	809	680	1340
	Chromium (Cr)-Total (mg/kg wwt)	0.11	0.12	0.17	<0.10	<0.10
	Cobalt (Co)-Total (mg/kg wwt)	0.162	0.053	0.159	0.042	0.135
	Copper (Cu)-Total (mg/kg wwt)	2.16	0.622	2.93	0.736	2.83
	Iron (Fe)-Total (mg/kg wwt)	46.0	5.13	29.2	7.18	97.8
	Lead (Pb)-Total (mg/kg wwt)	0.021	<0.020	0.038	<0.020	<0.020
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	213	248	206	230	172
	Manganese (Mn)-Total (mg/kg wwt)	2.04	0.354	1.97	0.477	2.77
	Mercury (Hg)-Total (mg/kg wwt)		0.0215		0.0242	
	Molybdenum (Mo)-Total (mg/kg wwt)	0.078	<0.010	0.122	<0.010	0.110
	Nickel (Ni)-Total (mg/kg wwt)	0.46	<0.10	0.52	<0.10	0.12
	Phosphorus (P)-Total (mg/kg wwt)	2730	1860	2260	2070	2520
	Potassium (K)-Total (mg/kg wwt)	4640	3170	4380	3170	4040
	Selenium (Se)-Total (mg/kg wwt)	5.37	2.59	6.31	2.75	6.44
	Sodium (Na)-Total (mg/kg wwt)	1300	671	1170	704	1160
	Strontium (Sr)-Total (mg/kg wwt)	0.780	0.409	0.537	0.496	0.588
	Thallium (Tl)-Total (mg/kg wwt)	0.015	<0.010	0.047	<0.010	0.028
	Tin (Sn)-Total (mg/kg wwt)	<0.050	<0.050	<0.050	<0.050	<0.050
	Titanium (Ti)-Total (mg/kg wwt)	<1.0	<0.10	<1.0	<0.10	<1.0
	Uranium (U)-Total (mg/kg wwt)	0.0021	<0.0020	0.0032	<0.0020	<0.0020
	Vanadium (V)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Zinc (Zn)-Total (mg/kg wwt)	41.6	9.50	42.1	9.67	42.2

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-21 HC3A-GRAYLING #2 MUSCLE	L600816-22 HC3A-GRAYLING #2 LIVER	L600816-23 HC3A-GRAYLING #3 MUSCLE	L600816-24 HC3A-GRAYLING #3 LIVER	L600816-25 HC3A-GRAYLING #4 MUSCLE
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		4.0	<10	2.3	8.9	2.2
	Antimony (Sb)-Total (mg/kg wwt)		<0.010	<0.050	<0.010	<0.020	<0.010
	Arsenic (As)-Total (mg/kg wwt)		0.248	0.651	0.280	0.825	0.086
	Barium (Ba)-Total (mg/kg wwt)		0.210	0.100	0.066	0.203	0.047
	Beryllium (Be)-Total (mg/kg wwt)		<0.10	<0.50	<0.10	<0.20	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)		<0.030	<0.15	<0.030	<0.060	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)		0.0223	0.190	0.0151	0.147	0.0133
	Calcium (Ca)-Total (mg/kg wwt)		1730	1790	559	1610	283
	Chromium (Cr)-Total (mg/kg wwt)		<0.10	<0.50	<0.10	<0.20	<0.10
	Cobalt (Co)-Total (mg/kg wwt)		0.080	0.20	0.065	0.183	0.049
	Copper (Cu)-Total (mg/kg wwt)		1.07	2.92	0.745	2.81	0.434
	Iron (Fe)-Total (mg/kg wwt)		8.63	93.5	8.64	62.6	6.32
	Lead (Pb)-Total (mg/kg wwt)		<0.020	<0.10	<0.020	0.046	<0.020
	Lithium (Li)-Total (mg/kg wwt)		<0.10	<0.50	<0.10	<0.20	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)		228	186	238	197	284
	Manganese (Mn)-Total (mg/kg wwt)		1.38	2.52	0.886	3.61	0.432
	Mercury (Hg)-Total (mg/kg wwt)		0.0231		0.0398		0.0914
	Molybdenum (Mo)-Total (mg/kg wwt)		<0.010	0.061	<0.010	0.105	<0.010
	Nickel (Ni)-Total (mg/kg wwt)		<0.10	<0.50	<0.10	<0.20	<0.10
	Phosphorus (P)-Total (mg/kg wwt)		2720	2650	2250	2920	2100
	Potassium (K)-Total (mg/kg wwt)		2890	4250	3400	4640	3490
	Selenium (Se)-Total (mg/kg wwt)		3.20	4.8	2.54	4.93	0.97
	Sodium (Na)-Total (mg/kg wwt)		999	1540	863	1190	752
	Strontium (Sr)-Total (mg/kg wwt)		1.75	0.576	0.536	0.752	0.228
	Thallium (Tl)-Total (mg/kg wwt)		<0.010	<0.050	<0.010	0.043	<0.010
	Tin (Sn)-Total (mg/kg wwt)		<0.050	<0.25	<0.050	<0.10	<0.050
	Titanium (Ti)-Total (mg/kg wwt)		<0.30	<1.0	<0.30	<1.0	<0.10
	Uranium (U)-Total (mg/kg wwt)		<0.0020	<0.010	<0.0020	<0.0040	<0.0020
	Vanadium (V)-Total (mg/kg wwt)		<0.10	<0.50	<0.10	<0.20	<0.10
	Zinc (Zn)-Total (mg/kg wwt)		13.1	39.7	12.2	48.0	6.34

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Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-26 HC3A-GRAYLING #4 LIVER	L600816-27 HC3A-GRAYLING #5 MUSCLE	L600816-28 HC3A-GRAYLING #5 LIVER	L600816-29 HC3A-GRAYLING #6 MUSCLE	L600816-30 HC3A-GRAYLING #6 LIVER
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		2.9	2.4	5.0	<2.0	4.4
	Antimony (Sb)-Total (mg/kg wwt)		<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg wwt)		0.091	0.127	0.423	0.138	0.240
	Barium (Ba)-Total (mg/kg wwt)		0.071	0.042	0.099	0.058	0.183
	Beryllium (Be)-Total (mg/kg wwt)		<0.10	<0.10	<0.10	<0.10	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)		<0.030	<0.030	<0.030	<0.030	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)		0.495	0.0130	0.272	0.0080	0.216
	Calcium (Ca)-Total (mg/kg wwt)		236	270	315	305	350
	Chromium (Cr)-Total (mg/kg wwt)		<0.10	<0.10	<0.10	<0.10	0.15
	Cobalt (Co)-Total (mg/kg wwt)		0.233	0.126	0.601	0.078	0.266
	Copper (Cu)-Total (mg/kg wwt)		1.49	0.618	1.79	0.538	1.67
	Iron (Fe)-Total (mg/kg wwt)		87.0	6.47	65.4	6.51	74.4
	Lead (Pb)-Total (mg/kg wwt)		0.078	<0.020	0.102	<0.020	0.047
	Lithium (Li)-Total (mg/kg wwt)		<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)		238	265	219	294	238
	Manganese (Mn)-Total (mg/kg wwt)		3.71	0.895	17.9	1.36	16.5
	Mercury (Hg)-Total (mg/kg wwt)			0.0414		0.0378	
	Molybdenum (Mo)-Total (mg/kg wwt)		0.072	<0.010	0.087	<0.010	0.098
	Nickel (Ni)-Total (mg/kg wwt)		0.10	0.10	0.37	<0.10	0.22
	Phosphorus (P)-Total (mg/kg wwt)		2920	1970	2290	2170	2950
	Potassium (K)-Total (mg/kg wwt)		3180	3340	3200	4800	3540
	Selenium (Se)-Total (mg/kg wwt)		3.47	1.66	4.22	2.00	5.38
	Sodium (Na)-Total (mg/kg wwt)		1310	781	1010	681	1180
	Strontium (Sr)-Total (mg/kg wwt)		0.231	0.208	0.251	0.311	0.346
	Thallium (Tl)-Total (mg/kg wwt)		0.014	<0.010	0.013	<0.010	0.013
	Tin (Sn)-Total (mg/kg wwt)		<0.050	<0.050	<0.050	<0.050	<0.050
	Titanium (Ti)-Total (mg/kg wwt)		<0.30	<0.10	<0.30	<0.10	<0.30
	Uranium (U)-Total (mg/kg wwt)		0.0023	<0.0020	<0.0020	<0.0020	<0.0020
	Vanadium (V)-Total (mg/kg wwt)		<0.10	<0.10	<0.10	<0.10	<0.10
	Zinc (Zn)-Total (mg/kg wwt)		24.3	7.15	27.5	7.46	32.2

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Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID				
		L600816-31 HC3B-GRAYLING MUSCLE	L600816-32 HC3B-GRAYLING LIVER	L600816-33 L1A-GRAYLING #1 MUSCLE	L600816-34 L1A-GRAYLING #1 LIVER	L600816-35 L1A-GRAYLING #2 MUSCLE
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	<2.0	5.4	5.3	109	6.7
	Antimony (Sb)-Total (mg/kg wwt)	<0.010	<0.010	<0.010	<0.30	<0.010
	Arsenic (As)-Total (mg/kg wwt)	0.078	0.143	0.410	3.94	0.315
	Barium (Ba)-Total (mg/kg wwt)	0.054	0.138	0.165	2.78	0.075
	Beryllium (Be)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<3.0	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)	<0.030	<0.030	<0.030	<0.90	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)	0.0103	0.343	0.0265	0.55	0.0525
	Calcium (Ca)-Total (mg/kg wwt)	473	280	983	5600	750
	Chromium (Cr)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<3.0	<0.10
	Cobalt (Co)-Total (mg/kg wwt)	0.055	0.306	0.094	<0.60	0.115
	Copper (Cu)-Total (mg/kg wwt)	0.540	1.80	0.859	9.97	1.03
	Iron (Fe)-Total (mg/kg wwt)	5.98	70.9	6.75	154	10.6
	Lead (Pb)-Total (mg/kg wwt)	<0.020	0.094	<0.020	<0.60	<0.020
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<3.0	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	300	217	227	661	222
	Manganese (Mn)-Total (mg/kg wwt)	0.592	4.65	0.797	4.93	1.12
	Mercury (Hg)-Total (mg/kg wwt)	0.0546		0.0210		0.0212
	Molybdenum (Mo)-Total (mg/kg wwt)	<0.010	0.116	<0.010	<0.30	<0.010
	Nickel (Ni)-Total (mg/kg wwt)	<0.10	0.12	<0.10	<3.0	<0.10
	Phosphorus (P)-Total (mg/kg wwt)	2340	2570	2610	5960	2430
	Potassium (K)-Total (mg/kg wwt)	3640	3550	3580	11400	3600
	Selenium (Se)-Total (mg/kg wwt)	1.60	4.31	2.23	11.5	2.12
	Sodium (Na)-Total (mg/kg wwt)	733	1280	992	3250	900
	Strontium (Sr)-Total (mg/kg wwt)	0.453	0.335	0.977	3.16	0.715
	Thallium (Tl)-Total (mg/kg wwt)	<0.010	0.014	<0.010	<0.30	<0.010
	Tin (Sn)-Total (mg/kg wwt)	<0.050	<0.050	<0.050	<1.5	<0.050
	Titanium (Ti)-Total (mg/kg wwt)	<0.10	<0.30	<0.30	<4.0	<0.30
	Uranium (U)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.060	<0.0020
	Vanadium (V)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<3.0	<0.10
	Zinc (Zn)-Total (mg/kg wwt)	5.76	25.9	13.9	76.1	12.8

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Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-36 L1A-GRAYLING #2 LIVER	L600816-37 L1A-GRAYLING #3 MUSCLE	L600816-38 L1A-GRAYLING #3 LIVER	L600816-39 L1A-GRAYLING #4 MUSCLE	L600816-40 L1A-GRAYLING #4 LIVER
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		<10	<2.0	3.4	<2.0	4.1
	Antimony (Sb)-Total (mg/kg wwt)		<0.050	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg wwt)		1.68	0.233	0.500	0.285	1.14
	Barium (Ba)-Total (mg/kg wwt)		0.286	0.028	0.092	0.015	0.064
	Beryllium (Be)-Total (mg/kg wwt)		<0.50	<0.10	<0.10	<0.10	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)		<0.15	<0.030	<0.030	<0.030	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)		0.403	0.0127	0.425	0.0126	0.325
	Calcium (Ca)-Total (mg/kg wwt)		1810	222	291	204	199
	Chromium (Cr)-Total (mg/kg wwt)		<0.50	<0.10	<0.10	<0.10	<0.10
	Cobalt (Co)-Total (mg/kg wwt)		0.32	0.047	0.219	0.034	0.187
	Copper (Cu)-Total (mg/kg wwt)		3.78	0.564	1.97	0.422	1.93
	Iron (Fe)-Total (mg/kg wwt)		71.2	6.15	98.6	5.53	72.6
	Lead (Pb)-Total (mg/kg wwt)		<0.10	<0.020	<0.020	<0.020	0.044
	Lithium (Li)-Total (mg/kg wwt)		<0.50	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)		252	282	214	283	229
	Manganese (Mn)-Total (mg/kg wwt)		2.55	0.468	6.12	0.685	9.94
	Mercury (Hg)-Total (mg/kg wwt)			0.0528		0.0573	
	Molybdenum (Mo)-Total (mg/kg wwt)		0.209	<0.010	0.138	<0.010	0.144
	Nickel (Ni)-Total (mg/kg wwt)		<0.50	<0.10	0.11	<0.10	<0.10
	Phosphorus (P)-Total (mg/kg wwt)		3370	2040	2620	1980	2700
	Potassium (K)-Total (mg/kg wwt)		6140	3450	2990	4710	3570
	Selenium (Se)-Total (mg/kg wwt)		4.8	2.87	6.99	1.67	4.00
	Sodium (Na)-Total (mg/kg wwt)		1730	771	1180	735	1170
	Strontium (Sr)-Total (mg/kg wwt)		0.765	0.157	0.242	0.123	0.194
	Thallium (Tl)-Total (mg/kg wwt)		<0.050	<0.010	<0.010	<0.010	<0.010
	Tin (Sn)-Total (mg/kg wwt)		<0.25	<0.050	<0.050	<0.050	<0.050
	Titanium (Ti)-Total (mg/kg wwt)		<1.0	<0.10	<0.30	<0.10	<0.30
	Uranium (U)-Total (mg/kg wwt)		<0.010	<0.0020	<0.0020	<0.0020	<0.0020
	Vanadium (V)-Total (mg/kg wwt)		<0.50	<0.10	<0.10	<0.10	<0.10
	Zinc (Zn)-Total (mg/kg wwt)		50.0	6.09	31.3	5.88	24.8

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Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L600816-45 L1B-GRAYLING MUSCLE	L600816-46 L1B-GRAYLING LIVER	L600816-47 HC1-SCULPIN COMP #1	L600816-48 HC1-SCULPIN COMP #2	L600816-49 HC1-SCULPIN COMP #3
TISSUE							
Total Metals	Aluminum (Al)-Total (mg/kg wwt)		<2.0	4.8	65.9	21.1	44.1
	Antimony (Sb)-Total (mg/kg wwt)		<0.010	<0.010	0.031	0.023	0.030
	Arsenic (As)-Total (mg/kg wwt)		0.118	0.416	1.05	0.580	0.939
	Barium (Ba)-Total (mg/kg wwt)		0.025	0.335	2.96	2.76	3.10
	Beryllium (Be)-Total (mg/kg wwt)		<0.10	<0.10	<0.10	<0.10	<0.10
	Bismuth (Bi)-Total (mg/kg wwt)		<0.030	<0.030	0.089	<0.030	<0.030
	Cadmium (Cd)-Total (mg/kg wwt)		0.0165	0.384	0.0375	0.0350	0.0413
	Calcium (Ca)-Total (mg/kg wwt)		245	247	10200	12600	11800
	Chromium (Cr)-Total (mg/kg wwt)		<0.10	<0.10	0.35	0.19	0.25
	Cobalt (Co)-Total (mg/kg wwt)		0.047	0.250	0.109	0.070	0.095
	Copper (Cu)-Total (mg/kg wwt)		0.441	1.27	0.812	0.753	0.851
	Iron (Fe)-Total (mg/kg wwt)		4.36	55.0	131	40.1	74.1
	Lead (Pb)-Total (mg/kg wwt)		<0.020	0.042	0.155	0.055	0.076
	Lithium (Li)-Total (mg/kg wwt)		<0.10	<0.10	0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)		296	189	253	293	270
	Manganese (Mn)-Total (mg/kg wwt)		0.340	9.30	19.3	30.5	29.5
	Mercury (Hg)-Total (mg/kg wwt)		0.0539				
	Molybdenum (Mo)-Total (mg/kg wwt)		<0.010	0.065	0.051	0.033	0.039
	Nickel (Ni)-Total (mg/kg wwt)		<0.10	0.10	0.33	0.19	0.24
	Phosphorus (P)-Total (mg/kg wwt)		2270	2310	6790	8480	7820
	Potassium (K)-Total (mg/kg wwt)		5000	3370	2440	2930	2720
	Selenium (Se)-Total (mg/kg wwt)		1.67	4.79	1.47	1.60	1.63
	Sodium (Na)-Total (mg/kg wwt)		692	1170	968	1210	1170
	Strontium (Sr)-Total (mg/kg wwt)		0.168	0.329	12.5	15.2	14.5
	Thallium (Tl)-Total (mg/kg wwt)		<0.010	<0.010	<0.010	<0.010	<0.010
	Tin (Sn)-Total (mg/kg wwt)		<0.050	<0.050	<0.050	<0.050	<0.050
	Titanium (Ti)-Total (mg/kg wwt)		<0.10	<0.30	2.35	0.71	1.53
	Uranium (U)-Total (mg/kg wwt)		<0.0020	<0.0020	0.0173	0.0132	0.0095
	Vanadium (V)-Total (mg/kg wwt)		<0.10	<0.10	0.22	<0.10	0.15
	Zinc (Zn)-Total (mg/kg wwt)		4.57	20.7	28.1	35.2	34.0

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Grouping	Analyte	L600816-50 HC2-SCULPIN COMP #1	L600816-51 HC2-SCULPIN COMP #2	L600816-52 HC2-SCULPIN COMP #3	L600816-53 HC3-SCULPIN COMP #1	L600816-54 HC3-SCULPIN COMP #2
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	48.9	35.9	44.1	26.5	38.5
	Antimony (Sb)-Total (mg/kg wwt)	0.034	0.017	0.015	0.016	<0.020
	Arsenic (As)-Total (mg/kg wwt)	1.16	0.978	1.03	0.752	0.735
	Barium (Ba)-Total (mg/kg wwt)	2.66	1.61	2.31	2.45	2.80
	Beryllium (Be)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.20
	Bismuth (Bi)-Total (mg/kg wwt)	<0.030	<0.030	<0.030	<0.030	<0.060
	Cadmium (Cd)-Total (mg/kg wwt)	0.0413	0.0254	0.0361	0.0289	0.025
	Calcium (Ca)-Total (mg/kg wwt)	11600	7810	10500	13400	12500
	Chromium (Cr)-Total (mg/kg wwt)	3.82	0.49	1.13	0.33	0.79
	Cobalt (Co)-Total (mg/kg wwt)	0.211	0.078	0.110	0.064	0.109
	Copper (Cu)-Total (mg/kg wwt)	0.942	0.925	1.03	0.770	0.786
	Iron (Fe)-Total (mg/kg wwt)	151	84.1	96.8	65.0	92.4
	Lead (Pb)-Total (mg/kg wwt)	0.103	0.055	0.070	0.034	0.063
	Lithium (Li)-Total (mg/kg wwt)	0.10	<0.10	<0.10	<0.10	<0.20
	Magnesium (Mg)-Total (mg/kg wwt)	267	221	260	258	295
	Manganese (Mn)-Total (mg/kg wwt)	16.6	7.04	12.2	6.78	14.3
	Mercury (Hg)-Total (mg/kg wwt)					
	Molybdenum (Mo)-Total (mg/kg wwt)	0.131	0.042	0.063	0.029	0.035
	Nickel (Ni)-Total (mg/kg wwt)	2.03	0.33	0.67	0.20	0.53
	Phosphorus (P)-Total (mg/kg wwt)	8000	5830	7320	8540	8230
	Potassium (K)-Total (mg/kg wwt)	2890	2650	3130	2830	2840
	Selenium (Se)-Total (mg/kg wwt)	1.91	2.21	1.98	2.14	1.48
	Sodium (Na)-Total (mg/kg wwt)	1240	1090	1120	1140	1070
	Strontium (Sr)-Total (mg/kg wwt)	12.5	8.52	11.4	15.2	15.7
	Thallium (Tl)-Total (mg/kg wwt)	<0.010	<0.010	<0.010	<0.010	<0.020
	Tin (Sn)-Total (mg/kg wwt)	<0.050	<0.050	<0.050	<0.050	<0.10
	Titanium (Ti)-Total (mg/kg wwt)	1.61	1.65	2.25	1.42	1.17
	Uranium (U)-Total (mg/kg wwt)	0.0127	0.0088	0.0120	0.0102	0.0173
	Vanadium (V)-Total (mg/kg wwt)	0.20	0.14	0.16	0.11	0.21
	Zinc (Zn)-Total (mg/kg wwt)	35.0	28.1	31.6	31.9	33.0

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L600816-55 HC3-SCULPIN COMP #3	L600816-56 IR1-SCULPIN COMP #1	L600816-57 IR1-SCULPIN COMP #2	L600816-58 IR1-SCULPIN COMP #3	L600816-59 L1-SCULPIN COMP #1
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	27.9	121	60.7	60.6	40.2
	Antimony (Sb)-Total (mg/kg wwt)	0.011	0.016	<0.010	<0.020	<0.020
	Arsenic (As)-Total (mg/kg wwt)	0.416	0.327	0.261	0.368	1.11
	Barium (Ba)-Total (mg/kg wwt)	1.96	3.24	2.41	3.56	3.33
	Beryllium (Be)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.20	<0.20
	Bismuth (Bi)-Total (mg/kg wwt)	<0.030	<0.030	<0.030	<0.060	<0.060
	Cadmium (Cd)-Total (mg/kg wwt)	0.0350	0.0551	0.0459	0.058	0.060
	Calcium (Ca)-Total (mg/kg wwt)	13300	12500	13600	12200	16000
	Chromium (Cr)-Total (mg/kg wwt)	0.40	0.68	0.88	0.92	0.50
	Cobalt (Co)-Total (mg/kg wwt)	0.088	0.172	0.134	0.144	0.066
	Copper (Cu)-Total (mg/kg wwt)	0.905	1.13	1.01	1.03	0.976
	Iron (Fe)-Total (mg/kg wwt)	70.8	256	141	225	77.9
	Lead (Pb)-Total (mg/kg wwt)	0.045	0.121	0.074	0.077	0.072
	Lithium (Li)-Total (mg/kg wwt)	<0.10	0.11	<0.10	<0.20	<0.20
	Magnesium (Mg)-Total (mg/kg wwt)	381	404	392	288	501
	Manganese (Mn)-Total (mg/kg wwt)	12.3	16.6	17.3	13.1	12.9
	Mercury (Hg)-Total (mg/kg wwt)					
	Molybdenum (Mo)-Total (mg/kg wwt)	0.023	0.030	0.038	0.031	0.030
	Nickel (Ni)-Total (mg/kg wwt)	0.20	0.53	0.59	0.61	0.28
	Phosphorus (P)-Total (mg/kg wwt)	6720	6710	7260	7880	9230
	Potassium (K)-Total (mg/kg wwt)	2500	2740	2820	2960	2550
	Selenium (Se)-Total (mg/kg wwt)	1.87	2.04	1.81	1.69	1.47
	Sodium (Na)-Total (mg/kg wwt)	1130	1170	1170	1110	1150
	Strontium (Sr)-Total (mg/kg wwt)	13.9	13.7	14.5	13.6	18.4
	Thallium (Tl)-Total (mg/kg wwt)	<0.010	0.012	<0.010	<0.020	<0.020
	Tin (Sn)-Total (mg/kg wwt)	<0.050	<0.050	<0.050	<0.10	<0.10
	Titanium (Ti)-Total (mg/kg wwt)	0.77	3.26	1.65	2.51	1.77
	Uranium (U)-Total (mg/kg wwt)	0.0075	0.0159	0.0115	0.0130	0.0122
	Vanadium (V)-Total (mg/kg wwt)	<0.10	0.30	0.16	0.21	0.21
	Zinc (Zn)-Total (mg/kg wwt)	40.9	32.8	33.3	36.0	39.3

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L600816-60	L600816-61			
	Description					
	Sampled Date					
	Sampled Time					
	Client ID	L1-SCULPIN COMP #2	L1-SCULPIN COMP #3			
Grouping	**Analyte**					
TISSUE						
Total Metals	Aluminum (Al)-Total (mg/kg wwt)	66.1	27.5			
	Antimony (Sb)-Total (mg/kg wwt)	<0.020	<0.020			
	Arsenic (As)-Total (mg/kg wwt)	1.00	0.789			
	Barium (Ba)-Total (mg/kg wwt)	3.13	2.58			
	Beryllium (Be)-Total (mg/kg wwt)	<0.20	<0.20			
	Bismuth (Bi)-Total (mg/kg wwt)	<0.060	<0.060			
	Cadmium (Cd)-Total (mg/kg wwt)	0.042	0.040			
	Calcium (Ca)-Total (mg/kg wwt)	14800	14600			
	Chromium (Cr)-Total (mg/kg wwt)	0.95	0.32			
	Cobalt (Co)-Total (mg/kg wwt)	0.059	0.054			
	Copper (Cu)-Total (mg/kg wwt)	0.924	0.943			
	Iron (Fe)-Total (mg/kg wwt)	80.9	58.0			
	Lead (Pb)-Total (mg/kg wwt)	0.064	0.052			
	Lithium (Li)-Total (mg/kg wwt)	<0.20	<0.20			
	Magnesium (Mg)-Total (mg/kg wwt)	438	464			
	Manganese (Mn)-Total (mg/kg wwt)	6.24	8.57			
	Mercury (Hg)-Total (mg/kg wwt)					
	Molybdenum (Mo)-Total (mg/kg wwt)	0.043	0.029			
	Nickel (Ni)-Total (mg/kg wwt)	0.47	<0.20			
	Phosphorus (P)-Total (mg/kg wwt)	9240	8950			
	Potassium (K)-Total (mg/kg wwt)	2870	2840			
	Selenium (Se)-Total (mg/kg wwt)	1.49	1.52			
	Sodium (Na)-Total (mg/kg wwt)	1190	1110			
	Strontium (Sr)-Total (mg/kg wwt)	16.7	16.7			
	Thallium (Tl)-Total (mg/kg wwt)	<0.020	<0.020			
	Tin (Sn)-Total (mg/kg wwt)	<0.10	<0.10			
	Titanium (Ti)-Total (mg/kg wwt)	2.70	1.18			
	Uranium (U)-Total (mg/kg wwt)	0.0120	0.0079			
	Vanadium (V)-Total (mg/kg wwt)	0.20	<0.20			
	Zinc (Zn)-Total (mg/kg wwt)	30.4	34.9			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
HG-WET-CVAFS-VA	Tissue	Mercury in Tissue by CVAFS	PUGET SOUND PROTOCOLS

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. Tissue samples are homogenized either mechanically or manually prior to digestion. The hotplate or block digestion involves the use of nitric acid followed by repeated additions of hydrogen peroxide. Instrumental analysis is by atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-WET-ICP-VA	Tissue	Metals in Tissue by ICPOES	PUGET SOUND PROTOCOLS, EPA 6010B

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. Tissue samples are homogenized either mechanically or manually prior to digestion. The hotplate or block digestion involves the use of nitric acid followed by repeated additions of hydrogen peroxide. Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-WET-MS-VA	Tissue	Metals in Tissue by ICPMS	PUGET SOUND PROTOCOLS, EPA 6020A

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. Tissue samples are homogenized either mechanically or manually prior to digestion. The hotplate or block digestion involves the use of nitric acid followed by repeated additions of hydrogen peroxide. Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.
The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in enviromental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALSE Login No: **L600816**

Client: **JACQUES WHITFORD**
Job No: **1028268.12**

ALSE sample ID	Client ID	Fork Length (mm)	Weight (g)
L600816-1 and 2	DG1-GRAYLING #1	91.5	9.4
L600816-3 and 4	DG1-GRAYLING #2	104.1	11.6
L600816-5 and 6	DG1-GRAYLING #3	108	11.02
L600816-7 and 8	DG1-GRAYLING #4	123.8	25.2
L600816-9 and 10	DG1-GRAYLING #5	129.1	28.8
L600816-11 and 12	DG1-GRAYLING #6	123.2	24.06
L600816-13 and 14	DG1-GRAYLING #7	119.7	17.37
L600816-15 and 16	DG1-GRAYLING #8	149.2	50.11
L600816-17 and 18	DG1-GRAYLING #9	165.8	154.5
L600816-19 and 20	HC3A-GRAYLING #1	153.9	51.93
L600816-21 and 22	HC3A-GRAYLING #2	101.1	12.2
L600816-23 and 24	HC3A-GRAYLING #3	135.4	27.6
L600816-25 and 26	HC3A-GRAYLING #4	333	558.6
L600816-27 and 28	HC3A-GRAYLING #5	255	269.23
L600816-29 and 30	HC3A-GRAYLING #6	275	297.4
L600816-31 and 32	HC3B-GRAYLING	350	595.14
L600816-33 and 34	L1A-GRAYLING #1	74.4	4.5
L600816-35 and 36	L1A-GRAYLING #2	90.4	10.02
L600816-37 and 38	L1A-GRAYLING #3	354	492
L600816-39 and 40	L1A-GRAYLING #4	320	408
L600816-45 and 46	L1B-GRAYLING	380	679
L600816-47 COMP #1	HC1-SCULPIN 1	60.3	2.967
	HC1-SCULPIN 2	48	1.725
L600816-48 COMP #2	HC1-SCULPIN 1	57.4	2.837
	HC1-SCULPIN 2	56.3	2.347
L600816-49 COMP #3	HC1-SCULPIN 1	46.6	1.6
	HC1-SCULPIN 2	54.2	1.648
	HC1-SCULPIN 3	54.5	2.053
L600816-50 COMP #1	HC2-SCULPIN 1	102.9	16.292
	HC2-SCULPIN 2	71.5	4.52
	HC2-SCULPIN 3	90.1	9.2
L600816-51 COMP #2	HC2-SCULPIN 1	85.8	10.14
	HC2-SCULPIN 2	84.2	9.841
	HC2-SCULPIN 3	64.8	5.937
L600816-52 COMP #3	HC2-SCULPIN 1	77.2	7.31
	HC2-SCULPIN 2	74.6	7.89
	HC2-SCULPIN 3	56.5	1.92
	HC2-SCULPIN 4	65.4	3.2
	HC2-SCULPIN 5	59.8	3.39
	HC2-SCULPIN 6	66.7	4.06
	HC2-SCULPIN 7	49.8	2.02
	HC2-SCULPIN-8	53	1.983
	HC2-SCULPIN-9	56.6	2.18
L600816-53 COMP #1	HC3-SCULPIN 1	89.8	10.48
	HC3-SCULPIN 2	81.8	9.42
	HC3-SCULPIN 3	71.6	6.13
L600816-54 COMP #2	HC3-SCULPIN 1	77.4	8.82
	HC3-SCULPIN 2	77	6.98
	HC3-SCULPIN 3	70.1	5.19
L600816-55 COMP #3	HC3-SCULPIN 1	94.1	12.44
	HC3-SCULPIN 2	56.9	1.9

	HC3-SCULPIN 3	51.3	2.3
	HC3-SCULPIN 4	54	2.28
	HC3-SCULPIN 5	52.3	1.68
L600816-56 COMP #1	IR1-SCULPIN 1	102	16.55
	IR1-SCULPIN 2	91.9	11.11
	IR1-SCULPIN 3	82.7	6.34
	IR1-SCULPIN 4	82.7	6.6
L600816-57 COMP #2	IR1-SCULPIN 1	92.9	12.06
	IR1-SCULPIN 2	88.8	8.25
	IR1-SCULPIN 3	67.5	5.7
L600816-58 COMP #3	IR1-SCULPIN 1	86.1	8.17
	IR1-SCULPIN 2	102.8	11.03
	IR1-SCULPIN 3	85.7	6.08
L600816-59 COMP #1	L1-SCULPIN 1	75.8	5.24
	L1-SCULPIN 2	63.9	3.29
	L1-SCULPIN 3	67.5	3.42
L600816-60 COMP #2	L1-SCULPIN 1	82.9	6.16
	L1-SCULPIN 2	66.2	3.84
	L1-SCULPIN 3	68.8	3.74
L600816-61 COMP #3	L1-SCULPIN 1	78.6	4.79
	L1-SCULPIN 2	72.6	4.89
	L1-SCULPIN 3	69.9	3.73
	L1-SCULPIN 4	57.9	2.36

ALS Lab
ANALYTICAL CHEMIS
Environmen

Short Holding Time
TISSUES
Rush Processing Required

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM
CANADA TOLL FREE 1-800-668-9878
www.alsenviro.com

COC # A019631
L600816

Page 1 of 2

REPORT TO:	REPORT FORMAT / DISTRIBUTION	SERVICE REQUESTED
COMPANY: JACQUES WHITFORD AXYS	STANDARD X OTHER	REGULAR SERVICE (DEFAULT) X
CONTACT: TODD GOODSELL	PDF X EXCEL X CUSTOM FAX	RUSH SERVICE (2-3 DAYS)
ADDRESS: 4370 DOMINION STREET	EMAIL 1: todd.goodsell@JACQUESWHITFORD.COM	PRIORITY SERVICE (1 DAY or ASAP)
BURNABY BC V5G 4L7	EMAIL 2:	EMERGENCY SERVICE (<1 DAY / WEEKEND) - CONTACT ALS
PHONE: 436 3014 FAX: 436 3752		ANALYSIS REQUEST
INVOICE TO: SAME AS REPORT ? (YES) / NO	INDICATE BOTTLES: FILTERED / PRESERVED (F/P) → → →	
COMPANY:	CLIENT / PROJECT INFORMATION:	
CONTACT:	JOB #: 1028268.12	
ADDRESS:	PO /AFE:	
	Legal Site Description:	
PHONE: FAX:	QUOTE #:	
Lab Work Order # (lab use only)	SAMPLER (Initials):	

Sample #	SAMPLE IDENTIFICATION (This description will appear on the report)	DATE	TIME	SAMPLE TYPE	Hg by CVAA (MUSCLE)	MS SCAN METALS (MUSCLE)	MS SCAN METALS (LIVER)	MS SCAN METALS (WHOLE FISH)	HAZARDOUS?	HIGHLY CONTAMINATED?	NUMBER OF CONTAINERS
1	DG1 - GRAYLING (9 FISH)			ANALYZE EA. FISH	X	X	X				
2	HC3 A - GRAYLING (6 FISH)			EACH FISH	X	X	X				
3	HC3 B - GRAYLING (1 FISH)			EACH FISH	X	X	X				
4	L1 A - GRAYLING (6 FISH)			EACH FISH	X	X	X				
5	L1 B - GRAYLING (1 FISH)			EACH FISH	X	X	X				
6	HC1 - SCULPIN (10 FISH)			COMPOSITE				X			
7	HC2 - SCULPIN (10 FISH)			COMPOSITE				X			
8	HC3 - SCULPIN (9 FISH)			COMPOSITE				X			
9	IR1 - SCULPIN (10 FISH)			COMPOSITE				X			
10	L1 - SCULPIN (10 FISH)			COMPOSITE				X			

GUIDELINES / REGULATIONS	SPECIAL INSTRUCTIONS / HAZARDOUS DETAILS
	SAMPLES 1-5: ANALYZE EACH FISH SEPARATELY SAMPLES 6-10 COMPOSITE MIN OF 3 FISH

Failure to complete all portions of this form may delay analysis. Please fill in this form *LEGIBLY*.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the reverse page of the white report copy.

RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	SAMPLE CONDITION (lab use only)	
		AR	19:33 Feb 8/08	TEMPERATURE	SAMPLES RECEIVED IN GOOD CONDITION ? YES / NO (If no provide details)
RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	-6	

APPENDIX C

Collection Licences

Victoria GOLD CORP

Stantec

Licence #: S-09/10-1025-NU-A1

Janine Beckett
500, 4370 Dominion Street
Burnaby, BC, CA V5G 4L7

Dear Janine Beckett,

Enclosed is your Licence to Fish for Scientific Purposes issued pursuant to Section 52 of the Fishery (General) Regulations.

Please be advised that this licence only permits those activities stated on your licence. Any other activity may require approval under the Fisheries Act or other legislation. It is the Project Authority's responsibility to obtain any other approvals.

Failure to comply with any of the conditions specified on the attached licence may result in a contravention of the Fishery (General) Regulations.

Please ensure that you include the licence number and project title in any future correspondence and that you complete the Summary Harvest Report upon completion of activities under this licence.

Yours truly,

Chris Lewis

Aug. 14/09
Date

Chris Lewis
Fisheries Managemen Biologist
Eastern Arctic Area
Central and Arctic Region
Fisheries and Oceans Canada

Enclosure

LICENCE TO FISH FOR SCIENTIFIC PURPOSES

AMENDMENT

S-09/10-1025-NU-A1

Pursuant to Section 52 of the Fishery (General) Regulations, the Minister of Fisheries and Oceans hereby authorizes the individual(s) listed below to fish for scientific purposes, subject to the conditions specified.

Project Authority: Janine Beckett
500, 4370 Dominion Street
Burnaby, BC, CA V5G 4L7

Nunami Jacques Whitford

Other Personnel: Janine Beckett, M.Sc.
Ben Wheeler, M.Sc. R.P.Bio
Todd Goodsell, B.Sc
Carey Sibbald, B.Sc., CEPIT
Marina Winterbottom, B.Sc., MMM
Thomas Hicks, B.Sc.

Objectives: Project Title: 2009 Kiggavik Marine Wildlife Baseline Studies summer and fall.

Project Objectives (2-3 sentences): To support future environmental permitting and environmental management of AREVA Resources Canada Inc. (AREVA) proposed Kiggavik Mine Project, Nunami Jacques Whitford has been hired to complete marine wildlife baseline studies (the Project). The Project will collect information on marine mammals along the proposed shipping route from Baker Lake, NU, to Chesterfield Inlet, NU, and marine water quality within Chesterfield Inlet. In Baker Lake, fish and fish habitat, and water quality seasonal data will be collected at the proposed dock site and a control site in spring, summer and fall.

CONDITIONS

Specified Conditions:

Fish tissue collection will sacrifice only the fish needed for contaminent tests.

Waters:

Water Body: Baker Lake Area (64° 19' N, 96° 02' W)

Species: Cisco

Gear: 10 MM Mesh Gillnets and Larger
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	5

Water Body: Baker Lake Area (64° 19' N, 96° 02' W)

Species: Whitefish (Unspecified)

Gear: 10 MM Mesh Gillnets and Larger
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	5

Species: Sucker (spp)

Gear: 10 MM Mesh Gillnets and Larger
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	15

Species: Sculpins Spp.

Gear: 10 MM Mesh Gillnets and Larger
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	15

Species: Arctic Charr (SR OR LL)

Gear: 10 MM Mesh Gillnets and Larger
Angling
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	200

Species: Trout, Lake

Gear: 10 MM Mesh Gillnets and Larger
Angling
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	200

Water Body: Baker Lake Area (64° 19' N, 96° 02' W)

Species: Whitefish, Lake

Gear: 10 MM Mesh Gillnets and Larger
Angling
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	200

Species: Burbot

Gear: 10 MM Mesh Gillnets and Larger
Angling
Egg Mat
Longline
Seine

Total Weight Sampled (Kg)	Weight Live Sampled (Kg)	Weight Dead Sampled (Kg)	Total Number Sampled	Number Live Sampled	Number Dead Sampled
				200	5

Water Body: CHESTERFIELD INLET AREA (63° 20' N, 90° 42' W)

Species: Beluga — Gear: Aerial Survey

No Samples Permitted

Species: Narwhal — Gear: Aerial Survey

No Samples Permitted

Species: Whale, Bowhead — Gear: Aerial Survey

No Samples Permitted

Species: Walrus, Atlantic — Gear: Aerial Survey

No Samples Permitted

Species: Seal, Bearded — Gear: Aerial Survey

No Samples Permitted

Species: Seal, Ringed — Gear: Aerial Survey

No Samples Permitted

Fishing Period: June 30, 2009 to October 31, 2009

A copy of this licence must be available at the study site and produced at the request of a fishery officer.

Live fish may not be retained unless specified in the conditions of this licence.

The licence holder shall immediately cease fishing when the total fish killed or live sampled reaches any of the maximums set for any of the species listed.

Transportation:

Other approvals/permits may be necessary to collect or transport certain species, such as Marine Mammal Transportation Permits. For marine mammal parts, products and derivatives a Marine Mammal Transportation Licence is required for domestic transport and, for international transport a Canadian CITES Export Permit is also required.

Disposal of Fish Caught:

Fish not required for the purpose of dead sampling and/or retention MUST be returned to the water at the site of capture. Retained fish may be made available to the nearest settlement for domestic consumption or sold commercially within the Territory. Any dead fish for commercial sale beyond the Territory in which it was caught requires authorization under the Fish Inspection Regulations. Disposal of any fish remains must be in accordance with local land use regulations.

Retention & Disposal of Fish Caught:

Fish not required for the purpose of dead sampling and/or retention MUST be returned to the water at the site of capture. Retained fish may be made available to the nearest settlement for domestic consumption or sold commercially within the Territory. Any dead fish for commercial sale beyond the Territory in which it was caught requires authorization under the Fish Inspection Regulations. Disposal of any fish remains must be in accordance with local land use regulations.

Report on Activities:

The Project Authority will provide the Scientific Licence Coordinator, Resource Management, Department of Fisheries and Oceans, within one month of the expiry date, with a report stating:

i) whether the field work was conducted; and
ii) waterbody location, the number or amount of fish harvested (collected) or marked and the date or period of harvest.

The Project Authority also will provide a copy of any published or public access documents which result from the project. Information supplied will be used for population management purposes by the Department of Fisheries and Oceans and becomes part of the public record.

Notification of Commencement:

Prior to the commencement of fishing the Project Authority will contact:

Fisheries Management Biologist
Fisheries and Oceans Canada
Box 358
Iqaluit, NU X0A 0H0
email: XCA-NUpermit@dfo-mpo.gc.ca

Eric Kan

2009.08.14

Eric Kan
Area Director, Eastern Arctic Area
Central and Arctic Region
Fisheries and Oceans Canada

Date

For the Minister of Fisheries and Oceans.

Pursuant to Section 52 of the Fishery (General) Regulations.

License to Collect Fish
Pursuant to Part VII of the Fishery (General) Regulations
Yukon/Transboundary Rivers Area
Fisheries and Oceans Canada
PHONE (867)393-6722
FAX (867)393-6738

License No. *CL-08-05* **Date Issued:** *April 18, 2008*

License Holder: Todd Goodsell

Company/Institution: Jacques Whitford AXYS Ltd

Address: 500-4370 Dominion Street
Burnaby, BC
V6C 2B3

Assistants: Kirby Ottenbreit and unnamed assistants

The following conditions will apply to this license:

1. **Purpose**: This licence is only valid for the purpose of scientific research activities conducted pursuant to the terms and conditions outlined within this license. The objective is to obtain baseline data on overwintering fish presence in four (4) manmade ponds and streams adjacent to a potential mining operation. Lethal sampling is proposed via gill net sets in placer ponds only. The purpose of the sampling program is to rule out overwintering fish presence in placer ponds.

2. **Samplers:** It is the responsibility of the license holder to ensure that samplers are experienced and competent in the fish collection methods authorized in this license. Additional samplers are to be identified in summary report (Section 13).

3. **Collection Period:** April 15th to May 15th 2008. This license is subject to immediate termination upon written or verbal notice from a representative of the Yukon Government - Department of Environment, or of Fisheries and Oceans Canada.

4. **Species/Life Stages/Quantity:** All species/life stages may be captured under the authority of this license.

5. **Collection Area:** Watercourses in the vicinity of Mayo, Yukon including Dublin Gultch, Stuttle Gulch, Eagle Pup, Stewart Gulch, Olive Gulch, Cascallen Gulch, Platinum Gulch, Gill Gulch, 15 Pup, Fisher Gulch, Bawn Bay Gulch, Ironrust Creek, Haggart Creek and Lynx Creek. All sites are to be identified within the summary report (Section 13).

6. **Collection Methods:** Minnow traps and gillnetting.

7. **Marking of gear:** All gear left unattended must be clearly labelled CL-08-05.

8. **Notice:** Prior to commencing sampling, notice is to be given to:

- Fisheries & Oceans Canada, Yukon/Transboundary Rivers Area
  Tel: (867) 393-6722 Fax (867) 393-6738
- Susan Thompson, Environment Yukon Fisheries Section
  Tel: (867) 667-5199 Fax (867) 393-6263
- The appropriate First Nation Government(s).
- **Note:** Notice is also to be given to the Government of Yukon Conservation Officer responsible for any area where sampling is to take place at least 24 hours prior to the start of sampling.

The following information is to be included:

i. The Collection License number;
ii. The watercourse or water body on which the sampling is to occur, and the location where the sampling is to take place;
iii. The dates on which sampling will occur;
iv. The names of any unnamed assistants engaged in sampling activities;
v. In cases where angling is included as a collection method and if angling is to be conducted in the presence of, or for, adult salmon, the Fishery Officer in Whitehorse is to be notified a minimum of 24 hours prior to the sampling and provided with the time(s) and location(s) this activity will occur. The officer can be contacted by fax at (867) 393-6738 or telephone at (867) 393-6722.

9. **Disposition of fish:** Any fish captured and retained under the authority of this license are not to enter any commercial markets or establishments. Any fish collected and retained, or incidental mortalities associated with non-lethal sampling, are not to be utilized for human consumption or personal use purposes unless authorized by Fisheries & Oceans Canada.

10. **Release of fish**: All live fish must be released unharmed into the water body or course from which they originated and as near as possible to the location from which they were sampled. Exception to this is where fish are retained for identification, forensic or analysis purposes.

11. **Transport or transplant of live fish and/or eggs/milt:** Live fish and/or eggs (spawn) cannot be transported without prior written approval of the transplant committee or transplanted without a licence granted pursuant to Section 56 of the Fishery (General) Regulations.

12. **Need to carry and produce permit:** A copy of this license must be in the immediate possession of the samplers during sampling, and must be produced upon the request of any representative designated as a Fishery Officer or Fishery Guardian pursuant to the Federal Fisheries Act.

13. **Report:** A report must be submitted after completion of sampling, preferably in an electronic format. The report must include the following:

a. The Collection License number
b. The location(s) of the sampling. GPS coordinates are preferred however a map may be used, or the location described in detail;
c. The dates on which the sampling occurred;
d. The number of fish sampled, by species;
e. The number of fish retained for analysis;
f. Any mortalities

The report is to be submitted by December 31 2008 to:

Nathan Ferguson
Senior Habitat Biologist
Fisheries and Oceans Canada
100-419 Range Rd
Whitehorse Yukon
Y1A 3V1
Fax (867) 393-6737
nathan.ferguson@dfo-mpo.gc.ca

Authorized by:

Frank Quinn
Area Director, Yukon / Transboundary Rivers Area

License to Collect Fish
Pursuant to Part VII of the Fishery (General) Regulations
Yukon/Transboundary Rivers Area
Fisheries and Oceans Canada
PHONE (867)393-6722
FAX (867)393-6738

License No. CL-07-56 **Date Issued:** August 2, 2007

License Holder: Todd Goodsell

Company/Institution: Jacques Whitford - AXYS

Address: 500 – 4370 Dominion Street
Burnaby, B.C.
V5G 4L7

Assistants: Micheal Brown
Kirby Ottenbreit
Josh Taylor
Jason Baird
Bonnie Burns
Ken Nordin

The following conditions will apply to this license:

1. **Purpose:** To obtain baseline data on fish presence, habitat, migration and population characteristics on 14 streams for the Dublin Gulch Project approximately 48km NW of Mayo.

2. **Samplers:** It is the responsibility if the license holder to ensure that samplers are experienced and competent in the fish collection methods authorized in this license.

3. **Collection Period:** From August 6 to October 31, 2007. This license is subject to immediate termination upon written or verbal notice from a representative of the Yukon Government- Department of Environment, or of Fisheries and Oceans Canada.

4. **Species/Life Stages/Quantity:** All species and life stages may be captured under authority of this license.

5. **Collection Area:** Fish sampling will be conducted in the following streams: Dublin Gulch, Stuttle Gulch, Eagle Pup, Stewart Gulch, Olive Gulch, Cascallen Gulch, Platinum Gulch, Gill Gulch, 15 Pup, Fisher Gulch, Bawn Bay Gulch, Ironrust Creek, Haggert Creek and Lynx Creek.

6. **Collection Methods:** Electrofishing, minnow trapping, beach seining, angling. ***(Note – Electrofishing is not to be conducted where evidence of active spawning occurs, including the presence of redds).***

7. **Marking of gear:** All gear left unattended must be clearly labelled CL-07-56.

8. **Notice:** Prior to commencing sampling, notice is to be given to:

- Fisheries and Oceans Canada, Yukon/Transboundary Rivers Area
  Tel: (867) 393-6722 Fax (867) 393-6738

- Susan Thompson, YTG Fisheries
  Tel: (867) 667-5199 Fax (867) 393-6263

- All First Nations Governments which have responsibility over the traditional territories where sampling will take place.

- **Note:** Notice is also to be given to the Government of Yukon Conservation Officer responsible for any area where sampling is to take place at least 24 hours prior to the start of sampling.

The following information is to be included:

i. The Collection License number,
ii. The watercourse or water body on which, and the location where the sampling is to take place,
iii. The dates on which sampling will occur,
iv. The names of any unnamed assistants engaged in sampling activities.

9. **Disposition of fish:** Any fish captured and retained under the authority of this license are not to enter any commercial markets or establishments. Any fish collected and retained, or incidental mortalities associated with non-lethal sampling, are not to be utilized for human consumption or personal use purposes unless authorized by Fisheries & Oceans Canada.

10. **Release of fish:** All live fish must be released unharmed into the water body or course from which they originated and as near as possible to the location from which they were sampled. Up to 10 Arctic grayling and 10 slimy sculpins may be retained for metals/tissue analysis from each of the 14 listed streams, if present. Exception to this is where fish are retained for identification or forensic purposes.

11. **Transport or transplant of live fish and/or eggs/milt:** Live fish and/or eggs (spawn) cannot be transported without prior written approval of the transplant committee or transplanted without a licence granted pursuant to Section 56 of the Fishery (General) Regulations.

12. **Need to carry and produce permit:** A copy of this license must be in the immediate possession of the samplers during sampling, and must be produced upon the request of any representative designated as a Fishery Officer or Fishery Guardian pursuant to the Fisheries Act (Canada).

13. **Report:** A report must be submitted after completion of sampling. The report may be in the form of photocopied data sheets or field notes, or as the final report for the project, and must include the following:

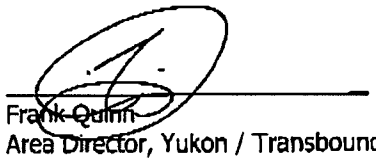
a. The Collection License number;
b. The location(s) of the sampling. A map may be used, or the location described in detail;
c. The dates on which the sampling occurred;
d. The number of fish sampled, by species;
e. Any mortalities.

The report is to be submitted by December 31, 2007 to:

Paul Christensen
A/Senior Habitat Biologist
Fisheries and Oceans Canada

100-419 Range Rd
Whitehorse Yukon
Y1A 3V1
Fax (867) 393-6737
christensenp@dfo-mpo.gc.ca

Authorized by:



Frank Quinn
Area Director, Yukon / Transboundary Rivers Area

Tremblay, Lina

From: Christensen, Paul
Sent: Thursday, August 02, 2007 1:27 PM
To: Tremblay, Lina

Hey Lina,

Here's the fax info for that collection license

Thanks

Paul

TO ->
Jacques Whitford-AXYS
4370 Dominion Strect, 5th Floor
Burnaby, BC V5G 4L7
T: 604 436 3014
F: 604 436 3752

Paul Christensen
A/Senior Habitat Biologist | A/Biologist principal en habitat
Habitat Protection and Sustainable Development | Protection de l'habitat et Développement durable
Oceans, Habitat and Enhancement Branch | Direction des Océans, de l'habitat et de la mise en valeur
Fisheries and Oceans Canada | Pêches et Océans Canada
Yukon/Transboundary Rivers Area | Secteur du Yukon/Rivières transfrontalier
100-419 Range Road | 100-419, chemin Range, bureau 100
Whitehorse, YT Y1A 3V1
(867) 393-6730 [Ph]
(867) 393-6737 [Fax]
mailto:christensenp@dfo-mpo.gc.ca
http://www.dfo-mpo.gc.ca/canwaters-eauxcan/index.html

Yukon
Tourism and Culture
Box 2703, Whitehorse, Yukon Y1A 2C6

File # 6800-20-757

CULTURAL SERVICES BRANCH
HERITAGE RESOURCES UNIT

August 6, 2007

TO Channa Pelpola (Jacques Whitford - AXYS Consultants Ltd.)
Environment, Habitat Management (V-5R)
Lands Use Section, Lands Branch (K-320)
ASTIS, Arctic Institute of North America
Mayo District Renewable Resources Council
First Nation of Nacho Ny'a'k Dun

RE: Channa Pelpola (Jacques Whitford - AXYS Consultants Ltd.)

Please be advised that the attached License has been issued under the Yukon Scientists and Explorers Act (1958).

Jeff Hunston, Manager
Heritage Resources Unit

Enclosure

Yukon
Tourism and Culture

License Number : 07-89S&E

YUKON·CANADA
SCIENTISTS AND EXPLORERS ACT
LICENSE

PURSUANT to the provisions of the Scientists and Explorers Act (1958) of the Yukon, permission is hereby granted to:

Channa Pelpola (Jacques Whitford – AXYS Consultants)

to enter the Yukon Territory to conduct scientific research with respect to:

Dublin Gulch Baseline Fisheries, Hydrology and Aquatics Baseline Environmental Data Collection.

GENERAL CONDITIONS

1. A complete, final report of the research conducted under this license shall be submitted, in duplicate, within one year of completion or termination of the project.
   a) A field or progress report, including descriptions or catalogues of collections made (where applicable) shall be submitted in duplicate on, or before, the expiry date written below.
   b) The Licensee shall provide a copy of any report or article published on the research conducted under this license to Heritage Resources Unit.

2. All camps shall be established according to the provisions of the Territorial Land Use Regulations.

3. All steps shall be taken to avoid unnecessary disturbance of wildlife.
   a) No camp site shall be established within 2 km of an active raptor nest.
   b) When using aircraft, maintain a minimum of 1,000 feet over wildlife such as sheep, raptor nests and migrating caribou.
   c) Pay particular attention to bear habitat, and take all steps necessary to avoid contact with bears.

4. The Licensee shall meet with and inform any nearby First Nation(s) of the field activities conducted under this license, and shall not proceed as long as there are irreconcilable objections from the First Nation(s). The Licensee shall provide a copy of any report or article published on the research conducted under this license to the First Nation(s).

5. The Licensee shall strictly observe all applicable Territorial and Federal legislation and regulations.

OTHER CONDITIONS
NIL

THIS License is valid for the period **August 6th** to **October 1st** **, 2007.**

DATED at the City of Whitehorse, in the Yukon Territory, this **6th** **day of August , A.D., 2007.**

Manager, Heritage Resources Unit
Cultural Services Branch
Tourism and Culture

APPENDIX D

Results of Statistical Analyses

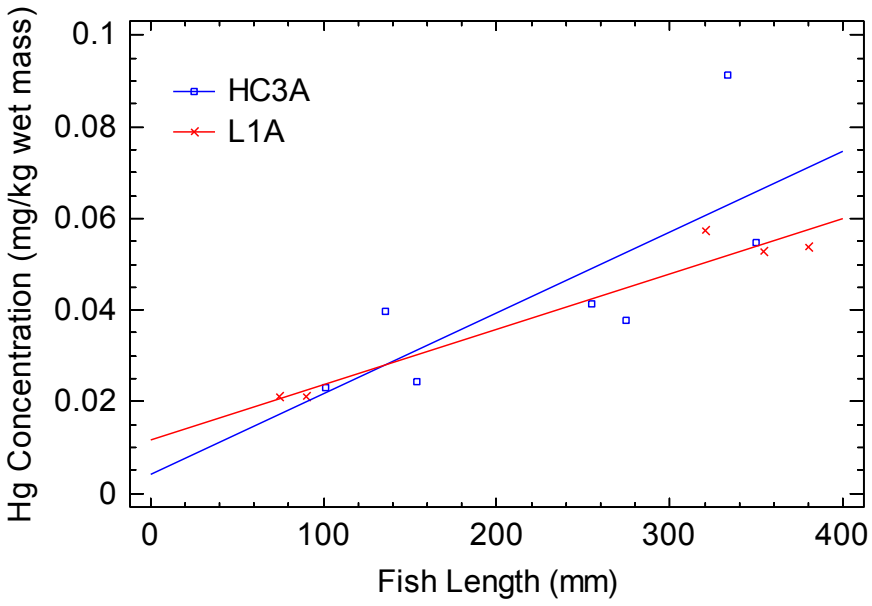
Victoria GOLD CORP

Stantec

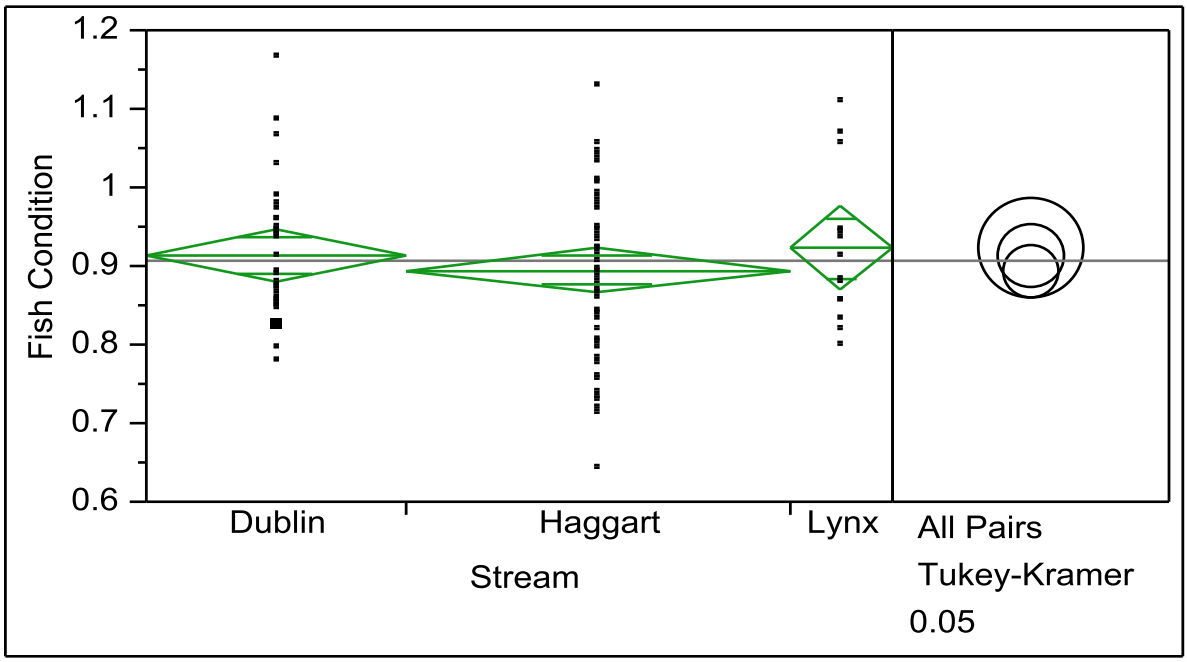
Appendix D – ANCOVA Test on Arctic Grayling Mercury Accumulation Rates, Eagle Gold Project

Model Output

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Fish length	0.0029702	1	0.0029702	16.08	0.0039
Intercepts	0.0000871484	1	0.0000871484	0.47	0.5116
Slopes	0.000109495	1	0.000109495	0.59	0.4635
Model	0.00316685	3			



Appendix D – ANOVA Results for Arctic Grayling Condition by Stream



Oneway Anova
Summary of Fit

Rsquare	0.012805
Adj Rsquare	-0.00734
Root Mean Square Error	0.100063
Mean of Response	0.905249
Observations (or Sum Wgts)	101

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Stream	2	0.01272741	0.006364	0.6356	0.5318
Error	98	0.98123467	0.010013		
C. Total	100	0.99396208			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Dublin	35	0.914346	0.01691	0.88078	0.94791
Haggart	52	0.894608	0.01388	0.86707	0.92215
Lynx	14	0.922032	0.02674	0.86896	0.97510

Std Error uses a pooled estimate of error variance

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
2.37986	0.05

Dif=Mean[i]-Mean[j]	Lynx	Dublin	Haggart

Dif=Mean[i]-Mean[j]	**Lynx**	**Dublin**	**Haggart**
Lynx	0.00000	0.00769	0.02742
Dublin	-0.00769	0.00000	0.01974
Haggart	-0.02742	-0.01974	0.00000

Comparisons for all pairs using Tukey-Kramer HSD cont.

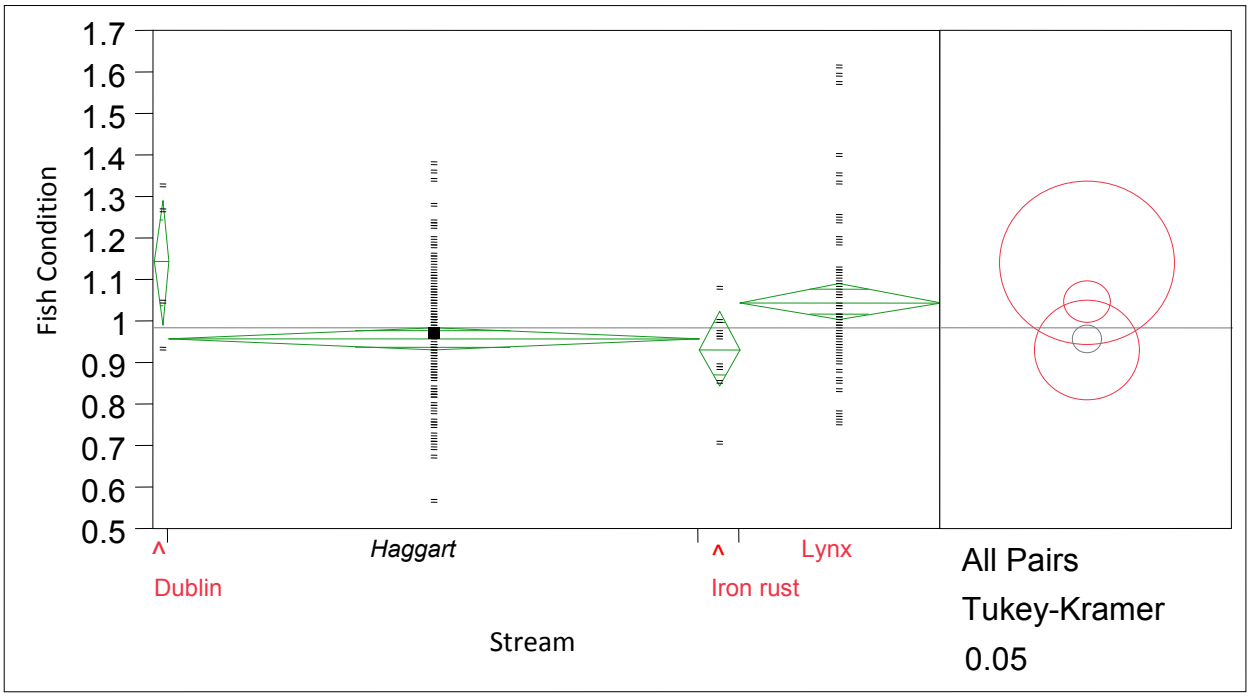
Abs(Dif)-LSD	**Lynx**	**Dublin**	**Haggart**
Lynx	-0.09001	-0.06762	-0.04428
Dublin	-0.06762	-0.05693	-0.03233
Haggart	-0.04428	-0.03233	-0.0467

Positive values show pairs of means that are significantly different.

Level		**Mean**
Lynx	A	0.92203241
Dublin	A	0.91434564
Haggart	A	0.89460833

Levels not connected by same letter are significantly different.

Appendix D – ANOVA Results for Slimy Sculpin Condition by Stream



Oneway Anova
Summary of Fit

Rsquare	0.084267
Adj Rsquare	0.071185
Root Mean Square Error	0.152037
Mean of Response	0.985524
Observations (or Sum Wgts)	214

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Stream	3	0.4466925	0.148897	6.4415	0.0003*
Error	210	4.8542013	0.023115		
C. Total	213	5.3008938			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Dublin	4	1.14356	0.07602	0.9937	1.2934
Haggart	144	0.96039	0.01267	0.9354	0.9854
Iron Rust	11	0.93522	0.04584	0.8448	1.0256
Lynx	55	1.04990	0.02050	1.0095	1.0903

Std Error uses a pooled estimate of error variance

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
2.58974	0.05

Dif=Mean[i]-Mean[j]	Dublin	Lynx	Haggart	Iron Rust
Dublin	0.00000	0.09365	0.18317	0.20834
Lynx	-0.09365	0.00000	0.08952	0.11469
Haggart	-0.18317	-0.08952	0.00000	0.02517
Iron Rust	-0.20834	-0.11469	-0.02517	0.00000

Abs(Dif)-LSD	Dublin	Lynx	Haggart	Iron Rust
Dublin	-0.27841	-0.11025	-0.01641	-0.02155
Lynx	-0.11025	-0.07508	0.027105	-0.01536
Haggart	-0.01641	0.027105	-0.0464	-0.09799
Iron Rust	-0.02155	-0.01536	-0.09799	-0.16789

Positive values show pairs of means that are significantly different.

Level			Mean
Dublin	A	B	1.1435582
Lynx	A		1.0499044
Haggart		B	0.9603873
Iron Rust	A	B	0.9352154

Levels not connected by same letter are significantly different.

APPENDIX E

Fish Sampling Effort, Population Estimates and Biological Data

Appendix E – Arctic Grayling and Slimy Sculpin Observed Catch Rates and Density Estimates for Electrofishing Depletion Surveys, Eagle Gold Project

Site	Sample Date	Species	Area Sampled (m^2)	No. of Fish Captured	Observed Catch Rate (fish/100m^2)	Population Estimate (# of fish)	Est. Fish Density (fish/100m^2)	95% C.I. (#of fish)	95% C.I. (fish/100 m^2)
Dublin Gulch (DG1)	August 2007	Arctic grayling	360	9	2.5	9	2.5	9-11	2.5-3.1
Dublin Gulch (DG1.1)	July 2009	Arctic grayling	275	5*	1.8	5	1.8	N/A	N/A
Dublin Gulch (DG1.2)	July 2009	Arctic grayling	464	10	2.16	10.05	2.17	10.02-10.08	2.16-2.17
Dublin Gulch (DG1.3)	July 2009	Arctic grayling	300	7	2.3	7.02	2.34	6.98-7.02	2.33-2.34
Haggart Creek (HC1)	August 2007	Arctic grayling	736	25	3.4	a	a	a	a
Haggart Creek (HC1)	October 2007	Arctic grayling	736	17	2.3	33	4.5	17-99	2.3-13.5
Haggart Creek (HC2)	August 2007	Arctic grayling	920	4	0.4	4	0.4	4-8	0.4-0.9
Haggart Creek (HC2)	October 2007	Arctic grayling	920	0	NFC	NFC	NFC	N/A	N/A
Haggart Creek (HC3)	August 2007	Arctic grayling	647	7	1.1	7	1.1	7-10	1.1-1.5
Ironrust Creek (IR2)	August 2007	Arctic grayling	410	1	0.2	1	0.2	1	0.2
Lynx Creek (L1)	August 2007	Arctic grayling	802	6	0.7	6	0.7	6-9	0.7-1.1
Lynx Creek (L4)	August 2007	Arctic grayling	696	7	1.0	10	1.4	7-27	1.0-3.9
Dublin Gulch (DG1)	August 2007	Slimy sculpin	360	0	NFC	NFC	NFC	N/A	N/A
Dublin Gulch (DG1.1)	July 2009	Slimy sculpin	275	4*	1.5	4	1.5	N/A	N/A
Haggart Creek (HC1)	August 2007	Slimy sculpin	736	34	4.6	44	6.0	34-63	4.6-8.6
Haggart Creek (HC1)	October 2007	Slimy sculpin	736	29	3.9	a	a	a	a
Haggart Creek (HC2)	August 2007	Slimy sculpin	920	25	2.7	a	a	a	a
Haggart Creek (HC2)	October 2007	Slimy sculpin	920	9	1.0	40	4.3	9-390	1.0-42
Haggart Creek (HC3)	August 2007	Slimy sculpin	647	37	5.7	a	a	a	a
Ironrust Creek (IR2)	August 2007	Slimy sculpin	410	3	0.7	3	0.7	3-6	0.7-1.5
Lynx Creek (L1)	August 2007	Slimy sculpin	802	37	4.6	a	a	a	a
Lynx Creek (L4)	August 2007	Slimy sculpin	696	10	1.4	13	1.9	10-26	1.4-3.7

NOTES:

2009 estimates were calculated according to methods outlined in Zippen (1958). All other estimates were calculated using the Microfish 2008™ software

NFC – no fish caught

N/A – Not applicable

*all fish captured during a single pass

a – estimates could not be calculated from catch data

Appendix E – Detailed Fish Sampling and Effort Summary for Electrofishing Depletion Surveys, Eagle Gold Project

Site	Sampling Date	Pass	Effort (seconds)	Length (m)	Area (m^2)	Number of Fish Captured[1]
Dublin Gulch (DG1)	August 2007	1	760	100	360	GR (7), CCG (0)
		2	705	100	360	GR (2), CCG (0)
		3	794	100	360	GR (0), CCG (0)
Dublin Gulch (DG1.1)	July 2009	1	747	110	275	GR(5), CCG (4)
		2	715	110	275	GR(0), CCG (0)
		3	719	110	275	GR(0), CCG (0)
Dublin Gulch (DG1.2)	July 2009	1	662	116	464	GR(8), CCG (0)
		2	651	116	464	GR(2), CCG (0)
		3	692	116	464	GR(0), CCG (0)
Dublin Gulch (DG1.3)	July 2009	1	489	100	300	GR(6), CCG (0)
		2	720	100	300	GR(1), CCG (0)
		3	704	100	300	GR(0), CCG (0)
Haggart Creek (HC1)	August 2007	1	545	65	736	GR (3), CCG (12)
		2	531	65	736	GR (11), CCG (12)
		3	530	65	736	GR (2), CCG (4)
		4	625	65	736	GR (9), CCG (6)
	October 2007	1	708	55	736	GR (9), CCG (7)
		2	794	55	736	GR (8), CCG (22)
		3	758	55	736	GR (0), CCG (0)
Haggart Creek (HC2)	August 2007	1	611	100	920	GR (1), CCG (3)
		2	428	100	920	GR (2), CCG (0)
		3	839	100	920	GR (0), CCG (12)
		4	659	100	920	GR (1), CCG (10)
	October 2007	1	961	100	920	GR (0), CCG (3)
		2	921	100	920	GR (0), CCG (2)
		3	1138	100	920	GR (0), CCG (4)
Haggart Creek (HC3)	August 2007	1	686	100	647	GR (4), CCG (1)
		2	698	100	647	GR (1), CCG (16)
		3	745	100	647	GR (0), CCG (7)
		4	728	100	647	GR (2), CCG (13)
Ironrust Creek (IR2)	August 2007	1	604	100	410	GR (1), CCG (2)
		2	729	100	410	GR (0), CCG (1)
Lynx Creek (L1)	August 2007	1	790	100	802	GR (3), CCG (9)
		2	708	100	802	GR (0), CCG (9)
		3	822	100	802	GR (2), CCG (11)
		4	750	100	802	GR (1), CCG (8)
Lynx Creek (L4)	August 2007	1	825	115	696	GR (2), CCG (3)
		2	760	115	696	GR (2), CCG (3)
		3	890	115	696	GR (1), CCG (2)
		4	910	115	696	GR (2), CCG (2)

NOTE:
[1] GR = Arctic grayling, CCG = slimy sculpin

Appendix E – Fish Length and Weight Summary, Eagle Gold Project

Site	Fish Species	Number of Fish Sampled	Length (mm)			Weight (g)		
			Mean	Range	±SD	Mean	Range	±SD
Dublin Gulch (DG1)	GR	13	138.8	111 – 185	21.4	30.1	11.7 - 80.3	19.1
Dublin Gulch (DG1.1)	GR	5	237.0	219 – 295	32.7	144.7	110 – 252	60.6
Dublin Gulch (DG1.2)	GR	10	198.8	123 – 245	36.6	91.5	17.4 – 160	44.7
Dublin Gulch (DG1.3)	GR	7	196.9	130 – 265	44.9	99.7	28.3 – 216	63.5
Haggart Creek (HC1)	GR	41	74.3	61 – 143	16.3	4.3	2.1 – 27.3	4.7
Haggart Creek (HC2)	GR	4	192.3	111 – 358	116.2	165.7	12.8 – 560	264.6
Haggart Creek (HC3)	GR	7	255.1	113 – 395	112.0	278.0	14.5 – 648	262.8
Ironrust Creek (IR2)	GR	2	143.5	138 – 149	7.8	38	34.6 – 41.4	4.8
Lynx Creek (L1)	GR	7	121.0	65 – 380	115.0	101.3	3.0 – 679	254.7
Lynx Creek (L4)	GR	7	322.1	160 – 400	76.6	426.7	40.1 – 746	216.8
Large pool on Haggart Creek	GR	40	220.3	141 – 386	57.1	N/A	N/A	N/A
Arctic Grayling Totals		**143**	**168.9**	**61 - 400**	**90.4**	**90.2**	**2.1 - 746**	**165.4**
Dublin Gulch (DG1.1)	CCG	4	100.3	86 – 110	10.3	11.8	6.5 – 17.5	4.6
Haggart Creek (HC1)	CCG	64	61.5	35 – 90	13.4	2.3	0.3 – 6.3	1.5
Haggart Creek (HC2)	CCG	34	68.7	36 – 120	22.1	4.1	0.4 – 17.5	4.1
Haggart Creek (HC3)	CCG	46	62.9	41 – 119	19.3	3.2	0.7 – 17.8	3.8
Ironrust Creek (IR2)	CCG	11	107.2	89 – 131	11.3	11.8	6.7 – 21.6	4.3
Lynx Creek (L1)	CCG	45	63.0	36 – 105	16.0	2.8	0.5 – 8.9	2.0
Lynx Creek (L4)	CCG	10	101.6	65 – 120	19.7	14.3	3.3 – 27	8.2
Eagle Pup Placer Pond 1	CCG	4	77.0	68 – 80	6.0	4.0	2.6 – 5.3	1.1
Large pool on Haggart Creek	CCG	1	63	-	-	-	-	-
Tributary to Eagle Pup Pond 2	CCG	1	35	-	-	-	-	-
Slimy Sculpin Totals		**220**	**68.2**	**35 – 131**	**21.3**	**4.1**	**0.3 - 27**	**4.6**

NOTE:

SD = standard deviation, N/A = data not available because of malfunctioning equipment at time of sampling

APPENDIX F

Fish Ageing Results

Appendix F - Fish Aging Results, Eagle Gold Project

Total Collected by Site	Sample Date	Species	Fork Length (mm)	Weight (g)	Type	Age
DG1	8/18/2007	GR	115	15	Scale	0+
DG1	8/18/2007	GR	111	11.7	Scale	1+
DG1	8/18/2007	GR	138	27.7	Scale	1+
DG1	8/18/2007	GR	119	14.6	Scale	1+
DG1	8/18/2007	GR	132	21.3	Scale	1+
DG1	8/18/2007	GR	137	27.5	Scale	2+
DG1	8/18/2007	GR	144	33.1	Scale	2+
DG1	8/18/2007	GR	174	57.5	Scale	2+
DG1	8/18/2007	GR	185	80.3	Scale	2+
HC1	8/13/2007	GR	71	3.5	Scale	0+
HC1	8/13/2007	GR	67	2.9	Scale	0+
HC1	8/13/2007	GR	68	3.3	Scale	0+
HC1	8/13/2007	GR	78	3.2	Scale	0+
HC1	8/13/2007	GR	69	2.9	Scale	0+
HC1	8/13/2007	GR	67	2.5	Scale	0+
HC1	8/13/2007	GR	73	3.8	Scale	0+
HC1	8/13/2007	GR	82	5.2	Scale	0+
HC1	8/13/2007	GR	108	14	Scale	1+
HC1	8/13/2007	GR	143	27.3	Scale	1+
HC2	8/16/2007	GR	358	560	Otolith	8+
HC2	8/16/2007	GR	112	13	Scale	1+
HC2	8/16/2007	GR	111	12.8	Scale	1+
HC2	8/16/2007	GR	188	76.8	Otolith	3+
HC3	8/17/2007	GR	113	14.5	Scale	1+
HC3	8/17/2007	GR	169	58.2	Scale	2+
HC3	8/17/2007	GR	145	31.6	Scale	2+
HC3	8/17/2007	GR	310	319	Scale	4+
HC3*	8/17/2007	GR	291	285	Scale	4+?
HC3	8/17/2007	GR	363	590	Scale	6+
HC3	8/17/2007	GR	395	648	Scale	6+
IR1	8/21/2007	GR	149	41.4	Scale	2+
IR1	8/21/2007	GR	138	34.6	Scale	2+
L1	8/14/2007	GR	66	3	Scale	0+
L1	8/14/2007	GR	69	3.5	Scale	0+
L1	8/14/2007	GR	86	6	Scale	0+
L1	8/14/2007	GR	102	11.2	Scale	1+
L1	8/14/2007	GR	380	679	Scale	5+
L1	8/14/2007	GR	354	492	Scale	5+
L1	8/14/2007	GR	320	408	Scale	5+
L4	8/12/2007	GR	160	40.1	Scale	1+
L4	8/12/2007	GR	330	384	Scale	3+
L4	8/12/2007	GR	345	436	Scale	4+
L4	8/12/2007	GR	355	550	Scale	4+
L4	8/12/2007	GR	350	497	Scale	5+
L4	8/12/2007	GR	310	334	Scale	5+
L4	8/12/2007	GR	400	746	Scale	5+
HC1	8/13/2007	CCG	70	3.5	Otolith	3+
HC1	8/13/2007	CCG	72	2.9	Otolith	4+
HC1	8/13/2007	CCG	70	3.1	Otolith	4+
HC1	8/13/2007	CCG	80	4.9	Otolith	4+
HC1	8/13/2007	CCG	87	5.5	Otolith	5+
HC1	8/13/2007	CCG	82	4.9	Otolith	5+
HC1	8/13/2007	CCG	76	3	Otolith	6+
HC1	8/13/2007	CCG	72	3.2	Otolith	6+
HC1	8/13/2007	CCG	90	5.4	Otolith	6+
HC1	8/13/2007	CCG	85	5	Otolith	7+

Total Collected by Site	Sample Date	Species	Fork Length (mm)	Weight (g)	Type	Age
HC2	8/16/2007	CCG	65	2.7	Otolith	3+
HC2	8/16/2007	CCG	69	2.7	Otolith	3+
HC2	8/16/2007	CCG	66	2.6	Otolith	3+
HC2	8/16/2007	CCG	82	5.1	Otolith	3+
HC2	8/16/2007	CCG	82	4.1	Otolith	4+
HC2	8/16/2007	CCG	72	3	Otolith	4+
HC2	8/16/2007	CCG	80	5.1	Otolith	4+
HC2	8/16/2007	CCG	100	9.9	Otolith	5+
HC2	8/16/2007	CCG	111	12.1	Otolith	5+
HC2	8/16/2007	CCG	98	9.3	Otolith	5+
HC3	8/17/2007	CCG	72	3.6	Otolith	3+
HC3	8/17/2007	CCG	66	2.8	Otolith	3+
HC3	8/17/2007	CCG	67	2.8	Otolith	3+
HC3	8/17/2007	CCG	96	9.6	Otolith	4+
HC3	8/17/2007	CCG	92	8.1	Otolith	4+
HC3	8/17/2007	CCG	67	2.9	Otolith	4+
HC3	8/17/2007	CCG	105	11.6	Otolith	4+
HC3	8/17/2007	CCG	98	8.6	Otolith	4+
HC3	8/17/2007	CCG	119	17.8	Otolith	8+
IR2	8/21/2007	CCG	106	10.5	Otolith	4+
IR2	8/21/2007	CCG	96	8.7	Otolith	4+
IR2	8/21/2007	CCG	106	11.5	Otolith	4+
IR2	8/21/2007	CCG	102	7.4	Otolith	4+
IR2	8/21/2007	CCG	89	6.7	Otolith	4+
IR2	8/21/2007	CCG	100	8.4	Otolith	5+
IR2	8/21/2007	CCG	110	14.2	Otolith	5+
IR2	8/21/2007	CCG	117	14.1	Otolith	8+
IR2	8/21/2007	CCG	115	14.6	Otolith	8+
IR2*	8/21/2007	CCG	131	21.6	Otolith	8+/9+
L1	8/14/2007	CCG	80	4.7	Otolith	4+
L1	8/14/2007	CCG	78	4.9	Otolith	4+
L1	8/14/2007	CCG	74	3.3	Otolith	4+
L1	8/14/2007	CCG	95	6.3	Otolith	4+
L1	8/14/2007	CCG	84	5.1	Otolith	4+
L1	8/14/2007	CCG	84	4.9	Otolith	4+
L1	8/14/2007	CCG	88	6.3	Otolith	5+
L1	8/14/2007	CCG	84	5.3	Otolith	7+
L1	8/14/2007	CCG	96	8.2	Otolith	8+
L1	8/14/2007	CCG	103	8.7	Otolith	8+
L4	8/12/2007	CCG	65	3.3	Otolith	3+
L4	8/12/2007	CCG	8.1	4.8	Otolith	3+
L4	8/12/2007	CCG	85	6.5	Otolith	4+
L4	8/12/2007	CCG	90	8.5	Otolith	4+
L4	8/12/2007	CCG	118	18.3	Otolith	6+
L4	8/12/2007	CCG	115	16.5	Otolith	6+
L4	8/12/2007	CCG	112	16.7	Otolith	7+
L4	8/12/2007	CCG	120	27	Otolith	8+
L4	8/12/2007	CCG	130	27	Otolith	8+
L4	8/12/2007	CCG	120	24	Otolith	9+

* These samples could not be confidently aged by Hamaguchi Fish Aging Services or Jacques Whitford AXYS fisheries biologists

APPENDIX G

ERED Criteria

Victoria GOLD CORP

Stantec

Appendix G – Summary of ERED Effects Criteria, Eagle Gold Project

Metal	Test Species	Body Part	Species Lifestage	Effect Class	Conc. (mg/kg) (min, max)	Exposure Route
Molybdenum	Sockeye salmon	Liver	Juvenile	Behaviour	16	Water
Thallium	Atlantic salmon	Whole body	Juvenile	Growth	0.27	Water